STUDY ON SOIL STABILIZATION USING FLY ASH MIXTURES

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ABSTRACT

Soil stabilization is one of the important feature for construction in connection with road pavement and foundation construction because it improve the engineering properties of soil such as strength volume stability and durability. In the present, investigation is to evaluate the compaction and unconfined compressive strength of stabilized black cotton soil using fine and coarse fly ash mixture. The percentage of ash mixture used in black cotton soil varied from 5 to 30. From the study it is reveals that addition of fine, coarse fly ash improves the strength of stabilized black cotton soil and exhibit relative by well defined moisture density relationship it was found that peak strength attained by fine fly ash mixture was 25% when compared to coarse fly ash.

Key terms: *- soil stabilization, black-cotton soil and fine and coarse fly-ash.*

INTRODUCTION

Soil stabilization is a technique for increasing or maintaining the stability of soil mass and chemical alteration of soil to enhance their engineering properties

Civil engineering project located in area with expensive on weak soil have incorporated improvement of soil properties by using wide range of sub grade materials.

Use of fly ash as a stabilization material for improvement of soil admixture, when found viable, will be effective in terms of cost and good approach to the environment to preserve and minimize accumulation of industrial waste.

Benefit of the stabilization process can including higher resistance value reduction in plasticity, low permeability, reduction of pavement thickness, elimination of extension excavation material

Stabilization of cotton soil with add mixtures controls the potential of soils for change in volume and improve the strength of soil the soiling of expensive soil caused by moisture change in significant distresses and hence in sub damage to overlying structure different place have different susceptibility to soiling & shrinking such soils expand when they are moist having contact with wetted and shrink when dried this movement exerts pressure to crack side walls, basements flow, pipeline & foundation.

In India due to industrial development there is an increase in a demand for energy which has resulted in construction of considerable thermal power plants which broad with problem of self disposal or beneficial utilization of large quantity of by product like fly ash every year and there is a single requirement to be carried out in management of fly ash disposal and utilization fly ash utilize in cement & construction industry. However the rate of production is greater than consumption, unconsumed use of fly ash create environmental and ecological problems.

As according to ASTN 'c' 618 to major classes of fly ash are recognized i.e. class 'c' and class 'f' this two classes are related to types of coal burnt class 'f' fly ash obtain by burning of sub bituminous lignite coal class 'f' fly ash with CaO contained <6% designated as location as not self hardening but generally exhibit pozolonic properties.

This ashes contain more than 2% unburnt coal which determine by low sum ignitia quartz, mullite and hematite are the major crystalline phases identified fly ash class 'c' fly ash containing more then 15% of CaO & also called high calcium ashes and become available for use in concrete industry.

Specific gravity of fly ash reported to be related to shape color as well as chemical composition of fly ash particles, which is an indirect parameter for determining the performance of fly ash in soil mixture .the uniformity of the fly ash is monitored by limiting the variability of the specific gravity and fineness as measured by the amount retained of 45nom. Mesh sieve in general sp. Gravity of fly ash is typically i.e. 2.5 the lower density associated with a high loss of ignition and some variability intelligentsias of particle with smaller ones having higher densities .

The variation in particle density means that sedimentation technique for determine by particle size distribution are not suitable but lesser scattering is more appropriate method are presently used.

COMPACTION OF SOIL FLY ASH MIXTURES

The compacted unit weight of the material depends on the amount of energy application grain size distribution plasticity characteristics and moisture content at compaction .the variation of dry density with moisture content for fly ash is less compare to that for well graded soil both having the same grain size the tendency for fly ash to be less sensitive to variation in moisture content than for soil is due to voids the higher void content could tent to limit the buildup of pores pressure during compaction thus allowing the fly ash to be compaction over a larger range of water content.

BLACK COTTON SOIL

Natural black cotton soil of Malwa region around Indore dist. of M.P. state its dark gray to black with property of high moisture retentively and predominantly consist of expansive montmorillonite as a principal clay mineral the engineering and index properties of the soil under investigation are given in following table and soil was classified in accordance with Indian standard classification of soil for engineering purpose.

Natural water content	Specific gravity	Grain size distribution			Atterberg's limit			
		gravel	sand	Silt & clay	Liquid limit	Plastic limit	Plasticity index	Shrinkage limit
8.91%	2.71	0.0%	11.06%	88.94	65.93	37.12%	28.81	11.41

Table 2 : minerals, compaction and compressive strength of black cotton soil

Max.dry density in gm/cc	Opti mum moisture contain in %	Compressive strength in kpa
1.9	23	1128

Fly ash is a fine residue collected from the burning of pulverized coal in power generation it is silt size ,non cohesive material having a relatively smaller specific gravity than the normal soils, fly ash has been used in a variety of construction activity such concrete brick liner , construction of embankment and as a compacted fills fly ash also passes excellent pozolonic value hence is used to manufacture ppc cement by adding limited quantity to opc clinker as recommended by is code.

Fly ash of class 'F' category used in present investigation procured from Grasim industry nagda nearest power plant based on pulverized coal is light brown to light grey in colour and the physical properties we given below

Specific gravity	Grain size distribution			Atterberg limits		
	Gravel	Sand	Silt &clay	Liquid limit	Plastic limit	Shrinkage limit
2.11	Nil	39%	61%	36 %	Non plastic	18.50 %

COMPACTION TEST FOR SOIL MIXTURES

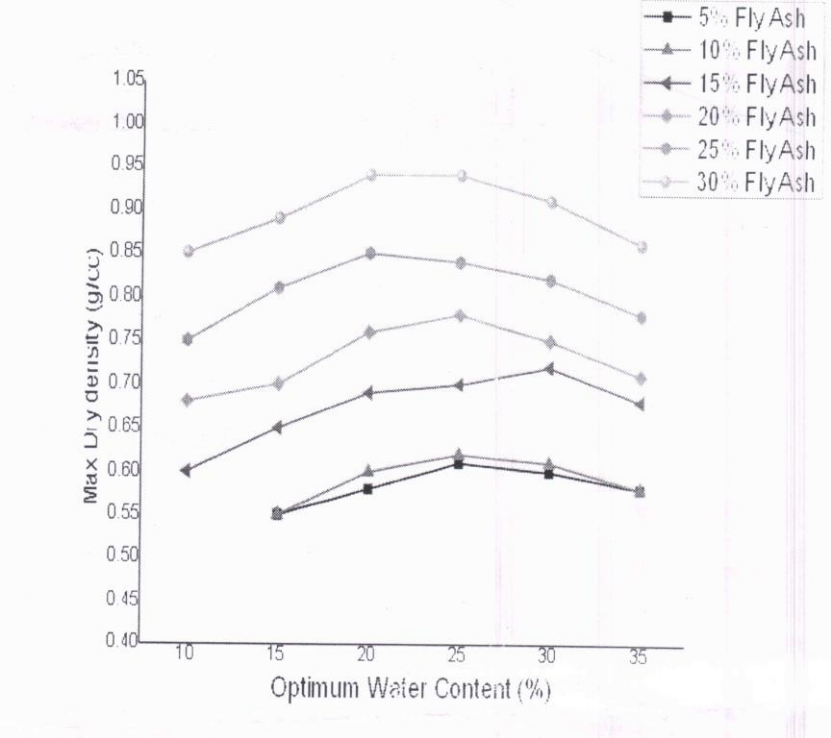
Three identical samples were prepared for their maximum dry density and optimum moisture content base on compaction curve obtained the sample was subjected to various curing periods (1,7,14 & 28 days) according to their trial combination chosen all sample intended for immediate testing wer tested immediately . the unconfined compression test was carried out according to is 2720(part 10)-1973,by using unconfined compression test apparatus at a strain rate of 1.25 mm/minute ring reading was noted for 30 division on a deformation dial gauge. The loading was continued until reading of the load dial showed a decreasing or a constant strain rate of 20 % had been reached.

RESULT AND DISCUSSIONS

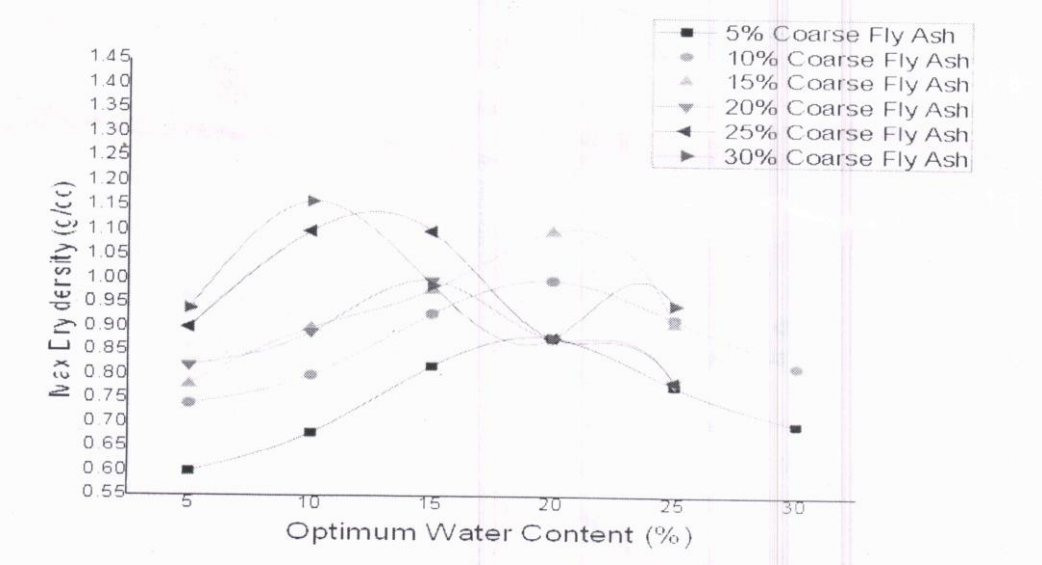
the unit weight of soil fly ash mixtures is an important parameter since it controls the strength compressibility, permeability and densification the strength of soft soil can be altered by the addition of fly ash in various percentage and unit weight of compacted mixture depend on the method and amount of energy applied, grain size distribution, plasticity characteristics and moisture content of compaction

in the present study a series of compaction test was carried out by varying soil and fine fly ash is compacted at respective optimum moisture.

The behavior of coarse fly ash is also studied as a part of present investigation and a series of compaction test were carried out by varying soil and coarse fly ash which is compacted at respective optimum moisture content the corresponding maximum dry density and optimum moisture content are presented in table it is deserved that with the increase of coarse fly ash content maximum dry density decreases.



Soil + fly ash (coarse) %	Optimum water content %	Max. dry density Gm/cc
95+5	10.5	1.35
90+10	14.5	1.30
85+15	16.3	1.22
80+20	18.8	1.18
75+25	20.3	1.10
70+30	21.3	1.00



The variation of maximum dry density with coarse fly ash content for different proportion of soil fly ash mixtures is presented in fig. 2 it is observed that with the increase in optimum water content the dry density decreases up to 30 5 moisture content , hence the addition of fly ash to black cotton soil in various percentages affect the compaction characteristics in same way as it was observed with fine fly ash content (OMC) the corresponding maximum dry density and optimum moisture content we presented in the table below

Soil + fly ash (%)	Optimum water content (%)	Max dry density (Gm/cc)
95+5	22.5	1.35
90+10	23.8	1.20
85+15	25.0	0.90
80+20	26.0	0.80
75+25	28.0	0.65
70+30	30.0	0.60

Table – 4 compaction of fine fly ash mixture

The variation of maximum dry unit weight with fly ash content for different proportion of soil fly ash mixture is presented in fig 1. By this fig. it can be observed that with the increase in OWC the dry density decreases up to 30 % moisture content. Hence the addition of fly ash in black cotton soil in various percentage affects the compaction characteristics which is primarily due to alteration of gradation of soil mixtures the decreases of the dry density with increases with the percentage of fly ash is mainly due to the lower specific gravity of the fly ash compared with

expensive soil. It can also be observed that the OMC was increased with increase in the ash content in the mixture.

SUMMARY AND CONCLUSION

It was observed in the both types fine and coarse fly ash that with increase in water content the dry density decreases up to 20-30 % moisture content. The maximum dry density in range of 1.35 gm/cc highest for 95% soil and 5% fly ash in mixture and lowest density was about 0.6 gm/cc for 70% soil and 30% fly ash mixture. This variation of density is due to alteration of gradation of soil mixtures. The decrease of the maximum dry density with the increase in the percentage of the fly ash mainly due to lower specific gravity of fly ash compared with expensive soil and the formation of cemented product by hydration which reduces the density of soil. The decrease in dry density with increase in fine fly ash content is due to alteration of gradation of soil mixtures. Whereas decrease in dry density with the increase in coarse fly ash mixtures was due to cation exchange between the additive fly ash particles and expansive soil which decrease the thickness of electric double layer and promotes the flocculation

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