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Civil, Structural & Environmental Engineering

Stud work: 150 x 44 @ 600 mm h = 3 m Vertical load D: 8 kN/m I: 8 kN/m Lateral Load 1.0 kN/m²	Project: Engineers Ireland Eurocode		Course & Year:
	Part of structure: Timber stud		Calc. Sheet No.: 1
	Drawing Ref.	Calculations by: JJM	Checked by	Date: 20/10/09

REFERENCE	CALCULATIONS	OUTPUT
	Assume no load sharing and stud restrained at mid height about z axis $l_{ez} = 1500$ mm $l_{ey} = 3000$ mm	
	Dead load 8 kN/m x 0.6 m : 4.8 kN/stud Imposed load 8 kN/m x 0.6m : 4.8 kN/stud Wind load 1 kN/m² x 0.6m : 0.6 kN/m per stud $\psi_0 = 0.7$ (Table NA2)	
EN1990 Eq 6.10	$1.35 \times 4.8 + 1.5 \times 4.8$ = 13.68 kN axial $0.7 \times 1.5 \times 0.6$ = 0.63 kN/m udl M = 0.71 kNm ($ql^2/8$)	Imposed leading 13.68 kN axial M = 0.71 kNm
	$1.35 \times 4.8 + 0.7 \times 1.5 \times 4.8$ = 11.52 kN axial 1.5×0.6 = 0.9 kN/m udl M = 1.01 kNm	Wind leading 11.52 kN axial M = 1.01 kNm
	Do calculations for N = 11.52 kN M = 1.01 kNm (Other combination should also be checked)	
EN 338 Table 1	C20 $f_{m,k} = 20$ N/mm² $f_{c,0,k} = 19$ N/mm² $E_{0,05} = 6.4$ kN/mm² $G_{0,05} = 0.59$ kN/mm²	
	$\sigma_{m,y,d} = \frac{1.01 \times 10^6}{\frac{44 \times 150^2}{6}} = 6.136$ N/mm²	$\sigma_{m,y,d} = 6.136$ N/mm²
	$\sigma_{c,0,d} = \frac{11520}{44 \times 150} = 1.745$ N/mm²	$\sigma_{c,0,d} = 1.745$ N/mm²
Table 2.3	$\gamma_M = 1.3$	
Table 3.1	$k_{mod} = 0.9$ (short-term) (Service class 2)	
Cl. 3.2 (3)	k_h does not apply	

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Bending + axial stress Stability	Project: Engineers Ireland Eurocode		Course & Year:
	Part of structure: Timber stud		Calc. Sheet No.: 2
	Drawing Ref.	Calculations by: JTM / Checked by	Date: 20/10/09

REFERENCE	CALCULATIONS	OUTPUT
Cl 3.4.1 (1)	$f_{c,0,d} = \frac{f_{c,0,k} \times k_{mod}}{\gamma_M} = \frac{19 \times 0.9}{1.3} = 13.154 N/mm^2$	
	$f_{m,y,d} = \frac{f_{m,k} \times k_{mod}}{\gamma_M} = \frac{20 \times 0.9}{1.3} = 13.846 N/mm^2$	
Cl 6.2.4 Eq 6.19	$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{my,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \leq 1$	
	$\left(\frac{1.745}{13.154}\right)^2 + \frac{6.136}{13.846} + 0 = 0.461 \leq 1$ → OK	Combined stresses OK
	$\lambda_y = \frac{3000}{150/\sqrt{12}} = 69.28$	
Cl. 6.3.2	$\lambda_z = \frac{1500}{44/\sqrt{12}} = 118.09$	
Eqn 6.21	$\lambda_{rel,y} = \frac{69.28}{\pi}\sqrt{\frac{19}{6400}} = 1.202$	
Eqn 6.22	$\lambda_{rel,z} = \frac{118.09}{\pi}\sqrt{\frac{19}{6400}} = 2.048$	
Eqn 6.27	$k_y = 0.5\left(1 + 0.2(1.202 - 0.3) + 1.202^2\right) = 1.313$	
Eqn 6.25	$k_{cy} = \frac{1}{1.313 + \sqrt{1.313^2 - 1.202^2}} = 0.543$	
Eqn 6.28	$k_z = 0.5\left(1 + 0.2(2.048 - 0.3) + 2.048^2\right) = 2.772$	
Eqn 6.26	$k_{cz} = \frac{1}{2.772 + \sqrt{2.772^2 - 2.048^2}} = 0.216$	

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Civil, Structural & Environmental Engineering

Stability	Project: Engineers Ireland Eurocode		Course & Year:
	Part of structure: Timber stud		Calc. Sheet No.: 3
	Drawing Ref.	Calculations by: JOM / Checked by	Date: 20/10/09

REFERENCE	CALCULATIONS	OUTPUT
Eqn 6.23	$\frac{1.745}{0.543 \times 13.154} + \frac{6.136}{13.846} = 0.687 \leq 1$	Stability of 'column' OK
Eqn 6.24	$\frac{1.745}{0.216 \times 13.154} + 0.7\,\frac{6.136}{13.846} = 0.924 \leq 1$	
Cl 6.1.6(2)	$(k_m = 0.7)$	
Eqn 6.32	$\sigma_{m,crit} = \frac{0.78 \times 44^2}{150 \times 2700} \times 6400 = 23.863\ N/mm^2$	
Table 6.1	$l_{ef} = 0.9 \times 3000 = 2700\ mm$	
Eqn 6.30	$\lambda_{rel,m} = \sqrt{\frac{20}{23.863}} = 0.915$	
Eqn 6.34	$k_{crit} = 1.56 - 0.75 \times 0.915 = 0.873$	
Eqn 6.35	$\left(\frac{6.136}{0.873 \times 13.846}\right)^2 + \frac{1.745}{0.216 \times 13.154} = 0.872 \leq 1$	Stability of 'beam' OK