



Boise Cascade VersaWorks<sup>®</sup> Veneer Laminated Timber PR-L335  
Boise Cascade Wood Products, LLC Issued October 4, 2022

Products: Boise Cascade VersaWorks<sup>®</sup> Veneer Laminated Timber  
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1. Basis of the product report:

- 2021, 2018, and 2015 International Building Code (IBC): Section 2303.1.4 Structural glued cross-laminated timber
- 2012 IBC: Section 104.11 Alternative materials
- 2021, 2018, and 2015 International Residential Code (IRC): Sections R502.1.6, R602.1.6, and R802.1.6 Cross-laminated timber
- 2012 IRC: Section R104.11 Alternative materials
- ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber, recognized in the 2021 IBC and IRC
- ANSI/APA PRG 320-2017, PRG 320-2012, and PRG 320-2011, recognized in the 2018 IBC and IRC, 2015 IRC, and 2015 IBC, respectively
- ASTM D5456-18, D5456-14b, D5456-13, and D5456-09 recognized by the 2021 IBC and IRC, 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively
- APA Reports T2021P-02, T2021P-32, T2022P-03, and T2022M-20, and other qualification data

2. Product description:

Boise Cascade VersaWorks<sup>®</sup> Veneer Laminated Timber (VLT) is manufactured with Boise Cascade 1-1/16-inch-thick 1.5E 1800<sub>plank</sub> Douglas-fir laminated veneer lumber (LVL), which is produced only for use as VLT laminations with allowable properties specified in Table 1, 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 2 to 48 inches, thicknesses of 2-1/8 to 12-3/4 inches (2 to 12 plies), and lengths up to 66 feet.

3. Design properties:

Boise Cascade VLT shall be designed with the design properties and capacities provided in Table 2 or recommendations provided by the manufacturer. The design adjustment factors shall be in accordance with Chapter 10 of the 2018 National Design Specification for Wood Construction (NDS) 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 shearwalls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be designed in accordance with Sections 4.4 and 4.5 of the 2021 ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS), or consulted 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 Chapter 16 of the 2018 NDS for cross-laminated timber (CLT) shall be permitted for use in designing Boise Cascade VLT for a fire exposure up to 2 hours.
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 shall be designed in accordance with principles of 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 is less than 16%.
  - c) Design properties for Boise Cascade VLT, when used as beams or lintels with loads applied parallel to the face-bond glue lines, are beyond the scope of this report.
  - d) Boise Cascade VLT shall be manufactured in accordance with proprietary Boise Cascade VLT manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
  - e) Boise Cascade VLT is produced at the Boise Cascade facility in White City, Oregon under a quality assurance program audited by APA.
  - f) Properties shown in this report are limited to VLT manufactured with Boise Cascade 1-1/16-inch-thick 1.5E 1800<sub>plank</sub> Douglas-fir LVL, which is produced only for use as VLT laminations and documented in the in-plant manufacturing standard approved by APA.
  - g) This report is subject to re-examination in one year.
8. Identification:  
Boise Cascade VLT described in this report is 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, and a means of identifying the date of manufacture.

Table 1. ASD Reference Design Values<sup>(a)</sup> for LVL Laminations Used in Boise Cascade VLT (for Use in the U.S.)

| VLT Grade | Laminations Used in Major Strength Direction    |                      |   |                      |                      |                        |                      |                      | Laminations Used in Minor Strength Direction    |                      |   |                      |                      |                        |                      |                      |
|-----------|---|----------------------|---|----------------------|----------------------|------------------------|----------------------|----------------------|---|----------------------|---|----------------------|----------------------|------------------------|----------------------|----------------------|
|           | Grade & Species                                 | F <sub>b</sub> (psi) | E <sub>apparent</sub> (10 <sup>6</sup> psi) | F <sub>t</sub> (psi) | F <sub>c</sub> (psi) | F <sub>c,L</sub> (psi) | F <sub>v</sub> (psi) | F <sub>s</sub> (psi) | Grade & Species                                 | F <sub>b</sub> (psi) | E <sub>apparent</sub> (10 <sup>6</sup> psi) | F <sub>t</sub> (psi) | F <sub>c</sub> (psi) | F <sub>c,L</sub> (psi) | F <sub>v</sub> (psi) | F <sub>s</sub> (psi) |
| 1.5E      | Boise Cascade 1.5E 1800 <sub>plank</sub> DF LVL | 1,800                | 1.4   | 1,200                | 2,500                | 450                    | 150                  | 75                   | Boise Cascade 1.5E 1800 <sub>plank</sub> DF LVL | 1,800                | 1.4   | 1,200                | 2,500                | 450                    | 150                  | 37.5                 |

For SI: 1 psi = 0.006895 MPa

<sup>(a)</sup> Tabulated values are allowable design values and not permitted to be changed for the LVL size adjustment factor. The design values shall be used in conjunction with the section properties provided by the VLT manufacturer based on the actual layout used in manufacturing the VLT panel (see Table 2).

Table 2. ASD Reference Design Values<sup>(a,b,c,d)</sup> for Boise Cascade VLT (for Use in the U.S.)

| VLT Grade | Thickness, t <sub>p</sub> (in.) | Major Strength Direction                          |  |  |                           | Minor Strength Direction                           |   |   |                            |
|-----------|---------------------------------|---|--|--|---------------------------|--|---|---|----------------------------|
|           |                                 | (F <sub>b</sub> S) <sub>eff,f,0</sub> (lbf-ft/ft) | (EI) <sub>eff,f,0</sub> (10 <sup>6</sup> lbf-in. <sup>2</sup> /ft) | (GA) <sub>eff,f,0</sub> (10 <sup>6</sup> lbf/ft) | V <sub>s,0</sub> (lbf/ft) | (F <sub>b</sub> S) <sub>eff,f,90</sub> (lbf-ft/ft) | (EI) <sub>eff,f,90</sub> (10 <sup>6</sup> lbf-in. <sup>2</sup> /ft) | (GA) <sub>eff,f,90</sub> (10 <sup>6</sup> lbf/ft) | V <sub>s,90</sub> (lbf/ft) |
| 1.5E      | 2 1/8                           | 1,110   | 13.5   | 0.72   | 1,230                     | 120  | 0.60  | 0.14  | 250                        |
|           | 3 3/16                          | 2,550   | 47   | 1.1  | 1,870                     | 275  | 2.0   | 0.14  | 380                        |
|           | 4 1/4                           | 4,625   | 115  | 1.5  | 2,525                     | 500  | 5.0   | 0.14  | 510                        |
|           | 5 5/16                          | 7,225   | 224  | 1.8  | 3,150                     | 500  | 5.0   | 0.14  | 640                        |
|           | 6 3/8                           | 10,225  | 380  | 2.6  | 3,775                     | 500  | 5.0   | 0.14  | 1,050                      |
|           | 7 7/16                          | 13,625  | 585  | 3.0  | 4,350                     | 500  | 5.0   | 0.14  | 1,050                      |
|           | 8 1/2                           | 17,600  | 863  | 3.7  | 4,975                     | 500  | 5.0   | 0.14  | 1,050                      |
|           | 9 9/16                          | 22,300  | 1,229  | 4.2  | 5,600                     | 500  | 5.0   | 0.14  | 1,050                      |
|           | 10 5/8                          | 25,625  | 1,602  | 4.6  | 6,225                     | 500  | 5.0   | 0.14  | 1,050                      |
|           | 11 11/16                        | 31,000  | 2,132  | 5.1  | 6,850                     | 500  | 5.0   | 0.14  | 1,050                      |
| 12 3/4    | 36,900                          | 2,768   | 5.6  | 7,475  | 500                       | 5.0  | 0.14  | 1,050   |                            |

For SI: 1 in. = 25.4 mm; 1 ft = 304.8 mm; 1 lbf = 4.448N

- <sup>(a)</sup> Tabulated values are allowable design values.
- <sup>(b)</sup> Tabulated values are limited to VLT manufactured with Boise Cascade 1-1/16-inch-thick 1.5E<sub>true</sub> Douglas-fir LVL documented in the in-plant manufacturing standard approved by APA.
- <sup>(c)</sup> Equivalent Specific Gravity (ESG) = 0.50 for nails and bolts installed into the wide or narrow face under lateral or withdrawal loading.
- <sup>(d)</sup> Deflection under a specified uniformly distributed load, w, acting perpendicular to the face of a single-span panel may be calculated as a sum of the deflections due to moment and shear effects using the effective bending stiffness, (EI)<sub>eff</sub>, and the effective in-plane shear rigidity, (GA)<sub>eff</sub>, as follows:

$$\delta = \frac{22.5wL^4}{(EI)_{eff}} + \frac{9wL^2}{5(GA)_{eff}} \quad [1]$$

where: δ = estimated deflection, inches;  
 L = span, feet;

w = uniform load, lbf/ft<sup>2</sup>;  
 (EI)<sub>eff</sub> = tabulated effective bending stiffness, 10<sup>6</sup> lbf-in.<sup>2</sup>/ft; and

$(GA)_{eff}$  = tabulated effective in-plane shear rigidity,  $10^6$  lbf/ft.

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

$$\delta = \frac{36PL^3}{(EI)_{eff}} + \frac{18PL}{5(GA)_{eff}} \quad [2]$$

where:  $\delta$  = estimated deflection, inches;  $P$  = concentrated load, lbf/ft of width;  
 $L$  = span, feet;  $(EI)_{eff}$  = tabulated effective bending stiffness,  $10^6$  lbf-in.<sup>2</sup>/ft; and  
 $(GA)_{eff}$  = tabulated effective in-plane shear rigidity,  $10^6$  lbf/ft.

Table 3. ASD In-Plane Reference Design Values<sup>(a,b,c)</sup> for Boise Cascade VLT (for Use in the U.S.)

| VLT Grade | Thickness, $t_p$ (in.) | In-Plane Shear Capacity |                   | In-Plane Shear Stiffness |                      |                          |                      |
|-----------|------------------------|-------------------------|-------------------|--------------------------|----------------------|--------------------------|----------------------|
|           |                        | Both Directions         |                   | Major Strength Direction |                      | Minor Strength Direction |                      |
|           |                        | (psi)                   | (lbf/ft of width) | G (ksi)                  | GA (kip/ft of width) | G (ksi)                  | GA (kip/ft of width) |
| 1.5E      | 2 1/8                  | 225                     | 5,550             | 155                      | 3,837                | 53                       | 1,312                |
|           | 3 3/16                 | 225                     | 8,425             | 155                      | 5,812                | 53                       | 1,987                |
|           | 4 1/4                  | 225                     | 11,350            | 155                      | 7,826                | 53                       | 2,676                |
|           | 5 5/16                 | 225                     | 14,200            | 155                      | 9,783                | 53                       | 3,345                |
|           | 6 3/8                  | 225                     | 17,025            | 155                      | 11,740               | 53                       | 4,014                |
|           | 7 7/16                 | 225                     | 19,675            | 155                      | 13,557               | 53                       | 4,635                |
|           | 8 1/2                  | 225                     | 22,475            | 155                      | 15,493               | 53                       | 5,297                |
|           | 9 9/16                 | 225                     | 25,300            | 155                      | 17,430               | 53                       | 5,959                |
|           | 10 5/8                 | 225                     | 28,100            | 155                      | 19,368               | 53                       | 6,622                |
|           | 11 11/16               | 225                     | 30,925            | 155                      | 21,304               | 53                       | 7,284                |
| 12 3/4    | 225                    | 33,725                  | 155               | 23,240                   | 53                   | 7,946                    |                      |

For SI: 1 in. = 25.4 mm; 1 ft = 304.8 mm; 1 lbf = 4.448N

- (a) Tabulated values are allowable design values.
- (b) Tabulated values are limited to VLT manufactured with Boise Cascade 1-1/16-inch-thick 1.5E 1800<sub>plank</sub> Douglas-fir LVL documented in the in-plant manufacturing standard approved by APA.
- (c) Equivalent Specific Gravity (ESG) = 0.50 for nails and bolts installed into the wide or narrow face under lateral or withdrawal loading.

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