ICC-ES Evaluation Report

ESR-2993

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This report is subject to re-examination in one year.

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DIVISION: 06—WOOD AND PLASTICS
Section: 06170—Prefabricated Structural Wood

REPORT HOLDER:

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EVALUATION SUBJECT:

STRUCTURAL COMPOSITE LUMBER: REDLAM™ LAMINATED VENEER LUMBER (LVL)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- BOCA® *National Building Code*/1999 (BNBC)
- 1999 *Standard Building Code*© (SBC)
- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated:

- Structural
- Fire resistance

2.0 USES

The structural composite lumber (SCL) products described in this evaluation report are used as alternatives to sawn lumber for wall, floor and roof structural members. These structural applications include use as beams, headers, joists, rafters, columns, and rim boards. The products are also used as components of built-up structural members, such as flanges for I-joists and chords for trusses, as detailed in a current ICC-ES evaluation report.

3.0 DESCRIPTION

3.1 General:

The structural composite lumber (SCL) described in this report is an alternative material to that described in Chapter 23 of the IBC, BNBC, SBC, and UBC, and complies with the requirements noted in Section 2303.1.9 of the IBC, Section 2301.2.1 of the IBC for allowable stress design, and Section 2303.4 of the BNBC. Section 2308 of the IBC, Section 2305 of the BNBC and Chapters 5, 6 and 8 of the IRC are applicable to the SCL described in this report.

3.2 Rim Board:

The rim board product described in this evaluation report is a continuously supported structural element located at the joist elevation in an end bearing wall or parallel to the joist framing that is the full depth of the joist space and manufactured in minimum continuous 8-foot-long (2.44 m) segments for the length of the wall. The rim boards may be used for any combination of the following:

a. To transfer, from above to below, all vertical loads at the rim board location. Allowable vertical loads are noted in Table 3.

b. To provide diaphragm attachment (sheathing to top edge of rim board).

c. To transfer in-plane lateral loads from the diaphragm to the wall plate below.

d. To provide lateral support to the joist or rafter (resistance against rotation) through attachment to the joist or rafter.

e. To provide closure for ends of joists or rafters.

f. To provide an attachment base for siding or an exterior deck ledger.

The rim board properties and species, adhesive, manufacturing parameters, and finished product thickness, width and length shall meet the requirements noted in the approved quality control manual that contains the manufacturing standard.

3.3 Redlam LVL:

Redlam LVL is manufactured from veneers of a single wood species, or species combinations and adhesives meeting the requirements specified in the approved quality control manual and manufacturing standard prepared by RedBuilt™. During manufacture, the veneers are placed in a continuous-feed press, with all grain oriented parallel to the length of the member, and the veneers are bonded together with the approved adhesives. Redlam LVL is available in thicknesses from $^3/_4$ inch (19.1 mm) to $3^1/_2$ inches (89 mm), depths from $2^1/_2$ inches (63.5 mm) to 24 inches (610 mm), and lengths up to 80 feet (24 380 mm).

3.4 Redlam LVL Rim Board:

Redlam LVL rim board may be used in rim board application, as defined in Section 3.2.

4.0 DESIGN AND INSTALLATION

4.1 General:

The design and installation of RedBuilt™ structural composite lumber shall comply with this report and the manufacturer's published installation instructions. The

manufacturer's published installation instructions shall be available at the jobsite at all times during installation. Design of the structural composite lumber products described in this report is governed by the applicable code and the ANSI/AF&PA National Design Specification for Wood Construction (NDS). This report shall govern if there are conflicts between the manufacturer's published installation instructions and this report.

4.2 Redlam LVL:

4.2.1 Design and Allowable Stresses: The design provisions for wood construction noted in Chapter 23 of the BNBC, SBC, and UBC, Section 2301.2(1) of the IBC (for allowable stress design) and Section R301.1.3 of the IRC, shall be applicable to Redlam LVL, unless otherwise noted in this report. Allowable unit stresses, sizes and veneer species for Redlam LVL for dry conditions of use shall be as specified in Table 1 of this report.

Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

Allowable withdrawal and lateral loads for nails installed perpendicular or parallel to the wide face of Redlam LVL shall be as prescribed in the applicable code for sawn lumber having a minimum specific gravity of 0.50, such as for Douglas fir–larch. Spacings of nails installed perpendicular to the glue lines on the wide face of Redlam LVL shall be as prescribed in Section 2318.3 of the UBC and Part 11 of the ANSI/AF&PA National Design Specification for Wood Construction (NDS), for sawn lumber. Spacing of nails and staples installed parallel to the glue lines on the narrow face of the material shall be as prescribed in Table 2 of this report. Other nail spacings for specific applications, such as prefabricated steel components or hangers, may be used as detailed for Redlam LVL in a current ICC-ES evaluation report.

Allowable lateral loads for machine bolts installed perpendicular to the wide face of Redlam LVL (perpendicular to the glue lines), with loads applied parallel or perpendicular to the grain of the wood veneers, shall be as prescribed in the applicable code for sawn lumber having a minimum specific gravity of 0.50, such as for Douglas fir–larch.

4.2.2 Fire-Resistance: The provisions of IBC Section 721.6.3, on design of fire-resistant exposed wood members, shall be applicable to Redlam LVL.

4.2.3 Redlam LVL Rim Board: Toenailed connections are not limited by the 150 plf (2189 N/m) lateral load capacity noted for seismic zones 3 and 4 in Section 2318.3.1 of the UBC, or for Seismic Design Categories D, E and F in Section 2305.1.4 of the IBC. The ability of Redlam LVL to transfer shear shall be as described in Footnote 1 to Table 3 of this report.

4.2.4 Fire-Blocking: Redlam LVL Rim Board may be used in lieu of sawn lumber for fire blocking.

5.0 CONDITIONS OF USE

The Redlam LVL Structural Composite Lumber products described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0, subject to the following conditions:

5.1 Design stresses shall comply with the values noted in this report.

5.2 Design calculations and details shall be furnished to the code official, verifying that the material is used in compliance with this report. The calculations shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Redlam LVL products described in this report shall be limited to covered end-use installations with dry conditions of use. Dry conditions of use are those environmental conditions represented by sawn lumber in which the equilibrium moisture content is equal to or less than 16 percent. The use of these products in covered installations, where the moisture content exceeds 16 percent, has not been reviewed and is beyond the scope of this evaluation report.

5.4 Increases for duration of load, as provided for wood members and their connections, shall be in accordance with the limitations specified in the applicable code and as set forth in this report, unless specifically prohibited by this report.

5.5 Where flexural bending members qualify as repetitive members, as defined in the NDS, an increase of 4 percent is permitted in allowable bending stresses.

5.6 Length dimensions of Redlam LVL may be cut to size for required application. Depth shall not be cut to less than $3^1/_2$ inches (89 mm). For all material used in structural applications, the product identification described in Section 7.0 shall be maintained on all material, or the material shall be re-stamped with the appropriate identification only under the approval and direction of PFS Corporation. Additionally, Redlam LVL may be notched, drilled, or tapered end cut provided design is by a design professional.

5.7 Installation, fabrication, identification, and connection details shall be in accordance with this report, the manufacturer's published installation instructions and the applicable code.

5.8 Redlam LVL is produced at the RedBuilt™ plant in Stayton, Oregon, with quality control inspections by PFS Corporation (AA-652).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Structural Wood-based Products (AC47), dated October 2006.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Rim Board Products (AC124), dated October 2004.

6.3 Reports of fire tests conducted in accordance with ASTM E 119.

7.0 IDENTIFICATION

Redlam LVL is identified with a stamp bearing the manufacturer's name (RedBuilt™) and/or logo (see Figure 1), the name or logo of the inspection agency (PFS Corporation), as applicable, the evaluation report number (ESR-2993), the plant number, the product designation or type, the production date, the grade, and the species or species group designation. Redlam LVL is also identified with the marking "AGS" following the grade designation, if the advanced grading system specified in the approved quality control manual was used in the manufacturing process.

TABLE 1—REDLAM™ LVL ALLOWABLE FRAMING LUMBER DESIGN STRESSES [1, 2] (pounds per square inch)

BILLET MATERIAL THICKNESS	GRADE SPECIES[3]	AXIAL		JOIST/BEAM				PLANK		
		Ft[4]	Fc	Fb[5,6]	Fv[7]	MOE (x10^6)	Fc⊥[8]	Fb[9]	Fv	Fc⊥[8]
3/4 inch	1.6 DF/LP/WH	1240	2100	2140	285	1.6	750	2530	190	480
to	1.8 DF/LP/WH	1450	2375	2445	285	1.8	750	2890	190	480
3 1/2 inches	1.9 DF/LP/WH	1555	2510	2600	285	1.9	750	3075	190	480
	2.0 DF/LP/WH	1660	2635	2750	285	2.0	750	3255	190	480
	2.0 DF/LP/WH [10]	1660	2635	2900	285	2.0	750	3430	190	480
	2.2 DF/LP/WH	1865	2870	3060	285	2.2	750	3615	190	480
	2.4 DF/LP/WH	2075	3080	3365	285	2.4	750	3980	190	480
	2.6 DF/LP/WH	2285	3270	3675	285	2.6	750	4345	190	480

For **SI:** 1 psi = 0.00689 MPa, 1 inch = 25.4 mm.

[1]Allowable stresses are based on covered, dry conditions of use. Dry conditions of use are those environmental conditions represented by sawn lumber at which the moisture content is less than or equal to 16%.

[2]For uniformly loaded simple span beams, deflection is calculated as follows:

$$\Delta = \frac{270WL^4}{Ebd^3} + \frac{28.8WL^2}{Ebd}$$

where: W = Uniform load, plf; Δ = Deflection, inches; L = Span, feet; b = Beam width, inches; d = Beam depth, inches; E = Modulus of Elasticity, psi

[3]DF = Douglas fir–larch; LP = lodgepole pine; WH = Western hemlock; DF, LP and WH are permitted to be combined as Western Species (WS).

[4]The F_t values in the table are reduced to reflect the volume effects of length, width and thickness for a range of common application conditions. Therefore the F_t values in the Table do not apply to Redlam LVL when used as a component of engineered products manufactured by RedBuilt™ which are listed in ICC-ES evaluation reports.

[5]Fb includes allowances for variations in span to depth ratio and method of loading and must be used without further adjustment except as noted below. For depths other than 12 inches, regardless of thickness, table values must be multiplied by $(12/d)^{0.136}$. Adjustments for common depths are shown below. For depths less than 3.5 inches, the factor for the 3.5-inch depth must be used.

Depth	3.5	5.5	7.25	9.25	12	16	20	24
Multiplier	1.18	1.11	1.07	1.04	1.00	0.96	0.93	0.91

[6]When structural members qualify as repetitive members in accordance with the applicable code, a 4 percent increase in accordance with NDS is permitted, in addition to the increases permitted in Footnote 5, above. This increase does not apply to field assembled multi-member beams.

[7]For simplicity, use 285 psi for depths up to 24 inches and 260 psi for depths greater than 24 inches. When a more accurate analysis is desired, the allowable horizontal shear for all depths greater than 12 inches is $Fv = 285\ (12/d)^{0.065}$.

[8]Compression perpendicular to grain values (Fc⊥) may not be increased for duration of load.

[9]Values shown are for thicknesses up to 3.5 inches.

[10]Used in header or beam applications only.

TABLE 2—SPACING OF NAILS AND STAPLES IN REDLAM® LVL

REDLAM LVL DIMENSIONS	FASTENER (Installed parallel to glue lines on the narrow face of the material)	MINIMUM SPACING (inches)
Minimum $^3/_4$ inch thick and $3^1/_2$ inches deep	8d nail	3
	10d nail	4
	12d nail	4
	No. 14 gage staple	4
Minimum $1^1/_2$ inches thick and $3^1/_2$ inches deep	10d nail	4
	12d nail	4
	16d nail	8
	No. 14 gage staple	4

For **SI:** 1 inch = 25.4 mm.

TABLE 3—REDLAM LVL RIM BOARD [1, 2, 3, 4, 5]

THICKNESS (inches)	ALLOWABLE VERTICAL LOAD (plf)[4]	DEPTH RANGE (inches)
1.25[5]	4250	$9^1/_2$ to $11^7/_8$

For **SI:** 1 inch = 25.4 mm; 1 plf + 14.59 N/m.

[1]The allowable shear values in pounds per foot for horizontal wood structural diaphragm with framing of nominally 2-inch-thick Douglas fir–larch or Southern pine noted in Table 23-II-H of the UBC and Table 2306.3.1 of the IBC are applicable to $1^1/_4$-inch Redlam LVL Rim board for unblocked diaphragms.
[2]Redlam LVL rim board shall be laterally supported at the top and continuously supported at the bottom, and the gravity loads shall be uniformly applied along the top, in lieu of design by a design professional or other conditions
[3]Fastener capacities for Redlam LVL rim board are as recognized in Section 4.2.1 of this report, except as provided in footnote 5, below.
[4]Compression perpendicular to grain capacities of the sill plate and floor sheathing shall be checked.
[5]The allowable lateral load capacity of a ½-inch-diameter lag screw installed perpendicular to the veneers and loaded perpendicular to the grain is 325 lbs.

FIGURE 1—MANUFACTURER LOGO