15 PROVOST ROAD
LONDON
NW3 4ST

CALCULATIONS

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Job No: 4748
Date: MARCH 2018

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JOB: 15 PROVOST ROAD LONDON NW3 4ST

Made by: C.J.C.
Date: 16.2.18
Ref No: 4748

Office: 5056

Location: GENERAL LOADINGS

Unit loads for elements of structure

Sloping roofs with angle of 30 degrees

Serviceability loads

Dead load on plan for sloping member = Load / Cos roof angle

Rafters 50 mm x 100 mm at 400 mm c/c

Loads	Loads in kN/m² On horizontal	On slope
Rafters	0.0694	0.0601
Felt load	0.017	0.0147
Batten load	0.0385	0.0333
Tile/slate load	0.5524	0.4784
Sub total for dead load (Gk)	0.6772 kN/m²	
Live load on horizontal (Qk)	0.75 kN/m²	
Total load (Gk+Qk)	1.427 kN/m²	
Ultimate dead load (Factor 1.4)	0.9481 kN/m²	
Ultimate live load (Factor 1.6)	1.2 kN/m²	

Loading with plaster/plasterboard for roofs with angle of 30°

Serviceability loads

Loads	On horizontal	On slope
Dead load from above	0.6772 kN/m²	
Plaster/board load	0.2038 kN/m²	0.1765 kN/m²
Allowance for insulation etc.	0.1155 kN/m²	0.1 kN/m²
Sub total for dead load (Gk)	0.9965 kN/m²	
Live load on horizontal (Qk)	0.75 kN/m²	
Total Gk+Qk with plaster/board	1.746 kN/m²	
Ultimate dead load (Factor 1.4)	1.395 kN/m²	
Ultimate live load (Factor 1.6)	1.2 kN/m²	

Ceilings to roof spaces

Serviceability loads

Load for 50 mm x 100 mm ceiling joists at 350 mm c/c

Ceiling joists	0.0687
Plasterboard load	0.1765
Allowance for insulation etc.	0.1 kN/m²
Sub total for dead load (Gk)	0.3452 kN/m²
Live load (Qk)	0.25 kN/m²
Total load (Gk+Qk)	0.5952 kN/m²

Loadings for water tanks must be included separately in their actual locations

Ultimate dead load (Factor 1.4)	0.4832 kN/m²
Ultimate live load (Factor 1.6)	0.4 kN/m²

Existing floors with a live load of 1.5 kN/m²

Serviceability loads

50 mm x 225 mm joists at 350 mm c/c

Joist load	0.1545 kN/m²
Boarding load	0.1431 kN/m²
Plasterboard load	0.2343 kN/m²
Allowance for insulation etc.	0.1 kN/m²
Sub total for dead load (Gk)	0.6319 kN/m²
Live load (Qk)	1.5 kN/m²
Total load (Gk+Qk)	2.132 kN/m²
Ultimate dead load (Factor 1.4)	0.8846 kN/m²
Ultimate live load (Factor 1.6)	2.4 kN/m²

225 mm brick wall

450 BRICK WALL.

Serviceability loads

Brick	4.752	9.50
Plaster/plasterboard	0.2392	0.24
Exterior render/tiles	0.2943	0.29
Dead load total (Gk)	5.285 kN/m²	10.03
Ultimate dead load (Factor 1.4)	7.399 kN/m²	
Ultimate dead load (Factor 0.9)	4.757 kN/m²	

340 mm brick wall

Serviceability loads

Brick	7.18
Plaster/plasterboard	0.2392
Exterior render/tiles	0.2943
Dead load total (Gk)	7.714 kN/m²
Ultimate dead load (Factor 1.4)	10.8 kN/m²
Ultimate dead load (Factor 0.9)	6.942 kN/m²

105 mm brick wall

Serviceability loads

Brick	2.217
Plaster/plasterboard both sides	0.4784
Dead load total (Gk)	2.696 kN/m²
Ultimate dead load (Factor 1.4)	3.774 kN/m²
Ultimate dead load (Factor 0.9)	2.426 kN/m²

Existing stud partitions

Serviceability loads

Load for 50 mm x 100 mm studs at 400 centres	0.0601
Plaster/plasterboard both sides	0.4686
Allowance for noggins, insultn.	0.1 kN/m²
Total live load (Qk)	0.6287 kN/m²
Ultimate live load (Factor 1.6)	1.006 kN/m²

NOTE: Movable stud partitions have been assumed to comply with the requirements of BS6399-1:1996.

New stud partitions

Serviceability loads

Load for 50 mm x 100 mm studs at 400 mm c/c

Studs	0.0601
Plaster/plasterboard both sides	0.353
Allowance for noggins, insultn.	0.1
Total live load (Qk)	0.5131 kN/m²
Ultimate live load (Factor 1.6)	0.8209 kN/m²

NOTE: Movable stud partitions have been assumed to comply with the requirements of BS6399-1:1996.

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Location: LOAD ON INTERNAL LONGITUDINAL WALL AT GROUND FLOOR LEVEL

Eaves level

Loads are computed for unit length of wall and footing. Traditional masonry construction with a pitched roof is assumed.

Roof area carried by 1 m of wall	a(4)=6/2=3 m²
DL of pitched roof on plan	Ff(4)=0.99 kN/m²
Dead load attic floor	DL(4)=0.34 kN/m²
Edge load (upstand etc)	E(4)=0 kN/m
Live load excluded from reductions	LE(4)=0.25 kN/m²
Live load not so excluded on plan	LL(4)=0.75 kN/m²

Floor level 3

Floor area carried by 1 m of wall	a(3)=6/2=3 m²
Floor finishes	Ff(3)=0.1 kN/m²
Dead load of floor	DL(3)=0.63 kN/m²
Loading from external wall	E(3)=0.63*2.4=1.512 kN/m
Live ld excluded from reductions	LE(3)=0.5 kN/m²
Live load not so excluded	LL(3)=1.5 kN/m²

Floor level 2

Floor area carried by 1 m of wall	a(2)=6/2=3 m²
Floor finishes	Ff(2)=0.1 kN/m²
Dead load of floor	DL(2)=0.63 kN/m²
Loading from external wall	E(2)=0.63*3.0=1.89 kN/m
Live ld excluded from reductions	LE(2)=0.5 kN/m²
Live load not so excluded	LL(2)=1.5 kN/m²

Floor level 1

Floor area carried by 1 m of wall	a(1)=6/2=3 m²
Floor finishes	Ff(1)=0.1 kN/m²
Dead load of floor	DL(1)=0.63 kN/m²
Loading from external wall	E(1)=0.63*3.4=2.142 kN/m
Live ld excluded from reductions	LE(1)=0.5 kN/m²
Live load not so excluded	LL(1)=1.5 kN/m²

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Wall loading table

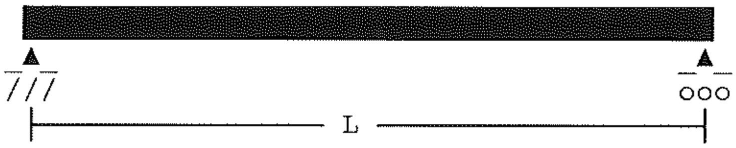
Loads from floors shown at floor levels, load at top of wall shown between floors. Reduced imposed loads contain reduction factors given in Table 2 of BS6399, but note that IStructE Green Book advises that these reduction factors should not be taken advantage of in the initial design except when assessing the load on the foundation.

	Characteristic loads			Factored loads		
	Dead (kN)	Live (kN)	Reduced live	Dead (kN)	Live (kN)	Reduced live
Roof level	3.99	3		5.586	4.8	
	3.99	3	3	5.586	4.8	4.8
2ND Level 3	3.702	6		5.1828	9.6	
	7.692	9	8.325	10.769	14.4	13.32
1ST Level 2	4.08	6		5.712	9.6	
	11.772	15	12.75	16.481	24	20.4
grd Level 1	4.332	6		6.0648	9.6	
	16.104	21	16.275	22.546	33.6	26.04

No710

Location: BEAM SUPPORTING SECOND FLOOR CEILING SPAN 1.7m

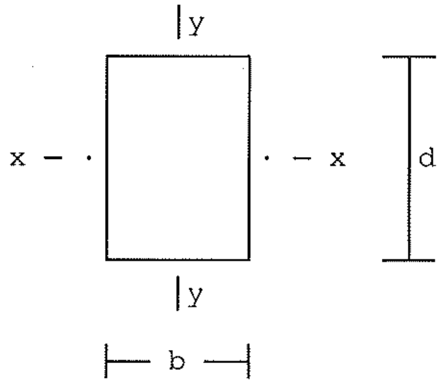
Timber beam to BS5268-2:2002



Simply supported beam subjected to vertical loads.

Beam span	L=1.7 m
Dist. from left support to start	Lau(1)=0.1 m
Distance from left support to end	Lbu(1)=1.6 m
Dead load (unfactored)	Gku(1)=4.0 kN/m
Imposed load (unfactored)	Qku(1)=3.0 kN/m
Maximum span bending moment	2.4937 kNm
Design shear force	Fve'=5.25

Section design parameters



Design axial load (+ve comp)	Fa=0 kN
Depth of section	d=200 mm
Width of section	b=100 mm
Eff length for bending about xx	Lex=1700 mm
Eff length for bending about yy	Ley=1700 mm
Length of bearing	lb=100 mm

From BS5268-2 Table 18, bearing is < 75 mm from joist end.

Bearing Modification factor	K4=1.0

Strength class C18 to Table 8.

Timber service class adopted	tmclass=2

Timber service class modification factor K2=1 as Table 16.

Duration of loading	K3=1
Depth factor	K7=(300/d)^0.11=1.0456
Load-sharing modification factor	K8=1.0
No notches exist at the support	K5=1.0

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DESIGN SUMMARY

Member: 200 mm x 100 mm
Strength class C18 to Table 8.
Moisture service class 2

Bending stress	3.7406 N/mm^2
Permissible bending	6.0645 N/mm^2
Deflection	2.2706 mm
Limiting deflection	5.1 mm
Shear stress	0.39375 N/mm^2
Permissible shear	0.67 N/mm^2
Bearing stress	0.525 N/mm^2
Permissible bearing	2.2 N/mm^2

No254

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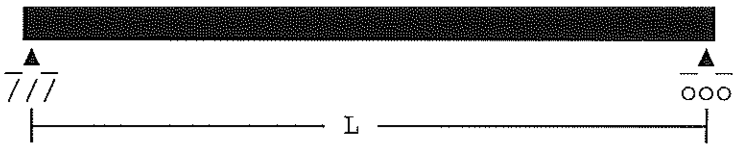
Location: BEAM SUPPORTING FIRST FLOOR CENTRAL WALL OVER SHOWER
SPAN 1.2m

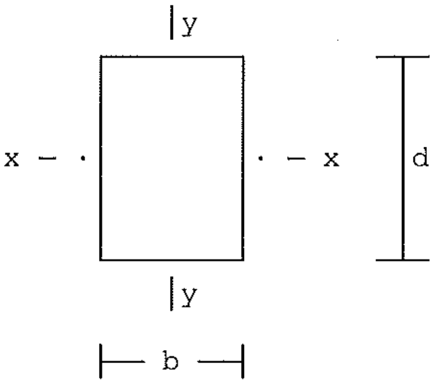
Timber beam to BS5268-2:2002



Simply supported beam subjected to vertical loads.

Beam span	L=1.2 m
Dist. from left support to start	Lau(1)=0.1 m
Distance from left support to end	Lbu(1)=1.1 m
Dead load (unfactored)	Gku(1)=7.7 kN/m
Imposed load (unfactored)	Qku(1)=9.0 kN/m
Maximum span bending moment	2.9225 kNm
Design shear force	Fve'=8.35

Section design parameters



Design axial load (+ve comp)	Fa=0 kN
Depth of section	d=200 mm
Width of section	b=100 mm
Eff length for bending about xx	Lex=1000 mm
Eff length for bending about yy	Ley=1000 mm
Length of bearing	lb=100 mm

From BS5268-2 Table 18, bearing is < 75 mm from joist end.

Bearing Modification factor	K4=1.0

Strength class C18 to Table 8.

Timber service class adopted	tmclass=2

Timber service class modification factor K2=1 as Table 16.

Duration of loading	K3=1
Depth factor	K7=(300/d)^0.11=1.0456
Load-sharing modification factor	K8=1.0
No notches exist at the support	K5=1.0

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DESIGN SUMMARY

Member: 200 mm x 100 mm
Strength class C18 to Table 8.
Moisture service class 2

Bending stress	4.3838 N/mm^2
Permissible bending	6.0645 N/mm^2
Deflection	1.5574 mm
Limiting deflection	3.6 mm
Shear stress	0.62625 N/mm^2
Permissible shear	0.67 N/mm^2
Bearing stress	0.835 N/mm^2
Permissible bearing	2.2 N/mm^2

No254

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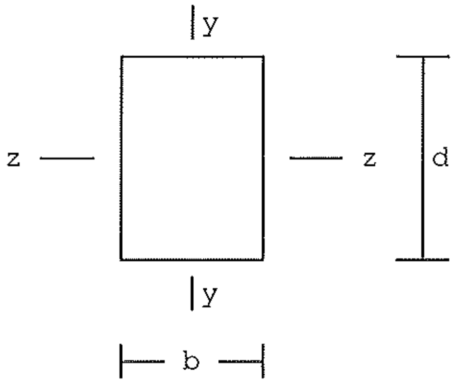
Location: POST TO FIRST FLOOR CENTRAL WALL BEAM



Rectangular timber member

subject to axial load and

bending about z-z axis

Calculations in accordance
with BS5268-2:2002.

Design BM about zz (positive)	Mz=8.350*0.10=0.835 kNm
Design shear force in y direction	V=0.1 kN
Design axial load (+ve compress)	F=8.35 kN
Eff length for bending about zz	Lez'=2.6 m
Depth of section	d=150 mm
Width of section	b=100 mm
Eff length for bending about yy	Ley'=2.6 m
Strength class C18 to Table 8.	
Timber service class adopted	tmclass=2
Timber service class modification	factor K2=1 as Table 16.
Duration of loading	K3=1
Depth factor	K7=(300/d)^0.11=1.0792
Load-sharing modification factor	K8=1.0

Modification factor K12=(0.5+(1+eta)*C/2)-((0.5+(1+eta)*C/2)^2 -C)^0.5=0.44147

Interaction factor factor=sigma/(sigmad*bsmf)+sigca /sigcad=0.55224

DESIGN SUMMARY

Depth of section	150 mm
Width of section	100 mm
Strength class C18 to Table 8.	
Timber moisture class	2
Applied comprn stress	0.55667 N/mm^2
Permiss comprn stress	3.1344 N/mm^2
Applied bending stress	2.2267 N/mm^2
Permiss bending stress	6.2595 N/mm^2
Interaction factor	0.55224
Applied shear stress	0.01 N/mm^2
Permiss shear stress	0.67 N/mm^2

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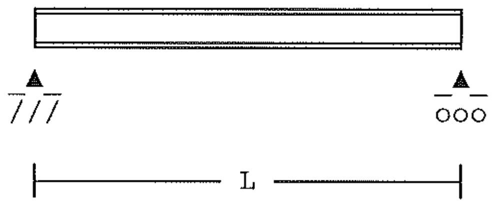
Location: BEAM SUPPORTING CENTAL WALL SPAN 4.0m



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span L=4.0 m

Section properties

203 x 203 x 52 UC.
Dimensions (mm): D=206.2 B=204.2 t=7.9 T=12.5 r=10.2
Properties (cm): Ix=5260 Iy=1780 Sx=567 Sy=264 J=31.8
A=66.3 ry=5.1815 rx=8.9071

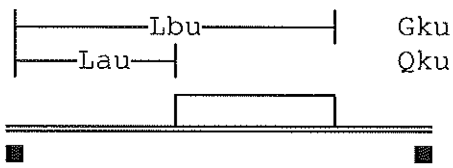
Strength of steel - Clause 3.1.1

The material thickness is 12.5 mm and the steel grade is S 275.
Design strength py=275 N/mm²
Young's Modulus E=205 kN/mm²

Loading

Dead load factor gamd=1.4
Imposed load factor gami=1.6

All loads are positive downwards, reactions are positive upwards, sagging moments are positive.



Gku Dead UDL
Qku Imposed UDL

Distances are measured from left hand support.

Uniformly distributed load 1 of 1
Dist. from left support to start Lau(1)=0.15 m
Distance from left support to end Lbu(1)=3.85 m
Dead load (unfactored) Gku(1)=16.1 kN/m
Imposed load (unfactored) Qku(1)=21.0 kN/m

BMs at 40th points, from left to right (sagging is positive)

0	10.386	20.702	30.526	39.789	48.491
	56.631	64.21	71.228	77.684	83.578
	88.912	93.684	97.894	101.54	104.63
	107.16	109.12	110.53	111.37	111.65
	111.37	110.53	109.12	107.16	104.63
	101.54	97.894	93.684	88.912	83.578
	77.684	71.228	64.21	56.631	48.491
	39.789	30.526	20.702	10.386	0

Maximum span bending moment 111.65 kNm

End shears

Shear force at left hand end	103.86 kN
Shear force at right hand end	103.86 kN
Design shear force	Fv=103.86 kN
Unfactored dead shear at LHE	29.785 kN
Unfactored imposed shear at LHE	38.85 kN
Unfactored dead shear at RHE	29.785 kN
Unfactored imposed shear at RHE	38.85 kN
Unfactored dead load deflection	4.9434 mm
Unfactored imposed load deflectn	6.4479 mm
Total DL & imposed deflection	11.391 mm
Span:defln ratio for dead load	809.16
Span:defln ratio for imposed load	620.35
Span:defln ratio for total load	351.14

From Table 8 of BS5950-1:2000,
Limiting deflection (brittle) DELlim=L*1000/360=11.111 mm
Since imposed load deflection ≤ DELlim (6.4479 mm ≤ 11.111 mm)
deflection within limiting value.

Classification - Clause 3.5.2

Classify outstand element of compression flange:

Parameter (Table 11 Note b)	e=(275/py)^0.5=1
Outstand	b=B/2=102.1 mm
Ratio	b'T=b/T=8.168

As b/T ≤ 9e (9), outstand element of compression flange is classified as Class 1 plastic.
Classify web of section:

Depth between fillets	d=D-2*(T+r)=160.8 mm
Ratio	d't=d/t=20.354

For sections with neutral axis at mid-depth
As d/t ≤ 80e (80), web is classified as Class 1 plastic.

Shear buckling

Since d/t ≤ 70e no check for shear buckling is required.

Buckling resistance

Since the beam is subject to possible lateral torsional buckling, the buckling resistance moment Mb is first considered rather than the moment capacity Mc as a guide to selection. A conservative analysis is adopted, taking the worst moment with the greatest effective length.

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Effective length - Clause 4.3.5.2

As no point loads are applied to the beam the effective length, Le is found by considering the restraint conditions at the supports from Table 13 based on the length between the restraints equal to the beam span LT=L=4 m
Compression flange laterally restrained.
Nominal torsional restraint about longitudinal axis.
Both flanges free to rotate on plan.
Normal loading conditions therefore
Effective length (Table 13) Le=1.0*LT=4 m

Clause 4.3.6.6 and Table 18

Equivalent uniform moment factor

The member is loaded between restraints.
For a beam carrying a distributed load over its entire span.
Equivalent uniform moment factor mLT=0.925

Resistance to lateral-torsional buckling - Clause 4.3.6

Radius gyration about minor axis	ry=SQR(Iy/A)=5.1815 cm
Slenderness of section	lambda=Le/ry*100=77.198
Buckling parameter	u=(4*Sx^2*(1-Iy/Ix)/(A^2*((D-T) /10)^2))^0.25 =0.84749
Torsional index	x=0.566*((D-T)/10)*(A/J)^0.5=15.83
Ratio	ratio=lambda/x=4.8766
Slenderness factor	v=1/((1+0.05*ratio^2)^0.25)=0.82212
Ratio βw	betaw=1.0
Equivalent slenderness	lamLT=u*v*lambda*(betaw)^0.5=53.787
Limiting slenderness	lamlo=0.4*((PI^2*E*10^3)/py)^0.5=34.31
Perry coefficient	etaLT=0.007*(lamLT-lamlo)=0.13634
Elastic strength	pe=PI^2*E*10^3/(lamLT^2)=699.36 N/mm²
Factor	phiLT=(py+(etaLT+1)*pe)/2=534.86 N/mm²
Factor	pey=pe*py=192325
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =228.68 N/mm²
Buckling resistance moment	Mb=Sx*pb/10^3=129.66 kNm
Equivalent uniform moment factor	mLT=0.925

Since M ≤ Mb/mLT (111.65 kNm ≤ 140.17 kNm), section OK for lateral torsional buckling resistance.

Check section for combined moment and shear

Conservatively the maximum shear is checked with the maximum moment.

Shear area	Av=t*D=1629 mm²
Shear capacity	Pv=0.6*py*Av/10^3=268.78 kN
Design shear force	Fv=103.86 kN
Elastic modulus	Zx=Ix/(D/20)=510.18 cm³
Since Fv < 0.6 Pv	
Moment capacity for compact sec	Mc=py*Sx/10^3=155.93 kNm
Limiting moment capacity	Mclim=1.2*py*Zx/10^3=168.36 kNm

Since M ≤ Mc (111.65 kNm ≤ 155.93 kNm), applied moment within moment capacity.
N.B. Buckling resistance is less than moment capacity and therefore

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buckling resistance controls the design.

UNIVERSAL COLUMN DESIGN SUMMARY	203 x 203 x 52 UC Grade S 275	
	Maximum shear force	103.86 kN
	Shear capacity	268.78 kN
	Max. applied moment	111.65 kNm
	Moment capacity	155.93 kNm
	Buckling resistance	129.66 kNm
	Moment factor (mLT)	0.925
	Resistance (Mb/mLT)	140.17 kNm
	Unfactored DL defln	4.9434 mm
	Unfactored LL defln	6.4479 mm
	Limiting deflection	11.111 mm
Unfactored end shears	DL shear at LHE	29.785 kN
	LL shear at LHE	38.85 kN
	DL shear at RHE	29.785 kN
	LL shear at RHE	38.85 kN

No408

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JOB: 15 PROVOST ROAD LONDON NW3 4ST

Made by: C.J.C.
Date: 16.2.18
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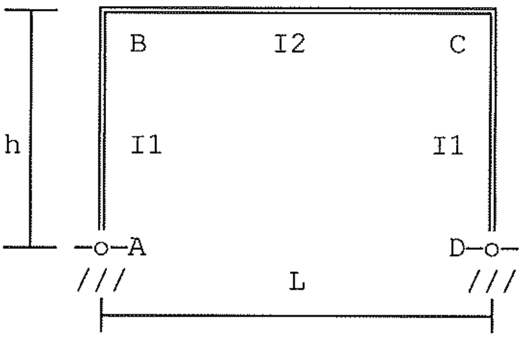
Location: ANLASIST FOR CENTRAL WALL FRAME

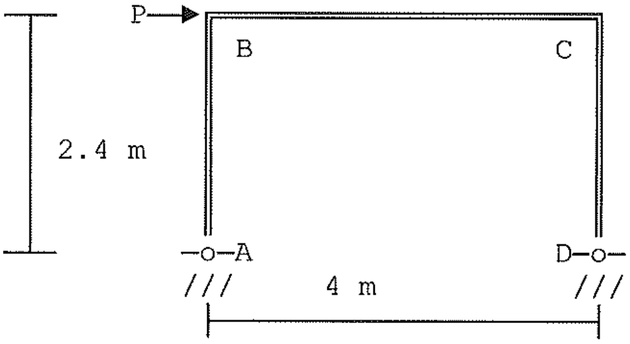


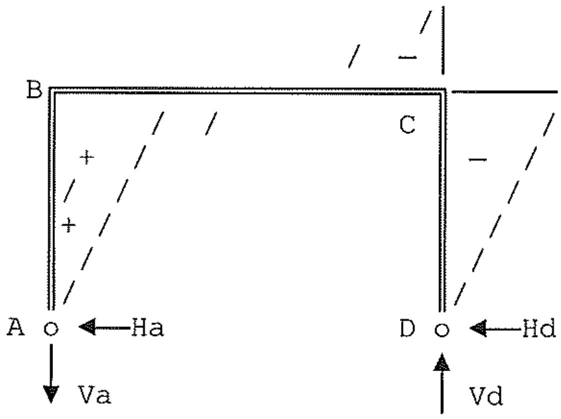
Sign conventions:

The direction of the load is considered to be positive.

The moments causing tension on the inside faces of the frame are considered to be positive. Upward vertical and inward horizontal reactions are positive.

Height of portal	h=2.4 m
Length of portal	L=4.0 m
Inertia of columns	I1=2.09E-6 m^4
Inertia of beam	I2=52.63E-6 m^4
Coefficients	k=I2*h/(I1*L)
	=52.63E-6*2.4/(2.09E-6*4)
	=15.109
	N=2*k+3=2*15.109+3=33.218

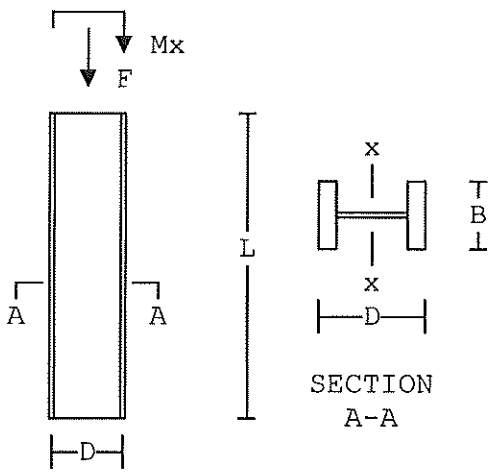




Horizontal point load at B	P=103.9*2*5/100=10.39 kN
Moment at B	Mb=P*h/2=10.39*2.4/2=12.468 kNm
Moment at C	Mc=-Mb=-12.468 kNm
Vertical reaction at A	Va=-P*h/L=-10.39*2.4/4=-6.234 kN
Vertical reaction at D	Vd=-Va=6.234 kN
Horizontal reaction at A	Ha=-P/2=-10.39/2=-5.195 kN
Horizontal reaction at D	Hd=-Ha=5.195 kN

No632

Location: FRAME COLUMNN IN INTERNAL WALL



I column in 'simple' construction

Calculations are in accordance with BS5950-1:2000 and 'Steelwork Design Guide to BS5950' published by SCI.

All beams supported by the column are assumed to be fully loaded. Based on Clause 4.7.7 it is not necessary to consider the effect of pattern loading.

Factored axial compressive load	F=103.9+6.2=110.1 kN
Factored BM about major axis x-x	Mx=12.5 kNm
Factored BM about minor axis y-y	My=1.0 kNm
Length between restraints	L=2600 mm

203 x 102 x 23 UB.

Young's Modulus — E=205 kN/mm²

Effective length factor	ef=1
Compressive strength	pc=pe*py/(phi+(phi^2-pe*py)^0.5) =123.01 N/mm²
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =225.57 N/mm²

SECTION — 203 x 102 x 23 UKB Grade S 275

	Design strength	275 N/mm²
DESIGN SUMMARY	Compressive strength	123.01 N/mm²
	Buckling strength	225.57 N/mm²
	Buckling check	0.65412 ≤ 1

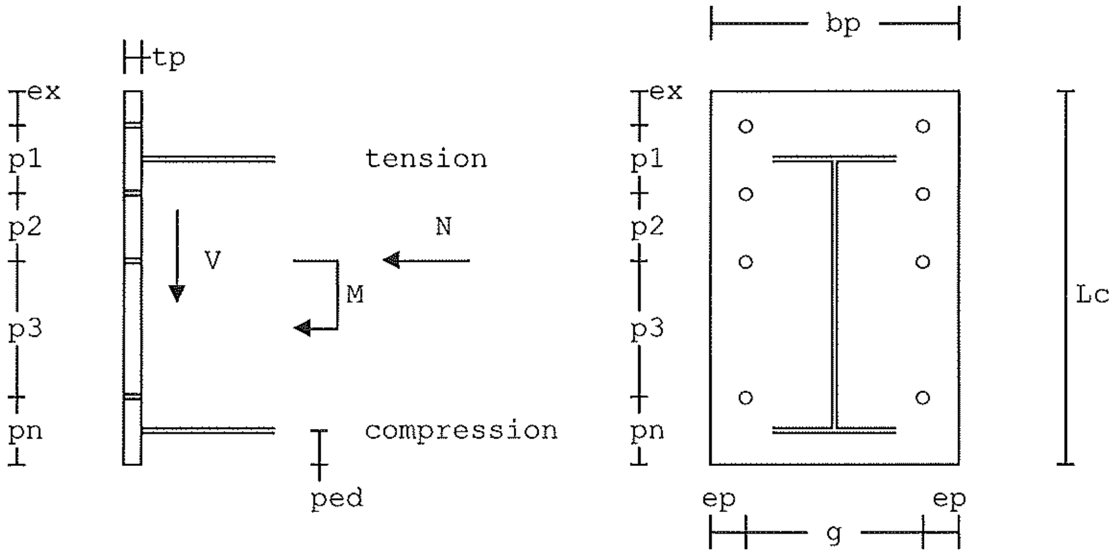
Section is satisfactory for bending, axial load, and overall buckling.

No452

Location: CONNECTION BETWEEN BEAM & COLUMN TO CENTRAL WALL FRAME

Bolted extended end plate connection - beam to column

Calculations are in accordance with BS5950-1:2000 and follow the procedure given in the SCI publication entitled 'Joints in Steel Construction Moment Connections'.
The connection is one sided. The web panel shear cannot be discounted in the determination of the compressive force.



Factored moment	Ma=12.5 kNm
Factored shear force	V=5.2 kN
Axial force (+ve compression)	N=110.1 kN

203 x 203 x 52 UC.
203 x 102 x 23 UB.

Diameter of bolts	bd=20 mm
Thickness of plate	tp=12 mm
Total number of bolts	bn=6
Number of shear bolts	ns=2
Distance to first row of bolts	ex=50 mm
Distance to beam flange	x=25 mm
Pitch to second row of bolts	p1=80 mm
Distance tension to shear bolts	p3=93 mm
Edge distance for shear bolts	pn=130 mm
Bolt cross-centres	g=120 mm
Width of end plate	bp=210 mm
Assumed web fillet weld size	sww=6 mm
Assumed flange fillet weld size	swf=8 mm

SUMMARY OF BOLT POTENTIAL RESISTANCES

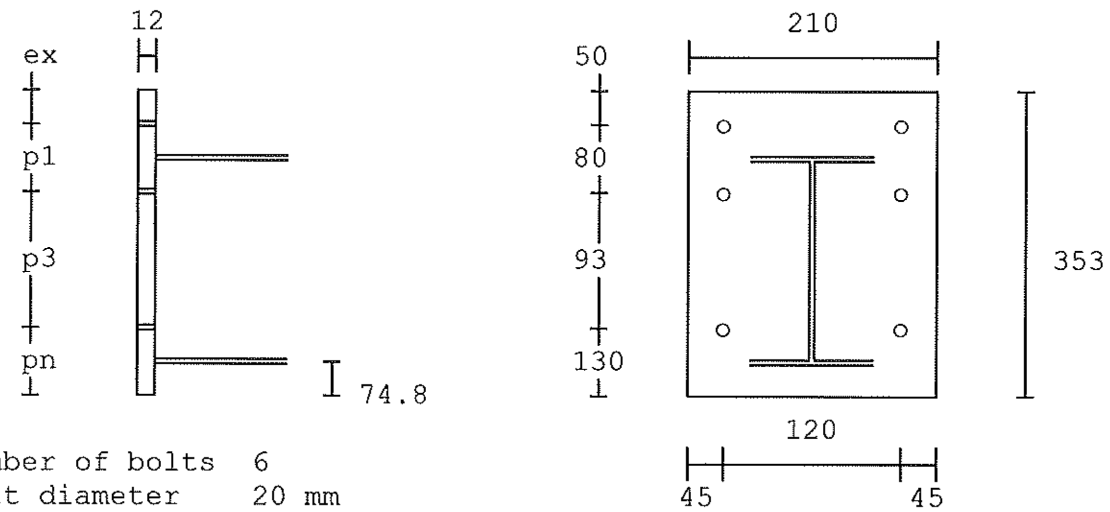
Top row of bolts	Pr1=186.67 kN
Row 2	Pr2=104.2 kN
Selected fillet weld size	swt=8

Full strength weld used.
Selected fillet weld size sfw=8 mm

Connection is considered to be suitable.

CONNECTION SUMMARY

Connection is one sided beam to column arrangement.



Number of bolts	6	
Bolt diameter	20 mm	
Bolt grade	8.8	
Welds	Tension flange fillet weld	8 mm
	Web fillet weld	8 mm
	Compression flange fillet weld	8 mm
Supporting column section	203 x 203 x 52 UC Grade S 275	
Beam / Rafter section	203 x 102 x 23 UB Grade S 275	

Column stiffener details

No enhancement of the column required.

No422

Office: 5056

Location: LOAD ON REAR WALL AT LOWER GROUND FLOOR LEVEL

Eaves level

Loads are computed for unit length of wall and footing. Traditional masonry construction with a pitched roof is assumed.

Roof area carried by 1 m of wall a(5)=3.6*2/3=2.4 m^2
DL of pitched roof on plan Ff(5)=0.99 kN/m^2
Dead load attic floor DL(5)=0.34 kN/m^2
Edge load (upstand etc) E(5)=0 kN/m
Live load excluded from reductions LE(5)=0.25 kN/m^2
Live load not so excluded on plan LL(5)=0.75 kN/m^2

Floor level 4

Floor area carried by 1 m of wall a(4)=0.5 m^2
Floor finishes Ff(4)=0.1 kN/m^2
Dead load of floor DL(4)=0.63 kN/m^2
Loading from external wall E(4)=2.5*5.3=13.25 kN/m
Live ld excluded from reductions LE(4)=0.5 kN/m^2
Live load not so excluded LL(4)=1.5 kN/m^2

Floor level 3

Floor area carried by 1 m of wall a(3)=0.5 m^2
Floor finishes Ff(3)=0.1 kN/m^2
Dead load of floor DL(3)=0.63 kN/m^2
Loading from external wall E(3)=7.72*3.1=23.932 kN/m
Live ld excluded from reductions LE(3)=0.5 kN/m^2
Live load not so excluded LL(3)=1.5 kN/m^2

Floor level 2

Floor area carried by 1 m of wall a(2)=0.5 m^2
Floor finishes Ff(2)=0.1 kN/m^2
Dead load of floor DL(2)=0.63 kN/m^2
Loading from external wall E(2)=7.71*3.4=26.214 kN/m
Live ld excluded from reductions LE(2)=0.5 kN/m^2
Live load not so excluded LL(2)=1.5 kN/m^2

Floor level 1

Floor area carried by 1 m of wall a(1)=0.5 m^2
Floor finishes Ff(1)=0.1 kN/m^2
Dead load of floor DL(1)=3.6 kN/m^2
Loading from external wall E(1)=10.0*2.4=24 kN/m
Live ld excluded from reductions LE(1)=0.5 kN/m^2
Live load not so excluded LL(1)=1.5 kN/m^2

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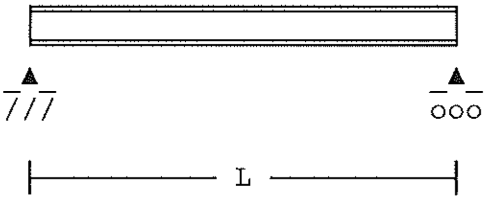
Wall loading table

Loads from floors shown at floor levels, load at top of wall shown between floors. Reduced imposed loads contain reduction factors given in Table 2 of BS6399, but note that IStructE Green Book advises that these reduction factors should not be taken advantage of in the initial design except when assessing the load on the foundation.

Level	Characteristic loads Dead (kN)	Characteristic loads Live (kN)	Characteristic loads Reduced live	Factored loads Dead (kN)	Factored loads Live (kN)	Factored loads Reduced live
Roof level	3.192	2.4		4.4688	3.84	
	3.192	2.4	2.4	4.4688	3.84	3.84
2ND Level 4	13.615	1		19.061	1.6	
	16.807	3.4	3.145	23.53	5.44	5.032
1ST Level 3	24.297	1		34.016	1.6	
	41.104	4.4	3.74	57.546	7.04	5.984
GRD Level 2	26.579	1		37.211	1.6	
	67.683	5.4	4.185	94.756	8.64	6.696
LWG Level 1	25.85	1		36.19	1.6	
	93.533	6.4	4.48	130.95	10.24	7.168

No710

Office: 5056
Location: BEAM SUPPORTING REAR WALL OVER WINDOW AT LGF SPAN 2.4m



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.4 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm²
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0.15 m
Distance from left support to end	Lbu(1)=2.25 m
Dead load (unfactored)	Gku(1)=93.5/2=46.75 kN/m
Imposed load (unfactored)	Qku(1)=6.4/2=3.2 kN/m
Maximum span bending moment	50.016 kNm
Design shear force	Fv=74.099 kN
Buckling parameter	u=(4*Sx^2*(1-Iy/Ix)/(A^2*((D-T)/10)^2))^0.25 =0.84629
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =269.55 N/mm²

UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

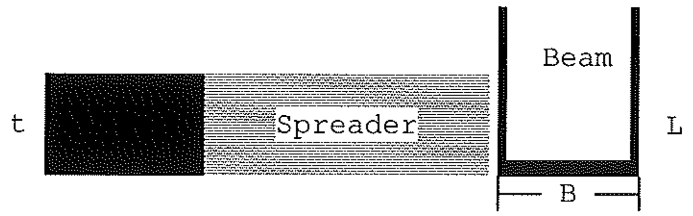
	Maximum shear force	74.099 kN
	Shear capacity	241.4 kN
	Max. applied moment	50.016 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	133.97 kNm
	Moment factor (mLT)	0.925
	Resistance (Mb/mLT)	144.83 kNm
	Unfactored DL defln	2.1154 mm
	Unfactored LL defln	0.1448 mm
	Limiting deflection	6.6667 mm
Unfactored end shears	DL shear at LHE	49.088 kN
	LL shear at LHE	3.36 kN
	DL shear at RHE	49.088 kN
	LL shear at RHE	3.36 kN

No408

Location: PADSTONE TO BEAM OVER REAR WALL WINDOW AT LGF

Masonry bearing

Design in accordance with BS5628-1:2005.



Plan view on wall

Bearing type 3
see Figure 5(c) in
BS5628.

t=wall thickness L=length of bearing ed=0 L=t

Proposed width of bearing	B=400 mm
Proposed length of bearing	L=450 mm
Thickness of leaf carrying load	t=450 mm
Local bearing safety factor	lbsf=2.0

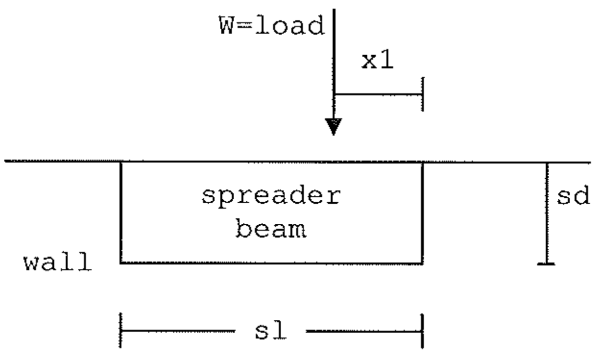
Masonry details

Mortar designation to Table 1 mortar=4
Masonry type (1=clay 2=cal silicate 3=conc brick 4=block) typ(1)=1
Compressive strength of units po=20 N/mm²
Char comp strength - Table 2(a) fk(a)=TABLE 2.1 for mortar=4, po=20
=4.1 N/mm²
Material partial safety factor gammam=3.1

Bearing requirements

Characteristic dead load	DL=49.1*2=98.2 kN
Characteristic live load	LL=3.4*2=6.8 kN
Design load on bearing	W=1.4*DL+1.6*LL=148.36 kN

Spreader beam



Select 'sd' such that the load dispersion line cuts through the vertical line of the spreader beam otherwise a reinforced spreader beam needs to be provided.

sd = spreader height

For bearing reference 3	lbsf=lbsf=2
Design stress capacity	fk1=lbsf*fk(a)/gammam=2.6452 N/mm²
Design load	W1=W*1000=148360 N
Length of spreader beam	sl=600 mm
Width of spreader beam	sb=x=450 mm (B or L to suit type)

Office: 5056

Offset load distance x1=300 mm
Triangular stress distribution is assumed for spreader not tied down.
Eccentricity of load ecc=ABS(sl/2-x1)=0 mm
Maximum stress under spreader fkm=Wl/(sl*sb)+Wl*ecc/((sb*sl^2)/6)
=0.54948 N/mm²

Max stress under spreader ≤ Max permissible
i.e. fkm (0.54948 N/mm²) ≤ fk1 (2.6452 N/mm²)
Therefore spreader satisfactory.

DESIGN SUMMARY	Length of spreader beam	600 mm
	Width of spreader beam	450 mm
	Eccentricity of load	0 mm
	Char comp strength	2.6452 N/mm²
	Local bearing safety factor	2
	Design stress capacity	2.6452 N/mm²
	Max stress under spreader	0.54948 N/mm²

No525