

Gabion analysis

Input data

Project

Date : 1.7.2018 r/

Settings

Standard - EN 1997 - DA2

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0,333
Verification methodology : according to EN 1997
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)				
Permanent design situation				
		Unfavourable	Favourable	
Permanent actions :	$\gamma_G =$	1,35 [-]	1,00	[-]
Variable actions :	$\gamma_Q =$	1,50 [-]	0,00	[-]
Water load :	$\gamma_w =$	1,35 [-]		

Partial factors for resistances (R)				
Permanent design situation				
Partial factor on overturning :	$\gamma_{Re} =$	1,40	[-]	
Partial factor on sliding resistance :	$\gamma_{Rh} =$	1,10	[-]	
Partial factor on bearing capacity :	$\gamma_{Rv} =$	1,40	[-]	
Partial factor on gabion mesh strength :	$\gamma_{Rn1} =$	1,10	[-]	
Partial factor on gabion joint strength :	$\gamma_{Rn2} =$	1,10	[-]	

Partial factors for variable actions				
Permanent design situation				
Factor for combination value :	$\psi_0 =$	0,70	[-]	
Factor for frequent value :	$\psi_1 =$	0,50	[-]	
Factor for quasi-permanent value :	$\psi_2 =$	0,30	[-]	

Material of blocks - filling

No.	Name	γ [kN/m ³]	φ [°]	c [kPa]
1	Габион	18,00	30,00	0,00

Material of blocks - mesh

No.	Name	Strength overh. R_t [kN/m]	Spacing of vert. meshes v [m]	Bear.cap. of front joint R_s [kN/m]
1	Габион	7,00	1,00	5,00

Geometry of structure

No.	Width b [m]	Height h [m]	Offset a [m]	Material
3	1,00	1,00	1,00	Габион

No.	Width b [m]	Height h [m]	Offset a [m]	Material
2	2,00	1,00	1,00	Габион
1	3,00	1,00	-	Габион

Gabion slope = 0,00 °
 Overall height = 3,00 m
 Overall wall volume = 6,00 m³/m

Soil parameters

Заскалявка

Unit weight : $\gamma = 22,00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 34,00^\circ$
 Cohesion of soil : $c_{ef} = 0,00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 34,00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{sat} = 22,00 \text{ kN/m}^3$



обратен насип

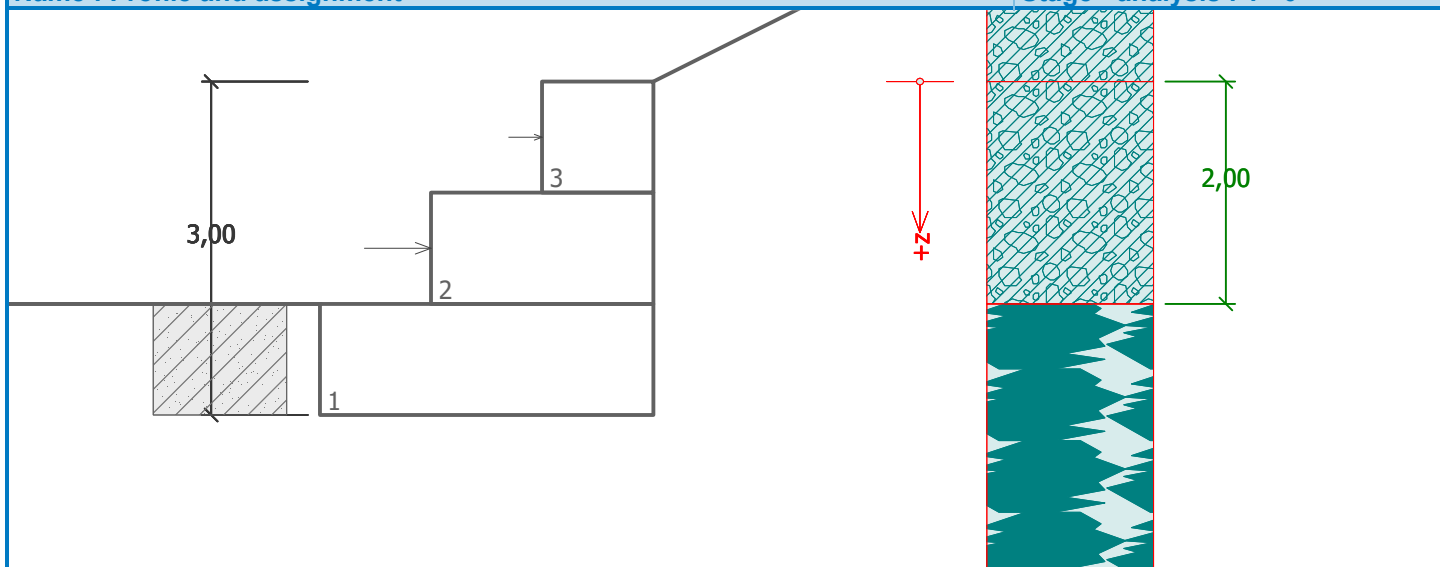
Unit weight : $\gamma = 20,00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 32,00^\circ$
 Cohesion of soil : $c_{ef} = 0,00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 32,00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{sat} = 20,00 \text{ kN/m}^3$

Речно корито

Unit weight : $\gamma = 16,00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 33,00^\circ$
 Cohesion of soil : $c_{ef} = 0,00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 33,00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{sat} = 16,00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	2,00	обратен насип	
2	-	Речно корито	



Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind construction has the slope 1: 2,00 (slope angle is 26,57 °).
Embankment height is 2,00 m, embankment length is 4,00 m.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: at rest

Soil on front face of the structure - Заскалявка

Soil thickness in front of structure $h = 1,00$ m

Terrain shape in front of structure

No.	Coordinate x[m]	Depth z[m]
1	0,00	0,00
2	0,00	-1,00
3	-3,00	-1,00
4	-6,00	0,00
5	-7,00	0,00
6	-10,00	1,00
7	-11,00	1,00

Origin [0,0] is located in bottom left edge of construction.

Positive coordinate +z has downward direction.

Applied forces acting on the structure

No.	Force new modification	Name	Action	F_x [kN/m]	F_z [kN/m]	M [kNm/m]	x [m]	z [m]
1	YES	Force No. 1	permanent	20,00	0,00	0,00	-1,00	0,50
2	YES	Force No. 2	permanent	40,00	0,00	0,00	-2,00	1,50

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Pressure at rest on front face of the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m ³]	K_r	Comment
1	1,00	0,00	34,00	0,00	22,00	0,441	

Pressure at rest distribution on front face of the structure

Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00	0,00	0,00	0,00
	1,00	22,00	0,00	9,70	9,70	0,00

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m ³]	δ_d [°]	K_a	Comment
1	1,00	0,00	32,00	0,00	20,00	32,00	0,476	
2	1,00	0,00	32,00	0,00	20,00	32,00	0,476	
3	1,00	0,00	33,00	0,00	16,00	33,00	0,268	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00	0,00	0,00	0,00
	1,00	20,00	0,00	9,52	8,07	5,04
2	1,00	20,00	0,00	9,52	8,07	5,04
	2,00	40,00	0,00	19,03	16,14	10,09
3	2,00	40,00	0,00	21,41	17,96	11,66
	3,00	56,00	0,00	25,69	21,55	13,99

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overturn.	Coeff. sliding	Coeff. stress
Weight - wall	0,00	-1,17	108,00	1,83	1,000	1,000	1,350
FF resistance	-4,85	-0,33	0,00	0,00	1,000	1,000	1,000
Active pressure	35,89	-1,02	22,91	3,00	1,350	1,350	1,350
Force No. 1	-20,00	-2,50	0,00	2,00	1,000	1,000	1,000
Force No. 2	-40,00	-1,50	0,00	1,00	1,000	1,000	1,000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 286,28$ kNm/m

Overturning moment $M_{ovr} = 47,63$ kNm/m

Wall for overturning is **SATISFACTORY**

Check for slip

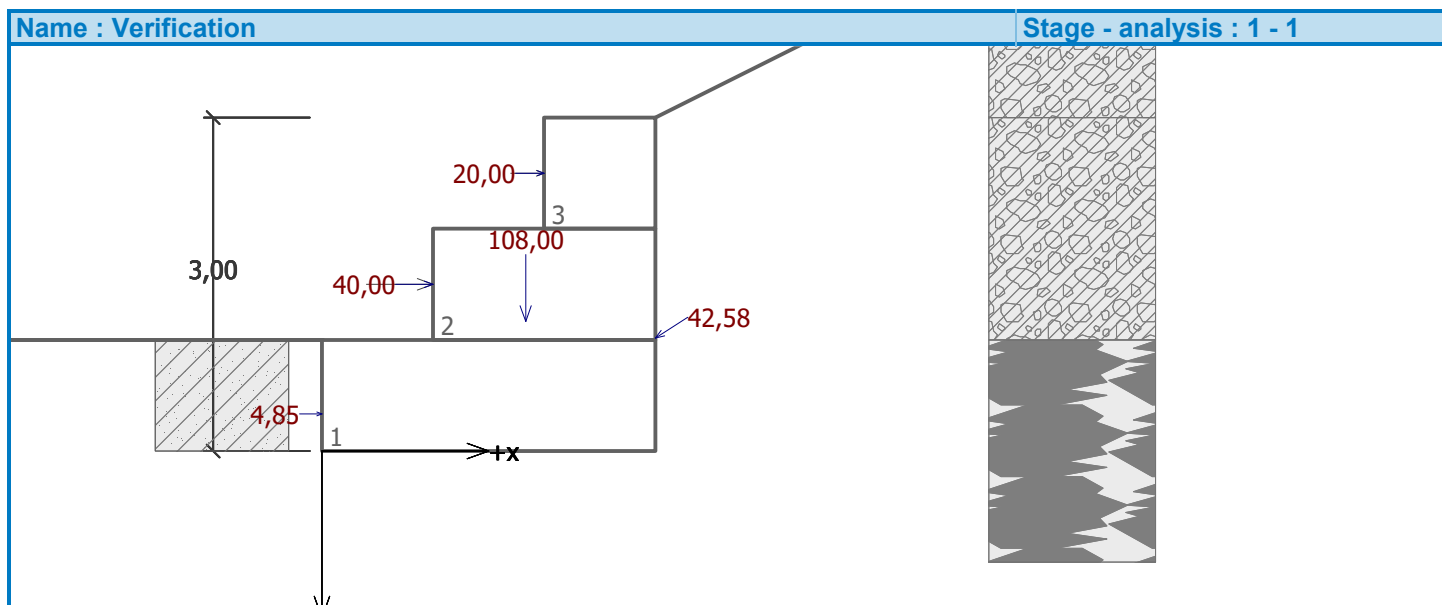
Resisting horizontal force $H_{res} = 82,02$ kN/m

Active horizontal force $H_{act} = -16,39$ kN/m

Wall for slip is **SATISFACTORY**

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 58,91 kPa



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [-]	Stress [kPa]
1	-157,37	176,73	-16,39	0,000	58,91
2	-144,77	138,93	-16,39	0,000	46,31

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	-145,51	130,91	-28,96

Verification of foundation soil

Eccentricity verification

Max. eccentricity of normal force $e = 0,000$

Maximum allowable eccentricity $e_{alw} = 0,333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Design bearing capacity of foundation soil $R = 150,00$ kPa

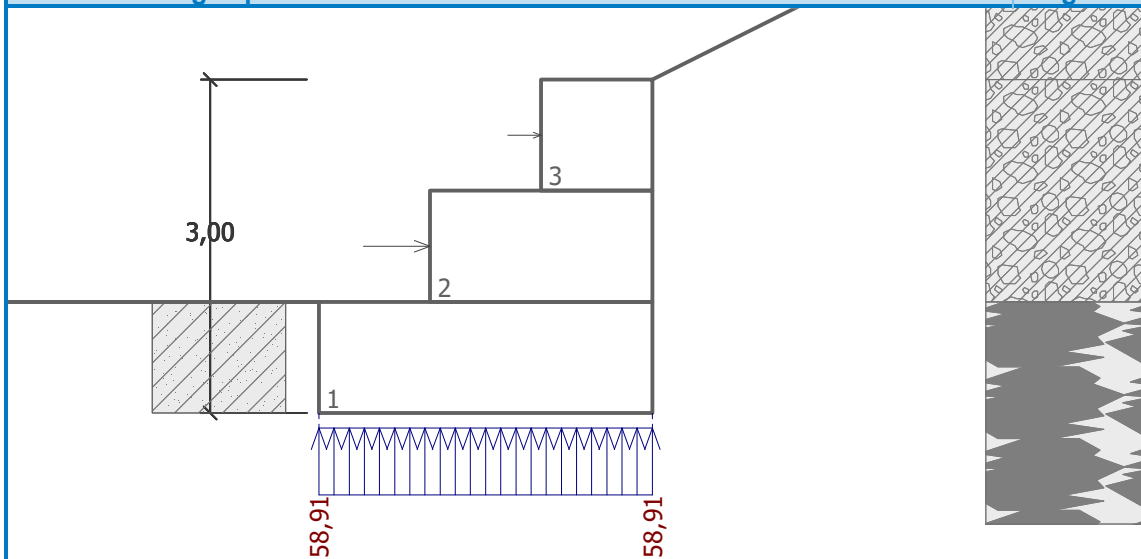
Partial factor on bearing capacity $\gamma_{Rv} = 1,40$

Max. stress at footing bottom $\sigma = 58,91$ kPa

Bearing capacity of foundation soil $R_d = 107,14$ kPa

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY



Dimensioning No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m ³]	δ_d [°]	K_a	Comment
1	1,00	0,00	32,00	0,00	20,00	32,00	0,476	
2	1,00	0,00	32,00	0,00	20,00	32,00	0,476	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00 1,00	0,00 20,00	0,00 0,00	0,00 9,52	0,00 8,07	0,00 5,04
	1,00 2,00	20,00 40,00	0,00 0,00	9,52 19,03	8,07 16,14	5,04 10,09

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overturn.	Coeff. sliding	Coeff. stress
Weight - wall	0,00	-0,83	54,00	1,17	1,000	1,000	1,350
Active pressure	16,14	-0,67	10,09	2,00	1,350	1,350	1,350
Force No. 1	-20,00	-1,50	0,00	1,00	1,000	1,000	1,000
Force No. 2	-40,00	-0,50	0,00	0,00	1,000	1,000	1,000

Verification of the most stressed construction joint - above the block No. 1

Check for overturning stability

Resisting moment $M_{res} = 100,17$ kNm/m

Overturning moment $M_{ovr} = 14,53$ kNm/m

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 35,49$ kN/m

Active horizontal force $H_{act} = -38,21$ kN/m

Joint for slip is SATISFACTORY

Maximum pressure on the bottom block = 43,26 kPa
 Red.Coeff. by offset of top block = 0,00
 Average value of pressure on face = 3,75 kPa
 Shear force transmitted by friction = 49,95 kN/m

Bearing capacity against transverse pressure:

Joint bear.capacity = 4,55 kN/m
 Computed stress-state = 1,88 kN/m

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 6,36 kN/m
 Computed stress-state = 1,88 kN/m

Joint between blocks is SATISFACTORY

