



Vehicle Assembly Building Modifications for Artemis Moon Missions

Challenge:

In preparation for NASA's Artemis missions returning to the Moon; the largest single-story building in the world, the Vehicle Assembly Building (VAB) at Kennedy Space Center, Florida, underwent structural upgrades and modifications to accommodate the Space Launch System (SLS) and Orion spacecraft. GRL Engineers, Inc. assisted Kingstruction-Advon Joint Venture and Geotechnical Foundation Systems (GFS) with the building construction upgrades. GRL performed Thermal Integrity Profiling (TIP) and APPLE high strain Dynamic Load Testing (DLT) on the new auger cast-in-place pile foundations for the project. The accelerated construction schedule specified Thermal Integrity Profiling (TIP) for quick pile integrity assessments following pile installation.

Method:

[Thermal Integrity Profiling \(TIP\)](#), ASTM D7949, method measures the elevated concrete temperatures that occur during the hydration process. These temperature measurements are made along the length of the pile and can determine the integrity over 100% of the pile cross section, both inside and outside the reinforcing cage. Combining the thermal measurements with the project construction records; average pile diameter/radius, local concrete cover, and cage alignment using multiple Thermal Wires can be determined from the test.

Additionally, high strain [Dynamic Load Testing \(DLT\)](#) was performed in accordance with ASTM D4945. GRL's APPLE 4-ton drop weight and guided lead system was used to apply impacts to the test piles with measurements of strain and acceleration made near the pile head. Dynamic pile testing data was processed with the CAPWAP® (CAsE Pile Wave Analysis Program) software program to estimate the static load bearing capacity of the test piles.

Results

Thermal Integrity Profiling (TIP) measurements were recorded from a single Thermal Wire tied to the full-length pile center reinforcing bar. **Figure 1** represents typical Thermal Integrity Profiling (TIP) results of Temperature vs. Depth, Diameter vs. Depth, and the 2D view of the Pile and Soil Profile. CAPWAP results, presented in **Figure 2**, provide the force measured and computed plot, the analyzed force and velocity measurements recorded with the Pile Driving Analyzer Model 8G (PDA), and a simulated static load test load-displacement plot.

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

Project Details

Client: Kingstruction-Advon Joint Venture

Contractor: Geotech Foundation Systems

Location: Kennedy Space Center, Florida

GRL Office: Florida

GRL Services

- Thermal Integrity Profiling
- APPLE Dynamic Pile Load Testing
- CAPWAP® Analyses



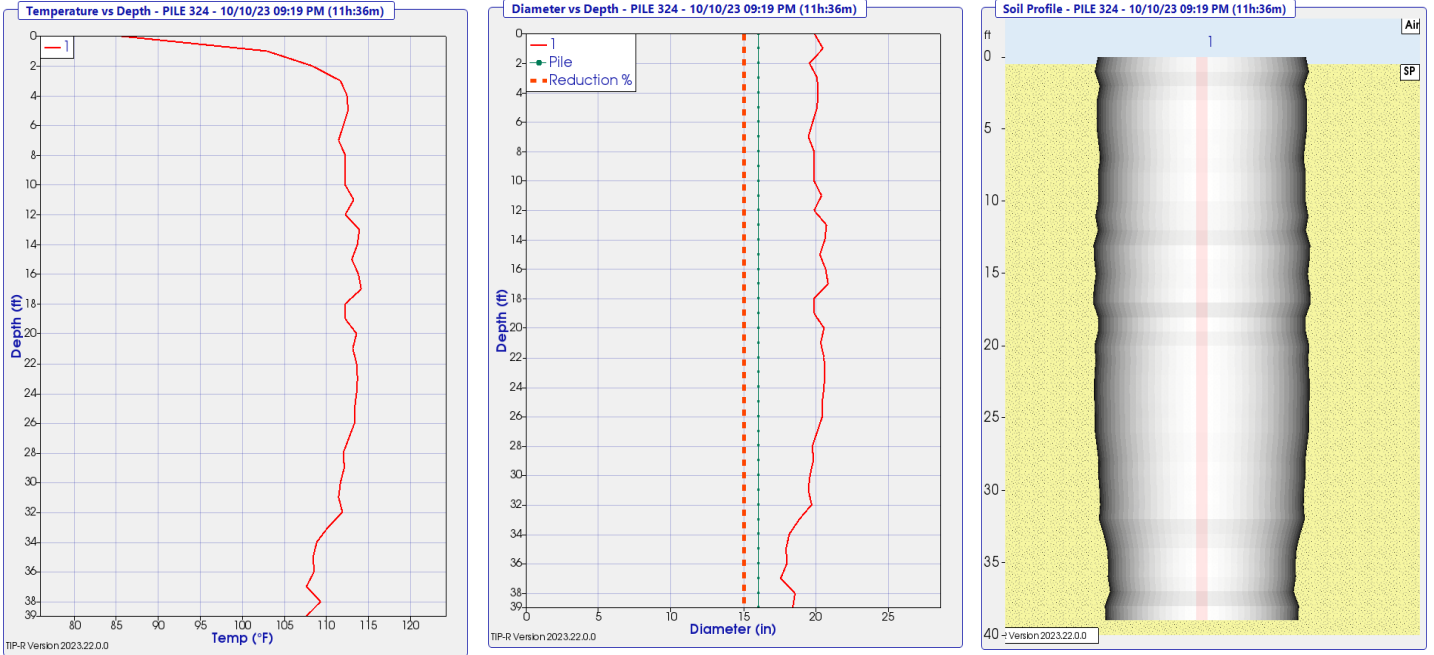
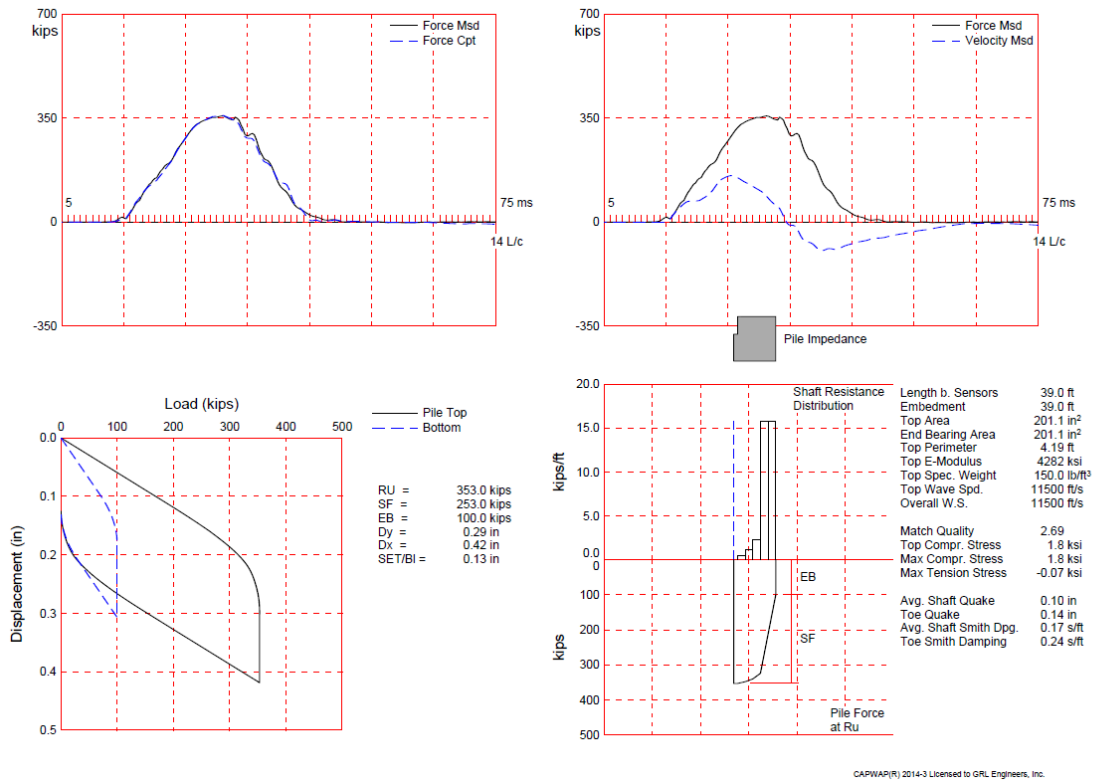


Figure 1. Thermal Integrity Profiling (TIP) results of Temperature vs Depth, Diameter vs. Depth, and Pile 2D view with Soil Profile



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Figure 2. CAPWAP Simulated Static Load Test Load-Displacement Plot, Force and Velocity Record and CAPWAP Force Matching Plot