

Nordic X-Lam – Panel Layups Available Upon Request

Characteristics

Nordic X-Lam cross-laminated timber (CLT) is certified according to E1 CLT stress grade, using 1950f-1.7E Spruce-Pine-Fir (S-P-F) MSR lumber in longitudinal layers and No. 3 S-P-F lumber in the transverse layers. Nordic X-Lam products shall be used in dry service conditions and are certified by APA (Product Report PR-L306) per the ANSI/APA PRG 320 Standard.

Material Design Properties

CLT stress grade	E1	
	Layers	
	Longitudinal	Transversal
Orientation	S-P-F	S-P-F
Species combination	1950f-1.7E MSR	No. 3
Stress class		
Bending at extreme fiber, F_b (psi)	1,950	500
Shear parallel to grain, F_v (psi)	135	135
Rolling shear, F_s (psi)	45	45
Compression parallel to grain, F_c (psi)	1,800	650
Compression perpendicular to grain, F_{cp} (psi)	425	425
Tension parallel to grain, F_t (psi)	1,375	250
Modulus of elasticity, E (psi)	1,700,000	1,200,000
Shear modulus, G (psi)	106,250	75,000
Rolling shear modulus, G_s (psi)	10,625	7,500

Note:

1. Appearance grades as defined in ANSI/APA PRG 320 do not affect the structural performance of CLT panels.

Panel Layups

Layup ^(a)	Thickness and orientation of layers ^(b)	Number of layers	Thickness		Weight		
			(mm)	(in.)	(kg/m ²)	(kN/m ²)	(psf)
140-4s	35L - 35T - 35T - 35L	4	140	5-1/2	71.9	0.71	14.7
140-4l	35L - 35L - 35T - 35L	4	140	5-1/2	71.9	0.71	14.7
315-9l	35L - 35L - 35T - 35L - 35T - 35L - 35T - 35L - 35L	9	314	12-3/8	162	1.59	33.2

a) The layup designation refers to the panel thickness (in mm), the number of layers, and the layer orientations ("s" for standard perpendicular layers, and "l" for doubled outermost parallel layers).

b) L = longitudinal, T = transversal, 35 = 1-3/8 in. = 34.925 mm, 19 = 3/4 in. = 19.05 mm

Floor/Roof Slabs – Design Properties

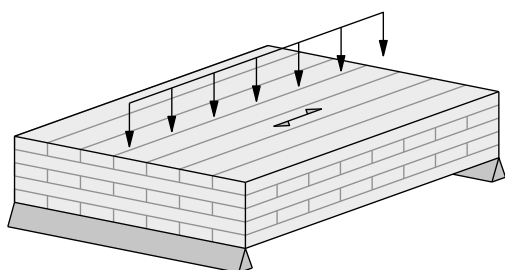
Floor/Roof Slabs – Design Properties

CLT stress grade	E1 (L = S-P-F 1950f MSR and T = S-P-F No. 3)		
Layup	140-4s	140-4l	315-9l
Bending in the major strength direction			
Effective flatwise bending moment capacity, $M_{eff,f,0}$ (lb-ft/ft) ^(a)	7,325	7,150	36,700
Flatwise shear capacity, $V_{s,0}$ (lb/ft)	1,980	1,980	4,450
Effective flatwise bending stiffness, $(EI)_{eff,f,0}$ (10^6 lb-ft-in. ² /ft)	248	261	2,794
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,0}$ (10^6 lb/ft)	0.54	0.70	1.8
Bending in the minor strength direction			
Effective flatwise bending moment capacity, $M_{eff,f,90}$ (lb-ft/ft) ^(a)	630	160	3,150
Flatwise shear capacity, $V_{s,90}$ (lb/ft)	990	495	2,480
Effective flatwise bending stiffness, $(EI)_{eff,f,90}$ (10^6 lb-ft-in. ² /ft)	25	3.1	313
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,90}$ (10^6 lb/ft)	1.2	0.67	1.9

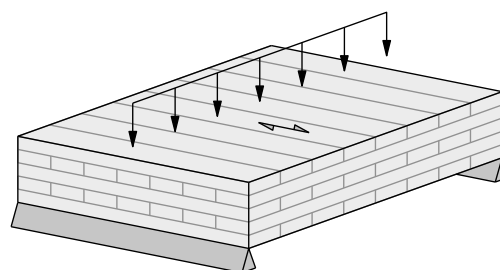
a) The effective flatwise bending moment capacity values in the major strength direction, $M_{eff,f,0}$, include the adjustment factor of 0.85 from ANSI/APA PRG 320.

Notes:

1. The tabulated design values are for dry service conditions and normal duration of loading.
2. The compressive capacity perpendicular to grain values shall be based on S-P-F No. 3 lumber ($f_{cp} = 425$ psi).
3. The specific gravity for dowel-type fastener design is 0.42.
4. The density for member weight is 32 pcf for a moisture content of 12%.
5. Design of CLT members shall be in accordance with the NDS.



Bending in the major strength direction



Bending in the minor strength direction

Walls – Design Properties

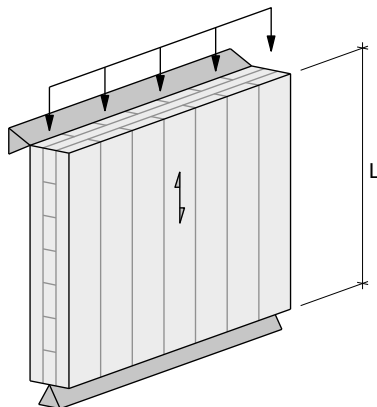
Walls – Design Properties

CLT stress grade	E1 (L = S-P-F 1950f MSR and T = S-P-F No. 3)		
Layup	140-4s	140-4l	315-9l
Loading parallel to outermost layers			
Compression in the major strength direction			
Compressive capacity, P_0 (10^3 lbf/ft) ^(a)	59	89	178
Effective cross-sectional area, $A_{eff,0}$ (in. ² /ft)	33	50	99
Effective out-of-plane moment of inertia, $I_{eff,0}$ (in. ⁴ /ft)	146	153	1,638
Effective out-of-plane radius of gyration, $r_{eff,0}$ (in./ft) ^(b)	2.1	1.8	4.1
Bending in the major strength direction			
Effective flatwise bending moment capacity, $M_{eff,f,0}$ (lbf-ft/ft) ^(c)	7,325	7,150	36,700
Flatwise shear capacity, $V_{s,0}$ (lbf/ft)	1,980	1,980	4,450
Effective flatwise bending stiffness, $(EI)_{eff,f,0}$ (10^6 lbf-in. ² /ft)	248	261	2,794
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,0}$ (10^6 lbf/ft)	0.54	0.70	1.8
Loading perpendicular to outermost layers			
Compression in the minor strength direction			
Compressive capacity, P_{90} (10^3 lbf/ft) ^(a)	21	11	32
Effective cross-sectional area, $A_{eff,90}$ (in. ² /ft)	33	17	50
Effective out-of-plane moment of inertia, $I_{eff,90}$ (in. ⁴ /ft)	21	2.6	257
Effective out-of-plane radius of gyration, $r_{eff,90}$ (in./ft) ^(b)	0.79	0.40	2.3
Bending in the minor strength direction			
Effective flatwise bending moment capacity, $M_{eff,f,90}$ (lbf-ft/ft) ^(c)	630	160	3,150
Flatwise shear capacity, $V_{s,90}$ (lbf/ft)	990	495	2,480
Effective flatwise bending stiffness, $(EI)_{eff,f,90}$ (10^6 lbf-in. ² /ft)	25	3.1	313
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,90}$ (10^6 lbf/ft)	1.2	0.67	1.9

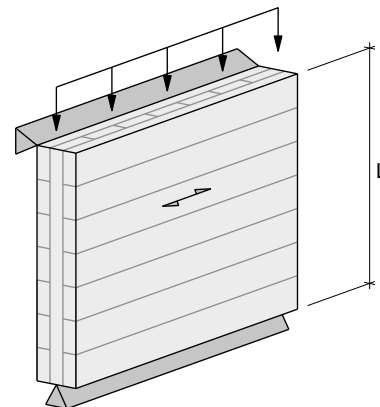
- a) The compressive capacity under axial load, P_0 and P_{90} , shall be adjusted by the column stability factor, C_p , as defined in the NDS. The effective flatwise bending stiffness, $(EI)_{eff,f}$, values shall be based on S-P-F 1950f MSR lumber ($E = 1,700,000$ psi) and on $I_{eff,0}$ for loading parallel to outermost layers, or on S-P-F No. 3 lumber ($E = 1,200,000$ psi) and on $I_{eff,90}$ for loading perpendicular to outermost layers. The critical buckling design value, F_{cE} , shall be calculated as follows: $F_{cE} = \pi^2 (EI)_{app-min} / (\ell_e^2 A_{eff})$.
- b) As per NDS 3.7.1.4, the slenderness ratio for walls, $\ell_e / (\sqrt{12} r_{eff})$, shall not exceed 50, except that during construction $\ell_e / (\sqrt{12} r_{eff})$ shall not exceed 75.
- c) The effective flatwise bending moment capacity values in the major strength direction, $M_{eff,f,0}$, include the adjustment factor of 0.85 from ANSI/APA PRG 320.

Notes:

- The tabulated design values are for dry service conditions and normal duration of loading.
- The compressive capacity perpendicular to grain values shall be based on S-P-F No. 3 lumber ($f_{cp} = 425$ psi).
- The specific gravity for dowel-type fastener design is 0.42.
- The density for member weight is 32 pcf for a moisture content of 12%.
- Design of CLT members shall be in accordance with the NDS.



Loading parallel to outermost layers



Loading perpendicular to outermost layers

Shear Walls, Lintels, and Diaphragms – Design Properties

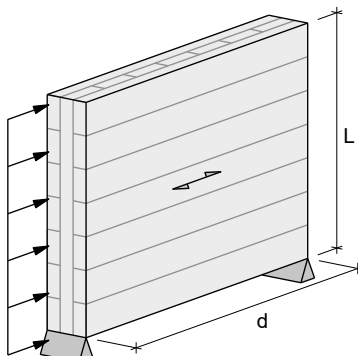
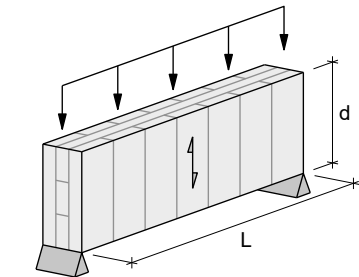
Shear Walls, Lintels, and Diaphragms – Design Properties

CLT stress grade	E1 (L = S-P-F 1950f MSR and T = S-P-F No. 3)		
Layup	140-4s	140-4l	315-9l
Loading parallel to outermost layers			
Edgewise bending in the minor strength direction			
Effective width in edgewise bending, $b_{\text{eff},e,90}$ (in.) ^(a)	2.75	1.38	4.13
Reference edgewise shear design value, $F_{v,e,90}$ (psi) ^(b)	190	190	215
Edgewise shear rigidity, $G_{e,90}t_p$ (10^6 lbf/ft) ^(c)	2.39	2.39	5.38
Loading perpendicular to outermost layers			
Edgewise bending in the major strength direction			
Effective width in edgewise bending, $b_{\text{eff},e,0}$ (in.) ^(a)	2.75	4.13	8.25
Reference edgewise shear design value, $F_{v,e,0}$ (psi) ^(b)	145	155	185
Edgewise shear rigidity, $G_{e,0}t_p$ (10^6 lbf/ft) ^(c)	2.39	2.39	5.38

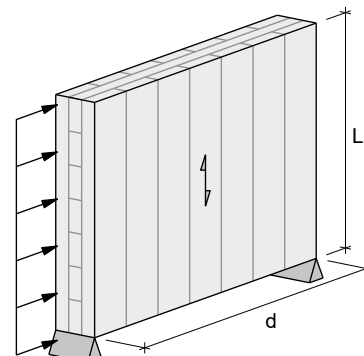
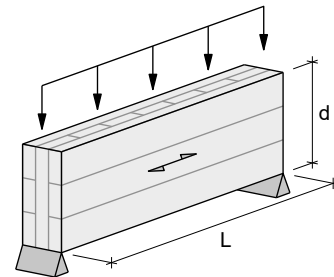
- a) The edgewise bending moment capacity, M_e , and the effective edgewise bending stiffness, $(EI)_{\text{eff},e}$, values shall be based on the effective width in edgewise bending and depth of the panel, $b_{\text{eff},e}$ and d (see table above and figures below), respectively. Calculations shall be based on S-P-F No. 3 lumber ($F_b = 500$ psi, $E = 1,200,000$ psi) for loading parallel to outermost layer, or on S-P-F 1950f MSR lumber ($F_b = 1,950$ psi, $E = 1,700,000$ psi) for loading perpendicular to outermost layer.
- b) The edgewise shear capacity values, V_e , shall be based on the gross cross-sectional area of the panel.
- c) $G_{e,0}$ and $G_{e,90} = 36,200$ psi based on product performance testing. Edgewise shear rigidity, $(GA)_{\text{eff},e}$, shall be calculated by multiplying G_{e,t_p} by the member depth, d , in feet (see figures below).

Notes:

- The tabulated design values are for dry service conditions and normal duration of loading.
- The compressive capacity perpendicular to grain values shall be based on S-P-F No. 3 lumber ($f_{cp} = 425$ psi).
- The specific gravity for dowel-type fastener design is 0.42.
- The density for member weight is 32 pcf for a moisture content of 12%.
- Design of CLT members shall be in accordance with the NDS.



Loading parallel to outermost layers



Loading perpendicular to outermost layers