

# STABILIZATION OF BLACK COTTON SOIL USING FLY-ASH AND COMMON SALT

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## ABSTRACT

Soil stabilization can be explained as the alteration of the soil properties by chemical or physical means in order to enhance the Engineering qualities of the soil. The main objectives of the soil stabilization are to increase the bearing capacity of the soil, its resistance to weathering process and soil permeability. Addition of Fly-ash and common salt will increase the physical as well as chemical properties of the soil. The varying percentages of common salt are 2%, 4%, in proportion with dry weight of soil, whereas the percentage of Fly-ash varies as 10%, 20%. The proposed variation of the mix of soil + % NaCl + % Fly-ash is to be tested in the laboratory for various tests like specific gravity, consistency limit, Compaction test, Unconfined Compression test and swelling pressure test.

**Keywords:** fly ash, common salt, laboratory tests, black cotton soil, stabilization, Engineering Characteristics, Compaction.

## I. INTRODUCTION

Improving an onsite soil's engineering properties is called soil stabilization. The soil stabilization means the improvement of stability or bearing power of the soil by the use of controlled compaction, proportioning and / or the addition of suitable admixture or stabilizers. Stabilized soils can often be adequate for airfields, traffic pavements, and parking and storage areas where an all-weather surface is required, yet traffic does not justify a higher-strength pavement. Surface treatments are also used to provide dust control. The most widely recognized form of stabilization is compaction, which improves the mechanical stability of virtually any soil. However, compaction alone is often not enough.

Black cotton soil or Expansive soils are the term applied to those soils, which have a tendency to swell and shrink with the variation in moisture content. The name "Black Cotton Soil" has an agricultural origin. Most of these soils are black in colour and are good for growing Cotton. All the black soils are not expansive and all the expansive soils are not black in colour. These soils pass high strength in summer and decrease rapidly in winter. Stabilization is commonly used for better soil gradation, reduction of the PI or swelling potential,

and increased durability and strength. Soils stabilized by additives often provide an all-weather working platform for construction operations.

**Table No.1.1 Indian Soils with Percentage of Coverage**

<i>SrNO.</i>	<i>Soil Types</i>	<i>Percentage of Total Area</i>
1	Alluvial soils	22.16
2	Black cotton Soils	29.69
3	Red and yellow Soils	28.00
4	Late-rite Soils	02.62
5	Arid Soils	06.13
6	Saline soils	01.29
7	Peaty and Organic Soils	02.17
8	Forest	07.94
	Total	100

### **Problems regarding Black Cotton Soil**

- Due to their peculiar nature Black Cotton soils are challenge for engineers everywhere in the world, and more so in tropical countries like India.
- India because of wide variation in temperature and because of distinct dry and wet seasons, leading to wide variations in moisture content of soils. The following problems generally occur in black cotton soil.
- **High Compressibility:** Black Cotton soils are highly plastic and compressible, when they are saturated. Footing, resting on such soils under goes consolidation settlements of high magnitude.
- **Swelling:** A structure built in a dry season, when the natural water content is low shows differential movement as result of soils during subsequent wet season. This causes structures supported by such swelling soils to lift up and crack. Restriction on having developed swelling pressures making the structure suitable.
- **Shrinkage:** A structure built at the end of the wet season when the natural water content is high, shows settlement and shrinkage cracks during subsequent dry season.

### **Utilization of Fly-Ash**

The **Low Value Utilizations** includes, Road construction, Embankment and dam construction, back filling, Mine filling, Structural fills, Soil stabilization, Ash dykes etc.

The **Medium Value Utilizations** includes Pozzolana cement, Cellular cement, Bricks/Blocks, Grouting, Fly ash concrete, Prefabricated building blocks, Light weight aggregate, Grouting, Soil amendment agents etc.

The **High Value Utilizations** includes Metal recovery, Extraction of magnetite, Acid refractory bricks, Ceramic Industry, Floor and wall tiles, Fly ash Paints and distempers.

## **II. EXPERIMENTAL INVESTIGATION**

### **2.1 Materials**

2.1.1 Fly-ash –Using industrial Fly-ash in Class C.

2.1.2 Common Salt - Common Salt is used in sea salt or rocky salt. It is deliquescent and hygroscopic.

2.1.3 Black Cotton soil – Using BCS from foundation work from construction site.

2.1.4 Water- Distilled water is use.

## **2.2. The following experiments conducting during the research**

- 2.2.1 Sieve analysis
- 2.2.2 Specific gravity
- 2.2.3 Liquid limit
- 2.2.4 Plastic limit
- 2.2.5 Modified Proctor Test
- 2.2.6 Shrinkage Limit
- 2.2.7 Unconfined Compression Test
- 2.2.8 Swelling pressure Test

## **2.3 Sample Preparation-**

Sample used in this study are prepared by air dried Black Cotton Soil with different percentages of common salt and Fly-Ash as stabilizer. Oven dried ingredients (BCS) are taken for the sample preparation for accurate proportioning by weight. The water is used to blend the mix properly.

The samples are prepared as:

- Black cotton soil is oven dried.
- The oven dried BCS is mixed with NaCl.

**Table No. 3.2.1 Percentage of Mix Designations**

<i>Sr. No.</i>	<i>Mix Designations</i>
01	Soil
02	Soil + 2 % NaCl + 10 % FA
03	Soil + 2% NaCl + 20% FA
04	Soil + 4 % NaCl + 10 % FA
05	Soil + 4 % NaCl + 20 % FA

## **III. OBJECTIVES OF PROJECT**

- The objective of this experimental study is to investigate the effect of Common Salt & Fly Ash on Engineering and Index Properties of Soil.
- To find eco friendly and cost effective method of soil improvement by Chemical Stabilization.

## **IV. SCOPE OF PROJECT**

The scope of the work is to compare the results of Fly-Ash and Common Salt (NaCl) fused in Black Cotton Soil. The addition/mixing of both the constituents in the Black Cotton Soil with different percentage will result in different laboratory test results. The observations obtained during test series, will then result into the conclusion of Soil Stabilization.

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