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Paper Authors

**B.V. Shiva Kumar<sup>1\*</sup>, M.Durga Prasad<sup>2\*\*</sup>, P.Leela Krishna<sup>3\*\*\*</sup>**



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## STABILIZATION OF BLACK COTTON SOIL BY USING FLY ASH

**B.V. Shiva Kumar<sup>1\*</sup>, M.Durga Prasad<sup>2\*\*</sup>, P.Leela Krishna<sup>3\*\*\*</sup>**

<sup>1,2,3</sup> Department of Civil Engineering, Welfare Engineering College, Visakhapatnam, 530047, AP, India

\*shivakumar.bandaru@gmail.com, \*\* medisettydurgaprasad@gmail.com, \*\*\* p.leela9@gmail.com

### ABSTRACT

Expansive clay soils are extensively distributed worldwide & are a source of great damage to infrastructure & buildings. It is therefore, necessary to mitigate the problems posed by expansive soils & prevent cracking of structures. Extensive laboratory have been carried out by various researchers & have shown promising results for application of such expansive soil after stabilization with additives such as lime, fly ash etc., As fly ash is freely available with low cost, for projects in the vicinity of thermal power plants, it can be used for stabilization of expansive soil for various uses. The present project describes a study carried out to check the stabilization of black cotton soils by using fly ash and designing. This project used for finding the pavement sub grade thickness based on result analysis.

Keywords: stabilization, fly ash, laboratory tests, engineering properties.

### 1. INTRODUCTION

Expansive soils, which are also called as swell-shrinksoil. Black Cotton soil is also called as Regur soils, expansive soils in the Indian subcontinent are mainly found over the Deccan trap (Deccan lava tract), which includes Maharashtra, Andhra Pradesh, Gujarat, Madhya Pradesh, and some scattered places in Odissa.

These soils are also found in the river valley of Narmada, Tapi, Godavari and Krishna. The depth of black cotton soil is very large in the upper parts of Godavari and Krishna, and the north-western part of Deccan Plateau. 20% of the total land area, on an average, of this country is covered by expansive soils.

#### 1.1 INTRODUCTION OF BLACK COTTON SOIL:

Black soils, locally called regur or black cotton soils, and internationally known as 'tropical black earths' or 'tropical chernozems' have been developed by the weathering of the Deccan lava.

Black soils are highly retentive of moisture, extremely compact and tenacious when wet, considerably contracted developing deep wide cracks on drying and self-ploughing.

#### 1.2 STRUCTURE OF BLACK COTTON SOIL:

The structure of these soils is usually cloddy but occasionally free able. Regur soils are calcareous neutral to mild alkaline in reaction, high in carbon exchange capacity and low in organic matter.

In general these soils are rich in iron, lime, calcium, potash, aluminum and magnesium carbonates but poor

in nitrogen, phosphorus and organic matter.

#### 1.3 DAMAGES CAUSED BY BLACK COTTON SOIL:



Figure:1 Damages due to shrinkage



Figure: 2 Damages in structures

#### 1.4 SOIL STABILIZATION

The soil stabilization means the improvement of stability or bearing capacity of the soil by the use of controlled compaction, proportioning and the addition of suitable admixtures

#### 1.5 Introduction of Fly Ash

Fly Ash is an industrial waste product from thermal

power plants which uses coal as fuel. One of the chief usages of volcanic ashes in the ancient ages was the use of it as hydraulic cements, and fly ash bears close resemblance to these volcanic ashes.

These ashes were believed to be one of the best pozzolana (binding agent) used in and around the globe. The demand of power supply has exponentially heightened these days due to increasing urbanization and industrialization phenomena. Extensive research is being carried out in most part of the world that could be accrued in the Utilization of fly ash, which is basically a waste product.

### 1.6 Objectives of fly ash in our project:

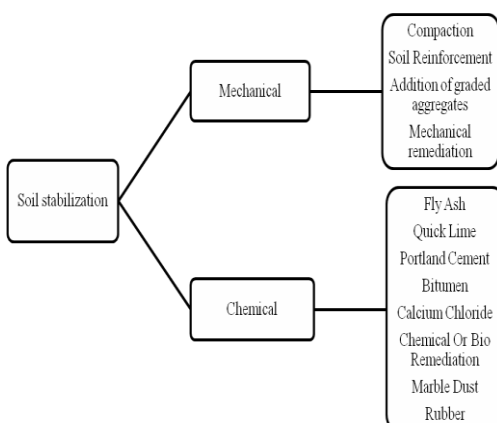
- To check the ambit of reducing expansiveness and improving CBR value by adding the fly ash.
- To stabilize the swelling of soil by using Fly Ash and mixing them in various proportions.
- To compare the soil properties before and after mixing fly ash, by conducting standard tests.

## 2. METHODOLOGY:

To evaluate the effect of fly ash as a stabilizing additive in expansive soil by conducting series of tests, where the content of fly ash in the expansive soil was varied with the proportions 10% to 40% (multiples of 10) by weight of the total quantity taken.

- The Indian Standard codes were followed during the conduction of the following experiments:
- Standard proctor test – IS : 2720 (Part 7) -1980
- California bearing ratio (CBR) test – IS : 2720 (Part 16) -1987
- Free swell index test – IS 2720 (Part 40) -1977
- Liquid & Plastic limit test – IS 2720 (Part 5) - 1985

### 2.1 The stabilization of soil can be done by two methods:



## 2.2 MATERIALS USED IN THE INVESTIGATIONS

- Black cotton soil
- Fly ash

### BLACK COTTON SOIL:

- Expensive soils are soils that expand when water is added, and shrink when they dry out. This continuous change in soil volume can cause the structures built on soil to move unevenly and crack.
- Collection of Soil:
- Black cotton soil is collected from Rampuram near Pendurti fields.

### FLY ASH:

- Fly ash is generally finely divided residue ash particle resulting from the combustion of coal in the furnaces which blows along with flue gas of the furnace. These ash are collected with the help of electric precipitators and termed as fly ash.
- Collection of Fly Ash:
- Fly ash is collected from NTPC, Paravada, Visakhapatnam.

## 3. RESULTS & ANALYSIS

- Thus, fly ash as an additive decreases the swelling and increases the strength of the black cotton soil.
- So as per the analysis the adding of fly ash amount will be decreases the thickness of pavement and it will be economical.

S. No	EXPERIMENTS CONDUCTED	SOIL	10% FLYASH	20% FLYASH	30% FLYASH	40% FLYASH	
1	Specific Gravity	2.36	2.39	2.41	2.45	2.46	
2	Liquid limit	58.36	54.26	49.16	46.23	44.63	
3	Plastic limit	30.02	29.01	27.81	26.12	25.1	
4	Free Swell Index	60	56	52	49	47	
5	Standard Proctor test	OMC	19.58	18.52	20.92	18.57	19.44
		MDD	1.41	1.4	1.42	1.66	1.42
6	CBR test	2.5m	5.75	10.4	14.93	9.35	8.25
		5.0m	5.99	10.58	16.67	9.95	8.61

## 4. CONCLUSION:

- Addition of fly ash reduces liquid limit, plastic limit, plasticity index and swelling characteristics of the soil. Hence fly ash

improves most of the engineering properties of the black cotton soil as expansive soil tends to become non expansive nature.

- Fly ash improves the CBR value of the black cotton soil. This improved value of CBR gives reduction in thickness of pavement which ultimately results in a cost saving.
- Fly ash is a hazardous industrial waste, which can be effectively utilized in road construction.
- 6.2 Scope for the future study:
- The following points are identified as the scope of further research in the direction, based on the experience of the present work.
- For designing foundation on black cotton soil instead of pavement design field tests are to be conducted to finding the safe bearing capacity of soil.
- We can also add extra additives to increase the strength of the black cotton soil along with fly ash.

9) Liquid & Plastic limit test – IS 2720 (Part 5) – 1985

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