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Performance of Lateritic Soil Mixed with Black Cotton Soil

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***Abstract* -Due to increase of the population of the world requires various civil engineering structures to fulfill the needs of human beings. Soil is common material used in backfills, earthen dam, embankment of road construction and various civil engineering structures. In India soil covers one third area and many other types of soils are present all over the remaining part of the country. In the above mentioned structures, we mainly use soil. The soil is having its own physical properties as well as engineering properties. There are mainly three types of soil namely Black cotton soil, lateritic soil and sand. In north Karnataka black cotton soil is having high swelling and low permeability properties, lateritic soil having low swelling and medium permeability properties. The design of mixed soil is required for appropriate use of soil mix for civil engineering works which may be Black cotton and Lateritic soil to get desirable compaction, permeability and free swelling potential. The results revealed that mixed soil behaviors have direct co relation with higher value of MDD, low permeability and low free swelling potential.**

Key words: MDD, Permeability, Free swelling potential, Lateritic soil, Black cotton soil.

1. INTRODUTION

In the retaining structures, back fill is mainly used as soil. When we are using expansive soil as backfill it is creates hydrostatic pressure, when water enters into soil in rainy season. Because of expansive soils have water holding capacity more, simultaneously increases earth pressure on retaining structures. To minimize the hydrostatic and swelling pressure, mix some percentages of lateritic soil in to Black cotton soil. This soil mix can reduce the hydrostatic pressure as well as earth pressure.

Earthen bund was mainly damaged from seepage, because of high permeability soil used in earthen bund or dam. In upstream side Dam or Bund the seepage takes place from Shell layer to core. To minimize this seepage add low percentage of black cotton soil in to lateritic soil

. Bhyan (2010) [5]-In the year 2010, studies on "using industrial blast furnace slag and fly ash".Adding some percentage stabilizer and conduct strength test for BC soil, finally obtained, increases in strength characteristics of black cotton soil.

Nadagouda.k.A. And. Hegde. R.A. (2010) [6]. - In the year 2010, studies on" The effective of lime stabilization on properties of black cotton soil". Select the BC soil, it was showing low to medium swelling potential and collected from Lathur and determining properties of soil. For 2 to 7% lime stabilizer, gradually decrease the differential free swell. But for 3.5% lime, there were no changes of MDD and only CBR values increases .

. Biju (2003) [1] In the year 2003, studied on the "mixing of terrazyme for pavement sub grade stabilization". Terrazyme is a bio-enzyme stabilizer used for stabilizing the soil. Conducted test for the strength properties like CBR. For 12% stabilizer increases the CBR. This process found to be most effective but soil containing larger amount of silt. This method is not an economy.

Raasta (2008) [2] In the year 2008, Conducted laboratory test, to study on "Properties of soil treated with cementations stabilizer". In this study, selected four different types of Silt Content soil and mixing with 2% stabilizer, by CBR test increase CBR up to 20%. After 7 days curing, no changes in the result with increase stabilizer content. Therefore it was concluded that low percentage 1-2% of stabilizer is most effective to improve the engineering properties of such clayey soil.

Anita(2009) [3]. S-In the year 2009 studied on "optimum percentage of stabilizer RBI grade 81 with lateritic soil". The stabilizer RBI grade 81, 2%, 4%, 6% mixing with lateritic soil.For 6% stabilizer increase the CBR value and other strength properties of soil.

AbdoullahNamdar (2009) [4]. -In the year 2010, studies on "ability of mixed soil technique", make various components of models, these were soils, gravels, sand and water. Conduct safe bearing capacity (SBC), direct shear test, cohesive, angle of friction and density for 0%, 3% and 6% moisture content, for the bearing capacity calculations for all models was assumed 1.5m*2.5m*2.5m depth, length and width of square footing. The SBC value increased w

Oriola, George (2010) [7]. - In the year 2010, studies on "Ground shell ash stabilization BC soil". Conduct the strength test for BC soil and concluded that BC soil was weak in strength add some percentage of GSA to the BC soil, finally obtained maximum strength for 28 days of curing period of UCS tests.

[8]. Ken C. Oneylowe(2011) [9].- In the year 2011, studies on" Cement stabilized Akwuete lateritic soil and the use of bagasse ashas admixture". The lateritic soil was collected from akwuete in Nigeria country. The stabilization was conduct using 4% and 6% cement with variation of bagasse ash proportion 0-10%. OMC, MDD and CBR tests were conducted. For the cement 6%and bagasse ash 0-10% increases MDD and CBR, decreases OMC.

OlugbengaOludolapo (2011) [9]. - In the year 2011 researched on "The suitability and lime stabilization requirement of some lateritic sample as pavement", in the obafemi Wallowa University in Nigeria. .Select soil samples A, B and C collected from dam site, stabilized with lime 2, 4, 6, 8 and 10%,. After that tests the plasticity indices and shear strength. For 8% lime stabilizer, the sample caused a reduction in the plasticity indices, and also improves the shear strength and compressive strength of soil.

Ghatgi Sandeep (2012) [10]. In the year 2012, studies on "Soil stabilization using waste shredded rubber tire chips". Select the clayey soil and adding 3 different percentage of rubber tire chips stabilizer 5%, 10% and 15% and strength tests was conducted CBR and UCS. Finally increases strength of soil for both UCS and CBR tests for curing period 3-15 days with addition of 4% of cement.

Y. I. Murthy (2012) [11]. In the year 2012, studies on "Stabilization of expansive soil using mill scale". Select the expansive soil and mix the 3-15% and test strength tests. For 15% mill scale stabilizer increase CBR three times as that of plane BC soil. And also constant permeability was increased by increase the stabilizer, the permeability value increases rapidly in the range 5-10% stabilizer, after which increases was comparatively less.

Akshya KumarSabat (2012) [12]. In the year 2012, Studies on "Stabilization of expansive soil using waste dust". Add 1-30% percentage of ceramic dust to the expansive soil and conduct strength properties of soil UCS, CBR as well as swell test. Both UCS and CBR were increases and swell was decreases.

[13]. Miss Kapilani (2014)-In the year 2014, studies on "Analysis of engineering properties of black cotton soil and stabilization using by lime". Test the soil properties like liquid limit, OMC and MDD. Conclude that BC soil have high liquid limit and high OMC, after that, for 6% lime stabilizer, increases MDD of BC soil.

[14]. Karthik. S., Ashok Kumar .E.(2014)–In the year 2014, studies on "Soil stabilization by using fly ash". By add fly ash 2%, 4%, 6%, 8%, in to the expansive soil. For 8% of fly ash, obtained the maximum percentage of strength properties of expansive soil, like CBR, UCS and other tests were carried;

2.Aim of present work

1.To control the seepage for core material in earthen bunds and dams
2.To control the hydrostatic and earth pressure on retaining wall back fill
3.The soil mix was used as sub grade of soil
4.To minimize the foundation dimension in weak soft clayey soil.

3. MATERIALS AND METHODOLOGY

3.1 Materials

Two materials were used namely,
1. Lateritic soil (LS) and
2. Black cotton soil (BCS)

Lateritic soil collected from industrial area Bidar district in Karnataka state as was used for this study. The sample was collected from depth of 0.9m from ground level. Black cotton soil collected from cross road of Bhalki taluk, Bidar district in Karnataka state as was used for this study. The sample was collected manually from depth of 0.9m

Above two soils kept in jute bags in Geo-Technical lab, soils are air dried for elimination of natural water content in tray up to 3 days after that oven dried soil was used for tests

3.2 Methodology

Initially basic tests were conducted (Grain size analysis, specific gravity, natural water content and Atterberg's limits) then engineering properties tests Compaction test, Permeability test and Free swelling potential test for LS, BCS and different percentages mixed soils, as per IS code and as follows

- Compaction test for LS and BCS as well as different percentages of mixed soils were LS75% BCS25%, LS50% BCS50%, LS25% BCS75%, LS85% BCS15%, LS90% BCS10% & LS95% BCS5%
- Permeability test for BCS, LS, LS90% BCS10% and LS80% BCS20%
- Free swelling potential test for BCS, LS, LS90% BCS10% and LS80% BCS20%. Results were discussed below

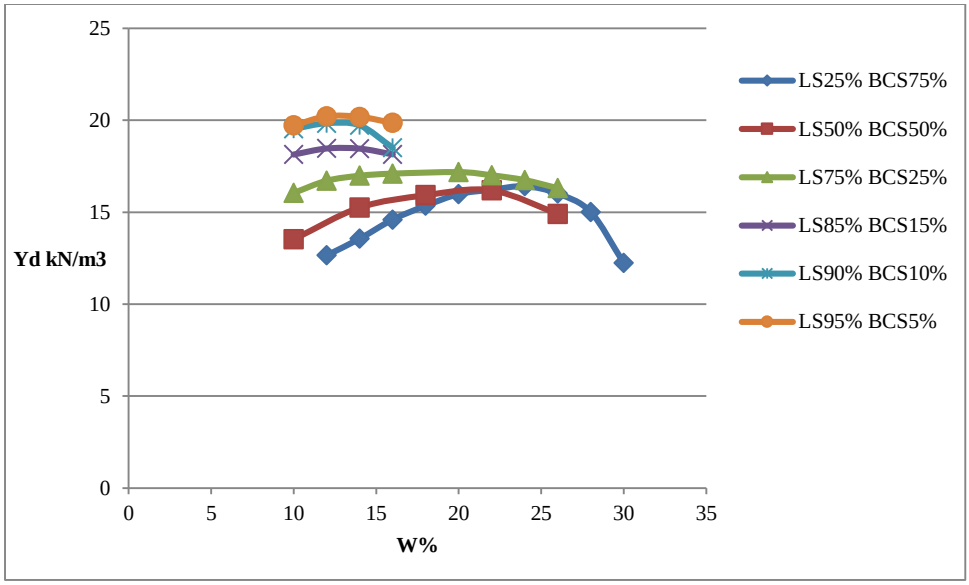
4. RESULTS

Table-1 Shows the physical properties of lateritic soil and BC soil.

	Parameters	Lateritic soil	Black cotton soil
1	Specific gravity Gs	2.7	2.6
2	Atterberg limits %		
	Liquid limit	44.5	60
	Plastic limit	35.3	45
	Plasticity index	9.2	15
3	Sieve analysis %		
	Sand	40	30.5
	Silt	25.5	44.3
	Clay	34.8	24.5
4	Optimum moisture content %	12	24
5	Maximum dry density kN/m3	20.405	15.901
6	IS classification	CH	MH

Table-2 Shows Compaction characteristics for LS25% BCS75%, LS50% BCS50%, LS75% BCS25%, LS85% BCS15%, LS90% BCS10%, and LS95% BCS%.

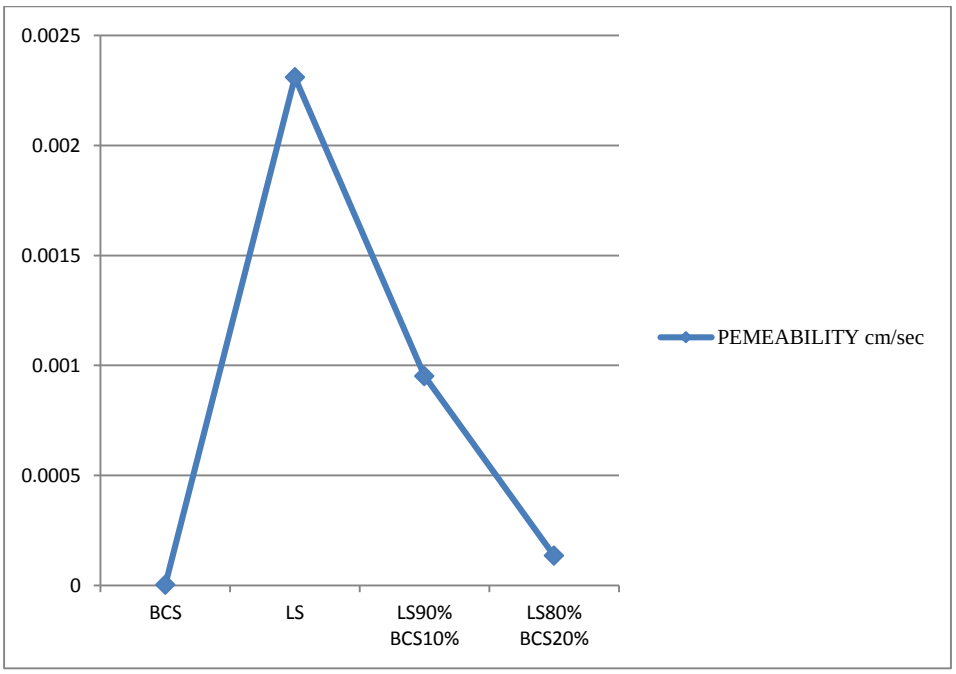
Mixed soil	MDD in kN/m3	OMC in %
LS-25% BCS75%	16.29	22
LS-50% BCS50%	17.18	20
LS-75% BCS25%	18.35	18
LS-85 BCS15%	18.464	16
LS-90% BCS10%	19.833	14
LS-95% BCS5%	20.213	13



Graph-1 Shows Compaction characteristics for LS25% BCS75%, LS50% BCS50%, LS75% BCS25%, LS85% BCS15%, LS90% BCS10%, and LS95% BCS%.

Table-3 Shows Permeability test values of BCS, LS, LS90% BCS10% and LS80% BCS20%

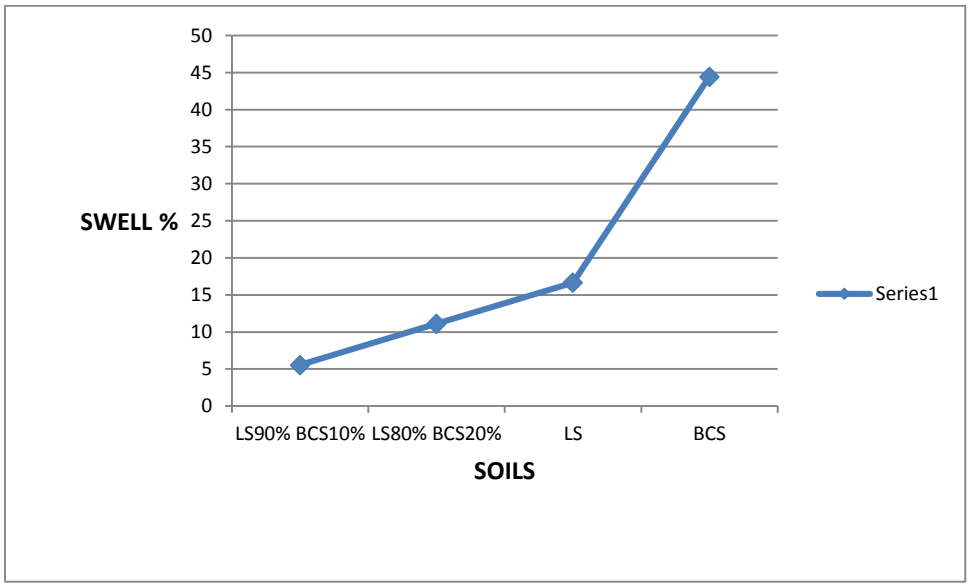
SOILS TYPE	PERMEABILITY CM/SEC
BC	0.00000201
LS	0.00231
LS90% BCS10%	0.000951
LS80% BCS20%	0.000134



Graph-2 Shows Permeability test values of BCS, LS, LS90% BCS10% and LS80% BCS20%

Table- 4 Shows Swelling lues for BCS & LS, LS80%- BCS20%, LS90%-BCS10%

SOILS TYPE	FREE SWELLIGN INDEX, PERCENTAGE
LS	16.666%
BCS	44.444%
LS80% BCS90%	11.11%
LS90% BCS10%	5.55%



Graph-3 Shows Swelling values for BCS & LS, LS80%- BCS20%, LS90%BCS10%.

5. CONCLUSIONS

[1] To control seepage, the soil mix LS80% BCS20% was found suitable for earthen bunds and dams for shell material.
[2] To control the hydrostatic pressure and earth pressure, the soil mix LS85% BCS15% was found suitable for retaining wall backfill.
[3] The mixed soil LS75% BCS25% was found suitable for sub grade for pavement.
[4] To minimize the dimensions of foundation in soft soil.

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