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EFFECT OF GEOTEXTILE REINFORCEMENT ON LOAD SETTLEMENT BEHAVIOUR OF SAND

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ABSTRACT- In order to investigate the use of geotextiles in improving the load carrying behaviour of soil,load tests were conducted on square model footings of three different sizes with sand as medium and jute fabric and plastic net as reinforcing material.It was observed that, placing of reinforcing material at a depth about 0.5 times the footing size results in maximum gain in ultimate bearing capacity. The gain in bearing capacity was found out to be 5 to 55% of that of homogeneous soil for lesser values of the ratio of the depth of reinforcement to footing size within a limit of settlement 0.2 times the footing size. Reinforcing material such as geojute appears to act as a separating medium in sand used, thus preventing the failure zones going beyond the reinforcement layer and influencing the settlement considerably.

INTRODUCTION

Ground improvement using geotextiles is one of the latest and fast growing technique in the field of geotechnical engineering.It is seen that mostly synthetic fibres have been used as geotextile to improve the load carrying capacity of the soil. Binquet and Lee (1),Huang and Tatsuoka (3),Michael and James (4),Sridharan et al (7) and many others have under taken research work in the subject using synthetic geotextiles. These synthetic geotextiles are very costly in India and cannot be used abudantly where finance is a constraint.On the other hand a few research work have been done so far where natural fibres like jute or coir are used as geotextiles. Researchers like Pandey (5) and Ramanatha et al (6) have investigated the use of jute or coir in improving the load carrying behaviour of soil. Hence in this paper an attempt has been taken to study the effect of geotextiles like geojute and low cost plastic net reinforcement on load carrying and settlement behaviour of soil.

TESTING PROGRAMME

All the test were conducted in a brick masonry tank of size 0.75m X 0.75m X 0.50m and it was assured that the failure zones developed during test were not restricted due to presence of sides and bottom of the tank based on the report of Chummar (2). Squre footing were selected to minimise the dimensional effect (strip and rectangular footings). The footing sizes selected were 100X100, 75X75, 50X50mm. Each footing was made up of 5mm thick mild steel plate, the bottom and sides surfaces of which were made rough to simulate the conditions for rough footing.

The footings were loaded by means of a loading beam and the settlement observations were recorded by two dial gauges. A total of 57 load tests were conducted. In each load test in reinforced soil the number of reinforcement layers was restricted to one.

Material Properties

Sand used

Dry sand passing through 2.36 mm IS sieve and retained in 75 micron IS sieve was used in all the tests. The sand is classified as poorly graded sand (SP) with a D_{50} of 0.6 and a uniformity coefficient (C_u) of 2.1. The specific gravity of sand was found to be 2.66. A bulk density of 13.74 kN/m^3 was adopted for sand sample for all the tests. The relative density was found out to be 12%.

Geotextiles used

For the test purpose, the following types of geotextiles were used.

a) Jute fabrics of appropriate sizes were obtained by cutting required number of pieces from commonly used gunny bags. The thickness of each strand of jute thread used in the fabric was approximately 1.00mm. The breaking extention of the jute was 1.8%. The tenacity and initial modulus were 0.31 N/tex and 17 N/tex respectively.

b) Plastic net is formed out of plastic thread of diameter of about 1.00mm. The size of opening in the net was kept about 25mm X 25mm.

TEST RESULTS AND DISCUSSION

The results of the present investigation are presented in Fig.-1 and Fig.-2. From Fig.-1, it is observed that maximum gain in ultimate bearing capacity (UBC) is achieved at a depth of reinforcement (D_r) of 0.5B. With increase in D_r, the UBC increases and reaches a minimum value (even less than the UBC of unreinforced soil, q_u) at D_r/B of 1. to 1.5. With further increase in D_r, the UBC increases and attains the value of q_u at D_r/B of 2.0 to 2.5. The soil appears to gain more bearing capacity with geojute reinforcement compared to the plastic net investigated.

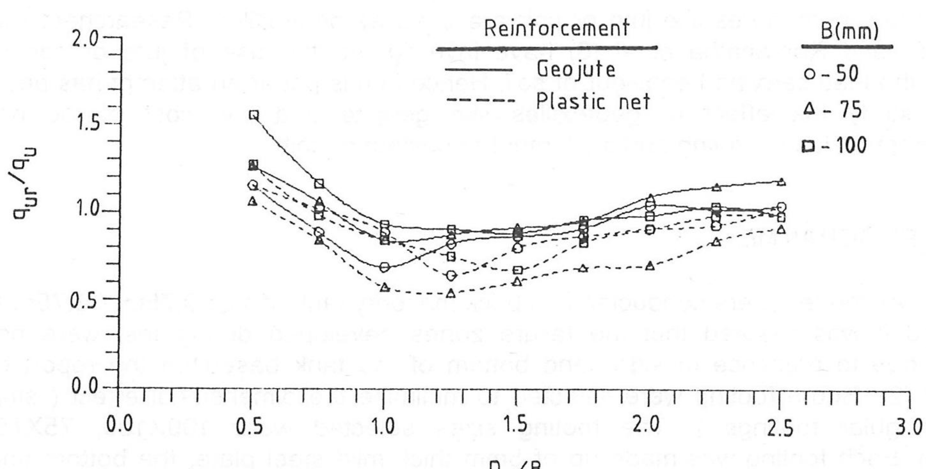

FIGURE - 1 D_r/B versus q_{ur}/q_u Curves of the Model Footings.

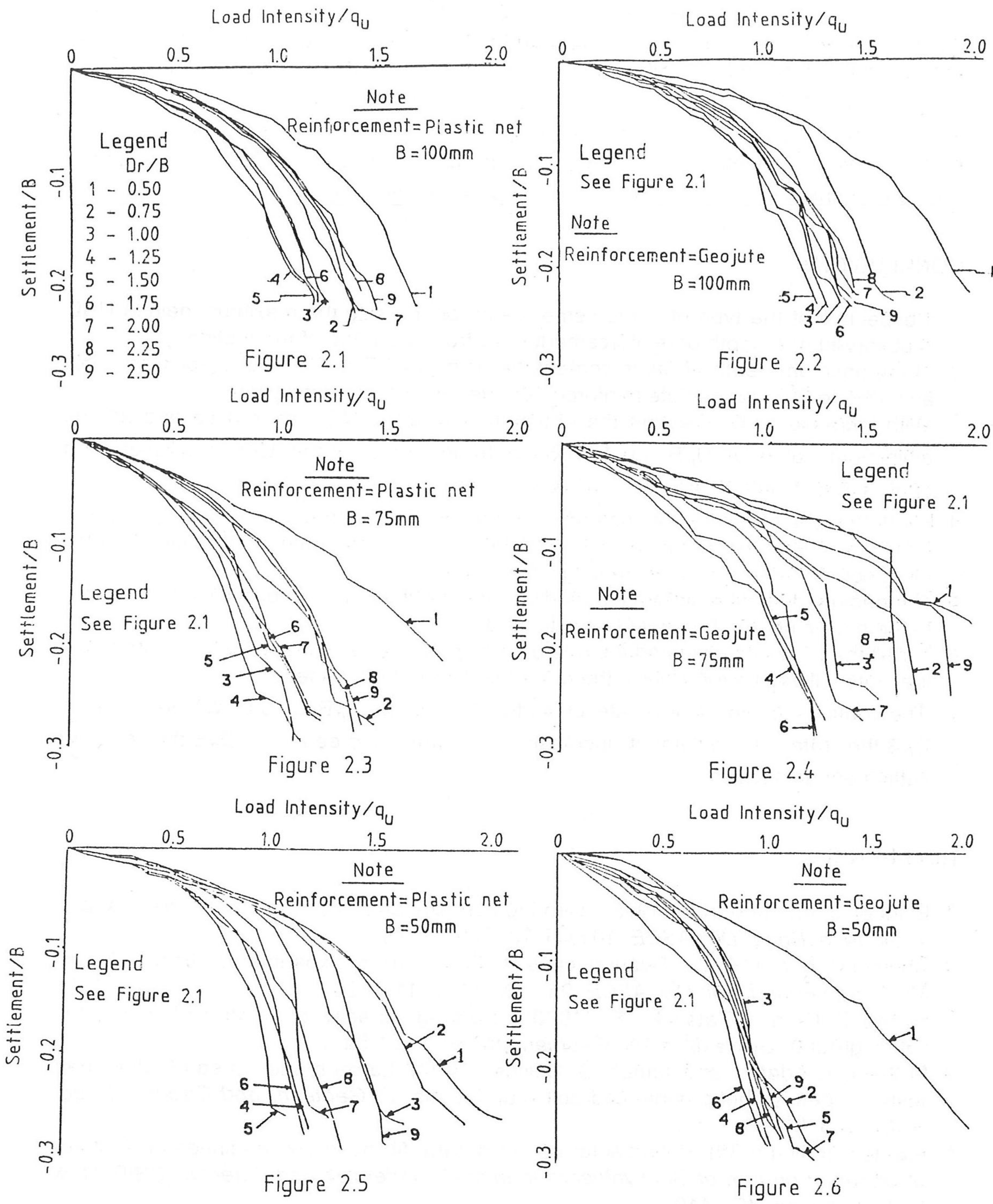

FIGURE - 2 Load Intensity /q_u versus Settlement /B Curves of the Model Footings.

Analysis of settlement behaviour is made from Fig.-2, which reveals that irrespective of the type of reinforcement and footing size the settlement varies linearly upto 0.5 times the load intensity /q_u. In all the cases low rate of settlement is observed upto D_r/B of 0.5. With increase in D_r/B, the rate of settlement increases and on further increase the rate of settlement decreases. Geojute appears to act as a separating medium and influences the settlement considerably. The effect of D_r on settlement is not so prominent in case of plastic net compared to geojute.

CONCLUSIONS

1. Irrespective of the type of reinforcement and footing size,the maximum gain in UBC is observed at a depth of reinforcement 0.5B from the base of the footing .
2. At the optimum depth of reinforcement,the gain in UBC is 6% to 27% for plastic net and 15% to 55% for geojute reinforcement depending on footing size.
3. With increase in D_r (beyond the optimum depth),the UBC decreases and attains aminimum value at D_r/B 1.0 to 1.5.On futher increase,the UBC increases and approaches a vlue of UBC of homogeneous soil at D_r/B 2.0 to 2.5.
4. For both types of reinforcing materials,the gain in UBC increases with increase in the footing size.Prototype foundations being larger in size,the gain in UBC will be much more compared to the model footings investigated.
5. The geojute acts as a separating medium and exhibits more improvement compared to the plastic net reinforcement investigated.
6. For all the cases investigated,the rate of settlement varies linearly up to 0.5 times the load intensity/$q_{u,}$beyond which the rate of settlement increases.
7. The footings exhibit a low rate of settlement up to D_r/B of 0.5.With increase in D_r/B,the rate of settlement increases.On futher increase in D_r/B,the rate of settlement decreases.

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SESSION III

HYDRAULIC APPLICATIONS

Discussion Papers