AXIOM
STRUCTURES

85 CAMDEN MEWS,
LONDON NW1

STRUCTURAL CALCULATIONS

PART C

NEW BASEMENT STRUCTURE

Notes:

- Basement Walls design
- Refer to part B for ground floor beams and frames
- Refer to part A for load run down to foundations

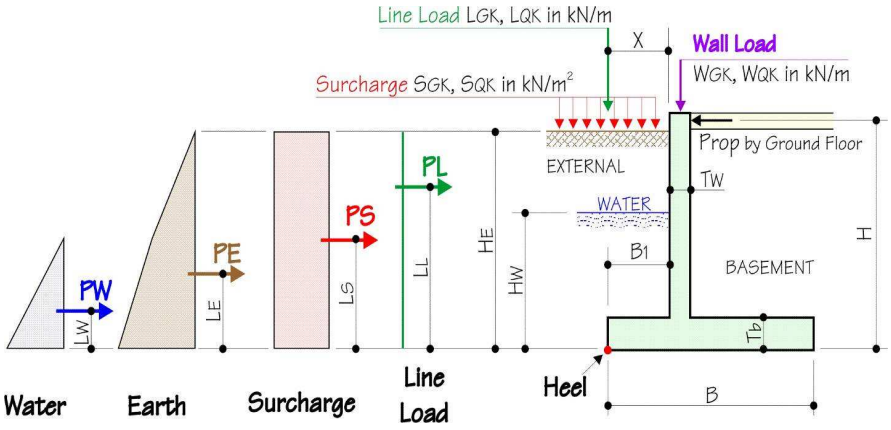
- Basement walls are designed generally as cantilevered but inner reinforcement is enhanced to one required as for propped by ground floor beams also for Temporary case.

Job Number: 15005
Date issue: December 2018
Prepared by: KK / AP

Project	85 Camden Mews		Axiom Structures
Client	Private		
Location	Party Wall 83/85		
	Basement wall design to BS8110:2005		
	Originated from 'RCC61 Basement Wall.xls' v4.0	© 2006 TCC	

Made by	Date	Page
KL	30-Nov-2018	
Checked	Revision	Job No
AP	-	15005

IDEALISED STRUCTURE and FORCE DIAGRAMS — DESIGN STATUS : VALID



DIMENSION (mm)

H =	3500	B =	1850	Tw =	350
Hw =	2500	Bl =	0	Tb =	300
He =	3500				

Wall Geometry

MATERIAL PROPERTIES — steel class A

fcu =	30	N/mm²	γm =	1.50	concrete
fy =	500	N/mm²	γm =	1.15	steel
Cover to tension reinforcement (co) =				50	mm
Max. allowable design surface crack width (W) =				0.3	mm (0.2 or 0.3 mm only)
Concrete density =				24.0	kN/m3

SOIL PROPERTIES

Design angle of int'l friction of retained mat'l (Ø) =	25	degree	
Design cohesion of retained mat'l (C) =	0	kN/m2	(Only granular backfill considered, ie "C" = 0)
Density of retained mat'l (q) =	20	kN/m3	
Submerged Density of retained mat'l (qs) =	13.33	kN/m3	(default=2/3 of q), only apply when Hw >0
Design angle of int'l friction of base mat'l (Øb) =	20	degree	= 13.33
Design cohesion of base mat'l (Cb) =	0	kN/m2	ASSUMPTIONS
Density of base mat'l (qb) =	10	kN/m3	a) Wall friction is zero
Allowable gross ground bearing pressure (GBP) =	150	kN/m2	b) Minimum active earth pressure = 0.25qH
LOADINGS (unfactored)			c) Granular backfill
Surcharge load -- live (SQK) =	5	kN/m2	h) Design not intended for walls over 3.5 m high
Surcharge load -- dead (SGK) =	0	kN/m2	i)Does **not** include check for temp or shrinkage
Line load -- live (LQK) =	7	kN/m	
Line load -- dead (LGK) =	37	kN/m	
Distance of line load from wall (X) =	200	mm	
Wall load -- live (WQK) =	5	kN/m	
Wall load -- Dead (WGK) =	35	kN/m	

LATERAL FORCES

Ko =	0.58	default Ko = (1-SIN Ø)	0.58
Kac =	1.52	= $2Ko^{0.5}$	

Force (kN)		Lever arm (m)		γ_f	Ultimate Force (kN)
PE =	58.69	LE =	1.235	1.20	70.43
PS(GK) =	0.00	LS =	1.75	1.40	0.00
PS(QK) =	10.10	LS =	1.75	1.60	16.17
PL(GK) =	21.36	LL =	3.33	1.40	29.91
PL(QK) =	4.04	LL =	3.33	1.60	6.47
PW =	31.25	LW =	0.83	1.20	37.50
Total	125.45				160.47

Project	85 Camden Mews	Axiom Structures		
Client	Private	Made by	Date	Page
Location	Party Wall 83/85	KL	30-Nov-2018	
	Basement wall design to BS8110:2005	Checked	Revision	Job No
	Originated from 'RCC61 Basement Wall.xls' v4.0 © 2006 TCC	AP	-	15005

mpa The Concrete Centre

EXTERNAL STABILITY

STABILITY CHECK : OK

ANALYSIS - Assumptions & Notes

1) Wall idealised as a propped cantilever (i.e. pinned at top and fixed at base)
2) Wall is braced.
3) Maximum slenderness of wall is limited to 15, i.e [0.9*(He-Tb/2)/Tw < 15]
4) Maximum Ultimate axial load on wall is limited to 0.1fcu times the wall cross-sectional area
5) Design Span (Effective wall height) = He - (Tb/2)
6) -ve moment is hogging (i.e. tension at external face of wall)
   +ve moment is sagging (i.e. tension at internal face of wall)
7) " Wall MT. " is maximum +ve moment on the wall.
8) Estimated lateral deflections are used for checking the **PΔ** effect .

UNFACTORED LOADS AND FORCES

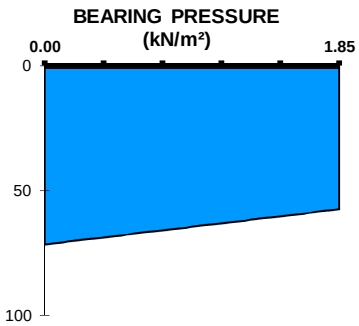
Lateral Force	Force (kN)	Lever arm to base (m)	Base MT. (kNm)	Wall MT. (kNm)	Reaction at Base (kN)	Reaction at Top (kN)	Estimated Elastic Deflection Δ (mm)
PE =	54.16	1.18	-24.38	12.32	42.33	11.83	0.3
PS(GK) =	0.00	1.68	0.00	#DIV/0!	0.00	0.00	0.0
PS(QK) =	9.67	1.68	-4.05	2.28	6.04	3.63	0.0
PL(GK) =	21.36	3.18	-1.79	3.32	1.60	19.76	0.0
PL(QK) =	4.04	3.18	-0.34	0.63	0.30	3.74	0.0
PW =	27.61	0.78	-11.85	4.41	24.69	2.92	0.1
Total	116.85		-42.40	#DIV/0!	74.97	41.88	0.4

GROUND BEARING FAILURE

LOAD CASE: Wall Load **MIN**
Surcharge **MAX**

Taking moments about centre of base (anticlockwise "+")

Vertical FORCES (kN)		Lever arm (m)	Moment (kNm)
Wall load =	35	0.75	26.24999965
Wall (sw) =	26.88	0.75	20.16
Base =	13.32	0.00	0.00
Earth =	0.00	0.92	0.00
Water =	0.00	0.92	0.00
Surcharge =	0.00	0.92	0.00
Line load =	44.00	0.00	0.00
∑ V =	119.20		∑ Mv = 46.41



MOMENT due to LATERAL FORCES, Mo = -42.40 kNm

RESULTANT MOMENT, M = Mv + Mo = 4.01 kNm

ECCENTRICITY FROM BASE CENTRE, M / V = 0.03 m

MAXIMUM GROSS BEARING PRESSURE = 71.46 kN/m^2 < 150 OK

SLIDING AT BASE (using overall factor of safety instead of partial safety fa F.O.S = 1.50

SUM of LATERAL FORCES, **P** = 74.97 kN

BASE FRICTION, $\mathbf{F_b}$ = - (**V** TANØb + B.Cb) = -43.39 kN

Factor of Safety, F_b / P = 0.58 < 1.50 FAIL .. but

therefore, LATERAL RESISTANCE to be provided by BASEMENT SLAB = 69.07 kN

Project	85 Camden Mews	Axiom Structures		
Client	Private	Made by: KL	Date: 30-Nov-2018	Page:
Location	Party Wall 83/85	Checked: AP	Revision: -	Job No: 15005

Basement wall design to BS8110:2005

Originated from 'RCC61 Basement Wall.xls' v4.0

STRUCTURAL DESIGNS (ultimate)

DESIGN CHECKS : OK

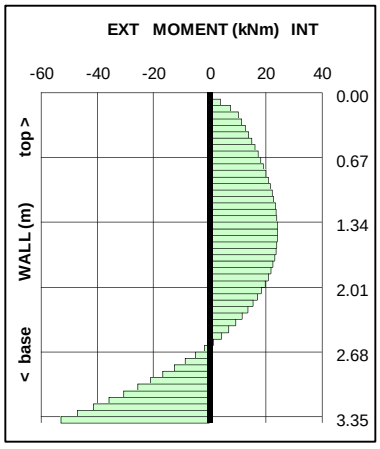
BS8110 reference

WALL (per metre length)

AXIAL LOAD CAPACITY (Limited to 0.1fcu) = 1050.00 kN > 57 OK 3.4.4.1

Lateral Force	Force (kN)	γ_f	Ultimate Force (kN)	Ult. Moment at base (kNm)	Ult. Shear at base (kN)	Ult. Shear at top (kN)
PE =	54.16	1.20	65.00	-29.26	50.79	14.20
PS(GK) =	0.00	1.40	0.00	0.00	0.00	0.00
PS(QK) =	9.67	1.60	15.47	-6.48	9.67	5.80
PL(GK) =	21.36	1.40	29.91	-2.50	2.25	27.66
PL(QK) =	4.04	1.60	6.47	-0.54	0.49	5.98
PW =	27.61	1.20	33.14	-14.22	29.63	3.50
Total	116.85		149.98	-53.00	92.83	57.15

Design Bending Moments



On INTERNAL face due to lateral forces, M_{int} =	24.25	kNm
On EXTERNAL face due to lateral forces, M_{ext} =	-53.00	kNm
Eccentricity of Axial Loads =	125	mm
LATERAL DEFLECTION " Δ " =	0.4	mm
Due to eccentricity of axial loads, M_{ecc} =	7.1	kNm
Due to **PΔ** effect, M_p =	0.02	kNm
Total Mmt on INTERNAL face (M_{int}+0.5M_{ecc}+M_p) =	27.8	kNm
Total Mmt on EXTERNAL face (M_{ext}+0.5M_{ecc}) =	-56.6	kNm

		EXTERNAL FACE		INTERNAL FACE				
WALL REINFORCEMENT :	Min. As =	455		455		mm^2		Table 3.25
	ϕ =	16		12		mm		
	centres =	200	< 766	200	< 762	mm	OK	3.12.11.2.7(b)
	As =	1005	> 455	565	> 455	mm^2	OK	
MOMENT of RESISTANCE :	d =	292		294		mm		
	z =	276		279		mm		3.4.4.4
	As' =	0		0		mm^2		3.4.4.4
	M_{res} =	120.5	> 56.56	68.7	> 27.83	kNm	OK	

		BASE of WALL		TOP of WALL				
SHEAR RESISTANCE:	As =	1005	ϕ =	12	@200 mm	566	mm^2/m	
	100As/bd =	0.34%	=	0.19%				
	vc =	0.51		0.42		N/mm^2		Table 3.8
	V_{res} =	148.7	> 92.83	123.1	> 57.15	kN	OK	3.5.5.2

ACK WIDTH to BS8100/8007	X =	82.72	mm	ε_m =	0.00045			BS8007
Temp & shrinkage effects not included	Acr =	107.60	mm	**W =**	0.10	< 0.30 mm	OK	App. B.2

REINFORCEMENT SUMMARY for WALL

	Type	ϕ mm	centres mm	As mm^2	Min. As mm^2	
INTERNAL FACE	H	12	200	565	455	OK
EXTERNAL FACE	H	16	200	1005	455	OK
TRANSVERSE	H	12	200	565	455	OK

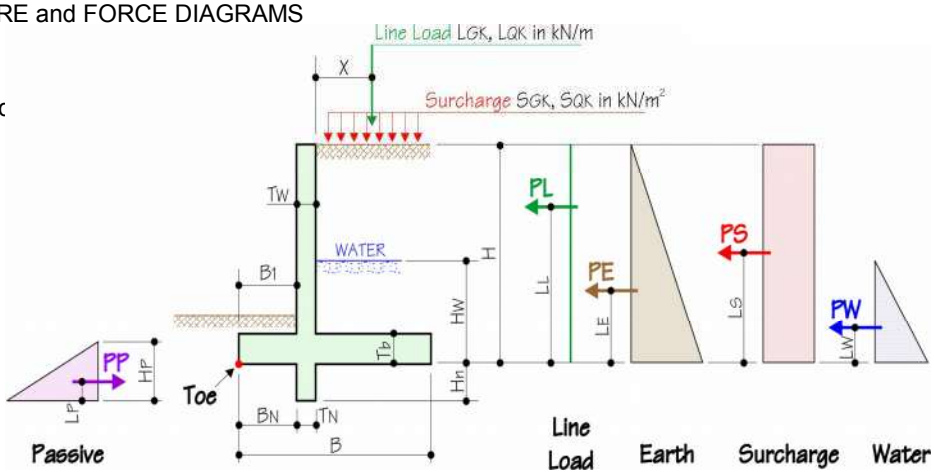
Project	85 Camden Mews	Axiom Structures Limited		
Client		Made by: KL	Date: 30-Nov-2018	Page:
Location	87-85 Camden Mews	Checked: AP	Revision: -	Job No: 15005

RETAINING WALL design to BS 8110:2005

Originated from 'RCC62.xls' v4.2 © 2006 TCC

IDEALISED STRUCTURE and FORCE DIAGRAMS

WARNING :
Passive pressure should only be considered if it can be guaranteed that there will be no future excavation in front of the wall.

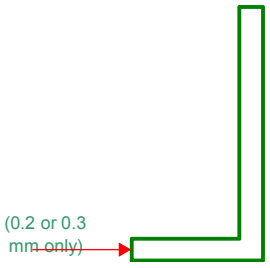


DIMENSIONS (mm)

H =	3500	B =	1825	Tw =	325
Hw =	2500	Bl =	1500	Tb =	300
Hp =	0	BN =	0	TN =	0
Hn =	0				

MATERIAL PROPERTIES

			steel class	A	
fcu =	35	N/mm²	γm =	1.5	concrete
fy =	500	N/mm²	γm =	1.15	steel
			cover to tension steel =	50	mm
			Max allowable design surface crack width (W) =	0.3	mm
			Concrete density =	24	kN/m³



Wall Geometry

SOIL PROPERTIES

Design angle of int'l friction of retained mat'l (Ø) =	25	degree	
Design cohesion of retained mat'l (C) =	0	kN/m²	(Only granular backfil considered, "C" = zero)
Density of retained mat'l (q) =	20	kN/m³	
Submerged Density of retained mat'l (qs) =	13.30	kN/m³	[default=2/3*q (only apply when H 13.33
Design angle of int'l friction of base mat'l (Øb) =	20	degree	ASSUMPTIONS
Design cohesion of base material (Cb) =	10	kN/m²	a) Wall friction is zero
Density of base material (qb) =	10	kN/m³	b) Minimum active earth pressure = 0.25qH
Allowable gross ground bearing pressure (GBP) =	150	kN/m²	c) Granular backfill

d)Does **not** include check of rotational slide/slop

LOADINGS

Surcharge load -- live (SQK) =	10	kN/m²	e)Does **not** include effect of seepage of ground
Surcharge load -- dead (SGK) =	0		water beneath the wall.
Line load -- live (LQK) =	1	kN/m	f)Does **not** include deflection check of wall due to
Line load -- dead (LGK) =	16	kN/m	lateral earth pressures
Distance of line load from wall (X) =	150	mm	h) Design not intended for walls over 3.0 m high

i) Does **not** include check for temp. or shrinkage

LATERAL FORCES (unfactored)

Ka =	0.41	[default ka = (1-SIN Ø)/(1+SIN Ø 0.41
Kp =	2.04	[default kp = (1+SIN Øb)/(1-SIN I 2.04
Kpc =	2.86	[default kpc = $2kp^{0.5}$] = 2.86
Kac =	1.27	[$2ka^{0.5}$]

	Force (kN)	Lever arm (m)	Moment about TOE (kNm)	γ_f	F_{ult} (kN)	M_{ult} (kNm)
PE =	41.22	LE = 1.235	50.92	1.20	49.46	61.11
PS(GK) =	0.00	LS = 1.75	0.00	1.40	0.00	0.00
PS(QK) =	14.21	LS = 1.75	24.86	1.60	22.73	39.77
PL(GK) =	6.49	LL = 3.37	21.91	1.40	9.09	30.67
PL(QK) =	0.41	LL = 3.37	1.37	1.60	0.65	2.19
PW =	31.25	LW = 0.83	26.04	1.20	37.50	31.25
Total	93.57		125.10		119.43	165.00
PP =	0.00	(LP-HN) = 0.00	0.00	1.00	0.00	0.00

Project	85 Camden Mews	Axiom Structures Limited		
Client	0	Made by: KL	Date: 30-Nov-2018	Page:
Location	87-85 Camden Mews	Checked: AP	Revision: -	Job No: 15005

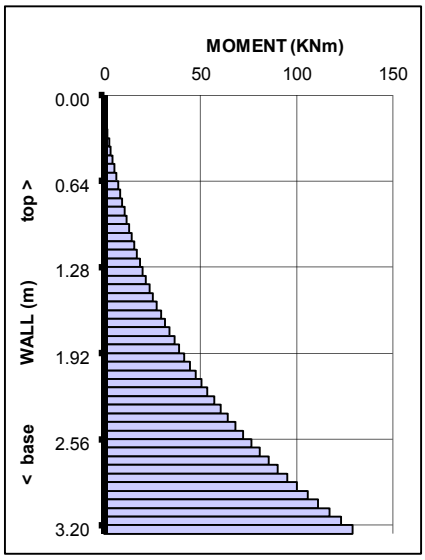
RETAINING WALL design to BS 8110:2005

Originated from 'RCC62.xls' v4.2

STRUCTURAL DESIGNS (ultimate)

WALL (per metre length)

	Force (kN)	Lever arm (m)	Moment (kNm)	γ_f	V ult (kN)	M ult (kNm)
EARTH	34.98	1.13	39.50	1.2	41.98	47.41
SURCHARGE(GK)	0.00	1.60	0.00	1.4	0.00	0.00
SURCHARGE(QK)	12.99	1.60	20.78	1.6	20.78	33.25
LINE LOAD(GK)	6.49	3.07	19.96	1.4	9.09	27.95
LINE LOAD(QK)	0.41	3.07	1.25	1.6	0.65	2.00
WATER	24.20	0.73	17.75	1.2	29.04	21.30
Total	79.07		99.24		101.54	131.89



Ultimate Bending Moment Diagram

BS8110 reference

MAIN REINFORCEMENT :

Min. As =	423	mm^2			Table 3.25
ϕ =	16	mm			
centres =	100	mm	< 313	OK	3.12.11.2.7(b)
Asprov =	2011	mm^2	> 423	OK	

MOMENT of RESISTANCE :

d =	267	mm			
z =	239.04	mm			3.4.4.4
As' =	0	mm^2			
Mres =	208.97	kNm	> 131.89	OK	

SHEAR RESISTANCE:

100 As/bd =	0.75%				
vc =	0.71	N/mm^2			Table 3.8
Vres =	190.00	kN	> 101.54	OK	3.5.5.2

CHECK CRACK WIDTH TO BS8110/BS80
(temperature and shrinkage effects not included)

X =	100.42	mm			
Acr =	68.58	mm			
ε_m =	0.00117				BS8007
W =	0.21	mm	< 0.30	OK	App. B.2

REINFORCEMENT SUMMARY for WALL

	Type	ϕ mm	Centres mm	As mm^2	Min. As mm^2	
VERTICAL OPEN FACE	H	12	200	565	423	OK
VERTICAL EARTH FACE	H	16	100	2011	423	OK
TRANSVERSE	H	12	200	565	423	OK

Project	85 Camden Mews	Axiom Structures Limited		
Client		Made by: KL	Date: 30-Nov-2018	Page:
Location	Façade	Checked: AP	Revision: -	Job No: 15005

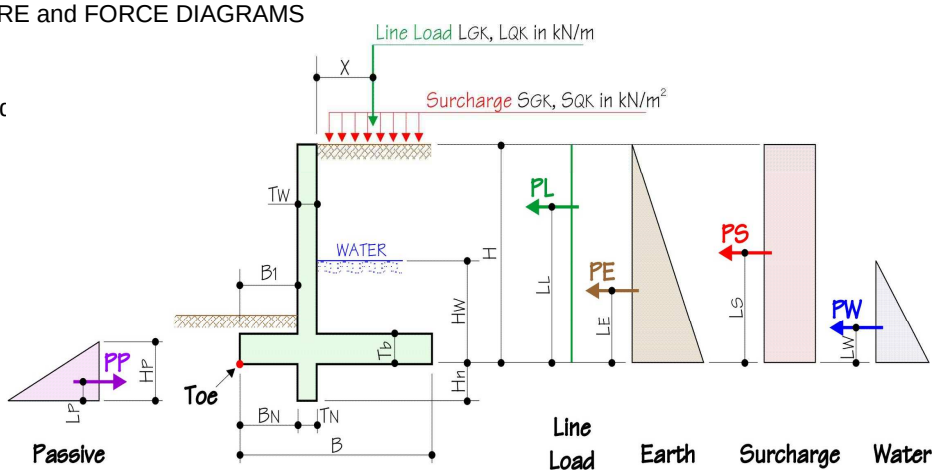
RETAINING WALL design to BS 8110:2005

Originated from 'RCC62.xls' v4.2 © 2006 TCC

IDEALISED STRUCTURE and FORCE DIAGRAMS

WARNING :

Passive pressure should only be considered if it can be guaranteed that there will be no future excavation in front of the wall.

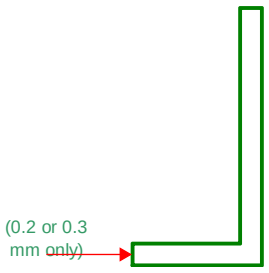


DIMENSIONS (mm)

H =	3550	B =	1800	Tw =	300
Hw =	2550	Bl =	1500	Tb =	300
Hp =	0	BN =	0	TN =	0
Hn =	0				

MATERIAL PROPERTIES — steel class: A

fcu =	35	N/mm²	γm =	1.5	concrete
fy =	500	N/mm²	γm =	1.15	steel
			cover to tension steel =	50	mm
			Max allowable design surface crack width (W) =	0.3	mm
			Concrete density =	24	kN/m³



Wall Geometry

SOIL PROPERTIES

Design angle of int'l friction of retained mat'l (Ø) =	25	degree
Design cohesion of retained mat'l (C) =	0	kN/m²
Density of retained mat'l (q) =	20	kN/m³
Submerged Density of retained mat'l (qs) =	13.30	kN/m³
Design angle of int'l friction of base mat'l (Øb) =	20	degree
Design cohesion of base material (Cb) =	10	kN/m²
Density of base material (qb) =	10	kN/m³
Allowable gross ground bearing pressure (GBP) =	150	kN/m²

(Only granular backfil considered, "C" = zero)

[default=2/3*q (only apply when H 13.33

ASSUMPTIONS

a) Wall friction is zero

b) Minimum active earth pressure = 0.25qH

c) Granular backfill

d)Does **not** include check of rotational slide/slop

e)Does **not** include effect of seepage of ground water beneath the wall.

f)Does **not** include deflection check of wall due to lateral earth pressures

h) Design not intended for walls over 3.0 m high

i) Does **not** include check for temp. or shrinkage

LOADINGS

Surcharge load -- live (SQK) =	10	kN/m²
Surcharge load -- dead (SGK) =	0	
Line load -- live (LQK) =	10	kN/m
Line load -- dead (LGK) =	34	kN/m
Distance of line load from wall (X) =	-150	mm

LATERAL FORCES (unfactored)

Ka =	0.41	[default ka = (1-SIN Ø)/(1+SIN Ø 0.41
Kp =	2.04	[default kp = (1+SIN Øb)/(1-SIN ! 2.04
Kpc =	2.86	[default kpc = $2kp^{0.5}$] = 2.86
Kac =	1.27	[$2ka^{0.5}$]

	Force (kN)	Lever arm (m)	Moment about TOE (kNm)	γ_f	F_{ult} (kN)	M_{ult} (kNm)
PE =	42.31	LE = 1.253	53.01	1.20	50.77	63.61
PS(GK) =	0.00	LS = 1.78	0.00	1.40	0.00	0.00
PS(QK) =	14.41	LS = 1.78	25.57	1.60	23.05	40.92
PL(GK) =	13.80	LL = 3.55	48.99	1.40	19.32	68.58
PL(QK) =	4.06	LL = 3.55	14.41	1.60	6.49	23.05
PW =	32.51	LW = 0.85	27.64	1.20	39.02	33.16
Total	107.09		169.62		138.65	229.33
PP =	0.00	(LP-HN) = 0.00	0.00	1.00	0.00	0.00

Project	85 Camden Mews	Axiom Structures Limited		
Client	0	Made by	Date	Page
Location	Façade	KL	30-Nov-2018	
	RETAINING WALL design to BS 8110:2005	Checked	Revision	Job No
	Originated from 'RCC62.xls' v4.2 © 2006 TCC	AP	-	15005

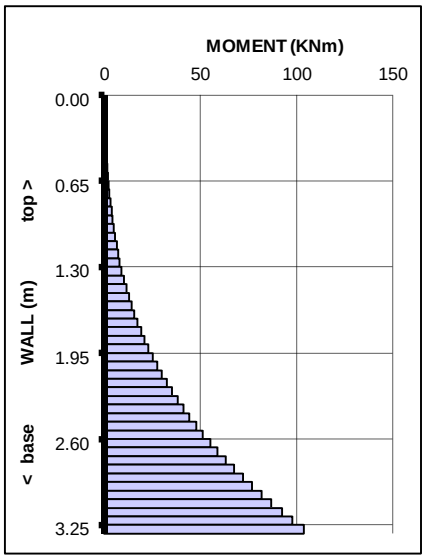
STRUCTURAL DESIGNS (ultimate)

DESIGN CHECKS : **OK**

WALL (per metre length)

	Force (kN)	Lever arm (m)	Moment (kNm)	γ_f	V ult (kN)	M ult (kNm)
EARTH	35.99	1.15	41.28	1.2	43.18	49.53
SURCHARGE(GK)	0.00	1.63	0.00	1.4	0.00	0.00
SURCHARGE(QK)	13.19	1.63	21.43	1.6	21.10	34.29
LINE LOAD(GK)	0.00	3.38	0.00	1.4	0.00	0.00
LINE LOAD(QK)	0.00	3.38	0.00	1.6	0.00	0.00
WATER	25.31	0.75	18.98	1.2	30.38	22.78
Total	74.49		81.70		94.66	106.61

BS8110 reference



Ultimate Bending Moment Diagram

MAIN REINFORCEMENT :

Min. As =	390	mm^2			Table 3.25
ϕ =	**16**	mm			
centres =	**100**	mm	< 314	OK	3.12.11.2.7(b)
Asprov =	2011	mm^2	> 390	OK	

MOMENT of RESISTANCE :

d =	242	mm			
z =	214.04	mm			3.4.4.4
As' =	0	mm^2			
Mres =	187.11	kNm	> 106.61	OK	

SHEAR RESISTANCE:

100 As/bd =	0.83%				
vc =	0.75	N/mm^2			Table 3.8
Vres =	182.38	kN	> 94.66	OK	3.5.5.2

CHECK CRACK WIDTH TO BS8110/BS80
(temperature and shrinkage effects not included)

X =	94.50	mm			
Acr =	68.58	mm			
ε_m =	0.00111				BS8007
W =	0.19	mm	< 0.30	OK	App. B.2

REINFORCEMENT SUMMARY for WALL

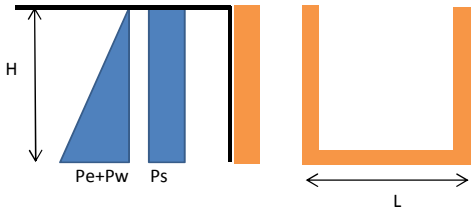
	Type	ϕ mm	Centres mm	As mm^2	Min. As mm^2	
VERTICAL OPEN FACE	H	**12**	**200**	565	390	OK
VERTICAL EARTH FACE	H	16	100	2011	390	OK
TRANSVERSE	H	**12**	**200**	565	390	OK

AXIOM
STRUCTURES

Lighwell Design:

Lateral Loads

Surcharge =	5	kN/m2
L =	6.8	m
H =	3.5	m
Ka =	0.41	
γ=	20	kN/m2



Earth Pressure = submerged

pe= 2/3x ka x g x h	19.1	kN/m/m
Pe_T = pe x (0.5xh)=	33.5	kN/m

Water Pressure =

pw= 10 x h =	25.0	kN/m/m	<= 1m below ground level
Pw_T= pw x (0.5xh)=	43.8	kN/m	

Surcharge Pressure = Front Garden

ps= ka x Surcharge =	2.1	kN/m/m
Ps_T = ps x h =	7.2	kN/m

Total P at 0 m =	2.1	kN/m/m
Total P at H =	46.2	kN/m/m

Combination:

SLS=	1.0 Ps + 1.0Pe + 1.0Pw
ULS=	1.6 Ps + 1.2Pe + 1.2Pw

From Analysis Robot, next page

Mmax xx uls = vertical=	68.0	kNm/m
Mmax yy uls = horizontal=	18.5	kNm/m

ELEMENT DESIGN to BS 8110:2005
SOLID SLABS
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INPUT Location Front lightwell

Design moment, M	18.5	kNm/m	fcu	35	N/mm²	γc =	1.50
ßb	1.00		fy	500	N/mm²	γs =	1.15
span	6800	mm	steel class	A			
Height, h	300	mm	Section location	SIMPLY SUPPORTED SP			
Bar Ø	12	mm	Compression steel	SPECIFY			
cover	62	mm to these bars		(deflection control only)			

ONE or TWO WAY SLAB

OUTPUT Front lightwell — Compression steel = H12@200(0.244%)

	d = 300 - 62 - 12/2 = 232.0 mm
(3.4.4.4)	K' = 0.156 > K = 0.010 ok
(3.4.4.4)	z = 232.0 [0.5 + (0.25 - 0.010 /0.893)]^½ = 229.4 > 0.95d = 220.4 mm
(3.4.4.1)	As = 18.50E6 /500 /220.4 x 1.15 = 193 < min As = 390 mm²/m
	PROVIDE H12 @ 275 = 411 mm²/m
(Eqn 8)	fs = 2/3 x 500 x 193 /411 /1.00 = 156.5 N/mm²
(Eqn 7)	Tens mod factor = 0.55 + (477 - 156.5) /120 /(0.9 + 0.344) = 2.000
(Equation 9)	Comp mod factor = 1 + 0.244/(3 + 0.244) = 1.075
(3.4.6.3)	Permissible L/d = 20.0 x 2.000 x 1.075 = 43.006
	Actual L/d = 6800 /232.0 = 29.310 ok

Use H12 @ 200. As,prov = 565 mm2/m

AXIOM STRUCTURES

ELEMENT DESIGN to BS 8110:2005

SOLID SLABS

Originated from RCC11.xls v4.0

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INPUT Location Front lightwell

Design moment, M	68.0	kNm/m	fcu	35	N/mm²	γc =	1.50
ßb	1.00		fy	500	N/mm²	γs =	1.15
span	3300	mm	steel class	A			
Height, h	300	mm	Section location	CANTILEVER			
Bar Ø	16	mm	Compression steel	SPECIFY			
cover	50	mm to these bars		(deflection control only)			

ONE or TWO WAY SLAB

OUTPUT Front lightwell — Compression steel = H12@200(0.234%)

d = 300 - 50 - 16/2 = 242.0 mm

(3.4.4.4) K' = 0.156 > K = 0.033 ok

(3.4.4.4) z = 242.0 [0.5 + (0.25 - 0.033 /0.893)]^½ = 232.7 > 0.95d = 229.9 mm

(3.4.4.1) As = 68.00E6 /500 /229.9 x 1.15 = 680 > min As = 390 mm²/m

PROVIDE H16 @ 150 = 1340 mm²/m *As increased by 100.0% for deflection*

(Eqn 8) fs = 2/3 x 500 x 680 /1340 /1.00 = 169.2 N/mm²

(Eqn 7) Tens mod factor = 0.55 + (477 - 169.2) /120 /(0.9 + 1.161) = 1.795

(Equation 9) Comp mod factor = 1 + 0.234/(3 + 0.234) = 1.072

(3.4.6.3) Permissible L/d = 7.0 x 1.795 x 1.072 = 13.470

Actual L/d = 3300 /242.0 = 13.636

Use H16 @ 150. As,prov = 1340 mm2/m

Vmax at support = uls 72.3 kN /m

ELEMENT DESIGN to BS 8110:2005

SLAB SHEAR

Originated from RCC11.xls v4.0

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INPUT Location Front lightwell

fcu = 35 N/mm² γc = 1.50

fyl = 500 N/mm² γs = 1.15

steel class A

d	b
242	1000

Main Steel		Link	Legs	Side cover	Shear V	UDL
7	16	10	0	50	72.3	
No	mm Ø	mm Ø	No	mm	kN	kN/m

OUTPUT Front lightwell

As = 1407 N/mm² = 0.582%

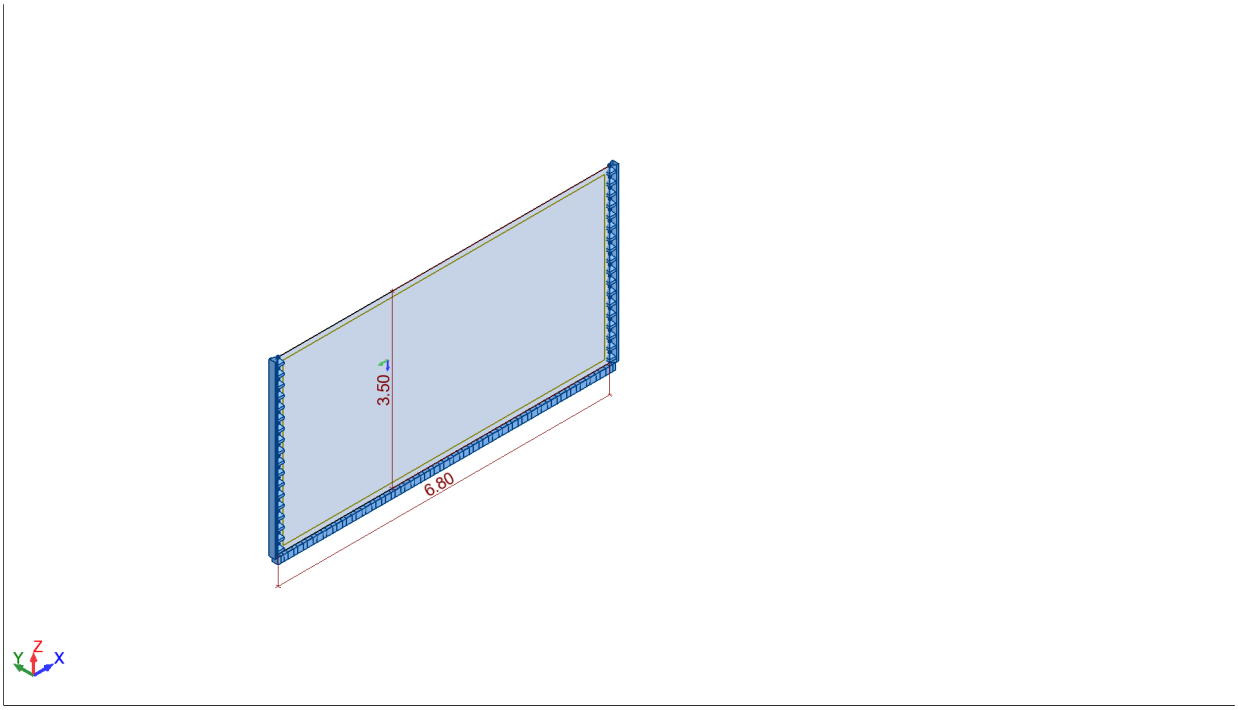
(Eqn 3) v = 72.3 x 10³ /1,000 /242 = 0.299 N/mm²

(Table 3.8) vc = 0.669 N/mm², from table 3.8

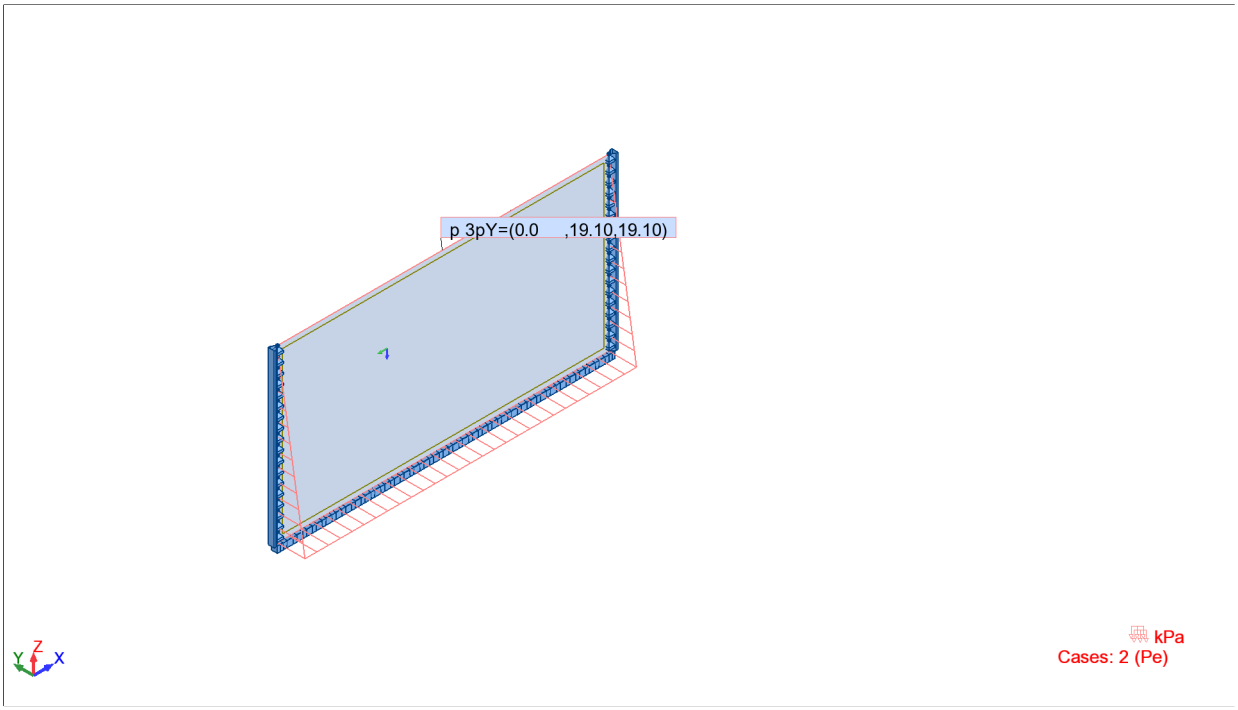
No links needed

H16 @ 150 are sufficient

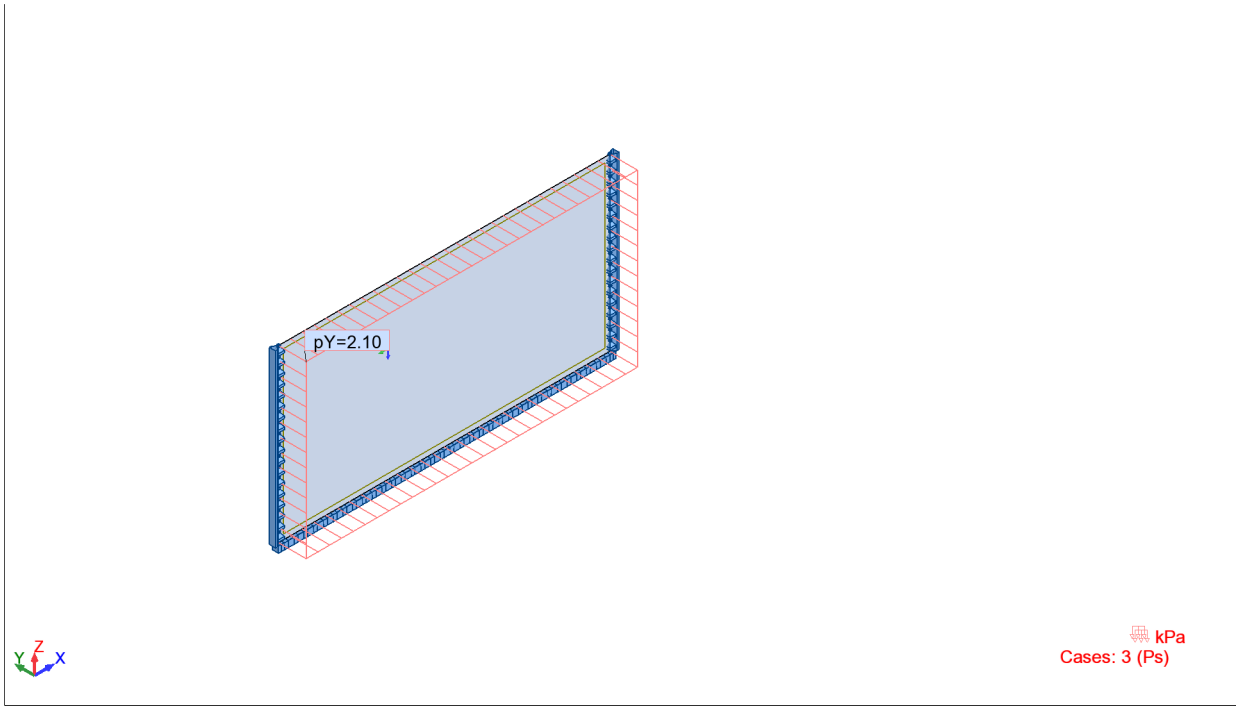
View - Cases: 2 (Pe) 1



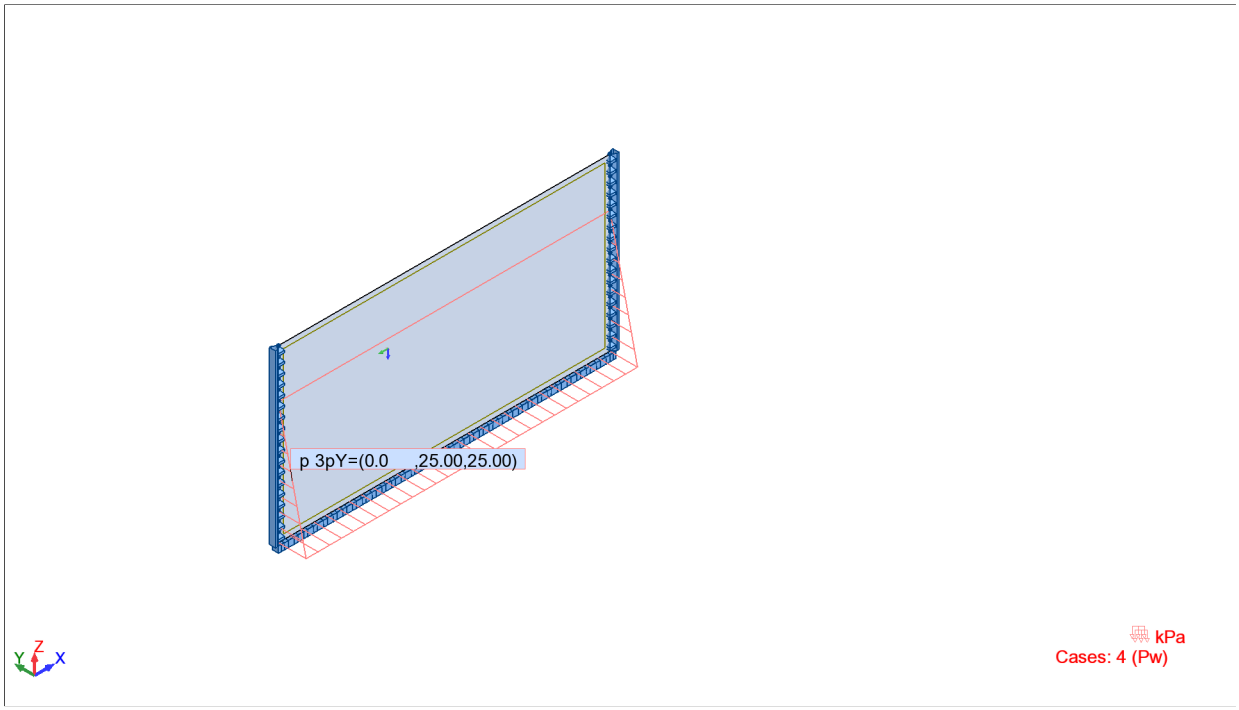
View - Cases: 2 (Pe) 2



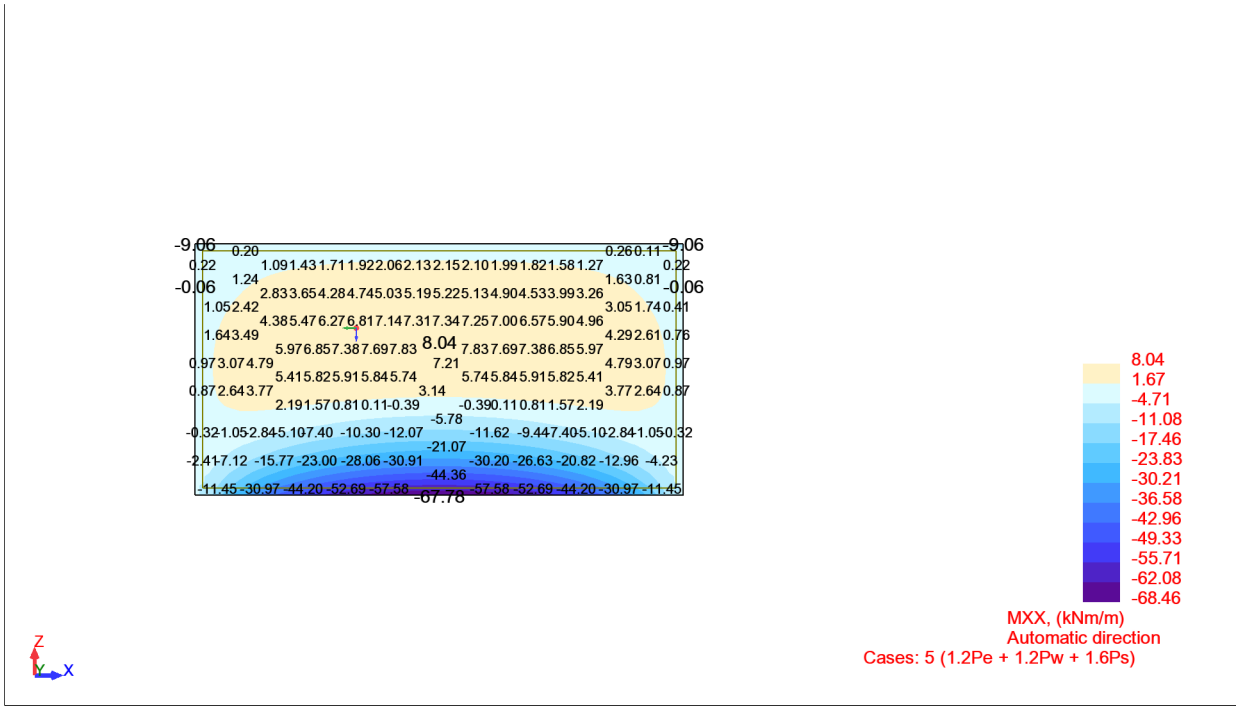
View - Cases: 3 (Ps) 1



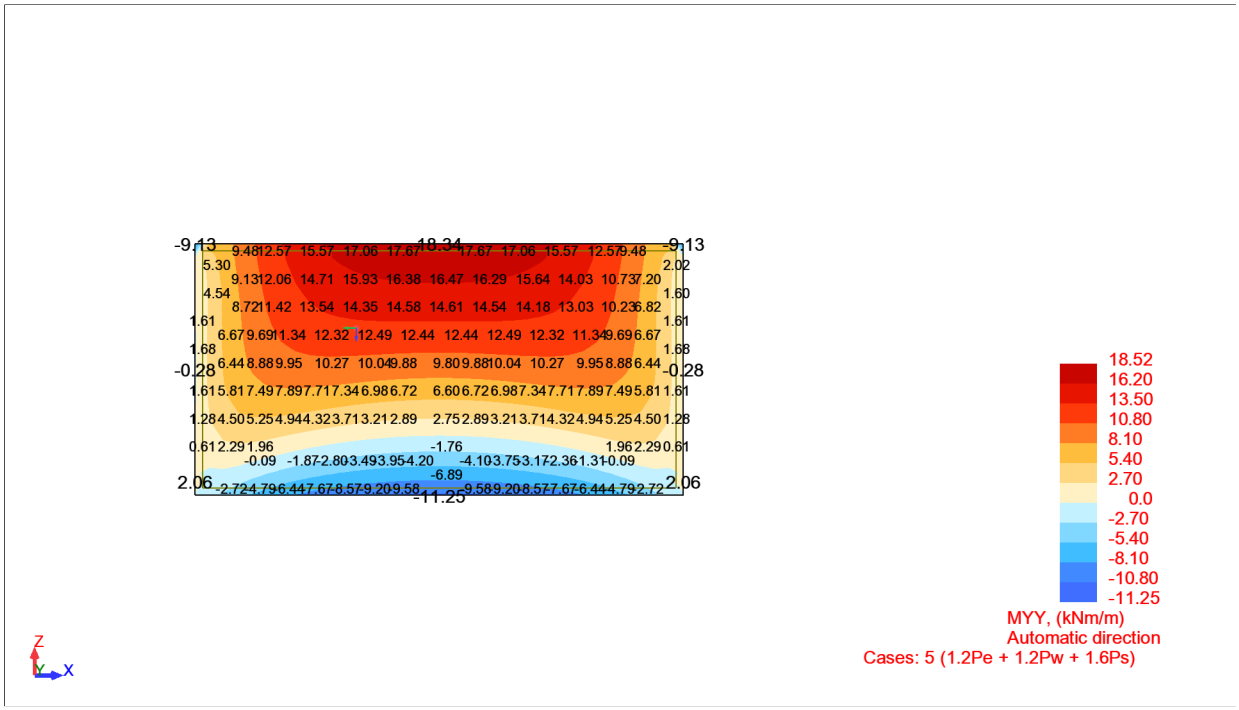
View - Cases: 4 (Pw) 1



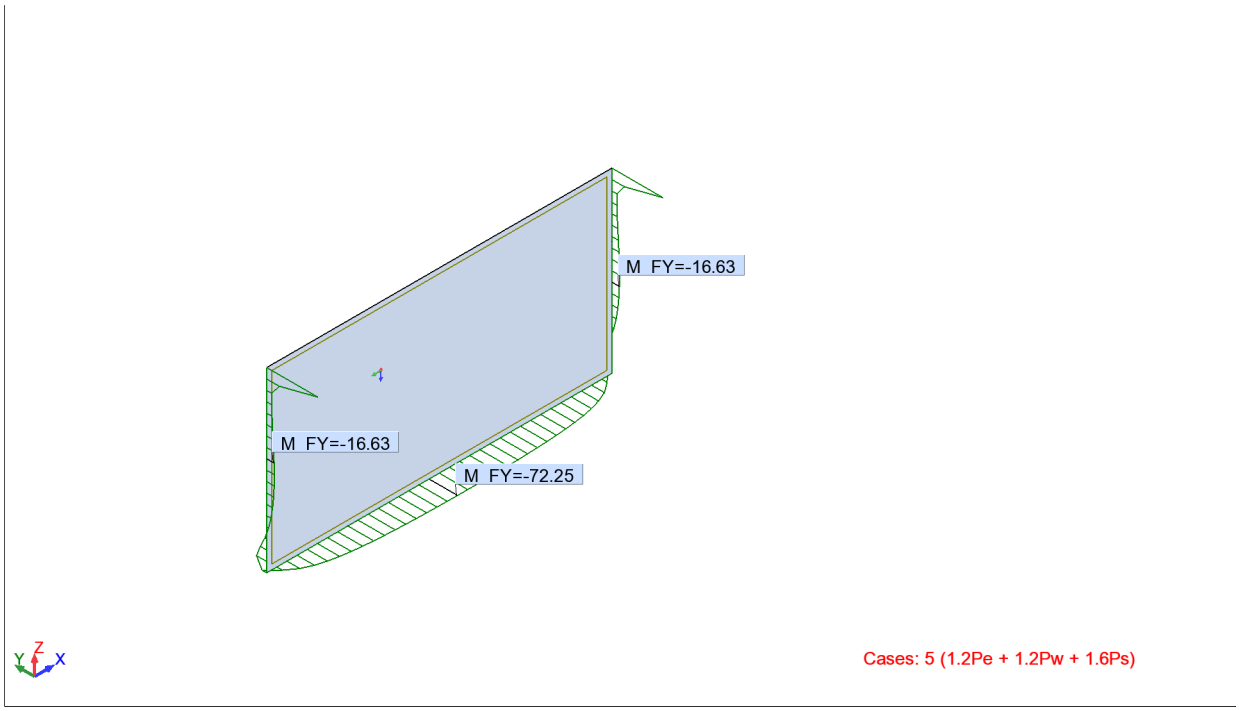
View - MXX (kNm/m) Automatic direction Cases: 5 (1.2Pe + 1.2Pw + 1.6Ps) 1



View - MYY (kNm/m) Automatic direction Cases: 5 (1.2Pe + 1.2Pw + 1.6Ps) 1



View - Reaction forces(kN,kN/m), Cases: 5 (1.2Pe + 1.2Pw + 1.6Ps) 1



AXIOM
STRUCTURES

300thk Rear Raft

	Heave/Uplift: kN/m2	Total
300thk Rear Raft Heave/Uplift from part A	13.0	
SLS=	13.0	13.0
ULS=	14.3	14.3

Vertical load to RC nibs:

RC Nib:

	L		DL only		DL+IL
1B1/3m				=	2.4 kN/m
GB1/3m				=	8.5 kN/m
Cavity wall x 5.3m	5.2	x	4.1	=	21.3 kN/m
200thk RC nib x 3m	3	x	4.8	=	14.4 kN/m
GB3/1.9m=					34.7 kN/m
			Sum sls:		81 kN/m

RC wall at the rear:

	L		DL only		DL+IL
300RC wall x 3m	3	x	7.2	=	21.6 kN/m
			Sum sls:		22 kN/m

Column C1 :

F sls= 80% x 252kN= 201.6 kN

Columns C2 :

F sls= 80% x 65kN= 52 kN

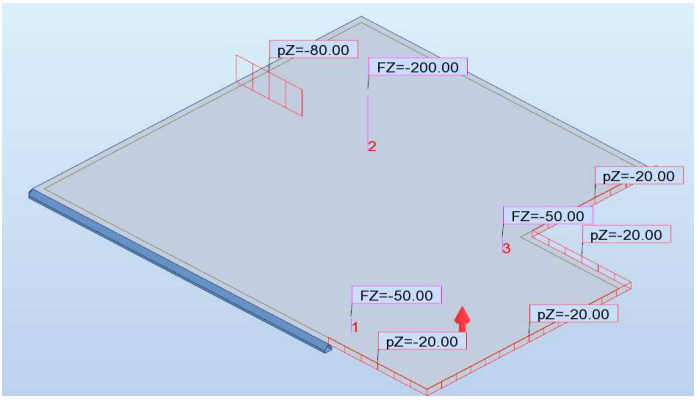
Combination:

SLS: 1.0 Heave/uplift + 1.0 DL

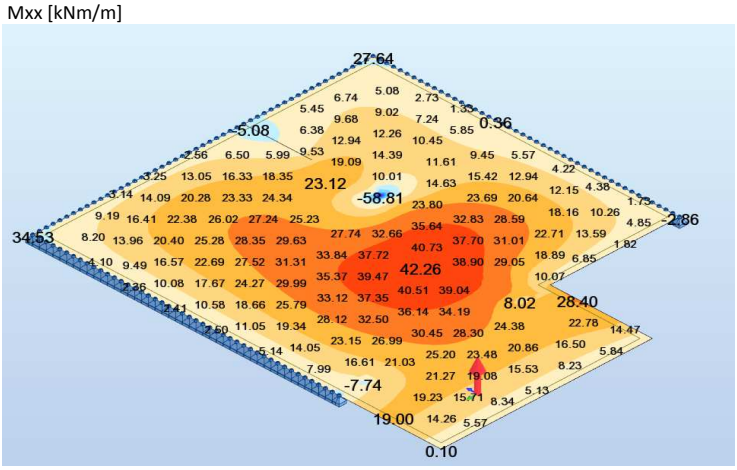
ULS: 1.2 Heave/uplift + 1.0DL

Input from Robot:

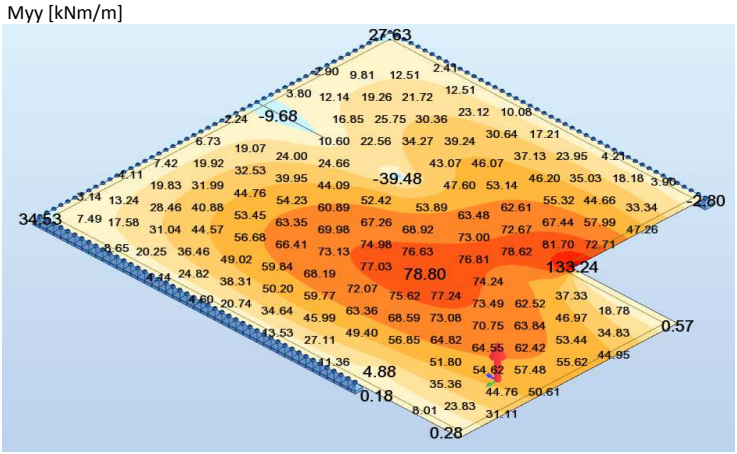
SLS:



Mxx [kNm/m]



Myy [kNm/m]



350thk Raft- max. value

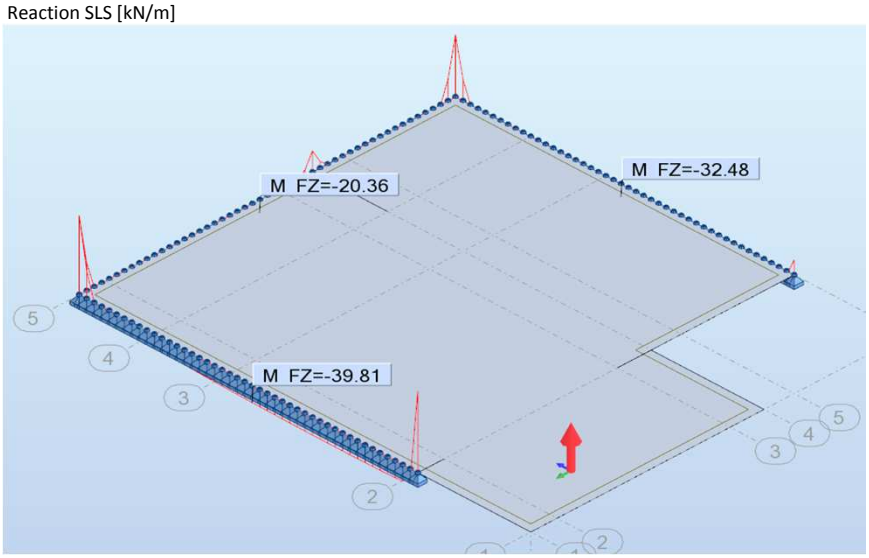
M yy max= = 79 kNm/m

Refer to next page use H16 at 200crs , A prov. = 1005 mm2/m

AXIOM STRUCTURES

Reaction- for linear support:

Reaction SLS [kN/m]



Max reaction =	40.00 kN/m	< Min. vertical loadings on raft = 75kN/m from Part A hence OK

ELEMENT DESIGN to BS 8110:2005

SOLID SLABS

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INPUT Location 300RC Raft

Design moment, M	79.0	kNm/m	fcu	40	N/mm²	γc =	1.50
ßb	1.00		fy	500	N/mm²	γs =	1.15
span	10000	mm	steel class	A			
Height, h	300	mm	Section location	CONTINUOUS SPAN			
Bar Ø	16	mm	Compression steel	SPECIFY			
cover	46	mm to these bars		*(deflection control only)*			

ONE or TWO WAY SLAB

OUTPUT 300RC Raft — Compression steel = H16@200(0.409%)

d = 300 - 46 - 16/2 = 246.0 mm

(3.4.4.4) K' = 0.156 > K = 0.033 ok

(3.4.4.4) z = 246.0 [0.5 + (0.25 - 0.033 /0.893)]^½ = 236.7 > 0.95d = 233.7 mm

(3.4.4.1) As = 79.00E6 /500 /233.7 x 1.15 = 777 > min As = 390 mm²/m

PROVIDE H16 @ 200 = 1005 mm²/m *As increased by 31.7% for deflection*

(Eqn 8) fs = 2/3 x 500 x 777 /1005 /1.00 = 257.8 N/mm²

(Eqn 7) Tens mod factor = 0.55 + (477 - 257.8) /120 /(0.9 + 1.305) = 1.378

(Equation 9) Comp mod factor = 1 + 0.409/(3 + 0.409) = 1.120

(3.4.6.3) Permissible L/d = 26.0 x 1.378 x 1.120 = 40.131

Actual L/d = 10000 /246.0 = 40.650