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STABILIZATION OF BLACK COTTON SOIL USING GRANITE WASTE AND QUARRY DUST

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Abstract -*The design basis on black cotton soil (expansive soil) has continually been a difficult task for the engineers as the structure resting on black cotton soil will fail without any caution. Black cotton soil is located in M.P, Karnataka, Maharashtra and Andhra Pradesh in our country. Soil proportion changes relying upon their constituents, i.e. water content , density, bulk density, angle of friction, shear strength and so forth. The properties of black cotton soil can be modified with the aid of stabilizing the soil by way of mechanical means. In this project a try has been made to stabilize the soil using Granite waste and Quarry dust. Experimental work has been completed with 10 %, 15% and 20 % of Granite waste and Quarry dust content. The experimental work is based totally on percentage changes of Granite waste and Quarry dust content in soil on tests for soil Liquid limit, O.M.C., M.D.D, Bulk density, Dry density and Grain size analysis. The purpose is to enhance the engineering properties of the black cotton soil such that the structure constructed in this soil can be correctly withstand the load applied. It turned into found that the engineering properties of black cotton soil appreciably progressed via addition of granite waste and quarry dust.*

***Key Words*: Granite waste, quarry dust, black cotton soil.**

1.INTRODUCTION

Soil improvement is of major concern in the construction activities due to rapid growth of urbanization and industrialization. The term soil improvement is used for the techniques which improve the index properties and other engineering characteristic of weak soils. In India expansive soil cover about 0.8x106 km2 area which is approximately one-fifth of its surface area. These soils contain montmorillonite mineral due to this they swell and shrink excessively with change of water content. Such tendency of soil is due to the presence of fine clay particles which swell, when they come in contact with water, resulting in alternate swelling and shrinking of soil due to which differential settlement of structure takes place.

Expansive soils can be stabilized by the addition of a small percentage of admixtures. These techniques have been used for many construction purposes, notably in highway, railroad and airport construction to improve subgrades and sub-bases. The Granite waste is a by-product produced in granite factories while cutting huge granite rocks to the desired shapes. About 3000 metric ton of granite waste is produced per day as a by-product during manufacturing of granite tiles and slabs from the raw blocks.

The marble and granite cutting industries are dumping these wastes in nearby pits or open lands. This leads to serious environmental pollution and occupation of vast area of land. This project work presents the effect of quarry dust on engineering properties of black cotton soil blended with 10%, 15% and 20% of quarry dust by weight of soil.

1.1 MATERIALS

Properties of Black Cotton Soil :

The soil formed and shaped in Deccan India with the disintegration of black lava. In India, expansive soils are known as Black Cotton soil. The name “Black Cotton” as an agricultural origin. Most of those soils are black in colour and are desirable for growing Cotton. All the black soils are not expansive soils and all the expansive soils are not black in colour. These soils posses high strength in summer season and decreased swiftly in winter. The soil has a swelling property due to the presence of montmorillonite mineral. The swelling soils of India have their origin in subsqueous decomposition of basalt rocks or weathering In-Situ. It's far very vital to speak about the Engineering properties of soils. From this information civil structures can be averted from the damages inflicting Expansive soils. Black soils are highly argillaceous and are enormously rich in Caco3.

Properties of quarry dust:

The quarry dust is formed by the processing of the granite stones which broken downs into the coarse aggregates of different sizes. Advantages of Quarry dust is the specific gravity depends on the nature of the rock from which it is processed and the variation is much less. Risk of Quarry dust is shrinkage is more in while in comparison to that of the natural river sand.

Properties of granite waste:

The granite waste is a by-product produced in granite factories while cutting huge granite rocks to the desired shapes. About 3000 metric ton of granite waste is produced per day as a by-product during manufacturing of granite tiles and slabs from the raw blocks. Economic way of stabilization because granite which is available in huge quantity from granite industries.The properties of waste depend upon the granite from which it is taken.

1.2 METHODOLOGY

The soil sample used for this study was collected by method of disturbed sampling at average depths of 1.0. The preliminary tests for identification of the natural soil and the geotechnical properties of the soil treated with quarry dust. Black cotton soil is mixed with granite and quarry dust powder in different proportions. For the present study, the various tests are performed along with a brief description of the procedure have been included. The tests include the index test for Soil, granite waste & Quarry dust, the engineering tests to understand the behavior of the soil. These tests were performed on locally available Black cotton soil.

The test performed are:

Sieve analysis.
Specific gravity.
Unconfined compression tests.
Standard proctor test.
Liquid limit test - Casagrande's method.

2. PERCENTAGE OF GRANITE WASTE AND QUARRY DUST

The laboratory activies were carried out on the samples of soil ,soil+granite waste+quarry dustfor different percentage of granite waste and quarry dustas shown in below proportion by weight of soil.

SOIL PARTICULARS	PERCENTAGE OF ROBO SAND	SYMBOLUSED
NATURAL SOIL	0	NS
SOIL SAMPLE 1	NATURAL SOIL + 10%(GRANITE WASTE+QUARRY DUST)	S1
SOIL SAMPLE 2	NATURAL SOIL + 15%(GRANITE WASTE+QUARRY DUST)	S2
SOIL SAMPLE 3	NATURALSOIL + 20%(GRANITE WASTE+QUARRY DUST)	S3

RESULTS AND DISCUSSIONS

Following table shows overall result of liquid limit , optimum moisture content , maximum dry density, unconfined compressive strength , coefficient of uniformity , coefficient of curvature , specific gravity

DESCRIPTION	NS	S1	S2	S3
LIQUID LIMIT %	15.5	21	20	17
OPTIMUM MOISTURE CONTENT %	12	12	10	10
MAXIMUM DRY DENSITY g/cc	1.95	2.14	2.41	2.45
UNCONFINED COMPRESSION STRENGTH kg/cm^2	3.15	1.8	2.3	3.3
COEFFICIENT OF UNIFORMITY	2.53	3.6	3.63	3.95
COEFFICIENT OF CURVATURE	1.01	1.6	1.9	1.6
SPECIFIC GRAVITY	2.85	2.84	2.87	3

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

LIQUID LIMIT:

Chart 1 shows liquid limit goes on decreasing on adiition of granite waste and quarry dust

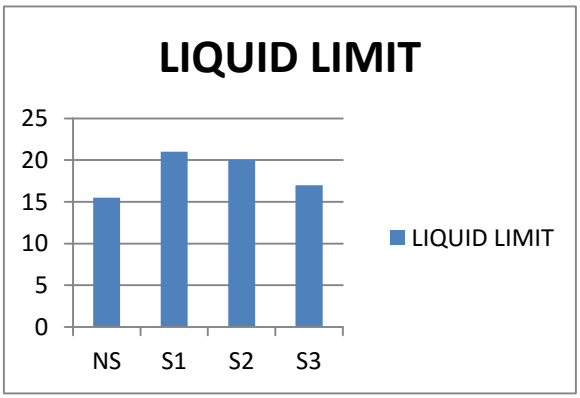

Chart 1:Variation in liquid limit for varying percentage of granite waste and quarry dust

OPTIMUM MOISTURE CONTENT:

Chart 2 shows the optimum moisture content goes on with decreasing with addition of granite waste and quarry dust.

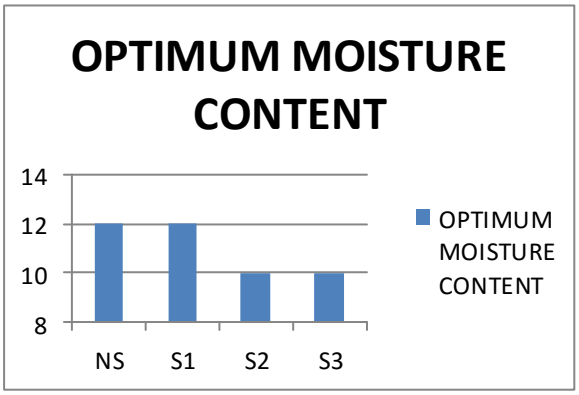

Chart 2:Variation in optimum moisture content for varying percentage of granite waste and quarry dust

MAXIMUM DRY DENSITY:

Chart 3 shows maximum dry density for soil goes on increasing with addition of granite waste and quarry dust.

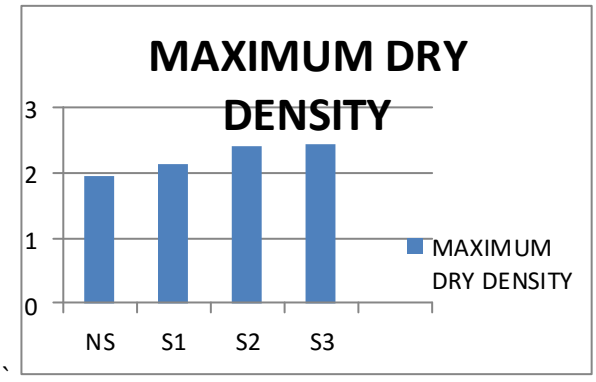

Chart 3:Variation in maximum dry densityfor varying percentage of granite waste and quarry dust

UNCONFINED COMPRESSIVE STRENGTH:

Chart 4 shows the unconfined compressive strength goes on increasing with addition of granite waste and quarry dust.

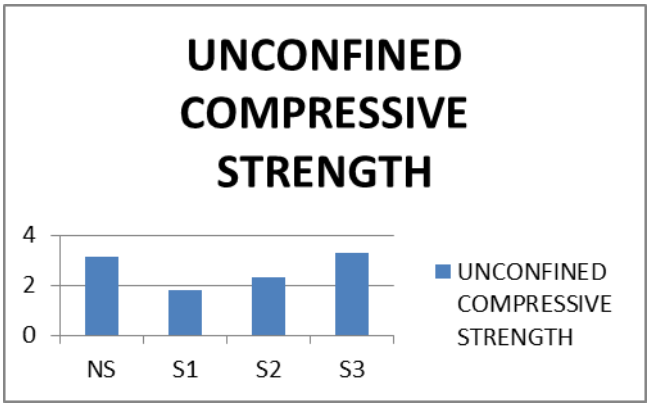

Chart 4:Variation in unconfined compressive strength for varying percentage of granite waste and quarry dust.

COEFFICIENT OF UNIFORMITY:

Chart 5 coefficient of uniformity for soil goes on increasing with addition of granite waste and quarry dust.

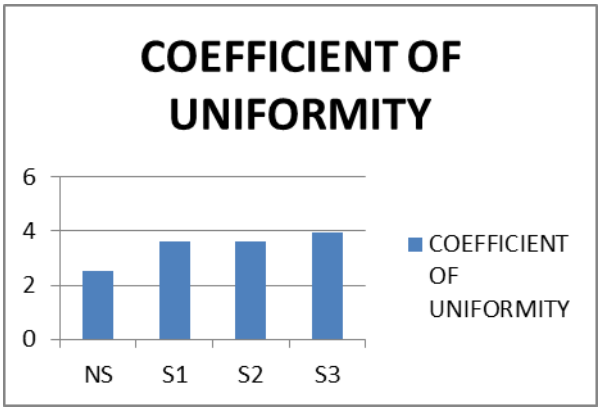

Chart 5:Variation in coefficient of uniformity for varying percentage of granite waste and quarry dust

COEFFICIENT OF CURVATURE :

Chart 6 shows the variation of coefficient of curvature goes on increasing for soil with addition of granite waste and quarry dust.

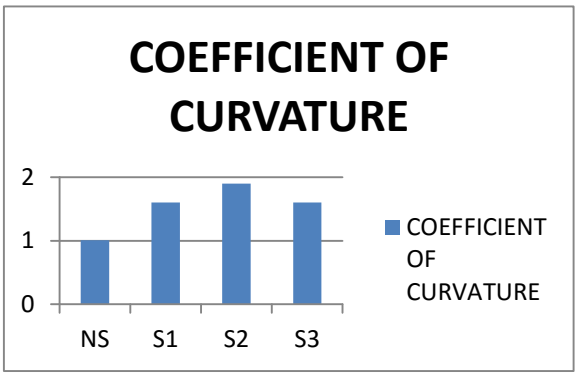

Chart 6:Variation in coefficient of curvature for varying percentage of granite waste and quarry dust

SPECIFIC GRAVITY :

Chart 6 shows specific gravity for soil goes on increasing with addition of granite waste and quarry dust.

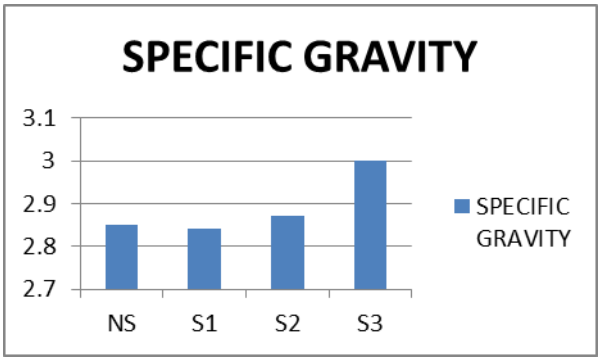

Chart 1:Variation in specific gravity for varying percentage of granite waste and quarry dust

3. CONCLUSIONS

From the series of tests conducted on Black Cotton soil mixed with granite waste and quarry dust the following conclusions are drawn:

•Specific gravity of Black cotton soil increased with the addition of quarry dust and granite waste, this increment of specific gravity value may be due to the addition of plasticity character of Black cotton soil.

•It has been observed that the liquid limit decreased from 21%to 17% with the addition of quarry dust and granite waste from 0% to 20%.

•Unconfined compressive strength improved in Black cotton soil after adding 20% quarry dust and granite waste.

•Addition of different ratio of quarry dust and granite waste to the black cotton soil gets stabilized, thus the Maximum dry density increases and Optimum moisture content goes on decreases.

•Coefficient of curvature and coefficient of uniformity goes on increasing on addition of granite waste and quarry dust.

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