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Joint Evaluation Report

ESR-1040
Reissued September 2016
Revised May 2017
This report is subject to renewal September 2018.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 13—Laminated Veneer Lumber

REPORT HOLDER:

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EVALUATION SUBJECT:

VERSA-LAM® LAMINATED VENEER LUMBER

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- * 2015, 2012, 2009 ~~and 2006~~ *International Residential Code®* (IRC)

Properties evaluated:

- Structural
- Fire resistance
- Fireblocking material

2.0 USES

VERSA-LAM® is used for structural applications such as beams, headers, joists, rafters, wall studs and rim joists.

3.0 DESCRIPTION

VERSA-LAM® products are structural composite lumber products complying with ASTM D5456. They consist of laminated veneer lumber (LVL), manufactured with the wood fibers primarily oriented parallel to the length of the member such that the veneers are vertical (joist orientation) when the member is installed in its primary application. Qualified adhesives, veneer species and veneer grades are as specified in the approved Quality Control Manual.

VERSA-LAM® is available in various grades as indicated in Table 1. VERSA-LAM® is produced in thicknesses up to 7 inches (178 mm), with depths up to 48 inches (1219 mm) and lengths up to 66 feet (20.1 m).

VERSA-LAM® is also distributed under the proprietary name of VERSA-STUD®, and is manufactured to match commonly available solid-sawn lumber sizes.

4.0 DESIGN AND INSTALLATION

4.1 General:

The design provisions for structural composite lumber in the ANSI/AWC *National Design Specification® for Wood Construction* (NDS), are applicable to VERSA-LAM® unless otherwise noted in this report. Reference design values for dry conditions of use of VERSA-LAM® are indicated in Table 1.

4.2 Connections:

The design of connections for VERSA-LAM® must be in accordance with the NDS for solid wood species with an equivalent specific gravity. The equivalent specific gravity characteristics for nail and bolt design for dry-use conditions are found in Table 4. Allowable connector spacing is indicated in Table 3.

4.3 Fire Blocking:

VERSA-LAM® may be substituted for solid-sawn lumber fireblocking provided the minimum sizes of LVL, as indicated in this report, are as specified by the applicable code for solid-sawn material.

4.4 Rim Board:

For the purposes of this evaluation report, rim boards are defined as continuously supported structural members (except as noted in the last sentence of Section 4.4 of this report), located at the joist elevation either perpendicular to, or parallel to, the joist framing, that are the full depth of the joist space and that are used for the following purposes:

1. Transfer, from above to below, of vertical loads at the rim board location. Allowable vertical loads are noted in Table 2.
2. Providing diaphragm attachment (sheathing to top edge of rim board).
3. Transferring in-plane lateral loads from the diaphragm to the wall plate below.
4. Providing lateral support to the joist or rafter (resistance against rotation) through attachments to the joist or rafter.
5. Providing closure for ends of joists or rafters.

* Deleted by City of Los Angeles

6. Providing an attachment base for siding or exterior deck ledger.

Allowable vertical and lateral load transfer capacities for VERSA-LAM® are provided in Table 2. Rim board must be installed in accordance with the prescriptive provisions of the applicable code. Design of rim board installed over wall openings must be based on the reference design values noted in Table 1.

4.5 Calculated Fire Resistance:

For applications under the 2015, 2012 and 2009 IBC, the fire resistance of exposed VERSA-LAM® members may be calculated in accordance with Chapter 16 of the NDS.

4.6 Wall Studs:

4.6.1 General: VERSA-LAM® may be used as wall stud material in accordance with the prescriptive requirements in Section 2308.5 of the 2015 IBC, Section 2308.9 of the 2012, 2009 and 2006 IBC and Section R602 of the IRC, subject to the following conditions:

1. VERSA-LAM® used as wall studs must have a thickness of $1^1/_2$ inches (38 mm) or greater.
2. Cutting, notching and boring of nominally 2-by-4 and 2-by-6 VERSA-LAM® studs is permitted in accordance with Sections 2308.5.9 and 2308.5.10 of the 2015 IBC, Sections 2308.9.10 and 2308.9.11 of the 2012, 2009 and 2006 IBC and Section R602.6 of the IRC.

Allowable shear values for nailed wood structural panel shear walls utilizing VERSA-LAM® framing members may be determined using Section 2306.3 of the 2015 and 2012 IBC, Table 2306.3 of the 2009 IBC or Table 2306.4.1 of the 2006 IBC, for shear walls with framing of Douglas fir-Larch, subject to the following conditions:

1. A double VERSA-LAM® stud must be used at adjoining wood structural panel edges. Studs must be stitch nailed together with two staggered rows of 0.148 inch (3.8 mm) diameter (10d common) nails spaced at 8 inches on center in each row.
2. Nails at panel edges must be staggered along two nailing lines spaced approximately $^1/_2$ inch (12.7 mm) apart. Nails at panel edges must also be at least $^3/_8$ inch (9.5 mm) from the edges of the VERSA-LAM® stud and the wood structural panel.
3. The tabulated shear values for nailed wood structural panel shear walls using 8d or 10d box or common nails at a panel edge nail spacing of 2 inches (51 mm) must be multiplied by a factor of 0.90.
4. The tabulated shear values for nailed wood structural panel shear walls using 10d box or common nails at a panel edge nail spacing of 3 inches (76 mm) must be multiplied by a factor of 0.90.

4.6.2 Fire-resistance-rated Wall Construction: VERSA-LAM® is permitted to be used in fire-resistance-rated wall construction as follows:

1. For conventional light-frame construction, VERSA-LAM® is permitted to be used as a direct replacement for solid-sawn lumber in any 1-hour fire-resistance-rated wall assembly listed in Table 720.1(2) of the IBC, provided the following conditions are met:
   a. The VERSA-LAM® studs have a minimum depth of $5^1/_2$ inches (140 mm) (nominal 2-by-6).
   b. Tape and joint compound must be applied to fastener heads and gypsum wallboard joints on the exposed surface(s).
2. For engineered, load-bearing wall construction, VERSA-LAM® is permitted to be used in 1-hour fire-resistance-rated wall assemblies provided the following conditions are met:
   a. The VERSA-LAM® studs have a minimum depth of $5^1/_2$ inches (140 mm) (nominal 2-by-6).
   b. Studs must be spaced no more than 16 inches (406 mm) on center.
   c. Minimum $^5/_8$-inch (15.9 mm) Type X gypsum wallboard must be attached with $2^1/_4$-inch-long (57 mm) Type S drywall screws spaced 7 inches (178 mm) on center along each stud.
   d. Tape and joint compound must be applied to fastener heads and gypsum wallboard joints on the exposed surface(s).
   e. The design axial compressive stress within the studs must not exceed the least of the following:
      i. 525 psi (3620 kPa).
      ii. $0.46F_c'$, where F_c' is the compression design value parallel-to-grain, adjusted by all applicable adjustment factors in accordance with the NDS, including the column stability factor, C_P.
      iii. 0.46 F_c', where F_c' is calculated in accordance with the NDS assuming a slenderness ratio, l_e/d, of 21.

4.7 Installation:

VERSA-LAM® LVL products must comply with this report and the wood construction requirements noted in the applicable code, as indicated in this report.

5.0 CONDITIONS OF USE

The VERSA-LAM® LVL products described in this report comply with, or are suitable alternatives to what is specified in those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 VERSA-LAM® LVL products are manufactured by Boise Building Solutions Manufacturing, LLC, in White City, Oregon, and Alexandria, Louisiana, under a quality-control program with inspections by ICC-ES and APA—The Engineered Wood Association (AA-649).

5.2 The service conditions for the LVL products described in this report must be a covered, dry condition of use. Dry conditions of use are those conditions of use represented by sawn lumber at which the moisture content is less than 16 percent.

5.3 Calculations and details for specific applications, demonstrating that the use of VERSA-LAM® LVL products comply with this report, must be submitted to the code official upon request. The documents in question must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 Duration-of-load adjustments, as provided for wood members and their connections, may be applied in accordance with the limitations specified in the applicable code, as indicated in this report.

5.5 The use of treatments on the products listed in this report, such as preservatives and fire retardants, is outside the scope of this report.

5.6 Cutting and notching of VERSA-LAM® LVL products is outside the scope of this report except when used as wall studs.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with ICC-ES Acceptance Criteria for Structural Wood-based Products (AC47), dated June 2016 (editorially revised August 2016).

6.2 Data in accordance with ICC-ES Acceptance Criteria for Rim Board Products (AC124), dated October 2016.

6.3 Data in accordance with ICC-ES Acceptance Criteria for Wood-based Studs (AC202), dated June 2009 (editorially revised July 2016).

6.4 Reports of fire tests conducted in accordance with ASTM E119.

7.0 IDENTIFICATION

VERSA-LAM® products are identified with a stamp noting the manufacturer's name (Boise Cascade) and plant location, the product name (including MOE, design flexural stress and design axial tensile stress, as applicable), the date of manufacture, the evaluation report number (ESR-1040), and the name of the inspection agency (APA-The Engineered Wood Association). Unless otherwise identified, all products from White City, Oregon, are manufactured from primarily Douglas fir and all products from Alexandria, Louisiana, are manufactured from primarily southern yellow pine. VERSA-LAM® products manufactured in White City, Oregon from primarily southern yellow pine are identified with 'SYP'.

TABLE 1—REFERENCE DESIGN VALUES FOR VERSA-LAM® (pounds per square inch)[1,2]

PRODUCT GRADE	MODULUS OF ELASTICITY[5] E (×10^6 psi)	FLEXURAL STRESS, F_b		TENSION PARALLEL TO GRAIN[4], F_t	COMP. PARALLEL TO GRAIN, F_C	COMPRESSION PERPENDICULAR TO GRAIN, $F_{c\perp}$		HORIZONTAL SHEAR, F_v	
		Joist[3]	Plank			Perp. to Narrow Face (Plank)	Parallel to Narrow Face (Joist)	Parallel to Narrow Face (Plank)	Perp. to Narrow Face (Joist)
1.3 1600[6]	1.3	1600	1600	1100	2500	450	525	150	225
1.3 1750[6]	1.3	1750	1600	1100	2500	450	525	150	225
1.4 1800/1100	1.4	1800	1800	1100	2500	450	525	150	225
1.4 1950/1100	1.4	1950	1800	1100	2500	450	525	150	225
1.4 1800[6]	1.4	1800	1800	1250	2500	450	525	150	225
1.4 1950[6]	1.4	1950	1800	1250	2500	450	525	150	225
1.5 2050/1250	1.5	2050	2050	1250	2500	450	525	150	225
1.5 2250/1250	1.5	2250	2050	1250	2500	450	525	150	225
1.5 2050[6]	1.5	2050	2050	1400	2500	450	525	150	225
1.5 2250[6]	1.5	2250	2050	1400	2500	450	525	150	225
1.6 2250/1400	1.6	2250	2250	1400	2500	450	525	150	225
1.6 2450/1400	1.6	2450	2250	1400	2500	450	525	150	225
1.6 2250[6]	1.6	2250	2250	1500	2500	450	525	150	225
1.6 2450[6]	1.6	2450	2250	1500	2500	450	525	150	225
1.7 2400/1500	1.7	2400	2400	1500	3000	450	750	190	285
1.7 2650/1500	1.7	2650	2400	1500	3000	450	750	190	285
1.7 2400[6]	1.7	2400	2400	1650	3000	450	750	190	285
1.7 2650[6]	1.7	2650	2400	1650	3000	450	750	190	285
1.8 2500/1650	1.8	2500	2500	1650	3000	450	750	190	285
1.8 2750/1650	1.8	2750	2500	1650	3000	450	750	190	285
1.8 2500[6]	1.8	2500	2500	1825	3000	450	750	190	285
1.8 2750[6]	1.8	2750	2500	1825	3000	450	750	190	285
1.9 2600/1825	1.9	2600	2600	1825	3000	450	750	190	285
1.9 2850/1825	1.9	2850	2600	1825	3000	450	750	190	285
1.9 2600[6]	1.9	2600	2600	1950	3000	450	750	190	285
1.9 2850[6]	1.9	2850	2600	1950	3000	450	750	190	285
2.0 2800/1950	2.0	2800	2800	1950	3000	450	750	190	285
2.0 3100/1950	2.0	3100	2800	1950	3000	450	750	190	285
2.0 2800[6]	2.0	2800	2800	2150	3000	450	750	190	285
2.0 3100[6]	2.0	3100	2800	2150	3000	450	750	190	285
2.1 2900/2150	2.1	2900	2900	2150	3000	450	750	190	285
2.1 3200/2150	2.1	3200	2900	2150	3000	450	750	190	285
2.1 2900[6]	2.1	2900	2900	2250	3000	450	750	190	285
2.1 3200[6]	2.1	3200	2900	2250	3000	450	750	190	285
2.2 3100/2250	2.2	3100	3100	2250	3000	450	750	190	285
2.2 3400/2250	2.2	3400	3100	2250	3000	450	750	190	285
2.2 3100[6]	2.2	3100	3100	2425	3000	450	750	190	285
2.2 3400[6]	2.2	3400	3100	2425	3000	450	750	190	285

For **SI:** 1 psi=0.00689 MPa.

[1]Reference design values are based on dry conditions of use where the in-service moisture content of the LVL is less than 16 percent.
[2]Reference design values must be adjusted, as applicable, in accordance with Section 8.3 of the NDS.
[3]The tabulated reference flexural stress, F_b, is for LVL with a 12-inch depth. For other depths, multiply by the size factor $C_f = (12/d)^{1/9}$, where d is the member depth in inches.
[4]The tabulated reference tension stress, F^t, is for LVL with a 4-foot length. For longer lengths, multiply by the length factor $C_L = (4/L)^{1/8}$, where L is the member length in feet.
[5]The reference modulus of elasticity for beam stability and column stability calculations, E_{min}, must be calculated in accordance with Appendix D of the NDS. When calculating E_{min}, the coefficient of variation of modulus of elasticity, COV_E, may be taken as 0.10.
[6]Product may also be labeled according to both F_b and F_t. Example: 2.0 2800 is equivalent to 2.0 2800/2150.

For uniformly loaded, simple span beams, deflection is calculated as follows:

$$D = \frac{270WL^4}{Ebd^3}$$

where:
D = Deflection (inches)
W = Uniform load (plf)
L = Span (feet)
E = Modulus of elasticity (psi)
b = Beam width (inches)
d = Beam depth (inches)

TABLE 2—VERSA-LAM® ALLOWABLE RIM BOARD DESIGN CAPACITIES

MODULUS OF ELASTICITY, E (x10^6 psi)	MINIMUM THICKNESS (inches)	ALLOWABLE VERTICAL LOAD[1]				LATERAL CAPACITY[5,6,7] (lb/ft)	CONTAINS CROSS-PLY VENEER
		Distributed Load (lb/ft)		Concentrated Load ($3^1/_2$ in. Min. Width) (lb)			
		$d^2 \le 16$	$16 < d^2 \le 20$	$d^2 \le 16$	$16 < d^2 \le 20$		
1.3 - 1.6	1	2000	N/A	N/A	N/A	190	No
	$1^1/_{16}$	2000	N/A	N/A	N/A	205	No
	$1^1/_8$	2000	N/A	N/A	N/A	220	No
	$1^3/_{16}$	2000	N/A	N/A	N/A	230	No
	$1^1/_4$	3250	3250	2250	2250	See Note 3	No
	$1^5/_{16}$	6000	5450	4450	4450	See Note 3	Yes
	$1^1/_2$	6480	5600[8]	4600	4450[8]	See Note 3	Yes
	$2^1/_4$	3250	3250	2250	2250	See Note 4	No
1.7 - 2.2	1	4250	3700	3700	3500	190	No
	$1^1/_{16}$	4250	3700	3700	3500	205	No
	$1^1/_8$	4250	3700	3700	3500	220	No
	$1^3/_{16}$	4250	3700	3700	3500	230	No
	$1^1/_4$	4250	3700	3700	3500	See Note 3	No
2.0 - 2.2	$1^1/_2$	5450	4300	4300	3900	See Note 3	No
	$1^3/_4$	5700	4300	4300	3900	See Note 3	No
	$2^1/_4$	5700	4300	4300	3900	See Note 4	No

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.4 N, 1 lb/ft = 47.8 Pa.

[1]Allowable loads given in this table are not permitted to be increased by the load duration factor, C_D.
[2]d = member depth (inches).
[3]The lateral capacity (in-plane shear) is as permitted in the applicable code for solid-sawn lumber framing in horizontal wood diaphragms with nominally 2-inch-thick framing.
[4]The lateral capacity (in-plane shear) is as permitted in the applicable code for solid-sawn lumber framing in horizontal wood diaphragms with nominally 3-inch-thick framing.
[5]VERSA-LAM® used as rim joist may be substituted for solid-sawn framing in horizontal wood diaphragms as shown in Tables 4.2A, 4.2B and 4.2C of the 2015 ANSI/AWC SDPWS, Table 2306.2.1(1) of the 2009 IBC and Table 2306.3.1 of the 2006 IBC (maximum horizontal shear values must be limited as noted).
[6]Toe-nailed connections are not limited by the 150 plf lateral load capacity noted for Seismic Design Categories D, E, and F in Section 4.1.7 of the 2015 ANSI/AWC SDPWS and Section 2305.1.4 of the 2006 IBC.
[7]See Table 3 for minimum nail spacing requirements.
[8]The applicable depth range is between 16 inches and 24 inches for the indicated values corresponding to $1^1/_2$ inch-thick product with cross-ply veneers.

TABLE 3—ALLOWABLE NAIL SPACING FOR VERSA-LAM® (inches)[1,2]

CONNECTOR SIZE	NAILS PARALLEL TO THE GLUE LINE										NAILS PERP. TO THE GLUE LINE	
	Minimum Thickness 1 inch		Minimum Thickness $1^1/_4$ inches		Minimum Thickness[3] $1^1/_2$ inches		Minimum Thickness[3] $1^3/_4$ inches		Minimum Thickness[3] $3^1/_2$ inches		All Thicknesses[3]	
	o.c.	End[4]	o.c.	End[4]	o.c.	End[4]	o.c.	End[4]	o.c.	End[4]	o.c.	End[4]
8d box	3	$1^1/_2$	3	$1^1/_2$	3	$1^1/_2$	2	1	2	$^1/_2$	2	$^1/_2$
8d common	4	3	3	2	3	2	3	2	2	1	2	1
10d & 12d box	4	3	3	2	3	2	3	2	2	1	2	1
16d box	4	3	3	2	3	2	3	2	2	1	2	1
10d & 12d common	6	4	4	3	4	3	4	3	2	2	2	2
16d sinker	6	4	4	3	4	3	4	3	2	2	2	2
16d common	6	4	6	4	6	4	6	3	2	2	2	2

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

[1]Spacing requirements and maximum nail size for panel edge nailing of wall sheathing at adjoining panels must also be in accordance with Section 4.6.
[2]Edge distances must be sufficient to prevent splitting.
[3]For multiple rows of fasteners, the rows must be offset $^1/_2$ inch or more from each other, equally spaced from the centerline of the LVL member and staggered.
[4]"End" refers to the minimum distance between the nail and the end(s) of the piece(s) being connected.

TABLE 4—EQUIVALENT SPECIFIC GRAVITIES FOR CONNECTOR DESIGN

PRODUCT	MODULUS OF ELASTICITY, E ($x10^6$ psi)	NAILS					
		Lateral Installed into Wide Face		Lateral Installed into Narrow Face		Withdrawal	
		Loaded Parallel to Length	Loaded Perpendicular to Length	Loaded Parallel to Length	Loaded Perpendicular to Length	Installed into Wide Face	Installed into Narrow Face
VERSA-LAM®	1.3 – 2.2	0.50	0.50	0.50	0.50	0.50	0.50

PRODUCT	MODULUS OF ELASTICITY, E ($x10^6$ psi)	BOLTS			
		Lateral Installed into Wide face		Lateral Installed into Narrow Face	
		Loaded Parallel to Length	Loaded Perpendicular to Length	Loaded Parallel to Length	Loaded Perpendicular to Length
VERSA-LAM®	1.3 – 2.2	0.50	0.50	0.50	0.50