



ICC Evaluation Service, Inc.
Birmingham Regional Office
900 Montclair Road, Suite A
Birmingham, AL 35213
tel: 205.599.9800
fax: 205.599.9850
www.icc-es.org

April 1, 2009

**TO: PARTIES INTERESTED IN PREFABRICATED WALL PANELS
USING WOOD I-STUDS**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Prefabricated Wall
Panels Using Wood I-Studs, Subject AC138-0409-R1 (JS/PB)**

Dear Madam or Sir:

The revisions proposed to the subject acceptance criteria, as presented in the enclosed criteria draft, are being posted on the ICC-ES web site to allow for public comment. The revisions include:

1. The criteria has been updated to the 2006 *International Building Code*[®] (IBC) and 2006 *International Residential Code*[®] (IRC). All references to ASTM Standards in Section 1.3.2 and Table 3 have also been updated.
2. A reference to ASTM D 7247-07a^{e1} has been added to Section 1.3.2.
3. The provisions relating to product identification have been moved from Section 4.4 to Section 2.1.3. These provisions have been revised to match the requirements of Section 2.3.3 of the ICC-ES Acceptance Criteria for Prefabricated Wood I-joists (AC14), in addition to the requirement that each I-stud bear the wording "For use in prefabricated wall panels only."
4. Section 3.8 has been revised to clarify that the minimum sample size for shear capacity qualification tests must be in accordance with Section 3.2.
5. Section 3.12.2 has been revised to limit the applicability of allowable shear values for shear walls framed with I-studs to wind loads, Seismic Design Categories A, B and C (under the IBC), and Seismic Zones 0, 1 and 2 (under the UBC).
6. A new section (Section 3.13) has been added to address heat durability requirements for adhesives used in the web-to-web, flange-to-web and flange-to-flange joints of the I-studs. These requirements are similar to the provisions found in Section 4.1.2 of AC14.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. An explanation of the alternate criteria process can be found on our web site at http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml.

All comments received in the 30-day comment period will be considered. During this same 30-day period, however, the draft criteria will be balloted to the Evaluation Committee. If the public comments raise major issues, generate controversy, or require the criteria to be substantially rewritten, then ICC-ES staff may decide to reballot the criteria; or place a revised draft on the web site for further public comment; or put the criteria on the agenda for a future Evaluation Committee meeting.

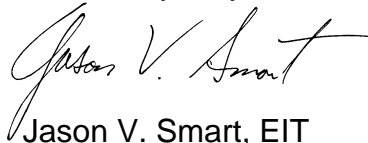
Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

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. 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.

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 5692, or Peter Bahlo, PE, senior staff engineer, at extension 3306. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Jason V. Smart, EIT
Senior Evaluation Specialist

JVS/raf

Enclosure

cc: Evaluation Committee

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR PREFABRICATED WALL PANELS USING WOOD I-STUDS

AC138

Proposed April 2009

Previously approved October 2003 and September 1998

PREFACE

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

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

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

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

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

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1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for prefabricated wall panels using wood I-studs to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 ~~2000~~ *International Building Code*[®] (IBC), the 2006 ~~2000~~ *International Residential Code*[®] (IRC), the BOCA[®] *National Building Code/1999* (BNBC), the 1999 *Standard Building Code*[®] (SBC) and the 1997 *Uniform Building Code*[™] (UBC). The bases of recognition are IBC Section 104.11, IRC Section 104.11, BNBC Section 106.4, SBC Section 103.7 and UBC Section 104.2.8.

1.2 Scope: The criteria applies to prefabricated wall panels with wood I-studs. Recognition of individual prefabricated wood I-studs as alternatives to individual solid-sawn studs used in wood-framed construction is outside the scope of this criteria.

1.3 Codes and Reference Standards: Where standards are referenced in this criteria, these standards shall be applied consistently with the code upon which compliance is based. Standard editions applicable to each code are summarized in Table 3.

1.3.1 Codes:

1.3.1.1 2006 ~~2000~~ *International Building Code*[®] (IBC), International Code Council.

1.3.1.2 2006 ~~2000~~ *International Residential Code*[®] (IRC), International Code Council.

1.3.1.3 BOCA[®] *National Building Code/1999* (BNBC).

1.3.1.4 1999 *Standard Building Code*[®] (SBC).

1.3.1.5 1997 *Uniform Building Code*[™] (UBC).

1.3.2 ASTM International (ASTM):

1.3.2.1 ASTM D 198-~~08~~ ~~02~~^{et}, Standard Test Methods of Static Tests of Lumber in Structural Sizes.

1.3.2.2 ASTM D 2915-03, Practice for Evaluating Allowable Properties for Grades of Structural Lumber.

1.3.2.3 ASTM D 5055, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists.

1.3.2.4 ASTM D 7247-07a^{e1}, Standard Test Method for Evaluating the Shear Strength of Adhesive Bonds in Laminated Wood Products at Elevated Temperatures.

1.3.2.5 ~~1.3.2.5-4~~ ASTM D 5456-98, Specification for Evaluation of Structural Composite Lumber Products.

1.3.2.6 ~~1.3.2.6-5~~ ASTM E 4-08 ~~02~~, Standard Practice for Force Verification of Testing Machines.

1.3.2.7 ~~1.3.2.7-6~~ ASTM E 72-02, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

1.3.2.8 ~~1.3.2.8-7~~ ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 Definitions:

1.4.1 Prefabricated Wood I-Stud: Prefabricated wood I-studs are structural members used to support axial compressive loads and combined axial and transverse loads; and are manufactured using solid-sawn lumber flanges. The flanges shall be continuous solid-sawn lumber without finger joints, joined by an oriented strand board web that is keyed into the flanges, and glued with an exterior-grade adhesive, forming an I-shaped cross section.

1.4.2 Prefabricated Wall Assembly Using I-studs: The wall panels consist of prefabricated wood I-studs, a rigid insulation between the I-studs, one top and one bottom solid-sawn wood plate, and all framing required around rough openings. The panels are permitted to be fabricated without the interior or exterior wall-finish material applied. The I-studs are oriented so that the flanges are on the inside and outside faces of the wall assembly.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning material specifications, thickness, size and the manufacturing process.

2.1.2 Installation Instructions: Installation details and limitations, fastening methods, joint treatments, and face treatments.

2.1.3 Packaging and Identification: A description of the method of packaging and field identification of the panel must be submitted. The product must be labeled in accordance with Section 13.1 of ASTM D 5055, and shall also indicate the evaluation report number, flange grade and species. If a product series is unique to a specific flange grade and species, and if the relationship between grade, species and series is shown in the evaluation report, the series designation, rather than the flange grade and species, is permitted to be indicated on the product. Additionally, each I-stud shall bear the wording "For use in prefabricated wall panels only." ~~See Section 4.4 of this criteria for identification provisions.~~

2.1.4 Field Preparation: A description of the methods of field-cutting, application and finishing.

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

2.3 Test Reports: Test reports shall comply with AC85 and shall provide information on the following:

2.3.1 Location of testing (the manufacturer's or the test agency's facility).

2.3.2 The test specimen and its construction. The general description shall identify the lumber grade, the specific gravity, the **moisture** content, the specimen dimensions and any visible defects. Additionally, statements are required indicating whether specimens

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were produced in accordance with the minimum requirements of the approved quality control manual.

2.3.3 The method of conditioning test specimens.

2.3.4 Details describing the test setup, test methods and test procedures, including load application rate and specimen restraint.

2.3.5 Load-measuring equipment. The equipment shall have a degree of accuracy of 2 percent, as determined in accordance with ASTM E 4.

2.3.6 Test observations. Test personnel shall record the performance of test specimens and mode of failure. Photographs shall be taken of test specimens and typical failure modes.

2.3.7 Deflection/load readings. For flexural test specimens, the deflection/load readings at $1/180$, $1/240$ and $1/360$ of the span shall be highlighted in the test report.

2.4 Product Sampling: Products shall be sampled in accordance with Section 3.1 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: Evidence shall be provided to demonstrate that the product provides an acceptable level of safety, serviceability and durability.

3.2 Number of Test Specimens: For the 8-foot (2438 mm) studs, a minimum of 28 test specimens are required for axial-load, flexural-load and shear-load tests. For each additional 2-foot (610 mm) length of stud, there shall be 10 test specimens for axial-load tests and 10 test specimens for flexural-load tests. Table 1 specifies the minimum number of test specimens.

3.3 Specimens: The lumber used in the prefabricated wood I-studs shall be grade-marked and have a moisture content within 3 percent of specified levels. Lumber shall be considered representative of the species group if its relative density is within the range specified in Table 2 for its species group.

3.4 Length of Specimens: Test specimen I-stud length shall be 8 feet (2438 mm). Additional I-stud lengths, in 2-foot (610 mm) increments, shall also be tested, up to the maximum I-stud length for which recognition in the evaluation report is requested.

3.5 Specimen Conditioning: If, during fabrication, the lumber moisture content does not exceed 16 percent, the testing shall be conducted on specimens "as received." In cases where the lumber moisture content is permitted to be between 16 and 19 percent during fabrication, the specimens shall be dried to a 16 percent moisture content for the testing program.

3.6 Axial-Load Tests: Axial-load tests for the I-studs shall be conducted in accordance with ASTM D 198, with the following exceptions:

3.6.1 Lateral restraint shall only be provided in the weak axis of the I-stud, and shall be representative of lateral restraint for conventional building construction. I-studs shall be tested without lateral restraint if recognition of I-studs is requested for installations that typically do not have sheathing providing lateral restraint, such as underfloor crawl spaces, garages, and gable-end walls in attics.

3.6.2 The load must be positioned in accordance with Section 9.3.1 of ASTM E 72, to induce a bending moment in the strong axis of the I-stud. See Figure 1. I-studs subjected to a combination of bending about one or both principal axes and axial compression shall be tested to verify the applicable provisions of Section 3.9.2 of the NDS.

3.6.3 Web holes in the I-stud shall be representative of jobsite installation.

3.7 Flexural-load Tests: Flexural-load tests for the wood I-studs shall be conducted in accordance with ASTM D 198. The web holes in the I-studs shall be representative of jobsite installation.

3.8 Shear Capacity Qualification: Shear capacity qualification of the wood I-studs shall be derived in accordance with Section 6.2 of ASTM D 5055, except that the minimum sample size shall be in accordance with Section 3.2. Holes in webs shall be substantiated by shear testing in accordance with ASTM D 5055.

3.9 Shear Wall Tests: Test procedures and equipment shall comply with ASTM E 72. Deflection transducers and automated data recording equipment may be substituted for dial gages specified in ASTM E 72.

3.9.1 Two identical walls shall be tested for each type of sheathing material. If the ultimate loads vary by more than 10 percent, a third wall shall be tested and the weaker two averaged to obtain the design load. If the test series includes a number of variables, such as different grades of sheathing material, only one wall test is required for each change in construction. Evidence shall be submitted demonstrating that the sheathing material used in the test specimens is representative of end-use conditions.

3.9.2 The I-stud framed walls shall be 8 feet by 8 feet (2438 mm by 2438 mm) for walls having an aspect ratio of 1:1, and shall be 8 feet by 4 feet (2438 mm by 1219 mm) for walls having an aspect ratio of 2:1, with the I-studs placed at 24 inches (610 mm) on center unless the structural wood-based panel thickness requires closer spacing. There shall be a double stud at each end of the wall, with the sheathing attached only to end studs with fasteners placed at the minimum edge distance. The fastener edge distance shall not exceed the minimum edge distance specified in the code.

3.9.3 Structural wood-based panels shall be attached to boundary framing members with fasteners spaced 3 inches (76 mm) on center, and shall be attached to intermediate framing members with fasteners spaced 12 inches (305 mm) on center, unless the panel-thickness/I-stud-spacing combination requires closer spacing. Gypsum wallboard shall be attached to boundary and intermediate framing members using the minimum and maximum fastener schedule specified in the applicable code.

3.9.4 Each wall shall be loaded three times, the first time to the code-established design shear, the second time to twice the design shear, and the final time to ultimate. Deflection readings shall be recorded at minimum increments of one-quarter design shear. After the first and second load applications, the load is removed and the residual deflection (set) is recorded after a 5-minute recovery period at no load. On the third load

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application, deflections shall be recorded to a minimum of 2¹/₂ times design load.

3.9.5 Deflection at the design load and at twice the design load, set after removal of load, and description of failure, shall be included in the test report. The number of overdriven and underdriven fasteners, and the number of fasteners with reduced edge margin, shall be reported for each wall.

3.10 Fire-resistance-rated Fire-resistive Assemblies: Wall panel assemblies with wood I-studs are permitted to be recognized as ~~fire-resistive~~ fire-resistance-rated assemblies, provided the assemblies meet the test requirements specified in ASTM E 119.

3.11 Sound-rated Assemblies: Wall panel assemblies with wood I-studs are permitted to be recognized as sound-transmission-control assemblies, provided the assemblies meet the test requirements specified in the applicable code.

3.12 Analysis of Test Results:

3.12.1 Axial, Flexural and Shear Capacity: The capacity of the wood I-studs shall be derived analytically, ignoring the axial contribution of the web in compression as well as its contribution in bending, through the use of recognized engineering principles and the use of published design values for the lumber grade of the wood components of the I-stud.

Allowable design values of the wood I-stud shall be established based on the values obtained analytically, and shall subsequently be confirmed empirically through the testing program found in this criteria. ASTM D 2915 and ASTM D 5456 may be used for guidance in establishing design values. The test results obtained by following this criteria shall be used to qualify only the tested I-stud heights, and shall not be used for interpolation or extrapolation.

The evaluation report applicant is permitted to develop an engineering mechanics-based algorithm or model to represent the wood I-stud behavior, provided all assumptions are correlated to test results, based on strength and deflection. Additionally, the method of supporting the panels at points of reaction in actual building construction shall be considered in determining the allowable loads.

3.12.2 Shear Wall Capacity: The allowable shear values for wood structural panel shear walls specified in the code are applicable to I-stud framed shear walls, provided the ultimate shear load of the walls tested, divided by the allowable shear, yields a minimum load factor of 3.0. For the purposes of this criteria, allowable shear values for wood structural panel shear walls are applicable to wind, Seismic Design Categories A, B and C (IBC), and Seismic Zones 0, 1 and 2 (UBC).

3.13 Performance Requirements for Adhesives: Adhesives used to fabricate the I-studs shall comply with Section 5.3 of ASTM D 5055. Additionally, adhesives used for web-to-web, web-to-flange and flange-to-flange

joints shall be qualified for heat durability performance through testing in accordance with ASTM D 7247. The test temperature and heat exposure duration for specimens tested at elevated temperature (Section 7.2 of ASTM D 7247) shall meet the requirements of Sections 3.13.1, 3.13.2, 3.13.3 and 3.13.4 of this criteria.

3.13.1 For the bonded specimens, the minimum target bondline temperature shall be 220°C (428°F). For the matched solid wood control specimens, the minimum target temperature at the shear plane shall be 220°C (428°F).

3.13.2 The minimum target temperatures in Section 3.13.1 of this criteria shall be maintained for a minimum of 10 minutes or until a residual strength ratio for the solid wood control specimens of 30±10% has been achieved, whichever is longer.

3.13.3 Block shear testing shall be conducted at a test laboratory room temperature not less than 15.5°C (60°F) immediately after removal from the oven. The time interval from the removal of the test specimen from the oven to failure of the block shear specimen shall not exceed 60 seconds for each specimen tested.

Note:The intent of setting the time interval is to prevent the test specimen bondline or shear plane temperature from dropping more than 5 C (9 F) prior to failure after leaving the oven.

3.13.4 The residual shear strength ratio for the bonded specimens, as calculated in accordance with ASTM D 7247, shall be equal to or higher than the lower 95% confidence interval on the mean residual shear strength ratio for the solid wood control specimens.

4.0 QUALITY CONTROL

4.1 The products shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS), or as otherwise acceptable to ICC-ES.

~~4.2 A quality control manual~~ Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Control ~~Manuals~~ Documentation (AC10) shall be submitted.

4.3 Quality control shall comply with Sections 8, 9 and 10 of ASTM D 5055.

~~The product label information shall indicate the evaluation report number, the manufacturer's name, the manufacturer's location, the product name, and the name of the inspection agency. If a product series is unique to a specific flange grade and species, and if the relationship between grade, species and series is shown in the evaluation report, the series designation, rather than the flange grade and species, is permitted to be indicated on the product. Additionally, each I-stud shall bear the wording "For use in prefabricated wall panels only."~~ ■

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TABLE 1—MINIMUM NUMBER OF TEST SPECIMENS

I-STUD DEPTH (inches)	I-STUD LENGTH (feet)				
	8	10	12	14	16
	Minimum Number of Test Specimens for Column-Compression, Flexure and Shear Testing				
5.5	28	10	10	10	10
7.25	28	10	10	10	10

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

TABLE 2—ALLOWABLE BASIC RELATIVE DENSITY RANGES FOR NLGA GRADED LUMBER

SPECIES GROUP	SPECIES TO BE USED FOR TEST SPECIMEN	ALLOWABLE SPECIFIC GRAVITY RANGE
Douglas fir-larch (N)	Douglas fir	0.39 - 0.46
Hem-fir (N)	Hem-fir	0.31 - 0.37
S-P-F	Spruce (any species)	0.31 - 0.36
North species	White pine	0.31 - 0.37

TABLE 3—REFERENCED STANDARDS

STANDARD	DATE OF STANDARD				
	IBC	IRC	BNBC	SBC	UBC
ASTM D 5055	04 97 ⁰¹	04 97e04	98a	90	90
ASTM D 5456	03 98	—	96	—	—
ASTM E 72	02	—	98	—	—
ASTM E 119	00 98	00 98	98	95a	83

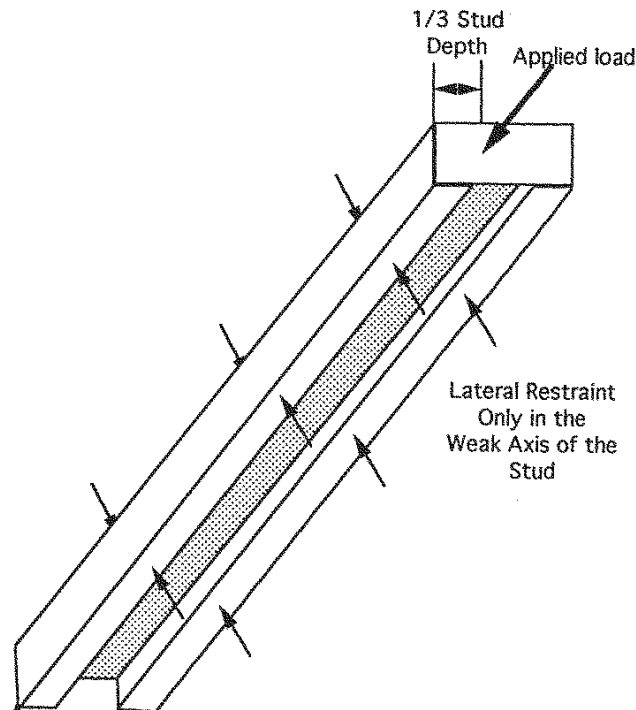


FIGURE 1—AXIAL TEST SPECIMEN