

# GRL Engineers, Inc.

Driving solutions in deep foundations

By GRL Engineers, Inc.



**G**R L Engineers, Inc. is a professional engineering firm established to provide specialized testing, analysis and consulting services to the deep foundation construction industry. Under the direction of Professor George G. Goble, and with the participation of Frank Rausche and Garland Likins, a research project in 1964 at Case Institute of Technology in Cleveland, Ohio, is where it all began. This research pioneered the basic concept of dynamic pile testing, now referred to as the Case Method. The success of the research project provided the basis for a valuable new tool for pile design and construction control known as the Pile Driving Analyzer® (PDA). The CAPWAP® software program for deriving the soil resistance from pile top measurements was also developed from this research effort.

In the early 1970s, the research team began a consulting practice to provide a service based on the Case Method and utilizing the PDA for the deep foundation industry. Since its incorporation in 1975, GRL Engineers has continued to expand its capabilities in the dynamic testing field through in-house research efforts and the results of several funded studies. In 1976, the Wave Equation Analysis Program (WEAP) for pile driving evaluations was developed for the Federal Highway Administration (FHWA). This program was updated in 1980 and in 1987 before becoming the proprietary program known today as GRLWEAP. In 1986, The Performance of Pile Driving Systems, was developed for and published by the FHWA. GRL has also authored the last three editions of the FHWA manual Design and Construction of Driven Pile Foundations in 1996, 2006 and 2016.

GRL operates the largest dynamic pile testing firm in the world. The dynamic test methods originally developed by the founding principals of the firm are applied worldwide on a routine basis, both on land and offshore. The methods provide improved foundation solutions, better quality control and often significant savings in foundation cost or construction time.

## Specialized deep foundation testing and analysis services

### Bonner Bridge Replacement in North Carolina

Located in the outer banks of North Carolina, the three-mile-long Bonner Bridge had endured numerous hurricanes since its inception in 1965. Due to the scour damage and destabilization of the bridge, a new design for a replacement bridge began to take shape. During a preconstruction test program, GRL Engineers performed both static and dynamic load tests to assess the pile capacity for designers of the new structure. The team performed one static compression load test on a 36-inch prestressed concrete pile that had 11 levels of embedded strain gages for load transfer information. A lateral load test including deflected shape versus depth measurements was also performed.

GRL Engineers on-site to perform load tests

Photo courtesy of GRL Engineers, Inc.



## MEMBER PROFILE – ENGINEERING AFFILIATE

During construction, PDA testing was performed on temporary piles as well as the production piles, which included square prestressed concrete and concrete cylinder piles. Production testing was performed using SiteLink® technology, which allowed the dynamic testing data to be viewed and evaluated in real time both on site by project personnel and in a remote location by the GRL engineer operating the PDA software. Dynamic testing and analysis were essential in assessing that the requisite pile capacity was achieved below design scour depths as deep as elevation -85. The use of SiteLink technology helped to keep the project on time and as cost effective as possible. GRL's dynamic testing results were used extensively for pile capacity assessment and acceptance of the production piles in these difficult soil conditions.

### I-4 Ultimate Ongoing in Florida

The reconstruction of the interstate highway I-4 through Orlando has proven to be a huge endeavor for the Florida Department of Transportation. Originally constructed in 1965, the "Orlando Expressway" was built in six segments over seven years. Located in the heart of downtown Orlando, the interstate was designed to withstand up to 70,000 vehicles per day. Although the highway endured many reconstructions and lane widening over the years, a new larger, more robust highway system through Orlando was needed. The "I-4 Ultimate" project required 13 bridges to be widened, 74 bridges to be replaced, and 53 bridges to be added along the 21-mile corridor.

Since 2015, the GRL Florida team has been providing dynamic pile testing and analysis services throughout the I-4 Ultimate project. The dynamic testing and analysis results have been

used to keep the schedule driven project through heavily congested Orlando moving forward. GRL Engineers have been an integral partner during project construction and will continue to provide essential testing and analysis services on the driven pile foundations.

### Driving forward with PDCA

"GRL has been a very active PDCA member since PDCA was formed. GRL has benefited from our PDCA membership through the industry forum PDCA provides on driven pile foundation benefits, issues and solutions," said GRL Engineers president and past PDCA Board member, Patrick Hannigan, P.E.

Many of the GRL engineers participate in local chapter events, and several GRL staff sit on various committees within the organization. Scott Webster, P.E., manager of GRL-North Carolina is a current PDCA board member.

"PDCA provides a community that allows contractors, suppliers and engineers to meet, discuss and learn more about pile driving and the pile driving industry, which certainly benefits GRL/PDI and our efforts with dynamic pile testing," said Webster. "Being part of this community allows us to stay in touch with new developments and helps GRL/PDI provide new services and equipment which expands pile driving options and new developments."

GRL has maintained its leading role in the industry by providing the latest technology testing and analysis solutions combined with high quality professional service. GRL's central office and 11 branch offices are staffed by more than 40 highly accomplished foundation engineers, many with advanced degrees and 10 or more years of experience. ▼

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