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AT-XP® ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE

CSI Sections:
03 16 00—Concrete Anchors
03 15 19—Cast-in Concrete Anchors
05 05 19—Post-Installed Concrete Anchors

1.0 SCOPE OF EVALUATION

1.1 Compliance with the following codes & regulations:

- 2021, 2018, 2015, 2012, and 2009 International Building Code® (IBC)
- 2021, 2018, 2015, 2012, and 2009 International Residential Code® (IRC)
- 2023 City of Los Angeles Building Code (LABC) – attached Supplement
- 2023 City of Los Angeles Residential Code (LARC) – attached Supplement

1.2 Evaluated in accordance with:

- ICC-ES AC308, approved February 2022
- ACI 318-19, ACI 318-14, ACI 318-11
- ACI 355.4-19, ACI 355.4-11

1.3 Properties assessed:

- Structural

2.0 PRODUCT USE

The Simpson Strong-Tie® AT-XP Adhesive Anchors are used to resist static, wind, and earthquake (Seismic Design Categories A through F under the IBC) tension and shear loads in cracked and uncracked normalweight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). 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. The adhesive anchor is an alternative to anchors described in Section 1901.3 of the 2021, 2018, and 2015 IBC; Sections 1908 and 1909 of the 2012 IBC; and Sections 1911 and 1912 of the 2009 IBC. The anchors may also be used where an engineering design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 PRODUCT DESCRIPTION

3.1 Product Information: The AT-XP Adhesive Anchors are post-installed anchors, inserted into hardened concrete that transfer loads to the concrete by the bond between the anchor and the adhesive, and the bond between the adhesive and the concrete. The adhesive anchor system is comprised of the following components:

- AT-XP adhesive packaged in cartridges
- Adhesive mixing and dispensing equipment
- Equipment for hole cleaning and adhesive injection

AT-XP adhesive is used with continuously threaded steel rods or deformed steel reinforcing bars. The Manufacturer's Printed Installation Instructions (MPII) are included with each adhesive unit package as shown in Figure 1 of this report.

3.2 Material Information

3.2.1 AT-XP Adhesive: AT-XP adhesive is an injectable, two-component, acrylic-based adhesive that is mixed in a 10 to 1 volume ratio of resin to the initiator. AT-XP is available in 9.4 ounce (280 ml), 12.5 ounce (370 ml), and 30 ounce (885 ml) cartridges. The two components combine and react when dispensed through a static mixing nozzle attached to the cartridge. Gel and cure times after placement into holes occur according to conditions given in Table C of this report. The shelf life, as indicated by the expiration date printed on the cartridge, applies to unopened cartridges stored at temperatures between 32ºF and 80ºF in accordance with the MPII.

3.2.2 Dispensing Equipment: AT-XP adhesive shall be dispensed using Simpson Strong-Tie manual dispensing tools, battery-powered dispensing tools, or pneumatic dispensing tools as listed in Tables 8 and 9 of this report.

3.2.3 Hole Cleaning Equipment:

3.2.3.1 Standard Equipment: Hole cleaning equipment consists of hole-cleaning brushes and air nozzles. Brushes shall be Simpson Strong-Tie hole cleaning brushes, identified by Simpson Strong-Tie catalog number series ETB. Tables 8 and 9 in this report, and the MPII shown in Figure 1 of this report provide additional information. Air nozzles shall be equipped with an extension capable of reaching the bottom of the drilled hole.

3.2.3.2 Vacuum Dust Extraction System with Bosch®/Simpson Strong-Tie DXS Hollow Carbide Drill Bits: For the elements described in Section 3.2.4 of this

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.

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report for ⅝ to 1¼ inch (15.9 to 31.9 mm) diameter steel threaded rods and No. 4 to No. 10 steel reinforcing bars, the Bosch/Simpson Strong-Tie DXS hollow carbide drill bit with a carbide drilling head conforming to ANSI B212.15 shall be used. A dust extraction adapter is used in conjunction with a vacuum equipped with an automatic filter cleaning system, which has a minimum airflow = 129 cfm (3.7 m³/min.). The maximum no-load rpm for the rotary hammer drill used with the vacuum dust extraction system is 760 rpm. The vacuum dust extraction system removes the drilling dust during the drilling operation, eliminating the need for additional hole cleaning.

3.2.4 Anchor Materials

3.2.4.1 Threaded Steel Rods: Threaded anchor rods, having diameters from $^3/_8$ inch to $1^1/_4$ inch (9.5 mm to 31.7 mm), shall be carbon steel conforming to ASTM F1554, Grade 36, or ASTM A193, Grade B7; or stainless steel conforming to ASTM A193, Grade B6, B8, or B8M. Table 3 in this report provides additional details. Threaded rods shall be clean, straight, and free of indentations or other defects along their lengths. The embedded portions of the threaded rods shall be free of mill scale, rust, mud, oil, and other coatings that may impair the bond with the adhesive. The tensile strength of the threaded anchor rods shall not exceed 145,000 psi (1,000 MPa).

3.2.4.2 Deformed Steel Reinforcing Bars (Rebars): Deformed steel rebars, having sizes from No. 3 to No. 8, and No. 10 shall conform to ASTM A615 Grade 60 or ASTM A706 Grade 60. Table 4 in this report provides additional details. The embedded portions of reinforcing bars shall be straight, and free of mill scale, rust, mud, oil, and other coatings that may impair the bond with the adhesive. Reinforcing bars shall not be bent after installation except as set forth in Section 26.6.3.2 (b) of ACI 318-19, Section 26.6.3.1 (b) of ACI 318-14, or Section 7.3.2 of ACI 318-11, with the additional condition that the bars shall be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

3.2.4.3 Ductility: In accordance with ACI 318 (-19 and -14) 2.3 or ACI 318-11 D.1, in order for a steel element to be considered ductile, the tensile test elongation shall be at least 14 percent and reduction of the area shall be at least 30 percent. Steel elements used for anchoring with a tensile test elongation of less than 14 percent or a reduction of area less than 30 percent, or both, shall be considered brittle. Where values are nonconforming or unstated, the steel shall be considered brittle. Except as modified by ACI 318-19 17.10.5.3 (a) (vi), ACI 318-14 17.2.3.4.3 (a) (vi), and ACI 318-11 D.3.3.4.3 (a) 6 for earthquake effects, deformed reinforcing bars meeting the requirements of ASTM A615 or A706 shall be considered as ductile steel elements.

3.2.5 Concrete: Normalweight and lightweight concrete shall conform to Sections 1901 and 1903 of the 2021, 2018, 2015, and 2012 IBC or Sections 1903 and 1905 of the 2009 IBC. The specified compressive strength of the concrete shall be from 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa), but not less than that required by the applicable code, including IBC Section 1904, ACI 318-19, and ACI 318-14 Section 19.3.2 or ACI 318-11 Section 4.3, or the structural design.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design

4.1.1 General:

The design strength of anchors under the 2021 IBC, as well as Section R301.1.3 of the 2021 IRC, shall be determined in accordance with ACI 318-19 and this report. The design strength of anchors under the 2018 and 2015 IBC and Section R301.1.3 of the 2018 and 2015 IRC shall be determined in accordance with ACI 318-14 as amended in IBC Section 1905 and this report. The design strength of anchors under the 2012 and 2009 IBC and Section R301.1.3 of the 2012 and 2009 IRC shall be determined in accordance with ACI 318-11 Appendix D and this report.

Design parameters are based on ACI 318-19 for use with the 2021 IBC, ACI 318-14 for use with the 2018 and 2015 IBC, and ACI 318-11 for use with the 2012 and 2009 IBC unless noted otherwise in Sections 4.1.1 through 4.1.10 of this report.

The strength design of anchors shall conform to the requirements of ACI 318-19 17.5.1.2, ACI 318-14 17.3.1 or ACI 318-11 D 4.1, except as required in ACI 318-19 17.10, ACI 318-14 17.2.3; or ACI 318-11 D.3.3.

Anchor categories are as follows:

Bar Size		Continuous Special Inspection		Periodic Special Inspection	
		Dry Concrete	Water-saturated concrete	Dry Concrete	Water-saturated concrete
⅜	#3	1	3	2	3
½	#4	1	3	2	3
⅝	#5	1	3	2	3
¾	#6	1	3	2	3
⅞	#7	1	3	2	3
1	#8	2	3	3	3
1¼	#10	2	3	3	3

Anchor designs shall satisfy the requirements of ACI 318-19 17.5.1.2 and 17.5.2.2, ACI 318-14 17.3.1.1 and 17.3.1.2; or ACI 318-11 D.4.1.1 and D.4.1.2. Anchor group effects shall be considered in accordance with ACI 318-19 17.5.1.3.1, ACI 318-14 17.2.1.1, or ACI 318-11 D.3.1.1. Design parameters are provided in Tables 3, 4, 5, 6, and 7 of this report. Strength reduction factors, ϕ, described in ACI 318-19 17.5.3, ACI 318-14 17.3.3, or ACI 318-11 D.4.3, and noted in Tables 3, 4, 5, 6, and 7 of this report, shall be used for load combinations calculated in accordance with Section

1605.2 of the IBC, ACI 318-19 17.5.3, ACI 318-14 5.3, and ACI 318-11 Section 9.2. Strength reduction factors, ϕ, described in ACI 318-11 D.4.4 shall be used for load combinations calculated in accordance with Appendix C of ACI 318-11.

Construction documents shall include the information specified in ACI 318-19 26.7, ACI 318-14 17.7.7 and 26.7; or ACI 318-11 1.2 and D.8.7.

4.1.2 Static Steel Strength in Tension: The nominal steel strength of a single anchor in tension, N_{sa}, in accordance with ACI 318-19 17.6.1.2, ACI 318-14 17.4.1.2; or ACI 318-11 D.5.1.2, and the corresponding strength reduction factors, ϕ, depending on whether the steel is considered brittle or ductile, in accordance with ACI 318-19 17.5.3, ACI 318-14 17.3.3; or ACI 318-11. D.4.3, are provided in Tables 3 and 4 of this report for each anchor type referenced in this report.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal static concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, shall be calculated in accordance with ACI 318-19 17.6.2, ACI 318-14 17.4.2; or ACI 318-11 D.5.2.

The basic concrete breakout strength of a single anchor in tension, N_b, shall be calculated in accordance with ACI 318-19 17.6.2.2, ACI 318-14 17.4.2.2; or ACI 318-11 D.5.2.2 using the values of, $k_{c,cr}$, and $k_{c,uncr}$, as described in Table 5 of this report. Where analysis indicates no cracking in accordance with ACI 318-19 17.6.2.5, ACI 318-14 17.4.2.6; or ACI 318-11 D.5.2.6, N_b shall be calculated using $k_{c,uncr}$ and $\Psi_{c,N}$ =1. The modification factor, λ, shall be taken as 1.0 for normalweight concrete. For anchors installed in lightweight concrete, the corresponding modification factors, λ and λ_a, shall be applied to the breakout strengths in accordance with ACI 318-19 17.2.4, ACI 318-14 17.2.6; or ACI 318-11 D.3.6. The value of f'_c used for calculation purposes shall be limited to 8,000 psi (55.1 MPa) maximum.

4.1.4 Static Bond Strength in Tension: The nominal static bond strength of a single anchor or group of anchors in tension, N_a or N_{ag}, shall be calculated in accordance with ACI 318-19 17.6.5, ACI 318-14 17.4.5, or ACI 318-11 D.5.5. Bond strength values are a function of the concrete condition (cracked or uncracked), the installation conditions (dry or water-saturated concrete), drilling method (i.e., rotary hammer drill), and special inspection level (i.e., continuous or periodic) provided. Strength reduction factors, ϕ, listed in this section and in Tables 6 and 7 of this report, shall be utilized for anchors installed in dry or saturated concrete in accordance with the level of inspection specified (periodic or continuous), as applicable. Bond strength values, τ_k, shall be modified with the factor K_{sat}, listed below and in Tables 6 and 7 of this report, for cases where the holes are drilled in water-saturated concrete as follows:

Special Inspection Level	Permissible Installation Condition	Bond Strength	Associated Strength Reduction Factor
Continuous	Dry Concrete	τ_k	$\Phi_{dry,ci}$
Continuous	Water-saturated concrete	$\tau_k \times K_{sat,ci}$	$\Phi_{sat,ci}$
Periodic	Dry Concrete	τ_k	$\Phi_{dry,pi}$
Periodic	Water-saturated concrete	$\tau_k \times K_{sat,pi}$	$\Phi_{sat,pi}$

The bond strength τ_k in the table above refers to $\tau_{k,cr}$ or $\tau_{k,uncr}$, and where applicable, the modified bond strengths shall be used in lieu of $\tau_{k,cr}$ or $\tau_{k,uncr}$. For anchors installed in lightweight concrete, the corresponding modification factors, λ and λ_a, shall be applied to ACI 318-19 Eq. (17.6.5.2.1) in accordance with ACI 318-19 17.2.4, ACI 318-14 Eq. (17.4.5.2) in accordance with ACI 318-14 17.2.6 or ACI 318 Eq. (D-22) in accordance with ACI 318-11 D.3.6.

4.1.4.1 Sustained Loads: In addition to requirements in Section 4.1.4 of this report for the design of a single anchor in tension to resist sustained loads, ACI 318-19 17.5.2.2, ACI 318-14 17.3.1.2 or ACI 318-11 D.3.5 and D.4.1.2 shall apply, using $\tau_{k,uncr}$ or $\tau_{k,cr}$ from Tables 6 and 7 of this report in lieu of τ_{cr}.

4.1.4.2 Splitting Control: Replace Section D.5.5.5 of ACI 318-11 Appendix D, Section 17.4.5.5 of ACI 318-14 as follows or Section 17.6.5.4 of ACI 318-19:

D.5.5.5 (17.4.5.5 for ACI 318-14, 17.6.5.5 for ACI 318-19) – The modification factor for adhesive anchors designed for uncracked concrete in accordance with D.5.5.2 (17.4.5.2 for ACI 318-14, 17.6.5.2 for ACI 318-19) without supplementary reinforcement to control splitting, $\psi_{cp,Na}$, shall be computed as:

If $c_{a,min} \geq c_{ac}$ then $\psi_{cp,Na} = 1.0$
(D-26 for ACI 318-11, 17.4.5.5.a for ACI 318-14, or 17.6.5.5.a for ACI 318-19))

If $c_{a,min} < c_{ac}$ then $\psi_{cp,Na\ a,min} = c_{a,min} / c_{ac}$
(D-27 for ACI 318-11, or 17.4.5.5.b for ACI 318-14, or 17.6.5.5.b for ACI 318-19)

where

c_{ac} *shall be determined in accordance with Eq. (D-27a for ACI 318-11, or 17.4.5.5.c for ACI 318-14, or 17.6.5.5.c for ACI 318-19) for anchor diameters up to 1¼ inches and for characteristic bond strengths in uncracked concrete less than or equal to 3000 psi.*

$c_{ac} = h_{ef}(\tau_{k,uncr}/1160)^{0.4} \times [3.1 - 0.7(h/h_{ef})]$ (inches) (D-27a for ACI 318-11, or 17.4.5.5.c for ACI 318-14, or 17.6.5.5.c for ACI 318-19)

where

(h/h_{ef}) need not be taken as larger than 2.4; and $\tau_{k,uncr}$ = characteristic bond strength stated in Tables 6 and 7 of this Evaluation Report, whereby $\tau_{k,uncr}$ need not be taken as larger than:

$$\tau_{k,uncr} = k_{uncr}\left((h_{ef} \times f'_c)^{0.5}/(\pi \times d)\right)$$

For all cases where $c_{Na}/c_{ac} < 1.0$, $\psi_{cp,Na}$ determined from Eq. (D-27) for ACI 318-11, or 17.4.5.5.b for ACI 318-14, or 17.6.5.5.b for ACI 318-19) need not be taken less than c_{Na}/c_{ac}. For all other cases, $\psi_{cp,Na}$ shall be taken as 1.0.

4.1.5 Static Steel Strength in Shear: The nominal static steel strength of a single anchor in shear as governed by the steel, V_{sa}, and the corresponding strength reduction factors, ϕ, complying with ACI 318-19 17.7.1.2, ACI 318-14 17.5.1.2 and 17.3.3; or ACI 318-11 D.6.1.2, and D.4.3, respectively are given in Tables 3 and 4 of this report. Where grout pads are present, the nominal strengths shall be reduced in accordance with ACI 318-19 17.7.1.3, ACI 318-14 17.5.1.3, or ACI 318-11 D.6.1.3.

4.1.6 Static Concrete Breakout Strength in Shear: The nominal static concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, shall be calculated in accordance with ACI 318-19 17.7.2, ACI 318-14 17.5.2; or ACI 318-11 D.6.2, based on the information given in Table 5 of this report. The basic concrete breakout strength of a single anchor in shear, V_b, shall be calculated in accordance with ACI 318-19 17.7.2.2, ACI 318-14 17.5.2.2; or ACI 318-11 D.6.2.2 using the values of d_a as described in Table 5 of this report for the corresponding anchor steel. In addition, h_{ef} shall comply with the range given in Table 5 and shall replace l_e in the calculation. In no case shall h_{ef} exceed $8d_a$. For anchors in lightweight concrete, the modification factors λ and λ_a shall be applied in accordance with ACI 318-19 17.2.4, ACI 318-14 17.2.6; or ACI 318-11 D.3.6. The value of f'_c shall be limited to 8,000 psi (55.1 MPa) maximum.

4.1.7 Static Concrete Pryout Strength in Shear: The nominal static pryout strength of a single anchor or group of anchors in shear, V_{cp} or V_{cpg}, shall be calculated in accordance with ACI 318-19 17.7.3, ACI 318-14 17.5.3; or ACI 318-11 D.6.3.

4.1.8 Interaction of Tensile and Shear Forces: For designs that include combined tension and shear as noted in ACI 318-19 17.5.2.3, ACI 318-14 17.3.1.3 or ACI 318-11 D.4.1.3, the interaction of tension and shear loads shall be calculated in accordance with ACI 318-19 17.8, ACI 318-14 17.6; or ACI 318-11 D.7.

4.1.9 Minimum Member Thickness, h_{min}, Minimum Anchor Spacing, s_{min}, and Minimum Edge Distance, c_{min}: In lieu of ACI 318-19 17.9.2, ACI 318-14 17.7.1 and 17.7.3; or ACI 318-11 D.8.1 and D.8.3, values of c_{min} and s_{min} used for anchor design and installation shall conform to the values provided in Tables 1 and 2 of this report. In lieu of ACI 318-19 17.9.4, ACI 318-14 17.7.5, or ACI 318-11 D.8.5, the minimum member thicknesses, h_{min}, shall be in accordance with Tables 1 and 2 of this report. For anchors where the installation will not be torqued, ACI 318-19 17.9.3, ACI 318-14 17.7.4; or ACI 318-11 D.8.4 applies. For adhesive anchors that will be torqued, the minimum edge distance and spacing shall be taken from Table 4 of this report.

4.1.10 Design Strength in Seismic Design Categories C, D, E, and F:

4.1.10.1 General: In structures assigned to Seismic Design Category C, D, E, or F under the IBC or IRC, the design shall be performed according to ACI 318-19 17.10, ACI 318-14 17.2.3 as modified by 2021, 2018, and 2015 IBC Section 1905.1.8; or ACI 318-11 D.3.3 as modified by Section 4.1.11.2 of this report, which replaces 2012 IBC Section 1905.1.9. The nominal steel shear strength, V_{sa}, shall be adjusted by $\alpha_{V,seis}$ as given in Tables 3 and 4 of this report for the types of anchors included in this report. The nominal bond strength, $\tau_{k,cr}$, shall be adjusted by $\alpha_{N,seis}$ as given in the footnotes to Table 6 of this report.

4.1.10.2 2012, and 2009 IBC: Replace Section 1905.1.9 of the 2012 IBC with the following:

Modify ACI 318-11 Section D.3.3.4.2, D.3.3.4.3 (d) and D.3.3.5.2 to read as follows:

D.3.3.4.2 - Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with D.3.3.4.3. The anchor design tensile strength shall be determined in accordance with D.3.3.4.4.

Exception:

Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy Section D.3.3.4.3 (d).

D.3.3.4.3 (d) – The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with E increased by Ω_o. The anchor design tensile strength shall be calculated from D.3.3.4.4.

D.3.3.5.2 – Where the shear component of the strength-level earthquake force applied to anchors exceeds

20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with D.3.3.5.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with D.6.

Exceptions:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or non-bearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with D.6.2 and D.6.3 need not be computed and D3.3.5.3 need not apply provided all of the following are satisfied:

1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.

1.2. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).

1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

1.4. Anchor bolts are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with D.6.2 and D.6.3 need not be computed and D3.3.5.3 need not apply provided all of the following are satisfied:

2.1. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.

3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching a sill plate or track to foundation or foundation stem wall need not satisfy D.3.3.5.3(a) through (c) when the design strength of the anchors is determined in accordance with D.6.2.1(c).

4.2 Allowable Stress Design (ASD)

4.2.1 General: For anchors designed using load combinations in accordance with Section 1605.1 of the 2021 IBC, or Section Section 1605.3 of the 2018, 2015, 2012, and 2009 IBC, allowable loads shall be established using Eq. (4-2) or Eq. (4-3):

$$T_{allowable,ASD} = \phi N_n/\alpha \qquad \text{Eq. (4-2)}$$

and

$$V_{allowable,ASD} = \phi V_n/\alpha \qquad \text{Eq. (4-3)}$$

where:

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN)
$V_{allowable,ASD}$ = Allowable shear load (lbf or kN)

ϕN_n = The lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318 (-19 and -14) Chapter 17 or ACI 318-11 Appendix D as amended in Section 4.1 of this report.

ϕV_n = The lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318 (-19 and -14) Chapter 17 or ACI 318-11 Appendix D as amended in Section 4.1 of this report.

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α shall include all applicable factors to account for non-ductile failure modes and required over-strength.

The requirements for member thickness, edge distance, and spacing, described in Tables 1 and 2 of this report, shall apply.

4.2.2 Interaction of Tensile and Shear Forces: In lieu of ACI 318-19 17.8.2 and 17.8.3, ACI 318-14 17.6.1, 17.6.2, and 17.6.3; or ACI 318-11 Sections D.7.1, D.7.2 and D.7.3, the interaction of tension and shear loads shall be calculated as follows:

17.8.2a (17.6.1,D.7.1): If $V_{applied} \leq 0.2\ V_{allowable,ASD}$ for the governing strength in shear, then the full allowable strength in tension, $T_{allowable,ASD}$, shall be permitted.

17.8.2b (17.6.2, D.7.2): If $T_{applied} \leq 0.2\ T_{allowable,ASD}$ for the governing strength in tension, then the full allowable strength in shear, $V_{allowable,ASD}$, shall be permitted.

17.8.3 (17.6.3, D.7.3): If If $V_{applied} \leq 0.2\ V_{allowable,ASD}$ for the governing strength in shear and $T_{applied} \leq 0.2\ T_{allowable,ASD}$ for the governing strength in tension, then Eq. (4-4) shall apply:

$$T_{applied}/T_{allowable,ASD} + V_{applied}/V_{allowable,ASD} \leq 1.2 \qquad \text{Eq. (4-4)}$$

4.3 Installation

Installation parameters are provided in Tables 1, 2, 8, 9, and C and in Figure 1 of this report. Installation shall be in accordance with ACI 318-19 26.7.2, ACI 318-14 17.8.1 and 17.8.2; or ACI 318-11 D.9.1 and D.9.2. Anchor locations shall comply with this report, and the plans and specifications approved by the building official. Installation of the AT-XP Adhesive Anchor System shall conform to the manufacturer's printed installation instructions (MPII) included in each package unit and as described in Figure 1 of this report. The nozzles, brushes, dispensing tools, adhesive piston plugs, adhesive tubing, and adhesive retaining caps listed in Table 8 and 9 of this report, supplied by the manufacturer, shall be used along with the adhesive cartridges.

The anchors may be used for floor (vertically down), wall (horizontally inclined), and ceiling (upwardly inclined/overhead) applications. For wall and ceiling applications with ⅜-inch (9.7 mm) diameter anchors and No. 3 reinforcing bars, the adhesive shall be directly injected into the back of the hole using the adhesive tubing as described in Table 8 and 9 of this report, cut to appropriate lengths. For wall and ceiling applications with ½-inch through 1¼-inch (12.7 to 31.8 mm) diameter anchors and No. 4 through No. 10 reinforcing bars, the adhesive shall be directly injected into the back of the hole using the adhesive piston plugs and adhesive tubing cut to appropriate lengths, as described in Table 8 and 9 of this report.

The use of anchors in water-filled holes or submerged concrete is beyond the scope of this report.

4.4 Special Inspection

4.4.1 General: Installations may be made under continuous special inspection or periodic special inspection in accordance with ACI 318 (-19 and -14) 26.13.3; ACI 318-11 D.9.2; or as determined by the registered design professional. Section 4.1.4 and Tables 6 and 7 of this report specify special inspection requirements, including strength reduction factors, ϕ, corresponding to the type of inspection provided.

Continuous special inspection is required for all cases where adhesive anchors are installed in horizontally or upwardly inclined orientations that are designed to resist sustained tension loads in accordance with ACI 318-19 26.13.3.2(e), ACI 318-14 17.8.2.4 and 26.13.3.2 (c); or ACI 318-11 D.9.2.4.

Under the IBC, additional requirements as set forth in Sections 1704, 1705, 1706, or 1707 shall be observed, where applicable.

4.4.2 Continuous Special Inspection: Installations made under continuous special inspection with an onsite proof loading program shall be performed in accordance with 2021, 2018, 2015, and 2012 IBC Sections 1705.1 and 1705.3, or 2009 IBC Sections 1704.4 and 1704.15, whereby continuous special inspection is defined in IBC Section 1702.1 and this report. The special inspector shall be on the job site continuously during anchor installation to verify anchor type, adhesive identification, and expiration date, anchor dimensions, concrete type, concrete compressive strength and age, hole drilling method, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, tightening torque and adherence to the manufacturer's printed installation instructions (MPII).

4.4.3 Periodic Special Inspection: Periodic special inspection shall be performed where required in accordance with 2021, 2018, 2015, and 2012 IBC Sections 1705.1 and 1705.3, or 2009 IBC Sections 1704.4 and 1714.15, and this report. The special inspector shall be on the job site initially during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, tightening torque and adherence to the MPII. The special inspector shall verify the initial installations of each type and size of the adhesive anchor by construction personnel on-site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation shall require an initial inspection. For ongoing installations over an extended period, the special inspector shall make regular inspections to confirm the correct handling and installation of the product.

4.4.4 Proof Loading Program: Where required, a program for on-site proof loading, that is, a proof loading program, to be conducted as part of the special inspection shall be established by the registered design professional or design

professional of record and shall conform to the following minimum requirements:

1. Frequency of proof loading based on anchor type, diameter, and embedment.
2. Proof loads by anchor type, diameter, embedment, and location.
3. Acceptable displacements at proof load.
4. Remedial action in the event of failure to achieve proof load or excessive displacement.

Unless otherwise directed by the registered design professional or design professional of record, proof loads shall be applied as confined tension tests in accordance with ASTM E488 or ACI 355.4. Proof loads shall not exceed the lesser of 67 percent of the load corresponding to the nominal bond strength as calculated from the characteristic bond stress for uncracked concrete modified for edge effects and concrete properties or 80 percent of the minimum specified anchor element yield strength ($A_{se,N} \cdot f_{ya}$). Maintain the proof load at the required load level for a minimum of 10 seconds.

5.0 CONDITION OF USE

The Simpson Strong-Tie AT-XP Adhesive Anchor System described in this report is a suitable alternative to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 AT-XP adhesive anchors shall be installed in accordance with the manufacturer's printed installation instructions (MPII) as shown in Figure 1 of this report.

5.2 The anchors shall be installed in cracked and uncracked normalweight concrete having a specified compressive strength f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) and a minimum age of 21 days at the time of installation, subject to the conditions of this report.

5.3 The values of f'_c used for calculation purposes shall not exceed 8,000 psi (55.1 MPa) for both cracked and uncracked concrete.

5.4 Anchors shall be installed in concrete base materials in holes predrilled with carbide-tipped drill bits complying with ANSI B212.15-1994 in accordance with the installation details shown in Figure 1 of this report.

5.5 Loads applied to the anchors shall be adjusted in accordance with Section 1605.2 of the IBC for strength design. Strength design values shall be established in accordance with Section 4.1 of this report.

5.6 Loads applied to the anchors shall be adjusted in accordance with Section 1605.3 of the IBC for allowable stress design. Allowable design values shall be established in accordance with Section 4.2 of this report.

5.7 AT-XP adhesive anchors are recognized for use to resist short and long-term loads, including wind and earthquake loads, subject to the conditions of this report.

5.8 In structures assigned to Seismic Design Category C, D, E, or F under the IBC or IRC, anchor strength shall be adjusted in accordance with Section 4.1.10 of this report.

5.9 AT-XP adhesive anchors are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchor, subject to the conditions of this report.

5.10 Minimum anchor spacing, minimum edge distance, minimum member thickness, critical spacing, and minimum critical edge distance shall comply with the values described in this report.

5.11 Prior to installation, calculations, and details demonstrating compliance with this report shall be submitted to the building official. The calculations and details shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.12 Fire-resistive construction: Anchors are not permitted to support fire-resistive construction. Where not otherwise prohibited in the IBC or IRC, AT-XP adhesive anchors are permitted for installation in fire-resistive construction provided at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.
- Anchors that support gravity load-bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.13 Since an evaluation criteria for evaluating data to determine the performance of adhesive anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under such conditions is beyond the scope of this report.

5.14 Threaded rods, nuts, washers, and deformed reinforcing bars are standard elements and shall conform to applicable national or international specifications.

5.15 Use of zinc-plated carbon steel threaded rods or steel reinforcing bars is limited to dry, interior locations.

5.16 Steel anchoring materials in contact with preservative-treated and fire-retardant-treated wood shall be zinc-coated steel or stainless steel. The coating weights for zinc-coated steel shall be in accordance with ASTM A153 Class C or D.

5.17 Hot-dipped galvanized carbon steel threaded rods with coating weights in accordance with ASTM A153 Class C or D, or stainless steel threaded rods, are permitted for exterior exposure or damp environments.

5.18 The use of anchors in water-filled holes or submerged concrete is beyond the scope of this report.

5.19 Special inspection shall be provided in accordance with Section 4.4 of this report. Continuous special inspection for anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads shall be provided in accordance with Section 4.4 of this report.

5.20 Anchors installed in a horizontally inclined orientation or upwardly inclined orientation to resist sustained tension loads shall be performed by personnel certified by an applicable certification program in accordance with ACI 318-19 26.7.2(e), ACI 318-14 17.8.2.2 or 17.8.2.3; or ACI 318-11 D.9.2.2 or D.9.2.3.

5.21 AT-XP adhesive is manufactured and packaged into cartridges by Simpson Strong-Tie Company, Inc., in West Chicago, Illinois, with inspections under the supervision of IAPMO UES.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with ACI 318-19 and -14, ACI 355.4-19 and ACI 355.4-11, and the ICC-ES Acceptance Criteria for Post-installed Adhesive Anchors in Concrete (AC308), approved February 2022. Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 IDENTIFICATION

7.1 AT-XP Adhesive is identified in the field by labels on the cartridge or packaging, bearing the company name (Simpson Strong-Tie Company, Inc.), product name (AT-XP), the batch number, the expiration date, and the IAPMO UES evaluation report number (ER-263). Either IAPMO UES Mark of Conformity below may also be used.

or

IAPMO UES ER-263

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

TABLE 1 – AT-XP Adhesive Anchor Installation Information – Threaded Rod Anchors

Characteristic	Symbol	Units	Nominal Rod Diameter d_o (inch)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
Drill Bit Diameter	d_o	In.	7/16	9/16	11/16	13/16	1	1 1/8	1 3/8
Maximum Tightening Torque	T_{inst}	ft-lbs.	10	20	30	45	60	80	125
Minimum Embedment Depth	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
Maximum Embedment Depth	$h_{ef,max}$	in.	7 1/2	10	12 1/2	15	17 1/2	20	25
Minimum Concrete Thickness	h_{min}	in.	h_{ef} + 1 1/4		$h_{ef} + 2d_o$				
Critical Edge Distance	c_{ac}	in.	See Section 4.1.4.2 of this report.						
Minimum Edge Distance	c_{min}	in.	1 ¾						2 3/4
Minimum Anchor Spacing	s_{min}	in.	3						6

For **SI units:** 1 inch = 25.4 mm, 1 ft-lbs. = 1.356 Nm.

TABLE 2 – AT-XP Adhesive Anchor Installation Information – Reinforcing Bar (Rebar)

Characteristic	Symbol	Units	Bar Size						
			#3	#4	#5	#6	#7	#8	#10
Drill Bit Diameter	d_o	in.	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8
Minimum Embedment Depth	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
Maximum Embedment Depth	$h_{ef,max}$	in.	7 1/2	10	12 1/2	15	17 1/2	20	25
Minimum Concrete Thickness	h_{min}	in.	h_{ef} + 1 1/4		$h_{ef} + 2d_o$				
Critical Edge Distance	c_{ac}	in.	See Section 4.1.4.2 of this report.						
Minimum Edge Distance	c_{min}	in.	1 ¾						2 ¾
Minimum Anchor Spacing	s_{min}	in.	3						6

For **SI units:** 1 inch = 25.4 mm, 1 ft-lbs. = 1.356 Nm.

TABLE 3 – Steel Design Information – Threaded Rod Anchors

Characteristic	Symbol	Units	Nominal Rod Diameter (inch)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
Nominal Diameter	d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Minimum Tensile Stress Area	A_{se}	in.^{2}	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Tension Resistance of Steel - ASTM F1554, Grade 36[2]	N_{sa}	lbs.	4525	8235	13110	19370	26795	35150	56200
Tension Resistance of Steel - ASTM A193, Grade B7[2]			9750	17750	28250	41750	57750	75750	121125
Tension Resistance of Steel - Stainless Steel ASTM A193, Grade B6 (Type 410)[2]			8580	15620	24860	36740	50820	6660	106590
Tension Resistance of Steel - Stainless Steel ASTM A193, Grade B8 & B8M (Types 304 & 316)[2,3]			4445	8095	12880	19040	26335	34540	55235
Strength Reduction Factor for Tension - Steel Failure[1]	Φ		0.75						
Minimum Shear Stress Area	A_{se}	in.^{2}	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Shear Resistance of Steel - ASTM F1554, Grade 36[2]	V_{sa}	lbs.	2260	4940	7865	11625	16080	21090	33720
Shear Resistance of Steel - ASTM A193, Grade B7[2]			4875	10650	16950	25050	34650	45450	72675
Shear Resistance of Steel - Stainless Steel ASTM A193, Grade B6 (Type 410)[2]			4290	9370	14910	22040	30490	40000	63955
Shear Resistance of Steel - Stainless Steel ASTM A193, Grade B8 & B8M (Types 304 & 316)[2,3]			2225	4855	7730	11425	15800	20725	33140
Reduction for Seismic Shear - ASTM F1554, Grade 36	$\alpha_{V,seis}$		0.85						
Reduction for Seismic Shear - ASTM A193, Grade B7			0.85						
Reduction for Seismic Shear - Stainless Steel ASTM A193, Grade B6 (Type 410)			0.85	0.75					0.85
Reduction for Seismic Shear - Stainless Steel ASTM A193, Grade B8 & B8M (Types 304 & 316)			0.85	0.75					0.85
Strength Reduction Factor for Shear-Steel Failure[1]	Φ		0.65						

[1] The tabulated values of Φ apply when both the load combinations of Section 1605.2.1 of the IBC, ACI 318 (-19 and-14) Section 5.3, or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3 are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318-11 D.4.4.

[2] Bars are considered ductile steel elements in accordance with Section 3.2.4.3 of this report.

[3] Class 2 B8 bars 3/4 inch in diameter and smaller are considered brittle elements in accordance with Section 3.2.4.3 of this report. The corresponding value of Φ shall be 0.65 for tension, and 0.60 for shear.

TABLE 4 – Steel Design Information – Reinforcing Bar (Rebar)

Characteristic	Symbol	Units	Bar Size						
			#3	#4	#5	#6	#7	#8	#10
Nominal Diameter	d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.27
Minimum Tensile Stress Area	A_{se}	in.^{2}	0.11	0.20	0.31	0.44	0.60	0.79	1.27
Tension Resistance of Steel-Rebar (ASTM A615, Grade 60)[2]	N_{sa}	lbs.	9900	18000	27900	39600	54000	71100	114000
Tension Resistance of Steel - Rebar (ASTM A706, Grade 60)[2]			8800	16000	24800	35200	48000	63200	101600
Strength Reduction Factor for Tension - Steel Failure[1]	Φ		0.75						
Minimum Shear Stress Area	A_{se}	in.^{2}	0.11	0.20	0.31	0.44	0.60	0.79	1.27
Shear Resistance of Steel - Rebar (ASTM A615, Grade 60)[2]	V_{sa}	lbs.	4950	10800	16740	23760	32400	42660	68580
Shear Resistance of Steel - Rebar (ASTM A706, Grade 60)[2]			4400	9600	14880	21120	28800	37920	60960
Reduction for Seismic Shear - Rebar (ASTM A615, Grade 60)	$\alpha_{V,seis}$		0.56			0.80			
Reduction for Seismic Shear - Rebar (ASTM A706, Grade 60)									
Strength Reduction Factor for Shear -- Steel Failure[1]	Φ		0.65						

[1] The tabulated values of Φ apply when both the load combinations of Section 1605.2.1 of the IBC, ACI 318 (-19 and-14) Section 5.3, or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3 are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318-11 D.4.4.

[2] Bars are considered ductile steel elements in accordance with Section 3.2.4.3 of this report.

TABLE 5 – Concrete Breakout and Pryout Design Information – Threaded Rod Anchors and Reinforcing Bar

Characteristic	Symbol	Units	Nominal Rod/Rebar Diameter						
			3/8" or #3	1/2" or #4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8	1-1/4" or #10
Nominal Diameter	d_o	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Minimum Embedment Depth	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
Maximum Embedment Depth	$h_{ef,max}$	in.	7 1/2	10	12 1/2	15	17 1/2	20	25
Minimum Concrete Thickness	h_{min}	in.	h_{ef} + 1 1/4		$h_{ef} + 2d_o$				
Critical Edge Distance	c_{ac}	in.	Section 4.1.4.2 of this report provides the provisions.						
Minimum Edge Distance	c_{min}	in.	1 3/4						2 3/4
Minimum Anchor Spacing	s_{min}	in.	3						6
Effectiveness Factor for Uncracked Concrete	$k_{c,uncr}$		24						
Effectiveness Factor for Cracked Concrete	$k_{c,cr}$		17						
Strength Reduction Factor - Concrete Breakout Failure in Tension[1]	Φ		0.65						
Strength Reduction Factor - Concrete Breakout Failure in Shear[1]	Φ		0.70						
Strength Reduction Factor - Pryout Failure[1]	Φ		0.70						

[1] The tabulated values of Φ apply when both the load combinations of Section 1605.2.1 of the IBC, ACI 318 (-19 and-14) Section 5.3, or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318-11 D.4.4 for Condition B.

TABLE 6 – AT-XP Adhesive Anchor Bond Strength Design Information – Threaded Rod Anchors

Condition	Characteristic		Symbol	Units	Nominal Rod Diameter d_o (inch)						
					3/8	1/2	5/8	3/4	7/8	1	1 1/4
Uncracked Concrete[2,3]	Characteristic Bond Strength[1]		$\tau_{k,uncr}$	psi	1390	1590	1715	1770	1750	1655	1250
	Permitted Embedment Depth Range	Minimum	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
		Maximum	$h_{ef,max}$		7 1/2	10	12 1/2	15	17 1/2	20	25
Cracked Concrete[2,3]	Characteristic Bond Strength[1,4,5,6]		$\tau_{k,cr}$	psi	1085	1035	980	950	815	800	700
	Permitted Embedment Depth Range	Minimum	$h_{ef,min}$	in.	3	3	3 1/8	3 1/2	3 3/4	4	5
		Maximum	$h_{ef,max}$		7 1/2	10	12 1/2	15	17 1/2	20	25
Continuous Inspection	Strength Reduction Factor - Dry Concrete[7]		$\Phi_{dry,ci}$		0.65					0.55	
	Strength Reduction Factor - Water-Saturated Concrete[7]		$\Phi_{sat,ci}$		0.45						
	Additional Factor - Water-Saturated Concrete		$K_{sat,ci}$		0.54		0.77			0.96	
Periodic Inspection	Strength Reduction Factor - Dry Concrete[7]		$\Phi_{dry,pi}$		0.55					0.45	
	Strength Reduction Factor - Water-Saturated Concrete[7]		$\Phi_{sat,pi}$		0.45						
	Additional Factor - Water-Saturated Concrete		$K_{sat,pi}$		0.46		0.65			0.81	

[1] Bond strength values correspond to concrete compressive strength f'_c =2,500 psi. Bond strength values shall not be increased for concrete compressive strength.

[2] Maximum short-term temperature of 180°F. The maximum long-term temperature of 110°F.

[3] Short term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are constant over a significant time period.

[4] As detailed in Section 4.1.10 of this report, bond strength values for 1/2 inch, 5/8 inch, 3/4 inch, and 1 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.85.

[5] As detailed in Section 4.1.10 of this report, bond strength values for 1-1/4 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.75.

[6] As detailed in Section 4.1.10 of this report, bond strength values for 7/8 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.59.

[7] The tabulated values of Φ apply when load combinations of Section 1605.2 of the IBC, ACI 318 (-19 and-14) Section 5.3, or ACI 318-11 Section 9.2 are used in accordance with ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3.

If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318-11 D.4.4.

TABLE 7 – AT-XP Adhesive Anchor Bond Strength Design Information – Reinforcing Bar (Rebar)

Condition	Characteristic		Symbol	Units	Bar Size						
					#3	#4	#5	#6	#7	#8	#10
Uncracked Concrete[2,3]	Characteristic Bond Strength[1]		$\tau_{k,uncr}$	psi	1010	990	970	955	935	915	875
	Permitted Embedment Depth Range	Minimum	$h_{ef,min}$	in.	2 3/8	2 3/4	3 1/8	3 1/2	3 3/4	4	5
		Maximum	$h_{ef,max}$		7 1/2	10	12 1/2	15	17 1/2	20	25
Cracked Concrete[2,3]	Characteristic Bond Strength[1]		$\tau_{k,cr}$	psi	340	770	780	790	795	795	820
	Permitted Embedment Depth Range	Minimum	$h_{ef,min}$	in.	3	3	3 1/8	3 1/2	3 3/4	4	5
		Maximum	$h_{ef,max}$		7 1/2	10	12 1/2	15	17 1/2	20	25
Continuous Inspection	Strength Reduction Factor - Dry Concrete[4]		$\Phi_{dry,ci}$		0.65					0.55	
	Strength Reduction Factor - Water-Saturated Concrete[4]		$\Phi_{sat,ci}$		0.45						
	Additional Factor - Water-Saturated Concrete		$K_{sat,ci}$		0.54		0.77			0.96	
Periodic Inspection	Strength Reduction Factor - Dry Concrete[4]		$\Phi_{dry,pi}$		0.55					0.45	
	Strength Reduction Factor - Water-Saturated Concrete[4]		$\Phi_{sat,pi}$		0.45						
	Additional Factor - Water-Saturated Concrete		$K_{sat,pi}$		0.46		0.65			0.81	

[1] Bond strength values correspond to concrete compressive strength f'_c =2,500 psi. Bond strength values shall not be increased for concrete compressive strength.

[2] Maximum short-term temperature of 180°F. The maximum long-term temperature of 110°F.

[3] Short term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are constant over a significant time period.

[4] As detailed in Section 4.1.10 of this report, bond strength values for 1/2 inch, 5/8 inch, 3/4 inch, and 1 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.85.

[5] As detailed in Section 4.1.10 of this report, bond strength values for 1-1/4 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.75.

[6] As detailed in Section 4.1.10 of this report, bond strength values for 7/8 inch diameter anchors shall be multiplied by $\alpha_{N,seis}$ = 0.59.

[7] The tabulated values of Φ apply when load combinations of Section 1605.2 of the IBC, ACI 318 (-19 and-14) Section 5.3, or ACI 318-11 Section 9.2 are used in accordance with ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3.

If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318-11 D.4.4.

TABLE 8– Installation Details – Threaded Rod Anchors

Anchor Diameter (in)	Drill Bit Diameter[1,2] (in)	Brush Part Number	Nozzle Part Number	Dispensing Tool Part Number	Adhesive Retaining Cap Part Number[3]	Adhesive Tubing Part Number[3,4]	Adhesive Piston Plug Part Number[3,4]
3/8	7/16[6]	ETB6[6]	AMN19Q	ADT13S, ADT30S, ADTA30P, ADT30CKT, CDT10S	ARC37A-RP25	PPFT25	Not Available
1/2	9/16[6]	ETB6[6]			ARC50A-RP25		PP56-RP10
5/8	11/16	ETB6[5]			ARC62A-RP25		PP68-RP10
3/4	13/16	ETB8[5]			ARC75A-RP25		PP81-RP10
7/8	1	ETB10[5]			ARC87-RP25		PP100-RP10
1	1-1/8	ETB10[5]			ARC100-RP25		PP112-RP10
1-1/4	1-3/8	ETB12[5]			ARC125-RP25		PP137-RP10

For **SI units:** 1 inch = 25.4 mm, 1 ft-lbs. = 1.356 N-m.

[1] Rotary Hammer shall be used to drill all holes.

[2] Drill bits shall comply with the requirements of ANSI B212.15.

[3] Adhesive Retaining Caps, Adhesive Piston Plugs, and Adhesive Tubing are to be used for wall and ceiling (horizontally and upwardly inclined) installation orientations.

[4] For ⅜ inch diameter wall and ceiling installation (horizontally and upwardly inclined) orientations, adhesive shall be directly injected into the back of the hole using the Adhesive Tubing only.

[5] Hole cleaning brushes are not needed when using the vacuum dust extraction system and the Bosch®/Simpson Strong-Tie DXS hollow carbide drill bits described in Section 3.2.3.2 of this report to drill and clean holes.

[6] Hole cleaning brushes are always needed, since the 7/16 and 9/16 inch drill bit diameters have not been evaluated for use with the vacuum dust extraction system.

TABLE 9 – Installation Details – Reinforcing Bar (Rebar) Anchors

Bar Designation No.	Drill Bit Diameter[1,2] (in)	Brush Part Number	Nozzle Part Number	Dispensing Tool Part Number	Adhesive Retaining Cap Part Number[3]	Adhesive Tubing Part Number[3,4]	Adhesive Piston Plug Part Number[3,4]
#3	1/2[6]	ETB6[6]	AMN19Q	ADT13S, ADT30S, ADTA30P, ADT30CKT, CDT10S	ARC37-RP25	PPFT25	Not Available
#4	5/8	ETB6[5]			ARC50-RP25		PP62-RP10
#5	3/4	ETB6[5]			ARC62-RP25		PP75-RP10
#6	7/8	ETB8[5]			ARC75-RP25		PP87-RP10
#7	1	ETB10[5]			ARC87-RP25		PP100-RP10
#8	1 1/8	ETB10[5]			ARC100-RP25		PP112-RP10
#10	1 3/8	ETB12[5]			ARC125-RP25		PP137-RP10

For SI units: 1 inch = 25.4 mm, 1 ft-lbs. = 1.356 N-m.

[1] Rotary Hammer shall be used to drill all holes.

[2] Drill bits shall comply with the requirements of ANSI B212.15.

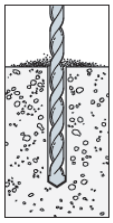
[3] Adhesive Retaining Caps, Adhesive Piston Plugs, and Adhesive Tubing are to be used for wall and ceiling (horizontally and upwardly inclined) installation orientations.

[4] For #3 wall and ceiling installation (horizontally and upwardly inclined) orientations, the adhesive shall be directly injected into the back of the hole using the Adhesive Tubing only.

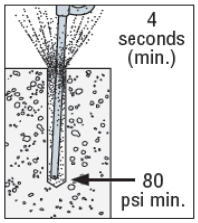
[5] Hole cleaning brushes are not needed when using the vacuum dust extraction system and the Bosch®/Simpson Strong-Tie DXS hollow carbide drill bits described in Section 3.2.3.2 of this report to drill and clean holes.

[6] Hole cleaning brushes are always needed, since the ½ inch drill bit diameter has not been evaluated for use with the vacuum dust extraction system.

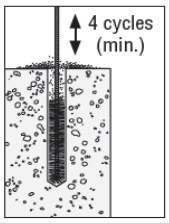
1A Hole Preparation Standard Equipment – Horizontal, Vertical and Overhead Applications



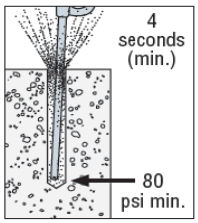
1. Drill.
Drill hole to specified diameter and depth.



2. Blow.
Remove dust from hole with oil-free compressed air for a minimum of four (4) seconds. Compressed air nozzle must reach the bottom of the hole.

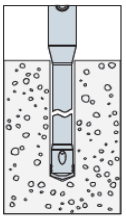


3. Brush.
Clean with a nylon brush for a minimum of four (4) cycles. Brush MUST reach the bottom of the hole. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



4. Blow.
Remove dust from hole with oil-free compressed air for a minimum of four (4) seconds. Compressed air nozzle must reach the bottom of the hole.

1B Hole Preparation Vacuum Dust Extraction System with Bosch®/Simpson Strong-Tie® DXS Hollow Carbide Drill Bit – Horizontal, Vertical and Overhead Applications



1. Drill.
Drill hole to specified diameter and depth using a Bosch/Simpson Strong-Tie DXS hollow carbide drill bit and vacuum dust extraction system described in Section 3.2.3.2.

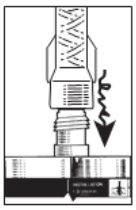
Bosch/Simpson Strong-Tie DXS drill bit used with the vacuum dust extraction system described in Section 3.2.3.2

Note: Refer to Tables A and B for proper drill bit size and brush part number.

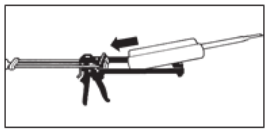
2 Cartridge Preparation

1. Check.
Check expiration date on product label. Do not use expired product. Product is usable until end of printed expiration month.

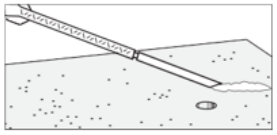
2. Open.
Open cartridge per package instructions.



3. Attach.
Attach proper Simpson Strong-Tie® nozzle and extension to cartridge. Do not modify nozzle.



4. Insert.
Insert cartridge into dispensing tool.



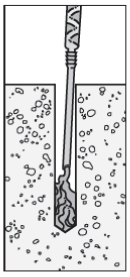
5. Dispense.
Dispense adhesive to the side until properly mixed (uniform color).

Note: Review MSDS prior to use. Refer to Tables A and B for proper nozzle and dispensing tool part number. Refer to Tables C and E for proper adhesive storage temperatures, permitted concrete temperature range and adhesive gel times.

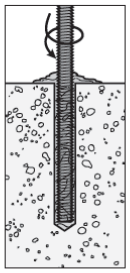
3A Filling the Hole – Vertical Anchorage

Prepare the hole per "Hole Preparation."

DRY AND DAMP HOLES:

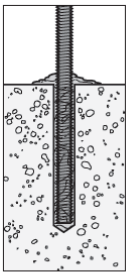


1. Fill.
Fill hole ½ to ⅔ full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



2. Insert.
Insert clean, oil-free anchor (marked with the required embedment depth), turning slowly until the anchor contacts the bottom of the hole.

Threaded rod or rebar



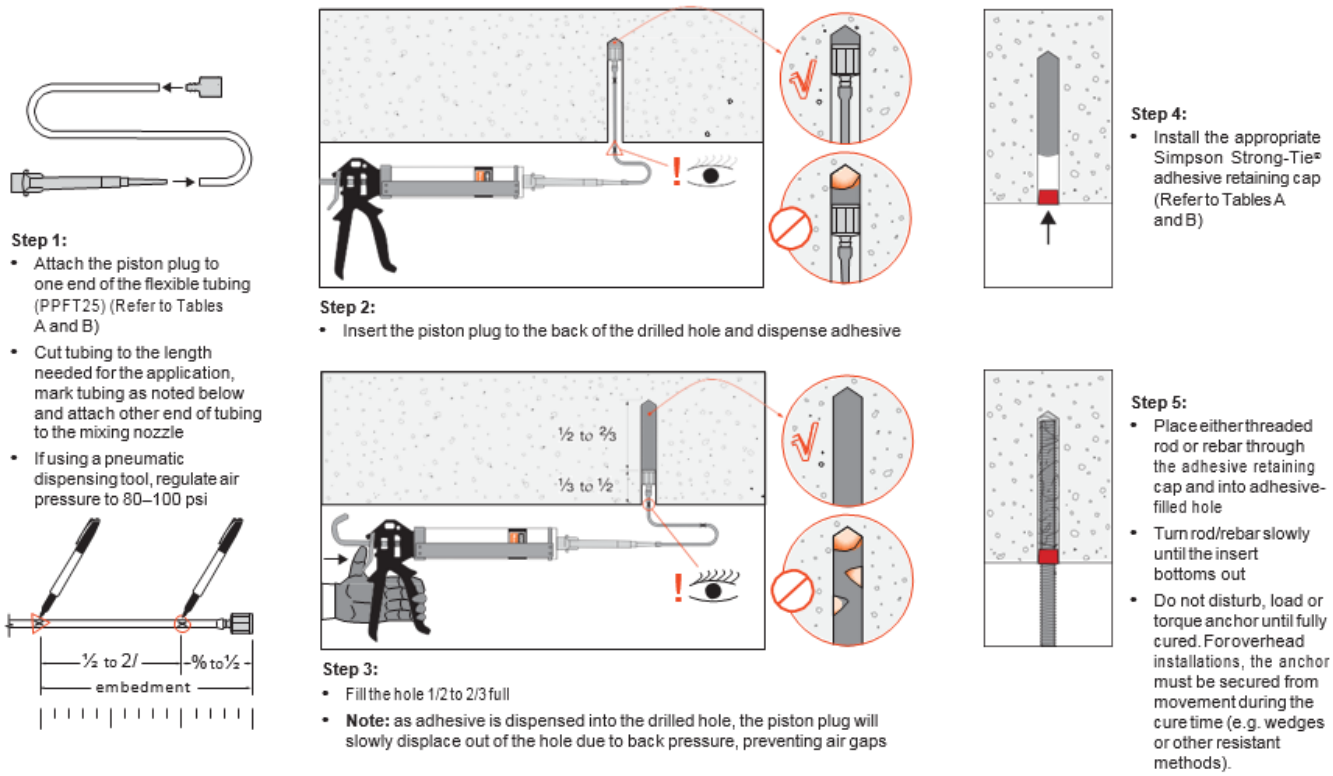
3. Do not disturb.
Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

Note: Refer to Table C for proper gel times and cure times and Table D for maximum tightening torque. Nozzle extensions may be needed for deep holes.

FIGURE 1 – INSTALLATION DETAILS (cont'd next pages)

3B Filling the Hole – Horizontal and Overhead Anchorage with Adhesive Retaining Caps

Prepare the hole per "Hole Preparation."



Note: Refer to Table C for proper gel times and cure times and Table D for maximum tightening torque.

FIGURE 1 – INSTALLATION DETAILS (continued)

TABLE A — Installation Details for Threaded Rod Anchors

Anchor Diameter (in)	Drill Bit Diameter[1,2] (in)	Brush Part Number	Nozzle Part Number	Dispensing Tool Part Number	Adhesive Retaining Cap Part Number[3]	Adhesive Tubing Part Number[3,4]	Adhesive Piston Plug Part Number[3,4]
3/8	7/16[6]	ETB6	AMN19Q	ADT13S, ADT30S, ADTA30P, ADT30CKT, CDT10S	ARC37A-RP25	PPFT25	NotAvailable
1/2	9/16[6]	ETB6			ARC50A-RP25		PP56-RP10
5/8	11/16	ETB6[5]			ARC62A-RP25		PP68-RP10
3/4	13/16	ETB8[8]			ARC75A-RP25		PP81-RP10
7/8	1	ETB10[5]			ARC87-RP25		PP100-RP10
1	1-1/8	ETB10[5]			ARC100-RP25		PP112-RP10
1-1/4	1-3/8	ETB12[5]			ARC125-RP25		PP137-RP10

1. A Rotary Hammer shall be used to drill all holes.
2. Drill bits shall meet the requirements of ANSI B212.15.
3. Adhesive Retaining Caps Adhesinge Piston Plugs and Tubing shall be used for wall and ceiling (horizontally and upwardly inclined installation orientations.
4. For 3/8-inch diameter wall and ceiling installation (horizontally and upwardly inclined) orientations, adhesive shall be directly injected into the back of the hole using the Adhesive Tubing only.
5. Hole Cleaning brushes are not needed when using a vacuum dust extraction system and the Bosch® /Simpson Strong-Tie DXS hollow carbide drill bits described in Section 3.2.3.2 of this report to drill and clean holes.
6. The 7/16- and 9/16-inch drill bit diameters have not been evaluated for use with the vacuum dust extraction system.

TABLE B — Installation Details for Reinforcing Bar Anchors

Bar Designation No.	Drill Bit Diameter[1,2] (in.)	Brush Part Number	Nozzle Part Number	Dispensing Tool Part Number	Adhesive Retaining Cap Part Number[3]	Adhesive Tubing Part Number[3,4]	Adhesive Piston Plug Part Number[3,4]
#3	1/2[6]	ETB6	AMN19Q	ADT12S, ADT30S, ADTA30P, ADT30CKT, CDT10S	ARC37-RP25	PPFT25	NotAvailable
#4	5/8	ETB6[5]			ARC50-RP25		PP62-RP10
#5	3/4	ETB6[5]			ARC62-RP25		PP75-RP10
#6	7/8	ETB8[5]			ARC75-RP25		PP87-RP10
#7	1	ETB10[5]			ARC87-RP25		PP100-RP10
#8	1-1/8	ETB10[5]			ARC100-RP25		PP112-RP10
#10	1-3/8	ETB12[5]			ARC125-RP25		PP137-RP10

1. Rotary Hammer Shall be used to drill all holes.
2. Drill bits shall comply with the requirements of ANSI B212.15.
3. Adhesive Retaining Caps, Adhesive piston Plugs, and Tubing shall be used for wall and Ceiling (horizontally and upwardly inclined) installation orientations.
4. For #3 wall and ceiling installation (horizontally and upwardly inclined) orientations, adhesive shall be directly injected to the back of the hole using the adhesive Tubing only.
5. Hole cleaning brushes are not needed when using a vacuum dust extraction system and the Bosch®/Simpson Strong-Tie® DXS hollow carbide drill bits described in Section 3.2.3.2 of this report are used to drill and clean holes.
6. The ½-inch drill bit has not been evaluated for use with the vacuum dust extraction system.

TABLE C – Cure Schedule

Concrete Temperature (F°)	Concrete Temperature (C°)	Gel Time (minutes)	Cure Time[1]
14	-10	30	24 hours
32	0	15	8 hours
50	10	7	3 hours
68	20	4	60 minutes
85	30	1.5	30 minutes
100	38	1	20 minutes

1. For water-saturated concrete, the cure times should be doubled.

TABLE D – Anchor Tightening Torque, Embedment Depth, and Placement Details

Anchor Diameter (in.)	Maximum Tightening Torque T_{inst} (fl-lb.)	Min. Emb. Depth $h_{ef,min}$ (in.)	Max. Emb. Depth $h_{ef,max}$ (in.)	Min. Anchor Spacing s_{min} (in.)	Min. Edge Distance c_{min} (in.)	Min. Concrete Thickness h_{min} (in.)
3/8	10	2-3/8	7-1/2	3	1-3/4	h_{ef} + 1-1/4
1/2	20	2-3/4	10			
5/8	30	3-1/8	12-1/2			$h_{ef}+2d_o$
3/4	45	3-1/2	15			
7/8	60	3-3/4	17-1/2			
1	80	4	20			
1-1/4	125	5	25	6	2-3/4	

TABLE E — Storage Information

(F°)	(C°)
32 to 80	0 to 27

CITY OF LOS ANGELES SUPPLEMENT

SIMPSON STRONG-TIE COMPANY INC.
225956 West Las Positas Boulevard
Pleasanton, California 94588
(800) 999-5099
www.strongtie.com

AT-XP® ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE

CSI Sections:
03 16 00—Concrete Anchors
03 15 19—Cast-in Concrete Anchors
05 05 19—Post-Installed Concrete Anchors

1.0 RECOGNITION

The Simpson Strong-Tie® AT-XP Adhesive Anchors recognized in ER-263 have been evaluated for use to resist dead, live, wind, and seismic tension and shear loads. The structural performance properties of the Simpson Strong-Tie® AT-XP Adhesive Anchors were evaluated for compliance with the following codes:

- 2023 City of Los Angeles Building Code (LABC)
- 2023 City of Los Angeles Residential Code (LARC)

2.0 LIMITATIONS

The Simpson Strong-Tie® AT-XP Adhesive Anchors described in IAPMO UES ER-263 and this supplement comply with the 2023 LABC Chapter 19 and 2023 LARC subject to the following limitations:

2.1 For use under the 2023 LABC and LARC, the design, installation, conditions of use, and identification of the Simpson Strong-Tie® AT-XP adhesive anchors shall be in accordance with the 2021 International Building Code and the 2021 International Residential Code as noted in ER-263.

2.2 Prior to installation, calculations, and details demonstrating compliance with this approval report and the Los Angeles Building Code or Los Angeles Residential Code, as applicable, shall be submitted to the structural plan check section for review and approval. The calculations and details shall be prepared, stamped, and signed by a California registered design professional.

2.3 The design, installation, and inspection of the Simpson Strong-Tie® AT-XP adhesive anchors shall be in accordance with LABC Chapters 16 and 17, as applicable, due to local amendments to these chapters.

2.4 The design information listed in the report and tables of ER-263 is valid for anchorage to concrete only. Connected members also shall be analyzed for structural capacities in accordance with the applicable requirements in the LABC or LARC.

2.5 Periodic special inspection shall be provided by the Registered Deputy Inspector in accordance with Section 1705 of the LABC during installations of the Simpson Strong-Tie® AT-XP adhesive anchors.

2.6 Under the LARC a design in accordance with Sections R301.1.3 and R301.1.3.3 shall be submitted.

2.7 This supplement expires concurrently with ER-263.

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

FLORIDA SUPPLEMENT

AT-XP® ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE

REPORT HOLDER:
SIMPSON STRONG-TIE COMPANY INC.
225956 West Las Positas Boulevard
Pleasanton, California 94588
(800) 999-5099
www.strongtie.com

CSI Sections:
03 16 00—Concrete Anchors
03 15 19—Cast-in Concrete Anchors
05 05 19—Post-Installed Concrete Anchors

1.0 RECOGNITION

Simpson Strong-Tie® AT-XP® adhesive anchors recognized in ER-263 have been evaluated for use to resist dead, live, seismic, and wind tension and shear loads. The structural performance properties of the Simpson Strong-Tie® AT-XP® adhesive anchors were evaluated for compliance with the following codes:

- 2023 Florida Building Code, Building, 8th Edition (FBC–Building)
- 2023 Florida Building Code, Residential, 8th Edition (FBC–Residential)

2.0 LIMITATIONS

Simpson Strong-Tie® AT-XP™ adhesive anchors described in IAPMO UES ER-263 comply with the 2023 FBC–Building and the 2023 FBC–Residential, subject to the following limitations:

2.1 The design and installation of the Simpson Strong-Tie® AT-XP™ adhesive anchors shall be in accordance with the 2021 International Building Code and the 2021 International Residential Code as noted in ER-263.

2.2 Load combinations shall be in accordance with Section 1605.2 of the FBC–Building.

2.3 Design wind loads shall be in accordance with Section 1609.1.1 of the FBC–Building or Section R301.2.1.1 of the FBC–Residential, as applicable, and Section 1620 of the FBC–Building where used in High-velocity Hurricane Zones (HVHZ).

2.4 Use of Simpson Strong-Tie® ET-HP™ adhesive anchors in High-velocity Hurricane Zones (HVHZ) as set forth in Section 2321.5.2 of the FBC–Building and Section R4409 of the FBC–Residential to resist wind uplift is permitted. The anchors shall be designed to resist the uplift forces as required in Section 1620 (HVHZ) of the FBC–Building or 700 pounds (3114 N), whichever is greater, per FBC–Building Section 2321.7.

2.5 Use of Simpson Strong-Tie® AT-XP™ adhesive anchors in High-velocity Hurricane Zones (HVHZ) as set forth in Section 2122.7 of the FBC–Building and Section R4407 of the FBC–Residential to resist wind forces is permitted. The anchors shall be designed to resist the horizontal forces as required in Section 1620 (HVHZ) of the FBC–Building or 200 pounds per lineal foot (2919 N/m) of the wall, whichever is greater, per FBC–Building Section 2122.7.3.

2.6 Use of Simpson Strong-Tie® AT-XP™ adhesive anchors with stainless steel or galvanized carbon steel threaded rod complies with the High-Velocity Hurricane Zone (HVHZ) provisions set forth in Sections 2324.2 of the FBC–Building.

2.7 Use of Simpson Strong-Tie® AT-XP™ adhesive anchors with carbon steel threaded rods or reinforcing bars in applications exposed to the weather within High-velocity Hurricane Zones (HVHZ) set forth in the FBC–Building and the FBC–Residential is beyond the scope of this supplemental report.

2.8 For products falling under Section (5)(d) of Florida Rule 61G20-3.008, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission (or the building official when the report holder does not possess an approval by the Commission) is required to provide oversight and determine that the products are being manufactured as described in this evaluation report to establish continual product performance.

2.9 This supplement expires concurrently with ER-263.

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