**DISCLAIMER**

These structural calculations have been prepared by BuildRegs using the drawings, dimensions and information supplied by the client and/or their appointed designer.

These calculations are intended solely for the project and address stated within this document and must not be used for any other purpose.

No responsibility is accepted for inaccuracies arising from incomplete, incorrect or outdated information supplied by others.

Any deviations from the approved drawings, unforeseen site conditions, hidden defects, or variations encountered during construction must be referred back to BuildRegs for review prior to proceeding with the works.

All works must be carried out by competent contractors and in accordance with current Building Regulations, relevant British Standards, Eurocodes and manufacturer recommendations.

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**DESIGN ASSUMPTIONS**

Unless stated otherwise, the following assumptions have been adopted in the preparation of these calculations:

- Existing structure is in good condition and free from significant defects.
- Dimensions shown on the submitted drawings are accurate.
- Contractor to verify all dimensions on site prior to commencement of works.
- Structural steelwork grade S275 unless noted otherwise.
- Timber grade C24 unless noted otherwise.
- Masonry construction assumed to be of standard residential quality.
- Foundations and ground conditions assumed suitable for the imposed loads unless specifically designed within this document.
- Wind and imposed loads assessed in accordance with current British Standards and Eurocodes.

Any discrepancies identified on site must be reported before construction proceeds.

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**SCOPE OF WORKS**

These calculations have been prepared for the following elements only:

- Structural steel beams and lintels.
- Padstones and bearing arrangements.
- Load-bearing wall alterations.
- Timber trimming and associated structural members where indicated.

- Structural elements specifically referenced within this document.

The following items are excluded unless specifically stated otherwise:

- Foundation design.
- Drainage design.
- Temporary works design.
- Retaining walls.
- Construction sequencing and methodology.
- Party Wall matters.
- Site inspections.
- Any elements not specifically detailed within these calculations.

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**BUILDING CONTROL STATEMENT**

These structural calculations have been prepared to demonstrate compliance with the structural requirements of the Building Regulations applicable to the proposed works described within this document.

These calculations are suitable for submission to Local Authority Building Control or an Approved Inspector as part of the Building Regulations application process.

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**CONSTRUCTION NOTES**

- All dimensions must be verified on site by the contractor prior to fabrication and installation.
- No dimensions are to be scaled from these calculations.
- Any discrepancies between site conditions and the submitted drawings must be reported immediately.
- Any proposed design changes must be reviewed and approved prior to implementation.
- All materials and workmanship shall comply with current Building Regulations and relevant British Standards.

Steelwork, connections and bearings shall be installed strictly in accordance with these calculations and associated drawings.

**STRUCTURAL DESIGN CALCULATIONS**

**PROJECT:**

**STRUCTURAL CALCULATIONS**

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THE CALCULATIONS ARE PREPARED IN ACCORDANCE WITH THE FOLLOWING BRITISH STANDARDS:

| | |
|---|---|
| Weight of building materials | BS 648w |
| Loadings | BS 6399 |
| Structural Concrete | BS 8110 |
| Structural Steel | BS 5950 |
| Structural Timber | BS 5268 |

**Loading Data:**

Flat Roof:

Dead Load

| | |
|---|---|
| ➢ Chippings | 0.24 Kn/m² |
| ➢ Boarding | 0.12 Kn/m² |
| ➢ Felt | 0.15 Kn/m² |
| ➢ Joists | 0.18 Kn/m² |
| ➢ Plasterboard | 0.12 Kn/m² |
| | …… |
| Total | 0.81 Kn/m² |
| Imposed Load | 0.75 Kn/m² |
| | …… |
| Total | 1.56 Kn/m² |
| | …… |

## STRUCTURAL DESIGN CALCULATIONS

**A1**

Length : 5600 mm  Loadings: (In worst condition)

Dead Load:

| | | | | |
|---|---|---|---|---|
| Pitched Roof | : | 1.08Kn/m² x (3.0)/2 | = | 1.62 Kn/m |
| Flat Roof | : | 0.81Kn/m² x (3.2)/2 | = | 1.30 Kn/m |
| Total | | | | 2.92 Kn/m |

Live Load:

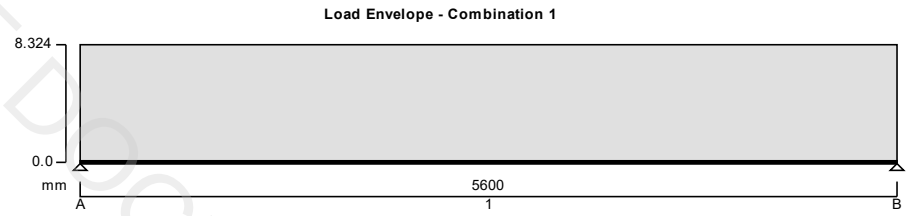
| | | | | |
|---|---|---|---|---|
| Pitched Roof | : | 0.75Kn/m² x (3.0)/2 | = | 1.13 Kn/m |
| Flat Roof | : | 0.75Kn/m² x (3.2)/2 | = | 1.20 Kn/m |
| Total | | | | 2.33 Kn/m |

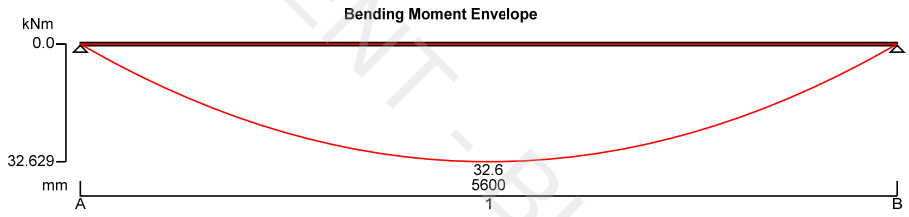
# A1

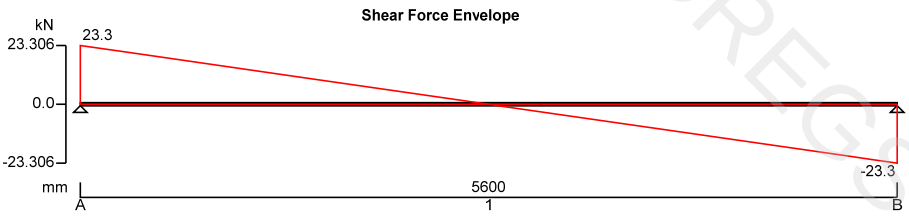
## STEEL BEAM ANALYSIS & DESIGN (BS5950)

**In accordance with BS5950-1:2000 incorporating Corrigendum No.1**

TEDDS calculation version 3.0.05




**Support conditions**

| | |
|---|---|
| Support A | Vertically restrained |
| | Rotationally free |
| Support B | Vertically restrained |
| | Rotationally free |

**Applied loading**

| | | |
|---|---|---|
| Beam loads | Dead self weight of beam × 1 | |
| | Dead full UDL 2.92 kN/m | |
| | Imposed full UDL 2.33 kN/m | |

**Load combinations**

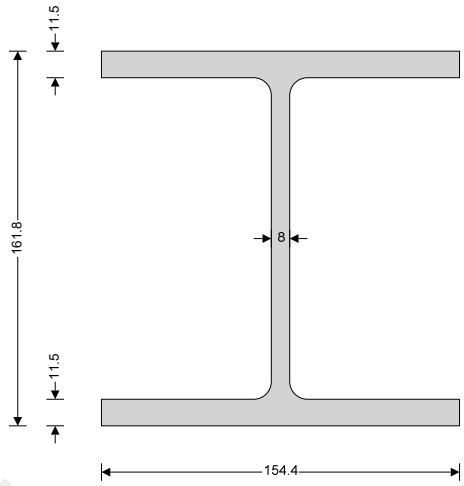
| | | |
|---|---|---|
| Load combination 1 | Support A | Dead × 1.40 |
| | | Imposed × 1.60 |
| | | Other × 1.00 |
| | Span 1 | Dead × 1.40 |
| | | Imposed × 1.60 |
| | | Other × 1.00 |
| | Support B | Dead × 1.40 |
| | | Imposed × 1.60 |
| | | Other × 1.00 |

**Analysis results**

| | | |
|---|---|---|
| Maximum moment; | $M_{max}$ = **32.6** kNm; | $M_{min}$ = **0** kNm |
| Maximum shear; | $V_{max}$ = **23.3** kN; | $V_{min}$ = **-23.3** kN |
| Deflection; | $\delta_{max}$ = **6.6** mm; | $\delta_{min}$ = **0** mm |
| Maximum reaction at support A; | $R_{A\_max}$ = **23.3** kN; | $R_{A\_min}$ = **23.3** kN |
| Unfactored dead load reaction at support A; | $R_{A\_Dead}$ = **9.2** kN | |
| Unfactored imposed load reaction at support A; | $R_{A\_Imposed}$ = **6.5** kN | |
| Maximum reaction at support B; | $R_{B\_max}$ = **23.3** kN; | $R_{B\_min}$ = **23.3** kN |
| Unfactored dead load reaction at support B; | $R_{B\_Dead}$ = **9.2** kN | |
| Unfactored imposed load reaction at support B; | $R_{B\_Imposed}$ = **6.5** kN | |

**Section details**

| | |
|---|---|
| Section type; | **UC 152x152x37 (BS4-1)** |
| Steel grade; | **S275** |
| **From table 9: Design strength $p_y$** | |
| Thickness of element; | max(T, t) = **11.5** mm |
| Design strength; | $p_y$ = **275** N/mm$^2$ |
| Modulus of elasticity; | E = **205000** N/mm$^2$ |




**Lateral restraint**

Span 1 has lateral restraint at supports only

**Effective length factors**

Effective length factor in major axis; $K_x$ = **1.00**

Effective length factor in minor axis; $K_y$ = **1.00**

Effective length factor for lateral-torsional buckling; $K_{LT.A}$ = **1.20**; + 2 × D

**Classification of cross sections - Section 3.5**

$\varepsilon = \sqrt{[275\ N/mm^2 / p_y]}$ = **1.00**

**Internal compression parts - Table 11**

Depth of section; d = **123.6** mm

d / t = 15.5 × ε <= 80 × ε; Class 1 plastic

**Outstand flanges - Table 11**

Width of section; b = B / 2 = **77.2** mm

b / T = 6.7 × ε <= 9 × ε; Class 1 plastic

***Section is class 1 plastic***

**Shear capacity - Section 4.2.3**

Design shear force; $F_v = max(abs(V_{max}), abs(V_{min}))$ = **23.3** kN

d / t < 70 × ε

***Web does not need to be checked for shear buckling***

Shear area; $A_v = t \times D$ = **1294** $mm^2$

Design shear resistance; $P_v = 0.6 \times p_y \times A_v$ = **213.6** kN

***PASS - Design shear resistance exceeds design shear force***

**Moment capacity - Section 4.2.5**

Design bending moment; $M = max(abs(M_{s1\_max}), abs(M_{s1\_min}))$ = **32.6** kNm

Moment capacity low shear - cl.4.2.5.2; $M_c = min(p_y \times S_{xx}, 1.2 \times p_y \times Z_{xx})$ = **84.9** kNm

**Effective length for lateral-torsional buckling - Section 4.3.5**

Effective length for lateral torsional buckling; $L_E = ((1.2 + 1.0) \times L_{s1} + 2 \times D) / 2 =$ **6322** mm

Slenderness ratio; $\lambda = L_E / r_{yy} =$ **163.278**

**Equivalent slenderness - Section 4.3.6.7**

Buckling parameter; u = **0.848**

Torsional index; x = **13.334**

Slenderness factor; $v = 1 / [1 + 0.05 \times (\lambda / x)^2]^{0.25} =$ **0.586**

Ratio - cl.4.3.6.9; $\beta_W =$ **1.000**

Equivalent slenderness - cl.4.3.6.7; $\lambda_{LT} = u \times v \times \lambda \times \sqrt{[\beta_W]} =$ **81.115**

Limiting slenderness - Annex B.2.2; $\lambda_{L0} = 0.4 \times (\pi^2 \times E / p_y)^{0.5} =$ **34.310**

***$\lambda_{LT} > \lambda_{L0}$ - Allowance should be made for lateral-torsional buckling***

**Bending strength - Section 4.3.6.5**

Robertson constant; $\alpha_{LT} =$ **7.0**

Perry factor; $\eta_{LT} = \max(\alpha_{LT} \times (\lambda_{LT} - \lambda_{L0}) / 1000, 0) =$ **0.328**

Euler stress; $p_E = \pi^2 \times E / \lambda_{LT}^2 =$ **307.5** N/mm$^2$

$\phi_{LT} = (p_y + (\eta_{LT} + 1) \times p_E) / 2 =$ **341.6** N/mm$^2$

Bending strength - Annex B.2.1; $p_b = p_E \times p_y / (\phi_{LT} + (\phi_{LT}^2 - p_E \times p_y)^{0.5}) =$ **162.3** N/mm$^2$

**Equivalent uniform moment factor - Section 4.3.6.6**

Moment at quarter point of segment; $M_2 =$ **24.5** kNm

Moment at centre-line of segment; $M_3 =$ **32.6** kNm

Moment at three quarter point of segment; $M_4 =$ **24.5** kNm

Maximum moment in segment; $M_{abs} =$ **32.6** kNm

Maximum moment governing buckling resistance; $M_{LT} = M_{abs} =$ **32.6** kNm

Equivalent uniform moment factor for lateral-torsional buckling;

$m_{LT} = \max(0.2 + (0.15 \times M_2 + 0.5 \times M_3 + 0.15 \times M_4) / M_{abs}, 0.44) =$ **0.925**

**Buckling resistance moment - Section 4.3.6.4**

Buckling resistance moment; $M_b = p_b \times S_{xx} =$ **50.1** kNm

$M_b / m_{LT} =$ **54.2** kNm

***PASS - Buckling resistance moment exceeds design bending moment***

**Check vertical deflection - Section 2.5.2**

Consider deflection due to imposed and other loads

Limiting deflection; $\delta_{lim} = L_{s1} / 360 =$ **15.556** mm

Maximum deflection span 1; $\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min})) =$ **6.584** mm

***PASS - Maximum deflection does not exceed deflection limit***