Appendix B: Structural Calculations

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Structural Calculations
For
Former Spiritualist Temple
Rochester Square
London

2016061

December 2016

Company No. 3873122
VAT Registration No. 894 2993 61
Registered in England And Wales

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Job Title	Former Spiritualist Temple, Rochester Square	Date	Made By	Checked By
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CLIENT

Camden Land Partnerships Ltd

ARCHITECT

Spacelab

CODES USED

- NHBC
- BS 648: 1964 – Weights of Building Materials
- BS 6399: Pt 1: 1998 – Design Loads
- BS 5950: Pt 1: 2008 – Structural Steel
- BS 5628: Pt 1: 2005 – Masonry
- BS 5268: Pt 2: 2002 – Structural Timber
- BS 8110: 1997 – Reinforced Concrete

IMPOSED LOADS

- Domestic Floors – 1.5 kN/m²

GROUND CONDITIONS

- London Clay – Allowable Safe Ground Bearing Pressure – 140 kN/m² (See LMB Geo report)

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LOADS		kg/m²		DEAD kN/m²	LIVE
Tiled Roof - (With Lining)	Tiles	75			
	Felt & Battens	6			
	Rafters	6			
	Battens & Insulation	4			
	Plasterboard & Skim	15			
		106 kg/m²			
	Plan Load	20°	=	1.13	0.75
		30°	=	1.22	0.75
		35°	=	1.29	0.67
		40°	=	1.38	0.58
		45°	=	1.5	0.5
		50°	=	1.66	0.42
Ceilings -	Joists	8			
	Insulation	2			
	Plasterboard & Skim	15			
		25 kg/m²		0.25	0.25
New Cavity -	102 Brick	210			
	100 Block	80			
	Plasterboard & Skim	24			
		314 kg/m²		3.14	
New Tile Hung Cavity	Tiles	75			
	Felt & Battens	6			
	100 Block	80			
	100 Block	80			
	12mm Plaster	24			
		265 kg/m²		2.65	

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LOADS (Cont'd)		**kg/m²**	**DEAD kN/m²**	**LIVE**
Stud Walls	Plasterboard x 2	20		
	Skim Coat x 2	10		
	Studs 75x50@400c/c's	10		
		40 kg/m²	0.4	

Note: 12mm plasterboard with no skim coat similar. For glazed tiling add 6 kg/m² per side.

Lath & Plaster	As Above with Lath	60	0.6	
Built-Up Felt Roof	Felt & Chippings	40		
	Boards & Insulation	15		
	Joists & Firings	10		
	Plasterboard & Skim	15		
		80 kg/m²	0.8	
			No Access	0.75
			Access	1.5
Timber Floor	Boards	15		
	Joists	15		
	Plasterboard & Skim	15		
		45 kg/m²	0.45	
			Domestic	1.5

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201606		

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Section	12/16	DJ	

LOAD TAKE DOWN FROM PROPOSED STRUCTURE ONTO SECANT PILES TO EAST & WEST BOUNDARIES.

ASSUME UPPER FLOORS + ROOF ARE TIMBER FLOOR CONSTRUCTION.

ROOF LOAD (ALLOW FOR SERVICES) 1 kN/m² × 7m/2 = 3.5 kN/m DL

ALLOW FOR ACCESS ON FLAT ROOF 1 kN/m² × 7m/2 = 3.5 kN/m LL

1ST & 2ND FLOOR (ALLOW FOR SERVICES) 0.6 kN/m² × 7m/2 = 2.1 kN/m DL

PARTITIONS 1 kN/m² × 7m/2 = 3 kN/m DL

LIVE LOAD 1.5 kN/m² × 7m/2 = 5.25 kN/m LL

=> 5.6 kN/m DL PER FLOOR × 2 = 11.2 kN/m DL

5.25 kN/m LL PER FLOOR × 2 = 10.5 kN/m LL

GROUND FLOOR SLAB 250mm RC - 100mm SCREED

8.4 kN/m² × 7m/2 = 29.4 kN/m DL

GALLERY 5 kN/m² × 7m/2 = 17.5 kN/m LL

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CAVITY WALL:

8.5m x 3.4 kN/m² = 29kN/m DL.

∴ LOAD PER M RUN:

73.1kN/m DL.

33.25kN/m LL

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EXPECTED HEAVE FORCES

DETAILED ANALYSIS HAS BEEN UNDERTAKEN BY CHD GEOSOLUTIONS – SEE APPENDIX C.

APPROXIMATE CONSERVATIVE HEAVE FORCES

EXCAVATION DEPTH = 3.55m.

HYDROSTATIC PRESSURE = 3.55m × 10kN/m³ = 35.5kN/m²

OVERBURDEN PRESSURE = 3.55m × 18kN/m³ = 64kN/m²

HEAVE = 35.5kN/m² + 0.5 (64kN/m² − 35.5kN/m²) = 49.75kN/m²

SLAB SW = 0.5m × 24kN/m³ = 12 kN/m²

+ SCREED = 2kN/m²

14 kN/m²

∴ OVERALL UPLIFT = 49.75kN/m² − 14 kN/m²

= 36 kN/m².

HEAVE FORCES FROM THE SOIL ARE TO BE IGNORED FOR THE BASEMENT SLAB DESIGN AS HEAVE PROTECTION PRODUCT (CELLCORE HX S OR SIMILAR) WILL BE LAID BENEATH.

∴ SLAB TO BE DESIGNED FOR UPLIFT OCCURRING DUE TO HYDROSTATIC PRESSURES.

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UPLIFT - $35.5\,kN/m^2 - 16\,kN/m^2 = 21.5\,kN/m^2$.

ULTIMATE FACE = $21.5\,kN/m^2 \times 1.6$

$= 34\,kN/m^2$.

MAXIMUM MOMENT ON SLAB : $\frac{34.5 \times 1.0m \times 7.1m^2}{8}$

$= 217\,kNm$

- REFER TO SPREADSHEET DESIGN ANALYSIS.

PROVIDE H20 TBARS @ 150mm C/S

ELEMENT DESIGN to BS 8110:2005

SOLID SLABS

Originated from RCC11.xls v4.0

mpa The Concrete Centre

INPUT Location Basement Slab Design

Design moment, M	217.0	kNm/m	fcu	40	N/mm²	γc =	1.50
ßb	1.00		fy	500	N/mm²	γs =	1.15
span	7100	mm	steel class	A			
Height, h	400	mm	Section location	SIMPLY SUPPORTED SP.			
Bar Ø	20	mm	Compression steel	NOMINAL			
cover	50	mm to these bars		(deflection control only)			

ONE or TWO WAY SLAB

OUTPUT Basement Slab Design — Compression steel = NOMINAL 0.13%

d = 400 - 50 - 20/2 = 340.0 mm

(3.4.4.4) K' = 0.156 > K = 0.047 ok

(3.4.4.4) z = 340.0 [0.5 + (0.25 - 0.047 /0.893)]^½ = 321.2 < 0.95d = 323.0 mm

(3.4.4.1) As = 217.00E6 /500 /321.1 x 1.15 = 1554 > min As = 520 mm²/m

PROVIDE H20 @ 200 = 1571 mm²/m *As increased by 2.3% for deflection*

(Eqn 8) fs = 2/3 x 500 x 1554 /1571 /1.00 = 329.9 N/mm²

(Eqn 7) Tens mod factor = 0.55 + (477 - 329.9) /120 /(0.9 + 1.877) = 0.992

(Equation 9) Comp mod factor = 1 + 0.130/(3 + 0.130) = 1.042

(3.4.6.3) Permissible L/d = 20.0 x 0.992 x 1.042 = 20.654

Actual L/d = 7100 /340.0 = 20.882