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STABILIZATION OF EXPANSIVE SOIL

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ABSTARCT:

Soil stabilization is one of most important for the construction which is widely used in foundation construction because it improves the engineering properties of soil such as strength, volume stability and durability. The projects such as highways, railways, water reservoirs, reclamation etc. requires earth material in very large quantity. The soil is stabilised by using flash ash as admixture in percentage of 10 to 30.

KEYWORDS: Test of all soil related, Flyash expansive soil

INTRODUCTION: Soil stabilization means chemical or mechanical treatment designed to increase or maintain the stability of a soil mass or otherwise to improve its engineering properties, as by increasing its shear strength, reducing its compressibility, or decreasing its tendency to absorb water.

Stabilization of soil is treatment of the soil which renders it more stable. In engineering construction, stabilization refers to addition & mixing an admixture known to be stabilizing agent with soil before compaction is carried out, so as to altering the chemical make-up of soil resulting in more stable material. Stabilization may be applied in natural position or as it is placed in a fill. Also stabilization may be applied in a plant & transported to the job site for placement & compaction. It is the process which is used to improve the engineering properties of the soil & thus making it more stable. It is required when the soil available for construction is not suitable for the intended purpose. It includes compaction, pre-consolidation, drainage & many other such processes.

METHODOLOGY:

COMPONENTS OF STABILIZATION

Soil stabilization involves the use of stabilizing materials in weak soils for improvement of its properties such as compressibility, strength, permeability and durability. Components which use in the stabilization technology include soils and soil minerals and stabilizing materials.

SOIL

Most of stabilization has to be done on soft soils for achieve engineering properties. According to Sherwood (1993) finegrained granular materials are the easiest to stabilize due to their large surface area in relation to their particle diameter. A clay soil compared to others has a large surface area due to flat and elongated particle shapes. On the other hand, silty materials can be sensitive to small change in moisture and, therefore, may prove difficult during stabilization. In such soils, successful stabilization has to depend on the proper selection of binder and amount of binder added (Hebib and Farrell, 1999; Lahtinen and Jyrävä, 1999, Åhnberg et al, 2003).

STABILIZING AGENTS

These are hydraulic (primary binders) or non-hydraulic (secondary binders) materials that when in contact with water or in the presence of pozzolanic minerals reacts with water to form cementitious composite materials. The commonly used binders are:

- Cement
- Lime
- Flyash
- Blast Furnace Slag

FLY-ASH

Fly ash is a byproduct of coal fired electric power generation facilities. It has little cementitious

properties compared to lime and cement. Most of the fly ashes belong to secondary binders; these binders cannot produce the desired effect on their own. However, in the presence of a small amount of activator, it can react chemically to form cementitious compound that contributes to improved strength of soft soil. Fly ashes are readily available, cheaper and environmental friendly. There are two main classes of fly ashes; class C and class F . Class C fly ashes are produced from burning subbituminous coal; it has high cementing properties because of high content of free CaO. Class C from lignite has the highest CaO (above 30%) resulting in self-cementing characteristics (FM 5-410).

Soil fly ash stabilization has the following limitations,

- Soil to be stabilized shall have less moisture content; therefore, dewatering may be required.
- Soil-fly ash mixture cured below zero and then soaked in water is highly susceptible to slaking and strength loss.
- Sulfur contents can form expansive minerals in soil-fly ash mixture, which reduces the long term strength and durability.

PROPERTIES OF FLYASH

Sr. No.	Characteristics	Requirement Grade of Flyash	
		I	II
1	Fineness – Specific Surface in m^2/kg by Blaine's permeability method, Min	320	250
2	Lime Reactivity – Average Compressive Strength N/mm^2, Min	4.0	3.0
3	Compressive Strength at 28 days, N/mm^2, Min	Not less than 80% of the strength of corresponding plain cement mortar cube	
4	Drying Shrinkage, %, Max	0.15	0.10
5	Soundness by autoclave test expansion of specimen, %, max	0.8	0.8

Physical Properties of Flyash

PREPARATION OF SOIL AND EXPERIMENTS

Flyash is mixed with sol in varying percentage of 10% 20% and 30% with the natural soil. The flyash is mixed with soil on fully dry weight in required proportion. The different test of soil which is preformed in the laboratory according to IS CODE standards .

The following test is to be carried out

- Core Cutter Test
- Specific Gravity
- Atterberg's Limit
- Proctor Compaction
- Triaxial Shear Test
- Unconfined Compressive Strength
- Free Swell Test

RESULTS AND DISCUSSION

Field bulk density of soil is 1.27 gm/cc

Dry density of soil is 1.14 gm/cc

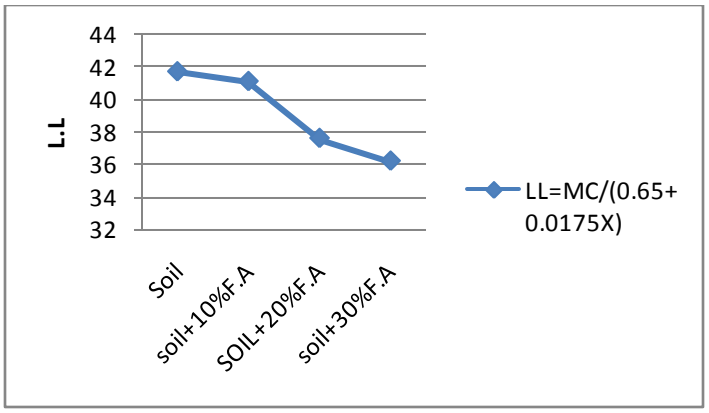
Moisture content of soil is 11%

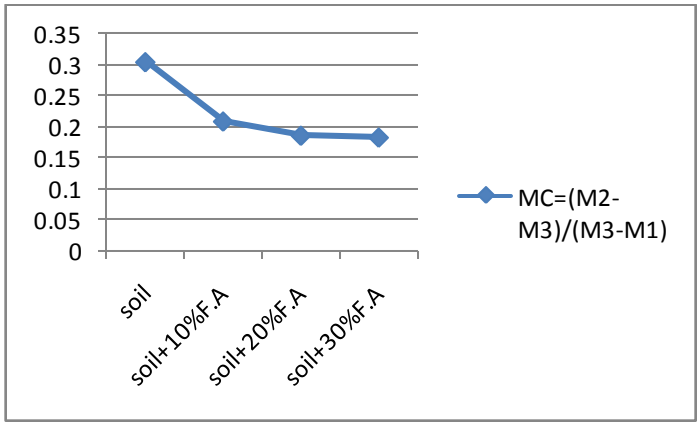
Specific gravity of soil is 2.5

Atterberg's Limit

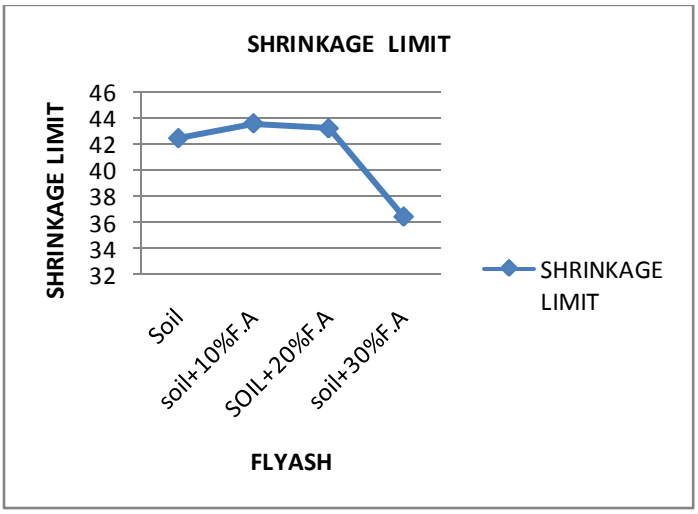
SR NO	Soil + Flysh	LIQUID LIMIT
1	Soil	41.7
2	Soil + 10% Fly ash	41.1
3	Soil + 20% Fly ash	37.6
4	Soil + 30% Fly ash	36.2

SR NO	Soil + Flysh	PLASTIC LIMIT
1	Soil	30.5
2	Soil + 10% Fly ash	20.96
3	Soil + 20% Fly ash	18.69
4	Soil + 30% Fly ash	18.36



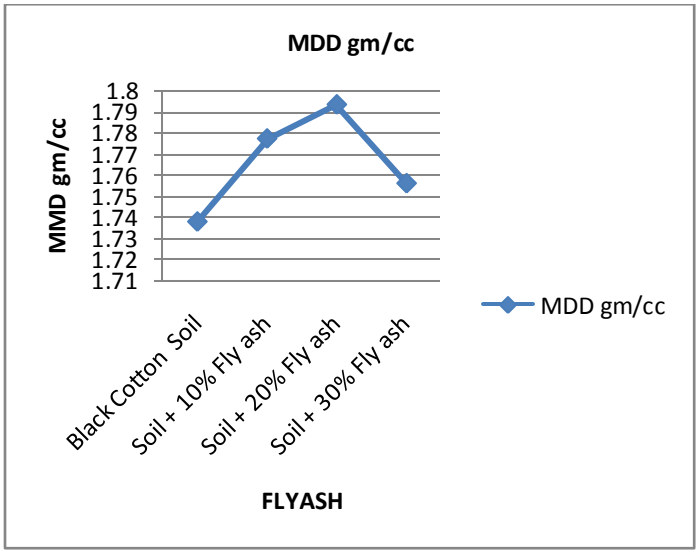


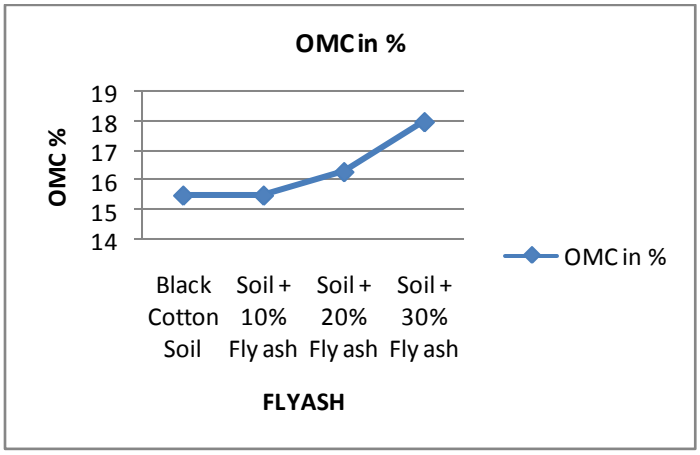
SR NO	Soil + Flysh	SHRINKAGE LIMIT
1	Soil	42.2
2	Soil + 10% Fly ash	43.55
3	Soil + 20% Fly ash	43.17
4	Soil + 30% Fly ash	36.44



PROCTOR COMPACTION TEST:

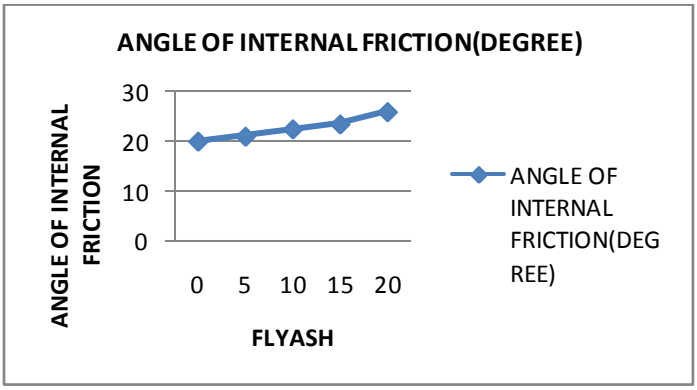
SR NO	Soil + Flysh	MDD gm/cc	OMC in %
1	Soil	1.738	15.50
2	Soil + 10% Fly ash	1.777	15.5
3	Soil + 20% Fly ash	1.793	16.3
4	Soil + 30% Fly ash	1.756	18

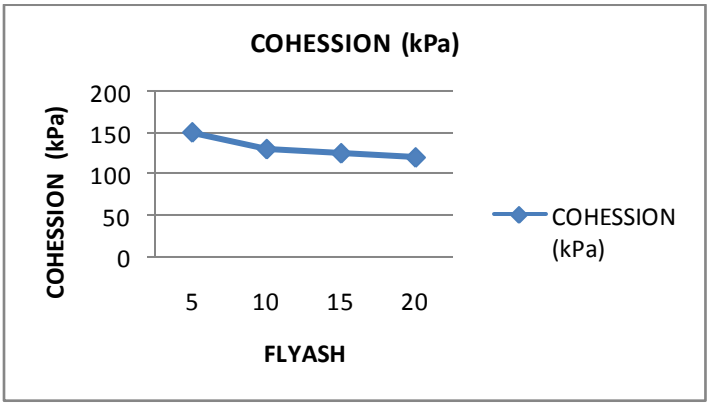




TRIAXIAL SHEAR TEST

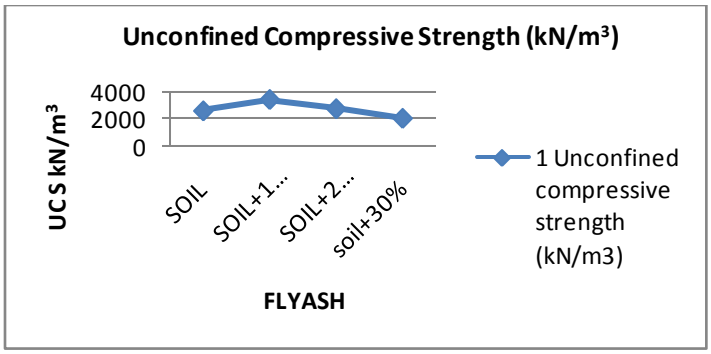
FLYASH (%)	ANGLE OF INTERNAL FRICTION(DEGREE)	COHESSION (kPa)
0	20	150
5	21	130
10	22.5	125
15	23.5	120
20	26	100





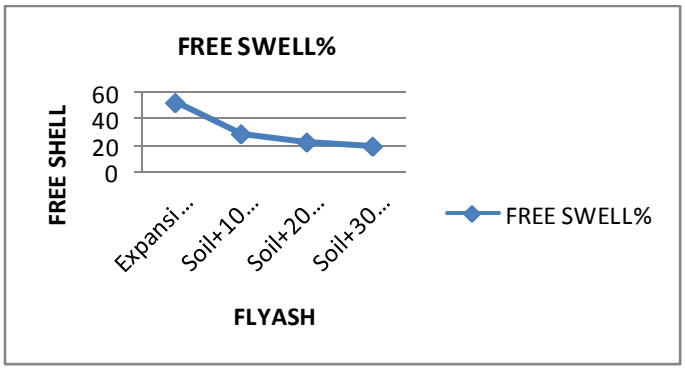
UNCONFINED COMPRESSIVE STRENGTH

SR NO	SAMPLE	SOIL	SOIL+10%	SOIL+20%	soil+30%
1	UCS (kN/m^3)	2696	3513	2850	2159



FREE SWELL TEST

SR.NO	SOIL	FREE SWELL%
1	Expansive soil	52.39
2	Soil+10%fly ash	28.35
3	Soil+20%fly ash	22
4	Soil+30%fly ash	18.82



CONCLUSIONS:

Graphical representation of the test results are presented above with varying percentage of Flyash. Based on the test result following conclusions are established.

- From % Flyash v/s Liquid Limit, it can be concluded that with increase in Flyash content, the liquid limit decreases.
- From % Flyash v/s Plastic Limit, it can be concluded that with increase in Flyash content, the Plastic limit decreases.
- Illustrates that with increase in Flyash percentage beyond 20%, the dry density of the mix reduces.

- Cohesion also decreases with increase in the flyash content.
- Angle of internal friction increases with increase in the flyash content.
- UCS value gets reduced beyond 10% Flyash.
- Free Swell value reduces with increase in Flyash % .
- The use of fly ash shows that fly ash has good potential for use in geotechnical applications. Its low specific gravity, freely draining nature, ease of compaction, insensitiveness to changes in moisture content, good frictional properties, etc. can be gainfully exploited in the construction of embankments, roads, reclamation of low-lying areas, fill behind retaining structures, etc.
- It solves the problems associated with the disposal of fly ash but also helps in conserving the precious top soil required for growing food.

REFERENCES:

-International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 1, January 2013

- Determination of liquid limit and plastic limit. Indian standard methods for testing of soil. IS2720 (a) Indian standard Institution, New Delhi, India, part 5, pp 109-144,1985.

-ASTM, Standard test method for 24-h batch –type measurement of Contaminant by soils and sediments, International American Standard testing method D464687 (reapproved2001. USA, 2001.

-KanirajS R, Havanagi V.G Geo technical characteristics of fly- ash soil mixtures. Geo technical Engineering journal, 1999, 30 (2):129-147.