Dr Shanthi Thomas

124 St Pancras Way, NW1

Structural Planning Calculations

ENTUITIVE

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April 2017

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Entuitive is a trading name of Tall Engineers Ltd Company No. 5393264
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Project Number: 4369

INTRODUCTION

The full address is:

124 St Pancras Way
London
NW1 9NB

The house is a terraced building over three storeys, including a single below ground storey of reduced head height. There is also a small three storey rear addition to the back of the main house. The external walls are loadbearing masonry walls and the floors are of timber construction as is the roof. The foundations are traditional stepped brick.

SCOPE OF WORK

The proposed alterations involve the formation of a basement extension, within the rear garden, to the rear of the existing property. We propose that this work be undertaken via the formation of the reinforced concrete underpins constructed in a hit and miss sequence.

Stability to the rear of the house and the new rear extension will be provided by a steel box frame.

The attached calculation pages A00-A12 confirm the outline structural calculations required to achieve the above work. Drawings 4369/P-SK-01 to 05 show the required structural intervention to construct the works.

Sincerely,
Entuitive

John Maguire
Senior Engineer
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ENTUITIVE	Project 124 St Pancras, NW1				Page
	Project No. 4369	Made by JM	Checked	Date April 2017	Revision

CONTENTS

ENTUITIVE	Project: 124 St Pancras Way, NW1				Page: A01
	Project No.: 4369	Made by: JM	Checked:	Date: April 2017	Revision:

LOADING (BS 6399 - 1 & 3)

Roof (existing)

DEAD LOAD (on plan) Description	Weight (kN/m²)
Slates:	0.6
Rafters + Battens	0.1
Insulation:	0.01
Deck etc	0.1
Ceiling joists	0.05
Ceiling:	0.19
Other:	0
Total:	**1.05** kN/m²

LIVE LOAD (on plan) Description	Weight (kN/m²)
Snow/Maintenance	0.60
Total:	**0.60** kN/m²

Partial factor on dead load = 1.4 Partial factor on live load = 1.6

w_{sls} = **1.65** kN/m² w_{uls} = **2.43** kN/m²

Roof (flat)

DEAD LOAD (on plan) Description	Weight (kN/m²)
Finishes	0.50
Joists	0.10
Insulation	0.01
Deck etc	0.10
Ceiling + Services	0.19
Other	0.00
Total:	**0.9** kN/m²

LIVE LOAD (on plan) Description	Weight (kN/m²)
Snow/Maintenance	0.75
Total:	**0.75** kN/m²

Partial factor on dead load = 1.4 Partial factor on live load = 1.6

w_{sls} = **1.65** kN/m² w_{uls} = **2.46** kN/m²

Floors

DEAD LOAD Description	Weight (kN/m²)
Finishes	0.12
Floating floor	0.00
Boards/deck	0.10
Joists	0.13
Insulation	0.01
Ceiling + Services	0.24
Other	0.00
Total:	**0.60** kN/m²

LIVE LOAD Description	Weight (kN/m²)
Domestic	1.50
Total:	**1.50** kN/m²

Partial factor on dead load = 1.4 Partial factor on live load = 1.6

w_{sls} = **2.1** kN/m² w_{uls} = **3.24** kN/m²

ENTUITIVE	Project: 124 St Pancras Way, NW1				Page: A02
	Project No.: 4369	Made by: JM	Checked:	Date: April 2017	Revision:

LOADING (BS 6399 - 1 & 3)

Walls (internal) — DEAD LOAD

Description	Weight (kN/m²)	
Finishes (face 1)	0.6	30mm thick, 20kN/m³ plaster
Studwork/masonry	3.87	18kN/m³ 215-thick brickwork wall
Insulation	0	
Finishes (face 2)	0.3	
Total:	**4.77** kN/m²	

Partial factor on dead load = 1.4

w_{sls} = **4.77** kN/m² w_{uls} = **6.678** kN/m²

Walls (stud) — DEAD LOAD

Description	Weight (kN/m²)
Finishes (face 1)	0.2
Studwork/masonry	0.05
Insulation	0
Finishes (face 2)	0.2
Total:	**0.45** kN/m²

Partial factor on dead load = 1.4

w_{sls} = **0.45** kN/m² w_{uls} = **0.63** kN/m²

ENTUITIVE	Project: 124 Saint Pancras Way, NW1				Page: A03
	Project No.: 4369	Made by: JM	Checked:	Date: Mar '17	Revision:

LOADING ON SIDE WALLS:

NO. 126 SIDE

GRD. FLOOR

DL = 1.05 x 3.3/2 — 1.75 kN/m

LL = 0.6 x 3.3/2 — 1.0 kN/m

wall = 0.3 x 20 x 2.8 — 16.8 kN/m

underpinning

DL = 1.5 x 24 x 0.45 — 16.5 kN/m

35.1 kN/m — 1.0 kN/m

LOADING ON EXTERNAL WALL TO REAR ADDITION:

1st FLOOR

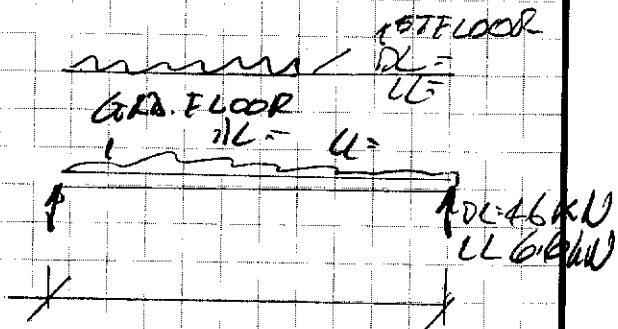
ROOF DL = 1.0 x 1.05 = 1.05 kN/m

LL = 1.0 x 0.6 = 0.6 kN/m

wall DL = 0.25 x 2.8 x 20 = 14.0 kN/m

FLOOR DL = 0.6 x 1.0 = 0.6 kN/m

LL = 1.0 x 1.5 = 1.5 kN/m



GRD FLOOR

FLOOR DL = 0.6 kN/m

LL = 1.5 kN/m

wall DL = 0.25 x 2.8 x 0.8 x 20 = 11.5

DL = 28.0 kN/m

LL = 3.6 kN/m

ENTUITIVE	Project: 124 Saint Pancras Way, NW1				Page: A04
	Project No.: 4369	Made by: JM	Checked:	Date: Mar '17	Revision:

LOADINGS ON WALLS FOR BIA

Rear wall of house:

Roof

DL = 1.05 x 0.6 — DL 0.63kN/m

LL = 0.6 x 0.6 — LL 0.36kN/m²

2ND, 1ST FLOORS

DL = 0.6 x 2.0 x 2 — 2.4kN/m

LL = 1.5 x 2 x 2 — 6.0kN/m

wall 1st + 4/5 roof = 0.390 x 20 x 5.9 x 0.8 — 36.82kN/m

wall @ roof = 0.390 x 20 x 0.75 = 5.85kN/m²

Grd floor:

DL = 1.2 + (1.0 x 2.4) — 3.6kN/m

LL = 3.07 (6.6 x 2.4) — 4.44kN/m

wall Grd to 1st = 0.39 x 20 x .8 x 3 = 18.72kN/m

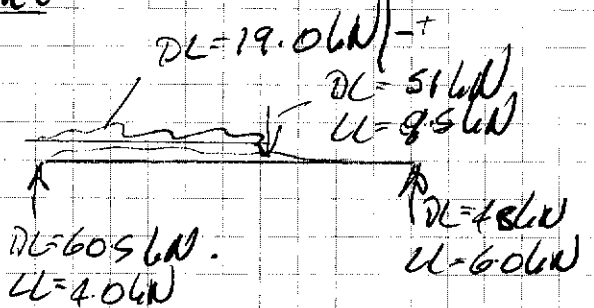
Basement wall = 0.54 x 20 x 0.65 x 2.5 = 17.55kN/m

underpinning = 1.0 x 24 x 0.55 = 13.2kN/m

98.77kN/m — 11.04kN/m

LOADING ON REAR BOX FRAME:

span = 5.0m.

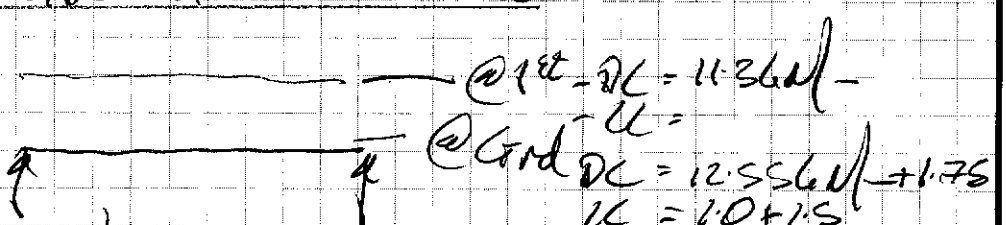


Assume line load @ basement

DL = (51/4.0) + (0.018 x 26 x 2.5) + (0.42 x 0.42 x 24) + (14.25)
= 32.5kN/m

LL = 9.5/4 = 2.5kN/m

LOADING ON SIDE WALL NO. 122 SIDE



w/ring = 16.5kN/m

DL_{TOT} = 11.3 + 12.55 + 1.75 + 16.5 = 42.1kN/m + 16.8 = 58.9kN/m

LL_{TOT} = 1.0 + 1.5 = 2.5kN/m

LOADING ON SLAB:

Tiles + bedding = 0.05 x 25 =
Insulation = 0.1
Screed to fall = 0.075 x 24 =
slab 300 thk = 0.3 x 24 = 7.2
10.5kN/m

ENTUITIVE	Project: 124 Saint Pancras Way, NW1				Page: A06
	Project No.: 4369	Made by: JM	Checked:	Date: Mar '17	Revision:

FLOATION CHECK:

- Dead load on basement slab = 9.0kN/m²
- Dead load from box frame = 100kN/4.8x2.0 = 10.4kN/m²
- Dead load from retaining wall = 0.3x24x2.5÷2 = 9.0kN/m²

Total dead load acting against floatation = 28.4kN/m²

Assume uplift pressure = 3/4 x 2.75 x 9.81
= 20.5kN/m².

=> Total dead load for the basement slab + weight of retaining wall @ the rear + weight on the rear box frame will be greater than the assumed uplifting water pressure.

ENTUITIVE	Project: 124 Saint Pancras Way, NW1				Page: A07
	Project No.: 4369	Made by: JM	Checked	Date: Mar '17	Revision

Outline design for the RC retaining walls @ rear

Horizontal loads on walls

Soil properties ... ref CGL BIA report

- made ground ≈ 1.0m dp.
  - unit weight = 18kN/m³
  - ϕ = 29°
- Possible Head Deposits ≈ 1.15m dp.
  - unit weight = 20kN/m³
  - ϕ = 24° (Assumed).
- Weathered London Clay ≈ 1.35m dp.
  - unit weight = 20kN/m³
  - ϕ = 24°

Ka made grd. = 0.326

Ka weath. L.C. = $\frac{0.41}{1+0.41}$ = 0.29

P_{s1} = 0.326 × 18 × 1.0/2 = 2.934kN/m

P_{s2} = 0.326 × 18 × 1.0/2 + 1.8 = 1.63kN/m

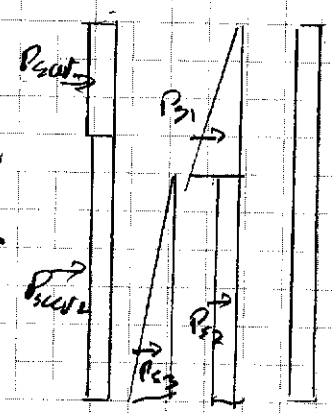
P_{s3} = 0.29 × 20 × 1.8/2 = 9.4kN/m

P_{surc1} = 0.326 × 2.5 = 0.814kN/m

P_{surc2} = 0.29 × 2.5 = 0.72kN/m

P_{water} = 9.81 × 2.1²/2 = 21.63kN/m

↳ Take account of water in permanent condition



ENTUITIVE	Project: 124 Saint Pancras Way, NW1				Page: A08
	Project No.: 4369	Made by: JM	Checked:	Date: Mar '17	Revision:

LOADINGS ON RC UNDERPIN WALLS:

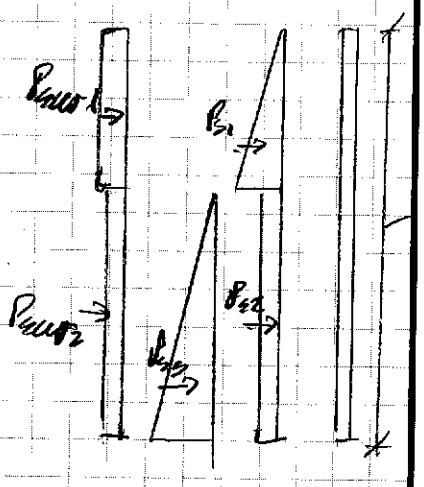
$P_{s1} = 0.326 \times 18 \times 1.0^2/2 = 2.934\,kN$

$P_{s2} = 0.326 \times 18 \times 1.0^2/2 \div 1.5 = 1.63\,kN$

$P_{s3} = 0.29 \times 20 \times 1.5^2/2 = 6.525\,kN$

$P_{wall1} = 0.326 \times 2.5 = 0.814\,kN$

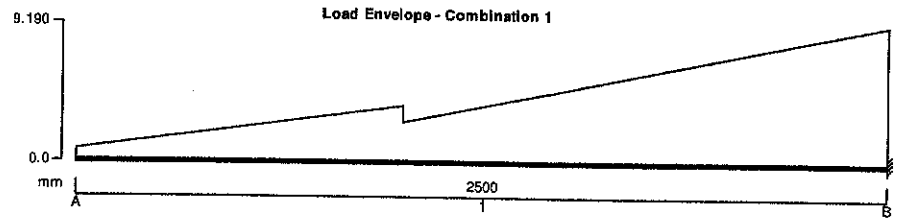
$P_{wall2} = 0.29 \times 2.5 = 0.726\,kN$

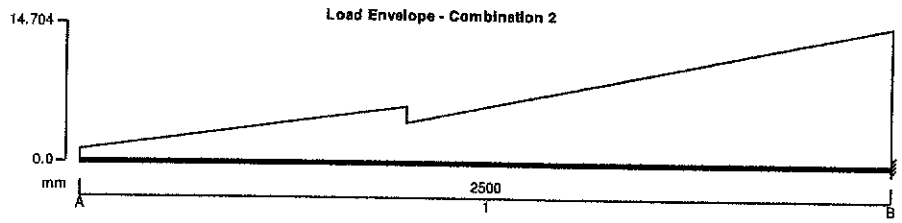


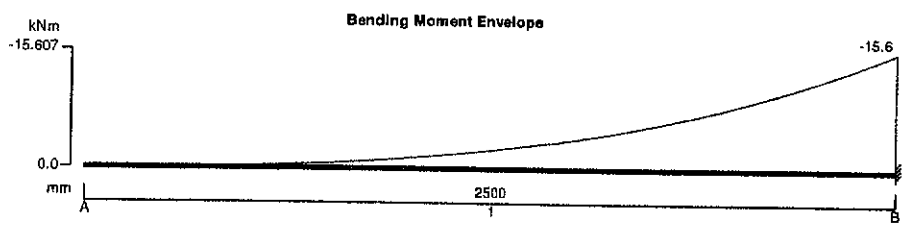
CSC ▶ TEDDS	Project				Job Ref.	
ENTUITIVE 143 Cownstone Road London SW2 1NB	124 ST. PANCRAS WAY NW1				4369	
	Section Retaining wall underpin temporary condition				Sheet no./rev. A09	
	Calc. by JM	Date 25/04/2017	Chk'd by	Date	App'd by	Date

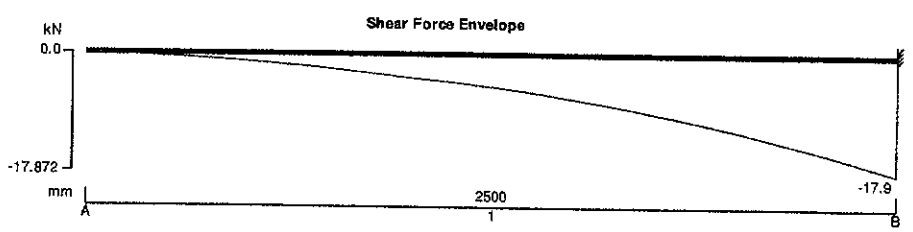
RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.0.01









Support conditions

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

Applied loading

Imposed partial VDL 0 kN/m at 0 mm to 2.93 kN/m at 1000 mm
Imposed partial UDL 1.95 kN/m from 1000 mm to 2500 mm

Imposed partial VDL 0 kN/m at 1000 mm to 6.52 kN/m at 2500 mm
Imposed partial UDL 0.81 kN/m from 0 mm to 1000 mm
Imposed partial UDL 0.72 kN/m from 1000 mm to 2500 mm

Load combinations

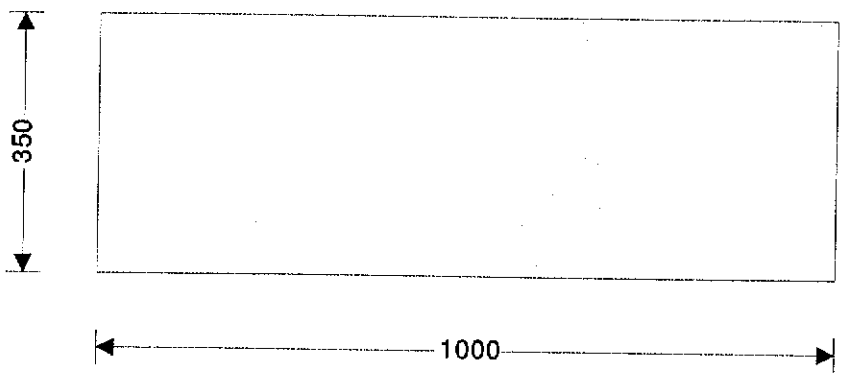
Load combination 1	Support A	Dead × 1.00
		Imposed × 1.00
	Span 1	Dead × 1.00
		Imposed × 1.00
	Support B	Dead × 1.00
		Imposed × 1.00
Load combination 2	Support A	Dead × 1.40
		Imposed × 1.60
	Span 1	Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment support A	M_{A_max} = **0** kNm	M_{A_red} = **0** kNm
Maximum moment span 1 at 0 mm	M_{s1_max} = **0** kNm	M_{s1_red} = **0** kNm
Maximum moment support B	M_{B_max} = **-16** kNm	M_{B_red} = **-16** kNm
Maximum shear support A	V_{A_max} = **0** kN	V_{A_red} = **-6** kN
Maximum shear support A span 1 at 300 mm	$V_{A\_s1\_max}$ = **0** kN	$V_{A\_s1\_red}$ = **-4** kN
Maximum shear support B	V_{B_max} = **-18** kN	V_{B_red} = **-6** kN
Maximum shear support B span 1 at 2200 mm	$V_{B\_s1\_max}$ = **-14** kN	$V_{B\_s1\_red}$ = **-2** kN
Maximum reaction at support A	R_A = **0** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **0** kN	
Maximum reaction at support B	R_B = **18** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **11** kN	

Rectangular section details

Section width	b = **1000** mm
Section depth	h = **350** mm



Concrete details

Concrete strength class	**C40/50**
Characteristic compressive cube strength	f_{cu} = **50** N/mm²

Modulus of elasticity of concrete	$E_c = 20kN/mm^2 + 200 \times f_{cu} = \mathbf{30000}$ N/mm²
Maximum aggregate size	$h_{agg} = \mathbf{20}$ mm

Reinforcement details

Characteristic yield strength of reinforcement	$f_y = \mathbf{500}$ N/mm²
Characteristic yield strength of shear reinforcement	$f_{yv} = \mathbf{500}$ N/mm²

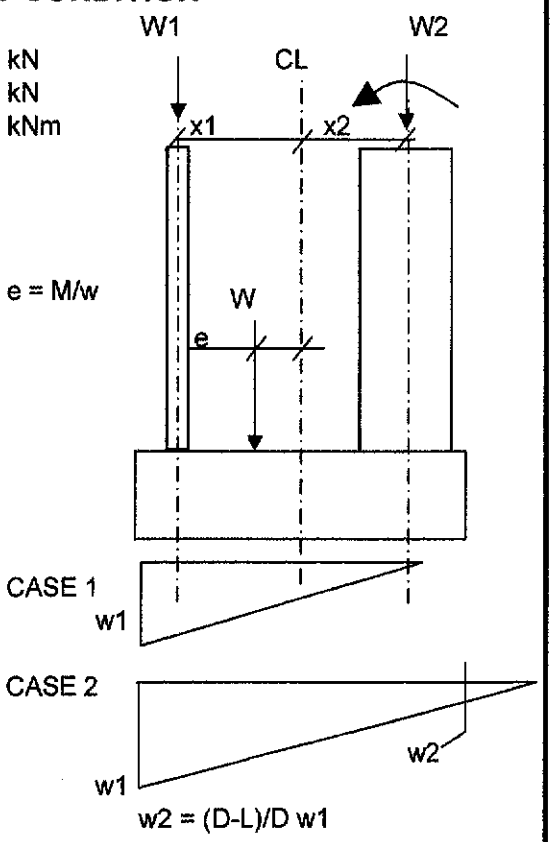
Nominal cover to reinforcement

Nominal cover to top reinforcement	$c_{nom\_t} = \mathbf{35}$ mm
Nominal cover to bottom reinforcement	$c_{nom\_b} = \mathbf{50}$ mm
Nominal cover to side reinforcement	$c_{nom\_s} = \mathbf{35}$ mm

ENTUITIVE	Project: 124 Saint Pancras Way NW1			Page No.: A12
	Project No.:	4369	Made by: JM	Rev:
	Date:	Apr '17		Chkd:

FOUNDATION FOR RETAINING WALL IN TEMPORARY CONDITION

	WL	DL	LL	SLS	
W1		0	0	0	kN
W2		40	1	41	kN
M	15.6				kNm
	(WL can be + or -)				
combination	1.0	1.0	1.0		



foundation size, L =	1.5	m
foundation size, B =	1	m
foundation depth =	0.4	m
x1 =	0	m
x2 =	0.325	m
Base moment =	28.925	kNm (SLS)
Weight =	41	kN (SLS)
foundation weight =	14.4	kN
total load =	55.4	kN
Z of foundation =	0.375	m3

Load factor on overturning moment =	1
Load factor on restoring forces =	1

M =	28.925	kNm
W =	55.4	kN
eccentricty of axial load, e =	0.522112	m
width of triangular stress block, D =	0.683664	m

	CASE 1	
maximum stress under base, w1 =	162.0679	kN/m²
minimum stress under base, w2 =	0	kN/m²

reaction checks

moment reaction =	28.925	kNm
upwards reaction =	55.4	kN

the above ignores pressure on side of foundation - conservative