Lorna & Peter Klimt

10 Elsworthy Road,

London, NW3

Structural Planning Calculations

ENTUITIVE

Lorna & Peter Klimt

10 Elsworthy Road, London, NW3

Structural Planning Calculations

October 2017

ENTUITIVE

143 Crownstone Road, London SW2 1NB
(t) +44 (0)20 7733 6837
(e) mail@entuitive.com

Entuitive is a trading name of Tall Engineers Ltd Company No. 5393264
Registered address: 149A Southampton Way, London, SE5 7EW

Project Number: 4512

INTRODUCTION

The full address is:

10 Elsworthy Road,

London, NW3 3DJ

The property is a mid-terrace three-storey house with a one-storey rear extension. There is an existing cellar under the full extent of the house. The building has been separated into flats and it is our understanding the owner wants to convert it into a single dwelling. 10 Elsworthy Road lies on the northern side of Elsworthy Road approximately half way down the street and shares party walls with residential properties, 8 and 12 Elsworthy Road, to the east and west respectively.

It is assumed that the existing house has loadbearing masonry walls, suspended timber floors throughout and loadbearing masonry and timber internal walls. The roof is assumed to be of timber construction with a slate finish. The existing foundations consist of stepped brick foundations.

The BGS Maps indicate the soil to be London Clay.

SCOPE OF WORK

The proposed works involve forming a new basement floor under the full extent of the house, to create front and rear lightwell to the basement level and to extend the flank wall up to the boundary with no.8 Elsworthy Road. lowering the floor level of the existing basement, demolishing the existing rear addition and conservatory extension, demolishing a considerable number of internal walls and partitions at ground floor level and constructing a new single storey rear extension. The chimney stacks are also to be removed at ground floor level.

From a review of Camden's planning records it appears that a similar sized basement extension has been undertaken below the neighbouring house at no.8 to the east of no.10. We also understand that planning permission has been granted for a similar sized basement extension below the neighbouring house at n.12 to the west of no.10. For the purposes of this report we have assumed that by the time the works to no.10 are undertaken the basement extension works to no.12 will have been completed and the differential depths of the foundations in relation to the adjoining structures are not expected to be significantly increased by the development at no.10.

We propose that this work be undertaken via the formation of the reinforced concrete underpins constructed in a hit and miss sequence. Likewise the basement slab will be cast according to an agreed sequence.

Stability to the rear of the house and the new rear extension will be provided by the existing masonry walls and new steel box frames.

The attached calculation pages A00-A64 confirm the necessary structural interventions required to achieve the above work. Drawings 4512/S-L-01 to 02, S-D-01, 02 show the required structural intervention to construct the works, and S-SK01, SK02 provides an outline sequence of works to safely undertake the basement extension works.

Yours sincerely,

John Maguire
BSc Eng CEng MIStructE
Entuitive

ENTUITIVE	Project **10 Elsworthy Road, NW3**			Page A00
	Project No. 4512	Made by JM	Checked	Date October 2017	Revision

CONTENTS

ENTUITIVE	Project: 10 Elsworthy Road, NW3			Page: 401
	Project No.: 4512	Made by: JM	Checked:	Date: AUG/2017	Revision:

DESIGN OF THE RC RETAINING WALLS BELOW FLANK WALL No. 8

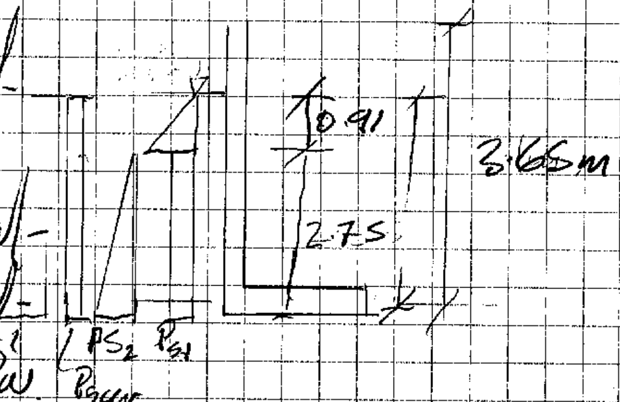
LOADING ON WALL:

$P_{water} = 9.81 \times 2.75^2/2 = 37.1$ kN

$P_{sur} = 0.438 \times 2.5 = 1.1$ kN

$P_{s1} = 0.438 \times 18 \times 0.91^2/2 = 3.5$ kN

$P_{s2} = 0.438 \times 10 \times 2.75^2/2 = 16.56$ kN



Angle friction = 23°

$\Rightarrow K_a = \frac{1-0.39}{1.39} = 0.438$

$M_{ult} = 60.0$ kN-m/m $d = 350 - 50 - 10 - 6 = 284$ mm

$V_{ult} = 110.0$ kN/m $A_{req} = 468.2$ mm²/m A_{prov} 1131

Deflection check

$M/bd^2 = 0.748$ N/mm² $f_s = 138.0$ N/mm²

$MF_{tens} = 2.0$

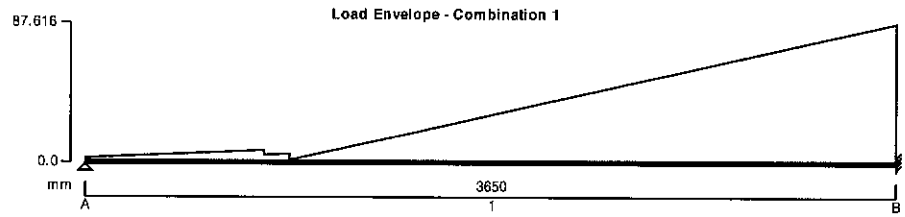
$MF/D_{basic} = 20$ ∴ $l/d_{allow} = 40.0$

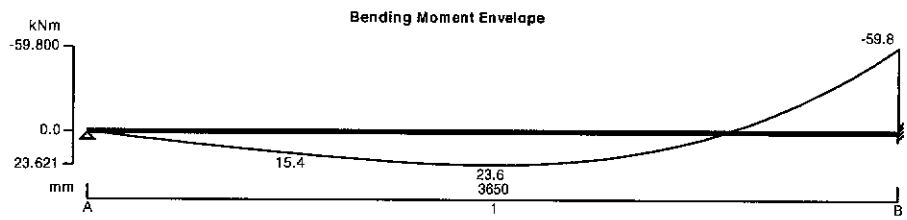
$l/d_{act} = 12.85$ ⇒ section is o.k. for deflection.

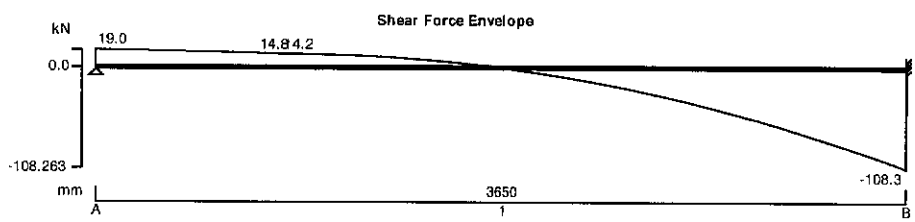
CSC ▶ TEDDS TALL Engineers 143 Cownstone Road London SW2 1NB	Project 10 Elsworthy Road, NW3			Job Ref. 4512	
	Section Underpinning retaining wall below flank wall			Sheet no./rev. A02	
	Calc. by JM	Date 11/10/2017	Chk'd by	Date	App'd by	Date

RC BEAM ANALYSIS & DESIGN BS8110

TEDDS calculation version 2.0.01







Support conditions

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

Applied loading

Imposed partial VDL 0 kN/m at 0 mm to 3.5 kN/m at 910 mm
Imposed partial UDL 1.1 kN/m from 910 mm to 3650 mm
Imposed partial VDL 0 kN/m at 910 mm to 16.56 kN/m at 3650 mm
Imposed partial UDL 1.81 kN/m from 0 mm to 800 mm
Imposed partial VDL 0 kN/m at 910 mm to 37.1 kN/m at 3650 mm

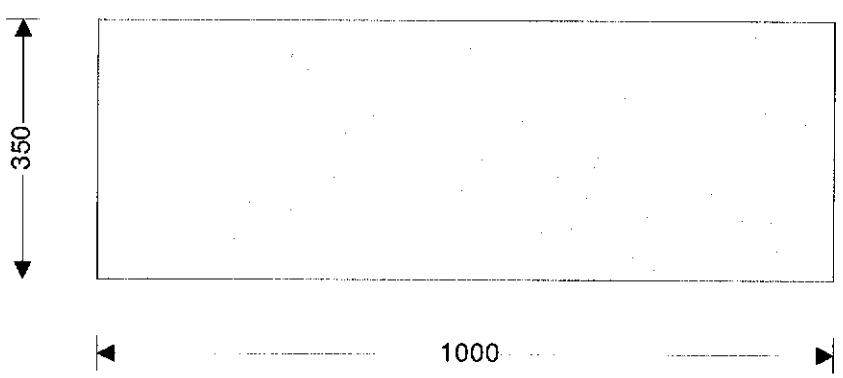
Load combinations

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} = **0** kNm	M_{A_red} = **0** kNm
Maximum moment span 1 at 1807 mm	M_{s1_max} = **24** kNm	M_{s1_red} = **24** kNm
Maximum moment support B	M_{B_max} = **-60** kNm	M_{B_red} = **-60** kNm
Maximum shear support A	V_{A_max} = **19** kN	V_{A_red} = **42** kN
Maximum shear support A span 1 at 300 mm	$V_{A\_s1\_max}$ = **18** kN	$V_{A\_s1\_red}$ = **41** kN
Maximum shear support B	V_{B_max} = **-108** kN	V_{B_red} = **-75** kN
Maximum shear support B span 1 at 3350 mm	$V_{B\_s1\_max}$ = **-83** kN	$V_{B\_s1\_red}$ = **-50** kN
Maximum reaction at support A	R_A = **19** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **12** kN	
Maximum reaction at support B	R_B = **108** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **68** 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/mm² + 200 × f_{cu} = **30000** N/mm²
Maximum aggregate size	h_{agg} = **20** mm

Reinforcement details

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

Nominal cover to reinforcement

Nominal cover to top reinforcement	c_{nom_t} = **35** mm
Nominal cover to bottom reinforcement	c_{nom_b} = **50** mm
Nominal cover to side reinforcement	c_{nom_s} = **35** mm

ENTUITIVE	Project: 10 Elsworthy Road, NW3				Page: A04
	Project No.: 4512	Made by: JM	Checked:	Date: AUG/2017	Revision:

DESIGN OF CANTILEVERED LIGHTWELL WALLS:

⇒ LIGHTWELL WALLS WILL BE UNPROPPED @ GROUND FLOOR LEVEL + WILL ACT AS VERTICAL CANTILEVERS.

Assume Thickness of wall of 400mm.

$F_y = 400$, $d = 400 - 50 - 10 - 6 = 334mm$

$M_{ult} = 130kNm/m$, $V_{ult} = 128kN/m$.

Moment steel design:

$K = 0.0233$, $z = 0.95d$

$A_{req} = 862.54mm^2/m + M_{sup} = 1211$

Deflection check:

$M/bd^2 = 1.166$ $f_s = 254.2N/mm^2$

$M/F_{req} = 1.44$ $f/f_{basic} = 7$ $f/f_{all} = 10.14$

$f/f_{act} = 3650/334 = 10.928$

Try 450 thick ⇒ 384mm

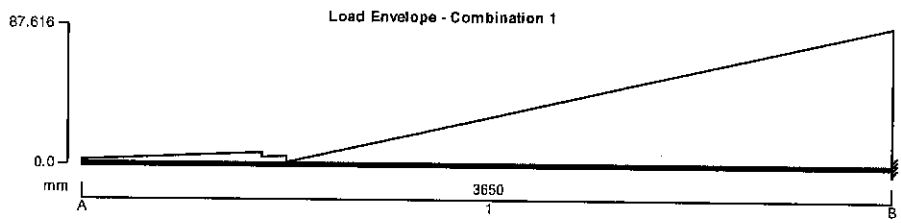
$M/bd^2 = 0.80$ $f_s = 254.2N/mm^2$

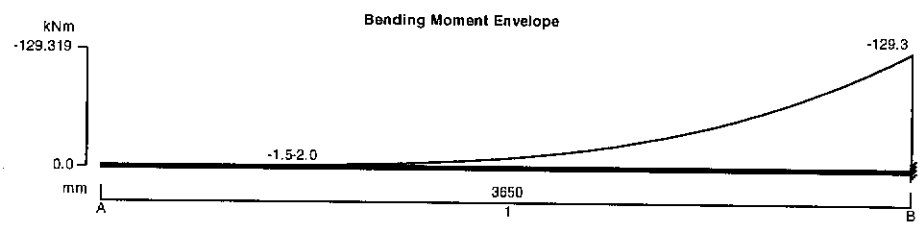
$M/F_{req} = 1.59$ $f/f_{allow} = 11.65$

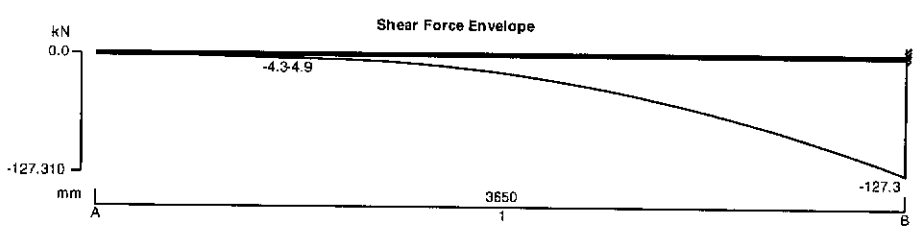
$f/f_{act} = 3650/384 = 9.5$ ⇒ section OK

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 3.5 kN/m at 910 mm
Imposed partial UDL 1.1 kN/m from 910 mm to 3650 mm
Imposed partial VDL 0 kN/m at 910 mm to 16.56 kN/m at 3650 mm
Imposed partial UDL 1.81 kN/m from 0 mm to 800 mm
Imposed partial VDL 0 kN/m at 910 mm to 37.1 kN/m at 3650 mm

Load combinations

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

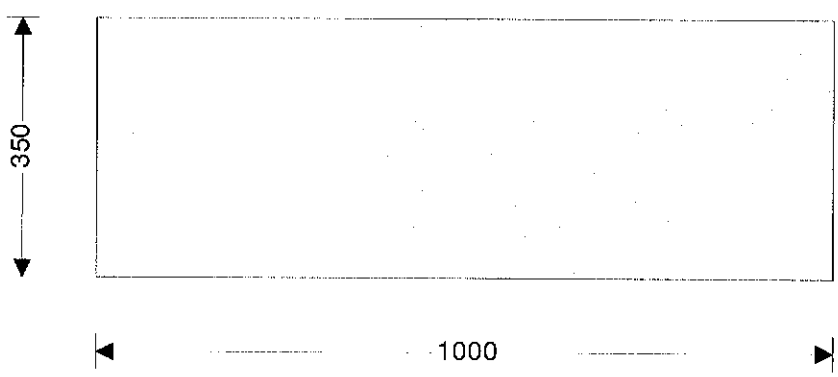
	Support B	Dead × 1.40 Imposed × 1.60

Analysis results

Maximum moment support A	M_{A_max} = **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} = **-129** kNm	M_{B_red} = **-129** kNm
Maximum shear support A	V_{A_max} = **0** kN	V_{A_red} = **-35** kN
Maximum shear support A span 1 at 300 mm	$V_{A\_s1\_max}$ = **0** kN	$V_{A\_s1\_red}$ = **-37** kN
Maximum shear support B	V_{B_max} = **-127** kN	V_{B_red} = **-35** kN
Maximum shear support B span 1 at 3350 mm	$V_{B\_s1\_max}$ = **-102** kN	$V_{B\_s1\_red}$ = **-11** 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 = **127** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **80** 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/mm² + 200 × f_{cu} = **30000** N/mm²
Maximum aggregate size	h_{agg} = **20** mm

Reinforcement details

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

Nominal cover to reinforcement

Nominal cover to top reinforcement	c_{nom_t} = **35** mm
Nominal cover to bottom reinforcement	c_{nom_b} = **50** mm
Nominal cover to side reinforcement	c_{nom_s} = **35** mm

DESIGN OF RC BASEMENT SLAB.

IN DESIGNING SLAB WE TAKE A/C OF POSSIBILITY OF FLOATATION WITH A 2.75m HIGH HEAD OF WATER PRESSURE SIMILAR TO THE DESIGN OF THE RETAINING WALLS;

FROM THE SI REPORT THE WORSE CASE HEAVE IS EXPECTED AT THE FRONT LIGHTWELL WITH A TOTAL UPWARD PRESSURE OF 60kN/m². THAT CAN BE BROKEN DOWN INTO 40% INITIAL RECOVERY AND 60% LONG TERM, i.e. THE SLAB MUST BE DESIGNED FOR AN UPWARD PRESSURE OF $(0.6\times60)+(2.75\times9.81)=63.06\,kN/m^2$

WITH THE CENTRAL SECTION OF THE HOUSE FRONT WALL EXTENDING TO THE BASEMENT THE WORSE CASE SLAB SPAN FOR DESIGN OF FRONT LIGHTWELL SLAB IS 4.750m.

$M_{ult} = 220\,kNm/m$.

FOR THE REAR LIGHTWELL

Total upward heave = 40kN/m² with 60% recovery the resultant pressure = $0.6\times40 = 24\,kN/m^2$

Total upward pressure = $2.25\times0.75\times9.81 = 16.55\,kN/m^2$

slab s/w = $0.5\times24 = 12.0\,kN/m^2$

$W_{ult\,uplift}$ = 39.9 kN/m²

M_{ult} = 39.9 × 10²/8 = 496 kNm/m

h = 500, d = 500 − 35 − 10 = 455

Moment steel design

k = 0.068 z = 0.917 d

$A_{s\,req}$ = 2502 mm²/m H25 @ 125 ctrs = 3927 mm²/m

Deflection check:

M/bd² = 2.395 f_s = 212.375 N/mm²

MF_{Ten} = 1.21 l/d allow = 24.385

l/d act = 21.97

⇒ 500 dp. slab is ok in deflection.

Remaining basement slab

Heave pressure = 30 kN/m²

long term recovery = 0.6 × 30 = 18 kN/m²

upward water pressure = 16.56

less 400 dp. slab = 9.6

24.96 kN/m²

$W_{uplift\,ult}$ = 34.93 kN/m²

M_{ult} = 415.6 kNm/m

h = 400, d = 400 − 35 − 10 = 355 mm

Moment steel design

K = 0.0724, z = 0.914 d

$M_{ULS} = 2371.2$ kNm/m $\quad M_{SLS} = M_{ULS} @ 1.25 \gamma_f = 2927$ kNm/m

Deflection check:

$M/bd^2 = 2.523$ $\quad f_s = 201.3$ N/mm²

$MF_{req} = 1.211$ $\quad MF_{allow} = 24.4$

$l/d_{act} = 24.6 = l/d_{allow}$

⇒ section size is OK