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An Experimental Study on Stabilization of Clayey Soils by using Ceramic Waste Materials

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ABSTRACT

The environment is being polluted by humans & in doing so, not only air & water but land is also being contaminated. The major contaminant present in the soil is montomornollite mineral it is the main responsible for swelling and shrinkage parameters in the clayey soils. These contaminations largely affect the geotechnical properties of soil, especially physical & chemical. Taking into consideration the structural safety of structures of such location it is necessary to consider the change in the geotechnical properties due to such contaminations

In present study, the soil samples prepared with addition of ceramic waste by 5%, 10%,15%,20% and 25% has been used at first, in this paper the changes in the geotechnical properties like plastic limit, liquid limit, specific gravity, Optimum Moisture Content (OMC) was determined through proctor test. At those OMC, several tests like CBR, UCS, Consolidations tests were conducted. CBR test was carried in both un soaked and soaked conditions variation of ceramic waste has been used to modify their engineering properties and index properties of a black cotton soil.

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INTRODUCTION

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In present study, the soil samples prepared with addition of ceramic waste by 5%, 10%,15%,20% and 25% has been used at first, in this paper the changes in the geotechnical properties like plastic limit, liquid limit, specific gravity, Optimum Moisture Content (OMC) was determined through proctor test. At those OMC, several tests like CBR, UCS, Consolidations tests were conducted. CBR test was carried in both un soaked and soaked conditions variation of ceramic waste has been used to modify their engineering properties and index properties of a black cotton soil.

Major Types of soils in India

Six Different Types of Soils Found in India are as follows:
Soil is our prime natural and economic resource. Soils in India differ in composition and structure.

1. Alluvial Soils:

These are formed by the deposition of sediments by rivers. They are rich in humus and very fertile. They are found in Great Northern plain, lower valleys of Narmada and Tapti and Northern Gujarat. These soils are renewed every year.

2. Black Soils:

These soils are made up of volcanic rocks and lava-flow. It is concentrated over Deccan Lava Tract which includes parts of Maharashtra, Chhattisgarh, Madhya Pradesh, Gujarat, Andhra Pradesh and Tamil Nadu. It consists of CW, Iron, Magnesium and also Potash but lacks in Phosphorus, Nitrogen and Organic matter

3. Red Soils:

These are derived from weathering of ancient metamorphic rocks of Deccan Plateau. Its redness is due to iron composition. When iron content is lower it is yellow or brown. They cover almost the whole of Tamil Nadu, Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra and parts of Orissa.

4. Laterite Soils:

These soils are formed due to intense leaching and are well developed on the summist of hills and uplands. They are commonly found in Kerala, Tamil Nadu, Maharashtra, Chhattisgarh and hilly areas of Orissa and Assam.

5. Mountain Soils:

These soils are formed as a result of the accumulation of organic matter derived from forest grow eighth. They are found in Himalayan region and vary in different regions

according to altitude. Tea is grown in those areas which receive sufficient rainfall.

6. Desert Soils:

In the desert regions of Rajasthan, soils are not well developed. As evaporation is in excess of rainfall, the soil has a high salt content and saline layer forms a hard crust. These soils are generally sandy and deficient in organic matter.

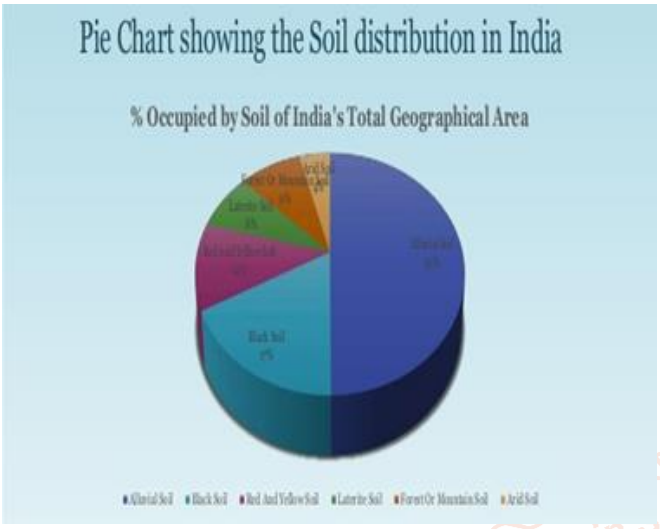


Fig-1: pie diagram showing various soil orders and their extent in India

Standard Specific gravity values:

S. No	Type of Soil	Specific Gravity
1	Sand	2.63 – 2.67
2	Silt	2.65 – 2.7
3	Clay and Silty Clay	2.67 – 2.9
4	Organic Clay	< 2.0

Specific gravity of Soil $G_s = \frac{W2-W1}{((W2-W1)-(W3-W4))}$

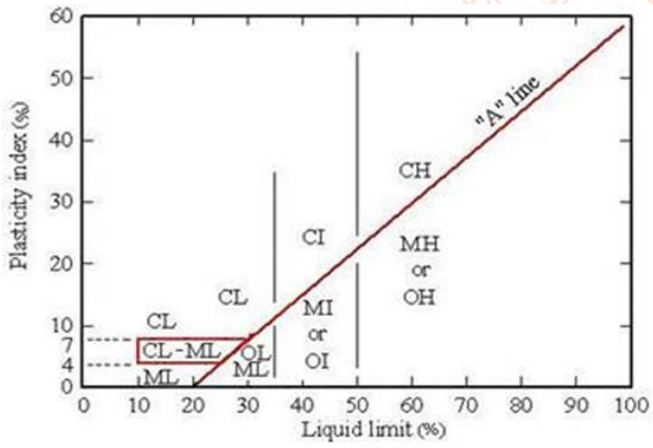


Fig-2 Soil classification chart

Liquid limit:

About 120g of air dried soil passing through IS sieve 425 micron is taken and mixed with water such that the soil attains a putty- like consistency. A portion of the paste is placed in the cup and is levelled so as to have a maximum depth of about 10mm. A groove is cut in the soil placed in the cup, using the grooving tool. In cutting the groove, the grooving tool is drawn through the sample along the symmetrical axis of the cup, holding the tool perpendicular to the cup. The handle is rotated at the rate of 2 revolutions per second and the number of blows necessary to close the groove for a distance of 13mm is noted. About 10g of soil near the closed groove is taken to determine its water content. A liquid limit is determined by reading the water content corresponding to 25 blows from the flow curve. Graph is then plotted between number of blows N on a logarithmic scale and the water content (w) on natural scale.

Fig-3 Casagrande's Liquid Limit Device

Differential free swells (DFS):

Observations and Calculations of D.F.S:

After 24hrs Settlement,

- Volume of soil specimen read from the graduated cylinder containing distilled water
  $V_d = 13.5cc$
- Volume of soil specimen read from the graduated cylinder containing kerosene.
  $V_k = 9$ cc
- $DFS = \frac{V_d - V_k}{V_k} \times 100 = \frac{13.5-9}{9} \times 100 = 50\%$

Table1: Observation table to determine the compaction characteristics:

Height of the Mould	12.73	mm
Diameter of the Mould	15.00	mm
Volume of the Mould	2250	cc
Weight of the Empty Mould	4980	gms

Black Cotton	**20**	**1.58**
BC + 5% CW	20	1.78
BC + 10% CW	20	1.8
BC + 15% CW	20	1.8
BC+ 20% CW	20	1.81
BC+25% CW	20	1.71

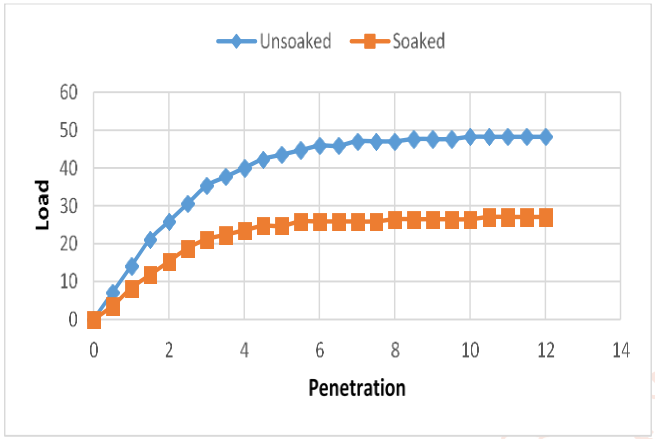
Table: 2 OMC and MDD values of BC + CW%

S. no	Observation	
1	Height of the Mould	150mm
2	Diameter of the Mould	175mm
3	Height of the Spacer Disc	47.7mm
4	Weight of the each Surcharge Disc	2.5kg
5	Volume of the Specimen	2470cc
6	Weight of the empty mould	5.839kg
7	Weight of the Rammer Used	4.89kg
8	Free fall of the Rammer Used	450mm

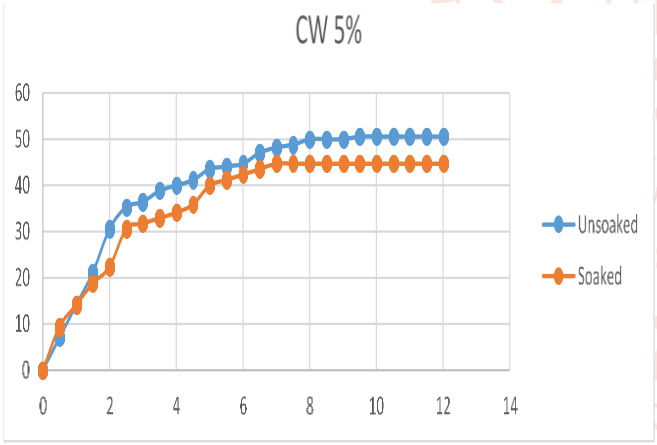
Standard Load values at specified penetration:

Table:3 Standard Load values at specified penetration:

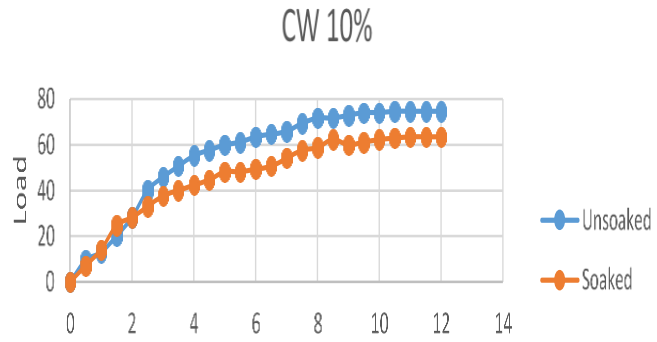
S. no	Penetration (mm)	Unit Standard Load (kgf/cm²)	Total Standard Load (kgf)
1	2.50	70	1370
2	5.00	105	2055
3	7.50	134	2630
4	10.00	162	3180
5	12.50	183	3600



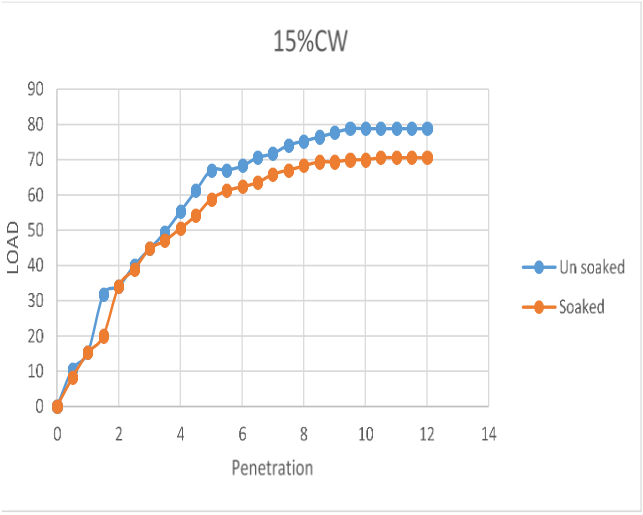
Graph1: Load Vs Penetration graph for Black Cotton Soil (Unsoaked & Soaked)



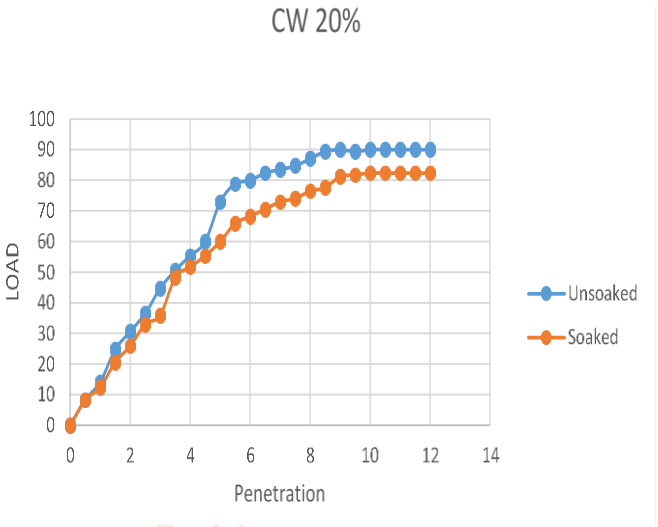
Graph 2: Load Vs Penetration graph for BC+5%CW (Unsoaked & Soaked)



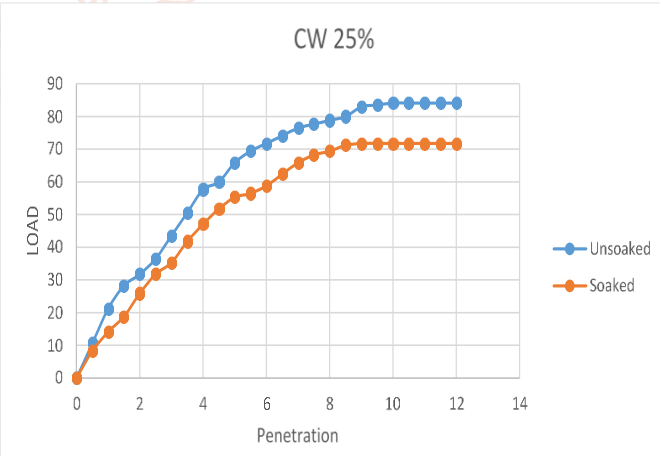
Graph 3: Load Vs Penetration graph for BC+10%CW (Unsoaked & Soaked)



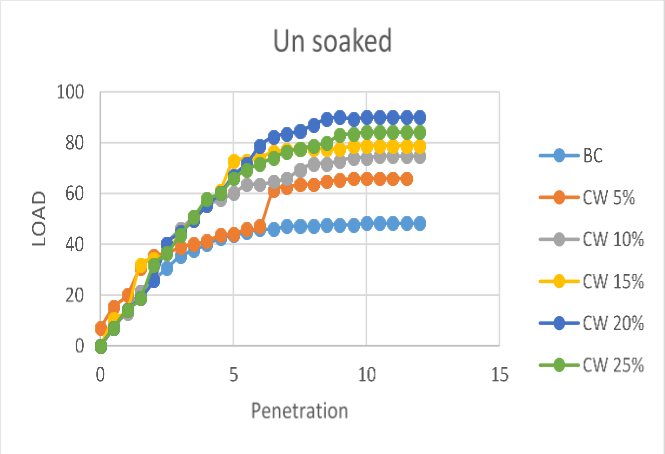
Graph 4: Load Vs Penetration graph for BC +15% CW (Unsoaked & Soaked)



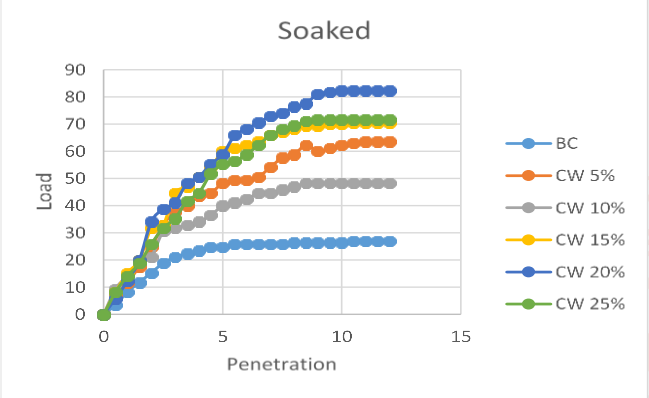
Graph5: Load Vs Penetration graph for BC +20%CW (Unsoaked & Soaked)



Graph6: Load Vs Penetration graph for Black Cotton Soil+25% CW (Unsoaked & Soaked)



Graph6: Load Vs Penetration graphs of Unsoaked CBR at different percentages of CW



Graph7: Load Vs Penetration graphs of Soaked CBR at different percentages of CW

CONCLUSSION

The following conclusions are drawn based on the laboratory studies carried out.

- The cost effectiveness of using CW mixes for stabilization is an economic analysis.
- From the results obtained from Atterberg Limits, the collected soil sample in this study is classified as Clay of Low Compressibility (CH) from A-Line chart.
- The Specific Gravity of normal soil sample obtained is2.69
- From Compaction Test, Max. Dry density and OMC for normal soil are found to be 1.8 gm/cc and 20%respectively.
- CBR (Unsoaked) value for normal soil at 2.5 mm penetration is found to be3.54
- %. CW with those results the following conclusions are drawn
- From the results obtained from Compaction Test, we have observed that there is a gradual increase in the Optimum Moisture Content from 5 % to 20 %
- As we increase the addition of CW increase in maximum dry density and increasing the moisture content up to 20% CW had been observed.
- The CBR value had maximum value is occurred when treat with CW 20% and with further increasing of CW the CBR value had been reduced.
- The CBR value for untreated CW is 2.2%, CBR value of 20% CW is 2.54
- In Procter test, with increase in ceramic dust with cement and soil the Optimum Moisture Content value has been decreasing trend than the parent soil.

REFERENCES:

[1] IS: 1498(1970), -Indian Standard Methods of Test for Soils: Classification and Identification of Soil for General Engineering Purposes||, Bureau of Indian Standards.

[2] IS: 2720(Part7)(1974),-Indian Standard Methods of Test for Soils: Determination of Moisture Content-Dry Density Relation using Light Compaction||, Bureau of Indian Standards.

[3] IS:2720(Part10)(1991),-Indian Standard Methods of Test for Soils: Determination of Unconfined Compressive Strength||, Bureau of Indian Standards

[4] Abd EI-Aziz, M., and Abo-Hashema, M. A.(2012)

[5] -Measured effects on engineering properties of clayey sub grade using lime-homra stabiliser, || International Journal of Pavement Engineering, DOI: 10.1080/10298436.2012.655739

[6] Baser, O.(2009)-Stabilization of expansive soils using waste marble dust, || Master of Science thesis submitted to Civil Engineering Department, Middle East, Technical University

[7] H. (2007) -Effect of crushed ceramic and basaltic pumice as fine aggregates on concrete mortars properties,|| Construction and Building Materials, Vol. 21, pp 1191-1197

[8] Chen, F. H. (1988) Foundations on expansive soils, by using Ceramic Waste Elsevier Science publication, Newyork.

[9] Ene, E., and Okagbue, C.(2009) -Some basic geotechnical properties of expansive soil modified using pyroclastic dust, || Engineering Geology,