GRL Engineers, Inc.

1000-Ton Load Test in Ohio

Challenge:

A project in Ohio for a large plant was initiated in 2023. A substantial test program was established. The goal of the program was to confirm the shaft design in compression, tension, and lateral capacity, as well as establish proper shaft installation techniques for production shafts. Integrity testing was used to identify potential anomalies in the concrete shafts.

Method:

The job was divided into three test locations, which each utilized compressive static load testing, tension and lateral load testing, dynamic load testing, low strain integrity testing, and thermal integrity profiling all on 36-inch diameter drilled test shafts. These shafts were installed using 39-inch outer diameter temporary casings. The shafts were constructed using the free fall method of concrete placement in a dry shaft.

Results:

Sample results from Test Site Location 3 will be used to show testing results. The compressive static load test utilized a maximum compression load of 1,05 kips in increments of 5% with each load being held for 10 minutes. The load was removed in 5 decrements, each held for 10 minutes. Measurements collected by displacement gages can be viewing in Figure 3-1. The tension load test was applied and held for 10 minutes per increment. Measurements from the tension load test can be reviewed in Figure 3-2. The lateral load test was specified to be 300 kips. Results can be viewed in Figure 3-3.

The dynamic load test utilized an APPLE 9 load test system with a 16-ton ram weight. The load was dropped from distances ranging from 6 inches to 5 feet. A top force transducer was utilized, as well as plywood for cushion. One of the impacts from the test was selected for CAPWAP analyses. Results from this analysis can be reviewed in Figure 3-4.

Thermal Integrity Profiling was utilized to assess the shaft shape, integrity, and concrete quality. TIP results are displayed in Figure 3-5. Low Strain Integrity Testing was also conducted, and results can be viewed in Figure 3-6.

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

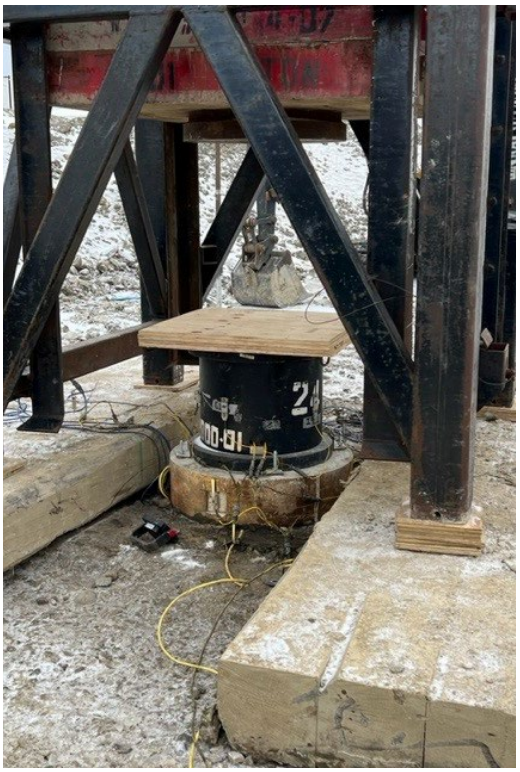
Project Details

Location: Central Ohio

GRL Office: Ohio

GRL Services

- Compressive Static Load Testing
- Lateral Static Load Testing
- Tension Static Load Testing
- APPLE Dynamic Load Testing
- Thermal Integrity Profiling
- Low Strain Integrity Testing
- CAPWAP Analysis



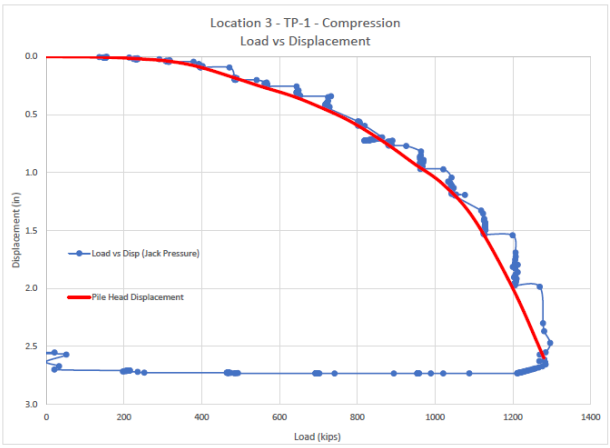


Figure 3-1. Compressive Static Load Test Results

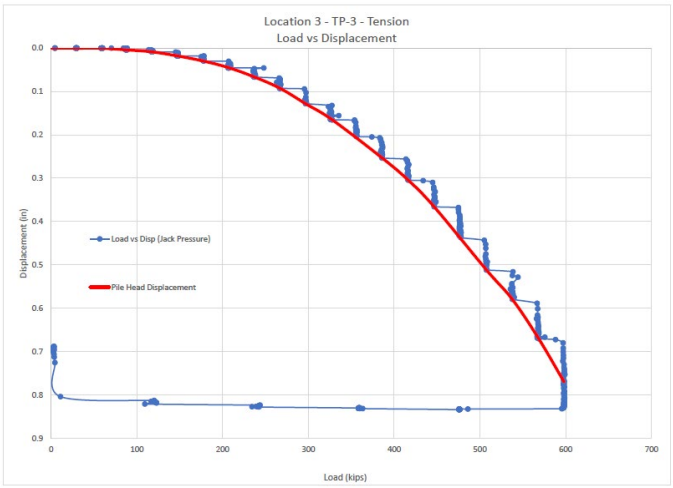


Figure 3-2. Tension Static Load Test Results

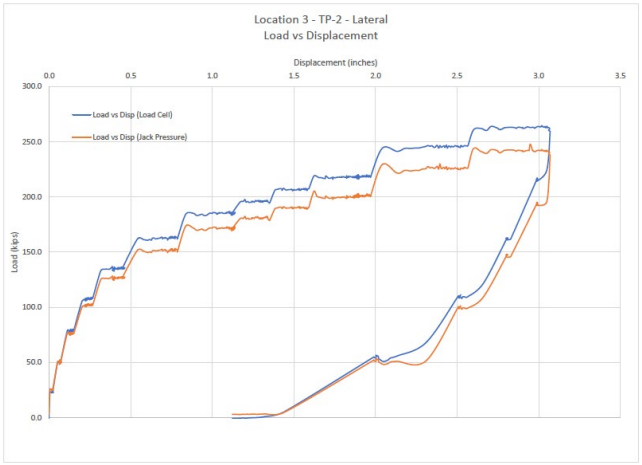


Figure 3-3. Lateral Static Load Test Results

Summary of Case Method Results

Project: Hammer: APPLE 9 (16-ton drop weight)

Shaft Number	Test Date	Pile Diameter (in)	Reported[1] Shaft Length (ft)	Impact No.	Ram Drop Height (in)	Set per[2] Blow (in)	Transf'd Energy (kip-ft)	Max. Compressive[3] Force (kips)	Max. Compressive[3] Stress (ksi)	CAPWAP Mobilized Capacity (kips)
TP-1	1/10/2024	36	33.1	1	6	0.02	4.3	483	0.50	-
				2	12	0.03	10.2	695	0.7	-
				3	24	0.08	23.6	1,142	1.1	-
				4	36	0.14	43.0	1,893	1.9	-
				5	48	0.27	70.4	2,753	2.7	915
				6	60	0.42	97.6	3,488	3.4	-

Notes:
1 - Shaft length below existing grade
2 - Set measured using scale on pile and tripod-mounted level
3 - Average stress near the pile top calculated from multiple strain gages located on the pile top transducer

Summary of CAPWAP Results

Project: Hammer: APPLE 9 (16-ton drop weight)

Shaft No.	Ram drop Height (in)	Observed Set (in)	Mobilized Capacity Total (kips)	Mobilized Capacity Shaft (kips)	Mobilized Capacity Toe (kips)	Soil Damping Shaft (sec/ft)	Soil Damping Toe (sec/ft)	Soil Quake Shaft (in)	Soil Quake Toe (in)
TP-1	48	0.27	**915**	635	280	0.16	0.40	0.29	0.66

Figure 3-4. Dynamic Load Test Results

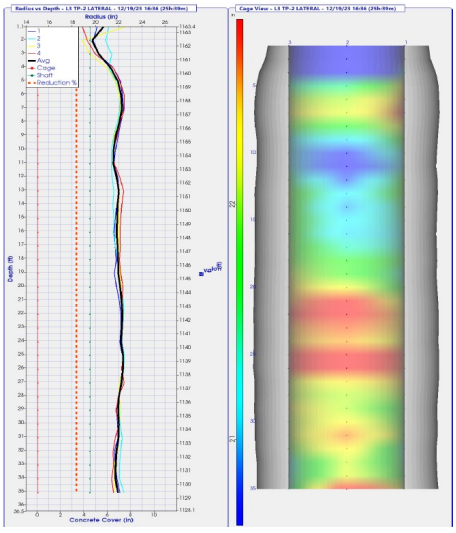


Figure 3-5. Thermal Integrity Profiling Results

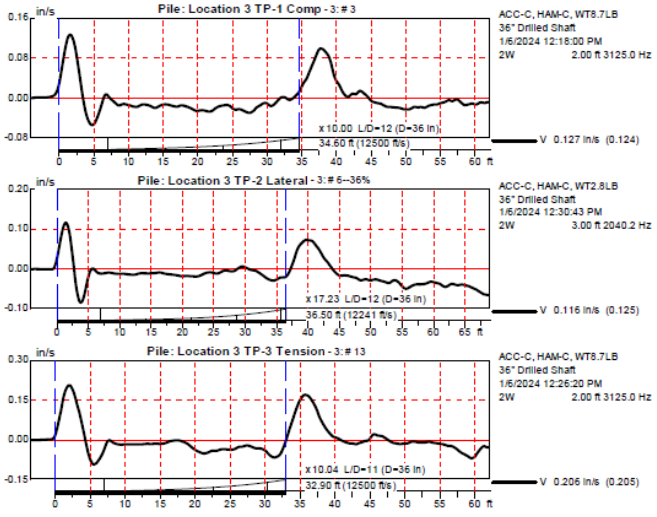


Figure 3-6. Low Strain Integrity Testing Results