JULY 2005 MEETING

Wednesday, July 15, 2005

TECHNICAL PROGRAM

Designing, Constructing and Testing ACIP Piles in Texas Gulf Coast Soils

Speaker: C. Vipulanandan, Ph.D., P.E., Chairman and Professor of Civil Engineering at the University of Houston, Tel. No. 713-743-4278.

Dr. Vipu has earned a BSCE degree from University of Moratuwa, Sri Lanka, and MS and PhD degrees in Civil Engineering from Northwestern University, Evanston, Illinois. He has authored or co-authored over 140 papers and is the recipient of a research award from TxDOT on Auger Cast-In-Place Piles (ACIP)

PRESENTATION SUMMARY

To an audience of about 60 Dr. Vipu gave a PowerPoint presentation entitled, "Designing, Constructing and Testing ACIP Piles in Texas Gulf Coast Soils". The study was started in the mid-90's by Dr. Michael O'Neill, Professor of Civil Engineering at the University of Houston and has been continued under Dr. Vipu after Dr. O'Neill's death in August 2003. For a summary of Dr. Michael O'Neill's 2002 FPA presentation on ACIP piles, click here

Dr. Vipu's presentation covered two areas: 1) the use of Augered Cast-In-Place (ACIP) piles for a highway bridge and 2) the development of an axial load displacement relationship for ACIP piles in the Texas Gulf Coast area.

According to Dr. Vipu, ACIP piles have been used in the United States since the 1970's. Their use was curtailed for a number of years because of failures, but now the research being done at U of H and elsewhere has allowed them to become an acceptable alternative to drilled shafts and driven piles. They have an advantage in that they can be installed through sand and weak strata without using casings or slurries. Also, they do not have the noise and vibration problems associated with driven piles.

U of H has installed ACIP piles to 65 feet penetration while others have claimed up to 100 feet penetration. The pile diameters are currently limited to 42 inches. U of H has installed them at up to a 4:1 batter. The concrete must be 3/8" maximum aggregate with 7 to 9" slump, 5000 psi compressive strength, and is pumped with about 15 feet of head.

The installation sequence consists of using a long crane-mounted auger rotated down to full penetration, then pulling out the auger (while continuing the rotation) and while pulling, pumping the concrete down the center shaft of the auger to fill the hole from the bottom up. After extraction of the auger, the rebar cage is dropped or vibrated in. The concreting and reinforcing operation must take place in 45 minutes to ensure no early setup.

The project that they supervised was a TxDOT bridge on US 90 at Hwy. 2100, north of Highlands. Because there was also a span with driven piles, they were able to compare the two systems, both specified to have an allowable capacity of 90 tons:

- The driven pile was 16" x 46 ft penetration pile with a failure load of 165 tons, an axial deflection of 1.3", an alpha factor of 0.53, and an installed cost of $22/ft.
- The ACIP pile was 18" x 57 ft penetration with a failure load of 215 tons, an axial deflection of 0.9", an alpha factor of 0.83, and an installed cost of $20/ft.

The TxDOT specification required that the pile shoe was in a sand layer. While this was advantageous for the driven pile, the ACIP pile could have stopped anywhere since there is no allowance for end bearing resistance, due to the concrete installation method. They concluded from the comparison that the ACIP pile is cost-effective as compared to the driven pile.

Further work is being done at U of H to develop P-Z curves from CPT test results.

PAST PRESENTATIONS (click here)