

PWT™ Laminated Veneer Lumber and Rim Board
PWT

PR-L233

Revised May 8, 2024

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 in 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 in the 2021 IBC and IRC, 2018 IBC and IRC, and the 2015 IBC and IRC, respectively
 - ANSI/APA PRR 410-2016 and ANSI/APA PRR 410-2011 recognized in the 2021 IBC and IRC, 2018 IBC and IRC, and 2015 IBC and IRC, respectively
 - 2021, 2015, and 2008 ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS) recognized in the 2021, 2018 and 2015, and 2012 IBC, respectively
 - PFS Corporation Test Reports: Gang-Lam LVL
 - APA Reports T99P-18, T99P-19, T99P-20, T99P-21, T2001P-52, T2001P-76, T2004P-15, T2004P-72, T2005P-37, T2005P-47, T2005P-49, T2005P-72A, T2005P-76A, T2006P-06, T2006P-10, T2006P-21, T2006P-88, T2008P-47, T2009P-45, T2010P-14, T2010P-18, T2011P-24, T2011P-30, T2011P-48, T2011P-68, T2011P-69, T2012P-08, T2012P-20, T2012P-32, T2013P-15, T2014P-16, T2014P-27A, T2014P-28, T2015P-23, T2017P-09, T2017P-20, T2017P-23, T2018P-04, T2018P-06, T2018P-07, T2018P-09, T2019P-52, T2020P-04, T2023P-33, and T2023P-34, and other qualification data
2. Product description:

PWT LVL is made with wood veneers laminated with grain parallel to the length of the member in accordance with the in-plant manufacturing standard approved by APA. PWT LVL is available with thicknesses up to 3-1/2 inches, and a range of widths and lengths. Products up to 7 inches in thickness are fabricated by means of a secondary face-bonding process. PWT X-ply LVL is PWT LVL with two or more veneers oriented 90 degrees (cross-ply) to the length. PWT X-ply LVL is available with a minimum thickness of 1-1/8 inches. Refer to the manufacturer's technical guide (www.pwtewp.com) and a local PWT distributor for product availability.
3. Design properties:

Table 1 lists Allowable Stress Design reference properties. Table 2 lists the allowable loads for PWT LVL used as rim board. Table 3 lists allowable spacing for fasteners. Table 4 lists the equivalent specific gravities for connection design. PWT LVL shall be designed and installed in accordance with the recommendations provided by the manufacturer (see link above).

- 3.1 Beams, headers, joists, rafters, columns:
All grades of PWT LVL are permitted for use as beams, headers, joists, rafters, and columns.
- 3.2 Rim Board:
All grades of PWT LVL are permitted for use as rim board. Product stamped with the addition of "RIM" meet the requirements of ASTM D7672.
- 3.3 Wall framing:
 - 3.3.1 Prescriptive stud wall applications:
PWT LVL having a grade of 1.5E or greater shall be permitted for use as studs in conventional construction in accordance with Sections 2308.5.9 of the 2021 and 2018 IBC, 2308.5.10 of the 2015 IBC, 2308.9.10 of the 2012 IBC, and R602.6 of the 2012 through 2021 IRC.
 - 3.3.2 Engineered stud wall applications:
PWT LVL having a grade of 1.5E or greater shall be permitted for use as studs in engineered wall applications when designed based on net section analysis in accordance with the National Design Specification for Wood Construction (NDS) and the restrictions specified in Section 4.3.2. The allowable design stress for bending, axial compression, and axial tension shall be multiplied by the strength reduction factors in Table 5 to account for stress concentrations in notches and holes.
 - 3.3.3 The allowable shear values for nailed wood structural panel shear walls using PWT LVL having a grade of 1.5E or greater as the wall studs shall be determined using Table 4.3A of 2021, 2015, and 2008 SDPWS where the PWT LVL shall be considered to be equivalent to sawn lumber studs with a specific gravity of 0.50, when subjected to the nailing restrictions specified in Section 4.3.3 of this report.
- 4. Product installation:
 - 4.1 Beams, headers, joists, and rafters:
PWT LVL shall be installed in accordance with the recommendations provided by the manufacturer (see link above). Permissible details and allowable hole sizes shall be in accordance with the recommendations provided by the manufacturer.
 - 4.2 Columns:
 - 4.2.1 PWT LVL used as free-standing columns shall not be drilled or notched without the approval of a professional engineer or the manufacturer. Bolts, lag screws, and self-tapping screws shall only be inserted through the face of the column, perpendicular to the face of the veneers in PWT LVL.
 - 4.2.2 Built-up columns: When used for built-up columns, PWT LVL shall be constructed using connections specified by the manufacturer (see link above).
 - 4.3 Wall framing:
 - 4.3.1 PWT LVL used as wall framing shall be installed in accordance with the recommendations provided by the manufacturer (see link above) and the building code.
 - 4.3.2 Prescriptive stud wall applications: Cutting, notching, and boring of PWT LVL having a grade of 1.5E or greater and used as studs in conventional construction are permitted in accordance with Sections 2308.5.9 of the 2021 and 2018 IBC, 2308.5.10 of the 2015

IBC, 2308.9.10 of the 2012 IBC, and R602.6 of the 2012 through 2021 IRC. Stud wall nailing restrictions and requirements are presented in Section 4.3.3 of this report.

- 4.3.3 Engineered stud wall applications: Cutting, notching, and boring of PWT LVL having a grade of 1.5E or greater shall be permitted in engineered wall applications with the following restrictions:
- a. Holes up to 40% of the stud depth are allowed anywhere in the stud height for bearing walls, except that a hole shall not be placed within 6 inches of either end of the stud. A minimum edge distance of 5/8 inch shall be maintained for all holes for stud depths of 5-1/2 inches (i.e., nominal 2x6) or less. For larger depths, a minimum edge distance of 12% of the stud depth shall be maintained for all holes.
 - b. Notches up to 25% of the stud depth are allowed anywhere in the stud height, except that a notch shall not be placed within 6 inches of either end of the stud. The notch length shall not exceed 8 inches.
 - c. Holes and notches shall not be cut at the same cross-section, and the minimum clear vertical space between hole and notch shall be 2 times the hole diameter or 2 times the notch length, whichever is greater.
 - d. Stud wall nailing restrictions and requirements are presented in Section 4.3.4.
- 4.3.4 Nailing restrictions and requirements
- a. Attach wall plate to studs in accordance with the code.
 - b. Sheathing to 1.5E or greater PWT LVL used as studs
 - For sheathing attached with 8d common nails (0.131 inch x 2-1/2 inches) or smaller with a spacing no closer than 6 inches on center, a single stud shall be permitted for framing at adjoining panel edges. Nails shall be installed a minimum 3/8 inch from all panel edges. 10d common nails (0.148 inch x 3 inches) are not allowed where a single stud is used at adjoining panel edges.
 - For sheathing attached with 10d common nails (0.148 inch x 3 inches) spaced no closer than 4 inches on center or 8d common nails (0.131 inch x 2-1/2 inches) spaced no closer than 3 inches on center a double, stitch-nailed, a stud or single 2-1/2-inch-thick piece of PWT LVL used as a stud is required at adjoining panel edges. Nails shall be installed a minimum 1/2 inch from all panel edges and shall be staggered a minimum of 1/4 inch for each row of nails.
 - c. Nails for attaching sheathing to studs shall not be spaced closer than 3 inches on center.
 - d. Maximum nail size for attaching sheathing to studs is 10d common (0.148 inch x 3 inches).
 - e. Stitch nailing for double studs
 - For stud wall applications in accordance with the IRC and the conventional light-frame construction provisions of the IBC, double PWT LVL used as studs shall be stitch-nailed together with 2 staggered rows of nails (minimum 0.120 inch x 2-7/8 inches) spaced 8 inches in each row.
 - For engineered stud wall applications, the stitch nailing of double PWT LVL used as studs shall be designed to transfer the required lateral shear using an assumed equivalent specific gravity of 0.50.
- 4.4 Rim board:
PWT LVL used as rim board shall be installed in accordance with the recommendations provided by the manufacturer (see link above) and the code.
5. Fire-rated assemblies:
- 5.1 Fire-rated assemblies:
Design of fire-resistant exposed wood members in accordance with Chapter 16 of the 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 Fire-Rated Systems, Form W305 (www.apawood.org/resource-library), and the manufacturer.

- 5.2 When used as joists or rafters, PWT LVL having a grade of 1.5E or greater are permitted to be used as direct replacement for solid-sawn lumber having the same actual dimensions, in any fire-resistance-rated floor/roof assemblies listed in Table 721.1(3) of the 2012 through 2021 IBC.
- 5.3 The provisions of Section R302.13, Exception 4 of the 2021, 2018, and 2015 IRC and Section R501.3, Exception 4 of the 2012 IRC for fire protection of floors shall be applicable to floor assemblies constructed with PWT LVL having a grade of 1.5E or greater with a nominal 2x10 dimension (i.e., 1-1/2 inches by 9-1/4 inches net dimension) or greater.
- 5.4 When used as wall studs, PWT LVL having a grade of 1.5E or greater are permitted to be used as a direct replacement for solid-sawn lumber, having the same actual dimensions, same fire-resistance-rated wall assemblies listed in Table 721.1(2) of the 2012 through 2021 IBC.
- 5.5 As an alternative to the prescriptive fire-resistance-rated wall assemblies listed in Table 721.1(2) of the 2012 through 2021 IBC, a one-hour fire-resistance-rated wall assembly shall be permitted to be designed and constructed with the limitations listed below, provided that the applied axial stress on each stud does not exceed 550 psi for 1.5E or greater PWT LVL. When the slenderness ratio exceeds 33, the F_c' , which is the F_c value tabulated in Table 1 for each stud grade adjusted for all applicable adjustment factors, including column stability factor, in accordance with NDS, shall be multiplied by 0.63 for PWT LVL having a grade of 1.5E or greater.
 - a. The stud spacing shall be no greater than 24 inches on center,
 - b. The top and bottom plates of the wall shall be constructed in accordance with the nailing schedule specified in Table 2304.10.2 of the 2021 IBC, Table 2304.10.1 of the 2018 and 2015 IBC, or Table 2304.9.1 of the 2012 IBC or Table R602.3(1) of the 2021 through 2012 IRC.
 - c. The wall shall be covered with one layer of 5/8-inch Type X gypsum wall board attached to studs with 2-1/4-inch-long Type S drywall screws at 7 inches on center on the perimeter and in the field, and
 - d. A minimum of 2.5 lbf/ft³ mineral wool insulation shall be placed in the stud cavity.
- 5.6 Fire-rated assemblies for PWT LVL rim board shall be constructed in accordance with APA Product Report PR-S238.
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 facilities in Burlington, Washington, USA; Wilmington, North Carolina, USA; and Golden, British Columbia, Canada under a quality assurance program audited by APA. A list of the PWT LVL grades manufactured at different PWT facilities is maintained by APA for independent auditing purposes.
 - 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 for the Burlington plant, 1066 for the Golden plant, and 1071 for the Wilmington plant), 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)

Grade	Beam ^(b)				Plank ^(c)				Axial	
	E (10 ⁶ psi) ^(d,e)	F _b (psi) ^(f)	F _v (psi)	F _{c⊥} (psi) ^(g)	E (10 ⁶ psi) ^(d,e)	F _b (psi) ^(f)	F _v (psi)	F _{c⊥} (psi) ^(g)	F _t (psi)	F _c (psi)
1.3E 1550Fb X-ply	1.3	1,550 ^(h)	250	680	1.1	1,550	140	550	1,200 ⁽ⁱ⁾	1,700
1.5E 2250Fb	1.5	2,250 ⁽ⁱ⁾	285	750	1.5	2,250 ^(k)	150	650	1,500 ⁽ⁱ⁾	2,350
1.55E 2250Fb	1.55	2,250 ⁽ⁱ⁾	255	750	1.55	2,250 ^(m)	150	650	1,500 ⁽ⁱ⁾	2,350
1.6E 2250Fb	1.6	2,250 ⁽ⁿ⁾	255	750	1.6	2,250 ^(m)	150	650	1,500 ^(o)	2,350
2.0E 2900Fb	2.0	2,900 ⁽ⁱ⁾	285	750	2.0	2,950 ^(m)	140	550	1,800 ⁽ⁱ⁾	3,200
2.1E 3100Fb	2.1	3,100 ⁽ⁿ⁾	285	850	2.1	3,100 ^(m)	150	650	2,100 ^(o)	3,200
2.2E 3100Fb	2.2	3,100 ⁽ⁱ⁾	290	750	2.2	2,950 ^(k)	140	550	1,800 ⁽ⁱ⁾	3,200
2.3E 3100Fb	2.3	3,100 ⁽ⁿ⁾	285	850	2.3	3,100 ^(m)	150	650	2,350 ^(o)	3,200

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 where the equivalent moisture content of sawn lumber does not exceed 16%. Except for modulus of elasticity, E, and compression perpendicular to grain, F_{c⊥}, the tabulated values are permitted to be adjusted for the duration of load as approved 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 E 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:

$$\delta = \frac{270wL^4}{Ebh^3} + \frac{28.8wL^2}{Ebh} \quad \text{[Eq. 1]}$$

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

- (e) Coefficient of variation of modulus of elasticity, COV_E = 0.10.
- (f) The tabulated flexural stress, F_b, may be increased by 4% when the member qualifies as repetitive as defined in the NDS.
- (g) When designing with the tabulated compressive stress perpendicular to grain (F_{c⊥}), the Bearing Area Factor (C_b) stipulated in Section 3.10.4 of the NDS shall be permitted to be applied.
- (h) Flexural stress, F_b, for the beam orientation is based on a reference depth of 12 inches. For other depths, modify F_b as follow:
 - For thickness of 1-1/8 inches, multiply F_b by (12/d)^{0.323}.
 - For thickness of 1-1/4 inches and greater, multiply F_b by (12/d)^{0.261}.
- (i) Tension parallel to grain, F_t, is based on a reference length of 3 feet. For other lengths, the allowable tensile stress shall be modified by (3/L)^{0.111}, where L = length in feet. For lengths less than 3 feet, use the allowable tension stresses in Table 1.
- (j) Flexural stress, F_b, for the beam orientation is based on a reference depth of 12 inches. For depths greater than 12 inches, multiply F_b by (12/d)^{0.143}. For depths less than 12 inches, multiply F_b by (12/d)^{0.111}. For depths less than 3-1/2 inches, the factor for the 3-1/2-inch depth shall be used.
- (k) Flexural stress, F_b, for the plank orientation is based on a reference depth of 1-3/4 inches. For other depths, multiply F_b by a size factor of (1.75/d)^{0.250}. For depths less than 1-3/4 inches, multiply F_b by 1.00.
- (l) Flexural stress, F_b, for the beam orientation is based on a reference depth of 12 inches. For depths greater than 12 inches, multiply F_b by (12/d)^{0.200}. For depths less than 12 inches, multiply F_b by (12/d)^{0.111}. For depths less than 3-1/2 inches, the factor for the 3-1/2-inch depth shall be used.
- (m) Flexural stress, F_b, for the plank orientation is based on a reference depth of 1-3/4 inches. For depths greater than 1-3/4 inches, multiply F_b by (1.75/d)^{0.333}. For depths less than 1-3/4 inches, multiply F_b by 1.00.
- (n) Flexural stress, F_b, for the beam orientation is based on a reference depth of 12 inches. For other depths, multiply F_b by a size factor of (12/d)^{0.200}. For depths less than 1-3/4 inches, multiply F_b by 1.47.
- (o) Tension parallel to grain, F_t, is based on a reference gage length of 4 feet. For longer lengths, multiply F_t by a length factor of (4/L)^{0.100}, where L is the length in feet. For lengths less than 4 feet, multiply F_t by 1.00.

Table 2. Allowable Loads for PWT LVL used as Rim Board^(a,b,c)

Grade	Thickness (in)	Depth (in)	Lateral Load Capacity ^(d, e) (lbf/ft)	Vertical Uniform Load ^(f) (lbf/ft)	Vertical Concentrated Load (lbf)	Deck Ledger Connection for ½ inch dia. Lag Screws (lbf)	Deck Ledger Connection for ½ inch dia. Bolt (lbf)	Deck Ledger Connection for ½ inch dia. Bolt w/ air gap ^(g) (lbf)
1.3E 1550Fb X-ply	t ≥ 1-1/4	d ≤ 16	250	9,350	4,210	450	n/a	n/a
		16 < d ≤ 24		5,070				
1.6E 2250Fb 2.1E 3100Fb	t = 1-1/4	d = 11-7/8	200	4,250	3,760	550	550	350
		d = 14		3,550	3,550			
		d = 16		2,900	2,900			
	t = 1-1/2	d = 11-7/8	250	6,480	2,900	550	615	615
		d = 14		5,600	4,500			
		d = 16		4,800	4,500			
		d = 18		3,900	2,700			
		d = 20		3,200	2,700			
		d = 24		2,250	2,250			
	t = 1-3/4	d = 11-7/8	250	7,560	5,200	675	725	615
		d = 14		6,900	5,200			
		d = 16		6,200	5,200			
		d = 18		5,500	4,200			
		d = 20		4,800	4,200			
d = 24	3,500	3,500						
1.5E 2250Fb 1.55E 2250Fb ^(h) 2.0E 2900Fb 2.2E 3100Fb	1-1/2 ≤ t < 1-3/4	d ≤ 16	250	4,000	2,700	450	n/a	n/a
		16 < d ≤ 24		2,300 ⁽ⁱ⁾				
	t ≥ 1-3/4	d ≤ 16		4,500				
		16 < d ≤ 24		3,450				

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 where the equivalent moisture content of sawn lumber does not exceed 16%.
- ^(b) The tabulated 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 with the applicable building code except that the vertical uniform load capacity and vertical concentrated load capacity are not permitted to be increased for any load durations shorter than the normal load duration (10 years).
- ^(c) Other design values are as provided for PWT LVL in Table 1.
- ^(d) 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.
- ^(e) The nailing schedule for sheathing to rim and rim board to sill plate (toe-nailed) is based on 8d box (0.113 inch x 2-1/2 inches) nails at 6 inches on center (refer to APA W345, APA Performance Rated Rim Boards® for full details). Lateral load capacity is permitted to be increased by a factor of 1.4 when subjected to wind loads. Commercial framing connectors may be used to achieve lateral load capacities exceeding the values shown in this table. Calculations shall be based on the equivalent specific gravity values listed in Table 2 subjected to the nailing spacing provided in Table 4.
- ^(f) The allowable vertical uniform load capacity is based on the strength of the rim board and may need to be reduced based on the bearing capacity of the supporting wall plate.
- ^(g) Air gap is defined as up to ½-inch shimmed air space between Rim Board and deck ledger.
- ^(h) Product trademarked with mill number 1047 (Burlington, WA) may use the values for 1.6E 2250Fb.
- ⁽ⁱ⁾ Product trademarked with mill numbers 1066 (Golden, BC) or 1071 (Wilmington, NC) may use 2,500 lbf/ft.

Table 3. Allowable Nail Spacing for PWT LVL^(a,b,c)

Thickness (in)	Orientation ^(d)	Common Nail Size ^(e, f)	Diameter (in)	Length (in)	Minimum End Distance (in)	Minimum Nail Spacing (in)		Maximum Nail Penetration (in)
						Single Row	Multiple Rows ^(g, h)	
< 1-1/2	Edge ⁽ⁱ⁾	8d & smaller	0.131	2.5	2.5	4	n/a	2.25
		10d & 12d	0.148	3.25	2.5	4	n/a	2.5
		16d	0.162	3.5	3.5	5	n/a	2
	Face ⁽ⁱ⁾	8d & smaller	0.131	2.5	1.5	3	3	n/a
		10d & 12d	0.148	3.25	1.5	3	3	n/a
		16d	0.162	3.5	1.5	5	5	n/a
≥ 1-1/2	Edge ⁽ⁱ⁾	8d & smaller	0.131	2.5	2.5	3	4	2.25
		10d & 12d	0.148	3.25	3.5 ^(k)	4	5	2.5
		16d	0.162	3.5	3.5	5	6 ^(l)	2
	Face ⁽ⁱ⁾	8d & smaller	0.131	2.5	1.5	3	3	n/a
		10d & 12d	0.148	3.25	1.5	3	3	n/a
		16d	0.162	3.5	1.5	5	5	n/a

For SI: 1 inch = 25.4 mm

- (a) Spacing requirements and maximum nail size for panel edge nailing of wall sheathing at adjoining panels must be in accordance with Section 4.3.4.
- (b) Edge distance shall be sufficient to prevent splitting.
- (c) Nail sizes and closest on-center spacing not specifically described in this table are outside the scope of this report.
- (d) Face orientation applies to nails driven into the face of the member, such that the long axis of the nail is perpendicular to the wide faces of the veneers. Edge orientation applies to nails driven into the edge of the member.
- (e) Nails listed are common wire nails. For box nails, the spacing and end distance requirements of the next shorter common nail may be used: e.g., a 16d box nail may be spaced the same as a 10d and 12d common nail. Larger nail sizes and shank types not specifically described above are beyond the scope of this report.
- (f) 16d sinkers (0.148 inch x 3-1/4 inches) may be spaced the same as a 12d common wire nail (0.148 inch x 3-1/4 inches).
- (g) Multiple rows must be spaced 1/2 inch or more from each other and offset one-half of the tabulated minimum nail spacing, as shown in Figure 1.
- (h) Multiple rows must be equally spaced about the centerline of the edge or face (whichever applies).
- (i) Nail penetration for edge nailing shall not exceed 2 inches for 16d common nails (0.162 inch x 3-1/2 inches) and 2-1/2 inches for all nails with a smaller shank diameter.
- (j) Tabulated closest on-center spacing for face orientation is applicable to nails that are installed in rows parallel to the grain (length) of the member. For nails installed in rows perpendicular to the direction of grain (width/depth) of the member, the closest on-center spacing for face orientation shall be sufficient to prevent splitting.
- (k) Minimum end distance is permitted to be reduced to 2-1/2 inches for single row nailing.
- (l) Minimum nail spacing may be reduced to 5 inches when the member is at least 1-3/4 inches in thickness.

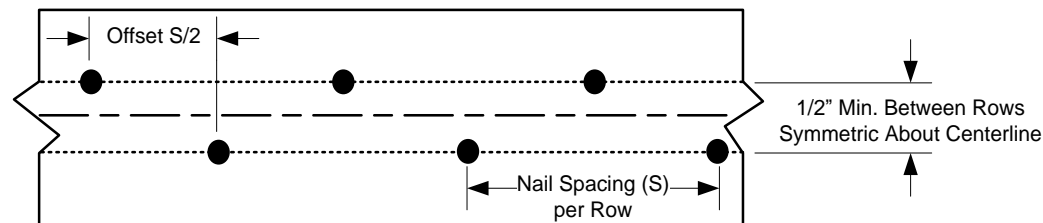


Figure 1. Spacing of multiple rows of nails.

Table 4. Equivalent Specific Gravity for Connection Design in PWT LVL^(a,b,c)

Nails		Nails and Wood Screws		Bolts and Lag Screws ^(f)	
Withdrawal Load		Lateral Load		Lateral Load	
Installed in Edge ^(d)	Installed in Face ^(e)	Installed in Edge ^(d)	Installed in Face ^(e)	Installed in Face ^(e)	
				Loaded Parallel to Grain	Loaded Perpendicular to Grain
0.46	0.50	0.50	0.50	0.46	0.50

- (a) Fastener types and orientation not specifically described in this table are beyond the scope of this report.
- (b) Fastener design values calculated using the tabulated equivalent specific gravities given above must be adjusted by the applicable adjustment factors specified in the NDS for connections.
- (c) Fastener spacing, and end and edge distances must be as specified in the NDS, except that nail spacing and end distance must be as specified in Table 3.
- (d) Edge orientation applies to member faces showing the narrow edge of all veneers, typically the narrow faces of the member.
- (e) Face orientation applies to member faces showing the face of one veneer, typically the wide faces of the member.
- (f) The capacities for 1/2-inch-diameter lag screws installed into PWT LVL used as rim board for ledger attachment shall be in accordance with Table 2.

Table 5. Strength Reduction Factors for Notches and Holes in PWT LVL used as studs^(a, b, c)

Notches			Holes		
Bending	Compression	Tension	Bending	Compression	Tension
0.80	0.90	0.60	0.95	0.95	0.95

- (a) Design of PWT LVL used as studs with notches and holes used in engineered wall framing must be based on a net-section analysis in accordance with the NDS. See Section 4.3.3 of this report for limitations on the allowed size and placement of notches and holes.
- (b) The reference design stresses for bending, compression, and tension from Table 1 must be multiplied by the strength reduction factors in the above table.
- (c) See Section 4.3.2 for notching and boring of holes in PWT LVL used as studs in prescriptive wall framing.

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