



Earth pressure on structure analysis

Input data

Project

Date : 29.10.2015

Settings

Standard - safety factors

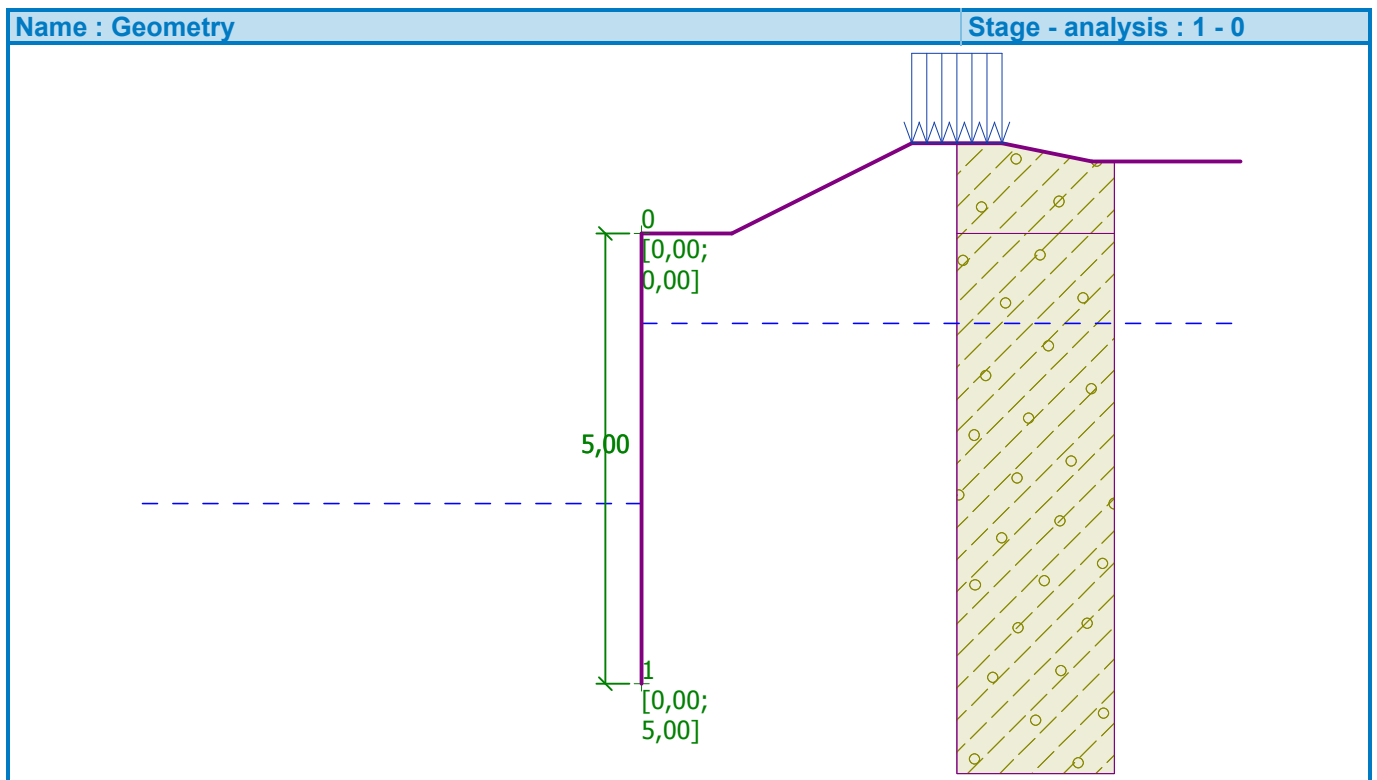
Excavations

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Verification methodology : Safety factors (ASD)

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0,00	0,00
2	0,00	5,00
3	0,00	0,00

The origin [0,0] is located at the most upper point of the structure.



Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	Soil No. 1		29,00	8,00	19,00	9,00	12,00

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



Soil parameters

Soil No. 1

Unit weight : $\gamma = 19,00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{\text{ef}} = 29,00^\circ$
 Cohesion of soil : $c_{\text{ef}} = 8,00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 12,00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{\text{sat}} = 19,00 \text{ kN/m}^3$

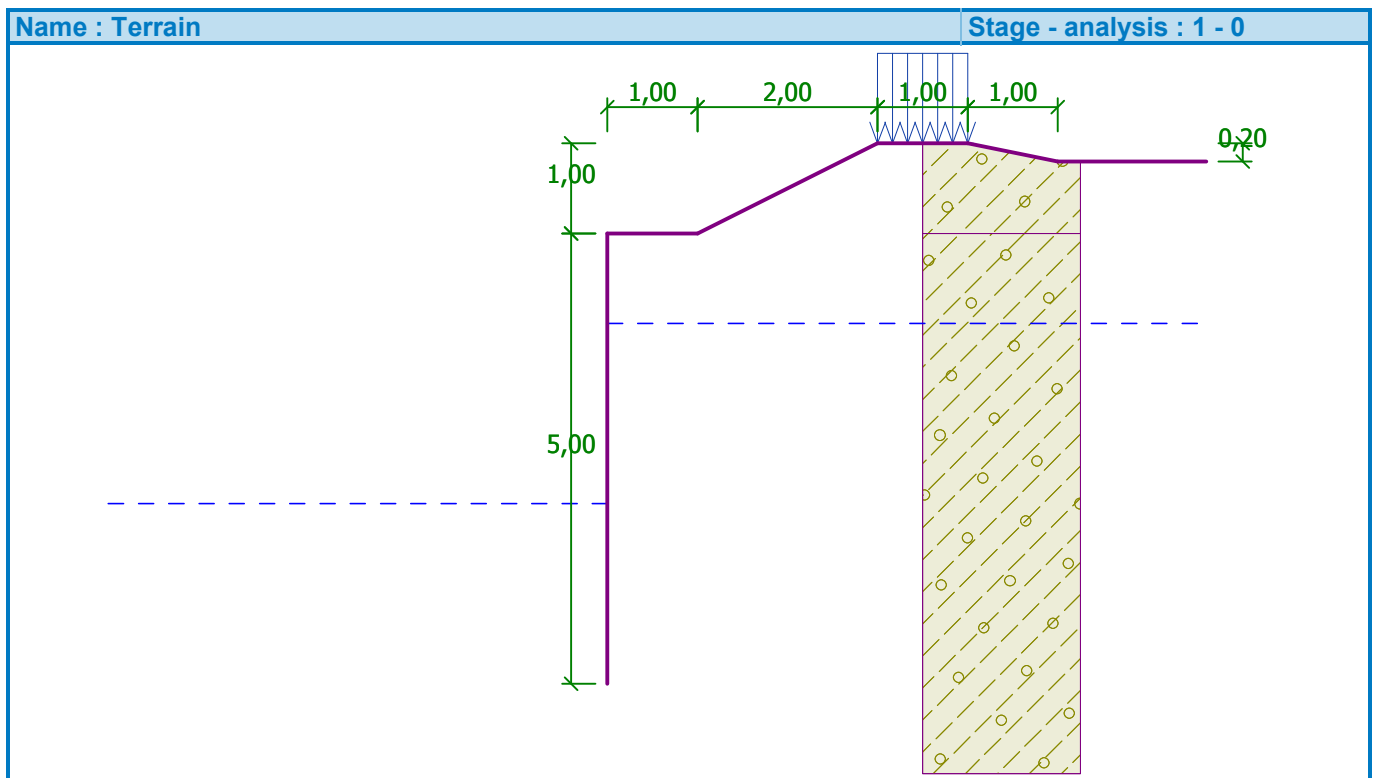
Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	-	Soil No. 1	

Terrain profile

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,00
2	1,00	0,00
3	3,00	-1,00
4	4,00	-1,00
5	5,00	-0,80
6	6,00	-0,80

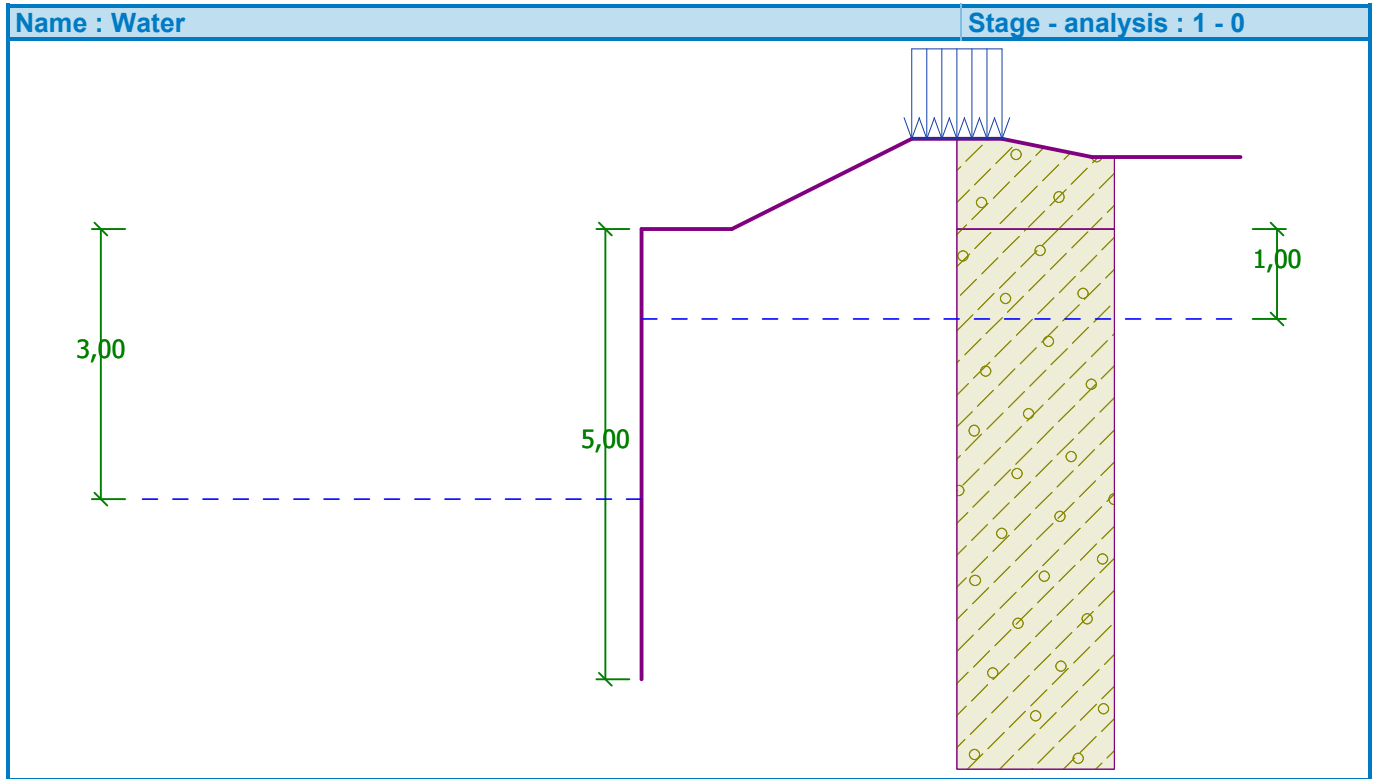
Origin [0,0] is located in upper right edge of construction.
 Positive coordinate +z has downward direction.





Water influence

GWT behind the structure lies at a depth of 1,00 m
GWT in front of the structure lies at a depth of 3,00 m
Subgrade at the heel is not permeable.



Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	Yes		permanent	12,00		3,00	1,00	on terrain

No.	Name
1	Surcharge No. 1

Settings of the stage of construction

Design situation : permanent

Analysis No. 1

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m ³]	δ_d [°]	K_a	Comment
1	0,50	0,00	29,00	8,00	19,00	12,00	0,317	
2	0,50	0,00	29,00	8,00	19,00	12,00	0,317	
3	0,61	0,00	29,00	8,00	9,00	12,00	0,317	
4	0,23	0,00	29,00	8,00	9,00	12,00	0,317	
5	0,17	0,00	29,00	8,00	9,00	12,00	0,317	
6	0,99	0,00	29,00	8,00	9,00	12,00	0,563	
7	1,74	0,00	29,00	8,00	9,00	12,00	0,563	
8	0,26	0,00	29,00	8,00	9,00	12,00	0,317	



Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00	0,00	0,00	0,00
	0,50	9,50	0,00	0,00	0,00	0,00
2	0,50	9,50	0,00	0,00	0,00	0,00
	1,00	19,00	0,00	0,00	0,00	0,00
3	1,00	19,00	0,00	0,00	0,00	0,00
	1,61	24,53	6,14	0,00	0,00	0,00
4	1,61	24,53	6,14	0,00	0,00	0,00
	1,85	26,64	8,49	0,00	0,00	0,00
5	1,85	26,64	8,49	0,00	0,00	0,00
	2,01	28,13	10,15	0,47	0,46	0,10
6	2,01	28,13	10,15	0,47	0,46	0,10
	3,00	37,00	20,00	5,47	5,35	1,14
7	3,00	37,00	20,00	5,47	5,35	1,14
	4,74	52,64	20,00	14,27	13,96	2,97
8	4,74	52,64	20,00	14,27	13,96	2,97
	5,00	55,00	20,00	15,02	14,69	3,12

Water pressure distribution

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00
2	0,50	0,00	0,00
3	1,00	0,00	0,00
4	1,61	6,14	0,00
5	1,85	8,49	0,00
6	2,01	10,15	0,00
7	3,00	20,00	0,00
8	4,74	20,00	0,00
9	5,00	20,00	0,00

Pressure profile due to surcharge - Surcharge No. 1

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00
2	0,00	0,00	0,00
3	0,50	0,00	0,00
4	0,66	0,00	0,00
5	0,66	2,11	0,45
6	1,00	1,99	0,42
7	1,61	1,78	0,38
8	1,85	1,70	0,36
9	2,01	1,64	0,35
10	3,00	1,29	0,27
11	4,74	0,65	0,14
12	5,00	0,55	0,12



Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Active pressure	23,43	3,97	4,98	0,00	1,000
Water pressure	60,00	3,44	0,00	0,00	1,000
Surcharge No. 1	5,83	2,41	1,24	0,00	1,000

Overall pressure acting on the structure

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00
2	0,00	0,00	0,00
3	0,50	0,00	0,00
4	0,66	0,00	0,00
5	0,66	0,00	2,11
6	1,00	0,00	1,99
7	1,61	0,00	7,93
8	1,85	0,00	10,19
9	2,01	0,00	12,25
10	3,00	0,00	26,64
11	4,74	0,00	34,61
12	5,00	0,00	35,25

Resultant forces

Cohesion of soils has not been subtracted from pressures caused by a surcharge.

Total horizontal pressure acting on construction = 89,26 kN/m
Application point of horiz. comp. lies in depth = 3,51 m
Total vertical pressure acting on construction = 6,22 kN/m
Dist. of vertical comp. from top of constr. = 0,00 m

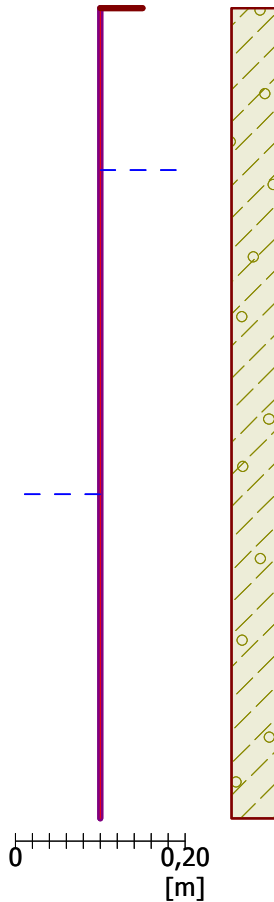


Name : Analysis

Stage - analysis : 1 - 1

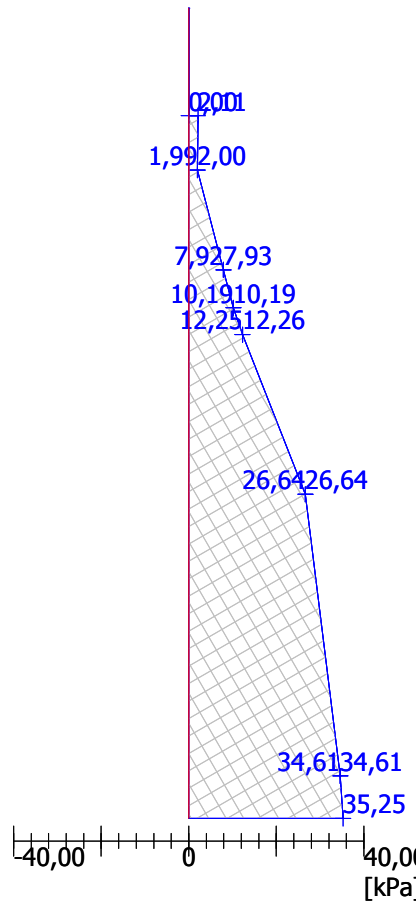
Geometry of structure

Length of structure = 5,00 m



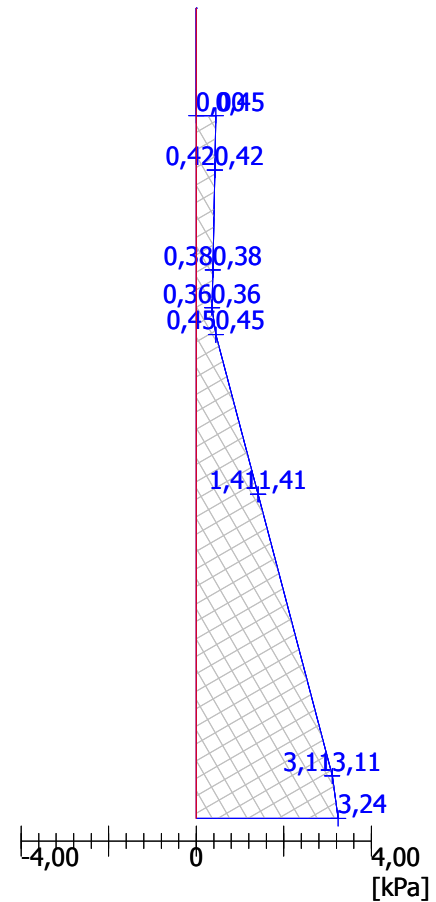
Horizontal component

Overall force = 89,26 kN/m
Depth of centroid = 3,51 m



Vertical component

Overall force = 6,22 kN/m
Shift of centroid = 0,00 m



Analysis No. 2

Pressure at rest behind the structure - partial results

Layer No.	Thickness [m]	α [°]	Φ_d [°]	c_d [kPa]	γ [kN/m ³]	K_r	Comment
1	0,50	0,00	29,00	8,00	19,00	0,515	
2	0,50	0,00	29,00	8,00	19,00	0,515	
3	0,96	0,00	29,00	8,00	9,00	0,515	
4	1,04	0,00	29,00	8,00	9,00	0,784	
5	2,00	0,00	29,00	8,00	9,00	0,784	

Pressure at rest distribution behind the structure (without surcharge)

Layer No.	Start [m]	End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,50	0,00	0,00	0,00	0,00	0,00
	0,50	1,00	9,50	0,00	4,89	4,89	0,00
2	1,00	1,50	19,00	0,00	9,79	9,79	0,00
	1,50	2,00	27,68	9,65	14,26	14,26	0,00



Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
4	1,96	27,68	9,65	14,26	14,26	0,00
	3,00	37,00	20,00	21,57	21,57	0,00
5	3,00	37,00	20,00	21,57	21,57	0,00
	5,00	55,00	20,00	35,69	35,69	0,00

Water pressure distribution

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,00	0,00
2	0,50	0,00	0,00
3	1,00	0,00	0,00
4	1,96	9,65	0,00
5	3,00	20,00	0,00
6	5,00	20,00	0,00

Pressure profile due to surcharge - Surcharge No. 1

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,56	0,00
2	0,20	0,62	0,00
3	0,40	0,67	0,00
4	0,50	0,69	0,00
5	0,60	0,71	0,00
6	0,80	0,73	0,00
7	1,00	0,73	0,00
8	1,20	0,73	0,00
9	1,40	0,71	0,00
10	1,60	0,69	0,00
11	1,80	0,67	0,00
12	1,96	0,64	0,00
13	1,96	0,98	0,00
14	2,00	0,97	0,00
15	2,20	0,92	0,00
16	2,40	0,87	0,00
17	2,60	0,83	0,00
18	2,80	0,78	0,00
19	3,00	0,73	0,00
20	3,20	0,69	0,00
21	3,40	0,64	0,00
22	3,60	0,60	0,00
23	3,80	0,56	0,00
24	4,00	0,53	0,00
25	4,20	0,49	0,00
26	4,40	0,46	0,00
27	4,60	0,43	0,00
28	4,80	0,40	0,00
29	5,00	0,38	0,00



Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Pressure at rest	92,30	3,26	0,00	0,00	1,000
Water pressure	60,00	3,44	0,00	0,00	1,000
Surcharge No. 1	3,30	2,32	0,00	0,00	1,000

Overall pressure acting on the structure

Point No.	Depth [m]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0,00	0,56	0,00
2	0,20	2,58	0,00
3	0,40	4,59	0,00
4	0,50	5,59	0,00
5	0,60	6,58	0,00
6	0,80	8,56	0,00
7	1,00	10,52	0,00
8	1,20	13,44	0,00
9	1,40	16,36	0,00
10	1,60	19,26	0,00
11	1,80	22,16	0,00
12	1,96	24,55	0,00
13	1,96	24,89	0,00
14	2,00	25,48	0,00
15	2,20	28,85	0,00
16	2,40	32,21	0,00
17	2,60	35,57	0,00
18	2,80	38,94	0,00
19	3,00	42,30	0,00
20	3,20	43,67	0,00
21	3,40	45,04	0,00
22	3,60	46,41	0,00
23	3,80	47,78	0,00
24	4,00	49,16	0,00
25	4,20	50,53	0,00
26	4,40	51,91	0,00
27	4,60	53,30	0,00
28	4,80	54,68	0,00
29	5,00	56,07	0,00

Resultant forces

Total horizontal pressure acting on construction = 155,61 kN/m
Application point of horiz. comp. lies in depth = 3,31 m
Total vertical pressure acting on construction = 0,00 kN/m
Dist. of vertical comp. from top of constr. = 0,00 m