Ingleton Wood

Billericay
Cambridge
Colchester
Hertford
London
Norwich

www.ingletonwood.co.uk

79 Redington Road

Mr & Mrs Tarn

Job No. 811365

Structural Design Calculations

Author	[Adrian J Wong]
Checked by	[Andrew Wright]
Date	[06/02/18]
Status	[Preliminary]

architecture
building surveying
building services
planning
sustainability
civil and structural
quantity surveying
project management
CDM and H&S services

Vision, form and function

DOCUMENT CONTROL

Project Information

Job no	811365
Project Title	79 Redington Road
Client	Mr & Mrs Tarn

Document Check

Prepared by	**AJW**	Signed	
Checked by	**ABW**	Signed	

Issue	Date	Status
1 First issue	06/04/18	Preliminary
2		
3		
4		

Ingleton Wood	Project: 79 Redington Road			Project Number: 811365	
	Calculation			Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: AW	Date: JAN 18	Check by	Date

Ref	Calculations	Output

ROOF LOADS Pitched Roof 45°

TILES : 0.64
BATTENS & RAFTERS : 0.21
FELT & INSULATION : 0.06
0.91 × $\frac{1}{\cos 45°}$

ON SLOPE : 1.29
CEILING JOISTS : 0.12
INSULATION : 0.06
PLASTERBOARD : 0.17
1.64 kN/m²

LIVE : 0.75 kN/m²

FLOOR LOADS

BOARDS & SERVICES : 0.35
JOISTS : 0.15
PLASTERBOARD & SKIM : 0.17
0.67 kN/m²

LIVE + PARTITIONS : 2.50 kN/m²

MASONRY LOADS

330mm BRICKWALL : 6.95
PLASTERWORK : 0.25
7.20 kN/m²

215mm BRICKWORK : 4.53
PLASTERWORK : 0.50
5.03

Ingleton Wood

Project	Project Number
79 Redington Road	811365

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FLAT ROOF LOADS

FELT : 0.17

OSB BOARDS : 0.12

FIRRINGS : 0.1

JOISTS : 0.15

INSULATION : 0.06

PLASTERBOARD & SKIM : 0.17

0.77 kN/m²

LIVE : 0.75 kN/m²

CONCRETE SLAB (SUSPENDED BL) METAL DECK ??

200mm THK : 4.8

INSULATION : 0.06

FINISHES 75mm Screed : 1.8

6.7 kN/m²

LIVE + PARTITIONS 2.50 kN/m²

METAL DECK (RIB DECK 80)

METAL DECK : 0.20

150mm CONCRETE : 3.60

FINISHES : 0.50

4.30 kN/m²

LIVE + PARTITIONS 2.50 kN/m²

Ingleton Wood	Project: 79 Redington Road			Project ref: 811365		
	Part of Structure: EXISTING WALL LINE LOADS			Sheet no: 1		Rev.
	Drawing ref.	Calc by: AW	Date: Jan-18	Check by	Date	Date

Project 79 Readington Road

Loadings All weights from BS 648 1964 Schedule of Weights for Building Materials
Live Loads based on BS 6399 Pt 1 1984

Element Loads

	Live Load (kN/m^2)	Dead Load (kN/m^2)
Pitched Truss Roof		
Tiles		0 65
Boards/Felt		0 25
Truss & Battens		0 35
Ceiling & Services		0 40
Ceiling Imposed		
Rafter Imposed	0 75	
	0 75	**1 65**
Second Floor		
Boards & Services		0 35
Joists		0 15
Plasterboard & Skim		0 17
Imposed	1 50	
Partitions	0 50	
	2 00	**0.67**
First Floor		
Boards & Services		0 35
Joists		0 15
Plasterboard & Skim		0 17
Imposed	1 50	
Partitions	0 50	
	2 00	**0 67**
Ground Floor		
Boards & Services		0 35
Joists		0 15
Plasterboard & Skim		0 17
Imposed	1 50	
Partitions	0 50	
	2.00	**0 67**
330mm Solid Wall		
Masonry		6 90
Plaster		0 25
		7.15
Internal Wall		
215mm THK Blockwork		4 53
Plaster both sides		0 50
		5.03
	6 75	**15 84**

Ingleton Wood	Project			Project ref		
	79 Redington Road			811365		
	Part of Structure			Sheet no.		Rev
	EXISTING WALL LINE LOADS			2		
	Drawing ref.	Calc by	Date	Check by	Date	Date
		AW	Jan-18			

Project 79 Readington Road

LINE LOADS **Refer to Load case Plan**

Load Case **Wall A**

Grid Ref

			Service Load (kN/m run) Live Load	Dead Load
Pitched Truss Roof	2 3	m^2/m	1 73	3 80
Second Floor	2 4	m^2/m	4 80	1 61
First Floor	2 4	m^2/m	4 80	1 61
Ground Floor	2 4	m^2/m	4 80	1 61
330mm Solid Wall	8	m		57 60
Internal Wall		m		
		m		
		m		
		m		
Beam Self Weight		kN/m		
			16.13	66 22

Design Service Load = 82 34 kN/m

Design Ultimate Load = 118 51 kN/m

Load Case **Wall B**

Grid Ref.

			Service Load (kN/m run) Live Load	Dead Load
Pitched Truss Roof	5	m^2/m	3 75	8 25
Second Floor	5 4	m^2/m	10 80	3 62
First Floor	5 4	m^2/m	10 80	3 62
Ground Floor	5 4	m^2/m	10 80	3 62
330mm Solid Wall		m		
Internal Wall	8	m		40 24
		m		
		m		
		m		
Beam Self Weight		kN/m		
			36.15	59 34

Design Service Load = 95 49 kN/m

Design Ultimate Load = 140 92 kN/m

Load Case **Wall C**

Grid Ref.

			Service Load (kN/m run) Live Load	Dead Load
Pitched Truss Roof	2 7	m^2/m	2 03	4 46
Second Floor	2 7	m^2/m	5 40	1 81
First Floor	2 7	m^2/m	5 40	1 81
Ground Floor	2 7	m^2/m	5 40	1 81
330mm Solid Wall	8	m		57 60
Internal Wall		m		
		m		
		m		
		m		
Beam Self Weight		kN/m		
			18 23	67 48

Design Service Load = 85 71 kN/m

Design Ultimate Load = 123.63 kN/m

Load Case **Wall D**

Grid Ref

			Service Load (kN/m run) Live Load	Dead Load
Pitched Truss Roof	2 75	m^2/m	2 06	
Second Floor	2 75	m^2/m	5 50	1 84
First Floor	2 75	m^2/m	5 50	1 84
Ground Floor	2 75	m^2/m	5 50	1 84
330mm Solid Wall	8	m		57 60
Internal Wall		m		
		m		
		m		
Beam Self Weight		kN/m		
			18 56	63 13

Design Service Load = 81 69 kN/m

Design Ultimate Load = 118 08 kN/m

Ingleton Wood	Project 79 Redington Road			Project ref. 811365		
	Part of Structure EXISTING WALL LINE LOADS			Sheet no 3		Rev.
	Drawing ref	Calc by AW	Date Jan-18	Check by	Date	Date

Project 79 Readington Road

LINE LOADS **Refer to Load case Plan**

Load Case **All other external walls**

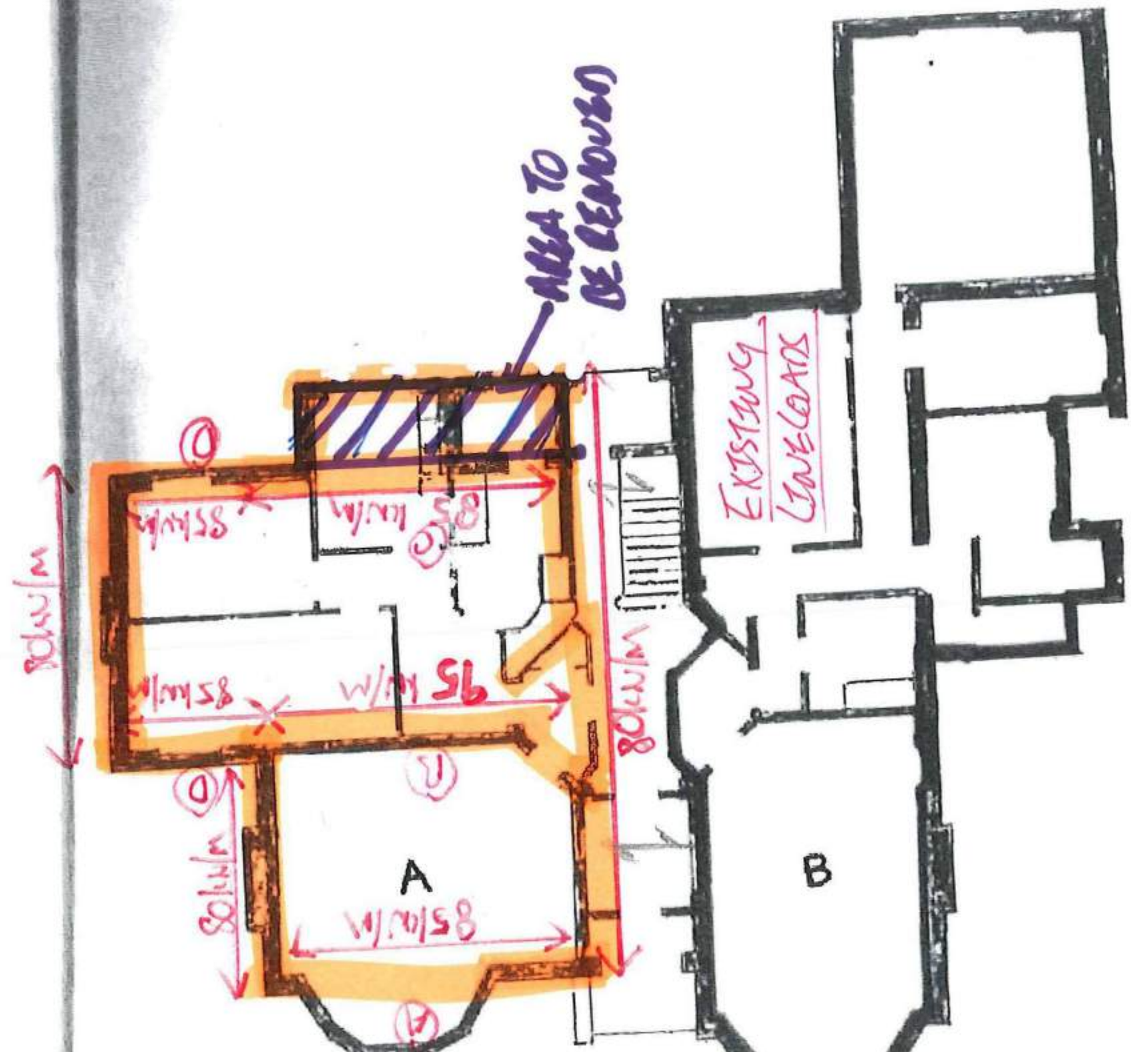
Grid Ref

			Service Load (kN/m run) Live Load	Dead Load
Pitched Truss Roof		m^2/m		
Second Floor		m^2/m		
First Floor		m^2/m		
Ground Floor		m^2/m		
330mm Solid Wall	10 7	m		77 04
Internal Wall		m		
		m		
		m		
		m		
Beam Self Weight		kN/m		
				77 04

Design Service Load = **77 04** **kN/m**

Design Ultimate Load = **107 86** **kN/m**

'B'



No 79 REDINGTON ROAD NW3

GROUND FLOOR

Ingleton Wood	Project: 79 Pedrestan Road		Project Number: 811365
	Calculation:		Calc sheet no: 1 — Rev: -
	Drawing ref:	Calc by: IAW — Date: JAN 19	Check by: — Date:

Ref	Calculations	Output

<u>PROPOSED WALL LINELOADS</u>

<u>EXTERNAL LIGHTWELL WALL</u>

WALL UDL $D - 7.2 \times 3 = 25$ kN/m

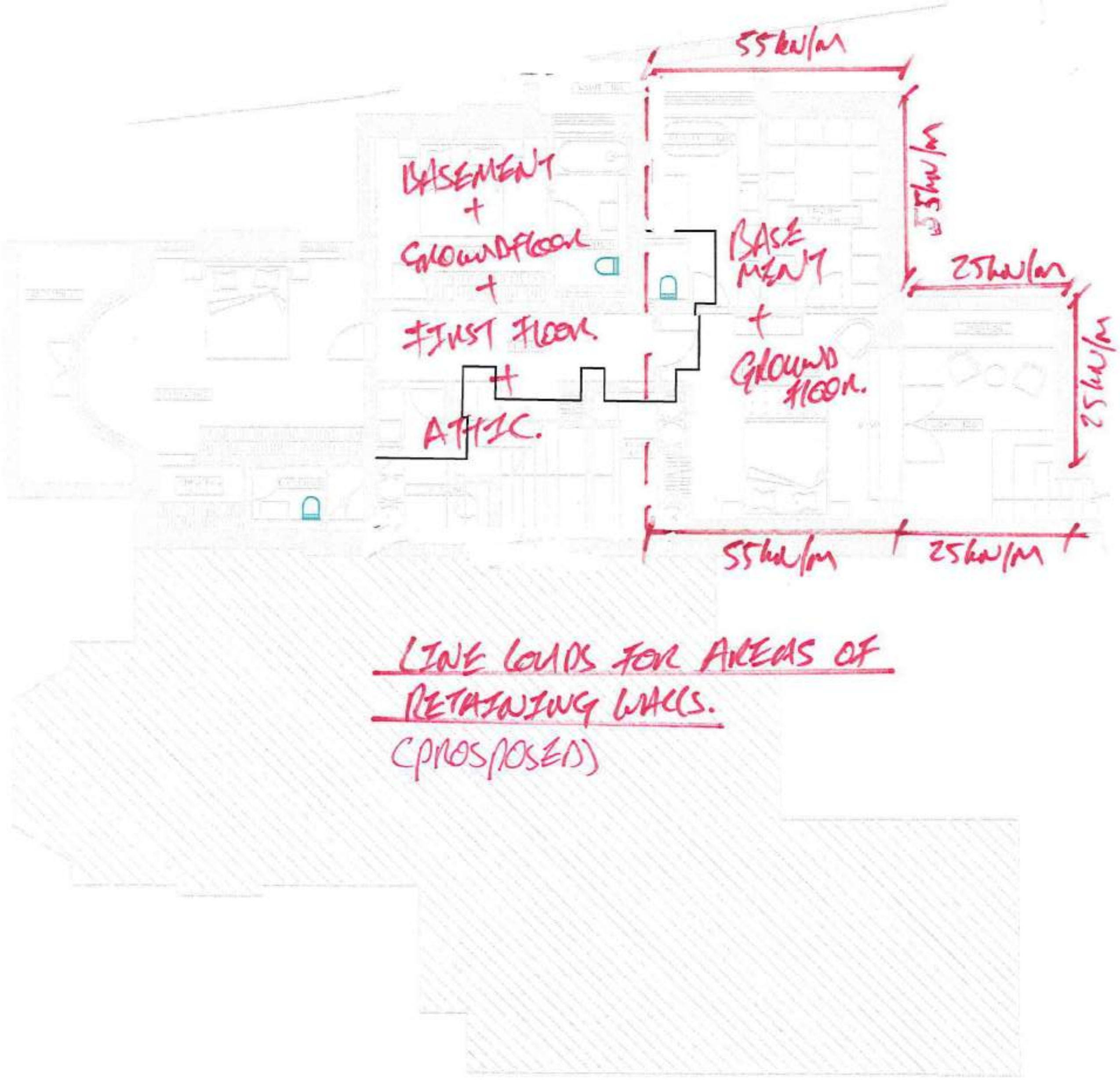
<u>WALL LOADS</u> (SINGLE STOREY).

WALL UDL $D - 7.2 \times 6.0 = 43.2$

FLOOR UDL $D - 0.43 \times 2.2 = 0.95$
$L - 2.50 \times 2.2 = 5.5$

ROOF UDL $D - 1.04 \times [illegible] = 3.6$
$L - 1.00 \times 2.2 = 2.2$

55 kN/m



LINE LOADS FOR AREAS OF RETAINING WALLS.

(PROPOSED)

Ingleton Wood	Project: 79 Redington Road	Project Number: 811365
	Calculation: BEAM 1	Calc sheet no: 1 Rev: -
	Drawing ref:	Calc by: AW Date: 3JAN18	Check by: Date:

Ref	Calculations	Output

(1) - Design existing condition. (SPAN 5m)

Roof udl.   D - 1.64 x 2.7 = 4.43 x 1.4 = 6.2
             L - 0.75 x 2.7 = 2.03 x 1.6 = 3.25
                              6.5   9.5

2ND FLOOR   D - 0.67 x 2.7 = 1.81 x 1.4 = 2.53
             L - 2.50 x 2.7 = 6.75 x 1.6 = 10.80
                              8.56   13.33

1ST FLOOR   D - 0.67 x 2.7 = 1.81 x 1.4 = 2.53
             L - 2.50 x 2.7 = 6.75 x 1.6 = 10.80
                              8.56   13.33

WALL (330)   D - 7.20 x 2.8 = 20.2 x 1.4 = 28.3
                              44 kN/m   64.5 kN/m

Output: D - 28 kN/m, L - 10.23

$M = \frac{64.5 \times 5^2}{8} = 202$ kNm   Deflection limit = 5mm (D+0.5L)

$I_{x\,REQ} = \frac{5 \times (28 + 15/2) \times 5000^4}{384 \times 205 \times 10^3 \times 5 \times 10^4} = 28185\ cm^4$

∴ PROVIDE 305x305UC137 (M - 597 kNm, I_{xx} - 27700 cm^4)

(2) - Design proposed condition (span 5m)

RSJ PL   D - 3.8 x 4.8 = 18.24 x 1.4 = 26
             L - 1.7 x 4.8 = 8.16 x 1.6 = 13.1
                             26.4 kN   39.1 kN.

+

ANALYSE WITH LOADS ABOVE

Refer to TEDDS DESIGN

Deflection LIMIT - 13.9mm (L/360)

∴ PROVIDE 305x305UC137

WORSTCASE LOADING ABOVE

Ingleton Wood	Project: 79 Redington Road	Project Number: 811365
	Calculation: BEAM 2	Calc sheet no: 1 Rev: -
	Drawing ref: Calc by: A.D Date: JAN 18	Check by: Date:

Ref	Calculations	Output

(B2) - SPAN 3.8m (Proposed Loading)

USE SAME LOADS AS BEAM (1)

EXISTING UDL ✓

D - 28 x 1.4 = 39.2
L - 15.0 x 1.6 = 24.0
43 kN/m 63.2 kN/m

NEW FLATROOF UDL

D - 0.77 x 2.3 = 1.8 x 1.4 = 2.52
L - 0.75 x 2.3 = 1.7 x 1.6 = 2.72
3.5 kN/m 5.24 kN/m

MOMENT = 123 kN.M

TOTAL UDL 47 kN/m 68.44 kN/m

DEFL SPAN/250 = 15.2mm

$I_{xx\,req} = \frac{5 \times 47 \times 3800^4}{384 \times 2.05 \times 10^5 \times 15.2 \times 10^4} = 4095$ cm⁴

(B2) - SPAN 3.8m (Existing Loading)

USE SAME LOADS AS BEAM (1)

D - 28 x 1.4 = 39.2
L - 15 x 1.6 = 24
43 kN/m 63.2 kN/m

MOMENT - 114 kN.M (Deflection limit 5mm) D + 0.5L

$I_{xx\,req} = \frac{5 \times (28 + 15.0/2) \times 3800^4}{384 \times 2.05 \times 10^5 \times 5 \times 10^4} = 9403$ cm⁴

∴ PROVIDE 254 x 254 UC 89 (M_c - 380 kN.m, I_{xx} - 14300 cm⁴)

Ingleton Wood	Project: 79 Redington Road		Project Number: 81365	
	Calculation		Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: AW / Date: 3Nov 19	Check by	Date

Ref	Calculations	Output

(B3) - SPAN 4.8M

Pitched UDL Roof

D - 1.64 × 2.3 = 3.8 × 1.4 = 5.32
L - 0.75 × 2.2 = 1.7 × 1.6 = 2.72

5.5kN/m   8.04kN/m

M - 23.2kN.m

Deflection Limit - 4800/360 = 13.3mm

I_{xx} req - $\frac{5 \times 5.5 \times 4800^4}{384 \times 205\times10^5 \times 13.3\times10^4}$ = 1394cm⁴

∴ provide 203×133×30 UB (M - 55kN.m, I_{xx} - 2900cm⁴)

B4/B5 SPAN 3.3M

BEAM 5 WORSTCASE

FLAT ROOF UDL.

D - 0.77 × 2.3 = 1.78 × 1.4 = 2.5
L - 0.75 × 2.3 = 1.73 × 1.6 = 2.8

3.51kN/m   5.3kN/m

MOMENT - 7.5kN.m

Deflection Limit - 10mm

I_{xx} req - $\frac{5 \times 3.51 \times 3300^4}{384 \times 205\times10^5 \times 10\times10^4}$ = 264.4cm⁴

∴ provide 178×102×19 UB (M - 36kN.m, I_{xx} - 1360cm⁴)

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	Calculation			Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: A.W	Date: JAN 18	Check by	Date

Ref	Calculations	Output
	B6 – SPAN 2.5m	
	Pitched Roof UDL: D – 1.64 x 5 = 8.2 x 1.4 = 11.5; L – 0.75 x 5 = 3.75 x 1.6 = 6	
	2nd Floor: D – 0.67 x 5.4 = 3.62 x 1.4 = 5.1; L – 1.50 x 5.4 = 8.10 x 1.6 = 13	
	1st Floor: D – 0.67 x 5.4 = 3.62 x 1.4 = 5.1; L – 1.50 x 5.4 = 8.10 x 1.6 = 13	
	Wall (215): D – 5.03 x 6 = 30.18 x 1.4 = 42	
	66kN/m 96kN/m	D – 46, L – 20
	B7 + B8 (blockwork) PL: D – 6.3 x 2.5 = 15.8 x 1.4 = 22	
	15.8kN 22kN	
	Refer to Tedds design UC 254x254x71	
	B7/B8 – SPAN 2.5m	
	2nd Floor: D – 0.67 x 2.1 = 1.41 x 1.4 = 1.97; L – 1.50 x 2.1 = 3.2 x 1.6 = 5.12	
	1st Floor: D – 0.67 x 2.1 = 1.41 x 1.4 = 1.97; L – 1.50 x 2.1 = 3.15 x 1.6 = 5.12	
	Blockwork + plaster: D – 2.1 x 3 = 6.3 x 1.4 = 8.82	
	16kN/m 23kN/m	
	Moment – 18kN.m Deflection limit – 5mm (D+0.5L)	D – 9.12, L – 6.40
	$I_{req} = \frac{5 \times (9.12 + 6.4/2) \times 2500^4}{384 \times 2.05 \times 10^5 \times 5 \times 10^4} = 611cm^4$	
	Provide 203x102x23 UB (M_c – 56kN.m, I_{xx} – 2340cm⁴)	

Ingleton Wood	Project: 79 Medinstow Road			Project Number: C11365	
	Calculation			Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: AW	Date: SAN 19	Check by	Date

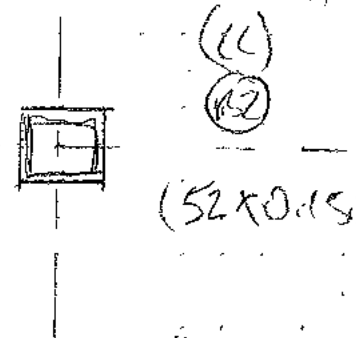
Ref	Calculations	Output

P1 - POST DESIGN

B1 - Proposed loading   D - 55.4 x 1.4 = 78 kN
                         L - 77.2 x 1.6 = 124 kN

B2 - Proposed loading   D - 30 x 3.8m = 114/2 x 1.4 = 80 kN
                         L - 17 x 3.8m = 64.6/2 x 1.6 = 52 kN

(DL+LL) B1   (LL) B2



(78+124) 0.150 = 30.3 kNm   (52 x 0.150) = 7.8 kNm

NOTIONAL MOMENT (30.3 - 7.8) = 22.5 kNm

TOTAL AXIAL FORCE (78+124+80+52) = 334 kN

Refer to TEDDS DESIGN - PROVIDE 120x120x10 SHS

First Floor - Pitched Roof Rafters.

∴ 50x150 dp C24 Rafters @ 600 centers

Refer to TEDDS DESIGN

First Floor - FLAT ROOF JOISTS.

∴ 50x200 dp C24 Joists @ 450 centers

Refer to TEDDS DESIGN

Ingleton Wood	Project: 79 Reddington Road		Project Number: 81365	
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Ref	Calculations	Output

BASEMENT BEAM (1) - SPAN 4.8m

EXISTING FLOOR UDL
D - 0.67 × 2.9 = 1.94 × 1.4 = 2.72 kN/m
L - 2.50 × 2.9 = 7.3 × 1.6 = 11.7 kN/m

METAL DECK
D - 4.30 × 2.65 = 11.4 × 1.4 = 16 kN/m
L - 2.50 × 2.65 = 6.6 × 1.6 = 10.6 kN/m
27.2 kN/m 41 kN/m

PL POST (1) @ 3.8m
D - 55 + 57 = 112 (unfactored).
L - 77 + 32 = 109

Refer to TEDDS DESIGN, provide UC 254×254×107 (3.55)

BASEMENT BEAM (2) - SPAN 3.3m

NEW FLAT ROOF UDL
D - 0.77 × 2.3 = 1.8 × 1.4 = 2.53 kN/m
L - 0.75 × 2.3 = 1.7 × 1.6 = 2.72 kN/m

330mm WALL ABOVE
D - 7.20 × 6.0 = 43.2 × 1.4 = 60.5 kN/m
47 kN/m 66 kN/m

MOMENT - 90 kN.m

10mm Limit Deflection. (FOLDING door)

$$I_{xx\,req} = \frac{5 \times 47 \times 3300^4}{384 \times 205 \times 10^6 \times 10 \times 10^4} = 3540\,cm^4$$

∴ provide 254×146×31 UB (M_c 101 kN.m, I_{xx} 4410 cm⁴)

BASEMENT BEAM (3) - SPAN 4.9m

Timber floor UDL
D - 0.77 × 3 = 2.31 × 1.4 = 3.23
L - 2.50 × 3 = 7.50 × 1.6 = 12

Refer to TEDDS design

∴ provide 254×146 UB 31

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	Drawing ref	Calc by: AW / Date: JAN 18	Check by	Date

Ref	Calculations	Output

BASEMENT PADSTONES

BB1 UCS - 370kN

Used masonry - 7.5 N/mm²

$$\frac{370 \times 10^3}{1.5(2.5/3.6)} = 355200\ mm^2$$

Material factor - 3.5

∴ Provide 2No 150 x 1200 x 215 Dp concrete lintel padstone.

BB1 UCS - 177kN -

Used masonry - 2.8 N/mm²

$$\frac{177 \times 10^3}{1.5(2.5/3.6)} = 169920\ mm^2$$

Material factor - 3.5

∴ Provide 200 x 900 x 215 Dp concrete lintel padstone

BB2 UCS - 109kN

New masonry - 3.6 N/mm²

$$\frac{109 \times 10^3}{1.5(3.6/3.5)} = 70648\ mm^2$$

Material factor - 3.5

∴ Provide 200 x 450 x 215 concrete lintel padstone

FLOOR JOISTS @ G7

50 x 200 Dp C24 @ 400 centres

? Refer to TEAMS DESIGN

Ingleton Wood	Project: 79 Redington Road		Project Number: 811365	
	Calculation		Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: AW / Date: 20/11/14	Check by	Date

Ref	Calculations	Output

BASEMENT SLAB DESIGN (Suspended). 4.7m - SPAN

DL : 6.7 x 1 = 6.7 x 1.4 = 9.4
LL : 2.5 x 1 = 2.5 x 1.6 = 4.0
9.2 kN/m   13.4 kN/m   per metre width

HYDROSTATIC WATER PRESSURE (WP) (2m DP). : 20 x 1 = 20 x 1.6 = 32 kN/m.

LOADCASE 1 (DL+LL) TENSION BOT

- MOMENT - $\frac{13.4 \times 4.7^2}{8}$ = 37 kNm/m
- S.F - $\frac{13.4 \times 4.7}{2}$ = 31 kN/m

LOADCASE 2 (WP-DL). TENSION TOP UPLIFT

- MOMENT - $\frac{(32-9.4) \times 4.7^2}{8}$ = 62.4 kNm/m
- S.F - $\frac{(32-9.4) \times 4.7}{2}$ = 53 kN/m

REFER TO TEDDS DESIGN.

PROVIDE 275mm RC SLAB
B785 MESH TOP & BOT

Ingleton Wood	Project: 79 Redington Road.		Project Number: 811368.	
	Calculation		Calc sheet no: 1	Rev: -
	Drawing ref	Calc by: A.W / Date: JAN 18	Check by	Date

Ref	Calculations	Output

RETAINING WALL DESIGN

SECTION 2-2, Underpinning from BASEMENT LEVEL.

Vertical LOAD - 80 kN/m

Horizontal LOAD @ TOP OF WALL.

- Active Pressure $\frac{1}{3} \times 19 \times 2 = 12.7$ kN/m²
- Surcharge $\frac{1}{3} \times 10 \times 2 = 6.6$ kN/m²

Force $0.5 \times 19.4 \times 2 = 19.4$ kN

Refer TO TEDDS DESIGN.

SECTION 1-1, underpinning from GF LEVEL.

Vertical LOAD - 55 kN/m

Horizontal LOAD @ TOP OF WALL.

- Active Pressure $\frac{1}{3} \times 19 \times 1 = 6.3$
- Surcharge $\frac{1}{3} \times 10 \times 1 = 3.3$

Force $0.5 \times 9.6 \times 1 = 4.8$ kN

Refer TO TEDDS DESIGN

SECTION 3-3, Underpinning from BASEMENT LEVEL (with TOE).

- Vertical LOAD - 85 kN/m

NO horizontal LOAD, JUST surcharge on plan.

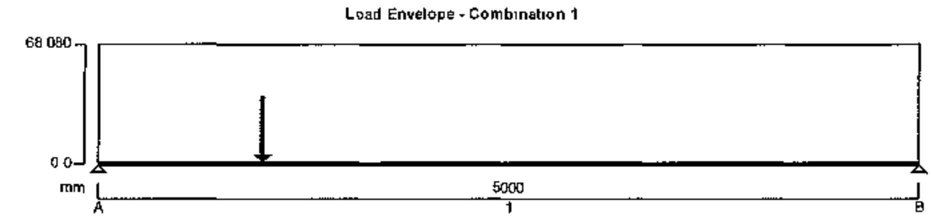
Refer TO TEDDS Design.

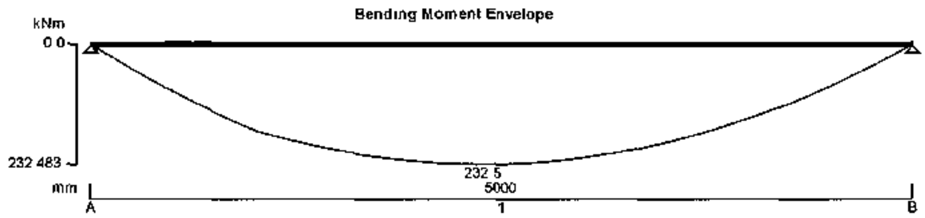
Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
	Calcs for Beam 1- Proposed Loading				Start page no /Revision 1	
	Calcs by A W	Calcs date 05/04/2018	Checked by	Checked date	Approved by	Approved date

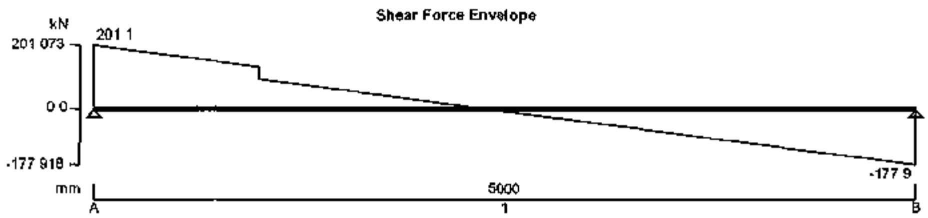
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1.2000 incorporating Corrigendum No 1

TEDDS calculation version 3 0 05







Support conditions

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

Applied loading

Beam loads	Dead point load 18 24 kN at 1000 mm
	Imposed point load 8 16 kN at 1000 mm
	Imposed full UDL 28 25 kN/m
	Dead full UDL 15 kN/m
	Dead self weight of beam × 1

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

Ingleton Wood	Project: 79 Redington Road				Job no: 811365	
Ingleton Wood, 1 Alie Street, London	Calcs for: Beam 1- Proposed Loading				Start page no /Revision: 2	
	Calcs by: A W	Calcs date: 05/04/2018	Checked by	Checked date	Approved by	Approved date

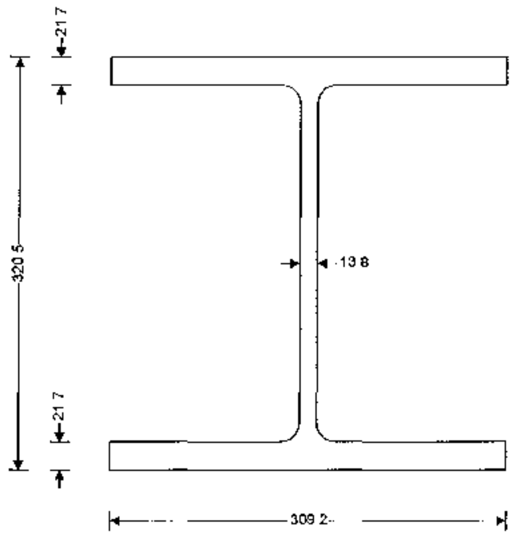
Imposed × 1 60

Analysis results

Maximum moment	M_{max} = **232.5** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **201 1** kN	V_{min} = **-177.9** kN
Deflection	δ_{max} = **3.6** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **201.1** kN	R_{A_min} = **201.1** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **55.4** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **77.2** kN	
Maximum reaction at support B	R_{B_max} = **177.9** kN	R_{B_min} = **177 9** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **44 5** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **72.3** kN	

Section details

Section type **UC 305x305x137 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3 5

Tensile strain coefficient ε = **1 02** Section classification **Plastic**

Shear capacity - Section 4 2.3

Design shear force F_v = **201.1** kN Design shear resistance P_v = **703.2** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4 2.5

Design bending moment M = **232.5** kNm Moment capacity low shear M_c = **608.6** kNm

Buckling resistance moment - Section 4 3.6.4

Buckling resistance moment M_b = **513 3** kNm M_b / m_{LT} = **513.3** kNm

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2 5 2

Consider deflection due to imposed loads

Limiting deflection δ_{lim} = **13.889** mm Maximum deflection δ = **3 597** mm

PASS - Maximum deflection does not exceed deflection limit

Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
	Calcs for Beam 6- Existing Loading				Start page no /Revision 1	
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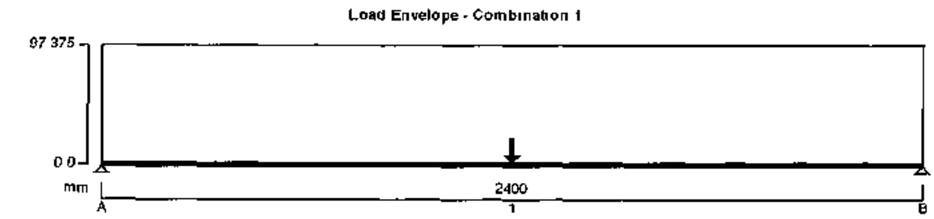
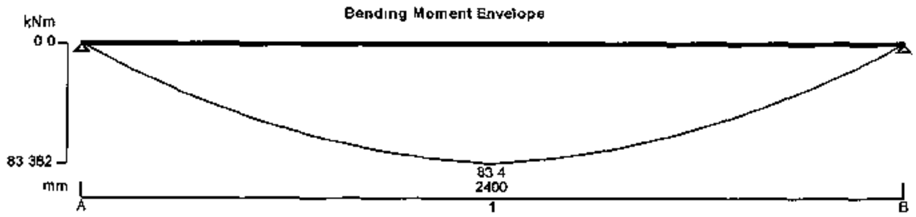
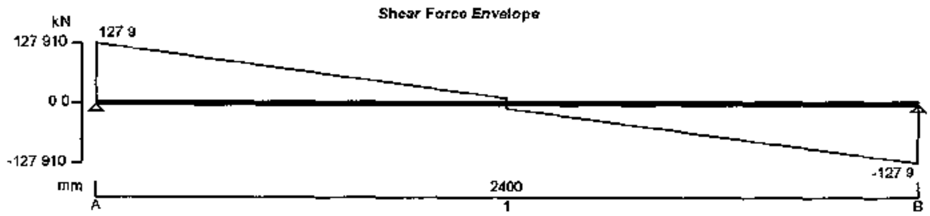
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1·2000 incorporating Corrigendum No.1

TEDDS calculation version 3 0 05







Support conditions

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

Applied loading

Beam loads	Dead point load 15 8 kN at 1200 mm	
	Imposed full UDL 20 kN/m	
	Dead full UDL 46 kN/m	
	Dead self weight of beam × 1	

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

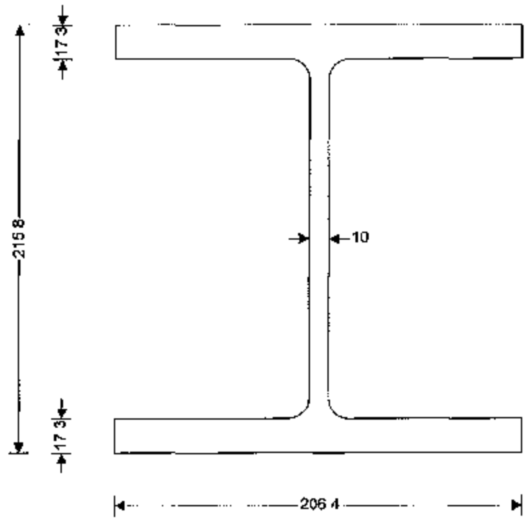
Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
	Calcs for Beam 6- Existing Loading				Start page no /Revision 2	
	Calcs by A W	Calcs date 02/02/2018	Checked by	Checked date	Approved by	Approved date

Analysis results

Maximum moment	M_{max} = **83.4** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **127 9** kN	V_{min} = **-127.9** kN
Deflection	δ_{max} = **2.1** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **127.9** kN	R_{A_min} = **127.9** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **63.9** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **24** kN	
Maximum reaction at support B	R_{B_max} = **127.9** kN	R_{B_min} = **127.9** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **63.9** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **24** kN	

Section details

Section type **UC 203x203x71 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = **1.02** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = **127.9** kN Design shear resistance P_v = **343.1** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2 5

Design bending moment M = **83.4** kNm Moment capacity low shear M_c = **211.7** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment M_b = **202 1** kNm M_b / m_{LT} = **202 1** kNm

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2 5 2

Consider deflection due to dead and imposed loads

Limiting deflection δ_{lim} = **5** mm Maximum deflection δ = **2.136** mm

PASS - Maximum deflection does not exceed deflection limit

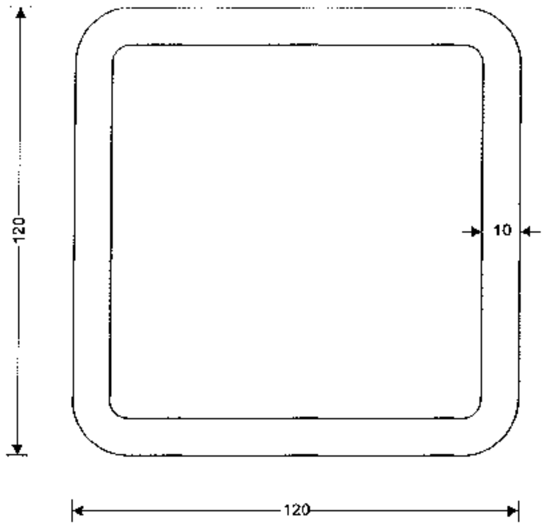
STEEL MEMBER DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3 0 05

Section details

Section type **SHS 120x120x10.0 (Tata Steel Celsius)** Steel grade **S275**



Classification of cross sections - Section 3 5

Tensile strain coefficient ε = **1 00** Section classification **Semi-compact**

Moment capacity - Section 4.2.5

Design bending moment M = **22.5** kNm Moment capacity low shear M_c = **46.9** kNm

PASS - Moment capacity exceeds design bending moment

Compression members - Section 4 7

Design compression force F_c = **334** kN Compression resistance P_{cx} = **979.4** kN

PASS - Compression resistance exceeds design compression force

Compression members with moments - Section 4 8.3

Comp and bending check $F_c / (A \times p_y) + M / M_c$ = **0 763**

PASS - Combined bending and compression check is satisfied

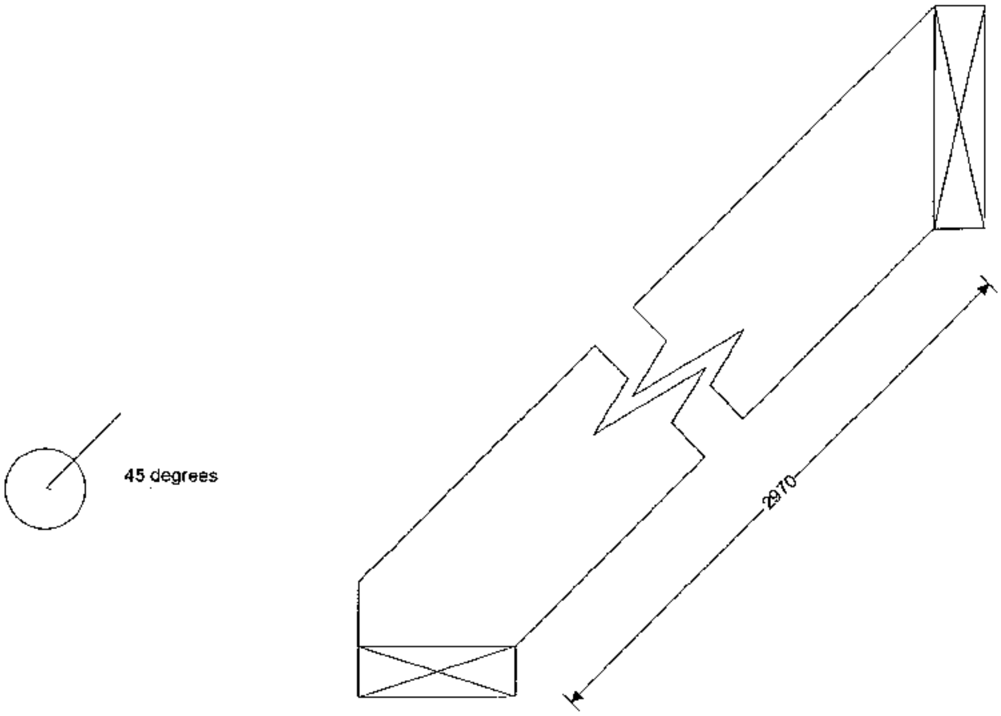
Member buckling resistance - cl.4 8.3 3.3

Buckling resistance check $F_c / P_{cx} + m_x \times M / M_c \times (1 + 0 5 \times F_c / P_{cx})$ = **0.903**

PASS - Member buckling resistance checks are satisfied

TIMBER RAFTER DESIGN (BS5268-2:2002)

TEDDS calculation version 1 0 03



Rafter details

Breadth of timber sections	b = **47** mm	Depth of timber sections	h = **147** mm
Rafter spacing	s = **600** mm	Rafter span	**Single span**
Clear length of span on slope	L_{cl} = **2970** mm	Rafter slope	α = **45 0** deg
Timber strength class	**C24**		

Section properties

Cross sectional area of rafter	A = **6909** mm^2	Section modulus	Z = **169270** mm^3
Radius of gyration	r = **42** mm	Second moment of area	I = **12441382** mm^4

Loading details

Rafter self weight	F_j = **0.02** kN/m	Dead load on slope	F_d = **1.20** kN/m^2
Imposed snow load on plan	F_u = **0.75** kN/m^2	Imposed point load	F_p = **0.90** kN

Modification factors

Section depth factor	K_7 = **1.08**	Load sharing factor	K_8 = **1.10**

Consider long term load condition

Load duration factor	K_3 = **1.00**	Total UDL perp to rafter	F = **0.526** kN/m
Notional bearing length	L_b = **6** mm	Effective span	L_{eff} = **2976** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **8.923** N/mm^2	Applied bending stress	σ_{m_max} = **3.440** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp stress	σ_{c_adm} = **5.161** N/mm^2	Applied compressive stress	σ_{c_max} = **0.453** N/mm^2

PASS - Applied compressive stress within permissible limits

Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
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Check combined bending and compressive stress parallel to grain

Combined loading check **0.484 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0 781** N/mm^2 Applied shear stress τ_{max} = **0.170** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **8 929** mm Total deflection δ_{max} = **4.148** mm

PASS - Total deflection within permissible limits

<u>Consider medium term load condition</u>

Load duration factor K_3 = **1.25** Total UDL perp to rafter F = **0.751** kN/m

Notional bearing length L_b = **9** mm Effective span L_{eff} = **2979** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **11.154** N/mm^2 Applied bending stress σ_{m_max} = **4.921** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp stress σ_{c_adm} = **5.998** N/mm^2 Applied compressive stress σ_{c_max} = **0.648** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.566 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.976** N/mm^2 Applied shear stress τ_{max} = **0.243** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **8 937** mm Total deflection δ_{max} = **5.944** mm

PASS - Total deflection within permissible limits

<u>Consider short term load condition</u>

Load duration factor K_3 = **1.50** Total UDL perp to rafter F = **0.526** kN/m

Notional bearing length L_b = **9** mm Effective span L_{eff} = **2979** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **13.385** N/mm^2 Applied bending stress σ_{m_max} = **6.246** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp stress σ_{c_adm} = **6 677** N/mm^2 Applied compressive stress σ_{c_max} = **0.546** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.562 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.172** N/mm^2 Applied shear stress τ_{max} = **0.308** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **8 936** mm

Total deflection δ_{max} = **6 892** mm

PASS - Total deflection within permissible limits

Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Reddington road			Job no 811365	
	Calcs for Flat Roof Timber Joists			Start page no /Revision 1	
	Calcs by A W	Calcs date 02/02/2018	Checked by	Checked date	Approved by	Approved date

TIMBER JOIST DESIGN (BS5268-2:2002)

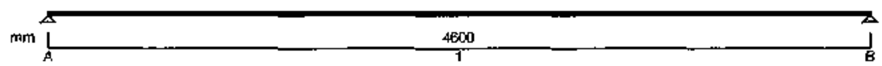
Tedds calculation version 1 1 04

Joist details

Joist breadth b = **47** mm | Joist depth h = **200** mm

Joist spacing s = **450** mm | Service class of timber **1**

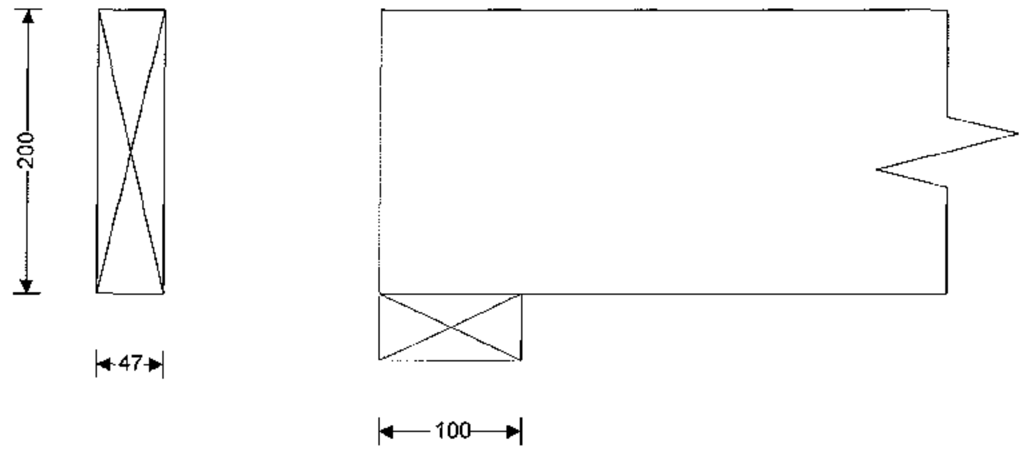
Timber strength class **C24**



Span details

Number of spans N_{span} = **1** | Length of bearing L_b = **100** mm

Clear length of span L_{s1} = **4600** mm



Section properties

Second moment of area I = **31333333** mm^4 | Section modulus Z = **313333** mm^3

Loading details

Joist self weight F_{swt} = **0.03** kN/m | Dead load F_{d_udl} = **0.77** kN/m^2

Imposed UDL(Medium term) F_{i_udl} = **0.60** kN/m^2

Imposed point load (Short) F_{i_pt} = **0.90** kN

Consider medium term loads

Design bending moment M = **1.716** kNm | Design shear force V = **1.492** kN

Design support reaction R = **1 492** kN | Design deflection δ = **11.502** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **10 783** N/mm^2 | Applied bending stress σ_{m_max} = **5.477** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0 976** N/mm^2 | Applied shear stress τ_{max} = **0.238** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3 300** N/mm^2 Applied bearing stress σ_{c_max} = **0.317** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **13.800** mm Actual deflection δ = **11 502** mm

PASS - Actual deflection within permissible limits

Consider short term loads

Design bending moment M = **2.037** kNm Design shear force V = **1.771** kN

Design support reaction R = **1 771** kN Design deflection δ = **12.304** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **12.939** N/mm^2 Applied bending stress σ_{m_max} = **6.501** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.172** N/mm^2 Applied shear stress τ_{max} = **0.283** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.960** N/mm^2 Applied bearing stress σ_{c_max} = **0.377** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **13.800** mm Actual deflection δ = **12.304** mm

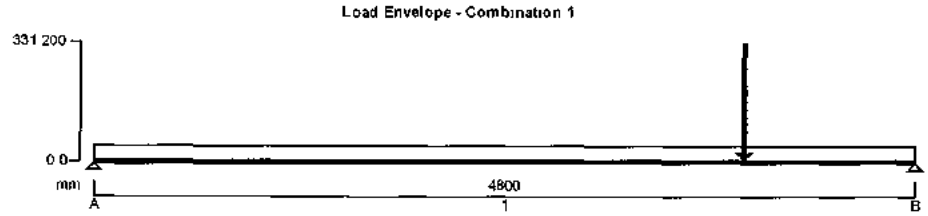
PASS - Actual deflection within permissible limits

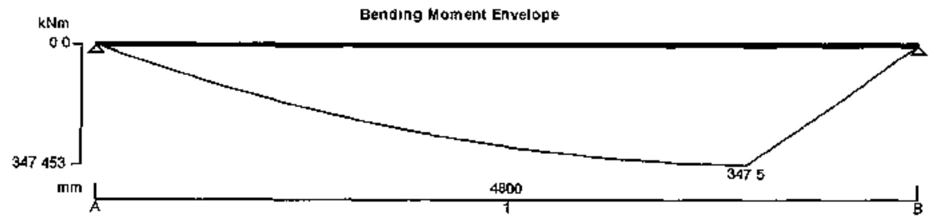
Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Readington Road				Job no 811365	
	Calcs for Basement Beam 1				Start page no /Revision 1	
	Calcs by A W	Calcs date 05/04/2018	Checked by	Checked date	Approved by	Approved date

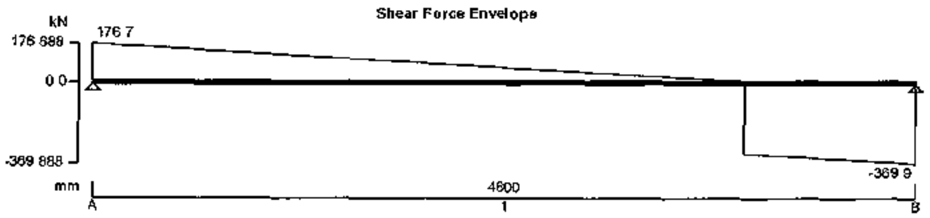
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1·2000 incorporating Corrigendum No 1

TEDDS calculation version 3 0 05







Support conditions

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

Applied loading

Beam loads	Dead point load 112 kN at 3800 mm
	Imposed point load 109 kN at 3800 mm
	Imposed full UDL 14 kN/m
	Dead full UDL 15 kN/m
	Dead self weight of beam × 1

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

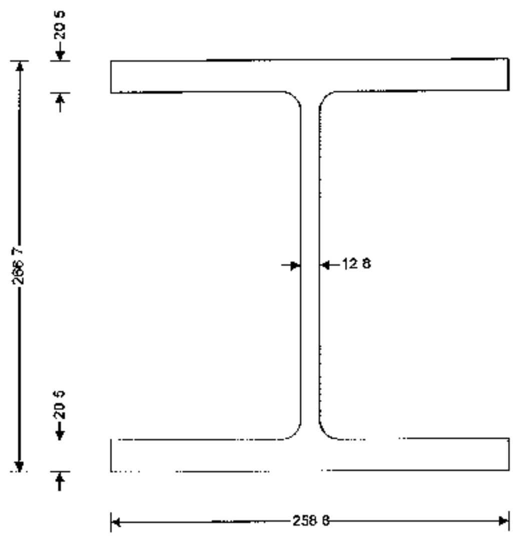
Imposed × 1 60

Analysis results

Maximum moment	M_{max} = 347.5 kNm	M_{min} = 0 kNm
Maximum shear	V_{max} = 176 7 kN	V_{min} = -369 9 kN
Deflection	δ_{max} = 6.9 mm	δ_{min} = 0 mm
Maximum reaction at support A	R_{A_max} = 176.7 kN	R_{A_min} = 176.7 kN
Unfactored dead load reaction at support A	R_{A_Dead} = 61 9 kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = 56.3 kN	
Maximum reaction at support B	R_{B_max} = 369.9 kN	R_{B_min} = 369.9 kN
Unfactored dead load reaction at support B	R_{B_Dead} = 127.2 kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = 119 9 kN	

Section details

Section type **UC 254x254x107 (BS4-1)** Steel grade **S355**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = 0.89 Section classification **Plastic**

Shear capacity - Section 4 2.3

Design shear force F_v = 369.9 kN Design shear resistance P_v = 706.6 kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment M = 347 5 kNm Moment capacity low shear M_c = 512.1 kNm

PASS - Moment capacity exceeds design bending moment

Check vertical deflection - Section 2 5 2

Consider deflection due to imposed loads

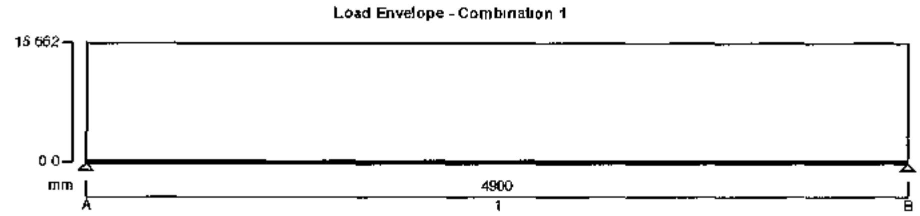
Limiting deflection δ_{lim} = 13.333 mm Maximum deflection δ = 6.862 mm

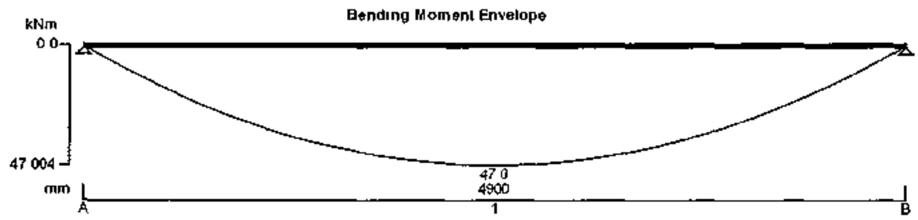
PASS - Maximum deflection does not exceed deflection limit

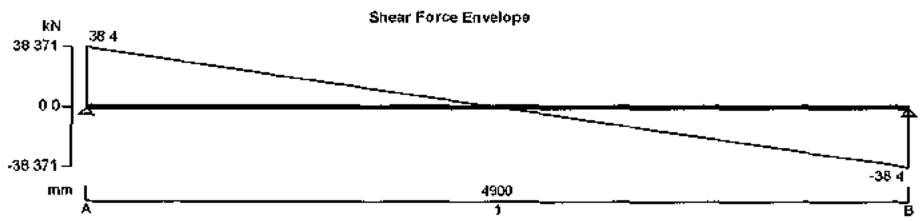
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3 0 05







Support conditions

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

Applied loading

Beam loads	Imposed full UDL 7 5 kN/m	
	Dead full UDL 2 31 kN/m	
	Dead self weight of beam × 1	

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

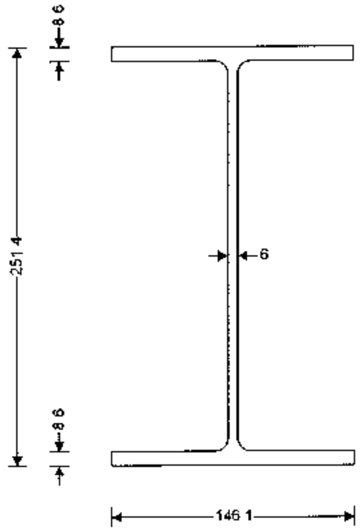
Ingleton Wood 1 Alie Street London	Project: 79 Redington Road				Job no: 811365	
	Calcs for: Basement Beam 3				Start page no /Revision: 2	
	Calcs by: A W	Calcs date: 05/04/2018	Checked by	Checked date	Approved by	Approved date

Analysis results

Maximum moment	M_{max} = 47 kNm	M_{min} = 0 kNm
Maximum moment span 1 segment 1	$M_{s1\_seg1\_max}$ = 47 kNm	$M_{s1\_seg1\_min}$ = 0 kNm
Maximum moment span 1 segment 2	$M_{s1\_seg2\_max}$ = 47 kNm	$M_{s1\_seg2\_min}$ = 0 kNm
Maximum shear	V_{max} = 38.4 kN	V_{min} = -38.4 kN
Maximum shear span 1 segment 1	$V_{s1\_seg1\_max}$ = 38 4 kN	$V_{s1\_seg1\_min}$ = 0 kN
Maximum shear span 1 segment 2	$V_{s1\_seg2\_max}$ = 0 kN	$V_{s1\_seg2\_min}$ = -38 4 kN
Deflection segment 3	δ_{max} = 6 2 mm	δ_{min} = 0 mm
Maximum reaction at support A	R_{A_max} = 38.4 kN	R_{A_min} = 38 4 kN
Unfactored dead load reaction at support A	R_{A_Dead} = 6.4 kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = 18.4 kN	
Maximum reaction at support B	R_{B_max} = 38.4 kN	R_{B_min} = 38.4 kN
Unfactored dead load reaction at support B	R_{B_Dead} = 6 4 kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = 18.4 kN	

Section details

Section type **UB 254x146x31 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3 5

Tensile strain coefficient ε = **1 00** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = 38.4 kN Design shear resistance P_v = **248.9** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity at span 1 segment 1 - Section 4.2.5

Design bending moment M = 47 kNm Moment capacity low shear M_c = **108.1** kNm

Buckling resistance moment - Section 4 3 6.4

Buckling resistance moment M_b = **64.7** kNm M_b / m_{LT} = 64 7 kNm

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2 5.2

Consider deflection due to imposed loads

Limiting deflection δ_{lim} = **13 611** mm Maximum deflection δ = **6 222** mm

PASS - Maximum deflection does not exceed deflection limit

RC SLAB DESIGN (BS8110:PART1:1997)

TEDDS calculation version 1 0 04

CONCRETE SLAB DESIGN (CL 3.5.3 & 4)

SIMPLE ONE WAY SPANNING SLAB DEFINITION

Overall depth of slab h = **275** mm

Cover to tension reinforcement resisting sagging c_b = **40** mm

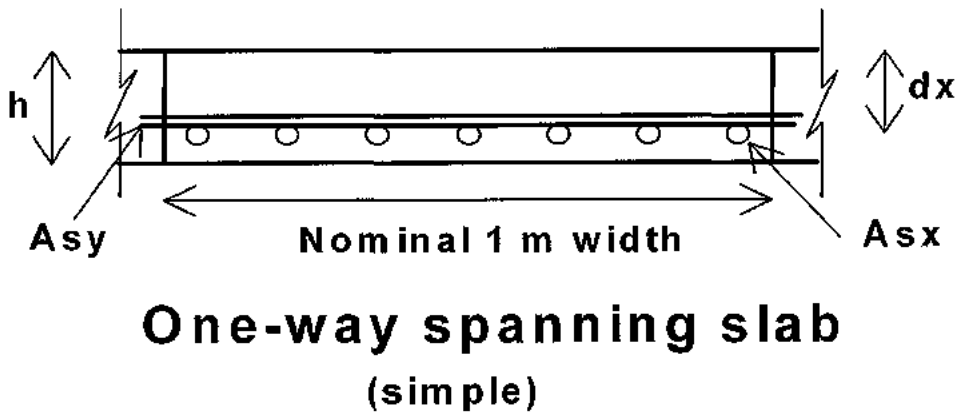
Trial bar diameter D_{tryx} = **16** mm

Depth to tension steel (resisting sagging)

$d_x = h - c_b - D_{tryx}/2$ = **227** mm

Characteristic strength of reinforcement f_y = **500** N/mm^2

Characteristic strength of concrete f_{cu} = **35** N/mm^2



ONE WAY SPANNING SLAB (CL 3 5 4)

MAXIMUM DESIGN MOMENTS IN SPAN

Design sagging moment (per m width of slab) m_{sx} = **62.4** kNm/m

CONCRETE SLAB DESIGN – SAGGING – OUTER LAYER OF STEEL (CL 3.5.4)

Design sagging moment (per m width of slab) m_{sx} = **62.4** kNm/m

Moment Redistribution Factor β_{bx} = **1 0**

Area of reinforcement required

$K_x = abs(m_{sx}) / (d_x^2 \times f_{cu})$ = **0 035**

$K'_x = min(0\ 156, (0\ 402 \times (\beta_{bx} - 0\ 4)) - (0\ 18 \times (\beta_{bx} - 0\ 4)^2))$ = **0.156**

Outer compression steel not required to resist sagging

One-way Spanning Slab requiring tension steel only (sagging) - mesh

$z_x = min((0\ 95 \times d_x),(d_x \times (0\ 5+\sqrt{(0\ 25-K_x/0\ 9)})))$ = **216** mm

Neutral axis depth $x_x = (d_x - z_x) / 0\ 45$ = **25** mm

Area of tension steel required

A_{sx_req} = abs(m_{sx}) / (1/γ_{ms} × f_y × z_x) = **666** mm²/m

Tension steel

Use B785 Mesh

A_{sx_prov} = A_{sl} = **785** mm²/m A_{sy_prov} = A_{st} = **252** mm²/m

D_x = d_{sl} = **10** mm D_y = d_{st} = **8** mm

Area of tension steel provided sufficient to resist sagging

Check min and max areas of steel resisting sagging

Total area of concrete A_c = h = **275000** mm²/m

Minimum % reinforcement k = **0.13** %

A_{st_min} = k × A_c = **358** mm²/m

A_{st_max} = 4 % × A_c = **11000** mm²/m

Steel defined

Outer steel resisting sagging A_{sx_prov} = **785** mm²/m

Area of outer steel provided (sagging) OK

Inner steel resisting sagging A_{sy_prov} = **252** mm²/m

Less than min area of inner steel (sagging) FAIL

SHEAR RESISTANCE OF CONCRETE SLABS (CL 3.5.5)

Outer tension steel resisting sagging moments

Depth to tension steel from compression face d_x = **227** mm

Area of tension reinforcement provided (per m width of slab) A_{sx_prov} = **785** mm²/m

Design ultimate shear force (per m width of slab) V_x = **53** kN/m

Characteristic strength of concrete f_{cu} = **35** N/mm²

Applied shear stress

v_x = V_x / d_x = **0.23** N/mm²

Check shear stress to clause 3.5.5 2

$v_{allowable}$ = min ((0 8 $N^{1/2}$/mm) × √(f_{cu}), 5 N/mm²) = **4.73** N/mm²

Shear stress - OK

Shear stresses to clause 3.5.5.3

Design shear stress

f_{cu_ratio} = if (f_{cu} > 40 N/mm², 40/25 , f_{cu}/(25 N/mm²)) = **1 400**

v_{cx} = 0 79 N/mm² × min(3,100 × A_{sx_prov} / d_x)$^{1/3}$ × max(0 67,(400 mm / d_x)$^{1/4}$) / 1 25 × $f_{cu\_ratio}^{1/3}$

v_{cx} = **0.57** N/mm²

Applied shear stress

v_x = **0.23** N/mm²

No shear reinforcement required

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CONCRETE SLAB DEFLECTION CHECK (CL 3.5.7)

Slab span length l_x = **4 600** m

Design ultimate moment in shorter span per m width m_{sx} = **62** kNm/m

Depth to outer tension steel d_x = **227** mm

Tension steel

Area of outer tension reinforcement provided A_{sx_prov} = **785** mm^2/m

Area of tension reinforcement required A_{sx_req} = **666** mm^2/m

Moment Redistribution Factor β_{bx} = **1 00**

Modification Factors

Basic span / effective depth ratio (Table 3 9) $ratio_{span\_depth}$ = **20**

The modification factor for spans in excess of 10m (ref cl 3 4 6 4) has not been included

$f_s = 2 \times f_y \times A_{sx\_req} / (3 \times A_{sx\_prov} \times \beta_{bx})$ = **282 6** N/mm^2

$factor_{tens}$ = min (2 , 0 55 + (477 N/mm^2 - f_s) / (120 × (0 9 N/mm^2 + m_{sx} / d_x^2))) = **1.317**

Calculate Maximum Span

This is a simplified approach and further attention should be given where special circumstances exist Refer to clauses 3 4 6 4 and 3 4 6 7

Maximum span $l_{max} = ratio_{span\_depth} \times factor_{tens} \times d_x$ = **5.98 m**

Check the actual beam span

Actual span/depth ratio l_x / d_x = **20 26**

Span depth limit $ratio_{span\_depth} \times factor_{tens}$ = **26 35**

Span/Depth ratio check satisfied

CHECK OF NOMINAL COVER (SAGGING) – (BS8110:PT 1, TABLE 3.4)

Slab thickness h = **275** mm

Effective depth to bottom outer tension reinforcement d_x = **227 0** mm

Diameter of tension reinforcement D_x = **10** mm

Diameter of links L_{diax} = **0** mm

Cover to outer tension reinforcement

$c_{tenx} = h - d_x - D_x / 2$ = **43.0** mm

Nominal cover to links steel

$c_{nomx} = c_{tenx} - L_{diax}$ = **43.0** mm

Permissable minimum nominal cover to all reinforcement (Table 3 4)

c_{min} = **35** mm

Cover over steel resisting sagging OK

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	Calcs for Ground Floor Timber Joists			Start page no /Revision 1	
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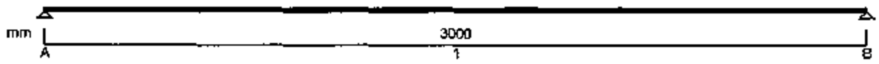
TIMBER JOIST DESIGN (BS5268-2:2002)

Tedds calculation version 1 1 04

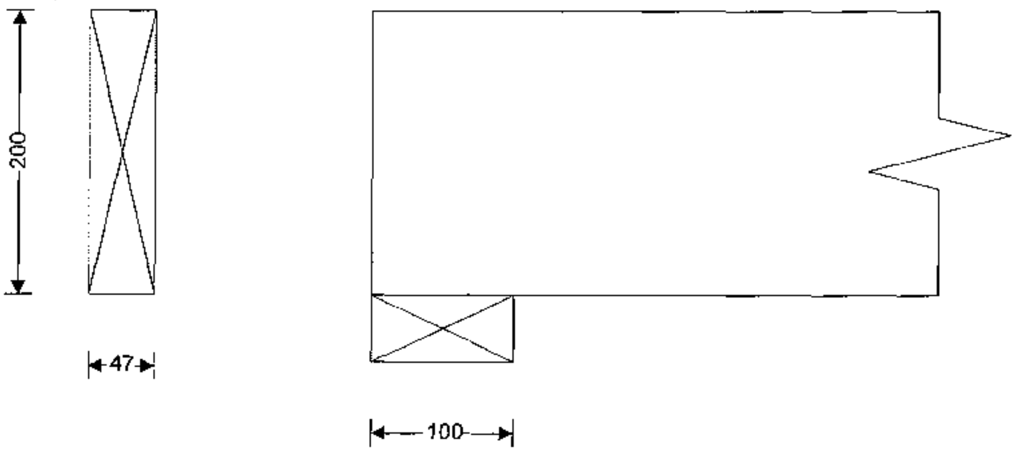
Joist details

Joist breadth	b = **47** mm	Joist depth	h = **200** mm
Joist spacing	s = **450** mm	Service class of timber	**1**
Timber strength class	**C24**		



Span details

Number of spans	N_{span} = **1**	Length of bearing	L_b = **100** mm
Clear length of span	L_{s1} = **3000** mm		



Section properties

Second moment of area	I = **31333333** mm^4	Section modulus	Z = **313333** mm^3

Loading details

Joist self weight	F_{swt} = **0.03** kN/m	Dead load	F_{d_udl} = **0.75** kN/m^2
Imposed UDL(Long term)	F_{i_udl} = **2.50** kN/m^2		
Imposed point load (Medium)	F_{i_pt} = **1.40** kN		

Consider long term loads

Design bending moment	M = **1.682** kNm	Design shear force	V = **2.242** kN
Design support reaction	R = **2 242** kN	Design deflection	δ = **4 977** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **8 626** N/mm^2	Applied bending stress	σ_{m_max} = **5.367** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress	τ_{adm} = **0 781** N/mm^2	Applied shear stress	τ_{max} = **0.358** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **2 640** N/mm^2 Applied bearing stress σ_{c_max} = **0 477** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.000** mm Actual deflection δ = **4.977** mm

PASS - Actual deflection within permissible limits

Consider medium term loads

Design bending moment M = **1.466** kNm Design shear force V = **1 955** kN

Design support reaction R = **1 955** kN Design deflection δ = **3.757** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **10 783** N/mm^2 Applied bending stress σ_{m_max} = **4.679** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.976** N/mm^2 Applied shear stress τ_{max} = **0.312** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.300** N/mm^2 Applied bearing stress σ_{c_max} = **0.416** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.000** mm Actual deflection δ = **3.757** mm

PASS - Actual deflection within permissible limits

Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
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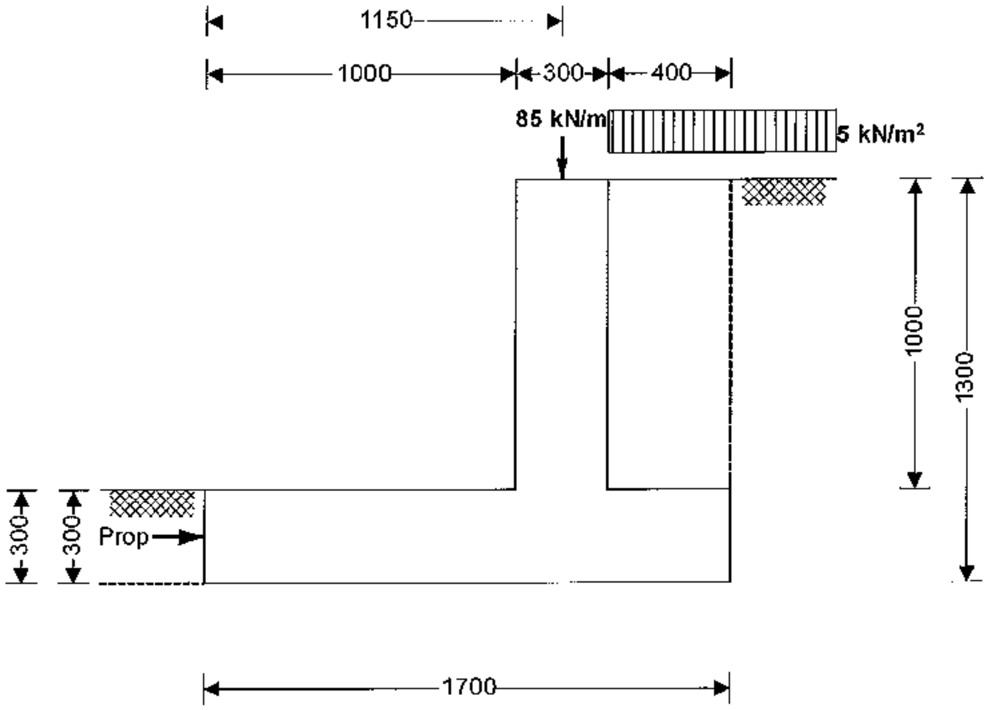
RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1 2 01 06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **1000** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1000** mm	Length of heel	l_{heel} = **400** mm
Overall length of base	l_{base} = **1700** mm	Base thickness	t_{base} = **300** mm
Height of retaining wall	h_{wall} = **1300** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **850** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **300** mm
Height of ground water	h_{water} = **0** mm	Density of water	γ_{water} = 9 81 kN/m³
Density of wall construction	γ_{wall} = **23.6** kN/m³	Density of base construction	γ_{base} = **23.6** kN/m³
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **1300** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m³	Saturated density	γ_s = **21.0** kN/m³
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m³	Allowable bearing	$P_{bearing}$ = **130** kN/m²

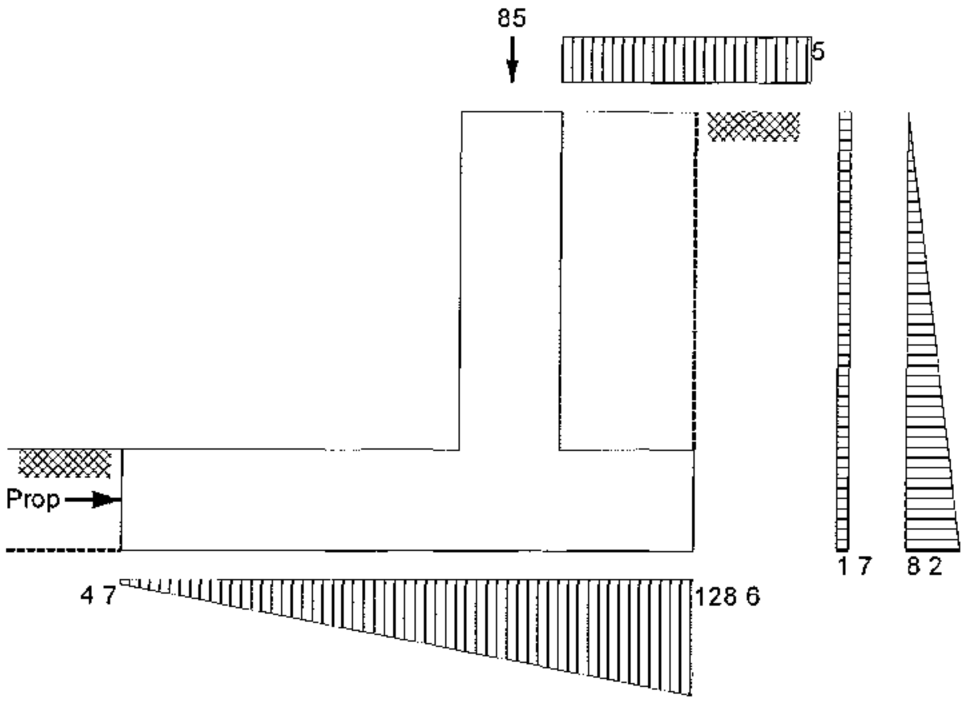
Using Coulomb theory

Active pressure	K_a =**0.369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0 590**		

Loading details

Surcharge load	Surcharge = **5.0** kN/m²		
Vertical dead load	W_{dead} = **75.0** kN/m	Vertical live load	W_{live} = **10.0** 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} = **1150** 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} = **0.0** kN/m

Check bearing pressure

Total vertical reaction R = **113 3** kN/m   Distance to reaction x_{bar} = **1113** mm

Eccentricity of reaction e = **263** mm

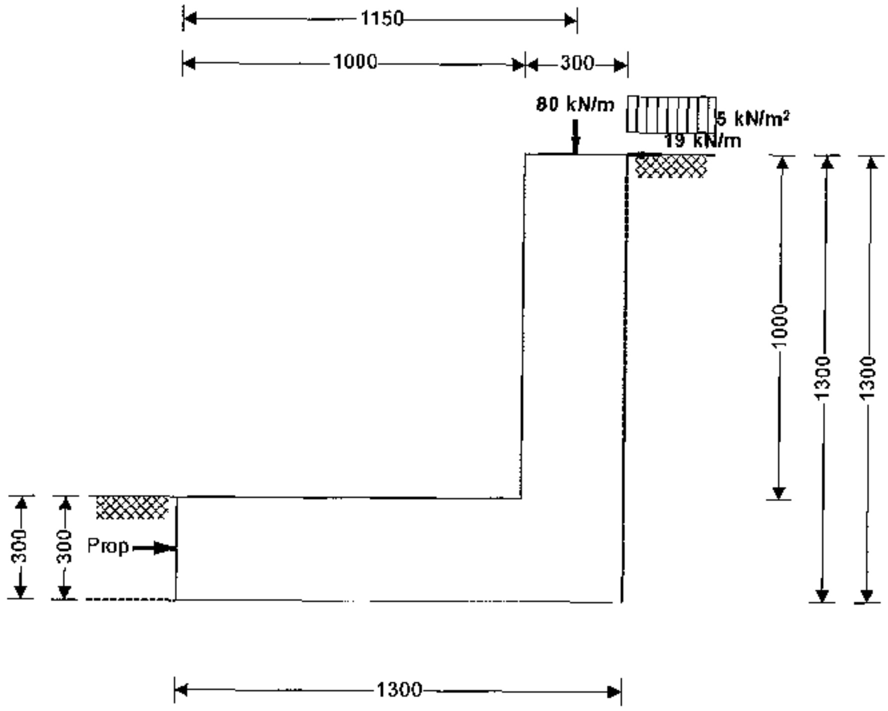
Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **4.7** kN/m²   Bearing pressure at heel p_{heel} = **128.6** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

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} = **1000** 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} = **300** mm
Height of retaining wall	h_{wall} = **1300** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **850** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **300** mm
Height of ground water	h_{water} = **0** mm	Density of water	γ_{water} = **9 81** kN/m³
Density of wall construction	γ_{wall} = **23 6** kN/m³	Density of base construction	γ_{base} = **23.6** kN/m³
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **1300** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18 0** kN/m³	Saturated density	γ_s = **21.0** kN/m³
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18 0** kN/m³	Allowable bearing	$P_{bearing}$ = **130** kN/m²

Using Coulomb theory

Active pressure	K_a =**0 369**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **5.0** kN/m²		
Vertical dead load	W_{dead} = **70.0** kN/m	Vertical live load	W_{live} = **10.0** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **19.4** kN/m

Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Redington Road			Job no 811365	
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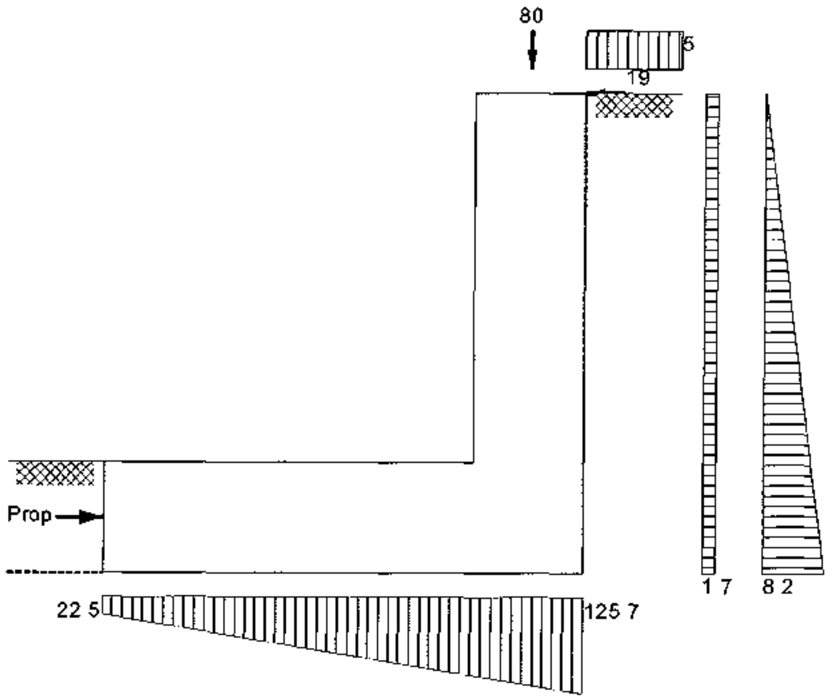
	Calcs by A W	Calcs date 06/02/2018	Checked by	Checked date	Approved by	Approved date

Position of vertical load l_{load} = **1150** mm Height of horizontal load h_{load} = **1300** mm



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

Calculate propping force

Propping force F_{prop} = **0.0** kN/m

Check bearing pressure

Total vertical reaction R = **96.3** kN/m Distance to reaction x_{bar} = **801** mm

Eccentricity of reaction e = **151** mm

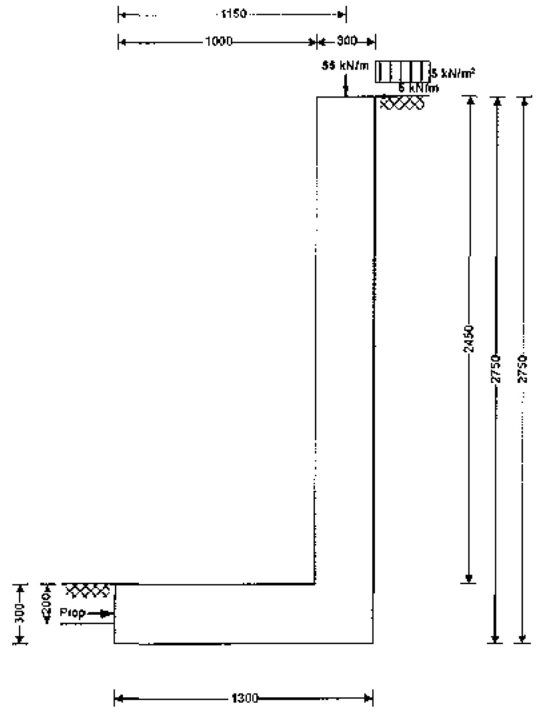
Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **22.5** kN/m² Bearing pressure at heel p_{heel} = **125.7** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

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} = **2450** 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} = **300** mm
Height of retaining wall	h_{wall} = **2750** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **850** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **200** mm
Height of ground water	h_{water} = **0** mm	Density of water	γ_{water} = 9 81 kN/m³
Density of wall construction	γ_{wall} = **23.6** kN/m³	Density of base construction	γ_{base} = **23 6** kN/m³
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **2750** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18 0** kN/m³	Saturated density	γ_s = **21.0** kN/m³
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **18.6** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m³	Allowable bearing	$P_{bearing}$ = **130** kN/m²

Using Coulomb theory

Active pressure	K_a =**0.369**	Passive pressure	K_p = **4 187**
At-rest pressure	K_0 = **0.590**		

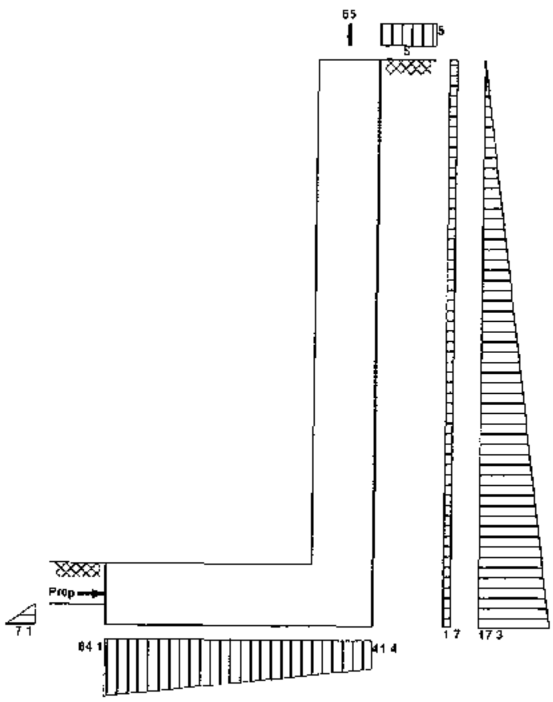
Loading details

Surcharge load	Surcharge = **5 0** kN/m²		
Vertical dead load	W_{dead} = **40.0** kN/m	Vertical live load	W_{live} = **15.0** kN/m
Horizontal dead load	F_{dead} = **0 0** kN/m	Horizontal live load	F_{live} = **5.0** kN/m

Ingleton Wood Ingleton Wood 1 Alie Street London	Project 79 Redington Road				Job no 811365	
	Calcs for Underpinning from GF level				Start page no /Revision 2	
	Calcs by A W	Calcs date 06/02/2018	Checked by	Checked date	Approved by	Approved date

Position of vertical load l_{load} = **1150** mm

Height of horizontal load h_{load} = **2750** mm



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

Calculate propping force

Propping force F_{prop} = **10.9** kN/m

Check bearing pressure

Total vertical reaction R = **81.6** kN/m

Distance to reaction x_{bar} = **576** mm

Eccentricity of reaction e = **74** mm

Reaction acts within middle third of base

Bearing pressure at toe p_{toe} = **84.1** kN/m²

Bearing pressure at heel p_{heel} = **41 4** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure