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Date	Job no.	Sheet
Aug 16	1636/01	PRO
Engineer DP		
Checked by —		
Project 62 AVENUE ROAD		

Design of Basement Retaining Wall at planning stage to BS8002

The retaining wall structure to the basement will comprise a bored contiguous piled wall with a lining wall

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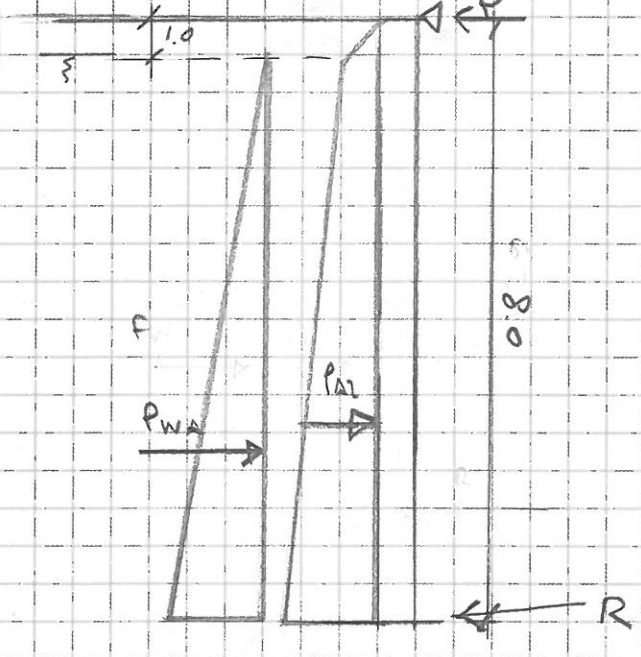
Date	Job no.	Sheet
NOV 12	1630/01	CB 1
Engineer LF		
Checked by DP		
Project 62 AVENUE ROAD		

DESIGN OF CAPPING BEAM AROUND CAR LIFT

THE CAPPING BEAM WILL BE DESIGNED TO PROVIDE PROPPING ACTION TO THE TOP OF THE PILES IN THE PERMANENT CASE

Soil parameters $k_a = 0.35$ $\gamma_s = 20\ kN/m^3$



$P_{A1} = \frac{1}{2} \times 0.35 \times (10 + 20 \times 1) = 5.25\ kN$

$P_{A1} = 5.25\ kN$

$P_{A2} = \frac{1}{2} \times 0.35 \times (10 + 20 \times 1 + 20 \times 8.0 - 10 \times 7) \times 7 =$

$= 14.7\ kN$

$P_W = \frac{1}{2} \times 10 \times 7^2 = 24.5\ kN$

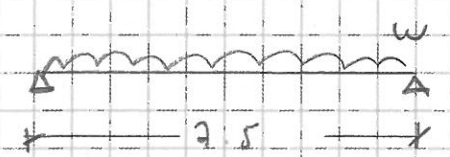
$\Downarrow$

$P = 84\ kN/m$

$R = 35\ kN/m$

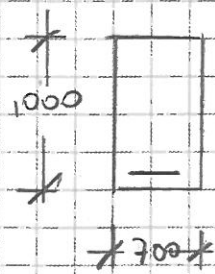
DESIGN THE CAPPING BEAM FOR A UDL OF

$84 \times 1.4 = 118\ kN/m$, SPANNING 7.5m



$w = 118\ kN/m$ (ULS)

$M = 118 \times 7.5^2/8 = 830\ kN/m$



$B = 700\ mm$

$H = 1000\ mm$

$d = 1000 - 50 - 12 - 10 = 928\ mm$

$K = M/(f_{cu} b d^2) = 830 \times 10^6 / (40 \times 700 \times 928^2) =$

$= 0.034$

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NOV 12	16361 01	CB2
Engineer UR		
Checked by DP		

Project: 62 AVENUE ROAD

$z = d[0.5 + \sqrt{0.25 - K/0.9}] = 0.95d = 882$ mm

$A_s = M/(0.87 f_y z) = 839 \times 10^6 / (0.87 \times 500 \times 882) = 2163$ mm^2

USE 6 No. B25 $A_s = 2950$ mm^2

SHEAR REINFORCEMENT:

$V = wL/2 - 118 \times 7.5/2 = 442.5$ kN (ULS)

$v = V/bd = 442.5 \times 10^3 / (700 \times 928) = 0.68$ N/mm^2 < 5 N/mm^2

$\frac{100 A_s}{bd} = \frac{100 \times 2950}{700 \times 928} = 0.45$ $\quad \frac{400}{d} = \frac{400}{928} = 0.43$

$\left(\frac{f_{cu}}{25}\right) = 1.6$

$v_c = 0.79 \times 0.45^{1/3} \times 0.43^{1/4} \times 1.6^{1/3} / 1.25 = 0.46$ N/mm^2

$0.5 v_c = 0.23$ N/mm^2

$0.5 v_c < v < v_c + 0.4$ $\quad \frac{A_s}{s_v} = \frac{0.4 b}{0.95 f_{yv}} = \frac{0.4 \times 700}{0.95 \times 500} =$

$= 0.59$

R10 links @ 200 c/c $\quad \frac{A_s}{s_v} = 0.785 > 0.59$ ∴ OK

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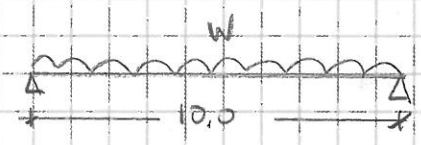
Date	Job no.	Sheet
NOV 12	16361 01	CB3
Engineer LP		
Checked by DP		

Project: 62 AVENUE ROAD

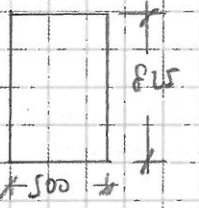
DESIGN OF CAPPING BEAM AROUND BASEMENT

DESIGN THE CAPPING BEAM AS SPANNING ROUND AND SUBJECT TO AN UDL = PROPPING FORCE FROM PAGE CB1 $P_1 = 11.8$ kN/m

$w = 11.8 \times 1.4 = 16.5$ kN/m (ULS)



$M = wL^2/8 = 16.5 \times 10^2/8 = 207$ kNm



$H = 825$ mm

$B = 500$ mm

$d = 825 - 50 - 12 - 10 = 753$ mm

$K = M/(f_{cu} b d^2) =$

$= 207 \cdot 10^6/(40 \times 500 \times 753^2) =$

$= 0.018$

$z = d\left[0.5 + \sqrt{0.25 - K/0.9}\right] = 0.95d = 715$ mm

$A_s = M/(0.87 f_y z) = 207 \cdot 10^6/(0.87 \times 500 \times 715) = 665$ mm^2

USE 4 no B20 = 1260 mm^2 = A_s

SHEAR REINFORCEMENT

$V = wL/2 = 16.5 \times 10/2 = 82.5$ kN (ULS)

$v = V/bd = 82.5 \cdot 10^3/(500 \times 753) = 0.22$ N/mm^2 < 5 N/mm^2 ∴ OK

$\frac{100 A_s}{bd} = \frac{100 \times 1260}{500 \times 753} = 0.33$ $\quad \frac{400}{d} = \frac{400}{753} = 0.53$

$(f_{cu}/25) = 1.6$

$v_c = 0.79 \times 0.33^{1/3} \times 0.53^{1/4} \times 1.6^{1/3}/1.25 = 0.44$ N/mm^2

$0.5 v_c < v < v_c + 0.4 \rightarrow \frac{A_s}{s_v} = \frac{0.4 b}{0.87 f_{yv}} = \frac{0.4 \times 500}{0.95 \times 500} = 0.42$

USE B10 LINKS @ 200 c/c $\quad A_s/s_v = 0.785 > 0.42$ ∴ OK

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Date	Job no.	Sheet
NOV 12	1636/01	PR1
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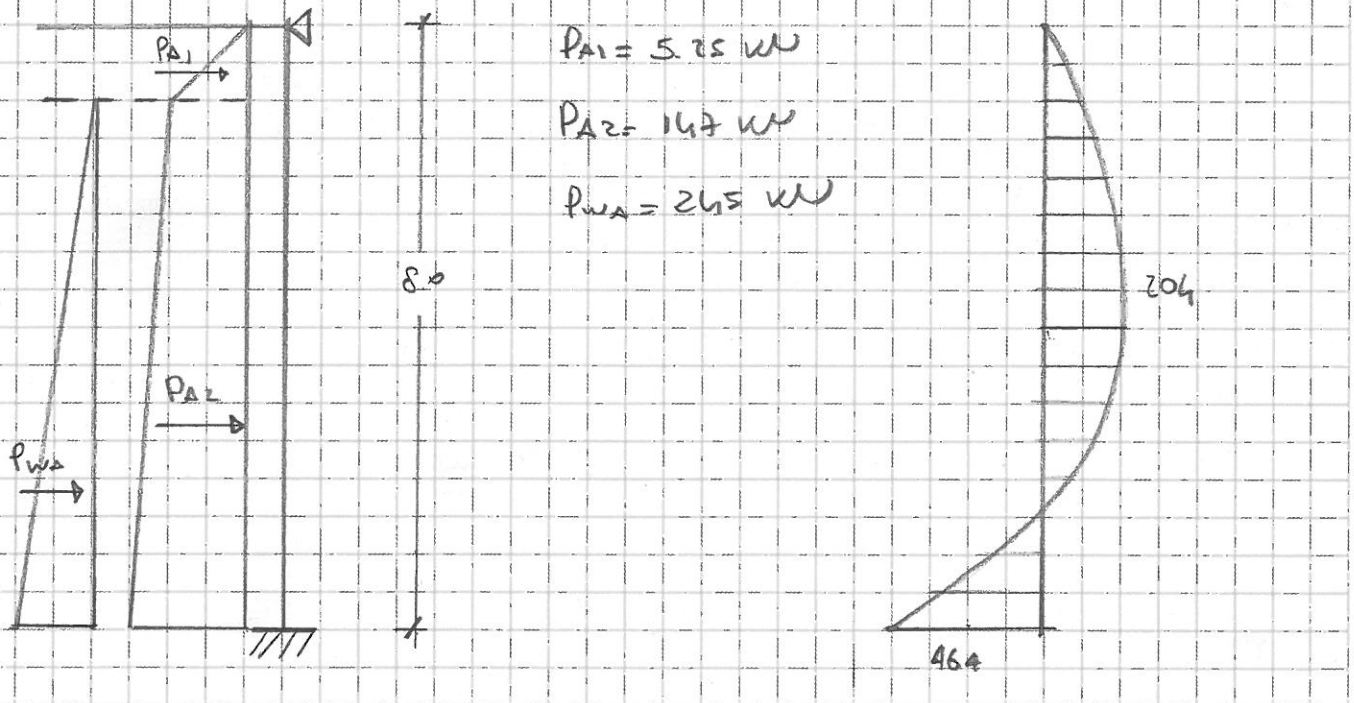
Project: 62 AVENUE ROAD		

DESIGN OF PILE REINFORCEMENT

Conservatively assumed piled wall is not propped by slab at midspan. In actual case piles will be.

LOAD ON PILES / m RUN AS PER PAGE CB1 OF CALCULATIONS



$P_{A1} = 5.25$ kN

$P_{A2} = 14.7$ kN

$P_{WA} = 24.5$ kN

CONSIDERING Ø600 @ 750 c/c PILES, THE MAX BENDING MOMENT PER PILE WILL BE $M_{PILE} = 46.4 \times 0.75 = 34.8$ kNm (SLS)

M_{PILE} (ULS) $= 34.8 \times 1.4 = 48.7$ kNm

VERTICAL LOAD $= 75$ kN/m $\times 0.75 = 56$ kN

PILE WEIGHT $= 24 \times \pi \times \frac{0.6^2}{4} \times 8 = 54$ kN

N (SLS) $= 110$ kN

N (ULS) $= 110 \times 1.5 = 165$ kN

DESIGN CIRCULAR SECTION FOR $N = 165$ kN, $M = 48.7$ kNm (ULS)

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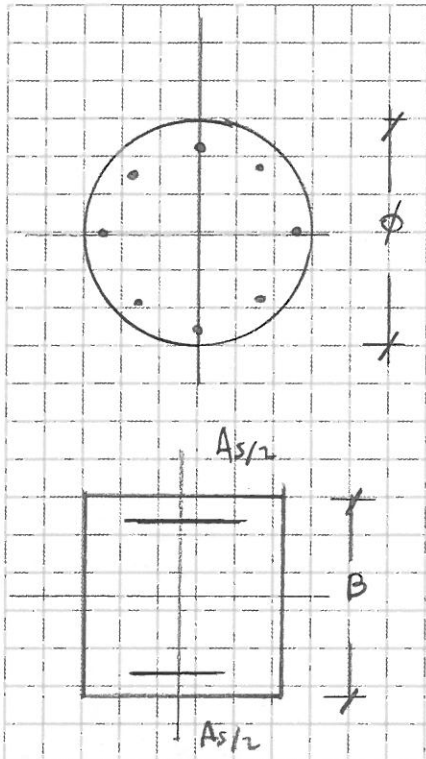

$I = \frac{\pi \phi^4}{64} = \frac{3.14 \times 600^4}{64} = 6.36.10^9 \text{ mm}^4$

$= B^4/12 \Rightarrow B = 526 \text{ mm}$

ANALYSE THE CIRCULAR SECTION $\phi = 600$ mm AS A SQUARE SECTION WITH THE SAME $I \Rightarrow B = 526$ mm

$\delta = 100$ mm $\quad d = 526 - 100 = 426$ mm

$d/B = 0.80$

$M/bh^2 = M/B^3 = 487.10^6 / 526^3 = 3.35$

$N/bh = N/B^2 = 165.10^3 / 526^2 = 0.60$

$\frac{100\,As}{bh} = 2.5 \quad As = \frac{2.5 \times B^2}{100} = \frac{2.5 \times 526^2}{100} = 6920 \text{ mm}^2$

USE 11 ϕ 32 = 8860 mm^2