ICC-ES Evaluation Report

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 00—Shop-Fabricated Structural Wood

REPORT HOLDER:

ROSEBURG FOREST PRODUCTS CO.
4500 RIDDLE BY-PASS ROAD
RIDDLE, OREGON 97469
(541) 784-4005
www.roseburg.com

EVALUATION SUBJECT:

RIGIDRIM® RIMBOARD AND RIGIDLAM® LAMINATED VENEER LUMBER (LVL)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 and 2006 *International Building Code®* (IBC)
- 2009 and 2006 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL are laminated veneer lumber products used as alternatives to solid sawn lumber. RIGIDRIM® Rimboard LVL is used in rim board applications. RIGIDLAM® LVL is intended for structural applications such as beams, headers, joists, rafters, columns and wall studs.

3.0 DESCRIPTION

RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL laminated veneer lumber (LVL) comply with ASTM D 5456. The structural composite lumber products consist of veneers of a single wood species, or species combinations meeting the requirements specified in the manufacturer's approved quality control manual and manufacturing standard. The veneers are laminated with the grain parallel to the length of the member. An exterior-type phenol-formaldehyde adhesive, complying with ASTM D 2559, is used in the manufacturing of the LVL to bond veneers in the layup pattern specified in the manufacturer's quality control manual.

Veneers for the RIGIDLAM® LVL members are nominally $^1/_8$ inch thick (3.2 mm) (1.3E, 1.5E, 1.8E, 2.0E and 2.2E grades Douglas fir, 2.0E grade mixed species and 1.5E grade hemlock LVL) or $^1/_{10}$ inch thick (2.5 mm) (1.8E and 2.0E grades Douglas fir LVL). RIGIDLAM® LVL members are available in thicknesses of $1^1/_4$ to $1^3/_4$ inches (38 to 44 mm), depths of $3^1/_2$ to 24 inches (89 to 610 mm) and lengths up to 66 feet (20.13 m).

Additionally, the $1^3/_4$-inch-thick (44 mm) members are glued together to make $3^1/_2$-, $5^1/_4$-, and 7-inch-thick (89, 133, 178 mm) built-up LVL headers and beams.

Veneers for the RIGIDRIM® Rimboard LVL members are nominally $^1/_8$ inch thick (3.2 mm) (1.3E grade Douglas fir LVL). RIGIDRIM® Rimboard LVL is available in a $1^1/_2$-inch (38 mm) thickness, depths of up to 16 inches (406 mm) and lengths up to 66 feet (20.13 m).

4.0 DESIGN AND INSTALLATION

4.1 Installation:

Installation of RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL must comply with this report and with the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

The RIGIDRIM® Rimboard LVL must be installed as a continuously supported structural element located at the joist elevation in an end bearing wall or parallel to the joist framing. It must be the full depth of the joist space and be used for any combination of the following:

- To transfer, from above to below, all vertical loads at the rim board location.
- To provide diaphragm attachment (sheathing to top edge of rim board).
- To transfer in-plane lateral loads from the diaphragm to the wall plate below.
- To provide lateral support to the joist or rafter (resistance against rotation) through attachment to the joist or rafter.
- To provide closure for ends of joists or rafters.
- To provide an attachment base for siding and/or exterior deck ledger.

4.2 Design and Allowable Stresses:

4.2.1 General: Reference design values for loads of normal duration in covered dry conditions of use are given in Table 1 of this report. The design provisions in the *American Forest and Paper Association's National Design Specification for Wood Construction* (AF&PA NDS), as indicated in the applicable code, are applicable to RIGIDLAM® LVL, except as noted otherwise in this report.

Except as noted otherwise in this report, reference design values given in Table 1 must be adjusted by applicable adjustment factors in accordance with the AF&PA NDS. Where members qualify as repetitive members, as defined by the AF&PA NDS, the repetitive member factor must be taken as $C_r = 1.04$.

4.2.2 Connections: Reference lateral and withdrawal design values for nails installed perpendicular or parallel to the wide face of the LVL are as specified in the NDS for lumber having a specific gravity as indicated in Table 3 of this report. Nails installed parallel to the gluelines on the narrow face of material must be spaced in accordance with Table 2 of this report.

Reference lateral design values for connections with bolts installed perpendicular to the wide face of the LVL are as specified in the NDS for lumber having a specific gravity as indicated in Table 3 of this report.

Reference design values for nailed and bolted connections must be adjusted by applicable adjustment factors in accordance with the AF&PA NDS, except as otherwise noted in this report.

Connections, other than nailed and bolted connections described herein, are outside the scope of this report.

Exception: Lag screw connections between RIGIDRIM Rimboard and deck ledgers have an allowable lateral load of 400 pounds (1.78 kN) per lag screw, under the following conditions:

a. Lag screws must have a minimum nominal diameter of $^1/_2$ inch (12.7 mm), and sufficient length such that the lag screw shank penetrates through the rim board (not including the length of the tapered tip).

b. Deck ledgers must consist of minimum nominally 2-by-6 lumber having a minimum assigned specific gravity of 0.42.

c. Sheathing between the rim board and the deck ledger must consist of wood structural panels meeting PS-1 or PS-2 and be attached to the rim board in accordance with the applicable code.

d. One flat washer must be used between the deck ledger and the lag screw head.

e. Edge distances from the center of the lag screw to the edges of the rim board and deck ledger must be 2 inches (51 mm) or greater. End distances must be 4 inches (102 mm) or greater.

f. Adjustment factors in accordance with the NDS must be applied as applicable.

g. Rim board and deck ledgers must be checked for load carrying capacity at connections in accordance with Section 10.1.2 of the NDS.

Toe nailed connections of rim boards are not limited by the 150 plf (2189 N/m) lateral load capacity noted for Seismic Design Categories D, E, and F in Section 4.1.7 of the ANSI/AF&PA SDPWS and Section 2305.1.4 of the 2006 IBC.

4.2.3 Wall Stud Applications: RIGIDLAM LVL grades of 1.5E, 1.8E or 2.0E Douglas fir, or 2.0E mixed species, may be used as alternatives to sawn lumber wall studs in accordance with the prescriptive requirements of the applicable code, subject to the following conditions:

1. The minimum thickness of the LVL must be $1^1/_2$ inches.

2. Cutting, notching and boring of RIGIDLAM LVL studs is permitted in accordance with Sections 2308.9.10 and 2308.9.11 of the IBC and Section R602.6 of the IRC.

3. RIGIDLAM LVL wall studs must be installed in accordance with the following nailing requirements:

   a. The maximum allowable nail size for sheathing attachment to RIGIDLAM LVL studs is 10d common [3 inches long by 0.148 inches diameter (76 mm by 3.76 mm)].

   b. For sheathing attached with nails spaced no closer than 6 inches (152 mm) on center, a single RIGIDLAM LVL stud may be used for framing at adjoining panel edges. Panel edge nails must be installed with a minimum $^3/_8$-inch (9.5 mm) edge distance from the panel edges (see Detail A in Figure 1).

   c. For sheathing attached with nails spaced closer than 6 inches (152 mm) on center, a double LVL stud is required at adjoining panel edges, and compliance with the following is required (see Detail B in Figure 1):

      i. Double RIGIDLAM LVL studs must be stitch-nailed together with nails of the same size and spacing as the nailing required to attach the sheathing to the framing at the panel edges, provided a minimum nail penetration of 6 times the nail diameter is achieved in accordance with Section 11.1.5.5 of the NDS.

      ii. Panel-edge nails must be installed with a minimum $^3/_8$-inch (9.5 mm) and maximum 1-inch (25.4 mm) edge distance from the panel edges, and must be staggered a minimum of $^1/_4$-inch (6.4 mm) horizontally within each line of nails.

      iii. The minimum allowable spacing for nails smaller than or equal to 8d common [2.5 inches long by 0.131 inches diameter (64 mm by 3.33 mm)] is 3 inches (76 mm) on center. The minimum allowable spacing for nails larger than 8d common is 4 inches (102 mm) on center.

4. The allowable shear values for nailed wood structural panel shear walls utilizing RIGIDLAM LVL framing are to be determined in accordance with Table 2306.3 of the 2009 IBC or Table 2306.4.1 of the 2006 IBC, based on the values given for shear walls with framing of Douglas fir-Larch.

5. RIGIDLAM LVL wall studs are permitted to be used in fire-resistance-rated construction and are considered to be a direct replacement for solid-sawn lumber, having the same dimensions, in any fire-resistance-rated wall assembly listed in Table 720.1(2) of the IBC. Minimum 2.5 pcf mineral wool insulation must be placed in the stud cavity.

6. Engineered design of RIGIDLAM LVL studs is outside the scope of this evaluation report.

4.2.4 Fire-Blocking: RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL, with a minimum thickness of $1^1/_2$ inches, may be used as fire blocking in lieu of the materials listed in IBC Section 717.2.1, 2009 IRC Section R302.11.1 or 2006 IRC Section R602.8.1, as applicable.

5.0 CONDITIONS OF USE

The RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL described in this report comply with those codes specifically listed in Section 1.0 of this report, subject to the following conditions:

5.1 Installation complies with this report, the manufacturer's published installation instructions and the applicable code. In the event of a conflict, this report governs.

5.2 Design values must not exceed those set forth in Table 1 of this report except for adjustments with the applicable adjustment factors as specified by the AF&PA NDS. Where members qualify as repetitive members, as defined by the NDS, an additional increase of 4 percent is permitted for the allowable flexural stress.

5.3 Service conditions for RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL must be covered, dry conditions of use. Dry conditions of use are those under which the moisture content in service is less than 16 percent.

5.4 RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL having fire-retardant or preservative chemical treatments are outside the scope of this report.

5.5 Connection design must comply with Section 4.2.2 of this report.

5.6 Minimum bearing length and anchorage of RIGIDLAM® LVL must be as specified in the applicable code, as indicated in this report, for solid sawn lumber.

5.7 Design calculations and details for specific applications, demonstrating that RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL products comply with this report, must be submitted to the code official. The design calculations and details for specific applications must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.8 Except for cutting to final length for installation and when used as wall studs in accordance with Section 4.1.3, cutting and notching of RIGIDLAM® LVL is outside the scope of this report.

5.9 RIGIDRIM® Rimboard LVL and $1^1/_4$- to $1^3/_4$-inch-thick (38 to 44 mm) RIGIDLAM® LVL are produced in Riddle, Oregon, under a quality control program with inspections by APA—The Engineered Wood Association (AA-649).

5.10 $3^1/_2$-, $5^1/_4$-, and 7-inch-thick (89, 133, 178 mm) built-up LVL headers and beams from RIGIDLAM® LVL are produced by Roseburg Forest Products Co. in Riddle, Oregon; or produced for Roseburg Forest Products Co. by Duco-Lam in Drain, Oregon and by American Laminators in Swisshome, Oregon, under a quality control program with inspections by APA—The Engineered Wood Association (AA-649).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Structural Wood-based Products (AC47), dated February 2011.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Rim Board Products (AC124), dated October 2004, (editorially revised July 2010).

6.3 Data in accordance with the ICC-ES Acceptance Criteria for Wood-based Studs (AC202), dated June 2009.

6.4 Engineering analysis comparing the report subjects to the subjects of compressive testing completed on 1.5E LVL, signed and sealed by a registered design professional.

6.5 Engineering analysis to support changes in nail withdrawal specific gravities, signed and sealed by a registered design professional.

7.0 IDENTIFICATION

The RIGIDRIM® Rimboard LVL and RIGIDLAM® LVL described in this report are identified by a stamp bearing the manufacturer's name (Roseburg Forest Products), the product type, grade designation, the name of the inspection agency (APA—The Engineered Wood Association) and the evaluation report number (ESR-1210). In addition, RIGIDRIM® Rimboard LVL is marked with the product thickness.

TABLE 1—RIGIDLAM® AND RIGIDRIM® RIMBOARD LVL DESIGN STRESSES[1]

PROPERTY	REFERENCE DESIGN VALUE						
	RIGIDRIM® Rimboard LVL 1.3E Grade	RIGIDLAM® LVL					
		1.3E Grade	1.5E Grade Hemlock	1.5E Grade	1.8E Grade	2.0E Grade	2.2E Grade
Flexural stress (psi) Joist/Beam[2]	2250	2250	2250	2250	2600	2900	3400
Flexural stress (psi) Flat-wise/Plank[3]	2250	2250	—	2250	2600	2900	3400
Modulus of elasticity (10^6) (psi)	1.3	1.3	1.5	1.5	1.8	2.0	2.2
Tension parallel to grain (psi)[4]	1500	1500	1500	1500	1700	1900	2425
Compression parallel to grain (psi)	1950	1950	1950	1950	2400	2750	3200
Compression perp. to grain (psi) Joist/Beam	560	560	575	575	700	750	850
Compression perp. to grain (psi) Flat-wise/Plank	500	500	—	500	500	500	500
Horizontal Shear (psi) Joist/Beam	200	200	220	220	285	285	325
Horizontal Shear (psi) Flat-wise/Plank	130	130	—	130	130	130	130

For **SI:** 1 in. = 25.4 mm, 1 psi = 0.00689 MPa.

1. Reference design values provided in Table 1 are based on covered, dry conditions of use. Dry conditions of use are those environmental conditions represented by solid sawn lumber in which the moisture content is 16 percent or less.
2. Tabulated joist/beam flexural stresses are based on loads of a normal duration and a reference depth of 12 inches. For other depths, the tabulated flexural stress must be adjusted by a depth effect factor $K_d = (12/d)^{1/8}$. The maximum permitted depth effect factor is 1.17. The size factor derived in this footnote is cumulative with the duration of load adjustment factor.
3. Tabulated flat-wise (plank-wise) flexural stresses are based on a reference thickness of $1^3/_4$ inches. For thicknesses greater than $1^3/_4$ inches, the tabulated flat-wise (plank-wise) flexural stress, F_b, must be adjusted by the depth effect factor $K_d = (1.75/t)^{1/5}$, where t is the LVL thickness in inches. For thicknesses less than $1^3/_4$ inches, this adjustment must not be applied.
4. Tabulated tensile stresses are for a 4-foot (1243 mm) LVL length. For greater lengths, the value must be adjusted by multiplying the table value by (4.0/LVL length in feet)$^{1/9}$. For lengths less than 4 feet (1243 mm), use the value indicated in Table 1 for 4-foot (1243 mm).

TABLE 2—NAIL SPACING[2,4]—INSTALLED PARALLEL TO THE GLUE LINE

RIGIDRIM® RIMBOARD LVL AND RIGIDLAM® LVL THICKNESS	NAIL TYPE AND SIZE	MINIMUM NAIL SPACING[1,3] (in.)	NAIL END DISTANCE[1] (in.)
Less than $1^1/_2$ in.	8d box	3	$1^1/_2$
	8d common	3	2
	10d and 12d box	3	2
	10d and 12d common	4	3
	16d sinker	4	3
	16d common	6	4
$1^1/_2$ in. and greater	8d box	2	1
	8d common	3	2
	10d and 12d box	3	2
	10d and 12d common	4	3
	16d sinker	4	3
	16d common	6	3

For **SI:** 1 in. = 25.4 mm.

1. Spacing and end distances apply to single rows of nails.
2. Table 2 is based on minimum member depth of $3^1/_2$ inches when nailing into the narrow face of the material, parallel to the glueline.
3. The minimum allowable edge distance is $^1/_4$ inch.
4. Allowable lateral and withdrawal nail load capacities are as specified in the NDS for lumber having a specific gravity as indicated in Table 3 of this report.

TABLE 3—MINIMUM EQUIVALENT SPECIFIC GRAVITY FOR FASTENERS[1]

VENEER SPECIES	LVL GRADE	NAILS				BOLTS[5]
		Lateral Loads		Withdrawal Loads		Lateral Loads
		Face[2]	Edge[3]	Face[2]	Edge[3]	Face[2]
Douglas fir	1.3E	0.50	0.47	0.50	0.47	0.47
	1.5E	0.50	0.50	0.50	0.50	0.47
	1.8E	0.50	0.50	0.50	0.50	0.50
	2.0E[4]	0.50	0.50	0.50	0.50	0.50
	2.2E	0.50	0.50	0.50	0.50	0.50
Hemlock	1.5E	0.50	0.47	0.50	0.47	0.47

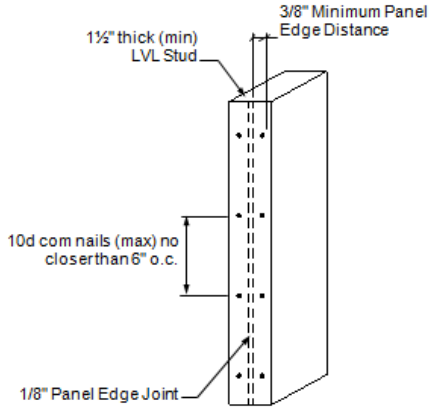
1. Similar to those values provided in the applicable code for solid sawn lumber having a minimum specific gravity shown.
2. Installed perpendicular to the wide face of the LVL.
3. Installed parallel to the wide face of the LVL.
4. 2.0 E grade includes Douglas fir only and combinations of Douglas fir and other species meeting the requirements specified in the manufacturer's approved quality control manual and manufacturing standard.
5. For $^1/_2$- or $^3/_4$-inch-diameter (12.7 or 19.1 mm) bolts.

TABLE 4—ALLOWABLE DESIGN PROPERTIES FOR RIGIDRIM® RIMBOARD LVL[1]

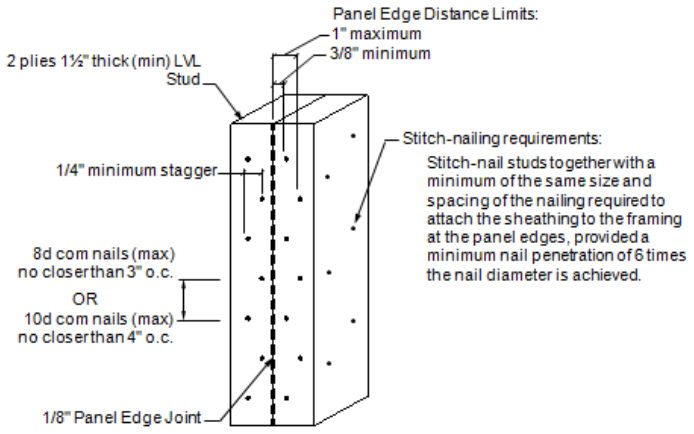
LVL GRADE	NOMINAL THICKNESS, *t* (in.)	LATERAL LOAD TRANSFER CAPACITY, *H* (lbf/ft)	VERTICAL BEARING LOAD, *V* (lbf/ft)	LATERAL RESISTANCE ($^1/_2$-INCH LAG SCREW), *Z* (lbf)
1.3E	$1^1/_2$	215	4900	(See Footnote 2)

For **SI:** 1 in. = 25.4 mm, 1 lbf/ft = 0.0015 kg/mm, 1 lbf = 0.454 kg.

1. Maximum allowable rim board depth is 16 inches (406 mm).
2. Lag screw connections between RIGIDRIM Rimboard LVL and deck ledgers have an allowable load of 400 pounds (1.78 kN) per lag screw, provided the conditions under the exception to Section 4.2.2 are met.



Detail A - Nailing Restrictions for Single Stud at Adjoining Panel Edges



Detail B - Nailing Restrictions for Double Studs at Adjoining Panel Edges

FIGURE 1—NAILING REQUIREMENTS FOR RIGIDLAM LVL STUDS