Elyse G. Levy, S.E.
Senior Staff Engineer
ICC Evaluation Service, Inc.
Chicago Regional Office
4051 W. Flossmoor Road
Country Club Hills, IL 60478

January 19, 2010

Subject: Hilti Comments on Proposed Revisions to Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements, AC70

Dear Ms. Levy,

This letter constitutes the official public comments from Hilti, Inc. on the proposed revisions to ICC-ES AC70. These comments are offered in addition to the public comments from PATMI.

The Hilti, Inc. position is that many of the proposed revisions are not required by the addition of the International Building Code (IBC) 2009 and International Residential Code (IRC) 2009. We would request that at this time, ICC-ES only make the changes to ICC-ES AC70 necessary to allow the Acceptance Criteria to be used for recognition under the IBC 2009 and IRC 2009. This would allow time to properly review and discuss these other topics without unnecessarily delaying the ability of ICC-ES to issue evaluation reports under the 2009 IBC and 2009 IRC.

Many of the other proposed changes are not warranted and in some cases, biased against power-driven fastening systems. Unfortunately, some of the proposed changes would place a significant additional financial burden upon the ICC-ES AC70 report holders to comply with additional test requirements and analysis that in our opinion is unnecessary.

Comments are provided herein in good faith in order to develop a useful acceptance criteria for industry. Specific comments on the items are provided as follows:

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Letter Item 1. Hilti agrees with removal of the legacy codes from the criteria as long as ICC-ES will provide guidance to Building Officials and Design Professionals in any jurisdiction that still allows the use of the legacy codes when questions arise. ICC-ES should be willing to officially state for Building Officials and Design Professionals that the legacy codes do not contain any requirements for power-driven fasteners that differ from those in the IBC 2009 and IRC 2009. Such an explanation would be more readily accepted from ICC-ES as the ESR issuer than from the various report holders or manufacturers themselves.

However, this statement underlies a key point in the overall response to the proposed revisions in that nothing has changed in the IBC 2009 or IRC 2009 that would warrant additional test requirements and analysis being proposed for power-driven fasteners.

Letter Item 2. Hilti agrees with the clarification of the scope to include "sill plate anchorage" in Section 1.2. For clarity, Hilti recommends that "Ceiling clip fastening" be revised to "Suspended ceiling hangers".

Letter Item 3. Hilti agrees with these revisions to the code referenced standards as part of the update to IBC 2009 and IRC 2009.

Letter Item 4. Hilti agrees with this editorial revision to remove definitions not used in the remainder of the criteria.

Letter Item 5. Hilti agrees with this editorial revision defining and revising the notation to be used in the criteria.

Letter Item 6. Hilti agrees with this editorial revision moving the requirements of Section 2.1.1.11 to Section 3.2.1.

Letter Item 7. Hilti agrees with this proposed revision.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

HILTI

Letter Item 8. Hilti agrees with the proposed revision. The load reductions should not be cumulative. This would be overly restrictive considering the fact that the minimum safety factor allowed for power-driven fasteners in any substrate is 5:1. This is a relatively high safety factor for fastening applications that adequately covers variations in the base materials and fastened materials. If reductions due to base material overstrength, steel deck overstrength and fastener hardness or tensile strength were considered simultaneously, then many applications where power-driven fasteners have traditionally been used may no longer be possible. This would create additional problems in the construction industry.

Specifically, with regards to reductions for steel deck overstrength when power-driven fasteners are tested in lightweight or normal weight concrete over metal deck have traditionally not been applied. Most of the anchorage of the power-driven fastener in the base material is due to the embedment in the concrete and the steel deck thickness does not contribute significantly to the overall tensile and shear performance. This would be overly restrictive and unnecessary and is not similarly required for post-installed concrete anchors which are used in similar composite deck applications.

Letter Item 9. Hilti disagrees with this proposed revision. This is not required and overly restrictive. Manufacturers develop narrow hardness tolerance ranges for their proprietary fasteners based on their proprietary manufacturing techniques. The proprietary fasteners are intended for use only with proprietary power-actuated tool systems from the same manufacturer (e.g. the power-actuated fastening system). Furthermore, AC70 applies a safety factor of 5:1 for power-driven fasteners. Any reduction due to fastener overstrength would only be a factor if a tensile or shear fracture of the fastener occurred (e.g. steel failure), thus, the applicable safety factor should be 3:1. For this reason, this requirement is unwarranted and unnecessary.

Letter Item 10. Hilti agrees with this proposed revision for Section 3.4.1 Fasteners Intended for Use in Wood Sill Plates. However, for clarity, Hilti proposes revising Section 3.4.2 to "Assemblies Comprised of Power-driven

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Fasteners and Premounted Components Intended for Suspended Ceiling Hanger Applications".

Letter Item 11. Hilti agrees with this change.

Letter Item 12. Hilti disagrees with these changes. There have been no reported field problems associated with the deflection of ceiling clips. There are no ASTM standards that require deflection limitations on ceiling clips. No similar deflection limitations are addressed for the suspended ceiling wire component or the wrapping of the wire, which contributes to the overall performance of the hanger. This is an arbitrary deflection limit that can be accommodated in the field by the installer when installing and leveling the suspended ceiling system. Specific comments to the items 12a, 12b and 12c are as follows:

Letter Item 12 a. Ductility has never been a requirement for performance of power-driven fasteners in the past and should not be required now. Ductility is not a requirement of post-installed concrete anchorage or screw fasteners. Requiring a ductile connection for power-driven fasteners alone is biased and unwarranted.

Letter Item 12 b. Hilti's position is that a safety factor less than 5, for an accessory component / combination element could be justified. The safety factor should be 3:1 for a failure mode controlled by a steel accessory like a sheet steel ceiling clip, or 2:1 for a failure mode controlled by a ceiling wire. Hilti disagrees with the statement that load eccentricity on thin sheet steel ceiling clips adversely affects the performance of the power-driven fasteners. Pre-mounted ceiling clips with power-driven fasteners have been used for over thirty years with literally millions of fasteners in place throughout North America, without any such issues with load eccentricity.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Letter Item 12 c. Hilti's position is that this proposed change is over-reaching and unnecessary. The hanger component is not significantly stiffer. This is a subjective statement. Most of the deflection accumulated due to installed ceiling clips is due to the ceiling wire component. The ceiling wire elongates and the ceiling wire wraps tighten or cinch up on one another. This would amount to much more than 1/8 inch of deflection, so placing a deflection limitation on the ceiling clip accessory would be useless as the intended use includes the ceiling wire component. The ceiling wire is looped through the eyelet of the ceiling clip in the field and tied off by the installer. ICC-ES is engaging in means and methods and is in danger of causing unnecessary issues in the industry, especially considering the very long history of successful use of these products. Additionally, if a displacement criterion might be once added, the precise test and measurement procedure is needed in order to compare apples with apples. Borrowing a deflection limitation from another product Acceptance Criteria for a completely different application than suspended ceilings is unwarranted. No similar deflection limitation would be imposed if a different type of connector was used.

There are no similar requirements for suspended ceiling systems, which is the end use of ceiling clips, in ASTM C 635, ASTM C 636, ASTM E580, ICC-ES AC368 and CISCA guidelines. This is an arbitrary limit being imposed by ICC-ES and it's biased against power-actuated fastening technology. Once again, there is a very long history of successful use of these products for this application.

Letter Item 13

Letter Item 13 a. Hilti agrees with this revision.

Letter Item 13 b. Hilti disagrees with this revision. Item 14a contradicts the statement that "no new testing will be needed as a result of this revision". New testing would be required as existing testing would only be valid for up to 2500 psi concrete. Testing of power-driven fasteners in 2000 psi Normal Weight Concrete has traditionally been done and should be acceptable for use in higher normal weight concrete strengths.

Letter Item 14

Letter Item 14 a. Hilti disagrees with this new approach to concrete compressive strength and the associated limitation. This change is not required by the IBC 2009 and IRC 2009 code change. Presenting fastener performance data in multiple concrete compressive strengths has traditionally been acceptable and is not being questioned by the industry.

Historical testing from manufacturers has traditionally been in 2000, 4000 and 6000 psi normal weight concrete, which provides a comprehensive overview of power-driven fastener product performance in normal weight concrete and should allow for interpolation between concrete strengths. Would this new requirement cause the manufacturer to have to test in 3000 psi and 5000 psi normal weight concrete as well? This seems unwarranted and unnecessary.

It needs to be clarified as to whether this wording change will affect the ability to interpolate between tested concrete strengths. Hilti would oppose this wording change if it will create a requirement for more, unnecessary testing. Additionally, sufficient industry testing and research has proven that allowable load values consistently increase from 2000 psi to 4000 psi concrete. For this reason, it seems reasonable to allow manufacturers to test and publish data in less than 4000 psi concrete and still use it for concrete strengths up to 4000 psi concrete.

The common practice of allowing interpolation for allowable load values between tested concrete strengths should still be allowed, but for concrete strengths greater than 4000 psi, extrapolation past the highest tested concrete strength should be limited to +500 psi.

Letter Item 14 b. For many years, the power-driven fastening industry has been limited to a minimum safety factor of 5:1 for steel base materials, while the AISI safety factor for screw fastened connections for steel base materials is limited to 3:1. Power-driven fasteners are, in general, more consistent and reliable in steel base materials than screws, and should therefore be allowed to use a lower safety factor.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Hilti's position is that the current AC70 safety factors should remain with a minimum of 5:1. However, this is also why ICC-ES should not require this much detail to be published in their evaluation reports on power-driven fasteners. If this amount of detail was required, then a lower minimum safety factor could be justified.

If this proposal was required, Hilti recommends to either use penetration from top surface of the base material (driving distance / embedment) or nail head stand-off measurements. Power-driven fastenings to hollow steel sections or other construction types would make measurement of point penetration impossible as the backside of the steel base material cannot be accessed. Also, with some steel thicknesses, through point penetration is not achievable, so driving distance from the top surface would be a more accurate measurement. For consistency, the terminology "embedment" should be used instead of "penetration" as there are certain cases where "penetration" is not required. Hilti's position is that this is adequately addressed in the ESR with table footnotes for cases where point penetration does not occur.

Letter Item 14 c. Hilti agrees with this revision.

Letter Item A. Hilti's position is that "consistency" of power-driven fastenings installed in concrete base materials can be obtained reliably. Trial fastenings on the project site should be done by the installer in accordance with the manufacturer's recommended installation instructions and ANSI A10.3. No holds have traditionally not been considered as valid tests for the computation of allowable loads. This is consistent with how no holds are treated on the project site – they are not used for fastening points. The degree of concrete spalling is another subjective determination. Concrete spalling also occurs with installation of certain concrete anchoring systems and hammer drilling of the holes for post-installed anchors. Why would spalling of concrete for power-driven fasteners be more troublesome than spalling due to drilling of post-installed anchor holes? This should be a determination that the Design Professional makes. The ICC-ES AC70 ESR's should reference the manufacturer's recommended installation instructions for minimizing the spalling of concrete.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Letter Item A.1. "Damage" is subjective and needs to be defined or quantified. There are too many connected material types for suitability tests to be practical and financially possible. This would unnecessarily restrict the applications where power-driven fasteners are traditionally used and negatively impact the construction industry.

Past ICC-ES AC70 ESR's have simply required that "fastened materials needed to be evaluated separately". This has been sufficient and remains so.

AC70 should include a non-mandatory statement allowing for testing of the fastened material component with the fastener as a connection test.

Letter Item A.2 Manufacturers would set the acceptable number of no-holds with recommended application limits for the fastener being evaluated. Excessive no holds would not be recommended by the manufacturer or accepted by the end user or Design Professional. 20% is somewhat arbitrary.

Letter Item A.3 This is why ANSI A10.3.2006 should be recommended as part of ICC-ES AC70.

Letter Item A.4 Hilti's position is that the proposed requirement is biased against power-driven fastening technology. Since no similar guidance exists for handling other types of inadequate fastenings including screw fasteners, bolts, welds or concrete anchors, that to require guidance on how to compensate for inadequately installed power-driven fasteners would be biased. This issue is not just applicable to power-driven fasteners. Theoretically, it could apply to any type of connection.

Letter Item B Hilti's position is that the considerations for power-driven fasteners used to attach steel deck to steel supports as part of diaphragm system construction should remain in ICC-ES AC43 and not be incorporated into ICC-ES AC70.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

Letter Item B.1 **This type of testing in AISI S905 to determine the strength and stiffness of mechanically fastened cold-formed steel connections is and should be limited to ICC-ES AC43. Allowing this type of recognition within ICC-ES AC70 could allow the applicants and the end user to "sidestep" the ICC-ES AC43 requirements for steel deck diaphragm applications. This could create a safety concern for the performance of larger structural systems such as steel deck diaphragms. Similarly, there are other ICC-ES Acceptance Criteria that involve the use of power-driven fastening systems as part of larger structural assembly evaluations. These are not referenced in ICC-ES AC70 and should not be. In this sense, the parent acceptance criteria would refer to AC70. The difference here is that ICC-ES AC70 refers to single-point fastener load tests, while the other acceptance criteria involve testing and evaluation of larger structural assemblies.**

Letter Item B.2 **ICC-ES AC43 should include test requirements in accordance with AISI S905 to establish the tensile (uplift) capacity of steel deck connections with power-driven fasteners. This should not be included in ICC-ES AC70.**

Letter Item B.3 This requirement should remain as part of ICC-ES AC43 and confirmed through full-scale diaphragm system tests.

Letter Item B.4 **This requirement should remain as part of ICC-ES AC43 and confirmed through full-scale diaphragm system tests.**

Specifically concerning AC70 Equation 3-6, the revised equation is incorrect. The inequality sign should be "$\geq$ 1" as originally in AC70 before the terminology change. The oblique loading tests would be done to prove the applicability of the combined loading equation. With the inequality sign as shown in the draft AC70, a relatively poor performance of a fastener in the 45 degree load test would easily satisfy this requirement. The intent of the requirement should be to ensure good performance in the 45 degree load test. Furthermore, the applicant should be able to apply for a different exponent (e.g. 3/2 or tri-linear), if the test data fits this combined loading equation more closely.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa OK 74146

1-800-879-8000
www hilti com

In addition to these public comments, Hilti is also providing electronic comments on the attached AC70 draft file. We look forward to working with ICC-ES in order to create a reasonable and useful acceptance criteria for the evaluation of power-driven fasteners. We welcome an opportunity to continue our dialogue on ICC-ES AC70 prior to the hearing. Please contact me by phone at (636)544-1290 or by e-mail at william.gould@hilti.com.

Regards,

William G. Gould, P.E.
Director, Codes & Approvals
Hilti, Inc.
5400 S. 122nd E. Ave.
Tulsa, OK 74146

cc: Andrew Liechti, P.E.
Michael Beaton, P.E.

ICC EVALUATION SERVICE

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

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR FASTENERS POWER-DRIVEN INTO CONCRETE, STEEL AND MASONRY ELEMENTS

AC70

Proposed December 2009

Previously approved October 2006, October 2004, October 2003, September 1995

PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the *International Building Code®* reads as follows:

> The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

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

Summary of Comments on Pages from 14 - AC70 - Hilti.pdf

This page contains no comments

PROPOSED REVISIONS TO THE ACCEPTENCE CRITERIA FOR FASTENERS POWER-DRIVEN INTO CONCRETE, STEEL AND MASONRY ELEMENTS

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for fasteners power-driven into concrete, steel and masonry elements to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the ~~2006~~ 2009 *International Building Code*® (IBC)~~,~~ and the ~~2006~~ 2009 *International Residential Code*® (IRC)~~, the BOCA® *National Building Code*/1999 (BNBC), the 1999 *Standard Building Code*© (SBC) and the 1997 *Uniform Building Code*™ (UBC)~~. The bases of recognition are IBC Section 104.11~~,~~ and IRC Sections R104.11 and R301.1~~, BNBC Section 106.4, SBC Section 103.7 and UBC Section 104.2.8~~. The reason for the development of this criteria is to provide guidelines for the evaluation of alternative fasteners to those addressed by the codes.

1.2 Scope: This acceptance criteria applies to fasteners power-driven into uncracked concrete, minimum $^{1}/_{8}$-inch-thick (4.8 mm) steel and uncracked masonry elements as alternatives to anchor bolts in concrete and concrete masonry and bolts in steel. The fasteners form connections between the uncracked concrete, steel, and uncracked concrete masonry base materials and other building elements. Other base materials such as brick may be considered if substantiated by appropriate data. Fasteners addressed under this criteria are limited to allowable stress design (ASD). Fasteners are not permitted for earthquake load resistance except when used in areas enforcing the IBC or IRC, with architectural, electrical and mechanical components ~~as~~ described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, and when used to attach wood foundation sills to concrete foundations as specified in Section 3.4 of this criteria. This criteria addresses requirements for power-driven fasteners intended for general use, and additional requirements for fasteners intended for the following end uses:

- Sill plate anchorage
- Ceiling clip fastening

1.3 Reference Standards:

1.3.1 ~~2006~~ 2009 *International Building Code*® (IBC), International Code Council.

1.3.2 ~~2006~~ 2009 *International Residential Code*® (IRC), International Code Council.

~~**1.3.3** BOCA® *National Building Code*/1999 (BNBC).~~

~~**1.3.4** 1999 *Standard Building Code*© (SBC).~~

~~**1.3.5** 1997 *Uniform Building Code*™ (UBC).~~

1.3.3 ACI 211.1-91 (Reapproved 2002), Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, American Concrete Institute.

1.3.4 ACI 318-~~05~~ 08, Building Code Requirements for Structural Concrete, American Concrete Institute.

~~**1.3.8** ACI 530-05, Building Code Requirements for Masonry Structures, American Concrete Institute.~~

~~**1.3.9** ANSI A10.3-95, Operations – Safety Requirements for Powder-actuated Fastening Systems, American National Standards Institute.~~

1.3.5 ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers/Structural Engineering Institute.

1.3.6 National Design Specification (NDS) for Wood Construction, 2005 edition, American Forest & Paper Association. ~~See Table 3 for the edition applicable to the referenced code.~~

1.3.7 ASTM C 31-~~98~~ 06, Standard Practice for Making and Curing Concrete Test Specimens in the Field, ASTM International.

1.3.8 ASTM C 33-03, Standard Specification for Concrete Aggregates, ASTM International.

1.3.9 ASTM C 39-99ae1, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, ASTM International.

1.3.10 ASTM C 42-99, Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM International.

1.3.11 ASTM C 55-~~03~~ 06e01, Standard Specification for Concrete Brick, ASTM International.

1.3.12 ASTM C 90-~~03~~ 06b, Standard Specification for Loadbearing Concrete Masonry Units, ASTM International.

1.3.13 ASTM C 330-~~04~~ 05, Standard Specification for Lightweight Aggregates for Structural Concrete, ASTM International.

1.3.14 ASTM C 270-~~04~~ 07, Standard Specification for Mortar for Unit Masonry, ASTM International.

1.3.15 ASTM C 476-02, Standard Specification for Grout for Masonry, ASTM International.

1.3.16 ASTM C 1314-~~03b~~ 07, Standard Test Methods for Compressive Strength of Masonry Prisms, ASTM International.

1.3.17 ASTM E 1190-95 (20~~00~~ 7), Standard Test Methods for Strength of Power-Driven Fasteners in Structural Members, ASTM International.

1.3.18 Standard 4450, Approval Standard for Class I Insulated Steel Deck, February 1989, FM Global.

1.3.19 Standard 4470, Approval Standard for Class I Roof Covers, 1992, FM Global.

1.3.20 TMS 402-08/ACI 530-08/ASCE 5-08, Building Code Requirements for Masonry Structures, The Masonry Society/American Concrete Institute/American Society of Civil Engineers.

1.4 Definitions:

1.4.1 Alignment Tips: Alignment tips are a washer, eyelet or other guide member located on the fastener shank to align and retain fasteners in driving equipment.

~~**1.4.2 Evaluation Report:** An evaluation report is a document published by ICC-ES recognizing fastener performance features required by the IBC, IRC, BNBC, SBC or UBC.~~

~~**1.4.3 Eye Pin:** An eye pin is a fastener with a hole in the head for receiving chains and wires, which in turn support suspended ceilings, light fixtures, etc.~~

Page: 2

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:14:55 PM
basis

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:15:06 PM
bolts and screws

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:15:36 PM
brick or other metals

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 2:59:07 PM
Suspended Ceiling Hangers

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 5:54:08 PM
Do not remove. Reference response to Letter Item 7 and Letter Item A. Update to the 2006 version.

1.4.2 Fasteners: Fasteners are drive pins or threaded studs manufactured from special heat-treated steel, which attach one component to another.

1.4.3 Fastener Test Series: A fastener test series is a group of identical fasteners tested under identical conditions. Identical conditions encompass fastener type, diameter, length, embedment, spacing, edge distance, concrete/masonry density/weight, test member thickness and concrete/masonry compressive strength, steel thickness and steel strength.

1.4.4 Masonry: Masonry is ~~masonry~~ construction with masonry units, mortar, grout and masonry units ~~that~~ comply with Section 3.1.

~~**1.4.7 Power-driven Fastening System:** A power-driven fastening system is a system that uses explosive powder, gas combustion, compressed air or other gas to embed the fastener into base materials.~~

1.4.5 Stabilizer: A stabilizer is an accessory supplied with driving tools and used to reduce flying particles and hold the driving tool perpendicular to material surface.

1.4.6 Test Member: The test member is the structural member, usually a concrete slab, steel plate or masonry prism, receiving fasteners to be tested.

1.4.7 Tool Class: Tool class is a velocity class of power-actuated tools used in the tests, designated in accordance with ANSI A 10.3.

1.4.8 Uncracked Concrete/Masonry: Concrete or masonry elements where analysis indicates no cracking (f_t < f_r) due to service loads or deformations. For concrete, f_r is defined in ACI-318, Section 9.5.2.3 ~~(IBC, BNBC, and SBC) or in UBC Section 1909.5.2.3~~. For masonry, f_r is defined in ~~ACI 530~~ TMS 402, Section 3.1.8.2 (IBC)~~, or UBC Section 2108.2.4.6~~.

1.4.9 Additional definitions are noted in Section 3 of ASTM E 1190.

1.5 Notation:

COV = Coefficient of variation of the test series (=s/F).

f'_c = Minimum specified concrete strength at time of installation, psi (kpa).

$f'_{c,max}$ = Maximum concrete strength applicable to recognized allowable load, psi (kpa).

$f'_{c,test}$ = Actual compressive strength of concrete test specimen, psi (kpa).

f_r = Modulus of rupture of concrete.

f_t = Extreme fiber tension stress in concrete.

F = Average ultimate load of the test series, lbf (N).

F_{all} = Allowable load for fastener, lbf (N).

F_u = Specified tensile strength of steel base material, ksi (mpa).

$F_{u,test}$ = Actual tensile strength of steel base material, ksi (mpa).

H_c = Minimum specified Rockwell C core hardness.

$H_{c,test}$ = Actural Rockwell C core hardness of tested fasteners.

n = Exponent for combined loading.

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

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

P_u = Average ultimate tension test load from tension test, lbf (N).

$P_{u,45}$ = Average ultimate tension test load from combined load test, lbf (N).

R = Governing reduction factor.

R_c = Reduction factor for overstrength of concrete test specimen.

R_f = Reduction factor for overstrength of fastener.

R_s = Reduction factor for overstrength of steel base material test specimen.

s = Standard deviation of the test series.

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

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

V_u = Average ultimate shear test load from tension test, lbf (N).

$V_{u,45}$ = Average ultimate shear test load from combined load test, lbf (N).

Ω = Safety factor.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description:

2.1.1.1 Generic or trade name.

2.1.1.2 Manufacturer's catalog number.

2.1.1.3 Fastener head diameter and thickness.

2.1.1.4 Nominal fastener or shank diameter.

2.1.1.5 Fastener shank length.

2.1.1.6 Permitted manufacturing tolerances.

2.1.1.7 Washer or clip size and thickness, if used.

2.1.1.8 Alignment tips.

2.1.1.9 Shank ~~treatment~~ characteristics. If knurled, the knurl pattern must be described.

2.1.1.10 Fastener and, as applicable, washer or clip material specifications, including protective coatings and physical properties, such as tensile strength and/or hardness.

~~**2.1.1.11** Appropriate national standard for the fastener and, as applicable, washer or clip materials. All tested fasteners, whether they are prototypes or production fasteners, shall be proven by the testing laboratory to conform to the manufacturer's fastener specifications. This evaluation shall include confirmation of equivalent dimensions, chemical composition, and material properties, such as strength and/or hardness. As an alternative to chemical testing, a mill certificate for the raw wire material, corresponding to the tested fastener lot, may be submitted to demonstrate compliance with the chemical composition requirements. Where the actual material strength exceeds the specified strength, fastener~~

Page: 3

Author: LIECDRE
Subject: Comment on Text
Date: 1/13/2010 4:53:10 PM
delete. This is a repeat with the wording addition.

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 5:55:23 PM
Why is this definition being deleted?

Author: LIECDRE
Subject: Sticky Note
Date: 1/11/2010 5:17:59 PM
psi (kpa)

Author: LIECDRE
Subject: Sticky Note
Date: 1/11/2010 5:18:05 PM
psi (kpa)

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:18:16 PM
Actual

~~load test results shall be adjusted by the quotient of F_u specified/F_u actual, when failure is attributed to the subject fastener material. Where no physical property specifications exist, acceptable properties shall be submitted for installation, application and design.~~

2.1.2 Installation Instructions: Recommended installation procedures. Manufacturer's published instructions shall be submitted for installation, application and design.

2.1.3 Packaging and Identification: A description of the method of packaging and manner of field identification prior to or after installation is needed. The manufacturer's name or insignia and the product's type and size shall be marked on the fastener or packaging units. The ICC-ES evaluation report number shall be placed on packaging.

2.1.4 Exposure: When fasteners are recognized for exterior exposure or damp environments, evidence of durability shall be established using appropriate methods such as Factory Mutual Research Corrosion Test Procedure in Standards 4450 and 4470.

2.2 Testing Laboratories: Testing laboratories shall comply with the ICC-ES Acceptance Criteria for Test Reports (AC85), and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

2.3 Test Reports: Test reports shall comply with AC85. In addition, test reports shall include the following information:

2.3.1 Information specified in report section of the applicable test standard.

2.3.2 Method of failure for each test (e.g., concrete or masonry cracking, concrete spalling, fastener pullout, fastener shear, steel tear out, or ductile steel failure).

2.3.3 Seal of a registered design professional.

2.3.4 Fastener Identification:

2.3.4.1 Manufacturer's catalog number or model line designation.

2.3.4.2 Physical dimensions, which may be shown on drawings.

2.3.4.3 Washer dimensions, which may be shown on drawings.

2.3.4.4 Description of coatings or finishes.

2.3.5 Data collection sheets.

2.3.6 The fasteners, tool setting aids and necessary driving aids, such as stabilizers, used in the tests.

2.4 Product Sampling: Sampling of the fasteners for tests under this criteria shall comply with Sections 3.2, 3.3 and 3.4 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 Test Member Specifications:

3.1.1 Concrete:

3.1.1.1 To obtain desired concrete compressive strengths, the mix shall be based on recommendations for proportioning in the Design and Control of Concrete Mixtures, ACI 211.1, and Chapter 19 of the IBC (ACI 318). Proportions are permitted vary to meet local requirements and to achieve desired nominal compressive strength. The reasons for variations shall be documented in the test report.

3.1.1.2 Coarse and fine aggregate in concrete shall comply with either ASTM C 33 or ASTM C 330. The aggregate description shall include the rock and mineral components, shape, hardness, maximum size, and grading specification.

3.1.1.3 Concrete test members shall be prepared in accordance with ASTM C 31. Compressive strength cylinders shall be stored and cured in accordance with Section 9.3.1 of ASTM C 31 (field cure). These cylinders are tested in accordance with ASTM C 39 and Section 3.1.3 of this criteria.

3.1.1.4 Where cylinders are unavailable, compressive strength shall be determined by obtaining, preparing and testing drilled cores. Procedures in ASTM C 42 shall be followed. One sample from each of three cores shall be tested in accordance with ASTM C 42 and Section 3.1.3 of this criteria.

3.1.1.5 Reinforcement is used only to stabilize test members during transportation. Reinforcing elements in concrete test members shall be outside the potential failure region of each test fastener. The testing laboratory shall control and verify location of reinforcing.

3.1.2 Masonry:

3.1.2.1 Masonry test specimens shall be prepared in accordance with IBC Chapter 21. Masonry strength shall be determined in accordance with IBC Chapter 21 where masonry unit, mortar, and grout strengths are less than or equal to 110 percent of specified values. As an alternative, masonry strength may be determined by prism tests without limitations to masonry unit, mortar and grout strengths.

3.1.2.2 The testing laboratory shall verify that masonry units comply with the following standards, as appropriate:

3.1.2.2.1 Concrete building brick: ASTM C 55. The grade and density shall be identified.

3.1.2.2.2 Concrete masonry units: ASTM C 90. The density (normal weight, medium weight, or lightweight) shall be identified.

3.1.2.2.3 Brick not conforming with above-noted standards shall comply with a nationally recognized standard.

3.1.2.3 Mortar shall be prepared in accordance with IBC Section 2103 and ASTM C 270. The testing laboratory shall report the mortar composition, mortar type, proportions, and compliance with the standard. The compressive strength of the mortar used in the test specimens shall be 110 percent (maximum) of specified values.

3.1.2.4 Grout shall be prepared in accordance with IBC Section 2103 and with ASTM C 476. The testing laboratory shall report grout composition, grout type, proportions and compressive strength. The compressive strength of the grout used in the test specimens shall be 110 percent maximum of specified values.

3.1.2.5 When masonry strength is determined by prism tests, masonry prisms shall be prepared and tested in accordance with ASTM C 1314 and Section 3.1.3 of this criteria.

3.1.2.6 Reinforcement shall only be used to stabilize test members during transportation. Reinforcing elements in masonry test members shall be outside the potential failure region of each test fastener. The testing laboratory shall control and verify the location of reinforcing.

3.1.3 Concrete and Masonry Strength Determination:

3.1.3.1 Concrete and masonry test members shall age a minimum of 21 days prior to the beginning of fastener load tests described in Section 4.1 of this criteria. For masonry where strength is determined according to IBC Table 2105.2.2.1.2, fastener load tests shall be done when masonry reaches 21 to 35 days of age, and masonry unit, mortar and grout tests for strength shall be done at 28 days of age.

Exception: For tests to determine performance of fasteners in high early strength or uncured concrete.

3.1.3.2 For concrete or masonry less than 90 days old, two cylinders, cores or prisms, prepared according to Section 3.1.1 or 3.1.2 of this criteria, shall be tested at the beginning and two at the end of fastener load testing, as indicated in Table 1. The beginning test shall be concurrent with the initiation of fastener testing. The beginning and end strength results shall be averaged (four cylinders, cores or prisms total) to establish the strength of the test members during the test period.

3.1.3.3 For concrete or masonry aged 90 days or more, the compressive strength shall be the average of a single test of three cylinders, cores, or prisms determined after at least 90 days, and within 30 days of fastener testing.

3.1.3.4 Reported concrete or masonry strength for any anchor test series shall be determined from the tests in this section within the time limitations indicated in Table 1 of this criteria.

3.1.4 Steel: Steel plates and steel deck panels shall comply with the appropriate standard for structural quality steel. Compliance is determined by test reports submitted by the mill or a testing laboratory. Tensile strength of the steel shall be established through mill certification or by testing in accordance with ASTM A 370.

3.1.5 Other Test Members: Test members not otherwise described in Section 3.1 of this criteria shall be described and shall meet applicable standards.

3.2 Test Program:

3.2.1 Fastener Verification: All tested fasteners, whether they are prototypes or production fasteners, shall be proven by the testing laboratory to conform to the manufacturer's fastener specifications. This evaluation shall include confirmation of equivalent dimensions, chemical composition, and material properties, such as strength and/or hardness. As an alternative to chemical testing, a mill certificate for the raw wire material, corresponding to the tested fastener lot, may be submitted to demonstrate compliance with the chemical composition requirements.

3.2.2 Load Test Program: For determining allowable loads used in structural designs, tests shall be done in accordance with Sections 4.1 and 4.3 of this criteria, as applicable.

3.3 Allowable Load Determination:

3.3.1 General: The documents containing allowable load determinations shall be sealed by a registered design professional.

Based on results from tests described in Sections 4.1 through 4.3 of this criteria, the allowable load shall be computed using Equation 3-1:

$$F_{all} = \frac{F \cdot R}{\Omega} \qquad (3\text{-}1)$$

where:

Ω = Safety factor determined in accordance with Section 3.3.2

R = Most severe reduction factor determined in accordance with Section 3.3.3, as applicable.

When sample size is ten and the COV is 15 percent or greater, the allowable load shall be determined by applying the safety factor to the lowest ultimate load of the ten tests.

3.3.2 ~~**Concrete, Masonry and Steel**~~ **Safety Factor, Ω**: ~~Based on results from tests described in Sections 4.1 through 4.3 of this criteria, the allowable load shall be computed using Equation 3-1. Where the COV is less than 15 percent, a safety factor of no less than 5 shall be applied to the average ultimate load. When testing satisfies the alternate sample size described in Section 8.1 of ASTM E 1190 (the COV from ten tests is 15 percent or greater), the allowable load shall be determined by applying a minimum safety factor of 5 to the lowest ultimate load of the ten tests.~~ The safety factor shall be determined using Equation 3-2.

$$F_{all} = \frac{F - 2s}{3.5} = F\,\frac{(1 - 2COV)}{3.5} \qquad (3\text{-}1)$$

$$\Omega = \frac{3.5}{(1 - 2COV)} \geq 5 \qquad (3\text{-}2)$$

~~where:~~

~~F_{all} = allowable load, pounds (N).~~

~~COV = s/F = coefficient of variation in a test series.~~

~~s = standard deviation in a test series.~~

~~F = average ultimate load in test series, pounds (N).~~

3.3.3 Load Adjustment (Reduction Factors):

3.3.3.1 Concrete: Where the concrete test member's compressive strength, $f'_{c,test}$, exceeds ~~f_{ci}~~ f'_c by more than 10 percent, but is within 1,000 psi (6,895 kPa), the fastener test values shall be ~~adjusted~~ reduced using Equation 3-~~2~~3:

Page: 5

Author: LIECDRE
Subject: Sticky Note
Date: 1/11/2010 5:20:05 PM
max (R_c, R_s, R_f)

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:20:37 PM
of 5.0 to

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:20:27 PM
a

Author: LIECDRE
Subject: Comment on Text
Date: 1/13/2010 4:56:21 PM
Why 5? Reference response to Letter Item 14b.

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:23:29 PM
reduction factor for overstrength of concrete test specimen, R_e, shall be calculated.

$$F_l = F_t\sqrt{\frac{f_{ci}}{f_{ct}}} \qquad (3\text{-}2)$$

$$R_c = \sqrt{\frac{f'_c}{f'_{c,test}}} \qquad (3\text{-}3)$$

where:

F_l = allowable load described in evaluation report, pounds (N).

F_t = allowable load derived from test series, pounds (N).

f_{ci} = specified concrete compressive strength described in evaluation report, psi (kPa).

f_{ct} = compressive strength of concrete test member at time of fastener test, psi (kPa).

3.3.3.2 Masonry: Where masonry units used in test members have net area compressive strength properties exceeding 110 percent of the specified values, or dimensions varying from specified values, design loads for fasteners installed directly into units shall be adjusted based on ratios of test member values to specified values.

Where mortar compressive strength exceeds 110 percent of the specified values, design loads for fasteners installed in mortar joints shall be adjusted based on ratios of tested mortar strength to specified mortar strength.

Where grout compressive strength exceeds 110 percent of the specified values, design loads for fasteners installed down into the top of grouted cells shall be adjusted based on ratios of tested grout strength to specified grout strength.

3.3.3.3 Steel: Design loads derived from tests in steel shall be adjusted for steel strength as follows:

1. If tests have been conducted in one steel strength, the following relationship shall be used to derive design values the reduction factor for lesser steel strengths:

$$F_l = F_t \cdot \left(1 - \frac{F_{u,test} - F_u}{100}\right) \quad \text{[lb, N]} \qquad (3\text{-}3)$$

$$R_s = 1 - \frac{F_{u,test} - F_u}{100} \qquad (3\text{-}4)$$

where:

$F_u \le F_{u,test}$

F_u = Specified steel tensile strength, ksi (MPa).

$F_{u,test}$ = Steel tensile strength of test member, ksi (MPa).

2. If tests have been conducted in more than one steel tensile strength with the difference between the maximum and minimum tested steel tensile strengths, Δ_{fu}, greater than or equal to 10 ksi (68.9 MPa), a relationship for the influence of steel tensile strength on fastener capacity may be derived from the test results. Maximum fastener capacity shall be limited to those values associated with the maximum tested steel tensile strength.

3.3.3.4 Fastener: When failure is attributed to the fastener material, and the average core hardness of the fasteners, $H_{c,test}$, exceeds the minimum specified core hardness, H_c, by more than five percent, fastener load test results shall be adjusted by the following reduction factor:

$$R_f = \frac{H_c}{H_{c,test}} \qquad (3\text{-}5)$$

3.3.4 Combined Loads: Allowable loads for fasteners subjected to combi43-5.

$$\left(\frac{P_s}{P_t}\right)^n + \left(\frac{V_s}{V_t}\right)^n \le 1 \qquad (3\text{-}4)$$

$$\left(\frac{p}{P_a}\right)^n + \left(\frac{v}{V_a}\right)^n \le 1 \qquad (3\text{-}5)$$

where:

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

P_t = service tension load, pounds (N).

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

V_t = service shear load, pounds (N).

To permit $n = {}^5/_3$ in Equation 3-43-5, combined load oblique tension tests described in Section 4.1.87 of this criteria, at 45 degrees are required to confirm the Equation 3-53-6. If combined load tests are not done or if Equation 3-5 is not satisfied, then n = 1 in Equation 3-43-5.

$$\left(\frac{P_a}{P_u}\right)^{5/3} + \left(\frac{V_a}{V_u}\right)^{5/3} \ge 1 \qquad (3\text{-}5)$$

$$\left(\frac{P_{u,45}}{P_u}\right)^{5/3} + \left(\frac{V_{u,45}}{V_u}\right)^{5/3} \le 1 \qquad (3\text{-}6)$$

Where:

P_a = average ultimate tension test load from combined load test, pounds (N).

P_u = average ultimate tension test load from tension load test, pounds (N).

V_s = average ultimate shear test load from combined load test, pounds (N).

V_u = average ultimate shear test load from shear load test, pounds (N).

3.3.5 Wood to Steel, Concrete or Masonry: Reference shear load values are determined according to the NDS. Bending yield strength values shall result from tests conducted on the fasteners in accordance with the ICC-ES Acceptance Criteria for Test Method to Determine

Page: 6

Author: LIECDRE
Subject: Comment on Text
Date: 1/13/2010 4:58:32 PM
Remove. Reference response to Letter Item 9.

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:25:31 PM
combined loads:

Author: LIECDRE
Subject: Comment on Text
Date: 1/11/2010 5:23:59 PM
Shouldn't these be reduction factors like R_e?

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 5:59:57 PM
>

Should be greater than and not less than.

Reference Hilti comments regarding 3-6 in the letter.

Bending Yield Moment of Nails (AC95). If hardness values under Section 2.1.1.10 and 2.1.1.11 of this criteria give Rockwell C hardness values greater than ~~R_c~~ 45, then bending yield strength tests do not have to be performed and the bending yield strength values for the fasteners shall be the values noted in the NDS based on nail diameter.

3.4 ~~Foundation Sill Plate Application for Conventional Light Wood-frame Construction~~ Requirements Based on Intended End Use:

3.4.1 Fasteners Intended for Use in Wood Sill Plates: ~~Fastener spacing for attaching wood foundation sills to foundations in Seismic Design Category A or B (IBC or IRC), Seismic Performance Category A, B, C or D (BNBC or SBC), Seismic Zones 0, 1, 2, and 3 (UBC) and in areas with basic wind speeds up to 85 mph (137 km/h) fastest mile wind speed or 100 mph (161 km/h) 3-second-gust wind speed, shall be according to Table 2 of this criteria, provided fastener test results conducted in accordance with Section 4.2 of this criteria satisfy shear and tension load requirements in Table 2 of this criteria. For use of fasteners in 90 mph (145 km/h) fastest mile wind speed or greater basic wind speed areas, or 105 mph (161 km/h) 3-second-gust wind speed or greater basic wind speed areas, or when test results do not satisfy minimum load requirements of Table 2 of this criteria,~~ Recognition of power-driven fasteners used as sill plate anchorage shall be limited to Seismic Design Category A or B. ~~A~~an engineer~~ing~~ed design is required that uses allowable loads determined in accordance with Section 3.3 ~~of this criteria~~, based on testing in accordance with Section 4.2. Fasteners used to attach code-complying preservative-treated wood foundation sills to concrete foundations shall comply with IBC Section 2304.9.5.

EXCEPTION: ~~The seismic and wind limitations of Section 3.4.1 are permitted to be waived for fasteners used in interior non-shear wall applications.~~

3.4.2 Assemblies Comprised of Power-driven Fasteners and Premounted Components Intended for Use as Ceiling Wire Hangers: ~~Fasteners used to attach code-complying preservative-treated wood foundation sills to concrete foundations shall comply with IBC Section 2304.9.5.~~

3.4.2.1 Testing: Ceiling wire hanger assemblies shall be tested in accordance with Section 4.3.

3.4.2.2 Conditions of Acceptance: When subjected to load, ceiling wire hanger assemblies shall exhibit a ductile mode of failure involving the mounted components, prior to fastener pullout.

The allowable hanger load shall be the least of the following:

1. The ultimate test load, divided by a safety factor of 5.

2. The test load, adjusted by a ratio of specified minimum tensile strength of the clip steel to actual tensile strength of the clip steel test specimens, divided by a safety factor of 3.

3. The applied load that results in a deflection o[illegible]h.

4.0 TEST METHODS

4.1 Fastener-load Testing Procedures:

4.1.1 Concrete Test Specimens: Concrete slabs are formed and poured to sufficient size to permit installation of ~~a~~ fasteners with spacings and edge distances complying with Table 1of ASTM E 1190.

4.1.2 Masonry Test Specimens: Masonry assemblies shall be fully grouted, partially grouted or ungrouted and be of sufficient size to permit installation of fasteners with spacings and edge distances complying with Table 1 of ASTM E 1190. Fastener locations include face shells of units into grouted spaces, ungrouted spaces, mortar joints or down through grouted cells, simulating concrete masonry foundation walls. The fastener position used in the test establishes the position specified in the evaluation report.

4.1.3 Steel Test Specimens: Steel plates shall be of sufficient size to permit installation of fasteners with spacings and edge distances complying with Table 2 of ASTM E 1190.

4.1.4 Installation: Fasteners shall be installed into the test member according to the manufacturer's recommended procedure, with spacing from edges and adjacent fasteners as set forth in Table 1 of ASTM E 1190. Additional tests may be required to determine fastener loads at spacings and edge distances described in the manufacturer's installation instructions. Fasteners shall be driven into concrete or masonry when the specified compressive strength is attained plus or minus a 400 psi (2.8 MPa) deviation. Fastener embedment shall be observed and recorded.

4.1.5 Sample Size: The minimum sample quantity for each data category shall comply with Section 8 of ASTM E 1190.

4.1.6 Testing Methods: Test apparatus shall comply with Section 5 of ASTM E 1190, for tensile and shear loading. Test procedures shall comply with Section 9 of ASTM E 1190. Ultimate load and failure mode shall be recorded for each test.

4.1.7 Combined Loads: For combined loads, tests shall be done by loading the fastener obliquely at a 45° angle from test member surface. Figure 1 of this criteria illustrates loading set-up. Other aspects of the test program shall comply with general requirements in ASTM E 1190.

4.2 Sill Attachment Test Procedure:

4.2.1 Installation: Fasteners shall be placed into the concrete test member through the center of a nominal 2-inch-thick (51 mm) wood member with a specific gravity of 0.5 or greater. ~~The concrete compressive strength shall be 2,000 psi ± 400 psi (13.8 MPa ± 2.8 MPa) when the fastener is installed and tested.~~ Any concrete spalling or cracking after installation shall be reported.

For recognition of use to attach sill plates for exterior shear walls, interior shear walls, and interior non-shear walls, the fastener shall be installed with a ~~minimum~~ $1^3/_4$-inch (44.5 mm) edge distance.

For recognition of use to attach sill plates to slab foundations, away from the edges, ~~for interior shear walls and interior non-shear walls only~~, the fastener shall be

Page: 7

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 6:05:16 PM
Do not delete. Why is this exception no longer considered valid?

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 4:13:46 PM
Suspended Ceiling Hanger Applications.

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 4:14:17 PM
Suspended ceiling

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 6:06:36 PM
This should be deleted. Reference response to Letter Item 12a.

Author: LIECDRE
Subject: Highlight
Date: 1/13/2010 5:00:56 PM
Delete. Reference response to Letter Item 12.

Author: LIECDRE
Subject: Sticky Note
Date: 1/18/2010 6:03:14 PM
4. Test load controlled by wire failure divided by a safety factor of 2.

installed with an edge distance equal to or greater than the minimum edge distance, *c*, specified in Table 1 of ASTM E 1190.

4.2.2 Testing: The fasteners shall be tested for shear and tension loads according to ASTM E 1190, except that edge distance shall be as described in Section 4.2.1 of this criteria, depending on the installation conditions and locations that are sought. The sill plate shall be removed before testing. The shear load shall be applied towards the closest test member edge.

4.3 Ceiling Clip Assemblies (fastener and clip combination):

4.3.1 Installation: Assemblies shall be installed into test members as a complete unit.

4.3.2 Testing: Assemblies shall be tested by loading the assembly in the same manner as the loading when assemblies are installed in field conditions, i.e., load attached to the hole where the wire would attach.

5.0 QUALITY CONTROL

5.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. The quality control program shall verify component compliance with specifications described in Section 2.1 of this criteria.

5.2 Third-party follow-up inspections are not required under this acceptance criteria.

6.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include the following:

6.1 Basic information required by Section 2.1 of this criteria, including product description, installation procedures, packaging and identification.

6.2 Allowable loads for each fastener and ceiling clip assembly determined by Section 3.3 of this criteria. The allowable loads shall include tension, shear and combined loads, as applicable.

6.3 Unless data in accordance with Section 2.1.4 of this criteria is submitted, the evaluation report shall state that installation must be limited to dry, interior conditions.

6.4 Information concerning connections with wood, in accordance with Section 3.3.5 of this criteria, as applicable.

6.5 Information concerning use as foundation sill plate anchorage ~~application~~, based on Sections 3.4 and 4.2 of this criteria, as applicable~~.~~, including the following:

6.5.1 Allowable shear [illegible] (uplift) loads, based on capacity in concrete[illegible]

6.5.2 Bearing area for washers, to allow for calculation of pull through capacity.

6.6 The evaluation reports shall state that earthquake load resistance is beyond the scope of the report.

EXCEPTIONS:

1. Fasteners used with architectural, electrical and mechanical components ~~as~~ described in Section 13.1.4 of ASCE/SEI 7 (IBC and IRC) as exempt from seismic design requirements.

2. Foundation sill plate applications complying with Section 3.4 of this criteria.

6.7 The evaluation reports shall state that use is limited to uncracked concrete or masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

6.8 The applicable concrete strength for the fasteners shall be reported as a range. The low end of the range shall be the specified minimum concrete strength, f'_c. The upper end of the range $f'_{c,max}$ shall be a maximum of 500 psi above the actual strength of the concrete test specimen.

6.9 For power-driven fasteners installed in steel base materials, the required length of penetration through the steel shall be reported.

TABLE 1—TEST MEMBER STRENGTH TEST TIME LIMITATIONS

AGE OF CONCRETE OR MASONRY AT BEGINNING OF FASTENER TEST	MAXIMUM TIME BETWEEN TEST MEMBER STRENGTH TESTS (TEST PERIOD)	COMMENTS
Less than 21 days	3 days	Per Section 3.1.3.1, for special tests only
21 - 35 days	7 days	None
36 - 56 days	14 days	None
57 - 90 days	30 days	None
More than 90 days	—	See Section 3.1.3.3

Page: 8

Author: LIECDRE
Subject: Sticky Note
Date: 1/13/2010 5:01:34 PM
and thickness

Author: LIECDRE
Subject: Comment on Text
Date: 1/13/2010 5:02:56 PM
This needs to be clarified. Reference response to Letter Item 14a.

Author: LIECDRE
Subject: Comment on Text
Date: 1/18/2010 6:09:12 PM
embedment

Reference response to Letter Item 14b.

~~TABLE 2—LOAD AND SPACING REQUIREMENTS FOR WOOD SILL PLATE ANCHORAGE~~

~~NOMINAL FASTENER SHANK DIAMETER (inch)~~[10]	~~MINIMUM FASTENER LENGTH (inches)~~	~~MINIMUM LOAD REQUIREMENTS FOR SILL PLATE ANCHORAGE (lbs)~~[1,2]		~~FASTENER SPACING (ft.)~~[3,4,5,6,7]		
		~~Allowable Shear Load (lbs)~~[8]	~~Allowable Tensile Load (lbs)~~[8]	~~Interior Shear Walls~~[5,9]	~~Interior Nonshear Walls~~[10]	~~Exterior Shear Walls~~[5,9]
~~0.136 - 0.142~~	~~2 7/16~~	~~100~~	~~100~~	~~1~~	~~2~~	~~1~~
~~0.143 - 0.155~~	~~2 3/4~~	~~150~~	~~125~~	~~1.5~~	~~3~~	~~1.5~~
~~0.156 - 0.187~~	~~3~~	~~200~~	~~150~~	~~2~~	~~4~~	~~2~~
~~0.188 and greater~~	~~3~~	~~300~~	~~250~~	~~3~~	~~4~~	~~3~~

~~For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 74.6 N/m, 1 psi = 6.89 kPa.~~

~~[1]Allowable loads from tests conducted under Section 4.2.2 of this criteria are calculated using the methods described in Section 3.3 of this criteria.~~
~~[2]For step shank fasteners, the smallest diameter of the fastener is considered the shank diameter for purposes of this table.~~
~~[3]Spacings are based on the attachment through the center of 2-inch nominal thickness wood with specific gravity of 0.5 or greater to concrete floor slabs or footings in accordance with BNBC Section 2305.17, SBC Section 2307.1or UBC Sections 1806.6 and 2320.6, as applicable [Section 2308.6 of the IBC or Section R403.1.6 of the IRC (for maximum two-story buildings)]. For other species of lumber, the required spacings of fasteners require special calculations complying with the NDS.~~
~~[4]Fasteners shall not be driven until the concrete has reached a minimum concrete compressive strength of 2,000 psi.~~
~~[5]Bearing walls shall have bracing in accordance with IBC Section 2308.9.3, IRC Section R602.10, BNBC Section 2305.8, SBC Section 2308.2.2 or UBC Section 2320.11.3, as applicable. Interior and nonbearing partitions are not assumed to be braced.~~
~~[6]Fasteners shall not be used to attach shear walls having a unit shear exceeding 100 pounds per foot to other building elements.~~
~~[7]All fasteners must be installed with a minimum 3/4-inch-diameter (19.1 mm), No. 16 gage (0.0598-inch) washer.~~
~~[8]Larger category shank diameter may meet minimum load requirements of a smaller category shank diameter, provided spacing requirements are also applied.~~
~~[9]Walls shall have two fastenersplaced 6 inches and 10 inches, respectively, from each end of sill plates with maximum spacing between, as shown in this table.~~
~~[10]Walls shall have fasteners placed at 6 inches from ends of sill plates with maximum spacing between, as shown in this table.~~

~~TABLE 3—CODE-REFERENCED STANDARDS~~

~~STANDARD~~	~~2006 IBC~~	~~2006 IRC~~	~~1999 BNBC~~	~~1999 SBC~~	~~1997 UBC~~
~~NDS~~	~~ANSI/AF&PA NDS-2005~~	~~ANSI/AF& NDS-2005~~	~~ANSI/AF&PA NDS-1997~~	~~ANSI/AF&PA NDS-1997~~	~~ANSI/NFoPA NDS-1991~~

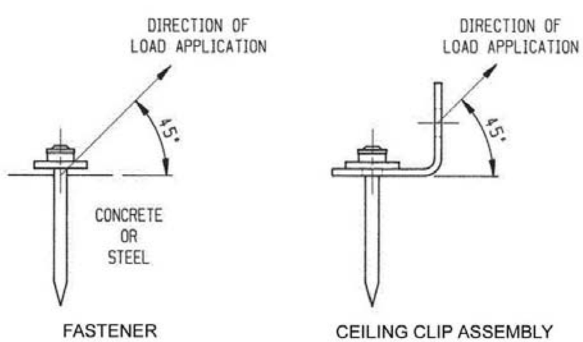

FIGURE 1—FASTENER AND CEILING CLIP ASSEMBLY

This page contains no comments

POWDER ACTUATED TOOL MANUFACTURERS' INSTITUTE
136 South Main Street, Suite 2-E
St. Charles, Missouri 63301
www.patmi.org

James A. Borchers
Executive Director

Telephone 314-889-7166
FAX 314-725-6592
E-Mail: jborchers@patmi.org

January 15, 2010

Ms. Elyse G. Levy (via e-mail)
Senior Staff Engineer
ICC Evaluation Service, Inc.
Chicago Regional Office
4051 W. Flossmoor Road
Country Club Hills, Illinois 60478

Re: Proposed Revisions to Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements, Subject AC70- 0201(EL/DP)

Dear Ms. Levy;

This letter is in response to the above referenced proposed revisions to AC70 published December 29, 2009; and follows our conference call discussions on Thursday, January 14th.

The Powder Actuated Tool Manufacturers Institute (PATMI), represents the powder actuated fastening manufacturing industry and has long been dedicated to the safe use of this unique fastening technology.

We are disappointed in the rush to make such significant revisions without any input from those who would be impacted by them. Had these issues been discussed in the past, or in obvious need for review, we would better understand the push. This hurry to change is especially puzzling in light of the Evaluation Service's historical effort to give the public, and particularly, the affected industry, ample opportunity to study proposed changes. There is no emergency or danger to the public that would justify such a sudden move. Which leads us to question the Evaluation Service's dedication to (and compliance with) the principle of due process.

Following the conference call discussions, PATMI does not object to proposed changes which are required by the addition of (or change to) the International Building Code (IBC) 2009 and International Residential Code (IRC) 2009. This would include:

(1) proposed revisions 1 through 6
(2) correcting sill plate issues
(3) minor editorial (non substantive) changes.

Some PATMI members will be providing separate comments to ICC-ES on AC70; but as an industry we collectively believe that many of these revisions are unwarranted, and in some cases, would create conditions that obligate AC70 report holders to conduct additional tests and analysis not required by the IBC 2009 and IRC 2009.

We, therefore, request that consideration of the other proposed (i.e. those not listed above) revisions be tabled until the June, 2010 hearings agenda. PATMI already has a meeting scheduled on February 4, 2010, in conjunction with the World of Concrete, to address and study these proposed revisions. It's likely that a subsequent follow up meeting will be necessary to complete our comments. You can be assured that we will organize our comments and contribute our experience in a timely fashion; and we look forward to working with you.

In turn, we are happy, at anytime, to receive your suggestions and input.

Sincerely,

James A. Borchers

James A. Borchers
Executive Director & General Counsel

JAB/bp
cc: Board of Directors

January 18, 2010

To Whom It May Concern:

RE: Proposed revisions to AC70

The purpose of this letter is to comment on the proposed changes to AC70 in the letter dated December 29, 2009. Some of the proposed revisions appear to be acceptable and require no further comments. Ramset is also aware that the Powder Actuated Manufacturers Institute (PATMI) has submitted a letter asking that many of the proposals be tabled until the June 2010 ICC meeting. We agree with this proposal, as many of the items should have further discussion before being officially adopted. The sections below are areas that Ramset believes require additional discussion and submit the following comments:

In proposal number 7, it is suggested that to gain recognition in the various types of block, each block must be tested. We disagree with this position. It would seem that based on the comment, the concern from the staff engineers is the density of the block, with the potential that higher densities negatively affect fastener performance. While this may be true in concrete, this is not likely to be true in block which has no course aggregate. It is the course aggregate that adds much of the variability. If testing is done in lightweight block, then these same tested values should apply to medium and normal weight block. This route is pretty conservative.

Proposal number 9 adds a reduction based on over strength of the fasteners. While the reduction seems reasonable, where did the five percent figure come from in 3.3.3.4? All things in the manufactured world have a tolerance applied, fasteners and their hardness levels are no exception. The manufacturer's hardness range specified is often based on long standing manufacturing techniques, where if a fastener is produced within a range there is no difference in performance. Consideration should be given to reviewing the various manufacturers hardness ranges and basing the percentage from this.

Proposal 10 revises section 3.4 for sill plate applications. The last sentence in 3.4.1 refers to fastener corrosion protection in section 2304.9.5 of the IBC. The statement should be amended to include AC257. The heat treat requirements for forced entry fasteners often require other types of corrosion protection different from what the IBC code specifies.

The revisions in proposal 11 section 3.4, removes table 2 from the criteria and would rely on engineered design. The intent here seems good; however the data used within table 2 and on the subsequent evaluation reports are useful to the average building official and contractor. By referencing the evaluation report, this provides maximum spacing requirements to which the fasteners can be installed and inspected to. A general performance number for the fastener is also provided based on shank diameter regardless of manufacturer. This general number can also be helpful to the engineered design in that specific literature is not needed. Perhaps table two can be left in place with an option where it may be superseded by an engineered design.

Proposal number 12a seeks comments regarding forced entry ceiling clips. We disagree with the proposal to add requirements to ceiling clip failure mode. Failure modes will likely vary depending upon fastener embedment. Deeper embedments may result in metal clip failure, but shallow embedments such as ¾-inch penetration, result in fastener withdrawal. Situations do exist such as with post tension cable slabs where maximum embedment is ¾-inch; in these applications a shorter fastener/assembly is needed. The IBC code references the CISCA 3-4 document where it is specified that a ¾-inch minimum embedment be used.

Proposal 12b requests input on ceiling clip conditions for acceptance and safety factors. AC70 Section 4.3 basically states that the fastener assembly shall be tested as an assembly. We believe that this should continue to be the case. The conservative approach would be to apply a minimum safety factor of 5 to the tested assembly; this keeps the criteria constant regardless of the various assembly geometries being tested.

Proposal 12c suggests a deflection limit be placed on ceiling clips during testing. Within the proposal it says "…there should be a limit on movement of the hanger under normal use." Normal use for a ceiling clip is that it must hold about 4 pounds per square foot. We can also relate normal use back to the building code. In UBC 25-2 there is a statement that the connection device must be capable of carrying not less than 100lbs. The IBC codes eventually reference the CISCA 3-4 document which also has a similar 100 pound statement. From the various tests performed, it's unlikely that there will be much if any movement in the ceiling clip during the initial 100 pound load. Any movement in the clip assembly during the test will normally occur far beyond 100lbs. As it relates to the building code, if it can be shown that there is no movement in the clip assembly during the first 100 pounds of the load then there should not be a need for further defection limits.

Proposal 14a adds a concrete compressive strength range for fastener recognition. We agree that the reported "minimum" strength can be removed however we disagree with the compressive strength range proposed. Using a compressive strength range of plus/minus 1000psi would seem to be reasonable and keep testing costs in line. By testing in 2000psi, 4000psi and 6000psi this would cover a majority of compressive strengths encountered in the field with the larger tolerance range. Using a plus/minus 500psi range would double the cost of testing to cover a full range, making it increasingly unaffordable for many. Perhaps consideration can be given to allow for performance interpolation between concrete strengths with a note in the evaluation report allowing for this.

Proposal 14b adds a requirement to report the amount of penetration through steel base materials. While adding the requirement for the information to be included in the ES submitted test report seems acceptable. Including this as part of the evaluation report may not be the best idea and could introduce further confusion and questions into the process. Should the information be included in the evaluation report it may be something that a building official would want to verify. How could this "penetration depth" be accurately verified in the field? The measuring techniques used to gain this type of measurement can certainly be accomplished in a laboratory environment, as it would likely be reported in thousandths of an inch or millimeters. Could this level of measuring accuracy be achieved in the field? Screws can also be used to make similar attachments and use only a three to one safety factor. Current requirements of a five to one safety factor for forced entry fasteners conservatively account for minor variances in embedment depth.

Comments were also requested regarding proper installation. The next few paragraphs discuss some of the topics from the ES proposal letter.

Base materials such as steel and lightweight concrete tend to be consistent with fastener performance. The irregularities mentioned on page 5 section "A" tend to occur with normal weight concrete due to the course aggregate content. The current methodology of large sample sizes and high safety factors applied to testing with high COV's account for this issue. It is in those tests with high COV's where it is likely the larger number of no holds and increased spalling is found.

Many manufacturers often have multiple series of forced entry fasteners with various geometries. If one specific type results in installation problems, another series can be used to resolve or improve the difficulties. Without trying the various series or types of fasteners in a difficult base material, one cannot jump to the conclusion regarding suitability.

Proper installation also follows proper specification and use of the fastener. Increasingly there has been a trend toward larger shank diameters and deeper embedment depths. Some of these specified embedments exceed the 1-1/2 published values. While the data may look attractive to those that specify, field installation issues are sometimes the result. In high compressive strength normal weight concrete, installation using a large shank diameter fastener with deep embedment depths is often the cause of many of these field installation issues. Using smaller shank fasteners at a slightly shallower depth with reduced spacing intervals can sometimes provide for equivalent performance and remove many installation issues.

Forced entry fasteners can be used for a number of connections. There are a multitude of materials in various sizes, shapes, forms, thicknesses, densities, etc, that can be attached to the typical base materials that AC70 covers. Complete coverage of all these various types of connections would not be possible within the criteria. Manufacturers published documents, evaluation reports, and other literature can be used by the design professional to determine what is possible. When questions come up or installation issues occur, the manufacturer's sales or technical people can often be called upon to help engineer a solution.

We would agree that the installation section of the evaluation report include that test firing be performed in the field to determine a proper fastening. These test firings should be done using the manufacturer's installation instructions. However the report must be clear that these test firings be done by the contractor performing the work. Specific information such as power settings placed in the evaluation report may violate manufacturer safety instructions.

If there is a continued concern with the staff that the evaluation report needs installation instructions, perhaps ICC-ES should consult with various industry groups such as PATMI and collaborate over some brief, general installation instructions that could be included in all forced entry evaluation reports, in addition to referring to the manufacturers specific instructions; as these specific instructions are likely to be detailed and complete.

Best regards,

Dave Jablonski
Product Validation Manager

STANLEY
Fastening Systems

Robert J. Leichti, Ph.D.
Compliance Manager,
Fasteners

Briggs Drive
East Greenwich, RI 02818

Tel 401-884 -2500
Fax 401-884-2485
Voice Mail X32166
rleichti@stanleyworks.com

January 18, 2010

Ms. Elyse Levy
ICC – Evaluation Service
4051 Flossmoor Road
Country Club Hills, IL 60478

RE: AC70-0210R1

Dear Ms. Levy;

These comments are offered for the Staff and Committee consideration in the revision of AC70-0210R1.

Section 1.2. The new last sentence of this section is important in that it identifies three uses for products that could have an AC70 report: (1) general use, (2) wood sill plate anchorage and (3) ceiling clip fastening. One presumes that building officials will interpret "general use" to include such common applications as fastening CFS to concrete or connections in steel deck roof and floor systems. A statement that identifies some examples of "general use" would facilitate interpretation. A guidance sentence might begin as, "General use includes but is not limited to CFS-to-concrete fastening; steel roof-deck fastening; nail-strip attachment to steel, concrete or masonry; and others."

Section 1.4.4. Masonry units are identified twice.

Section 3.2.1. In the first sentence, the testing laboratory is held responsible for proving that the test fasteners are in compliance with the manufacturer specifications. The testing laboratory is accredited to test but not to prove compliance. The sentence should be reworded so that the testing laboratory provides test data that is used (by others) to assess compliance with the manufacturer specifications.

Section 3.3.1. This is an improvement over the existing adjustment format and misapplication of adjustment factors. Some clarification is needed to assure the equation 3-1 is properly calculated. The variable *F* is defined as the average load of the test series in Section 1.5, but in Section 3.3.1, *F* can also be the lowest value in a test series of 10 specimens that has a COV equal to or greater than 15 percent. It is assumed that the safety factor (*O*) and the reduction factor (*R*) are applied to *F* whether is the average value or the lowest value definition.

ASTM E1190 provides some latitude in the number of test specimens "depending on the purpose of the test" for a sample size of 10 or a sample size of 30. The safety factor calculation and its application to the lowest test value are explicit if the sample size is equal to 10 and COV is equal to or greater than 15 percent. Based on Section 3.3.2, equation 3-2, even if COV is less than 15 percent, the safety factor cannot be less than 5. Further, it is implied, but not stated that the safety factor is used with the test mean when either the sample size is 10 and COV is less than 15 percent or the sample size is 30 with any COV. However, the condition of this AC is not enumerated, that is, the sample size of 10 and COV equal to or greater than 15 percent.

The issue is clarified in the AC by expanding the definition of *F* in Section 1.5:

F = The average of the test series, or the lowest value of a test series when the number of samples is 10 and COV=15 percent, lbf (N).

Section 3.3.5. The second line of this section references Section 2.1.1.11, which is to be deleted and reference to it should be deleted from this section.

Ceiling clip assemblies have a number of very specific issues related to them beyond the fastener. The performance of the clip assembly system may be substantively affected by the interaction of the strength and stiffness of the assembly components as much as the withdrawal resistance of the fastener. Design and performance testing of the entire assembly may ultimately require a separate AC, or an alternate management solution is to add an annex for each of the specific end uses. For example, wood sill plate fastening and ceiling clips would each have a separate annex so that special considerations and evaluation report recognitions related to these applications of pins driven into concrete and steel can be addressed separate from general use. The strategy of using an annex for each special application will facilitate long-term maintenance of the AC and will make it possible to incorporate new special applications under the same AC as new special applications are brought forward by proponents.

Stanley Fastening Systems appreciates the considerable work represented by this revision and opportunity to review and comment on the revision of this acceptance criteria, which should be approved with an immediate implementation date at the hearing.

Sincerely,

STANLEY FASTENING SYSTEMS, L.P.

[electronic]

Robert J. Leichti
Compliance Manager, Fasteners