

GP LAM[®] & VERSA-LAM[®] LVL
Boise Cascade Company

PR-L266C

Revised March 20, 2018

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

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www.bc.com/manufacturing/gp-lvl/ and www.bcewp.com

1. Basis of the product report:
 - 2015 National Building Code of Canada: Clause 1.2.1.1 of Division A and Clauses 4.1, 4.3.1.1, and 9.23 of Division B
 - CSA O86-14 (Reprint 2016) Engineering Design in Wood
 - ASTM D5456-14b recognized by CAN/CSA O86-14 (Reprint 2016)
 - 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, 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 19 mm (3/4 inch) to 89 mm (3-1/2 inches), widths of 89 mm (3-1/2 inches) to 1,219 mm (48 inches) and lengths up to 24 m (80 feet).
3. Design properties:

Table 1 lists the Limit States Design properties; Table 2 lists the equivalent relative densities for connection design; Table 3 lists the minimum fastener spacing for GP Lam; and Table 4 lists the minimum fastener spacing for VERSA-LAM LVL. The factored resistances 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 maximum hole sizes shall be in accordance with the recommendations provided by the manufacturer.
5. Fire-rated assemblies:

Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer and approved by the authority having jurisdiction.
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, as defined in CSA O86, at which the average equilibrium moisture content of solid-sawn lumber over a year is 15 percent or less and does not exceed 19 percent.
 - c) The 1.9E (1.9E-2750F_b), and 2.0E-ES (2.0E-2900F_b), and 2.0E-3100F_b GP Lam LVL grades are produced at Boise Cascade's facility in Roxboro, North Carolina or Thorsby, Alabama under a quality assurance program audited by APA.

- d) The VERSA-LAM 2.0 3100, VERSA-LAM 1.8 2750 and VERSA-LAM 1.7 2650, 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 (or PR-L266C), 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. Specified Strengths and MOE (Limit States Design for Use in Canada) for GP Lam and VERSA-LAM LVL^(a,b)

Property		Specified Strengths and MOE for Limit States Design, MPa (psi)						
		GP Lam LVL				VERSA-LAM		
		1.5-ES or 1.5E- 2250F _b	1.9E or 1.9E- 2750F _b	2.0-ES or 2.0E- 2900F _b	2.0E- 3100F _b	1.7 2650	1.8 2750	2.0 3100
Bending (f _b) ^(c)	Joist	28.67 (4,155)	35.04 (5,080)	36.95 (5,360)	39.50 (5,730)	33.8 (4,900)	35.0 (5,080)	39.5 (5,730)
	Plank	28.67 (4,155)	35.04 (5,080)	36.95 (5,360)	39.50 (5,730)	30.6 (4,435)	31.9 (4,620)	35.7 (5,175)
Tension parallel to grain (f _t) ^(d)		15.19 (2,200)	18.44 (2,675)	19.80 (2,870)	20.61 (2,990)	17.2 (2,494)	19.0 (2,759)	22.4 (3,250)
Longitudinal shear (f _v)	Joist	3.63 (525)	3.76 (545)	3.76 (545)	3.76 (545)	4.00 (580)	4.00 (580)	4.00 (580)
	Plank	NA	2.23 (325)	2.23 (325)	2.23 (325)	2.07 (300)	2.07 (300)	2.07 (300)
Compression parallel (f _c)		24.21 (3,510)	27.51 (3,990)	28.61 (4,150)	33.01 (4,785)	30.3 (4,400)	34.7 (5,035)	34.7 (5,035)
Compression perpendicular (f _{cp})	Joist	9.41 (1,365)	10.61 (1,535)	10.61 (1,535)	10.61 (1,535)	10.51 (1,525)	10.51 (1,525)	10.51 (1,525)
	Plank	NA	5.65 (820)	5.65 (820)	5.65 (820)	5.58 (810)	5.58 (810)	5.58 (810)
Modulus of Elasticity (E)	Joist & Plank	10,342 ^(f) (1.5x10 ⁶) ^(f)	13,100 ^(e) (1.9x10 ⁶) ^(e)	13,790 ^(f) (2.0x10 ⁶) ^(f)	13,790 ^(e) (2.0x10 ⁶) ^(e)	11,721 ^(e) (1.7x10 ⁶) ^(e)	12,411 ^(e) (1.8x10 ⁶) ^(e)	13,789 ^(e) (2.0x10 ⁶) ^(e)

- (a) The tabulated values are specified strengths and modulus of elasticity for standard-term load duration. All values, except for E, are permitted to be adjusted for other load durations as permitted by the code. The tabulated values are limited to dry service conditions.
- (b) Joist = load parallel to glue-line. Plank = load perpendicular to glue-line.
- (c) The tabulated plank values require no depth modification. The tabulated joist values are based on a reference depth of 305 mm (12 inches). For other depths, when loaded edgewise, the specified bending strength (f_b) shall be modified by (305/d)^{1/9} for 2.0E-ES (2.0E-2900F_b) GP-Lam, and VERSA-LAM 1.7 2650, 1.8 2750, and 2.0 3100 VERSA-LAM, where d = depth in mm; and (305/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, where d = depth in mm. For depths less than 89 mm (3-1/2 inches), the factor for the 89 mm (3-1/2 inches) depth shall be used.

	Depth mm (in.)	89 (3-1/2)	140 (5-1/2)	184 (7-1/4)	235 (9-1/4)	286 (11-1/4)	305 (12)	406 (16)	457 (18)	508 (20)	610 (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

- (d) The tabulated values are based on a reference length of 6,096 mm (20 feet). For other lengths, the specified tensile strength shall be modified by (6,096/ℓ)^{1/10} for GP Lam LVL and (6,096/ℓ)^{1/8} for all grades of VERSA-LAM LVL, where ℓ = length in mm. For lengths less than 1,219 mm (4 feet), the factor for the length of 1,219 mm (4 feet) shall be used.
- (e) 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 (f) may be ignored.

- (f) 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:

$$\delta = \frac{156.3 wL^4}{Ebd^3} \times 10^6 + \frac{2400 wL^2}{Ebd}$$

Where: δ = estimated deflection, mm w = uniform load, N/m
 L = span, m E = modulus of elasticity, MPa
 b = beam width, mm d = beam depth, mm

or

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

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

Table 2. Fastener Details for GP Lam® and VERSA-LAM® LVL^(a)

LVL Grade	Equivalent Relative Density (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	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)
1.7 2650, 1.8 2750 and 2.0 3100 VERSA-LAM	S-P-F (0.42)	Douglas- fir/ larch (0.50)	S-P-F (0.42)	Douglas -fir/ larch (0.50)	Douglas- fir/ larch (0.50)	Douglas-fir/ larch (0.50)

- (a) Fastener values determined using the equivalent relative densities in this table are for standard-term load duration and are permitted to be adjusted for other load durations as permitted by the code.

Table 3. Minimum Fastener Spacing for Installation Parallel to the Glue Line in GP Lam^(a,b,c)

Minimum Member Size, mm (in.)	Connector: Length, mm (in.)	Nails Installed in the Narrow Face
		Minimum On-Center Spacing, mm (in.)
19 x 89 (3/4 x 3-1/2)	10d box or common, 12d common, 16d sinker: 82 (3-1/4) and smaller	152 (6)
	14 gage staples: 1.6 (1/16))	152 (6)
44 x 140 (1-3/4 x 5-1/2)	10d box or common, 12d common, 16d sinker: 82 (3-1/4) and smaller	102 (4)
	14 gage staples: 1.6 (1/16)	102 (4)
	16d common: 89 (3-1/2)	203 (8)

- (a) The minimum on-center spacing permitted for nails installed in the wide face of GP Lam, i.e., perpendicular to the glue line, is the same as that permitted by the applicable code for solid-sawn lumber.
 (b) Edge distance shall be sufficient to prevent splitting.
 (c) Fastener sizes and minimum on-center spacing not specifically described above are beyond the scope of this report.

Table 4. Minimum Fastener Spacing for Installation Parallel to the Glue Line in VERSA-LAM®
 (a,b,c)

Minimum Member Size, mm (in.)	Connector: Length, mm (in.)	Nails Installed in the Narrow Face
		Minimum On-Center Spacing, mm (in.)
25 x 89 (1 x 3-1/2)	8d box or common, 10d box or common, 12d box or common, 16d sinker	152 (6)
	16d common	203 (8)
38 x 89 (1-1/2 x 3-1/2)	8d box or common, 10d box or common, 12d box or common, 16d sinker	152 (6)
	16d common	203 (8)
44 x 140 (1-3/4 x 5-1/2)	8d box or common, 10d box or common, 12d box or common, 16d sinker	102 (4)
	16d common	203 (8)
89 x 140 (3-1/2 x 5-1/2)	8d box or common, 10d box or common, 12d box or common, 16d sinker	102 (4)
	16d common	203 (8)

- (a) The minimum on-center spacing permitted for nails installed in the wide face of VERSA-LAM®, i.e., perpendicular to the glue line, is the same as that permitted by the applicable code for solid-sawn lumber.
- (b) Edge distance is similar to Minimum On-Center Spacing.
- (c) Fastener sizes and minimum on-center spacing not specifically described above are beyond the scope of this report.

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