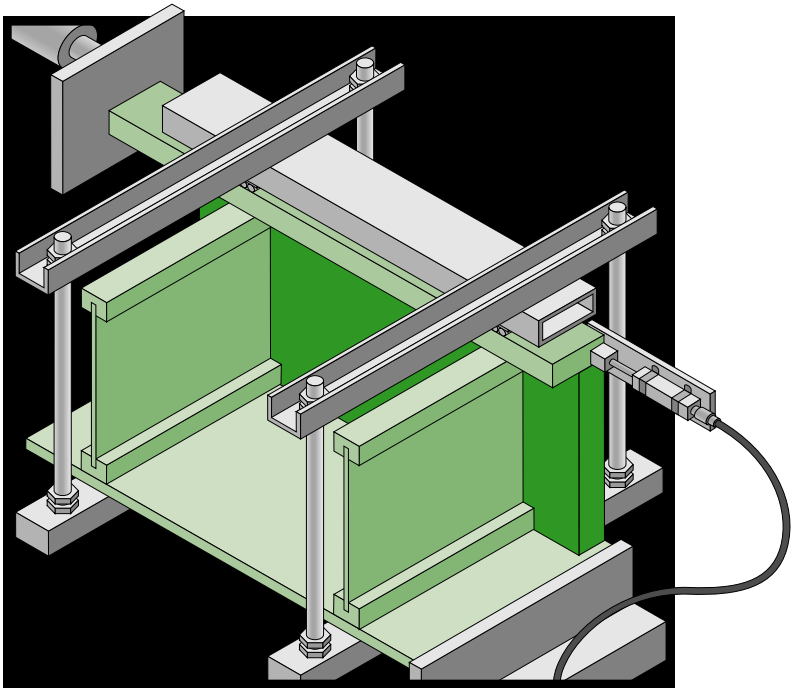
A P A  S T A N D A R D

# PRR-401®
# Performance Standard for APA EWS Rim Boards

*Effective Date April 2006*



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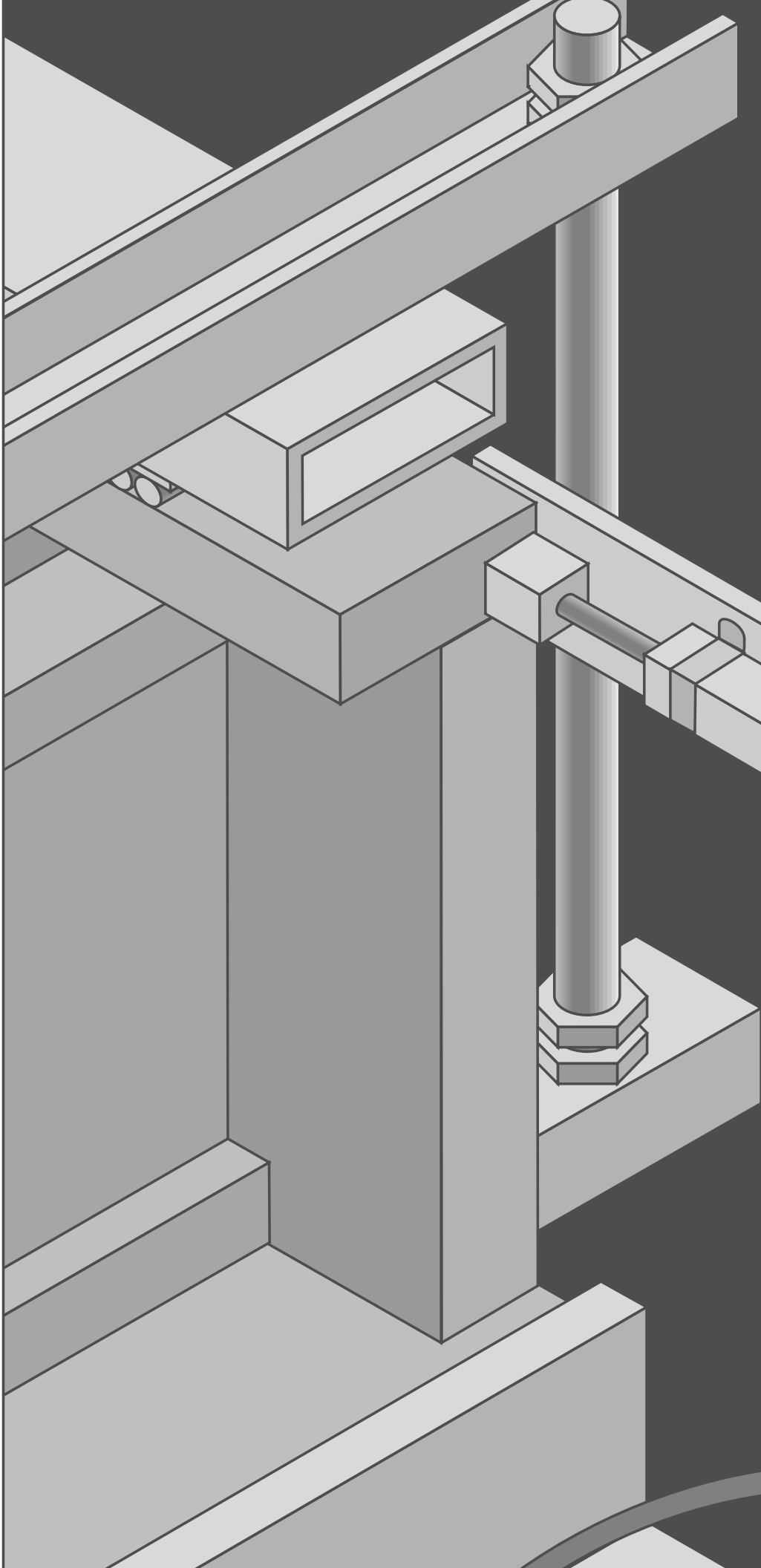


**PRR-401®**

# PERFORMANCE STANDARD FOR *APA EWS* RIM BOARDS

April 27, 2006

## 1. Scope

1.1 An *APA EWS* Rim Board is a rectangular-shaped structural-use panel, resawn structural glued laminated timber, or structural composite lumber manufactured specifically to meet the performance requirements of rim boards in wood frame construction.

1.2 Unless otherwise specified, the term "*APA EWS* Rim Boards" represents the rim board products qualified as either *APA EWS* Rim Board or *APA EWS* Rim Board Plus under this standard.

1.3 This standard provides dimensions and tolerances, performance requirements, test methods, quality assurance, and trademarking for *APA EWS* Rim Boards.

1.4 *APA EWS* Rim Boards shall be used in dry service conditions where the average moisture content of solid-sawn lumber is less than 16%.

1.5 Products carrying an *APA EWS* Rim Board trademark are to be designed and installed in accordance with recommendations published by *APA – The Engineered Wood Association*.

## 2. Referenced Documents

***2.1 ASTM Standards:***

*D 9-05* Standard Terminology Relating to Wood and Wood-Based Products

*D 1037-99* Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

*D 2395-02* Standard Test Methods for Specific Gravity of Wood and Wood-Base Materials

*D 2915-03* Standard Practice for Evaluating Allowable Properties for Grades of Structural Lumber

*D 3737-05* Standard Practice for Establishing Stresses for Structural Glued Laminated Timber (Glulam)

*D 4761-05* Standard Test Methods for Mechanical Properties of Lumber and Wood-Based Structural Material

*D 5456-06* Standard Specification for Evaluation of Structural Composite Lumber Products

*F 1667-05* Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

***2.2 Other Standards:***

APA PRP-108, Performance Standards and Qualification Policy for Structural-Use Panels

APA Plywood Design Specification

APA OSB Qualification Policy

2005 National Design Specification (NDS)

US Product Standard *PS 1-95* Construction and Industrial Plywood

US Product Standard *PS 2-04* Performance Standard for Wood-Based Structural-Use Panels

ANSI Standard *A190.1-02* Structural Glued Laminated Timber

ANSI/ASME Standard *B18.2.1-1996* Square and Hex Bolts and Screws (Inch Series)

CAN/CSA O325.0-92 (R2003) *Construction Sheathing*

## 3. Terminology

3.1 Definitions: See the referenced documents for definitions of terms used in this standard.

3.2 Description of terms specific to this standard:

3.2.1 *Rim Board:* A structural component that is installed in an end bearing wall or wall parallel to the joist framing to encompass the floor framing and transfer horizontal (shear) and bearing (vertical) loads.

3.2.2 *Horizontal (Shear) Load Transfer Capacity:* The mechanical capacity of rim boards to transfer applied lateral loads, such as wind or seismic, through shear load transfer provided by the connections between rim board and floor sheathing, and rim board and sill plate.

3.2.3 *Bearing (Vertical) Load Capacity:* The mechanical capacity of rim boards to resist applied gravity loads, such as wall loads, through bearing load transfer from rim board to sill plate.

3.2.4 *Edgewise Bending Properties:* The mechanical properties of rim boards, including allowable bending stress ($F_{be}$), shear stress ($F_{ve}$), compressive stress perpendicular to grain ($F_{c\perp e}$), and modulus of elasticity ($E_e$) when subjected to loading on the edge of the rim boards. The edgewise bending properties for rim boards manufactured from mat-formed and composite panels, and qualified in accordance with this standard are limited to a design span of 4 feet or less.

## 4. Dimensions and Tolerances

4.1 The nominal thickness shall not be less than 1 inch for *APA EWS* Rim Board and 1-1/8 inches for *APA EWS* Rim Board Plus.

4.2 The depth for *APA EWS* Rim Boards shall not exceed 24 inches.

4.3 Tolerances – Dimension tolerances permitted at the time of manufacture for *APA EWS* Rim Boards shall be as follows:

Thickness – Plus or minus 5%

Depth – Plus 1/16 inch or minus 0 inch (measured to 1/32 inch)

## 5. Performance Requirements

*APA EWS* Rim Boards shall meet the performance requirements established in this section.

5.1 Sampling

5.1.1 Test samples shall be representative of normal production.

5.1.2 For structural-use panels, a minimum of 20 full-size (4 feet by 8 feet) panels shall be sampled for all evaluation tests. For other products, a minimum of 50 lineal feet from representative productions shall be sampled.

5.1.3 The sample size required for horizontal load transfer capacity, bearing load capacity, lag screw tests, and concentrated load capacity, if applicable, shall be sufficient for estimating the population mean within 5% precision with 75% confidence, or 10 assemblies, whichever is larger. In general, a sample size larger than 10 assemblies is needed when the coefficient of variation is greater than 12.8%.

5.1.4 For rim boards manufactured from mat-formed and composite panels, a minimum of 28 specimens with a dimension of 2 inches by 36 inches shall be sampled from representative production and tested for edgewise bending strength and modulus of elasticity in accordance with Section 6.8.

### *5.2 Structural Performance Criteria*

5.2.1 The structural performance level for *APA EWS* Rim Boards shall be established based on the structural performance, including horizontal load transfer capacity, bearing load capacity, lag screw (1/2-inch diameter) lateral resistance, and edgewise bending properties when applicable, of the product under evaluation.

5.2.2 The concentrated load capacity shall be evaluated only when the rim board exceeds 16 inches in depth.

5.2.3 The edgewise bending strength and modulus of elasticity shall be evaluated when the rim boards are manufactured from mat-formed and composite panels. For other materials, the edgewise bending properties shall be established by applicable product standards or design specifications. For example, the edgewise bending properties shall be evaluated in accordance with *ASTM D 3737* and *D 5456* for rim boards manufactured from glulam and SCL, respectively. The edgewise bending properties for all-veneer panels are documented in the *Plywood Design Specification*.

5.2.4 Structural performance shall be evaluated for each rim board thickness, depth, and species combination unless otherwise noted in the test method.

5.2.5 *APA EWS* Rim Boards shall meet the minimum structural performance given in Tables 1 and 2 if applicable based on the APA test methods described in Section 6.

5.2.6 Recognition of structural performance levels superior to those given in Table 1 shall be permitted provided the following conditions are met:

a) Test results shall meet or exceed the values given in Table 1.

b) Design values shall be derived from test results using the adjustment factors given in Footnote a to Table 1 and rounded down to the nearest 5 lbf/ft for horizontal load, 50 lbf/ft for uniform

| Thickness, t, (in.) | Design Horizontal (Shear) Load Transfer Capacity, $H_a$, (lbf/ft) |
|---|---|
| Less than 1 in. | Not Permitted |
| 1 in. | 180 lbf/ft ≤ $H_a$ ≤ 190 lbf/ft |
| 1-1/8 in. | 180 lbf/ft ≤ $H_a$ ≤ 220 lbf/ft |
| 1-1/4 in. or thicker | 180 lbf/ft ≤ $H_a$ |

TABLE 1

**REQUIRED MEAN TEST VALUES[a] FOR *APA EWS* RIM BOARDS.**

| Grade | $t_{min}$[b] (in.) | H[c] (lbf/ft) | V[d] (lbf/ft) | | Z[e] (lbf) | P[f] (lbf) |
|---|---|---|---|---|---|---|
| | | Depth (d) Limitation (in.) | | | | |
| | | d ≤ 24 | d ≤ 16 | 16 < d ≤ 24 | d ≤ 24 | 16 < d ≤ 24 |
| Rim Board | 1 | 505 | 9,900 | 4,950 | 1,200 | 10,500 |
| | 1-1/8 | 505 | 13,200 | 9,000 | 1,400 | 10,500 |
| Rim Board Plus | 1 | N/A[g] | N/A[g] | N/A[g] | N/A[g] | N/A[g] |
| | 1-1/8 | 560 | 14,550 | 9,600 | 1,400 | 10,500 |

(a) The tabulated values are the average test values. For design purposes, the tabulated values shall be multiplied by an adjustment factor given below:

Horizontal load transfer capacity (H): 1/2.8
Vertical load capacity (V) and concentrated load capacity (P): 1/3
Lag screw lateral resistance (Z): 1/4

See Appendix A for the analysis of the adjustment factors. The calculated design values are applicable to the long-term load duration (10 years), except for the calculated horizontal load transfer capacity which is based on the short-term load duration (10 minutes), and permitted to be adjusted for other load durations in accordance with the applicable code.

(b) Minimum thickness (see Section 4.3 for the thickness tolerance).

(c) Mean test value for the horizontal (shear) load transfer capacity.

(d) Mean test value for the bearing (vertical) load capacity.

(e) Mean test value for the lateral resistance of a 1/2-inch-diameter lag screw.

(f) Mean test value for the concentrated load capacity, which is required only when the rim board exceeds 16 inches in depth.

(g) The minimum thickness for *APA EWS* Rim Board Plus is 1-1/8 inches.

vertical load, 100 lbf for concentrated vertical loads, and 25 lbf for lag screw lateral resistance.

c) Design values shall be identified in the trademark.

d) The design horizontal (shear) load transfer capacity is subject to the following limitations:

***5.3 Mechanical Properties***

5.3.1 Mat-formed panels – Control values for mechanical properties, including dry bending strength and stiffness in both the along and across directions, and redry (cycled per APA Test Method D-4) bending strength in the along direction (S-14 tests), of the product qualified under structural performance (Section 5.2) shall be established in accordance with *APA OSB Qualification Policy.*

5.3.2 All-veneer panels – Specification for species, thickness, and grade shall be established in accordance with APA *PRP-108* or *PS 1.*

5.3.3 Composite panels – Control values for mechanical properties shall be established in accordance with APA *PRP-108* or *PS 2.*

5.3.4 Glulams – Control values for mechanical properties shall be established based on *ANSI A190.1* and the principles set forth in *ASTM D 3737.*

5.3.5 Structural composite lumber – Control values for mechanical properties shall be established based on the principles set forth in *ASTM D 5456.*

***5.4 Durability Performance***

5.4.1 Mat-formed and composite panels – Control values for glue bond durability shall be established based on tests conducted in accordance with Section 6.2.4.1 of *PS 2* or other alternative method recognized by APA.

5.4.2 All-veneer panels – Glue bond durability shall be established based on tests conducted in accordance with Section 6.1.5 of *PS 1* or other alternative method recognized by APA.

5.4.3 Glulams – Glue bond durability shall meet the criteria specified in *ANSI A190.1* or other alternative method recognized by APA.

5.4.4 Structural composite lumber – Glue bond durability shall meet the criteria specified in *ASTM D 5456* or other alternative method recognized by APA.

TABLE 2

**REQUIRED EDGEWISE BENDING VALUES FOR RIM BOARDS MANUFACTURED FROM MAT-FORMED AND COMPOSITE PANELS[a]**

| Grade | $f_{be}$[b] (psi) | $E_e$[c] (psi) | $f_{ve}$[d] (psi) | $f_{c\perp e}$[e] (psi) |
|---|---|---|---|---|
| Rim Board and Rim Board Plus | 2,070 | 580,000 | 850 | 920 |

(a) The tabulated values are test values. For design purposes, the tabulated characteristic values shall be multiplied by an adjustment factor given below:

Edgewise bending strength ($f_{be}$): 1/(2.1 x 1.45 x 1.08 x 1.05) or 1/3.45
Edgewise modulus of elasticity ($E_e$): 1/1.05
Edgewise shear strength ($f_{ve}$): 1/3.15
Edgewise compressive stress perpendicular to grain at 0.04-in. deformation ($f_{c\perp e}$): 1/1.67

See Appendix A for the analysis of the adjustment factors for $f_{be}$ and $E_e$. The calculated design values are applicable to the long-term load duration (10 years) and permitted to be adjusted for other load durations in accordance with the applicable code except for edgewise modulus of elasticity and compressive stress perpendicular to grain.

(b) Characteristic (fifth percentile with 75% confidence) edgewise bending strength.

(c) Characteristic (mean) edgewise apparent modulus of elasticity.

(d) Characteristic (fifth percentile with 75% confidence) edgewise shear strength.

(e) Characteristic (mean) edgewise compressive strength perpendicular to grain at 0.04-in. deformation.

***5.5 Physical Properties***

5.5.1 Samples used for establishing the physical properties of *APA EWS* Rim Boards shall be prepared from those panels required in Section 5.1.

5.5.2 Requirements specified in Sections 5.5.3 through 5.5.5 do not apply to all-veneer panels, laminated veneer lumber, or glulam.

5.5.3 Density – The control value for panel density shall be established in accordance with *ASTM D 2395* using the same panels tested for structural performance (Section 5.2). One specimen with a dimension of 6 inches by 6 inches shall be prepared from each panel (20 specimens in total) for the density determination based on oven-dry weight and as--tested volume. The minimum control value shall be established as follows:

Minimum density = Mean density – 2.1 x standard deviation

For quality control purposes, the density based on weight and volume at typical environmental conditions of the manufacturing facility shall be established.

5.5.4 Internal bond – The control value for the internal bond shall be established based on *ASTM D 1037* using 5 samples (2 inches by 2 inches) from each panel (100 specimens in total) tested for structural performance (Section 5.2). The minimum control value shall be established as follows:

Minimum internal bond = Mean internal bond – 2.1 x standard deviation

5.5.5 Thickness swell – Thickness swell shall be evaluated based on the 24-hour water soak method of *ASTM D 1037* using 5 samples (6 inches by 6 inches) from each of 5 panels (25 specimens in total) tested for structural performance (Section 5.2). The average thickness swell for the whole sample population shall not exceed 10% and no individual value shall exceed 12%.

### *5.6 Edge Nailing Durability*

5.6.1 Samples used for evaluating the edge nailing durability of *APA EWS* Rim Boards shall be prepared from those panels required in Section 5.1.2.

5.6.2 Requirements specified in this section do not apply to all-veneer panels, laminated veneer lumber, or glulam.

5.6.3 Tests shall be conducted in accordance with the procedures given in Section 6.7.

5.6.4 The mean edge nailing durability shall be at least 75% of the mean lateral load transfer capacity determined from Section 6.2.

## 6. APA Test Methods

### *6.1 General*

6.1.1 Test methods given in this section shall be used to establish the structural capacities of *APA EWS* Rim Boards.

6.1.2 Deviations from the standard test methods, including nailing schedule, sheathing thickness, and sill plate species, shall be permitted when properly documented. However, design capacities shall reflect such deviations.

### *6.2 APA Test Method RB-1, Horizontal (Shear) Load Transfer Capacity*

6.2.1 Specimen preparation

6.2.1.1 Horizontal (shear) load transfer capacity of *APA EWS* Rim Boards shall be determined using the assembly consisting of rim board, sheathing, I-joists, and sill plate shown in Figure 1.

6.2.1.2 Dimensions for each component of the assembly shall meet the requirements given in Table 3. The sill plate shall be 2 by 4 spruce-pine-fir.

6.2.1.3 Nailing schedules for the assembly shall follow the requirements given in Table 4. The first and last nails between sheathing and rim board (edge nails) shall be 3 inches from each rim board end. Nails between sheathing and I-joist shall be 3 inches from each I-joist end. The first and last toe nails between rim board and sill plate shall be 3 inches from each rim board end. Nails used for the assembly shall be in conformance with the sizes specified in *ASTM F 1667*.

6.2.1.4 Joist spacing for the assembly shall be 24 inches.

6.2.1.5 The assembly shall be fabricated at least 12 hours before mechanical testing.

FIGURE 1

**TEST ASSEMBLY FOR DETERMINING THE HORIZONTAL LOAD TRANSFER CAPACITY**

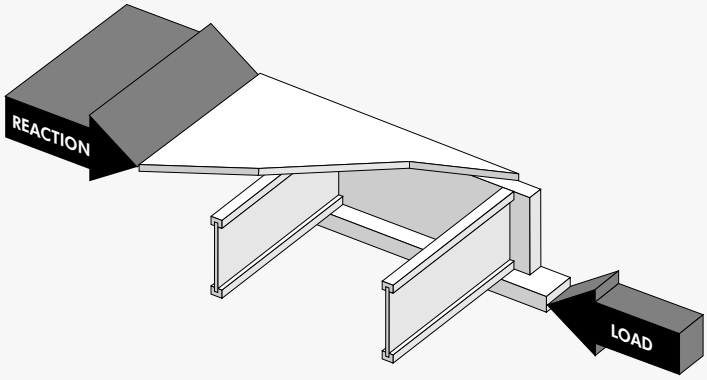



TABLE 3

**MATERIAL DIMENSIONS**

| Material | Thickness (in.) | Depth or Width (in.) | Length (in.) |
|---|---|---|---|
| Rim Board | 1 minimum | 24 maximum | 36 |
| I-Joist | 1-3/4 maximum | 24 maximum | 12 |
| Sheathing (OSB) | 23/32 | 12 | 39 minimum |
| Sill Plate (SPF) | Nominal 2 | Nominal 4 | 39 minimum |

TABLE 4

**NAILING SCHEDULE**

| | Nailing (Box Nail) | | |
|---|---|---|---|
| Sheathing to Rim Board or Joist | Rim Board to Sill Plates (Toe Nail) | Joist to Sill Plate (Slanted) | Rim Board to Joist |
| 8d @ 6 in. o.c. | 8d @ 6 in. o.c. | 2-8d | 2-8d |

6.2.2 Test procedures

6.2.2.1 Horizontal loads shall be applied through the sill plate while the sheathing reacts through full-width bearing, or vice versa. Vertical tie-rods or other similar devices shall be used to provide vertical restraints to avoid overturning the assembly. These restraints, however, shall not interfere with the lateral displacement of the assembly in the direction parallel to the loading.

6.2.2.2 Assembly displacements shall be measured based on the relative lateral displacements between the sill plate and

sheathing along the entire length of the rim board. Vertical displacements caused by overturning forces, if any, shall be isolated from the measurements of lateral displacements.

6.2.2.3 The loading rate shall not exceed 450 lbf per minute.

6.2.2.4 The assembly shall be tested up to the ultimate load or 0.4-inch lateral displacement, whichever occurs first. No preload shall be applied. Load and displacement readings shall be taken at approximately equal load increments.

6.2.3 The maximum lateral load transfer capacity (test value) for each assembly is equal to the maximum load determined from Section 6.2.2.4 divided by the rim board length.

6.2.4 The lateral load transfer capacity determined from Section 6.2.3 is applicable to a shallower rim board of the same thickness and species combination.

***6.3 APA Test Method RB-2, Bearing (Vertical) Load Capacity***

6.3.1 Specimen preparation

6.3.1.1 Specimens used for determining the bearing (vertical) load capacity of *APA EWS* Rim Boards shall be prepared in accordance with Sections 6.2.1, 6.3.1.2 and 6.3.1.3.

6.3.1.2 The sill plate is not required for the assembly used for determining the bearing load capacity.

6.3.1.3 An end notch of approximately 1/2 inch in depth and at least 3-1/2 inches in length shall be provided on the flange (sill-plate side only) of the I-joists to avoid direct bearing on the I-joists.

6.3.2 Test procedures

6.3.2.1 Vertical loads shall be applied uniformly on the entire length and thickness of the rim board while the sheathing serves as the reaction plate, or vice versa. No lateral supports shall be used for testing the assembly.

6.3.2.2 Vertical assembly displacements shall be measured based on the displacements over the entire depth (crosshead movement).

6.3.2.3 The average time to failure shall be approximately two minutes.

6.3.2.4 A preload of no more than 10% of the estimated ultimate load is permitted to be applied. After that, the load and displacement readings shall be taken at approximately equal load increments until the ultimate load is reached.

6.3.3 The maximum bearing load capacity (test value) for each assembly is equal to the ultimate load determined from Section 6.3.2.4 divided by the rim board length or 3 times the load at 0.06-inch vertical displacement divided by the rim board length, whichever is less.

6.3.4 The bearing load capacity determined from Section 6.3.3 is applicable to a shallower rim board of the same thickness and species combination.

6.3.5 As an alternative to the test method given above, the bearing load capacity is permitted to be determined in accordance with the method given in Section 6.4.

***6.4 Alternative Test Method for Bearing (Vertical) Load Capacity***

6.4.1 Specimen preparation

6.4.1.1 Specimens used for this alternative test method shall be at least 12 inches in length and tested as a stand-alone column.

6.4.2 Test procedures

6.4.2.1 Test procedures shall follow Section 6.3.2 except that the vertical loads shall be applied uniformly on the entire length and thickness of the stand-alone rim board. The loading direction shall be consistent with the intended application of the rim board.

6.4.3 The maximum bearing load capacity (test value) for each assembly is equal to the ultimate load determined from Section 6.4.2 divided by the rim board length, or 3 times the load at 0.06-inch vertical displacement divided by the rim board length, whichever is less.

6.4.4 The bearing load capacity determined from Section 6.4.3 is applicable to a shallower rim board of the same thickness and species combination.

***6.5 APA Test Method RB-3, Lag Screw Lateral Resistance***

6.5.1 Specimen preparation

6.5.1.1 Specimens used for determining the lag screw lateral load resistance of *APA EWS* Rim Boards shall be prepared in accordance with Figure 2. Dimensions for each component of the assembly shall meet the requirements given in Figure 2. A wax paper shall be inserted between the ledger and sheathing to minimuze friction.

6.5.1.2 A 1/2-inch-diameter lag screw with washer shall be used for testing. The lag screw used for the assembly shall be in conformance with ANSI/ASME B18.2.1.

6.5.1.3 The ledger shall be 2 by 6 spruce-pine-fir.

6.5.1.4 A clearance hole and lead hole shall be bored in accordance with the guidelines provided in the 2005 NDS. The diameter for the lead hole shall be 5/16 inch.

6.5.1.5 The assembly shall be fabricated at least 12 hours before mechanical testing.

6.5.2 Test procedures

6.5.2.1 Loads shall be applied through the ledger while the rim board and sheathing react through full-width bearing, or vice versa.

6.5.2.2 Assembly displacements shall be measured based on the movement of the machine cross head.

6.5.2.3 The loading rate shall not exceed 0.1 inch per minute.

6.5.2.4 The assembly shall be tested up to the ultimate load or 0.6-inch displacement, whichever occurs first. No preload shall be applied. Load and displacement readings shall be taken at approximately equal load increments.

6.5.3 The maximum lag screw lateral resistance (test value) for each assembly is equal to the maximum load determined from Section 6.5.2.4.

6.5.4 The lag screw lateral resistance determined from Section 6.5.3 is applicable to all rim boards of the same thickness and species combination.

***6.6 Concentrated Load Capacity (applicable to rim boards deeper than 16 inches)***

6.6.1 Specimen preparation

6.6.1.1 Specimens used for this test method shall be at least 16 inches in length and tested as stand-alone columns.

6.6.2 Test procedures

6.6.2.1 Test procedures shall follow Section 6.3.2 except that the concentrated load shall be applied through a 4-1/2-inch-long steel bar with a minimum thickness of 1/2 inch and a width of not less than the rim board thickness. The steel bar shall be centered on the 16-inch specimen length.

6.6.3 The maximum concentrated load capacity (test value) for each assembly is equal to the ultimate load determined from Section 6.6.2, or 3 times the load at 0.06-inch vertical displacement, whichever is less.

6.6.4 The concentrated load capacity determined from Section 6.6.3 is applicable to a shallower rim board of the same thickness and species combination.

***6.7 Edge Nailing Durability***

6.7.1 Specimen preparation

6.7.1.1 Specimens used for this test method shall be prepared in accordance with Section 6.2.1. A minimum of 3 assemblies shall be tested for each rim board species, depth, and thickness combination.

6.7.1.2 The 24-hour water soak method of *ASTM D 1037* shall be applied to each rim board specimen before the test assembly is fabricated. The test assembly shall be fabricated while the rim board specimen is still wet.

6.7.1.3 The assembly shall be redried to a moisture content of 8 to 12 percent before mechanical testing.

6.7.2 Test procedures

6.7.2.1 Test procedures shall follow Section 6.2.2.

6.7.3 The maximum edge nailing durability (test value) for each assembly is equal to the maximum load determined from Section 6.7.2 divided by the rim board length.

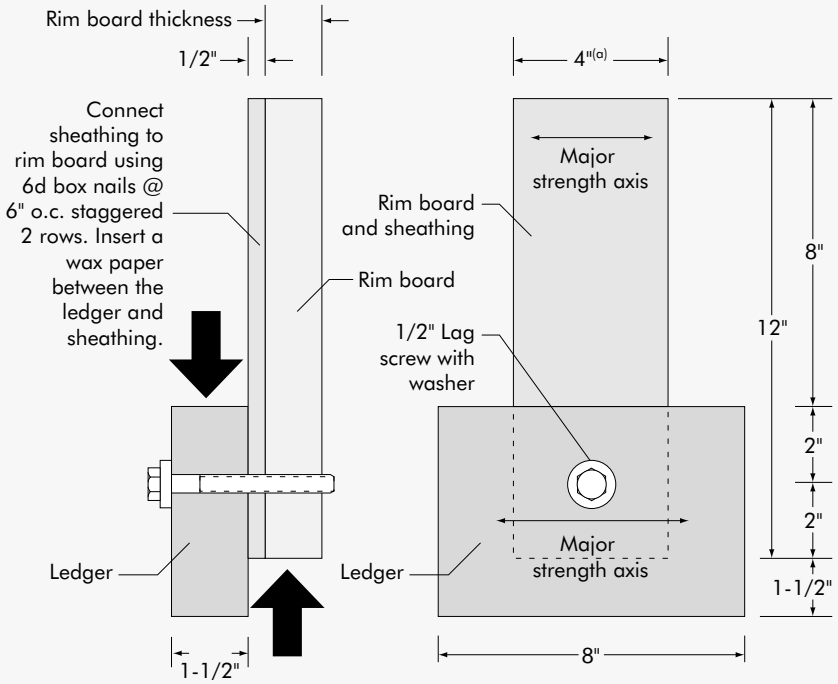
6.7.4 The edge nailing durability determined from Section 6.7.3 is applicable to a shallower rim board of the same thickness and species combination.

***6.8 Edgewise Bending Strength and Modulus of Elasticity***

The edgewise bending specimens, as specified in Section 5.1.4, shall be tested using the method given in Sections 6 through 11, *Bending Edgewise,* of ASTM D 4761 with the exception that the load shall be applied at mid-span (center-point loading), the specimen depth shall be 2 inches, and the test span shall be 33 inches. Prior to testing, all specimens shall be placed in indoor conditions for at least 5 days.

FIGURE 2

**ASSEMBLY FOR DETERMINING THE LAG SCREW LATERAL RESISTANCE**




(a) The dimension may be increased to avoid splitting provided the deviation is reported and noted in the Mill Specification.

## 7. Qualification Policy

### *7.1 Qualification Tests*

Required qualification tests and criteria are detailed in Section 5 of this standard. Retesting shall be conducted using a new independent sample set.

### *7.2 Product Evaluation*

Upon satisfactory completion of the requirements given in Section 5, a Mill Specification shall be established for the product. The Mill Specification shall include the properties specified under Sections 5.2 through 5.5 of this standard. This specification shall be used in conjunction with the Quality Assurance Policy given in Section 8.

### *7.3 Trademarking*

*APA EWS* Rim Board shall be identified with an *APA EWS* trademark bearing the manufacturer's mill number. Typical trademarks are given in Section 9.

## 8. Quality Assurance Policy

### *8.1 Scope*

This policy is intended for use with a structural panel, glued laminated timber or structural composite lumber product that has qualified for performance-based trademarking as either *APA EWS* Rim Board or *APA EWS* Rim Board Plus, undergone product evaluation, and for which a Mill Specification and a Producer's Quality Control Manual have been written as set forth in the Qualification Policy of this standard.

### *8.2 Purpose*

The purpose of this policy is to assure product quality by detecting changes in properties which may adversely affect rim board performance. In all cases, the criteria to which *APA EWS* Rim Board is tested will be provided in the Mill Specification.

### *8.3 Referenced Standards*

*APA EWS* Rim Boards can be made from a variety of wood-based products, each with unique test requirements. Quality Assurance Policies exist in different forms for many of these products. The following documents are standards defining Quality Assurance for different *APA EWS* Rim Board products:

- APA OSB Quality Assurance Policy
- APA Adhesive Policy
- APA Performance Standards and Policies for Structural-Use Panels, PRP-108
- Construction and Industrial Plywood, PS 1
- Performance Standard for Wood-Based Structural-Use Panels, PS 2
- EWS Quality Assurance Policy for Glued Laminated Timber Products

### *8.4 Quality Assurance Procedures*

*APA EWS* Rim Board quality assurance requirements will be considered satisfied when the requirements for the referenced standards in Section 8.3 and any additional requirements are met. Referenced standards shall be specified by product type to define appropriate procedures and/or guidelines for quality assurance. If a product trademarked as either *APA EWS* Rim Board or *APA EWS* Rim Board Plus is trademarked under another standard, samples shall be taken for both standards.

8.4.1 Mat-formed panels – Quality assurance requirements for OSB are specified in the *OSB Quality Assurance Policy.* Additional tests include internal bond (IB), density, and thickness swell. Requirements for IB and density shall be developed during qualification. Thickness swell shall meet the criteria given in Section 5.5.5. The edgewise bending strength and modulus of elasticity shall be tested in accordance with Section 6.8 in conjunction with the quarterly program and shall meet the values given in Table 2.

8.4.2 All-veneer panels – Certified Inspectors and Auditors shall sample according to *APA's Adhesive Policy.* Tests shall be in accordance with *PS 1*.

8.4.3 Composite panels – Quality assurance requirements for composite panels are specified in APA *PRP-108.* Internal bond, density, and thickness swell will also be evaluated. Test requirements for IB, density, and thickness swell shall be developed during qualification. The edgewise bending strength and modulus of elasticity shall be tested in accordance with Section 6.8 in conjunction with the quarterly program and shall meet the value given in Table 2.

8.4.4 Glulams – Quality assurance procedures shall be specified in accordance with *EWS Quality Assurance Policy for Glued Laminated Timber Products.*

8.4.5 Structural composite lumber – Quality assurance requirements for structural composite lumber shall be in accordance with *ASTM D 5456.*

## 9. Typical Trademarks



## APPENDIX A

## ADJUSTMENT FACTORS FOR DERIVING THE ALLOWABLE PROPERTIES OF *APA EWS* RIM BOARDS

### 1. Background

A general equation used to derive the allowable properties of most engineered wood products can be expressed as follows:

$$F_{10\ yrs} = \frac{R_{.05,10\ mins}}{C_{adj}} = \frac{R_{.05,10\ yrs}}{S.F.} \quad [1]$$

where:

$F_{10\ yrs}$ = Allowable property for an estimated 10-year load duration,

$R_{.05,10\ mins}$ = Characteristic test value (5th percentile with 75% confidence) with a test duration of approximately 10 minutes,

$R_{.05,10\ yrs}$ = Characteristic value (5th percentile with 75% confidence) with a load duration of approximately 10 years. This is generally a theoretical value,

$C_{adj}$ = Adjustment factor, which is equal to 2.1 when $F_{10\ yrs}$ is the allowable bending stress,

S.F. = Nominal factor of safety, which is equal to $C_{adj}$ / 1.6. When $C_{adj}$ is equal to 2.1, S.F. = 1.3.

Based on a normal distribution,

$$R_{.05,10\ mins} = R_{.5,10\ mins}\ (1 - kv) \quad [2]$$

where:

$R_{.5,10\ mins}$ = Mean test value with a test duration of approximately 10 minutes,

k = A statistic for one-sided tolerance limit, which depends on a desired probability, sample size, and confidence level. For the 5th percentile estimate with 75% confidence based on a sample size of 10, k ≈ 2.104. When the sample size represents a large population, k ≈ 1.645,

v = Coefficient of variation in fraction.

Substituting Eq. 2 into Eq. 1,

$$F_{10\ yrs} = \frac{R_{.5,10\ mins}\ (1 - kv)}{C_{adj}} \quad [3]$$

Given

$$a = \frac{C_{adj}}{1 - kv} \quad [4]$$

then

$$F_{10\ yrs} = \frac{R_{.5,10\ mins}}{a} \quad [5]$$

Note that in accordance with Eq. 5, the 10-year-based allowable property can be derived by dividing the mean test value, $R_{.5,10\ mins,}$ by the adjustment factor "a." For example, the typical "a" factor used to derive the allowable bending stress for 24F-V4/DF glulam beams can be obtained by substituting $C_{adj}$ = 2.1, k = 1.645, and v = 0.15 into Eq. 4. This gives "a" = 2.79.

For nailed wood connections, "a" is traditionally set as 5.0. When used in the design of shear walls or diaphragms, the basis of the design value is a 10-minute load duration. Since $F_{10\ mins} = 1.6 \times F_{10\ yrs,}$

$$F_{10\ mins} = \frac{R_{.5,10\ mins}(1.6)}{a} \quad [6]$$

Given

$$b = \frac{a}{1.6} \quad [7]$$

then

$$F_{10\ mins} = \frac{R_{.5,10\ mins}}{b} \quad [8]$$

Note that, in theory, b = 5.0 / 1.6 or 3.1 for nailed wood connections. In several Acceptance Criteria published by ICBO, such as AC 04 *(Acceptance Criteria for Sandwich Panels)* and AC 91 *(Acceptance Criteria for Formed-Cement Walls),* "b" is specified as 3.0 for wall panels subjected to racking-wall tests. It is important to recognize that most racking-wall tests are in fact the evaluation of the mechanical properties of connections.

Combining Eqs. 4 and 7,

$$b = \frac{C_{adj}}{1.6\ (1 - kv)} \quad [9]$$

For the design values of typical wood connections, k = 1.645 (applicable to a large population) and v = 0.25. When b = 3.0, it can be determined from Eq. 9 that $C_{adj}$ = 2.83. This value is about 35% higher than the typical $C_{adj}$ of 2.1, as applicable to the allowable bending stress of most engineered wood bending members, and provides a factor of safety (S.F.) of approximately 1.77. The use of this higher S.F. reflects the higher variability in the mechanical properties of wood connections, as compared to the allowable bending stress of most engineered wood products (S.F. = 1.3).

### 2. Adjustment Factor for Horizontal (Shear) Load Capacity

Based on $C_{adj}$ = 2.83, it is possible to determine the required "b" for the horizontal (shear) load capacity of *APA EWS* Rim Boards, while maintaining the same factor of safety of 1.77, as applicable to wood connections. For *APA EWS* Rim Boards, the typical sample size is 10 (k = 2.104) and the coefficient of variation (v) based on APA's experience with a variety of rim board products is no more than 12% when tested in accordance with APA Test Method RB-1. Therefore, the required "b" can be determined based on Eq. 9 as

$$b = \frac{2.83}{1.6\ (1 - 2.104 \times 0.12)} = 2.37 \quad [10]$$

This lower "b" value, as compared to the value of 3.0 for wood connections, reflects the lower coefficient of variation for *APA EWS* Rim Boards. For conservative reasons, APA chooses to use a "b"

factor of 2.8 in deriving the allowable horizontal load capacity for *APA EWS* Rim Boards. Based on b = 2.8, k = 2.104, and v = 0.12, as applicable to typical *APA EWS* Rim Boards, $C_{adj}$ = 3.35 based on Eq. 9. As a result, a factor of safety of 3.35 / 1.6, or 2.1 (see Eq. 1) is provided for the assigned allowable horizontal load capacity of *APA EWS* Rim Boards. This factor of safety is about 19% higher than the factor of safety of 1.77, as provided to typical wood connections.

### 3. Adjustment Factor for Bearing (Vertical) Load Capacity

The bearing (vertical) load capacity of *APA EWS* Rim Boards is typically designed for a long-term load duration. Therefore, the adjustment factor used for deriving the bearing load capacity of *APA EWS* Rim Boards shall be based on the "a" factor given in Eqs. 4 and 5.

As the likely failure mode of *APA EWS* Rim Boards when subjected to bearing loads is buckling, it is appropriate to set $C_{adj}$ = 2.1 to be consistent with the factor applicable to the allowable bending stress of most engineered wood bending members. For *APA EWS* Rim Boards, the typical sample size is 10 (k = 2.104) and the coefficient of variation (v) based on APA's experience with a variety of rim board products is no more than 10% when tested in accordance with APA Test Method RB-2. Therefore, the required "a" factor can be determined based on Eq. 4 as

$$a = \frac{2.1}{1 - 2.104 \times 0.1} = 2.66 \qquad [11]$$

In this standard, however, the "a" factor has been set as 3.0 for conservative reasons. This provides a factor of safety of approximately 1.48, which is about 14% higher than the factor of safety of 1.3, as applicable to the allowable bending stress of most engineered wood products.

### 4. Adjustment Factor for Allowable Edgewise Bending Stress

The adjustment factor of 3.45 for the allowable edgewise bending stress for *APA EWS* Rim Boards manufactured from mat-formed and composite panels is based on a combination of the following factors:

(a) The factor of 2.1 is the adjustment factor used to relate the test value to the allowable bending stress.

(b) The factor of 1.45 accounts for an assumed volume effect between the qualification size of 2 inches by 33 inches and the maximum permissible span of 4 feet with a depth of 24 inches based on a 2-parameter Weibull theory by assuming a COV of 15%.

(c) The factor of 1.08 relates the center-point loading configuration to the uniform load used in design.

(d) The factor of 1.05 accounts for the moisture effect on edgewise MOR between the qualification (as-received) and standard moisture (65% RH and 68°F) conditions. This moisture factor was derived based on a rim board edgewise bending study conducted by APA. In accordance with the results obtained from the same study, the moisture factor was determined as negligible for edgewise MOE between the qualification (as-received) and standard moisture (65% RH and 68°F) conditions. However, the factor of 1.05 is applied to edgewise MOE for qualification based on the judgment of the APA Technical Advisory Committee.

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