Steel Beam Calculation

* You can add your own text, diagrams and photos here *

Beam details

178 x 102 x 19 UB S275

Beam effective span length: 3 metres

Width: 101.2 mm
Depth: 177.8 mm
Web: 4.8 mm
Flange: 7.9 mm
Radius: 7.6 mm
Mass per metre: 19 kg/m

Safety factors, restraints & deflection limits

Permanent load safety factor: 1.35
Variable load safety factor: 1.5

Beam is fully restrained along its length: No
Length between lateral restraints: 3 metres

Variable load deflection limit: Span/360 = 8.33 mm
Total load deflection limit: Span/200 = 15 mm

Load details

UDL 1: Ceiling beneath sloping roof
Permanent (dead) load per square metre: 0.3 kN/m²
Variable (live) load per square metre: 0.25 kN/m²
Width of load perpendicular to beam, or height of load supported by beam: 3.5 metres

UDL 2: 102.5mm Brickwork + Plaster or render on BOTH sides
Permanent (dead) load per square metre: 2.45 kN/m²
Variable (live) load per square metre: 0 kN/m²
Width of load perpendicular to beam, or height of load supported by beam: 2.8 metres

UDL 3: Lightweight timber stud partitions, on floor plan
Permanent (dead) load per square metre: 0 kN/m²
Variable (live) load per square metre: 0.25 kN/m²
Width of load perpendicular to beam, or height of load supported by beam: 3.5 metres
**UDL 4: Timber floor (domestic dwelling)**

Permanent (dead) load per square metre: **0.6 kN/m²**

Variable (live) load per square metre: **1.5 kN/m²**

Width of load perpendicular to beam, or height of load supported by beam: **3.5 metres**

**Calculations**

**Bending moments**

\[ M_{c,y} = 47 \text{kNm} > 27.3 \text{kNm} \text{, Therefore OK} \]

- \( M_{c,y} \) value from Tata Steel 'blue book' to BS EN 1993-1-1
- \( M_b = 31.6 \text{kNm} > 27.3 \text{kNm} \text{, Therefore OK} \)
- \( M_b \) value INTERPOLATED from Tata Steel 'Blue Book' to BS EN 1993-1-1
- \( C_1 \) value conservatively taken as 1.0

**Shear forces**

\[ V_c = 157 \text{kN} \times 0.5 = 78.5 \text{kN} > 36.4 \text{kN} \text{, Therefore OK} \]

- Shear Capacity, \( V_c \) from Tata Steel ‘Blue Book’ to BS EN 1993-1-1
- Reduction of moment resistance by high coincident shear force has been avoided by checking that the shear force is no more than 50% of the shear resistance

**Deflection**

\[ \text{Variable load deflection} = 2.59 \text{mm} < 8.33 \text{mm}, \text{ Therefore OK} \]

\[ \text{Total load deflection} = 6.37 \text{mm} < 15 \text{mm}, \text{ Therefore OK} \]

**Notes**

- \( M_{c,y} \) value from Tata Steel 'Blue Book' to BS EN 1993-1-1
- \( M_b \) value interpolated from Tata Steel 'Blue Book' to BS EN 1993-1-1
- \( C_1 \) value conservatively taken as 1.0
- Shear Capacity, \( V_c \) from Tata Steel 'Blue Book' to BS EN 1993-1-1
- Reduction of moment resistance by high coincident shear force has been avoided by checking that the shear force is not more than 50% of the shear resistance
- Ends of beam are to be laterally restrained. Ends of beams can be laterally restrained using one of the following methods;
  1) End of beam built into masonry wall.
2) End of beam fixed to a masonry wall.
3) End of beam fixed to a column or a beam.

The designer is to ensure that the proposed detail adequately ensures that the end of the beam is laterally restrained.

No allowance has been made for destabilising loads which are outside the scope of these calculations (Destabilising loads would not normally occur in a traditional masonry structure)