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Effect of chemical admixtures on the Engineering Properties of Red earth treated with cement.

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Abstract:*In the present study an attempt has been made to compare the variation of Atterberg limits on mixing the admixtures with red earth soil. The paper describes a study on the effect of chemical admixtures fly ash were used. The variation of index properties of non expansive soil were studied. The amounts cement and fly ash added to the sample, as a percentage of the dry soil mass was in the range of 5-10% and 10-30% respectively. The results of the study show that the addition of the chemical admixture can improve the engineering properties of soil. The soil liquid limit is found to decrease with an increase in cement and fly ash content while the soil void ratio is found to decrease with increase in admixtures.*
Key words*: agglomeration, flocculation, cement, fly ash*

I. Introduction:

Red earth is a non expansive soil having Kaolinite as primary clay mineral and it is abundantly available natural soil in vast areas in Karnataka. Fly ash is an industrial by product produced in large quantities from thermal power plant whose disposal is of major environmental concern. In recent years there is an increase in trend to utilise the fly ash mixed with some proportions of quarry dust for geotechnical applications. Stabilisation is found to be one of the effective methods to improve the engineering properties of soils. Soosan et al(2005) [1] investigated that the addition of quarry dust in two different type of cohesive soils viz kaolinite and Cochin marine clay resulted in the improvement of compaction properties and CBR values. A similar approach has been made to use industrial waste fly ash for ground improvement technique to solve the environmental pollution problems. With these objectives studies have been taken to assess the suitability of fly ash along with stone dust and cement treated soils for improving the engineering properties of red earth for different proportions of the admixtures.

II. Materials and Methods.

2.1 Materials:

2.1.1 Red earth.

The red earth was collected at a depth of 1.5 meters below the natural ground level at Bangalore University, jnanabharathi campus, Bangalore, India. Red earth is typically non- expansive clayey soil containing Kaolinite as its chief mineral constituent. To ensure the uniformity of the soil sample it was oven dried, pulverised and sieved through 425 micro meter sieve before used in the present investigation.

2.1.2 Stone dust:

The stone dust for the present study was obtained from the nearby crusher having the specific gravity of 2.56. The stone dust used was oven dried, pulverised and sieved through the IS sieve 425 micrometer for the analysis of Atterberg limits.

2.1.3 Fly ash:

The fly ash is one of the waste products obtained from the Raichur thermal power plant. It was air dried pulverised and passed through 425 micrometer sieve before used for present investigation. The physical properties of the various admixtures used are presented in table 1.

Table 1: index properties of red earth, fly ash and stone dust.

Properties	Values		
	Red earth	Fly ash	Stone dust
Colour	Brick red	Pale gray	Gray
Specific gravity	2.39	2.08	2.56
Liquid limit(%)	28	24.38	-
Plastic limit (%)	21	-	-
Shrinkage limit (%)	19	-	-
Maximum dry density (kN.m^3)	17.3	16.2	19
OMC (%)	15.12	20	22

Table 2: chemical properties of Red earth. (soil chemical analysis by P R Hesse)

Chemical composition	Percentage
Silicon dioxide	60.4
Alumina	15.05
Iron oxide	6.6
Titanium dioxide	0.2
Calcium oxide	6.9
Magnesium oxide	1.7
Potassium oxide	0.4
Loss on ignition	8.4
Sodium oxide	0.3

2.2 Methodology adopted.

2.2.1 Specific gravity: The specific gravity were determined for various proportions of red earth mixed with stone dust and cement, red earth mixed with fly ash and cement.

2.2.2 Compaction.

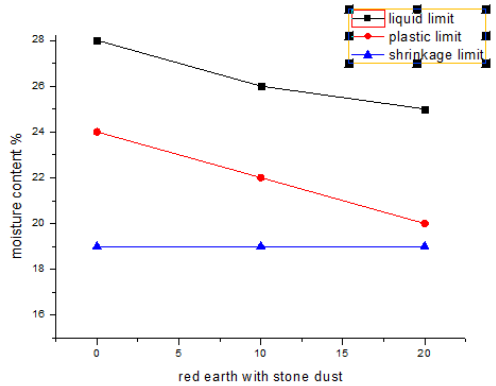
The compaction tests were carried out on red earth and stone dust mixture along with some percentages of fly ash and cement. The compaction tests were conducted using mini compaction test apparatus as per the procedure of (Sridharan and Sivapullaiah 2005)[6].

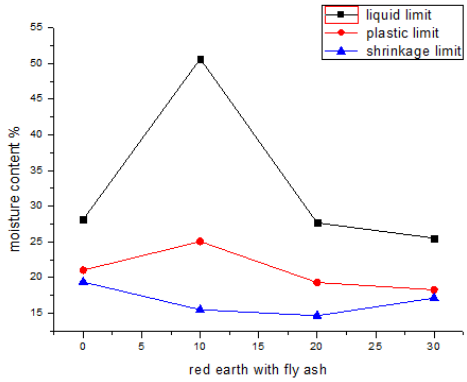
2.2.3 Atterberg limits:

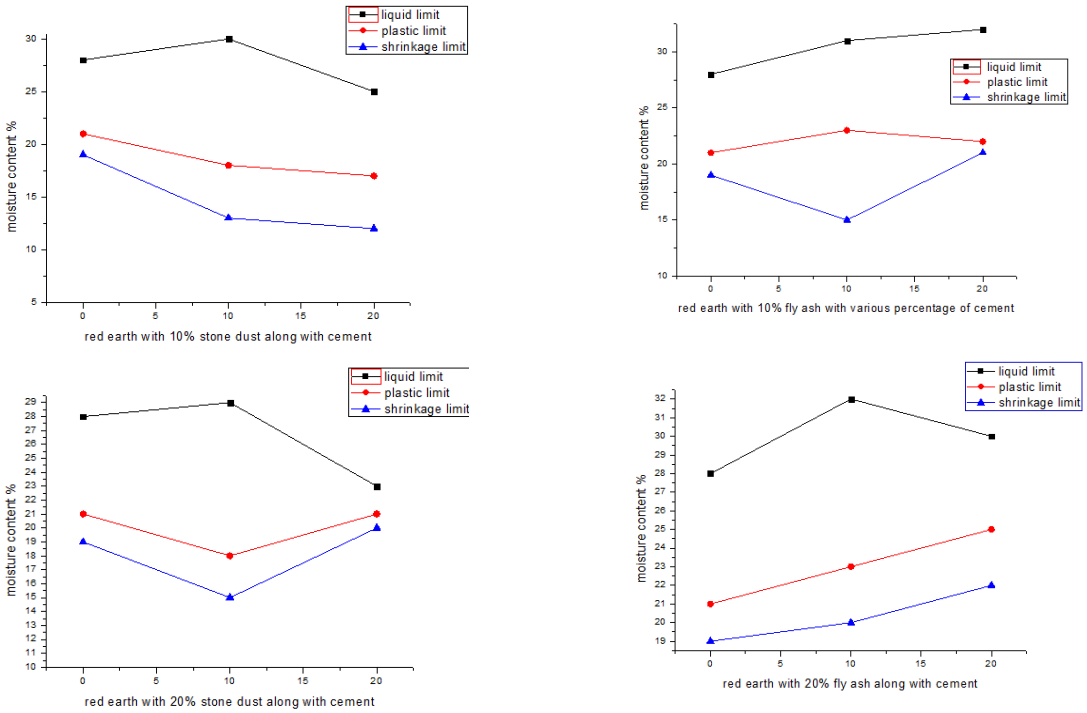
The Atterberg limits were determined for various proportions were carried out on red earth and stone dust mixed with some percentage of fly ash and cement. Through the tests it has been found for the immediate effect that Red earth mixed with various percentages of stone dust and cement was found to decrease with increase in percentage of admixtures.

III. Results and Discussions.

The graphs show the effect of fly ash and stone dust mixed with some percentage of cement on different physical properties of red earth. Atterberg limits play an important role in soil identification and classification. It is known that addition of fly ash can reduce the thickness of the diffuse double layer of soil which cause flocculation of the particles and increase the coarser particles content by substitute finer soil particles with coaerser fly ash particles. (Shivapullaiah et al. 1996).







Variation of Atterberg limits with red earth- stone dust, red earth- fly ash mixed with cement.

IV. Conclusions:

From the above graphs the following conclusions may be drawn:

1. Addition of stone to red earth decreases the aterberg limits where as addition of fly ash to red earth increases the Atterberg limits, this is due to binding obtained through the fly ash content.
2. Addition of 10% cement content to the red earth stone dust mixture, it has been found that there is considerable increase in liquid limit, where as there is decrease in plastic and shrinkage limit. This is due to the fact that there is pozzolonic activity between cement and red earth stone dust mixture.
3. Addition of 10% cement content to The red earth fly ash mixture, it hasbeen found that there is considerable increase in liquid limit, where as there is increase in plastic and shrinkage limit. This is due to the fact that there is activity between fly ash and red earth stone dust mixture.

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