

Prevention of Foundation Cracks in Expansive soil by Stabilizing it by Groundnut Shell Ash

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ABSTRACT: The foundation is very important for any structure and it has to be strong enough to support the entire structure. For foundation to be strong the soil around it plays a very important roll. To work on soils, we need to have proper knowledge about their properties and factors which affect their behaviour. Expansive soils like black cotton soil always create problems more for lightly loaded structures than moderately loaded structures. The problems are swelling, shrinkage and unequal settlement. In this paper the experimental results for stabilization of black cotton soil by using groundnut shell ash, has been used to find their performance. The tests such as liquid limit, plastic limit, and standard proctor compaction test have been conducted to check the improvement in the properties of Black cotton soil. These tests are to be conducted at both non stabilized and stabilized states by adding 3%, 6%, 9%, and 12% of groundnut shell ash. The test results obtained on expansive black cotton soil mixed at different proportion of groundnut ash are presented and discussed in this paper. The objective of this study is to analyse the causes of cracks in foundation rested on expansive soil and overcoming it by stabilizing expansive soil and easy disposal of groundnut ash using as stabilizing material to obtain maximum stability for the black cotton soil. This paper will discuss about the problems in foundation due to expansive soil & its remedies.

KEYWORDS: Black cotton soil, Stabilization, Groundnut Shell Ash(GSA) .Liquid limit, Plastic limit

I. INTRODUCTION

Expansive soil, also called shrink-swell soil, is a very common cause of foundation problems. Depending upon the supply of moisture in the ground, shrink-swell soils will experience changes in volume of up to thirty percent or more. Expansive soil is the soil which expand when the moisture content of soil is increased. The clay mineral montmorillonite is mainly responsible for expansive characteristics of soil. The expansive soil are also called swelling soil or black cotton soil. Expansive soil are generally residual soil left at the place of their formation after chemical decomposition of rock such as basalt and trap. The soil expand as the water content is increased and contract or shrink as water content decreased. Structure built on such soil may experienced cracking and damage due to swelling and contraction of soil. These cracks may travel deep into ground. Maximum width of cracks usually limited to 20 mm. Expansion soil will also exert pressure on vertical face on foundation, basement or retaining wall resulting in lateral moment. Expansive soil composed of verity of material, most of which do not expand in the presence of moisture. However, a no of clay mineral are expansive, these include bentonite and montmorillonite. When soil contain potential amount of these mineral it has the significant expansion. In expansion soil to cause cracking problem in foundation must be due to changes in water content in it. To avoid these cracking problem in foundation we have to keep water content in the soil constant. This can be achieved stabilizing the expansive soil.

Soil stabilization is the alteration of one or more soil properties, by mechanical or chemical means, to create an improved soil material possessing the desired engineering properties. Soils may be stabilized to increase strength and durability or to prevent erosion and dust generation. The need to bring down the cost of waste disposal and the growing

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cost of soil stabilizers has lead to intense global research towards economic utilization of wastes for engineering purposes. The safe disposal of industrial and agricultural waste products demands urgent and cost effective solutions because of the debilitating effect of these materials on the environment and to the health hazards that these wastes constitute. The over dependence on industrially manufactured soil improving additives (cement, lime etc) have kept the cost of construction of stabilized building financially high. Thus, the possible use of agricultural waste such as Groundnut Shell Ash (GSA) will considerably reduce the cost of construction and as well as reduce or eliminate the environmental hazards caused by such waste.

II.MATERIAL COLLECTION

SOIL: The black cotton soil for the study has collected from the site, near the government college of engineering Jalgaon girls' hostel building which has following properties shown in result table no 2 as per test conducted on it in geotechnical laboratory.

GROUNDNUT SHELL ASH: Ground nut shell ash used for study was sourced locally ashed by locally open air burning. The resultant ash was sieved through 0.075mm is to remove unwanted material.

HOW BLACK COTTON SOIL IS CLASSIFIED:

Black cotton soil is classified according to their plasticity index.

Table No. 1

PLASTICITY INDEX	RATE OF EXPANSION
< 20	Less expansive
20 to 40	Expansive
40 to 60	Highly expansive
>60	Very high expansive

III.FAILURE FOUNDATION DUE TO EXPANSIVE SOIL

As we know the expansion soil contain, the expansive clay mineral like bentonite and montmorillonite because of which soil get swelled due to absorption moisture and shrinked due to loss of moisture from it. During the continuous process of swelling and shrinking by absorption and losing of moisture, the volume of soil changes continuously with the time itself. If foundation is situated on such soil it subjected to continuous upward and downward pressure which leads to producing cracks and ultimately damage the structure.

IV.PREVENTION OF FAILURE

1. The structure on the soil are made strong and rigid to endure the volumetric changes in the soil
2. The structure are made flexible so that they change shape depending upon condition
3. Deep foundation such as drilled pier and under reamed pile are constructed to isolate the foundation from the swelling effect of soil.
4. Stabilizing soil by stabilizer.

V.OBJECT OF STUDY

1. To study the properties of black cotton soil consistency limits and standard proctor test.
2. To study the changes in properties of black cotton soil by adding stabilizers.
3. To find out optimum amount of stabilizer required for stabilization of black cotton soil.

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VI. TEST SETUP AND PROCEDURE

Specific Gravity:

Objective: To determine the specific gravity of soil by using a pycnometer.



Fig no.1 Specific Gravity Apparatus

LIQUID LIMIT:

Objective: The value of liquid limit for various proportions of black cotton soil and black cotton soil with GSA% are given in table. The value of liquid limit is decreased after addition of wastes with respect to untreated soil. In case of addition of 12% GSA liquid limit value is greatly decreased from 73 % to 53.3%. The liquid limit values of soil after addition of various percentages of wastes are listed in Table.

Theory: The liquid limit is the moisture content at which the groove formed by a standard tool into the sample of soil taken in the standard cup closes for 10mm on being given 25 blow in a standard manner. At this limit the soil poses low shear strength.



Fig no.2 Liquid Limit Apparatus

PLASTIC LIMIT:

Objective: To find water content at which the soil will just begin to crumble when rolled into a thread of approximately 3mm dia. Diameter of the thread is frequently compared with 3 mm steel rod.



Fig no.3 Plastic Limit Apparatus

STANDARD COMPACTION TEST:

Objective: Determination of CBR of soil either in undisturbed or Remoulded and unsoaked condition.

This method covers the determination of the relationship between moisture content and the density of soil compacted in a mould of a given size with 2.6kg rammer dropped from a height of 310 mm. This test is required to assess the amount of compaction and water content required on the field

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Fig no.4 Standard Compaction Test Apparatus

VII. TEST RESULT

Test Result of Black cotton soil:

Table no.2

PROPERTY	RESULT
Specific gravity %	2.35
Liquid Limit %	73
Plastic Limit %	40.24
Plasticity Index %	32.76
OMC %	18.44
MDD (gm/cc)	1.5

Test result for Groundnut shell Ash:

Table no.3

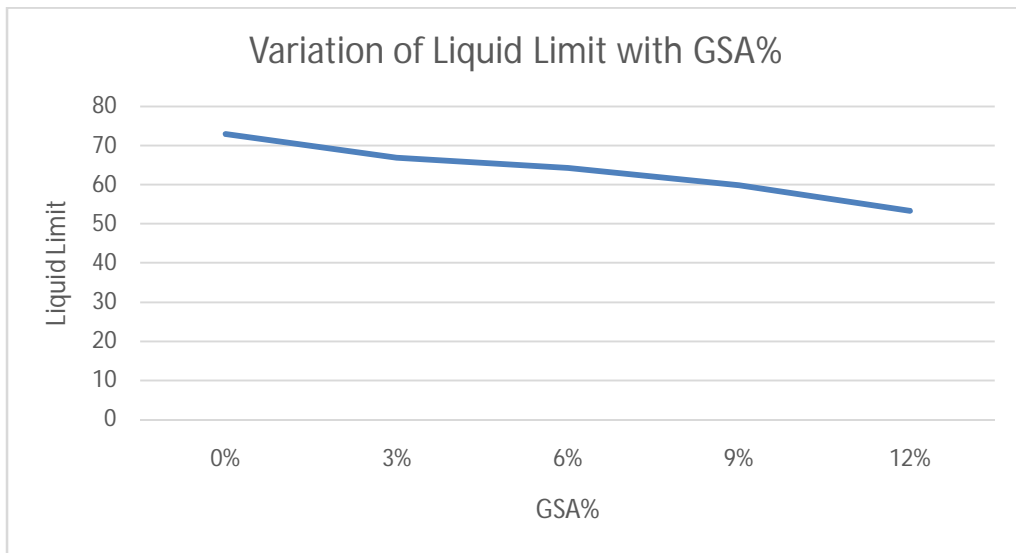
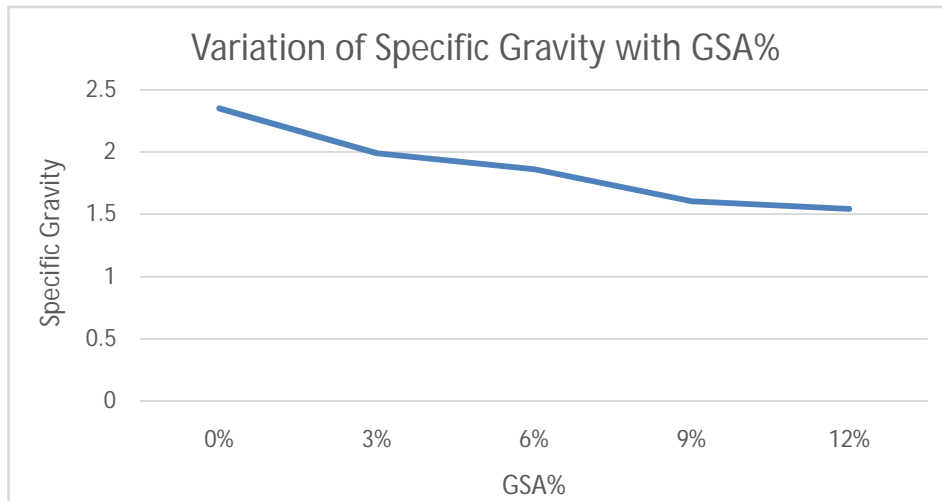
	SPECIFIC GRAVITY	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
100%SOIL + 0%GSA	2.35	73	40.24	37.86
97%SOIL + 3%GSA	1.99	67	38.15	28.85
94%SOIL + 6%GSA	1.86	64.3	36.96	27.34
91%SOIL + 9%GSA	1.6	59.80	35.2	23.60
88%SOIL + 12%GSA	1.54	53.3	34.43	18.87

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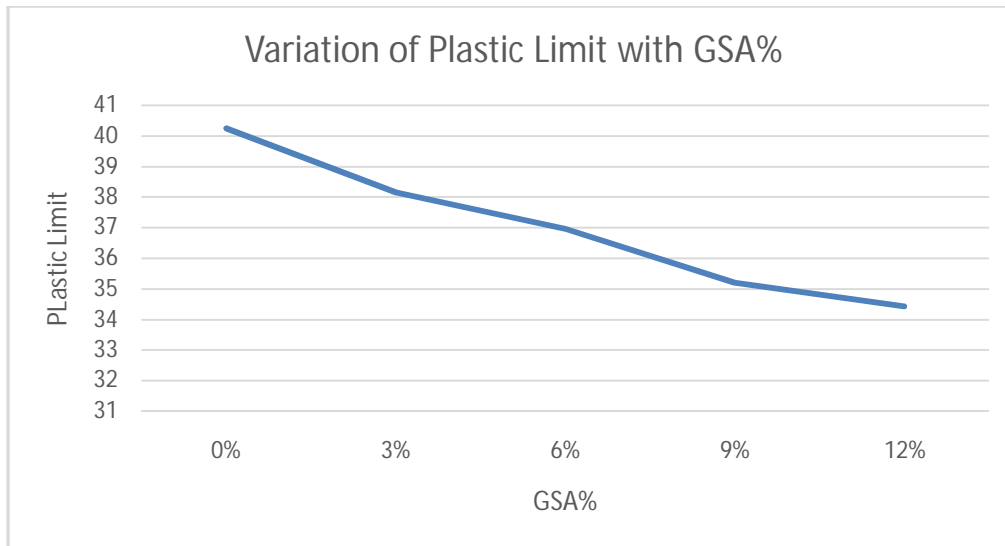


Table no.4

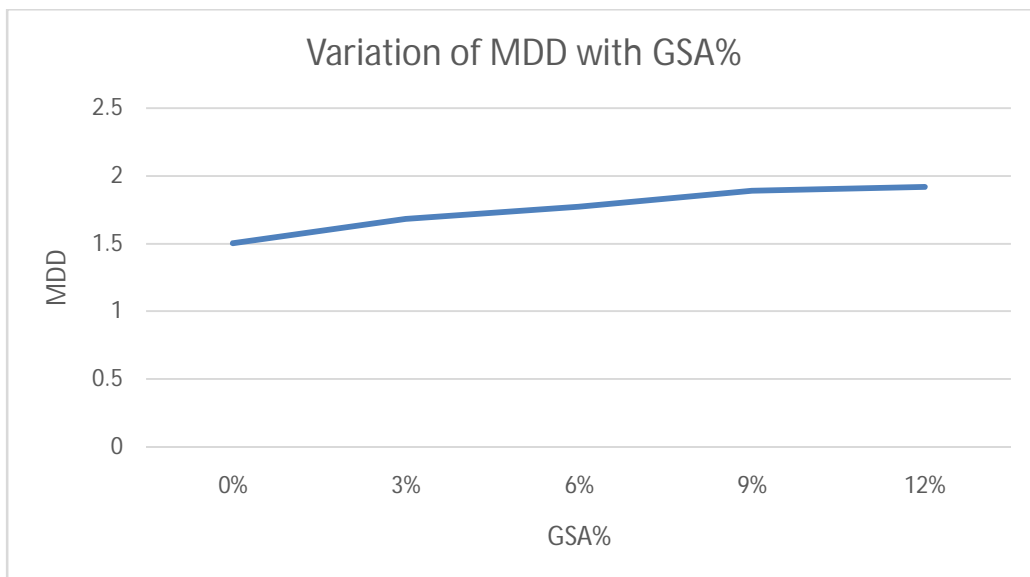
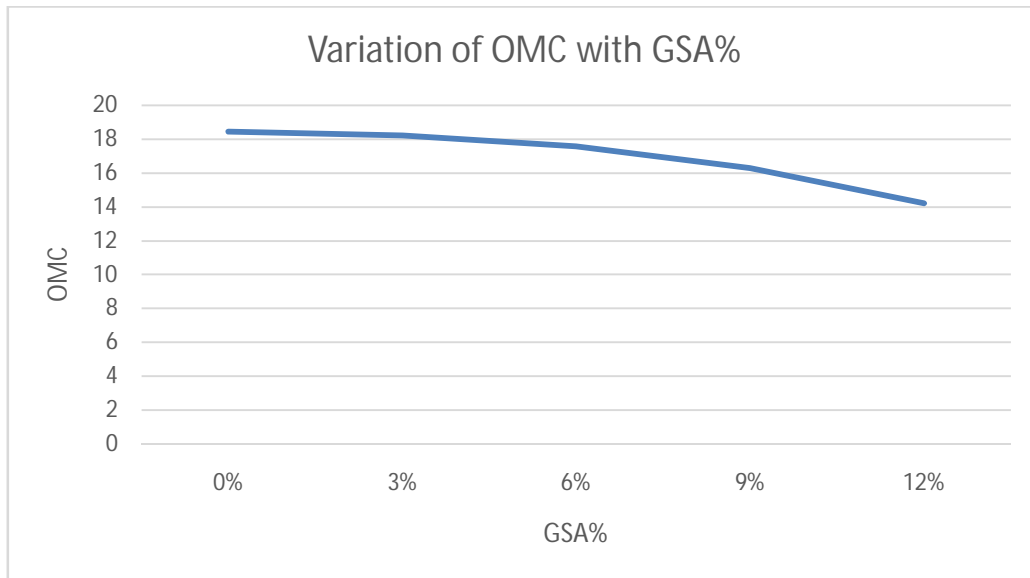
	OMC	MDD
100%SOIL + 0%GSA	18.44	1.5
97%SOIL + 3%GSA	18.22	1.68
94%SOIL + 6%GSA	17.58	1.77
91%SOIL + 9%GSA	16.3	1.89
88%SOIL + 12%GSA	14.22	1.92

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VIII.CONCLUSION

As we know main cause of cracks in foundation is change in water content. From above result it is found that the liquid limit values of black cotton soil decreased after addition of GSA. It has been seen that maximum decrement by 53.3% after addition of 12% GSA. Reduction in liquid limit improves the drainage property of soil. The value of maximum dry density also increased continuously after addition of GSA. Maximum increased by 1.92gm/cc at 12% GSA. Improvement in maximum dry density helps us to provide stable working platform mainly in rainy season. Most

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important factor is that effective utilization of million ton of ground nut in stabilizing expansive soil. Plasticity index is reduced from 32.76 to 18.67 making soil less expansive.

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