EVALUATION REPORT Number: 812

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SUPPORTWORKS POWERBRACE™ SYSTEM

CSI Section:

03 01 00 - Maintenance of Concrete
04 01 20 – Maintenance of Unit Masonry

1.0 RECOGNITION

The Supportworks, Inc. PowerBrace™ system, recognized in this report, has been evaluated for use as a retrofit bracing system for stabilizing existing below-grade foundation walls. The structural performance properties of the Supportworks, Inc. PowerBrace system complies with the intent of the provisions of the following codes and regulations:

- 2021, 2018, 2015, 2012, 2009, and 2006 International Building Code® (IBC)
- 2021, 2018, 2015, 2012, 2009, and 2006 International Residential Code® (IRC)

2.0 LIMITATIONS

Use of the PowerBrace system recognized in this report is subject to the following limitations:

2.1 The PowerBrace system is manufactured, identified, and installed in accordance with this report, approved construction documents (engineering drawings and specifications), and the manufacturer's published installation instructions. In case of conflicts, the more restrictive governs.

2.2 The PowerBrace system has been evaluated for foundation use in resisting inward lateral wall movement and loads due to earth pressure excluding seismic hazards and dynamic seismic lateral earth pressure. Other loading conditions, including axial loads, have not been evaluated.

2.3 The ability of the wall to transfer the load to the PowerBrace system is outside the scope of this report.

2.4 The PowerBrace system has not been evaluated for use in realignment or straightening the foundation walls.

2.5 The use of brackets with screw anchors is limited to use with uncracked concrete and in Seismic Design Categories A and B. Uncracked concrete in the region of the anchorage may be assumed provided analysis indicates no cracking at service loads in accordance with ACI 318-19 17.6.2.5 and 17.7.2.5, ACI 318-14 17.4.2.6 and 17.5.2.7 or ACI 318-11 D.5.2.6 and D.6.2.7. The analysis for the determination of crack formation shall include the effects of restrained shrinkage, as applicable in accordance with ACI 318-19 and ACI 318-14 24.4.2 or ACI 318-11 7.12.1.2.

2.6 The PowerBrace beam shall not impose eccentric loads on the top and bottom brackets.

2.7 The adequacy of the existing structure is outside the scope of this report and, when required by the building official, shall be verified by a registered design professional, and submitted for approval.

2.8 The PowerBrace™ system is manufactured at Power Brace, LLC, Des Moines, Iowa.

3.0 PRODUCT USE

3.1 General: The Supportworks, Inc. PowerBrace system is used to stabilize below-grade foundation walls that exhibit inward displacement due to lateral earth pressure from the retained soils. Steel beams are installed vertically at a given interval and connected to the floor above and the slab below using connections described in this report.

3.2 Design:

3.2.1 System Requirements: The required beam spacings for bowing and leaning walls have been evaluated for, wall heights, and backfill heights as detailed in Tables 1 and 2 of this report.

3.2.2 Beam Selection: The system includes two beams; S4x7.7 and a W4x13. Which to use is determined by the location of maximum displacement of the foundation wall. The notes in Tables 1 and 2 of this report define which beam to use for each situation.

3.2.3 Top Connection with Wood Joists Parallel to the Stabilized Wall: The system utilizes the lever bracket assembly for the top connection when the floor joists run parallel to the wall. Wood members connected to the bracket shall have a minimum specific gravity of 0.50. The lever bracket transfers the compression load to a low-profile steel runner, which is used to distribute the load to the floor system (Figure 3).

3.2.4 Top Connection with Wood Joists Perpendicular to the Stabilized Wall: The system utilizes either the Steel Bridge bracket or Alternate Wood Bridge bracket for the top connection when the floor joist runs perpendicular to the wall (Figures 1 and 2 of this report). Wood members connected to

the brackets shall have a minimum specific gravity of 0.50. The Steel Bridge bracket can span 12 inches (305 mm) to 15¾-inches (400 mm) between joists and the Wood Bridge bracket can span up to 24 inches (610 mm) between joists.

3.2.5 Top Connection with Concrete Slab: The system utilizes a Concrete Deck Bracket for installations where the top bracket is attached to a concrete slab. The concrete deck bracket is designed to be used with a minimum of 4¾-inch-thick (121 mm) concrete slabs with a minimum compressive strength of 2,500 psi (17.2 MPa). The concrete deck bracket is attached by screw anchors as detailed in Section 3.3.2.4 of this report.

3.2.6 Bottom Connection to a Concrete Slab: The bottom of the beam may be connected to the concrete floor slab using a bottom bracket and screw anchors as detailed in Section 3.3.3.1 of this report. Alternatively, the beam may be directly embedded into the concrete slab, as described in Section 3.3.3.2 of this report. Both connections were evaluated for use on a full concrete slab having a minimum compressive strength of 2,500 psi (17.2 MPa) and a minimum thickness of 3½ inches. Connection to concrete placed or located at support locations only has not been evaluated.

3.3 Installation:

3.3.1 Installation General: The PowerBrace system shall be installed by Supportworks trained dealers in accordance with this report, and the manufacturer's published installation instructions. In case of conflicts, the more restrictive governs. PowerBrace beams shall be spaced in accordance with Tables 1 and 2. The selected beam size shall be cut to the required length. The top bracket and bottom connection shall be selected based on the configuration that corresponds to the structure, location of maximum wall displacement, and the concrete slab requirements as defined in Section 3.2.6 of this report.

3.3.2 Top Bracket Installation: The top bracket is selected based on the structure above. Beams shall be in line with the top connection to not introduce any eccentricity. With the bottom of the beam placed against the wall, the location of the beam on the structure above shall be determined.

3.3.2.1 Steel Bridge Bracket Installation (Wood Joists Perpendicular to Wall): The steel bridge bracket shall be placed in the joist cavity aligned with the marked beam location. Bolts, washers, and nuts shall be installed to secure the bracket to the joists. The tightening bolt, T-Nut, and top plate shall be installed snug against the beam (Figure 1 of this report).

3.3.2.2 Wood Bridge Bracket Installation (Alternate for Wood Joists Perpendicular to Wall): The wood bridge bracket saddle supports shall be placed in the joist cavity aligned with the beam location. Bolts, washers, and nuts shall be used to secure the brackets to the joists. Two-by-eight or larger lumber shall be cut to fit and slide into the saddles. The font plate shall be secured against the lumber. The tightening bolt, front plate, and top plate shall be installed snug against the beam (Figure 2 of this report).

3.3.2.3 Lever Bracket Installation (Wood Joists Parallel to Wall): Wood blocking shall be installed where the lever bracket is used. Full-depth blocking shall be placed the length of the top bracket runner, alternating from one edge to the other, centered on the top bracket runner fastening locations. The bay closest to the lever bracket shall include double blocking. Blocking shall be fastened in accordance with the applicable code. The lever bracket shall be secured with the pivot bolt and nut. The top bracket runner shall be secured below the blocking and against the bracket with the wood screws. The tightening bolt and top plate shall be installed snug against the beam. Figure 3 of this report details fastening for lever bracket installation.

3.3.2.4 Concrete Top Bracket Installation: The concrete deck bracket shall be aligned with the beam location. Holes shall be drilled and the concrete screw anchors installed. The Hilti KH-EZ 1/2-inch diameter (13 mm) by 3-inch-long (76 mm) screw anchors shall be installed per the anchor manufacturer's published installation instructions, evaluation report, and special inspection requirements, with a minimum nominal embedment of 2⅝ inches (67 mm). The bracket installation is illustrated in Figure 4 of this report

3.3.3 Beam Bottom Installation: The bottom of the PowerBrace beam shall be restrained with a bottom bracket or embedded in the concrete floor slab in accordance with Tables 1 and 2.

3.3.3.1 Beam Bottom Bracket Installation: The PowerBrace beam shall be placed on the floor against the wall and aligned with the installed top bracket. The bottom bracket shall be centered on the beam. HILTI KH-EZ ½-inch-diameter (13 mm) diameter by 3-inch-long (76mm) screw anchors shall be installed, per the anchor manufacturer's published installation instructions, (MPII), evaluation report, and special inspection requirements with a minimum nominal embedment of 2⅝ inches (66.7 mm). The anchor shall have a minimum cover of 1½ inches, which may include the wall footing. Verification of the concrete cover, when required for installation, shall be done in a location that will not affect the system and anchor performance. The bottom beam installation is detailed in Figures 5a and 5b of this report.

3.3.3.2 Bottom Beam Embedment Installation (when required by Tables 1 and 2): The existing slab shall be removed around the base of the beam location. With the bottom of the beam against the bottom of the wall, resting on the wall footing and aligned with the top bracket, new concrete having a minimum of 2,500 psi (17.2 MPa) compressive strength, shall be placed around the PowerBrace beam. The Concrete shall be in contact with the wall, slab edges, and the beam and level with the existing slab. The system shall not be tightened per Section 3.3.4 of this report until the concrete has reached the minimum compressive

strength. Beam embedment is detailed in Figure 6 of this report.

3.3.4 Tightening the System: After all the components are assembled and in proper alignment, the connections shall be tightened in accordance with the requirements given in Tables 1 and 2 of this report using a torque wrench.

4.0 PRODUCT DESCRIPTION

4.1 General: The PowerBrace system described in this report has two steel beam options and three top connection bracket options. The connection at the bottom of the beam to the concrete floor slab is performed by; the use of one of two bracket types with screw anchors or direct embedment into the concrete slab. The steel beam finish is either hot-dipped galvanized in accordance with ASTM A123 or zinc-coated in accordance with ASTM B633, with thickness class Fe/Zn 8. All other steel system components are zinc coated in accordance with ASTM B633, with thickness class Fe/Zn 8.

4.2 Top Brackets

4.2.1 PBTBEXP Steel Bridge Bracket Assembly: The bracket assembly is manufactured from No. 10 gauge steel plate conforming to ASTM A572 Grade 50 or other High-Strength, Low-Alloy (HSLA) steel with equal or better mechanical properties. The bracket assembly is attached to the wood floor joists using two 0.75-inch diameter (19.1 mm) by 3-inch-long (76.2 mm) ASTM A307 Grade A bolts with SAE J995 Grade 2 nuts and matching washers at each joist. The assembly is illustrated in Figure 1 of this report.

4.2.2 PB2TB1 Alternate Wood Bridge Bracket Assembly: The bracket assembly is manufactured from No. 12 gauge steel conforming to ASTM A1011, with a minimum yield strength of 41 ksi (283 MPa) and a minimum tensile strength of 49 ksi (338 MPa). The bracket assembly uses two 2x8 wood studs with a minimum SG of 0.50 and is attached to the wood floor joists using two 0.75-inch diameter (19 mm) by 3-inch long (76 mm) ASTM A307 Grade A bolts with SAE J995 Grade 2 nuts and matching washers at each joist. The assembly is illustrated in Figure 2 of this report.

4.2.3 PB2TB2 and PB2TBR Lever Bracket and Runner Assembly: The lever bracket and runner are manufactured from 0.31-inch-thick (8 mm) and No. 10 gauge steel plates, respectively. The steel plate conforms to ASTM A572 Grade 50 or other HSLA steel with equal or better mechanical properties. The lever bracket is attached to the floor joist with wood blocking and one 0.75-inch (19 mm) diameter ASTM A307 Grade A bolt and SAE J995 Grade 2 nut. The assembly is illustrated in Figure 3 of this report.

4.2.4 PB2TBC Top Concrete Deck Bracket: The top concrete deck bracket consists of an 8-inch (203 mm) by 10.78-inch (274 mm) bent steel plate with a factory-welded 1-inch (25 mm) nut conforming to SAE J995 Grade 5. The steel plate is 0.31-inches (8 mm) thick and conforms to ASTM A36 with a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa) or other HSLA steel with equal or better mechanical properties. The bracket installation is illustrated in Figure 4 of this report.

4.2.5 PB2TBW4 (W4) and SJ288TPS4 (S4) Beam Top Plates: The top plates interact between the top brackets and the W4 or S4 beam. The top plates are manufactured from 0.18-inch-thick (5 mm) bent steel plates conforming to ASTM A36 with a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa) or other HSLA steel with equal or better mechanical properties. The top plates have a factory-welded 1.5-inch (38 mm) outside diameter and 1-inch (25 mm) inside diameter steel tube conforming to ASTM A519 CDS Grade 1018, 1020, or 1026 or ASTM A513 Type 5 Grade 1026 with a minimum yield strength of 60 ksi (414 MPa) and a minimum tensile strength of 70 ksi (483 MPa). The top plates are shown in Figures 1, 2, 3, and 4 of this report.

4.2.6 PBHW-0906 or PBHW-0901 Tightening Bolt- The tightening bolt is used to transfer load from the beams to the top brackets (Figures, 1, 2, 3, and 4 of this report). The bolt is a 1-inch-diameter (25 mm) fully threaded standard hex tap bolt conforming to ASTM A307. It is 9-inches (229 mm) long for PBHW-0906 or 5-inches (127 mm) long for PBHW-0901.

4.2.7 PBTBTN Steel Bridge Bracket T-Nut and PB2TB3 Wood Bridge Bracket Nut: The PBTBTN T-nut is used with the tightening bolt to transfer the load to the steel bridge bracket assembly. The T-nut is manufactured from a 0.25-inch (6 mm) steel plate conforming to ASTM A572 Grade 50 or other HSLA steel with equal or better mechanical properties. The PB2TB3 nut is used to transfer the load to the wood bridge bracket assembly. The nut is manufactured from a 0.38-inch-thick (10 mm) steel plate conforming to ASTM A36 with a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa) or other HSLA steel with equal or better mechanical properties. The PB2TB3 steel plate also has a factory-welded 1-inch-diameter (25 mm) nut conforming to SAE J995 Grade 5.

4.3 PBB and PBBW4 PowerBrace Beams: The PowerBrace beams are used to transfer wall loads to the top and bottom bracket assemblies. The PBB is an S4x7.7 beam and the PBBW4 is a W4x13 beam. The steel beams conform to ASTM A572, Grade 50, or other HSLA steel with equal or better mechanical properties.

4.4 PB2BB1 and EBPBBB Bottom Brackets: The bottom brackets are fastened to the concrete floor slab using screw anchors and provide lateral support at the bottom of the beam. The PB2BB1 is used with the S4x7.7 beam and the EBPBBB is used with the W4x13 beam. The PB2BB1 and EBPBBB brackets are manufactured from ¼-inch-thick (6 mm) thick and 0.38-inch-thick (10 mm) bent steel plates, respectively. Both brackets use steel plates conforming to ASTM A572,

Grade 50, or other HSLA steel with equal or better mechanical properties.

5.0 IDENTIFICATION

The PowerBrace system is assembled into kits. PowerBrace kits and components are identified by labels on kits and components that include; the report holder's name (Supportworks, Inc.); the name and address of Power Brace, LLC, the product name, the model number or part number; and the IAPMO UES evaluation report number (ER-812). The IAPMO Uniform Evaluation Service Mark of Conformity may also be used as shown below

IAPMO UES ER-812

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with IAPMO UES Evaluation Criteria for Joist Hangers and Miscellaneous Connectors, EC002, adopted August 2018, editorially revised January 2021.

6.2 Engineering Analysis.

6.3 Test Reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on Supportworks, Inc. PowerBrace system to assess conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product certification. Products are manufactured at locations noted in Section 2.8 of this report under a quality control program with periodic inspection under the supervision of IAPMO UES.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org

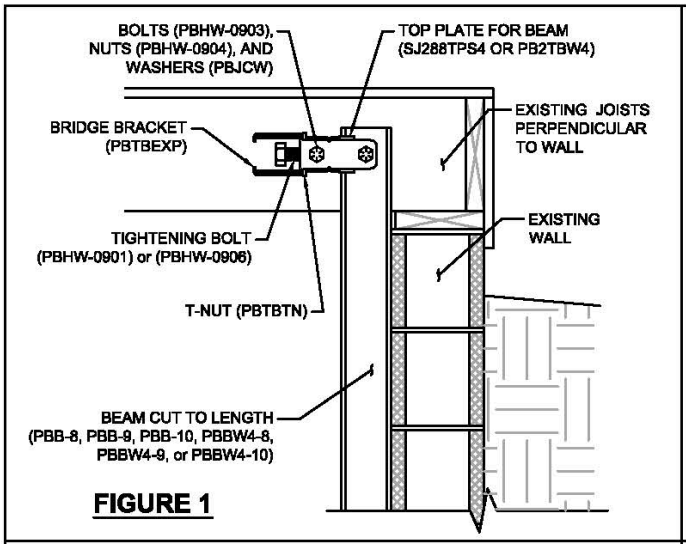

FIGURE 1

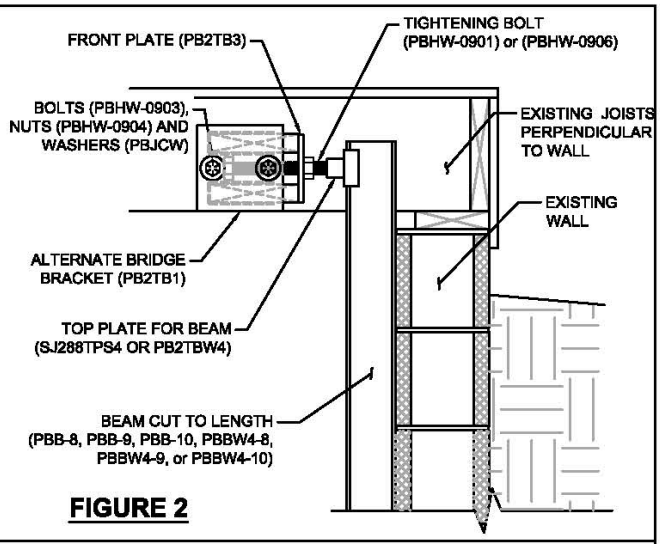

FIGURE 2

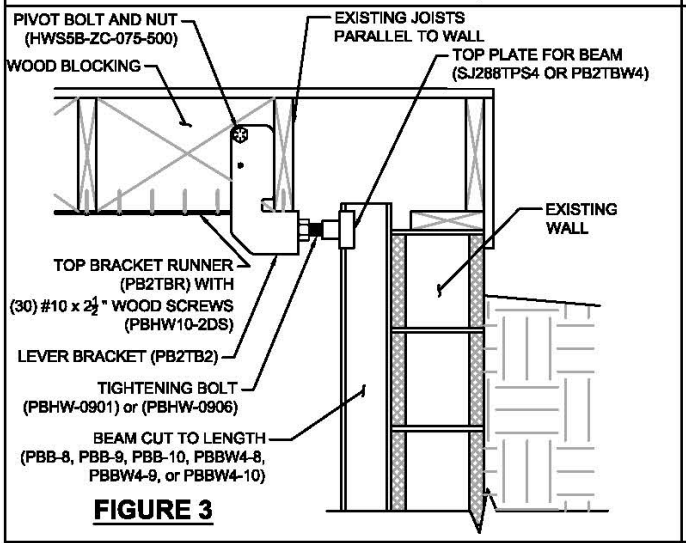

FIGURE 3

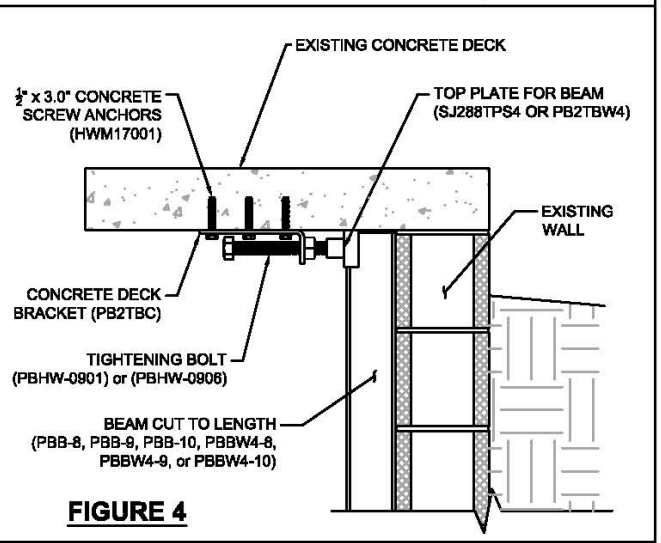

FIGURE 4

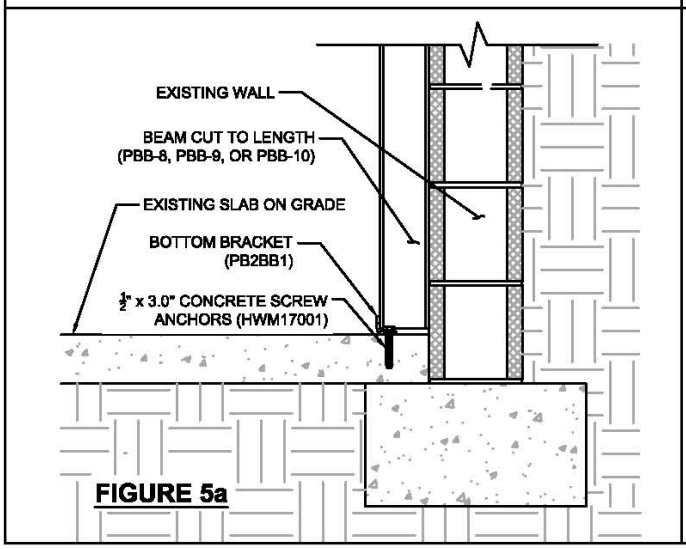

FIGURE 5a

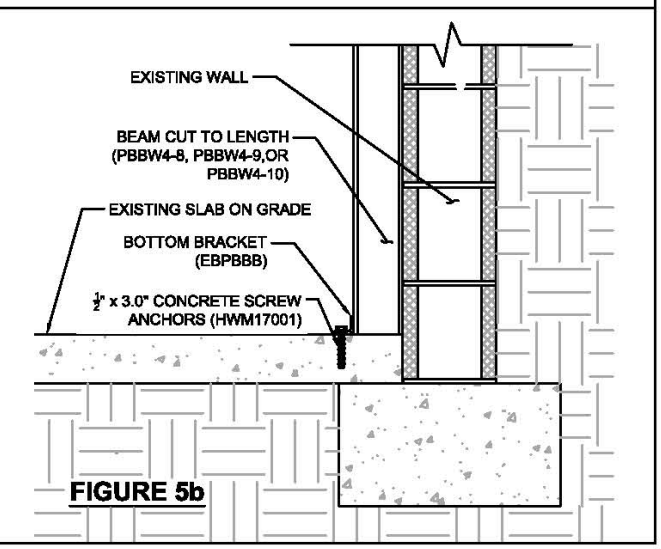

FIGURE 5b

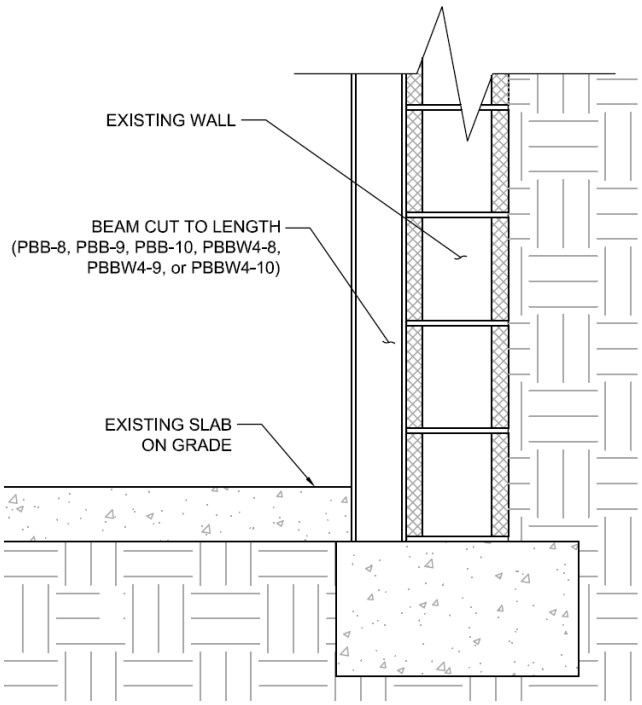

FIGURE 6

TABLE 1 -SPACING RECOMMENDATIONS FOR LEANING (POURED CONCRETE) WALLS[1] (ft)

Backfill Elevation Below Top of Wall (ft)	Wall Height	
	8 ft	9 ft
Full Backfill	4.0	3.0
1	5.5	4.0
2	6.0	5.5
3	6.0	6.0
4	6.0	6.0
5	6.0	6.0

TABLE 2- SPACING RECOMMENDATIONS FOR BOWING (BLOCK) WALLS[2,3] (ft)

Backfill Elevation Below Top of Wall (ft)	Wall Height		
	7ft-4in (11 Courses)	8ft (12 Courses)	8ft-8in (13 Courses)
Full Backfill	4.5	4.0	3.0
1	5.5	4.5	4.0
2	6.0	5.5	4.0
3	6.0	6.0	5.5
4	6.0	6.0	5.5
5	6.0	6.0	6.0

[1] For leaning wall application, a trough of 50 ft-lb shall be applied to the tightening bolt at the top bracket.

[2] For bowing wall applications, a torque of 45 ft-lb shall be applied to the tightening bolt at the top bracket.

[3] The S4x7.7 beam shall be used when the maximum displacement of the wall occurs within 32 inches from the top of the wall. The W4x13 beam shall be used when the maximum displacement of the wall occurs between 32 inches and 62 inches from the top of the wall. The bottom of the W4x13 shall be embedded in concrete when the maximum displacement occurs below 40 inches from the top of the wall. Deflections occurring lower than 62 inches from the top of the wall requires an engineering design using recognized engineering principles as described in IBC Section 1604.4, and shall be prepared by a registered design professional and provided to the building official for approval.