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July 31, 2009

**To:** Parties Interested in Evaluation Reports on Structural Wood-based Products Used as Wall Studs

**Subject:** Revisions to the Acceptance Criteria for Wood-based Studs, Subject AC202-0609 (JS/KS)

Dear Madam or Sir:

In June 2009, proposed revisions to the subject acceptance criteria were posted on the ICC-ES web site for public comment, under the alternative criteria process. The revised criteria was concurrently balloted to the ICC-ES Evaluation Committee, which approved the revisions as proposed, with an effective date of August 1, 2009.

A copy of the revised acceptance criteria is enclosed. Evaluation reports issued on or after the effective date noted above, and falling within the scope of this criteria, will be required to comply with the enclosed edition of the criteria. Evaluation reports issued prior to the effective date may be in compliance either with the enclosed criteria or with the previous edition. Evaluation reports based on a superseded version of an acceptance criteria must be brought into compliance with the most recent edition at the time the reports are reissued. Therefore, affected report holders should submit data verifying compliance at the time they apply for re-examination.

If you have any questions, please contact Jason V. Smart, Senior Evaluation Specialist at (800) 423-6587, extension 5692. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,

A handwritten signature in black ink that reads 'Kurt Stochlia'.

Kurt Stochlia, P.E.  
Technical Director

KS/raf

Enclosure

cc: Evaluation Committee

## ACCEPTANCE CRITERIA FOR WOOD-BASED STUDS

**AC202**

**Approved June 2009**

**Effective August 1, 2009**

**Previously approved October 2003**

### 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.

This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable code(s) referenced in the acceptance criteria. The criteria was developed and adopted following public hearings conducted by the ICC-ES Evaluation Committee, and is effective on the date shown above. All reports issued or reissued on or after the effective date must comply with this criteria, while reports issued prior to this date may be in compliance with this criteria or with the previous edition. If the criteria is an updated version from the previous edition, a solid vertical line (|) in the margin within the criteria indicates a technical change, addition, or deletion from the previous edition. A deletion indicator (→) is provided in the margin where a paragraph has been deleted if the deletion involved a technical change. This criteria may be further revised as the need dictates.

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 set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise demonstrate compliance with the performance features 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 if 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.***

# ACCEPTANCE CRITERIA FOR WOOD-BASED STUDS (AC202)

## 1.0 INTRODUCTION

**1.1 Purpose:** To establish minimum requirements for mechanical properties, fire resistance, fastener capacities and durability performance of wood-based studs that are to be recognized in ICC-ES evaluation reports under Section 104.11 of the **2006 and 2009 International Building Code**® (IBC) for allowable stress design; Section 104.11 of the **2006 and 2009 International Residential Code**® (IRC); Section 106.4 of the **BOCA**® *National Building Code/1999* (BNBC); Section 103.7 of the **1999 Standard Building Code**® (SBC); and Section 104.2.8 of the **1997 Uniform Building Code**™ (UBC).

**1.2 Scope:** Materials complying with this criteria are considered to be alternatives to sawn lumber studs complying with Section 2308.9 of the IBC, Section R602 of the IRC, Section 2305 of the BNBC, Section 2308 of the SBC, and Section 2320.11 of the UBC. Materials that do not comply with Section 3.0 of this criteria are beyond the scope of this criteria.

### 1.3 Codes and Referenced Standards:

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

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

**1.3.3 2006 International Building Code**® (2006 IBC), International Code Council.

**1.3.4 2006 International Residential Code**® (2006 IRC), International Code Council.

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

**1.3.6 1999 Standard Building Code**® (SBC).1

**1.3.7 997 Uniform Building Code**™ (UBC).

**1.3.8 ASTM E 72-05**, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

**1.3.9 ASTM E 119-07**, Standard Test Methods for Fire Tests of Building Construction and Materials.

**1.3.10 ASTM D 1761-06**, Standard Test Method for Mechanical Fasteners in Wood, ASTM International.

**1.3.11 ASTM D 2395-07a**, Standard Test Method for Specific Gravity of Wood and Wood Based Materials, ASTM International.

**1.3.12 ASTM D 4442-07**, Standard Test Method for Direct Moisture Content Measurement of Wood and Wood-based Materials, ASTM International.

**1.3.13 ASTM D 5456-05a**, Standard Specification for Evaluation of Structural Composite Lumber Products, ASTM International.

**1.3.14 ASTM D 6815-02a**, Standard Specification for the Evaluation of Duration of Load and Creep Effects of Wood and Wood-based Products, ASTM International.

**1.3.15 ANSI/AF&PA NDS-05**, National Design Specification (NDS) for Wood Construction with **2005 Supplement**, American Forest & Paper Association.

**1.3.16 ICC-ES Acceptance Criteria for Structural Wood-based Products** (AC47).

**1.3.17 ICC-ES Acceptance Criteria for Rim Board Products** (AC124).

## 2.0 BASIC INFORMATION AND REPORT OF TESTS

**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, and fastening methods.

**2.1.3 Identification:** Products shall be identified with a stamp bearing the manufacturer's name, the plant number, the product designation or type, the production date, the grade, the species or species group designation, the name or logo of the inspection agency, and the evaluation report number.

### 2.2 Testing Laboratories, Reports of Tests, and Product Sampling:

**2.2.1** Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and with Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

**2.2.2** Test reports shall comply with AC85.

**2.2.3** Product sampling shall be in accordance with Section 3.1 of AC85. Specimens for qualification testing shall be representative of production.

## 3.0 TEST PERFORMANCE AND ANALYSIS

### 3.1 General:

**3.1.1** For purposes of this criteria, wood-based studs, having a rectangular cross section, are produced from materials described in AC47.

**3.1.2** The minimum thickness of wood-based studs shall be 1.5 inches (38.1 mm), subject to the tolerances noted in Section 5.1.3 of this criteria.

**3.1.3** Moisture content and specific gravity shall be measured and reported for specimens tested in the qualification program. Measurements for moisture content shall be in accordance with ASTM D 4442, and measurements for specific gravity shall be in accordance with ASTM D 2395. Density measurements may be used as an alternative to specific gravity measurements.

**3.1.4** The wood-based stud material shall meet all applicable requirements in AC47 and ASTM D 5456, in addition to the requirements in this criteria.

**3.1.5** Assemblies required to be tested in accordance with Section 3.2.3 are not required to be conditioned unless otherwise noted in this criteria.

### 3.2 Allowable Design Properties:

**3.2.1 Mechanical Properties:** Allowable design stresses shall be determined in accordance with AC47 and Section 7 of ASTM D 5456.

#### 3.2.2 Fastener Capacities:

**3.2.2.1** In addition to the fastener requirements in AC47, fastener capabilities are required for (a) connection of the structural wall sheathing or covering, and (b) attachment of the stud to the top and bottom wall plates. Item (a) shall be resolved by conducting tests in accordance with Section 3.2.3 of this criteria. Item (b) shall

be resolved by conducting tests in accordance with Section 3.2.2.2.

The minimum allowed spacing of nails or other fasteners driven into the stud edge shall be determined such that splitting detrimental to the stud performance or fastener capacity is avoided.

**3.2.2.2 Attachment to Top and Bottom Plates:** The lateral nail capacity for attachment of stud to top and bottom plates shall be determined in accordance with the method described in this section (Section 3.2.2.2).

**3.2.2.2.1** A minimum of ten assemblies of each combination of stud specific gravity shall be tested. Consideration needs to be given to the type and species of wood plate material, since SPF lumber is specified in the tests.

**3.2.2.2.2** The assembly shall be as described in Figure 2.

**3.2.2.2.3** Testing shall be conducted in accordance with the applicable procedures noted in Sections 27 and 28 of ASTM D 1761.

**3.2.2.2.4** The average nail lateral capacity for ten assemblies of each combination (4-16d common nails per assembly) shall be not less than 845 pounds (3.77 kN).

### **3.2.3 Lateral Load Transfer Capacity:**

**3.2.3.1 General:** A relationship needs to be established between the lateral load transfer capacity, derived from small-scale tests noted in Section 3.2.3.2, and full-scale shear wall tests noted in Section 3.2.3.3. Establishing such a relationship results in avoidance of the need to conduct numerous full-scale shear wall tests to verify that the wood-based studs are a viable substitute for sawn lumber studs, in shear wall systems. This assumes that recognition for code shear wall values will be requested. In lieu of pursuing a viable substitute approach, it is permitted to derive specific (proprietary) lateral load capacities, based on specific construction details. The extent of small-scale (Section 3.2.3.2) and full-scale (Section 3.2.3.3) testing will depend on how wide a spectrum of shear values, based on materials of construction and fastener details, is requested.

A test program, including a test matrix, for both small-scale and full-scale tests shall be submitted to the ICC-ES staff for review prior to the commencement of testing. The goal of the test program is to establish the equivalency of the wood-based stud assemblies to the sawn lumber assemblies noted in the code shear wall tables, or to derive proprietary shear values based on specific construction details.

**3.2.3.2 Small-scale Test:** Test results shall be used with the full-scale tests to derive proprietary lateral load capacity values or to verify table values. In lieu of small-scale testing, all testing may be full-scale.

**3.2.3.2.1** A minimum of ten assemblies of each critical combination of minimum stud material specific gravity, thickness of sheathing, minimum stud size and nailing schedule shall be tested.

**3.2.3.2.2** A test assembly shall consist of a wood-based stud and sheathing as shown in Figure 3 (also note minimum nailing requirements). Note: Sheathing needs to be restrained or attached to a rigid base.

**3.2.3.2.3** The minimum nailing schedule for the test assembly shall follow the requirements given in Figure

3. The first and last nails between sheathing and the stud shall be 3 inches (76 mm) from the end.

**3.2.3.2.4** The assemblies shall be fabricated at least 12 hours before testing.

**3.2.3.2.5** The assemblies prepared in accordance with Sections 3.2.3.2.1 through 3.2.3.2.4 shall be tested as follows:

**3.2.3.2.5.1** The load shall be applied through the stud while the sheathing reacts through full width bearing, or vice versa. Vertical restraints, such as rollers that do not interfere with the lateral resistance, or other similar devices, may be used to provide vertical restraint to avoid overturning of the assembly. The restraints shall not interfere with the lateral deformation of the assembly in the direction parallel to the loading. (See Figure 2.)

**3.2.3.2.5.2** Assembly deformations shall be measured based on the relative lateral displacements between the sheathing and the stud along the entire length of the stud. Vertical displacements caused by overturning forces, if any, shall be isolated from the measurements of lateral deformations.

**3.2.3.2.5.3** The loading rate shall not exceed a rate that will cause time to failure to be less than 5 minutes.

**3.2.3.2.5.4** The assembly shall be loaded to ultimate load. No preload shall be applied. Load and deformation readings shall be taken at approximately equal load increments.

**3.2.3.2.6** The maximum lateral load transfer capacity for each assembly shall be determined from the test results of Section 3.2.3.2.5 divided by the stud length, in plf. The shear value for each stud combination shall be the average of the maximum lateral load capacities (average of ten assemblies) divided by 3.0 or the shear capacity resulting from an average net deformation (average of ten assemblies) that does not exceed the calculated deformation (using the construction details for each assembly) using the  $e_n$  derived from Section 3.2.3.5 of this criteria. The lateral load transfer capacity shear value shall not be increased for duration of load.

**3.2.3.3 Full-scale Test:** Test results shall be used with the small-scale tests (unless all the testing consists of full scale testing) to derive proprietary lateral load capacity values or to verify table values.

**3.2.3.3.1** A minimum of two wall assemblies (8 feet by 8 feet) shall be constructed and tested in accordance with ASTM E 72 (except as noted below), as a minimum for establishing a relationship with the small-scale tests and the code tables. The maximum nail size and minimum nail spacing for which recognition is requested shall be tested. The sheathing shall be the type and thickness, developing the highest shear value, for which recognition is requested. Additional assembly testing may be required based on the objectives of the test program noted in Section 3.2.3.1 of this criteria.

- The following deviations from ASTM E 72 shall apply in order to align with current industry practice and with PS-2:

- Each wall test shall be cycled to load levels of 1x and 2x design prior to being loaded to failure. The first cycle shall be completed in not less than 2 minutes. All

subsequent cycles shall be loaded at the same load rate (lbs/min).

- The test material does not need to be conditioned.
- As an alternate, deflections may be measured using a single measurement device at the top corner using a frame similar to that depicted in Figure 2 of APA Research Report 154.

**3.2.3.3.2** If the ultimate shear capacity of the two wall assemblies differs by more than 15 percent, an additional wall assembly shall be tested.

**3.2.3.3.3** The shear value, in plf, for each test assembly, shall be the lesser of the ultimate shear capacity [plf (N/m)] divided by 2.8 or the average shear capacity [plf (N/m)] at which the in-plane deflection of the wall equals 0.20 inch (5.1 mm). Alternative performance levels are acceptable when the applicant's test program demonstrates equivalence to sawn lumber framing.

**3.2.3.3.4** The shear value, used in the comparison described in Section 3.2.3.4 of this criteria, shall be the average shear value obtained from the two or three test results (Section 3.2.3.3.3 of this criteria). More than one shear value may be required for comparison, based on the objectives of the test program.

**3.2.3.4** The shear values determined in accordance with Section 3.2.3.3.4 shall be compared to comparable code shear wall table values for the purpose of determining equivalence of the wood-based studs, when used as framing elements in shear wall assemblies, to sawn lumber studs. Failure to meet, or choosing not to meet, a favorable comparison will result in proprietary shear values based on specific construction details.

**3.2.3.5** The values for  $e_n$  shall be determined using the lateral nail tests conducted in accordance with ASTM D 1761.

### 3.3 Durability:

- The wood-based stud material shall be tested in accordance with Section 4.2 of AC124 and meet the thickness swell requirements noted in this section, for materials qualified under Section 3.3 of AC47.

- Lateral edge nailing durability connection test protocol shall be conducted in accordance with Section 4.3 of AC124, using the assembly noted in Figure 2 of this criteria. The wood-based material must meet the requirements noted in Section 4.3.6 of AC124.

**3.4 Creep and Duration of Load:** If deemed appropriate, creep and duration of load (DOL) testing shall be conducted in accordance with ASTM D 6815.

**3.5 Notches and Holes:** A test program shall be developed and submitted to the ICC-ES staff for review. Testing must be conducted in accordance with the principles noted in ASTM D 5456. Both axial, and a combination of axial and lateral, loads shall be considered. The test program is permitted to pursue two approaches:

- Location and size for proprietary notches and holes, derived from the test results.
- Results of tests verifying that the cutting, notching, and boring comply with Sections 2308.9.10 and 2308.9.11 of the IBC, Section R602.6 of the IRC, Section 2305.5.1 of the NBC, Section 2308.7 of the SBC, and Sections 2326.11.9 and 2326.11.10 of the UBC.

**3.6 Fire Resistance (Optional):** If recognition for fire-resistive construction is desired, the wall assembly constructed with wood-based studs shall be tested in accordance with ASTM E 119. Details of the fire-resistive assembly construction shall be submitted to the ICC-ES staff for review, prior to commencement of the fire tests.

## 4.0 DESIGN AND APPLICATION CONSIDERATIONS

**4.1** Duration of load adjustments applicable to solid sawn lumber studs are applicable to wood-based studs, provided the requirements in Section 3.4 of this criteria are met, except as noted in Section 3.2.3.2.6.

**4.2** A repetitive member or load sharing factor of 1.04 may be applied to the design bending stress of all wood-based studs that (a) meet the requirements of this acceptance criteria; (b) are in mutual contact or spaced no more than 24 inches (610 mm) on center; (c) are not less than three in number; and (d) are joined by load distributing elements adequate to support the applicable design loads.

**4.3** The design of wood-based studs shall comply with NDS-05. The volume factors applicable to bending and axial tension shall be determined in accordance with Section 7.4.1 of ASTM D 5456.

## 5.0 QUALITY CONTROL

### 5.1 General:

**5.1.1** Wood-based studs shall be produced under a quality control program administered by an inspection agency accredited by International Accreditation Service, Inc., or otherwise acceptable to ICC-ES. **Quality documentation** complying with the **ICC-ES Acceptance Criteria for Quality Documentation (AC10)** shall be submitted.

**5.1.2** Quality control shall comply with Section 5.2 of this criteria, and Section 3 of AC47.

**5.1.3** Wood-based studs shall be manufactured to the following tolerances: width: +/- 1/16 inch (+/- 1.6 mm); thickness: +/- 1/16 inch, (+/- 1.6 mm).

### 5.2 Quality Assurance Testing:

**5.2.1 Test Equipment:** Test equipment shall be properly maintained, calibrated and evaluated for accuracy and adequacy at a frequency satisfactory to the inspection agency.

**5.2.2 Required Tests:** The following shall be considered to be the scope of a minimum testing program:

**5.2.2.1** The thickness swell test described in Section 3.3 shall be used for quality assurance of thickness swell.

**5.2.2.2** Moisture content and specific gravity data shall be determined by the same process as in Section 3.1.3, at a frequency that provides a representative sample of production.

**5.2.2.3** Modulus of rupture, tension and modulus of elasticity tests shall be conducted, for edgewise bending, in accordance with ASTM D 5456. The specimen cross section shall not be less than the minimum structural size. Loading for edgewise bending shall be at third points and with a span-to-depth ratio in the range of 17 to 21.

**5.2.2.4** Test frequency for all tests shall be chosen to yield quality assurance performance that is consistent

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA  
FOR WOOD-BASED STUDS

with design values assigned to the product and its intended use

**5.3 Process Control:** Process control is to be conducted in accordance with Section 10 of ASTM D 5456.

**6.0 EVALUATION REPORT RECOGNITION**

Installation instructions or drawings shall accompany the product to the jobsite. The instructions shall include any

special instructions required for the product as well as weather protection and handling requirements. In cases where attachment requirements, lateral support details, framing details and bearing or connection requirements are not adequately covered by general notes, standard sketches and charts shall be included with the installation instructions, or specific job drawings shall properly cover these requirements. ■

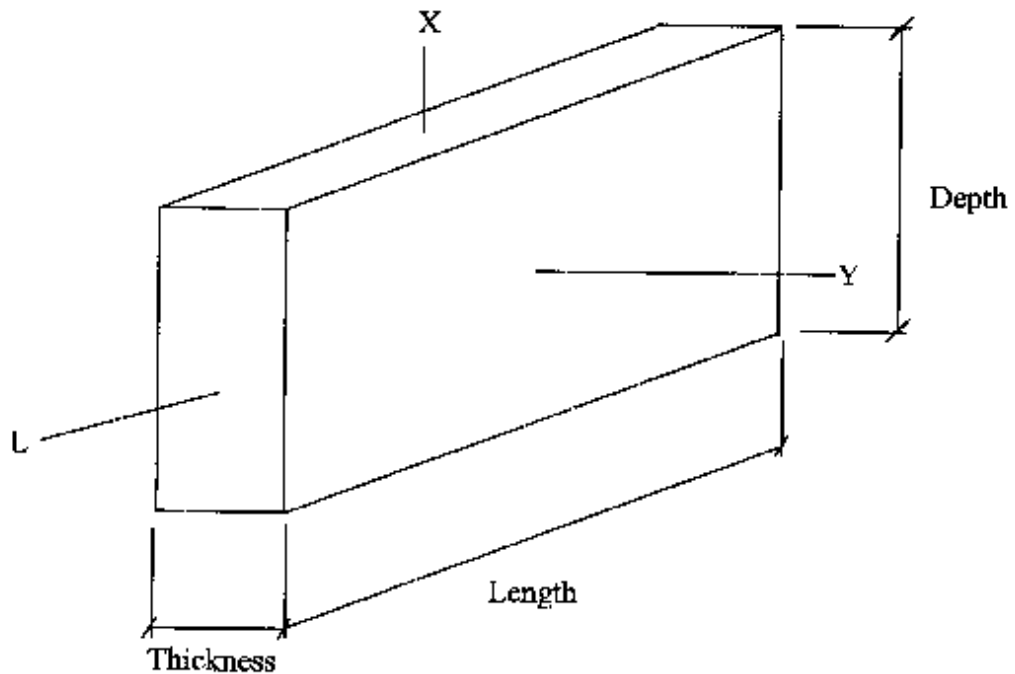
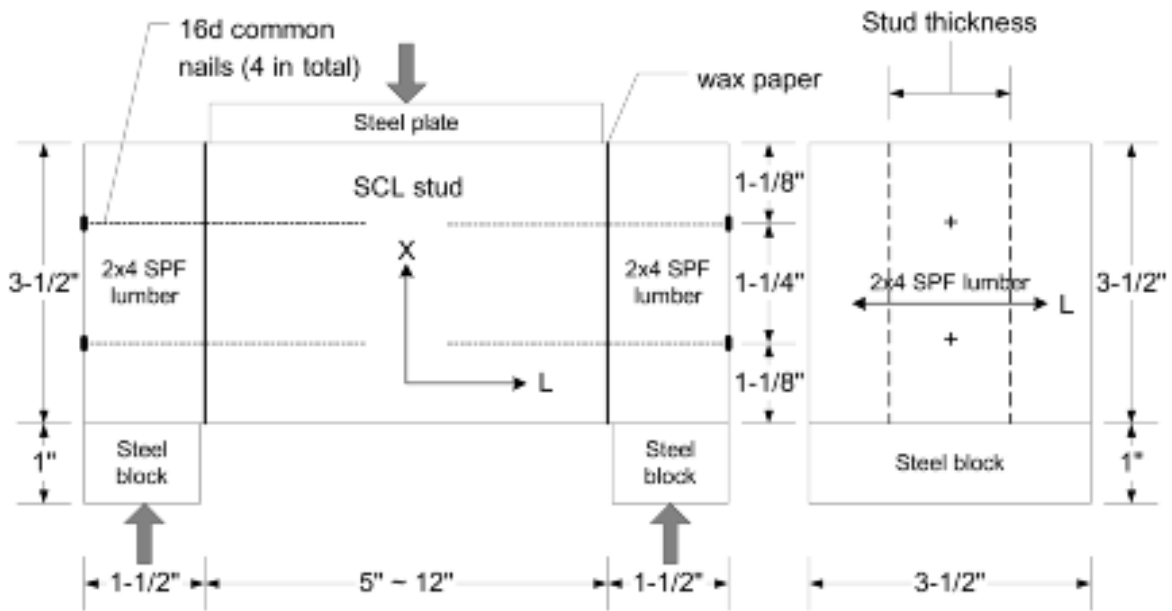


FIGURE 1—STUD ORIENTATION



- Lateral restraints are permitted on the outer faces of the 2x4 SPF lumber to prevent the assembly from rotation.
- The steel blocks and plate shall be properly sized so as not to interfere with the vertical movement of the SCL stud.

FIGURE 2—LATERAL END GRAIN CAPACITY TEST

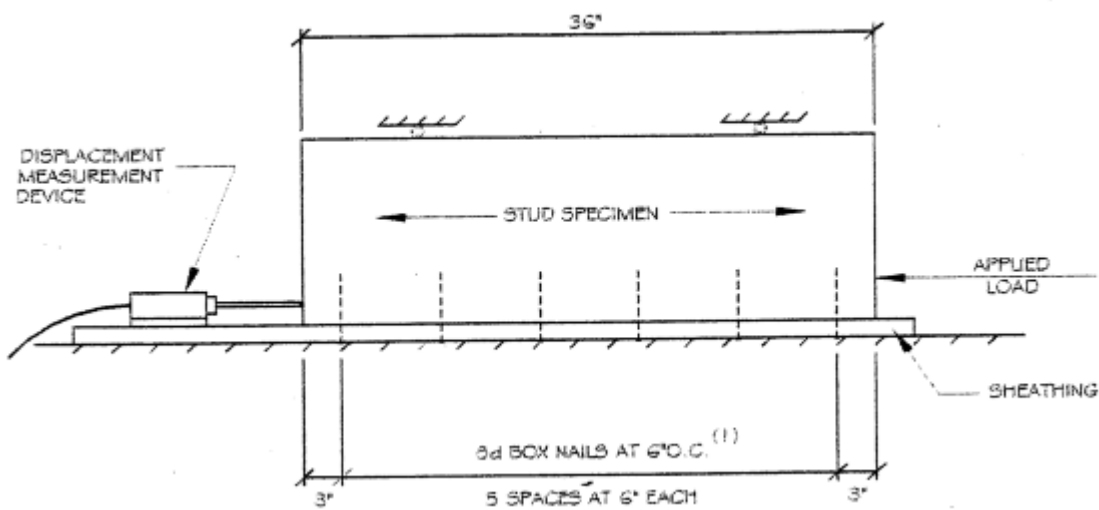


FIGURE 3—LATERAL END GRAIN CAPACITY TEST