

Proposed Retaining Wall at:

25, Heol Corn Du,
Beacon Heights,
Merthyr Tydfil

Mar-21

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 =	2.10 m
	Horizontal Thrust Pa =	βgh
	Pa =	9.11 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 =	9.56 Kn/m ²

Overturning Moment

$$= 9.56 \times 0.700$$

$$= 6.69 \text{ Knm}$$

6.69 Knm

Balancing Moments

							Kn				Knm
C1	0.225	x	1.80	x	19	=	7.695	x	0.163	=	1.250
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	0.000	x	0.00	x	19	=	0.000	x	0.950	=	0.000
S1	0.225	x	0.30	x	16	=	1.080	x	0.388	=	0.419
S2	0.225	x	0.70	x	16	=	2.520	x	0.613	=	1.544
S3	0.225	x	1.40	x	16	=	5.040	x	0.838	=	4.221
S4	0.000	x	1.80	x	16	=	0.000	x	0.950	=	0.000
S5	0.150	x	1.80	x	16	=	4.320	x	1.025	=	4.428
B1	1.100	x	0.30	x	24	=	<u>7.920</u>	x	0.550	=	<u>4.356</u>
							<u>41.400</u>				<u>23.015</u>

Therefore

Factor of Safety (Overturning) =

3.44

Satisfactory

Position of Ground Reaction

$$\frac{23.015 - 6.692}{41.400} = 0.39 \text{ m}$$

Middle third range 0.367 0.733

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

$$\begin{aligned} R_s &= W \tan \theta \\ &= \mathbf{20.70} \text{ Kn} \end{aligned}$$

Factor of Safety against Sliding =

2.17

Satisfactory

Check Ground Bearing Pressure

Eccentricity (e) = **0.1557** m

Therefore

$$\begin{aligned} q_a &= W/A + (W)x(e)/(bd^2/6) \\ &= \mathbf{69.608} \text{ Kn/m}^2 \end{aligned}$$

$$\begin{aligned} \text{or } q_b &= W/A - (W)x(e)/(bd^2/6) \\ &= \mathbf{5.66} \text{ Kn/m}^2 \end{aligned}$$

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

Factor of Safety = **2.15**

Satisfactory
Considered ok

CHECK EACH SECTION

SECTION 1--1

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 0.090 \\ &= \underline{\underline{0.195}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{0.020}} \text{ Knm}$$

Balancing Moments

$$0.225 \times 0.3 \times 19 \times 0.11 = 0.144$$

$$\text{Therefore F.O.S (Overturning)} = \frac{0.14}{0.02} = \boxed{7.39} \quad \underline{\underline{\text{Satisfactory}}}$$

Sliding

$$\begin{aligned} Rs &= 1.283 \times 0.50 \\ &= \underline{\underline{0.64}} \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \boxed{3.29} \quad \underline{\underline{\text{Satisfactory}}}$$

SECTION 2--2

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16.00 \times 0.5 \\ &= \underline{\underline{1.06}} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = \underline{\underline{0.25}} \text{ Knm}$$

Balancing Moments

$$\begin{array}{llllllll} \text{S1} & 0.225 \times & 0.3 & \times & 16 & = & 1.080 & \times & 0.338 & = & 0.365 \\ \text{C1} & 0.225 \times & 0.7 & \times & 19 & = & 2.993 & \times & 0.113 & = & 0.337 \\ \text{C2} & 0.225 \times & 0.3 & \times & 19 & = & \underline{\underline{1.283}} & \times & 0.338 & = & \underline{\underline{0.433}} \\ & & & & & & \underline{\underline{5.355}} & \text{Kn} & & & \underline{\underline{1.134}} \text{ Knm} \end{array}$$

$$\text{Therefore F.O.S (Overturning)} = \frac{1.134}{0.248} = \boxed{4.58} \quad \underline{\underline{\text{Satisfactory}}}$$

Sliding

$$\begin{aligned} Rs &= 5.36 \times 0.500 \\ &= \underline{\underline{2.68}} \text{ Knm} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{2.678}{1.062} = \boxed{2.52} \quad \underline{\underline{\text{Satisfactory}}}$$

SECTION 3--3

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 1.960 \\ &= \underline{4.25} \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = 1.983 \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.30	x	16	=	1.08	x	0.338	=	0.365
S2	0.225	x	0.70	x	16	=	2.52	x	0.563	=	1.418
C1	0.225	x	1.40	x	19	=	5.99	x	0.113	=	0.673
C2	0.225	x	1.10	x	19	=	4.70	x	0.338	=	1.587
C3	0.225	x	0.70	x	19	=	<u>2.99</u>	x	0.563	=	<u>1.683</u>
							<u>17.28</u>	Kn			<u>5.726</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{5.726}{1.983} = \boxed{2.89} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} R_s &= 17.28 \times 0.500 \\ &= \underline{8.64} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{8.640}{4.25} = \boxed{2.03} \quad \textbf{\underline{Satisfactory}}$$

SECTION 4--4

$$\begin{aligned} Pa &= 0.5 \times 0.271 \times 16 \times 3.240 \\ &= 7.02 \text{ Kn} \end{aligned}$$

$$\text{O.T.M} = 4.214 \text{ Knm}$$

Balancing Moments

S1	0.225	x	0.30	x	16	=	1.08	x	0.338	=	0.365
S2	0.225	x	0.70	x	16	=	2.52	x	0.563	=	1.418
S3	0.225	x	1.40	x	16	=	5.04	x	0.788	=	3.969
C1	0.225	x	1.80	x	19	=	7.70	x	0.113	=	0.866
C2	0.225	x	1.50	x	19	=	6.41	x	0.338	=	2.164
C3	0.225	x	1.10	x	19	=	4.70	x	0.563	=	2.645
C4	0.225	x	0.40	x	19	=	<u>1.71</u>	x	0.788	=	<u>1.347</u>
							<u>29.16</u>	Kn			<u>12.77</u> Knm

$$\text{Therefore F.O.S (Overturning)} = \frac{12.773}{4.214} = \boxed{3.03} \quad \textbf{\underline{Satisfactory}}$$

Sliding

$$\begin{aligned} R_s &= 29.16 \times 0.500 \\ &= \underline{14.58} \text{ Kn} \end{aligned}$$

$$\text{Therefore F.O.S (Sliding)} = \frac{14.58}{7.02} = \boxed{2.08} \quad \textbf{\underline{Satisfactory}}$$

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

$$Pa = 0.5 \times 0.271 \times 16 \times 3.24 = 7.02 \text{ Kn}$$

$$O.T.M = \text{Knm} \quad \textbf{Not Applicable}$$

Balancing Moments

S1	0.225	x	0.300	x	16	=	1.080	x	0.338	=	0.365
S2	0.225	x	0.700	x	16	=	2.520	x	0.563	=	1.418
S3	0.225	x	1.400	x	16	=	5.040	x	0.788	=	3.969
S4	0.000	x	1.800	x	16	=	0.000	x	0.900	=	0.000
C1	0.225	x	1.800	x	19	=	7.695	x	0.113	=	0.866
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	0.000	x	0.000	x	19	=	<u>0.000</u>	x	0.900	=	<u>0.000</u>
							<u>29.16</u>	Kn			
										<u>12.77</u>	Knm

$$\text{Therefore F.O.S(Overturning)} = \frac{12.773}{\boxed{}} = \textbf{\underline{Not Applicable}}$$

Sliding

$$Rs = 29.16 \times 0.500 = \textbf{\underline{14.58}} \text{ Kn}$$

$$\text{Therefore F.O.S(Sliding)} = \frac{14.580}{7.02} = \boxed{} = \textbf{\underline{Not Applicable}}$$

Lf	0.050
Lb	0.150
W1=	0.225
W2=	0.225
W3=	0.225
W4=	0.225
W5=	0.000
H1=	1.800
H2=	1.500
H3=	1.100
H4=	0.400
H5=	0.000

B1=	1.100
B2=	0.300
O	0.500

