APA PRODUCT REPORT®

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SmartLam Cross-Laminated Timber — PR-L319
SmartLam, LLC

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Products: SmartLam Cross-Laminated Timber

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1. Basis of the product report:
   - 2018 and 2015 International Building Code (IBC): Section 2303.1.4 Structural Glued Cross-Laminated Timber
   - 2012 IBC: Section 104.11 Alternative materials
   - 2018 and 2015 International Residential Code (IRC): Sections R502.1.6, R602.1.6, and R802.1.6 Cross-Laminated Timber
   - 2012 IRC: Section R104.11 Alternative materials
   - ANSI/APA PRG 320-2017, PRG 320-2012, and PRG 320-2011 Performance Rated Cross-Laminated Timber, recognized in the 2018 IBC and IRC, 2015 IRC, and 2015 IBC, respectively
   - APA Reports T2016P-34, T2016P-36, and T2017P-16A, and other qualification data

2. Product description:
   SmartLam cross-laminated timber (CLT) is manufactured with Spruce-pine-fir south (SPF-S) or Hem-fir lumber in accordance with a custom layup combination approved by APA through product qualification and/or mathematical models using principles of engineering mechanics. Allowable design properties for lumber laminations used in SmartLam CLT are provided in Table 1. SmartLam CLT can be used in floor, roof, and wall applications, and is manufactured with nominal widths of 12 to 120 inches, thicknesses of 4 1/8 to 12 3/8 inches, and lengths up to 40 feet.

3. Design properties:
   SmartLam CLT shall be designed with the design capacities provided in Tables 2 and 3. Note that the unbalanced layups listed in Table 3 can be only used in simple span applications and the compression side must be stamped with the word “TOP”, which shall be installed on the compression (top) side of the simple span. The design adjustment factors, such as load duration, creep, moisture, and temperature factors, etc., shall be based on the 2015 National Design Specification for Wood Construction (NDS) and approved by the engineer of record. The lateral resistance of SmartLam CLT, when used as shearwalls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be consulted with the CLT manufacturer and approved by the engineer of record.

4. Product installation:
   SmartLam CLT shall be installed in accordance with the recommendations provided by the manufacturer (www.smartlam.com) and the engineering drawing approved by the engineer of record. Permissible details shall be in accordance with the engineering drawing.

5. Fire-rated assemblies:
   Procedures specified in Chapter 16 of the 2015 NDS shall be permitted for use in designing SmartLam CLT for a fire exposure up to 2 hours.

6. Limitations:
   a) SmartLam CLT shall be designed in accordance with principles of mechanics using the design properties specified in this report or provided by the manufacturer.
   b) SmartLam CLT products shall be limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16 percent.
   c) Design properties for SmartLam CLT, when used as beams or lintels with loads applied parallel to the face-bond gluelines, are beyond the scope of this report.
   d) Unblanced SmartLam CLT layups shall be limited to simple span applications and shall be installed with the “TOP” mark on the compression (top) side of the simple span.
   e) SmartLam CLT shall be manufactured in accordance with the custom layup combination specified in this report and documented in the SmartLam in-plant manufacturing standard approved by APA.
   f) SmartLam CLT is produced at the SmartLam, LLC, Columbia Falls, Montana facilities under a quality assurance program audited by APA.
   g) This report is subject to re-examination in one year.

7. Identification:
   SmartLam CLT described in this report is identified by a label bearing the manufacturer's name (SmartLam) and/or trademark, the APA assigned plant number (1119), the product standard (ANSI/APA PRG 320), the APA logo, the CLT grade (SL-V4), the report number PR-L319, and a means of identifying the date of manufacture.

Table 1. ASD Reference Design Values[a] for Lumber Laminations Used in SmartLam CLT (for Use in the U.S.)

CLT Grade	Laminations Used in Major Strength Direction						Laminations Used in Minor Strength Direction					
	F_b (psi)	E (10^6 psi)	F_t (psi)	F_c (psi)	F_v (psi)	F_s (psi)	F_b (psi)	E (10^6 psi)	F_t (psi)	F_c (psi)	F_v (psi)	F_s (psi)
SL-V4	775	1.1	350	1,000	135	45	775	1.1	350	1,000	135	45

For SI: 1 psi = 0.006895 MPa

[a] Tabulated values are allowable design values and not permitted to be increased for the lumber flat use or size factor in accordance with the NDS. The design values shall be used in conjunction with the section properties provided by the CLT manufacturer based on the actual layup used in manufacturing the CLT panel (see Tables 2 and 3).

Table 2. ASD Reference Design Values[a] for SmartLam **Balanced** CLT Listed in Table 1 (for Use in the U.S.)

CLT Layup[b]	Layup ID[c]	Thick-ness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	$(F_bS)_{eff,f,0}$ (lbf-ft/ft)	$(EI)_{eff,f,0}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,0}$ (10^6 lbf/ft)	$V_{s,0}$ (lbf/ft)	$(F_bS)_{eff,f,90}$ (lbf-ft/ft)	$(EI)_{eff,f,90}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,90}$ (10^6 lbf/ft)	$V_{s,90}$ (lbf/ft)
SL-V4[d]	3-alt	4 1/8	1 3/8	1 3/8	1 3/8							1,800	74	0.41	1,490	245	2.9	0.41	495
	4-maxx	5 1/2	1 3/8	1 3/8 x 2	1 3/8							2,925	161	0.49	1,980	975	23	0.85	990
	5-alt	6 7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8					4,150	286	0.83	2,480	2,120	74	0.83	1,490
	5-maxx	6 7/8	1 3/8 x 2	1 3/8	1 3/8 x 2							5,150	355	0.85	2,480	245	2.9	0.49	495
	6-maxx	8 1/4	1 3/8 x 2	1 3/8 x 2	1 3/8 x 2							7,200	596	0.83	2,975	975	23	0.83	990
	7-alt	9 5/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			7,325	707	1.2	3,475	4,875	286	1.2	2,480
	7-maxx	9 5/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8 x 2					9,425	909	1.2	3,475	2,120	74	0.89	1,490
	8-maxx	11	1 3/8 x 2	1 3/8	1 3/8 x 2	1 3/8	1 3/8 x 2					11,875	1,309	1.7	3,950	3,425	161	0.97	1,980
	9-alt	12 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	11,375	1,410	1.7	4,450	8,625	707	1.7	3,475
	9-maxx	12 3/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8 x 2				14,600	1,811	1.6	4,450	4,875	286	1.3	2,480

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

[a] Tabulated values are allowable design values and not permitted to be increased for the lumber flat use or size factor in accordance with the NDS.

[b] The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

[c] The layup designation refers to the number of layers and the layup series (alt or maxx).

[d] The SL-V4 grade uses all visually graded No. 2 SPF-S or Hem-fir lumber in both major and minor strength directions.

Table 3. ASD Reference Design Values[a] for SmartLam **Unbalanced** CLT[b] Listed in Table 1 (for Use in the U.S.)

CLT Layup[c]	Layup ID[d]	Thick-ness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	$(F_bS)_{eff,f,0}$ (lbf-ft/ft)	$(EI)_{eff,f,0}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,0}$ (10^6 lbf/ft)	$V_{s,0}$ (lbf/ft)	$(F_bS)_{eff,f,90}$ (lbf-ft/ft)	$(EI)_{eff,f,90}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,90}$ (10^6 lbf/ft)	$V_{s,90}$ (lbf/ft)
SL-V4[e]	4-alt	5 1/2	1 3/8	1 3/8	1 3/8	1 3/8						1,800	74	0.41	1,490	245	2.9	0.41	495
	6-alt	8 1/4	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8				4,150	286	0.83	2,480	2,120	74	0.83	1,490
	8-alt	11	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8		7,325	707	1.2	3,475	4,875	286	1.2	2,480

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

[a] Tabulated values are allowable design values and not permitted to be increased for the lumber flat use or size factor in accordance with the NDS. Tabulated values ignore the contribution of the outermost compression layer.

[b] Unbalanced CLT layups can be only used in simple span applications. The compression side must be stamped with the word “TOP”, which shall be installed on the compression (top) side of the simple span.

[c] The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

[d] The layup designation refers to the number of layers and the layup series (alt).

[e] The SL-V4 grade uses all visually graded No. 2 SPF-S or Hem-fir lumber in both major and minor strength directions.

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