

To: Don Allen, Steel Framing Alliance

Fr: Bob Shluzas, President; Aerosmith Fastening Systems

Re: Comments on Proposed ICC Acceptance Criteria-AC230

Date: August 21, 2008

Don, I believe both the Steel Framing Alliance and the Steel Stud Manufacturers Association need to weigh in with persuasive comment to ICC regarding proposed AC230, and by association AC322. My suggested questions/comments follow:

- 1) Since the basis for both AC230 and AC322 seems to be ASTM E2126-07...Why do we need two AC criteria? This duplicates costs AND more significantly creates confusion with design professionals/code officials. Which one do you use for what products in what geography, etc.? {Sect. 1.3.11}**
- 2) Why are BOTH proposed protocols more demanding than the AISI Lateral Design Criteria 2004? (the latter is referenced in both IBC & UBC) {Sect. 1.3.14}**
- 3) If AISI Lateral Design Criteria 2004 is inadequate then what information does ICC have on its failure rate? Should this not be shared with the industry?**
- 4) Will threaded fastener manufacturers required to do these same tests?**
- 5) Fasteners to be recognized for exterior use require corrosion resistance testing. This makes sense. However, using the same requirement for “damp environments” should be dropped because (a) most shear walls are covered from the exterior conditions; (b) there are no code requirements for “damp environments”; (c) there is no definition of “damp environments” quantified. {Sect. 3.1.3}**
- 6) Corrosion resistance durability for the fastener requires two tests: ASTM G87-02 AND FM Research Standard 4450 or 4470. In addition ASTM A 90 is required to measure “coating thickness”. THESE ARE ALL OVERKILL. First, it needs to be pointed out that with coating technology of today you can achieve extended corrosion resistance with thinner coatings. For example, a traditional “hot-dipped, zinc galvanized” fastener corrosion resistance can be exceeded with much thinner nickel alloy electro plated fasteners (in both driven or bulk states). So ASTM A 90 should be dropped. Rationale is it only measures a “feature” of the fastener and is NOT related to performance. Second, the corrosion resistance of the steel framing member is not required. This means the salt and/or sulfuric acid sprays required in the FM roof deck tests and ASTM G87 for fasteners alone are again OVERKILL. The thick amount of steel in the pin relative to the stud shows the stud will fail from corrosion BEFORE the pin. Lastly, ASTM B117 is a salt spray protocol used for fasteners for decades and therefore can be related to failure points with greater precision. Use of the ASTM B117 will also control costs by not**

- duplicating this requirement with new and imprecise tests. {Sect. 3.1.3.1 & Sect. 2.1.1.4}**
- 7) The requirement in Sect. 2.1.1.3 for “description of recommended tools and recommended tool operation” should be dropped and only installation details are needed (results). The reasons for this edit are: (a) threaded fastener manufacturers are not required to do the same; (b) ICC must assume the liability of providing timely updates on all technical notes associated with these tools that are released subsequent to the manufacturers’ issued report; (c) the type of tool used does not change the required installation of the fastener, for example, wood and plywood manufacturers are not required to specify a tool or hammer type yet they require fasteners not be “overdriven”, etc.**
 - 8) The wall “height to length” aspect ratios do not appear accommodating for low & mid-rise steel construction. {Sect. 3.5.2}**
 - 9) Sect. 3.6.1 – The documentation.....shall be sealed by a design professional.”
For what state(s)?**
 - 10) Sect. 3.4.2 et al: Applying the same safety factor (2.5) for pins as for screws to DIFFERENT sample collection methods is inherently biased. The screws use the average of the “lower bound” of the sample while pins are being asked to use the entire sample average. The better and correct method should be calculating the safety factor for pins based on AISI NAS Section F.**
 - 11) Applications in 97 mil steel need to be included.**



September 1, 2008

ICC Evaluation Service
5360 Workman Mill Road
Whittier, CA 90601

RE: AC230-0808-R1: Acceptance Criteria for Power-Driven Pin Fasteners for Wood Sheathed Shear Wall Assemblies with Cold-Formed Steel Framing

Mr. Bahlo:

Thank you for the opportunity to comment on the proposed revisions to AC230. We are also in receipt of an e-mail dated August 27th from Mr. Robert Leichti, of Stanely Fastening Systems, that we believe represents the latest work of the Task Group formed to address these issues (see attached).

We would like to express our support of the criteria with the incorporation of the information contained in Mr. Leichti's correspondence. However, we would like to offer the following suggestions relating to Mr. Leichti's e-mail:

Section 3.5.1; Mr. Leichti writes:

Editorially revise the section to highlight the importance of construction details in the test specimen follow to recognition in the evaluation report. Proposed revision is,

...consistent with ~~those intended for recognition~~ the details of construction to be recognized in the

For clarification we would add the following wording:

...consistent with the details of construction to be recognized, including minimum fastener edge distances and framing section profile, in the

Section 3.5.2; Mr. Leichti writes:

The adjustment for shear wall aspect ratios greater than 2.0 (line 11) is stated as an upper bound, that is, adjustment = $2w/h$ based on wall geometry. However, this criterion prevents the use of a more conservative adjustment even if the data show a more conservative adjustment is appropriate.

We agree with Mr. Leichti's assessment that $2w/h$ should not be an upper bound for this adjustment. However, we are uncomfortable with removing this historical adjustment

completely from the text. 2w/h should instead be a lower bound for aspect ratio adjustment. We feel a greater reduction should be used if witnessed in the testing program, but a more robust testing program would be needed to reduce the value by something less than 2w/h.

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



Fastening Systems

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August 27, 2008

Mr. Peter Bahlo
ICC-Evaluation Service
5360 Workman Mill Road
Whittier, CA 90601

RE: AC230 alternate agenda ballot

Dear Peter;

I reviewed AC230 posted on the Alternate Agenda and would like to offer several revisions that will improve the criteria. While only section 4.3.4 is the subject of the ballot, I hope that these other revisions will be considered as improvements to the criteria.

Section 3.1.3: The reference sections are incorrect in lines 4 and 9 of this paragraph.

The correct reference sections are shown for,

Line 4 -- ...Section 3.1.4.~~3.1~~ or Section 3.1.4.~~3.2~~. the pin fasteners shall be ...

Line 9 -- ...Section 3.1.4.~~3.1~~ or 3.1.4.~~3.2~~. In addition, coating thickness ...

Section 3.4: The reference section in line 4 of the section is incorrect. The correct reference section is shown,

Line 4 -- ... the provisions of Section 4.3.2.~~4~~.

Section 3.5.1: Editorially revise the section to highlight the importance of construction details in the test specimen follow to recognition in the evaluation report. Proposed revision is,

....consistent with ~~those intended for recognition~~ the details of construction to be recognized in the

Section 3.5.2: The adjustment for shear wall aspect ratios greater than 2.0 (line 11) is stated as an upper bound, that is, adjustment = $2w/h$ based on wall geometry. However, this criterion prevents the use of a more conservative adjustment even if the data show a more conservative adjustment is appropriate. The section requires that the adjustment is to be determined from test evidence, and I suggest an appropriate revision is to delete the $2w/h$ aspect ratio adjustment based on wall geometry. This change makes the wall geometry aspect ratio adjustment unbounded – it does not impose a minimum adjustment and at the same time does not limit adjustment to a more conservative adjustment if it is indicated by the test evidence.

Section 4.2.1: The empirical assignment of shear wall design values requires validation for every cell of the design matrix. However, evidence in the literature clearly shows that performance can be reasonably predicted by interpolation between maximum and

Mr. Peter Bahlo
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minimum fastener spacing for combinations of stud thickness and sheathing panels. Hence revision of Section 4.2 is proposed as,

4.2.1 *For reference unit shear values based upon empirical analysis, every cell of the planned shear wall design matrix shall be based on cyclic shear wall test data analysis as described in applicable sections of Sections 3.5 and 3.6. a cyclic shear wall test program shall be conducted as described in Section 3.5. The test program shall include the maximum and minimum fastener spacings for each fastener/sheathing/stud thickness combination to be recognized. The shear wall test data analysis shall be as described in the applicable parts of Section 3.6. Linear interpolation is permitted to establish capacities at intermediate fastener spacings.*

Section 4.2.2: The reference sections of lines 3 and 7 are incorrect. They are correctly stated as,

Line 3 -- ...3.3.4.3.1 and 3.3.5.2 for the steel framing show that the pin or ...

Line 7 -- ...according to the provisions of Sections 3.1.2, 3.3.5.1, and ...

Section 4.3.1: Delete the last line of the section based on revisions to Section 4.3.5.

This is the revision to the last three lines of the section,

... shear resistance based on the provisions of Section 4.3.4 and the calculated value scaling provisions of Section 4.3.5.

Section 4.3.3: The reference sections of lines 2, 3 and 7 contain some errors. They are correctly stated as,

Line 2 -- ...wire used to fabricate pins and of Section 3.3.4.3.1 and ...

Line 3 -- ...3.3.5.3.4 for the steel framing show material properties differ ...

Line 7 -- ...Sections 3.1.2, 3.3.5.1, and 3.3.5.2, as applicable.

Section 4.3.4: The strategy for sampling the design matrix affords a lot of flexibility for a validation plan. A more prescriptive approach will simplify and unify the selection of design matrix cells for validation of the analytical design matrix, which will facilitate evaluation and reduce interpretation. The intent of the proposed approach is to have the proponent address the range of design forces that includes the extremes primarily because these are the conditions where analytical models are usually the least robust and the controlling failure modes are likely to be well differentiated. Shank diameter and head geometry are to be included in the validation plan. It requires tests with all shank diameters. However, it does not require tests of all head geometries because a manufacturer may choose to assign conservative design values to pins with larger and flatter heads based on the smallest head or the pin with the greatest pull-through failure rates in the single-fastener connection tests. The proposed language requires validation for each shank diameter in at least four cells, and for most design tables, a fifth cell will be required.

4.3.4 *Cyclic-load shear wall testing in accordance with Section 3.5 shall be conducted and the results shall be used to validate the in-plane shear values analytically derived for shear wall assemblies with cold-formed steel framing, wood structural panels, and power-driven pins. Critical features of the power-driven pins, such as nominal shank diameter and head geometry, shall be incorporated in the validation test plan. The test*

wall assemblies shall have aspect ratios in accordance with section 3.5.2. At a minimum, test wall assemblies shall represent the calculated design properties by evaluating the nominal shear resistance, F_v , specified in sections 4.3.4.1 through 4.3.4.4. The minimum test program for each fastener diameter and head geometry (where appropriate) shall include:

4.3.4.1 The thinnest sheathing with the thinnest stud at maximum and minimum fastener spacing;

4.3.4.2 The thickest sheathing with the thickest stud at the minimum and maximum fastener spacing;

4.3.4.3 And for those design tables with more than two stud thicknesses and two sheathing thicknesses, an intermediate thickness sheathing with an intermediate thickness stud and minimum fastener spacing.

Section 4.3.5: The section was first drafted to be a method of tuning the design model and test results, which should be done by the proponent separate from the evaluation report. The proposed revision deletes the existing section 4.3.5 and replaces it because the section needs to assess shear wall performance relative to the design method,

4.3.5 For the purpose of model validation of the unit design shears, the allowable loads from the shear wall tests for each tested configuration shall be derived in accordance with Sections 3.7 and 3.8. The test-based design loads shall meet or exceed those predicted by the model calculated reference unit shear design values derived in accordance with Sections 4.3.1 through 4.3.3. For the purpose of proving seismic equivalency in Appendix A, the calculated reference unit shear wall design values derived in accordance with Sections 4.3.1 through 4.3.3 shall be used to compute the parameters with the load and deflection data of the validation tests.

I believe that the inclusion of these modifications will improve the criteria. While I cannot speak for the original task group members or the Evaluation Committee, I think the proposed revisions, especially those to Section 4, fit with the final position of the task group and the Evaluation Committee. For those reasons, I hope that Staff will be able to implement the revisions without an additional hearing. If you have questions related to my comments, please feel free to contact me.

Sincerely,

STANLEY FASTENING SYSTEMS, L.P.

[electronic]

Robert J. Leichti
Compliance Manager, Fasteners

/rjl

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August 25, 2008

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

Subject: Proposed Revisions to the Acceptance Criteria for Power-driven Pins Shear Wall Assemblies with Cold-formed Steel Framing and Wood Structural Panels, Subject AC230-0808-R1 (PB)

Dear Mr. Bahlo:

ET&F Fastening Systems, Inc is in opposition to the proposed acceptance criteria dated August 2008. Among our objections are:

- Paragraph 3.3.5.1 requires test results to be modified in part based on a ratio of F_y (specified) divided by F_y (tested). By industry convention, cold formed steel is typically supplied at yield strengths considerably higher than that specified. This will cause test results to be significantly reduced. To accommodate this convention, the expected yield strength of the steel F_y (expected), is often used as a more accurate measure of cold formed steel strength. We suggest replacing F_y (specified) with F_y (expected) in the equation in paragraph 3.3.5.1.
- Paragraph 3.5.2 requires shear wall test assemblies have an aspect ratio of 1:1. This is not conservative and is not consistent with the referenced AISI lateral standard. Further, the argument that it is necessary for the test assembly to have a panel butt joint over a central stud is not relevant for steel framing. This requirement seems to come from that for wood framing, where splitting of the stud is a possible failure mode; this cannot happen with steel. There is also no basis for a concern for splitting the plywood panel. For a standard stud with 1-5/8" wide flange, a butt joint over the flange provides more than 3/4" overlap for each panel over the stud. As 3/8" fastener edge distance in common on all edges, the central butt joint fastening location is no different than that along the edges. We recommend changing the 1:1 aspect ratio to 2:1.

Mr. Peter Bahlo, P.E.

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- Paragraph 4.3.1 provides for submission of an outline of the analytical method of deriving unit shear wall design values to ICC-ES. Since this method is fundamental part of the acceptance criteria (in fact it is the critical component to the derivation of design values by calculation), the “documented engineering practice” referred to in AC230 should be explicitly identified in the final ES report. We strongly recommend identification of the method used in the final report.
- Paragraph 6.4 requires periodic inspections of shear walls with power driven pins. The primary difference between the wall configurations evaluated under AC230 and those listed in the AISI Lateral Standards is the fastener. Further, as stated in Section 1.2 of this criteria, the walls considered under AC230 are alternatives to the systems described in the IBC and UBC. The installation of pins is no more problematic than the installation of screws and does not result in a less safe design. Thus, the same requirements that apply to the cold-formed shear walls referenced in the IBC and UBC should apply. Additional language requiring periodic inspections is neither necessary nor required, unless the same is also required for applications with screws.

Very truly yours,
ET&F Fastening Systems, Inc



David Nolan, P.E.
Vice President

MEMORANDUM

TO: Peter Bahlo, P.E.
FROM: Reynaud Serrette
SUBJECT: ICC-ES AC230-1008-R1, Proposed Revisions to the Acceptance Criteria for Power-driven Pins for Shear Wall Assemblies with Cold-formed Steel Framing and Wood Structural Panels
DATE: 9/1/2008
CC:

In response to your letter dated August 1, 2008, the comments below on ICC-ES AC230-1008-R1 are submitted for your consideration and committee deliberation. Please do not hesitate to contact me should you need clarification or further explanation of my comments.

Section 4.3.4: The requirements in Section 4.3.4 appear to be an acceptable first step toward providing a semi-rational methodology for verification of design values based on calculation.

In Section 4.3.4.3, it appear that “resistance ,200” should be “resistance 1,200”

The following additional comments are based on my review of the entire AC.

1. Sections 1.5.6 and 1.5.8: There appears to be an extraneous period in the “specified” subscript.
2. Section 1.5.16: Is δ_x an elastic or inelastic deflection?
3. Section 1.5: Δ_{USL} is identified as the deflection at the strength limit state but the strength limit state is not explicitly defined. Is the strength limit state the same as the peak shear strength (V_p) from the first cycle envelope curve?
4. Section 3.7.1.1: Is there a difference between Δ_{SLS} and Δ_{USL} ? If not, consideration should be given to consolidating the notation.
5. Section 1.1.15: It appears that “llowable” should be “Allowable.”
6. Sections 3.7.1.2 and 3.7.2.2: Both “h” and “H” are used for wall height. Consider using “h” instead of “H” throughout the document or change “h” to “H” in Section 1.5.2.

7. Section 3.3.5.1: As explained in the following narrative, the recommended reduction factor does not accurately reflect the intent of AISI-NAS Section F1.1(c), the provisions of the AISI Lateral Standard and the AISI-NAS design.
- The requirements in AISI-NAS Section F1.1(c) were intended to address test results when the failure mode is governed by the member. If failure of a shear wall is not controlled by the framing, material strength reductions may not be necessary.
 - The ONLY difference in construction of a cold-formed steel shear wall where steel pins are used to attach wood structural panels to the framing instead of screws is the fastener. Screws tend to work steel studs more than the steel pins currently used in this form of construction. If the proposed material strength reductions were not adopted in the development of the AISI Lateral Standard design values, such a requirement in this AC is unjustified.
 - For a variety of reasons including cost and current green production methods, the expected and stable material strength of cold-formed steel is consistently higher than the associated ASTM specified minimums. Table C5-1, AISI S213-07 gives acceptable material strength modification factors (R_y and R_t) for both yield strength and tensile strength, respectively. Using these modification factors, $F_{y(\text{expected})} = R_y F_{y(\text{specified})}$ and $F_{t(\text{expected})} = R_t F_{t(\text{specified})}$. These expected material strengths should be the basis of any considered modification of shear wall design values.
 - Unlike wood framed shear wall design, boundary studs in cold-formed steel shear walls are currently required to be designed in accordance with AISI-NAS for the nominal strength of the wall or the amplified design load.

Based on the above comments, the following revised language is proposed for Section 3.3.5.1

If the measured yield strength of the steel from which the tested cold-formed steel structural members forming the assembly is larger than the expected yield value, the test results shall be calibrated to the expected yield value of the steel by the following adjustment factor, R_s :

$$R_s = \frac{F_{y(\text{expected})}}{F_{y(\text{tested})}} \times \frac{t_{(\text{specified})}}{t_{(\text{tested})}} \leq 1.0$$

Where $F_{y(\text{expected})} = R_y F_{y(\text{specified})}$ and R_y is determined from Table x.

Table x. R_y and R_t values

$F_{y(\text{specified})}$	R_y (expected yield strength factor)	R_t (expected tensile strength factor)
33 ksi (230 MPa)	1.5	1.2
50 ksi (340 MPa)	1.1	1.1

A similar adjustment shall be made on the basis of the tensile strength instead of the yield strength where the tensile strength is a critical factor. The factor that results in the greater reduction shall be used.

8. Section 3.5.2: As noted above, the ONLY difference between the shear walls addressed in this AC and those in the 2006 IBC/AISI Lateral Standard is the fastener used to attach the sheathing. The 1:1 aspect ratio limit in this section is not consistent with the basis for the design values in the 2006 IBC/AISI Lateral Standard. The 2006 IBC/AISI Lateral Standard design values for cold-formed steel framed shear walls are based on 2:1 aspect ratio testing, hence the limit in the Standard. The 1:1 aspect ratio requirement as currently should be changed to reflect the current code provisions. When the basis for the code design values changes, this AC should be updated to reflect the change.
9. Section 3.8: $\phi = 0.6$ under the 2006 IBC/AISI Lateral Standard. $\phi = 0.55$ under the UBC. This difference should be reflected in the AC.

The term “LRFD nominal resistance” does not appear to be correct. In the context of this section, it appears the appropriate term should be “LRFD resistance.” “LRFD nominal resistance” appears several times in this section.

10. Section 4.2.2: If the proposed requirement does not apply to screws in the current code, its application to steel pins is not justified.
11. Section 4.3.3: The referenced sections appear to be incorrect.
12. Section 4.3.5: Language should be added stating that scaling up is not permitted.

No guidance is provided on the scaling procedure when the scale factor differs depending on the prototypical shear wall configuration test. Should the maximum scale factor reduction be applied across the board?

13. Section 4.5.2: As shown below (excerpt from ASCE/SEI 7), when $R = 3.0$ it appears that in SDC C the story height limitation is defined as NL (not limited). What’s the basis for the SDC A and B restriction in this criteria?

TABLE 12.2-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE-RESISTING SYSTEMS (continued)

Seismic Force-Resisting System	ASCE 7 Section where Detailing Requirements are Specified	Response Modification Coefficient, R^a	System Overstrength Factor, Ω_o^g	Deflection Amplification Factor, C_d^b	Structural System Limitations and Building Height (ft) Limit ^c				
					Seismic Design Category				
					B	C	D ^d	E ^d	F ^e
H. STEEL SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE, EXCLUDING CANTILEVER COLUMN SYSTEMS	14.1	3	3	3	NL	NL	NP	NP	NP

^aResponse modification coefficient, R , for use throughout the standard. Note R reduces forces to a strength level, not an allowable stress level.
^bReflection amplification factor, C_d , for use in Sections 12.8.6, 12.8.7, and 12.9.2
^cNL = Not Limited and NP = Not Permitted. For metric units use 30.5 m for 100 ft and use 48.8 m for 160 ft. Heights are measured from the base of the structure as defined in Section 11.2.
^dSee Section 12.2.5.4 for a description of building systems limited to buildings with a height of 240 ft (73.2 m) or less.
^eSee Section 12.2.5.4 for building systems limited to buildings with a height of 160 ft (48.8 m) or less.
^fOrdinary moment frame is permitted to be used in lieu of intermediate moment frame for Seismic Design Categories B or C.
^gThe tabulated value of the overstrength factor, Ω_o , is permitted to be reduced by subtracting one-half for structures with flexible diaphragms, but shall not be taken as less than 2.0 for any structure.
^hSee Sections 12.2.5.6 and 12.2.5.7 for limitations for steel OMFs and IMFs in structures assigned to Seismic Design Category D or E.
ⁱSee Sections 12.2.5.8 and 12.2.5.9 for limitations for steel OMFs and IMFs in structures assigned to Seismic Design Category F.
^jSteel ordinary concentrically braced frames are permitted in single-story buildings up to a height of 60 ft (18.3 m) where the dead load of the roof does not exceed 20 psf (0.96 kN/m²) and in penthouse structures.
^kIncrease in height to 45 ft (13.7 m) is permitted for single story storage warehouse facilities.

14. Section 6.0(4): As noted above, the ONLY difference between cold-formed steel shear walls with pins and cold-formed steel shear walls with screws is the fastener used to attach the sheathing. The design requirements for the structure are well established and will be identical whether pins or screws are used.
15. Appendix A: Consider using one notation " V_{asd} " or " V_{ASD} " if they represent the same quantity.

Thank you.