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STABILIZATION OF BLACK COTTON SOIL USING GRANITE WASTE

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ABSTRACT

Black cotton soil is highly expansive soil due to the presence of montmorillonite. Montmorillonite gives high swelling and high shrinkage properties to the soil. It reduces the stability of black cotton soil. The project deals with the stabilization of black cotton soil using granite waste. Stabilization means improving the engineering properties of a soil using admixtures. On specific engineering projects, soil additives may help to enhance soil properties, prepare the ground for shallow foundations, and stabilize slopes. Addition of granite waste is one way of improving the soil. Granite waste is a type of solid waste material that is obtained from granite crushing industries. Disposal of such waste materials creates a lot of problems to the environment and public. Considering the aspect an experimental study was conducted on locally available expansive soil by mixing it with granite waste. This paper presents the variation of index and engineering properties of expansive soil such as liquid limit, plastic limit, plasticity index, compaction characteristics, California bearing ratio when it is mixed with different percentages (0%,10%,20%,30%) of granite waste and the results were found that up to the addition of 10% of granite waste there is an increase in strength properties beyond it is not effective.

Key words: Black cotton soil, Granite waste, Soil stabilization.

I. INTRODUCTION

Black cotton soil: Black cotton soil are problematic for engineers everywhere in the world and more so in tropical countries like India because of wide temperature variations and because of distinct dry and wet seasons leading to wide temperature variations in moisture content of soil. The following problems generally occur in black cotton soil.

Black cotton soil has High compressibility, High swelling and High shrinkagecharacteristic's.

Granite waste: with the rise in development of India the industries are developing and the rate of production of waste is also developing and they causing various problems like pollution, health hazards to human. Granite waste is one of the solid waste material obtained from aggregate crushing and polishing industries.This waste is not disposed in proper manner and its disposal is not economically viable.

But it is blended with the constructional material like black cotton soil

Then it can be useful to various construction purposes.

Soil stabilization: soil stabilization is the technique of improving the engineering properties of weak soil like black cotton soil by adding the solid waste.

In this project we are using granite waste to the black cotton soil and to improve the index and engineering properties of black cotton soil and we are adding the granite waste in terms of percentages from 0% to 30%

Varying of 10% increasing each.

By using this granite waste to the black cotton soil we can overcome the problems occurring for black cotton soil by increasing weak properties towards construction.

II. LITERATURE REVIEW

A number of researches have worked in developing different methods of soil stabilization which are practical and economical. In the recent past, many researches have carried out experimental and field studies for the stabilization of expansive soils using granite waste. Modification of black cotton soil by chemical admixtures is commonly adopted method for stabilizing the swell-shrink tendency of expansive soil.

Soil stabilization involves the use of stabilizing agents (binder materials) in weak soils to improve its geotechnical properties such as compressibility, strength, and permeability.

Various researches have been done on granite waste for stabilization of black cotton soil like

(A)Jag Mohan Mishra studied the effect of granite dust on significance decrease in the expansive behaviour of the black cotton soil as the liquid limit and plasticity index decreases from 37% to 28% and 17.45% to 4.80%, respectively if black cotton soil is blended with 5% lime and granite dust 0% to 30% by weight of black cotton soil. With the increase in the granite dust percentage the liquid limit values decreases from 37.2% to 3.7%, differential free swell decreased drastically from 56.6% to 4.1%, shrinkage limit values increase from 8.15% to 18% with the increase in granite dust.

(B)Bashara (2014) reported the effect of stone dust on geotechnical properties of poor soil and concluded that the CBR and MDD of poor soils can be improved by mixing stone dust. They also indicated that the liquid limit, plastic limit, plasticity index and optimum moisture content decrease by adding stone dust which in turn increases usefulness of soil.

(C) Satyanarayana (2013) conducted plasticity, compaction and strength tests on gravel soil with various percentage of stone dust and found that by addition of stone dust plasticity characteristics were reduced and CBR of the mixes proved.

(D) H. Venkateshwara etc., all conducted a study on behaviour of expansive soil treated with quarry dust and found that the engineering properties are increased with the addition of quarry dust and Atterberg limits are decreased with addition of quarry dust.

(E) R. Tirumalai, Dr. Suresh babu etc., all conducted a study on behaviour of black cotton soil after stabilizing with granite waste and quarry dust and found that the properties of black cotton soil are improved.

III. OBJECTIVES OF THE STUDY

An investigation has been carried out to evaluate the efficiency in utilization of granite waste in geotechnical field in order to justify safe reuse, management and disposal of granite waste samples. To achieve this aim, the following objectives have been identified.

- To increase the strength or stability of soil.
- To reduce the construction cost by making best use of locally available materials.
- To improve the engineering properties of the soil.
- To compare the results before and after adding the percentage of granite waste.
- To control the shrinkage and swelling characteristics.
- To analyse the results and make appropriate recommendations for optimal use.

The project work shall be limited to the use of granite waste for improvement of soil. The material used in the work is most abundantly available black cotton soil, granite waste which is a waste product from the granite industries and work would involve the collection of soil materials and determination of their geotechnical properties after which the granite waste will be incorporated into the soil sample and the appropriate recommendations would be made for their best use.

IV.METHODOLOGY AND MATERIALS USED

Materials: BLACK COTTON SOIL, GRANITE WASTE

Methodology: The soil sample is collected from open field and the type of soil is black cotton soil. without using the granite waste, we have founded the properties of black cotton soil and also founded the properties of black cotton soil after using the granite waste and we have compared the properties how they reacting and gave the conclusion it is useful or not.

Proportions added and their designation:

Soil particulars	Percentage soil and granite waste added	Designation we used
Natural soil	Soil-100%, Granite waste -0%	NS
Sample 1	Soil-90%, Granite waste-10%	S1
Sample 2	Soil-80%, Granite waste-20%	S2
Sample	Soil-70%, Granite waste-30%	S3

Tests performed:

1. Liquid limit -Casagrande's method
2. Plastic limit
3. Specific gravity
4. Coefficient of uniformity
5. Standard proctor compaction test
6. California bearing ratio
7. Unconfined compressive strength.

The above tests are performed on locally available black cotton soil and the results are shown below.

V. RESULTS AND DISCUSSIONS

Description	NS	S1	S2	S3
Liquid limit (%)	**33%**	31.2%	29.95%	29.4%
Plastic limit (%)	14%	10.05%	9.75%	7.85%
Specific gravity	2.16	2.198	2.35	2.43
Coefficient of uniformity	2.34	3.2	3.53	3.85
OMC (%)	12.89%	11.98%	10.78%	10%
Dry density(g/cc)	1.479	1.5825	1.685	1.6875
California bearing ratio (%)	1.7%	3.65%	4.53%	5.24%
Unconfined compressive strength (Kg/cm^2)	2.85	3.15	3.85	4.12

Thus, the results are tabulated using the graphs and the results are analysed.

LIQUID LIMIT:

Chart 1 shows liquid limit goes on decreasing by addition of granite waste to the black cotton soil.

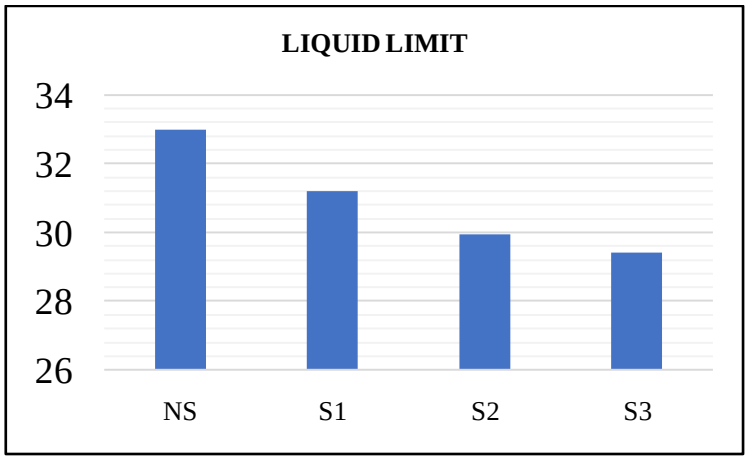

Chart 1: variation of liquid limit for varying percentage

Of granite waste with black cotton soil

PLASTIC LIMIT:

Chart 2 shows plastic limit goes on decreasing by addition of granite waste to the black cotton soil.

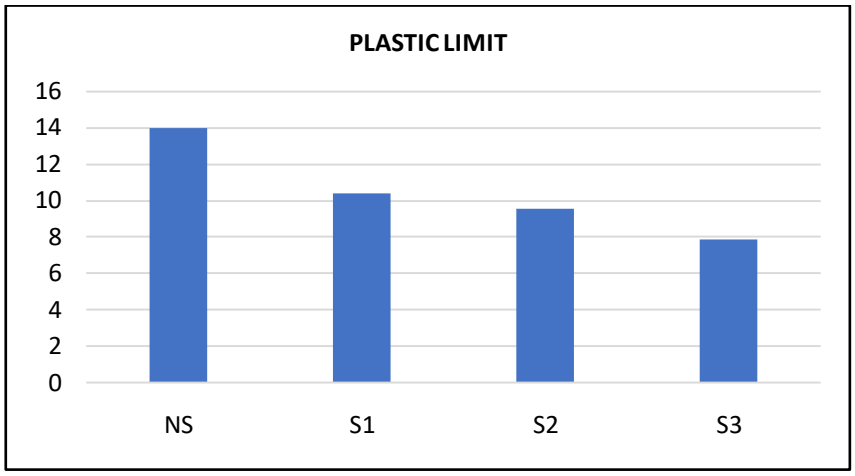

Chart 2: variation of plastic limit for varying percentages of granite Waste with black cotton soil

SPECIFIC GRAVITY:

Chart 3 shows specific gravity goes on increasing by addition of granite waste with black cotton soil.

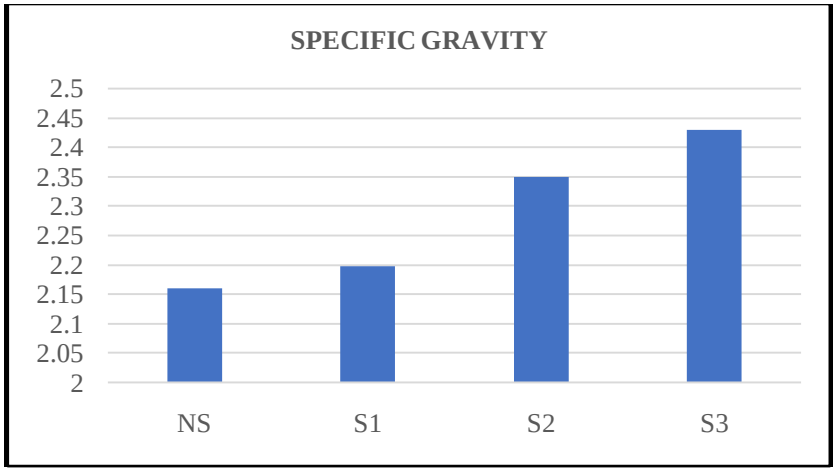

Chart 3: variation of specific gravity for varying percentages of granite waste with black cotton soil

co-efficient of uniformity:

chart 4 shows co-efficient of uniformity for soil goes on increasing with addition of granite waste with black cotton soil.

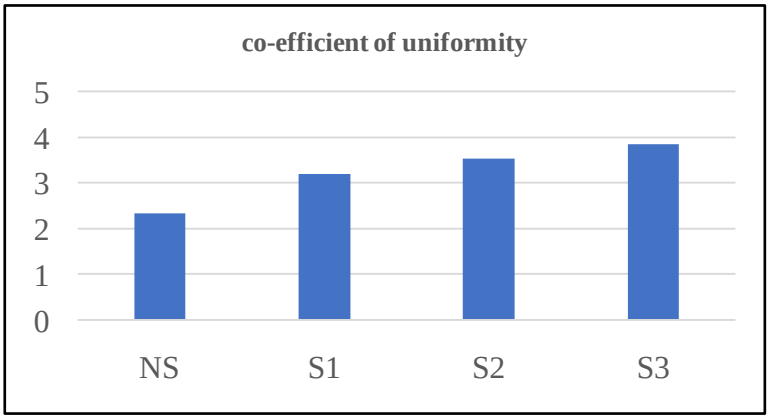

Chart -4: variation of co-efficient of uniformity for varying PercentagesOf granite waste with black cotton soil

Standard proctor compaction test:

1.Optimum moisture content:

Chart 5 shows optimum moisture content goes on decreasing with the addition of granite waste with black cotton soil.

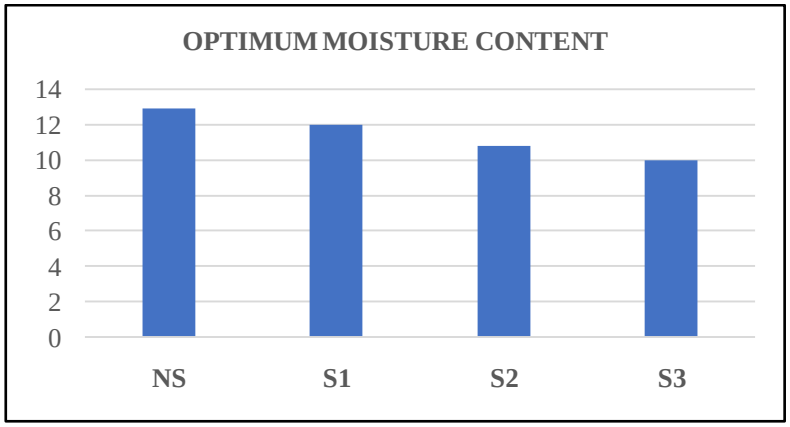

Chart-5: variation of optimum moisture content for varying Percentages Of granite waste with black cotton soil

2. Dry density:

Chart 6 shows dry density goes on increasing with the addition of granite waste with black cotton soil.

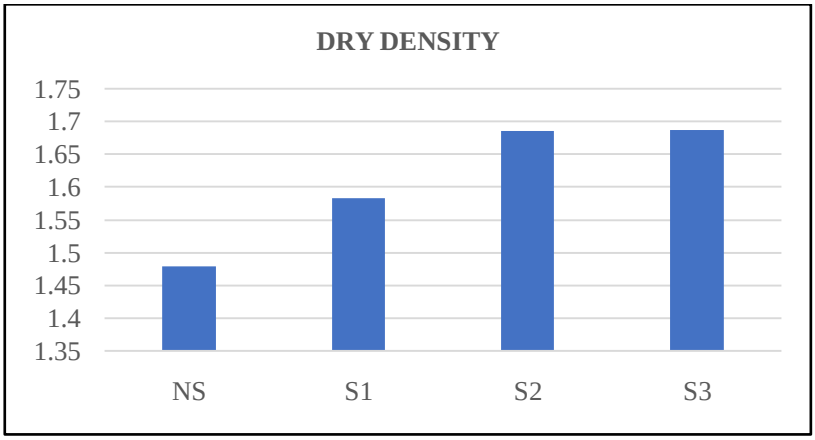

Chart 6: variation of dry density for varying percentages of Granite waste with black cotton soil

California bearing ratio:

Chart 7 shows California bearing ratio goes on increasing with the addition of granite waste with black cotton soil.

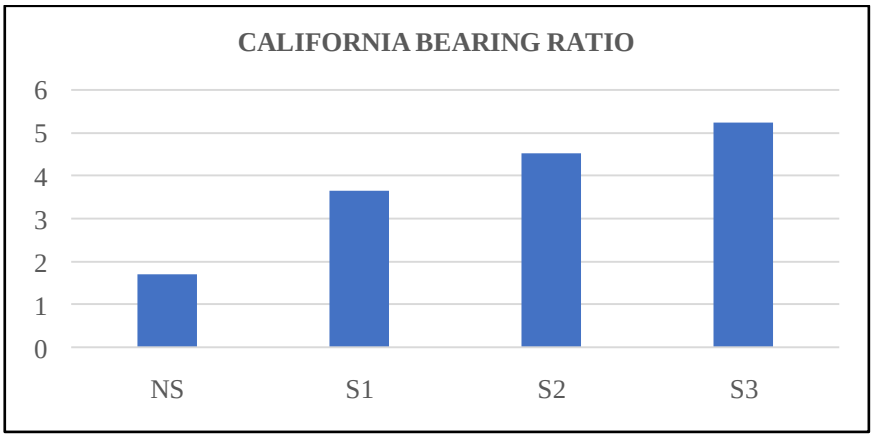

Chart-7: variation of California bearing ratio for varying percentages Of granite waste with black cotton soil

Unconfined compressive strength:

Chart 8 shows unconfined compressive strength goes on increasing with the addition of granite waste with black cotton soil.

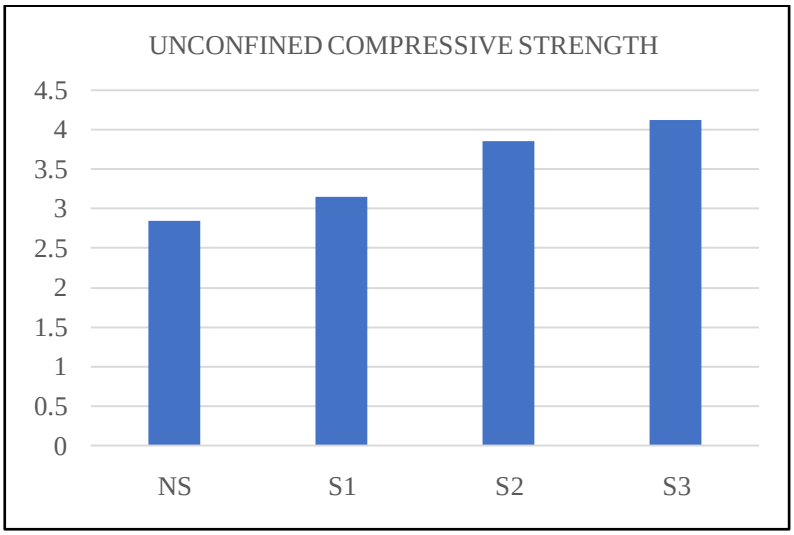

Chart 8: variation of unconfines compressive strength for varying

Percentages of granite waste with black cotton soil

VI. CONCLUSION:

From the above tests results on black cotton soil mixed with granite waste the following conclusions are founded:

1.Liquid limit, plastic limit goes on decreasing by the addition of granite waste to the black cotton soil of varying percentages.

Liquid limit decreases from 33% to 29.4% and plastic limit decreases from 14% to 7.85%

2. specific gravity increases from 2.16 to 2.43

3.co-efficent of uniformity increases from 2.34 to 3.85

4. optimum moisture decreases from 12.89% to 10%

5. dry density increases from 1.479 g/cc to 1.6875 g/cc

6.C.B.R increase from 1.7% to 5.24%

7.unconfined compressive strength increases from 2.85 Kg/cm^2 to 4.12 Kg/cm^2.

VII. REFERENCES:

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