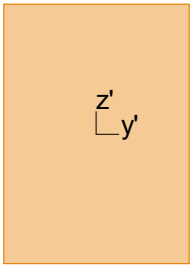
C.28.1
Maximum of load combinations

C30
(Solid), Service class 1

$E_{0,05}$	=	8000 N/mm^2	$f_{t,90,k}$	=	0.40 N/mm^2
$G_{0,05}$	=	500 N/mm^2	$f_{c,0,k}$	=	24.00 N/mm^2
γ_M	=	1.25	$f_{c,90,k}$	=	2.70 N/mm^2
$\gamma_{M,acc./seis.}$	=	1.00	$f_{v,k}$	=	4.00 N/mm^2
k_{sys}	=	1.00			

Sawn lumber 125x175



A	=	21875 mm^2	$f_{t,0,k}$	=	19.00 N/mm^2
W_1	=	6.380e+05 mm^3	$f_{m,1,k}$	=	30.00 N/mm^2
W_2	=	4.557e+05 mm^3	$f_{m,2,k}$	=	31.11 N/mm^2
i_1	=	51 mm			
i_2	=	36 mm			
I_2	=	2.848e+07 mm^4			
I_t	=	6.388e+07 mm^4			

Combined bending and axial tension - 6.2.3
Not relevant

Combined bending and axial compression - 6.1.4, 6.2.4
LC: 'LC5ULS', k_{mod} = 0.90, x = 3000.00 mm

$\sigma_{c,0,d}$ = 4.92 N/mm^2 ≤ $f_{c,0,d}$ = 17.28 N/mm^2 (6.2) - OK

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,1,d}}{f_{m,1,d}} + k_m \frac{\sigma_{m,2,d}}{f_{m,2,d}} = \left(\frac{4.92}{17.28}\right)^2 + \frac{5.41}{21.60} + 0.70\,\frac{0.02}{22.40} = 0.33 \le 1.00 \quad \text{(6.19) - OK}$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,1,d}}{f_{m,1,d}} + \frac{\sigma_{m,2,d}}{f_{m,2,d}} = \left(\frac{4.92}{17.28}\right)^2 + 0.70\,\frac{5.41}{21.60} + \frac{0.02}{22.40} = 0.26 \le 1.00 \quad \text{(6.20) - OK}$$

Combined shear and torsion - 6.1.7, 6.1.8
LC: 'LC5ULS', k_{mod} = 0.90, x = 2000.00 mm

τ_d = 0.17 N/mm^2 ≤ $f_{v,d}$ = 2.88 N/mm^2 (6.13) - OK

Flexural buckling around axis 1 - 6.3.2

LC: 'LC5ULS', k_{mod} = 0.90, x = 3000.00 mm

$\beta_c = 0.2$ (6.29)

$$\lambda_1 = \frac{l_0}{i_1} = \frac{3000}{51} = 59.38$$

$$\lambda_{rel,1} = \frac{\lambda_1}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,05}}} = \frac{59.38}{\pi}\sqrt{\frac{24.00}{8000}} = 1.035 \quad (6.21)$$

$$k_1 = 0.5\left(1 + \beta_c\left(\lambda_{rel,1} - 0.3\right) + \lambda_{rel,1}^{\ 2}\right) =$$

$$= 0.5\left(1 + 0.2\left(1.035 - 0.3\right) + 1.035^2\right) = 1.110 \quad (6.27)$$

$$k_{c,1} = \frac{1}{k_1 + \sqrt{k_1^{\ 2} - \lambda_{rel,1}^{\ 2}}} = \frac{1}{1.110 + \sqrt{1.110^2 - 1.035^2}} = 0.663 \quad (6.25)$$

$$\frac{\sigma_{c,0,d}}{k_{c,1} \cdot f_{c,0,d}} + \frac{\sigma_{m,1,d}}{f_{m,1,d}} + k_m \cdot \frac{\sigma_{m,2,d}}{f_{m,2,d}} = \frac{4.92}{0.663 \cdot 17.28} + \frac{5.41}{21.60} + 0.70 \cdot \frac{0.02}{22.40} = 0.68 \le 1.00 \quad (6.23) \text{ - OK}$$

Flexural buckling around axis 2 - 6.3.2

LC: 'LC5ULS', k_{mod} = 0.90, x = 3000.00 mm

$\beta_c = 0.2$ (6.29)

$$\lambda_2 = \frac{l_0}{i_2} = \frac{3000}{36} = 83.14$$

$$\lambda_{rel,2} = \frac{\lambda_2}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,05}}} = \frac{83.14}{\pi}\sqrt{\frac{24.00}{8000}} = 1.449 \quad (6.22)$$

$$k_2 = 0.5\left(1 + \beta_c\left(\lambda_{rel,2} - 0.3\right) + \lambda_{rel,2}^{\ 2}\right) =$$

$$= 0.5\left(1 + 0.2\left(1.449 - 0.3\right) + 1.449^2\right) = 1.665 \quad (6.28)$$

$$k_{c,2} = \frac{1}{k_2 + \sqrt{k_2^{\ 2} - \lambda_{rel,2}^{\ 2}}} = \frac{1}{1.665 + \sqrt{1.665^2 - 1.449^2}} = 0.402 \quad (6.26)$$

$$\frac{\sigma_{c,0,d}}{k_{c,2} \cdot f_{c,0,d}} + k_m \cdot \frac{\sigma_{m,1,d}}{f_{m,1,d}} + \frac{\sigma_{m,2,d}}{f_{m,2,d}} = \frac{4.92}{0.402 \cdot 17.28} + 0.70 \cdot \frac{5.41}{21.60} + \frac{0.02}{22.40} = 0.88 \le 1.00 \quad (6.24) \text{ - OK}$$

Lateral torsional buckling - 6.3.3

LC: 'LC5ULS', k_{mod} = 0.90, x = 3000.00 mm

$$l_{ef} = l \,/\, \frac{12.5 \cdot M_{max}}{2.5 \cdot M_{max} + 3 \cdot M_2 + 4 \cdot M_3 + 3 \cdot M_4} + 2 \cdot h =$$

$$= 3000 \,/\, \frac{12.5 \cdot 3.45}{2.5 \cdot 3.45 + 3 \cdot 0.32 + 4 \cdot 0.94 + 3 \cdot 2.19} + 2 \cdot 175 = 1735 \text{ mm}$$

$$\sigma_{m,crit} = \frac{\pi\sqrt{E_{0,05} \cdot I_2 \cdot G_{0,05} \cdot I_t}}{l_{ef} \cdot W_1} = \frac{\pi\sqrt{8000 \cdot 2.848e{+}07 \cdot 500 \cdot 6.388e{+}07}}{1735 \cdot 6.380e{+}05} = 242.08 \text{ N/mm}^2 \quad (6.31)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,1,k}}{\sigma_{m,crit}}} = \sqrt{\frac{30.00}{242.08}} = 0.352 \quad (6.30)$$

$\lambda_{rel,m} = 0.352 \le 0.75 \rightarrow k_{crit} = 1.000$ (6.34)

$$\frac{\sigma_{m,1,d}}{k_{crit} \cdot f_{m,1,d}} = \frac{5.41}{1.000 \cdot 21.60} = 0.25 \le 1.00 \quad (6.33) \text{ - OK}$$

$$\left(\frac{\sigma_{m,1,d}}{k_{crit} \cdot f_{m,1,d}}\right)^2 + \frac{\sigma_{c,0,d}}{k_{c,2} \cdot f_{c,0,d}} = \left(\frac{5.41}{1.000 \cdot 21.60}\right)^2 + \frac{4.92}{0.40 \cdot 17.28} = 0.77 \le 1.00 \quad (6.35) \text{ - OK}$$

Bending at apex - 6.4.3
Not relevant

Tension at apex - 6.4.3
Not relevant

Summary