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Comparison of Lateral Resistance on Conventional and Sustainable Concrete Piles in Cohesionless Soil

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Abstract: **In this modern era, pile foundation has become a common solution for improving bearing capacity of soil. They transfer the load to a greater depth on to good bearing strata. They also transfer load to soil by friction. Normally pile foundation are used in offshore structures where the bearing capacity of the soil is less. Lateral movement is mainly the seismic movement and wind pressure that causes a structure to drift and sliding moment. Generally a foundation remains static only upto its ultimate lateral resistance. when it crosses, the foundation tends to move in horizontal direction and structure tends to fail. The main objective of this paper is to find out the behaviour of lateral resistance of conventional and sustainable concrete piles. Cohesionless soil is chosen for the test. The properties of sand were determined. The experimental setup was fabricated for the testing. The test were made for conventional pileand its compared to sustainable pile.**

Keywords: **Cohesionless Soil, Pile Foundation, Lateral Resistance.**

I. INTRODUCTION

Foundation is the element of architectural structure which connects it to the ground and transfers the loads from the structure to the ground. It maintains the stability of the structure. Pile foundations are useful in regions with unstable upper soil that may erode, or for large buildings. Piles are generally used when the bearing capacity of the soil is considered to be inadequate for the structural load of heavy construction. The piles transfer the load to the solid ground located at a depth. If the shallow soil is not stable, or the settlement estimated is not tolerable, then the use of piles may be the only practicable solution. Furthermore, if the conditions of soil necessitate extensive ground development that is expensive, the use of piles may be more economical. Use of piles is not only beneficial in unstable shallow soil, but also helpful in normal ground conditions to withstand vertical and horizontal loads, or foundations over water like jetties. Pile foundations are capable of taking more loads than conventional spread footings. It is proven that laterally loaded piles embedded in sand can be analyzed within the working load range assuming a linear relationship between lateral load and lateral displacement. The distribution of lateral loads among piles in a pile predicts the safe design lateral load of a pile. The response of a laterally loaded pile is a complicated soil–structure interaction problem, because pile deflection depends on soil reaction and in turn soil reaction influences by pile deflection. Piles may also be subjected to lateral loading on abutments and piers which may be caused by earth pressure, ship mooring and berthing forces and wave action. Also lateral loads may occur as a result of wind and unpredicted events such as earthquakes, slope failure and lateral ground spreading induced by liquefaction. The soil around the pile, loading angle, pile diameter has been varied and the response has been obtained. Also deflection is evaluated for a typical pile in cohesionless soil and their results are presented.

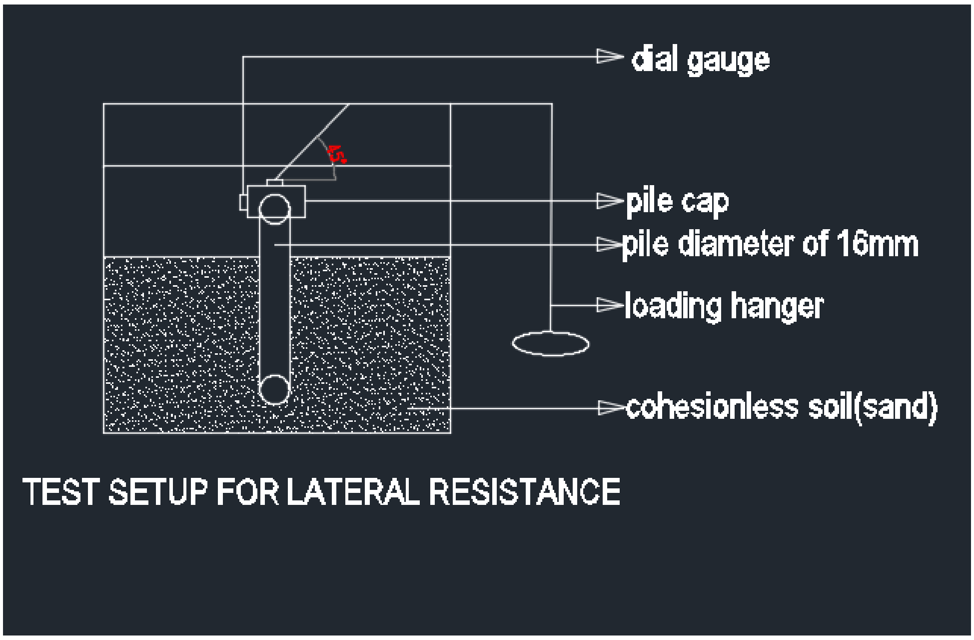
II. EXPERIMENTAL PROGRAM

The pile of diameter 16 mm has been casted with the length of 45 cm. conventional pile is being casted

and the pile is tested by varying density around the soil and by loading angle and the maximum load carrying capacity is obtained in each case. similarly the sustainable pile has been casted by replacing cement with 25% of flyash and experiment is being done and results are being compared.

III. TEST SETUP

The base plate is levelled with the level adjustment screws fixed to the bottom of the base plate. The circular tank is placed in position and centred. The soil is filled into the tank layer by layer for the density to be tested. The top surface of the soil is levelled. The levelling is not be done by vibration or tamping as it will change the density of soil. The irregular soil should be moved with the trowel so with less effort so that the soil density does not change. While filling the soil the pile should be placed at the centre of the tank at a depth according to l/d ratio. The embedment depth is of 30 cm. For first 4 cm depth the soil is be filled and then the pile is placed at the centre and the soil is filled on the sides of the pile without disturbing the alignment of pile. The clamp is fixed to the pile. The bolts are screwed into position to fasten the pile in position. One end of the wire is connected to clamp and the other end to the weight hanger passing over pulleys for 0 ° or 45 °. The dial gauges are fixed to the shaft and the needle rests on the straight rod fitted on the clamp of pile. The weight is added to the hanger in a gradual manner. The next increment is done only after the dial gauge reading is stabilised. The addition of weight is continued up to failure load. The failure is identified by movement of pile from its centre. The final weight on the hanger is noted as ultimate load.



IV. PROPERTIES OF COHESIONLESS SOIL

The Sample is collected from Cauvery river banks, Karur district. (Tamilnadu, India). Cohesion less soil passing through 4. 75 mm sieve is taken for laboratory investigations. Latitude and longitude of soil location is 10. 960078 and 78. 076604 respectively. several experiments are done and the properties were determined. The specific gravity is 2. 665,coefficient of curvature is 1. 36 and coefficient of uniformity is 3. 257. The bulking is of 6%

V. DENSITY ACHIEVEMENT

The required density is achieved by height and fall method. The Relative density adopted is of 17% and 20%. This is achieved by 2 cm and 5 cm height of fall. The circular tank is placed over the base . The soil is taken in a container and dropped with the respective height in order to achieve the density. The filling is done layer by layer, finally the top surface is levelled without disturbing the density of soil.

VI. FIXING OF DIAL GAUGES

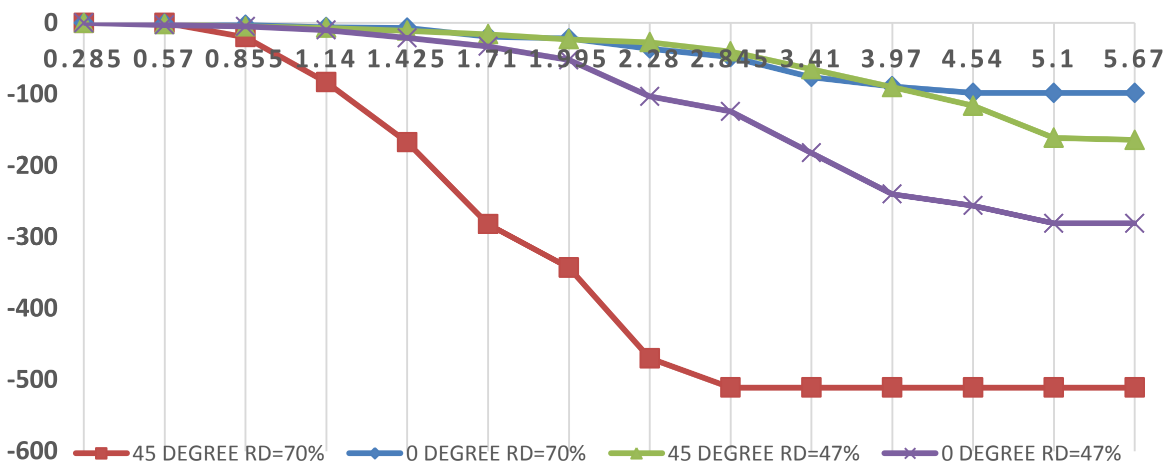
The frame has a two steel shaft projecting from the support over which dial gauges are fixed. The least count of the dial gauge is 0. 002mm. the two shafts are fixed to the side frame. The level of the steel shaft can be adjusted according to the projection of pile over the top soil surface. The dial gauges are fixed on the straight steel rod fitted to the clamp of pile. The clamp is hollow rectangular having inner dimension of 5cm x5cm x 4cm. it is designed so that the inner space can accommodate the pile. The sides if the clamp has threaded holes on each side to accommodate the bolts. The bolts are thrust onto the pile surface to fasten the pile. The clamp has a hook to which a wire is connected, it passes over the pulleys and the other end of the wire is connected to the slotted weight hanger. Additionally a setup is welded with two roller to fit with the existing setup in order to find the lateral resistance of pile at 0 °

VII. TEST PROCEDURE

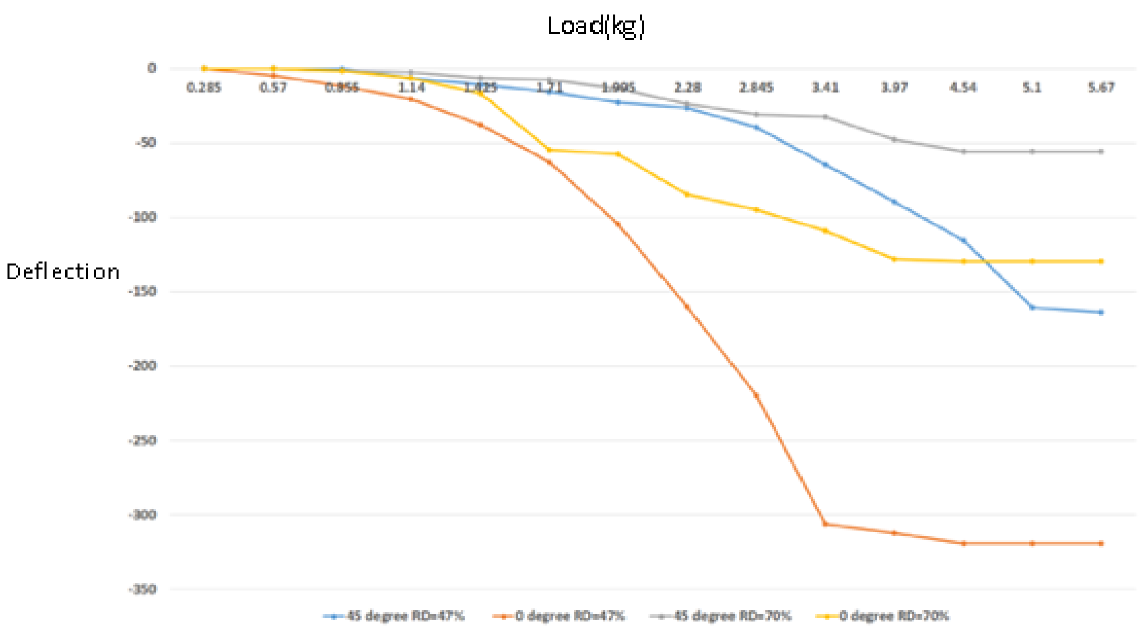
The piles of conventional and sustainable has been tested with different densities and loading angle has been tested. The pile is been fixed and the soil is filled up to the mark level. The dial gauges has been fixed and load is given to the pile. The maximum resistance of a pile and the movement of pile from its position is being measured in each cases.

VIII. RESULTS AND DISCUSSIONS

Both conventional and sustainable concrete piles are being tested and its lateral resistance is being obtained in each cases and the results are being compared in graphs. The load vs deflection is as follows:



Lateral resistance for diameter of 16 mm sustainable pile



Lateral resistance for 16mm conventional pile

IX. CONCULSION

The experimental investigations were done for different conditions The following conclusions were drawn:When density is increased by 17. 64% the load carrying capacity is increased by 25% in horizontal direction, whereas in inclined direction when the density is increased by 17. 64% the load carrying capacity is increased by 25. 71%. When the loading angle is increased from 0˚to 45˚, the pile resists more in different relative densities and vice-versa. Sustainable piles carries 18% more load than conventional piles Thus conventional piles can be replaced by sustainable pile for resisting lateral movement. Project cost is reduced by 10% byreplacing of cement with fly ash of 25% for sustainable pile. Fly ash reduces cement content which reduces the emission of carbon dioxide emission during the manufacturing process, thus emission of greenhouse gases are reduced. Sustainable pile is replaced by conventional pile, which is the best cost effective, durable, load carrying and ecofriendly.

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. Kubilay kelesoglu, M. Tugrul ozkan,“Three-dimensional nonlinear finite element modeling for laterally loaded vertical piles”

[5] P. Jeyalakshmi, V. Jeyanthi Vineetha, “Behavior of laterally loaded piles in cohesive soils”

[6] W. Jerin Wiba, V. Jeyanthi Vineetha, “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 Xinjun Zou, “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] Dipanjan Basu, Monica Prezzi,“ Analysis of Laterally Loaded Piles in Multilayered Soil Deposits”