

Study on Strength Characteristics of Cement Stabilized Rock Flour

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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 with regards to volume stability, and strength improvement in terms of unconfined compressive strength, bearing capacity and permeability. The present study is intended to assess the suitability of locally available Rock Flour soil stabilized by cement for use as an alternative to low-grade conventional concretes. The present work aims to check the suitability of locally available flour stabilised with cement at varying percentages from 0 to 12 in increments of 3% by the weight of the rock flour.

I. 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. 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 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

Shanker and Ali (1992) have studied engineering properties of rock flour and reported that the rock flour can be used as alternative material in place of sand in concrete based on grain size data.

Rao et al. have reported that the sand can be replaced fully with rock flour. However, a slight loss in workability has been noticed with increase in replacement of sand by rock flour.

Sahu A. K. et.al (2003) reported significant increase in compressive strength, modulus of rupture and split tensile strength when 40 percent of sand is replaced by Quarry Rock Dust in concrete.

3. DETAILS OF THE STUDY

To determine the properties of the locally available rock flour soil with and without stabilizing with the different percentages of cement as per the IS code of practice

Table 1 Properties of Rock Flour

S.No	Engineering Properties	Values
1	Specific Gravity	2.64
2	Liquid Limit (%)	NP
3	Plastic Limit (%)	NP
4	Grain Size Analysis	
	(a) Gravel (%)	11.0
	(b) Sand (%)	84.1
	(c) Fines (%)	5.0
	(d) Coefficient of Uniformity	13.8
5	(e) Coefficient of Curvature	1.02
	IS Classification	SW

6	Compaction Characteristics	20.0
	(a) Maximum Dry Density (KN/m ³)	
7	(b) Optimum Moisture Content (%)	8
	CBR value (%)	8.66
8	Coefficient of Permeability(cm/s)	6.524×10 ⁻³

Table 2 Properties of Cement

S.No	Property	Value
1	Specific Gravity	3.1
2	Fineness (%)	93.6
3	Consistency (a) Normal Consistency (%)	29
	(b) Initial Setting Time.	28 minutes
	Final Setting Time.	9hr 10minutes
4	Compressive Strength (Mpa) at 3 days	28.2
	at 7 days	34.1

4. EFFECT OF CEMENT ADDITION ON COMPACTION CHARACTERISTICS

The compaction characteristics have been determined by conducting IS heavy compaction tests on the Rock Flour 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.

Table 3 Variation of OMC & MDD with % of Cement

S.No	Cement Content (%)	Optimum Moisture Content (%)	Maximum Dry Density(kN/m ³)
1	3	6.5	21.6
2	6	8.6	21.9
3	9	9.2	22.6
4	12	10.3	23.1

Table 4 Variation of Compressive Strength with % of Cement

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

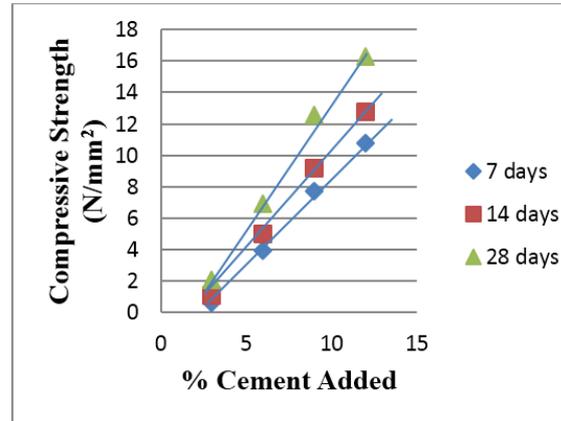


Fig 1: Variation of Compressive Strength with % of Cement

5. CALIFORNIA BEARING RATIO TEST

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

Table 5 Variation of CBR Values with % Cement

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

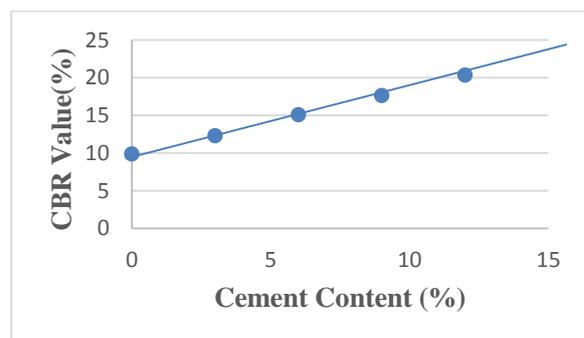


Fig2: Variation of CBR With % of Cement

6. CONCLUSIONS

By Conducting extensive laboratory investigations on Rock Flour with and without adding the cement, the following conclusions were drawn.

- The compressibility of Rock Flour 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 Rock Flour.
- The compressive strength of cement stabilized Rock Flour increases linearly with increase in percentage of cement used for stabilization.
- The strength of cement stabilized Rock Flour increases with curing period.
- The compressive strength of cement stabilized Rock Flour 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 Rock Flour treated with cement increase significantly.

7. REFERENCES

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