Analysis of strength characteristics of clayey soil using Marble dust as Stabilizer

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Abstract – Soil stabilization is the alteration of soils to enhance their geotechnical properties. In this paper, Marble dust is added in clayey soil to improve strength characteristics of soil. Marble dust is the fine waste portion of marble formed through the chiseling and polishing of marble pieces. This is discarded as slurry, which on drying gets transported by wind and cause problems to human and society. Thus the effective utilization of marble dust is of high importance. Soil was collected from Neyyattinkara by manual excavation. The soil was classified as CI from plasticity chart. The marble dust were added at percentages 0%, 5%, 10%, 15%, 20% and 25%. With Marble dust addition, unconfined compressive strength increased up to 15% and decreased with further addition. The optimum percentage was obtained as 15%.

Key Words: Stabilization, Marble dust, clayey soil, unconfined compressive strength

1. INTRODUCTION

In geotechnical engineering, soil stabilization or other methods are required when a given site does not have suitable engineering properties to support structures, roads, and foundations. One possibility is to adapt the foundation to the geotechnical conditions at the site. Another possibility is to try to stabilize or improve the engineering properties of the soils at the site. Depending on the circumstances, this second approach may be the most economical solution to the problem Production of waste from any industry is a part of the industry's functioning. It is of utmost importance to ensure that the waste produced does not affect the society or living organisms. Waste marble dust is the fine waste portion of marble formed through the chiselling and polishing of marble pieces. These processes are done by spraying water over it. So the waste marble is discarded as slurry, which on drying gets transported by wind and cause problems to humans and society. These wastes are also produced from buildings under construction where tiles are laid and polished. Thus the effective utilization of this waste is of high importance, and has been used as cement replacement additive in concrete blocks. Studies relating to utilization of marble dust to improve soil properties have been evolving in the recent past. In this paper, Marble dust is added at various percentages to soil.

2. MATERIALS AND METHODOLOGY

2.1 Soil

The soil is collected from Neyyattinkara at a depth of 1m by manual excavation. The soil was air dried and was brown in color. Figure 1 shows the soil sample. Table 1 shows the index properties of soil.

Fig -1: Soil

Table -1: Index properties of soil

Properties	Values
Specific gravity	2.69
Grain size distribution Clay (%) Silt (%)	 56.5 43.5
UCS (kPa)	126.9
Soil classification	CI

The specific gravity of soil was found to be 2.69. The unconfined compressive strength of soil was 126.9 kPa. The soil has a clay content of 56.5% and silt content of 43.5%. The soil was classified as CI from plasticity chart.

2.2 Marble dust

It is the fine waste portion of marble formed through the chiseling and polishing of marble pieces. Figure 2 shows the Marble dust sample.

Fig -2: Marble dust

2.3 Methodology

Soil is collected and index properties were found out. Specific gravity was found using Pyconometer. Grain size distribution was found using hydrometer. The Marble dust was added at 0%, 5%, 10%, 15%, 20% and 25%.

3. RESULTS AND DISCUSSIONS

3.1 Unconfined compressive strength

Table -2: Unconfined compressive strength characteristics of soil with Marble dust addition

Marble dust addition (%)	UCS (kPa)
0	126.90
5	170.37
10	205.19
15	244.44
20	226.98
25	192.59

Table 2 shows the variation of unconfined compressive strength characteristics of soil with Marble dust addition. The unconfined strength increased from 126.90 kPa to 244.44 kPa up to 15% addition of Marble dust. With further addition Unconfined compressive strength of soil decreased. The increase in strength is attributed to the bonding of calcium ions of Marble dust with silicate and aluminate present in soil.

4. CONCLUSION

In this paper, improvement of strength characteristics of clayey soil using marble dust was evaluated. The soil was classified as CI from plasticity chart. The unconfined compressive strength increased up to 15% addition of marble dust. With further addition of Marble dust unconfined compressive strength decreased. The optimum percentage of marble dust was obtained as 15%.

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