

ACCEPTANCE CRITERIA FOR DECK BOARD SPAN RATINGS AND GUARDRAIL SYSTEMS (GUARDS AND HANDRAILS)

AC174

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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 by ICC-ES 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 the basis of recognition of deck board span ratings and guardrail system performance (guards and handrails), in ICC Evaluation Service, Inc. (ICC-ES), evaluation reports, under the 2009 *International Building Code*[®] (2009 IBC), the 2009 *International Residential Code*[®] (2009 IRC), the 2006 *International Building Code*[®] (2006 IBC), the 2006 *International Residential Code*[®] (2006 IRC), the 1997 *Uniform Building Code*[™] (UBC), the BOCA[®] *National Building Code/1999* (BNBC), and the 1999 *Standard Building Code*[®] (SBC). Bases of recognition are IBC Section 104.11, IRC Section R104.11.1, UBC Section 104.2.8, BNBC Section 106.4, or SBC Section 103.7, as applicable. The reason for development of this criteria is that the code does not address the use of materials identified in Section 1.2 of this criteria for use in deck board and guardrail applications.

1.2 Scope: Recognition of the deck boards in an ICC-ES evaluation report shall be restricted for use to exterior applications for residential buildings classified as Type V-B (IBC), Type V-N (UBC), Type 5B (BNBC), or Type VI (SBC) construction, and dwellings regulated by the IRC.

Recognition of the guardrail systems (guards and handrails) in an ICC-ES evaluation report shall be restricted to exterior applications for residential and/or nonresidential buildings classified as Type V-B (IBC), Type V-N (UBC), Type 5B (BNBC), or Type VI (SBC) construction, and dwellings regulated by the IRC.

Exceptions:

1. Deckboard products that meet the additional requirements noted in Section 4.1.3 of this criteria shall not be restricted to residential use.

2. Use as guards is permitted under the IBC on buildings of other types of construction in applications where untreated wood is permitted by Section 1406.3.

Deck boards and guardrail systems (guards and handrails) covered by this acceptance criteria shall be of any shape and thickness (solid or non-solid). Deckboards and guardrails (guards and handrails) shall be manufactured from materials not prescribed by the applicable code, such as wood, steel, concrete, and aluminum, except that they are permitted to be reinforced with materials prescribed by the applicable code, such as steel or aluminum.

A deck board and a deck board used as a stair tread are assigned a span rating indicating the board's ability to comply with functions identified for its specific end use. A guardrail system (guard and handrail) is recognized for its ability to meet minimum code requirements specified in IBC Section 1607.7.1, BNBC Section 1606.4, SBC Section 1608.2, or UBC Section 1607.3.4, as applicable.

Note: There is a general assumption in this criteria that the stair treads are produced from the same material as the deck boards. If this is not the case, the stair treads are required to comply with all the deck board requirements, except as noted.

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).

1.3.7 1997 *Uniform Building Code*[™] (UBC).

1.3.8 ASTM D 7031-04, Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products, ASTM International.

1.3.9 ASTM D 7032-07, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails), ASTM International.

1.3.10 ASTM E 84[-04 (2006 IBC), -07 (2009 IBC)], Test Methods for Surface Burning Characteristics of Building Materials, ASTM International.

1.3.11 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference, ASTM International.

1.3.12 ASTM D 2017-05, Standard Test Method of Accelerated Laboratory Test of Natural Decay Resistance of Woods, ASTM International.

1.4 Definitions:

1.4.1 Guard: A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level. Guards shall comply with IBC Section 1013, IRC Section R312, BNBC Section 1021.1, SBC Section 1015.1 or UBC Section 509, as applicable.

1.4.2 Guardrail System: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from walking surface to the lower level.

1.4.3 Handrail: A horizontal or sloping rail intended for grasping by the hand for guidance or support. Handrails shall comply with 2009 and 2006 IBC Section 1012, 2009 IRC Section R311.7.7, 2006 IRC Section R311.5.6, BNBC Section 1022, SBC Section 1007.5, and UBC Section 1003.3.3.6, as applicable.

1.4.4 Span Rating: An index number that identifies the test span used in all structural load testing, which is the maximum center-to-center support spacing for the specified end use, and allowable design capacity, in pounds per square foot (kN/m²), determined in accordance with this acceptance criteria. For example, a deck span rating of 16/100 recognizes the deck board for installation on floor joists spaced a maximum of 16 inches (406 mm)

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on center, and for supporting the load combinations required by the applicable code, which in this case cannot exceed 100 psf (4.79 kN/m²).

1.4.5 Standard Terminology: Standard terminology for deck boards and guardrail systems (guards and handrails) given in Section 3.0 of ASTM D 7032 is applicable to this acceptance criteria.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: 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: The report shall indicate how the product will be identified. Identification shall be in accordance with the following:

2.1.3.1. Decking and guardrail assemblies shall be identified by a product label. Labels shall identify the product, the manufacturer, the ICC-ES evaluation report number and the inspection agency. In addition, decking and guardrail assemblies complying with the 2009 IBC and the 2009 IRC must include the performance level on the label. The performance level shall include the span rating for use as deck board and the allowable span for stair treads and guardrail assemblies.

2.1.3.2. Labels may be permanent or removable.

2.1.3.3. Labeling may be applied to the finished product or the product packaging.

2.1.3.3.1. When package labeling is used, packages must be labeled as sold, by the report holder or an approved fabricator/repackaging facility (see Section 6.1 of this criteria), and must be identifiable by the local building official.

2.1.3.3.2. When not labeling the entire assembly, individual components or their packaging may be labeled.

2.1.3.3.3. Other methods of product identification using the ICC-ES evaluation report number must be approved by the report holder's inspection agency and ICC-ES.

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 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.

2.4 Product Sampling: Products for testing shall be sampled in accordance with Section 3.1 of AC85. Products shall be sampled at the manufacturing site by an accredited inspection agency or testing laboratory acceptable to ICC-ES. Exceptions to sampling at the manufacturing site, such as at a warehouse or distribution center, require written consent by ICC-ES. The sampled

product shall be representative of the standard manufactured product for which recognition is sought.

Variations in color shall be considered in the evaluation of products establishing flexural properties under Section 3.4 and UV resistance under Section 3.7, unless data is submitted indicating there is no effect.

3.0 TEST PERFORMANCE AND REQUIREMENTS

3.1 General: ASTM D 7032 is used as a primary reference for this criteria. Only those sections of ASTM D 7032 specifically referenced in this criteria are applicable.

3.2 Sample Size: The sample sizes for testing shall be determined in accordance with Section 4.2 of ASTM D 7032 for deckboards and ASTM D 7032 Sections 6.2 and 6.3 for guardrails, with the exceptions noted in this acceptance criteria.

3.3 Conditioning: Conditioning of test material shall be performed in accordance with Section 4.3 of ASTM D 7032.

3.4 Deck Board Flexural Tests: All flexural tests shall be conducted in accordance with Section 4.4 of ASTM D 7032, except that the constant strain rate shall be determined by using the "nonsimplified version" of the formula used to calculate strain rate and the appropriate geometric properties (stiffness) shall be utilized at the location where the failure occurs (positive and negative). A preliminary test would be required to determine which location is applicable.

The two-span test method defined in Annex 1 of ASTM D 7032 shall also be permitted for flexural testing of deck boards and deck boards used as stair treads. Also, see Section 4.1.5 in this criteria.

Data resulting from testing shall be used to determine a span rating, which shall identify the maximum center-to-center spacing (inches or mm) of the joists and the allowable load capacity of the deck boards (psf or kN/m²).

3.5 Guardrail System (Guard and Handrail) Performance Rating: Structural load testing in accordance with Section 5.0 of this acceptance criteria is required to establish a guardrail system (guard and handrail) performance rating based on code-prescribed load requirements specified in IBC Section 1607.7.1, IRC Table R301.5, BNBC Section 1606.4, SBC Section 1608.2, and UBC Section 1607.3.4, as applicable.

3.6 Temperature and Moisture Effects: To establish the effect of temperature and moisture on materials used to fabricate deck boards and components of guardrail systems, all tests shall be conducted in accordance with Section 4.5 of ASTM D 7032. Moisture effect testing is not required for deck boards and components of guardrail systems (guards and handrails) manufactured with materials that do not absorb water.

3.7 Ultraviolet (UV) Resistance: The resistance to UV exposure of materials used to fabricate deck boards and components of guardrail systems (guards and handrails) shall be evaluated in accordance with Section 4.6 of ASTM D 7032, except that adjustment factors for stiffness also shall be considered. Alternatively, evaluation is permitted to be conducted in accordance with ASTM D 2565 Cycle 1.

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3.8 Freeze-Thaw Resistance: The resistance to freeze-thaw cycles of materials used to fabricate deck boards and components of guardrail systems (guards and handrails) shall be evaluated in accordance with Section 4.7 of ASTM D 7032.

3.9 Termite and Decay Resistance: For deck board and guardrail systems (guards and handrails) fabricated with wood or other cellulosic materials, termite and decay resistance shall be determined in accordance with Section 4.8 of ASTM D 7032. The sampling requirements for ASTM D 2017 shall be modified to require six specimens for each of the two fungi tested. Termite and decay testing is not required for deck boards and components of guardrail systems (guards and handrails) that do not contain wood or cellulosic material. Such components shall be listed as “equivalent to preservative-treated or naturally durable wood for termite resistance” in the evaluation report.

3.10 Flame Spread: The flame-spread rating of materials used to fabricate deck boards and components of guardrail systems (guards and handrails) shall be determined by testing in accordance with Section 4.9 of ASTM D 7032. Alternatively, any other approved test procedure is permitted to be used for determining a flame-spread rating of the materials that will give comparable results to tests conducted in accordance with ASTM E 84.

3.11 Duration of Load: The duration of load effect shall be considered for deck boards. Testing shall be conducted in accordance with Section 5.10.2 of ASTM D 7032. A minimum of 15 specimens shall be loaded to a minimum of two times the expected span load, increased by the applicable adjustment factors from Sections 3.7 and 3.8 of this criteria. Tests only need to be conducted on a worst case (e.g., deck product size, span and load rating that indicates the highest flexural stress in the deck board). Condition of acceptance is zero failures and no evidence of tertiary creep (i.e., increasing creep rate).

Exception: In lieu of testing for duration of load as noted above, a comprehensive duration of load study could be considered.

4.0 DECK BOARD PERFORMANCE REQUIREMENTS

4.1 Deck boards and deck boards used as stair treads shall meet all requirements as specified in Sections 5.2 through 5.5 of ASTM D 7032, except for the following:

4.1.1 When a stair tread performance rating is desired, ASTM D 7032 shall be followed with the following exception, the maximum deflection shall be $\frac{1}{8}$ inch (3.2 mm) at 300 pounds, plus adjustments for end use, as stated in Section 5.1.2 of ASTM D 7032.

4.1.2 The sample size shall be a minimum of 15 for establishing the baseline flexural properties of the deck boards and deck boards used as stair treads in residential use applications.

4.1.3 To remove the residential end-use limitation noted in Section 1.2, the sample size shall be a minimum of 28. The unadjusted allowable load for strength determination, noted in Section 5.3 of ASTM D 7032, shall apply, except for the following: the lesser of: (a) the average ultimate load divided by 2.5, or (b) the nonparametric 5th percentile ultimate load divided by 2.1.

4.1.4 Mechanical fastener tests shall be conducted in accordance with Section 5.5 of ASTM D 7032. Proprietary fastener systems may be evaluated in accordance with ASTM E 330 in lieu of Section 5.5.

4.1.5 Two-Span Adjustment: As noted in Section 5.3.3 of ASTM D 7032, for stair treads only, when flexural testing is conducted to failure using a simple-span condition per ASTM D 7032, and the failure mode is flexure (e.g., not a crushing failure at a load point or support), two-span adjustments for flexural strength and stiffness shall be permitted. For flexural strength (MOR or moment capacity) the increase is 23 percent, and for flexural stiffness (MOE or EI) the increase is 39 percent.

Note: When using this section, consideration shall be given to the allowable load assigned to the interior support, due to the possibility of a higher load being assumed, which could cause local crushing.

5.0 GUARDRAIL SYSTEM (GUARD AND HANDRAIL) PERFORMANCE REQUIREMENTS

5.1 Guardrail System Test Requirements: Testing of guardrail systems (guards and handrails) shall be performed in accordance with Section 6.1, 6.2, and 6.3 of ASTM D 7032, except for the following:

Note: The post connection load testing described in Section 6.2.4 of ASTM D 7032 is the minimum requirement. Testing at higher loads for the post connections may be required depending on the tributary loads resulting from Section 6.2.3 of ASTM D 7032. Also, Section 6.2.1 assumes a two end post condition. Consideration needs to be given to the uniform load multiplied by the post spacing.

5.1.1 When compliance with SBC code requirements is desired, the following test loads in ASTM D 7032 shall be increased.

5.1.1.1. The stated in-fill load in Section 6.2.2 of ASTM D 7032 shall be increased to 400 lbf (1.78 kN), plus any adjustments required per Section 6.1.1 of ASTM D 7032.

5.1.1.2. The stated uniform load in Section 6.2.3 of ASTM D 7032 shall be increased to 235 lbf/ft (3.28 kNm), applied in an outward direction (based on normal installation requirements) at an angle of 58 degrees from horizontal, plus any adjustments required per Section 6.1.1 of ASTM D 7032.

5.2 Assembly Fastener Testing (Guardrail): When the guardrail system is to be installed with top rails in a corner/angled condition, determination of the connection capacity shall be established when tested in accordance with Section 5.5 of ASTM D 7032.

5.3 Guardrail Engineering Analysis Option: The allowable design stress for each component of the guardrail system shall be determined in accordance with the principles used for the deck board adjusted allowable stress derivation shown in this criteria. For components with similar cross sections, engineering stress analysis shall be permitted to be used to compute the capacity of untested profiles. Such engineering stress analysis shall be supplemented by minimal component testing (minimum of three test replications) to verify that the average capacity is being accurately predicted by the calculations. Additionally, the allowable design capacity of each

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connection shall be determined in accordance with applicable standards. The condition of acceptance of a given guardrail system shall be that the design capacity meets or exceeds the code-prescribed capacity for all components and connections. The guardrail engineering analysis option may be used in lieu of the guardrail testing criteria noted in Sections 5.1 - 5.3 of this criteria, subject to the following:

5.3.1 An engineering analysis plan covering the items noted in Sections 5.3 and 5.3.2 shall be submitted to the ICC-ES staff for review, prior to the commencement of any testing or formal submittal.

5.3.2 The following additional items shall be considered in the engineering analysis

- local buckling
- specific test protocol standards to be used in developing the connection capacities
- unbraced length effects

6.0 QUALITY CONTROL

6.1 Deck boards and guardrail systems (guards and handrails) shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS) or otherwise acceptable to ICC-ES. If any fabrication and/or repackaging is performed by anyone other than the report holder, that fabricator and/or packaging facility must be under an approved quality control program with inspections by an accredited inspection agency

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

6.3 The quality documentation shall contain a process evaluation technique and a procedure for re-evaluation of compliance with the provisions of this criteria when a significant change in the product occurs. Examples of items that shall be considered for inclusion in the quality documentation are as follows:

6.3.1 Process Evaluation Techniques:

6.3.1.1. Threshold levels shall be the same as performance values determined during the qualification testing. Quality control testing shall be performed as specified in the quality control manual. Explanations shall be provided for target quality control values established based on an analysis of qualification test data and load span ratings noted in the evaluation report. These targets shall also consider potential sources of production variability (batches, manufacturing lines, etc.).

6.3.1.2. The quality control procedures may be based on the methodology specified in *MIL-STD-1916, April, 1996, DOD Preferred Methods for Acceptance of Product*, Department of Defense.

6.3.2 Formulation and Manufacturing Change: ICC-ES will be notified in writing if there is a significant change in the product, manufacturing procedures or quality system documentation from what was recognized

upon issuance of the evaluation report. A significant change is one that may reduce the performance of the product as it pertains to applicable test standards or acceptance criteria.

7.0 EVALUATION REPORT RECOGNITION

7.1 For products evaluated as deck boards and deck boards evaluated as stair treads, the evaluation report shall contain the maximum allowable span determined by the procedures described in this acceptance criteria. For products evaluated as a guardrail system (guard and handrail), the report shall specify the maximum allowable center-to-center post spacing as determined by the procedures described in this Acceptance Criteria. In cases where the top rail (guard) is to be installed with supporting construction other than posts, the report shall specify the maximum length of the rail.

7.2 For products evaluated as deck boards or stair treads, the report shall contain the following statement: Deck boards used as stair treads shall be installed in a minimum of a two-span condition.

7.3 The report shall contain the range of temperatures utilized in the testing performed in accordance with Section 3.6 of this acceptance criteria.

7.4 The report shall contain the following statement: Compatibility of the supporting construction materials with all fasteners, metal post mount components, and other hardware components is subject to approval by the code official.

7.5 The report shall contain a complete description of the fasteners and attachment methods of a guardrail system (guard and handrail). The report shall contain the following statement: Only those types of fasteners and fastening methods described in this report have been evaluated for the installation of the [product name(s)]; other methods of attachment are outside the scope of this report.

7.6 When the product is evaluated for use in areas adopting the BNBC, for guardrail systems (guard and handrail), the distance between posts or other support structure shall be limited to 10 feet (3050 mm).

7.7 When guards are evaluated for use with one- and two-family dwellings only under the IBC and IRC, as provided in Section 6.2.1.1 of ASTM D 7032, the following shall occur:

7.7.1 The report shall include the following statement: The use of this product shall be limited to exterior use as a guard system for balconies and porches for one- and two-family dwellings of Type V-B (IBC) construction and structures constructed in accordance with the IRC.

7.7.2 The Identification section of the report shall include the following statement: The label shall also include the phrase "For Use in One- and Two-Family Dwellings Only."

7.7.3 The evaluation report shall state the type of handrail (i.e., Type I or Type II). ■