

ICC-ES Evaluation Report

ESR-3631

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A Subsidiary of the International Code Council®

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

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EVALUATION SUBJECT:

STRUCTURLAM CROSSLAM® CLT

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2015, 2012, and 2009 *International Building Code*® (IBC)
- 2015, 2012, and 2009 *International Residential Code*® (IRC)

Property evaluated:

Structural

1.2 Evaluation to the following green code(s) and/or standards:

- 2016 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2015, 2012 and 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2015, ICC 700-2012 and ICC 700-2008)

Attributes verified:

See Section 3.1

2.0 USES

- * Structurlam CrossLam® CLT is a cross-laminated timber (CLT) panel for use as components in ~~floors and~~ roofs in Type I and II Construction (IBC) and in roof and floor decks in Type III (interior floor decks only), IV and V construction (IBC). When panels are installed under the IRC, an engineered design is required in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The Structurlam CrossLam® CLT panels described in this evaluation report comply with requirements noted in

Section 2303.1.4 of the 2015 IBC, for allowable stress design in accordance with IBC Section 2301.2(1) and consist of three to nine layers of nominally 2x sawn lumber boards (laminations) stacked with wood grain orientation alternating 90 degrees at each layer. The Structurlam CrossLam® CLT panels are manufactured by face-bonding each layer using a non-formaldehyde based, exterior-type structural adhesive and then are placed in a press to form a dimensionally stable structural element, or plank billet. The Structurlam CrossLam® CLT panels are available in plank billets with nominal thickness of 4.13 inches (105 mm) to 12.5 inches (318 mm), nominal widths of 12 inches (305 mm) to 120 inches (3050 mm), and lengths up to 40 feet (12 190 mm). Refer to Table 1 for the grade and layup designations of Structurlam CrossLam® CLT panels. Figure 2 depicts typical 3-ply and 5-ply layups of Structurlam CrossLam® CLT panels.

The attributes of the Structurlam CrossLam® CLT have been verified as conforming to the provisions of (i) CALGreen Sections A4.404.3 for efficient framing techniques; (ii) ICC 700-2015 and ICC 700-2012 Section 608.1(2), 11.608.1(2) and 12(A).608.1 for resource-efficient materials; and (iii) ICC 700-2008 Section 607.1(2) for resource-efficient materials. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.2 Material:

3.2.1 Wood Lamination: Wood laminations used in manufacturing Structurlam CrossLam® CLT panels must be No. 1/No. 2 spruce-pine fir (SPF) sawn lumber having a minimum specific gravity of 0.42 and reference design values provided in Table 4A of the *National Design Specifications*® (NDS) for wood construction. Laminations in both major strength and minor strength directions must be nominally 2 by 6 (50 mm x 150 mm) sawn lumber.

3.2.2 Adhesives: Adhesive used to face-bond layers of Structurlam CrossLam® CLT panels is non-formaldehyde based, exterior-type structural adhesive and adhesive used for finger-joints of wood laminations is two-component melamine urea, conforming to product specifications in the approved quality documentation

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of Structurlam CrossLam® CLT panels described in this evaluation report must be in

accordance with this evaluation report, the applicable code provisions and the manufacturer's published design and/or installation instructions. The manufacturer's design and/or installation instructions must be available at the jobsite at all times during installation. The requirements specified for allowable stress design in accordance with IBC Section 2301.2(1), and Chapter 10 of the 2015 NDS, are applicable to Structurlam CrossLam® CLT panels.

4.2 Reference Design Values:

Tables 2 and 3 provide, respectively, reference design values for bending capacities and in-plane shear capacities of Structurlam CrossLam® CLT panels. The reference design values in Tables 2 and 3 are intended for allowable stress design and must be adjusted in accordance with Section 4.3 of this evaluation report.

4.3 Adjustment Factors:

The reference design values in Tables 2 and 3 must be adjusted using the adjustment factors specified in Table 10.3.1 of the 2015 NDS. The reference design values in Table 2 must not be increased for the lumber size adjustment factor in accordance with NDS. The time dependent deformation (creep) factor, K_{cr} , of 2.0, as specified in Section 3.5.2 of the NDS must be used to calculate the total deflection due to long-term loading for Structurlam CrossLam® CLT panels used as components in floor and roof decks under dry service condition where the moisture content in lumber in service is less than 16 percent, as in most covered structures.

4.4 Fire Resistance:

When fire performance is required, the fire resistance for the exposed Structurlam CrossLam® CLT panels must be determined by calculation in accordance with Chapter 16 of the 2015 NDS. As an alternative to the NDS calculation, the Structurlam CrossLam® CLT panels must be tested in accordance with ASTM E119 and must be rated for fire resistance in accordance with the test results and conditions of such tests.

5.0 CONDITIONS OF USE

The Structurlam CrossLam® CLT described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Fabrication, design, and installation must comply with this evaluation report and the manufacturer's published design/installation instructions. In the event of a conflict between the manufacturer's published design/installation instructions and this evaluation report, the most restrictive one governs.

- 5.2 Use of Structurlam CrossLam® CLT panels must be limited to dry service conditions where the moisture content in lumber in service is less than 16 percent, as in most covered structures.
- 5.3 Calculations and drawings demonstrating compliance with this evaluation report must be submitted to the code official. The calculations and drawings must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 Connectors and connections for Structurlam CrossLam® CLT panels used as components in floor and roof decks have not been evaluated and are out of the scope of this evaluation report.
- 5.5 Cutting, drilling, and notching of Structurlam CrossLam® CLT panels when used as components in floor and roof decks have not been evaluated and are out of the scope of this evaluation report.
- 5.6 Structurlam CrossLam® CLT panels used as components in roof and floor decks have not been evaluated for diaphragm design and the diaphragm design is out of the scope of the evaluation report.
- 5.7 Structurlam CrossLam® CLT panel roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with applicable provisions of IBC Chapter 15.
- 5.8 The special inspection shall be conducted in accordance with the applicable requirements of Sections 1704 and 1705 of the IBC.
- 5.9 Structurlam CrossLam® CLT panels used as components in floor and roof decks under the IRC when engineered design is submitted in accordance with Section R301.1.3 Structurlam CrossLam® CLT panels are fabricated in Okanagan Falls, British Columbia, Canada, under a quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cross-laminated Timber Panels for Use as Components in Floor and Roof Decks (AC455), dated February 2015.

7.0 IDENTIFICATION

Structurlam CrossLam® CLT panels are identified with stamps noting the Structurlam Products LP name or logo (Figure 1), plant number, product designation, grade, production date and shift, and ICC-ES evaluation report number (ESR-3631).



FIGURE 1—COMPANY LOGO FOR STRUCTURLAM PRODUCTS LP

TABLE 1—STRUCTURLAM CROSSLAM® CLT PANEL GRADE AND LAYUPS

GRADE ¹	LAYUP DESIGNATION	THICKNESS ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)							
			=	⊥	=	⊥	=	⊥	=	⊥
V2M1.1	105V	4.14	1.38	1.38	1.38	-	-	-	-	-
	175V	6.90	1.38	1.38	1.38	1.38	1.38	-	-	-
	245V	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38	-
	315V	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38

For SI: 1 in. = 25.4 mm.

¹The CLT grade is developed based on the 2012 ANSI/APA PRG 320, using visually graded sawn lumber noted in Section 3.2.1 of the evaluation report.

²Actual thickness of CLT panels.

³Actual thickness of lamination after planing. “=”: Major strength direction and “⊥”: Minor strength direction.

TABLE 2—REFERENCE DESIGN VALUES FOR BENDING CAPACITIES OF THE STRUCTURLAM CROSSLAM® CLT PANELS¹

GRADE	LAYUP DESIGNATION	MAJOR STRENGTH DIRECTION				MINOR STRENGTH DIRECTION			
		$F_b S_{eff,0}$ (lb _r -ft./ft.)	$E I_{eff,0}$ ($\times 10^6$ lb _r -in. ² /ft.)	$GA_{eff,0}$ ($\times 10^6$ lb _r /ft.)	$V_{s,0}$ (lb _r /ft.)	$F_b S_{eff,90}$ (lb _r -ft./ft.)	$E I_{eff,90}$ ($\times 10^6$ lb _r -in. ² /ft.)	$GA_{eff,90}$ ($\times 10^6$ lb _r /ft.)	$V_{s,90}$ (lb _r /ft.)
V2M1.1	105V	2,050	96	0.53	1,440	280	3.7	0.53	495
	175V	4,725	367	1.1	1,980	2,410	96	1.1	1,440
	245V	8,350	910	1.6	2,500	5,500	364	1.6	1,970
	315V	12,925	1,814	2.1	3,025	9,675	898	2.1	2,470

For SI: 1 in. = 25.4 mm; 1 ft. = 304.8 mm; 1 lb_r = 4.448 N

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

TABLE 3—REFERENCE DESIGN VALUES FOR IN-PLANE SHEAR OF THE STRUCTURLAM CROSSLAM® CLT PANELS¹

GRADE	LAYUP DESIGNATION	FACE LAMINATION ORIENTATION (psi)	
		= ²	⊥ ²
V2M1.1	105V	130	195
	175V	180	195 ⁴
	245V	180 ³	195 ⁴
	315V	180 ³	195 ⁴

For SI: 1 psi = 6,895 Pa

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD).

²“=”: Major strength direction and “⊥”: Minor strength direction.

³Based on test results from 175V.

⁴Based on test results from 105V.

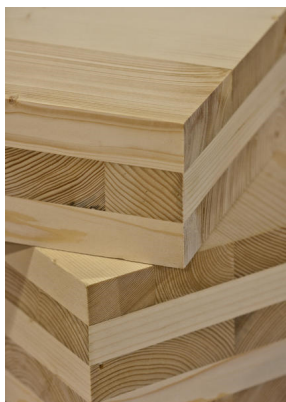


FIGURE 2—TYPICAL 3-PLY and 5-PLY STRUCTURLAM CROSSLAM® CLT PANEL LAYUPS