

# PHYSICIANS' CLINIC OF IOWA PARKING GARAGE

Location: Cedar Rapids, IA

Project Type: Commercial



**DUROTERRA™**



## DUCTILE IRON PILE ADVANTAGES

- Low vibrations
- High capacity in end-bearing
- Rapid installations
- Compatibility with ground improvement system
- Easily adjust to variable rock depths

## INTRODUCTION

Construction consisted of a new 450-car, five-level parking garage. The western edge of the proposed garage was located along the property line and bordered an existing commercial building. Column loads in this location of the project were up to 900 kips.

## GEOTECHNICAL CONDITIONS

Soil borings encountered up to 8 feet of fill (sand, silty/clayey sand, clay) underlain by very loose to medium dense sand and silt to 22 feet. Medium dense to very dense sand was then encountered followed by bedrock at depths ranging from 38 to 48 feet. No groundwater was encountered.

## PROJECT CHALLENGES

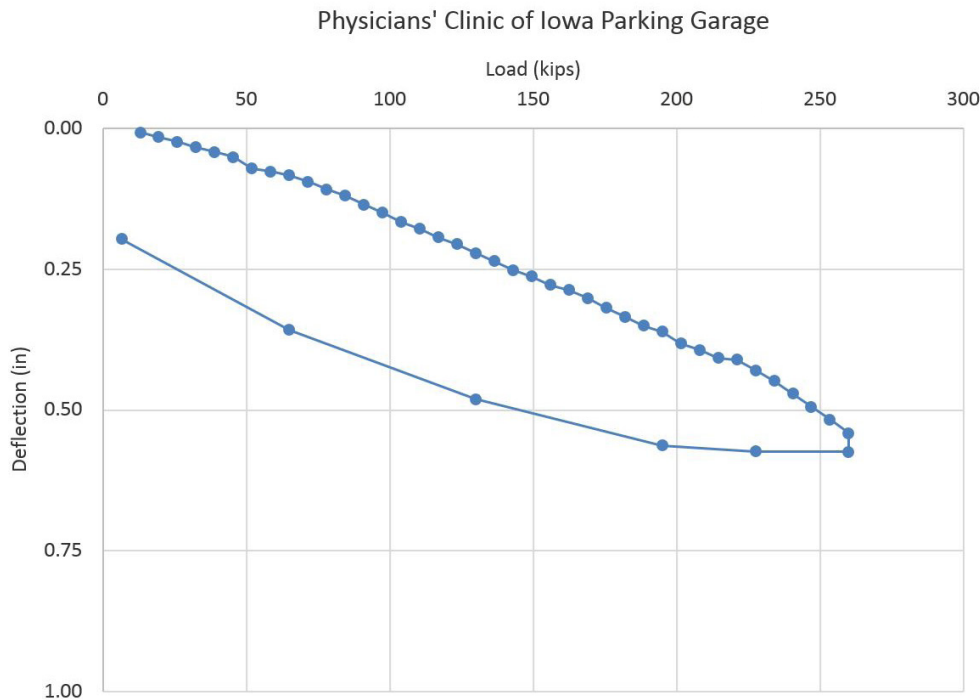
Provide a low vibration foundation support solution to minimize impacts on the adjacent building and be compatible with the ground improvement system used for foundation support elsewhere on the project.



## DESIGN & CONSTRUCTION SOLUTION

Ground improvement methods were originally planned for support of all parking garage foundations. However, vibrations in the vicinity of the existing building reached levels of 0.6 in/sec during installations of the displacement Geopier® system and were deemed excessive. The project team looked for alternative foundation support solutions that would minimize vibrations and potential impacts on the adjacent building. With a Ductile Iron Pile project being installed by Peterson Contractors, Inc. (PCI) only a few miles away, the team was able to observe installations and monitor vibrations at the nearby site. Results showed that vibrations of only 0.26 in/sec were measured at 10 feet from the installation location which met the vibration tolerance of 0.4 in/sec or less.

Ground Improvement Engineering, Inc. (GIE) and the project team immediately began working to develop a foundation support solution using the Ductile Iron Pile system. A design featuring Series 170/7.5 (170 mm outer diameter and 7.5 mm wall thickness) piles would develop 65 ton working capacity when installed to achieve set on the very dense sand or rock. Engineers at Lynch Mykins Structural Engineers redesigned the foundations along a portion of the perimeter wall line using pile caps and grade beams incorporating the 65 ton pile working capacity. One shear wall location also required lateral load resistance of 4 kips per pile. A total of 44 piles were required.



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Prior to production pile installation, a non-production test pile was installed for load testing to verify the design capacity. The test pile was driven to a depth of 38 feet and achieved a set of  $\frac{3}{4}$ -inch in 50 seconds. Load test results showed only 0.22 inches of movement at 130 kips (100% of the design load). A deflection of 0.57 inches was recorded at 260 kips (200% of design load) following a hold period to evaluate creep. Upon unloading, the pile rebounded to about 0.2 inches.

Following successful load testing, the production piles were all installed and the project was able to continue moving forward. The Ductile Iron Pile solution was able to provide a low vibration alternative and be designed for compatible settlements with the ground improvement system used on the remainder of the project. In addition, since GIE and PCI were experienced at designing and installing both systems, the project could move forward without having to bring in a new design/build specialty contractor.



## PROJECT TEAM

**Ductile Iron Pile Designer:** Ground Improvement Engineering, Inc.

**Ductile Iron Pile Installer:** Peterson Contractors, Inc.

**General Contractor:** BBL Construction Services

**Geotechnical Engineer:** TEAM Services, Inc.

**Vibration Monitoring Engineer:** Braun Intertec, Inc.

**Structural Engineer:** Lynch Mykins Structural Engineers, P.C.