



Evaluation Report CCMC 13485-R

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RedLam™ LVL

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 2005:

- 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 (CAN/CSA-O86-01, “Engineering Design in Wood,” Supplement #1 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 4.1 provided by the Report Holder.

2. Description

“RedLam™ LVL” 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),” 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 RedBuilt™ “RedLam™ LVL Manufacturing Standards.”

“RedLam™ LVL” 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, Los Angeles, California and/or by Intertek Testing Services (ITS) NA Ltd., Coquitlam, British Columbia.

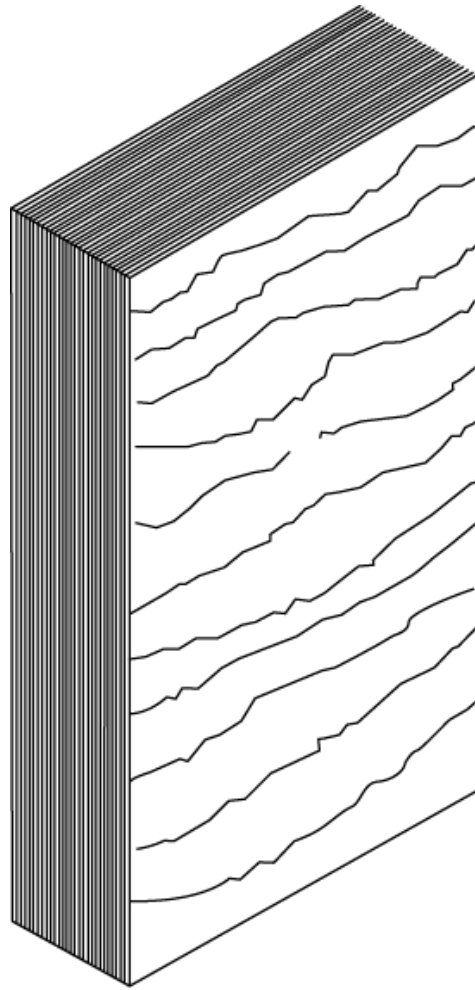


Figure 1. Product details for “RedLam™ LVL” – veneer orientation

3. Conditions and Limitations

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

- “RedLam™ LVL” as with all SCL, is intended for dry service applications only.⁽¹⁾

(1) 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% 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 2005.

- “RedLam™ LVL” 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 CAN/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) RedBuilt™ Pre-engineered Tables

There are no pre-engineered tables currently published in the “RedLam™ LVL” literature at this time. The spans for “RedLam™ LVL,” 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 A-1 to A-9 of the NBC 2005, except where a floor is required to support a concentrated load or a specified unfactored live load in excess of 1.9 kN/m^2 , and in lieu of engineering design. Maximum deflections must conform to Subsection 9.4.3., Deflections, of Division B of the NBC 2005. Floor joists must be designed to meet the deflection and vibration set in the NBC for lumber.

“RedLam™ LVL” must be installed in accordance with RedBuilt™'s installation guidelines engineered on a case-by-case basis.

- ii) RedBuilt™ Installation Details

Installation instructions and details must be engineered on a case-by-case basis.

- iii) Engineering Required

For structural applications beyond the scope/limitations of Tables A-1 to A-9 of the NBC 2005 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.

Installations beyond the scope/limitations of Sections 3(i) and (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 2005 pre-engineered beam/lintel tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2005 pre-engineered lumber floor/roof joist tables.

The engineer must design in accordance with CAN/CSA-O86, and may use as a guide the “Engineering Guide for Wood Frame Construction,” published by the Canadian Wood Council.

The specified strengths for “RedLam™ LVL” must not exceed the values set forth in Table 4.1.1.1. See Figure 1 for joist/beam veneer orientation.

The ends of all “RedLam™ LVL” 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 “RedLam™ LVL” members used as joists, rafters and beams must be laterally supported at least every 610 mm, except where design is done in accordance with CAN/CSA-O86.

Nailing of “RedLam™ LVL” perpendicular to glue lines must conform to Table 9.23.3.4., Nailing for Framing, of Division B of the NBC 2005. Nails must be installed parallel to the glue lines on the narrow face of the product, that is at least 19 mm thick x 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 x 89 mm wide must be spaced at a minimum of 200 mm o.c.

iv) Engineering Support Provided by Manufacturer

RedBuilt™ may provide engineering services in conjunction with RedBuilt™ 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 WHI certification mark of Intertek Testing Services and/or the mark of PFS Corporation.

4. Technical Evidence

CCMC's Technical Guide for “RedLam™ LVL” sets out the nature of the technical evidence required by CCMC to enable it to evaluate a product as an acceptable or alternative solution in compliance with the NBC 2005. The Report Holder has submitted documentation for CCMC's evaluation. Testing was conducted at independent laboratories recognized by CCMC. The corresponding test results for “RedLam™ LVL” are summarized below.

4.1 NBC 2005 Compliance Data for “RedLam™ LVL” on which CCMC Based its Opinion in Section 1

4.1.1 Design Requirements

Table 4.1.1.1 “RedLam™ LVL” specified strengths (MPa)⁽²⁾⁽⁹⁾

Billet 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
46 mm to 89 mm	2.6 DF/LP/WH	29.15	36.00	46.80	3.65	17 925	9.40	55.35	2.45	6.05
	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:

(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) F_t values in the table are reduced 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 RedBuilt™ 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 (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 CAN/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 duration of load.

(8) Values shown are for thicknesses up to 89 mm.

(9) Simple span uniform load deflection is calculated as follows:

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

where: Δ = 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 4.1.1.2 Equivalent wood species for determining fastener capacities for “RedLam™ LVL”

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

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 and/or Intertek Testing Services NA Ltd. as part of the product certification.

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

Report Holder: RedBuilt, LLC
200 E Mallard
Boise, ID 83706
U.S.A.
Tel: 866-859-6757
Fax: 208-364-1300

Plant(s): Stayton, OR, U.S.A.

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APPENDIX A

The design values obtained from testing to ASTM D 5456, “Evaluation of Structural Composite Lumber Products,” as specified in CAN/CSA-O86-01, “Engineering Design in Wood,” 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 CAN/CSA-O86 was used to determine the specified strength.
Shear	Specimens were tested in shear 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 CAN/CSA-O86 was used to determine the specified strength.
Compression parallel to grain	Specimens were tested in compression parallel to grain 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 CAN/CSA-O86 was used to determine the specified strength.
Compression perpendicular to grain	Specimens were tested in compression perpendicular to grain to establish the characteristic value. The characteristic value was multiplied by 1.09 to establish the specified strength in accordance with CAN/CSA-O86.
Tension parallel to grain	Specimens were tested in tension 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 CAN/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 was determined.
Creep and recovery	Creep testing was conducted in accordance with CCMC's 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),” (CCMC 13019-L).