Strengthening Of Soil Using Waste Plastic on Cement Stabilized Soil

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Abstract: Soil adaptation is an improvement of soil physical properties, for example, shear quality, the bearing limit to be possible through use of compaction or the expansion of appropriate admixtures such as cement, sand, fly ash or geo textiles, geo-synthetics, etc. Extended soils such as black cotton are always problems with swelling and shrinking and unequal settlement of foundation. Black Cotton soils with high swelling and contracting potential are one of India's main soil deposits because of a change in moisture content. The foundations of any structure must be necessary and be able to assist the entire structure. The soil around it plays a very important role to establish the foundation to be strong. Plastic waste is one of the world's biggest issues. Use of plastic sacks, bottles and other plastic materials increases step by step exponentially. We face different ecological problems because of this. The new method of soil adaptation can be used adequately to tackle society's difficulties, reduce waste quantities, and generate valuable material from non-helpful waste. There is a review paper here that focuses on stabilizing soils through the use of plastic waste. In order to monitor improvement in the properties of Soil tests such as liquid and plastic limit, standard proctor compaction, California bearing ratio (CBR), and a direct scissors test were conducted. The black cotton soil is fitted with different plastic waste content by weight ranging from 0.5% to 1.5% and the optimal proportion of plastic strips was detected by the California bearing ratio test 2% to 10% cement is used as a stabilizer.

Keywords: Black cotton soil, Plastic waste, Cement, Soil Stabilization, California Bearing Ratio, Direct Shear test.

1. Introduction

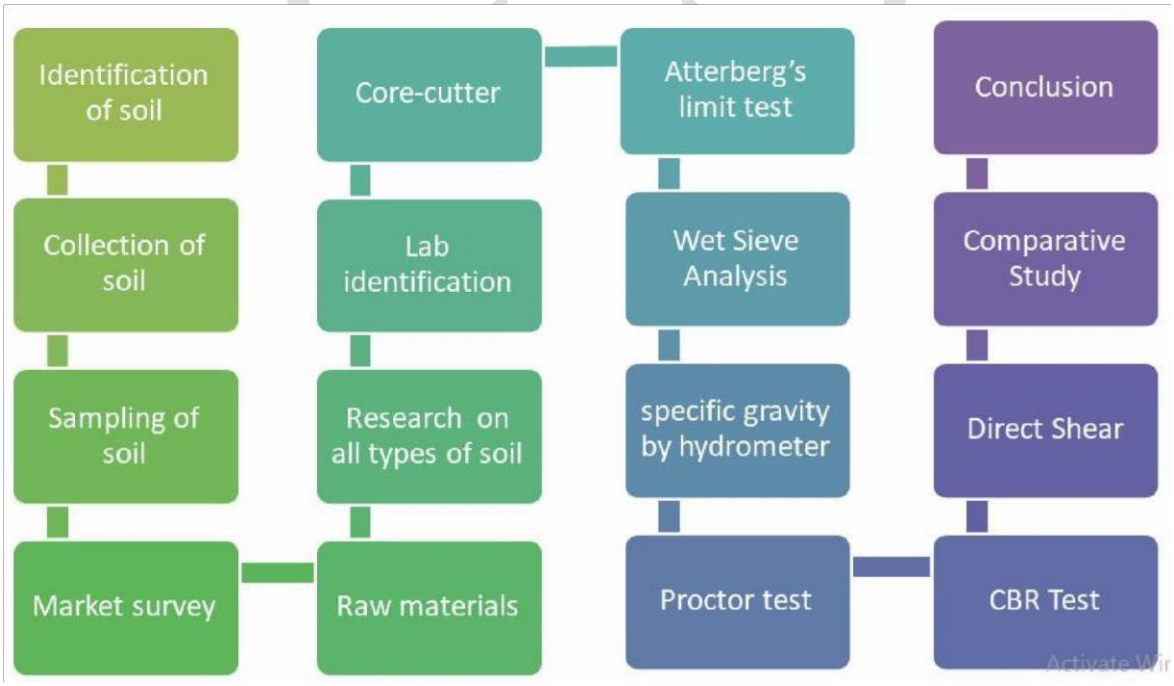
Soil is the main part of our everyday life. For various purposes, human beings and animals use soil like irrigation, which is extremely important for human survival. Much of this existing soil is a terrestrial soil that disturbs soil characteristics. The process of enhancing the different property of the ground is called stabilization to make it more compatible. A study on the mixing of cement into soil was undertaken with the aim of stabilising clay-based soil and the significant increase in the shear strength was observed. To attain the desired amount of strength, a specific material called polypropylene which has better elastic properties is mixed in this soil. In this project work we have focused on the addition of plastic fiber mixed with cement to improvement of soil properties. The use of plastic fiber results in increasing the durability of the soil while also maintaining its elastic properties. The plastic material which we are using is banned plastic in India which also helps to reduce the harsh effects on

environment by this project. Utilization of cement in this project helps strengthen the connecting properties of the soil. If this method is adopted at site it will surely make the entire construction work economical. The inclusion of plastic fiber will intersect the failure plane which will ultimately provide resistance to shear when the soil is subjected to any loading. The reinforced soil obtained by applying the concept derived through this project can be used as a subgrade material for the pavement as well as in case of foundation trenches.

2. Methodology

The aim of the project is to stabilize the soil for improving the various properties such as shear strength, capacity by using different mixes of plastic strips and cement. Soil type was determined by examine of various soil parameters like OMD, MDD, Atterberg's limit and Wet sieve analysis. In addition, the parameters of C.B.R and direct shear testing for soil have determined that their shear strength is increased. The S100 sample mix shows 100% soil. Cement 2%, 4%, 6%, 8%, 10% is mixed with the plastic strips of 0.5%, 1%, and 1.5% in proportion with soil sample.

3. Process Plan



4. Materials

I. **Soil**: Extended soil in India, commonly used to as black cotton soil, is the problems of civil engineering construction. The basic mineralogical composition is very important among the various factors that impact the swelling behavior of the soils. In mineral, montmorillonite and some illite, the farthest reaching soil is rich. When dry, it reduces and is tough like stone and has very high carrying capacity.The soil's main features are that it shrinks when dry, hard as stone and very strongly bears. . In the bulk of the soil there are enormous cracks, but when the ground is moist it spreads, it becomes extremely weak and lose its carrying power

II. **Cement**: cement is a binding material used for construction. Various grades of cement are available in the market as we studied such as, M15, M20, M25, M30 etc. Cement has hydrating properties which results in even setting and hardening under water. Here, we are

using M53 grade of cement for the project

III. **Plastic strips**: plastic is hazardous material for the environment as well as human life. Plastic strips obtained from polythene bags, bottles etc. As we know, plastic has some useful properties such as elastic property and toughness, resistance to chemical. Nowdays, Plastics of 50 microns or less have been prohibited in the market. So here, we are using banned plastic strips with the soil and cement for further study and experimental purpose.

5. Tests to be performed

I. **Core cutter test**: This method is used to determine the soil's dry density. The stability analysis of slopes, soil bearing capacity and underground structure design must be determined. It is a very good quality control test, it requires compaction.

II. **Atterberg's limit test**: Using this method, the water content of fine graded soil is determined. It is further classified into three types.:

a. **Plastic Limit**: This test is carried out in ASTM to determine the humidity content of the soil.

b. **Liquid Limit:** Testing to determine the behavior of soil changes from plastic to liquid.

c. **Shrinkage Limit:** This test is performed to determine water content losses and will not result in soil volume reduction. This test is rarely used in comparison with liquid limit and plastic limit.

III. **Wet sieve analysis:** Wet sieve testing is performed to obtain the % of different grain sizes in the soil. Sieve analysis is a distribution of particles of coarser and larger size. Wet sieving is a system used to assess a granular material's distribution of particle size or gradation. Wet sieving is a perfect example of how specimens with a high fraction of granular materials can be arranged and it is not easy to obtain enough fines.

IV. **Specific gravity Test by hydrometer**: Using hydrometer, specific gravity testing is performed to obtain the gravity of fine graded soil. As it is at a equal temperature the air weight ratio of material to the air weight of an same volume of distilled water at a similar temperature.

V. **Standard Proctor test**: SPT is used to determine the relation between the moisture content and density of soil compacted in the mould of a given size. This gave the values of OMC & MDD present in the soil.

VI. **CBR Test:** CBR is a penetration test used to assess subgrade soil mechanical strength and to determine the required pavement thickness. Subgrade of a pavement should be sufficiently able to give satisfactory help to the pavement and for supporting and distributing the wheel loads. The design and behavior of an flexible pavement depends mainly on the soundness of the subgrade soil, which can be expanded by compacting the soil at ideal moisture content, OMC and MDD are the most vital parameters affecting the CBR test.

VII. **Direct Shear Test:** To determine the shear strength of the soil, direct shear test. The CBR test is a proportion of a material's obstruction to standard plunger penetration under controlled density and humidity conditions. Collect the specimen of the soil that is either undisturbed or remolded. Use sampler and Rammer to take the sample. Note the maximum value that is nothing but the soil's failure stress.

6. Results and Discussions

We have studied all the various tests conducted on this project. Now, here we are going to

do a comparative study on plastic waste and cement mixed with the soil. Firstly, we performing tests on normal soil and another tests with plastic fiber mixed soil. We compare both the values in tests and observe the change in their properties. We noticed and came to the results that the soil which is mixed with plastics is having better strength and having good elastic properties as compared to the normal soil without any composition.

7. Conclusion

shear strength is the most important parameter of the soil which ultimately reflects the quality of the soil. When the soil is mixed with the plastic waste and cement, it changes some properties of the soil. The tests on the reinforced soil with a definite proportion is yet to be decided. The remaining proportions and variation is to be done shortly.

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