



VAAGEN

TIMBERS

Cross Laminated Timber Design Guide



Intended Usage

	Visual	Non-Visual
Intended Use	Visual where one or both faces are exposed	Where both faces are covered by another material
Face Layer-V series	Douglas Fir Larch #2 & Btr	Douglas Fir Larch #2 & Btr
Sanded Face	100 grit	N/A

CLT Specifications

Max. panel size 4'0" x 60'0"

Max. thickness 9.625 in.

Min. thickness 4.125 in.

Production widths 48 in.

Moisture Content 12% +/- 3%

Glue specs. Eco bind adhesive

Species Douglas Fir Larch
SPF (Coming Q4 2019)

Lumber Grades 2 & Btr

Stress Grades V1M3

Manufacturing Certification APA PR-320 product report
PR-L328

Density ~31lbs/ft2 (estimated)

Dimensional Tolerances

Thickness: +/- 1/16in (1.6mm) or 2% of the CLT thickness, whichever is greater

Width: +/- 1/8in (3.2mm) of the CLT width

Length: +/- 1/4in (6.4mm) of the CLT length





Laminations used for Major Strength Direction							Laminations used for Minor Strength Direction						Status	
CLT Grade	F _b (psi)	E (106 psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)	F _b (psi)	E (106 psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)		
V1M3	900	1.35	575	1350	180	60	900	1.35	575	1350	180	60	CERTIFIED	
E1	4095	1.7	2885	3420	425	140	1050	1.2	525	1235	425	140		*Testing
E2	3465	1.5	2140	3230	565	185	1100	1.4	680	1470	565	185		*Testing
V1	1890	1.6	1205	2565	565	185	1100	1.4	680	1470	565	185		*Testing
V2	1835	1.4	945	2185	425	140	1050	1.2	525	1235	425	140		*Testing

*Testing to be completed Q4 2019

Table 1. ASD Reference Design Values^(a) for Lumber Laminations Used in Vaagen 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)
V1M3	900	1.35	575	1,350	180	60	900	1.35	575	1,350	180	60

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 Table 2).

Table 2. ASD Reference Design Values^(a, b) for Vaagen 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 _b S) _{eff,0} (lbf-ft/ft)	(EI) _{eff,0} (10 ⁶ lbf-in. ² /ft)	(GA) _{eff,0} (10 ⁶ lbf/ft)	V _{s,0} (lbf/ft)	(F _b S) _{eff,90} (lbf-ft/ft)	(EI) _{eff,90} (10 ⁶ lbf-in. ² /ft)	(GA) _{eff,90} (10 ⁶ lbf/ft)
V1M3 ^(e)	DFL3	4 1/8	1 3/8	1 3/8	1 3/8					2,090	91	0.51	1,980	285	3.5	0.51	660
	DFL5	6 7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			4,825	350	1.0	3,300	2,460	91	1.0	1,980
	DFL7	9 5/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	8,525	868	1.5	4,625	5,675	350	1.5	3,300

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 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, 10⁶ lbf-in.²/ft; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10⁶ 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:

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

where: δ = Estimated deflection, inches; P = concentrated line load, lbf;
 L = span, feet; $(EI)_{eff}$ = tabulated effective bending stiffness, 10⁶ lbf-in.²/ft; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10⁶ lbf/ft

^(c) The CLT grade and layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

^(d) The layup identification (ID) refers to lumber lamination species and number of layers.

^(e) The V1M3 grade and layups use No.2 Douglas fir-Larch lumber in both major and minor strength directions.