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March 29, 2024

TO: **PARTIES INTERESTED IN MECHANICAL ANCHORS IN CRACKED AND UNCRACKED MASONRY**

SUBJECT: Proposed Revisions to the Acceptance Criteria for Mechanical Anchors in Cracked and Uncracked Masonry Elements, Subject AC01-0624-R1 (HS/MC)

Hearing Information:
WebEx Event Meeting
Tuesday, June 25, 2024
8:00 am Pacific Daylight Time
Click the date above to register

Dear Colleague:

You are invited to comment on revisions to the ICC-ES Acceptance Criteria for Mechanical Anchors in Cracked and Uncracked Masonry Elements (AC01), which will be discussed at the Evaluation Committee hearing noted above. The proposed revisions to the criteria are based on a February 23, 2024 submittal from the Concrete and Masonry Anchor Manufacturers Association (CAMA).

The proposed revision is to add a new factor "alpha-location" (α_{loc}) used in the assessment of the anchor strength in tension to be published in evaluation reports. For installation in grouted concrete masonry unit (CMU) members, AC01 currently requires testing at the minimum embedment sought for evaluation in the face of the CMU in three locations: in the grouted cell, in the bed joint, and in the unit web (Tables 4.1 and 4.2, Test numbers 1a, 1b, and 1c, respectively). The lowest of these capacities controls the capacity to be published in the evaluation report. However, for evaluation at deeper embedments, only testing in the grouted cell location is required for all embedment locations. The new term α_{loc} is applied as a reduction factor to the deeper tested anchor strength in the grouted cell, where shallow embedment testing indicates that the grouted cell location is not the controlling strength.

Should the Evaluation Committee approve the proposed revision, no new mandatory compliance date will be enforced; current applicants will need to consider the approved requirement. Existing report holders of published reports have already incorporated these requirements.

You are invited to submit written comments on this or any other agenda item, or to attend the Evaluation Committee hearing and present your views in person. If you wish to contribute to the discussion, please note the following:

1. Regarding written comments and presentations:

   a. You should submit these via e-mail to es@icc-es.org by the applicable due date.

   b. Comments are to be received by **April 25, 2024.** These written comments will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site shortly after the deadline for submission. Written comments that are not submitted by this deadline will not be considered at the meeting.

   c. Rebuttal comments, from the proponent noted in this letter, are to be received by **May 16, 2024**. They will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site shortly after the deadline for submission. Written rebuttal comments that are not submitted by the deadline will not be considered at the meeting.

   d. If you want to make a visual presentation at the hearing, it must be received in PowerPoint format. The presentation is to be received by **May 30, 2024.** These will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site after the deadline for submission. Presentations that are not submitted by the deadline cannot be presented at the meeting. **Note:** Videos will not be posted on the web site.

      Presentations will be retained with other records of the meeting.

   e. ICC-ES will post to the web site, on **June 11, 2024**, memos by the ICC-ES staff, responding to the previously received public comments.

   f. If you miss the deadlines for submission of written comments and visual presentations, your verbal comments can be presented at the meeting.

   g. Proposed criteria, written public comments, visual presentations, and responses by ICC-ES staff for this agenda item are all available on our website.

2. Regarding verbal comments and presentations:

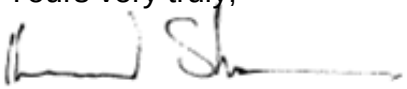
   Please plan to speak for not more than ten minutes. As noted above, visuals are to be in PowerPoint format.

3. Keep in mind that all materials submitted for committee consideration are part of the public record and will not be treated as confidential. It is the presenter's responsibility to certify to ICC-ES staff that no materials infringe copyright.

4. Please do not communicate with committee members before the meeting about any items on the agenda.

We appreciate your interest in the work of the Evaluation Committee. If you have any questions, please contact me at (800) 423-6587, extension 3996, or Manuel Chan, P.E., S.E., Principal Structural Engineer at extension 3288. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Howard Silverman, PE
Director Anchors and Fastening

HS/MC/ls

Encl.

cc: Evaluation Committee

CONCRETE AND MASONRY ANCHOR MANUFACTURERS ASSOCIATION

Thomas Associates
Executive Director

February 23, 2024

Howard Silverman
ICC Evaluation Services, LLC.
Western Regional Office
3060 Saturn Street, Suite 100
Brea, CA 92821

Email: hsilverman@icc-es.org

SUBJECT: Draft Letter for Proposed Changes to AC01 Criteria

Dear Mr. Howard Silverman,

CAMA is submitting a proposal for revisions of AC01 – Acceptance Criteria for Mechanical Anchors in Cracked and Uncracked Masonry Elements. The proposed changes are shown below.

This proposal for AC01 includes the addition of a factor to properly assess untested embedment depths by way of a new factor called "alpha location" or "α_{loc}".

Add the following definition:

α_{loc} = Reduction factor to account for different installation locations (see 8.5.5.2.2)

Amend 8.5.5.2.2 as follows:

8.5.5.2.2 For anchors qualified in accordance with Table 4.1 and Table 4.2, reduce the nominal characteristic capacity in uncracked masonry, $N_{k,nom,uncr}$, in accordance with Eq. (8-14) and the nominal characteristic capacity in cracked masonry (Table 4.2 only), $N_{k,nom,cr}$, in accordance with (8-15). Report the limiting characteristic pullout capacity in uncracked masonry, $N_{k,uncr}$, and cracked masonry, $N_{k,cr}$, for each combination of mandatory and optional use conditions specified.

$$N_{k,uncr} = N_{k,nom,uncr} \cdot \alpha_{cat2} \cdot \alpha_{loc} \quad (8\text{-}14)$$

$$N_{k,ucr} = N_{k,nom,uncr} \cdot \alpha_{cat2} \cdot \alpha_{cr} \cdot \alpha_{loc} \quad (8\text{-}15)$$

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where

$N_{k,nom,uncr}$ = ;

= minimum tested nominal characteristic tensile capacity at each embedment as determined with Section 5.4, lb (N);

$N_{k,(1a,1b,1c)}$ = characteristic tensile capacities from Table 4.1, Tests 1a, 1b, and 1c, respectively and Table 4.2, Tests 1a, 1b, and 1c, respectively, as determined with Eq. (8-10) and normalized in accordance with Section 8.3, lb. (N);

$N_{k,nom,cr}$ = cracked nominal pullout capacity; taken as $N_{k,nom,uncr} \cdot \alpha_{cr}$, lb. (N); with

α_{cr} = ratio of cracked to uncracked tensile capacity in the bed joint (i.e., $N_{k,1e} / N_{k,1b} \leq 1.0$);

α_{cat2} = reduction factor for Anchor Category 2 as determined in Section 8.5.4.

α_{loc} = location factor accounting for installation locations at untested embedment depths

α_{loc} shall be taken as 1.0 for all embedments where Tests 1a, 1b, and 1c have all been completed.

α_{loc} for the deepest embedment when testing in accordance with Table 4.1 shall be determined as follows:

1. α_{loc} = 1.0 when either Test No. 1a or 1b hold the lowest characteristic tensile capacity at the tested shallow embedment;

2. $\alpha_{loc} = N_{k1,c,shallow}/N_{k1,a,shallow}$ when Test 1c holds the lowest characteristic tensile capacity at the tested shallow embedment and Test 1a holds the lowest characteristic tensile capacity at the tested deep embedment;

3. $\alpha_{loc} = N_{k1,c,shallow}/N_{k1,b,shallow}$ when Test 1c holds the lowest characteristic tensile capacity at the tested shallow embedment and Test 1b holds the lowest characteristic tensile capacity at the tested deep embedment;

$\alpha_{loc} = \min\left(1.0; N_{k,1b,shallow}/N_{k,1a,shallow}; N_{k,1c,shallow}/N_{k,1a,shallow}\right)$ for all untested embedments in other cases.

If there are any questions or if further information is required, please contact us.

Sincerely,

CRAIG H. ADDINGTON

CHA/als

ICC EVALUATION SERVICE, LLC, RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE

The purpose of the Evaluation Committee is to review and approve acceptance criteria on which evaluation reports may be based.

2.0 MEMBERSHIP

2.1 The Evaluation Committee has a membership of not fewer than nine, with one of the members named by the ICC-ES president each year to serve as the chairman–moderator.

2.2 All members of the committee shall be representatives of a body enforcing regulations related to the built environment.

2.3 Persons are appointed to the committee by the ICC-ES president, from among individuals who have formally applied for membership.

2.4 The ICC-ES Board of Managers, using simple majority vote, shall ratify the nominations of the president.

2.5 Committee membership is for one year, coinciding with the calendar year. Members may be renominated and reappointed.

2.6 In the event that a member is unable to attend a committee meeting or complete a term on the committee, the ICC-ES president may appoint a replacement to fill in at the meeting or for the remainder of the member's term. Any replacement appointed for only one meeting must have prior experience as a member of the Evaluation Committee. Appointments under this section (Section 2.6) are subject to ratification as noted in Section 2.4.

3.0 MEETINGS

3.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1.0, subject to Section 3.0.

3.2 All scheduled meetings shall be publicly announced. There shall be three to six meetings per year (as necessary).

3.3 More than half of the Evaluation Committee members, counting the chairman, shall constitute a quorum. A majority vote of members present is required on any action. To avoid any tie vote, the chairman may choose to exercise or not exercise, as necessary, his or her right to vote.

3.4 In the absence of the chairman–moderator, Evaluation Committee members present shall elect an alternate chairman from the committee for that meeting. The alternate chairman shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

3.5 Minutes shall be kept and shall be the official record of each meeting.

3.6 An electronic record of meetings may be made by ICC-ES if deemed necessary; no other audio, video, electronic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before the presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy.

3.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items must be delivered to ICC-ES and shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting. Such materials will be posted on the ICC-ES web site (www.icc-es.org) prior to the meeting. Comments and submissions not meeting the following deadlines will not be considered at the meeting:

- Initial comments on agenda items shall be submitted at least 28 days before the scheduled meeting.
- A rebuttal comment period shall follow, whereby rebuttal comments to the initial comments may be submitted by the proponent at least 21 days before the scheduled meeting.
- Those planning on giving a visual presentation at the meeting must submit their presentation, in PowerPoint format only, at least 10 days before the scheduled meeting.

The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section.

4.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that at the discretion of the chairman, staff counsel may be necessary. Also, matters related to clients or potential clients covered by confidentiality requirements of ICC-ES Rules of Procedure for Evaluation Reports are discussed only during closed meetings.

5.0 ACCEPTANCE CRITERIA

5.1 Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, or method of construction. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the ICC-ES President.

EXCEPTIONS: The following acceptance criteria are controlled by the ICC-ES executive staff and are not subject to committee approval:

- The Acceptance Criteria for Quality Documentation (AC10)
- The Acceptance Criteria for Test Reports (AC85)
- The Acceptance Criteria for Inspections and Inspection Agencies (AC304)

5.2 Procedure:

5.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 4.0 of these rules.

5.2.2 Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

5.2.3 The committee shall be informed of all pertinent written communications received by ICC-ES.

5.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members. In the interest of fairness, each speaker requesting to testify on a proposed acceptance criteria or proposed changes to an existing acceptance criteria will be given the same amount of time, as follows:

a. A 10-minute time limit applies to speakers giving their first testimony on any item, which applies to both verbal testimony and/or visual presentations.

b. A 5-minute time limit applies to speakers returning to the microphone to offer additional testimony and/or to rebut testimony given by others.

c. A 2-minute time limit applies to speakers offering testimony on the staff recommendation to criteria.

Should a company have multiple speakers, the speaker time limits above apply the company, in that multiple speakers from the same company shall share the testimony time, i.e., multiple speakers from the same company shall not each get their own testimony times. Time limits do not include time needed to answer questions from the staff and/or committee members. The chairman–moderator shall have limited authority to modify time limitations on testimony. The chairman–moderator shall also have the authority to adjust time limits as necessary in order to get through the hearing agenda.

An automatic timing device shall keep time for testimony and shall provide the time remaining to the speaker testifying. Interruptions during testimony will not be tolerated. It is the responsibility of the chairman–moderator to maintain decorum and order during all testimony.

5.3 Approval of any action on an acceptance criteria shall be as specified in Section 3.3 of these rules. Possible actions made by the Evaluation Committee include: Approval; Approval with Revisions; Disapproval; or Further Study. The Evaluation Committee must give the reason(s) for any Disapproval or Further Study actions with specific recommendations.

5.4 Actions of the Evaluation Committee may be appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria or the ICC-ES Rules of Procedure for Appeals of Evaluation Committee Technical Decisions.

6.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

6.1 Acceptance criteria may be revised without a public hearing following a 30-day public comment period and a majority vote for approval by the Evaluation Committee (i.e., alternative criteria development process), when at the discretion of the ICC-ES executive staff, the subject is a revision that requires formal action by the Evaluation Committee.

6.2 Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

a. *Lack of clarity*: There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)

b. *Insufficiency*: The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)

c. *The subject of the acceptance criteria is not within the scope of the applicable codes*: A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)

d. *The subject of the acceptance criteria needs to be discussed in public hearings*. The committee member requests additional input from other committee members, staff or industry.

6.3 An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

7.0 COMMITTEE COMMUNICATION

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report, shall take place only in a public hearing of the Evaluation Committee. Accordingly:

7.1 Committee members receiving an electronic ballot should respond only to the sender (ICC-ES staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a

decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

7.2 Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members.■

Revised November 2023

ICC EVALUATION SERVICE®

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PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR MECHANICAL ANCHORS IN CRACKED AND UNCRACKED MASONRY ELEMENTS

AC01

Proposed March 2024

Compliance date – August 15, 2025

Previously approved February 2024, July 2023, February 2021, March 2018, November 2015, May 2012, December 2009, December 2006, June 2005, October 2004, April 2002, November 2001, January 2001, January 1999, September 1997, January 1993

(Previously editorially revised, February 2023, May 2014 and August 2013)

PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes, and may include other codes, as applicable. For alternative materials design and methods of construction and equipment, see Section 104.2.3 of the 2024 International Building Code® (IBC), Section 104.11 of the 2021 IBC and earlier editions, and Section R104.11 of the 2021 IRC and earlier editions.

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports.

anchor, lb. (N)

N_{sa} = characteristic steel tensile capacity of an anchor, lb. (N)

$N_{st,mean}$ = average ultimate steel capacity determined from tensile tests on full-sized anchor specimens, lb. (N)

N_{u,f_m} = peak load measured in a tension test normalized by relevant material properties, lb. (N)

$N_{u,resid}$ = peak residual load measured after conduct of applicable service condition tests, lb. (N)

$N_{u,test}$ = peak load measured in a tension test, lb. (N)

$\overline{N}_{u,i}$ = mean tensile capacity for reliability test series conducted in masonry batch i, lb. (N)

N_w = tensile load applied to anchor during crack width cycling, lb. (N)

n = number of replicates in a test series, number of anchors in an anchor group

$s_{\min}$ = minimum spacing permitted for consideration of multiple anchor capacities in ungrouted CMU construction ($s_{\min,ug}$) and brick masonry construction ($s_{\min,br}$), in. (mm). Refer to Section 3.4.2.2.2 and Section 3.6.2.2.2 for ungrouted CMU and brick construction, respectively.

T_{inst} = specified tightening torque for setting or prestressing of an anchor in accordance with the MPII, ft-lb (kN-m)

T_{screw} = specified maximum installation torque required for setting a screw anchor in accordance with the MPII, ft-lb (kN-m)

t_{brick} = actual thickness of brick unit in installed condition; parallel to axis of anchor installation, in. (mm)

t_f = thickness of face shell, in. (mm)

t_{wall} = actual thickness of wall in installed condition; parallel to axis of anchor installation, in. (mm)

V_{eq} = maximum shear load to be applied in the simulated seismic shear tests, lb. (N)

V_{int} = intermediate shear load to be applied in the simulated seismic shear tests, lb. (N)

V_m = minimum shear load to be applied in the simulated seismic shear tests, lb. (N)

V_{sa} = characteristic shear capacity corresponding to shear failure, lb. (N)

$V_{s,seis}$ = seismic shear capacity as governed by steel failure, lb. (N)

v_x = sample coefficient of variation for test series x equal to the sample standard deviation divided by the mean, percent

w_{str} = length of stretcher leg as pictured in Figures 5.2 and 7.2.

α = ratio of reliability to reference tensile test results

α_{cat2} = additional reduction factor for Anchor Category 2

α_{cr} = ratio of cracked to uncracked tensile capacity in the bed joint (i.e., $\tau_{k,1e} / \tau_{k,1b}$)

α_{fm} = normalization factor accounting for masonry composite strength

α_{futa} = normalization factor accounting for steel strength

α_{loc} = reduction factor to account for different installation locations (see 8.5.5.2.2)

$\alpha_{req,cat2}$ = α_{req} corresponding to Anchor Category 2 for corresponding reliability test

$\alpha_{masonry}$ = reduction factor for the inhomogeneity of masonry materials in breakout and pullout strength determination

α_{top} = ratio of cracked to uncracked tensile capacity in top-of-wall tests (i.e., $\tau_{k,1e} / \tau_{k,1b}$)

Δ = anchor displacement within a test, in. (mm)

Δ_h = minimum of 1.5 in. (38 mm) for grouted CMU construction; minimum of 1 in. (25 mm) for solid CMU and solid brick units

Δ_w = change in crack width, in. (mm)

$\Delta_{0.3}$ = displacement at $N = 0.3N_u$, in. (mm)

ϕ = strength reduction factor for masonry failure and steel failure modes corresponding with the Anchor Category

Ω_o = amplification factor to account for overstrength of the seismic-force-resisting system determined in accordance with the building code**.**

2.0 Basic information

2.1 General—The following information shall be submitted:

2.1.1 Product description: Anchors shall be described as to:

2.1.1.1 Generic or trade name.

2.1.1.2 Manufacturer's catalog number.

2.1.1.3 Nominal thread size.

2.1.1.4 Nominal anchor or sleeve diameter.

ratio of $N_{k,r} / N_{k,o}$ from all reliability tests, establish the anchor category using Table 8.3. For each diameter, report a single category representing the lowest category determined by the tests at all embedment depths.

8.5.4.2 It shall be permitted to evaluate the ratio $N_{k,r} / N_{k,o}$ on the basis of mean test results provided that the following are satisfied: 1) the difference in the number of replicates in each test series is not greater than five; and 2) the coefficient of variation associated with the test results in all of the reliability test series is less than or equal to the coefficient of variation associated with the corresponding reference tests or less than 10 percent.

8.5.4.3 Where the controlling value of $N_{k,r} / N_{k,o}$ is less than the threshold value for Anchor Category 2 in Table 8.3 but greater than 0.50, the anchor shall be assigned to Anchor Category 2 and an additional reduction factor α_{cat2} for the determination of $N_{k(cr/uncr)}$ shall be determined in accordance with Eq. (8-12). For all other cases, α_{cat2} shall be taken as 1.0.

$$\alpha_{cat2} = \left(\frac{N_{k,r} / N_{k,o}}{0.7} \right) \qquad (8\text{-}12)$$

8.5.5 Determination of limiting characteristic capacity in fully grouted CMU:

8.5.5.1 Determine the corresponding pullout capacity $N_{u,nom}$ for each reference and service-condition tension test normalized to grout strength of 2,000 psi (13.8 MPa) and unit strength of 2000 psi (13.8 MPa) using Eq. (8-13).

$$N_{u,nom} = N_{u,f_m} \qquad (8\text{-}13)$$

where

N_{u,f_m} = peak tensile load measured in a tension test conducted in test series x normalized to grout strength $f_g = 2{,}000$ psi (13.8 MPa) and unit strength $f_b = 2{,}000$ psi (13.8 MPa) in accordance with Eq. (8-4), lb. (N);

8.5.5.2 Nominal characteristic capacity:

8.5.5.2.1 Determine the normalized nominal characteristic capacity in accordance with Section 5.4.

8.5.5.2.2 For anchors qualified in accordance with Table 4.1 and Table 4.2, reduce the nominal characteristic capacity in uncracked masonry, $N_{k,nom,uncr}$, in accordance with Eq. (8-14) and the nominal characteristic capacity in cracked masonry (Table 4.2 only), $N_{k,nom,cr}$, in accordance with (8-15). Report the limiting characteristic pullout capacity in uncracked masonry, $N_{k,uncr}$, and cracked masonry, $N_{k,cr}$, for each combination of mandatory and optional use conditions specified.

$$N_{k,uncr} = N_{k,nom.uncr} \cdot a_{cat2} \cdot \underline{a_{loc}} \qquad (8\text{-}14)$$

$$N_{k,cr} = N_{k,nom.cr} \cdot a_{cat2} \cdot \underline{a_{loc}} \qquad (8\text{-}15)$$

where

$N_{k,nom,uncr}$ = minimum tested uncracked nominal characteristic tensile capacity at each embedment as determined with Section 5.4, lb (N); ~~taken as the least uncracked nominal capacity observed in reference tests near the head joint, in the bed joint, and in the web, lb. (N);~~

~~= $\min\left(N_{k,1a}, N_{k,1b}, N_{k,1c}\right)$, as determined with Section 5.4;~~

$N_{k,(1a,1b,1c)}$ = characteristic tensile capacities from Table 4.1, Tests 1a, 1b, and 1c, respectively and Table 4.2, Tests 1a, 1b, and 1c, respectively, as determined with Eq. (8-10) and normalized in accordance with Section 8.3, lb. (N);

$N_{k,nom,cr}$ = cracked nominal pullout capacity; taken as $N_{k,nom,uncr} \cdot \alpha_{cr}$, lb. (N); with

α_{cr} = ratio of cracked to uncracked tensile capacity in the bed joint (i.e., $N_{k,1e} / N_{k,1b} \leq 1.0$);

α_{cat2} = reduction factor for Anchor Category 2 as determined in Section 8.5.4.

$\underline{a_{loc}}$ = location factor accounting for installation locations at untested embedment depths.

$\underline{a_{loc}}$ shall be taken as 1.0 for all embedments where Test Nos. 1a, 1b, and 1c have all been completed.

$\underline{a_{loc}}$ for deeper embedments when testing in accordance with Table 4.1 shall be determined as follows:

1. $\underline{a_{loc}}$ = 1.0 when either Test No. 1a or 1b represent the lowest characteristic tensile capacity at the tested shallow embedment;

2. $\underline{a_{loc}} = \underline{N_{k,1c,shallow} / N_{k,1a,shallow}}$ when Test No. 1c represents the lowest characteristic tensile capacity at the tested shallow embedment and Test No, 1a represents the lowest characteristic tensile capacity at the tested deep embedment.

3. $\underline{a_{loc}} = \underline{N_{k,1c,shallow} / N_{k,1b,shallow}}$ when Test No. 1c represents the lowest characteristic tensile capacity at the tested shallow embedment and Test No, 1b represents the lowest characteristic tensile capacity at the tested deep embedment.

α_{loc} = min(1.0; $N_{k,1b,shallow}$ / $N_{k,1a,shallow}$; $N_{k,1c,shallow}$ / $N_{k,1a,shallow}$) for all untested embedments in other cases.

8.5.5.2.3 Capacity for seismic tension: Further modify the limiting characteristic pullout resistance $N_{k(cr,uncr)}$ for seismic tension loading cases in accordance with Eq. (8-16).

$$N_{k,seis(cr,uncr)} = N_{k(cr,uncr)} \cdot \frac{N_{eq,reduced}}{N_{eq}} \quad (8\text{-}16)$$

where

$N_{eq,reduced}$ = reduced seismic tensile testing loads established for Eq. (7-7), lb. (N);

N_{eq} = calculated seismic tensile testing loads established for Eq. (7-7), lb. (N);

$N_{k,seis(cr,uncr)}$ = pullout capacity under seismic tensile loading, lb. (N).

8.5.5.2.4 Pullout capacity for installations in the top of fully grouted masonry: Further modify the limiting characteristic capacity $N_{k(cr,uncr)}$ for top-of-wall installation cases in accordance with Eqs. (8-17) through (8-19).

$$N_{k,top,uncr} = N_{k,uncr} \cdot \alpha_{top,uncr} \quad (8\text{-}17)$$

where

$N_{k,top,uncr}$ = pullout capacity of top-of-wall installations in uncracked masonry, lb. (N);

$N_{k,uncr}$ = characteristic pullout capacity in uncracked masonry defined in Eq. (8-15), lb. (N);

$\alpha_{top,uncr}$ = reduction factor for uncracked top-of-wall installations, i.e., $N_{k,1d} / N_{k,nom,uncr}$; and

$N_{k,nom,uncr}$ = uncracked nominal characteristic pullout capacity defined in Eq. (8-15).

$N_{k,top,cr} = N_{k,top,uncr} \cdot \alpha_{cr}$, lb. (N). (8-18)

where

$N_{k,top,cr}$ = pullout capacity of top-of-wall installations in cracked masonry, lb. (N); and

α_{cr} = ratio of cracked to uncracked tensile capacity in the bed joint (i.e., $N_{k,1e} / N_{k,1b}$).

$$N_{k,top,seis(cr,uncr)} = N_{k,top(cr,uncr)} \cdot \frac{N_{eq,reduced}}{N_{eq}} \quad (8\text{-}19)$$

where

$N_{k,top,seis,(cr,uncr)}$ = pullout capacity of top-of-wall installations under seismic tensile loading for cracked and uncracked masonry, respectively, lb. (N); and

$N_{eq,reduced}$ = reduced seismic tensile testing loads established for Eq. (7-7), lb. (N);

N_{eq} = calculated seismic tensile testing loads established for Eq. (7-7), lb. (N);

8.5.6 Capacity of anchors in ungrouted CMU:

8.5.6.1 Determine the uncracked characteristic capacity, $N_{k,ug,uncr}$, in accordance with Eq. (8-20).

$$N_{k,ug,uncr} = \alpha_{drill} \cdot \alpha_{cat2} \cdot N_{k,ug,nom} \quad (8\text{-}20)$$

Where

$N_{k,ug,uncr}$ = uncracked characteristic resistance determined in accordance with Eq. (8-10), lb. (N);

α_{drill} = 0.75 as the default design value and in all cases where rotation-mode-only drilling is employed during qualification testing;

= 1.0 where hammer-mode drilling is employed during qualification testing. The drill type used for testing, as characterized by the impact energy used for testing, shall be reported and the evaluation report shall note the required maximum impact energy permitted. This information shall be included in the MPII;

α_{cat2} = reduction factor for Anchor Category 2 as determined in Section 8.5.4; and

$N_{k,ug,nom}$ = nominal capacity in ungrouted CMU; taken as the least nominal capacity observed in reference tests in the center of the cell, the bed joint, and the web, lb. (N)

= $\min\left(N_{k,ug,1a}, N_{k,ug,1b}, N_{k,ug,1c}\right)$;

8.5.6.2 Tensile capacity for seismic tension: Further modify the limiting characteristic resistance $N_{k,ug}$ for seismic tension loading cases in accordance with Eq. (8-21).

$$N_{k,ug,seis(uncr)} = N_{k,ug(uncr)} \cdot \frac{N_{eq,reduced}}{N_{eq}} \quad (8\text{-}21)$$

where

$N_{k,ug,seis,uncr}$ = characteristic tensile capacity under seismic tensile for uncracked masonry, respectively, lb. (N);