DIXON HURST

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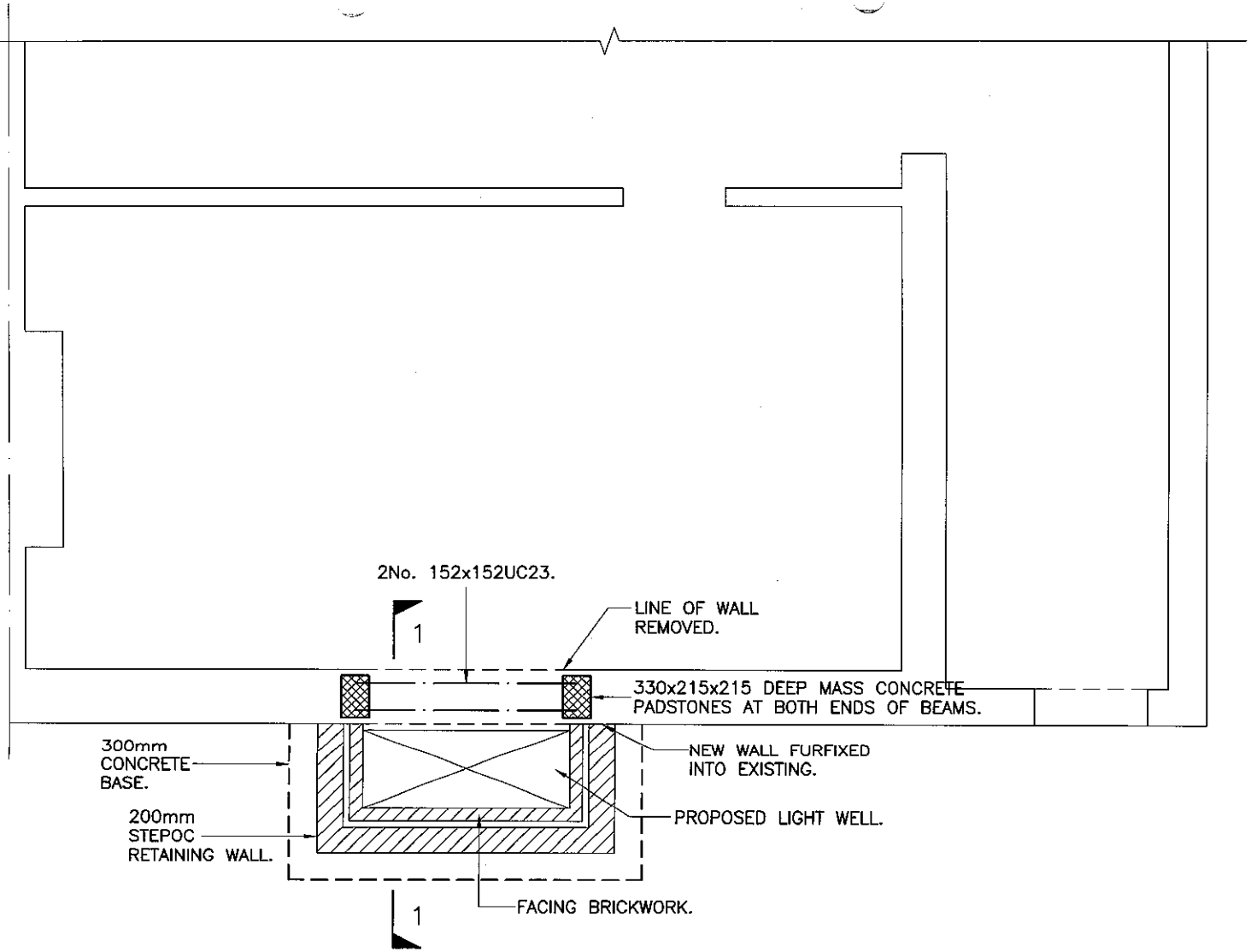
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Structural Calculations

For

57 New Road, Shoreham

Date: July 2017
Project No: 51846

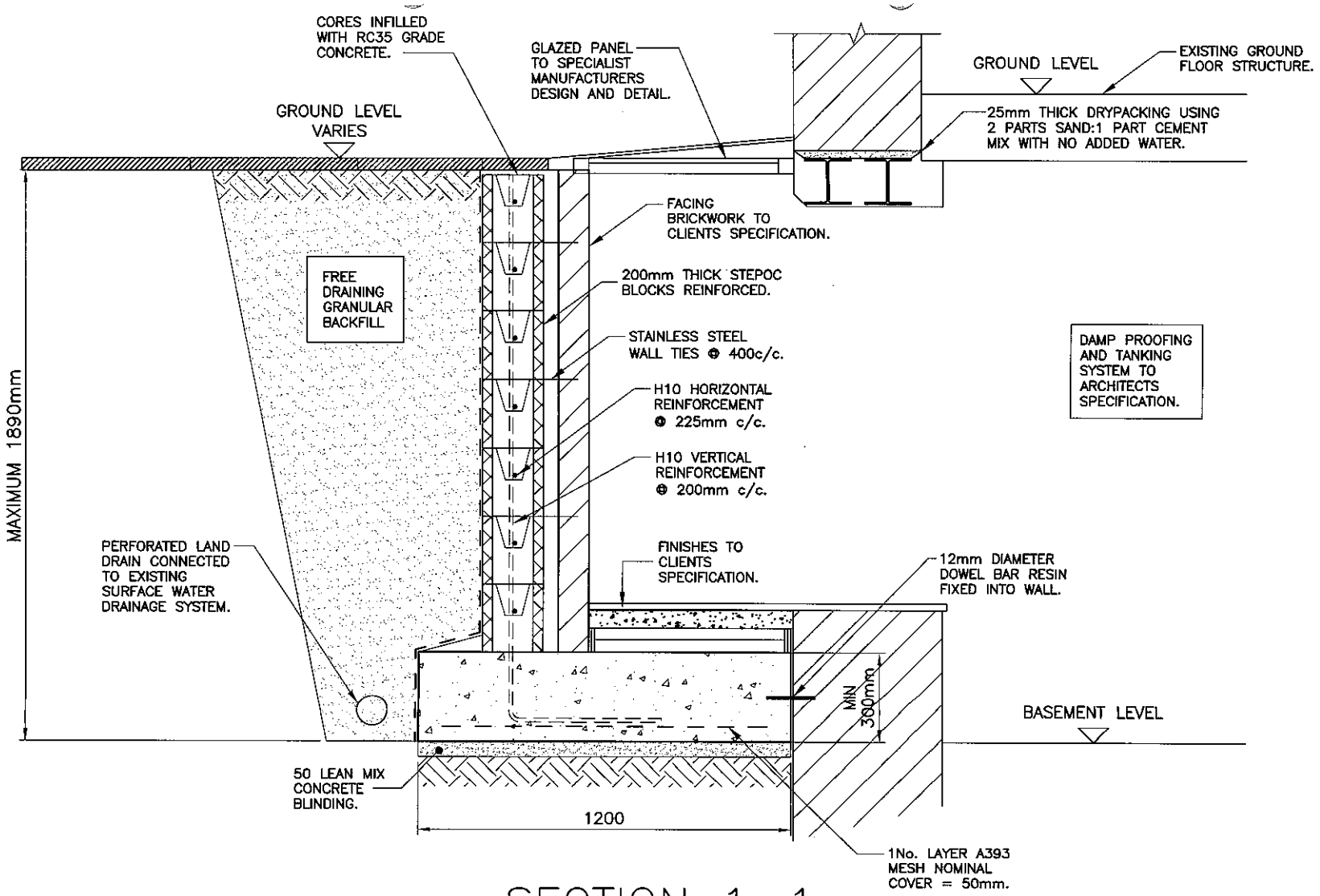


GROUND FLOOR PART PLAN

Scale 1:50 @ A4

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Job Title			Item		
57 NEW ROAD, SHOREHAM.			GROUND FLOOR PART PLAN.		
Designed by	Date	Checked by	Job No.	Sheet	Rev.
IG	JULY 2017		51846	01	



SECTION 1–1

Scale 1:20 @ A4

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Job Title			Item		
57 NEW ROAD, SHOREHAM.			STEPOC RETAINING WALL SECTION.		
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IG	JULY 2017	NLP	51846	02	

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Job Title			Item		
57 NEW ROAD, SHOREHAM					
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BEAM B1 AT GROUND LEVEL — SPAN = 1.7m (DESIGN)

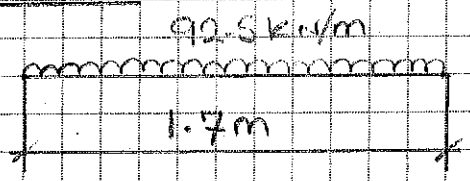
SERVICE LOADS:

	gk	qk
PITCHED ROOF = 8/2 x (0.85 + 0.75) =	3.4	3
1ST FLOOR CEILING = 8/2 x (0.25 + 0.25) =	1	1
1ST FLOOR = 3.6/2 x (0.5 + 1.5) =	0.9	2.7
GROUND FLOOR = 3.6/2 x (0.5 + 1.5) =	0.9	2.7
MASONRY WALL = 6.1 x 0.4 x 20 =	4.8.8	
BEAM S/W = 0.3	0.3	
	55.3 +	9.4 = 64.7 kN/m.

ULTIMATE LOADS.

55.3 x 1.4 + 9.4 x 1.6 = 92.5 kN/m.

LAYOUT



REACTION = 92.5 x 1.7/2 = 79 kN
MOMENT = 92.5 x 1.7²/8 = 33.4 kNm
LE = 1.0 x 1.7 + 2 x 0.2 = 2.1
δ = 1700/360 = 4.7mm
$I_{req} = 5 \times 64.7 \times 1700^4 / 384 \times 205 \times 4.7 \times 10^7$
= 730 cm⁴.

FROM BLUE BOOK PROVIDE 2 No. 152 x 152 UC23 — M_b = 33.4 kNm @ LE = 2, I_{xx} = 1250 cm⁴.

PADSTONES REQUIRED.

79000 x 3.5/3.5 x 1.5 x 330 = 160 mm

PROVIDE 330 x 215 x 215 DEEP PADSTONES

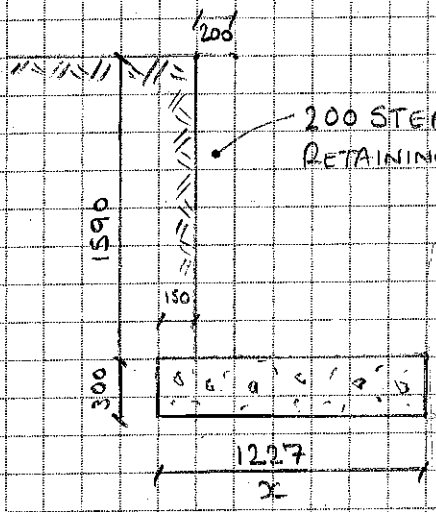
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CONSULTING CIVIL & STRUCTURAL ENGINEERS

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57 NEW ROAD, SHOREHAM					
Designed by	Date	Checked by	Job No.	Sheet	Rev.
I.G.	JULY 2017		51846.	04	

STEPOC RETAINING WALL.

RETAINED HEIGHT = 1890 mm.



SOIL = 19 KN/m³
SURCHARGE = 2.5 KN/m²

t_s = 200mm
t_b = 300mm

x = 1227 mm.

OVERTURNING.		FORCE		LEVER ARM		MOMENT.
① 1/3(19)(1.9)²/2	=	11.4 KN.	×	1.9/3	=	7.2 KNm
② 1/3(2.5)(1.9)	=	1.6 KN	×	1.9/2	=	1.5 KNm.
	Fa =	13 KN			Ma =	8.7 KNm

RESTORING.						
③ 1.59(0.2)(24)	=	7.6 KN	×	1.227 − 0.15 − 0.2/2	=	7.4 KNm
④ 1.59(0.15)(18)	=	4.3 KN	×	1.227 − 0.15/2	=	4.9 KNm
⑤ 1.227(0.3)(24 KN/m³)	=	8.8 KN	×	1.227/2	=	5.4 KNm.
	Fp =	20.7 KN			Mp	= 17.7 KNm

FACTORS OF SAFETY.

OVERTURNING. $M_p/M_a = 16.3/8.7 = 2.03 > 2.0$ ACCEPT.

SLIDING. $[20.7(\tan 20°) + 1.227(20)]/13 = 2.4 > 1.5$ ACCEPT

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I.G.	JULY 2017		51846	05	

STEM DESIGN USING 200mm STEPOC BLOCKS.

STEM HEIGHT $H = 1.6$ m

SOIL $\gamma = 18$ kN/m^3, $k_a = 1/3$

SURCHARGE $= 2.5$ kN/m^2

$\gamma_g = 1.4$, $\gamma_q = 1.6$

ULTIMATE SHEAR $1/3\,(1/2(1.6)^2(18)(1.4) + 2.5(1.6)(1.6))$ $V = 17.2$ kN.

ULTIMATE BM $1/2(1/3)(1/3(1.6)^3(18)(1.4) + 2.5(1.6)^2(1.6))$ $M = 16$ kN.

FROM STEPOC GRAPH ① min $A_s = 350$mm^2/m

PROVIDE H10 BARS @ 200 c/c ($A_s = 392.7$mm^2/m)

FROM STEPOC GRAPH ② max $V = 23.5$ kN.

23.5kN > 17.2 kN. ACCEPT.

BASE DESIGN.

MOMENT @ BASE $8.7 - 7.6(0.997) - 4.3(1.152)$ (STEM) (BACK-FILL) $M_q = -3.7$ kNm.

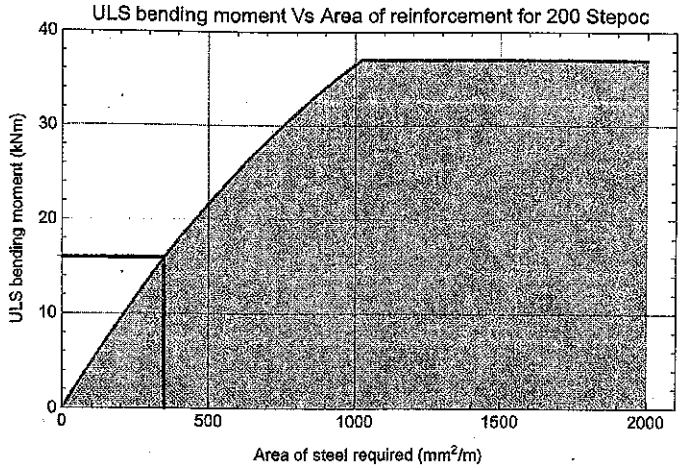
TOTAL VERTICAL LOAD $N = 20.7$ kN.

$M/N = -3.7/20.7 = -0.2 < b/6 = 2.0/6 = 0.33$ ACCEPT.

MAXIMUM PRESSURE $20.7/(1.227) + (-3.7)/(1.227)^2\ 5 = 2.17$ kN/m^2

ASSUMED ALLOWABLE GBP (TBC ON SITE) $= 100$ kN/m^2

2.17 kN/m^2 $<$ 100 kN/m^2 ACCEPT.



(1)

From this graph it can be seen that the area of steel required = 234.084 mm^2

Use H8 bars at 200 mm centres to provide 251.327 mm^2

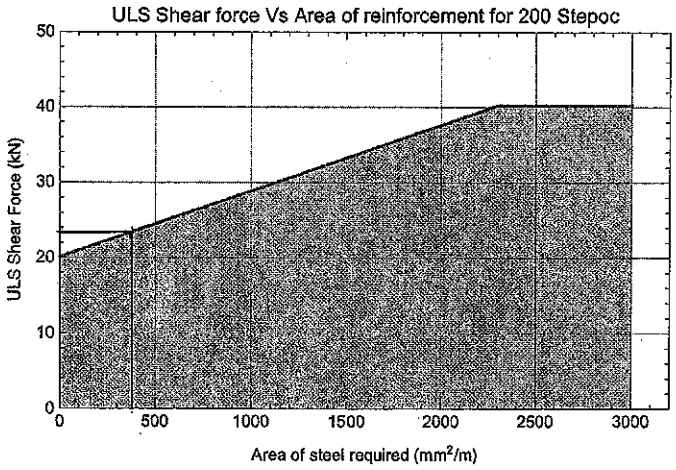
Establish the shear capacity of the section

The shear capacity of the section is assessed based on the calculation procedure within Annex J of BS EN 1996-1-1

The base design shear strength $f_{vd} = \frac{0.35 + 17.5\rho}{\gamma Mm}$

Where $\rho = \frac{As}{b\,d}$ (d = effective depth and b = breadth of section)

These equations are solved for shear force by multiply shear strength by the breadth and effective depth of the section the solution presented in graphical form. Below is the relevant graph



(2)

On this graph we read up from the area of bending steel that we have chosen above to calculate the basic ULS shear capacity of the section.

Shear capacity $F_{vd\,basic}$ = 22.3241 kN

It is possible where $\frac{a_v}{d}$ in cantilevers and simply supported beams is 6 or less to enhance the shear capacity of the section. In which:

shear span $a_v = \frac{(\text{maximum moment})}{(\text{maximum shear})}$