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ICC-ES Evaluation Report
ESR-4621

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

REPORT HOLDER:

TMG MANUFACTURING CORP.

EVALUATION SUBJECT:

HELICAL PILE FOUNDATION SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)

Properties evaluated:

- Structural
- Geotechnical

2.0 USES

2.1 IBC:

The TMG Manufacturing Helical Pile Foundation System is used to underpin concrete foundations of existing structures and as deep foundations for new structures assigned to Seismic Design Categories (SDCs) A, B and C. When underpinning existing concrete foundations, the system is designed to transfer compression loads to suitable soil bearing strata using an underpinning bracket (Type A side-load brackets) attached to the pile shaft component. When supporting new structures, the system is designed to transfer compression, tension, and lateral loads to suitable soil bearing strata using a pile cap (Type B direct-load bracket) that is attached to the pile shaft component and embedded in the supported concrete.

2.2 IRC:

The TMG Manufacturing Helical Pile Foundation System may be used as an alternate foundation system supporting light-frame construction, exterior porch deck, elevated walkway and stairway construction and accessory tructures assigned to Seismic Design Categories (SDCs) A, B and C.

3.0 DESCRIPTION

3.1 Helical Pile Foundation System and Components:

The TMG Manufacturing Helical Pile Foundation System consists of a helical pile and either an underpinning bracket or a pile cap. The helical pile shafts have an outside diameter of $2^{7}/_{8}$ inches (73 mm), with a nominal wall thickness of 0.276 inch (7.0 mm). Each helical pile, consists of a starter shaft with one or more helical plates; extension shafts, which may also have helical plates; and an underpinning bracket or pile cap. See Table 1 for evaluated component model numbers.

3.1.1 Helical Pile Starter Shafts: Helical pile starter shafts are available in several different lengths with various combinations of helical plates. The lowest helical plate (closest to the driving end of the shaft) is located 6 inches (152 mm) from the shaft end. When multiple helical plates are used, the smallest diameter plate is located nearest the driving end of the starter shaft. Subsequent helical plates are spaced at a distance of 3 times the diameter of the next lower helical plate. The helical plates are factory welded to the starter shaft. Helical plates are available in diameters of 8, 10, 12 and 14 inches (203, 252, 305 and 356mm). Each helical plate is $^{3}/_{8}$ inch or $^{1}/_{2}$ inch (9.5 or 12.7 mm) thick with a pitch of 3 inches (76 mm). The driving end of the starter shaft is beveled at a 45-degree angle. At the top of the shaft there are two $^{7}/_{8}$ inch (22 mm) bolt holes. See Figure 1.

3.1.2 Helical Pile Extension Shafts: Extension shafts are available in lengths up to 10 feet (3 m) with zero, one or two helical plates. At the top of the shaft there are two $^{7}/_{8}$ inch (22 mm) bolt holes. At the lower end of the shaft, a coupler comprised of a 9 inch (229 mm) long pipe sleeve is factory welded to the shaft. At the bottom of the coupler are two $^{7}/_{8}$ inch (22 mm) bolt holes to allow for bolting to the lower section of helical pile shaft. The coupler pipe sleeve has an outside diameter of $3^{1}/_{2}$ inches (89 mm) and a nominal wall thickness of 0.25 inch (6.4 mm). Two $^{3}/_{4}$ inch (19 mm) diameter bolts and matching nuts are supplied with each extension shaft. See Figure 2.

3.1.3 Underpinning Brackets: Underpinning brackets are used to support an existing concrete foundation element from the side. The brackets consist primarily of a L8x6x$^{1}/_{2}$ structural steel angle supported by triangular plates which are welded to a short section of pipe. The top of the triangular plates and the pipe are welded to a cap plate, which has two threaded holes to receive 1 inch (25.4 mm) diameter threaded rods. A jacking plate is installed over these threaded rods, to allow for adjustment of the height of the bracket in the field. The plate and threaded rods are supplied with the bracket. The brackets are also supplied with a guide sleeve inside the pipe section, to facilitate

installation over the pile shaft. A Medium Duty bracket and a Heavy Duty bracket are available. The Heavy Duty bracket has $^1/_2$-inch (12.7 mm) thick triangular plates while the Medium Duty bracket has $^1/_4$-inch (6.4 mm) thick triangular plates. See Figure 3.

3.1.4 Pile Caps: Pile caps are available for use in supporting new construction. The caps consist of a square, flat plate welded to a short section of pipe. The plates are 8, 10, 12 or 14 inches (203, 254, 305 or 356 mm) square and are either $^3/_8$ or $^1/_2$ inch (9.5 or 12.7 mm) thick. The plate is welded to a pipe with an outside diameter of $3^1/_2$ inches (89 mm) and a nominal wall thickness of 0.25 inch (6.4 mm). Near the top of the pipe are two $^7/_8$ inch (22 mm) bolt holes to allow for bolting the pile cap to the helical pile shaft. Two $^3/_4$ inch (19 mm) diameter bolts and matching nuts are supplied with each pile cap. See Figure 4.

3.2 Material:

3.2.1 General: Components of the TMG Manufacturing Helical Pile Foundation System are manufactured from carbon steel complying with the manufacturer's documented specifications and are hot-dip galvanized in accordance with ASTM A123.

3.2.2 Shaft Sections: Pipe sections used to manufacture starter shafts and extension shafts comply with ASTM A53 Grade B, 2.5 inch NPS, Schedule 80, and the manufacturer's more stringent specifications of F_y = 71,000 psi and F_u = 74,000 psi.

3.2.3 Coupler, Underpinning Bracket and Pile Cap Pipe Sleeves: Pipe sections used to manufacture coupler sleeves, underpinning bracket sleeves and pile cap sleeves comply with ASTM A513 Grade 1026AK, Type 5, Drawn Over Mandrel (DOM) and the manufacturer's specifications of F_y = 84,500 psi and F_u = 96,600 psi.

3.2.4 Helical Plates: Each helical plate is cut from steel plate complying with ASTM A36 and press formed.

3.2.5 Flat Plates: All flat plates used for pile caps and underpinning brackets are cut from steel plate complying with ASTM A36.

3.2.6 Bracket Seats: Underpinning bracket seats are cut from steel angle complying with ASTM A36.

3.2.7 Bolts, Nuts and Threaded Rod: Bolts supplied with pile caps and extension shafts are Grade $8^3/_4$-inch-10 UNC4 bolts complying with SAE J429. Nuts supplied with pile caps and extension shafts are complying with ASTM A563 Grade A. Threaded rod supplied with underpinning brackets complies with ASTM A307.

4.0 DESIGN

4.1 Design:

4.1.1 Evaluated Conditions: The helical pile system has been evaluated for support of structures assigned to SDCs A, B and C in accordance with IBC Section 1613 and IRC Section R301.

The load capacities shown in this report for steel elements of the helical pile foundation system are based on allowable stress design (ASD) described in IBC Sections 1602 and 1802.1 and AISC 360 Section B3.4. The design values in this report assume that the supported concrete structure is laterally braced against side-sway. The supported concrete structure must be able to provide adequate lateral restraint (bracing) for the shaft that is equal to or greater than 0.4 percent of the allowable axial compression load of the helical pile system.

Determination of compliance with the second paragraph of IBC Section 1810.3.6 and with IBC Section 1810.3.6.1 is outside the scope of this report.

Connections of underpinning brackets to the foundation have not been evaluated for compliance with IBC Section 1810.3.11.1.

4.1.2 Requirements for Engineering and Investigation under the IBC: Foundation designs must be prepared by a registered design professional based on accepted engineering principles described in IBC Section 1604.4, applicable requirements in IBC Section 1810, the design information in this report and a geotechnical investigation meeting the requirements of Section 4.1.2.3. Calculations and drawings documenting the foundation design must be submitted to and approved by the code official for each project.

4.1.2.1 Requirements for the Helical Pile System: The design of the helical pile elements of the foundation system must consider the following:

1. All applicable internal forces due to the applied loads and load eccentricities, including axial load, shear loads, bending moments and torsional moments, as applicable.
2. The minimum embedment depth for the helical pile system, based on the most severe of the following requirements: engineering analysis; tested conditions and specified minimum pile embedment described in this report; the site-specific geotechnical investigation report; and site-specific load tests, if applicable.
3. Group effects on the pile-soil capacity, when the center-to-center spacing of axially loaded helical piles is less than three times the diameter of the largest helical plate at the depth of bearing, or when the center-to-center spacing of laterally loaded helical piles is less than eight times the least horizontal dimension of the pile shaft at the ground surface. The spacing between helical plates must not be less than 3*D*, where *D* is the diameter of the largest helical plate, measured from the edge of the helical plate to the edge of the helical plate of the adjacent helical pile; or 4*D*, where the spacing is measured from the center-to-center of the adjacent helical pile plates.
4. Estimates of the axial tension and/or compression capacities of the helical piles, as applicable, and the expected total and differential foundation movements due to a single pile or pile group, as applicable.
5. Settlement of the helical pile system.

4.1.2.2 Requirements for the Supported Concrete: The design of the supported concrete portion of the foundation system must consider the following:

1. The ability of the supported concrete structure to transmit the expected loads to the helical foundation system, considering both strength and stiffness of the supported structural elements and spacing of the helical piles.
2. The magnitude of local forces exerted on the foundation system and associated moments, if applicable.
3. The specified compressive strength of the supported concrete must be 2,500 psi (17.22 MPa) or greater.

4.1.2.3 Requirements for Geotechnical Investigation and Analysis: A geotechnical investigation report issued by a registered design professional must be submitted to the

code official at the time of permit application and must include the following:

1. Information required by IBC Section 1803.6.
2. Confirmation of the suitability of helical foundation systems for the specific project.
3. Corrosive properties of the soil to demonstrate that a potential pile corrosion situation does not exist.
4. A determination as to whether the soil is considered stiff or soft, to determine proper application of IBC Section 1810.2.1. Stiff soils are defined as soils with a Standard Penetration Test (SPT) blow count of five or greater. Soft soils are defined as soil with a SPT blow count greater than zero and less than five. Fluid soils are defined as soil with a SPT blow count of zero. SPT blow count must be determined in accordance with ASTM D1586
5. Soil design parameters, including allowable bearing pressure.
6. Recommended center-to-center spacing of helical pile foundations and reduction of allowable loads due to the resulting group action, if necessary.
7. Effects of groundwater and any questionable soil characteristics and special design provisions, as necessary.
8. Support conditions for the helical pile shaft.

4.1.3 Requirements for Engineering and Investigation under the IRC: A registered design professional must design the helical pile system and devices, including the bracket or pile cap, to be used as a foundation element. The applied loads must not exceed the capacity of the helical pile system described in this report. The registered design professional must determine the design forces in accordance with IRC Section R301, or in accordance with the IBC as allowed by IRC Section R301.1.3.

A site specific soil investigation report is not required when the helical pile system is used to support building elements listed in Section 2.2.

4.1.4 Allowable Helical Pile Axial Load: The allowable axial compression or tension capacity of the TMG Manufacturing helical pile foundation system is limited in accordance with IBC Section 1810.3.3.1.9 to the least of the following:

- P1: The allowable axial capacity of the underpinning bracket or pile cap, which is addressed in Section 4.1.5.
- P2: The allowable axial capacity of the helical pile shaft, which is addressed in Section 4.1.6.
- P3: The sum of the allowable bearing capacities of the helical plates affixed to the pile shaft and extensions, which is addressed in Section 4.1.7 of this report.
- P4: Allowable axial capacity based on interaction of the installed pile with the soil, which is the least of the following:
  - The allowable capacity determined from well-documented correlations with installation torque. See Section 4.1.8.1 of this report.
  - The sum of the bearing areas of the helical bearing plates multiplied by the ultimate bearing capacity of the soil or rock comprising the bearing stratum, divided by a safety factor of 2. Under the IBC, the ultimate bearing capacity of the soil or rock must be determined by a registered design professional based on site-specific soil conditions. Under the IRC, when a geotechnical evaluation is not required by IRC Section R401.4, the allowable bearing pressure must be determined from IRC Table R401.4.1.
  - Allowable axial capacity predicted by dividing the ultimate axial capacity determined from site-specific axial load tests by a safety factor of at least 2.0. This capacity must be determined by a registered design professional for each site-specific condition.

4.1.5 Bracket and Pile Cap Capacity (P1): Only localized limit states related to the concrete, including bearing, punching shear and breakout, and limit states related to the steel bracket or cap and its connection to the pile shaft have been accounted for when determining the design values in this report.

Both Medium Duty and Heavy Duty underpinning brackets have an allowable compression strength of 26.3 kips (117 kN) based on testing with plain (unreinforced) concrete with a minimum compressive strength of 2,500 psi (17.2 MPa) and a thickness of 36 inches (914 mm). This is based on testing of an assembly which included a length of helical pile shaft, and accounts for the eccentricity between the load applied to the bracket and the centroid of the helical pile shaft.

Design values for the pile caps based on Conventional Design are given in Table 2 for the specific conditions of concrete cover described in Table 2.

The allowable overturning moment due to structure eccentricity is outside the scope of this evaluation report and must be determined by a registered design professional.

4.1.6 Pile Shaft Capacity (P2):

4.1.6.1 General: The shaft capacity of helical piles in air, water, or fluid soils is outside the scope of this evaluation and must be determined by a registered design professional.

Critical dimensions, section properties and other characteristics for the pile shaft are given in Table 3, based on expected corrosion effects over a 50-year time period.

4.1.6.2 Allowable Axial Compression: Table 4 gives allowable axial compression strengths for various unbraced lengths for piles with concentric loads. Allowable compression strength for other unbraced lengths must be determined by a registered design professional using the mechanical properties in Table 3.

In accordance with IBC Section 1810.2.1, any soil other than fluid soil is deemed to afford sufficient lateral support to prevent buckling of pile shafts and the unbraced length is defined as the length of pile standing in air, water or in fluid soils plus an additional 5 feet (1524 mm) when embedment is into stiff soil, or an additional 10 feet (3048 mm) when embedment is into soft soil.

Under the IRC, helical pile shafts embedded into soil conditions defined in IRC Table R401.4.1 are deemed adequate to prevent buckling of the shaft.

The top of the pile shafts must be braced against sidesway as described in IBC Section 1810.2.2. Eccentric loading of pile shafts due to bearing of the concrete on underpinning brackets has been addressed in the testing to determine the bracket capacity

4.1.6.3 Allowable Axial Tension, Shear and Bending Moment: See Table 4 for allowable tension load, allowable shear load and allowable bending moment. For the case of combined lateral and axial loading, the strength of the pile shaft is governed by the interaction equation given in AISC 360. For tension applications, the distance between the uppermost helical plate and the ground surface must be a

minimum of 12D, where D is the diameter of the largest helical plate.

4.1.6.4 Elastic Deformation: The elastic shortening of the pile shaft due to compression for loads equal to or less than the allowable load can be estimated as follows:

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

where:

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

P = Applied axial load, kips (kN).

L = Total length of shaft from uppermost helical plate to top of shaft, inches (mm).

A = Cross-sectional area of the shaft with corrosion effects, in^2 (mm^2). See Table 3.

E = Modulus of elasticity, 29,000 ksi (200 MPa).

The elastic lengthening of the pile shaft due to tension for loads equal to or less than the allowable load can be estimated as follows:

$$\Delta_{shaft} = P\,L/(A\,E) + n^*\Delta_{splice}$$

where:

n = Number of mechanical splices in the pile.

Δ_{splice} = The slip of each mechanical splice at the tabulated allowable tension load, inch (mm). See Table 3.

4.1.7 Helical Plate Capacities (P3): Table 5 gives allowable helical plate capacities. For helical piles with more than one helical plate, the allowable helical plate capacity for piles supporting axial compression and/or tension loads is the sum of the allowable capacities of each individual helical plate.

4.1.8 Soil Capacity (P4):

4.1.8.1 Allowable Axial Load Based on Installation Torque: Table 6 provides the critical soil interaction properties for the helical piles.

The torque correlation method must be used to predict the ultimate axial capacity (Q_{ult}) of the pile based on the minimum expected installation torque (Equation 1). The allowable axial capacity (Q_{all}) of the pile must be determined in accordance with Equation 2, when a geotechnical investigation report is available; or in accordance with Equation 3, when a geotechnical investigation report is not available, as allowed under the IRC.

$$Q_{ult} = K_t T \quad \text{(Equation 1)}$$

$$Q_{all} = 0.5\,Q_{ult} \quad \text{(Equation 2)}$$

$$Q_{all} = 0.4\,Q_{ult} \quad \text{(Equation 3)}$$

where:

Q_{ult} = Ultimate axial compressive or tensile capacity (lbf or N) of the helical pile, which must be limited to the applicable maximum ultimate soil capacity noted in Table 6.

Q_{all} = Allowable axial compressive or tensile capacity (lbf or N) of helical pile, which must be limited to the applicable maximum allowable soil capacity noted in Table 6.

K_t = Torque correlation factor from Table 6.

T = Final installation torque (ft-lbf or N-m). The final installation torque is defined as the last torque reading taken during the pile installation.

4.1.8.2 Lateral Load: The allowable lateral load of the helical pile shaft installed a minimum of 15 feet (4.6m) into firm clay with a minimum SPT blow count of 11 at a depth of 4 feet (1.2 m) is 1,400 lbf (6.2 kN). For other soil conditions, lateral soil resistance must be determined by a registered design professional.

4.1.8.3 Combined Axial and Lateral Loads: The combined lateral and axial capacity for soil is outside the scope of the evaluation report.

4.2 Installation:

The TMG Manufacturing Helical Pile Foundation System must be located and installed in accordance with this this report; IBC Section 1810.4.11; the manufacturer's published installation instructions; and approved site-specific construction documents (approved plans). In case of a conflict, the most stringent requirements govern. The manufacturer's published installation instructions must be available at the jobsite at all times during pile installation.

4.2.1 Shaft Installation: The starter shaft is connected to the torque motor using the drive tool and connection pins. The starter shaft is installed vertically into the ground with a maximum allowable angle of inclination of ±1 degree from vertical. Shaft extensions are bolted to lower sections as installation progresses, in accordance with the manufacturer's published installation instructions. The starter shaft and extensions are rotated into the ground to achieve the termination criteria (minimum depth and torque). Starter and extension shafts must be advanced into the soil in a smooth, continuous manner at a rate of rotation recommended by the manufacturer, using sufficient crowd (constant axial force) to ensure that the helical pile advances into the ground as recommended by manufacturer.

The final installation torque for the pile must equal or exceed the torque required by the torque correlation method to support the applied design loads of the structure, but must not exceed the maximum allowable installation torque given in Table 6.

The uppermost extension shaft must be cut in the field to the required height. The cut edge must be protected from corrosion in accordance with the manufacturer's installation instructions.

4.2.2 Pile Cap Installation and Embedment: Pile caps must be installed over the uppermost shaft extension and welded or bolted to the shaft extension in accordance with the manufacturer's instructions. The elevation of the top surface of the pile cap must comply with the approved plans. The location of the cap within the concrete must comply with Table 2 and the approved plans. Reinforcement must be placed and the concrete must be cast around the bracket in accordance with the approved plans. The design values in this report assume that concrete has reached the specified 28-day strength prior to loading of the concrete.

4.2.3 Underpinning Bracket Installation: The top of the helical pile must extend above the intended elevation of the concrete foundation. The soil must be excavated below the concrete structure to allow for installation of the bracket, taking care not to damage the existing concrete. The underpinning bracket is installed over the uppermost shaft extension and lowered and rotated to allow the bracket seat to extend under the concrete. After installation, the vertical face and underside of the concrete structure are expected to be in direct contact with the vertical and horizontal legs of the bracket seat, respectively. If needed to ensure full contact with the bracket seat, non-shrink grout may be placed in any voids between the concrete and bracket seat and must be allowed to cure prior to lifting of the concrete.

In order to lift the concrete structure to the specified

elevation, a jacking plate is added in the field on top of the pile shaft, using the two supplied threaded rods to engage with the underpinning bracket. The equipment pulls up on the threaded rods, thereby lifting the concrete to the desired elevation. The nuts are then tightened to maintain the elevation of the underpinning bracket. The excavation must be backfilled in accordance with IBC Section 1804.

4.3 Special Inspection:

Where on-site welding is required, special inspection of welding in accordance with IBC Section 1705.2 (2009 IBC Section 1704.3) is required.

Special inspection of the installation of the helical pile system in accordance with IBC Section 1705.9 (2009 IBC Section 1704.10) is required. At a minimum, the inspector's responsibilities must include the following:

1. Verifying that the helical pile system manufacturer, the equipment used, and helical pile components, including configurations and dimensions, are as specified in the approved plans.
2. Verifying that installed helical pile location, depth, angle of installation, tip elevation, final installation torque, and other pertinent installation data are as required by the registered design professional in responsible charge, and that installation of the helical pile system is as specified in the approved plans, including the geotechnical report, and this report.
3. Verifying accurate placement and quality of all welds and proper installation of bolts.
4. Documenting the equipment used.
5. Verifying that the helical pile system manufacturer's published installation instructions are present at the jobsite.

5.0 CONDITIONS OF USE

The TMG Manufacturing Helical Pile Foundation System 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 helical pile system is manufactured, identified, and installed in accordance with this report and the manufacturer's published installation instructions, which must be available at the jobsite at all times during installation. In the event of a conflict between these documents, the most restrictive requirements govern.

5.2 The helical pile system has been evaluated for support of structures assigned to Seismic Design Categories (SDCs) A, B and C in accordance with IBC Section 1613 and IRC Section R301. Use of the systems to support structures regulated under the IBC and assigned to SDC D, E, or F or that are located in Site Class E or F; or to support structures regulated under the IRC and assigned to SDCs D_0, D_1, D_2 and E; are outside the scope of this report.

5.3 Use of the helical pile system is limited to support of uncracked normalweight concrete, where analysis indicates no cracking will occur at service load levels.

5.4 Structures supported by the helical piles must be laterally braced in accordance with IBC Section 1810.2.2.

5.5 An engineering analysis must be prepared by a registered design professional and submitted to the code official in accordance with Section 4.1.2.

5.6 A geotechnical investigation report in accordance with Section 4.1.2.3 of this report must be submitted to the code official for approval.

5.7 Use of the helical pile system in soil conditions that are indicative of potential pile deterioration or corrosion situations is outside the scope of this report. Soil conditions that are indicative of potential pile deterioration or corrosion situations include the following: (1) soil resistivity less than 1,000 ohm-cm; (2) soil pH less than 5.5; (3) soil with high organic content; (4) soil sulfate concentrations greater than 1,000 ppm; (5) soils located in landfills; or (6) soils containing mine waste.

5.8 All helical pile system components must be galvanically isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.9 The helical piles must be installed vertically into the ground with a maximum allowable angle of inclination of 1 degree from vertical.

5.10 The superstructure must be designed to resist the effects of helical pile mislocation in accordance with IBC Section 1810.3.1.3.

5.11 Special inspection must be provided in accordance with Section 4.3 of this report.

5.12 The load combinations prescribed in Section 1605.3.2 of the IBC must be used to determine the applied loads. When using the alternative basic load combinations prescribed in Section 1605.3.2, the stress increases allowed by material chapters of the IBC or by referenced standards are not allowed.

5.13 Settlement of the helical pile is outside the scope of this report and must be determined by a registered design professional, as required in IBC Section 1810.2.3.

5.14 In cases where the installation depth of the helical pile system is less than 12D, where D is the diameter of the largest helical plate, the minimum embedment depth shall be determined by a registered design professional based on site-specific soil conditions which must be subject to the approval of the code official.

5.15 For tension application of the helical pile systems, where the helical pile is installed at an embedment depth less than 12D, the torque-correlation soil capacity, P4, is outside the scope of this evaluation report.

5.16 The helical pile system components are manufactured by TMG Manufacturing in Tampa, Florida, and San Rafael de Alajuela, Costa Rica, 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 Pile Systems and Devices (AC358), dated June 2020 (editorially revised October 2020).

7.0 IDENTIFICATION

7.1 The TMG Manufacturing Helical Pile Foundation System components are identified with a label bearing the name and address of the report holder, product name and model number and the evaluation report number (ESR-4621).

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

TMG MANUFACTURING CORP.
5517 W. SLIGH AVENUE
SUITE 100
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TABLE 1—TMG MANUFACTURING HELICAL PILE FOUNDATION SYSTEM COMPONENTS

MODEL NUMBERS FOR EVALUATED COMPONENTS OF THE HELICAL PILE SYSTEM			
Starter Shaft	**Extension Shaft**	**Pile Cap**	**Underpinning Brackets**
600-28-S80-#-##-G where # designates the shaft length and ## designates the helical plate diameter(s)	601-28-S80-#-G where # designates the shaft length	602-28-#-##-G where # designates the cap plate size and ## designates the cap plate thickness	700-630-MD-G 700-630-HD-G

TABLE 2—NEW CONSTRUCTION PILE CAP CAPACITY (P1)[1,5]

PILE CAP SIZE (inches)	PILE CAP THICKNESS (inch)	ALLOWABLE CAPACITY (kips) [2,3,4]		
		Compression	Tension	Lateral
		Cover above plate of 4 inches or greater	3 inch cover below plate	
8 x 8	3/8	10.72	2.01	1.52
	1/2	10.72	2.01	
10 x 10	3/8	11.25	2.46	1.76
	1/2	12.51	2.46	
12 x 12	3/8	9.92	2.90	2.01
	1/2	14.29	2.90	
14 x 14	3/8	9.12	3.35	2.25
	1/2	16.08	3.35	

For **SI:** 1 inch = 25.4 mm, 1 kip = 1000 lbf = 4.45 kN.

[1]Allowable capacities are based on expected corrosion effects of a 50-year time period.
[2]Load capacities are based on conventional design in accordance with AC358.
[3]Load capacities are based on the supported concrete being normalweight concrete having a minimum compressive strength of 2,500 psi and having a minimum width beyond the cap plate in all directions of 4 inches.
[4]Load capacities are based on concrete punching shear capacity. For grade beam and similar applications, the beam shear capacity must be determined by a registered design professional.
[5]See Figure 5 for typical installation.

TABLE 3—SHAFT (P2) CRITICAL CHARACTERISTICS[1]

CHARACTERISTIC	DESIGN VALUE
Design Outside Diameter (inch)	2.868
Design Inside Diameter (inch)	2.399
Design Wall Thickness (inch)	0.2345
Gross cross-sectional Area, A (inch^2)	1.94
Moment of Inertia, I (inch^4)	1.70
Radius of Gyration, r (inch)	0.93
Section Modulus, S (inch^3)	1.18
Plastic Section Modulus, Z (inch^3)	1.52
Slip at allowable tension load, Δ_{splice} (inch/coupler)	0.195

For **SI:** 1 inch = 25.4 mm; 1 in^2 = 645 mm^2; 1 inch^3 = 16,390 mm^3.

[1]Dimensions and section properties are for galvanized shaft components based on expected corrosion effects of a 50-year time period.

TABLE 4—PILE SHAFT ALLOWABLE CAPACITIES (P2)[1,2,3]

UNBRACED SHAFT LENGTH, L_u (ft)[4]	COMPRESSION (kips)			TENSION (kips)	LATERAL SHEAR (kips)	BENDING MOMENT (ft-kips)
	No Coupler	1 Coupler[5]	2 Couplers[5]			
0 (fully braced)	72.0	72.0	72.0	29.0	16.7	5.40
5	33.0	23.4	15.7			
10	15.4	12.9	10.2			

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 kip = 1,000 lbf = 4.45 kN; 1 ft-kip = 1.36 kN-m.

[1]The tabulated values apply to concentrically loaded piles installed with a maximum of 1 degree of inclination from vertical.
[2]Allowable capacities are based on expected corrosion effects of a 50-year time period.
[3]Couplers must be fastened with both of the supplied bolts and nuts.
[4]L_u=Total unbraced pile length including the length in air, water or fluid soils plus and the applicable embedment length into non-fluid soil in accordance with IBC Section 1810.2.1. Design values assume that the top of the pile is braced against side-sway.
[5]Number of couplings within the unbraced length.

TABLE 5—HELICAL BEARING PLATE CAPACITY (P3)[1,2]

HELICAL PLATE DIAMETER (inches)	ALLOWABLE TENSION OR COMPRESSION BEARING CAPACITY (kips)
8	56.6
10	39.8
12	49.2
14	42.3

For **SI:** 1 inch = 25.4 mm, 1 kip = 1,000 lbf = 4.45 kN.

[1]For helical piles with more than one helical plate, the allowable helical plate capacity (P3) for the helical foundation systems, may be taken as the sum of the allowable capacities of each individual helical plate.
[2]Allowable capacities are based on expected corrosion effects of a 50-year time period.

TABLE 6—SOIL CAPACITY (P4)[1]

GEOTECHNICAL RELATED PROPERTIES	COMPRESSION	TENSION
Maximum Ultimate Soil Capacity (lbf) [2]	71,400	71,300
Maximum Allowable Soil Capacity (lbf)[3]	35,700	35,600
Maximum Allowable Soil Capacity (lbf) when a geotechnical investigation report is not available, as allowed by the IRC [4]	28,600	28,500
Maximum Allowable Installation Torque (ft-lbf)	7,932	7,932
Torque Correlation Factor, K_t (ft^{-1})	9.0	9.0

For **SI:** 1 ft^{-1} = 0.305 m^{-1}; 1 lbf = 4.45 N, 1 ft-lbf = 1.36 N-m.

[1]Soil capacity (P4) must be determined in accordance with Section 4.1.8 of this report.
[2]Maximum ultimate soil capacity is determined from $P_{ult} = K_t \times T$ based on the corresponding maximum allowable installation torque.
[3]Maximum allowable soil capacity is determined from $P_a = P_{ult}/2.0$ based on the corresponding maximum installation torque rating.
[4]Maximum allowable soil capacity is determined from $P_a = P_{ult}/2.5$ based on the corresponding maximum installation torque rating.

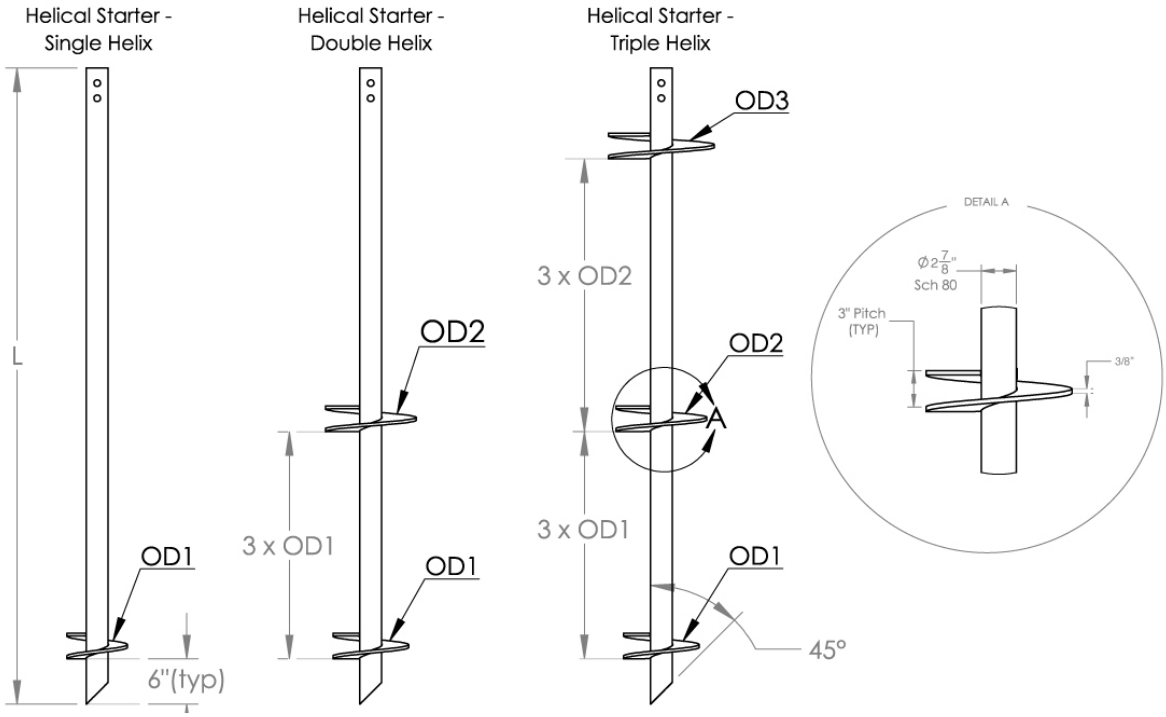

FIGURE 1—HELICAL PILE STARTER SHAFT – 600-28-S80-#-##-G

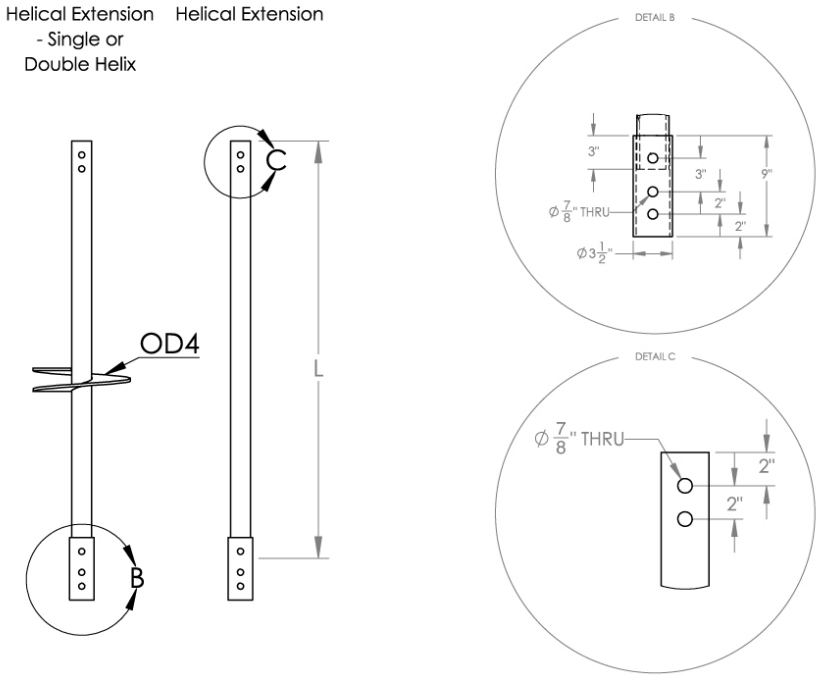

FIGURE 2—HELICAL PILE EXTENSION SHAFT – 601-28-S80-#-G

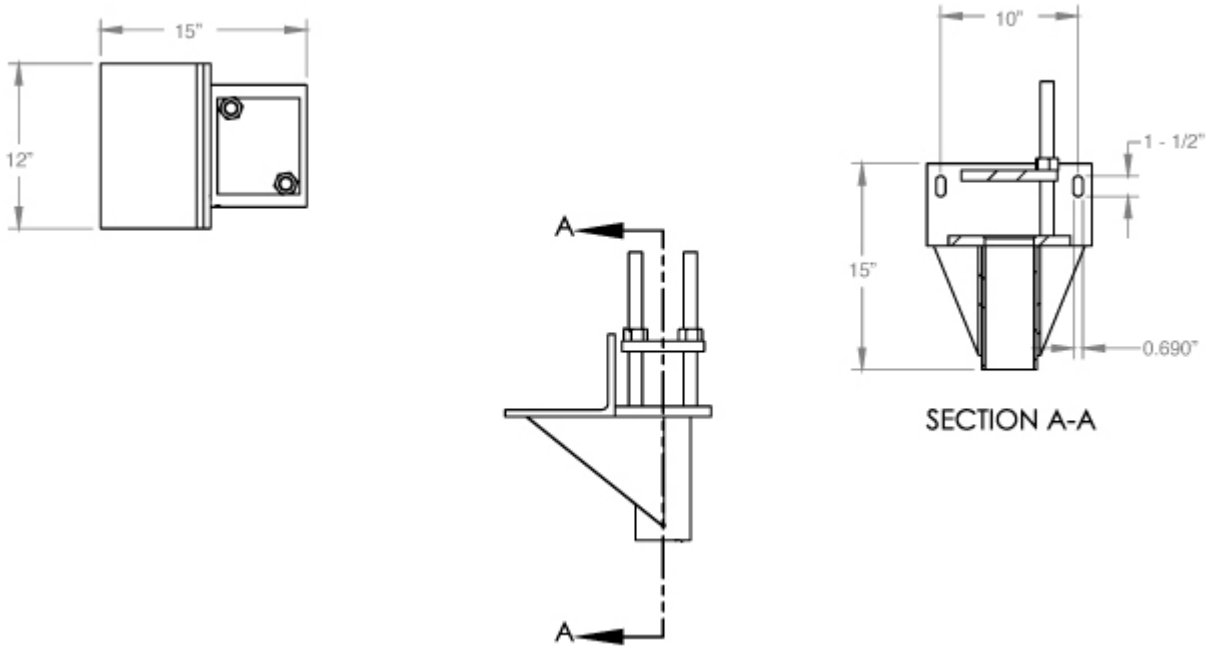

FIGURE 3— UNDERPINNING BRACKET – 700-630-MD-G or 700-630-HD-G

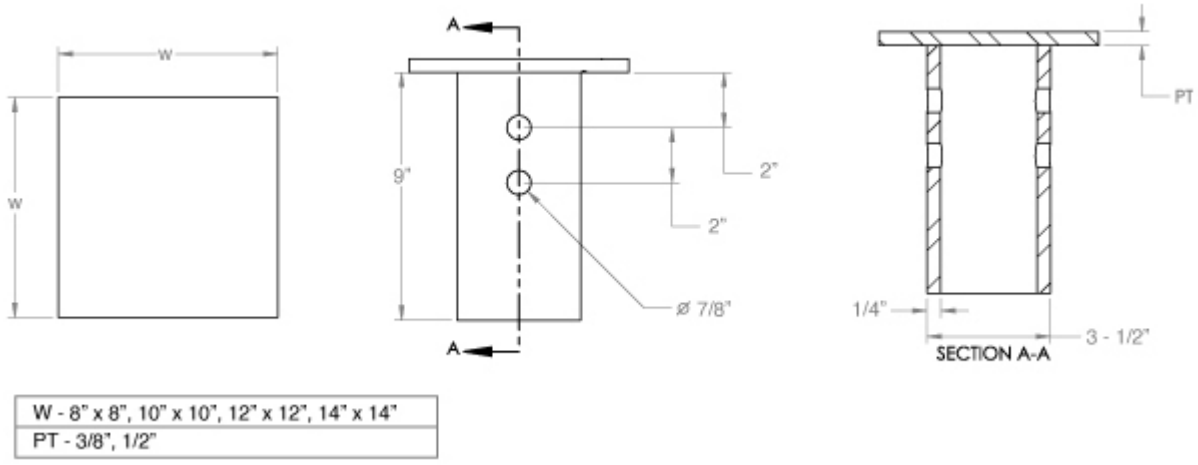

FIGURE 4 – HELICAL PILE CAP – 602-28-#-##-G

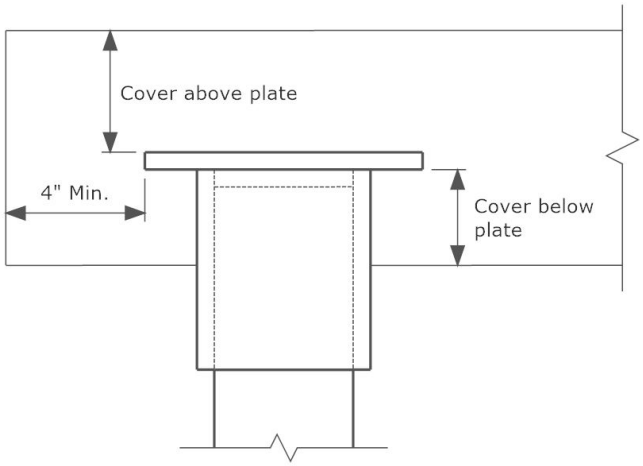

FIGURE 5 – HELICAL PILE CAP INSTALLATION

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

REPORT HOLDER:

TMG MANUFACTURING CORP.

EVALUATION SUBJECT:

HELICAL PILE FOUNDATION SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the TMG Manufacturing Helical Pile Foundation System, described in ICC-ES evaluation report ESR-4621, has also been evaluated for compliance with the codes noted below.

Applicable code edition:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care and Information (HCAI) and the Division of the State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code (CRC)*

2.0 CONCLUSIONS

2.1 CBC:

The TMG Manufacturing Helical Pile Foundation System, described in Sections 2.0 through 7.0 of evaluation report ESR-4621, complies with CBC Chapters 18, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 18, as applicable.

2.1.1 OSHPD: The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA: The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The TMG Manufacturing Helical Pile Foundation System, described in Sections 2.0 through 7.0 of evaluation report ESR-4621, complies with CRC Chapter 3, provided the design and installation are in accordance with the 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report reissued October 2023.

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

REPORT HOLDER:

TMG MANUFACTURING CORP.

EVALUATION SUBJECT:

HELICAL PILE FOUNDATION SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the TMG Manufacturing Helical Pile Foundation System, addressed in ICC-ES evaluation report ESR-4621, has also been evaluated for compliance with the codes noted below.

Applicable code edition:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The TMG Manufacturing Helical Pile Foundation System, described in Sections 2.0 through 7.0 of evaluation report ESR-4621, complies with the *Florida Building Code—Building* and the *Florida Building Code—Residential*. The design requirements must be determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-4621 for the 2018 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of TMG Manufacturing Helical Pile Foundation System for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* has not been evaluated, and is outside the scope of this supplemental report.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality-assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued October 2023.