Beam: Draycott examples 2.2/2.7: Timber beam Span: 4.25 m.

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	G	Dead load	2.0/L	0		L	1.00	1.00
U	QB	Imposed load	3.5/L	0		L	1.75	1.75
					Total load (unfactored): 5.50 kN		2.75	2.75
					Dead/Permanent (unfactored): 2.00 kN		1.00	1.00
					Live/Variable (unfactored): 3.50 kN		1.75	1.75
						(6.10): 7.95 kN	3.97	3.97

Load types: U:UDL; Load positions are measured in m. from R1
Load durations: G: Dead; Qx: Imposed: QB: Office

Maximum B.M. = 4.22 kNm (6.10) at 2.13 m. from R1

Maximum S.F. = -3.97 kN (6.10) at R2

Mid-span deflections: Dead: 2.00 x 10^8/EI *(E in N/mm^2, I in cm^4)*
Live: 3.50 x 10^8/EI
Total: 5.50 x 10^8/EI

Timber beam calculation to BS EN1995-1-1 using C16 timber

Use 72 x 220 C16 *5.9 kg/m approx*

$W_{el,y}$ = 580.8 cm^3 I_y = 6,389 cm^4 Depth factor, $k_{h,y}$ = 1.00 [EC5 eq.(3.1)]

Timber grade: C16

Grade bending strength, $f_{m,k}$ = 16.0 N/mm^2 [BS EN 338: 2009 Table 1]

Grade shear strength, $f_{v,k}$ = 3.2 N/mm^2 [BS EN 338: 2009 Table 1]

Material partial factor, g_M = 1.3 [EC5 UK Table NA.3]

$E_{0.05}$ = 5,400 N/mm^2; $E_{0,mean}$ = 8,000 N/mm^2 [BS EN 338: 2009 Table 1]

Loading modification factor, k_{mod} = 0.8 (Service class 2; Live load duration: Medium term) [EC5 Tables 2.2/3.1]

Load sharing factor, k_{sys} = 1.0

Deflection modification factor, k_{def} = 0.80 [EC5 Table 3.2]

Bending

Height factor, k_h = 1.0 [EC5 3.2(3)]

Design bending strength, $f_{m,y,d} = f_{m,k}.k_{mod}.k_h.k_{sys}/g_m$ = 16.0 x 0.80 x 1.00 x 1.0/1.30 = 9.85 N/mm^2

Design bending stress, $s_{m,y,d}$ = 4.22 x 1000/581 = 7.27 N/mm^2 OK

Bending resistance = 9.85 x 581/1000 = 5.72 kNm

Shear

Effective width for shear, $b_{ef} = k_{cr}.b$ = 0.67 x 72 = 48.2 mm. [A1:2008 (6.13a)]

Design shear strength, $f_{v,d} = f_{v,k}.k_{mod}.k_{sys}/g_m$ = 3.20 x 0.80 x 1.0/1.30 = 1.97 N/mm^2

Design shear stress, $s_{v,y,d}$ = 3.97 x 1000 x (3/2)/(48.2 x 220) = 0.56 N/mm^2 OK

Shear resistance = 1.97 x 48.2 x 220 x (2/3)/1000 = 13.9 kN

Deflection

Final deflection limit = L/150 = 28.33 mm

Instantaneous mid-span shear deflection = 1.2 x 2.92 x 10^6/((E/16) x 72 x 220) = 0.44 mm

Final shear deflection is assumed to increase in proportion to total bending deflection

Mid-span deflections:	x $1e^8$/EI	Inst. mm	y_2	k_{def}	Fin. mm	
Dead:	2.00	3.91	1.00	0.80	7.04	
Live QB:	3.50	6.84	0.30	0.80	8.49	
Shear deflection:		0.44			0.64	
Total mm.		11.20			16.17	OK

Notes

You can add your own notes if desired