FRERES SINGLE-PLY Laminated Veneer Lumber   PR-L324

Freres Lumber Co., Inc.   Revised September 21, 2023

Product: Freres LVL

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1. Basis of the product report:
   - 2021, 2018, and 2015 International Building Code (IBC): Sections 104.11 Alternative materials and 2303.1.10 Structural composite lumber
   - 2012 IBC: Sections 104.11 Alternative materials and 2303.1.9 Structural composite lumber
   - 2021, 2018, and 2015 International Residential Code (IRC): Sections R104.11 Alternative materials, and R502.1.5, R602.1.5, and R802.1.4 Structural composite lumber
   - 2012 IRC: Section R104.11 Alternative materials, and R502.1.7, R602.1.4, and R802.1.6 Structural composite lumber
   - ASTM D5456-18, D5456-14b, D5456-13, and D5456-09 recognized in the 2021 IBC and IRC, 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively
   - ASTM D7672-14e1, ASTM D7672-14, and ASTM D7672-12 recognized in the 2021 IBC and IRC, 2018 IBC and IRC, and 2015 IBC and IRC, respectively
   - ANSI/APA PRR 410-2016 and ANSI/APA PRR 410-2011 recognized in the 2021 IBC and IRC and 2018 IBC and IRC, and 2015 IBC and IRC, respectively
   - 2021, 2015, and 2008 ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS) recognized in the 2021 and 2018, 2015, and 2012 IBC, respectively
   - APA Reports T2018P-14, T2018P-15, T2018P-37, T2018P-38, T2018P-40, T2021P-25, T2023P-15, T2023P-16, T2023P-17, and T2023P-18, and other qualification data

2. Product description:
   Freres LVL is made with multiple layers of Douglas-fir veneers in accordance with the APA-approved in-plant manufacturing standard. The strength axis of the veneers is arranged primarily in the longitudinal direction of the LVL with some cross-grain veneers. The final length of the LVL is achieved by scarf-jointing. Freres LVL is available in nominal thicknesses (t) of 1 to 1-1/2 inches, nominal widths (w) of 1-1/2 to 24 inches, and lengths up to 60 feet (see Figure 1). Freres LVL Rim Board is made of Freres 1.55E LVL with the exception that the nominal thicknesses (t) are 1, 1-1/8, and 1-1/4 inches.

3. Design properties:
   Table 1 lists the Allowable Stress Design properties for Freres LVL. Table 2 lists the equivalent specific gravities for the fastener design of Freres LVL. The allowable spans for Freres LVL shall be in accordance with the recommendations provided by the manufacturer. Table 3 lists the allowable loads for rim boards and Table 4 lists the allowable nail spacing for Freres LVL.

4. Product installation:
   Freres LVL shall be installed in accordance with the recommendations provided by the manufacturer (https://frereswood.com/products-and-services/mass-ply-products/). The permissible notching and drilling are beyond the scope of this report and shall consult with manufacturer's recommendations.

5. Fire-rated assemblies:
    Design of fire-resistant exposed wood members in accordance with Chapter 16 of the National Design Specification for Wood Construction (NDS), Section 722.1 of the 2021, 2018, and 2015 IBC, or Section 722.6.3 of the 2012 IBC shall be applicable to Freres LVL. Fire-rated assemblies shall be constructed in accordance with the recommendations provided by APA Design/Construction Guide: *Fire-Rated Systems*, Form W305 (www.apawood.org/resource-library), and the manufacturer.

6. Limitations:
    a) Freres LVL shall be designed in accordance with the code using the design properties specified in this report.
    b) Freres LVL is limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16%.
    c) Freres LVL is produced at the Freres facility in Lyons, Oregon under a quality assurance program audited by APA.
    d) Properties shown in this report are limited to 1-inch to 1-1/2-inch thick Freres LVL up to 24 inches in depth, except for Freres 1.55E LVL rim boards, which have thicknesses of 1, 1-1/8, and 1-1/4 inches.
    e) This report is subject to re-examination in one year.

7. Identification:
    Freres LVL described in this report is identified by a label bearing the manufacturer's name and/or trademark, the APA assigned plant number (1122), the LVL grade, the APA logo, the report number PR-L324, and a means of identifying the date of manufacture.

Table 1. Allowable Stress Design Properties for Freres LVL[a,b]

Property		Design Stress (psi)					
		2.1E	1.9E	1.6E	1.55E	Enhanced 1.0E	1.0E
Bending (F_b)[c]	Joist[d]	2,800	2,150	1,900	1,700	1,100	950
	Plank	3,100	2,650	2,400	2,200	1,450	1,200
Modulus of Elasticity (E)[e]	Joist	2,100,000	1,900,000	1,600,000	1,550,000	1,000,000	900,000
	Plank	2,100,000	1,900,000	1,400,000	1,400,000	1,000,000	950,000
Horizontal Shear (F_v)	Joist	190	235	255	255	300	300
	Plank	130	55	90	90	55	40
Compression Perpendicular to Grain ($F_{c\perp}$)	Joist	750	750	750	750	750	750
	Plank	750	600	600	600	600	600
Tension parallel to grain (F_t)[f]		1,750	1,550	1,300	950	700	200
Compression parallel ($F_{c\parallel}$)		2,900	2,425	2,400	2,100	1,550	1,550

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lbf = 4.448 N, 1 psi = 6.9 kPa.

[a] The tabulated values are design values for 1-inch to -1/2-inch thick LVL under the normal duration of load. All values, except for E and $F_{c\perp}$, are permitted to be adjusted for other load durations as permitted by the code. The design values are limited to dry-use conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16%.

[b] Joist = load parallel to glueline, plank = load perpendicular to glueline (see Figure 1).

[c] The tabulated bending stress (F_b) may be increased by 4 percent when the member qualifies as a repetitive member as defined in the NDS.

[d] The tabulated values are based on a reference depth of 12 inches. For other depths, when loaded edgewise, the allowable bending stress (F_b) shall be modified by $(12/d)^{1/6}$ as shown in the following table, where d = member depth in inches. For depths less than 3-1/2 inches, the factor for the 3-1/2-inch depth shall be used.

Depth, d (in.)	3-1/2	5-1/2	7-1/4	9-1/4	9-1/2	11-1/4	11-7/8	14	16	18	24
2.1E, 1.9E, 1.6E, 1.55E, Enhanced 1.0E, and 1.0E	1.23	1.14	1.09	1.04	1.04	1.01	1.00	0.97	0.95	0.93	0.89

[e] Apparent modulus of elasticity.

[f] The tabulated values are based on a reference length of 4 feet. For lengths longer than 4 feet, the allowable tensile stress shall be modified by $(4/L)^{1/7}$, where L = member length in feet. For lengths shorter than 4 feet, use the tabulated value unadjusted.

Table 2. Equivalent Specific Gravity for Fastener Design of Freres LVL

Grade	Equivalent Specific Gravity (ESG)					
	Nails and Wood Screws				Bolts and Lag Screws	
	Withdrawal Load		Lateral Load		Lateral Load	
					Installed in Face	
	Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Parallel to Grain	Perpendicular to Grain
2.1E	0.49	0.50	0.49	0.60	0.54	0.59
1.9E	0.40	0.50	0.32	0.59	0.52	0.63
1.6E & 1.55E	0.42	0.50	0.41	0.62	0.42	0.63
Enhanced 1.0E	0.43	0.50	0.41	0.62	0.43	0.63
1.0E	0.42	0.50	0.34	0.58	0.41	0.63

Table 3. Allowable Design Properties for Freres LVL Rimboard[a]

Grade	Thickness, t (in.)	Lateral Load[b,c,d] (lbf/ft)	Vertical Load Capacity				Lateral Resistance for ½-inch-dia. Lag Screws[e] (lbf)
			Uniform (lbf/ft)		Concentrated (lbf)		
			Depth ≤ 16 in.	16 in. < Depth ≤ 24 in.	Depth ≤ 16 in.	16 in. < Depth ≤ 24 in.	
1.55E	t ≥ 1¼	240	5,400	4,000	3,800	3,800	500
	t = 1⅛	220	4,860	4,000	3,500	3,500	475
	t = 1	190	4,000	2,500	3,500	2,000	450

For SI: 1 inch = 25.4 mm, 1 lbf. = 4.45 N, 1 lbf/ft = 14.6 N/m.

[a] The tabulated design values are applicable to the normal load duration (10 years) for wood products, except for the lateral load capacity, which is based on the short-term load duration (10 minutes). Design values shall be adjusted for other load durations in accordance with the applicable building code except that the vertical uniform load capacity and vertical concentrated load capacity are not permitted to be increased for any load durations shorter than the normal load duration (10 years).

[b] The lateral load capacity is for seismic design and is permitted to be multiplied by 1.4 for wind load applications. For shear loads of normal or permanent load duration as defined by the NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

[c] Toe-nailed connections are not limited by the 150 lbf/ft lateral load capacity noted for Seismic Design Categories D, E, and F in Section 4.1.10 of the 2021 SDPWS and Section 4.1.7 of the 2015 and 2008 SDPWS.

[d] The nailing schedule for sheathing-to-rim and rim-to-sill plate (toe-nailed) is based on minimum 8d box nails (0.113 in. x 2-1/2 in.) at 6 inches on center. Commercial framing connectors fastened to the face of the rim board and wall plates may be used to achieve lateral load capacities exceeding values in this table. Calculations must be based on equivalent specific gravity listed in Table 2, and the nail spacing must be at least 6 inches on center.

[e] The lag screw shall be inserted with a washer in a lead hole in accordance with the NDS by turning with a wrench, not by driving with a hammer.

Table 4. Minimum Allowable Nail Spacings for Freres LVL[a,b]

Orientation	Common Nail Size[c,d]	Minimum End Distance (in.)	Minimum Nail Spacing (in.)	
			Single Row	Multiple Rows
Edge[e]	12d (0.148 in. x 3-1/4 in.) & smaller	1-1/2	3	NR[g]
	16d (0.162 in. x 3-1/2 in.)	NR[g]		
Face[f]	16d (0.162 in. x 3-1/2 in.) & smaller	1	2	2

For SI: 1 inch = 25.4 mm.

[a] Edge distance shall be sufficient to prevent splitting.

[b] The tabulated values are limited to LVL with a thickness of 1 inch or thicker.

[c] 16d sinkers (0.148 in. x 3-1/4 in.) may be spaced the same as a 12d common wire nail (0.148 in. x 3-1/4 in.).

[d] Nails listed are common wire nails. For box nails, the spacing and end distance requirements of the next shorter common nails may be used: e.g., a 16d box (0.135 in. x 3-1/2 in.) nail may be spaced the same as a 12d common (0.148 in. x 3-1/4 in.) nail. Fastener sizes and closest on-center spacing not specifically described above are beyond the scope of this report.

[e] Nail penetration for edge nailing shall not exceed 2-1/2 inches for 12d common nails (0.148 in. x 3-1/4 in.) and 2-1/4 inches for 8d common nails (0.131 in. x 2-1/2 in.).

[f] Tabulated closest on-center spacing for face orientation is applicable to nails that are installed in rows parallel to the grain (length) of the LVL. For nails installed in rows perpendicular to the direction of grain (width/depth) of the LVL, the closest on-center spacing for face orientation shall be sufficient to prevent splitting of the LVL.
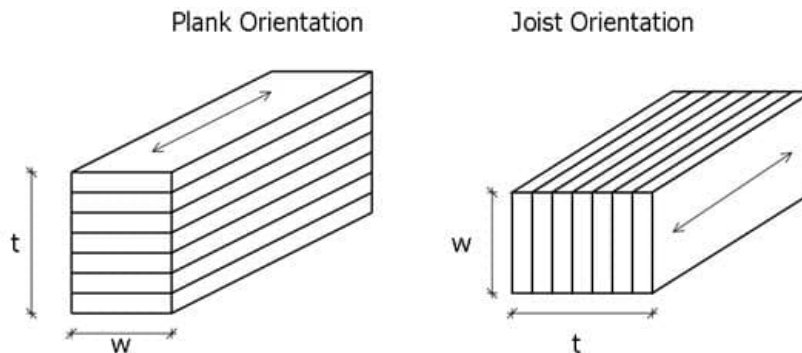
[g] Not recommended.

Figure 1. Freres LVL Orientations

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