

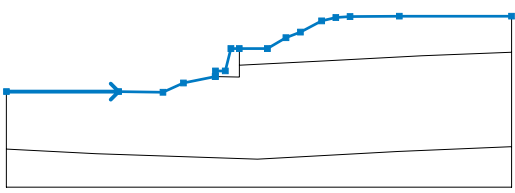
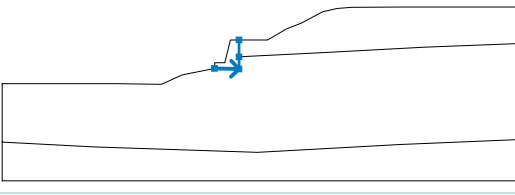
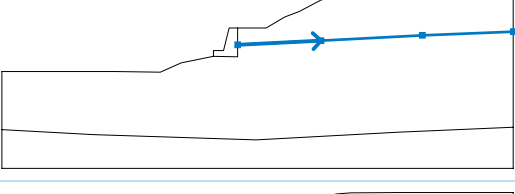
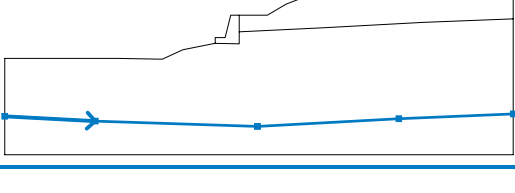
## Slope stability analysis

### Project




Date : 3.11.2005

Analysis type : in effective parameters


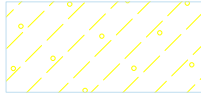

### Interface

No.	Interface location	Coordinates of interface points [m]					
		X	Z	X	Z	X	Z
1		-20,00	115,32	0,00	115,32	7,89	115,20
		11,54	116,85	17,20	117,99	17,25	118,00
		17,25	119,00	19,00	119,00	20,00	122,98
		21,50	122,98	26,50	122,98	29,80	124,92
		32,39	125,92	36,16	127,92	38,69	128,51
		41,22	128,69	50,00	128,75	70,00	128,75
2		17,20	117,99	21,50	117,90	21,50	120,02
		21,50	122,98				
3		21,50	120,02	36,18	120,75	53,99	121,70
		70,00	122,34				
4		-20,00	105,06	-3,99	104,21	24,73	103,26
		49,75	104,63	70,00	105,48		

### Soil parameters - effective stress state

No.	Name	Pattern	$\Phi_{ef}$ [°]	$C_{ef}$ [kPa]	$\gamma$ [kN/m <sup>3</sup> ]
1	Silt with medium plasticity		21,00	12,00	20,00
2	Sandy silt		26,50	16,00	18,00
3	Sandstone		40,00	50,00	19,00

### Soil parameters - uplift

No.	Name	Pattern	$\gamma_{sat}$ [kN/m <sup>3</sup> ]	$\gamma_s$ [kN/m <sup>3</sup> ]	n [-]
1	Silt with medium plasticity		22,00		
2	Sandy silt		18,00		
3	Sandstone		22,00		

### Soil parameters

#### Silt with medium plasticity

Unit weight :  $\gamma = 20,00 \text{ kN/m}^3$   
 Angle of intern. friction :  $\varphi_{ef} = 21,00^\circ$   
 Cohesion of soil :  $c_{ef} = 12,00 \text{ kPa}$   
 Saturated unit weight :  $\gamma_{sat} = 22,00 \text{ kN/m}^3$


#### Sandy silt

Unit weight :  $\gamma = 18,00 \text{ kN/m}^3$   
 Angle of intern. friction :  $\varphi_{ef} = 26,50^\circ$   
 Cohesion of soil :  $c_{ef} = 16,00 \text{ kPa}$   
 Saturated unit weight :  $\gamma_{sat} = 18,00 \text{ kN/m}^3$

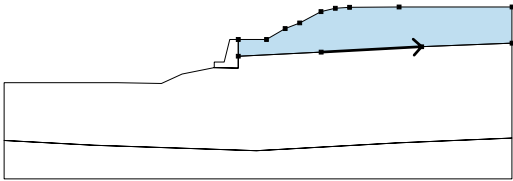

#### Sandstone

Unit weight :  $\gamma = 19,00 \text{ kN/m}^3$   
 Angle of intern. friction :  $\varphi_{ef} = 40,00^\circ$   
 Cohesion of soil :  $c_{ef} = 50,00 \text{ kPa}$   
 Saturated unit weight :  $\gamma_{sat} = 22,00 \text{ kN/m}^3$

### Rigid bodies

No.	Name	Pattern	$\gamma$ [kN/m <sup>3</sup> ]
1	Tuhé těleso číslo: 1		25,00

### Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		X	Z	X	Z	
1		36,18	120,75	53,99	121,70	Silt with medium plasticity
		70,00	122,34	70,00	128,75	
		50,00	128,75	41,22	128,69	
		38,69	128,51	36,16	127,92	
		32,39	125,92	29,80	124,92	
		26,50	122,98	21,50	122,98	
		21,50	120,02			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		X	Z	X	Z	
2		21,50	117,90	21,50	120,02	Tuhé těleso číslo: 1 
		21,50	122,98	20,00	122,98	
		19,00	119,00	17,25	119,00	
		17,25	118,00	17,20	117,99	
3		-3,99	104,21	24,73	103,26	Sandy silt 
		49,75	104,63	70,00	105,48	
		70,00	122,34	53,99	121,70	
		36,18	120,75	21,50	120,02	
		21,50	117,90	17,20	117,99	
		11,54	116,85	7,89	115,20	
4		0,00	115,32	-20,00	115,32	Sandstone 
		-20,00	105,06			
		49,75	104,63	24,73	103,26	
		-3,99	104,21	-20,00	105,06	
		-20,00	98,26	70,00	98,26	
		70,00	105,48			

### Surcharge

No.	Type	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope $\alpha$ [°]	Magnitude		
							q, q <sub>1</sub> , f, F	q <sub>2</sub>	unit
1	strip	on terrain	22,40	3,50		0,00	12,00		kN/m <sup>2</sup>

### Surcharges

No.	Name
1	Surcharge No. 1

### Water

Water type : No water

### Earthquake

Earthquake not included.

### Analysis settings

Analysis settings : Czech Republic

Analysis type : Safety factor

Safety factor : 1,50

### Analysis 1 (stage 1)

#### Circular slip surface

Slip surface parameters						
Center :	x =	14,29	[m]	Angles :	$\alpha_1 =$	-11,55 [°]
	z =	146,61	[m]		$\alpha_2 =$	55,96 [°]
Radius :	R =	32,06	[m]			

The slip surface after optimization.

### Slope stability verification (Petterson)

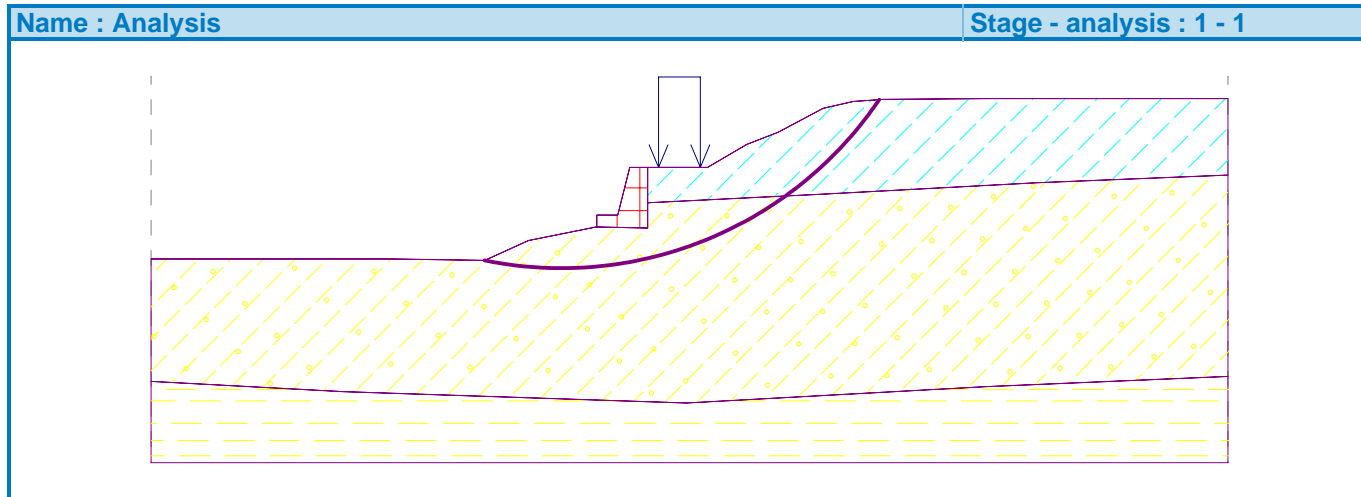
Sum of active forces :  $F_a = 1060,23$  kN/m

Sum of passive forces :  $F_p = 1831,08$  kN/m

Sliding moment :  $M_a = 33985,86 \text{ kNm/m}$   
Resisting moment :  $M_p = 58695,77 \text{ kNm/m}$

Factor of safety = 1,73 > 1,50

**Slope stability SATISFACTORY**



### Analysis 2 (stage 1)

#### Polygonal slip surface

Coordinates of slip surface points [m]									
X	Z	X	Z	X	Z	X	Z	X	Z
7,93	115,22	16,78	114,74	22,30	117,10	29,47	120,47	34,50	122,70
41,87	128,69								
Specified slip surface.									

#### Slope stability verification (Sarima)

**The analysis has not been carried out.**

## Stage 2

### Earth cut

No.	Cut location	Coordinates of cut points [m]					
		X	Z	X	Z	X	Z
1		41,00	128,67	41,50	127,50	53,00	127,50
		54,00	128,75				

### Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		X	Z	X	Z	
1		36,18	120,75	53,99	121,70	Silt with medium plasticity 
		70,00	122,34	70,00	128,75	
		54,00	128,75	53,00	127,50	
		41,50	127,50	41,00	128,67	
		38,69	128,51	36,16	127,92	
		32,39	125,92	29,80	124,92	
		26,50	122,98	21,50	122,98	
2		21,50	117,90	21,50	120,02	Tuhé těleso číslo: 1 
		21,50	122,98	20,00	122,98	
		19,00	119,00	17,25	119,00	
		17,25	118,00	17,20	117,99	
3		-3,99	104,21	24,73	103,26	Sandy silt 
		49,75	104,63	70,00	105,48	
		70,00	122,34	53,99	121,70	
		36,18	120,75	21,50	120,02	
		21,50	117,90	17,20	117,99	
		11,54	116,85	7,89	115,20	
		0,00	115,32	-20,00	115,32	
4		49,75	104,63	24,73	103,26	Sandstone 
		-3,99	104,21	-20,00	105,06	
		-20,00	98,26	70,00	98,26	
		70,00	105,48			

### Surcharge

No.	Surcharge		Type	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope $\alpha$ [°]	Magnitude		
	new	change							$q, q_1, f, F$	$q_2$	unit
1	No	No	strip	on terrain	22,40	3,50		0,00	12,00		kN/m <sup>2</sup>
2	Yes		strip	on terrain	42,00	10,00		0,00	200,00		kN/m <sup>2</sup>

### Surcharges

No.	Name
1	Surcharge No. 1
2	Surcharge - building

### Water

Water type : No water

### Earthquake

Earthquake not included.

### Analysis settings

Analysis settings : Czech Republic

Analysis type : Safety factor

Safety factor : 1,50

**Analysis 1 (stage 2)**  
**Circular slip surface**

Slip surface parameters							
Center :	x =	14,56	[m]	Angles :	$\alpha_1 =$	-7,57	[°]
	z =	166,63	[m]		$\alpha_2 =$	41,04	[°]
Radius :	R =	51,88	[m]				
Specified slip surface.							

**Slope stability verification (Bishop)**  
**The analysis has not been carried out.**

**Analysis 2 (stage 2)**  
**Polygonal slip surface**

Coordinates of slip surface points [m]											
X	Z	X	Z	X	Z	X	Z	X	Z		
13,62	117,27	17,12	116,42	22,19	117,53	29,86	120,48	34,87	121,24		
42,23	122,83	46,85	127,50								
Specified slip surface.											

**Slope stability verification (Sarima)**  
**The analysis has not been carried out.**

**Stage 3**

**Assigning and surfaces**

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		X	Z	X	Z	
1		36,18	120,75	53,99	121,70	Silt with medium plasticity 
		70,00	122,34	70,00	128,75	
		54,00	128,75	53,00	127,50	
		41,50	127,50	41,00	128,67	
		38,69	128,51	36,16	127,92	
		32,39	125,92	29,80	124,92	
		26,50	122,98	21,50	122,98	
		21,50	120,02			
2		21,50	117,90	21,50	120,02	Tuhé těleso číslo: 1 
		21,50	122,98	20,00	122,98	
		19,00	119,00	17,25	119,00	
		17,25	118,00	17,20	117,99	
3		-3,99	104,21	24,73	103,26	Sandy silt 
		49,75	104,63	70,00	105,48	
		70,00	122,34	53,99	121,70	
		36,18	120,75	21,50	120,02	
		21,50	117,90	17,20	117,99	
		11,54	116,85	7,89	115,20	
		0,00	115,32	-20,00	115,32	
		-20,00	105,06			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		X	Z	X	Z	
4		49,75	104,63	24,73	103,26	Sandstone 
		-3,99	104,21	-20,00	105,06	
		-20,00	98,26	70,00	98,26	
		70,00	105,48			

### Anchors

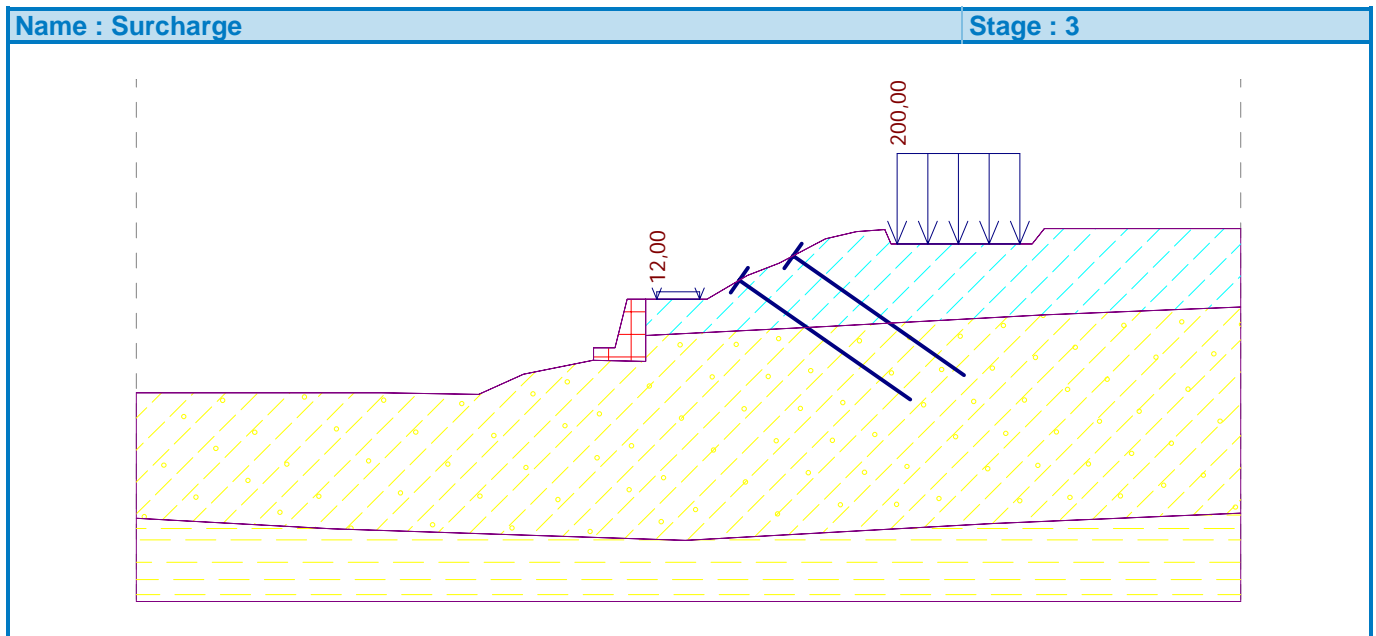
No.	Anchor		Origin		Length l [m]	Slope $\alpha$ [°]	Anchor spacing b [m]	Force F [kN]
	new	post-str	x [m]	z [m]				
1	Yes		29,14	124,53	17,00	35,00	1,00	120,00
2	Yes		33,52	126,52	17,00	35,00	1,00	120,00

### Surcharge

No.	Surcharge		Type	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope $\alpha$ [°]	Magnitude		
	new	change							$q, q_1, f, F$	$q_2$	unit
1	No	No	strip	on terrain	22,40	3,50		0,00	12,00		kN/m <sup>2</sup>
2	No	No	strip	on terrain	42,00	10,00		0,00	200,00		kN/m <sup>2</sup>

### Surcharges

No.	Name
1	Surcharge No. 1
2	Surcharge - building



### Water

Water type : No water

### Earthquake

Earthquake not included.

**Analysis settings**

Analysis settings : Czech Republic  
Analysis type : Safety factor  
Safety factor : 1,50

**Analysis 1 (stage 3)**

**Circular slip surface**

Slip surface parameters							
Center :	x =	16,42	[m]	Angles :	$\alpha_1 =$	-10,43	[°]
	z =	161,63	[m]		$\alpha_2 =$	43,70	[°]
Radius :	R =	47,21	[m]				

The slip surface after optimization.

**Slope stability verification (Bishop)**

Sum of active forces :  $F_a = 2207,19$  kN/m

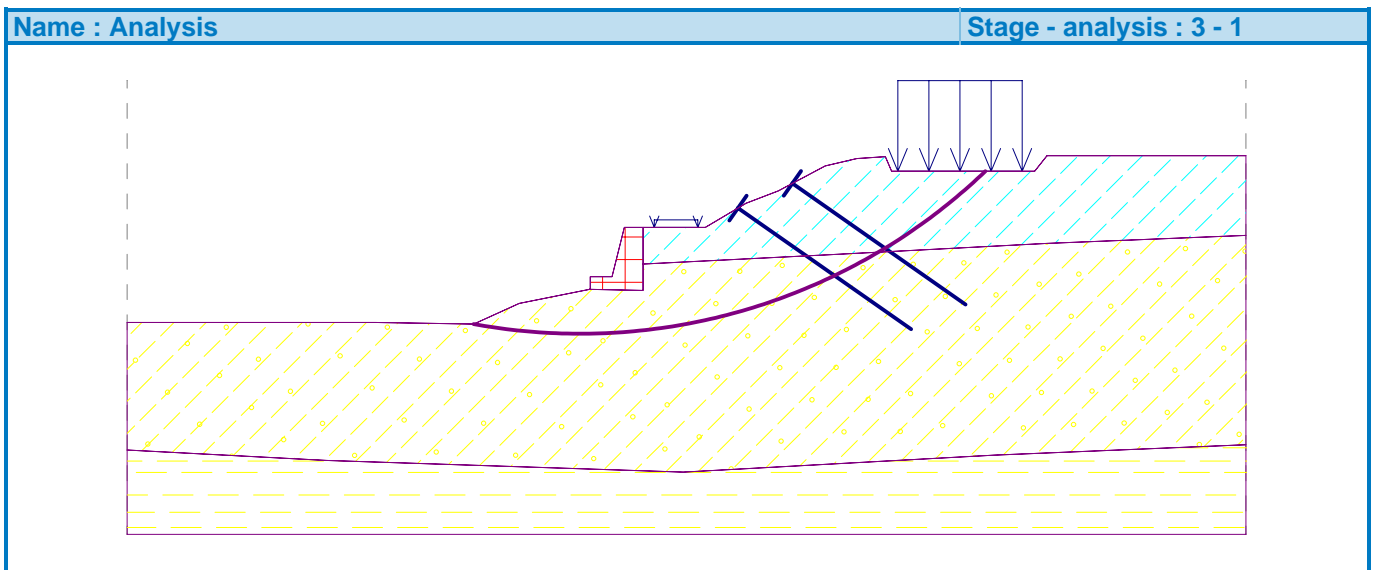
Sum of passive forces :  $F_p = 3400,31$  kN/m

Sliding moment :  $M_a = 104208,30$  kNm/m

Resisting moment :  $M_p = 165585,37$  kNm/m

Factor of safety = 1,59 > 1,50

**Slope stability SATISFACTORY**



**Analysis 2 (stage 3)**

**Polygonal slip surface**

Coordinates of slip surface points [m]									
X	Z	X	Z	X	Z	X	Z	X	Z
13,07	117,16	17,12	116,15	22,19	117,53	29,86	120,48	36,40	121,48
42,18	122,20	47,63	127,50						

Specified slip surface.

**Slope stability verification (Sarma)**

**The analysis has not been carried out.**