

Full-Scale Load Test on Instrumented Augered Cast-In-Place Pile

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Abstract

In order to better understand the behavior of Augered Cast-In-Place (ACIP) pile behaves in Houston-Gulf Coastal soils, a full-scale axial load test was performed on instrumented ACIP pile. Despite the lack of load transfer in the lower part of the pile, the measured capacity of 1913 kN (215 tons) was 2.4 times as high as the design load for the pile.

1. Introduction

Augered, cast-in-place piles (ACIP), also known as continuous-flight-auger (CFA) piles, and augercastTM piles, have been used to support moderate vertical loads (design loads of up to about 1 MN) in the United States for over 50 years. ACIP piles are a form of small-diameter (0.36 – 0.51 m) bored pile, although with drilling rigs of high torque, large-diameter piles (> 1 m) are possible. A full-scale ACIP test pile with a diameter of 0.46 m (18 in) and a length of 18.9 m (18.9 ft) was installed at Krenek Road on U.S. highway 90 in Crosby, Texas. The site consisted of a mixed soil profile of generally stiff clays and medium dense sands. The site is located in the Beaumont formation, a Pleistocene-aged deposit on the Texas Gulf Coastal plain. The ACIP test pile was installed by rotating a continuous, hollow-shaft flight auger into the ground to a specified depth. Then, a sand-cement-water grout was injected continuously through the auger shaft as the auger was being slowly withdrawn. A reinforcing steel cage can then be inserted into the grout after the auger is fully withdrawn. The ACIP test pile was instrumented along the pile length with sixteen vibrating wire sister bars and subjected to axial load test in order to investigate the load-settlement and distribution behaviors. Design load of the pile was 800 kN (90 ton).

2. Objectives

The overall objective of this study was to understand the load settlement and load distribution behaviors of single ACIP pile tipped in dense sand layer in Houston-Gulf Coastal soils.

3. Testing Program

Before installing the test pile, the reinforcing cage for the pile was instrumented with vibrating wire sister bars. Vibrating wire sister bars are essentially strain gauges that operate on the vibrating wire principle rather than the electric resistance principle common to most strain gauges. The vibrating wire sister bars measures strain in a member by measuring the change in frequency of a tensioned piano wire clamped in a fixture securely attached to the member (McRae and Simmonds, 1991). These sister bars allow for the measurement of both strain and temperature in the grout. The full-scale axial load test was performed in general accordance with ASTM D1143, "Standard Method of Testing Piles under Static Axial Compression load". The pile was loaded in 222 kN increments up to 1779 kN. Load increments above 1779 kN were then reduced to

89 kN to failure, due to the higher rate of pile head deflection that was observed for loads in excess of 1557 kN. The failure load was determined by the Davisson failure criterion.

4. Results

From the load-settlement curve shown in Fig. 1, the failure load was 1913 kN (215 ton). Load vs. depth relationships measured at various applied loads are compared in Fig. 2. The load at the tip of the pile at failure was very small (only about 2% of the failure load) indicating very low load transfer at the pile toe despite that toe being in dense sand. This effect was likely due to a rapid pore water pressure reduction in the sand resulting from the drilling process, followed by an upward flow of sand and groundwater through the auger (Kim, 2004)

5. Conclusions

Despite the lack of load transfer in the lower part of the pile, the measured capacity of 1913 kN (215 ton) was 2.4 times as high as the design load for the ACIP pile.

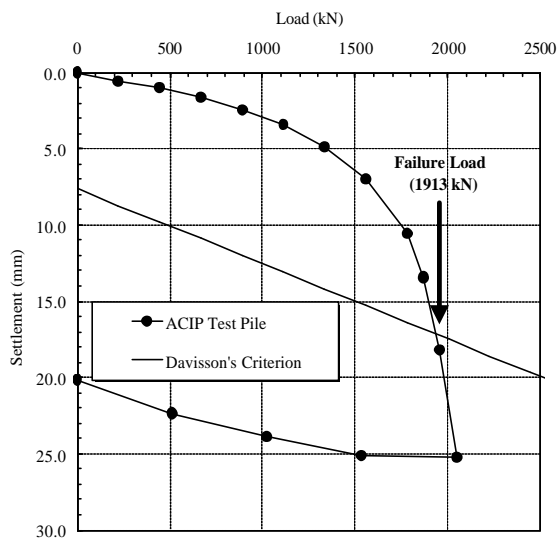


Fig. 1. Load-Settlement Curve for ACIP pile

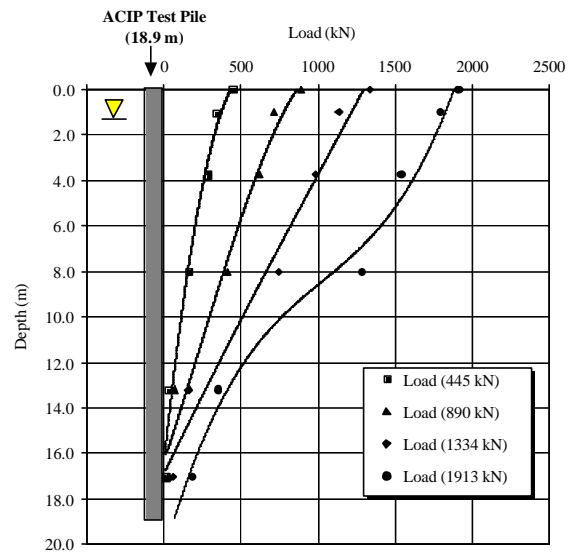


Fig. 2. Load Distribution Curves for ACIP pile

6. Acknowledgement

The authors are grateful to the personnel from the TxDOT Houston District laboratory, under the direction of Mr. Stanley Yin, who assisted in selecting the site, performing soil tests, and installing instrumentations. The authors also acknowledge Mr. Tim Roberts of Fugro South Inc. for performing the full-scale axial load test.

7. References

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