ICC-ES Evaluation Report

ESR-2621

Issued January 1, 2010

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

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

REPORT HOLDER:

UNITEX
3101 GARDNER AVE
KANSAS CITY, MISSOURI 64120
www.unitex-chemicals.com
mail@unitex-chemicals.com

EVALUATION SUBJECT:

PRO-POXY 300 FAST EPOXY ADHESIVE ANCHORS FOR UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with 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)

Property evaluated:

Structural

2.0 USES

The Unitex Pro-Poxy 300 FAST Adhesive Anchors are used to resist static, wind, tension and shear loads in uncracked, normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). The anchors are alternatives to cast-in-place anchors described in Sections 1911 and 1912 of the 2006 IBC, Sections 1912 and 1913 of the 2003 IBC, and Sections 1923.1 and 1923.2 of the UBC. The anchors may also be used where an engineering design is submitted in accordance with Section R301.1.3 of the 2006 and 2003 IRC.

3.0 DESCRIPTION

3.1 General:

The Pro-Poxy 300 FAST Epoxy Adhesive Anchor System is comprised of the following components:

- Pro-Poxy 300 FAST epoxy adhesive
- Adhesive mixing and dispensing equipment
- Hole cleaning equipment

The Pro-Poxy 300 FAST epoxy adhesive is used with continuously threaded carbon steel rods. Installation instructions and parameters, included with each adhesive unit package, are replicated in Figure 1.

The primary components of the Pro-Poxy 300 FAST epoxy adhesive anchor system, including the side-by-side cartridge, static mixing nozzle, nozzle extension tube and steel anchor elements, are shown in Figure 2 of this report.

3.1.1 The Pro-Poxy 300 FAST: The Pro-Poxy 300 FAST are two-component (resin and hardener) epoxy-based adhesives, supplied in 250 mL, 400 mL, 600 mL, and 1500 ml cartridges separating the chemical components, which are combined in a 1:1 ratio by volume when dispensed through the system static mixing nozzle. Each cartridge label is marked with the adhesive expiration date, reflecting a shelf life of two years when the material is stored in the manufacturer's unopened containers at temperatures between 40°F (4.4°C) and 95°F (35°C).

3.1.2 Dispensing Equipment: The Pro-Poxy 300 FAST epoxy adhesive must be dispensed using a Unitex pneumatic or manual actuated extrusion tool and static-mixing nozzle intended for the cartridge size.

3.2 Hole Preparation:

The holes must be drilled with carbide drills placed in a percussion electric drill (or equivalent). The holes must be cleaned in accordance with the installation instructions using the corresponding-size nylon cleaning brush supplied by Unitex.

3.3 Anchor Element Materials:

3.3.1 Threaded Rod: The $^3/_8$-inch- to $^7/_8$-inch- diameter (9.5 mm to 22.2 mm) threaded anchor rods must be formed from carbon steel and comply with ASTM F 1554 Grade 36 or ASTM A 193 Grade B7, and must be dry and free of dirt, mud, scale, rust, oil, and other coatings that decrease bond. Threaded rods must be straight and free of indentations or other defects along their lengths. Nuts must comply with ASTM A 563 Grade A for use with rods complying with ASTM F 1554 Grade 36; or ASTM A 194 in a grade and type developing specified proof load stresses equal to or greater than the minimum tensile strength of the rods complying with ASTM A 193 Grade B7. Table 1 contains further details.

3.3.2 Ductility: In accordance with D.3.3.4 of ACI 318-05, for the steel element to be considered as ductile, the threaded rod elongation must be not less than 14 percent and have a reduction of area not less than 30 percent. Steel elements that have an elongation of less than 14 percent or a reduction of area less than 30 percent must be considered brittle.

Rods complying with both ASTM A 307 Grade C, and ASTM A 193 Grade B7, may be designed as ductile steel elements.

3.4 Concrete:

Normal-weight concrete with a minimum compressive strength, at the time of anchor installation, of 2,500 psi (17.2 MPa) but not less than that required by the applicable code, nor more than 8,500 psi (58.6 MPa), must comply with Sections 1903 and 1905 of the IBC or UBC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: Anchor design strengths, ϕN_n and ϕV_n, must be determined in accordance with ACI 318-05 (ACI 318) Appendix D and this report. An example set of calculations is presented in Figure 3. Design parameters are provided in Table 1. The anchor design must satisfy the requirements of the applicable code, ACI 318 D.4.1, and, where the anchor design includes earthquake forces, ACI D.3.3. Strength reduction factors, ϕ, described in ACI 318 Section D.4.4, and noted in Table 1 of this report, must be used for the load combinations calculated in accordance with Section 1605.2.1 of the IBC, ACI 318 Section 9.2, or UBC Section 1612.2.1. Strength reduction factors, ϕ, described in ACI 318 Section D.4.5 must be used for load combinations calculated in accordance with Appendix C of ACI 318 or Section 1909.2 of the UBC.

This section provides amendments to ACI 318 Appendix D as required for the strength design of post-installed adhesive anchors in hardened concrete. In conformance with ACI 318, all equations are expressed in inch-pound units.

Modify ACI 318 D.4.1.2 as follows:

D.4.1.2 — In Eq. (D-1) and (D-2), ϕN_n and ϕV_n are the lowest design strengths determined from all appropriate failure modes. ϕN_n is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ϕN_{sa}, either ϕN_a or ϕN_{ag}, and either ϕN_{cb} or ϕN_{cbg}. ϕV_n is the lowest design strength in tension of an anchor or group of anchors as determined from consideration of ϕV_{sa}, either ϕV_{cp} or ϕV_{cpg}, and either ϕV_{cb} or ϕV_{cbg}. For adhesive anchors subjected to tension resulting from sustained loading, refer to D.4.1.4 in this report for additional requirements.

Add ACI 318 D.4.1.4 as follows:

D.4.1.4 — For adhesive anchors subjected to tension resulting from sustained loading, a supplementary check shall be performed using Eq. (D-1), whereby N_{ua} is determined from the sustained load alone, e.g., the dead load and that portion of the live load acting that may be considered as sustained and ϕN_n is determined as follows:

D.4.1.4.1 — For single anchors, $\phi N_n = 0.75\phi N_{ao}$

D.4.1.4.2 — For anchor groups, Eq. (D-1) shall be satisfied by taking $\phi N_n = 0.75\phi N_{ao}$ for that anchor in an anchor group that resists the highest tension load.

D.4.1.4.3 — Where shear loads act concurrently with the sustained tension load, the interaction of tension and shear shall be analyzed in accordance with D.4.1.3.

4.1.2 Static Steel Strength in Tension: The nominal steel strength of a single anchor in tension, N_{sa}, shall be calculated in accordance with ACI 318 Section D.5.1.2. N_{sa} and the strength reduction factor, ϕ, in accordance with ACI D.4.4 are given in Table 1 of this report.

Static Concrete Breakout Strength in Tension: The nominal concrete breakout strength in tension of a single anchor or group of anchors, N_{cb} and N_{cbg}, must be calculated in accordance with ACI 318 D.5.2, with the following modifications as described in this section.

D.5.2.9 — The limiting concrete strength of adhesive anchors in tension shall be calculated in accordance with D.5.2.1 to D.5.2.8 where the value of k_c to be used in Eq. (D-7) shall be:

$k_{c,uncr}$ = 24 (SI units) or 10 (Imperial units)

where analysis indicates no cracking ($f_t < f_r$) at service load levels in anchor vicinity (uncracked concrete).

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318 D.5.2.2 using the values of h_{ef} and $k_{c,uncr}$ as given in Table 1 of this report.

The value of f'_c used in the design must be limited to a maximum of 8,000 psi (55.1 MPa) in accordance with ACI 318 D.3.5.

4.1.3 Static Pullout Strength in Tension: In lieu of determining the nominal pullout strength in accordance with ACI 318 D.5.3, the nominal bond strength in tension must be calculated using values noted in Table 1 of this report and in accordance with the following sections added to ACI 318:

D.5.3.7 — The nominal strength of an adhesive anchor, N_a, or group of adhesive anchors, N_{ag}, in tension must not exceed:

(a) for a single anchor

$$N_a = \frac{A_{Na}}{A_{Nao}}\psi_{ed,Na}\psi_{p,Na}N_{a0} \qquad \text{(D-16a)}$$

(b) for a group of anchors

$$N_{ag} = \frac{A_{Na}}{A_{Nao}}\psi_{g,na}\psi_{ec,Na}\psi_{ed,Na}\psi_{p,Na}N_{a0} \qquad \text{(D-16b)}$$

where:

A_{na} is the projected area of the failure surface for the anchor or group of anchors that shall be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward a distance $c_{cr,Na}$ from the centerline of the anchor, or in the case of a group of anchors, from a line through a row of adjacent anchors. A_{Na} must not exceed nA_{Na0} where n is the number of anchors loaded in tension in the group. In ACI 318 Figures RD.5.2.1a and RD.5.2.1b, the terms $1.5h_{ef}$ and $3.0h_{ef}$ are replaced with $c_{cr,Na}$ and $s_{cr,Na}$ respectively. A_{Na0} is the projected area of the failure surface of a single anchor without the influence of proximate edges in accordance with Eq. (D-16c):

$$A_{Na0} = (s_{cr,Na})^2 \qquad \text{(D-16c)}$$

with:

$$s_{cr,Na} = 20\cdot d\cdot(\tau_{k,uncr}/1{,}450)^{1/2} \le 3\cdot h_{ef} \qquad \text{(D-16d)}$$

D.5.3.8 — The critical spacing $s_{cr,Na}$ and critical edge distance $c_{cr,Na}$ shall be calculated as follows:

$s_{cr,Na}$ = as given by Eq. D-16d

$$c_{cr,Na} = s_{cr,Na}/2 \qquad \text{(D-16e)}$$

D.5.3.9 — The basic strength of a single adhesive anchor in tension in uncracked concrete shall not exceed:

$$N_{a0} = \tau_{k,uncr}\cdot\pi\cdot d\cdot h_{ef} \qquad \text{(D-16f)}$$

where:

$\tau_{k,uncr}$ = characteristic bond resistance in uncracked concrete.

Table 1 in this report provides the values for each anchor diameter.

D.5.3.10 — The modification factor for the influence of the failure surface of a group of adhesive anchors is:

$$\psi_{g,Na} = \psi_{g,Na0} + [(s/s_{cr,Na})^{0.5} \cdot (1 - \psi_{g,Na0})] \quad \text{(D-16g)}$$

where:

s = actual spacing of the anchors.

$$\psi_{g,Na0} = \sqrt{n} - [(\sqrt{n} - 1) \cdot (\tau_{k,uncr}/\tau_{k,max,uncr})^{1.5}] \geq 1.0 \quad \text{(D-16h)}$$

n = the number of tension loaded adhesive anchors in a group.

$$\tau_{k,max,uncr} = \tau_{k,max,uncr} = \frac{k_{c,uncr}}{\pi \cdot d} \cdot \sqrt{h_{ef} \cdot f'_c} \quad \text{(D-16i)}$$

The value of f'_c shall be limited to 8,000 psi (55 MPa), maximum, in accordance with ACI 318 D.3.5

D.5.3.11 — The modification factor for eccentrically loaded adhesive anchor groups is:

$$\psi_{ec,Na} = \psi_{ec,Na} = \frac{1}{1 + \frac{2e'_N}{s_{cr,Na}}} \leq 1.0 \quad \text{(D-16j)}$$

Eq. (D-16j) is valid for $e'_N \leq s/2$

If the loading on an anchor group is such that only some anchors are in tension, only those anchors that are in tension shall be considered when determining the eccentricity e'_N for use in Eq. (D-16j).

In the case where eccentric loading exists about two orthogonal axes, the modification factor $\psi_{ec,Na}$ shall be computed for each axis individually and the product of these factors used as $\psi_{ec,Na}$ in Eq. (D-16b).

D.5.3.12 — The modification factor for edge effects for single adhesive anchors or anchor groups loaded in tension is:

$$\Psi_{ed,Na} = 1.0 \quad \text{(D-16l)}$$

when $c_{a,min} \geq c_{cr,Na}$

or

$$\psi_{ed,Na} = [0.7 + 0.3 \cdot (c_{a,min}/c_{cr,Na})] \leq 1.0 \quad \text{(D-16m)}$$

when $c_{a,min} < c_{cr,Na}$

D.5.3.13 — Since the anchor is limited to use in uncracked concrete, the modification factor $\psi_{p,Na}$ shall be taken as:

$$\psi_{p,Na} = 1.0 \text{ when } c_{a,min} \geq c_{cr,Na} \quad \text{(D-16o)}$$

$$\psi_{p,Na} = \frac{max\left|c_{a,min}; c_{cr,Na}\right|}{c_{ac}} \text{ when } c_{a,min} < c_{ac} \quad \text{(D-16p)}$$

Values of c_{ac} and $c_{a,min}$ shall be as noted in Table 1 of this report. The value of $c_{cr,Na}$ shall be determined using Eq. (D-16e).

Additional information for the determination of nominal bond strength in tension is given in Section 4.1.8 of this report.

4.1.4 Static Steel Strength in Shear V_{sa}: The nominal static steel strength of a single anchor in tension as governed by the steel, V_{sa}, in accordance with ACI 318 D.6.1.2 and strength reduction factor, ϕ, in accordance with ACI 318 D.4.4, are given in Table 1 for the corresponding anchor steel.

4.1.5 Static Concrete Breakout Strength in Shear V_{cb} or V_{cbg}: The nominal static concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, respectively, must be calculated in accordance with ACI 318 D.6.2 based on information given in Table 1 for the corresponding anchor steel. The basic concrete breakout strength in shear, V_b, must be calculated in accordance with ACI 318 D.6.2.2 using the values of d and h_{ef} given in Table 1 of this report in lieu of d_o and l_e respectively. The value of f'_c must be limited to 8,000 psi (55.1 MPa), maximum, in accordance with ACI 318 Section D.3.5.

4.1.6 Static Concrete Pryout Strength in Shear V_{cp} or V_{cpg}: In lieu of determining the nominal pryout strength in accordance with ACI 318 Section D.6.3.1, nominal pryout strength in shear must be calculated in accordance with the following sections added to ACI 318:

D.6.3.2 — The nominal pryout strength of an adhesive anchor or group of adhesive anchors shall not exceed:

(a) for a single adhesive anchor :

$$V_{cp} = \min\left|k_{cp} \cdot N_a ; k_{cp} \cdot N_{cb}\right| \quad \text{(D-30a)}$$

(b) for a group of adhesive anchors :

$$V_{cpg} = \min\left|k_{cp} \cdot N_{ag} ; k_{cp} \cdot N_{cbg}\right| \quad \text{(D-30b)}$$

where:

k_{cp} = 1.0 for h_{ef} < 2.5 in. (64 mm)

k_{cp} = 2.0 for $h_{ef} \geq$ 2.5 inches (64 mm)

N_a is calculated in accordance with Eq. (D-16a)

N_{ag} is calculated in accordance with Eq. (D-16b)

N_{cb} and N_{cbg} are determined in accordance with D.5.2.1.

4.1.7 Bond Strength Determination: Bond strength values are a function of installation conditions (dry concrete). The characteristic bond strength must be multiplied with the strength reduction factors ϕ_d (installation in dry concrete).

CONCRETE	HOLE DRILLING METHOD	PERMISSIBLE INSTALLATION CONDITIONS	BOND STRENGTH	ASSOCIATED STRENGTH REDUCTION FACTOR
Uncracked	Hammer drilled	Dry concrete	$\tau_{k,uncr} \cdot \kappa_d$	ϕ_d

4.1.8 Requirements for Minimum Member Thickness h_{min}, Anchor Spacing s_{min} and Edge Distance c_{min}: In lieu of ACI 318 D.8.3, values of c_{min} and s_{min} described in Table 1 of this report must be observed for anchor design and installation. Likewise, in lieu of ACI 318 D.8.5, the minimum member thickness, h_{min}, described in Table 1 of this report must be observed for anchor design and installation. In determining minimum edge distances, c_{min}, the following section must be added to ACI 318, Appendix D:

D.8.8 — For adhesive anchors that will remain untorqued, the minimum edge distances shall be based on minimum cover requirements for reinforcement in 7.7. For adhesive anchors that will be torqued, the minimum edge distance and spacing shall be taken as described in Table 1 of this report.

4.1.9 Critical Edge Distance c_{ac}: In lieu of using ACI 318 Section D.8.6, values of c_{ac} must be as provided in Table 1 of this report.

4.1.10 Requirements for Seismic Design: Load combinations including earthquake loads are not permitted, except for structures assigned to Seismic Design Category A or B.

4.1.11 Interaction of Tensile and Shear Forces: For loadings that include combined tension and shear, the design must be performed in accordance with ACI Section D.7.

4.2 Installation:

Installation parameters are provided in Table 1 and Figure 1. Anchor locations must comply with this report and the plans and specifications approved by the code official. Installation of the Pro-Poxy 300 FAST Epoxy Adhesive Anchor System must conform to the manufacturer's published installation instructions included in each package and reproduced in Figure 1.

4.3 Special Inspection:

Installations made under continuous special inspection with an on-site proof loading program must be performed in accordance with Sections 1704.4 and 1704.13 of the IBC or Section 1701.5.2 of the UBC. The special inspector must be on the jobsite continuously during anchor installation to verify hole drilling method in accordance with manufacturer's printed installation instructions, hole location, hole diameter and depth, hole cleaning in accordance with the manufacturer's printed installation instructions, anchor type, anchor diameter and length, adhesive identification and expiration date, adhesive installation in accordance with the manufacturer's printed installation instructions, edge distances, anchor spacing, concrete type, concrete compressive strength, concrete thickness and installation torque. The proof loading program must be established by the registered design professional. As a minimum, the following requirements are to be addressed in the proof loading program:

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, proof loads must be applied as confined tension tests. Proof load levels must not exceed the lesser of 50 percent of expected peak load based on adhesive bond strength or 80 percent of the anchor yield strength. The proof load shall be maintained at the required load level for a minimum of 10 seconds.

Installations made under periodic special inspection must be performed where required in accordance with Section 1704.13 of the IBC or Section 1701.5 of the UBC. Periodic special inspection is defined in this report and Section 1701.6.2 of the UBC and Section 1702.1 of the IBC. The special inspector must be on the jobsite initially during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, and tightening torque. The special inspector must verify the initial installation of each type and size of adhesive anchor by personnel on the site. Subsequent installations for the same anchor type and size by the same construction personnel is permitted to be performed in the absence of the special inspector in accordance with the statement of special inspection. Any change in the anchor product being installed or in the personnel performing the installation will require an additional, initial inspection. For ongoing installations over an extended period of time, the special inspector must make regular inspections to confirm continuing correct use and installation of the product.

See Table 1 of this report for additional special inspection requirements.

For cases where anchors are designed to resist sustained tension loads, continuous special inspection is required.

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

5.0 CONDITIONS OF USE

The Unitex Pro-Proxy 300 FAST Epoxy Adhesive Anchor System described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Pro-Poxy 300 FAST epoxy adhesive anchors must be installed in accordance with the manufacturer's published installation instructions as included in the adhesive packaging and reproduced in Figure 1 of this report.

5.2 The anchors must be installed in uncracked normal-weight 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 is determined by there being no cracks or by analysis which shows $f_t < f_r$.

5.3 Anchors must be installed in concrete base materials in holes predrilled with carbide-tipped drill bits complying with ANSI B212.15-1994 in accordance with Section 4.2 and the instructions provided in Figure 1.

5.4 Pro-Poxy 300 FAST epoxy adhesive anchors are recognized for use to resist short- and long-term loads, including wind and earthquake loads (Seismic Design Categories A and B only), subject to the conditions of this report. Use of anchors in structures assigned to seismic design category C, D, E, or F under the IBC, or Seismic Zone 2, 3, or 4 under the UBC, is beyond the scope of this report.

5.5 Strength design values must be established in accordance with Section 4.1 of this report.

5.6 Minimum anchor spacing and edge distance, as well as minimum member thickness, must comply with the values provided in this report.

5.7 Installations with the anchor element oriented horizontally or vertically downward (overhead) are beyond the scope of this report.

5.8 Installations are permitted in dry, clean holes only.

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

5.10 Where not otherwise prohibited in the code, Pro-Poxy 300 FAST epoxy adhesive anchors are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:

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

5.11 Since an ICC-ES acceptance 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 project.

5.12 Use of threaded rods made of carbon steel with zinc electroplated coating as specified in Section 3.2.4.1 of this report must be limited to dry, interior locations.

5.13 Steel anchor materials must not be in contact with preservative-treated wood or fire-retardant-treated wood.

5.14 Continuous or periodic special inspection is provided in accordance with Section 4.3 of this report.

5.15 Pro-Poxy 300 FAST epoxy adhesive is manufactured and packaged into cartridges by Unitex in Kansas City, Missouri, with quality control inspections by CEL Consulting (AA-639).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Post-installed Adhesive Anchors in Concrete (AC308), dated October 2008.

7.0 IDENTIFICATION

7.1 Pro-Poxy 300 FAST Epoxy Adhesive is identified in the field by labels on the cartridge or packaging, bearing the company name (Unitex), product name (Pro-Poxy 300 FAST), the batch number, the expiration date, the name of the inspection agency (CEL Consulting), and the evaluation report number (ESR-2621).

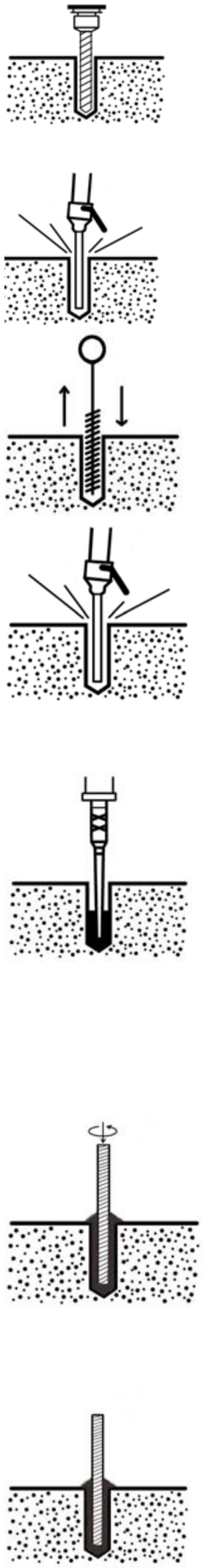
7.2 Threaded rods, nuts, and washers are standard elements, and must conform to applicable specifications as set forth in Section 3.2.1 of this report.

TABLE 1—PRO-POXY 300 FAST DESIGN INFORMATION[1,2]

Unitex Pro-Poxy 300 Fast Adhesive Anchors for Use in Uncracked Concrete													
Anchor Manufacturer / Unitex	Anchor Name / Pro Poxy 300 Fast	Criteria / AC308 T4.1	Symbol	Units	Nominal Anchor Diameters (inch)								
					3/8		1/2		5/8		3/4		7/8
Anchor Diameter			d	in.	0.375		0.5		0.625		0.75		0.875
Drill Bit Diameter			d_b	in.	1/2		5/8		3/4		7/8		1
Nominal Hole Diameter			d_o	in.	9/16		11/16		3/4		7/8		1
Maximum Installation Torque			T_{inst}	ft·lb	14		25		73		119		144
Effective Embedment Depth			h_{ef}	in.	2	3 3/8	2 1/2	4	3 1/4	5 5/8	3 3/8	6 3/4	4	7 7/8
Minimum Member Thickness			h_{min}	in.	4	5	5	6	6	9	7	10 1/8	8	12
Critical Edge Distance			c_{ac}	in.	4	6 3/4	5	9 1/2	6 1/2	12	6 3/4	14 1/2	8	15 3/4
Minimum Anchor Spacing			s_{min}	in.	3		3 3/4		4 7/8		5		8
Minimum Edge Distance			c_{min}	in.	3		3 3/4		4 7/8		5		6
Effective Anchor Tension Area			A_{se}	in^2	0.0775		0.1419		0.226		0.334		0.462
Anchor Steel Yield Strength[3]	A 307 Grade C		f_y	lb/in^2	36,000								
	A 193 Grade B7				105,000								
Anchor Steel Ultimate Strength[3]	A 307 Grade C		f_{ut}	lb/in^2	52,000								
	A 193 Grade B7				125,000								
Nominal Steel Strength of Single Anchor, Tension	A 307 Grade C		N_{sa}	lbf	4,030		7,380		11,750		17,370		24,025
	A 193 Grade B7				9,690		17,740		28,250		41,750		57,750
Strength Reduction Factor for Steel Strength in Tension			ϕ^4	-	0.75								
Nominal Steel Strength of Single Anchor, Shear	A 307 Grade C		V_{sa}	lbf	2,420		4,425		7.050		10,420		14,415
Nominal Steel Strength of Single Anchor, Shear	A 193 Grade B7				5,815		10,645		16,950		25,050		34,650
Strength Reduction Factor for Steel Strength in Tension			ϕ^4	-	0.65								
Effectiveness factor for uncracked concrete			$k_{c,uncr}$	-	24								
Strength reduction factor for tension, concrete failure modes, Condition B[5]			ϕ	-	0.65								
Strength reduction factor for shear, concrete failure modes, Condition B[5]			ϕ	-	0.70								
Anchor Category, Periodic Inspection			-	-	2	2	2	2	3	3	3	3	3	3
Strength reduction factor for bond strength, dry concrete, with periodic special inspection			ϕ_d	-	0.55	0.55	0.55	0.55	0.45	0.45	0.45	0.45	0.45	0.45
			K_d	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.7	**0.7**
Anchor Category, Continuous Inspection			-	-	1	1	1	1	2	2	2	2	3	3
Strength reduction factor for bond strength, dry concrete, with continuous special inspection			ϕ_d	-	0.65	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.45	0.45
			K_d	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9
Characteristic Bond Resistance in Uncracked Concrete, Temperature Range A[5,6]			$\tau_{k,uncr}$	lb/in^2	676		681		418		523		645
Characteristic Bond Resistance in Uncracked Concrete, Temperature Range B[5,6]			$\tau_{k,uncr}$	lb/in^2	406		409		251		314		288

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1-ft·lb = 1.356 N·m, 1 in^2 = 645 mm^2, 1 psi = 0.006895 MPa, °C = 5/9 (°F - 32).

[1]The data presented is applicable to use with uncracked, normal weight, structural concrete having a compressive strength between 2,500 and 8,500 psi.
[2]The Pro-Poxy 300 Fast anchor system is recognized for applications in dry concrete, internal exposure only, non-acidic environment, minimum base material temperature of not less than 50°F, and in holes drilled with a carbide drill bit used with a hammer drill.
[3]Values provided for common threaded rod material types based on specified strengths and calculated in accordance with ACI 318 Eq. (D-3) and Eq. (D-20). Nuts must be appropriate for the rod, as listed in Section 3.2.1 of this report.
[4]The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C or Section 1909.2 of the UBC are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5.
[5]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pullout or pryout governs, as set forth in ACI 318 Section D.4.4. The tabulated value of ϕ applies when the load combinations of Section 1605.2.1 of the IBC, Section 1612.2.1 of the UBC, or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C or Section 1909.2 of the UBC are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5.
[5]Characteristic bond strength is dependent on temperature:
Temperature Range A: Maximum short term temperature = 110°F and Maximum long term temperature = 75°F.
Temperature Range B: Maximum short term temperature = 162°F and Maximum long term temperature = 110°F.
Short term elevated concrete temperatures are those that occur over brief intervals, such as due to diurnal cycling, and long term concrete temperatures are roughly constant over significant periods of time.
[6]Characteristic bond strengths are for normal-weight concrete with a minimum compressive strength f'_c = 2,500 psi and are for sustained loads including dead and live loads. For load combinations consisting of short-term loads such as due to wind, and for Temperature Range B only, the listed bond strength may be increased 40 percent.



Step 1: Bore hole in concrete using a rotary-percussion power drill and a carbon-tipped SDS or SDS-Plus type drill bit complying with ANSI B212.15.1994, to the embedment depth adhering to minimum spacing, minimum edge distance, and minimum concrete member thickness.

Step 2: Blow out hole using oil-free compressed air at a minimum of 70 psi with a nozzle as described in Table 3. While blowing air, insert the nozzle into the hole until in contact with the bottom for not less than one second, and then withdraw. Repeat.

Step 3: Insert a nylon cleaning brush as suggested in Table 3. Thrust the brush to the bottom of the borehole while twisting. Once the brush is in contact with the bottom of the hole, turn the brush one-half revolution, and then quickly withdraw the brush with a vigorous, twisting pull.

Step 4: Repeat blow out of hole with air as per item 2 above.

Step 5: Check cartridge for expiration date to confirm the material is within the expiration date and for any physical defects. Concrete temperature must be 50°F minimum. Condition cartridge and contents to a temperature of 65°F to 95°F for easier dispensing. Insert the cartridge into the extrusion tool, and attach the supplied mixing nozzle to the cartridge. Prior to injection, dispense some mixed epoxy through the mixing nozzle and discard until the color of the extruded material becomes uniform. After uniform color is achieved, insert the end of the mixing nozzle into the borehole until in contact with the bottom. Then, dispense the adhesive while slowly withdrawing the nozzle until borehole is approximately 2/3 full, and then withdraw the mixing nozzle. Keep the nozzle attached on the partially used cartridges. A new mixing nozzle must be used if the gel time has been exceeded between injections.

Step 6: Insert the clean and oil-free anchor rod into the adhesive in the borehole, turning it slowly as it is pushed downward until contact with the bottom of the borehole. Make sure the hole is completely filled with adhesive.

Step 7: Adjust the alignment of the anchor in the hole immediately. Do not disturb it between the Gel Time and the Minimum Cure Time as shown in Table 2.

FIGURE 1—INSTALLATION INSTRUCTIONS

TABLE 2—CURE TIME

Curing Temperature °F	Minimum Cure Time hours	Recommended Cure Time hours
50	24	48
60	12	36
70	8	24
80	6	24
90	4	24
100	2	12

For **SI:** °C = 5/9 (°F - 32).

TABLE 3—INSTALLATION EQUIPMENT

Anchor Diameter (inch)	Drill Bit Diameter (inch)	Brush Part Number	Nozzle Part Number	Dispensing Tool Part Number
$^{3}/_{8}$	$^{1}/_{2}$	0706136000	0701001000	0740001000
$^{1}/_{2}$	$^{5}/_{8}$	0706137000	0702001000	0750001000
$^{5}/_{8}$	$^{3}/_{4}$	0706237000	0703001000	0752001000
$^{3}/_{4}$	$^{7}/_{8}$	0706138000	0720001000	0754001000
$^{7}/_{8}$	1	0706238000		

FIGURE 2—COMPONENTS OF THE PRO-POXY 300 FAST EPOXY ADHESIVE ANCHOR SYSTEM: ADHESIVE CARTRIDGE, STATIC MIXING NOZZLE, THE NOZZLE EXTENSION TUBE AND NYLON BRUSH

Determine if a single $^1/_2$ inch diameter, ASTM A 193 Grade B7 anchor rod set with Pro-Poxy 300 FAST with an embedment of 4 inches, installed 5 inches from an edge of 10 inch thick concrete is sufficient for an allowable tension load of 300 lbf and shear load of 50 lbf, live only. Assume the concrete is normal weight with a compressive strength is 2,500 psi. Further assume that the anchor will be subjected to a maximum short term temperature of 110°F and long term temperature of 75°F. The anchor will be installed with continuous special inspection in dry concrete.

1. Determine the factored Tension and Shear design loads in accordance with ACI 318.9.2.1 Eq. (9-4):

   N_{ua} = 1.6W = 1.6·300 = 480 lbf

   V_{ua} = 1.6W = 1.6·50 = 80 lbf

2. This is a combined tension and shear interaction condition where values for both ϕN_n and ϕV_n must be evaluated. ϕN_n is the limiting design tension strength controlled by the lesser of ϕN_{sa} (steel), ϕN_{cb} (concrete breakout), or ϕN_a (adhesive bond strength). ϕV_n is limited by the design shear strength controlled by the lesser of ϕV_{sa} (steel), ϕV_{cb} (concrete breakout) or ϕV_{cp} (concrete pryout).

3. Steel Strength, Tension load:

   $\phi N_{sa} \geq N_{ua}$

   N_{sa} = 17,740 lbf (tensile strength of $^1/_2$" B7 steel element—see Table 1)

   ϕ = 0.75 –see Table 1

   Therefore, ϕN_{sa} = 0.75 · 17,740 lbf = 13,305 lbf > 480 lbf—okay

4. Concrete Breakout, Tension load:

   $\phi N_{cb} \geq N_{ua}$

   $N_{cb} = (A_{Nc}/A_{Nco})\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b$

   $N_b = k_c f'_c{}^{0.5} h_{ef}{}^{1.5}$

   $k_c = 24$

   $c_{min} = 3^3/_4$ inches — From Table 1

   $c_{ac} = 9^1/_2$ inches — From Table 1

   $\psi_{cp,N} = c_{a,min}/c_{cd}$ = 5 inches /$9^1/_2$ inches = 0.5263 ≤ $1.5h_{ef}/c_{ac}$ = 1.5·4/$9^1/_2$ = 0.6316

   $\psi_{ed,N} = 0.7 + 0.3(c_{a,min}/1.5h_{ef})$ = 0.7+0.3(5/(1.5·4)) = 0.95

   $\psi_{c,N}$ = 1.0 where k_c = 24

   ϕ = 0.65—From Table 1

   $A_{Nco} = 9h_{ef}^2 = 9 \cdot 4^2$ = 144 sq. inch

   $A_{Nc} = (c_{a1} + 1.5h_{ef})\ (2 \cdot 1.5h_{ef})$ = (5+1.5· 4)(2·1.5·4) = 132 sq. inch

   A_{Nc}/A_{Nco} = 132/144 = 0.92

   $\phi N_{cb} = 0.65 \cdot 0.92 \cdot 1.0 \cdot 0.95 \cdot 0.5263 \cdot 24 \cdot (2,500)^{0.5} \cdot (4)^{1.5}$ = 2,870 lbf > 480 lbf, okay

5. Adhesive Bond Strength, Tension load:

   $\phi N_a \geq N_{ua}$

   $N_a = A_{Na}/A_{Nao}\ \psi_{ed,Na}\ \psi_{p,Na}\ N_{ao}$

   $N_{ao} = \kappa_d \tau_{k,cr} \pi d h_{ef}$ = 1.0 · 681 · π · 0.5 · 4 = 4,279 lbf

   $s_{cr,Na} = 20d(\tau_{k,uncr}/1450)^{0.5} \leq 3h_{ef} = 20 \cdot 0.5 \cdot (681/1450)^{0.5}$ = 6.9 inches < 3 · 4 = 12 inches

   $s_{cr,Na}$ = 6.9 inches

   $c_{cr,Na} = s_{cr,Na}/2$ = (6.9)/2 = 3.5 inches

   $A_{Nao} = (s_{cr,Na})^2 = (6.9)^2$ = 48 sq in.

   $A_{Na} = (c_{a1} + c_{cr,Na})(s_{cr,Na})$ = (4 + 3.5)(6.9) = 52 sq in.

FIGURE 3—EXAMPLE CALCULATION

A_{Na}/A_{Nao} = 52/48 = 1.08 > 1, therefore, use 1.0

$\psi_{ed,Na}$ = 1.0, if $c_{a,min} > c_{cr,Na}$; 5 > 3.5

$\psi_{p,Na} = \max(c_{a,min}, c_{cr,Na})/c_{ac}$ = max(5, 3.5)/9.5 = 0.53

ϕ = 0.65

ϕN_a = 0.65 · 1.0 · 1.0 · 0.526 · 4,279 = 1,463 lbf > 480, okay

6. For Tension, the adhesive bond strength controls at 1,463 lbf.

7. Steel Strength, Shear load

$\phi V_a \geq V_{sa}$

V_{sa} = 10,650 lbf

ϕ = 0.65

ϕV_a = 0.65 · 10,645 lbf = 6,919 > 80, okay

8. Concrete breakout, shear

$\phi V_{cb} \geq V_{ua}$

$V_{cb} = (A_{Vc}/A_{Vco})\ \psi_{ed,V}\ \psi_{c,V}\ V_b$

$V_b = 7(\ell_e/d_o)^{0.2}\ d_o^{0.5} f'_c{}^{0.5} c_{a1}^{1.5}$

d_o = 0.5 in.

$\ell_e = h_{ef}$ = 4.0 in.; $\ell_e \leq 8d_o$ = 8(0.5) = 4.0 in.

c_{a1} = 5 in.

ϕ = 0.65

$A_{Vco} = 4.5c_{a1}^2 = 4.5 \cdot (5)^2$ = 112 sq in.

$A_{Vc} = 2(1.5c_{a1})(1.5c_{a1})$ = 2(1.5 · 5)(1.5 · 5) = 112 sq in.

A_{Vc}/A_{Vco} = 1.0

$\psi_{ed,V}$ = 1.0 because $c_{a2} > 1.5c_{a1}$

$\psi_{c,V}$ = 1.4 for uncracked concrete

$\phi V_{cb} = 0.65 \cdot 1.0 \cdot 1.0 \cdot 1.4 \cdot 7 \cdot (4.0/0.5)^{0.2} \cdot (0.5)^{0.5} \cdot (2{,}500)^{0.5}$ = 341 lbf > 80, okay

9. Concrete Pryout, Shear load:

ϕV_{cp}

ϕ = 0.65

$V_{cp} = \min.\ [k_{cp}N_a,\ k_{cp}N_{cp}]$

k_{cp} = 2.0 for $h_{ef} \geq$ 2.5 inches

$N_a = \phi N_a/\phi$ = 1,463/0.65 = 2,251 lbf

$N_{cb} = \phi N_{cb}/\phi$ = 2,870/0.65 = 4,415 lbf

V_{cp} = 2 · 2,251 = 4,502 lbf

ϕV_{cp} = 0.65 · 4,502 = 2,926 > 80 lbf, okay

10. For Shear, the concrete breakout controls at 341 lbf.

11. Interaction:

$N_{ua}/\phi N_n + V_{ua}/\phi V_n \leq 1.2$

480/1,463 + 80/341 = 0.563<1.2, okay

FIGURE 3—EXAMPLE CALCULATION (Continued)

ICC-ES Evaluation Report

ESR-2621 Supplement

Issued January 1, 2010

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

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

REPORT HOLDER:

UNITEX
3101 GARDNER AVENUE
KANSAS CITY, MISSOURI 64120
www.unitex-chemicals.com
mail@unitex-chemicals.com

EVALUATION SUBJECT:

PRO-POXY 300 FAST EPOXY ADHESIVE ANCHORS FOR UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2007 *Florida Building Code—Building*
- 2007 *Florida Building Code—Residential*

Property evaluated:

Structural

2.0 USES

This supplement is issued to indicate that the Unitex Pro-Poxy 300 FAST Adhesive Anchors in uncracked concrete as described in the master report comply with the 2007 *Florida Building Code—Building* and the 2007 *Florida Building Code—Residential*, when designed and installed in accordance with the master evaluation report.

Use of Unitex Pro-Poxy 300 FAST Adhesive Anchors in uncracked concrete as described in the master evaluation report to comply with the High Velocity Hurricane Zone Provisions of the 2007 *Florida Building Code—Building* has not been evaluated, and is outside the scope of this supplement.

For products falling under Florida Rule 9B-72, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report issued January 1, 2010.