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Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
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Legacy report on the 1997 *Uniform Building Code*™

DIVISION: 02—SITE CONSTRUCTION
Section: 02465—Bored Piles

RAM JACK® FOUNDATION SYSTEMS

GREGORY ENTERPRISES, INC.
3065 FOREST LANE
GARLAND, TEXAS 75042

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

1.0 SUBJECT

Ram Jack® Foundation Systems.

2.0 DESCRIPTION

2.1 General:

The Ram Jack® Foundation Systems consist of brackets that are in contact with the load-bearing foundation or the slab of a structure and either helical anchors or hydraulically driven steel pilings. The helical anchor system transfers loads from the new or existing foundation to a soil suitable for the loads applied and can also be used to transfer tension loads in tieback applications. The steel piling system is used to transfer the loads on existing foundations to load-bearing soil strata that can support the downward-applied compression loads. Brackets are used to transfer the load from the foundation or slab of a structure to the helical anchor or steel piling.

2.2 System Components:

2.2.1 Helix Anchor Lead Shafts and Extensions: The lead shafts consist of $2^3/_8$-inch- (60 mm) or $2^7/_8$-inch-diameter (73 mm) seamless steel pipe with helical-shaped discs welded to the pipe, which advance the anchors into the soil when the anchor is rotated. Helical discs (plates) are 8, 10, 12 or 14 inches (203, 254, 305 or 356 mm) in diameter, and are cut from $^3/_8$-inch- (9.53 mm) or $^1/_2$-inch-thick (12.7 mm) steel plate. The helical plates are pressed, using a hydraulic press and die, to achieve a $3^1/_2$-inch (89 mm) pitch, and are then welded to the helical lead shaft. Figure 1 illustrates the helical anchors. The extensions have shafts similar to the helical anchors, without the helical plates. The helical anchor lead shafts and extensions connect using a screw-together system that consists of a nut welded into the trailing end of the helical anchor lead section and a nut welded into each end of the extension. A threaded stem is then used to screw the components together. Figure 2 illustrates the helical anchor extension connections. The final product is coated with a polyethylene copolymer coating described in the approved quality control manual (QCM).

2.2.2 Pilings and Connectors: Pilings consist of $2^7/_8$-inch-outside-diameter (73 mm) pipe, in either 3-, 5- or 7-foot-long (914, 1524, or 2134 mm) sections. Connectors are 12-inch-long (305 mm), $2^3/_8$-inch-outside-diameter (60.3 mm) pipe, crimped and inserted in one end of the $2^7/_8$-inch-diameter (73 mm) pipe so that approximately 6 inches (152 mm) 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 3 illustrates a typical piling used in conjunction with a bracket. The initial starter joint, consisting of a $2^7/_8$-inch-diameter (73 mm) steel pipe with soil plug and soil-expansion ring, leads the pier in order to expand the soil away from the piling to reduce skin friction. Figure 4 illustrates a typical starter joint. A steel pipe guide sleeve, described in Figure 3, is used to laterally strengthen the pier. The starter, guide sleeve, and pilings are coated with a corrosion-resistant polymer coating as described in the approved QCM.

2.2.3 Brackets: Brackets are constructed from steel plate and steel pipe components, which are welded together. The different brackets are described in Sections 2.2.3.1 through 2.2.3.5. All brackets are coated with a corrosion-resistant polymer coating as described in the QCM.

2.2.3.1 Commercial Bracket #4021: This bracket is used to support existing foundations. The bracket is constructed of $^1/_2$-inch-thick (12.7 mm) steel plate welded to $4^1/_2$-inch-outside-diameter (114.3 mm) steel sleeve. The sleeve, a $2^7/_8$-inch-outside-diameter (73 mm) steel piling, is connected to the support piling. Figure 5 shows additional details.

2.2.3.2 HD Commercial Bracket #4022: This bracket is similar to the commercial bracket #4021, except that it uses a larger support strap. The larger support strap is constructed using 2-inch-by-2-inch-by-8-inch (50.8 mm by 50.8 mm by 203 mm) steel. Figure 5 contains additional details.

2.2.3.3 Porch Bracket #4067: The porch bracket is used to stabilize or lift lightweight structures for remedial foundation repair. The bracket consists of $^1/_2$-inch-thick (12.7 mm) steel plate, welded to $2^7/_8$-inch-outside-diameter (73 mm) steel pipe sleeve. The porch bracket is typically used with $2^3/_8$-inch-diameter (60.3 mm) helical anchors and extensions. Figure 6 contains additional details.

2.2.3.4 Preconstruction Bracket #4075: The bracket consists of $^1/_2$-inch-thick (12.7 mm) steel plate welded to a $3^1/_2$-inch-outside-diameter (88.9 mm) steel pipe. This bracket is typically used with $2^7/_8$-inch-outside-diameter (73 mm) helical shafts and extensions. They are installed prior to construction and tied to rebar before concrete is poured. Figure 7 contains additional details.

2.2.3.5 Slab Bracket #4062: The slab bracket consists of two 17-inch-long (431.8 mm) steel channels spaced 2 inches (51 mm) apart, with four $^3/_{16}$-inch-thick-by-4-inch-by-4-inch (4.76 mm by 101.6 mm by 101.6 mm) steel plates welded on top and bottom on each end. The lifting tube is $2^7/_8$-inch-outside-diameter-by-12-inch-long (73 mm by 304.8 mm) steel with a $^1/_4$-inch-by-3-inch-by-3-inch (6.35 mm by 76.2 mm by 76.2 mm) plate containing a $1^1/_4$-inch-diameter (31.8 mm) hole in the center. A $1^1/_4$-inch (31.8 mm) nut is welded over the hole in the plate, and the plate is welded to one end of the lifting tube. The lifting tube is attached to the bracket as shown in Figure 8. The slab bracket is typically installed with $2^3/_8$-inch-diameter (60.3 mm) helical shafts and extensions. The slab bracket is used to lift and stabilize concrete slabs as a remedial repair. Figure 8 contains additional details.

2.3 Material Specifications:

2.3.1 Helix Plates: The carbon steel plates conform to ASTM A 36, having a minimum yield strength of 36,000 psi (248 MPa) and a minimum tensile strength of 60,000 psi (413 MPa).

2.3.2 Helical Anchor Lead Shaft and Extensions: The shaft and extensions are carbon steel pipe that conforms to American Petroleum Institute (API) J-55 grade, having a minimum yield strength of 65,000 psi (448 MPa) and a minimum tensile strength of 85,000 psi (586 MPa).

2.3.3 Piling Sections: The piling sections, connectors, soil plugs and guide sleeves are carbon steel pipe that conform to API J-55 grade, having a minimum yield strength of 65,000 psi (448 MPa) and a minimum tensile strength of 85,000 psi (586 MPa).

2.3.4 Brackets:

2.3.4.1 Plates and Channels: The carbon steel plates and channels used in the brackets conform to ASTM A 36, having a minimum yield strength of 36,000 psi (248 MPa) and a minimum tensile strength of 60,000 psi (413 MPa).

2.3.4.2 Sleeves: The carbon steel pipe used in the bracket assembly conforms to API J-55 grade, having a minimum yield strength of 65,000 psi (448 MPa) and a minimum tensile strength of 85,000 psi (586 MPa).

2.3.5 Bolts and Nuts:

2.3.5.1 Helical Anchors: The threaded bolts used in connecting helical lead shafts and extensions together conform to ASTM A 193, Grade 4140, and the nuts are machined from bars complying with ASTM A 29, Grade 1018. The bolts and nuts are Class B hot-dipped galvanized in accordance with ASTM A 153.

2.3.5.2 All Other Fastening Assemblies (Including Brackets): The bolts conform to ASTM A 193, Grade B7, and the nuts conform to ASTM A 563. The bolts and nuts are Class B hot-dipped galvanized in accordance with ASTM A 153.

2.4 Design:

2.4.1 General: Structural calculations must be submitted to the building official for each project, and must be based on accepted engineering principles. The design of the steel components must be in accordance with the Allowable Stress Design (ASD) Specification in Chapter 22, Division III, of the 1997 *Uniform Building Code*™ (UBC). The ASD design strengths of the steel components are described in Tables 1 and 2. The overall capacity of the Ram Jack Foundation System depends upon the analysis of the interaction of the helical plates and the soil, or the interaction with load-bearing strata for the driven piers, and may be more or less than the ASD design strengths noted in this report. The effects of combined flexural and compressive stresses and column buckling of the piers due to compression loads must be included in the analysis. The development of tension loads may require sections be positively connected together, as determined by the structural design. Construction in Seismic Zones 3 and 4 requires compliance with Section 1809.5.1 of the UBC. A soil investigation report complying with Section 1804 of the UBC is necessary, and must include the following:

1. Soil properties, including those affecting design.
2. Allowable soil bearing pressure.
3. Suitability for use in seismically active areas.
4. Information on groundwater table, frost depth and corrosion.

2.4.2 Connection to Building Structure: Downward-acting ASD allowable design loads for the foundation brackets are noted in Table 1. The concrete foundation and slab must be designed and justified to the satisfaction of the building official for concentrated loads due to the foundation and slab repair brackets. Bearing areas on the attachment seat angle not exceeding 100 square inches (64 516 mm^2) shall be used to calculate the concrete bearing stress at the seat of the foundation brackets. Bolted connections shall be designed to resist applicable loads in accordance with the UBC or an appropriate evaluation report. In addition, the effects of reduced lateral sliding resistance due to uplift from wind or seismic loads shall be considered for each project.

2.5 Installation:

The Ram Jack® Foundation Systems shall be installed by Ram Jack® Manufacturing LLC certified and trained installers. The Ram Jack® foundation systems shall be installed in accordance with this section (Section 2.5) and the manufacturer's installation instructions.

2.5.1 Hydraulically Driven Steel Piling/Pier Installation:

1. An excavation shall be made adjacent to and underneath the foundation.
2. Excess concrete shall be removed from the underside and from the face of the foundation in order to obtain a proper interface between the foundation and bracket.
3. Hydraulic rams shall be attached to the bracket, and the pier drive head is attached to the hydraulic cylinder rods at the top. Hoses shall be coupled to the cylinders with the other end coupled to the control valve, which in turn is connected to the hydraulic pump.
4. The guide sleeve shall be installed simultaneously with the lead starter section and the first pile section, by engaging the drive head with the pile and retracting the hydraulic cylinders. A guide-setting tool shall be used until the top of the guide is in contact with the top of the bracket.
5. The pier must be driven so the orientation is as close to vertical as possible.
6. The hydraulic rams shall be reciprocated up and down, with the pier being advanced with each downward stroke. Pier sections shall be added as needed by placing the open end of the section over the connection of the section previously installed.
7. Final termination of pier driving shall be achieved when the foundation begins to flex upward as the pier is driven downward or the desired hydraulic pressure is achieved.

8. After piling termination, the excess piling shall be cut off at a sufficient height to allow for foundation lifting. The securing strap shall be installed, and the lifting tool is placed on top of the pier.
9. When the desired foundation lift is achieved, the nuts shall be tightened on the securing strap.
10. The lifting tool and hydraulics shall be removed.
11. The excavation shall be back-filled and soil properly compacted. Excess material shall be removed.

2.5.2 Helical Anchor Installation:

Helical anchors are installed using a hydraulic over planetary gear rotary torque drive head. The helical anchors shall be installed according to a preapproved plan of placement. A helical anchor lead shaft shall be pinned to the drive lead assembly and advanced into the ground by rotating the helical anchor. Additional extension shafts shall be added to increase the shaft length to reach the required depth into the ground.

2.5.3 Pre-construction Anchor Installation:

1. The head helix shall be installed and successive extensions shall be added as needed until the desired depth into the ground is achieved.
2. The last helix is cut to the desired height.
3. The pre-construction bracket is placed over the top of the anchor extension.
4. Steel reinforcement bars are placed and tied to the bracket.
5. The excavation is back-filled and soil properly compacted. Excess material is removed.

2.5.4 Porch Bracket Installation:

1. An excavation is made adjacent to and under the structure to be stabilized.
2. The helix anchor is installed, and successive extensions are added as needed until the desired depth into the soil is achieved.
3. The last helix is cut to the desired height.
4. The bracket is installed over the helical anchor and then spun 180 degrees so that the lifting arm of the bracket is under the structure.
5. The securing strap is placed over the extension and the nuts are tightened over the securing strap. Tightening of the nuts can usually achieve the desired lift, though a lifting tool can be used for heavier loads.
6. The excavation is back-filled and soil properly compacted. Excess material is removed.

2.5.5 Slab Bracket Installation:

1. A hole is cored through the concrete slab with a coring tool.
2. An excavation is made beneath the slab that is large enough to accommodate the slab bracket [approximately 1 to 2 cubic feet (0.03 to 0.06 m^3)].
3. The slab bracket is placed beneath the slab and to one side of the cored opening.
4. A helical anchor is installed through the hole cored in the slab, and successive extensions are added as needed until the desired depth into the soil is achieved.
5. The shaft of the helical anchor is cut 6 inches (152 mm) below the bottom of the slab.
6. The helical cap and adjuster sleeve are placed over the helical anchor, followed by the slab bracket.
7. The threaded adjuster is installed through the bracket and into the adjuster sleeve by turning it clockwise until the desired lift is achieved.
9. The void area under the slab is back-filled with sand, the sand is compacted, and the concrete is placed into the covered concrete void.

2.6 Special Inspection:

Special inspection in accordance with Section 1701 of the UBC is required for installation of the Ram Jack® foundation system. Inspection must include the following:

1. Verification of product numbers (see Table 1).
2. Types and configurations of helical pier lead sections, pilings, extensions, brackets, bolt type and torque.
3. Installation procedures and anticipated piering depth.
4. Required target installation torque of piers.
5. Inclination and position of helical pier, hub of pier extension in full contact with bracket; full-surface contact of foundation brackets with concrete; tightness of all bolts; and evidence that anchoring systems are installed by an approved Ram Jack® installer.

2.7 Identification:

The Ram Jack® Foundation Systems 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, the evaluation report number (PFC-5996), and the name of the inspection agency (SGS U.S. Testing Company, Inc.).

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Corrosion Protection of Steel Foundation Systems Using Polymer (EAA) Coatings (AC228), dated November 1, 2003; material specifications; installation instructions; load tests; and a quality control manual.

4.0 FINDINGS

That the Ram Jack® Foundation Systems described in this report comply with the 1997 *Uniform Building Code*™, subject to the following conditions:

4.1 The foundation systems are manufactured, identified and installed in accordance with this report.

4.2 Special inspection is provided in accordance with Section 2.6 of this report.

4.3 Engineering calculations and drawings, in accordance with recognized engineering principles and design parameters, are provided to the building official.

4.4 A soil investigation for each project site must be provided to the building official for approval in accordance with Section 2.4.1 of this report.

4.5 The Ram Jack® Foundation Systems are manufactured at the Ram Jack Manufacturing LLC facility located in Ada, Oklahoma, under a quality control program with inspections by SGS U.S. Testing Company, Inc. (AA-693).

This report is subject to re-examination in one year.

TABLE 1—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS: BRACKETS AND PILINGS

PRODUCT NUMBER	DESCRIPTION	STEEL TUBING DIAMETER (inches)	ALLOWABLE COMPRESSION LOAD[1] (pounds)
4021	Commercial bracket	—	36,000
4022	Commercial bracket HD	—	60,000
4062	Slab bracket	—	25,000
4067	Porch bracket	—	25,000
4075	Preconstruction bracket		25,000
4223	3-foot piling	$2^{7}/_{8}$	60,500
4225	5-foot piling	$2^{7}/_{8}$	60,500
4227	7-foot piling	$2^{7}/_{8}$	60,500
4230	8-foot piling	$2^{7}/_{8}$	60,500

For **SI:** 1 inch = 25.4 mm, 1 pound = 0.00448 kN.

[1]Loads apply to anchors only. System capacity may be limited by other factors, such as soil interaction capacity or foundation capacity. Allowable loads reflect the downward-acting compression loads.

TABLE 2—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS: HELIX ANCHOR SHAFT AND EXTENSIONS WITH $2^{3}/_{8}$-INCH TUBING

PRODUCT NUMBER	1st HELIX ANCHOR DISC[1] DIAMETER (inches)	2nd HELIX ANCHOR DISC[1] DIAMETER (inches)	HELIX ANCHOR SHAFT LENGTH (feet)	HELIX ANCHOR SHAFT DIAMETER (inches)	ALLOWABLE AXIAL COMPRESSION LOAD (pounds)	ALLOWABLE AXIAL TENSION LOAD (pounds)
4348	8	NA	2	$2^{3}/_{8}$	12,000	12,000
4340	8	NA	5	$2^{3}/_{8}$	12,000	12,000
4341	8	NA	7	$2^{3}/_{8}$	12,000	12,000
4350	10	NA	2	$2^{3}/_{8}$	10,250	10,250
4351	10	NA	3.5	$2^{3}/_{8}$	10,250	10,250
4342	10	NA	5	$2^{3}/_{8}$	10,250	10,250
4343	10	NA	7	$2^{3}/_{8}$	10,250	10,250
4352	12	NA	3.5	$2^{3}/_{8}$	9,250	9,250
4344	12	NA	5	$2^{3}/_{8}$	9,250	9,250
4345	12	NA	7	$2^{3}/_{8}$	9,250	9,250
4322	8	10	5	$2^{3}/_{8}$	22,250	22,250
4324	8	10	7	$2^{3}/_{8}$	22,250	22,250
4328	8	10	10	$2^{3}/_{8}$	22,250	22,250
4330	10	12	5	$2^{3}/_{8}$	19,500	19,500
4332	10	12	7	$2^{3}/_{8}$	19,500	19,500
4308	NA	NA	2	$2^{3}/_{8}$	29,000	22,250
4310	NA	NA	3.5	$2^{3}/_{8}$	29,000	22,250
4312	NA	NA	4	$2^{3}/_{8}$	29,000	22,250
4315	NA	NA	5	$2^{3}/_{8}$	29,000	22,250
4317	NA	NA	7	$2^{3}/_{8}$	29,000	22,250

For **SI:** 1 inch = 25.4 mm, 1 kip = 4.448 kN.

NA = Not applicable.
[1]Helix plates are $^{3}/_{8}$ inch thick.
[2]Loads apply to anchor or extension capacity only. System capacity may be limited by other factors such as soil interaction capacity, bracket capacity, or foundation capacity.

TABLE 3—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS: HELIX ANCHOR SHAFT AND EXTENSIONS WITH 2$^7/_8$-INCH TUBING

PRODUCT NUMBER	1ST HELIX ANCHOR DISC[1] DIAMETER (inches)	2ND HELIX ANCHOR DISC[1] DIAMETER (inches)	3RD HELIX ANCHOR DISC[1] DIAMETER (inches)	HELIX ANCHOR SHAFT LENGTH (feet)	HELIX ANCHOR SHAFT DIAMETER	ALLOWABLE AXIAL COMPRESSION LOAD (pounds)	ALLOWABLE AXIAL TENSION LOAD (pounds)
4379	10	NA	NA	2	2$^7/_8$	11,750	11,750
4378	10	NA	NA	3.5	2$^7/_8$	11,750	11,750
4373	10	NA	NA	5	2$^7/_8$	11,750	11,750
4374	10	NA	NA	7	2$^7/_8$	11,750	11,750
4377	12	NA	NA	3.5	2$^7/_8$	10,250	10,250
4375	12	NA	NA	5	2$^7/_8$	10,250	10,250
4376	12	NA	NA	7	2$^7/_8$	10,250	10,250
4368	10	12	NA	5	2$^7/_8$	22,000	22,000
4370	10	12	NA	7	2$^7/_8$	22,000	22,000
4371	10	12	14	7	2$^7/_8$	56,000	56,000
4382	NA	NA	NA	2	2$^7/_8$	36,750	39,250
4383	NA	NA	NA	3.5	2$^7/_8$	36,750	39,250
4385	NA	NA	NA	5	2$^7/_8$	36,750	39,250
4387	NA	NA	NA	7	2$^7/_8$	36,750	39,250

For **SI:** 1 inch = 25.4 mm, 1 pound = 0.00448 kN.

NA = Not applicable.
[1]Helix plates are $^3/_8$-inch steel plate for 8-, 10-, and 12-inch-diameter plates. Helix plates are $^1/_2$-inch steel plate for 14-inch-diameter plates.
[2]Loads apply to anchor or extension capacity only. System capacity may be limited by other factors such as soil interaction capacity, bracket capacity, or foundation capacity.

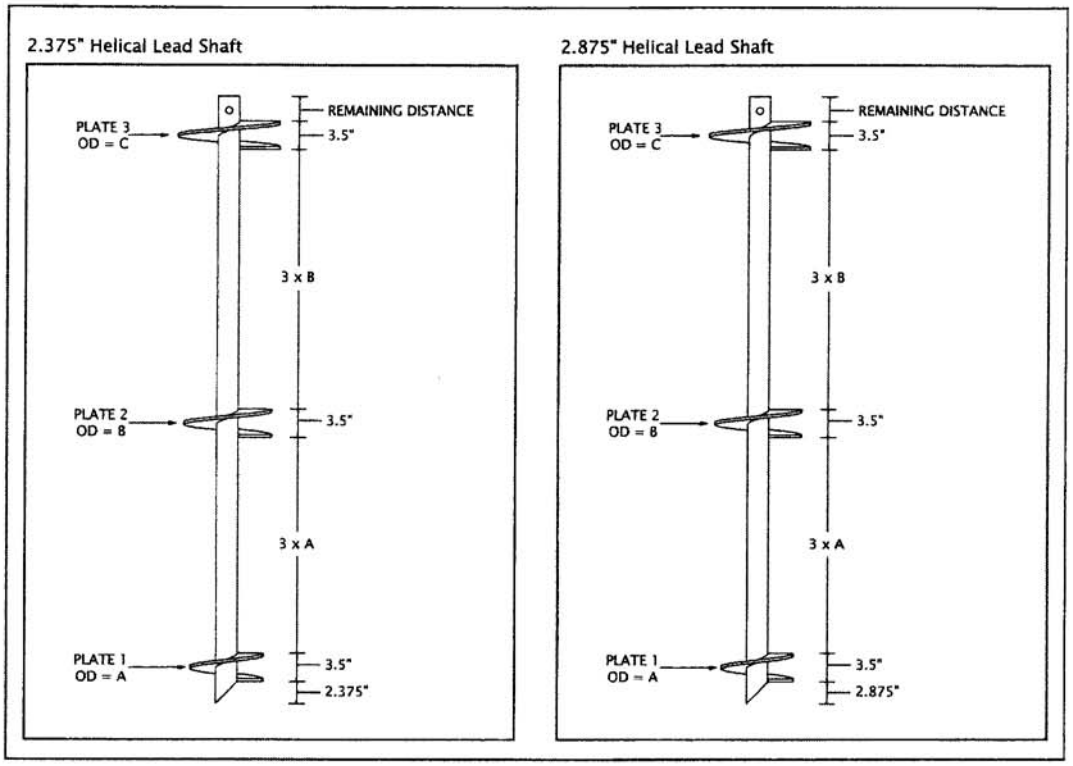
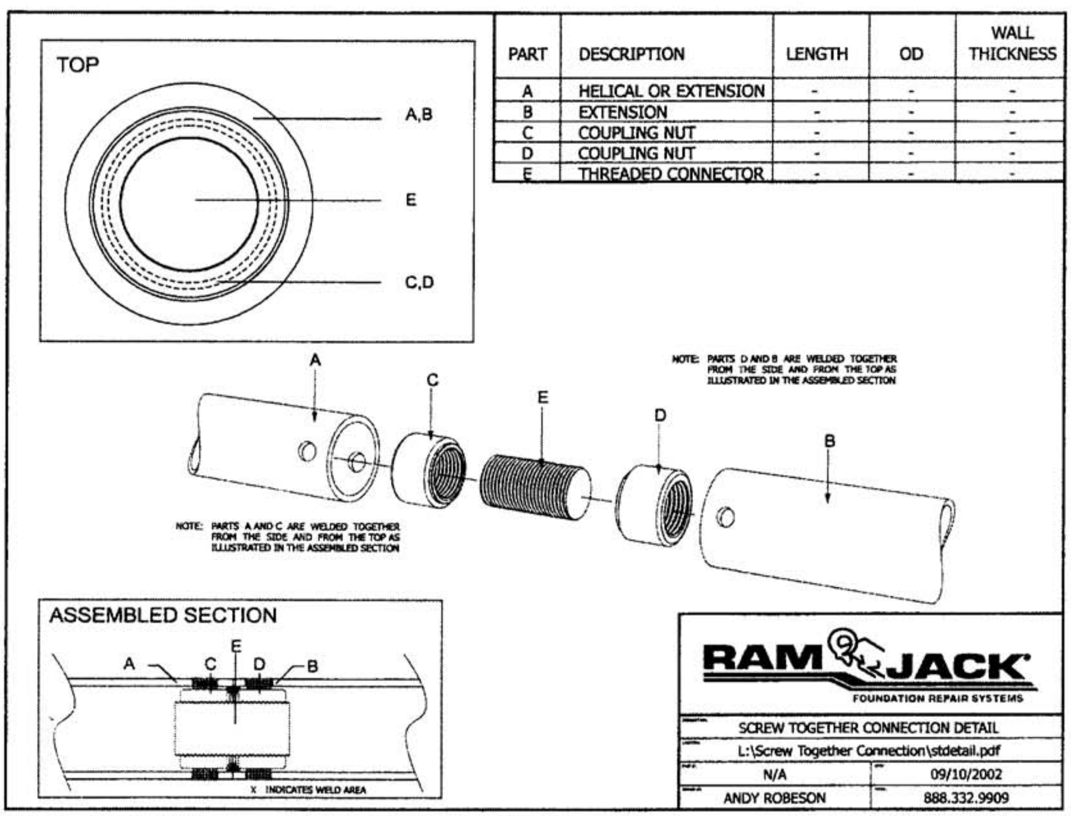


FIGURE 1—TYPICAL HELICAL ANCHORS AND THEIR PLATE SPACING CHARACTERISTICS



PART	DESCRIPTION	LENGTH	OD	WALL THICKNESS
A	HELICAL OR EXTENSION	-	-	-
B	EXTENSION	-	-	-
C	COUPLING NUT	-	-	-
D	COUPLING NUT	-	-	-
E	THREADED CONNECTOR	-	-	-

FIGURE 2—HELICAL ANCHOR AND EXTENSION SCREW-TOGETHER CONNECTION DETAIL

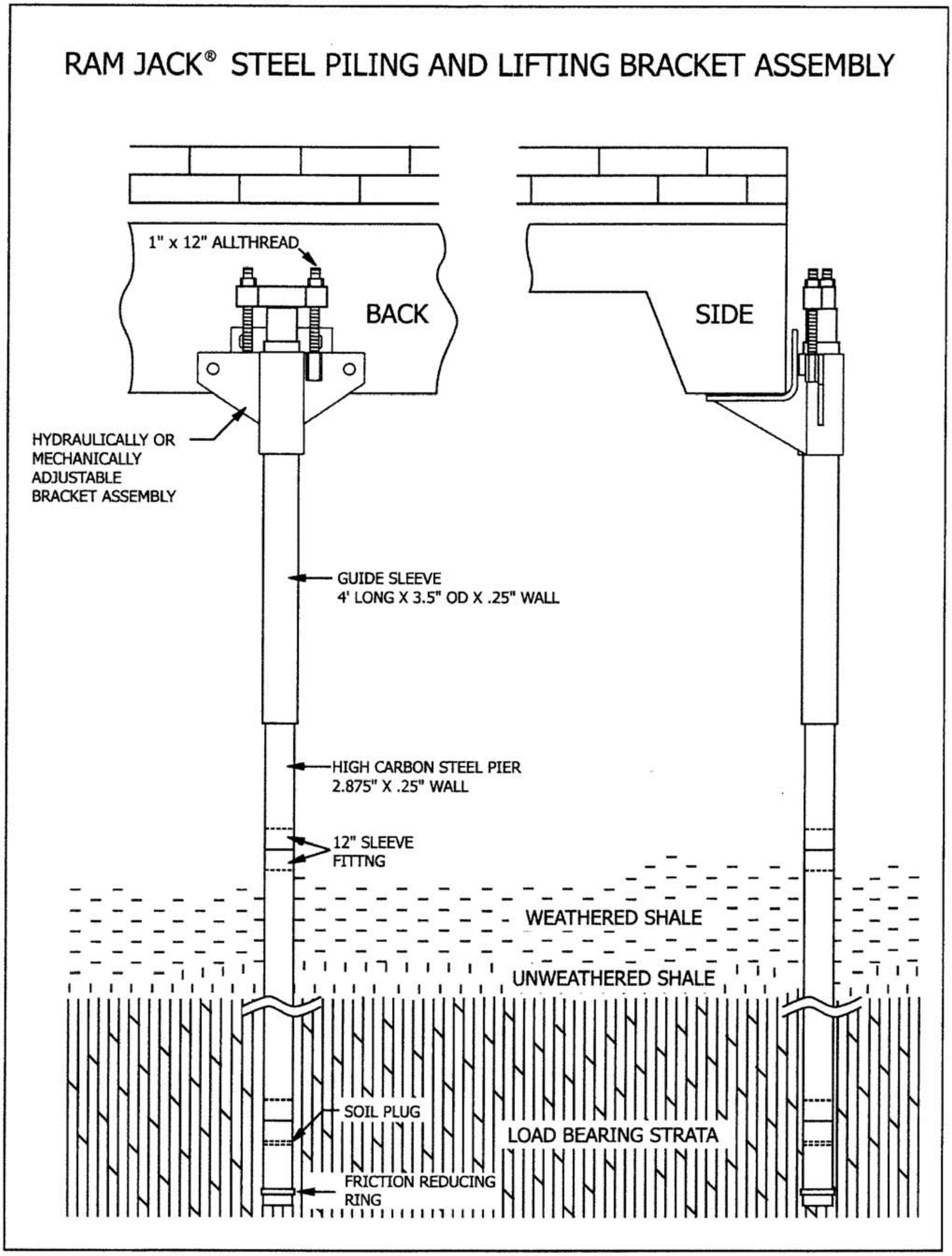


FIGURE 3—TYPICAL DRIVEN PILING USED IN CONJUNCTION WITH THE COMMERCIAL BRACKET #4021

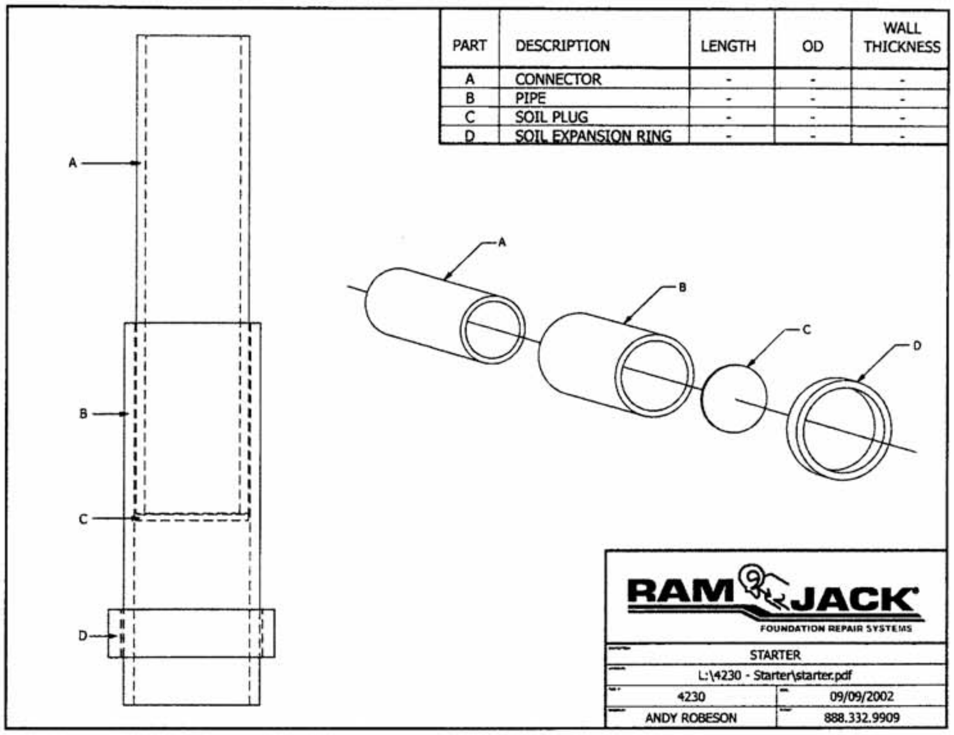


FIGURE 4—DETAIL OF STARTER JOINT

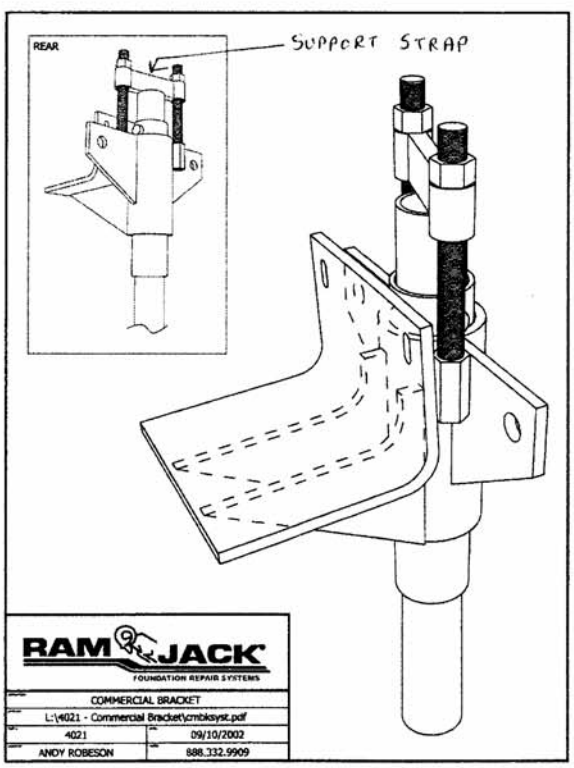


FIGURE 5—COMMERCIAL BRACKET ASSEMBLY (WITH GUIDE AND PILING)

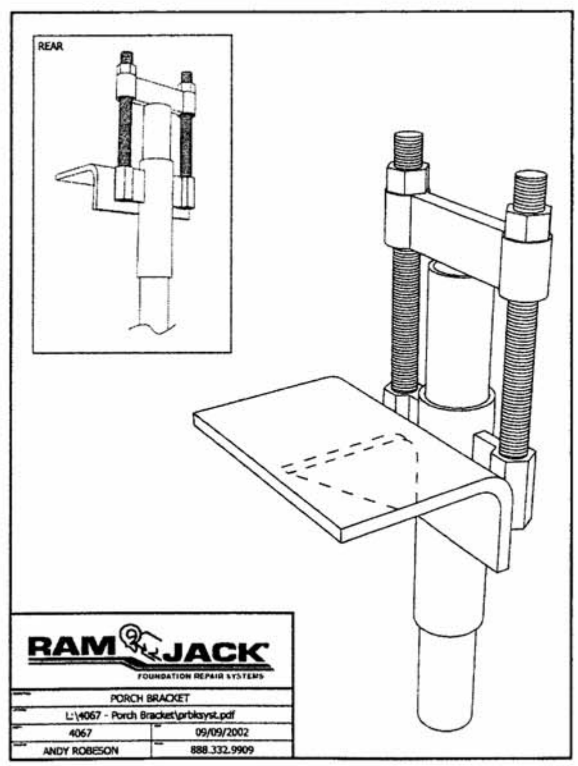
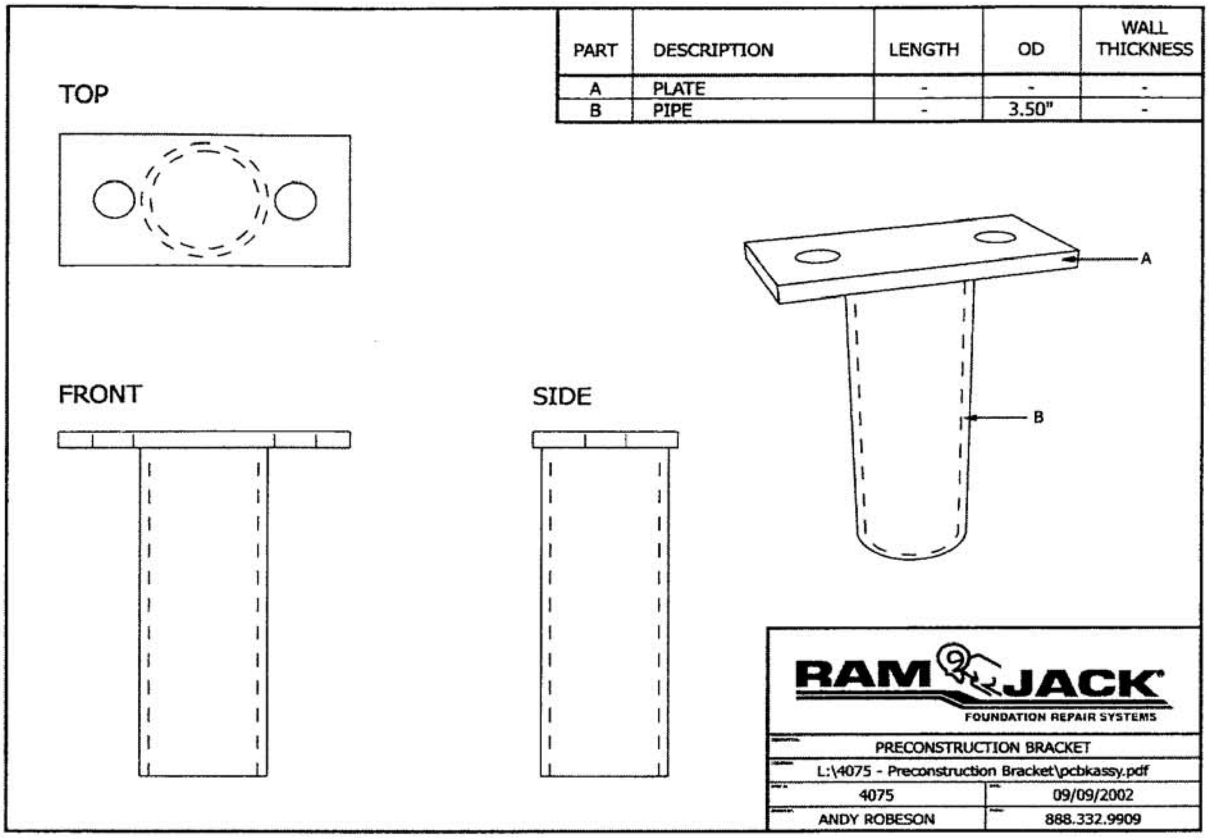
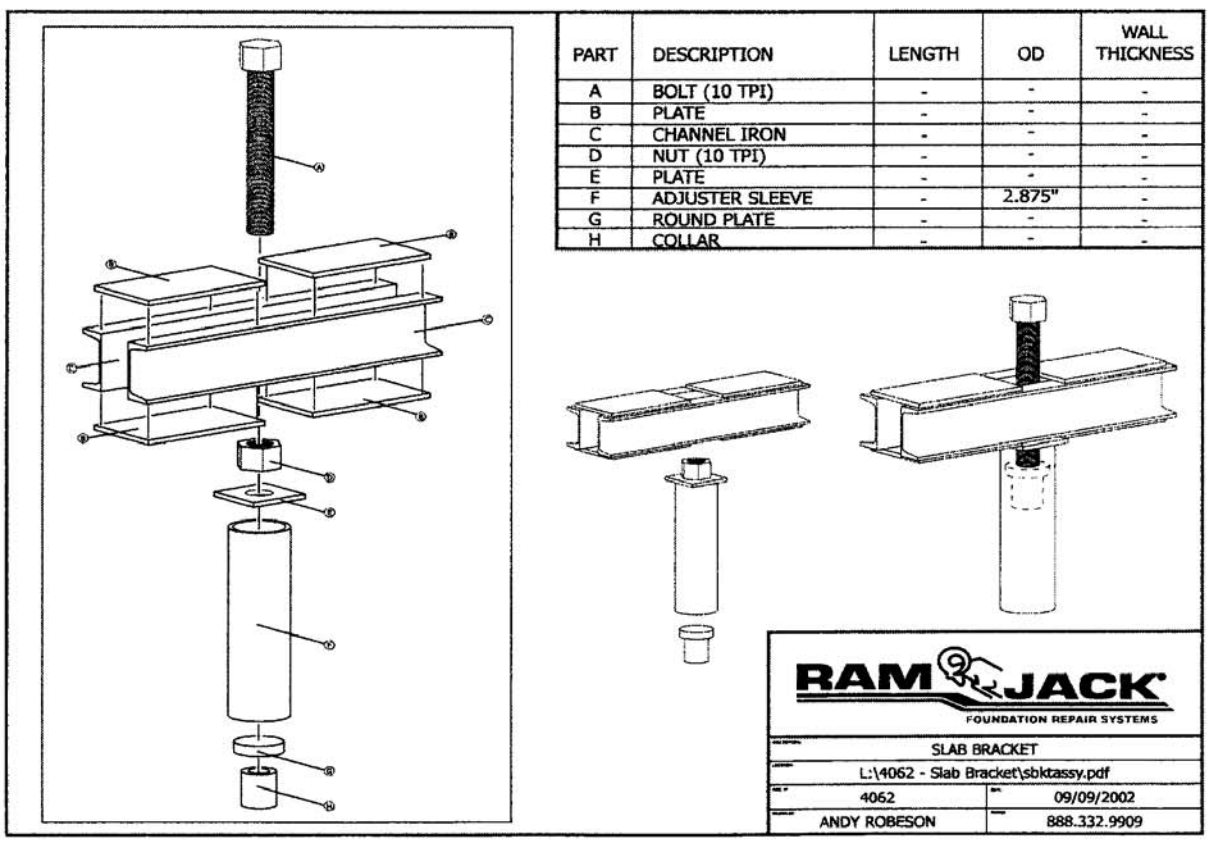


FIGURE 6—PORCH BRACKET ASSEMBLY (WITH PILING)



PART	DESCRIPTION	LENGTH	OD	WALL THICKNESS
A	PLATE	-	-	-
B	PIPE	-	3.50"	-

FIGURE 7—PRE-CONSTRUCTION BRACKET DETAIL



PART	DESCRIPTION	LENGTH	OD	WALL THICKNESS
A	BOLT (10 TPI)	-	-	-
B	PLATE	-	-	-
C	CHANNEL IRON	-	-	-
D	NUT (10 TPI)	-	-	-
E	PLATE	-	-	-
F	ADJUSTER SLEEVE	-	2.875"	-
G	ROUND PLATE	-	-	-
H	COLLAR	-	-	-

FIGURE 8—DETAIL OF THE SLAB BRACKET ASSEMBLY