

200209

Proposed Retaining Wall at:

16, The Park,
Treharris
Merthyr Tydfil

MTCD
PLANNING DEPARTMENT

Jul-2017 SEP 2020

Ref

Calculations

Output

Weight of Soil = 16 Kg/m³

Weight of Concrete Block = 19 Kg/m³

Weight of Concrete = 24 Kg/m³

Height of Retaining Wall = 2.25 m

Horizontal Thrust Pa = βgh

Pa = 9.76 Kn/lin m

Rankines Coefficient (Ka) = $\frac{1 - \sin \theta}{1 + \sin \theta}$

Where $\theta = 35^\circ$

= 0.271

Active Pressure P_A = 0.50 K_A gh²

P_A = 10.98 Kn/m²

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COUNTY BOROUGH
COUNCIL
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REMOVE

Overturning Moment

= 10.98 x 0.750

= 8.23 Knm

8.23 Knm

Balancing Moments

							Kn			Knm
C1	0.225	x	2.00	x	19	=	8.550	x	0.163	= 1.389
C2	0.225	x	1.50	x	19	=	6.413	x	0.388	= 2.485
C3	0.225	x	1.10	x	19	=	4.703	x	0.613	= 2.880
C4	0.225	x	0.40	x	19	=	1.710	x	0.838	= 1.432
C5	0.225	x	0.10	x	19	=	0.428	x	1.063	= 0.454
S1	0.225	x	0.50	x	16	=	1.800	x	0.388	= 0.698
S2	0.225	x	0.90	x	16	=	3.240	x	0.613	= 1.985
S3	0.225	x	1.60	x	16	=	5.760	x	0.838	= 4.824
S4	0.225	x	1.90	x	16	=	6.840	x	1.063	= 7.268
S5	0.100	x	2.00	x	16	=	3.200	x	1.225	= 3.920
B1	1.275	x	0.25	x	24	=	<u>7.650</u>	x	0.638	= <u>4.877</u>
							<u>50.293</u>			<u>32.211</u>

Therefore

Factor of Safety (Overturning) = **3.91** **Satisfactory**

Position of Ground Reaction

$$\frac{32.211 - 8.231}{50.293} = 0.48 \text{ m}$$

Middle third range 0.425 0.850

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

$$\begin{aligned} R_s &= W \tan \theta \\ &= \underline{\underline{25.15}} \text{ Kn} \end{aligned}$$

Factor of Safety against Sliding = **2.29** **Satisfactory**

Check Ground Bearing Pressure

Eccentricity (e) = **0.1607** m

Therefore

$$\begin{aligned} q_a &= \frac{W}{A} + \frac{(W)x(e)}{(bd^2/6)} \\ &= \underline{\underline{69.273}} \text{ Kn/m}^2 \end{aligned}$$

$$\begin{aligned} \text{or } q_b &= \frac{W}{A} - \frac{(W)x(e)}{(bd^2/6)} \\ &= \underline{\underline{9.62}} \text{ Kn/m}^2 \end{aligned}$$

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

Factor of Safety = **2.17** **Satisfactory**

CHECK EACH SECTION

SECTION 1--1

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

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

Balancing Moments

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

$$\text{Therefore F.O.S (Overturning)} = \frac{0.24}{0.09} = \boxed{2.66} \quad \textbf{\underline{Satisfactory}}$$

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

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16.00 \times 0.8 \\ &= \underline{1.76} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = 0.53 \text{ Knm}$$

Balancing Moments

$$\begin{array}{llll} \text{S1} & 0.225 \times 0.5 \times 16 & = & 1.800 \times 0.338 = 0.608 \\ \text{C1} & 0.225 \times 0.9 \times 19 & = & 3.848 \times 0.113 = 0.433 \\ \text{C2} & 0.225 \times 0.5 \times 19 & = & \underline{2.138} \times 0.338 = \underline{0.721} \\ & & & \underline{7.785} \text{ Kn} \quad \underline{1.762} \text{ Knm} \end{array}$$

$$\text{Therefore F.O.S (Overturning)} = \frac{1.762}{0.527} = \boxed{3.34} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} Rs &= 7.79 \times 0.500 \\ &= \underline{3.89} \text{ Knm} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{3.893}{1.756} = \boxed{2.22} \quad \textbf{\underline{Satisfactory}}$$

SECTION 3--3

$$Pa = 0.5 \times 0.271 \times 16 \times 2.560 = 5.55 \text{ Kn}$$

$$O.T.M = 2.960 \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.50	x	16	=	1.8	x	0.338	=	0.608
S2	0.225	x	0.90	x	16	=	3.24	x	0.563	=	1.823
C1	0.225	x	1.60	x	19	=	6.84	x	0.113	=	0.770
C2	0.225	x	1.10	x	19	=	4.70	x	0.338	=	1.587
C3	0.225	x	0.70	x	19	=	2.99	x	0.563	=	1.683
							<u>19.58</u>	Kn			<u>6.470</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{6.470}{2.960} = \boxed{2.19} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$Rs = 19.58 \times 0.500 = 9.79$$

$$\text{Therefore F.O.S (Sliding)} = \frac{9.788}{5.55} = \boxed{1.76} \quad \textbf{\underline{Satisfactory}}$$

SECTION 4--4

$$Pa = 0.5 \times 0.271 \times 16 \times 3.610 = 7.83 \text{ Kn}$$

$$O.T.M = 4.957 \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.50	x	16	=	1.80	x	0.338	=	0.608
S2	0.225	x	0.90	x	16	=	3.24	x	0.563	=	1.823
S3	0.225	x	1.60	x	16	=	5.76	x	0.788	=	4.536
C1	0.225	x	1.90	x	19	=	8.12	x	0.113	=	0.914
C2	0.225	x	1.40	x	19	=	5.99	x	0.338	=	2.020
C3	0.225	x	1.00	x	19	=	4.28	x	0.563	=	2.405
C4	0.225	x	0.30	x	19	=	1.28	x	0.788	=	1.010
							<u>30.47</u>	Kn			<u>13.31</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{13.314}{4.957} = \boxed{2.69} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$Rs = 30.47 \times 0.500 = 15.23 \text{ Kn}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{15.23}{7.83} = \boxed{1.95} \quad \textbf{\underline{Satisfactory}}$$

SECTION 5-5 (Interface concrete & blockwork)

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 4 \\ &= 8.67 \text{ Kn} \\ \text{O.T.M} &= 5.781 \text{ Knm} \end{aligned}$$

Balancing Moments

S1	0.225	x	0.500	x	16	=	1.800	x	0.338	=	0.608
S2	0.225	x	0.900	x	16	=	3.240	x	0.563	=	1.823
S3	0.225	x	1.600	x	16	=	5.760	x	0.788	=	4.536
S4	0.225	x	1.900	x	16	=	6.840	x	1.013	=	6.926
C1	0.225	x	2.000	x	19	=	8.550	x	0.113	=	0.962
C2	0.225	x	1.500	x	19	=	6.413	x	0.338	=	2.164
C3	0.225	x	1.100	x	19	=	4.703	x	0.563	=	2.645
C4	0.225	x	0.400	x	19	=	1.710	x	0.788	=	1.347
C5	0.225	x	0.100	x	19	=	0.428	x	1.013	=	0.433
								<u>39.44</u>	Kn		<u>21.44</u> Knm

$$\text{Therefore F.O.S(Overturning)} = \frac{21.442}{5.781} = \boxed{3.71} \quad \text{Satisfactory}$$

Sliding

$$\begin{aligned} R_s &= 39.44 \times 0.500 \\ &= 19.72 \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S(Sliding)} = \frac{19.721}{8.67} = \boxed{2.27} \quad \text{Satisfactory}$$



Lf	0.050
Lb	0.100
W1=	0.225
W2=	0.225
W3=	0.225
W4=	0.225
W5=	0.225
H1=	2.000
H2=	1.500
H3=	1.100
H4=	0.400
H5=	0.100

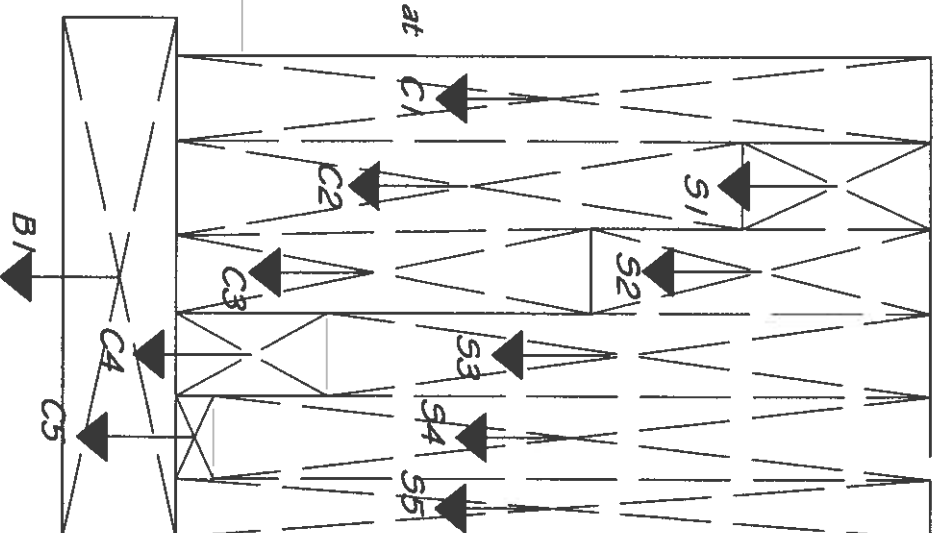
B1=	1.275
B2=	0.250
O	0.500

Front of wall to be clad in brickwork to match existing.

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75mm diameter
weep-holes spaced at
1.5m centres.



FORCE DIAGRAM 1:20