

ICC-ES Evaluation Report

ESR-2811

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This report is subject to re-examination in one year.

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DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

DIVISION 04—MASONRY
Section: 04081—Masonry Anchorage

DIVISION: 05—METALS
Section: 05090—Metal Fastening

REPORT HOLDER:

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EVALUATION SUBJECT:

**SIMPSON STRONG-TIE® GDP GAS-ACTUATED
 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)

Property evaluated:

Structural

2.0 USES

Simpson Strong-Tie® GDP Gas-Actuated Fasteners are used for general fastening of building components, such as cold-formed steel framing members, to normal-weight concrete, structural sand-lightweight concrete, steel decks filled with structural sand-lightweight concrete, concrete masonry units (CMUs) and steel base materials. The fasteners are alternates to the cast-in-place anchors described in IBC Section 1911. 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 Gas-Actuated Fasteners are manufactured from steel complying with ASTM A 510, Grade 10B60, and austempered to a Rockwell “C” core hardness of 53-56. Fasteners have a straight, smooth

shank with a diameter of 0.106 inch (2.7 mm), and a head diameter of 0.24 inch (6.2 mm). Fasteners are provided with a zinc-plated finish, and are supplied in collated strips.

3.2 Materials:

3.2.1 Concrete: Normal-weight and structural sand-lightweight concrete must comply with IBC Sections 1903 and 1905, IRC Section R402.2, and UBC Sections 1903 and 1905, as applicable. The minimum concrete compressive strength at the time of fastener installation must be as noted in Tables 1, 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 (IBC and IRC), or Grade N, Type II, lightweight blocks conforming to UBC Standard 21-4.

3.2.3 Steel: Structural steel must comply with the minimum requirements of ASTM A 36 or ASTM A 572, Grade 50, 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 and 2.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: The allowable shear and tension (pullout) values in Tables 1 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 and 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. Except for fasteners used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7, use of fasteners to resist earthquake loads is outside the scope of this report.

Allowable shear and tension values for Simpson Strong-Tie® GDP Gas-Actuated Fasteners driven into different base materials may be determined by referencing tables as follows:

BASE MATERIAL	TABLE
Normal-weight concrete	1, 2
Structural sand-lightweight concrete	3
Concrete masonry units (CMUs)	4
Steel	5

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

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

where:

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

P_t = Allowable service tension load, pounds (N).

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

V_t = Allowable service shear load, pounds (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® GDP 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 or Section 2318.3 of the UBC, as applicable, are applicable to Simpson Strong-Tie® GDP 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® GDP 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® GDP 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 1 through 5. The stress increases and load reductions described in Section 1605.3 of the IBC and 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.
- 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 as described in Section 13.1.4 of ASCE/SEI 7 (IBC and IRC), 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 October 2006.

7.0 IDENTIFICATION

Containers of fasteners are identified with the manufacturer's name (Simpson Strong-Tie®), the product name (GDP Gas-Actuated Fasteners), 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.

TABLE 1—ALLOWABLE TENSION LOADS FOR SIMPSON STRONG-TIE® GDP 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)	3,000 psi (lbf)	4,000 psi (lbf)	5,000 psi (lbf)
GDP-XX ⁵	0.106	⁵ / ₈	4	3	25	30	45	45
GDP-XX ⁵	0.106	³ / ₄	4	3	30	30	30	30

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 is three times the fastener embedment into the concrete.

²The allowable tension 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 vertical loads. No adjustment is allowed for vertical 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. The fastener must be long enough to provide for the minimum embedment.

TABLE 2—ALLOWABLE SHEAR LOADS FOR SIMPSON STRONG-TIE® GDP 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)	3,000 psi (lbf)	4,000 psi (lbf)	5,000 psi (lbf)
GDP-XX ⁵	0.106	⁵ / ₈	4	3	25	25	25	25
GDP-XX ⁵	0.106	³ / ₄	4	3	45	55	75	75

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 is three times the fastener embedment into the concrete.

²The allowable 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 vertical loads. No adjustment is allowed for vertical 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. The fastener must be long enough to provide for the minimum embedment.

TABLE 3—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GDP 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	⁵ / ₈	4	3	75	35	65	195	60	180
GDP-XX ⁶	0.106	³ / ₄	4	3	105	140	130	270	60	180

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 and 2, 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 2. 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. The fastener must be long enough to provide for the minimum embedment.

TABLE 4—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GDP 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

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 shall 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. The minimum allowable nominal size of the CMU must be 8 inches high by 8 inches wide by 16 inches long, with a minimum, 1¹/₄-inch-thick face shell thickness (Grade N, Type II, concrete masonry units).

³Installation may be anywhere on the face of the CMU, with distance from edge of individual blocks as shown in Table 4.

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

TABLE 5—ALLOWABLE TENSION AND SHEAR LOADS FOR SIMPSON STRONG-TIE® GDP 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	
					TENSION (lbf)	SHEAR (lbf)	TENSION (lbf)	SHEAR (lbf)	TENSION (lbf)	SHEAR (lbf)
GDP-XX ³	0.106	1	0.5	ASTM A36	125	285	210	225	220	205
GDP-XX ³	0.106	1	0.5	ASTM A572, Grade 50	—	—	225	250	185	145

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).

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. The fastener must be long enough to provide for the minimum embedment.

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

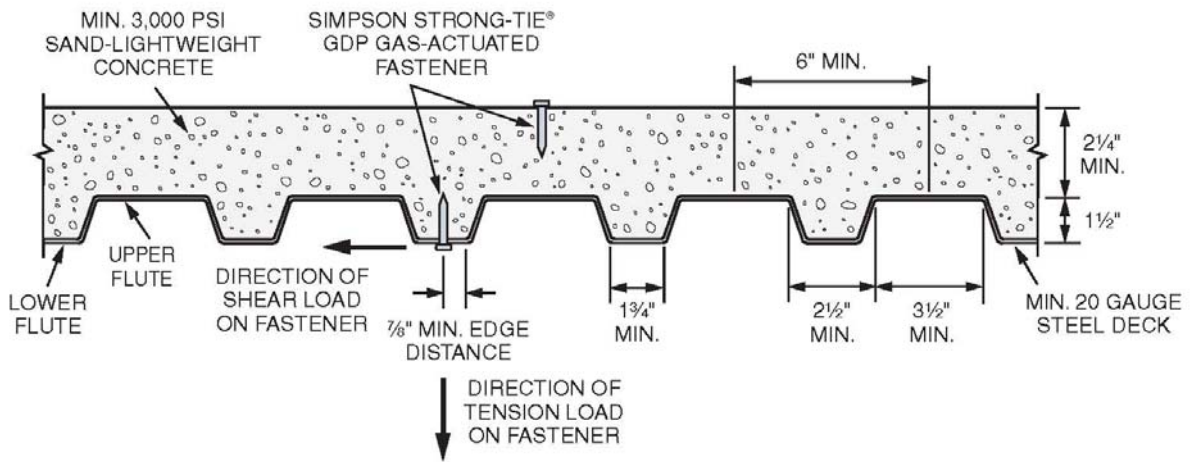


FIGURE 1A—GDP GAS-ACTUATED FASTENER INSTALLATION INTO CONCRETE FILLED 1 1/2-INCH-DEEP COMPOSITE FLOOR DECK

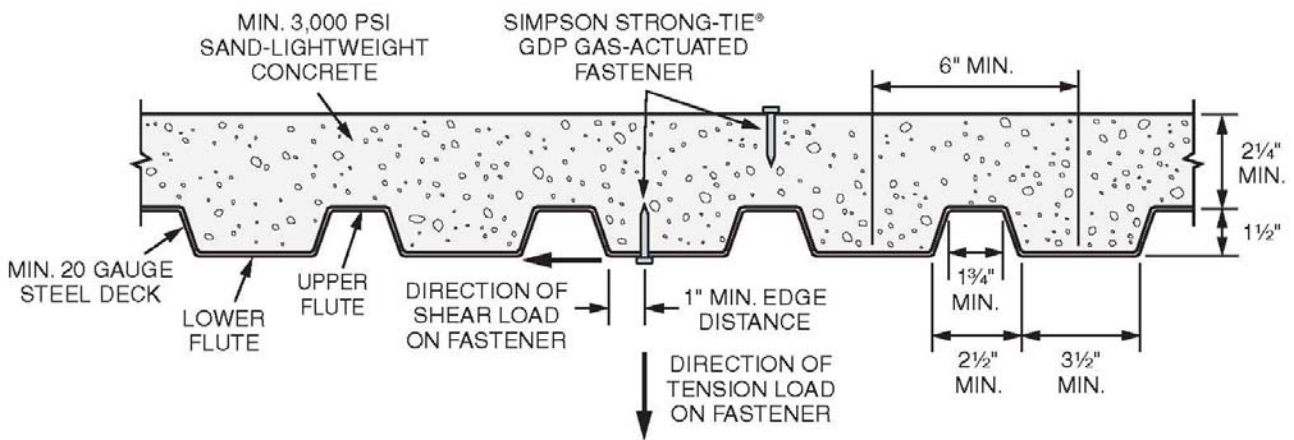


FIGURE 1B—GDP GAS-ACTUATED FASTENER INSTALLATION INTO CONCRETE FILLED INVERTED 1 1/2-INCH-DEEP COMPOSITE FLOOR DECK

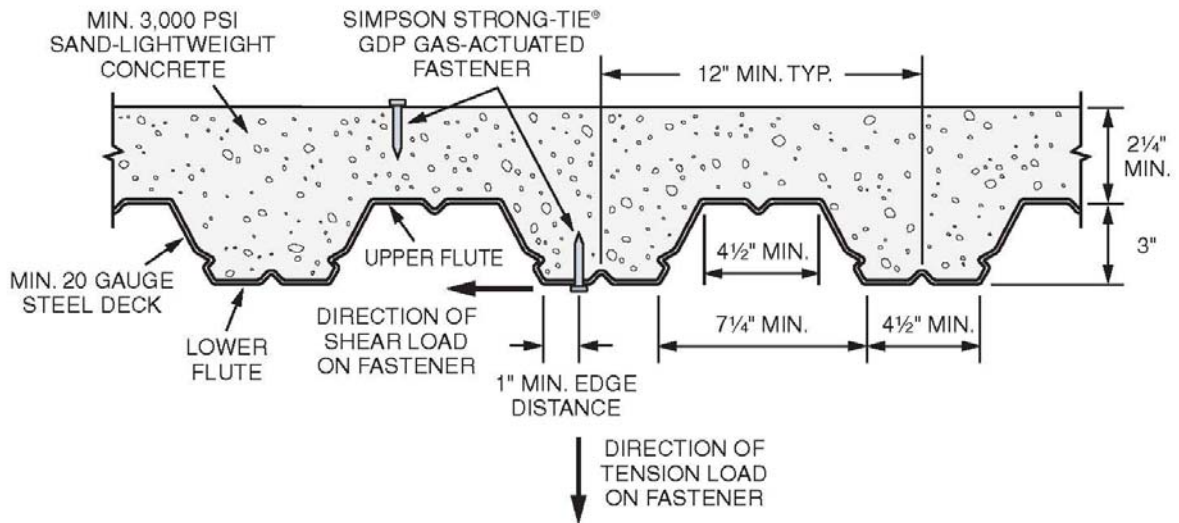


FIGURE 2—GDP GAS-ACTUATED FASTENER INSTALLED IN CONCRETE FILLED 3-INCH-DEEP COMPOSITE FLOOR DECK

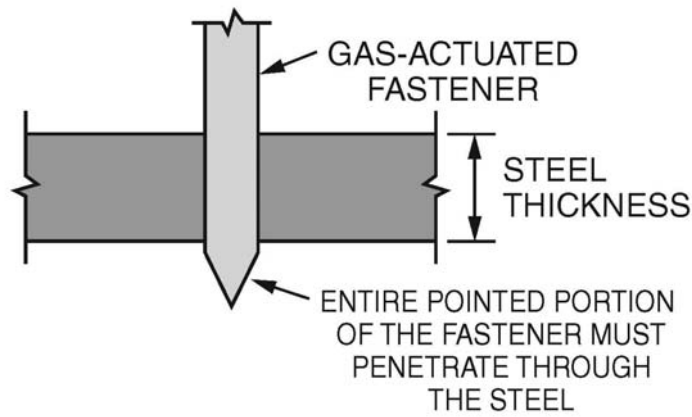


FIGURE 3—REQUIRED FASTENER PENETRATION THROUGH STEEL



FIGURE 4—COLLATED GDP GAS-ACTUATED FASTENER