Retrofit helical piles to support an existing column at a school

steers, rubber-tired back-hoes and large track equipment.

5. *Where minimal vibrations from installation are required.* Helical piles are typically installed with smaller equipment and the pile installation does not create vibrations. This means there is little impact to surrounding homes or businesses during this phase of construction.

6. *In areas of known or potential soil contamination.* The installation of helical piles does not auger soil to the surface to create spoils. Therefore, in most cases, if the contaminated soil remains in place, there are no additional costs to the project for treating this material or disposing of this material in designated landfills.

7. *For environmentally sensitive sites.* Installation with smaller equipment typically means there will be less disturbance to the project site. For wetland and boardwalk projects, a proper design and sequenced construction can allow pile installation and boardwalk construction in sections without ever disturbing the wetlands below.

Jeff Kortan, P.E.
Director of Engineering

8. *For schedule sensitive projects.* Helical piles install quickly, typically 15 to 25 per day per crew for a pile length of about 30 feet. With no time needed for pile concrete to cure, reinforcing steel can be placed and structural concrete poured immediately following pile installation.

9. *After the project is underway and additional support is determined.* Many helical projects develop this way. FSI carries millions of dollars in inventory and can quickly ship product to the installing contractor. The contractor can typically be installing piles within a few days notice to proceed.

Design professionals are becoming increasingly more aware of the benefits and applications of helical foundation systems. Please contact FSI or your local Foundation Supportworks installing contractor if you have any questions about helical products or your specific application.

Helical piles to support foundations of a medical center addition

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BENEFITS AND USES of Helical Foundation Systems

Jeff Kortan, P.E.
Director of Engineering

Helical piles to support foundations of a high school weight room addition

Many designers view helical foundation systems with some degree of skepticism as a fairly new technology, especially in applications such as deep foundation support for a structure. In actuality, the use of helical piles in construction dates back nearly 200 years. In the 1830's, the earliest versions of today's helical piles were used in England for moorings and for the foundations of lighthouse structures. Today, helical piles are gaining worldwide acceptance throughout the construction industry and engineering community due to the versatility of both the product and the installation equipment. In 2007, the International Code Council Evaluation Services, Inc. (ICC-ES) approved AC358, Acceptance Criteria for Helical Foundation Systems and Devices. Helical piles are also now included in the 2009 International Building Code (IBC).

With the use of helical foundation systems on the rise, let's consider a few situations where you may choose helical piles as the most appropriate deep foundation alternative:

1. *When deep foundations are required due to the site, soil, and/or construction conditions and allowable/service loads are within the typical range for helical foundations.* AC358 provides normal capacity limits of 6 kips lateral and 60 kips in axial compression and axial tension.

2. *As an alternative to deep excavations for the removal and replacement of foundation soils.* The break-even point for excavation versus deep foundations varies from project to project depending upon factors such as excavation depth, excavation volume, haul distance to a disposal site and availability of suitable backfill soils. The decision for or against a deep excavation may also be influenced by the elevation of the groundwater table and the construction schedule.

3. *As an alternative to other deep foundations such as auger-cast piles, drilled shafts and driven piles.* Helical piles may not achieve similar high capacities as the other deep foundation options. However, even if more helical piles are required, they may still be the more cost-effective option. Helical piles can be installed with relatively small installation equipment, so mobilization costs are much less. Helical piles are especially cost-competitive where pile numbers are limited, typically less than about 60 to 80. In larger quantities other factors, some of which are listed below, may still make helicals the favored option.

4. *In conditions of limited or tight access.* Helical piles are selected for many projects simply because the piles and the installation equipment can be sized according to the accessibility of the job. Helical piles can be installed with hand-held equipment, mini-excavators, skid

Helical piles to support crane pads at a construction site

Continued on back . . .

FOUNDATION SUPPORTWORKS

- New Construction and Retrofit Helical Piles
- Helical Tiebacks
- Hydraulically Driven "Push" Piers
- Wall Anchors
- SmartJacks™
- Slab Piers
- PowerBrace™

Distribution Checklist

❑ _____
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❑ _____
❑ _____
❑ _____

CASE STUDIES

New Construction Helical Piles

Commercial

Project: YMCA Swimming Pool
Location: Fond du Lac, WI
Foundation Supportworks™ Dealer/Installer: Foundation Supportworks of Wisconsin

Challenge: In 2009, the YMCA began construction of a 13 million dollar addition, which was to include a new child care area, locker rooms, workout studios and natatorium. The natatorium consisted of a large indoor waterpark including a 29′ by 76′ lap pool with shallow and deep ends of 3′6″ and 9′3″ inches, respectively. While making the excavation, the pool contractor encountered weak organic soils at the bottom of pool elevation. The design team then decided to support the pool on a deep foundation system to prevent potential damaging differential settlements. The foundations, exterior walls and roof of the addition were completed prior to excavating for the pool, which created a potential challenge for equipment access. Although several deep foundation systems were considered, helical piles were selected as the ideal option given the limited access, limited anticipated ground disturbance with smaller installation equipment, and the ability to quickly mobilize equipment and product to the job site.

Solution: Soil borings from the geotechnical investigation identified very stiff glacial till at depths of about 30′ to 40′. The foundation design included 34 Model 350 (3.5-inch OD by 0.313-inch wall) round shaft helical piles with 10″-12″-14″ triple-helix lead sections to support the design load of 65 kips per pile with a factor of safety of 1.5. A temporary earthen ramp was constructed to create access for equipment and materials. The general contractor located and marked the pile locations. Sixteen piles were installed in the deep end of the pool to average depths of 26′ below pool bottom and 18 piles were installed in the shallow end of the pool to an average depth of 33′ below pool bottom. The piles were advanced into the very stiff till and to torque values of at least 14,000 ft-lbs, which correlated to an ultimate capacity of at least 97.5 kips. The piles were cut off to the design elevation and specialty new construction brackets were tack-welded to the piles. Foundation Supportworks of Wisconsin installed the 34 piles in two and one half days to an average depth of 37′ below deck grade. The helical piles were installed within 10 days after Foundation Supportworks of Wisconsin was first contacted about the project.


Limited access for installation equipment


Helical piles advanced

Commercial

New Construction Helical Piles


Advancing helical piles


Finished project

Project: Holiday Inn Hotel and Water Park
Location: Omaha, NE
Foundation Supportworks™ Dealer/Installer: Foundation Supportworks by Thrasher

Challenge: The new Holiday Inn Hotel and Water Park was constructed just north of downtown Omaha, north of the Qwest Center and north of the new baseball stadium built for the College World Series. The project site is located within the alluvial plane of the Missouri River and in an area of Omaha where multiple prior phases of site development and redevelopment were likely. The hotel is a three-story structure supported on auger cast pile foundations.

One of the waterslides for the park was designed to exit the building with multiple bends and turns and then re-enter. However, auger cast piles had not been placed to support the slide at the same time piles were installed for the building. Excessive differential settlement was a concern for shallow spread footings bearing within undocumented fill over weak alluvial (water-deposited) soils. Access to the back of the building was limited, timing was critical and cost was a major factor in completion of the project.

Solution: The design team recommended helical piles extending through the fill and weak native clays to bear within the deeper, dense alluvial sands. The two column foundations were each designed with four helical piles, each pile with a design working load of 20 kips. The helical pile configuration consisted of 2 7/8″ OD by 0.276″ wall hollow round shaft with an 8″-10″ double-helix lead section. Standard extensions were used to advance the piles to an average depth of 35′. Installation torques for the piles correlated to ultimate pile capacities of at least 40 kips (FOS ≥ 2). Helical piles were the ideal deep foundation alternative for this project. The total cost for the helical pile installation was less than the remobilization cost alone for the auger cast option. The helical piles were installed in one day.

New Construction Helical Piles

Commercial

Project: Downtown Revitalization
Location: Chappaqua, NY
Foundation Supportworks™ Dealer/Installer: Foundation Supportworks of New Jersey

Challenge: Downtown Chappaqua is undergoing a revitalization including renovation of existing older structures to support new businesses. One building in particular was constructed in the late 1800's. In the mid-1900's, an addition was constructed at the rear of the building. The building was formerly a three story, mixed use structure with retail space on the main floor and offices above. The top two floors were removed years ago, giving the appearance of a one story retail shop. The building is being renovated for a high end women's boutique.

The building was constructed within the alluvial plane of the Saw Mill River, presumably on fill soils over organic river deposits over bedrock. Subsurface information was available from a neighboring property. The rear exterior load-bearing wall of the addition had settled under the existing roof load and the self-weight of the masonry block. The project engineers planned to re-support the roof system and also remove the roof load permanently from the rear wall so the wall could be effectively repaired.

Solution: Four interior columns were proposed to support the roof load. Two of the new columns would support an existing girder while the other two columns would support a new girder positioned along the rear wall. Helical pile foundations were selected for this project due to the limited interior working space and the ability to penetrate the existing fill and soft native soils. The helical pile configuration consisted of the Model 288 (2.875″ OD by 0.276″ wall) with a 12″ diameter by 1/2″ thick single helix blade on the lead section. Twelve helical piles, three at each column location, were extended to depths ranging from 20′ to 33′ to bear on or within the bedrock. The helical piles were installed until spin off occurred on the bedrock surface or to torque values correlating to ultimate pile capacities of at least 60 kips for a factor of safety of 2 or more. The twelve piles were installed in two days.


Building to undergo renovation as part of the downtown revitalization


Mini-excavator used to install helical piles in limited access and headroom conditions

Commercial

New Construction Helical Piles


Installation of helical pile lead section


Pile installation complete, placing fill

Project: Gundersen Lutheran-Cogeneration System
Location: La Crosse, WI
Foundation Supportworks™ Dealer/Installer: Foundation Supportworks of Minnesota

Challenge: The Gundersen Lutheran Medical Center owned land near a tributary of the Mississippi River where they planned to construct a cogeneration system, a system that simultaneously generates both electricity and useful heat. Two test borings were completed to depths of 31′. The test borings encountered up to 18′ of loosely compacted silty sand fill with varying amounts of brick and wood pieces. The fill was 18′ deep in the boring closest to the water's edge, but only 7′ deep in the boring further upslope. The fill was underlain by very loose to medium dense alluvial sand. Two options were considered for the support of the proposed mat foundation for the generator. The first option was partial removal of the existing fill soils to a depth of five feet below the foundation, and replacement of this material with well-compacted sand fill. However, with the high variability of the fill soils to remain, there would still be a risk that differential settlements could occur. The second option was to support the mat foundation on helical piles penetrating the fill soils and bearing within the deeper alluvial sands.

Solution: The foundation design included 18 helical piles sized accordingly to support a working load of 25 kips. A helical pile configuration consisting of a 2 7/8″ outside diameter round shaft with a 10-12 double-helix lead section was selected. The density/strength of the alluvial sand also proved variable across the approximate 41′ length of the foundation, with depths of the helical piles ranging from about 25′ to 50′ from one end to the other. Ultimate capacities of the production piles were estimated by correlation to installation torque and were at least twice the design working load (FOS ≥ 2). Installation of the 18 helical piles was completed in less than two days.