STABILIZATION OF BLACK COTTON SOIL: A REVIEW

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Abstract:

Soil Stabilization in a wide sense incorporates different methods utilized for altering the properties of soil to enhance its physical properties and engineering performance. the most well known application being in the road construction, airfield pavements and construction of high-rise buildings. Soil Stabilization is used to reduce the permeability and compressibility of the soil mass in earth structures and to increase its shear strength. Soil stabilization is required to increase the bearing capacity of foundation soils. In Maharashtra and particularly Vidarbha region top layers comprises of black cotton soils deposits are observed everywhere which is basically a clayey soil comprises of montmorillonite clay mineral as its major constituent. These soils are black in color thus the name black cotton soilsuggested, are found suitable for agricultural purposes but are problematic in nature to the civil engineering projects. The main aim of the research paper is to review Soil Stabilization Soil Stabilization methods black cotton soil.

1. INTRODUCTION

Soil Stabilisation in a wide sense incorporates different methods utilized for altering the properties of soil to enhance its physical properties and engineering performance. Soil stabilisation is, no doubt utilized for arange of engineering tasks, the most well- known application being in the road construction and airfield pavements, where the primary goal is to build the soil quality or stability and to lessen the development cost by making best utilization of locally accessible materials. Soil Stabilisation is the process of improving the engineering properties of the soil and thus making it more stable. It is required when the soil available for construction is not suitable for the intended purpose. In its broadest senses, stabilization includes compaction, preconsolidation, drainage and many other such processes. However, the term stabilization is generally restricted to the processes which alter the soil material itself for improvement of its properties. A cementing material or a chemical is addedto a natural soil for the purpose of stabilization. Soil Stabilisation is used to reduce the permeability and compressibility of the soil mass in earth structures and to increase its shear strength. Soil stabilisation is required to increase the bearing capacity of foundation soils. However, the main use of stabilization is to improve the natural soils for the construction of highways and airfields. The principles of soil stabilisation are used for controlling the grading of soils and aggregates in the construction of bases and sub-bases of the highways and airfields. Soil Stabilisation is also used to make an area trafficable within a short period of time for military and other emergency purposes. Sometimes, soil stabilisation is used for city and suburban streets to make them more noise- absorbing. In Maharashtra and particularly Vidharbha region top layers comprises of black cotton soils deposits are observed everywhere which is basically a clayey soil comprises of montmorillonite

clay mineral as its major constituent. These soils are black in color thus the name black cotton soil suggested, are found suitable for agricultural purposes but are problematic in nature to the civil engineering projects. Effect of volumetric changes in the form of swelling and shrinkage under the water influence pose numerous problems to the structures built on it such as cracks, undulations, uneven surfacing, settlement of different nature and magnitudes, etc. These soils are having less bearing capacity, less shearing resistance and are generally not suitable / ideal as a foundation soil for construction purposes.

2. LITERATURE REVIEW

Amu et al. (2005) had investigated the effects of egg shell powder (ESP) on the stabilizing potential of lime on an expansive soil. Based on different tests they found that ESP cannot replace lime, for stabilization of soil. by substituting eggshell powder in the place of lime, the resultant soil stabilization was increased when compared with the untreated soils. Here, 0.5%- 2.0% of eggshell powders were introduced to the overall soil weight in the formation of the mixture. Thus, 25% substitution of lime with eggshell powders offered increased tensile strengths, and thereby largely be applicable for the real-world purpose.

A.U. Ravishankar et.al (2006) conducted a comprehensive study of the Terra Zyme soil stabilizer product with abundantly available lateritic soil in Dakshina Kannada and Udupi districts does not satisfy the requirements (Liquid Limit ≤25% and Plasticity Index ≤6 %) to be used as a base course material in pavements. In order to improve its properties, the soil is blended with sand at different proportions unless until it satisfies the Atterberg's Limits for subbase course. The effect of enzyme on soil and blended soil in terms of Unconfined Compressive Strength (UCC), and permeability are studied.

According to Foroutan R., et al (2007) eggshell constitutes a 10-11% in a total weight of the egg. In Iraq, the yearly production of eggshell waste according to the above statistics is about 23,000 tons, considering that the weight of the shell is (10%). In the country, landfill pollution can be reduced by effectively generating and managing this large amount of waste. The use of eggshells to stabilize the soil will therefore be an available option when there is the absence of an effective waste policy. The process of improving or treating the technical properties of soil layers by adding other types of soils and minerals, or by binding the proper chemical compositions into the powdered soil and then compact for soil stabilization. In order to find out the optimal percentages in addition to the effect on the properties of the soil strength, various eggshell powder percentages were treated to management the expansive soils and have made an attempt in this present work for studying about their geotechnical properties of expansive soils (9,10). Because of the finding optimal of 15% ESP and forming a close packing density by effectively bounding the eggshell powder, increased total strength values are provided in the test results.

To assess different constructions that were carried out using black cotton soils, Abdulrahman S.M. et al (2007) carried out their research towards assessing the black cotton based soil based constructions in Iraq. Different locations in Iraq were considered to select the samples and assessing their properties of buildings that

were raised using gypsum. Different percentages of ESP ranging from 5%, 10%, 15%, 20% that were mixed with the collapsed soil have been analyzed by the authors. Also, the analysis was done with different percentages of the collapsed soil before and after mixing ESP. The effects of ESP on liquidity index, stabilization and soil strengths were studied.

Anoop S.P. et al (2009) studied the features of soil stabilization with the replacement of lime with eggshell fillers. They have carried out experimental investigations so as to assess the betterment of attaining soil stabilization with the help of eggshell powder instead of lime. A conclusion was made in such a way that, by substituting eggshell powder in the place of lime, the resultant soil stabilization was increased when compared with the untreated soils. Here, 0.5%- 2.0% of eggshell powders were introduced to the overall soil weight in the formation of the mixture. Thus, 25% substitution of lime with eggshell powders offered increased tensile strengths, and thereby largely be applicable for the real-world purpose.

Oluwatuyi O.E. et al (2010) defined the peculiar conclusions over laboratory assessments towards lateritic soil that was treated with crushed eggshell powder and cement, both mixed in equal proportion, as a mixture for the construction of highways. These fillers were added to the soil ranging from 0%-8% over the soil weight. Subsequently, these mixtures were assessed with numerous experimental investigations. Results showed an increase in CBR value with increased stabilization. Moreover, the UCS value was observed to be increased. Accordingly, 8% mixing of crushed eggshell powder with the overall soil weight offered increased stabilization and was potentially applicable in highway constructions.

Barzesh et al. (2012) and Nayankson et al. (2013) has also found the positive effects of egg shell powder on properties of expansive soil.

Amit Tiwari (2014), "Experimental Study on Stabilization of Black Cotton Soil byFly Ash, Coconut Coir Fiber & Crushed Glass" Accordingly, 8% mixing of crushed glass powder with the overall soil weight offered increased stabilization and was potentially applicable in highway constructions.

Anas Ashraf, Mariamma Joseph. (2014), "Soil stabilization using raw plastic bottles", Proceedings of Indian Geotechnical Conference Baleshwar Singh, Shivanand Mali (2013), "Soil stabilization using glass powder", International Journal of Scientific & Engineering Researchby weight of the soil & glass powder was added at the rate of 2%, 4%, 6% & 8%. There is an appreciable improvement in the optimum moisture content and maximum dry density for the soil treated with glass powder.

Michel B, Aderinle, (2014), "Clay soil stabilization using powdered glass", Journal of Engineering Science and Technology. 0.5%- 2.0% of eggshell powders were introduced to the overall soil weight in the formation of the mixture. Thus, 25% substitution of lime with eggshell powders offered increased tensile strengths.

Sahu, et al., (2019) incorporated glass powder and rice husk ash (RHA) into the soil. He performed particle size distribution, Atterberg's limit, Compaction and CBR tests etc. on normal soil. 15% of rice husk ash was added by weight of the soil & glass powder was added at the rate of 2%, 4%, 6% & 8%. There is an appreciable

improvement in the optimum moisture content and maximum dry density for the soil treated with glass powder and rice husk ash. The soil becomes non-plastic with the addition of glass powder and rice husk. It was found that the optimum percentage of the powdered glass in sandy soils lies between 5% and 10% by mass of the soil. This is because the corresponding maximum values from both the compaction and CBR tests were obtained at 5% glass powder content while the maximum values from the shear strength test were obtained at 10% glass powder content.

Javed, and Chakraborty, (2020) investigated the effect of glass powder in cohesive soils. Glass powder was mixed with the soil samples by 2%, 4%, 6%, 8% and 10% of dry weight of soil. Liquid limit, plastic limit and plasticity index continuously decreased and were found to be 33.9%, 18.4% and 15.5% respectively at 10% of glass powder. Both unsoaked and soaked CBR increased with the addition of glass powder and found maximum viz., 22.5% and 10.4% respectively. Unconfined compressive strength was increasing up to 8% of glass powder and found maximum of 133.5 KN/m2 and then decreased to 119.7 KN/m2 when 10% of glass powder as added. The maximum dry density value increased from 1.83% to 2.03% with the addition of waste glass up to 8% and then remain constant when added 10%. On the other hand, optimum moisture content decreased from 17.53% to 10.5% with the increment of glass powder. This study found that the optimum percentage of glass powder is 8% of dry weight of soil. Though a number of researches have been conducted to stabilize the soils using different waste materials, the comparison of waste glass powder and waste marble dust will make my research a novel in comparison with others.

Eberemu et al. (2012) had investigated the stabilizing effects of glass cullet on engineering properties of expansive soil. The glass cullet's added were from 5-20% at an increment of 5%. With increase in percentage addition of glass cullet, there was continuous decrease in wL, wP, OMC, C, Ps and continuous increase in Ip, specific gravity (G), MDD, UCS, Ø, CBR.

Oluwatuyi O.E. et al (2016) defined the peculiar conclusions over laboratory assessments towards lateritic soil that was treated with crushed eggshell powder and glass powder, both mixed in equal proportion, as a mixture for the construction of highways. These fillers were added to the soil ranging from 0%-8% over the soil weight. Subsequently, these mixtures were assessed with numerous experimental investigations. Results showed an increase in CBR value with increased stabilization. Moreover, the UCS value was observed to be increased. Accordingly, 8% mixing of crushed eggshell powder with the overall soil weight offered increased stabilization and was potentially applicable in highway constructions.

3. CONCLUSION

1. The process of Soil stabilisation is quite important significantly nowadays. Long ago, people can look for the best soil and build a structure over it.
2. Nowadays, the best soils already have structures over them, but people still need to expand, which is why we have no choice but to build over soils even if they are not stable enough.
3. Road stabilization not only protects against road maintenance and

construction but also against many other things.

4. It also helps for protecting the building against any kind of erosion in different places. Without the process of stabilization of soil, the places wherever the structures are constructed can go down over the time.
5. This would cause several cracks in the structures & then the buildings would become unsafe. This would become a very big loss to the organization who built it.The soils which were not properly stabilized might be quite dangerous.
6. Whenever heavy rains pourdown it makes the soil soft that makes it less strong. In case the soil didn't go through the process of stabilization, it might slide-down and als put people inside the building which might be in danger.

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