Supplier	CLT Layup	Orientation	Method		
XLam	XL5/200	Primary Vertical	ProHolz		
Design Method	**Loading Code**	**Load Combinations**	**$f'_{V,gross,k}$ (MPa)**	**$f'_{V,net,k}$ (MPa)**	**$f'_{t,k}$ (MPa)**
Eurocode 5	Eurocode 1	Default Load Combination	2.5	5	1.5

Loading Data

G_{sdl}	Q	H_{beam}
2 (kN/m)	2 (kN/m)	0.5 (m)

Loading Conditions

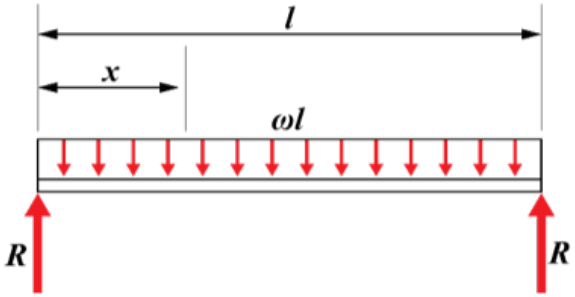
Condition	Span	Transverse Direction Lamellas Width, b_{90} (mm)	Longitudinal Direction Lamellas Width, b_0 (mm)
Simply Supported	4.00 (m)	85 (mm)	50 (mm)

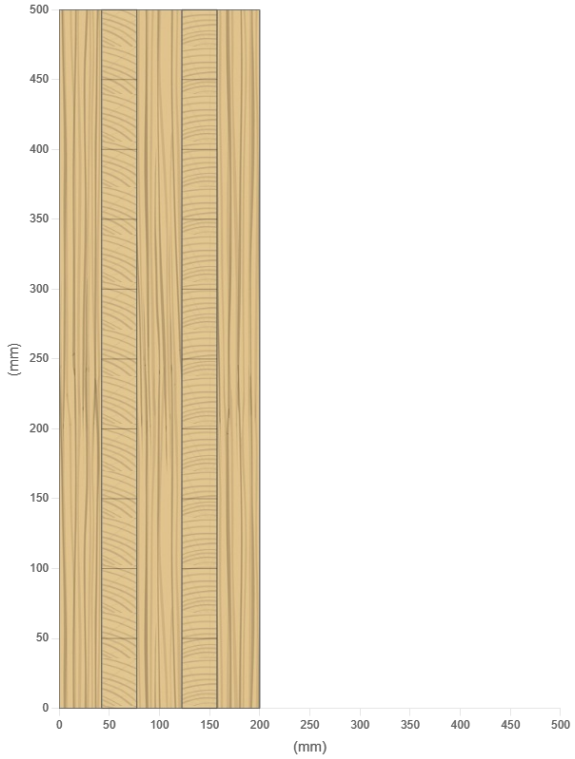
Design Data Eurocode 5

$\phi_{2,1}$	k_{sys}	w_c	Service Class	Deflection Ratio (inst)	Deflection Ratio (net,fin)
0.3	1.08	0.4	1	300	300

Output Summary

Deflection	Bending	Shear
OK	OK	OK
39.24%	90.85%	22.71%





Panel Properties

H_{beam} (m)	0.5

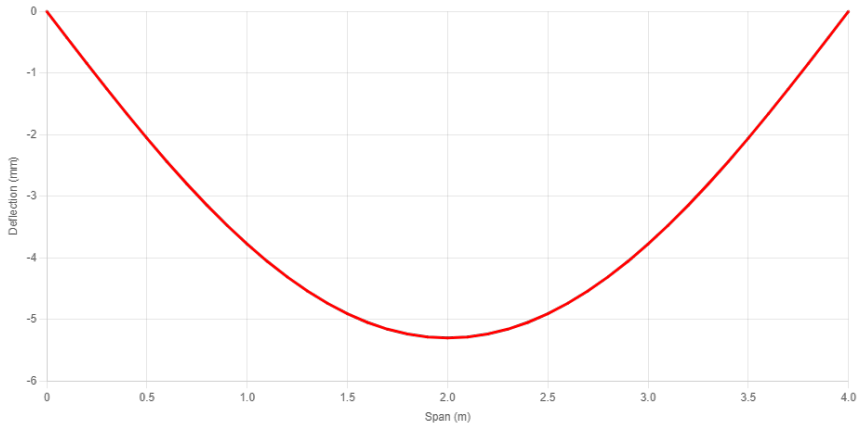
t		Orientation	Grade	E (MPa)	f'_b (MPa)	ρ (kg/m3)
t_1	42.50	90	MGP10	0	17	500
t_2	35.00	0	MGP6	6000	10	480
t_3	45.00	90	MGP6	0	10	480
t_4	35.00	0	MGP6	6000	10	480
t_5	42.50	90	MGP10	0	17	500

Calculate Section Modulus

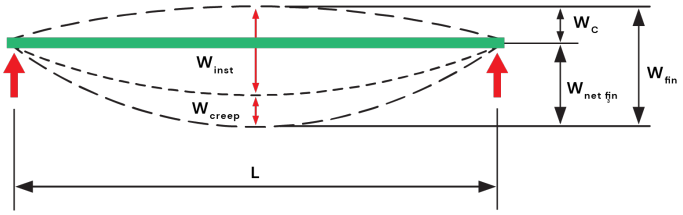
t		d_{90} (mm)	$b_{eff}\ t_i^3/12$ (mm^4)	EI_{eff} (Nmm^2)	Z_{eff} (mm^3)
t_1	0.00	0.00	0.0e+0	0.0e+0	0.0e+0
t_2	35.00	85.00	3.6e+8	2.2e+12	1.5e+6
t_3	0.00	0.00	0.0e+0	0.0e+0	0.0e+0
t_4	35.00	85.00	3.6e+8	2.2e+12	1.5e+6
t_5	0.00	0.00	0.0e+0	0.0e+0	0.0e+0

Bending Stiffness Properties of CLT		**Primary**
EI_{eff} (Nmm^2)	Bending Stiffness (assuming perfect connection between layers)	4.38e+12
Z_{eff} (mm^3)	Section modulus (using EI eff with perfect connection)	2.92e+6

Deflection

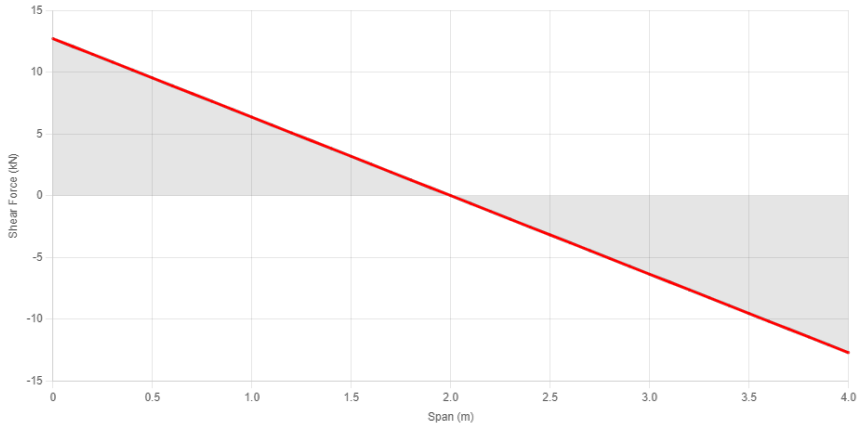


$G_{beam\ sw}$ (kN/m)	0.49	
G_{sdl} (kN/m)	2.00	
G_{total} (kN/m)	2.49	
Q_{total} (kN/m)	2.00	
$\Psi_{2,1}$	0.30	
k_{deff}	0.60	
EI_{eff} (Nmm^2)	4.38e+12	Ambient conditions



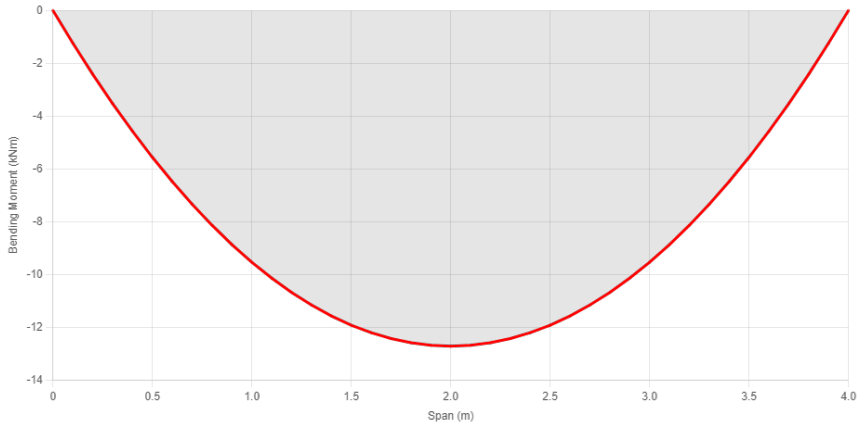
	w (kN/m)	Deflection (mm)	Limit (mm)	
w_{inst}	4.5	-3.4	13.33	25.6%
w_{creep}	1.9	-1.41		
w_c		0.40		
w_{fin}	6.3	-4.8	13.3	
$w_{net,fin}$		-5.23		39.2%

Shear Actions



	Ambient	Ambient
Load Combination	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W
w (kN/m)	6.36	6.36
V^*max	12.72	12.72

Bending Moment Actions



	Ambient	Ambient
Load Combination	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W
M^*_+ (kNm)	0.00	0.00
M^*_- (kNm)	-12.72	-12.72

Bending Design

$$\sigma_{m,z,d} = \frac{M_{z,d}}{W_{z,net}} \leq f_{m,d} = k_{mod} \frac{f_{m,k}}{\gamma_m}$$

k_{sys}
1.08

Z_{eff} (mm^3)	2.92e+6	
$f'_{m,k}$ (MPa)	10	Minimum of all layers assumed.

	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W	
k_{mod}	0.60	0.90	
γ_M	1.25	1.25	
$f_{m,d}$ (kNm)	4.80	7.20	
M^*_+(kNm)	12.72	12.72	
$\sigma_{m,y,d}$	4.36	4.36	
Ratio	91%	61%	91%

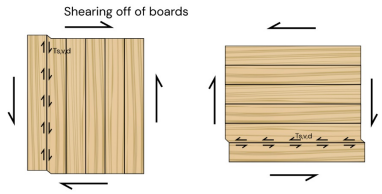
Shear Design

Mechanism 1: Shearing-off failure of the boards along a joint.

$$\tau_{v,net,d} \leq f_{v,net,d}$$

$$\tau_{v,net,d} = \frac{V_{net,d}}{A_{x,net}}$$

$$f'_{v,net,d} = k_{mod} \frac{f_{v,net,k}}{\gamma_m}$$



$f_{V,net,k}$ (MPa)	5.00	
A_0 (mm^2)	3.50e+4	Along height of beam
A_{90} (mm^2)	5.20e+5	Along length of beam
$A_{x,net}$ (mm^2)	2.33e+4	Minimum value taken

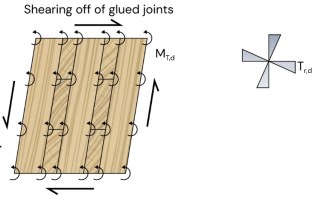
	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W	
k_{mod}	0.60	0.90	
γ_M	1.25	1.25	
$f_{v,net,d}$ (MPa)	2.40	3.60	
V_{max} (kN)	12.72	4.05	
$\tau_{net,d}$ (MPa)	0.55	0.17	
Ratio	22.71%	4.82%	23%

Mechanism 2: Shearing failure of the glued surface at the intersection of joints.

$$\tau_{T,d} \leq f_{v,T,d} \qquad W_p = \frac{I_p}{\frac{d}{2}}$$

$$\tau_{T,d} = \frac{M_{T,d}}{n_t W_p}$$

$$f_{v,T,d} = k_{mod}\frac{f_{v,T,k}}{\gamma_m} \qquad n_t = n_s \times n_f \qquad I_p = \frac{bd(b^2+d^2)}{12}$$



$f_{t,k}$ (MPa)	1.50	Shear of glued surfaces (Mechanism 2)
$\Sigma n_k I_p$ (mm^4)	1.38e+9	
a_{des}	50.00	Take largest board width in direction of load (most conservative)

	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W	
k_{mod}	0.60	0.90	
γ_M	1.25	1.25	
$f_{v,T,d}$ (MPa)	0.72	1.08	
$M_{T,d}$ (kNm)	1.08	1.08	
$\tau_{T,d}$ (MPa)	0.02	0.02	
Ratio	3%	2%	3%

Mechanism 3: Shearing-off failure of the boards along a joint.

$$\tau_{v,gross,d} \leq f_{v,gross,d}$$

$$\tau_{v,gross,d} = \frac{V_{net,d}}{A_{gross}}$$

$$f_{v,gross,d} = k_{mod}\frac{f_{v,gross,k}}{\gamma_M}$$

$f_{V,gross,k}$ (MPa)	2.50	Shear of entire plate strength (Mechanism 3)
A_{gross} (mm^2)	1.00e+5	Along height of beam

	1.35G + 1.50Q	1.35G + 1.50Q + 0.90W	
k_{mod}	0.60	0.90	
γ_M	1.25	1.25	
$f'_{v,gross,d}$(MPa)	1.20	1.80	
V_d(kN)	12.72	12.72	
$\tau_{gross,d}$(MPa)	0.13	0.13	
Ratio	10.60%	7.07%	11%