STRUCTURAL CALCULATIONS

Using
MASTERSERIES POWERPAD

Loft Structural Calculation

119 Fort Road
Southwark, London

BETTERLIVINGSPACE LTD

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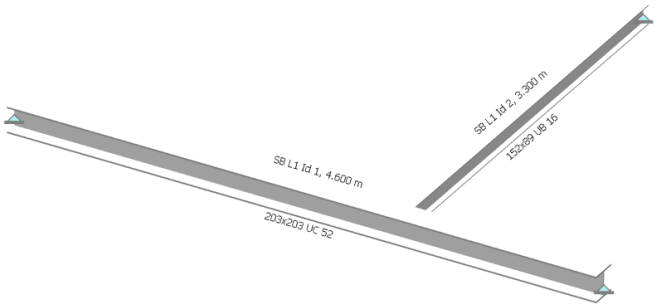
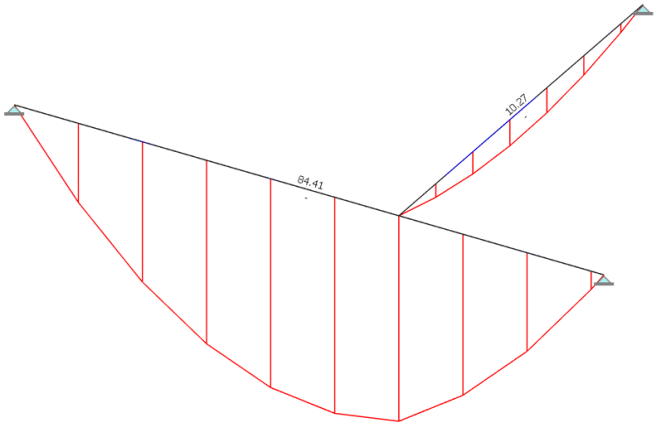
MasterFrame : Graphics



Load Case 001 : Dead+Live 1.25D0+1.25D1+1.50L1 (Ultimate)
Frame Geometry - Full Frame - 3D Front View



Load Case 001 : Dead+Live 1.25D0+1.25D1+1.50L1 (Ultimate)
Bending Moment Diagram - Full Frame - 3D Front View
Bending Moment Values (kN.m)
50 kN.m = 1m

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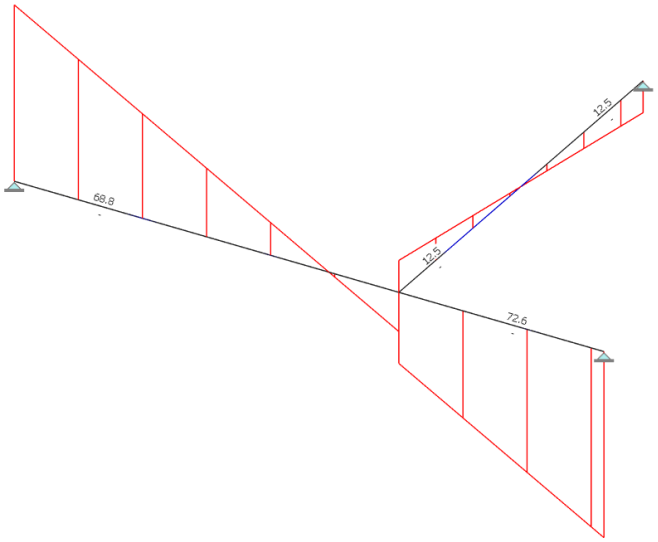

Load Case 001 : Dead+Live 1.25D0+1.25D1+1.50L1 (Ultimate)
Shear Force Diagram - Full Frame - 3D Front View
Shear Force Values (kN)
50 kN = 1m

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AXIAL WITH MOMENTS (MEMBER)
Support 1
Member SB L1 Id 1 @ Level 1 in Load Case 4

Support 1

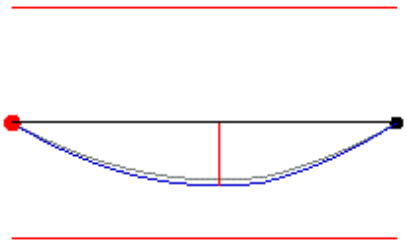
LOADINGS

TOTAL =	No	Load	Length			Comment
Wall	1	1.80	2.60	4.68	kN/m	Average full height of wall
Roof (Main Roof)	1	0.75	4.10	3.08	kN/m	
Roof (2nd Roof)	0	0.75	0.00	0.00	kN/m	
Ceiling	1	0.25	4.10	1.03	kN/m	
First Floor	1	0.50	4.10	2.05	kN/m	
Second Floor	0	0.25	0.00	0.00	kN/m	
TOTAL =				**10.83**	kN/m	
Live Loads						
Roof (Main Roof)	1	0.50	4.10	2.05	kN/m	
Roof (2nd Roof)	0	0.75	0.00	0.00	kN/m	
Ceiling	1	0.25	4.10	1.03	kN/m	
First Floor	1	1.50	4.10	6.15	kN/m	
Second Floor	0	1.50	0.00	0.00	kN/m	
TOTAL =				**9.23**	**kN/m**	

Member Loading and Member Forces

Loading Combination : 1 UT + 1.25 D0 + 1.25 D1 + 1.5 L1

D1 D 077.010 (kN/m³)
D1 UDLY -010.830 (kN/m)
L1 UDLY -009.230 (kN/m)



Member Forces in Load Case 4 and Maximum Deflection from Load Case 3

Member No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN) y-y	Shear Force (kN) z-z	Bending Moment (kN.m) y-y	Bending Moment (kN.m) z-z	Maximum Moment (kN.m @ m) y-y	Maximum Moment (kN.m @ m) z-z	Maximum Deflection (mm @ m)
	1	0.13T	0.00	68.78	0.00	0.00	0.00	84.41	0.00	12.40
	3	0.25C	0.00	-72.57	0.00	0.00	0.00	@ 2.460	@ 0.000	@ 2.310

Classification and Effective Area (EN 1993: 2006)

Section (52.03 kg/m)	203x203 UC 52 [S 275]		
Class = Fn(b/T,d/t,f_y,N,M_y,M_z)	8.17, 20.35, 275, 0.25, 84.4, 0	(Axial: Non-Slender)	Class 1
Auto Design Load Cases	1-2 & 4		

Local Capacity Check

$V_{y.Ed}/V_{pl.y.Rd}$	0.634 / 297.577 =	0.002	Low Shear
$M_{c.y.Rd} = f_y.W_{pl.y}/\gamma_{M0}$	275 x 567.4/1	156.035 kN.m	
$N_{pl.Rd} = Ag.fy/\gamma_{M0}$	66.28x275/1 (No bearing / block tearing design)	1822.7 kN	
$n = N_{Ed}/N_{pl.Rd}$	-0.134 / 1822.7 =	0.000	OK
$W_{pl.N.y} = Fn(W_{pl.y}, A_{vy}, n)$	567.4, 18.743, 0	567.4 cm³	
$M_{N.y.Rd} = W_{pl.N.y}.f_y/\gamma_{M0}$	567.4 x 275/1	156.035 kN.m	
$(M_{y.Ed}/M_{N.y.Rd})+(M_{z.Ed}/M_{N.z.Rd})$	$(84.399/156.035)^2+(0)^1=$	0.293	OK

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Compression Resistance N.b.Rd

Ley = Ky.Ly	1x4.6 =	4.6	
$\lambda y = \sqrt{A.fy/Ncr}$	√66.28x275/5153.82	0.595	
$N_{b.y.Rd}$ = Area.χ.f_y/ γ_{M1}	66.28x0.84x275/10/1 =	1530.553 kN	Curve b
Lez = Kz.Lz	1x4.6 =	4.6	
$\lambda z = \sqrt{A.fy/Ncrz}$	√66.28x275/1744	1.023	
$N_{b.z.Rd}$ = Area.χ.f_y/ γ_{M1}	66.28x0.527x275/10/1 =	960.132 kN	Curve c
Let = Kt.Lx	1x4.6 =	4.6	
$\lambda T = \sqrt{A.fy/NcrT}$	√66.28x275/3951.52	0.679	
$N_{b.T.Rd}$= Area.χ.fy/ γ_{M1}	66.28x0.738x275/10/1 =	1344.319 kN	Curve c

Equivalent Uniform Moment Factors C1, C.mLT, C.mz, and C.my

C_1= fn(M_1, M_2, M_o, ψ,μ)	0.1, 0.1, 84.0, 0.917, 300.000	1.127	Uniform
C_{mLT}=0.95+0.05α_h	M_h= 0.07, M_s= 84.07, ψ = 0.917, α_s= 0.001	0.95	Table B.3
C_{mz}=Max(0.6+0.4ψ, 0.4)	M = 0, ψ = 1.000	1	Table B.3
C_{my}=0.95+0.05α_h	M_h= 0, M_s= 84.07, ψ = 1.000, α_s= 0.000	0.95	Table B.3

Lateral Buckling Check M.b.Rd

Le = 1.00 L	1 x 4.6 =	4.6 m	
M_{cr}= Fn(C_1,L_e,I_z,I_t,I_w,E)	1.127, 4.600, 1781, 31.76, 0.1666, 210000	304.918 kN.m	
λ_{LT}= √ W.f_y/M_{cr}	√ 567.4 x 275 / 304.918	0.715	
χ_{LT}= Fn(λ_{LT}, λ_{LT5950})	0.715, 0.685	0.862	Curve b
χ_{LT}.mod = Fn(χ_{LT},λ_{LT},k_c,f)	0.862, 0.715, 0.942, 0.971	0.887	6.3.2.3
$M_{b.Rd}$ = χ $W_{pl.y}$.f_y≤ $M_{c.y.Rd}$	0.887 x 567.4 x 275 ≤ 156.035 =	138.447 kN.m	

Buckling Resistance

$U_{N.y}$ = N_{Ed}/(χ_y.N_{Rk}/γ_{M1})	0.251 / 1530.553	0.000	OK
$U_{N.z}$ = N_{Ed}/(χ_z.N_{Rk}/γ_{M1})	0.251 / 960.132	0.000	OK
$U_{M.y}$ = $M_{y.Ed}$/(χ_{LT}.$M_{y.Rk}$/γ_{M1})	84.399 / 138.447	0.610	OK
$U_{M.z}$ = $M_{z.Ed}$/($M_{z.Rk}$/γ_{M1})	0 / 72.655	0.000	OK
k_{yy}=C_{my}{1+(λ_y-0.2)$U_{N.y}$}		0.950	
k_{zz}=C_{mz}{1+1.4$U_{N.z}$}		1.000	
k_{yz}=0.6 k_{zz}		0.600	
k_{zy}= 1- {0.1λ_z/(C_{mLT}-0.25)}$U_{N.z}$		1.000	
U_{Ny}+k_{yy}.$U_{M.y}$+k_{yz}.$U_{M.z}$	0.000+0.950x0.610+0.600x0.000	0.579	OK
U_{Nz}+k_{zy}.$U_{M.y}$+k_{zz}.$U_{M.z}$	0.000+1.000x0.610+1.000x0.000	0.610	OK

Deflection Check - Load Case 3

In-span δ ≤ Span/360	12.4 ≤ 4600 / 360	12.4 mm	OK

FOUNDATION CHECK

Loaded Area	**2.88**	m^2	2.4m to underside of Foundation and 600 wide
Normal Wall Load	**30.00**	**kN/m**	6m two storey wall plus floor loads
	144.00		Total wall load
Additional Point Load	**0.00**	**kN**	None
Additional load	**66.16**	**kN**	From above
Total Load on Foundation =	**72.97**	**kN/m²**	< 75 kN/m2 therefore OK

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AXIAL WITH MOMENTS (MEMBER)
Support 2
Member SB L1 Id 2 @ Level 1 in Load Case 2

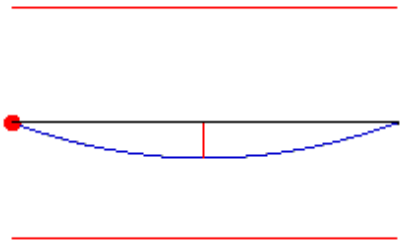
Support 2

LOADINGS	No	Load	Length			Comment
TOTAL =						
Wall	1	1.80	2.60	4.68	kN/m	Average full height of wall
Roof (Main Roof)	0	0.75	0.00	0.00	kN/m	
Roof (2nd Roof)	0	0.75	0.00	0.00	kN/m	
Ceiling	0	0.25	0.00	0.00	kN/m	
First Floor	0	0.50	0.00	0.00	kN/m	
Second Floor	0	0.25	0.00	0.00	kN/m	
TOTAL =				**4.68**	kN/m	
Live Loads						
Roof (Main Roof)	1	0.50	2.00	1.00	kN/m	Nominal load
Roof (2nd Roof)	0	0.75	0.00	0.00	kN/m	
Ceiling	0	0.25	0.00	0.00	kN/m	
First Floor	0	1.50	0.00	0.00	kN/m	
Second Floor	0	1.50	0.00	0.00	kN/m	
TOTAL =				**1.00**	**kN/m**	

Member Loading and Member Forces

Loading Combination : 1 UT + 1.35 D0 + 1.35 D1 + 1.05 L1

D1 D 077.010 (kN/m³)
D1 UDLY -004.680 (kN/m)
L1 UDLY -001.000 (kN/m)



Member Forces in Load Case 2 and Maximum Deflection from Load Case 3										
Member No.	Node End1 End2	Axial Force (kN)	Torque Moment (kN.m)	Shear Force (kN)		Bending Moment (kN.m)		Maximum Moment (kN.m @ m)		Maximum Deflection (mm @ m)
				y-y	z-z	y-y	z-z	y-y	z-z	
3	2	0.00C	0.00	12.51	0.00	0.00	0.00	10.32		5.14
	4	0.00C	0.00	-12.51	0.00	0.00	0.00	@ 1.650		@ 1.650

Classification and Effective Area (EN 1993: 2006)

Section (15.95 kg/m)	152x89 UB 16 [S 275]		
Class = Fn(b/T,d/t,f_y,N,M_y,M_z)	5.76, 27.07, 275, 0, 10.31, 0	(Axial: Non-Slender)	Class 1
Auto Design Load Cases	1-2 & 4		

Moment Capacity Check M.c.y.Rd

$V_{y.Ed}/V_{pl.y.Rd}$	0.002 / 129.829 =	0	Low Shear
$M_{c.y.Rd} = f_y.W_{pl.y}/ \gamma_{M0}$	275 x 123.3/1	33.908 kN.m	
$M_{y.Ed}/M_{c.y.Rd}$	10.314 / 33.908 =	0.304	OK

Equivalent Uniform Moment Factor C1

C_1= fn(M_1, M_2, M_o, ψ,μ)	0.0, 0.0, 10.3, 0.909, 300.000	1.127	Uniform

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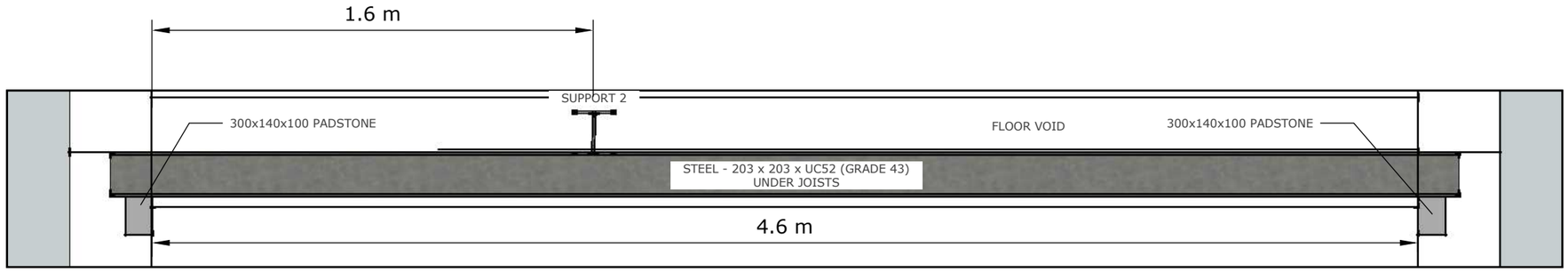
Lateral Buckling Check M.b.Rd

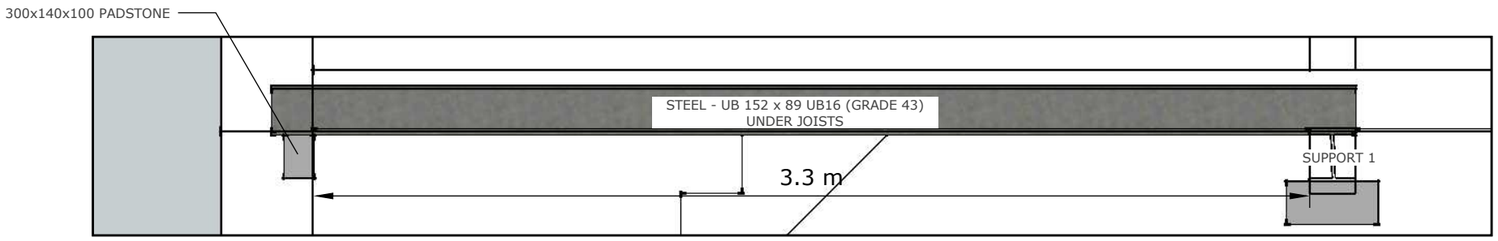
Le = 1.00 L	1 x 3.3 =	3.3 m	
M_{cr}= Fn(C_1,L_e,I_z,I_t,I_w,E)	1.127, 3.300, 90.6, 3.561, 0.004688, 210000	28.727 kN.m	
λ_{LT}= √ W.f_y/M_{cr}	√ 123.3 x 275 / 28.727	1.086	
χ_{LT}= Fn(λ_{LT}, λ_{LT5950})	1.086, 1.124	0.647	Curve b
χ_{LT}.mod = Fn(χ_{LT},λ_{LT},k_c,f)	0.647, 1.086, 0.942, 0.976	0.663	6.3.2.3
$M_{b.Rd}$ = χ $W_{pl.y}$.f_y≤ $M_{c.y.Rd}$	0.663 x 123.3 x 275 ≤ 33.908 =	22.477 kN.m	
$M_{y.Ed}$/$M_{b.Rd}$	10.314 / 22.477	0.459	OK

Deflection Check - Load Case 3

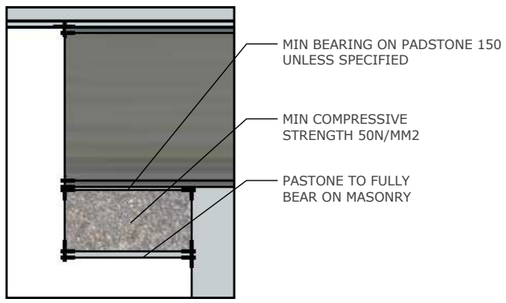
In-span δ ≤ Span/360	5.14 ≤ 3300 / 360	5.14 mm	OK



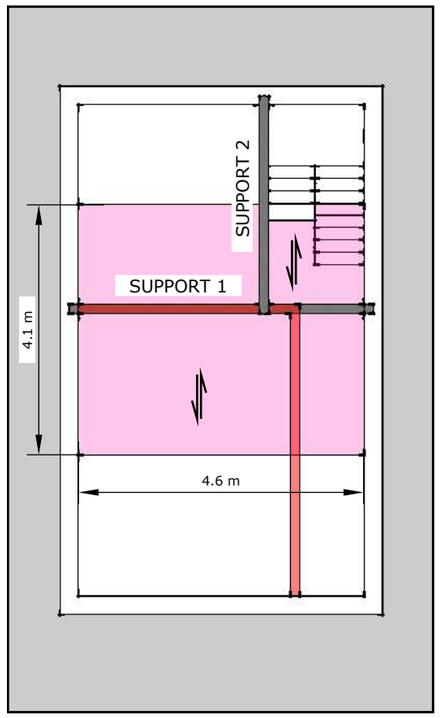
SUPPORT 1
SCALE 1:20



SUPPORT 2 INSULATED CATNIC LINTEL
SCALE 1:20



PADSTONE
SCALE 1:10



SUPPORT LAYOUT
SCALE 1:100

NOTES

1) All installations are to be fully compliant with the following

   i.) Approve building control drawings

   ii.) Current health and safety legislation

   iii.) Current building regulations

   iv) BS 8000 series workmanship on building sites - code of practice

1) The contractor must report all conflicts and/or discrepancies to BetterLivingSpace Ltd

2) All dimensions are in millimetres unless stated.The contractor is responsible for checking all dimensions for accuracy prior to the commencement of any construction activities

3) The contractor is responsible for all temporary works.

4) The dimensions as stated on the drawing are clear internal measurements. If the contractor cannot achieve the measurements, then the client must be notified prior to the start of any construction activity.

5)

6) All structural beams are to be fire protected in accordance with current building regulations

7) All blockwork to have a minimum compressive strength of 7N/mm^2

8) All structural steel members are to have a minimum 150 end bearing unless otherwise indicated

9) All lintels and structural steel are to be supported from masonry walls are to use padstones with a minimum compressive strength of 50 N/mm^2

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A	FOR BUILDING CONTROL APPROVAL	27/09/2018

PROJECT
119 FORT ROAD
SOUTHWARK

DRAWING TITLE
STRUCTURAL STEELWORK

SIZE	SCALE	DRAWING NO.	REV
A3	AS SHOWN	1809-119FR- 001	A