DID YOU KNOW? *Newsletter No. 113 - March 2025*

PDI's CAPWAP® (Case Pile Wave Analysis Program) is the only method with a correlation database.

Advanced Testing Characterizes Robust Foundations at Gilbert Road Bridge

by Camilo Alvarez, P.E. and William Chambers, P.E.

Gilbert Road, Arizona – The Gilbert Road bridge replacement project over the Salt River in Phoenix, AZ, prioritized structural integrity through advanced testing of its drilled shaft foundations. Faced with challenging soil conditions, extreme summer heat, and the need for deep, large-diameter shafts, the Maricopa County Department of Transportation (MCDOT) and its partners employed a rigorous quality control program, with a focus on Shaft Area Profile Evaluation (SHAPE®) and Thermal Integrity Profiling (TIP™). Keller – North America, the foundation contractor, played a crucial role in implementing these technologies.

The project replaced an aging two-lane bridge with a four-lane structure designed to withstand significant flood events. The design engineer specified some of the largest and deepest drilled shafts ever constructed in Arizona to ensure stability, requiring 10-foot (3 m) diameter shafts reaching 165 feet (50.2 m) depth for the installation of eight (8) piers.

To assess the integrity of the shafts, Keller employed SHAPE and TIP testing in combination with Crosshole Sonic Logging (CSL) and Gamma-Gamma Logging (GGL) methods. SHAPE testing, conducted before concrete placement, used ultrasonic measurements in polymer drilling fluid to create a three-dimensional image of the excavated borehole. This allowed project engineers to measure the shaft's geometry and verticality, and to identify potential initial areas of concern. TIP testing, requiring Thermal Wire® cables to be instrumented along the reinforcement cage, was performed during concrete placement. TIP's Thermal Wire temperature sensors monitor the heat generated by the hydrating concrete. The resulting temperature profiles and the placed concrete volume provided information about the quality and uniformity of the concrete, as well as the shaft's geometry.

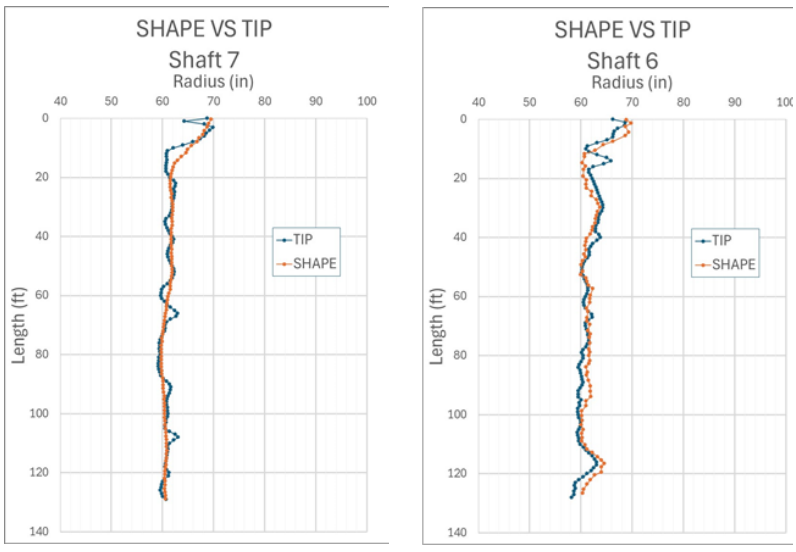

Figure 1. Comparing SHAPE and TIP results on shafts 6 and 7

The combination of both test methods allowed for a clear understanding of the concrete placement of each foundation element. **Figure 1** illustrates the estimated average radius relationship obtained from comparing SHAPE and TIP testing on two shafts, presenting a clear correlation between both tests.

Looking at the 3-dimensional interpretation, shown in **Figure 2**, the relationship between the actual drilled hole, placed concrete and rebar cage can be demonstrated.

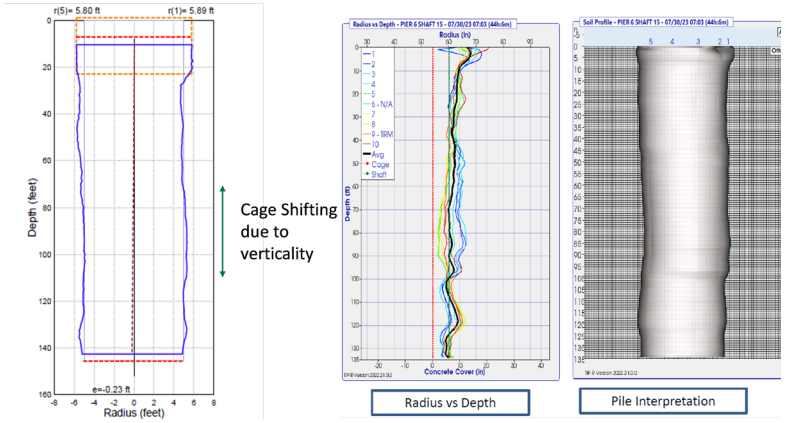

Figure 2. SHAPE profile (left), with Effective Radius and three-dimensional visualization from Thermal Integrity Profiling

The relationship of the rebar cage location and thus the amount of concrete cover provided can be assessed by TIP results. Thus where installation procedures result in too little concrete cover, modifications to the shaft installation procedures can be provided.

The added power of SHAPE and TIP lies in their synergistic use. By comparing the results from both tests, engineers can gain a more comprehensive understanding of the drilled shaft's integrity. For example:

- If SHAPE indicates a necking in the excavated borehole, and TIP confirms a corresponding reduction in concrete temperature in that area, it provides strong evidence of a potential reduction in shaft diameter.
- If SHAPE indicates eccentricity in the borehole, and TIP shows a consistent temperature profile across the shaft, it suggests that the concrete was placed uniformly despite the eccentricity.
- Discrepancies between SHAPE and TIP results can trigger further investigation, using other testing methods or even physical inspection, to fully assess the condition of the shaft.
- If both tests show large drilling variations that could potentially affect the shaft structural performance,

installation procedures can be modified early in the project so the structure's foundation can be appropriately installed. As an example, with the Gilbert Road bridge project, additional centralizers were placed on the shafts along with closer attention to drilling verticality resulting in concrete cover requirements being achieved for the length of the shafts.

While Crosshole Sonic Logging (CSL) showed anomalies, likely due to debonding issues (due to the PVC access tubes used for Gamma-Gamma Logging (GGL) testing), TIP and GGL indicated overall shaft integrity, avoiding costly remedial work. The combination of testing methods allowed for early detection of potential problems, assessment of concrete quality, and enhanced structural integrity. Keller completed the drilled shaft installations ahead of schedule, showcasing the expertise of the construction team and success of the testing program.

The Gilbert Road bridge project demonstrates the value of advanced integrating testing technologies to help confirm the long-term stability of infrastructure projects. This project proves that proactive quality control measures, combined with experienced contractors, can overcome complex challenges and deliver durable, resilient infrastructure for the community.

Cage Instrumented with Thermal Wire® Cables

Upcoming Events

Mar 10	**Deep Foundation Integrity Testing & Wave Equation Analysis, Orlando, FL; *Instructor: Ryan Allin***
Mar 11-12	**High Strain Dynamic Foundation Testing Workshop & Proficiency Test, Orlando, FL; Instructor*: Ryan Allin***
Mar 17-19	GeoVirginia, Smithfield, VA; Booth #7
Mar 17-19	Design Build in Transportation and Aviation, Washington D.C.; ***Moderator: Mohamad Hussein***
Mar 20-21	ASCE Deep Foundations Course, Reston, VA; ***Instructor: Mohamad Hussein***
Mar 26-27	West Virginia Construction & Design Expo, Charleston, WV; Booth #424 ***Presenter: Ben White***
Mar 27	DFI COPRI NYC Ports and Marine Engineering Seminar, Brooklyn, NY; ***Presenter: Alex Ryberg***
Mar 28	GMEC Conference, Orlando, FL; ***Presenter: Mohamad Hussein***
Apr 9-11	Structures Congress 2025, Phoenix, AZ; Booth #107
Apr 24-25	Christian Veder Kolloquium, Graz, Austria
May 5-6	2nd Annual International Geotechnical Innovation Conference, Jeddah, SA. ***Presenter: Mohamad Hussein***
May 7-8	DFI Helical Piles - Tiebacks - Anchors Tradeshow, Durham, CT. ***Instructor: Ben White***
May 7-9	ADSC Kelowna, BC, Canada. ***Presenter: George Piscsalko***
May 19-21	Southwest Geotechnical Engineering Conference, Sacramento, CA
May 21-23	DFI-EFFC Geotechnics Reimagined, Bruges, Belgium; Booth #205. ***Poster Presentation: George Piscsalko and Matthias Schallert***
Jun 18-20	SuperPile 25, Cleveland, OH; Booth #303. ***Hal Hunt Lecturer: Mohamad Hussein; Presenters: Ben White, Van Komurka, and Travis Coleman***

A complete list of PDI and GRL events can be found on pile.com or grlengineers.com

GRL Engineers' Texas and Central Offices Expand Teams

In January of 2025, Shahriar Abdullah joined the GRL Texas office as a Staff Engineer. Sharhriar brings experience in drilled shaft inspection.

Eric Wooten also recently joined the GRL-Texas office as a Staff Engineer. Eric brings his background in Civil Engineering for bridges and roadway designs.

GRL-Central, located in Cleveland, OH, added Staff Engineer, Venkat Kishan Gangadhari. Venkat recently completed his Masters in Civil Engineering from Texas A&M University. Welcome Shahriar, Eric, and Venkat.

Shahriar Abdullah

Eric Wooten

Venkat Kishan Gangadhari

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