



## COVER ARTICLE

FSI Engineering Department Offers Preliminary Design Services

“The FSI engineering department also offers project consulting and preliminary design services free of charge to design professionals and FSI installing contractors.”



Don Deardorff (FSI) assisting with a helical pile load test.

### FEATURED CASE STUDIES:

Renovation and Seismic Upgrades - Portland, OR

Citizens First Credit Union - Oshkosh, WI

SRT Communications Sidewalk Stabilization - Minot, ND

Plantation House Elevator - Captiva Island, FL

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## UPCOMING WEBINAR OPPORTUNITIES

**An Introduction to Helical Foundation Systems**

1st Wednesday of every month 11:30am(CST) and 1:30pm(CST)

**An Introduction to Polyurethane Foam Injection**

2nd Wednesday of every month 11:30am(CST) and 1:30pm(CST)

**An Introduction to Hydraulically Driven Push Pier Systems**

3rd Wednesday of every month 11:30am(CST) and 1:30pm(CST)

To sign up email Kimberly at [kimberly.hancock@foundationsupportworks.com](mailto:kimberly.hancock@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



**HelixPro™ Design Software** is a state-of-the-art program that allows you to calculate bearing and uplift capacities of FSI helical piles as well as tension capacities of FSI helical tiebacks as they pertain to specific site and soil parameters.

Register today to use this FREE state-of-the-art software program:  
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# FOUNDATION NATION

FSI NEWSLETTER FOR DESIGN PROFESSIONALS


## FSI Engineering Department Offers Preliminary Design Services

Jeff Kortan, P.E. • Director of Engineering

You discovered that your project requires a deep foundation to provide adequate structural support. You also suspect based on the design loads and soil conditions, coupled with limited equipment access, high groundwater, contaminated soil, tight construction schedule, or just economy that helical piles could be the ideal solution. Now what? Most design professionals do not feel as though they are experts in the design and installation of helical piles. So instead of recommending helical piles for the project, you settle on one of the more traditional deep foundation options; i.e., drilled shafts, augercast piles, or driven piles, in which you have developed a comfort level over your career. We know this happens...you told us!

report is written. The report can then be written with confidence knowing that helical piles are a viable option. You may then also get an estimate of installed costs from a local FSI installing contractor to compare against other deep foundation options.

To be clear, the FSI preliminary design recommendations are just that...recommendations. We do not act as the engineer of record, or provide signed and stamped drawings for the project. Instead, we rely on the local experts for that. When a signature and stamp are required, FSI installing contractors either utilize local engineers, or one of two specific consultants that have been trained on FSI products and are licensed in 49 of 50 states.

For more information about Foundation Supportworks® or to locate a Foundation Supportworks® dealer in your area, please visit our website at [www.foundationsupportworks.com](http://www.foundationsupportworks.com) or call 800.281.8545.

**Contact Information:**

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The fact is, helical piles are used more and more often and continue to gain acceptance throughout the engineering community and construction industry. To further promote awareness of helical systems along with design and installation considerations, FSI engineers routinely present technical content through webinars and in-person seminars. The FSI commercial website [www.OnStableGround.com](http://www.OnStableGround.com) has over 100 case studies documenting the successful use of helical piles and tiebacks in a wide range of projects. In 2012, we released HelixPro™, “Helical Foundation Design Software for Professionals,” a web-based helical foundation design tool.

The FSI engineering department also offers project consulting and preliminary design services free of charge to design professionals and FSI installing contractors. If you have an inquiry about whether helical piles or tiebacks are a good option for your project, simply give us a call to discuss the project specifics. For a more in-depth evaluation, submit the project information, geotechnical report, pile/tieback loads and deflection criteria and we can provide a recommendation for shaft size, helix plate configuration and depth. We are often asked to provide recommendations after the soil borings are completed, but before the geotechnical

### MEET THE TEAM!



Jeff Kortan, P.E.  
Director of Engineering



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Senior Structural Engineer



Don Deardorff, P.E.  
Senior Application Engineer



Jake Blessen, E.I.T.  
Application Engineer



James Malone  
Engineering Project Manager



- New Construction and Retrofit Helical Piles
- Helical Tiebacks
- Helical Soil Nails
- Hydraulically Driven “Push” Piers
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# CASE STUDIES

## Model 288 Helical Piles

**Project:** Renovation and Seismic Upgrades ● **Location:** Portland, OR  
**Foundation Supportworks® Dealer/Installer:** TerraFirma Foundation Systems

**Challenge:** Renovations were planned for a circa 1920s, two-story building in downtown Portland. The project involved adding a third story to the structure as well as seismic upgrades to include new braced frames and moment frames. However, a structural evaluation found that the building was generally constructed with unreinforced concrete and wood framing. In order to complete the proposed renovation, a new three-foot wide, 40-foot long grade beam had to be installed to support three new columns. Deep foundations would be required to resist both compression and tension loading. A geotechnical investigation at the site identified four feet of silt fill underlain by native alluvial soils (sandy silt and silty sand) to the explored depth of 35 feet. Six-inch diameter grouted micropiles with calculated design lengths on the order to 60 feet were originally proposed to resist the design loads.

**Solution:** TerraFirma Foundation Systems was contacted to discuss the feasibility of using helical piles in lieu of micropiles. It was determined that helical piles could support the design loads for the project, the piles could be installed inside the building and around the temporary column supports, and product and equipment could be mobilized quickly to keep the project on schedule. The foundation design included twelve (12) Model 288 (2.875-inch OD by 0.276-inch wall) hollow round shaft piles with a 10"-12" double-helix lead section to support design working loads of 27.6 kips in compression and 19.8 kips in tension. Some of the piles would be installed vertically, while others would be installed with an outward batter of three degrees to provide a center to center spacing of at least three times the diameter of the helix plate at the helix plate depths. A tension load test was completed on one of the production piles in general accordance with the procedures of ASTM D3689. Measured pile deflections at design load and two times design load met the specified criteria. The piles were installed to a depth of 32 feet below the bottom of grade beam elevation to exceed the minimum required installation depth. Installation torque was monitored as the piles were advanced and terminated to determine torque-correlated ultimate pile capacities for both tension and compression. Factors of safety based on torque-correlated ultimate capacities were generally higher than 1.5 for compression and 2.0 for tension. Factors of safety extrapolated from the successful load test were higher. New construction brackets were bolted to the tops of the helical piles and cast into the grade beam. The production piles were installed and the load test was completed in less than two days.

### Commercial



Installing vertical pile; equipment between temporary supports



Tension test frame and equipment

### Commercial



Advancing helical pile lead section



Pile installation close to building

## Model 288 Helical Piles

**Project:** SRT Communications Sidewalk Stabilization ● **Location:** Minot, ND  
**Foundation Supportworks® Dealer/Installer:** Innovative Foundation Supportworks®

**Challenge:** SRT Communications, the largest telecommunications company in the state of North Dakota, is headquartered in the city of Minot within the area of "North Hill". This area of Minot is known for foundation and slab-on-grade instability issues due to local soil conditions, seasonal wetting and drying of "active" soil, and a high groundwater table. At the SRT headquarters building, the issue was differential movement of six-foot and nine-foot wide exterior concrete sidewalks. The sidewalks experienced cyclical heave and settlement with changes in moisture content of the subgrade soils. The differential movement created trip hazards between sections of the concrete and at the entrance/exit locations of the building. The bottoms of doors would also wedge against heaved sidewalk sections, preventing the doors from being opened fully. The project included removing the existing sidewalks and replacing those with new structurally-reinforced sidewalks designed with deep foundation support. Proximity of the sidewalks to the building, tight working spaces, and landscaping that could not be disturbed during construction, were a few of the challenges associated with installation of a deep foundation system. Subsurface information was also not available for design of the sidewalk foundations.

**Solution:** Helical piles were an ideal deep foundation option given the limited working space. Helical piles could be installed with smaller equipment that could mobilize quickly to the site. Without soil information for design, helical pile capacities could also be estimated by correlation to installation torque. Sixty-one (61) Model 288 (2.875-inch O.D. by 0.276-inch wall) round shaft helical piles with 10"-12"-14" triple-helix lead sections were installed with a tracked skid-steer. Design working loads were 18 kips and 24 kips for the 6-foot and 9-foot wide sidewalks, respectively. The piles were installed to lengths of 13.5 to 20 feet and to installation torques of at least 4,000 ft-lb and 5,400 ft-lb to achieve the respective torque-correlated ultimate capacities of at least 36 kips and 48 kips (FOS ≥ 2). After the piles were installed, new construction brackets with 6-inch square cap plates were bolted to the tops of the piles and embedded within the poured concrete slabs. The helical piles were hot-dip galvanized for corrosion protection. The 61 helical piles were installed in just four days.

## Models 288 and 349 Helical Piles

**Project:** Citizens First Credit Union ● **Location:** Oshkosh, WI  
**Foundation Supportworks® Dealer/Installer:** Foundation Supportworks® of Wisconsin

**Challenge:** A new Citizens First Credit Union was to be constructed across two previously developed properties with existing structures. The existing structures would be demolished and completely removed to allow for the construction of the new slab-on-grade single-story building, canopy-covered drive-thru lanes and parking areas. A geotechnical investigation included the advancement of four soil borings within the proposed building footprint. The borings identified five to 7.5 feet of very loose to loose uncontrolled fill over stiff to very stiff residual clays. The original geotechnical recommendation for foundation support included over-excavation of the existing fill soils and replacement with compacted and tested engineered fill. However, an excavation made north of the proposed building to remove underground storage tanks raised concern that contaminated soils could exist within the limits of the proposed over-excavation. Excavation and either treatment or disposal of contaminated soils would add significant costs to the project. Helical piles were then considered as an attractive deep foundation option since they do not generate spoils during installation.

**Solution:** The foundation design included helical piles with two shaft sizes and three helix plate configurations. The Model 288 (2.875-inch OD by 0.276-inch wall) round shaft with a 10"-12" lead section was selected to support a design working load of 15 kips, the Model 288 shaft with a 12"-14" lead was selected to support a design working load of 27 kips, and the Model 349 (3.50-inch OD by 0.300-inch wall) round shaft with an 8"-10"-12"-14" configuration was selected to support a design working load of 35 kips. The helical piles were designed with a factor of safety of 2.5 due to weaker soil identified at the bottom of one of the borings and the anticipated pile depths being near or below the bottoms of the test borings. The piles were installed to torque values ranging from 4,200 to 12,500 foot-pounds to provide torque-correlated ultimate capacities (based on default torque correlation factors) exceeding the respective design working loads by the factor of safety. Pile depths ranged from about 11.5 feet to 19 feet to achieve the desired torque and to advance all helix plates below the fill.

### Commercial

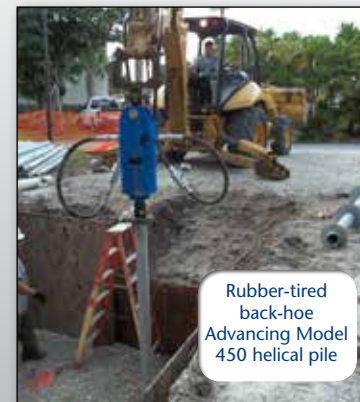


Helical piles advanced at isolated column location



Completed pile-supported column pad

### Commercial



Rubber-tired back-hoe Advancing Model 450 helical pile



Helical piles fitted with new construction brackets

## Model 450 Helical Piles

**Project:** Plantation House Elevator ● **Location:** Captiva Island, FL  
**Foundation Supportworks® Dealer/Installer:** N Square, Inc.

**Challenge:** The Plantation House is one of many luxurious guest buildings at the South Seas Island Resort on Florida's west coast. The 330-acre resort offers this three story structure as rentable beach front condominiums to vacationing guests year-round. In order to make the upper floor levels more easily accessible, an elevator addition was proposed to replace one of the three exterior stairwells at the front of the Plantation House. The 12-foot by 18-foot elevator addition would be supported on a three-foot thick concrete mat foundation and poured concrete foundation walls. The elevator walls above grade would be constructed of masonry block. A single test boring was completed to a depth of 65 feet. A generalized subsurface profile consists of very loose to loose sand with medium dense sand layers in the upper 45 feet, very dense sand from 45 to 52 feet, and medium dense to dense sand to the bottom of the boring. The groundwater table was encountered 4.5 feet below the ground surface elevation at the time of the boring. A deep foundation system was required to transfer the structural loads to the competent medium dense to very dense sands below a depth of 40 feet. The deep foundation system would also have to be installed with smaller equipment capable of accessing the project site and working within the tight construction area. Minimal noise and ground vibrations were additional requirements as the elevator construction would be completed at a time of high resort occupancy.

**Solution:** N Square consulted with the engineering staff at Foundation Supportworks®, Inc. to provide the general contractor with an efficient and functional helical pile recommendation. Buckling of the piles had to be considered with very loose and "weight of hammer" sand layers in the upper 35 feet of the profile. The foundation design included eleven (11) Model 450 (4.50-inch OD by 0.337-inch wall) round shaft helical piles with 10"-12"-14" triple-helix lead sections to support a design working load of 45 kips per pile. The helical piles were installed to torque-correlated ultimate capacities of at least 90 kips (FOS ≥ 2). Pile lengths varied from 36 to 49 feet with the tops of the piles set approximately six feet below ground surface elevation. Select piles were installed with a slight batter of two degrees to provide adequate separation of the piles at the helix plate depths. New construction brackets with ¾-inch thick by 11-inch square cap plates were placed on the tops of the piles and cast into the mat foundation. The eleven piles were installed within two days.