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Converting Project from CSL to TIP Leads to Cost Savings and Accelerated Construction Schedule

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In the electrical power transmission industry, Multi-Value Projects (MVP) are large, strategically planned projects that provide regional benefits through upgrades to the electrical transmission infrastructure. The MidAmerican Energy Company (MEC) projects MVP-3 and MVP-4 will construct or upgrade four electrical substations, upgrade existing 161kV transmission lines, and add new 345kV lines across the state of Iowa. Combined, these projects total approximately 191 miles (307 km) of upgraded or new lines. A total of 1,068 new drilled shaft foundations will be completed over the 2 ½ year project schedule to support the transmission line towers. EC Source Services has been contracted through MEC to perform engineering, procurement, and construction services for these projects. Neil Russo is in charge of overseeing the daily QA/QC management for the foundations.

Initially, the Illinois Office of GRL Engineers was retained to provide Thermal Integrity Profiling (TIP) on the foundations of 86 tangent structures. Tangent structures are the towers located along the straight portions of a transmission line, and are designed to withstand wind and dead weight loads. These are the most common towers along a transmission line and support the cables as they pass from one structure to the next. The drilled shaft foundations of the tangent structures to be tested were 5 to 7 feet (1.5 to 2.1 m) in diameter and approximately 32 feet (10 m) in length. The project QA/QC specification originally required Cross Hole Sonic Logging (CSL) with confirmation from Pulse Echo Pile Integrity Tests (PIT) on these shafts.

Cross Hole Sonic Logging assesses concrete integrity using sonic waves that travel between transmitter and receiver probes inserted in parallel tubes pre-installed in the shafts. It cannot assess the concrete cover outside the reinforcing cage. Pulse Echo integrity tests evaluate integrity based on reflections from a stress wave created by the impact of a hand held hammer. In some situations it has depth limitations.

CSL had yielded false positives in some shafts, which led to coring costs of US\$5K to 10K per shaft. TIP, using the Thermal Wire® method, was presented as an alternative due to the fast analysis turn-around time (one to 3 days versus up to 7 days after installation for CSL or PIT), potential cost savings over CSL and PIT (fewer false positives), and the unique ability of TIP to evaluate the positioning of the rebar cage and thickness of concrete cover. Concrete cover is of particular importance, structurally, in shafts subject to lateral loads like from wind.

Thermal Integrity Profiling using the Thermal Wire method consists of attaching specialty cables fitted with thermal sensors at every 300 mm along the rebar cage. The sensors record concrete temperatures as the

concrete cures; the analysis of temperature patterns helps identify shaft anomalies, if any, and evaluate the position of the rebar cage within the shaft. This test examines the critical concrete area outside the rebar cage and has practically no depth limitations.

Upon successful completion of the testing of multiple tangent structures with TIP, GRL was contracted to conduct TIP on 5 critical dead end shafts. These shafts support dead-end towers, which are the structures where a transmission line ends or turns at a very wide angle. Compared to tangent structures, a dead-end structure is larger, and designed to withstand significantly higher lateral loads. In the MVP-3 and MVP-4 projects, the critical dead-end shafts were approximately twice the size of the tangent shafts: 11 feet (3.4 m) in diameter and 75 feet (22.9 m) in length. TIP results and the corresponding CSL and PIT results were presented to the Engineer of Record for approval of replacing CSL with TIP on the remaining critical structures. The comparison was also aimed to highlight both the success of the TIP for use in future bids and cost savings associated with using it instead of CSL.

Following successful integrity tests on the 5 critical structures, EC Source proposed and converted 79 additional structures from Cross-Hole Sonic Logging to Thermal Integrity Profiling. GRL is now performing TIP on 170 foundations on the project. Neil Russo, who played a key role in implementing TIP into the project, commented on his experience: "Due to the magnitude and scheduling challenges of these projects, TIP has proved to be an invaluable part of the successful completion of its foundations. TIP has allowed us the flexibility to speed up production and reduce the need for additional Non Destructive Testing suggested by CSL. EC Source will be marketing TIP as the sole preferred method of integrity testing for all future transmission line projects."



10 ft (3 m) Diameter Reinforcing Cage for Critical High Load Structure

Highlights of the 2016 Calendar of events (Feb-July)

More events, info and registration forms at www.pile.com/events

Pile Dynamics Seminar on Deep Foundation Integrity Testing and Wave Equation Analysis, followed by High Strain Dynamic Foundation Testing Workshop and Proficiency Test:

March 9-11 in Orlando, FL in association with the Pile Driving Contractors Association. Info: Holly@piledrivers.org

April 20-22 in Jakarta, Indonesia in association with Geotech Efathama

High Strain Dynamic Foundation Testing Seminar and Proficiency Test

April 28 in Seoul, Korea in association with Young Shin Consultant and Korea Geotechnical Society

PDI and GRL Webinars - Learn without leaving your desk. Selected webinars are complimentary, as noted: All webinars require Internet and phone connection and start at 9:00 am Eastern Time (New York Time). info: registration@pile.com

February 16, 17, 23 and 24: Wave Equation Analysis of Piles using GRLWEAP with Dr. Frank Rausche and Ryan Allin (in 4 sessions)

March 8: Quality Control of ACIP/CFA Piles with George Piscalko

April 12: The new 8th generation (8G) Pile Driving Analyzer® with Brent Robinson and Ryan Allin. No fee.

April 19: Thermal Integrity Profiling of Concrete Foundations with George Piscalko

May 10-11: Fundamentals of High Strain Dynamic Foundation Testing (PDA) with Ryan Allin (in 2 sessions)

May 17 (in Spanish): El nuevo PDA (Pile Driving Analyzer®) de 8ª generación (8G) con Jorge Beim. Webinar gratuito.

May 24-25: Wave Mechanics and Proper Practices for Existing PDA Users with Ryan Allin (in 2 sessions)

May 31 and June 1, 7 and 8: Advanced Applications of CAPWAP® 2014 Software with Brent Robinson (in 4 sessions)

June 14-21 (in Spanish): Seminario Web sobre Análisis de Ecuación de Onda en Pilotes usando GRLWEAP con Jorge Beim (en 3 sesiones)

GRL, PDI and/or PDI representatives will exhibit at the following events (a good chance to learn about new developments!)

February 14-17 in Phoenix, AZ: Visit **PDI** at Booth 327 of the ASCE Geotechnical & Structural Engineering Congress 2016. **Dr. Anna Sellountou** and **Anna Klesney** will be presenting papers at this event. www.geo-structures.org.

March 17-18 in South Korea, Visit **PDI** representative Youngshin at the Korean Geotechnical Society's Geo Expo 2016.

April 18-20 in Charlotte, NC: Visit **GRL** at Booth 132 of the 2016 Design-Build in Transportation Conference. www.dbia.org

April 24-28 in Tacoma, WA: Visit the **GRL** Booth at the National Association of County Engineers Annual Meeting, Management & Technical Conference. www.countyengineers.org

May 9-12 in Kansas City, KS: Visit the **PDI** Booth at the 41st Southwest Geotechnical Engineering Conference. www.swgeotech2016.org

May 17-19 in New Orleans, LA: Visit **PDI** at Booth 303 of the PDCA 20th Annual International Conference & Expo. **GRL** is proud to be an event sponsor. **Ben White** will be presenting. www.piledrivers.org

Other Learning Opportunities:

February 16-20 in Scottsdale, AZ: **Brent Robinson** will make a presentation about the new PDI product SQUID at the ADSC Annual Meeting. www.adsc-iafd.com

March 14-15 in Orlando, FL: **Mohamad Hussein** will teach the ASCE Deep Foundations: Design, Construction, and Quality Control course. <http://mylearning.asce.org/diweb/catalog/item/id/333150/q/n=1&o=t&c=79&t=2116&t=2108>

April 28-29 in Leuven, Belgium: **Oswald Klingmüller** will speak at the ETC3 International Symposium "Design of Piles in Europe". www.etc3.be/symposium2016

May 16 in New Orleans, LA: **Mohamad Hussein** will teach the PDCA Pile Driving Inspection Course. www.piledrivers.org



With Newsletter Issue 80, GRL Turns 40!

Founded in 1976, GRL Engineers, Inc. is proudly celebrating 40 years of serving the deep foundations industry. Also, this newsletter is celebrating its 80th issue!

GRL Welcomes Two Senior Engineers

GRL is delighted to welcome **Van E. Komurka, P.E., D.GE, F.ASCE**, to its Central office. Van, who holds an MS from Colorado State University, has a 30 year career as a geotechnical engineer, most recently at the helm of the Wagner Komurka Geotechnical Group. As an experienced engineer, author and educator who serves on numerous industry association committees, Van will be a valuable addition to the Central office, which serves international locations, assists in complex situations and conducts research and educational activities. He joins GRL in early 2016.



In October of 2015 GRL welcomed **Mike Sharp, P.E.** to its Ohio office. Mike comes to GRL with 26 years of foundation testing, design and project management expertise. He holds an ME in Geotechnical Engineering from the University of Florida and has achieved Master level on the PDCA/PDI Dynamic Measurement and Analysis Proficiency Test. Mike has authored several papers related to pile design and dynamic pile testing. He is a great fit for GRL and is already helping better serve the region covered by the OH office.

PDI Adds a New Member to its Sales Team

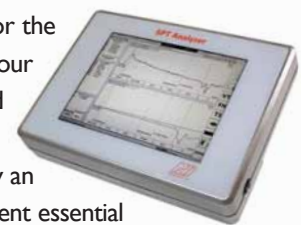
As the Pile Dynamics product line increases, so does demand for its vast array of systems for QA/QC of deep foundations. In an effort to keep the high level of customer support it is known for, PDI added Mark Jaskiewicz, who has 25 years of sales experience, to its team. Welcome!



Mark Jaskiewicz

New SPT Analyzer

Following the release of the SPT Software for the Pile Driving Analyzer® system, announced in our September newsletter, PDI has redesigned the hardware of the SPT Analyzer. The SPT Analyzer measures the energy transferred by an SPT hammer to the drilling rod, a measurement essential for SPT hammer calibration according to several codes. In addition to the new software, the SPT Analyzer now includes Smart Sensor technology which considerably simplifies the initial test setup, and a tablet type device that responds to multi-touch gestures. PDI has made it simpler to adjust the display color scheme and time scale to view data in the field, enhanced data quality checks and made customization easier.



www.pile.com: the portal for deep foundation testing services, instruments and software

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