GRL Engineers, Inc.

Unionport Bridge Replacement Project

Challenge:

GRL Engineers were brought onto the Unionport bridge replacement project in Bronx, NY to provide various drilled shaft testing. This moving bridge, also known as a drawbridge, was originally constructed in 1953 to connect the Bruckner Expressway with the Cross Bronx Expressway. The new foundation included 43 drilled shafts with diameters between 3 and 6 ft., with lengths extending upwards of 83 ft. All shafts were constructed with a rock-socket.

Working with Kiewit Foundations, GRL primarily performed project specified crosshole sonic logging (CSL) testing on the newly constructed drilled shafts. Bi-directional static load testing was also provided on a demonstration shaft, as well as thermal integrity profiling and low strain integrity testing using the pulse echo method.

Method:

The project's demonstration shaft was constructed within a 50-in permanent casing and with concreted length of approximately 57-ft. The shaft was constructed through flowing river water with a measured depth of 12 feet from top of concrete to mudline. A 9-ft long rock socket of similar diameter was utilized for the bottom of shaft and a bi-directional cell was installed and located approximately 6-in above the shaft base (extending up 1.7-ft). GRL performed integrity testing via crosshole sonic logging and the wire method of thermal integrity profiling.

GRL also performed a bi-directional static load test to a maximum test load of 2500 kips. A single 1500-ton GRL-Cell hydraulic jack was used for loading. Four levels of internal strain readings were collected during testing to generate t-z curves and evaluate unit shaft resistances. Displacements were measured using a digital survey and extensometers attached to telltale rods.

Results:

Representative CSL results shown in **Figure 1** indicate an arrival time delay in the vicinity of the bi-directional cell, with no other anomalies over the remaining tested length. In a similar manner, the TIP results show a temperature reduction at this location as presented in the three selected thermal profiles from the time of concrete placement to peak temperature at 30.5 hours (**Figure 2**). A mid-shaft temperature roll off was also noted near a depth of 12 feet from the top of concrete and is due to the thermal boundary change represented by the external environment conditions of soil and flowing water. The demonstration shaft was considered to have acceptable overall integrity.

Results of the bi-directional static load test indicated nearly the entirety of the mobilized shaft resistance in the rock socketed section of the shaft.

Project Details

Client: Kiewit

Location: Bronx, NY

GRL Office: Pennsylvania

GRL Services

- Thermal Integrity Profiling (TIP) Instrumentation and Analysis
- Crosshole Sonic Logging (CSL) and Tomography Analysis
- Bi-Directional Static Load Testing
- Low Strain Integrity Testing

For the remainder of the project's 42 production drilled shafts, GRL performed CSL testing to evaluate shaft integrity. Using CSL allowed for several shafts to be tested in a single day, which reduced the total time required for an engineer to be onsite.

During the construction of one shaft, a CSL tube became blocked mid length and therefore only 3 of the 4 access tubes were able to be utilized full length for CSL testing. As a result, only 3 of the 6 collected CSL profiles had full length data. Low strain integrity testing was performed to supplement the partial CSL data. In this case, the low strain integrity test indicated a strong compression reflection in the vicinity of the expected rock socket location, several feet above the shaft base (**Figure 3**). With both the partial CSL data and pulse echo test data, the shaft was able to be accepted without further remediation or testing.

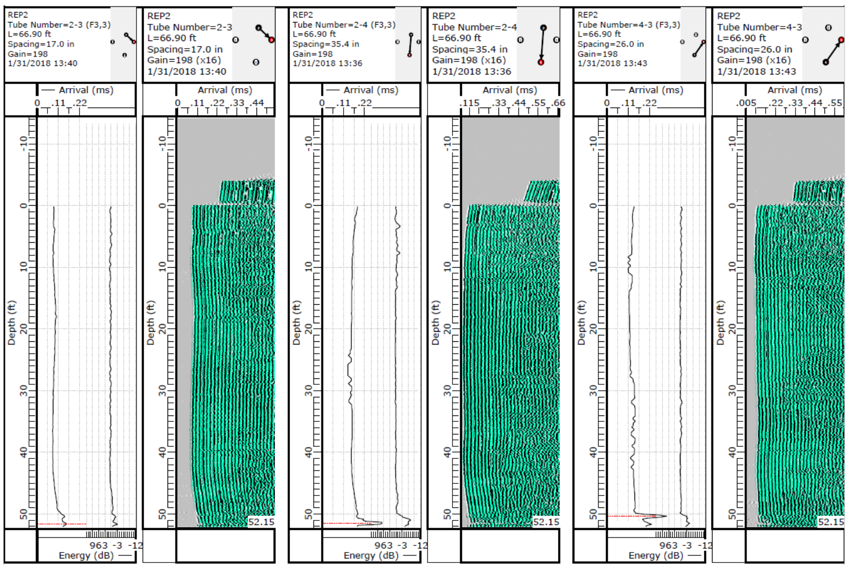

Figure 1: CSL arrival time waterfall diagrams

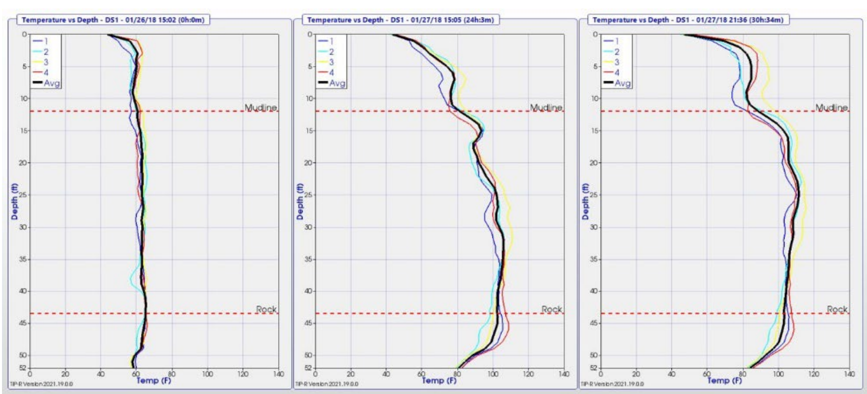

Figure 2: TIP Temperature profiles at 0, 24, and 30.5 hours after placement

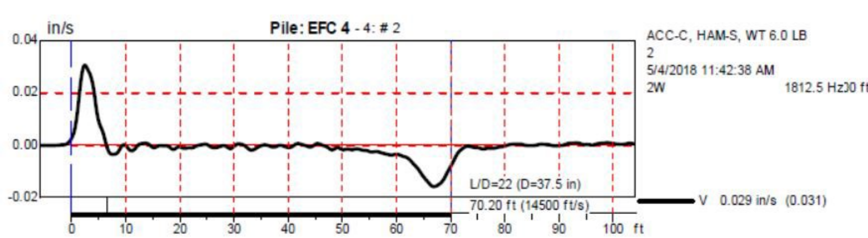

Figure 3: Low strain integrity test results

To learn more about GRL Engineers, visit www.grlengineers.com or email us at info@grlengineers.com.