AN EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF SOIL WITH THE ADDITION OF PLASTIC WASTE MATERIAL STRIPS

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ABSTRACT: Soil reinforcement is the process of improving the engineering properties of the soil mass and thus making the soil mass to bear more loads or to become more stable. In reinforced soil the friction gets developed between the reinforcement and the soil mass, thus we can say that the angle of internal friction gets increased which means the shear strength gets increased as per the equation given by coulomb.

In this analysis the plastic is used as a reinforcement in the soil mass. The plastic with fixed length and width was used in this analysis to stabilize the soil mass. The plastic used here varies from 0.4 to 1.2% by mass in the soil mass. The reinforced soil mass samples with different plastic content were prepared in the laboratory and were tested. In this analysis the index properties of soil was found. The direct shear test (DST) was done on the reinforced soil sample in order to find the shear strength parameters of the reinforced soil mass.

Based on the results from the laboratory tests the main conclusion was that the plastic used as a reinforcement is effective in increasing the shear strength parameters of the soil mass i.e. the stress strain curve of the soil mass gets modified.

Key words:- Reinforced soil mass, index properties and direct shear test (DST).

I. INTRODUCTION

The strength of soil is improved with the addition of reinforcement in the soil. The reinforcement is done with the help of the materials like steel reinforcement. Plastic strips, Geogrids and Geomats etc. The main purpose of this reinforcement is to increase the bearing capacity and the shear strength of soil. As we know the use plastic materials like bottles, carry bags, packing materials etc is increasing day by day, it has become now difficult to dispose such huge amount of waste material. In this study this waste material (plastic carry bags) is used as a random reinforcement for improving the properties of soil.

II. LITRATURE REVIEW

In examination to deliberately strengthened soils, less data has been accounted for an haphazardly appropriated fiber-fortified soils in the writing. In any case, an expanding number of test and numerical studies on the subject have been directed by a few analysis couple of decades (e.g, Hoare, 1979; Wasti and Butan, 1996; Gray and Ohashi, 1983; Freitag, 1986; Gray and Al-Refeai,1986; Ranjan et al, 1996; Kumar et al;1999; Consoli et al, 1998)

These previous studies indicate that the strength properties of arbitrarily distributed fiber reinforced soils and a function of content or amount of fiber used, aspect ratio and fiber surface friction along with the soil and giber index and strength characteristics.

III. MATERIALS

The materials used in this study were soil and the used plastic carry bags.

3.1 SOIL:- The soil used was taken from the zirakpur area of Punjab.

3.2 PLASTIC:-The used polythene carry bags taken from the hostels of UIET was used as a plastic material in this study.

Fig3.2a, shows used plastic carry bags

Fig 3.2b, shows plastic carry bag strips

IV. METHODOLOGY

In this study the used polythene carry bag pieces were randomly mixed with the soil sample by varying percentage by mass. The cuts of required dimensions was done with the help of an instrument like cutters etc. The tests were performed on the prepared soil sample mixed with random reinforcement to check the strength.

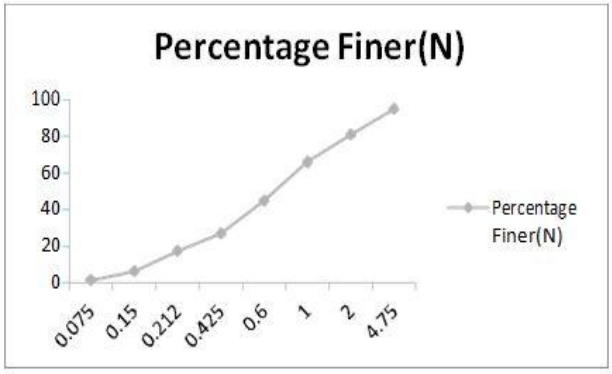
V. INDEX PROPERTIES

5.1 SPECIFIC GRAVITY

It is defined as the ratio of the mass of a given volume of solids to the mass of an equal volume of water. The specific gravity of soil was determined according to IS 2720:Part III: Sec 1: 1980 and was found 2.59.

5.2 PARTICLE SIZE ANALYSIS

The particle size analysis was done according to IS 2720:Part IV: 1985. The particle size distribution curve is plotted between particle size(mm) as abscissa on log scale and percentage fine as(%) as ordinate. The particle size curve is given below.



Graph 5.2a, shows particle size distribution

From the particle size curve:

- Effective size, D_{10} = 0.01
- D_{60} = 0.062
- D_{30} = 0.034
- Uniformity Coefficient, $C_u = D_{60}/D_{10}$ = 6.2
- Coefficient of Curvature, $C_c = (D_{30})^2/(D_{60} \times D_{10})$ = 1.86

5.3 LIQUID LIMIT

The Liquid Limit of soil was determined by using Casagrande's Apparatus according to IS 2720:
Part 5: 1985. The Liquid Limit of soil was found 40. 6%.

5.4 PLASTIC LIMIT

The Plastic Limit of soil was determined according to IS 2720: Part 5: 1985 and was found 29.4%.

VI. DIRECT SHEAR TEST

6.1 Stress Strain Characteristics of DST of soil sample without addition of reinforcement.

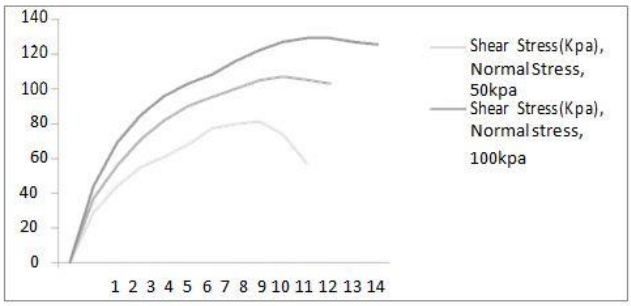


Fig 6.1a, Shows stress strain curve

Normal Stress(kpa)	Shear Stress At Failure(kpa)
50	81.20
100	107
150	129.1

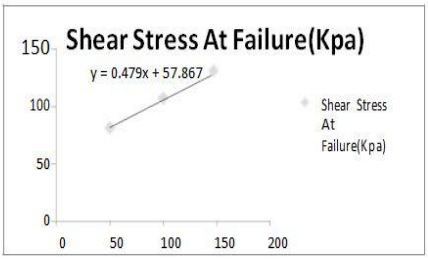


Table 6.1a, Shows Shear Stress At Failure Fig 6.1b, Shows, Normal Stress Shear Stress Graph.

Here, Cohesion Intercept is 57.867kpa and Angle of Internal Friction is 25.6°.

6.2 Stress Strain Characteristics of DST of soil sample with addition of reinforcement of 0.4% by mass.

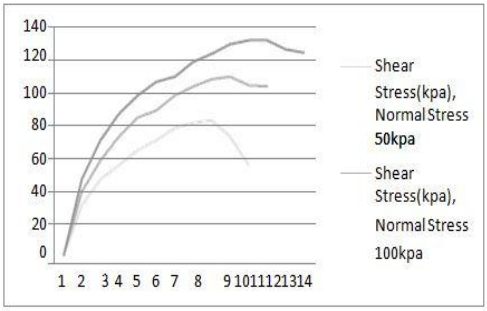


Fig 6.2a, shows stress strain curve with the addition of 0.4% plastic with soil sample

Normal Stress(kpa)	Shear Stress at failure(kpa)
50	83
100	109.56
150	131.97

Table 6.2a,shows shear stress failure

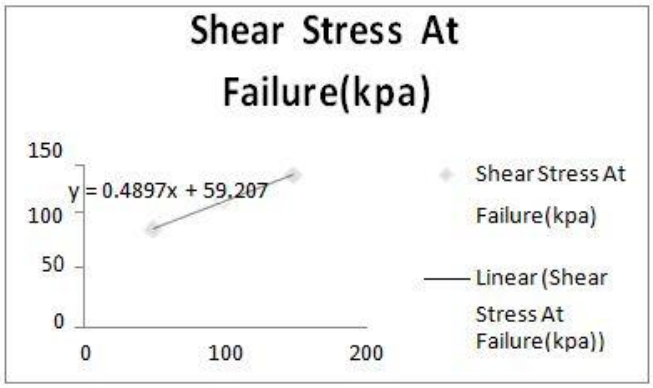


Fig 6.2b, shows normal stress shear stress graph

Here, the Cohesion Intercept is 59.207kpa and angle of Internal Friction is 26.1^{o}

6.3 Stress Strain Characteristics of DST of soil sample with addition of reinforcement of 0.8% by mass.

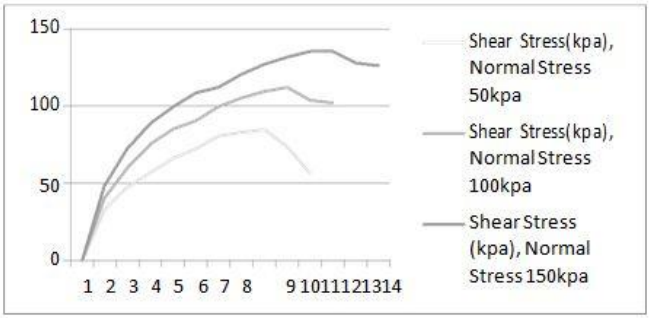


Fig 6.3a, shows stress strain curve with the addition of 0.8% plastic with soil

Normal Stress(kpa)	Shear Stress At Failure(kpa)
50	84.66
100	112.05
150	135.29

Table 6.3a, shows shear stress at failure

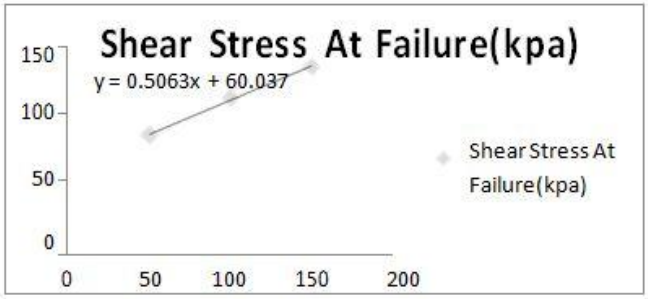


Fig 6.3b, shows Normal Stress Shear Stress graph.

Here, the value of Cohesion Intercept is 60.037 kpa and the Angle of Internal Friction is 26.9^{o}

6.4 Stress Strain Characteristics of DST of soil sample with addition of reinforcement of 1.2% by mass.

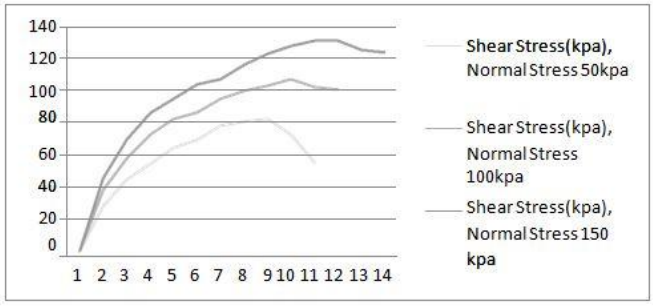


Fig 6.4a, shows, stress strain curve of soil with the addition of 1.2% plastic

Normal Stress(kpa)	Shear Stress at Failure(kpa)
50	83
100	107.9
150	131.97

Table 6.4a, shows shear stress at failure

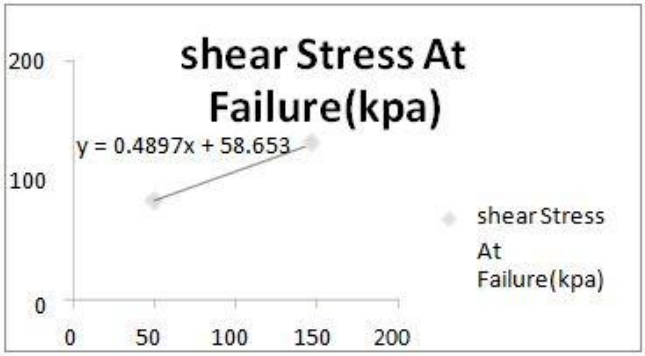


Fig 6.4b, shows Normal stress shear shress graph

Here, the Cohesion Intercept is 58.653kpa and the Angle of Internal Friction is 26.1^{o}

IIV. CONCLUSION

- The addition of plastic strips is effective in increasing in the shear strength of the soil. It was that the shear strength parameters increase with increase in the plastic strips in the soil.
- It was found that upto1% addition of plastic strips by mass, the shear strength increases. After further increase of plastic strips, the shear strength decreases.
- The decrease of shear strength beyond 1% addition of plastic strips in the soil is because the slippage develops between the soil and the plastic material

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