STRUCTURAL CALCULATIONS

FOR

LOFT CONVERSION & REAR EXTENSION AND

INTERNAL REMODELLING & CHIMNEY REMOVAL

PROJECT

108 FRANT ROAD, THORNTON HEATH, CR7 7JX

ON

19th JUNE 2026

BY

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REFERENCE:

CALCULATIONS ARE PREPARED IN ACCORDANCE WITH THE FOLLOWING CODES OF PRACTICE:

BS 5268 [TIMBER SC3 GRADE]
CODE OF PRACTICE FOR USE OF TIMBER

BS 648 [WEIGHT OF BUILDING MATERIAL]
CODE OF PRACTICE FOR BUILDING MATERIAL

BS 5950 PART 1 – 2000
STRUCTURAL USE OF STEELWORK IN BUILDING

BS 5628 PART 1 – 1992
CODE OF PRACTICE FOR USE OF MASONRY

BS 6399 PART 1 – 1996
LOADING FOR BUILDINGS
[DEAD AND IMPOSED LOADS]

BS 6399 PART 3 - 1988 LOADING FOR BUILDINGS
[IMPOSED ROOF LOAD]

SPAN TABLES FOR SOLID TIMBER MEMBERS IN FLOORS, CEILINGS AND ROOFS FOR DWELLINGS --TRADA 2004

LOAD CALCULATIONS:

FLAT ROOF

	DEAD LOAD (kN/m^2)	**LIVE LOAD (kN/m^2)**
PLASTER BOARD	0.12	SNOW & REPAIR ACCESS = 0.75 kN/m^2
JOIST	0.18	-
FELT	0.15	-
CHIPPINGS	0.24	-
BOARDING	0.12	-
TOTAL	**0.81 kN/m^2**	**0.75 kN/m^2**

PITCHED ROOF

	DEAD LOAD (kN/m^2)	**LIVE LOAD (kN/m^2)**
RAFTERS	0.12	SNOW & REPAIR ACCESS = 0.75 kN /m2
BATTENS	0.04	-
FELT	0.05	-
TILES	0.68	-
	0.89 (On Slope)	-
	0.89 / Cos 45 Degrees	-
TOTAL	**= 1.26 (On Plan)**	**0.75 kN/m^2**

FLOOR

	DEAD LOAD (kN/m^2)	**LIVE LOAD (kN/m^2)**
CEILING	0.15	IMPOSED = 1.50 kN /m2
JOIST	0.15	-
BOARDING	0.20	-
TOTAL	**0.50 kN/m^2**	**1.50 kN/m^2**

CEILING

	DEAD LOAD (kN/m^2)	LIVE LOAD (kN/m^2)
CEILING	0.25	-
TOTAL	**0.25 kN/m^2**	-

BRICK WORK

	DEAD LOAD (kN/m^3)	LIVE LOAD (kN/m^3)
BRICKS	22.00	-
TOTAL	**22.00 kN**/m^3	-

BLOCK WORK

	DEAD LOAD (kN/m^3)	LIVE LOAD (kN/m^3)
BLOCKS	14.00	-
TOTAL	**14.00 kN**/m^3	-

INTERNAL STUDDING

	DEAD LOAD (kN/m^2)	LIVE LOAD (kN/m^2)
PLASTER BOARD	0.04	-
STUD	0.68	-
TOTAL	**0.72 kN/m^2**	-

EXTERNAL STUDDING

	DEAD LOAD (kN/m^2)	**LIVE LOAD (kN/m^2)**
PLASTER BOARD	0.12	-
TILING	0.68	-
FELT	0.05	-
BATTENS	0.04	-
STUD	0.12	-
TOTAL	**1.01 kN/m^2**	-

GENERAL AND SAFETY NOTES:

1. All dimensions, setting out and levels are to be verified on site with the architect prior to the commencement of any site work.

2. Building control approval must be obtained prior to the commencement of building works.

3.The contractor shall be responsible for and must take all necessary precautions to ensure the stability of the existing structure and earthworks on adjoining sites during the course of the contract.

4.Materials and constructions are to be in accordance with the relevant British Standards and Codes of Practice.

5.Any services or drainage which pass through the foundation are to be encased in a flexible sleeve.

6.The dimensions of all steel sections required should be measured on site by the client (or their representative contractor or steelwork fabricator). All Steel Beams to have minimum of 1/2hr Fire Resistance via 'Nullifire' Paint or 19mm Gyproc Plank tied with 1.6mm wire binding@100mm c/c and finished in Carlite Bonding 16mm thick.

7. It is the responsibility of the Client / Contractor to notify the designer of any discrepancies.

8. Note that all steel (Sizes & Quantity) shown on the drawings are should be checked prior to ordering any material.

9. Structural Drawings provided here are based on architectural drawings and site survey therefore are indicative only and are NOT TO SCALE.

10. All existing foundations and lintels to be exposed and to be checked for adequacy by Builder / Building Control Officer and or replaced if necessary.

11. Depth of all footings is to be approved by the local building inspector. Minimum of 1 m deep, advise engineer if footings are located within 30m of large trees or hedges. Also notify if water is struck, tree roots are found or clay soil appears very dry and brittle.

LOAD CALCULATIONS FOR STEEL BEAM 1:

CLEAR SPAN OF THE STEEL BEAM 1 = 3700mm

LOADING:

DEAD LOAD ON STEEL BEAM 1:

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 1.8m

= 0.75 kN/m

BRICK WORK = 22 kN/m^3 x THICKNES OF WALL x HEIGHT OF WALL IN MTS.
(100mm)

= 22 kN/m^3 x 0.100m x 2.6m

= 5.72 kN/m

THEREFORE TOTAL DEAD LOAD ON SB1 = 0.90 + 5.72 = 6.62 kN/m.

LIVE LOAD ON STEEL BEAM 1:

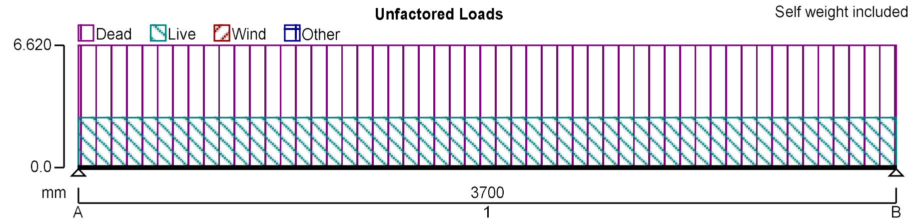
TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.50 kN/m^2 x 1.8m

= 2.70 kN/m

THEREFORE TOTAL LIVE LOAD ON SB1 = 2.70 kN/m

STRUCTURAL REPORT FOR STEEL BEAM 1:



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **3700** mm Cross-sectional area = **2940** mm^2 Moment of inertia = **21.0×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **6.6** kN/m

Load 3 UDL Live load **2.7** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Wind + 1×Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-25.7** kN Min react = **-25.7** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

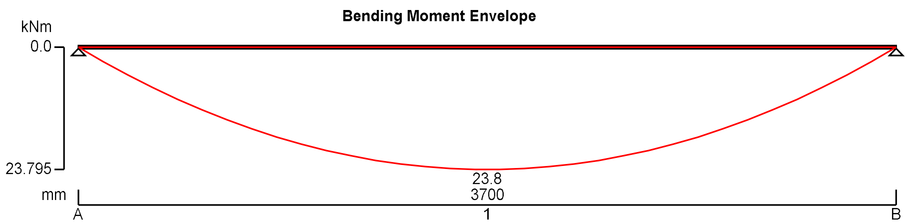
Support B Max react = **-25.7** kN Min react = **-25.7** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

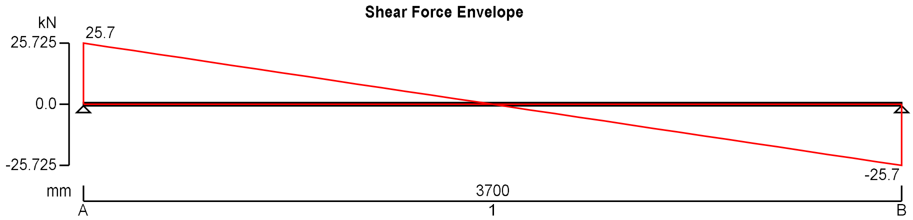
Beam Max/Min results - Combination Summary

Maximum shear = **25.7** kN Minimum shearF_{min} = **-25.7** kN

Maximum moment = **23.8** kNm Minimum moment = **0.0** kNm

Maximum deflection = **7.9** mm Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UB 203x102x23"**	Classification	**"Plastic"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **1.5** mm	δ_{lim} = **10.0** mm	**Span / 360 or 10.0 mm**	**Pass**
Shear	F_{vy} = **25.7** kN	P_{vy} = **233.7** kN	**Low shear**	**Pass**
Moment	M_x = **23.8** kNm	M_{cx} = **83.1** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **23.8** kNm	M_b / m_{LT} = **24.3** kNm	L_{E_LT} = **4.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR STEEL BEAM 2:

CLEAR SPAN OF THE STEEL BEAM 2 = 7450(3750+3700)mm

LOADING:

DEAD LOAD ON STEEL BEAM 2:

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 1.2m

= 0.60 kN/m

STUD WORK = 0.5 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 0.5 kN/m^2 x 2.3m

= 1.15 kN/m

THEREFORE TOTAL DEAD LOAD ON SB2= 0.60 + 1.15 = 1.75 kN/m.

PARTIAL UDL FROM 1100mm to 2500mm & 5100mm to 6500mm

BRICK WORK = 22 kN/m^3 x THICKNES OF WALL x HEIGHT OF WALL IN MTS.
(100mm)

= 22 kN/m^3 x 0.100m x 5.0m

= 11.00 kN/m

LIVE LOAD ON STEEL BEAM 2:

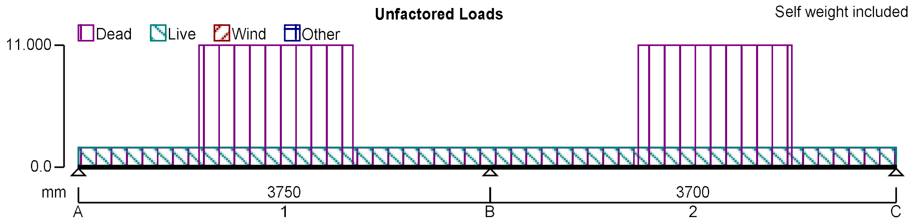
TIMBER FLOOR = 1.5 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.5 kN/m^2 x 1.2m

= 1.80 kN/m

THEREFORE TOTAL LIVE LOAD ON SB2 = 1.80 kN/m

STRUCTURAL REPORT FOR STEEL BEAM 2:



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **2**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Support C Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **3750** mm Cross-sectional area = **3826** mm^2 Moment of inertia = **17.5×10^6** mm^4

Span 2 Length = **3700** mm Cross-sectional area = **3826** mm^2 Moment of inertia = **17.5×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **1.8** kN/m

Load 3 UDL Live load **1.8** kN/m

Load 4 Partial UDL Dead load **11.0** kN/m from **1.100** m to **2.500** m

Load 5 Partial UDL Dead load **11.0** kN/m from **5.100** m to **6.500** m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Other

Span 2 1.4×Dead + 1.6×Live + 1×Wind + 1×Other

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-15.6** kN Min react = **-15.6** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

Support B Max react = **-54.2** kN Min react = **-54.2** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

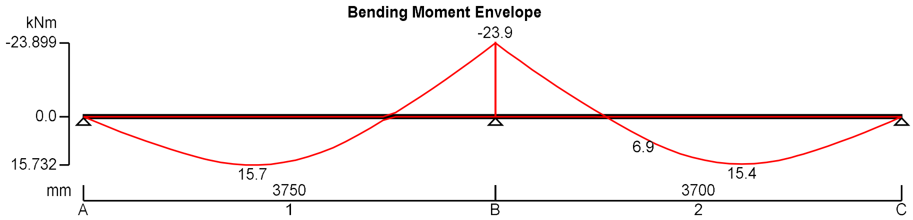
Support C Max react = **-16.1** kN Min react = **-16.1** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

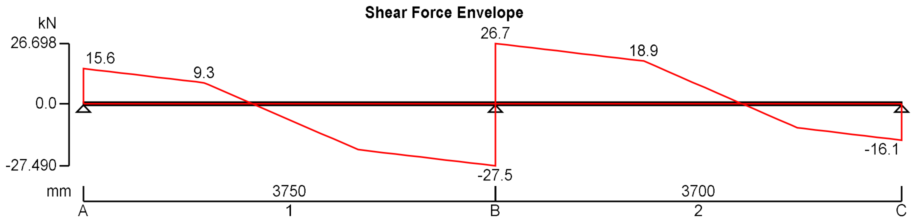
Beam Max/Min results - Combination Summary

Maximum shear = **26.7** kN Minimum shearF_{min} = **-27.5** kN

Maximum moment = **15.7** kNm Minimum moment = **-23.9** kNm

Maximum deflection = **4.6** mm Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UC 152x152x30"**	Classification	**"Compact"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **0.5** mm	δ_{lim} = **10.0** mm	**Span / 360 or 10.0 mm**	**Pass**
Shear	F_{vy} = **27.5** kN	P_{vy} = **218.2** kN	**Low shear**	**Pass**
Moment	M_x = **23.9** kNm	M_{cx} = **87.9** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **23.9** kNm	M_b / m_{LT} = **60.2** kNm	L_{E_LT} = **3.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR STEEL BEAM 3:

CLEAR SPAN OF THE STEEL BEAM 3 = 2800mm

LOADING:

DEAD LOAD ON STEEL BEAM 3:

PITCHED ROOF = 1.26 kN/m^2 x SPAN OF ROOF IN MTS.

= 1.26 kN/m^2 x 1.5

= 1.89 kN/m

BRICK WORK = 22 kN/m^3 x THICKNES OF WALL x HEIGHT OF WALL IN MTS.
(225mm)

= 22 kN/m^3 x 0.225m x 0.60m

= 2.97 kN/m

THEREFORE TOTAL DEAD LOAD ON SB3=1.89+2.97= 4.86kN/m

LIVE LOAD ON STEEL BEAM 3:

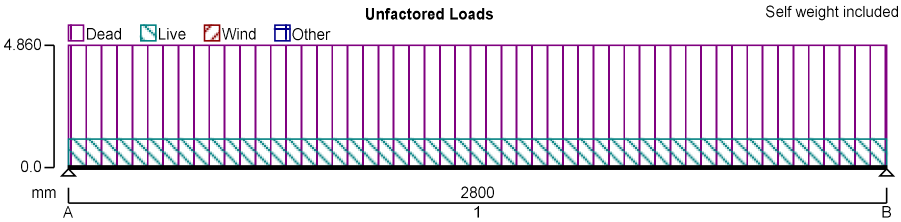
PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 1.5m

= 1.13 kN/m

THEREFORE TOTAL LIVE LOAD ON SB4 = 1.13 kN/m

STRUCTURAL REPORT FOR STEEL BEAM 3:



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **2800** mm Cross-sectional area = **5873** mm^2 Moment of inertia = **45.7×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **4.9** kN/m

Load 3 UDL Live load **1.1** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Wind + 1×Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-12.9** kN Min react = **-12.9** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

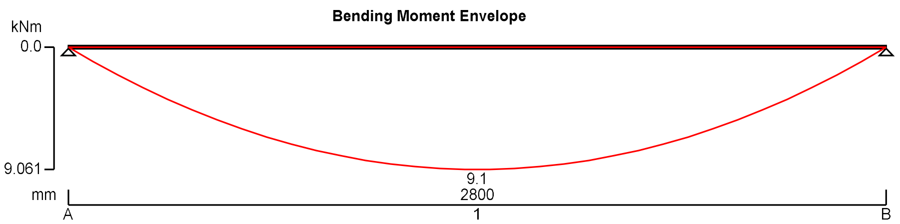
Support B Max react = **-12.9** kN Min react = **-12.9** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

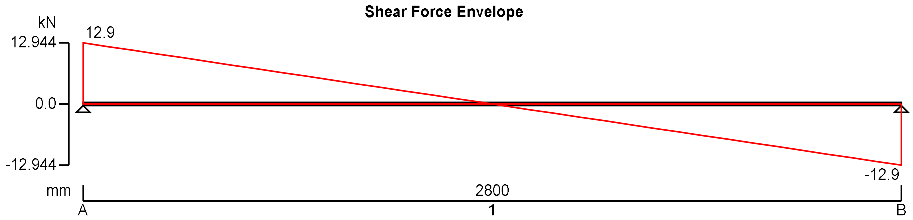
Beam Max/Min results - Combination Summary

Maximum shear = **12.9** kN Minimum shearF_{min} = **-12.9** kN

Maximum moment = **9.1** kNm Minimum moment = **0.0** kNm

Maximum deflection = **0.8** mm Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UC 203x203x46"**	Classification	**"Semi-Compact"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **0.1** mm	δ_{lim} = **7.8** mm	**Span / 360 or 8.0 mm**	**Pass**
Shear	F_{vy} = **12.9** kN	P_{vy} = **311.6** kN	**Low shear**	**Pass**
Moment	M_x = **9.1** kNm	M_{cx} = **159.6** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **9.1** kNm	M_b / m_{LT} = **126.6** kNm	L_{E_LT} = **4.0** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR 100mm STEEL POSTS (SHS)

HEIGHT OF SHS POST = 2200mm [Builder to confirm on site prior to ordering material]

ASSUME SHS POST = 100 x 100 x 10mm SHS

LOAD FROM STEEL BEAM 3 = 20.00 kN

TOP & BOTTOM PLATES = 15mm THICK

BOLTES = 4NOS M20 GR.8.8 BOLTS

LOAD CALCULATIONS FOR STEEL POSTS (SHS):

STEEL MEMBER DESIGN TO BS5950: PART 1: 2000

Member design checks for a steel member to BS 5950:2000

Section properties

Try SHS 100x100x10.0 section.

D = **100** mm B = **100** mm T = t = **10.0** mm A_g = A = **34.9** cm^2

d_x = D - 3 × t = **70.0** mm b_x = B - 3 × t = **70.0** mm $b_y = d_x$ $d_y = b_x$

A_{vy} = A × D / (D + B) = **17.5** cm^2 A_{vx} = A × B / (D + B) = **17.5** cm^2

I_x = **462** cm^4 I_y = **462** cm^4 r_x = **3.64** cm r_y = **3.64** cm

S_x = **116.2** cm^3 S_y = **116.2** cm^3 Z_x = **92.4** cm^3 Z_y = **92.4** cm^3

d_{vx} = A_{vx} / (2 × t) = **87.3** mm d_{vy} = A_{vy} / (2 × t) = **87.3** mm

S_{vx} = 2 × t × d_{vy}^2 / 4 = **38.1** cm^3 S_{vy} = 2 × t × d_{vx}^2 / 4 = **38.1** cm^3

Strut curve (a) for x-axis and y-axis. (Tables 23 & 24) z_1 = 5/3 z_2 = 5/3

Steel grade **"S355"** p_y = **355** N/mm^2 $p_{yw} = p_y$ $\varepsilon = \sqrt{(275 \text{ N/mm}^2 / p_y)}$ = **0.880** K_e = **1.1**

Cl. 3.1.1 & 3.4.3

Geometry

Member has no intermediate restraint.

L = **2200** mm

Buckling:	Restraint:	End 1:	End 2:
Normal to x-axis	Position	**X**	**X**
	Direction		
Normal to y-axis	Position	**X**	**X**
	Direction		

For strut buckling normal to x-axis K_x = **1.00** L_{Ex} = **2200** mm

For strut buckling normal to y-axis K_y = **1.00** L_{Ey} = **2200** mm

Cl. 4.3.5 & 4.7.3

Loading

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

F_t = 0 kN F_c = **20.00** kN n = F_c / (A × p_y) = **0.016**

F_{vx} = 0 kN

F_{vy} = 0 kN

M_x = 0 kNm

M_y = 0 kNm

Section classification

b_x / t = **7.0** d_x / t = **7.0** b_y / t = **7.0** d_y / t = **7.0**

r_{1x} = min(1.0, max(-1.0, F_c / (2 × d_x × t × p_{yw}))) = **0.040**

r_{1y} = min(1.0, max(-1.0, F_c / (2 × d_y × t × p_{yw}))) = **0.040**

r_2 = F_c / (A_g × p_{yw}) = **0.016**

Section classification is Plastic

Cl. 3.5.1 - 3.5.5

Compression resistance - strut buckling about x-axis

F_c = **20.0** kN L_{Ex} = **2.20** m $\lambda_x = L_{Ex} / r_x$ = **60**

Strut curve (a) applies $\lambda_0 = 0.2 \times (\pi^2 \times E_{S5950} / p_y)^{0.5}$ = **15** a_x = **2.0**

$\eta_x = \max(0, a_x \times (\lambda_x - \lambda_0) / 1000)$ = **0.091** $p_{ex} = \pi^2 \times E_{S5950} / \lambda_x^2$ = **553** N/mm^2

$\phi_x = (p_y + (\eta_x + 1) \times p_{ex}) / 2$ $p_{cx} = p_{ex} \times p_y / (\phi_x + (\phi_x^2 - p_{ex} \times p_y)^{0.5})$ = **297** N/mm^2

p_{cx} = **297** N/mm^2 $P_{cx} = A \times p_{cx}$ = **1036.8** kN

Check $F_c \leq P_{cx}$ Pass - Compression

Slenderness less than 180

Cl. 4.7.4 & Annex C

Compression resistance - strut buckling about y axis

F_c = **20.0** kN L_{Ey} = **2.20** m $\lambda_y = L_{Ey} / r_y$ = **60**

Strut curve (a) applies $\lambda_0 = 0.2 \times (\pi^2 \times E_{S5950} / p_y)^{0.5}$ = **15** a_y = **2.0**

$\eta_y = \max(0, a_y \times (\lambda_y - \lambda_0) / 1000)$ = **0.091** $p_{ey} = \pi^2 \times E_{S5950} / \lambda_y^2$ = **553** N/mm^2

$\phi_y = (p_y + (\eta_y + 1) \times p_{ey}) / 2$ $p_{cy} = p_{ey} \times p_y / (\phi_y + (\phi_y^2 - p_{ey} \times p_y)^{0.5})$ = **297** N/mm^2

$P_{cy} = A \times p_{cy}$ = **1036.8** kN

Check $F_c \leq P_{cy}$ Pass - Compression

Slenderness less than 180

Cl. 4.7.4 & Annex C

Results summary

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"SHS 100x100x10.0"**	Classification	**"Plastic"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Strut buckling (x-axis)	F_c = **20.0** kN	P_{cx} = **1036.8** kN	L_{Ex} = **2.2** m **Slenderness < 180**	**Pass**
Strut buckling (y-axis)	F_c = **20.0** kN	P_{cy} = **1036.8** kN	L_{Ey} = **2.2** m **Slenderness < 180**	**Pass**

LOAD CALCULATIONS FOR TIMBER RAFTERS:

SPAN OF RAFTERS = 3000mm

ASSUME RAFTERS = 50mm x 150mm

TIMBER GRADE = C24

JOISTS CENTERS = 400mm

LOADING:

DEAD LOAD ON TIMBER RAFTERS:

PITCHED ROOF = 1.26 kN/m^2 x SPAN OF ROOF IN MTS.

= 1.26 kN/m^2 x 0.40m

= 0.50 kN/m

THEREFORE TOTAL DEAD LOAD ON TIMBER RAFTERS = 0.50 kN/m

LIVE LOAD ON TIMBER RAFTERS:

PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 0.40m

= 0.30 kN/m

THEREFORE TOTAL LIVE LOAD ON TIMBER RAFTERS = 0.30 kN/m

LOAD CALCULATIONS FOR TIMBER RAFTERS:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span (mm)	Factors for moments & forces			Factors for deflection		
	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3000	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**0.5**	**0**	-	**3000**
2	**"Imposed"**	UDL	**0.3**	**0**	-	**3000**

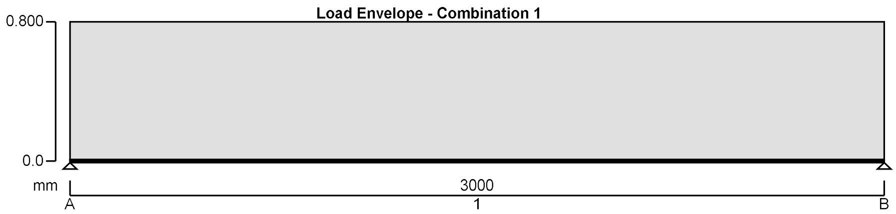
Analysis results - entire span

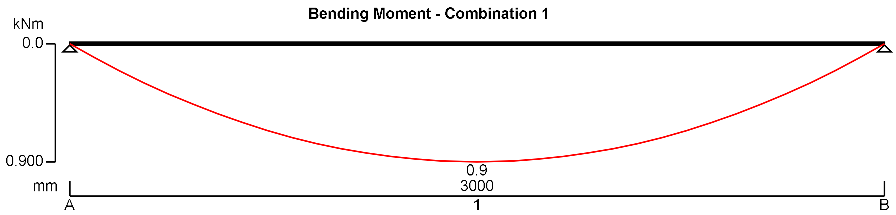
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
1.2	**1.2**	**1.2**	**0.9**	**"Sagging"**	**0.84**	**"Down"**

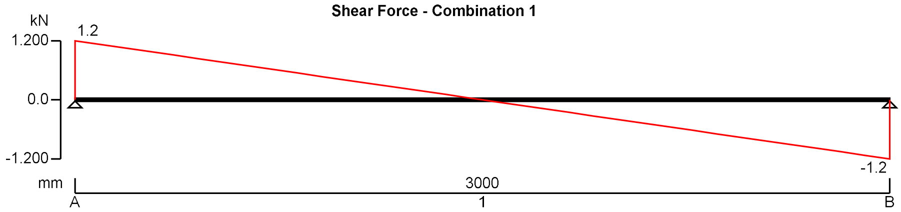
Unfactored support reactions

Support A	Dead load **-0.7** kN	Live load **-0.4** kN	Wind load **0.0** kN
Support B	Dead load **-0.7** kN	Live load **-0.4** kN	Wind load **0.0** kN

Beam Loads







Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **150** mm	B = **50** mm	A= **7500** mm^2	
Section properties (x-x)	I_{xx} = **14062500** mm^4	Z_{xx} = **187500** mm^3	r_{xx} = **43.3** mm	
(y-y)	I_{yy} = **1562500** mm^4	Z_{yy} = **62500** mm^3	r_{yy} = **14.4** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para} = M / Z_{xx}$ = **4.80** N/mm^2	$\sigma_{m.adm.para}$ = **8.09** N/mm^2	Moment M = **0.9** kNm	**Pass**
Shear stress	τ_a = **0.24** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **1.2** kN	**Pass**
Deflection	δ = **5.8** mm	14 mm		**Pass**
	δ / L_s = **0.00192**	0.003		**Pass**

DESIGN OF MILD STEEL PLATE SPREADER:

1. SPREADER DESIGN FOR STEEL BEAM 2 INTERNAL WALL BEARING:

Maximum reaction from loft beam = 54.20 kN x 0.7 = 37.94 kN [Unfactored]

As per Structural Renovation of Traditional Buildings (CIRIA-REPORT:1986)

The basic compressive stress = 0.42 N/mm^2 and Local bearing factor is 1.5

So the allowable compressive stress = 0.42 N/mm^2 x 1.5 = 0.63N/mm^2

Length of Spreader is (37.94 x 1000) / (0.63 x 100) = 600mm

Therefore provide 600mm Long x 100mm Wide x 25mm THICK Mild Steel Plate As Spreaders

2. SPREADER DESIGN FOR STEEL BEAM TO EXTERNAL WALL BEARING:

Maximum reaction from roof beam = 16.10 kN x 0.7 = 11.27 kN [Unfactored]

As per Structural Renovation of Traditional Buildings (CIRIA-REPORT:1986)

The basic compressive stress = 0.42 N/mm2 and Local bearing factor is 1.5

So the allowable compressive stress = 0.42 N/mm^2 x 1.5 = 0.63N/mm^2

Length of Spreader is (11.27 x 1000) / (0.63 x 100) =179mm

Therefore provide 300mm Long x 100mm Wide x 25mm THICK Mild Steel Plate As Spreader

LOAD CALCULATIONS FOR ROOF BEAM (RB):

CLEAR SPAN OF THE ROOF BEAM (RB) = 4525mm

LOADING:

DEAD LOAD ON ROOF BEAM (RB):

PITCHED ROOF = 1.26 kN/m^2 x SPAN OF ROOF IN MTS.

= 1.26 kN/m^2 x 1.50m

= 1.89 kN/m

FLAT ROOF = 0.81 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.81 kN/m^2 x 1.75m

= 1.42 kN/m

THEREFORE TOTAL DEAD LOAD ON RB = 1.89 + 1.42 = 3.31 kN/m.

LIVE LOAD ON ROOF BEAM (RB):

PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 1.50m

= 1.13 kN/m

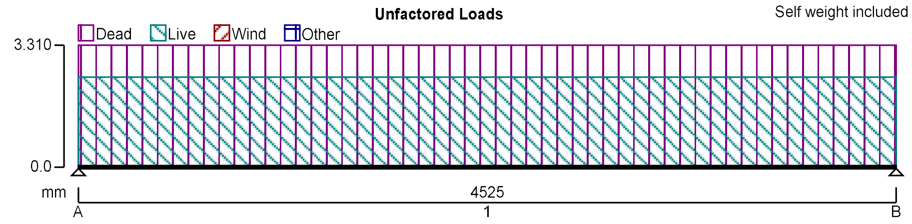
FLAT ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 1.75m

= 1.31 kN/m

THEREFORE TOTAL LIVE LOAD ON RB = 1.13 + 1.31 = 2.44 kN/m

STRUCTURAL REPORT FOR ROOF BEAM (RB):



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **4525** mm Cross-sectional area = **4711** mm^2 Moment of inertia = **22.1×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **3.3** kN/m

Load 3 UDL Live load **2.4** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Wind + 1×Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-20.5** kN Min react = **-20.5** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

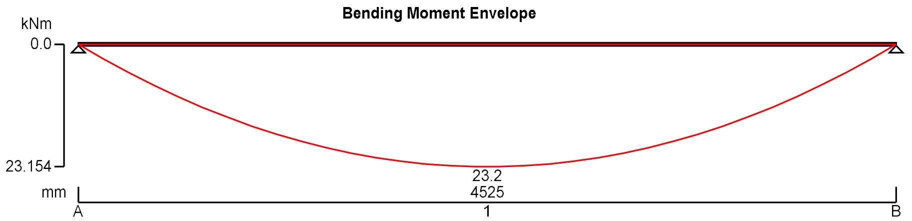
Support B Max react = **-20.5** kN Min react = **-20.5** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

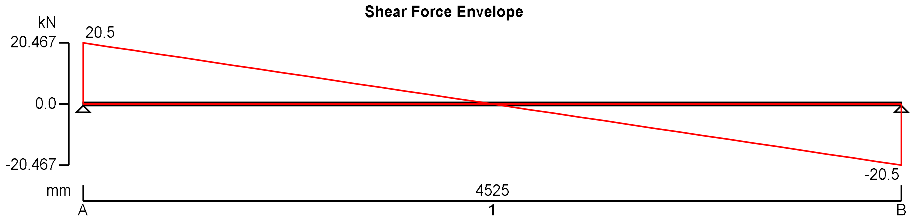
Beam Max/Min results - Combination Summary

Maximum shear = **20.5** kN Minimum shearF_{min} = **-20.5** kN

Maximum moment = **23.2** kNm Minimum moment = **0.0** kNm

Maximum deflection = **10.9** mm Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UC 152x152x37"**	Classification	**"Plastic"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **2.9** mm	δ_{lim} = **12.6** mm	**Span / 360 or 13.0 mm**	**Pass**
Shear	F_{vy} = **20.5** kN	P_{vy} = **275.7** kN	**Low shear**	**Pass**
Moment	M_x = **23.2** kNm	M_{cx} = **109.6** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **23.2** kNm	M_b / m_{LT} = **61.1** kNm	L_{E_LT} = **5.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR STAIR TRIMMER 1:

CLEAR SPAN OF STAIR TIMMER 1 = 850mm

LOADING:

DEAD LOAD ON STAIR TRIMMER 1:

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 1.60m

= 0.80 kN/m

STUD WORK = 0.5 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 0.5 kN/m^2 x 2.30m

= 1.15kN/m

THEREFORE TOTAL DEAD LOAD ON STAIR TRIMMER= 0.80 +1.15 = 1.95 kN/m

LIVE LOAD ON STAIR TRIMMER 1:

TIMBER FLOOR = 1.5 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.5 kN/m^2 x 1.60m

= 2.40 kN/m

THEREFORE TOTAL LIVE LOAD ON TRIMMER = 2.40 kN/m

STRUCTURAL REPORT FOR STAIR TRIMMER 1:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span (mm)	Factors for moments & forces			Factors for deflection		
	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
850	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**2.0**	**0**	-	**850**
2	**"Imposed"**	UDL	**2.4**	**0**	-	**850**

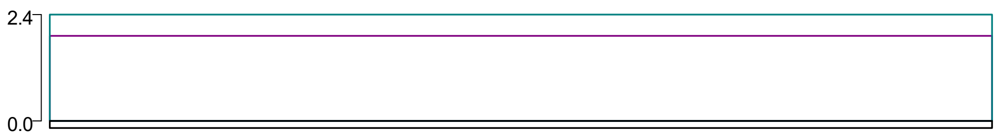
Analysis results - entire span

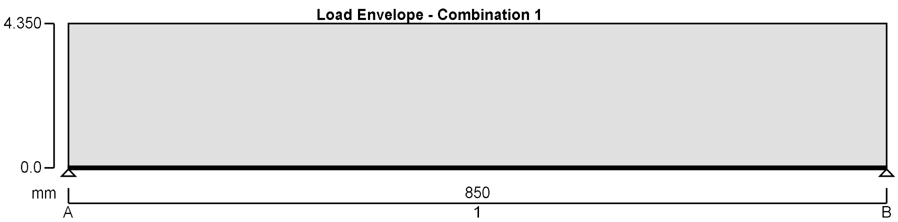
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
1.8	**1.8**	**1.8**	**0.4**	**"Sagging"**	**0.03**	**"Down"**

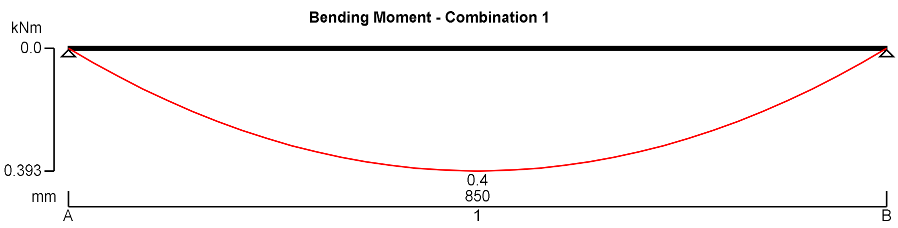
Unfactored support reactions

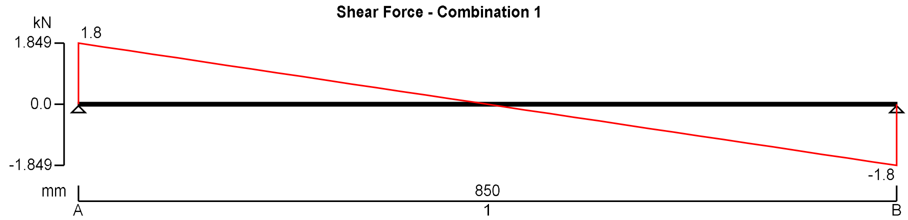
Support A	Dead load **-0.8** kN	Live load **-1.0** kN	Wind load **0.0** kN
Support B	Dead load **-0.8** kN	Live load **-1.0** kN	Wind load **0.0** kN

Beam Loads









Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **200** mm	B = **100** mm	A= **20000** mm^2	
Section properties (x-x)	I_{xx} = **66666667** mm^4	Z_{xx} = **666667** mm^3	r_{xx} = **57.7** mm	
(y-y)	I_{yy} = **16666667** mm^4	Z_{yy} = **333333** mm^3	r_{yy} = **28.9** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para} = M / Z_{xx}$ = **0.59** N/mm^2	$\sigma_{m.adm.para}$ = **7.84** N/mm^2	Moment M = **0.4** kNm	**Pass**
Shear stress	τ_a = **0.14** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **1.8** kN	**Pass**
Deflection	δ = **0.1** mm	14 mm		**Pass**
	δ / L_s = **0.00009**	0.003		**Pass**

LOAD CALCULATIONS FOR STAIR TRIMMER 2:

CLEAR SPAN OF STAIR TIMMER 2 = 3100mm

LOADING:

DEAD LOAD ON STAIR TRIMMER 2:

TIMBER FLOOR = 0.51 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.51 kN/m^2 x 0.20m

= 0.10 kN/m

STUD WORK = 0.5 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 0.5 kN/m^2 x 2.30m

= 1.15 kN/m

THEREFORE TOTAL DEAD LOAD ON STAIR TRIMMER 2 =0.10+1.15 = 1.25 kN/m

LIVE LOAD ON STAIR TRIMMER 2:

TIMBER FLOOR = 1.5 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.5 kN/m^2 x 0.20m

= 0.30 kN/m

THEREFORE TOTAL LIVE LOAD ON STAIR TRIMMER 2 = 0.30 kN/m

POINT LOAD FROM STAIR TRIMMER 1 = 1.80 kN@0.30m from L.H.S

STRUCTURAL REPORT FOR STAIR TRIMMER 2:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span (mm)	Factors for moments & forces			Factors for deflection		
	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3100	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**1.3**	**0**	-	**3100**
2	**"Imposed"**	UDL	**0.3**	**0**	-	**3100**
3	**"Dead"**	Point load	**1.8** kN	**300**	-	-

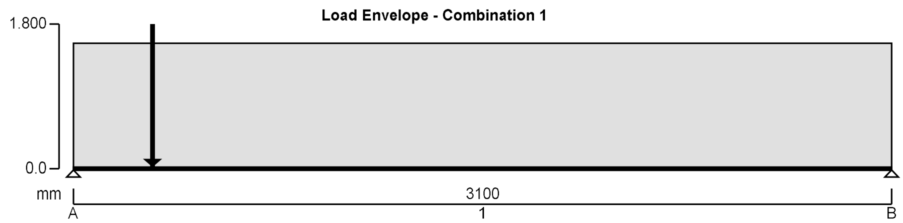
Analysis results - entire span

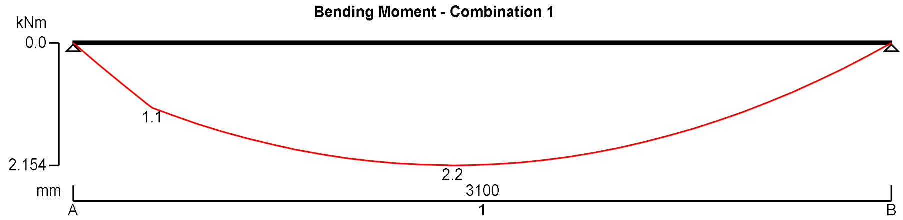
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
4.0	**2.6**	**4.0**	**2.2**	**"Sagging"**	**2.20**	**"Down"**

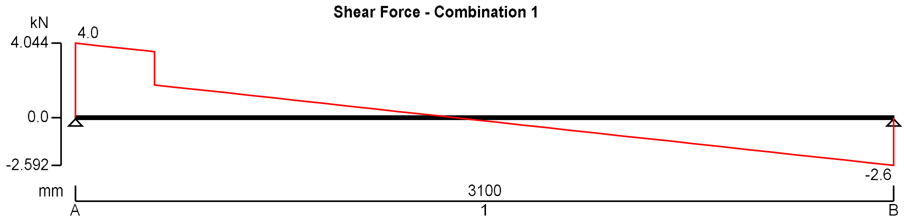
Unfactored support reactions

Support A	Dead load **-3.6** kN	Live load **-0.5** kN	Wind load **0.0** kN
Support B	Dead load **-2.1** kN	Live load **-0.5** kN	Wind load **0.0** kN

Beam Loads







Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **150** mm	B = **150** mm	A= **22500** mm^2	
Section properties (x-x)	I_{xx} = **42187500** mm^4	Z_{xx} = **562500** mm^3	r_{xx} = **43.3** mm	
(y-y)	I_{yy} = **42187500** mm^4	Z_{yy} = **562500** mm^3	r_{yy} = **43.3** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **3.83** N/mm^2	$\sigma_{m.adm.para}$ = **8.09** N/mm^2	Moment M = **2.2** kNm	**Pass**
Shear stress	τ_a = **0.27** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **4.0** kN	**Pass**
Deflection	δ = **5.0** mm	14 mm		**Pass**
	δ / L_s = **0.00161**	0.003		**Pass**

LOAD CALCULATIONS FOR LOFT BEAM (LB1):

CLEAR SPAN OF THE LOFT BEAM (LB1) = 4525mm

LOADING:

DEAD LOAD ON LOFT BEAM (LB1):

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 3.15m

= 1.58 kN/m

STUD WORK = 0.5kN /m2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 0.5 kN/m^2 x 2.30m

= 1.15kN/m

THEREFORE TOTAL DEAD LOAD ON LB1 = 1.58 + 1.15 = 2.73 kN/m.

LIVE LOAD ON LOFT BEAM, LB1:

TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

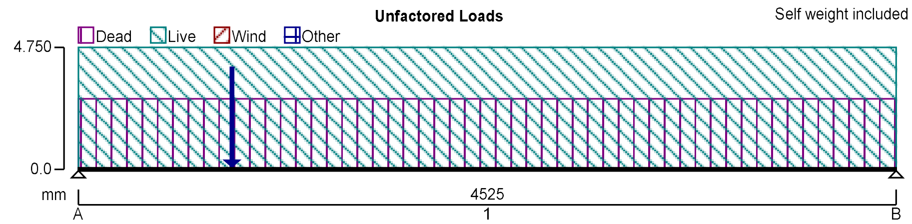
= 1.50 kN/m^2 x 3.15m

= 4.73 kN/m

THEREFORE TOTAL LIVE LOAD ON LB1 = 4.73 kN/m

POINT LOAD FROM STAIR TRIMMER 2 = 4.00 kN@0.85m from L.H.S

STRUCTURAL REPORT FOR LOFT BEAM (LB1):



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **4525** mm Cross-sectional area = **4711** mm^2 Moment of inertia = **22.1×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **2.8** kN/m

Load 3 UDL Live load **4.8** kN/m

Load 4 Point Other load **4.0** kN at **0.850** m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-30.3** kN Min react = **-30.3** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

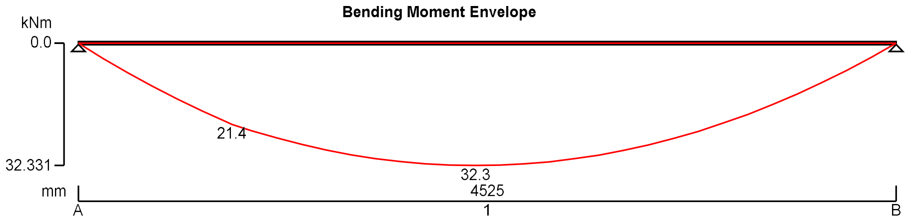
Support B Max react = **-27.8** kN Min react = **-27.8** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

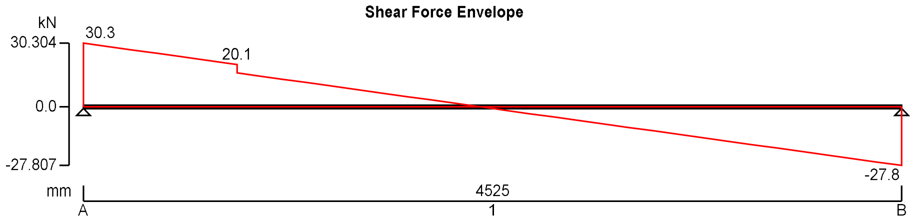
Beam Max/Min results - Combination Summary

Maximum shear = **30.3** kN   Minimum shearF_{min} = **-27.8** kN

Maximum moment = **32.3** kNm   Minimum moment = **0.0** kNm

Maximum deflection = **15.3** mm   Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UC 152x152x37"**	Classification	**"Plastic"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **5.7** mm	δ_{lim} = **12.6** mm	**Span / 360 or 13.0 mm**	**Pass**
Shear	F_{vy} = **30.3** kN	P_{vy} = **275.7** kN	**Low shear**	**Pass**
Moment	M_x = **32.3** kNm	M_{cx} = **109.6** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **32.3** kNm	M_b / m_{LT} = **61.1** kNm	L_{E_LT} = **5.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR LOFT BEAM (LB2):

CLEAR SPAN OF THE LOFT BEAM (LB2) = 4525mm

LOADING:

DEAD LOAD ON LOFT BEAM (LB2):

PITCHED ROOF = 1.26 kN/m^2 x SPAN OF ROOF IN MTS.

= 1.26 kN/m^2 x 2.2

= 2.77 kN/m

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 1.6m

= 0.60 kN/m

STUD WORK = 0.50 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 0.50 kN/m^2 x 1.0m

= 0.50kN/m

THEREFORE TOTAL DEAD LOAD ON LB2 = 2.77+ 0.80 + 0.50 = 4.07 kN/m.

LIVE LOAD ON LOFT BEAM, LB2:

PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 2.2m

= 1.65 kN/m

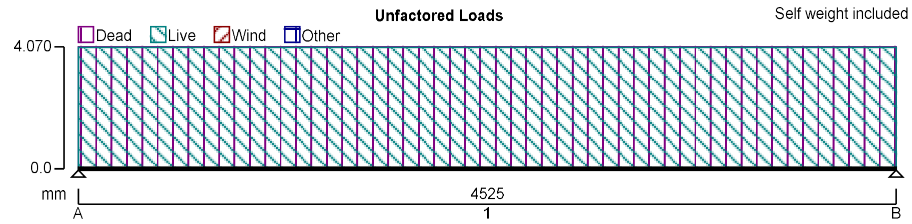
TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.5 kN/m^2 x 1.6m

= 2.40 kN /m

THEREFORE TOTAL LIVE LOAD ON LB2 = 1.65 + 2.40 = 4.05 kN/m

STRUCTURAL REPORT FOR LOFT BEAM (LB2):



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2

Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **4525** mm Cross-sectional area = **4711** mm^2 Moment of inertia = **22.1×10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **4.1** kN/m

Load 3 UDL Live load **4.1** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4×Dead + 1.6×Live + 1×Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-28.7** kN Min react = **-28.7** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

Support B Max react = **-28.7** kN Min react = **-28.7** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

Maximum shear = **28.7** kN

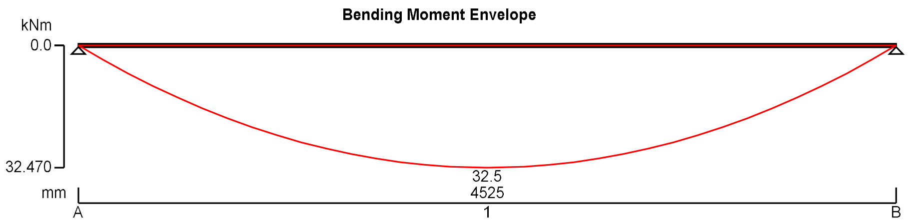
Minimum shearF_{min} = **-28.7** kN

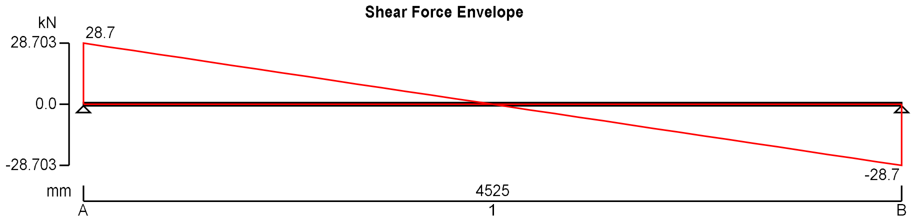
Maximum moment = **32.5** kNm

Minimum moment = **0.0** kNm

Maximum deflection = **15.3** mm

Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2		
Section	**"UC 152x152x37"**	Classification	**"Plastic"**	

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **4.9** mm	δ_{lim} = **12.6** mm	**Span / 360 or 13.0 mm**	**Pass**
Shear	F_{vy} = **28.7** kN	P_{vy} = **275.7** kN	**Low shear**	**Pass**
Moment	M_x = **32.5** kNm	M_{cx} = **109.6** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **32.5** kNm	M_b / m_{LT} = **61.1** kNm	L_{E_LT} = **5.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR LOFT BEAM (LB3):

CLEAR SPAN OF THE LOFT BEAM (LB3) = 4525mm

LOADING:

DEAD LOAD ON LOFT BEAM LB3):

FLAT ROOF = 0.81 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.81 kN/m^2 x 1.75m

= 1.42 kN/m

TIMBER FLOOR = 0.50 kN / m2 x SPAN OF FLOOR IN MTS.

= 0.50 x 1.60

= 0.80 kN/m

EXTERNAL STUD WORK = 1.01 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 1.01 kN/m^2 x 2.30m

= 2.32 kN/m

THEREFORE TOTAL DEAD LOAD ON LB3 = 1.42 + 0.80 + 2.32 = 4.54 kN/m.

LIVE LOAD ON LOFT BEAM, LB3:

FLAT ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 1.75m

= 1.31 kN/m

TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

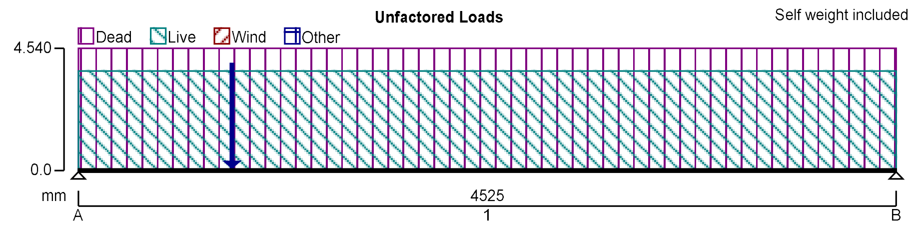
= 1.50 kN/m^2 x 1.60m

= 2.40 kN /m

THEREFORE TOTAL LIVE LOAD ON LB3 = 1.31 + 2.40 = 3.71 kN/m

POINT LOAD FROM STAIR TRIMMER 2 = 4.00 kN@0.85m from L.H.S

STRUCTURAL REPORT FOR LOFT BEAM (LB3):



BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **1**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A Vertically **"Restrained"** Rotationally **"Free"**

Support B Vertically **"Restrained"** Rotationally **"Free"**

Span Definitions:

Span 1 Length = **4525** mm Cross-sectional area = **4711** mm^2 Moment of inertia = **22.1**$\times$**10^6** mm^4

LOADING DETAILS

Beam Loads:

Load 1 Self weight Dead load = **1.000**

Load 2 UDL Dead load **4.5** kN/m

Load 3 UDL Live load **3.7** kN/m

Load 4 Point Other load **4.0** kN at **0.850** m

LOAD COMBINATIONS

Load combination 1

Span 1 1.4$\times$Dead + 1.6$\times$Live + 1$\times$Other

BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

Support A Max react = **-32.2** kN Min react = **-32.2** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

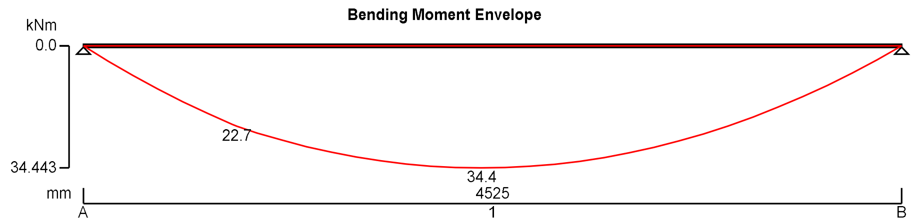
Support B Max react = **-29.7** kN Min react = **-29.7** kN Max mom = **0.0** kNm Min mom = **0.0** kNm

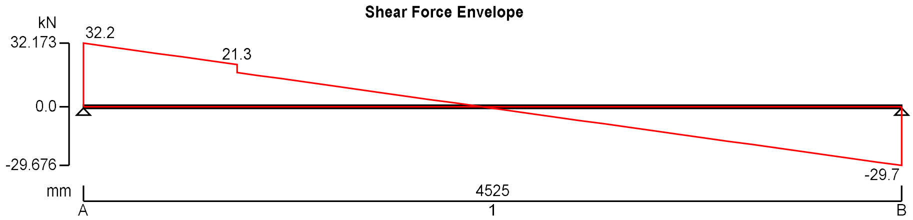
Beam Max/Min results - Combination Summary

Maximum shear = **32.2** kN Minimum shearF_{min} = **-29.7** kN

Maximum moment = **34.4** kNm Minimum moment = **0.0** kNm

Maximum deflection = **16.3** mm Minimum deflection = **0.0** mm





DESIGN SPAN 1

Member design checks for a simply-supported steel beam to BS 5950 (with LTB)

Summary of results

Material	Grade = **"S355"**	p_y = **355** N/mm^2	
Section	**"UC 152x152x37"**	Classification	**"Plastic"**

Check	*Load*	*Capacity*	*Notes*	*Result*
Deflection	δ_{y_max} = **4.5** mm	δ_{lim} = **12.6** mm	**Span / 360 or 13.0 mm**	**Pass**
Shear	F_{vy} = **32.2** kN	P_{vy} = **275.7** kN	**Low shear**	**Pass**
Moment	M_x = **34.4** kNm	M_{cx} = **109.6** kNm	**Low shear**	**Pass**
LTB	M_{LT} = **34.4** kNm	M_b / m_{LT} = **61.1** kNm	L_{E_LT} = **5.8** m m_{LT} = **1.00**	**Pass**

LOAD CALCULATIONS FOR LOFT BEAM (LB4):

CLEAR SPAN OF THE LOFT BEAM (LB4) = 1600mm

LOADING:

DEAD LOAD ON LOFT BEAM, LB4:

FLAT ROOF = 0.81 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.81 kN/m^2 x 1.50m

= 1.22 kN/m

TIMBER FLOOR = 0.50 kN / m2 x SPAN OF FLOOR IN MTS.

= 0.50 x 1.50

= 0.75 kN/m

EXTERNAL STUD WORK = 1.01 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 1.01 kN/m^2 x 2.30m

= 2.32 kN/m

THEREFORE TOTAL DEAD LOAD ON LB4 = 1.22 + 0.75 + 2.32 = 4.29 kN/m.

LIVE LOAD ON LOFT BEAM, LB4:

FLAT ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 1.50m

= 1.13 kN/m

TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.50 kN/m^2 x 1.50m

= 2.25 kN /m

THEREFORE TOTAL LIVE LOAD ON LB4 = 1.13 + 2.25 = 3.38 kN/m

STRUCTURAL REPORT FOR LOFT BEAM (LB4):

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span	Factors for moments & forces			Factors for deflection		
(mm)	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
1600	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**4.3**	**0**	-	**1600**
2	**"Imposed"**	UDL	**3.4**	**0**	-	**1600**

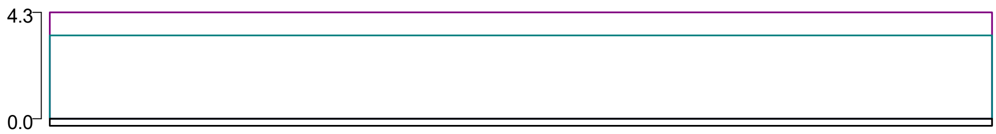
Analysis results - entire span

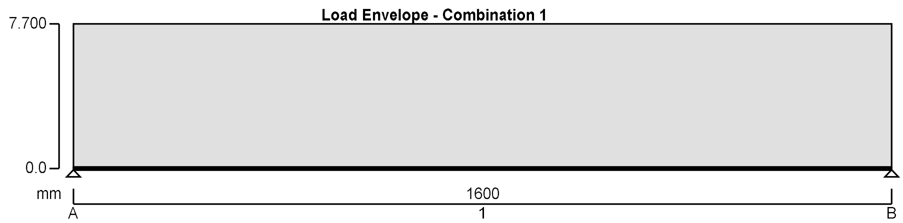
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
6.2	**6.2**	**6.2**	**2.5**	**"Sagging"**	**0.66**	**"Down"**

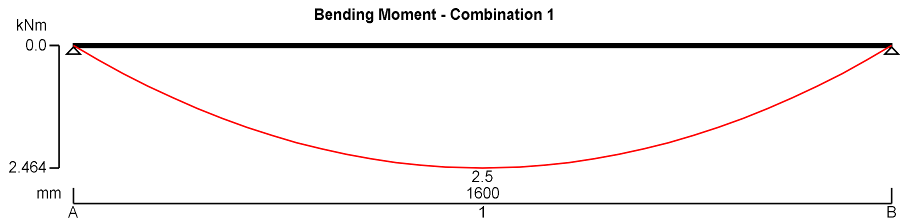
Unfactored support reactions

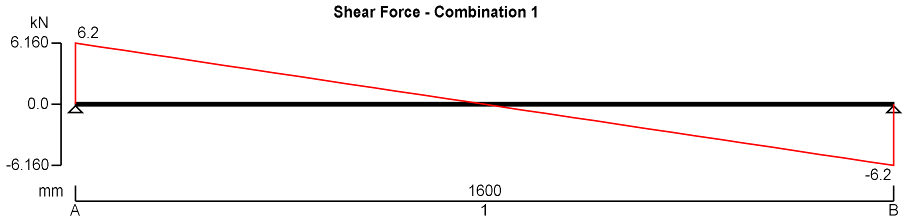
Support A	Dead load **-3.4** kN	Live load **-2.7** kN	Wind load **0.0** kN
Support B	Dead load **-3.4** kN	Live load **-2.7** kN	Wind load **0.0** kN

Beam Loads









Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **150** mm	B = **150** mm	A= **22500** mm^2	
Section properties (x-x)	I_{xx} = **42187500** mm^4	Z_{xx} = **562500** mm^3	r_{xx} = **43.3** mm	
(y-y)	I_{yy} = **42187500** mm^4	Z_{yy} = **562500** mm^3	r_{yy} = **43.3** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **4.38** N/mm^2	$\sigma_{m.adm.para}$ = **8.09** N/mm^2	Moment M = **2.5** kNm	**Pass**
Shear stress	τ_a = **0.41** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **6.2** kN	**Pass**
Deflection	δ = **1.6** mm	14 mm		**Pass**
	δ / L_s = **0.00102**	0.003		**Pass**

LOAD CALCULATIONS FOR LOFT BEAM (LB5):

CLEAR SPAN OF THE LOFT BEAM (LB5) = 3270mm

LOADING:

DEAD LOAD ON LOFT BEAM, LB5:

FLAT ROOF = 0.81 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.81 kN/m^2 x 0.2m

= 0.16 kN/m

TIMBER FLOOR = 0.50 kN / m2 x SPAN OF FLOOR IN MTS.

= 0.50 x 0.2

= 0.10 kN/m

EXTERNAL STUD WORK = 1.01 kN/m^2 x HEIGHT OF STUD PARTITION IN MTS.
(100mm)

= 1.01 kN/m^2 x 2.30m

= 2.32 kN/m

THEREFORE TOTAL DEAD LOAD ON LB5 = 0.16 + 0.10 + 2.32 = 2.58 kN/m.

LIVE LOAD ON LOFT BEAM, LB5:

FLAT ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 0.2m

= 0.15 kN/m

TIMBER FLOOR = 1.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.50 kN/m^2 x 0.2m

= 0.30 kN /m

THEREFORE TOTAL LIVE LOAD ON LB5 = 0.15 + 0.30 = 0.45 kN/m

POINT LOAD FROM LOFT BEAM, LB4 = 6.20 kN@2.93m from L.H.S

STRUCTURAL REPORT FOR LOFT BEAM (LB5):

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span	Factors for moments & forces			Factors for deflection		
(mm)	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3270	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

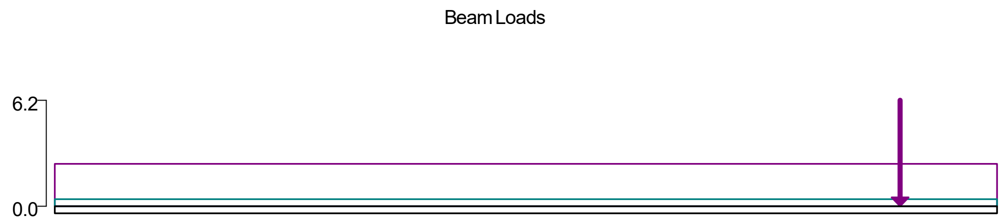
Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**2.6**	**0**	-	**3270**
2	**"Imposed"**	UDL	**0.5**	**0**	-	**3270**
3	**"Dead"**	Point load	**6.2** kN	**2930**	-	-

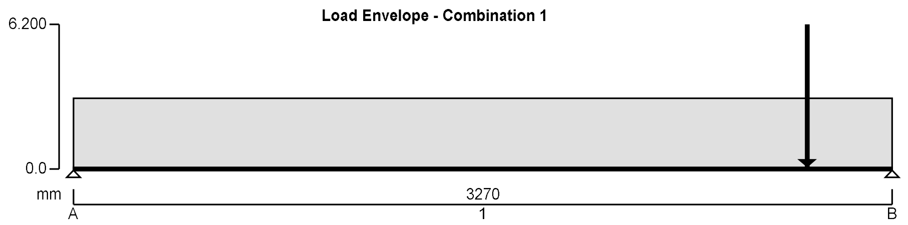
Analysis results - entire span

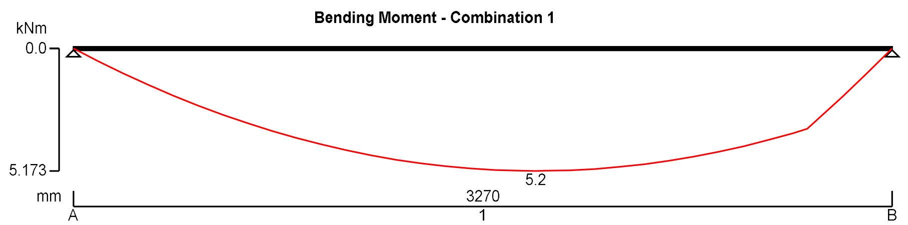
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
5.6	**10.5**	**10.5**	**5.2**	**"Sagging"**	**5.91**	**"Down"**

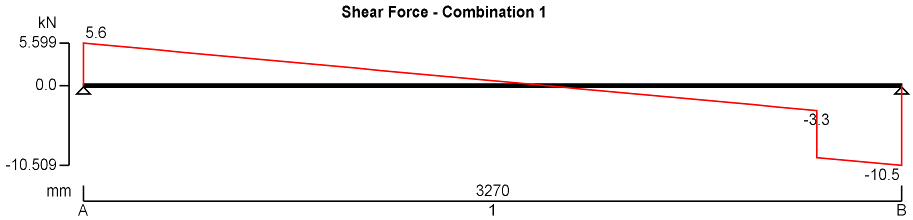
Unfactored support reactions

Support A	Dead load **-4.9** kN	Live load **-0.7** kN	Wind load **0.0** kN
Support B	Dead load **-9.8** kN	Live load **-0.7** kN	Wind load **0.0** kN









Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **200** mm	B = **150** mm	A= **30000** mm^2	
Section properties (x-x)	I_{xx} = **100000000** mm^4	Z_{xx} = **1000000** mm^3	r_{xx} = **57.7** mm	
(y-y)	I_{yy} = **56250000** mm^4	Z_{yy} = **750000** mm^3	r_{yy} = **43.3** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **5.17** N/mm^2	$\sigma_{m.adm.para}$ = **7.84** N/mm^2	Moment M = **5.2** kNm	**Pass**
Shear stress	τ_a = **0.53** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **10.5** kN	**Pass**
Deflection	δ = **5.8** mm	14 mm		**Pass**
	δ / L_s = **0.00177**	0.003		**Pass**

LOAD CALCULATIONS FOR TIMBER FLOOR JOISTS:

SPAN OF FLOOR JOISTS = 3150mm

ASSUME FLOOR JOISTS = 50mm x 150mm

TIMBER GRADE = C24

JOISTS CENTERS = 400mm

LOADING:

DEAD LOAD ON TIMBER FLOOR JOISTS:

TIMBER FLOOR = 0.50 kN/m^2 x SPAN OF FLOOR IN MTS.

= 0.50 kN/m^2 x 0.40m

= 0.20 kN/m

THEREFORE TOTAL DEAD LOAD ON TIMBER FLOOR JOISTS= 0.20 kN/m

LIVE LOAD ON TIMBER FLOOR JOISTS

TIMBER FLOOR = 1.5 kN/m^2 x SPAN OF FLOOR IN MTS.

= 1.5 kN/m^2 x 0.40m

= 0.60 kN/m

THEREFORE TOTAL LIVE LOAD ON TIMBER FLOOR JOISTS = 0.60 kN/m

LOAD CALCULATIONS FOR TIMBER FLOOR JOISTS:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span	Factors for moments & forces			Factors for deflection		
(mm)	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3150	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**0.2**	**0**	-	**3150**
2	**"Imposed"**	UDL	**0.6**	**0**	-	**3150**

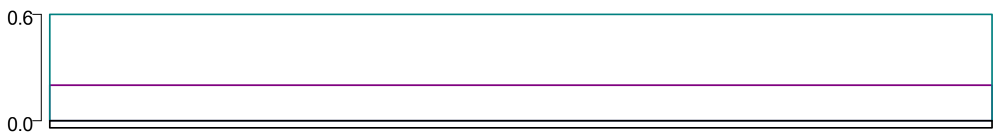
Analysis results - entire span

R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
1.3	**1.3**	**1.3**	**1.0**	**"Sagging"**	**1.03**	**"Down"**

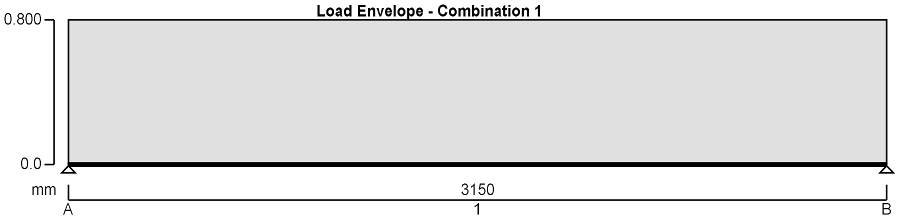
Unfactored support reactions

Support A	Dead load **-0.3** kN	Live load **-0.9** kN	Wind load **0.0** kN
Support B	Dead load **-0.3** kN	Live load **-0.9** kN	Wind load **0.0** kN

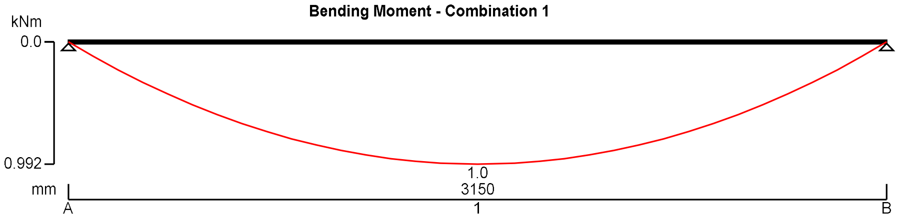
Beam Loads

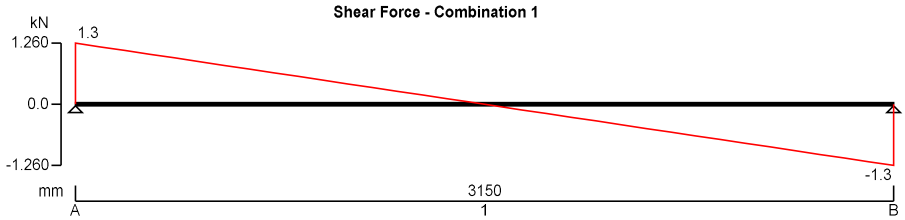


Load Envelope - Combination 1



Bending Moment - Combination 1





Member design checks for a simply-supported single-span timber beam to BS 5268

<u>Timber member design BS 5268-2:2002</u>

Summary of results				
Section size	D = **150** mm	B = **50** mm	A= **7500** mm^2	
Section properties (x-x)	I_{xx} = **14062500** mm^4	Z_{xx} = **187500** mm^3	r_{xx} = **43.3** mm	
(y-y)	I_{yy} = **1562500** mm^4	Z_{yy} = **62500** mm^3	r_{yy} = **14.4** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **5.29** N/mm^2	$\sigma_{m.adm.para}$ = **8.09** N/mm^2	Moment M = **1.0** kNm	**Pass**
Shear stress	τ_a = **0.25** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **1.3** kN	**Pass**
Deflection	δ = **7.0** mm	14 mm		**Pass**
	δ / L_s = **0.00222**	0.003		**Pass**

LOAD CALCULATIONS FOR FLAT ROOF JOISTS:

SPAN OF JOISTS = 3500mm

ASSUME FLAT ROOF = 50mm x 150mm

TIMBER GRADE = C24

JOISTS CENTERS = 400mm

LOADING:

DEAD LOAD ON FLAT ROOF JOISTS:

FLAT ROOF = 0.81 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.81 kN/m^2 x 0.40m

= 0.32 kN/m

THEREFORE TOTAL DEAD LOAD ON FLAT ROOF JOISTS= 0.32 kN/m

LIVE LOAD ON FLAT ROOF JOISTS:

PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 0.4m

= 0.30 kN/m

THEREFORE TOTAL LIVE LOAD ON FLAT ROOF JOISTS = 0.30 kN/m

LOAD CALCULATIONS FOR FLAT ROOF JOISTS:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span	Factors for moments & forces			Factors for deflection		
(mm)	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3500	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**0.3**	**0**	-	**3500**
2	**"Imposed"**	UDL	**0.3**	**0**	-	**3500**

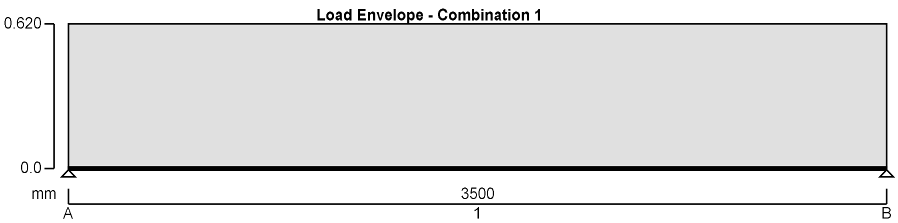
Analysis results - entire span

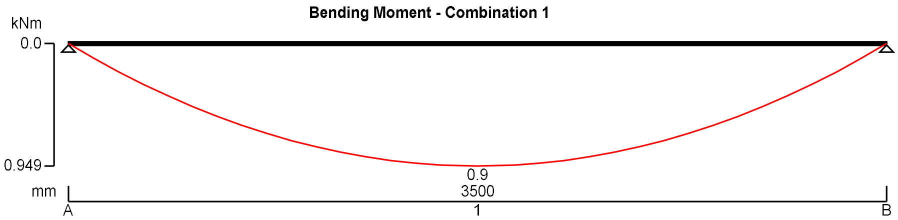
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
1.1	**1.1**	**1.1**	**0.9**	**"Sagging"**	**1.21**	**"Down"**

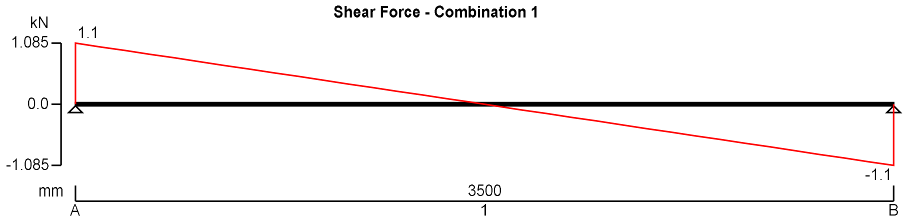
Unfactored support reactions

Support A	Dead load **-0.6** kN	Live load **-0.5** kN	Wind load **0.0** kN
Support B	Dead load **-0.6** kN	Live load **-0.5** kN	Wind load **0.0** kN

Beam Loads







Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **175** mm	B = **50** mm	A= **8750** mm^2	
Section properties (x-x)	I_{xx} = **22330729** mm^4	Z_{xx} = **255208** mm^3	r_{xx} = **50.5** mm	
(y-y)	I_{yy} = **1822917** mm^4	Z_{yy} = **72917** mm^3	r_{yy} = **14.4** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **3.72** N/mm^2	$\sigma_{m.adm.para}$ = **7.96** N/mm^2	Moment M = **0.9** kNm	**Pass**
Shear stress	τ_a = **0.19** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **1.1** kN	**Pass**
Deflection	δ = **5.2** mm	14 mm		**Pass**
	δ / L_s = **0.00149**	0.003		**Pass**

LOAD CALCULATIONS FOR TIMBER RAFTERS:

SPAN OF RAFTERS = 3000mm

ASSUME RAFTERS = 50mm x 150mm

TIMBER GRADE = C24

JOISTS CENTERS = 400mm

LOADING:

DEAD LOAD ON TIMBER RAFTERS:

PITCHED ROOF = 1.26 kN/m^2 x SPAN OF ROOF IN MTS.

= 1.26 kN/m^2 x 0.40m

= 0.50 kN/m

THEREFORE TOTAL DEAD LOAD ON TIMBER RAFTERS = 0.50 kN/m

LIVE LOAD ON TIMBER RAFTERS:

PITCHED ROOF = 0.75 kN/m^2 x SPAN OF ROOF IN MTS.

= 0.75 kN/m^2 x 0.40m

= 0.30 kN/m

THEREFORE TOTAL LIVE LOAD ON TIMBER RAFTERS = 0.30 kN/m

LOAD CALCULATIONS FOR TIMBER RAFTERS:

Analysis for a simply-supported single-span timber beam to BS 5268

TEDDS calculation version 1.0.02

Span length & partial factors for loading

Span	Factors for moments & forces			Factors for deflection		
(mm)	γ_{fd}	γ_{fi}	γ_{fw}	γ_{dd}	γ_{di}	γ_{dw}
3000	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Loading data (unfactored)

Ref.	Category	Type	Load kN/m	Position mm	Load kN/m	Position mm
1	**"Dead"**	UDL	**0.5**	**0**	-	**3000**
2	**"Imposed"**	UDL	**0.3**	**0**	-	**3000**

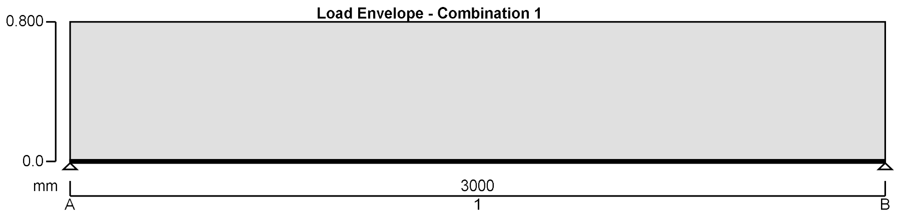
Analysis results - entire span

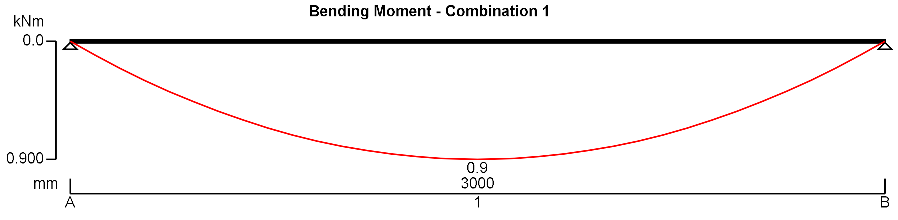
R_a	R_b	V	M		Deflection: δEI	
kN (fac)	kN (fac)	kN (fac)	kNm (fac)	Sense	kNm^3	Direction
1.2	**1.2**	**1.2**	**0.9**	**"Sagging"**	**0.84**	**"Down"**

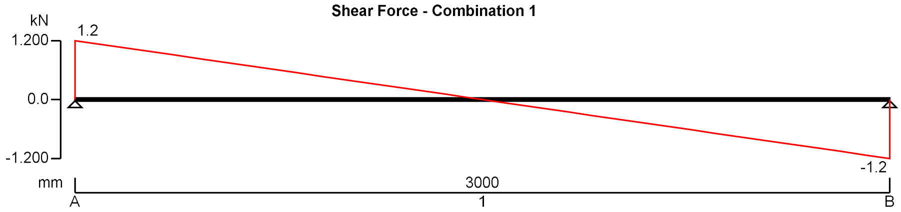
Unfactored support reactions

Support A	Dead load **-0.7** kN	Live load **-0.4** kN	Wind load **0.0** kN
Support B	Dead load **-0.7** kN	Live load **-0.4** kN	Wind load **0.0** kN

Beam Loads







Member design checks for a simply-supported single-span timber beam to BS 5268

Timber member design BS 5268-2:2002

Summary of results				
Section size	D = **150** mm	B = **50** mm	A= **7500** mm^2	
Section properties (x-x)	I_{xx} = **14062500** mm^4	Z_{xx} = **187500** mm^3	r_{xx} = **43.3** mm	
(y-y)	I_{yy} = **1562500** mm^4	Z_{yy} = **62500** mm^3	r_{yy} = **14.4** mm	
Grade	**"C24"**	σ_c = **7.90** N/ mm^2		
Check	*Stress*	*Capacity*	*Notes*	*Result*
Bending stress	$\sigma_{m.a.para}$ = M / Z_{xx} = **4.80** N/mm^2	$\sigma_{m.adm.para}$ = **8.09** N/mm^2	Moment M = **0.9** kNm	**Pass**
Shear stress	τ_a = **0.24** N/mm^2	τ_{adm} = **0.71** N/mm^2	Shear V = **1.2** kN	**Pass**
Deflection	δ = **5.8** mm	14 mm		**Pass**
	δ / L_s = **0.00192**	0.003		**Pass**

DESIGN OF MILD STEEL PLATE SPREADER:

1. SPREADER DESIGN FOR LOFT BEAM, LB1 & LB2 [WORST CASE]:

Maximum reaction from loft beam = 40.00 kN x 0.7 = 28.00 kN [Unfactored]

As per Structural Renovation of Traditional Buildings (CIRIA-REPORT:1986)

The basic compressive stress = 0.42 N/mm^2 and Local bearing factor is 1.5

So the allowable compressive stress = 0.42 N/mm^2 x 1.5 = 0.63N/mm2

Length of Spreader is (28.00 x 1000) / (0.63 x 100) = 445mm

Therefore provide 500mm Long x 100mm Wide x 25mm THICK Mild Steel Plate As Spreaders

2. SPREADER DESIGN FOR ROOF BEAM (RB) [WORST CASE]:

Maximum reaction from roof beam = 20.00 kN x 0.7 = 14.00 kN [Unfactored]

As per Structural Renovation of Traditional Buildings (CIRIA-REPORT:1986)

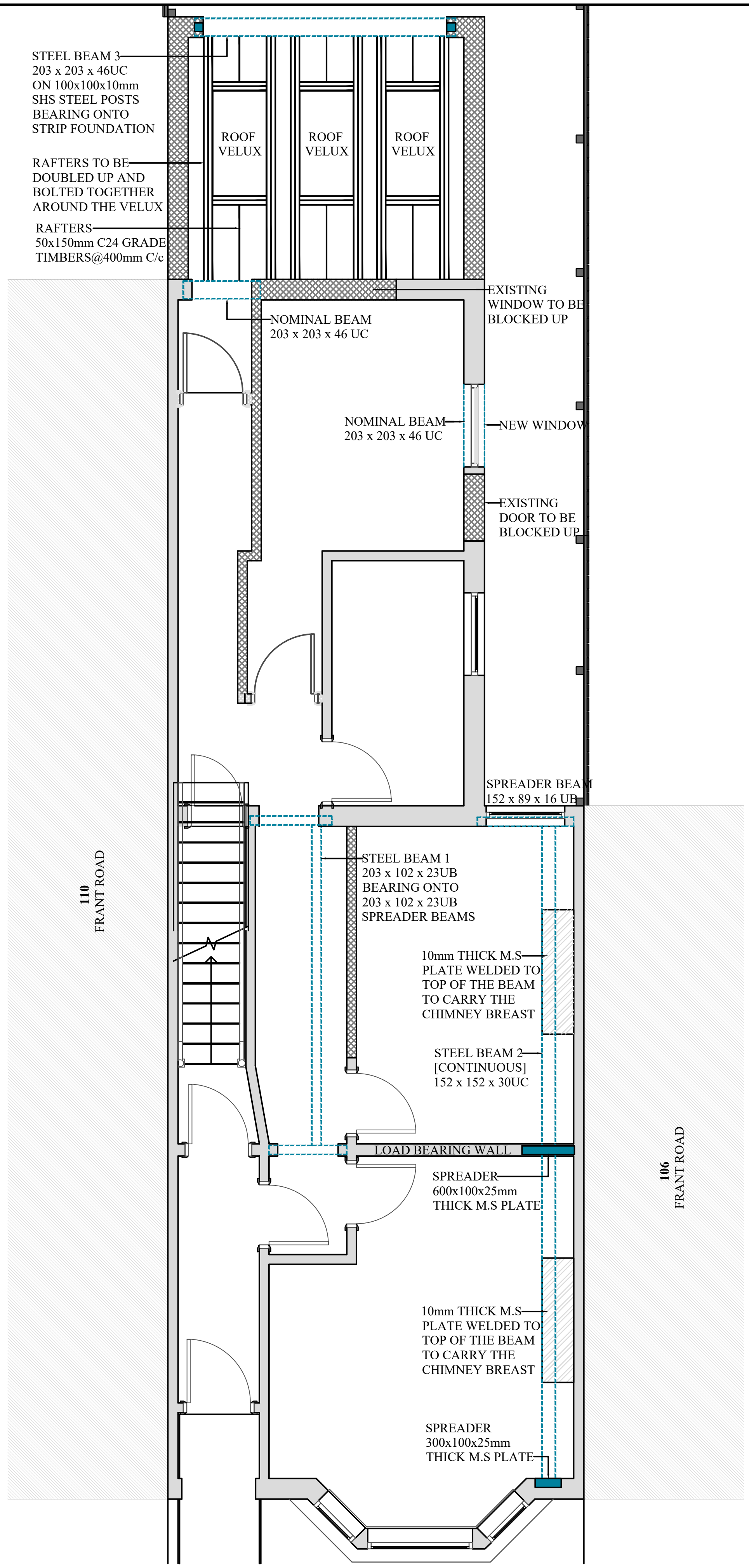
The basic compressive stress = 0.42 N/mm2 and Local bearing factor is 1.5

So the allowable compressive stress = 0.42 N/mm^2 x 1.5 = 0.63N/mm^2

Length of Spreader is (14.00 x 1000) / (0.63 x 100) = 223mm

Therefore provide 300mm Long x 100mm Wide x 25mm THICK Mild Steel Plate As Spreader

Note: Under dormer cheeks provide 3x50x150 mm C24 grade timbers bolted together.



PROJECT	108 FRANT ROAD, THORNTON HEATH, CR7 7JX
DESCRIPTION	PROPOSED GROUND FLOOR STRUCTURAL PLAN
SCALE	NOT TO SCALE
DRAWINGS NO.	S01
DATE	19-06-2026
CLIENT	MR. EDWARD DUBLIN
PREPARED BY	MOHAMMED NAYEEM MSc. (Hons.)

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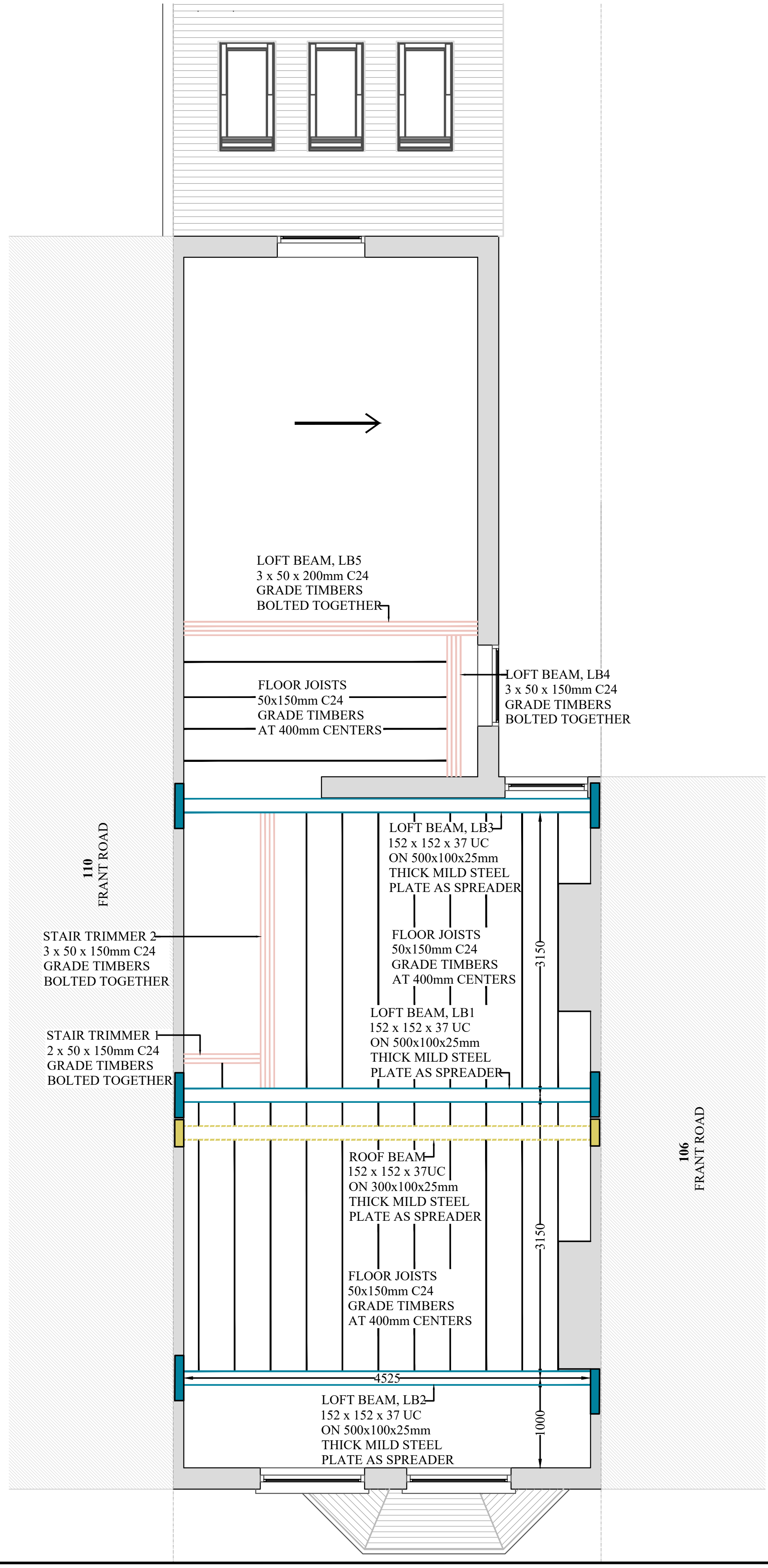

PROJECT	108 FRANT ROAD, THORNTON HEATH, CR7 7JX
DESCRIPTION	PROPOSED LOFT FLOOR STRUCTURAL PLAN
SCALE	NOT TO SCALE
DRAWINGS NO.	S02
DATE	19-06-2026
CLIENT	MR. EDWARD DUBLIN
PREPARED BY	MOHAMMED NAYEEM MSc. (Hons.)

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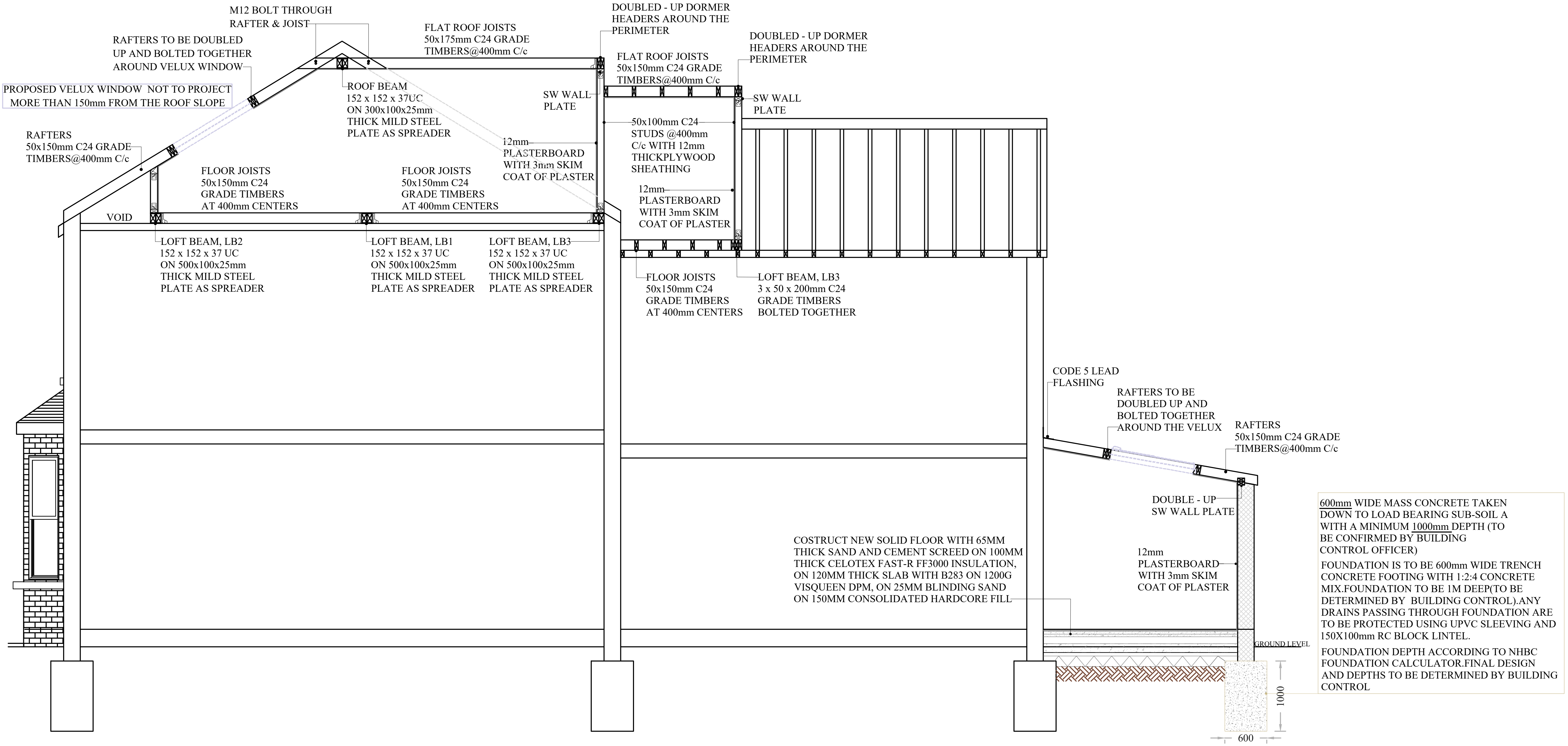

PROJECT	108 FRANT ROAD, THORNTON HEATH, CR7 7JX
DESCRIPTION	PROPOSED ROUGH SECTION
SCALE	NOT TO SCALE
DRAWINGS NO.	S03
DATE	19-06-2026
CLIENT	MR. EDWARD DUBLIN
PREPARED BY	MOHAMMED NAYEEM MSc. (Hons.)
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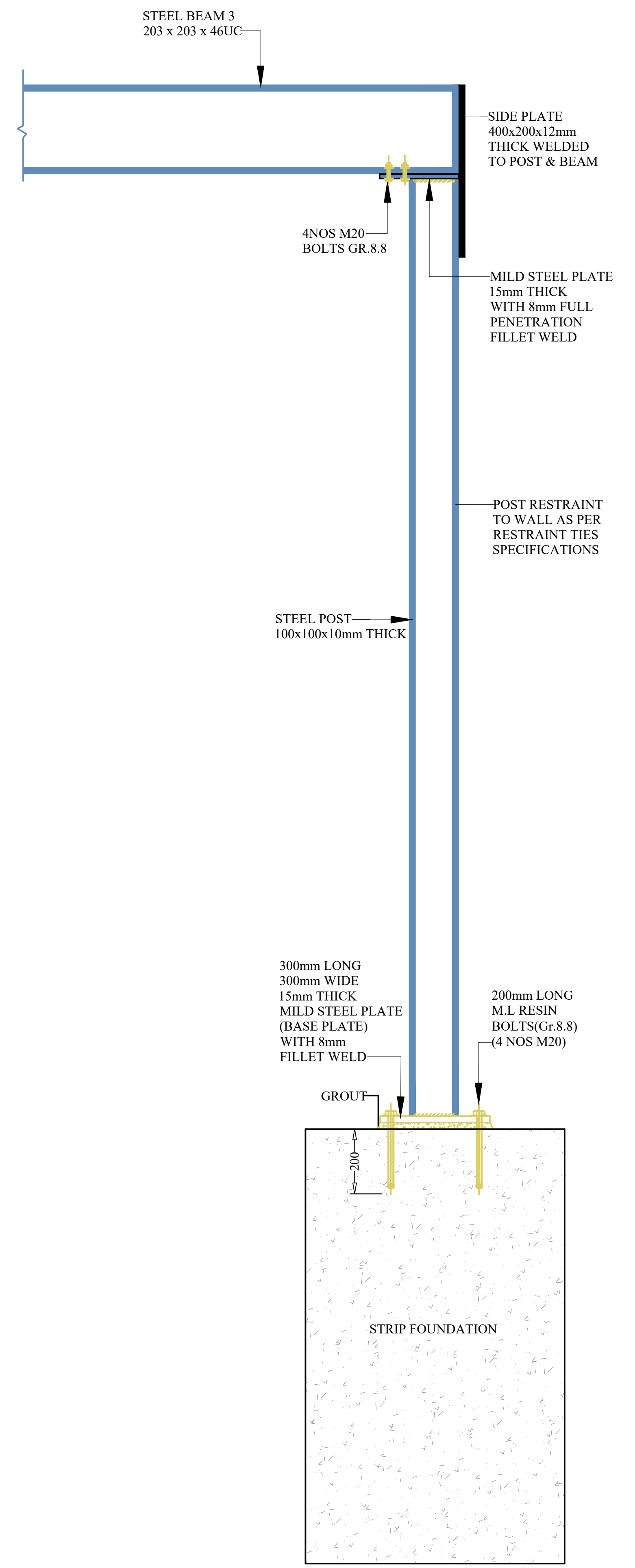
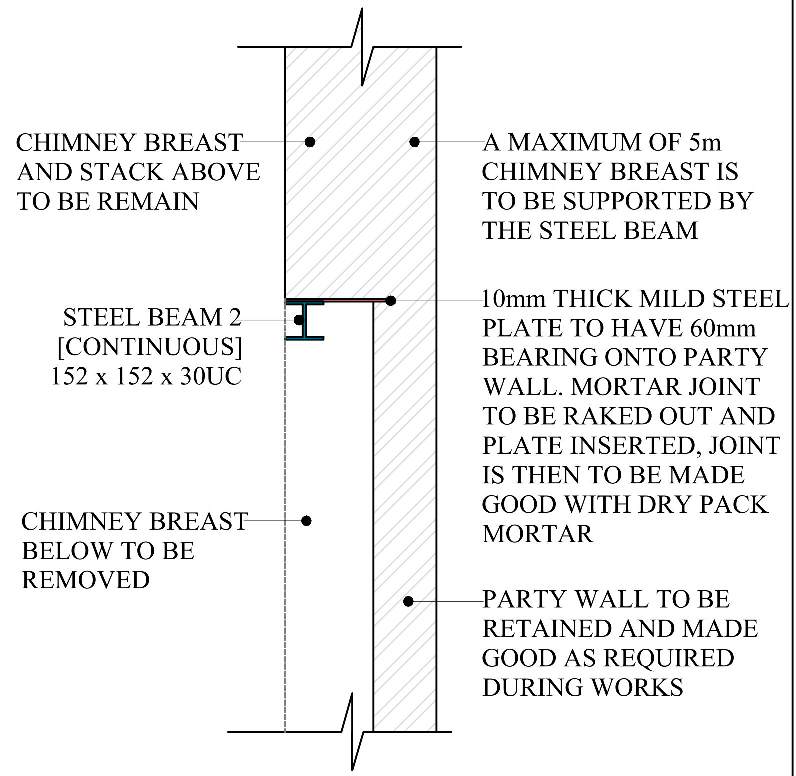
STEEL BEAM 3 TO STEEL POST TO STRIP FOOTING CONNECTION DETAILS





TYPICAL SECTION
THROUGH CHIMNEY
BREAST SUPPORT

PROJECT	108 FRANT ROAD, THORNTON HEATH, CR7 7JX
DESCRIPTION	CONNECTIONS
SCALE	NOT TO SCALE
DRAWINGS NO.	S01
DATE	19-06-2026
CLIENT	MR. EDWARD DUBLIN
PREPARED BY	MOHAMMED NAYEEM MSc. (Hons.)
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