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Date	Sheet No.
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Job No. 16.440	

28 CANFIELD GARDENS NW6.

LOAD CASES

ELEMENTS		DL	LL	TOTAL kN/m²
PITCHED ROOF	:	1.35	0.75	2.1
FLAT ROOF	:	1.05	0.75	1.8
DOMESTIC LOFT FLOOR	:	0.50	1.50	2.0
STORAGE LOFT FLOOR	:	0.50	0.50	1.0
DOMESTIC ROOM FLOOR	:	0.70	1.50	2.2
STUD PARTITION (DIRECT)	:	0.50	—	0.5
PLASTER PARTITION	:	1.00	—	1.0
112mm BRICKWORK	:	2.50	—	2.5
225mm BRICKWORK	:	4.80	—	4.8
330mm BRICKWORK	:	7.50	—	7.5
450mm BRICKWORK	:	9.80	—	9.8
COMMUNAL STAIRCASE	:	0.50	3.00	3.5

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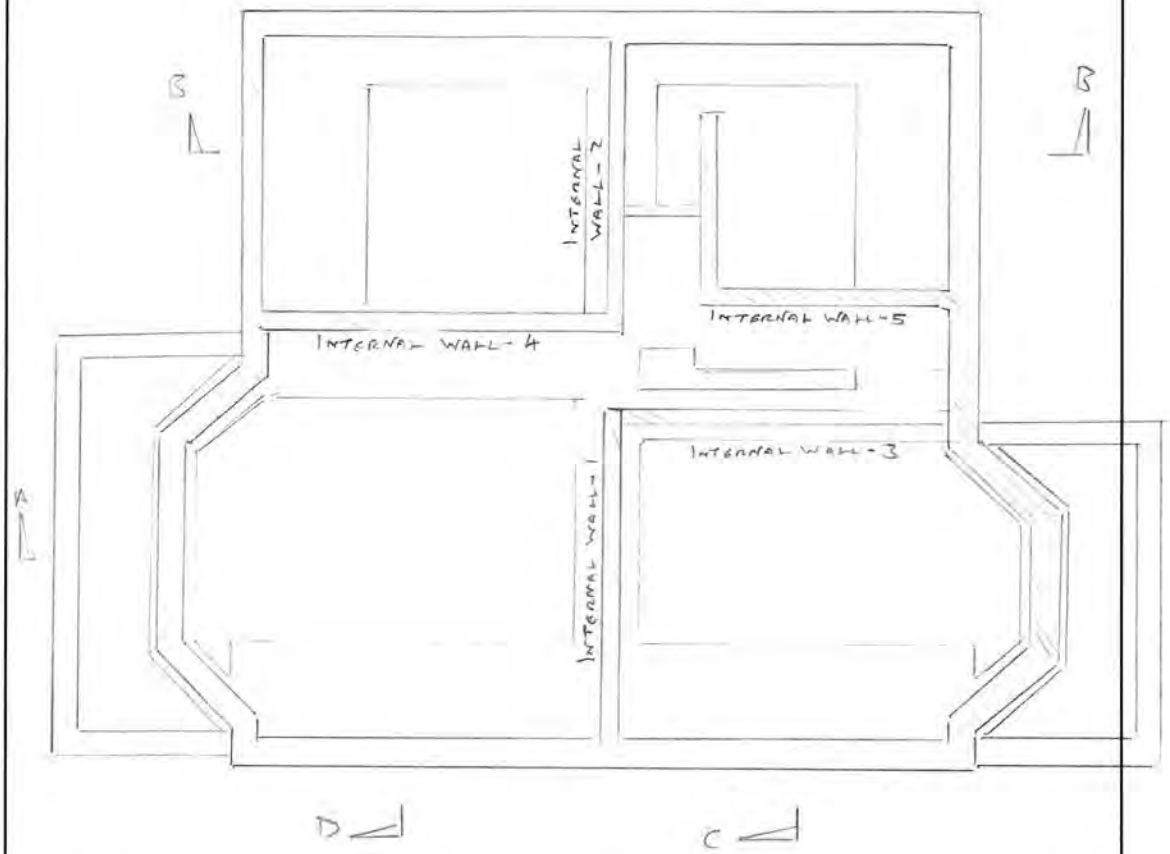
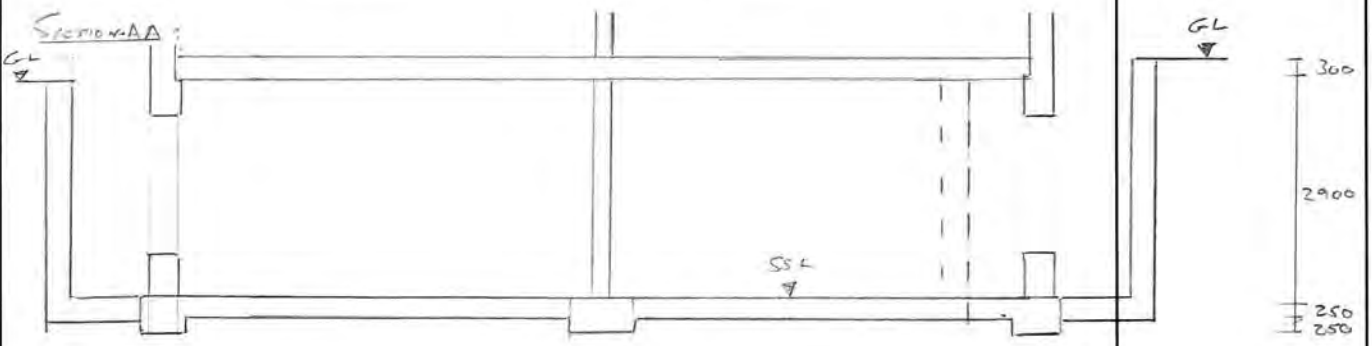
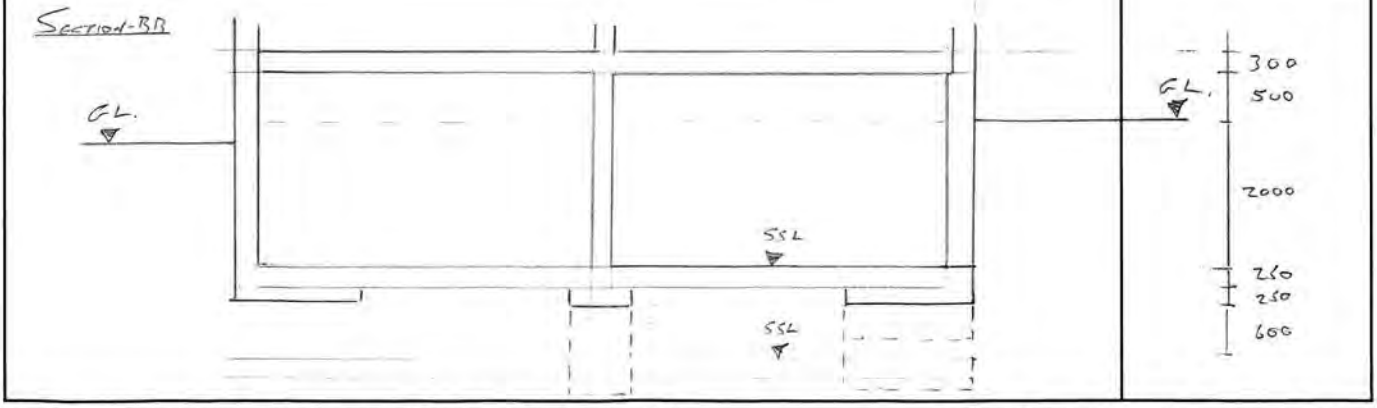
28 Canfield Gardens NW6.

Basement Structure.







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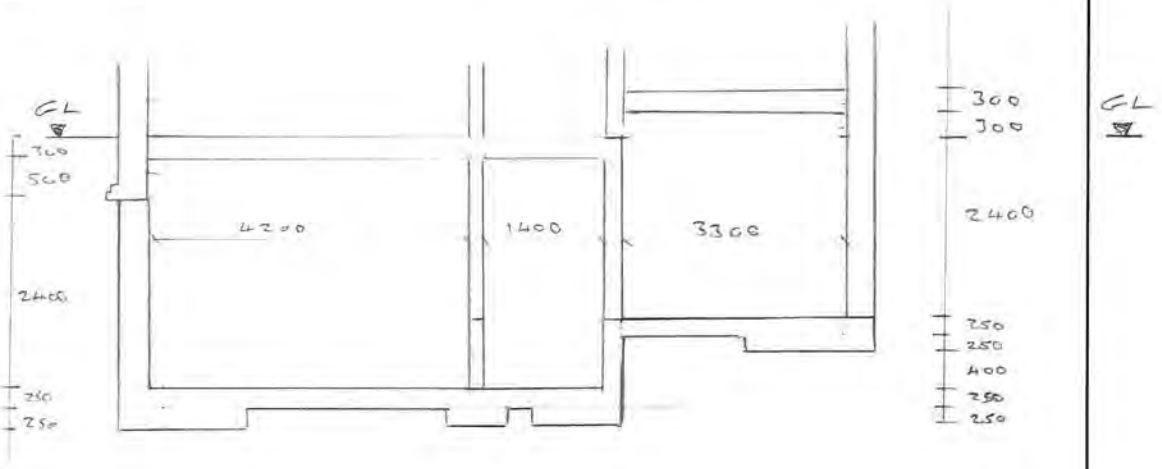
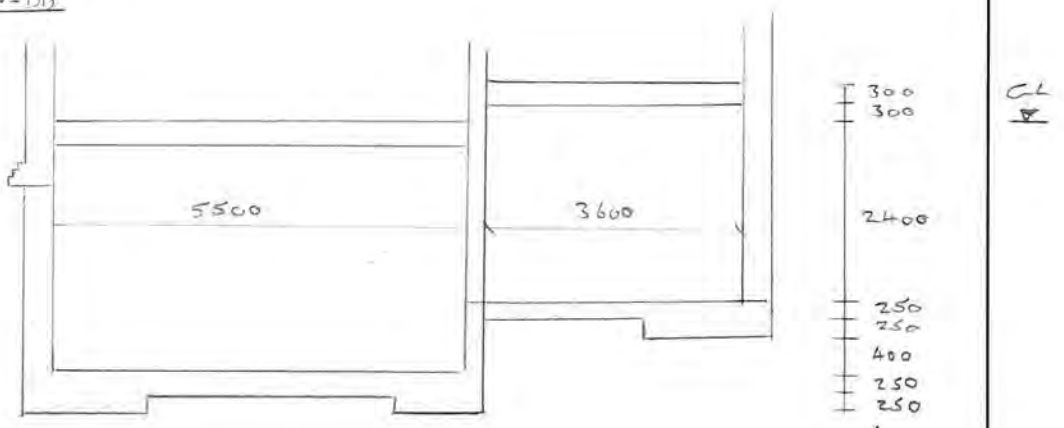
28 CANFIELD GARDENS NW6.

SECTION - CC



SECTION - DD



BY REFERENCE TO GEOLOGICAL SURVEY MAP GROUND CONDITIONS ARE LONDON CLAY.

∴ BASIC GROUND BEARING PRESSURE = 100 kN/m² @ SURFACE LEVEL

UNDERSIDE OF FOUNDATION DEPTH BETWEEN 2.9 - 3.7m BELOW GROUND SURFACE LEVEL.

∴ CLAY LIKELY TO BE FIRM TO STIFF & WELL COMPACTED

∴ CONSERVATIVE GROUND BEARING PRESSURE RANGES 100 - 150 kN/m².

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28 CANFIELD GARDENS NW6.

INTERNAL LOAD BEARING WALLS

THERE ARE 5 NO. WALLS OF STRUCTURAL SIGNIFICANCE INTERNALLY.
WALLS 4 & 5 ARE RETAINING WALLS & ARE CALCULATED IN THAT SECTION.
WALLS 1, 2 & 3 ARE LOAD BEARING WALLS BEARING ON STRIP FOUNDATIONS.

LOAD RUNDOWNS:

		DL	LL	TOTAL
WALL 1 : VDL	: SPINE WALL-1 : SEE SHEET.	= 42.6		
	" " "	=	18.3	
	330mm BRICK : 7.5 x 2.9	= 21.8		
		64.4	18.3	82.7 kN/m
WALL 2 : VDL	: SPINE WALL-2 : SEE SHEET.	= 34.3		
	" " "	=	17.8	
	330mm BRICK : 7.5 x 2.7 x 0.85	= 17.2		
		51.5	17.8	69.3 kN/m
WALL 3 : VDL	: SPINE WALL-3 : SEE SHEET.	= 58.7		
	" " "	=	23.0	
	330mm BRICK : 7.5 x 2.9 x 0.85	= 18.5		
		77.2	23.0	100.2 kN/m

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28 CANFIELD GARDENS NW6.

BY REFERENCE TO GEOLOGICAL SURVEY MAP GROUND CONDITIONS ARE LONDON CLAY.

∴ BASIC GROUND BEARING PRESSURE = 100 kN/m²

UNDERSIDE OF FOUNDATION DEPTH BETWEEN 2.9 - 3.7m BELOW GROUND LEVEL.

∴ CLAY LIKELY TO BE FIRM TO STIFF & WELL COMPACTED & 20% ADDITIONAL STRENGTH FACTOR ACCEPTABLE

∴ GBP = 120 kN/m².

WALL-1: $\frac{82.7}{120} = 0.689$m WIDTH PER M RUN.

WALL-2: $\frac{69.3}{120} = 0.578$m WIDTH PER M RUN.

WALL-3: $\frac{100.2}{120} = 0.835$m WIDTH PER M RUN.

∴ WALLS 1 & 2 TO HAVE 700mm WIDE CONCRETE STRIP FOUNDATION

WALL-3 TO HAVE 900mm WIDE CONCRETE STRIP FOUNDATION

ALL CONCRETE TO BE MINIMUM C-35/(SR) GRADE & 500mm DEEP. FORMATION TO WALL-2 TO STEP DOWN WITH 2NO TRANSITION BASES TO SAME LEVEL AS INTERNAL WALL-4 RETAINING WALL BASE.

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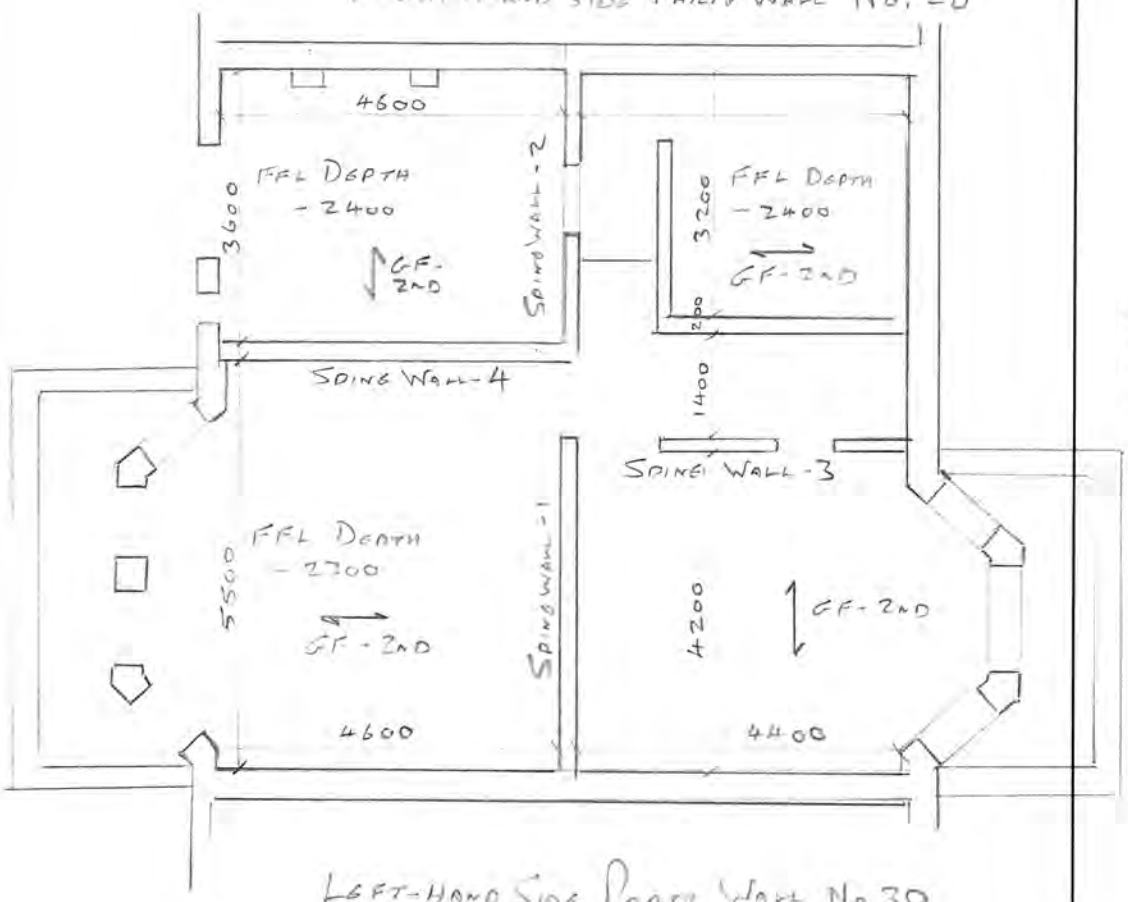
28 Canfield Gardens NW6.

Existing Load Rundowns



3rd Floor Structure Spans Front to Back (Rafters, Floor Joists etc) Bearing onto Intermediate Floor Beams which Span Side to Side.

Property Layout to 26, 28 & 30 are the same (except for Loft Extension)

∴ Only Floor Span From One Property Spans on Each Party Wall

& Roofs From 26 & 30 Span Front to Back Bearing on Their own Internal Walls.

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28 CANFIELD GARDENS NW6.

LOADS TO GROUND LEVEL

		DL	LL	TOTAL
PARTY WALL RIGHT (FRONT) : UDL : ROOF (VIA FLOOR BEAMS)*	$1.35 \times \frac{4.8}{2}$ =	3.2		
	$0.75 \times \frac{4.8}{2}$ =		1.8	
3RD FLOOR*	$0.50 \times \frac{4.8}{2}$ =	1.2		
	$1.50 \times \frac{4.8}{2}$ =		3.6	
L.W BLANKET* PARTITIONS	$0.50 \times \frac{4.8}{2}$ =	1.2		
COMMUNAL STAIR LANDINGS (x3)	$3\left(0.50 \times \frac{1.7}{2}\right)$ =	0.9		
	$3\left(3.0 \times \frac{1.7}{2}\right)$ =		5.4	
GROUND - 2ND FLOORS (NO 26)	$3\left(0.70 \times \frac{4.2}{2}\right)$ =	4.4		
	$3\left(1.50 \times \frac{4.2}{2}\right)$ =		9.5	
BLANKET PARTITIONS	$3\left(1.00 \times \frac{4.2}{2}\right)$ =	6.3		
225mm CAVITY	$4.8 \times 2.8 \times \frac{1}{2}$ =	6.7		
225mm WALL	4.8×6.2 =	29.8		
330mm WALL	7.5×3.3 =	24.8		
		78.5	20.3	98.8 kN/m
PARTY WALL RIGHT (REAR) : UDL : ROOF	$1.35 \times \frac{3.6}{2}$ =	2.4		
	$0.75 \times \frac{3.6}{2}$ =		1.4	
3RD FLOOR	$0.50 \times \frac{3.6}{2}$ =	0.9		
	$1.50 \times \frac{3.6}{2}$ =		2.7	
L.W BLANKET PARTITIONS	$0.50 \times \frac{3.6}{2}$ =	0.9		
GROUND 1ST & 2ND FLOOR	$3\left(0.70 \times \frac{3.6}{2}\right)$ =	3.8		
	$3\left(1.50 \times \frac{3.6}{2}\right)$ =		8.1	
BLANKET PARTITIONS	$3\left(1.00 \times \frac{3.6}{2}\right)$ =	5.4		
	SUBTOTAL	13.4	12.2	—

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28 CANFIELD GARDENS NW6

			DL	LL	TOTAL
PARTY WALL RIGHT (REAR)	VDL	SUB TOTAL = SEE LAST SHEET =	12.4		
		" " " =		12.2	
CONTINUED		225mm GABLE = $2.8 \times 2.8 \times \frac{1}{2}$ =	6.7		
		225mm WALL = 4.8×6.2 =	29.8		
		330mm WALL = 7.5×4.3 =	32.3		
			82.2	12.2	94.4 kN/M
FRONT WALL	VDL	PITCHED ROOF = $1.35 \times \frac{1.0}{2}$ =	0.7		
		$0.75 \times \frac{1.0}{2}$ =		0.4	
		LOFT STORAGE = $0.50 \times \frac{1.0}{2}$ =	0.3		
		$0.50 \times \frac{1.0}{2}$ =		0.3	
		GROUND - 2ND FLOORS = $3\left(0.20 \times \frac{7.2}{2}\right)$ =	2.3		
		$3\left(1.5 \times \frac{7.2}{2}\right)$ =		5.0	
		BLANKET PARTITION = $3\left(1.0 \times \frac{7.2}{2}\right)$ =	3.3		
		225mm WALL = $4.8 \times 6.2 \times 0.85$ =	25.3		
		330mm WALL = $7.5 \times 3.3 \times 0.85$ =	21.0		
			52.9	5.2	58.6 kN/M
FRONT BAY	VDL	PITCHED ROOF = $1.35 \times \frac{1.1}{2}$ =	0.7		
		$0.75 \times \frac{1.1}{2}$ =		0.4	
		LOFT STORAGE = $0.50 \times \frac{1.1}{2}$ =	0.3		
		$0.50 \times \frac{1.1}{2}$ =		0.3	
		GROUND - 2ND FLOORS = $3\left(0.20 \times \frac{1.1}{2}\right)$ =	1.2		
		$3\left(1.50 \times \frac{1.1}{2}\right)$ =		2.5	
			2.2	3.2	5.4 kN/M

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28 CANFIELD GARDENS NW6

			DL	LL	TOTAL
FRONT : UDL : SUB TOTAL	: See Previous Sheet	=	21.2		
BAY	" " "	=		3.2	
CONTINUED					
35% REDUCTION FOR LARGE WINDOW VOIDS	225mm WALL	: 4.8 x 6.2 x 0.65 =	19.3		
	330mm WALL	7.5 x 3.3 x 0.65 =		16.1	
			21.5	19.3	40.8 kN/M
FRONT : UDL - WALL (ENTRANCE)	PITCHED ROOF	: 1.35 x 1.1/2 =	0.7		
		0.75 x 1.1/2 =		0.4	
	LOFT STORAGE	: 0.50 x 1.1/2 =	0.3		
		0.50 x 1.1/2 =		0.3	
	: 1ST - 2ND FLOORS	: 2 (0.20 x 4.14/2) =	3.1		
		+ (1.50 x 4.14/2) =		6.6	
	GROUND FLOOR COMMUNAL	: 0.20 x 4.14/2 =	1.5		
		3.00 x 4.14/2 =		6.6	
	BLANKET PARTITION	: 3 (1.10 x 4.14/2) =	6.6		
	225mm WALL	: 4.8 x 6.2 x 0.65 =	25.3		
	330mm WALL	: 2.5 x 3.3 x 0.65 =	21.0		
			58.5	13.9	72.4 kN/M

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28 Canfield Gardens NW6.

Loads to Ground Level

			DL	LL	Total
Party Wall Left (Front)	UDL : Roof (via Front Beam)	$= 1.35 \times \frac{4.2}{2}$	2.8		
		$0.75 \times \frac{4.2}{2}$		1.6	
	3rd Floor (via Front Beam)	$= 0.50 \times \frac{4.2}{2}$	1.1		
		$1.50 \times \frac{4.2}{2}$		3.2	
	L.W Blanket Partitions	$= 0.50 \times \frac{4.2}{2}$	1.1		
	Ground - 2nd Floors	$= 3\left(0.70 \times \frac{4.2}{2}\right)$	4.4		
		$3\left(1.50 \times \frac{4.2}{2}\right)$		9.5	
	Blanket Partition	$= 3\left(1.00 \times \frac{4.2}{2}\right)$	6.3		
	225mm Cable	$= 4.8 \times 2.8 \times \frac{1}{2}$	6.7		
	225mm Wall	$= 4.8 \times 6.2$	29.8		
	330mm Wall	$= 7.5 \times 3.3$	24.8		
			77.0	14.3	91.3 kN/m
Party Wall Left (Rear)	UDL : Roof (via Front Beam)	$= 1.35 \times \frac{5.5}{2}$	3.7		
		$0.75 \times \frac{5.5}{2}$		2.1	
	3rd Floor (via Front Beam)	$= 0.50 \times \frac{5.5}{2}$	1.4		
		$1.50 \times \frac{5.5}{2}$		4.1	
	L.W Blanket Partitions	$= 0.50 \times \frac{5.5}{2}$	1.4		
	Ground - 2nd Floors (Adjoining)	$= 3\left(0.70 \times \frac{3.6}{2}\right)$	3.8		
		$3\left(1.50 \times \frac{3.6}{2}\right)$		8.1	
	Blanket Partition	$= 3\left(1.0 \times \frac{3.6}{2}\right)$	5.4		
	225mm Cable & Wall	$= 6.7 + 29.8$	36.5		
	330mm Wall	$= 7.5 \times 4.3$	32.3		
			84.5	14.3	98.8 kN/m

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28 CANFIELD GARDENS NW6.

		DL	LL	TOTAL
REAR WALL (REAR) : UDL	PITCHED ROOF : $1.35 \times \frac{1.0}{2}$ =	0.7		
	$0.75 \times \frac{1.0}{2}$ =		0.4	
	LOFT STORE : $0.50 \times \frac{1.0}{2}$ =	0.3		
	$0.50 \times \frac{1.0}{2}$ =		0.3	
	225mm WALL : $4.8 \times 6.2 \times 0.85$ =	25.3		
	330mm WALL : $2.5 \times 4.3 \times 0.85$ =	27.4		
		53.7	0.7	54.4 kN/m
REAR BAY : UDL	FLAT ROOF : $1.05 \times \frac{1.1}{2}$ =	0.6		
	$0.75 \times \frac{1.1}{2}$ =		0.4	
	GROUND - 2ND FLOORS : $3\left(0.70 \times \frac{1.1}{2}\right)$ =	1.2		
	$3\left(1.50 \times \frac{1.1}{2}\right)$ =		2.5	
	225mm WALL : $4.8 \times 6.2 \times 0.85$ =	19.3		
	330mm WALL : $7.5 \times 4.3 \times 0.85$ =	21.0		
		42.1	2.9	45.0 kN/m

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28 CANFIELD GARDENS NW6.

INTERNAL WALLS :

			DL	LL	TOTAL
SPINE WALL 1 : UDL	= PITCHED ROOF	$1.35 \times \frac{7.0}{2}$ =	4.7		
		$0.75 \times \frac{7.0}{2}$ =		2.6	
	3RD FLOOR	$0.50 \times \frac{7.0}{2}$ =	1.8		
		$1.50 \times \frac{7.0}{2}$ =		5.3	
	L.W PARTITIONS	$0.50 \times \frac{7.0}{2}$ =	1.8		
	GROUND - 2ND FLOOR (REAR)	$3\left(0.7 \times \frac{4.6}{2}\right)$ =	4.8		
		$3\left(1.5 \times \frac{4.6}{2}\right)$ =		10.4	
	BLANKET PARTITION	$3\left(1.0 \times \frac{4.6}{2}\right)$ =	6.9		
	STEEL WALLS 2ND & 3RD	$0.5 \times 5.0 \times 0.85$ =	2.1		
	112mm BRICK WALL @ 1ST	$2.5 \times 3.3 \times 0.85$ =	7.0		
	225mm BRICK WALL @ GROUND	$4.8 \times 3.3 \times 0.85$ =	13.5		
			42.6	18.3	60.9 kN/M
SPINE WALL 2 : UDL	= PITCHED ROOF	$1.35 \times \frac{7.0}{2}$ =	4.7		
		$0.75 \times \frac{7.0}{2}$ =		2.6	
	3RD FLOOR	$0.50 \times \frac{7.0}{2}$ =	1.8		
		$1.50 \times \frac{7.0}{2}$ =		5.3	
	L.W PARTITIONS	$0.50 \times \frac{7.0}{2}$ =	1.8		
	STAIRCASE	$3\left(0.5 \times \frac{2.2}{2}\right)$ =	1.7		
		$3\left(3.0 \times \frac{2.2}{2}\right)$ =		9.9	
	STEEL WALLS 2ND & 3RD	0.5×5.0 =	2.5		
	112mm BRICK WALL @ 1ST	2.5×3.3 =	8.3		
	225mm BRICK WALL @ GROUND	$4.8 \times 3.3 \times 0.85$ =	13.5		
			34.3	17.8	52.1 kN/M

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28 Canfield Gardens NW6.

			DL	LL	TOTAL
Spine Wall 3 : UDL	: Pitched Roof (via Floor Beam)	= 1.35 × 9.2/2 =	6.2		
		0.75 × 9.2/2 =		3.5	
	3rd Floor (Av)	: 0.5 × 9.2/2 =	2.3		
		1.5 × 9.2/2 =		6.9	
	L-W Partitions	: 0.5 × 9.2/2 =	2.3		
	Ground - 2nd Floor	: 3(0.7 × 5.6/2) =	5.9		
		3(1.5 × 5.6/2) =		12.6	
	Blockwork Partition	: 3(1.0 × 5.6/2) =	8.4		
	Grd Wall 3rd	: 0.5 × 2.3 × 0.85 =	1.0		
	112mm Brick 2nd	: 2.5 × 2.7 × 0.85 =	5.7		
	225mm Brick 1st & Ground	: 4.8 × 6.6 × 0.85 =	26.9		
			58.7	23.0	81.7 kN/m
Spine Wall 4 : UDL	= Pitched Roof	: 1.35 × 9.2/2 =	6.2		
		: 0.75 × 9.2/2 =		3.5	
	3rd Floor (Av)	: 0.50 × 9.2/2 =	2.3		
		: 1.50 × 9.2/2 =		6.9	
	L-W Partitions	: 0.50 × 9.2/2 =	2.3		
	Ground - 2nd Floors	: 3(0.7 × 3.6/2) =	3.8		
		3(1.5 × 3.6/2) =		8.1	
	Blockwork Partition	= 3(1.0 × 3.6/2) =	5.4		
	Walls to Match Spine Wall 3	: 1.0 + 5.7 + 26.9 =	33.6		
			53.6	18.5	72.1 kN/m

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28 Canfield Gardens NW6.

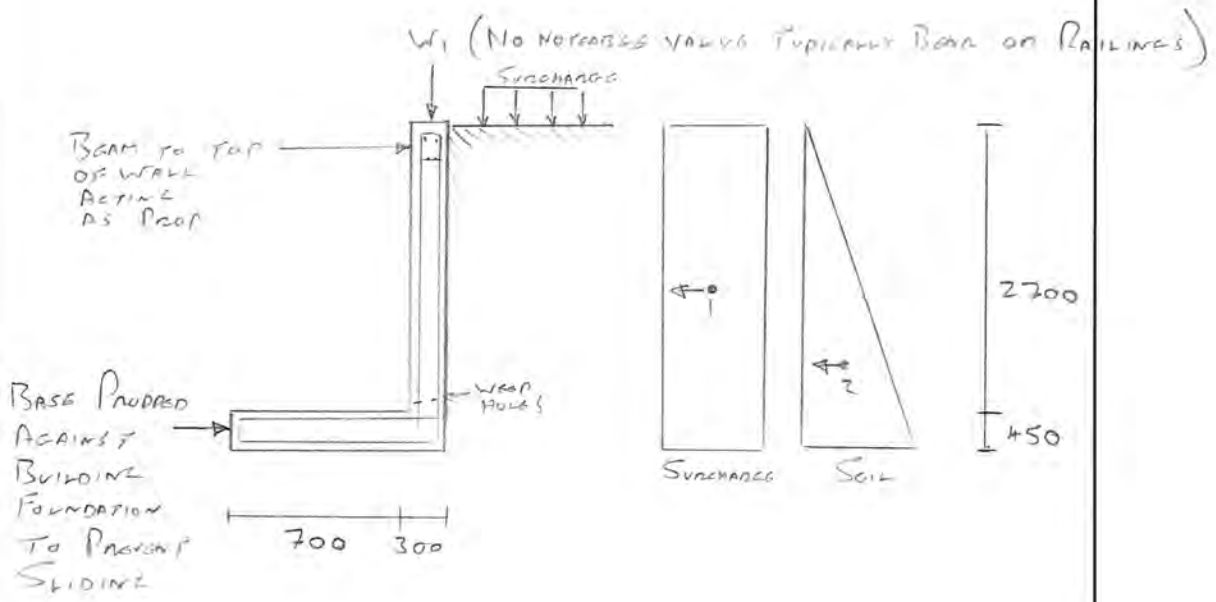
External Lightwell Retaining Wall Design.

Surcharge Load Cases : Similar to other External Walls.

Front (Vehicle Area) = 10.0 kN/m²

Rear (Garden) = 5.0 kN/m²

Water Pressure : Lined weep holes are to be formed near the base of the wall. Water to run into drainage (by others) in the base of the lightwells.



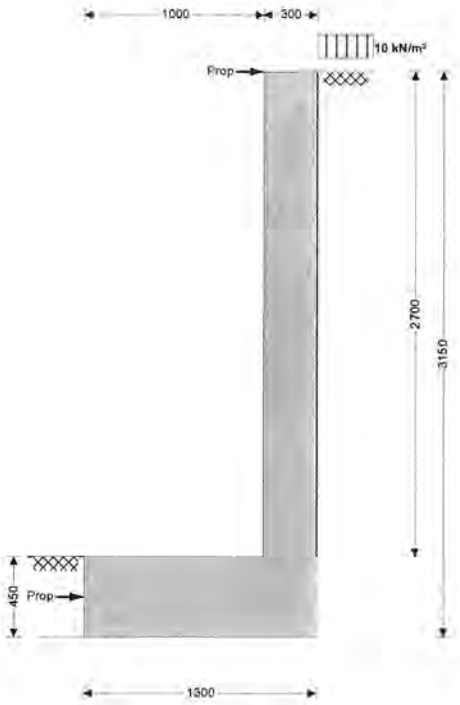
General wall design carried out using Tedds Program & Assuming:

- C-35(40) Grade Concrete
- H16 Bars @ 200mm c/c Top & Bottom to Base.
- H16 Bars @ 200mm c/c to both faces in wall vertically.
- H12 Bars @ 250mm c/c to both faces in wall horizontally.

Tedds Martin Redston Associates 4 Edward Square London N1 0SP	Project 28 CANFIELD GARDENS, LONDON				Job no. 16.440	
	Calcs for LIGHTWELL RETAINING WALL SECTION (front)				Start page no./Revision D<-15	
	Calcs by PS	Calcs date 22/12/2016	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2700** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1000** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1300** mm	Base thickness	t_{base} = **450** mm
Height of retaining wall	h_{wall} = **3150** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **450** mm
Position of downstand	l_{ds} = **-250** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **0** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **3150** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **100** kN/m^2

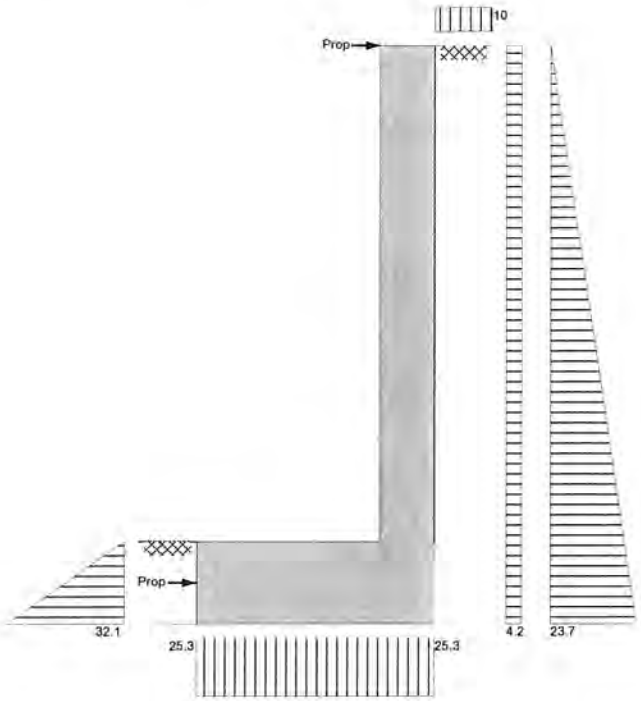
Using Coulomb theory

Active pressure	K_a =**0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **10.0** kN/m^2		
Vertical dead load	W_{dead} = **0.0** kN/m	Vertical live load	W_{live} = **0.0** kN/m

Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **0** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m²

Calculate propping force

Propping force F_{prop} = **32.2** kN/m

Check bearing pressure

Total vertical reaction	R = **32.9** kN/m	Distance to reaction	x_{bar} = **650** mm
Eccentricity of reaction	e = **0** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **25.3** kN/m²	Bearing pressure at heel	p_{heel} = **25.3** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall	F_{prop_top} = **14.767** kN/m	Propping force to base of wall	F_{prop_base} = **17.480** kN/m

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **32.2** kN/m

Calculate propping forces to top and base of wall

Propping force to top of wall $F_{prop\_top\_f}$ = **31.931** kN/m Propping force to base of wall $F_{prop\_base\_f}$ = **45.947** kN/m

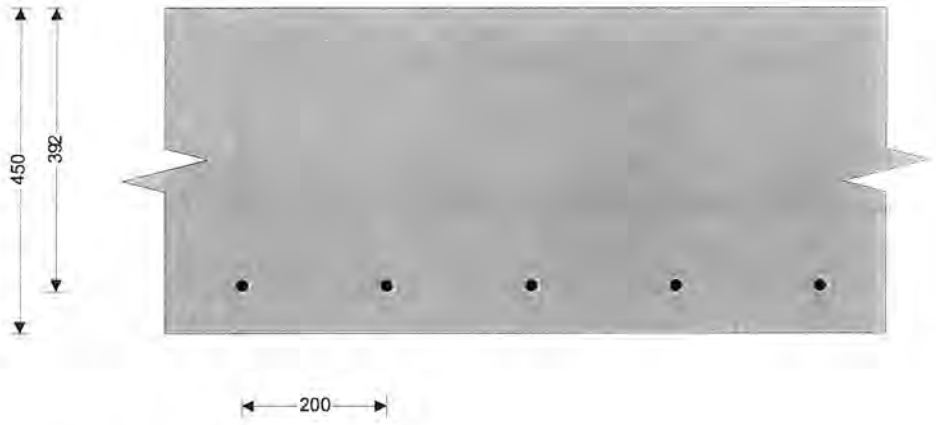
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **35** N/mm² Strength of reinforcement f_y = **500** N/mm²

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **50** mm



Design of retaining wall toe

Shear at heel V_{toe} = **20.6** kN/m Moment at heel M_{toe} = **13.6** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 200 mm centres**

Area required $A_{s\_toe\_req}$ = **585.0** mm²/m Area provided $A_{s\_toe\_prov}$ = **1005** mm²/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.053** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.451** N/mm²

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

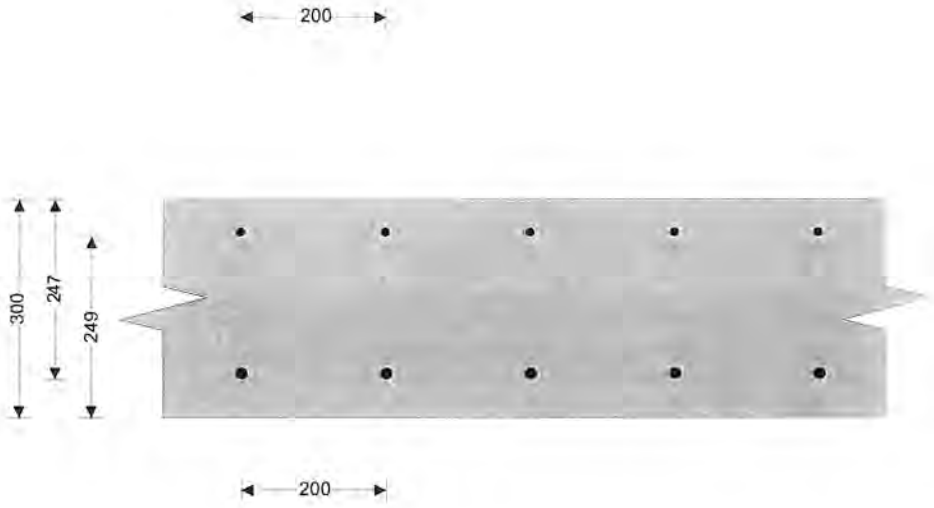
Material properties

Strength of concrete f_{cu} = **35** N/mm² Strength of reinforcement f_y = **500** N/mm²

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **45** mm Cover in wall c_{wall} = **45** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **57.4** kN/m Moment at base of stem M_{stem} = **33.2** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 200 mm centres**

Area required $A_{s\_stem\_req}$ = **390.0** mm²/m Area provided $A_{s\_stem\_prov}$ = **1005** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.233** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.591** N/mm²

v_{stem} < v_{c_stem} - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **15.7** kNm/m

Compression reinforcement is not required

Reinforcement provided **12 mm dia.bars @ 200 mm centres**

Area required $A_{s\_wall\_req}$ = **390.0** mm²/m Area provided $A_{s\_wall\_prov}$ = **565** mm²/m

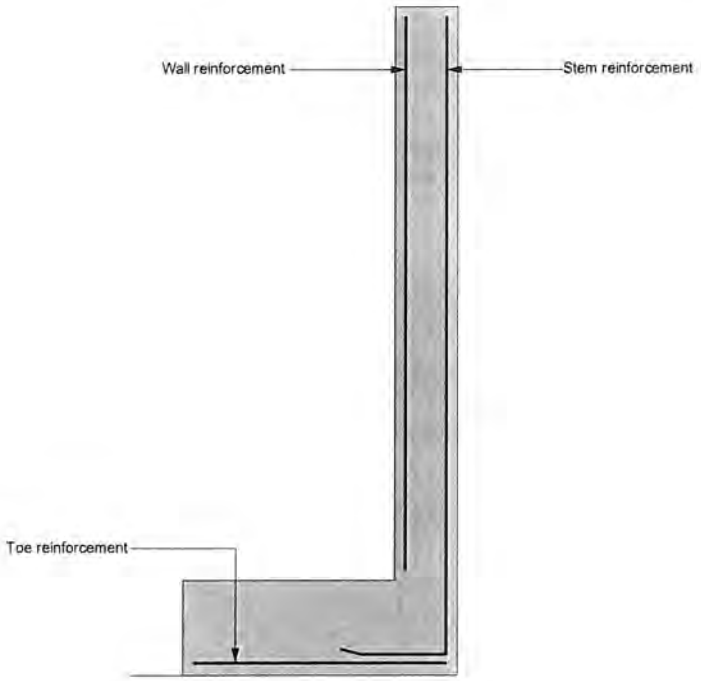
PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **40.00** Actual span/depth ratio $ratio_{act}$ = **10.93**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 200 mm centres - (1005 mm^2/m)
Wall bars - 12 mm dia.@ 200 mm centres - (565 mm^2/m)
Stem bars - 16 mm dia.@ 200 mm centres - (1005 mm^2/m)

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Date	Sheet No.
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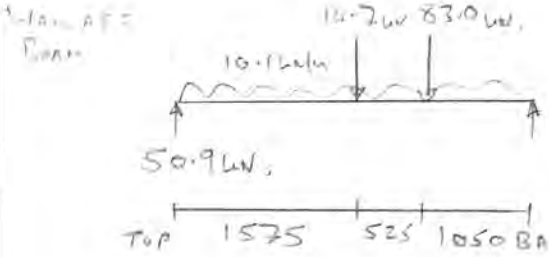
28 CANFIELD GARDENS NW6

TOP BEAM :

ASSESS FORCES ON BACK OF WALL AS BEAM BEARING ONTO TOP BEAM AS

		FACTORED
SELFWEIGHT (UDL)	$0.3 \times 24 = 7.2$ kN/m PER M WIDTH.	10.1 kN/m
SURCHARGE	$: \frac{1}{3} \times 10 \times 3.15 = 10.5$ kN	14.7 kN.
SOIL	$: \frac{1}{3} \times \frac{1}{2} \times 18 \times 3.15^2 = 59.3$ kN.	83.0 kN.

(BS 8110 GENERAL SAFETY FACTOR = 1.4)



MAX SPAN BETWEEN RESTRAINTS = 4.0m. (INCLUDING BEARINGS)

$M = \frac{wl^2}{12} = 67.9$ kNm.

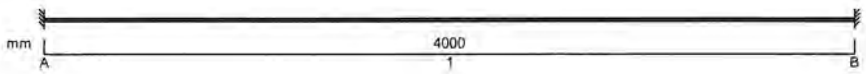
BEAM TO BE FORMED WITHIN RETAINING WALL DEPTH (PROVISIONAL SIZE 300×300mm)

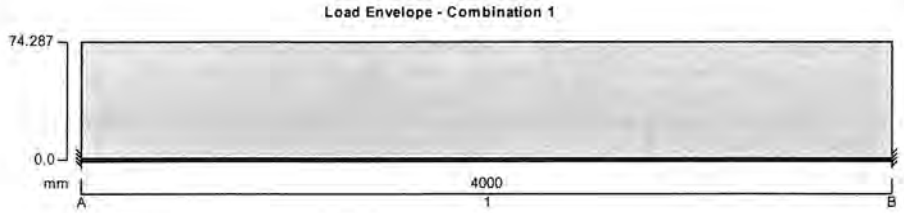
ASSUMING 2NO H20 BARS TO "TOP & BOTTOM" & H10 LINKS AT REQUIRED CENTRES.

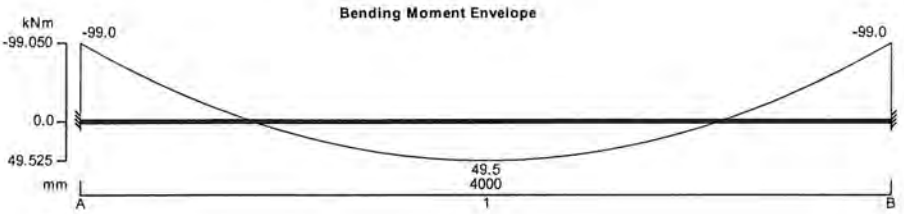
Tedds Martin Redston Associates 4 Edward Square London N1 0SP	Project 28 CANFIELD GARDENS, NW6				Job no. 16-440	
	Calcs for LIGHTWELL TOP BEAM				Start page no./Revision Pc-21	
	Calcs by PS	Calcs date 22/12/2016	Checked by	Checked date	Approved by	Approved date

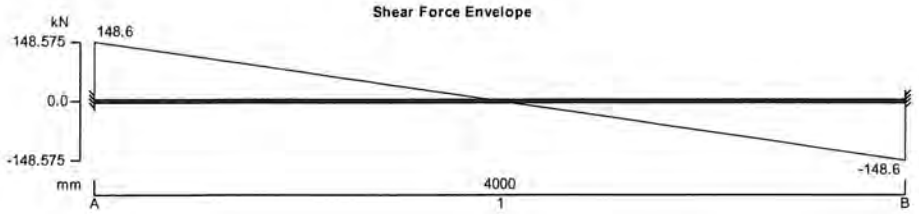
RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.1.12









Support conditions

Support A	Vertically restrained
	Rotationally restrained
Support B	Vertically restrained
	Rotationally restrained

Applied loading

Dead self weight of beam × 1

Dead full UDL 50.9 kN/m

Load combinations

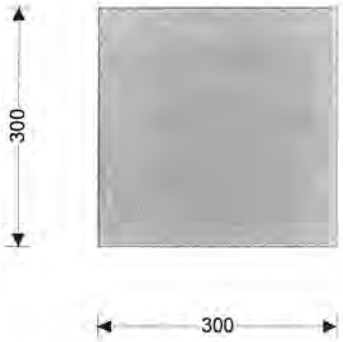
Load combination 1	Support A	Dead × 1.40
		Imposed × 1.60
	Span 1	Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment support A	M_{A_max} = **-99** kNm	M_{A_red} = **-99** kNm
Maximum moment span 1 at 2000 mm	M_{s1_max} = **50** kNm	M_{s1_red} = **50** kNm
Maximum moment support B	M_{B_max} = **-99** kNm	M_{B_red} = **-99** kNm
Maximum shear support A	V_{A_max} = **149** kN	V_{A_red} = **149** kN
Maximum shear support A span 1 at 250 mm	$V_{A\_s1\_max}$ = **130** kN	$V_{A\_s1\_red}$ = **130** kN
Maximum shear support B	V_{B_max} = **-149** kN	V_{B_red} = **-149** kN
Maximum shear support B span 1 at 3750 mm	$V_{B\_s1\_max}$ = **-130** kN	$V_{B\_s1\_red}$ = **-130** kN
Maximum reaction at support A	R_A = **149** kN	
Maximum reaction at support B	R_B = **149** kN	

Rectangular section details

Section width b = **300** mm Section depth h = **300** mm



Material details

Concrete strength class	**C35/45**	Char comp cube strength	f_{cu} = **45** N/mm²
Modulus of elasticity of conc	E_c = **29000** N/mm²	Maximum aggregate size	h_{agg} = **20** mm
Char yield strength of reinf	f_y = **500** N/mm²	Char yield str of shear reinf	f_{yv} = **500** N/mm²
Nominal cover to top reinf	c_{nom_t} = **35** mm	Nominal cover to bottom reinf	c_{nom_b} = **35** mm
Nominal cover to side reinf	c_{nom_s} = **35** mm		

Mid span 1

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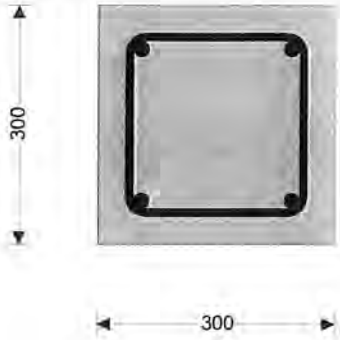
	Calcs for LIGHTWELL TOP BEAM				Start page no./Revision Pc23	
	Calcs by PS	Calcs date 22/12/2016	Checked by	Checked date	Approved by	Approved date



2 x 20ϕ bars

2 x 10ϕ shear legs at 150 c/c

2 x 20ϕ bars

Design moment resistance of rectangular section (cl. 3.4.4)

Design bending moment	M = **50** kNm	Depth to tension reinf.	d = **245** mm
	K = **0.061**		K' = **0.156**
			K' > K - No compression reinforcement is required
Lever arm	z = **227** mm	Depth of neutral axis	x = **40** mm
Area of tension reinf req'd	$A_{s,req}$ = **501** mm^2	Tension reinf provided	2 × 20ϕ bars
Area of tension reinf prov	$A_{s,prov}$ = **628** mm^2	Minimum area of reinf	$A_{s,min}$ = **117** mm^2
Maximum area of reinf	$A_{s,max}$ = **3600** mm^2		
	PASS - Area of reinforcement provided is greater than area of reinforcement required		

Rectangular section in shear

Shear reinforcement provided	2 × 10ϕ legs at 150 c/c		
Area of shear reinf provided	$A_{sv,prov}$ = **1047** mm^2/m	Minimum area of shear reinf	$A_{sv,min}$ = **276** mm^2/m
	PASS - Area of shear reinforcement provided exceeds minimum required		
Max longitudinal spacing	$s_{vl,max}$ = **184** mm		
	PASS - Longitudinal spacing of shear reinforcement provided is less than maximum		

Spacing of reinforcement (cl 3.12.11)

Actual dist between bars	s = **170** mm	Min dist between bars	s_{min} = **25** mm
			PASS - Satisfies the minimum spacing criteria
Design service stress	f_s = **266.0** N/mm^2	Max distance between bars	s_{max} = **177** mm
			PASS - Satisfies the maximum spacing criteria

Span to depth ratio (cl. 3.4.6)

Span to depth ratio (T.3.9)	$span\_to\_depth_{basic}$ = **20.0**	Service stress in tension rein	f_s = **266.0** N/mm^2
Modification for tension reinf	f_{tens} = **1.032**	Modification for comp reinf	f_{comp} = **1.222**
Modification for span > 10m	f_{long} = **1.000**	Allowable span to depth ratio	$span\_to\_depth_{allow}$ = **25.2**
Actual span to depth ratio	$span\_to\_depth_{actual}$ = **16.3**		
			PASS - Actual span to depth ratio is within the allowable limit

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Date	Sheet No.
Eng. PS	PC-24
Job No. 16.440	

24 Canfield Gardens NW6.

External Retaining Wall Design.

Surcharge Load Cases

The surcharge to the higher level ground behind the walls varies

Front (vehicle axels) = 10.0 kN/m²
Rear (Garden) = 5.0 kN/m²
Flanks (Domestic + Parking) = 2.5 kN/m²

Water Pressure

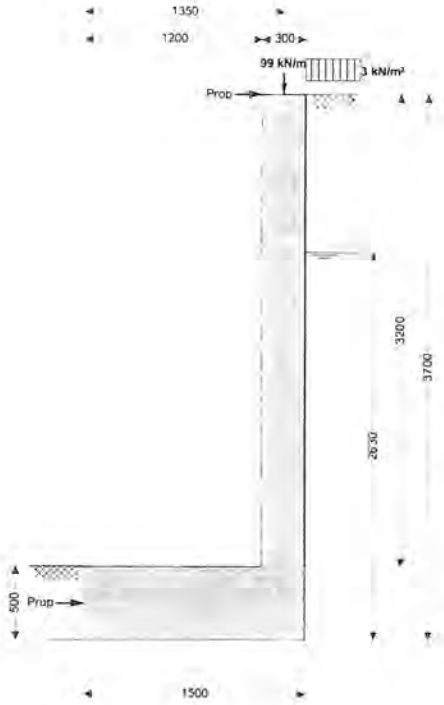
Previous guidance in the surrounding area indicates that there is unlikely to be any water for a minimum of 2.5m below ground level.

However assume conservative water level on 2/3 height of wall, rising to 3/4 for temporary condition.

Tedds	Project				Job no.	
Martin Redston Associates 4 Edward Square London N1 0SP	28 CANFIELD GARDENS, LONDON				16.440	
	Calcs for LEFT-HAND PARTY WALL RETAINING WALL SECTION				Start page no./Revision PC- 25	
	Calcs by PS	Calcs date 03/01/2017	Checked by	Checked date	Approved by	Approved date

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **3200** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1200** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1500** mm	Base thickness	t_{base} = **500** mm
Height of retaining wall	h_{wall} = **3700** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **500** mm
Position of downstand	l_{ds} = **-250** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **2630** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **3700** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **100** kN/m^2

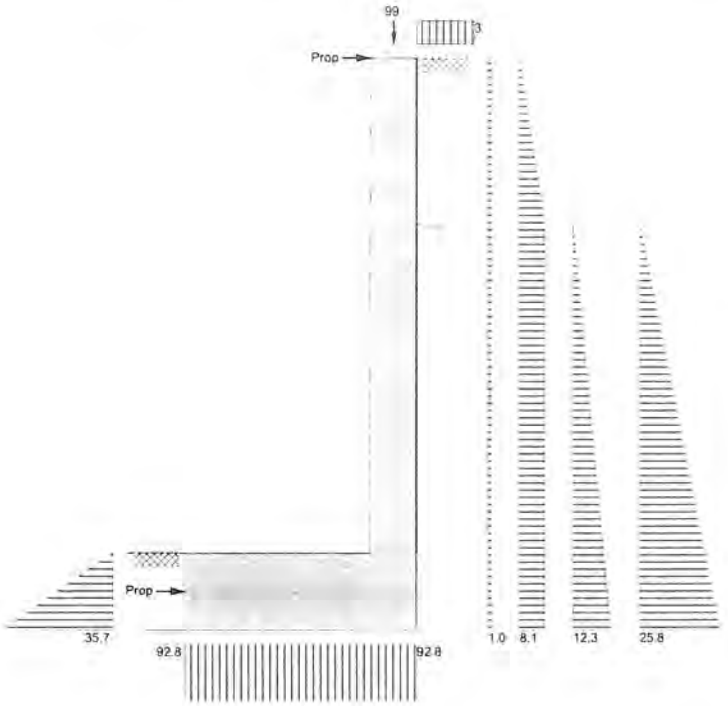
Using Coulomb theory

Active pressure	K_a =**0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **2.5** kN/m^2		
Vertical dead load	W_{dead} = **84.5** kN/m	Vertical live load	W_{live} = **14.3** kN/m

Horizontal dead load F_{dead} = **0.0** kN/m
Horizontal live load F_{live} = **0.0** kN/m
Position of vertical load l_{load} = **1350** mm
Height of horizontal load h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **28.6** kN/m

Check bearing pressure

Total vertical reaction R = **139.2** kN/m
Distance to reaction x_{bar} = **750** mm
Eccentricity of reaction e = **0** mm

Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **92.8** kN/m^2
Bearing pressure at heel p_{heel} = **92.8** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

Calculate propping forces to top and base of wall

Propping force to top of wall F_{prop_top} = **9.030** kN/m
Propping force to base of wall F_{prop_base} = **19.531** kN/m

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **28.6** kN/m

Calculate propping forces to top and base of wall

Propping force to top of wall $F_{prop\_top\_f}$ = **13.254** kN/m Propping force to base of wall $F_{prop\_base\_f}$ = **53.981** kN/m

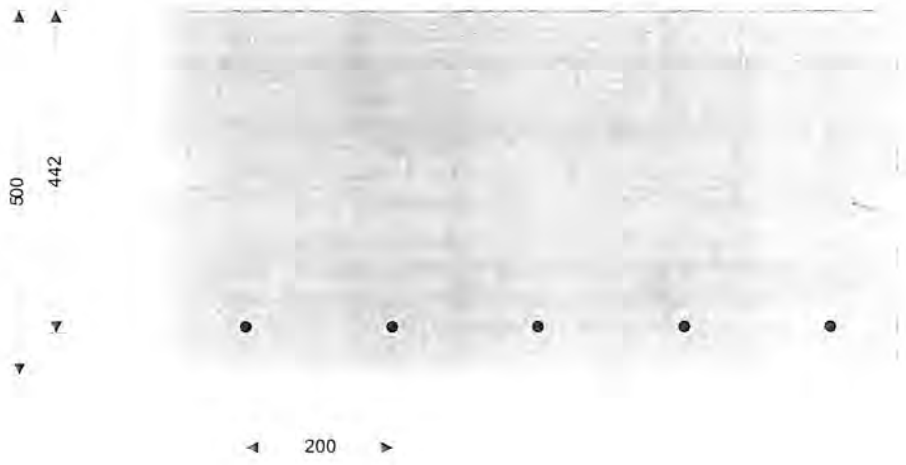
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **35** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **50** mm



Design of retaining wall toe

Shear at heel V_{toe} = **138.3** kN/m Moment at heel M_{toe} = **105.0** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 200 mm centres**

Area required $A_{s\_toe\_req}$ = **650.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **1005** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.313** N/mm^2 Allowable shear stress v_{adm} = **4.733** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.432** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

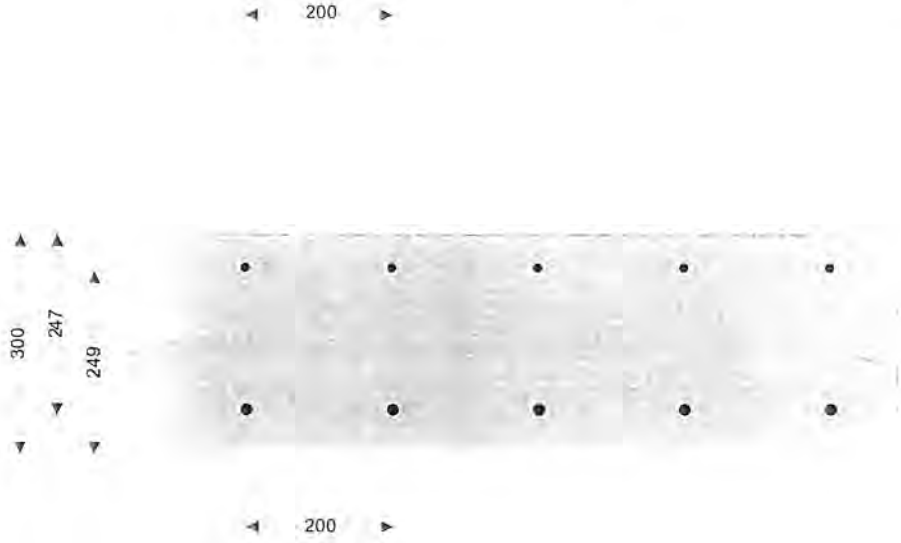
Material properties

Strength of concrete f_{cu} = **35** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **45** mm Cover in wall c_{wall} = **45** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **81.3** kN/m Moment at base of stem M_{stem} = **46.3** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 200 mm centres**

Area required $A_{s\_stem\_req}$ = **453.9** mm²/m Area provided $A_{s\_stem\_prov}$ = **1005** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.329** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.591** N/mm²

$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **22.0** kNm/m

Compression reinforcement is not required

Reinforcement provided **12 mm dia.bars @ 200 mm centres**

Area required $A_{s\_wall\_req}$ = **390.0** mm²/m Area provided $A_{s\_wall\_prov}$ = **565** mm²/m

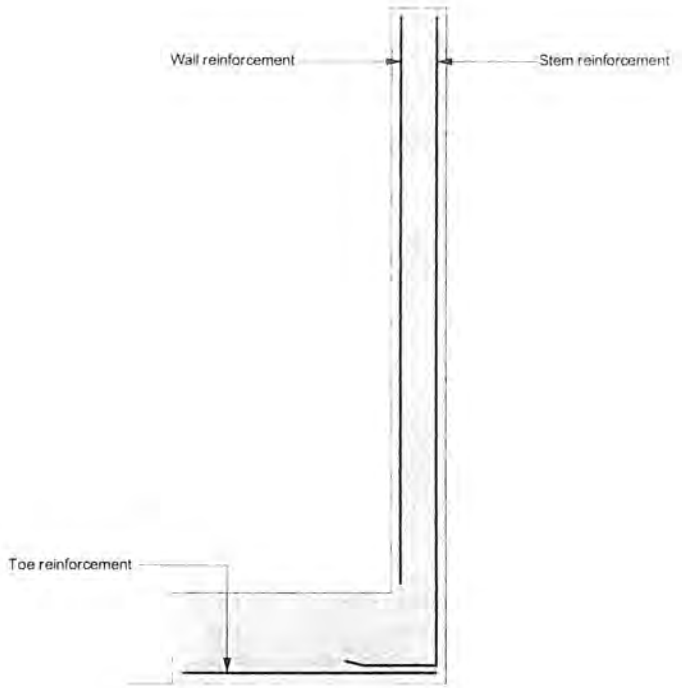
PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **40.00** Actual span/depth ratio $ratio_{act}$ = **12.96**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 16 mm dia.@ 200 mm centres - (1005 mm^2/m)
Wall bars - 12 mm dia.@ 200 mm centres - (565 mm^2/m)
Stem bars - 16 mm dia.@ 200 mm centres - (1005 mm^2/m)