

IB MAX-CORE[®] Cross-Laminated Timber
IB X-LAM USA, LLC

PR-L327

Revised December 3, 2020

Products: IB MAX-CORE[®] 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 320-2019 Performance Rated Cross-Laminated Timber
 - 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 T2018P-35 and T2018P-39, Timber Products Inspection (TP) Report A18-085, and other qualification data
2. Product description:

IB MAX-CORE[®] cross-laminated timber (CLT) is manufactured in Dothan, Alabama with Southern pine lumber in accordance with the V3 grade of ANSI/APA PRG 320 through product qualification and/or mathematical models using principles of engineering mechanics. Allowable design properties for lumber laminations used in IB MAX-CORE CLT are provided in Table 1. IB MAX-CORE CLT is permitted for use in floor, roof, and wall applications, and is manufactured with nominal widths up to 138 inches, thicknesses of 4-1/8 to 12-3/8 inches, and lengths up to 52-1/2 feet.
3. Design properties:

IB MAX-CORE CLT shall be designed with the design properties and capacities provided in Tables 2 and 3. **Note that the unbalanced layups listed in Table 3 can be only used in wall and simple span applications and the compression side that consists of lumber laminations in the minor strength direction is stamped with the word “TOP”, which shall be installed on the compression (top) side of the simple-span bending member.** The design adjustment factors, such as load duration, creep, moisture, and temperature factors, etc., shall be based on Chapter 10 of the 2018 National Design Specification for Wood Construction (NDS) and approved by the engineer of record. The lateral resistance of IB MAX-CORE 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.

Design values for the Load and Resistance Factor Design (LRFD) used in the U.S. for IB MAX-CORE CLT can be derived from the ASD values published in Table 2 of this report in accordance with Tables 10.3.1, N1, N2, and N3 of the 2018 NDS.
4. Product installation:

IB MAX-CORE 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:
Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer (see link above). Procedures specified in Chapter 16 of the 2018 NDS shall be permitted for use in designing IB MAX-CORE CLT for a fire exposure up to 2 hours.

6. Limitations:
 - a) IB MAX-CORE CLT shall be designed in accordance with principles of mechanics using the design properties specified in this report or provided by the manufacturer.
 - b) IB MAX-CORE 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 IB MAX-CORE CLT, when used as beams or lintels with loads applied parallel to the face-bond gluelines, are beyond the scope of this report.
 - d) IB MAX-CORE CLT shall be manufactured in compliance with ANSI/APA PRG 320 and documented in the IB X-Lam USA, LLC's in-plant manufacturing standard approved by APA.
 - e) IB MAX-CORE CLT is produced at the Dothan, Alabama facility under a quality assurance program audited by APA.
 - f) This report is subject to re-examination in one year.

7. Identification:
IB MAX-CORE CLT described in this report is identified by a label bearing the manufacturer's name (IB X-Lam USA, LLC) and/or trademark, the APA assigned plant number (1136), the product standard (ANSI/APA PRG 320), the APA logo, the CLT grade, the report number PR-L327, and a means of identifying the date of manufacture.

Table 1. ASD Reference Design Values^(a) for Lumber Laminations Used in IB MAX-CORE CLT (for Use in the U.S.)

CLT Grade	Laminations Used in Major Strength Direction							Laminations Used in Minor Strength Direction						
	Grade & Species	F _b (psi)	E (10 ⁶ psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)	Grade & Species	F _b (psi)	E (10 ⁶ psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)
V3	No. 2 SP	750	1.4	450	1,250	175	55	No. 3 SP	450	1.3	250	725	175	55

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, b) for IB MAX-CORE **Balanced** CLT Listed in Table 1 (for Use in the U.S.)

CLT Grade ^(c)	Layup ID ^(d)	CLT Thickness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	⊥	$(F_bS)_{eff,f,0}$ (lb-ft/ft)	$(EI)_{eff,f,0}$ (10^6 lbf-in. ² /ft)	$(GA)_{eff,f,0}$ (10^6 lbf/ft)	$V_{s,0}$ (lb/ft)	$(F_bS)_{eff,f,90}$ (lb-ft/ft)	$(EI)_{eff,f,90}$ (10^6 lbf-in. ² /ft)	$(GA)_{eff,f,90}$ (10^6 lbf/ft)
V3	3-alt	4 1/8	1 3/8	1 3/8	1 3/8							1,740	95	0.49	1,820	140	3.4	0.52	605
	4-maxx	5 1/2	1 3/8	1 3/8 x 2	1 3/8							2,825	205	0.58	2,420	565	27	1.1	1,210
	5-alt	6 7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8					4,000	363	0.98	3,025	1,230	88	1.0	1,820
	5-maxx	6 7/8	1 3/8 x 2	1 3/8	1 3/8 x 2							4,975	451	1.0	3,025	140	3.4	0.62	605
	6-maxx	8 1/4	1 3/8 x 2	1 3/8 x 2	1 3/8 x 2							6,975	758	0.98	3,625	565	27	1.0	1,210
	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			7,100	899	1.5	4,225	2,825	338	1.6	3,025
	7-maxx	9 5/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8 x 2					9,125	1,157	1.5	4,225	1,230	88	1.1	1,820
	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	11,000	1,793	2.0	5,450	5,025	837	2.1	4,225

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) Deflection under a specified uniformly distributed load, w , acting perpendicular to the face of a single-span CLT panel shall be permitted to be calculated as a sum of the deflections due to moment and shear effects using the effective bending stiffness, $(EI)_{eff}$, and the effective in-plane (planar) shear rigidity, $(GA)_{eff}$, as follows:

$$\delta = \frac{22.5wL^4}{(EI)_{eff}} + \frac{3wL^2}{2(GA)_{eff}} \quad [1]$$

where: δ = estimated deflection, inches; w = uniform load, plf;
 L = span, feet; $(EI)_{eff}$ = tabulated effective bending stiffness, 10^6 lbf-in.²/ft; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10^6 lbf/ft

For a concentrated line load, P , located in the middle of a single span CLT panel acting perpendicular to the panel, the deflection shall be permitted to be calculated as follows:

$$\delta = \frac{36PL^3}{(EI)_{eff}} + \frac{3PL}{(GA)_{eff}} \quad [2]$$

where: δ = estimated deflection, inches; P = concentrated line load, lbf;
 L = span, feet; $(EI)_{eff}$ = tabulated effective bending stiffness, 10^6 lbf-in.²/ft; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10^6 lbf/ft

- (c) The CLT grade and 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 or maxx).

Table 3. ASD Reference Design Values^(a, b) for IB MAX-CORE **Unbalanced** CLT^(c) Listed in Table 1 (for Use in the U.S.)

CLT Grade ^(d)	Layup ID ^(e)	CLT Thickness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	$(F_b S)_{eff, f, 0}$ (lb-ft/ft)	$(EI)_{eff, f, 0}$ (10^6 lb-ft ² /ft)	$(GA)_{eff, f, 0}$ (10^6 lb/ft)	$V_{s, 0}$ (lb/ft)	$(F_b S)_{eff, f, 90}$ (lb-ft/ft)	$(EI)_{eff, f, 90}$ (10^6 lb-ft ² /ft)	$(GA)_{eff, f, 90}$ (10^6 lb/ft)	$V_{s, 90}$ (lb/ft)
V3	4-alt	5 1/2	1 3/8	1 3/8	1 3/8	1 3/8						1,740	95	0.49	1,820	140	3.4	0.52	605
	6-alt	8 1/4	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8				4,000	363	0.98	3,025	1,230	88	1.0	1,820
	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		7,100	899	1.5	4,225	2,825	338	1.6	3,025

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) Refer to Footnote (b) of Table 2 for deflection under different loading scenarios.
- (c) **Unbalanced CLT layups can be only used in wall and simple span applications. The compression side that consists of lumber laminations in the minor strength direction is stamped with the word “TOP”, which shall be installed on the compression (top) side of the simple-span bending member.**
- (d) The CLT grade and layups were developed based on ANSI/APA PRG 320, as permitted by the standard.
- (e) The layup designation refers to the number of layers and the layup series (alt).

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