DID YOU KNOW?

The completely updated, LRFD-compatible, 2016 FHWA Manual on the Design and Construction of Driven Piles can now be downloaded.

GRL engineers, inc. Pile Dynamics, Inc.

NEWSLETTER No. 83 - Jan. 2017

SQUID Evaluates Bottom of Drilled Shafts

Brent Robinson

PDI's new **S**haft **Q**uantitative **I**nspection **D**evice (SQUID) provides measured load-penetration curves at the base of drilled shafts and bored piles. It provides construction professionals quick and reliable information about the cleanliness of the hole and the strength of the interface between a bearing layer and the base of a drilled shaft. SQUID is lowered into the borehole by quickly attaching it to the drill stem or Kelly Bar after bottom clean-out by the contractor. SQUID testing can be completed within a few minutes, minimally interrupting construction.

SQUID, shown in Figure 1, is configured with three standard-size cone penetrometers (10 cm2) to calculate the force required to penetrate the bearing layer and three displacement sensors to measure the distance each cone penetrates, starting from the top of a debris layer. The displacement near each penetrometer is measured by a high accuracy displacement transducer attached to a plate that rests on the debris layer.

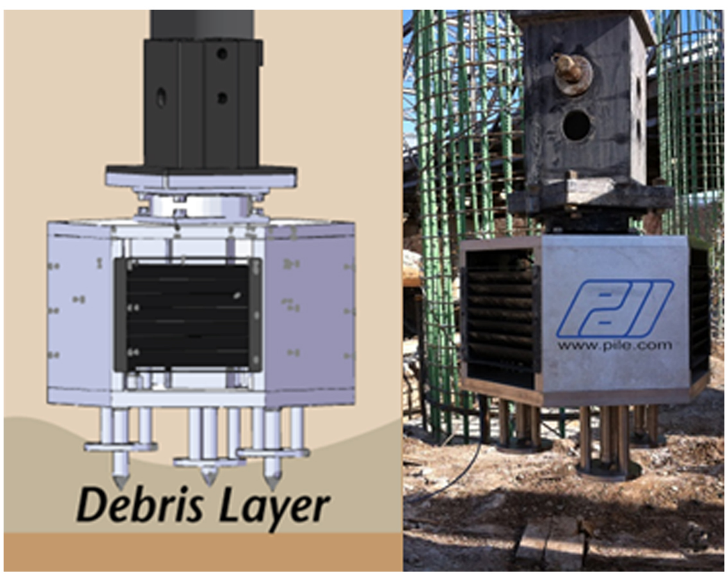
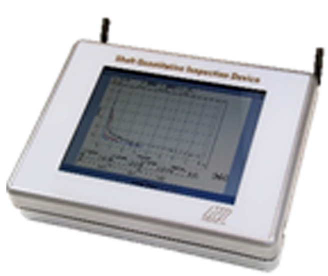


Figure 1. *SQUID penetrometers penetrate the debris layer*

The SQUID Analyzer provides the output and remains in the hands of the inspector a safe distance from the shaft excavation. Load and penetration measurements can be displayed in real time with a wired connection from the SQUID to a wireless transmitter at the top of the hole. The wire can also be replaced with an on-board wireless transmitter that collects data from several tests at the shaft bottom, and transmits that data upon return to the surface back to the SQUID Analyzer.



SQUID Analyzer

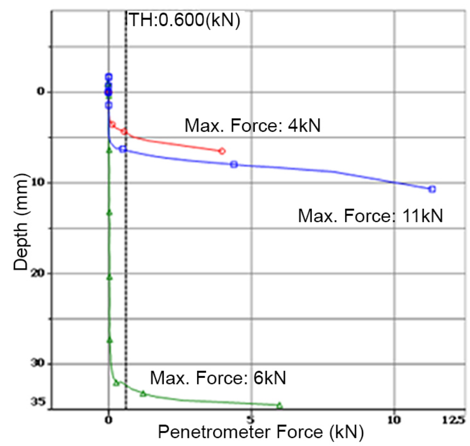


Figure 2. *SQUID Testing Results – Depth vs Resistance to Penetration*

To determine debris thickness, the engineer defines a threshold force or tip resistance. The debris layer is defined when the measured load-penetration curves exceed the threshold force.

On a recent site, drilled shafts of approximately 1 m in diameter were drilled to rock, and the bottoms tested with SQUID for debris thickness. Site specifications required debris layer thickness measurements of less than 12.5 mm (1/2 inch) over 50% of the shaft bottom. Figure 2 from the SQUID software report illustrates significant increases in Penetrometer Force (x-axis) with minimal penetration (y-axis). The identified force threshold was crossed at 5, 6 and 32 mm, respectively. Because more than two measurements of the three measurements were less than 12.5 mm, it is theorized that the third penetrometer penetrated into a groove caused by the drilling teeth, the onsite inspectors accepted the shaft. SQUID measurements proceeded to the next foundation element.

For shafts requiring end bearing, the measurements may also be used to confirm that cone tip resistance measurements on production shafts are similar to or exceed cone tip resistance measurements on shafts that are subjected to static or dynamic load testing. This verification, in conjunction with site soil exploration and observations during drilling, will provide designers with further confidence in their designs or a justification to shorten shafts. SQUID is the only device that measures parameters that could be used for the assessment of the material at the bottom of the shaft without the need of mobilizing geotechnical drilling rigs to the site.

In summary, force and displacements measured with SQUID can be used to determine cone resistance and compare it with other parameters to quantitively and qualitatively assess the soil conditions at the bottom of the shaft. A SQUID installation and demonstration video is available on PDI's YouTube page at www.youtube.com/PileDynamicsInc.

SQUID is the latest addition to Pile Dynamics extensive line of quality assurance and quality control systems for the deep foundations industry.

UPCOMING EVENTS

For a complete list of 2017 events and contact information, please visit pile.com/events

February

17 ASCE Deep Foundations Class
21: Quality Control of ACIP/CFA Piles Webinar

March

1: Seminar On Deep Foundation Integrity Testing and Wave Equation Analysis
2-3: High Strain Dynamic Foundation Testing Workshop and Proficiency Test
7-11: CONEXPO-CON/AGG 2017
12-15: ASCE-GI Geotechnical Frontiers
12-15: Fundamentals of High Strain Dynamic Foundation Testing (PDA) Webinar
26-30: ACI The Concrete Convention and Exposition
27-29: Design-Build In Transportation
29-1: 13th Annual International Workshop on Micropiles

April

11-12: Geo3T2 (Raleigh, NC)
25: Thermal Integrity Profiling Introduction Promotional Webinar

Geotechnical Engineering Circular No. 12 – Design and Construction of Driven Pile Foundations
The recently released Geotechnical Engineering Circular No. 12 – Design and Construction of Driven Pile Foundations is the US Federal Highway Administration's (FHWA) primary guidance and reference document on driven pile foundations. GEC 12 updates and replaces the previous Design and Construction of Driven Pile Foundations documents published in 2006. It reflects changes in the practice of designing, constructing and inspecting driven pile foundations that occurred in the industry in the past 10 years. Most notably, the Circular incorporates Load and Resistance Factor Design methods, following current American Association of State and Highway Transportation Officials (AASHTO) specifications. GRL is proud to have been the editor and main contributor, under the leadership of its President Patrick Hannigan, P.E., its founders Frank Rausche, PhD, P.E. and Garland Likins, P.E., and its engineers Brent Robinson, P.E., and Matthew Becker to this effort. The work was done for Ryan R. Berg & Associates, Inc. and in cooperation with the FHWA Technical Working Group composed of Naser Abu-Hejleh, PhD, P.E., Scott Anderson, PhD, P.E., and Silas Nichols, P.E. The two volume manual covers analysis, design, and construction of driven pile foundations for highway structures. A third volume provides a complete example. All volumes can be downloaded from the link provided on the home page of www.GRLengineers.com

Aksan Kawanda from Geotech Efathama, a PDI Representative, worked together with ISGE and the Ministry of Public Works to do Research and Development to draft the Indonesian Deep Foundations Testing Manual and National Standard document. The revolutionary document, covering research and design of deep foundation testing, was signed at the 20th Annual National Conference Indonesian Society for Geotechnical Engineering. The event took place in Jakarta on November 15-16, 2016, where 550+ participants attended.

GRL Engineers Welcomes Glenn Santulli, E.I. to the Pennsylvania office. Glenn is a testing and analysis engineer holding an MS and BS in Civil Engineering from Drexel University where he concentrated in Structural Engineering. He joins GRL with three years of field construction experience where he focused on support of excavations, driven pile foundations and construction engineering.

Since joining GRL in November, Glenn states, "I have enjoyed my two plus months with GRL and have been amazed with the amount of different job types and complexities that I have been exposed to thus far. I look forward to contributing my knowledge to support the GRL team in whatever clients happen to bring across our table. I have a strong interest in the APPLE Dynamic Load Testing and hope to work with a large diverse amount of clients and GRL personnel."

The American Society for Testing and Materials, ASTM, has revised the Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations, D5882.
Pile Dynamics Supports this Standard covering both the Pulse Echo and Transient Response Methods of evaluating integrity. Both methods are expedient procedures to investigate the potential existence of major cracks or voids in concrete foundations.The D5882 Standard now encourages considering the soil profile, construction method, site records and results of tests on other foundations at the same site when evaluating data obtained by these methods. Depending on the type of deep foundation tested, it also suggests examining data from concrete placement automated monitoring, concrete cylinder or core strength tests, crosshole sonic logging (ASTM Standard D6760) and thermal integrity profiling (ASTM Standard D7949).