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Lateral Resistance of Sustainable Concrete Pile in Cohesion less Soil

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Abstract: **This paper discusses the result of study conducted on lateral resistance of sustainable concrete pile in cohesion less soil. Pile is a type of foundation used for massive structures to increase the bearing capacity of soil. Piles acts as a barrier to lateral loads since it has greater capacity to resist lateral loads (seismic forces) than the conventional foundation. Sustainability is achieved in pile by replacing cement by fly ash. The main objective of this paper is to investigate the load carrying capacity of both conventional and sustainable pile under similar conditions and compare the results thus obtained. Load is applied to pile in the horizontal direction (lateral loads) and the corresponding deflection of pile is observed in loose sand. Sustainable pile carries load similar to conventional pile. The experimental investigation of piles indicates that conventional pile can be replaced by sustainable pile.**

Keywords: **Sustainable pile, lateral resistance, foundation, bearing capacity.**

I. INTRODUCTION

It is one of the most complex soil-structure interaction problems in the field of foundation engineering on the response of a single pile to externally applied lateral load. Piles are used under tall chimneys, high-rise high structures, offshore structures etc. The methods available for predicting the ultimate lateral resistance to piles in cohesion less soils often produce significantly differently ultimate resistance values making it difficult for civil engineers to efficiently select the method when designing laterally loaded piles in cohesion less soils. Lateral load behaviour of single pile in cohesion less soils is attempted for loose soil condition. Piles used to study the lateral resistance are designed based on estimating the ultimate and safe working load conditions. Sustainable pile is designed by replacing 25% of cement by fly ash.

II. EXPERIMENTAL PROGRAM

The experiments were carried out on a 16 mm diameter pile surrounded by 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% based on literature study for loose soil condition. Both conventional and sustainable pile was casted and cured for 28 days.

III. TEST SETUP

The piles were tested with the help of a loading frame 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 three rollers on same plane. 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.

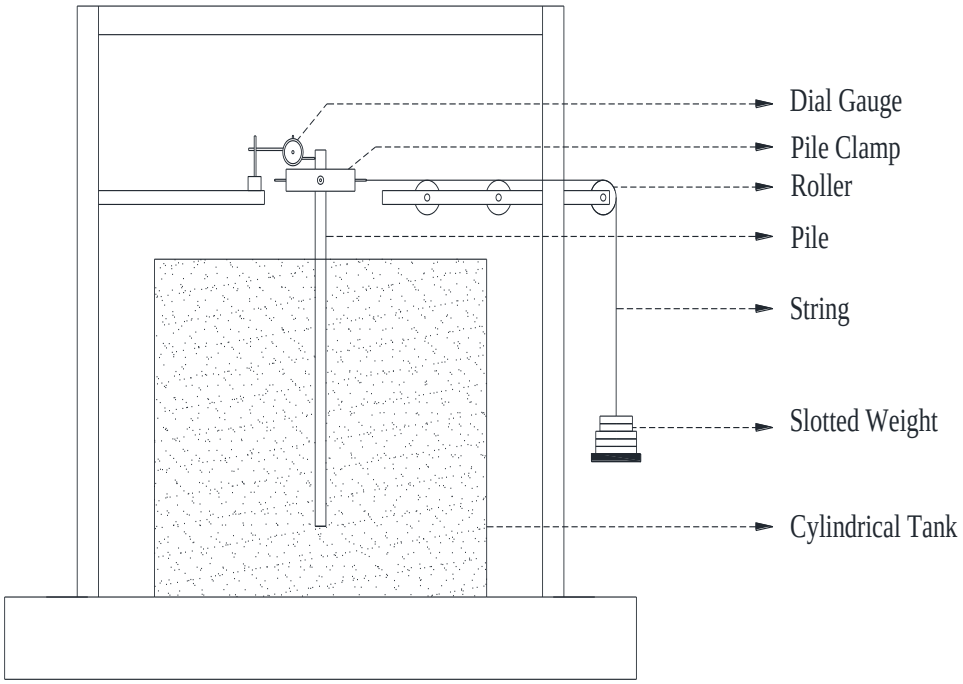

Fig 1 Typical test arrangement for load deflection behavior of pile

IV. PROPERTIES OF 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 ACHIEVEMENT

Cohesion less soil (sand) passing through 4.75 mm sieve was used to fill the soil bed. An empty cylinder of known mass and known volume was taken. The required density is achieved by the method of height of fall. 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 by

Density = B - A / V

Where, A is the mass of the empty cylinder in Kg.

V is the volume of the cylinder in cm

B is the mass of the cylinder with soil sample in Kg.

When the soil is dropped from a height of about 2 cm the density achieved was 17%. This condition is the loose density condition adopted.

VI. CONSTRUCTION OF PILES

The conventional and sustainable pile is designed for ultimate load condition. A hollow PVC 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 53 with specific gravity of 3.15.The fine aggregate used is of specific gravity 2.665. The water-cement ratio adopted is 0.45. In case of sustainable pile 25% of cement was replaced fly ash of specific gravity.

VII. TEST PROCEDURE

The load deflection behaviour of the conventional and sustainable pile has been studied by applying horizontal load with the help of a loading frame. The cylindrical drum is filled with cohesion less soil from a height of about 2 cm until the cylinder is filled for 4 cm. The conventional 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 adopted for sustainable pile and the load deflection behaviour has been studied.

VIII. RESULTS AND DISCUSSIONS

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

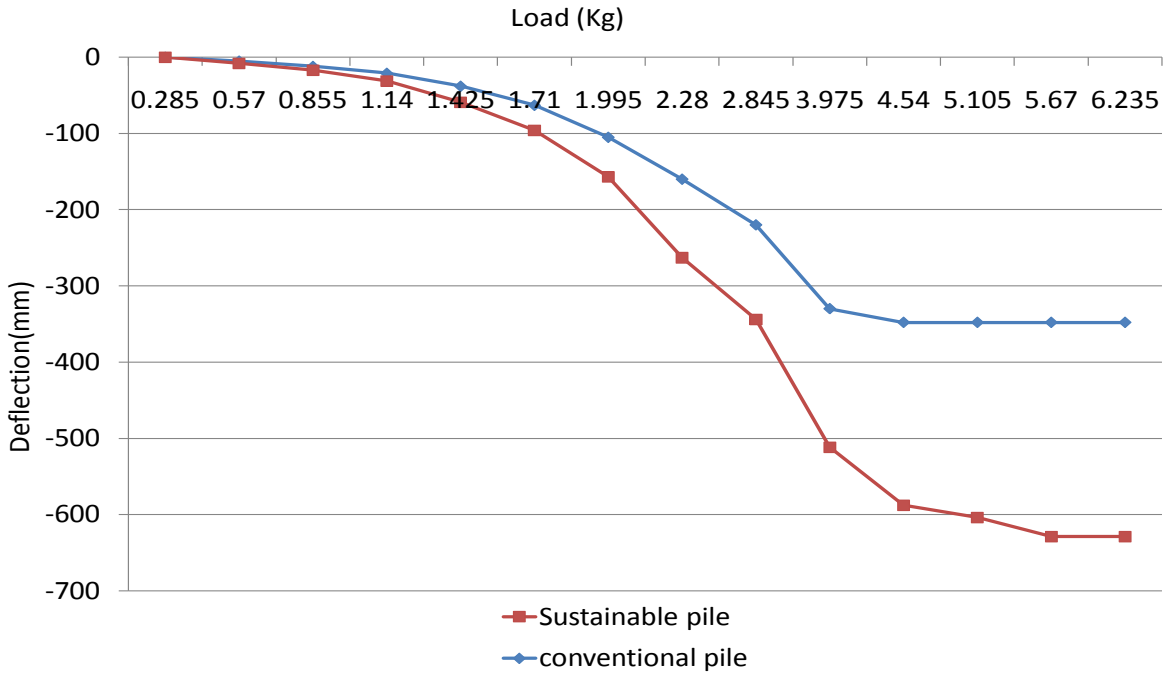

Fig N Load deflection curve conventional and sustainable pile

The conventional pile fails at a load much lesser than that of the sustainable pile. The conventional pile fails suddenly whereas the sustainable pile shows indications before the ultimate failure.

IX. CONCULSION

The experiment was conducted to investigate the replacement of conventional pile by sustainable pile. Load carrying capacity increases in sustainable piles. The values that were obtained shows good results. The major conclusions drawn from the study are as follows,

- Sustainable piles carries load greater than conventional piles.
- Project cost is reduced by 10% by replacing cement by fly ash of 25% for sustainable pile.
- It is an economical foundation technique that can be used for massive construction.
- Fly ash reduces cement content which reduces the emission of carbon dioxide emission during the manufacturing process, thus emission of greenhouse gases are reduced.
- Conventional pile can be replaced by sustainable pile, which is the best cost effective, durable, load carrying and eco friendly.

REFERENCES

[1] Salini U. and Girish M. S, "Lateral Load Capacity of Model Piles on Cohesionless Soil"

[2] V. S. Phanikanth, Deepankar Choudhury, G. Rami Reddy, "Behaviour of Fixed Head Single Pile in Cohesionless Soil under Lateral Loads"

[3] V. S. Phanikanth, Deepankar Choudhury, G. Rami Reddy, "Response of Single Pile under Lateral Loads in Cohesionless Soils"

[4] M. Kubilaykelesoglu, M. Tugrulozkan,"Three-dimensional nonlinear finite element modeling for laterally loaded vertical piles"

[5] P. Jeyalakshmi, V. JeyanthiVineetha, "Behavior of laterally loaded piles in cohesive soils"

[6] W. JerinWiba, V. JeyanthiVineetha, "Behaviour of laterally loaded piles in cohesionless soils"

[7] Zhaohui Yang and Boris Jeremic, " Study of soil layering effects on lateral loading behavior of piles"

[8] Ling Zhang; Minghua Zhao; and XinjunZou, "Behavior of Laterally Loaded Piles in Multilayered Soils"

[9] Mohammad M. Ahmadi and Mahdi Ehsani, "Dynamic analysis of piles in sand based on soil-pile interaction"

[10] V. Padmavathi, E. Saibaba Reddy and M. R. Madhav, "Behaviour of laterally loaded rigid piles in cohesive soils based on kinematic approach"

[11] Ravi Jain, Prof. P. J. Salunke, Prof. N. G. Gore,"Static analysis of laterally loaded pile"

[12] DipanjanBasu, Monica Prezzi," Analysis of Laterally Loaded Piles in Multilayered Soil Deposits"