



Remote SQUID Testing at Frankfort Road over Raccoon Creek – ECMS 101165

Challenge:

GRL Engineers, Inc., provided drilled shaft base cleanliness testing services for the Frankfort Road over Raccoon Creek Bridge Replacement Project in Monaca, PA. GRL was contracted in 2025 to provide **SQUID testing**, a quick and reliable method to obtain quantitative measurements of the debris thickness at the bottom of 43 drilled shafts under the structure. The project's requirements for shaft base debris thickness were very strict, less than 0.5 inches of debris over 50% of the shaft bottom and no location greater than 1.5 inches.

Method:

SQUID tests were conducted at 5 locations around the base of each shaft (**Figure 1**). A Shaft Quantitative Inspection Device (SQUID) (**Picture 1**) utilizes three penetrometers and three displacement plates to measure force and displacement of debris at the bottom of a drilled excavation, quantitatively assessing the base cleanliness (**Figure 2**). The SQUID is deployed using the drill rig's Kelly bar.

GRL Engineers provided training to onsite personnel on the operation of SQUID equipment. While the onsite personnel conducted the SQUID operations, GRL provided real time data collection and analysis services via **Remote Testing** capabilities, greatly reducing the testing costs and increasing the flexibility of the testing schedule.

Results:

SQUID tests indicated sediment/debris thickness above specification for several shafts during the initial testing. Cleanout methods were repeated and optimized over the project lifespan to yield acceptable debris thicknesses for all shafts (**Figure 3**). Specifications for debris thickness prior to concrete placement were eventually met for all 43 shafts. During the initial testing, some shafts required up to 4 tests before the cleanliness requirements were met, while most tests indicated acceptable results on the first test after optimizing cleanout methods based on earlier test results. **Figure 4** represents the test number vs. the average debris thickness for an early-stage test (shaft 40) and an optimized single test (shaft 42). All SQUID tests were completed in less than 15 minutes, with most tests completed in under 10 minutes, which helped with the field operations' pace. Additional savings in testing costs and project time reductions were enhanced with GRL's Remote Testing Services.

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

Project Details

Client: Force Drilling LLC

Location: Monaca, PA

GRL Office: Ohio

GRL Services

- Drilled Shaft Base Cleanliness Evaluation
- Remote Testing Services

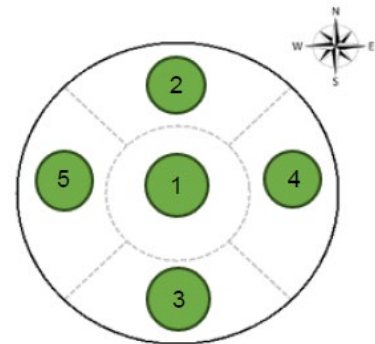


Figure 1. SQUID bottom Testing Locations



Picture 1. SQUID Device

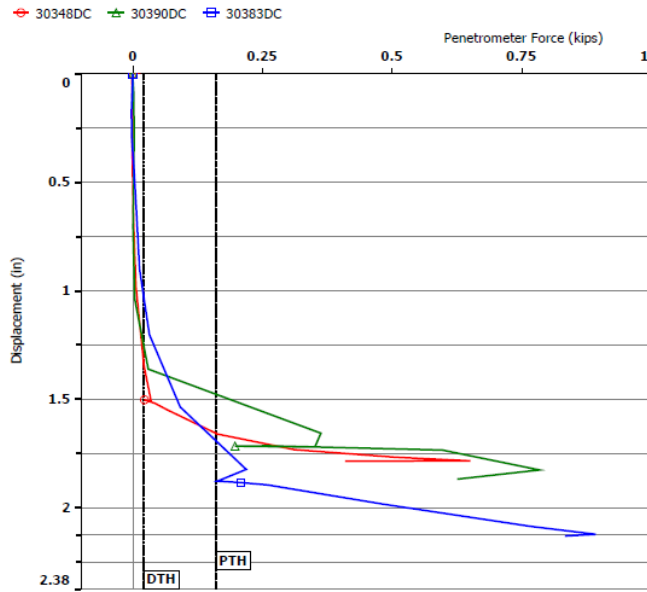


Figure 2. Force vs Displacement Results from SQUID (from the 3 penetrometers)

Flat Tip penetrometers	30348DC	30390DC	30383DC
Disp. at 0.160 kips (in)	1.66	1.48	1.69
Disp. at 0.020 kips (in)	1.31	1.24	1.01
Debris thickness (in)	0.34	0.24	0.68

Figure 3. Debris Thickness Results from SQUID Test (from the 3 penetrometers)

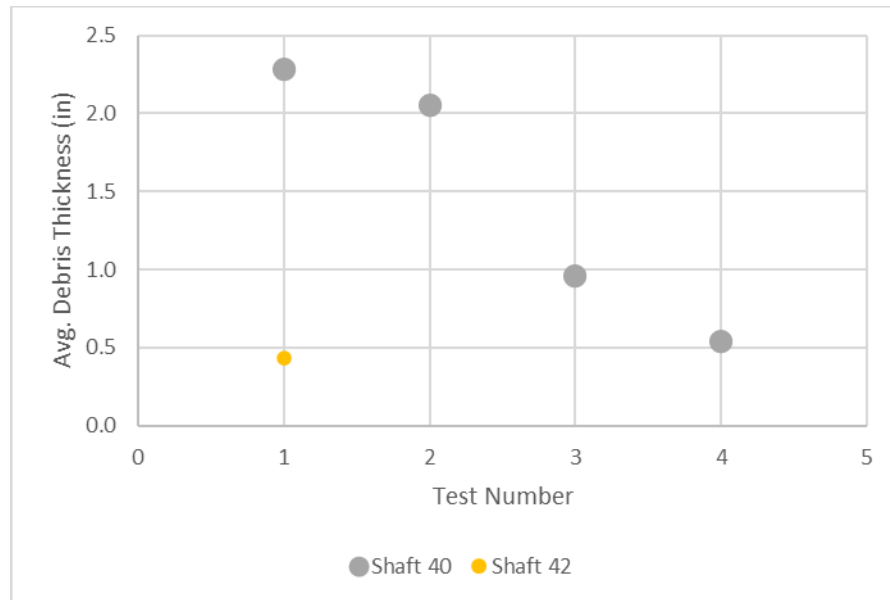


Figure 4. Test number and Debris Thickness for shafts 40 & 42