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STABILIZATION OF NON PLASTIC SILT USING MARBLE DUST

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ABSTRACT

An environment friendly and cost effective way of soil stabilization is with the help of industrial waste. In cost heavy projects if we can reduce the cost of stabilization of soil, it will make our project economical. Marble dust is one of the industrial waste that can be utilized in the stabilization of soil economically and without having any adverse effect on environment. This paper presents the result of laboratory study undertaken to investigate the effect of marble dust on strength of low plastic silt soil. The optimum percentage of marble dust was found to be 15% by unconfined compressive test. Further addition of marble dust had negative effects on the unconfined compressive strength of soil. The Maximum Dry Density (MDD) goes on decreasing and Optimum Moisture Content (OMC) goes on increasing with increase in the percentage addition of marble dust. Soil samples with different percentage of marble dust have maximum value of UCS= 1.032 kg/cm^2 at 15% value. The soil samples made for UCS started showing brittle characteristics with increase in percentage of marble dust after 5%.

Keywords: ***Marble dust, Stabilization, Unconfined compressive strength, maximum dry density***.

1. INTRODUCTION

Soil stabilization is the process of improving the engineering properties of the soil and thus making it more stable. It is required when soil available for construction is not suitable for the intended purpose. In the broad sense, stabilization includes compaction, pre-consolidation, drainage and many other such processes. Stabilization is the process of blending and mixing materials with a soil to improve certain properties of the soil. The process may include the blending of soils to achieve a desired gradation by the mixing of commercially available additives that may alter the gradation, texture or plasticity, or act as a binder for cementation of the soil. Soil stabilization is used to reduce the permeability and compressibility of the soil mass in earth structures, to reduce the swell in case of expansive soils and to increase its shear strength. Soil stabilization is required to increase the bearing capacity of foundation soils.

Due to the increasing cost of high quality materials needed for different geotechnical projects, engineers try to improve the physical properties of local soils through different methods and techniques. The word improvement means to increase the shear strength, reduce settlement, resist harsh environment conditions such as thawing and freezing, and decrease or eliminate all problems associated with weak soils. Soil stabilization could be applied to both sandy and clayey soil through mechanical and chemical methods. There are many common methods-mechanical or chemical-found in the literatures that were used to improve the physical properties of the soils.

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Hence appropriate measures are to be taken for the improvement of properties of soils, preferably before conducting construction work. A wide range of soil improvement methods has been used, including soil replacement, dynamic compaction, lime/cement columns, stone columns, and soil reinforcements with fibrous materials. The selection of an appropriate method depends on ground characteristics, effectiveness, and practicality of the preferred technique and associated costs.

The stabilization with cement and lime is well documented. Soil stabilization using cement is not generally preferable because of the increasing cost and environmental concerns related to it like the CO_2 emission during its production. Production of lime also causes the emission of CO_2. Moreover lime contains sulphates which may increase swelling due to formation of swelling minerals such as ettringite and thaumasite. Over the last few years, use of industrial wastes like blast furnace slag, fly ash, rice husk ash, steel slag, marble dust, bagasse ash, ceramic tile waste etc. has increased as stabilizing materials for naturally occurring fine-grained soils. These waste products pose a serious environmental problem if not disposed of properly. Their use serves two purposes; firstly the disposal of waste material and secondly, use as construction material.

Marble is the most preferred stone of India and is available in Rajasthan and Madhya Pradesh. Marble dust is the wastes/dust obtained during cutting and cleaning of marble. The rapid development of commercial enterprises of marble produces risky waste material. It becomes a major issue to the people surrounding them and moreover it goes about as a toxin so as to influence natural environment of the Earth. It has been observed that marble dust is a successful waste material in soil stabilization strategy which enhances the compaction qualities, subgrade characteristics, swelling characteristics, compressibility characteristics.

The purpose of present study is to see the effect of industrial wastes (marble dust), in improving the UC strength of silt soil. A better understanding of these characteristics will enhance the usage of these materials in geotechnical engineering works in places where they are abundant and thereby making clays suitable for foundation purpose. The study also focuses at reduction of huge stockpile of the various industrial wastes and their potential impact on the environment.

II. OVERVIEW OF EARLIER RESEARCH

Akshaya Kumar Sabat, Radhikesh P. Nanda (2011) examined the impact of marble dust on strength and durability of rice husk ash stabilized expansive soil and found that addition of marble dust increases the strength, decreases the swelling pressure and made the soil rice husk ash mixes strong. The ideal mixture of soil: rice husk ash: marble dust was observed to be 70:10:20.

R. Ali, H. Khan, A. A. Shah (2012) utilized marble dust and bagasse ash for expansive soil improvement. Different laboratory tests on expansive soil without the addition of these wastes and with the addition of these waste were conducted and their impact on swelling and different properties were determined.

Sachin N. Bhavsar, Hiral B. Joshi, Priyanka K. Shrof, Patel Ankit J. (2013) evaluated swelling potential of expansive soil in its natural state as well as when mixed with varying proportion of marble dust (from 30 to 50%). It is concluded that the impact of marble powder on black cotton soil is positive. It gives maximum improvement in the swelling and linear shrinkage properties of black cotton soil.

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Rozhan Sirwan Abdulla, Nadhmiah Najmaddin Majeed (2014) investigated the soil from two spots Bastora and Erbil Airport with Bastora soil as CH soil and Erbil Airport as CL soil. The marble waste powder was included in percentages of 10%, 20% and 30% by weight of soil. The results demonstrate that increase in percentage of marble dust decreases liquid limit, plasticity index and plastic limit and swelling potential.

Chayan Gupta and Ravi Kumar Sharma (2014) demonstrated the impact of waste materials, for example, marble dust, fly ash on the sub grade qualities of black cotton soil. They concluded that the 15% marble dust is adequate to increase the California bearing ratio soaked strength up to around 200%.

Parte Shyam Singh, and R. K. Yadav (2014) examined the impact of 0% to 40% marble dust on index properties of black cotton soil. The test outcomes demonstrated a huge change in consistency limits of specimens containing marble dust. Liquid limit reduced from 57.67% to 33.9%. The plasticity index reduced from 28.35% to 16.67% and shrinkage limit increased from 8.06% to 18.39% with the addition of marble dust. Also, differential free swell decreased from 66.6% to 20.0%.

III. MATERIALS AND METHODS

The material used in this study is silty soil and marble dust. Soil is procured from Khajni village in Gorakhpur distict. Marble dust is procured from Thanesar town Kurukshetra distict.

MATERIAL	SPECIFIC GRAVITY
Soil	2.41
Marble dust	2.13

3.1. Experimental Procedure

- In this test, a cylinder of soil without support was tested to failure in simple compression, at constant rate of strain. The compressive load per unit area required to fail the specimen as called UC strength of soil.
- From Procter test the soil is mixed with optimum water content with weight of dry soil (as calculated from MDD).then it is kept wrapped in polyethene for one day for maturing.
- After 24 hours the soil sample was taken out and placed in UCS standard mould. A cylindrical sample was made and dimensions were recorded again keep it for 24 hours of maturing.
- Standard UCS test is conducted and the changed dimensions were recorded.

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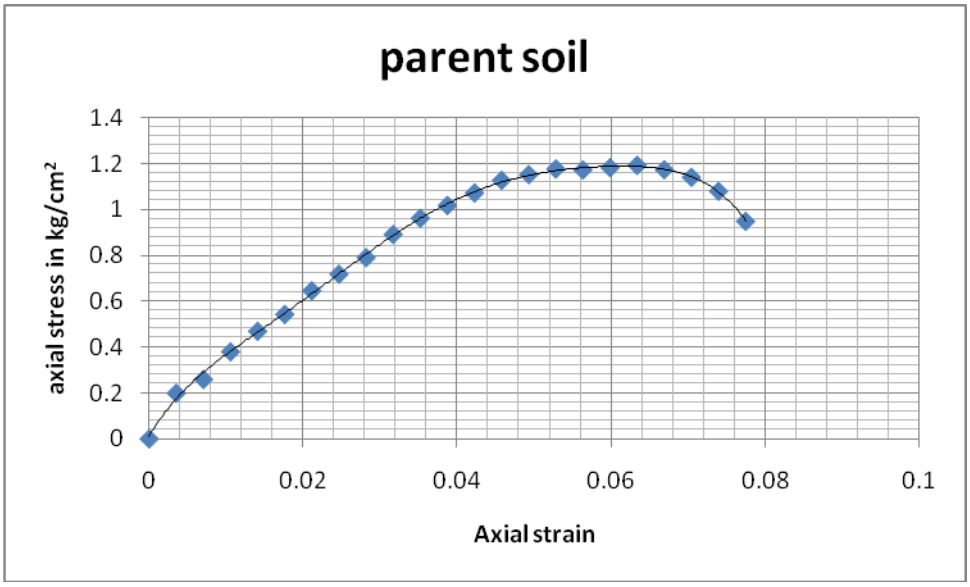
3.2. Experimental Results

3.2.1- Parent Soil

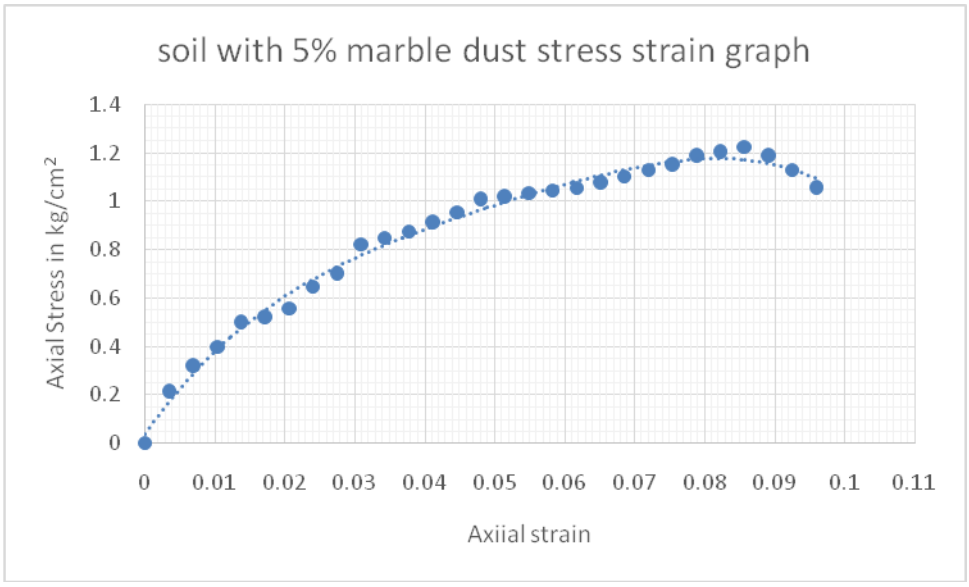


Interpretation and reporting

Unconfined compressive strength of the soil = 1.1928

Shear strength of the soil = 1.1928/2 = 0.5964

3.2.2- Soil With 5% Marble Dust



Interpretation and reporting

Unconfined compressive strength of the soil = 1.22

Shear strength of the soil = 1.22/2 = 0.61

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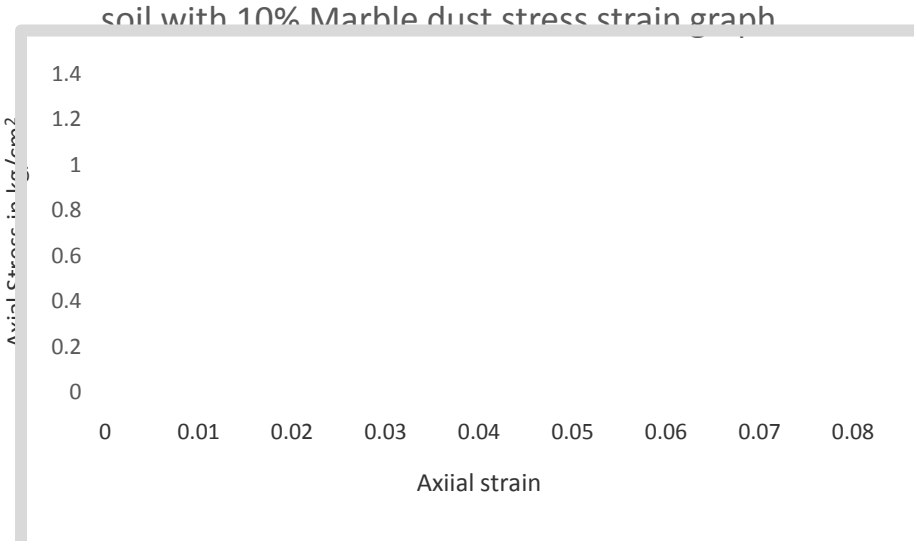
3.2.3- Soil With 10% Marble Dust

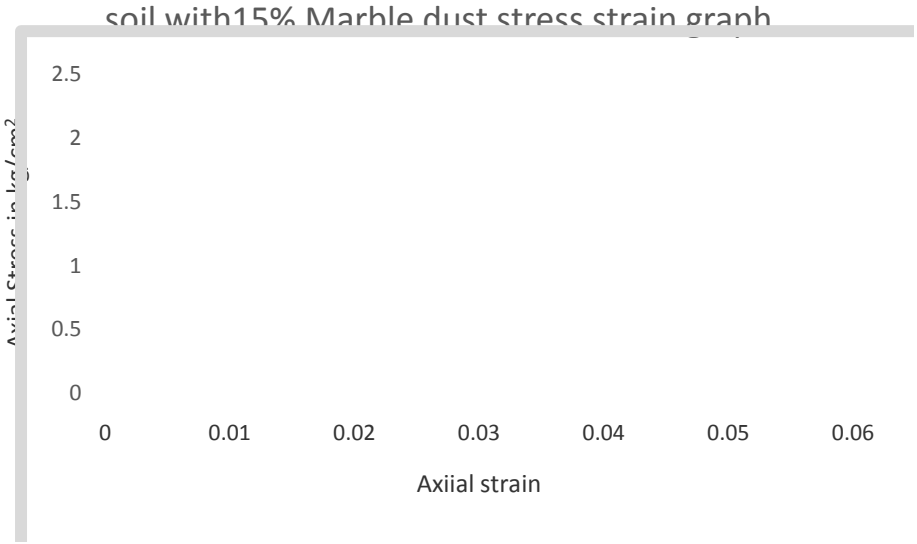


Interpretation and reporting

Unconfined compressive strength of the soil = 1.2933

Shear strength of the soil = 1.2933/2 = 0.6466

3.2.4- Soil With 15% Marble Dust



Interpretation and reporting

Unconfined compressive strength of the soil = 2.064

Shear strength of the soil = 2.064/2 = 1.032

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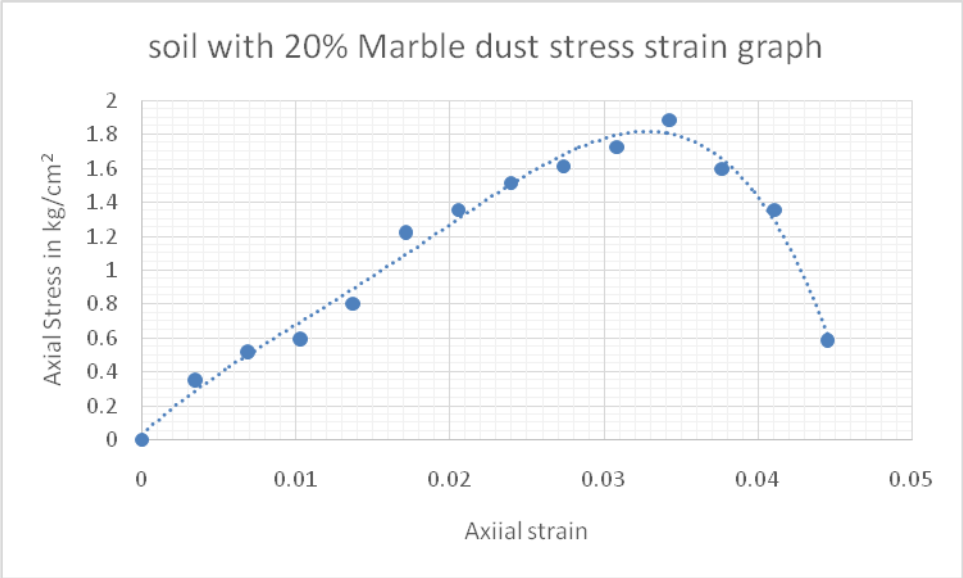
3.2.5- Soil With 20% Marble Dust



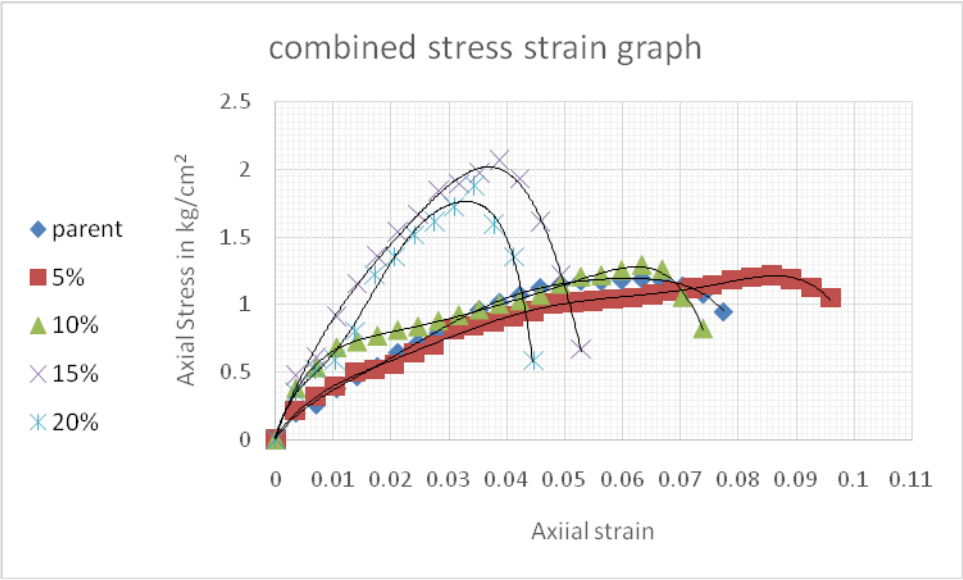
Interpretation and reporting

Unconfined compressive strength of the soil = 1.88

Shear strength of the soil = 1.88/2 = 0.94

IV. CONCLUSION

- Optimum value of marble dust comes out to be 15% by weight of dry soil.
- Maximum unconfined compressive strength of sample is = 1.032 for 15% marble dust addition..
- With increase in percentage of marble dust dry density decreases and optimum moisture contain increases.
- Samples turned brittle on higher percentage of marble dust.



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REFERENCES

Journal Papers:

[1.] IS: 1498 (1970), "Indian Standard Methods of Test for Soils: Classification and Identification of Soil for General Engineering Purposes", Bureau of Indian Standards.

[2.] IS: 2720 (Part 7) (1974), "Indian Standard Methods of Test for Soils: Determination of Moisture Content-Dry Density Relation using Light Compaction", Bureau of Indian Standards.

[3.] IS: 2720 (Part 15) (1986), "Indian Standard Methods of Test for Soils: Determination of Consolidation Properties", Bureau of Indian Standards.

[4.] ASTM: STP 892 (1986), "Consolidation of Soils: Testing and Evaluation", American Society for Testing and Materials.

[5.] Panagiotis Ch. Eskioglou (2009), "Influence of Soil Type on Stabilization with Marble Dust for Forest Road Construction", IJSRET, ISSN:2058-0282.

[6.] Sabat, A. K. and Nanda, R. P. (2011), "Effect of Marble Dust on Strength and Durability of Rice Husk Ash Stabilized Soil", International Journal of Civil and Structural Engineering, Vol-1, No-4.