Historic Preservation Services
Community Development & Neighborhood Services
281 North College Avenue
P.O. Box 580
Fort Collins, CO 80522.0580

970.416.4250
preservation@fcgov.com
fcgov.com/historicpreservation

REPORT OF ALTERATIONS TO DESIGNATED RESOURCE
Site Number/Address: May 10, 2022
Laurel School National Register Historic District
ISSUED: May 10, 2022

Todd Miller & Donna Kirkpatrick
426 Peterson St.
Fort Collins, CO 80524

Dear Property Owner:

This report is to inform you of the results of this office's review of proposed alterations to the Rowe/Peasley/Kreutzer Residence at 426 Peterson Street, pursuant to Fort Collins Municipal Code, Chapter 14, Article IV. A copy of this report may be forwarded to the Colorado Office of Archaeology and Historic Preservation as well.

The alterations reviewed include:

- Installation of 3 helical piers along the south/southeast foundation to stabilize the building.

Our staff review of the proposed work finds the alterations do meet the SOI Standards for Rehabilitation and the project appears to be routine in nature with minimal effects to the historic resource, meeting the requirements of Article IV cited above.

Notice of the approved application has been provided to building and zoning staff to facilitate the processing of any permits that are needed for the work. Please note that work beyond that indicated in your permit application/correspondence requires additional approval.

If you have any questions regarding this report, or if I may be of any assistance, please do not hesitate to contact me. I may be reached at jbertolini@fcgov.com or 970-416-4250.

Sincerely,

Jim Bertolini
Senior Historic Preservation Planner

PLAN OF REPAIR

FOR
Mr. Todd Miller
426 Peterson Street
Fort Collins, CO 80524

Job # 13229

May 3, 2022

Steven D. Norton, PE
(#53346)

STRUCTURAL GENERAL CONDITIONS

Contractor shall maintain comprehensive general liability, workman's compensation, automobile liability and/or other insurance as appropriate for the work performed which will provide protection from any and all construction or completed operations claims. Certificates of Insurance shall be provided to LEVEL ENGINEERING LLC and/or the Client upon request. The limits will not be less than the minimum mandatory amounts required by the State of Colorado.

All construction shall be performed in accordance with all applicable codes and standards, and good construction practices. Contractor shall obtain and pay for any and all permit fees, taxes and licenses required by governing agencies to complete the work. Contractor shall be responsible for all labor, materials, equipment, tools, operations and any other item necessary for proper completion of the work.

Contractor should visit the site prior to bid submittal to fully understand the scope of the project and the conditions at the site. By submitting a bid for the work proposed in this PLAN OF REPAIR, the contractor is implying that they have fully reviewed all associated documents and that they have full understanding of the work to be completed.

The Contractor shall conduct a full review of this PLAN OF REPAIR prior to beginning work. If during this review or at any time during the construction process the contractor notes any errors or omissions in the plan, work shall be stopped and LEVEL ENGINEERING LLC shall be contacted immediately.

Recommendations and specifications contained herein are based on general assumptions of the conditions, some of which cannot be observed during typical nondestructive visual observations. If unexpected conditions are encountered during the course of work, the Contractor shall contact LEVEL ENGINEERING LLC prior to proceeding.

The Client shall provide water and electric hook-ups for temporary use. (Contractor must pre-arrange with Owner.)

All utility lines and easements shall be located, marked and protected from damage throughout the performance of the work. Contractor shall call for utility locations unless other arrangements are made. Any damage to utility lines caused by the Contractor shall be repaired at the Contractor's expense.

Contractor shall field verify all dimensions and existing conditions prior to commencement of work. Contractor shall notify LEVEL ENGINEERING LLC upon determination of any significant variation of the information provided on the attached documentation for his/her interpretation and decision, and such decision shall be final. Information provided regarding the existing conditions are believed to be accurate, however, the Contractor shall be responsible for, and shall only use, his/her own measurements to verify existing conditions.

THE REPAIR DESIGN prepared by **LEVEL Engineering, LLC** makes no provisions for construction conditions that may arise during the performance of the work. Contractor shall be responsible for maintaining the stability and integrity of existing structures (bracing, shoring, benching, etc.).

Contractor shall be responsible for the acts or omissions of his/her agents and subcontractors in the performance of their work. The Contractor shall be responsible for the means, methods, techniques, and sequences of construction.

Existing material or property outside the scope of work that is damaged during construction shall be repaired to match their pre-construction condition at Contractor's expense.

Unless noted otherwise, no substitutions or deviations from the repair plan and specifications are permitted without the express approval of LEVEL ENGINEERING LLC. Unauthorized modifications to the repair plan and specifications may deem the work unacceptable.

All unacceptable work shall be promptly correct at the Contractor's expense under the direction of the LEVEL ENGINEERING LLC.

Contractor shall maintain a safe jobsite. The Contractor is to stack all necessary equipment and materials in a low traffic area or in an area that will insure the safety of all individuals potentially present at this site during construction. OSHA standards shall be used as a guideline.

Contractor shall keep the jobsite thoroughly clean at the end of each day. All surplus materials shall be safely stacked in a low traffic area or hauled away from the site.

Contractor agrees to perform the work in a diligent manner and in full conformance with the repair plan.

If a condition arises during the repair process which requires a change in the scope of work, LEVEL ENGINEERING LLC may submit addendums or modifications to the design which may add, delete or modify the scope of repair. Performance of any extra work, or payment for same, shall only be considered upon prior written authorization from the Client.

This document is for bid purposes only, The Contractor shall be responsible for utilizing a qualified Colorado Licensed Professional Engineer to inspect the repair work and to verify that the repair specifications described within this document are in compliance with local building codes and applicable Manufacturer standards.

The proposal shall include a description of the Contractor's Warranty Terms and Conditions was well as Warranty Limitations. The proposal shall also include a description of the system as applicable.

CONCRETE

All concrete shall conform to the most recent editions of the Building Code and ACI 318 adopted by the governing agencies in which the project is to be completed.

All concrete shall have a 28 day compressive strength of 3000 psi.

All concrete shall have a maximum aggregate size of ¾" and no pea-gravel shall be used without written approval of this office.

Minimum concrete coverage for steel reinforcement shall be as follows:

Concrete cast against and permanently exposed to earth……..3"
Concrete cast in forms and exposed to earth or weather
No. 6 bar and larger……..2"
No. 5 bar and smaller……1-1/2"
Concrete not exposed to weather or in contact with ground……1-1/2"

Non-shrink grout shall conform to ASTM C-1107

Care shall be taken to properly consolidate concrete thoroughly without causing segregation of the materials.

STEEL REINFORCEMENT

All reinforcement steel shall be deformed bars conforming to ASTM A-615, grade 60.

Welding of steel reinforcement shall conform to AWS D-1.4.

Provide chairs concrete blocks, spacer bars, ties, etc. As required to securely hold bars in place.

When reinforcement must be spliced the bars should overlap at least 24', UNO. Overlapping bars shall be securely tied together with wire ties.

Provide a minimum concrete cover of 3" where concrete is cast on the surface of the ground and 1-12" at all other locations, UNO.

STRUCTURAL STEEL AND BOLTS

All steel fabrication and installation shall conform to the latest addition of the AISC Manual of Steel Construction.

All welding shall be completed by a certified welder using an AWS prequalified welding method in accordance with the requirements specified by the AWS in the structural welding code.

E70xx electrodes shall be used for welds.

All structural steel shall conform to ASTM A-36, UNO.

All wide flange beams shall conform to ASTM A-572, grade 50.

All pipe columns shall conform to ASTMA-53, grade B or A-501

All tube steel shall conform to ASTM A-500, Grade B.

Bolts and all-thread shall comply with ASTM A-325

Epoxy for epoxy bolts shall be Hilti Hit HY-150 or approved equal.

Expansion bolts shall be Hilti Kwik Bolt III Expansion Anchors or approved equal.

HELICAL PIERS

The Helical Pier and concrete contractor shall be fully experienced in all aspects of helical pier installation.

SPECIFICATION FOR HELICAL PILE FOUNDATIONS COMPRESSION APPLICATIONS

1 SCOPE

1.1 The work consists of designing, furnishing and installing helical piles and load transfer devices used to support compressive loads according to the project Plans and these specifications.

1.2 The parties and contract terms referred to in this specification are as follows:

1.2.1 The Owner is the person or entity that owns the facility or will own the facility once it is completed. The Owner may have contractual agreements with, and be represented by, other parties such as engineers, architects or contractors that perform services under the direction of the Owner. Where Owner is used in this specification, it refers to the owner or the Owner's contracted representatives separate from the Installing Contractor.

1.2.2 The Pile Designer is the individual or firm generally hired by the Installing Contractor to design the helical piles.

1.2.3 The Installing Contractor installs and tests (if necessary) the helical piles, and possibly performs other tasks associated with the project.

1.2.4 The Plans refer to the contract documents; including but not limited to the drawings and specifications for the project.

1.3 The work may include helical pile load testing.

1.4 The Owner will be responsible for obtaining any right-of-way or easement access permits necessary for the helical pile installation.

1.5 Unless otherwise noted, the Installing Contractor shall provide all labor, tools, equipment and materials necessary to accomplish the work.

1.6 The Owner will provide suitable access to the construction site for the Installing Contractor's personnel and equipment.

1.7 Unless specifically noted otherwise in the contract documents, the Owner will remove and replace any structures, utilities, pavements, landscaping orother surficial improvements in the work area as necessary to facilitate the work.

1.8 The Owner will be responsible for overall construction oversight to preclude the development of unsafe conditions.

1.9 The Owner will be responsible for a horizontal field survey of the helical pile locations prior to helical pile installation and an elevation survey to determine pile shaft cutoff height subsequent to helical pile installation.

1.10 The work does not include any post-construction monitoring of pile performance unless specifically noted otherwise in the contract documents.

2 REFERENCES

2.1 American Institute of Steel Construction (AISC)

2.1.1 AISC 360: Specification for Structural Steel Buildings

2.2 American Society for Testing and Materials (ASTM)

2.2.1 ASTM A36: Carbon Structural Steel

2.2.2 ASTM A123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2.2.3 ASTM A153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware

2.2.4 ASTM A307: Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

2.2.5 ASTM A325: Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

2.2.6 ASTM A500: Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

2.2.7 ASTM A513: Electric-Resistance Welded Carbon and Alloy Steel Mechanical Tubing

2.2.8 ASTM A572: High-Strength Low-Alloy Columbian-Vanadium Structural Steel

2.2.9 ASTM B633: Electrodeposited Coatings of Zinc on Iron and Steel

2.2.10 ASTM D1143: Deep Foundations Under Static Axial Compressive Load

2.3 International Code Council Evaluation Services (ICC-ES)

2.3.1 Acceptance Criteria 358 (AC358): Acceptance Criteria for Helical Pile Systems and Devices

2.4 Society of Automotive Engineers (SAE)

2.4.1 SAE J429: Mechanical and Material Requirements for Externally Threaded Fasteners

3 DEFINITIONS

3.1 The following terms apply to helical piles used to support compressive loads:

3.1.1 Allowable Stress Design: A structural and geotechnical design methodology that states that the summation of the actual estimated loads (nominal loads) must be less than or equal to the allowable design load (required strength). Allowable loads are obtained by dividing a nominal resistance (strength) by an appropriate factor of safety.

3.1.2 Bearing Stratum: The soil layer (or layers) that provide the helical pile end-bearing capacity through load transfer from the helical plates.

3.1.3 Crowd: Axial compressive force applied to the helical pile shaft as needed during installation to ensure the pile advances at a rate approximately equal to the helix pitch for each revolution.

3.1.4 Design Loads: A generic and ambiguous term used to describe any load used in design. It is not specific to factored or unfactored loads or any particular design methodology. It is a term; therefore, that should be avoided when specifying load

requirements. FSI recommends using the term service load, nominal load or factored load, as described herein, where applicable.

3.1.5 Design Strength: A term used in structural design which is defined as the product of the nominal strength and the applicable resistance factor. An equivalent term typically used in geotechnical design is, also sometimes referred to as factored resistance (Load and Resistance Factor Design).

3.1.6 Extension Section: Helical pile shaft sections connected to the lead section or other extension sections to advance the helix plates to the required bearing depth. Plain extensions (without helix plates) or helical extensions (with one or more helix plates) may be used depending upon soil conditions or project requirements.

3.1.7 Factor of Safety: The ratio of the ultimate pile capacity or nominal resistance (strength) to the nominal or service load used in the design of any helical pile component or interface (Allowable Stress Design).

3.1.8 Factored Load: The product of a nominal load and an applicable load factor (Load and Resistance Factor Design).

3.1.9 Factored Resistance: The product of a nominal resistance and an applicable resistance factor (Load and Resistance and Factor Design).

3.1.10 Geotechnical Capacity: The maximum load or the load at a specified limit state, that can be resisted through the piles interaction with the bearing soils (see also Ultimate Pile Capacity).

3.1.11 Helical Pile: Consists of a central steel shaft with one or more helix-shaped bearing plates and a load transfer device (bracket) that allows attachment to structures. Helical piles are installed into the ground by application of torque and axial compressive force ("crowd").

3.1.12 Helix (Helical) Plate: Generally round steel plate formed into a helical spiral and welded to the central steel shaft. When rotated in the ground, the helix shape provides thrust along the pile's longitudinal axis thus aiding in pile installation. The plate transfers axial load to the soil through bearing.

3.1.13 Helix Pitch: The distance measured along the axis of the shaft between the leading and trailing edges of the helix plate.

3.1.14 Lead Section: The first helical pile shaft component installed into the soil. It consists of one or more helical plates welded to a central steel shaft.

3.1.15 Limit State: A condition beyond which a helical pile component or interface becomes unfit for service and is judged to no longer be useful for its intended function (serviceability limit state) or to be unsafe (ultimate limit state (strength)).

3.1.16 Load and Resistance Factor Design: A structural and geotechnical design methodology that states that the Factored Resistance (Design Strength) must be greater than or equal to the summation of the applied factored loads.

3.1.17 Load Factor: A factor that accounts for the probability of deviation of the actual load from the predicted nominal load due to variability of material properties, workmanship, type of failure and uncertainty in the prediction of the load (Load and Resistance Factor Design).

3.1.18 Load Test: A process to test the ultimate pile capacity and relation of applied load to pile head settlement by application of a known load on the helical pile head and

monitoring movement over a specific time period.

3.1.19 Loads: Forces that result from the weight of all building materials, occupants and their possessions, environmental effects, differential movement, and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude. All other loads are variable loads (see also Nominal Loads).

3.1.20 Mechanical Strength: The maximum load or the load at a specified limit state that can be resisted by the structural elements of a helical pile.

3.1.21 Net Deflection: The total settlement at the pile head minus the theoretical elastic deformation of the pile shaft during a load test.

3.1.22 Nominal Loads: The magnitude of the loads specified, which include dead, live, soil, wind, snow, rain, flood and earthquakes (also referred to as service loads or working loads).

3.1.23 Nominal Resistance: The pile capacity at a specified ultimate limit state (Load and Resistance Factor Design). See Ultimate Pile Capacity.

3.1.24 Nominal Strength: A term used in structural design which is defined as the structure or member capacity at a specified strength limit state. See Ultimate Pile Capacity.

3.1.25 Resistance Factor: A factor that accounts for the probability of deviation of the actual resistance (strength) from the predicted nominal resistance (strength) due to variability of material properties, workmanship, type of failure and uncertainties in the analysis (Load and Resistance Factor Design).

3.1.26 Service Loads: See "Nominal Loads" above.

3.1.27 Ultimate Pile Capacity: The helical pile capacity based on the least capacity determined from applicable ultimate limit states for mechanical and geotechnical capacity.

1.1 SCOPE OF WORK

The work shall consist of the Helical Pile Contractor furnishing all labor, tools, equipment, materials and supervision to install Helical Piles according to the specifications contained herein and shown on the construction drawings. The Helical Pile Contractor shall install the helical pile which will provide a minimum load capacity of 3.500 ft/lbs. of torque unless indicated otherwise on the construction documents/plans.

1.2 DEFINITIONS

Some of the terms used in this specification may be unfamiliar to the reader, or may be used with a specific meaning not commonly known outside the helical pile industry. In determining the meaning of any term used herein, a definition contained in the following list shall take precedence.

A. **Bearing Stratum** – The undisturbed soil layer at any pile excavation location which provides a significant portion of the axial resistance of an installed helical pile

bearing on one or more of the pile helices.

B. **Contractor -** The person/firm responsible for performing the helical pile work.

C. **Crowd** – Axial compressive force applied to the head (top) of the helical pile shaft during installation as required to ensure the pile progresses into the ground with each revolution a distance approximately equal to the helix pitch.

D. **Extension** – A pile section without helical plates. Extension(s) are installed after the lead section. Each extension is connected with integral couplings which provide a rigid load transferring connection. Their purpose is to extend the lead section with helical plates to a load bearing stratum.

E. **Helix Driver** – A high torque hydraulic motor used to advance (screw) a helical pile into the soil to a load bearing stratum. Depending on the capacity of the helix driver, it may be either hand held or machine operated.

F. **Helical Pile** – A steel pile consisting of one or more helical plates which is torqued into the soil until the lead section is embedded into a load bearing stratum. They're purpose is to transfer structural loads (tension and/or compression) to a load bearing stratum.

G. **Helix Plate** – A round plate formed into a ramped spiral. When rotated into the soil, the helical shape provides thrust along its longitudinal axis thus aiding in pile installation. After installation, the plate transfers axial load into the soil through bearing.

H. **Installation Torque** – The resistance generated by a helical pile when installed into the soil. The installation resistance is a function of the strength properties of the soil the helical piles are being installed in as well as the shaft geometry of the pile shaft and helical plates.

I. **Lead Section** - The first helical pile section installed into the soil consisting of one or more helix plates welded to the pile shaft.

J. **Torque Rating** – The maximum torque energy that can be applied to a helical pile during installation into the soil.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM)

a. ASTM-A29 Steel Bars, Carbon and Alloy, Hot Wrought and Cold Finished
b. ASTM-A36 Structural Carbon Steel
c. ASTM-A53 Welded and Seamless Steel Pipe
d. ASTM-A500, Grade C, Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
e. ASTM-A307 Carbon Steel bolts and Studs
f. ASTM-563 Carbon and Alloy Steel Nuts

B. American Welding Society (AWS)

a. AWS D1.1 Structural Welding Code – Steel

C. Society of Automotive Engineers (SAE)

a. SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners

D. International Code Council - Evaluation Services (ICC-ES)

a. Acceptance Criteria for Corrosion Protection of Steel Foundation Systems Using Polymer (EAA) Coatings (AC228)
b. Acceptance Criteria for Helical Pile Systems and Devices (AC358)
c. Evaluation Service Report (ESR)

E. International Organization for Standardization (ISO)

a. ISO 9001:2008 – Quality Management System

1.4 SUBMITTALS

A. Five (5) sets of site specific shop drawings sealed by a registered professional engineer. Shop drawings to include:

a. Helical pile/anchor identification number and location
b. Helical pile/anchor design load
c. Type and size of helical pile/anchor shaft
d. Helical configuration (number and diameter of helical plates)
e. Minimum effective torque required
f. Connection details

B. Copies of certified calibration reports for all hydraulic gages. The calibrations shall have been performed within one (1) year of the proposed starting date of the pile installation.

C. Provide steel manufacturer's mill test reports, covering physical and chemical tests, for all steel piles.

D. Provide strength and properties sections of pile sections and calculations by a Professional Engineer demonstrating the pile will meet or exceed the strength requirements of the design loads as shown on the construction documents.

a. If applicable, the calculation(s) shall include the load eccentricity on the pile. The eccentricity shall be measured from the vertical face of the footing to the center of the pile shaft.

b. If the helical pile is deemed laterally unbraced per section 1808.2.5 of the International Building Code (IBC), the allowable load capacity calculation(s) of the pile shall take into consideration the unbraced length of the pile per section 1808.2.9.2 of the International Building Code (IBC).

E. Installation Records: Within 7 days after pile installation, submit 2 copies of the installation record for each pile installed.

   a. The installation record shall clearly indicate the pile identification number or mark, pile diameter, helix configuration, installation depth, installation torque, ultimate and allowable capacity of pile.

   b. Where helical piles are being installed on existing structures provide final lifting force/design load applied to pile, the amount of elevation recovery of each pile.

1.5 QUALITY ASSURANCE

A. The Contractor performing the Work of this Section shall have been regularly engaged in pile work for a period of not less than 5 years and shall be properly equipped to execute the Work. If directed, furnish a list of projects of a similar type and magnitude executed by the Contractor.

B. In lieu of the Contractor achieving 5 years of Helical Pile experience, a certificate of competency can be provided by the manufacturer. The certificate should state that the Contractor has been trained and is authorized to install the underpinning pile system or the manufacturer shall provide a letter expressing the ability and intent to provide on-site supervision of the pile installation.

C. Design of the helical piles/anchors shall be performed by a professional engineer licensed in the state of the project in accordance with existing building code requirements.

D. The helical pile shall be recognized by the International Code Council (ICC) and the manufacturer shall hold a current ICC-ES issued ESR report showing compliance with AC358 and the current International Building Code (IBC).

E. The manufacturer shall have been issued an International Organization for Standardization – (ISO) 9001:2008 – Quality Management System Certificate and be compliant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transport, store, and handle piles in a manner to prevent damage to the piles. Piles shall be stored above the ground surface by pallets, blocking or other means.

PART 2: PRODUCTS

2.1 MATERIAL

A. Manufacturer:

Grip-Tite Manufacturing Company, LLC
115 W. Jefferson St.
Winterset, Iowa 50273
Tel: (515) 462-1313; Fax: (515) 462-3465
www.griptite.com

See attached Grip-Tite Evaluation Report for full specifications.

Note: Equivalent systems may be substituted. System equivalence will be determined by comparing a manufacturer's current ICC-ES issued ESR report to ESR-3533.

B. The helical piles/anchors shall have a central shaft that is cold formed welded and seamless carbon steel structural round tubing with a minimum yield strength of 65 ksi and meeting the dimensional and workmanship requirements of ASTM A500 as well as the following properties:

2 7/8" diameter piling/anchor:
Torsional strength rating = 8,000 ft-lbs Ultimate
resistance capacity = 72,000 lbs

a. Shall conform to ASTM A-36 and have minimum yield strength (F_Y) of 50 ksi.

b. Shall have a minimum thickness of ¼".

C. All other flat plate steel shall conform to ASTM A-36 unless noted otherwise on the plans.

D. All coupling connection thru bolts shall be ¾" diameter and conform to SAE J429 Grade 8 or equivalent. (minimum yield strength (F_Y) = 130 ksi and minimum tensile strength (F_U) = 150 ksi)

E. All piling sections and brackets shall be coated with a polymer alloy thermoplastic powder coating, Plascoat PPA 571ES or equal, in compliance with ICC-ES acceptance criteria AC228 for corrosion resistance.

2.2 PERFORMANCE REQUIREMENTS

A. All helical piles shall be designed to support the design load(s) as shown on the

plans.

B. Except where noted on the plans, all helical pile components shall be selected to provide a minimum factor of safety against ultimate mechanical failure of two (2).

C. The helical pile design shall take into account pile spacing, soil stratification and strain compatibility issues as are present for the project. See drawings for reference for the project geotechnical report. A copy of the project geotechnical report shall be provided to and reviewed by the Pile Contractor prior to bid submittal.

D. Where helical piles are subjected to lateral or base shear loads as indicated on the plans, the bending moment and stress from said loads shall be determined using a lateral load analysis program such as LPILE or equal commercially available software. The required soil parameters (c, Ø, γ and k_s) for use with LPILE or equal shall be provided in the geotechnical report(s). The allowable lateral deflection of the helical pile shall be limited to one (1") inch unless noted otherwise on the plans.

E. The helical pile bracket shall distribute the design load(s), as indicated on the plans, to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stress in the steel plate/welds do not exceed AISI allowable stresses for steel members.

F. Helical piles shall be designed by a licensed professional engineer in accordance with the current International Building Code (IBC) adopted by the local jurisdiction.

PART 3: EXECUTION

3.1 PREPARATION

A. Before entering the construction site to begin work, the Helical Pile Contractor shall provide proof of insurance coverage as stated in the general specification and/or the contract.

B. The Helical Pile Contractor shall request markings of underground utilities by an underground utility location service. All efforts shall be made to protect any underground utilities encountered during the excavation and pile installation. Any separations or damage caused to the underground utilities shall be repaired/performed by a licensed professional.

C. Mark all pile installation locations as shown on the plans or approved shop drawings. The Engineer of Record shall be notified if the piles are relocated more than 12" from the locations shown on the plans or approved shop drawings. Relocation of the piles will not be allowed unless approved by the Engineer of Record.

D. A torque indicator shall be used during helical pile/anchor installation. The torque indicator can be an integral part of the installation system or externally

mounted in-line.

E. A third party inspector shall be retained to oversee all aspects of installation of the helical piles/anchors. The items to be inspected include, but not limited to the following:

   a. Verify the type of helical pile/anchor being installed is as specified on the shop drawings.
   b. Verify final embedment depth of helical pile/anchor.
   c. Verify final installation torque readings as specified on the shop drawings.

3.2 INSTALLATION

A. Installation torque serves as empirical verification of pier capacity yielding an onsite load test for each pier. Therefore, soils testing is not necessary for generating a theoretical capacity.

B. The lead section shall be positioned at the location as shown on the construction drawings. Battered helical piles/anchors can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required battered angle shall be established.

C. The helical pile/anchor sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 25 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the construction drawings. Connect sections together using coupling bot(s) and nut torqued to snug tight per AISC.

D. Sufficient down pressure shall be applied to uniformly advance the helical pile/anchor sections approximately 3-inches per revolution. The rate of down pressure (crowd) shall be adjusted for different soil conditions and depths.

E. The minimum installation torque and minimum overall length criteria as shown on the construction drawings shall be satisfied prior to terminating the helical pile/anchor installation.

F. If the torsional strength rating of the pile shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

   a. Terminate the installation depth obtained subject to the review and acceptance of the Engineer of Record, or:

   b. Remove the existing helical pile/anchor and install a new one with fewer and/or smaller diameter helix plates. The new helix plate configuration shall be subject to review and acceptance of the Engineer of Record. If re-installing in the same location, the top-most helix of the new helical pile/anchor shall be terminated at least three feet (3'-0) beyond the terminating depth of the original helical pile/anchor.

G. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length and there is no maximum length constraint, the Contractor shall have the following options:

a. Install the helical pile/anchor deeper using additional extension sections, or:

b. Remove the existing helical pile/anchor and install a new one with additional and/or larger diameter helix plates. The new helix plate configuration shall be subject to review and acceptance of the Engineer of Record. If re-installing in the same location, the top-most helix of the new helical pile/anchor shall be terminated at least three feet (3'-0) beyond the terminating depth of the original helical pile/anchor.

c. De-rate the load capacity of the helix pile/anchor and install additional helical piles/anchors. The de-rated capacity and additional helical piles/anchors location shall be subject to the review and acceptance of the Engineer of Record.

H. If the helical pile/anchor is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile/anchor removed. The obstruction shall be removed, if feasible, and the helical pile/anchor re-installed. If the obstruction can't be removed, the helical pile/anchor shall be installed at an adjacent location, subject to the review and acceptance of the Engineer of Record.

I. The Contractor shall conduct his construction operations in a manner to insure the safety of persons and property in the vicinity of the work. The Contractor's personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.

J. The portion of the construction site occupied by the Helical Pile Contractor, his equipment and his material stockpiles shall be kept reasonably clean and orderly.

3.3 FIELD QUALITY CONTROL

A. The Helical Pile Contractor shall furnish and install all helical piles per the plans and approved pile design documentation. In the event of conflict between the plans and approved pile design documentation, the contractor shall not begin construction on any affected items until such conflict has been resolved.

B. Centerline of helical piles/anchors shall not be more than three inches (3") from indicated plan location unless approved by the Engineer of Record.

C. Helical pile/anchor plumbness shall be within 2 degrees of the design alignment.

3.4 CLEAN UP

A. Within seven (7) days of completion of the work. The Helical Pile Contractor shall

remove any and all material, equipment, tools, building materials, concrete forms, debris or other items belonging to the Contractor or used under the Contractor's direction.

END OF SPECIFICATION

4 QUALIFICATIONS OF INSTALLING CONTRACTOR AND DESIGNER

4.1 The Installing Contractor and/or Pile Designer shall submit to the Owner, a proposal including the documentation required in this Section. Work shall not begin until all the submittals have been received and approved by the Owner. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Installing Contractor.

4.2 Evidence of Installing Contractor's competence in the installation of helical piles shall be provided to the Owner's satisfaction and may include any or all of the following:

4.2.1 Pile manufacturer's certificate of competency for the installation of helical piles,

4.2.2 A list of at least three projects completed within the previous three years wherein the Installing Contractor installed helical piles similar to those shown in the project Plans. Such list to include names and phone numbers of those project representatives who can verify the Installing Contractor's participation in those projects, and/or

4.2.3 A letter from the pile manufacturer or manufacturer's representative expressing ability and intent to provide on-site supervision of the pile installation.

4.3 A listing of all safety violations lodged against the Installing Contractor within the previous three years and the current status or final resolutions thereof. Descriptions of safety improvements instituted within the previous three years may also be submitted, at the Installing Contractor's discretion.

4.4 Evidence of Pile Designer's competence shall be provided to the Owner's satisfaction and may include any or all of the following:

4.4.1 Registration as a Professional Engineer or recognition by the local jurisdictional authority,

4.4.2 A list of at least three projects completed within the previous three years wherein the Pile Designer designed helical piles similar to those shown in the project Plans. The list shall include names and phone numbers of those project representatives who can verify the Pile Designer's participation in those projects, and/or

4.4.3 Recommendation from the pile manufacturer or manufacturer's representative.

5 PRE-CONSTRUCTION SUBMITTALS

5.1 Within 2 weeks of receiving the contract award, the Installing Contractor and/or Pile Designer shall submit the following helical pile design documentation:

5.1.1 Certification from the Pile Designer that the proposed piles meet the requirements of this specification.

5.1.2 Qualifications of the Installing Contractor and Pile Designer per Section 8.

5.1.3 Product designations for helical lead and extension sections and all ancillary products to be supplied at each helical pile location.

5.1.4 Individual pile nominal loads, factors of safety, LRFD load and resistance factors and required ultimate torque correlated capacities, where applicable.

5.1.5 Individual pile loading requirements (if any).

5.1.6 Manufacturer's published allowable system capacities for the proposed pile assemblies, including load transfer devices.

5.1.7 Calculated mechanical and theoretical geotechnical capacities of the proposed piles.

5.1.8 Minimum pile termination torque requirements.

5.1.9 Maximum estimated installation torque and allowable installation torque rating of the proposed piles.

5.1.10 Minimum and/or maximum embedment lengths or other site specific embedment depth requirements as may be appropriate for the site soil profiles.

5.1.11 Inclination angle and location tolerance requirements.

5.1.12 Load test procedures and failure criteria, if applicable.

5.1.13 Copies of certified calibration reports for torque measuring equipment and load test measuring equipment to be used on the project. The calibrations shall have been performed within one year of the proposed helical pile installation starting date or as recommended by the equipment manufacturer.

5.1.14 Provide proof of insurance coverage as stated in the general specifications and/or contract.

6 PLACEMENT REQUIREMENTS

6 Helical piles shall be installed within 3-inches of the indicated plan location.

6.1 Helical pile shaft alignment shall be within 2-degrees of the inclination angle shown on the Plans.

6.2 Top elevation of the helical piles shall be within 2-inches of the design vertical elevation.

7 PILE/PIER INSTALLATION

7.1 Installing Contractor shall furnish and install all helical piles per the project Plans and approved pile design documentation. In the event of conflict between the project Plans and the approved pile design documentation, the Installing Contractor shall not begin construction on any affected items until such conflict has been resolved.

7.2 The Installing Contractor shall conduct their construction operations in a manner to insure the safety of persons and property in the vicinity of the work. The Installing Contractor's personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.

7.3 The Owner shall request marking of underground utilities by an underground utility location service as required by law, and the Installing Contractor shall avoid contact with all marked underground facilities.

7.4 The portion of the construction site occupied by the Installing Contractor, including equipment and material stockpiles shall be kept reasonably clean and orderly.

7.5 Installation of helical piles may be observed by representatives of the Owner for quality assurance purposes. The Installing Contactor shall give the Owner at least 24 hours' notice prior to the pile installation operations.

7.6 The helical pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project. The lead section shall be positioned at the appropriate site survey stake location as determined from the plan drawings.

7.7 The helical pile sections shall be advanced into the soil in a continuous manner at a rate of rotation less than 25 revolutions per minute (rpm). Sufficient crowd shall be applied to advance the helical pile sections at a rate approximately equal to the pitch of the helix plate per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths. Extension sections shall be provided to obtain the required minimum overall length and minimum torsional resistance as shown on the project Plans.

\

8 TERMINATION CRITERIA

8.1 The minimum final torsional resistance and/or any required pile length and embedment depth criteria, as specified in the Pre-Construction Submittals, must be satisfied prior to terminating the pile installation. In the event a helical pile fails to meet these production quality control termination criteria, the following remedies may be suitable if authorized by the Owner:

8.1.1 If the installation fails to meet the minimum torsional resistance criterion at the minimum embedment length:

8.1.1.1 Continue the installation to greater depths until the torsional resistance criterion is met, provided that, if a maximum length constraint is applicable, continued installation does not exceed said maximum length constraint, or

8.1.1.2 Demonstrate acceptable pile performance through pile load testing, or

8.1.1.3 Replace the pile with one having a different helix plate configuration. The replacement pile must not exceed any applicable maximum embedment length criteria and either: (A) be embedded to a length that places the last helix plate at least equal to its own diameter beyond the depth of the first helix plate of the replaced pile and meet the minimum torsional resistance criterion; or (B) pass pile load testing criteria.

8.1.2 If the torsional resistance during installation reaches the helical pile's allowable torque rating prior to satisfaction of the minimum embedment length criterion:

8.1.2.1 Terminate the installation at the depth obtained, or

8.1.2.2 Replace the pile with one having a shaft with a higher torsional strength rating. The replacement pile must be installed to satisfy the minimum embedment length criterion. It must also be embedded to a length that places the last helix plate at least equal to its own diameter beyond the depth of the first helix plate of the replaced pile without exceeding any applicable maximum embedment length requirements and it must meet the minimum final torsional resistance criterion, or

8.1.2.3 Replace the pile with one having a different helix plate configuration. The replacement pile must be installed to satisfy the minimum embedment length criterion. It must also be embedded to a length that places the last helix plate at least equal to its own diameter beyond the depth of the first helix plate of the replaced pile without exceeding any applicable maximum embedment length requirements, and it must meet the minimum final torsional resistance criterion.

8.1.3 If the installation reaches a specified maximum embedment length without achieving the minimum torsional resistance criterion:

8.1.3.1 If allowed, remove and reinstall the pile at a position at least three times the diameter of the largest helix plate away from the initial location. Original embedment length and torsional resistance criteria must be met. The pile repositioning may require the

installation of additional helical piles with nominal loads adjusted for these spacing changes, or

8.1.3.2 Demonstrate acceptable pile performance through pile load testing, or

8.1.3.3 De-rate the load capacity of the helical pile based on default or site specific torque correlation factors and install additional piles as necessary.

8.1.3.4 Replace the pile with one having a different helix plate configuration. The replacement pile must be installed to satisfy the minimum and/or maximum embedment length criterion and it must meet the minimum final torsional resistance criterion.

8.1.4 If a helical pile fails to meet the acceptance criteria in a pile load test:

8.1.4.1 Install the pile to a greater depth and installation torque and re- test; provided that, if a maximum embedment length constraint is applicable, continued installation will not exceed said maximum length constraint, or

8.1.4.2 Replace the pile with one having more and/or larger helix plates. The replacement pile must be embedded to a length that places the last helix plate at equal to its own diameter beyond the depth of the first helix plate of the replaced pile without exceeding any applicable maximum embedment length requirements. The replacement pile must be re-tested, or,

8.1.4.3 De-rate the load capacity of the helical pile based on the results of the load test and install additional piles. Additional piles must be installed at positions that are at least three times the diameter of the largest helix plate away from any other pile locations.

8.1.5 If a helical pile fails a production quality control criterion as described in this Section or for any reason other than described in this Section, any proposed remedy must be approved by the Owner prior to initiating its implementation at the project site.

9 INSTALLATION RECORD SUBMITTALS

9.1 The Installing Contractor shall provide the Owner copies of the individual helical pile installation records within 24 hours after each installation is completed. Formal copies shall be submitted within 30 days following the completion of the helical pile installation. These installation records shall include, but are not limited to, the following information:

9.1.1 Date and time of installation

9.1.2 Location of helical pile and pile identification number

9.1.3 Installed helical pile model and configuration

9.1.4 Termination depth, pile head depth, and length of installed pile

9.1.5 Actual inclination of the pile

9.1.6 Final torsional resistance

9.1.7 Calculated geotechnical capacity based on final torsional resistance

9.1.8 Comments pertaining to interruptions, obstructions, or other relevant information

10 FIELD COMPRESSION LOAD TESTING

10.1 If field compression load testing is required, the Installing Contractor shall furnish all labor, equipment and pre-production helical piles necessary to accomplish the testing as shown in the approved pile design documentation. Installing Contractor shall apply the specified loads for the specified durations and record the specified data, for the specified number of piles. No deviations from the test plan(s) will be allowed without explicit approval in writing from the Owner. Pile testing shall be in general accordance with the ASTM D1143 quick test method and the following criteria:

10.1.1 Failure criteria shall be in accordance with AC358 and is when plunging occurs or when the net deflection exceeds 10% of the average helix plate diameter, whichever occurs first.

10.1.2 An alignment load equal to 5% of the anticipated failure load or maximum anticipated test load may be applied prior to the start of the test to take out slack in the load test frame.

10.1.3 Loading increments shall be performed at 5% of the anticipated failure load or maximum anticipated test load with a minimum hold time of 4 minutes at each increment.

10.1.4 Upon completion of the maximum test load hold increment, the pile shall be unloaded in 5 to 10 even increments with minimum hold times of 4 minutes at each increment.

10.2 Installing Contractor shall provide the Owner copies of raw field test data within 24 hours after the completion of each load test. Formal test reports shall be submitted within 30 days following test completion. Formal test reports shall include the following information:

10.2.1 Name of project and Installing Contractor's representative(s) present during load testing.

10.2.2 Name of manufacturer's representative(s) present during load testing, if any.

10.2.3 Name of third party test agency and personnel present during load testing, if any.

10.2.4 Date, time, duration and type of the load test.

10.2.5 Unique test identifier and map showing the test pile location.

10.2.6 Pile model and installation information including shaft type, helix configuration, lead and extension section quantities and lengths, final pile tip depth, installation date, total test pile length and final termination torque.

10.2.7 Calibration records for applicable pile installation and test equipment.

10.2.8 Tabulated test results including cumulative pile head movement, loading increments and hold times.

10.2.9 Plots showing load versus deflection for each loading/unloading interval.

LIMITATIONS

This repair design does not represent a complete analysis of the entire structure; it addresses conditions covered under the structural warranty provided by the contractor. The interpretations of the distress to be repaired are based on the visual observations of the structure. No detailed study was made of the structural elements of any part of the building. Therefore, no opinion is presented or shall be implied concerning the structural integrity of those elements not subject to visual inspection. Investigation and analysis of other portions of the structure are beyond the scope of this design at this time.

LEVEL Engineering, LLC will not be responsible for 1) knowledge of subsurface conditions away from the existing borings, if any, without extensive geotechnical information supplied by a competent geotechnical engineer, 2) knowledge of distresses, or differential displacements that have occurred in an area which had not been exposed for visual observation during our site visit and 3) any other elements such as joists or beams and other structural members that are not readily visible.

LEVEL Engineering, LLC assumes that all information provided by the Client, Contractor, or other Consultants is correct, accurate, and may be acted upon accordingly, and shall have no liability for the validity of information provided.

LEVEL Engineering, LLC shall have no liability for acts or omissions of the Contractor or any other agents performing the work on this project or for the failure of the Contractor to carry out the work in accordance with the plans and specifications if not inspect as intended. **LEVEL Engineering, LLC** shall not be responsible for the construction means, methods, techniques, sequence, procedures, or safety precautions related to this project and its execution that is under the control or direction of the Contractor.

This PLAN OF REPAIR is to be used with the accompanying drawings. Do not rely on one or the other, all materials contained in THE PLAN OF REPAIR including but not limited to the cover letter, notes, plans, details, shall be used together to perform the proposed remedial construction.

WORK DESCRIPTION

For the purposes of this report, the front of the home is considered to face West. The structure is a two-story, single-family home and is a conventionally framed residence. The home has a full basement and the foundation consists of stacked stone and grouted walls. The work area is a section of the south basement foundation wall near the southeast corner. The repairs shall consist of installing Helical piers to reduce foundation movement and further reduce cracking of the walls. Once complete if the owner wishes to tuck point cracks in the exposed foundation wall areas it will be at the direction of the owner.

Areas of the exterior of the foundation structure are settling. These issues are causing cracking of the foundation and unevenness of the roof and floor structures. Helical underpinning is part of this work. This area of repair is referenced in the attached drawings (see plan).

Once the piles are installed, all restoration of finishes exterior and interior flatwork shall be restored in kind and in accordance with the owner's approval. The contractor is responsible for coordinating these types of repair scopes with the owner. The contractor is required to coordinate these expectations with the owner and include the necessary work items in their bid proposals.

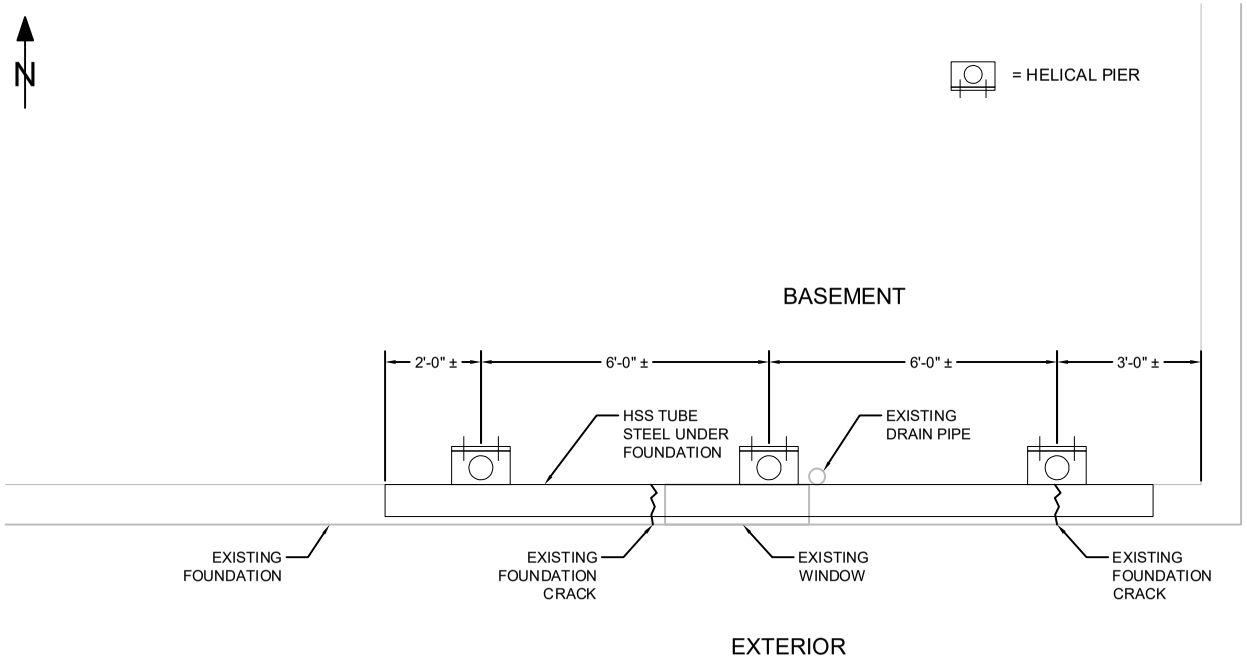
REPAIR RECOMMENDATIONS

1. The concrete slab and walls are to be braced as required during the repair process by the Contractor.
2. Remove decks, pavers, slabs etc. to excavate the soil required to install the new helical foundation devices, in accordance with drawings prepared by Level Engineering LLC.
3. Excavate the soil required to install the helical piers and anchors in accordance with drawings prepared by Level Engineering LLC.
4. Install 3 helical piles/piers to a depth of 25 ft. and/or 3500 ft-lbs of torque. Install steel angle at each pier per drawings. Coordinate location with engineer per pier manufacturer specifications and recommendations and drawings including specifications prepared by Level Engineering LLC.
5. Restore all finishes exterior and interior in accordance with agreements with owner.

PROPOSED COMPLIANCE OBSERVATIONS

All observations shall be conducted by a qualified Colorado Licensed Professional Engineer. More than one observation may be conducted during a site visit. The contractor is to determine the number of site visits required to do the observations and include this information in the bid documents**. LEVEL Engineering, LLC** is willing to complete the observation under contract.

1. Pre-Construction Meeting
2. Attachment of brackets to foundation walls.
3. Load tests
4. Epoxy Injection of foundation wall cracks (directed by owner)
5. Review pier logs
6. Final



NOTES:

1. LOADING CRITERIA USED FOR DESIGN
   - 1.1. Roof Load 30 psf LL + 15 psf DL
   - 1.2. Floor Load 40 psf LL + 15 psf DL
   - 1.3. Wind Load 140 MPH
   - 1.4. Ground Snow Load = 35 PSF
2. Presumptive soil bearing pressure is 1500 PSF
3. All work to be conformance with the 2021 IRC as adopted and amended by the governing jurisdiction.
4. The helix pier shall be placed a minimum of 25 feet or 3,500- ft-lbs torque. If bedrock is encountered contact engineer for direction.
5. Pier spacing shall be no more than 6'-0" on center, and no more than 3'-0" from corner (as shown on drawings).

PRIOR TO THE COMMENCEMENT OF ANY WORK, THE CONTRACTOR/BUILDER IS TO CHECK AND/OR DETERMINE ALL CONSTRUCTION DETAILS, INCLUDING CHECKING EXISTING SITE LEVELS AND DIMENSIONS. THE DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS, CONSTRUCTION NOTES AND/OR PROJECT SPECIFICATIONS. ALL DISCREPANCIES SHOULD BE REPORTED IMMEDIATELY.

Engineer's Stamp

No.	Date	Revisions
0	5/3/2022	ISSUED FOR CONSTRUCTION

LEVEL ENGINEERING AND INSPECTION

Client
TODD MILLER

LEVEL Job # **13229**

Job Title/Address
426 PETERSON STREET
FORT COLLINS, CO 80524

Drawing Title/Address
PLAN

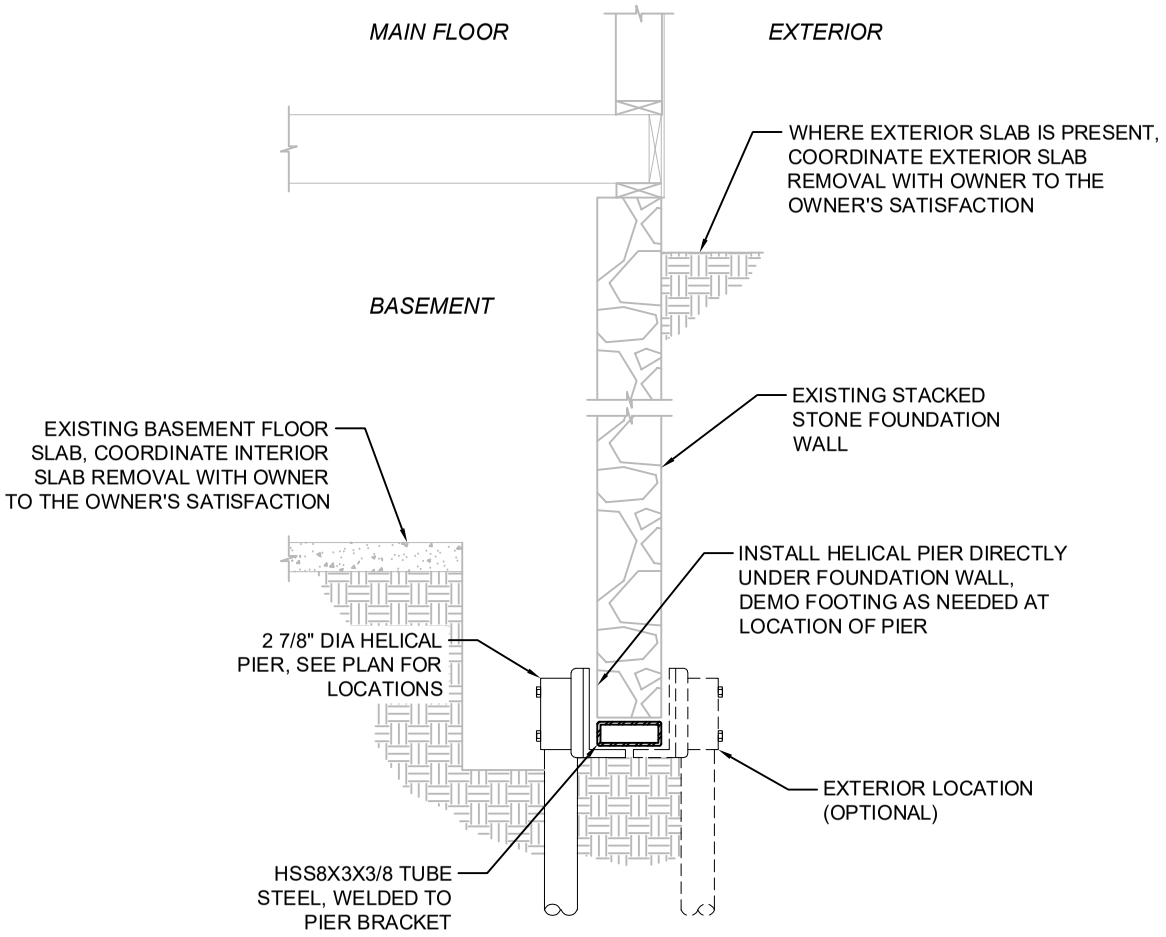
Scale **N.T.S.**

Date **5/3/2022**

Drawn By **SDN**

Drawing Number **S1.0**

Revision **0**



TYPICAL HELICAL PIER SECTION AT BASEMENT FOUNDATION WALL

PRIOR TO THE COMMENCEMENT OF ANY WORK, THE CONTRACTOR/BUILDER IS TO CHECK AND/OR DETERMINE ALL CONSTRUCTION DETAILS, INCLUDING CHECKING EXISTING SITE LEVELS AND DIMENSIONS. THE DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS, CONSTRUCTION NOTES AND/OR PROJECT SPECIFICATIONS. ALL DISCREPANCIES SHOULD BE REPORTED IMMEDIATELY.

Engineer's Stamp

No.	Date	Revisions
0	5/3/2022	ISSUED FOR CONSTRUCTION

LEVEL ENGINEERING AND INSPECTION

Client
TODD MILLER

LEVEL Job # **13229**

Job Title/Address
426 PETERSON STREET
FORT COLLINS, CO 80524

Drawing Title/Address
DETAIL #1

Scale	N.T.S.	
Date	5/3/2022	Drawn By SDN

Drawing Number	Revision
S1.1	0

ICC EVALUATION SERVICE®

ICC-ES Evaluation Report

ESR-3533

Issued May 2021
Revised June 2021
This report is subject to renewal May 2022.

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

REPORT HOLDER:

GRIP-TITE MANUFACTURING CO., LLC

EVALUATION SUBJECT:

GRIP-TITE® HELICAL FOUNDATION SYSTEMS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015 and 2012 *International Building Code®* (IBC)

Properties evaluated:

- Structural
- Geotechnical

2.0 USES

Grip-Tite Helical Pile Systems include a helical steel pile (screw) system used to transfer compressive, tension, and lateral loads from a new or existing structure to a soil bearing strata. Brackets are used to transfer the loads from the structure to the helical pile systems.

3.0 DESCRIPTION

3.1 General:

The Grip-Tite Helical Pile Foundation System consists of helical piles connected to brackets that are in contact with the structure's load-bearing foundation or wall. Each helical pile, consisting of a lead section and one or more extension sections, are screwed into the ground by application of torsion to a depth that conforms to project requirements for avoidance of unsatisfactory subsurface conditions and ensures a suitable soil or bedrock bearing stratum has been reached. The bracket is then installed to connect the pile to the concrete foundation or wall of the supported structure.

3.2 System Components:

3.2.1 RDS2875 Lead Section and Extensions: The lead shafts and extensions consist of 2⅞-inch (73 mm) outside diameter (OD) structural steel tubing having a nominal shaft thickness of 0.262-inch (6.6 mm). Helical-shaped discs, welded to the shaft, advance the helical piles into the soil when the piles are rotated. The extensions and lead sections are made from the same shafts and the extensions can be constructed with or without helical plates. The helical pile lead sections and extensions are connected to each other using an external coupler factory-welded to the leading end of each extension. Each extension consists of a factory-welded coupler and three (3) 3/4-inch-diameter (19.0 mm) structural bolts. The lead shafts, extensions and bolts are available bare steel or offered with an optional galvanization coating complying with ASTM A123 as described in the approved quality documentation. See Figure 1 and Table 1 provide details for RDS2875 lead sections and Figure 2 and Table 2 provide details for RDS2875 extension sections.

3.2.2 RDS2875 Helical Plates: The helical plates (helices or discs) are 8, 10, 12 or 14-inches (203, 254, 305 or 356 mm) in diameter, and are cut from minimum ⅜-inch (9.5 mm) thick steel plate conforming to ASTM A36, having a minimum yield strength of 36 ksi (248 MPa) and a minimum ultimate tensile strength of 58 ksi (400MPa). The helical plates are deformed using a hydraulic press and die, to achieve a 3-inch +/- 1/4-inch (76 +/- 6.4mm) helical pitch, and are then factory-welded to the helical lead shaft or extension in accordance with the manufacturers approved quality documentation. The helical plates are available bare steel or galvanized in accordance with ASTM A123.

3.2.3 RDS2875 Couplers: The external coupler consist of 3½-inch (89 mm) OD ASTM A500, Grade B structural steel tubing having a nominal shaft thickness of 0.300 inch (7.6 mm) having a minimum yield strength of 50 ksi (345MPa) and a minimum tensile strength of 58 ksi (400MPa). The coupler is factory welded to the extension in accordance with the approved quality control documentation.

3.2.4 Brackets: Brackets are constructed from steel plate and round structural steel tubing components which are factory- welded together. The different brackets are described in the following subsections. Bracket assemblies are available in bare steel and with an optional galvanization coating complying with ASTM A123 as described in the approved quality documentation.

3.2.4.1 Standard Duty Bracket GTFP3BA (FP3BA): This retrofit or repair bracket is used on existing structures and existing foundations. The bracket is constructed from two (2) ½-inch (12.7 mm) thick steel plates factory-welded to achieve a 90-degree angle. The L-shaped bracket measures 10-inches (254 mm) wide by 8-inches (203 mm) long. The L-shaped seat is factory-welded to a bracket

sleeve consisting of a 12-inch (305 mm) long structural tube with an OD of 3⅞-inch (98 mm) and a 3⅛-inch (79 mm) inside diameter (ID). A bracket plate consisting of a 5-inch (127 mm) by 9½-inch (241 mm) by ¾-inch (19.1 mm) thick flat plate is factory-welded to the top of the bracket sleeve and onto the back side of the vertical face of the L-shaped seating angle. Two gusset wedges made from ⅜-inch (9.5 mm) thick plate steel are factory-welded to the bottom of the L-shaped seat and the side of the bracket sleeve. An 8-inch (203 mm) by 4-inch (102 mm) by 1-inch (25.4 mm) thick cap plate is centered on top of the pile and is attached to the bracket sleeve with two 12-inch (305 mm) long ¾-inch (19 mm) all-thread bolts and matching nuts (longer rods are available). Figure 3 along with Tables 4 and 5 provides additional FP3BA details.

3.2.4.2 New Construction Brackets GT2875-NCB: The new construction brackets are used in the new construction of concrete foundations where the steel bearing plate of the bracket is cast into the new concrete foundations (grade beam, footing or pile cap). The brackets are available to transfer compression, tension and lateral loads between the pile and the concrete foundation. The new construction brackets come with a 1-inch thick-by-4-inch-wide-by-8-inch-long (25.4, 102 and 203 mm) bearing steel plate. Each steel bearing steel plate comes with three (3) 13/16-inch (20.6 mm) diameter predrilled holes and is factory welded to a 3½-inch (89 mm) OD, 0.3-inch-thick (7.6 mm) and 7-inch (178 mm) long steel tube (sleeve) with three 13/16-inch (20.6 mm) pre-drilled holes used to fasten bracket to helical pile shaft. The steel plate is made from steel components as indicated in approved quality documentation. The bracket is attached to the pile shaft with either one (1), two (2) or three (3) ¾-inch (19 mm) structural bolts with matching nuts, as shown in Figure 4 of this report along with Tables 4 and 6.

3.2.5 Threaded Rods, Bolts and Nuts:

3.2.5.1 Helical Lead Shaft and Extensions Coupler Bolts and Nuts: The 3/4-in (19 mm) bolts used to connect helical lead shafts and extensions must conform to SAE J429, Grade 8 specification, having a minimum yield tensile stress of 130 ksi (897 MPa) and a minimum ultimate tensile stress of 150 ksi (1034 MPa) with matching nuts conforming to SAE J995.

3.2.5.2 Repair Brackets Threaded Rod: The standard 3/4-in (19 mm) and 7/8-in (22 mm) all-thread rods and matching nuts must conform to ASTM A193 having a minimum yield tensile stress of 105 ksi (725 MPa) and a minimum ultimate tensile stress of 125 ksi (863 MPa) with matching nuts complying with ASTM A194, Grade 2H. The bolts and all-thread rods and matching nuts must be either zinc coated in accordance to ASTM B633 or hot-dip galvanized in accordance to ASTM A153, as required by the registered design professional.

3.2.5.3 New Construction Bracket Bolts and Nuts: The 3/4-in (19 mm) bolts used to connect helical pile shaft to GT2875-NCB sleeve must conform to SAE J429, Grade 8 specification having a minimum yield tensile stress of 130 ksi (897 MPa) and a minimum ultimate tensile stress of 150 ksi (1034 MPa) with matching nuts conforming to SAE J995.

3.2.5.4 Repair Brackets Anchor Bolts: Each repair bracket must be installed by connecting the brackets to the concrete foundations. The vertical face of the repair bracket includes four (4) 9/16-inch (14.3 mm) holes in order to utilize up to four (4) ½-inch or 5/8-inch (12.7 mm or 15.9 mm) diameter with 5-inch (114 mm) effective embedment, Simpson Strong-Tie Company, Inc. Titen HD Screw Anchors (ESR-2713) or equivalent as determined by a registered the structural engineer design professional. The concrete anchors may be factory zinc coated or hot-dip galvanized complying with ASTM B633 or ASTM A153.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Structural calculations and drawings prepared by a registered design professional must be submitted to the code official for each project based on accepted engineering principles, as described in IBC Section 1604.4 and must conform to IBC Section 1810. The design method for steel components is Allowable Strength Design (ASD), described in IBC Section 1602 and AISC 360 Section B3.4. The structural analysis must consider all applicable internal forces (shear, bending moments and torsional moments, if applicable) due to applied loads, structural eccentricity and maximum span(s) between helical pile foundations. The result of the analysis and the structural capacities must be used to select a helical pile foundation system. The minimum embedment depth for various loading conditions must be included based on the most stringent requirements of the following: engineering analysis, tested conditions described in this report, site-specific geotechnical investigation report, and site-specific load tests, if applicable. For helical pile foundation systems subject to combined lateral and axial (compression or tension) loads, the allowable strength under combined loads must be determined using the interaction equation prescribed in Chapter H of AISC 360.

A soils investigation report must be submitted to the code official as part of the required submittal documents, prescribed in IBC Section 107, at the time of permit application. The geotechnical report must include, but not be limited to, all of the following (as applicable):

1. A plot showing the location of the soil investigation.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of soil profile.
4. Information on groundwater table, frost depth and corrosion-related parameters, as described in Section 5.5 of this report.
5. Soil properties, including those affecting the design such as support conditions for the piles.
6. Recommendations for design criteria, including but not limited to mitigations of effects of differential settlement and varying soil strength, and effects of adjacent loads.
7. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity when required).
8. Any questionable soil characteristics and special design provisions, as necessary.

4.1.2 Foundation System: The Grip-Tite helical pile system described in this report complies with IBC Section 1810.3.1.5. The allowable axial design load of helical piles shall comply with IBC Section 1810.3.3.1.9. The overall capacity of the Grip-Tite helical pile foundation system (in tension and compression) depends upon the analysis of interaction of brackets, shafts, helical plates and soils, and must be the lowest value of the bracket capacity (P1), the shaft capacity (P2), the helical bearing plate capacity (P3) and the allowable soil capacity (P4), and the allowable capacity must be limited to no more than 60 kips (267 kN).

4.1.3 Bracket Capacity (P1): 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 including punching (two-way) shear and concrete breakout have been evaluated in this evaluation report. All other limit states described in Chapter 17 of ACI 318-19 under the 2021 IBC, Chapter 17 of ACI 318-14 under the 2018 and 2015 IBC and Appendix D of ACI 318-11 under the 2012 IBC for anchors in shear (such as concrete breakout and pry out), beam (one-way) shear, and flexural (bending) related limit states, and all limit states related to bending moment transfer among pile shaft/new construction pile cap/and concrete footing, have not been evaluated in this evaluation report and must be determined by registered design professional, as applicable. The concrete foundation and interaction of pile shaft, new construction pile cap and concrete footing for moment transfer, as applicable, must be designed and justified to the satisfaction of the code official, with due consideration to all applicable limit states and the direction and eccentricity of applied loads, including reactions provided by the brackets, acting on the concrete foundation. Refer to Tables 5 and 6 for selected allowable bracket capacity ratings.

4.1.4 Pile Shaft Capacity (P2): The top of shaft must be braced as described in IBC Section 1810.2.2. In accordance with IBC Section 1810.2.1, 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 standing in air, water, or in fluid soils plus an additional five (5) feet (1524 mm) when embedded into firm soil or an additional ten (10) feet (3054 mm) when embedded into soft soil. Firm soils must be defined as any soil with a Standard Penetration Test blow count (SPT N value) of five (5) or greater. Soft soils must be defined as any soil with SPT N value greater than zero (0) and less than five (5). Fluid soils must be defined as any soil with a SPT N value of zero (0) [weight of hammer (WOH) or weight of rods (WOR)]. The SPT N value must be conducted under the supervision of a registered design professional in accordance with ASTM D1586. The allowable stress design (ASD) shaft capacities are provided in Table 3.

4.1.5 Helix Plate Capacity(P3): The allowable helix compression (+) and tension (-) load capacities (P3) are listed below. For helical piles with more than one helix, the allowable helix capacity (P3) for the helical foundation system may be taken as the sum of the least allowable capacity of each individual helix:

- 8-inches by ⅜-inch thick: ±84.97 kips (378 kN)
- 10-inches by ⅜-inch thick: ±68.37 kips (304 kN)
- 12-inches by ⅜-inch thick ±66.00 kips (293 kN)
- 14-inches by ½-inch thick: ±74.44 kips (331 kN)

4.1.6 Soil Capacity (P4): The design axial compressive and tensile load capacities of helical piles based on soil resistance (P4) must be conducted under the supervision of a registered design professional in accordance with a site-specific geotechnical report, as described in Section 4.1.1 of this report, combined with the individual helix bearing method (Method 1), or from field loading tests conducted under the supervision of a registered design professional (Method 2). For either Method 1 or Method 2, the predicted axial load capacities must be confirmed during the site-specific production installation, such that the axial load capacities predicted by the torque correlation method must be equal to or greater that that predicted by Method 1 or Method 2, described above. With the individual helix bearing method, the total nominal axial load capacity of the helical pile is determined as the sum of the individual areas of the helical bearing plats times the ultimate bearing capacities of the soil or rock comprising the respective bearing strata for the plates, as follows:

$$Q_{tot} = \sum(A_n q_u) \quad \text{(Equation 1)}$$

Where:

Q_{tot} = Predicted nominal axial tensile or compressive capacity of the helical pile, lbf (N).

A_n = Net area of an individual helix bearing plate, in^2, (mm^2).

q_u = Ultimate unit bearing capacity of the soil or rock comprising the bearing stratum for the individual helix bearing plate, psf (MPa).

The unit bearing capacity of the bearing stratum for each helix plate can be estimated using the general bearing capacity equation for deep foundations as follows:

$$q_u = cN_c + q'N_q \quad \text{(Equation 2)}$$

where:

c = Undrained shear strength parameter, considering the effect of soil disturbance due to the helix pile installations, psf (MPa).

N_c, N_q = Bearing capacity factors.

q' = Effective overburden pressure at helix plate foundation depth, psf (MPa).

Either the bearing capacity factors (Nc and Nq) and the soil parameters needed to estimate the ultimate/allowable soil bearing capacities of the major soil types or the recommended ultimate/allowable soil bearing capacities for the major soil types must be obtained from the site-specific geotechnical report.

The design allowable axial load must be determined by dividing the total ultimate axial load capacity predicted by either Method 1 or Method 2, above, by a safety factor of at least two (2).

The Foundation Design Documentation must include documentation of the derivation of the design allowable capacity and the minimum effective torsional resistance pile termination criterion, derived using the torque correlation method. With the torque correlation method, the total ultimate axial load capacity of the helical pile is predicted as follows:

$$Q_{ult} = K_t(T) \quad \text{(Equation 3)}$$

$$Q_{all} = 0.5(Q_{ult}) \quad \text{(Equation 4)}$$

Q_{ult} = Ultimate axial tensile or compressive capacity, lbf (N), of the helical pile.

Q_{all} = Allowable axial tensile or compressive capacity, lbf (N), of the helical pile.

K_t = Maximum torque correlation factors of 9 ft-1 and 7 ft-1 should be used for compression and tension piles, respectively.

T = Effective torsional resistance, which is defined as follows: For single-helix piles supporting axial compression loads, it is the installation torque measured when the pile reaches its final tip embedment; for all piles supporting axial tension loads and for multi-helix piles supporting axial compression loads, it is the average of the last three (3) installation

torque measurements. Such torque measurements, in-lbf (N-m), must be made at one (1) foot (305 mm) increments of tip embedment as the lead helix moves from a position, which is two (2) feet (710 mm) prior to the final tip embedment, to the final tip embedment.

The minimum effective torsional resistance pile termination criterion is calculated as follows:

Treq = (F.S.)(Qall)/(Kt) (Equation 5)

Where:

Treq = Minimum effective torsional resistance pile termination criterion, in lbf-ft (N-m).

F.S. = An appropriate factor of safety for the project, but not less than two (2).

The allowable lateral capacity of the pile is 318 lbf and is based on field testing of the helical pile with a single 8-inch diameter helical plate installed in firm clay soil, having an average standard penetration test blow count of 20, at a minimum embedment of 15 feet. Installation is limited for use with the new construction brackets having minimum concrete edge distance of 4 inches. For soil conditions other than firm clay, the lateral capacity of the pile must be determined by a registered design professional.

4.1.7 Settlement Analysis: The pile head vertical movement at allowable load of a Grip-Tite® helical pile may be estimated as the sum of the following: the movement at helix plates due to soil deformation and helix plate deflection, and the shaft elastic shortening or lengthening. The corresponding equation is described below:

$\Delta total = \Delta helix + \Delta shaft$ (Equation 6)

Where:

$\Delta total$ = Total pile head vertical movement, in (mm).

$\Delta helix$ = Movement of helix plates within the soil, in (mm).

$\Delta shaft$ = Shaft elastic shortening/lengthening, in (mm).

The reliability of the foundation system capacity and settlement predictions may be improved by performing full-scale field tests at the construction site using piles of same configuration as the intended production piles.

4.1.8 Shaft Elastic Shortening and Lengthening: Elastic shortening or lengthening of a Grip-Tite® RDS2875 helical pile shaft may be a significant contributor to overall pile head movement under load for long piles. For loads up to and including the allowable load limits found in the tables of this report, the length change can be estimated as:

$\Delta shaft = PL/AE$

shaft = Length change of shaft resulting from elastic shortening or lengthening, in (mm)

P = Applied axial load, lbf (N).

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

A = Cross sectional area of the shaft, in2 (mm2), see Tables 1, and 2.

E = Young's modulus of the shaft, may be taken as 29,000 ksi (200,000 MPa).

The effective length of the shaft, L, may be approximated as the average of the distances from the point of load application to each helical plate.

The elastic shortening/lengthening of the pile shaft will be controlled by strength and section properties of the helical shaft and the following:

- Bare Steel
  - Potential elastic shortening due to compression load= 0.012 in/ft of shaft and 0.003 in/coupler.
  - Potential elastic lengthening due to tensile load= 0.007 in/ft of shaft and 0.003 in/coupler.
  - Slip in coupler due to compression of tensile load= 0.197 in/coupler.
- Galvanized Steel
  - Potential elastic shortening due to compression load= 0.012 in/ft of shaft and 0.003 in/coupler.
  - Potential elastic lengthening due to tensile load= 0.008 in/ft of shaft and 0.002 in/coupler.
  - Slip in coupler due to compression of tensile load= 0.151 in/coupler.

4.1.9 Helix Movement: The evaluation of helix movement due to helix deformation, soil deformation, and helix-soil interaction, is beyond the scope of this evaluation report. It is recommended that the user of this report consult with the helical pile manufacture (Grip-Tite® Manufacturing Co., LLC).

4.2 Installation:

The Grip-Tite® Helical Pile Foundation Systems must be installed by Grip-Tite® Manufacturing Co., LLC certified and trained installers. The Grip-Tite® Helical Pile Foundation Systems must be installed in accordance with this section (Section 4.2) and the manufacturer's installation instructions, or the site-specific approved construction documents, whichever is most stringent governs. If galvanized product is used, all field-cut or drilled pilings must be protected from corrosion as recommended by the registered design professional.

4.3 Special Inspections:

Continuous special inspection in accordance with IBC Section 1705.9 must be provided for the installation of foundation piles and foundation brackets. Where on-site welding is required, special inspection in accordance with IBC Section 1705.2 is also required. Items to be confirmed by the special inspector include, but are not limited to, the manufacturer's certification of installers, verification of the product manufacturer, helical pile and bracket configuration and identification, inclination and position of the helical pies, the installation torque and depth of the foundation piles, compliance of the installation with the approved construction documents and this evaluation report.

5.0 CONDITIONS OF USE

The Grip-Tite® Manufacturing Co., LLC Helical Foundation Systems described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Grip-Tite® Manufacturing Co., LLC helical foundation systems are manufactured, identified and installed in accordance with this report, the approved

construction documents (engineering drawings and specifications), and the manufacturer's written installation instructions, which must be available at the jobsite at all times during installation. In case of conflict, the most stringent requirement governs.

5.2 The Grip-Tite® Manufacturing Co., LLC helical foundation systems have been evaluated for support of structures assigned to Seismic Design Categories A, B and C in accordance with IBC Section 1613. Helical foundation systems that support structures assigned to Seismic Design Category D, E or F, or that 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 Installations of the helical foundation systems are limited to regions of concrete members where analysis indicates no cracking will occur at service load levels.

5.4 Remedial Repair Brackets and New Construction Brackets must be used only to support structures that are laterally braced as defined in IBC Section 1810.2.2. Shaft couplings must be located within firm or soft soil as defined in Section 4.1.3. Table 5 provides the allowable capacities at various unbraced lengths and coupling configurations.

5.5 The helical foundation systems must not be used in conditions that are indicative of potential pile deterioration or corrosion situations as defined by the following: (1) soil resistivity less than 1,000 ohm-cm; (2) soil pH less than 5.5; (3) soils with high organic content; (4) soil sulfate concentrations greater than 1,000 ppm; (5) soils located in a landfill, or (6) soil containing mine waste.

5.6 Hot-dip galvanized steel and bare steel components must not be combined in the same system, unless bare steel capacity is used as the design capacity. All helical foundation components must be isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.7 The new construction helical piles (piles with new construction brackets) must be installed vertically into the ground with a maximum allowable angle of inclination of ±1° from the design installation angle. The tops of pile caps must be embedded into the concrete footing with a minimum 4-inch (101.6 mm) vertical embedment and a minimum 4-inch (101.6 mm) side embedment beyond the perimeter of the steel cap plates, except as specifically noted in Table 6 and Figure 5.

5.8 The retrofit helical piles must be installed such that the angle of inclination does not exceed 0° ± 1°.

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 as described in IBC Section 1604.4, are prepared by a registered design professional and approved by the code official.

5.11 The adequacy of the concrete structures that are connected to the Grip-Tite® Manufacturing Co., LLC brackets must be verified by a registered design professional in accordance with applicable code provisions such as Chapter 13 of ACI 318-19 under the 2021 IBC, Chapter 13 of ACI 318-14 under the 2018 and 2015 IBC (Chapter 15 of ACI 318-11 under the 2012) and Chapter 18 of the IBC. Verification is subject to the approval of the code official.

5.12 A geotechnical investigation report for each project site must be provided to the code official for approval in accordance with Section 4.1.1 of this report.

5.13 When using the alternative basic load combinations prescribed in IBC Section 1605.3.2, the allowable stress increases permitted by material chapters of the IBC or the referenced standards are prohibited.

5.14 The minimum helical pile center-to-center spacing is three (3) times and eight (8) times the diameter of the largest helical bearing plate for axially and laterally loaded piles, respectively. For piles with closer spacing, the recommended allowable load reductions due to pile group effects must be included in the geotechnical report described in Section 4.1.1 of this report and must be considered in the helical pile design by a registered design professional. Load reductions are subject to the approval of the code official.

5.15 Evaluation of compliance with IBC Section 1810.3.6.1 for buildings assigned to Seismic Design Category (SDC) C, is outside of the scope of this evaluation report. Such compliance must be addressed by a registered design professional for each site, and the work of the design professional is subject to approval by the code official.

5.16 The Grip-Tite® Manufacturing Co., LLC helical foundation systems are manufactured by Grip-Tite® Manufacturing Co., LLC, 115 W. Jefferson St., Winterset, IA 50273; under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Helical Foundation Systems and Devices (AC358), dated June 2020, Revised March 2021.

7.0 IDENTIFICATION

7.1 Product labeling shall include, the name of the report holder, and the ICC-ES mark of conformity. The listing or evaluation report number (ICC-ES ESR-3533) may be used in lieu of the mark of conformity.

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

GRIP-TITE® MANUFACTURING CO., LLC
505 EAST MADISON STREET
WINTERSET, IOWA 50273
(515) 462-1313
www.griptite.com
steve@griptite.com

GTRDS2875
Ø2.875" ROUND SHAFT HELICAL PILES

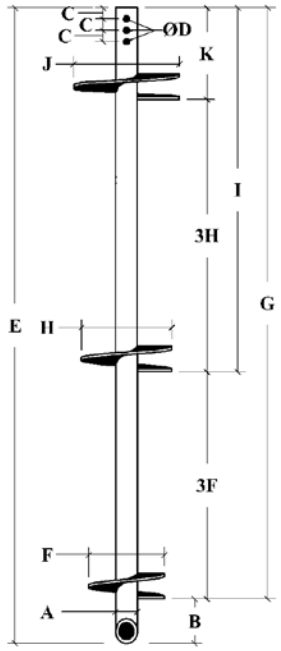

Figure No. 1 -
RDS2875 Lead Sections

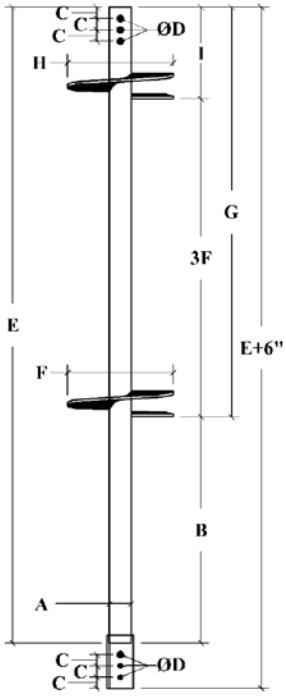

Figure No. 2 -
RDS2875 Extensions

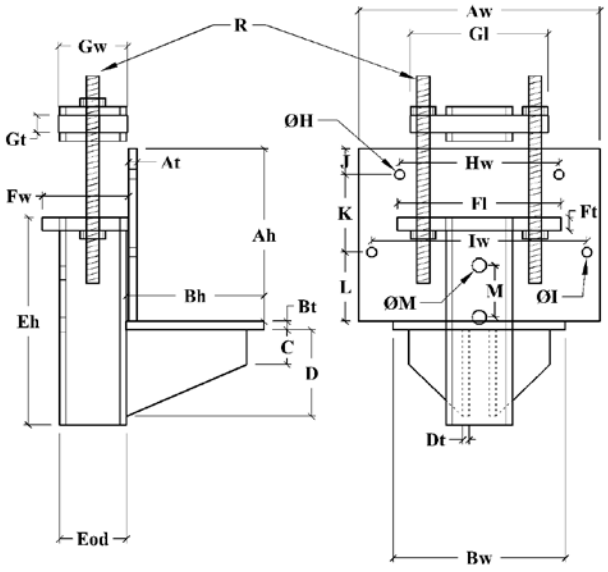

Figure No. 3 - FP3BA
Standard Duty Remedial Repair Bracket

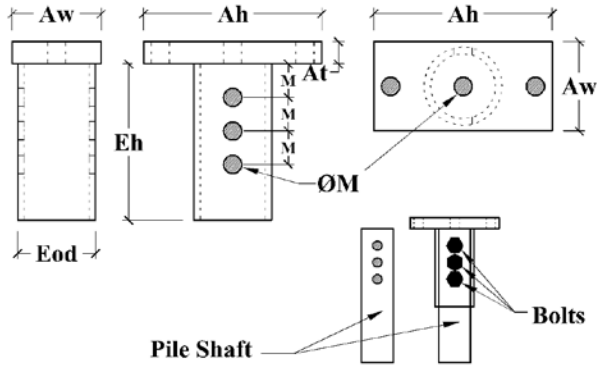

Figure No. 4 - RDS2875-NCB
New Construction Brackets

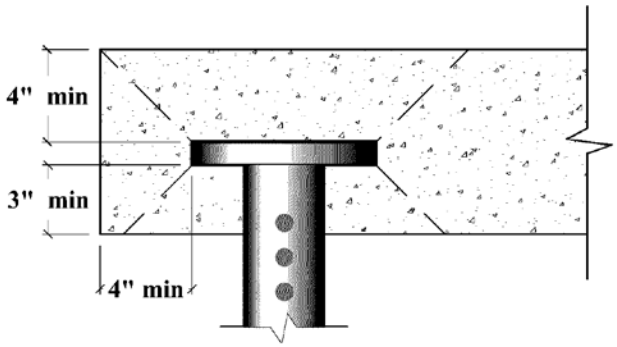

Figure No. 5 - Grade Beam with
RDS2875-NCB New Construction Bracket

TABLE—1 DIMENSIONS OF RDS2875 HELICAL PILE LEAD SECTIONS BY THE PRODUCT CATALOG NUMBER[1]

Helical Pile Lead Steel Material (See Figure 1)	Catalog Number [3]	Shaft Cross-Sectional Area, in^2	Nominal Dimensions, (in) [2]												
			A	B	C	ØD	E	F	3F	G	H	3H	I	J	K
ASTM A500 Grade B Fy=50 ksi Fu=58 ksi	2LS8	1.72 (1.96)	2.839 (2.869)	5.75	1.5	0.8125 (13/16)	24	8		18.125					
	2LS10						24	10		18.125					
	2LS12						24	12		18.125					
	2LS14						24	14		18.125					
	5LS8						60	8		54.125					
	5LS10						60	10		54.125					
	5LS12						60	12		54.125					
	5LS810						60	8	24	54.125	10		30.125		
	5LS14						60	14		54.125					
	5LS1012						60	10	30	54.125	12		24.125		
	5LS1214						60	12	36	54.125	14		18.125		
	7LS8						84	8		78.125					
	7LS10						84	10		78.125					
	7LS12						84	12		78.125					
	7LS810						84	8	24	78.125	10		54.125		
	7LS14						84	14		78.125					
	7LS1012						84	10	30	78.125	12		48.125		
	7LS81012						84	8	24	78.125	10	30	54.125	12	24.125
	7LS1214						84	12	36	78.125	14		42.125		
	7LS101214						84	10	30	78.125	12	36	42.125	14	12.125

For SI: 1 inch = 25.4 mm; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Bare steel dimensions (galvanized dimensions): Includes reduced dimensions for corrosion and a 50-year design life in accordance with Section 3.9 of AC358. Helical pile components consist of steel materials as described in Section 3.0 of this report. The helical lead sections and extensions are either bare or hot-dip galvanized steel per ASTM A123.
[2]See Figure No. 1 for dimension designations.
[3]Galvanized product will have a "G" suffix added to the end of the products' catalog number.
i.e. 2LS8 is bare steel and 2LS8G is galvanized steel.

TABLE—2 DIMENSIONS OF RDS2875 HELICAL PILE EXTENSIONS BY THE PRODUCT CATALOG NUMBER[1,4]

Helical Pile Extensions Steel Material (See Figure 2)	Catalog Number[3]	Shaft Cross-Sectional Area, in^2	Nominal Dimensions, (in)[2]									
			A	B	C	ØD	E	F	3F	G	H	I
ASTM500 Grade B Fy= 50 ksi Fu= 58 ksi	3E	1.72 (1.96)	2.839 (2.869)		1.5	0.8125 (13/16)	36	Plain Extensions				
	5E						60	Plain Extensions				
	7E						84	Plain Extensions				
	3E14			11.875			36	14		24.125		
	5E14			11.875			60	14		48.125		
	5E14x			29.875			60	14		30.125		
	7E14			11.875			84	14		72.125		
	7E14x			29.875			84	14		54.125		
	7E1414			11.875			84	14	42	72.125	14	30.125
	7E1414x			29.875			84	14	42	54.125	14	12.125

For SI: 1 inch = 25.4 mm; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Bare steel dimensions (galvanized dimensions): Includes reduced dimensions for corrosion and a 50-year design life in accordance with Section 3.9 of AC358. Helical pile components consist of steel materials as described in Section 3.0 of this report. The helical lead sections and extensions are either bare or hot-dip galvanized steel per ASTM A123.
[2]See Figure No. 2 for dimension designations.
[3]Galvanized product will have a "G" suffix added to the end of the products' catalog number.
i.e. 2LS8 is bare steel and 2LS8G is galvanized steel.
[4]Coupler bolts must have a protection, zinc coated per ASTM B633 or ASTM B695.

TABLE—3 ALLOWABLE CAPACITIES[4] AND RECOMMENDED MAXIMUM INSTALLATION TORQUE FOR RDS2875 HELICAL PILES [1,2]

Helical Pile Steel Material	Allowable Axial Capacity Limits[4] Bare Steel, (Hot-Dip Galvanized)								Recommended Capacity-Torque Ratio[4], K_t (ft^{-1})	Recommended Max Installation Torque[3], T(ft-lbs)	Ultimate Load at Max Torque Capacity, $Qu=TK_t$ (kips)	Allowable Load at Max Torque Capacity, (kips) $Qu/2=Qa$ [4]
	Compression, (kips)					Tension, (kips)	Shear, (kips)	Bending, (ft-k)				
	Unbraced Length, Lu (ft) [1]	kLu=0	kLu=5	kLu=10	kLu=15							
RDS2875A STM A500 Grade B Fy=50 ksi Fu=58 Ksi	0 Couplings-no eccentricity	55.5 (60.0)	18.1 (19.9)	8.2 (9.0)	4.4 (4.8)	32.1 (37.7)	16.7 (18.4)	2.52 (2.76)	Comp Kt=9 Ten Kt=7	9,000 9,000	67 51	33.5 25.5
	1 Coupling	35.0 (40.8)	15.0 (19.0)	8.1 (8.9)	4.4 (4.8)							
	2 Couplings	22.8 (26.0)	13.4 (15.0)	7.2 (7.9)	4.1 (4.5)							

For SI: 1 inch = 25.4mm; 1 lbf = 1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2mm^2; 1 psi =6.89 kPa

[1]Refer to Section 4.1.4 Pile Shaft Capacity for the description of unbraced length, soft and firm soil conditions.

[2]Capacity ratings include an allowance for corrosion over a minimum 50-year service design life in accordance with Section 3.9 of AC358 and presume the support structure is braced in accordance with IBC Section 1810.2.1 and the lead section will provide sufficient helical capacity to develop the full shaft capacity. See section 4.1.3 entitled Bracket Capacity (P1) for applicable limit states that must be evaluated by a registered design professional.

[3]Maximum useable torque for calculating the pile's ultimate capacity using the equation Q=TK. Maximum torque applied to the helical pile anytime during installation should not exceed 9495 ft-lbs for the RDS2875 helical piles.

[4]The listed capacity-to-torque ratios can be adjusted to lower values on a case-by-case, if necessary. The listed allowable capacity includes a minimum Factor of Safety (FS) of 2. A higher Factor of Safety may be used to estimate the pile's allowable capacity on a case-by-case basis, if necessary.

TABLE—4 REMEDIAL REPAIR AND NEW CONSTRUCTION BRACKET DIMENSIONS BY THE PRODUCT CATALOG NUMBER

Product [4]	Helical Pile	Aw Ah At[1]	Bw Bh Bt[1]	C D Dt	Eh Eod	Fl Fw Ft	Gi Gw Gt	Hw ØH Iw ØI	J K L	M ØM	All-Threaded Rods/Bolts dia-pitch x Length, in (R_1)[2]	Concrete Anchors[3]
Remedial Repair Bracket FP3BA FP3BAG (Figure 3)	RDS2875	14 10 ½	10, 8, ½	2 5 3/8	12 3-7/8	9.5 5 ¾	8 4 1	9.25 9/16 12.15 9/16	1.5 4.5 4	3 13/16	¾ - 10 x 12 ASTM A193 Gr B7 and ASTM A194 2H Heavy Hex Nuts Fy = 105 Ksi Fu = 125Ksl	Titen HD Screw Anchors 1/2” x 5.5”
New Construction Bracket RDS2875-NCB RDS2875-NCBG (Figure 4)	RDS2875	8 4 1			7 3- ½					1.5 13/16	¾ - 10 x 4 ½ SAE J429 Grade 8	

For SI: 1 inch = 25.4 mm;1 psi = 6.89 kPa

[1]Main plate dimensions in direct contact with foundation.
[2]12-inch long all-thread rods and bolts are provided with the remedial brackets. Longer or additional rods can be used if additional lift is needed, as necessary.
[3]Concrete anchors shall be provided by the installer. Either 1/2” or 5/8” concrete anchors can be used to support the remedial brackets. The brackets were placed under a 2500 psi concrete foundation with 4 post-installed Titen HD screw anchors fastened through the face of the bracket into the side of the foundation. The screw anchors should be installed in accordance to the manufacturer’s recommendations (ICC-ESR-2713).
[4]Galvanized product includes the suffix “G”.

TABLE—5 REMEDIAL REPAIR ALLOWABLE CAPACITIES BY THE PRODUCT CATALOG NUMBER

Product [8]	Main Plate Dim., inches[1]		RDS2875 ASTM A500 Fy = 50 ksi Fu = 58 ksi			All-Thread Rods[6]	Concrete Anchors [6,7]	
	Aw, Ah, At[1]	Bw, Bh, Bt[1]	Allowable Capacities, kips [2,3,4, 5]					
			Comp.	Tension	Lateral	Ø – pitch x Length, inches (R_1)		
Remedial Repair Brackets FP3BA FP3BAG (see Figure 3)	14, 10, ½	10, 8, ½	27.2	To be determined by registered design professional		¾ - 10 x 12 AST A193 G*r* B7 and ASTM A194 2H Heavy Hex Nuts Fy = 105 ksi Fu = 125 Ksi	Titen HD Screw Anchors, or equivalent	1/2” x 5.5”

For SI: 1 inch = 25.4 mm; 1 lbf = 1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Main plate dimensions in direct contact with foundation.

[2]Based on full scale load tests conducted using the Grip-Tite Standard foundation Pier Bracket (GTFP3BA). The allowable capacities include a minimum Factor of Safety of 2. A higher Factor of Safety value may be used on a case-by-case basis, if necessary.

[3]Systems that require uplift capacities must include two (2) Ø3/4”x2” bolts thru the bracket tube sleeve into the existing shaft. One (1) bolt or two (2) Ø3/4”x2” long bolts can be installed utilized. As an alternative, the pile shaft could be welded in the field to the bracket using the two holes in the bracket sleeve, below the bracket tube or by other means as directed by the registered engineer.

[4]Fully braced foundation and shaft conditions.

[5]Lateral capacities are provided by four Titen HD concrete anchors with a minimum embedment of 5 inches.

[6]Corrosion protection, zinc coated per ASTM B633 or ASTM B695.

[7]The brackets were placed under a 2500 psi concrete foundation with four (4) Titen HD screw anchors fastened through the face of the bracket into the side of the foundation. The screw anchors must be installed in accordance with ESR-2713.

TABLE—6 GRIP-TITE NEW CONSTRUCTION BRACKET MINIMUM EMBEDMENT DEPTHS AND ALLOWABLE CAPACITIES BY THE PRODUCT CATALOG NUMBER

Product	Main Plate Dimensions, inches[1]	RDS2875 ASTM A500 Fy = 50 ksi Fu = 58 ksi			
	Aw, Ah, At	Minimum Concrete Cover Below (Tension) and Above (Compression) the Bracket Plate, inches		Allowable Compression and Tension Capacities, kips	Allowable Lateral Capacities, kips
				2500 psi PCC	2500 Psi PCC
New Construction Bracket RDS2875-NCB (see Figure 4)	8 4 1	3 4	Tension Comp	1.4 8.2	2.5
		6	Tension Comp	8.2 14.8	
		8	Tension Comp	14.8 23.0	
		10	Tension Comp	23.0 32.9	
		12	Tension Comp	32.9 40.0	

For SI: 1 inch=25.4mm; 1 lbf=1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2 mm^2; 1 psi=6.89 kPa

[1]Main plate dimensions in direct contact with foundation.

[2]The listed allowable capacities are limited by either the punching shear capacity of the grade beam, bearing or bending capacity of the bracket plate the weld strength between the bearing plate and the bracket sleeve or the shear capacities of the connecting bolts. The allowable capacities include a minimum Factor of Safety of 2. A high Factor of Safety value may be used on a case-by-case basis, if necessary.

[3]Systems that require uplift capacities must include one (1), two (2) or three (3) 3/4"x4$^1/_2$" bolts through the bracket tube sleeve into the existing shaft. As an alternative, the existing pile shaft can be plug-welded to the bracket using the three bolt holes in the bracket sleeve or the New Construction Bracket could be welded to the shaft at the base of the bracket.

[4]Fully braced foundation and shaft conditions.

[5]Corrosion protection, zinc coated per ASTM B633-07 or ASTM B695-04.

[6]Galvanized product includes the suffix "G".