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SOIL STABILIZATION USING MARBLE DUST AND POLYPROPLYNE FIBER

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ABSTRACT

Soil stabilization is one of the essential part of strong infrastructure construction. Soil strength not only carry the loads but also retain the strength, stability and stiffness of the structure. Soil of appropriate bearing capacity is the prime requisite of any project development. True classification of strength parameter is the part of good quality practice for the construction purposes. Soil Stabilization has always been the keen interest of Researchers and various practices has been adopted for soil stabilization along with different additives more popularly like cement, lime, Fly Ash etc. In order to carry forward the soil stabilization research interest is focused on the usage of marble dust powder and polypropylene Fiber. Soil sample was collected from Mullanpur New Chandigarh SAS Nagar and Marble dust powder was collected from Marble Market, Landran Mohali and PPF was procured from Chandigarh Local market. Marble dust was taken in proportion of 10%, 20% and 30% weight of soil along with 0.1% , 0.2% and 0.3% of PPF by weight of soil was taken. Different soil parameter test was tested in order to get a clear picture about their effect on soil stabilization. The parameter under the consideration in this research study are OMC-MDD, CBR and UCS. Test was conducted as per the IS 2720. The Best results for OMC and MDD was obtained at soil with 30% of marble dust while the best CBR results was obtained at a combination of 30% marble dust and 0.1% polypropylene Fiber . Satisfactory and significant enhancement in soil parameter was obtained in the Research Study.

Keywords: Soil Stabilization, Marble Dust, Polypropylene Fiber, Waste Utilization.

I. INTRODUCTION

Significant structural schemes, such as high-rise towers, railway track laying, dams and reservoirs, bridges and highways, and so on, necessitate a large quantity of soil for their base and structural members. Since the higher the house, the greater the burden on the floor, it is the duty of the soil to carry the load and provide protection to the construction so that it can remain erected for the remainder of its existence without being destroyed by soil. The country's infrastructure growth is being propelled by a boom in urbanization and large-scale industrialization in this modern age. As a consequence, engineers must improve the technical properties of poor-quality soils. So, without an option, building works must be carried out on whatever land is available, regardless of its suitability. As a result, if land is considered to be unsuitable, it must be built using acceptable and cost-effective engineering techniques. Previously unsuitable land (characterized by soft compressive clay, expansive clay, deformable sub-soil, etc.) could be used for building as a result of this process could be utilized for construction purposes after appropriate modification of its engineering properties. Improving the engineering properties of soil by numerous creative and cost-effective methods has always been a challenge for geotechnical engineers. The stabilization method will enhance the engineering properties of soil. Stabilization, in a general context, refers to the different methods for altering a soil's properties in order to enhance its engineering capability.

Soil Stabilization

Soil stabilization is the result of modifying certain soil properties by various means; either mechanical or chemical, to create an enhanced soil content that has all the necessary engineering properties. Compaction, pre-consolidation, draining, and other methods including the addition of a cementing agent or a solvent to natural soil is also examples of soil stabilization. It is used to boost the shear strength and bearing capability of base soils by reducing permeability and compressibility of the soil mass in earth structures. The properties of soil vary greatly between areas, or in some cases, even within a single area, and the effectiveness of soil stabilization depends on research. Until applying the methods used to stabilize the soil on the ground, they should be checked in the lab with the soil content.

II. METHODOLOGY

The recommended research technique is a step-by-step approach for conducting the proposed study and chieving the above-mentioned goals. It specifies the materials to be utilised and how they will be procured.

The following information is based on Indian Standard codes for determining various soil characteristics.

- Soil is collected from Mohali, S.A.S Nagar
- Marble dust powder is collected from SAS Nagar Mohali Local vendor Shop.
- Polypropylene Fiber was collected from the Chandigarh Market.
- Soil Classification was conducted on the Virgin soil as per IS : 1498 and IS: 2720
- The result obtained from sieve analysis will be used to plot the particle size curve on a semi-log graph with particle diameter or the sieve size as the abscissa with logarithmic axis and the percentage passing as the ordinate gives a clear idea about the particle size distribution.
- Atterberg limit will be calculated as per the IS :2720 part-5, 1985
- Specific gravity will be determined to have an idea of unit weight of different mixes as per the IS:2720, Part-3, 1987
- Different mix proportion of material will be calculated in alignment of the objectives defined.
- Proctor compaction test will be conducted to determine the OMC-MDD as per the IS:2720,part-6 1980 at original and with additive soil sample
- CBR test will be conducted to determining the load-penetration curve as per IS:2720, part 6 1979 on desired soil samples.
- Unconfined compressive strength will be conducted as per IS 2720 part 10 on virgin soil as well as soil with additives.
- Data Analysis and Result interpretation will be done

III. RESULTS AND DISCUSSION

With the aid of analysis and laboratory studies, an effort has been made to use Marble Dust in combination with Polypropylene fibers to stabilize the soil in the current experimental sample. The physical properties of raw soil, as well as soil mixed with marble dust and Polypropylene fibres in various amounts, were calculated using the Standard Proctor's Compaction Test. The California bearing test CBR and direct shear test were performed on all soil samples to determine the CBR value, and UCS was performed on parental soil and various soil mixes to determine the CBR value. The key aim of this study was to perform a comprehensive investigation in order to determine the optimum proportion of marble dust and Polypropylene fibers for soil stabilization. All the three parameters are analyzed individual and in comparison with each other. An effort has been made to strengthen the soil using marble dust and Polypropylene fibres in varying amounts in the present experimental work. The geotechnical properties of raw soil samples and stabilized soil samples were then assessed in the laboratory using a variety of tests. The shear strength of soil was investigated using this experimental work, which included deciding the Optimum Moisture Content (OMC), Maximum Dry Density (MDD), California Bearing Ratio (CBR) value, and UCS. Understanding the behavior of the soil when reinforced with marble dust powder and Polypropylene fibers was carried out with the aid of the current research, which clarified whether these materials help to reinforce the soil or not.

Table 1 Soil Mixes

S.No	Soil Description	Soil %	Marble Dust %	Polypropylene Fibre %
1	Parent soil	100	0	0
2	Soil with 10% of Marble Dust	90	10	0
3	Soil with 20% of Marble Dust	80	20	0
4	Soil with 30% of Marble Dust	70	30	0
5	The Soil with 30% of Marble Dust and 0.1% Polypropylene Fibre.	69.9	30	0.1
6	The Soil with 30% of Marble Dust and 0.2% Polypropylene Fibre.	69.8	30	0.2
7	The Soil with 30% of Marble Dust and 0.3% Polypropylene Fibre.	69.7	30	0.3

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Table 2 1 Values of MDD and OMC for Parental soil and stabilized soil

S.No	Soil Discription	OMC	MDD
1	Parent soil	11.34	1.98
2	Soil with 10% of Marble Dust	10.50	2.05
3	Soil with 20% of Marble Dust	10.10	2.09
4	Soil with 30% of Marble Dust	9.60	2.15
5	The Soil with 30% of Marble Dust and 0.1% Polypropylene Fibre.	10.88	2.04
6	The Soil with 30% of Marble Dust and 0.2% Polypropylene Fibre.	11.93	1.90
7	The Soil with 30% of Marble Dust and 0.3% Polypropylene Fibre.	12.80	1.80

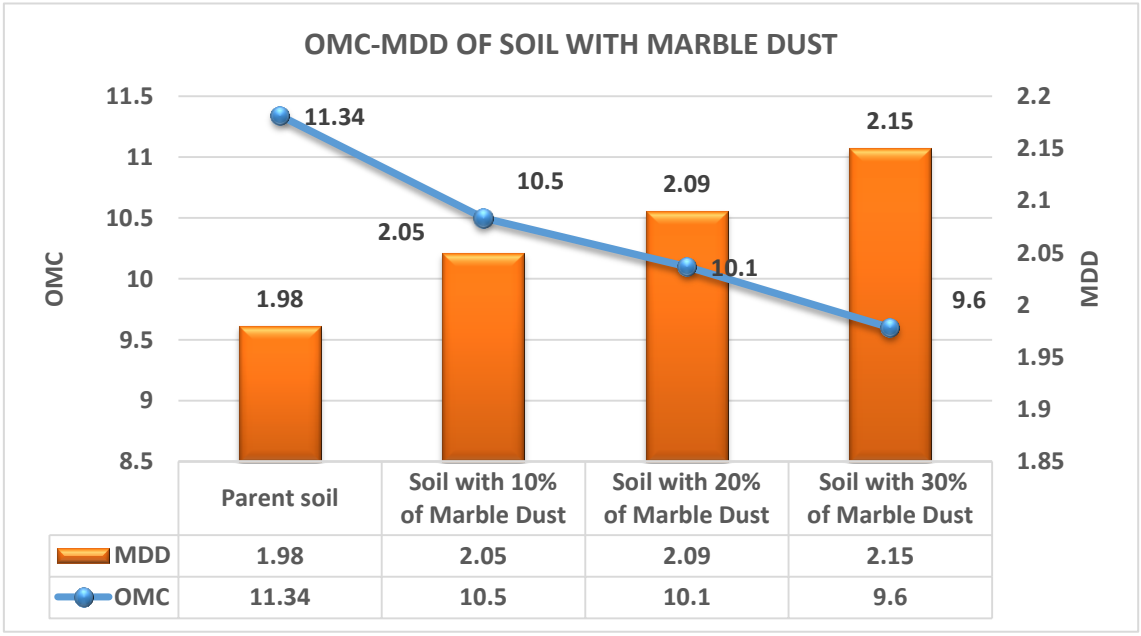

Figure 1: Analysis of OMC-MDD

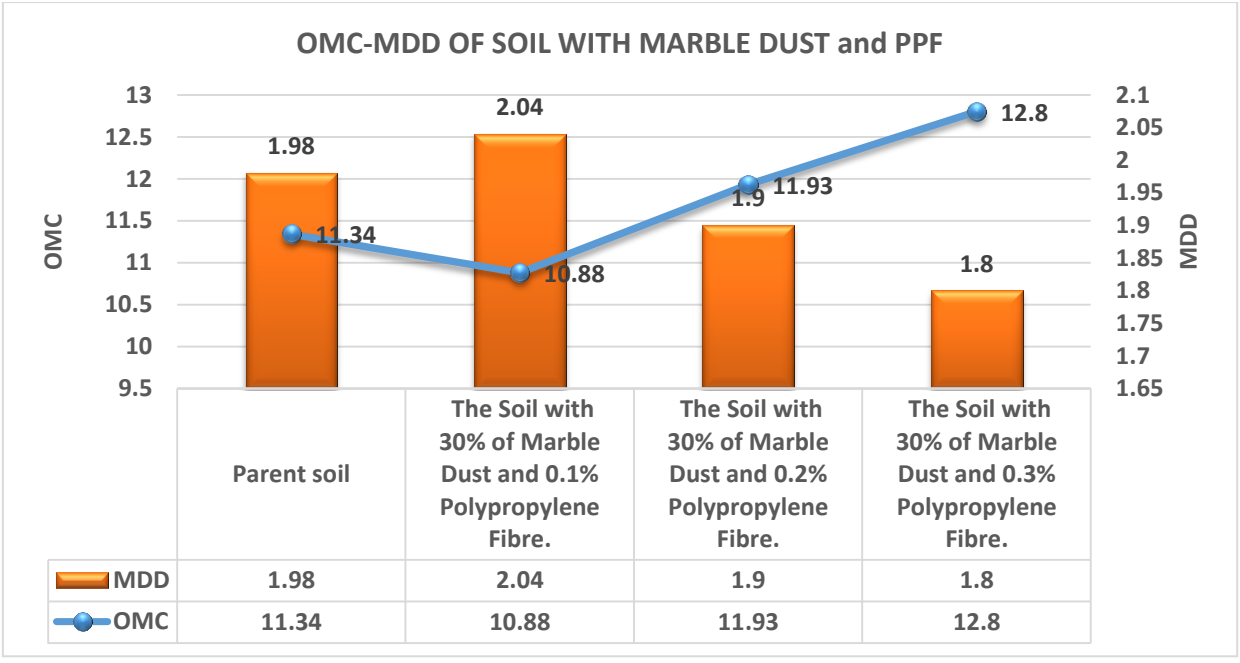

Figure 2

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Analysis of CBR Test values

In the laboratory, the various test soil samples were prepared at maximum dry density for CBR analyses. The CBR value was determined at 2.5 mm penetration and 5 mm penetration, and the results are shown in the table below:

Table 3: CBR values for various soil samples

S.No	Soil Discription	CBR 2.5 mm
1	**Parent soil**	4.7
2	**Soil with 10% of Marble Dust**	5
3	**Soil with 20% of Marble Dust**	5.4
4	**Soil with 30% of Marble Dust**	6.1
5	**The Soil with 30% of Marble Dust and 0.1% Polypropylene Fibre.**	6.4
6	**The Soil with 30% of Marble Dust and 0.2% Polypropylene Fibre.**	5.8
7	**The Soil with 30% of Marble Dust and 0.3% Polypropylene Fibre.**	5.6

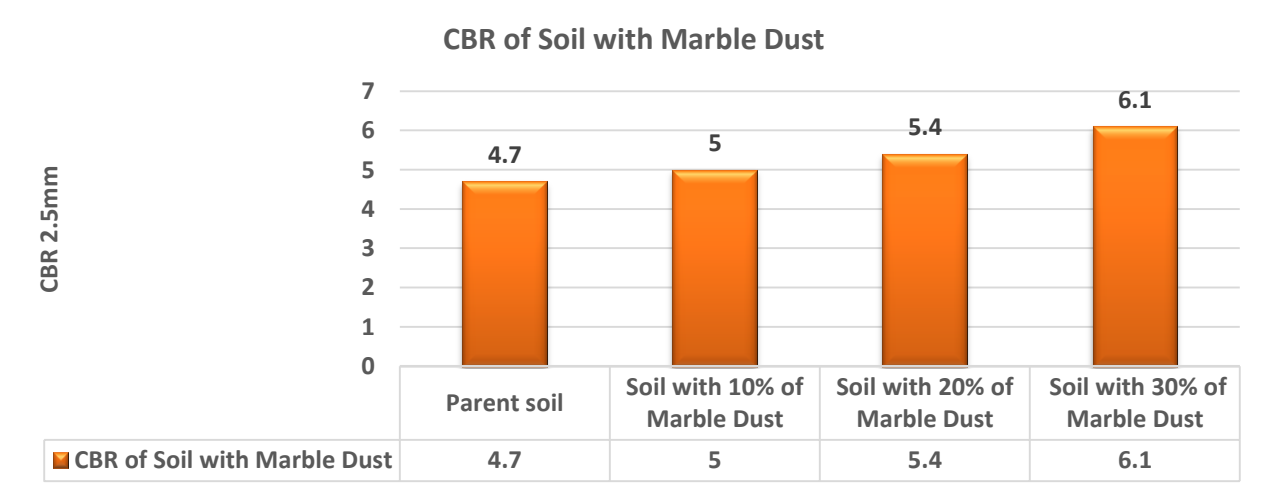

Figure3

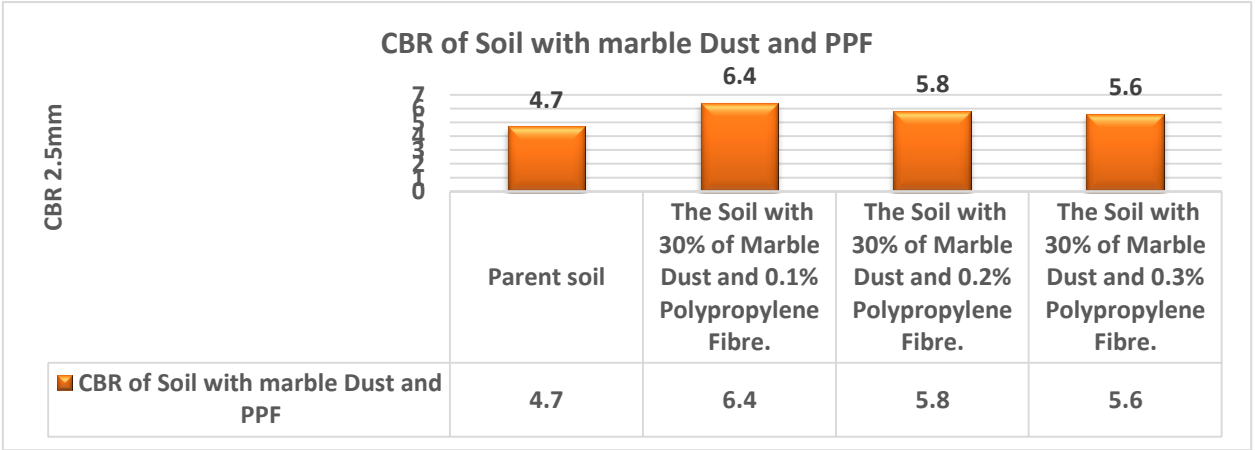

Figure 4: CBR of Soil with Marble Dust and PPF

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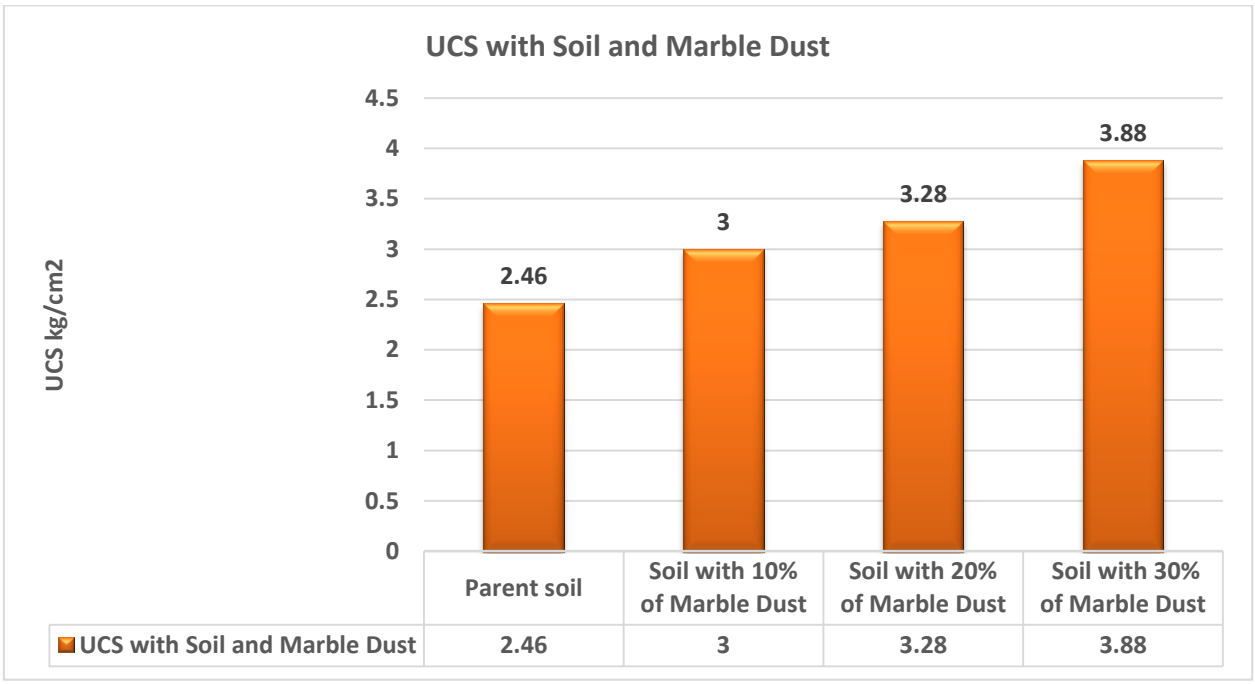
Analysis of UCS Test Results

Unconfined Compressive strength test is conducted to get the idea of shear strength of soil. UCS was conducted on raw soil along with the Marble Dust and PPF. The result summary and analysis is mentioned below



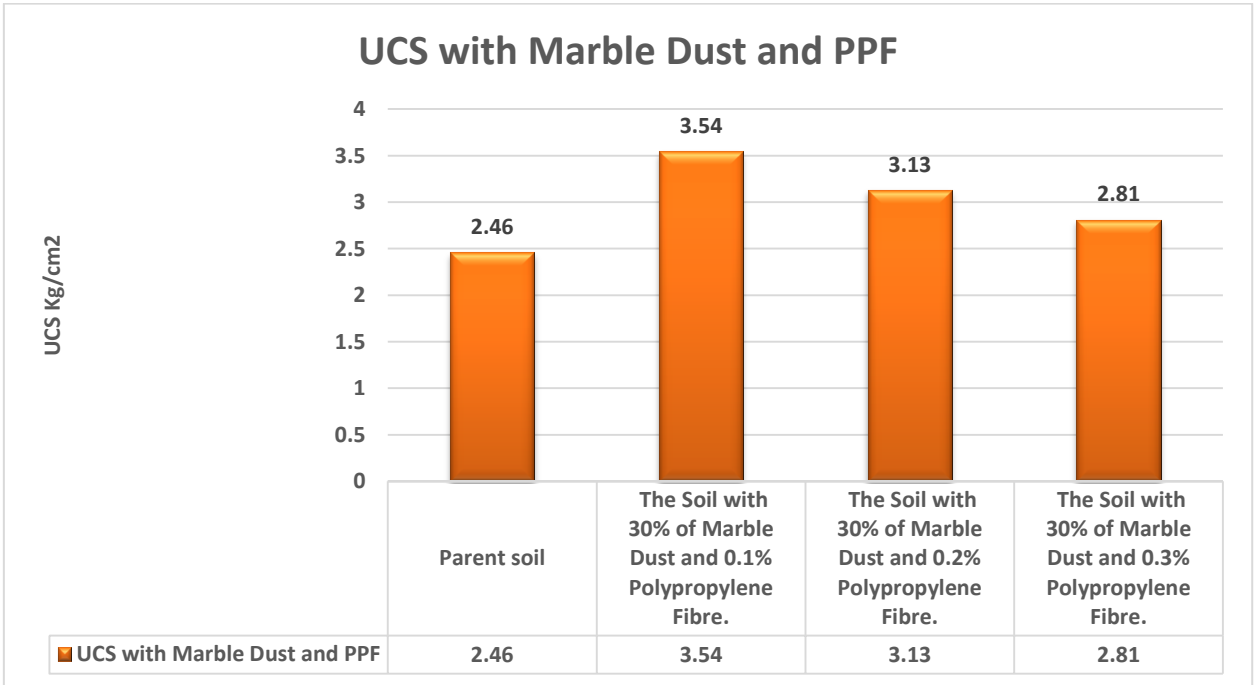


Figure 5: UCS of Soil with Marble Dust and PFF

IV. CONCLUSION

- The maximum OMC was obtained at the Soil with 30% of Marble Dust and 0.3% Polypropylene Fibre with a value of 12.8% and minimum OMC gained at Soil with 30% of Marble Dust with a value of 9.6%.
- The maximum MDD was obtained at Soil with 30% of Marble Dust with a value of 2.15g/cc and minimum MDD was obtained at 30% of Marble Dust and 0.3% Polypropylene Fibre with a value of 1.8g/cc.
- The maximum and minimum value of 2.5mm CBR is 6.4% and 4.7% at The Soil with 30% of Marble Dust and 0.1% Polypropylene Fibre giving the highest value and the lowest result of soil with no additive .

- The lowest value of UCS is 2.46kg/cm2 of the parental soil and highest value at Soil with 30% of Marble Dust.
- Soil parameter show the increasing trend with the increase of marble dust except CBR whose maximum values are attained at 30% of marble dust with 0.1% PPF.

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