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A Review Paper on Under Reamed Pile Foundation

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Abstract

Under-reamed piles are broadcast-in-situ concrete piles having one or more number of bulbs formed by enlarging the pile considerable ground movements occur due to seasonal variations, filled up grounds or in soft soil strata. Provision of under reamed bulbs has the advantage of increasing the bearing and uplift capacities. It also provides better anchorage at greater depths. An experimental work was programmed and carried out to understand the behavior of under-reamed piles subjected to vertical load. The type of soil used in the present laboratory investigation was sand and mild steel under-reamed pile models this study presents the design of pile based on the influence of geometrical features of the under-reamed pile on its ultimate load carrying capacity. The geometrical features include the length of the pile, number, spacing and position of the bulb.

Keywords: *Under-reamed piles, Concrete piles, Siltstrata*

INTRODUCTION

When the ground consists of expansive soil, for example black cotton soil, the bulb of the under-reamed pile provides anchorage against uplift due to swelling pressure -apart from the increased bearing. In case, of filled-up or otherwise weak

Strata overlying The firm strata, enlarged base in that form of under- reamed bulb in

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firm strata provides larger bearing area and piles of greater bearing capacity can be made. In loose to medium pervious sandy and siltstrata, bored compaction piles can be used as the process of compaction increases the load bearing capacity of the piles. Under-reamed piles may also be used under situations where the vibration and noise caused during construction of piles are to be avoided.

The provision of bulb is of special advantage in under-reamed piles to resist uplift and they can be used as anchors. The load carrying capacity of under-reamed pile depends mainly on the pile dimensions and soil strata. Axial load on a pile is transmitted by point bearing at the toe and the projected area of the bulb and skin friction along the pile stem. Depending upon the nature of soil and pile geometry, in addition to the skin friction on stem, friction can develop on the soil cylinder between the extreme bulbs.

In under-reamed compaction piles, the mechanism of load transfer remains the same but soil properties improved by compaction process are considered. In uplift load, point bearing component at toe is absent but unlike other straight shaft piles, point bearing on an annular projection of the bulb is present.

Treatments (such as a bituminous surface treatment (BST) generally found on lower volume roads) or, HMA surface courses (generally used on higher volume roads such as the Interstate highway network).These types of pavements are called “flexible" since the total pavement structure "bends" or "deflects" due to traffic loads.

LITERATURE REVIEW –

The degree of swelling of an expansive soil can be estimated through index properties also. The Atterberg limits, clay content, activity etc. are used as parameters to categorize the degree of swelling (Chen, 1988).

Skempton (1953) observed that volume change characteristics of a soil depends on “activity”, which is defined as the ratio of the plasticity index of the soil to the percentage clay particles i.e., fraction of soil finer than 2 micron (0.002mm). Subsequently, this definition was modified for natural soils (Seed et al. 1962) as

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Activity= plasticity index/%of finer less than 2 micron

A soil with an activity of less than 0.75 is termed as inactive i.e., it indicates a low potential for volume change and a soil with an activity of more than 1.25 is termed as active, indicating a high potential for volume change. The values lying between 0.75 and 1.25 indicate medium potential and soils with these values are classified as normal.

Altmeyer (1955) characterized the degree of expansion of a soil based on its shrinkage limit and linear shrinkage as given in Table 2.1. Linear shrinkage is defined as the ratio of decrease in linear dimension of a specimen to its initial dimension, expressed as a percentage and given by the nearest whole number.

Holtz and Gibbs (1956) developed a simple test called the free swell test for the determination of swell potential of a soil. The test is performed by pouring 10cc of dry soil passing 425micron sieve into a graduated cylindrical glass jar of 100ml capacity filled with water and observing the swollen volume. Free swell index (FSI) is expressed as a percentage increase in the volume to the original volume of the soil. Soils having a free swell of more than 100% pose more damage to lightly loaded structures, and those having an FSI of less than 50% do not pose serious problems to structures.

Mohan and Goel (1959) suggested a more convenient method, which was later adopted by Indian Standards Institution. In this method, 10g of oven dried soil passing 425 micron sieve is poured separately into two graduated cylindrical glass jars of 100ml capacity, one containing distilled water and the other kerosene. Allowing both the jars to stand for 24 hours, the final volumes of the soil in the two cylinders are noted. The differential free swell, which was later redesigned as free swell index (FSI), expressed as a percentage, is given as,

FSI = (Vs –Vk/Vk)*100

Where, Vk = final volume of the soil in kerosene, which is a non-polar liquid, and

Vs = final volume of the soil in water which causes swelling of the soil.

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CONCLUSION

The conclusions drawn from the above studies have been stated below in a quantitative form to the extent possible.

The test results obtained in this study clearly shows that the load carrying capacity of under-reamed piles under compression is much higher in comparison with the conventional pile.

It was found that the ultimate load is generally insensitive to change in length for under-reamed piles.

For a given soil and pile, the influence of location of the bulb is not significant beyond the standard height 175 mm from the base of the pile for the location of the under-ream.

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