



## Evaluation Report CCMC 12904-R West Fraser™ LVL

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### 1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “West Fraser™ LVL”, when used as structural composite lumber (SCL) in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Sentence 4.3.1.1.(1), Design Basis for Wood (CSA O86-09, for SCL qualification)
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.23.4.2.(3), Spans for Joists, Rafters and Beams

This opinion is based on CCMC’s evaluation of the technical evidence in Section 4 provided by the Report Holder.

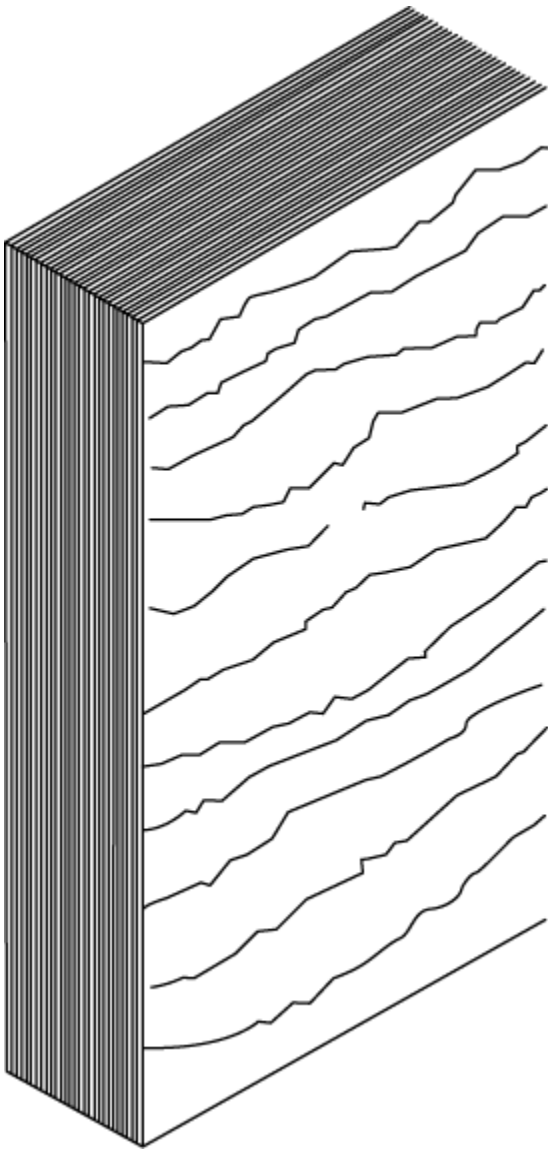
Ruling No. 09-08-206 (12904-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2009-04-16 (revised on 2013-03-07) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

### 2. Description

The product is a laminated veneer lumber (LVL) (see Figure 1) that is manufactured by laminating veneers of lodgepole pine, Douglas fir, aspen and white spruce singularly or in combination at the Rocky Mountain House plant. The grain of the veneer is oriented parallel to the length of the member. The 3-mm-thick veneers are bonded with an exterior-type phenolic resin (phenol formaldehyde) complying with CSA O112.10-08, “Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)” (see CCMC 13192-L). 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 of the product – 1700Fb-1.3E, 2750Fb-1.7E, 3000Fb-1.8E, 3000Fb-1.9E and 3100Fb-2.0E – are available in 25.4-mm to 89-mm thicknesses, 89-mm to 1 219-mm depths, and a maximum length of 24.38 m.

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



**Figure 1. Laminated veneer lumber**

### **3. Conditions and Limitations**

CCMC's compliance opinion in Section 1 is bound by the "West Fraser™ LVL" being used in accordance with the conditions and limitations set out below.

- The product, as with all SCL, is intended for dry service applications only<sup>1</sup>.
- The product is intended for use in construction as an alternative material to lumber. Proprietary design values presented for the product are to be used by professional engineers for design in accordance with CSA O86-09, "Engineering Design in Wood," for structural applications such as beams, headers, joists, rafters, and columns as intended by the product manufacturer. The specific application must be qualified through specific testing and validated by the manufacturer. Applications such as I-joist flanges, studs and metal-plated truss chords are beyond the scope of this evaluation.
- The pre-engineered tables in the literature outlined below has been provided to CCMC by the manufacturer to demonstrate compliance with Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ):

i. Manufacturer's Pre- engineered Tables<sup>2</sup>

- When the product is used as floor beams in simple spans supporting uniform loads only, the installation must be in accordance with the content of the manufacturer's publications entitled:
  1. "West Fraser™ LVL User's Guide," dated April 2015 (0415 CDN);
  2. "West Fraser™ LVL Supplement to User's Guide," dated April 2015 (0415 CDN – SUP).
- The product must be installed in accordance with the manufacturer's installation guidelines noted in this document for those applications falling within the scope of the document. Applications outside the scope of these installation

guidelines require engineering on a case-by-case basis.

ii. Manufacturer's Installation Details

- Nails and bolts in the attachment of the product must be used and installed in accordance with the manufacturer's size and spacing specifications.
- The ends of all beams must be restrained to prevent rollover.
- The compression edges of all beams must be continuously laterally supported.

iii. Engineering Required

- For structural applications beyond the scope/limitations of the above-referenced publication, or when required by the AHJ, the drawings or related documents must bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.
- The product must be designed in accordance with the requirements of CSA O86 and Part 4 of Division B of the NBC 2010. The specified strengths and fastener limits for the product must not exceed the values set forth in Tables 4.1.1. and 4.1.2 of this Report.
- The engineer must design in accordance with CSA O86, and may use as a guide, the "Engineering Guide for Wood Frame Construction," published by the Canadian Wood Council.

iv. Engineering Support Provided by Manufacturer

- West Fraser Mills Ltd., through Sundre Forest Products Inc., provides engineering support and may be consulted at:  
**Telephone:** (250) 991-5350  
**Fax:** (250) 991-5351

<sup>1</sup> 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 wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with Article 9.3.2.5., Moisture Content, of Division B of the NBC 2010.

<sup>2</sup> The pre-engineered tables present the pre-engineered factored resistance of the beam. The AHJ may require further engineering to determine the factored load in accordance with Part 4 of Division B of the NBC 2010.

## 4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

### 4.1 Design Requirements

Table 4.1.1 Product Specified Strengths for Dry Service Conditions<sup>4</sup>

Mechanical Properties	Specified Strengths for Product Grades <sup>1</sup> (MPa)				
	1700Fb-1.3E	2750Fb-1.7E	3000Fb-1.8E	3000Fb-1.9E	3100Fb-2.0E
Flexural stress, $f_b$ <sup>2</sup> - joist	21.7	35.1	38.2	38.2	39.5
Tension parallel to grain, $f_t$ <sup>3</sup>	14.3	21.5	21.5	21.5	23.1
Compression parallel to grain, $f_{c  }$	19.8	25.9	25.9	27.5	33.0
Compression perp. to grain, $f_{c\perp}$ - 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	3.7	3.7	3.8	3.8
Modulus of elasticity (MOE)	8 960	11 720	12 400	13 100	13 790
MOE column, E05	7 799	10 200	10 798	11 397	11 997

## Notes to Table 4.1.1:

- 1 Lodgepole pine, Douglas fir, aspen and white spruce, singularly or in combination in these grades.
- 2 Tabulated values are based on loads of a normal duration and a reference depth of 305 mm. For depths of 89 mm and deeper that are loaded edgewise, the specified bending strength must be modified by  $(305/d)^{1/9}$  for 1.3E, 1.7E and 2.0E grades as shown in the following table:

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

For 1.8E and 1.9E grades, the specified bending strength must be modified by  $(305/d)^{1/7.35}$  as shown in the following table:

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

- 3 Tension values for 1.3E, 1.7E, 1.8E, 1.9E and 2.0E grades are 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.
- 4 For uniformly loaded simple span beams, the deflection must be calculated as follows:

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

where:

$\Delta$  = deflection, mm  
 $E$  = modulus of elasticity (shear-free), MPa  
 $W$  = specified uniform load, N/m  
 $L$  = span, m  
 $b$  = beam width, mm  
 $d$  = beam depth, mm

**Table 4.1.2 Product Fastener Capacities**

Fastener Properties		Nail Orientation or Bolt Size	Load Direction	Specific Gravity of Equivalent Species for Design Purposes
Nail withdrawal	1.3E LVL	Edge	Withdrawal	Hem-fir, SG = 0.43
		Face	Withdrawal	
	1.7E, 1.8E LVL	Edge	Withdrawal	Hem-fir (north), SG = 0.46
		Face	Withdrawal	
	1.9E, 2.0E LVL	Edge	Withdrawal	Hem-fir, SG = 0.43
		Face	Withdrawal	DF-L, SG = 0.50
Lateral nail capacity	1.3E LVL	Edge	Perpendicular to wide face	Hem-fir, SG = 0.43
		Face	Parallel to wide face	
	1.7E LVL	Edge	Perpendicular to wide face	DF-L, SG = 0.50
		Face	Parallel to wide face	Hem-fir, SG = 0.43
	1.8E, 1.9E LVL	Edge	Perpendicular to wide face	DF-L, SG = 0.50
		Face	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

Fastener Properties		Nail Orientation or Bolt Size	Load Direction	Specific Gravity of Equivalent Species for Design Purposes
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	
		19.0 mm	Perpendicular to grain	
	1.7E, 1.8E, 1.9E, 2.0E 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	

This Evaluation Report is applicable only to the product labelled with the APA-EWS certification mark and the phrase “CCMC 12904-R” on each beam or header member.

The manufacturing quality assurance program has been updated to include requirements specified in ASTM D 5456-01, “Standard Specification for Evaluation of Structural Composite Lumber Products,” and has been verified by APA-EWS as part of the product certification. APA-EWS conducts monthly audits of the manufacturing plants and the quality assurance program.

## Report Holder

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Quesnel, BC V2J 6P5

**Telephone:** 250-991-5350

**Fax:** 250-991-5351

## Plant(s)

Rocky Mountain House, AB

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## Appendix A

The design values obtained from testing to ASTM D 5456-01 as specified in CSA O86-01 is summarized below. The manufacturer's published pre-engineered beam and header spans were then designed in accordance with CSA O86.

**Table A1 Additional Test Information for the Product**

Property	Test Information
<b>Bending</b>	Bending of 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 were used to establish the applicable coefficient of variation, $CV_w$ , and the reliability normalization factor from CSA O86 was used to determine the specified strength.
<b>Shear</b>	Specimens were tested edgewise as full-size specimens (ASTM D 5456-03). A non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Test data were used to establish the applicable coefficient of variation, $CV_w$ , and the reliability normalization factor for full-size specimens from CSA O86 was used to determine the specified strength.
<b>Compression parallel to grain</b>	Specimens were tested and a non-parametric, 5% tolerance limit with 75% confidence level approach was used to determine the characteristic value. Test data were used to establish the applicable coefficient of variation, $CV_w$ , and the reliability normalization factor from CSA O86 was used to determine the specified strength.
<b>Compression perpendicular to grain</b>	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.
<b>Tension parallel to grain</b>	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.
<b>Nail withdrawal</b>	Nail withdrawal values were established following ASTM D 1761-88, "Standard Test Methods for Mechanical Fasteners in Wood," 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 5456-01, Appendix A2.4.
<b>Nail bearing</b>	Dowel bearing strength was determined as per ASTM D 5764-95, "Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products," using 10d common nails with a nominal diameter of 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 5456-01, Appendix A2.5.
<b>Bolt bearing</b>	Bolt bearing capacity was determined as per ASTM D 5764-95 using 12.5-mm and 19.0-mm bolts. 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 5456-01, Appendix A2.5.
<b>Creep and recovery</b>	Specimens of the product were tested in accordance with a 90-day creep and recovery test, resulting in acceptable performance.
<b>Adhesives</b>	APA has confirmed that the adhesive, Hexion Cascophen MX-06C, complies with CSA O112.10-08, "Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)." See CCMC 13192-L.

**Date modified:**  
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