

Vale Consultancy

CONSULTING CIVIL & STRUCTURAL ENGINEERS

RETAINING WALL CALCULATIONS

Angus House
Aberfan
CF48 4TQ

Prepared for: Liam Taylor
Project Ref: 23691

01656 863 794 | enquiries@vale-consultancy.co.uk | <http://vale-consultancy.co.uk>
29 Bocam Park | Old Field Road | Pencoed | Bridgend | CF35 5LJ

Thornlink Limited T/A Vale Consultancy
Registered Number | 04140053 | VAT Number | 879 7269 45

DOCUMENT CONTROL

Project:	Angus House, Aberfan, CF48 4TQ
Client:	Liam Taylor
Vale Consultancy Ref:	23691

Issue	Prepared by	Approved by	Date	Status
01	Louis Morgan BEng (Hons)	Matt Jones <i>MEng FISTructE FICE CEng</i> Managing Director	10.03.2026	First issue

DESIGN STATEMENT

The design has been completed in accordance with British Standards BS6399, BS5628 (Masonry), BS5268 (Timber) & BS 5950 (Steel).

Information for this has been collated from survey/site visit and information provided by the client.

Refer to our sketches 23691-V1(Retaining Wall General Arrangement) for references.

Retaining wall designed for allowable bearing pressure of 100KN/m² bearing pressure, to be confirmed on site prior to construction.

All dimensions, weights, member lengths, member tables, and any other relevant design information contained within this package is for analysis, and design purposes only, for submission to building control, and must not be used for pricing or fabrication purposes. All queries are to be directed to the engineer prior to tendering, pricing or fabrication. All structural members dimensions need to be taken accurately on site by the contractor prior to fabrication.

During any initial site visits performed by our Engineer, assumptions have to be made where structural elements may have been obscured by finishes. Opening up works should be undertaken prior to fabrication or construction of any structural members to confirm that the structural layout as indicated in our proposed sketches/detailed drawings is correct.

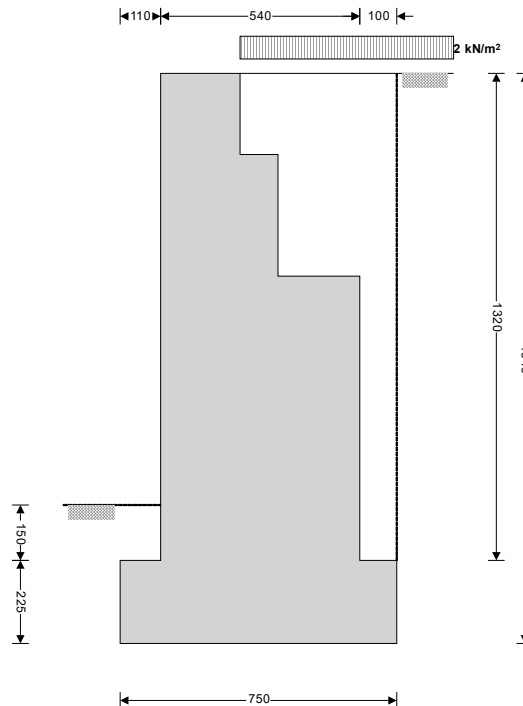
If there are any discrepancies, the Engineer MUST be informed immediately, and prior to proceeding with construction works on site.

CDM Comments:

- All temporary propping/support is to correspond to contractor's specification and details.

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.09



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

Retained material details

Mobilisation factor

Moist density of retained material

Unpropped cantilever with stepped rear face

3
 $h_{\text{stem}} = 1320 \text{ mm}$
 $l_{\text{toe}} = 110 \text{ mm}$
 $l_{\text{heel}} = 100 \text{ mm}$
 $l_{\text{base}} = l_{\text{toe}} + l_{\text{heel}} + t_{s1} = 750 \text{ mm}$
 $t_{\text{base}} = 225 \text{ mm}$
 $d_{\text{ds}} = 0 \text{ mm}$
 $l_{\text{ds}} = 300 \text{ mm}$
 $t_{\text{ds}} = 225 \text{ mm}$
 $h_{\text{wall}} = h_{\text{stem}} + t_{\text{base}} + d_{\text{ds}} = 1545 \text{ mm}$
 $d_{\text{cover}} = 150 \text{ mm}$
 $d_{\text{exc}} = 0 \text{ mm}$
 $h_{\text{water}} = 0 \text{ mm}$
 $h_{\text{sat}} = \max(h_{\text{water}} - t_{\text{base}} - d_{\text{ds}}, 0 \text{ mm}) = 0 \text{ mm}$
 $\gamma_{\text{wall}} = 23.6 \text{ kN/m}^3$
 $\gamma_{\text{base}} = 23.6 \text{ kN/m}^3$
 $\alpha = 90.0 \text{ deg}$
 $\beta = 0.0 \text{ deg}$
 $h_{\text{eff}} = h_{\text{wall}} + (l_{\text{heel}} + t_{s1} - t_{s3}) \times \tan(\beta) = 1545 \text{ mm}$
 $M = 1.5$
 $\gamma_m = 18.0 \text{ kN/m}^3$

Project				Job no.	
Angus House, Aberfan				23691	
Calcs for				Start page no./Revision	
Max 1.10m Retaining Wall				4	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
LM	10/03/2026	MJ	04/03/2026	MJ	04/03/2026

Saturated density of retained material $\gamma_s = 21.0 \text{ kN/m}^3$

Design shear strength $\phi' = 24.2 \text{ deg}$

Angle of wall friction $\delta = 0.0 \text{ deg}$

Base material details

Moist density $\gamma_{mb} = 18.0 \text{ kN/m}^3$

Design shear strength $\phi'_b = 24.2 \text{ deg}$

Design base friction $\delta_b = 18.6 \text{ deg}$

Allowable bearing pressure $P_{\text{bearing}} = 100 \text{ kN/m}^2$

Using Coulomb theory

Active pressure coefficient for retained material

$$K_a = \sin(\alpha + \phi')^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta) \times [1 + \sqrt{(\sin(\phi' + \delta) \times \sin(\phi' - \beta) / (\sin(\alpha - \delta) \times \sin(\alpha + \beta)))^2})] = 0.419$$

Passive pressure coefficient for base material

$$K_p = \sin(90 - \phi'_b)^2 / (\sin(90 - \delta_b) \times [1 - \sqrt{(\sin(\phi'_b + \delta_b) \times \sin(\phi'_b) / (\sin(90 + \delta_b)))^2})] = 4.187$$

At-rest pressure

At-rest pressure for retained material $K_0 = 1 - \sin(\phi') = 0.590$

Loading details

Surcharge load on plan Surcharge = **1.5 kN/m²**

Applied vertical dead load on wall $W_{\text{dead}} = 0.0 \text{ kN/m}$

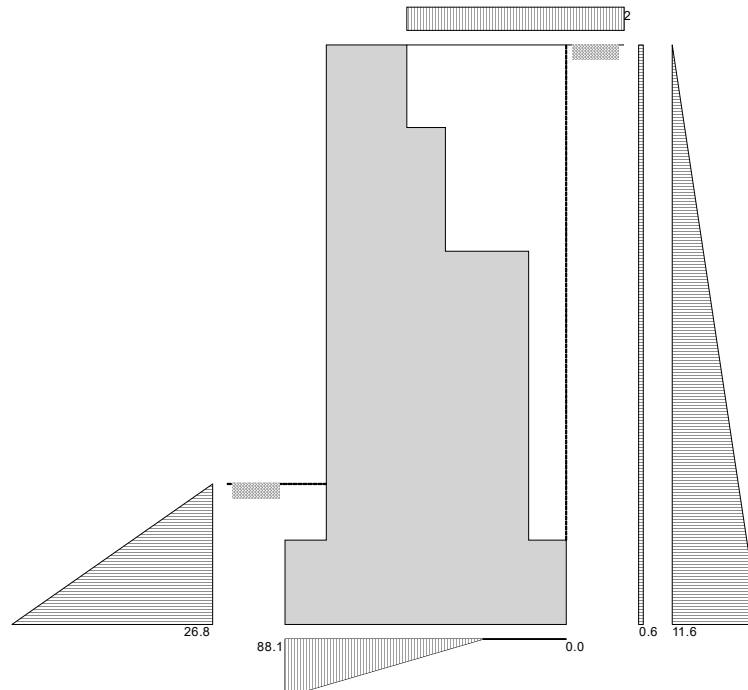
Applied vertical live load on wall $W_{\text{live}} = 0.0 \text{ kN/m}$

Position of applied vertical load on wall $l_{\text{load}} = 0 \text{ mm}$

Applied horizontal dead load on wall $F_{\text{dead}} = 0.0 \text{ kN/m}$

Applied horizontal live load on wall $F_{\text{live}} = 0.0 \text{ kN/m}$

Height of applied horizontal load on wall $h_{\text{load}} = 0 \text{ mm}$



Loads shown in kN/m, pressures shown in kN/m²

Project Angus House, Aberfan				Job no. 23691	
Calcs for Max 1.10m Retaining Wall				Start page no./Revision 5	
Calcs by LM	Calcs date 10/03/2026	Checked by MJ	Checked date 04/03/2026	Approved by MJ	Approved date 04/03/2026

Vertical forces on wall

Wall step no. 3

$$W_{\text{step3}} = h_{s3} \times t_{s3} \times \gamma_{\text{wall}} = \mathbf{1.1 \text{ kN/m}}$$

Wall step no. 2

$$W_{\text{step2}} = h_{s2} \times t_{s2} \times \gamma_{\text{wall}} = \mathbf{2.5 \text{ kN/m}}$$

Wall step no. 1

$$W_{\text{step1}} = h_{s1} \times t_{s1} \times \gamma_{\text{wall}} = \mathbf{9.8 \text{ kN/m}}$$

Wall base

$$W_{\text{base}} = l_{\text{base}} \times t_{\text{base}} \times \gamma_{\text{base}} = \mathbf{4 \text{ kN/m}}$$

Surcharge

$$W_{\text{sur}} = \text{Surcharge} \times [l_{\text{heel}} + (t_{s1} - t_{s3})] = \mathbf{0.6 \text{ kN/m}}$$

Moist backfill to step no. 3

$$W_{m_w3} = (l_{\text{heel}} + t_{s1} - t_{s3}) \times h_{s3} \times \gamma_m = \mathbf{1.7 \text{ kN/m}}$$

Moist backfill to step no. 2

$$W_{m_w2} = (l_{\text{heel}} + t_{s1} - t_{s2}) \times h_{s2} \times \gamma_m = \mathbf{1.9 \text{ kN/m}}$$

Moist backfill to step no. 1

$$W_{m_w1} = (l_{\text{heel}} + t_{s1} - t_{s1}) \times h_{s1} \times \gamma_m = \mathbf{1.4 \text{ kN/m}}$$

Soil in front of wall

$$W_p = l_{\text{toe}} \times d_{\text{cover}} \times \gamma_m = \mathbf{0.3 \text{ kN/m}}$$

Total vertical load

$$W_{\text{total}} = W_{\text{step3}} + W_{\text{step2}} + W_{\text{step1}} + W_{\text{base}} + W_{\text{sur}} + W_{m_w3} + W_{m_w2} + W_{m_w1} + W_p = \mathbf{23.3 \text{ kN/m}}$$

Horizontal forces on wall

Surcharge

$$F_{\text{sur}} = K_a \times \text{Surcharge} \times h_{\text{eff}} = \mathbf{1 \text{ kN/m}}$$

Moist backfill above water table

$$F_{m_a} = 0.5 \times K_a \times \gamma_m \times (h_{\text{eff}} - h_{\text{water}})^2 = \mathbf{9 \text{ kN/m}}$$

Total horizontal load

$$F_{\text{total}} = F_{\text{sur}} + F_{m_a} = \mathbf{10 \text{ kN/m}}$$

Calculate stability against sliding

Passive resistance of soil in front of wall

$$F_p = 0.5 \times K_p \times \cos(\delta_b) \times (d_{\text{cover}} + t_{\text{base}} + d_{\text{ds}} - d_{\text{exc}})^2 \times \gamma_{\text{mb}} = \mathbf{5 \text{ kN/m}}$$

Resistance to sliding

$$F_{\text{res}} = F_p + (W_{\text{total}} - W_{\text{sur}} - W_p) \times \tan(\delta_b) = \mathbf{12.6 \text{ kN/m}}$$

PASS - Resistance force is greater than sliding force

Overturning moments

Surcharge

$$M_{\text{sur}} = F_{\text{sur}} \times (h_{\text{eff}} - 2 \times d_{\text{ds}}) / 2 = \mathbf{0.7 \text{ kNm/m}}$$

Moist backfill above water table

$$M_{m_a} = F_{m_a} \times (h_{\text{eff}} + 2 \times h_{\text{water}} - 3 \times d_{\text{ds}}) / 3 = \mathbf{4.6 \text{ kNm/m}}$$

Total overturning moment

$$M_{\text{ot}} = M_{\text{sur}} + M_{m_a} = \mathbf{5.4 \text{ kNm/m}}$$

Restoring moments

Wall step no. 3

$$M_{\text{step3}} = W_{\text{step3}} \times (l_{\text{toe}} + t_{s3} / 2) = \mathbf{0.2 \text{ kNm/m}}$$

Wall step no. 2

$$M_{\text{step2}} = W_{\text{step2}} \times (l_{\text{toe}} + t_{s2} / 2) = \mathbf{0.7 \text{ kNm/m}}$$

Wall step no. 1

$$M_{\text{step1}} = W_{\text{step1}} \times (l_{\text{toe}} + t_{s1} / 2) = \mathbf{3.7 \text{ kNm/m}}$$

Wall base

$$M_{\text{base}} = W_{\text{base}} \times l_{\text{base}} / 2 = \mathbf{1.5 \text{ kNm/m}}$$

Moist backfill to step no. 3

$$M_{m_w3} = W_{m_w3} \times (l_{\text{base}} - (l_{\text{heel}} + t_{s1} - t_{s3}) / 2) = \mathbf{0.9 \text{ kNm/m}}$$

Moist backfill to step no. 2

$$M_{m_w2} = W_{m_w2} \times (l_{\text{base}} - (l_{\text{heel}} + t_{s1} - t_{s2}) / 2) = \mathbf{1.1 \text{ kNm/m}}$$

Moist backfill to step no. 1

$$M_{m_w1} = W_{m_w1} \times (l_{\text{base}} - (l_{\text{heel}} + t_{s1} - t_{s1}) / 2) = \mathbf{1 \text{ kNm/m}}$$

Total restoring moment

$$M_{\text{rest}} = M_{\text{step3}} + M_{\text{step2}} + M_{\text{step1}} + M_{\text{base}} + M_{m_w3} + M_{m_w2} + M_{m_w1} = \mathbf{9.1 \text{ kNm/m}}$$

Check stability against overturning

Total overturning moment

$$M_{\text{ot}} = \mathbf{5.4 \text{ kNm/m}}$$

Total restoring moment

$$M_{\text{rest}} = \mathbf{9.1 \text{ kNm/m}}$$

PASS - Restoring moment is greater than overturning moment

Check bearing pressure

Surcharge

$$M_{\text{sur}_r} = W_{\text{sur}} \times (l_{\text{base}} - (l_{\text{heel}} + t_{s1} - t_{s3}) / 2) = \mathbf{0.3 \text{ kNm/m}}$$

Soil in front of wall

$$M_{p_r} = W_p \times l_{\text{toe}} / 2 = \mathbf{0 \text{ kNm/m}}$$

Total moment for bearing

$$M_{\text{total}} = M_{\text{rest}} - M_{\text{ot}} + M_{\text{sur}_r} + M_{p_r} = \mathbf{4.1 \text{ kNm/m}}$$

Total vertical reaction

$$R = W_{\text{total}} = \mathbf{23.3 \text{ kN/m}}$$

Distance to reaction

$$X_{\text{bar}} = M_{\text{total}} / R = \mathbf{176 \text{ mm}}$$

Project Angus House, Aberfan				Job no. 23691	
Calcs for Max 1.10m Retaining Wall				Start page no./Revision 6	
Calcs by LM	Calcs date 10/03/2026	Checked by MJ	Checked date 04/03/2026	Approved by MJ	Approved date 04/03/2026

Eccentricity of reaction

$$e = \text{abs}((l_{\text{base}} / 2) - x_{\text{bar}}) = \mathbf{199 \text{ mm}}$$

Reaction acts outside middle third of base

Bearing pressure at toe

$$p_{\text{toe}} = R / (1.5 \times x_{\text{bar}}) = \mathbf{88.1 \text{ kN/m}^2}$$

Bearing pressure at heel

$$p_{\text{heel}} = 0 \text{ kN/m}^2 = \mathbf{0 \text{ kN/m}^2}$$

PASS - Maximum bearing pressure is less than allowable bearing pressure