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**Title: Structural Calculations for mass
block retaining wall at**

**Project: 20035 - MJ - 23 Woodland Road,
Glyncorrwg, Port Talbot**

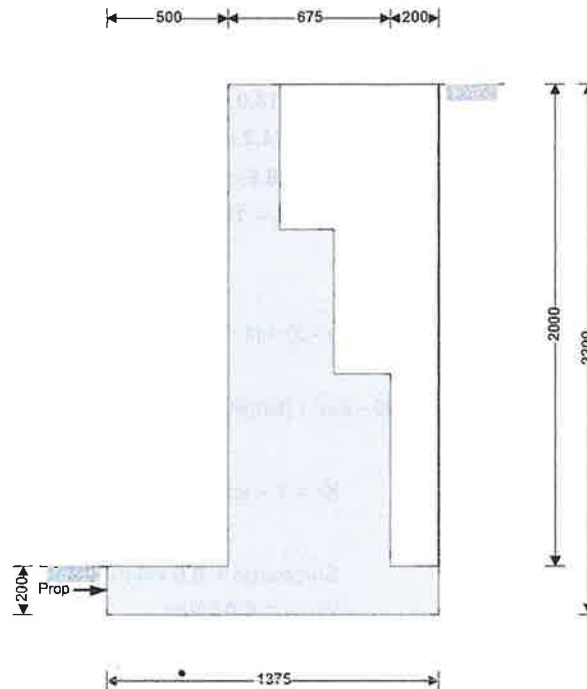
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Tekla Tedds 29 Bocam Park, Old Field Road Pencoed, Bridgend. CF63 4AT	Project 20035 - MJ - 23 Woodland Road, Glynccorwg, Port Talbot				Job no. 20035	
	Calcs for Mass Block Retaining Wall				Start page no./Revision 1	
	Calcs by MNJ	Calcs date 05/07/2024	Checked by MNJ	Checked date 05/07/2024	Approved by JHM	Approved date 05/07/2024

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.08



Wall details

Retaining wall type
Number of steps
Height of retaining wall stem
Length of toe
Length of heel
Overall length of base
Thickness of base
Depth of downstand
Position of downstand
Thickness of downstand
Height of retaining wall
Depth of cover in front of wall
Depth of unplanned excavation
Height of ground water behind wall
Height of saturated fill above base
Density of wall construction
Density of base construction
Angle of rear face of wall
Angle of soil surface behind wall
Effective height at virtual back of wall

Cantilever with stepped rear face propped at base

3

$h_{\text{stem}} = 2000 \text{ mm}$
 $l_{\text{toe}} = 500 \text{ mm}$
 $l_{\text{heel}} = 200 \text{ mm}$
 $l_{\text{base}} = l_{\text{toe}} + l_{\text{heel}} + t_{s1} = 1375 \text{ mm}$
 $t_{\text{base}} = 200 \text{ mm}$
 $d_{\text{ds}} = 0 \text{ mm}$
 $l_{\text{ds}} = 300 \text{ mm}$
 $t_{\text{ds}} = 200 \text{ mm}$
 $h_{\text{wall}} = h_{\text{stem}} + t_{\text{base}} + d_{\text{ds}} = 2200 \text{ mm}$
 $d_{\text{cover}} = 0 \text{ mm}$
 $d_{\text{exc}} = 0 \text{ mm}$
 $h_{\text{water}} = 0 \text{ mm}$
 $h_{\text{sat}} = \max(h_{\text{water}} - t_{\text{base}} - d_{\text{ds}}, 0 \text{ mm}) = 0 \text{ mm}$
 $\gamma_{\text{wall}} = 23.6 \text{ kN/m}^3$
 $\gamma_{\text{base}} = 23.6 \text{ kN/m}^3$
 $\alpha = 90.0 \text{ deg}$
 $\beta = 0.0 \text{ deg}$
 $h_{\text{eff}} = h_{\text{wall}} + (l_{\text{heel}} + t_{s1} - t_{s3}) \times \tan(\beta) = 2200 \text{ mm}$

Retained material details

Mobilisation factor
Moist density of retained material

$M = 1.5$
 $\gamma_m = 18.0 \text{ kN/m}^3$

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Vertical forces on wall

Wall step no. 3

$$W_{step3} = h_{s3} \times t_{s3} \times \gamma_{wall} = 3 \text{ kN/m}$$

Wall step no. 2

$$W_{step2} = h_{s2} \times t_{s2} \times \gamma_{wall} = 6.2 \text{ kN/m}$$

Wall step no. 1

$$W_{step1} = h_{s1} \times t_{s1} \times \gamma_{wall} = 12.7 \text{ kN/m}$$

Wall base

$$W_{base} = l_{base} \times t_{base} \times \gamma_{base} = 6.5 \text{ kN/m}$$

Moist backfill to step no. 3

$$W_{m_w3} = (l_{heel} + t_{s1} - t_{s3}) \times h_{s3} \times \gamma_m = 7.1 \text{ kN/m}$$

Moist backfill to step no. 2

$$W_{m_w2} = (l_{heel} + t_{s1} - t_{s2}) \times h_{s2} \times \gamma_m = 4.7 \text{ kN/m}$$

Moist backfill to step no. 1

$$W_{m_w1} = (l_{heel} + t_{s1} - t_{s1}) \times h_{s1} \times \gamma_m = 2.9 \text{ kN/m}$$

Total vertical load

$$W_{total} = W_{step3} + W_{step2} + W_{step1} + W_{base} + W_{m_w3} + W_{m_w2} + W_{m_w1} = 43.2$$

kN/m

Horizontal forces on wall

Moist backfill above water table

$$F_{m_a} = 0.5 \times K_a \times \gamma_m \times (h_{eff} - h_{water})^2 = 18.2 \text{ kN/m}$$

Total horizontal load

$$F_{total} = F_{m_a} = 18.2 \text{ kN/m}$$

Calculate propping force

Passive resistance of soil in front of wall

$$F_p = 0.5 \times K_p \times \cos(\delta_b) \times (d_{cover} + t_{base} + d_{ds} - d_{exc})^2 \times \gamma_{mb} = 1.4 \text{ kN/m}$$

Propping force

$$F_{prop} = \max(F_{total} - F_p - (W_{total}) \times \tan(\delta_b), 0 \text{ kN/m})$$

$$F_{prop} = 2.3 \text{ kN/m}$$

Overturning moments

Moist backfill above water table

$$M_{m_a} = F_{m_a} \times (h_{eff} + 2 \times h_{water} - 3 \times d_{ds}) / 3 = 13.4 \text{ kNm/m}$$

Total overturning moment

$$M_{ot} = M_{m_a} = 13.4 \text{ kNm/m}$$

Restoring moments

Wall step no. 3

$$M_{step3} = W_{step3} \times (l_{toe} + t_{s3} / 2) = 1.8 \text{ kNm/m}$$

Wall step no. 2

$$M_{step2} = W_{step2} \times (l_{toe} + t_{s2} / 2) = 4.5 \text{ kNm/m}$$

Wall step no. 1

$$M_{step1} = W_{step1} \times (l_{toe} + t_{s1} / 2) = 10.7 \text{ kNm/m}$$

Wall base

$$M_{base} = W_{base} \times l_{base} / 2 = 4.5 \text{ kNm/m}$$

Moist backfill to step no. 3

$$M_{m_w3} = W_{m_w3} \times (l_{base} - (l_{heel} + t_{s1} - t_{s3}) / 2) = 7.4 \text{ kNm/m}$$

Moist backfill to step no. 2

$$M_{m_w2} = W_{m_w2} \times (l_{base} - (l_{heel} + t_{s1} - t_{s2}) / 2) = 5.4 \text{ kNm/m}$$

Moist backfill to step no. 1

$$M_{m_w1} = W_{m_w1} \times (l_{base} - (l_{heel} + t_{s1} - t_{s1}) / 2) = 3.7 \text{ kNm/m}$$

Total restoring moment

$$M_{rest} = M_{step3} + M_{step2} + M_{step1} + M_{base} + M_{m_w3} + M_{m_w2} + M_{m_w1} = 38$$

kNm/m

Check bearing pressure

Total moment for bearing

$$M_{total} = M_{rest} - M_{ot} = 24.7 \text{ kNm/m}$$

Total vertical reaction

$$R = W_{total} = 43.2 \text{ kN/m}$$

Distance to reaction

$$x_{bar} = M_{total} / R = 571 \text{ mm}$$

Eccentricity of reaction

$$e = \text{abs}((l_{base} / 2) - x_{bar}) = 117 \text{ mm}$$

Reaction acts within middle third of base

Bearing pressure at toe

$$p_{toe} = (R / l_{base}) + (6 \times R \times e / l_{base}^2) = 47.5 \text{ kN/m}^2$$

Bearing pressure at heel

$$p_{heel} = (R / l_{base}) - (6 \times R \times e / l_{base}^2) = 15.4 \text{ kN/m}^2$$

PASS - Maximum bearing pressure is less than allowable bearing pressure

