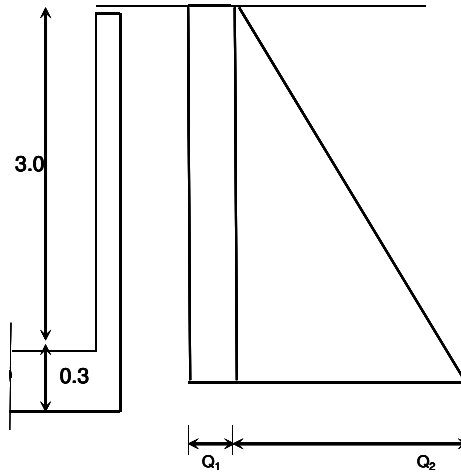


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### RETAINING WALL DESIGN

Angle of internal friction,  $\phi = 30$



Coefficient of active earth pressure,  $K_a = \frac{1 - \sin(\phi)}{1 + \sin(\phi)} = 0.33$

surcharge (q) = 2 kN/m<sup>2</sup>

Soil density ( $\gamma$ ) = 18 kN/m<sup>3</sup>

Total Height of soil pressure acting = 3.15 m  
(Bottom of raft - Raft thk/2)=3.3-0.15

Lateral pressure due to Surcharge  $Q_1 = K_a q = 0.33 \times 2 = 0.66$  kN/m<sup>2</sup> per meter run

Lateral pressure due to soil  $Q_2 = K_a \cdot \gamma \cdot h_1 = 0.33 \times 18 \times 3.15 = 18.71$  kN/m<sup>2</sup> per meter run

Lateral pressure at top  $Q_1 = 0.66$  kN/m<sup>2</sup> per meter run

Lateral pressure at bottom  $Q_1 + Q_2 = 19.37$  kN/m<sup>2</sup> per meter run

Moment due to soil  $M_1 = K_a \gamma h_1^3 / 6 = 0.33 \times 18 \times 3.15^3 / 6 = 30.94$  kNm per meter run

Moment due to surcharge  $M_2 = K_a q h_1^2 / 2 = 0.33 \times 2 \times 3.15^2 / 2 = 3.3$  kNm per meter run

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<b>MAIN REINFORCEMENT (VERTICAL)</b>		<b>Design for Maximum moment</b>			
Characteristic strength of concrete	$f_{cu}$	=	30	N/mm <sup>2</sup>	
Characteristic strength of steel	$f_y$	=	460	N/mm <sup>2</sup>	
Factored bending moment	$1.4 \times M_1 = M_u$	=	47.90	kNm	
Width of wall	$b$	=	1000	mm	
Thickness of wall	$D$	=	200	mm	
Clear cover	$c$	=	50	mm	
Diameter of main reinforcement	$d_m$	=	20	mm	
Diameter of secondary reinforcement	$d_s$	=	12	mm	
Effective depth	$d$	=	$D - c - d_m - d_s / 2$		
		=	124	mm	
	$K = M_u / (b \times d^2 \times f_{cu})$	=	0.104		
	$z = d \times [0.5 + \text{SQRT}(0.25 - K / 0.9)]$	=	107.49	mm	
	$0.95 \times d$	=	117.8	mm	
	Since $0.95 \times d$ is greater than $z$ , value of $z$ is	=	107.49		
Reinforcement required	$A_{st} = M / (0.95 \times f_y \times z)$	=	1020	mm <sup>2</sup>	
Min reinf. each face per table 3.25 BS 8110-1 = 0.2%		=	400	mm <sup>2</sup>	
	Main reinforcement		20 @ 200	mm c/c	
	+ Extra reinforcement		0 @ 0	mm c/c	
Area of reinforcement provided		=	1570	mm <sup>2</sup>	
			<b>Hence OK.</b>		
	Horizontal reinforcement		12 @ 200	mm c/c	
Area of reinforcement provided		=	565	mm <sup>2</sup>	
<u>Reinforcement Summary:</u>					
<b>Provide vertical reinforcement T20 @ 200 mm c/c.</b>					
<b>Provide horizontal reinforcement T12 @ 200 mm c/c.</b>					