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Stabilization of Soil by Using Waste Plastics

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A B S T R A C T

Soil is an essential part of this situation, it is full of food, shelter, clothing and soil. One of the most important soil deposits in India, black cotton is very soft due to the change in humidity. Soil stabilization is the process of improving the physical properties of the soil, including: B. New soil stabilization technologies such as geotextiles, synthetic geotextiles, or wastes to increase shear strength by adding material that can be obtained by controlling compaction or providing the necessary material such as cement, lime, sand, fly ash, etc. It can solve social problems that reduce waste and replace waste that is not suitable for valuable products. Disposal of various forms of plastic such as chairs, bottles and bags is increasing rapidly and it is a problem. Environmental concerns, using plastic as sludge to reduce the plastic waste problem can also increase soil density and California Carrying Rate (CBR). The current research aims to tackle the problems occurring in Bhiwandi. This study is a pilot project aiming to improve black cotton production in urban areas. The new Bhiwandi in Maharashtra uses plastic waste as soil stabilizer. Various levels of plastic strips (ranging from 0% to 2% by weight) can be added to the black cotton and the percentage of plastic wrap on the floor can be obtained by monitoring the California Evaluation Test.

Keywords: Polyethylene (PET), plasticstrip, California Bearing Test (CBR), penetration test, Slight weight compression test.

1. Introduction

1.1 General

Soil stabilization is the process of improving the physical properties of soil, including: B. Increased shear strength, load capacity, etc. Compression or addition of suitable additives such as cement, lime and waste such as fly ash, phosphorous gypsum. This new technology of soil stabilization can be effectively used to reduce waste levels and meet the social challenge of producing from unusable materials - useful waste materials. Plastics such as plastic bags are used as reinforcement to conduct CBR studies, but can be mixed with soil to improve engineering performance. From subterranean soil. Pieces of plastic recovered from plastic waste were randomly mixed with soil. A series of randomized California Bearing Ratio (CBR) tests were conducted. Reinforced bottom via various ratio plastic strips of various lengths and ratios. CBR test results showed that the placement of plastic waste strips on the ground at the appropriate level improved the strength and deformation behavior of the subterranean floor essentially.Considering the harmful effects of plastics on the environment and climate, this study proposed the use of plastics as an additive to soil. This way plastic waste is put to better use and less plastic is sent to landfills. The concept of soil stabilization has existed for thousands of years. The need to strengthen the soil arose when it was discovered that certain vulnerable areas of soil and their properties that impeded movement of people could be improved by mixing certain materials known as stabilizers, such as limestone. when The goal of soil stabilization is to improve soil strength through soil particle binding, particle waterproofing, or a combination of both, as well as improving soil strength and increasing resistance to water softening (Sherwood et al. , 1993) . .Plastic can be recycled or reused. This means that this plastic waste can be reprocessed into useful products. waste ofPlastic can be used as a stabilized soil mixture. Plastic waste can be recycled many times, making it reusable and reducing waste. Using plastic waste to improve soil properties is an effective and economical method of stabilization. The use of materials made of plastic is increasing day by day, but plastic disposal is increasing the plastic content of the waste. Society's technology is advancing day by day, and new soil stabilization technologies are being discovered that make effective use of large amounts of waste such as plastic, bamboo, plastic bags, and bottles to improve soil.soil properties. Since these wastes are increasing in our society day by day and causing various natural problems, the use of plastic waste as an admixture should be implied. This increases soil strength, reduces admixture costs, and leads to economic use. We use plastics without causing hazards to the environment and the environment.

1.2 Soil stabilization:

Soil stabilization is an effective way to improve soil properties and pavement system performance. The goals of each stabilization technique used are:It increases the strength and rigidity of the floor, improves the workability and workability of the floor, and lowers the plasticity index. Many stabilization methods are used for any given soil Various stabilizers are effective in improving site soil properties rather than removing and replacing material. Availability or financial considerations may also play a role It is the determining factor in the choice of stabilizer.

The basic principles of soil stabilization are:

- Assessment of soil properties.
- Determination of poor soil properties and selection of the best possible soil stabilization techniques according to economic and functional criteria.
- Design how the stabilized soil mixture will be used to achieve the intended durability and stability values.

Soil stabilization is the most general term for any physical, chemical, biological, or combination thereof used to ensure a particular soil improvement.Natural floor properties that meet the intended technical requirements. The process of using cement and lime to stabilize soil began long ago and has been well-tested, but in recent times the use of cement has gained little recognition due to its cost and adverse environmental impact during production. No. You can imagine about 1 tonne of carbon dioxide (CO2) being emitted from this concept.1 tonne of cement is produced. This, along with the rising cost of additives, has led to the development of other stabilizing additives such as plastics, wood ash and fiberglass. The utilization of solid waste in soil stabilization has become an effective waste management option. provided one such means (White et al., 1995). Solid waste is a term used for unwanted, discarded, or left behind materials generated from a variety of activities including, but not limited to, domestic, industrial, commercial, agricultural, and biomedical. solid waste texture It can be a liquid, solid, semi-solid or even gaseous substance in a container (Franklin, 1997). From the first industrial-scale production of synthetic polymers in the early 1940s,Plastics and materials made from plastics have always played a major role in our daily activities in various fields.

1.3 Plastic and its potentiality for recycling:

Plastics and the materials made from them have become an integral part of our daily life in different ways at different stages, but the disposal and landfilling of used and unwanted plastics is an important part of civilization regarding their production and use. It poses a great threat to society.Plastics are materials composed of synthetic or semi-synthetic organic compounds that can be molded into solid materials. Plastics are a class of high molecular weight organic polymers that also contain other substances. They are mainly derived from petrochemicals. because Plastics are used in many products due to their properties such as waterproofness, low cost, ease of manufacture and versatility. Uses conventional materials as they are wood. In developed countries, about one-third of all plastics are used in packaging, and about the same amount in pipes and plumbing. Total plastic consumption.

1.4 Objective of the work:

1. Investigation of changes in soil strength (i.e., stability) upon addition of various amounts of plastic bottle strips of 0%, 0.5%, 1%, and 2%.
2. Provide alternative solutions for disposing of plastic waste.
3. Providing economical soil stabilization solutions using waste plastics.
4. Get the best combination for your floor and plastic strip combination.

1.5 Types of Stabilization Techniques:

1. Mechanical Stabilizations

2. Chemical Stabilization

1.6 Soil:

Soil stabilization is carried out mainly on soft soils (loamy, peat, muddy and organic soils) in order to obtain favorable technical properties. Sherwood (1993) states that using fine-grained materials is the easiest way to ensure stability due to their large surface area and particle size. Clay soils have a large surface area compared to other soil types due to their elongated and flattened particle shape. Mud, on the other hand, tends to be sensitive to small changes in moisture and can be difficult to stabilize. Organic soils contain high exchange capacities, and while calcium silicates and calcium aluminates hydrate within the cement and maintain satisfactory exchange capacities, water It can affect the sum process. Successful soil stabilization depends on both the correct choice of binder and the amount of binder added (Hebib and Farrell, 1999; Lahtinen and Jyrävä, 1999, Åhnberg et al., 2003).

1.8 Soil Properties:

Different geotechnical properties of soils affect civil structures differently (Roy and Bhalia, 2017). To determine suitability as soil As a foundation and building material, information on its geotechnical properties is required and in order to assess these properties its physical and technical properties are of great importanceimportant (Laskar and Pal, 2012). Information about surface and subsoil is essential for planning and designing structures. This is because some investment in subsoil exploration, including the construction of heavy structures, is more profitable than over-engineering and costly (Roy and Bhalia, 2017). Clay soils usually harden when dry and lose hardness when saturated. Soft clays are associated with low and excessive compressive strength. settlement. This loss of strength due to moisture causes severe damage to buildings and foundations. Soil behavior can be a challenge for

designers when planning infrastructure in clay deposits. Damages associated with vast soils are not due to lack of inadequate technical solutions, the existence and extent of these soils were not recognized in the early stages of project planning.

1.9 Applications for soil stabilization

The process of soil stabilization is useful for:

1. Reduced soil permeability.

2. Increase the load-bearing capacity of the subsoil.

3. Increases soil shear strength.

4. Improves durability under adverse humidity and load conditions.

5. Improving natural soil for construction of highways and airfields.

6. Separate management of base and aggregateHighway and airfield support points

2. Review of Literature

2.1 Research works carried out on soil stabilization by using plastic:

The utilization of Light sending concrete has wide use. The work has been finished by different specialists on utilization of fractional support of optical Tarun Kumar, Suryaketen "Soil Behavior with Mixed Plastic Strips", International Research Journal of Engineering and Technology e-ISSN:2395-0056, Volume 5, Issue 05, May2018. This study is being conducted on a very important road development. It must be strong enough to withstand various loads. plastics to meet these challenges Waste is used in the form of strips of various sizes to identify the required proportion It provides the amount of plastic strips and alternative ways to dispose of plastic waste.To study this reinforcing effect of mixed plastic strips in soil, a series of standard proctors Animmersed CBR test has been performed and on this basis:The maximum dry density of plastic-mixed soils decreases as the percentage of plastic increases CBR increases as the percentage of streaks, and plastic streaks increases within a certain range national borders. Based on this conclusion, by increasing the amount of plasticThe MDD value decreases and the OMC value increases. The CBR value of the floor increases as the percentage of plastic strip increases. of The maximum CBR value is obtained when the plastic strip percentage is 0.8% dry. Floor weight. Therefore, a 2 cm long 0.8% strip is considered the required quantity.

Prof. Harish C, Ashwini HM also studied soil stabilization with plastic waste. ofplastic waste d. H. PET bottles are used in this project. waste PET bottles Take and cut into small strips.Add these small strips to the soil in varying proportions and run tests likeB. Liquid limit, plastic limit, compaction test, CBR test, etc. The soil is then stabilized.Increase soil load-bearing capacity and strength properties such as shear Strength through controlled compression. Soil stabilization with PET bottles Significantly improves the strength properties of floors.

Hatem Nsaif et al. Closed in 2013 after mixing waste plastic with two types of soil(clay soil and sand soil) Different mixing ratio (0.2.4.6.8) wt%This means that the internal increase will significantly increase the strength of the floor.friction.The rate of increase of the internal friction angle in sandy soil is Although it is of clay soil, there is no significant increase in cohesion in either soil type. In addition, we have reached the conclusion that there is also a decrease due to the low specific gravity of resin parts.MDD and OMC in soil.Nilo César Consoli (2000):Clamp compression test, cleavage test, etc. Saturation shrinkage triaxle compression tests with local strain measurements were performedAssess the benefits of using randomly distributed recycled waste Improving technology by combining fast-hardening Portland cement and synthetic fibersBehaviourof inform fine sand.Individual and combined effects of fiber content (up to 0.9 wt. %), fiber length (up to 36mm), cement content (0-7% by weight), and initial average effective stress (20, 60, and 100KN/m2) Floor deformation and strength characteristics Design of experiments and multiple regression analysis.

3. Methodology

3.1 Material Equipment

Expanded soil, waste PET plastic bottles and equipment IS sieve kits: 4.75 mm, 2.0 mm, 1.0 mm, 600 µ, 425 µ, 300 µ, 150 µ, 75 µ. Furnace, steel tube, 20mm and 4.

3.2 Test performed on blocks

Specific gravity of soil, Liquid limit, plastic limit, Grain size distribution, I.S light compaction test, California Gearing Ratio (CBR) test.

3.3 Summary

In this chapter, all the material requirements, design requirement as well as the methodology incorporated to carryout testing of stabilized plastic mix soil are briefly discussed. Along with that the test which are required to be carried out on stabilized plastic mix soil are discussed.

4. Result and Discussions

4.1 General:

The aim of the present study is to investigate to soil properties, by adding the plastic strips to the soil. They can give best and economical solution for the soil stabilization. Based on the experimental investigation the results obtained are tabulated and some are represented in the form of graphs and figures wherever necessary.

4.2 Results for Grain size distribution:

The percentages of various sizes of particles in a given soil sample is found by sieve analysis. The grain size distribution curve gives amide are grading the gradation of the soil. it is possible to identify whether the soil Is well graded or poorly graded. In mechanical stabilization, for proportioning the selected soils the grain size distribution of each soil is to be first known.

Table 4.1observationsofsieveanalysis

Sievesize	**Weightretained**	**%retained**	**Cumulative%retained**	**%finer**
4.75 mm	0	0	0	100
2.0 mm	30g	3	3	97
1.0 mm	108g	10.8	13.8	86.2
600	58g	5.8	19.6	80.4
425	56g	5.6	25.2	74.8
300	52g	5.2	30.4	69.6
150	549g	54.9	85.3	14.7
75	126g	12.6	97.6	2.1
Pan	21g	2.1	100	0

4.3 I.S. light compaction test:

Compactionisaprocessbywhichthesoilparticlesarerearranged andpackedtogetherintoacloserstatebymeanstodecreasetheporosity.Optimum moisture content is defined as the water content of which aparticular soil attains a maximum dry density for a specific amount ofcompactionenergy. Table.4.2 observation of light compaction.

Table.4.3 observation of light compaction

Trailno.	**Wt.ofcompactedsoil +mould**	**Wt.ofsoil(g)**	**Amountof wateradded(ml)**	**Moisturecontent**	**Bulkdensity γ(g/cc)**	**Drydensity(g/cc)**
1	6087	1804	120	4%	1.804	1.73
2	6226	1943	240	8%	1.943	1.86
3	6360	2077	330	11%	2.077	1.99
4	6461	2178	420	14%	2.178	2.09
5	6429	2146	510	17%	2.146	2.058
6	6380	2097	600	20%	2.097	1.974

4.4 Result for CBR:

The C.B.R test is a method developed by the California Department of Public Works to classify and evaluate subgrade floors and base materials for resilient pavements. CBR is a measure of the material's resistance to slip under controlled speed and humidity conditions. C.B.R is defined as the ratio of the force required to penetrate a sample material at a speed of 1.25 mm/min with a 50 mm diameter circular piston..

$$\text{CBR} = \frac{\text{Test load}}{\text{standard load}}$$

Where standard loads penetration resistance of the plunger into a standard sample of crushed stone for the corresponding penetration.

Table 4.4CBR Test Result

s.no	Item (%)	CBR (%)
1	Soil Sample (0% Plastic)	7.96
2	Soil Sample (0.5% Plastic)	7.96
3	Soil Sample (1% Plastic)	13.94
4	Soil Sample (1.5% Plastic)	11.94
5	Soil Sample (2% Plastic)	5.97

4.5 Discussion

The C.B.R test is a method developed by the California Department of Public Works to classify and evaluate subgrade floors and base materials for resilient pavements. CBR is a measure of the material's resistance to slip under controlled speed and humidity conditions. C.B.R is defined as the ratio of the force required to pierce the ground with a 50 mm diameter circular piston at 1.25 mm/min to the force required for input corresponding to a standard product.

5. Conclusion

5.1 General

In this study, the improvement of soil CBR is due to the addition of plastic strips. Plastic can be used as one of the materials that can be used as a soil stabilizer, but an appropriate amount of plastic must be present to help improve the CBR of the soil. From this it can be concluded that the CBR content increases up to 1% of the plastic content in the soil and decreases with increasing plastic content. Therefore, it can be said that 1% plastic content is a good plastic waste content in the soil. The use of all kinds of plastic products is increasing day by day. This is inherently bad. You can't stop using it. In this case, how to deal with plastic waste without harming the environment has become a real challenge for today's society. Use this plastic as a soil stabilizer. It is a commercial and profitable application as it is not a good soil suitable for different building types. This project is a way to solve the problems that are developing the new city of Maharashtra, Bhiwandi and the wider community by reducing plastic waste and making useful products from this useless waste that produces plastic. We will lay the foundation of sustainable life.

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