

## Model 350 Push Piers

**Project:** Memorial Union Stabilization  
**Location:** Columbia, MO  
**Date:** August 2014

### Challenge:

Memorial Union serves as a community center and student union building for the University of Missouri. The building's prominent bell tower is considered by many to be the unofficial symbol of the university. Settlement was observed at the ten-foot by 20-foot covered upper landing connecting an ADA-compliant wheelchair ramp to the rear of the building. The settlement was evident by separation of the stone and brick façade where the walls of the covered landing met the building. The university feared the settlement was putting stress on an existing propylene glycol radiant snowmelt system running through the ramp and landing slabs. A retrofit foundation support system would be required to stabilize the landing and prevent further settlement without putting additional stress on the radiant system.

Soil borings performed for previous construction on campus provided a general subsurface profile consisting of 35 feet of silty clay underlain by shale bedrock.

### Solution:

Hydraulically-driven push piers were selected as the ideal solution to permanently stabilize the upper landing. A total of four (4) push piers, two each on two perpendicular walls of the landing, were installed on the outside faces of the walls to prevent removal of the landing slab. The push pier system consisted of Model 350 (3.50-inch OD by 0.165-inch wall) pier tube and side-load retrofit brackets to support design working loads from 26 to 49 kips. The footing was prepared at each pier location by removing excess concrete that extended beyond the plane of the vertical face of the poured foundation wall. The push piers were advanced to an average depth of 45 feet below the bottoms of the footings to achieve hydraulic fluid pressures from 5,500 to 8,000 psi, corresponding to approximately 51 to 77 kips of drive force, respectively (FOS>1.5). After the piers were driven individually, they were reloaded to their respective design working load and locked-off to stabilize the structure and prevent further settlement. Adhesive anchors were installed to connect the brackets to the foundation. The bracket assembly components were hot-dip galvanized and the pier tubes were triple-coated, in-line galvanized for corrosion protection. The retrofit brackets and upper portions of the piers were encased in concrete to provide additional stability and corrosion protection. The pier installation was completed in one day.

## Project Summary

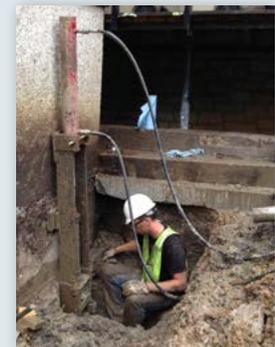
**Structural Engineer:** Structural Engineering Associates  
**General Contractor:** KBR, Inc  
**Specialty Foundation Engineer:** SFA Design Group, LLC  
**Certified Pier Installer:** Foundation Recovery Systems  
**Products Installed:** (4) Foundation Supportworks® PP350 Push Piers, Average Installation Depth of 45 feet; Design Working Loads from 26 to 49 kips



Memorial Union bell tower



Footing preparation



Driving Model 350 pier tube



Push piers installed



Retrofit bracket encased in concrete