



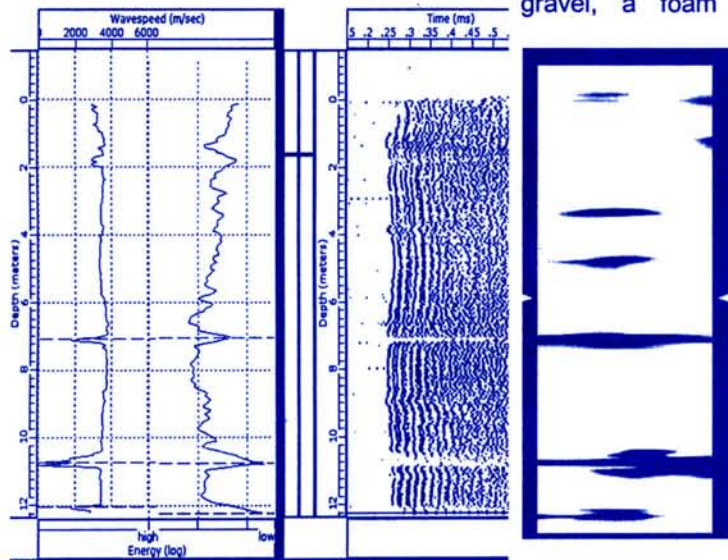
Test Shaft Installation for CSL
by Brent Robinson, GRL Engineers, Inc.



On March 3, 2003 (a cold, breezy day this winter at 10°F), McKinney Drilling Company installed the 40 foot long, 60 inch diameter shaft at Pile Dynamics' yard for PDI's research and training purposes. Four concrete mix designs were used (in 10 foot lifts) to evaluate ultrasonic signals in different mixes including nominal strengths of 3000, 4000 and 6000 psi and a self-consolidating concrete, or SCC, designed by Master Builders, Inc.

The shaft has planned defects. Eight CSL access tubes were attached to a full length reinforcing cage to allow cross hole sonic logging (CSL) using PDI's Cross-Hole Analyzer™ (CHA). Various manufactured defects were suspended on the cage.

The defects included buckets and cones filled with sand or gravel, a foam



Processed arrival and energy (left) and raw "waterfall" data (center)

2-D image

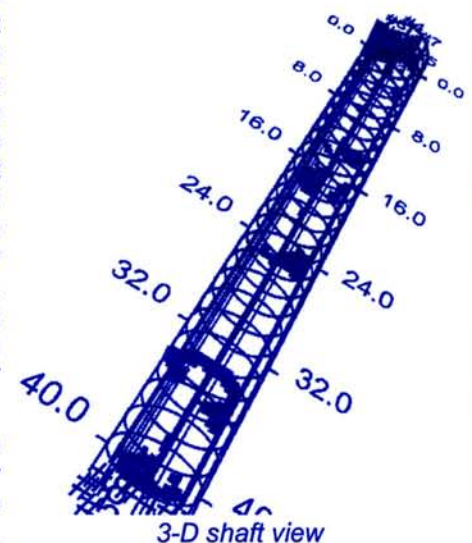
plate covering half the shaft diameter, and various localized defects around some tubes or outside the cage. Sand at the shaft bottom simulates a "soft bottom". Defects were chosen to investigate defect size and position that could be detected by non-destructive testing methods.

To avoid damaging the carefully placed defects, the concrete was installed using a pump truck. During pumping, PDI engineers monitored the concrete volume versus depth with magnetic flow meters typically used to record grout volume in augercast piles with a Pile Installation Recorder (PIR-A). EDP Consultants measured slump, entrained air, and concrete temperature and broke concrete cylinders for each 10 ft concrete layer at 7, 28 and 56 days.

Immediately after installation, the tubes were filled with water and anti-freeze. Soon afterward, testing with the CHA began. After taking limited data on the day of installation, cross hole data was taken twice a day for the first week. CHA and Pile Integrity Tester (PIT) tests continued daily for the next two weeks. Testing activities still continue at this time.

The testing has revealed interesting results about detecting various defects, as well as changes with wave speed and CSL data quality with time. A sample of CHA processing for one tube pair (at 3 days curing time) is shown at the lower left of this page with processed arrival time and energy, and the raw data "waterfall". The CHA's exclusive "Defect Analysis" found three major defects at the dashed line depths on the processed results plot in this particular scan.

Cross hole tomography, created using our TomoSonic software, shows both 2-D and 3-D images of the shaft. The black and white image to the right of the waterfall diagram is a 2-D slice of a 3-D analysis. It shows black holes (defects) in the shaft which corresponds to the planned defect locations. The 3-D image shows defects spatially along the shaft. The illustration would be even clearer had a color printer been used.



3-D shaft view

If you want to try out the CHA or PIT for yourself on our test shaft, contact Steve DeWitt or John Wargelin at PDI. Keep in mind, however, that Cleveland is warmest from May to October and, at least this year, feels coldest in March.

CALENDAR OF EVENTS

2003

June 22-26, Cambridge, MA: 12th Panamerican Conference on Soil Mechanics and Geotechnical Engineering and 39th US Rock Mechanics Symposium. For information: www.soilrock.mit.edu.

July 16-18, Logan, UT: Pile Foundation and Wave Equation Short Course. Presented by the Dept. of Civil and Environmental Engineering of Utah State University. For information call 1-435-797-2896 or email joe@cc.usu.edu.

Sept. 18-19, Chicago, IL: PDCA Design & Installation of Cost Efficient Driven Piles Symposium. For info: www.piledrivers.org.

Oct. 22-24, Miami, FL: DFI 28th Annual Members Conference. For information call 1-201-567-4232 or email dfihq@dfi.org.

Oct. 30 - Nov. 1, Akron, OH: The University of Akron presents "Design and Construction of Deep Foundations" a course by Dr. George G. Goble and Mr. Jerry A. DiMaggio. For information contact Dr. Robert Liang at 1-330-972-7190

Nov. 5-8, Cleveland, OH: Pile Dynamics presents the Seminar "Basic Overview of Deep Foundations Testing" and more thorough workshops on PDA, CAPWAP®, Integrity Testing, and GRLWEAP analysis. For information call 1-216-831-6131.

Nov. 13-14, Houston, TX: ASCE presents the short course "Deep Foundations: Design, Construction, and Quality Control". For information visit www.asce.org.

Nov. 17-21, Paris, France: PDI in cooperation with G-Octopus of Paris, will conduct a series of seminars and workshops on Deep Foundation Testing and Analysis, specifically, on PDA, CAPWAP, Integrity Testing, and GRLWEAP analysis. For information call 1-216-831-6131 or in France +33 6 87 85 00 12.

2004

Aug. 8-10, Petaling Jaya, Malaysia: Seventh International Conference on the Application of Stresswave Theory to Piles, Stresswave 2004, the Millennium Challenge.

Two Calls for Papers on dynamic pile testing:

(1) Current Practices and Future Trends in Deep Foundations, a Geotechnical Special Publication Honoring George G. Goble

The ASCE-GeoInstitute sponsors this special publication honoring Professor Goble, a distinguished educator, researcher, practitioner, entrepreneur, and visionary who significantly contributed to the state-of-the-art and practice of deep foundations worldwide. Preference is given to topics related to Dr. Goble's work. The deadline for a 300 word abstract is July 11, 2003. (Jerry DiMaggio, Mohamad Hussein, editors) Contact: jerry.dimaggio@fhwa.dot.gov.

(2) Stresswave 2004 The organizing committee invites papers relating to dynamic pile measurements, theory and testing using stresswaves. This important international conference is held every 4 years since 1980 and focuses on dynamic pile testing. Abstracts are due on August 1, 2003. Submit abstracts (300 words or less) to [Richard Yu \(yucl@tm.net.my\)](mailto:Richard.Yu@tm.net.my).

New PDI Representative

Pile Dynamics is pleased to announce that Forsen Machinery Services & Trading Inc has been appointed as PDI's representative in Turkey, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Forsen may be contacted at +90-212-393-2400, by fax at +90-212-393-2424 or by email at info@forsen.com.tr.

Pile Dynamics, Inc. (PDI) Launches New PIT

PDI has released a re-engineered Pile Integrity Tester™ (PIT) with reduced noise electronics, higher analog to digital sampling resolution, and faster sampling rate. The new PIT has a large high resolution touch screen and a built-in PCMCIA memory card.

GRLWEAP 2003 Released

PDI shipped the latest version of GRLWEAP™ as a free update to users of the 2002 program. This program provides a few corrections and enhancements and additional hammer models. For this version the hammer data file is also available on our web page. Please contact judy@pile.com for updating information.

DFI Augered Cast-in-Place Pile Manual

The Deep Foundations Institute released a new ACIP Pile Manual for construction and quality control. The manual stresses incremental grout volume measurements. Order at www.dfi.org.

New Sample Specification for High Strain Dynamic Testing

Visit www.pile.com to download an updated electronic copy of a sample specification for "High Strain Dynamic Pile Testing". You can adapt this sample specification into your job specifications.

Readers Write

Sameh H. Bendary, ABB Egypt: "It has been a pleasure working with you in Alexandria Wastewater Treatment Plants and Pumping Station Improvements Phase II Project. The High Strain Dynamic Tests (HSDT) helped accelerate our pile load testing program and satisfactorily provided the needed information for the pile design. In addition, using HSDT for testing some production piles helped verify the foundation design and construction quality over the 2 year construction of more than 5,000 piles while minimizing delays in the structural design and pile construction."

Dr. Julian Seidel, Foundation QA, Australia: "I have been very impressed with the data collected by the PIT-FV on two recent projects. The first involved testing 30 m spliced timber piles through a concrete pile cap. I was very skeptical about obtaining meaningful results, but PIT data showed very clean pile responses from which both the pile splice and the pile toe could be clearly identified. The second project involved PIT testing of precast concrete piles. Again, the data quality was excellent with near perfect proportionality between the force and velocity responses. Both sets of PIT testing gave the clients the confidence in the long-term durability of their foundations they required."

John White, President, APE Hammers: "Your class presented by Mohamad Hussein, GRL FL, was the best thing that ever happened to APE. I am very grateful that you have the skills, talent and experience to adapt your teaching style to fit our group."

PDCA Seminar

At the PDCA Roundtable (Atlanta, Feb. 2003) many excellent presentations on driven piles were made. Van Komurka (Wagner Komurka Geotechnical Group) spoke on innovative CAPWAP use to reduce piling costs, and Prof Jim Bay (Utah State) discussed "Pile Driving Vibrations: a Perception Issue". Other interesting topics included a job installing 2000 piles in 30 days, piles with high design stresses, hammer noise suppression devices, vibration monitoring at the Woodrow Wilson Bridge, and the FHWA driven pile inspector qualification program. Scott Webster (GRL NC) presented a paper entitled "Effect of Pile Impedance on Driveability and Capacity". Be sure to attend the next PDCA event - see www.piledrivers.org.



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