Stabilization of Red Soil using Lime and Fly Ash

Aravind.V.
Assistant Professor,
Nandha College Of Technology, Erode-638052, Anna university, Chennai, Tamil Nadu, India.

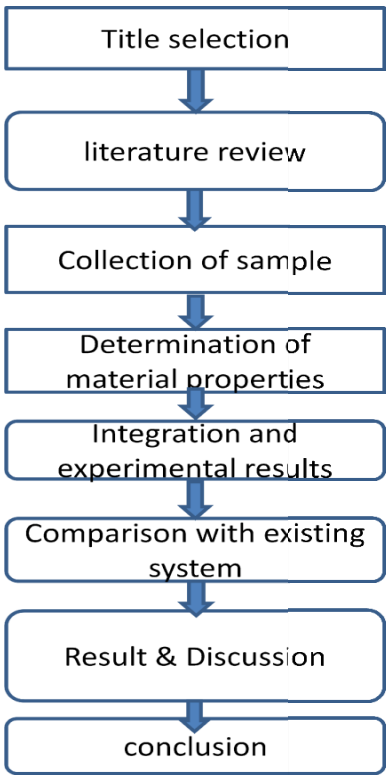
Boobesh. A, Gnanamanikandan. K,
Jawahar Sundhar. A Raman.P,
PG Students, Department of civil Engineering ,
Nandha College Of Technology, Erode-638052, Anna university, Chennai, Tamil Nadu, India.

Abstract: Soil stabilization has become the major issue in construction activity. In this project we focus on the improvement of engineering properties of soil using lime and flyash. The aim of present investigation is to check if lime and fly ash are good for stabilization and its emphasis depend upon the effective utilization of lime and flyash with a view of decreasing the construction cost. It enhance the engineering properties in case of pavement and earthen slope.

INTRODUCTION

Stabilization is the process of blending and mixing materials with a soil to improve certine properties of soil.Additive stabilization is achieved by the addition of proper percentage of cement,lime,flyash, etc.Stabilization process that result in improvement of some properties of soil for improved constructability but does not provide the design with a significant increase soil strength and durability. In the presence of moisture ,fly ash react with lime at ordinary temperature and form a compound possessing cementitious properties.The reaction between lime and fly ash produce calcium silicate hydrates which are responsible for development of strength in fly ash,lime in the form of bricks and blocks.

METHODOLOGY



MATERIAL PROPERTIES

RED SOIL: Red soil is a type of soil that develope in a warm temp moist climate inder deciduous forest, improvement of some properties of soil for improved constructability but does not provide the design with a having thin orginaic and in- organic mineral layers overlying a yellowish brown leached layer resting on alluvium red layer. Red soil generally derived from crystalline rock. They are usually poor growing soils , low in nutrians and humus and diffcult to cultivate because of its low water holding capacity. In india covering a area of 3.5 lakhs sq.km and 10.6% of india's area

Table 1:Properties of red Soil

Sl. No.	Property / Parameter	For red Soil
1	Specific Gravity	2.65
2	Grain size an lysis	
	% of gravel	0.2
	% of sand particles	54.43
	% of silt size particles	30.26
	% of clay size particles	15.11
3	Atterberg"s limits	
	Liquid limit	26.80
	Plastic limit %	25.40
	Shrinkage limit %	26.78
4	Plasticity ind x	15.40
6	Free swell	15%
7	Compaction haracteristics	
	Max. dry density (g/ cc)	1.48
	Optimum Moisture content (OMC) in %	26.36

RESULTS AND DISCUSSION

Specific Gravity Values for Soil and Fly Ash (FA) Mixes:

The results presented in this table indicate that there is very small variation in specific gravity of the soil - fly ash mixes. This may be due to the fact that the specific gravity of fly ash is also close to that of Redsoil used in this study.

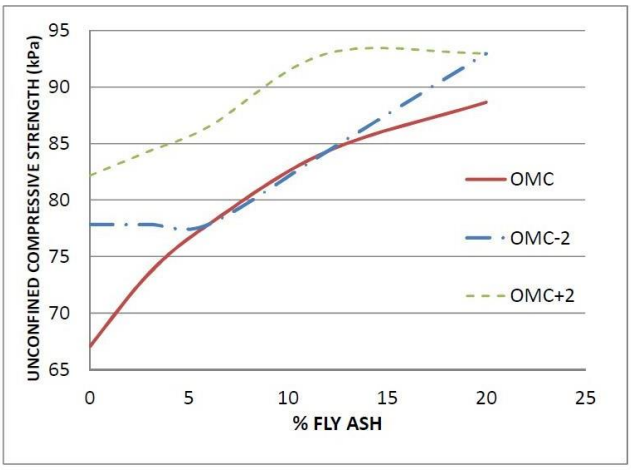
Unconfined Compression Test : Unconfined compression tests were carried out on proportion mix of soil and fly ash for three different moisture contents at OMC-2%, OMC and OMC+2%, to determine the unconfined compressive strength (Cu) and the stress-strain modulus (Es). For specimens tested with water contents of OMC+2%, there is a steep increase in unconfined compressive strength at 3% fly ash content. Thereafter the strength increased with a decreasing rate. Specimens prepared at water contents equal to OMC showed a steady increase in unconfined compressive strength with increasing fly ash

content. Specimens prepared and tested at water contents of OMC-2% also showed a similar tendencyFigure 1: Variation of MDD and OMC w.r.t. percentage of fly ash.

Unconfined Compression Test : Unconfined compression tests were carried out on proportion mix of soil and lime for three different moisture contents at OMC-2%, OMC and OMC+2%, to determine the unconfined compressive strength (Cu) and the stress-strain modulus (Es). For specimens tested with water contents of OMC+2%, there is a steep increase in unconfined compressive strength at 6%lime content. Thereafter the strength increased with a decreasing rate. Specimens prepared at water contents equal to OMC showed a steady increase in unconfined compressive strength with increasing lime content. Specimens prepared and tested at water contents of OMC-2% also showed a similar tendency.

Figure 3: Variation of MDD and OMC w.r.t. percentage of lime.

Figure 2:Variation of Unconfined Strength with Increasing Fly Ash.



Specific Gravity Values for Soil and Lime Mixes:

The results presented in this table indicate that there is variation in specific gravity of the soil - fly ash mixes. This may be due to the fact that the specific gravity of lime is also little close to that of use redsoil in this study.

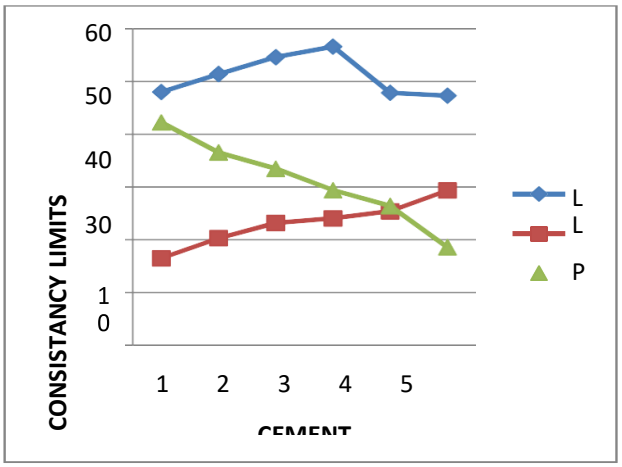
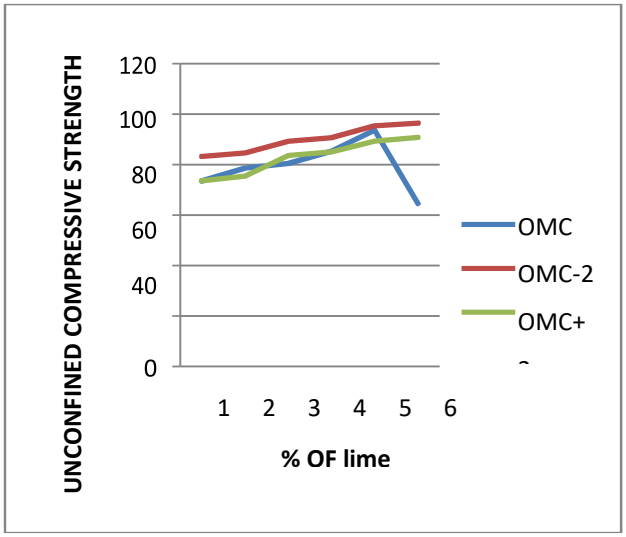


Figure 3:Variation of Unconfined Strength with Increasing lime.

Soil+0% FA	Soil+3% FA	Soil+6% FA	Soil+12% FA	Soil+20% FA
2.63	2.68	2.75	2.78	2.82



CONCLUSIONS

1. Addition of fly ash to the silt has shown no significant change in specific gravity values of the mixtures.
2. Addition of a small percentage of fly ash (about 3%) increases plasticity characteristics of silty soil. However increasing ash content tends to decrease plasticity properties. Higher percentage of ash content shows reduction in plasticity of soil. This is undesirable since higher percentage of fly ash failed to render the silty soil binding properties.
3. From this experimental work it may be concluded that fly ash is not very effective stabilizer to stabilize in ease of silty soil. This may be due to the following reasons
    1. Both silt and ash have similar grain sizes and specific gravity.
    2. Both materials are either non-plastic or low plastic.
    3. Similar grain size distribution failed to impart friction.
4. Addition of cement to the silt has shown significant change in specific gravity values of the mixtures.
5. Addition of a small percentage of fly ash (about 6%) increases plasticity characteristics of silty soil. It has higher percentage of cement to binding with silty soil properties.
6. From the experimental work it may be concluded that cement is an effective method of stabilize in ease of silty soil. This may due high comperssive strength.

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