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EVALUATION REPORT

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DIXIE ANCHORING SYSTEMS

ALUMA-FORM/DIXIE
3625 OLD GETWELL ROAD
MEMPHIS, TENNESSEE 38118

1.0 SUBJECT

Dixie Anchoring Systems.

2.0 DESCRIPTION

2.1 General:

The Dixie Anchoring Systems are used to underpin foundations of existing structures, to form deep foundations for new structures, to retrofit or remediate deficient foundations of existing structures, and to provide bearing for new foundations. The systems consist of foundation attachments (brackets) and helical steel piers. The foundation attachments are used to connect the foundation of the structure to the installed helical steel pier.

2.2 System Components:

2.2.1 Helical Steel Piers: The steel piers consist of one or more helical-shaped circular steel plates welded to a central steel hub. After fabrication, the piers have a Class B1, hot-dipped, galvanized coating, complying with ASTM A 153, as applied. The depth of the helical piers in the soil is typically extended by adding one or more steel hub extension shafts mechanically coupled together to form one long, continuous pier. Extensions can be with or without attached helical-shaped steel plates.

Each helical steel plate is $3/8$ inch (10 mm) or $1/2$ inch (13 mm) thick and has an outer diameter ranging from 6 to 15 inches (152 to 381 mm), and an inner annulus either $1 1/4$, $1 1/2$ or $1 3/4$ inches (31.7, 38 or 44.5 mm) square. Each plate is formed with all radial sections normal to the central longitudinal axis, ± 3 degrees. The helix pitch is 3 inches (76 mm).

The central steel hub of lead sections and extension sections is round cornered square (RCS), solid steel bars. RCS bars are either $1 1/4$, $1 1/2$ or $1 3/4$ inches (31.7, 38 or 44.5 mm) square.

Each lead section of a helical steel pier has provisions at the top for a connection to an extension, and has an earth-penetrating pilot at the bottom. Each extension has provisions for a coupler at one end and a connection at the other. The coupler is an integrally forged socket that slips over an RCS hub of the same size. Each socket has a transverse hole so that lead sections and extensions can be connected with a bolt and nut.

For all helical pier leads and some extension shafts, helical plates are welded to their respective hubs. Nominal spacing between helical plates is not less than 2.36 times the diameter

of the lower helix. Figure 1 illustrates the helical piers and extension shafts.

2.2.2 Foundation Attachments (Brackets): The foundation repair attachments (brackets), Catalog No. N-6401-0046 (Standard Bracket) and N-6401-0049 (Light Duty Bracket), are used to address foundation settlement. The bracket designs conform to the Fasteel "ULTRA" (patent pending) lifting bracket specifications. The brackets consist of $1/2$ -inch-thick (12.7 mm) steel support angles welded to a $1/2$ -inch-thick (12.7 mm) steel support body. After assembly, the attachments are coated with a Class B1, hot-dipped, galvanized coating, complying with ASTM A 153. Figure 2 illustrates the foundation attachments.

2.3 Material Specifications:

2.3.1 Helical Plates and Foundation Attachments

(Brackets): Hot-wrought carbon steel for the helical plates conforms to ASTM A 36, with a minimum yield strength of 36,000 psi (248 MPa) and a minimum tensile strength of 58,000 psi (400 MPa).

2.3.2 Pier Hubs (Lead Sections and Extensions):

The $1 1/4$ -, $1 1/2$ - and $1 3/4$ -inch (31.7, 38, and 44.5 mm) square RCS hubs are formed from hot-wrought carbon steel conforming to ASTM A 576, Grade C-1045, having minimum yield and tensile strengths of 45 and 82 ksi (310 and 565 MPa), respectively. The hubs are also available in steel conforming to ASTM A 576, Grade 1530M, having minimum yield and tensile strengths of 60 ksi and 110 ksi (414 MPa and 758 MPa), respectively.

2.3.3 Bolts: Coupling bolts are $5/8$ inch (15.9 mm), $3/4$ inch (19.1 mm) or $7/8$ inch (22 mm) in diameter and shall comply with ASTM A 325 Type 1, and shall have a Class C hot-dipped zinc coating that complies with ASTM A 153. The corresponding nut shall conform to either ASTM A 194 Grade 2H or ASTM A 563 Grade DH. Nuts shall have a Class C hot-dipped zinc coating that complies 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 code. The ASD design strengths of the steel components are described in Tables 1, 2 and 3. The overall capacity of the Dixie Anchoring System depends upon the analysis of the interaction of the helical plates and the soil, and may be less than the ASD design strengths noted in this report. Combined flexural and compressive stresses, and column buckling of the piers due to compression loads, must be included in the analysis. Construction in Seismic Zones 3 and 4 requires com-

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pliance with Section 1809.5.1 of the code. A soil investigation report 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 ground-water table, frost depth and corrosion.

2.4.2 Connection to Building Structure: Downward-acting ASD design strength is 60,000 pounds (267 kN) for the Fasteel "ULTRA" Standard foundation bracket or 15,000 pounds (134 kN) for the Fasteel "ULTRA" Light Duty bracket.

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 (2540 mm²) shall be used to calculate the concrete bearing stress at the seat of the Fasteel ULTRA foundation brackets. Bolted connections shall be designed to resist applicable loads in accordance with the code or 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:

2.5.1 General: The helical pier foundation system is installed by Aluma-Form/Dixie certified installers, trained to install the Dixie Anchoring System.

2.5.1.1 Helical Steel Piers: The helical piers are installed using rotary motors having forward and reverse capabilities. The torque rating (torsional force) for each of the included three helical pier shaft sizes are 3.4 kip-feet (4.61 kN-m) for 1¹/₄-inch (31.8 mm) RCS shafts, 6.0 kip-feet (13.56 kN-m) for 1¹/₂-inch (38 mm) RCS shafts and 10.0 kip-feet (13.56 kN-m) for 1³/₄-inch (45 mm) RCS shafts. The piers must be positioned and angled as specified in the approved plans. Helical piers attached to structures are installed either vertically plumb or at a slight inward slope projecting under the foundations. The helical piers must be installed in a continuous manner, with the rate of pier rotation in the range of 5 to 20 revolutions per minute. Extensions are selected based on the number and length, installation torque and site conditions as specified in the approved plans and are connected to the helical pier with the coupling bolts. Coupling bolts must be tightened firmly with a wrench. The piers are installed to the minimum depth shown on plans, but with the top helix not less than 5 feet (1525 mm) below the bottom of the foundation.

2.5.1.2 Fasteel ULTRA Foundation Attachments: Piering bracket attachments are installed by qualified and trained helical pier subcontracting dealers/installers as specified in the approved plans. The foundation slab must be excavated to create "L" shaped cavities with nominal 30 inches (762 mm) per side square openings to a depth of at least 18 inches (457 mm) below the foundation bottom surface. The exposed foundation surfaces must be prepared and smoothly dressed to receive the piering attachment ("lifting bracket") without obstruction on the bearing or facing surfaces. The attachment must be pinned firmly to the foundation by driven or threaded fasteners. This connection may occur during or after pier installation. The helical pier (anchor) and shaft extensions must be driven into soil as set forth in Section 2.5.1.1 of this report. Upon obtaining satisfactory installation, the excess shaft extension above the foundation may be cut, normally about 8 to 10 inches (203 to 254 mm) above the footing (or turn down) base. Threaded form rods are placed through the locking plate, then the subassembly is positioned in place on top of the insert. Nuts are placed on each threaded rod and hand-tightened against the locking plate. A hydraulic/

pneumatic jack is positioned with its actuator bearing against this locking plate. The jack is then actuated to transfer the structural load from soil to pier(s). The foundation and/or structure must be monitored for elevation change, using an optical or electronic level. The jack is stopped when the foundation or structure baseline reaches predetermined height as measured by an optical or electronic level. The nuts are immediately tightened by torque wrench or equivalent device on threaded form rods to 75 foot-pounds (102 N-m).

2.6 Special Inspection:

Special inspection in accordance with Section 1701 of the code is required for installation of the helical piers and foundation lifting brackets. Inspection must include the following:

1. Verification of catalog numbers.
2. Types and configurations of helical pier lead sections, extensions, brackets, bolt type and torque.
3. Installation procedure and anticipated piercing 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 system and Fasteel "ULTRA" bracket are installed by an approved Aluma-Form[®]/Dixie authorized foundation stabilization or remediation contractor.

2.7 Identification:

Helical piers have "D" stamped on the hub. The helical piers are also identified by a tag or label bearing the name and address of Aluma-Form/Dixie, the catalog number, the product description, the evaluation report number (ICBO ES PFC-5551), and the name of the quality control agency (SGS U.S. Testing Company, Inc.).

The Fasteel "ULTRA" foundation brackets are identified by labels bearing the catalog number, the product description, the name and address of Aluma-Form/Dixie, the evaluation report number (ICBO ES PFC-5551), and the name of the quality control agency (SGS U.S. Testing Company, Inc.).

3.0 EVIDENCE SUBMITTED

Material specifications, installation instructions, load tests and a quality control manual.

4.0 FINDINGS

That the Dixie Anchoring System described in this report complies with the 1997 Uniform Building Code[™], subject to the following conditions:

- 4.1 The helical piers and accessories 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 2.5.1 of this report.
- 4.5 The helical piers and foundation attachments (lifting brackets) are manufactured at the Aluma-Form/Dixie facility located in Birmingham, Alabama, under a quality control program with inspections by SGS U.S. Testing Company, Inc.

This report is subject to re-examination in two years.

TABLE 1—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS: STANDARD, SINGLE HELIX, AND MULTI-HELIX EXTENSIONS¹

CATALOG NUMBER	SHAFT LENGTH (inches)	SHAFT WIDTH (inches)	HELIX DIAMETER ² (inches)		HELIX THICKNESS ² (inch)	ALLOWABLE AXIAL LOAD (pounds) ³
			1st	2nd		
N-6401-0016	42	1.25	NA	NA	NA	34,000
N-6401-0017	60	1.25	NA	NA	NA	34,000
N-6401-0018	84	1.25	NA	NA	NA	34,000
N-6401-0019	120	1.25	NA	NA	NA	34,000
N-6401-0004	42	1.50	NA	NA	NA	56,250
N-6401-0005	60	1.50	NA	NA	NA	56,250
N-6401-0006	84	1.50	NA	NA	NA	56,250
N-6401-0007	120	1.50	NA	NA	NA	56,250
N-6401-0024	60	1.50	10	NA	0.375	26,900
N-6401-0025	60	1.50	12	NA	0.375	26,900
N-6401-0026	84	1.50	14	NA	0.375	26,900
N-6401-0008	42	1.75	NA	NA	NA	76,560
N-6401-0009	60	1.75	NA	NA	NA	76,560
N-6401-0010	84	1.75	NA	NA	NA	76,560
N-6401-0011	120	1.75	NA	NA	NA	76,560
N-6401-0020	60	1.75	12	NA	0.375	30,650
N-6401-0021	60	1.75	14	NA	0.375	30,650
N-6401-0027	84	1.75	14	14	0.375	61,300

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

¹Bolts connect extensions to helix anchors or other extensions.

²NA = Not available.

³Loads 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. The allowable axial load reflects the lesser of tension or compression capacity.

TABLE 2—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS: SINGLE HELIX ANCHORS¹

CATALOG NUMBER	SHAFT LENGTH (inches)	SHAFT WIDTH (inches)	HELIX DIAMETER (inches)	HELIX THICKNESS (inch)	ALLOWABLE AXIAL LOAD (pounds) ²
N-6202-0001	9 ¹ / ₂	1.25	6	0.375	20,167
N-6202-0002	9 ¹ / ₂	1.25	8	0.375	20,167
N-6202-0003	9 ¹ / ₂	1.25	10	0.375	17,500
N-6202-0004	9 ¹ / ₂	1.25	12	0.375	17,500
N-6202-0005	9 ¹ / ₂	1.25	14	0.375	17,500
N-6202-0006	84	1.25	8	0.375	20,167
N-6202-0007	84	1.25	10	0.375	17,500
N-6202-0008	84	1.25	12	0.375	17,500
N-6202-0009	84	1.25	14	0.375	17,500
N-6202-0010	84	1.25	15	0.375	17,500
N-6203-0018	9 ¹ / ₂	1.50	6	0.375	26,900
N-6203-0019	9 ¹ / ₂	1.50	8	0.375	26,900
N-6203-0020	9 ¹ / ₂	1.50	10	0.375	26,900
N-6203-0021	9 ¹ / ₂	1.50	12	0.375	26,900
N-6203-0022	9 ¹ / ₂	1.50	14	0.375	26,900
N-6203-0001	60	1.50	8	0.375	26,900
N-6203-0002	60	1.50	10	0.375	26,900
N-6203-0003	60	1.50	12	0.375	26,900
N-6203-0004	60	1.50	14	0.375	26,900
N-6203-0009	84	1.50	8	0.375	26,900
N-6203-0010	84	1.50	10	0.375	26,900
N-6203-0012	84	1.50	14	0.375	26,900
N-6203-0032	60	1.50	8	0.500	51,110
N-6203-0033	60	1.50	10	0.500	51,110
N-6203-0013	60	1.50	12	0.500	51,110
N-6203-0014	60	1.50	14	0.500	51,110
N-6203-0007	84	1.50	8	0.500	51,110
N-6203-0008	84	1.50	10	0.500	51,110
N-6203-0011	84	1.50	12	0.500	51,110
N-6203-0034	84	1.50	14	0.500	51,110

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

¹Bolts connect extensions to helix anchors or other extensions.

²Loads 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. The allowable axial load reflects the lesser of the tension or compression capacity.

**TABLE 3—FOUNDATION ANCHOR MECHANICAL STRENGTH RATINGS:
DOUBLE HELIX, TRIPLE HELIX AND QUADRUPLE HELIX ANCHORS¹**

CATALOG NUMBER	SHAFT LENGTH (inches)	SHAFT WIDTH (inches)	HELIX DIAMETER ² (inches)				HELIX THICKNESS (inch)	ALLOWABLE AXIAL LOAD (pounds) ³
Double Helix Anchors								
			1st	2nd	3rd	4th		
N-6202-0011	84	1.25	8	10	NA	NA	0.375	34,000
N-6203-0005	60	1.50	6	6	NA	NA	0.375	53,800
N-6203-0006	60	1.50	6	8	NA	NA	0.375	53,800
N-6203-0025	60	1.50	8	10	NA	NA	0.375	53,800
N-6203-0026	60	1.50	10	12	NA	NA	0.375	53,800
N-6203-0027	84	1.50	6	8	NA	NA	0.375	53,800
N-6203-0028	84	1.50	8	10	NA	NA	0.375	53,800
N-6203-0029	84	1.50	10	12	NA	NA	0.375	53,800
N-6203-0017	120	1.50	8	10	NA	NA	0.375	53,800
N-6203-0023	60	1.50	8	10	NA	NA	0.500	56,250
N-6203-0024	60	1.50	10	12	NA	NA	0.500	56,250
N-6206-0002	60	1.75	8	10	NA	NA	0.375	61,300
N-6206-0003	60	1.75	10	12	NA	NA	0.375	61,300
Triple Helix Anchors								
			1st	2nd	3rd	4th		
N-6202-0012	84	1.25	8	10	12	NA	0.375	34,000
N-6203-0030	84	1.50	8	10	12	NA	0.375	56,250
N-6203-0031	84	1.50	10	12	14	NA	0.375	56,250
N-6206-0004	84	1.75	8	10	12	NA	0.375	76,560
N-6206-0005	84	1.75	10	12	14	NA	0.375	76,560
Quadruple Helix Anchors								
			1st	2nd	3rd	4th		
N-6203-0015	120	1.50	8	10	12	14	0.500	56,250
N-6203-0016	120	1.50	10	12	14	14	0.500	56,250
N-6206-0006	120	1.75	8	10	12	14	0.375	76,560
N-6206-0007	120	1.75	10	12	14	14	0.375	76,560

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

¹Bolts connect extensions to helix anchors or other extensions.

²NA = Not available.

³Loads 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. The allowable axial load reflects the lesser of the tension or compression capacity.

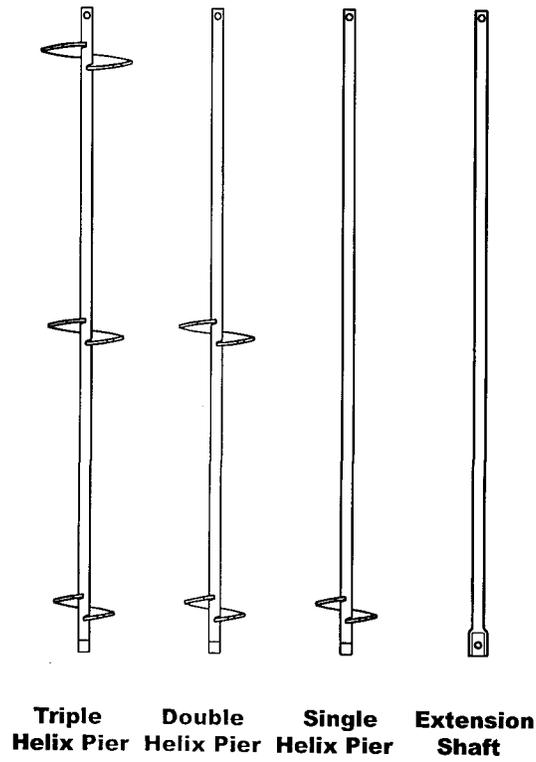
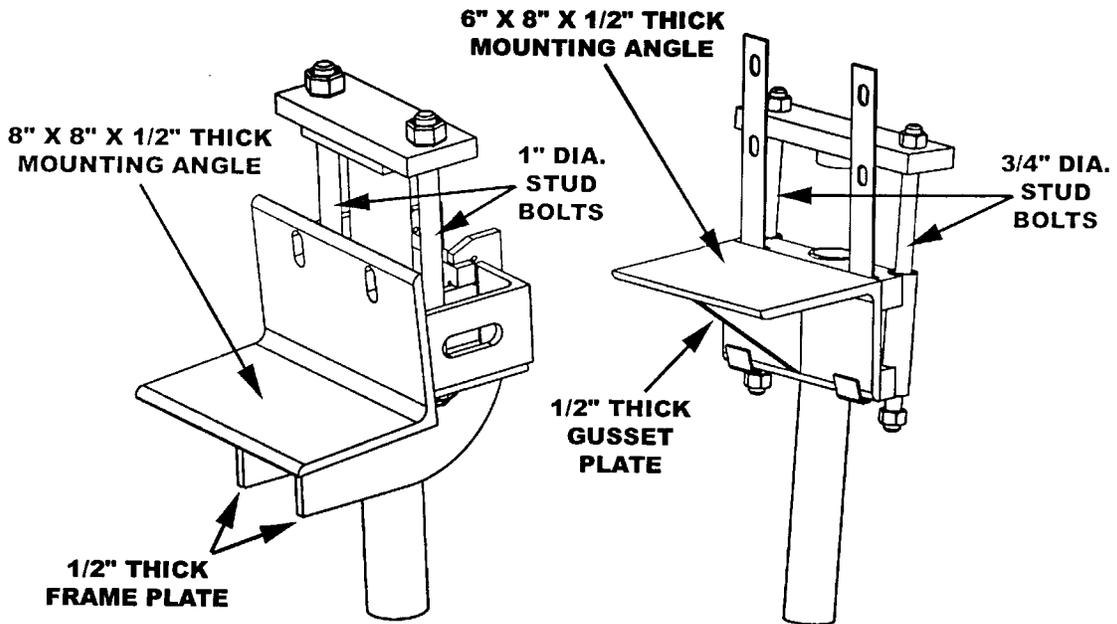


FIGURE 1—HELICAL PIERS AND EXTENSION SHAFT



FAsteel "ULTRA" Standard Bracket

FAsteel "ULTRA" Light Duty Bracket

FIGURE 2—FOUNDATION ATTACHMENTS ("LIFTING BRACKETS")