# Slope stability analysis

## Input data

### Project

Task : Sanacija plazu na LC 456251 Leskovec - Cirkulane pri hiši Pistava 15
Description : Povratna stabilnostna analiza
Customer : Občina Cirkulane
Author : GEOING d.o.o.
Date : 21/02/2025

### Settings

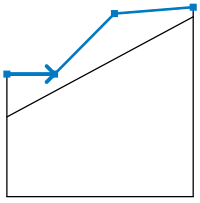
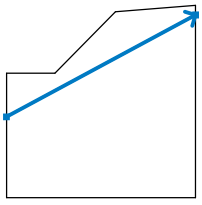
Slovenia - EN 1997 (36)

### 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 | 2,70 | 3,00 | 2,70 | 6,75 | 6,50 |
| | | 11,70 | 6,90 | | | | |
| 2 |  | 0,00 | 0,00 | 11,70 | 6,30 | | |

### Soil parameters - effective stress state

| No. | Name | Pattern | $\varphi_{ef}$ [°] | $c_{ef}$ [kPa] | $\gamma$ [kN/m3] |
|---|---|---|---|---|---|
| 1 | Glina | | 24,00 | 3,00 | 19,00 |
| 2 | Lapor | | 34,00 | 30,00 | 23,00 |

### Soil parameters - uplift

| No. | Name | Pattern | $\gamma_{sat}$ [kN/m3] | $\gamma_s$ [kN/m3] | n [–] |
|---|---|---|---|---|---|
| 1 | Glina | | 19,00 | | |



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| No. | Name | Pattern | $\gamma_{sat}$ [kN/m$^3$] | $\gamma_s$ [kN/m$^3$] | n [–] |
|---|---|---|---|---|---|
| 2 | Lapor | | 23,00 | | |

## Soil parameters

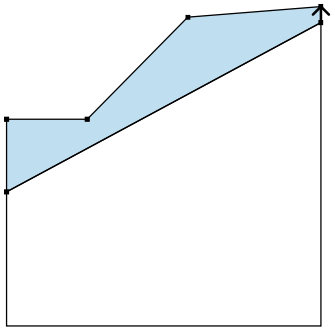
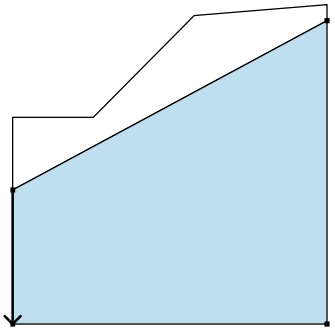
**Glina**

Unit weight : $\gamma$ = 19,00 kN/m$^3$
Stress-state : effective
Angle of internal friction : $\varphi_{ef}$ = 24,00 °
Cohesion of soil : $c_{ef}$ = 3,00 kPa
Saturated unit weight : $\gamma_{sat}$ = 19,00 kN/m$^3$

**Lapor**

Unit weight : $\gamma$ = 23,00 kN/m$^3$
Stress-state : effective
Angle of internal friction : $\varphi_{ef}$ = 34,00 °
Cohesion of soil : $c_{ef}$ = 30,00 kPa
Saturated unit weight : $\gamma_{sat}$ = 23,00 kN/m$^3$

## Assigning and surfaces

| No. | Surface position | Coordinates of surface points [m] x | z | x | z | Assigned soil |
|---|---|---|---|---|---|---|
| 1 |  | 11,70 | 6,30 | 11,70 | 6,90 | Glina |
| | | 6,75 | 6,50 | 3,00 | 2,70 | |
| | | 0,00 | 2,70 | 0,00 | 0,00 | |
| 2 |  | 0,00 | 0,00 | 0,00 | -5,00 | Lapor |
| | | 11,70 | -5,00 | 11,70 | 6,30 | |

## Water

Water type : No water

## Tensile crack

Tensile crack not input.

## Earthquake

Earthquake not included.



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### Settings of the stage of construction

Design situation : permanent

## Results (Stage of construction 1)

### Analysis 1

**Circular slip surface**

| Slip surface parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| Center : | x = | 0,38 | [m] | Angles : | $\alpha_1$ = | 17,58 | [°] |
| | z = | 11,07 | [m] | | $\alpha_2$ = | 59,27 | [°] |
| Radius : | R = | 8,75 | [m] | | | | |
| Analysis of the slip surface without optimization. | | | | | | | |

**Slope stability verification (Bishop)**

Sum of active forces : $F_a$ = 50,64 kN/m
Sum of passive forces : $F_p$ = 48,76 kN/m

Sliding moment : $M_a$ = 443,14 kNm/m
Resisting moment : $M_p$ = 426,68 kNm/m
Factor of safety = 0,96 < 1,50
**Slope stability NOT ACCEPTABLE**



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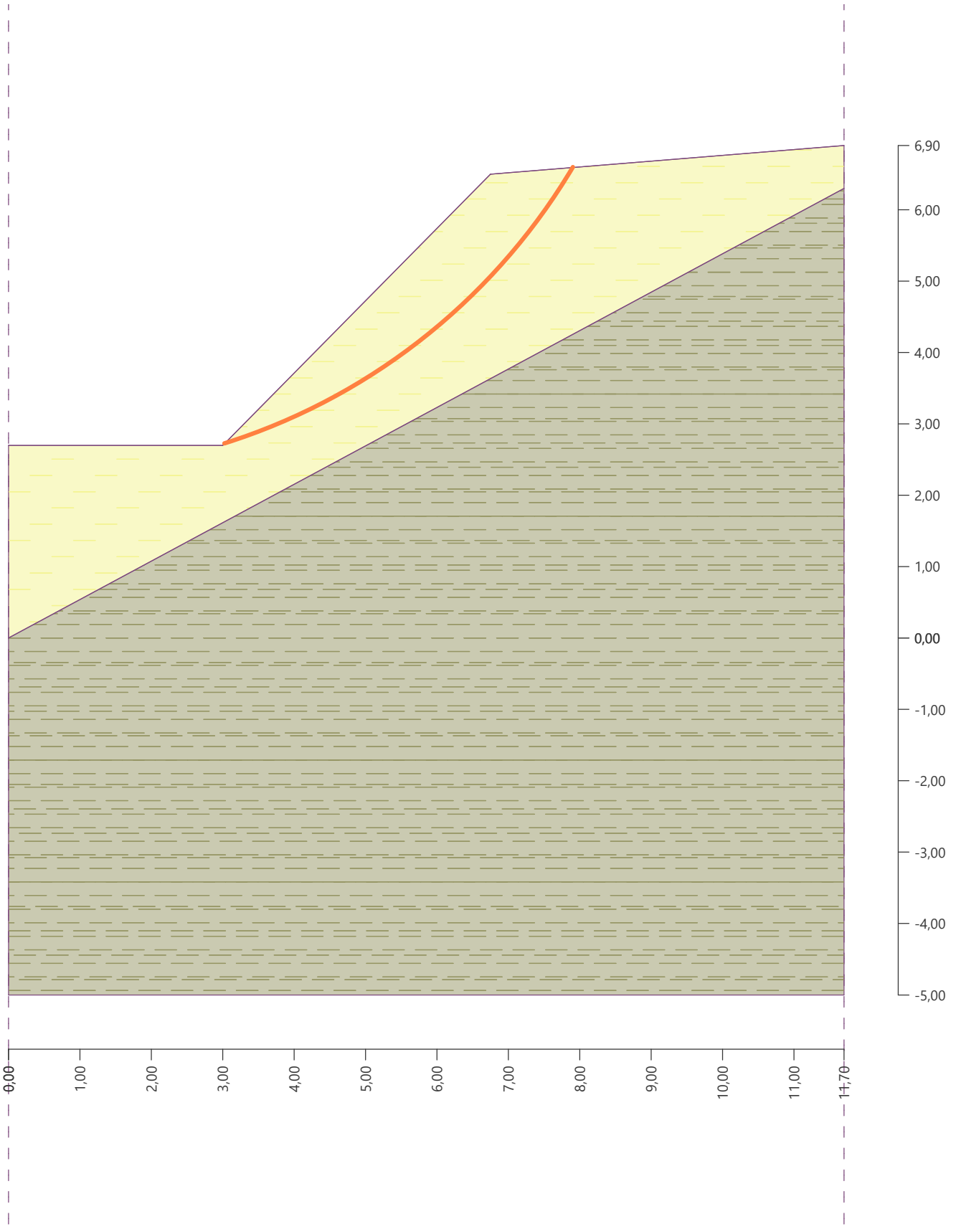
**Name : Analysis** | **Stage - analysis : 1 - 1**

**Description : Drsina 1**



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## Analysis 2

### Circular slip surface

| Slip surface parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| Center : | x = | 1,61 | [m] | Angles : | $\alpha_1$ = | 8,99 | [°] |
| | z = | 11,53 | [m] | | $\alpha_2$ = | 57,18 | [°] |
| Radius : | R = | 8,94 | [m] | | | | |
| Analysis of the slip surface without optimization. | | | | | | | |

**Slope stability verification (Bishop)**

Sum of active forces : $F_a$ = 78,56 kN/m
Sum of passive forces : $F_p$ = 80,89 kN/m

Sliding moment : $M_a$ = 701,98 kNm/m
Resisting moment : $M_p$ = 722,82 kNm/m
Factor of safety = 1,03 < 1,50
**Slope stability NOT ACCEPTABLE**


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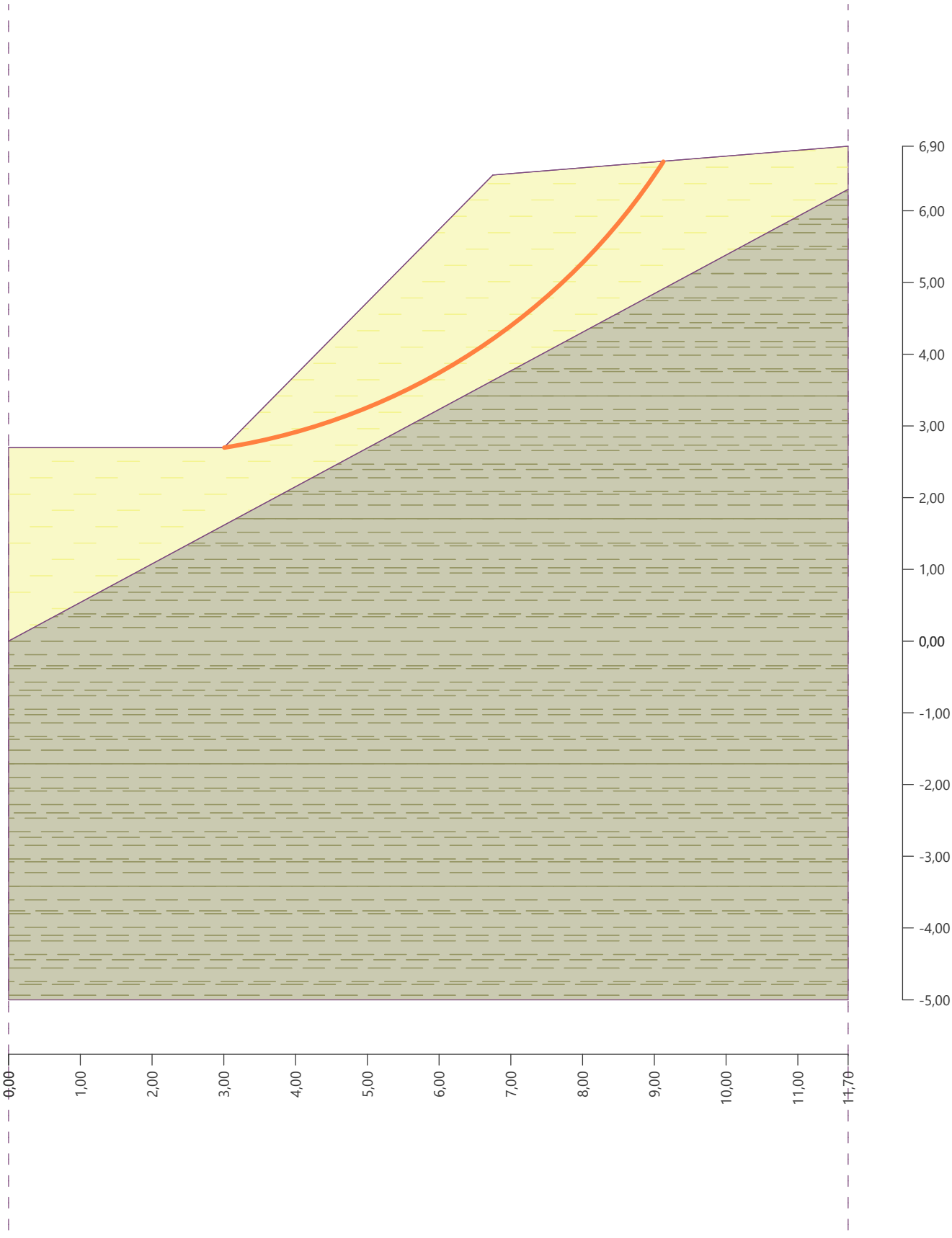
**Name : Analysis** | **Stage - analysis : 1 - 2**

**Description : Drsina 2**



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## Analysis 3

### Circular slip surface

| Slip surface parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| Center : | x = | 0,12 | [m] | Angles : | $\alpha_1$ = | 11,21 | [°] |
| | z = | 17,80 | [m] | | $\alpha_2$ = | 44,15 | [°] |
| Radius : | R = | 15,30 | [m] | | | | |
| Analysis of the slip surface without optimization. | | | | | | | |

**Slope stability verification (Bishop)**

Sum of active forces : $F_a$ = 88,71 kN/m
Sum of passive forces : $F_p$ = 106,28 kN/m

Sliding moment : $M_a$ = 1356,94 kNm/m
Resisting moment : $M_p$ = 1625,84 kNm/m
Factor of safety = 1,20 < 1,50
**Slope stability NOT ACCEPTABLE**


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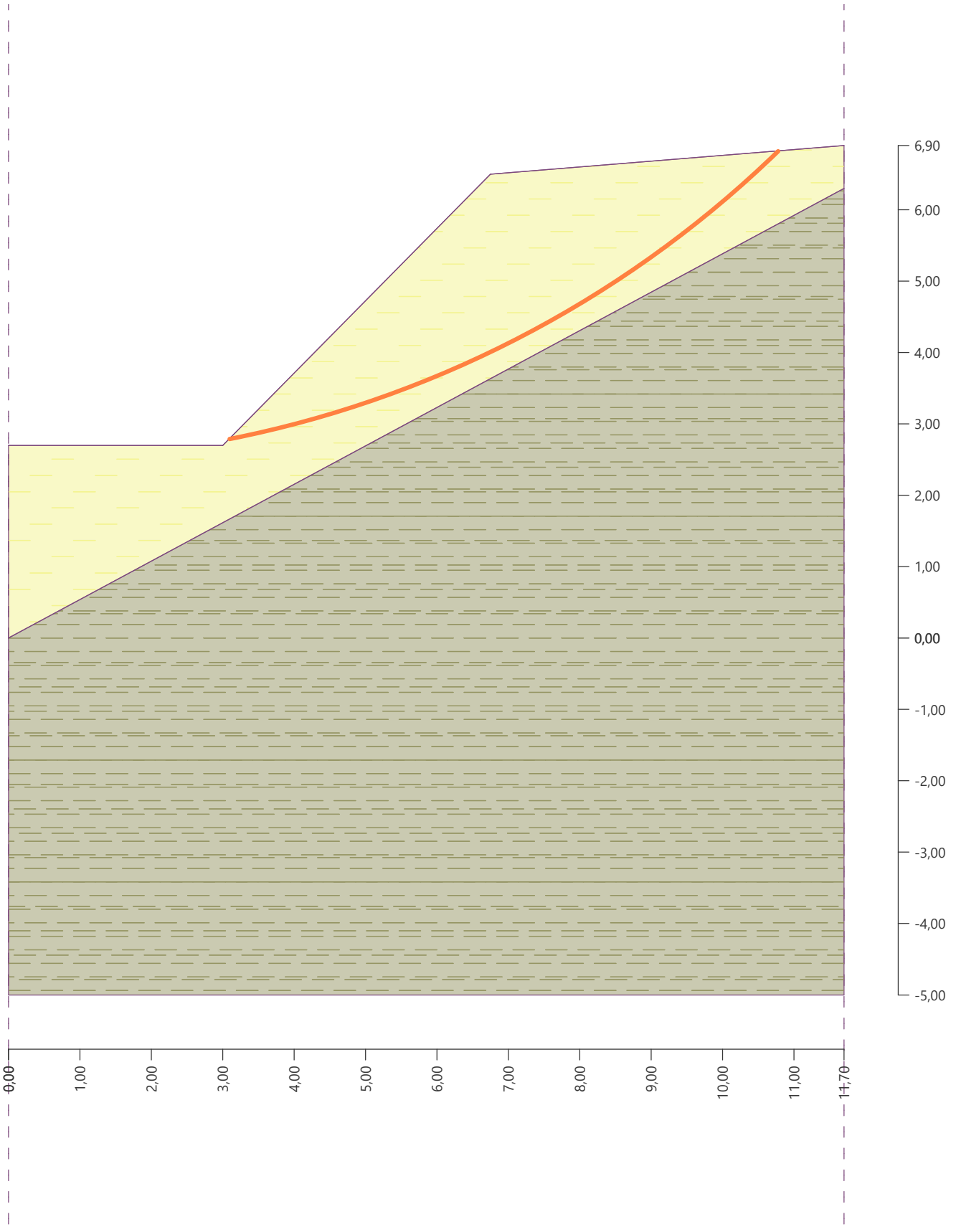
**Name : Analysis** | **Stage - analysis : 1 - 3**

**Description : Drsina 3**



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## Analysis 4

### Circular slip surface

| Slip surface parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| Center : | x = | 2,33 | [m] | Angles : | $\alpha_1$ = | -18,17 | [°] |
| | z = | 8,60 | [m] | | $\alpha_2$ = | 71,38 | [°] |
| Radius : | R = | 6,21 | [m] | | | | |
| Analysis of the slip surface without optimization. | | | | | | | |

**Slope stability verification (Bishop)**

Sum of active forces : $F_a$ = 80,43 kN/m
Sum of passive forces : $F_p$ = 94,25 kN/m

Sliding moment : $M_a$ = 499,55 kNm/m
Resisting moment : $M_p$ = 585,37 kNm/m
Factor of safety = 1,17 < 1,50
**Slope stability NOT ACCEPTABLE**


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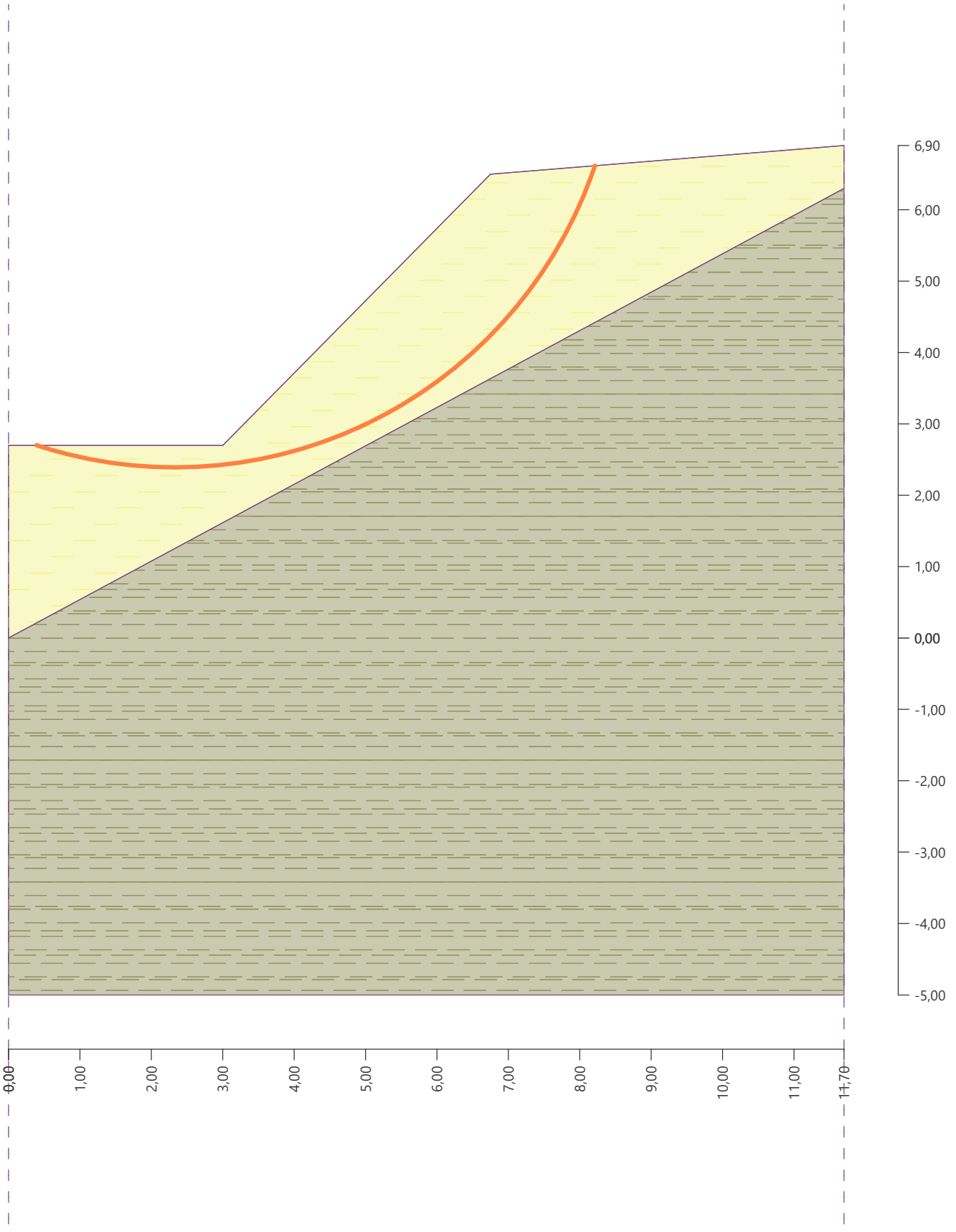
**Name : Analysis** | **Stage - analysis : 1 - 4**

**Description : Drsina 4**



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## Analysis 5

### Circular slip surface

| Slip surface parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| Center : | x = | 3,14 | [m] | Angles : | $\alpha_1$ = | -21,50 | [°] |
| | z = | 9,11 | [m] | | $\alpha_2$ = | 69,80 | [°] |
| Radius : | R = | 6,89 | [m] | | | | |
| Analysis of the slip surface without optimization. | | | | | | | |

**Slope stability verification (Bishop)**

Sum of active forces : $F_a$ = 120,10 kN/m
Sum of passive forces : $F_p$ = 307,23 kN/m

Sliding moment : $M_a$ = 827,38 kNm/m
Resisting moment : $M_p$ = 2116,57 kNm/m
Factor of safety = 2,56 > 1,50
**Slope stability ACCEPTABLE**


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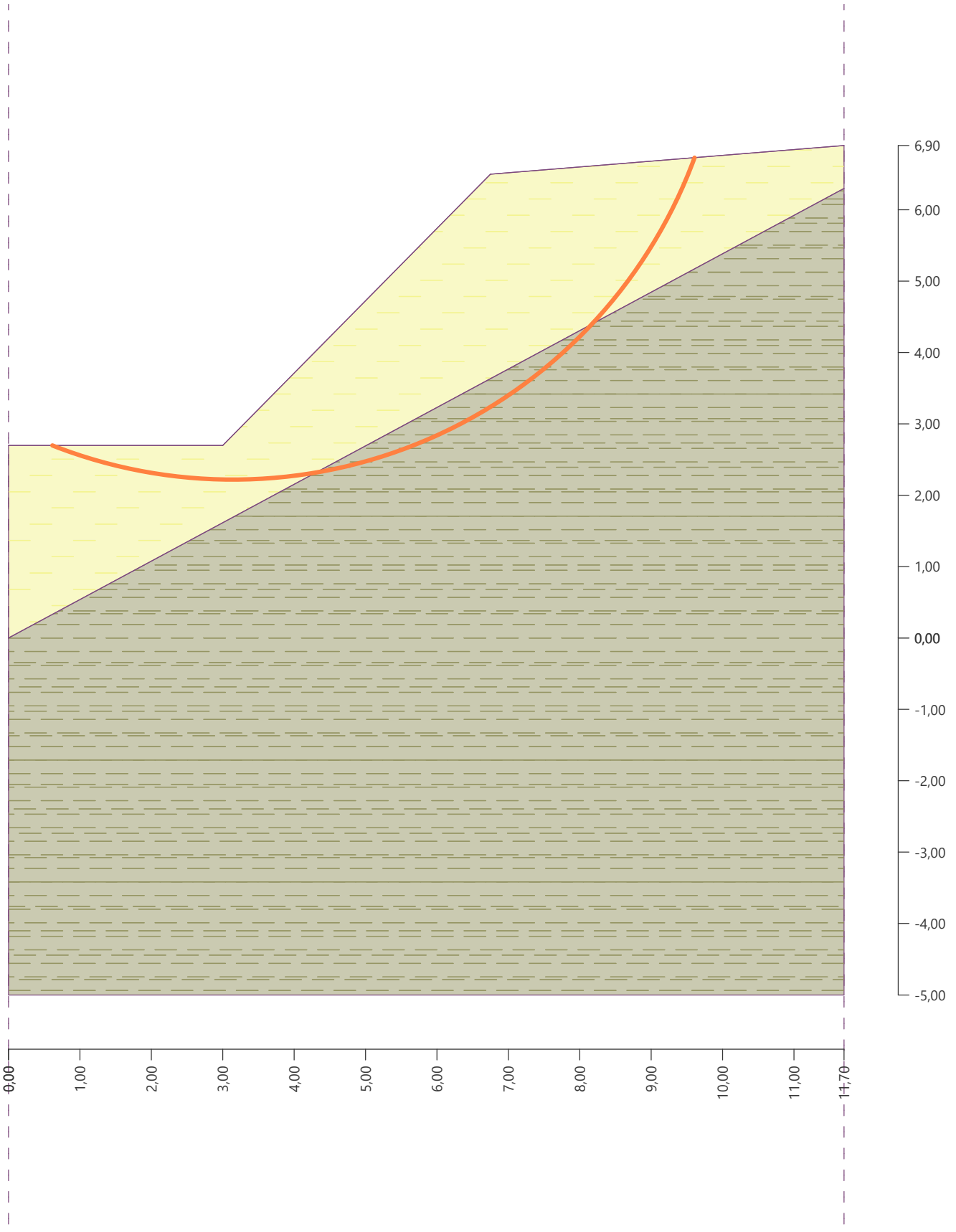
**Name : Analysis** | **Stage - analysis : 1 - 5**

**Description : Drsina 5**



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