International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 08 | Aug 2022 www.irjet.net p-ISSN: 2395-0072

Soil Stabilization by Cement and Marble Dust for Highways

Jatin Sekhri[1], Er. Neeraj Kumar [2]

[1]M. Tech. Scholar SRMIET Khora Bhura Naraingarh, Ambala, Haryana, India
[2] HOD and Assistant Professor, Dept. of Civil Engineering SRMIET Khora Bhura Naraingarh, Ambala, Haryana, India

---

Abstract - *Stabilization is improved in strength of soil with the help of addition of material. Stabilization of soil can be with mechanical method, chemical method and geosynthetic method, in this study the addition of cement and waste material i.e. marble dust for soil. With addition of mentioned materials the strength of soil is improved as per outcomes and the 12 percent addition of marble dust and 24 percent of cement values optimum. With the help of marble dust soil improves its properties and its uses give relaxation to environment. Dry density, optimum water content, California bearing ratio for socked and unsocked sample did the experiments to found the optimum values.*

Key Words: **Stabilization, marble dust, cement, optimum, water content, unsocked, socked,addition.**

1.INTRODUCTION

Soil is a major component of the earth's surface which sustains life. It is made up by the disintegration of rocks due to various environmental processes like changing weather, volcanic action, erosion of rocks by water etc. Some of the various types of soil that are found in our country are alluvial soil, laterite soil, black cotton soil or expansive soil etc. The type and availability of these soils are based upon the climatic and geographical location of a particular area. Apart from helping the plants grow, soil also helps the humans to carry out all the basic activities on it like travelling, construction, agriculture etc. A developing country like India demands rapid growth in its infrastructure i.e. a proper network of roads and buildings for development. All the constructions related to civil engineering, like a simple house or a multi-storey building, a road or a highway, everything is built on the soil. It is very important to check all the engineering properties of the soil like the cohesion, capillarity, permeability etc before starting any constructional work on it because all the soils are not suitable for constructional ways.

Before starting the construction of any project, site selection is the fore most objective of engineering department. One of the main purposes of site selection or investigation is to determine stable and good quality soil where the construction is to be done. It also helps in collecting all the relevant information about soil and its properties. Afterwards, soil with the best quality is selected for construction so that it would result in better structure. Foundation is the main part of any construction and it largely depends upon the type of soil.

1.2 Material

The following materials are used for the study:

I. Cement

II. Marble Dust

I. Cement

Commonly binding material used in concrete in cement. Easily availability is a big opportunity to its effective use. With the help of cement material used as a stabilizer in soil is to improve soil properties.

II. Marble Dust

Marble dust is generated in large quantity during production, cutting, sawing and polishing process of marble and it is found that about 20% to 25% of original marble mass is lost in theform of dust.

Fig. 1.1 Marble dust

2. LITERATURE REVIEW

Much literature reviews available in this topic in which some important literatures are given below:

Yadu, and Tripathi, (2013) [1] studied the effects of granulated blast furnace slag in the engineering behavior of stabilized soft soil. The performance of GBS stabilized soil was evaluated using physical and strength performance tests. Based on strength performance tests the optimum GBS was determined as 9% among 3%, 6%, 9% and 12%. Inclusion of GBS increases the strength of soil as well as the soaked and unsoaked CBR values.

Kumar, et al., (2014) [2] accomplished the study on the compaction and sub grade characteristics of clayey soil by

mixing it with foundry sand, fly ash and tile waste. These materials were taken in a ratio of 10% to 50% with an increment of 10%. Results showed an increase in the value of the CBR value from 2.43% to 7.35% when all the three materials were added into the soil. Thus they concluded that clayey soil mixed with foundry sand, fly ash and tile waste can be effectively used in the construction of sub-grade so roads with low traffic volume.

Singh, and Yadav, (2014) [3] carried out study on the effect of marble dust on the index properties of black cotton soil. Marble dust was taken in the ratio of 0% to 40% by the dry weight of the soil. Results concluded that the plasticity index of the black soil decreased gradually from 28.35% to 16.67%, while the shrinkage limit increased from 8.06% to 18.34% at 40% addition of marble dust. Apart from this the expansiveness of the soil reduced from being very high to low on addition of marble powder, thus making the soil suitable for construction.

Pokale, et al., (2015) [4] carried out an experimental investigation for Stabilization of Black Cotton soil by using waste material-Brick Dust. On the basis of experimental test results, it is observed that the moisture content (MC) reduces after 7 days and 28 days results respectively. MC of 30% BD is reduces to 26.46%. Hence replacement of brick dust is more effective.

Joe, and Rajesh, (2015) [5] observed that there is an appreciable improvement in the optimum moisture content and maximum dry density for the soil treated with industrial waste. In terms of material cost, the use of less costly Admixtures can reduce the required amount of industrial waste. Soils had the greatest improvement with all soils becoming non-plastic with the addition of sufficient amounts of industrial waste. The study after conducting several experiments revealed the following significances in using lime and industrial waste as a stabilizing agent.

Kumar, et al., (2015) [6] had studied Marble dust addition, showed improved performance in problematic soils with the help of caption exchange reaction. The presence of excess Ca2+ions is responsible for the improved performance. The liquid Limit of soil sample is 61%. Soil sample is classified as Highly Compressible clay (CH). The unconfined compressive strength (UCS) of untreated soil sample is 99.2 kN/m2. On addition of marble dust, unconfined compressive strength increases to 286.5 kN/m2.

Prajapati, et al., (2016) [7] carried out the stabilization on silty sands using marble dust and used foundry sand as stabilizing agents. The mix involved utilization of foundry and marble dust separately with the soil starting from 5% upto 30% with a difference of 5%. The testing procedure involved tests like the California Bearing Ratio test, Standard Proctor Test, Hydrometer analysis, Particle Size Distribution, Liquid Limit and Plastic Limit. For the CBR testing results it was observed that the foundry sand helped in increasing the CBR value of the soil while with the addition of marble dust the CBR value decreased. The maximum CBR value i.e. 6.8%, of the soil was achieved with addition of 30% foundry sand by weight of soil as against 4.82% of the normal soil. While the CBR value decreased to 4.3% from 5% with the addition of marble dust. At 30% addition of marble dust the CBR value was found to be least. Thus it is very clear that foundry sand proved to be a better stabilizing agent for the soil as compared to the marble dust.

Prakash, and Raveendran, (2016) [8] The UCC test is the most common test to determine the strength of stabilized soil. The results indicate that the strength characteristics of the soil are improved with the addition optimum percentage of paper sludge when compared to RHA and the improvement was found to be 96%. The strength achievement of soil is due to the pozzolanic reaction and the cementation process of paper sludge. From the studies, it can be observed that the soil stabilized with paper sludge can be effectively used as a ground improvement technique for constructions.

Kumar, et al., (2016) [9] studied the stabilization of the sub grade soil using waste foundry sand. Foundry sand was used in varying percentage starting with 5%, 10%, 15% and 20%. The tests performed on the soil samples were the Standard Proctor test, Direct Shear Test, California Bearing Ratio test. At 10% addition of the foundry sand there is a reduction in the optimum moisture content of the soil while it is increased at 20%. The CBR value of the soil increased from 8.9% to 18.91% at addition of 20% foundry sand by weight of soil, also the angle of friction increased from 22 to 28 degrees at 20% addition of the foundry sand.

Mahvash, et al., (2017) [10] studied the effect of class F flash on fine sand compaction through soil stabilization. The sand was stabilized with three proportions of FA (5%, 10% and 15%) and constant cement content of 3% was used as an activator. For better comparison, the sand was also stabilized by 3% cement only so that the effect of FA could be observed more clearly. The results were in line with the literature for other types of soil, i.e. as the % of FA increases, reduction in maximum dry density and higher optimum moisture content were observed.

Ouston, et al., (2017) [11] used Polymers for stabilization of soft clay soils. The influence of two chemical additives, (i.e., polyvinyl alcohol), PVA and 1,2,3,4 Butane Tetra Carboxylic Acid BTCA on the engineering properties of an expansive clay soil is investigated. The results indicated that such hydrophilic polymers improve the compression strength of both dense and soft clay soils significantly and their strength even increases with curing time. PVA and BTCA added at dosages of 0.1% to 1.5% and 0.1% to 0.5% respectively.

3. METHODOLOGY

The following steps are followed to complete the study:

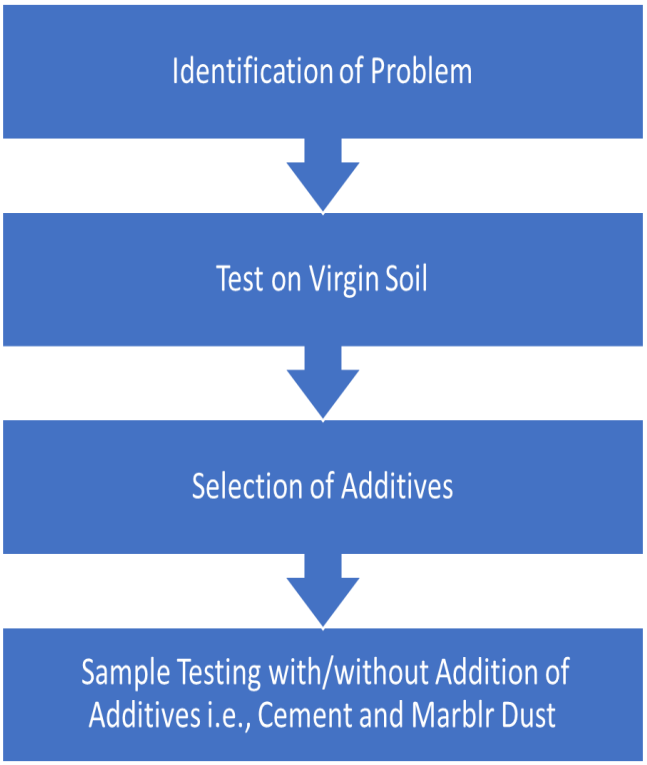

Fig. 3.1 Flow Chart

4. CONCLUSION

From the test results dissertation work concluded that:

- The maximum Dry Density achieved for natural soil was 1.86 g/cc with 14% water content, while 2.4 g/cc with 24% addition of Cement with 22% water content and while 1.85 g/cc on addition of 6% Marble Dust with 14% water content.
- CBR value of natural soil for unsocked specimen is 9.14%, while 21.23% with 24% addition of cement and 12.32% with 12% addition of marble dust.
- CBR value of natural soil for socked specimen is 6.95%, while 23.45% with 24% addition of cement and 10.93% with 12% addition of marble dust.
- Thus, all the above test results concluded that cement is a better stabilizing material when compared to marble dust.
- Marble dust as a stabilizer is used with 12% addition where lesser founds.

5. Scope for Future Work

This study is concentrated on a comparative study of Cement and waste material marble dust for stabilization of soil:

I. Stabilization can be done with the help of different wastes material like rice husk ash, waste plastic, waste stone powder etc.

II. Utilizing of waste materials in a better way will help to reduce the pollution caused in the environment due to their disposal.

III. The above materials can be used in construction field on large scale to minimize the construction cost and bad environmental effect as well.

REFERENCES

[1] Yadu L.and Tripathi R.K., "Stabilization of Soft Soil with Granulated Blast Furnace Slag and Fly Ash", *International Journal of Research in Engineering and Technology*, pp.15-119, 2013.

[2] Kumar A., Kumar R. and Singh B., "Effect of Waste Materials on Strength Characteristics of Local Clay", *International Journal of Civil Engineering Research,*ISSN2278-3652, 2014.

[3] Singh P. S. and Yadav R. K., "Effect of Marble dust on Index properties of black cotton soil", *International Journal of Engineering Sciences and Research Technology (IJESRT)*, Vol.3, issue 3, ISSN2319-5991, 2014.

[4] Pokale K. R., Borkar Y. and Jichkar R. R., "Experimental Investigation for stabilization of black cotton soil by using waste material-Brick dust", *International Research Journal of Engineering and Technology (IRJET),* Volume: 2, e-ISSN: 2395-0056, 2015.

[5] Joe M. A. and Rajesh A. M., "Soil stabilization using Industrial waste and Lime", *International Journal of Scientific Research Engineering &Technology(IJSRET)*, ISSN 2278–0882, 2015.

[6] Kumar S., Babu V.and Sharmila M. R., "Soil stabilization using Marble dust", *International Journal of Civil EngineeringandTechnology(IJCIET)*, Volume 8, Issue 4, pp.638-645, 2015.

[7] Prajapati B., Dr. A. K., Tiwari R. P. and Singh N. K., "Comparative Study of used foundry sand and marble dust on geotechnical properties of Silty Soil", *International Research Journal of Engineering and*

Technology (IRJET), Volume: 03 Issue: 05, p-ISSN:2395-0072, 2016.

[8] M. Prakash and R. Raveendran, "Comparison Between Paper Sludge And rice husk ash as a stabilizing agent for soft soil", *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, p-ISSN: 2320-334X,PP08-11, 2016.

[9] Kumar P., M. C. Paliwal and A. K. Jain, "Stabilization of sub grade soil by using foundry sand waste in various percentages", *International Journal of Engineering Sciences and Research Technology (IJESRT),* ISSN2277:9655, 2016.

[10] Razvi S. S., Sujahat S. and Saud M., "Stabilization of soil by using foundry sand and fly ash with the help of standard proctor test andthe California bearing ratio test", *International Research Journal of Engineering and Technology (IRJET)*, Volume: 02 Issue: 04, p-ISSN:2395-0071, 2016.

[11] M. Mirzababaeia, A. Arulrajah and M. Ouston, "Use of Polymers for stabilization of soft clay soils", *International Research Journal of Engineering and Technology (IRJET),* pp.1045-1052, 2017.

[12] GhutkeM. V., Bhandari M. P., "Stabilization of soil by using rice huskash",*The International Journal of Engineering and Science (IJES)*, PP 92-95, 2018.

[13] Kumari T. and Kumar Neeraj, "Improvement in CBR Value of Soil by Adding Lime and Fly ash", *International Research Journal of Engineering and Technology (IRJET)*, Volume:06, Issue:01, p-ISSN:2395-0072, 2019.