APA PRODUCT REPORT®

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PWT™ Laminated Veneer Lumber and Rim Board PR-L233

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Products: PWT™ Laminated Veneer Lumber and Rim Board
PWT, 1850 Park Lane, Burlington, Washington 98233
(888) 707-2285
www.pwtewp.com

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: Section 104.11 Alternative materials and Section 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: Sections R104.11 Alternative materials, and R502.1.7, R602.1.4, and R802.1.6 Structural composite lumber
   - ASTM D5456-18, ASTM D5456-14b, ASTM D5456-13, and ASTM D5456-09 recognized by 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 by the 2021 IBC and IRC, 2018 IBC and IRC, and the 2015 IBC and IRC, respectively
   - 2021, 2015, and 2008 ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS) recognized by the 2021, 2018 and 2015, and 2012 IBC, respectively
   - APA Reports T99P-18, T99P-19, T99P-20, T2001P-52, T2001P-76, T2002P-31, T2003P-50, T2004P-1, T2006P-10, T2006P-88, T2008P-47, T2009P-45, T2011P-48, T2012P-32, T2015P-23, T2018P-06, T2018P-07, T2018P-09, T2019P-52, and T2020P-04, and other qualification data

2. Product description:
   PWT™ Laminated Veneer Lumber (LVL) is pressed into billets that are approximately 48 inches in width, 3/4 to 3-1/2 inches in thickness, and up to approximately 66 feet in length. LVL billets are ripped into products that are 1-3/4 to 48 inches in depth. Products up to 7 inches in thickness are fabricated by means of a secondary face-bonding process. PWT 1.55E (True) and 1.6E (True) LVL shall be permitted for use as rim board in thicknesses of 1-1/4, 1-1/2, and 1-3/4 inches.

3. Design properties:
   The structural design provisions for wood construction provided in the building code are applicable to PWT LVL unless noted otherwise in this report. Table 1 lists Allowable Stress Design reference properties. Table 2 lists the allowable loads for PWT LVL rim board. Minimum spacings for fasteners installed on the edge and face of a member are provided in Table 3. Table 4 lists the equivalent specific gravities for connection design. The allowable spans for PWT LVL shall be in accordance with the recommendations provided by the manufacturer (www.pwtewp.com).

4. Product installation:
   PWT LVL shall be installed in accordance with the recommendations provided by the manufacturer (see link above).

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 PWT 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 (see link above). Fire-rated assemblies for PWT LVL rim board shall be constructed in accordance with APA Product Report PR-S262.

6. Limitations:
   a) PWT LVL shall be designed in accordance with the code using the design properties specified in this report.
   b) PWT LVL is limited to dry service conditions where the average moisture content of sawn lumber is less than 16%.
   c) PWT LVL is produced at the PWT manufacturing plant located in Burlington, Washington, under a quality control program audited by APA.
   d) This report is subject to re-examination in one year.

7. Identification:
   PWT LVL is sold under the PWT and various private-label brands. Regardless of the brand applied, all products are identified by a label bearing the manufacturer's name (PWT) and/or trademark, the APA assigned plant number (1047), the LVL grade, the APA logo, this report number (PR-L233), and a means of identifying the date of manufacture.

Table 1. Allowable Stress Design Reference Properties for PWT LVL[a]

True E		Apparent E		Beam[b]			Plank[c]			Axial	
Grade	MOE (10^6 psi)[d][f]	Grade	MOE (10^6 psi)[e][f]	F_b (psi)[g][i]	F_v (psi)	$F_{c\perp}$ (psi)	F_b (psi)[h][i]	F_v (psi)	$F_{c\perp}$ (psi)[j]	F_t (psi)[k]	F_c (psi)[l]
1.55E	1.55	1.45E	1.45	2250	255	750	2250	150	650	1500	2350
1.6E	1.6	1.5E	1.5	2250	255	750	2250	150	650	1500	2350
1.9E	1.9	1.8E	1.8	2750	285	850	2750	150	650	1850	2450
2.0E	2.0	1.9E	1.9	2900	285	750	2950	150	650	2100	3200
2.1E	2.1	2.0E	2.0	2900	285	850	2900	150	650	2100	3200
2.1E	2.1	2.0E	2.0	3100	285	850	3100	150	650	2100	3200
2.3E	2.3	2.2E	2.2	3100	285	850	3100	150	650	2350	3200

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 apply to protected, dry service conditions. Except for modulus of elasticity (MOE) and compression perpendicular to grain ($F_{c\perp}$), the tabulated values are permitted to be adjusted for the duration of load as provided in the code.

[b] Beam values apply to members loaded and supported on faces showing the narrow edge of all veneers, typically the narrow faces of the member.

[c] Plank values apply to members loaded and supported on faces showing the face of one veneer, typically the wide faces of the member.

[d] The tabulated MOE values are the shear-free modulus of elasticity. When calculating deflection, both bending and shear deflections must be included. The deflection equation for a simple-span beam under uniform load is:

$$\delta = \frac{270\,wL^4}{E_{true}bh^3} + \frac{28.8wL^2}{E_{true}bh}$$

where: δ = Estimated total deflection, inches; w = uniform load, plf; L = span, feet; E_{true} = tabulated true modulus of elasticity, psi; b = beam width, inches; h = beam depth, inches

[e] The tabulated MOE values are the apparent modulus of elasticity and include the effects of shear deflection. When calculating deflection, only the bending deflection needs to be included. The deflection equation for a simple-span beam under uniform load is:

$$\delta = \frac{270\,wL^4}{E_{apparent}bh^3}$$

where: δ = Estimated total deflection, inches; w = uniform load, plf; L = span, feet; $E_{apparent}$ = tabulated apparent modulus of elasticity, psi; b = beam width, inches; h = beam depth, inches

[f] Coefficient of variation of modulus of elasticity, $COV_E = 0.10$.

[g] Flexural stress, F_b, for the beam orientation is based on a reference depth of 12 inches. For other depths, multiply by a size factor of $(12/d)^{1/5}$, where *d* is the depth in inches. For depths less than 1-3/4 inches, multiply by 1.47.

[h] Flexural stress, F_b, for the plank orientation is based on a reference depth of 1-3/4 inches. For other depths, multiply by a size factor of $(1.75/d)^{1/3}$, where *d* is the depth in inches. For depths less than 1-3/4 inches, multiply by 1.00.

[i] Flexural stress, F_b, values are permitted to be increased by 4% for repetitive members as provided by the code.

[j] The tabulated compressive stress perpendicular to grain ($F_{c\perp}$) value is based on the average stress at the proportional limit or 0.04-in. deformation, whichever is less.

[k] Tension parallel to grain, F_t, is based on a reference gage length of 4 feet. For longer lengths, multiply by a length factor of $(4/L)^{1/10}$, where L is the length in feet.

[l] Compression parallel to grain, F_c.

Table 2. 1-1/4, 1-1/2, and 1-3/4-inch Rim Board Allowable Loads[a][b][c][d]

True E (10^6 psi)	Apparent E (10^6 psi)	Minimum Thickness (in.)	Depth (in.)	Vertical Load Capacity		Lateral Load Capacity[e] (plf)	Deck Ledger Connection[f] (1/2" dia. lag screw) (lbf)	Deck Ledger Connection[f] (1/2" dia. bolt) (lbf)	Deck Ledger Connection[f][g] (1/2" dia. bolt w/ air gap) (lbf)
				Uniform Load (plf)	Concentrated Load (lbf)				
1.55E and 1.6E	1.45E and 1.5E	1-1/4	11-7/8	4,250	3,760	200	550	550	350
			14	3,550	3,550				
			16	2,900	2,900				
		1-1/2	11-7/8	6,480	4,500	250	550	615	615
			14	5,600	4,500				
			16	4,800	4,500				
			18	3,900	2,700				
			20	3,200	2,700				
			24	2,250	2,250				
		1-3/4	11-7/8	7,560	5,200	250	675	725	615
			14	6,900	5,200				
			16	6,200	5,200				
			18	5,500	4,200				
			20	4,800	4,200				
			24	3,500	3,500				

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

[a] The design loads given in this table are for rim boards installed in accordance with the manufacturer's recommendations.
[b] Tabulated design values are based on dry conditions of use.
[c] All 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 Section 2.3.2 of the NDS except the uniform vertical load and concentrated vertical load are not permitted to be increased for any load durations shorter than the normal load duration (10 years).
[d] Other design values are as provided for 1.55E or 1.6E grade PWT LVL in Table 1.
[e] 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 or Section 4.1.7 of the 2015 and 2008 SDPWS.
[f] Deck ledger connections shall be installed following the manufacturer's recommendations.
[g] Air gap is defined as up to ½-inch shimmed air space between rim board and deck ledger.

Table 3. Minimum Spacing and Distance for Fasteners Installed into Edge of PWT LVL

Nominal LVL Thickness	Orientation	Nail Size[b]	Nail Diameter (in.)	Nail Length (in.)	Minimum End Distance (in.)	Minimum Nail Spacing[b] (in.)		Maximum Nail Penetration[c] (in.)
						Single Row	Double Row	
Less than 1-1/2 in.	Edge	8d & smaller	0.131	2.5	2-1/2	3	NA	2.25
		10d & 12d	0.148	3.25	2-1/2	4		2.5
		16d	0.162	3.5	3-1/2	5		2
	Face[d]	12d & smaller	0.148	3.25	1-1/2	3	3	
		16d	0.162	3.5	1-1/2	5	5	
1-1/2 in. and greater	Edge	8d & smaller	0.131	2.5	2-1/2	3	4	2.25
		10d & 12d	0.148	3.25	3-1/2[e]	4	5	2.5
		16d	0.162	3.5	3-1/2	5	6[f]	2
	Face[d]	12d & smaller	0.148	3.25	1-1/2	3	3	
		16d	0.162	3.5	1-1/2	5	5	

For SI: 1 inch = 25.4 mm

[a] Edge distance shall be sufficient to prevent splitting.
[b] Nail sizes and closest on-center spacing not specifically described in this table are outside the scope of this report.
[c] Penetration length includes the nail tip.
[d] 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.
[e] Minimum end distance is permitted to be reduced to 2-1/2 in. for single row nailing.
[f] Minimum nail spacing may be reduced to 5 in. when LVL is 1-3/4 in. or thicker.

Table 4. Equivalent Specific Gravity for Connection Design

Connection Type	Face[(a)]	Edge[(b)]
Nails or Wood Screws – Withdrawal	0.50	0.47
Nails or Wood Screws – Lateral	0.50	0.50
Bolts or Lag Screws – Lateral	0.50	N. A.

(a) Member faces showing the face of one veneer, typically the wide faces of the member.
(b) Member faces showing the narrow edge of all veneers, typically the narrow faces of the member.

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APA – THE ENGINEERED WOOD ASSOCIATION
HEADQUARTERS
7011 So. 19th St. ▪ Tacoma, Washington 98466
Phone: (253) 565-6600 ▪ Fax: (253) 565-7265 ▪ Internet Address: www.apawood.org

PRODUCT SUPPORT HELP DESK
(253) 620-7400 ▪ *E-mail Address*: help@apawood.org

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