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Soil Stabilization By Lime Utilization

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ABSTRACT

Since the black cotton soil is extremely weak in strength and highly expansive and contractive in nature. And lime which is in enormous quantum is available in Hyderabad Karnataka area where authors belong to. And it is very problematic for civil Engineers to construct structures over BC Soil. This has motivated the authors to do the study under consideration of soil stabilization by using lime. Typically, lime addition to expansive soils initiates four types of reactions between lime and the silicate/aluminates constituents of the expansive clay. These are flocculation, cat-ion exchange, carbonation and pozzolanic reaction. These reactions contribute to mineralogical and micro-structural changes in the treated or stabilized soils. Due to this reason, lime treated expansive soil behavior is significantly different from natural or untreated expansive soils. Added amount of lime had been varied in proportions of 1%, 2%, 3% and 4%. Use of lime in geotechnical engineering for enhancing the soil properties has received great attention in the recent times. This paper presents the investigation of behavior of pavement subgrade soil stabilized with lime. It is found that the 2% of lime content CBR test strength is showing highest result.

KEYWORDS Plasticity, liquid limit, Soil Stabilization, Black Cotton Soil, Lime, CBR

1.Introduction

Clayey soil or black cotton soil is an expansive soil, which swells or shrinks excessively due to change in moisture content. When an engineering structure is associated with black cotton soil, it experiences either settlement or heave, depending on the stress level and the swelling pressure. Design and construction of civil engineering structures on and with expansive soils is a challenging task for geotechnical engineers. Improving their soils engineering properties is called soil stabilization. Soils containing significant levels of silt are clay, have changing geotechnical characteristics: They swell and become plastic in the presence of water, shrink when dry, and expand when exposed to frost. In India, black cotton soils have liquid limit values ranging from 50 to100%. The amount of swell generally increases with increase in the plasticity index. The swelling potential depends on the type of clay mineral, crystal lattice structure, cat-ion exchange capacity, ability of water absorption, density and water content. The test results such as Of lime had been varied in proportions of 1%,2%,

3%, and 4%. The view of lime used in this study is shown in Fig.1 and FIG standard proctor test, CBR test and UCS test conducted on BC Soil showed that 10% addition of stone dust and CCR individually to the BC Soil controls the swelling behavior[1]. Great improvement in engineering properties of BC Soil, by stabilizing it with 50% of replacement by marble powder which result in large decrement in swelling and shrinkage of soil[5]. Some soil of the brick satisfy the provision in respect of strength only, L-FA(40:60) brick satisfy requirement of Indian standard code in respect of strength and water absorption charecteristics[8].

3 MATERIALS USED

The soil used in this study collected from Kumasi village, Kalaburagi District, Karnataka, India. Classification of soil as per BIS is CI which is clay with intermediate compressibility. Added amount of lime had been varied in proportions of 1%, 2%, 3% and 4%. The view of lime used in the study is shown in Fig.1 and Fig 2.

Fig. 1: Lime with Black Cotton soil

Fig. 2 Lime

3. CBR VALUE OF SOIL-LIME

CBR tests were conducted on soil and soil -lime mixtures to determine the CBR value from which the suitability of soil stabilized with lime can be assessed. In addition to that the thickness of the pavement can also be determined from the CBR value. The tests were conducted a corresponding water is added by OMC and MDD of the soil, soil -lime mixtures. The soil is mixed with lime of 1%, 2%, 3% and 4% by weight of soil and standard proctor test were conducted on soil-lime mixtures. The CBR values of the soil and soil-lime mixtures are summarized in the respective tables. The variation of CBR value with percentage of lime is shown in Fig. 3and Fig.4.

CBR value of Plain soil: 1) Unsoaked= 4.48% 2) Soaked=1.24%

Table 3.1: CBR value of Soil-lime mixture UNSOAKED

Limecontent %	Curing period	Curing period of
	Of 3days	7 days
0	4.14	4.8
1	6.31	7.1
2	9.66	10.25
3	6.50	7.49
4	5.76	6.7

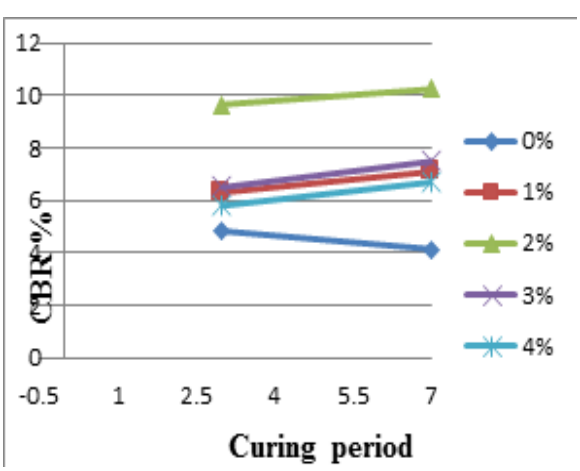

Fig 3.1 Variation of California bearing ratio (unsoaked) for curing period of 3 and 7 days on black cotton soil with the addition of lime.

Table 3.2: CBR value of Soil-lime mixture SOAKED

Lime content(%)	Curing period Of 3days	Curing period of 7 days
0	1.11	1.27
1	1.59	1.65
2	1.83	2.38
3	1.64	2.15
4	1.35	1.93

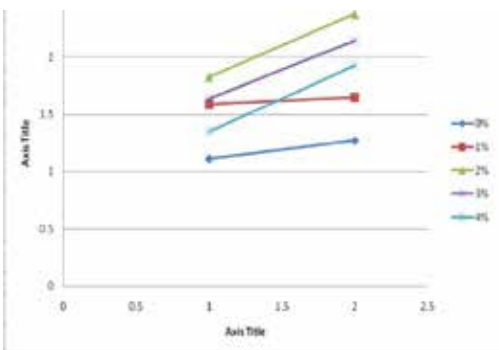

Fig 3.2 Variation of California bearing ratio (soaked) for curing period of 3 and 7 days on black cotton soil with the addition of lime.

4. CONCLUSIONS

Based on the experiments carried out on soil and lime mixtures, the following observations and conclusions are drawn:

The optimum moisture content as well as maximum dry density is found to decrease with the increase of the percentage of lime content.

ii. Lime mixed with soil showed enhancement in CBR value with adding up to 2 % and add more amount of lime to get more strength.

Deep foundations and raft foundations for structures on soil with low bearing capacity can be replaced by shallow foundation with soil stabilized by lime considered as a good binding material.

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