

PLOT 20 FOREST LODGE
CWMFAN
PORT TALBOT

PROPOSED NEW DWELLING
RETAINING WALL DESIGN

STRUCTURAL DESIGN
CALCULATIONS

JANUARY 2025

betaConsult
Ystalyfera
Swansea
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Design Retaining Wall in Empty Boundary.
Plot 20 Fenced bridge
Design Calculation -
Order

ETC
Page.

Bridge
 Retaining
 Masonry
 Design
 Section Detail
 Calculation.
 002
 002
 002
 003
 006
 007

Relay Wall Design

PROJECT
 Plot 20 Foulkheady

Block

Design of Retaining Wall on boundary of property
 between Foulkhead Lane & property for change - level
 Design refer to drainage Condition Ref 4. of
 Planning Approval Ref. 2024/0401.

Reference

- 1) Approval Drawing & Plot 20.
- 2) Planning Approval Ref 2024/0401 (NPT)
- (a) Scale, Side Elevation & Design

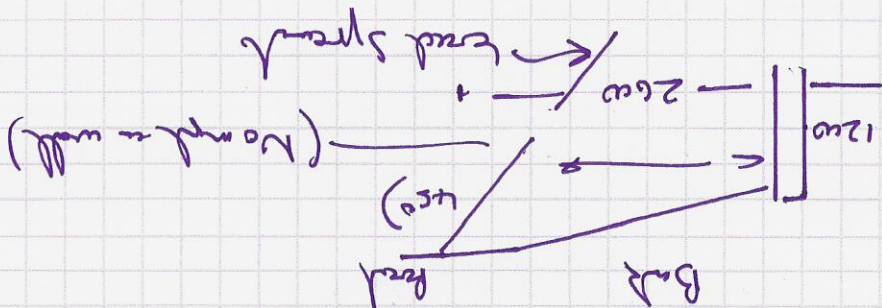
Masonry

Concrete Masonry Retaining Wall in Block A
 will fabricate to Retain good access to property
 Wall set so that no load & head on
 it $> 45^\circ$ Angle away

PROJECT
01-20 Foulridge
Body Wall - Day Sech

Day Sech

Day Sech is in Fig 1: - From Side
consider max height to be retained. in 1.120m
in shown - This depth & Maxum Cons.

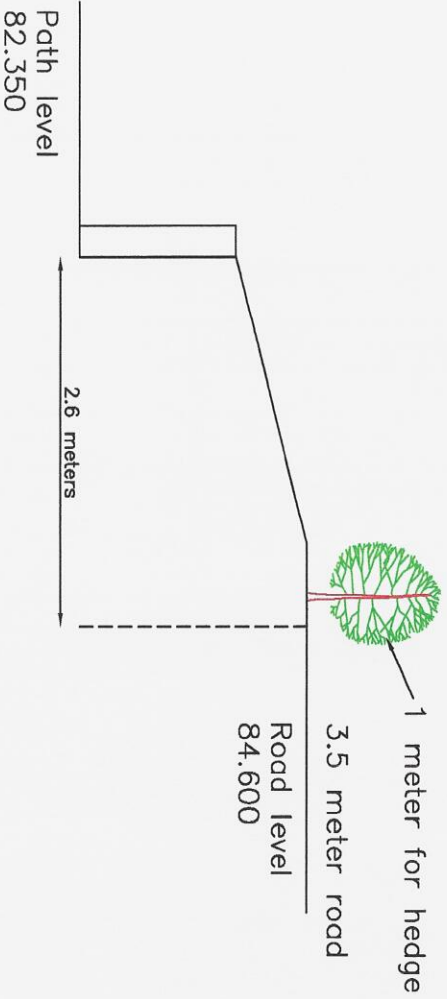


Day Sech

- Day wall & Side Sech
shown & the Day Sech & Fig 2 below:-
and the lead is shown - Fig 1/1.



NOTES



CLIENT
K O'Mahony

PROJECT
Plot 20 Forest Lodge
Cwmafan

TITLE
Wall Section

CONSTRUCTION

GENERAL NOTES
1. All dimensions are in millimetres unless otherwise stated.
2. The contractor is responsible for obtaining all necessary permissions and consents for the proposed works.
3. The contractor is responsible for the safety of all workers and the public during the construction of the wall.
4. The contractor is responsible for the removal of all waste and debris from the site.
5. The contractor is responsible for the reinstatement of the site to its original condition.

DATE: Jan 2025
SCALE: 1:10
DRAWN BY: E.Pe
CHECKED: []
APPROVED: []

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FOR REVISION: 24/05/1
REVISION: 405

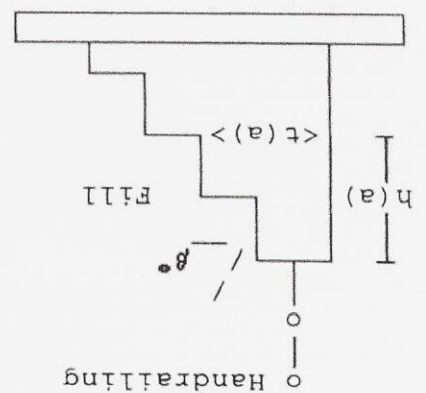
R3 1/11

[illegible]

Made by: gmg
Date: 23/01/25
Ref No: 24/

Designed in accordance with BS5628:Part 1: 1992.
Location: wall plot 20

o Handralling



Weight/unit volume of soil & wall $w = 18 \text{ kN/m}^3$
Internal angle of friction $\phi = 35^\circ$
Angle of backfill $\beta = 18^\circ$

Active soil pressure is applicable.

Cosine angle of internal friction $cp = \cos(\text{RAD}(phi)) = 0.8192$

Cosine angle of slope beta $cb = \cos(\text{RAD}(beta)) = 0.9511$

$cc = (cb^2 - cp^2)^{.5}$

$= (0.9511^2 - 0.8192^2)^{.5}$

$= 0.4832$

Horizontal active pressure coeff $ce = cb^2 * (cb - cc) / (cb + cc)$

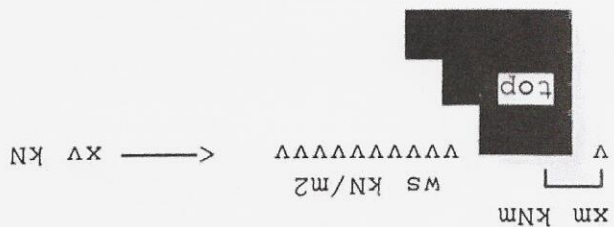
$= 0.9511^2 * (0.9511 - 0.4832)$

$= 0.295$

Mortar designation to Table 1
mortar=3
Masonry type (1=clay 2=calc silicate 3=conc brick 4=block)
typ(1)=4

Height
Least horiz dimension
ratio height/least horiz dim
Compressive strength of blocks
Characteristic flexural strength
250mm thick - Table 3
Partial safety factor material
gamma_m=3.5
=0.15 N/mm²
fb(a)=TABLE 3.71 for po=7, mortar=3
For bed failure and leaf greater than
po=7.00 N/mm²
rb=hb/lhd=215/100=2.15
lhd=100 mm
hb=215 mm

External loading



Applied moment at top of wall
Applied shear at top of wall
Weight/unit area of surcharge
Load factor external loads at top
Load factor surcharge
Load factor earth pressure
Load factor self weight
 $\gamma_{max}=1.6$
 $\gamma_{mas}=1.6$
 $\gamma_{mae}=1.4$
 $\gamma_{maf}=0.9$

Wall design

Number of steps proposed in wall steps=3

Step 1 Typical Analysis which is repeated for each step

Proposed height at step
Proposed thickness at step
Moment at height h
surcharge
Ultimate moment at height h
Section modulus at thickness t
Weight/unit area at depth h
Moment of resistance
Applied moment less than moment of resistance (0.1846 <= 0.3967)
therefore section is satisfactory.
Step 1
width 0.215 m
height 0.45 m

$$h(1)=0.45 \text{ m}$$

$$t(1)=0.215 \text{ m}$$

$$me=ce*we*h(a)^{1/3}/6=0.295*18*0.45^{1/3}/6$$

$$ms=ce*ws*h(a)^{1/2}/2=0.295*1.5*0.45^{1/2}/2$$

$$mu=me*\gamma_{mae}+ms*\gamma_{mas}+(xm+xv*h(a))$$

$$\gamma_{max}=0.08066 \text{ kNm}$$

$$\gamma_{mae}=0.04481 \text{ kNm}$$

$$\gamma_{maf}=0.00864 \text{ N/mm}^2$$

$$gd=(ws+we*h(a))*\gamma_{maf}/1000$$

$$z=t(a)^{1/2}/6=0.215^{1/2}/6=0.007704 \text{ m}^3$$

$$mr=(fb(1)/\gamma_{mam}+gd)*z*1000$$

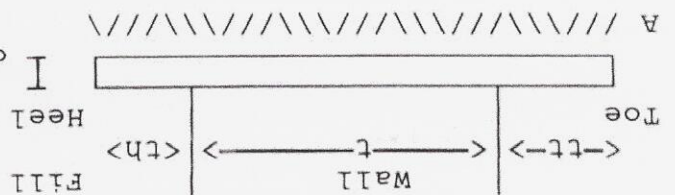
$$=(0.15/3.5+0.00864)*0.007704*1000$$

$$=0.3967 \text{ kNm}$$

Office: 5860

Step height	Step thickness	Ultimate Moments (kNm)	Resistance Applied
(m)	(m)		
0.45	0.215	0.3967	0.1846
0.9	0.45	1.984	1.19
1.2	0.75	5.967	2.651

Stability and bearing check



Width of toe $tt=0.15$ m
 Width of heel $th=0.15$ m
 Thickness of wall $t=0.75$ m
 Height of wall $h=1.2$ m
 Width of base $tb=tt+th=0.75+0.15+0.15$
 Depth of base $db=0.30$ m
 Overall depth $od=h+db=1.2+0.3=1.5$ m
 Weight of fill and wall $wf=we*(t+th)*h=18*(0.75+0.15)*1.2=19.44$ kN
 Eccentricity from A $ef=tt+(t+th)/2=0.15+(0.75+0.15)/2=0.6$ m
 Weight of base $wb=tb*db*24=1.05*0.3*24=7.56$ kN
 Earth horizontal force $sfe=ce*we*od^2/2=0.295*18*1.5^2/2=5.975$ kN
 Moment due to earth pressure $me=sfe*od/3=5.975*1.5/3=2.987$ kNm
 Surcharge horizontal force $sfs=ws*ce*od=1.5*0.295*1.5=0.6638$ kN
 Moment due to surcharge $ms=sfs*od/2=0.6638*1.5/2=0.4979$ kNm

Wall shear

Horizontal shear force

Shear stress at bottom of wall

Weight at bottom of step 1

Weight at bottom of step 2

Weight at bottom of step 3

$ust=(sfe*gammae)+(sfs*gammaas)$
 $= (5.975*1.4)+(0.6638*1.6)$
 $= 9.426$ kN
 $uss=ust/(t(steps)*1000)$
 $= 9.426/(0.75*1000)$
 $= 0.01257$ N/mm²
 $uwt=t(a)*we*h(a)*gammaat$
 $= 0.215*18*0.45*0.9$
 $= 1.567$ kN
 $uwt=uwt+(t(a)*we*h(a)*gammaaf)$
 $= 1.567+(0.45*18*0.9*0.9)$
 $= 8.128$ kN
 $uwt=uwt+(t(a)*we*h(a)*gammaaf)$
 $= 8.128+(0.75*18*1.2*0.9)$
 $= 22.71$ kN

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Weight per. unit area

$$\begin{aligned} ga &= wlt / (t(\text{steps}) * 1000) \\ &= 22.71 / (0.75 * 1000) \\ &= 0.03028 \text{ N/mm}^2 \\ fv &= 0.15 + 0.6 * ga = 0.15 + 0.6 * 0.03028 \\ &= 0.1682 \text{ N/mm}^2 \end{aligned}$$

Permissible shear stress

Applied shear less than shear resistance ($0.01257 < 0.1682$)
therefore section is satisfactory.

Overturning

Overturning moment about A

$$\begin{aligned} om &= me + ms + (xm + xv * od) \\ &= 2.987 + 0.4979 + (0 + 0 * 1.5) \\ &= 3.485 \text{ kNm} \end{aligned}$$

Restoring moment abt A fill/wall

$$\begin{aligned} rmf &= wf * ef = 19.44 * 0.6 = 11.66 \text{ kNm} \\ rmb &= wb * tb / 2 = 7.56 * 1.05 / 2 = 3.969 \text{ kNm} \\ rms &= ws * (t + th) * ef = 1.5 * (0.75 + 0.15) * 0.6 \\ &= 0.81 \end{aligned}$$

total

$$\begin{aligned} rm &= rmf + rmb + rms = 11.66 + 3.969 + 0.81 \\ &= 16.44 \end{aligned}$$

Factor of safety

Sliding (passive resistance ignored)

Sliding force

$$sf = sfe + sfs + xv = 5.975 + 0.6638 + 0 = 6.638$$

Details of bearing stratas
angle of friction
cohesion

$$\begin{aligned} \phi_{ib} &= 40^\circ \\ cu &= 0 \text{ kN/m}^2 \\ cf &= \tan(\text{RAD}(\phi_{ib} * 2/3)) \\ &= \tan(\text{RAD}(40 * 2/3)) \\ &= 0.5022 \end{aligned}$$

Resisting force

$$\begin{aligned} rfi &= wf * cf = 19.44 * 0.5022 = 9.763 \text{ kN} \\ rfb &= wb * cf + tb * cu / 2 \\ &= 7.56 * 0.5022 + 1.05 * 0 / 2 \\ &= 3.797 \text{ kN} \end{aligned}$$

surchage

$$\begin{aligned} rfs &= ws * (t + th) * cf \\ &= 1.5 * (0.75 + 0.15) * 0.5022 \\ &= 0.678 \text{ kN} \end{aligned}$$

total

$$\begin{aligned} rf &= rfi + rfb + rfs = 9.763 + 3.797 + 0.678 \\ &= 14.24 \text{ kN} \\ fss &= rf / sf = 14.24 / 6.638 = 2.145 \end{aligned}$$

Factor of safety

Bearing pressure

Weight of surcharge

$$sw = ws * (t + th) = 1.5 * (0.75 + 0.15) = 1.35 \text{ kN}$$

Moments about centre of base

$$\begin{aligned} m &= om + (wf + sw) * (tb / 2 - ef) \\ &= 3.485 + (19.44 + 1.35) * (1.05 / 2 - 0.6) \\ &= 1.926 \text{ kNm} \end{aligned}$$

Section modulus of base

$$\begin{aligned} zb &= tb^2 / 6 = 1.05^2 / 6 = 0.1838 \text{ m}^3 \\ tw &= wf + sw + wb = 19.44 + 1.35 + 7.56 \\ &= 28.35 \text{ kN} \end{aligned}$$

Total weight

Pressure due to weight

$$pw = tw / tb = 28.35 / 1.05 = 27 \text{ kN/m}^2$$

forest lodge
 wall along private road
 design
 Date: 23/01/25
 Made by: gmg
 Ref No: 24/

Office: 5860
 Pressure due to moment (+/-)
 Maximum pressure
 Minimum pressure
 $pm = m/zb = 1.926/0.1838 = 10.48 \text{ kN/m}^2$
 $pmax = pw + pm = 27 + 10.48 = 37.48 \text{ kN/m}^2$
 $pmin = pw - pm = 27 - 10.48 = 16.52 \text{ kN/m}^2$

Summary of stability check

Factor of safety overturning
 Factor of safety sliding
 Maximum base pressure

4.718
 2.145
 37.48 kN/m²

DESIGN SUMMARY

Wall height
 Wall design
 Step thickness
 (m)
 (m)

1.2 m
 Ultimate Moments (kNm)
 Resistance Applied

0.45
 0.9
 1.2
 0.215
 0.45
 0.75
 0.3967
 1.984
 5.967
 0.1846
 1.19
 2.651

Summary of stability check

Factor of safety overturning
 Factor of safety sliding
 Maximum base pressure

4.718
 2.145
 37.48 kN/m²