Slope stability analysis

Input data

Project

Task : Vukovski vrh 7
Part : P-5
Description : Povratne stabilnostne analize
Customer : Občina Pesnica
Author : GEOING d.o.o.
Date : 22.4.2022

Settings

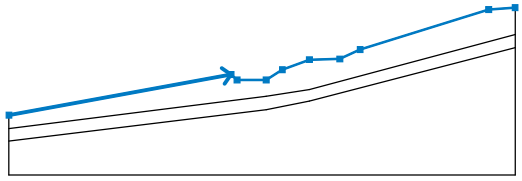
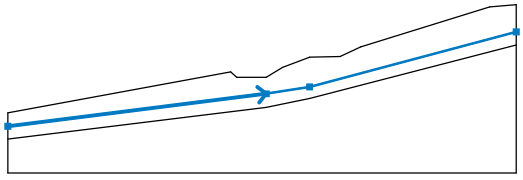
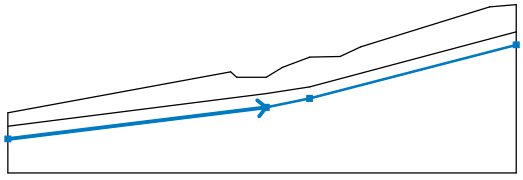
Slovenia - EN 1997 (19)

Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1,50	[–]

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	4,40	32,80	10,40	33,70	9,60
		38,00	9,60	40,40	11,10	44,40	12,60
		48,90	12,70	51,90	14,10	70,90	20,00
		74,80	20,30				
2		0,00	2,40	38,00	7,20	44,40	8,20
		74,80	16,30				
3		0,00	0,55	38,00	5,20	44,40	6,50
		74,80	14,40				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]
1	Glina		17,50	0,00	19,00
2	Preperina		30,00	10,00	21,00
3	Hribina		40,00	80,00	22,00

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Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Glina		19,00		
2	Preperina		21,00		
3	Hribina		22,00		

Soil parameters

Glina

Unit weight :	γ =	19,00 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	17,50 °
Cohesion of soil :	c_{ef} =	0,00 kPa
Saturated unit weight :	γ_{sat} =	19,00 kN/m^3

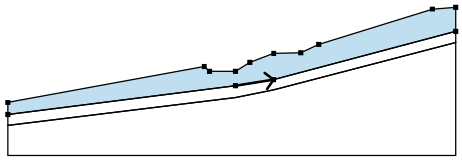
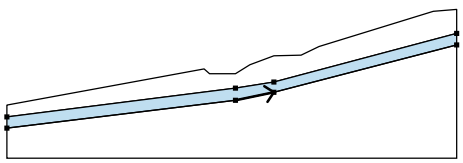
Preperina

Unit weight :	γ =	21,00 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	30,00 °
Cohesion of soil :	c_{ef} =	10,00 kPa
Saturated unit weight :	γ_{sat} =	21,00 kN/m^3

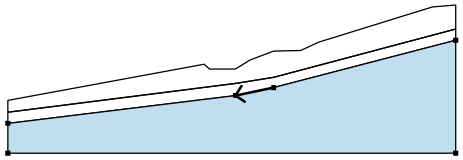
Hribina

Unit weight :	γ =	22,00 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	40,00 °
Cohesion of soil :	c_{ef} =	80,00 kPa
Saturated unit weight :	γ_{sat} =	22,00 kN/m^3

Assigning and surfaces

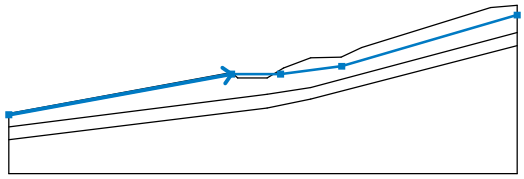
No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		38,00	7,20	44,40	8,20	Glina
		74,80	16,30	74,80	20,30	
		70,90	20,00	51,90	14,10	
		48,90	12,70	44,40	12,60	
		40,40	11,10	38,00	9,60	
		33,70	9,60	32,80	10,40	
		0,00	4,40	0,00	2,40	
2		38,00	5,20	44,40	6,50	Preperina
		74,80	14,40	74,80	16,30	
		44,40	8,20	38,00	7,20	
		0,00	2,40	0,00	0,55	

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No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
3		44,40	6,50	38,00	5,20	Hribina
		0,00	0,55	0,00	-4,45	
		74,80	-4,45	74,80	14,40	

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		0,00	4,20	32,80	10,19	40,00	10,19
		48,98	11,34	74,80	18,88		

Tensile crack

Tensile crack not input.

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 =	18,86	[m]	Angles :	α_1 =	-4,32	[°]
	z =	119,75	[m]		α_2 =	29,02	[°]
Radius :	R =	113,80	[m]				
Analysis of the slip surface without optimization.							

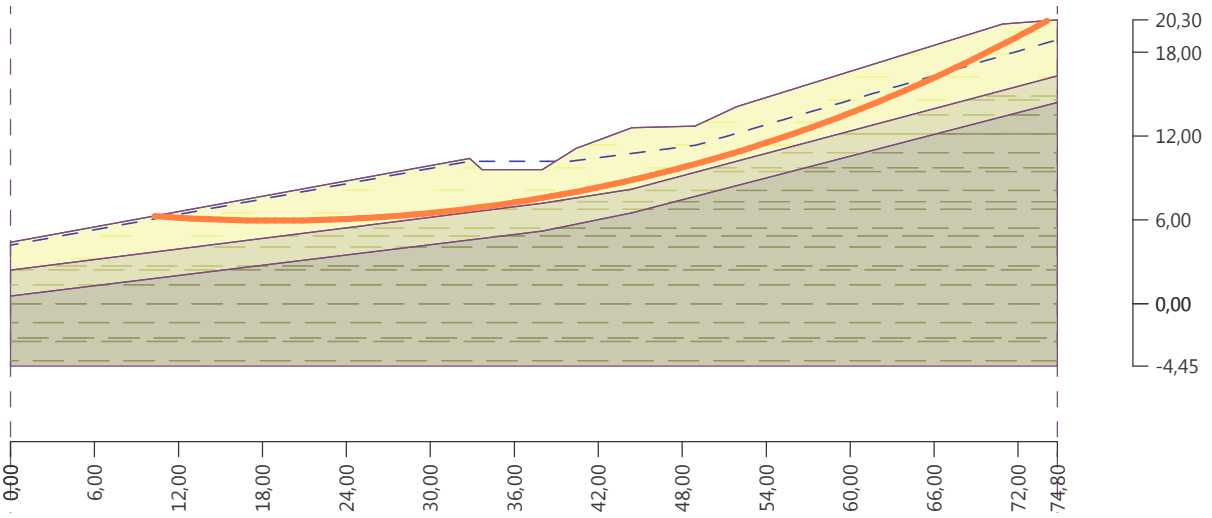
Slope stability verification (Bishop)

Sum of active forces : F_a = 648,63 kN/m
Sum of passive forces : F_p = 633,00 kN/m

Sliding moment : M_a = 73814,65 kNm/m
Resisting moment : M_p = 72035,08 kNm/m
Factor of safety = 0,98 < 1,50
Slope stability NOT ACCEPTABLE

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Name : Analysis	Stage - analysis : 1 - 1
Description : Drsina 1	



Analysis 2

Circular slip surface

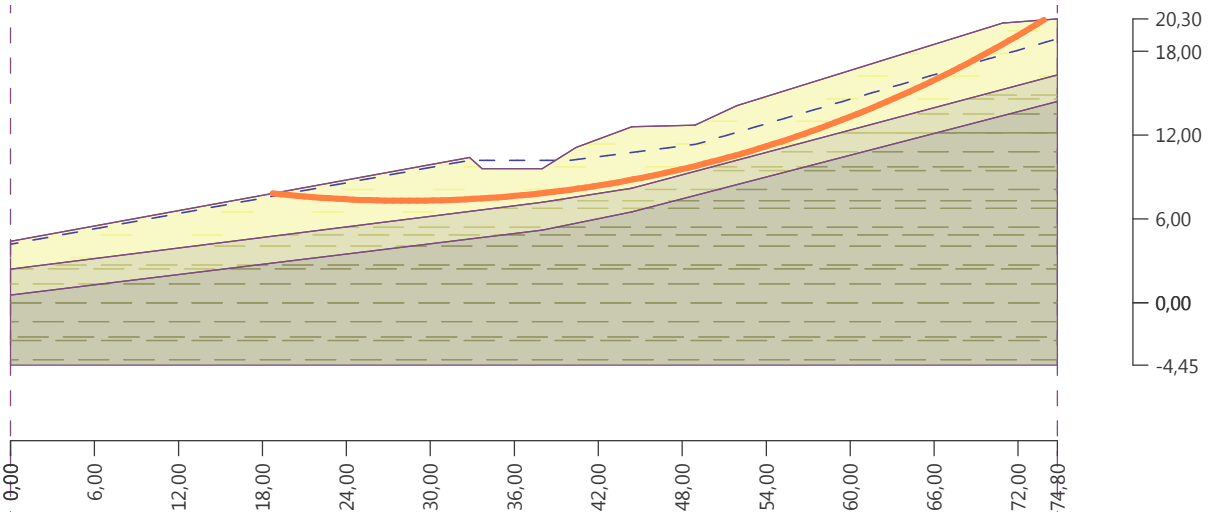
Slip surface parameters							
Center :	x =	28,31	[m]	Angles :	α_1 =	-6,34	[°]
	z =	93,97	[m]		α_2 =	31,70	[°]
Radius :	R =	86,67	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 594,97 kN/m
Sum of passive forces : F_p = 568,91 kN/m

Sliding moment : M_a = 51566,34 kNm/m
Resisting moment : M_p = 49307,33 kNm/m
Factor of safety = 0,96 < 1,50
Slope stability NOT ACCEPTABLE

Name : Analysis	Stage - analysis : 1 - 2
Description : Drsina 2	



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Analysis 3

Circular slip surface

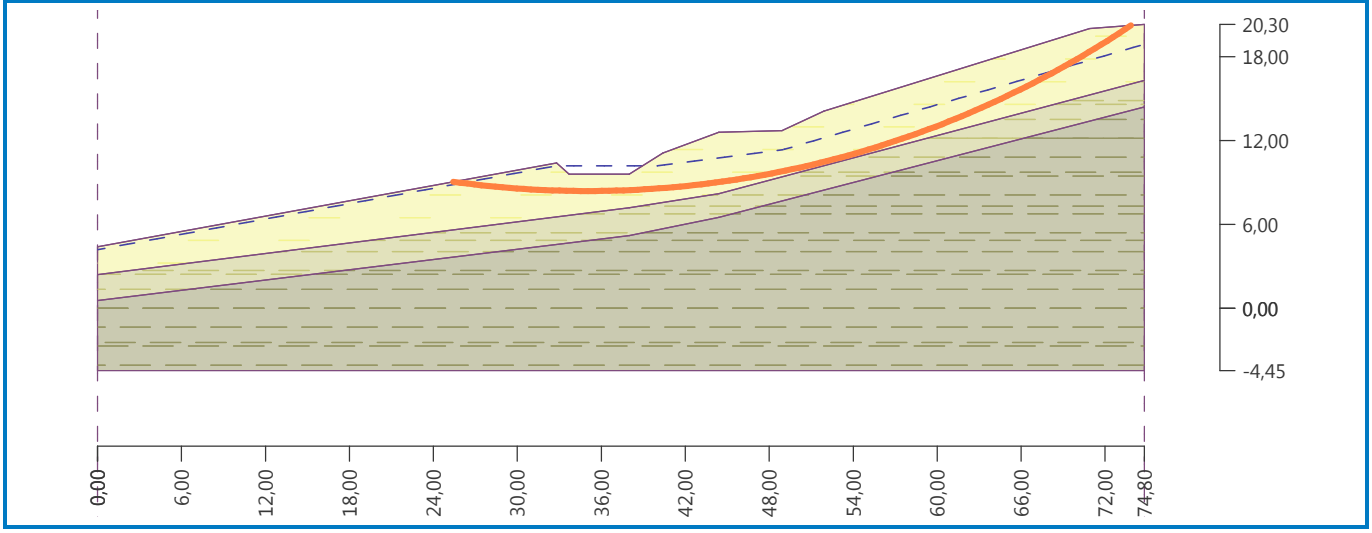
Slip surface parameters							
Center :	x =	34,99	[m]	Angles :	α_1 =	-7,90	[°]
	z =	78,06	[m]		α_2 =	33,90	[°]
Radius :	R =	69,67	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 551,90 kN/m
Sum of passive forces : F_p = 514,71 kN/m

Sliding moment : M_a = 38450,90 kNm/m
Resisting moment : M_p = 35859,68 kNm/m
Factor of safety = 0,93 < 1,50
Slope stability NOT ACCEPTABLE

Name : Analysis | **Stage - analysis : 1 - 3**
Description : Drsina 3



Analysis 4

Circular slip surface

Slip surface parameters							
Center :	x =	5,51	[m]	Angles :	α_1 =	-1,42	[°]
	z =	161,59	[m]		α_2 =	25,73	[°]
Radius :	R =	156,94	[m]				
Analysis of the slip surface without optimization.							

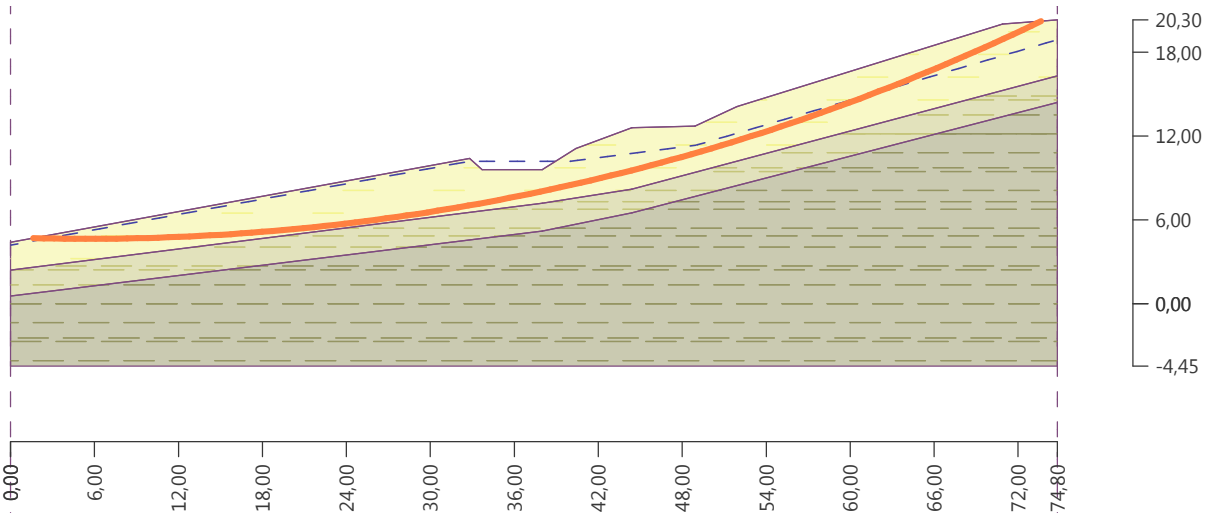
Slope stability verification (Bishop)

Sum of active forces : F_a = 598,46 kN/m
Sum of passive forces : F_p = 608,76 kN/m

Sliding moment : M_a = 93921,90 kNm/m
Resisting moment : M_p = 95538,44 kNm/m
Factor of safety = 1,02 < 1,50
Slope stability NOT ACCEPTABLE

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Name : Analysis	Stage - analysis : 1 - 4
Description : Drsina 4	



Analysis 5

Circular slip surface

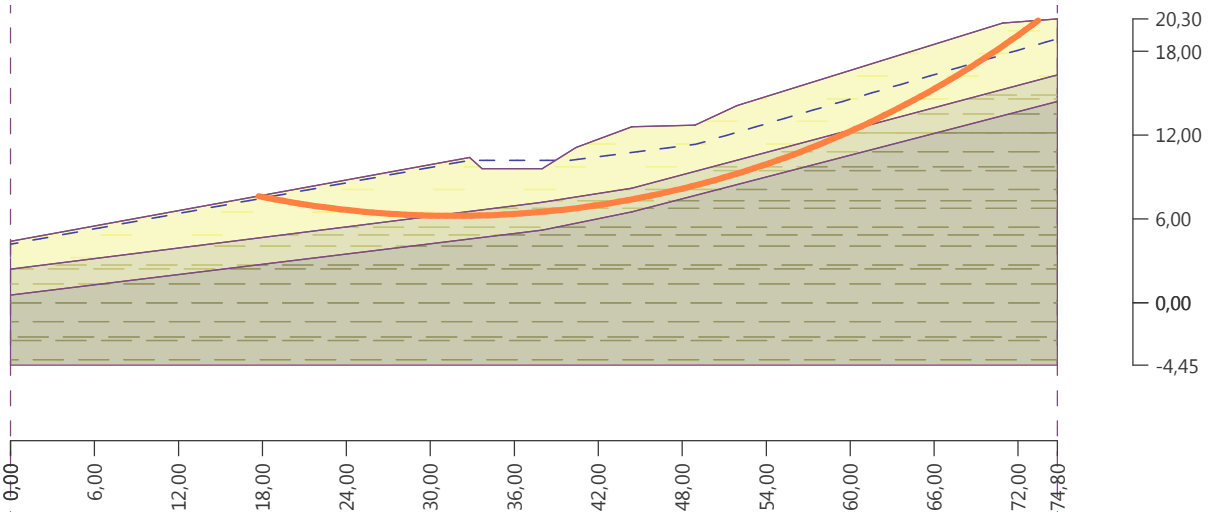
Slip surface parameters							
Center :	x =	31,67	[m]	Angles :	α_1 =	-11,59	[°]
	z =	75,66	[m]		α_2 =	36,98	[°]
Radius :	R =	69,44	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 809,29 kN/m
Sum of passive forces : F_p = 1449,01 kN/m

Sliding moment : M_a = 56197,11 kNm/m
Resisting moment : M_p = 100618,92 kNm/m
Factor of safety = 1,79 > 1,50
Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 1 - 5
Description : Drsina 5	



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Analysis 6

Circular slip surface

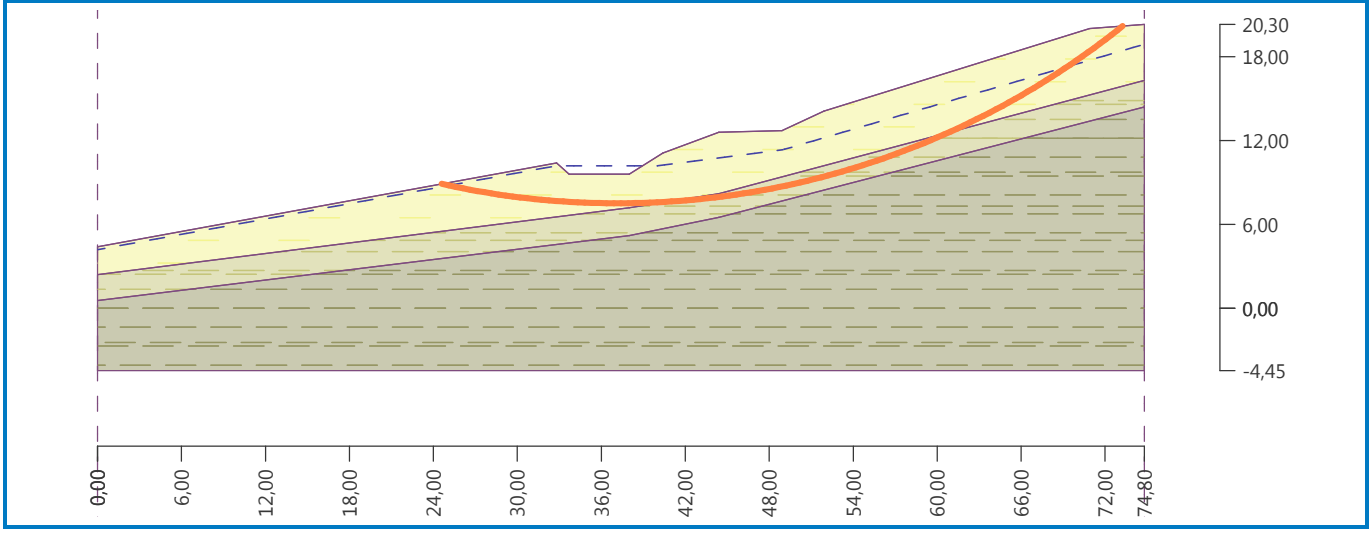
Slip surface parameters							
Center :	x =	37,17	[m]	Angles :	α_1 =	-12,58	[°]
	z =	65,24	[m]		α_2 =	38,69	[°]
Radius :	R =	57,73	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 694,27 kN/m
Sum of passive forces : F_p = 1120,37 kN/m

Sliding moment : M_a = 40080,03 kNm/m
Resisting moment : M_p = 64679,11 kNm/m
Factor of safety = 1,61 > 1,50
Slope stability ACCEPTABLE

Name : Analysis | **Stage - analysis : 1 - 6**
Description : Drsina 6



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