

West Fraser LVL and LVL Studs
Sundre Forest Products Inc.

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Products: West Fraser™ LVL and LVL Studs
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1. Basis of the product report:
 - 2020 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 recognized in the 2020 NBC
 - ASTM D5456-18 recognized in CSA O86-19
 - APA Reports T99P-37, T99-40, T99P-41, T2000P-13, T2002P-38, T2003M-76, T2003P-47, T2003P-51, T2005P-07, T2005P-42, T2007P-12, T2007P-44, T2009P-72, T2015P-13, T2021P-06, T2021P-07, T2021P-08, T2021P-09, T2023P-02, T2023P-03, T2023P-04, T2023P-21 and T2023P-22, and other qualification data
2. Product description:

West Fraser™ laminated veneer lumber (LVL) is a structural composite lumber product consisting of lodgepole pine, white spruce, Douglas fir and aspen veneers singularly or in combination and laminated with grain parallel to the length of the member in accordance with the in-plant manufacturing standard approved by APA. West Fraser LVL is available in thicknesses of 19 to 89 mm (3/4 to 3-1/2 inches), depths of 38 to 1,219 mm (1-1/2 to 48 inches), and lengths up to 24.4 m (80 feet).

West Fraser LVL studs are used as Part 9 wall framing in accordance with Clause 9.23.10 of the 2020 NBC and in Part 4 engineered wall systems subjected to limitations specified in this report. The minimum thickness of the LVL studs is 38 mm (1-1/2 inches). The LVL studs described in this report are 1.7E or greater grade LVL.
3. Design properties:

The structural design provisions for wood construction provided in the building code are applicable to West Fraser LVL, and West Fraser LVL studs, unless noted otherwise in this report. Table 1 lists the Limit States Design (LSD) properties, and Table 2 lists the equivalent relative density (G) for connection design.

 - 3.1 Beams and headers:

The allowable spans for West Fraser LVL shall be in accordance with the recommendations provided by the manufacturer (www.westfraser.com).
 - 3.2 Wall framing:

West Fraser LVL shall be permitted for use as wall studs in accordance with the prescriptive requirements of Part 9 of the 2020 NBC. The specified shear strength for nailed structural panel shear walls utilizing West Fraser LVL shall be determined in accordance with Clause 11.3 of CSA O86 utilizing the equivalent relative density specified in Table 2.

 - 3.2.1 Part 9 Prescriptive Stud Wall Applications:

West Fraser LVL used as studs shall be permitted in accordance with Clause 9.23.10 of the 2020 NBC, the conditions specified in Section 4.2 of this report, and the following requirements:

- a) Braced wall panels utilizing West Fraser LVL studs are subject to the limitations in Clause 9.23.1.1 of the 2020 NBC, as applicable,
- b) Fasteners for sheathing shall conform to Tables 9.23.3.5.-A and 9.23.3.5.-B of the 2020 NBC,
- c) West Fraser LVL stud size and spacing shall conform to Table 9.23.10.1 of the 2020 NBC, and
- d) West Fraser LVL stud-braced walls shall be detailed in accordance with Clause 9.23.13 of the 2020 NBC and Section 4.2 of this report.

3.2.2 Part 4 Engineered Stud Wall Applications:

West Fraser LVL used as studs shall be permitted when designed in accordance with Clause 4.3.1 of the 2020 NBC, the recommendations provided by the manufacturer (see link above), the conditions specified in Section 4.2 of this report, and the following requirements:

- a) Blocked shear walls with West Fraser LVL studs can be used as lateral load resisting systems in wood construction in Canada with no height limitation. Unblocked shear walls are limited to a height of 4.9 m (16 feet) in accordance with Clause 11.4.4 of CSA O86-19.
- b) Blocked shear walls shall be used in high seismic zones (i.e., SC3 and SC4 in Part 4, and $S_a(0.2) \geq 0.7$ in Part 9 of the 2020 NBC).
- c) For double-sided walls:
 - 1) West Fraser LVL studs shall be a minimum nominal 2x6 for connections with 8d nails and a minimum nominal 2x8 for connections with 10d nails at any nail spacing of less than 100 mm (4 inches).
 - 2) Stud size and sheathing attachment shall be in accordance with Clause 11.5.3.5 of CSA O86-19.
- d) The nail diameter for sheathing-to-framing connections in any walls shall not exceed 3.76 mm (0.148 inch).
- e) The nail spacing in any case shall be equal to or greater than 76 mm (3 inches).
- f) The size of the nail heads shall meet the requirement specified in CSA B111 or ASTM F1667.
- g) Maximum sheathing thickness shall not exceed 15.8 mm (5/8 inch).
- h) The stud spacing shall not exceed 610 mm (24 inches) on center.
- i) The 64-mm (2.5-inch) stud or double 38-mm (1.5-inch) stud requirements outlined in Clause 11.3.2 of CSA O86-19 shall be applied. The double wall studs shall be constructed by joining single studs by a sufficient number of either nails or screws. The connection between plies shall be designed with mechanical fasteners to resist the shear force at the stud interface and to prevent separation of the studs.

4. Product installation:

4.1 Beams and headers:

West Fraser 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 Wall framing:

4.2.1 Part 9 Prescriptive Stud Wall Applications:

Cutting, notching, and boring of West Fraser LVL used as studs is permitted in accordance with Clause 9.23.5.3 of the 2020 NBC with the exception that the notch shall not exceed 25% of the stud depth. Stud wall nailing restrictions and requirements are presented in Section 4.2.3 of this report.

4.2.2 Part 4 Engineered Stud Wall Applications:

Design for cutting, notching, and boring of West Fraser LVL shall be based on the recommendations provided by the manufacturer (see link above), a net section analysis in accordance with the provisions of CSA O86, and the following:

- a) Hole size shall not exceed 40% of the LVL stud depth.
- b) The factored resistance for bending and/or for tension is reduced by 30%.
- c) The edge distance for holes shall have a minimum clear distance of 16 mm (5/8 inch) for LVL stud depth of 140 mm (5-1/2 inches) and less. For larger LVL studs, the minimum edge distance shall be 12% of the LVL stud depth.
- d) Notch depth shall not exceed 25% of the LVL stud depth. The notch length shall not exceed 203 mm (8 inches).
- e) Holes or notches shall not be placed within 152 mm (6 inches) of either end of the LVL stud.
- f) Holes and notches shall not be placed in the same cross-section. A clear vertical separation of at least twice the length of the notch or twice the diameter of the hole shall be maintained, whichever is greater.
- g) LVL stud wall nailing restrictions and requirements are prescribed in Section 4.2.3 of this report.

4.2.3 West Fraser LVL Stud Wall Nailing Restrictions And Requirements:

- a) For sheathing attached with 3.76 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) or smaller, spaced no closer than 152 mm (6 inches) on center, a single LVL stud shall be permitted for framing at adjoining panel edges.
- b) For sheathing attached with 3.33 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) or smaller, spaced no closer than 102 mm (4 inches) on center, a single LVL stud shall be permitted for framing at adjoining panel edges.
- c) For 3.76 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) spaced closer than 152 mm (6 inches) on center, and 3.33 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) or smaller, spaced closer than 102 mm (4 inches), a double LVL stud is required at adjoining panel edges. Double LVL studs must be stitch-nailed together using a minimum of the same size and frequency of the nailing required to attach the sheathing to the framing at the panel edges. Panel-edge nails must be installed a minimum of 10 mm (3/8 inch) from the panel edges and must be staggered a minimum of 13 mm (1/2 inch) within each line of nails.
- d) For sheathing attached with 3.33 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) spaced no closer than 51 mm (2 inches) on center or 3.76 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) spaced closer than 76 mm (3 inches) on center, a double, stitch-nailed, LVL stud or single 64 mm (2-1/2 inch) thick LVL stud is required at adjoining panel edges. Nails shall be installed a minimum of 10 mm (3/8 inch) from all panel edges and shall be staggered a minimum of 6 mm (1/4 inch) for each row of nails.
- e) For Part 9 Prescriptive Stud Wall Applications: Double LVL studs shall be stitch-nailed together with 2 staggered rows of nails [minimum 3.76 mm x 76 mm nails (10d common: 0.148 inch x 3 inches)] spaced 203 mm (8 inches) in each row.
- f) For Part 4 Engineered Stud Wall Applications: The stitch nailing of double LVL studs shall be designed to transfer the required lateral shear using an equivalent relative density of 0.50.
- g) Nails into the edge of LVL studs shall not be spaced closer than 76 mm (3 inches) on center.
- h) Maximum nail size is 3.76 mm x 76 mm (10d common: 0.148 inch x 3 inches).

5. Fire-rated assemblies:

Fire-rated wall assemblies for West Fraser LVL have not been evaluated in fire-resistance-rated wall construction.

6. Limitations:
 - a) West Fraser LVL and West Fraser LVL studs shall be designed in accordance with the code using the design properties specified in this report.
 - b) West Fraser LVL and West Fraser LVL studs 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% or less and does not exceed 19%.
 - c) West Fraser LVL (all grades) and West Fraser studs (1.7E and greater) are produced at Sundre Forest Products Inc., Rocky Mountain House, Alberta, Canada, under a quality assurance program audited by APA.
 - d) This report is subject to re-examination in one year.

7. Identification:

The West Fraser LVL and West Fraser LVL studs described in this report are identified by a label bearing the company name, the product name, the product grade, the APA assigned plant number (1050), the APA logo, the report number PR-L349 or PR-L349C, and a means of identifying the date of manufacture.

Table 1. LSD Specified Strengths and MOE for West Fraser™ LVL (a,b)

Product Grade	Modulus of Elasticity, E MPa (10 ⁶ psi) ^(c)	Flexural Stress, F _b , MPa (psi)		Tension Parallel to Grain, F _t , MPa (psi) ^(e)	Comp. Parallel to Grain, F _c , MPa (psi)	Compression Perpendicular to Grain, F _{cL} , MPa (psi)		Horizontal Shear, F _v , MPa (psi)	
		Beam ^(d)	Plank			Beam	Plank ^(f)	Beam	Plank
1700F _b -1.3E	8,960 (1.30)	21.7 (3,142)	24.2 (3,511)	14.3 (2,075)	19.8 (2,873)	7.5 (1,092)	--	2.8 (407)	--
2750F _b -1.7E	11,720 (1.70)	35.1 (5,082)	33.1 (4,805)	21.5 (3,113)	25.9 (3,751)	9.4 (1,365)	6.2 (901)	3.7 (536)	1.4 (210)
3000F _b -1.8E	12,400 (1.80)	38.2 (5,544)	38.2 (5,544)	21.5 (3,113)	25.9 (3,751)	9.0 (1,310)	6.2 (901)	3.7 (536)	2.2 (320)
3000F _b -1.9E	13,100 (1.90)	38.2 (5,544)	38.2 (5,544)	21.5 (3,113)	27.5 (3,990)	9.0 (1,310)	6.2 (901)	3.8 (554)	2.2 (320)
3100F _b -2.0E	13,790 (2.00)	39.5 (5,729)	44.6 (6,468)	23.1 (3,353)	33.0 (4,788)	9.0 (1,310)	6.2 (901)	3.8 (554)	2.2 (320)

(a) Design values provided in this table are based on covered, dry conditions of use, as defined in CSA O86, for the standard-term load duration. All values, except for E and F_{cL}, are permitted to be adjusted for other load durations as permitted by the code.

(b) Beam (edgewise) = load parallel to glue-line; plank (flatwise) = load perpendicular to glue-line.

(c) 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:

$$\text{In Metric Units: } \delta = \frac{156.3wL^4}{Ebd^3} \times 10^6 + \frac{2400wL^2}{Ebd}$$

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

or

$$\text{In Imperial Units: } \delta = \frac{270wL^4}{Ebd^3} + \frac{28.8wL^2}{Ebd}$$

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

(d) The tabulated values are based on a reference depth of 305 mm (12 inches). For other depths, when loaded edgewise, the allowable bending stress (F_b) shall be modified by a depth factor, $K_d = (305/d)^{(1/9)}$ for 1.3E, 1.7E and 2.0E grades or $K_d = (305/d)^{(1/7.35)}$ for 1.8E and 1.9E grades.

1.3E, 1.7E and 2.0E grades $(305/d)^{1/9}$									
Depth (mm)	89	140	185	241	305	356	407	458	610
Multiply by	1.15	1.09	1.06	1.03	1.00	0.98	0.97	0.96	0.93

1.8E and 1.9E grades $(305/d)^{1/7.35}$									
Depth (mm)	89	140	185	241	305	356	407	458	610
Multiply by	1.18	1.11	1.07	1.03	1.00	0.98	0.96	0.95	0.91

(e) Tabulated tensile stresses are for a 6.096 m (20-foot) LVL length. For shorter lengths, the value shall be adjusted by multiplying the tabulated value by $(6.096/L)^{1/11}$, where L is the LVL length in meters.

(f) The tabulated compressive stress perpendicular to grain ($F_{c\perp}$) is based on the average stress at the proportional limit or 1 mm (0.04 in.) deformation, whichever is less.

Table 2. Equivalent Relative Density for Connection Design^(a)

Connection Type	Product Grade	Face ^(b)	Edge ^(c)
Nails and Wood Screws – Withdrawal	1.3E	0.43	0.43
	1.7E	0.46	0.43
	1.8E	0.46	0.43
	1.9E	0.50	0.43
	2.0E	0.50	0.43
Nails and Wood Screws – Lateral	1.3E	0.43	0.43
	1.7E	0.50	0.43
	1.8E	0.50	0.43
	1.9E	0.50	0.43
	2.0E	0.50	0.43
Bolts and Lag Screws – Lateral Loaded parallel to grain	1.3E	0.34	NA
	1.7E	0.43	NA
	1.8E	0.43	NA
	1.9E	0.43	NA
	2.0E	0.43	NA
Bolts and Lag Screws – Lateral Loaded perpendicular to grain	1.3E	0.43	NA
	1.7E	0.43	NA
	1.8E	0.43	NA
	1.9E	0.43	NA
	2.0E	0.43	NA

^(a) Similar to those values provided in the applicable code for solid sawn lumber having a minimum specific gravity shown.

^(b) Installed perpendicular to the wide face of the LVL.

^(c) Installed parallel to the wide face of the LVL.

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**APA – THE ENGINEERED WOOD ASSOCIATION
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