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CHARACTERISTICS OF EXPANSIVE SOIL USING FLY ASH

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Abstract : Expansive soils cause severe issues in the practice of civil engineering because they swell and contract under moisture content fluctuations. This alternative swelling and shrinkage makes it impossible to rely on transportation and other buildings. These clays ability to swell can be successfully reduced by fly ash treatment, which can also stop swell from occurring beneath minor foundation stresses. This paper presents the study of the stabilization of expansive soil by by addition of 10%, 15%,20%,and 25% of Fly Ash as per weight of the total soil sample. Swell pressure and swell tests are conducted on the samples compacted at optimum moisture content by standard Proctor test. The significant variation in Liquid Limit, Plasticity Index also has been found Samples with fly ash caused a decrease in Liquid limit, plasticity index, swell pressure and thus swell percentage decrease substantially**.**

IndexTerms **– Expansive Soil,Fly ash , Standard Proctor test, Swell pressure**

I. INTRODUCTION

Stabilizing expansive soil using additives that prevent volume changes or appropriately changing the expansive soil's volume change characteristics are two ways to regulate the volume changes of expansive soil. Under footings and the subgrade, expansive soils have been stabilized with fly ash to relatively shallow depths. Fly ash, a byproduct of coal combustion produced in power plants, is the admixture used in these studies. Usually, it is treated as a waste that has to be disposed of in the same way as municipal waste materials. Power plant fly ash makes up an enormous component of industrial trash. In order to determine whether fly ash may be used as an engineering material in a range of construction applications, such as fills, concrete, and liners, there has been extensive research done in this area. Under ionized situations, fly ash can offer a sufficient variety of divalent and trivalent cations (Ca2+, Al3+, Fe3+, etc.) that may encourage flocculation of dispersed clay particles. As a result, the sample surface area and water affinities decrease, which implies that the swell potential is also reduced. Therefore, the use of fly ash in cations exchange could potentially efficiently stabilize expansive soils. This method of utilizing fly ash has the additional advantage of reinventing a by-product of industrial waste without significantly harming the environment or possible land usage.

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II. MATERIALS USED

BENTONITE

The expansive soil used for experimental work has been collected from Thiruvanthapuram city, The basic physical properties of the soil have been listed in Table1.Soil is classified as fine grained soil, which has been further classified as CH According to IS: 1498-1970, the degree of expansion has been classified as high to very high.

Table 1: Properties of bentonite

Properties	Values
Liquid Limit, *LL* (%)	380
Plastic Limit, PL (%)	80
Plasticity index, PI (%)	300
Shrinkage Limit, SL (%)	18.34
Specific gravity, G	2.62
FSI	90%

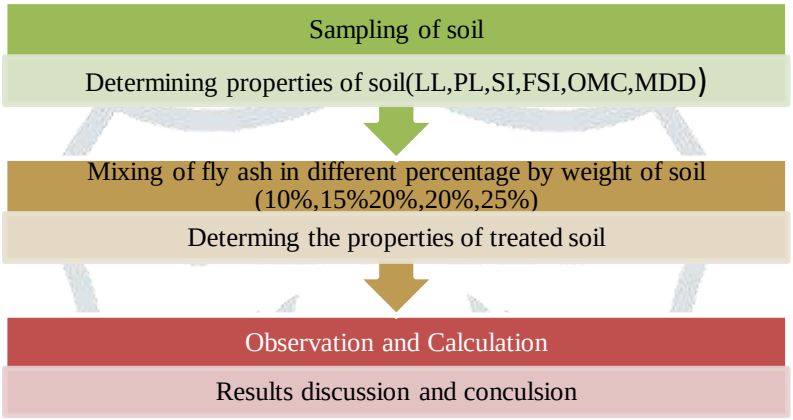
FLY ASH

Fly ash for the present study has been supplied by India Mart

Table 2: Properties of Fly ash

Properties	Values
Liquid Limit, *LL* (%)	Non- Plastic
Plastic Limit, PL (%)	
Plasticity index, PI (%)	
Shrinkage Limit (%)	Vary with initial water content
Specific Gravity	2.02
OMC (%)	35
MDD (kN/m^3)	12.60

III. RESEARCH METHOLOGY



IV. RESULT AND DISSCUSSION

3.1 Free Swell Index (FSI)

Figures 1 present the variation in of FSI with the addition of fly ash. From Figure 1, it is observed that the FSI values of the expansive soil have decreased with the increase in percentage of fly ash. The clay is replaced as the admixture content improves, which leads to less swelling and shrinkage of the admixture-treated clay. From the test results, it is observed that at at 25% addition of fly ash, there is a 55% reduction in FSI

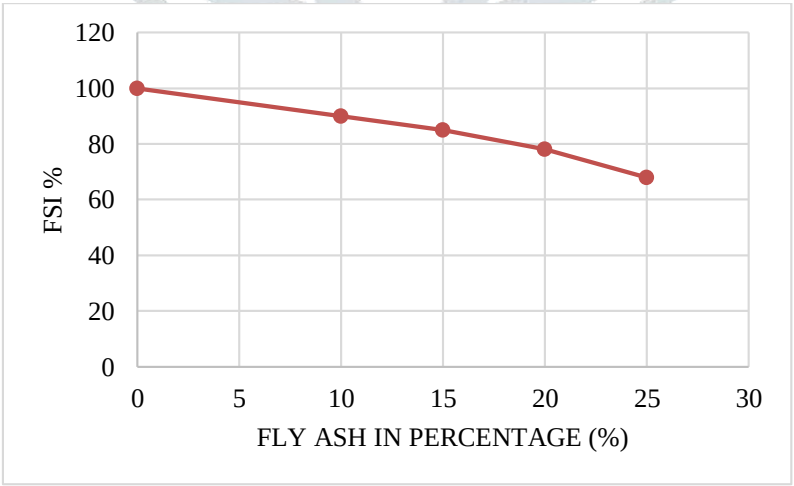


Fig 1:Influence of fly ash on soil

3.2 Liquid limit and Plastic Limit

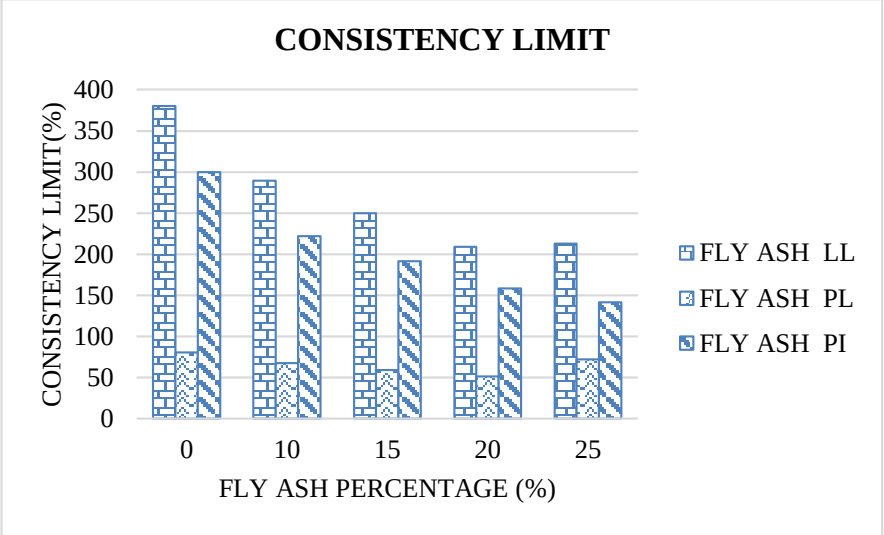


Fig 2:Influence of fly ash on liquid limit,plastic limit

From Figure2,it is observed that as the percentage of Fly Ash increases ,there is marked reduction in Liquid Limit and Plastic Limit of soil tested. After the addition of 20% Fly Ash, the soil's Liquid Limit first reduces and then rebounds which is due to the effect of reduction in the diffused double layer thickness as well as effect of dilution

3.3 Shrinkage Limit

As can be seen from Fig.3, The limit of soil shrinkage becomes greater by the addition of fly ash. It increased as the proportion of fly ash increases. When additional fly ash is added, a gradual rise becomes obvious and reaches up to 60%.. The increase in the shrinkage limit is mainly due to flocculation of clay particles

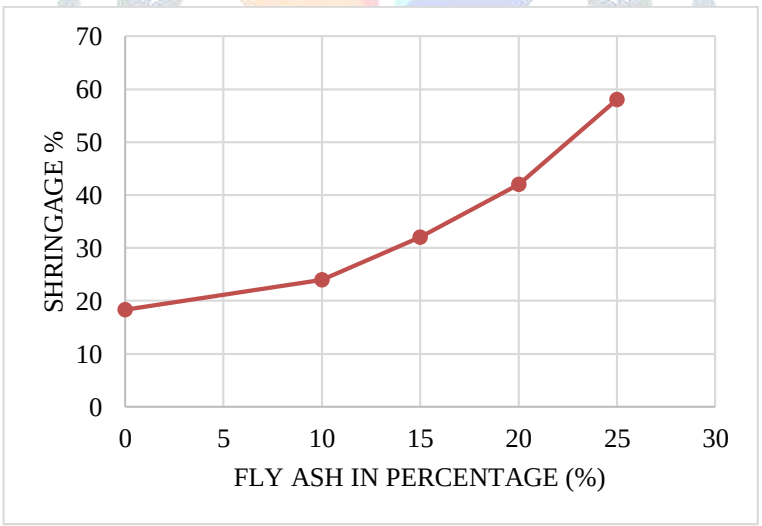


Fig 3:Influence of fly ash on shrinkage

3.4 OMC AND MDD

Figure 4 and 5 shows the variation of the Optimum Moisture Content(OMC) and Maximum Dry Density(MDD) of Soil with fly ash content .It depicts that the Optimum moisture content of the soil has decreased from 25% to 18% with 20% with inecrease in OMC with further addition of fly ash. The higher void ratio in soil mixtures developed by the coarser grain size of fly ash as compared to natural soil may be that caused the increase in OMC.The MDD has increased from 1.3 g/cc to 1.7 g/cc for 20% Fly Ash with further decrease in MDD with addition of Fly Ash

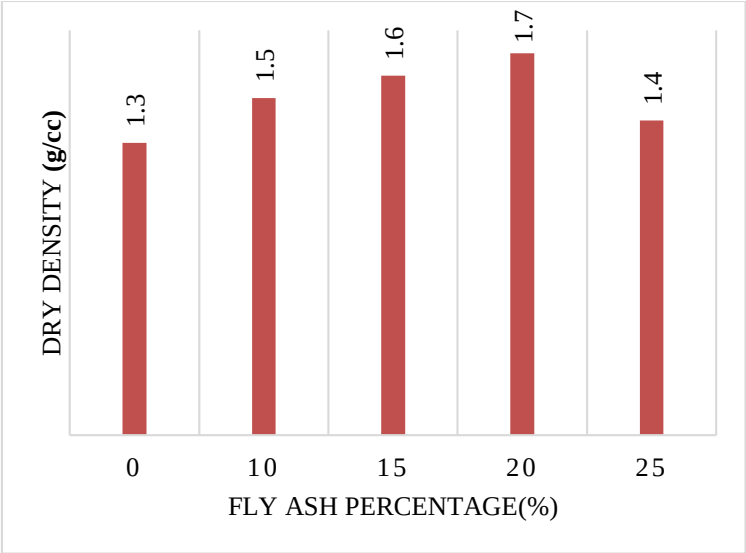


Fig 4: Variation of MDD with Fly ash

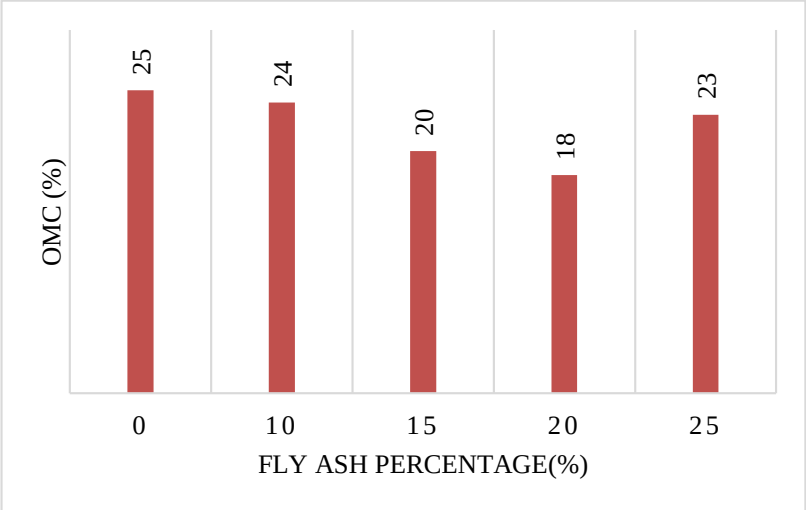


Fig 5: Variation of OMC with Fly ash

V CONCLUSIONS

In this paper,it has been found that the properties of expansive soil get effectively modified by various properties of fly-ash In this experimental result, stabilization of soil has been carried out by mixing fly-ash percentages (10%, 15%, 20%, and 25%).

1. The Maximum Dry density (MDD) of soil has increased 31% for 20% addition of the Fly Ash than untreated Soils.
2. The fly ash treatment is effective in improving the plasticity of expansive soil

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