Market Support Engineering

iLevel™ by Weyerhaeuser

October 6, 2008

Peter Bahlo, P.E.
Senior Staff Engineer
ICC Evaluation Service
5360 Workman Mill Road
Whittier, CA 90601

RE: Proposed Acceptance Criteria for Cast-in-place Cold-formed Steel Connectors in Concrete for Light-frame Construction, Subject AC 398-1008-R4

Dear Mr. Bahlo:

Thank you for the opportunity to comment on the proposed revisions to AC 398. Our staff has reviewed the proposed criteria and we have some concerns, mostly editorial, relative to the proposed methodology.

I have listed our concerns below by their corresponding section number:

Section 2.3.6 – For clarification you may want to add reference to data required in Section 3.1.1.2 (wood species and grade).

Section 2.3.12 typo – … method of inducing the crack …

Section 3.2.2 - Line 313 to 314 – For clarification you may want to add the following:
…(1) wood member material (species and grade) specified for the installation; …

Section 3.3.2.1 – Lines 379-380
For NDS calculations, the specific gravity of the wood and orientation of the wood grain is also needed along with the size and number of fasteners for connector capacity calculations. For clarification you may want to reword as follows:
…shall be determined in accordance with the applicable provisions of the NDS when connector strength is based solely on ~~the size and number of fasteners~~ the strength of the wood connection.

Section 3.3.2.1 – Lines 388-391
The justification for Rsg is not immediately clear. For clarification you may want to reword as follows:
…,~~to account for increased fastener perpendicular to grain strength used in the tests.~~ (Rsg accounts for variation in the orientation of wood grain and connector diameter).

Section 3.3.3 – Line 407 typo –…Section 1.4.3) ~~the~~ designed using Allowable Stress Design…

Thank you for consideration of these comments. If you have any questions regarding these comments please don't hesitate to contact me at 208-429-3715 or at Daniel.Cheney2@Weyerhaeuser.com

Sincerely,

Daniel W. Cheney (sent via e-mail)

Daniel W. Cheney, P.E.
Manager of Product Acceptance

July 31, 2008

Peter Bahlo, P.E.
Senior Staff Engineer
ICC Evaluation Service, Inc.
Los Angeles Business/Regional Office
5360 Workman Mill Road
Whittier, CA 90601

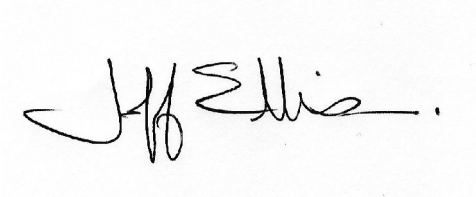
Subject: ICC-ES AC398 June Alternative Criteria Process Public Comments Responses

Dear Mr. Bahlo,

Please find attached Simpson Strong-Tie's responses to the public comments on ICC-ES AC398 entitled "Proposed Acceptance Criteria for Cast-in-Place Cold-Formed Steel Connectors in Concrete for Light-Frame Construction" and posted to the June Alternative Criteria Process agenda.

Please contact me at jellis@strongtie.com or call me at 714-738-2029 with any questions or comments you may have.

Sincerely,
Simpson Strong-Tie Co., Inc.



Jeff Ellis, P.E., S.E. dw/SF
Senior Engineering Project Manager

Attachment: Responses to June Alternative Criteria Public Comments on AC398

ICC-ES AC398 Comments			
2008 June Alternative Criteria Process			
No.	**Comment**	**SST Agree, Disagree, Partial**	**SST Response**
Hilti			
1	Purpose and scope clearly defined and limited to devices shown in original version	P	No change necessary. The devices are cold-formed and the ones to be evaluated by this criteria are defined. It's my understanding that ICC-ES's plan is to use this criteria for CFS connectors in concrete and add to the definitions as new products types are needed to be evaluated. Perhaps make a revision to state that only the products defined in the definition section may be evaluated using this criteria to more easily permit future additions.
2	Use code terminology for anchor straps	A	See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
3	Define specific type of devices	D	No change necessary. The devices are cold-formed and the ones to be evaluated by this criteria are defined. It's my understanding that ICC-ES's plan is to use this criteria for CFS connectors in concrete and add to the definitions as new products types are needed to be evaluated.
4	Replace CFS connectors with specific names	D	No change necessary. The devices are cold-formed and the ones to be evaluated by this criteria are defined. It's my understanding that ICC-ES's plan is to use this criteria for CFS connectors in concrete and add to the definitions as new products types are needed to be evaluated.
5	Delete wall connector from AC	D	The strap holdowns in concrete walls used as horizontal wall anchorage are a CFS connector resisting a tension load in concrete. This is basically the same as a device in a foundation, although the foundation is larger. The strap holdowns used as wall anchorage have been used for 40 year, been subjected to many seismic events and they are addressed specifically by the code. A specific test setup should be added.
6	Use anchor strap terminology	A	See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
7	Reference to AISI is unnecessary	A	Revise
8	Delete Cold-formed in 1.4.5	A	Revise
9	Revise 3.3.3.1 verbiage	A	Revise

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10	Supplementary reinforcement not addressed by AC so delete phi's for it.	D	Addressed as well as Appendix D
11	Revise 3.3.3.3 verbiage	A	This should read: "...C, D, E, and F, either the connection shall undergo ductile yielding at a load level corresponding to anchor forces no greater than the available anchor strength, or the available anchor...."
12	Define available anchorage strength	A	Revise
13	Revise figures of test setups to be more exact	D	Not necessary. ICC-ES AC's and ASTMs typically do not get specific regarding every installation that might occur (ie; AC13, ASTM D7147, etc). ICC-ES will review test setups with manufacturers as is typical.
14	Per ACI355.2 9.6.2 shear load parallel to crack	P	Disagree for products installed near foundation edges. Agree for unsymmetrical products installed away from the edge of foundation.
15	Revise 4.2.6 language	D	Should have 10% tolerance as stated and similar tolerances are permited throughout similar AC's and ASTM's.
16	Revise quality control language	D	Disagree. These proposed revisions are not requirements of other light-frame connectors or for CIP anchors (ie; special inspection not required for CIP anchors). These CIP products are simple and not complex as PI anchors nor are they subject to as many installation variables as PI anchors.
Powers			
1	Define CFS connector. Studs should not be used.	P	A definition for CFS connector (ie; that conforming to AISI NAS) can be added to the definition section. Studs is a term used for CFS vertical wall framing members as well as for wood.
2	ASD and LRFD	A	Revise
3	Can other CFS connectors be evaluated using this AC?	P	Revise to state that only the products defined in the definition section may be evaluated using this criteria to more easily permit future additions.
4	Further definition of CFS framing member	P	A definition for CFS framing member (ie; that conforming to AISI NAS) can be added to the definition section.
5	Test finished product to determine materials properties	D	Not required for other light-frame connectors AC's or standards.
6	When weld is failure mode, should overstrength be considered?	P	These connectors do not fail with the weld failing. However, if they did, it should be considered a brittle failure unless the connection undergoes ductile yielding at a load level corresponding to anchor forces no greater than the available anchor strength

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7	When concrete failure, calculate per Appendix D to account for large variety of concrete mixes	D	Increase in the safety factor and better test control and methodology should take care of the differences in mix design. In addition, this has not been done in the past and there are no reported concrete failures of these products.
8	Suggest putting the 0.5 factor into main eq.	D	Doesn't always apply
9	Perform parallel not perp crack shear tests	P	Disagree for products installed near foundation edges. Agree for unsymmetrical products installed away from the edge of foundation.
10	LRFD vs ASD	A	Make ASD and LRFD provision more clear
11	Establish guidance when multiple failure modes occur	D	This is not done for other ACs or ASTMs.
12	Establish maximum COV for a test series	D	This is not done for other ACs or ASTMs.
i-Level			
1	Review by ACI318 Committee	D	These are not new devices, but have been used successfully through many seismic and wind events since the 1960's. In addition, these are not complictated devices nor difficult to install. All products could be taken to various code and standard committees that are responsible for similar materials or structural members or connections. This is a very time consuming process. However, ICC-ES has for years provided a service to the building industry permitted a timely review of these products for building officials and engineers that would like to use the innovative products now.
2	ASD vs LRFD, phi's, alpha factor	P	The majority of light-frame deisgn is performed using ASD design. These devices are not specifically discussed in the code. The code permits ASD or LRFD to be used. Corrections will be made to clarify that ASD or LRFD can be used. The alpha factor is the same LRFD to ASD conversion factor used in AC308.
3	Linear adjustment for SG	D	Same requirement as in other AC's and standards (AC155, ASTM D7147)
4	List species and grademarked wood grade	D	Same requirement as in other AC's and standards (AC155, ASTM D7147)
5	COV	D	Same requirement as in other AC's and standards (AC155, ASTM D7147)
6	Why no cyclic testing	D	Cyclic testing is not required for any wood or CFS connection currently in light-frame construction. These are not new devices, but have been used successfully through many seismic and wind events since the 1960's. In addition, these are not complictated devices nor difficult to install.

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7	Rs to be used for steel member capacity	A	But not cumulative with Rs for connector. See AC261 language.
8	Show ttest/tspec below line 347	A	Revise to add tspec/ttest eq under section.
9	Unclear what analysis of cracking involves	D	As commentor states, this is the same as ACI318. Designers can determine whether a concrete section cracking will be significant enough to consider.
10	How to calc alpha factor	D	The alpha factor is the same LRFD to ASD conversion factor used in AC308 and has been calculated by PI manufacturers.
11	Revise wall anchor verbiage	A	Perhaps revise verbiage. See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
12	Revise connector pullout failure	A	See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
13	Delete test specimens was for line 193	A	See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
14	Revise verbiage in Section 3.1.3.2	P	Clarify
15	Line 238 section reference incorrect	P	Clarify
16	Revise section 3.3.3.3	P	See SST letter to ICC-ES dated July 3, 2008 on June Posting of AC398
17	Capacity variance over 20% statement removed	A	Add back in or see if referenced in other section of AC398
18	Line 480 delete thickness with width	A	Revise
Serrette			
1	Minimum safety factor of 3.5 for seismic	A	Agree with minimum s.f. for SDC C to F.
2	Either connector ductility reqmts stated and cyclic testing or use min sf of 3.5	P	Partially agree.
3	Should state min physical prop's per ASTM	P	There are some ASTMs that reference more than one grade of steel such as ASTM A653 (GR33, GR40, GR50 etc). Perhaps it should read “Minimum specified and measured steel……”
4	3.1.2.1 permits mill certs. Other AC's too?	D	This is permitted in other ICC-ES AC’s such as in AC155.
5	Use TS-3 unless not practical	D	2006 IBC 104.11 permits alternate methods.
6	Predrilled hole requirements	A	If predrilled holes are used, requirements should be listed (ie; size of predrilled hole, etc).
7	Should state min physical prop's per ASTM	P	There are some ASTMs that reference more than one grade of steel such as ASTM A653 (GR33, GR40, GR50 etc). Perhaps it should read “Minimum specified and measured steel……”

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8	Take reductions for Fy as well as Fu	D	These connectors are limited by the concrete, steel fracture, calculation, or displacement. I'm not aware of any that has been limited by yielding of the steel except in the case that it contributes to the displacement when the displacement limit governs.
9	Minimum safety factor of 3.5 for seismic and basis of phi's	P	Agree with minimum s.f. for SDC C to F. Phi's from ACI318-05 D.4.4.
10	Either connector ductility reqmts stated and cyclic testing or use min sf of 3.5	P	Partially agree.
Hardy			
1A	Remove references to connector ductility	D	ACI318-05 Appendix D references ductility of constituent material
1B	Use min s.f.	A	Agree with minimum s.f. for SDC C to F. Phi's from ACI318-05 D.4.4.
2	Clarification of intent of approved alt when ASTM or AISI standards referenced.	D	2006 IBC 104.11 permits alternate methods.
3A	Use both Fu and Fy reductions	D	These connectors are limited by the concrete, steel fracture, calculation, or displacement. I'm not aware of any that has been limited by yielding of the steel except in the case that it contributes to the displacement when the displacement limit governs.
3B	State specified minimum values	P	There are some ASTMs that reference more than one grade of steel such as ASTM A653 (GR33, GR40, GR50 etc). Perhaps it should read "Minimum specified and measured steel……"
3C	Delete the tspec/test equations	D	Same as other AC's (ie; AC261, AC155)
3D	Revise Rs equation and notation	D	These connectors are limited by the concrete, steel fracture, calculation, or displacement. I'm not aware of any that has been limited by yielding of the steel except in the case that it contributes to the displacement when the displacement limit governs.
4	Use of mill certs to determine properties	D	This is permitted in other ICC-ES AC's such as in AC155.

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USP STRUCTURAL CONNECTORS®
A GIBRALTAR INDUSTRIES COMPANY

October 7, 2008

Peter Bahlo, P.E.
ICC Evaluation Service, Inc.
5360 Workman Mill Road
Whittier, CA 90601

Re: Proposed Acceptance Criteria for Cast-in-place Cold-formed Steel Connectors in Concrete for Light-frame Construction, Subject AC398- 1008-R4 (PB/BG)

Mr. Bahlo:

Attached are our comments regarding the latest draft of AC398 Proposed Acceptance Criteria for Cast-in-place Cold-formed Steel Connectors in Concrete for Light-frame Construction.

Line 77 Strike *", or a reduction in area of less than 30 percent, or both"* from the end of the sentence. Reduction of area is not a measurement used with cold-formed steel. Furthermore there isn't any guidance on how to determine the reduction of area of the specimen in the acceptance criteria or the referenced standards. There is, however, an approved methodology to determine percent elongation for cold-formed steel members. In researching this it appears this requirement is a carryover from ACI 318 Appendix D. Removing this requirement will not impact the effectiveness of this criteria, but rather eliminate an unnecessary and undefined test.

Line 97 Replace "*diaphragm purlin*" with "*wood or cold-formed steel*". As written it could be interpreted to be unnecessarily restrictive.

Line 113 Strike the word "*wood*" as the sentence discusses both wood and cold-formed steel sill plates.

Line 135 Strike *"and a reduction in area of at least 30 percent"*. The reasoning is the same as explained for line 77.

Line 192 Fix the typo at the end of the line. It should read "*inducing*".

Section 3.1.2.2 The last sentence of section 3.1.2.1 should also be included at the end of this section. Elongation and base metal thickness is typically included on the mill certificate. As used in the criteria, the product is noted to be ductile or brittle based on the material specification for the product. There isn't an adjustment made to the test

results based on the elongation of the actual tested specimen.

Line 304 It is not necessary to include the "*0.95 ≤*" in the equation as Section 3.3.1.4 will not allow an increase if the tested specimen is thinner than the specified thickness.

Line 336 The second sentence in the definition of R_c is not necessary as the formula shown in line 334 will not allow the value of R_c to be greater than one.

Line 411 Revise the equations to read:

$$T = \frac{\Phi \times N_u \times (1-K \times COV) \times R_d \times R_{cr} \times (R_c \text{ or } R_s)}{\alpha}$$

$$V = \frac{\Phi \times V_u \times (1-K \times COV) \times R_d \times R_{cr} \times (R_c \text{ or } R_s)}{\alpha}$$

This change will then coordinate the formulas with the guidance contained in the variable definitions that follow.

Line 487 Strike *"and a reduction in area of at least 30 percent"*. The reasoning is the same as explained for line 77.

Line 489 Strike "*and a reduction area*". The reasoning is the same as explained for line 77.

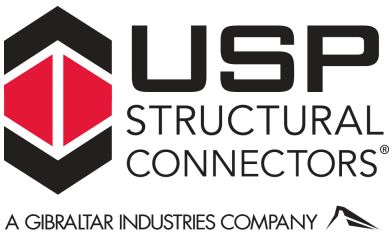
Line 489 Change "*can not*" to *cannot*" or "*can't*".

Many of the suggested changes noted above are editorial. Though the many reviews of this document we feel that the technical issues have been resolved. We believe the document is satisfactory and look forward to discussing it with you at the meeting in Albany.

If you have any questions or need additional information please do not hesitate to contact me.

Sincerely,

Greg Greenlee, P.E.
Director of Engineering



September 29, 2008

Peter Bahlo, P.E.
ICC Evaluation Service, Inc.
5360 Workman Mill Road
Whittier, CA 90601

Re: Proposed Acceptance Criteria for Cast-in-place Cold-formed Steel Connectors in Concrete for Light-frame Construction, Subject AC398- 0608-R2 (PB/BG)

Mr. Bahlo:

Per your request attached are USP's responses to the other public comments received during the alternate approval process for AC398. These comments provide background for the revised AC398 draft submitted to you in late July collectively by USP and Simpson.

	Comment	USP Comment	Notes
Hilti			
1	Purpose and scope clearly defined and limited to devices shown in original version	Disagree	Leave as is. The intention is to leave to criteria somewhat general to accommodate a larger range of products.
2	Use code terminology for anchor straps	Agree	OK. Revise line 94 per Simpson letter
3	Define specific type of devices	Disagree	Leave as is. Graphic and information presented is intended to add clarity to the document, not define a rigid scope.
4	Replace CFS connectors with specific names	Disagree	Leave as is. Graphic and information presented is intended to add clarity to the document, not define a rigid scope.

5	Delete wall connector from AC	Disagree	The performance of these products is not so significantly different that it would justify a new AC. OK to leave as is. Good idea to add language on how to address testing for products not installed at the edge of the concrete (post base, purlin anchor)
6	Use anchor strap terminology	Agree	OK. Revise line 94 per Simpson letter
7	Reference to AISI is unnecessary	Agree	OK.
8	Delete Cold-formed in 1.4.5	Agree	OK
9	Revise 3.3.3.1 verbiage	Agree	OK
10	Supplementary reinforcement not addressed by AC so delete phi's for it.	Disagree	The use of supplementary reinforcement is required for some products. It will be defined in the test setup and be part of the installation requirements noted in the product report.
11	Revise 3.3.3.3 verbiage	Agree	Language is messy. Simpson suggestion ok
12	Define available anchorage strength	Agree	OK
13	Revise figures of test setups to be more exact	Disagree	Better to keep general.
14	Per ACI355.2 9.6.2 shear load parallel to crack	Partially Agree	This is relevant for products not installed at the edge of the slab. Language should be added to address both parallel and perpendicular cracks for purlin anchors, post bases, etc.
15	Revise 4.2.6 language	Disagree	Based on our testing of this product ten percent is a reasonable number considering the inherent variability of other influencing factors
16	Revise quality control language	Disagree	Not required for other holdown products.
Powers			
1	Define CFS connector. Studs should not be used.	Partially Agree	A definition for CFS should be added
2	ASD and LRFD	Agree	OK

3	Can other CFS connectors be evaluated using this AC?	Agree	Products should be allowed if deemed by ICC-ES to be relevant to the scope of the document. Add clarifying language
4	Further definition of CFS framing member	Disagree	The inherent design, fabrication, and configuration of these products will limit their capacity.
5	Test finished product to determine materials properties	Disagree	Consistent with other AC
6	When weld is failure mode, should overstrength be considered?	Disagree	No different than AC155 products
7	When concrete failure, calculate per Appendix D to account for large variety of concrete mixes	Disagree	Appendix D equations do not apply to these products.
8	Suggest putting the 0.5 factor into main eq.	Disagree	Could move language, but needs to be separate
9	Perform parallel not perp. crack shear tests	Partially Agree	The configuration and application of these products are different than AC193, 308 products. Language should be added to address both parallel and perpendicular cracks for purlin anchors, post bases, etc.
10	LRFD vs ASD	Agree	Report can include both numbers. ASD is almost exclusively used in design.
11	Establish guidance when multiple failure modes occur	Disagree	Not required for AC155.
12	Establish maximum COV for a test series	Disagree	Not required for AC155.
i-Level			
1	Review by ACI318 Committee	Disagree	As written the AC will provide reasonable, conservative information based on our extensive history with these products.
2	ASD vs. LRFD, phi's, alpha factor	Partially Agree	Include both ASD and LRFD in the scope and results
3	Linear adjustment for SG	Disagree	Language is consistent with AC155
4	List species and grade marked wood grade	Disagree	Language is consistent with AC155

5	COV	Disagree	Language is consistent with AC155
6	Why no cyclic testing	Disagree	Not required for products covered under AC155
7	Rs to be used for steel member capacity	Agree	Should apply, but not in addition to.
8	Show ttest/tspec below line 347	Agree	good clarification
9	Unclear what analysis of cracking involves	Disagree	The question highlights the challenges behind the AC. Language provided is the best solution considering the current state of the art.
10	How to calc alpha factor	Partially Agree	Language should be added to clarify
11	Revise wall anchor verbiage	Agree	Revise as suggested in USP letter
12	Revise connector pullout failure	Agree	Simpson language OK
13	Delete test specimens was for line 193	Agree	Simpson language OK
14	Revise verbiage in Section 3.1.3.2	Agree	
15	Line 238 section reference incorrect		
16	Revise section 3.3.3.3	Agree	Repair language
17	Capacity variance over 20% statement removed	Agree	
18	Line 480 delete thickness with width		
Serrette			
1	Minimum safety factor of 3.5 for seismic	Agree	USP letter addresses
2	Either connector ductility reqmts stated and cyclic testing or use min sf of 3.5	Agree	USP letter addresses
3	Should state min physical prop's per ASTM	Agree	Add the word "minimum"

4	3.1.2.1 permits mill certs. Other AC's too?	Disagree	Language is consistent with AC155
5	Use TS-3 unless not practical	Disagree	Ok as is
6	Predrilled hole requirements	Agree	Add pre-drill information to test report
7	Should state min physical prop's per ASTM	Agree	Add the word "minimum"
8	Take reductions for Fy as well as Fu	Disagree	This is not representative of how these products fail.
9	Minimum safety factor of 3.5 for seismic and basis of phi's	Partially Agree	USP letter addresses
10	Either connector ductility reqmts stated and cyclic testing or use min sf of 3.5	Partially Agree	USP letter addresses

If you have any questions or need additional information please do not hesitate to contact me.

Sincerely,

Greg Greenlee, P.E.
Director of Engineering