STUDY OF BEARING CAPACITY OF VARIOUS TYPES OF SOIL BY USING GEOSYNTHETICS

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Abstract – Foundation is the most important part of any structure. It gets the load of the whole building and therefore it is important to properly design foundation of the building. Bearing capacity of the soil underneath and the settlement of footing are the two major concerns in the design. A lot of work from a long time is going on for the improvement of bearing capacity of soil by using geosynthetics and the settlement of the footing. This paper reviews the work done so far on these.

Keyword: Bearing capacity, settlement

1. INTRODUCTION

Foundation design consists of two distinct parts: the ultimate bearing capacity of the soil under the foundation, and the tolerable settlement that the footing can undergo without affecting the superstructure. The ultimate bearing capacity aims at determining the load that the soil under the foundation can handle before shear failure; while, the calculation of the settlement caused by the superstructure should not exceed the limits of the allowed deformation for stability, function and aspects of construction. Research on the ultimate bearing capacity problems can be carried out using either analytical solutions or experimental investigations. The former could be studied through theory of plasticity or finite element analysis, while the latter is achieved through conducting prototype, model and full- scale tests. A satisfactory solution is found only when theoretical results agree with those obtained experimentally. A literature survey on the subject shows that the majority of the bearing capacity theories involve homogeneous soils under the foundations. Soil properties were assumed to remain constant for the bearing capacity analysis, and therefore analytical solutions, like Terzaghi's bearing capacity theory, matched with the experimental results. However, in cases where the soil properties vary with depth, most of these theories cannot be implemented . anthe analytical solutions that take into consideration the non-homogeneity of the soils are approximations, and

2. AIM AND OBJECTIVE

The aim of this present work is to study and assess the different types of geosynthetics available and to evaluate the improvement in bearing capacity of soil.

To achieve this aim, the following objectives have been identified:

(1) To classify the available geosynthetics in the country.

(2) To determine the maximum CBR for poorly graded sandy soil by placing geosynthetic materials in layers.

(3) To ensure the layer thickness in subgrade for poorly graded sandy soil by placing

(4) To build up a strategy and to assess the strength of soil

(5) To enhance the strength of soil by including geosynthetic material such as geogrid (non- woven)

(6) To analyse the results and make appropriate recommendations for optimal use.

3. LITERATURE REVIEW

In times past, various types of materials have been added to soil in order to increase its stability, for use as an engineering construction material. But these materials such as plant fibers, wood shavings and cotton are bio-degradable and therefore have short service life. In only a few decades, geosynthetics (geotextiles, geogrids, and geomembranes) have joined the list of traditional civil engineering construction materials.

In developing countries, the use of geosynthetics is relatively new but gaining widespread popularity in construction. Geosynthetics are becoming rapidly popular in construction because of their ability to perform certain necessary functions while offering practical advantages such as:

i). A wide availability of products from the market place

ii). The relative ease of shipping and field handling (flexibility)

iii). Rapid installation techniques, i.e. fast speed of construction, without the need for heavy equipment such as earth-moving machines.

iv). Lightweight in comparison with other construction materials, therefore imposing less stress upon the foundation

v). Durability and long life when properly selected

vi). General environment safety, since they will not degrade. (However, there is possibility of degradation if exposed to sunlight and certain highly corrosive chemicals) (Okunade, 2010)

4. MATERIALS USED

Geosynthetic materials like geotextiles, geogrids, geomembranes etc.

5. METHODOLOGY

The design methodology is based on following Points-

1. In this study, We have to study the bearing capacity of soil by using various types Geosynthetics material available in market.

2. We have to study the various types of standardized and empirical formulae for improvement of bearing capacity of soil.

3. We have to evaluate the bearing capacity of soil by using the following formulae and standard values –

Calculation of Bearing Capacity –

For the calculation of bearing capacity of soil, there are so many theories.

But all the theories are superseded by Terzaghi's bearing capacity theory

1. Terzaghi's bearing capacity theory qu = c'Nc + y Df Nq + 0.5 y B Ny

The above equation is called as Terzaghi's bearing capacity equation.

Where qu is the ultimate bearing capacity and

Nc, Nq, Ny are the Terzaghi's bearing capacity factors.

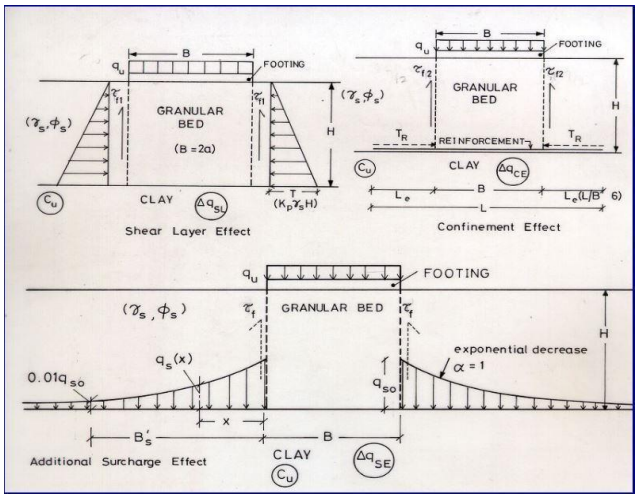

Fig. – Soil improvement effects BEARING CAPACITY IMPROVEMENT-

Using geosynthetics in soft soils

The ultimate bearing capacity of a footing resting on soft soil qu = CuNc

Use of geosynthetics results in improvement of bearing capacity.

The improvement is attributed to three effects

a) Shear layer effect

b) Confinement effect due to the interaction between sand and reinforcement in the sand layer and

c) Additional surcharge effects.

When a granular bed of thickness (H) of bulk density (gs) and friction angle (Θs) with reinforcement is provided over soft soil, the bearing capacity of the footing resting on this foundation medium is increased.

Frictional forces developed between the soil and the reinforcement induce tensile strains in the reinforcement.

The tensile strains developed provide the confining effect.

This will induce additional shearing resistance along the vertical plane at the edge and exponentially decrease with distance away from the edge of the footing.

The three effects contribute to increase in bearing capacity, given as

qu + DqR = Cu Nc + DqSL + DqCE + DqSE

LAYING GEOTEXTILE

6. RESULT

It can be noted that the original ultimate bearing capacity of the soft soil is likely to increase from

63.2 kN/m to 458.9 kN/m2, owing to the contribution in I improvement of bearing capacity from shear layer effect, confining effect and surcharge effect.

However, it is desirable that the improvement needs to be examined in relation to results that can be obtained from testing of a trial foundation.

7. CONCLUSION

Use of geosynthetics is very useful in bearing capacity problems to increase bearing capacity and reduce settlements.

The technique has been implemented successfully in many problematic areas.

Research is continuing on the material development, design methodologies, construction influences, and guidelines.

The overall study concludes that geosynthetics are substance that gains the strength of soil

(Bearing capacity of soil)

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