FOUNDATION NATION
FSI NEWSLETTER FOR DESIGN PROFESSIONALS

FSI Receives Push Pier Evaluation Report

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Foundation Supportworks® is pleased to announce the issuance of evaluation report ER-289 by the IAPMO Uniform Evaluation Service (UES). The report confirms compliance of FSI's Model 288 (2.875-inch O.D. by 0.165-inch wall) hydraulically-driven push pier system to the 2009, 2012 and 2015 editions of the International Building Code (IBC). Product evaluation followed submittal of design calculations, results from standardized retrofit bracket test procedures, and results from additional laboratory tests to address specific sections of IBC Chapter 18.

The group of companies that makes up the IAPMO have been involved in product recognition in building product listings and evaluation reports for over 70 years. Their evaluation reports are widely trusted by contractors, inspectors, building officials and design professionals across the country.

Hydraulically-driven push pier systems are most often used to lift and/or stabilize existing structures experiencing settlement, or to provide additional capacity of an existing foundation during a renovation or addition project. The foundation is exposed, the retrofit foundation bracket set, and pier sections are hydraulically-driven through the bracket using the combined structural weight and any contributory soil load as drive resistance. Design professionals familiar with how these systems work have found them to be a great foundation support option. This technology, although often thought to have been developed in the last 20 to 30 years, actually dates back to pre-1900. On June 30, 1896, Jules Breuchard was awarded with what is believed to be the first patent on a push pier system in the United States (US Patent No. 563,130).

Foundation Supportworks is one of only two manufacturers to have a push pier evaluation report based on standardized retrofit bracket test procedures and stating compliance with the applicable sections of the IBC. In the United States and Canada alone, there are about ten major manufacturers of push pier systems that distribute products to networks of installing contractors. There are likely over 50 other facilities that claim to manufacture push piers, with most of these fabricating product for their own use. These products generally have not been designed and tested for conformance to the IBC or any other documented standard. The claimed capacities for these other systems therefore demand much more scrutiny.

Foundation Supportworks is committed to being the leading manufacturer of helical foundation systems and hydraulically-driven push pier systems and is proud to have reached this important milestone in verifying code compliance of another one of our products. With this report, design and building professionals alike can have even more confidence that our products will perform as indicated. A copy of IAPMO UES ER-289 can be downloaded from the Foundation Supportworks website at *www.OnStableGround.com/Technical Information/Evaluation Reports.*

FOUNDATION SUPPORTWORKS

- **New Construction and Retrofit Helical Piles**
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- **Helical Soil Nails**
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CASE STUDIES - PUSH PIERS

Project: Private Residence Stabilization ● **Location:** Jacksonville, FL
Pier Installer: Alpha Foundation Specialists, Inc.

Challenge: A relative elevation survey showed that a 9,300 square-foot residence settled differentially up to 9.5 inches toward the rear of the house and up to six inches in the area of the attached garage. Sloping floors and cracks in the brick exterior were observed as a result of the settlement. The suspected cause of settlement was a soft layer of organic material found from a depth of approximately 5 to 25 feet below the existing home.

The home was originally built on a deep foundation system including 1.5-inch solid square shaft helical piles. However, these piles had likely failed due to the lack of lateral support and resistance within the very soft, organic soils. Solid square shaft helical products are more commonly recommended for tension applications where lateral support from the surrounding soils is less critical. Square shaft helical products also generally have less rigid coupling details and lower sectional properties than their round shaft counterparts.

Solution: Hydraulically-driven push piers were chosen to permanently stabilize and attempt to lift the settled structure. Two hundred thirty Model 350 (3.50-inch OD by 0.165-inch wall) push piers were installed along the exterior foundation and within a three-foot crawlspace. The piers were advanced to depths of approximately 30 feet to bear below the organic material and achieve a design working load of 20 kips per pier with a FOS ≥ 1.5. Hydraulic lift cylinders were fitted to the installed pier assemblies and connected in series to apply uniform load to stabilize and attempt to lift settled portions of the building. The original square shaft helical piles were detached from the structure prior to attempting a lift. As the garage foundations were lifted with the retrofit push piers, PolyLEVEL® polyurethane foam was injected under the slab to allow the foundations and slab to be lifted together. The garage floor slab was lifted back to level and the structure was lifted to within acceptable limits.

Rear of home with attached garage

Driving PP350 piers

Project: Promiseland Winery ● **Location:** Guttenburg, IA
Pier Installer: MidAmerica Basement Systems

Challenge: Within the first six months of construction, the northwest corner of a 1,600 square-foot winery settled approximately 3.5 inches. The area of settlement included a basement with foundation walls extending eight feet below grade. A geotechnical exploration was not performed; however, the contractor anticipated weak clay and sand soils to extend to the underlying bedrock at approximately 20 feet. The owner wanted the building stabilized with a deep foundation system that could also lift the structure back toward its original elevation.

Solution: A system of hydraulically-driven push piers was chosen as the most economical method to lift and stabilize the structure. A total of sixteen (16) Model 288 (2.875-inch O.D. by 0.165-inch wall) push piers were installed at a three-foot maximum center-to-center spacing. The continuous wall footings were notched to allow the side-load retrofit brackets to extend beneath the foundation wall. During installation, the bedrock was encountered deeper than originally anticipated and the piers were driven 34 to 49 feet below the bottoms of the basement footings to achieve driving pressures of at least 4,000 psi (drive load ≥ 38.4 kips). After the piers were each driven individually, the piers were connected in series with hydraulic lift cylinders and simultaneously loaded to lift the structure approximately 3.5 inches to its original elevation. Hydraulic pressures as much as 2,200 psi, which correspond to working loads up to 21 kips, were required to lift the structure. The push piers were installed to factors safety of at least 1.8 (FOS = driving pressure/lift pressure). Installation of the push piers and lifting of the structure were completed in just two days.

Hydraulic lift cylinders connected in series

Foundation lifted approximately 3.5 inches

COMMERCIAL AND RESIDENTIAL

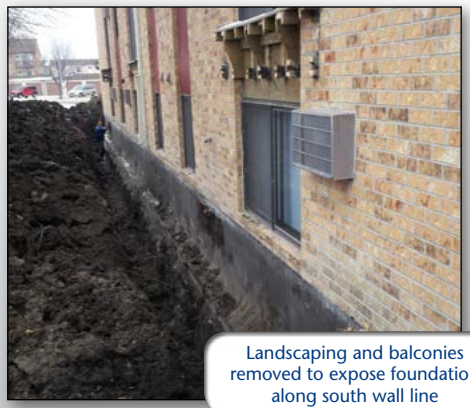
Air eliminator tank on mat foundation; limited access

Project: Stabilization of Air Eliminator Tank Pads ● **Location:** Eddystone, PA
Pier Installer: JES Construction, Inc.

Challenge: The project site is a former coal fired power station being renovated to receive crude oil delivered by rail from North Dakota. Two Air Eliminator Tanks associated with Pump Pits A and B were supported on 11'-0" by 12'-4" by 3-foot thick mat foundations (Pads A and B). The two foundations settled differentially when adjacent trench excavations were made. The pads were each originally constructed on four Geopiers (rammed aggregate piers); however, the Geopiers reportedly compressed and shifted laterally toward the excavations when lateral support was lost to the foundation soils. Although the excavations where quickly backfilled, the project engineer was concerned with long-term foundation alignment and stability, and recommended that both pads be underpinned. Pad B would require stabilization only, while Pad A, where settlement had been more significant, would be lifted as much as three to four inches, if possible.

Driving PP288 pier at Pad B

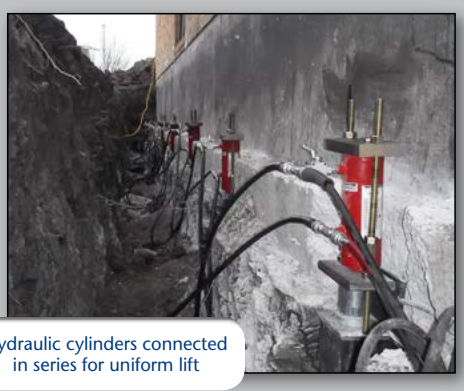
Solution: The foundation support detail included eight hydraulically-driven push piers at each mat foundation, two at each corner, to support a design working compression load of 15 kips per pier. Flush mount brackets were anchored to the sides of the concrete foundations with adhesive anchors to avoid excavation below the pads at the pier locations. The 16 Model 288 (2.875-inch OD by 0.165-inch wall) push piers were then driven from 22.5 to 37.5 feet below the bottoms of the foundations to achieve the target drive pressure of 4,000 psi (drive load of 38.5 kips). For added system rigidity, the pier tubes were filled with 5,000 psi bag mix concrete every six feet during the pier installation. Pad B was stabilized by reloading the piers to the design working load of 15 kips. Pad A was lifted 1 inch to 3.5 inches to achieve both proper elevations for surface drainage and equipment/piping alignment. The piers supporting Pad A were locked off at loads between 15 and 20 kips. The void created beneath Pad A was filled with PolyLEVEL® PL250, a two-part, rapidly setting polyurethane foam.



Landscaping and balconies removed to expose foundation along south wall line

Project: Skaff Apartments ● **Location:** Fargo, ND
Pier Installer: Innovative Foundation Supportworks®

Challenge: Building 4602 within the Skaff Apartments complex was constructed in 1987 of wood framing and brick veneer over poured concrete foundation walls and footings. The two-story structure has a partially buried daylight basement level and approximate plan dimensions of 57 feet by 170 feet. Signs of distress on both the interior and exterior of the building generally indicated settlement of the 170-foot long south (rear) wall of the building. Drywall cracks were observed in the corners of rooms and above doors and windows, some doors and windows were misaligned and did not operate properly, and the concrete floor slab along the south wall of the building sloped downward to the south. Outside the building, the expansion joint within the brick veneer on the west wall, approximately three feet north from the southwest corner of the building, indicated both vertical and horizontal movement. The owner was searching for a cost-effective repair solution that would stabilize and possibly lift the structure back toward its original position, while also minimizing disturbance to the property.



Hydraulic cylinders connected in series for uniform lift

Solution: Thirty-two (32) Model 288 (2.875-inch O.D. by 0.165-inch wall) hydraulically driven push piers were proposed at a six-foot maximum spacing to underpin the south wall and the southeast and southwest corners of the building. A continuous trench excavation was made outside the building to expose the footing. The footing was notched back to the face of the foundation wall at each pier location to install retrofit foundation bracket assemblies. The push piers were advanced to depths of 70 to 88 feet below bottom of footing elevation to bear on competent material. The piers were driven to hydraulic fluid pressures averaging 4,000 psi, corresponding to 38.5 kips of drive force. Hydraulic cylinders were used to stabilize and then uniformly lift the wall approximately ¾-inch back toward its original elevation. The excavation, footing preparation, pier installation and site clean-up was completed in five days.

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Cover Article

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"Foundation Supportworks is one of only two manufacturers to have a push pier evaluation report based on standardized retrofit bracket test procedures and stating compliance with the applicable sections of the IBC."

Upcoming Webinar Opportunities

An Introduction to Helical Foundation Systems
1st Wednesday of every month 11:30am(CT) and 1:30pm(CT)

An Introduction to Polyurethane Foam Injection
2nd Wednesday of every month 11:30am(CT) and 1:30pm(CT)

An Introduction to Hydraulically Driven Push Pier Systems
3rd Wednesday of every month 11:30am(CT) and 1:30pm(CT)

To sign up email us at *training@foundationsupportworks.com* with the following information:

- Name of the firm
- Location of firm
- Approximate number of engineers/architects/GCs that will be in attendance

*FSI is an approved provider through the AIA, RCEP and the Florida State Board of Engineers for continuing education credits

Featured Case Studies:

- Private Residence Stabilization - Jacksonville, FL
- Promiseland Winery - Guttenburg, IA
- Stabilization of Air Eliminator Tank Pads - Eddystone, PA
- Skaff Apartments - Fargo, ND

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