



RYMER DESIGN & DETAILING

**Building Control Calculations
for Proposed Works**

to

**24 Pool Green, Neston,
Corsham, Wiltshire. SN13 9SN**

for

Ms K. Knowlton

Clients are to check their responsibilities and the requirements of CDM 2015 and the Building Safety Act 2022:

N.B. Rymer Design and Detailing Limited are NOT a Principle Designer

Project Ref: 1773
Issue Date: March 2026
Revision:

RYMER DESIGN & DETAILING

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RYMER DESIGN & DETAILING

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Project name : 24 Pool Green
Project Ref : 1773
Sheet Number : 01
Date : March 2026
Calc. By : R. Rymer

LOADINGS

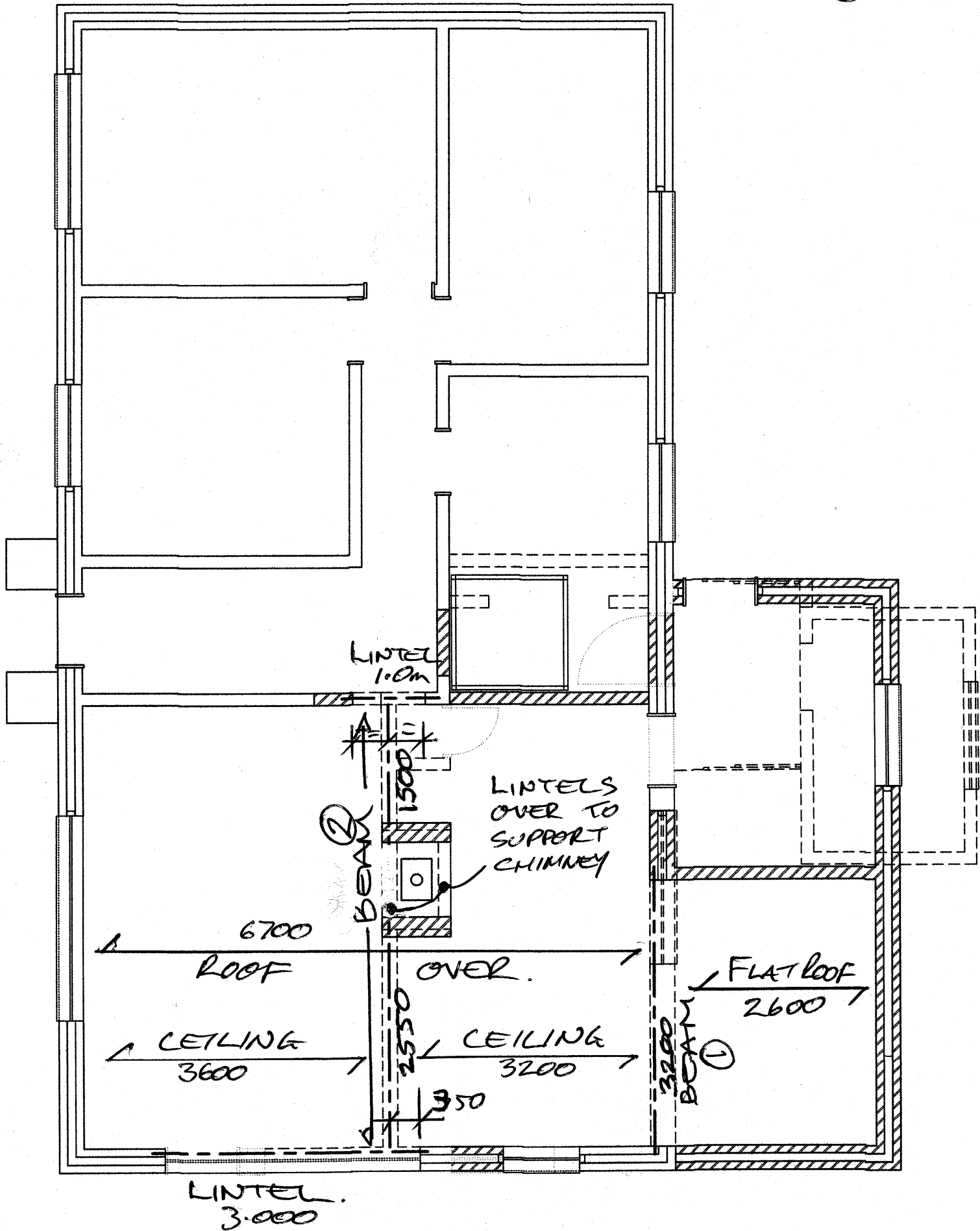
	kN/m ² G _K	kN/m ² Q _K
<u>Tiled Pitched Roof:</u>		
Tiles, battens, felt, rafters,	0.8	
Joists, insulation, ceiling & plaster skim	0.41	
Live Load Roof		0.6
Roof	0.8	0.6
Ceiling	0.41	0.25
<u>Flat roof:</u>		
Single ply membrane	0.15	
Insulation	0.1	
Plywood and battens	0.2	
Timber rafters	0.1	
ceiling & plaster skim	0.22	
Live Load including snow		0.6
	0.77	0.6
<u>General floor load:</u>		
Floor boards, joists, insulation, ceiling and skim	0.79	
Domestic live load		1.5
	0.79	1.5
<u>Beam and block floor:</u>		
75 screed and finishes	1.65	
150dp pcc beam and block floor	2.1	
Domestic live load		1.5
	3.75	1.5
<u>External solid masonry wall:</u>		
215mm thk wall	4.32	
Plater finish to wall	0.22	
	4.54	
<u>External cavity:</u>		
100 cast ashlar block	2.2	
Insulation	0.05	
100 block	1.65	
Plaster finish	0.22	
	4.12	
<u>Internal block wall:</u>		
plaster finish x2	0.44	
100 block	1.65	
	2.09	

All dimensions are for design purposes only and are not to be used for fabrication or building work.

Structural member sizes calculated are minimum and can be replaced with larger elements. Any changes to be reported to Rymer Design.

PROPOSED FLOOR PLAN

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Project name :
Project Reference :
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Date :
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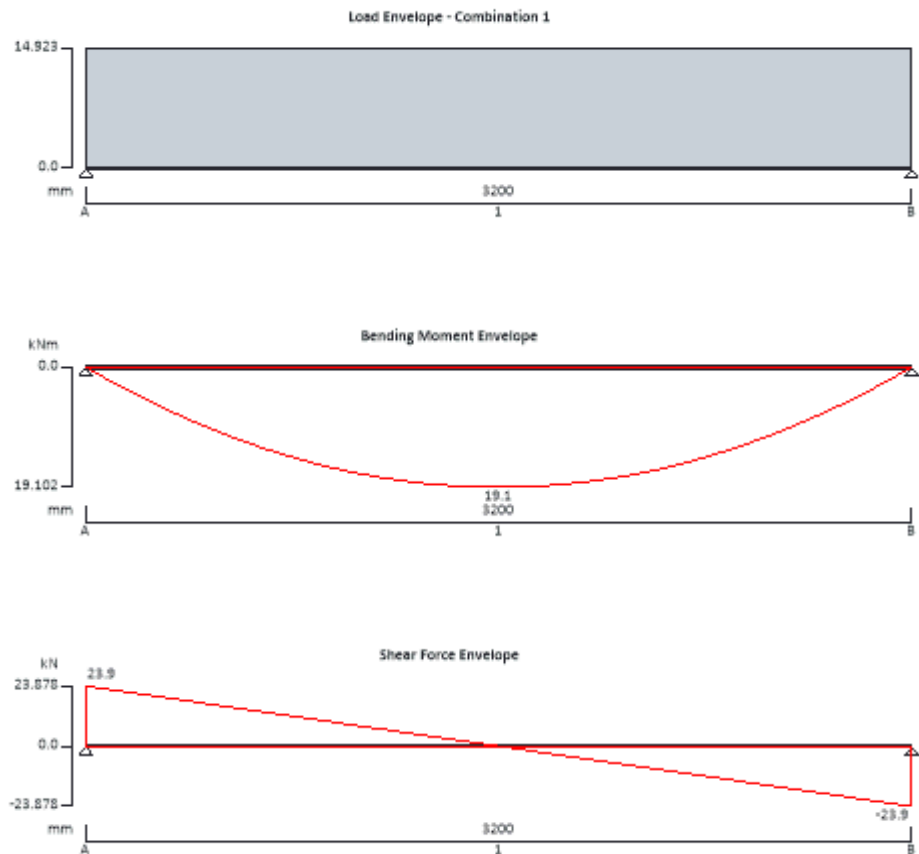
<u>BEAM ①</u>		SPAN	3200
	LOAD	G_K	kN/m Q_K
Flat. Roof	$0.75 \times 2.6/2$		0.98
	$0.77 \times 2.6/2$	1.0	
High Roof	$\frac{0.8}{\cos 35} \times 6.7/2$	3.27	
	$\frac{0.75}{\cos 35} \times 6.7/2$		3.07
Loft.	$0.41 \times 3.2/2$	0.66	
	$0.5 \times 3.2/2$		0.8
		4.93	4.85
<u>BEAM END REACTION.</u>			
$F = 23.9 \text{ kN}$ $G_R = 6.1 \text{ kN}$ $Q_R = 6.1 \text{ kN}$			
ASSUME BEARING ONTO EXISTING BLOCKWORK 3.5N.			
$\therefore \frac{23.9 \times 10^3 \times 3.5}{1.25 \times 100 \times 3.5} = 1912 \text{ mm}$			
USE 250lg x 100wd x 150dp PADSTONE.			

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	Calcs for Beam 1 over kitchen				Start page no./Revision 4	
	Calcs by R.Rymer	Calcs date 25/03/2026	Checked by	Checked date	Approved by	Approved date

STEEL BEAM ANALYSIS & DESIGN (BS5950)

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

TEDDS calculation version 3.0.08



Support conditions

Support A

Vertically restrained

Rotationally free

Support B

Vertically restrained

Rotationally free

Applied loading

Beam loads

Dead self weight of beam $\times$ 1

Dead full UDL 4.93 kN/m

Imposed full UDL 4.85 kN/m

Load combinations

Load combination 1

Support A

Dead $\times$ 1.40

Imposed $\times$ 1.60

Dead $\times$ 1.40

Imposed $\times$ 1.60

Support B

Dead $\times$ 1.40

Imposed $\times$ 1.60

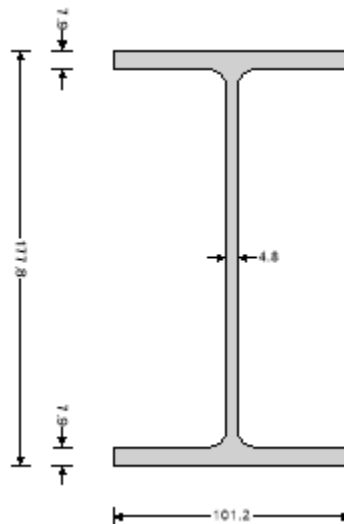
Rymer Design & Detailing Limited 4 Moor Park Neston, Corsham Wiltshire	Project 24 Pool Green Neston				Job no. 1773	
	Calcs for Beam 1 over kitchen				Start page no./Revision 5	
	Calcs by R.Rymer	Calcs date 25/03/2026	Checked by	Checked date	Approved by	Approved date

Analysis results

Maximum moment	$M_{max} = 19.1$ kNm	$M_{min} = 0$ kNm
Maximum shear	$V_{max} = 23.9$ kN	$V_{min} = -23.9$ kN
Deflection	$\delta_{max} = 4.9$ mm	$\delta_{min} = 0$ mm
Maximum reaction at support A	$R_{A_max} = 23.9$ kN	$R_{A_min} = 23.9$ kN
Unfactored dead load reaction at support A	$R_{A_Dead} = 8.2$ kN	
Unfactored imposed load reaction at support A	$R_{A_Imposed} = 7.8$ kN	
Maximum reaction at support B	$R_{B_max} = 23.9$ kN	$R_{B_min} = 23.9$ kN
Unfactored dead load reaction at support B	$R_{B_Dead} = 8.2$ kN	
Unfactored imposed load reaction at support B	$R_{B_Imposed} = 7.8$ kN	

Section details

Section type **UB 178x102x19 (British Steel Section Range 2022 (BS4-1))** Steel grade **S355**



Classification of cross sections - Section 3.5

Tensile strain coefficient $\varepsilon = 0.88$ Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force $F_v = 23.9$ kN Design shear resistance $P_v = 181.8$ kN
PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment $M = 19.1$ kNm Moment capacity low shear $M_c = 60.8$ kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment $M_b = 20.4$ kNm $M_b / m_{LT} = 22$ kNm
PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection $\delta_{lim} = 14$ mm Maximum deflection $\delta = 4.895$ mm
PASS - Maximum deflection does not exceed deflection limit

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Project name :
Project Reference :
Sheet Number : 6
Date :
Calc. By : R. Rymer

BEAM ②

SPLIT SPAN EITHER SIDE OF CHIMNEY. $L_{max} = 2550 \text{ mm}$.

LOADS	G_K	kN/m	Q_K
Ceiling. $0.41 \times \frac{3.4 + 3.2}{2}$	1.39		
$0.5 \times \frac{3.6 + 3.2}{2}$			1.7
Roof. $\frac{0.8}{\cos 35} \times \frac{6.7}{2}$	3.27		
$\frac{0.75}{\cos 35} \times \frac{6.7}{2}$			3.07
	4.66		4.77

BEAM END REACTION.

$$F = 18.3 \text{ kN}.$$

CHECK BEARING ON 3.5N BLOCKS.

$$\frac{18.3 \times 10^3 \times 3.5}{125 \times 100 \times 3.5} = 146.4 \text{ mm}$$

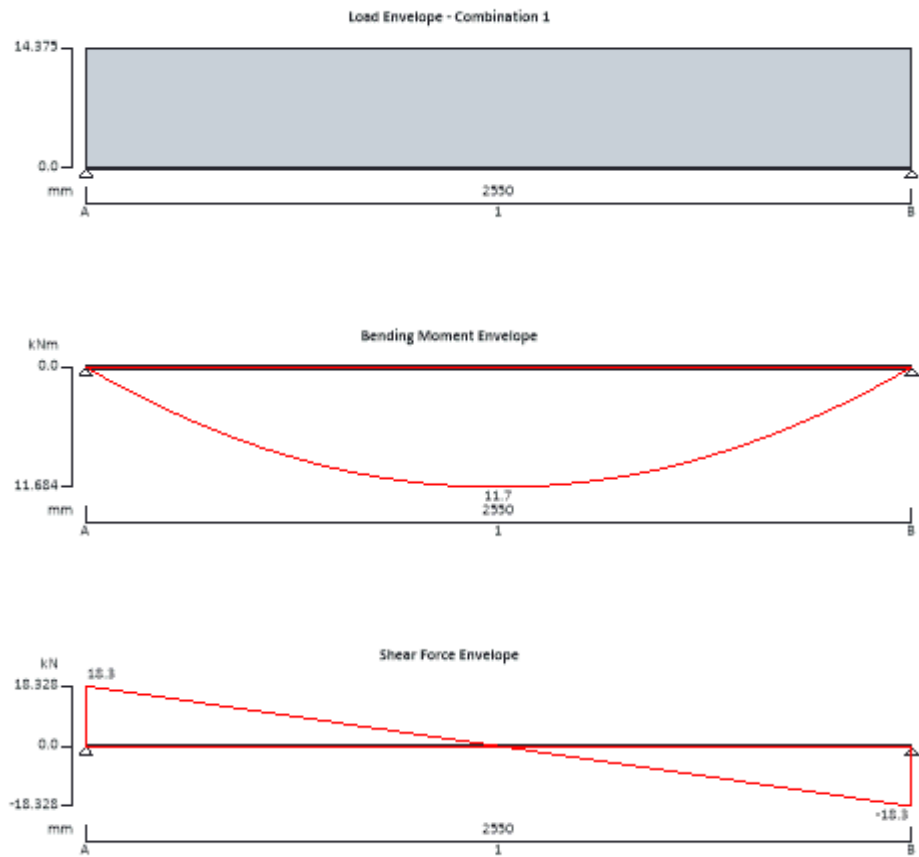
USE 200g x 100wd x 150dp PADSTONE.

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	Calcs for Beam 2				Start page no./Revision 7	
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STEEL BEAM ANALYSIS & DESIGN (BS5950)

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

TEDDS calculation version 3.0.08



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 4.66 kN/m Imposed full UDL 4.77 kN/m
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Load combinations

Load combination 1	Support A	Dead × 1.40 Imposed × 1.60
		Dead × 1.40 Imposed × 1.60
	Support B	Dead × 1.40 Imposed × 1.60
		Dead × 1.40 Imposed × 1.60

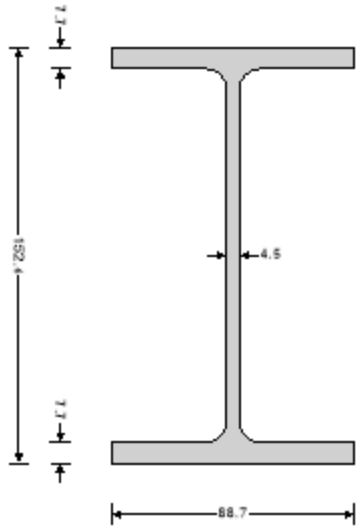
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	Calcs for Beam 2				Start page no./Revision 8	
	Calcs by R.Rymer	Calcs date 26/03/2026	Checked by	Checked date	Approved by	Approved date

Analysis results

Maximum moment	$M_{max} = 11.7 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 18.3 \text{ kN}$	$V_{min} = -18.3 \text{ kN}$
Deflection	$\delta_{max} = 3.1 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_max} = 18.3 \text{ kN}$	$R_{A_min} = 18.3 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_Dead} = 6.1 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_Imposed} = 6.1 \text{ kN}$	
Maximum reaction at support B	$R_{B_max} = 18.3 \text{ kN}$	$R_{B_min} = 18.3 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_Dead} = 6.1 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_Imposed} = 6.1 \text{ kN}$	

Section details

Section type UB 152x89x16 (British Steel Section Range 2022 (BS4-1)) Steel grade S355



Classification of cross sections - Section 3.5

Tensile strain coefficient $\epsilon = 0.88$ Section classification Plastic

Shear capacity - Section 4.2.3

Design shear force $F_v = 18.3 \text{ kN}$ Design shear resistance $P_v = 146.1 \text{ kN}$
PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment $M = 11.7 \text{ kNm}$ Moment capacity low shear $M_c = 43.8 \text{ kNm}$

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment $M_b = 17.5 \text{ kNm}$ $M_b / m_{LT} = 18.9 \text{ kNm}$
PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection $\delta_{lim} = 12.75 \text{ mm}$ Maximum deflection $\delta = 3.086 \text{ mm}$
PASS - Maximum deflection does not exceed deflection limit

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Project name :
Project Reference :
Sheet Number : 9
Date :
Calc. By : R.Rymer

LINTEL OVER Bi-FOLDS SPAN=3000.

ALLOW FOR MASONRY TOWER LOADING
OVER OPENING. USE 2.0m HIGH WALL.

INCLUDE EXTRA LOAD FROM BEAM 2
 $G_k = 6.1 \text{ kN} \neq Q_k = 6.1 \text{ kN}$ @ 350 FROM R.

$$M_{\text{EXTRA}} = \frac{18.3 \times 0.35 \times 2.65}{3.0} = \underline{5.66 \text{ kNm}}$$

S_{EXTRA} USE 2mm

BEAM END REACTION

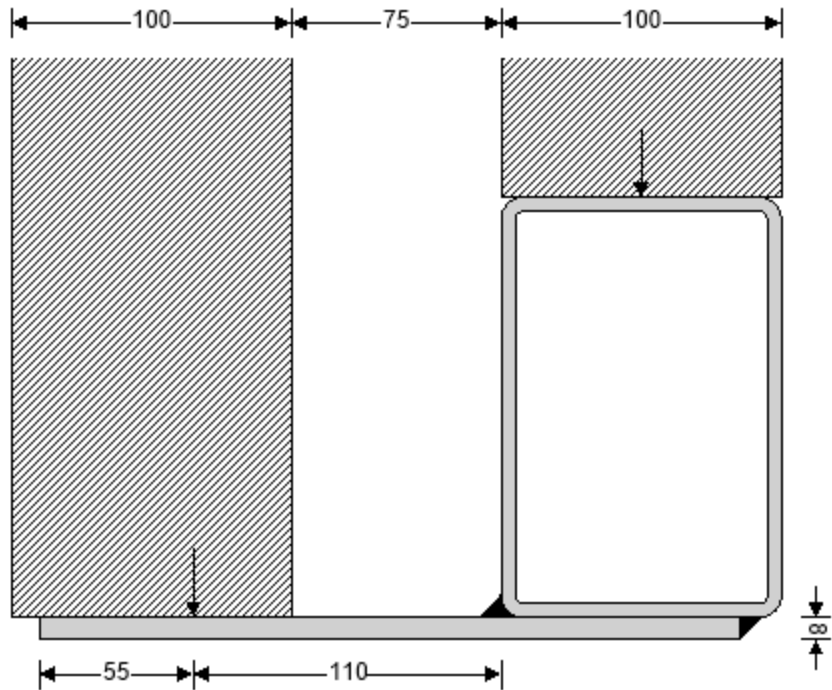
$$F = \underline{35.7 \text{ kN}}.$$

Rymer Design & Detailing Limited 4 Moor Park Neston, Corsham Wiltshire	Project				Job no.	
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	Calcs for				Start page no./Revision	
	intel beam over bi-fold doors				10	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	R.Rymer	26/03/2026				

STEEL MASONRY SUPPORT

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

Tedds calculation version 1.0.06



Steel member details

Torsion beam	RHS 150x100x5.0
Masonry support plate	User
Steel grade of support plate	S355
Design strength of support plate	$p_{ysb} = 355 \text{ N/mm}^2$
Modulus of elasticity	$E = 205000 \text{ N/mm}^2$
Constant	$\varepsilon = \sqrt{(275\text{N/mm}^2 / p_{ysb})} = 0.880$
Length of plate beyond beam	$l_h = 165 \text{ mm}$
Total length of plate	$l_{plate} = 250 \text{ mm}$
Thickness of plate	$t_{sb} = 8 \text{ mm}$
Width of main beam	$B_{mb} = 100 \text{ mm}$
Area of plate	$A_{sbu} = t_{sb} \times l_{plate} = 2000.0 \text{ mm}^2$
Distance from weld position to CoG	$C_{yysb} = l_h / 2 - (l_{plate} - l_h) / 2 = 40 \text{ mm}$

Supported materials detail

Density of masonry on main beam	$\rho_{m,mb} = 18.7 \text{ kN/m}^3$
Width of masonry on main beam	$b_{mmb} = 100 \text{ mm}$
Height of masonry on main beam	$h_{mmb} = 2000 \text{ mm}$
Eccentricity of main beam material	$e_{mb} = 0 \text{ mm}$
Add dead force main beam (not from masonry)	$P_{Gaddmb} = 0.0 \text{ kN/m}$
Add live force main beam (not from masonry)	$P_{Qaddmb} = 0.0 \text{ kN/m}$
Density of masonry on support beam	$\rho_{m,sb} = 21.0 \text{ kN/m}^3$
Width of masonry on support beam	$b_{msb} = 100 \text{ mm}$
Height of masonry on support beam	$h_{msb} = 2000 \text{ mm}$

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Add dead force support beam (not from masonry) $P_{Gaddsb} = 0.0$ kN/m

Add live force support beam (not from masonry) $P_{Qaddsb} = 0.0$ kN/m

Geometry

Cavity width $c = 75$ mm

Supported width of masonry $d_m = l_h + e_{mb} - c = 90$ mm

Biaxial stress effects in the plate (SCI-P-110)

Maximum overall bending moment $M_x = 18.7$ kNm

Dist to NA combined section (CoG torsion beam) $y_{e,all} = (D_{mb} + t_{sb}) \times A_{sbu} / (2 \times (A_{mb} + A_{sbu})) = 36$ mm

Second moment of area of combined section $I_{xx,all} = (I_{xxmb} + A_{mb} \times y_{e,all}^2) + A_{sbu} \times (D_{mb} / 2 + t_{sb} / 2 - y_{e,all})^2 = 1416$ cm⁴

Elastic section modulus of combined section $Z_{xx,all} = I_{xx,all} / (D_{mb} / 2 + t_{sb} - y_{e,all}) = 302.12$ cm³

Section modulus of plate $Z_{xx,plate} = 1m \times t_{sb}^2 / (6 \times 1m) = 10.67$ cm³/m

Eccentricity of support beam masonry $e_1 = 110$ mm

Force of masonry on support plate $P_1 = (b_{msb} \times h_{msb} \times \rho_{m,sb} + P_{Gaddsb}) \times \gamma_{fG} + P_{Qaddsb} \times \gamma_{fQ} = 5.9$ kN/m

Bending at heel $M_{x,plate} = P_1 \times e_1 = 0.6$ kNm/m

Moment capacity of plate $M_c = 1.2 \times Z_{x,plate} \times p_{ysb} = 4.5$ kNm/m

PASS - Design strength exceeds stress at heel

Longitudinal stress due to overall bending $\sigma_1 = M_x / Z_{xx,all} = 61.9$ N/mm²

Constant relating to Von Mises curve $C_{fp} = (4 \times p_{ysb}^2 - 3 \times \sigma_1^2)^{0.5} = 701.9$ N/mm²

Transverse bending stress ratio limit $\alpha_{ts} = (C_{fp}^2 - \sigma_1^2) / (2 \times C_{fp} \times p_{ysb}) = 0.981$

Transverse bending stress ratio $\alpha_{ls} = M_{x,plate} / M_c = 0.142$

PASS - Transverse bending stress ratio less than allowable limit

Deflection at toe

Unfactored force on support angle $P_{1SLS} = b_{msb} \times h_{msb} \times \rho_{m,sb} + P_{Gaddsb} + P_{Qaddsb} = 4.2$ kN/m

Distance from weld to load position $a_m = e_1 = 110$ mm

Length of load resultant to edge of plate $b_m = l_h - e_1 = 55$ mm

Dist from weld to load position as ratio of length $a_l = a_m / (a_m + b_m) = 0.667$

Effective second moment of inertia $I_{eff_def} = t_{sb}^3 / 12 = 42667$ mm⁴/m

Deflection at toe $\delta = (a_l^2 \times (3 - a_l) / 6) \times (P_{1SLS} \times (a_m + b_m)^3) / (E_{S5950} \times I_{eff_def}) = 0.37$ mm

Deflection limit $\delta_{lim} = 2.00$ mm

PASS - Deflection is within specified criteria

Weld details - assume a full length weld and that the plate acts as a propped cantilever with the prop at the weld position and the fixed end at the centre of the torsion beam

Leg length of weld $S_{weld} = 8$ mm

Throat size of weld $a_{weld} = 1/\sqrt{2} \times S_{weld} = 5.7$ mm

Shear force at weld position $R_A = P_1 \times \max((1 + (3 \times e_1) / (2 \times B_{mb} / 2)), 1.4) = 25.3$ kN/m

Maximum possible force in plate $R_p = (l_h + B_{mb}) \times t_{sb} \times p_{ysb} = 752.6$ kN

Longitudinal shear between beam and plate $R_l = 2 \times R_p / L = 501.7$ kN/m

Horizontal shear between beam and plate $R_h = P_1 \times e_1 / (S_{weld} / 2 + t_{sb} / 2) = 80.8$ kN/m

Resultant weld force $R_{weld} = (R_A^2 + R_l^2 + R_h^2)^{0.5} = 0.509$ kN/mm

Strength of weld (Table 37) $p_{weld} = 220.0$ N/mm²

Capacity of full length weld $p_{c,weld} = a_{weld} \times p_{weld} = 1.245$ kN/mm

PASS - Capacity of weld exceeds resultant force on weld

Torsional loading ULS

Loading of support beam masonry $W_{1ULS} = (h_{msb} \times b_{msb} \times \rho_{m,sb} + P_{Gaddsb}) \times \gamma_{fG} + P_{Qaddsb} \times \gamma_{fQ} = 5.88$ kN/m

Loading of main beam masonry $W_{2ULS} = (h_{mmb} \times b_{mmb} \times \rho_{m,mb} + P_{Gaddmb}) \times \gamma_{fG} + P_{Qaddmb} \times \gamma_{fQ} = 5.24$ kN/m

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Self weight of support beam

$$W_{3ULS} = A_{sbu} \times \rho_{sb} \times \gamma_{fG} = \mathbf{0.22 \text{ kN/m}}$$

Torsional loading SLS

Loading of support beam masonry

$$W_{1SLS} = h_{msb} \times b_{msb} \times \rho_{m, sb} + P_{Gaddsb} + P_{Qaddsb} = \mathbf{4.20 \text{ kN/m}}$$

Loading of main beam masonry

$$W_{2SLS} = h_{mmb} \times b_{mmb} \times \rho_{m, mb} + P_{Gaddmb} + P_{Qaddmb} = \mathbf{3.74 \text{ kN/m}}$$

Self weight of support beam

$$W_{3SLS} = A_{sbu} \times \rho_{sb} = \mathbf{0.16 \text{ kN/m}}$$

Eccentricities

Distance to shear centre of main beam

$$e_{0mb} = \mathbf{0 \text{ mm}}$$

Eccentricity of support beam masonry

$$e_{1mb} = (B_{mb} + b_{msb}) / 2 + c - e_{mb} = \mathbf{175 \text{ mm}}$$

Eccentricity of main beam masonry

$$e_{2mb} = (B_{mb} - b_{mmb}) / 2 - e_{mb} = \mathbf{0 \text{ mm}}$$

Eccentricity of support beam

$$e_{3mb} = B_{mb} / 2 + C_{yysb} = \mathbf{90 \text{ mm}}$$

Torsional effects

Applied torque (ULS)

$$T_{qULS} = \text{abs}(W_{1ULS} \times e_{1mb} + W_{2ULS} \times e_{2mb} + W_{3ULS} \times e_{3mb}) = \mathbf{1.05 \text{ kNm/m}}$$

Total torque (ULS)

$$T_q = T_{qULS} \times L = \mathbf{3.15 \text{ kNm}}$$

Applied torque (SLS)

$$T_{qSLS} = \text{abs}(W_{1SLS} \times e_{1mb} + W_{2SLS} \times e_{2mb} + W_{3SLS} \times e_{3mb}) = \mathbf{0.75 \text{ kNm/m}}$$

Total torque (SLS)

$$T_{qu} = T_{qSLS} \times L = \mathbf{2.25 \text{ kNm}}$$

STEEL BEAM TORSION DESIGN

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

Tedds calculation version 2.0.04

Section details

Section type

RHS 150x100x5.0

Steel grade

S355

Design strength

$$\rho_{yw} = p_y = \mathbf{355 \text{ N/mm}^2}$$

Constant

$$\varepsilon = \sqrt{(275 \text{ N/mm}^2 / p_y)} = \mathbf{0.880}$$

Geometry - Beam unrestrained against lateral-torsional buckling between supports.

Effective span

$$L = \mathbf{3000 \text{ mm}}$$

Length of segment for LT buckling

$$L_{LT} = \mathbf{3000 \text{ mm}}$$

Compression flanges laterally unrestrained

Partial torsional restraint against rotation about longitudinal axis provided only by pressure of bottom flange onto supports

Effective length for LT buckling

$$L_{E,LT} = L_{LT} \times 1.2 + 2 \times D = \mathbf{3900 \text{ mm}}$$

Loading - Torsional loading comprises only full-length uniformly distributed load(s)

Internal forces & moments on member under factored loading for uls design

Applied shear force

$$F_{vy} = \mathbf{35.7 \text{ kN}}$$

Maximum bending moment

$$M_{LT} = M_x = \mathbf{18.71 \text{ kNm}}$$

Applied torque

$$T_q = \mathbf{3.15 \text{ kNm}}$$

Minor axis bending moment

$$M_y = \mathbf{0 \text{ kNm}}$$

Compression force

$$F_c = \mathbf{0 \text{ kN}}$$

Equivalent uniform moment factors

EUM factor (Cl. 4.3.6.6 and T18)

$$m_{LT} = \mathbf{1.000}$$

Torsional deflection analysis

Beam is torsion fixed at each end. (as defined in SCI-P-057 section 2.1.6)

Maximum torque (at supports)

$$T_o = T_q / 2 = \mathbf{1.57 \text{ kNm}}$$

Average torque between support & centreline

$$T_{av} = T_o / 2 = \mathbf{0.79 \text{ kNm}}$$

Max. angle of twist (at midspan)

$$\phi = T_{av} / (G \times J) \times L / 2 \times 1 \text{ rads} = \mathbf{0.002 \text{ rads}}$$

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Section classification

$$b_x / t = 17.0$$

$$d_x / t = 27.0$$

$$b_y / t = 27.0$$

$$d_y / t = 17.0$$

$$r_{1sx} = \min(1.0, \max(-1.0, F_c / (2 \times d_x \times t \times p_{yw}))) = 0.000$$

$$r_{1sy} = \min(1.0, \max(-1.0, F_c / (2 \times d_y \times t \times p_{yw}))) = 0.000$$

$$r_{2s} = F_c / (A_g \times p_{yw}) = 0.000$$

Section classification is plastic

Shear capacity (parallel to y-axis)

Design shear force $F_{vy} = 35.7$ kN

Design shear resistance (Cl. 4.2.3) $P_{vy} = 0.6 \times p_y \times A_{vy} = 303.3$ kN

Pass - Shear

Moment capacity (x-axis)

Design bending moment $M_x = 18.7$ kNm

Moment capacity $M_{cxu} = p_y \times S_x = 42.4$ kNm

Moment capacity low shear (Cl. 4.2.5.1) $M_{cx} = \min(p_y \times S_x, 1.2 \times p_y \times Z_x) = 42.0$ kNm

Pass - Moment capacity exceeds design bending moment

Lateral torsional buckling

Effective length for lateral torsional buckling $L_{E_LT} = 3900$ mm

Slenderness ratio - cl 4.3.6.5 $\lambda = L_{E_LT} / r_y = 96$

$D / B = 1.5$

LTB check not required

Buckling resistance moment $M_b = M_{cx} = 42.0$ kNm

Buckling under combined bending & torsion - SCI-P-057 section 2.3

For simplicity, a conservative check is applied using the maximum stresses due to each of the separate load effects, even though these do not necessarily all occur at the same section along the member.

Maximum angle of twist $\phi = 0.002$ rads

Induced minor axis moment $M_{yt} = M_x \times \phi / 1 \text{ rad} = 0.03$ kNm

Normal stress at corner due to M_{yt} $\sigma_{byt} = M_{yt} / Z_y = 0$ N/mm²

Interaction index $i_b = M_x \times m_{LT} / M_b + \sigma_{byt} / p_y \times (1 + 0.5 \times M_x \times m_{LT} / M_b) = 0.45$

Pass - Combined bending and torsion check satisfied

Local capacity under combined bending & torsion

For simplicity, a conservative check is applied using the maximum stresses due to each of the separate load effects, even though these do not necessarily all occur at the same section along the member.

Max. direct stress due to M_x $\sigma_{bx} = M_x / Z_x = 190$ N/mm²

Combined stress - eqn 2.22 $\sigma_{bx} + \sigma_{byt} = 190$ N/mm²

Design strength $p_y = 355$ N/mm²

Pass - Local capacity

Combined shear stresses SCI-P-057 section 2.3

For simplicity, a conservative check is applied using the maximum shear stresses due to each of the separate load effects, even though these do not necessarily all occur at the same section along the member.

Max. shear stress due to bending $\tau_{bw} = F_{vy} \times Q_w / (I_x \times 2 \times t) = 29$ N/mm²

Max. shear stresses due to torsion $\tau_t = T_o / C = 12$ N/mm²

Amplified shear stress due to torsion $\tau_{vt} = \tau_t \times (1 + 0.5 \times M_x \times m_{LT} / M_b) = 15$ N/mm²

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Combined shear due to bending & torsion	$\tau = \tau_{bw} + \tau_{vt} = \mathbf{44\ N/mm^2}$	
Shear strength	$p_v = 0.6 \times p_y = \mathbf{213\ N/mm^2}$	
		Pass - Combined shear stresses
Twist check		
Total applied torque (unfactored)	$T_{qu} = \mathbf{2.25\ kNm}$	
Maximum twist under sls loading	$\phi_{sls} = \phi \times T_{qu} / T_q = \mathbf{0.08\ deg}$	
Twist limit	$\phi_{lim} = \mathbf{1.00\ deg}$	
		Pass - Twist
Deflection		
Maximum y-axis deflection	$\delta_{y_max} = \mathbf{7.8\ mm}$	
Deflection limit - cl. 2.5.2	$\delta_{lim} = \min(L/ k_{\delta}, \delta_{lim_abs}) = \mathbf{10.0\ mm}$	
		Pass - Deflection within specified limit

LINTEL BEAM BEARING.

$$F_{\text{TOTAL}} = 35.7 \text{ kN}$$

ASSUME $\frac{1}{3}$ OUTER $\frac{2}{3}$ INNER.

$$\therefore \frac{35.7}{3} \times 2 = \underline{23.8 \text{ kN}}$$

$$\frac{35.7}{3} = \underline{11.9 \text{ kN}}$$

3.5N INNER BLOCKS + 7.0N
OUTER BLOCKS.

$$\therefore \frac{23.8 \times 10^3 \times 3.5}{1.25 \times 100 \times 3.5} = \underline{190.4 \text{ mm}}$$

USE 250lg x 100wd x 150dp PADSTONE.

$$\frac{11.9 \times 10^3 \times 3.5}{1.25 \times 100 \times 6.4} = \underline{52.1 \text{ mm}}$$

USE 150lg MIN BEARING FOR PLATE.

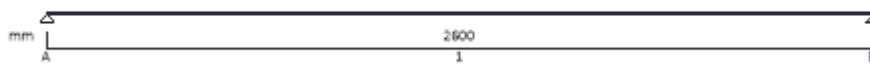
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	R.Rymer	26/03/2026				

TIMBER JOIST DESIGN (BS5268-2:2002)

Tedds calculation version 1.1.04

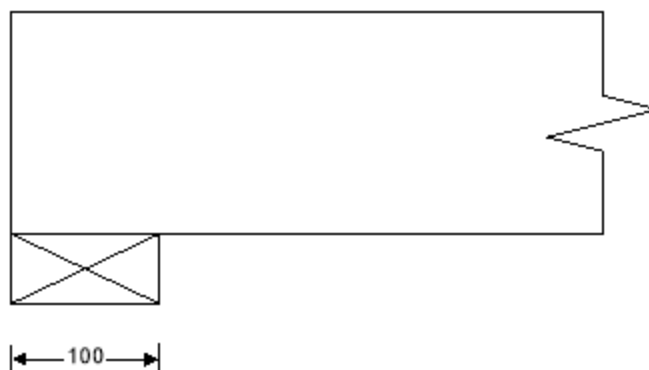
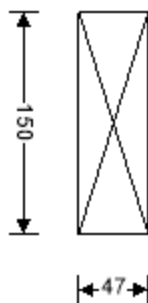
Joist details

Joist breadth	b = 47 mm
Joist depth	h = 150 mm
Joist spacing	s = 600 mm
Timber strength class	C24
Service class of timber	1



Span details

Number of spans	N _{span} = 1
Length of bearing	L _b = 100 mm
Effective length of span	L _{s1} = 2600 mm



Section properties

Second moment of area	$I = b \times h^3 / 12 = 13218750 \text{ mm}^4$
Section modulus	$Z = b \times h^2 / 6 = 176250 \text{ mm}^3$

Loading details

Joist self weight	$F_{swt} = b \times h \times \rho_{char} \times g_{acc} = 0.02 \text{ kN/m}$
Dead load	$F_{d_udl} = 0.79 \text{ kN/m}^2$
Imposed UDL(Medium term)	$F_{i_udl} = 0.75 \text{ kN/m}^2$
Imposed point load (Short term)	$F_{i_pt} = 0.90 \text{ kN}$

Modification factors

Service class for bending parallel to grain	K _{2m} = 1.00
Service class for compression	K _{2c} = 1.00
Service class for shear parallel to grain	K _{2s} = 1.00
Service class for modulus of elasticity	K _{2e} = 1.00
Section depth factor	K ₇ = 1.08

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Load sharing factor

$$K_8 = 1.10$$

Consider medium term loads

Load duration factor

$$K_3 = 1.25$$

Maximum bending moment

$$M = 0.801 \text{ kNm}$$

Maximum shear force

$$V = 1.233 \text{ kN}$$

Maximum support reaction

$$R = 1.233 \text{ kN}$$

Maximum deflection

$$\delta = 4.154 \text{ mm}$$

Check bending stress

Bending stress

$$\sigma_m = 7.500 \text{ N/mm}^2$$

Permissible bending stress

$$\sigma_{m_adm} = \sigma_m \times K_{2m} \times K_3 \times K_7 \times K_8 = 11.130 \text{ N/mm}^2$$

Applied bending stress

$$\sigma_{m_max} = M / Z = 4.546 \text{ N/mm}^2$$

PASS - Applied bending stress within permissible limits

Check shear stress

Shear stress

$$\tau = 0.710 \text{ N/mm}^2$$

Permissible shear stress

$$\tau_{adm} = \tau \times K_{2s} \times K_3 \times K_8 = 0.976 \text{ N/mm}^2$$

Applied shear stress

$$\tau_{max} = 3 \times V / (2 \times b \times h) = 0.262 \text{ N/mm}^2$$

PASS - Applied shear stress within permissible limits

Check bearing stress

Compression perpendicular to grain (no wane)

$$\sigma_{cp1} = 2.400 \text{ N/mm}^2$$

Permissible bearing stress

$$\sigma_{c_adm} = \sigma_{cp1} \times K_{2c} \times K_3 \times K_8 = 3.300 \text{ N/mm}^2$$

Applied bearing stress

$$\sigma_{c_max} = R / (b \times L_b) = 0.262 \text{ N/mm}^2$$

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection

$$\delta_{adm} = \min(L_{s1} \times 0.003, 14 \text{ mm}) = 7.800 \text{ mm}$$

Bending deflection (based on E_{mean})

$$\delta_{bending} = 3.952 \text{ mm}$$

Shear deflection

$$\delta_{shear} = 0.202 \text{ mm}$$

Total deflection

$$\delta = \delta_{bending} + \delta_{shear} = 4.154 \text{ mm}$$

PASS - Actual deflection within permissible limits

Consider short term loads

Load duration factor

$$K_3 = 1.50$$

Maximum bending moment

$$M = 1.006 \text{ kNm}$$

Maximum shear force

$$V = 1.548 \text{ kN}$$

Maximum support reaction

$$R = 1.548 \text{ kN}$$

Maximum deflection

$$\delta = 4.638 \text{ mm}$$

Check bending stress

Bending stress

$$\sigma_m = 7.500 \text{ N/mm}^2$$

Permissible bending stress

$$\sigma_{m_adm} = \sigma_m \times K_{2m} \times K_3 \times K_7 \times K_8 = 13.355 \text{ N/mm}^2$$

Applied bending stress

$$\sigma_{m_max} = M / Z = 5.708 \text{ N/mm}^2$$

PASS - Applied bending stress within permissible limits

Check shear stress

Shear stress

$$\tau = 0.710 \text{ N/mm}^2$$

Permissible shear stress

$$\tau_{adm} = \tau \times K_{2s} \times K_3 \times K_8 = 1.172 \text{ N/mm}^2$$

Applied shear stress

$$\tau_{max} = 3 \times V / (2 \times b \times h) = 0.329 \text{ N/mm}^2$$

PASS - Applied shear stress within permissible limits

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Check bearing stress

Compression perpendicular to grain (no wane)

$$\sigma_{cp1} = \mathbf{2.400 \text{ N/mm}^2}$$

Permissible bearing stress

$$\sigma_{c_adm} = \sigma_{cp1} \times K_{2c} \times K_3 \times K_8 = \mathbf{3.960 \text{ N/mm}^2}$$

Applied bearing stress

$$\sigma_{c_max} = R / (b \times L_b) = \mathbf{0.329 \text{ N/mm}^2}$$

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection

$$\delta_{adm} = \min(L_{s1} \times 0.003, 14 \text{ mm}) = \mathbf{7.800 \text{ mm}}$$

Bending deflection (based on E_{mean})

$$\delta_{bending} = \mathbf{4.385 \text{ mm}}$$

Shear deflection

$$\delta_{shear} = \mathbf{0.254 \text{ mm}}$$

Total deflection

$$\delta = \delta_{bending} + \delta_{shear} = \mathbf{4.638 \text{ mm}}$$

PASS - Actual deflection within permissible limits