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ESR-4331

Issued 10/2018

This report is subject to renewal 02/2019.

DIVISION: 31 00 00—EARTHWORK

SECTION: 31 63 00—BORED PILES

REPORT HOLDER:

GREGORY ENTERPRISES, INC.

EVALUATION SUBJECT:

RAM JACK® DRIVEN (PUSH) FOUNDATION SYSTEM



“2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence”



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ICC-ES Evaluation Report

ESR-4331

Issued October 2018

This report is subject to renewal February 2019.

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DIVISION: 31 00 00—EARTHWORK
Section: 31 63 00—Bored Piles

REPORT HOLDER:

GREGORY ENTERPRISES, INC.

ADDITIONAL LISTEE:

RAM JACK MANUFACTURING, LLC

EVALUATION SUBJECT:

RAM JACK® DRIVEN (PUSH) FOUNDATION SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, 2009 and 2006 *International Building Code (IBC)*
- 2018, 2015, 2012, 2009 and 2006 *International Residential Code (IRC)*
- 2013 *Abu Dhabi International Building Code (ADIBC)*†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see [ESR-4331 LABC Supplement](#).

Property evaluated:

Structural

2.0 USES

Ram Jack® Driven or Push Foundation System; otherwise known as hydraulically driven steel piling system, is designed to resist axial compressive loads from the supported structures.

When driven piles are installed under the IRC, an engineered design is required in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The Ram Jack® Driven Foundation System consists of hydraulically driven steel piling connected to brackets that are in contact and connected with the load-bearing foundation of a structure.

3.2 System Components:

3.2.1 Hydraulically Driven Pile System—Pilings, Connectors, Starter, and Guide Sleeve: The pilings

consist of either 2⁷/₈- or 3¹/₂-inch-outside-diameter (73 or 89 mm) pipe having a nominal shaft thickness of 0.217 or 0.254 inch (5.5 or 6.5 mm), respectively, in either 3-, 5- or 7-foot-long (914, 1524, or 2134 mm) sections. Connectors used to connect the 2⁷/₈- or 3¹/₂-inch-outside-diameter pilings together are 12-inch-long (305 mm), 2³/₈- or 2⁷/₈-inch-outside-diameter (60.3 or 73 mm), respectively, pipe having a nominal shaft thickness of 0.19 or 0.217 inch (4.8 or 5.5 mm), respectively, shop crimped and inserted in one end of the piling section so that approximately 6 inches of the connector extends out of one end of the piling section. During installation, the subsequent piling section slides over the connector of the previous piling section. Figure 1 illustrates a typical piling used in conjunction with a bracket. The starter consists of a 2⁷/₈- or 3¹/₂-inch-diameter (73 or 89 mm) steel pipe having a nominal shaft thickness of 0.217 or 0.254 inch (5.5 or 6.5 mm), respectively, and a 2³/₈- or 2⁷/₈-inch-outside-diameter (60.3 or 73 mm) pipe having a nominal shaft thickness of 0.19 or 0.21 inch (4.8 or 5.5 mm), respectively, which is shop crimped and inserted in one end of the piling section so that approximately 6 inches of the connector extends out of one end of the piling section. A 2³/₈- or 2⁷/₈-inch-diameter-by-1¹/₈-inch-thick (3.2 mm by 60.3 or 73 mm) ASTM A36 steel soil plug is shop-welded inside the 2⁷/₈- or 3¹/₂-inch (73 or 89 mm) starter section against the 2³/₈- or 2⁷/₈-inch (60.3 or 73 mm), respective connector. The starter section is jobsite-installed into the end of the initial piling and leads the piling in order to expand the soil away from the piling with a 3¹/₂- or 4¹/₂-inch-outside-diameter (89 or 114 mm) steel ring having a nominal wall thickness of 0.254 inch, shop-welded to the starter section 1 inch (25.4 mm) from the bottom edge to reduce skin friction. Figure 2 illustrates a typical starter joint. A steel pipe guide sleeve, shown in Figure 1, is used to laterally strengthen the driven pile. The starter, guide sleeve, and pilings are coated with polymer coating complying with AC228 and having a minimum coating thickness of 18 mils (0.46 mm), as described in the approved quality documentation.

3.2.2 Brackets: Brackets are constructed from steel plate and steel pipe components, which are factory-welded together. The different brackets are described in Sections 3.2.2.1 through 3.2.2.3. All brackets are coated with polymer coating complying with AC228 and having a minimum thickness of 18 mils (0.46 mm), as described in the approved quality documentation.

3.2.2.1 Support Bracket #4021.1: This bracket is used to support existing concrete foundations supporting axial compressive loading. The bracket is constructed from a 3¹/₈-inch-thick (9.5 mm) steel plate bent to a 90-degree angle seat measuring 10 inches (254 mm) wide by

9 inches (229 mm) long on the horizontal leg and 7 inches (178 mm) on the vertical leg. The seat is factory-welded to a 4¹/₂-inch-outside-diameter (114 mm) steel bracket sleeve having a nominal wall thickness of 0.438 inch. The external guide sleeve, a 3¹/₂-inch-outside-diameter (89 mm) steel pipe having a nominal wall thickness of 0.254 inch, is inserted through the bracket sleeve. The 2⁷/₈-inch-outside-diameter (73 mm) pile is inserted through the external guide sleeve. Once the 2⁷/₈-inch-outside-diameter (73 mm) pile shaft has been installed through the external guide sleeve, the pile is cut approximately 6 inches above the bracket. Two 1-inch-diameter (25 mm) all-thread bolts are installed into the matching nuts which are factory-welded to each side of the bracket sleeve. A 3³/₄-inch-thick (19 mm) support strap measuring 5 inches (127 mm) long by 2 inches (51 mm) in width is then placed over the all-thread bolts and centered on top of the pile. The support strap is then attached to the bracket with two 1-inch (25 mm) hex nuts screwed down on the all-threads. Figure 3 shows additional details.

3.2.2.2 Support Bracket #4021.55: The bracket is similar to the 4021.1 bracket but is designed to support larger axial compressive loads from existing structures. The bracket is constructed of a 3³/₈-inch-thick (9.5 mm) steel plate bent to a 90-degree angle seat measuring 10 inches (254 mm) wide by 9 inches (229 mm) long on the horizontal leg and 7 inches (178 mm) on the vertical leg. The seat is factory-welded to a 5¹/₂-inch-outside-diameter (140 mm) steel bracket sleeve having a nominal wall thickness of 0.375 inch. The external sleeve, a 4¹/₂-inch-outside-diameter (114 mm) steel pipe having a nominal wall thickness of 0.438 inch, is inserted through the bracket sleeve. A 3¹/₂-inch-outside-diameter (89 mm) pile is inserted through the external guide sleeve. Once the 3¹/₂-inch-outside-diameter (89 mm) pile shaft has been installed through the external guide sleeve, the pile is cut approximately 6 inches (152 mm) above the bracket. Two 1¹/₄-inch-diameter (32 mm) all-thread bolts are installed into the matching hex nuts which are shop-welded to each side of the bracket sleeve. A 2¹/₄-inch-square-bar support strap is then placed over the all-thread bolts and centered on top of the pile. The support strap is then attached to the bracket with two 1¹/₄-inch (32 mm) hex nuts screwed down on the all-threads. Figure 3 shows additional details.

3.2.2.3 Support Bracket #4039.1: This is a low-profile bracket used to underpin existing structures to support axial compressive loads where the bottom of the footing is approximately 6 inches to 10 inches below grade. The bracket is constructed of a 3³/₈-inch-thick (9.5 mm) steel plate measuring 10 inches (254 mm) wide by 6.75 inches (172 mm) long, factory-welded to a 4¹/₂-inch-outside-diameter (114 mm) steel bracket sleeve. The external guide sleeve, a 3¹/₂-inch-outside-diameter (89 mm) steel pipe, is inserted through the bracket sleeve. The 2⁷/₈-inch-outside-diameter (73 mm) pile is inserted through the external guide sleeve. Once the 2⁷/₈-inch-outside-diameter (73 mm) pile has been installed, the pile is cut approximately 6 inches above the bracket. Two 1-inch-diameter (25 mm) all-thread bolts are installed in matching hex nuts which are factory-welded to each side of the bracket sleeve. A 3³/₄-inch-thick (19 mm) support strap is then placed over the all-thread bolts and centered on top of the pile. The support strap is then attached to the bracket with two 1-inch (25 mm) hex nuts screwed down on the all-threads. Figure 4 shows additional details.

3.3 Material Specifications:

3.3.1 Piling Sections: The piling sections, connectors, starters and guide sleeves are carbon steel round tube

conforming to ASTM A500, Grade C, except they have a minimum yield strength of 65,000 psi (448 MPa) and a minimum tensile strength of 76,000 psi (524 MPa).

3.3.2 Brackets:

3.3.2.1 Plates: The 3³/₈-inch-thick (10 mm) steel plate used in the brackets conform to ASTM A36, but have a minimum yield strength of 50,000 psi (345 MPa) and a minimum tensile strength of 70,000 psi (483 MPa).

3.3.2.2 Sleeves: The carbon steel round tube used in the bracket assembly as a sleeve conforms to ASTM A500, Grade C, except it has a minimum yield strength of 65,000 psi (448 MPa) and a minimum tensile strength of 80,000 psi (552 MPa).

3.3.2.3 Threaded Rods and Nuts:

The threaded rods conform to ASTM A307 and ASTM A449. The nuts conform to ASTM A563, Grade DH. The threaded rods and nuts are Class B hot-dipped galvanized in accordance with ASTM A153.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Engineering calculations (analysis and design) and drawings, prepared by a registered design professional, must be submitted to and be subjected to the approval of the code official for each project, and must be based on accepted engineering principles, as described in IBC Section 1604.4, and must conform to 2018, 2015, 2012 and 2009 IBC Section 1810 and 2006 IBC Section 1808. The design method for the steel components is Allowable Strength Design (ASD), described in IBC Section 1602 and AISC 360 Section B3.4. The engineering analysis must address hydraulically-driven foundation system performance related to structural and geotechnical requirements.

The structural analysis must consider all applicable internal forces (shears, bending moments and torsional moments, if applicable) due to applied loads, structural eccentricity and maximum span(s) between push pier systems. The minimum embedment depth for various loading conditions must be included based on the most stringent requirements of the following: engineering analysis, allowable capacities noted in this report, site-specific geotechnical investigation report, and site-specific load tests, if applicable. A soil investigation report in accordance with this section (Section 4.1.1) must be submitted for each project. The soil interaction capacity between the pile and the soil including the required safety factor and the soil effects of the hydraulically driven steel pile installation must be determined in accordance with the applicable code by a registered design professional. The maximum installation force and working capacity of the hydraulically driven steel piling system must be determined in accordance with Ram Jack installation instructions and as recommended by a registered design professional. The allowable strengths (allowable capacities) of the steel components of the Ram Jack driven foundation system are described in Table 1 (for brackets, P1) and Table 3 (for shafts, P2).

A written report of the geotechnical investigation must be submitted to the code official as part of the required submittal documents, prescribed in 2018, 2015, 2012 and 2009 IBC Section 107 and 2006 IBC Section 106, at the time of the permit application. The geotechnical report must include, but not be limited to, all of the following information:

- A plot showing the location of the soil investigation.
- A complete record of the soil boring and penetration test logs and soil samples.

- A record of soil profile.
- Information on ground-water table, frost depth and corrosion related parameters, as described in Section 5.5 of this report.
- Soil properties, including those affecting the design such as support conditions of the piles.
- Soil design parameters; soil deformation parameters; and relative pile support conditions as defined in 2018, 2015, 2012 and 2009 IBC Section 1810.2.1 and 2006 IBC Section 1808.2.9.
- Confirmation of the suitability of Ram Jack driven foundation system for the specific project.
- Recommendations for design criteria, including but not be limited to: mitigations of effects of differential settlement and varying soil strength; and effects of adjacent loads.
- Recommended center-to-center spacing of pile foundations, if different from Section 5.14 of this report; and reduction of allowable loads due to the group action, if necessary.
- Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity when required).
- Load test requirements.
- Any questionable soil characteristics and special design provisions, as necessary.
- Expected total and differential settlement.
- The axial compression load soil capacities for allowable capacities that cannot be determined from this evaluation report.
- Minimum pile depth, if any, based on local geologic hazards such as frost, expansive soils, or other condition.

4.1.2 Bracket Capacity: The concrete foundation must be designed and justified to the satisfaction of the code official with due consideration to the eccentricity of applied loads, including reactions provided by the brackets, acting on the concrete foundation. Only localized limit states of supporting concrete foundation, including bearing and punching shear, have been evaluated in this evaluation report. Other limit states are outside the scope of this evaluation report and must be determined by the registered design professional. The effects of reduced lateral sliding resistance due to uplift from wind or seismic loads must be considered for each project. Reference Table 1 for the allowable bracket capacity ratings.

4.1.3 Pile Shaft Capacity: Table 3 describes the allowable axial compression loads of the shafts and Table 2 describes the mechanical properties of the shafts, which are based on a 50-year corrosion effect in accordance with Section 3.9 of the ICC-ES Acceptance Criteria for Helical Pile Systems and Devices (AC358). The top of shafts must be braced as prescribed in 2018, 2015, 2012 and 2009 IBC Section 1810.2.2 and 2006 IBC Section 1808.2.5, and the supported foundation structures such as concrete footings are assumed to be adequately braced such that the supported foundation structures provide lateral stability for the pile systems. In accordance with 2018, 2015, 2012 and 2009 IBC Section 1810.2.1 and 2006 IBC Section 1808.2.9, any soil other than fluid soil must be deemed to afford sufficient lateral support to prevent buckling of the systems that are braced, and the unbraced length is defined as the length of piles that is standing in air, water or in fluid soils plus additional 5 feet (1524 mm) when embedded into firm soil or

additional 10 feet (3048 mm) when embedded into soft soil. Firm soils shall be defined as any soil with a Standard Penetration Test blow count of five or greater. Soft soil shall be defined as any soil with a Standard Penetration Test blow count greater than zero and less than five. Fluid soils shall be defined as any soil with a Standard Penetration Test blow count of zero [weight of hammer (WOH) or weight of rods (WOR)]. Standard Penetration Test blow count shall be determined in accordance with ASTM D1586.

The elastic shortening of the pile shaft will be controlled by the strength and section properties of the shaft sections and coupler(s). For loads up to and including the allowable load limits found in this report, the elastic shortening of shaft can be estimated as:

$$\Delta_{\text{shaft}} = P L / (A E)$$

where:

Δ_{shaft} = Length change of shaft resulting from elastic shortening, in (mm).

P = applied axial load, lbf (N).

L = effective length of the shaft, in. (mm).

A = cross-sectional area of the shaft, see Table 2, in.² (mm²).

E = Young's modulus of the shaft, see Table 2, ksi (MPa).

4.2 Installation:

The Ram Jack[®] Driven Foundation System must be installed by Ram Jack[®] Manufacturing LLC certified and trained installers. The Ram Jack[®] Driven Foundation System must be installed in accordance with this section (Section 4.2) and the manufacturer's installation instructions.

4.2.1 Hydraulically Driven Steel Piling/Pier and Bracket Installation:

1. An area must be excavated immediately adjacent to the building foundation to expose the footing, bottom of grade beam, stem wall or column to a width of at least 24 inches (610 mm) and at least 12 inches (305 mm) below the bottom of the footing or grade beam.
2. The vertical and bottom faces of the foundation must, to the extent possible, be smooth and at right angles of each other for the mounting of the pile bracket. The surfaces in contact with the support bracket must be free of all dirt, debris and loose concrete so as to provide firm bearing surfaces. Reference Figure 3 for proper bracket placement.
3. The spread footing, if applicable, must be notched to allow the support bracket seat to mount directly under the bearing load of the stem or basement wall.
4. The pile lead section, guide sleeve and first pile section must be inserted through the bracket sleeve. The double action hydraulic rams must be connected to the support bracket. The pile should not be more than 1 degree from vertical. Hydraulic rams used to install the pile must have the capability of exerting a minimum installation force of 60,000 or 100,000 lbs (267 or 445 kN).
5. The hydraulic rams must be reciprocated up and down, with the pile being advanced with each downward stroke. Pile sections must be continuously added as required to advance the pile through unstable soils as required. Advancement of the pile will continue until one of the following occurs: the structure begins to

experience uplift flexure as the pile is being advanced, the desired hydraulic pressure is achieved or as determined by the foundation investigation. All piles must be installed individually utilizing the maximum resistance of the structure as a reaction force to install each pile. The location of the driven pile system must be determined by a registered design professional. Lifting of the structure must be verified by the registered design professional to ensure that the foundation and/or superstructure are not overstressed.

6. After piling termination, the excess piling must be cut off squarely at a sufficient height to allow for foundation lifting. The support strap assembly must be installed with the hex nuts, and the lifting tool is placed on the head of the pile.
7. The excavation must be back-filled and the soil properly compacted. Excess soil must be removed.

4.3 Special Inspection:

Special inspection in accordance with 2018, 2015 and 2012 IBC Section 1705.7 and 2009 and 2006 IBC Section 1704.8, is required for installation of the Ram Jack[®] driven foundation system. The special inspector must verify the following:

1. Verification of manufacturer product model numbers (see Section 3.0).
2. Types, configurations and identifications of hydraulically driven steel pile sections, pilings, extensions and brackets as specified in this report and the construction documents.
3. Installation procedures, anticipated and actual piling depth.
4. Tip elevations, the installation pressure and final depth of the driven foundation system.
5. Inclination and position/location of hydraulically driven steel piles.
6. Compliance of the installation with the approved construction documents and this evaluation report.

5.0 CONDITIONS OF USE

The Ram Jack[®] Driven Foundation System described in this report comply with, or is a suitable alternative to what is specified in, those codes indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1 The driven foundation system is manufactured, identified and installed in accordance with this report, the approved construction documents and the manufacturer's published installation instructions. In the event of a conflict between this report, the approved construction documents and the manufacturer's published installation instructions, the most restrictive governs.
- 5.2 Driven pile systems have been evaluated to support structures in Seismic Design Categories (SDCs) A, B and C. Use of the systems to support structures assigned to SDC D, E or F, or which are located in Site Class E or F, are outside the scope of this report and are subject to the approval of the building official, based upon submission of a design in accordance with the code by a registered design professional.
- 5.3 Installation of the hydraulically driven pile systems must be limited to support of uncracked normal-weight concrete, as determined in accordance with the applicable code.

5.4 Brackets must be used only to support structures that are laterally braced as defined in 2018, 2015, 2012 and 2009 IBC Section 1810.2.2 and 2006 IBC Section 1808.2.5.

5.5 Use of the hydraulically driven pile systems in conditions that are indicative of a potential pile corrosion situation as defined by soil resistivity of less than 1000 ohm-cm, a pH of less than 5.5, soils with high organic content, sulfate concentrations greater than 1000 ppm, landfills, or mine waste is beyond the scope of the evaluation report.

5.6 Powder-coated steel may be combined with zinc-coated steel and bare steel components. All hydraulically driven pile components must be galvanically isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.7 The adequacy of the concrete structures that are connected to the Ram Jack brackets must be verified by a registered design professional, in accordance with applicable code provisions, such as Chapter 13 of ACI 318-14 under the 2018 and 2015 IBC (Chapter 15 of ACI 318 under the 2012, 2009 and 2006 IBC) and Chapter 18 of IBC, and subject to the approval of the code official.

5.8 The hydraulically driven piles must be installed vertically into the ground with a maximum allowable angle of inclination of 1 degree.

5.9 Special inspection is provided in accordance with Section 4.3 of this report.

5.10 Engineering calculations and drawings, in accordance with recognized engineering principles and design parameters as described in IBC Section 1604.4, and in compliance with Section 4.1 of this report, are prepared by a registered design professional and approved by the building official.

5.11 A soils investigation for each project site must be provided to the building official for approval in accordance with Section 4.1.1 of this report.

5.12 Evaluation of compliance with 2018, 2015, 2012 and 2009 IBC Section 1810.3.11.1 and 2006 IBC Section 1808.2.23.1 for buildings assigned to Seismic Design Category (SDC) C, and with 2018, 2015, 2012 and 2009 IBC Section 1810.3.6 and 2006 IBC Section 1808.2.7 for all buildings, is outside of the scope of this evaluation report. Such compliance must be addressed by a registered design professional for each site, and is subject to approval by the code official.

5.13 Settlement of the hydraulically driven pile is outside the scope of this evaluation report and must be determined by a registered design professional as required in 2018, 2015, 2012 and 2009 IBC Section 1810.2.3 and 2006 IBC 1808.2.12.

5.14 The interaction between the hydraulically driven pile system and the soil is outside the scope of this report.

5.15 The Ram Jack[®] Driven Foundation Systems are manufactured at the Ram Jack Manufacturing, LLC, facility located in Ada, Oklahoma, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- Bracket load tests.
- Engineering calculations of shaft.
- Quality control documentation and installation instructions.

7.0 IDENTIFICATION

7.1 The Ram Jack® Driven Foundation System components are identified by a tag or label bearing the Ram Jack logo; the name and address of Gregory Enterprises, Inc.; the catalog number; the product description; and the evaluation report number (ESR-4331).

7.2 The report holder's contact information is the following:

GREGORY ENTERPRISES, INC.
 13655 COUNTY ROAD 1570
 ADA, OKLAHOMA 74820
 (580) 332-9980
www.ramjack.com
steve@ramjack.com

7.3 The additional listee's contact information is the following:

RAM JACK MANUFACTURING, LLC
 13655 COUNTY ROAD 1570
 ADA, OKLAHOMA 74820

TABLE 1—FOUNDATION STRENGTH RATINGS OF BRACKETS^{1,2,3}

PRODUCT NUMBER	DESCRIPTION	PILING DIAMETER (inches)	ALLOWABLE COMPRESSION CAPACITY (kips)
4021.1	Side load bracket	2 ⁷ / ₈	33.65
4021.55	Side load bracket	3 ¹ / ₂	55.12
4039.1	Side load bracket	2 ⁷ / ₈	32.07

For **SI**: 1 inch = 25.4 mm, 1 kip (1000 lbf) = 4.48 kN.

¹Load capacity is based on full scale load tests per AC358 with an installed 5'-0" unbraced pile length having a maximum of one coupling per 2018, 2015, 2012 and 2009 IBC Section 1810.2.1 and 2006 IBC 1808.2.9.2. A 4-foot-long guide sleeve must be installed at the top of the shaft as required in Figures 3, 5 and 7. Side load bracket must be concentrically loaded. Side load bracket plate must be fully engaged with bottom of concrete foundation. Only localized limit states such as mechanical strength of steel components and concrete bearing have been evaluated.

²The capacities listed in Table 1 assume the structure is sideways braced per 2018, 2015, 2012 and 2009 IBC Section 1810.2.2 and 2006 IBC Section 1808.2.5.

³The tabulated values are based on installation with normal-weight concrete having a minimum compressive strength of 2500 psi (17.23 MPa).

TABLE 2—MECHANICAL PROPERTIES AFTER CORROSION LOSS¹ OF 2.875- AND 3.5-INCH-DIAMETER SHAFT

Mechanical Properties	SHAFT DIAMETER (inches)	
	2.875	3.5
Steel Yield Strength, F _y (ksi)	65	65
Steel Ultimate Strength, F _u (ksi)	76	76
Modulus of Elasticity, E (ksi)	29,000	29,000
Nominal Wall Thickness (inch)	0.217	0.254
Design Wall Thickness (inch)	0.1758	0.2102
Outside Diameter (inch)	2.8490	3.4740
Inside Diameter (inch)	2.4974	3.0536
Cross Sectional Area (inch ²)	1.48	2.16
Moment of Inertia, I (inch ⁴)	1.32	2.88
Radius of Gyration, r (inch)	0.95	1.16
Section Modulus, S (inch ³)	0.93	1.66
Plastic Section Modulus, Z(inch ³)	1.26	2.24

For **SI**: 1 inch = 25.4 mm; 1 ksi = 6.89 MPa, 1 ft-lbf =1.36 N-m; 1 lbf =4.45 N.

¹Dimensional properties are based on powder coated steel losing 0.026-inch steel thickness as indicated in Section 3.9 of AC358 for a 50-year service life.

TABLE 3—ALLOWABLE COMPRESSION CAPACITY OF 2⁷/₈- AND 3¹/₂- INCH-DIAMETER PILE WITH COUPLER ECCENTRICITY¹ (kips)

2 ⁷ / ₈ Fully Braced (L _u = 0)	3 ¹ / ₂ Fully Braced (L _u =0)
57.5	83.9

For SI: 1 inch = 25.4 mm; 1 ft = 0.305 m; 1 kip (1000 lbf) = 4.48 kN.

¹L_u=Total unbraced pile length per 2018, 2015, 2012 and 2009 IBC Section 1810.2.1 and 2006 IBC Section 1808.2.9.2, including the length in air, water or in fluid soils, and the embedment length into firm or soft soil (non-fluid soil). kL_u = total effective unbraced length of the pile, where kL_u = 0 represent a fully braced condition in that the total pile length is fully embedded in firm or soft soil and the supported structure is braced in accordance 2018, 2015, 2012 and 2009 IBC Section 1810.2.2 (Section 1808.2.5 of the 2006 IBC).

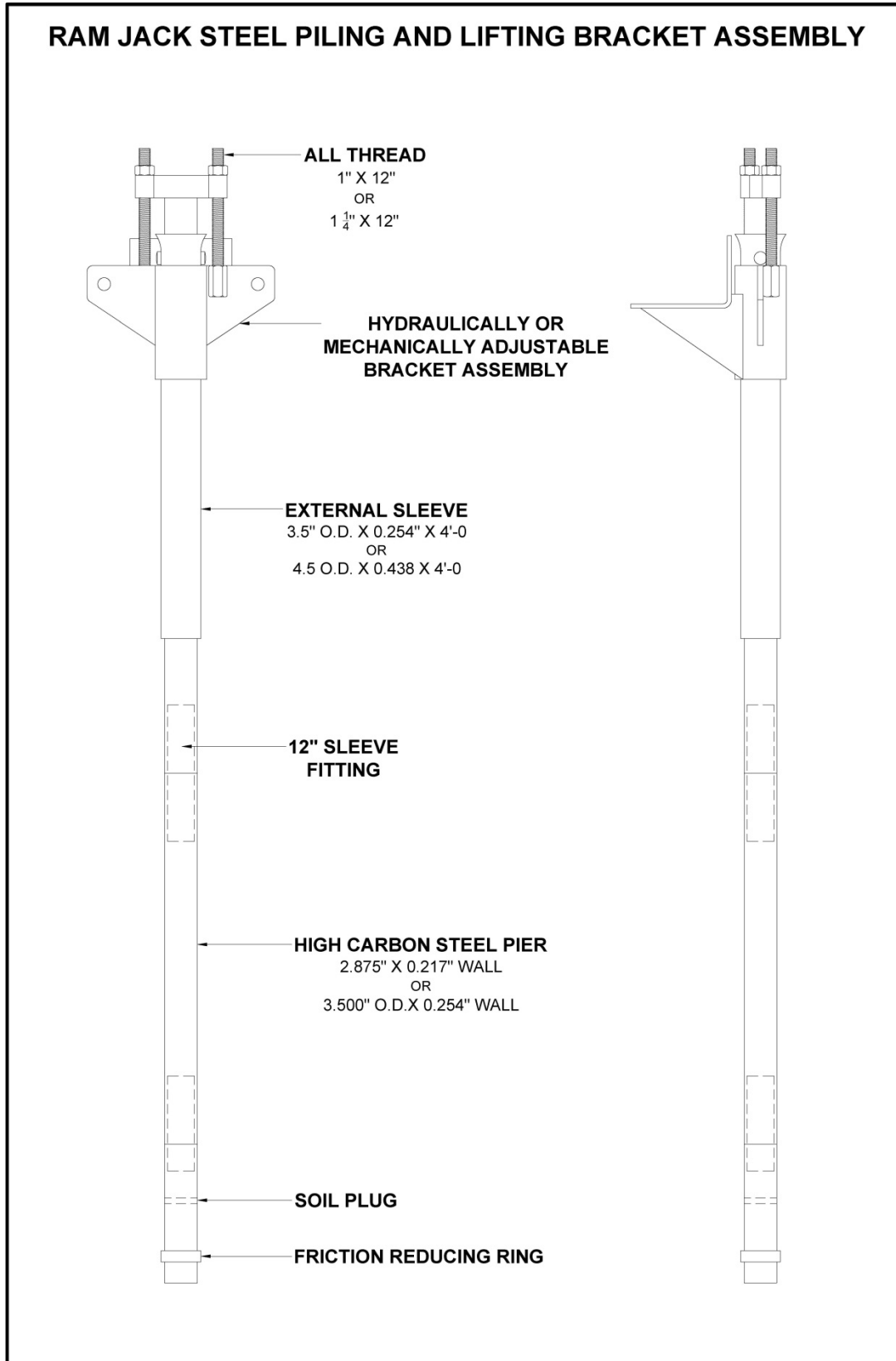


FIGURE 1- TYPICAL DRIVEN PILING USED IN CONJUNCTION WITH THE COMMERCIAL BRACKET #4021

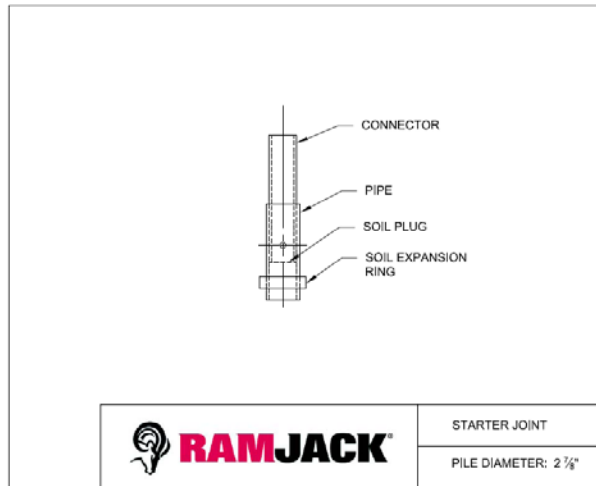


FIGURE 2—DETAIL OF STARTER JOINT

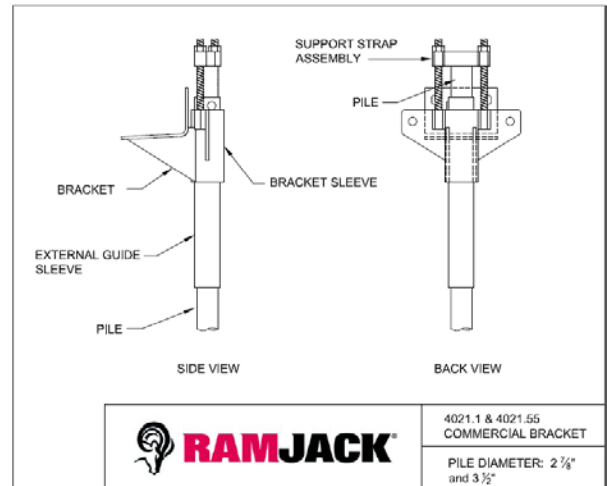


FIGURE 3—4021.1 SUPPORT BRACKET ASSEMBLY WITH GUIDE SLEEVE AND PILING

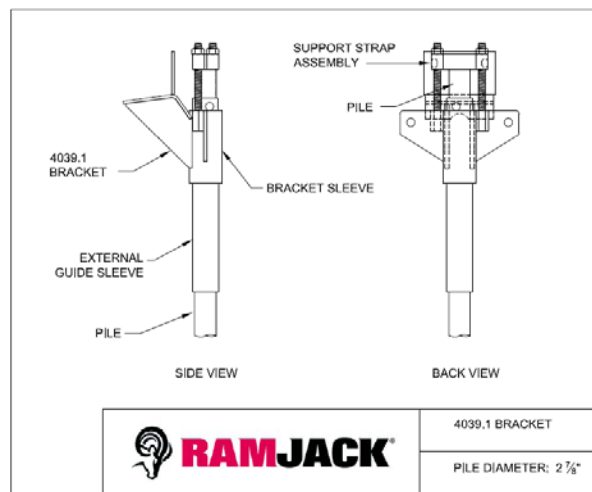


FIGURE 4—4039.1 SUPPORT BRACKET AND PILING

ICC-ES Evaluation Report

ESR-4331 LABC and LARC Supplement

Issued October 2018

This report is subject to renewal February 2019.

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Section: 31 63 00—Bored Piles

REPORT HOLDER:

GREGORY ENTERPRISES

EVALUATION SUBJECT:

RAM JACK® DRIVEN (PUSH) FOUNDATION SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Ram Jack Driven or Push Foundation System, described in ICC-ES master evaluation report [ESR-4331](#), have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Ram Jack Driven Foundation System, described in Sections 2.0 through 7.0 of the master evaluation report [ESR-4331](#), comply with the LABC Section 1810, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Ram Jack Driven Foundation System described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the master evaluation report [ESR-4331](#).
- The design, installation, conditions of use and identification of the driven foundation system are in accordance with the 2015 *International Building Code*® (2015 IBC) provisions noted in the master evaluation report [ESR-4331](#).
- The Ram Jack Driven Foundation System are used to underpin foundations of existing structures or retrofit or remediate deficient foundations of existing structures, and must not be used to support new structures.
- The Ram Jack Driven Foundation System must not be used to resist any horizontal loads.
- Sections 5.2 and 5.12 of the master evaluation report [ESR-4331](#) are not applicable to this supplement.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the master report, issued October 2018.

ICC-ES Evaluation Report

ESR-4331 FBC Supplement

Issued October 2018

This report is subject to renewal February 2019.

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A Subsidiary of the International Code Council®

DIVISION: 31 00 00—EARTHWORK

Section: 31 63 00—Bored Piles

REPORT HOLDER:

GREGORY ENTERPRISES, INC.

EVALUATION SUBJECT:

RAM JACK® DRIVEN (PUSH) FOUNDATION SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Ram Jack® Driven or Push Foundation System, recognized in ICC-ES master evaluation report ESR-4331, has also been evaluated for compliance with the codes noted below.

Applicable code edition:

- 2017 *Florida Building Code—Building*
- 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Ram Jack® Driven Foundation System, described in Sections 2.0 through 7.0 of the master evaluation report ESR-4331, complies with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2015 *International Building Code*® provisions noted in the master report and the following conditions apply:

Use of Ram Jack® Driven Foundation System for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* have not been evaluated, and is outside the scope of this supplemental report.

For products falling under Florida Rule 9N-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report, issued October 2018.