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Stresswave 2008: All you need to know about dynamic foundation testing

By Gina Beim, PE

The Eighth International Conference on the Application of Stress Wave Theory to Piles ("Stresswave 2008") took place in Lisbon, Portugal in September 2008. Professor Jaime Santos of Instituto Superior Técnico chaired the highly successful event that attracted close to 200 attendees from all over the world.

Academics and practitioners presented approximately 100 papers; GRL and PDI engineers authored fourteen of them. The full text of the noteworthy PDI and GRL contributions summarized below may be downloaded from the PDI - GRL website.

Likins, Piscsalko, Roppel and Rausche review the evolution and current state-of-practice of High Strain Dynamic Testing in "**PDA Testing: 2008 State of the Art**". The authors assert that "while the basic methods have changed relatively little since 1980", the field has benefited from significant technological advances of the past 30 years, transforming itself from an academic exercise to routine practice now specified or recommended by multiple codes and standards and widely applied throughout the world. Papers summarized in this article corroborate this statement. Likins et al note that the primary technology developments of recent years have improved acceleration signals under extreme conditions, have introduced wireless data transmission from transducers to the Pile Driving Analyzer® and have permitted remote testing at reduced testing cost to provide expertly reviewed results more quickly.

A particularly interesting example of current testing capabilities as applied to high capacity drilled shaft foundations is presented in "**Large scale dynamic high-strain load testing of a bridge foundation**" (Hussein, Rausche, Bullock and McGillivray). Other recent developments related to high capacity tests include a dynamic PDA-based testing system that bridges the gap between dynamic and rapid load testing (Hybridnamic). This system is described in two papers: "**The effect of ram mass on pile stresses and pile penetration**" (Rausche, Likins, Miyasaka and Bullock), and "**Rapid load test on high capacity piles**" (Miyasaka, Kuwabara, Likins and Rausche). Additional practical applications of recent research in Dynamic Load Testing include "**Load rate effects on high strain tests in high plasticity soils**" in the city of Bogotá (Rodriguez, Alvarez and Velandia), "**Dynamic testing in sensitive and difficult soil conditions**" (Morgano, White and Allin), and "**A simplified method for predicting load-settlement curves**" (Beim and Hussein) which could be applied to Case Method results.

In the keynote lecture "**Mastering the Art of Pile Testing**", Frank Rausche and co-authors Nagy and Likins echo the theme of the significant evolution of High Strain Dynamic Testing, while presenting some of the challenges facing professionals of this field. The authors offer guidelines for optimal results. The theme of guidelines for proper testing and analysis is enhanced by Likins and Rausche in "**What Constitutes a Good PDA Test?**". Readers of these two papers are made aware of several potential pitfalls during data input, field data collection and during analysis: To overcome the variability of Smith soil model parameters (quakes and damping) testers are



Stresswave 2008 Exhibit Hall

urged to always perform signal matching by CAPWAP® analysis and rely on refined wave equation analysis for parameter selection. The importance of choosing the appropriate test conditions such as hammer selection and the time of testing is highlighted. In order to avoid dynamic monitoring problems, readers are urged to be careful when instrumenting piles, inputting data and analyzing the data both during monitoring and in post-processing analysis.

Case studies include tests performed on a Wind Farm in New Jersey (Teferra, Saavadra and Echaniz) and offshore oil platforms (Webster, Givet and Griffith). These and multiple other papers presented at Stresswave 2008, bring to life the assertion that High Strain Dynamic Testing is now in common use throughout the world.

Codes and Standards pertaining to PDA testing are discussed by Beim and Likins in "**Worldwide Dynamic Foundation Testing Codes and Standards**". Documents pertaining not only to High Strain Dynamic Testing, but also to Low-Strain Testing (e.g. Pulse Echo), Cross-Hole Sonic Logging, and measurement of energy delivered by SPT systems are reviewed.

Traditionally, most papers presented at Stresswave conferences have focused on High Strain Dynamic Testing. The works "**Effect of Soil Resistance on the Low Strain Mobility Response of Piles Using Impulse Transient Response Method**" (Liang and Beim) and "**Comparing Cross-Hole Sonic Logging and Low-Strain Integrity Testing Results**" (White, Nagy and Allin) highlight the other major dynamic foundation testing methods.

The papers noted throughout this article may be downloaded from www.pile.com/references. The complete Proceedings of the "8th International Conference on the Application of Stress-Wave Theory to Piles", published in 2008 by IOS Press, may be ordered from iosbooks@iospress.com (USA and Canada), sales@gazellebooks.co.uk (UK and Ireland), or order@iospress.nl (rest of the world).

2009 Calendar of Events Highlights

For a complete listing visit www.pile.com/events

February 13, 2009, Omaha, NE: Geo-Omaha 2009. Sponsored by ASCE Nebraska Section. **Frank Rausche will present. Visit the PDI/GRL exhibit booth.**

February 18. Berlin, Germany: Dynamic Pile Testing - Capacity and Integrity. Sponsored by BAM (German Federal Institute for Materials and Testing), GSP and PDI. Oswald Klingmüller and Frank Rausche will present. Info: www.bam.de/fg-82.htm or Ernst.Niederleithinger@bam.de.

February 19-20. Braunschweig, Germany: Pfahlsymposium (in German). Sponsored by University of Braunschweig. **Frank Rausche and Oswald Klingmüller will present. Info: www.tu-braunschweig.de/zfw/vanst/pfahl2009/ziele. Visit the booth of PDI representative GSP.**

March 5. Stockholm, Sweden: Swedish Foundation Day (Grundläggningdag - in Swedish). Sponsored by SGF. Info: www.grundlaggningsdagen.nu or lennart.stark@omnium.se. **Visit the booth of PDI representative Pile Dynamics Europe / Pålanalyt.**

March 15. Orlando, Florida: High Strain Dynamic Testing for Driven and Drilled Deep Foundations (SC3). Sponsored by IFCEE'09. Frank Rausche and Garland Likins will present. Info: www.ifcee09.org/i4a/pages/index.cfm?pageid=3304 or info@ifcee09.org. The Foundation QA HSDPT Examination will be offered during IFCEE09. Info: www.hsdptregister.org or melanie@foundationqa.com.

March 15. Orlando, FL: Installation and Design of ACIP Piles (SC5). Sponsored by IFCEE'09. **George Piscalko will present. Info: info@ifcee09.org or www.ifcee09.org/i4a/pages/index.cfm?pageid=3304.**

March 16-19. Orlando, Florida: 2009 International Foundation Congress and Equipment Exposition. Sponsored by Geolnstitute of ASCE, PDCA, ADSC. **Visit the PDI and GRL exhibit booths. Info: www.IFCEE09.org or info@ifcee09.org.**

March 26-27. St. Louis, Missouri: Deep Foundations: Design, Construction and Quality Control. Sponsored by ASCE. **Mohamad Hussein will present. Info: www.asce.org/conted/seminars or seminars@asce.org.**

June 14-20. Utah State University, UT: Professor's Driven Pile Institute. Sponsored by PDCA. Info: www.piledrivers.org.

September 23-25 (tentative), Philadelphia, PA: Foundation QA HSDPT Exam, preceded by preparatory Workshop. Sponsored by PDCA. Info: melanie@foundationqa.com. Details to be announced.

October 21-23. Kansas City, MO: 34th Annual Conference on Deep Foundations. Sponsored by Deep Foundations Institute. Info: www.dfi.org or dfihq@dfi.org.

ILLINOIS OFFICE OF GRL MOVES AND ADDS ENGINEER

The Illinois office of GRL Engineers has moved to 1540 E. Dundee Road, Suite 108, Palatine, IL 60074. New phone numbers are Tel: 847-221-2750 and Fax: 847-221-2752. Please update your records.

The Illinois office also welcomes Susheel Kolwalkar to its staff. That office serves Illinois, Indiana, Wisconsin, Iowa, Minnesota, South Dakota, North Dakota, Montana and Missouri (including Kansas City Metro area). All engineers in the Illinois office may be reached by emailing GRL-IL@pile.com.

WEEK-LONG EVENT IN CLEVELAND A BIG SUCCESS

In October of last year the 2008 GRL Case Dynamic Foundation Testing Seminar and Workshops attracted 90 attendees from 15 countries to Cleveland, among them several Pile Dynamics international representatives. Events included a foundation testing seminar, work-shops on PDA, CAPWAP and GRLWEAP, and field demonstrations of PDI's equipment. The international representatives also toured PDI's manufacturing facilities and received training to better serve potential customers in their respective territories.



Some of Pile Dynamics international representatives, flanked by PDI staff.

HIGH STRAIN DYNAMIC TESTING ON NOTABLE TALL BUILDINGS

Veteran PDA user Wassim Iskandarani from Gulf Pile Dynamics reports having tested the foundations of the highest tower in Qatar, the 600 meters tall Convention Tower, part of the Doha Convention Center & Tower Project. Gulf used a 40 Ton hammer that activated a very high capacity on the tested drilled shafts.

The Council on Tall Buildings and Urban Habitat (CTBUH), the world's leading authority on tall building design and construction, designated the Shanghai World Financial Center (SWFC) the world's "Best Tall Building Overall" in 2008 at its annual awards ceremony in Chicago. The Shanghai World Financial Center is supported by steel piles that were dynamically tested with a Pile Driving Analyzer® by the Shanghai Harbour Engineering Design and Research Institute. Shanghai Harbour Engineering Design and Research Institute has been using PDI equipment since 1990.



Foundations for Convention Tower, Qatar

PILE DYNAMICS GETS THANKS FOR HELPING EDUCATE GEOTECHNICAL ENGINEERS

James H. Long Department of Civil Engineering University of Illinois writes: "For the last several years, you allowed me to download the educational version of GRLWEAP for use in my graduate class on deep foundations. This year I have 10 students in the class. They use (GRL)WEAP as part of the class to understand and quantify the effects of pile driving. (GRL)WEAP is such a useful tool. We are fortunate indeed that you make it available to us. Please pass along my gratitude to all the decision makers that control this policy. Thanks again."

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