DEEP FOUNDATIONS

DUCTILE IRON PILES

PETERBOROUGH ST. APARTMENTS

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INTRODUCTION

Redevelopment on Peterborough Street in the Fenway Park District of Boston consisted of construction of a 5-story apartment building immediately adjacent to existing 3- to 4-story residences.

GEOTECHNICAL CONDITIONS

Subsurface conditions at the site were typical for urban construction with up to 9 feet of loose to medium dense "urban" sand fill underlain by soft peat and organic clay/silt to 28 feet. The fill and organics were underlain by very soft to medium stiff clay extending to a depth of 175 feet where bedrock was encountered.

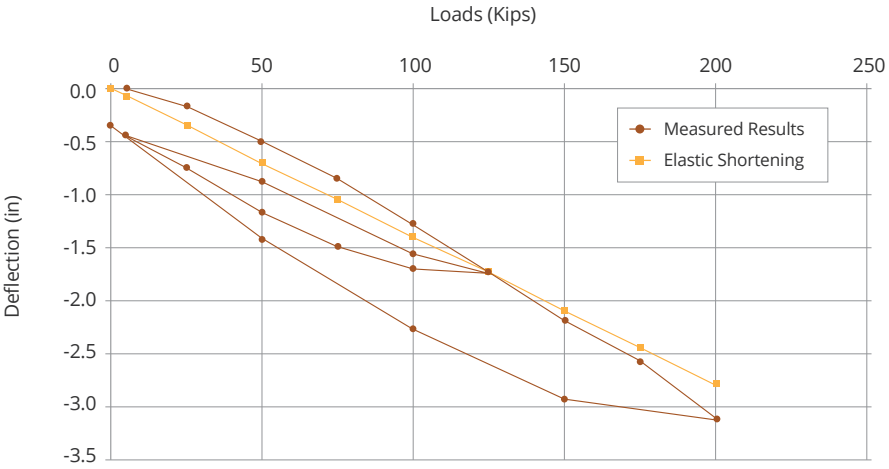
PROJECT CHALLENGES

Install a foundation system capable of transferring the high building loads through the deep, soft soils with minimal vibrations in the dense, residential neighborhood.

DESIGN AND CONSTRUCTION SOLUTION

Common options for foundation support in the urban environment included steel H-piles, caissons and drilled mini-piles. Steel H-piles driven through the fill / soft soils to rock to generate 100 ton capacities were initially considered by the design team to support the loads approaching 600 kips. High vibrations coupled with the challenges of transporting long pile sections and the added cost/time for pile splicing led the design team towards a more practical solution for the urban site. Ductile Iron Piles were selected as a more cost-effective and faster alternative to the H-piles and traditional drilled micropiles. The Ductile Iron Pile system provided a 2:1 replacement of the H-piles with a working capacity of 50 tons.

The design of the Ductile Iron Pile system was performed by Helical Drilling and featured a Series 118/7.5 (118 mm diameter with 7.5 mm wall thickness) to develop the 50 ton working capacity. A pre-production test pile was installed by Helical to terminate on rock at a depth of 175 feet. The test pile was loaded using a gravity reaction load test setup because of the costs associated with deep rock anchors for tension resistance. Load testing of the end-bearing Ductile Iron Piles showed a deflection of 1.25 inches at the design load (100%) of 50 tons. The load test was performed to 200% of the design load (100 tons). The response was nearly perfectly elastic with a deflection at the maximum test load approaching 3 inches. The deflection of the 175-ft long test pile met expectations for compression of a long micropile. The results met the project teams expectations while also delivering foundation economy.



With the specialized Plug-and-Drive connection that eliminated the need for splicing or welding of the joints, installation of the DIPs was accomplished rapidly at the site despite winter working conditions. Production pile installation was performed at rates of 1,000 feet per day or more. A total of 87 piles were installed in just over 2 weeks. Vibration monitoring performed during installation recorded peak particle velocities of only 0.3 inches/second on the ground 2 feet away from installations. The vibrations were reduced to 0.15 inches/second a distance of 4 feet away. Measurements on the existing building foundations were less than 0.15 inches/second while installations were within 2 feet from the building.

PROJECT DETAILS

Location: Boston, MA
Project Type: Housing
Service: Deep Foundations
Technique: Ductile Iron Piles (End-Bearing)
Geotechnical Challenge: Unsuitable Soil Conditions, Work Adjacent to Existing Structures, Difficult Access

DUCTILE IRON PILE ADVANTAGES

- Rapid installation
- Minimal vibration levels
- Verifiable performance with load testing
- High capacity