

ARIN REALTY OFFICE BUILDING

Location: Newton, MA

Project Type: Office Building



DUROTERRA™



DUCTILE IRON PILE ADVANTAGES

- More than twice the capacity as helical piles
- Reduced pile quantity by 35%
- Low vibration installations

PROJECT DESCRIPTION

The project involved construction of a new 2.5-story commercial office building located immediately between two existing commercial buildings. Loading conditions ranged from 30 to 120 kips at column locations and 3.5 k/ft along perimeter grade beams.

GEOTECHNICAL CONDITIONS

Subsurface investigations encountered a layer of very loose to medium dense sand fill extending to depths of approximately 6 to 9 feet. The fill was underlain by up to 7 feet of peat and organic silt. The fill and organic deposit were underlain by medium dense to dense alluvial sand and gravel extending to the maximum explored depth of 27 feet. Groundwater was encountered at approximately 10 feet below grade.

PROJECT CHALLENGES

Use a low-vibration, friction pile to develop sufficient capacity in the sand and gravel to replace lower capacity helical piles for foundation support.



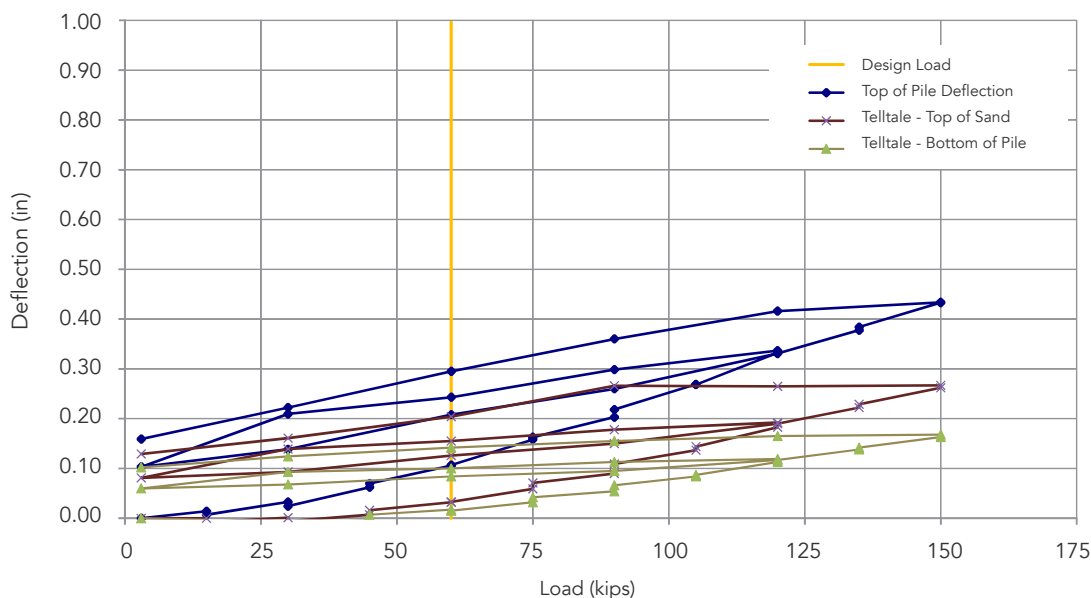
DESIGN AND CONSTRUCTION SOLUTION

The project was originally designed for (85) 15-ton helical piles to provide pile cap and grade beam support. During installation, the helical piles generated insufficient torque in the sand and gravel prior to “spinning out” on very dense soils. As an alternate to the helical piles, the design team elected to utilize a low vibration, higher-capacity friction Ductile Iron Pile to provide foundation support. An increased capacity of 30 tons was selected, reducing the quantity to 56 piles.

A Series 118/7.5 (118 mm diameter with 7.5 mm wall thickness) pile with a 220 mm oversized conical grout cap was selected for design. The DIP design required penetration of the fill and organics followed by development of a 14-foot bond length in the medium dense sand and gravel layer.

A pre-production tension load test was performed at the site. The pile moved 0.11 inches at the design load of 60 kips (100%) and 0.33 inches at 120 kips (200%). After rebounding back to the seating load, the pile was loaded up to 150 kips (250%) and experienced movement of 0.43 inches of movement. Net deflection after unloading was 0.16 inches. Telltales confirmed at least 150% of the design load was transferred to the top of the bond zone. Test results confirmed the working capacity.

Vibration levels measured during installation ranged from about 0.3 to 1.0 in/s with an average level around 0.4 in/s at distances of 5 feet from pile installation. Vibration levels continued to rapidly dissipate with distance.



PROJECT TEAM

DIP Design/Build Partner: Helical Drilling, Inc.
Geotechnical Engineer: McPhail Associates, LLC
Structural Engineer: Leavitt Associates, Inc.
Owner/Developer: Arin Realty Co., Inc.