

COND. 4.

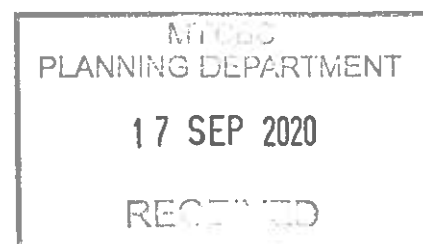
Proposed Retaining Wall at:

**Frondeg
Gwaunfarren, Merthyr Tydfil**

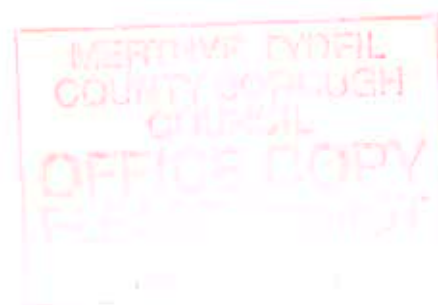
Mar-20

Ref	Calculations	Output
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200224



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} =	0.33 Kn/m ²
P _A + P _{A1}	5.53 Kn/m ²



Overturning Moment due to P_{A1}

$$= 0.33 \times 0.517$$

$$= 0.17 \text{ Knm}$$

0.17 Knm

Overturning Moment due to P_A

$$= 5.21 \times 0.517$$

$$= 2.69 \text{ Knm}$$

2.69 Knm

Total Overturning Moment

2.86 Knm

Balancing Moments

							Kn			Knm
C1	0.225	x	1.30	x	19	=	5.558	x	0.213	= 1.181
C2	0.225	x	0.80	x	19	=	3.420	x	0.438	= 1.496
C3	0.225	x	0.30	x	19	=	1.283	x	0.663	= 0.850
C4	0.000	x	0.60	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	0.50	x	16	=	1.800	x	0.438	= 0.788
S2	0.225	x	1.00	x	16	=	3.600	x	0.663	= 2.385
S3	0.000	x	0.70	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	=	5.550	x	0.463	= 2.567
							<u>24.330</u>			<u>11.918</u>

Therefore

Factor of Safety (Overturning) =

4.17

Satisfactory

Position of Ground Reaction

$$\frac{11.918}{24.330} - \frac{2.691}{24.330} = 0.38 \text{ m}$$

Middle third range 0.308 and 0.617

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

$$\begin{aligned} R_s &= W \tan \theta \\ &= \underline{12.17} \text{ Kn} \end{aligned}$$

Factor of Safety against Sliding =

2.20

Satisfactory

Check Ground Bearing Pressure

Eccentricity (e) = **0.083** m

Therefore

$$\begin{aligned} q_a &= \frac{W/A + (W)x(e)/(bd^2/6)}{1} \\ &= \underline{40.51} \text{ Kn/m}^2 \end{aligned}$$

$$\begin{aligned} \text{or } q_b &= \frac{W/A - (W)x(e)/(bd^2/6)}{1} \\ &= \underline{12.10} \text{ Kn/m}^2 \end{aligned}$$

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

Factor of Safety = **3.70**

Satisfactory

CHECK EACH SECTION

SECTION 1--1

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 0.250 \\ &= \underline{0.542} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.090} \text{ Knm}$$

$$\begin{aligned} Pa1 &= 0.5 \times 0.271 \times 1.00 \times 0.250 \\ &= \underline{0.034} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.006} \text{ Knm}$$

$$\text{Total OTM} = \underline{0.10} \text{ Knm}$$

Balancing Moments

$$0.225 \times 0.5 \times 19 \times 0.11 = 0.240$$

$$\text{Therefore F.O.S (Overturning)} = \frac{0.24}{0.10} = \boxed{2.51} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} Rs &= 2.138 \times 0.50 \\ &= \underline{1.07} \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \boxed{1.97} \quad \textbf{\underline{Satisfactory}}$$

SECTION 2--2

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16.00 \times 1 \\ &= \underline{2.17} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.72} \text{ Knm}$$

$$\begin{aligned} Pa1 &= 0.5 \times 0.271 \times 1.00 \times 1 \\ &= \underline{0.14} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.05} \text{ Knm}$$

$$\text{Total OTM} = \underline{0.77} \text{ Knm}$$

Balancing Moments

$$\begin{array}{llll} S1 & 0.225 \times & 0.5 \times & 16 = 1.800 \times 0.338 = 0.608 \\ C1 & 0.225 \times & 1 \times & 19 = 4.275 \times 0.113 = 0.481 \\ C2 & 0.225 \times & 0.500 \times & 19 = \underline{2.138} \times 0.338 = \underline{0.721} \\ & & & \underline{8.213} \text{ Kn} \quad \underline{1.810} \text{ Knm} \end{array}$$

$$\text{Therefore F.O.S (Overturning)} = \frac{1.810}{0.768} = \boxed{2.36} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} \text{Rs} &= 8.21 \times 0.500 \\ &= \underline{4.11} \text{ Knm} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{4.106}{2.168} = \boxed{1.89} \quad \textbf{\underline{Satisfactory}}$$

SECTION 3--3

$$\begin{aligned} \text{Pa} &= 0.5 \times 0.271 \times 16 \times 0.490 \\ &= \underline{1.06} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = 0.248 \text{ Knm}$$

$$\begin{aligned} \text{Pa1} &= 0.5 \times 0.271 \times 1.00 \times 0.490 \\ &= \underline{0.07} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = 0.015 \text{ Knm}$$

$$\text{Total OTM} = \underline{0.263} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.50	x	16	=	1.8	x	0.338	=	0.608
S2	0.225	x	1.00	x	16	=	3.6	x	0.563	=	2.025
C1	0.225	x	0.70	x	19	=	2.99	x	0.113	=	0.337
C2	0.225	x	0.20	x	19	=	0.86	x	0.338	=	0.289
C3	0.225	x	-0.30	x	19	=	-1.28	x	0.563	=	-0.721
							<u>7.97</u>	Kn			<u>2.536</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{2.536}{0.263} = \boxed{9.63} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} \text{Rs} &= 7.97 \times 0.500 \\ &= \underline{3.98} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{3.983}{1.06} = \boxed{3.75} \quad \textbf{\underline{Satisfactory}}$$

SECTION 4--4

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

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

$$\begin{aligned} \text{Pa1} &= 0.5 \times 0.271 \times 1.00 \times 1.690 \\ &= 0.23 \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{0.099} \text{ Knm}$$

$$\text{Total OTM} = \underline{1.687} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.50	x	16	=	1.80	x	0.338	=	0.608
S2	0.225	x	1.00	x	16	=	3.60	x	0.563	=	2.025
S3	0.000	x	0.70	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	0.80	x	19	=	3.42	x	0.338	=	1.154
C3	0.225	x	0.30	x	19	=	1.28	x	0.563	=	0.721
C4	0.000	x	0.60	x	19	=	0.00	x	0.675	=	0.000
							<u>15.66</u>	Kn		<u>5.13</u>	Knm

Therefore F.O.S (Overturning) = $\frac{5.133}{1.687} =$ **Not Applicable**

Sliding

$$Rs = 15.66 \times 0.500$$

$$= \underline{7.83} \text{ Kn}$$

Therefore F.O.S (Sliding) = $\frac{7.83}{3.66} =$ **Not Applicable**

SECTION 5--5 (Interface concrete & blockwork)**Not Applicable**

$$Pa = 0.5 \times 0.271 \times 16 \times 1.69$$

$$= 3.66 \text{ Kn}$$

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

$$Pa1 = 0.5 \times 0.271 \times 1.00 \times 1.69$$

$$= 0.23 \text{ Kn}$$

$$O.T.M = \underline{0.099} \text{ Knm}$$

$$\text{Total OTM} = \underline{1.687} \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.500	x	16	=	1.800	x	0.338	=	0.608
S2	0.225	x	1.000	x	16	=	3.600	x	0.563	=	2.025
S3	0.000	x	0.700	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	0.800	x	19	=	3.420	x	0.338	=	1.154
C3	0.225	x	0.300	x	19	=	1.283	x	0.563	=	0.721
C4	0.000	x	0.600	x	19	=	0.000	x	0.675	=	0.000
C5	0.000	x	0.000	x	19	=	0.000	x	0.675	=	0.000
							<u>15.66</u>	Kn		<u>5.13</u>	Knm

Therefore F.O.S(Overturning) = $\frac{5.133}{1.687} =$ **Not Applicable**

Sliding

$$\begin{aligned} R_s &= 15.66 \times 0.500 \\ &= \underline{7.83} \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S(Sliding)} = \frac{7.830}{3.66} =$$

Not Applicable



Surcharge = 1.00 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=	0.800
H3=	0.300
H4=	0.600
H5=	0.000
B1=	0.925
B2=	0.250
O	0.500

