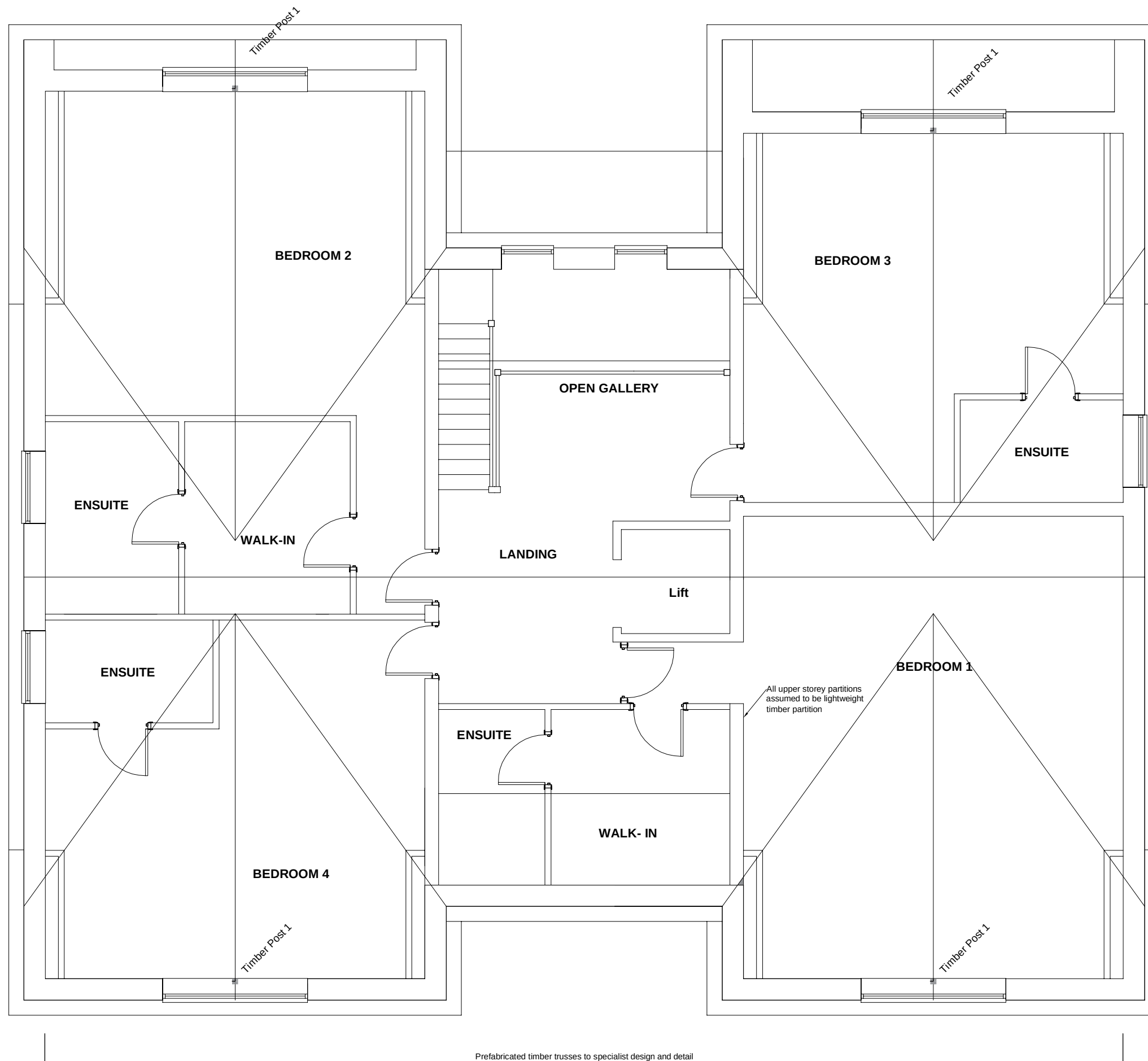


Job No	Project	Engineer	Date	Page										
7462	Daisy Barn, Rushden, Herts	HB	22/08/24	1										
<u>INTRODUCTION</u> These calculations have been prepared in accordance with instructions received from J K Architecture. The calculations are to provide information in respect to Building Regulation approval as shown on detailed drawings in connection with the proposed works. Any inspection of the work has not been undertaken in accordance with our instructions. Calculations to comply with and with reference to the following Codes of Practice:- <table><tr><td>BS 6399</td><td>Design Loading for Buildings</td></tr><tr><td>BS 5268</td><td>Structural Use of Timber</td></tr><tr><td>BS 5628</td><td>Use of Masonry</td></tr><tr><td>BS 8110</td><td>Structural Use of Concrete</td></tr><tr><td>BS 5950</td><td>Structural Use of Steelwork</td></tr></table> The current Building Regulations <u>PREAMBLE</u> It is proposed to construct a 3 storey residential house. The following calculations are to justify the new timber framing, steel beams and bearings and foundations. Our brief is limited to these items only. This project contains no known items which we consider to be of a greater risk than an experienced builder would expect to find on a similar project. The existing structure is to be fully exposed and checked to confirm structure prior to commencing work and ordering materials Full Building Regulations approval should be obtained prior to commencement of works on site and any works carried out prior to approval is done so at the contractors risk. The works are to be carried out to the approval and satisfaction of the Building Inspector and to accepted good building practice and in full compliance with all relevant British Standards and Codes of Practice. These calculations are for building regulation purpose and do not constitute full working drawings/details for the project. All beam lengths used in these calculations are design lengths. For ordering all beams/joists lengths are to be taken to suit site dimensions. A Party Wall award may be required, specialist advice should be obtained.					BS 6399	Design Loading for Buildings	BS 5268	Structural Use of Timber	BS 5628	Use of Masonry	BS 8110	Structural Use of Concrete	BS 5950	Structural Use of Steelwork
BS 6399	Design Loading for Buildings													
BS 5268	Structural Use of Timber													
BS 5628	Use of Masonry													
BS 8110	Structural Use of Concrete													
BS 5950	Structural Use of Steelwork													

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	22/08/24	2
	<u>LOADING DATA:</u>			kN/m2
	<u>Pitched Roof:-</u>			
	Tiles		0.55	
	Battens/felt		0.05	
	Rafters		0.1	
	Insulation		0.03	
	Ceiling		0.18	
	Imposed		0.75	
				1.66
	<u>Loft:-</u>	Allow	1.05	
	<u>Flat Roof:-</u>			
	Chips and Bitumen		0.2	
	3 Layers felt		0.1	
	Boarding		0.15	
	Joists		0.14	
	Insulation		0.03	
	Ceiling		0.18	
	Imposed		0.75	
				1.55
	<u>Floor:-</u>			
	Finishes		0.06	
	Boarding		0.15	
	Joists		0.17	
	Ceiling		0.18	
	Imposed		1.5	
				2.06
	<u>Stud Wall:</u>			
	Studs/noggins		0.09	
	Plasterboard		0.36	
				0.45
	<u>Blockwall:</u>			
	100mm block		0.7	
	Plaster x 2		0.7	
				1.4

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	22/08/24	3
	<u>Brickwall:-</u>			
		215mm brick	4.3	
		Plaster/render	0.7	
			5.00	
	<u>Cavity Wall:</u>			
		105mm Brick	2.15	
		100 block	0.7	
		Plaster	0.35	
			3.20	
	<u>Floor:</u>			
		Finishes	0.06	
		Screed	1.8	
		Insulation	0.05	
		PC Floor	3	
		Imposed	1.5	
		Parts	1	
			7.41	
	<u>External Stud Wall:</u>			
		Timber Boarding	0.18	
		Battens/felt	0.1	
		Insulation	0.05	
		Studs	0.2	
		Plasterboard	0.36	
			0.89	
	<u>Wind:-</u>			
		V	40	
		S1	1	
		S2	0.6	
		S3	1	
			0.35	
		Vs		



Roof Plan. [1:50]

Job No	7462 Daisy Barn	Engineer	Date	Page
		HB	22/08/24	5
Roof				
Pre-fabricated roof trusses by others. Loading based on Apex drawing A28681A. To be confirmed prior to construction.				
Timber Post 1 Height = 2.75m				
<u>Loading:</u>				
Ridge	Dead = $0.91 \times 3.5 \times 5.2 \times 0.5$	= 8.30 kN		
	Live = $0.75 \times 3.5 \times 5.2 \times 0.5$	= 6.83 kN		
	M = $(8.30 + 6.83) \times 0.15$	= 2.27 kNm		
Timber Post 2 Height = 2.25m				
<u>Loading:</u>				
Ridge	Dead = $0.91 \times 3.5 \times 6.6 \times 0.5$	= 10.6 kN		
	Live = $0.75 \times 3.5 \times 6.6 \times 0.5$	= 8.70 kN		
	M = $(10.6 + 8.70) \times 0.15$	= 2.90 kNm		

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	22/08/2024	6

Timber Post 1

TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03

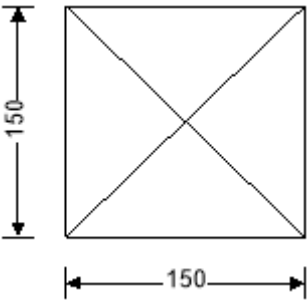
Analysis results

Design moment in major axis

Design axial compression

$M_x = 2.270 \text{ kNm}$

$P = 15.200 \text{ kN}$



Timber section details

Breadth of section	$b = 150 \text{ mm}$	Depth of section	$h = 150 \text{ mm}$
Number of sections	$N = 1$	Breadth of beam	$b_b = 150 \text{ mm}$
Timber strength class	C24		

Member details

Service class of timber	2	Load duration	Long term
Unbraced length in x-axis	$L_x = 2750 \text{ mm}$	Unbraced length in y-axis	$L_y = 2750 \text{ mm}$
factor in x-axis	$K_x = 1$	Effective length factor in y-axis	$K_y = 1$
Effective length in x-axis	$L_{ex} = 2750 \text{ mm}$	Effective length in y-axis	$L_{ey} = 2750 \text{ mm}$

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	2.00	Actual depth-to-breadth ratio	1.00
			<i>PASS - Lateral support is adequate</i>

Slenderness ratio - cl.2.11.4

Slenderness ratio	$\lambda = 63.509$	Permissible slenderness ratio	$\lambda_{max} = 180$
			<i>PASS - Slenderness ratio is less than permissible slenderness ratio</i>

Bending parallel to grain

Permissible bending stress	$\sigma_{m_adm} = 8.094 \text{ N/mm}^2$	Applied bending stress	$\sigma_{m_a} = 4.036 \text{ N/mm}^2$
			<i>PASS - Applied bending stress is less than permissible bending stress</i>

Compression parallel to grain

Permissible comp.stress	$\sigma_{c_adm} = 5.069 \text{ N/mm}^2$	Applied compressive stress	$\sigma_{c_a} = 0.676 \text{ N/mm}^2$
			<i>PASS - Applied compressive stress is less than permissible compressive stress</i>

Members subject to axial compression and bending - cl.2.11.6

Comb.comp.and bending	0.651 < 1		
			<i>PASS - Combined compressive and bending stresses are within permissible limits</i>

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	22/08/2024	7

Timber Post 2

TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03

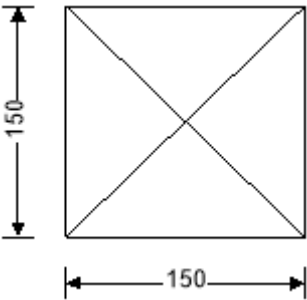
Analysis results

Design moment in major axis

Design axial compression

$M_x = 2.900 \text{ kNm}$

$P = 19.300 \text{ kN}$



Timber section details

Breadth of section	$b = 150 \text{ mm}$	Depth of section	$h = 150 \text{ mm}$
Number of sections	$N = 1$	Breadth of beam	$b_b = 150 \text{ mm}$
Timber strength class	C24		

Member details

Service class of timber	2	Load duration	Long term
Unbraced length in x-axis	$L_x = 2250 \text{ mm}$	Unbraced length in y-axis	$L_y = 2250 \text{ mm}$
factor in x-axis	$K_x = 1$	Effective length factor in y-axis	$K_y = 1$
Effective length in x-axis	$L_{ex} = 2250 \text{ mm}$	Effective length in y-axis	$L_{ey} = 2250 \text{ mm}$

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	2.00	Actual depth-to-breadth ratio	1.00
			<i>PASS - Lateral support is adequate</i>

Slenderness ratio - cl.2.11.4

Slenderness ratio	$\lambda = 51.962$	Permissible slenderness ratio	$\lambda_{max} = 180$
			<i>PASS - Slenderness ratio is less than permissible slenderness ratio</i>

Bending parallel to grain

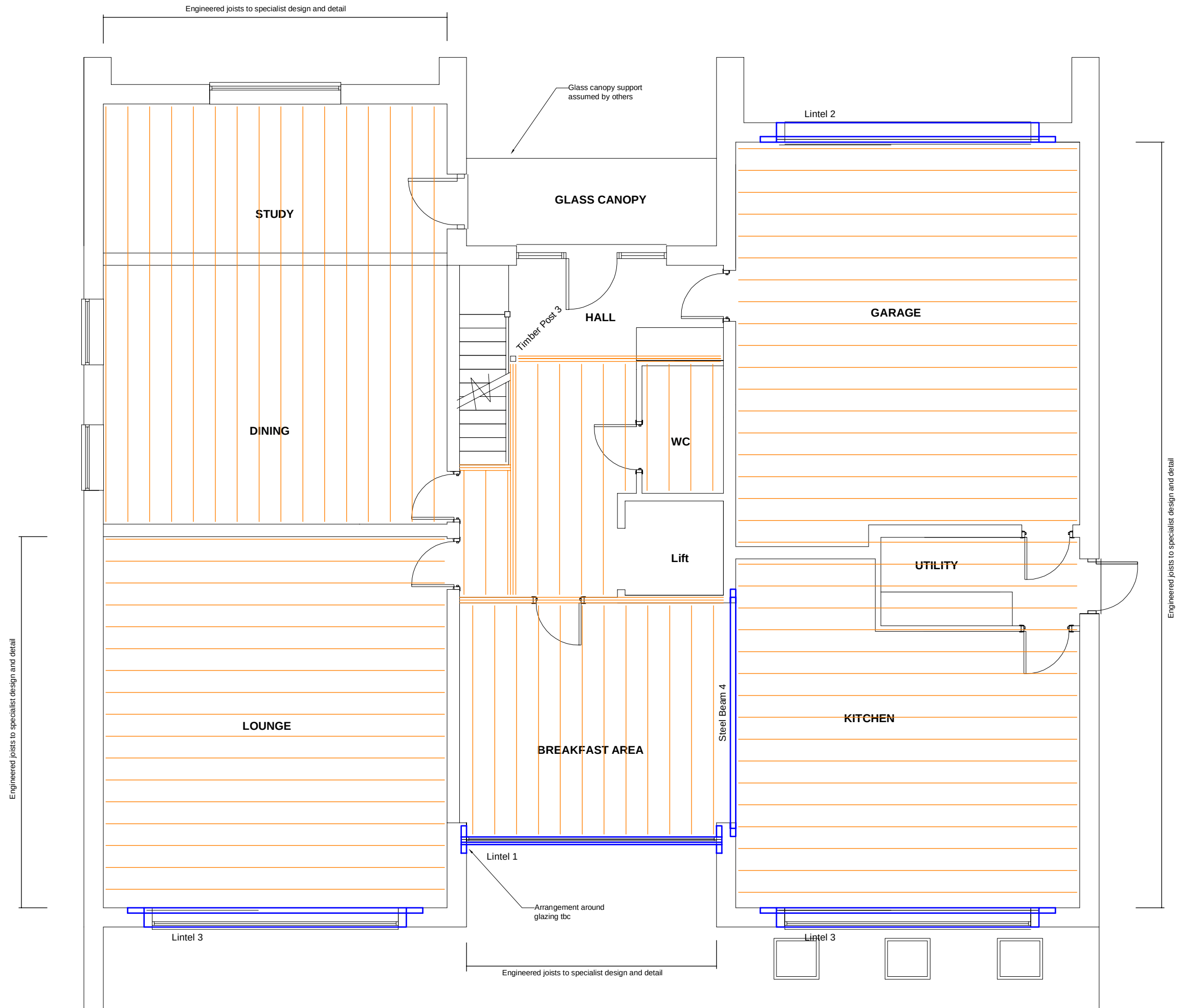
Permissible bending stress	$\sigma_{m_adm} = 8.094 \text{ N/mm}^2$	Applied bending stress	$\sigma_{m_a} = 5.156 \text{ N/mm}^2$
			<i>PASS - Applied bending stress is less than permissible bending stress</i>

Compression parallel to grain

Permissible comp.stress	$\sigma_{c_adm} = 5.704 \text{ N/mm}^2$	Applied compressive stress	$\sigma_{c_a} = 0.858 \text{ N/mm}^2$
			<i>PASS - Applied compressive stress is less than permissible compressive stress</i>

Members subject to axial compression and bending - cl.2.11.6

Comb.comp.and bending	0.811 < 1		
			<i>PASS - Combined compressive and bending stresses are within permissible limits</i>



First Floor Plan.
Setting out to be confirmed by others prior to construction.

Job No		Engineer	Date	Page
7462	Daisy Barn	HB	22/08/24	9
<u>First Floor</u> Posi joists by others. Loadings based on Apex timber drawing A28681B. To be confirmed prior to construction. <u>Timber Post 3</u> Height = 2.75m <u>Loading:</u> Atrium beam Dead = $0.56 \times 4.5 \times 0.5 \times 3.8 \times 0.5 = 2.40 \text{ kN}$ Live = $1.50 \times 4.5 \times 0.5 \times 3.8 \times 0.5 = 6.42 \text{ kN}$ M = $(2.40 + 6.42) \times 0.15 = 1.33 \text{ kNm}$ Stair trimmer Dead = $0.56 \times (0.6 + 3.7/4) = 0.86 \text{ kN}$ Live = $1.50 \times (0.6 + 3.7/4) = 2.29 \text{ kN}$ M = $(0.86 + 2.29) \times 0.15 = 0.48 \text{ kNm}$ <u>Lintel 1</u> Span = 4.75m <u>Loading:</u> Roof Dead= $0.91 \times 4.0 \times 0.5 = 1.82 \text{ kN/m}$ Live = $0.75 \times 4.0 \times 0.5 = 1.50 \text{ kN/m}$ Floor Dead= $0.56 \times 4.5 \times 0.5 = 1.26 \text{ kN/m}$ Live = $1.50 \times 4.5 \times 0.5 = 3.38 \text{ kN/m}$ Wall Dead= $3.20 \times 2.0 = 6.40 \text{ kN/m}$ Door Dead = 1.00 kN/m <u>Padstone:</u> assumes 3.5N/mm^2 block R = 54.9 kN Req'd Length = $\frac{54.9 \times 1000 \times 3.1}{100 \times 3.5} = 486 \text{ mm}$ Use: 500lg x 100wd x 250dp conc. padstone				

Job No	Engineer	Date	Page
7462	HB	22/08/24	10
Daisy Barn			
Lintel 2 Span = 4.75m			
<u>Loading:</u>			
Roof	Dead= 0.91 x 6.6 x 0.5	= 3.01 kN/m	
	Live = 0.75 x 6.6 x 0.5	= 2.48 kN/m	
Floor	Dead= 0.56 x 0.6	= 0.37 kN/m	
	Live = 1.50 x 0.6	= 0.90 kN/m	
Wall	Dead= 3.20 x 3.5	= 11.2 kN/m	
Door	Dead	= 1.00 kN/m	
<u>Padstone:</u> assumes 3.5N/mm2 block			
R = 66.4 kN			
Req'd Length	= $\frac{66.4 \times 1000 \times 3.1}{100 \times 3.5}$ = 588 mm		
Use:	600lg x 100wd x 300dp conc. padstone		
Lintel 3 Span = 4.75m			
<u>Loading:</u>			
Roof	Dead= 0.91 x 5.2 x 0.5	= 2.37 kN/m	
	Live = 0.75 x 5.2 x 0.5	= 1.95 kN/m	
Floor	Dead= 0.56 x 0.6	= 0.37 kN/m	
	Live = 1.50 x 0.6	= 0.90 kN/m	
Wall	Dead= 3.20 x 3.5	= 11.2 kN/m	
Door	Dead	= 1.00 kN/m	
<u>Padstone:</u> assumes 3.5N/mm2 block			
R = 62.3 kN			
Req'd Length	= $\frac{62.3 \times 1000 \times 3.1}{100 \times 3.5}$ = 552 mm		
Use:	575lg x 100wd x 300dp conc. padstone		

Job No	7462 Daisy Barn		Engineer	Date	Page
			HB	22/08/24	11
	Steel Beam 4		Span = 4.25m		
	<u>Loading:</u>				
	Roof	Dead= 0.91 x 11 x 0.5	= 5.01 kN/m		
		Live = 0.75 x 11 x 0.5	= 4.13 kN/m		
	Floor	Dead= 0.56 x 6.2 x 0.5	= 1.74 kN/m		
		Live = 1.50 x 6.2 x 0.5	= 4.65 kN/m		
	Wall	Dead= 0.45 x 2.5	= 1.13 kN/m		
	<u>Padstone:</u> assumes 3.5N/mm2 block				
	R = 54.2 kN				
	Req'd Length	$= \frac{54.2 \times 1000 \times 3.1}{100 \times 3.5} = 480 \text{ mm}$			
	Use:	500lg x 100wd x 250dp conc. padstone			

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7462	Daisy Barn	HB	22/08/2024	12

Timber Post 3

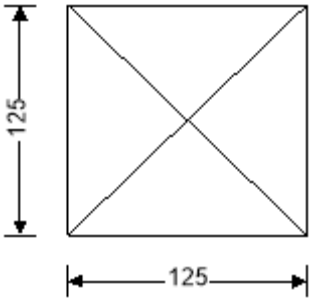
TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03

Analysis results

Design moment in major axis
Design moment in minor axis
Design axial compression

$M_x = 1.330 \text{ kNm}$
 $M_y = 0.480 \text{ kNm}$
 $P = 12.000 \text{ kN}$



Timber section details

Breadth of section	$b = 125 \text{ mm}$	Depth of section	$h = 125 \text{ mm}$
Number of sections	$N = 1$	Breadth of beam	$b_b = 125 \text{ mm}$
Timber strength class	C24		

Member details

Service class of timber	2	Load duration	Long term
Unbraced length in x-axis	$L_x = 2750 \text{ mm}$	Unbraced length in y-axis	$L_y = 2750 \text{ mm}$
factor in x-axis	$K_x = 1$	Effective length factor in y-axis	$K_y = 1$
Effective length in x-axis	$L_{ex} = 2750 \text{ mm}$	Effective length in y-axis	$L_{ey} = 2750 \text{ mm}$

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	2.00	Actual depth-to-breadth ratio	1.00
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PASS - Lateral support is adequate

Slenderness ratio - cl.2.11.4

Slenderness ratio	$\lambda = 76.210$	Permissible slenderness ratio	$\lambda_{max} = 180$
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PASS - Slenderness ratio is less than permissible slenderness ratio

Bending parallel to grain

Permissible bending stress	$\sigma_{m_adm} = 8.258 \text{ N/mm}^2$	Applied bending stress	$\sigma_{m_a} = 5.560 \text{ N/mm}^2$
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PASS - Applied bending stress is less than permissible bending stress

Compression parallel to grain

Permissible comp.stress	$\sigma_{c_adm} = 4.349 \text{ N/mm}^2$	Applied compressive stress	$\sigma_{c_a} = 0.768 \text{ N/mm}^2$
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PASS - Applied compressive stress is less than permissible compressive stress

Members subject to axial compression and bending - cl.2.11.6

Comb.comp.and bending	0.887 < 1
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PASS - Combined compressive and bending stresses are within permissible limits

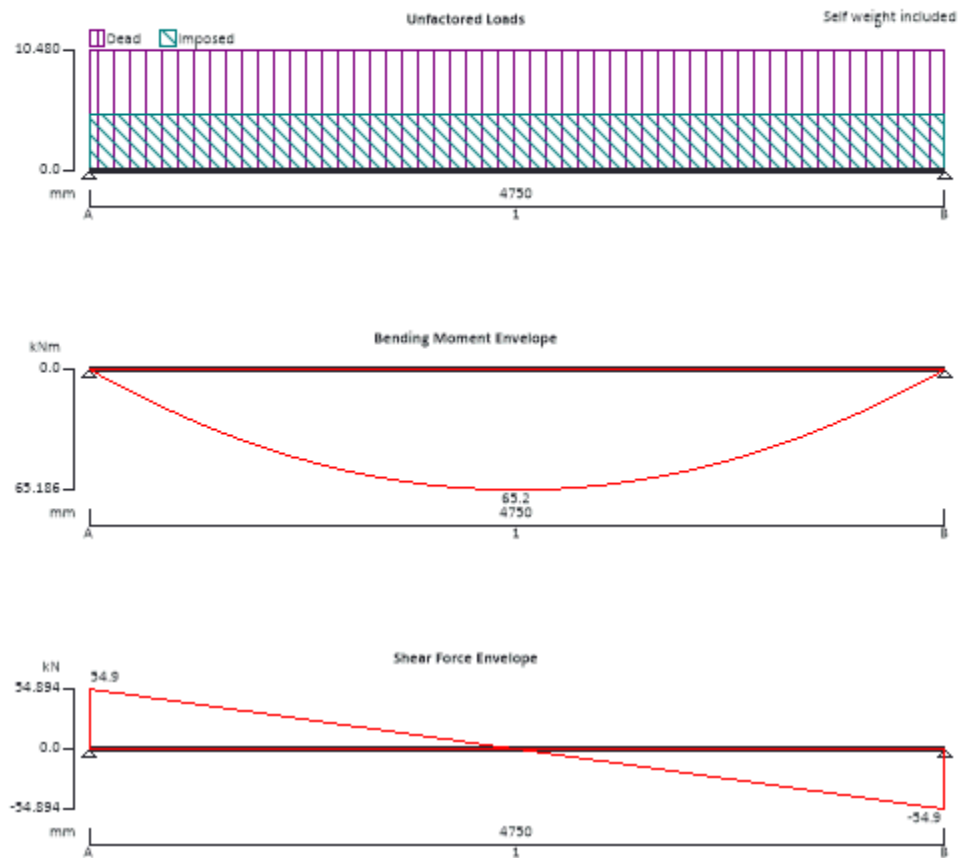
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	13

Lintel 1

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 10.48 kN/m Imposed full UDL 4.88 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

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7462	Daisy Barn	HB	23/08/2024	14

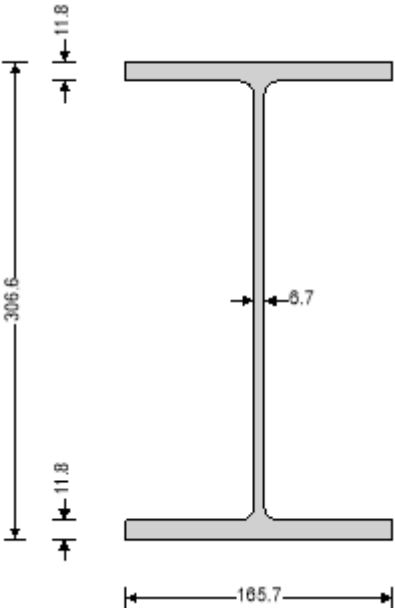
Lintel 1

Analysis results

Maximum moment	$M_{max} = 65.2 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 54.9 \text{ kN}$	$V_{min} = -54.9 \text{ kN}$
Deflection	$\delta_{max} = 5.2 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_{max}} = 54.9 \text{ kN}$	$R_{A_{min}} = 54.9 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_{Dead}} = 26 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_{Imposed}} = 11.6 \text{ kN}$	
Maximum reaction at support B	$R_{B_{max}} = 54.9 \text{ kN}$	$R_{B_{min}} = 54.9 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_{Dead}} = 26 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_{Imposed}} = 11.6 \text{ kN}$	

Section details

Section type	UB 305x165x46 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.88$	Section classification	Plastic
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 54.9 \text{ kN}$	Design shear resistance	$P_v = 437.5 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

Design bending moment	$M = 65.2 \text{ kNm}$	Moment capacity low shear	$M_c = 255.6 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 114.8 \text{ kNm}$	$M_b / m_{LT} = 124.1 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 6 \text{ mm}$	Maximum deflection	$\delta = 5.165 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			

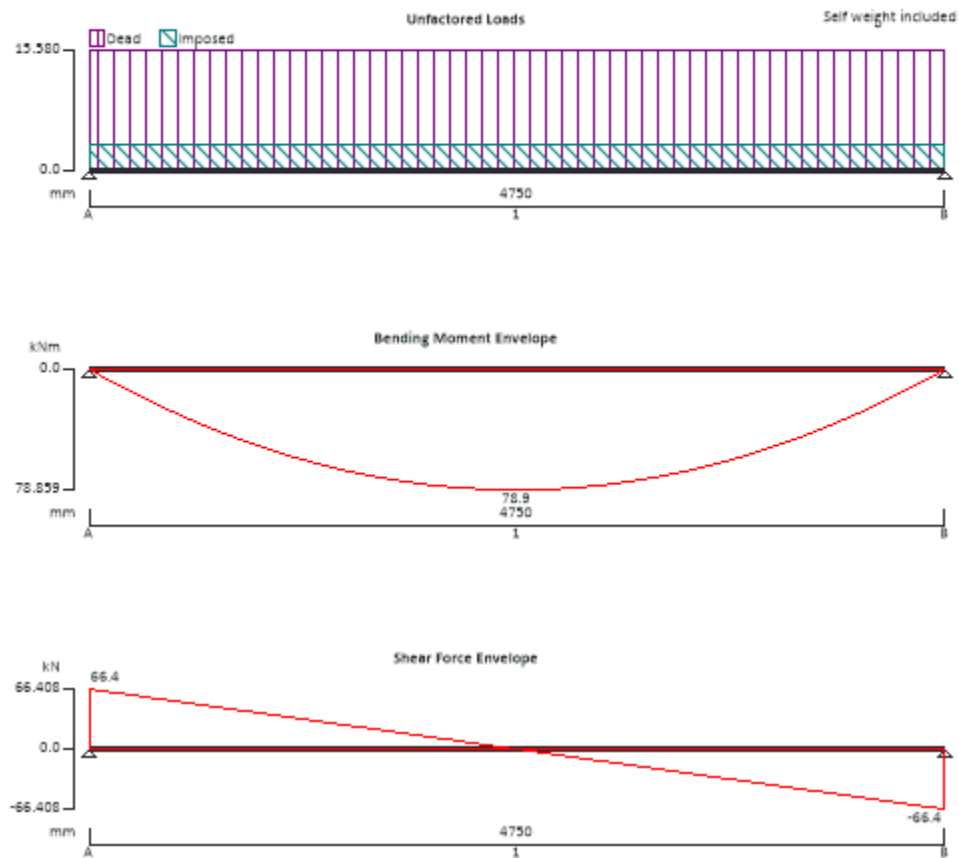
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	15

Lintel 2

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 15.58 kN/m Imposed full UDL 3.38 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

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7462	Daisy Barn	HB	23/08/2024	16

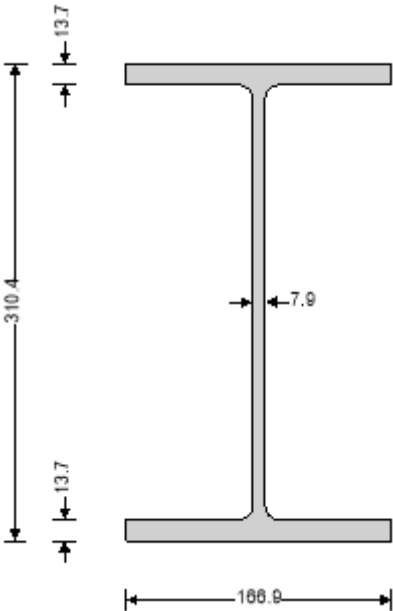
Lintel 2

Analysis results

Maximum moment	$M_{max} = 78.9 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 66.4 \text{ kN}$	$V_{min} = -66.4 \text{ kN}$
Deflection	$\delta_{max} = 5.4 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_{max}} = 66.4 \text{ kN}$	$R_{A_{min}} = 66.4 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_{Dead}} = 38.3 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_{Imposed}} = 8 \text{ kN}$	
Maximum reaction at support B	$R_{B_{max}} = 66.4 \text{ kN}$	$R_{B_{min}} = 66.4 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_{Dead}} = 38.3 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_{Imposed}} = 8 \text{ kN}$	

Section details

Section type	UB 305x165x54 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.88$	Section classification	Plastic
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 66.4 \text{ kN}$	Design shear resistance	$P_v = 522.3 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

Design bending moment	$M = 78.9 \text{ kNm}$	Moment capacity low shear	$M_c = 300.4 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 143.3 \text{ kNm}$	$M_b / m_{LT} = 155 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 6 \text{ mm}$	Maximum deflection	$\delta = 5.388 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			

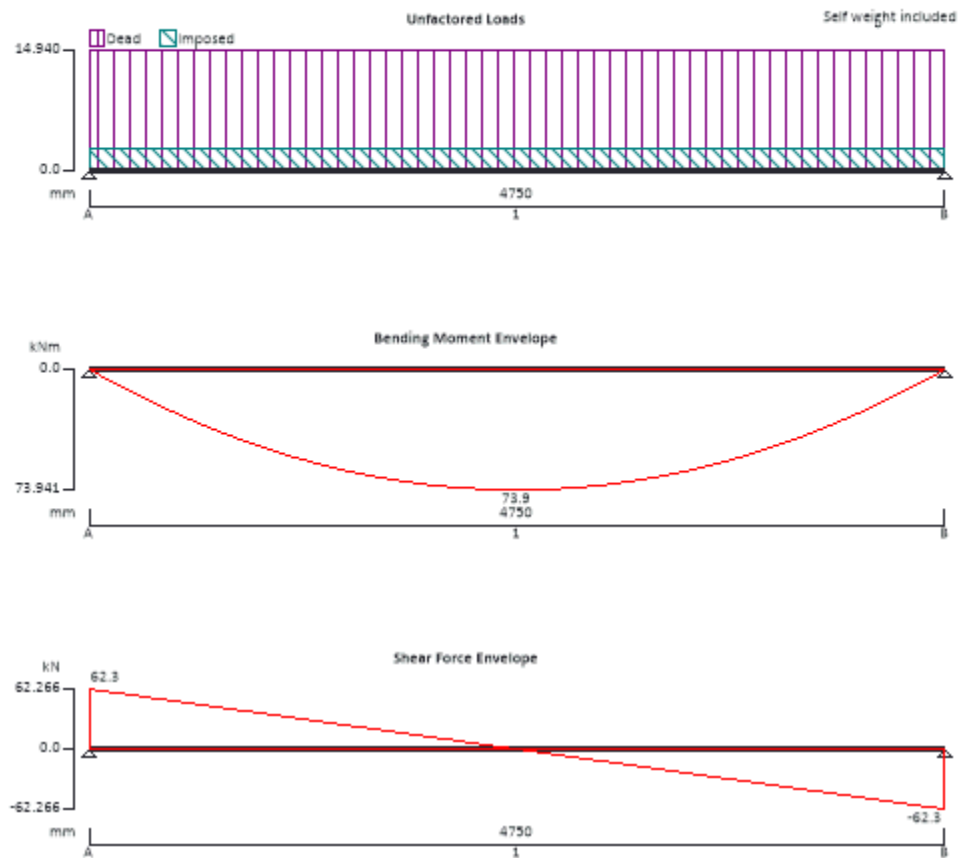
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	17

Lintel 3

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 14.94 kN/m Imposed full UDL 2.85 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

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	18

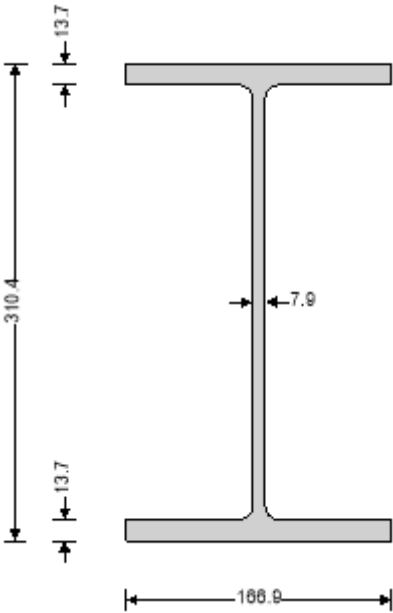
Lintel 3

Analysis results

Maximum moment	$M_{max} = 73.9 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 62.3 \text{ kN}$	$V_{min} = -62.3 \text{ kN}$
Deflection	$\delta_{max} = 5.1 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_{max}} = 62.3 \text{ kN}$	$R_{A_{min}} = 62.3 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_{Dead}} = 36.7 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_{Imposed}} = 6.8 \text{ kN}$	
Maximum reaction at support B	$R_{B_{max}} = 62.3 \text{ kN}$	$R_{B_{min}} = 62.3 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_{Dead}} = 36.7 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_{Imposed}} = 6.8 \text{ kN}$	

Section details

Section type	UB 305x165x54 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.88$	Section classification	Plastic
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 62.3 \text{ kN}$	Design shear resistance	$P_v = 522.3 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

Design bending moment	$M = 73.9 \text{ kNm}$	Moment capacity low shear	$M_c = 300.4 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 143.3 \text{ kNm}$	$M_b / m_{LT} = 155 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 6 \text{ mm}$	Maximum deflection	$\delta = 5.065 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			

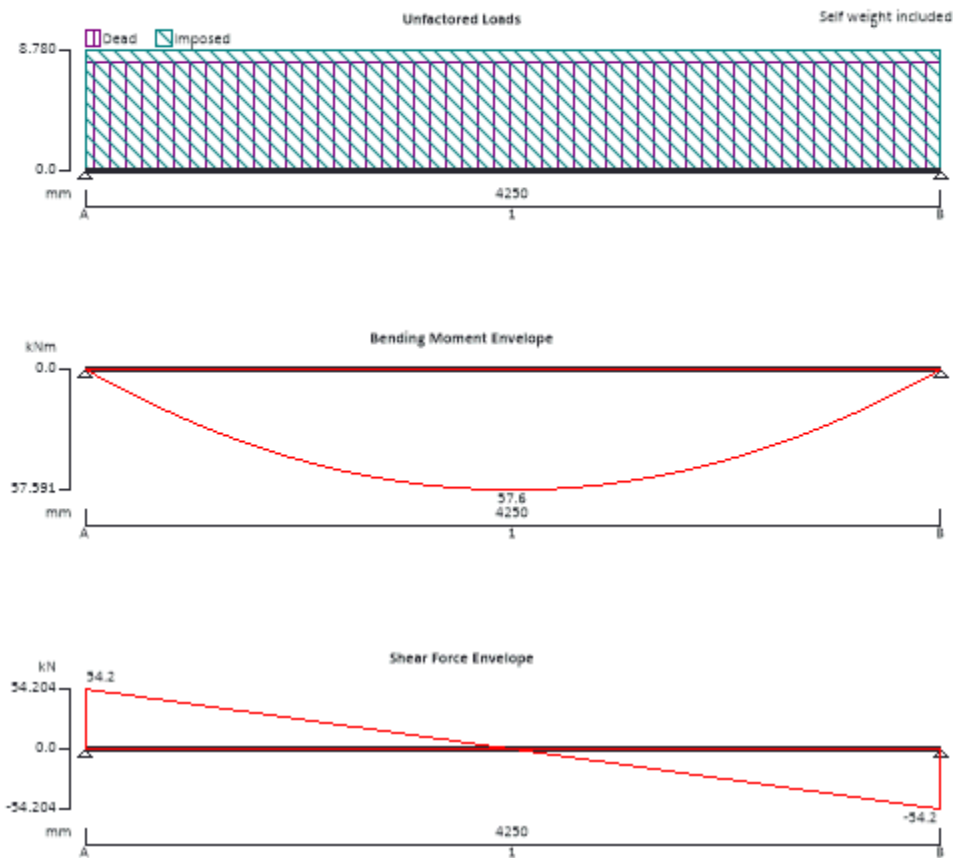
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	19

Steel Beam 4

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 7.88 kN/m Imposed full UDL 8.78 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

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7462	Daisy Barn	HB	23/08/2024	20

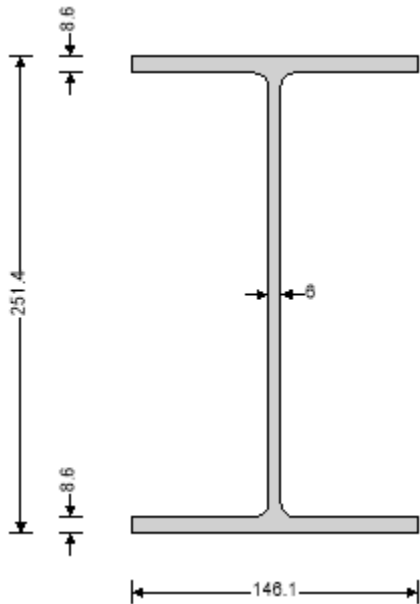
Steel Beam 4

Analysis results

Maximum moment	$M_{max} = 57.6 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 54.2 \text{ kN}$	$V_{min} = -54.2 \text{ kN}$
Deflection	$\delta_{max} = 8 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_max} = 54.2 \text{ kN}$	$R_{A_min} = 54.2 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_Dead} = 17.4 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_Imposed} = 18.7 \text{ kN}$	
Maximum reaction at support B	$R_{B_max} = 54.2 \text{ kN}$	$R_{B_min} = 54.2 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_Dead} = 17.4 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_Imposed} = 18.7 \text{ kN}$	

Section details

Section type	UB 254x146x31 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.88$	Section classification	Compact
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 54.2 \text{ kN}$	Design shear resistance	$P_v = 321.3 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

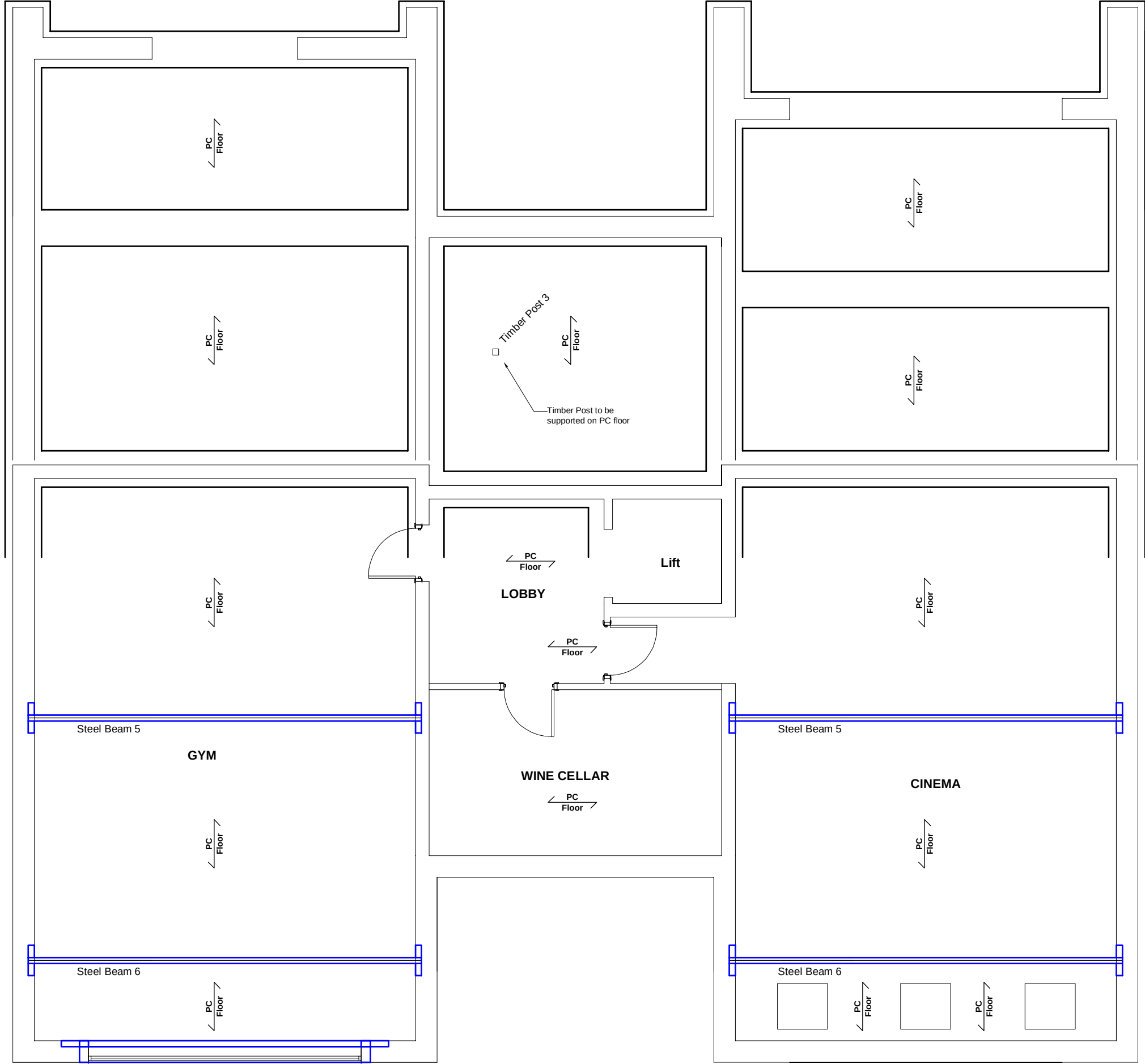
Design bending moment	$M = 57.6 \text{ kNm}$	Moment capacity low shear	$M_c = 139.5 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 59.3 \text{ kNm}$	$M_b / m_{LT} = 64.1 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 11.806 \text{ mm}$	Maximum deflection	$\delta = 7.966 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			



Ground Floor / FoundationPlan.
Setting out to be confirmed by others prior to construction.
PC Floor denotes span of pc beam and block floor

Job No		Engineer	Date	Page
7462	Daisy Barn	HB	22/08/24	22
<u>Ground Floor</u>				
<u>Steel Beam 5</u>		Span = 6.50m		
<u>Loading:</u>				
Floor	Dead= 5.91 x 8.0 x 0.5	= 23.7 kN/m		
	Live = 1.50 x 8.0 x 0.5	= 6.00 kN/m		
<u>Padstone:</u> assumes 3.5N/mm2 block				
R = 145 kN				
Req'd Length	= $\frac{145 \times 1000 \times 3.1}{100 \times 7.0}$ = 643 mm			
Use:	650lg x 100wd x 325dp conc. padstone			
<u>Steel Beam 6</u>		Span = 6.50m		
<u>Loading:</u>				
Roof	Dead= 0.91 x 5.2 x 0.5	= 2.37 kN/m		
	Live = 0.75 x 5.2 x 0.5	= 1.95 kN/m		
Floor	Dead= 0.56 x 0.6	= 0.37 kN/m		
	Live = 1.50 x 0.6	= 0.90 kN/m		
Wall	Dead= 3.20 x 3.5	= 11.2 kN/m		
Door	Dead	= 1.00 kN/m		
Floor	Dead= 5.91 x 5.4 x 0.5	= 16.0 kN/m		
	Live = 1.50 x 5.4 x 0.5	= 4.05 kN/m		
<u>Padstone:</u> assumes 3.5N/mm2 block				
R = 185 kN				
Req'd Length	= $\frac{185 \times 1000 \times 3.1}{100 \times 7.0}$ = 819 mm			
Use:	850lg x 100wd x 215dp conc. prestressed lintel			

Job No			Engineer	Date	Page
7462	Daisy Barn		HB	22/08/24	23
Lintel 7 Span = 4.75m Loading: Floor Dead= 5.91 x 1.5 x 0.5 = 4.43 kN/m Live = 1.50 x 1.5 x 0.5 = 1.13 kN/m Wall Dead= 3.20 x 0.5 = 1.60 kN/m Door Dead = 1.00 kN/m Padstone: assumes 3.5N/mm2 block R = 40.3 kN Req'd Length = $\frac{40.3 \times 1000 \times 3.1}{100 \times 7.0}$ = 178 mm Use: 250lg x 100wd x 150dp conc. padstone					

Job No		Engineer	Date	Page
7462	Daisy Barn	HB	22/08/24	24

Beam and Block Floor

Span = 4.25m

Loading:

Dead = 5.91 kN/m2

Live = 1.50 kN/m2



Beam & block load/span tables T155

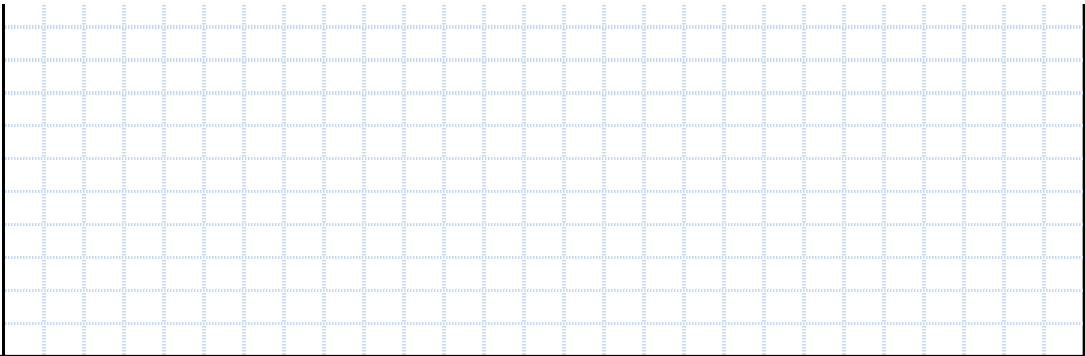
60
estimating@milbank.co.uk
01787 223931

155mm deep T beam (1 hour fire resistance)
Medium Density Infill blocks 1450kg/m³

Maximum Clear Span* in metres below allows for the characteristics live loads as
stated + Self weight + 1.8 kN/m²(75mm Screed) finishes + 1.00 kN/m² partition
allowance

Beam centres(mm)	Block Spacing'		Self-Weight (kN/m2)	Imposed Live Load kN/m2							
				0.75	1.50	2.00	2.5	3.00	4.00	5.00	7.50
	510	W	1.78	3.75	3.50	3.30	3.20	3.05	2.85	2.70	2.35
	398	A	1.88	4.20	3.90	3.75	3.60	3.45	3.25	3.05	2.70
	285	N	2.06	4.95	4.60	4.40	4.20	4.15	3.80	3.60	3.15
	620	DW	2.11	4.70	4.40	4.20	4.05	3.90	3.65	3.45	3.05
	508	DA	2.26	5.15	4.80	4.60	4.45	4.25	4.00	3.80	3.35
	395	DN	2.50	5.70	5.35	5.15	4.95	4.80	4.50	4.25	3.75
	505	TN	2.75	6.10	5.70	5.50	5.30	5.10	4.80	4.75	4.05

*Clear span between supporting walls / **W = wid (440mm) A = Alternate (440+215) N = Narrow (215mm) / DW =
Double beams Wide / DA = Double beams Alternate / DN = Double beams Narrow / TN = Triple beams Narrow



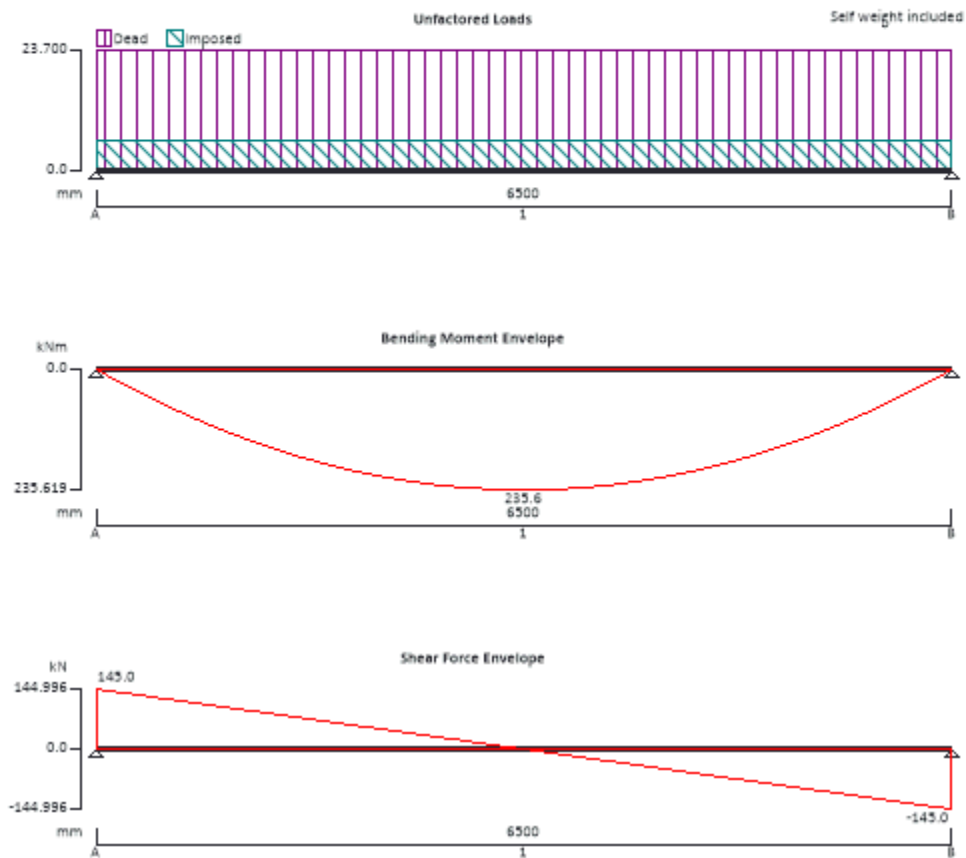
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	25

Steel Beam 5

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 23.7 kN/m Imposed full UDL 6 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

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7462	Daisy Barn	HB	23/08/2024	26

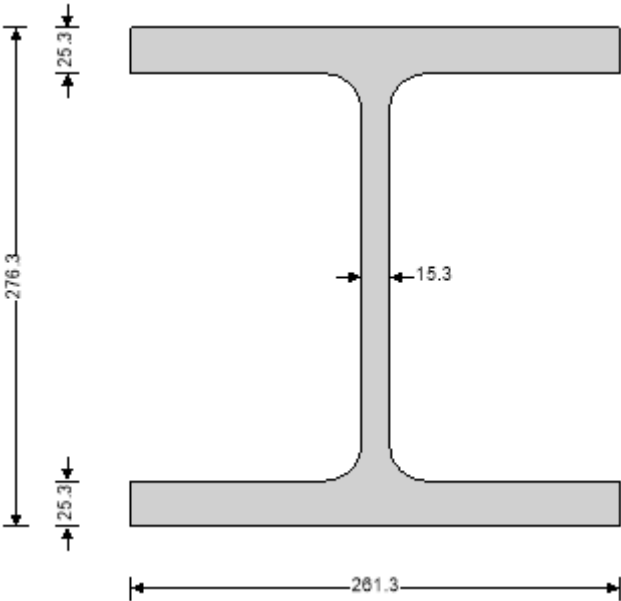
Steel Beam 5

Analysis results

Maximum moment	$M_{max} = 235.6 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 145 \text{ kN}$	$V_{min} = -145 \text{ kN}$
Deflection	$\delta_{max} = 15.4 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_max} = 145 \text{ kN}$	$R_{A_min} = 145 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_Dead} = 81.3 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_Imposed} = 19.5 \text{ kN}$	
Maximum reaction at support B	$R_{B_max} = 145 \text{ kN}$	$R_{B_min} = 145 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_Dead} = 81.3 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_Imposed} = 19.5 \text{ kN}$	

Section details

Section type	UC 254x254x132 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.89$	Section classification	Plastic
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 145 \text{ kN}$	Design shear resistance	$P_v = 875.1 \text{ kN}$
PASS - Design shear resistance exceeds design shear force			

Moment capacity - Section 4.2.5

Design bending moment	$M = 235.6 \text{ kNm}$	Moment capacity low shear	$M_c = 652.5 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 516 \text{ kNm}$	$M_b / m_{LT} = 557.8 \text{ kNm}$
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	$\delta_{lim} = 18.056 \text{ mm}$	Maximum deflection	$\delta = 15.445 \text{ mm}$
PASS - Maximum deflection does not exceed deflection limit			

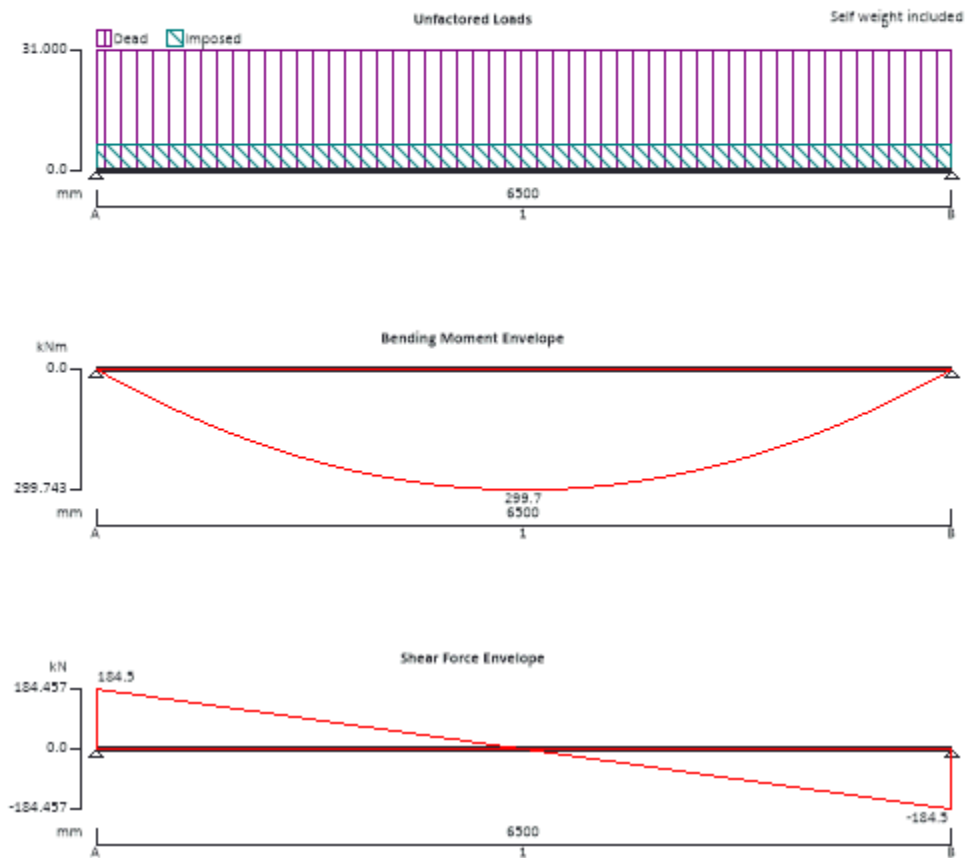
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	27

Steel Beam 6

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 31 kN/m Imposed full UDL 6.9 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

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7462	Daisy Barn	HB	23/08/2024	28

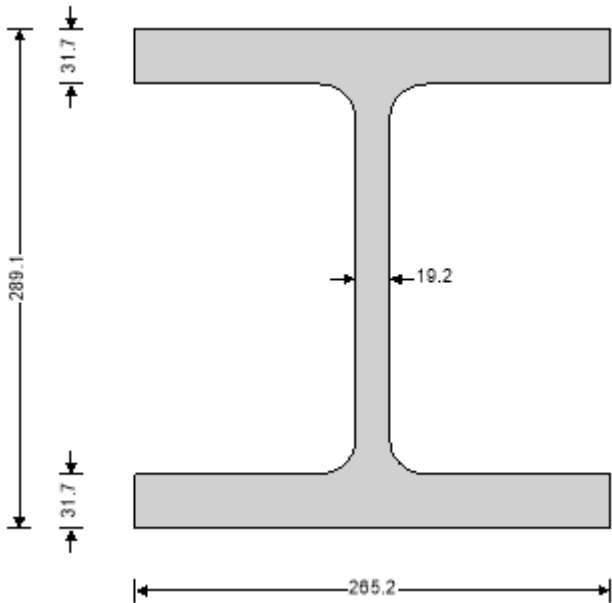
Steel Beam 6

Analysis results

Maximum moment	$M_{max} = 299.7 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 184.5 \text{ kN}$	$V_{min} = -184.5 \text{ kN}$
Deflection	$\delta_{max} = 14.8 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_max} = 184.5 \text{ kN}$	$R_{A_min} = 184.5 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_Dead} = 106.1 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_Imposed} = 22.4 \text{ kN}$	
Maximum reaction at support B	$R_{B_max} = 184.5 \text{ kN}$	$R_{B_min} = 184.5 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_Dead} = 106.1 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_Imposed} = 22.4 \text{ kN}$	

Section details

Section type	UC 254x254x167 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.89$	Section classification	Plastic
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 184.5 \text{ kN}$	Design shear resistance	$P_v = 1149 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

Design bending moment	$M = 299.7 \text{ kNm}$	Moment capacity low shear	$M_c = 843.7 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 705 \text{ kNm}$	$M_b / m_{LT} = 762.2 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 18.056 \text{ mm}$	Maximum deflection	$\delta = 14.833 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			

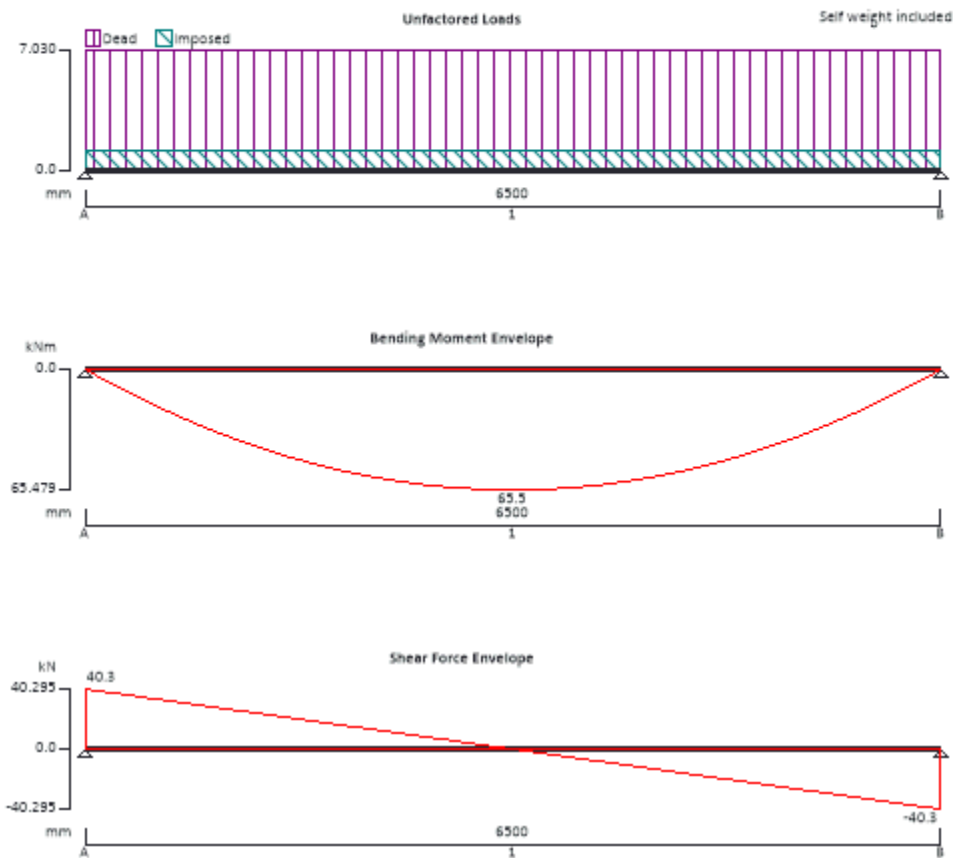
Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	29

Lintel 7

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 7.03 kN/m Imposed full UDL 1.13 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

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	30

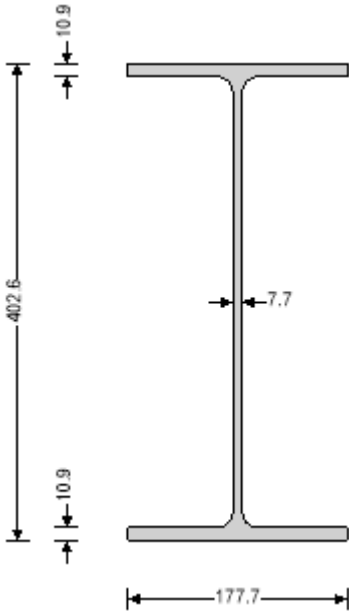
Lintel 7

Analysis results

Maximum moment	$M_{max} = 65.5 \text{ kNm}$	$M_{min} = 0 \text{ kNm}$
Maximum shear	$V_{max} = 40.3 \text{ kN}$	$V_{min} = -40.3 \text{ kN}$
Deflection	$\delta_{max} = 5.2 \text{ mm}$	$\delta_{min} = 0 \text{ mm}$
Maximum reaction at support A	$R_{A_{max}} = 40.3 \text{ kN}$	$R_{A_{min}} = 40.3 \text{ kN}$
Unfactored dead load reaction at support A	$R_{A_{Dead}} = 24.6 \text{ kN}$	
Unfactored imposed load reaction at support A	$R_{A_{Imposed}} = 3.7 \text{ kN}$	
Maximum reaction at support B	$R_{B_{max}} = 40.3 \text{ kN}$	$R_{B_{min}} = 40.3 \text{ kN}$
Unfactored dead load reaction at support B	$R_{B_{Dead}} = 24.6 \text{ kN}$	
Unfactored imposed load reaction at support B	$R_{B_{Imposed}} = 3.7 \text{ kN}$	

Section details

Section type	UB 406x178x54 (British Steel Section Range 2022 (BS4-1))	Steel grade	S355
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Classification of cross sections - Section 3.5

Tensile strain coefficient	$\epsilon = 0.88$	Section classification	Compact
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Shear capacity - Section 4.2.3

Design shear force	$F_v = 40.3 \text{ kN}$	Design shear resistance	$P_v = 660.3 \text{ kN}$
<i>PASS - Design shear resistance exceeds design shear force</i>			

Moment capacity - Section 4.2.5

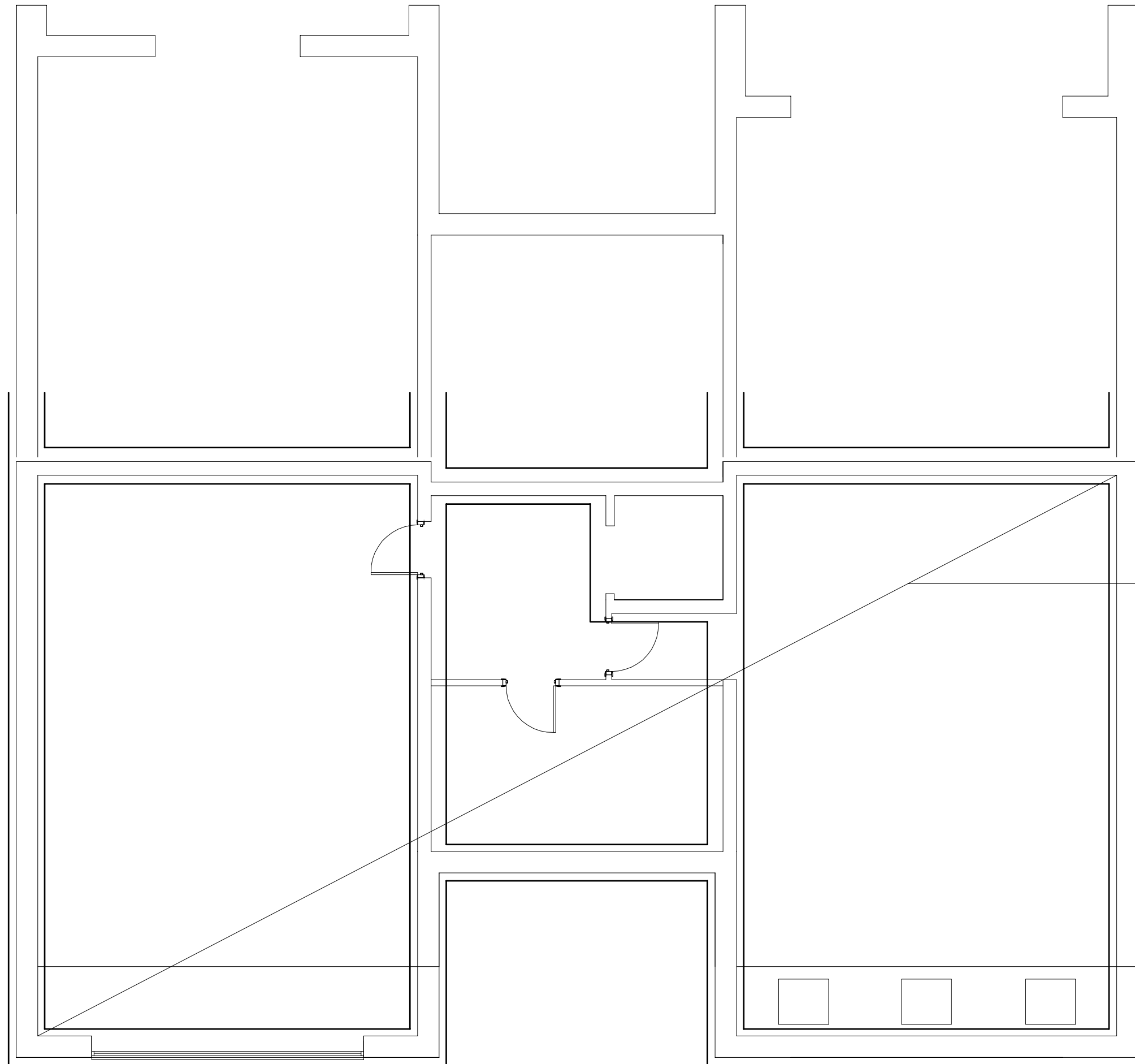
Design bending moment	$M = 65.5 \text{ kNm}$	Moment capacity low shear	$M_c = 377.7 \text{ kNm}$
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Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment	$M_b = 104.8 \text{ kNm}$	$M_b / m_{LT} = 113.3 \text{ kNm}$
<i>PASS - Buckling resistance moment exceeds design bending moment</i>		

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads			
Limiting deflection	$\delta_{lim} = 6 \text{ mm}$	Maximum deflection	$\delta = 5.218 \text{ mm}$
<i>PASS - Maximum deflection does not exceed deflection limit</i>			



150mm thk RC ground floor slab with 1 layer
A393 mesh in bottom (40mm cover)
finish to client requirements,
laid on 1200 gauge polythene DPM on 50mm thk
concrete blinding over min. 150mm thk imported
certified DTp type 1 granular fill material, placed
and compacted with a 10 tonne vibrating roller.
All the above placed on approved formation level,
proof rolled with a 10 tonne vibrating roller and
any soft spots encountered are to be removed
and replaced with DTp type 1 fill material in layers
not exceeding 150mm, compacted as noted above.

Lower Ground Floor / Foundation Plan.

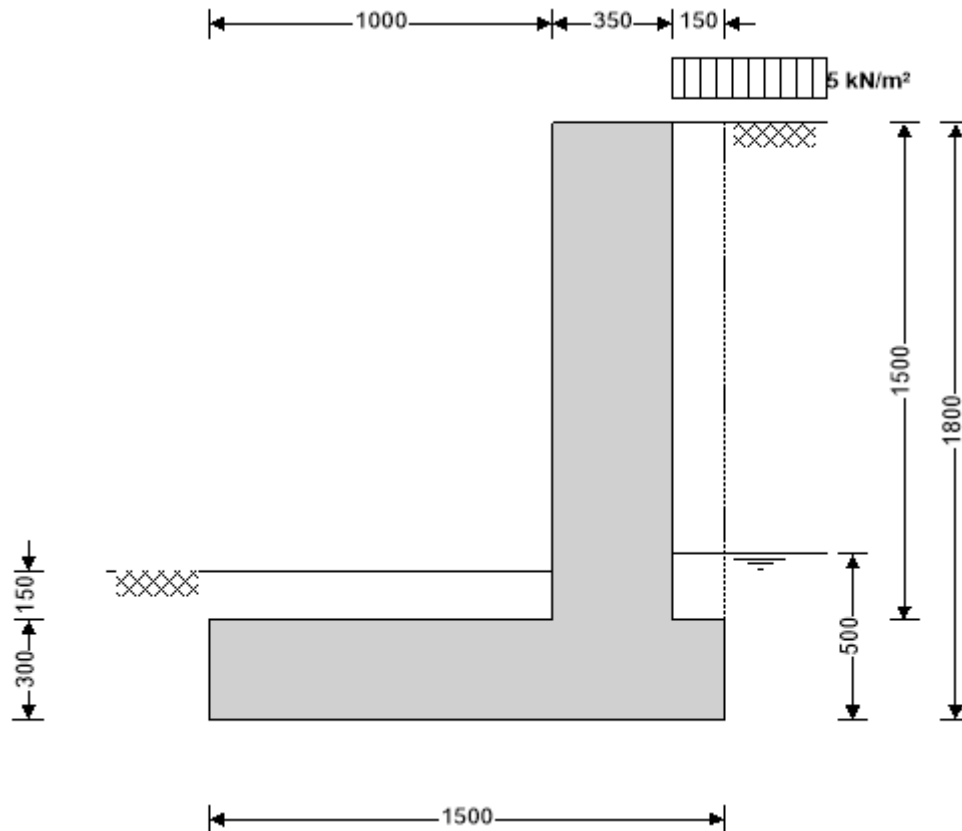
Setting out to be confirmed by others prior to construction.

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	32

Retaining Wall

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

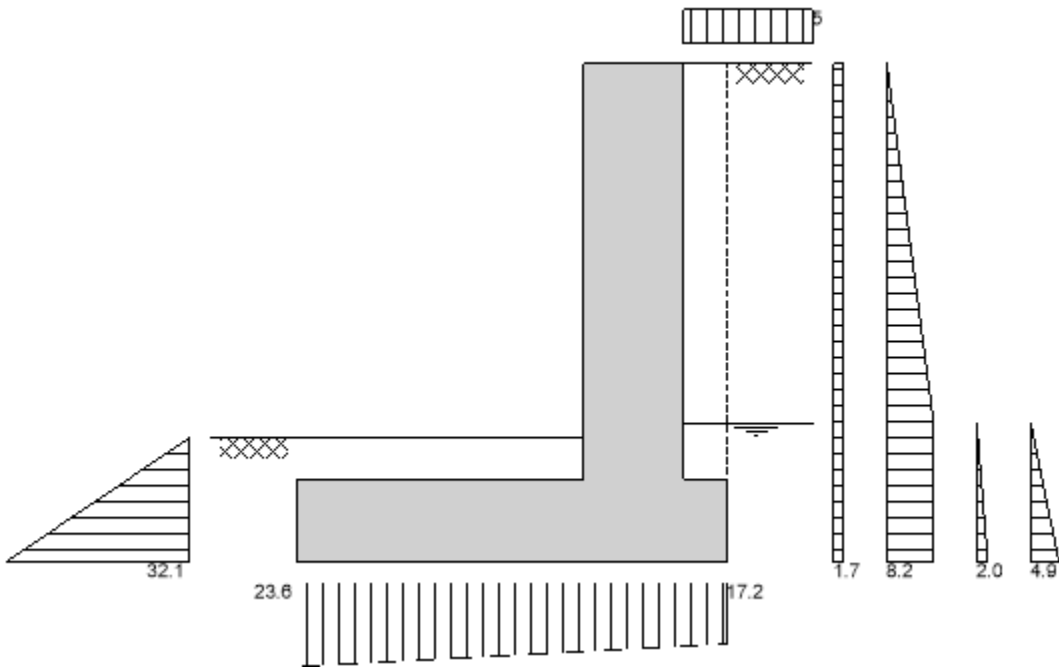
Retaining wall type	Cantilever	Wall stem thickness	$t_{wall} = \mathbf{350 \text{ mm}}$
Height of wall stem	$h_{stem} = \mathbf{1500 \text{ mm}}$	Length of heel	$l_{heel} = \mathbf{150 \text{ mm}}$
Length of toe	$l_{toe} = \mathbf{1000 \text{ mm}}$	Base thickness	$t_{base} = \mathbf{300 \text{ mm}}$
Overall length of base	$l_{base} = \mathbf{1500 \text{ mm}}$	Thickness of downstand	$t_{ds} = \mathbf{300 \text{ mm}}$
Height of retaining wall	$h_{wall} = \mathbf{1800 \text{ mm}}$	Unplanned excavation depth	$d_{exc} = \mathbf{0 \text{ mm}}$
Depth of downstand	$d_{ds} = \mathbf{0 \text{ mm}}$	Density of water	$\gamma_{water} = 9.81 \text{ kN/m}^3$
Position of downstand	$l_{ds} = \mathbf{1050 \text{ mm}}$	Density of base construction	$\gamma_{base} = \mathbf{23.6 \text{ kN/m}^3}$
Depth of cover in front of wall	$d_{cover} = \mathbf{150 \text{ mm}}$	Effective height at back of wall	$h_{eff} = \mathbf{1800 \text{ mm}}$
Height of ground water	$h_{water} = \mathbf{500 \text{ mm}}$	Saturated density	$\gamma_s = \mathbf{21.0 \text{ kN/m}^3}$
Density of wall construction	$\gamma_{wall} = \mathbf{23.6 \text{ kN/m}^3}$	Angle of wall friction	$\delta = \mathbf{18.6 \text{ deg}}$
Angle of soil surface	$\beta = \mathbf{0.0 \text{ deg}}$	Design base friction	$\delta_b = \mathbf{18.6 \text{ deg}}$
Mobilisation factor	$M = \mathbf{1.5}$	Allowable bearing	$P_{bearing} = \mathbf{100 \text{ kN/m}^2}$
Moist density	$\gamma_m = \mathbf{18.0 \text{ kN/m}^3}$	Passive pressure	$K_p = \mathbf{4.187}$
Design shear strength	$\phi' = \mathbf{24.2 \text{ deg}}$		
Design shear strength	$\phi'_b = \mathbf{24.2 \text{ deg}}$		
Moist density	$\gamma_{mb} = \mathbf{18.0 \text{ kN/m}^3}$		
Using Coulomb theory			
Active pressure	$K_a = \mathbf{0.369}$		
At-rest pressure	$K_0 = \mathbf{0.590}$		

Job No	Project	Engineer	Date	Page
7462	Daisy Barn	HB	23/08/2024	33

Retaining Wall

Loading details

Surcharge load	Surcharge = 5.0 kN/m ²		
Vertical dead load	W _{dead} = 0.0 kN/m	Vertical live load	W _{live} = 0.0 kN/m
Horizontal dead load	F _{dead} = 0.0 kN/m	Horizontal live load	F _{live} = 0.0 kN/m
Position of vertical load	l _{load} = 0 mm	Height of horizontal load	h _{load} = 0 mm



Loads shown in kN/m, pressures shown in kN/m²

Check stability against sliding

Total horizontal load on wall	F _{total} = 14.3 kN/m	Resistance to sliding	F _{res} = 16.4 kN/m
PASS - Resistance force is greater than sliding force			

Check stability against overturning

Overturning moment	M _{ot} = 9.1 kNm/m	Restoring moment	M _{rest} = 28.4 kNm/m
PASS - Restoring moment is greater than overturning moment			

Check bearing pressure

Total vertical reaction	R = 30.6 kN/m	Distance to reaction	X _{bar} = 710 mm
Eccentricity of reaction	e = 40 mm	Reaction acts within middle third of base	
Bearing pressure at toe	p _{toe} = 23.6 kN/m ²	Bearing pressure at heel	p _{heel} = 17.2 kN/m ²
PASS - Maximum bearing pressure is less than allowable bearing pressure			

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RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.08

Ultimate limit state load factors

Dead load factor	$\gamma_{f_d} = 1.4$	Live load factor	$\gamma_{f_l} = 1.6$
Earth pressure factor	$\gamma_{f_e} = 1.4$		

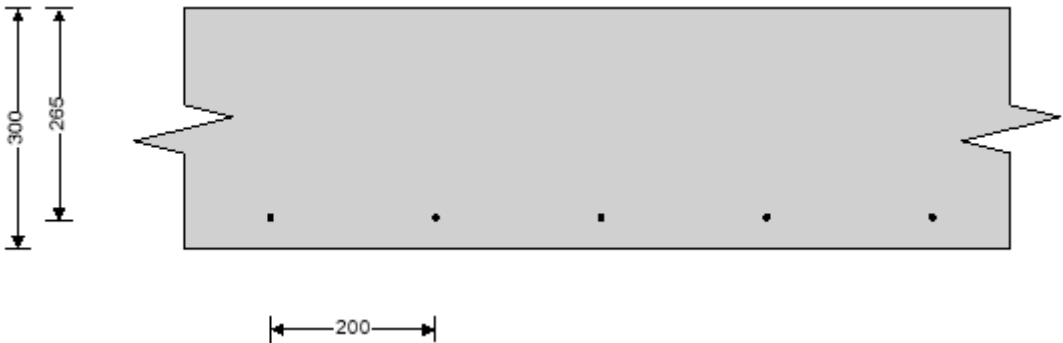
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete	$f_{cu} = 40 \text{ N/mm}^2$	Strength of reinforcement	$f_y = 500 \text{ N/mm}^2$
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Base details

Minimum reinforcement	$k = 0.13 \%$	Cover in toe	$C_{toe} = 30 \text{ mm}$
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Design of retaining wall toe

Shear at heel	$V_{toe} = 24.9 \text{ kN/m}$	Moment at heel	$M_{toe} = 20.2 \text{ kNm/m}$
			Compression reinforcement is not required

Check toe in bending

Reinforcement provided	A393 mesh		
Area required	$A_{s_toe_req} = 390.0 \text{ mm}^2/\text{m}$	Area provided	$A_{s_toe_prov} = 393 \text{ mm}^2/\text{m}$
			PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress	$V_{toe} = 0.094 \text{ N/mm}^2$	Allowable shear stress	$V_{adm} = 5.000 \text{ N/mm}^2$
			PASS - Design shear stress is less than maximum shear stress
Concrete shear stress	$V_{c_toe} = 0.519 \text{ N/mm}^2$		
			$V_{toe} < V_{c_toe}$ - No shear reinforcement required

Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

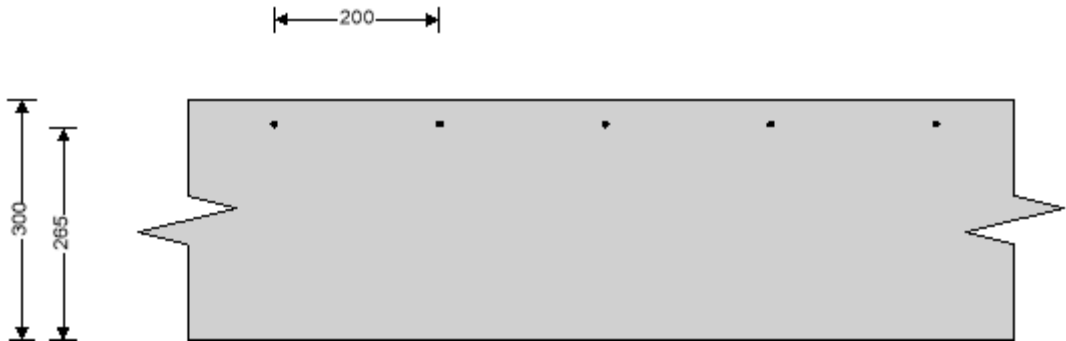
Strength of concrete	$f_{cu} = 40 \text{ N/mm}^2$	Strength of reinforcement	$f_y = 500 \text{ N/mm}^2$
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Base details

Minimum reinforcement	$k = 0.13 \%$	Cover in heel	$C_{heel} = 30 \text{ mm}$
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Design of retaining wall heel

Shear at heel $V_{heel} = 8.2 \text{ kN/m}$ Moment at heel $M_{heel} = 2.1 \text{ kNm/m}$
Compression reinforcement is not required

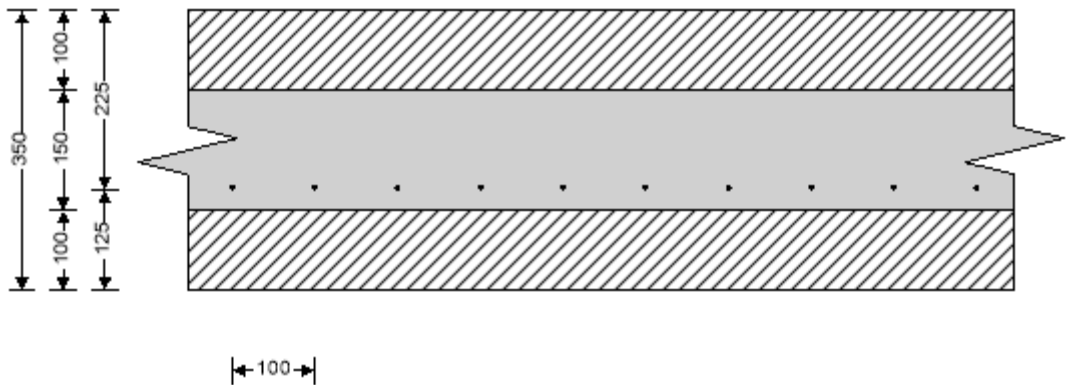
Check heel in bending

Reinforcement provided **A393 mesh**
Area required $A_{s_heel_req} = 390.0 \text{ mm}^2/\text{m}$ Area provided $A_{s_heel_prov} = 393 \text{ mm}^2/\text{m}$
PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress $V_{heel} = 0.031 \text{ N/mm}^2$ Allowable shear stress $V_{adm} = 5.000 \text{ N/mm}^2$
PASS - Design shear stress is less than maximum shear stress
Concrete shear stress $V_{c_heel} = 0.519 \text{ N/mm}^2$
 $V_{heel} < V_{c_heel}$ - No shear reinforcement required

Design of cavity reinforced masonry retaining wall stem - BS5628-2:2000



Wall details

Thickness of outer leaf of wall $t_{outer} = 100 \text{ mm}$ Thickness of inner leaf of wall $t_{inner} = 100 \text{ mm}$
Thickness of reinforced cavity $t_{cavity} = 150 \text{ mm}$

Masonry details

Masonry type **Aggregate concrete blocks no voids** Compressive strength of units $p_{unit} = 10.0 \text{ N/mm}^2$
Mortar designation **ii** Char. compressive strength $f_k = 8.1 \text{ N/mm}^2$
Manufacture control of units **Normal** Material strength safety factor $\gamma_{mm} = 2.3$

Design of retaining wall stem

Shear at base of stem $V_{stem} = 24.0 \text{ kN/m}$ Moment at base of stem $M_{stem} = 16.6 \text{ kNm/m}$

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Check maximum design moment

Maximum design moment $M_{d_stem} = 72 \text{ kNm/m}$
PASS - Applied moment is less than maximum design moment

Check wall stem in bending

Reinforcement provided **8 mm dia.bars @ 100 mm centres**
Area required $A_{s_stem_req} = 455.0 \text{ mm}^2/\text{m}$ Area provided $A_{s_stem_prov} = 503 \text{ mm}^2/\text{m}$
PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress $V_{stem} = 0.107 \text{ N/mm}^2$ Allowable shear stress $V_{adm} = 0.353 \text{ N/mm}^2$
PASS - Design shear stress is less than maximum shear stress

Check limiting dimensions

Limiting span/eff.depth ratio $ratio_{max} = 18.00$ Actual span/eff.depth ratio $ratio_{act} = 7.17$
PASS - Span to depth ratio is acceptable

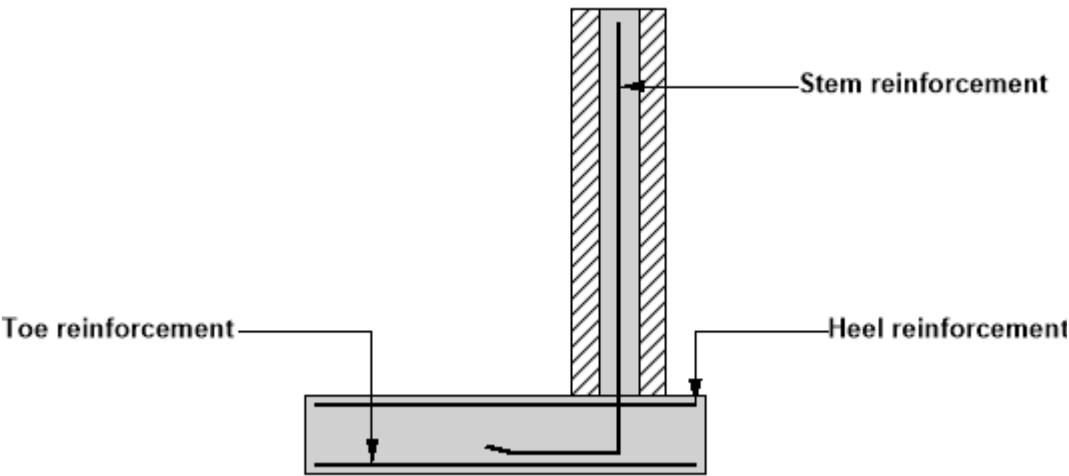
Axial load check

Factored axial load on wall $N_{wall} = 17.3 \text{ kN/m}$ Limiting axial load $N_{limit} = 285.0 \text{ kN/m}$
Applied axial load may be ignored - calculations valid

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Indicative retaining wall reinforcement diagram



- Toe mesh - A393 - (393 mm²/m)
- Heel mesh - A393 - (393 mm²/m)
- Stem bars - 8 mm dia.@ 100 mm centres - (503 mm²/m)

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<u>Notes:-</u> The structural worthiness of the existing and/or proposed foundations should be assessed on site after careful consideration of the prevailing ground conditions and, if considered relevant, the intensity and size of any trees and/or shrubs presently in existence, and/or to be planted, within the zone of influence of the proposed works. In the case of existing buildings the structural worthiness of the existing load carrying elements, such as walls and lintels etc. in respect to their capability to accept any additional loads should be carefully assessed on site. The main contractor is to design supply and remain responsible for all temporary works required to ensure the complete safety and structural stability of the property and all surrounding buildings for the duration of the contract works. Structural concrete to be grade C35. Blinding concrete to be grade 20. All concrete below ground to be grade C35/SRC. Mass concrete padstones to be strength class C25 to BS 5328 with a minimum cement content of 250kg/m3 and a maximum water/cement ratio of 0.70. Steel to be grade S355, typically class EX2 complying with all current British Standards. Steelwork to be shot blasted to SA 2.5 of BS 7079:Part 1 and painted one coat of Leighs Paint Epigrip C400 Epoxy Zinc Phosphate Primer 75 microns DFT. Steelwork encased in concrete or masonry to receive an additional coat of brush applied bitumastic paint. All timber to be grade C16/C24 as noted to BS 5268 and to be double vacuum treated. Sawn ends are to be treated with a compatible preservative. All joist hangers are to be galvanised mild steel with a minimum thickness of 2.5mm. Joists to be doubled under baths and partitions. For joist spans greater than 2.5m herringbone strutting is to be installed in accordance with the Building Regulations. Provide solid strutting under all partitions running at right angles to joists under. All doubled up joists to be bolted together using M12 (4.6) bolts and 51mm dia toothed plate connectors at 500mm crs. Solid blocking is to be installed between joists where notched into steel beams or supported on joist hangers. The client's attention is drawn to the current Construction (Design & Management) Regulations 2015 which relate to any Building works involving more than 500 man hours or longer than thirty days in duration. It is the clients responsibility to appoint CDM coordinator on all relevant projects which require compliance with CDM regulations.				