Slope stability analysis

Input data

Project

Task : Sanacija plazu na LC 440291 Zg.Gruškovje-Straža pri hiši Zg.Gruškovje 6
Description : Konzolna pilotna stena
Customer : Občina Oplotnica
Author : GROING d.o.o.
Date : 05/08/2025

Settings

Slovenia - EN 1997 (90)

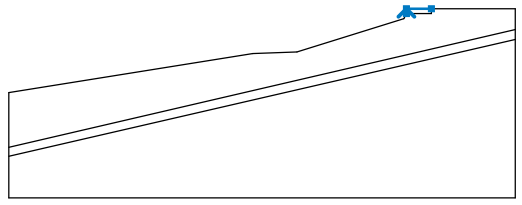
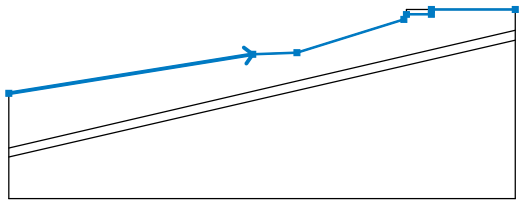
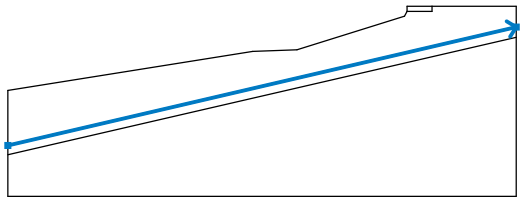
Stability analysis

Earthquake analysis : Standard
Verification methodology : according to EN 1997
Design approach : 2 - reduction of actions and resistances

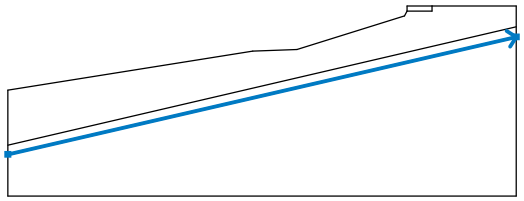
Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1,35	[–]	1,00	[–]
Variable actions :	γ_Q =	1,50	[–]	0,00	[–]
Water load :	γ_w =	1,35	[–]		

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on sliding resistance (on slip surface) :	γ_{Rs} =	1,10	[–]

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		47,90	17,20	47,90	17,80	50,90	17,80
2		0,00	7,70	29,40	12,40	34,70	12,60
		47,60	16,60	47,90	17,20	50,90	17,20
		50,90	17,80	61,00	17,80		
3		0,00	1,10	61,00	15,30		

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No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		0,00	0,00	61,00	14,10		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Glina		14,50	1,00	19,00
2	Preperina		32,00	10,00	20,00
3	Hribina		34,00	30,00	22,00
4	Greda		45,00	50,00	24,00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Glina		19,00		
2	Preperina		20,00		
3	Hribina		22,00		
4	Greda		24,00		

Soil parameters

Glina

Unit weight : γ = 19,00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 14,50 °
Cohesion of soil : c_{ef} = 1,00 kPa
Saturated unit weight : γ_{sat} = 19,00 kN/m^3

Preperina

Unit weight : γ = 20,00 kN/m^3

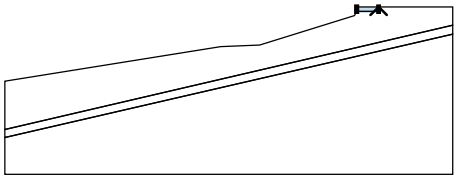
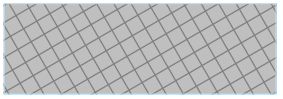
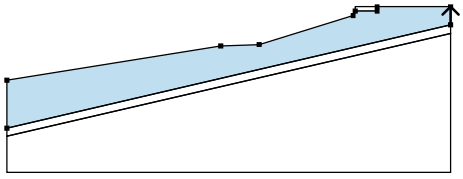
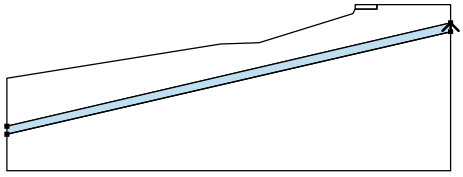
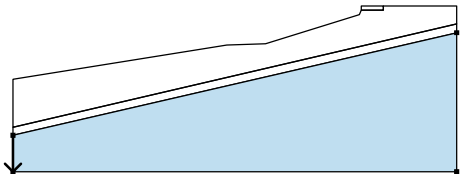
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Stress-state : effective
Angle of internal friction : φ_{ef} = 32,00 °
Cohesion of soil : c_{ef} = 10,00 kPa
Saturated unit weight : γ_{sat} = 20,00 kN/m^3

Hribina
Unit weight : γ = 22,00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 34,00 °
Cohesion of soil : c_{ef} = 30,00 kPa
Saturated unit weight : γ_{sat} = 22,00 kN/m^3

Greda
Unit weight : γ = 24,00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 45,00 °
Cohesion of soil : c_{ef} = 50,00 kPa
Saturated unit weight : γ_{sat} = 24,00 kN/m^3

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		50,90	17,20	50,90	17,80	Greda
		47,90	17,80	47,90	17,20	
						
2		61,00	15,30	61,00	17,80	Glina
		50,90	17,80	50,90	17,20	
		47,90	17,20	47,60	16,60	
		34,70	12,60	29,40	12,40	
		0,00	7,70	0,00	1,10	
3		61,00	14,10	61,00	15,30	Preperina
		0,00	1,10	0,00	0,00	
						
4		0,00	0,00	0,00	-5,00	Hribina
		61,00	-5,00	61,00	14,10	
						

Anti-Slide piles

No.	Point		Length	Pile spacing	Cross-section	Pile bearing capacity			
	x [m]	z [m]	l [m]	b [m]	[m]	Distribution along the pile	Max. bearing capacity V_u [kN]	Gradient K [–]	Passive force direction
1	48,40	17,80	10,10	1,00	d = 0,50	linear	150,00	0,50	perpendicular to pile

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No.	Point		Length	Pile spacing	Cross-section	Pile bearing capacity			
	x [m]	z [m]	l [m]	b [m]	[m]	Distribution along the pile	Max. bearing capacity V_u [kN]	Gradient K [–]	Passive force direction
2	49,40	17,80	10,10	1,00	d = 0,50	linear	150,00	0,50	perpendicular to pile

Surcharge

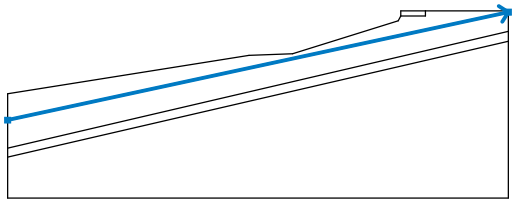
No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude q, q_1, f, F	Magnitude q_2	Magnitude unit
1	strip	permanent	on terrain	x = 50,90	l = 10,00		0,00	75,00		kN/m^2

Surcharges

No.	Name
1	Objekt

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		0,00	4,50	61,00	17,65		

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

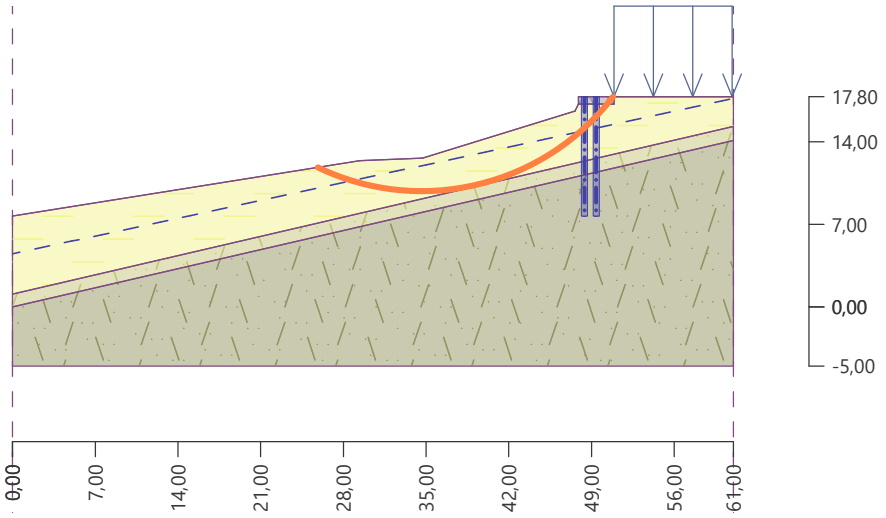
Slip surface parameters							
Center :	x =	34,65	[m]	Angles :	α_1 =	-25,59	[°]
	z =	30,23	[m]		α_2 =	52,46	[°]
Radius :	R =	20,40	[m]				
Specified slip surface.							

Slope stability verification (Morgenstern-Price)

Analysis has not been performed.

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



Analysis 2

Circular slip surface

Slip surface parameters							
Center :	x =	35,71	[m]	Angles :	α_1 =	-11,60	[°]
	z =	58,31	[m]		α_2 =	31,26	[°]
Radius :	R =	47,39	[m]				
Analysis of the slip surface without optimization.							

The forces acting on the pile

Anti-Slide Pile No. 1 (48,40; 17,80 [m])

Horizontal active force:	177,65	kN/m
Horizontal passive force:	42,08	kN/m
Depth of slip surface:	5,15	m
The length of pile below terrain:	10,10	m

Anti-Slide Pile No. 2 (49,40; 17,80 [m])

Horizontal active force:	245,41	kN/m
Horizontal passive force:	107,63	kN/m
Depth of slip surface:	4,85	m
The length of pile below terrain:	10,10	m

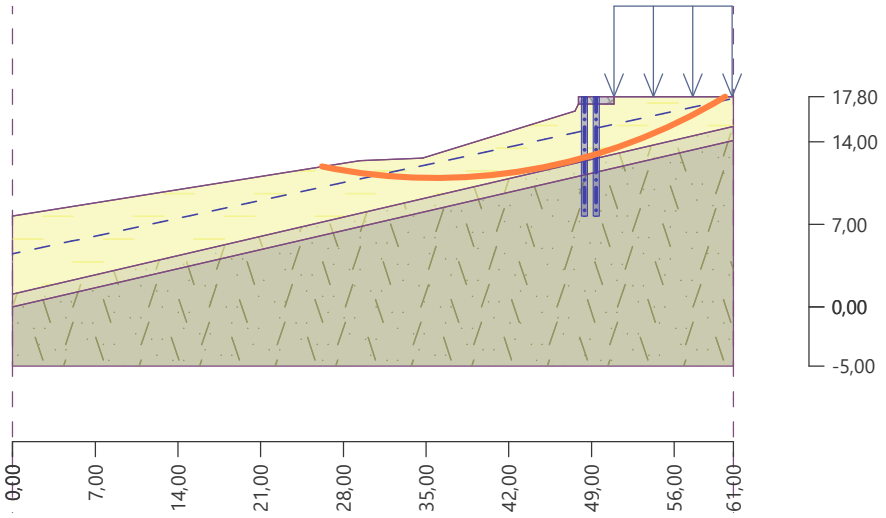
Slope stability verification (Morgenstern-Price)

Utilization : 94,9 %

Slope stability ACCEPTABLE

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



Analysis 3

Circular slip surface

Slip surface parameters							
Center :	x =	35,23	[m]	Angles :	α_1 =	-20,89	[°]
	z =	35,91	[m]		α_2 =	45,28	[°]
Radius :	R =	25,74	[m]				
Analysis of the slip surface without optimization.							

The forces acting on the pile

Anti-Slide Pile No. 1 (48,40; 17,80 [m])
- Horizontal active force: 145,71 kN/m
- Horizontal passive force: 7,69 kN/m
- Depth of slip surface: 3,99 m
- The length of pile below terrain: 10,10 m

Anti-Slide Pile No. 2 (49,40; 17,80 [m])
- Horizontal active force: 213,30 kN/m
- Horizontal passive force: 76,09 kN/m
- Depth of slip surface: 3,38 m
- The length of pile below terrain: 10,10 m

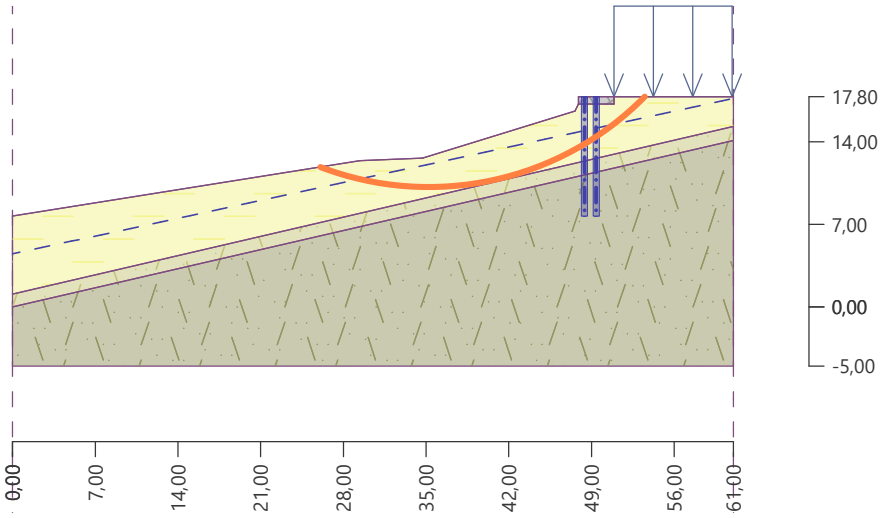
Slope stability verification (Morgenstern-Price)

Utilization : 93,5 %

Slope stability ACCEPTABLE

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Name : Analysis	Stage - analysis : 1 - 3
Description : Porušnica 3	



Piles verification 1

Anti-Slide pile : Anti-Slide Pile No. 2 (49,40; 17,80 [m])
Analysis : Calculation 2 (slip surface circular)
Method : Morgenstern-Price

Analysis of anti-slide pile

Input data

Settings

Slovenia - EN 1997 (90)

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard
Steel structures : EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section : γ_{M0} = 1,00

Pressure analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Modulus of subsoil reaction : standard
Consider reduction of the modulus of subsoil reaction for a braced sheeting
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 :	γ_G =	1,35	[–]	1,00	[–]
Variable actions :	γ_Q =	1,50	[–]	0,00	[–]
Water load :	γ_w =	1,35	[–]		

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on earth resistance :	γ_{Re} =	1,40	[–]

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Anchors

Verification methodology : Limit states (LSD)

Reduction coefficients			
Reduction. coeff of steel strength :	γ_s =	1,35	[–]
Reduction coefficient of pull out resistance (soil) :	γ_e =	1,35	[–]
Reduction coefficient of pull out resistance (grouting) :	γ_c =	1,35	[–]

Geometry of structure

Structure length = 10,10 m

Cross-section name : Pile curtain d = 0,50 m; a = 1,00 m
Material of pile : concrete
Computed coefficient of pressure reduction below the ditch = 1,00
Area of cross-section A = 1,96E-01 m^2/m
Moment of inertia I = 3,07E-03 m^4/m
Elastic modulus E = 33000,00 MPa
Shear modulus G = 13750,00 MPa

Forces above the slip surface

Depth of slip surface h_{s1} = 4,85 m

Input of active horizontal force : residual active force
Input of passive horizontal force : residual passive force

Active horizontal force T = 245,41 kN/m
Passive horizontal force P = 107,63 kN/m

Distribution of active force : triangle
Distribution of passive force : triangle

Material of structure

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 30/37
Cylinder compressive strength f_{ck} = 30,00 MPa
Tensile strength f_{ctm} = 2,90 MPa
Elasticity modulus E_{cm} = 33000,00 MPa
Shear modulus G = 13750,00 MPa

Longitudinal steel : B500
Yield strength f_{yk} = 500,00 MPa

Transverse steel: B500
Yield strength f_{yk} = 500,00 MPa

Modulus of reaction

Modulus of subsoil reaction is computed by method Schmitt.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
1	Glina		14,50	1,00	19,00	9,00	14,50
2	Preperina		32,00	10,00	20,00	10,00	32,00
3	Hribina		34,00	30,00	22,00	12,00	34,00

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No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
4	Greda		45,00	50,00	24,00	14,00	45,00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	Glina		cohesive	-	0,40	-	-
2	Preperina		cohesive	-	0,25	-	-
3	Hribina		cohesive	-	0,20	-	-
4	Greda		cohesive	-	0,16	-	-

Parameters of soils to compute modulus of subsoil reaction (Schmitt)

No.	Name	Pattern	ν [–]	E_{oed} [MPa]	E_{def} [MPa]
1	Glina		0,40	3,00	-
2	Preperina		0,25	20,00	-
3	Hribina		0,20	50,00	-
4	Greda		0,16	50,00	-

Soil parameters

Glina

Unit weight :	γ =	19,00 kN/m^3
Stress-state :	effective	
Angle of internal friction :	φ_{ef} =	14,50 °
Cohesion of soil :	c_{ef} =	1,00 kPa
Angle of friction struc.-soil :	δ =	14,50 °
Soil :	cohesive	
Poisson's ratio :	ν =	0,40
Oedometric modulus :	E_{oed} =	3,00 MPa
Saturated unit weight :	γ_{sat} =	19,00 kN/m^3

Preperina

Unit weight :	γ =	20,00 kN/m^3
Stress-state :	effective	
Angle of internal friction :	φ_{ef} =	32,00 °
Cohesion of soil :	c_{ef} =	10,00 kPa
Angle of friction struc.-soil :	δ =	32,00 °
Soil :	cohesive	
Poisson's ratio :	ν =	0,25
Oedometric modulus :	E_{oed} =	20,00 MPa
Saturated unit weight :	γ_{sat} =	20,00 kN/m^3

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Hribina

Unit weight :	γ	=	22,00 kN/m^3
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34,00 °
Cohesion of soil :	c_{ef}	=	30,00 kPa
Angle of friction struc.-soil :	δ	=	34,00 °
Soil :	cohesive		
Poisson's ratio :	ν	=	0,20
Oedometric modulus :	E_{oed}	=	50,00 MPa
Saturated unit weight :	γ_{sat}	=	22,00 kN/m^3

Greda

Unit weight :	γ	=	24,00 kN/m^3
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	45,00 °
Cohesion of soil :	c_{ef}	=	50,00 kPa
Angle of friction struc.-soil :	δ	=	45,00 °
Soil :	cohesive		
Poisson's ratio :	ν	=	0,16
Oedometric modulus :	E_{oed}	=	50,00 MPa
Saturated unit weight :	γ_{sat}	=	24,00 kN/m^3

Pile fixed into the rock

Length of wall in the rock l = 4,00 m
Bearing capacity of rock R = 3000,00 kPa

Geological profile and assigned soils

Position information
Terrain elevation = 17,80 m

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Altitude [m]	Assigned soil	Pattern
1	0,60	0,00 .. 0,60	17,80 .. 17,20	Greda	
2	4,54	0,60 .. 5,14	17,20 .. 12,66	Glina	
3	1,18	5,14 .. 6,32	12,66 .. 11,48	Preperina	
4	-	6,32 .. ∞	11,48 .. -	Hribina	

Excavation

Soil in front of wall is excavated to a depth of 0,00 m.

Ditch bottom shape

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,01
2	-1,25	0,01
3	-1,25	0,60
4	-1,55	1,20
5	-14,45	5,20

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No.	Coordinate x [m]	Depth z [m]
6	-19,75	5,40
7	-49,15	10,10
8	-50,15	10,10

Origin [0,0] is located at the ditch bottom.
Positive coordinate +z has downward direction.

Terrain profile

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,00
2	0,10	0,00
3	1,25	0,00
4	2,25	0,00

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

Water influence

GWT behind the structure lies at a depth of 2,60 m
GWT in front of the structure lies at a depth of 2,70 m
Subgrade at the heel is not permeable.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m^2]	Mag.2 [kN/m^2]	Ord.x x [m]	Length l [m]	Depth z [m]
1	Yes		permanent	75,00		1,25	10,00	on terrain

No.	Name
1	Objekt

Global settings

Number of FEs to discretize wall = 100
Analysis of depending pressures : reduce according to analysis settings
Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0{,}20\sigma_z$

Settings of the stage of construction

Design situation : permanent

Analysis results

Pressure above the slip surface

Depth [m]	Passive pressure [kPa]	Active pressure [kPa]
0	0,00	0,00
0,00	0,00	0,00
0,00	0,00	0,00
4,85	44,37	101,18

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Distribution of pressures acting on the structure (in front and behind the wall) - above slip surface

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.12	0.12	0.12
0.23	0.00	0.00	0.00	2.75	2.75	2.75
0.51	0.00	0.00	0.00	5.91	5.91	5.91
0.59	0.00	0.00	0.00	6.91	6.91	6.91
0.60	0.00	0.00	0.00	7.03	7.03	7.03
0.71	0.00	0.00	0.00	8.31	8.31	8.31
0.77	0.00	0.00	0.00	9.06	9.06	9.06
1.01	0.00	0.00	0.00	11.83	11.83	11.83
1.19	0.00	0.00	0.00	13.93	13.93	13.93
1.20	0.00	0.00	0.00	14.05	14.05	14.05
1.52	0.00	0.00	0.00	17.74	17.74	17.74
1.84	0.00	0.00	0.00	21.54	21.54	21.54
1.84	0.00	0.00	0.00	21.58	21.58	21.58
2.01	0.00	0.00	0.00	23.55	23.55	23.55
2.02	0.00	0.00	0.00	23.65	23.65	23.65
2.09	0.00	0.00	0.00	24.51	24.51	24.51
2.23	0.00	0.00	0.00	26.14	26.14	26.14
2.39	0.00	0.00	0.00	27.94	27.94	27.94
2.52	0.00	0.00	0.00	29.56	29.56	29.56
2.60	0.00	0.00	0.00	30.44	30.44	30.44
2.70	0.00	0.00	0.00	31.61	31.61	31.61
3.02	0.00	0.00	0.00	35.36	35.36	35.36
3.03	0.00	0.00	0.00	35.48	35.48	35.48
3.54	0.00	0.00	0.00	41.39	41.39	41.39
3.80	0.00	0.00	0.00	44.53	44.53	44.53
4.04	0.00	0.00	0.00	47.30	47.30	47.30
4.54	0.00	0.00	0.00	53.22	53.22	53.22
4.64	0.00	0.00	0.00	54.38	54.38	54.38
4.85	0.00	0.00	0.00	56.80	56.80	56.80

Distribution of pressures acting on the structure (in front and behind the wall) - below the slip surface

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
4.85	-20.79	-20.79	-20.79	97.44	97.44	110.02
5.05	-22.52	-22.52	-22.52	98.48	98.48	112.65
5.14	-23.30	-23.30	-23.30	98.96	98.96	113.85
5.14	-6.26	-24.41	-226.86	37.02	51.09	396.44
5.19	-6.40	-24.55	-228.02	35.10	51.25	398.85
5.39	-6.92	-25.10	-232.64	27.38	51.92	408.46
5.55	-5.31	-19.27	-236.45	21.02	52.47	416.38
6.06	-0.39	-1.41	-248.12	1.54	54.15	440.65
6.10	0.00	0.00	-249.05	0.00	0.00	442.57
6.10	Rock	Rock	Rock	Rock	Rock	Rock
6.32	Rock	Rock	Rock	Rock	Rock	Rock
6.32	Rock	Rock	Rock	Rock	Rock	Rock
6.57	Rock	Rock	Rock	Rock	Rock	Rock

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Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
7.07	Rock	Rock	Rock	Rock	Rock	Rock
7.58	Rock	Rock	Rock	Rock	Rock	Rock
8.08	Rock	Rock	Rock	Rock	Rock	Rock
8.59	Rock	Rock	Rock	Rock	Rock	Rock
9.09	Rock	Rock	Rock	Rock	Rock	Rock
9.60	Rock	Rock	Rock	Rock	Rock	Rock
10.09	Rock	Rock	Rock	Rock	Rock	Rock
10.10	Rock	Rock	Rock	Rock	Rock	Rock

Distributions of the modulus of subsoil reaction and internal forces on the structure

Depth [m]	kh,p [MN/m^3]	kh,z [MN/m^3]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-65.73	0.00	-0.00	0.00
0.01	0.00	0.00	-65.57	0.16	-0.00	0.00
0.51	0.00	0.00	-59.96	5.91	-1.49	0.25
1.01	0.00	0.00	-54.20	11.83	-5.97	2.01
1.51	0.00	0.00	-48.44	17.74	-13.44	6.79
2.02	0.00	0.00	-42.70	23.65	-23.89	16.08
2.52	0.00	0.00	-37.00	29.56	-37.33	31.42
3.03	0.00	0.00	-31.38	35.48	-53.75	54.29
3.53	0.00	0.00	-25.90	41.39	-73.16	86.21
4.04	0.00	0.00	-20.64	47.30	-95.55	128.68
4.54	0.00	0.00	-15.71	53.22	-120.94	183.22
4.85	0.00	0.00	-12.96	56.76	-137.55	222.25
4.86	0.00	0.00	-12.90	76.63	-138.09	223.35
5.05	0.00	0.00	-11.24	75.96	-152.95	251.70
5.55	24.46	0.00	-7.40	-179.27	-67.85	310.17
6.06	24.46	0.00	-4.34	-105.94	3.34	324.90
6.56	83.00	0.00	-2.08	-173.02	80.64	306.79
7.07	83.00	0.00	-0.60	-49.52	134.36	249.89
7.57	0.00	83.00	0.26	21.96	139.43	179.24
8.08	0.00	83.00	0.67	55.87	118.50	113.40
8.58	0.00	83.00	0.79	65.83	87.01	61.30
9.09	0.00	83.00	0.76	62.69	54.19	25.72
9.59	0.00	83.00	0.65	53.89	24.63	6.00
10.10	0.00	83.00	0.53	43.60	-0.00	-0.00

Maximum shear force = 152,95 kN/m
Maximum moment = 324,90 kNm/m
Maximum displacement = 65,7 mm
Displacement in the depth of slip surface = 12,9 mm

Verification of rock bearing capacity

Bearing capacity of rock R = 3000,00 kPa
Partial factor on rock bearing capacity γ_{Rr} = 1,40
Max. stress σ = 479,52 kPa
Design bearing capacity of rock R_d = 2142,86 kPa

Bearing capacity of rock is SATISFACTORY

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Terrain settlement behind the structure

Terrain settlement δ_{max} = 29,3 mm

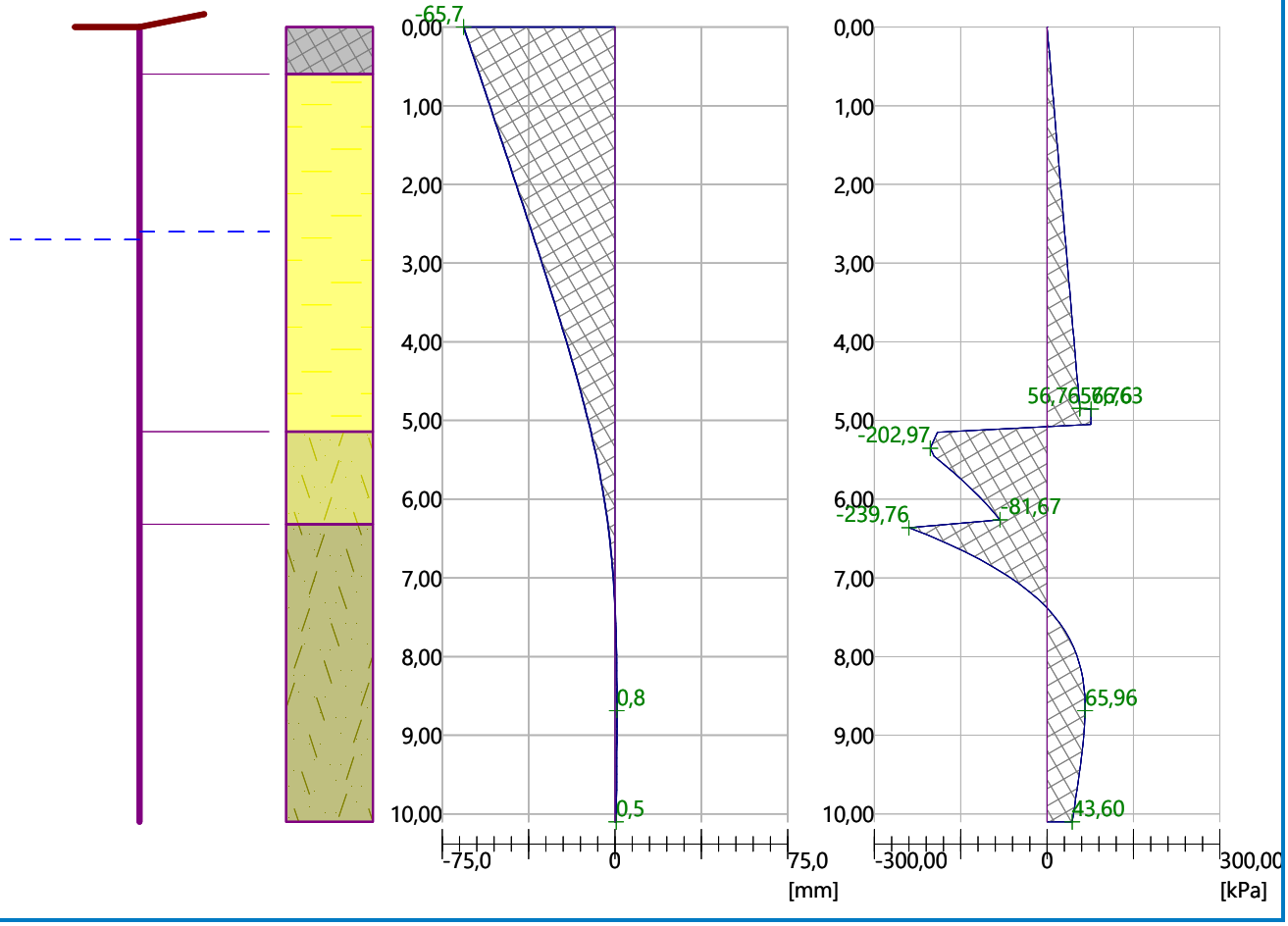
	Coordinate x [m]	Settlement z [mm]
1	0,00	32,6
2	0,81	39,9
3	1,61	44,8
4	2,42	47,4
5	3,23	47,7
6	4,04	45,6
7	4,84	41,2
8	5,65	34,4
9	6,46	25,3
10	7,27	13,8
11	8,07	0,0
12	8,07	0,0

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

Geometry of structure
Length of structure = 10,10m

Displacement of structure
Max. disp. = 65,7 mm

Pressure acting on structure
Max. pressure = 239,76 kPa



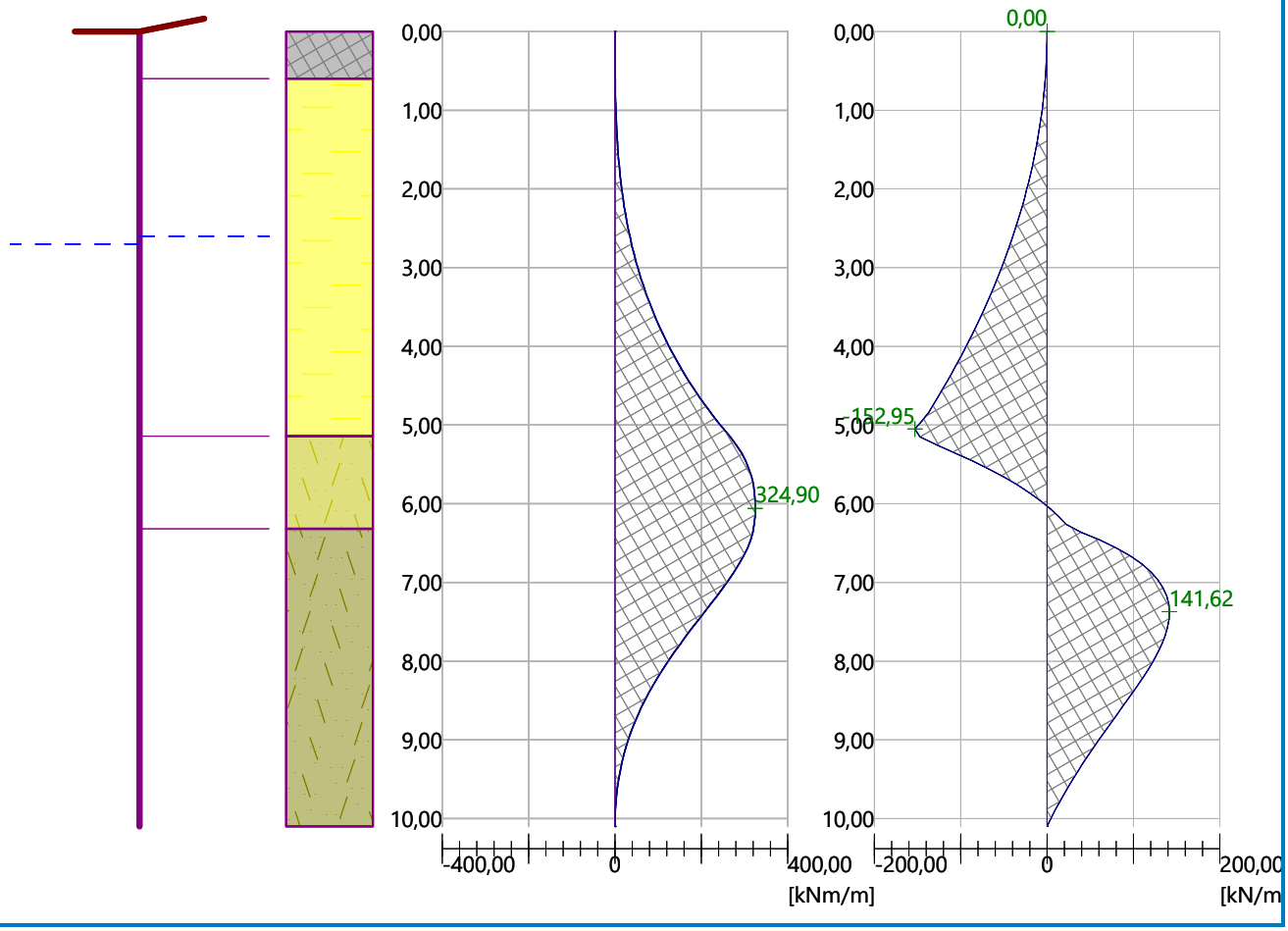
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Name : Analysis	Stage - analysis : 1 - -1

Geometry of structure
Length of structure = 10,10m

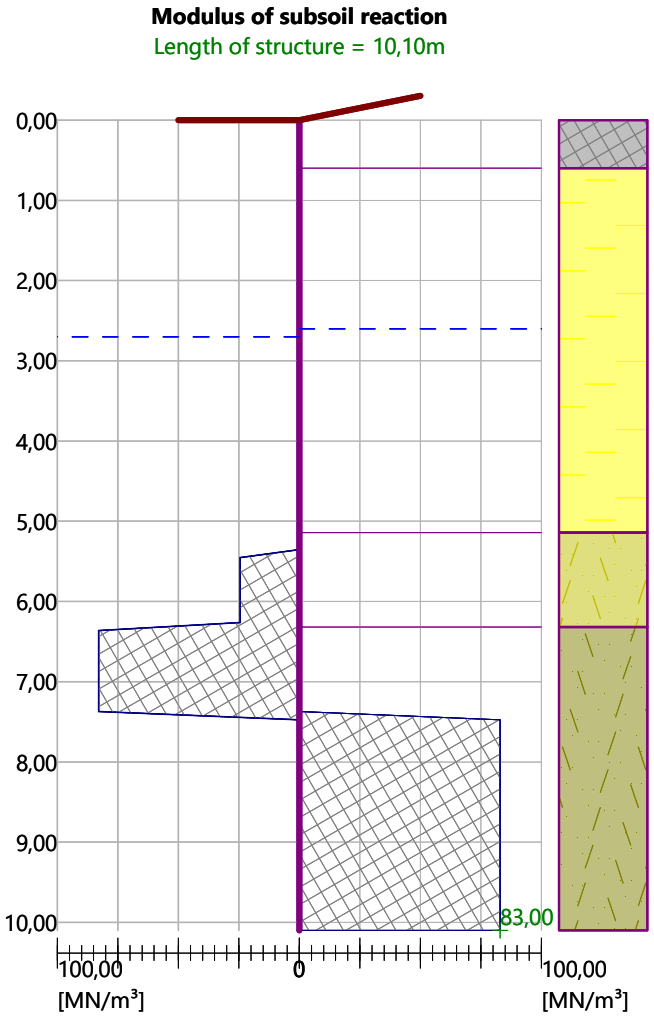
Bending moment
Max. M = 324,90 kNm/m

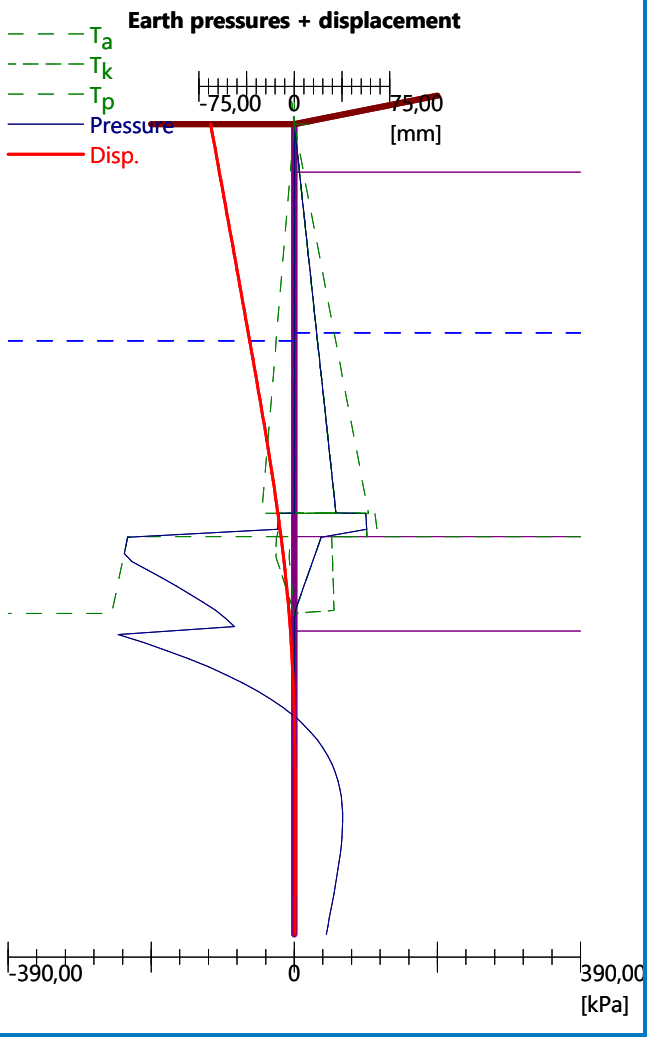
Shear force
Max. Q = 152,95 kN/m



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Name : Analysis	Stage - analysis : 1 - -1





Dimensioning No. 1

	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
0.00	-65.73	-65.73	-0.00	-0.00	0.00	0.00
0.01	-65.66	-65.66	-0.00	-0.00	0.00	0.00
0.01	-65.66	-65.66	-0.00	-0.00	0.00	0.00
0.01	-65.57	-65.57	-0.00	-0.00	0.00	0.00
0.01	-65.57	-65.57	-0.00	-0.00	0.00	0.00
0.51	-59.96	-59.96	-1.49	-1.49	0.25	0.25
1.01	-54.20	-54.20	-5.97	-5.97	2.01	2.01
1.51	-48.44	-48.44	-13.44	-13.44	6.79	6.79
2.02	-42.70	-42.70	-23.89	-23.89	16.08	16.08
2.52	-37.00	-37.00	-37.33	-37.33	31.42	31.42
3.03	-31.38	-31.38	-53.75	-53.75	54.29	54.29
3.53	-25.90	-25.90	-73.16	-73.16	86.21	86.21
4.04	-20.64	-20.64	-95.55	-95.55	128.68	128.68
4.54	-15.71	-15.71	-120.94	-120.94	183.22	183.22
4.85	-12.96	-12.96	-137.55	-137.55	222.25	222.25
4.85	-12.96	-12.96	-137.55	-137.55	222.25	222.25

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	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
4.86	-12.90	-12.90	-138.09	-138.09	223.35	223.35
4.86	-12.90	-12.90	-138.09	-138.09	223.35	223.35
5.05	-11.24	-11.24	-152.95	-152.95	251.70	251.70
5.55	-7.40	-7.40	-67.85	-67.85	310.17	310.17
6.06	-4.34	-4.34	3.34	3.34	324.90	324.90
6.56	-2.08	-2.08	80.64	80.64	306.79	306.79
7.07	-0.60	-0.60	134.36	134.36	249.89	249.89
7.57	0.26	0.26	139.43	139.43	179.24	179.24
8.08	0.67	0.67	118.50	118.50	113.40	113.40
8.58	0.79	0.79	87.01	87.01	61.30	61.30
9.09	0.76	0.76	54.19	54.19	25.72	25.72
9.59	0.65	0.65	24.63	24.63	6.00	6.00
10.10	0.53	0.53	-0.00	-0.00	-0.00	-0.00

Maximum values of internal forces

Maximum displacement = -65,7 mm
Minimum displacement = 0,8 mm
Maximum bending moment = 324,90 kNm/m
Minimum bending moment = 0,00 kNm/m
Maximum shear force = 152,95 kN/m

Verification of RC cross section (Pile curtain d = 0,50 m; a = 1,00 m)

All construction stages are taken into the analysis.
Reduct. coefficient of bearing capacity = 1,00

Verification of cross section in bending:

Reinforcement - 16 pc bars 20,0 mm; cover 40,0 mm
Type of structure (reinforcement ratio) : beam
Reinforcement ratio ρ = 1,280 % > 0,151 % = ρ_{min}
Load : M_{Ed} = 324,90 kNm
Bearing capacity : M_{Rd} = 357,80 kNm
Designed pile reinforcement is SATISFACTORY

Verification of cross section in shear:

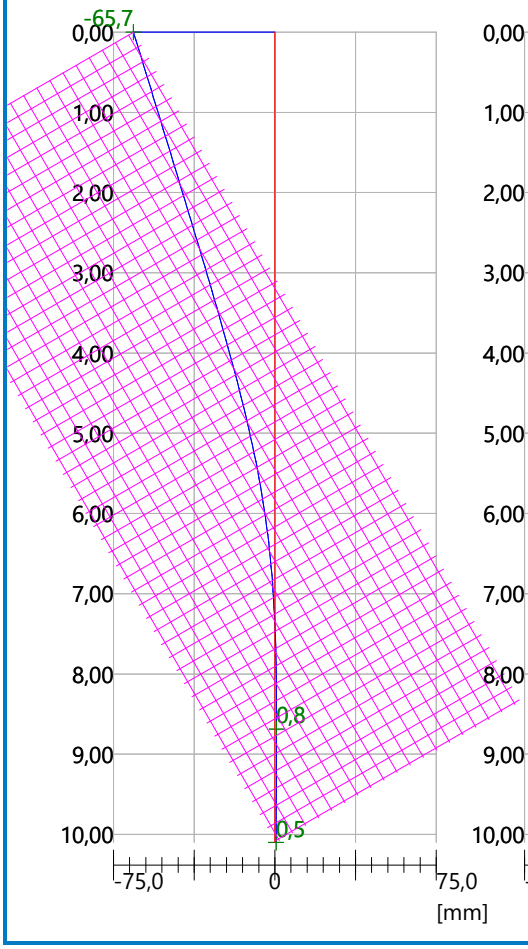
Shear reinf. - 2 profile 10,0 mm; distance 200,0 mm
A_{sw} = 785,4 mm^2
Ultimate shear force: V_{Rd} = 307,33 kN > 152,95 kN = V_{Ed}
Cross-section is SATISFACTORY.

Overall verification: Cross-section is SATISFACTORY

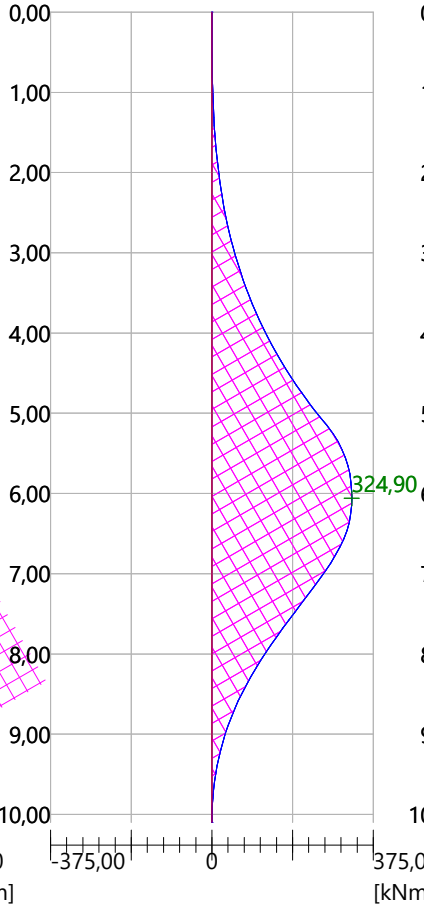
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Name : Dimensioning | **Stage - analysis : 1 - 1**

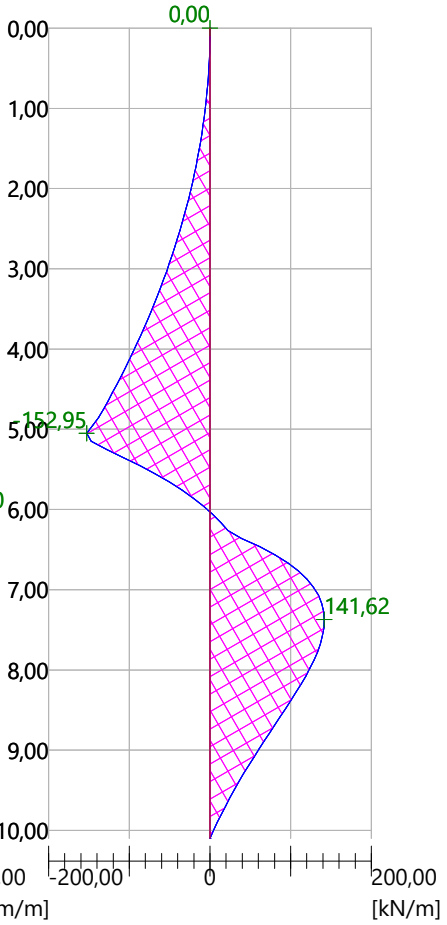
Displacement
Min1 = 0,8; Min2 = -65,7mm
Max1 = 0,8; Max2 = -65,7mm



Bending moment
Min1 = 324,90; Min2 = 0,00kNm/m
Max1 = 324,90; Max2 = 0,00kNm/m



Shear force
Min1 = 141,62; Min2 = -152,95kN/m
Max1 = 141,62; Max2 = -152,95kN/m



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