Michael Blacker Partnership
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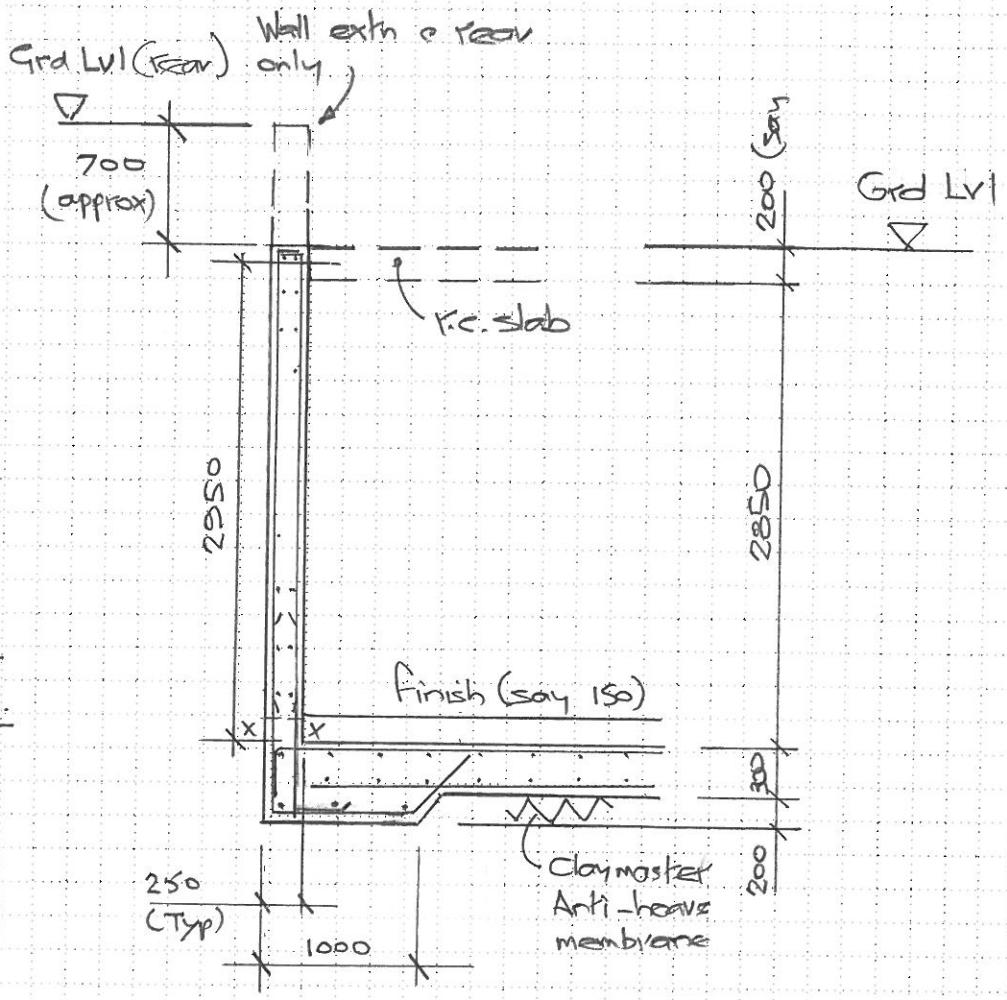
PROJECT 5 Hermit Place London NW6 4BZ
DRG TITLE
DRG No.

Job No. 4201
Sht. No. 01A
Date Dec '14

Preliminary Basement Wall Design (Fcu = 35N/mm²)



Typical Section.

Earth density = 18 kN/m³ (say)
θ = ° k = 0.42
Surcharge 20 kN/m²

Treat wall as free standing cantilever

M.c base of wall (xx)

= 18 × 0.42 × 2.95³ × 1.4/6 + 20 × 0.42 × 2.95² × 1.6/2

= 103.8 kNm/m

cont'd/

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'Wall design cont'd

$d = 250 - 35 - 10 = 205\ mm$

$K = 103.8 / 10^3 \times 0.205^2 \times 35 = 0.07$

$A = 103.8 / 0.87 \times 0.5 \times 0.94 \times 0.205 = 1279\ mm^2/m$

Provide H16 @ 150 mm crs ($1340\ mm^2/m$) O.F. (Vert)
+ H10 @ 200 mm crs - horiz. E.F (Horiz)

check for M on inner wall face if wall treated as propped cantilever.

$M = 9 \times 20 \times 0.42 \times 2.95^2 \times 1.6/128$
$+ 0.0596 \times 18 \times 0.42 \times 2.95^3 \times 1.4/2$
$= 16.3\ kNm/m$

$d_1 = 250 - 25 - 6 = 219\ mm$

$A_t = 16.3 / 0.87 \times 0.5 \times 0.94 \times 0.219 = 183\ mm^2/m$

Provide H12 @ 200mm c/c - vert. ($566\ mm^2/m$)

Summary:

Vert. reinft: H16 @ 150 mm crs - Outer face
H12 @ 200mm crs - Inner face

Horiz reinft: H10 @ 200mm crs - Each face

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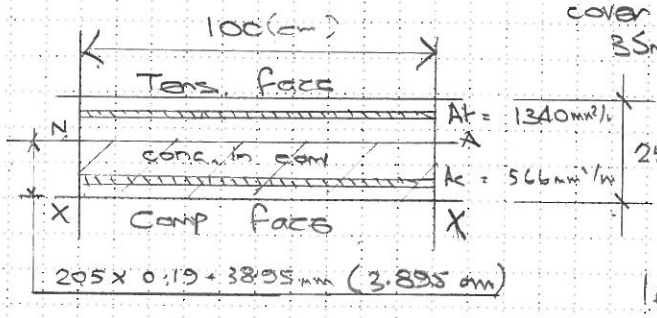
Check approx. deflection at top of wall with reinft. in wall as shown above but with surcharge = 1.5 kN/m²

check to be carried out using equivalent concrete section on the basis of modular ratio with M·15



1340 x 15 = 20100 mm²/m = 201 cm²/m

566 x (15-1) = 7924 mm²/m = 79.24 cm²/m

205 x 0.19 + 3895 mm (3.895 cm)

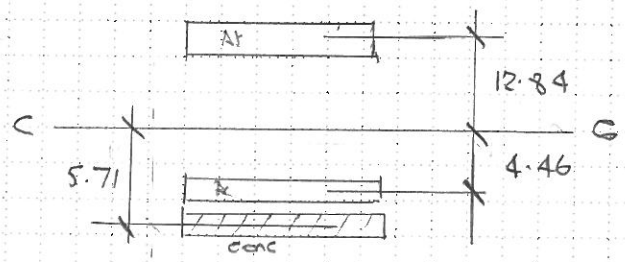
let E_{conc} = 20000 N/mm² = 13800 N/mm² = 1.38 x 10⁶ N/cm²

Determine CG of area:

XX

	Area (cm²)	Arm (cm)	Area Mom
conc	100 x 3.895 = 389.5	1.9475	758.550
Ac/c	79.24	3.2	253.568
At/c	201.00	20.5	4120.500
	669.74		5132.618

∴ $\bar{x}$ = 5132.618/669.74 = 7.66 from XX



∴ I_{CG} = $100 \times 3.895^3/12 + 389.5 \times 5.71^2 + 79.24 \times 4.46^2 + 201 \times 12.84^2$

47906 cm⁴

Σ earth load a wall = $18 \times 0.42 \times 2.95^2/2$ = 32.9 kN/m (Δ) (W)

Σ Surcharge " " " = $1.5 \times 0.42 \times 2.95$ = 1.86 " (UDL)

∴ Δ at top of wall: 1) from earth = $25.6\,WL^3/384EI$

= $25.6 \times 32.9 \times 2.95^3 \times 10^6 / 384 \times 1.38 \times 47906 \times 10^{16}$

= 0.85 cm

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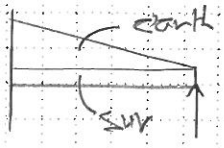
check approx deflection (max) on inside face of wall when wall is propped at top and with surcharge = 1.5 kN/m²

Σ earth load on wall = 32.9 kN/m (P₃ 03)
Σ surcharge " " 1.86 " (")



Approx Δ due to earth : $0.0047 WL^3/EI$

$= 0.0047 \times 32.9 \times 2.95^3 \times 10^5 / 1.83 \times 4.7906 \times 10^{10}$

$= 0.045$ cm

Approx Δ dus to surcharge $= 0.0054 WL^3/EI$

$= 0.0054 \times 1.86 \times 2.95^3 \times 10^5 / 1.83 \times 4.7906 \times 10^{10}$

$= 0.003$ cm

∴ Σ Deflection = 0.048 cm Negligible

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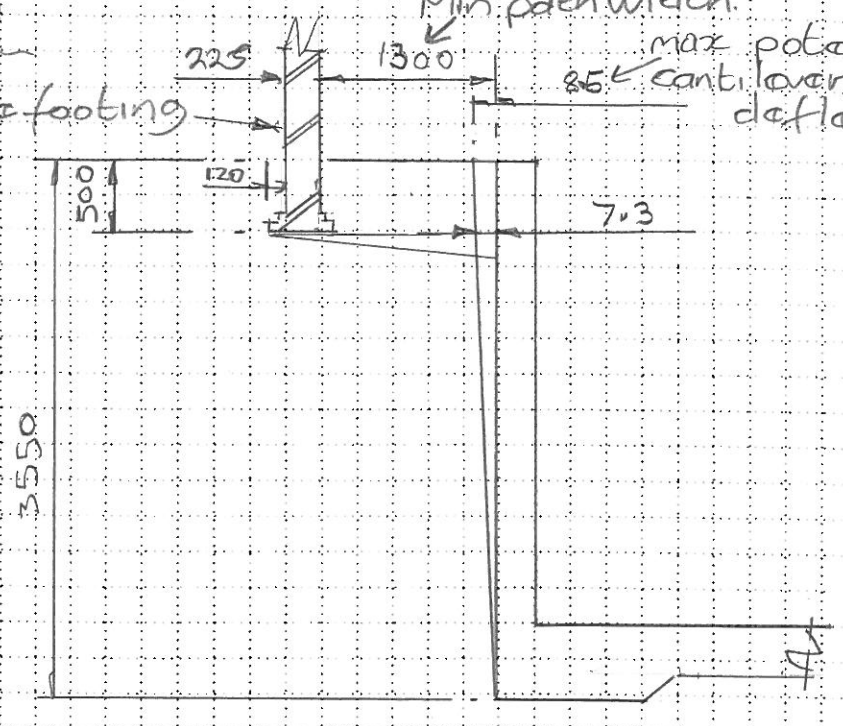
Cantilever Wall

Assumed house footing



$\frac{8.5}{3550} \times 3050 = 7.3$

Volumn per meter of deflected triangle

$= 1 \times \frac{.073 \times 3.55}{2} = .113\ M^2$

Max potential vertical movement against retaining wall

$\frac{1.645}{.13} = 12.65\ mm$

1300
225
120
1645

Potential vertical movement under edge of footing

$\frac{12.65}{1.645} \times .345 = 2.65\ mm$

This is acceptable

BUT cantilever case should never occur as finished "Box" is a propped cantilever

From sheet 04 max deflection with surcharge = .48mm which can be ignored