

## Model 350 Retrofit Helical Piers and PolyLevel®

**Project:** Four-Story Stair Tower

**Location:** Omaha, NE

**Date:** March 2019

### Challenge:

A stair tower addition to an existing four-story building experienced settlement not long after construction. The stair tower is approximately 53 feet high, 16 feet long and 13 feet wide and constructed with 1-foot thick insulated precast concrete panels on a poured concrete foundation wall and a shallow spread footing. Service loads for the tower were estimated to be about 10.7 kips per linear foot.

Total settlement was estimated at up to 1.25 inches with differential settlement across the width of the stair between  $\frac{5}{8}$  and  $\frac{3}{4}$  inch. The differential settlement resulted in the stair tower tipping away from the face of the main structure about 3 inches at the top of the wall. Soil borings advanced near the stair tower showed about 8 feet of very soft to medium stiff clay fill underlain by very soft to medium stiff fat clay to a depth of about 38 feet, where it transitioned to a loose to medium dense sand to a depth of about 93 feet. An immediate solution was needed to prevent further settlement of the stair tower. Other structures in close proximity to the tower limited access for large construction equipment.

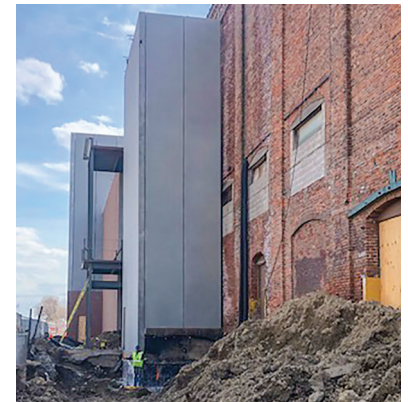
### Solution:

Underpinning and lifting with retrofit helical piers was the preferred deep foundation option since the mobilization, installation and lift operations could be performed quickly in the limited access area. Thrasher Commercial Group was contracted to install retrofit helical piers at 14 locations around the exterior walls of the stair tower. The piers were spaced at a maximum of 3.5 feet to support a design working load of 37.5 kips. The helical pier design consisted of the Model 350 (3.50-inch OD by 0.340-inch wall) hollow round shaft with a 10"-12"-14"-14" helix plate configuration. The piers were installed to lengths ranging from 33 to 75 feet below the footings after achieving at least 10,700 ft-lbs of torque and torque-correlated ultimate capacities of at least twice the design working load. Three piers were proof tested using a gradual loading schedule up to a maximum 52.5 kip load (1.4 times the working load) with a 10 minute hold time. The proof testing showed deflections less than 0.001 inch during the hold period. Following testing, the piers were simultaneously loaded and the structure was lifted up to 1.25 inches at the foundation level and the piers were "locked off." The lift operations effectively moved the top of the stair tower back to its original position against the building. Following lift and lock-off operations, the inner annulus of the piers were filled with a 3,000 psi grout mix and the void space created under the footings and interior floor slab was filled with 100 pounds of PolyLevel PL400. PL400 is a two-part liquid urethane that is mixed and injected through small 3/8-inch drilled holes in the slab to expand into a rigid foam. PL400 has an installed density of 4 to 6 pcf with a compressive strength of 70 to 80 psi.

## Project Summary

**Pier and PolyLevel® Installer:** Thrasher Commercial Group

**Product Installed:** (14) Supportworks® Model 350 Helical Piers, 10"-12"-14"-14" Plate Configuration, Design Working Compression Load of 37.5 kips, Installed Lengths of 33 to 75 feet; 100 lbs of PolyLevel® PL400



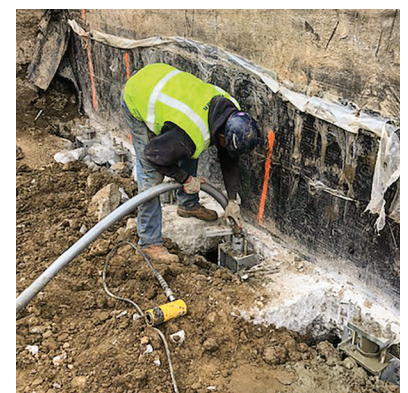
Four-story stair tower addition



Helical piers and retrofit brackets installed



Simultaneous loading with hydraulic cylinders during lift and lock off operations



Grout filling installed helical piers