

Proposed Retaining Wall at: 1, Ash Villas, Troedyrhiw,, Merthyr Tydfil	May-22
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Ref	Calculations	Output
	Weight of Soil =	16 Kg/m ³
	Weight of Concrete Block =	19 Kg/m ³
	Weight of Concrete =	24 Kg/m ³
	Height of Retaining Wall =	1.55 m
	Horizontal Thrust Pa =	βgh
	Pa =	6.72 Kn/lin m
	Rankines Coefficient (Ka) =	$\frac{1 - \sin \theta}{1 + \sin \theta}$
	Where $\theta =$	35 °
	=	0.271
	Active Pressure P _A =	0.50 K _A gh ²
	P _A =	5.21 Kn/m ²
	Surcharge Pressure P _{A1} =	2.12 Kn/m ²
	P _A + P _{A1}	7.32 Kn/m ²

Overturning Moment due to P_{A1}

$$\begin{aligned}
 &= 2.12 \times 0.517 \\
 &= 1.09 \text{ Knm}
 \end{aligned}
 \qquad \qquad \qquad \mathbf{1.09 \text{ Knm}}$$

Overturning Moment due to P_A

$$\begin{aligned}
 &= 5.21 \times 0.517 \\
 &= 2.69 \text{ Knm}
 \end{aligned}
 \qquad \qquad \qquad \mathbf{2.69 \text{ Knm}}$$

$$\mathbf{\underline{\underline{Total Overturning Moment}} \qquad \qquad \qquad \mathbf{3.78 \text{ Knm}}}$$

Balancing Moments

							Kn				Knm
C1	0.225	x	1.30	x	19	=	5.558	x	0.213	=	1.181
C2	0.225	x	0.90	x	19	=	3.848	x	0.438	=	1.683
C3	0.225	x	0.40	x	19	=	1.710	x	0.663	=	1.133
C4	0.000	x	0.00	x	19	=	0.000	x	0.775	=	0.000
C5	0.000	x	0.00	x	19	=	0.000	x	0.775	=	0.000
S1	0.225	x	0.40	x	16	=	1.440	x	0.438	=	0.630
S2	0.225	x	0.90	x	16	=	3.240	x	0.663	=	2.147
S3	0.000	x	1.30	x	16	=	0.000	x	0.775	=	0.000
S4	0.000	x	1.30	x	16	=	0.000	x	0.775	=	0.000
S5	0.150	x	1.30	x	16	=	3.120	x	0.850	=	2.652
B1	0.925	x	0.25	x	24	=	<u>5.550</u>	x	0.463	=	<u>2.567</u>
							<u>24.465</u>				<u>11.993</u>

Therefore

Factor of Safety (Overturning) =

3.17

Satisfactory

Position of Ground Reaction

$$\frac{11.993}{24.465} - \frac{2.691}{24.465} = 0.38 \text{ m}$$

Middle third range 0.308 and 0.617

This is within the middle third, therefore no tension in the joints

$$R_s = W \tan \theta$$

$$= \underline{12.23} \text{ Kn}$$

Factor of Safety against Sliding =

1.67

Satisfactory

Check Ground Bearing Pressure

Eccentricity (e) = **0.082** m

Therefore

$$q_a = \frac{W/A + (W)x(e)/(bd^2/6)}{}$$

$$= \underline{40.57} \text{ Kn/m}^2$$

$$\text{or } q_b = \frac{W/A - (W)x(e)/(bd^2/6)}{}$$

$$= \underline{12.33} \text{ Kn/m}^2$$

Assume an allowable ground bearing pressure = **150** Kn/m²

Factor of Safety = **3.70**

Satisfactory

CHECK EACH SECTION

SECTION 1--1

$$\begin{aligned}
 Pa &= 0.5 \times 0.271 \times 16 \times 0.160 \\
 &= \underline{\underline{0.347}} \text{ Kn} \\
 O.T.M &= \underline{\underline{0.046}} \text{ Knm} \\
 Pa1 &= 0.5 \times 0.271 \times 6.50 \times 0.160 \\
 &= \underline{\underline{0.141}} \text{ Kn} \\
 O.T.M &= \underline{\underline{0.019}} \text{ Knm} \\
 \text{Total OTM} &= \underline{\underline{0.07}} \text{ Knm}
 \end{aligned}$$

Balancing Moments

$$0.225 \times 0.4 \times 19 \times 0.11 = 0.192$$

$$\text{Therefore F.O.S (Overturning)} = \frac{0.19}{0.07} = \boxed{2.96} \quad \underline{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned}
 Rs &= 1.710 \times 0.50 \\
 &= \underline{\underline{0.86}} \text{ Kn}
 \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \boxed{2.46} \quad \underline{\underline{Satisfactory}}$$

SECTION 2--2

$$\begin{aligned}
 Pa &= 0.5 \times 0.271 \times 16.00 \times 0.8 \\
 &= \underline{\underline{1.76}} \text{ Kn} \\
 O.T.M &= \underline{\underline{0.53}} \text{ Knm} \\
 Pa1 &= 0.5 \times 0.271 \times 6.50 \times 0.8 \\
 &= \underline{\underline{0.71}} \text{ Kn} \\
 O.T.M &= \underline{\underline{0.21}} \text{ Knm} \\
 \text{Total OTM} &= \underline{\underline{0.74}} \text{ Knm}
 \end{aligned}$$

Balancing Moments

S1	0.225 x	0.4 x	16	=	1.440 x	0.338 =	0.486
C1	0.225 x	0.9 x	19	=	3.848 x	0.113 =	0.433
C2	0.225 x	0.500 x	19	=	<u>2.138</u> x	0.338 =	<u>0.721</u>
					<u>7.425</u> Kn		<u>1.640</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{1.640}{0.741} = \boxed{2.21} \quad \underline{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} R_s &= 7.43 \times 0.500 \\ &= \underline{\underline{3.71}} \text{ Knm} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{3.713}{1.756} = \boxed{2.11} \quad \textbf{\underline{Satisfactory}}$$

SECTION 3--3

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 1.690 \\ &= \underline{\underline{3.66}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{1.588}} \text{ Knm}$$

$$\begin{aligned} Pa1 &= 0.5 \times 0.271 \times 6.50 \times 1.690 \\ &= \underline{\underline{1.49}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{0.645}} \text{ Knm}$$

$$\text{Total OTM} = \underline{\underline{2.233}} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.40	x	16	=	1.44	x	0.338	=	0.486
S2	0.225	x	0.90	x	16	=	3.24	x	0.563	=	1.823
C1	0.225	x	1.30	x	19	=	5.56	x	0.113	=	0.625
C2	0.225	x	0.90	x	19	=	3.85	x	0.338	=	1.299
C3	0.225	x	0.40	x	19	=	1.71	x	0.563	=	0.962
							<u>15.80</u>	x			<u>5.194</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{5.194}{2.233} = \boxed{2.33} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} R_s &= 15.80 \times 0.500 \\ &= \underline{\underline{7.90}} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{7.898}{3.66} = \boxed{2.16} \quad \textbf{\underline{Satisfactory}}$$

SECTION 4--4

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 1.690 \\ &= \underline{\underline{3.66}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{1.588}} \text{ Knm}$$

$$\begin{aligned} Pa1 &= 0.5 \times 0.271 \times 6.50 \times 1.690 \\ &= \underline{\underline{1.49}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{0.645}} \text{ Knm}$$

$$\text{Total OTM} = \underline{\underline{2.233}} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.40	x	16	=	1.44	x	0.338	=	0.486
S2	0.225	x	0.90	x	16	=	3.24	x	0.563	=	1.823
S3	0.000	x	1.30	x	16	=	0.00	x	0.675	=	0.000
C1	0.225	x	1.30	x	19	=	5.56	x	0.113	=	0.625
C2	0.225	x	0.90	x	19	=	3.85	x	0.338	=	1.299
C3	0.225	x	0.40	x	19	=	1.71	x	0.563	=	0.962
C4	0.000	x	0.00	x	19	=	<u>0.00</u>	x	0.675	=	<u>0.000</u>
								<u>15.80</u>	Kn	<u>5.19</u>	Knm

Therefore F.O.S (Overturning) = $\frac{5.194}{2.233} =$ Not Applicable

Sliding

$$\begin{aligned} R_s &= 15.80 \times 0.500 \\ &= \underline{7.90} \text{ Kn} \end{aligned}$$

Therefore F.O.S (Sliding) = $\frac{7.90}{3.66} =$ Not Applicable

SECTION 5--5 (Interface concrete & blockwork)

Not Applicable

$$\begin{aligned} P_a &= 0.5 \times 0.271 \times 16 \times 1.69 \\ &= 3.66 \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{1.588} \text{ Knm}$$

$$\begin{aligned} P_{a1} &= 0.5 \times 0.271 \times 6.50 \times 1.69 \\ &= 1.49 \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.645} \text{ Knm}$$

$$\text{Total OTM} = \underline{2.233} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.400	x	16	=	1.440	x	0.338	=	0.486
S2	0.225	x	0.900	x	16	=	3.240	x	0.563	=	1.823
S3	0.000	x	1.300	x	16	=	0.000	x	0.675	=	0.000
S4	0.000	x	1.300	x	16	=	0.000	x	0.675	=	0.000
C1	0.225	x	1.300	x	19	=	5.558	x	0.113	=	0.625
C2	0.225	x	0.900	x	19	=	3.848	x	0.338	=	1.299
C3	0.225	x	0.400	x	19	=	1.710	x	0.563	=	0.962
C4	0.000	x	0.000	x	19	=	0.000	x	0.675	=	0.000
C5	0.000	x	0.000	x	19	=	<u>0.000</u>	x	0.675	=	<u>0.000</u>
								<u>15.80</u>	Kn	<u>5.19</u>	Knm

Therefore F.O.S(Overturning) = $\frac{5.194}{2.233} =$ Not Applicable

Sliding

$$\begin{aligned} R_s &= 15.80 \times 0.500 \\ &= \underline{\underline{7.898}} \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S(Sliding)} = \frac{7.898}{3.66} = \underline{\underline{\text{Not Applicable}}}$$

I

Surcharge = 6.50 Kg/m³

Lf	0.100
Lb	0.150
W1=	0.225
W2=	0.225
W3=	0.225
W4=	0.000
W5=	0.000
H1=	1.300
H2=	0.900
H3=	0.400
H4=	0.000
H5=	0.000
B1=	0.925
B2=	0.250
O	0.500

3, Ash Villas, Troedyrhiw, Merthyr Tydfil

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