ICC EVALUATION SERVICE

ICC-ES Evaluation Report

ESR-4471

Issued May 2020
Revised May 28, 2020
This report is subject to renewal May 2021.

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

REPORT HOLDER:

EARTH CONTACT PRODUCTS, LLC

EVALUATION SUBJECT:

EARTH CONTACT PRODUCTS (ECP) STEEL PIERS™ SYSTEMS

1.0 EVALUATION SCOPE

Compliance with the following codes:

2018 and 2015 *International Building Code®* (IBC)

For evaluation for compliance with codes adapted by Los Angeles Department of Building and Safety (LADBS), see ESR-4471 LABC Supplement.

Property evaluated:

Structural

2.0 USES

ECP Steel Piers™ Systems, otherwise known as hydraulically driven steel piling systems, are designed to resist axial compressive loads from the supported structures.

3.0 DESCRIPTION

3.1 General:

ECP Steel Piers™ Systems consist of hydraulically driven steel piling using pipe sections connected to brackets that are in contact and connected with the load-bearing foundation of a structure.

3.2 System Components:

ECP Steel Piers™ Systems consist of either $2^7/_8$- or 3½-inch-outside-diameter (73 mm or 89 mm) starter and extension pipe sections with inertia sleeves and control sleeves (PPB-350 only) and Type A side-load bracket (PPB-300 and PPB-350), for attachment to concrete foundations.

3.2.1 Piling Shaft - Starter and Extension Pipe Sections: The starter and extension pipe sections are either $2^7/_8$- or 3½-inch-outside-diameter (73 mm or 89 mm) in 3.5-foot-long (1067 mm) sections. All pipes have a nominal thickness of 0.165 inch (4.2 mm). Custom lengths are available upon request. See Figures 1 and 2 for PPB-300 and PPB-350 Steel Piers™ systems.

3.2.2 Sleeves: Inertia sleeves are an optional component and are used to stiffen the pipe joints when passing through weak soil. The segments are connected with a pier coupler which is factory-welded inside the inertia sleeve. Each sleeve comes in either $2^3/_8$- or $3^1/_8$-inch-outside-diameter (60.3 or 79.4 mm) by nominal 3-foot-long (914 mm) sections. All sleeves have a nominal thickness of either 0.183 inch or 0.192 inch (4.6 mm or 4.8 mm), respectively. See Figure 3 for Inertia sleeves with standard pipe sections.

A control sleeve is used for 3½-inch-outside-diameter (89 mm) pipes to be used with PPB-350 brackets. The control sleeve consists of a $11^7/_8$-inch-long (301.6 mm), 4-inch-square (101.6 mm) hollow structural steel section (HSS) with a nominal overall thickness of 0.186 inch (4.7 mm). See Figure 4 and 6 for where the control sleeve is used for PPB-350 brackets only.

3.2.3 ECP Brackets: PPB-300 and PPB-350 bracket assemblies are side-load brackets that connect with $2^7/_8$- and 3½-inch-outside-diameter (73 mm and 89 mm) pipes, respectively. The brackets support axial compression loads only, which introduce both structure eccentricity (eccentricity between applied loading and reactions acting on the foundation structure) and bracket eccentricity (eccentricity between applied loading and reactions acting on the bracket assembly). The different brackets are described in Sections 3.2.3.1 through 3.2.3.4. See Figures 5 and 6 for PPB-300 and PPB-350, respectively.

3.2.3.1 ECP PPB-300 Bracket Assembly: The ECP PPB-300 bracket assembly is designed to be used with $2^7/_8$-inch-outside-diameter (73 mm) pipe sections and is used to transfer compressive loading from existing concrete foundations to the pipe sections. The bracket assembly consists of a bracket subassembly; three face plates; one pier cap plate; and two $^3/_4$-inch-diameter by $17^7/_8$-inch-long (19.0 mm x 454.0 mm) all-threaded rods, with four matching $^3/_4$-inch (19.0 mm) hex nuts. Six $^1/_2$-inch-diameter (12.7 mm) hex nuts are used to attach the three face plates to the bracket subassembly, with two nuts attaching each face plate to the two $^1/_2$-inch-diameter (12.7 mm) steel all-threaded studs that are factory-welded to the bracket subassembly, so as to ensure the piling is in proper alignment and position with the bracket assembly. Two

3/4-inch (19.0 mm) all-threaded rods and four matching nuts are used to connect the pier cap plate to the bracket subassembly. The installing contractor must supply two (2) post-installed concrete anchor bolts complying with Section 3.2.3.1.4, which are used to attach the bracket subassembly to the concrete foundations. See Figures 4 and 5 for bracket details and components.

3.2.3.1.1 Bracket Subassembly: Each bracket subassembly is constructed from one 3/8-inch-thick-by 7½-inch-wide by 11 3/4-inch-long (9.5 mm x 190.5 mm x 298.5 mm) steel vertical mounting plate; one 1/2-inch-thick by 7-inch wide by 9¾-inch long (12.7 mm x 177.8 mm x 247.7 mm) steel horizontal bearing plate (seat plate); two overall 3/8-inch-thick by 10 3/8-inch-wide by 14½-inch-long (9.5 mm x 263.5 mm x 368.3 mm) steel vertical side plates (side shoes); two HSS 1 1/4-inch by 1 1/4-inch by 3/16-inch-thick (31.8 mm x 31.8 mm x 4.8 mm) by 9-inch-long (228.6 mm) tubular sleeves (side tubes); and six 1/2-inch-diameter (12.7 mm) steel all-threaded studs (mounting studs) that are factory-welded together. The vertical mounting plate has four 9/16-inch-diameter (14.3 mm) factory-made circular holes for installation of concrete anchors into concrete foundation.

3.2.3.1.2 Pier Cap Plate: Each Pier Cap Plate consists of a steel cap plate and a steel collar that are factory-welded together. The steel cap plate is 1½-inch-thick by 4-inch-wide by 7 7/8-inch-long (38.1 mm x 101.6 mm x 200 mm). The steel collar is a steel round HSS, measuring 2 3/8-inch-outside-diameter (60.3 mm) by 1-inch-long (25.4 mm) and a nominal wall thickness of 0.150 inch (3.8 mm). The cap plate has two 7/8-inch diameter (22.2 mm) circular holes which are drilled and finished at the factory. Two 3/4-inch-diameter (19.0 mm) all-threaded rods are used to hold the bracket subassembly to the pile shaft. The steel collar is located at the center of the cap plate, and it fits into the inside of the pile shaft as to ensure the pile shaft alignment to the bracket assembly.

3.2.3.1.3 Face Plate: Each steel face plate measures 3/8-inch thick by 2-inch wide by 6 3/8-inch long (9.5 mm x 50.8 mm x 161.9 mm). The face plate has two slotted holes, with each slot consisting of a straight cut hole of 5/8-inch-wide by 15/16-inch-long (15.9 by 406.4 mm) and a semi-circular hole of 5/8-inch diameter (15.9 mm), which are used for attaching two 1/2-inch-diameter (12.7 mm) mounting studs.

3.2.3.1.4 Concrete Anchors: Each bracket must be installed with post-installed anchors with an effective minimum embedment of 3¼-inches (82.5 mm); two 1/2-inch-diameter by 3 1/4-inch long (12.7 mmm x 82.6 mm) Hilti KwikBolt 3 (KB3), carbon steel concrete anchors (ESR-2302) along with matching hex nuts and matching flat washers or equivalent as determined by the structural design professional, with hot-dip galvanized coating complying with ASTM A153. The two concrete anchors must be installed at the top or bottom row of holes in the steel vertical mounting plate.

3.2.3.1.5 ECP PPB-350 Bracket Assembly: The ECP PPB-350 bracket assembly is designed to be used with 3 1/2-inch-outside-diameter (88.9 mm) pipe sections and is used to transfer compressive loading from existing concrete foundations to the pipe sections. The bracket assembly consists of a bracket subassembly; three face plates; one pier cap plate; and two 7/8-inch-diameter (22.2 mm) by 18-inch-long (457.2 mm) all-threaded rods, with four matching 7/8-inch (22.2 mm) hex nuts. Six 1/2-inch-diameter (12.7 mm) hex nuts are used to attach the three face plates to the bracket subassembly, with two nuts attaching each face plate to the two 1/2-inch-diameter (12.7 mm) steel all-threaded studs that are factory-welded to the bracket subassembly, so as to ensure the piling is in proper alignment and position with the bracket assembly. Two 7/8-inch (22.2 mm) all-threaded rods and four matching nuts are used to connect the pier cap plate to the bracket subassembly. The installing contractor must supply two (2) post-installed concrete anchor bolts complying with Section 3.2.3.1.4, which are used to attach the bracket subassembly to the concrete foundations. See Figure 4 and 6 for bracket details and components.

3.2.3.1.6 Bracket Subassembly: Each bracket subassembly is constructed from one 1/2-inch-thick by 7½-inch-wide by 13-inch-long (12.7 mm x 190.5 mm x 330.2 mm) steel vertical mounting plate; one 5/8-inch-thick by 8-inch-wide by 9 7/8-inch-long (15.9 mm x 203.2 mm x 250.8 mm) steel horizontal bearing plate (seat plate); two overall 5/8-inch-thick by 12-inch-wide by 18-inch-long (15.9 mm x 304.8 mm x 457.2 mm) steel vertical side plates (side shoes); two HSS 1 1/2-inch by 1 1/2-inch by 0.197-inch-thick (38.1 mm x 38.1 mm x 5.0 mm) by 9 7/8-inch-long (250.8 mm) tubular sleeves (side tubes); and six 1/2-inch-diameter (12.7 mm) steel all-threaded studs (mounting studs) that are factory-welded together. The vertical mounting plate has four 9/16-inch-diameter (14.3 mm) factory-made circular holes for installation of concrete anchors into concrete foundation.

3.2.3.1.7 Pier Cap Plate: Each Pier Cap Plate consists of a steel cap plate and a steel collar that are factory-welded together. The steel cap plate is 1½-inch thick by 4-inch wide by 9-inch long (38.1 mm x 73 mm x 228.6 mm). The steel collar is a steel round HSS, measuring 4.0-inch-outside-diameter (50.8 mm) by 1-inch-long (25.4 mm), and a nominal wall thickness of 0.204 inch (5.2 mm). The cap plate has two 1-inch-diameter (25.4 mm) circular holes which are drilled and finished at the factory. Two 7/8-inch-diameter (22.2 mm) all-threaded rods are used to hold the bracket subassembly to the pile shaft. The steel collar is located at the center of the cap plate, and it fits into the inside of the pile shaft as to ensure the pile shaft alignment to the bracket assembly.

3.2.3.1.8 Face Plate: Each steel face plate measures 3/8-inch thick by 2-inch wide by 7 1/4-inch long (9.5 mm x 50.8 mm x 184.2 mm). The face plate has two slotted holes, with each slot consists of a straight cut hole of 5/8-inch wide by 15/16-inch long (15.9 by 406.4 mm) and a semi-circular hole of 5/8-inch diameter (15.9 mm), which are used for attaching two 1/2-inch-diameter (12.7 mm) mounting studs.

3.2.3.1.9 Concrete Anchors: See Section 3.2.3.1.4.

3.3 Material Specifications:

3.3.1 Piling Shaft - Starter and Extension Pipe Sections: The starter and extension pipe sections are carbon steel round structural tubes, conforming to ASTM A500, Grade B, having a minimum yield strength of 55 ksi (379 MPa) and a minimum tensile strength of 62 ksi (425 MPa). The pipe sections used in the piling shafts are hot-dipped galvanized in accordance with ASTM A123, Grade 100.

3.3.2 Sleeves: The inertia and control sleeves are carbon steel round and square structural tubes, conforming to ASTM A500, Grade B, having a minimum yield strength of 55 ksi (379 MPa) and a minimum tensile strength of 62 ksi (425 MPa). The sleeves are hot-dipped galvanized in accordance with ASTM A123, Grade 100.

3.3.3 ECP PPB-300 and PPB-350 Bracket Assemblies:

3.3.3.1 Bracket Subassembly: The steel vertical mounting plate, horizontal bearing plate and vertical side

plates conform to ASTM A572, Grade 50, having a minimum yield strength of 50 ksi (345 MPa) and a minimum tensile strength of 65 ksi (448 MPa). The side tubes conform to ASTM A500, Grade B, having a minimum yield strength of 55 ksi (379 MPa) and a minimum tensile strength of 62 ksi (425 MPa). The mounting studs are $^1/_2$-13 UNC 2A threaded rods, conforming to ASTM 193, Grade B7, having a minimum yield strength of 105 ksi (720 MPa) and a minimum tensile strength of 125 ksi (860 MPa). The factory-welded assembly is hot-dipped galvanized in accordance with ASTM A123, Grade 100, except the mounting studs are zinc coated in accordance with ASTM B633, with a Coating Classification of Fe/Zn 5 and a Surface Condition code of SC1.

3.3.3.2 Pier Cap Plate: The steel cap plate conforms to ASTM A572, Grade 50, having a minimum yield strength of 50 ksi (345 MPa) and a minimum tensile strength of 65 ksi (448 MPa). The steel collar conforms to ASTM A500, Grade B, having a minimum yield strength of 42 ksi (290 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The welded assembly is hot-dipped galvanized in accordance with ASTM A123, Grade 100.

3.3.3.3 Face Plate: The steel face plate conforms to ASTM A572, Grade 50, having a minimum yield strength of 50 ksi (345 MPa) and a minimum tensile strength of 65 ksi (448 MPa). The face plate is hot-dipped galvanized in accordance with ASTM A123, Grade 100.

3.3.3.4 Structural Fasteners for Bracket Assembly: The threaded rods, used in connecting the T-tube cap plate subassembly to the bracket subassembly, are $^3/_4$-10 UNC 2A threaded rods, conforming to ASTM A193, Grade B7, having a minimum yield strength of 105 ksi (720 MPa) and a minimum tensile strength of 125 ksi (860 MPa). The matching nuts are $^3/_4$-10 UNC 2B hex nuts, conforming to SAE J995, Grade 2. The steel nuts used to connect face plate assemblies to the mounting studs of the bracket subassembly are $^1/_2$-13 UNC 2B hex nut, conforming to ASTM A563, Grade A. The threaded rods and matching nuts and the nuts for connecting to the mounting studs are zinc-coated in accordance with ASTM B633, with a Coating Classification of Fe/Zn 5 and a Surface Condition code of SC1.

4.0 DESIGN AND INSTALLATION

4.1 Design:

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

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

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

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

4.1.2 Bracket Capacity (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 foundation, including bearing and punching shear, have been evaluated in this evaluation report. Other limit states are outside the scope of this evaluation report and must be determined by the registered

design professional. The effects of reduced lateral sliding resistance due to uplift from wind or seismic loads must be considered for each project. Reference Table 1 for the allowable bracket capacity ratings.

4.1.3 Pile Shaft Capacity (P2): Table 3 describes the allowable axial compression loads of the shafts and Table 2 describes the mechanical properties of the shafts, which are based on a 50-year corrosion effect in accordance with Section 3.6 of the ICC-ES Acceptance Criteria for Push Pier Foundation Systems (AC517). The tops of shafts must be braced as prescribed in IBC Section 1810.2.2, and the supported foundation structures such as concrete footings are assumed to be adequately braced such that the supported foundation structures provide lateral stability for the pile systems. In accordance with 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 that is standing in air, water or in fluid soils plus additional 5 feet (1524 mm) when embedded into firm soil or additional 10 feet (3048 mm) when embedded into soft soil. Firm soils shall be defined as any soil with a Standard Penetration Test blow count of five or greater. Soft soil shall be defined as any soil with a Standard Penetration Test blow count greater than zero and less than five. Fluid soils shall be defined as any soil with a Standard Penetration Test blow count of zero [weight of hammer (WOH) or weight of rods (WOR)]. Standard Penetration Test blow count shall be determined in accordance with ASTM D1586.

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

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

where:

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

P = applied axial load, lbf (N).

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

A = cross-sectional area of the shaft, see Table 2, in.^{2} (mm^2).

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

4.2 Installation:

4.2.1 General:

1. ECP Steel Piers™ Systems must be installed in accordance with this section (Section 4.2), site-specific approved construction documents (engineering drawings and specifications), and the manufacturer's written installation instructions. In case of conflict, the most stringent requirement governs.
2. ECP Steel Piers™ Systems must be installed by ECP trained and certified installers.
3. The hydraulic equipment is portable and must be capable of providing the proper installation angle and the downward force (crowd).
4. The foundation piles must be aligned both vertically and horizontally as specified in the approved plans. ECP Steel Piers™ Systems must be installed vertically plumb into the ground with a maximum allowable angle of inclination 0° ± 1° for piling shaft installed with either PPB-300 or PPB-350 bracket.
5. ECP Steel Piers™ Systems must be installed in accordance with the approved plans and specifications.

4.2.2 Installation Procedures for ECP Steel Pier™ Systems with PPB-300 and PPB-350 Brackets (See Figure 7):

1. Thoroughly investigate the site for any and all underground utilities prior to excavating.
2. An area at each location adjacent to the building foundation must be excavated to expose the footing or grade beam. The excavation must be approximately a depth of 14 inches (356 mm) and a width of 10 inches (254 mm) below the bottom of the foundation.
3. Soil attached to the bottom of the footing or grade beam must be removed. The footing or grade beam may be prepared by chipping away irregularities from the bottom and side faces. Notching the footing or grade beam is recommended to allow the bracket to mount directly and adjacent to the load-bearing wall/column, but it must be performed with the approval of the registered design professional and the code official. The vertical and horizontal surfaces of the footing or grade beam must be flat and smooth before the bracket is mounted.
4. Reinforcing steel within the foundation must not be cut without the approval of the registered design professional and the code official.
5. The bearing surface of the concrete must be smooth, and free of all soil, debris and loose concrete, so as to provide a firm bearing surface for the bracket. A level must be used to verify that the portion of the footing upon which the bracket will bear is level in directions that are perpendicular and parallel to the foundation.
6. The bracket and drive stand unit must be placed under the footing where the bearing plate of the bracket is in full contact with previously prepared bottom surface of the footing. Inspection must confirm that the vertical mounting plate and the horizontal bearing plate of the bracket evenly bear across the entire bottom of the footing and against the vertical face of the footing.
7. The bracket must be held in the approximate installation location and the pier cap plate must be connected to both sides of the bracket using the threaded rods and nuts provided with the bracket. The face plates or face plate subassemblies must be connected to the mounting studs of the bracket subassembly using the supplied nuts. All nuts must be tightened to snug-tight condition as defined in Section J3 of AISC 360.
8. Securely anchor the drive stand and pier bracket to the bearing structure. Two post-installed anchors, as described in Section 3.2.3.1.4 of this report, must be installed to connect the bracket to the supported concrete foundation.
9. Attach drive cylinder to the pile lead section. Align the pile lead section with an inclination to vertical 0° ± 1° for piles installed with PPB-300 and PPB-350 brackets.
10. The pile lead section must be inserted into the excavation and must be positioned with shaft adjacent to the foundation.

11. Start drive cylinder and maintain the pile shaft inclination angles as prescribed in step 9, above.
12. If extension sections are to be used, the drive cylinder must be removed, and the shaft extensions must be added in proper sequence in accordance with the approved foundation plans.
13. Continue steps 11 through 12 until the termination criteria (such as depth) prescribed in the construction documents are met and the top of the shaft is at the required elevation, which is the top of the bracket plus the amount of expected lift plus $^1/_2$ inch (12.7 mm).
14. After driven pile has been installed, any excess length above the required elevation must be cut off to allow for mounting to the bracket. Cutting must comply with manufacturer's installation instruction and applicable code including AISC 360, and to ensure the top of shaft is true level, and to ensure a uniform contact between pile shaft and the bracket cap subassembly.
15. An appropriate lift assembly must be installed on top of the bracket, and a hydraulic ram must be placed between the lift assembly and the bracket cap subassembly.
16. Lifting of the structure can be done by activating the hydraulic rams associated with lifting assemblies. Any lifting of the structure must be verified by qualified personnel (a registered design professional) to ensure that no part of the foundation, structure, or push pier is overstressed and is subjected to approval of the code official.
17. Once the foundation has been raised or stabilized, as a minimum, all nuts must be tightened to a snug-tight condition to secure the pier cap plate and the face plates to the bracket and pile shaft. The bracket to the foundation or grade beam must be connected by means of the concrete anchor bolts described in Section 3.0 of this report. The installation of concrete anchors must be strictly in accordance the ICC-ES evaluation report noted in Section 3.0 of this report.
18. The hydraulic rams must then be removed.
19. The excavation must be backfilled with properly compacted soil. Excess soil and debris must be removed.
20. The full installation instructions are contained in the installation instructions available from the report holder (ECP, LLC).

4.3 Special Inspections:

Special inspections in accordance with Section 1705.7 of the IBC and must be performed continuously during installation of the ECP Steel Pier™ systems (piles and brackets). Items to be recorded and confirmed by the special inspector must include, but are not necessarily limited to, the following:

1. Verification of the product manufacturer and the manufacturer's certification of installers.
2. Product configuration and identification (including catalog numbers) for lead sections, extension sections, brackets/Face Plates/Pier cap plate assemblies, bolts/threaded rods, and nuts as specified in the construction documents and this evaluation report.
3. Installation equipment used.
4. Written installation procedures.
5. Verification that the actual, as-constructed pile tip embedments are within the limits specified in the construction document and this evaluation report.
6. Inclination and horizontal position/location of the piles.
7. Tightness of all bolts/threaded rods.
8. Verification of bracket bearing plate and mounting plate, as applicable, in full contact with the concrete foundation and absence of cracks in the foundation in the vicinity of the bracket.
9. Compliance of the installation with the approved construction documents and this evaluation report.
10. Where on-site welding is required, special inspection in accordance with IBC Section 1705.2 must be conducted.

5.0 CONDITIONS OF USE

The ECP Steel Piers™ Systems described in this report comply with, or are 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 driven foundation system is manufactured, identified and installed in accordance with this report, the approved construction documents and the manufacturer's published installation instructions. In the event of a conflict between this report, the approved construction documents and the manufacturer's published installation instructions, the most restrictive governs.

5.2 Driven pile systems have been evaluated to support structures in Seismic Design Categories (SDCs) A, B and C. Use of the systems to support structures assigned to SDC D, E or F, or which are located in Site Class E or F, are outside the scope of this report and are subject to the approval of the building official, based upon submission of a design in accordance with the code by a registered design professional.

5.3 Installation of the hydraulically driven pile systems must be limited to support of uncracked normal-weight concrete, as determined in accordance with the applicable code.

5.4 Brackets must be used only to support structures that are laterally braced as defined in IBC Section 1810.2.2.

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

5.6 All hydraulically driven pile components must be galvanically isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.7 The adequacy of the concrete structures that are connected to the ECP brackets must be verified by a registered design professional, in accordance with applicable code provisions, such as Chapter 13 of ACI 318-14 under the IBC and Chapter 18 of IBC, and subject to the approval of the code official.

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

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

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

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

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

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

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

5.15 The ECP Steel Piers™ Systems are manufactured in Olathe, Kansas; under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Push Pier Foundation Systems (AC517), dated February 2020.

7.0 IDENTIFICATION

The ECP Steel Piers™ Systems described in this report including starter and extension pipe sections, brackets and connection hardware are identified by product package labels that include the report holder's name (Earth Contact Products, LLC) and address, the product part number, and the ICC-ES evaluation report number (ESR-4471). Additionally, each bracket is identified by a product purchase order stamped onto the side of the bracket. Each piling shaft (starter and extension) is identified by a product identification number "XXXXYZ" (where "XXXX" are the numerical purchase order code, "Y" is the material size/grade code, and "Z" is the production location code) stamped into the shaft.

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

EARTH CONTACT PRODUCTS, LLC
15620 SOUTH KEELER TERRACE
OLATHE, KANSAS 66062
(913) 393-0007
www.earthcontactproducts.com
eng@getecp.com

TABLE 1—FOUNDATION STRENGTH RATINGS OF BRACKETS[1,2,3,4]

PRODUCT NUMBER	DESCRIPTION	PILING DIAMETER (inches)	ALLOWABLE COMPRESSION CAPACITY (kips)
PPB-300	Side load bracket	$2^{7}/_{8}$	22.2
PPB-350	Side load bracket	3½	22.2

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

[1]Load capacity is based on full scale load tests per AC517 with an installed 5'-0" unbraced pile length having a maximum of one coupling per IBC Section 1810.2.1. A 3.5-foot-long inertia sleeve must be installed at the top of the shaft when passing through weak soil, see Figure 3. Side load bracket must be concentrically loaded. Side load bracket plate must be fully engaged with bottom of concrete foundation. Only localized limit states such as mechanical strength of steel components and concrete bearing have been evaluated.

[2]The capacities listed in Table 1 assume the structure is sidesway braced per IBC Section 1810.2.2.

[3]The tabulated values are based on installation with normal-weight concrete having a minimum compressive strength of 2,500 psi (17.23 MPa).

[4]Installation must comply with Section 4.2.2 of this report.

TABLE 2—MECHANICAL PROPERTIES AFTER CORROSION LOSS[1] OF 2.875- AND 3.5-INCH-DIAMETER SHAFT

Mechanical Properties	SHAFT DIAMETER (inches)	
	2.875	**3.5**
Steel Yield Strength, F_y (ksi)	55	55
Steel Ultimate Strength, F_u (ksi)	62	62
Modulus of Elasticity, E (ksi)	29,000	29,000
Nominal Wall Thickness (inch)	0.165	0.165
Design Wall Thickness (inch)	0.153	0.153
Outside Diameter (inch)	2.862	3.487
Inside Diameter (inch)	2.545	3.170
Cross Sectional Area (inch^2)	1.346	1.657
Moment of Inertia, I (inch^4)	1.234	2.300
Radius of Gyration, r (inch)	0.957	1.178
Section Modulus, S (inch^3)	0.862	1.319
Plastic Section Modulus, Z(inch^3)	1.160	1.757

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

[1]Dimensional properties are based on zinc coated steel losing 0.013-inch steel thickness as indicated in Section 3.6 of AC517 for a 50-year service life.

TABLE 3—ALLOWABLE COMPRESSION CAPACITY OF $2^7/_8$- AND 3½-INCH-DIAMETER PILE WITH COUPLER ECCENTRICITY[1,2] (kips)

$2^7/_8$ Fully Braced in Soft Soil (L_u = 0)	$2^7/_8$ Fully Braced in Firm Soil (L_u = 0)	3½ Fully Braced in Soft Soil (L_u=0)	3½ Fully Braced in Firm Soil (L_u=0)
27.2	48.2	36.5	49.5

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

[1]L_u=Total unbraced pile length per IBC Section 1810.2.1, including the length in air, water or in fluid soils, and the embedment length into firm or soft soil (non-fluid soil). kL_u = total effective unbraced length of the pile, where kL_u = 0 represent a fully braced condition in that the total pile length is fully embedded in firm or soft soil and the supported structure is braced in accordance IBC Section 1810.2.2.
[2] Tabulated load values are based on zinc-coated steel losing 0.013-inch steel thickness as indicated in Section 3.6 of AC517 for a 50-year service life.

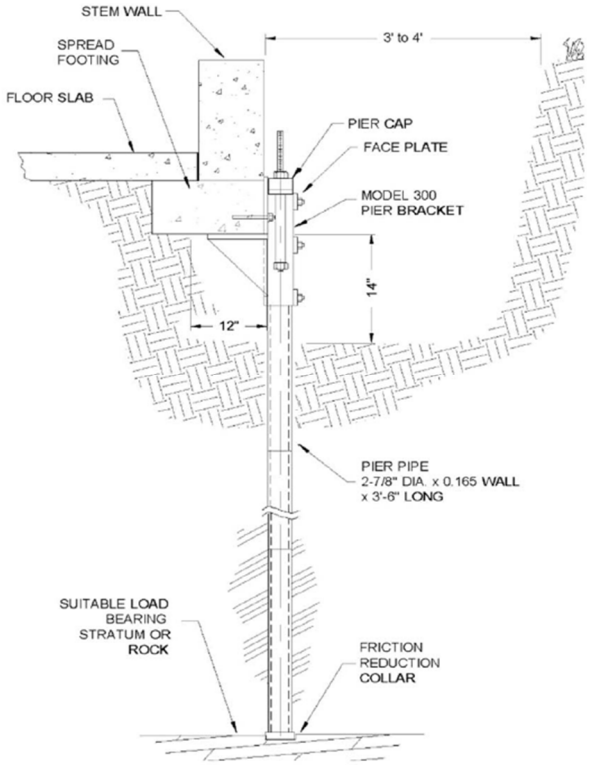

FIGURE 1—PPB-300 STEEL PIERS™ SYSTEM APPLICATION

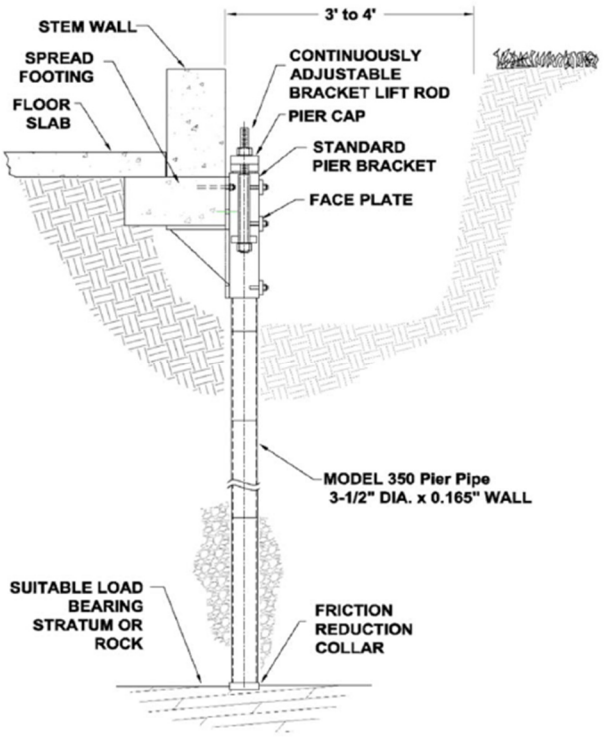

FIGURE 2—PPB-350 STEEL PIERS™ SYSTEM APPLICATION

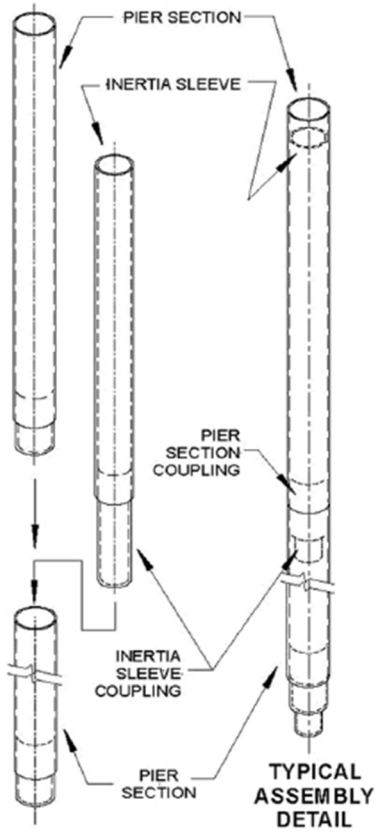

FIGURE 3—INERTIA SLEEEVE WITH PIPE SECTIONS

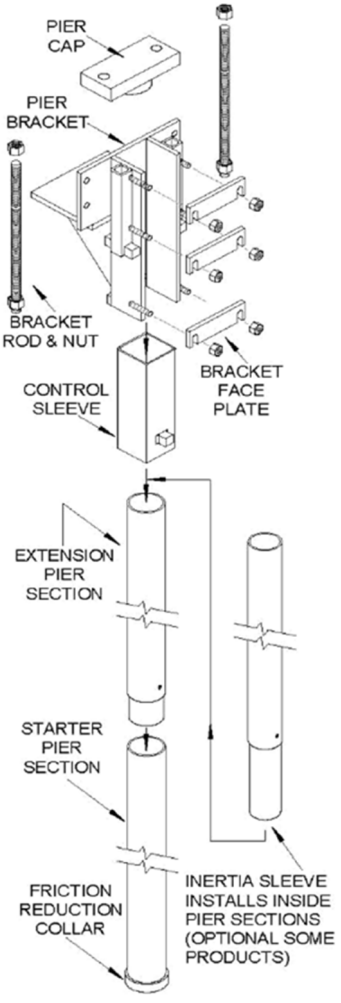

FIGURE 4—ECP STEEL PIERS™ SYSTEM COMPONENTS

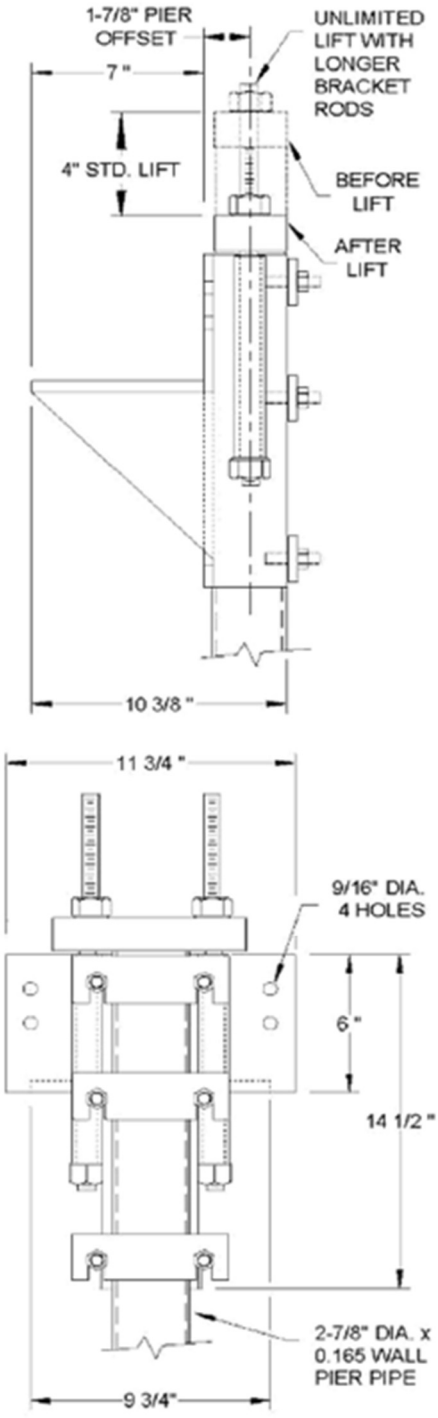

FIGURE 5—PPB-300 BRACKET DETAILS

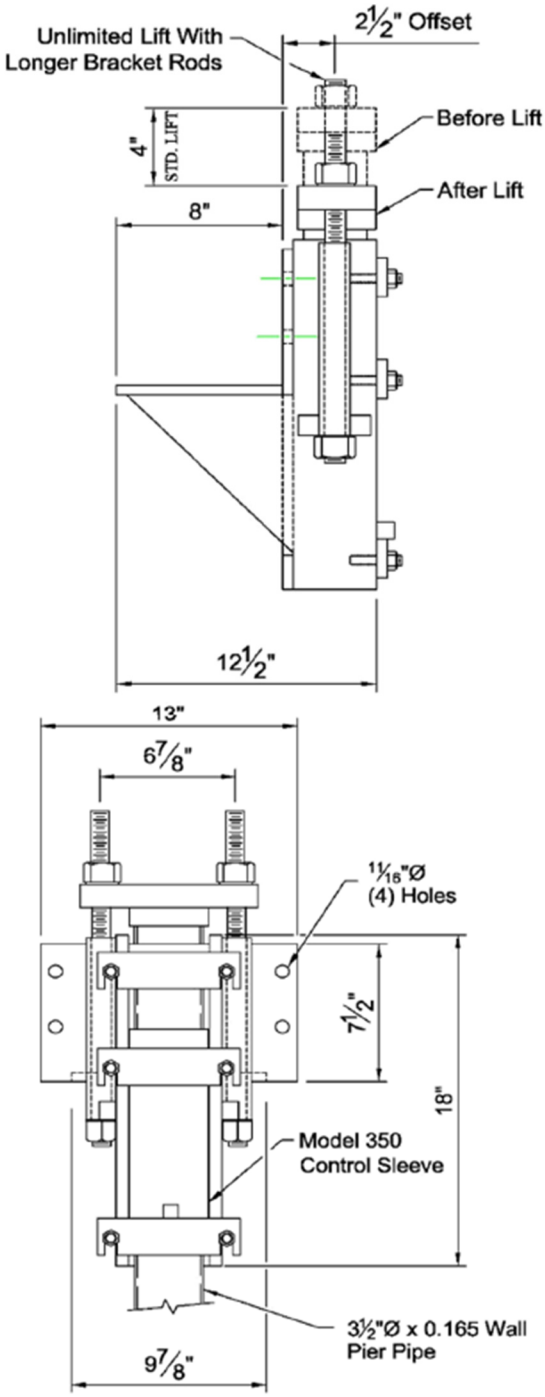

FIGURE 6—PPB-350 BRACKET DETAILS

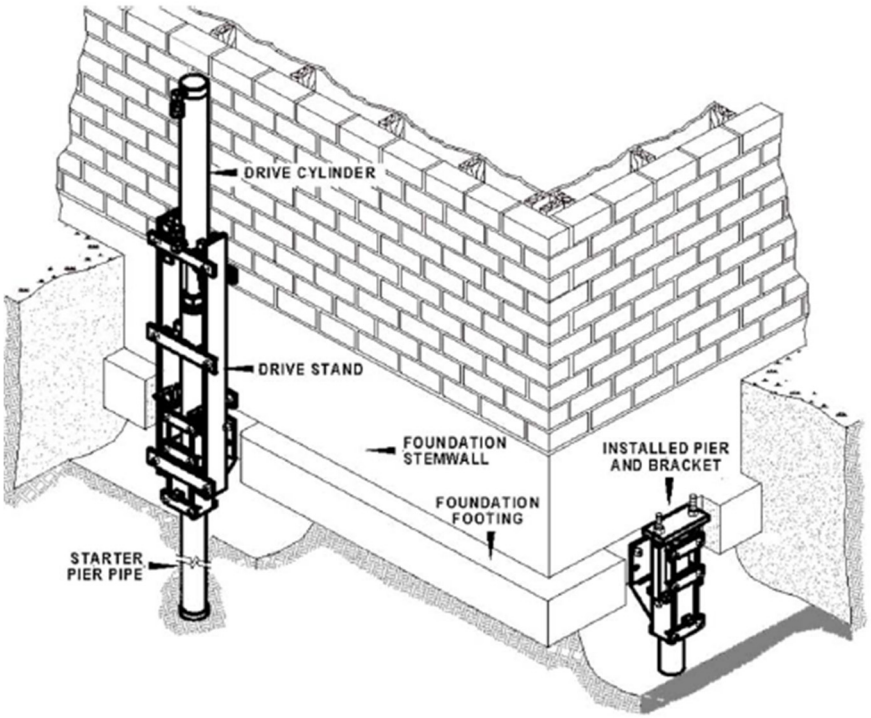

FIGURE 7—INSTALLATION OF TYPICAL ECP STEEL PIERS™ SYSTEM

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

REPORT HOLDER:

EARTH CONTACT PRODUCTS, LLC

EVALUATION SUBJECT:

EARTH CONTACT PRODUCTS (ECP) STEEL PIERS™ SYSTEMS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Earth Contact Products (ECP) Steel Piers™ Systems, described in ICC-ES evaluation report ESR-4471, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code edition:

2020 *City of Los Angeles Building Code* (LABC)

2.0 CONCLUSIONS

The Earth Contact Products (ECP) Steel Piers™ Systems, described in Sections 2.0 through 7.0 of the evaluation report ESR-4471, comply with the LABC Section 1810 and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Earth Contact Products (ECP) Steel Piers™ Systems described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-4471.
- The design, installation, conditions of use and identification of the driven foundation system are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-4471.
- The design, installation and inspection are in accordance with the additional requirements of LABC Chapters 16, 17 and 18 as applicable.
- The Earth Contact Products (ECP) Steel Piers™ Systems must not be used to resist any horizontal loads.
- Sections 5.2 and 5.12 of the evaluation report ESR-4471 are not applicable to this supplement.

This supplement expires concurrently with the evaluation report, issued May 2020 and revised May 28, 2020.