TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.5.07

Applied loading

Beam loads

Imposed full UDL 10.500 kN/m
Dead full UDL 10.500 kN/m
Dead self weight of beam × 1

Load combinations

Load combination 1

Support A  Dead × 1.00
Span 1       Imposed × 1.00
Support B  Dead × 1.00
            Imposed × 1.00

Analysis results

Maximum moment  \( M_{\text{max}} = 10.579 \text{ kNm} \)  \( M_{\text{min}} = 0.000 \text{ kNm} \)
Design moment   \( M = \max(\text{abs}(M_{\text{max}}), \text{abs}(M_{\text{min}})) = 10.579 \text{ kNm} \)
Maximum shear   \( F_{\text{max}} = 21.158 \text{ kN} \)  \( F_{\text{min}} = -21.158 \text{ kN} \)
Design shear    \( F = \max(\text{abs}(F_{\text{max}}), \text{abs}(F_{\text{min}})) = 21.158 \text{ kN} \)
Total load on beam  \( W_{\text{tot}} = 42.316 \text{ kN} \)
Reactions at support A
Unfactored dead load reaction at support A  \( R_{A,\text{Dead}} = 10.658 \text{ kN} \)
Unfactored imposed load reaction at support A  \( R_{A,\text{Imposed}} = 10.500 \text{ kN} \)
Reactions at support B
Unfactored dead load reaction at support B  \( R_{B,\text{Dead}} = 10.658 \text{ kN} \)
Unfactored imposed load reaction at support B  \( R_{B,\text{Imposed}} = 10.500 \text{ kN} \)

Timber section details
Breadth of sections  \( b = 100 \text{ mm} \)
Depth of sections  \( h = 350 \text{ mm} \)
Number of sections in member  \( N = 1 \)
Overall breadth of member  \( b_r = N \times b = 100 \text{ mm} \)
Timber strength class  \( C30 \)

Member details
Service class of timber  \( 1 \)
Load duration  \( \text{Long term} \)
Length of bearing  \( L_b = 150 \text{ mm} \)

Section properties
Cross sectional area of member  \( A = N \times b \times h = 35000 \text{ mm}^2 \)
Section modulus  \( Z_x = N \times b \times h^2 / 6 = 2041667 \text{ mm}^3 \)
  \( Z_y = h \times (N \times b)^2 / 6 = 583333 \text{ mm}^3 \)
Second moment of area  \( I_x = N \times b \times h^3 / 12 = 35729167 \text{ mm}^4 \)
  \( I_y = h \times (N \times b)^3 / 12 = 29166667 \text{ mm}^4 \)
Radius of gyration  \( i_x = \sqrt{(I_x / A)} = 101.0 \text{ mm} \)
  \( i_y = \sqrt{(I_y / A)} = 28.9 \text{ mm} \)

Modification factors
Duration of loading - Table 17  \( K_3 = 1.00 \)
Bearing stress - Table 18  \( K_4 = 1.00 \)
Total depth of member - cl.2.10.6  \( K_r = 0.81 \times (h^2 + 92300 \text{ mm}^2) / (h^2 + 56800 \text{ mm}^2) = 0.97 \)
Load sharing - cl.2.9  \( K_8 = 1.00 \)

Lateral support - cl.2.10.8
No lateral support
Permissible depth-to-breadth ratio - Table 19  \( 2.00 \)
Actual depth-to-breadth ratio  \( h / (N \times b) = 3.50 \)

FAIL - Lateral support is inadequate

Compression perpendicular to grain
Permissible bearing stress (no wane)  \( \sigma_{c,\text{adm}} = \sigma_{c,\text{crit}} \times K_3 \times K_4 \times K_8 = 2.700 \text{ N/mm}^2 \)
Applied bearing stress  \( \sigma_{c,a} = R_{A,\text{max}} / (N \times b \times L_b) = 1.411 \text{ N/mm}^2 \)
σ_{c,a} / σ_{c,adm} = 0.522

**PASS - Applied compressive stress is less than permissible compressive stress at bearing**

**Bending parallel to grain**

Permissible bending stress

\[ \sigma_{m,adm} = \sigma_m \times K_3 \times K_7 \times K_8 = 10.674 \text{ N/mm}^2 \]

Applied bending stress

\[ \sigma_{m,a} = \frac{M}{Z_x} = 5.182 \text{ N/mm}^2 \]

\[ \frac{\sigma_{m,a}}{\sigma_{m,adm}} = 0.485 \]

**PASS - Applied bending stress is less than permissible bending stress**

**Shear parallel to grain**

Permissible shear stress

\[ \tau_{adm} = \tau \times K_3 \times K_8 = 1.200 \text{ N/mm}^2 \]

Applied shear stress

\[ \tau_a = 3 \times \frac{F}{(2 \times A)} = 0.907 \text{ N/mm}^2 \]

\[ \frac{\tau_a}{\tau_{adm}} = 0.756 \]

**PASS - Applied shear stress is less than permissible shear stress**

**Deflection**

Modulus of elasticity for deflection

\[ E = E_{\text{min}} = 8200 \text{ N/mm}^2 \]

Permissible deflection

\[ \delta_{adm} = \text{min}(14 \text{ mm}, 0.003 \times L_{s1}) = 6.000 \text{ mm} \]

Bending deflection

\[ \delta_{b,s1} = 1.505 \text{ mm} \]

Shear deflection

\[ \delta_{v,s1} = 0.708 \text{ mm} \]

Total deflection

\[ \delta_a = \delta_{b,s1} + \delta_{v,s1} = 2.212 \text{ mm} \]

\[ \frac{\delta_a}{\delta_{adm}} = 0.369 \]

**PASS - Total deflection is less than permissible deflection**