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Remote Dynamic Foundation Testing

Edited by Gina Beim from contributions from Casey Jones (FTC) and from GRL Engineers.

Remote PDA Testing – more formally known as Remote Dynamic Foundation Testing – is popular around the world. In Sweden and Australia, most foundation tests are now performed without an on-site engineer, eliminating testing delays and scheduling the testing at the convenience of the contractor. Australian testers have reported Remote PDA Testing costs four times lower than those of tests with an engineer on site, a result attributed to better time management of the test engineer and avoidance of unproductive time spent on travel and on-site construction delays. In the United Kingdom, Remote PDA Testing has enabled one consultant to test up to 10 piles per hour. This testing method may also avoid the need for a test engineer to undergo safety or hazardous materials training.¹

Remote PDA Testing consists of equipping job sites with a Pile Driving Analyzer® (PDA) model PAX. Job site personnel attach the necessary sensors to the foundation to be tested. The PDA model PAX then transmits the dynamic test data over the Internet during the test, in real time, to a PDA engineer stationed anywhere in the world.

In the USA, where Departments of Transportation struggle to reconcile reduced budgets with increased testing requirements resulting from FHWA Load Resistance Factor Design (LRFD), Remote PDA Testing is emerging as the solution of choice. Its inherent lower costs allow for an increased number of foundation load tests, yielding in turn a less costly foundation design under LRFD.

For some time GRL Engineers has encouraged its clients to adopt this approach. The Cleveland office of GRL has recently cooperated with PDA owners in Michigan to provide remote testing services for the Hammond-Keystone Connector in Traverse City, MI and for the Hawkins Rd over I-94 project in Jackson County, MI, both MDOT projects. The GRL Chicago office has completed seven bridge projects using remote PDA testing. On these projects, Wisconsin DOT personnel attached their remote PDA system on HP 12x53 H-piles with ultimate pile capacities of up to 215 tons, and the dynamic test data was transmitted in real time to GRL. Fifty-nine piles were tested during initial driving and thirty-seven during restrike. The North Carolina office of GRL performed remote testing on 14 inch square concrete piles supporting the Isle of Wight Water Tank for ECS Mid-Atlantic. The piles, driven by Northstar Contractor, were designed for a load of 70 tons, with an ultimate capacity of 140 tons. GRL will perform a restrike on the test pile to confirm soil setup conditions.

GRL has been conducting Remote PDA Tests for Chris-Hill Construction Company of Memphis, TN routinely for several years. Craig Christenbury and Jon Hill, the owners of the company, have made it clear that “we will not fly in an engineer for testing”. A recent project required that 350 mm (14 inch) concrete piles, driven with a D19-42 diesel hammer, be monitored for tension stresses during driving. Long term bearing capacity also had to be assessed, since it was suspected that soil setup would have a significant effect. A PDA Model PAX was shipped to Chris-Hill a few days before the test. Jon Hill operated this equipment while his crew attached the sensors to the pile. When refusal occurred at a shallower than expected penetration, the ultimate capacity was only 75% of the required value. Six days later,



Concrete Cylinder Piles form the New Orleans IHNC Floodwall; Work Trestle in foreground. Photo courtesy of Foundation Testing and Consulting.

however, a restrike test confirmed that sufficient soil setup had generated an ultimate capacity of slightly more than the required 200 tons. Without any time delay, these capacity values were calculated by CAPWAP® analysis and a preliminary report was issued less than two hours after the actual test. Compared to traditional testing, a saving of almost 50% was realized due to reduced engineering time and travel costs.

Remote PDA testing was also used on the largest design-build project in the history of the U.S. Army Corps of Engineers, the Inner Harbor Navigation Canal Surge Barrier (IHNC). This floodwall extending from the Gulf Intracoastal Waterway to the Mississippi River Gulf Outlet is being constructed in New Orleans, LA by the joint venture team of Traylor-Massman-Weeks since April, 2009. A part of post-Hurricane Katrina improvements, the 2.3 km (1.4 mile) long wall consists of 43 m (140 ft) long concrete cylinder piles with a diameter of 1,680 mm (66 inch) and smaller concrete piles driven in gaps between the cylinder piles. Lateral support on the protected side of the barrier wall is provided by 910 mm (36 inch) diameter steel pipe batter piles. A temporary work trestle permits pile installation. Genesis Structures of Kansas City, Missouri designed the trestle and retained Foundation Testing and Consulting (FTC) of Overland Park, Kansas, to provide the geotechnical foundation design for this work trestle. The trestle bridge foundation design required pile capacity to be achieved within 7 days of pile installation to support the aggressive schedule of the project, while the soils typically require setup time periods of up to 6 weeks to develop full capacity. FTC's Casey Jones, P.E. used his PDA model PAX to perform extensive Remote Dynamic Testing and confirm installation requirements for the 36-inch diameter steel pipe trestle piles. The PDA was on site for the complete project duration. The project Quality Control staff, from Volkert and Associates, was trained to properly attach the required sensors to the pile and make the Internet connection of the PAX to the FTC Kansas office. Later, the Remote PDA Testing scope expanded to the concrete cylinder piles on an on-call basis during both day and night-time shifts. FTC stated that “...the remote PDA system was a huge success by extending our service capabilities and providing great value to the project. We are looking forward to using the remote system on our next large project.”

[1] Likins, Hermansson, Kightley, Cannon, and Klingberg, March, 2009. *Advances in Dynamic Foundation Testing Technology. Contemporary Topics in Deep Foundations; 2009 International Foundation Congress and Equipment Exposition, GSP No. 185. ASCE. This paper can be retrieved from PDI's web site: www.pile.com.*

What's happening in 2010 - more info at www.pile.com/events

February 20-24, West Palm Beach, FL: Geo-Florida 2010. Sponsored by the Geo-Institute of ASCE. **Garland Likins will present. Visit the PDI exhibit booth.** Info: content.asce.org/conferences/geoflorida2010

March 12, Baltimore, MD: Joint Conference on Driven Pile. Sponsored by DFI and PDCA. Info: www.piledrivers.org

March 17-19, Orlando, FL: Dynamic Foundation Testing Seminar and Workshop. Sponsored by Pile Dynamics, Inc. and PDCA. **Frank Rausche, Garland Likins, Mohamad Hussein and Jorge Beim will present.** Foundation QA High Strain Dynamic Pile Testing Examination will be offered on March 20. Contact PDI for additional details.

March 18-19, Pittsburgh, PA: Deep Foundations: Design, Construction and Quality Control. Sponsored by ASCE. **Mohamad Hussein will present.** Info: www.asce.org

March 25, Hamburg, Germany: GRLWEAP Workshop (in English). Sponsored by GSP and Pile Dynamics, Inc. **Frank Rausche and Oswald Klingmüller will present.** Info: www.gsp-mannheim.de

April 8-9, Orlando, FL: 2010 FHWA Bridge Engineering Conference - Highways for LIFE and Accelerated Bridge Construction. Sponsored by FHWA and various DOTs. **Visit the PDI/GRL exhibit booth.** Info: www.highwayforlife.com or contact Dr. Atorod Azizinami at azizi@highwayforlife.com.

April 26, noon: Installation, Verification and Application of Driven Piles. An ASCE Webinar. **Garland Likins will present.** Info: www.asce.org

May 6-8, Coeur d' Alene, ID: PDCA Annual Conference. Info: www.piledrivers.org

May 26-28, London, UK: 11th Geotechnical Conference - Geotechnical Challenges in Urban Regeneration. Sponsored by DFI-Europe and EFCF. Info: www.geotechnicalconference.com/ **Meet several PDI representatives at Booth Number 4.**

EVENTS IN PLANNING:

International Dynamic Foundation Testing Seminars

Following the success of Dynamic Foundation Testing Seminars offered in the Fall of 2009 in Brazil, Italy, UAE and Chile, Pile Dynamics is actively planning the next series of international educational events. Tentative dates and locations include:

Spring 2010: India, Colombia, Peru and Mexico

Fall 2010: Poland, Spain and Vietnam

Our next USA Seminar will take place in March, see above.

Webinars

GRLWEAP: tentatively planned for February.

Pile Integrity Testing: tentatively planned for April.

Watch our website for upcoming details. Email announcements will be sent when registration opens - keep your contact information current on www.pile.com/brochure

SMALLER, WIRELESS PILE INTEGRITY TESTER UNVEILED - PIT-X

Pile Dynamics has launched a Pile Integrity Tester that fits in the palm of your hand, and works with a wireless accelerometer. PIT-X will initially be available with one channel of data acquisition (velocity). All functions available on the latest edition of the PIT-V model have been preserved, including a built-in FFT feature. PDI has also updated the PIT analysis software, having recently launched PIT-W 2009 in both Standard and Professional versions.



PIT-X with wireless accelerometer and handheld hammer.

GRL IN LOUISIANA

GRL has opened a new office in New Orleans. This office will serve the needs of the entire State of Louisiana and surrounding area. GRL Louisiana is headed by GRL Florida's Mohamad Hussein, P.E. and staffed locally by Matt Nagy, who was formerly with the GRL Main Office in Cleveland. The Louisiana office is located at 2931 Layton Lane, Slidell, LA 70458. You may reach this office by emailing GRL-LA@PILE.COM or calling (985) 640-7961.

GRL ILLINOIS WELCOMES NEW ENGINEER

Joey Link, PE, has joined the Illinois office of GRL. Joey brings several years of experience as a senior staff engineer with Schnabel Engineering in Richmond, Virginia, where he conducted high and low-strain dynamic pile tests and analyses for deep foundations.

WE NOTE WITH SADNESS THE PASSING OF

Fritz Koltermann. Fritz had been an engineer with DELMAG and Pileco and eventually Foundation Equipment Company (FEC) of Dover, OH, which he managed until his retirement. During the past 8 years, Fritz engineered GRL's APPLE systems and generously helped GRL with his well reasoned advice, knowledge and experience.

Jose Antonio Mendez Lecanda. Antonio headed Pruebas Dinamicas en Pilotes SA in Mexico, a company that only in March saw the passing of its founder Ing. Carlos Molina. Antonio worked very hard, often in close cooperation with GRL, and enjoyed the many facets of dynamic pile testing. He had recently visited PDI to stay abreast of recent software and hardware developments and helped GRL with an offshore assignment in the Gulf of Mexico.

All of us at GRL and PDI will very much miss these two outstanding engineers.

GRL ENGINEERS DAYS

In keeping with its mission of delivering exceptional dynamic testing and analysis services to its clients, GRL held its annual in-house 2 day long training. 40 engineers - from GRL and from sister company Pile Dynamics - attended and shared their job site experiences, research efforts and testing systems recent developments. Topics included wireless high strain dynamic testing on an offshore oil platform in the Caspian Sea, remote dynamic foundation testing, recent developments of dynamic testing of drilled shafts with GRL's various APPLES, and preview of the wireless PIT-X among many others.

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