



GRL
engineers, inc.

PDI
Pile Dynamics, Inc.

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Pile Dynamics Celebrates 30th Anniversary

Pile Dynamics, Inc was founded in August 1972 to provide engineers, contractors, owners and agencies with an innovative tool for pile testing: the Pile Driving Analyzer®. Our PDA is now used all over the world, with many codes of practice incorporating PDI's quality assurance methods. During these past 30 years, PDI expanded its product range, but has remained focused on the deep foundations industry. Through joint efforts with our many clients, our technical team developed high performance, technically unsurpassed equipment. We thank our clients and staff who have made these achievements possible.

Crosshole Sonic Logging

by Scott Webster, GRL Engineers, Inc.

Crosshole Sonic Logging (CSL) is performed on a growing number of projects throughout the United States. CSL tests the concrete quality of recently constructed drilled shafts using steel or PVC access tubes placed around the perimeter of the reinforcing cage during construction. A transmitter and receiver are placed at the bottom of two parallel water filled tubes and then raised together to the shaft top while sonic/ultrasonic waves are transmitted between the tubes at intervals of a few inches. In this way, a log of the drilled shaft over depth is recorded and voids, soil inclusions, or weak concrete can be identified.

Research on CSL technology started in the 1970s in France, but a commercial system became widely available only in the late 1980s. By the mid 1990s, the FHWA and State Highway engineers began specifying CSL testing on a regular basis and in 1997 GRL began providing CSL services. Pile Dynamics, Inc., then developed a second generation CSL tester.

GRL has performed CSL testing with PDI's Cross Hole Analyzer™ (CHA) on numerous USA projects. The Windows® based CHA collects, evaluates and presents data to 100 m depth (with standard cable) or more. Two independent depth sensors allow the receiver and transmitter positions to be known at all times. This facilitates placing of sensors to different elevations for an improved evaluation of defect size and location. As a safety measure, the voltage in the probe cables is only 12 Volts which then is amplified in the transmitter to 800 Volts for clear signal transmissions through over 3.5 m of sound concrete. Replaceable probe cables feature a rugged polyurethane jacket for extended life. During data collection or reanalysis, the CHA user can choose to view processed results of wavespeed, signal arrival time, relative signal energy (on left half of each figure pair shown), along with a traditional "waterfall diagram" and all of the original signals (not shown here) in English or SI units. PDI's CHA complies with and exceeds the requirements of ASTM D6760.

Generally, GRL's experience suggests that the percentage of defective shafts on a given project is relatively small. However, on a recent project three of the fifty shafts tested were found to have defects. The original testing program consisted of testing only four out of fifty shafts. The left CHA record shown here, for tube pair 1-6

of one of these four shafts, clearly suggested a problem. After the CSL testing revealed this defect, the shaft was cored, confirming segregated concrete, i.e. mostly gravel, at the depth indicated. Post grouting of the zone of bad concrete was then performed and CSL testing was repeated. The right half of the figure shows a CSL record taken after the remedial grouting, and confirming that the grouting substantially improved the concrete quality in the affected zone.

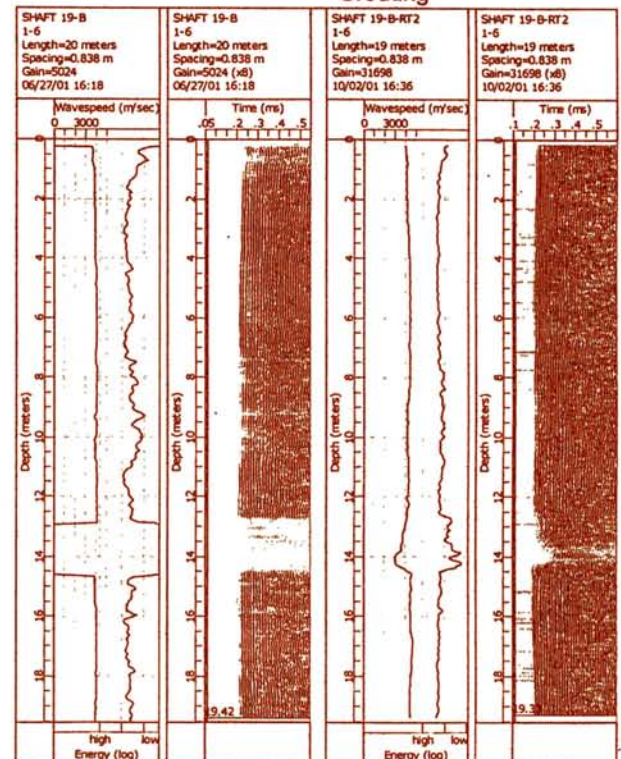
After CSL revealed this production shaft with segregated concrete in the shaft middle (14 m depth), it was decided that all shafts should be CSL tested. Two more defective shafts were found, this time with a problem "soft toe". These shafts were core drilled to confirm the CSL results and were repaired by post grouting. Again, CSL tests performed after remedial grouting confirmed adequately repaired shafts.

Results such as these clearly show the need for quality control inspection of drilled shaft installations. Had the decision to extend testing to all shafts not been made, the two shafts with soft bottoms would not have been discovered. This would have resulted in a deficient foundation for the affected bridge piers.

Drilled shaft foundations tend to have reduced redundancy, making the quality of each shaft more important. It is suggested that all drilled shafts should have CSL access tubes installed to facilitate possible testing, should questions arise during construction. In our opinion, the cost of testing is small compared to the cost of potential failures due to defective shafts.

Original CHA Record

CHA Record after Post Grouting



CALENDAR OF EVENTS

2002

Sept. 23-25, Bingen, Germany: Workshops on PIT (in German) and PDA, CAPWAP, GRLWEAP (in English). For information call Dr. Klingmüller at +49-621-331-361 or email gsp-ife-ok@t-online.de.

Sept. 30-Oct. 2, Charleston, SC: Geotechnical and Structural Design and Construction Monitoring of Deep Foundations. Presented by Foundation Courses (Dr. G. Goble and J. DiMaggio). Call 303-494-0702 or email law@bridgetest.com.

Oct. 8-11, San Diego, CA: DFI Testing of Deep Foundations and DFI's 27th Annual Members Conference. The Foundation QA High Strain Dynamic Testing Examination will be offered in conjunction with this event. Call (201) 567-4232 or email dfihq@dfi.org.

Nov. 13, Cleveland, OH: PDA Workshop (Part 1). The Foundation QA High Strain Dynamic Testing Examination will be offered in conjunction with this event. Call 216-831-6131 or email info@pile.com.

Nov. 14, Cleveland, OH: PDA Data Interpretation (Part 2) and CAPWAP Workshop. Call 216-831-6131 or email info@pile.com.

Nov. 15, Cleveland, OH: Integrity Testing Workshop and GRLWEAP Workshop (Parallel Sessions). Call 216-831-6131 or email info@pile.com.

Nov. 14-15, Orlando, FL: ASCE Short Course on Deep Foundations: Design, Construction & Quality Control. Call 800-548-2723 or email conted@asce.org.

Nov. 17-20, College Station, TX: First International Conference on Scour of Foundations. Call 979-845-6554 or email briaud@tamu.edu.

2003

Feb. 13-15, Florida: GRLWEAP, PDA, CAPWAP, and Integrity Testing Workshop. Call 216-831-6131 or email info@pile.com.

Feb. 21-22, Atlanta, GA: PDCA Winter Roundtable. For information go to <http://www.piledrivers.org/pdca/events.cfm>.

Oct. 23-25, Miami, FL: DFI 28th Annual Members Conference. Call 201-567-4232 or email dfihq@dfi.org.

Workshops Replace Users Days

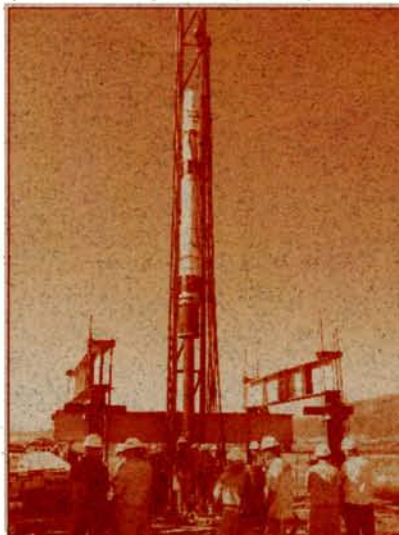
For the past couple of years, Users Days participants have been asked to provide us with feedback and suggestions for improvements. We have listened to your comments and given the Users Days a makeover. PDA, CAPWAP, PIT and GRLWEAP Workshops have a fresh new format and will be offered back-to-back, allowing you to attend one or more of the sessions depending on your needs and interests. The new workshops emphasize data interpretation and correct testing procedures and thus are ideal for training of beginners as well as experienced engineers. They also provide an excellent opportunity for engineers using these services to upgrade their ability to assess the quality and reliability of the testing results they receive. IACET continuing education credits will be awarded. We encourage anyone providing or specifying dynamic testing and analysis tools to attend.

GRLWEAP News

GRLWEAP 2002-1 is now being shipped. This program offers many improvements in analysis accuracy and user friendliness. User response has been overwhelmingly positive. The program comes with either software or hardware keys. From time to time, hammer file updates will be made and posted on our web page for user retrieval.

PDCA Professors Institute

Twenty five of the nation's most esteemed geotechnical professors gathered in picturesque Logan, UT to learn from expert instructors about modern driven pile installation and analysis techniques. Organized by the Pile Driving Contractor's Association (PDCA), programmed by Dr. George Goble and executed by Professors Joe Caliendo and Loren Anderson of Utah State University, the event not only transferred knowledge but also generated lively discussions among the well informed participants. GRL's Pat Hannigan and Dr. Frank Rausche participated as



instructors. Highlights of the course were demonstrations of a pipe pile installation with PDA testing and CAPWAP[®] analysis, plus static compression, uplift and lateral testing and even measurements of SPT energy and seismic surface waves. Wild west cookouts in the mountains surrounding Logan helped everyone relax. PDCA received and shared with us several notes of appreciation from participants. Indeed, such positive response helped PDCA decide to repeat the course.

Large Scale PDA Testing in Rio de Janeiro, Brazil

Project specifications for the Gas Chemical Complex "Rio Polimeros", in the outskirts of Rio de Janeiro, call for 15,000 precast concrete piles to be driven in 7 months. Three percent of the piles have to be dynamically tested with the Pile Driving Analyzer[®] (PDA), which means about 450 tests in the 7 months. Pile driving is being done by a consortium of four companies: Benaton, Incopre, Protendit and SCAC. ABB Lummus Global and Snamprogetti are the project managers. PDI Engenharia is the independent agency responsible for the test.

Web Site

Our newly updated site (www.pile.com) now has even more information. We have added a feature that allows download of brochures in pdf format and have added additional publications on dynamic testing and quality assurance methods for deep foundations. Sample specifications for dynamic testing and cross hole sonic logging can be downloaded for direct insertion into project specifications. Past newsletter feature articles are available in the Newsletter section. Stop by and visit this valuable reference tool.



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