SECOND FLOOR, UNIT 5
BROOK BUSINESS CENTRE
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MMP DESIGN
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

PROJECT	59 SOLENT ROAD, NW6	JOB NO.	4580
CALCULATION SHEET	TITLE BASEMENT	DATE	14/02/16
	BY SM / CHECKED	SHEET NO.	GF/6 REV

BEAM GB15 - CAST

BEAM FB13	1	0.50 x 8.12	=	4.06	
	1	12.60	=		6.30
WALL	1	0.5 x 3.35 x 2.6	=	4.36	
				8.42	6.30 (0.5M LONG)

POINT LOAD GC8 = 24.6 GC9 = 30.6
= 31.4 = 26.4
GB11 = 27.9 GB12 = 19.4
= 13.3 = 14.5

FROM GFC/11, POOL 254 UC 107

BEAM GB16 - SPAN 2300

GF	1	2.30 x 1.00	=	2.30	
	1	1.50	=		3.45
o/w : SAY			=	0.25	
				2.55	3.45

BY INSPECTION, POOL 152 UC 23

(REACTIONS DL = 2.9, IL = 4.0)

BEAM GB18 - SPAN 1400

ROOF	1	1.00 x 1.05	=	1.05	
	1	0.90	=		0.90
FF	1	1.00 x 0.50	=	0.50	
	1	1.50	=		1.50
GF	1	1.00 x 1.00	=	1.00	
	1	1.50	=		1.50
WALL	1	4.50 x 4.60	=	21.60	
o/w	1	SAY	=	0.25	
				24.40	3.90

BY INSPECTION, POOL 152 UC 23

(REACTIONS DL = 17.1, IL = 2.7)

BEAM REF.	LHS DL	LHS IL	LHS ULT	RHS DL	RHS IL	RHS ULT
GB1	3.1	1.2	***6.3***	3.1	1.2	***6.3***
GB2	7.2	1.5	***12.5***	3.7	1.3	***7.3***
GB3	14.7	6.4	***30.8***	15.2	6.5	***31.7***
GB4	3.6	4.7	***12.6***	3.6	4.7	***12.6***
GB5	8.4	5.3	***20.2***	8.4	5.3	***20.2***
GB6	2.8	3.8	***10.0***	2.8	3.8	***10.0***
GB7	12.2	3.6	***22.8***	12.2	3.6	***22.8***
GB8	35.3	12.9	***70.1***	28.4	10.0	***55.8***
GB9	71.4	16.9	***127.0***	83.6	20.5	***149.8***
GB10	11.8	12.6	***36.7***	14.1	10.6	***36.7***
GB11	27.9	13.3	***60.3***	27.9	13.3	***60.3***
GB12	19.4	14.5	***50.4***	22.5	17.8	***60.0***
GB13	34.1	17.6	***75.9***	54.5	28.1	***121.3***
GB14	76.4	23.4	***144.4***	62.5	19.3	***118.4***
GB15	67.4	58.2	***187.5***	67.0	61.7	***192.5***
GB16	2.9	4.0	***10.5***	2.9	4.0	***10.5***
GB17	9.8	1.6	***16.3***	9.8	1.6	***16.3***
GB18	17.1	2.7	***28.3***	17.1	2.7	***28.3***

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CALCULATION SHEET						
	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	GF/8	Rev

BEAM BEARINGS

Allowable bearing stresses beneath concentrated loads such as beam bearings are;

For existing brickwork, 0.7 N/mm^2 (EXB)

For new 50N brickwork, 3.1 N/mm^2 (NWB)

For new 35N concrete, 5.9 N/mm^2 (CON)

CP = Concrete Padstone; EB = single Engineering Brick; BC = Bearing onto Concrete.

All loads are un-factored.

BEAM	END	LOAD	TYPE	BEARING
GB3	LH	21.1	EXB	350x100x150 CP
	RH	21.7	EXB	350x100x150 CP
GB8	LH	48.2	EXB	203x102 UB23 x 700mm long
	RH	38.4	EXB	203x102 UB23 x 600mm long
GB10	LH	24.4	EXB	400x100x150 CP
	RH	24.7	EXB	400x100x150 CP
GB11	LH	41.2	EXB	203x102 UB23 x 600mm long
GB13	LH	51.7	EXB	203x102 UB23 x 750mm long
GB16	LH	6.9	EXB	EB
	RH	6.9	EXB	EB
GB17	LH	11.4	EXB	EB

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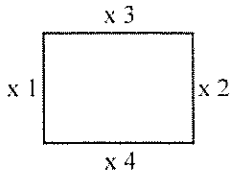
BENDING MOMENTS IN NEW COLUMNS BC1 & BC2



Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1			
at x2	GB9	83.60	20.50
at x3			
at x4			
		83.60	20.50

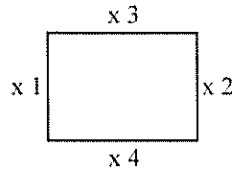
Total Load = **104.10** kN Enter Column Height = **3.20** m
Total Ultimate Load = **149.84** kN

Total Ultimate Sway (x1-x2) say = **2.93** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **83.60** kN Max. LL (x1-x2) = **20.50** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **24.35** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

BENDING MOMENTS IN NEW COLUMN BC3



Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1	GB13	54.50	28.10
at x2	GB14	76.40	23.40
at x3			
at x4			
		130.90	51.50

Total Load = **182.40** kN Column Height = **3.20** m
Total Ultimate Load = **265.66** kN

Total Ultimate Sway (x1-x2) say = **4.58** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **21.90** kN Max. LL (x1-x2) = **28.10** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **22.22** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

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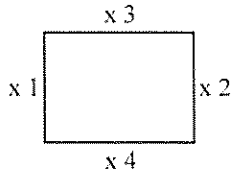
	By	SM Checked	Sheet No.	GF/10 Rev

BENDING MOMENTS IN NEW COLUMN BC4

Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1	GB14	62.50	19.30
at x2			
at x3			
at x4			
		62.50	19.30



Total Load = **81.80** kN Enter Column Height = **3.20** m
Total Ultimate Load = **118.38** kN

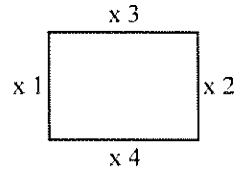
Total Ultimate Sway (x1-x2) say = **2.19** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **62.50** kN Max. LL (x1-x2) = **19.30** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **18.84** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

BENDING MOMENTS IN NEW COLUMNS BC5 & BC6

Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1	GB15	67.00	61.70
at x2			
at x3			
at x4			
		67.00	61.70



Total Load = **128.70** kN Column Height = **3.20** m
Total Ultimate Load = **192.52** kN

Total Ultimate Sway (x1-x2) say = **2.35** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.00** kN

Net DL (x1-x2) = **67.00** kN Max. LL (x1-x2) = **61.70** kN
Net DL (x3-x4) = **0.00** kN Max. LL (x3-x4) = **0.00** kN

Total Ultimate Moment (x1-x2) say = **26.76** kN.m
Total Ultimate Moment (x3-x4) say = **0.00** kN.m

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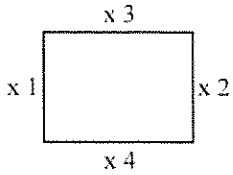
	By	SM	Checked	Sheet No.	GF/11 Rev

BENDING MOMENTS IN NEW COLUMNS BC7 & BC8

Enter the following:	Beam Ref;	Char. DL	Char. LL
at x1			
at x2	GB18	17.10	2.70
at x3	GB17	9.80	1.60
at x4			
		26.90	4.30



Total Load = **31.20** kN Enter Column Height = **3.20** m
Total Ultimate Load = **44.54** kN

Total Ultimate Sway (x1-x2) say = **0.60** kN (say 2.5% of Dead Load)
Total Ultimate Sway (x3-x4) say = **0.34** kN

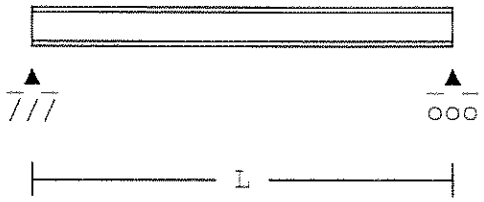
Net DL (x1-x2) = **17.10** kN Max. LL (x1-x2) = **2.70** kN
Net DL (x3-x4) = **9.80** kN Max. LL (x3-x4) = **1.60** kN

Total Ultimate Moment (x1-x2) say = **4.74** kN.m
Total Ultimate Moment (x3-x4) say = **2.73** kN.m

BASEMENT LEVEL COLUMN FORCES (ULTIMATE)

COL REF.	AXIAL LOAD	BENDING MOMENTS		SHEAR FORCES		OFFSET YES/NO	TYPE	REMARKS
		MAJOR AXIS	MINOR AXIS	MAJOR AXIS	MINOR AXIS			
BC1	150.0	0.0	24.4	0.0	2.9	Y	A	200 x 150 x 8 RHS
BC2	150.0	0.0	24.4	0.0	2.9	Y	A	200 x 150 x 8 RHS
BC3	265.7	22.2	0.0	4.6	0.0	N	B	200 x 100 x 12.5 RHS
BC4	118.4	0.0	18.8	0.0	2.2	Y	C	200 x 100 x 10 RHS
BC5	192.5	0.0	26.8	0.0	2.4	Y	A	200 x 150 x 8 RHS
BC6	192.5	0.0	26.8	0.0	2.4	Y	A	200 x 150 x 8 RHS
BC7	44.5	2.7	4.7	0.3	0.6	N	D	100 x 100 x 8 SHS
BC8	44.5	2.7	4.7	0.3	0.6	N	D	100 x 100 x 8 SHS

Location: GROUND FLOOR LEVEL BEAM GB2



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

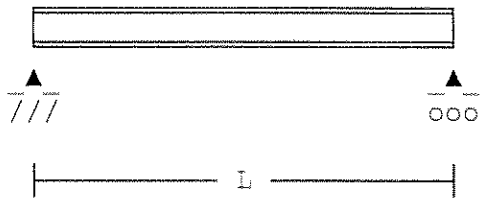
Beam span	L=2.15 m
203 x 102 x 23 UB.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.3 m
Dead load (unfactored)	Gkc(1)=4.8 kN
Imposed load (unfactored)	Qkc(1)=0.34 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.15 m
Dead load (unfactored)	Gku(1)=2.85 kN/m
Imposed load (unfactored)	Qku(1)=1.13 kN/m
Maximum span bending moment	4.5278 kNm
Design shear force	Fv=12.483 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =130.19 N/mm^2

UNIVERSAL BEAM DESIGN SUMMARY

203 x 102 x 23 UB Grade S 275

	Maximum shear force	12.483 kN
	Shear capacity	181.05 kN
	Max. applied moment	4.5278 kNm
	Moment capacity	64.35 kNm
	Buckling resistance	30.466 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	30.466 kNm
	Unfactored DL defln	0.277 mm
	Unfactored LL defln	0.079319 mm
	Limiting deflection	5.9722 mm
Unfactored end shears	DL shear at LHE	7.194 kN
	LL shear at LHE	1.5073 kN
	DL shear at RHE	3.7335 kN
	LL shear at RHE	1.2622 kN

Location: GROUND FLOOR LEVEL BEAM GB3



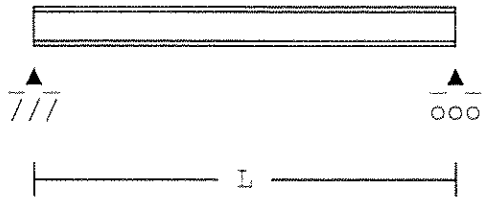
Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.65 m
203 x 203 x 46 UC. Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.5 m
Dead load (unfactored)	Gkc(1)=3.1 kN
Imposed load (unfactored)	Qkc(1)=1.2 kN
Distance from left support	Lc(2)=4.2 m
Dead load (unfactored)	Gkc(2)=3.7 kN
Imposed load (unfactored)	Qkc(2)=1.3 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.65 m
Dead load (unfactored)	Gku(1)=4.96 kN/m
Imposed load (unfactored)	Qku(1)=2.25 kN/m
Maximum span bending moment	31.697 kNm
Design shear force	Fv=31.745 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =162.41 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY	203 x 203 x 46 UC Grade S 275	
	Maximum shear force	31.745 kN
	Shear capacity	241.4 kN
	Max. applied moment	31.697 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	80.716 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	80.716 kNm
	Unfactored DL defln	3.6803 mm
	Unfactored LL defln	1.6306 mm
	Limiting deflection	12.917 mm
Unfactored end shears	DL shear at LHE	14.657 kN
	LL shear at LHE	6.428 kN
	DL shear at RHE	15.207 kN
	LL shear at RHE	6.5345 kN

Location: GROUND FLOOR LEVEL BEAM GB7



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

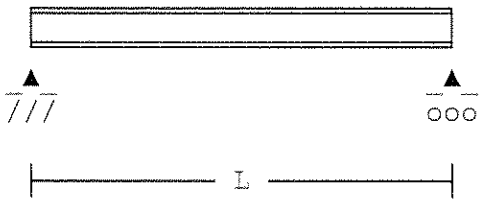
Beam span	L=2.2 m
152 x 152 x 23 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.2 m
Dead load (unfactored)	Gku(1)=11.06 kN/m
Imposed load (unfactored)	Qku(1)=3.30 kN/m
Maximum span bending moment	12.562 kNm
Design shear force	Fv=22.84 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =225 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

152 x 152 x 23 UC Grade S 275

	Maximum shear force	22.84 kN
	Shear capacity	145.85 kN
	Max. applied moment	12.562 kNm
	Moment capacity	45.112 kNm
	Buckling resistance	36.91 kNm
	Moment factor (mLT)	0.925
	Resistance (Mb/mLT)	39.903 kNm
	Unfactored DL defln	1.3165 mm
	Unfactored LL defln	0.39281 mm
	Limiting deflection	6.1111 mm
Unfactored end shears	DL shear at LHE	12.166 kN
	LL shear at LHE	3.63 kN
	DL shear at RHE	12.166 kN
	LL shear at RHE	3.63 kN

Location: GROUND FLOOR LEVEL BEAM GB8



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

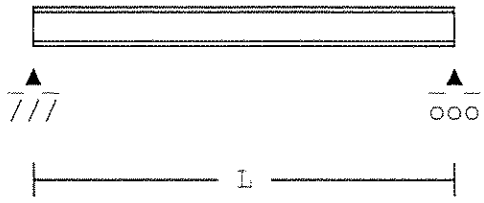
Beam span	L=4.65 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.1 m
Dead load (unfactored)	Gkc(1)=5.3 kN
Imposed load (unfactored)	Qkc(1)=3.4 kN
Distance from left support	Lc(2)=0.35 m
Dead load (unfactored)	Gkc(2)=1.9 kN
Imposed load (unfactored)	Qkc(2)=1.0 kN
Distance from left support	Lc(3)=0.5 m
Dead load (unfactored)	Gkc(3)=3.1 kN
Imposed load (unfactored)	Qkc(3)=1.2 kN
Distance from left support	Lc(4)=2.35 m
Dead load (unfactored)	Gkc(4)=12.2 kN
Imposed load (unfactored)	Qkc(4)=3.6 kN
Distance from left support	Lc(5)=4.2 m
Dead load (unfactored)	Gkc(5)=7.2 kN
Imposed load (unfactored)	Qkc(5)=1.5 kN
Distance from left support	Lc(6)=4.55 m
Dead load (unfactored)	Gkc(6)=1.9 kN
Imposed load (unfactored)	Qkc(6)=1.0 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.65 m
Dead load (unfactored)	Gku(1)=4.0 kN/m
Imposed load (unfactored)	Qku(1)=2.40 kN/m
Dist. from left support to start	Lau(2)=0 m
Distance from left support to end	Lbu(2)=0.5 m
Dead load (unfactored)	Gku(2)=19.69 kN/m
Imposed load (unfactored)	Qku(2)=0 kN/m
Dist. from left support to start	Lau(3)=4.2 m
Distance from left support to end	Lbu(3)=4.65 m
Dead load (unfactored)	Gku(3)=8.14 kN/m
Imposed load (unfactored)	Qku(3)=0 kN/m

Maximum span bending moment	60.055 kNm
Design shear force	Fv=69.944 kN
Length of beam between restraints	LT=2.35 m
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =244.28 N/mm2

UNIVERSAL COLUMN DESIGN SUMMARY — 203 x 203 x 46 UC Grade S 275

	Maximum shear force	69.944 kN
	Shear capacity	241.4 kN
	Max. applied moment	60.055 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	121.41 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	121.41 kNm
	Unfactored DL defln	6.6776 mm
	Unfactored LL defln	2.6592 mm
	Limiting deflection	12.917 mm
Unfactored end shears	DL shear at LHE	35.275 kN
	LL shear at LHE	12.85 kN
	DL shear at RHE	28.433 kN
	LL shear at RHE	10.01 kN

Location: GROUND FLOOR LEVEL BEAM GB9



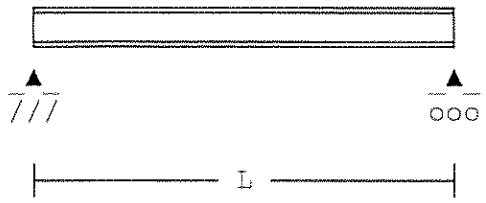
Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.65 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.1 m
Dead load (unfactored)	Gkc(1)=55.2 kN
Imposed load (unfactored)	Qkc(1)=9.7 kN
Distance from left support	Lc(2)=2.35 m
Dead load (unfactored)	Gkc(2)=15.0 kN
Imposed load (unfactored)	Qkc(2)=7.4 kN
Distance from left support	Lc(3)=4.55 m
Dead load (unfactored)	Gkc(3)=67.8 kN
Imposed load (unfactored)	Qkc(3)=13.4 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.65 m
Dead load (unfactored)	Gku(1)=3.65 kN/m
Imposed load (unfactored)	Qku(1)=1.50 kN/m
Maximum span bending moment	68.522 kNm
Design shear force	Fv=149.91 kN
Length of beam between restraints	LT=2.35 m
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =244.28 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY	203 x 203 x 46 UC Grade S 275	
	Maximum shear force	149.91 kN
	Shear capacity	241.4 kN
	Max. applied moment	68.522 kNm
	Moment capacity	135.48 kNm
	Buckling resistance	121.41 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	121.41 kNm
	Unfactored DL defln	7.4982 mm
	Unfactored LL defln	2.962 mm
	Limiting deflection	12.917 mm
Unfactored end shears	DL shear at LHE	71.377 kN
	LL shear at LHE	16.927 kN
	DL shear at RHE	83.596 kN
	LL shear at RHE	20.548 kN

Location: GROUND FLOOR LEVEL BEAM GB10



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.65 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
Distance from left support	Lc(1)=1.1 m
Dead load (unfactored)	Gkc(1)=3.6 kN
Imposed load (unfactored)	Qkc(1)=4.7 kN
Distance from left support	Lc(2)=2.35 m
Dead load (unfactored)	Gkc(2)=2.8 kN
Imposed load (unfactored)	Qkc(2)=3.8 kN
Distance from left support	Lc(3)=3.35 m
Dead load (unfactored)	Gkc(3)=8.4 kN
Imposed load (unfactored)	Qkc(3)=5.3 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.65 m
Dead load (unfactored)	Gku(1)=1.5 kN/m
Imposed load (unfactored)	Qku(1)=1.5 kN/m
Dist. from left support to start	Lau(2)=0 m
Distance from left support to end	Lbu(2)=1.1 m
Dead load (unfactored)	Gku(2)=1.5 kN/m
Imposed load (unfactored)	Qku(2)=2.25 kN/m
Dist. from left support to start	Lau(3)=3.35 m
Distance from left support to end	Lbu(3)=4.65 m
Dead load (unfactored)	Gku(3)=1.9 kN/m
Imposed load (unfactored)	Qku(3)=0 kN/m
Maximum span bending moment	46.575 kNm
Design shear force	Fv=36.785 kN
Length of beam between restraints	LT=2.35 m
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =244.28 N/mm2

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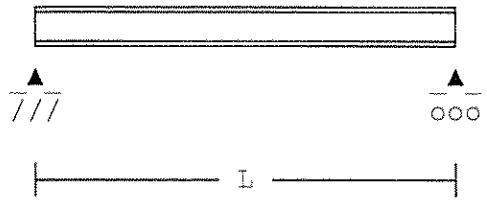
UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

Maximum shear force		36.785 kN
Shear capacity		241.4 kN
Max. applied moment		46.575 kNm
Moment capacity		136.68 kNm
Buckling resistance		121.41 kNm
Moment factor (mLT)		1
Resistance (Mb/mLT)		121.41 kNm
Unfactored DL defln		3.8858 mm
Unfactored LL defln		3.5937 mm
Limiting deflection		12.917 mm
Unfactored end shears	DL shear at LHE	11.769 kN
	LL shear at LHE	12.619 kN
	DL shear at RHE	14.126 kN
	LL shear at RHE	10.631 kN

No408

Location: GROUND FLOOR LEVEL BEAM GB11



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

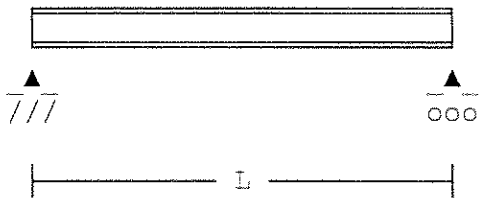
Beam span	L=3.7 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.7 m
Dead load (unfactored)	Gku(1)=15.09 kN/m
Imposed load (unfactored)	Qku(1)=7.20 kN/m
Maximum span bending moment	55.865 kNm
Design shear force	Fv=60.395 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =187.02 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

	Maximum shear force	60.395 kN
	Shear capacity	241.4 kN
	Max. applied moment	55.865 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	92.951 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	92.951 kNm
	Unfactored DL defln	3.9307 mm
	Unfactored LL defln	1.8755 mm
	Limiting deflection	10.278 mm
Unfactored end shears	DL shear at LHE	27.917 kN
	LL shear at LHE	13.32 kN
	DL shear at RHE	27.917 kN
	LL shear at RHE	13.32 kN

Location: GROUND FLOOR LEVEL BEAM GB12



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

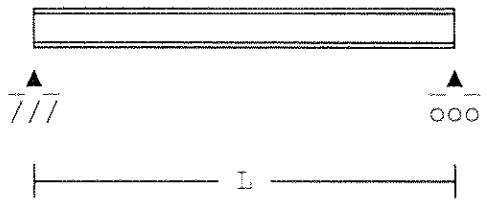
Beam span	L=3.9 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=2.3 m
Dead load (unfactored)	Gkc(1)=17.3 kN
Imposed load (unfactored)	Qkc(1)=18.3 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=3.9 m
Dead load (unfactored)	Gku(1)=6.32 kN/m
Imposed load (unfactored)	Qku(1)=3.6 kN/m
Maximum span bending moment	76.369 kNm
Design shear force	Fv=60.037 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =181.36 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275

	Maximum shear force	60.037 kN
	Shear capacity	241.4 kN
	Max. applied moment	76.369 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	90.138 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	90.138 kNm
	Unfactored DL defln	4.2105 mm
	Unfactored LL defln	3.4618 mm
	Limiting deflection	10.833 mm
Unfactored end shears	DL shear at LHE	19.421 kN
	LL shear at LHE	14.528 kN
	DL shear at RHE	22.527 kN
	LL shear at RHE	17.812 kN

Location: GROUND FLOOR LEVEL BEAM GB13



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.6 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
Distance from left support	Lc(1)=0.5 m
Dead load (unfactored)	Gkc(1)=18.18 kN
Imposed load (unfactored)	Qkc(1)=5.25 kN
Distance from left support	Lc(2)=1.1 m
Dead load (unfactored)	Gkc(2)=3.6 kN
Imposed load (unfactored)	Qkc(2)=4.7 kN
Distance from left support	Lc(3)=1.8 m
Dead load (unfactored)	Gkc(3)=7.1 kN
Imposed load (unfactored)	Qkc(3)=7.5 kN
Distance from left support	Lc(4)=1.8 m
Dead load (unfactored)	Gkc(4)=22.5 kN
Imposed load (unfactored)	Qkc(4)=17.8 kN
Distance from left support	Lc(5)=2.25 m
Dead load (unfactored)	Gkc(5)=28.42 kN
Imposed load (unfactored)	Qkc(5)=6.54 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.6 m
Dead load (unfactored)	Gku(1)=3.4 kN/m
Imposed load (unfactored)	Qku(1)=1.5 kN/m
Maximum span bending moment	71.409 kNm
Design shear force	Fv=121.33 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =222.93 N/mm2

UNIVERSAL COLUMN DESIGN SUMMARY	203 x 203 x 46 UC Grade S 275	
	Maximum shear force	121.33 kN
	Shear capacity	241.4 kN
	Max. applied moment	71.409 kNm
	Moment capacity	136.68 kNm
	Buckling resistance	110.8 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	110.8 kNm
	Unfactored DL defln	2.1125 mm
	Unfactored LL defln	1.2836 mm
	Limiting deflection	7.2222 mm

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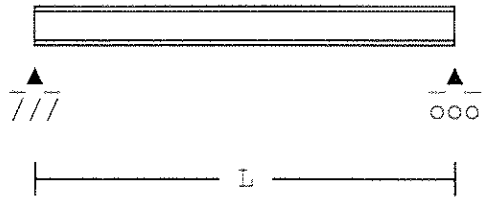
Unfactored end shears	DL shear at LHE	34.114 kN
	LL shear at LHE	17.567 kN
	DL shear at RHE	54.526 kN
	LL shear at RHE	28.123 kN

No408

Location: GROUND FLOOR LEVEL BEAM GB14



Simply supported steel beam

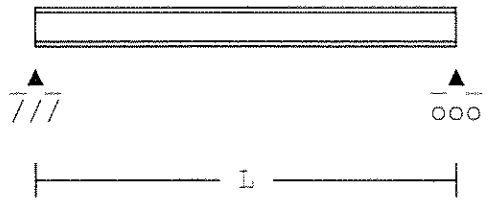
Calculations are in accordance with BS5950-1:2000.

Beam span	L=2.1 m
203 x 203 x 46 UC.	
Young's Modulus	E=205 kN/mm^2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=0.1 m
Dead load (unfactored)	Gkc(1)=68.7 kN
Imposed load (unfactored)	Qkc(1)=19.0 kN
Distance from left support	Lc(2)=0.9 m
Dead load (unfactored)	Gkc(2)=8.4 kN
Imposed load (unfactored)	Qkc(2)=5.3 kN
Distance from left support	Lc(3)=2.0 m
Dead load (unfactored)	Gkc(3)=54.7 kN
Imposed load (unfactored)	Qkc(3)=15.3 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=2.1 m
Dead load (unfactored)	Gku(1)=3.4 kN/m
Imposed load (unfactored)	Qku(1)=1.5 kN/m
Maximum span bending moment	25.754 kNm
Design shear force	Fv=144.45 kN
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =241.8 N/mm^2

UNIVERSAL COLUMN DESIGN SUMMARY

203 x 203 x 46 UC Grade S 275		
Maximum shear force		144.45 kN
Shear capacity		241.4 kN
Max. applied moment		25.754 kNm
Moment capacity		136.68 kNm
Buckling resistance		120.18 kNm
Moment factor (mLT)		1
Resistance (Mb/mLT)		120.18 kNm
Unfactored DL defln		0.6218 mm
Unfactored LL defln		0.24712 mm
Limiting deflection		5.8333 mm
Unfactored end shears	DL shear at LHE	76.403 kN
	LL shear at LHE	23.427 kN
	DL shear at RHE	62.537 kN
	LL shear at RHE	19.323 kN

Location: GROUND FLOOR LEVEL BEAM GB15



Simply supported steel beam

Calculations are in accordance with BS5950-1:2000.

Beam span	L=4.8 m
254 x 254 x 107 UC.	
Young's Modulus	E=205 kN/mm2
Dead load factor	gamd=1.4
Imposed load factor	gami=1.6
Distance from left support	Lc(1)=1.15 m
Dead load (unfactored)	Gkc(1)=27.9 kN
Imposed load (unfactored)	Qkc(1)=13.3 kN
Distance from left support	Lc(2)=1.35 m
Dead load (unfactored)	Gkc(2)=8.42 kN
Imposed load (unfactored)	Qkc(2)=6.3 kN
Distance from left support	Lc(3)=1.75 m
Dead load (unfactored)	Gkc(3)=24.6 kN
Imposed load (unfactored)	Qkc(3)=31.4 kN
Distance from left support	Lc(4)=1.8 m
Dead load (unfactored)	Gkc(4)=19.4 kN
Imposed load (unfactored)	Qkc(4)=14.5 kN
Distance from left support	Lc(5)=4.7 m
Dead load (unfactored)	Gkc(5)=30.6 kN
Imposed load (unfactored)	Qkc(5)=26.4 kN
Dist. from left support to start	Lau(1)=0 m
Distance from left support to end	Lbu(1)=4.8 m
Dead load (unfactored)	Gku(1)=4.9 kN/m
Imposed load (unfactored)	Qku(1)=5.85 kN/m
Maximum span bending moment	258.08 kNm
Design shear force	Fv=192.6 kN
Length of beam between restraints	LT=3.0 m
Bending strength	pb=(pey)/(phiLT+((phiLT^2-pey)^0.5)) =245.99 N/mm2

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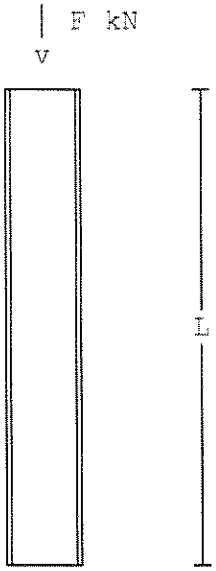
UNIVERSAL COLUMN DESIGN SUMMARY

254 x 254 x 107 UC Grade S 275

	Maximum shear force	192.6 kN
	Shear capacity	542.79 kN
	Max. applied moment	258.08 kNm
	Moment capacity	392.2 kNm
	Buckling resistance	364.06 kNm
	Moment factor (mLT)	1
	Resistance (Mb/mLT)	364.06 kNm
	Unfactored DL defln	5.2249 mm
	Unfactored LL defln	4.7713 mm
	Limiting deflection	13.333 mm
Unfactored end shears	DL shear at LHE	67.421 kN
	LL shear at LHE	58.246 kN
	DL shear at RHE	67.019 kN
	LL shear at RHE	61.734 kN

No408

Location: BASEMENT LEVEL COLUMNS BC1, BC2, BC5 & BC6



SHS column in 'simple' construction

Calculations are in accordance with BS5950 and 'SHS Design Examples to BS5950' published by British Steel General Steels.

The column is part of simple constr-uction and in accordance with 4.7.7 it is not necessary to consider the effect of pattern loading. All beams supported by the column are assumed to be fully loaded.

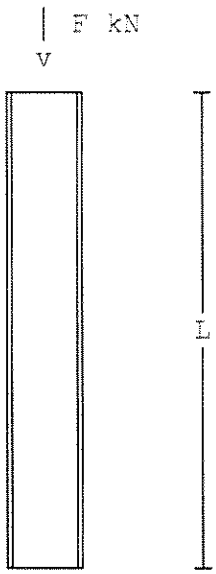
It is assumed that all elements of the column remain in compression.

Factored axial compressive load	F=192.5 kN
Factored BM about major axis x-x	Mx=0 kNm
Factored BM about minor axis y-y	My=26.8 kNm
Length between restraints	L=3200 mm

200 x 150 x 8 RHS - Hot finished.
Properties (cm): A=52.8 rx=7.5 Zx=297 Sx=359 Ix=2970
J=3640 C=398 Zy=253 Sy=294 Iy=1890 ry=5.99

Young's Modulus	E=205 kN/mm^2
Effective length factor	ef=2
Compressive strength	pc=pe*py/(phi+(phi^2-pe*py)^0.5) =142.86 N/mm^2
HOT FINISHED	In accordance with EN 10210
RECTANGULAR HOLLOW SECTION	200 x 150 x 8 RHS Grade S 275
SECTION SUMMARY	Section is satisfactory for axial load, buckling resistance and overall buckling check.
DESIGN SUMMARY	Axial compressive load 192.5 kN Compressive resistance 754.31 kN Moment about minor axis 26.8 kNm Minor axis resistance 69.575 kNm Overall buckling check 0.6404 < 1

Location: BASEMENT LEVEL COLUMNS BC3



SHS column in 'simple' construction

Calculations are in accordance with BS5950 and 'SHS Design Examples to BS5950' published by British Steel General Steels.

The column is part of simple constr-uction and in accordance with 4.7.7 it is not necessary to consider the effect of pattern loading. All beams supported by the column are assumed to be fully loaded.

It is assumed that all elements of the column remain in compression.

Factored axial compressive load	F=265.7 kN
Factored BM about major axis x-x	Mx=22.2 kNm
Factored BM about minor axis y-y	My=0 kNm
Length between restraints	L=3200 mm

200 x 100 x 12.5 RHS - Hot finished.
Properties (cm): A=67.1 rx=6.84 Zx=314 Sx=408 Ix=3140
J=2540 C=341 Zy=201 Sy=245 Iy=1000 ry=3.87

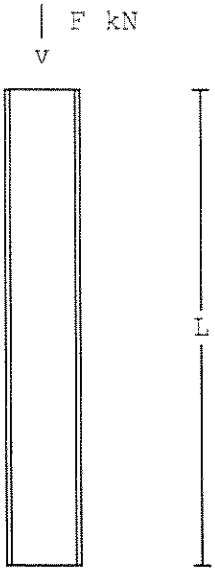
Young's Modulus E=205 kN/mm^2

Effective length factor ef=2

Compressive strength pc=pe*py/(phi+(phi^2-pe*py)^0.5)
=66.926 N/mm^2

HOT FINISHED	In accordance with EN 10210	
RECTANGULAR HOLLOW SECTION	200 x 100 x 12.5 RHS Grade S 275	
SECTION SUMMARY	Section is satisfactory for axial load, buckling resistance and overall buckling check.	
DESIGN SUMMARY	Axial compressive load	265.7 kN
	Compressive resistance	449.08 kN
	Moment about major axis	22.2 kNm
	Buckling resistance	112.2 kNm
	Overall buckling check	0.78952 < 1

Location: BASEMENT LEVEL COLUMN BC4



SHS column in 'simple' construction

Calculations are in accordance with BS5950 and 'SHS Design Examples to BS5950' published by British Steel General Steels.

The column is part of simple constr-uction and in accordance with 4.7.7 it is not necessary to consider the effect of pattern loading. All beams supported by the column are assumed to be fully loaded.

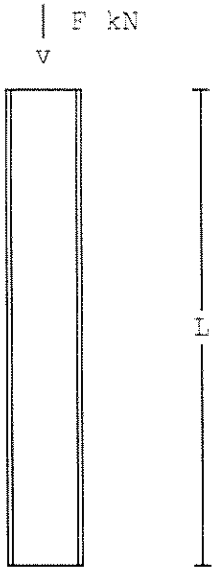
It is assumed that all elements of the column remain in compression.

Factored axial compressive load	F=118.4 kN
Factored BM about major axis x-x	Mx=0 kNm
Factored BM about minor axis y-y	My=18.8 kNm
Length between restraints	L=3200 mm

200 x 100 x 10 RHS - Hot finished.
Properties (cm): A=54.9 rx=6.96 Zx=266 Sx=341 Ix=2660
J=2160 C=295 Zy=174 Sy=206 Iy=869 ry=3.98

Young's Modulus	E=205 kN/mm^2
Effective length factor	ef=2
Compressive strength	pc=pe*py/(phi+(phi^2-pe*py)^0.5) =70.496 N/mm^2
HOT FINISHED	In accordance with EN 10210
RECTANGULAR HOLLOW SECTION	200 x 100 x 10 RHS Grade S 275
SECTION SUMMARY	Section is satisfactory for axial load, buckling resistance and overall buckling check.
DESIGN SUMMARY	Axial compressive load 118.4 kN Compressive resistance 387.02 kN Moment about minor axis 18.8 kNm Minor axis resistance 47.85 kNm Overall buckling check 0.69882 < 1

Location: BASEMENT LEVEL COLUMNS BC7 & BC8



SHS column in 'simple' construction

Calculations are in accordance with BS5950 and 'SHS Design Examples to BS5950' published by British Steel General Steels.

The column is part of simple constr-uction and in accordance with 4.7.7 it is not necessary to consider the effect of pattern loading. All beams supported by the column are assumed to be fully loaded.

It is assumed that all elements of the column remain in compression.

Factored axial compressive load	F=44.5 kN
Factored BM about major axis x-x	Mx=2.7 kNm
Factored BM about minor axis y-y	My=4.7 kNm
Length between restraints	L=3200 mm

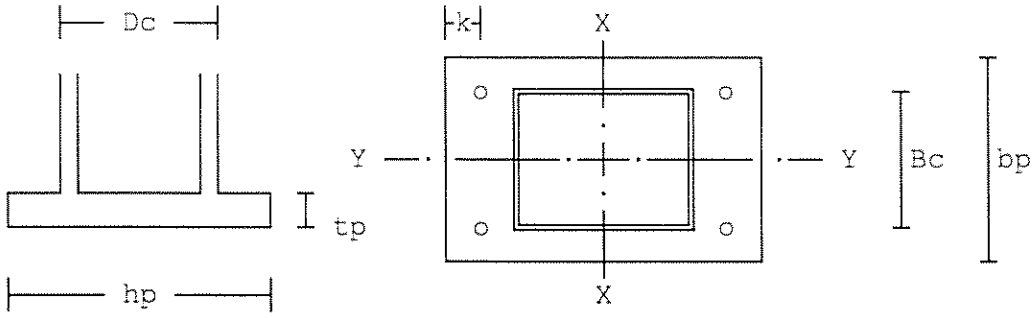
100 x 100 x 8 SHS - Hot finished.
Properties (cm): A=28.8 rx=3.73 Zx=79.9 Sx=98.2 Ix=400 J=646 C=116

Young's Modulus	E=205 kN/mm^2
Effective length factor	ef=2
Compressive strength	pc=pe*py/(phi+(phi^2-pe*py)^0.5) =62.484 N/mm^2
HOT FINISHED	In accordance with EN 10210
SQUARE HOLLOW SECTION	100 x 100 x 8 SHS Grade S 275
SECTION SUMMARY	Section is satisfactory for axial load, buckling resistance and overall buckling check.

DESIGN SUMMARY		
	Axial compressive load	44.5 kN
	Compressive resistance	179.95 kN
	Moment about major axis	2.7 kNm
	Buckling resistance	27.005 kNm
	Moment about minor axis	4.7 kNm
	Minor axis resistance	21.973 kNm
	Overall buckling check	0.56117 < 1

Location: BASEPLATE TO BASEMENT COLUMNS BC1, BC2, BC5 & BC6

Calculations are in accordance with 'Joints in Steel Construction Moment Connections' published by The Steel Construction Institute.



ELEVATION PLAN

Axial load (+ve compression)	N=192.5 kN
Moment about X-X axis	M=26.8 kNm
Shear on the base in Y direction	Fy=2.9 kN

200 x 150 x 8 RHS - Hot finished.
Properties (cm): A=52.8 rx=7.5 Zx=297 Sx=359 Ix=2970
J=3640 C=398 Zy=253 Sy=294 Iy=1890 ry=5.99

Length of baseplate	hp=400 mm
Breadth of baseplate	bp=350 mm
Edge distance to bolt centre line	k=40 mm
Assumed fillet weld size	sw=8 mm

Strength of concrete	fcu=35 N/mm^2

Special control must be applied over the placing of the high strength bedding material.

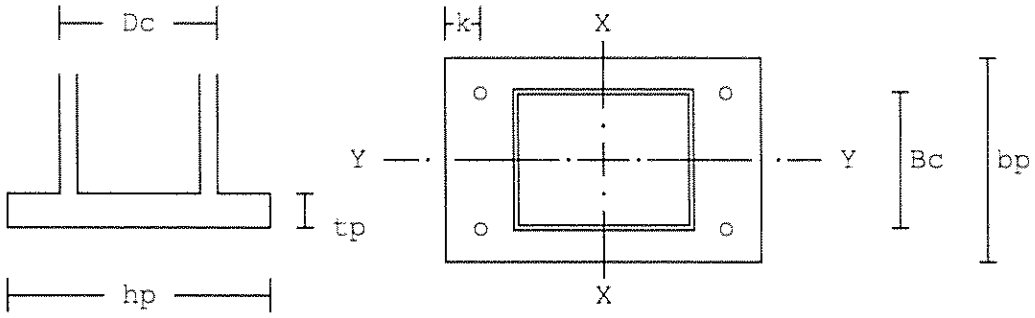
Assumed weld size	sw=8 mm
Selected baseplate thickness	tp=18 mm
Number of bolts to be used	n=4
Bolt diameter	bd=16 mm
Selected fillet weld size	sw=8 mm

SUMMARY

BASEPLATE	Size 400 mm x 350 mm x 18 mm	
REQUIREMENTS	Grade S 275 steel	
	Edge distance	40 mm
	Number of H.D. bolts	4
	Diameter of bolts	M 16
	Grade 4.6	
	Concrete/grout (fcu)	35 N/mm^2
WELDS	Fillet weld (all round)	8 mm
	Contact areas on the baseplate and column are machined to give a tight bearing contact.	

Location: BASEPLATE TO BASEMENT COLUMN BC3

Calculations are in accordance with 'Joints in Steel Construction Moment Connections' published by The Steel Construction Institute.



ELEVATION PLAN

Axial load (+ve compression)	N=265.7 kN
Moment about X-X axis	M=22.2 kNm
Shear on the base in Y direction	Fy=4.6 kN

200 x 100 x 12.5 RHS - Hot finished.
Properties (cm): A=67.1 rx=6.84 Zx=314 Sx=408 Ix=3140
J=2540 C=341 Zy=201 Sy=245 Iy=1000 ry=3.87

Length of baseplate	hp=400 mm
Breadth of baseplate	bp=300 mm
Edge distance to bolt centre line	k=40 mm
Assumed fillet weld size	sw=8 mm
Strength of concrete	fcu=35 N/mm^2

Special control must be applied over the placing of the high strength bedding material.

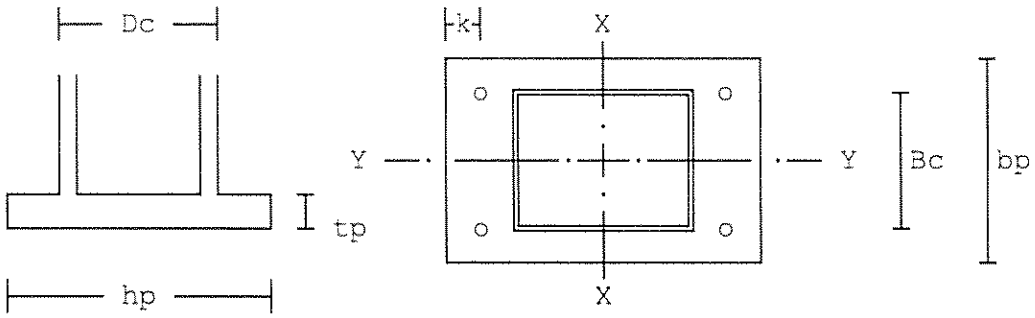
Assumed weld size	sw=8 mm
Selected baseplate thickness	tp=16 mm
Number of bolts to be used	n=4
Bolt diameter	bd=16 mm
Selected fillet weld size	sw=8 mm

SUMMARY

BASEPLATE	Size 400 mm x 300 mm x 16 mm	
REQUIREMENTS	Grade S 275 steel	
	Edge distance	40 mm
	Number of H.D. bolts	4
	Diameter of bolts	M 16
	Grade 4.6	
	Concrete/grout (fcu)	35 N/mm^2
WELDS	Fillet weld (all round)	8 mm
	Contact areas on the baseplate and column are machined to give a tight bearing contact.	

Location: BASEPLATE TO BASEMENT COLUMN BC4

Calculations are in accordance with 'Joints in Steel Construction Moment Connections' published by The Steel Construction Institute.



ELEVATION PLAN

Axial load (+ve compression)	N=118.4 kN
Moment about X-X axis	M=18.8 kNm
Shear on the base in Y direction	Fy=2.2 kN

200 x 100 x 10 RHS - Hot finished.
Properties (cm): A=54.9 rx=6.96 Zx=266 Sx=341 Ix=2660
J=2160 C=295 Zy=174 Sy=206 Iy=869 ry=3.98

Length of baseplate	hp=400 mm
Breadth of baseplate	bp=300 mm
Edge distance to bolt centre line	k=40 mm
Assumed fillet weld size	sw=8 mm
Strength of concrete	fcu=35 N/mm^2

Special control must be applied over the placing of the high strength bedding material.

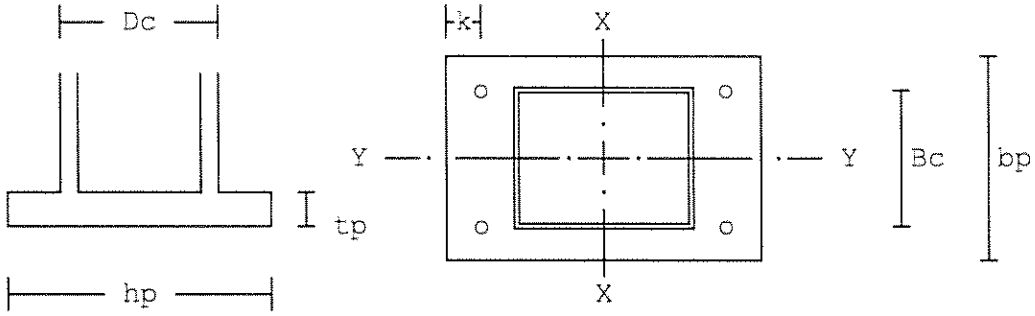
Assumed weld size	sw=8 mm
Selected baseplate thickness	tp=18 mm
Number of bolts to be used	n=4
Bolt diameter	bd=16 mm
Selected fillet weld size	sw=8 mm

SUMMARY

BASEPLATE	Size 400 mm x 300 mm x 18 mm	
REQUIREMENTS	Grade S 275 steel	
	Edge distance	40 mm
	Number of H.D. bolts	4
	Diameter of bolts	M 16
	Grade 4.6	
	Concrete/grout (fcu)	35 N/mm^2
WELDS	Fillet weld (all round)	8 mm
	Contact areas on the baseplate and column are machined to give a tight bearing contact.	

Location: BASEPLATE TO BASEMENT COLUMNS BC7 & BC8

Calculations are in accordance with 'Joints in Steel Construction Moment Connections' published by The Steel Construction Institute.



ELEVATION PLAN

Axial load (+ve compression)	N=44.5 kN
Moment about X-X axis	M=7.4 kNm
Shear on the base in Y direction	Fy=0.9 kN

100 x 100 x 8 SHS - Hot finished.
Properties (cm): A=28.8 rx=3.73 Zx=79.9 Sx=98.2 Ix=400 J=646 C=116

Length of baseplate	hp=300 mm
Breadth of baseplate	bp=300 mm
Edge distance to bolt centre line	k=40 mm
Assumed fillet weld size	sw=8 mm
Strength of concrete	fcu=35 N/mm2

Special control must be applied over the placing of the high strength bedding material.

Assumed weld size	sw=8 mm
Selected baseplate thickness	tp=16 mm
Number of bolts to be used	n=4
Bolt diameter	bd=20 mm
Selected fillet weld size	sw=8 mm

SUMMARY

BASEPLATE	Size 300 mm x 300 mm x 16 mm	
REQUIREMENTS	Grade S 275 steel	
	Edge distance	40 mm
	Number of H.D. bolts	4
	Diameter of bolts	M 16
	Grade 4.6	
	Concrete/grout (fcu)	35 N/mm2
WELDS	Fillet weld (all round)	8 mm

Contact areas on the baseplate and column are machined to give a tight bearing contact.

QFC/20

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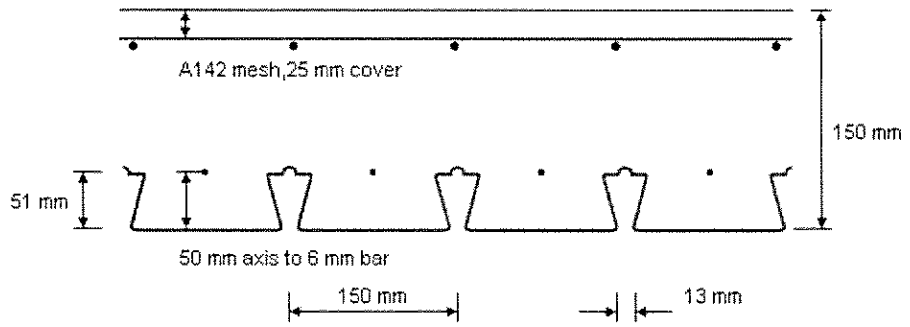
BS5950

Client		**Calculation By**	SM
Project Name	59 Solent Road, NW6	**Company Name**	MMP DESIGN
Project Ref.	4580	**Date**	16/03/2016
Slab Ref.		**Location**	Rear Slab
Comments			
Revision			

1 Overall Summary

Construction Stage	**PASS**	**Max. UF**	**0.83**
Composite Stage	**PASS**	**Max. UF**	**0.14**
Fire Stage	**PASS**	**Max. UF**	**0.46**



2 Input Parameters

2.1 Deck/Span Properties

Deck Type	R51, 0.9mm, S350	Span	2.200m
Span Type	Single	Support Width	100mm
Number of Props	N/A	Prop Width	N/A

2.2 Slab Properties

Slab Depth	150mm	Concrete Type	C35
Slab Type	Single	Wet/Dry Density	2400/2350 kg/m³
Concrete Volume	0.141m³/m²	Modular Ratio	14.00
Calculated Mesh	A142	Calculated Bar	6mm, 1 per trough
Mesh Yield Strength	500 N/mm²	Bar Yield Strength	500 N/mm²

2.3 Loadings

	SLS (kN/m²)	ULS (kN/m²)
Concrete Weight (wet)	3.32	4.65
Deck + Reinforcement	0.16	0.23
Total Slab (Construction Stage)	3.48	4.88
Construction Load	2.09	3.35
Imposed Load	1.50	2.40
Ceilings + Services	0.50	0.70
Finishes	2.00	2.80
Partitions	1.00	1.60
Total Selfweight	3.41	4.78

EFC/21

2.4 Concentrated Loading

Name	Type	Live (kN/(m))	Dead (kN/(m))	Finishes (mm)	Width (mm)	Location (mm)	Length (mm)	Start (mm)	Finish (mm)
No concentrated loading									

3 Design Criteria

Fire Period	1.0 hrs	Fire Analysis Method	Fire Engineering
Proportion of Live Load	0 %	Fire Load Factor	0.80
Live Load Factor	1.60	Dead Load Factor	1.40
Superimposed Load Factor	1.40		

4 Construction Stage

	Applied	Capacity/Limit	Unity Factor
Web Shear	8.84 kN/m	111.14 kN/m	0.08
Web Crushing	8.84 kN/m	30.82 kN/m	0.29
Bending (Sagging)	4.76 kNm/m	5.71 kNm/m	0.83
Deflection	7.6 mm	12.0 mm	0.64
	(Deflection limit is the lesser of Span/180 and 20mm)		

5 Composite Stage

Average Composite Inertia 19099455 mm^4

	Applied	Capacity/Limit	Unity Factor
Horizontal Shear	8.25 kN/m	61.26 kN/m	0.13
Vertical Shear	13.51 kN/m	98.78 kN/m	0.14
Bending Resistance	7.43 kNm/m	60.06 kNm/m	0.12
Imposed Load Deflection	0.2 mm	6.3 mm	0.03
	(Deflection limit is the lesser of Span/350 and 20 mm)		
Total Load Deflection	0.4 mm	8.8 mm	0.04
	(Deflection limit is the lesser of Span/250 and 20 mm)		
Dynamic Deflection	0.03 mm[1]		

6 Fire Stage

	Applied	Capacity/Limit	Unity Factor
Moment Resistance	4.64 kNm/m	10.12 kNm/m	0.46

Notes

- *This calculation is based on slab poured to the constant thickness specified. No account is taken for any additional concrete weight as a result of deflection of the supporting structure.*
- *Where "calculated minimum" is chosen for reinforcement, values represent minimum design code requirements. These may need to be increased for other purposes (e.g. crack control, transverse reinforcement for composite beams etc.)*
- *This calculation does not consider any reinforcement requirements not associated with composite action between deck and concrete (e.g. cantilever, void trimming etc.). These should be specified separately.*

[1] This figure represents the dynamic deflection of the slab only. This should be added to the dynamic deflection of supporting beams when considering natural frequency of floor plate (Refer SCI P-354)

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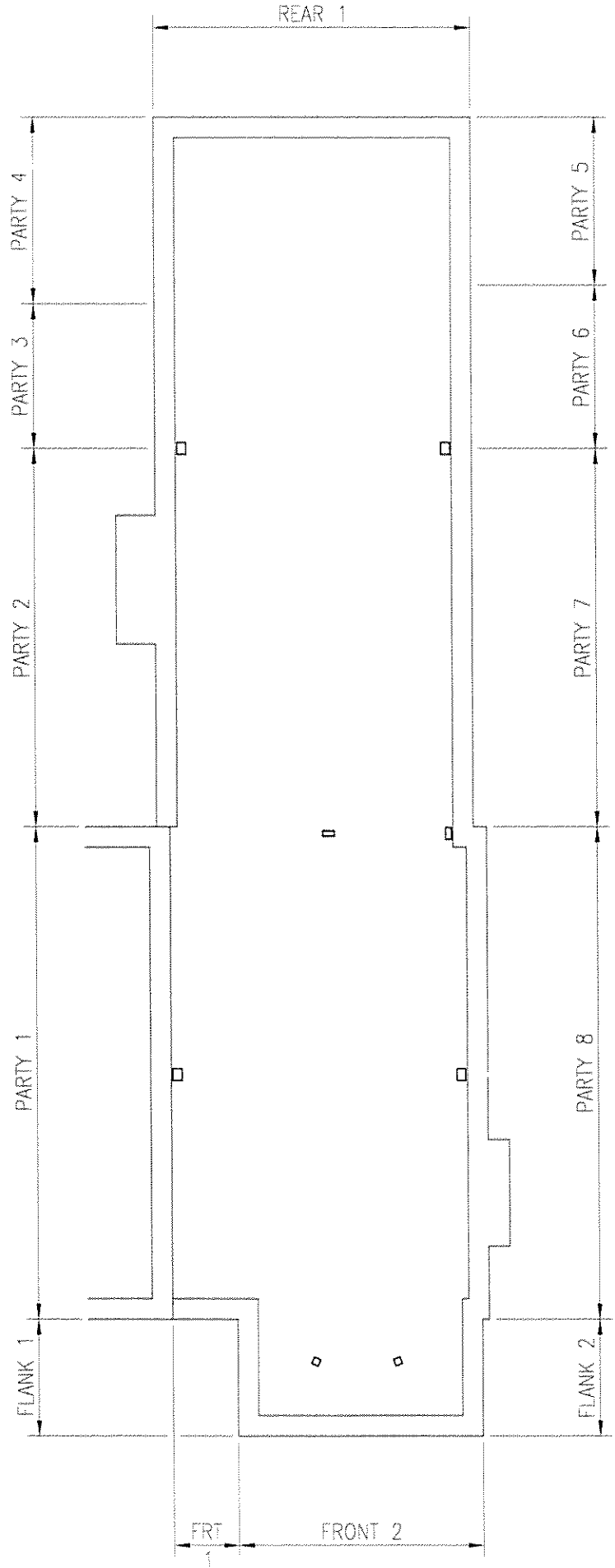
59 SOLENT ROAD, NW6

JOB. 1580

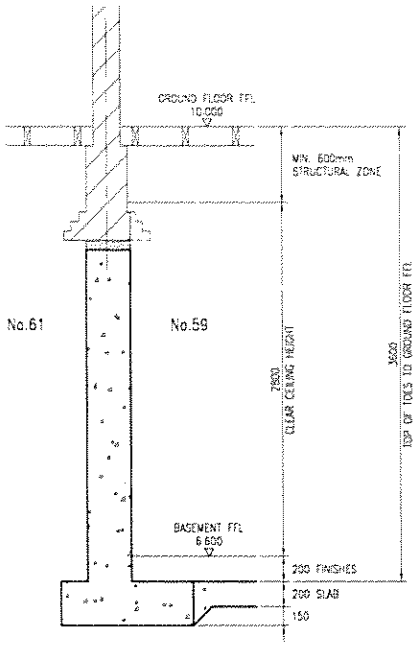
BASEMENT

PAGE 1S/1

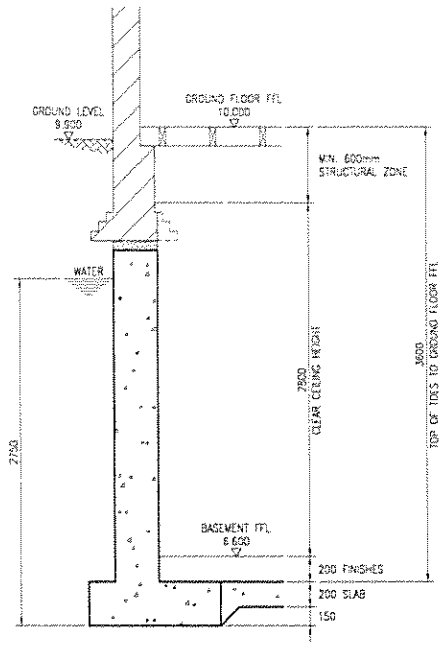


59 SOLENT ROAD, NW6 Job 4580

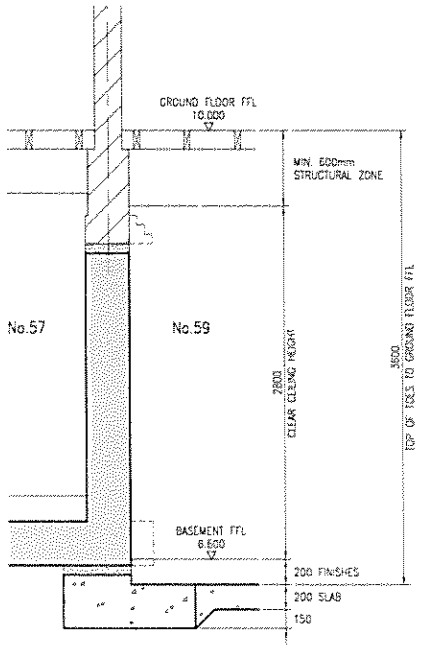
BASEMENT PAGE BS 1/2



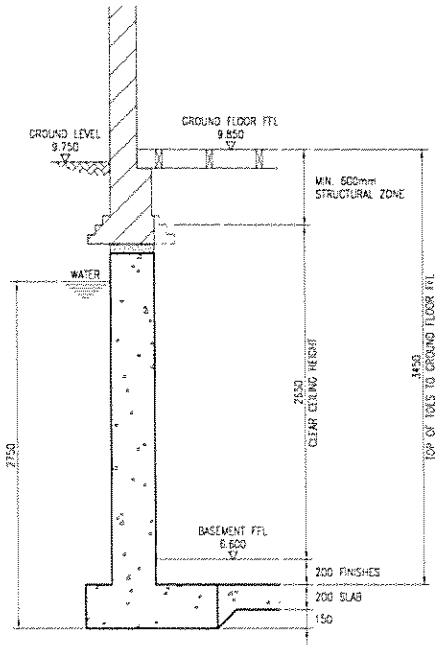
TYPICAL 59/61 PARTY WALL UNDERPIN DETAIL



TYPICAL FRONT WALL UNDERPIN DETAIL



TYPICAL 59/57 PARTY WALL UNDERPIN DETAIL



TYPICAL REAR WALL UNDERPIN DETAIL

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CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6	Job No.	4580
	Title	BASEMENT	Date	MAR/16
	By	SM Checked	Sheet No.	BS/3 Rev

FOUNDATION LINE LOADS OF EXISTING WALLS TO BE UNDERPINNED

WALL	Quantity	Unit load		Line Load		Total
		Dead	Imposed	Dead	Imposed	Load
FRONT WALL 1						
Pitched roof	2.30	1.05	0.65	2.42	1.50	3.91
Second floor	1.90	0.50	1.50	0.95	2.85	3.80
First floor	1.90	0.50	1.50	0.95	2.85	3.80
Ground floor	1.90	1.00	1.50	1.90	2.85	4.75
Ground - eaves/roof wall	6.50	4.80	0.00	31.20	0.00	31.20
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**42.82**	**10.05**	**52.86**
		WALL ONLY (kN/m)		**36.60**		
PARTY WALL 1						
Pitched roof	3.50	1.05	0.65	3.68	2.28	5.95
Second floor	4.00	0.50	1.50	2.00	6.00	8.00
First floor	2.00	0.50	1.50	1.00	3.00	4.00
Ground floor (say)	2.00	3.00	1.50	6.00	3.00	9.00
Ground - eaves/roof wall	8.80	4.80	0.00	42.24	0.00	42.24
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**60.32**	**14.28**	**74.59**
		WALL ONLY (kN/m)		**47.64**		
PARTY WALL 2.1						
Flat roof	3.60	1.00	0.75	3.60	2.70	6.30
Second floor	3.20	0.50	1.50	1.60	4.80	6.40
First floor	3.20	0.50	1.50	1.60	4.80	6.40
Ground floor	3.20	1.00	1.50	3.20	4.80	8.00
Ground - eaves/roof wall	8.10	4.80	0.00	38.88	0.00	38.88
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**54.28**	**17.10**	**71.38**
		WALL ONLY (kN/m)		**44.28**		
PARTY WALL 2.2						
Pitched roof	3.60	1.05	0.65	3.78	2.34	6.12
First floor	3.20	0.50	1.50	1.60	4.80	6.40
Ground floor	3.20	1.00	1.50	3.20	4.80	8.00
Ground - eaves/roof wall	6.00	4.80	0.00	28.80	0.00	28.80
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**42.78**	**11.94**	**54.72**
		WALL ONLY (kN/m)		**34.20**		

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CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/4	Rev

FOUNDATION LINE LOADS OF EXISTING WALLS TO BE UNDERPINNED

WALL	Quantity	Unit load		Line Load		Total
		Dead	Imposed	Dead	Imposed	Load
PARTY WALLS 3 & 6						
Flat roof	2.60	1.00	0.75	2.60	1.95	4.55
Ground floor	1.00	4.80	1.50	4.80	1.50	6.30
Ground - eaves/roof wall	3.20	4.80	0.00	15.36	0.00	15.36
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**28.16**	**3.45**	**31.61**
		WALL ONLY (kN/m)		**20.76**		
PARTY WALL 7						
Flat roof	0.90	1.00	0.75	0.90	0.68	1.58
Ground floor	1.20	1.00	1.50	1.20	1.80	3.00
Ground - eaves/roof wall	3.20	4.80	0.00	15.36	0.00	15.36
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**22.86**	**2.48**	**25.34**
		WALL ONLY (kN/m)		**20.76**		
PARTY WALL 8						
Pitched roof	3.50	1.05	0.65	3.68	2.28	5.95
Second floor	4.00	0.50	1.50	2.00	6.00	8.00
First floor	3.40	0.50	1.50	1.70	5.10	6.80
Ground floor	3.40	1.00	1.50	3.40	5.10	8.50
Ground - eaves/roof wall	8.80	4.80	0.00	42.24	0.00	42.24
Foundation - ground wall	0.75	7.20	0.00	5.40	0.00	5.40
		TOTALS (kN/m)		**58.42**	**18.48**	**76.89**
		WALL ONLY (kN/m)		**47.64**		

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CALCULATION SHEET				
	Project	59 SOLENT ROAD, LONDON NW6	Job No.	4580
	Title	BASEMENT	Date	MAR/16
	By	SM Checked	Sheet No.	BS/5 Rev

FOUNDATION LINE LOADS OF NEW WALLS

WALL	Quantity	Unit load		Line Load		Total
		Dead	Imposed	Dead	Imposed	Load
FLANK WALLS 1 & 2 AND FRONT WALL 2						
Wall own weight	3.50	8.40	0.00	29.40	0.00	29.40
PARTY WALLS 4 & 5 AND REAR WALL						
Ground floor	1.50	8.40	1.50	12.60	2.25	14.85
Wall own weight	3.30	5.00	0.00	16.50	0.00	16.50
		TOTALS (kN/m)		**29.10**	**2.25**	**31.35**
		WALL ONLY (kN/m)		**29.10**		

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CALCULATION SHEET					
	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580
	Title	BASEMENT		Date	MAR/16
	By	SM	Checked	Sheet No.	BS/6 Rev

MOMENT DUE TO RETAINED SOIL AND WATER - FRONT WALLS

London Clay density = 18 kN/m^3 and angle of internal friction = 28 °

Hence Ka =	**0.361**	m	and Dd = dry density
Retained depth (Hr) =	**3.85**	m	Ds = saturated density
Depth of water (Hw) =	**2.75**	m	Dw = density of water
Surcharge (W) =	**2.50**	kN/m^2	

Now calculate the maximum pressures from the retained material;

	At u/s base			At top of base
Pressure due to dry soil, P1 =	**7.15**	kN/m^2	= Ka x Dd x (Hr - Hw)	**7.15**
Pressure due to dry soil surcharge, P2 =	**7.15**	kN/m^2	= Ka x Dd x (Hr - Hw)	**7.15**
Pressure due to submerged soil, P3 =	**8.13**	kN/m^2	= Ka x Ds x Hw	**7.10**
Pressure due to water, P4 =	**26.98**	kN/m^2	= Dw x Hw	**23.54**
Pressure due to surcharge, P5 =	**0.90**	kN/m^2	= Ka x W	**0.90**

Hence the forces acting on the wall due to the retained pressures are;

Force due to dry soil, F1 =	**3.93**	kN	= P1 x (Hr - Hw) x 0.5	**3.93**
Force due to dry soil surcharge, F2 =	**19.66**	kN	= P2 x Hw	**17.16**
Force due to submerged soil, F3 =	**11.18**	kN	= P3 x Hw x 0.5	**8.52**
Force due to water, F4 =	**37.09**	kN	= P4 x Hw x 0.5	**28.25**
Force due to surcharge, F5 =	**3.47**	kN	= P5 x Hr	**3.16**

and the overturning moments due to the forces acting on the wall are;

OTM due to dry soil, M1 =	**12.25**	kN.m	= F1 x (Hw + (Hr - Hw)/3)	**10.88**
OTM due to dry soil surcharge, M2 =	**27.03**	kN.m	= F2 x Hw x 0.5	**20.59**
OTM due to submerged soil, M3 =	**10.25**	kN.m	= F3 x Hw / 3	**6.81**
OTM due to water, M4 =	**34.00**	kN.m	= F4 x Hw / 3	**22.60**
OTM due to surcharge, M5 =	**6.69**	kN.m	= F5 x Hr x 0.5	**5.53**

Therefore, total force due to retained soil and water =	**75.34**	kN	**61.02**	kN
and total overturning moment due to retained soil and water =	**90.22**	kN.m	**66.41**	kN.m

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CALCULATION SHEET

Project	59 SOLENT ROAD, LONDON NW6	Job No.	4580
Title	BASEMENT	Date	MAR/16
By	SM Checked	Sheet No.	BS/7 Rev

MOMENT DUE TO RETAINED SOIL AND WATER - PARTY WALL 1

London Clay density = 18 kN/m^3 and angle of internal friction = 28 °

Hence Ka =	**0.361**	m	and Dd = dry density
Retained depth (Hr) =	**1.05**	m	Ds = saturated density
Depth of water (Hw) =	**1.05**	m	Dw = density of water
Surcharge (W) =	**1.50**	kN/m^2	

Now calculate the maximum pressures from the retained material;

	At u/s base			At top of base
Pressure due to dry soil, P1 =	**0.00**	kN/m^2	= Ka x Dd x (Hr - Hw)	**0.00**
Pressure due to dry soil surcharge, P2 =	**0.00**	kN/m^2	= Ka x Dd x (Hr - Hw)	**0.00**
Pressure due to submerged soil, P3 =	**3.10**	kN/m^2	= Ka x Ds x Hw	**2.07**
Pressure due to water, P4 =	**10.30**	kN/m^2	= Dw x Hw	**6.87**
Pressure due to surcharge, P5 =	**0.54**	kN/m^2	= Ka x W	**0.54**

Hence the forces acting on the wall due to the retained pressures are;

Force due to dry soil, F1 =	**0.00**	kN	= P1 x (Hr - Hw) x 0.5	**0.00**
Force due to dry soil surcharge, F2 =	**0.00**	kN	= P2 x Hw	**0.00**
Force due to submerged soil, F3 =	**1.63**	kN	= P3 x Hw x 0.5	**0.72**
Force due to water, F4 =	**5.41**	kN	= P4 x Hw x 0.5	**2.40**
Force due to surcharge, F5 =	**0.57**	kN	= P5 x Hr	**0.38**

and the overturning moments due to the forces acting on the wall are;

OTM due to dry soil, M1 =	**0.00**	kN.m	= F1 x (Hw + (Hr - Hw)/3)	**0.00**
OTM due to dry soil surcharge, M2 =	**0.00**	kN.m	= F2 x Hw x 0.5	**0.00**
OTM due to submerged soil, M3 =	**0.57**	kN.m	= F3 x Hw / 3	**0.17**
OTM due to water, M4 =	**1.89**	kN.m	= F4 x Hw / 3	**0.56**
OTM due to surcharge, M5 =	**0.30**	kN.m	= F5 x Hr x 0.5	**0.13**

Therefore, total force due to retained soil and water =	**7.61**	kN	**3.51**	kN
and total overturning moment due to retained soil and water =	**2.76**	kN.m	**0.86**	kN.m

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CALCULATION SHEET				
	Project: 59 SOLENT ROAD, LONDON NW6		Job No.: 4580	
	Title: BASEMENT		Date: MAR/16	
	By: SM	Checked	Sheet No.: BS/8	Rev

MOMENT DUE TO RETAINED SOIL AND WATER - PARTY WALL 8

London Clay density = 18 kN/m^3 and angle of internal friction = 28 °

Hence Ka =	**0.361**	m	and Dd = dry density
Retained depth (Hr) =	**3.45**	m	Ds = saturated density
Depth of water (Hw) =	**2.75**	m	Dw = density of water
Surcharge (W) =	**1.50**	kN/m^2	

Now calculate the maximum pressures from the retained material;

	At u/s base			At top of base
Pressure due to dry soil, P1 =	**4.55**	kN/m^2	= Ka x Dd x (Hr - Hw)	**4.55**
Pressure due to dry soil surcharge, P2 =	**4.55**	kN/m^2	= Ka x Dd x (Hr - Hw)	**4.55**
Pressure due to submerged soil, P3 =	**8.13**	kN/m^2	= Ka x Ds x Hw	**7.10**
Pressure due to water, P4 =	**26.98**	kN/m^2	= Dw x Hw	**23.54**
Pressure due to surcharge, P5 =	**0.54**	kN/m^2	= Ka x W	**0.54**

Hence the forces acting on the wall due to the retained pressures are;

Force due to dry soil, F1 =	**1.59**	kN	= P1 x (Hr - Hw) x 0.5	**1.59**
Force due to dry soil surcharge, F2 =	**12.51**	kN	= P2 x Hw	**10.92**
Force due to submerged soil, F3 =	**11.18**	kN	= P3 x Hw x 0.5	**8.52**
Force due to water, F4 =	**37.09**	kN	= P4 x Hw x 0.5	**28.25**
Force due to surcharge, F5 =	**1.87**	kN	= P5 x Hr	**1.68**

and the overturning moments due to the forces acting on the wall are;

OTM due to dry soil, M1 =	**4.75**	kN.m	= F1 x (Hw + (Hr - Hw)/3)	**4.19**
OTM due to dry soil surcharge, M2 =	**17.20**	kN.m	= F2 x Hw x 0.5	**13.10**
OTM due to submerged soil, M3 =	**10.25**	kN.m	= F3 x Hw / 3	**6.81**
OTM due to water, M4 =	**34.00**	kN.m	= F4 x Hw / 3	**22.60**
OTM due to surcharge, M5 =	**3.22**	kN.m	= F5 x Hr x 0.5	**2.60**

Therefore, total force due to retained soil and water =	**64.25**	kN	**50.96**	kN
and total overturning moment due to retained soil and water =	**69.43**	kN.m	**49.31**	kN.m

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CALCULATION SHEET

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Title	BASEMENT	Date	MAR/16
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MOMENT DUE TO RETAINED SOIL AND WATER - PARTY WALLS 2, 3, 6 & 7

London Clay density = 18 kN/m^3 and angle of internal friction = 28 °

Hence Ka =	**0.361**	m	and Dd = dry density
Retained depth (Hr) =	**3.80**	m	Ds = saturated density
Depth of water (Hw) =	**2.75**	m	Dw = density of water
Surcharge (W) =	**1.50**	kN/m^2	

Now calculate the maximum pressures from the retained material:

	At u/s base			At top of base
Pressure due to dry soil, P1 =	**6.82**	kN/m^2	= Ka x Dd x (Hr - Hw)	**6.82**
Pressure due to dry soil surcharge, P2 =	**6.82**	kN/m^2	= Ka x Dd x (Hr - Hw)	**6.82**
Pressure due to submerged soil, P3 =	**8.13**	kN/m^2	= Ka x Ds x Hw	**7.10**
Pressure due to water, P4 =	**26.98**	kN/m^2	= Dw x Hw	**23.54**
Pressure due to surcharge, P5 =	**0.54**	kN/m^2	= Ka x W	**0.54**

Hence the forces acting on the wall due to the retained pressures are:

Force due to dry soil, F1 =	**3.58**	kN	= P1 x (Hr - Hw) x 0.5	**3.58**
Force due to dry soil surcharge, F2 =	**18.76**	kN	= P2 x Hw	**16.38**
Force due to submerged soil, F3 =	**11.18**	kN	= P3 x Hw x 0.5	**8.52**
Force due to water, F4 =	**37.09**	kN	= P4 x Hw x 0.5	**28.25**
Force due to surcharge, F5 =	**2.06**	kN	= P5 x Hr	**1.87**

and the overturning moments due to the forces acting on the wall are:

OTM due to dry soil, M1 =	**11.11**	kN.m	= F1 x (Hw + (Hr - Hw)/3)	**9.85**
OTM due to dry soil surcharge, M2 =	**25.80**	kN.m	= F2 x Hw x 0.5	**19.65**
OTM due to submerged soil, M3 =	**10.25**	kN.m	= F3 x Hw / 3	**6.81**
OTM due to water, M4 =	**34.00**	kN.m	= F4 x Hw / 3	**22.60**
OTM due to surcharge, M5 =	**3.91**	kN.m	= F5 x Hr x 0.5	**3.22**

Therefore, total force due to retained soil and water =	**72.68**	kN	**58.60**	kN
and total overturning moment due to retained soil and water =	**85.07**	kN.m	**62.14**	kN.m

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CALCULATION SHEET

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MOMENT DUE TO RETAINED SOIL AND WATER - PARTY WALLS 4 & 5 AND REAR WALL

London Clay density = 18 kN/m^3 and angle of internal friction = 28 °

Hence Ka =	**0.361**	m	and Dd = dry density
Retained depth (Hr) =	**3.70**	m	Ds = saturated density
Depth of water (Hw) =	**2.75**	m	Dw = density of water
Surcharge (W) =	**1.50**	kN/m^2	

Now calculate the maximum pressures from the retained material:

	At u/s base			At top of base
Pressure due to dry soil, P1 =	**6.17**	kN/m^2	= Ka x Dd x (Hr - Hw)	**6.17**
Pressure due to dry soil surcharge, P2 =	**6.17**	kN/m^2	= Ka x Dd x (Hr - Hw)	**6.17**
Pressure due to submerged soil, P3 =	**8.13**	kN/m^2	= Ka x Ds x Hw	**7.10**
Pressure due to water, P4 =	**26.98**	kN/m^2	= Dw x Hw	**23.54**
Pressure due to surcharge, P5 =	**0.54**	kN/m^2	= Ka x W	**0.54**

Hence the forces acting on the wall due to the retained pressures are:

Force due to dry soil, F1 =	**2.93**	kN	= P1 x (Hr - Hw) x 0.5	**2.93**
Force due to dry soil surcharge, F2 =	**16.98**	kN	= P2 x Hw	**14.82**
Force due to submerged soil, F3 =	**11.18**	kN	= P3 x Hw x 0.5	**8.52**
Force due to water, F4 =	**37.09**	kN	= P4 x Hw x 0.5	**28.25**
Force due to surcharge, F5 =	**2.00**	kN	= P5 x Hr	**1.81**

and the overturning moments due to the forces acting on the wall are:

OTM due to dry soil, M1 =	**8.99**	kN.m	= F1 x (Hw + (Hr - Hw)/3)	**7.97**
OTM due to dry soil surcharge, M2 =	**23.34**	kN.m	= F2 x Hw x 0.5	**17.78**
OTM due to submerged soil, M3 =	**10.25**	kN.m	= F3 x Hw / 3	**6.81**
OTM due to water, M4 =	**34.00**	kN.m	= F4 x Hw / 3	**22.60**
OTM due to surcharge, M5 =	**3.71**	kN.m	= F5 x Hr x 0.5	**3.04**

Therefore, total force due to retained soil and water =	**70.19**	kN	**56.33**	kN
and total overturning moment due to retained soil and water =	**80.30**	kN.m	**58.20**	kN.m

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CALCULATION SHEET					
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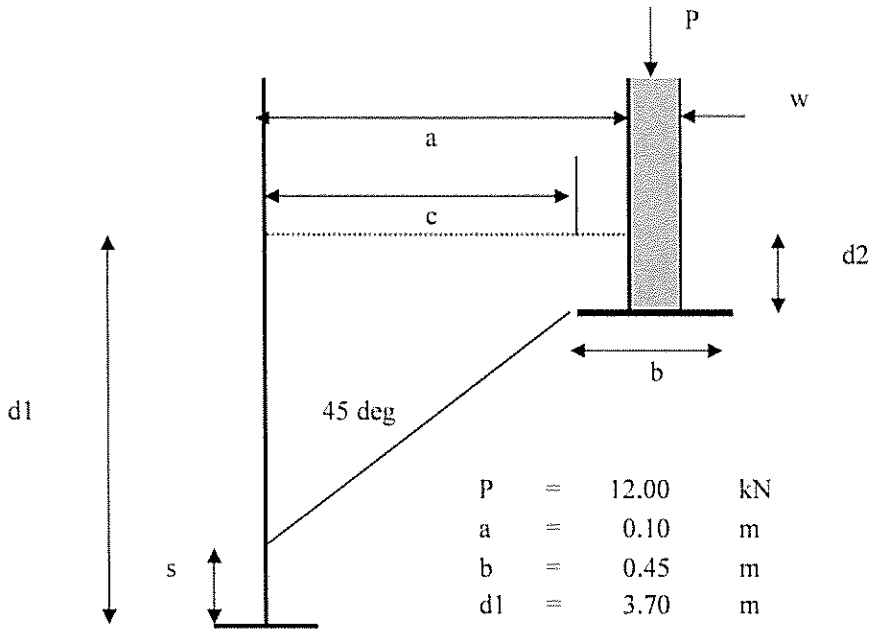
OVERTURNING MOMENTS FROM ADJACENT GARDEN WALL

PARTY WALLS 5, 6 & 7



P	=	12.00	kN
a	=	0.10	m
b	=	0.45	m
d1	=	3.70	m
d2	=	0.50	m
w	=	0.215	m
k	=	0.333	
Soil density	=	18.00	kN/m3

	U/S OF BASE		TOP OF BASE	
c = edge of adjacent footing to wall =	-0.02	m	-0.02	m
Width of load spread at strike level =	0.42	m	0.42	m
s = Height of strike above base of wall =	3.22	m	2.87	m
Vertical surcharge pressure at strike level =	28.92	kN/m2	28.92	kN/m2
Horizontal surcharge pressure at strike level =	9.64	kN/m2	9.64	kN/m2
Horizontal force =	31.01	kN	27.64	kN
Lever arm =	1.61	m	1.43	m
OTM =	49.89	kNm/m	39.63	kNm/m

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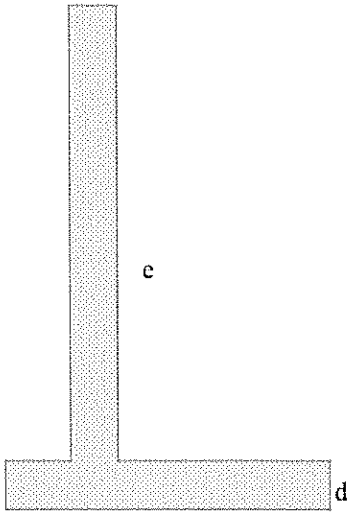
ECCENTRIC BASE DESIGN - FRONT WALL 1

Enter the following:-	Dim. a =	**0.150**	m
	Dim b =	**0.350**	m
	Dim c1 =	**0.150**	m
	Dim c2 =	**2.350**	m
	Dim c3 =	**2.800**	m
	Dim d =	**0.350**	m
	Dim e =	**2.700**	m
	OTM =	**90.20**	kN.m
	Load 1 =	**52.90**	kN/m - maximum vertical load
	Load 2 =	**36.60**	kN/m - self weight of wall

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	5.46	23.94	27.72
Lever arm stem =	0.325	2.525	2.975
Lever arm base =	0.325	1.425	1.650
Lever arm vertical load =	0.325	2.525	2.975
Restoring moment =	26.34	224.95	222.10
Applied OTM =	0.00	-90.20	-90.20
Total vertical load =	**81.04**	**99.52**	**87.00**
Net total moment =	**26.34**	**134.75**	**131.90**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.325	1.354	1.516	m
Hence, eccentricity =	0.000	0.071	0.134	m
W/A =	124.68	34.92	26.36	kN/m^2
M/Z =	0.00	5.22	6.42	kN/m^2
Hence, max. pressure =	**124.68**	**40.14**	**32.78**	**kN/m^2**
and min. pressure =	124.68	29.70	19.94	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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ECCENTRIC BASE DESIGN - PARTY WALL 1

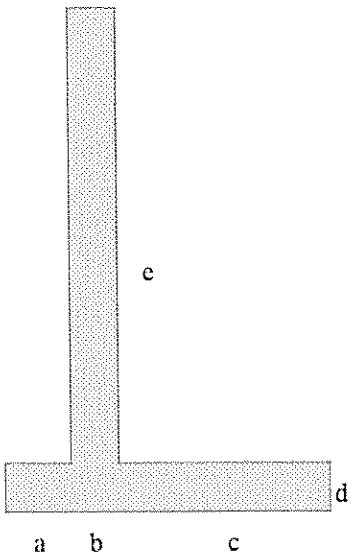
Enter the following:-			
Dim. a =	**0.200**	m	
Dim b =	**0.350**	m	
Dim c1 =	**0.200**	m	
Dim c2 =	**0.250**	m	
Dim c3 =	**0.250**	m	
Dim d =	**0.350**	m	
Dim e =	**2.700**	m	
OTM =	**2.80**	kN.m	
Load 1 =	**74.60**	kN/m	- maximum vertical load
Load 2 =	**47.60**	kN/m	- self weight of wall

Note

Case 1 = maximum load from above, no OTM

Case 2 = Case 1 with OTM added

Case 3 = self weight of wall above with OTM



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	6.30	6.72	6.72
Lever arm stem =	0.375	0.425	0.425
Lever arm base =	0.375	0.400	0.400
Lever arm vertical load =	0.375	0.425	0.425
Restoring moment =	38.84	44.03	32.56
Applied OTM =	0.00	-2.80	-2.80
Total vertical load =	**103.58**	**104.00**	**77.00**
Net total moment =	**38.84**	**41.23**	**29.76**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.375	0.396	0.386	m
Hence, eccentricity =	0.000	0.004	0.014	m
W/A =	138.11	130.00	96.25	kN/m^2
M/Z =	0.00	3.45	9.78	kN/m^2
Hence, max. pressure =	**138.11**	**133.45**	**106.03**	**kN/m^2**
and min. pressure =	138.11	126.55	86.47	kN/m^2
FoS v overturning =	**N/A**	**15.7**	**11.6**	

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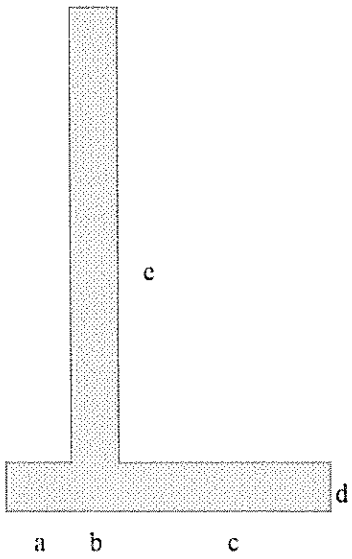
ECCENTRIC BASE DESIGN - PARTY WALL 2

Enter the following:-	Dim. a =	**0.200**	m
	Dim b =	**0.350**	m
	Dim c1 =	**0.200**	m
	Dim c2 =	**2.000**	m
	Dim c3 =	**2.600**	m
	Dim d =	**0.350**	m
	Dim e =	**2.700**	m
	OTM =	**85.10**	kN.m
	Load 1 =	**63.10**	kN/m - maximum vertical load
	Load 2 =	**39.20**	kN/m - self weight of wall

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM

Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	6.30	21.42	26.46
Lever arm stem =	0.375	2.175	2.775
Lever arm base =	0.375	1.275	1.575
Lever arm vertical load =	0.375	2.175	2.775
Restoring moment =	34.53	213.88	213.39
Applied OTM =	0.00	-85.10	-85.10
Total vertical load =	**92.08**	**107.20**	**88.34**
Net total moment =	**34.53**	**128.78**	**128.29**



	Case 1	Case 2	Case 3	
Distance to load centroid =	0.375	1.201	1.452	m
Hence, eccentricity =	0.000	0.074	0.123	m
W/A =	122.77	42.04	28.04	kN/m^2
M/Z =	0.00	7.29	6.56	kN/m^2
Hence, max. pressure =	**122.77**	**49.33**	**34.60**	**kN/m^2**
and min. pressure =	122.77	34.75	21.49	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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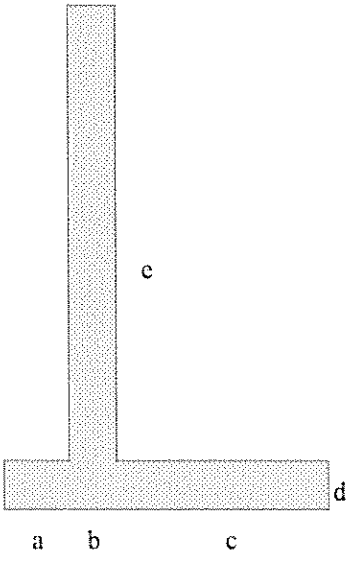
ECCENTRIC BASE DESIGN - PARTY WALLS 3 & 4 AND REAR WALL

Enter the following:-			
Dim. a =	**0.100**	m	
Dim b =	**0.350**	m	
Dim c1 =	**0.100**	m	
Dim c2 =	**2.850**	m	
Dim c3 =	**3.300**	m	
Dim d =	**0.350**	m	
Dim e =	**2.700**	m	
OTM =	**85.10**	kN.m	
Load 1 =	**31.60**	kN/m - maximum vertical load	
Load 2 =	**20.80**	kN/m - self weight of wall	

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	4.62	27.72	31.50
Lever arm stem =	0.275	3.025	3.475
Lever arm base =	0.275	1.650	1.875
Lever arm vertical load =	0.275	3.025	3.475
Restoring moment =	16.20	209.94	210.16
Applied OTM =	0.00	-85.10	-85.10
Total vertical load =	**58.90**	**82.00**	**74.98**
Net total moment =	**16.20**	**124.84**	**125.06**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.275	1.522	1.668	m
Hence, eccentricity =	0.000	0.128	0.207	m
W/A =	107.09	24.85	19.99	kN/m^2
M/Z =	0.00	5.77	6.63	kN/m^2
Hence, max. pressure =	**107.09**	**30.61**	**26.62**	**kN/m^2**
and min. pressure =	107.09	19.08	13.37	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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ECCENTRIC BASE DESIGN - PARTY WALLS 5, 6 & 7

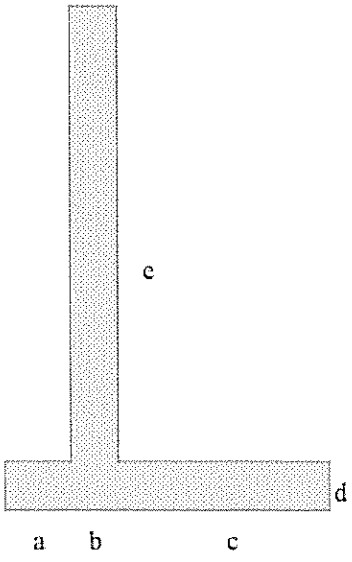
Enter the following:-			
Dim. a =	**0.100**	m	
Dim b =	**0.350**	m	
Dim c1 =	**0.100**	m	
Dim c2 =	**4.250**	m	
Dim c3 =	**4.800**	m	
Dim d =	**0.350**	m	
Dim e =	**2.700**	m	
OTM =	**135.00**	kN.m	
Load 1 =	**31.40**	kN/m - maximum vertical load	
Load 2 =	**20.80**	kN/m - self weight of wall	

Note

Case 1 = maximum load from above, no OTM

Case 2 = Case 1 with OTM added

Case 3 = self weight of wall above with OTM



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	4.62	39.48	44.10
Lever arm stem =	0.275	4.425	4.975
Lever arm base =	0.275	2.350	2.625
Lever arm vertical load =	0.275	4.425	4.975
Restoring moment =	16.14	332.08	332.08
Applied OTM =	0.00	-135.00	-135.00
Total vertical load =	**58.70**	**93.56**	**87.58**
Net total moment =	**16.14**	**197.08**	**197.08**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.275	2.106	2.250	m
Hence, eccentricity =	0.000	0.244	0.375	m
W/A =	106.73	19.91	16.68	kN/m^2
M/Z =	0.00	6.19	7.14	kN/m^2
Hence, max. pressure =	**106.73**	**26.09**	**23.83**	**kN/m^2**
and min. pressure =	106.73	13.72	9.54	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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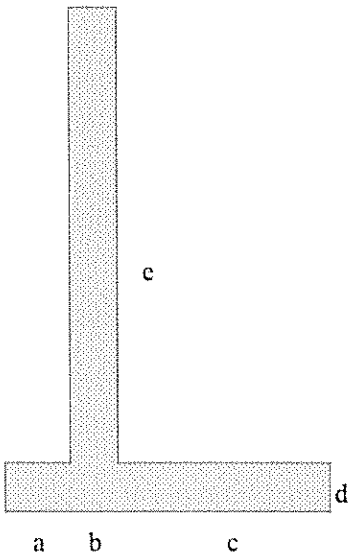
ECCENTRIC BASE DESIGN - PARTY WALL 8

Enter the following:-			
Dim. a =	0.200	m	
Dim b =	0.350	m	
Dim c1 =	0.200	m	
Dim c2 =	1.400	m	
Dim c3 =	1.900	m	
Dim d =	0.350	m	
Dim e =	2.700	m	
OTM =	69.40	kN.m	
Load 1 =	76.90	kN/m	- maximum vertical load
Load 2 =	47.60	kN/m	- self weight of wall

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM

Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	22.68	22.68	22.68
Retaining wall, base weight =	6.30	16.38	20.58
Lever arm stem =	0.375	1.575	2.075
Lever arm base =	0.375	0.975	1.225
Lever arm vertical load =	0.375	1.575	2.075
Restoring moment =	39.71	172.81	171.04
Applied OTM =	0.00	-69.40	-69.40
Total vertical load =	**105.88**	**115.96**	**90.86**
Net total moment =	**39.71**	**103.41**	**101.64**



	Case 1	Case 2	Case 3	
Distance to load centroid =	0.375	0.892	1.119	m
Hence, eccentricity =	0.000	0.083	0.106	m
W/A =	141.17	59.47	37.09	kN/m^2
M/Z =	0.00	15.23	9.66	kN/m^2
Hence, max. pressure =	**141.17**	**74.70**	**46.74**	**kN/m^2**
and min. pressure =	141.17	44.24	27.43	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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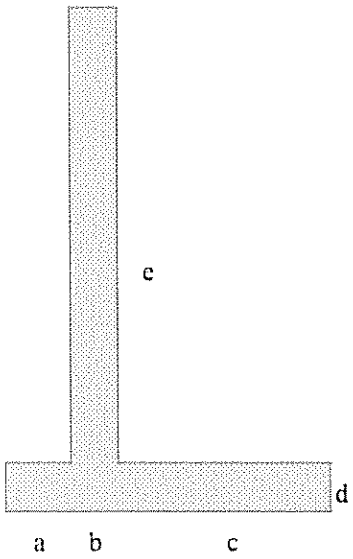
CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/18	Rev

ECCENTRIC BASE DESIGN - FRONT WALL 2 AND FLANK WALLS

Enter the following:-	Dim. a =	0.000	m
	Dim b =	0.350	m
	Dim c1 =	0.000	m
	Dim c2 =	4.400	m
	Dim c3 =	4.400	m
	Dim d =	0.350	m
	Dim e =	0.000	m
	OTM =	90.20	kN.m
	Load 1 =	29.40	kN/m - maximum vertical load
	Load 2 =	29.40	kN/m - self weight of wall

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM

Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	0.00	0.00	0.00
Retaining wall, base weight =	2.94	39.90	39.90
Lever arm stem =	0.175	4.575	4.575
Lever arm base =	0.175	2.375	2.375
Lever arm vertical load =	0.175	4.575	4.575
Restoring moment =	5.66	229.27	229.27
Applied OTM =	0.00	-90.20	-90.20
Total vertical load =	**32.34**	**69.30**	**69.30**
Net total moment =	**5.66**	**139.07**	**139.07**



	Case 1	Case 2	Case 3	
Distance to load centroid =	0.175	2.007	2.007	m
Hence, eccentricity =	0.000	0.368	0.368	m
W/A =	92.40	14.59	14.59	kN/m^2
M/Z =	0.00	6.79	6.79	kN/m^2
Hence, max. pressure =	**92.40**	**21.38**	**21.38**	**kN/m^2**
and min. pressure =	92.40	7.80	7.80	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/19	Rev

ECCENTRIC BASE DESIGN WITH COLUMN BC1 - PARTY WALLS 2 & 3

Enter the following:-

Dim. a =	**0.200**	m
Dim b =	**0.350**	m
Dim c1 =	**0.450**	m
Dim c2 =	**1.550**	m
Dim c3 =	**1.800**	m
Dim d =	**0.350**	m
Dim e =	**2.700**	m
Dim f =	**0.150**	m
OTM =	**85.10**	kN.m
Load 1 =	**47.35**	kN/m - maximum vertical load
Load 2 =	**30.00**	kN/m - self weight of wall

Note

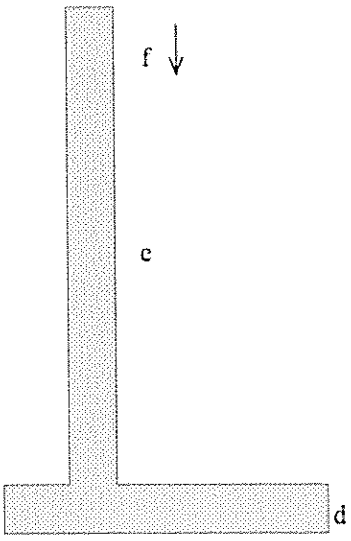
Case 1 = maximum load from above, no OTM

Case 2 = Case 1 with OTM added

Case 3 = self weight of wall above with OTM

Now enter load from pier/post = **88.30** kN

and enter o/a length of base = **1.7** m



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	38.56	38.56	38.56
Retaining wall, base weight =	14.28	29.99	33.56
Lever arm stem =	0.625	1.725	1.975
Lever arm base =	0.500	1.050	1.175
Lever arm vertical load =	0.625	1.725	1.975
Lever arm post/pier load =	0.300	1.400	1.650
Restoring moment =	108.04	360.47	362.00
Applied OTM =	0.00	-144.67	-144.67
Total vertical load =	**221.63**	**237.34**	**211.41**
Net total moment =	**108.04**	**215.80**	**217.33**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.487	0.909	1.028	m
Hence, eccentricity =	0.013	0.141	0.147	m
W/A =	130.37	66.48	52.92	kN/m^2
M/Z =	9.81	26.74	19.86	kN/m^2
Hence, max. pressure =	**140.18**	**93.22**	**72.78**	**kN/m^2**
and min. pressure =	120.56	39.75	33.05	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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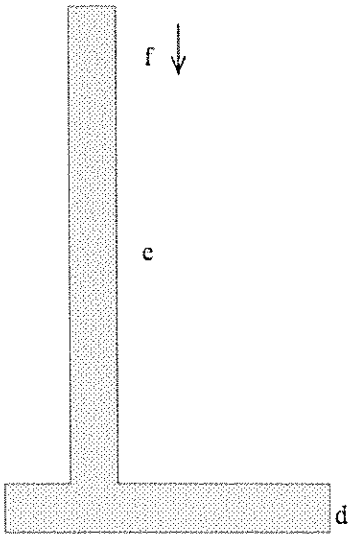
CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/20	Rev

ECCENTRIC BASE DESIGN WITH COLUMN BC2 - PARTY WALLS 6 & 7

Enter the following:-	Dim. a =	**0.100**	m
	Dim b =	**0.350**	m
	Dim c1 =	**0.450**	m
	Dim c2 =	**2.600**	m
	Dim c3 =	**2.800**	m
	Dim d =	**0.350**	m
	Dim e =	**2.700**	m
	Dim f =	**0.150**	m
	OTM =	**135.00**	kN.m
	Load 1 =	**28.50**	kN/m - maximum vertical load
	Load 2 =	**20.80**	kN/m - self weight of wall

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM

Now enter load from pier/post = **104.10** kN
and enter o/a length of base = **1.7** m



Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	38.56	38.56	38.56
Retaining wall, base weight =	12.85	43.55	46.41
Lever arm stem =	0.625	2.775	2.975
Lever arm base =	0.450	1.525	1.625
Lever arm vertical load =	0.625	2.775	2.975
Lever arm post/pier load =	0.300	2.450	2.650
Restoring moment =	91.39	562.91	571.18
Applied OTM =	0.00	-229.50	-229.50
Total vertical load =	**203.96**	**234.66**	**224.43**
Net total moment =	**91.39**	**333.41**	**341.68**

	Case 1	Case 2	Case 3	
Distance to load centroid =	0.448	1.421	1.522	m
Hence, eccentricity =	0.002	0.104	0.103	m
W/A =	133.31	45.26	40.62	kN/m^2
M/Z =	1.69	9.28	7.69	kN/m^2
Hence, max. pressure =	**135.00**	**54.53**	**48.31**	**kN/m^2**
and min. pressure =	131.61	35.98	32.93	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

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CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/21	Rev

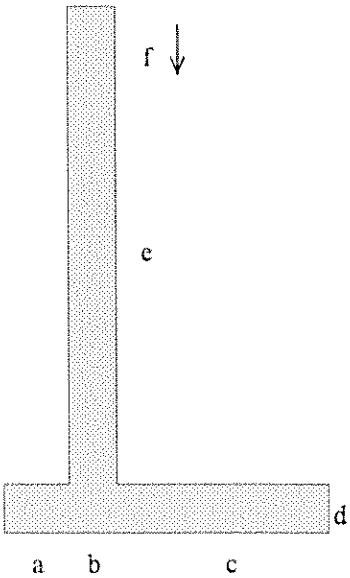
ECCENTRIC BASE DESIGN WITH COLUMN BC3 & BC4 - PARTY WALLS 7 & 8

Enter the following:-			
Dim. a =	0.100	m	
Dim b =	0.350	m	
Dim c1 =	2.150	m	
Dim c2 =	2.650	m	
Dim c3 =	2.700	m	
Dim d =	0.350	m	
Dim e =	2.700	m	
Dim f =	1.400	m	
OTM =	102.20	kN.m	
Load 1 =	51.10	kN/m - maximum vertical load	
Load 2 =	34.20	kN/m - self weight of wall	

Note
Case 1 = maximum load from above, no OTM
Case 2 = Case 1 with OTM added
Case 3 = self weight of wall above with OTM

Now enter load from pier/post = **300.80** kN
and enter o/a length of base = **1.6** m

Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	36.29	36.29	36.29
Retaining wall, base weight =	34.94	41.66	42.34
Lever arm stem =	2.325	2.825	2.875
Lever arm base =	1.300	1.550	1.575
Lever arm vertical load =	2.325	2.825	2.875
Lever arm post/pier load =	0.750	1.250	1.300
Restoring moment =	545.49	774.06	719.37
Applied OTM =	0.00	-163.52	-163.52
Total vertical load =	**453.79**	**460.51**	**434.14**
Net total moment =	**545.49**	**610.54**	**555.85**



	Case 1	Case 2	Case 3	
Distance to load centroid =	1.202	1.326	1.280	m
Hence, eccentricity =	0.098	0.224	0.295	m
W/A =	109.08	92.85	86.14	kN/m^2
M/Z =	24.65	40.29	48.35	kN/m^2
Hence, max. pressure =	**133.74**	**133.13**	**134.49**	**kN/m^2**
and min. pressure =	84.43	52.56	37.79	kN/m^2
FoS v overturning =	**N/A**	**4.7**	**4.4**	

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CALCULATION SHEET	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580	
	Title	BASEMENT		Date	MAR/16	
	By	SM	Checked	Sheet No.	BS/22	Rev

ECCENTRIC BASE DESIGN WITH COLUMN BC7 - FRONT WALL 2

Enter the following:-			
Dim. a =	0.000	m	
Dim b =	0.350	m	
Dim c1 =	1.350	m	
Dim c2 =	3.100	m	
Dim c3 =	3.100	m	
Dim d =	0.350	m	
Dim e =	0.000	m	
Dim f =	0.850	m	
OTM =	90.20	kN.m	
Load 1 =	29.40	kN/m - maximum vertical load	
Load 2 =	29.40	kN/m - self weight of wall	

Note

Case 1 = maximum load from above, no OTM

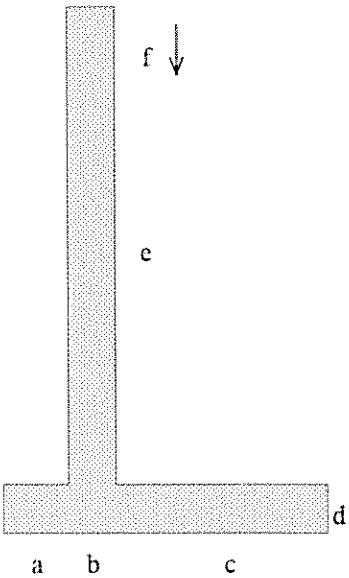
Case 2 = Case 1 with OTM added

Case 3 = self weight of wall above with OTM

Now enter load from pier/post = **31.20** kN

and enter o/a length of base = **0.9** m

Take moments about the toe	Case 1	Case 2	Case 3
Retaining wall, stem weight =	0.00	0.00	0.00
Retaining wall, base weight =	12.85	26.08	26.08
Lever arm stem =	1.525	3.275	3.275
Lever arm base =	0.850	1.725	1.725
Lever arm vertical load =	1.525	3.275	3.275
Lever arm post/pier load =	0.500	2.250	2.250
Restoring moment =	66.88	201.85	201.85
Applied OTM =	0.00	-81.18	-81.18
Total vertical load =	**70.51**	**83.74**	**83.74**
Net total moment =	**66.88**	**120.67**	**120.67**



	Case 1	Case 2	Case 3	
Distance to load centroid =	0.948	1.441	1.441	m
Hence, eccentricity =	-0.098	0.284	0.284	m
W/A =	46.09	26.97	26.97	kN/m^2
M/Z =	-16.01	13.32	13.32	kN/m^2
Hence, max. pressure =	**30.08**	**40.29**	**40.29**	**kN/m^2**
and min. pressure =	62.10	13.65	13.65	kN/m^2
FoS v overturning =	**N/A**	**2.5**	**2.5**	

SECOND FLOOR, UNIT 5
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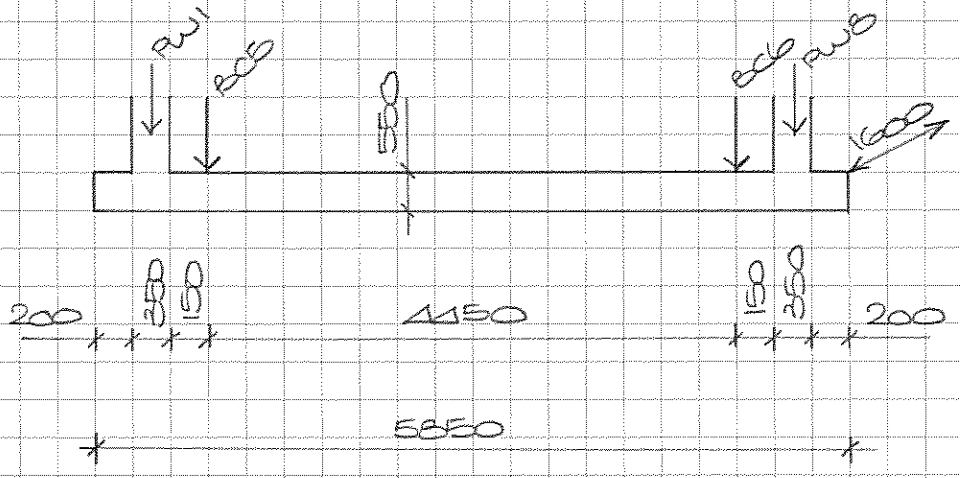
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

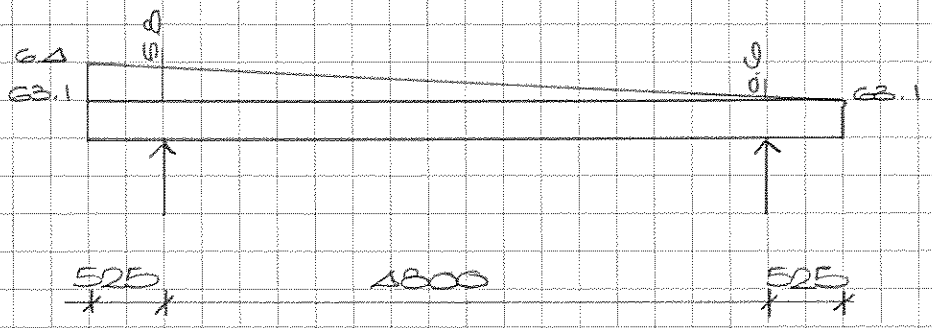
PROJECT	59 SOLENT ROAD, NW6	JOB NO.	4580
CALCULATION SHEET	TITLE BASEMENT	DATE	MAR/16
	BY SM / CHECKED	SHEET NO.	BS/23

COMBINED FOUNDATION C/S BC5 + BC6



PW1 = 74.6 kN/M BC5 = 125.6 kN

PW8 = 76.9 kN/M BC6 = 128.7 kN.



FROM PAGES BS/25-26

MAX. SPAN MOMENT (TOP) = 171.6 kN M (25A ULT.)

CANT. MOMENT (BOTT) = 9.6 kN M (1A ULT.)

SHEAR = 161.4 kN (235 ULT.)

FROM PAGES BS/27-28, PROV. 7H16 TOP/M WIDTH AND 7H12 BOTTOM + H10 LINKS AT 300 CTS (MIN. 4 LEGS).

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CALCULATION SHEET					
	Project	59 SOLENT ROAD, LONDON NW6		Job No.	4580
	Title	BASEMENT		Date	MAY/16
	By	SM	Checked	Sheet No.	BS/24 Rev

LOCATION OF LOAD CENTROID

COMBINED FOUNDATION FOR COLUMNS BC5 & BC6

Enter Foundation Dimensions Length = **5.85** Width = **1.60** Depth = **0.55**

DESCRIPTION	Load	LA x-x	Moment x	Load	LA y-y	Moment y
Party Wall 1	119.36	0.375	44.760	119.36	0.800	95.488
Column BC5	125.60	0.700	42.340	125.60	0.800	100.480
Column BC6	128.70	5.150	662.805	128.70	0.800	102.960
Party Wall 8	123.04	5.475	673.644	123.04	0.800	98.432
Foundation self weight	123.55	2.925	361.390	123.55	0.800	98.842
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	0.00	0.000	0.000	0.00	0.000	0.000
	620.25		**1784.939**	**620.25**		**496.202**

Origin to centroid x-x = **2.878** m
Origin to centroid y-y = **0.800** m

Hence Eccentricity x-x = **0.047** m **and Ey-y =** **0.000** m

Now Moment about x-x = **29.30** kN.m **and My-y =** **0.00** kN.m

Basic Pressures (kN/m²) **W/A =** **66.27** **Mx-x =** **3.21** **My-y =** **0.00**

Max. Pressure under Base = **69.48** kN/m²

Min. Pressure under Base = **63.06** kN/m²

```
* LOCATION: COMBINED FOUNDATION FOR COLUMNS BC5 & BC6
*
* 3 SPAN CONTINUOUS BEAM
* ----------------------
*
* All units are kN & m and combinations thereof.
* Left hand end span is a cantilever.
* Right hand end span is a cantilever.
* Member numbers are in brackets, other numbers are joint numbers.
*
* ╪═══════╪═══════╪═══════╪
* 1   (1)   2   (2)   3   (3)   4
*
* The effects of positive results for forces acting on the ends of
* spans are depicted below.  THINK OF THE JOINTS AS APPLYING FORCES
* TO THE BEAM SPAN ENDS.
*
*       Positive | SHEAR          Positive | SHEAR
*                |                       |
*                |  start          end   |
*                |                       |
*                |-> Positive MOMENT     |-> Positive MOMENT
TABULATE DISPLACEMENTS, FORCES, REACTIONS
PRINT DATA, RESULTS FROM BS/25
TYPE PLANE FRAME
METHOD ELASTIC
NUMBER OF JOINTS 4
NUMBER OF MEMBERS 3
NUMBER OF SUPPORTS 2
NUMBER OF SEGMENTS 5 TRACE
NUMBER OF LOADINGS 1
JOINT COORDINATES
1 0 0
2 0.525 0 SUPPORT
3 5.325 0 SUPPORT
4 5.85 0
JOINT RELEASES
2 THRU 3 MOMENT Z
3 FORCE X
MEMBER INCIDENCES
1 THRU 3 RANGE 1 2 3 4
CONSTANTS E 28E6 ALL G 11.2E6 ALL
MEMBER PROPERTIES
1  RECTANGLE DY 0.55 DZ 1
2  RECTANGLE DY 0.55 DZ 1
3  RECTANGLE DY 0.55 DZ 1
LOADING CASE 1: UNFACTORED DEAD & LIVE ON ALL SPANS
MEMBER LOADS
1 FORCE Y UNIFORM W -63.1
1 FORCE Y LINEAR WA -6.4 WB -5.8 LA 0 LB 0.525
2 FORCE Y UNIFORM W -63.1
2 FORCE Y LINEAR WA -5.8 WB -0.6 LA 0 LB 4.8
3 FORCE Y UNIFORM W -63.1
3 FORCE Y LINEAR WA -0.6 WB 0 LA 0 LB 0.525
SOLVE
```

LOADING CASE 1: UNFACTORED DEAD & LIVE ON ALL SPANS
JOINT DISPLACEMENTS

JOINT	X DISPLACEMENT	Y DISPLACEMENT	Z ROTATION
1	0.000000000	0.000380565	-0.000727352
2	0.000000000	0.000000000	-0.000731660
3	0.000000000	0.000000000	0.000729316
4	0.000000000	0.000379644	0.000725387
5	0.000000000	0.000304267	-0.000727386
6	0.000000000	0.000228105	-0.000727628
7	0.000000000	0.000152046	-0.000728283
8	0.000000000	0.000076037	-0.000729559
9	0.000000000	-0.000682722	-0.000589802
10	0.000000000	-0.001095527	-0.000220491
11	0.000000000	-0.001094102	0.000222804
12	0.000000000	-0.000680327	0.000588983
13	0.000000000	0.000075858	0.000727398
14	0.000000000	0.000151692	0.000726235
15	0.000000000	0.000227571	0.000725638
16	0.000000000	0.000303546	0.000725418

LOADING CASE 1: UNFACTORED DEAD & LIVE ON ALL SPANS
MEMBER FORCES AT START OF FIRST SEGMENT AND ENDS OF ALL SEGMENTS

MEMBER	JOINT	AXIAL FORCE	SHEAR FORCE	BENDING MOMENT
1	1	0.0000	0.0000	0.0000
	5	0.0000	7.2912	-0.3829
	6	0.0000	14.5698	-1.5307
	7	0.0000	21.8358	-3.4421
	8	0.0000	29.0892	-6.1158
	2	0.0000	36.3300	-9.5504
2	2	0.0000	161.3723	9.5504
	9	0.0000	-95.7275	113.7776
	10	0.0000	-31.0811	174.5658
	11	0.0000	32.5669	173.7727
	12	0.0000	95.2165	112.3568
	3	0.0000	156.8677	-8.7235
3	3	0.0000	33.2850	8.7235
	13	0.0000	-26.6028	-5.5795
	14	0.0000	-19.9332	-3.1365
	15	0.0000	-13.2762	-1.3931
	16	0.0000	-6.6318	-0.3481
	4	0.0000	0.0000	0.0000

LOADING CASE 1: UNFACTORED DEAD & LIVE ON ALL SPANS
SUPPORT REACTIONS

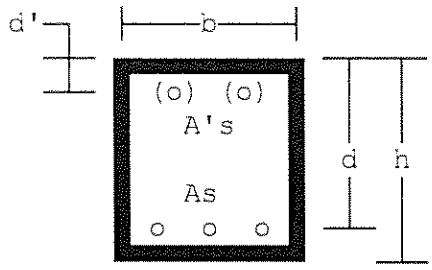
JOINT	X FORCE	Y FORCE	Z MOMENT
2	0.0000	197.7023	0.0000
3	0.0000	190.1527	0.0000

EQUILIBRIUM CHECK	SUM OF FORCES	REACTION
FORCES IN DIRECTION X	0.0000	0.0000
FORCES IN DIRECTION Y	-387.8550	387.8550
MOMENTS ABOUT AXIS Z	-1116.3570	1116.3570

Location: COMBINED FOUNDATION TO COLUMNS BC5 & BC6

Bending in rectangular beams with optional calculations for shear, lap lengths, bar curtailment and limiting span/effective-depth ratio

Calculations are based on formulae in Clause 3.4.4.4 of BS8110: Part 1 and thus assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to 0.5*d.



Design to BS8110(1997) with partial safety factor for steel gammaS=1.15
Moment before redistribution Mbef=254 kNm
Beam being analysed is considered as non-continuous.
Characteristic concrete strength fcu=35 N/mm2
Max.aggregate size (for bar spc) hagg=15 mm
Char.strength of long'l bars fy=500 N/mm2
Longitudinal reinforcement is high-yield steel.
Diameter of tension bars dia=16 mm
Diameter of link legs dial=10 mm
Char.strength of link steel fyv=500 N/mm2
High-yield steel shear reinforcement.
Nominal concrete cover cover=40 mm
Overall depth of section h=550 mm
Effective depth of section d=492 mm
Breadth of section b=1000 mm

Longitudinal reinforcement

Tension steel provided per=100*Aspr/(b*h)
=0.25336 % of gross section.

TENSION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	16 mm
	Number of bars	7
	arranged in a single layer	
	Cover to all steel	40 mm
	Area of steel required	1249.9 mm2
	Area of steel provided	1407.4 mm2
	Percentage provided	0.25336 %
	Weight of steel provided	11.048 kg/m
	Max.permissible spacing	158 mm
	Link size assumed	10 mm

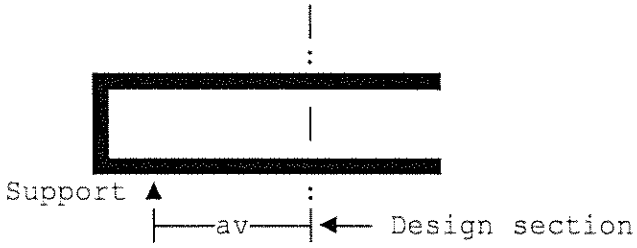
Check on span/effective-depth ratio

Basic ratio for simp.-sup.beam bs'd=20 see Table 3.9
As applied-moment factor M'bd2=M*1000*1000/(b*d^2)
=1.0389 N/mm^2

Mod.factor for tension steel from
equation 7 (Table 3.10) modf1=0.55+(477-fs)/(120*(.9+M'bd2))=1.3278
Number of comp.bars provided nbarc=7
Diameter of compression bars diac=12 mm
Area of comp.steel provided As'pr=791.68 mm^2
Percentage of compression steel per'n=100*As'pr/(b*d)=0.15932 %
From Equation 9 of BS8110, with percentage of comp.steel=0.15932 %,
Mod.factor for compression steel modf2=1+per'n/(3+per'n)=1.0504
Maximum permissible
span/effective-depth ratio ps'd=bs'd*modf1*modf2=27.896
Span of beam (see Cls.3.4.1.2-4) span=4.45 m
Actual span/effective-depth ratio as'd=1000*span/d=9.0447
As this does not exceed 27.896, this is Acceptable.

Shear reinforcement

Shear calculations are in
accordance with Clauses 3.4.5
of Code



Location for shear calculation: AT SUPPORT
Effective breadth for shear bv=1000 mm
Shear force due to ultimate load V=235 kN
Distance from support av=246 mm
No.of tension bars effective at section nbars=7
Design shear stress in concrete vc=0.79*pcnt^(1/3)*f00d^.25/1.25
=0.41643 N/mm^2
As bv exceeds 350 mm note the conditions in Clause 3.4.5.5:
i) that no longitudinal bar should be more than 150 mm from a vertical leg, and
ii) (because bv exceeds d), that the transverse spacing of the legs must not exceed the effective depth d (i.e. 492 mm).
Number of legs to be provided nlegs=4
Chosen link spacing sv'=300 mm

Use 10 mm links (4 legs), spaced at 300 mm ctrs.along beam.

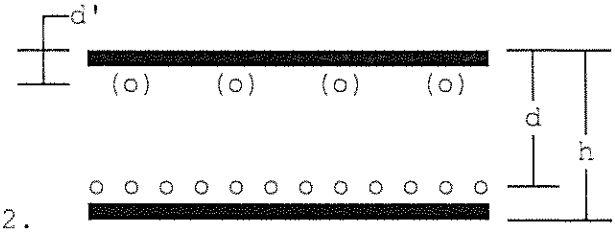
When detailing steel, watch carefully the requirements of Cl.3.4.5.5.

SHEAR REINFORCEMENT SUMMARY		
	Characteristic strength	500 N/mm^2
	Diameter of links	10 mm
	Number of legs	4
	Spacing	300 mm
	Approx.weight of links	10.131 kg/m

Location: UNDERPINNING - CHARACTERISITC MOMENT < 101.8 kN.m

Bending in solid slabs (with comp.steel if reqd.), designed per metre width, with checks on minimum steel and span/effective-depth ratio

Calculations are based on formulae in Clause 3.4.4.4 of BS8110: Part 1 and thus assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to d/2.



Design to BS8110(1997) with partial safety factor for steel gammaS=1.15
Moment before redistribution Mbef=1.4*101.8
=142.52 kNm per metre width
Slab containing section being analysed is considered as non-continuous.
Characteristic concrete strength fcu=35 N/mm2
Characteristic steel strength fy=500 N/mm2
Longitudinal reinforcement is high-yield steel.
Diameter of tension bars dia=20 mm
Nominal concrete cover cover=75 mm
Overall thickness of slab h=375 mm
Effective depth of section d=290 mm
Area of tension steel required As=M*10^6/(z*fy/gammaS)
=1198.7 mm2/metre width.
Chosen spacing of tension bars pch=200 mm
Diameter of distribution bars diamn=10 mm
Spacing of distribution bars pchDA=150 mm

TENSION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	20 mm
	Spacing of bars	200 mm
	Effective depth	290 mm
	Area of steel required	1198.7 mm2/m
	Area of steel provided	1570 mm2/m
	Percentage provided	0.41867 %
	Weight of steel provided	12.32 kg/m2
DISTRIBUTION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	10 mm
	Spacing of bars	150 mm
	Depth to bar centres	275 mm
	Area of steel required	487.5 mm2/m
	Area of steel provided	523 mm2/m
	Percentage provided	0.13947 %
	Weight of steel provided	4.11 kg/m2

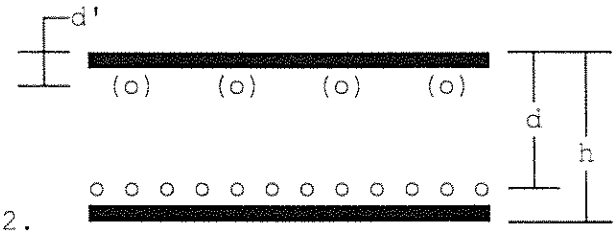
Check on span/effective-depth ratio

Basic ratio for cantilever slab	bs'd=7 (see Table 3.9)
Mod.factor for tension steel	modf1=1.2646
Diameter of compression bars	diac=16 mm
Spacing of comp.bars provided	pchCA=200
Compression steel provided	As'pr=1000/pchCA*PI*diac^2/4 =1005.3 mm^2 per m
Percentage of compression steel	per'=100*As'pr/(1000*d)=0.34666 %
From Equation 9 of BS8110, with percentage of comp.steel=0.34666 %,	
Mod.factor for compression steel	modf2=1+per'/(3+per')=1.1036
Maximum permissible span/effective-depth ratio	ps'd=bs'd*modf1*modf2=9.7691
Effective span of slab	span=2.75 m
True span/effective-depth ratio	as'd=1000*span/d=9.4828
As this does not exceed	9.7691, this is Acceptable.

Location: UNDERPINNING - CHARACTERISITC MOMENT < 66.4 kN.m

Bending in solid slabs (with comp.steel if reqd.), designed per metre width, with checks on minimum steel and span/effective-depth ratio

Calculations are based on formulae in Clause 3.4.4.4 of BS8110: Part 1 and thus assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to d/2.



Design to BS8110(1997) with partial safety factor for steel gammaS=1.15

Moment before redistribution	Mbef=1.4*66.4 =92.96 kNm per metre width
Slab containing section being analysed is considered as non-continuous.	
Characteristic concrete strength	fcu=35 N/mm2
Characteristic steel strength	fy=500 N/mm2
Longitudinal reinforcement is high-yield steel.	
Diameter of tension bars	dia=12 mm
Nominal concrete cover	cover=75 mm
Overall thickness of slab	h=350 mm
Effective depth of section	d=269 mm
Area of tension steel required	As=M*10^6/(z*fy/gammaS) =836.66 mm2/metre width.
Chosen spacing of tension bars	pch=100 mm
Diameter of distribution bars	diamn=8 mm
Spacing of distribution bars	pchDA=100 mm

TENSION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	12 mm
	Spacing of bars	100 mm
	Effective depth	269 mm
	Area of steel required	836.66 mm2/m
	Area of steel provided	1130 mm2/m
	Percentage provided	0.32286 %
	Weight of steel provided	8.87 kg/m2

DISTRIBUTION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	8 mm
	Spacing of bars	100 mm
	Depth to bar centres	259 mm
	Area of steel required	455 mm2/m
	Area of steel provided	502 mm2/m
	Percentage provided	0.14343 %
	Weight of steel provided	3.94 kg/m2

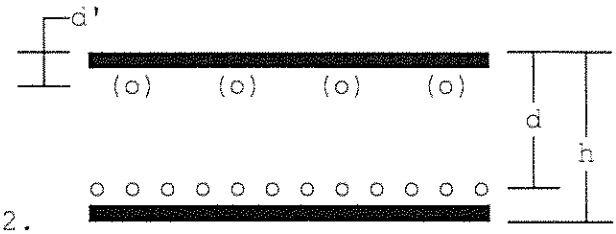
Check on span/effective-depth ratio

Basic ratio for cantilever slab	bs'd=7 (see Table 3.9)
Mod.factor for tension steel	modf1=1.4281
Diameter of compression bars	diac=12 mm
Spacing of comp.bars provided	pchCA=100
Compression steel provided	As'pr=1000/pchCA*PI*diac^2/4 =1131 mm^2 per m
Percentage of compression steel	per'=100*As'pr/(1000*d)=0.42044 %
From Equation 9 of BS8110, with percentage of comp.steel=0.42044 %,	
Mod.factor for compression steel	modf2=1+per'/(3+per')=1.1229
Maximum permissible span/effective-depth ratio	ps'd=bs'd*modf1*modf2=11.225
Effective span of slab	span=2.75 m
True span/effective-depth ratio	as'd=1000*span/d=10.223
As this does not exceed	11.225, this is Acceptable.

Location: UNDERPINNING - CHARACTERISITC MOMENT < 49.3 kN.m

Bending in solid slabs (with comp.steel if reqd.), designed per metre width, with checks on minimum steel and span/effective-depth ratio

Calculations are based on formulae in Clause 3.4.4.4 of BS8110: Part 1 and thus assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to d/2.



Design to BS8110(1997) with partial safety factor for steel gammaS=1.15
Moment before redistribution Mbef=1.4*49.3
=69.02 kNm per metre width
Slab containing section being analysed is considered as non-continuous.
Characteristic concrete strength fcu=35 N/mm2
Characteristic steel strength fy=500 N/mm2
Longitudinal reinforcement is high-yield steel.
Diameter of tension bars dia=10 mm
Nominal concrete cover cover=75 mm
Overall thickness of slab h=350 mm
Effective depth of section d=270 mm
Area of tension steel required As=M*10^6/(z*fy/gammaS)
=618.89 mm2/metre width.
Chosen spacing of tension bars pch=100 mm
Diameter of distribution bars diamn=10 mm
Spacing of distribution bars pchDA=100 mm

TENSION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	10 mm
	Spacing of bars	100 mm
	Effective depth	270 mm
	Area of steel required	618.89 mm2/m
	Area of steel provided	785 mm2/m
	Percentage provided	0.22429 %
	Weight of steel provided	6.16 kg/m2
DISTRIBUTION REINFORCEMENT SUMMARY	Characteristic strength	500 N/mm2
	Diameter of bars	10 mm
	Spacing of bars	100 mm
	Depth to bar centres	260 mm
	Area of steel required	455 mm2/m
	Area of steel provided	785 mm2/m
	Percentage provided	0.22429 %
	Weight of steel provided	6.16 kg/m2

Check on span/effective-depth ratio

Basic ratio for cantilever slab	bs'd=7 (see Table 3.9)
Mod.factor for tension steel	modf1=1.5166
Diameter of compression bars	diac=10 mm
Spacing of comp.bars provided	pchCA=100
Compression steel provided	As'pr=1000/pchCA*PI*diac^2/4 =785.4 mm^2 per m
Percentage of compression steel	per'=100*As'pr/(1000*d)=0.29089 %
From Equation 9 of BS8110, with percentage of comp.steel=0.29089 %,	
Mod.factor for compression steel	modf2=1+per'/(3+per')=1.0884
Maximum permissible span/effective-depth ratio	ps'd=bs'd*modf1*modf2=11.554
Effective span of slab	span=2.75 m
True span/effective-depth ratio	as'd=1000*span/d=10.185
As this does not exceed	11.554, this is Acceptable.