EFFECT OF FLYASH ON THE ENGINEERING PROPERTIES OF SOIL

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Abstract- Stabilization incorporates the various methods employed for modifying the properties of a soil to improve its engineering performance. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials. With addition of flyash in the soil, the index properties found to be improved. It is found that the optimum moisture content decreases while maximum dry density increases. The unconfined compressive strength of the soils increases upon the addition of fly ash.

Keywords- Flyash, Properties, Improve, Performance, Stabilization.

I. INTRODUCTION

One of the common approaches of subgrade stabilization is to remove the soft soil, and replace it with a stronger material of crushed rock. The high cost of replacement has caused highway agencies to evaluate alternative methods of highway construction on soft subgrades (Senol et al. 2006). Pavement performance can be largely attributed to the performance of its foundation, which is comprised of the subgrade and base layers. Base and subgrade layers must provide enough shear strength, stiffness modulus, resistance to moisture, stability and durability (Texas 2005).

Chemical stabilization relies on the use of an admixture to alter the chemical properties of the soil to achieve the desired effect. Stabilisers can be divided into (1) traditional stabilizers - hydrated lime, portland cement, and fly ash (2) byproduct stabilizers - cement kiln dust, lime kiln dust, and other forms of byproduct lime and (3) nontraditional stabilizers - sulfonated oils, potassium compounds, ammonium chloride, enzymes, polymers, and so on (Petry et al. 2002).

Stabilizing the subgrade with an appropriate chemical stabilizer increases subgrade stiffness and reduces expansion tendencies, it performs as a foundation.

II. OBJECTIVE OF STUDY

The objectives of the present experimental study are
i. To determine the properties of the local soil collected from the campus
ii. To evaluate the performance of the sample when stabilized with flyash as an admixture and its suitability.

III. SAMPLE PREPARATION

The samples used in the study are prepared by blending the soil with different percentage of flyash. The soil is oven dried after removing impurities like vegetation, impurities etc.

The oven dried soil and flyash (10 %, 15 %) are mixed in proportions by weight to form various mixes. The formed dry mixes are being blended together with water in order to get a homogenous blend. Different laboratory tests were performed in laboratory as per IS codes.

IV. MATERIALS AND PROPERTIES

4.1 Soil gradation and flyash properties
The distribution of different grain sizes affects the engineering properties of soil. Grain size analysis provides the grain size distribution, and it is required in classifying the soil.

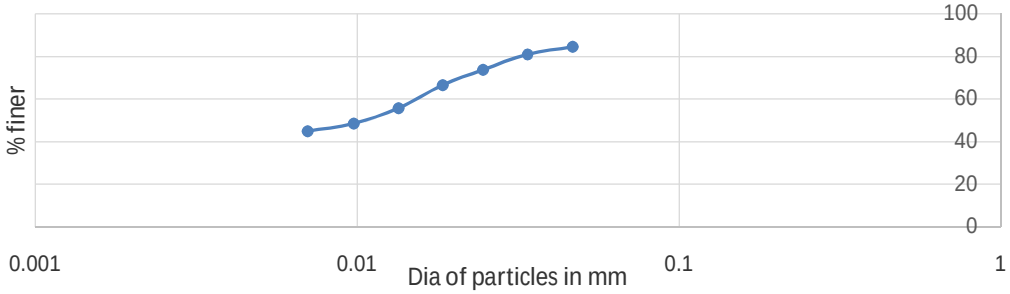


Fig. 1. Grain size distribution curve

The engineering properties of flyash is given in table 1.

Table 1 Engineering properties of Fly ash

S.no.	Parameter	Range
1.	Specific gravity	1.90-2.55
2.	Plasticity	Non plastic
3.	Maximum dry density (gm/cc)	0.9-1.6
4.	Optimum moisture content (%)	38-18
5.	Cohesion (kN/m^2)	Negligible
6.	Angle of internal friction (j)	$30^0 – 40^0$
7.	Coefficient of consolidation $C_v(cm^2/sec)$	$1.75 \times 10^{-5} – 2.01 \times 10^{-3}$
8.	Compression index C_c	0.05-0.4
9.	Permeability (cm/sec)	$8 \times 10^{-6} – 7 \times 10^{-4}$
10.	Particle size distribution (% of materials) a. Clay size fraction b. Silt size fraction c. Sand size fraction d. Gravel size fraction	 a. 1 – 10 b. 8 – 85 c. 7 – 90 d. 0 – 10
11.	Coefficient of uniformity	3.1-10.7

V. EXPERIMENTATION AND ANALYSIS

5.1 Effect of addition of fly ash on liquid limit

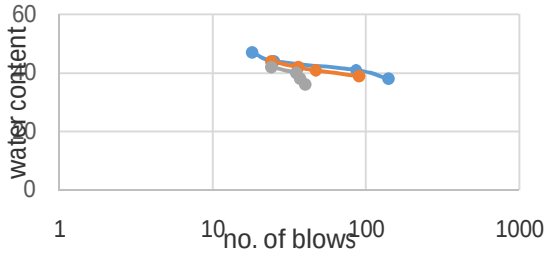


Fig. 2. Comparison of Liquid Limit of samples

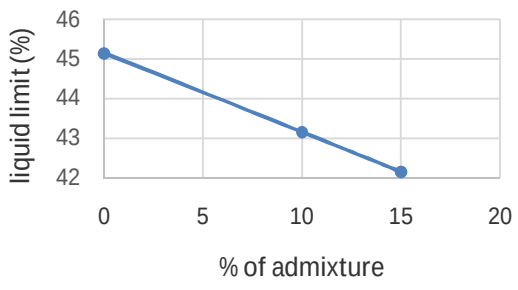


Fig. 3.Variation of liquid limit with fly ash

It can be seen from Fig 2 & Fig 3 that with increasing fly ash content liquid limit decreases.

5.2. Effect of Addition of Fly ash on Plastic Limit

Increased addition of fly ash with soil, the amount of soil to be flocculated decreases and the finer particles of fly ash may be incorporated in the voids of flocculated soil ; thereby decreasing the water held in the pores leading to the decrease in the plastic limit.

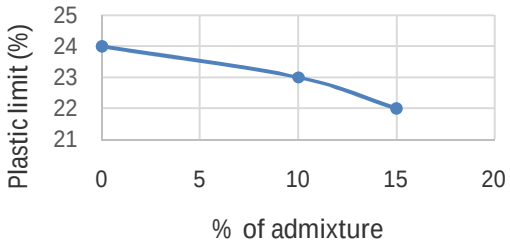


Fig. 4. Variation of plasic limit with fly ash

5.3 Effect of Addition of Fly ash on Compaction parameters of Soil

This test is done to determine the maximum dry density and the optimum moisture content of soil using light compaction as per IS: 2720 (Part 8) – 1983.

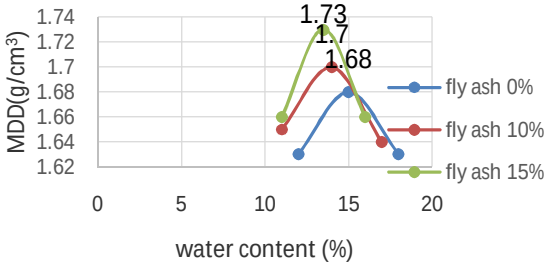


Fig. 5. Comparison of MDD of the samples

Fig 5. shows that Maximum dry density increases with increase in Fly Ash content with highest value for 15% Fly Ash. shows that with addition of fly ash OMC decreases

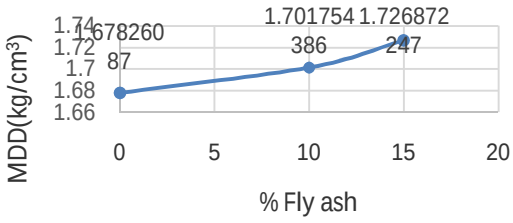


Fig 6. Variation of MDD with fly ash

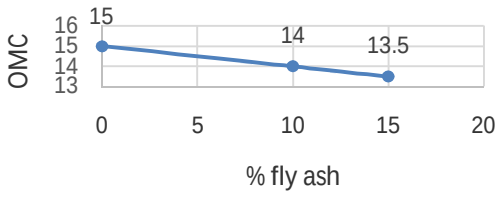


Fig 6 Variation of OMC with fly ash

Fig 5.4-3 shows that with addition of fly ash OMC decreases

5.4 Effect of Addition of Fly ash on Specific gravity of soil Specific gravity of the soil grains is an important property and is used to determine the voids ratio, porosity, and degree of saturation if density and water content are known.

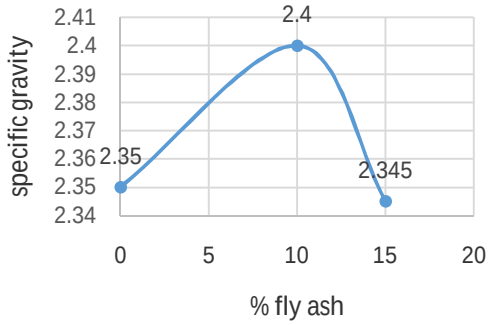


Fig 7 Variation of specific gravity with fly ash

5.5 Unconfined Compression Test

The Unconfined Compression Test is a laboratory test method that is used to assess the mechanical properties of rocks and fine-grained soils. It provides a measure of the undrained, unconfined compressive strength as well as the stress-strain characteristics of rock, soil or other material specimen. This test provides the most direct means of determining a material's strength and is often included in the laboratory testing program of geotechnical investigations, especially when dealing with rocks. In general, the test can be conducted on rock samples or on undisturbed, reconstituted or compacted cohesive soil samples.

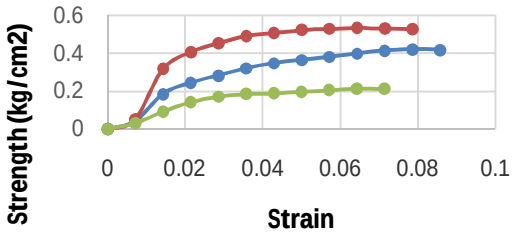


Fig 8. Variation of Unconfined Compressive Strength with Fly ash Content

CONCLUSION

- The Liquid limit is decreasing with increase in the amount of flyash.
- Shrinkage limit is increasing with the increase in the percent of flyash.
- The Plasticity Index is gradually decreased.
- With addition of flyash in the soil, the index properties are improved.
- The optimum moisture content decreases and Maximum dry density increases
- The unconfined compressive strength of these soils increases upon the addition of fly ash.

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