შპს,, მოდილიონი”

MODILIONI

საექსპერტო დასკვნა

ქ. თბილისში, სოფელ დიღომში, ვეფხისტყაოსნის ქუჩის #84-ში (ს/კ 01.72.14.038.711) საცხოვრებელი სახლის მშენებლობისას მოსაზღვრედ მდებარე შენობა-ნაგებობებზე ზეგავლენის შესახებ.

ექსპერტი, შპს “მოდილიონი“-ს დირექტორი,
საქართველოს ტექნიკური უნივერსიტეტის
აკადემიური დოქტორი

ზ. კაპანაძე

თბილისი 2023წ.

19.05.2023წ.

საექსპერტო დასკვნა

ქ. თბილისში, სოფელ დიღომში, ვეფხისტყაოსნის ქუჩის #84-ში (ს/კ 01.72.14.038.711) საცხოვრებელი სახლის მშენებლობისას მოსაზღვრედ მდებარე შენობა-ნაგებობებზე ზეგავლენის შესახებ

დამკვეთის მოთხოვნის საფუძველზე შესაფასებელია ქ. თბილისში, სოფელ დიღომში, ვეფხისტყაოსნის ქუჩის #84-ში (ს/კ 01.72.14.038.711) საცხოვრებელი სახლის მშენებლობისას მოსაზღვრედ მდებარე შენობა-ნაგებობებზე ზეგავლენა მდგრადობის თვალსაზრისით.

დამკვეთის მიერ საექსპერტიზოდ წარმოდგენილი იქნა შემდეგი მასალები:

1. სამშენებლო მოედნის საინჟინრო-გეოლოგიური კვლევების ელექტრონული ვერსია, Pdf ფაილი), რომელიც დამუშავებული იქნა **შპს ,,თბილინვესტპროექტი,,**-ს ინჟინერ-გეოლოგების მიერ 2023 წელს.
2. ასაშენებელი შენობის არქიტექტურული პროექტის ელექტრონული ვერსია (pln და pdf ფაილები);
3. საცხოვრებელი სახლის მონოლითური რკინაბეტონის მზიდ კონსტრუქციათა ტექნიკური გადაწყვეტები. მათ შორის, საძირკვლის კონსტრუქციები, სვეტების, კედლების, დიაფრაგმების, კიბეების და სართულშუა გადახურვების კონსტრუქციათა სამონტაჟო სქემები და მათი კვანძები, აგრეთვე კონსტრუქციების საყალიბე და ბეტონის მზიდი ელემენტების დაარმირებისათვის საჭირო საშემსრულებლო ნახაზები, მათი შემაერთებელი კვანძების გადაწყვეტის ტექნიკური დოკუმენტაცია.
4. ქვაბულის მოსაწყობად კონსტრუქციული გადაწყვეტების ტექნიკური დოკუმენტაცია.

მრავალფუნქციური შენობის გეგმარებითი პარამეტრები მოკლე აღწერა:

ასაშენებელი შენობა 10 სართულიანია ერთი მიწისქვეშა სართულით; გეგმაში მართკუთხა მოხაზულობისაა მაქსიმალური გაბარიტული ზომებით 0,00 ნიშნულზე **14,3X27,7მ.** მაქსიმალური მალი შეადგენს **L=6,7მ-ს.**

შენობის მიწისქვეშა სართულის სიმაღლე შეადგენს **H=3,1მ-ს;** პირველი მიწისზედა სართულის სიმაღლე **H=3.0მ**-ია, ხოლო დანარჩენი სართულების სიმაღლე კი **H=3,2მ-ია;**

საცხოვრებელი სახლის მიწისქვეშა სართული განკუთვნილია ავტოსადგომებისათვის; მიწისზედა პირველი სართული განკუთვნილია კომერციული ფართებისათვის, ხოლო დანარჩენი სართულები კი საცხოვრებელი ფართებისთვისაა განკუთვნილი.

საცხოვრებელ სახლს ,,ა,,-,,ბ,, და ,,ე,,-,,ე/,, ღერძებს შორის გააჩნია ერთსართულიანი მიწისქვეშა ნაგებობები ავტოსადგომებისათვის; ძირითადი შენობისაგან მიწისქვეშა ნაგებობები გამოყოფილია სადეფორმაციო (ანტისეისმური) ნაკერებით.

შენობა კონსტრუქციული თვალსაზრისით გადაწყვეტილია, როგორც ჩარჩოსებრ-კავშირებიანი სისტემა მონოლითური რკინაბეტონის დიაფრაგმებით;

მრავალფუნქციური შენობის დაფუძნების პირობების მოკლე აღწერა:

სამშენებლო მოედნის გეოტექნიკური აგებულებიდან გამომდინარე საცხოვრებელი სახლის და ერთსართულიანი მიწისქვეშა ნაგებობების დაფუძნება გადაწყვეტილია მთლიანი ფილის გამოყენებით ძნელპლასტიკური კონსისტენციის თიხოვან გრუნტზე (**ფენა 2.** თიხა მუქი-ყვისფერი, წყალშემცველი ქვიშნარის ლინზებით და შუაშრეებით*).* თიხოვანი გრუნტის (ფენა 2) პირობითი საანგარიშო წინაღობა R_0**=2,5კგძ/სმ².** დეფორმაციის მოდული - **E=150კგძ/სმ²** . შინაგანი ხახუნის კუთხე შეადგენს- **16⁰.** ხვედრითი შეჭიდულობა **C=0.44კგძ/სმ².**

საქართველოს ტერიტორიის სეისმური დარაიონებისა და საინჟინრო გეოლოგიური კვლევების შესაბამისი დასკვნებისა და რეკომენდაციების მიხედვით სამშენებლო მოედანი განლაგებულია 8 ბალიანი სეისმური საშიშროების ზონაში MSK64 სკალის მიხედვით (A=0.17); გრუნტის კატეგორია სეისმური თვისებების მიხედვით - II;

სამშენებლო მოედანზე ქარის ნორმატიული დატვირთვა შეადგენს - 85 კგძ/მ2 (15 წლიანი განმეორებადობის პერიოდით), ხოლო თოვლის საფარის ნორმატიული დატვირთვა - 50 კგძ/მ2 (14 დღე - თოვლის საფარის დღეთა რიცხვი).

ასაშენებელ საცხოვრებელ სახლს ჩრდილოეთის მხრიდან 9,2-9,6მ-ის დაშორებით ესაზღვრება ვეფხისტყაოსნის ქუჩა, ხოლო სამხრეთის მხრიდან ესაზღვრება 16-17,5მ-ის დაცილებით ერთბინიანი ინდივიდუალური საცხოვრებელი სახლი (ს/კ 01.72.14.038.027) სამხრეთ-დასავლეთის მხრიდან 12-12,3მ-ის მანძილზე ესაზღვრება ათ სართულიანი კარკასული ტიპის მრავალბინიანი საცხოვრებელი სახლი (ს/კ 01.72.14.038.424)

აღმოსავლეთის მხრიდან ასაშენებელ შენობას 2,6-2.8 მ-ის დაშორებით ესაზღვრება ორ სართულიანი შენობა (ს/კ 01.72.14.038.103) (იხ. დანართი-1. ნახ. 1)

დასავლეთის მხრიდან ასაშენებელ შენობას მომიჯნავედ ესაზღვრება კარკასული ტიპის 11 სართულიანი შენობა ერთი მიწისქვეშა სართულით (ს/კ 01.72.14.038.712)

კონსტრუქციული პროექტის მიხედვით, ადგილზე არსებული სიტუაციური მდგომარეობისა და შენობის დაფუძნების პირობებიდან გამომდინარე ქვაბულის მოწყობისას ჩრდილოეთისა და სამხრეთის მხრიდან ქვაბულის კედლები დახრებითა ჩააჭრილი, რის საშუალებასაც ფაქტიურად იძლევა სამშენებლო მოედანი და შესაბამისად რაიმე სპეციალური ღონისძიებების გატარებების აუცილებლობა ქვაბულის კედლების გასამაგრებლად, არ არსებობს; დასავლეთის მხრიდან მომიჯნავედ მდებარე 11 სართულიანი შენობის გასწვრივ მოწყობილია მიჯრით 350მმ დიამეტრის ხიმინჯების (არმირებული და არაარმირებული) ფარდა ბიჯით 700მმ, ხოლო აღმოსავლეთის მხრიდან ორ სართულიანი საცხოვრებელი სახლის გასწვრივ კი მოწყობილია 250მმ დიამეტრის

ხიმინჯების ფარდა ბიჯით 500მმ. (იხ. დანართი -1. ნახ. 1; ნახ. 2) ქვაბულის დამუშავებისას პროექტით ასევე გათვალისწინებულია შენობების გასწვრივ ლითონის მილკვადრატებისაგან (100x5) გამბრჯენების და მათი საყრდენი რკინაბეტონის კოჭების მოწყობა. წარმოდგენილი ანგარიშების მიხედვით, ქვაბულის მოწყობისას (იხ დანართი 1. გაანგარიშებათა შედეგები) მომიჯნავედ მდებარე შენობების მდგრადობის პირობებს საფრთხე არ შეექმნება.

დასკვნა:

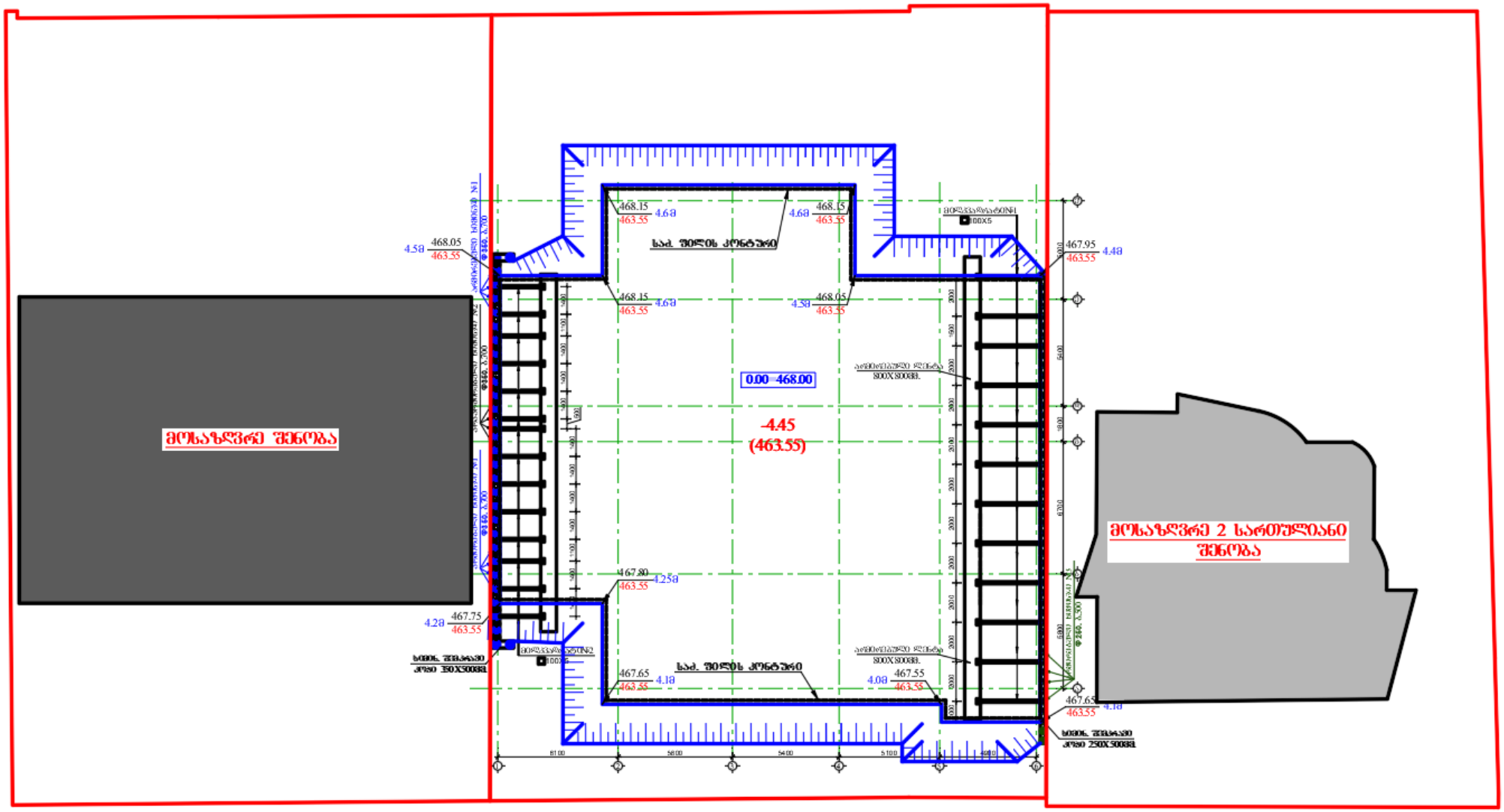
გამომდინარე შენობის დაფუძნების პირობებიდან და იმ ღონისძიებებიდან, რომლებიც განხორციელებულია პროექტის კონსტრუქციულ ნაწილში საინჟინრო-გეოლოგიურ კვლევებზე დაყრდნობით, შეიძლება გაკეთდეს დასკვნა, რომ საცხოვრებელი სახლის მშენებლობის პროცესი არ იქონიებს უარყოფით ზეგავლენას მოსაზღვრედ მდებარე შენობა-ნაგებობებზე მდგრადობის თვალსაზრისით.

სამშენებლო მოედანზე განთავსებული შენობა-ნაგებობები, რომელთა დემონტაჟიც უნდა განხორციელდეს თანმიმდევრულად ზემოდან ქვემოთ, სპეციალურად დამუშავებული პროექტის შესაბამისად შეიძლება ითქვას, რომ სადემონტაჟო სამუშაოები საფრთხეს არ შეუქმნის მოსაზღვრე შენობა-ნაგებობებს მდგრადობის თვალსაზრისით.

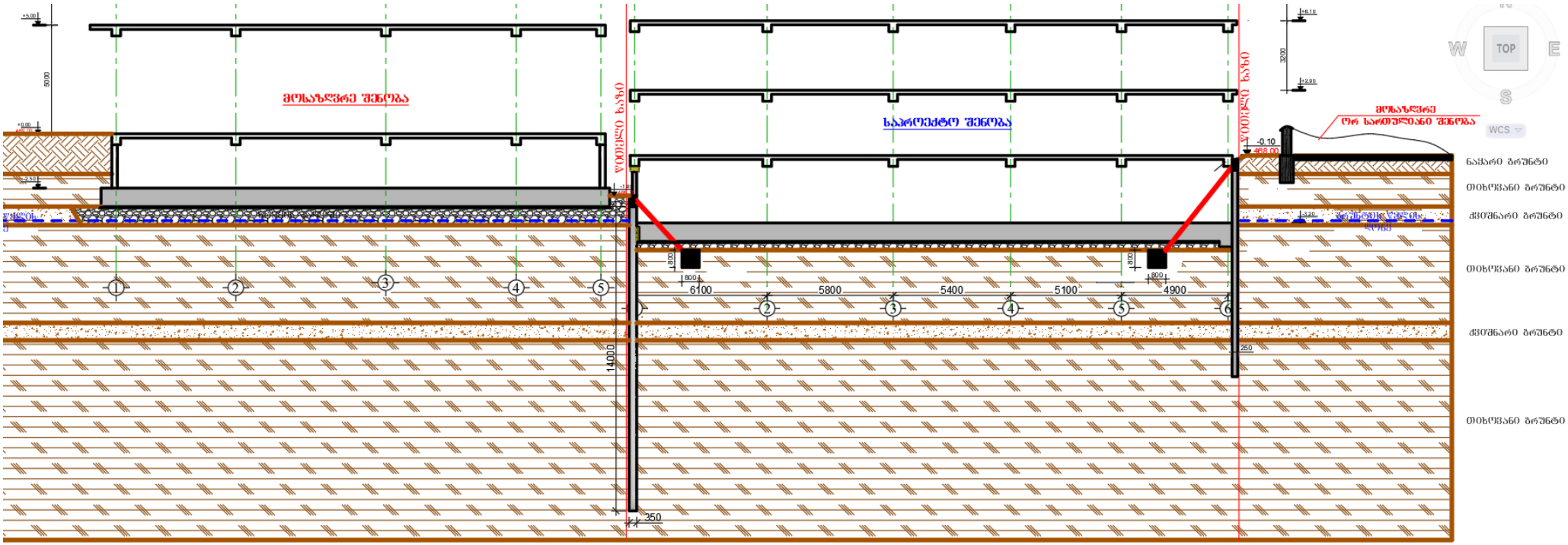
ექსპერტი, შპს "მოდილიონი"-ს დირექტორი,
საქართველოს ტექნიკური უნივერსიტეტის
აკადემიური დოქტორი ზ. კაპანაძე



დანართი-1


მოსაზღვრე შენობა
მოსაზღვრე 2 სართულიანი შენობა
0.00 468.00
-4.45
(463.55)

ნახ. 1


მოსაზღვრე შენობა
საპროექტო შენობა
წყებული ხაზი
წყებული ხაზი
მოსაზღვრე
ორ სართულიანი შენობა
TOP
WCS
ნაყარი ბრუნტი
თიხოვანი ბრუნტი
ქვიშნარი ბრუნტი
თიხოვანი ბრუნტი
ქვიშნარი ბრუნტი
თიხოვანი ბრუნტი
6100
5800
5400
5100
4900
14000
350

ნახ. 2

Sheeting structure verification

Input data

Project

Task : gamkofi farda (chrili 1-1)
Date : 19.05.2021

Settings

(input for current task)

Materials and standards

Concrete structures : SNiP 52-01-2003
Steel structures : EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section : γ_{M0} = 1,00

Excavations

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Consider reduction of the modulus of subsoil reaction for a braced sheeting
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor for internal stability of anchors :	SF_a =	1,50	[–]

Geometry of structure

Structure length = 14,50 m

Cross-section name : Pile curtain d = 0,35 m; a = 0,70 m
Coeff. of press. reduc. in front of wall = 1,00
Area of cross-section A = 1,37E-01 m^2/m
Moment of inertia I = 1,05E-03 m^4/m
Elastic modulus E = 30000,00 MPa
Shear modulus G = 12500,00 MPa

Material of structure

Analysis of concrete structures carried out according to the standard SNiP 52-01-2003.

Concrete : B25
Compressive strength R_b = 14,50 MPa
Tensile strength R_{bt} = 1,05 MPa
Elasticity modulus E_b = 30000,00 MPa
Shear modulus G = 12500,00 MPa

Longitudinal steel : A500
Tensile strength R_s = 435,00 MPa

Modulus of subsoil reaction determined according to the Schmitt theory.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
1	nayari grunti		10,00	0,00	18,50	8,50	0,00
2	tixa		16,00	44,00	19,00	9,00	0,00
3	qvishnari		21,00	11,00	18,50	8,50	0,00

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
4	xreshis balishi		30,00	0,00	19,50	9,50	0,00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	nayari grunti		cohesionless	10,00	-	-	-
2	tixa		cohesive	-	0,42	-	-
3	qvishnari		cohesive	-	0,30	-	-
4	xreshis balishi		cohesionless	30,00	-	-	-

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

No.	Name	Pattern	ν [–]	E_{oed} [MPa]	E_{def} [MPa]
1	nayari grunti		0,30	-	10,00
2	tixa		0,42	-	15,00
3	qvishnari		0,30	-	10,00
4	xreshis balishi		0,30	-	30,00

Soil parameters

nayari grunti

Unit weight : γ = 18,50 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 10,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesionless
Deformation modulus : E_{def} = 10,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 18,50 kN/m³

tixa

Unit weight : γ = 19,00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 16,00 °
Cohesion of soil : c_{ef} = 44,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesive
Poisson's ratio : ν = 0,42
Deformation modulus : E_{def} = 15,00 MPa
Poisson's ratio : ν = 0,42

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Saturated unit weight : γ_{sat} = 19,00 kN/m3

qvishnari

Unit weight : γ = 18,50 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 21,00 °
Cohesion of soil : c_{ef} = 11,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesive
Poisson's ratio : ν = 0,30
Deformation modulus : E_{def} = 10,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 18,50 kN/m3

xreshis balishi

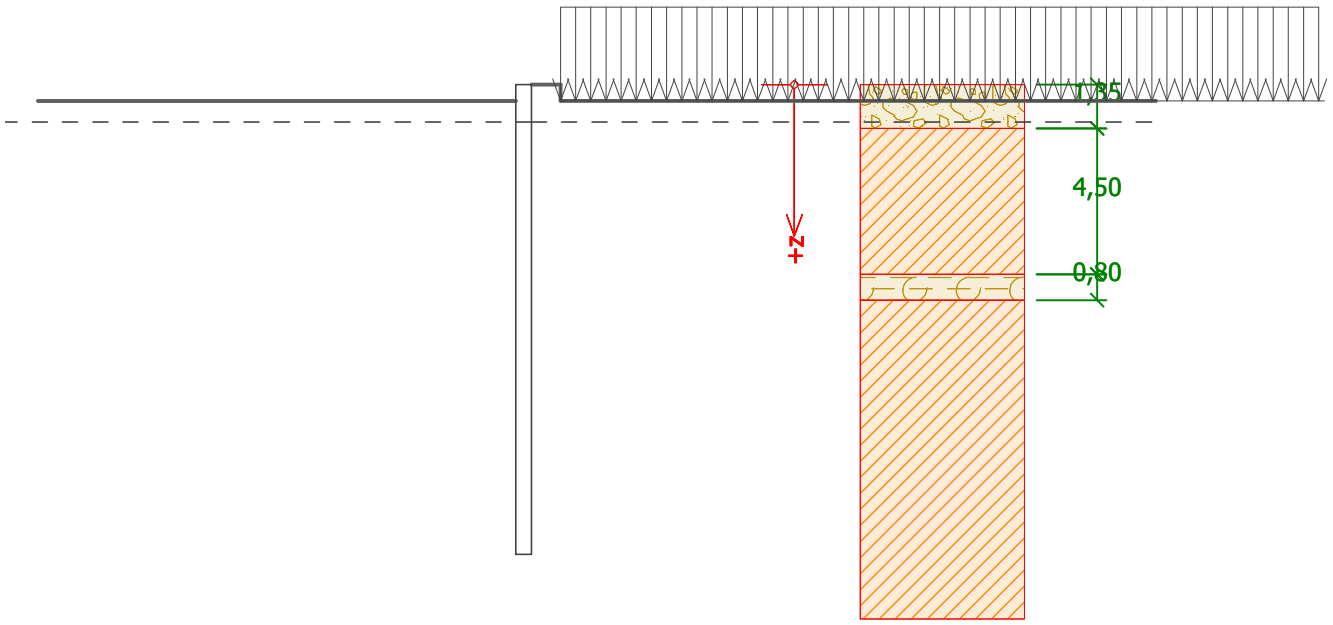
Unit weight : γ = 19,50 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 30,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesionless
Deformation modulus : E_{def} = 30,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 19,50 kN/m3

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1,35	xreshis balishi	
2	4,50	tixa	
3	0,80	qvishnari	
4	-	tixa	

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Profile and assignment	Stage - analysis : 1 - 0



Excavation

Soil in front of wall is excavated to a depth of 0,50 m.

Terrain profile

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,00
2	0,90	0,00
3	0,90	0,50
4	1,90	0,50

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 1,15 m
GWT in front of the structure lies at a depth of 1,15 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	220,00		0,90	23,40	0,50

No.	Name
1	mosazgvre shenoba

Global settings

Number of FEs to discretize wall = 40
Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0{,}20\sigma_z$

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Settings of the stage of construction

Design situation : permanent

Analysis results (Stage of construction 1)

Distribution of pressures acting on the structure (in front and behind the wall)

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
0.00	0.00	0.00	0.00	0.00	0.00	0.01
0.50	-0.00	-0.00	-0.00	3.25	4.87	29.23
0.52	-0.13	-0.20	-1.21	3.38	8.04	8.04
0.72	-1.46	-2.19	-13.15	4.71	39.40	39.40
0.90	-2.60	-3.90	-23.39	5.85	61.75	61.75
0.90	-2.61	-3.92	-23.50	5.86	57.08	57.08
1.02	-3.38	-5.07	-30.38	6.63	67.78	67.78
1.02	-3.38	-5.07	-30.38	80.78	80.78	80.78
1.15	-4.22	-6.34	-38.00	81.61	81.61	81.61
1.35	-4.86	-7.29	-43.70	82.21	90.35	90.35
1.35	-0.00	-10.55	-143.29	73.74	130.85	143.29
1.45	0.00	-11.21	-144.89	74.22	136.32	144.89
1.56	0.00	-11.92	-146.63	74.75	138.91	146.63
1.56	0.00	-11.92	-146.65	74.76	138.93	146.65
1.68	0.00	-12.73	-148.62	75.35	141.87	148.62
2.17	0.00	-15.93	-156.49	75.31	153.58	156.49
2.72	0.00	-19.46	-165.17	75.27	156.15	165.17
2.90	0.00	-20.66	-168.10	76.12	157.02	168.10
3.63	0.00	-25.38	-179.71	79.51	157.42	179.71
4.35	0.00	-30.11	-191.31	82.91	156.99	191.31
5.08	0.00	-34.83	-202.92	86.30	156.34	202.92
5.80	0.00	-39.56	-214.52	89.69	155.65	214.52
5.85	-0.00	-39.88	-215.32	89.93	155.61	215.32
5.85	-10.89	-23.60	-150.45	114.85	114.85	150.45
6.52	-13.60	-26.06	-162.76	117.41	117.41	162.76
6.65	-14.11	-26.52	-165.04	117.89	117.89	165.04
6.65	-0.00	-44.81	-227.42	93.58	154.65	227.42
7.25	0.00	-48.72	-237.02	96.48	154.24	237.02
7.97	0.00	-53.44	-248.63	99.98	153.87	248.63
8.70	0.00	-58.17	-260.24	103.48	153.66	260.24
9.42	0.00	-62.89	-271.84	106.98	153.61	271.84
10.15	0.00	-67.62	-283.45	110.48	153.74	283.45
10.88	0.00	-72.34	-295.05	113.98	154.06	295.05
11.60	0.00	-77.07	-306.66	117.48	154.55	306.66
11.67	0.00	-77.50	-307.74	117.80	154.62	307.74
12.32	0.00	-81.79	-318.27	120.98	155.24	318.27
12.75	-0.00	-84.56	-325.08	123.03	155.74	325.08
13.05	-1.53	-86.52	-329.87	124.48	156.10	329.87
13.78	-5.24	-91.24	-341.48	127.98	157.15	341.48
14.50	-8.94	-95.97	-353.08	131.48	158.38	353.08

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

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

Depth [m]	kh,p [MN/m3]	kh,z [MN/m3]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-1.54	0.00	0.00	0.00
0.36	0.00	0.00	-1.41	2.36	-0.43	0.05
0.49	0.00	0.00	-1.37	3.20	-0.79	0.13
0.51	0.00	0.00	-1.36	2.83	-0.83	0.14
0.72	0.00	0.00	-1.28	-8.44	-0.23	0.30
1.09	0.00	0.00	-1.15	46.86	-7.19	1.04
1.45	85.76	0.00	-1.03	-25.50	-10.13	3.86
1.81	85.76	0.00	-0.93	-17.86	-2.33	6.04
2.17	85.76	85.76	-0.85	-8.47	2.93	4.57
2.54	85.76	85.76	-0.80	-0.25	4.40	3.16
2.90	85.76	85.76	-0.77	4.64	3.52	1.67
3.26	85.76	85.76	-0.75	5.73	1.58	0.75
3.63	85.76	85.76	-0.74	5.18	-0.44	0.56
3.99	85.76	85.76	-0.74	2.75	-1.93	1.03
4.35	85.76	85.76	-0.75	-1.45	-2.22	1.84
4.71	85.76	85.76	-0.77	-8.06	-0.58	2.44
5.08	85.76	85.76	-0.81	-17.32	3.94	1.94
5.44	85.76	0.00	-0.86	-22.99	11.61	0.36
5.80	85.76	0.00	-0.91	-28.28	20.92	-5.48
6.16	21.28	0.00	-0.95	71.13	13.40	-12.35
6.53	21.28	0.00	-0.94	71.44	-12.40	-12.54
6.89	85.76	0.00	-0.88	-26.90	-20.08	-5.98
7.25	85.76	0.00	-0.80	-20.59	-11.45	-0.33
7.61	85.76	0.00	-0.72	-14.27	-5.15	2.61
7.97	85.76	0.00	-0.65	-9.01	-0.97	3.67
8.34	85.76	85.76	-0.60	-4.30	1.78	2.61
8.70	85.76	85.76	-0.56	-0.52	2.58	1.79
9.06	85.76	85.76	-0.54	1.32	2.38	0.88
9.43	85.76	85.76	-0.52	1.80	1.79	0.13
9.79	85.76	85.76	-0.51	1.55	1.16	-0.39
10.15	85.76	85.76	-0.50	0.87	0.72	-0.71
10.51	85.76	0.00	-0.49	0.34	0.43	-0.20
10.88	85.76	0.00	-0.48	0.35	0.30	-0.33
11.24	85.76	0.00	-0.47	0.32	0.18	-0.42
11.60	85.76	0.00	-0.47	0.27	0.07	-0.46
11.96	85.76	0.00	-0.46	0.23	-0.02	-0.46
12.32	85.76	0.00	-0.45	0.20	-0.10	-0.44
12.69	85.76	0.00	-0.45	0.17	-0.17	-0.39
13.05	85.76	0.00	-0.44	0.13	-0.22	-0.31
13.41	85.76	0.00	-0.43	0.06	-0.26	-0.22
13.78	85.76	0.00	-0.43	-0.09	-0.25	-0.13
14.14	85.76	0.00	-0.43	-0.33	-0.18	-0.04
14.50	85.76	0.00	-0.42	-0.70	-0.00	-0.00

Maximum shear force = 20,92 kN/m
Maximum moment = 12,54 kNm/m
Maximum displacement = 1,5 mm

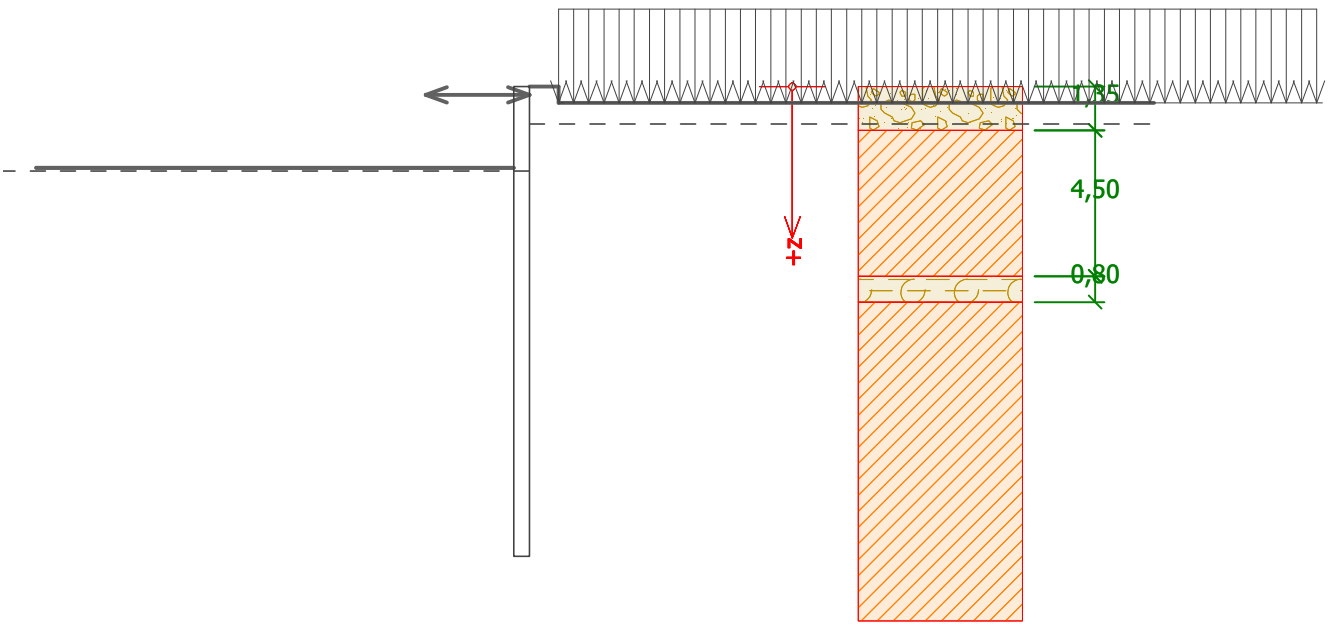
[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Input data (Stage of construction 2)

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1,35	xreshis balishi	
2	4,50	tixa	
3	0,80	qvishnari	
4	-	tixa	

Name : Profile and assignment | **Stage - analysis : 2 - 0**



Excavation

Soil in front of wall is excavated to a depth of 2,50 m.

Terrain profile

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,00
2	0,90	0,00
3	0,90	0,50
4	1,90	0,50

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 1,15 m

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

GWT in front of the structure lies at a depth of 2,60 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	NO	NO	permanent	220,00		0,90	23,40	0,50

No.	Name
1	mosazgvre shenoba

Inserted props

No.	New prop	Depth z [m]	Length l [m]	Spacing b [m]	Modif. stiffnesses	Modulus E [MPa]	Area A [mm^2]
1	YES	0,25	3,20	1,40	NO	206000,00	1790,000

Settings of the stage of construction

Design situation : permanent

Analysis results (Stage of construction 2)

Distribution of pressures acting on the structure (in front and behind the wall)

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
0.00	-0.00	-0.00	-0.00	0.00	0.00	0.01
0.50	-0.00	-0.00	-0.00	3.25	4.87	29.23
0.52	0.00	0.00	0.00	3.38	7.94	7.94
0.81	0.00	0.00	0.00	5.24	50.33	50.33
0.90	0.00	0.00	0.00	5.85	61.75	61.75
0.90	0.00	0.00	0.00	5.86	57.08	57.08
1.02	-0.00	-0.00	-0.00	6.63	67.78	67.78
1.02	0.00	0.00	0.00	80.78	80.78	80.78
1.15	-0.00	-0.00	-0.00	81.61	81.61	81.61
1.35	-0.00	-0.00	-0.00	84.21	92.35	92.35
1.35	0.00	0.00	0.00	75.74	132.85	145.29
1.56	-0.00	-0.00	-0.00	78.84	144.55	150.72
1.56	-0.00	-0.00	-0.00	78.85	144.60	150.75
1.61	0.00	0.00	0.00	79.61	147.47	152.08
1.68	-0.00	-0.00	-0.00	80.68	149.31	153.95
2.42	0.00	0.00	0.00	87.96	168.05	173.03
2.50	-0.00	-0.00	-0.00	88.79	169.31	175.20
2.50	-0.00	-0.00	-117.37	88.79	88.79	175.20
2.60	-0.00	-1.38	-120.74	89.78	170.73	177.80
2.72	-0.00	-2.14	-122.62	89.77	170.94	179.67
2.81	-0.00	-2.75	-124.11	89.76	171.11	181.17
3.22	0.00	-5.43	-130.70	91.74	171.87	187.76
4.03	0.00	-10.68	-143.60	95.63	171.73	200.65
4.83	0.00	-15.93	-156.49	99.52	171.06	213.55
5.64	0.00	-21.18	-169.39	103.41	170.30	226.44
5.85	-0.00	-22.56	-172.77	104.43	170.11	229.82
5.85	0.00	-13.35	-99.09	129.35	129.35	164.95

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
5.95	-0.00	-13.72	-100.94	129.73	129.73	166.79
6.44	-1.98	-15.52	-109.94	131.61	131.61	175.79
6.65	-2.81	-16.26	-113.69	132.39	132.39	179.54
6.65	-0.00	-27.48	-184.86	108.08	169.15	241.92
7.25	0.00	-31.39	-194.47	110.98	168.74	251.52
8.06	0.00	-36.64	-207.36	114.87	168.34	264.42
8.86	0.00	-41.89	-220.26	118.76	168.13	277.31
9.67	0.00	-47.14	-233.16	122.65	168.14	290.21
10.47	0.00	-52.39	-246.05	126.53	168.36	303.11
11.28	0.00	-57.64	-258.95	130.42	168.81	316.00
11.67	-0.00	-60.18	-265.18	132.30	169.14	322.24
12.08	0.00	-62.89	-271.84	134.31	169.49	328.90
12.75	-0.00	-67.24	-282.52	137.53	170.24	339.58
12.89	0.00	-68.14	-284.74	138.20	170.39	341.79
13.69	0.00	-73.39	-297.63	142.09	171.52	354.69
14.50	-0.00	-78.64	-310.53	145.98	172.88	367.58

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	-1.72	0.10	0.00	0.00
0.25	0.00	0.00	-2.22	1.66	-0.22	0.02
0.25	0.00	0.00	-2.22	1.66	63.22	0.02
0.36	0.00	0.00	-2.45	2.36	63.00	-7.08
0.72	0.00	0.00	-3.14	4.71	61.72	-29.71
1.09	0.00	0.00	-3.70	81.21	46.14	-50.10
1.45	0.00	0.00	-4.06	77.22	17.43	-61.58
1.81	0.00	0.00	-4.17	81.97	-11.43	-62.72
2.17	0.00	0.00	-4.02	85.56	-41.79	-53.11
2.49	0.00	0.00	-3.71	88.71	-69.41	-35.51
2.51	0.00	0.00	-3.69	-28.77	-69.89	-34.40
2.54	0.00	0.00	-3.66	-29.47	-69.03	-32.35
2.90	0.00	0.00	-3.15	-35.36	-57.28	-9.39
3.26	0.00	0.00	-2.61	-39.41	-43.73	8.96
3.63	0.00	0.00	-2.11	-43.46	-28.71	22.14
3.99	0.00	0.00	-1.69	-47.52	-12.22	29.60
4.35	85.76	0.00	-1.39	-35.22	4.92	28.62
4.71	85.76	0.00	-1.22	-20.84	14.78	24.90
5.08	85.76	0.00	-1.15	-15.60	21.14	18.33
5.44	85.76	0.00	-1.16	-17.16	26.91	9.64
5.80	85.76	0.00	-1.22	-22.42	34.03	-1.34
6.16	21.28	0.00	-1.27	89.03	22.31	-12.08
6.53	21.28	0.00	-1.28	88.86	-9.90	-14.33
6.89	85.76	0.00	-1.24	-26.05	-20.97	-8.17
7.25	85.76	0.00	-1.17	-20.53	-12.49	-2.16
7.61	85.76	0.00	-1.09	-14.48	-6.15	1.16
7.97	85.76	0.00	-1.02	-9.09	-1.91	2.56
8.34	85.76	0.00	-0.96	-4.88	0.58	2.76

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	kh,p [MN/m3]	kh,z [MN/m3]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
8.70	85.76	0.00	-0.92	-1.95	1.79	2.30
9.06	85.76	0.00	-0.89	-0.12	2.13	1.57
9.43	85.76	0.00	-0.88	0.84	1.98	0.82
9.79	85.76	0.00	-0.86	1.21	1.59	0.17
10.15	85.76	0.00	-0.86	1.21	1.15	-0.32
10.51	85.76	0.00	-0.85	1.04	0.74	-0.66
10.88	85.76	0.00	-0.85	0.81	0.40	-0.86
11.24	85.76	0.00	-0.84	0.59	0.15	-0.95
11.60	85.76	0.00	-0.84	0.42	-0.03	-0.97
11.96	85.76	0.00	-0.83	0.32	-0.17	-0.93
12.32	85.76	0.00	-0.82	0.27	-0.27	-0.84
12.69	85.76	0.00	-0.82	0.23	-0.36	-0.72
13.05	85.76	0.00	-0.81	0.18	-0.44	-0.58
13.41	85.76	0.00	-0.81	0.07	-0.49	-0.40
13.78	85.76	0.00	-0.80	-0.18	-0.47	-0.23
14.14	85.76	0.00	-0.80	-0.61	-0.33	-0.07
14.50	85.76	0.00	-0.80	-1.28	0.00	-0.00

Maximum shear force = 69,89 kN/m
Maximum moment = 62,72 kNm/m
Maximum displacement = 4,2 mm

Reactions in props

No.	Depth [m]	Reaction [kN]
1	0,25	88,82

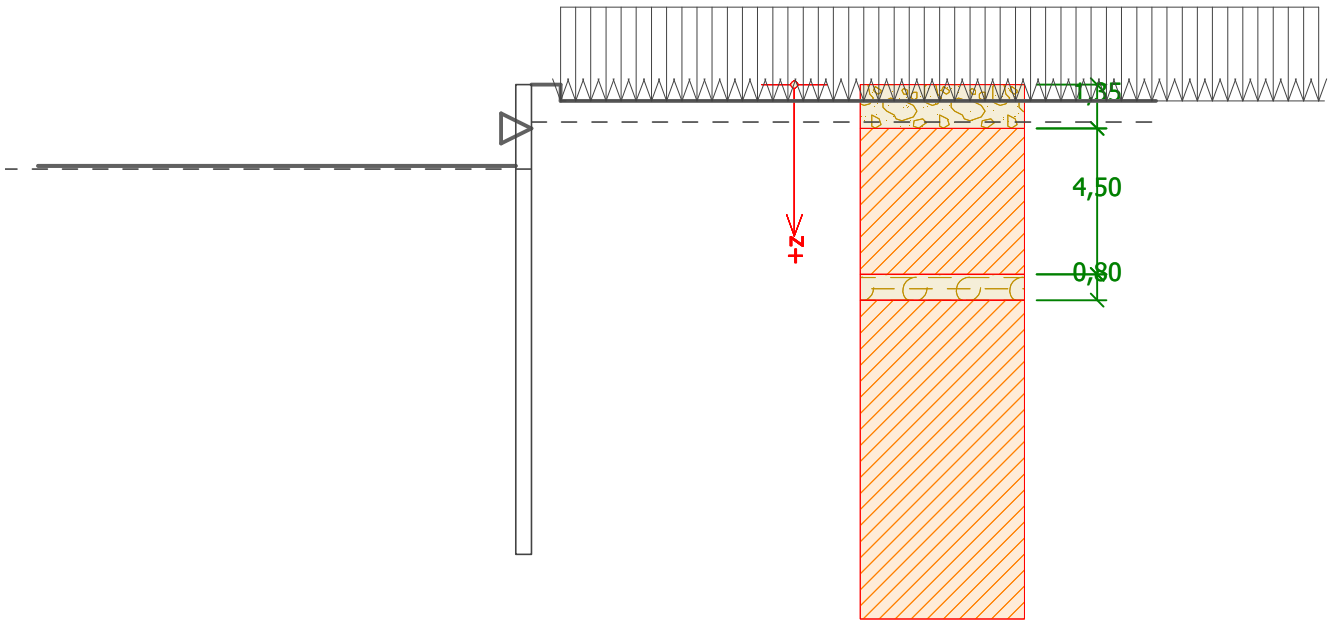
Input data (Stage of construction 3)

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1,35	xreshis balishi	
2	4,50	tixa	
3	0,80	qvishnari	
4	-	tixa	

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Profile and assignment	Stage - analysis : 3 - 0



Excavation

Soil in front of wall is excavated to a depth of 2,50 m.

Terrain profile

No.	Coordinate x [m]	Depth z [m]
1	0,00	0,00
2	0,90	0,00
3	0,90	0,50
4	1,90	0,50

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 1,15 m
GWT in front of the structure lies at a depth of 2,60 m
Subgrade at the heel is not permeable.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m²]	Mag.2 [kN/m²]	Ord.x x [m]	Length l [m]	Depth z [m]
1	NO	NO	permanent	220,00		0,90	23,40	0,50

No.	Name
1	mosazgvre shenoba

Inserted supports

No.	New support	Depth z [m]	Spacing b [m]
1	YES	1,35	0,55

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Type displacement	Spring [kN/m]	Forced displ. [mm]	Type spring	Spring [kNm/rad]	Forced displ. [rad]
1	Fixed		0,00	Fixed		

Settings of the stage of construction

Design situation : permanent

Analysis results (Stage of construction 3)

Distribution of pressures acting on the structure (in front and behind the wall)

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
0.00	-0.00	-0.00	-0.00	0.00	0.00	0.01
0.50	-0.00	-0.00	-0.00	3.25	4.87	29.23
0.52	0.00	0.00	0.00	3.38	7.94	7.94
0.81	0.00	0.00	0.00	5.24	50.33	50.33
0.90	0.00	0.00	0.00	5.85	61.75	61.75
0.90	0.00	0.00	0.00	5.86	57.08	57.08
1.02	-0.00	-0.00	-0.00	6.63	67.78	67.78
1.02	0.00	0.00	0.00	80.78	80.78	80.78
1.15	-0.00	-0.00	-0.00	81.61	81.61	81.61
1.35	-0.00	-0.00	-0.00	84.21	92.35	92.35
1.35	0.00	0.00	0.00	75.74	132.85	145.29
1.56	-0.00	-0.00	-0.00	78.84	144.55	150.72
1.56	-0.00	-0.00	-0.00	78.85	144.60	150.75
1.61	0.00	0.00	0.00	79.61	147.47	152.08
1.68	-0.00	-0.00	-0.00	80.68	149.31	153.95
2.42	0.00	0.00	0.00	87.96	168.05	173.03
2.50	-0.00	-0.00	-0.00	88.79	169.31	175.20
2.50	-0.00	-0.00	-99.91	88.79	88.79	175.20
2.60	-0.00	-1.38	-120.74	89.78	170.73	177.80
2.72	-0.00	-2.14	-122.62	89.77	170.94	179.67
2.81	-0.00	-2.75	-124.11	89.76	171.11	181.17
3.22	0.00	-5.43	-130.70	91.74	171.87	187.76
4.03	0.00	-10.68	-143.60	95.63	171.73	200.65
4.83	0.00	-15.93	-156.49	99.52	171.06	213.55
5.64	0.00	-21.18	-169.39	103.41	170.30	226.44
5.85	-0.00	-22.56	-172.77	104.43	170.11	229.82
5.85	0.00	-13.35	-99.09	129.35	129.35	164.95
5.95	-0.00	-13.72	-100.94	129.73	129.73	166.79
6.44	-1.98	-15.52	-109.94	131.61	131.61	175.79
6.65	-2.81	-16.26	-113.69	132.39	132.39	179.54
6.65	-0.00	-27.48	-184.86	108.08	169.15	241.92
7.25	0.00	-31.39	-194.47	110.98	168.74	251.52
8.06	0.00	-36.64	-207.36	114.87	168.34	264.42
8.86	0.00	-41.89	-220.26	118.76	168.13	277.31
9.67	0.00	-47.14	-233.16	122.65	168.14	290.21
10.47	0.00	-52.39	-246.05	126.53	168.36	303.11
11.28	0.00	-57.64	-258.95	130.42	168.81	316.00
11.67	-0.00	-60.18	-265.18	132.30	169.14	322.24

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
12.08	0.00	-62.89	-271.84	134.31	169.49	328.90
12.75	-0.00	-67.24	-282.52	137.53	170.24	339.58
12.89	0.00	-68.14	-284.74	138.20	170.39	341.79
13.69	0.00	-73.39	-297.63	142.09	171.52	354.69
14.50	-0.00	-78.64	-310.53	145.98	172.88	367.58

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

Depth [m]	kh,p [MN/m3]	kh,z [MN/m3]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-4.54	0.00	0.00	0.00
0.36	0.00	0.00	-4.38	2.36	-0.43	0.05
0.72	0.00	0.00	-4.23	4.71	-1.71	0.41
1.09	0.00	0.00	-4.07	81.21	-17.28	3.02
1.35	0.00	62.10	-3.96	86.74	-38.61	8.19
1.35	0.00	62.10	-3.96	86.74	90.17	8.19
1.45	0.00	85.76	-3.93	88.85	81.53	-0.52
1.81	0.00	85.76	-3.79	114.75	44.72	-23.76
2.17	0.00	85.76	-3.58	123.78	1.75	-32.23
2.49	0.00	85.76	-3.30	124.04	-37.34	-26.49
2.51	0.00	85.76	-3.28	22.38	-38.51	-25.88
2.54	0.00	85.76	-3.25	16.02	-39.08	-24.74
2.90	0.00	85.76	-2.84	-8.31	-40.32	-9.75
3.26	0.00	85.76	-2.40	-20.79	-35.04	4.32
3.63	0.00	85.76	-1.98	-32.42	-25.53	15.68
3.99	0.00	85.76	-1.63	-42.32	-12.21	22.85
4.35	85.76	85.76	-1.38	-32.73	2.94	22.42
4.71	85.76	0.00	-1.23	-21.83	11.29	21.61
5.08	85.76	0.00	-1.18	-17.66	18.23	16.22
5.44	85.76	0.00	-1.19	-19.53	24.83	8.44
5.80	85.76	0.00	-1.24	-24.65	32.79	-1.95
6.16	21.28	0.00	-1.29	88.57	21.53	-12.32
6.53	21.28	0.00	-1.30	88.51	-10.53	-14.32
6.89	85.76	0.00	-1.25	-27.02	-21.34	-7.98
7.25	85.76	0.00	-1.17	-21.12	-12.57	-1.89
7.61	85.76	0.00	-1.09	-14.78	-6.07	1.42
7.97	85.76	0.00	-1.02	-9.19	-1.76	2.78
8.34	85.76	0.00	-0.96	-4.87	0.74	2.92
8.70	85.76	0.00	-0.92	-1.87	1.93	2.41
9.06	85.76	0.00	-0.89	-0.03	2.24	1.64
9.43	85.76	0.00	-0.87	0.93	2.06	0.85
9.79	85.76	0.00	-0.86	1.28	1.64	0.18
10.15	85.76	0.00	-0.86	1.27	1.17	-0.33
10.51	85.76	0.00	-0.85	1.07	0.75	-0.67
10.88	85.76	0.00	-0.85	0.83	0.40	-0.87
11.24	85.76	0.00	-0.84	0.60	0.14	-0.96
11.60	85.76	0.00	-0.84	0.43	-0.04	-0.98
11.96	85.76	0.00	-0.83	0.32	-0.17	-0.93
12.32	85.76	0.00	-0.82	0.26	-0.28	-0.85

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	kh,p [MN/m³]	kh,z [MN/m³]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
12.69	85.76	0.00	-0.82	0.23	-0.36	-0.73
13.05	85.76	0.00	-0.81	0.18	-0.44	-0.58
13.41	85.76	0.00	-0.81	0.06	-0.49	-0.40
13.78	85.76	0.00	-0.80	-0.18	-0.47	-0.23
14.14	85.76	0.00	-0.80	-0.61	-0.33	-0.07
14.50	85.76	0.00	-0.80	-1.28	-0.00	-0.00

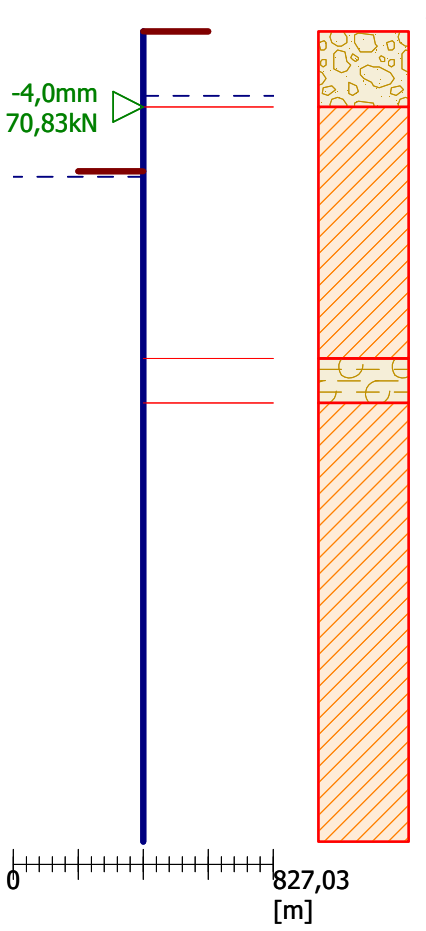
Maximum shear force = 90,17 kN/m
Maximum moment = 32,23 kNm/m
Maximum displacement = 4,5 mm

Reactions in supports

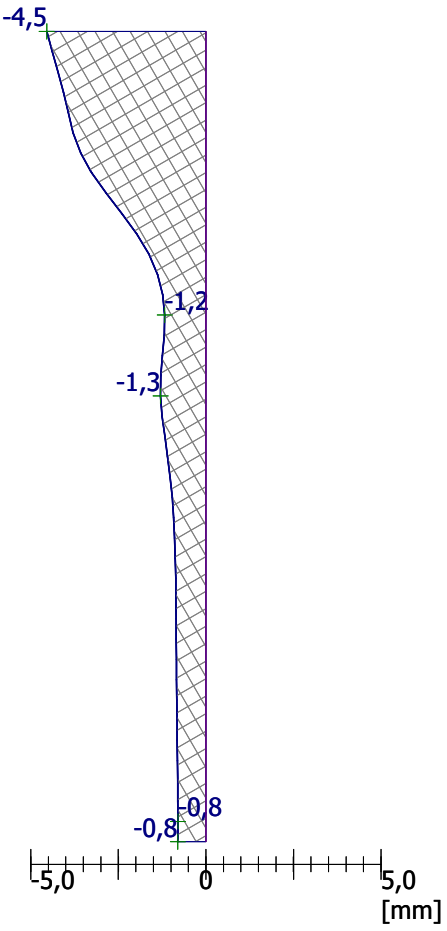
No.	Depth [m]	Displacement [mm]	Reaction [kN]
1	1,35	-4,0	70,83

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

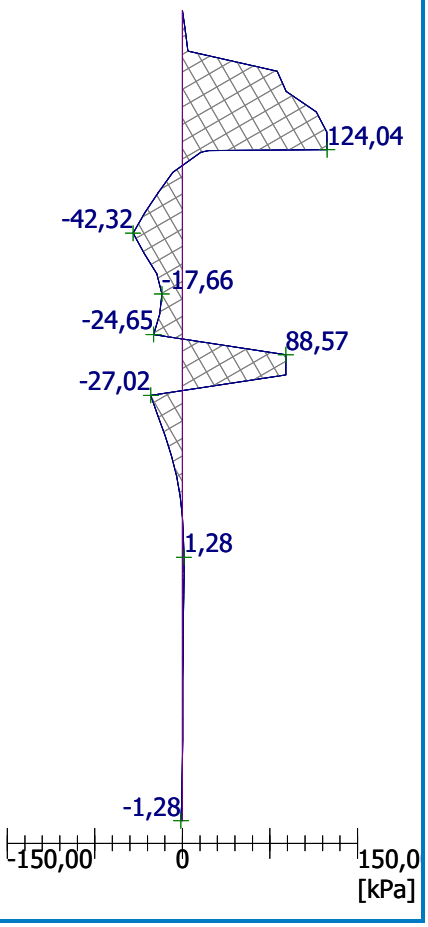
Geometry of structure
Length of structure = 14,50m



Displacement of structure
Max. disp. = 4,5 mm



Pressure acting on structure
Max. pressure = 124,04 kPa



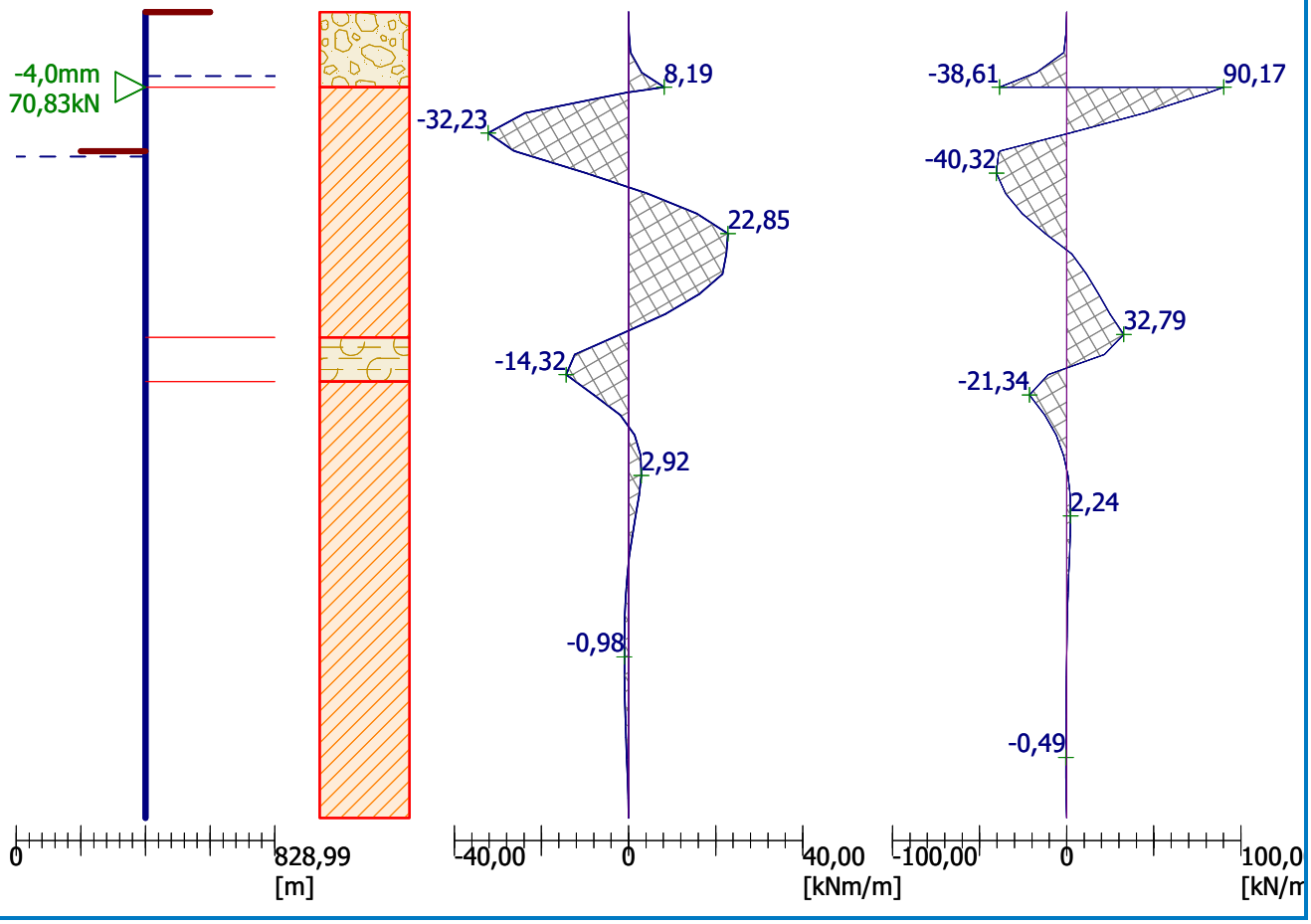
[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Analysis	Stage - analysis : 3 - -1

Geometry of structure
Length of structure = 14,50m

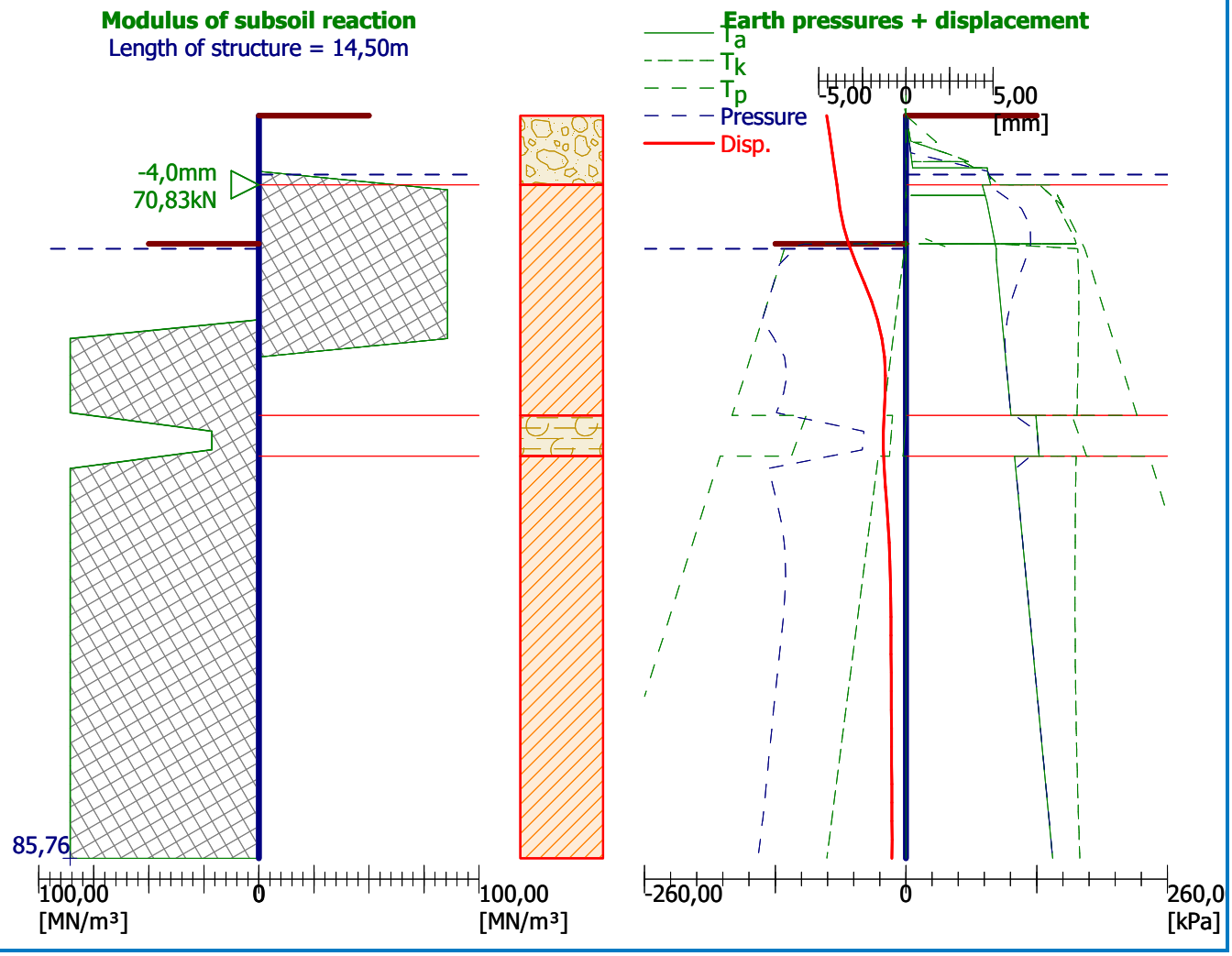
Bending moment
Max. M = 32,23 kNm/m

Shear force
Max. Q = 90,17 kN/m



[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Analysis	Stage - analysis : 3 - -1



Slope stability analysis

Input data

Project

Settings

(input for current task)

Materials and standards

SNiP - input coefficients according to SNIP standards

Coefficients according to SNiP			
Combination coefficient :	γ_k =	1,00	[–]
Coefficient of action conditions :	γ_c =	0,90	[–]
Coefficient of importance of structure :	γ_n =	1,10	[–]

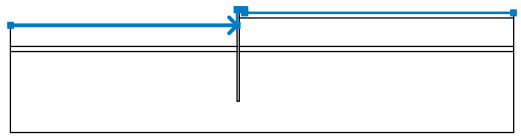
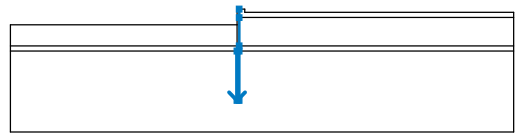
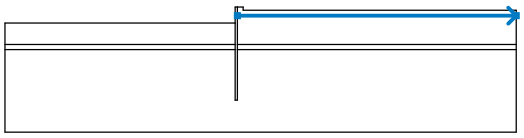
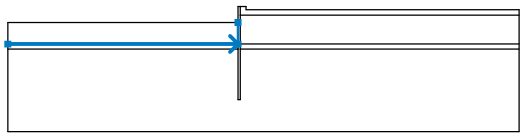
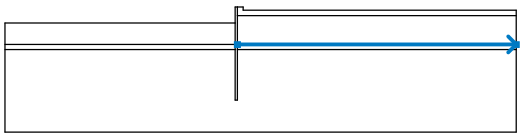
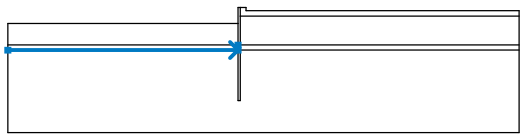
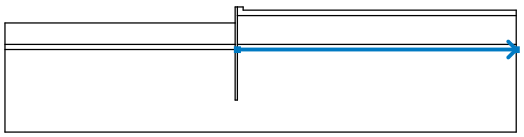
Stability analysis

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

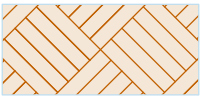
Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1,50	[–]

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Interface

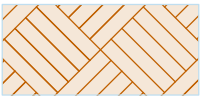
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		-36,25	-2,50	-0,35	-2,50	-0,35	0,00
		0,00	0,00	0,90	0,00	0,90	-0,50
		43,50	-0,50				
2		-0,35	-6,65	-0,35	-14,50	0,00	-14,50
		0,00	-6,65	0,00	-5,85	0,00	-1,35
		0,00	0,00				
3		0,00	-1,35	43,50	-1,35		
4		-36,25	-5,85	-0,35	-5,85	-0,35	-2,50
5		0,00	-5,85	43,50	-5,85		
6		-36,25	-6,65	-0,35	-6,65	-0,35	-5,85
7		0,00	-6,65	43,50	-6,65		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	nayari grunti		10,00	0,00	18,50
2	tixa		16,00	44,00	19,00
3	qvishnari		21,00	11,00	18,50
4	xreshis balishi		30,00	0,00	19,50

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	nayari grunti		18,50		
2	tixa		19,00		
3	qvishnari		18,50		
4	xreshis balishi		19,50		

Soil parameters

nayari grunti

Unit weight :	γ =	18,50 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	10,00 °
Cohesion of soil :	c_{ef} =	0,00 kPa
Saturated unit weight :	γ_{sat} =	18,50 kN/m^3

tixa

Unit weight :	γ =	19,00 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	16,00 °
Cohesion of soil :	c_{ef} =	44,00 kPa
Saturated unit weight :	γ_{sat} =	19,00 kN/m^3

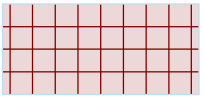
qvishnari

Unit weight :	γ =	18,50 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	21,00 °
Cohesion of soil :	c_{ef} =	11,00 kPa
Saturated unit weight :	γ_{sat} =	18,50 kN/m^3

xreshis balishi

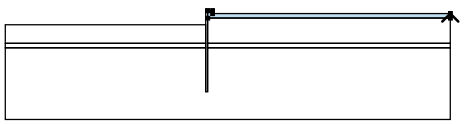
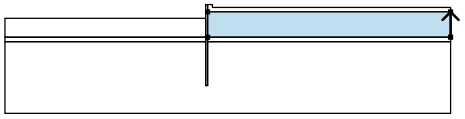
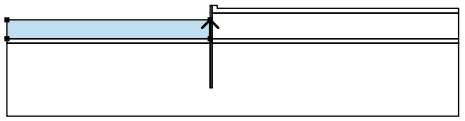
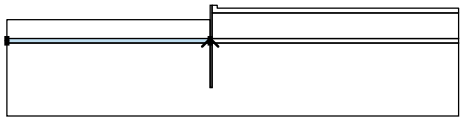
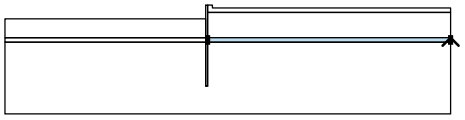
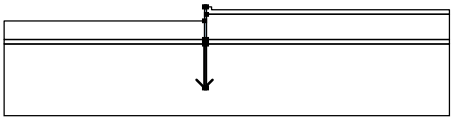
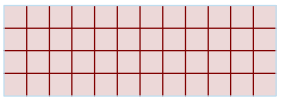
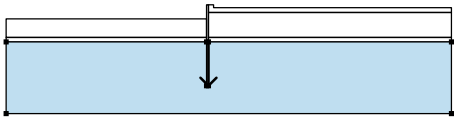
Unit weight :	γ =	19,50 kN/m^3
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	30,00 °
Cohesion of soil :	c_{ef} =	0,00 kPa
Saturated unit weight :	γ_{sat} =	19,50 kN/m^3

Rigid bodies

No.	Name	Sample	γ [kN/m^3]
1	Wall material		23,56

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
1		43,50	-1,35	43,50	-0,50	xreshis balishi
		0,90	-0,50	0,90	0,00	
		0,00	0,00	0,00	-1,35	
2		43,50	-5,85	43,50	-1,35	tixa
		0,00	-1,35	0,00	-5,85	
3		-0,35	-5,85	-0,35	-2,50	tixa
		-36,25	-2,50	-36,25	-5,85	
4		-0,35	-6,65	-0,35	-5,85	qvishnari
		-36,25	-5,85	-36,25	-6,65	
5		43,50	-6,65	43,50	-5,85	qvishnari
		0,00	-5,85	0,00	-6,65	
6		-0,35	-6,65	-0,35	-14,50	Wall material
		0,00	-14,50	0,00	-6,65	
		0,00	-5,85	0,00	-1,35	
		0,00	0,00	-0,35	0,00	
		-0,35	-2,50	-0,35	-5,85	
7		0,00	-6,65	0,00	-14,50	tixa
		-0,35	-14,50	-0,35	-6,65	
		-36,25	-6,65	-36,25	-19,50	
		43,50	-19,50	43,50	-6,65	

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	q_2	unit
1	strip	permanent	z = -0,50	x = 0,90	l = 23,40		0,00	220,00		kN/m^2

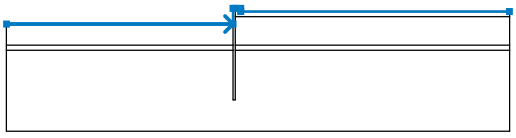
Surcharges

No.	Name
1	mosazgvre shenoba

Water

Water type : GWT

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-36,25	-2,60	0,00	-2,60	0,05	-1,15
		43,50	-1,15				

Tensile crack

Tensile crack not inputted.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

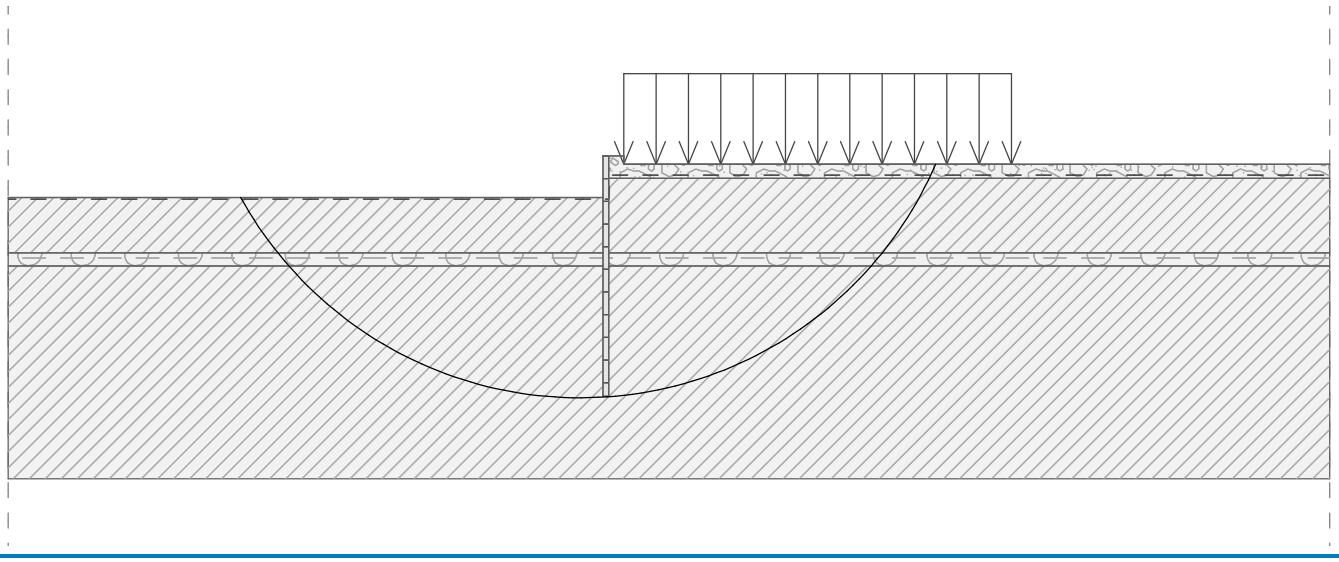
Slip surface parameters							
Center :	x =	-1,74	[m]	Angles :	α_1 =	-61,15	[°]
	z =	8,78	[m]		α_2 =	66,61	[°]
Radius :	R =	23,38	[m]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 2497,47 kN/m
Sum of passive forces : F_p = 4834,11 kN/m

Sliding moment : M_a = 58390,85 kNm/m
Resisting moment : M_p = 113021,50 kNm/m
Factor of safety = 1,94 > 1,50
Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 1 - 1



[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

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	-4.54	-1.54	0.00	0.00	0.00	0.00
0.25	-4.43	-1.45	-0.29	-0.22	0.02	0.04
0.25	-4.43	-1.45	-0.29	63.22	0.02	0.04
0.36	-4.38	-1.41	-0.43	63.00	-7.08	0.05
0.49	-4.33	-1.37	-0.88	62.54	-15.17	0.18
0.51	-4.32	-1.36	-0.94	62.48	-16.16	0.20
0.72	-4.23	-1.28	-1.71	61.72	-29.71	0.41
1.09	-4.07	-1.15	-17.28	46.14	-50.10	3.02
1.35	-3.96	-1.07	-38.61	25.35	-58.41	8.19
1.35	-3.96	-1.07	-9.32	90.17	-58.41	8.19
1.45	-4.06	-1.03	-10.13	81.53	-61.58	3.86
1.81	-4.17	-0.93	-11.43	44.72	-62.72	6.04
2.17	-4.02	-0.85	-41.79	2.93	-53.11	4.57
2.49	-3.71	-0.81	-69.41	4.21	-35.51	3.34
2.51	-3.69	-0.80	-69.89	4.28	-34.40	3.27
2.54	-3.66	-0.80	-69.03	4.40	-32.35	3.16
2.90	-3.15	-0.77	-57.28	3.52	-9.75	1.67
3.26	-2.61	-0.75	-43.73	1.58	0.75	8.96
3.63	-2.11	-0.74	-28.71	-0.44	0.56	22.14
3.99	-1.69	-0.74	-12.22	-1.93	1.03	29.60
4.35	-1.39	-0.75	-2.22	4.92	1.84	28.62
4.71	-1.23	-0.77	-0.58	14.78	2.44	24.90
5.08	-1.18	-0.81	3.94	21.14	1.94	18.33
5.44	-1.19	-0.86	11.61	26.91	0.36	9.64
5.80	-1.24	-0.91	20.92	34.03	-5.48	-1.34
6.16	-1.29	-0.95	13.40	22.31	-12.35	-12.08
6.53	-1.30	-0.94	-12.40	-9.90	-14.33	-12.54
6.89	-1.25	-0.88	-21.34	-20.08	-8.17	-5.98
7.25	-1.17	-0.80	-12.57	-11.45	-2.16	-0.33
7.61	-1.09	-0.72	-6.15	-5.15	1.16	2.61
7.97	-1.02	-0.65	-1.91	-0.97	2.56	3.67
8.34	-0.96	-0.60	0.58	1.78	2.61	2.92
8.70	-0.92	-0.56	1.79	2.58	1.79	2.41
9.06	-0.89	-0.54	2.13	2.38	0.88	1.64
9.43	-0.88	-0.52	1.79	2.06	0.13	0.85
9.79	-0.86	-0.51	1.16	1.64	-0.39	0.18
10.15	-0.86	-0.50	0.72	1.17	-0.71	-0.32
10.51	-0.85	-0.49	0.43	0.75	-0.67	-0.20
10.88	-0.85	-0.48	0.30	0.40	-0.87	-0.33
11.24	-0.84	-0.47	0.14	0.18	-0.96	-0.42
11.60	-0.84	-0.47	-0.04	0.07	-0.98	-0.46
11.96	-0.83	-0.46	-0.17	-0.02	-0.93	-0.46
12.32	-0.82	-0.45	-0.28	-0.10	-0.85	-0.44
12.69	-0.82	-0.45	-0.36	-0.17	-0.73	-0.39
13.05	-0.81	-0.44	-0.44	-0.22	-0.58	-0.31
13.41	-0.81	-0.43	-0.49	-0.26	-0.40	-0.22

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
13.78	-0.80	-0.43	-0.47	-0.25	-0.23	-0.13
14.14	-0.80	-0.43	-0.33	-0.18	-0.07	-0.04
14.50	-0.80	-0.42	-0.00	0.00	-0.00	-0.00

Maximum values of internal forces

Maximum displacement = -4,5 mm
Minimum displacement = -0,4 mm
Maximum bending moment = 29,60 kNm/m
Minimum bending moment = -62,72 kNm/m
Maximum shear force = 90,17 kN/m

Verification of RC cross section (Pile curtain d = 0,35 m; a = 0,70 m)

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

Dimensioning of reinforcement:

Reinforcement - 6 pc bars 20,0 mm; covering 80,0 mm
Type of structure (reinforcement ratio) : beam

Reinforcement ratio μ_s = 0,980 % > 0,100 % = $\mu_{s,min}$

Load : N = 0,00 kN (tension) ; M = 43,90 kNm
Bearing capacity : N_{ult} = 0,00 kN; M_{ult} = 67,66 kNm

Designed pile reinforcement is SATISFACTORY

Verification of shear reinforcement:

Shear reinf. - profile 8,0 mm; spacing 100,0 mm

Ultimate shear force: V_{ult} = 226,38 kN > 8,00 kN = Q
Cross-section is SATISFACTORY.
only minimal shear reinforcement

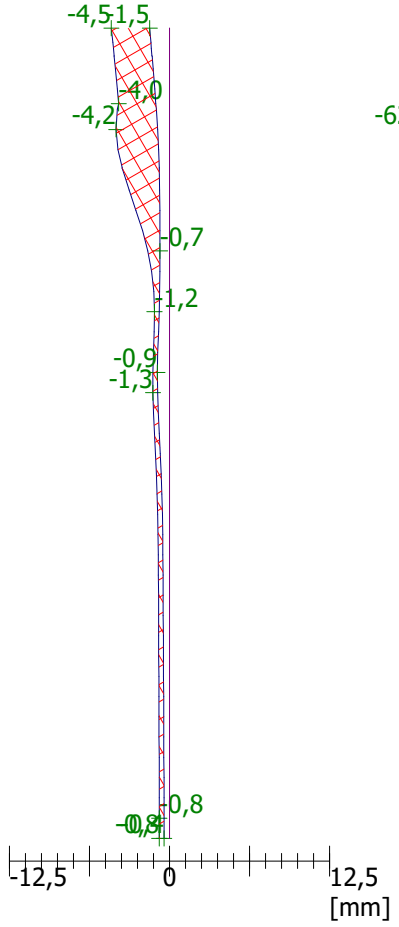
Cross-section is SATISFACTORY

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Dimensioning	Stage - analysis : 1 - 1

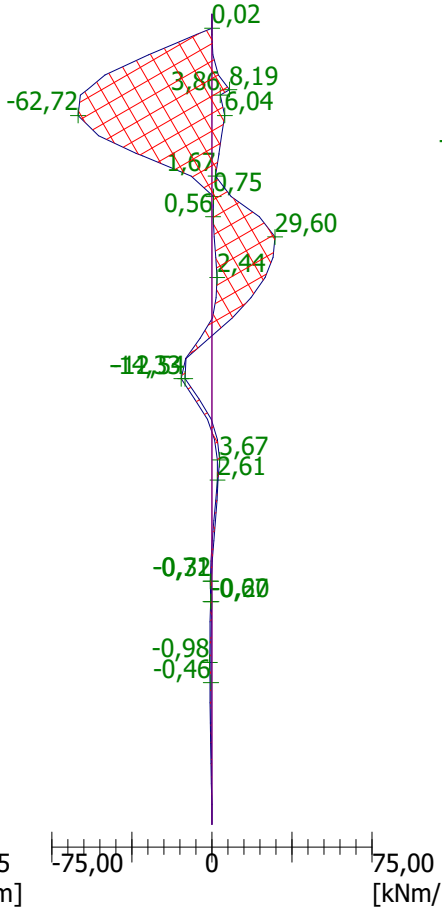
Displacement

Min1 = -0,8; Min2 = -4,5mm
Max1 = -0,4; Max2 = -1,5mm



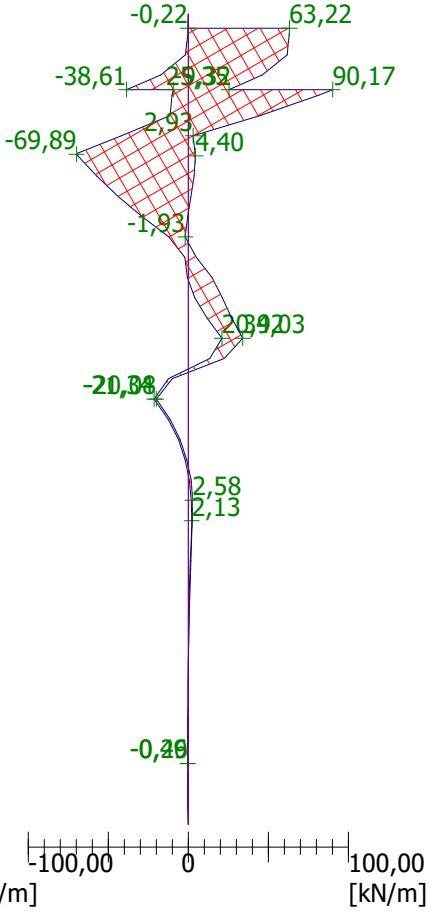
Bending moment

Min1 = 2,61; Min2 = -62,72kNm/m
Max1 = 29,60; Max2 = -12,54kNm/m



Shear force

Min1 = 20,92; Min2 = -69,89kN/m
Max1 = 90,17; Max2 = -20,08kN/m



[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Sheeting structure verification

Input data

Project

Task : chrili 2-2
Date : 19.05.2021

Settings

(input for current task)

Materials and standards

Concrete structures : SNiP 52-01-2003
Steel structures : EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section : γ_{M0} = 1,00

Excavations

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Consider reduction of the modulus of subsoil reaction for a braced sheeting
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor for internal stability of anchors :	SF_a =	1,50	[–]

Geometry of structure

Structure length = 10,00 m

Cross-section name : Pile curtain d = 0,25 m; a = 0,50 m
Coeff. of press. reduc. in front of wall = 1,00
Area of cross-section A = 9,82E-02 m^2/m
Moment of inertia I = 3,83E-04 m^4/m
Elastic modulus E = 30000,00 MPa
Shear modulus G = 12500,00 MPa

Material of structure

Analysis of concrete structures carried out according to the standard SNiP 52-01-2003.

Concrete : B25
Compressive strength R_b = 14,50 MPa
Tensile strength R_{bt} = 1,05 MPa
Elasticity modulus E_b = 30000,00 MPa
Shear modulus G = 12500,00 MPa

Longitudinal steel : A500
Tensile strength R_s = 435,00 MPa

Modulus of subsoil reaction determined according to the Schmitt theory.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
1	nayari grunti		10,00	0,00	18,50	8,50	0,00
2	tixa		16,00	44,00	19,00	9,00	0,00
3	qvishnari		21,00	11,00	18,50	8,50	0,00

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
4	xreshis balishi		30,00	0,00	19,50	9,50	0,00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	nayari grunti		cohesionless	10,00	-	-	-
2	tixa		cohesive	-	0,42	-	-
3	qvishnari		cohesive	-	0,30	-	-
4	xreshis balishi		cohesionless	30,00	-	-	-

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

No.	Name	Pattern	ν [–]	E_{oed} [MPa]	E_{def} [MPa]
1	nayari grunti		0,30	-	10,00
2	tixa		0,42	-	15,00
3	qvishnari		0,30	-	10,00
4	xreshis balishi		0,30	-	30,00

Soil parameters

nayari grunti

Unit weight : γ = 18,50 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 10,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesionless
Deformation modulus : E_{def} = 10,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 18,50 kN/m³

tixa

Unit weight : γ = 19,00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 16,00 °
Cohesion of soil : c_{ef} = 44,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesive
Poisson's ratio : ν = 0,42
Deformation modulus : E_{def} = 15,00 MPa
Poisson's ratio : ν = 0,42

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Saturated unit weight : γ_{sat} = 19,00 kN/m3

qvishnari

Unit weight : γ = 18,50 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 21,00 °
Cohesion of soil : c_{ef} = 11,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesive
Poisson's ratio : ν = 0,30
Deformation modulus : E_{def} = 10,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 18,50 kN/m3

xreshis balishi

Unit weight : γ = 19,50 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 30,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Angle of friction struc.-soil : δ = 0,00 °
Soil : cohesionless
Deformation modulus : E_{def} = 30,00 MPa
Poisson's ratio : ν = 0,30
Saturated unit weight : γ_{sat} = 19,50 kN/m3

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	0,85	nayari grunti	
2	1,50	tixa	
3	0,85	qvishnari	
4	4,50	tixa	
5	0,80	qvishnari	
6	-	tixa	

Excavation

Soil in front of wall is excavated to a depth of 0,50 m.

Terrain profile

Terrain behind the structure is flat.

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 2,60 m
Subgrade at the heel is not permeable.

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m²]	Mag.2 [kN/m²]	Ord.x x [m]	Length l [m]	Depth z [m]
1	YES		permanent	150,00		2,20	0,80	1,00
2	YES		permanent	7,00		3,00	7,00	on terrain

No.	Name
1	mosazgvre shenoba
2	droebiti datvirTva

Global settings

Number of FEs to discretize wall = 40
Minimum dimensioning pressure is considered as $\sigma_{a,min} = 0{,}20\sigma_z$

Settings of the stage of construction

Design situation : permanent

Analysis results (Stage of construction 1)

Distribution of pressures acting on the structure (in front and behind the wall)

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
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	6.20	8.08	12.48
0.50	-0.00	-0.00	-0.00	6.51	8.48	13.11
0.50	-0.00	-0.00	-0.00	6.51	7.65	13.11
0.53	-0.38	-0.44	-0.76	6.89	8.97	13.87
0.53	-0.38	-0.44	-0.76	11.58	11.58	13.87
0.85	-4.56	-5.35	-9.17	15.70	15.70	22.28
0.85	-0.00	-4.69	-128.88	3.15	12.58	145.33
0.95	0.00	-6.10	-132.34	3.53	14.11	148.79
1.00	0.00	-6.75	-133.95	3.71	15.49	150.40
1.43	0.00	-12.65	-148.43	5.34	27.91	164.89
1.63	0.00	-15.43	-155.27	6.11	33.01	171.72
1.90	0.00	-19.20	-164.53	7.15	39.92	180.98
2.35	-0.00	-25.33	-179.57	8.85	48.04	196.03
2.35	-1.40	-14.99	-107.30	40.55	40.55	127.16
2.38	-1.67	-15.23	-108.53	40.54	40.54	128.39
2.60	-3.59	-16.97	-117.23	40.47	40.47	137.08
2.86	-4.62	-17.91	-121.92	39.17	39.17	141.78
3.20	-5.99	-19.16	-128.18	37.44	37.44	148.03
3.20	-0.00	-32.37	-196.87	10.79	53.53	213.32
3.33	0.00	-33.24	-199.00	11.03	53.88	215.46
3.81	0.00	-36.34	-206.63	11.89	54.98	223.08
4.29	0.00	-39.44	-214.25	12.74	56.19	230.70
4.76	0.00	-42.55	-221.87	13.60	57.65	238.33
5.06	0.00	-44.46	-226.58	14.13	58.73	243.03
5.24	0.00	-45.65	-229.50	14.46	59.40	245.95
5.71	0.00	-48.76	-237.12	15.32	61.40	253.57
6.19	0.00	-51.86	-244.74	16.17	63.61	261.20
6.67	0.00	-54.96	-252.37	17.03	65.98	268.82

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
7.14	0.00	-58.07	-259.99	17.89	68.49	276.44
7.62	0.00	-61.17	-267.61	18.74	71.10	284.06
7.70	-0.00	-61.70	-268.91	18.89	71.56	285.36
7.70	-25.12	-36.51	-215.11	31.83	42.35	234.96
8.10	-26.71	-37.95	-222.32	33.37	43.59	242.17
8.50	-28.34	-39.43	-229.70	34.95	44.89	249.56
8.50	-0.00	-66.62	-281.00	20.25	75.85	297.45
8.57	0.00	-67.09	-282.15	20.38	76.27	298.60
9.05	0.00	-70.19	-289.77	21.24	79.09	306.22
9.52	0.00	-73.29	-297.39	22.09	81.95	313.84
9.73	0.00	-74.64	-300.69	22.46	83.20	317.14
10.00	-0.00	-76.40	-305.01	22.95	84.84	321.47

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

Depth [m]	kh,p [MN/m³]	kh,z [MN/m³]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-0.18	0.00	0.00	0.00
0.25	0.00	0.00	-0.16	3.26	-0.41	0.03
0.49	0.00	0.00	-0.13	6.41	-1.58	0.26
0.51	0.00	0.00	-0.13	6.41	-1.68	0.28
0.75	0.00	0.00	-0.11	7.87	-3.41	0.89
1.00	120.06	120.06	-0.09	-13.39	-2.47	1.61
1.25	120.06	120.06	-0.08	-7.41	0.08	1.87
1.50	120.06	120.06	-0.08	-4.16	1.48	1.65
1.75	120.06	120.06	-0.09	-3.82	2.43	1.15
2.00	120.06	120.06	-0.11	-5.74	3.60	0.40
2.25	120.06	120.06	-0.13	-9.35	5.49	-0.72
2.50	29.79	0.00	-0.15	19.92	4.40	-1.97
2.75	29.79	0.00	-0.15	17.59	-0.28	-2.46
3.00	29.79	0.00	-0.15	15.58	-4.41	-1.86
3.25	120.06	120.06	-0.13	-11.29	-4.74	-0.74
3.50	120.06	120.06	-0.12	-7.91	-2.33	0.13
3.75	120.06	120.06	-0.10	-4.80	-0.76	0.51
4.00	120.06	120.06	-0.08	-2.40	0.13	0.57
4.25	120.06	120.06	-0.07	-0.84	0.51	0.49
4.50	120.06	120.06	-0.07	0.09	0.59	0.35
4.75	120.06	120.06	-0.06	0.47	0.51	0.21
5.00	120.06	120.06	-0.06	0.61	0.37	0.10
5.25	120.06	120.06	-0.05	0.53	0.23	0.03
5.50	120.06	120.06	-0.05	0.45	0.10	-0.01
5.75	120.06	120.06	-0.05	0.31	0.01	-0.02
6.00	120.06	120.06	-0.05	0.20	-0.06	-0.02
6.25	120.06	120.06	-0.05	0.05	-0.09	0.00
6.50	120.06	120.06	-0.05	-0.12	-0.08	0.03
6.75	120.06	120.06	-0.05	-0.37	-0.02	0.04
7.00	120.06	120.06	-0.05	-0.71	0.11	0.04
7.25	120.06	120.06	-0.05	-1.14	0.34	-0.02
7.50	120.06	120.06	-0.05	-1.58	0.68	-0.14

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	kh,p [MN/m³]	kh,z [MN/m³]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
7.75	29.79	29.79	-0.05	2.91	0.52	-0.26
8.00	29.79	29.79	-0.05	2.84	-0.20	-0.30
8.25	29.79	29.79	-0.05	2.86	-0.91	-0.16
8.50	120.06	120.06	-0.04	-4.75	-0.64	0.03
8.75	120.06	120.06	-0.04	-0.49	0.01	0.08
9.00	120.06	120.06	-0.04	-0.16	0.09	0.07
9.25	120.06	120.06	-0.04	0.04	0.10	0.04
9.50	120.06	120.06	-0.04	0.14	0.08	0.02
9.75	120.06	120.06	-0.03	0.17	0.04	0.00
10.00	120.06	120.06	-0.03	0.13	0.00	0.00

Maximum shear force = 5,49 kN/m
Maximum moment = 2,46 kNm/m
Maximum displacement = 0,2 mm

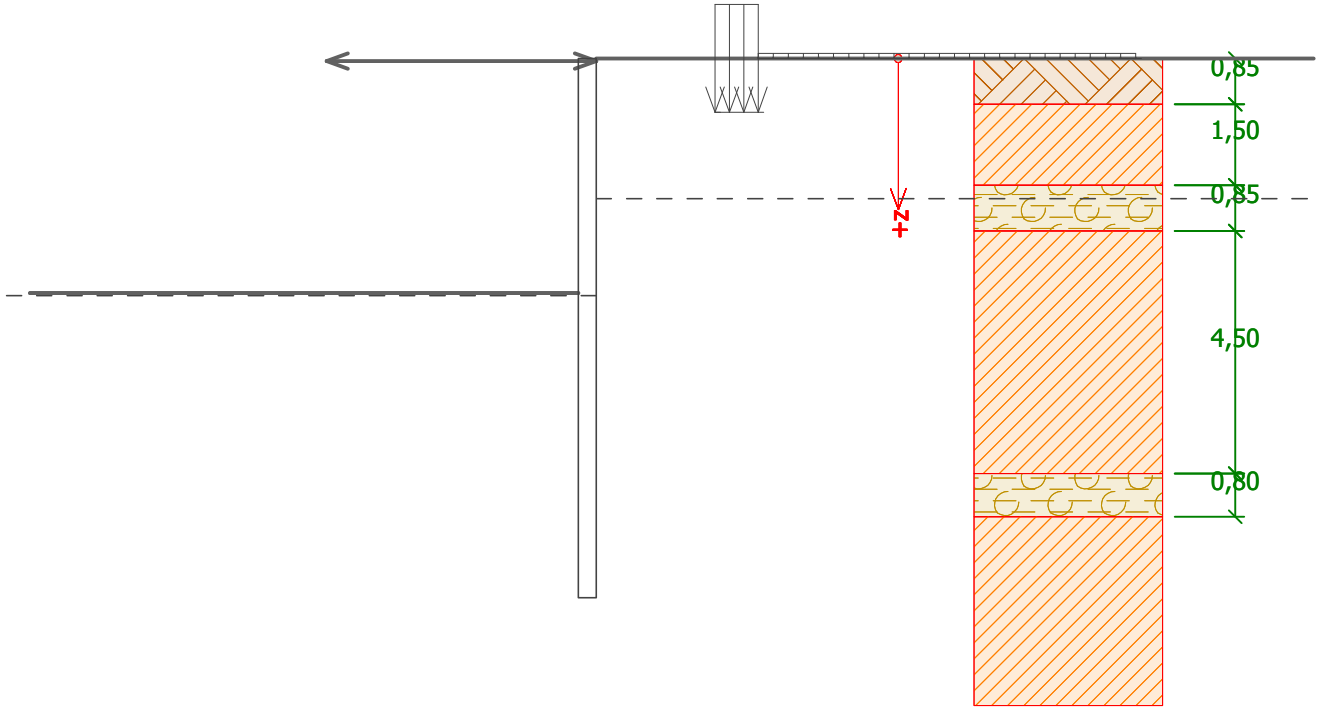
Input data (Stage of construction 2)

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	0,85	nayari grunti	
2	1,50	tixa	
3	0,85	qvishnari	
4	4,50	tixa	
5	0,80	qvishnari	
6	-	tixa	

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Profile and assignment	Stage - analysis : 2 - 0



Excavation

Soil in front of wall is excavated to a depth of 4,35 m.

Terrain profile

Terrain behind the structure is flat.

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 4,40 m
Subgrade at the heel is not permeable.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m²]	Mag.2 [kN/m²]	Ord.x x [m]	Length l [m]	Depth z [m]
1	NO	NO	permanent	150,00		2,20	0,80	1,00
2	NO	NO	permanent	7,00		3,00	7,00	on terrain

No.	Name
1	mosazgvre shenoba
2	droebiti datvirTva

Inserted props

No.	New prop	Depth z [m]	Length l [m]	Spacing b [m]	Modif. stiffnesses	Modulus E [MPa]	Area A [mm²]
1	YES	0,05	5,00	2,00	NO	206000,00	1790,000

Settings of the stage of construction

Design situation : permanent

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Analysis results (Stage of construction 2)

Distribution of pressures acting on the structure (in front and behind the wall)

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
0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00
0.50	-0.00	-0.00	-0.00	6.51	8.48	13.11
0.50	-0.00	-0.00	-0.00	6.51	8.48	13.11
0.53	-0.00	-0.00	-0.00	6.89	8.97	13.87
0.53	0.00	0.00	0.00	11.58	11.58	13.87
0.85	-0.00	-0.00	-0.00	15.70	15.70	22.28
0.85	0.00	0.00	0.00	3.15	12.58	145.33
1.00	-0.00	-0.00	-0.00	3.71	14.82	150.40
1.50	0.00	0.00	0.00	5.62	29.93	167.30
1.63	-0.00	-0.00	-0.00	6.11	33.06	171.72
2.00	0.00	0.00	0.00	7.52	41.90	184.20
2.35	-0.00	-0.00	-0.00	8.85	48.04	196.03
2.35	0.00	0.00	0.00	40.55	40.55	127.16
2.50	0.00	0.00	0.00	40.50	40.50	133.11
2.60	-0.00	-0.00	-0.00	40.47	40.47	137.08
3.00	0.00	0.00	0.00	42.45	42.45	148.38
3.20	-0.00	-0.00	-0.00	43.44	43.44	154.03
3.20	0.00	0.00	0.00	10.79	59.53	219.32
3.50	0.00	0.00	0.00	12.54	63.27	227.13
4.00	0.00	0.00	0.00	15.46	69.44	240.13
4.35	-0.00	-0.00	-0.00	17.50	73.87	249.23
4.35	-0.00	-0.00	-117.37	17.50	64.06	249.24
4.40	-0.00	-0.69	-119.05	18.00	74.51	250.53
4.50	0.00	-1.34	-120.65	18.00	74.81	252.13
5.00	0.00	-4.60	-128.66	18.00	76.49	260.14
5.06	-0.00	-4.96	-129.55	18.00	76.72	261.03
5.50	0.00	-7.86	-136.66	18.15	78.47	268.14
6.00	0.00	-11.12	-144.67	18.32	80.70	276.15
6.50	0.00	-14.37	-152.67	18.49	83.13	284.15
7.00	0.00	-17.63	-160.67	18.65	85.73	292.15
7.50	0.00	-20.89	-168.68	18.82	88.44	300.16
7.70	-0.00	-22.19	-171.88	18.89	89.56	303.36
7.70	0.00	-13.14	-98.02	49.83	60.35	252.96
7.86	-0.00	-13.72	-100.94	50.45	60.85	255.88
8.00	-0.56	-14.23	-103.49	51.00	61.29	258.43
8.50	-2.57	-16.05	-112.61	52.95	62.89	267.56
8.50	-0.00	-27.12	-183.97	20.25	93.85	315.45
9.00	0.00	-30.38	-191.98	21.15	96.80	323.46
9.50	0.00	-33.64	-199.98	22.05	99.80	331.46
9.73	-0.00	-35.14	-203.66	22.46	101.20	335.14
10.00	-0.00	-36.89	-207.99	22.95	102.84	339.47

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

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

Depth [m]	kh,p [MN/m3]	kh,z [MN/m3]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-0.55	0.00	-0.00	0.00
0.05	0.00	0.00	-0.73	0.65	-0.02	0.00
0.05	0.00	0.00	-0.73	0.65	20.23	0.00
0.25	0.00	0.00	-1.43	3.26	19.83	-4.01
0.50	0.00	0.00	-2.28	6.51	18.61	-8.84
0.75	0.00	0.00	-3.09	14.42	16.00	-13.20
1.00	0.00	0.00	-3.82	3.71	13.73	-16.86
1.25	0.00	0.00	-4.46	4.67	12.68	-20.17
1.50	0.00	0.00	-5.00	5.62	11.40	-23.19
1.75	0.00	0.00	-5.40	6.57	9.87	-25.85
2.00	0.00	0.00	-5.67	7.52	8.11	-28.10
2.25	0.00	0.00	-5.79	8.46	6.12	-29.89
2.50	0.00	0.00	-5.74	40.50	-0.00	-30.82
2.75	0.00	0.00	-5.53	41.21	-10.22	-29.54
3.00	0.00	0.00	-5.15	42.45	-20.68	-25.69
3.25	0.00	0.00	-4.64	11.08	-27.37	-19.52
3.50	0.00	0.00	-4.02	12.54	-30.32	-12.32
3.75	0.00	0.00	-3.34	14.00	-33.64	-4.33
4.00	0.00	0.00	-2.63	15.46	-37.32	4.53
4.25	0.00	0.00	-1.95	16.92	-41.37	14.36
4.34	0.00	0.00	-1.72	17.45	-42.95	18.24
4.36	0.00	0.00	-1.68	-100.05	-42.29	18.92
4.50	0.00	0.00	-1.35	-102.65	-27.89	23.91
4.75	120.06	0.00	-0.87	-89.63	-0.45	26.38
5.00	120.06	0.00	-0.54	-50.83	16.76	24.15
5.25	120.06	120.06	-0.33	-7.60	25.18	18.26
5.50	120.06	120.06	-0.22	17.15	23.56	12.04
5.75	120.06	120.06	-0.18	25.72	17.94	6.81
6.00	120.06	120.06	-0.19	24.77	11.49	3.14
6.25	120.06	120.06	-0.21	19.18	5.93	0.99
6.50	120.06	120.06	-0.24	11.71	2.05	0.03
6.75	120.06	120.06	-0.27	3.72	0.11	-0.20
7.00	120.06	120.06	-0.30	-4.50	0.21	-0.19
7.25	120.06	120.06	-0.34	-12.84	2.37	-0.47
7.50	120.06	120.06	-0.37	-20.94	6.61	-1.55
7.75	29.79	0.00	-0.39	24.96	6.48	-2.93
8.00	29.79	0.00	-0.41	24.69	0.29	-3.77
8.25	29.79	0.00	-0.40	24.97	-5.91	-3.07
8.50	120.06	0.00	-0.38	-8.19	-7.86	-1.36
8.75	120.06	120.06	-0.35	-16.62	-4.54	-0.07
9.00	120.06	120.06	-0.32	-10.06	-1.22	0.62
9.25	120.06	120.06	-0.30	-4.67	0.59	0.67
9.50	120.06	120.06	-0.28	-0.57	1.22	0.42
9.75	120.06	120.06	-0.26	2.55	0.96	0.13
10.00	120.06	120.06	-0.25	5.04	0.00	-0.00

Maximum shear force = 42,95 kN/m
Maximum moment = 30,82 kNm/m

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

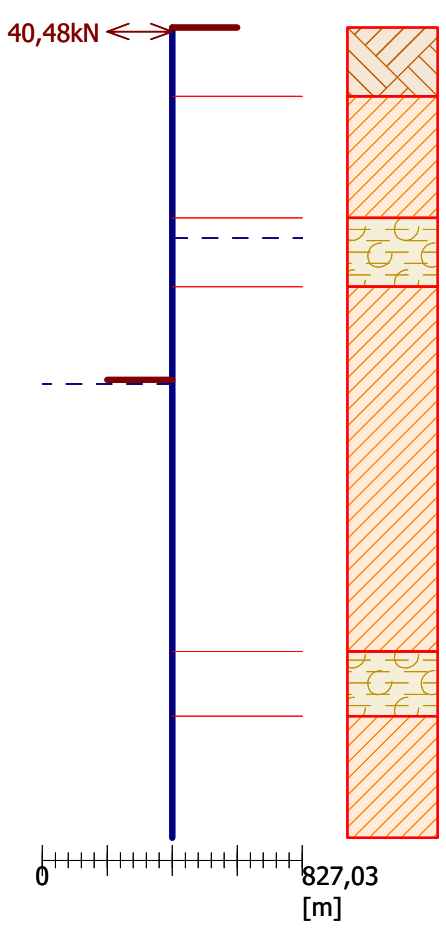
Maximum displacement = 5,8 mm

Reactions in props

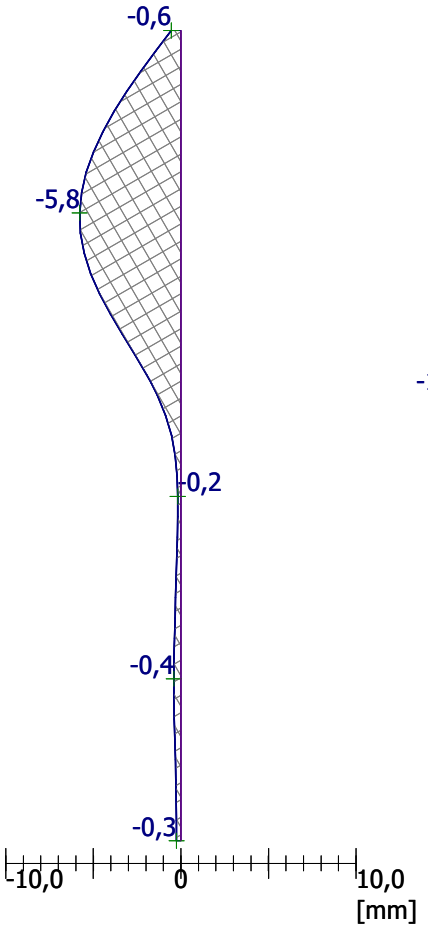
No.	Depth [m]	Reaction [kN]
1	0,05	40,48

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

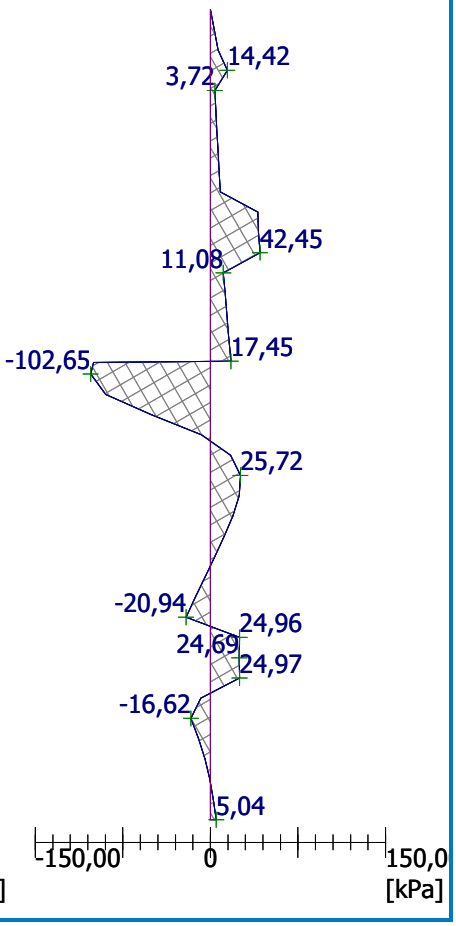
Geometry of structure
Length of structure = 10,00m



Displacement of structure
Max. disp. = 5,8 mm



Pressure acting on structure
Max. pressure = 102,65 kPa



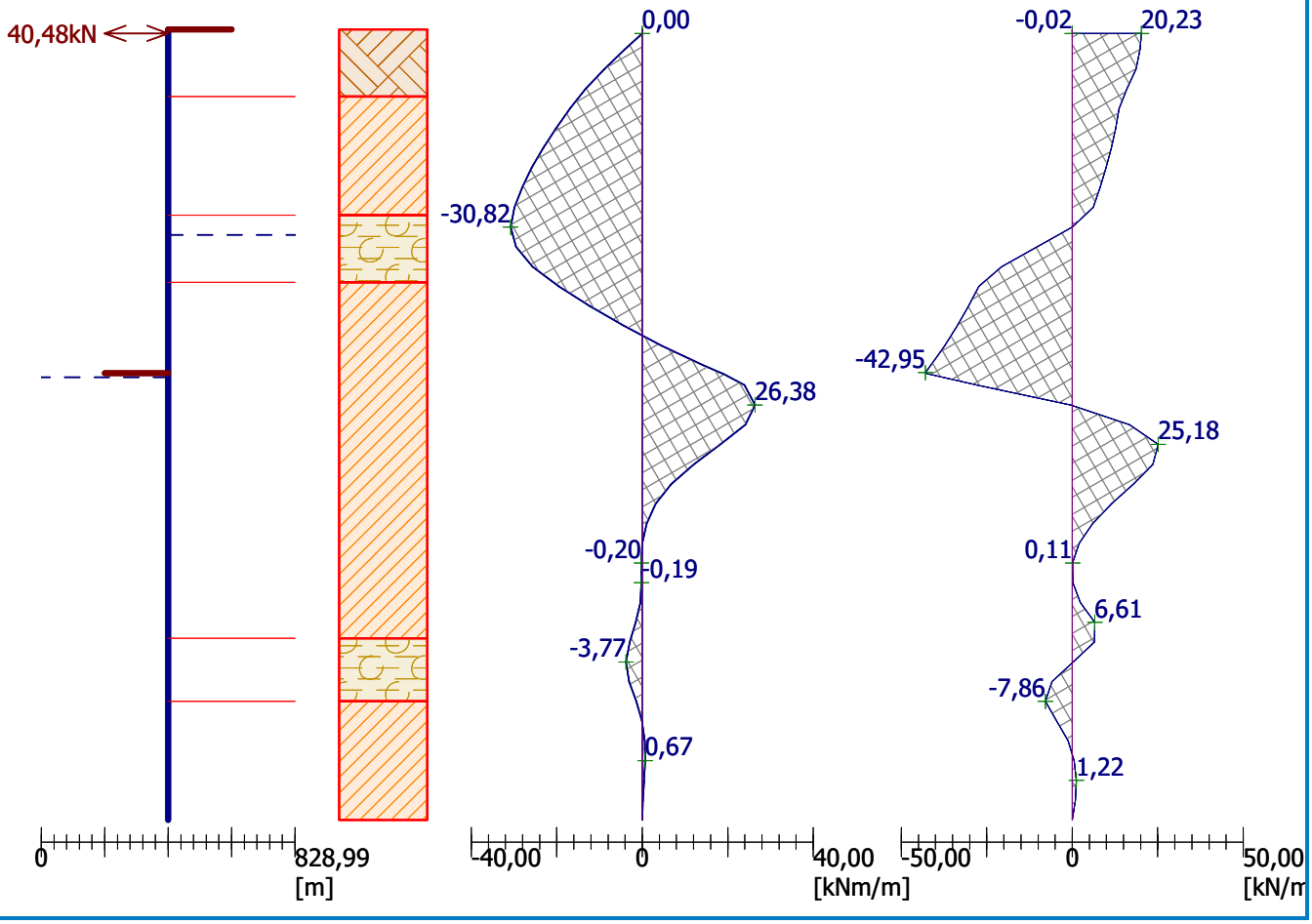
[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Analysis	Stage - analysis : 2 - -1

Geometry of structure
Length of structure = 10,00m

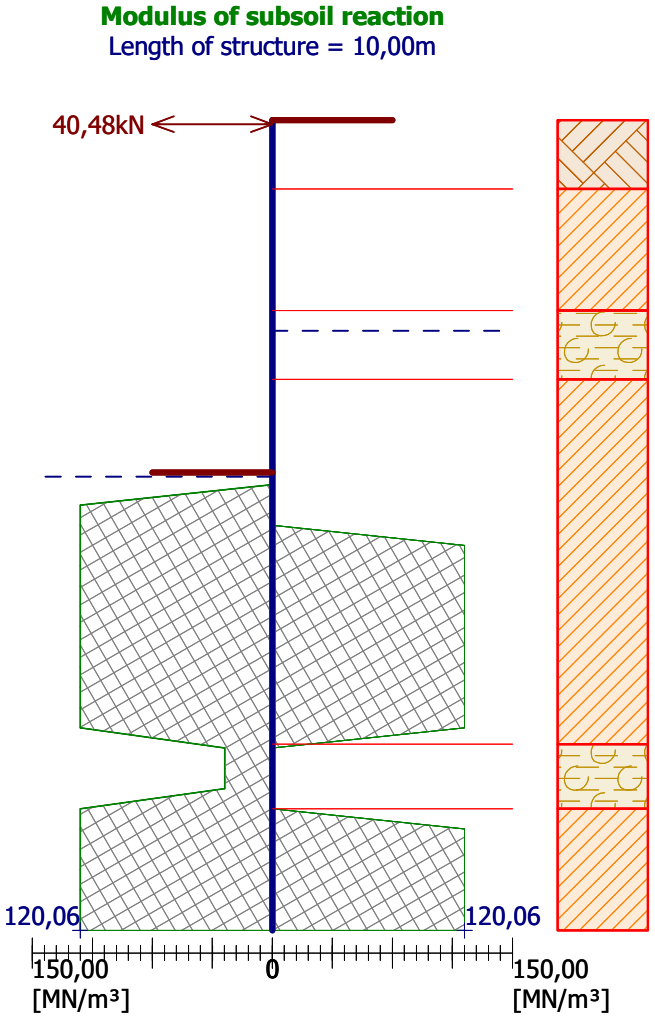
Bending moment
Max. M = 30,82 kNm/m

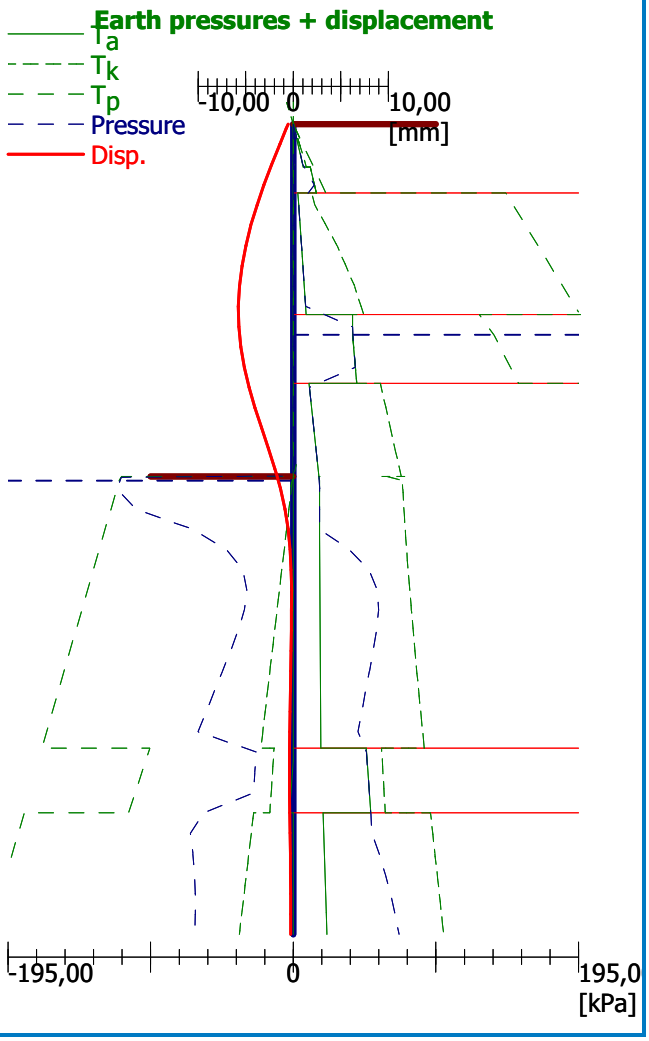
Shear force
Max. Q = 42,95 kN/m



[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Analysis	Stage - analysis : 2 - -1





Slope stability analysis

Input data

Project

Settings

(input for current task)

Materials and standards

SNiP - input coefficients according to SNIP standards

Coefficients according to SNiP			
Combination coefficient :	γ_k =	1,00	[–]
Coefficient of action conditions :	γ_c =	0,90	[–]
Coefficient of importance of structure :	γ_n =	1,10	[–]

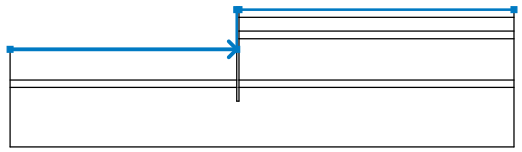
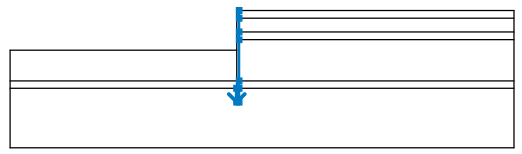
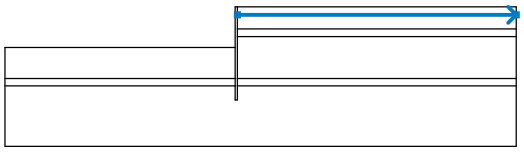
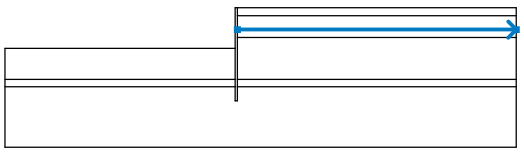
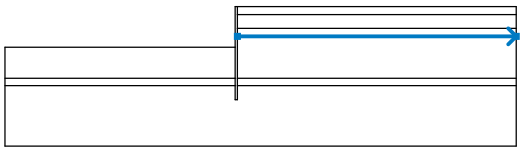
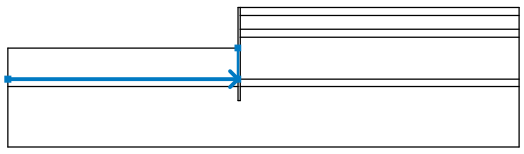
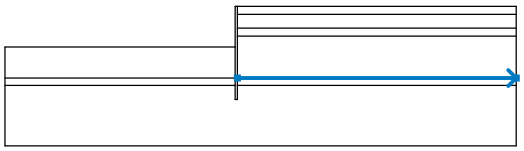
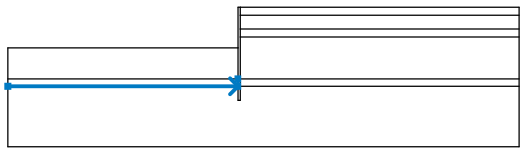
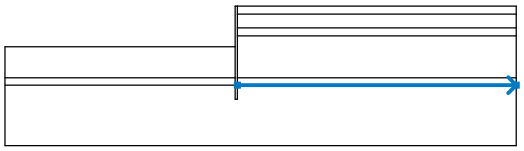
Stability analysis

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

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

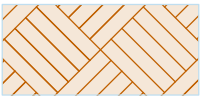
[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Interface

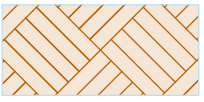
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		-25,00	-4,35	-0,25	-4,35	-0,25	0,00
		0,00	0,00	30,00	0,00		
2		-0,25	-8,50	-0,25	-10,00	0,00	-10,00
		0,00	-8,50	0,00	-7,70	0,00	-3,20
		0,00	-2,35	0,00	-0,85	0,00	0,00
3		0,00	-0,85	30,00	-0,85		
4		0,00	-2,35	30,00	-2,35		
5		0,00	-3,20	30,00	-3,20		
6		-25,00	-7,70	-0,25	-7,70	-0,25	-4,35
7		0,00	-7,70	30,00	-7,70		
8		-25,00	-8,50	-0,25	-8,50	-0,25	-7,70
9		0,00	-8,50	30,00	-8,50		

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]
1	nayari grunti		10,00	0,00	18,50
2	tixa		16,00	44,00	19,00
3	qvishnari		21,00	11,00	18,50
4	xreshis balishi		30,00	0,00	19,50

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	nayari grunti		18,50		
2	tixa		19,00		
3	qvishnari		18,50		
4	xreshis balishi		19,50		

Soil parameters

nayari grunti

Unit weight : γ = 18,50 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 10,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Saturated unit weight : γ_{sat} = 18,50 kN/m³

tixa

Unit weight : γ = 19,00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 16,00 °
Cohesion of soil : c_{ef} = 44,00 kPa
Saturated unit weight : γ_{sat} = 19,00 kN/m³

qvishnari

Unit weight : γ = 18,50 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 21,00 °

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

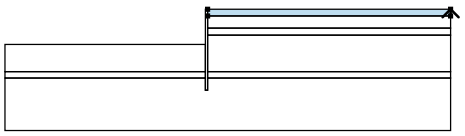
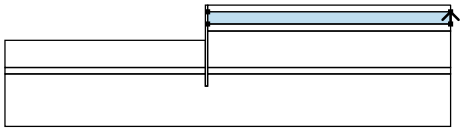
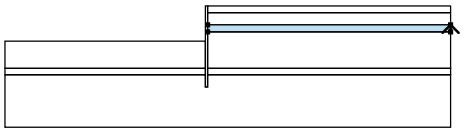
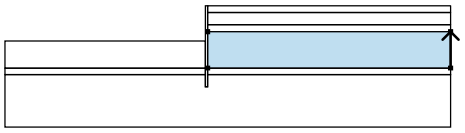
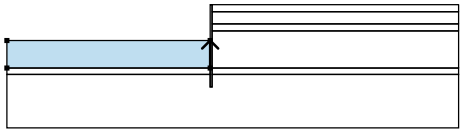
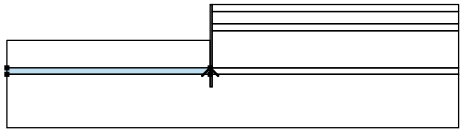
Cohesion of soil : c_{ef} = 11,00 kPa
Saturated unit weight : γ_{sat} = 18,50 kN/m3

xreshis balishi
Unit weight : γ = 19,50 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 30,00 °
Cohesion of soil : c_{ef} = 0,00 kPa
Saturated unit weight : γ_{sat} = 19,50 kN/m3

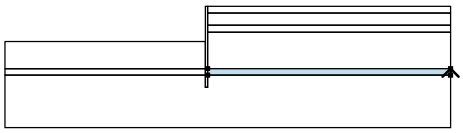
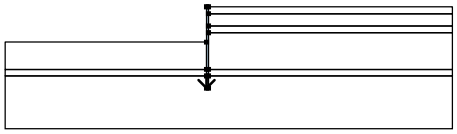
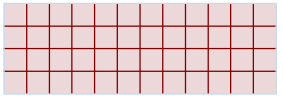
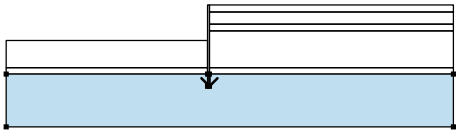
Rigid bodies

No.	Name	Sample	γ [kN/m3]
1	Wall material		23,56

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		30,00	-0,85	30,00	0,00	nayari grunti
		0,00	0,00	0,00	-0,85	
						
2		30,00	-2,35	30,00	-0,85	tixa
		0,00	-0,85	0,00	-2,35	
						
3		30,00	-3,20	30,00	-2,35	qvishnari
		0,00	-2,35	0,00	-3,20	
						
4		30,00	-7,70	30,00	-3,20	tixa
		0,00	-3,20	0,00	-7,70	
						
5		-0,25	-7,70	-0,25	-4,35	tixa
		-25,00	-4,35	-25,00	-7,70	
						
6		-0,25	-8,50	-0,25	-7,70	qvishnari
		-25,00	-7,70	-25,00	-8,50	
						

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
7		30,00	-8,50	30,00	-7,70	qvishnari
		0,00	-7,70	0,00	-8,50	
8		-0,25	-8,50	-0,25	-10,00	Wall material
		0,00	-10,00	0,00	-8,50	
		0,00	-7,70	0,00	-3,20	
		0,00	-2,35	0,00	-0,85	
		0,00	0,00	-0,25	0,00	
		-0,25	-4,35	-0,25	-7,70	
9		0,00	-8,50	0,00	-10,00	tixa
		-0,25	-10,00	-0,25	-8,50	
		-25,00	-8,50	-25,00	-15,00	
		30,00	-15,00	30,00	-8,50	

Surcharge

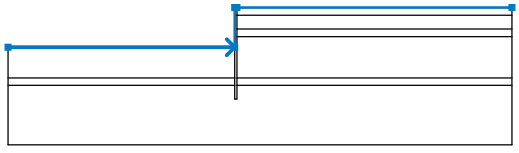
No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude q, q_1, f, F	q_2	unit
1	strip	permanent	z = -1,00	x = 2,20	l = 0,80		0,00	150,00		kN/m^2
2	strip	permanent	on terrain	x = 3,00	l = 7,00		0,00	7,00		kN/m^2

Surcharges

No.	Name
1	mosazgvre shenoba
2	droebiti datvirTva

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m] x	z	x	z	x	z
1		-25,00	-4,40	0,00	-4,40	0,05	-2,60
		30,00	-2,60				

Tensile crack

Tensile crack not inputted.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Slip surface parameters							
Center :	x =	-2,61	[m]	Angles :	α_1 =	-60,08	[°]
	z =	1,58	[m]		α_2 =	82,36	[°]
Radius :	R =	11,89	[m]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 497,27 kN/m

Sum of passive forces : F_p = 1648,47 kN/m

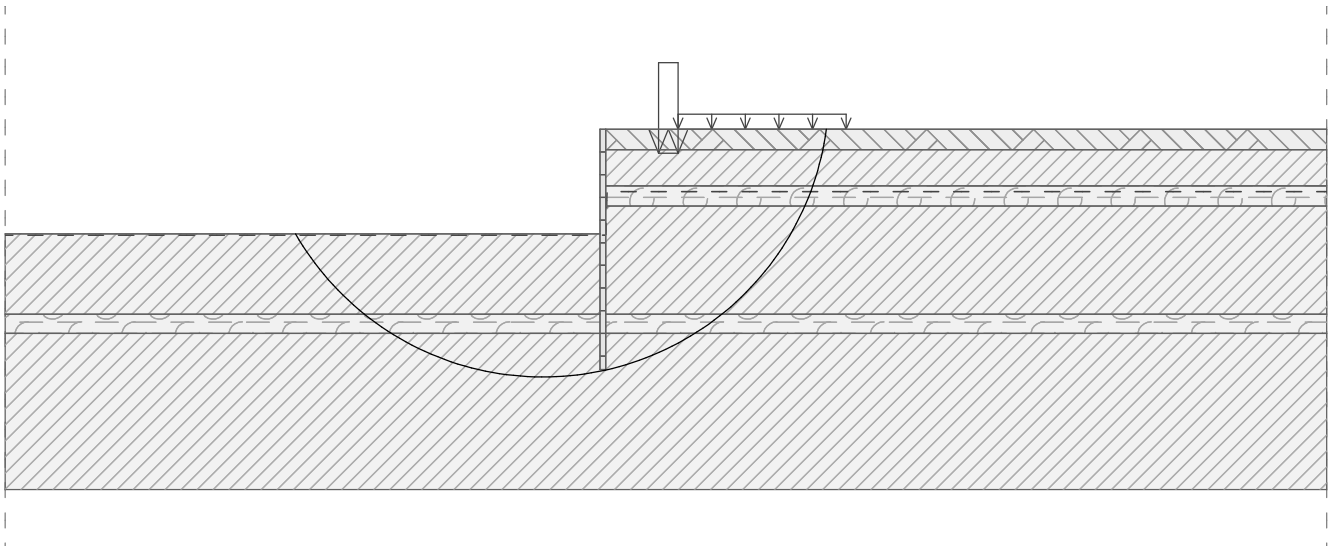
Sliding moment : M_a = 5912,55 kNm/m

Resisting moment : M_p = 19600,28 kNm/m

Factor of safety = 3,32 > 1,50

Slope stability ACCEPTABLE

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	-0.55	-0.18	-0.00	0.00	0.00	0.00
0.05	-0.73	-0.18	-0.08	-0.02	0.00	0.01
0.05	-0.73	-0.18	-0.08	20.23	0.00	0.01
0.25	-1.43	-0.16	-0.41	19.83	-4.01	0.03
0.49	-2.25	-0.13	-1.58	18.65	-8.68	0.26
0.50	-2.28	-0.13	-1.63	18.61	-8.84	0.27
0.51	-2.31	-0.13	-1.68	18.53	-8.98	0.28
0.75	-3.09	-0.11	-3.41	16.00	-13.20	0.89
1.00	-3.82	-0.09	-2.47	13.73	-16.86	1.61
1.25	-4.46	-0.08	0.08	12.68	-20.17	1.87
1.50	-5.00	-0.08	1.48	11.40	-23.19	1.65
1.75	-5.40	-0.09	2.43	9.87	-25.85	1.15
2.00	-5.67	-0.11	3.60	8.11	-28.10	0.40
2.25	-5.79	-0.13	5.49	6.12	-29.89	-0.72
2.50	-5.74	-0.15	-0.00	4.40	-30.82	-1.97
2.75	-5.53	-0.15	-10.22	-0.28	-29.54	-2.46

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
3.00	-5.15	-0.15	-20.68	-4.41	-25.69	-1.86
3.25	-4.64	-0.13	-27.37	-4.74	-19.52	-0.74
3.50	-4.02	-0.12	-30.32	-2.33	-12.32	0.13
3.75	-3.34	-0.10	-33.64	-0.76	-4.33	0.51
4.00	-2.63	-0.08	-37.32	0.13	0.57	4.53
4.25	-1.95	-0.07	-41.37	0.51	0.49	14.36
4.34	-1.72	-0.07	-42.95	0.54	0.44	18.24
4.36	-1.68	-0.07	-42.29	0.55	0.43	18.92
4.50	-1.35	-0.07	-27.89	0.59	0.35	23.91
4.75	-0.87	-0.06	-0.45	0.51	0.21	26.38
5.00	-0.54	-0.06	0.37	16.76	0.10	24.15
5.25	-0.33	-0.05	0.23	25.18	0.03	18.26
5.50	-0.22	-0.05	0.10	23.56	-0.01	12.04
5.75	-0.18	-0.05	0.01	17.94	-0.02	6.81
6.00	-0.19	-0.05	-0.06	11.49	-0.02	3.14
6.25	-0.21	-0.05	-0.09	5.93	0.00	0.99
6.50	-0.24	-0.05	-0.08	2.05	0.03	0.03
6.75	-0.27	-0.05	-0.02	0.11	-0.20	0.04
7.00	-0.30	-0.05	0.11	0.21	-0.19	0.04
7.25	-0.34	-0.05	0.34	2.37	-0.47	-0.02
7.50	-0.37	-0.05	0.68	6.61	-1.55	-0.14
7.75	-0.39	-0.05	0.52	6.48	-2.93	-0.26
8.00	-0.41	-0.05	-0.20	0.29	-3.77	-0.30
8.25	-0.40	-0.05	-5.91	-0.91	-3.07	-0.16
8.50	-0.38	-0.04	-7.86	-0.64	-1.36	0.03
8.75	-0.35	-0.04	-4.54	0.01	-0.07	0.08
9.00	-0.32	-0.04	-1.22	0.09	0.07	0.62
9.25	-0.30	-0.04	0.10	0.59	0.04	0.67
9.50	-0.28	-0.04	0.08	1.22	0.02	0.42
9.75	-0.26	-0.03	0.04	0.96	0.00	0.13
10.00	-0.25	-0.03	0.00	0.00	-0.00	0.00

Maximum values of internal forces

Maximum displacement = -5,8 mm
Minimum displacement = 0,0 mm
Maximum bending moment = 26,38 kNm/m
Minimum bending moment = -30,82 kNm/m
Maximum shear force = 25,18 kN/m

Verification of RC cross section (Pile curtain d = 0,25 m; a = 0,50 m)

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

Dimensioning of reinforcement:

Reinforcement - 6 pc bars 16,0 mm; covering 80,0 mm
Type of structure (reinforcement ratio) : beam

Reinforcement ratio μ_s = 1,229 % > 0,100 % = $\mu_{s,min}$

Load : N = 0,00 kN (tension) ; M = 15,41 kNm
Bearing capacity : N_{ult} = 0,00 kN; M_{ult} = 20,73 kNm

[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Designed pile reinforcement is SATISFACTORY

Verification of shear reinforcement:

Shear reinf. - profile 8,0 mm; spacing 100,0 mm

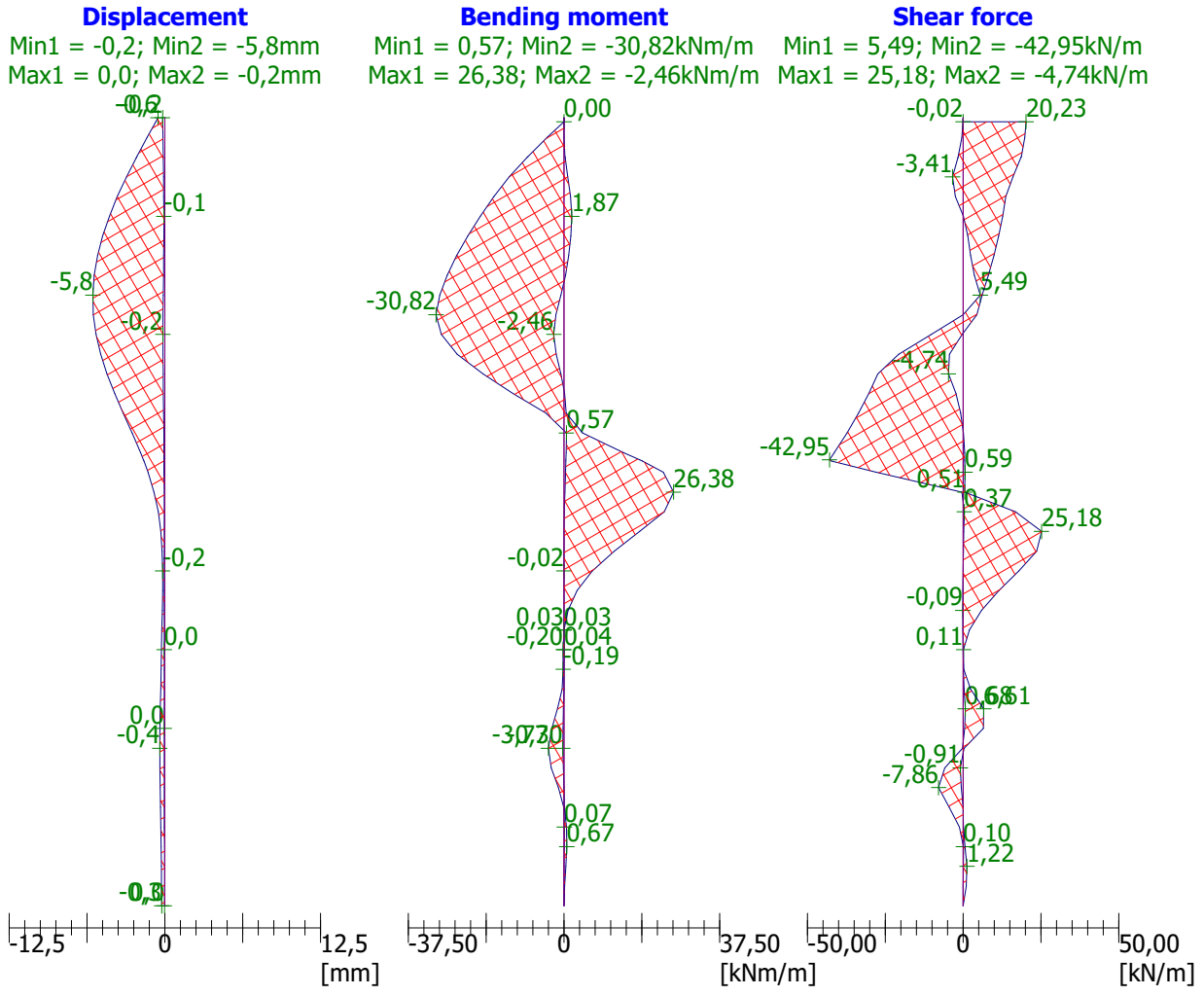
Ultimate shear force: V_{ult} = 115,50 kN > 0,00 kN = Q

Cross-section is SATISFACTORY.

only minimal shear reinforcement

Cross-section is SATISFACTORY

Name : Dimensioning	Stage - analysis : 1 - 1



[GeoStructural Analysis - Sheeting Check | version 5.19.5.0 | Copyright © 2015 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]