FOUNDATION SUPPORTWORKS®

CASE STUDY

Commercial

Model 288 Piers and PolyLEVEL® PL250

Project: Mid-Continent Public Library
Location: Liberty, MO
Date: September 2014

Challenge:

The 70-foot-long by 40-foot-deep "bump-out" section of the library experienced differential settlement relative to the main structure and along its exterior wall lines. Cracks were observed in the block and stucco interior and exterior wall finishes, respectively, as well as in the interior floor slab. The bump-out also included an architectural feature (window awning) extending from the exterior wall line and supported by two columns.

The general soil profile consisted of three feet of clay fill over very stiff silty clay to a depth of approximately 35 feet. The fat clay was underlain by weathered limestone bedrock.

Solution:

A system of hydraulically-driven push piers was selected to permanently stabilize and potentially lift the settled portion of the building. Eighteen (18) Model 288 (2.875-inch OD by 0.165-inch wall) push piers were installed along the exterior walls at a seven-foot maximum center-to-center spacing based on a design working load of 24 kips. A continuous excavation was made along the outside of the building to expose the footing. At each pier location, the underside of the footing was trimmed smooth for uniform bearing on the retrofit bracket. The push piers were advanced to depths from 33 to 37 feet below grade to bear on the competent bedrock and achieve hydraulic fluid pressures of at least 4,000 psi, corresponding to 56.7 kips of drive force. Hydraulic lift cylinders were then fitted to the installed pier assemblies and connected in series to uniformly lift the exterior walls approximately 2.25 inches back toward its original elevation. Lift pressures averaged 2,600 psi for a push pier factor of safety of at least 1.5 (FOS = drive pressure/lift pressure).

The lightly loaded columns supporting the window awning were supported by retrofit helical piers. Helical piers are often considered in lieu of push piers where adequate reaction is not provided by a light structure or building feature. Four (4) Model 288 (2.875-inch OD by 0.276-inch wall) hollow round-shaft helical piles with a 10"-12" double-helix plate configuration were installed, two per column, to support a design working column load of 15 kips. Standard extensions advanced the piles to depths from 18 to 21 feet to achieve torque-correlated ultimate capacities of at least twice the required design working pier load (FOS ≥ 2).

A large portion of the floor slab with significant settlement damage would have to be removed and replaced. Thirty four (34) Model 288 (2.875-inch OD by 0.165-inch wall) hydraulically-driven slab piers were installed to stabilize the remaining undamaged slab section. Slab pier locations were laid out in grid patterns with a maximum spacing generally less than six feet. Cored holes, eight inches in diameter, were made through the floor to allow for bracket installation. Slab piers were advanced until mobilization of the slab occurred. Hydraulic lift cylinders were again used to lift the slab back toward the original elevation. PolyLEVEL® polyurethane foam was then injected under the slab to fill voids. Once injected, the two liquid urethane components react to form a rapidly setting rigid foam with a compressive strength generally greater than 70 psi.

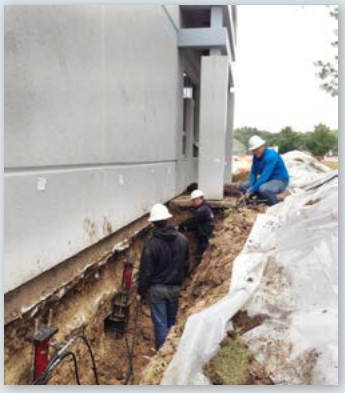
Project Summary

Structural Engineer: RTI Consultants, Inc.
Geotechnical Engineer: Olsson Associates
Certified Installer: Foundation Recovery Systems
Products Installed: (18) Foundation Supportworks® PP288 Push Piers, Depths from 33 to 37 feet, Design Working Load of 24 kips; (4) FSI HP288 Helical Piles, 10"-12" Helix Plate Configuration, Depths from 18 to 21 feet, Design working load of 15 kips; (34) FSI SP288 Slab Piers; PolyLEVEL® PL250

Bump-out with window awning on right

Driving exterior push piers

Slab pier installation



Lift cylinders fitted to installed piers

Void filling with PolyLEVEL®