

Study on Artificial Soil used as Recharge Medium and for Subgrade

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Abstract— Rapid rate of increase in urbanization and development has increased the plastic waste generation. As the plastic is non-degradable, it remains in the environment for several years and cause several problems. Hence, Plastic waste is a huge environmental burden and disposal of plastic waste is one of the major problems in the city. In this study, the plastic particles with predefined sizes are made from the plastic waste. Plastic particles will be mixed with the natural soil with various proportions to make the artificial soil. From this, the test samples will be prepared under the various field conditions. Double ring infiltration test will be carried out to find the infiltration rate of various samples. The suitability of artificial soil for rain water harvesting will be computed by the interpretation of test results.

Key words: Artificial Soil, Recharge Medium, Subgrade

I. INTRODUCTION

Plastics are considered as one of the important invention which has remarkably assisted in different aspect of life whether it might be in scientific field or others. It is the fact that we can reuse the plastic and make it useable for number of times so that its wastage will be reduced remarkably. So it can be used for the alternative method where its importance will be counted. Plastic – waste materials are produced in larger quantity such as polyethylene terephthalate (PET) plastic bottles, polypropylene (PP) of plastic sack, and polypropylene (PP) of carpet. But such material have been used in small quantity. These plastic wastes in the form of granules and mixed with soil and the behavior of the soil is similar. Plastic granules are distributed throughout a soil mass.

Hence, the uses of plastic waste for improving the engineering properties of soil are taken up in the present study. Preliminary experiments show that addition of recycled plastic waste granules lead to an improvement in permeability and there is a need to do detailed studies in this direction.



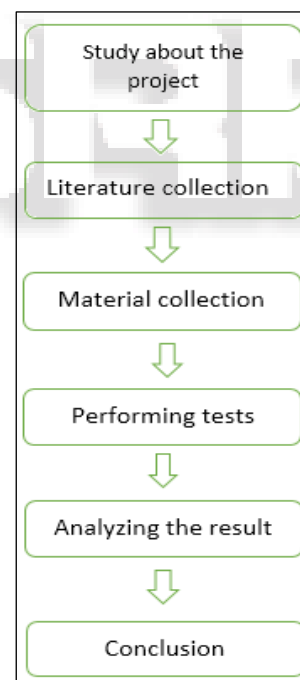
A. Recycling of Plastics

Plastics recycling is the process of recovering scrap or waste plastics and reprocessing the material into useful products, sometimes completely different in form from their original state. Since plastic is not normally biodegradable, recycling it is part of global efforts to reduce the plastic in the waste stream, especially the approximately 8 million metric tonnes of waste plastics that enter the earth's ocean every year.

II. OBJECTIVE

- 1) To prepare the artificial soil by mixing the recycled plastic particles (made from plastic waste) with the natural soil in various proportions.
- 2) To test the infiltration rate of artificial soil under the various proportions.
- 3) To analyze the test results and compute the suitability of artificial soil for rain water harvesting.

III. METHODOLOGY



A. Tests Performed

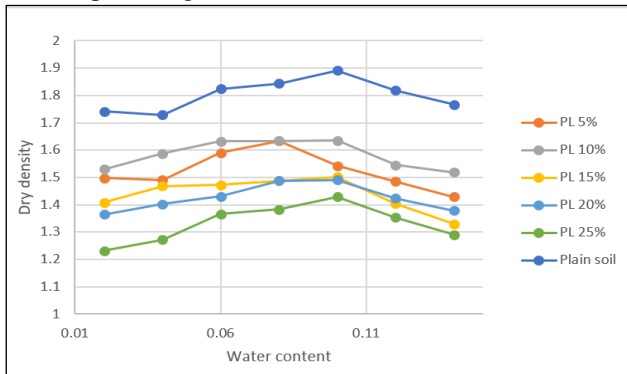
- Proctor compaction test
- Permeability test
- Double ring infiltrometer test

IV. EXPERIMENTAL INVESTIGATION

A. Proctor Compaction Test

Proctor compaction test is carried out to determine the optimal moisture content and dry density of the soil.

The below graph shows the comparison between the different percentages of artificial soil added to natural soil.



B. Permeability Test

Permeability test is performed to calculate the infiltration rate of water.

Permeability test was conducted for plain soil and adding two different percentages of artificial soil.

SAMPLE DESCRIPTION	AVERAGE K_f (cm/sec)
Normal soil	6.33×10^{-4}
Plastic soil 15%	1.236×10^{-3}
Plastic soil 25%	2.85×10^{-3}

The result obtained from the tests are clearly seen that when the amount of plastic soil is more, the infiltration rate of the soil also increases.

C. Double Ring Infiltrometer

The double ring infiltrometer is carried out in the field by adding 25% of plastic soil to natural soil.

Level of water cm	Duration sec	Permeability Cm/sec
3	1158	2.99×10^{-3}
5	3208	2.75×10^{-3}
7	6498	2.57×10^{-3}

The average permeability = 2.97×10^{-3} cm/sec.



The results of the permeability test and the double ring infiltrometer test are compared and are concluded that the infiltration rate increases when compared to the natural soil.

V. CONCLUSION

The characteristic features of artificial soil were studied by conducting various soil tests with various percentages of plastic granules and compared with the natural soil.

The infiltration capacity of artificial soil is increased when plastic soil is uniformly mixed with the natural soil.

The shear strength of the soil also increases when plastic granules are mixed.

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