

Boise Cascade VersaWorks[®] Veneer Laminated Timber PR-L335(C)
Boise Cascade Wood Products, LLC Issued September 27, 2023

Products: Boise Cascade VersaWorks[®] Veneer Laminated Timber
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1. Basis of the product report:
 - 2020 and 2015 National Building Code of Canada (NBC): Clause 1.2.1.1 of Division A and Clauses 4.1, 4.3.1.1, and 9.23 of Division B
 - CSA O86-19 Engineering Design in Wood
 - ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber
 - ANSI/APA PRG 320-2018 recognized in CSA O86-19
 - ASTM D5456-18 recognized in CSA O86-19
 - APA Reports T2021P-02, T2021P-32, T2022P-03, and T2022M-20, and other qualification data
2. Product description:

Boise Cascade VersaWorks[®] Veneer Laminated Timber (VLT) is manufactured with Boise Cascade 27-mm-thick (1-1/16-inch-thick) 1.5E_{true} 1800_{plank} Douglas-fir laminated veneer lumber (LVL), which is produced only for use as VLT laminations, in accordance with custom layups of ANSI/APA PRG 320 through product qualification and mathematical models using principles of engineering mechanics. The LVL layers contain crossband veneers and are parallel-laminated, bonded with qualified structural adhesives, and pressed to form a solid VLT panel. Boise Cascade VLT can be used in floor, roof, and wall applications, and is manufactured in a plank billet with nominal widths of 51 to 1,220 mm (2 to 48 inches), thicknesses of 54 to 324 mm (2-1/8 to 12-3/4 inches, 2 to 12 plies), and lengths up to 20.1 m (66 feet).
3. Design properties:

Boise Cascade VLT shall be designed with the design properties and capacities provided in Table 1 or recommendations provided by the manufacturer. The design adjustment factors shall be in accordance with Chapter 8 of CSA O86 or based on the recommendations provided by the manufacturer and approved by the engineer of record. The lateral resistance of Boise Cascade VLT, when used as shear walls or diaphragms, shall be permitted to be designed in accordance with Clause 11.9 of CSA O86 in consultation with the manufacturer and approved by the engineer of record.
4. Product installation:

Boise Cascade VLT shall be installed in accordance with the recommendations provided by the manufacturer and engineering drawings approved by the engineer of record. Permissible details shall be in accordance with the recommendations provided by the manufacturer and the engineering drawings.
5. Fire-rated assemblies:

Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer. Procedures specified in Annex B of CSA O86 shall be permitted for use in the fire design of Boise Cascade VLT.

6. Sound-rated floor/ceiling assemblies:
Boise Cascade VLT is permitted for use as a component of floor/ceiling assemblies required to have acoustical ratings in accordance with the code. Sound ratings are as provided by the manufacturer.
7. Limitations:
 - a) Boise Cascade VLT products shall be designed in accordance with principles of engineering mechanics using the design properties specified in this report or provided by the manufacturer.
 - b) Boise Cascade VLT products shall be limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber over a year is 15% or less and does not exceed 19%.
 - c) Boise Cascade VLT products shall be manufactured in accordance with proprietary Boise Cascade VLT manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
 - d) Boise Cascade VLT products are produced at the Boise Cascade facility in White City, Oregon under a quality assurance program audited by APA.
 - e) Properties shown in this report are limited to VLT products manufactured with Boise Cascade 27-mm-thick (1-1/16-inch-thick) 1.5E_{true} 1800_{plank} Douglas-fir LVL, which is produced only for use as VLT laminations and documented in the in-plant manufacturing standard approved by APA.
 - f) This report is subject to re-examination in one year.
8. Identification:
Boise Cascade VLT described in this report are identified by a label bearing the manufacturer's name (Boise Cascade) and/or trademark, the APA assigned plant number (1139), the product standard (ANSI/APA PRG 320), the APA logo, the VLT grade and thickness (or layup ID), the report number PR-L335 (or PR-L335C), and a means of identifying the date of manufacture.

Table 1. LSD Flatwise Bending Stiffness and Unfactored Resistance Values^(a,b,c) for Boise Cascade VLT (for Use in Canada)

VLT Grade ^(d)	Thickness, t _p (mm)	Major Strength Direction				Minor Strength Direction			
		(F _b S) _{eff,f,0} (10 ⁶ N-mm/m)	(EI) _{eff,f,0} (10 ⁹ N-mm ² /m)	(GA) _{eff,f,0} (10 ⁶ N/m)	V _{s,0} (kN/m)	(F _b S) _{eff,f,90} (10 ⁶ N-mm/m)	(EI) _{eff,f,90} (10 ⁹ N-mm ² /m)	(GA) _{eff,f,90} (10 ⁶ N/m)	V _{s,90} (kN/m)
1.5E	54	9.1	127	11	29	0.81	5.6	2.0	4.8
	81	21	442	16	44	1.8	19	2.0	7.3
	108	38	1,081	22	59	3.4	47	2.0	10
	135	59	2,105	26	74	3.4	47	2.0	12
	162	84	3,572	38	89	3.4	47	2.0	20
	189	112	5,498	44	102	3.4	47	2.0	20
	216	145	8,111	54	117	3.4	47	2.0	20
	243	183	11,551	61	131	3.4	47	2.0	20
	270	210	15,057	67	146	3.4	47	2.0	20
	297	255	20,039	74	161	3.4	47	2.0	20
	324	303	26,017	82	175	3.4	47	2.0	20

For Imperial: 1 mm = 0.0394 in.; 1 m = 3.28 ft; 1 N = 0.2248 lbf

- (a) Tabulated values are unfactored Limit States design values and are not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86.
- (b) Tabulated values are limited to VLT products manufactured with Boise Cascade 27-mm-thick (1-1/16-inch-thick) 1.5E_{true} 1800_{plank} Douglas-fir LVL documented in the in-plant manufacturing standard approved by APA.
- (c) Deflection under a specified uniformly distributed load, w, acting perpendicular to the face of a single-span VLT panel shall be permitted to be calculated as a sum of the deflections due to moment and shear effects using the effective bending stiffness, (EI)_{eff}, and the effective in-plane (planar) shear rigidity, (GA)_{eff}, as follows:

$$\delta = \frac{5wL^4}{384(EI)_{eff}} + \frac{wL^2}{8000(GA)_{eff}} \quad [1]$$

where: δ = estimated deflection, mm; w = uniform load, N/m²;
 L = span, m; (EI)_{eff} = tabulated effective bending stiffness, 10⁹ N-mm²/m; and
 (GA)_{eff} = tabulated effective in-plane (planar) shear rigidity, 10⁶ N/m.

For a concentrated load, P, located in the middle of a single-span VLT panel acting perpendicular to the panel, the deflection shall be permitted to be calculated as follows:

$$\delta = \frac{PL^3}{48(EI)_{eff}} + \frac{PL}{4000(GA)_{eff}} \quad [2]$$

where: δ = estimated deflection, mm; P = concentrated load, N/m of width;
 L = span, m; (EI)_{eff} = tabulated effective bending stiffness, 10⁹ N-mm²/m; and
 (GA)_{eff} = tabulated effective in-plane (planar) shear rigidity, 10⁶ N/m.

Table 2. LSD Specified In-Plane Shear Strength and Stiffness for Boise Cascade VLT^(a,b,c) (for Use in Canada)

VLT Grade	Thickness, t_p (mm)	In-Plane Shear Capacity		In-Plane Shear Stiffness			
		Both Directions		Major Strength Direction		Minor Strength Direction	
		$f_{v,e,0}$ Or $f_{v,e,90}$ (MPa)	$f_{v,e,0} t_p$ Or $f_{v,e,90} t_p$ (kN/m of width)	$G_{e,0}$ (MPa)	$(GA)_{eff,e,0}$ (kN/m of width)	$G_{e,90}$ (MPa)	$(GA)_{eff,e,90}$ (kN/m of width)
1.5E	54	2.9	150	1,069	55,985	365	19,143
	81	2.9	227	1,069	84,801	365	28,992
	108	2.9	306	1,069	114,187	365	39,045
	135	2.9	383	1,069	142,741	365	48,806
	162	2.9	459	1,069	171,295	365	58,567
	189	2.9	531	1,069	197,807	365	67,628
	216	2.9	606	1,069	226,054	365	77,287
	243	2.9	682	1,069	254,317	365	86,946
	270	2.9	758	1,069	282,594	365	96,620
	297	2.9	834	1,069	310,841	365	106,279
	324	2.9	909	1,069	339,089	365	115,938

For Imperial: 1 MPa = 145.04 psi

- (a) Tabulated values are LSD design values for use in Canada.
- (b) Tabulated values are limited to VLT products manufactured with Boise Cascade 27-mm-thick (1-1/16-inch-thick) 1.5E_{true} 1800_{plank} Douglas-fir LVL documented in the in-plant manufacturing standard approved by APA.
- (c) Equivalent relative density = 0.50 for nails and bolts installed into the wide or narrow face under lateral or withdrawal loading.

APA – The Engineered Wood Association is an approved national standards developer accredited by American National Standards Institute (ANSI). APA publishes ANSI standards and Voluntary Product Standards for wood structural panels and engineered wood products. APA is an accredited certification body under ISO/IEC 17065 by Standards Council of Canada (SCC), an accredited inspection agency under ISO/IEC 17020 by International Code Council (ICC) International Accreditation Service (IAS), and an accredited testing organization under ISO/IEC 17025 by IAS. APA is also an approved Product Certification Agency, Testing Laboratory, Quality Assurance Entity, Validation Entity, and Product Evaluation Entity by the State of Florida, and an approved testing laboratory by City of Los Angeles.

**APA – THE ENGINEERED WOOD ASSOCIATION
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