

# STATE DEPARTMENT OF TRANSPORTATION EXAMPLE SPECIFICATIONS

## SECTION 551 STEEL PUSH PIERS

### DESCRIPTION

**551.01** This work pertains to furnishing and installing steel push piers (a.k.a. hydraulically driven pipe micro-piles or resistance pier foundations) shown in the Contract in accordance with the Drawings and these specifications. Each steel push pier shall be installed and load tested at the location and to the elevation, minimum length, and design allowable load shown on the Plans or as established. These specifications are to be used in conjunction with State Department of Transportation Standard Specifications for Road and Bridge Construction.

### MATERIALS

#### **551.02 Guarantees and Insurance**

Steel push pier and bracket manufacturer shall furnish a guarantee for a period of ten (10) years from date of delivery against defects due to manufacturing of steel push pier and bracket. Steel push pier and bracket manufacturer must carry product liability insurance. Refer to General Conditions for additional insurance requirements.

#### **551.03 Prequalification Requirements**

Due to the special requirements for design and manufacture of steel push piers, and the requirements for proper performance of the structural system, as a whole, steel push piers and brackets shall be obtained from an organization specializing in the design and manufacture of steel push piers. The following manufacturers' products are prequalified for use on this project:

Magnum Piering, Inc.

A request for using any other manufactured steel push pier products desired for use on this project must be submitted to the Project Manager and Foundation Engineer for review not less than seven (7) calendar days prior to the bid date. The request must include:

1. A catalog or recent brochure describing the manufacturer.
2. Evidence showing manufacturer has at least ten (10) years experience in this area of work.
3. Detailed descriptions, schematic details, and material properties for all products to be used on this project.
4. Current ISO9001 quality control program accreditation.
5. Current ICCES/BOCA/ICBO product acceptance report or complete description of product testing and manufacturing quality assurance programs used to assess and maintain product quality.

Prior to bidding by any installer using a manufactured steel push pier system that is not prequalified, written approval to bid must be received from the Project Manager upon consultation with the Foundation Engineer. Project Manager shall grant approval based on compliance with specific criteria herein. The Project Manager's decision is final.

#### **551.04 Minimum Material Requirements**

Steel push piers shall have a minimum 3" O.D. round shaft and shall have the required shaft wall thickness so as to prevent buckling during installation. The potential for buckling is often evidenced by spring-back of the pier shaft after removing the applied installation load. Steel push piers shall have sufficient diameter and thickness to minimize observable spring-back. Steel push piers and brackets shall be protected from corrosion by hot-dip galvanizing per ASTM A123. Steel push pier connections shall consist of in-line, straight and rigid inner sleeves.

The steel push pier bracket shall have a maximum eccentricity (distance between the face of the bracket and the center of the steel push pier) of 2" or that acceptable to the Foundation Engineer. The connection between the steel push pier shaft and the bracket and between the bracket and the structure shall have sufficient strength to support design allowable loads shown on the Plans times a minimum factor of safety of 1.5.

## MATERIAL SELECTION

### 552.05 Design and Application

A list of all steel push pier and bracket materials to be used on this project shall be submitted with the bid package. The list shall clearly state the allowable mechanical capacity of all materials. The list shall be certified by the manufacturer's engineer. It is the steel push pier installation contractor's responsibility to select the appropriate size and type of steel push pier and bracket and design the connection of the bracket to the structure. These specifications and the Plans provide minimum requirements to aid the contractor in making appropriate materials selections. The size and type of steel push pier must be such that the steel push piers achieve the appropriate capacity in the soils at this site within the minimum and maximum length requirements. Failure to achieve proper capacity shall result in contractor replacing steel push piers as appropriate to support the required loads. All installation procedures, materials, and replacements shall be acceptable to Foundation Engineer.

## CONSTRUCTION REQUIREMENTS

### 551.06 Warranty and Insurance

Steel push pier installation contractor shall furnish a warranty for a period of ten (10) years from date of installation against defects due to workmanship on installation of steel push pier and bracket. Steel push pier installer must carry general liability insurance. Refer to General Conditions for additional insurance requirements.

### 551.07 Prequalification Requirements

Due to the special requirements for installation of steel push piers, and the requirements for proper performance of the structural system, as a whole, steel push piers and brackets shall be installed by an organization specializing in the installation of steel push piers. The following installation contractors are prequalified for work on this project:

Dwyer Concrete Lifting, Inc. - Cincinnati, OH  
Extreme Technology's, Inc. - Atlanta, GA  
Camden Construction Co. - Pierceton, IN  
Lipe Brothers Construction - Duluth, MN  
Terratec, Inc. - West Columbia, SC  
Agate Foundations - Knoxville, TN  
Advanced Builders, Inc. - Chesapeake, VA  
Marco Concrete Lifting - St. Albans, WV

Any other contractor desiring to bid as the steel push pier installer for this project shall submit a request to the Project Manager and Foundation Engineer for review not less than seven (7) calendar days prior to the bid date. The request must include:

1. A recent company brochure indicating experience in this type of work.
2. Evidence of having installed steel push piers on at least ten (10) projects, including project name, location, and client contact information.
3. Proposed method of installation/ load testing pier and bracket.

Prior to bidding by any installer that is not prequalified, written approval to bid must be received from the Project Manager upon consultation with the Foundation Engineer. Project Manager shall grant approval based on compliance with specific criteria herein. The Project Manager's decision is final.

### 551.08 Installation Equipment

Each steel steel push pier shall be advanced into the ground by application of axial force using a hydraulic ram(s) pressing directly against the pier. Installation equipment shall include a direct means of determining the installation load being applied to the steel push pier and a means for testing both the capacity of the bracket and connection of the bracket to the structure. Acceptable methods of load measurement include calibration of hydraulic ram pressure with axial force, a calibrated mechanical or electronic load cell, or other means acceptable to the Foundation Engineer. Current evidence of load calibration for Contractor's equipment shall be provided upon request of Engineer.

If installation equipment does not include a direct means of testing the capacity of the bracket and connection of the bracket to the structure, then Contractor shall submit to Foundation Engineer for acceptance detailed drawings of the proposed bracket and connection of bracket to structure stamped by a professional engineer registered in the State where the project is located. Drawings shall clearly indicate allowable load capacity.

#### **551.09 Equipment and Material Acceptance**

All steel push pier installation equipment and materials shall be acceptable to the Foundation Engineer prior to delivery to the site. Acceptance will be based upon submission of records and data requested by the Foundation Engineer, as discussed in Sections 551.02 through 551.08. Once accepted, changes in installation equipment and materials will not be permitted without additional acceptance, and will be considered only after Contractor has submitted any and all information requested by Foundation Engineer.

#### **551.10 Installing Steel push Piers**

Loads shown on the Plans are design allowable loads. A minimum factor of safety of 1.5 shall be used to determine the required minimum final installation force for the steel push piers. Contractor shall install and test all piers to the required final installation force at each pier location.

Steel push piers shall be installed vertically. Steel push piers may be out-of-plumb a maximum of 5% of the final installation length as measured by observation of the inside of the steel push pier upon completion.

Steel push pier brackets shall be installed at the locations shown on the Plans. Tolerances for bracket placement shall be 2" in both directions parallel with the face of the bracket and ½" in a direction perpendicular with the face of the bracket unless otherwise specified.

Steel push piers shall be installed to a final length appropriate to achieve the required final installation force. The minimum length of the steel push piers shall be such that the pier tip is at approximately the same or lower elevation as the surface of bedrock shown on the graphic logs of exploratory borings contained in the soil report.

Installation of steel push piers and brackets used to underpin an existing structure is typically performed utilizing the dead weight of the existing structure as the reaction force necessary to insert the piers into the ground. As such, steel push pier installation relies upon the strength of the concrete and reinforcing steel in the existing structure. Application of axial load, lateral load, and overturning moment to an existing structure through the process of underpinning is an unavoidable consequence of any underpinning system. The Contractor must evaluate the condition of an existing structure in the field and estimate the maximum installation load that can be applied safely to an existing structure without causing additional distress. The maximum installation load shall also not exceed that acceptable by the Foundation Engineer.

#### **551.11 Axial Load Capacity Testing**

An axial load capacity test shall be performed at each pier location. The load capacity test shall consist of application of an axial force to each pier equal to or exceeding the required final installation force and monitoring pier advancement rate for a minimum of 30 minutes. The test shall be deemed successful provided steel push pier advancement under the applied load is less than 1/16 inch per hour. Forward advancement of steel push piers shall be continued until a successful load capacity test has been completed at each steel push pier location.

In addition to the axial capacity of each steel push pier, each bracket and the connection of each bracket to the existing structure shall be tested during or after steel push pier installation. These capacity tests shall consist of applying an upward force equal to or exceeding the required final installation force on the steel push pier to the pier bracket in its final configuration and connection with the existing structure. If the Contractor's installation equipment is incapable of performing these capacity tests, then Contractor shall submit a detailed drawing of the pier bracket and connection of the bracket to the existing structure that clearly indicates the allowable capacity of the system in accordance with 551.08.

#### **551.12 Field Modifications**

Field welding, if required, shall be in accordance with the "Code for Welding in Building Construction" of the American Welding Society. Welding of galvanized steel can produce toxic gases and should be done in adequate

ventilation and with appropriate gas detection, breathing gear, and other safety equipment per OSHA regulations. Modification of manufactured steel push pier shaft, brackets, and connectors is prohibited and shall not be performed without approval of product manufacturing company and acceptance of Foundation Engineer.

**551.13 Quality Assurance Observation**

Installation of steel push piers shall be observed by Foundation Engineer or Foundation Engineer's representative/agent to verify the length and required final installation loads. Contractor shall notify Foundation Engineer or Foundation Engineer's representative/agent at least 24 hours prior to installation work.

**METHOD OF MEASUREMENT**

**551.14** Steel push piers will be measured on a per unit basis with one unit equal to the equipment, materials, including bracket and pier shaft, and labor required for proper installation and testing of one single steel push pier at the required final installation capacity, location, elevation, and minimum length specified.

**BASIS OF PAYMENT**

**551.15** The accepted quantities will be paid for at the unit price per unit of measurement for each of the pay items listed below that appear in the bid schedule. Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Steel push Pier & Bracket, Installed	Each

Compensation will not be made for any additional length required to achieve the final installation force that is beyond the specified minimum length. It is the Contractor's responsibility to anticipate the required length of the steel push piers and include these costs in the bid price per unit.