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Analysis and Stabilization of Dredged Material Using Marble Dust for Its Potential Use in Sub-Grade

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Abstract: ***This research paper deals about the experimental study on the stabilization of dredged material for its potential use in sub-grade. Large amounts of sediments are dredged from rivers and lakes as a result of environmental dredging in India. These dredged materials have poor geotechnical properties and are treated as wastes, On the other hand, there is a huge demand of sub-grade materials due to the increasing number of highway construction projects, so therefore it forms the significant topic for research. The stabilization of dredged material by marble dust is considered as an environmentally friendly option and economical because both marble dust and dredged material are waste products. Marble dust is formed by the cutting and polishing of marble stone. Marble dust contains high amount of calcium, silica, alumina which aids in the stabilization of the dredged material. Thus, the use of DM as sub-grade material may be considered as an environmentally friendly and economical option.***

Keywords: Dredged material, stabilization, environmental dredging, Subgrade etc.

I. INTRODUCTION

Dredged material is that material which is removed from rivers, lakes in order to make these waterways navigable.

The most devastating flood occurred in September 2014 which resulted in intolerable damage to life, property and also economy activities were disrupted. The present capacity of flood spill channel is significantly less thanits design capacity. This is mainly due to unplanned urbanization and encroachments along the banks of river Jhelum. There is a need to prevent such hazards and govt of Jammu and Kashmir has taken necessary actions against the same. One of the proposal was dredging of river Jhelum and its spill channel. Dredging facilitates water flow and increases the carrying capacity of the river but it also creates large quantity of dredged material and there is a need for proper disposal of the dredged material.

The dredging of Jhelum flood channel has also resulted in large quantity of dredged material. Therefore, initiatives must be taken to utilize this resource. Due to rapid urbanization and increase in population there is scarcity of good construction sites for the construction of various engineering projects. Therefore, investigations for characterization of various dredged material and steps to access the probable methods for the improvement of its properties for its application in construction industry are of immense necessity. The material is not suitable for use as a sub-base or base course due to low CBR value. However, it can be put to use as a sub-grade material after stabilization by various binders like cement, lime, marble dust etc. for stabilization of dredged material industry generated waste material which cause huge disposal problem can be effectively used, marble dust is one such product. The amount of marble slurry produced every year is in the range of 5-6 million ton. The marble dust powder has very high lime content and were report by many researchers which aids in stabilization

Fig dredged material collection site

II. BACKGROUND

Okagbue and onyeobi 1999 discussed the improvement of red tropical soils by the addition of marble dust powder in varying proportions. Plasticity was reduced to 20% to 33% and UCS and CBR increased by 30% to 46% and 27% to 55% respectively.
The highest UCS and CBR was achieved at 8% marble dust. Altus saygili investigated the possibility of utilizing waste marble dust in stabilizing clayey soils. Marble dust was added in 5%, 10%, 20% and 30% by weight.
The optimum moisture content ranges between 16.5% and 15.5% waste marble dust addition to the soil increased the UCS values from 110kpa (5% addition) to 220kpa (30% addition)
Parte shyam singh and Yadav R studied the effect of marble dust addition in varying proportions (10%, 20%, 30%, 40%, 50%) on the properties of black cotton soil. The liquid limit value showed a decrease from 57.67% to 33.9% and shrinkage limit value increased from 8.06% to 18.39%. The differential free swell was decreased from 66.6% to 20%.
Muthur kumar and tamilarsan observed an increase in UCS values by the addition of marble dust in varying percentages (5%, 10%, 15%, 20%, 25%) to expensive soil. An increase from 93KN/m^2 at 0% marble dust addition to 215 KN/m^2 at 15% marble dust addition was observed

III. OBJECTIVES

The objectives to be achieved during the execution of the project can be summarized as below:

1) To explore the potential application of mass stabilization for shallow mixing of the dredged material from Jhelum flood spill channel with marble dust as binder
2) To explore the influence of binder content on the strength characteristics of dredged material
3) To compare the results obtained by stabilizing the dredged material with the virgin sample

A. *Scope of Work*

1) Since the Dredged material is having poor geotechnical properties, there is need for its stabilization. Stabilization of dredged material (DM) aims at improving strength of existing dredged material for load bearing so that we can make use of it as sub-grade or sub-base.
2) Stabilization can improve shear and unconfined compressive strengths, and permanently lower the dredged materials permeability to water
3) Stabilized dredged material can have improved strength and Reduced compressibility while encapsulating the contaminants to be less mobile. These properties Can make the stabilized dredged material suitable for use in engineering applications

IV. MATERIALS AND METHODS

In the present study, samples have been taken from two sites along the bed of Jhelum flood spill channel. Open excavation method has been employed for retrieving samples. One core has been retrieved from each site. The samples have been retrieved from within the depth range of 1 to 1.5 m below the existing flood spill channel bed level.

All the samples have been tested according to relevant IS codes in the laboratory for determining the geotechnical parameters, as given in Table

S.no	test	Procedure as per is code no
1	Core cutter test	is 2720-29(1975)
2	Specific gravity test	is 2720-3(1980)
3	Liquid limit test	is 2720-5 (1985)
4	Plastic limit test	is 2720-5(1985)
5	particle size Distribution	is 2720-4(1985)
6	Standard proctor test	is 2720-7 (1980)
7	california bearing ratio	is 2720-16(1987)
8	unconfined compressive strength test	is 2720-10 (1991)

V. RESULTS

S.no	properties	Sample 1	Sample 2
1	In situ dry Density	1.49g/cm^3	1.51 g/cm^3
2	In bulk density	1.8986 g/cm^3	1.980 g/cm^3
3	Specific gravity Test	2.54	2.34
4	Liquid Limit Test	30.2435%	41.5%
5	Plastic Limit Test	22.27%	23.7%
6	Plasticity Index	7.9735%	17.80%
7	Flow index	9.52	12.5
8	Toughness index	0.837	1.424
9	Optimum moisture content (light compaction)	17.16%	22.9%
10	Maximum dry density (light compaction)	1.723g/cm^3	1.670 g/cm^3
11	CBR value (soaked and light compaction)	4.79%	2.92%
12	Unconfined compressive strength	2.127157Kg/Cm^2	1.025 Kg/cm^2

VI. STABILIZED MATERIAL CHARACTERISTICS

A. Sample 1

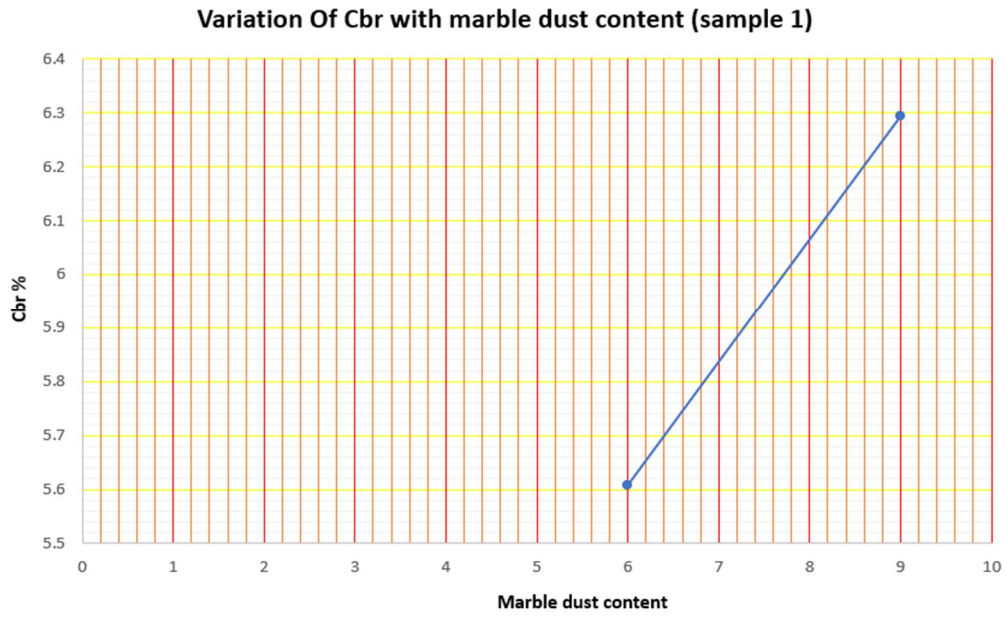
S.NO	Properties	6% MD	9 % Md
1	CBR VALUE	5.6071	6.294

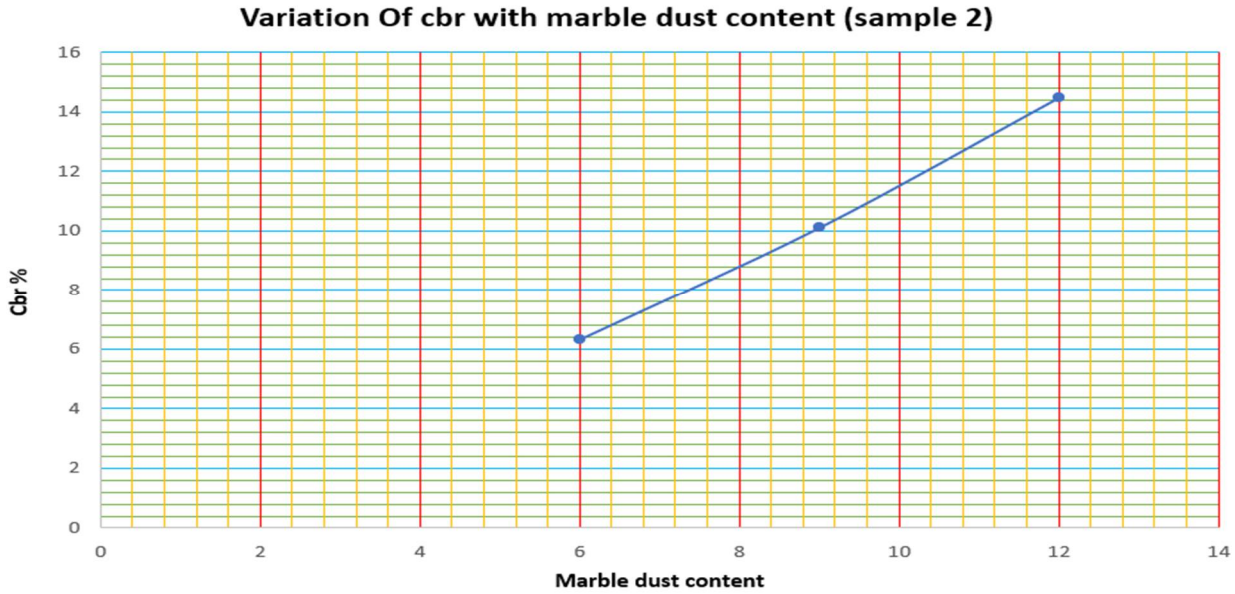
S.NO	Properties	6% marble dust	9% marble dust
1	Unconfined compressive strength	2.197273 kg/cm^2	2.31416 kg/cm^2

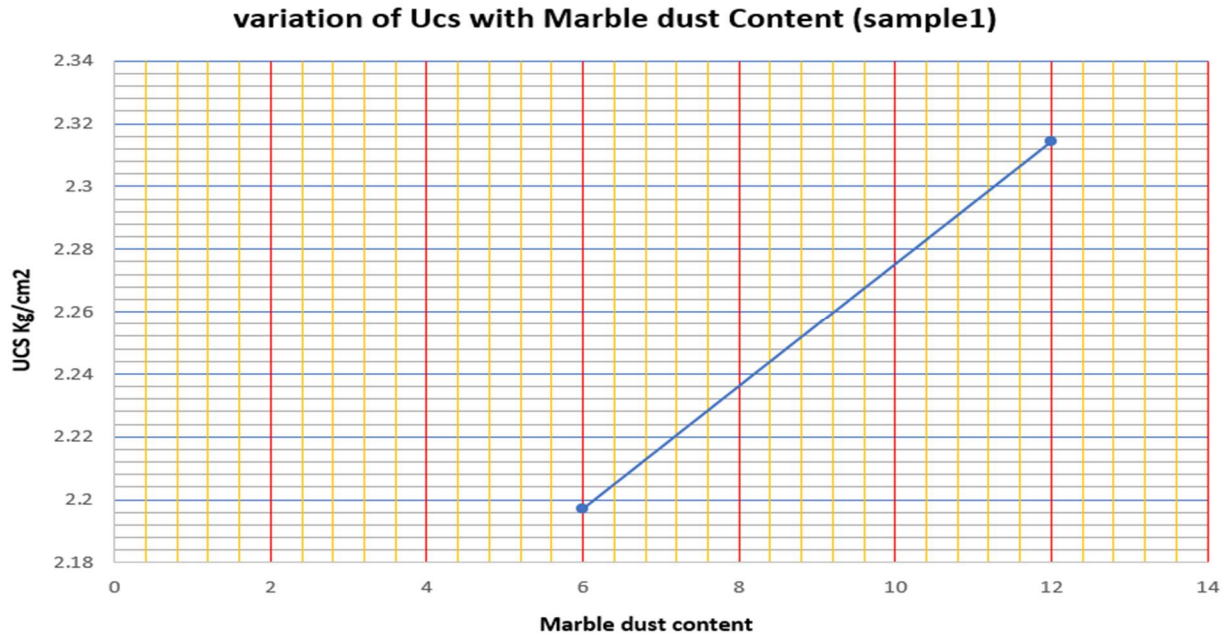
B. Sample 2

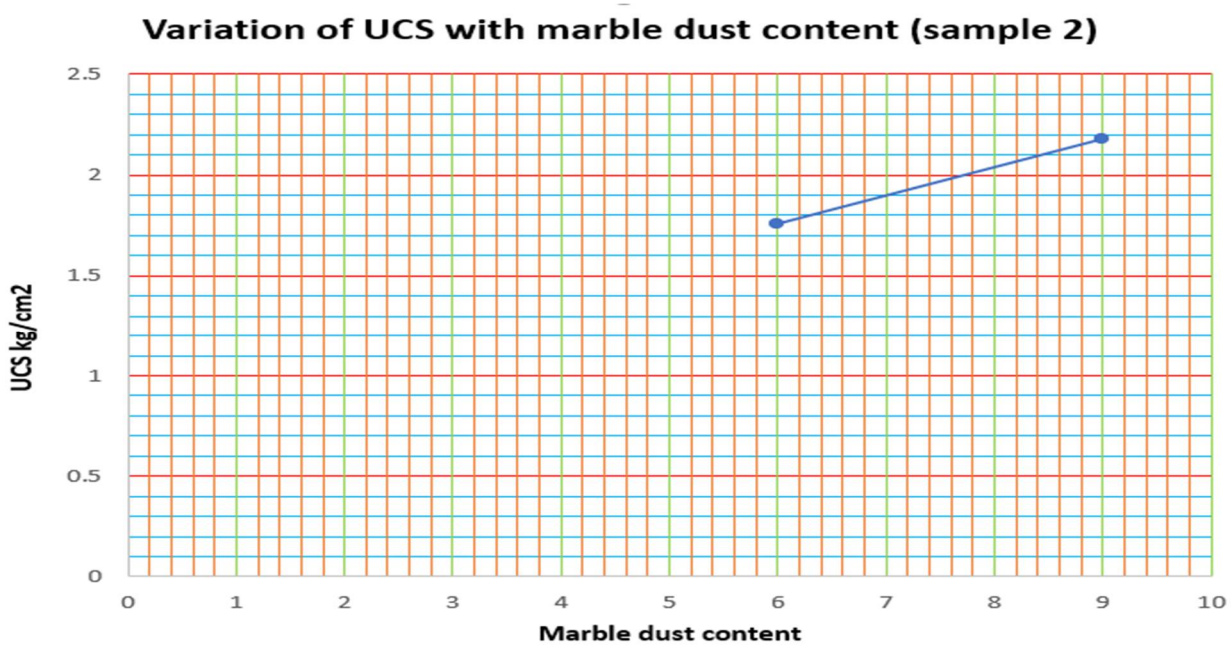
S. No	Properties	6% Md	9 % Md	12% Md
1	CBR VALUE	6.31%	10.10%	14.48%

S.No	Properties	6% Md	9 % Md
1	Unconfined compressive strength	1.757 kg/cm^2	2.179 kg/cm^2









VII. CONCLUSION

A. The dredged material available at the bed of flood spill channel consists of silty sand with appreciable fines

B. The material is not suitable for subgrade or base course due to low CBR value. However, it can be used as subgrade material for rural roads

C. The material may also be used for manufacture of bricks and tiles but more specific chemical and additional tests may be required. Also, the addition of additives may be required

D. CBR value of stabilized samples increases with increase in marble dust content

E. Unconfined compressive strength also increases with increase in marble dust content.

F. The material is now suitable for use of sub grade because of increase in CBR values.

VIII. FUTURE SCOPE OF WORK

The following work can be done in order to explore more about suitability of dredged material from Jhelum flood spill channel:

A. Conducting the laboratory direct shear test, permeability, consolidation and triaxial tests on the material
B. Determining the various geotechnical characteristics for the case of heavy compaction
C. Stabilization of dredged material can be carried out with more percentage of marble dust to determine the optimum content of stabilizer to be used

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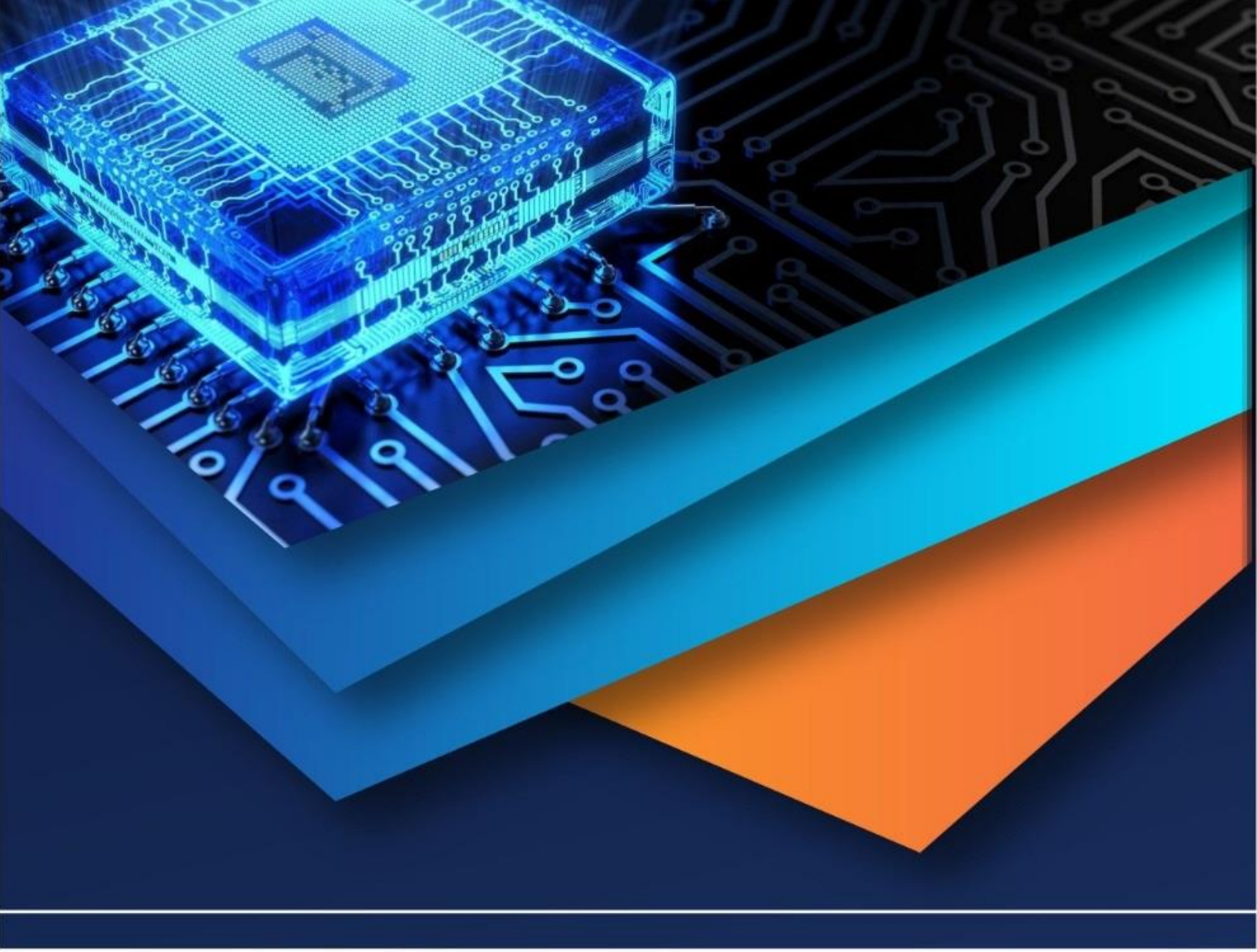

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