



December 28, 2007

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON COLD-FORMED STEEL FRAMING MEMBERS USED FOR INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

SUBJECT: Proposed Revisions to the Acceptance Criteria for Cold-formed Steel Framing Members—Interior Nonload-bearing Wall Assemblies, Subject AC86-0208-R1 (PB/WM)

Hearing Information:

Tuesday, February 5, 2008

8:00 a.m.

The Westin Los Angeles Airport

5400 West Century Boulevard

Los Angeles, California 90045

(310) 216-5858

Dear Madam or Sir:

Proposed revisions to the subject acceptance criteria will be considered by the ICC-ES Evaluation Committee at the hearing noted above. The following revisions to AC86 have been proposed by Dr. Reinhold Schuster, P.Eng., as explained in the enclosed December 4, 2007, letter:

1. Revise Section 3.1.3 to permit a variance of 25 percent rather than the 15 percent previously allowed for flexural strength values of gypsum panel products used in the wall assembly tests. Staff seeks input as to whether such a change is appropriate and/or whether there are other, more appropriate means to account for variation in wallboard materials. For instance, within Section F1.1(c) of AISI-NAS, the code requires test results to be adjusted down to minimum specified levels. Thus, staff is concerned with allowing any significant flexural over-strength (beyond the currently permitted 15 percent) in wallboard materials in the test assemblies without having some means to adjust test results to account for those over-strengths. It should also be noted that variations in wallboard materials are accounted for in the material factors in Section 3.3.1.3 of the acceptance criteria. Further discussion is needed as to whether any of these values should be adjusted to compensate for any over-strengths, should the acceptance criteria be revised to allow greater over-strengths.
2. Revise Section 3.2.2 to include the following statement: "In the case that L/120 deflection level cannot be obtained, it shall be permitted to use L/180 in place of

L/120.” Staff supports this proposed change, as shown in the enclosed preliminary draft of AC86.

3. Delete Section 3.2.2.3, i.e., delete the requirement that the test assemblies used to derive wall assembly stiffness be capable of resisting 50 percent more load causing maximum deflection. Staff supports this proposed change, as shown in the enclosed preliminary draft of the revised AC86.
4. Revise the target reliability index, β_o , from 2.5 to 1.5, as shown in Section 3.3.1.3. Staff seeks input as to whether this revision is appropriate. The β_o of 2.5 is based on values prescribed by the AISI-NAS, and staff believes it is inappropriate for ICC-ES to allow a change in safety factors required by the code and its referenced documents. Although staff recognizes that use of AC86 will result in a higher overall safety factor than used in Section D4.2 of the AISI-NAS, we believe the procedure in AC86 is consistent with the requirements of the code. Staff believes the use of wallboard materials acting in composite action with metal studs to enhance the transverse strength and stiffness of nonload-bearing wall assemblies will result in higher variations in test results from designs using the steel section alone. AISI-NAS, which is adopted by reference in Section 2210 of the IBC, deliberately requires higher safety factors when such higher variations exist and when one must test to determine design capacity.
5. Revise Section 4.1.2 to permit testing wall assemblies with maximum stud spacing, i.e., 24 inches on center. Staff partially supports this request; however, results of testing provided in Dr. Schuster’s letter show that there may be cases where wall assemblies with 12-inch spaced studs can be approximately 20 percent less stiff than walls with 24-inch spaced studs. Consequently, staff recommends that Section 4.1.2 of AC86 permit only walls with 24-inch spaced studs be tested provided a limited set of test data demonstrate no significant difference in wall stiffness regardless of wall stud spacing.

You are cordially invited to submit written comments, or to attend the Evaluation Committee hearing and present verbal comments. Written comments will be forwarded to the committee, **prior to the hearing**, if received by **January 23, 2008**. If the deadline is missed, you must provide 35 copies of the submittal material, collated, stapled and three-hole punched, to the Los Angeles business/regional office before the committee meeting. Your consideration in providing written responses by the deadline would be greatly appreciated. Consideration of written comments and presentations of a significant nature received the week of the hearing or at the hearing may be delayed until a future meeting as the committee and staff may not have adequate time for review.

Comments from interested parties that are submitted in response to proposed acceptance criteria will be posted on the ICC-ES web site prior to the meeting. Postings will occur shortly after the comment deadline (January 23, 2008). Staff memos responding to some of the comments, and comments received after the January 23 deadline, will be posted on February 1, 2008.

The purpose for posting the comments prior to the meeting is to help interested parties be better prepared to discuss the issues at the meeting.

Any written material submitted for committee consideration will be available for public distribution as set forth in Section 2.7 of the Rules of Procedure for the Evaluation Committee (copy enclosed).

Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) for viewing at meetings will be permitted only if the presenter provides to ICC-ES, before the presentation, a copy of the visual aid(s) in a medium that can be retained by ICC-ES with its record of the meeting, and that can also be provided to interested parties.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

If you have any questions, please contact the undersigned at (800) 423-6587, extension 3306. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Peter Bahlo, P.E.
Senior Staff Engineer

PB/WM/II

Enclosures

cc: Evaluation Committee

R.M. SCHUSTER PhD, P. Eng.
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December 4, 2007

Dear Mr. Bahlo;

Re: Suggested Revisions to AC86-07

I am presently involved in the structural evaluation of a new Interior Nonload-Bearing Steel Wall Stud Assembly, typically called a "Partition wall with gypsum board on both sides of the wall". Testing has been, and still is being carried out by Intertek ETL SEMKO in Coquitlam, BC, Canada in accordance with AC86-07. Having reviewed AC86-07 in detail, aside from some editorial items that I have already communicated to you in my August 28/07 E-mail, I hereby wish to formally submit four other more substantive items for possible change/action to AC86-07. Again, some of these items should be familiar to you from previous E-mail letters I had sent you. As well, the items detailed below should be considered in the context of the respective items in AC86-95.

ITEM 1 (Section 3.1.3)

It is currently stated in Section 3.1.3 that the type and product name of the gypsum panel product do not need to be reported in the evaluation report when the flexural strength of the gypsum panel products used in the tests does not exceed the minimum values set forth in the applicable ASTM standard by more than 15 %. The gypsum panel product shall be evaluated independently in accordance with ASTM C 473.

Numerous tests were carried out by Intertek ETL SEMKO in Coquitlam, BC, Canada in accordance with ASTM C 473-06 and the test results were then compared with the values given in ASTM C 1396/C 1396M-04. It can be observed from the test results (PDF attachment) that for the ½ inch USG sheetrock 8 ft gypsum panel, the 15% level specified in Section 3.1.3 was exceeded in a number of cases, up to about 25%. In fact, for other gypsum panel products such as C type and X type, the % increase was even greater. Based on these findings, it would be difficult at this time to establish a % value that would cover the products that the gypsum panel industry is currently offering. My recommendation is to ask the gypsum panel companies to supply test data with respective COV values so that one can establish an appropriate % value(s) that reflects actual product behaviour in the industry. This I feel is an urgent matter.

ITEM 2 (Section 3.2.2.3)

It is currently stated in Section 3.2.2.3 that the test assemblies are capable of resisting 1.5 times the load causing maximum deflection.

Based on testing per Section 3.2.2, the maximum deflection required is L/120. There is supporting data indicating that in most cases 8 foot test panels did not even reach the L/120 requirement. In the case of the 16 foot test panels, the L/120 deflection level is obtainable in all cases, but still some test panels will not be able to reach 1.5 times the load causing the maximum deflection of L/120. This results in only having two deflection readings at the L/360 and L/240 level for each panel instead of the three required. Based on this, it is recommended that a new sentence be added in Section 3.2.2, as follows.

In the case that the L/120 deflection level can not be obtained, it shall be permitted to use L/180 in place of L/120.

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This would result in three deflection readings [L/360, L/240 and (L/180 or L/120)] for each test panel, hence, permitting the establishment of a consistent flexural rigidity value, EI.

Also, it is recommended that Section 3.2.2.3 be entirely deleted since it serves no real purpose in any subsequent required calculations by AC86-07.

Once the controlling EI value has been established based on the three deflection panel test values, one can compute the limiting height values based on stiffness/deflection. To establish the limiting height values based on strength (flexure and end reaction), a totally different calculation has to be performed. The least of these two limiting height values will then govern.

ITEM 3 (Section 3.3.1.3)

It is currently stated that the safety factor, Ω , shall be in accordance with Section F1.2 of AISI-NAS. The following variables for the resistance factor equation in Chapter F of AISI-NAS) Eq. F1.1-2) shall be used, unless data justifying other variables are submitted:

β_o = Target reliability index = 2.5

M_m = Mean value of the material factor = 1.0

V_M = COV of the material factor = 0.10

V_F = COV of the fabrication factor = 0.15

Using Section 3.3.1.3 of AC86-07 and assuming that the COV of three test results, V_p is not greater than 6.5%, the factor of safety is **2.36**, which is considerably larger than **1.5**. In fact, the basic factor of safety in the AISI-NAS for bending/flexure for such cases as curtain walls is **1.67**. The exterior wind load on a curtain wall is surely of a larger magnitude and has a higher degree of uncertainty in comparison to an interior partition load.

Interior drywall stud assemblies have existed in North America for many years, and for many years a factor of safety of 1.5 has been used. In all my years of working in this business of cold formed steel, I have never heard of anyone ever getting killed or even hurt by an interior drywall stud assembly falling over when subjected to a uniformly distributed load. After all, we have a clear understanding of the structural theory involved in designing such systems - certainly not much uncertainty there ($wL^2/8$ rules the day). Agreed, the wall assembly is made up of gypsum board screw-fastened to steel studs. Here the only uncertainty lies in how the gypsum board is attached to the steel studs. In commercial installations, interior drywall assemblies are typically installed by drywall contractors that know what they are doing and are licensed for such work. If there were evidence of actual failures of such wall assemblies, then one could make a case for a factor of safety larger than 1.5. What needs to be addressed is the consequence of failure of partition walls under uniformly distributed loading, for which we design such wall assemblies. It is stated in the Commentary to the AISI-NAS that the reliability index, β_o , varies considerably for different kinds of loading, different types of construction and consequence of failure. Based on this, two possible revisions are recommended, however, I do prefer the first revision:

Revision 1 ; Change the target reliability index β_o to 1.5

This would result in a factor of safety of **1.72**

Revision 2 ; Change the factor of safety to 1.67

ITEM 4 (Section 4.1.2)

It is currently stated that a set of wall assembly test specimens shall define each combination of variables that affects the performance of the wall assembly, such as stud depth, uncoated minimum steel thickness, and stud spacing [maximum spacing shall be 24 inches (610 mm) on center]; type and thickness of gypsum

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panel products, panel orientation, and location of panel joints; and type and size of fasteners and fastener schedule.

The only item for possible change consideration is the stud spacing. Typically, three different stud spacings are used in this industry, i.e., 12", 16" and 24". Tests were carried out at Intertek ETL SEMKO in Coquitlam, BC, Canada for each of these stud spacings. More specifically, three identical specimens were tested for each of these stud spacings, using the 35/8" x 0.0155" steel stud assembly and the same gypsum board for both the 8' and 16' panel tests. In the case of the 35/8" x 0.0245" steel stud assembly tests only the 12" and 24" stud spacings were tested.

Summarized below are the test results obtained from Intertek ETL SEMKO. I have reviewed the data in an effort to establish a relationship regarding the spacing of the studs. In order to establish a proper comparison, I reduced the load and stiffness data on a per stud basis. As well, each data value is the average of three tests. Based on these findings, one can observe that there is no significant difference in either load or stiffness (EI) between the 12", 16" and 24" stud spacings of either the 8ft or 16ft 0.0155" tests. This can also be concluded from the 0.0245" test results for the 12" and 24" stud spacings.

Based on these findings, it is recommended that Section 4.1.2 be revised to read that only the 24" stud spacing needs to be tested.

The 16" stud spacing values can then be determined by multiplying the values of the 24" stud spacing by 1.5 and similarly, for the 12" stud spacing values the 24" stud spacing values are multiplied by 2.0.

8ft (7.67') – 35/8" x 0.0155"

Stud Spacing (in.)	Test load (psf)	Load/stud (psf)	Test EI (lb-in. ²)	EI/stud (lb-in. ²)
12 (4 studs)	59.8	15.0	3.74E+07	0.935E+07
16 (3 studs)	46.1	15.4	2.84E+07	0.948E+07
24 (2 studs)	31.2	15.6	1.97E+07	0.987E+07
Average		15.3		0.957E+07

16ft (15.67') – 35/8" x 0.0155"

Stud Spacing (in.)	Test load (psf)	Load/stud (psf)	Test EI (lb-in. ²)	EI/stud (lb-in. ²)
12 (4 studs)	18.0	4.51	4.93E+07	1.23E+07
16 (3 studs)	11.0	3.68	4.33E+07	1.44E+07
24 (2 studs)	7.30	3.65	2.64E+07	1.32E+07
Average		3.95		1.33E+07

8ft (7.67') – 35/8" x 0.0245"

Stud Spacing (in.)	Test load (psf)	Load/stud (psf)	Test EI (lb-in. ²)	EI/stud (lb-in. ²)
12 (4 studs)	84.4	21.1	4.95E+07	1.24E+07
16 (3 studs)				
24 (2 studs)	43.9	21.9	2.26E+07	1.13E+07
Average		21.5		1.19E+07

16ft (15.67') – 35/8" x 0.0245"

Stud Spacing (in.)	Test load (psf)	Load/stud (psf)	Test EI (lb-in. ²)	EI/stud (lb-in. ²)
12 (4 studs)	23.3	5.83	5.53E+07	1.38E+07
16 (3 studs)				
24 (2 studs)	11.6	5.80	3.33E+07	1.67E+07
Average		5.82		1.53E+07

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I trust that this will be received and dealt with in the spirit in which it is intended.

c.c. Kurt Stochlia, P.E.

Reinhold Schuster

Professor Emeritus
University of Waterloo



ICC EVALUATION SERVICE, INC., RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE

The purpose of the Evaluation Committee is to monitor the work of ICC-ES, in issuing evaluation reports; to evaluate and approve acceptance criteria on which evaluation reports may be based; and to sponsor related changes in the applicable codes.

2.0 MEETINGS

2.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1, subject to Section 3.

2.2 All scheduled meetings shall be publicly announced.

2.3 Two-thirds ($\frac{2}{3}$) of the voting Evaluation Committee members shall constitute a quorum. A majority vote of members present is required on any action.

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

2.5 Minutes of the meetings shall be kept.

2.6 An electronic audio record of meetings shall be made by ICC-ES; no other audio, video, electronic or stenographic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy. A copy of the ICC-ES recording of the meeting and such visual aids, if any, will be available to interested parties upon written request made to ICC-ES together with a payment as required by ICC-ES to cover costs of preparation and duplication of the copy. These materials will be available beginning five days after the conclusion of the meeting but will no longer be available after 30 days have elapsed from the conclusion of the meeting.

2.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items should be delivered to ICC-ES. All such written communications and submissions shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting, and shall be delivered at least ten days before the scheduled Evaluation Committee meeting if they are to be forwarded to the committee. Correspondence received by ICC-ES will not

be released to any party, except to the Evaluation Committee, prior to the meeting without permission of the author. The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section. All such communications and submissions will be available from ICC-ES upon written request and payment of costs associated with duplication. The materials will be available beginning five days after the conclusion of the meeting but will no longer be available after 30 days have elapsed from the conclusion of the meeting.

3.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that the chairman may call for a closed session to seek advice of counsel.

4.0 ACCEPTANCE CRITERIA

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

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

4.2 Procedure:

4.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 5.0 of these rules.

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

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

4.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members.

4.3 Approval of acceptance criteria shall be as specified in Section 2.3 of these rules.

4.4 The action of the Evaluation Committee may be appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria.

5.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

5.1 Acceptance criteria may be issued without a public hearing following a 45-day public comment period and a majority vote for approval by the Evaluation Committee when, in the opinion of ICC-ES staff, one or more of the following conditions have been met:

1. The subject is nonstructural, does not involve life safety, and is addressed in nationally recognized standards or generally accepted industry standards.
2. The subject is a revision to an existing acceptance criteria that requires a formal action by the Evaluation Committee, and public comments raised were resolved by staff with commenters fully informed.
3. Other acceptance criteria and/or the code provide precedence for the revised criteria.

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

- a. *Lack of clarity:* There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)
- b. *Insufficiency:* The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)
- c. *The subject of the acceptance criteria is not within the scope of the applicable codes:* A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)
- d. *The subject of the acceptance criteria needs to be discussed in a public hearings.* The committee member

requests additional input from other committee members, staff or industry.

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

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

6.0 COMMITTEE COMMUNICATION

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

6.1 Committee members receiving an electronic ballot should respond only to the sender (staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

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

Effective November 6, 2006



PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

AC86

Proposed December 2007

Previously approved June 2007, July 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.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

1.0 INTRODUCTION

1.1 Purpose: This criteria covers a procedure for testing and evaluating the structural performance of cold-formed steel vertical framing members (studs) used in interior, nonload-bearing wall assemblies, and establishing limiting wall heights for recognition in ICC Evaluation Service, Inc., (ICC-ES) evaluation reports under the 2006 *International Building Code*[®] (IBC), the 2006 *International Residential Code*[®] (IRC), the BOCA[®] *National Building Code/1999* (BNBC), the 1999 *Standard Building Code*[®] (SBC), and the 1997 *Uniform Building Code*[™] (UBC). Bases of recognition are IBC Section 104.11, IRC Section R104.11, BNBC Section 106.4, SBC Section 103.7, and UBC Section 104.2.8.

The reason for the development of this criteria is to establish an empirical method of determining limiting wall heights based on stiffness and strength characteristics of interior nonload-bearing wall assemblies, consisting of cold-formed steel studs and gypsum panel products installed on one or both sides of the wall such that the wall responds to transverse loading as an assembly. This empirical approach is an alternative to the sheathing-braced design referenced in the building codes for cold-formed steel stud wall assemblies resisting transverse loads.

1.2 Scope: The information obtained by the provisions of this criteria is applicable to the design of field-fabricated interior nonload-bearing walls when using the Allowable Stress Design (ASD) method where the transverse design loads are limited to 5, 7^{1/2}, 10, and 15 psf (240, 360, 480, and 720 Pa) and where the superimposed axial design load is zero pounds.

1.3 Codes and Referenced Standards:

1.3.1 2006 *International Building Code*[®] (IBC), International Code Council.

1.3.2 2006 *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).

1.3.6 AISI NAS-01, North American Specification for the Design of Cold-formed Steel Framing, including 2004 Supplement, American Iron and Steel Institute.

1.3.7 AISI General-04, Standard for Cold-formed Steel Framing—General Provisions, American Iron and Steel Institute.

1.3.8 AISI WSD-04, Standard for Cold-formed Steel Framing—Wall Stud Design, American Iron and Steel Institute.

1.3.9 ASTM A 370-05, Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

1.3.10 ASTM C 473-03, Standard Test Methods for Physical Testing of Gypsum Panel Products, ASTM International.

1.3.11 ASTM C 1178-04, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel, ASTM International.

1.3.12 ASTM C 1278-03, Standard Specification for Fiber-Reinforced Gypsum Panel, ASTM International.

1.3.13 ASTM C 1396-02, Standard Specification for Gypsum Board, ASTM International.

1.3.14 ASTM E 72-02, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction, ASTM International.

1.4 Definitions:

1.4.1 Interior Nonload-bearing Wall Assembly: A field-fabricated wall assembly consisting of cold-formed steel vertical framing members (studs) spaced a maximum of 24 inches (610 mm) on center and gypsum panel products sheathed on one or both sides of the wall assembly. Installation of the wall assemblies in a structure shall be limited to interior applications where the superimposed axial load is zero pounds.

1.4.2 Stud: A cold-formed steel vertical framing member in a wall assembly.

1.4.3 Gypsum Panel Products: The general name for a family of sheet products consisting essentially of gypsum.

1.4.4 Set Deflection: The deflection reading obtained five minutes after the application or release of test loads.

2.0 BASIC INFORMATION

2.1 General:

2.1.1 Description: Each component of the wall assembly shall be described with respect to material specifications, dimensions, and compliance with applicable standards or ICC-ES acceptance criteria.

2.1.1.1 Cold-formed steel framing members shall conform to the field identification and quality control requirements of the ICC-ES Acceptance Criteria for Cold-formed Steel Framing Members (AC46). Sheet steel materials used in the steel wall stud construction shall comply with the requirements in Section 2210.4 of the IBC.

2.1.1.2 Gypsum panel products shall comply with ASTM C 1396, C 1278, or C 1178, as applicable.

2.1.1.3 Fasteners shall comply with applicable standards, specifications, or ICC-ES acceptance criteria.

2.1.2 Installation Instructions: Installation instructions shall be submitted, and include information on type and thickness of the gypsum panel product, attachment of gypsum panel products to the steel studs (orientation of panel products, location of panel joints, type and size of panel fasteners, fastening schedule, and joint and face treatments) and attachment of steel studs to tracks.

2.1.3 Identification: A description of the method of field identification of the components of the interior nonload-bearing wall assembly qualified in accordance with this acceptance criteria shall be provided. Products shall be marked, as applicable, in accordance with the relevant acceptance criteria or ASTM specification, or both.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

2.2 Testing Laboratories: Testing laboratories shall comply with Section 2.0 of 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 and include:

2.3.1 A description of the test specimens, including installation details and specifications of the gypsum panel products, cold-formed steel framing members, fastener type and size, and fastener schedule. The description of studs and gypsum panel products shall also be supplemented by test data on the yield and tensile strength of the cold-formed studs, bare-metal thickness of the steel studs, and the flexural strength of the gypsum panel products, when required. The description of the test specimens shall also include the orientation of panel products and location of panel joints.

2.3.2 A description of the gypsum panel product type and product name, including the manufacturer's name, when required. (Refer to Section 3.1.3.)

2.3.3 A description of the test procedures, test results, deflection and load measurements, observations, calculations deriving limiting wall heights based on stiffness and strength test data of tested assemblies, and photographs of typical wall assembly test specimens and typical failures.

2.4 Product Sampling and Preparation of Test Assemblies: Sampling of the components of interior nonload-bearing walls for tests under this criteria shall comply with Section 3.2 of AC85. Preparation of test assemblies shall be witnessed by the testing laboratory in accordance with Section 3.3 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: The allowable height of an interior nonload-bearing wall assembly shall be the lesser of the limiting height based on wall assembly stiffness in accordance with Section 3.2 or the limiting height based on wall assembly strength in accordance with Section 3.3.

3.1.1 Test specimens shall be representative of the wall construction for which recognition in an evaluation report is desired, as to materials, workmanship, and details such as orientation of gypsum panel products and location of panel joints, except that joints and fasteners shall not be treated.

3.1.2 One representative steel sample shall be obtained from each tested wall assembly to verify steel thickness both before and after removal of the galvanized coating. When the manufacturing processes that cold forms steel to a shape make taking thickness measurements impossible, a minimum of ten samples cut from flat sheets taken from the same coil of steel used to cold form the steel studs, shall be obtained. Additionally, yield strength, tensile strength, and elongation shall be verified using ASTM A 370 test procedures. When the maximum allowable transverse load specified in the evaluation report for the interior nonload-bearing wall assembly is limited to 5 psf (240 Pa), only the yield strength need be verified.

3.1.3 The type, thickness, and product name of gypsum panel product shall be identified. The type and product name of the gypsum panel product do not need to be

reported in the evaluation report when the flexural strength of the gypsum panel products used in the tests does not exceed the minimum values set forth in the applicable ASTM standard by more than 15 percent. The gypsum panel product shall be evaluated independently in accordance with ASTM C 473, except none of the single test values shall be discarded, and the test data shall be included in the test report for the wall assemblies. At least three panels from each shipment received by the test agency shall be selected for physical property testing, provided they constitute a representative sample for the purpose of wall assembly tests.

3.1.4 Unsymmetrical wall systems shall be tested in the weakest and most flexible direction.

3.2 Limiting Heights Based on Wall Assembly Stiffness: Testing shall be in accordance with Section 4.1 of this criteria and the analysis of test data shall be in accordance with Sections 3.2.1 through 3.2.5.

3.2.1 Wall assembly bending stiffness, EI , shall be based on the equation for midspan deflection of a simply supported beam with uniformly distributed loading over its entire span. An EI value for each midspan deflection target shall be calculated based on the incremental deflection from previous set deflection after release of load to the current set deflection after application of load. Average EI values shall be determined from the test results for each test assembly height. For a specific test specimen, the arithmetical average of the EI values derived for each deflection target shall be used when the deviation of any individual deflection target EI value does not exceed ± 15 percent of the specimen's average EI value. If such a deviation from the average value exceeds 15 percent for any test assembly, then the EI values for each specific deflection target of all specimens shall be averaged. The deflection-target-specific EI values shall be used to calculate the limiting heights for that test assembly height.

3.2.2 The wall assembly's controlling EI value derived in accordance with Section 3.2.1 shall be used to calculate limiting wall heights for deflection target values $L/360$, $L/240$ and $L/120$ (in the case that $L/120$ deflection level cannot be obtained, it shall be permitted to use $L/180$ in place of $L/120$); and transverse design loads of 5, $7\frac{1}{2}$, 10, and 15 psf (240, 360, 480, and 720 Pa), provided:

3.2.2.1 The measured uncoated steel thickness of the studs in each test assembly does not vary from the specified (design) thickness by ± 5 percent when steel samples are obtained from each tested wall assembly to verify steel thickness.

3.2.2.2 The measured uncoated steel thickness of samples cut from flat sheets taken from coil steel does not vary from the coil steel thickness specified in the quality documentation by ± 5 percent when it is not possible to measure steel thickness of studs in each test assembly because the manufacturing processes that cold forms steel to a shape makes taking measurements impossible.

~~**3.2.2.3**—The test assemblies are capable of resisting $4\frac{1}{2}$ times the load causing maximum deflection.~~

3.2.2.3 The unloaded set deflection is less than 20 percent of the loaded set deflection.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

3.2.3 Limiting wall heights may be derived by linear interpolation between the derived limiting height value (H_1) from one test span and the derived limiting height value (H_2) from the next taller test span:

$$L_{LH} = \frac{(L_1 \times H_2) - (L_2 \times H_1)}{H_2 - H_1 - L_2 + L_1}$$

where:

- L_{LH} = Interpolated limiting wall height, ft (m).
- L_1 = Actual span of short test assembly, ft (m).
- L_2 = Actual span of tall test assembly, ft (m).
- H_1 = Derived limiting height for a specific deflection target and design load based on the controlling EI value from short-span wall test data, ft (m).
- H_2 = Derived limiting height for a specific deflection target and design load based on the controlling EI value from long-span wall test data, ft (m).

3.2.3.1 If the calculated limiting heights derived from the shorter test assemblies are greater than twice the height of the taller assemblies, then the calculated limiting height based on the taller test assemblies shall be used rather than an interpolated value.

3.2.3.2 If for any specific design load and deflection target combination a calculated limiting wall height based on the shorter test assemblies is less than the actual test span, the calculated height value shall be discarded and the wall assembly shall not be permitted to resist that specific design load and deflection target.

3.2.3.3 In no case shall the interpolated value, L_{LH} , be greater than the mean value between calculated values H_1 and H_2 .

3.2.4 Linear extrapolation of the controlling EI value may be used to determine limiting wall heights greater than the those tested, up to twice the height of the test assemblies.

3.2.5 A controlling EI value shall only be used to calculate limiting wall heights for target deflection values that are included in the derivation of the controlling EI value for the test wall assembly.

3.3 Limiting Heights Based on Wall Assembly Strength: The design of cold-formed steel studs for interior nonload-bearing wall assemblies shall be in accordance with AISI-WSD. When the wall assembly construction deviates from the AISI-WSD provisions, limiting wall heights based on strength characteristics of the wall assembly may be derived in accordance with the provisions of this section. Flexural and end-reaction testing shall be in accordance with Sections 4.1 and 4.2, respectively, and the analysis of test data shall be in accordance with Sections 3.3.1 and 3.3.2, respectively.

3.3.1 Wall assembly limiting height based on flexural strength shall be derived using the following formula:

$$L_f = \sqrt{\frac{R_s P L_t^2}{\Omega W}}$$

where:

- L_f = Limiting height based on flexural strength, ft (m).
- R_s = Adjustment factor (refer to Section 3.3.1.1).
- P = Controlling peak test load (refer to Section 3.3.1.2), psf (Pa).
- L_t = Span of test assembly, ft (m).
- Ω = Safety factor (refer to Section 3.3.1.3).
- W = Design load (refer to Section 3.3.1.4), psf (Pa).

3.3.1.1 If the yield point of the steel from which the studs are formed is larger than the specified minimum value, or the thickness of the steel is greater than the specified (design) thickness, or both, the controlling test peak load shall be scaled by an adjustment factor, R_s :

$$R_s = \left(\frac{F_{y-specified}}{F_{y-tested}} \right) \times \left(\frac{t_{specified}}{t_{tested}} \right) \leq 1.0$$

where:

- $F_{y-specified}$ = Specified yield stress of the steel, psi (MPa).
- $F_{y-tested}$ = Measured yield stress of the steel, psi (MPa).
- $t_{specified}$ = Design steel thickness specified in the evaluation report or the coil steel thickness specified in the quality documentation, as applicable, inch (mm).
- t_{tested} = Measured steel thickness, inch (mm)

3.3.1.2 The controlling peak test load of a set of wall assemblies of the same height shall be in accordance with Section 4.1.

3.3.1.3 Safety factor, Ω , shall be in accordance with Section F1.2 of AISI-NAS. The following variables for the resistance factor equation in Chapter F of AISI-NAS (Eq. F1.1-2) shall be used, unless data justifying other variables are submitted:

- β_o = Target reliability index = 2.5
- M_m = Mean value of the material factor = 1.0
- V_M = COV of the material factor = 0.10
- V_F = COV of the fabrication factor = 0.15

3.3.1.4 The transverse design loads, W , shall be limited to 5, 7¹/₂, 10, and 15 psf (240, 360, 480, and 720 Pa) and shall not be multiplied by 0.75 or any other factor associated with short-term loading. For compliance with the UBC, transverse design loads, W , may be multiplied by 0.75, or the allowable flexural resistance of the assembly determined in accordance with Section 3.3.1 may be increased by one-third, but not both.

3.3.1.5 Linear interpolation between the multiple test heights is permitted to derive limiting heights based on flexural strength between sets of wall assemblies having different heights.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

3.3.1.6 Linear extrapolation of flexural strength data may be used to derive limiting wall heights greater than those tested, up to twice the height of the tested assemblies.

3.3.2 Wall assembly limiting height based on end reaction strength shall be derived using the following formula:

$$L_r = \frac{R_s B L_t}{\Omega W}$$

where:

- L_r = Limiting height based on end reaction, ft (m).
- R_s = Adjustment factor (refer to Section 3.3.1.1).
- B = Controlling peak test load, psf (Pa), in accordance with Section 4.2 of this criteria.
- L_t = Actual span of the nominal 4-foot test assembly, ft (m).
- Ω = Safety factor in accordance with Section F1.2 of AISI-NAS.
- W = Transverse design load (refer to Section 3.3.1.4), psf (Pa).

4.0 TEST METHODS

4.1 Transverse Load Testing:

4.1.1 Wall assemblies at two different heights shall be tested. The taller set of wall test assemblies can be one-half the maximum allowable height of the wall assembly sought for recognition in an ICC-ES evaluation report.

4.1.2 A set of wall assembly test specimens shall define each combination of variables that affects the performance of the wall assembly, such as stud depth, uncoated minimum steel thickness, and minimum and maximum stud spacing, where the maximum spacing shall be 24 inches (610 mm) on center; type and thickness of gypsum panel products, panel orientation, and location of panel joints; and type and size of fasteners and fastener schedule. If it can be shown that the test data for walls with minimum spaced studs is statistically the same as walls with maximum spaced studs, then only walls with maximum spaced studs need be tested.

4.1.3 A set of wall assembly test specimens, consisting of not fewer than three identical specimens, shall be tested provided deviation of any individual test result from the average value does not exceed ±15 percent. If such a deviation from the average value exceeds ±15 percent, more tests of the same kind shall be conducted until the deviation of any individual test result from the average value obtained from all the tests does not exceed ±15 percent, or until at least three additional tests have been conducted.

4.1.4 Transverse load testing shall comply with ASTM E 72, using uniform air pressure loading on minimum 4-foot-wide (1220 mm) wall assembly test specimens placed in a vertical position as described in Section 12 of ASTM E 72, and Sections 4.1.4.1 through 4.1.4.7 of this criteria.

4.1.4.1 An initial load, or preload, is permitted to be applied to seat the assembly. This preload shall not exceed 10 percent of the average load associated with the L/120 deflection target value.

4.1.4.2 To reduce rotational restraint, cylindrical roller supports shall be used at both ends of the assembly, as shown in the vertical test setup in Figure 3 of ASTM E 72 and as described in Section 12.3 of ASTM E 72. The top and bottom tracks of the wall test specimen shall not be attached or fastened to supports.

4.1.4.3 The gypsum panel products shall be cantilevered at the edges of the wall assembly a distance representative of the tributary load area for the steel studs. To prevent premature failure of the cantilevered edges of the gypsum panel products in the test assemblies, maximum 4-inch-long (102 mm) steel tracks or wood blocks, having the same depth and width as the wall assembly's steel studs, shall be placed at the unsupported edges of the gypsum panel products. These supports shall be located 12 inches (305 mm) from the ends of the wall assembly and spaced 24 inches (610 mm) on center, and may be attached with a screw on one side of the assembly, provided the method of attachment does not increase the wall assembly's stiffness.

4.1.4.4 The chamber method of loading shall be used with an airtight frame surrounding the specimen. A polyethylene sheet or equivalent shall cover the specimen, overlap the frame, and be sealed to the wall of the test facility so that it is reasonably airtight. The polyethylene sheet or equivalent shall be applied loosely, such that it does not contribute to the stiffness of the assembly. A vacuum pump shall be used to reduce air pressure within the chamber behind the assembly. The difference between the chamber pressure and the ambient pressure shall be recorded.

4.1.4.5 Mid-height lateral deflections shall be measured using dial gages or electronic instruments that are aligned with at least two steel studs in the wall assembly and are mounted on a reference frame. The arithmetical average of the deflection readings shall be used to determine the mid-height deflection of the test assembly at each loading increment. As an alternate, a single deflection gage is permitted at the center of the test assembly, provided it is aligned midway between the steel studs.

4.1.4.6 Successive incremental loadings shall be applied for five minutes at each designated deflection target of L/360, L/240 and L/120. Deflections shall be measured at the initial application of each load increment, after five minutes of set, after release of the load increment, and after five minutes of set. Additional deflection targets or alternative deflection targets may be considered based on the specific assembly response characteristics, provided at least three target levels are investigated, and ICC-ES is consulted prior to testing.

4.1.4.7 Test assemblies shall be loaded to failure following the incremental loadings, where failure is defined as when the maximum pressure cannot be sustained without the sudden or continuous movement of the test assembly. After the conclusion of each test, the assembly shall be visually inspected for buckling or permanent deformation of the steel studs, fastener pullout or pullthrough, and gypsum panel failure. The mode of failure and the measured load at failure shall be reported for each test assembly.

4.2 Wall End Reaction Load Testing:

4.2.1 As a minimum, a series of three identical tests shall be performed for each combination of variables that

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS—INTERIOR NONLOAD-BEARING WALL ASSEMBLIES

affect the performance of the assembly, provided deviation of any individual test result from the average value does not exceed ± 15 percent. If such a deviation from the average value exceeds ± 15 percent, more tests of the same kind shall be conducted until the deviation of any individual test result from the average value obtained from all the tests does not exceed ± 15 percent, or until at least three additional tests have been conducted. Variables affecting performance include stud depth, spacing, and uncoated minimum base metal thickness; track configuration and uncoated minimum base metal thickness; type and thickness of gypsum panel products; fastener type, size, and schedule used to construct the assemblies; and fasteners used to attach the track to the supporting construction. If various wall configurations are sought for evaluation, the worst case configuration may be tested. If higher ratings are sought for stronger configurations, the additional configurations shall be tested.

4.2.2 Transverse load testing shall comply with ASTM E 72, using uniform air pressure loading on nominally 4-foot-tall-by-4-foot-wide (1220 mm by 1220 mm) wall assemblies placed in a horizontal or vertical position, as described in Section 11 or Section 12 of ASTM E 72, respectively; and Sections 4.2.2.1 through 4.2.2.5 of this criteria.

4.2.2.1 An initial load, or preload, is permitted to be applied to seat the assembly. This preload shall not exceed 10 percent of the peak load.

4.2.2.2 Cold-formed steel studs shall be spaced as intended for actual construction, except the maximum spacing shall be 24 inches (1220 mm) on center. Track sections shall be placed at the ends of the studs, and the wall assembly shall be sheathed with gypsum panel products in the same manner that simulates actual top and bottom wall construction. The minimum end distance of web holes of studs shall be considered in the test specimen wall construction.

4.2.2.3 One end of the wall assembly may bear against a cylindrical roller, and the other end shall be attached to a wood or steel cleat in such a manner that is representative of actual construction. The cleat shall be set against a rigid support of the test fixture.

4.2.2.4 The gypsum panel products shall be cantilevered at the edges of the wall assembly a distance representative of the tributary load area for the steel studs.

To prevent premature failure of the cantilevered edges of the gypsum panel products in the test assemblies, maximum 4-inch-long (102 mm) steel tracks or wood blocks, having the same depth and width as the wall assembly's steel studs, shall be placed at the unsupported edges of the gypsum panel products. These supports shall be located 12 inches (305 mm) from the ends of the wall assembly.

4.2.2.5 Test assemblies shall be loaded to failure, where failure is defined as when the maximum pressure cannot be sustained without the sudden or continuous movement of the test assembly. Each test assembly shall be visually inspected for buckling or permanent deformation of the steel studs or track, fastener pullout or pullthrough, or gypsum panel failure. The mode of failure and the measured load at failure shall be reported for each test assembly.

5.0 QUALITY CONTROL

5.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

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

6.0 EVALUATION REPORT RECOGNITION

6.1 The evaluation report for interior nonload-bearing walls that comply with this acceptance criteria shall include:

6.1.1 Material specifications for all wall assembly components, description of the wall assembly, and applicable fastener type and fastener schedule for interconnection of framing members and attachment of gypsum panel to cold-formed steel framing members.

6.1.2 Product name and manufacturer's name of proprietary components.

6.1.3 Tabulated limiting wall heights for wall assemblies resisting transverse design loads limited to 5, $7\frac{1}{2}$, 10, and 15 psf (240, 360, 480, and 720 Pa) at deflection limits of L/360, L/240 and L/120. Tabulated limiting wall heights governed by wall assembly strength shall be so identified.

6.1.4 A condition of use shall state the following: "The interior nonload-bearing wall assemblies shall be limited to interior installations where the superimposed axial load is zero pounds."■