APA PRODUCT REPORT®

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GP LAM® & VERSA-LAM® LVL — PR-L266

Boise Cascade Company

Revised March 1, 2018

Product: 1.5-ES (1.5E-2250F_b), 1.9E (1.9E-2750F_b), 2.0-ES (2.0E-2900F_b), and 2.0E-3100F_b GP Lam® LVL, and 1.7 2650, 1.8 2750, and 2.0 3100 VERSA-LAM® LVL

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1. Basis of the product report:
   - 2018 and 2015 International Building Code (IBC): Sections 104.11 Alternative materials and 2303.1.10 Structural composite lumber
   - 2012 and 2009 IBC: Sections 104.11 Alternative materials and 2303.1.9 Structural composite lumber
   - 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 and 2009 IRC: Section R104.11 Alternative materials, and 2012 IRC Sections R502.1.7, R602.1.4, and R802.1.6 Structural composite lumber
   - ASTM D5456-14b, ASTM D5456-13, D5456-09, and D5456-05a recognized by the 2018 IBC and IRC, 2015 IBC and IRC, 2012 IBC and IRC, and 2009 IBC, respectively
   - APA Reports T97P-26, T98P-10, T2000P-24, T2002P-12, T2002P-15, T2003P-46, T2003P-81A, T2004P-09, T2004P-25, T2004P-26, T2004M-41, T2004P-48, T2004M-56, T2004M-80, T2005M-23, T2005P-25, T2005M-97, T2007P-08, T2007P-09, T2007P-10, T2007P-59, T2007P-98, and T2016P-41A, T2016P-44, and T2017P-33, and other qualification data

2. Product description:
   GP Lam® and VERSA-LAM® LVL are made with veneer sheets of various species and grades in accordance with the in-plant manufacturing standards approved by APA. GP Lam and VERSA-LAM LVL are available in thicknesses from 3/4 inch to 3-1/2 inches, widths of 3-1/2 inches to 48 inches, and lengths up to 80 feet.

3. Design properties:
   Table 1 lists the design properties, Table 2 lists the equivalent specific gravities for connection design, and Table 3 lists the allowable fastener spacing for GP Lam and VERSA-LAM LVL. The allowable loads for GP Lam and VERSA-LAM LVL shall be in accordance with the recommendations provided by the manufacturer (www.bc.com/manufacturing/gp-lvl/ and www.bcewp.com).

4. Product installation:
   GP Lam and VERSA-LAM LVL shall be installed in accordance with the recommendations provided by the manufacturer. Permissible details and allowable hole sizes shall be in accordance with the recommendations provided by the manufacturer.

5. Fire-rated assemblies:
   The provisions of 2015 IBC Section 722 Calculated fire resistance, and 2012 IBC Section 722.6.3 and 2009 IBC Section 721.6.3 Design of fire-resistant exposed wood members shall be applicable to GP Lam and VERSA-LAM 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) GP Lam and VERSA-LAM LVL shall be designed in accordance with the code using the design properties specified in this report.
   b) GP Lam and VERSA-LAM LVL are limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16 percent.
   c) The 2.0 3100 VERSA-LAM, and 1.9E (1.9E-2750F_b), 2.0-ES (2.0E-2900F_b), and 2.0E-3100F_b GP Lam LVL grades are produced at Boise Cascade's facilities in Roxboro, North Carolina or Thorsby, Alabama under a quality assurance program audited by APA.
   d) The 1.7 2650 and 1.8 2750 VERSA-LAM, and 1.5-ES (1.5E-2250F_b) GP Lam LVL grades are produced at Boise Cascade's facility in Thorsby, Alabama under a quality assurance program audited by APA.
   e) This report is subject to re-examination in one year.

7. Identification:
   GP Lam and VERSA-LAM LVL described in this report are identified by a label bearing the manufacturer's name and/or trademark, the APA assigned plant number (1028 for the Roxboro plant or 1086 for the Thorsby plant), the LVL grade, the APA logo, the report number PR-L266, and a means of identifying the date of manufacture.

   Identification may include one or more of the following:

GP Lam LVL, VERSA-LAM®, Boise-Cascade, or Boise Cascade Company.
International Beams LVL (for International Beams Inc.)

Table 1. Design Properties (Allowable Stress Design) for GP Lam and VERSA-LAM LVL[a,b,c]

Property		Design Stress (psi)						
		GP Lam LVL				VERSA-LAM		
		1.5-ES or 1.5E-2250F_b[h]	1.9E or 1.9E-2750F_b[g]	2.0-ES or 2.0E-2900F_b[h]	2.0E-3100F_b[g]	1.7 2650[g]	1.8 2750[g]	2.0 3100[g]
Bending (F_b)[d,e]	Joist	2,250	2,750	2,900	3,100	2,650	2,750	3,100
	Plank	2,250	2,750	2,900	3,100	2,400	2,500	2,800
Tension parallel to grain (F_t)[f]		1,400	1,700	1,825	1,900	1,650	1,825	2,150
Longitudinal shear (F_v)	Joist	285	290	290	290	285	285	285
	Plank	NA	175	175	175	175	175	175
Compression parallel ($F_{c\|\|}$)		2,200	2,500	2,600	3,000	3,000	3,000	3,000
Compression perpendicular ($F_{c\perp}$)	Joist	750	845	845	845	750	750	750
	Plank	NA	450	450	450	450	450	450
Modulus of Elasticity, E	Joist & Plank	1.5 x 10^6	1.9 x 10^6	2.0 x 10^6	2.0 x 10^6	1.7 x 10^6	1.8 x 10^6	2.0 x 10^6

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 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 stresses are limited to conditions in which the maximum moisture content is less than 16 percent.

[b] Joist = load parallel to glueline; Plank = load perpendicular to glueline.

[c] ES = eastern species (any combination of southern pine, sweet gum and/or yellow poplar)

[d] Tabulated flexural stress (F_b) may be increased by 4 percent when the member qualifies as a repetitive member as defined in the NDS.

[e] The tabulated plank values require no depth modification. The tabulated joist 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 $(12/d)^{1/9}$ for 2.0-ES (2.0E-2900F_b) GP-Lam, and 1.7 2650, 1.8 2750, and 2.0 3100 VERSA-LAM; and $(12/d)^{1/6.5}$ for 1.5-ES (1.5E-2250F_b), 1.9E (1.9E-2750F_b), and 2.0E-3100F_b GP-Lam, as shown in the following table. For depths less than 3-1/2 inches, the factor for the 3-1/2-inch depth shall be used.

	Depth (in.)	3-1/2	5-1/2	7-1/4	9-1/4	11-1/4	12	16	18	20	24
2.0-ES (2.0E-2900F_b) GP Lam, and 1.7, 1.8, and 2.0 VERSA-LAM	Multiply by	1.15	1.09	1.06	1.03	1.01	1.0	0.97	0.96	0.94	0.93
1.5-ES (1.5E-2250F_b), 1.9E (1.9E-2750F_b), and 2.0E-3100F_b GP Lam		1.21	1.13	1.08	1.04	1.01	1.0	0.96	0.94	0.92	0.90

[f] The tabulated values are based on a reference length of 4 feet. For other lengths, the allowable tensile stress shall be modified by $(4/\ell)^{1/10}$ for all grades of GP Lam LVL and $(4/\ell)^{1/8}$ for all grades of VERSA-LAM LVL, where ℓ = length in feet. For lengths less than 4 feet, use the allowable tension stresses in Table 1 unadjusted.

[g] The MOE values given are the apparent modulus of elasticity and include the effects of shear deformations. When calculating deflection, only the bending deformations need be included and the second term of the equation in footnote (h) may be ignored.

[h] The MOE values given are the shear-free modulus of elasticity. When calculating deflection, both bending and shear deformations must be included. The deflection equation for a simply-supported beam under uniform load is:

$$\delta = \frac{270wL^4}{Ebh^3} + \frac{28.8wL^2}{Ebh}$$

Where: δ = Estimated deflection, inches; w = uniform load, plf; L = span, feet; E = tabulated modulus of elasticity, psi; b = beam width, inches; h = beam depth, inches

Table 2. Fastener Details for GP Lam and VERSA-LAM LVL

LVL Grade	Equivalent Specific Gravity (S.G.)					
	Nails				Bolts	
	Withdrawal Load		Lateral Load		Lateral Load	
	Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Installed in Face	
					Parallel to Grain	Perpendicular to Grain
1.5-ES (1.5E-2250F_b) GP Lam	Hemlock/ fir (0.43)	Hemlock/ fir (0.43)	Hemlock/ fir (0.43)	Western hemlock (0.47)	Hemlock/ fir (0.43)	Hemlock/ fir (0.43)
1.9E (1.9E-2750F_b), 2.0-ES (2.0E-2900F_b), and 2.0E-3100F_b GP Lam, and 1.7, 1.8 and 2.0 VERSA-LAM	Hemlock/ fir (0.43)	Douglas-fir/ larch (0.50)	Douglas-fir/ larch (0.50)	Douglas-fir/ larch (0.50)	Douglas-fir/ larch (0.50)	Douglas-fir/ larch (0.50)

Table 3. Allowable Fastener Spacing for Installation Parallel to the Glue Line in GP Lam and VERSA-LAM LVL[(a)]

Minimum Member Size (in.)	Connector Size	Nails Installed in the Narrow Face
		On-Center Spacing (in.)
3/4 x 3-1/2	10d box and common nails	6
	16d sinker and 12d common nails	6
	14 gage staples	6
1-3/4 x 5-1/2	10d box and common nails	4
	16d sinker and 12d common nails	4
	14 gage staples	4
	16d common nails	8

For SI: 1 inch = 25.4 mm

[(a)] The minimum on-center spacing permitted for nails installed in the wide face of GP Lam and VERSA-LAM LVL, i.e., perpendicular to the glue line, is the same as that permitted by the applicable code for solid-sawn lumber.

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