

Bearing Capacity Variation Analysis of Different Soils Admixed With Marble Waste

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ABSTRACT: The physical properties of natural clayey soils are generally improved with the addition of admixtures like lime and cement. The demand of lime and cement has been increasing in the construction industry which causes increasing their cost. Efforts therefore have been carried out since long time to use the materials as admixtures which are obtained as waste from the manufacturing processes. Marble powder is an easily available waste product obtained during the cutting and grinding processes of the marble pieces. Our Project involves an experimental study to investigate the use of the marble powder as a stabilizer to strengthen the weak natural clayey soils. Utilizing waste marble dust materials in problematic soils will have great contribution to the economy and conservation of resources.

KEYWORDS: Clay Soil, Marble Powder, Soil stabilizer, Bearing Capacity, admixtures, physical properties.

I. INTRODUCTION

The world witnesses a trend nowadays, i.e. "Utilizing the waste material for the improvement/strengthening of the poor soils". The main reason following the trend is the production of a large quantity of wastes like plastics, rice husk ash, fly ash and other industrial and agricultural wastes. These wastes cause the deposition problem and serious environmental concerns also. In order to resolve these problems one of the venues is to use these materials in different civil engineering projects. A good auspicious technology regarding to utilize these wastes regarding the civil engineering projects is the soil stabilization. Since decades, industrial products like lime and Portland cement are in use to attain good quality of the civil works, although these have proven to be very costly. A major problem with the common soil stabilizing agents is their manufacturing procedures being energy demanding and exhaling a big amount of Carbon-di- Oxide (CO₂). Almost one ton of CO₂ is transmitted during manufacture of one ton of cement. Marble has been used as a material for buildings since oldage. Expulsion of waste of the marble industry in very thin powder form is one of the major environmental issues today throughout world.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 9, Issue 3, March 2020

1. CLAY SOIL:



Fig.1: Clay Soil

The Clay soil is a type of expansive soil with intermediate plasticity and can retain moisture throughout the dry season which is why they are valuable for growing crops. It exhibits low bearing capacity, low permeability and high-volume change with variation in environment.

The maintenance of roads not only expensive but also difficult and the pavements shows early signs of failures. Following are the problems with Clay soil.

- In rainy season, these soils become very soft by filling up of water in the cracks and fissures. These soft soils reduce the bearing capacity of the soils.
- In saturated conditions, these soils have high consolidation settlements.
- These soils have high swelling nature. Due to this structure causes damages.
- When lands are applied on these soils in wet conditions. These soils get Shrinkage.

2. MARBLE POWDER:



Fig.2: Marble Powder

Marble is a non-foliated metamorphic rock composed of re-crystallized carbonate minerals, most commonly calcite or dolomite. Geologists use the “marble” to refer to metamorphosed limestone, however stonemasons use the term more broadly to encompass un-metamorphosed limestone. Marble is a metamorphic rock resulting from the transformation

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Vol. 9, Issue 3, March 2020

of a pure limestone. The purity of marble is responsible for its color and appearance; it is white if the limestone is composed solely of calcite. Marble is used for construction and decoration; marble is durable, has a noble appearance, and is consequently in great demand.

Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine minerals. The other mineral constituents vary from origin to origin. Quartz, muscovite, tremolite, actinolite, micro line, talc, garnet, osterite and biotite are the major mineral impurities whereas SiO₂, limonite, Fe₂O₃, manganese, 3H₂O and FeS₂ are the major chemical impurities associated with marble. The main impurities in raw limestone which can affect the properties of finished cement are magnesia, phosphate, leads, zinc, alkalis and sulfides.

Application of Marble dust:

- Power coating, paints and ceramic industry.
- Reinforced polyester glass fiber.
- Leather cloth and flooring applications.

II. METHODOLOGY

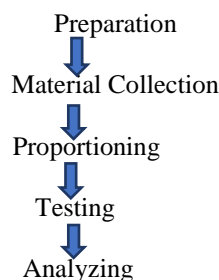


Fig.3: Methodology

Preparation:

Preparation for the analysis of different soils bearing capacity variation mixed with the marble waste. Then the 0% 5% 10%....., marble waste is added with the different soils.

Material Collection:

Material collection is Collection of material Clay is a finely-grained natural rock or soil material that combines one or more clay minerals and waste marble is collected from the marble industry and then the collected marble is grained for the marble powder that is called the marble waste.

Proportioning:

The collection of different soils is collected and fully grained natural rock or soil material and then mixed with marble waste in 5% 10% 15% 20% 25%. For the analysis of bearing capacity variation in the different soils.

Testing:

Testing for the bearing capacity variation of the different soils admixed with the marble waste with 5% 10% 15% 20% mixing of marble waste in the different soils and then analyzed variation of bearing capacity in the different soils.

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Vol. 9, Issue 3, March 2020

Analyzing:

Analyzing for the bearing capacity variation for the different soils admixed with the marble waste in 5% 10% 15% 20% 25%. And then analyzed for the bearing capacity variation of different soil.

III. TEST RESULTS

LIQUID LIMIT:

For kaolinite:

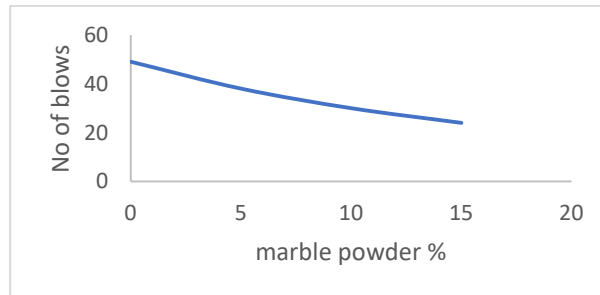


Fig.4: kaolinite in Liquid Limit

For illite:

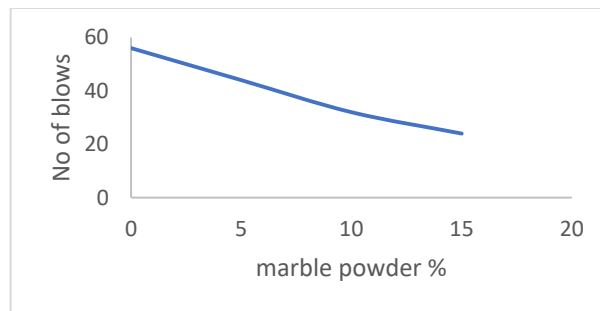


Fig.5: Illite in Liquid Limit

For Montmorillomite:

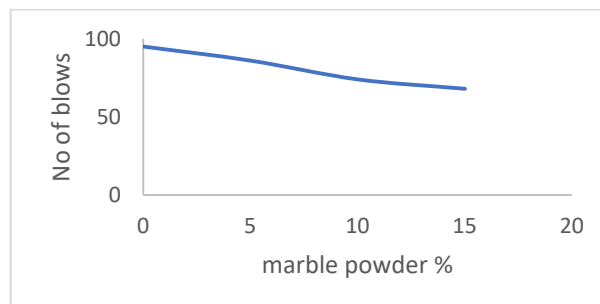


Fig.6: Montmorillomite in Liquid Limit

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PLASTIC LIMIT:

For kaolinite:

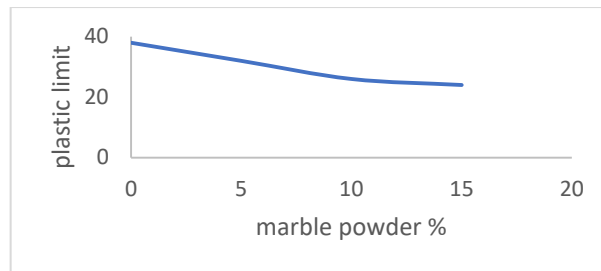


Fig.7: Kaolinite in Plastic Limit

For illite:

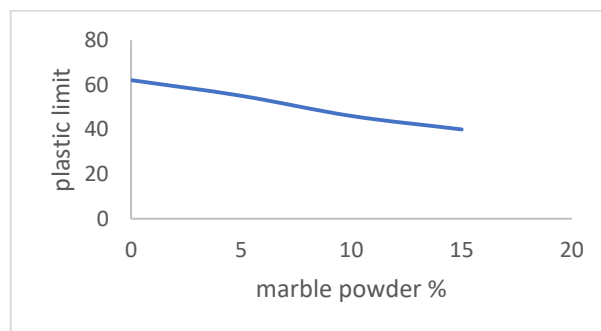


Fig.8: Illite in Plastic Limit

For Montmorillomite:

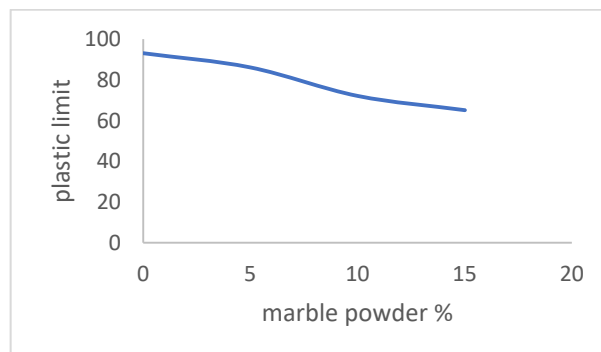


Fig.9: Montmorillomite in Plastic Limit

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UNCONFINED COMPRESSIVE STRENGTH:

For kaolinite:

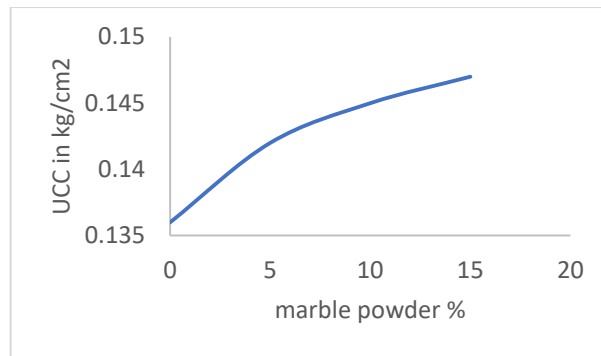


Fig.10: Kaolinite in UCC

For illite:

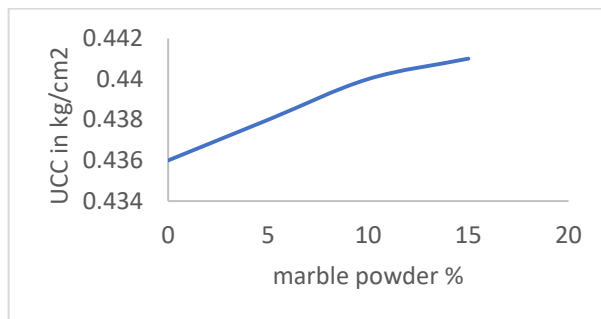


Fig.11: Illite in UCC

For montmorillomite:

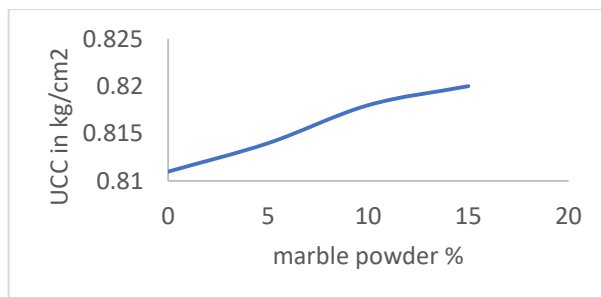


Fig.12: Montmorillomite in UCC

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IV. CONCLUSION

Based on the experimental results the liquid limit and plastic limit decrease with the addition of marble powder. From unconfined compressive test, the value increases gradually with the addition of marble powder. As a consequence, experimental results of this study reveal that using marble dust as an additive for soil stabilization gives good results and it is an environmentally friendly implementation in terms of solid waste management.

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