

PROJECT **ADJ TO 1 BEDLING TERRACE**
CLIENT **HAUS AGENT LTD**JOB No. **19/239**
DATE **APRIL 20**SHEET No.
01**CALCULATION HEADING SHEET****PREAMBLE**

THE FOLLOWING CALCULATIONS RELATE TO THE DESIGN OF STRUCTURAL ELEMENTS ASSOCIATED WITH THE RETAINING STRUCTURES REQUIRED ON THE BOUNDARY OF THE NEW DWELLING AT THE ABOVE ADDRESS.

CLIENT INFORMATION

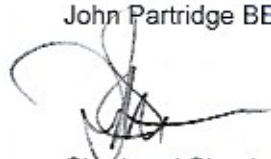
ARCHITECTURAL DRAWINGS RECEIVED, AS NOTED BELOW:
APEX ARCHITECTURE DRGS

REFERENCES:

BUILDING REGULATIONS – PART A STRUCTURE		✓
NHBC STANDARDS		✓
EUROCODES:		
Eurocode 0	BASIS OF STRUCTURAL DESIGN	
Eurocode 1	ACTIONS ON STRUCTURES	
Eurocode 2	DESIGN OF CONCRETE STRUCTURES	
Eurocode 3	DESIGN OF STEEL STRUCTURES	
Eurocode 4	DESIGN OF COMPOSITE STEEL AND CONCRETE STRUCTURES	
Eurocode 5	DESIGN OF TIMBER STRUCTURES	
Eurocode 6	DESIGN OF MASONRY STRUCTURES	
Eurocode 7	GEOTECHNICAL DESIGN / RETAINING WALLS	✓
ISTRUCTE MANUALS		
SCI MANUALS		
TRADA	Span tables for solid timber members	
GBG 27 – FOR RETAINING WALLS		✓

Calculations prepared by:

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Chartered Structural and Civil Engineer.

PROJECT **BEDLING TERRACE**

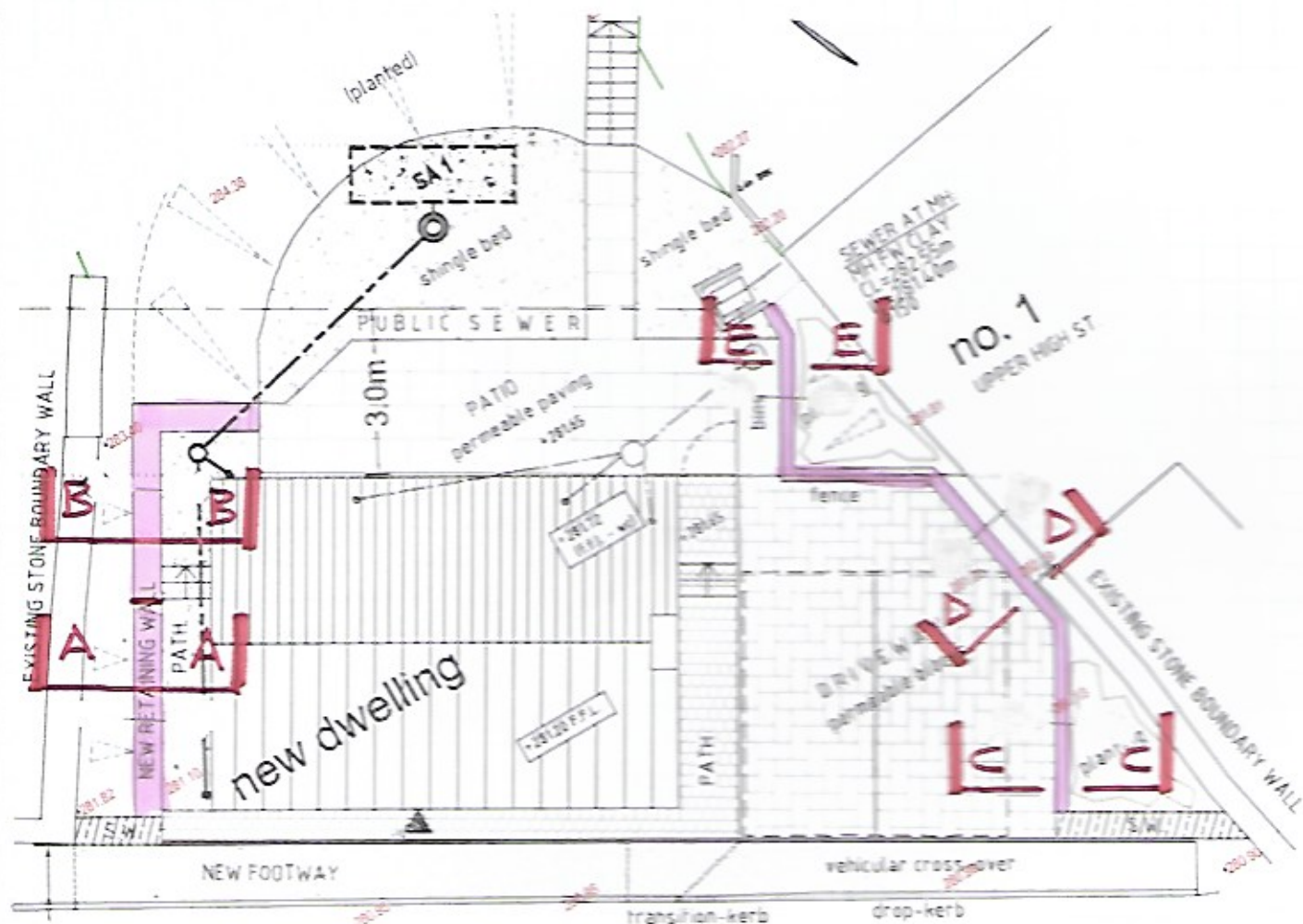
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02



SITE PLAN & WALL KEY

SEE SHEETS 03 & FOR

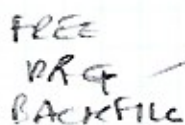
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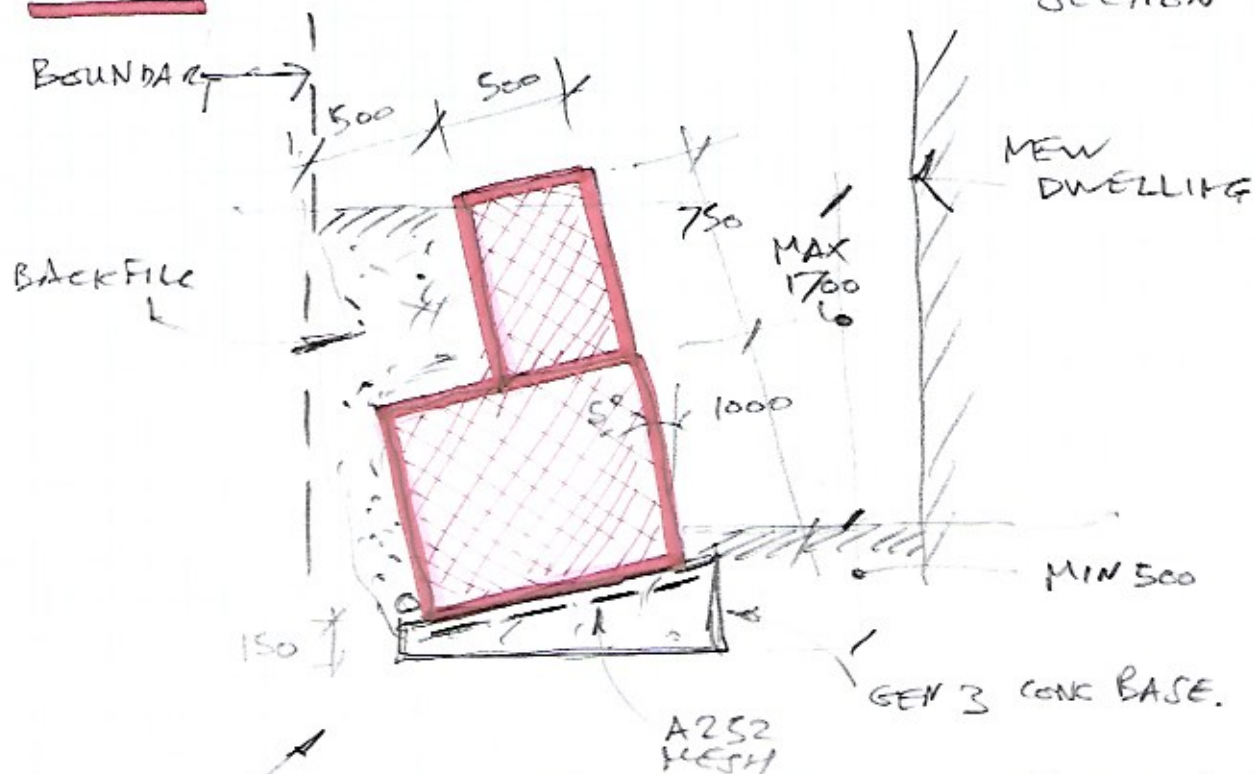
03

— NOT TO SCALE



A - A

— DESIGN CHECKS ON SHEETS 04 → 08
SECTION OK ✓



B-B

— DESIGN CHECK ON SHJ $9 \rightarrow 13 = \text{SECTION OK}$

DESIGN PARAMETERS:

ANGLE OF INT. FRICTION = 30°
BEARING CAPACITY SOIL = 100 kN/m^2

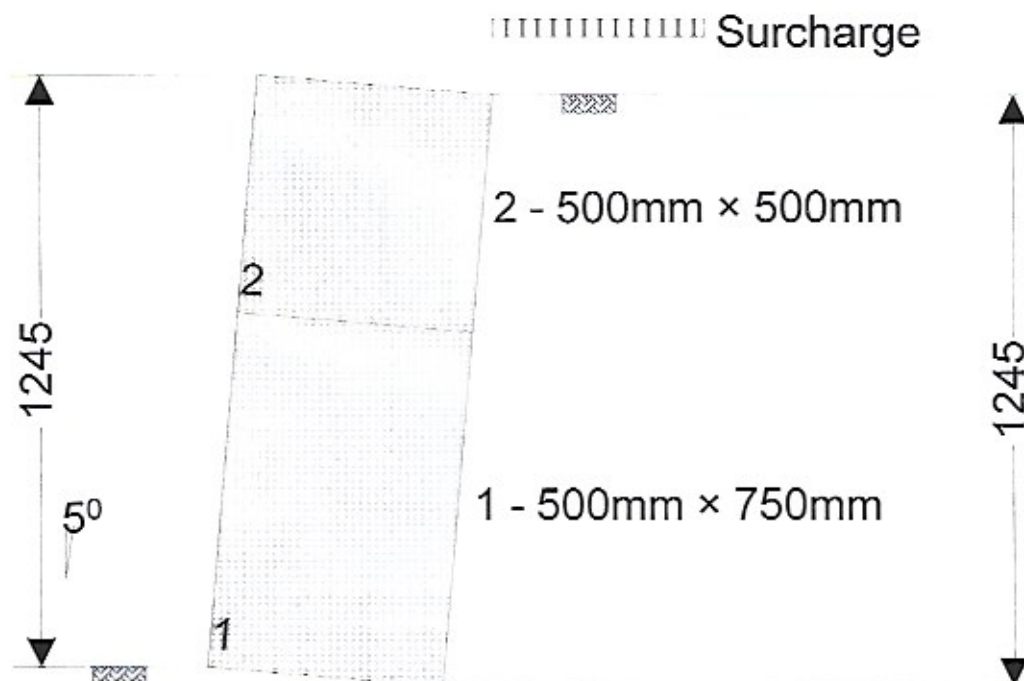
Project Bedlinnog Terrace				Job Ref. 19/239	
Section Gabion Wall: Case 2				Sheet no./rev. 04	
Calc. by DA	Date 09/04/2020	Chk'd by	Date	App'd by	Date

SECTION A-A

GABION RETAINING WALL ANALYSIS & DESIGN

In accordance with EN 1997-1:2004 - Code of Practice for Geotechnical design and the UK National Annex

Tedds calculation version 2.0.01



Wall geometry

Width of gabion 1;	$w_1 = 500 \text{ mm};$	Height of gabion 1;	$h_1 = 750 \text{ mm}$
Width of gabion 2;	$w_2 = 500 \text{ mm};$	Height of gabion 2;	$h_2 = 500 \text{ mm}$
Step to front face (1 and 2);	$s_2 = 0 \text{ mm}$		
Wall inclination;	$\epsilon = 5 \text{ deg}$		

Gabion properties

Unit weight of fill;	$\gamma_d = 18.0 \text{ kN/m}^3;$	Friction between gabions;	$\delta_{bgk} = 35.0 \text{ deg}$
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Loading

Variable surcharge;	$p_{o,q} = 2 \text{ kN/m}^2$
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Soil properties

Slope of retained soil;	$\beta = 0.0 \text{ deg};$	Char. shearing resist. angle;	$\phi'_{rk} = 30.0 \text{ deg}$
Char. saturated density of soil;	$\gamma_{sr} = 18.0 \text{ kN/m}^3$		
Coefficient for wall friction;	$k_{membrane} = 0.75;$	Wall friction angle;	$\delta_{rk} = 22.5 \text{ deg}$
Char base friction angle;	$\delta_{bbk} = 30.0 \text{ deg};$	Bearing capacity of soil;	$q = 100 \text{ kN/m}^2$

Wall geometry

Horiz dist to CoG gabion 1;	$x_{g1} = 250 \text{ mm};$	Vert dist to CoG gabion 1;	$y_{g1} = 375 \text{ mm}$
Weight of gabion 1;	$W_{g1} = 6.8 \text{ kN/m}$		
Horiz dist to CoG gabion 2;	$x_{g2} = 250 \text{ mm};$	Vert dist to CoG gabion 2;	$y_{g2} = 1000 \text{ mm}$
Weight of gabion 2;	$W_{g2} = 4.5 \text{ kN/m}$		
Weight of entire gabion;	$W_g = 11.3 \text{ kN/m};$	Horiz distance to CoG;	$x_g = 250 \text{ mm}$
Vert distance to CoG;	$y_g = 625 \text{ mm};$	Correcting for wall inclination;	$X_g = 304 \text{ mm}$
Vert height diff - inclination;	$H_f = 48 \text{ mm}$		

Design dimensions

Effect. angle rear plane of wall;	$\alpha = 95.0 \text{ deg};$	Effective face angle;	$\theta = 85.0 \text{ deg}$
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Effective height of wall; $H = 1245 \text{ mm}$; Height - toe to top gabion; $H_{incl} = 1245 \text{ mm}$
 Active pressure; $K_a = 0.262$
 Active thrust due to soil; $P_{a,soil} = 3.7 \text{ kN/m}$

Pressure at base

Horizontal forces

Retained soil; $F_{soil,h,q} = 3.5 \text{ kN/m}$
 Height of soil thrust (vert); $d_{h,soil} = 372 \text{ mm}$
 Surcharge; $F_{surch,h,q} = 0.5 \text{ kN/m}$
 Height of surcharge (vert); $d_{h,surch} = 579 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,q} = 11.3 \text{ kN/m}$; Retained soil; $F_{soil,v,q} = 1.1 \text{ kN/m}$
 Horiz dist to soil thrust acts; $b_{v,soil} = 534 \text{ mm}$
 Surcharge; $F_{surch,v,q} = 0.1 \text{ kN/m}$
 Horiz dist to surch thrust acts; $b_{v,surch} = 553 \text{ mm}$
 Force normal to base; $N_s = 12.8 \text{ kN/m}$; Eccentricity; $e = 53 \text{ mm}$

Reaction acts within middle third of base

Pressure at toe; $\sigma_{toe} = 41.9 \text{ kN/m}^2$; Pressure at heel; $\sigma_{heel} = 9.3 \text{ kN/m}^2$
 Factor of safety; $FoS_Q = 2.388$; Allowable factor of safety; $FoS_{Q,allow} = 1.000$

PASS - Design FoS for allowable bearing pressure exceeds min allowable pressure to base

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 1

Action factor set; A1
 Perm. unfavourable action; $\gamma_G = 1.35$; Permanent favourable action; $\gamma_{G,f} = 1.00$
 Variable unfavourable action; $\gamma_Q = 1.50$; Variable favourable action; $\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 1

Soil factor set; M1
 Angle of shearing resistance; $\gamma_\psi = 1.00$; Weight density; $\gamma_\gamma = 1.00$

Design soil properties

Design shearing resist angle; $\phi'_{rd} = 30.0 \text{ deg}$; Design sat. density of soil; $\gamma_{s,d} = 18 \text{ kN/m}^3$
 Design wall friction angle; $\delta_{rd} = 22.5 \text{ deg}$; Design base friction angle; $\delta_{bb,d} = 30.0 \text{ deg}$
 Active pressure; $K_a = 0.262$
 Active thrust due to soil; $P_{a,soil} = 3.7 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 4.7 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 372 \text{ mm}$
 Surcharge; $F_{surch,h} = 0.7 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 579 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 11.3 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 1.1 \text{ kN/m}$
 Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 2.2 \text{ kNm/m}$; Restoring moment; $M_R = 4.0 \text{ kNm/m}$
 Factor of safety; $FoS_M = 1.860$; Allowable factor of safety; $FoS_{M,allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 5.4 \text{ kN/m}$; Total vertical force; $N = 12.3 \text{ kN/m}$
 Sliding force; $F_f = 4.3 \text{ kN/m}$; Sliding resistance; $F_R = 7.4 \text{ kN/m}$

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Factor of safety; $FoS_s = 1.713$; Allowable factor of safety; $FoS_{s,allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2;	$x_{g2} = 250$ mm;	Vert dist to CoG gabion 2;	$y_{g2} = 250$ mm
Weight of gabion 2;	$W_{g2} = 4.5$ kN/m		
Weight of entire gabion;	$W_g = 4.5$ kN/m;	Horiz distance to CoG;	$x_g = 250$ mm
Vert distance to CoG;	$y_g = 250$ mm;	Correcting for wall inclination;	$X_g = 271$ mm
Vert height diff - inclination;	$H_f = 45$ mm		

Design dimensions

Effect. angle rear plane of wall;	$\alpha = 95.0$ deg;	Effective face angle;	$\theta = 85.0$ deg
Effective height of wall;	$H = 498$ mm;	Height - toe to top gabion;	$H_{incl} = 498$ mm
Active pressure;	$K_a = 0.262$		
Active thrust due to soil;	$P_{a,soil} = 0.6$ kN/m		

Horizontal forces

Retained soil;	$F_{soil,h} = 0.8$ kN/m;	Soil thrust height resolved vert.;	$d_{h,soil} = 122$ mm
Surcharge;	$F_{surch,h} = 0.3$ kN/m;	Surcharge thrust height (vert);	$d_{h,surch} = 205$ mm

Vertical forces

Gabion weight;	$F_{gabion,v,f} = 4.5$ kN/m;	Retained soil;	$F_{soil,v,f} = 0.2$ kN/m
Surcharge;	$F_{surch,v,f} = 0.0$ kN/m		

Overturning stability - take moments about the toe

Overturning moment;	$M_o = 0.1$ kNm/m;	Restoring moment;	$M_R = 1.3$ kNm/m
Factor of safety;	$FoS_M = 8.751$;	Allowable factor of safety;	$FoS_{M,allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force;	$T = 1.0$ kN/m;	Total vertical force;	$N = 4.7$ kN/m
Sliding force;	$F_r = 0.6$ kN/m;	Sliding resistance;	$F_R = 3.3$ kN/m
Factor of safety;	$FoS_s = 5.359$;	Allowable factor of safety;	$FoS_{s,allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 2

Action factor set;	A2		
Perm. unfavourable action;	$\gamma_G = 1.00$;	Permanent favourable action;	$\gamma_{G,f} = 1.00$
Variable unfavourable action;	$\gamma_Q = 1.30$;	Variable favourable action;	$\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 2

Soil factor set;	M2		
Angle of shearing resistance;	$\gamma_{\phi} = 1.25$;	Weight density;	$\gamma_r = 1.00$

Design soil properties

Design shearing resist angle;	$\phi'_{rd} = 24.8$ deg;	Design sat. density of soil;	$\gamma_{s,d} = 18$ kN/m ³
Design wall friction angle;	$\delta_{rd} = 18.3$ deg;	Design base friction angle;	$\delta_{bb,d} = 24.8$ deg

Wall geometry

Horiz dist to CoG gabion 1;	$x_{g1} = 250$ mm;	Vert dist to CoG gabion 1;	$y_{g1} = 375$ mm
Weight of gabion 1;	$W_{g1} = 6.8$ kN/m		
Horiz dist to CoG gabion 2;	$x_{g2} = 250$ mm;	Vert dist to CoG gabion 2;	$y_{g2} = 1000$ mm

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Weight of gabion 2; $W_{g2} = 4.5 \text{ kN/m}$
 Weight of entire gabion; $W_g = 11.3 \text{ kN/m}$; Horiz distance to CoG; $x_g = 250 \text{ mm}$
 Vert distance to CoG; $y_g = 625 \text{ mm}$; Correcting for wall inclination; $X_g = 304 \text{ mm}$
 Vert height diff - inclination; $H_f = 48 \text{ mm}$

Design dimensions

Effect. angle rear plane of wall; $\alpha = 95.0 \text{ deg}$; Effective face angle; $\theta = 85.0 \text{ deg}$
 Effective height of wall; $H = 1245 \text{ mm}$; Height - toe to top gabion; $H_{incl} = 1245 \text{ mm}$
 Active pressure; $K_a = 0.327$
 Active thrust due to soil; $P_{a,soil} = 4.6 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 4.4 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 372 \text{ mm}$
 Surcharge; $F_{surch,h} = 0.8 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 579 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 11.3 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 1.1 \text{ kN/m}$
 Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 2.1 \text{ kNm/m}$; Restoring moment; $M_R = 4.0 \text{ kNm/m}$
 Factor of safety; $FoSM = 1.895$; Allowable factor of safety; $FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 5.2 \text{ kN/m}$; Total vertical force; $N = 12.3 \text{ kN/m}$
 Sliding force; $F_t = 4.1 \text{ kN/m}$; Sliding resistance; $F_R = 5.9 \text{ kN/m}$
 Factor of safety; $FoSS = 1.423$; Allowable factor of safety; $FoSS_{allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2; $x_{g2} = 250 \text{ mm}$; Vert dist to CoG gabion 2; $y_{g2} = 250 \text{ mm}$
 Weight of gabion 2; $W_{g2} = 4.5 \text{ kN/m}$
 Weight of entire gabion; $W_g = 4.5 \text{ kN/m}$; Horiz distance to CoG; $x_g = 250 \text{ mm}$
 Vert distance to CoG; $y_g = 250 \text{ mm}$; Correcting for wall inclination; $X_g = 271 \text{ mm}$
 Vert height diff - inclination; $H_f = 45 \text{ mm}$

Design dimensions

Effect. angle rear plane of wall; $\alpha = 95.0 \text{ deg}$; Effective face angle; $\theta = 85.0 \text{ deg}$
 Effective height of wall; $H = 498 \text{ mm}$; Height - toe to top gabion; $H_{incl} = 498 \text{ mm}$
 Active pressure; $K_a = 0.327$
 Active thrust due to soil; $P_{a,soil} = 0.7 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 0.7 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 122 \text{ mm}$
 Surcharge; $F_{surch,h} = 0.3 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 205 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 4.5 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 0.2 \text{ kN/m}$
 Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 0.2 \text{ kNm/m}$; Restoring moment; $M_R = 1.3 \text{ kNm/m}$
 Factor of safety; $FoSM = 8.665$; Allowable factor of safety; $FoSM_{allow} = 1.000$

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PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force;	$T = 1.0 \text{ kN/m};$	Total vertical force;	$N = 4.7 \text{ kN/m}$
Sliding force;	$F_t = 0.6 \text{ kN/m};$	Sliding resistance;	$F_R = 2.7 \text{ kN/m}$
Factor of safety;	$FoS_s = 4.356;$	Allowable factor of safety;	$FoS_{s_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

RETAINING WALL OK ✓

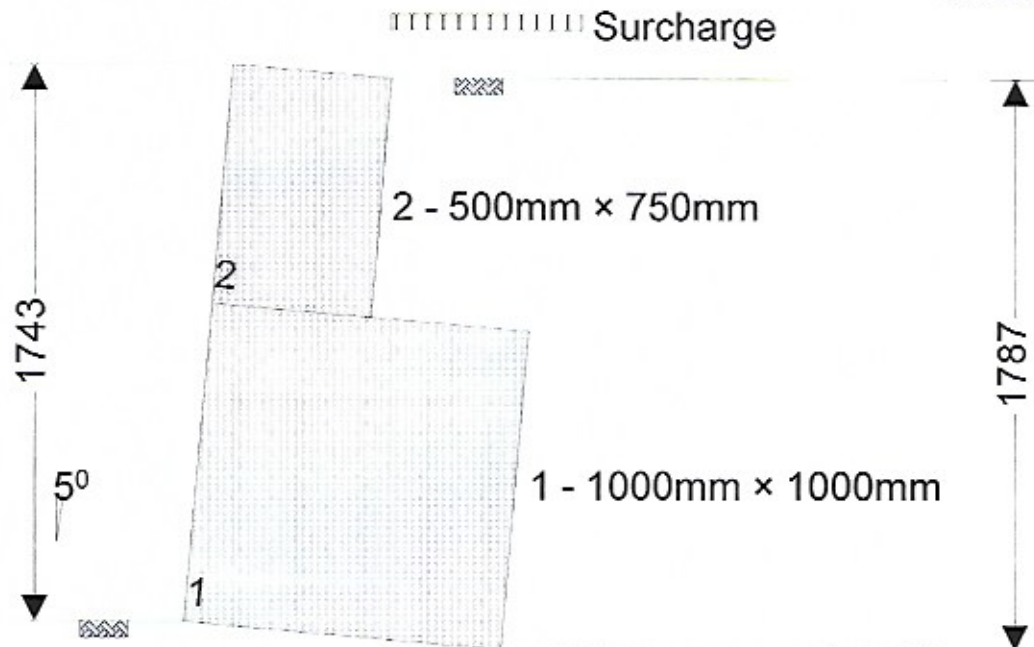
SECTION B-B

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GABION RETAINING WALL ANALYSIS & DESIGN

In accordance with EN 1997-1:2004 - Code of Practice for Geotechnical design and the UK National Annex

Tedds calculation version 2.0.01



Wall geometry

Width of gabion 1;	$w_1 = 1000 \text{ mm};$	Height of gabion 1;	$h_1 = 1000 \text{ mm}$
Width of gabion 2;	$w_2 = 500 \text{ mm};$	Height of gabion 2;	$h_2 = 750 \text{ mm}$
Step to front face (1 and 2);	$s_2 = 0 \text{ mm}$		
Wall inclination;	$\epsilon = 5 \text{ deg}$		

Gabion properties

Unit weight of fill;	$\gamma_d = 18.0 \text{ kN/m}^3;$	Friction between gabions;	$\delta_{bg,k} = 35.0 \text{ deg}$
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Loading

Variable surcharge;	$p_{o,Q} = 2 \text{ kN/m}^2$
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Soil properties

Slope of retained soil;	$\beta = 0.0 \text{ deg};$	Char. shearing resist. angle;	$\phi'_{rk} = 30.0 \text{ deg}$
Char. saturated density of soil;	$\gamma_{sr} = 18.0 \text{ kN/m}^3$		
Coefficient for wall friction;	$k_{\text{membrane}} = 0.75;$	Wall friction angle;	$\delta_{r,k} = 22.5 \text{ deg}$
Char base friction angle;	$\delta_{bb,k} = 30.0 \text{ deg};$	Bearing capacity of soil;	$q = 100 \text{ kN/m}^2$

Wall geometry

Horiz dist to CoG gabion 1;	$x_{g1} = 500 \text{ mm};$	Vert dist to CoG gabion 1;	$y_{g1} = 500 \text{ mm}$
Weight of gabion 1;	$W_{g1} = 18.0 \text{ kN/m}$		
Horiz dist to CoG gabion 2;	$x_{g2} = 250 \text{ mm};$	Vert dist to CoG gabion 2;	$y_{g2} = 1375 \text{ mm}$
Weight of gabion 2;	$W_{g2} = 6.8 \text{ kN/m}$		
Weight of entire gabion;	$W_g = 24.8 \text{ kN/m};$	Horiz distance to CoG;	$x_g = 432 \text{ mm}$
Vert distance to CoG;	$y_g = 739 \text{ mm};$	Correcting for wall inclination;	$X_g = 495 \text{ mm}$
Vert height diff - inclination;	$H_r = 50 \text{ mm}$		

Design dimensions

Effect. angle rear plane of wall;	$\alpha = 79.1 \text{ deg};$	Effective face angle;	$\theta = 85.0 \text{ deg}$
Effective height of wall;	$H = 1787 \text{ mm};$	Height - toe to top gabion;	$H_{\text{incl}} = 1743 \text{ mm}$

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Active pressure; $K_a = 0.386$
Active thrust due to soil; $P_{a,soil} = 11.1 \text{ kN/m}$

Pressure at base

Horizontal forces

Retained soil; $F_{soil,h,q} = 9.3 \text{ kN/m}$
Height of soil thrust (vert); $d_{h,soil} = 508 \text{ mm}$
Surcharge; $F_{surch,h,q} = 0.9 \text{ kN/m}$
Height of surcharge (vert); $d_{h,surch} = 806 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,q} = 24.8 \text{ kN/m}$; Retained soil; $F_{soil,v,q} = 6.1 \text{ kN/m}$
Horiz dist to soil thrust acts; $b_{v,soil} = 881 \text{ mm}$
Surcharge; $F_{surch,v,q} = 0.6 \text{ kN/m}$
Horiz dist to surch thrust acts; $b_{v,surch} = 823 \text{ mm}$
Force normal to base; $N_s = 32.2 \text{ kN/m}$; Eccentricity; $e = 106 \text{ mm}$

Reaction acts within middle third of base

Pressure at toe; $\sigma_{toe} = 52.6 \text{ kN/m}^2$; Pressure at heel; $\sigma_{heel} = 11.8 \text{ kN/m}^2$
Factor of safety; $FoS_Q = 1.900$; Allowable factor of safety; $FoS_{Q,allow} = 1.000$

PASS - Design FoS for allowable bearing pressure exceeds min allowable pressure to base

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 1

Action factor set; A1
Perm. unfavourable action; $\gamma_G = 1.35$; Permanent favourable action; $\gamma_{G,f} = 1.00$
Variable unfavourable action; $\gamma_Q = 1.50$; Variable favourable action; $\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 1

Soil factor set; M1
Angle of shearing resistance; $\gamma_\psi = 1.00$; Weight density; $\gamma_\gamma = 1.00$

Design soil properties

Design shearing resist angle; $\phi'_{r,d} = 30.0 \text{ deg}$; Design sat. density of soil; $\gamma_{s,d} = 18 \text{ kN/m}^3$
Design wall friction angle; $\delta_{r,d} = 22.5 \text{ deg}$; Design base friction angle; $\delta_{bb,d} = 30.0 \text{ deg}$
Active pressure; $K_a = 0.386$
Active thrust due to soil; $P_{a,soil} = 11.1 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 12.5 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 508 \text{ mm}$
Surcharge; $F_{surch,h} = 1.3 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 806 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 24.8 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 6.1 \text{ kN/m}$
Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 7.4 \text{ kNm/m}$; Restoring moment; $M_R = 17.6 \text{ kNm/m}$
Factor of safety; $FoS_M = 2.382$; Allowable factor of safety; $FoS_{M,allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 13.8 \text{ kN/m}$; Total vertical force; $N = 30.9 \text{ kN/m}$
Sliding force; $F_f = 11.1 \text{ kN/m}$; Sliding resistance; $F_R = 18.4 \text{ kN/m}$
Factor of safety; $FoS_S = 1.669$; Allowable factor of safety; $FoS_{S,allow} = 1.000$

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Section Gabion Wall: Case 1				Sheet no./rev. 11	
Calc. by D	Date 09/04/2020	Chk'd by	Date	App'd by	Date

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2;	$x_{g2} = 250$ mm;	Vert dist to CoG gabion 2;	$y_{g2} = 375$ mm
Weight of gabion 2;	$W_{g2} = 6.8$ kN/m		
Weight of entire gabion;	$W_g = 6.8$ kN/m;	Horiz distance to CoG;	$x_g = 250$ mm
Vert distance to CoG;	$y_g = 375$ mm;	Correcting for wall inclination;	$x_g = 282$ mm
Vert height diff - inclination;	$H_f = 46$ mm		

Design dimensions

Effect. angle rear plane of wall;	$\alpha = 95.0$ deg;	Effective face angle;	$\theta = 85.0$ deg
Effective height of wall;	$H = 747$ mm;	Height - toe to top gabion;	$H_{incl} = 747$ mm
Active pressure;	$K_a = 0.262$		
Active thrust due to soil;	$P_{a,soil} = 1.3$ kN/m		

Horizontal forces

Retained soil;	$F_{soil,h} = 1.7$ kN/m;	Soil thrust height resolved vert.;	$d_{h,soil} = 205$ mm
Surcharge;	$F_{surch,h} = 0.4$ kN/m;	Surcharge thrust height (vert);	$d_{h,surch} = 330$ mm

Vertical forces

Gabion weight;	$F_{gabion,v,f} = 6.8$ kN/m;	Retained soil;	$F_{soil,v,f} = 0.4$ kN/m
Surcharge;	$F_{surch,v,f} = 0.0$ kN/m		

Overturning stability - take moments about the toe

Overturning moment;	$M_o = 0.5$ kNm/m;	Restoring moment;	$M_R = 2.1$ kNm/m
Factor of safety;	$FoSM = 4.334$;	Allowable factor of safety;	$FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force;	$T = 2.1$ kN/m;	Total vertical force;	$N = 7.1$ kN/m
Sliding force;	$F_r = 1.5$ kN/m;	Sliding resistance;	$F_R = 5.1$ kN/m
Factor of safety;	$FoS_s = 3.452$;	Allowable factor of safety;	$FoS_{s,allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 2

Action factor set;	A2		
Perm. unfavourable action;	$\gamma_G = 1.00$;	Permanent favourable action;	$\gamma_{G,f} = 1.00$
Variable unfavourable action;	$\gamma_Q = 1.30$;	Variable favourable action;	$\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 2

Soil factor set;	M2		
Angle of shearing resistance;	$\gamma_\phi = 1.25$;	Weight density;	$\gamma_r = 1.00$

Design soil properties

Design shearing resist angle;	$\phi'_{rd} = 24.8$ deg;	Design sat. density of soil;	$\gamma_{s,d} = 18$ kN/m ³
Design wall friction angle;	$\delta_{rd} = 18.3$ deg;	Design base friction angle;	$\delta_{bb,d} = 24.8$ deg

Wall geometry

Horiz dist to CoG gabion 1;	$x_{g1} = 500$ mm;	Vert dist to CoG gabion 1;	$y_{g1} = 500$ mm
Weight of gabion 1;	$W_{g1} = 18.0$ kN/m		
Horiz dist to CoG gabion 2;	$x_{g2} = 250$ mm;	Vert dist to CoG gabion 2;	$y_{g2} = 1375$ mm
Weight of gabion 2;	$W_{g2} = 6.8$ kN/m		

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Weight of entire gabion; $W_g = 24.8 \text{ kN/m}$; Horiz distance to CoG; $x_g = 432 \text{ mm}$
 Vert distance to CoG; $y_g = 739 \text{ mm}$; Correcting for wall inclination; $X_g = 495 \text{ mm}$
 Vert height diff - inclination; $H_f = 50 \text{ mm}$

Design dimensions

Effect. angle rear plane of wall; $\alpha = 79.1 \text{ deg}$; Effective face angle; $\theta = 85.0 \text{ deg}$
 Effective height of wall; $H = 1787 \text{ mm}$; Height - toe to top gabion; $H_{incl} = 1743 \text{ mm}$
 Active pressure; $K_a = 0.450$
 Active thrust due to soil; $P_{a,soil} = 12.9 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 11.3 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 508 \text{ mm}$
 Surcharge; $F_{surch,h} = 1.4 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 806 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 24.8 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 6.3 \text{ kN/m}$
 Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 6.8 \text{ kNm/m}$; Restoring moment; $M_R = 17.8 \text{ kNm/m}$
 Factor of safety; $FoSM = 2.605$; Allowable factor of safety; $FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 12.6 \text{ kN/m}$; Total vertical force; $N = 31.1 \text{ kN/m}$
 Sliding force; $F_f = 9.9 \text{ kN/m}$; Sliding resistance; $F_R = 14.8 \text{ kN/m}$
 Factor of safety; $FoSS = 1.497$; Allowable factor of safety; $FoSS_{allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2; $x_{g2} = 250 \text{ mm}$; Vert dist to CoG gabion 2; $y_{g2} = 375 \text{ mm}$
 Weight of gabion 2; $W_{g2} = 6.8 \text{ kN/m}$
 Weight of entire gabion; $W_g = 6.8 \text{ kN/m}$; Horiz distance to CoG; $x_g = 250 \text{ mm}$
 Vert distance to CoG; $y_g = 375 \text{ mm}$; Correcting for wall inclination; $X_g = 282 \text{ mm}$
 Vert height diff - inclination; $H_f = 46 \text{ mm}$

Design dimensions

Effect. angle rear plane of wall; $\alpha = 95.0 \text{ deg}$; Effective face angle; $\theta = 85.0 \text{ deg}$
 Effective height of wall; $H = 747 \text{ mm}$; Height - toe to top gabion; $H_{incl} = 747 \text{ mm}$
 Active pressure; $K_a = 0.327$
 Active thrust due to soil; $P_{a,soil} = 1.6 \text{ kN/m}$

Horizontal forces

Retained soil; $F_{soil,h} = 1.6 \text{ kN/m}$; Soil thrust height resolved vert.; $d_{h,soil} = 205 \text{ mm}$
 Surcharge; $F_{surch,h} = 0.5 \text{ kN/m}$; Surcharge thrust height (vert); $d_{h,surch} = 330 \text{ mm}$

Vertical forces

Gabion weight; $F_{gabion,v,f} = 6.8 \text{ kN/m}$; Retained soil; $F_{soil,v,f} = 0.4 \text{ kN/m}$
 Surcharge; $F_{surch,v,f} = 0.0 \text{ kN/m}$

Overturning stability - take moments about the toe

Overturning moment; $M_o = 0.5 \text{ kNm/m}$; Restoring moment; $M_R = 2.1 \text{ kNm/m}$
 Factor of safety; $FoSM = 4.356$; Allowable factor of safety; $FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

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Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force;	$T = 2.1 \text{ kN/m};$	Total vertical force;	$N = 7.1 \text{ kN/m}$
Sliding force;	$F_s = 1.4 \text{ kN/m};$	Sliding resistance;	$F_R = 4.1 \text{ kN/m}$
Factor of safety;	$FoS_s = 2.843;$	Allowable factor of safety;	$FoS_{s_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

— Section OK ✓

PROJECT BEDLUND TERRACE

JOB No. 19/239

SHEET No.

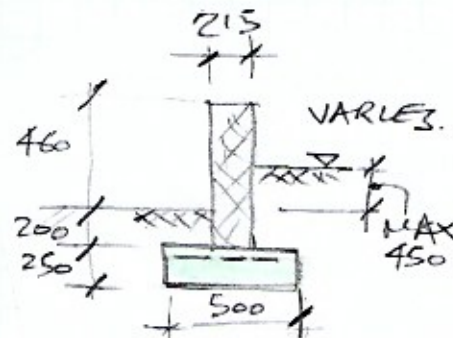
CLIENT HAUS AGENT LTD

DATE APRIL 20

14

SECTIONS C-C D-D & E-E

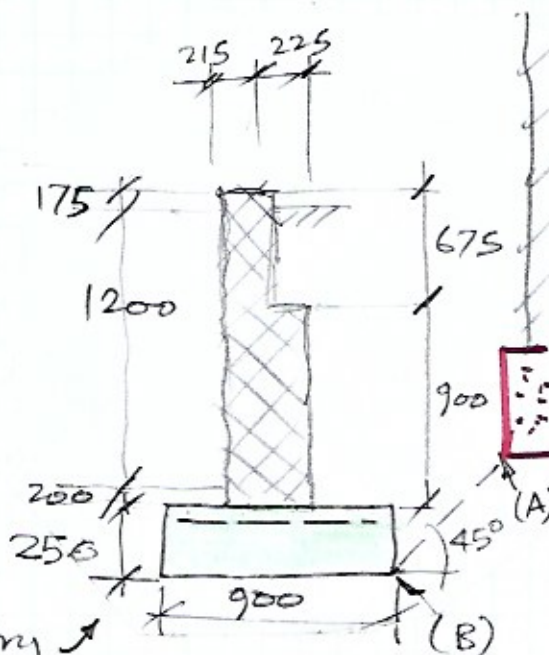
- 10N BLOCKWORK
- MORTAR 1: 1/4: 3



THESE
PARAMETERS
ARE ACCEPTABLE
IN ACCORDANCE
WITH GBG 27

SEE
SHEETS
15816

SECTION C-C - try

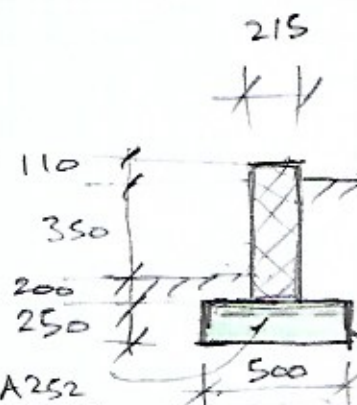


THESE
PARAMETER
ARE ACCEPTABLE
IN ACCORDANCE
WITH GBG 27

SECTION D-D

try

NOTE (A) MUST
NOT BE HIGHER
THAN THE
DASHED LINE
CUT FROM (B)



THESE
PARAMETERS ARE
ACCEPTABLE
IN ACCORDANCE WITH
GBG 27

SECTION E-E

A252
MESH

try:

GEN 3 CONCRETE

Recommended mixes for reinforced walls

		Ready-mixed	Site mixed
		to BS 5328	
For low sulfate soils		Designated RC35 mix or designed C35 mix (specify maximum water/cement ratio of 0.6 and minimum cement content 300 kg/m ³ for 20 mm maximum aggregate size). Nominal slump 75 mm for either option.	SITE MIXING IS NOT RECOMMENDED FOR REINFORCED WALLS
For soils with higher sulfate levels (see Digest 363 for classes)	Class	2 Designated FND2 3 Designated FND3 4 Designated FND4	

Specifications for bricks and blocks

Bricks
Minimum density 1500 kg/m³

Blocks
Minimum density 1700 kg/m³
Minimum strength 10.5 N/mm²

Remember!

Always check with the building supply merchant or the brick or block supplier that the bricks or blocks to be used provide moderate adhesion.

Suggested mortar mixes

Designation (i) mix
● 1 part PC 42.5 (OPC)
● 1/4 part lime
● 3 parts sand (Type S to BS 1200)

Designation (ii) mix
● 1 part PC 42.5 (OPC)
● 1/2 part lime
● 4 1/2 parts sand (Type S to BS 1200)

Bricks and blocks

Minimum density and strength for bricks and blocks is shown on the left.

Normally, calcium silicate bricks of Class 3 or stronger to BS 187, and dense concrete blocks and concrete bricks to BS 6073 are sufficiently frost resistant for use in most UK locations.

Use type MN or ML clay bricks to BS 3921 between the dpcs, but only if the coping/capping and high level dpc provide adequate protection to avoid saturation (see *Good Building Guide 17*).

Use type FL or FN clay bricks (or calcium silicate bricks of Class 4 or stronger) throughout the wall if it is difficult to provide rain protection or where there is a high risk of frost attack – for example, in areas with a high driving rain index (see *Climate and brickwork construction notes*).

Use frost resistant clay bricks (or calcium silicate bricks of Class 4 or stronger) above a high-level dpc, and from the top of the foundation to 200 mm above finished ground level in front of the wall.

The sizing of walls given in this guide assumes a moderate degree of adhesion between the mortar and the bricks or blocks. Do not use bricks or blocks which do not provide moderate adhesion. See BS 5628:Part 3 for advice on adjusting the moisture content of the mortar to achieve the required adhesion. Check after 7 days that using strong hand force only cannot dislodge the units from the wall.

Mortars

For most locations the Designation (ii) mortar mix is recommended for all levels in the wall (see Digest 362). If building in a very wet location, use a Designation (i) mortar below the low level dpc.

If normal salt content clay bricks (Designation N) are used, or if sulfates in the soil exceed Class 1 (see Digest 363), the use of sulfate-resisting Portland cement (SRPC) is recommended.

Use Type S (coarser) sands to BS 1199/1200.

Movement joint

Sealing movement joints improves the weather-tightness of the wall and may enhance its appearance. Make sure that the sealant and the backing to the sealant can accommodate the expected movement. See BS 6093 and BS 6213 for guidance on selecting and applying sealants.

EXTRACTS FROM GBG 27

Straight walls

Brickwork

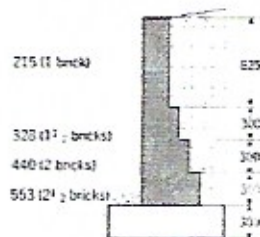
Maximum height
of retained soil (mm)

825

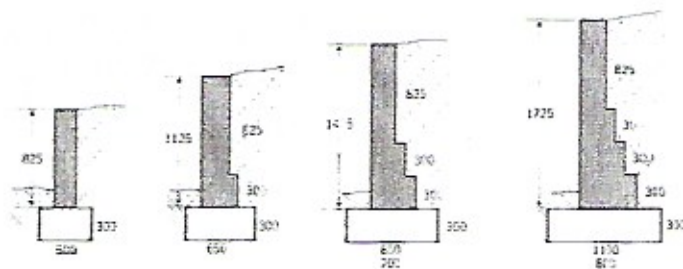
1125

1425

1725



Section showing the stepped increase in
wall thickness (mm)



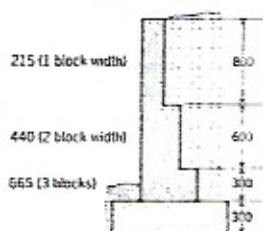
Blockwork (laid flat)

Maximum height
of retained soil (mm)

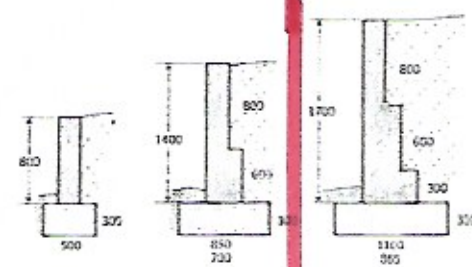
800

1400

1725



Section showing the stepped increase in
wall thickness (mm)



Remember!

The dimensions
shown in red may
be used only if the
wall is founded
on non-cohesive
soil (see page 2).

Staggered walls

Brickwork

Maximum height
of retained soil (mm)

1200

1350

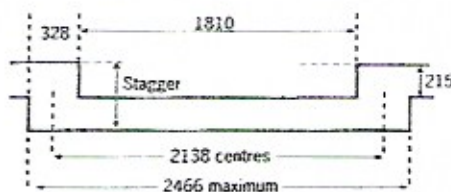
1575

Stagger (mm)

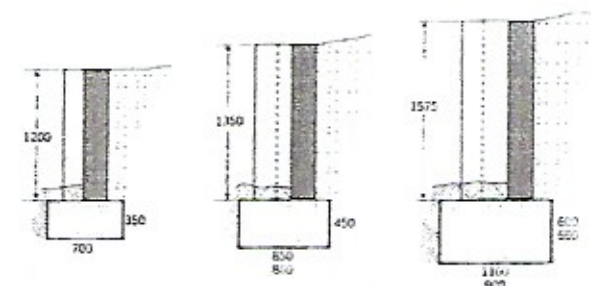
440

553

665



Plan view showing panel dimensions (mm)
for staggered brickwork walls



Blockwork (laid flat)

Maximum height
of retained soil (mm)

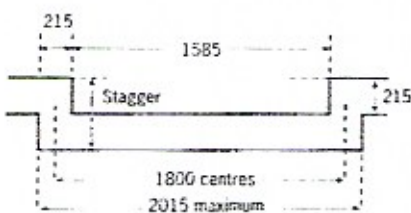
1100

1500

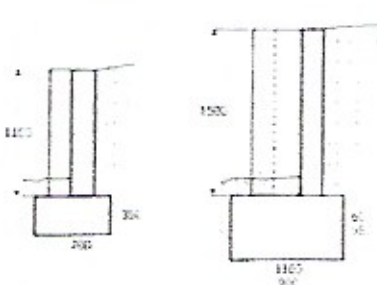
Stagger (mm)

440

665



Plan view showing panel dimensions (mm)
for staggered blockwork walls



Remember!

The dimensions
shown in red may
be used only if the
wall is founded
on non-cohesive
soil (see page 2).