

EuroBeam from Greentram Software

Typical calculations produced by the pre-release version

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EuroBeam 1.00x0

Draycott.eub

Calculations for timber post/stud to BS EN1995 using C16 timber

Location: Draycott example 2.10: Timber post, offset load

PosDur	Load	kN	Factored load		Offset	Moment y-y		Moment z-z	
			6.10a	6.10b		6.10a	6.10b	6.10a	6.10b
1 G	Axial load	$20.0/1.35 = 14.81$	<u>20.00</u>		-22.	<u>1.01</u>			
	Total load	<u>14.81</u>	20.00			1.01		0.00	

Load offsets are measured in mm. from faces of member; moments in kNm

Load durations: G: Dead

Member length = 3.5 m

Use: 97 x 145 C16

Cross sectional area = 14,065 mm² $Z_{yy} = 339.9 \text{ cm}^3$

Timber grade: C16

Loading duration factor, $k_{mod} = 0.8$ [EC5 Table 3.1] K_{sys} (load sharing factor) = 1.0

Material partial factor, $\gamma_m = 1.3$ [EC3 NA Table NA.3]

Grade compression stress, $f_{c,0,k} = 17.0 \text{ N/mm}^2$

Design compressive strength, $f_{c,0,d} = k_{mod} \cdot k_{sys} \cdot f_{c,0,k} / \gamma_m = 0.8 \times 1.0 \times 17.0 / 1.3 = 10.46 \text{ N/mm}^2$

Grade bending stress, $f_{m,k} = 16.0 \text{ N/mm}^2$

Design bending strength, $f_{m,d} = k_{mod} \cdot k_{sys} \cdot f_{m,k} / \gamma_m = 0.8 \times 1.0 \times 16.0 / 1.3 = 9.85 \text{ N/mm}^2$

Depth factors, $k_{h,y} = (150/145)^{0.2} = 1.01$; $k_{h,z} = (150/97)^{0.2} = 1.09$ [EC5 3.2]

Applying k_h depth factors $f_{m,y,d} = 1.01 \times 9.85 = 9.91 \text{ N/mm}^2$ $f_{m,z,d} = 1.09 \times 9.85 = 10.74 \text{ N/mm}^2$

Compression y-y axis

Applied compressive stress, $\sigma_{c,0,d} = 20.0 \times 1000 / (97 \times 145) = 1.42 \text{ N/mm}^2$

Effective length = $L_{Ev} = 1.0L = 3.5 \text{ m}$

Slenderness, $\lambda_v = 3.5 \times 1000 / (145 / \sqrt{12}) = 83.6$ $\lambda_{rel,y} = 1.49$

$k_v = 1.73$ $k_{c,v} = 0.382$

Permissible compressive stress = $k_{c,v} \cdot f_{c,0,d} = 0.382 \times 10.46 = 4.00 \text{ N/mm}^2$

Ultimate axial load capacity = $4.00 \times 97 \times 145 = 56.2 \text{ kN}$

Compression z-z axis

Applied compressive stress, $\sigma_{c,0,d} = 20.0 \times 1000 / (97 \times 145) = 1.42 \text{ N/mm}^2$

Effective length = $L_{Ez} = 1.0L = 3.5 \text{ m}$

Slenderness, $\lambda_v = 3.5 \times 1000 / (97 / \sqrt{12}) = 125$ $\lambda_{rel,z} = 2.23$

$k_z = 3.18$ $k_{c,z} = 0.183$

Permissible compressive stress = $k_{c,z} \cdot f_{c,0,d} = 0.183 \times 10.46 = 1.92 \text{ N/mm}^2$

Ultimate axial load capacity = $1.92 \times 97 \times 145 = 27.0 \text{ kN} \lll \text{ OK}$

Bending about y-y axis:

Elastic section modulus, $W_{yy} = 97 \times 145^2 / (6 \times 1000) = 339.9 \text{ cm}^4$

Applied moment = 1.01 kNm

Design bending stress, $\sigma_{m,v,d} = 1.01 \times 1000 / 339.9 = 2.97 \text{ N/mm}^2$

Moment capacity = $9.91 \times 339.9 / 1000 = 3.37 \text{ kNm OK}$

Bending about z-z axis:

N/A

Combined compression and bending

Ratios: Buckling y-axis : $1.42/4.00 = 0.356$

Buckling z-axis : $1.42/1.92 = 0.742$

Bending y-axis : $2.97/9.91 = 0.300$

Bending z-axis : $0.00/10.74 = 0.000$

Check 1: $0.356 + 0.300 + 0.7 \times 0.000 = 0.655 \leq 1.0 \text{ OK}$

Check 2: $0.742 + 0.7 \times 0.300 + 0.000 = 0.952 \leq 1.0 \text{ OK}$