APA PRODUCT REPORT®

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Mercer Cross-Laminated Timber PR-L347
Mercer Conway DBA Mercer Mass Timber Revised July 18, 2024

Products: Mercer Cross-Laminated Timber
Mercer Conway DBA Mercer Mass Timber, 1800 Sturgis Road, Conway, Arkansas 72034
(509) 606-0767
www.mercermasstimber.com

1. Basis of the product report:
   - 2024, 2021, 2018, and 2015 International Building Code (IBC): Section 2303.1.4 Cross-laminated timber (Structural glued cross-laminated timber in 2021, 2018, and 2015 IBC)
   - 2024, 2021, 2018, and 2015 International Residential Code (IRC): Sections R502.1.6, R602.1.6, and R802.1.5 (R802.1.6 in 2021, 2018, and 2015 IRC) Cross-laminated timber
   - ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber recognized in the 2024 and 2021 IBC and IRC
   - ANSI/APA PRG 320-2017, PRG 320-2012, and PRG 320-2011 recognized in the 2018 IBC and IRC, 2015 IRC, and 2015 IBC, respectively
   - APA Reports T2020P-19, T2020P-21, T2021P-19, T2021P-24, and T2021P-44, and other qualification data

2. Product description:
   Mercer cross-laminated timber (CLT) is manufactured with Southern pine (SP) lumber in accordance with ANSI/APA PRG 320 or proprietary layup combinations approved by APA through product qualification and/or mathematical models using principles of engineering mechanics. The laminating lumber shall have allowable reference design properties provided in Table 1. Mercer CLT can be used in floor, roof, and wall applications, and is manufactured with nominal widths of 12 to 144 inches, thicknesses of 3 to 12-3/8 inches, and lengths up to 60 feet.

3. Design properties:
   Mercer CLT shall be designed with the allowable design capacities provided in Tables 2 and 3. The design value adjustment factors shall be based on Table 10.3.1 of the ANSI/AWC National Design Specification (NDS) for Wood Construction. The lateral resistance of Mercer CLT, when used as shear walls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be designed in accordance with Sections 4.4 and 4.5 of the ANSI/AWC Special Design Provisions for Wind and Seismic (SDPWS), or consulted with the CLT manufacturer and approved by the engineer of record.

4. Product installation:
   Mercer CLT shall be installed in accordance with the recommendations provided by the manufacturer 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. Procedures specified in Chapter 16 of the NDS shall be permitted for use in designing Mercer CLT for a fire exposure up to 2 hours.

6. Limitations:
   a) Mercer CLT shall be designed in accordance with principles of mechanics using the allowable design properties specified in this report or provided by the manufacturer.

b) Mercer CLT shall be limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16%.
c) Design properties for Mercer CLT, when used as beams or lintels with loads applied parallel to the face-bond gluelines, are beyond the scope of this report.
d) Mercer CLT shall be manufactured in accordance with layup combinations specified in ANSI/APA PRG 320 or proprietary Mercer CLT manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
e) Mercer CLT is produced at the Mercer Conway DBA Mercer Mass Timber, Conway, Arkansas facilities under a quality assurance program audited by APA.
f) This report is subject to re-examination in one year.

7. Identification:
Mercer CLT described in this report is identified by a label bearing the manufacturer's name (Mercer) and/or trademark, the APA assigned plant number (1152), the product standard (ANSI/APA PRG 320), the APA logo, the CLT grade and thickness (or layup ID), the report number PR-L347, and a means of identifying the date of manufacture.

Table 1. ASD Reference Design Values[(a)] for Lumber Laminations Used in Mercer 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)	$F_{c\perp}$ (psi)	G	Grade & Species	F_b (psi)	E (10^6 psi)	F_t (psi)	F_c (psi)	F_v (psi)	F_s (psi)	$F_{c\perp}$ (psi)	G
E4M1	2700f-2.2E SP	2,700	2.2	2,150	2,100	190	60	805	0.57	No. 2 SP	750	1.4	450	1,250	175	55	565	0.55
E4M2 & E4M2.1	2100f-1.8E SP	2,100	1.8	1,575	1,875	175	55	805	0.57	No. 2 SP	750	1.4	450	1,250	175	55	565	0.55
E4M3 & E4M3.1	2100f-1.8E SP	2,100	1.8	1,575	1,875	175	55	805	0.57	No. 3 SP	450	1.3	250	725	175	55	565	0.55
V3 & V3.1	No. 2 SP	750	1.4	450	1,250	175	55	565	0.55	No. 3 SP	450	1.3	250	725	175	55	565	0.55
E4M11	2400f-2.0E SP	2,400	2.0	1,925	1,975	190	60	805	0.57	No. 3 SP	450	1.3	250	725	175	55	565	0.55
V3M1 & V3M1.1	No. 2 SP	750	1.4	450	1,250	175	55	565	0.55	No. 2 SP	750	1.4	450	1,250	175	55	565	0.55

For SI: 1 psi = 0.006895 MPa

(a) Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment 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 Table 2).

Table 2. ASD Reference Design Values[a, b] for Mercer CLT Listed in Table 1 (for Use in the U.S.)

CLT Grade[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)
V3	105 V	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
	175 V	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
	245 V	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
	315 V	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
V3.1	87 V	3.43	1.38	0.67	1.38							1,240	56	0.51	1,510	35	0.39	0.30	295
	139 V	5.47	1.38	0.67	1.38	0.67	1.38					2,850	206	1.0	2,410	485	23	0.61	1,200
	191 V	7.52	1.38	0.67	1.38	0.67	1.38	0.67	1.38			5,075	503	1.5	3,300	1,100	91	0.91	2,100
	243 V	9.57	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	7,900	996	2.1	4,200	1,920	227	1.2	3,000
V3M1	105 V	4.14	1.38	1.38	1.38							1,750	95	0.53	1,820	235	3.7	0.53	605
	175 V	6.90	1.38	1.38	1.38	1.38	1.38					4,025	366	1.1	3,025	2,060	95	1.1	1,820
	175 V XL	6.90	1.38 x 2	1.38	1.38 x 2							5,000	454	1.1	3,025	235	3.7	0.62	605
	245 V	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38			7,125	906	1.6	4,250	4,750	366	1.6	3,025
	245 V XL	9.66	1.38 x 2	1.38	1.38	1.38	1.38 x 2					9,150	1,164	1.6	4,250	2,060	95	1.1	1,820
	315 V	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	11,050	1,806	2.1	5,450	8,375	906	2.1	4,250
	315 V XL	12.42	1.38 x 2	1.38	1.38	1.38	1.38	1.38	1.38 x 2			14,200	2,320	2.1	5,450	4,750	366	1.6	3,025
V3M1.1	222 V	8.76	1.38	1.08	1.38	1.08	1.38	1.08	1.38			6,275	723	1.6	3,850	3,400	228	1.3	2,650
E4M1	105 E	4.14	1.38	1.38	1.38							6,300	150	0.54	1,820	235	3.7	0.79	660
	175 E	6.90	1.38	1.38	1.38	1.38	1.38					14,450	573	1.1	3,025	2,060	95	1.6	1,980
	245 E	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38			25,525	1,417	1.6	4,250	4,775	368	2.4	3,300
	315 E	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	39,550	2,821	2.2	5,450	8,450	913	3.1	4,625
E4M2	105 E	4.14	1.38	1.38	1.38							4,900	123	0.54	1,820	235	3.7	0.66	605
	175 E	6.90	1.38	1.38	1.38	1.38	1.38					11,250	469	1.1	3,025	2,060	95	1.3	1,820
	245 E	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38			19,900	1,161	1.6	4,250	4,750	367	2.0	3,025
	315 E	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	30,850	2,314	2.1	5,450	8,425	909	2.6	4,250
E4M2.1	97 E	3.84	1.38	1.08	1.38							4,300	100	0.53	1,690	145	1.8	0.54	475
	160 E	6.30	1.38	1.08	1.38	1.08	1.38					9,875	377	1.1	2,775	1,480	59	1.1	1,560
	222 E	8.76	1.38	1.08	1.38	1.08	1.38	1.08	1.38			17,500	927	1.6	3,850	3,400	229	1.6	2,650
	285 E	11.22	1.38	1.08	1.38	1.08	1.38	1.08	1.38	1.08	1.38	27,175	1,844	2.1	4,925	6,025	570	2.2	3,725

Table 2. ASD Reference Design Values[a, b] for Mercer CLT Listed in Table 1 (for Use in the U.S.) (continued)

CLT Grade[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)
E4M3	105 E	4.14	1.38	1.38	1.38							4,900	123	0.50	1,820	140	3.4	0.65	605
	175 E	6.90	1.38	1.38	1.38	1.38	1.38					11,250	469	1.0	3,025	1,240	89	1.3	1,820
	245 E	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38			19,875	1,160	1.5	4,250	2,850	341	2.0	3,025
	315 E	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	30,800	2,312	2.0	5,450	5,050	845	2.6	4,250
E4M3.1	87 E	3.43	1.38	0.67	1.38							3,475	72	0.53	1,510	35	0.39	0.38	295
	139 E	5.47	1.38	0.67	1.38	0.67	1.38					7,975	264	1.1	2,410	485	23	0.77	1,200
	191 E	7.52	1.38	0.67	1.38	0.67	1.38	0.67	1.38			14,200	646	1.6	3,300	1,100	91	1.2	2,100
	243 E	9.57	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	22,075	1,278	2.1	4,200	1,940	229	1.5	3,000
E4M11	105 E	4.14	1.38	1.38	1.38							5,575	135	0.50	1,820	140	3.4	0.72	660
	175 E	6.90	1.38	1.38	1.38	1.38	1.38					12,800	518	1.0	3,025	1,230	88	1.4	1,980
	175 E XL	6.90	1.38 x 2	1.38	1.38 x 2							15,950	645	1.1	3,025	140	3.4	0.86	660
	245 E	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38			22,600	1,280	1.5	4,225	2,850	339	2.1	3,300
	245 E XL	9.66	1.38 x 2	1.38	1.38	1.38	1.38 x 2					29,150	1,651	1.5	4,225	1,230	88	1.6	1,980
	315 E	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	35,025	2,549	2.0	5,450	5,050	842	2.9	4,625

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

[a] Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment 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:

$$\delta = \frac{22.5wL^4}{(EI)_{eff}} + \frac{9wL^2}{5(GA)_{eff}} \quad [1]$$

where: δ = estimated deflection, inches; w = uniform load, lbf/ft^2;
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 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:

$$\delta = \frac{36PL^3}{(EI)_{eff}} + \frac{18PL}{5(GA)_{eff}} \quad [2]$$

where: δ = estimated deflection, inches; P = concentrated load, lbf/ft of width;
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 layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

[d] The layup identification (ID) refers to the layup thickness (mm), lamination grade (visual graded or MSR) and series name (e.g. XL).

APA – The Engineered Wood Association is an approved national standards developer accredited by American National Standards Institute (ANSI). APA publishes ANSI standards and Voluntary Product Standards for wood structural panels and engineered wood products. APA is an accredited certification body under ISO/IEC 17065 by Standards Council of Canada (SCC), an accredited inspection agency under ISO/IEC 17020 by ANSI National Accreditation Board (ANAB), and an accredited testing organization under ISO/IEC 17025 by ANAB. APA is also an approved Product Certification Agency, Testing Laboratory, Quality Assurance Entity, Validation Entity, and Product Evaluation Entity by the State of Florida, and an approved testing laboratory by City of Los Angeles.

APA – THE ENGINEERED WOOD ASSOCIATION
HEADQUARTERS
7011 So. 19th St. ▪ Tacoma, Washington 98466
Phone: (253) 565-6600 ▪ Fax: (253) 565-7265 ▪ Internet Address: www.apawood.org

PRODUCT SUPPORT HELP DESK
(253) 620-7400 ▪ *E-mail Address*: help@apawood.org

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