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Uplift Capacity of Concrete Pile in Cohesion less Soil by Varying Density

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Abstract: **This paper discusses the uplift capacity of concrete pile under lateral load in cohesion less soil. Pile transfers building loads to the earth farther down from the surface than a shallow foundation does. A pile is a vertical structural element of a deep foundation, driven deep into the ground at the building site. Pile foundations are capable of taking higher loads than spread footings. This paper discusses the influence of forces on pile. Loads are applied at 45° angle and the corresponding deflection is studied. The experimental investigations shows the failure of pile and its failure pattern under the loading angle for the two condition of cohesion less soil viz loose soil and dense soil.**

Keywords: **Pile, lateral resistance, foundation, bearing capacity.**

I. INTRODUCTION

Piles are used under tall chimneys, high-rise high structures, offshore structures etc. Pile foundations are the generally used foundations in massive structures. The loads acting on the pile can be either horizontal loads or vertical loads. The pile foundation tends to fail under seismic loads since the loads tend to move the pile horizontally resulting in the failure of the structure. In this experimental study loads are applied at an angle of 45° and the results obtained are discussed in two different density of the cohesion less soil surrounding the pile.

II. EXPERIMENTAL PROGRAM

The experiments was carried out on a 22 mm diameter pile in cohesion less soil in a cylindrical tank. The cylindrical tank of diameter 615 mm and height 460 mm was used. The length of the pile is fixed to about 450 mm. Cohesion less soil sample (sand) passing through 4.75 mm sieve was used. The relative density of sand surrounding the pile was adopted as 47% and 70% based on literature study for loose and medium soil condition.

III. APPARATUS SETUP

The piles were tested with the help of a loadig setup. The frame rests on a base plate on which the cylindrical tank is placed. The frame consists of two vertical supports and a horizontal support. The horizontal support consists of two rollers fixed on the horizontal support to apply a load at 45°. These rollers are used for loading purpose by using a pulley. The string runs over the pulley. The one end is connected to clamp of the pile and the other end is connected to slotted weights. Dial gauge is fixed on the clamp to measure the deflection.

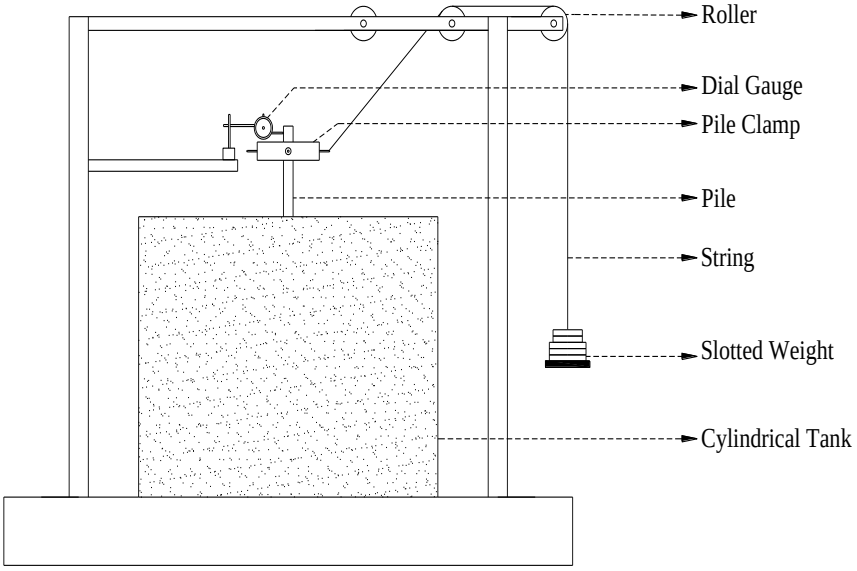

Fig 1 Typical test arrangement for load deflection behavior of pile

IV. COHESION LESS SOIL

The cohesion less soil used for the test is taken from (Latitude 11°20' N and Longitude 77º 50' E) in , Karur district, Tamilnadu, India. This cohesionless soil has a specific gravity of about 2.665. The coefficient of curvature is about 1.36 and the coefficient of uniformity is about 3.257.

V. DENSITY OF SOIL

An empty cylinder of known mass and known volume was taken. The required density is achieved by the method of height of fall. Cohesion less soil (sand) passing through 4.75 mm sieve was used to fill the soil bed .The soil sample was dropped from a height of 2 cm into the cylindrical vessel. The height was maintained constant till the vessel was filled. The mass of the full cylinder was found. By knowing the mass of soil and volume the density was found. The same procedure was repeated with 5cm height.

VI. CONCRETE PILE DESIGN

The conventional and sustainable pile is designed for ultimate load condition. A hollow CPVC tube with internal diameter 16 mm, coated with oil was used. The conventional piles is made of plain cement concrete of ratio 1:1.5:3 and of density 1.62 and compacted using tamping rod. The aggregate used in concrete is the one passing through 4.75 mm sieve and retained on 2.36 mm sieve with specific gravity of 2.7.The cement used is OPC of grade 43 with specific gravity of 3.15.The fine aggregate used is of specific gravity 2.665. The water-cement ratio adopted is 0.45.

VII. TESTING OF PILE

The load deflection behaviour of the pile has been studied by applying load with the help of a loading frame. The cylindrical drum is filled with cohesion less soil from a height of about 5 cm. The pile is placed at the middle of the cylinder and then the cylinder is again filled with the soil as before. The pile is now clamped and then a string is attached to the clamp and runs over the rollers and the other end is left for applying the load with the help of slotted weights and the corresponding deflection is found in the dial gauge until the pile fails. The same procedure is followed as above but the cohesion less soil is filled at the height of 2 cm where the density is 47%.

VIII. RESULTS AND DISCUSSIONS

The ultimate load carrying capacity in both cases was determined in load deflection curve. The values are compared as follows.

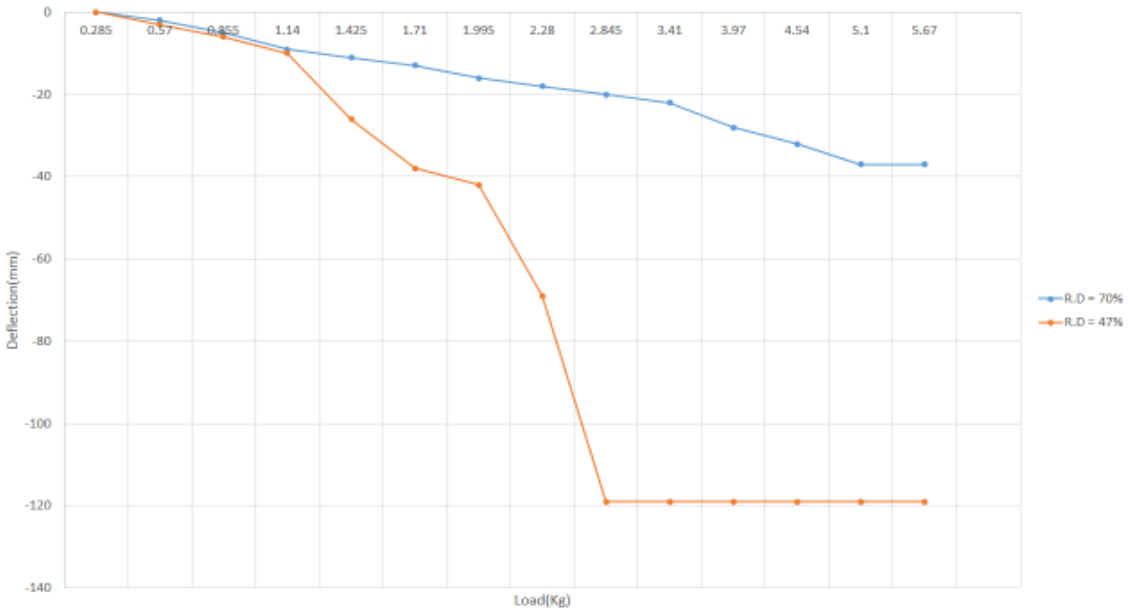

Fig. 2 Load deflection curve of pile

IX. CONCULSION

The experiment conducted resulted on the following conclusions which indicates that the density has a major role to play with.

- When the density is increased by 17.64% the load carrying capacity is increased by 25.71%.
- Piles resist more in the resultant angle of 45° than when the load is applied horizontally.
- The pile under loose soil shows great lateral movement than with the pile with dense soil condition.

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