



Evaluation Report CCMC 13485-R RedLam™ LVL

MasterFormat:	06 17 10
Evaluation issued:	2010-02-16
Re-evaluated:	2019-11-19

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “RedLam™ 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 (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a) of Division A, using the following acceptable solutions from Division B:
 - Sentence 4.3.1.1.(1), Design Basis for Wood (CSA O86-14, “Engineering Design in Wood,” for SCL qualification)
- Clause 1.2.1.1.(1)(b) of 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 the CCMC evaluation of the technical evidence in Section 4 provided by the Report Holder.

2. Description

The product is manufactured by laminating veneer sheets of wood species or species combinations coated with an exterior-type adhesive conforming to CSA O112.6-M1977(R2006), “Phenol and Phenol-Resorcinol Resin Adhesives for Wood (High-Temperature Curing),” (see CCMC 13019-L) in specific lay-up patterns, which are fed into a continuous press. The wood species, species combinations, lay-up patterns and adhesives used are as specified in the manufacturer’s manufacturing standards.

The product is manufactured in thicknesses ranging from 19 mm to 89 mm, in widths ranging from 63.5 mm to 1 220 mm and in lengths up to 24.4 m.

Independent, third-party quality control inspections are conducted by PFS Corporation as part of the PFS product certification.

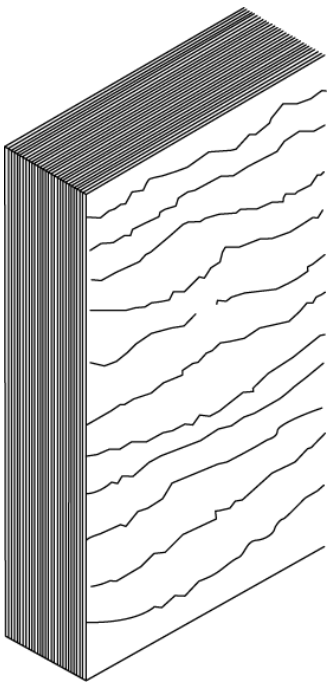


Figure 1. Joist/Beam veneer orientation of “RedLam™ LVL”

3. Conditions and Limitations

The CCMC compliance opinion in Section 1 is bound by the “RedLam™ LVL” being used in accordance with the conditions and limitations set out below:

- The product, as with all SCL, is intended for dry service¹ applications only.
- 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 for structural applications, such as beams, headers, joists, rafters and columns as intended by the product manufacturer. The specific application must be qualified through 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.

i. **Manufacturer’s Pre-engineered Tables**

There are no pre-engineered tables currently published in the product literature at this time. The spans for the product, when used as floor joists, rafters and beams, may conform to the spans for Select Structural Grade for the Douglas fir–larch group in Tables 9.23.4.2.A. to 9.23.4.2.I. of the NBC 2015 (for the same member sizes), except where a floor is required to support a concentrated load or a specified unfactored live load in excess of 1.9 kN/m², and in lieu of engineering design. Maximum deflections must conform to Subsection 9.4.3., Deflections, of Division B of the NBC 2015. Floor joists must be designed to meet the deflection and vibration set in the NBC for lumber.

ii. **Manufacturer’s Installation Details**

The product must be installed in accordance with the manufacturer’s installation guidelines engineered on a case-by-case basis.

iii. **Engineering Requirements**

For structural applications beyond the scope and limitations of Tables 9.23.4.2.A. to 9.23.4.2.I. of the NBC 2015 or when required by the authority having jurisdiction (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.

1. All lumber, wood-based panels and proprietary engineered wood products are intended for dry service conditions. “Dry service condition” is defined as the in-service environment in which the average 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% depending on 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 2015.

Installations beyond the scope/limitations of Sections 3.i. and 3.ii. of this Report imply, but are not limited to, the following:

- higher loads/longer spans;
- concentrated loads;
- areas of high wind or high seismicity;
- design of supporting stud members/columns or the total beam/header load exceeds the NBC 2015 pre-engineered beam/lintel tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2015 pre-engineered lumber floor/roof joist tables.

The engineer must design in accordance with CSA O86 and may use the *Engineering Guide for Wood-Frame Construction* published by the Canadian Wood Council.

The specified strengths for the product must not exceed the values set forth in Table 4.1.1. See Figure 1 for joist/beam veneer orientation.

The ends of all the product members used as joists, rafters and beams must be restrained to prevent rollover. This is normally achieved by attaching a diaphragm sheathing to the top or to the compression edge, and to an end wall or shear transfer panel capable of transferring a minimum unfactored uniform load 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.

The compression edges of all the product members used as joists, rafters and beams must be laterally supported at least every 610 mm, except where design is done in accordance with CSA O86.

Nailing of the product perpendicular to glue lines must conform to Table 9.23.3.4., Nailing for Framing, of Division B of the NBC 2015. Nails must be installed parallel to the glue lines on the narrow face of the product that is at least 19 mm thick × 89 mm wide. The nails must be spaced at a minimum of 75 mm on centre (o.c.) for 63.5-mm common nails, and 100 mm o.c. for 76-mm and 83-mm common nails and No. 14 gauge staples. Common 89-mm nails installed parallel to the glue lines on the narrow face of the product that is at least 38 mm thick × 89 mm wide must be spaced at a minimum of 200 mm o.c.

iv. **Engineering Support Provided by Manufacturer**

The manufacturer may provide engineering services in conjunction with the manufacturer's product specification and offers the following support contact number for their Canadian operations: 1-866-859-6757.

- This product must be identified with the phrase "CCMC 13485-R" along the side of the product. This CCMC number is only valid when it appears in conjunction with the certification mark of PFS Corporation.

4. Technical Evidence

The Report Holder has submitted technical documentation for the CCMC 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 (MPa)⁽²⁾⁽⁹⁾

Material Thickness	Grade Species ⁽¹⁾	Axial		Joist/Beam				Plank/Deck		
		F _t ⁽³⁾	F _c	F _b ⁽⁴⁾⁽⁵⁾	F _v ⁽⁶⁾	MOE	F _{c perp} ⁽⁷⁾	F _b ⁽⁸⁾	F _v	F _{c perp} ⁽⁷⁾
19 mm to 45 mm	1.6 DF/LP/WH	15.80	23.10	27.25	3.65	11 030	9.40	32.25	2.45	6.05
	1.8 DF/LP/WH	18.50	26.15	31.15	3.65	12 410	9.40	36.80	2.45	6.05
	1.9 DF/LP/WH	19.80	27.60	33.15	3.65	13 100	9.40	39.20	2.45	6.05
	2.0 DF/LP/WH	21.15	29.00	35.05	3.65	13 790	9.40	41.45	2.45	6.05
	2.0 DF/LP/WH	21.15	29.00	36.95	3.65	13 790	9.40	43.70	2.45	6.05
	2.2 DF/LP/WH	23.75	31.60	39.00	3.65	15 170	9.40	46.05	2.45	6.05
	2.4 DF/LP/WH	26.45	33.90	42.90	3.65	16 550	9.40	50.70	2.45	6.05
	2.6 DF/LP/WH	29.15	36.00	46.80	3.65	17 925	9.40	55.35	2.45	6.05
46 mm to 89 mm	1.6 DF/LP/WH	15.80	23.10	24.60	3.65	11 030	9.40	29.15	2.45	6.05
	1.8 DF/LP/WH	18.50	26.15	28.15	3.65	12 410	9.40	33.25	2.45	6.05
	1.9 DF/LP/WH	19.80	27.60	29.90	3.65	13 100	9.40	35.35	2.45	6.05
	2.0 DF/LP/WH	21.15	29.00	31.65	3.65	13 790	9.40	37.45	2.45	6.05
	2.2 DF/LP/WH	23.75	31.60	35.25	3.65	15 170	9.40	41.60	2.45	6.05
	2.4 DF/LP/WH	26.45	33.90	38.75	3.65	16 550	9.40	45.80	2.45	6.05
	2.6 DF/LP/WH	29.15	36.00	42.25	3.65	17 925	9.40	49.95	2.45	6.05

Notes to Table 4.1.1:

- (1) DF = Douglas fir–larch, LP = lodgepole pine, WH = western hemlock. DF, LP and WH can be combined as western species (WS).
- (2) Specified strengths are based on covered, dry service conditions of use. Dry service conditions of use are those in which a 19% MC will not be exceeded.
- (3) The F_t values in the Table are adjusted to a 20-ft. gauge length to reflect the volume effects of length, depth and thickness for a range of common application conditions. The F_t values for the product may be higher when approved by the manufacturer for use as a component of engineered products, which are manufactured under a recognized quality control program.
- (4) F_b values include allowances for variations in span-to-depth ratio and method of loading, and may be used without further adjustments except as noted below. For product depths other than 305 mm, regardless of thickness, multiply table values by (305/d)^{0.136}. Adjustments for common depths are shown below. For product depths less than 89 mm, the multiplier for the 89-mm depth shall be used.

Depth and Multiplier

Depth (mm)	89	140	184	241	305	406	457	610
Multiplier	1.18	1.11	1.07	1.04	1.00	0.96	0.93	0.91

- (5) When structural members qualify as repetitive members in accordance with CSA O86, a 4% increase is permitted for F_b in addition to the increases permitted in Table Note 4. This increase does not apply to field-assembled, multi-member beams.
- (6) For simplicity, use 3.65 MPa for product depths up to 610 mm, and 3.35 MPa for product depths greater than 610 mm. When a more accurate analysis is desired, the allowable horizontal shear for all depths greater than 305 mm is F_v = 3.65 (305/d)^{0.065}.
- (7) F_{c perp} shall not be increased for the duration of the load.
- (8) Values shown are for thicknesses up to 89 mm.
- (9) Simple span uniform load deflection is calculated as follows:

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

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

Table 4.1.2 Equivalent Wood Species for Determining Fastener Capacities of the Product

Fastener Property	Nail Orientation	Load Direction	Specific Gravity (SG) of Equivalent Species for Design Purposes
Nail withdrawal	Edge	Withdrawal	Douglas fir–larch (N), SG = 0.50
	Face	Withdrawal	
Lateral nail capacity	Edge	Parallel to grain	Douglas fir–larch (N), SG = 0.50
	Edge	Perpendicular to grain	
	Face	Parallel to grain	
	Face	Perpendicular to grain	
Bolt axial capacity	—	Parallel to grain	Douglas fir–larch (N), SG = 0.50
		Perpendicular to grain	

The manufacturing quality assurance program has been updated to include requirements specified in ASTM D 5456, “Evaluation of Structural Composite Lumber Products,” and has been verified by independent, third-party monitoring and inspection conducted by PFS Corporation as part of the product certification.

Note: RedLam™ and RedBuilt™ are trademarks of RedBuilt LLC, Boise, ID, USA.

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Disclaimer

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Date modified:
2019-11-19

Appendix A

The design values obtained from testing to ASTM D 5456, “Evaluation of Structural Composite Lumber Products,” as specified in CSA O86, are summarized below.

Table A1. Additional Test Information for “RedLam™ LVL”

Property	Test Information
Bending	Specimens were tested in edgewise and flatwise bending to establish the characteristic value. Data from quality control (QC) tests 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.
Shear	Specimens were tested in shear to establish the characteristic value. Data from QC tests 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.
Compression parallel to grain	Specimens were tested in compression parallel to the grain to establish the characteristic value. Data from QC tests 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.
Compression perpendicular to grain	Specimens were tested in compression perpendicular to the grain to establish the characteristic value. The characteristic value was multiplied by 1.09 to establish the specified strength in accordance with CSA O86.
Tension parallel to grain	Specimens were tested in tension to establish the characteristic value (adjusted to 20-ft. gauge length). Data from QC tests 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.
Nail withdrawal	Nail withdrawal values were established following ASTM D 1761, “Mechanical Fasteners in Wood,” for an 8d common nail having a 31.75-mm penetration. Specimens were tested and equivalent species capacity was determined in accordance with ASTM D 5456, A2.4.
Nail bearing	Dowel bearing strength was determined as per ASTM D 5764, “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. Specimens were tested and the mean bearing capacity was used to establish the equivalent species capacity as per ASTM D 5456, A2.5.
Bolt bearing	Bolt bearing capacity was determined as per ASTM D 5764 using 12.5-mm- and 19.0-mm-diameter bolts.
Creep and recovery	Creep testing was conducted in accordance with the CCMC creep and recovery test. After conditioning of the specimens, the creep and recovery performance was considered favourable. Long-term creep testing was also conducted, which demonstrated equivalency to duration of load behaviour of lumber.
Adhesive	The adhesive complies with CSA O112.6-M1977, “Phenol and Phenol-Resorcinol Resin Adhesives for Wood (High-Temperature Curing)” (see CCMC 13019-L). The heat durability of the adhesive was confirmed using ASTM D 7247-07ae1 according to ASTM D 5456-10a.