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*EVALUATION
REPORT*

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West Fraser™ LVL

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Plant: 1.3E, 1.7E, 1.8E, 1.9E, 2.0E
West Fraser™ LVL
Rocky Mountain House, Alberta

1. Purpose of Evaluation

The proponent sought confirmation from the Canadian Construction Materials Centre (CCMC) that “West Fraser™ LVL” can serve as “lumber” in compliance with the intent of the National Building Code of Canada (NBC) 1995.

2. Opinion

Subject to the limitations and conditions stated in this report, test results and assessments provided by the proponent show that “West Fraser™ LVL” complies with CCMC’s Technical Guide for “Structural Composite Lumber” Masterformat number 06173, and provides a level of performance equivalent to that required

- NBC of Canada 1995, Subsection 9.23.4, when designed in accordance with:
CSA O86-01, “Engineering Design in Wood”

Adhesives comply with:

- CSA O112.6-M1977, “Phenol and Phenol Resorcinol, Resin Adhesives for Wood (High Temperature Curing)”

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Canada Mortgage and Housing Corporation permits the use of this product in construction financed or insured under the National Housing Act.

3. Description

“West Fraser™ LVL” laminated veneer lumber (see Figure 1) is manufactured at the Rocky Mountain House plant by laminating veneers of Lodgepole Pine, Douglas Fir, Aspen and White Spruce singularly or in combination. The grain of the veneer shall be oriented parallel to the length of the member. The 3-mm-thick veneers are bonded with an exterior-type phenolic resin (phenol formaldehyde). The veneer joints are scarfed or lapped and staggered with a minimum distance between joints of not less than 100 mm. The lengths and widths are cut in square edges.

Five grades: 1700Fb-1.3E, 2750Fb-1.7E, 3000Fb-1.8E, 3000Fb-1.9E and 3100Fb-2.0E of “West Fraser™ LVL” are manufactured at the Rocky Mountain House plant, available in 25.4 mm to 89 mm thicknesses, 89 to 1 219 mm deep by maximum length of 24.38 m.

Quality control and testing is conducted by the APA-EWS (APA - Engineered Wood Association), as an independent third-party monitoring and inspection agency accredited by the Standards Council of Canada.

The permitted design values are outlined in Table 1.

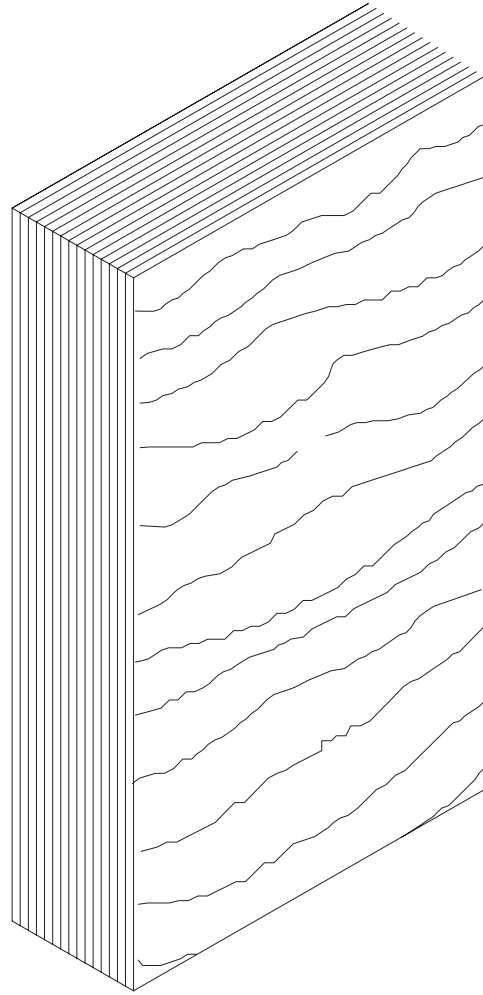


Figure 1. A block of “West Fraser™ LVL”

Table 1. Specified Strengths for “West Fraser™ LVL” for Dry Service Conditions (MPa)

Mechanical Properties (MPa)	West Fraser™ LVL				
	Rocky Mountain House Plant (Lodgepole pine ^(a))				
	1700F _b -1.3E	2750F _b -1.7E	3000F _b -1.8E	3000F _b -1.9E	3100F _b -2.0E
Flexural stress, f _b ⁽¹⁾ - joist	21.7	35.1	38.2	38.2	39.5
Tension parallel to grain, f _t ⁽²⁾	14.3	21.5	21.5	21.5	23.1
Compression parallel to grain, f _c //	19.8	25.9	27.5	27.5	33.0
Compression perp. to grain, f _c ⊥ •Parallel to the glue line (joist)	7.5	9.4	9.0	9.0	9.0
Horizontal Shear, F _v •Perp. to the glue line (joist)	2.8	3.8	4.5	4.5	4.5
Modulus of Elasticity (MOE)	8 960	11 720	12 400	13 100	13 790
MOE Column, E ₀₅	7 799	10 200	10 798	11 397	11 997

(a) Lodgepole pine, Douglas fir, Aspen and White Spruce, singularly or in combination in this grade.

1. Tabulated values are based on loads of a normal duration, edgewise loading, and reference depth of 305 mm.

1.3E, 1.7E, 1.8E, 1.9E 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

2. Tension values for 1.3E, 1.7E, 1.8E and 2.0E grades adjusted to a specified length of 6 096 mm (20 ft.). For applications with shorter lengths, (6 096/L)^{1/11} should be used to adjust F_t for the actual in-service length.
3. For uniformly loaded simple span beams, the deflection shall be calculated as follows:

$$\Delta = \frac{156WL^4 \times 10^6}{Ebd^3}$$

For 1.9E only, for uniformly loaded simple span beams, the deflection shall be calculated as follows:

$$\Delta = \frac{156WL^4 \times 10^6}{Ebd^3} + \frac{2400 WL^2}{Ebd}$$

where

- Δ = Deflection, mm
- E = Modulus of Elasticity, MPa
- W = Specified Uniform load (N/m)
- L = Span (m)
- d = Beam depth, mm
- b = Beam width, mm

Table 2. Fastener Capacities for “West Fraser™ LVL”

Fastener Property “West Fraser™ LVL”	Nail Orientation	Load Direction	Specific Gravity of Equivalent Species for Design Purposes ⁽¹⁾
Nail Withdrawal			
1.3E LVL	Edge	Withdrawal	Hem-Fir, SG=0.43
	Face	Withdrawal	
1.7E LVL	Edge	Withdrawal	
	Face	Withdrawal	
1.8E, 1.9E LVL	Edge	Withdrawal	Hem-Fir, SG=0.43
	Face	Withdrawal	DF-L, SG=0.50
2.0E LVL	Edge	Withdrawal	Hem-Fir, SG=0.43
	Face	Withdrawal	DF-L, SG=0.50
Lateral Nail Capacity			
1.3E LVL	Face	Perpendicular to wide face	Hem-Fir, SG=0.43
	Edge	Parallel to wide face	
1.7E LVL	Face	Perpendicular to wide face	DF-L, SG=0.50
	Edge	Parallel to wide face	Hem-Fir, SG=0.43
1.8E, 1.9E LVL	Face	Perpendicular to wide face	DF-L, SG=0.50
	Edge	Parallel to wide face	Hem-Fir, SG=0.43
2.0E LVL	Face	Perpendicular to wide face	DF-L, SG=0.50
	Edge	Parallel to wide face	Hem-Fir, SG=0.43
Bolt Bearing Capacity			
1.3E LVL	12.5 mm	Parallel to grain	Northern Spec., SG=0.43
	19.0 mm	Parallel to grain	
	12.5 mm	Perpendicular to grain	Hem-Fir, SG=0.43
	19.0 mm	Perpendicular to grain	
1.7E LVL	12.5 mm	Parallel to grain	
	19.0 mm	Parallel to grain	
	12.5 mm	Perpendicular to grain	
	19.0 mm	Perpendicular to grain	
1.8E, 1.9E LVL	12.5 mm	Parallel to grain	
	19.0 mm	Parallel to grain	
	12.5 mm	Perpendicular to grain	
	19.0 mm	Perpendicular to grain	

Table 2. Fastener Capacities for “West Fraser™ LVL” (cont’d)

Fastener Property “West Fraser™ LVL”	Nail Orientation	Load Direction	Specific Gravity of Equivalent Species for Design Purposes ⁽¹⁾
Bolt Bearing Capacity	Bolt Size	Load Direction	
2.0 E LVL	12.5 mm	Parallel to grain	Hem-Fir, SG=0.43
	19.0 mm	Parallel to grain	
	12.5 mm	Perpendicular to grain	
	19.0 mm	Perpendicular to grain	

1. The equivalent species specific gravity/mean relative density is provided for fastener design for bearing-type failures accordance with CSA O86-01, Section 10.

4. Usage and Limitations

“West Fraser™ LVL” is permitted for use in construction as an alternative material for lumber in various applications in ‘dry service’ conditions¹. The use of “West Fraser™ LVL” is subject to the following conditions:

- “West Fraser™ LVL” shall be designed in accordance with the requirements of the NBC 1995, Section 4.3. and CSA O86-01, Engineering Design in Wood (Limit States Design).
- The design stresses for “West Fraser™ LVL” shall not exceed the values set forth in Table 1.
- Except as noted below, the drawings and related documents shall bear the authorized seal and signature of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation. The drawings shall bear a statement to the effect that the design is in accordance with the requirements of NBC 1995, Section 4.3., and show the governing design loads and deflections.
- When used as a floor joist, “West Fraser™ LVL” must be designed to meet the serviceability vibration requirement specified in NBC 1995, Sentence 9.23.4.1.(2).
- Pre-engineered and sealed Tables have been provided to CCMC for when “West Fraser™ LVL” is used in buildings that fall within the scope of Part 9 of the NBC, and when used as a floor beam in simple spans supporting uniform loads only, installed in accordance with West Fraser™ LVL Product’s span tables and installation manual for Canada entitled “West Fraser™ LVL User’s Guide,” for 1.3E, 1.7E, 1.8E and 2.0E, dated May 2005.
- The compression edges of all “West Fraser™ LVL” joists, rafters and beams shall be laterally supported at least every 610 mm. The ends of all “West Fraser™ LVL” joists, rafters and beams must be restrained to prevent rollover. This is normally provided by diaphragm sheathing attached to the top or compression edge, and an end wall or shear transfer panel capable of transferring a minimum of 730 N/m or the required shear forces due to wind or seismic conditions. Blocking or cross-bracing with equivalent strength may be used.
- Nailing of “West Fraser™ LVL” shall conform to NBC 1995, Table 9.23.3.4., or as specific design requires. Nails installed parallel to the glue lines on the narrow face of the LVL shall be spaced a minimum of 76 mm for 64 mm common nails, 102 mm for 76 mm or 83 mm common nails, and 127 mm for 89 mm common nails.

- Notching and drilling shall conform to the manufacturer's installation instructions for Canada contained in "West Fraser™ LVL User's Guide," for 1.3E, 1.7E, 1.8E and 2.0E, dated May 2005.
- Moisture content of "West Fraser™ LVL" shall not exceed 19% at the time of installation, and the product shall not be used in applications where moisture content can exceed 19% or be exposed directly to weather and high humidity.
- This product must be identified with the phrase "CCMC # 12904-R" along the side of the joist or beam member. This CCMC number is only valid when it appears in conjunction with the certification mark of APA-EWS.

Installation must follow the manufacturer's current instructions. Detailed instructions for the installation of "West Fraser™ LVL" are available from the manufacturer.

¹*General Note: All lumber, wood-based panels and proprietary engineered wood products are intended for 'dry service' conditions. "Dry service" is defined as the in-service environment under which the equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all woodbased products should be protected from the weather as much as possible to ensure that the 19% MC is not exceeded as per 1995 NBC article 9.3.2.5.*

5. Performance

Testing of "West Fraser™ LVL" was conducted by a testing agency recognized by CCMC.

The manufacturer warrants "West Fraser™ LVL" to be free from manufacturing defects in workmanship and material, if used in strict accordance with the manufacturer's published instructions. The designer shall use the properties specified in Table 1 and Table 2.

Summary of Tests

Structural testing of "West Fraser™ LVL" was witnessed by an independent testing agency recognized by CCMC. The tests were in accordance with the CCMC Technical Guide "Structural Composite Lumber," Masterformat number 06173 and ASTM D5456-01, "Standard Specification for Evaluation of Structural Composite Lumber and CSA O86-01. The results of the test program are summarized below.

Bending Strength and Stiffness

Specimens were tested in edgewise and flatwise bending and multiple sizes to establish volume effects. A parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-01 was used to determine the specified strength.

Tension Parallel to Grain

Specimens were tested in tension for establishing the characteristic value and volume effects. A parametric 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value.

Test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-01 was used to determine the specified strength.

Compression Parallel to Grain

Specimens were tested and a non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CSA O86-01 was used to determine the specified strength.

Compression Perpendicular to Grain

Specimens were tested and the average stress for a 1 mm deformation was determined. This value was divided by 1.67 to establish the design value.

Shear

Specimens were tested edgewise as full-size specimens (ASTM D5456-03). A non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Test data have been used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor, for full-size specimens, from CSA O86-01 was used to determine the specified strength.

Creep and Recovery

“West Fraser™ LVL” were tested in accordance with a 90-day Creep and Recovery Test, resulting in acceptable performance.

Fasteners

Nail withdrawal values were established following ASTM D 1761-88 for an 8d common nail having a 31.75 mm penetration. Twenty specimens were tested and equivalent species capacity was determined in accordance with ASTM D 5456 Appendix A2.4.

Dowel bearing strength was determined as per ASTM D 5764-95 with 10d common nails with a nominal diameter on 3.76 mm and a lead hole diameter of 2.77 mm. Forty specimens (10 specimens for four combinations of load direction) of each LVL were tested and the mean bearing capacity was used to establish the equivalent species capacity as per ASTM D 5456 Appendix A2.5.

Bolt bearing capacity as per ATM D 5764-95 with 12.5 and 19.0 mm bolts was determined. One hundred and twenty specimens (30 specimens for each bolt and LVL face combination) were tested and the mean bolt bearing capacity was used to establish the equivalent species capacity as per ASTM D 5456 Appendix A2.5.

Manufacturing Quality Assurance

The manufacturing quality assurance program and records are verified by APA-EWS as part of the product certification.

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Note: Readers are asked to refer to limitations imposed by NRC on the interpretation and use of this report. These limitations are included in the introduction to CCMC's Registry of Product Evaluations, of which this report is part.

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