\_exVarsLib = "$(SysLbrDir)Gabion wall design-EN1997-si-engb.lbr"

\_exVarsItem = "Example variables 01"

EvalIf( GetVar("\_exFirstCalculate", True) == True, "EvalCalcItem(\_exVarsLib, \_exVarsItem)" ) = **0.000**

\_exFirstCalculate = False

Gabion retaining wall anlysis & design

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

Tedds calculation version 2.0.03

Design summary

Combination 1

| Action | Resistance | Force | FoS | Allowable FoS | Status |
| --- | --- | --- | --- | --- | --- |
| **Overturning, sliding and bearing at base level** | | | | | |
| Overturning (kNm/m) | 8869.5 | 1949.0 | 4.551 | 1.000 | PASS |
| Sliding (kN/m) | 1188.5 | 555.6 | 2.139 | 1.000 | PASS |
| Bearing (kN/m2) | 300.0 | 263.7 | 1.138 | 1.000 | PASS |
| Eccentricity (mm) | Reaction acts within the middle third of base | | | | PASS |
| **Overturning and sliding between courses 1 and 2** | | | | | |
| Overturning (kNm/m) | 6468.2 | 1446.1 | 4.473 | 1.000 | PASS |
| Sliding (kN/m) | 998.7 | 455.8 | 2.191 | 1.000 | PASS |
| **Overturning and sliding between courses 2 and 3** | | | | | |
| Overturning (kNm/m) | 4544.9 | 1037.7 | 4.380 | 1.000 | PASS |
| Sliding (kN/m) | 788.5 | 365.8 | 2.155 | 1.000 | PASS |
| **Overturning and sliding between courses 3 and 4** | | | | | |
| Overturning (kNm/m) | 3046.6 | 714.1 | 4.266 | 1.000 | PASS |
| Sliding (kN/m) | 603.1 | 285.6 | 2.112 | 1.000 | PASS |
| **Overturning and sliding between courses 4 and 5** | | | | | |
| Overturning (kNm/m) | 1920.0 | 465.4 | 4.126 | 1.000 | PASS |
| Sliding (kN/m) | 442.6 | 215.1 | 2.057 | 1.000 | PASS |
| **Overturning and sliding between courses 5 and 6** | | | | | |
| Overturning (kNm/m) | 1112.4 | 281.8 | 3.947 | 1.000 | PASS |
| Sliding (kN/m) | 307.0 | 154.5 | 1.987 | 1.000 | PASS |
| **Overturning and sliding between courses 6 and 7** | | | | | |
| Overturning (kNm/m) | 570.6 | 153.6 | 3.714 | 1.000 | PASS |
| Sliding (kN/m) | 196.2 | 103.5 | 1.896 | 1.000 | PASS |
| **Overturning and sliding between courses 7 and 8** | | | | | |
| Overturning (kNm/m) | 241.6 | 71.0 | 3.404 | 1.000 | PASS |
| Sliding (kN/m) | 110.3 | 62.2 | 1.772 | 1.000 | PASS |
| **Overturning and sliding between courses 8 and 9** | | | | | |
| Overturning (kNm/m) | 72.4 | 24.1 | 3.007 | 1.000 | PASS |
| Sliding (kN/m) | 49.3 | 30.5 | 1.618 | 1.000 | PASS |
| **Overturning and sliding between courses 9 and 10** | | | | | |
| Overturning (kNm/m) | 10.1 | 3.2 | 3.126 | 1.000 | PASS |
| Sliding (kN/m) | 13.4 | 7.6 | 1.754 | 1.000 | PASS |

Combination 2

| Action | Resistance | Force | FoS | Allowable FoS | Status |
| --- | --- | --- | --- | --- | --- |
| **Overturning, sliding and bearing at base level** | | | | | |
| Overturning (kNm/m) | 8903.7 | 1779.0 | 5.005 | 1.000 | PASS |
| Sliding (kN/m) | 953.5 | 503.4 | 1.894 | 1.000 | PASS |
| Bearing (kN/m2) | 300.0 | 263.7 | 1.138 | 1.000 | PASS |
| Eccentricity (mm) | Reaction acts within the middle third of base | | | | PASS |
| **Overturning and sliding between courses 1 and 2** | | | | | |
| Overturning (kNm/m) | 6495.6 | 1321.9 | 4.914 | 1.000 | PASS |
| Sliding (kN/m) | 801.4 | 413.3 | 1.939 | 1.000 | PASS |
| **Overturning and sliding between courses 2 and 3** | | | | | |
| Overturning (kNm/m) | 4566.2 | 950.2 | 4.805 | 1.000 | PASS |
| Sliding (kN/m) | 632.9 | 332.1 | 1.906 | 1.000 | PASS |
| **Overturning and sliding between courses 3 and 4** | | | | | |
| Overturning (kNm/m) | 3062.5 | 655.3 | 4.673 | 1.000 | PASS |
| Sliding (kN/m) | 484.3 | 259.6 | 1.865 | 1.000 | PASS |
| **Overturning and sliding between courses 4 and 5** | | | | | |
| Overturning (kNm/m) | 1931.4 | 428.3 | 4.510 | 1.000 | PASS |
| Sliding (kN/m) | 355.5 | 195.9 | 1.815 | 1.000 | PASS |
| **Overturning and sliding between courses 5 and 6** | | | | | |
| Overturning (kNm/m) | 1120.0 | 260.3 | 4.303 | 1.000 | PASS |
| Sliding (kN/m) | 246.7 | 141.0 | 1.750 | 1.000 | PASS |
| **Overturning and sliding between courses 6 and 7** | | | | | |
| Overturning (kNm/m) | 575.2 | 142.6 | 4.033 | 1.000 | PASS |
| Sliding (kN/m) | 157.8 | 94.9 | 1.663 | 1.000 | PASS |
| **Overturning and sliding between courses 7 and 8** | | | | | |
| Overturning (kNm/m) | 243.9 | 66.4 | 3.672 | 1.000 | PASS |
| Sliding (kN/m) | 88.8 | 57.4 | 1.546 | 1.000 | PASS |
| **Overturning and sliding between courses 8 and 9** | | | | | |
| Overturning (kNm/m) | 73.2 | 22.9 | 3.193 | 1.000 | PASS |
| Sliding (kN/m) | 39.7 | 28.6 | 1.390 | 1.000 | PASS |
| **Overturning and sliding between courses 9 and 10** | | | | | |
| Overturning (kNm/m) | 10.1 | 3.3 | 3.038 | 1.000 | PASS |
| Sliding (kN/m) | 10.7 | 7.7 | 1.384 | 1.000 | PASS |



Wall geometry

Width of gabion 1; w1 = **10000** mm

Height of gabion 1; h1 = **1000** mm

Width of gabion 2; w2 = **9000** mm

Height of gabion 2; h2 = **1000** mm

Step to front face between courses 1 and 2; s2 = **0** mm

Width of gabion 3; w3 = **8000** mm

Height of gabion 3; h3 = **1000** mm

Step to front face between courses 2 and 3; s3 = **0** mm

Width of gabion 4; w4 = **7000** mm

Height of gabion 4; h4 = **1000** mm

Step to front face between courses 3 and 4; s4 = **0** mm

Width of gabion 5; w5 = **6000** mm

Height of gabion 5; h5 = **1000** mm

Step to front face between courses 4 and 5; s5 = **0** mm

Width of gabion 6; w6 = **5000** mm

Height of gabion 6; h6 = **1000** mm

Step to front face between courses 5 and 6; s6 = **0** mm

Width of gabion 7; w7 = **4000** mm

Height of gabion 7; h7 = **1000** mm

Step to front face between courses 6 and 7; s7 = **0** mm

Width of gabion 8; w8 = **3000** mm

Height of gabion 8; h8 = **1000** mm

Step to front face between courses 7 and 8; s8 = **0** mm

Width of gabion 9; w9 = **2000** mm

Height of gabion 9; h9 = **1000** mm

Step to front face between courses 8 and 9; s9 = **0** mm

Width of gabion 10; w10 = **1000** mm

Height of gabion 10; h10 = **1000** mm

Step to front face between courses 9 and 10; s10 = **0** mm

Wall inclination; e = **0** deg

Gabion properties

Unit weight of fill; gd = **18.0** kN/m3

Friction between gabions; dbg.k = **35.0** deg

Loading

Variable surcharge; po,Q = **10** kN/m2

Soil properties

Slope of retained soil; b = **0.0** deg

Characteristic effective shearing resistance angle; f’r.k = **30.0** deg

Characteristic saturated density of retained soil; gsr = **19.0** kN/m3

Coefficient for wall friction; kmembrane = **0.75**

Wall friction angle; dr.k = **22.5** deg

Characteristic base friction angle; dbb.k = **34.0** deg

Bearing capacity of founding soil; q = **300** kN/m2

Wall geometry

Horizontal distance to centre of gravity gabion 1; xg1 = w1 / 2 = **5000** mm

Vertical distance to centre of gravity gabion 1; yg1 = h1 / 2 = **500** mm

Weight of gabion 1; Wg1 = gd ´ w1 ´ h1 = **180.0** kN/m

Horizontal distance to centre of gravity gabion 2; xg2 = w2 / 2 + s2 = **4500** mm

Vertical distance to centre of gravity gabion 2; yg2 = h2 / 2 + h1 = **1500** mm

Weight of gabion 2; Wg2 = gd ´ w2 ´ h2 = **162.0** kN/m

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 + s2 + s3 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 + h1 + h2 = **2500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s2 + s3 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h1 + h2 + h3 = **3500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s2 + s3 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h1 + h2 + h3 + h4 = **4500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s2 + s3 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h1 + h2 + h3 + h4 + h5 = **5500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s2 + s3 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h1 + h2 + h3 + h4 + h5 + h6 = **6500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 = **7500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 + h8 = **8500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **9500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg1 + Wg2 + Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **990.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg1 ´ xg1) + (Wg2 ´ xg2) + (Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **3500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg1 ´ yg1) + (Wg2 ´ yg2) + (Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **3500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **3500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w1 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.0** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w1 ´ sin(e)) - Hf = **10000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **10000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.k)2 / (sin(a)2 ´ sin(a - dr.k) ´ (1 + Ö(sin(f'r.k + dr.k) ´ sin(f'r.k - b) / (sin(a - dr.k) ´ sin(a + b))))2) = **0.901**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gsr ´ H2 = **855.5** kN/m

Pressure at base

Horizontal forces

Retained soil; Fsoil\_h,q = Pa,soil ´ cos(90 - a + dr.k) = **368.5** kN/m

Height of soil thrust resolved vertically; dh,soil = H / 3 - w1 ´ sin(e) = **3333** mm

Surcharge; Fsurch\_h,q = po,Q ´ Ka ´ H ´ cos(90 - a + dr.k) = **38.8** kN/m

Height of surcharge thrust resolved vertically; dh,surch = H / 2 - w1 ´ sin(e) = **5000** mm

Vertical forces

Gabion weight; Fgabion\_v,q = Wg = **990.0** kN/m

Retained soil; Fsoil\_v,q = Pa,soil ´ sin(90 - a + dr.k) = **772.1** kN/m

Horizontal dist to where soil thrust acts; bv,soil = w1 ´ cos(e) - (H / 3) / tan(a) = **7000** mm

Surcharge; Fsurch\_v,q = po,Q ´ Ka ´ H ´ sin(90 - a + dr.k) = **81.3** kN/m

Horizontal dist to where surcharge thrust acts; bv,surch = w1 ´ cos(e) - (H / 2) / tan(a) = **5500** mm

Total horizontal unfactored force; Tq = Fsoil\_h,q + Fsurch\_h,q = **407.3** kN/m

Total vertical unfactored force; Nq = Fgabion\_v,q + Fsoil\_v,q + Fsurch\_v,q = **1843.3** kN/m

Force normal to base; Ns = Nq ´ cos(e) + Tq ´ sin(e) = **1843.3** kN/m

Total unfactored overturning force; Mo,q = Fsoil\_h,q ´ dh,soil + Fsurch\_h,q ´ dh,surch = **1422.2** kNm/m

Total unfactored restoring force; MR,q = Fgabion\_v,q ´ Xg + Fsoil\_v,q ´ bv,soil + Fsurch\_v,q ´ bv,surch = **9316.5** kNm/m

Eccentricity; e = w1 / 2 - (MR,q - Mo,q) / Ns = **717** mm

Reaction acts within middle third of base

Pressure at toe; stoe = Ns / w1 ´ (1 + (6 ´ e / w1)) = **263.7** kN/m2

Pressure at heel; sheel = Ns / w1 ´ (1 - (6 ´ e / w1)) = **105.0** kN/m2

Factor of safety; FoSQ = q / max(stoe, sheel) = **1.138**

Allowable factor of safety; FoSQ\_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

Permanent unfavourable action; gG = **1.35**

Permanent favourable action; gG,f = **1.00**

Variable unfavourable action; gQ = **1.50**

Variable favourable action; gQ,f = **0.00**

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

Angle of shearing resistance; gf' = **1.00**

Weight density; gg = **1.00**

Design soil properties

Design effective shearing resistance angle; f’r.d = Atan(tan(f'r.k) / gf') = **30.0** deg

Design saturated density of retained soil; gs.d = gsr / gg = **19.0** kN/m3

Design wall friction angle; dr.d = min(atan(tan(dr.k) / gf'), f'r.d ´ kmembrane) = **22.5** deg

Design base friction angle; dbb.d = Atan(tan(dbb.k) / gf') = **34.0** deg

Design friction between gabions; dbg.d = Atan(tan(dbg.k) / gf') = **35.0** deg

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.901**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **855.5** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **497.4** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **58.2** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **990.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **772.1** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **1949.0** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **8869.5** kNm/m

Factor of safety; FoSM = MR / Mo = **4.551**

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 = Fsoil\_h + Fsurch\_h = **555.6** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1762.1** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **555.6** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbb.d) = **1188.5** kN/m

Factor of safety; FoSS = FR / Ff = **2.139**

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

Horizontal distance to centre of gravity gabion 2; xg2 = w2 / 2 = **4500** mm

Vertical distance to centre of gravity gabion 2; yg2 = h2 / 2 = **500** mm

Weight of gabion 2; Wg2 = gd ´ w2 ´ h2 = **162.0** kN/m

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 + s3 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 + h2 = **1500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s3 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h2 + h3 = **2500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s3 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h2 + h3 + h4 = **3500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s3 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h2 + h3 + h4 + h5 = **4500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s3 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h2 + h3 + h4 + h5 + h6 = **5500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s3 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h2 + h3 + h4 + h5 + h6 + h7 = **6500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h2 + h3 + h4 + h5 + h6 + h7 + h8 = **7500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **8500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg2 + Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **810.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg2 ´ xg2) + (Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **3167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg2 ´ yg2) + (Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **3167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **3167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w2 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w2 ´ sin(e)) - Hf = **9000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **9000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.890**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **684.9** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **403.4** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **52.4** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **810.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **616.3** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **1446.1** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **6468.2** kNm/m

Factor of safety; FoSM = MR / Mo = **4.473**

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 = Fsoil\_h + Fsurch\_h = **455.8** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1426.3** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **455.8** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **998.7** kN/m

Factor of safety; FoSS = FR / Ff = **2.191**

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 2 and 3

Wall geometry

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 = **500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h3 = **1500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h3 + h4 = **2500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h3 + h4 + h5 = **3500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h3 + h4 + h5 + h6 = **4500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h3 + h4 + h5 + h6 + h7 = **5500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h3 + h4 + h5 + h6 + h7 + h8 = **6500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **7500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **648.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w3 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.8** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w3 ´ sin(e)) - Hf = **8000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **8000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.877**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **533.3** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **319.2** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **46.7** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **648.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **478.0** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **1037.7** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **4544.9** kNm/m

Factor of safety; FoSM = MR / Mo = **4.380**

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 = Fsoil\_h + Fsurch\_h = **365.8** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1126.0** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **365.8** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **788.5** kN/m

Factor of safety; FoSS = FR / Ff = **2.155**

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 3 and 4

Wall geometry

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 = **500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h4 = **1500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h4 + h5 = **2500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h4 + h5 + h6 = **3500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h4 + h5 + h6 + h7 = **4500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h4 + h5 + h6 + h7 + h8 = **5500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h4 + h5 + h6 + h7 + h8 + h9 = **6500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **504.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w4 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **49.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w4 ´ sin(e)) - Hf = **7000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **7000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.861**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **400.7** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **244.7** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **40.9** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **504.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **357.3** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **714.1** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **3046.6** kNm/m

Factor of safety; FoSM = MR / Mo = **4.266**

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 = Fsoil\_h + Fsurch\_h = **285.6** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **861.3** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **285.6** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **603.1** kN/m

Factor of safety; FoSS = FR / Ff = **2.112**

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 4 and 5

Wall geometry

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 = **500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h5 = **1500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h5 + h6 = **2500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h5 + h6 + h7 = **3500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h5 + h6 + h7 + h8 = **4500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h5 + h6 + h7 + h8 + h9 = **5500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **378.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w5 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **50.2** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w5 ´ sin(e)) - Hf = **6000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **6000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.839**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **287.0** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **180.0** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **35.1** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **378.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **254.1** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **465.4** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **1920.0** kNm/m

Factor of safety; FoSM = MR / Mo = **4.126**

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 = Fsoil\_h + Fsurch\_h = **215.1** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **632.1** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **215.1** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **442.6** kN/m

Factor of safety; FoSS = FR / Ff = **2.057**

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 5 and 6

Wall geometry

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 = **500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h6 = **1500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h6 + h7 = **2500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h6 + h7 + h8 = **3500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h6 + h7 + h8 + h9 = **4500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **270.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w6 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **51.3** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w6 ´ sin(e)) - Hf = **5000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **5000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.809**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **192.2** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **125.2** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **29.3** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **270.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **168.4** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **281.8** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **1112.4** kNm/m

Factor of safety; FoSM = MR / Mo = **3.947**

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 = Fsoil\_h + Fsurch\_h = **154.5** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **438.4** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **154.5** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **307.0** kN/m

Factor of safety; FoSS = FR / Ff = **1.987**

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 6 and 7

Wall geometry

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 = **500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h7 = **1500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h7 + h8 = **2500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h7 + h8 + h9 = **3500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg7 + Wg8 + Wg9 + Wg10 = **180.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w7 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **53.1** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w7 ´ sin(e)) - Hf = **4000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **4000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.766**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **116.4** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **80.1** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **23.4** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **180.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **100.2** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **153.6** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **570.6** kNm/m

Factor of safety; FoSM = MR / Mo = **3.714**

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 = Fsoil\_h + Fsurch\_h = **103.5** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **280.2** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **103.5** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **196.2** kN/m

Factor of safety; FoSS = FR / Ff = **1.896**

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 7 and 8

Wall geometry

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 = **500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h8 = **1500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h8 + h9 = **2500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg8 + Wg9 + Wg10 = **108.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w8 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **56.3** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w8 ´ sin(e)) - Hf = **3000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **3000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.697**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **59.6** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **44.8** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **17.5** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **108.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **49.5** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **71.0** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **241.6** kNm/m

Factor of safety; FoSM = MR / Mo = **3.404**

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 = Fsoil\_h + Fsurch\_h = **62.2** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **157.5** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **62.2** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **110.3** kN/m

Factor of safety; FoSS = FR / Ff = **1.772**

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 8 and 9

Wall geometry

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 = **500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h9 = **1500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg9 + Wg10 = **54.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w9 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **63.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w9 ´ sin(e)) - Hf = **2000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **2000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.572**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **21.7** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **19.2** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **11.2** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **54.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **16.4** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **24.1** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **72.4** kNm/m

Factor of safety; FoSM = MR / Mo = **3.007**

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 = Fsoil\_h + Fsurch\_h = **30.5** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **70.4** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **30.5** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **49.3** kN/m

Factor of safety; FoSS = FR / Ff = **1.618**

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 9 and 10

Wall geometry

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 = **500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg10 = **18.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg10 ´ xg10)) / Wg = **500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg10 ´ yg10)) / Wg = **500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90 deg + e = **90.0** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w10 ´ sin(e)) - Hf = **1000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **1000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.296**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **2.8** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **3.5** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **4.1** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **18.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **1.1** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **3.2** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **10.1** kNm/m

Factor of safety; FoSM = MR / Mo = **3.126**

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 = Fsoil\_h + Fsurch\_h = **7.6** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **19.1** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **7.6** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **13.4** kN/m

Factor of safety; FoSS = FR / Ff = **1.754**

Allowable factor of safety; FoSS\_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

Permanent unfavourable action; gG = **1.00**

Permanent favourable action; gG,f = **1.00**

Variable unfavourable action; gQ = **1.30**

Variable favourable action; gQ,f = **0.00**

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

Angle of shearing resistance; gf' = **1.25**

Weight density; gg = **1.00**

Design soil properties

Design effective shearing resistance angle; f’r.d = Atan(tan(f'r.k) / gf') = **24.8** deg

Design saturated density of retained soil; gs.d = gsr / gg = **19.0** kN/m3

Design wall friction angle; dr.d = min(atan(tan(dr.k) / gf'), f'r.d ´ kmembrane) = **18.3** deg

Design base friction angle; dbb.d = Atan(tan(dbb.k) / gf') = **28.4** deg

Design friction between gabions; dbg.d = Atan(tan(dbg.k) / gf') = **29.3** deg

Wall geometry

Horizontal distance to centre of gravity gabion 1; xg1 = w1 / 2 = **5000** mm

Vertical distance to centre of gravity gabion 1; yg1 = h1 / 2 = **500** mm

Weight of gabion 1; Wg1 = gd ´ w1 ´ h1 = **180.0** kN/m

Horizontal distance to centre of gravity gabion 2; xg2 = w2 / 2 + s2 = **4500** mm

Vertical distance to centre of gravity gabion 2; yg2 = h2 / 2 + h1 = **1500** mm

Weight of gabion 2; Wg2 = gd ´ w2 ´ h2 = **162.0** kN/m

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 + s2 + s3 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 + h1 + h2 = **2500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s2 + s3 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h1 + h2 + h3 = **3500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s2 + s3 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h1 + h2 + h3 + h4 = **4500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s2 + s3 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h1 + h2 + h3 + h4 + h5 = **5500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s2 + s3 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h1 + h2 + h3 + h4 + h5 + h6 = **6500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 = **7500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 + h8 = **8500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h1 + h2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **9500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg1 + Wg2 + Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **990.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg1 ´ xg1) + (Wg2 ´ xg2) + (Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **3500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg1 ´ yg1) + (Wg2 ´ yg2) + (Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **3500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **3500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w1 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.0** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w1 ´ sin(e)) - Hf = **10000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **10000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.941**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **894.3** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **442.8** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **60.6** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **990.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **777.0** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **1779.0** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **8903.7** kNm/m

Factor of safety; FoSM = MR / Mo = **5.005**

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 = Fsoil\_h + Fsurch\_h = **503.4** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1767.0** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **503.4** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbb.d) = **953.5** kN/m

Factor of safety; FoSS = FR / Ff = **1.894**

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

Horizontal distance to centre of gravity gabion 2; xg2 = w2 / 2 = **4500** mm

Vertical distance to centre of gravity gabion 2; yg2 = h2 / 2 = **500** mm

Weight of gabion 2; Wg2 = gd ´ w2 ´ h2 = **162.0** kN/m

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 + s3 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 + h2 = **1500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s3 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h2 + h3 = **2500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s3 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h2 + h3 + h4 = **3500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s3 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h2 + h3 + h4 + h5 = **4500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s3 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h2 + h3 + h4 + h5 + h6 = **5500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s3 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h2 + h3 + h4 + h5 + h6 + h7 = **6500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h2 + h3 + h4 + h5 + h6 + h7 + h8 = **7500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s3 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **8500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg2 + Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **810.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg2 ´ xg2) + (Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **3167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg2 ´ yg2) + (Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **3167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **3167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w2 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w2 ´ sin(e)) - Hf = **9000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **9000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.932**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **716.9** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **358.8** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **54.6** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **810.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **620.6** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **1321.9** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **6495.6** kNm/m

Factor of safety; FoSM = MR / Mo = **4.914**

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 = Fsoil\_h + Fsurch\_h = **413.3** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1430.6** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **413.3** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **801.4** kN/m

Factor of safety; FoSS = FR / Ff = **1.939**

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 2 and 3

Wall geometry

Horizontal distance to centre of gravity gabion 3; xg3 = w3 / 2 = **4000** mm

Vertical distance to centre of gravity gabion 3; yg3 = h3 / 2 = **500** mm

Weight of gabion 3; Wg3 = gd ´ w3 ´ h3 = **144.0** kN/m

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 + s4 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 + h3 = **1500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s4 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h3 + h4 = **2500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s4 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h3 + h4 + h5 = **3500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s4 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h3 + h4 + h5 + h6 = **4500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s4 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h3 + h4 + h5 + h6 + h7 = **5500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s4 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h3 + h4 + h5 + h6 + h7 + h8 = **6500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s4 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h3 + h4 + h5 + h6 + h7 + h8 + h9 = **7500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg3 + Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **648.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg3 ´ xg3) + (Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg3 ´ yg3) + (Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w3 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **48.8** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w3 ´ sin(e)) - Hf = **8000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **8000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.920**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **559.1** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **283.6** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **48.5** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **648.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **481.8** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **950.2** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **4566.2** kNm/m

Factor of safety; FoSM = MR / Mo = **4.805**

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 = Fsoil\_h + Fsurch\_h = **332.1** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **1129.8** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **332.1** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **632.9** kN/m

Factor of safety; FoSS = FR / Ff = **1.906**

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 3 and 4

Wall geometry

Horizontal distance to centre of gravity gabion 4; xg4 = w4 / 2 = **3500** mm

Vertical distance to centre of gravity gabion 4; yg4 = h4 / 2 = **500** mm

Weight of gabion 4; Wg4 = gd ´ w4 ´ h4 = **126.0** kN/m

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 + s5 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 + h4 = **1500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s5 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h4 + h5 = **2500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s5 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h4 + h5 + h6 = **3500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s5 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h4 + h5 + h6 + h7 = **4500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s5 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h4 + h5 + h6 + h7 + h8 = **5500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s5 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h4 + h5 + h6 + h7 + h8 + h9 = **6500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg4 + Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **504.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg4 ´ xg4) + (Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg4 ´ yg4) + (Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w4 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **49.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w4 ´ sin(e)) - Hf = **7000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **7000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.904**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **420.9** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **217.2** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **42.5** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **504.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **360.5** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **655.3** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **3062.5** kNm/m

Factor of safety; FoSM = MR / Mo = **4.673**

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 = Fsoil\_h + Fsurch\_h = **259.6** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **864.5** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **259.6** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **484.3** kN/m

Factor of safety; FoSS = FR / Ff = **1.865**

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 4 and 5

Wall geometry

Horizontal distance to centre of gravity gabion 5; xg5 = w5 / 2 = **3000** mm

Vertical distance to centre of gravity gabion 5; yg5 = h5 / 2 = **500** mm

Weight of gabion 5; Wg5 = gd ´ w5 ´ h5 = **108.0** kN/m

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 + s6 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 + h5 = **1500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s6 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h5 + h6 = **2500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s6 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h5 + h6 + h7 = **3500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s6 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h5 + h6 + h7 + h8 = **4500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s6 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h5 + h6 + h7 + h8 + h9 = **5500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg5 + Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **378.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg5 ´ xg5) + (Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **2167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg5 ´ yg5) + (Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **2167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **2167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w5 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **50.2** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w5 ´ sin(e)) - Hf = **6000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **6000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.884**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **302.3** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **159.5** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **36.4** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **378.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **256.7** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **428.3** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **1931.4** kNm/m

Factor of safety; FoSM = MR / Mo = **4.510**

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 = Fsoil\_h + Fsurch\_h = **195.9** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **634.7** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **195.9** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **355.5** kN/m

Factor of safety; FoSS = FR / Ff = **1.815**

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 5 and 6

Wall geometry

Horizontal distance to centre of gravity gabion 6; xg6 = w6 / 2 = **2500** mm

Vertical distance to centre of gravity gabion 6; yg6 = h6 / 2 = **500** mm

Weight of gabion 6; Wg6 = gd ´ w6 ´ h6 = **90.0** kN/m

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 + s7 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 + h6 = **1500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s7 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h6 + h7 = **2500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s7 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h6 + h7 + h8 = **3500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s7 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h6 + h7 + h8 + h9 = **4500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg6 + Wg7 + Wg8 + Wg9 + Wg10 = **270.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg6 ´ xg6) + (Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg6 ´ yg6) + (Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w6 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **51.3** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w6 ´ sin(e)) - Hf = **5000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **5000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.856**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **203.3** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **110.7** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **30.3** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **270.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **170.5** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **260.3** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **1120.0** kNm/m

Factor of safety; FoSM = MR / Mo = **4.303**

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 = Fsoil\_h + Fsurch\_h = **141.0** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **440.5** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **141.0** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **246.7** kN/m

Factor of safety; FoSS = FR / Ff = **1.750**

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 6 and 7

Wall geometry

Horizontal distance to centre of gravity gabion 7; xg7 = w7 / 2 = **2000** mm

Vertical distance to centre of gravity gabion 7; yg7 = h7 / 2 = **500** mm

Weight of gabion 7; Wg7 = gd ´ w7 ´ h7 = **72.0** kN/m

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 + s8 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 + h7 = **1500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s8 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h7 + h8 = **2500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s8 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h7 + h8 + h9 = **3500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg7 + Wg8 + Wg9 + Wg10 = **180.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg7 ´ xg7) + (Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg7 ´ yg7) + (Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w7 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **53.1** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w7 ´ sin(e)) - Hf = **4000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **4000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.815**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **123.9** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **70.7** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **24.2** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **180.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **101.7** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **142.6** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **575.2** kNm/m

Factor of safety; FoSM = MR / Mo = **4.033**

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 = Fsoil\_h + Fsurch\_h = **94.9** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **281.7** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **94.9** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **157.8** kN/m

Factor of safety; FoSS = FR / Ff = **1.663**

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 7 and 8

Wall geometry

Horizontal distance to centre of gravity gabion 8; xg8 = w8 / 2 = **1500** mm

Vertical distance to centre of gravity gabion 8; yg8 = h8 / 2 = **500** mm

Weight of gabion 8; Wg8 = gd ´ w8 ´ h8 = **54.0** kN/m

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 + s9 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 + h8 = **1500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s9 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h8 + h9 = **2500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg8 + Wg9 + Wg10 = **108.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg8 ´ xg8) + (Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **1167** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg8 ´ yg8) + (Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **1167** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **1167** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w8 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **56.3** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w8 ´ sin(e)) - Hf = **3000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **3000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.750**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **64.1** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **39.4** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **18.0** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **108.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **50.5** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **66.4** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **243.9** kNm/m

Factor of safety; FoSM = MR / Mo = **3.672**

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 = Fsoil\_h + Fsurch\_h = **57.4** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **158.5** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **57.4** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **88.8** kN/m

Factor of safety; FoSS = FR / Ff = **1.546**

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 8 and 9

Wall geometry

Horizontal distance to centre of gravity gabion 9; xg9 = w9 / 2 = **1000** mm

Vertical distance to centre of gravity gabion 9; yg9 = h9 / 2 = **500** mm

Weight of gabion 9; Wg9 = gd ´ w9 ´ h9 = **36.0** kN/m

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 + s10 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 + h9 = **1500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg9 + Wg10 = **54.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg9 ´ xg9) + (Wg10 ´ xg10)) / Wg = **833** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg9 ´ yg9) + (Wg10 ´ yg10)) / Wg = **833** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **833** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90deg - Atan((w9 - (xg10 + (w10 / 2))) / (yg10 + h10 / 2)) + e = **63.4** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w9 ´ sin(e)) - Hf = **2000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **2000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.630**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **23.9** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **17.0** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **11.6** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **54.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **16.9** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **22.9** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **73.2** kNm/m

Factor of safety; FoSM = MR / Mo = **3.193**

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 = Fsoil\_h + Fsurch\_h = **28.6** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **70.9** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **28.6** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **39.7** kN/m

Factor of safety; FoSS = FR / Ff = **1.390**

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 9 and 10

Wall geometry

Horizontal distance to centre of gravity gabion 10; xg10 = w10 / 2 = **500** mm

Vertical distance to centre of gravity gabion 10; yg10 = h10 / 2 = **500** mm

Weight of gabion 10; Wg10 = gd ´ w10 ´ h10 = **18.0** kN/m

Weight of entire gabion; Wg = Wg10 = **18.0** kN/m

Horiz distance to centre of gravity entire gabion; xg = ((Wg10 ´ xg10)) / Wg = **500** mm

Vert distance to centre of gravity entire gabion; yg = ((Wg10 ´ yg10)) / Wg = **500** mm

Correcting for wall inclination horiz dist; Xg = xg ´ cos(e) + yg ´ sin(e) = **500** mm

Vertical change in height due to wall inclination; Hf = yg10 + h10/2 - ((yg10 + h10/2) ´ cos(e) - (xg10 + w10/2) ´ sin(e)) = **0** mm

Design dimensions

Effective angle of rear plane of wall; a = 90 deg + e = **90.0** deg

Effective face angle; q = 90deg - e = **90.0** deg

Effective height of wall; H = (yg10 + h10 / 2) + (w10 ´ sin(e)) - Hf = **1000** mm

Height of wall from toe to front edge of top gabion; Hincl = ((yg10 + h10 / 2) ´ cos(e) - (xg10 - (w10 / 2)) ´ sin(e)) = **1000**mm

Active pressure using Coulomb theory; Ka = sin(a + f'r.d)2 / (sin(a)2 ´ sin(a - dr.d) ´ (1 + Ö(sin(f'r.d + dr.d) ´ sin(f'r.d - b) / (sin(a - dr.d) ´ sin(a + b))))2) = **0.362**

Active thrust due to soil; Pa,soil = 0.5 ´ Ka ´ gs.d ´ H2 = **3.4** kN/m

Horizontal forces

Retained soil; Fsoil\_h = gG ´ Pa,soil ´ cos(90 - a + dr.d) = **3.3** kN/m

Surcharge; Fsurch\_h = po,Q ´ gQ ´ Ka ´ H ´ cos(90 - a + dr.d) = **4.5** kN/m

Vertical forces

Gabion weight; Fgabion\_v,f = gG,f ´ Wg = **18.0** kN/m

Retained soil; Fsoil\_v,f = gG,f ´ Pa,soil ´ sin(90 - a + dr.d) = **1.1** kN/m

Surcharge; Fsurch\_v,f = po,Q ´ gQ,f ´ Ka ´ H ´ sin(90 - a + dr.d) = **0.0** kN/m

Overturning stability - take moments about the toe

Overturning moment; Mo = Fsoil\_h ´ dh,soil + Fsurch\_h ´ dh,surch = **3.3** kNm/m

Restoring moment; MR = Fgabion\_v,f ´ Xg + Fsoil\_v,f ´ bv,soil + Fsurch\_v,f ´ bv,surch = **10.1** kNm/m

Factor of safety; FoSM = MR / Mo = **3.038**

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 = Fsoil\_h + Fsurch\_h = **7.7** kN/m

Total vertical force; N = Fgabion\_v,f + Fsoil\_v,f + Fsurch\_v,f = **19.1** kN/m

Sliding force; Ff = T ´ cos(e) - N ´ sin(e) = **7.7** kN/m

Sliding resistance; FR = (T ´ sin(e) + N ´ cos(e)) ´ tan(dbg.d) = **10.7** kN/m

Factor of safety; FoSS = FR / Ff = **1.384**

Allowable factor of safety; FoSS\_allow = **1.000**

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

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