WASTE PLASTIC FIBRE REINFORCED SOIL

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ABSTRACT

The main objective of this study is to investigate the use of waste fiber materials in geotechnical applications and to evaluate the effects of waste polypropylene fibers on shear strength of unsaturated soil by carrying out California bearing ratio tests and unconfined compression tests. The results obtained are compared for various tests and inferences are drawn towards the usability and effectiveness of fiber reinforcement as a replacement for deep foundation or raft foundation, as a cost effective approach.

Randomly distributed fiber reinforcement technique has successfully been used in a variety of applications such as slope stabilization, road sub grade and sub base etc. This is a relatively simple technique for ground improvement and has tremendous potential as a cost effective solution to many geotechnical problem. Keeping this in view the present study was taken up. In this study a series of compression tests under different confining pressures were conducted on soil sample without and with plastic reinforcement.

Plastic fibers are similar to the roots of trees and vegetation which provide an excellent ingredient to improve the soil and the stability. Safe and Economic disposal of solid wastes and development of economically feasible ground improvement techniques are among the important challenge being faced by the engineering community.

In this investigation, an attempt has been made to study the possibility of utilizing fibers these are the solid waste for stabilization of soil, since bulk utilization fibers is feasible in the case of geotechnical applications like construction of embankments, earth dams, and highway and air field pavements.

Keywords: waste plastic, CBR, Liquid Limit, Unconfined Compressive strength, Optimum Moisture Content

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I. INTRODUCTION

The bottled water is the fastest growing beverage industry in the world. According to the international bottled water association (IBWA), sales of bottled water have increased by 500 percent over the last decade and 1.5 million tons of plastic are used to bottle water every year. Plastic bottle recycling has not kept pace with the dramatic increase in virgin resin polyethylene terephthalate (PET) sales and the last imperative in the ecological triad of reduce / reuse / recycle, has emerged as the one that needs to be given prominence.

The general survey shows that 1500 bottles are dumped as garbage every second. PET is reported as one of the most abundant plastics in solid urban waste. In 2007, it was reported that the world's annual consumption of PET bottles is approximately 10 million tons and this number grows about up to 15% every year.

On the other hand, the number of recycled or returned bottles is very low. On an average, an Indian use one kilogram (kg) of plastics per year and the world annual average is an alarming 18 kg. It is estimated that approximately 4-5% postconsumer plastics waste by weight of Municipal Solid Waste (MSW) is generated in India and the plastics waste generation is more i.e. 6-9 % in USA, Europe and other developed countries.

II. SOIL REINFORCED WITH WASTE PLASTIC

Plastic waste when mixed with soil behaves like a fibre reinforced soil. When plastic waste fibers are distributed throughout a soil mass, they impart strength isotropy and reduce the chance of developing potential planes of weakness. Mixing of plastic waste fibers with soil can be carried out in a concrete mixing plant or with a self-propelled rotary mixer. Plastic waste fibers could be introduced either in specific layers or mixed randomly throughout the soil. An earth mass stabilized with discrete, randomly distributed plastic waste/fibers resembles earth reinforced with chemical compounds such as lime, cement etc. in its engineering properties.

III. RESULTS AND DISCUSSION

3.1 Liquid Limit

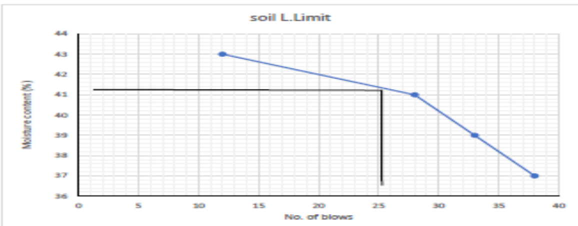

Figure 3.1 liquid limit for soil

3.2 Particle Distribution Graph

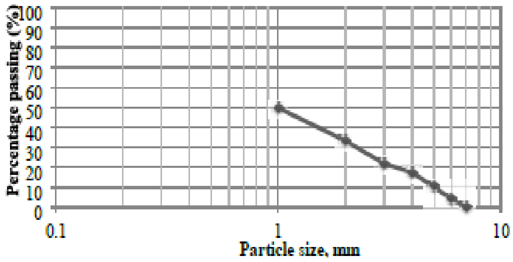

Figure 3.2 particle distribution of soil

3.3 OPTIMUM MOISTURE CONTENT

3.3.1 Soil Without Reinforced

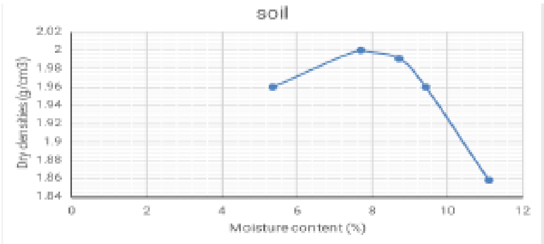

Figure 3.3 soil without reinforcement

3.3.2 Soil Reinforced With 0.4% Plastic Fibers

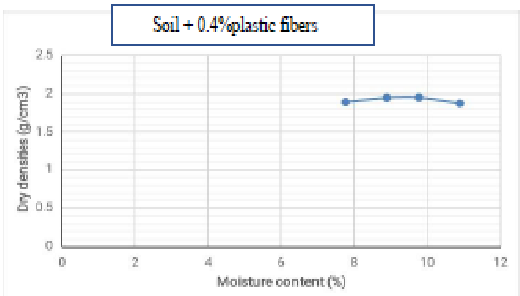

Figure 3.4 Soil + 0.4% plastic fibre

3.3.3 Soil Reinforced With 0.8% Plastic Fibers

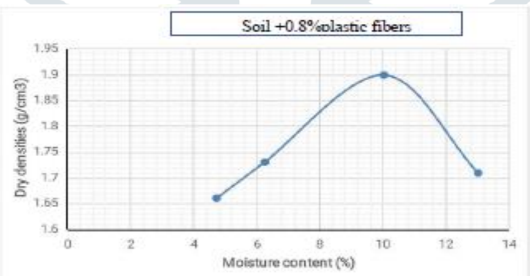

Figure 3.4 Soil + 0.8% plastic fibre

3.4UNCONFINED COMPRESSIVE STRENGTH

3.4.1. Soil Without Reinforced

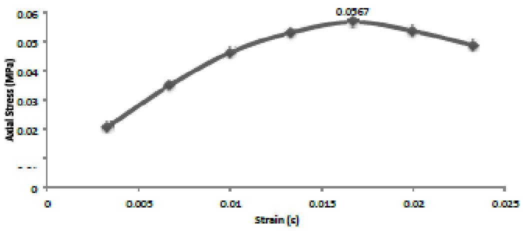

Figure 3.5 soil without reinforcement

3.4.2 Unconfined Compressive Strength For 0.4% Reinforced Soil

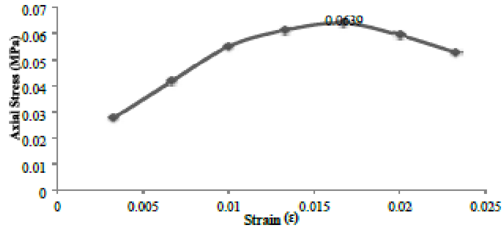

Figure 3.6 Soil + 0.4% plastic fibre

3.4.3 Unconfined Compressive Strength For 0.8% Reinforced Soil

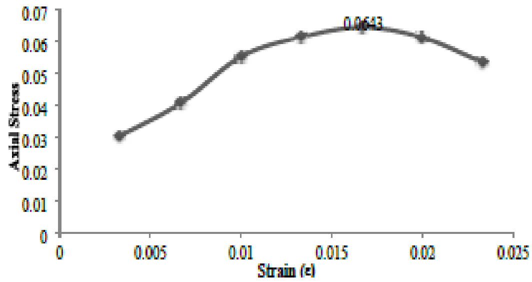

Figure 3.7 Soil + 0.8% plastic fibre

3.5 CBR VALUE OF SOIL

3.5.1 Soil Without Reinforced

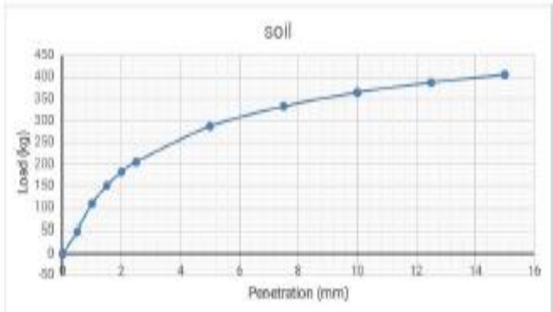

Figure 3.8 soil without reinforcement

3.5.2 Cbr Value Of Soil+0.4% Fibre

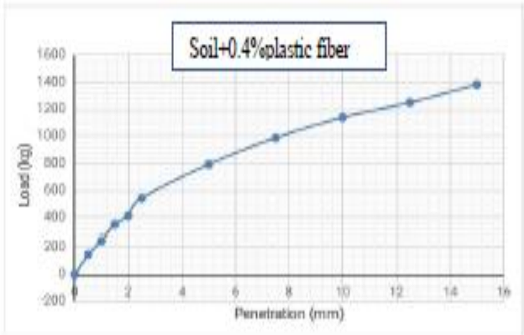

Figure 3.9 Soil + 0.4% plastic fibre

3.5.3 Cbr Value Of Soil+0.4% Fibre

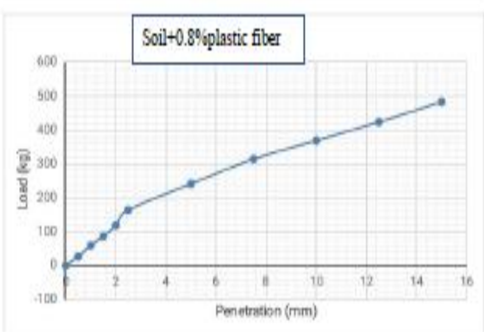

Figure 3.9 Soil + 0.8% plastic fibre

IV. CONCLUSION

The tests were conducted and the observed results were:

1. The cohesion value of unreinforced soil is 0.16 kg/cm2 while for soil with 0.4% reinforcement is 0.198 kg/cm2 which is an increase of 19.19%.
2. The cohesion value of unreinforced soil is 0.16 kg/cm2 while for soil with. 0.8%reinforcement is 0.199 kg/cm2 which is an increase of **19.50%.**
3. The Unconfined Compression Strength of unreinforced soil is at a maximum of 0.567, the sample which is made based on IS codes.
4. The Unconfined Compression Strength soil, reinforced with 0.4% of waste plastic fibers is at a peak value of 0.0639 MPa which is an increase of 11.26% from 0.0567 MPa for unreinforced soil.
5. The Unconfined Compression Strength soil, reinforced with 0.8% of waste plastic fibers is at a peak value of 0.0643 MPa which is an increase 12.10% from 0.0567 MPa for unreinforced soil.
5. There is improvement in CBR value when waste plastic fibers are mixed with the soil samples.
6. The addition of reclaimed plastic waste material was to increase the CBR value of the soil.
7. The increase in CBR value with addition of plastic fibers would mean that the thickness of the subgrade flexible pavement road would also be reduced.

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