Beam: **Draycott example 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): 5.500 kN	**2.75**	**2.75**
						(6.10): 7.950 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 R1

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*

$W_{el,v}$ = 580.8 cm^3 I_v = 6,389 cm^4
Depth factor, k_h = 1.00 [EC5 3.2]

Timber grade: C16

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

Grade shear stress, $f_{v,k}$ = 1.8 N/mm^2

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

$E_{0,mean}$ = 8,000 N/mm^2

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

Load sharing factor, k_{sys} = 1.0

Deflection modification factor, k_{def} = 0.800 [EC5 Table 3.2]

Bending

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

Applied bending stress, $\sigma_{m,y,d}$ = 4.22 x 1000/580.8 = 7.27 N/mm^2 OK

Shear

Design shear stress, $f_{v,d} = f_{v,k}.k_{mod}.k_{sys}/\gamma_m$ = 1.80 x 0.80 x 1.0/1.30 = 1.11 N/mm^2

Applied shear stress, $\sigma_{v,y,d}$ = 3.97 x 1000 x 3/2 x 72 x 220 = 0.38 N/mm^2 OK

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 1e8/EI	Inst. mm	ψ_2	kdef	Fin. mm	
Dead:	2.00	3.91		0.80	7.04	
Live QB:	3.50	6.84	0.30	0.80	8.49	
Shear deflection:		0.44			0.64	
Total		11.20			**16.17**	OK

Check: Final deflection should be 16.2mm