

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 1950 F_b-1.7E Spruce-Pine-Fir (S-P-F) MSR lumber in longitudinal layers and No. 3/Stud 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-L306C) 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	1950 F _b -1.7E MSR	No. 3/Stud
Stress class		
Bending at extreme fibre, f_b (MPa)	28.2	7.0
Longitudinal shear, f_v (MPa)	1.5	1.5
Rolling shear, f_s (MPa)	0.5	0.5
Compression parallel to grain, f_c (MPa)	19.3	9.0
Compression perpendicular to grain, f_{cp} (MPa)	5.3	5.3
Tension parallel to grain, f_t (MPa)	15.4	3.2
Modulus of elasticity, E (MPa)	11 700	9 000
Shear modulus, G (MPa)	731	563
Rolling shear modulus, G_s (MPa)	73.1	56.3

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	72.1	0.71	14.8
140-4l	35L - 35L - 35T - 35L	4	140	5-1/2	72.1	0.71	14.8
315-9l	35L - 35L - 35T - 35L - 35T - 35L - 35T - 35L - 35L	9	315	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 = 35 mm, 19 = 19.1 mm

Floor/Roof Slabs – Design Properties

Floor/Roof Slabs – Design Properties

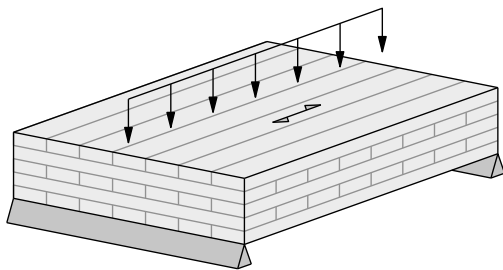
CLT stress grade	E1 (L = 1950 F _b -1.7E S-P-F MSR and T = No. 3/Stud S-P-F)		
Layup	140-4s	140-4l	315-9l
Bending in the major strength direction			
Flatwise bending moment resistance, $M_{r,f,0}$ (kN-m/m) ^(a)	62	60	310
Flatwise shear resistance, $V_{r,f,0}$ (kN/m) ^(b)	42	42	95
Effective flatwise bending stiffness, $(EI)_{eff,f,0}$ (10 ⁹ N-mm ² /m)	2 350	2 473	26 442
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,0}$ (10 ⁶ N/m)	8.5	11	29
Bending in the minor strength direction			
Flatwise bending moment resistance, $M_{r,f,90}$ (kN-m/m) ^(a)	5.1	1.3	26
Flatwise shear resistance, $V_{r,f,90}$ (kN/m) ^(b)	21	11	53
Effective flatwise bending stiffness, $(EI)_{eff,f,90}$ (10 ⁹ N-mm ² /m)	257	32	3 220
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,90}$ (10 ⁶ N/m)	18	9.8	29

a) The factored flatwise bending moment resistance values, $M_{r,f}$, include the resistance factor, ϕ , and the adjustment factor K_{tp} as defined in CSA O86:19.

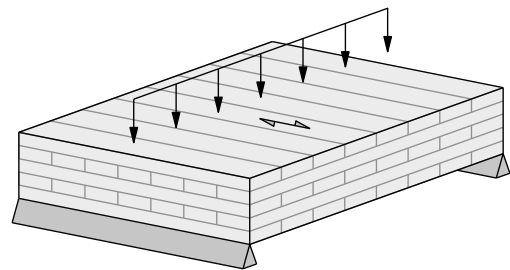
b) The factored flatwise shear resistance values, $V_{r,f}$, include the resistance factor, ϕ .

Notes:

1. The tabulated design values are for dry service conditions and standard-term duration of load.
2. The compressive resistance perpendicular to grain values shall be based on S-P-F No. 3/Stud lumber ($f_{cp} = 5.3$ MPa).
3. The specific gravity for dowel-type fastener design, G , is 0.42.
4. The density for member weight is 515 kg/m³ (5.1 kN/m³) for a moisture content of 12%.
5. Design of CLT members shall be in accordance with CSA O86:19.



Bending in the major strength direction



Bending in the minor strength direction

Walls – Design Properties

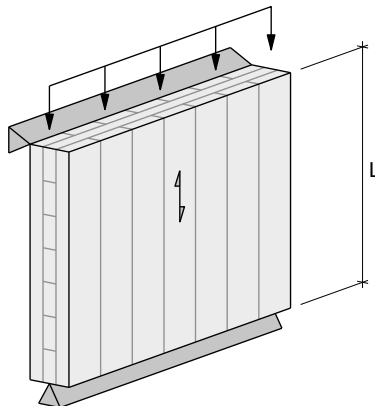
Walls – Design Properties

CLT stress grade	E1 (L = 1950 F _b -1.7E S-P-F MSR and T = No. 3/Stud S-P-F)		
Layup	140-4s	140-4l	315-9l
Loading parallel to outermost layers			
Compression in the major strength direction			
Compressive resistance, $P_{r,0}$ (kN/m) ^(a)	1 081	1 621	3 242
Effective cross-sectional area, $A_{eff,0}$ (10 ³ mm ² /m)	70	105	210
Effective out-of-plane moment of inertia, $I_{eff,0}$ (10 ⁶ mm ⁴ /m)	200	211	2 251
Effective out-of-plane radius of gyration, $r_{eff,0}$ (mm/m)	53	45	104
Bending in the major strength direction			
Flatwise bending moment resistance, $M_{r,f,0}$ (kN-m/m) ^(b)	62	60	310
Flatwise shear resistance, $V_{r,f,0}$ (kN/m) ^(c)	42	42	95
Effective flatwise bending stiffness, $(EI)_{eff,f,0}$ (10 ⁹ N-mm ² /m)	2 350	2 473	26 442
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,0}$ (10 ⁶ N/m)	8.5	11	29
Loading perpendicular to outermost layers			
Compression in the minor strength direction			
Compressive resistance, $P_{r,90}$ (kN/m) ^(a)	504	252	756
Effective cross-sectional area, $A_{eff,90}$ (10 ³ mm ² /m)	70	35	105
Effective out-of-plane moment of inertia, $I_{eff,90}$ (10 ⁶ mm ⁴ /m)	29	3.6	354
Effective out-of-plane radius of gyration, $r_{eff,90}$ (mm/m)	20	10	58
Bending in the minor strength direction			
Flatwise bending moment resistance, $M_{r,f,90}$ (kN-m/m) ^(b)	5.1	1.3	26
Flatwise shear resistance, $V_{r,f,90}$ (kN/m) ^(c)	21.0	11	53
Effective flatwise bending stiffness, $(EI)_{eff,f,90}$ (10 ⁹ N-mm ² /m)	257	32	3 220
Effective shear stiffness in flatwise bending, $(GA)_{eff,f,90}$ (10 ⁶ N/m)	18	9.8	29

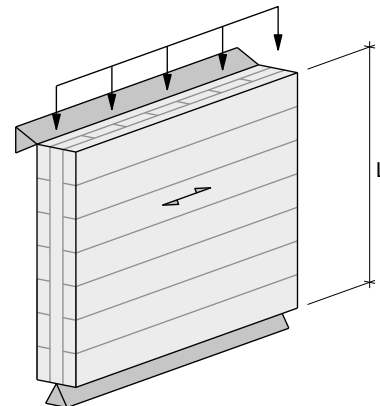
- a) The factored compressive resistance under axial load, P_r , include the resistance factor, ϕ . Furthermore, these values shall be adjusted by the size and slenderness factors, K_{Zc} and K_C , respectively, as defined in CSA O86:19.
- b) The factored flatwise bending moment resistance values, $M_{r,f}$, include the resistance factor, ϕ , and the adjustment factor $K_{r,b}$ as defined in CSA O86:19.
- c) The factored flatwise shear resistance values, $V_{r,f}$, include the resistance factor, ϕ .

Notes:

- The tabulated design values are for dry service conditions and standard-term duration of load.
- The compressive resistance perpendicular to grain values shall be based on S-P-F No. 3/Stud lumber ($f_{cp} = 5.3$ MPa).
- The specific gravity for dowel-type fastener design, G , is 0.42.
- The density for member weight is 515 kg/m³ (5.1 kN/m³) for a moisture content of 12%.
- Design of CLT members shall be in accordance with CSA O86:19.



Loading parallel to outermost layers



Loading perpendicular to outermost layers

Shear Walls, Lintels, and Diaphragms – Design Properties

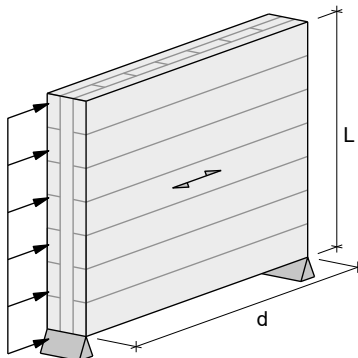
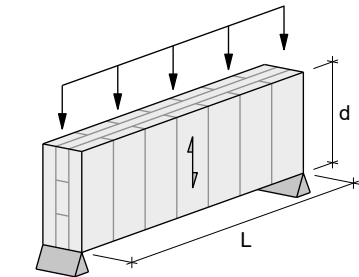
Shear Walls, Lintels, and Diaphragms – Design Properties

CLT stress grade	E1 (L = 1950 F _b -1.7E S-P-F MSR and T = No. 3/Stud S-P-F)		
Layup	140-4s	140-4l	315-9l
Loading parallel to outermost layers			
Edgewise bending in the minor strength direction			
Effective width in edgewise bending, $b_{\text{eff},e,90}$ (mm) ^(a)	70	35	105
Specified edgewise shear strength, $f_{v,e,90}$ (MPa) ^(b)	2.4	2.4	2.7
Shear stiffness in edgewise bending, $G_{e,90}t_p$ (10 ⁶ N/m) ^(c)	35	35	79
Loading perpendicular to outermost layers			
Edgewise bending in the major strength direction			
Effective width in edgewise bending, $b_{\text{eff},e,0}$ (mm) ^(a)	70	105	210
Specified edgewise shear strength, $f_{v,e,0}$ (MPa) ^(b)	1.8	2.0	2.4
Shear stiffness in edgewise bending, $G_{e,0}t_p$ (10 ⁶ N/m) ^(c)	35	35	79

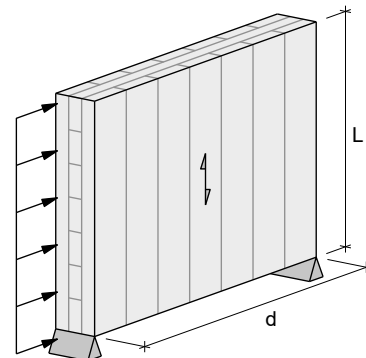
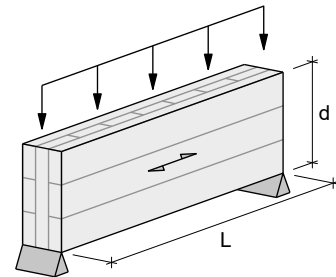
- a) The factored edgewise bending moment resistance, $M_{r,e}$, and the effective edgewise bending stiffness, $(EI)_{\text{eff},e}$, values shall be based on the effective width in edgewise bending and depth of the panel, $b_{\text{eff},e}$ and d (see table above and figures below), respectively, and Clause 7.5.6.5 of CSA O86:19. Calculations shall be based on S-P-F No. 3/Stud lumber ($f_b = 7.0$ MPa, $E = 9\,000$ MPa) for loading parallel to outermost layers, or on S-P-F MSR 1950 F_b-1.7E lumber ($f_b = 28.2$ MPa, $E = 11\,700$ MPa) for loading perpendicular to outermost layers.
- b) The factored edgewise shear resistance values, $V_{r,e}$, shall be based on Clause 7.5.7.3b) of CSA O86:19, taking into account the gross cross-sectional area of the panel and using the specified edgewise shear strength, $f_{v,e}$.
- c) $G_{e,0}$ and $G_{e,90} = 250$ MPa based on product performance testing. Shear stiffness in edgewise bending, $(GA)_{\text{eff},e}$, shall be calculated by multiplying G_{e,t_p} by the member depth, d (see figures below).

Notes:

- The tabulated design values are for dry service conditions and standard-term duration of load.
- The compressive resistance perpendicular to grain values shall be based on S-P-F No. 3/Stud lumber ($f_{cp} = 5.3$ MPa).
- The specific gravity for dowel-type fastener design, G , is 0.42.
- The density for member weight is 515 kg/m³ (5.1 kN/m³) for a moisture content of 12%.
- Design of CLT members shall be in accordance with CSA O86:19.



Loading parallel to outermost layers



Loading perpendicular to outermost layers