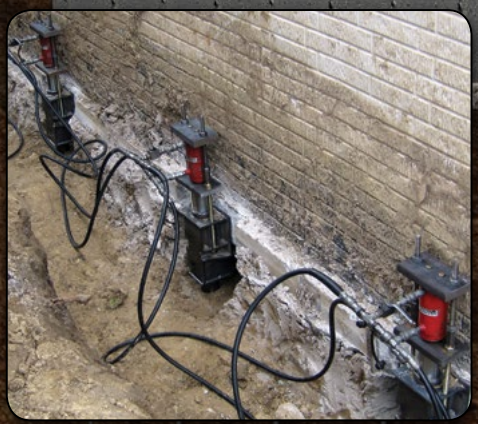
FOUNDATION

SUPPORTWORKS®

PUSH PIER SYSTEMS



STABILITY. SECURITY. INTEGRITY.

Push Pier Systems

PN #MBPPT

About FOUNDATION SUPPORTWORKS®


Omaha, Nebraska


Seymour, Connecticut

Foundation Supportworks® is a network of the most experienced and knowledgeable foundation repair and new construction piering and anchoring contractors in North America. With dealers from coast to coast, Foundation Supportworks® is focused on training, gathering, and sharing the best practices in the industry. Your authorized dealer is therefore operating with the resources of literally hundreds of years of combined experience. Each dealer is trained, authorized, and certified by Foundation Supportworks®.

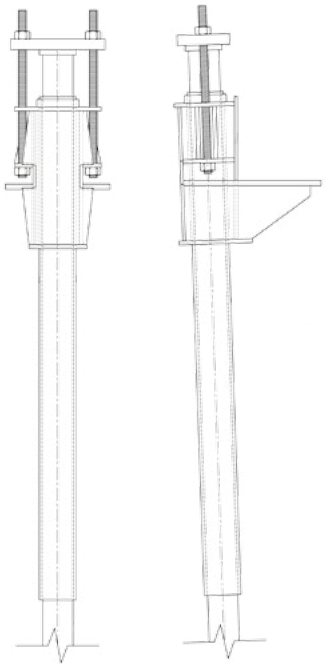
Foundation Supportworks® has major dealer support facilities in Omaha, Nebraska and Seymour, Connecticut.

ENGINEERING

Foundation Supportworks® has both geotechnical and structural engineers on staff for product design, quality assurance of products, and dealer support. Our in-house engineers are available to assist with preliminary designs and provide technical support to engineers, architects, building departments, and general contractors local to the projects.

PUSH PIERS

FSI Push Pier System



FSI Push Pier Systems utilize high-strength round steel tube sections and a load transfer bracket to stabilize and/or lift sinking or settling foundations. The foundation bracket is secured against the existing footing and pier sections are driven hydraulically through the foundation bracket and into the soil below using the combined structural weight and any contributory soil load as resistance. Pier sections are continuously driven until a suitable load bearing stratum is encountered. At that point, the structure either begins to lift or the target pressure/load is achieved. The weight of the structure is then transferred from the unstable soil, to the foundation brackets, through the piers, and to firm load bearing soil or bedrock.

Push Pier Systems develop a factor of safety against pier settlement by the pier installation methods used and the sequence with which multiple piers are driven and then re-loaded. Piers are first driven individually using the maximum weight of the structure and any contributory soil load. After all of the piers are driven, the piers are re-loaded simultaneously, and the total reaction load is distributed over the multiple pier locations. The average load on each pier during the load transfer operation is generally less than 75 percent of the load during pier installation/driving, for a factor of safety of at least 1.3. Typical factors of safety against pier settlement range from about 1.5 to 3.0, with higher values generally achieved for structures with greater rigidity. These factors of safety conservatively ignore any additional long-term frictional component to the pier's capacity (see page 7).

For additional information, request copies of the current FSI Push Pier Systems Technical Documents from your local Foundation Supportworks' Authorized Dealer or visit our website at www.fsicommercial.com.

Push Pier System

MODEL 288

Specifications

Bracket: Weldment manufactured from 0.25", 0.375", and 0.50"-thick steel plate. Yield strength = 36 ksi (min.), tensile strength = 58 ksi (min.).

Allowable System Capacity (48" Sleeve):
33,000 LBS.

External Sleeve: Ø3.50" x 0.216" wall x 30" or 48" long with sleeve collar welded to one end. Yield strength = 50 ksi (min.), tensile strength = 62 ksi (min.).

Pier Starter Tube: Ø2.875" x 0.165" wall x 50" long, triple-coated in-line galvanized. Yield strength = 50 ksi (min.), tensile strength = 55 ksi (min.). Ø3.375" x 0.188" wall x 1" long friction reducing collar welded to one end.

Pier Tube: Ø2.875" x 0.165" wall x 36" long, triple-coated in-line galvanized. Yield strength = 50 ksi (min.), tensile strength = 55 ksi (min.). Ø2.50" x 0.180" wall x 6" long internal coupler at one end with 3" extending out of pier tube.

Pier Cap: 5.0" wide x 9.0" long x 1" thick plate with confining ring welded to one side. Yield strength = 50 ksi (min.), tensile strength = 65 ksi (min.).

All-Thread Rod: Ø0.75" x 16" long, zinc plated, Grade B7, tensile strength = 125 ksi (min.).

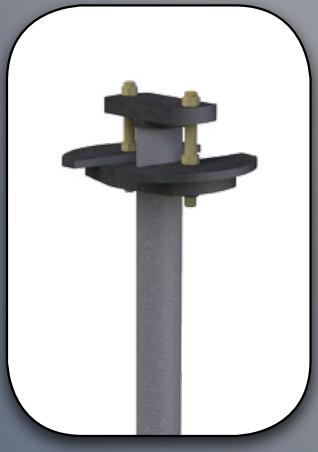
Model 288 Push Pier System

BRACKETS

Vertical or 2-Degree Bracket

Low Profile Bracket

Flush Mount Bracket



Slab Pier Bracket

Lateral Restraint Bracket

Rotational Support Bracket

Push Pier System
MODEL 350
Specifications

Allowable System Capacity (48" Sleeve):
44,000 LBS.

Bracket: Weldment manufactured from 0.38", 0.50", and 0.63" thick steel plate. Yield strength = 36 ksi (min.), tensile strength = 58 ksi (min.).

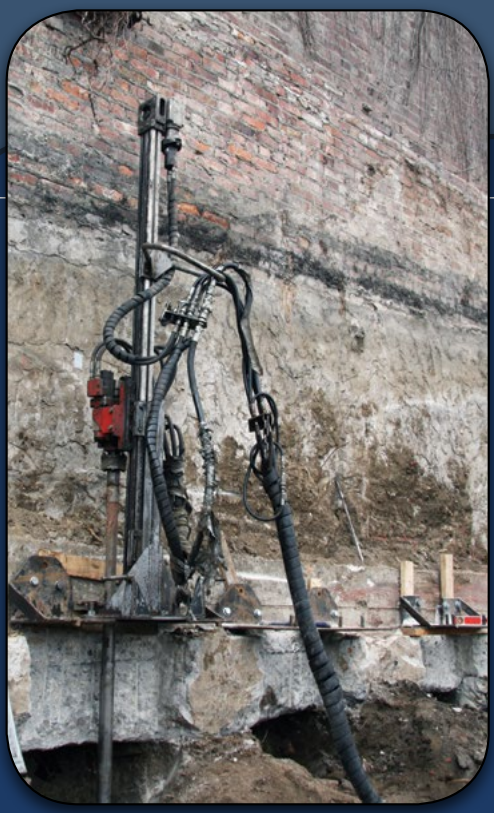
Pier Tube: Ø3.500" x 0.165" wall x 36" long, triple-coated in-line galvanized. Yield strength = 50 ksi (min.), tensile strength = 55 ksi (min.). Ø3.125" x 0.180" wall x 6" long internal coupler at one end with 3" extending out of pier tube.

Pier Starter Tube: Ø3.500" x 0.165" wall x 50" long, triple-coated in-line galvanized. Yield strength = 50 ksi (min.), tensile strength = 55 ksi (min.). Ø4.000" x 0.226" wall x 1" long friction reducing collar welded to one end.

External Sleeve: Ø4.000" x 0.226" wall x 48" long with sleeve collar welded to one end. Yield strength = 50 ksi (min.), tensile strength = 62 ksi (min.).

Pier Cap: 4.00" wide x 8.50" long x 1.25" thick plate with pier locator plate welded to one side. Yield strength = 50 ksi (min.), tensile strength = 65 ksi (min.).

All-Thread Rod: Ø.875" x 18" long, zinc plated. Grade B7, tensile strength = 125 ksi (min.).



Micro Pile
APPLICATIONS

The Foundation Supportworks® Model 350 push pier system works well with drilled and grouted micro pile applications. The presence of shallow floating rock lenses, cobble and rubble fill, or other unstable bearing strata that cannot be penetrated easily, can often be achieved by combining either an open hole solid bar or hollow bar grouted pile that is drilled down through the center of the FSI Pier System.

Rock drill equipment can be mounted directly to the bracket to ensure alignment of the micro pile and the pier assembly. Depending on the capacity required, the bracket system can range from the Model 288, Model 350, or Model 400. The FSI Push Pier Slab Bracket is also a good fit with grouted micro piles when ground conditions prove too challenging for pushing pipe.

Push Pier System

MODEL 400

Specifications

Bracket: Weldment manufactured from steel plates with integrated pipe sleeve. Steel plate: 0.38" and 0.50" thick steel plate, yield strength = 36 ksi (min.), tensile strength = 58 ksi (min.). Pipe sleeve: Ø4.50" x 0.237" wall x 14.50" long. ASTM A53 Grade B Type E & S, yield strength = 35 ksi (min.), tensile strength = 60 ksi (min.).

Allowable System Capacity (No Sleeve):
39,000 LBS.

Pier Tube: Ø4.00" x 0.226" wall x 36" long. ASTM A500 Grade B or C, yield strength = 50 ksi (min.), tensile strength = 62 ksi (min.). Ø3.50" x 0.216" wall x 8" long internal coupler at one end with 4" extending out of pier tube.

Pier Starter Tube: Ø4.00" x 0.226" wall x 36" long. ASTM A500 Grade B or C, yield strength = 50 ksi (min.), tensile strength = 62 ksi (min.). Ø4.50" x 0.237" wall x 1" long friction reducing collar welded to one end.

Pier Cap: 4.00" wide x 8.50" long x 1.25" thick plate with pier locator plate welded to one side. ASTM A572 Grade 50, yield strength = 50 ksi (min.), tensile strength = 65 ksi (min.).

All-Thread Rod: Ø0.875" x 18" long, zinc plated. ASTM A193 Grade B7, tensile strength = 125 ksi (min.).

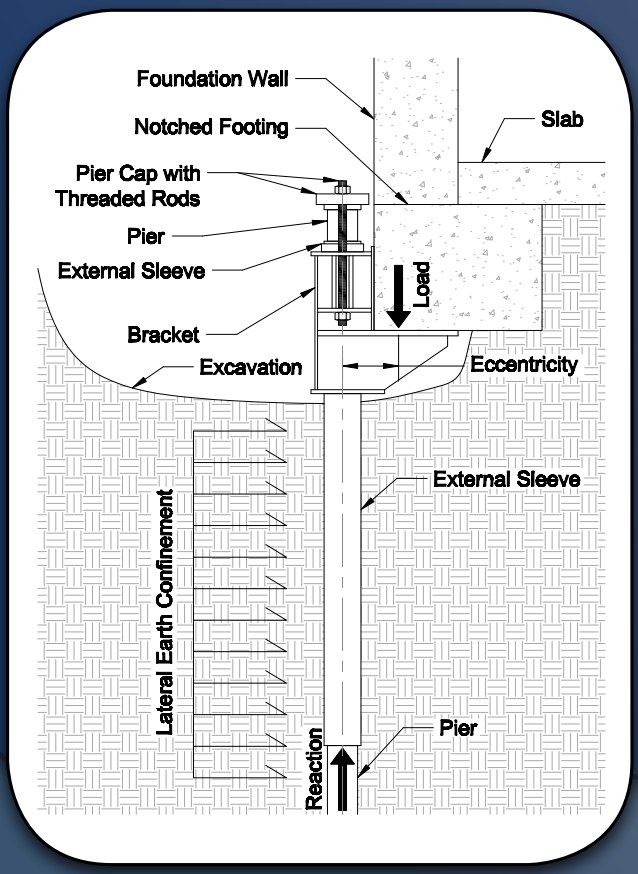
Model 400 Push Pier System

DESIGN CONSIDERATIONS

Foundation Supportworks Model 400 Push Pier System utilizes a four-inch outside diameter steel tube. In addition to being an end bearing pier, the four-inch tube section allows for additional axial compression capacity due to the skin friction of the shaft against the surrounding soils. Additional capacity gained from skin friction can be advantageous when bedrock or suitable load bearing strata is very deep, as the pier can develop its required resistance at shallower depths.

Push Pier Systems

DESIGN CONSIDERATIONS



Push pier systems are installed directly adjacent to the existing structure utilizing side-load brackets. This introduces eccentricity into the system. The Model 288 and Model 350 Push Pier Systems incorporate an external sleeve at the top of the pier to aid in resisting the bending forces generated by this loading condition. This helps preserve the axial compressive capacity of the pier shaft. The external sleeve extends through and below the foundation bracket to essentially create a bracket that is up to 48 inches tall.

The moment or bending force is localized within a relatively short distance below the bracket. Although the bending force is dissipated quickly by the pier bearing against the confining soil, it is significant and cannot be ignored. The depth or length of sleeve and pier over which the bending force dissipates is a function of the soil stiffness near the surface. The depth is greater in soft clay and loose sand, and less in stiff clay and dense sand. In soft or loose soils, a small portion of the bending force may be transferred to the pier below the sleeve, thereby reducing the pier's allowable axial compressive capacity. A modified, lower capacity system is also available with a shorter, 30-inch long sleeve for low headroom applications.

CORROSION PROTECTION

FSI Push Pier Systems were designed using the guidelines presented in ICC-ES AC358 for corrosion loss rates and design period (50 years). Corrosion loss rates are provided in AC358 for both bare steel and zinc-coated steel.

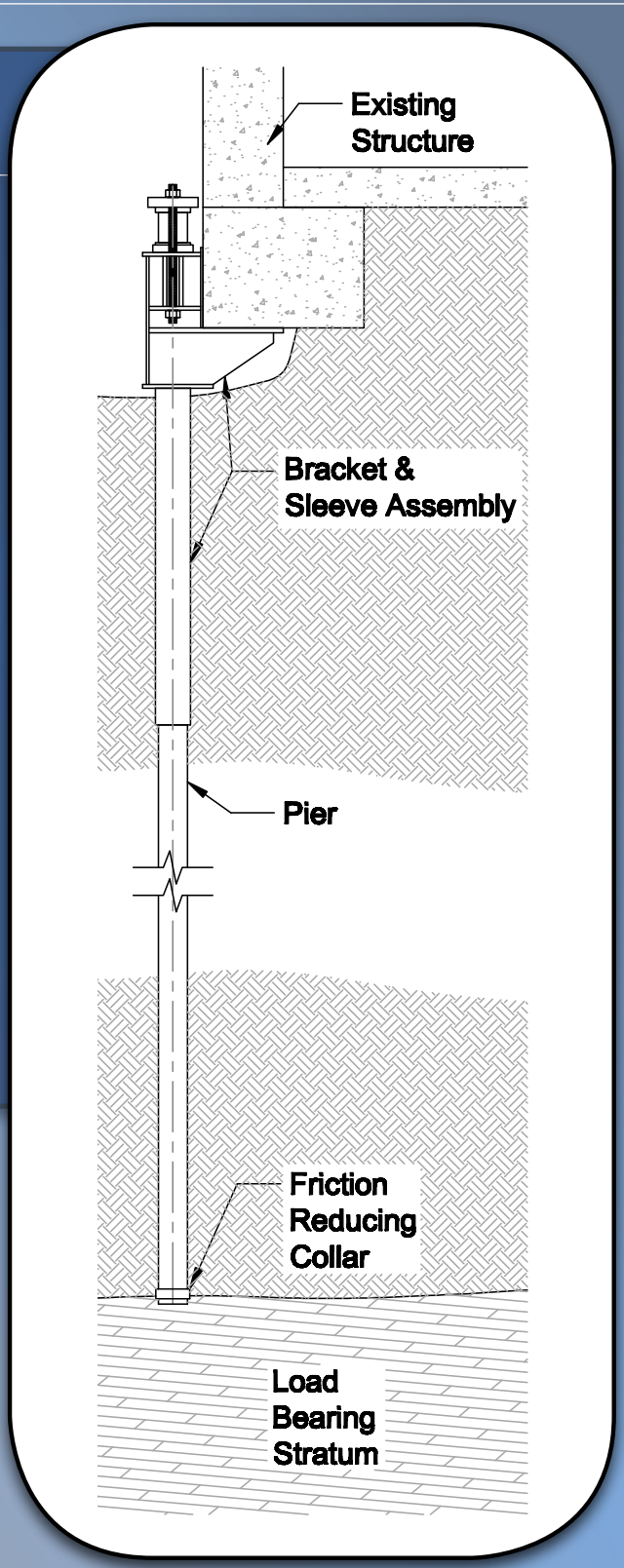
The pier tube used for FSI Push Pier Systems are manufactured with a triple-layer, in-line galvanized coating. This coating process consists of: (1) a uniform hot-dip zinc galvanizing layer; (2) an intermediate conversion coating to inhibit the formation of white rust and enhance corrosion resistance; and (3) a clear organic top coating to further enhance appearance and durability. The inside of the pier tube also has a zinc-rich coating.

The pier system bracket, external sleeve, and pier cap are available standard as black steel or optional with a hot-dip zinc coating for galvanic protection. The bracket, sleeve, and pier cap analyzed for the determination of allowable capacity for each system, as stated in this brochure, were black steel. The hot-dip galvanization process is in accordance with ASTM A123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products." The bracket and pier cap with steel plate thicknesses of at least 1/4-inch have an average zinc coating thickness of at least 3.9 mils (0.0039 inch) or 2.3 oz/ft^2. The external sleeve with a wall thickness between 3/16-inch and 1/4-inch has an aerage zinc coating thickness of at least 3.0 mils (0.003 inch) or 1.7 oz/ft^2.

The coil rod, all-thread rod, and heavy hex nuts come standard as zinc-plated in accordance with ASTM B633, "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel."

FRICTION REDUCING COLLAR

The first pier section advanced into the ground includes a larger-diameter "friction reducing collar" welded to the lead end. This collar, being larger in diameter than the pier tube, effectively creates annular space around the pier as it is advanced through most clayey soils. In soft clay or clean sand and gravel, an annular space may only temporarily be created. However, the larger diameter collar causes soil disturbance or remolding to occur, which also significantly reduces frictional resistance on the outside surface of the pier during driving. The result is a driven pier that generates most of its capacity in end-bearing. Over time, the soils surrounding the pier relax back into the annular space and against the pier shaft. This provides an additional frictional component to the pier's capacity. Even though this frictional capacity may be significant, it is conservatively ignored in the determination of the pier's factor of safety against pier settlement.



Push Pier System ADVANTAGES

- End bearing pier that does not rely on skin friction for capacity
- Portable equipment allows for installation in areas of limited access
- Piers are individually load-tested during installation
- System design allows for lifting of settled structures
- Factors of safety typically range from 1.5 to 3
- Galvanized pier sections for added corrosion protection

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12330 Cary Circle
Omaha, NE 68128

Phone: 800.281.8545 Fax: 402.393.4002

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