



Application Sheet

Lintel beam

Context: Lintel beam supporting a single roof beam

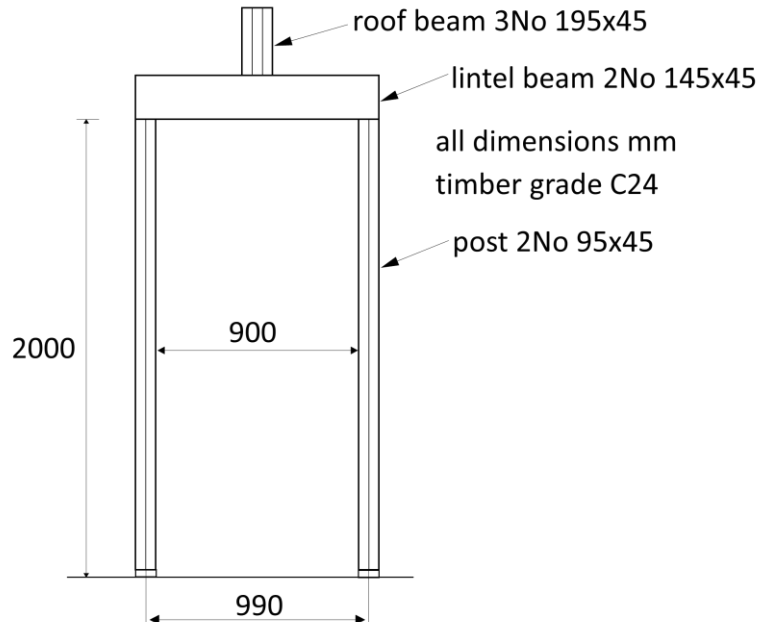
Objective: Technical assessment of a lintel beam for bending strength

Concepts used in this application sheet

- Force: applied load, uniformly distributed load, total load
- Stress: bending stress, allowable stress, actual stress
- Bending theory: bending moment, bending stress, section properties



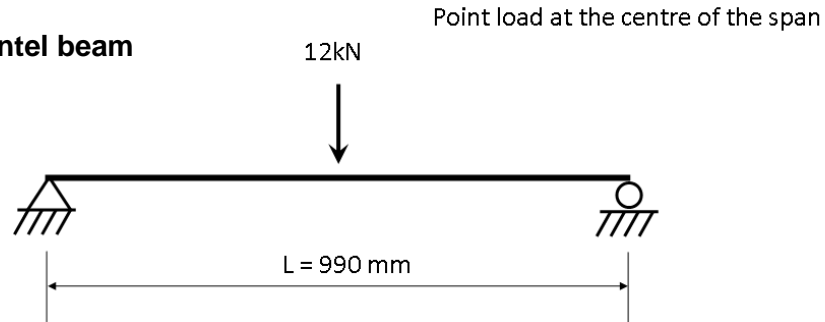
Engineering Model



All units in mm; all members: timber

Structural Analysis

Analysis model of the lintel beam



Assessment

Using the [allowable stress method](#)

Bending strength assessment

Strength criterion $\sigma_m / f_m \leq 1.0$

- σ_m is the bending stress due to loading
- f_m is the design bending strength (In this case expressed as a stress)

Data input

Load $W = 12\text{kN} = 12000\text{N}$

Span $L = 0.990\text{m} = 990\text{mm}$

Section dimensions: depth $d = 195\text{mm}$, width $b = 90\text{mm}$ (the width is 90mm rather than 45mm because it is a double lintel beam, meaning that two beams are next one another [in the direction in/out of the page] and are assumed attached, making the width 2×45)

$f_m = 11.0 \text{ N/mm}^2$ (from code of practice)

Calculations

Section modulus $Z = bd^2/6 = 90 \times 195^2/6 = 570375 \text{ mm}^3$

Bending moment $M = WL/4 = 12000 \times 990/4 = 2970000 \text{ Nmm}$

Bending stress $\sigma_m = M/Z = 2970000/570375 = 5.2 \text{ N/mm}^2$

Apply the criterion

$\sigma_m / f_m \leq 1.0 = 5.2/11 = 0.47$

Decision

The beam can withstand the bending stress

Deflection assessment

Criterion: Maximum deflection $\Delta / (L/300) \leq 1.0$ (common criterion for beams)

Data input

Young's modulus $E = 10.0 \text{ kN/mm}^2 = 10000 \text{ N/mm}^2$ (from code of practice)

Calculations

I value $I = bd^3/12 = 90 \times 195^3/12 = 55611562.5 \text{ mm}^4$

Central deflection $\Delta = WL^3/(48E) = 12000 \times 990^3/(48 \times 10000 \times 55611562.5) = 0.44\text{mm}$

$L/300 = 990/300 = 3.3\text{mm}$

Apply the criterion

$\Delta / (L/300) \leq 1.0 = 0.44/3.3 = 0.13$

Decision

The beam deflects less than the maximum allowable deflection. Thus, it is adequate.

A spreadsheet in which the above calculations can be checked can be found [here](#)

Last edited: 28.08.2020

Author: AL & ACR

Keywords: beam, bending strength, deflection