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STUDY ON STRENGTH CHARACTERISTICS OF CEMENT STABILIZED MOORUM SOIL

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Abstract: Soil stabilization is being done to improve the properties of locally available soils to make them suitable for required construction activity. Cement stabilization is one of the oldest methods of stabilization of soils to improve strength and reduce permeability. Most of the research on cement stabilization of soils is done which regards to volume stability, strength improvement in terms of unconfined compressive strength, bearing capacity and permeability. Present study, is intended to assess the suitability of locally available Moorum soil stabilized by cement for use as alternate to low grade conventional concretes. The present work is aimed to check the suitability of locally available moorum stabilized with cement of varying percentages from 0 to 12 in increments of 3% by weight of moorum. The strength characteristics of cement stabilized moorum can be assessed by conducting the california bearing ratio (CBR) test and direct shear test. The present study is also planned to asses the compressive strength of cement stabilized moorum by testing cubes of size 15cm×15cm×15cm after curing periods of 7,14 and 28 days and also laboratory investigation is planned to study the different engineering properties like compaction characteristics, permeability of moorum soil with and without stabilization.

1.INTRODUCTION

Soil stabilization is referred to as a procedure in which a special soil is proportioned or adding or removed, or a cementing material, or other chemical material is added to a natural soil material to improve one or more of its properties. One of the most common methods of stabilization includes the mixing of natural coarse-grained soil and fine-grained soil to obtain a mixture that develops adequate internal friction and cohesion and there by provides a material that is workable during placement but will remain stable further. Cement Stabilization is done by mixing pulverized soil and Portland cement with water and compacting the mix to attain a strong material. The material obtained by mixing soil and cement is known as soil-cement. The soil-cement becomes a hard and durable structural material as the cement hydrates and develops strength. The mechanism involved in the process of stabilization of soil by cement is not fully known. It is generally accepted that cement reacts with the siliceous soil to cement the

particles together. In 2 a soil-cement more of coarse-grained particles are cemented and the proportion of fine-grained soil cementation is small. The physical properties of soil-cement depend on the nature of soil treated, the type and amount of cement utilized, the placement and cure conditions adopted. Soil cement has been employed for many applications and in particular for the bases of roads and airfields.

2.LITERATURE REVIEW

Ramana Murthy et al. (2006) [9] studied the influence of cement stabilized moorum sub base and base course on load-deformation behavior of WBM test stretches. They concluded that total settlement is decreased by about 17%-36% and elastic settlement is decreased by 67%-72% for WBM stretches with cement treated moorum screening

Goecker et al.(2004) have studied about the stabilization of fine and coarse-grained soils with lime-fly ash admixtures, the evaluation of lime fly ash as an admixture for soil stabilization. They concluded that the properties of soil improved significantly with the addition of admixture

B.V. Venkatarama Reddy and A. Gupta (2004) have studied soil-cement blocks also known as compressed earth blocks or stabilized mud blocks are used for load bearing masonry. The study of various characteristics of soil-cement blocks using highly sandy soils through an experimental investigation. Characteristics of soil cement blocks having 3 different cement contents (6%, 8% and 12%) have been examined. The results indicate that there is 2.5 times increase in strength for doubling of cement content from 6%. Initial rate of absorption decreases drastically with the increase in cement content of the block.

3. EXPERIMENTAL INVESTIGATION

Index and engineering properties of Block Cotton Soil are examined with and with out adding cement at different percentages like 0 to 12% at different Curing Periods 7,14,21 and 28 days. Variation of OMC & MDD values and Compressive Strength of the soil is estimated by conducting the Modified Proctor Test and Cube Test.

4.RESULTS & DISCUSSION

By conducting the extensive laboratory investigation, the following results were obtained and indicated in the following table

Table 1: Index Properties of Soil

S.No	Engineering Properties	Values
1	Specific Gravity	2.67
2	Liquid Limit (%)	25
3	Plastic Limit (%)	NP
4	Grain Size Analysis (a) Gravel (%) (b) Sand (%) (c) Fines (%) (d) Coefficient of Uniformity (e) Coefficient Curvature	 36.3 54.7 9.0 26.4 1.1
5	IS Classification	GM-GC
6	Compaction Characteristics (a) Maximum Dry Density (g/cc) (b) Optimum Moisture Content (%)	 2.03 6.3
7	CBR value (%)	9.86
8	Coefficient of Permeability(cm/s)	2.18×10^{-2}

The properties of cement were determined by conducting the tests on OPC 53 grade cement.

Table 2: Properties of Cement

Property	Values
Normal Consistency	29%
Initial Setting Time	28min
Final Setting Time	9hr 10min
Specific Gravity	3.1
Fineness	93.6 %

The engineering properties of were determined by conducting the laboratory investigations on both unstabilized and cement stabilized soil samples.

Table 3: Engineering Properties of Unstabilized Soil

Property	Values
Compaction Characteristics (a) Maximum Dry Density (g/cc) (b) Optimum Moisture Content (%)	 2.03 6.3
CBR value (%)	9.86
Coefficient of Permeability(cm/s)	2.18×10^{-2}

4.1. EFFECT OF CEMENT ADDITION ON COMPACTION CHARACTERISTICS

The compaction characteristics have been determined by conducting IS heavy compaction tests on the Moorum stabilized by varying percentages of cement by weight (3, 6, 9 and 12). The O.M.C and M.D.D values obtained from the tests are presented below

Table:4 Variation of Compaction Characteristics with Different % of Cement

S.No	Cement Content (%)	Optimum Moisture Content (%)	Maximum Dry Density(g/cc)
1	3	6.5	2.16
2	6	8.6	2.19
3	9	9.2	2.26
4	12	10.3	2.31

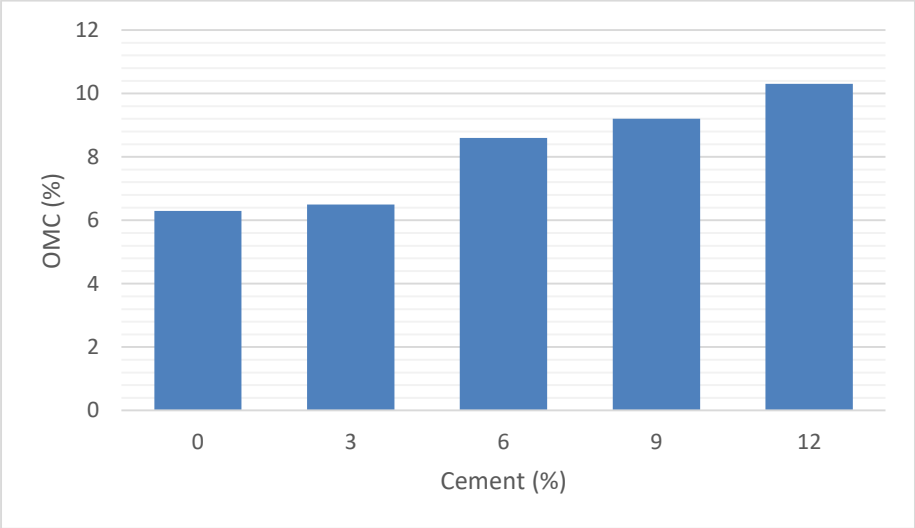


Fig 1: Variation of OMC with Percentage of Cement

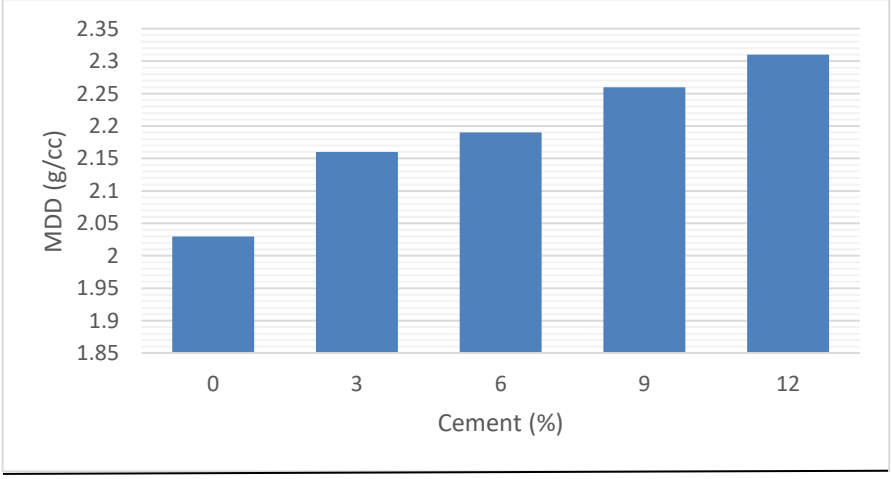


Fig 2: Variation of MDD with Percentage of Cement

4.2 EFFECT OF CEMENT ADDITION ON STRENGTH CHARACTERISTICS

Compressive strength of cement stabilized Moorum is evaluated by testing cubes of size 15cm×15cm×15cm. The cubes are cast using Moorum stabilizedwith3%, 6%, 9% and 12%cement by weight. The cubes are tested after curing period of 7days, 14days and 28 days. The test results are presented below.

Table 5: Compressive Strengths of Cement stabilized Moorum Cubes

S.No	Cement Content (%)	Compressive Strength of Cubes (N/mm^2)		
		7 days	14days	28 days
1	3	0.6	1.11	2.07
2	6	3.92	5.03	6.96
3	9	7.77	9.185	12.59
4	12	10.8	12.74	16.29

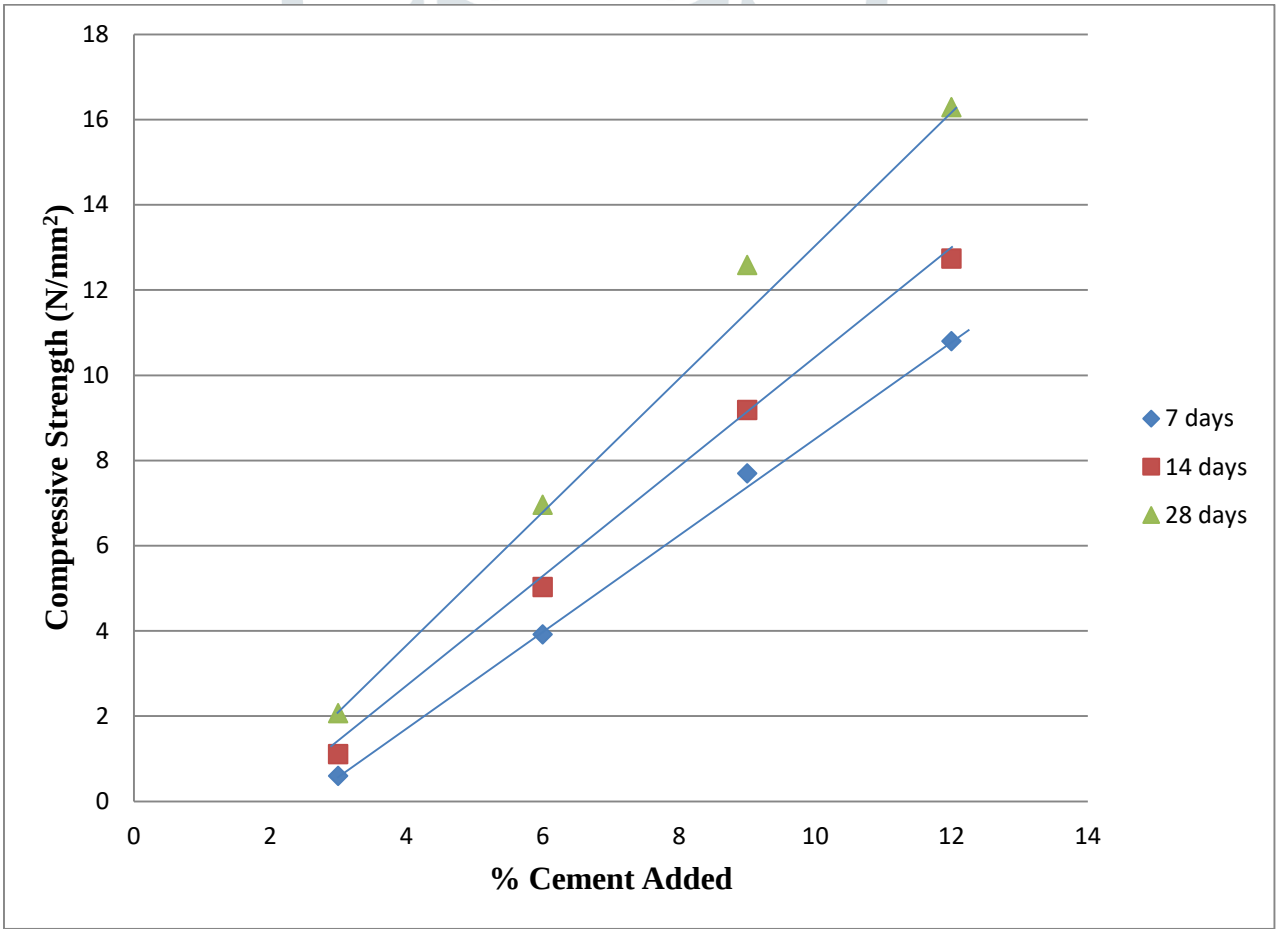


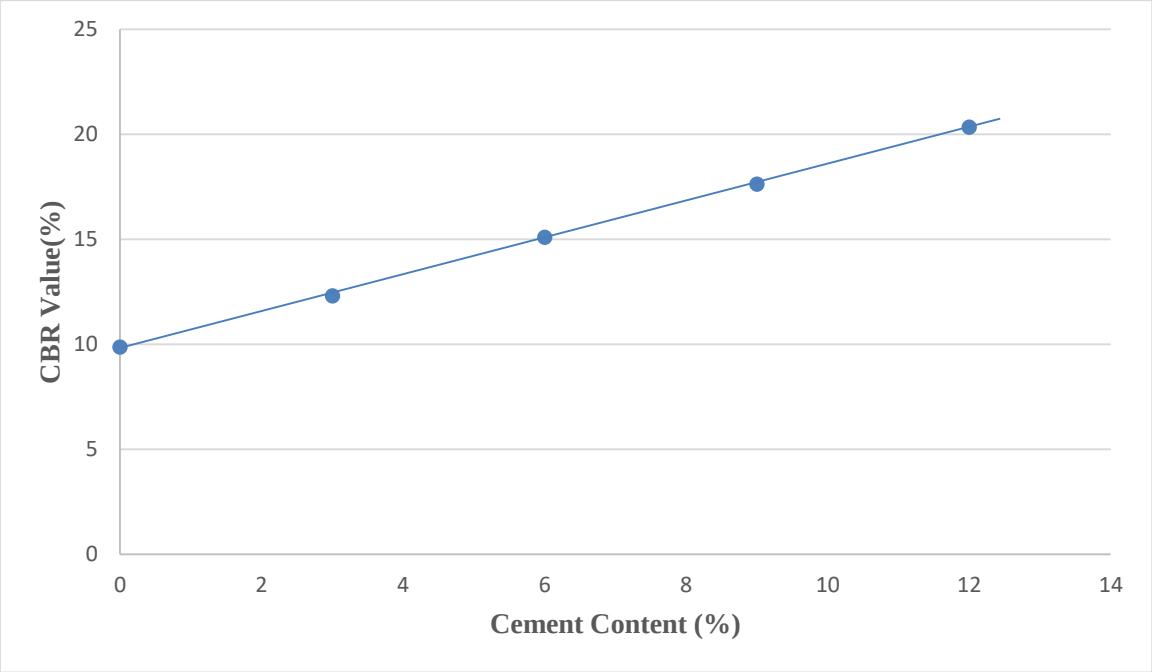
Fig 3: Variation of compressive strengths of Cubes with Increase in % Cement and Curing Period

5. CALIFORNIA BEARING RATIO TEST

The strength of cement stabilized Moorum is also evaluated in terms of C.B.R. C.B.R test have been performed using specimen prepared by compacting cement stabilized Moorum at respective O.M.C and M.D.D. The specimens are tested after a curing period of 7 days. The results of C.B.R tests are presented below.

Table 6: California Bearing Ratio Values of Cement Stabilized Moorum

S.No	Cement content (%)	Optimum Moisture Content (%)	Days	CBR value (%)
1	0	6.3	7	9.86
2	3	6.5	7	12.3
3	6	8.6	7	15.1
4	9	9.2	7	17.63
5	12	10.3	7	20.34



California Bearing Ratio Values of Cement Stabilized Moorum

6. CONCLUSIONS

Based on the results presented in this study, the following conclusions are drawn:

- The compressibility of Moorum decreases with increase in percentage of cement addition.
- The compaction characteristics both O.M.C and M.D.D increase with increase in percentage of cement added to the Moorum.
- The compressive strength of cement stabilized Moorum increases linearly with increase in percentage of cement used for stabilization.
- The strength of cement stabilized Moorum increases with curing period.

- The compressive strength of cement stabilized Moorum cubes with 7% and 9% cement have strengths equals to strengths of M7.5 and M10 grade concrete cubes.
- The C.B.R values of Moorum treated with cement increase significantly.
- The amount of cement required for modifying the Moorum as sub base material is only 3%.

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