

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

DIVISION: 04—MASONRY
Section: 04081—Masonry Anchorage

DIVISION: 05—METALS
Section: 05090—Metal Fastenings

REPORT HOLDER:

HILTI, INC.
5400 SOUTH 122nd EAST AVENUE
TULSA, OKLAHOMA 74146
800-879-8000
www.us.hilti.com

EVALUATION SUBJECT:

LOW-VELOCITY POWER-DRIVEN TRACK FASTENERS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)
- 1999 *Standard Building Code*® (SBC)

Properties evaluated:

Structural

2.0 USES

Hilti low-velocity power-driven track fasteners are used to attach light-gage cold-formed steel framing to concrete, structural lightweight concrete, metal decks with structural lightweight concrete fill, concrete masonry units (CMU) and steel-base materials. The fasteners are alternatives to the cast-in-place anchors described in IBC Sections 1911 and 1912, UBC Section 1923.1, and SBC Section 1914 for placement in concrete; the embedded anchors described in Section 2.1.4 of ACI 530 (which is referenced in IBC Section 2107) and UBC Section 2107.1.5 for placement in grouted masonry; and the bolts used to attach materials to steel, described in IBC Section 2204.2 and UBC Section 2205.11. The fasteners may be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

Hilti low-velocity power-driven track fasteners are manufactured from hardened steel complying with the manufacturer's quality documentation.

3.1.1 X-EGN and X-GN: The X-EGN fastener is a gas driven fastener for installation into steel. It has a tapered smooth shank with a nominal diameter at the base of 0.118 inch (3.0 mm). The X-GN fastener is a gas driven fastener for installation into concrete, CMU, and concrete filled metal deck. It has a tapered smooth shank with a nominal diameter at the base of 0.118 inch (3.0 mm). All fastener head diameters are 0.268 inch (6.8 mm). The fasteners have a 2-to-8-micron zinc finish, and are collated into plastic strips of ten fasteners each.

3.1.2 X-DAK: The X-DAK fastener is a powder-actuated fastener for installation into steel. It has a stepped shank with a nominal diameter at the base of 0.145 inch (3.7 mm). The fastener is zinc-plated to ASTM B 633, SC1, Type III. Single fasteners are supplied with a premounted plastic washer. Collated fasteners are also available.

3.1.3 X-DW: The X-DW fastener is a powder-actuated fastener for installation into steel, concrete, CMU and concrete filled metal deck. It has a smooth shank with a nominal diameter of 0.118 inch (3.0 mm). The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.1.4 X-ZF: The X-ZF fastener is a powder-actuated fastener for installation into steel, concrete, CMU, and concrete filled metal deck. X-ZF fasteners with shank lengths of $\frac{9}{16}$ inch (14.3 mm), $\frac{3}{4}$ inch (19.1 mm) and $2\frac{7}{8}$ inch (73 mm) have a shank diameter of 0.145 inch (3.7 mm). All other X-ZF fasteners have a shank diameter of 0.138 inch (3.5 mm). The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.1.5 X-ZF22P8T: The X-ZF22P8T fastener is a powder-actuated fastener for installation into concrete and concrete filled metal deck. It has a shank diameter of 0.138 inch (3.5 mm) and is supplied with a premounted steel tophat washer. The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.1.6 X-ZF20 THP: The X-ZF20 THP fastener is a powder-actuated fastener for installation into structural lightweight concrete and concrete filled metal deck. It has a shank diameter of 0.138 inch (3.5 mm) and is supplied with a premounted plastic tophat washer. The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.1.7 X-S13 THP: The X-S13 THP fastener is a powder-actuated fastener for installation into steel. It has a shank diameter of 0.145 inch (3.7 mm) and is supplied with a premounted plastic tophat washer. The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.1.8 X-S16P8TH: The X-S16P8TH fastener is a powder actuated fastener for installation into steel. It has a shank diameter of 0.145 inch (3.7 mm) and is supplied with a premounted steel tophat washer and a plastic washer. The fastener is zinc-plated to ASTM B 633, SC1, Type III.

3.2 Materials:

3.2.1 Normal-weight Concrete: Normal-weight concrete must be stone-aggregate and comply with Section 1905 of the

IBC, Section 402.2 of the IRC, Section 1905 of the SBC or Section 1903 of the UBC, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Table 2.

3.2.2 Structural Lightweight Concrete: Structural lightweight concrete must be sand- lightweight and must comply with Section 1905 of the IBC, Section 1905 of the SBC or Section 1903 of the UBC, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Tables 3 and 4.

3.2.3 Concrete Masonry Units (CMU): Concrete masonry units must be nominally 8 inches (203 mm) thick, minimum, normal weight block, complying with ASTM C 90 (IBC, IRC, SBC), or UBC Standard 21-4 as Grade N, Type 1. Mortar must be Type N (minimum) in accordance with Section 2103.8 of the IBC, Section R607 of the IRC, Table 2104.7A or Table 2104.7B of the SBC, or Section 2103.3 of the UBC. Grouted concrete-masonry construction must be fully grouted and must have minimum prism strength of 1,500 psi (10.3 MPa) at the time of fastener installation. Grout must comply with Section 2103.12 of the IBC, Section R609.1.1 of the IRC, Table 2104.7C of the SBC, or Section 2103.4 of the UBC, as coarse grout.

3.2.4 Steel: Structural steel used in supports must comply with the applicable referenced standard and must have minimum yield and tensile strengths and thickness as noted in Table 1.

3.2.5 Steel Deck: Where fasteners are placed through a steel deck into structural lightweight concrete in accordance with Tables 3 and 4 and Figures 1, 2 and 3, the steel deck must comply with the applicable reference standard. See the footnotes to Tables 3 and 4 for additional deck requirements.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The allowable tension and shear loads for fasteners installed in structural steel are shown in Table 1 and 2, respectively. The allowable tension and shear loads with required embedment depths, for fasteners installed in normal-weight concrete are shown in Table 2. The allowable tension and shear loads for fasteners installed in structural lightweight concrete are shown in Table 3. The allowable tension and shear loads for fasteners installed through steel deck into structural lightweight concrete fill are shown in Tables 3 and 4. The allowable tension and shear loads with required embedment depths for fasteners installed in hollow and grouted concrete-masonry construction, are shown in Table 5.

Allowable loads for fasteners subjected to combined shear and tension forces are determined by the following formula:

$$(P_s/P_t) + (V_s/V_t) \leq 1$$

where:

P_s = Applied service tension load, pounds (kg).

P_t = Allowable tension load, pounds (kg).

V_s = Applied service shear load, pounds (kg).

V_t = Allowable shear load, pounds (kg).

4.2 Installation:

Fastener installation requires a Hilti low-velocity power-actuated tool used in accordance with the manufacturer's published installation instructions.

When installation is in steel, minimum spacing between fasteners is 1 inch (25 mm) on center, and minimum edge distance is $1/2$ inch (12.7 mm). Unless otherwise noted, when

installation is in normal-weight and structural lightweight concrete, minimum spacing between fasteners is 4 inches (102 mm) on center and minimum edge distance is 3 inches (76 mm). Unless otherwise noted, concrete thickness must be a minimum of three times the embedment depth of the fastener. For concrete masonry units, the minimum fastener spacing is 8 inches (203 mm), and the minimum edge (boundary) distance is 8 inches (203 mm), with no more than one power-driven fastener installed per individual CMU cell.

For fasteners installed into concrete or masonry, the fasteners must not be driven until the concrete or masonry has reached the designated strength.

4.3 Connections of Drywall Tracks to Foundation:

Attachment of cold-formed steel tracks to the perimeter of concrete slabs is allowed under the following conditions:

1. No cold joint exists between the slab and foundation below the track.
2. Track is not installed on slabs supported by concrete block foundation walls.

5.0 CONDITIONS OF USE

The Hilti low-velocity power-driven track fasteners described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Fasteners are manufactured and identified in accordance with this report.
- 5.2 Fasteners must be installed in accordance with this report and the manufacturer's published installation instructions. In the event of conflicts between this report and the manufacturer's published installation instructions, this report governs.
- 5.3 The allowable tension and shear values must comply with Section 4.1 of this report. Calculations demonstrating that the applied loads are less than the allowable loads described in this report must be submitted to the code official for approval.
- 5.4 Use of fasteners in resisting earthquake loads is outside the scope of this report.

Exception: Fasteners used with architectural, electrical and mechanical components as described in the exceptions to Section 13.1.4 of ASCE/SEI 7 (IBC and IRC), subject to the limitations of Section 13.4.5 of ASCE 7.

- 5.5 The use of fasteners attaching cold-formed-steel tracks to foundations must comply with Section 4.3 of this report.
- 5.6 The fasteners must be limited to dry, interior locations.
- 5.7 The use of fasteners is limited to installation in uncracked concrete or masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven in Concrete, Steel, and Masonry Elements (AC70), dated October 2006.

7.0 IDENTIFICATION

Hilti low-velocity power-driven track fasteners must be identified by an "H" imprinted on the fastener head. All fasteners must be packaged in containers that bear the fastener type and size, the manufacturer's name (Hilti, Inc.), and the evaluation report number (ESR-1752).

TABLE 1—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO STEEL^{1,2,3,4,8} (lbs.)

FASTENER DESCRIPTION	FASTENER	SHANK DIAMETER (INCH)	STEEL THICKNESS (INCH)											
			$\frac{1}{8}$		$\frac{3}{16}$		$\frac{1}{4}$		$\frac{3}{8}$		$\frac{1}{2}$		$\frac{3}{4}$	
			Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
Track Fastener	X-S13 THP	0.145	140	300	300	450	300	450	300	450	--	--	--	--
Drywall Track, Smooth Shank w/Metal Tophat Washer	X-S16P8TH	0.145	--	--	225	420	225	430	225	430	225	430	--	--
Stepped Shank Knurling Lengthwise	X-DAK ⁷	0.145	160 ⁵	370 ⁵	180	370	230	370	420	470	365	500	365 ⁵	500 ⁵
Drywall Track Smooth Shank	X-DW	0.118	--	--	240	375	280	375	--	--	--	--	--	--
Track Fastener	X-EGN ⁶	0.118	140	230	220	245	225	290	280	330	--	--	--	--
Track Fastener	X-EGN ^{5,6}	0.118	--	--	220	295	260	355	280	385	--	--	--	--

For **SI**: 1 inch = 25.4 mm, 1 ksi = 6.89 MPa, 1 lbf = 4.44N.

¹The tabulated allowable load values are for the fastener only. Wood or steel members connected to the steel substrate must be investigated in accordance with accepted design criteria.

²The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1609.1 of the SBC and Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

³Unless otherwise noted, fasteners must be driven to where the point of the fastener penetrates through the steel base material.

⁴Unless otherwise noted, steel base material must have minimum yield and tensile strengths (F_y and F_u) equal to 36 ksi and 58 ksi, respectively.

⁵Steel base material must have minimum yield and tensile strengths (F_y and F_u) equal to 50 ksi and 65 ksi, respectively.

⁶For steel base-material thickness greater than or equal to $\frac{3}{8}$ inch, fastener point penetration through the steel is not necessary, provided a minimum embedment of 0.320 inch is achieved.

⁷X-DAK fasteners installed into greater than $\frac{1}{2}$ -inch thick steel require $\frac{3}{8}$ -inch minimum penetration.

⁸Earthquake load resistance is outside the scope of this report, except as noted in Section 5.4

TABLE 2—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO NORMAL-WEIGHT CONCRETE^{1,2,3,4,5} (lbs.)

FASTENER DESCRIPTION	FASTENER	DIAMETER (INCH)	EMBEDMENT (INCHES)	CONCRETE COMPRESSIVE STRENGTH			
				2,000 PSI ⁶		4,000 PSI	
				TENSION	SHEAR	TENSION	SHEAR
Track Fastener	X-GN	0.118	$\frac{3}{4}$	95	120	95	120
			1	115	220	115	220
Standard Nail	X-ZF	0.138	$\frac{3}{4}$	45	75	60	105
			1	85	150	90	200
			$1\frac{1}{4}$	130	210	130	290
Drywall Track Nail	X-ZF22P8T	0.138	$\frac{3}{4}$	55	130	90	170
Drywall Track Nail	X-DW	0.118	$\frac{5}{8}$	15	55	45	55
			$\frac{3}{4}$	60	65	90	65

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.8948 kPa, 1 pound = 4.45N.

¹The tabulated allowable load values are for the fastener only. Wood or steel members connected to the concrete substrate must be investigated in accordance with accepted design criteria.

²Fasteners must not be driven until the concrete has reached the designated minimum compressive strength.

³Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

⁴The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1609.1 of the SBC and Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

⁵Earthquake load resistance is outside the scope of this report, except as noted in Section 5.4

**TABLE 3—ALLOWABLE LOADS FOR FASTENERS INSTALLED
IN MINIMUM 3,000 psi STRUCTURAL LIGHTWEIGHT CONCRETE^{1,2,3,4,8} (lbs.)**

FASTENER DESCRIPTION	FASTENER	DIAMETER (INCH)	EMBEDMENT (INCHES)	INSTALLED INTO CONCRETE		INSTALLED THROUGH METAL DECK INTO CONCRETE ⁷			
						TENSION		SHEAR	
				TENSION (LBS.)	SHEAR (LBS.)	UPPER FLUTE	LOWER FLUTE	UPPER FLUTE	LOWER FLUTE
Track Fastener	X-GN ⁵	0.118	³ / ₄	115	140	75	85	175	215
			1	170	220	155	160	255	315
Standard Nail	X-ZF ⁶	0.138	³ / ₄	110	175	120	--	265	265
			1	135	180	215	145	485	485
			1 ¹ / ₄	220	260	250	205	500	500
Drywall Track Nail	X-ZF22P8T ⁶	0.138	³ / ₄	110	220	120	60	260	260
	X-ZF20THP ⁶	0.138	³ / ₄	55	110	--	45	285	285
Drywall Track Nail	X-DW ⁶	0.118	³ / ₄	100	180	70	35	170	170
			1	165	210	165	110	270	270

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.8948 kPa, 1 pound = 4.48 N.

¹The tabulated allowable load values are for the fastener only. Wood or steel members connected to the concrete substrate must be investigated in accordance with accepted design criteria.

²Fasteners must not be driven until the concrete has reached the designated minimum compressive strength.

³Unless otherwise noted, concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

⁴The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1609.1 of the SBC and Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

⁵Steel deck profile must be 3-inch-deep composite floor deck with minimum No. 20 gage (0.0359-inch-thick base steel thickness) and minimum yield strength of 38 ksi. Structural lightweight concrete fill above top of metal deck profiles must be 2¹/₂ inches thick for the ³/₄-inch fastener embedment and 3¹/₄ inches for the 1-inch fastener embedment.

⁶The steel deck profile must be 3-inch-deep composite floor deck, 33 mils thick with a 0.0329-inch base-metal thickness and minimum yield strength of 33 ksi. Lower and upper flute width must be a minimum of 4¹/₂ inches. Structural lightweight concrete fill depth above top of metal deck must be a minimum of 3¹/₄ inches.

⁷See Figure 1 for nominal flute dimensions, fastener locations, and load orientations.

⁸Earthquake load resistance is outside the scope of this report, except as noted in Section 5.4

**TABLE 4—ALLOWABLE LOADS FOR FASTENERS INSTALLED
IN MINIMUM 3,000 psi STRUCTURAL LIGHTWEIGHT CONCRETE over 1-1/2-INCH-DEEP, B-STEEL DECK^{1,2,3,4,7,8} (lbs.)**

FASTENER DESCRIPTION	FASTENER	DIAMETER (INCH)	EMBEDMENT (INCHES)	FASTENER LOCATION			
				Installed Through Metal Deck Into Concrete			
				Tension		Shear	
				Upper Flute	Lower Flute	Upper Flute	Lower Flute
Track Fastener	X-GN ⁵	0.118	³ / ₄	75	85	175	215
			1	155	160	255	315
Standard Nail	X-ZF ⁶	0.138	³ / ₄	80	80	315	315
			1	205	205	445	445
Drywall Track Nail	X-ZF22P8T ⁶	0.138	³ / ₄	90	110	295	295
Drywall Track Nail	X-DW ⁶	0.118	³ / ₄	105	65	315	315
			1	210	185	350	350

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.8948 kPa, 1 pound = 4.48 N.

¹The tabulated allowable load values are for the fastener only. Wood or steel members connected to the concrete substrate must be investigated in accordance with accepted design criteria.

²Fasteners must not be driven until the concrete has reached the designated minimum compressive strength.

³Unless otherwise noted, concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

⁴The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1609.1 of the SBC and Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

⁵Steel deck profile must be 1¹/₂-inch-deep, B-type deck, minimum No. 20 gage (0.0359-inch-thick base steel thickness) and minimum yield strength of 38 ksi. Structural lightweight concrete fill above top of metal deck profiles must be 2¹/₂ inches thick for the ³/₄-inch fastener embedment and 3¹/₄ inches for the 1-inch fastener embedment.

⁶The steel deck profiles are 1¹/₂-inch-deep, B-type deck with a thickness of 33 mils (0.0329 inch thick steel) and minimum yield strength of 38 ksi. Fasteners may be installed through the steel deck into structural lightweight concrete having both normal and inverted deck profile orientations with minimum lower flute widths of 1³/₄ and 3¹/₂ inches, respectively. Fasteners must be placed at centerline of deck flutes. Figures 2 and 3 describe additional flute dimensions, fastener locations and load orientations for both deck profiles.

⁷See Figures 2 and 3 for nominal flute dimensions, fastener locations, and load orientations.

⁸Earthquake load resistance is outside the scope of this report, except as noted in Section 5.4

TABLE 5—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN CONCRETE MASONRY UNITS (CMU)^{1,2,3,8,9,10} (lbs.)

FASTENER DESCRIPTION	FASTENER	SHANK DIAMETER	MINIMUM EMBEDMENT	HOLLOW CMU				GROUT FILLED CMU					
				Face Shell ⁴		Mortar Joint		Face Shell ⁴		Mortar Joint		Top of Grouted Cell ⁶	
				Tension	Shear	Tension	Shear ⁵	Tension	Shear	Tension	Shear	Tension	Shear ⁷
Track Fastener	X-GN	0.118	³ / ₄	90	115	65	55	95	120	70	85	65	90
			1	115	130	70	65	130	140	85	120	75	95
Standard Nail	X-ZF	0.138	³ / ₄	40	85	15	50	85	85	45	85	--	--
			1	--	--	--	--	--	--	--	--	115	175
Drywall Track Fastener	X-DW	0.118	1	115	130	30	65	120	140	45	120	120	165

For **SI**: 1 lbf = 4.48N, 1 inch = 25.4 mm.

¹The tabulated allowable load values are for the fastener only. Wood or steel members connected to the masonry substrate must be investigated in accordance with accepted design criteria.

²See Section 3.2.3 for CMU, mortar and grout requirements.

³No more than one fastener may be installed in an individual masonry unit cell.

⁴Fastener can be located anywhere on the face shell.

⁵Shear direction can be horizontal or vertical (bed joint or head joint) along the CMU wall plane.

⁶Fastener located in center of grouted cell installed vertically.

⁷Shear can be in any direction.

⁸Fasteners must be installed a minimum of 8 inches from the end of the wall. Multiple fasteners in a bed joint must be spaced a minimum of 8 inches.

⁹The stress increases and load reductions described in Section 1605.3 of the IBC and the stress increases described in Section 1609.1 of the SBC and Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone.

¹⁰Earthquake load resistance is outside the scope of this report, except as noted in Section 5.4

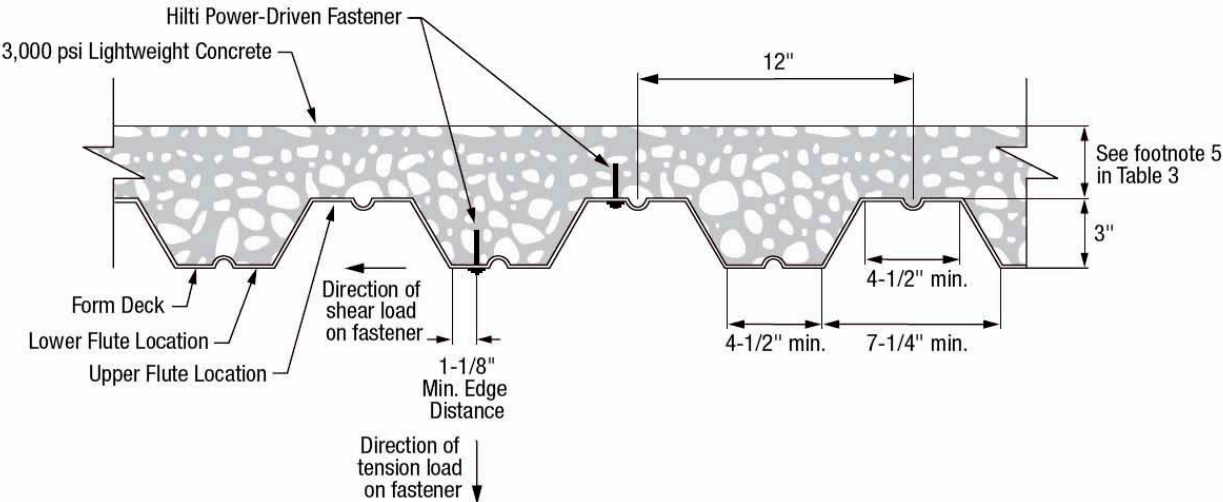


FIGURE 1—HILTI FASTENER INSTALLATION LOCATION IN 3-INCH-DEEP COMPOSITE FLOOR DECK

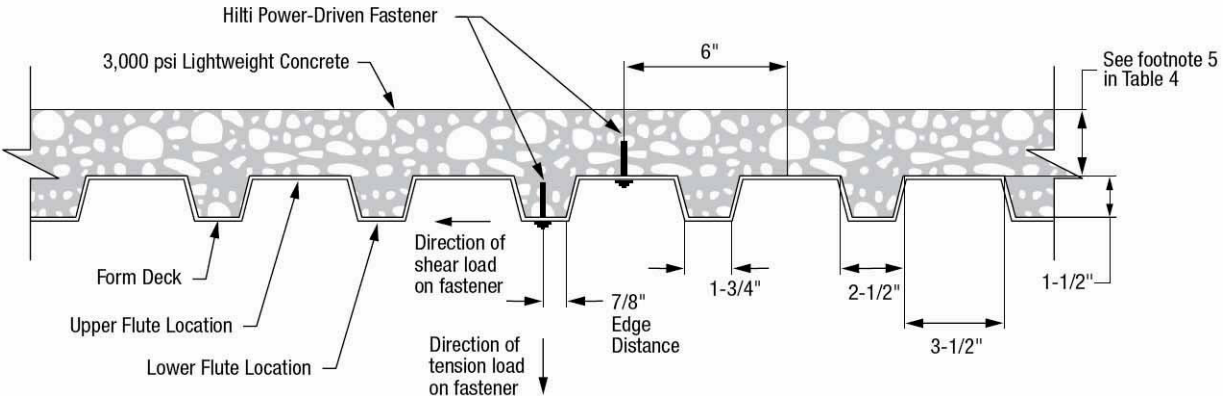


FIGURE 2—HILTI FASTENER INSTALLATION LOCATION IN 1 1/2-INCH-DEEP COMPOSITE FLOOR DECK

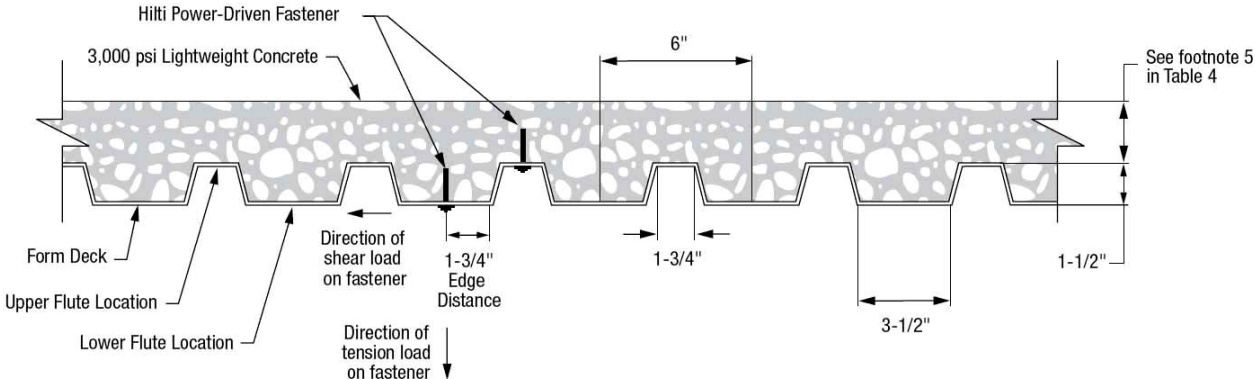


FIGURE 3—HILTI FASTENER LOCATIONS IN 1 1/2-INCH-DEEP COMPOSITE FLOOR DECK, INVERTED DECK PROFILE ORIENTATION