



CIVIL & STRUCTURAL CONSULTING ENGINEERS

LONDON • MIDLANDS • EAST ANGLIA • NORTH • EUROPE

www.jmsengineers.co.uk

Structural Calculations

Alterations to 19 Featherston Drive Burbage

Project No: CO18/322/08

Revision	Date	Changes
/	21.08.2018	Initial Issue





CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 2 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

General Construction Notes and Guidance on using these Calculations

1. Calculations are not to be used for the purpose of ordering materials and should only be used for Building Regulations submissions. All dimensions should be checked by the contractor on site.
2. All steelwork to be mechanically wire brushed and painted two coats of red oxide. Steelwork located in the cavity or below DPC to be suitably protected with 2 coats of bituminous paint.
3. All steelwork connections to use grade 8.8 bolts unless stated otherwise. These are to be spanner tightened using the appropriate podger spanner (min length 460mm) or suitable power tools in accordance with BS2583. If a torque wrench is used the torque applied should be around 90Nm for M16 bolts, 110Nm for M20 & 130Nm for M24.
4. All timber to be grade C24 (SC4), unless stated otherwise. Preservative treated to Architects details.
5. To be read in conjunction with Architects drawings, any inconsistencies between the drawings should be reported. If any site conditions or existing details are found that may affect the structural design, JMS Consulting Engineers are to be notified immediately.
6. For details of fire protection to steelwork, see Architects drawings.
7. The Contractor is to ensure that all existing construction is adequately supported, using needles and props as required. Where a new beam supports the existing construction, adequate pre-load is to be applied and suitable packs such as driven dry-slate introduced, then pointed up with mortar.
8. All blockwork to be 7.3 N/mm² in class III mortar below DPC in accordance with BS 5628 : Part 3 : 2005 or suitable 7.0 N/mm² foundation quality blocks in class II mortar in accordance with the manufacturer's instructions. All brickwork below DPC to be Engineering Bricks DPC in accordance with BS 5628 : Part 3 : 2005.
9. The project requires the introduction of heavy structural elements such as steel beams or concrete lintels. Although the Construction (Design and Management) Regulation 1994 would not normally apply to this type of construction, the designer still has an obligation to foresee risks and bring to the attention of the builder such risks. In consequence, the builder is to take into consideration the placement of all structural elements, ensuring that the method of lifting and placement is safely carried out. Responsibility for this element lies with the Contractor. As the existing walls need to be propped in order to introduce some of the lintels, this should also be considered in relationship to the risk assessment of the Contractor. Safe working procedures must be adopted. Responsibility for this element lies with the Contractor. Splice details for long-span beams can often be accommodated if required.
10. All construction products should be CE marked in accordance current legislation. This includes all fabricated structural steelwork in accordance with BS EN 1090-1 and BS EN 1090-2. The consequence class is CC2 unless noted otherwise. The service class is SC1 for all buildings, SC2 for all lifting beams, sculptures & fall arrest systems. Production category will be PC1 unless noted otherwise. All site welded items, S355 steelwork & CHS lattice girders will be PC2. As such the execution class for buildings will be EXC2.
11. CLIMATE CHANGE: The Building Research establishment have produced a document CBG 63 "Climate Change: impact on building design and construction". Part of their recommendations are that designers and builders should give consideration to:
 - a. Increased wind loading by providing additional laps and fixings to roof coverings
 - b. Consider foundation depth on shrinkable clays and to avoid future problems, increase the depth above standard requirements if there is a risk. This should be in accordance with the NHBC Standards, Chapter 4.2 Guidance on Building near Trees. If the calculations do not specifically design the depths of the foundations to take into account any local trees, then this should be checked and agreed with the Building Inspector on site.

Party Wall etc. Act 1996

If part of the work is adjacent to the boundary, the adjacent neighbours right to support could be affected; the issues associated with Party Wall Act may need to be considered. This may include providing information to the adjoining owner, giving sufficient notice of works in compliance with the Act. If the following list applies to this project then the Party Wall Act will apply. JMS Engineers can act as Party Wall Surveyors in this instance and should be contacted accordingly.

- Installing a new beam into the shared wall between properties
- Demolishing, building or under-pinning an existing shared wall
- Building a new wall at or on the boundary or junction of two properties
- Damp-proofing all the way through a party wall
- Digging foundations that are within 3m of a Party Wall, where the new foundations are deeper than the existing ones
- Where the new foundations are within 6m and lower than a 45° line from the bottom of the existing foundations



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 3 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Loading

Roof:	Tiles	=	0.65 kN/m ²		<u>Dead</u>	<u>Live</u>
	Rafters, felt, insulation etc.	=	0.30 kN/m ²			
			0.95 kN/m ² /Cos 35	=	1.16 kN/m ²	
	Plasterboard	=			0.25 kN/m ²	
			TOTAL	=	1.41 kN/m²	
	Attic	=			0.25	
	Roof snow loading	=	0.6*((60-35)/30)	=	0.50 kN/m ²	
			TOTAL	=		0.75 kN/m²

Vaulted Roof:

	Tiles	=	0.65 kN/m ²		<u>Dead</u>	<u>Live</u>
	Plasterboard	=	0.25 kN/m ²			
	Rafters, felt, insulation etc.	=	0.30 kN/m ²			
			1.20 kN/m ² /Cos 35	=	1.47 kN/m ²	
			TOTAL	=	1.47 kN/m²	
	Attic	=			0.25	
	Roof snow loading	=	0.6*((60-35)/30)	=	0.50 kN/m ²	
			TOTAL	=		0.75 kN/m²

Floor:

	Joists	=	0.15 kN/m ²			
	Boarding	=	0.2 kN/m ²			
	Plasterboard	=	0.25 kN/m ²			
			TOTAL	=	0.6 kN/m²	
	Imposed loading	=			1.5	
	Partitions loading	=			0.5kN/m ²	
			TOTAL	=		2.0 kN/m²

Walls:

	2.4m high, 100mm blockwork	=	2.4*1.8	=	4.32 kN/m	
	Plasterwork both sides	=	2.4*0.25*2	=	1.2 kN/m	
			TOTAL	=	5.52 kN/m	
	2.4m high, 100mm brickwork	=	2.4*2.1	=	5.04 kN/m	
	Plasterwork both sides	=	2.4*0.25*2	=	1.2 kN/m	
			TOTAL	=	6.24 kN/m	
	2.4m high, studwork	=	2.4*0.12	=	0.29 kN/m	
	Plasterwork both sides	=	2.4*0.15*2	=	0.72 kN/m	
			TOTAL	=	1.01 kN/m	
	2.7m high, cavity wall blockwork	=	2.7*(2.1+1.8)	=	10.53 kN/m	
	Plasterwork to one side	=	2.4*0.25	=	0.60 kN/m	
			TOTAL	=	11.13 kN/m	
	2.7m high, solid brickwork	=	2.7*2.1*0.215	=	12.2 kN/m	
	Plasterwork to one side	=	2.4*0.25	=	0.60 kN/m	
			TOTAL	=	12.8 kN/m	

2.4m Bi-fold door:

	(6mm float glass triple glazed)	=	2.4*0.75 kN/m ²			
			TOTAL	=	1.8 kN/m	

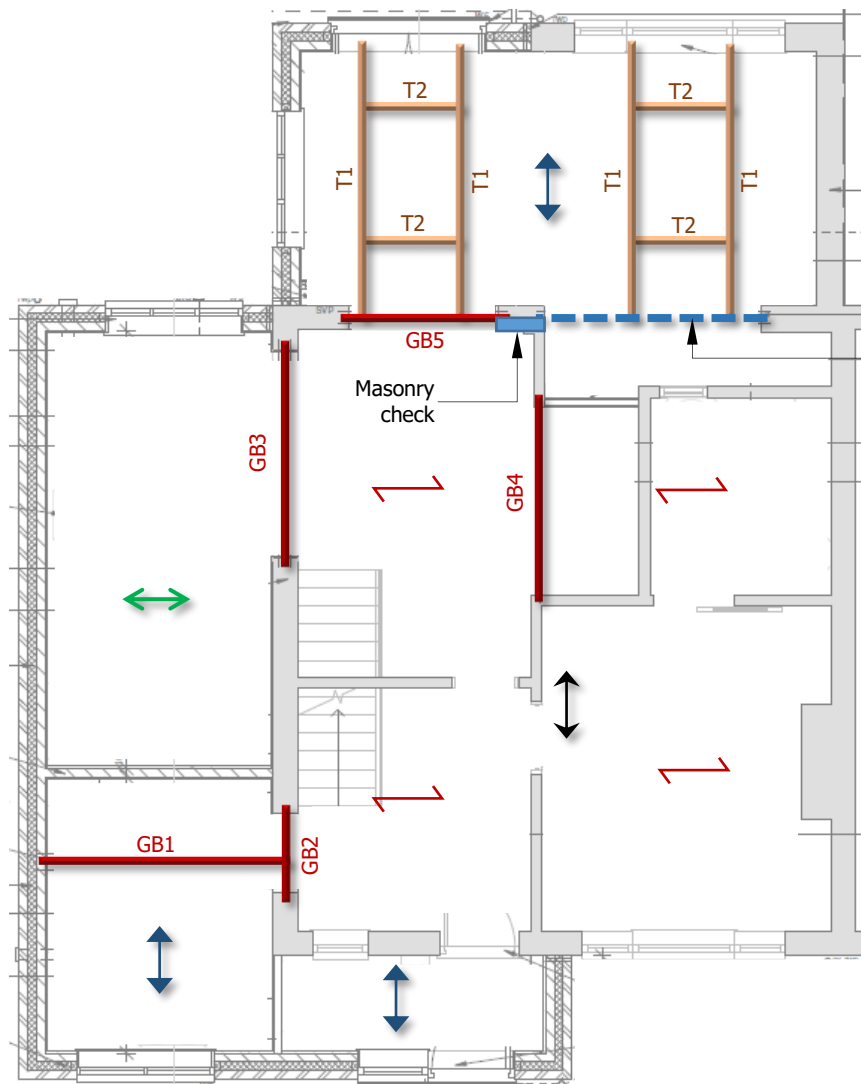


CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 4 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Ground Floor Plan Structure Over



Existing steel size to be confirmed to check if it is adequate to support the new loads applied.

Note:

All presumptions including:

- Floor joists spans
- Roofs span and construction
- Load bearing wall,
- Wall sizes and construction
- Foundation sizes

All to be confirmed by builder and building inspector. Any discrepancies to be notified to JMS Structural Engineers



Presumed span of existing trussed rafters



Span of new timber floor joist



Presumed span of existing timber floor joist



Span of new pitched rafters

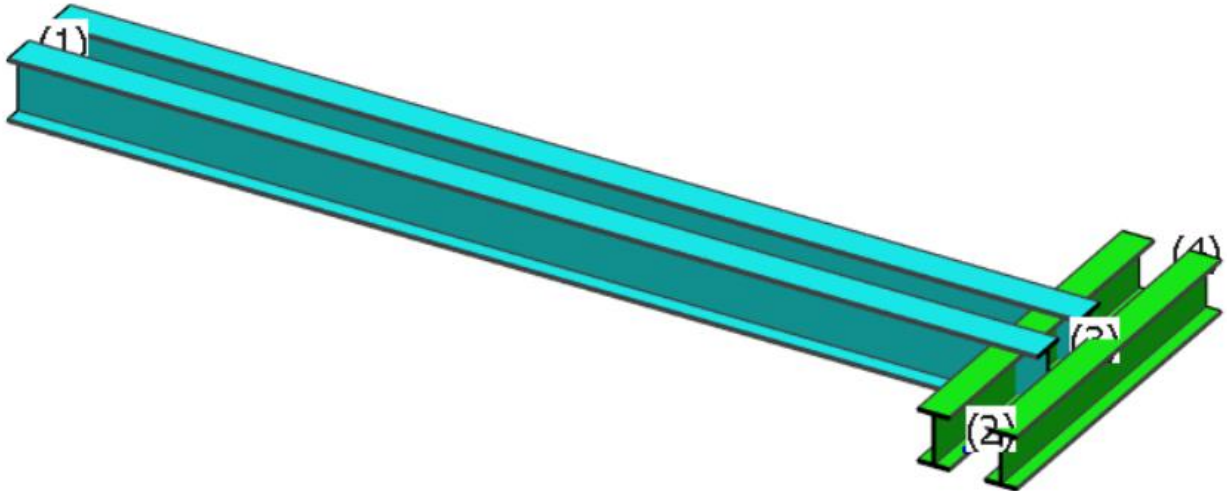


CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 5 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Frame:



Section Size
Default Grade S 275
2 No. 178x102 UB 19
2 No. 152x89 UB 16



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 6 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Beam: GB1

L: 2.9 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(2.1) *2.9	6.1	0	0	
Masonry Block	(2.05) *2.9	6	0	0	
Trussed Rafters	(1.41) *6.3*0.5	4.5	(0.75) *6.3*0.5	2.4	
Lean to Rafters	(1.47) *2.3*0.5	1.7	(0.75) *2.3*0.5	0.9	
Total		18.3	0	3.3	21.6

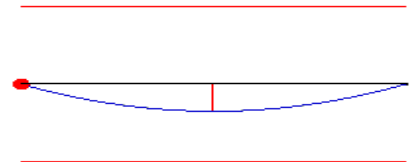
C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\GF1.\$5

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

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 D 077.010 (kN/m³)
D1 UDLY -018.300 (kN/m)
L1 UDLY -003.300 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 4										
Mem ber 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)
				x-x	y-y	x-x	y-y	x-x	y-y	
1	1	0.00C	0.00	45.18	0.00	0.00	0.00	32.76		3.61
	3	0.00C	0.00	-45.18	0.00	0.00	0.00	@ 1.450		@ 1.450

Classification and Properties (BS 5950: 2000)

Section (19.04 kg/m) 2 No. 178x102 UB 19 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 6.41, 30.58, 275, 0, 32.76, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1

Moment Capacity Check Mc

Fv/Pv 0.005 / 281.635 = 0 Low Shear
Mc = py.Sxx ≤ 1.2 py.Zxx 275 x 342.6 ≤ 1.2 x 275 x 305.26 = 94.215 kN.m
MA/Mc 32.757 / 94.215 = 0.348 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (.15M2 + .5M3 + .15M4) / Mmax 0.2 + (.15x25 + .5x33 + .15x25) / 33 = 0.44 0.925 Table 18

Lateral Buckling Check Mb

Le = 1.00 L 1 x 2.9 = 2.9 m
λ = Le/ryy 2.9 / 2.38 121.85 OK
v = Fn(x,Le,ryy,λ) 22.562, 2.9, 2.38, 121.85 0.799 Table 19
λLT = u.v.λ.√βw 0.889 x 0.799 x 121.85 √1 86.56
pb = Fn(py,λLT) 275, 86.56 150.56 N/mm² Table 16
Mb = Sxx.pb ≤ Mc 342.6 x 150.56 ≤ 94.215 = 51.581 kN.m
MA/(Mb/mLT) 32.757 / (51.581 / 0.925) 0.587 OK

Deflection Check - Load Case 4

Deflection Limits (Internal Beams) In-span δ ≤ 2900/360 = 8.1 mm Live (Case 2) 0.55 mm OK
In-span δ ≤ 2900/250 = 11.6 mm D+L (Case 4) 3.61 mm OK

Consider Bearings

Length = Fvx * 1000 * 3.5 / (1.5 * Fk) / Bw 46 * 1000 * 3.5 / (1.5 * 3.5) / 100 310 mm
Depth = (L-beam width) * 0.5 / Bd (310-102) * 0.5 / 65 2 courses

Adopt: 2 No. 178x102 UB 19 [S 275] bolted together with M16 bolts and spacer tubes on 440mm long x 100mm wide 3 course engineering brick padstones. Beam to extend to back of padstone where possible.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 7 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Beam: GB2

L: 1 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(2.1) *1.5	3.2	0	0	
Masonry Block	(2.05) *1.5	3.1	0	0	
Floor Joists	(0.6) *6*0.5	1.8	(2) *6*0.5	6	
Total		8.1	0	6	14.1

C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\GF1.\$5

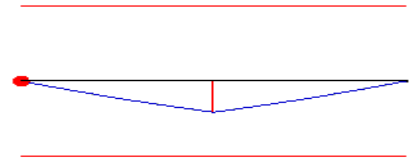
AXIAL WITH MOMENTS (MEMBER)

Member SB L1 Id 2 @ Level 1 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 D 077.010 (kN/m³)
D1 UDL -008.100 (kN/m)
L1 UDL -006.000 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 4										
Mem ber 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)
				x-x	y-y	x-x	y-y	x-x	y-y	
	2	0.00C	0.00	33.17	0.00	0.00	0.00	13.94		0.49
	4	0.00C	0.00	-33.17	0.00	0.00	0.00	@ 0.500		@ 0.500

Classification and Properties (BS 5950: 2000)

Section (15.95 kg/m) 152x89 UB 16 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 5.76, 27.07, 275, 0, 13.94, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1

Moment Capacity Check Mc

Fv/Pv 22.594 / 113.157 = 0.2 Low Shear
Mc = py.Sxx ≤ 1.2 py.Zxx 275 x 123.3 ≤ 1.2 x 275 x 109.61 = 33.908 kN.m
MA/Mc 13.944 / 33.908 = 0.411 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (.15M2 + .5M3 + .15M4) / Mmax 0.2 + (.15x8 + .5x14 + .15x8) / 14 = 0.44 0.864 Table 18

Lateral Buckling Check Mb

Le = 1.00 L 1 x 1 = 1 m
λ = Le/ryy 1 / 2.11 47.39 OK
v = Fn(x,Le,ryy,λ) 19.589, 1, 2.11, 47.39 0.938 Table 19
λLT = u.v.λ.√βw 0.892 x 0.938 x 47.39 √ 1 39.67
pb = Fn(py,λLT) 275, 39.67 262.62 N/mm² Table 16
Mb = Sxx.pb ≤ Mc 123.3 x 262.62 ≤ 33.908 = 32.381 kN.m
MA/(Mb/mLT) 13.944 / (32.381 / 0.864) 0.372 OK

Deflection Check - Load Case 4

Deflection Limits (Internal Beams) In-span δ ≤ 1000/360 = 2.8 mm Live (Case 2) 0.1 mm OK
In-span δ ≤ 1000/250 = 4 mm D+L (Case 4) 0.49 mm OK

Consider Bearings

Length = Fvx * 1000 * 3.5 / (1.5 * Fk) / Bw 34 * 1000 * 3.5 / (1.5 * 3.5) / 100 226 mm
Depth = (L-beam width) * 0.5 / Bd (310-102) * 0.5 / 65 2 courses

Adopt: 2 No. 152x89 UB 16 [S 275] bolted together with M16 bolts and spacer tubes on 215mm long x 100mm wide 2 course engineering brick padstones. Beam to extend to back of padstone where possible.



jms

CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 8 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Beam: GB3

L: 2.6 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(2.1) *2.9	6.1	0	0	
Masonry Block	(2.05) *2.9	6	0	0	
Trussed Rafters	(1.41) *4.5*0.5	3.2	(0.75) *4.5*0.5	1.7	
Floor Joists	(0.6) *6*0.5	1.8	(2) *6*0.5	6	
Total		17.1	0	7.7	24.8

C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\GF3.\$5

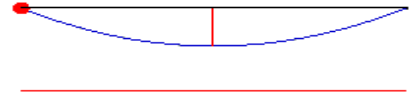
AXIAL WITH MOMENTS (MEMBER)

Member SB L1 Id 1 @ Level 1 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 D 077.010 (kN/m³)
D1 UDLY -017.100 (kN/m)
L1 UDLY -007.700 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 4										
Mem ber 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)
				x-x	y-y	x-x	y-y	x-x	y-y	
1	1	0.00C	0.00	47.71	0.00	0.00	0.00	31.01		4.36
	2	0.00C	0.00	-47.71	0.00	0.00	0.00	@ 1.300		@ 1.300

Classification and Properties (BS 5950: 2000)

Section (15.95 kg/m) 2 No. 152x89 UB 16 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 5.76, 27.07, 275, 0, 31.01, 0
Auto Design Load Cases 1

(Axial: Non-Slender)

Plastic

Moment Capacity Check Mc

Fv/Pv 0.004 / 226.314 =
Mc = py.Sxx ≤ 1.2 py.Zxx 275 x 246.6 ≤ 1.2 x 275 x 219.22 =
MA/Mc 31.008 / 67.815 =

0 Low Shear
67.815 kN.m
0.457 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (.15M2 + .5M3 + .15M4) / Mmax 0.2 + (.15x23 + .5x31 + .15x23) / 31 = 0.44

0.925 Table 18

Lateral Buckling Check Mb

Le = 1.00 L 1 x 2.6 =
λ = Le/ryy 2.6 / 2.11
v = Fn (x, Le, ryy, λ) 19.589, 2.6, 2.11, 123.22
λLT = u.v.λ.√βw 0.892 x 0.761 x 123.22 √ 1
pb = Fn (py, λLT) 275, 83.71
Mb = Sxx.pb ≤ Mc 246.6 x 156.63 ≤ 67.815 =
MA/(Mb/mLT) 31.008 / (38.624 / 0.925)

2.6 m
123.22 OK
0.761 Table 19
83.71
156.63 N/mm² Table 16
38.624 kN.m
0.743 OK

Deflection Check - Load Case 4

Deflection Limits (Internal Beams) In-span δ ≤ 2600/360 = 7.2 mm Live (Case 2)
In-span δ ≤ 2600/250 = 10.4 mm D+L (Case 4)

1.34 mm OK
4.36 mm OK

Consider Bearings

Length = Fvx * 1000 * 3.5 / (1.5 * Fk) / Bw 47 * 1000 * 3.5 / (1.5 * 3.5) / 100
Depth = (L-beam width) * 0.5 / Bd (313-89) * 0.5 / 65

313 mm
2 courses

Adopt: 2 No. 152x89 UB 16 [S 275] bolted together with M16 bolts and spacer tubes on 215mm long x 100mm wide 2 course engineering brick padstones. Beam to extend to back of padstone where possible.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 9 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Beam: GB4

L: 2.3 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Block	(2.3) *2.9	6.7	0	0	
Floor Joists	(0.6) *6.3*0.5	1.9	(2) *6.3*0.5	6.3	
Total		8.6	0	6.3	14.9

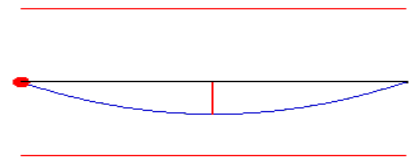
C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\GF4.\$5

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

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 D 077.010 (kN/m³)
D1 UDLY -008.600 (kN/m)
L1 UDLY -006.300 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 4										
Mem ber 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)
				x-x	y-y	x-x	y-y	x-x	y-y	
1	1	0.00C	0.00	25.69	0.00	0.00	0.00	14.77		3.20
	2	0.00C	0.00	-25.69	0.00	0.00	0.00	@ 1.150		@ 1.150

Classification and Properties (BS 5950: 2000)

Section (15.95 kg/m) 152x89 UB 16 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 5.76, 27.07, 275, 0, 14.77, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1

Moment Capacity Check Mc

Fv/Pv 0.003 / 113.157 = 0 Low Shear
Mc = py.Sxx ≤ 1.2 py.Zxx 275 x 123.3 ≤ 1.2 x 275 x 109.61 = 33.908 kN.m
MA/Mc 14.77 / 33.908 = 0.436 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (.15M2 + .5M3 + .15M4) / Mmax 0.2 + (.15x11 + .5x15 + .15x11) / 15 = 0.44 0.925 Table 18

Lateral Buckling Check Mb

Le = 1.00 L 1 x 2.3 = 2.3 m
λ = Le/ryy 2.3 / 2.11 109 OK
v = Fn (x, Le, ryy, λ) 19.589, 2.3, 2.11, 109 0.791 Table 19
λLT = u.v.λ.√βw 0.892 x 0.791 x 109 √1 77
pb = Fn (py, λLT) 275, 77 171.72 N/mm² Table 16
Mb = Sxx.pb ≤ Mc 123.3 x 171.72 ≤ 33.908 = 21.173 kN.m
MA/(Mb/mLT) 14.77 / (21.173 / 0.925) 0.645 OK

Deflection Check - Load Case 4

Deflection Limits (Internal Beams) In-span δ ≤ 2300/360 = 6.4 mm Live (Case 2) 1.34 mm OK
In-span δ ≤ 2300/250 = 9.2 mm D+L (Case 4) 3.2 mm OK

Consider Bearings

Length = Fvx * 1000 * 3.5 / (1.5 * Fk) / Bw 26 * 1000 * 3.5 / (1.5 * 3.5) / 100 174 mm
Depth = (L-beam width) * 0.5 / Bd (174-89) * 0.5 / 65 2 courses

Adopt: 152x89 UB 16 [S 275] with (if required) 10mm bottom plate 6mm fillet welded to beam with 100mm hit, 200mm miss to achieve flushed ceiling. Beam to be installed on 215mm long x 100mm wide 2course engineering brick padstones. Beam to extend to back of padstone where possible.



jms

CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 10 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Beam: GB5

L: 1.9 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(2.1) *2.9	6.1	0	0	
Masonry Block	(2.05) *2.9	6	0	0	
Trussed Rafters	(1.41) *7.1*0.5	5.1	(0.75) *7.1*0.5	2.7	
Lean to Rafters	(1.41) *3*0.5	2.2	(0.75) *3*0.5	1.2	
Total		19.4	0	3.9	23.3

C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\GF5.\$5

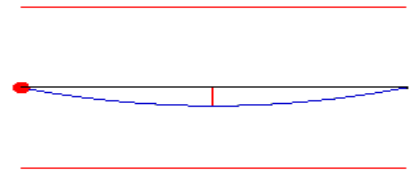
AXIAL WITH MOMENTS (MEMBER)

Member SB L1 Id 1 @ Level 1 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.6 L1

D1 D 077.010 (kN/m³)
D1 UDLY -019.400 (kN/m)
L1 UDLY -003.900 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 4										
Mem ber 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)
				x-x	y-y	x-x	y-y	x-x	y-y	
1	1	0.00C	0.00	32.15	0.00	0.00	0.00	15.27		1.17
	2	0.00C	0.00	-32.15	0.00	0.00	0.00	@ 0.950		@ 0.950

Classification and Properties (BS 5950: 2000)

Section (15.95 kg/m) 2 No. 152x89 UB 16 [S 275]
Class = Fn(b/T,d/t,py,F,Mx,My) 5.76, 27.07, 275, 0, 15.27, 0 (Axial: Non-Slender) Plastic
Auto Design Load Cases 1

Moment Capacity Check Mc

Fv/Pv 0.004 / 226.314 = 0 Low Shear
Mc = py.Sxx ≤ 1.2 py.Zxx 275 x 246.6 ≤ 1.2 x 275 x 219.22 = 67.815 kN.m
MA/Mc 15.268 / 67.815 = 0.225 OK

Equivalent Uniform Moment Factor mLT

mLT = 0.2 + (.15M2 + .5M3 + .15M4) / Mmax 0.2 + (.15x11 + .5x15 + .15x11) / 15 = 0.44 0.925 Table 18

Lateral Buckling Check Mb

Le = 1.00 L 1 x 1.9 = 1.9 m
λ = Le/ryy 1.9 / 2.11 = 90.05 OK
v = Fn(x,Le,ryy,λ) 19.589, 1.9, 2.11, 90.05 0.835 Table 19
λLT = u.v.λ.√βw 0.892 x 0.835 x 90.05 √1 = 67.11
pb = Fn(py,λLT) 275, 67.11 195.52 N/mm² Table 16
Mb = Sxx.pb ≤ Mc 246.6 x 195.52 ≤ 67.815 = 48.216 kN.m
MA/(Mb/mLT) 15.268 / (48.216 / 0.925) = 0.293 OK

Deflection Check - Load Case 4

Deflection Limits (Internal Beams) In-span δ ≤ 1900/360 = 5.3 mm Live (Case 2) 0.19 mm OK
In-span δ ≤ 1900/250 = 7.6 mm D+L (Case 4) 1.17 mm OK

Consider Bearings

Length = Fvx * 1000 * 3.5 / (1.5 * Fk) / Bw 32 * 1000 * 3.5 / (1.5 * 3.5) / 100 = 213 mm
Depth = (L-beam width) * 0.5 / Bd (215 - 213) * 0.5 / 65 = 1 courses

Adopt: 2 No. 152x89 UB 16 [S 275] bolted together with M16 bolts and spacer tubes on 215mm long x 100mm wide 2 course engineering brick padstones. Beam to extend to back of padstone where possible.



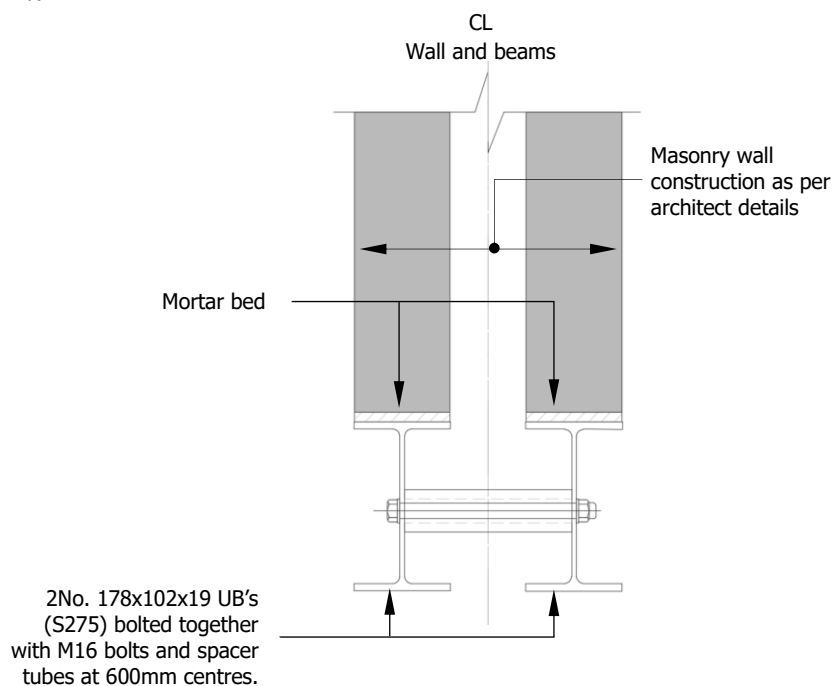
CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 11 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

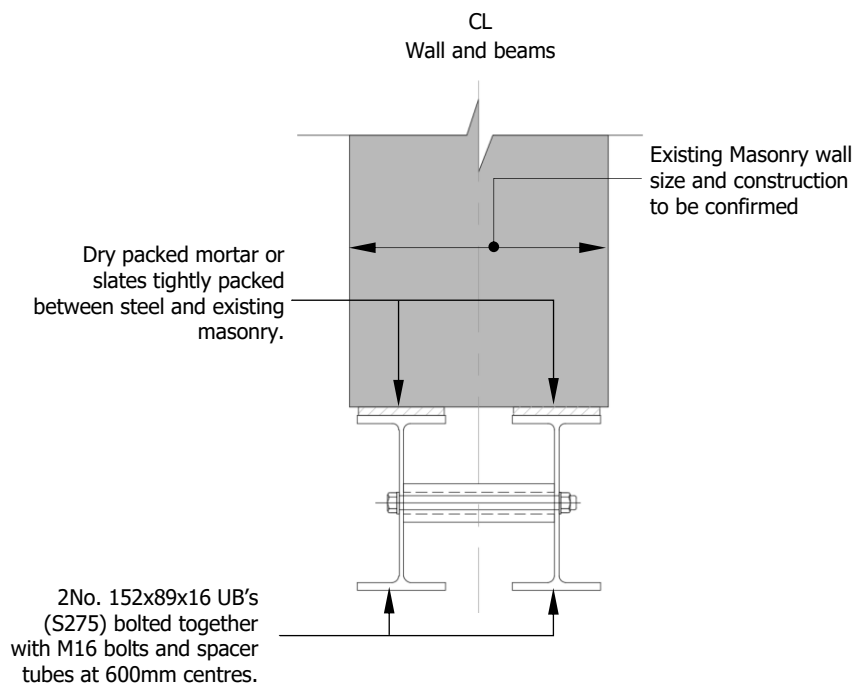
Structural Details

(Drawn indicative only)



Section Through Beam

Beam: GB1



Section Through Beams

Beams: GB2, GB3, GB5



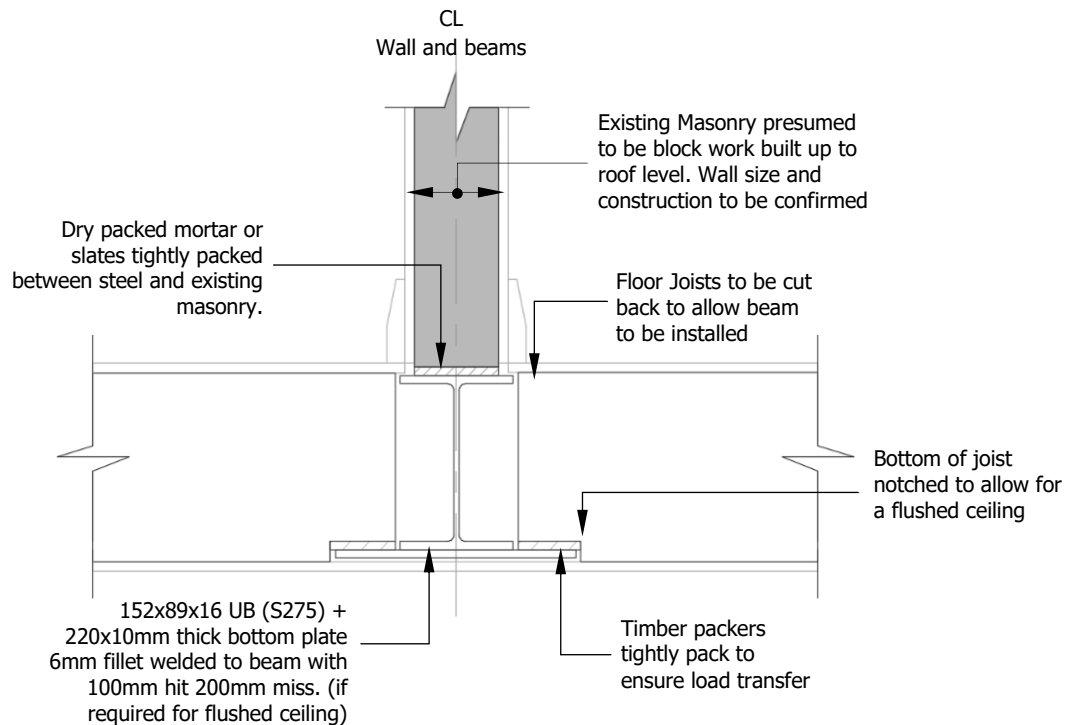
CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 12 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Structural Details

(Drawn indicative only)



Section Through Beam

Beam: GB4



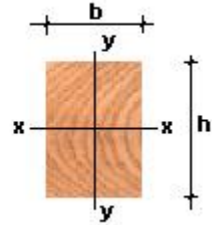
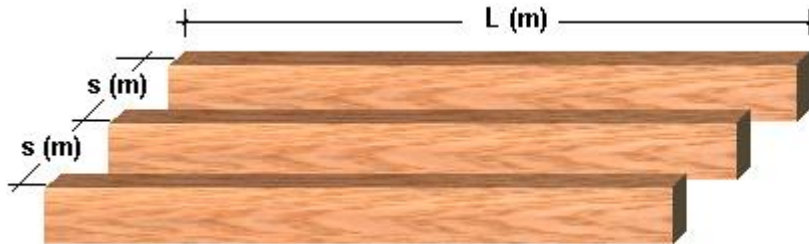
CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 13 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Pitched Rafters

L: 3.1 m



Data and Specifications

Member and Bearing Lengths

Loading Information

Specifications

Regularized Section

Strength Class C24

List(K_3, K_4, K_7, K_8, K_9)

List($E_{min}, E_{mean}, E, Mass$)

List($\sigma_{m,adm}, \sigma_{c, \perp, adm}, \tau_{adm}$)

L=3.1 m, Bearing Length = 50 mm, Distance To Bearing=50 mm

$F_d=1.47 \text{ kN/m}^2$, $s=0.6 \text{ m}$, $F_i=0.5 \text{ kN/m}^2$, $F_p=0.9 \text{ kN}$, ServiceClass=2

Medium term, Load-sharing

Rectangular, $b=47 \text{ mm}$, $h=175 \text{ mm}$

$\sigma_m=7.5$, $\sigma_c=7.9$, $\sigma_t=4.5$, $\sigma_{c, \perp}=1.9$, $\tau=0.71$

$K_3=1.25$, $K_4=1$, $K_7=1.061$, $K_8=1.1$, $K_9=1$

$E_{min}=7200$, $E_{mean}=10800$, $E=10800$, $Mass=3.06$

$\sigma_{m,adm}=10.94$, $\sigma_{c, \perp, adm}=2.61$, $\tau_{adm}=0.98$

N/mm²

Table 7

Design Forces

$W_d=F_d \cdot s + SW$

$W_i=F_i \cdot s$

$W=W_i+W_d$

$F=$

$F_v=F \cdot L/2$

$M=F \cdot L^2/8$

$1.47 \cdot 0.6 + 0.03$

$0.5 \cdot 0.6$

$0.3 + 0.912$

$\text{Max}(w_d, w/1.25, w_d/1.5 + 2 \cdot F_p/L/1.5)$, Long term equivalent

$0.995 \cdot 3.1/2$

$0.995 \cdot 3.1^2/8$

0.912 kN/m

0.3 kN/m

1.212 kN/m

0.995 kN/m

1.542 kN

1.195 kN.m

Bending Check

$\sigma_{m,a}=M/Z_x$

$U_{tm}=\sigma_{m,a}/\sigma_{m,adm}$

$1.195/239.8958$

$4.981/10.94$

4.981 N/mm²

0.455

≤ 1 OK

Shear Check

$\tau_a=1.5 \cdot F_v/(b \cdot h)$

$U_{ts}=\tau_a/\tau_{adm}$

$1.5 \cdot 1.542/(47 \cdot 175)$

$0.281/0.98$

0.281 N/mm²

0.287

≤ 1 OK

Bearing Check

$\sigma_{c, \perp, a}=F_v/(b \cdot \text{Bearing Length})$

$U_{tb}=\sigma_{c, \perp, a}/\sigma_{c, \perp, adm}$

$1.542/(47 \cdot 50)$

$0.656/2.61$

0.656 N/mm²

0.251

≤ 1 OK

Deflection Check

$F=$

$\delta_m=5 \cdot F \cdot L^4/(384 \cdot I_x \cdot E)$

$F=$

$\delta_s=12 \cdot F \cdot L^2/(5 \cdot E \cdot b \cdot h)$

$\delta=\delta_m+\delta_s$

$\text{Max}(w, w_d + 1.6 \cdot F_p/L)$

$5 \cdot 1.377 \cdot 3.1^4/(384 \cdot 2099.089 \cdot 10800)$

$\text{Max}(w, w_d + 2 \cdot F_p/L)$

$12 \cdot 1.493 \cdot 3.1^2/(5 \cdot 10800 \cdot 47 \cdot 175)$

$7.304 + 0.388$

1.377 kN/m

7.304 mm

1.493 kN/m

0.388 mm

7.692 mm

$\delta_m + \delta_s \leq 14$ OK

$\leq 3 \cdot L$ OK



Adopt: 47x175 C24 Timbers at 600mm centres.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 14 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Timber Trimmers

L: 3.1 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(1.47) *1.7*0.5	1.3	(0.75) *1.7*0.5	0.7	
Total		1.3	0	0.7	2

C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\TRIMMERS.\$5

MASTERKEY : TIMBER DESIGN

AXIAL LOAD WITH MOMENT DESIGN TO BS 5268 : PART 2

Member TBL1Id 1 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, 1.0 D1, 1.0 D1 + 1.0 L1
Deflection Cases Covered	1.0 L1, 1.0 D1, 1.0 D1 + 1.0 L1
Section Size	b = 94, h = 175, 175x94 in Strength Class C24
Section Properties (cm ² , cm ³ , cm)	Area 164.5, Zx 479.8, Zy 257.7, rx 5.05, ry 2.71
Specification	2 : Covered and generally heated, Long term loading Load sharing, Use minimum modulus
Integrated Design	Critical Case 4
Member Details	F = 0.0 kN, L = 3.1 m, Lx = 3.1 m, Ly = 3.1 m, Lex = 1.0 Lx, Ley = 1.0 Ly Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C24)

$\sigma_{mx,adm} = K_2.K_3.K_7.K_8.\sigma_m$	1.00 x 1.00 x 1.06 x 1.10 x 7.50	8.75 N/mm ²
$\sigma_{my,adm} = K_2.K_3.K_7.K_8.\sigma_m$	1.00 x 1.00 x 1.14 x 1.10 x 7.50	9.37 N/mm ²
$\sigma_{c\perp,adm} = K_2.K_3.K_4.K_8.\sigma_{c\perp}$	1.00 x 1.00 x 1.14 x 1.10 x 1.90	2.38 N/mm ²
$\tau_{adm} = K_2.K_3.K_8.\tau$	1.00 x 1.00 x 1.10 x 0.71	0.78 N/mm ²
$E = K_2.K_9.E_{min}$	1.00 x 1.14 x 7200	8208 N/mm ²

Axial Load with Moments Check

Critical Design Location	X = 1.550		
$\sigma_{mx,a} = Mx/Zx$	2.598 / 479.79 ≤ 8.75	5.41 N/mm ²	OK
$\sigma_{mx}/\sigma_{mx,adm}$	5.41/8.75	0.618	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 3.355 / 164.5 ≤ 0.78	0.31 N/mm ²	OK
$\sigma_{c\perp,ax} = F_v x / (b.Bx)$	3.355 / (94 x 75) ≤ 2.38	0.48 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 004 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 7.55 ≤ L/333	7.55 mm	OK

Adopt: 2No. 47x175 C24 Timbers glued and screwed together with structural resin-based glue or fixed together with M10 bolts at 600mm centres.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

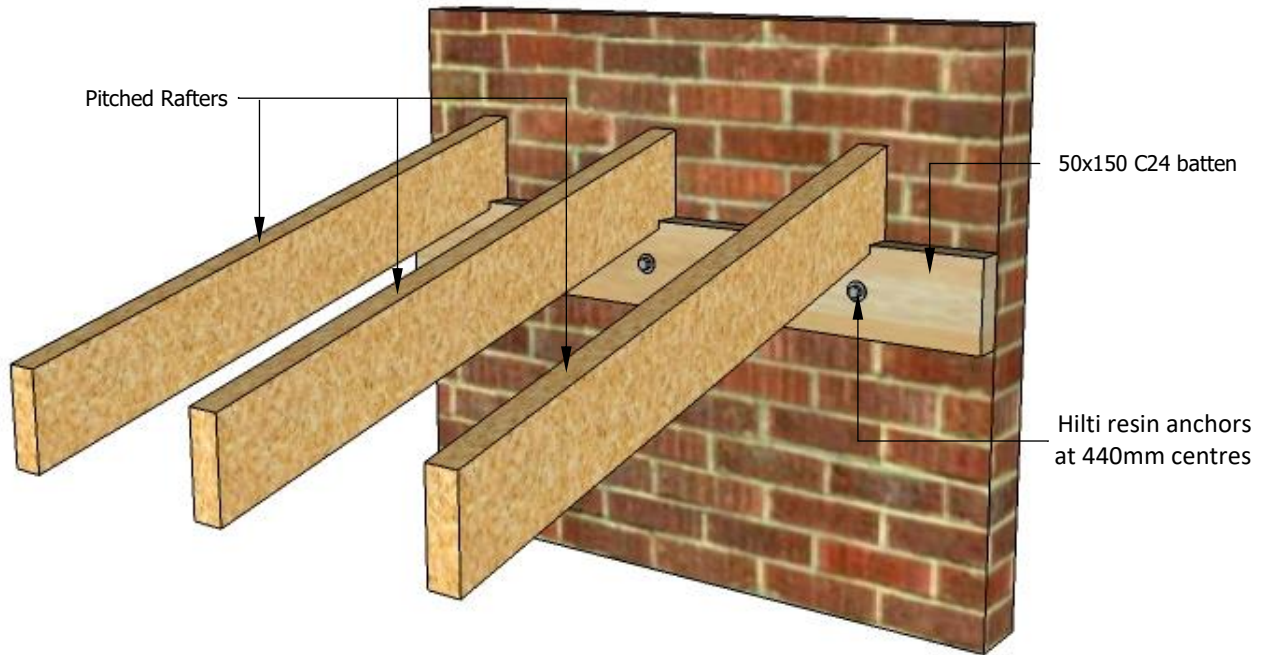
Project No : CO18/322/08
Sheet : Sheet Ref / 15 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Batten Design against Existing wall

Pitched Rafters are to be supported on a 150x50 C24 batten resin anchored to the wall.

L: 3.1 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Pitched Roof	(1.47) *3.1*0.5*1.4	3.19	(0.75) *3.1*0.5*1.6	1.86	
Total		3.19	0	1.86	5.05



Assume bolts are at 440mm centres, load per bolt = $(5.05) * 0.44 = 2.2\text{kN}$

			HIT-AC, HIT-V, HAS, HAS-E					HIT-IC / HIT-IG			
Anchor size			M6	M8	M10	M12		M8	M10	M12	
Base material	Setting depth [mm]		HIT-SC 12x...	HIT-SC 16x...	HIT-SC 16x...	HIT-SC 18x...	HIT-SC 22x...	HIT-SC 16x...	HIT-SC 18x... ^{c)}	HIT-SC 22x...	HIT-SC 22x...
London yellow Multi Stock EN 771-3 $f_b^{b)} \geq 16 \text{ N/mm}^2$ L x H x B [mm] 215 x 100 x 65  Great Britain	50	N_{rec} [kN]	1,0	1,3	1,3	1,7	1,7	-	-	-	-
		V_{rec} [kN]	1,4	1,9	1,9	1,9	2,5	-	-	-	-
	80	N_{rec} [kN]	2,0	3,0	3,0	3,0	4,0	3,0	3,0	3,0	4,0
		V_{rec} [kN]	1,4	2,5	2,5	2,5	3,0	2,5	2,5	3,0	3,0

a) Recommended load values with consideration of a global safety factor $\gamma_{global} = 3,0$: $F_{rec} = F_{Rk} / \gamma_{global}$

b) f_b = brick strength

Adopt: Hilti M8 HAS rod with HIT HY-70 resin @ 440 mm centres. Bolts to be installed to centres of brickwork where possible.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

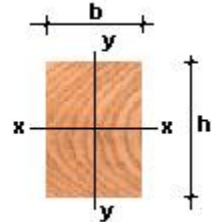
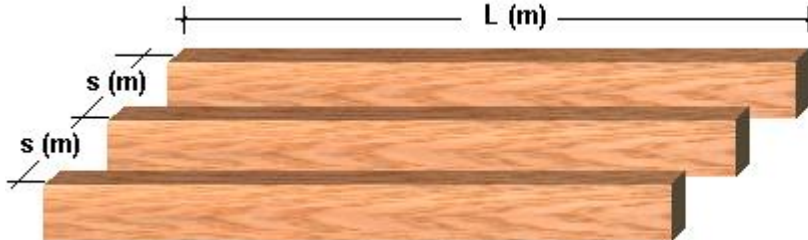
www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 16 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Floor Joists

L: 2.8 m

Domestic floor Joists



Data and Specifications

Member Length	L=2.8 m
Bearing Lengths	Bearing Length = 50 mm, Distance To Bearing=50 mm
Loading Information	$F_d = 0.6 \text{ kN/m}^2$, $s = 0.6 \text{ m}$, $F_i = \text{Max}(3.6/L, 2)$, ServiceClass=2
Specifications	Medium term, Load-sharing
Regularized Section	Rectangular, $b = 47 \text{ mm}$, $h = 175 \text{ mm}$
Strength Class C24	$\sigma_m = 7.5$, $\sigma_c = 7.9$, $\sigma_t = 4.5$, $\sigma_{c,\perp} = 1.9$, $\tau = 0.71$
List(K_3, K_4, K_7, K_8, K_9)	$K_3 = 1.25$, $K_4 = 1$, $K_7 = 1.061$, $K_8 = 1.1$, $K_9 = 1$
List(E_{min} , E_{mean} , E , Mass)	$E_{min} = 7200$, $E_{mean} = 10800$, $E = 10800$, Mass = 3.06
List($\sigma_{m,adm}$, $\sigma_{c,\perp,adm}$, τ_{adm})	$\sigma_{m,adm} = 10.94$, $\sigma_{c,\perp,adm} = 2.61$, $\tau_{adm} = 0.98$

N/mm²

Table 7

Design Forces

$F = (F_i + F_d) \cdot s + s w$	$(2 + 0.6) \cdot 0.6 + 0.03$	1.59 kN/m
$F_v = F \cdot L / 2$	$1.59 \cdot 2.8 / 2$	2.226 kN
$M = F \cdot L^2 / 8$	$1.59 \cdot 2.8^2 / 8$	1.558 kN.m

Bending Check

$\sigma_{m,a} = M / Z_x$	1.558/239.8958	6.494 N/mm ²	
$U_{tm} = \sigma_{m,a} / \sigma_{m,adm}$	6.494/10.94	0.594	<=1 OK

Shear Check

$\tau_a = 1.5 \cdot F_v / (b \cdot h)$	$1.5 \cdot 2.226 / (47 \cdot 175)$	0.406 N/mm ²	
$U_{ts} = \tau_a / \tau_{adm}$	0.406/0.98	0.414	<=1 OK

Bearing Check

$\sigma_{c,\perp,a} = F_v / (b \cdot \text{Bearing Length})$	$2.226 / (47 \cdot 50)$	0.947 N/mm ²	
$U_{tb} = \sigma_{c,\perp,a} / \sigma_{c,\perp,adm}$	0.947/2.61	0.363	<=1 OK

Deflection Check

$\delta_m = 5 \cdot F \cdot L^4 / (384 \cdot I_x \cdot E)$	$5 \cdot 1.59 \cdot 2.8^4 / (384 \cdot 2099.089 \cdot 10800)$	5.613 mm	
$\delta_s = 12 \cdot F \cdot L^2 / (5 \cdot E \cdot b \cdot h)$	$12 \cdot 1.59 \cdot 2.8^2 / (5 \cdot 10800 \cdot 47 \cdot 175)$	0.337 mm	$\delta_m + \delta_s <= 14 \text{ OK}$
$\delta = \delta_m + \delta_s$	5.613 + 0.337	5.95 mm	<=3•L OK



Adopt: 47x175 C24 Timbers at 600mm centres.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

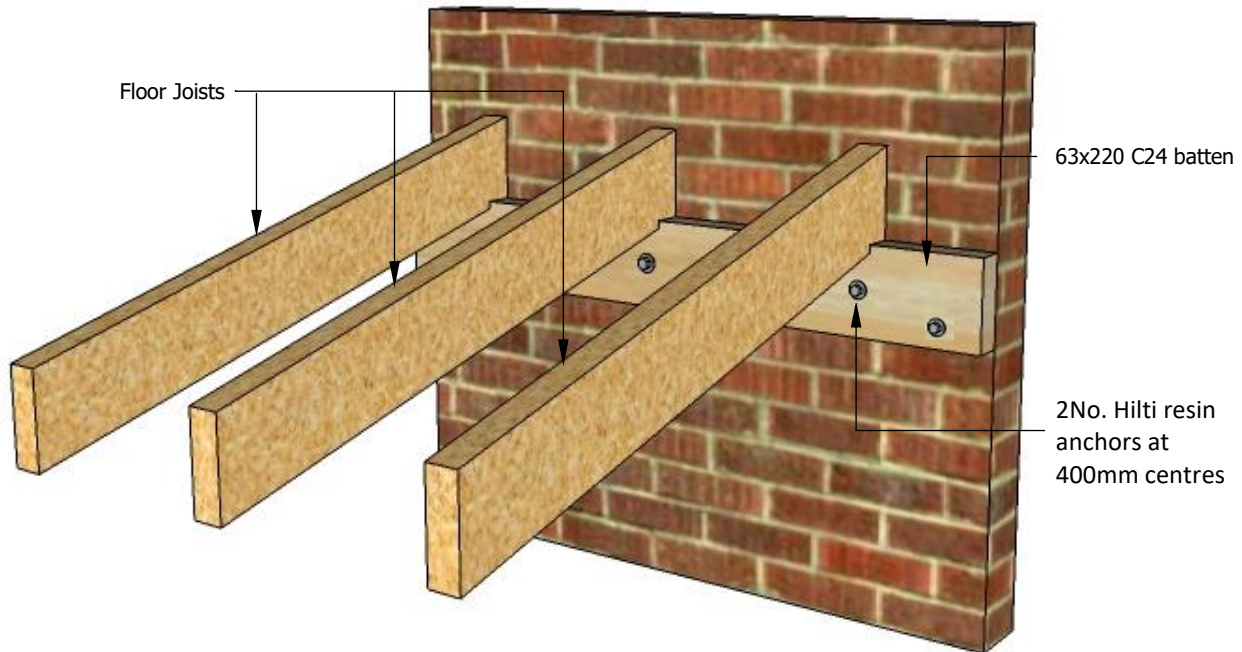
Project No : CO18/322/08
Sheet : Sheet Ref / 17 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Batten Design against Existing wall

Floor Joists are to be supported on a 220x63 C24 batten resin anchored to the wall.

L: 2.2 m

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Floor Joists	(0.6) *2.8*1.4*0.5	1.18	(2) *2.8*1.6*0.5	4.48	
Total		1.18	0	4.48	5.66



Presume bolts are at 440mm centres, load per bolt = $(5.66) * 0.400 = 2.3\text{kN}$

			HIT-AC, HIT-V, HAS, HAS-E					HIT-IC / HIT-IG			
Anchor size			M6	M8	M10	M12		M8	M10	M12	
Base material	Setting depth [mm]		HIT-SC 12x...	HIT-SC 16x...	HIT-SC 16x...	HIT-SC 18x...	HIT-SC 22x...	HIT-SC 16x...	HIT-SC 18x... ^{c)}	HIT-SC 22x...	HIT-SC 22x...
London yellow Multi Stock EN 771-3 $f_b^{b)} \geq 16 \text{ N/mm}^2$ L x H x B [mm] 215 x 100 x 65  Great Britain	50	$N_{rec} \text{ [kN]}$	1,0	1,3	1,3	1,7	1,7	-	-	-	-
		$V_{rec} \text{ [kN]}$	1,4	1,9	1,9	1,9	2,5	-	-	-	-
	80	$N_{rec} \text{ [kN]}$	2,0	3,0	3,0	3,0	4,0	3,0	3,0	3,0	4,0
		$V_{rec} \text{ [kN]}$	1,4	2,5	2,5	2,5	3,0	2,5	2,5	3,0	3,0

a) Recommended load values with consideration of a global safety factor $\gamma_{global} = 3,0$: $F_{rec} = F_{Rk} / \gamma_{global}$

b) f_b = brick strength

Adopt: Hilti M8 HAS rod with HIT HY-70 resin @ 400 mm centres. Bolts to be installed to centres of brickwork where possible.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 18 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Masonry Check

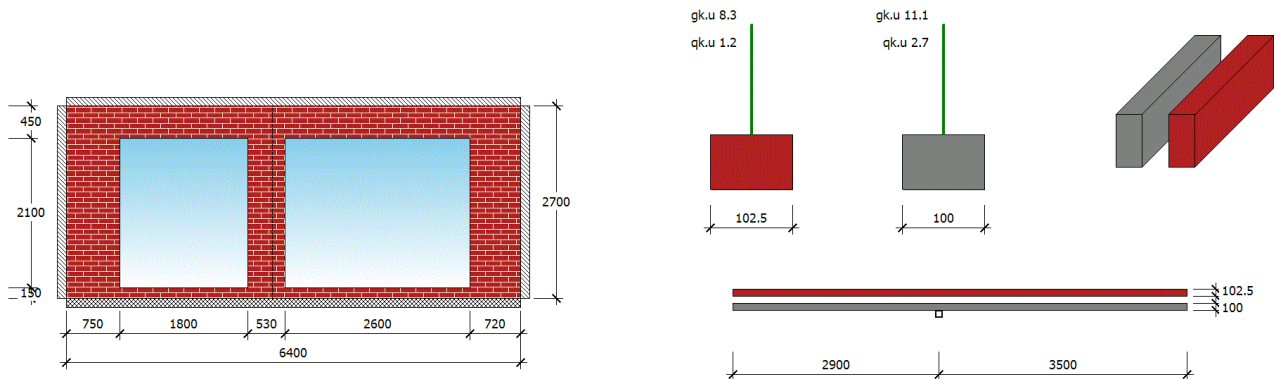
L: 2.8 m

C:\USERS\MC PHIPPS\DESKTOP\WORK 2017\322 - 19 FEATHERSTON DRIVE BURBAGE\JMS\MS\MASNRY CHECK.MSN

TWO WAY SPANNING, VERTICALLY LOADED, CAVITY WALL

DESIGN TO BS 5628 : 1992

Brief Title



Summary of Design Data

Wall Dimensions	h=2.700 m, hef=2.700 m, L=6.400 m, Lef=6.400 m		
Wind Post L reduction	Wnd post assumed to act as stiffeneing, L = 3.500 m, Lef = 3.500 m		
Support Conditions	Bottom Cont., Top Simple, Left Simple, Right Simple		
Cavity Wall (mm)	t1=102.5, t2=100, tef=135		
Limiting Dimensions	$\lambda=20 \leq \lambda_{lim}=27$	0.741	OK

Outer-Leaf Design

Partial Safety Factor (γ_{mc}/γ_{mf})	Normal manufacturing, Normal construction	3.5/3	Table 4a/4b
Material	Clay bricks with water absorption over 12%		
Units and Mortar Strength	20 N/mm ² , Mortar designation (iii)		
Compressive Strength (fk)	Standard format bricks, $\gamma=20$ kN/m ³	5.8 N/mm ²	Table 2
Loads from above	Dead Load=8.3 kN/m, Live Load=1.2 kN/m		
Section Properties	Area=1025 cm ² /m, Zp=1751 cm ³ /m		
Critical axial compressive case	$1.4(\gamma_{tk}.h+gku)+1.6qku$		
Max local stress @	X=2.55 m, Y=1.125 m < f_k/γ_{mc}	0.81 N/mm ²	OK
Max axial buckling force @	X=2.815 m, Y=1.62 m averaged over width of 0.53 m	82.85kN/m	
Capacity reduction factor top, β	ex=0.0 mm, hef=525 mm, tef=135.0 mm, t=102.5 mm	0.990	
Wind Post Stiffening	Wind post is assumed to act as stiffener, influencing hef		
$Fr=\beta.f_k.t_k/\gamma_{mc}$	$0.990 \times 4.53 \times 102.5/3.5$	131.4 kN/m	
Fd/Fr	82.9/131.4	0.630	OK

Inner-Leaf Design

Partial Safety Factor (γ_{mc}/γ_{mf})	Normal manufacturing, Normal construction	3.5/3	Table 4a/4b
Material	Concrete blocks, $\gamma=20$ kN/m ³		
Units and Mortar Strength	7 N/mm ² , Mortar designation (iii)		
Blocks Ratio	Unit height=215, Least horizontal dimensions=100	2.15	
Compressive Strength (fk)	Solid Concrete block wall	6.4 N/mm ²	Table 2
Loads from above	Dead Load=11.1 kN/m, Live Load=2.7 kN/m		
Section Properties	Area=1000 cm ² /m, Zp=1667 cm ³ /m		
Critical axial compressive case	$1.4(\gamma_{tk}.h+gku)+1.6qku$		
Max local stress @	X=2.55 m, Y=1.125 m < f_k/γ_{mc}	1.15 N/mm ²	OK
Max axial buckling force @	X=2.815 m, Y=1.62 m averaged over width of 0.53 m	115.09kN/m	
Capacity reduction factor top, β	ex=0.0 mm, hef=525 mm, tef=135.0 mm, t=100.0 mm	0.990	
Wind Post Stiffening	Wind post is assumed to act as stiffener, influencing hef		
$Fr=\beta.f_k.t_k/\gamma_{mc}$	$0.990 \times 4.99 \times 100/3.5$	141.1 kN/m	
Fd/Fr	115.1/141.1	0.816	OK

Adopt: inner leaf of masonry pier to be rebuilt in 7.3N/mm² Block work or engineering bricks in type (iii) mortar from finished floor level.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

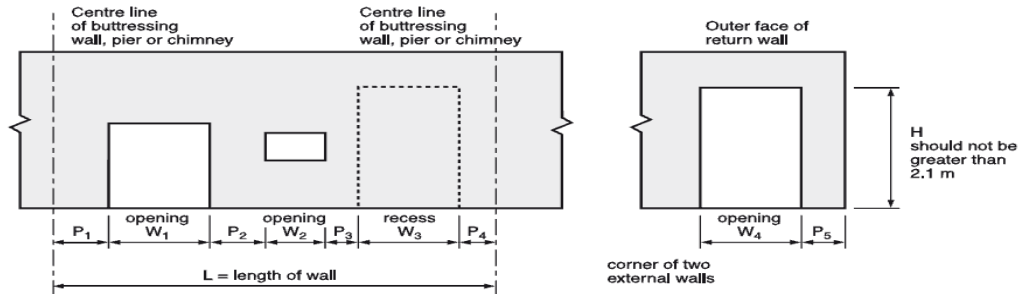
www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 19 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Size of opening check

Diagram 14 Sizes of openings and recesses

See para 2C29



Notes

Requirements (refer to Table 6 for values of Factor X).

- 1 $W_1 + W_2 + W_3$ should not exceed $\frac{2L}{3}$
- 2 W_1, W_2 or W_3 should not exceed 3m
- 3 P_1 should be greater than or equal to $\frac{W_1}{X}$
- 4 P_2 should be greater than or equal to $\frac{W_1 + W_2}{X}$

- 5 P_3 should be greater than or equal to $\frac{W_2 + W_3}{X}$

- 6 P_4 should be greater than or equal to $\frac{W_3}{X}$

- 7 P_5 should be greater than or equal to $\frac{W_4}{X}$ but should not be less than 665mm.

- 8 Take the value of the Factor X from Table 6, or it can be given the value 6, provided the compressive strength of the bricks or blocks (in the case of a cavity wall – in the loaded leaf) is not less than 7N/mm².

Inputs

L=	6561 mm
P1=	665 mm
W1=	1810 mm

X=	6
P2=	1000 mm
W2=	2386 mm

P3=	700 mm
W3=	0 mm

P4=	0 mm
-----	------

P5=	0 mm
W4=	0 mm

Pier checks

Check 1 & 2	$2L/3 =$	4374 mm	$W_1+W_2+W_3 =$	4196 mm	Hence OK
Check 3	$W_1/X =$	302 mm	$P_1 =$	665 mm	Hence OK
Check 4	$(W_1+W_2)/X =$	699 mm	$P_2 =$	1000 mm	Hence OK
Check 5	$(W_2+W_3)/X =$	398 mm	$P_3 =$	700 mm	Hence OK
Check 6	$W_3/X =$	N/A	$P_4 =$	N/A	N/A
Check 7	$W_4/X =$	N/A	$P_5 =$	N/A	N/A

Openings and buttressing comply with The Building Regulations 2010, (Structure A) therefore no additional windposts or sheathing required.



CIVIL & STRUCTURAL CONSULTING ENGINEERS
LONDON • MIDLANDS • EAST ANGLIA • MANCHESTER • GREECE

www.jmsengineers.co.uk

Project No : CO18/322/08
Sheet : Sheet Ref / 20 - Rev -
Made By : Mc. Phipps
Date : August 2018
Checked : A. Kenyon
Office : Midlands Tel: 02476 350505

Foundation Check

(GB5 and Existing Beam)

UDL					
Structure	Dead	kN/m	Live	kN/m	Total kN/m
Masonry Brick	(2.1) *2.9	6.1	0	0	
Masonry Block	(2.05) *2.9	6	0	0	
Trussed Rafters	(1.41) *7.1*0.5	5.1	(0.75) *7.1*0.5	2.7	
Lean to Rafters	(1.41) *3*0.5	2.2	(0.75) *3*0.5	1.2	
Total		19.4	0	3.9	23.3
PL					
Structure	Dead + Live	Total			
Beams	(23.3) *4.9*0.5	57.1			
Walls	(4.15) *2.8*0.5	5.8			
Total		62.9			

Load = 63 kN

Assume existing foundation is 450mm wide and 600mm deep.

Bearing Pressure = $63 / (0.45 * (0.6 + 0.5 + 0.6))$

= 83 kN/m²

Foundation Check

(Side to extension)

Dead Loads	Load	Span/height	Number	UDL
Wall Load	4.15	5.7	1	23.655
1st Floor	0.6	6	0	0
2nd Floor	0	0	0	0
Roof	1.47	2	1	1.47
Total Dead	25.1			
Live Loads	Load	Span/height	Number	UDL
1st Floor	2.5	6	0	0
2nd Floor	0	0	0	0
Roof	0.75	2	1	0.75
Total Live	0.8			
Point Loads	40	Spread	2.8	14.3
Allowable Bearing Pressure (kN/m ²)				100.0
Foundation width required (m)				0.40
Foundation depth required (minimum)				0.10

Presuming an allowable bearing pressure of 100kN/m² and a foundation size of 450mm wide x 600mm deep the existing foundations are acceptable. Foundation sizes to be confirmed prior to proceeding with the works.