GRL Engineers, Inc.

Rehabilitating the Van Wyck Expressway

Challenge:

Nine bridges over Van Wyck Expressway (VWE) in Queens, NY required repairs, major rehabilitation, and/or replacement. To address the structural repairs and facilitate future widening of the VWE, the existing conventional abutments were replaced with new abutments, constructed using top-down construction techniques behind the existing abutments. The new design utilized a single row of partially cased micropiles, and proof testing was proposed to be performed using conventional static load testing procedures. The design-builder evaluated the contract requirements and encountered multiple challenges, including lane/traffic closure limitations, utility conflicts, serviceability of the existing bridge, and accessibility to pile locations. Initially, static proof tests were performed onsite on sacrificial piles near the proposed bridge abutments. Drilling the permanent casing to the tip elevation, and withdrawing the casing while grouting was problematic and caused the casing to become damaged. GRL Engineers, Inc. was consulted, and dynamic load testing was suggested as an alternative testing method. Because the NYSDOT required Type B micropiles in soil, Thermal Integrity Profiling (TIP) was added to assess integrity of the alternatively constructed piles.

Necessary changes were integrated into the testing plan and GRL performed dynamic load testing using our APPLE drop weight system to assess soil resistance with focus on the bond zone which was uncased. An additional testing challenge presented itself as the tops of the production piles were approximately 6 feet below ground level (road). A follower system had to be fabricated and approved for testing to be performed. Thermal Integrity Profiling (TIP) was also performed to assess grout integrity and quality along the pile bond lengths.

Method:

Dynamic load testing was performed on thirty-three (33) 16-inch O.D. micropiles using an APPLE drop weight system (fig. 1). The micropiles were impacted with a load testing device utilizing a 9-kip ram weight and variable drop heights. The loading stack consisted of an instrumented top transducer, a 6.5 ft follower section, followed by the micropile itself. Drop heights used during testing ranged from 1.0 - 6.5 ft. Dynamic load testing was performed during night shifts to meet traffic control requirements and was completed during two different phases in 2021 and 2022. Each test allowed the designers and owner to check the design and load carrying capability of each tested pile.

Pile integrity was evaluated with Thermal Wire® cables, and TAG or TAP-Edge data collectors installed by the design-build team throughout the length of the project after initial onsite training was provided by a GRL Engineer. The thermal data was uploaded in real time to a secure cloud server and analyzed, without the need for a GRL engineer to visit the jobsite.

Project Details

Client: Posillico-El Sol Joint Venture

Engineer: Dewberry Engineers, Inc.

Owner: NYS Department of Transportation

Location: Queens, NY

GRL Office: Pennsylvania

GRL Services

- Thermal Integrity Profiling (TIP)
- Dynamic Load Testing with APPLE
- CAPWAP® Data Analysis

Results:

Dynamic load testing using the APPLE drop weight system allowed for multiple load tests to be conducted quickly and at a fraction of the cost of performing static load tests. The piles tested had required nominal axial pile resistances ranging from 240 to 552 kips, which were achieved with dynamic load testing. Data acquired from the drop weight test was then analyzed with CAPWAP® software to further evaluate static pile capacity including the soil resistance distribution along the shaft with focus on the bond zone and at the toe, upon completion of testing. Utilization of TIP provided 3D plots (Figure 1) of each test pile, allowing for integrity evaluations in coordination with load capacity assessments from dynamic load testing results (Figure 2).

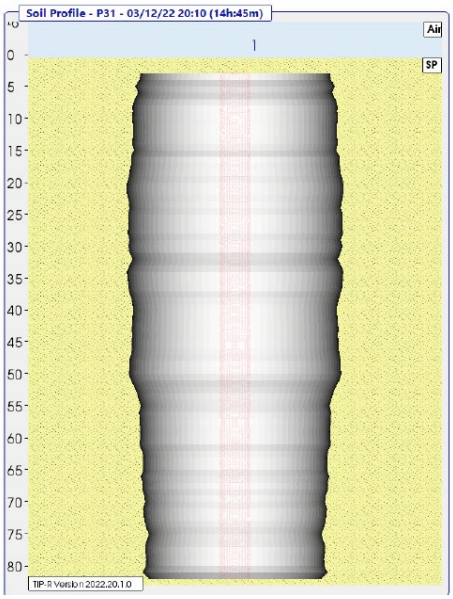

Figure 1: 3D plot of pile with soil profile

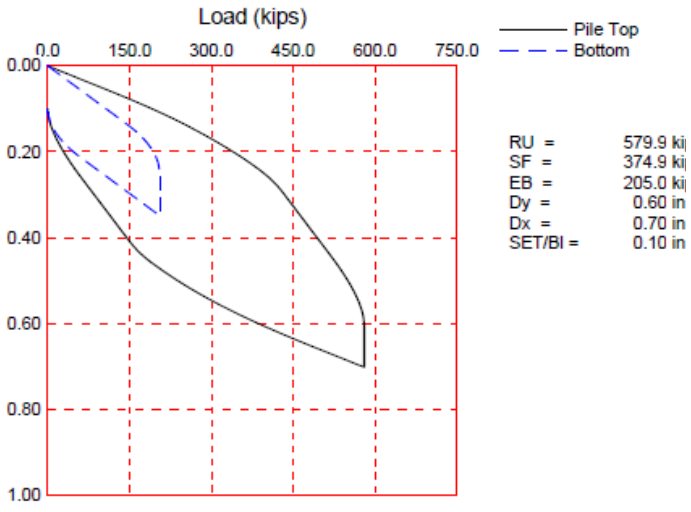

Figure 2: Load vs Displacement