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BEARING CAPACITY OF FOOTING ON SAND BED WITH DOUBLE LAYER FABRIC REINFORCEMENT

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SYNOPSIS : A series of bearing capaciy tests were performed on reinforced sand using strip footing. The sand bed was reinforced with double layer fabric reinforcement. The aim of present investigation is to find the suitable placement of double layer fabric reinforcement for improving bearing capacity and reducing settlement.

INTRODUCTION : Geotextiles are now widely used in road sub-bases, air field pavements and railway ballasts in order to provide separation from poor underlying soils, filtration/ drainage at the sub base, subgrade interface and a measure of reinforcement. This paper deals with the behaviour of footing on sand bed with double layer fabric reinforcement.

Binquet and Lee (1975) performed the first laboratory tests on reinforced earth Slabs. The results of the homogeneous deep sand tests clearly indicate that the bearing capacity of soil can be significantly increased by adding layers of horizontal reinforcement. They found that the optimum depth to the uppermost layer of reinforcing is one-third the footing width. Patel (1981) based on laboratory model experiments suggested that the bearing capacity of the subsoil can be improved by introducing a thin layer of frictional sand with a cover of suitable fabric on its either face. It was reported that the natural tendancy of lateral movement of the frictional sand is prevented by a cover of fabric on either face of element and high interlocking, that developed between these two materials provides stiffness and flexural rigidity to the reinforcing element.

In the present study, work has been done for finding bearing capacity of footing on sand bed with double layer fabric reinforcement placed at different depths below the footing. The depth of top layer was kept constant and thickness of sand bed is varied by keeping second layer at deeper depths. It is intended to study the load settlement behaviour of footing resting on sand bed with double layer fabric reinforced dune sand. The findings of these studies have been analysed and their practical significance identified.

EXPERIMENTAL TECHNIQUE : Dune sand of (Mohan Garh) Jaisalmer was selected for the present study. It is a fine sand containing 2% of silt. It has coefficient of uniformity, Cu=1.73, coefficient of curvature, Cc = 1.23 and mean particle size of 0.177 mm. The test density of sand was kept to 1.60 g/cm^3. Strip footing of 80 mm x 500 mm size made of cast iron was used for conducting the tests.

Testing tank measuring 1.25 m x 0.50 m in plan and 0.90 m in depth was used in this study. To obtain a uniform and reproducible density the sand was deposited in tank by raining technique. The test observations show that the density of 1.60 $\pm$ 0.005 g/cm^3 is achieved for the height of fall equal to or greater than 0.60 m. The loads were applied to the footing by means of dead lead system and were also recorded through a proving ring.

While filling the tank the fabric reinforcement was placed at the required positions. The footing was placed and adjusted with considerable care and effort so as to receive the load application point at its centre. After applying the seating pressure and releasing the same, equal increment of loads were applied and maintained till the rate of settlement was less than 0.05 mm per hour. The settlement of footing was observed by two dial gauges positioned on footing till the soil failed. The test was repeated at least twice to ensure the reproducibility of the test results.

TEST RESULTS AND DISCUSSION : Average pressure settlement observations were taken for strip footing unreinforced and reinforced with double layer fabric reinforcement with top layer keeping at constant depth of 0.25 B (B = width of footing) and depth of second layer varied as 0.5B, 0.75B, 1.0B and 1.25 B (Fig. 1). The non dimentional term bearing capacity ratio (B.C.R.) defined as ratio of ultimate load carrying capacity of double layer reinforced sand bed to load carrying capacity of unreinforced sand bed were determined.

The effect of double layer fabric reinforcement on settlement of footing has been presented as observed settlement at constant pressure. The results have been presented in non dimensional form in terms of settlement ratio, defined as the ratio of settlement of reinforced double layer sand bed (S) to settlement of unreinforced sand bed (So) at constant pressure. Values of settlement ratio have been determined at a pressure of 5 kN/m^2 and 75 kN/m^2, (Fig.2), from graph it is seen that the settlement ratio decreases with double layer fabric reinforcement.

Similarly the pressure ratio for footings has been worked out ata settlement value of 4mm and 8 mm (Fig. 3). From graph it is found that the pressure ratio increases with double layer fabric reinforcement, placed at 0.25B and 0.5B below footing.

CONCLUSIONS : Model tests were conducted on strip footing resting on dune sand bed reinforced with double layer fabric of FGWR to study pressure settlement relationship with varying depth of sand bed. Following conclusions have been drawn from this study :

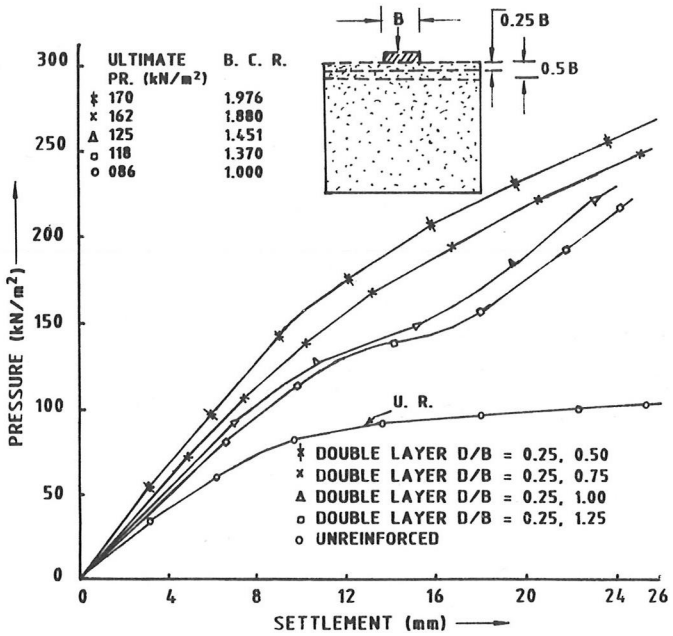

FIG. I: PRESSURE - SETTLEMENT CURVES
FOR STRIP FOOTING, TOP LAYER REINF. AT CONSTANT D/B = 0.25
SECOND LAYER AT VARIABLE D/B RATIOS.

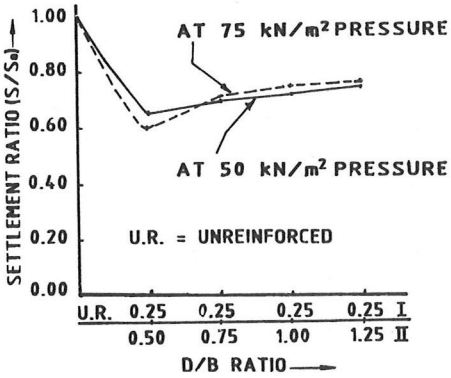

FIG.2: SETTLEMENT RATIO AT CONSTANT
PRESSURE v/s D/B RATIO (80mm x 500mm FOOTING).

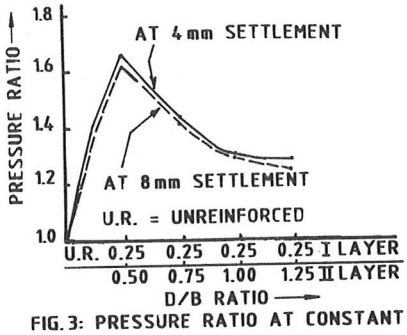

FIG. 3: PRESSURE RATIO AT CONSTANT
SETTLEMENT v/s D/B RATIO(80MM X 500MM FOOTING)

The B.C.R. increased about 1.976 for strip footing placed on double layer fabric reinforced dune sand. (When placement depth is D/B = 0.25, 0.50). Settlement ratio for a given value of pressure decreased and for a given value of settlement the pressure ratio increases for double layer fabric reinforced sand bed.

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