



Prefab wall analysis

Input data

Project

Date : 28.10.2005

Settings

(input for current task)

Materials and standards

Concrete structures : CSN 73 1201 R

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 : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor for overturning :	$SF_o =$	1,50	[-]
Safety factor for sliding resistance :	$SF_s =$	1,50	[-]
Safety factor for bearing capacity :	$SF_b =$	1,00	[-]
Safety factor for sliding along geo-reinforcement :	$SF_{sr} =$	1,50	[-]

Geometry of structure

Slope of wall = 0,00 °

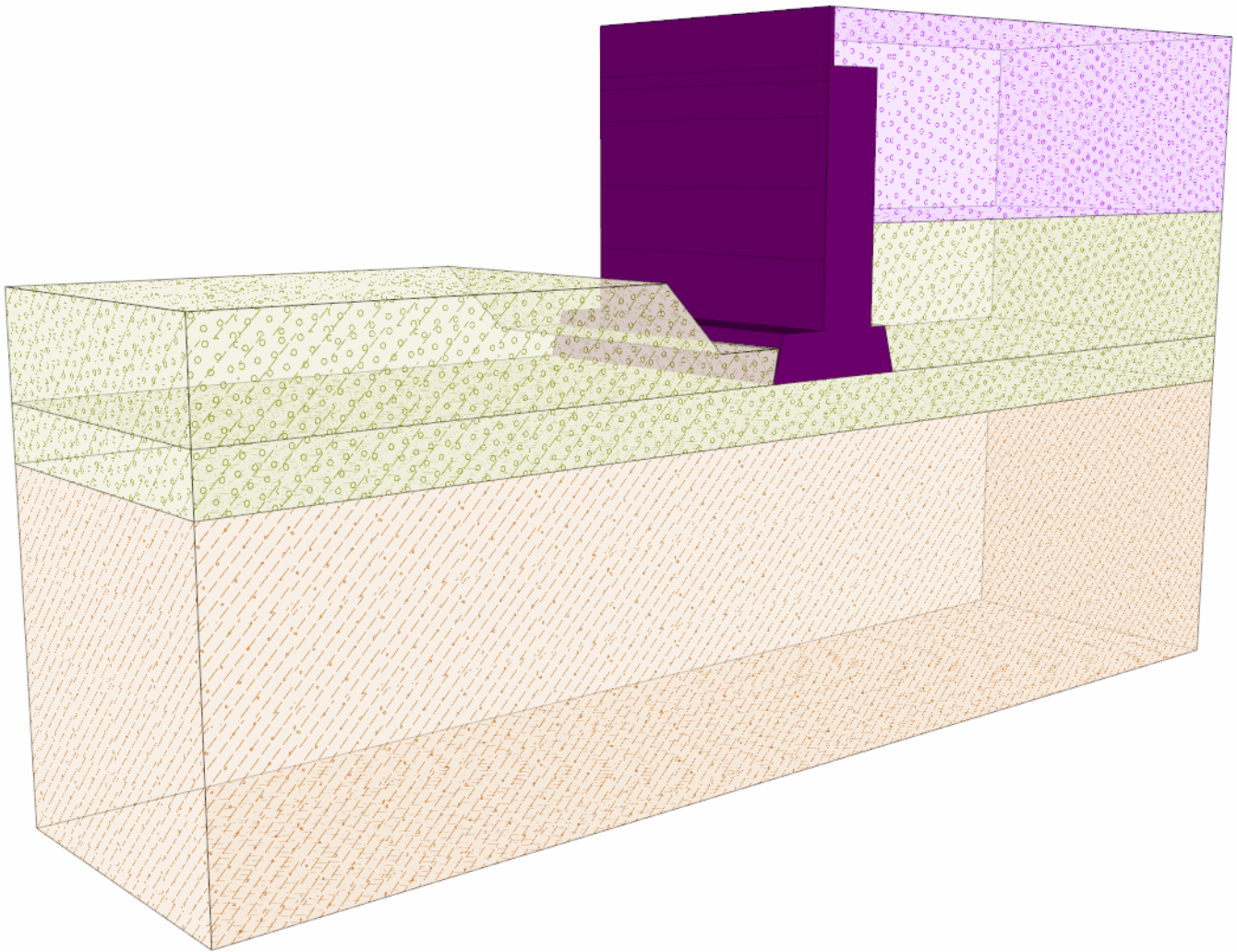
No.	Width b [m]	Height h [m]	Offset k [m]	Offs.(L) o ₁ [m]	Offs.(R) o ₂ [m]	Self w. [kN/m ³]	Friction [-]	Cohesion [kPa]	Shear bear.cap. R _s [kN/m]
7	0,30	0,80	0,00	0,00	0,00	20,00	0,533	0,00	0,00
6	1,60	0,20	0,00	0,00	0,00	20,00	0,533	0,00	0,00
5	1,00	0,50	0,00	0,60	0,00	20,00	0,533	0,00	0,00
4	1,00	1,00	0,00	0,00	0,00	20,00	0,533	0,00	0,00
3	1,00	1,00	0,00	0,00	0,00	20,00	0,357	1,20	0,00
2	1,00	1,00	0,80	0,00	0,00	20,00	0,533	1,10	0,00
1	2,50	0,70	0,00	-0,20	-0,20	20,00	-	-	-

Note: Blocks are ordered from bottom to the top



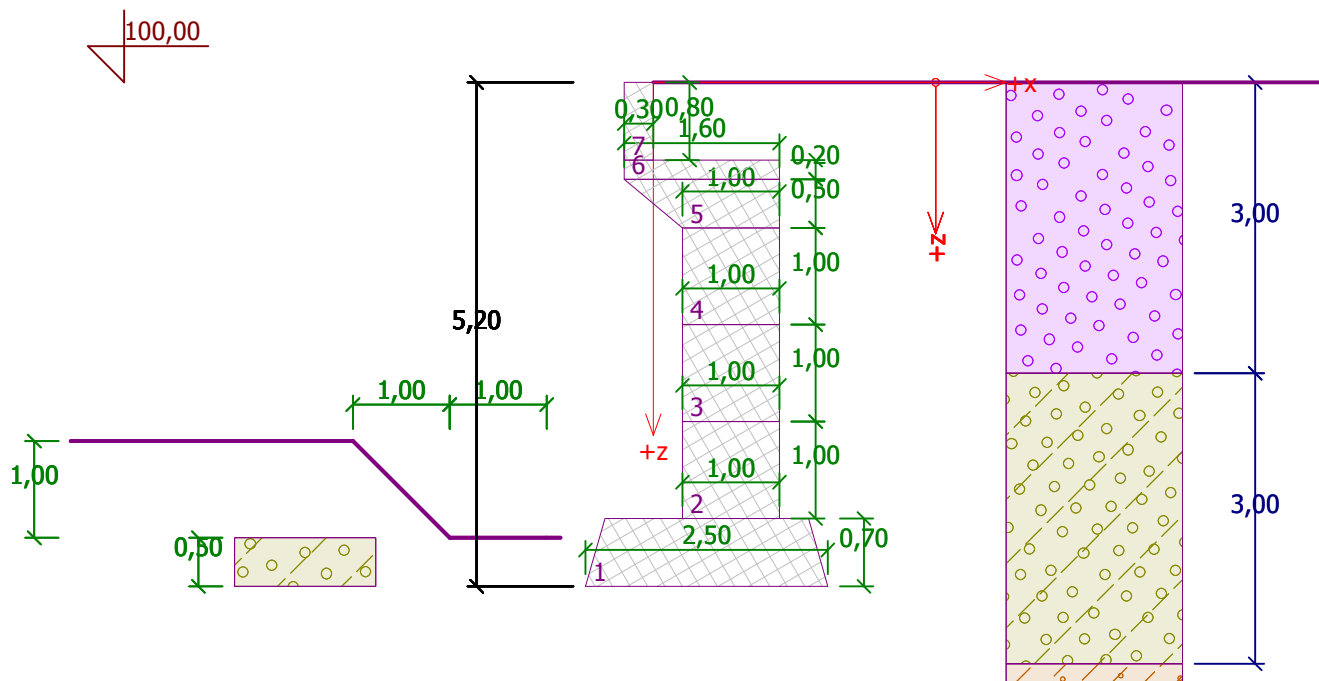
Name : Geometry

Stage - analysis : 1 - 0



Name : Geometry

Stage - analysis : 1 - 0



Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	Zemina 1		30,00	5,00	20,00	10,00	15,00
2	Třída F3, konzistence měkká		26,50	12,00	18,00	10,00	15,00
3	Třída G3, středně ulehlá		32,50	0,00	19,00	10,00	15,00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Zemina 1

Unit weight :	γ = 20,00 kN/m ³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 30,00 °
Cohesion of soil :	c_{ef} = 5,00 kPa
Angle of friction struc.-soil :	δ = 15,00 °
Soil :	cohesionless
Saturated unit weight :	γ_{sat} = 20,00 kN/m ³

Třída F3, konzistence měkká

Unit weight :	γ = 18,00 kN/m ³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 26,50 °
Cohesion of soil :	c_{ef} = 12,00 kPa
Angle of friction struc.-soil :	δ = 15,00 °
Soil :	cohesionless
Saturated unit weight :	γ_{sat} = 20,00 kN/m ³



Třída G3, středně ulehlá

Unit weight : $\gamma = 19,00 \text{ kN/m}^3$
Stress-state : effective
Angle of internal friction : $\varphi_{\text{ef}} = 32,50^\circ$
Cohesion of soil : $c_{\text{ef}} = 0,00 \text{ kPa}$
Angle of friction struc.-soil : $\delta = 15,00^\circ$
Soil : cohesionless
Saturated unit weight : $\gamma_{\text{sat}} = 20,00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	3,00	Třída G3, středně ulehlá	
2	3,00	Zemina 1	
3	-	Třída F3, konzistence měkká	

Foundation

Type of foundation : soil from geological profile

Terrain profile

Terrain behind the structure is flat.

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 - Zemina 1

Soil thickness in front of structure $h = 0,50 \text{ m}$

Terrain shape in front of structure

No.	Coordinate x[m]	Depth z[m]
1	0,00	0,00
2	0,00	-0,50
3	-1,00	-0,50
4	-2,00	-1,50
5	-3,00	-1,50

Origin [0,0] is located in bottom left edge of construction.
Positive coordinate +z has downward direction.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0,00	-2,11	116,40	1,36	1,000
FF resistance	-1,20	-0,17	0,69	0,05	1,000
Weight - earth wedge	0,00	-0,87	1,56	2,10	1,000
Weight - earth wedge	0,00	-4,77	16,42	1,25	1,000
Active pressure	71,82	-1,63	48,38	2,17	1,000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 286,74 \text{ kNm/m}$

Overtopping moment $M_{OVR} = 116,91 \text{ kNm/m}$

Safety factor = 2,45 > 1,50

Wall for overturning is SATISFACTORY

Check for slip

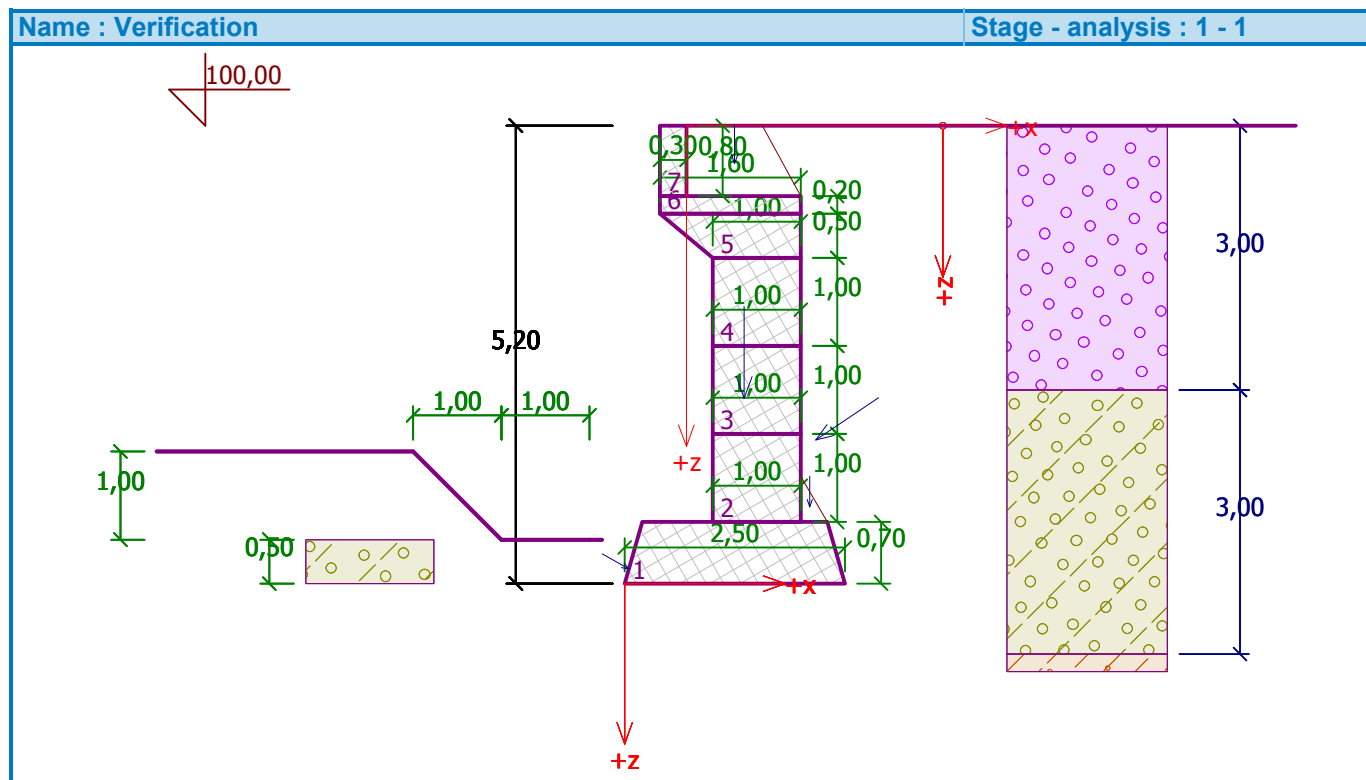
Resisting horizontal force $H_{res} = 115,17 \text{ kN/m}$

Active horizontal force $H_{act} = 70,61 \text{ kN/m}$

Safety factor = 1,63 > 1,50

Wall for slip is **SATISFACTORY**

Overall check - WALL is SATISFACTORY



Bearing capacity of foundation soil

Design load acting at the center of footing bottom



Soil Boring Co.
London, Colson Rd 125/5
United Kingdom

Project: Shopping center Black Rose
Geotechnics and foundation - project reports
Designer: Ing. John Williams

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [-]	Stress [kPa]
1	59,48	183,45	70,61	0,130	99,08

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	59,48	183,45	70,61

Verification of foundation soil

Eccentricity verification

Max. eccentricity of normal force $e = 0,130$

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

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

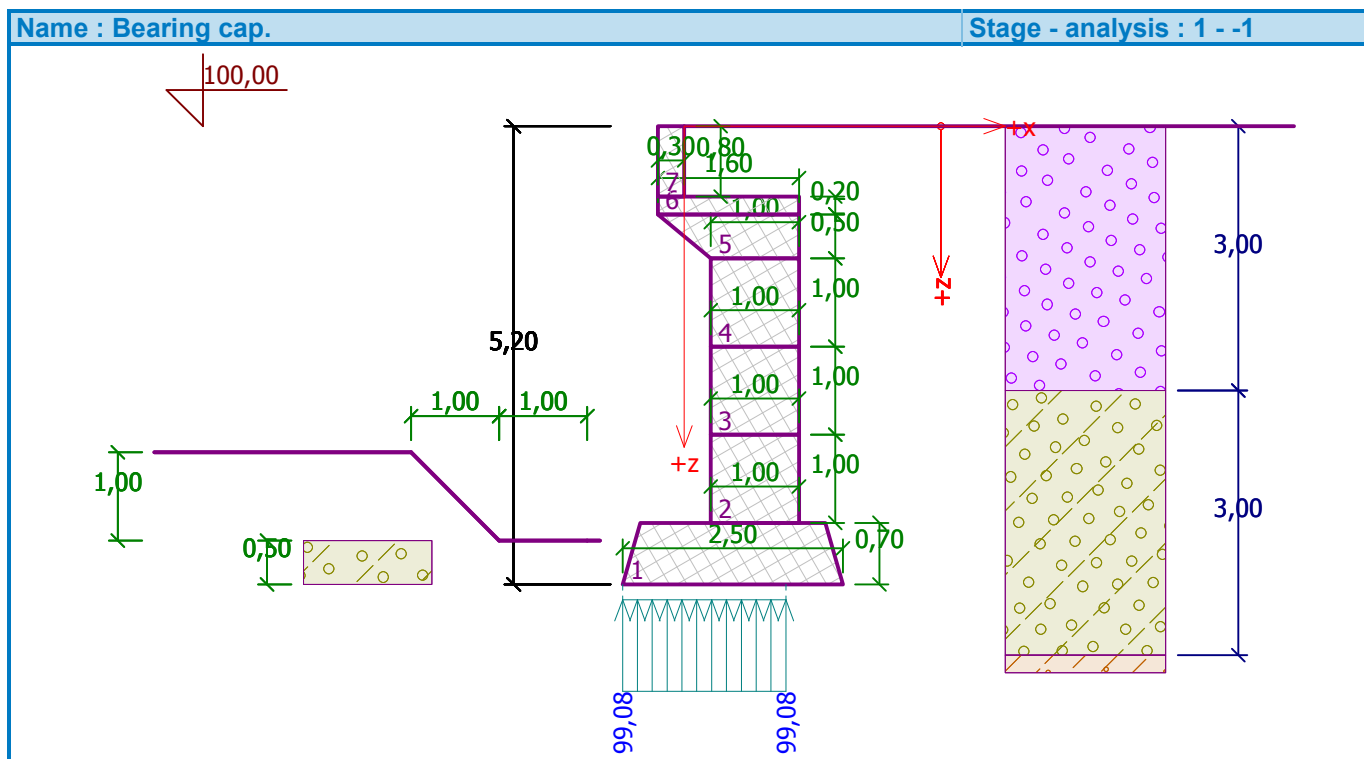
Max. stress at footing bottom $\sigma = 99,08 \text{ kPa}$

Bearing capacity of foundation soil $R_d = 200,00 \text{ kPa}$

Safety factor = $2,02 > 1,00$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY



Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0,00	-1,06	44,20	0,31	1,000
Weight - earth wedge	0,00	-2,07	16,42	0,25	1,000
Active pressure	15,92	-0,85	7,11	0,93	1,000



Verification of construction joint above the block No.: 3

Check for overturning stability

Resisting moment $M_{res} = 24,21 \text{ kNm/m}$

Overturning moment $M_{ovr} = 13,52 \text{ kNm/m}$

Safety factor = $1,79 > 1,50$

Joint for overturning stability is SATISFACTORY

Check for slip

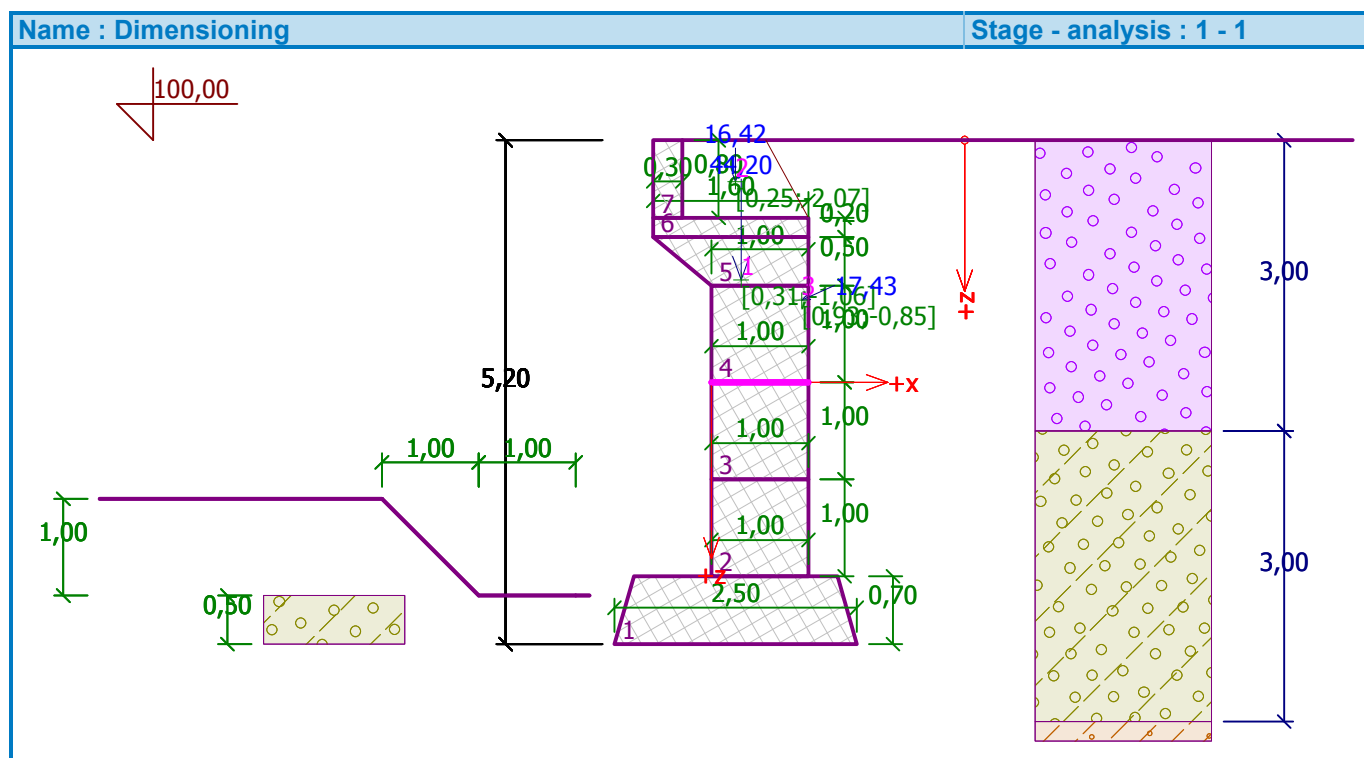
Resisting horizontal force $H_{res} = 36,10 \text{ kN/m}$

Active horizontal force $H_{act} = 15,92 \text{ kN/m}$

Safety factor = $2,27 > 1,50$

Joint for slip is SATISFACTORY

Joint is SATISFACTORY



Slope stability analysis

Input data

Project

Settings

(input for current task)

Stability analysis

Earthquake analysis : Standard

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable



Partial factors on actions (A)

Permanent design situation

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 sliding resistance (on slip surface) :	$\gamma_{Rs} =$	1,10 [-]
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Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	100,00	0,00	99,20	0,90	99,20
		0,90	99,00	0,90	98,50	0,90	97,50
		0,90	97,00	15,60	97,00		
2		-13,00	96,30	-3,10	96,30	-2,10	95,30
		-1,10	95,30	-0,96	95,30	-0,90	95,50
		-0,10	95,50	-0,10	96,50	-0,10	97,50
		-0,10	98,50	-0,10	99,00	-0,10	99,20
		-0,10	100,00	0,00	100,00	15,60	100,00
3		0,90	97,00	0,90	96,50	0,90	95,50
		1,20	95,50	1,40	94,80		
4		-13,00	94,80	-1,10	94,80	-0,96	95,30
5		-1,10	94,80	1,40	94,80	15,60	94,80
6		-13,00	94,00	15,60	94,00		



Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]
1	Zemina 1		30,00	5,00	20,00
2	Třída F3, konzistence měkká		26,50	12,00	18,00
3	Třída G3, středně ulehlá		32,50	0,00	19,00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Zemina 1		20,00		
2	Třída F3, konzistence měkká		20,00		
3	Třída G3, středně ulehlá		20,00		

Soil parameters

Zemina 1

Unit weight : $\gamma = 20,00 \text{ kN/m}^3$
Stress-state : effective
Angle of internal friction : $\varphi_{ef} = 30,00^\circ$
Cohesion of soil : $c_{ef} = 5,00 \text{ kPa}$
Saturated unit weight : $\gamma_{sat} = 20,00 \text{ kN/m}^3$

Třída F3, konzistence měkká

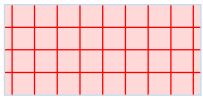
Unit weight : $\gamma = 18,00 \text{ kN/m}^3$
Stress-state : effective
Angle of internal friction : $\varphi_{ef} = 26,50^\circ$
Cohesion of soil : $c_{ef} = 12,00 \text{ kPa}$
Saturated unit weight : $\gamma_{sat} = 20,00 \text{ kN/m}^3$

Třída G3, středně ulehlá

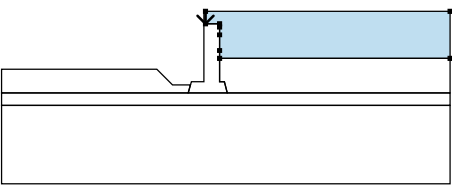
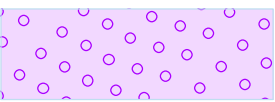
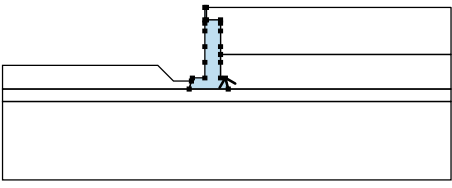
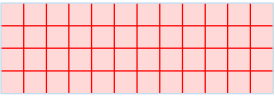
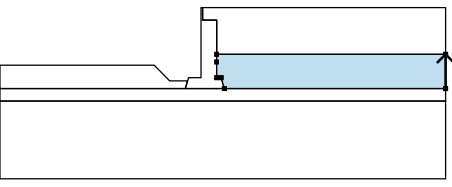
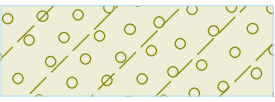
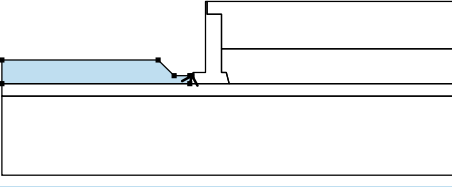
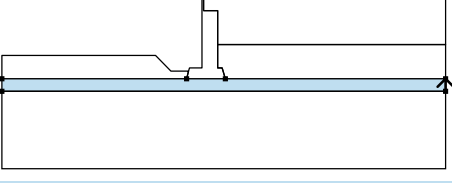
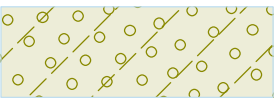
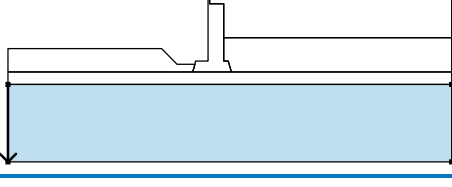
Unit weight : $\gamma = 19,00 \text{ kN/m}^3$
Stress-state : effective
Angle of internal friction : $\varphi_{ef} = 32,50^\circ$
Cohesion of soil : $c_{ef} = 0,00 \text{ kPa}$
Saturated unit weight : $\gamma_{sat} = 20,00 \text{ kN/m}^3$



Rigid bodies

No.	Name	Sample	γ [kN/m ³]
1	Wall material		20,00

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0,00	100,00	0,00	99,20	Třída G3, středně ulehlá 
		0,90	99,20	0,90	99,00	
		0,90	98,50	0,90	97,50	
		0,90	97,00	15,60	97,00	
		15,60	100,00			
2		1,40	94,80	1,20	95,50	Wall material 
		0,90	95,50	0,90	96,50	
		0,90	97,00	0,90	97,50	
		0,90	98,50	0,90	99,00	
		0,90	99,20	0,00	99,20	
		0,00	100,00	-0,10	100,00	
		-0,10	99,20	-0,10	99,00	
		-0,10	98,50	-0,10	97,50	
		-0,10	96,50	-0,10	95,50	
		-0,90	95,50	-0,96	95,30	
3		15,60	94,80	15,60	97,00	Zemina 1 
		0,90	97,00	0,90	96,50	
		0,90	95,50	1,20	95,50	
		1,40	94,80			
4		-1,10	94,80	-0,96	95,30	Zemina 1 
		-1,10	95,30	-2,10	95,30	
		-3,10	96,30	-13,00	96,30	
		-13,00	94,80			
5		15,60	94,00	15,60	94,80	Zemina 1 
		1,40	94,80	-1,10	94,80	
		-13,00	94,80	-13,00	94,00	
6		-13,00	94,00	-13,00	89,00	Třída F3, konzistence měkká 
		15,60	89,00	15,60	94,00	

Water

Water type : No water



Tensile crack

Tensile crack not inputted.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters					
Center :	x =	-0,24 [m]	Angles :	α_1 =	-47,24 [°]
	z =	100,00 [m]		α_2 =	90,00 [°]
Radius :	R =	5,45 [m]			
The slip surface after optimization.					

Slope stability verification (Bishop)

Sum of active forces : $F_a = 213,64$ kN/m

Sum of passive forces : $F_p = 390,90$ kN/m

Sliding moment : $M_a = 1164,33$ kNm/m

Resisting moment : $M_p = 1936,72$ kNm/m

Utilization : 60,1 %

Slope stability ACCEPTABLE

