

Study of Soil Solidification by Plastic Waste

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Abstract— Reuse of waste plastic in India isn't as expected coordinated. Around 60% of the waste plastic which is gathered and arranged prepares reused and for the utilization of individuals. A public plastic waste administration gathering team has been arrangement by coordinated effort of legislature of India, Ministry of Environment with the relationship of branch of petrol and compound, Ministry of Union issues and various gatherings or relationship of plastic producers. Their point is to appropriately deal with the reusing or overseeing of plastic waste. In India city strong waste contain around 3% of plastic waste. It's anything but a significant wellspring of danger to the climate. On the off chance that polythene packs consumed recklessly, delivers high number of poisonous gases like chlorine, sulphur dioxide, nitrogen dioxide and carbon monoxide.

Keywords: Soil Solidification, Plastic Waste

I. INTRODUCTION

Soil stabilization process includes various materials such as bitumen, fly ash, lime, cement etc are added which helps in increasing the bearing capacity and shearing strength of soil, which leads to the enhancement of the properties of soil. It controls the shrink as well as swell properties, increases shear and bearing strength of soil, Plastic is a renewable and non-bio-degradable material. The disposal of waste plastic bottles causes environmental pollution. Plastic can be recycled or reused i.e. reprocessing these plastic wastes and make some useful products. Waste of plastics can be used as admixture for stabilized soil. Waste plastic materials can be reused because it can be recycled many times thus reducing the wastage. Use of the plastic waste for the enhancement of the properties of soil is an effective and economical way of stabilization. Uses of materials made of plastic are increases day by day, but the disposal of plastic increasing the waste plastic content in municipal waste. As technology is improving in the society day by day, a new technique of soil stabilization is found in which waste quantities such as plastic, bamboo, polythene bags, bottles etc, are effectively utilized for enhancing the soil properties. As these waste materials are increasing in society day by day which leads to different natural problems hence the use of waste plastic materials as an admixture should be imply which improves the strength of the soil, reduces the cost of admixtures and leads to economical use of plastic without causing any environmental and ecological hazards. Stabilized soil is more durable having comparatively high strength, good quality of soil, less permeability of soil and useful for constructions of roads by reducing the thickness of pavement and also control the shrinkage and swelling properties of soil, which helps in achieving better soil gradation. It can significantly improve the working platform for various construction operations.

II. OVERVIEW OF METHODOLOGY

Distinctive kind of materials is accessible from which soil adjustment can be accomplished which relies on the diverse inner factor which depicts the holding among stabilizer and soil utilized, the dirt adjustment strategies are significantly sorted into two sorts. They are-

A. Mechanical stabilization

In this technique for soil adjustment grinding assumes the key part. In this technique the grinding among soil and admixture helps in expanding the properties of soil

B. Chemical stabilization

In this strategy for soil adjustment, a synthetic response happens between the minerals in soil and the various admixtures added to the dirt.

Plastics are considered as perhaps the main development which has helped critical in different fields of life. The employments of plastic have been enormously expanding from recent years. However, presently, it is turning into the significant contamination of Environment due to the propensity for utilizing it and tossing it. The utilization of plastic must be limited in any case human and climate needs to look in future for the unfriendly impacts of plastic. For using the loss to the dirt and settling it for different future purposes, to lead this different examination are going on. In this way, utilizing plastic as stabilizer will help one in aiding the issue of arranging the plastic waste with no unfriendly impact and besides, balancing out the similarly more fragile soil for the development reason and different exercises. Present investigation is directed on the dirt taken from Gomti waterway front which is arranged in Gomti Nagar and plastic jugs strips are added for its adjustment. For examination of solidarity between normal soil and soil having plastic strips, UCS (unconfined pressure strength) test is done in this investigation.

III. INTRODUCTION TO PLASTIC MATERIAL

Plastic is a material which comprises of semi-manufactured or engineered natural mixtures that can be additionally formed into strong materials. Plastic is a kind of natural polymers of high sub-atomic mass and furthermore contains different substances. Plastics are for the most part subordinate of petrochemicals. Because of their properties of permeability to water, minimal expense, simplicity of creation and adaptability, plastics are utilized in huge loads of items. They have taken over regular material like wood. In many created nations, around 33% of absolute plastic is utilized in bundling and practically the equivalent in plumbing and channelling. Different regions incorporate cars, furniture's, and toys. India's utilization in bundling is around 40% of absolute plastic utilization. From the mid twentieth century the achievement of plastics prompts the colossal worry of climate

because of extremely sluggish decay rate yet towards the finish of twentieth century, one novel and most ideal approach to handle this issue was taken and that way is reusing of plastic.

IV. PLASTIC INDUSTRY

Plastic creation is a significant piece of the substance business and the vast majority of the greatest compound organizations have been included from absolute starting point, as BASF and DOW. These organizations came from eighteen nations in which in excess of two third of the organizations has settle in the United States. For the most part, these plastic assembling organizations were situated in only three nations: United States (12), Japan (8), Germany (6). From India, fare of plastic items remained at US\$ 8.85 billion in 2017(source: plastics trade advancement gathering) and it offers work to around 4 million individuals.

The Indian plastic industry fare and creates a wide scope of crude materials, polyester films, polyvinylchloride, delicate gear thing, baggage garments and sheeting's.

Sterile fittings, tarpaulin, electrical frill and others. Among the business' the significant qualities of the accessibility of crude materials in the nation is its greatest. As indicated by a report utilization of plastic in India will cross 20 million tons by 2020. This shows that Indian plastic industry developing at a high rate with plastic utilization pace of 16% each year. In spite of having a populace of 125 crore plastic organizations are detailing of lack of work. This lack of work has prompted interest in current innovation like transport lines and so on Alongside deficiency of work, India is likewise dealing with issue of force shortage of around 15%. In India different fields has share in the plastic utilization. A portion of these is gadgets industry, bundling industry, transportation industry, farming and so forth

V. PLASTIC WASTE MANAGEMENT IN INDIA.

Recycle of waste plastic in India is not properly organized. Around 60% of the waste plastic which is collected and sorted gets recycled and ready for the use of people. A national plastic waste management council task force has been setup by collaboration of government of India, Ministry of Environment with the association of department of petroleum and chemical, Ministry of Union affairs and different groups or association of plastic manufacturers. Their aim is to properly manage the recycling or managing of plastic waste. In India municipal solid waste contain around 3% of plastic waste. It is a major source of hazard to the environment. If polythene bags burnt irresponsibly then releases high number of toxic gases like chlorine, sulphur dioxide, nitrogen dioxide and carbon monoxide.

A. Properties of Plastic

Plastic consists of many properties that make them far superior and usable than any other material. These different properties are categorized mainly into chemical properties and physical properties.

B. Physical Properties

Plastic is transparent, flexible elastic, water resisting, electrical resistance and becomes soft when heated.

Strain (%)	Stress (kN/m ²)
0	234
1	289
2	348
3	439
4	591
5	601
6	470
7	393
8	310

Plastic is somehow reactive to oxygen but over the time it degrades as it comes and reacting to oxygen. These are some physical properties of plastic.

C. Chemical Properties

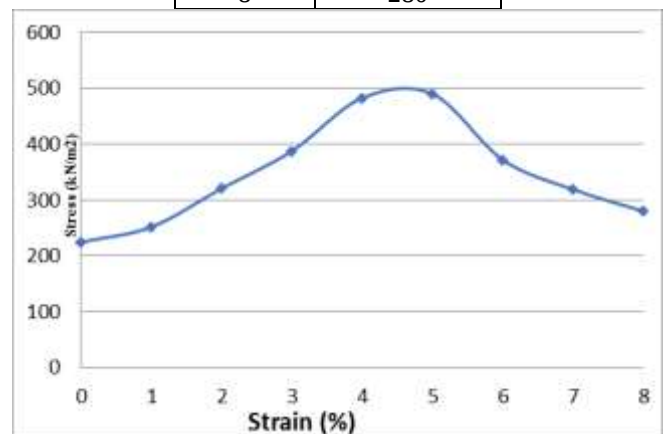
Chemical properties of plastic include chemical and thermal resistivity, chemical and thermal reactivity, flammability, combustible Plastic doesn't react with any acids but sometimes sulphuric acid can react with some of the plastics.

VI. EXPERIMENTAL INVESTIGATION

In this project UCT is performed which gives the strength of soil. Prior to this, proctor test is done to find the optimum moisture content of the soil which is found to be 15%. The soil in which test is conducted is collected from Gomti river front which is located in Gomti Nagar. The unconfined test is conducted on triaxial apparatus. Results obtained from the test are drawn into graphs and comparison is done between soil sample mixed with different proportion of cement and plastic strips. Graphs are drawn between stress and percentage strain values. Stress- strain curve of normal soil without any admixture is shown below.

- 1) Sample 1- In this sample no cement and plastic strips are added. UCS test is being carried out and stress vs strain curve are plotted.

Strain (%)	Stress (kN/m ²)
0	225
1	252
2	321
3	388
4	483
5	490
6	372
7	319
8	280



Strain (%)	Stress (kN/m ²)
0	234
1	289
2	348
3	439
4	591
5	601
6	470
7	393
8	310

Table 4.1: stress vs strain curve for normal soil.

From the stress vs strain curve, it is clear that the strength of this soil sample having no admixture is 500kN/m².

- Sample 2 - In this soil sample, cement is added in the soil in the amount of 1% of dry weight of soil. No plastic bottles strips are added in this sample.

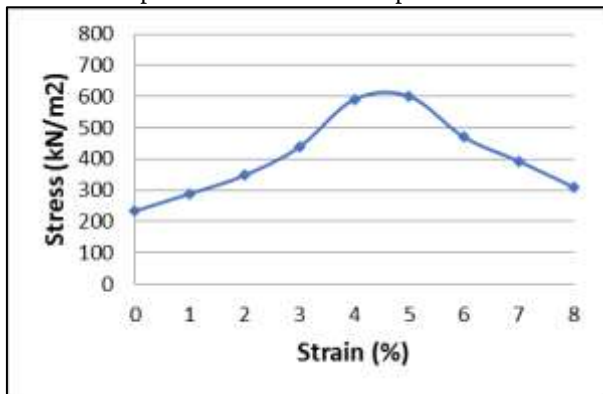


Fig. 4.2 stress vs strain curve of soil containing 1% cement

After conducting test on this sample stress vs strain curve is drawn. From the stress vs strain curve, it is clear that the value of strength obtained of this sample containing 1% cement and 0% plastic is 620kN/m². While the normal soil sample without any admixture has strength of 500kN/m², this soil sample having 1% cement has a strength value of 620 kN/m². So, it can be said that the amount of cement added has significant impact on the strength of soil.

VII. CONCLUSION

After conducting test and observing the results obtained, following conclusions are made-

- There is rise in strength of soil with increase in the amount of cement added to the soil.
- The soil having 1% cement and 0% plastic bottle strips content has a strength of 620KN/m² while soil sample having 1.5% cement and 0% plastic bottle strips has a strength of 670KN/m².
- There is also rise in the strength of soil by increasing the amount of plastic bottle strips to the soil.
- The strength of soil without any admixture is 500KN/m², which increases up to 1050 KN/m² at a cement content of 1.5% and plastic bottle strips content of 0.5%.
- But increasing the amount of plastic bottle strips beyond 0.5% of weight of dry soil will decrease the strength of the soil.
- After increasing the plastic bottle strips beyond 0.75% to 0.75%, there is decrease in the strength of the soil. The strength of the soil at 1.5% cement content and 0.5% plastic bottle strips is 1050 KN/m² which decreases to

900KN/m² at a cement content of 1.5% and plastic bottle strip content of 0.75%.

- So the optimum amount of plastic bottle strips to be added to enhance the strength of the soil is 0.5% at a cement content of 1.5%.
- In this study aspect ratio is kept as 2. For further study, carried out aspect ratio 1 and 1.5 for various different ratio (so that the large value of aspect ratio is covered).

VIII. RESULT PRESENTATION

A. Comparison of Strength between Different Samples

- In this stress vs strain curve, plastic bottle strip content is kept constant at 0% and curve is plotted for cement value of 1% and 1.5% and observation is being made.

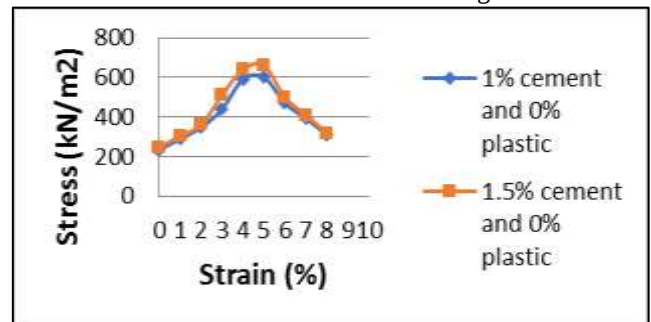


Fig. 5.1: comparison of stress vs strain curve of soil sample containing 1% and 1.5% cement and 0% plastic. After observing the above stress vs strain curve of soil sample having 0% plastic strip content and cement content of 1% and 1.5% respectively, we can say that the strength of soil sample containing 1.5% cement have slightly greater strength than sample containing 1% cement content.

- In this comparison of stress vs strain, soil samples containing 0.25% plastic strip content and cement content of 1% and 1.5% are taken.

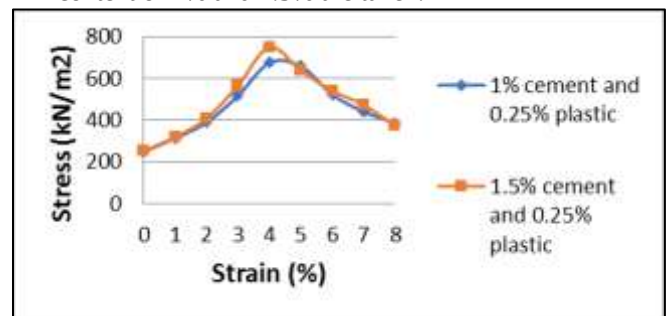


Fig. 5.2: comparison of stress vs strain curve of soil containing 1% and 1.5% cement and 0.25% plastic strips.

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