

ICC-ES Evaluation Report

ESR-2811*

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

REPORT HOLDER:

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EVALUATION SUBJECT:

**SIMPSON STRONG-TIE® GDP, GDPS, GDPM, GW AND
 GTH GAS-ACTUATED FASTENERS**

1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2009 *International Building Code*® (2009 IBC)
- 2009 *International Residential Code*® (2009 IRC)
- 2006 *International Building Code*® (2006 IBC)*
- 2006 *International Residential Code*® (2006 IRC)*
- 2003 *International Building Code*® (2003 IBC)*
- 2003 *International Residential Code*® (2003 IRC)*
- 1997 *Uniform Building Code*™ (UBC)*

*Codes indicated with an asterisk are addressed in Section 8.0.

Property evaluated:

Structural

2.0 USES

Simpson Strong-Tie® Gas-Actuated Fasteners described in this report are used for general fastening of building components, such as cold-formed steel framing members, to normal-weight concrete, to structural sand-lightweight concrete, to steel decks filled with structural sand-lightweight concrete, to concrete masonry units (CMUs) and to steel base materials. The fasteners are alternates to the cast-in-place anchors described in IBC Section 1911; the embedded anchors described in Section 2.1.4 of TMS 402/ACI 530/ASCE 5 (which is referenced in IBC Section

2107) for placement in grouted masonry; and the bolts used to attach materials to steel, described in IBC Section 2204.2.

The fasteners may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION
3.1 Fasteners:

Simpson Strong-Tie® GDP and GDPS Gas-Actuated Fasteners are manufactured from steel complying with ASTM A 510, Grade 1060 or 10B60, and austempered to a Rockwell "C" core hardness of 53 to 56.

Simpson Strong-Tie® GDPM, GW, and GTH Gas-Actuated Fasteners are manufactured from steel complying with ASTM A 510 Grade 1060 to 1065 or 10B60 to 10B65, austempered to a Rockwell "C" core hardness of 53 to 56.

See Table 1 for additional descriptions of Simpson Strong-Tie® Gas Actuated fasteners.

3.2 Materials:

3.2.1 Concrete: Normal-weight and structural sand-lightweight concrete must comply with IBC Sections 1903 and 1905 or IRC Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation must be as noted in Tables 2 and 3.

3.2.2 Concrete Masonry Units: Concrete masonry units (CMUs) must be minimum 8-inch-thick (203 mm) lightweight blocks complying with ASTM C 90 for GDP fastener. CMUs must be a minimum 8-inch-thick (203 mm) medium-weight blocks complying with ASTM C 90 for GDPM, GW, and GTH fasteners.

3.2.3 Steel: Structural steel must comply with the minimum requirements of ASTM A 36, ASTM A 572 Grade 50 or ASTM A 992, and have the minimum thicknesses as noted in Table 5.

3.2.4 Steel Deck: Steel deck properties and configurations must be as described in Table 3 and Figures 1A, 1B, 2A and 2B.

4.0 DESIGN AND INSTALLATION
4.1 Design:

4.1.1 General: The allowable tension and shear (pullout) values in Tables 2 through 5 are for use in allowable stress design, and are for fasteners driven into the materials specified. The stress increases and load reductions described in Section 1605.3 of the IBC are not allowed for wind loads acting alone or when combined with gravity

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loads. No increase is allowed for gravity loads acting alone. Except for fasteners used with architectural, electrical and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, use of fasteners to resist earthquake loads is outside the scope of this report.

Allowable tension and shear values for Simpson Strong-Tie® Gas-Actuated Fasteners driven into different base materials may be determined by referencing the applicable tables listed in Table 1.

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

$$(p/P_a) + (v/V_a) \leq 1$$

where:

p = Actual tension load on fastener, lbf (N).

P_a = Allowable tension load on fastener, lbf (N).

v = Actual shear load on fastener, lbf (N).

V_a = Allowable shear load on fastener, lbf (N).

4.1.2 Wood to Steel, Concrete, or Masonry: Reference lateral design values for nails with diameters equal to or less than the diameter of the Simpson Strong-Tie® Gas-Actuated Fasteners and penetration into the main member of 10 fastener diameters, determined in accordance with Part 11 and/or Table 11N of ANSI/AF&PA NDS are applicable to Simpson Strong-Tie® Gas-Actuated Fasteners. The wood element is the side member. The fastener bending yield strength must be limited to the value noted in the footnotes to Table 11N of ANSI/AF&PA NDS, based on the diameter of the Simpson Strong-Tie® Gas-Actuated Fasteners.

4.2 Installation:

The fasteners must be installed with a power fastening tool in accordance with Simpson Strong-Tie® recommendations. The fastening procedures must comply with the Simpson Strong-Tie® published installation instructions. These instructions must be available on the jobsite at all times during fastener installation.

The fasteners must be installed with the fastener penetration, spacing and edge distances specified in this report. Concrete thickness must be a minimum of three times the fastener penetration depth. Face shell thickness of a CMU must be a minimum of 1¹/₄ inches (32 mm). Fasteners must not be installed into concrete until the concrete has reached the specified compressive strength. Fasteners must be placed through the steel deck into the structural sand-lightweight concrete in accordance with Table 3. Installation is limited to dry, interior locations.

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

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

5.0 CONDITIONS OF USE

The Simpson Strong-Tie® Gas-Actuated 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 The fasteners are manufactured and identified in accordance with this report.

- 5.2 Fastener installation complies with this report and the Simpson Strong-Tie® published installation instructions. In the event of conflict between this report and the Simpson Strong-Tie® published installation instructions, this report governs.

- 5.3 Allowable tension and shear values are as noted in Tables 2 through 5. The stress increases and load reductions described in Section 1605.3 of the IBC are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for gravity loads acting alone.

- 5.4 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. The calculations are to be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

- 5.5 The minimum concrete thickness must be three times the fastener penetration depth. Face shell thickness of CMUs must be a minimum of 1¹/₄ inches (32 mm).

- 5.6 Except for fasteners used with architectural, electrical and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, use of fasteners to resist earthquake loads is outside the scope of the report.

- 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.

- 5.8 Use of fasteners is limited to dry, interior locations.

- 5.9 Use of fasteners in contact with preservative-treated or fire-retardant-treated wood is not permitted.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70), dated February 2011.

7.0 IDENTIFICATION

Containers of fasteners are identified with the manufacturer's name (Simpson Strong-Tie®), the product name, the fastener catalog number, the length, the quantity, the manufacturing date and the evaluation report number (ESR-2811). In addition, each fastener is identified by ≠ (the "no equal" sign) stamped on the fastener head.

8.0 OTHER CODES

8.1 Scope:

In addition to the 2009 IBC and IRC, the products described in this report were evaluated for compliance with the requirements of the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 1997 *Uniform Building Code*™ (UBC)

8.2 Uses:

Simpson Strong-Tie® Gas-Actuated Fasteners are used for general fastening of building components as described in Section 2.0. The fasteners are alternates to the cast-in-place anchors described in 2006 IBC Sections 1911 and 1912, 2003 IBC Sections 1912 and 1913 and UBC Section 1923.1 for placement in concrete; the embedded anchors described in Section 2.1.4 of ACI 530 (which is referenced

in 2006 and 2003 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 2006 and 2003 IBC Section 2204.2 and UBC Section 2205.11. The fasteners may be used where an engineered design is submitted in accordance with 2006 and 2003 IRC Section R301.1.3.

8.3 Description:

8.3.1 Fasteners: See Section 3.1.

8.3.2 Materials:

8.3.2.1 Concrete: See Section 3.2.1. Under the UBC, concrete must conform to UBC Section 1903, as applicable.

8.3.2.2 CMUs: Under the UBC, CMUs must be minimum 8-inch-thick (203 mm), Grade N, Type II, lightweight blocks complying with UBC Standard 21-4 for GDP fastener and medium weight blocks complying with UBC Standard 21-4 for GDPM, GW and GTH fasteners.

8.3.2.3 Steel: See Section 3.2.3.

8.3.2.4 Steel Deck: See Section 3.2.4.

8.4 Design and Installation:

8.4.1 Design:

8.4.1.1 General: See Section 4.1. Under the UBC, the stress increases described in Section 1612.3.2 of the UBC are not allowed for wind loads acting alone or when combined with gravity loads. Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC), use of fasteners to resist earthquake loads is outside the scope of this report.

8.4.1.2 Wood to Steel, Concrete, or Masonry: For the 2006 IBC, 2006 IRC, 2003 IBC and 2003 IRC, see Section 4.1.2, For the UBC, design values for nails with diameters equal to or less than the diameter of the Simpson Strong-Tie® Gas-Actuated Fasteners, determined in accordance with Section 2318.3 of the UBC, are applicable to Simpson Strong-Tie® Gas-Actuated Fasteners. The wood element is the side member. The fastener bending yield strength must be limited to the value noted in the footnotes to UBC Tables 23-III-C-1 and 23-III-C-2, based on the diameter of the Simpson Strong-Tie® Gas-Actuated Fasteners.

8.4.2 Installation: See Section 4.2.

8.5 Conditions of Use:

See Section 5.0, and the following:

8.5.1 Allowable tension and shear values are as noted in Tables 2 through 5. The stress increases and load reductions described in Section 1605.3 of the 2006 and 2003 IBC, and the stress increases described in Section 1612.3.2 of the UBC, are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

8.5.2 Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC), use of fasteners to resist earthquake loads is outside the scope of this report.

8.6 Evidence Submitted:

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

8.7 Identification:

See Section 7.0.

TABLE 1—SIMPSON STRONG-TIE® GAS-ACTUATED FASTENERS

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	HEAD DIAMETER (inch)	FASTENER GALVANIZATION DESIGNATION	WASHER GALVANIZATION DESIGNATION	APPLICATION TABLES	FIGURE
GDP ²	0.106	0.240	ASTM B 695, CLASS 5, TYPE I	-	2, 3, 4, 5	4
GDPS	0.110/0.091 ³	0.240	ASTM B 633, SC1, TYPE 1	-	5	5
GDPM-75 & -100 ²	0.126	0.252	ASTM B 695M CLASS 5, TYPE 1	-	2, 3, 4	-
GDPM-50	0.128/0.110 ³	0.252	ASTM B 695, CLASS 5, TYPE 1	-	5	-
GW-75 & -100 w/ washer ²	0.126	0.283	ASTM B 695, CLASS 5, TYPE 1	ASTM B 633, SC1, TYPE 1	2, 3, 4	6
GW-50 w/ washer	0.128/0.110 ³	0.299	ASTM B 695, CLASS 5, TYPE 1	ASTM B 633, SC1, TYPE 1	5	6
GTH (Tophat) ^{1,2}	0.126	0.283	ASTM B 695, CLASS 5, TYPE 1	-	2, 3, 4	7
GTH-50 (Tophat) ¹	0.128/0.110 ³	0.283	ASTM B 695, CLASS 5, TYPE 1	-	5	7

¹The tophat is manufactured from aluminum complying with the manufacturer's approved quality documentation.

²Smooth shank fasteners.

³Step shank fasteners (Diameter of shank above the step)/(Diameter of shank below the step).

TABLE 2—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GAS-ACTUATED FASTENERS INSTALLED IN NORMAL-WEIGHT CONCRETE^{1,2,3,4}

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	CONCRETE COMPRESSIVE STRENGTH f'_c									
					2,000 psi (lbf)		2,500 psi (lbf)		3,000 psi (lbf)		4,000 psi (lbf)		5,000 psi (lbf)	
					Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
GDP-XX ⁵	0.106	$\frac{5}{8}$	4	3	25	25	25	25	30	25	45	25	45	25
	0.106	$\frac{3}{4}$	4	3	30	45	30	50	30	55	30	75	30	75
GDPM-75 GDPM-100 GW-75 GW-100 GTH	0.126	$\frac{5}{8}$	4	3	60	55	65	60	70	65	95	95	-	-
		$\frac{3}{4}$	4	3	85	120	95	135	105	145	190	215	-	-

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

¹The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate must comply with ASTM C 33. Minimum concrete thickness must be three times the fastener embedment into the concrete.

²The allowable tension and shear values are only for the fasteners in the concrete. Members connected to the concrete must be investigated in accordance with accepted design criteria.

³The stress increases and load reductions described in IBC Section 1605.3 and the stress increases described in UBC Section 1612.3 are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for gravity loads acting alone.

⁴For installations under the IBC and IRC, the concrete compressive strength, f'_c , at 28 days must be a minimum of 2,500 psi.

⁵The XX designation in the model number is replaced with the length of the fastener expressed in inches multiplied by 100. The fastener must be long enough to provide for the minimum embedment.

TABLE 3—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GAS-ACTUATED FASTENERS INSTALLED IN MINIMUM 3,000 psi COMPRESSIVE STRENGTH (f'_c) STRUCTURAL SAND-LIGHTWEIGHT CONCRETE^{1,2}

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE ³ (inches)	INSTALLED IN CONCRETE		INSTALLED THROUGH METAL DECK (LOWER FLUTE) ^{4,5}			
					TENSION (lbf)	SHEAR (lbf)	1.5-INCH "B" DECK		3-INCH "W" DECK	
							TENSION (lbf)	SHEAR (lbf)	TENSION (lbf)	SHEAR (lbf)
GDP-XX ⁶	0.106	$\frac{5}{8}$	4	3	75	35	65	195	60	180
	0.106	$\frac{3}{4}$	4	3	105	140	130	270	60	180
GDPM-75 GDPM-100 GW-75 GW-100 GTH	0.126	$\frac{5}{8}$	4	3	60	110	-	-	35	215
		$\frac{3}{4}$	4	3	115	130	-	-	55	235

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

¹The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Concrete aggregate must comply with ASTM C 330. Minimum concrete thickness is three times the fastener embedment into the concrete.

²The allowable shear and tension values are only for the fasteners in the concrete. Members connected to the concrete must be investigated in accordance with the accepted design criteria.

³For fasteners installed in concrete (not through metal deck), the fastener must be installed with a minimum edge distance of 3 inches from the edge of the concrete.

⁴For fasteners installed through metal deck, the fastener must be installed through the lower flutes of the deck with minimum edge distances as shown in Figures 1A, 1B, 2A and 2B, and 3 inches from the end of the deck.

⁵The allowable values are applicable to fasteners installed through the underside of a steel deck at the ribs and into structural sand-lightweight concrete with a minimum compressive strength, f'_c , of 3,000 psi. See Figures 1A, 1B and 2A for GDP fasteners. See Figure 2B for GDPM, GW and GTH fasteners. The steel deck must have a minimum base-metal thickness of 20 gage with a minimum yield strength of 38 ksi.

⁶The XX designation in the model number is replaced with the length of the fastener expressed in inches multiplied by 100. The fastener must be long enough to provide for the minimum embedment.

TABLE 4—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GAS-ACTUATED FASTENERS INSTALLED IN CONCRETE MASONRY UNITS (CMUs)^{1,2,3}

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	INSTALLED IN CMU FACE SHELL	
					TENSION (lbf)	SHEAR (lbf)
GDP-XX ⁴	0.106	⁵ / ₈	8	3	35	50
GDPM-75 GDPM-100 GW-75 GW-100 GTH	0.126	⁵ / ₈	8	3	55	65

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

¹The tabulated allowable load values are for the fasteners only. Members connected to the CMU receiving elements must be designed in accordance with the applicable code and accepted design criteria.

²The tabulated allowable load values are for fasteners installed in a hollow CMU conforming to ASTM C 90 or UBC 21-4, as applicable. The minimum allowable nominal size of the CMU must be 8 inches high by 8 inches wide by 16 inches long, with a minimum, 1/4-inch-thick face shell thickness. See Sections 3.2.2 and 8.3.2.2 of this report.

³Installation may be anywhere on the face of the CMU, with distance from edge of individual blocks.

⁴The XX designation in the model number is replaced with the length of the fastener expressed in inches multiplied by 100. The fastener must be long enough to provide for the minimum embedment.

TABLE 5—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GAS-ACTUATED FASTENERS INSTALLED IN STEEL^{1,2}

FASTENER MODEL NUMBER	SHANK DIAMETER (inch)	MINIMUM SPACING (inch)	MINIMUM EDGE DISTANCE (inch)	MINIMUM STEEL STRENGTH ⁴	STEEL THICKNESS (inch)									
					¹ / ₈		³ / ₁₆		¹ / ₄		³ / ₈		¹ / ₂	
					Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
GDP-XX ³	0.106	1	¹ / ₂	ASTM A 36	125	285	210	225	220	205	—	—	—	—
GDP-XX ³	0.106	1	¹ / ₂	ASTM A 572, Grade 50 or ASTM A 992	—	—	225	250	185	145	—	—	—	—
GDPS-XX ³	0.110/0.091 ⁷	1	¹ / ₂	ASTM A 36	—	—	95	180	170	265	165 ⁵	225 ⁵	145 ⁵	225 ⁵
GDPS-XX ³	0.110/0.091 ⁷	1	¹ / ₂	ASTM A 572, Grade 50 or ASTM A 992	—	—	110	205	170	305	155 ⁵	205 ⁵	—	—
GDPM-50 GW-50 GTH-50	0.128/0.110 ⁷	1	¹ / ₂	ASTM A 36	-	-	225	400	275	345	245 ⁶	310 ⁶	-	-
				ASTM A 572 Grade 50 or ASTM A 992	-	-	240	380	215 ⁶	325 ⁶	280 ⁶	350 ⁶	-	-

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N, 1 ksi = 6.895 MPa.

¹The entire pointed portion of the fastener must penetrate through the steel to obtain the tabulated values (see Figure 3), except as noted in footnotes 5 and 6.

²The allowable tension and shear values are for the fastener only. Members connected to the steel must be investigated separately in accordance with accepted design criteria.

³The XX designation in the model number is replaced with the length of the fastener expressed in inches multiplied by 100. The fastener must be long enough to provide for the minimum penetration.

⁴Steel strength must comply with the minimum requirements of ASTM A 36 (F_y = 36 ksi, F_u = 58 ksi), ASTM A 572, Grade 50 (F_y = 50 ksi, F_u = 65 ksi) or ASTM A 992 (F_y = 50 ksi, F_u = 65 ksi).

⁵Tabulated values are based on minimum penetration of the fastener point into the steel of 0.35 inch (8.9 mm).

⁶Tabulated values are based on minimum penetration of the fastener point into the steel of 0.25 inch (6.4 mm).

⁷(Diameter of shank above the step)/(Diameter of shank below the step).

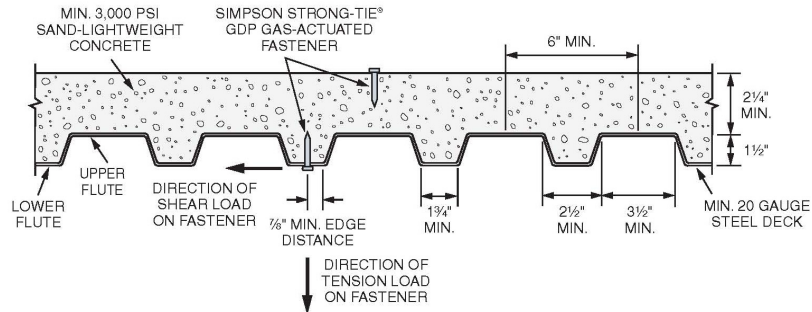


FIGURE 1A—GDP GAS-ACTUATED FASTENER INSTALLED INTO CONCRETE FILLED 1 1/2-INCH-DEEP COMPOSITE FLOOR “B” DECK

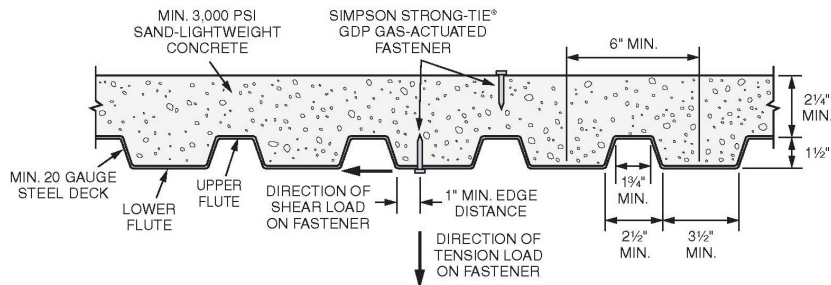


FIGURE 1B—GDP GAS-ACTUATED FASTENER INSTALLED INTO CONCRETE FILLED INVERTED 1 1/2-INCH-DEEP COMPOSITE FLOOR “B” DECK

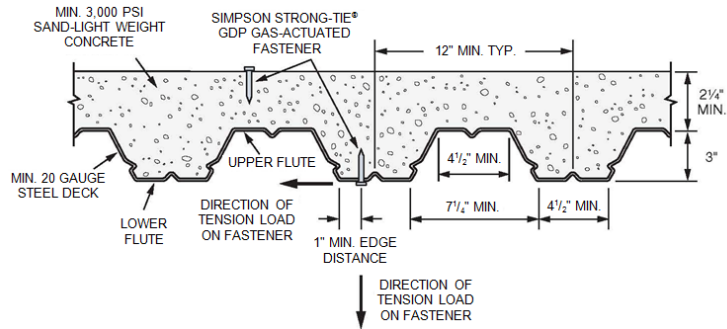


FIGURE 2A—GDP GAS-ACTUATED FASTENER INSTALLED IN CONCRETE FILLED 3-INCH-DEEP COMPOSITE FLOOR “W” DECK

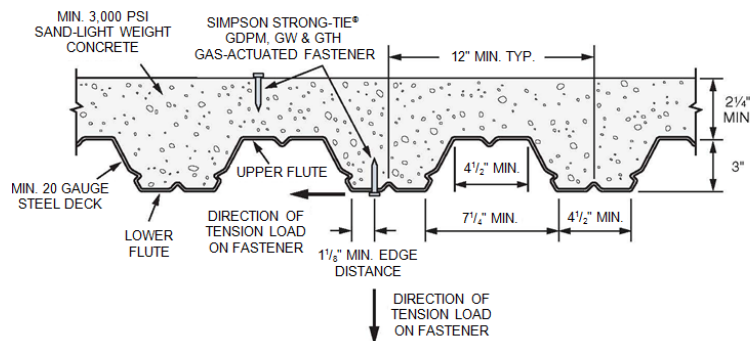


FIGURE 2B—GDPM, GW & GTH GAS-ACTUATED FASTENER INSTALLED IN CONCRETE FILLED 3-INCH-DEEP COMPOSITE FLOOR “W” DECK

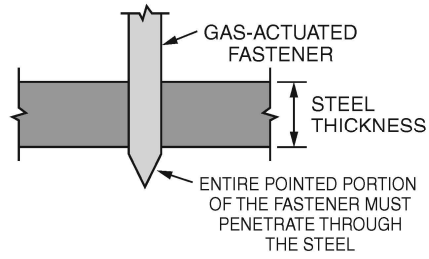


FIGURE 3—FASTENER PENETRATION THROUGH STEEL WHERE REQUIRED



FIGURE 4—COLLATED GDP GAS-ACTUATED SMOOTH SHANK FASTENER



FIGURE 5—COLLATED GDPS GAS-ACTUATED STEP SHANK FASTENER



FIGURE 6—GW GAS-ACTUATED SMOOTH OR STEP SHANK FASTENER



FIGURE 7—GTH GAS-ACTUATED SMOOTH OR STEP SHANK FASTENER