



Analysis using finite element method

Topology

Project

Date : 27.2.2014

Global settings

Project type : Plane strain
Analysis type : Consolidation
Tunnels : no
Advanced input : no
Detailed results : no
Concrete structures : EN 1992-1-1 (EC2)

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		-10,00	0,00	-4,29	4,00	4,29	4,00
		10,00	0,00				
2		-15,00	0,00	-10,00	0,00	10,00	0,00
		15,00	0,00				
3		-15,00	-4,50	15,00	-4,50		

Soil parameters - basic data

No.	Name	Sample	γ [kN/m ³]	E [MPa]	ν [-]
1	Jílovitá zemina		18,50	1,00	0,35
2	Sypanina		20,00	30,00	0,30
3	Písčitá hlína		19,50	30,00	0,30

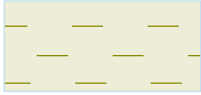
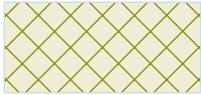

Soil parameters - data according to model

No.	Material model
1	elastic
2	elastic



No.	Material model
3	elastic

Soil parameters - uplift

No.	Name	Sample	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Jílovitá zemina		19,00		
2	Sypanina		20,00		
3	Písčitá hlína		20,00		

Soil parameters

Jílovitá zemina

Material model : elastic
 Unit weight : $\gamma = 18,50$ kN/m³
 Poisson's ratio : $\nu = 0,35$
 Elastic modulus : $E = 1,00$ MPa
 Saturated unit weight : $\gamma_{sat} = 19,00$ kN/m³
 Soil : consolidates
 Permeability coeff. in X-direction : $k_{x,sat} = 1,000E-04$ m/day
 Permeability coeff. in Z-direction : $k_{z,sat} = 1,000E-04$ m/day

Sypanina

Material model : elastic
 Unit weight : $\gamma = 20,00$ kN/m³
 Poisson's ratio : $\nu = 0,30$
 Elastic modulus : $E = 30,00$ MPa
 Saturated unit weight : $\gamma_{sat} = 20,00$ kN/m³
 Soil : does not consolidate

Písčitá hlína

Material model : elastic
 Unit weight : $\gamma = 19,50$ kN/m³
 Poisson's ratio : $\nu = 0,30$
 Elastic modulus : $E = 30,00$ MPa
 Saturated unit weight : $\gamma_{sat} = 20,00$ kN/m³
 Soil : consolidates
 Permeability coeff. in X-direction : $k_{x,sat} = 1,000E-02$ m/day
 Permeability coeff. in Z-direction : $k_{z,sat} = 1,000E-02$ m/day



Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		10,00	0,00	4,29	4,00	Sypanina
		-4,29	4,00	-10,00	0,00	
2		15,00	-4,50	15,00	0,00	Jílovitá zemina
		10,00	0,00	-10,00	0,00	
		-15,00	0,00	-15,00	-4,50	
3		-15,00	-4,50	-15,00	-10,00	Písčitá hlína
		15,00	-10,00	15,00	-4,50	

Lines refinement

No.	Location	Radius r [m]	Length l [m]
1	Interface No. 2, line No. 2	2,00	0,25

Mesh generation

Mesh generation parameters

Element edge length : 1,00 [m]
 Mesh smoothing : yes
 Generate multinode elements : yes

Mesh generation result

Finite element mesh was successfully generated.

Number of nodes 3394

Number of elements 2047 (region 1227, beam 205, interface 615)

Input data (Stage of construction 1)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Inactive	



No.	Region	Active / inactive	Assigned soil
2		Active	Jílovitá zemina
3		Active	Písčítá hlína

Line supports

No.	Location	Support	
		Direction X	Direction Z
A1	Mesh line No. 10	fixed	free
A2	Mesh line No. 8	fixed	free
A3	Mesh line No. 12	fixed	free
A4	Mesh line No. 5	fixed	free
A5	Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

General

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial calculation step : 0,25
 Displacement error : 0,0100
 Imbalanced forces error : 0,0100
 Energy error : 0,0100
 Respect material interfaces : no

Newton - Raphson

Relaxation factor of calculation step : 2
 Maximum number of relaxations of calculation step : 2
 Min. number of iterations for one calc. step : 1

Line search

Solution method : iterate no
 Line search limit - minimum : 0,100



Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
Change of permeability matrix : after each iteration
Max. number of iterations for one calc. step : 20
Pore pressure error : 0,0100
Equilibrium state error : 0,0100
Respect material interfaces : no

Results (Stage of construction 1)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Attained loading = 100,00 %

Extremes (Stress)

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma Z, tot. [kPa]	3,87	0,00	0,00	12,74	-10,00	193,39
Sigma Z, eff. [kPa]	3,87	0,00	0,00	12,74	-10,00	93,39
Sigma X, tot. [kPa]	4,06	0,00	0,17	12,74	-10,00	140,03
Sigma X, eff. [kPa]	4,06	0,00	0,17	12,74	-10,00	40,03
Tau xz [kPa]	10,89	-4,50	-0,04	-9,85	-4,50	0,04

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	3,87	0,00	0,02	8,84	-3,80	2,45

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	-13,51	-10,00	100,00

Input data (Stage of construction 2)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Active	Sypanina
2		Active	Jílovitá zemina



No.	Region	Active / inactive	Assigned soil
3		Active	Písčítá hlína

Line supports

No.	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 10	fixed	free
A2	Yes		Mesh line No. 8	fixed	free
A3	Yes		Mesh line No. 12	fixed	free
A4	Yes		Mesh line No. 5	fixed	free
A5	Yes		Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Line flows

No.	Line flow		Location	Boundary type
	new	modified		
1	Yes		Mesh line No. 1	impermeable
2	Yes		Mesh line No. 2	impermeable
3	Yes		Mesh line No. 3	impermeable
4	Yes		Mesh line No. 5	permeable
5	Yes		Mesh line No. 6	impermeable
6	Yes		Mesh line No. 7	impermeable
7	Yes		Mesh line No. 8	permeable
8	Yes		Mesh line No. 10	permeable
9	Yes		Mesh line No. 11	permeable
10	Yes		Mesh line No. 12	permeable

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

Consolidation

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial division of time step : 100
 Solution error tolerance : 0,0100
 Equilibrium error tolerance : 0,0100
 Respect material interfaces : no



Newton - Raphson

Relaxation factor of calculation step : 2
Maximum number of relaxations of calculation step : 2

Line search

Solution method : iterate no
Line search limit - minimum : 0,100
Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
Change of permeability matrix : after each iteration
Max. number of iterations for one calc. step : 20
Pore pressure error : 0,0100
Equilibrium state error : 0,0100
Respect material interfaces : no

Results (Stage of construction 2)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Stage time attained = 1,00000 day

Overall attained time = 1,00000 day

Extremes (Stress)

Displacements (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [m]	8,23	-1,75	-72,4	-8,18	-1,69	72,4
Displacements z [m]	-11,57	0,00	-45,3	0,00	2,91	64,6

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma z, tot. [kPa]	10,52	0,00	-5,94	-1,00	-10,00	252,00
Sigma z, eff. [kPa]	-1,31	4,00	-23,48	-1,00	-10,00	152,00
Sigma x, tot. [kPa]	-0,12	0,18	-101,60	-1,00	-10,00	163,14
Sigma x, eff. [kPa]	-0,12	0,18	-130,48	-1,00	-10,00	63,14
Tau xz [kPa]	7,04	2,07	-28,43	-7,04	2,07	27,24

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	0,00	2,91	0,01	6,89	-3,79	4,90

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	-0,98	-3,78	124,92

Calculated total inflow / outflow

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 4		-5,9E-05
Line flow No. 7		-5,9E-05
Line flow No. 8		-1,3E-04



Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 9		-2,0E-03
Line flow No. 10		-1,3E-04
Total	0,0E+00	-2,3E-03

Input data (Stage of construction 3)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Active	Sypanina
2		Active	Jílovitá zemina
3		Active	Písčitá hlína

Line supports

No.	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 10	fixed	free
A2	Yes		Mesh line No. 8	fixed	free
A3	Yes		Mesh line No. 12	fixed	free
A4	Yes		Mesh line No. 5	fixed	free
A5	Yes		Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Line flows

No.	Location	Boundary type
1	Mesh line No. 1	impermeable
2	Mesh line No. 2	impermeable
3	Mesh line No. 3	impermeable
4	Mesh line No. 5	permeable
5	Mesh line No. 6	impermeable
6	Mesh line No. 7	impermeable
7	Mesh line No. 8	permeable
8	Mesh line No. 10	permeable
9	Mesh line No. 11	permeable
10	Mesh line No. 12	permeable



Surcharge

No.	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope α [°]	Magnitude		
	new	change		z [m] / x ₁ [m]	x [m] / z ₁ [m]	l [m] / x ₂ [m]	b [m] / z ₂ [m]		q, q ₁ , f, F	q ₂	unit
1	Yes		strip	on interface	x = -4,00	l = 8,00		0,00	20,00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

Consolidation

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial division of time step : 100
 Solution error tolerance : 0,0100
 Equilibrium error tolerance : 0,0100
 Respect material interfaces : no

Newton - Raphson

Relaxation factor of calculation step : 2
 Maximum number of relaxations of calculation step : 2

Line search

Solution method : iterate no
 Line search limit - minimum : 0,100
 Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
 Change of permeability matrix : after each iteration
 Max. number of iterations for one calc. step : 20
 Pore pressure error : 0,0100
 Equilibrium state error : 0,0100
 Respect material interfaces : no

Results (Stage of construction 3)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Stage time attained = 10,00000 day

Overall attained time = 11,00000 day

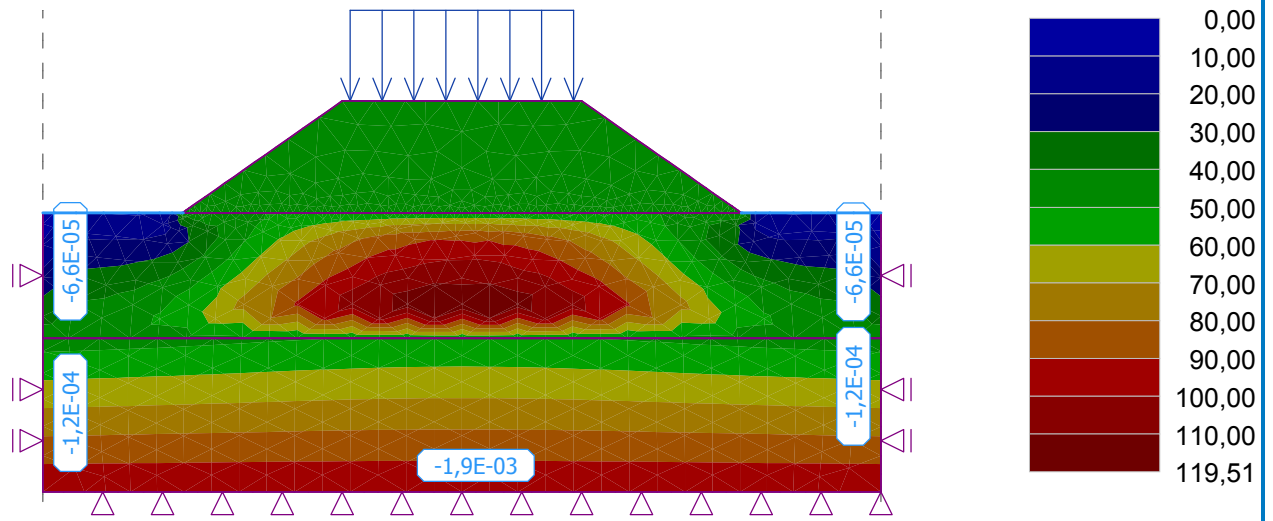


Name : Analysis

Stage : 3

Results : overall; variable : Pore pressure u; range : <0,00; 119,51> kPa

ΣQ [m³/day/m]



Extremes (Stress)

Displacements (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [m]	8,23	-1,75	-83,2	-8,18	-1,69	83,3
Displacements z [m]	-11,57	0,00	-49,3	0,00	2,91	102,1

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma z, tot. [kPa]	15,00	0,00	-1,82	-1,00	-10,00	262,56
Sigma z, eff. [kPa]	-10,00	0,00	-39,27	-1,00	-10,00	162,56
Sigma x, tot. [kPa]	0,12	0,18	-149,87	-1,00	-10,00	167,76
Sigma x, eff. [kPa]	0,12	0,18	-199,72	-1,00	-10,00	67,76
Tau xz [kPa]	7,04	2,07	-40,93	-7,04	2,07	39,53

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	0,00	2,91	0,06	4,93	-3,79	6,17

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	0,01	-3,27	119,51

Calculated total inflow / outflow

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 4		-6,6E-05
Line flow No. 7		-6,6E-05
Line flow No. 8		-1,2E-04
Line flow No. 9		-1,9E-03



Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 10		-1,2E-04
Total	0,0E+00	-2,3E-03

Input data (Stage of construction 4)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Active	Sypanina
2		Active	Jílovitá zemina
3		Active	Písčitá hlína

Line supports

No.	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 10	fixed	free
A2	Yes		Mesh line No. 8	fixed	free
A3	Yes		Mesh line No. 12	fixed	free
A4	Yes		Mesh line No. 5	fixed	free
A5	Yes		Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Line flows

No.	Location	Boundary type
1	Mesh line No. 1	impermeable
2	Mesh line No. 2	impermeable
3	Mesh line No. 3	impermeable
4	Mesh line No. 5	permeable
5	Mesh line No. 6	impermeable
6	Mesh line No. 7	impermeable
7	Mesh line No. 8	permeable
8	Mesh line No. 10	permeable
9	Mesh line No. 11	permeable
10	Mesh line No. 12	permeable

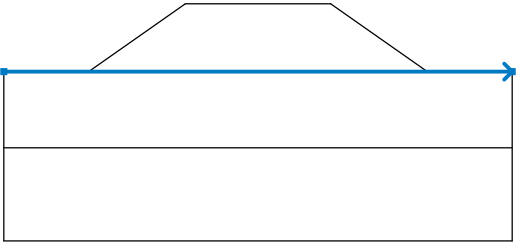


Surcharge

No.	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope α [°]	Magnitude		
	new	change		z [m] / x ₁ [m]	x [m] / z ₁ [m]	l [m] / x ₂ [m]	b [m] / z ₂ [m]		q, q ₁ , f, F	q ₂	unit
1	No	No	strip	on interface	x = -4,00	l = 8,00		0,00	20,00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

Consolidation

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial division of time step : 100
 Solution error tolerance : 0,0100
 Equilibrium error tolerance : 0,0100
 Respect material interfaces : no

Newton - Raphson

Relaxation factor of calculation step : 2
 Maximum number of relaxations of calculation step : 2

Line search

Solution method : iterate no
 Line search limit - minimum : 0,100
 Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
 Change of permeability matrix : after each iteration
 Max. number of iterations for one calc. step : 20
 Pore pressure error : 0,0100
 Equilibrium state error : 0,0100
 Respect material interfaces : no

Results (Stage of construction 4)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Stage time attained = 30,00000 day

Overall attained time = 41,00000 day

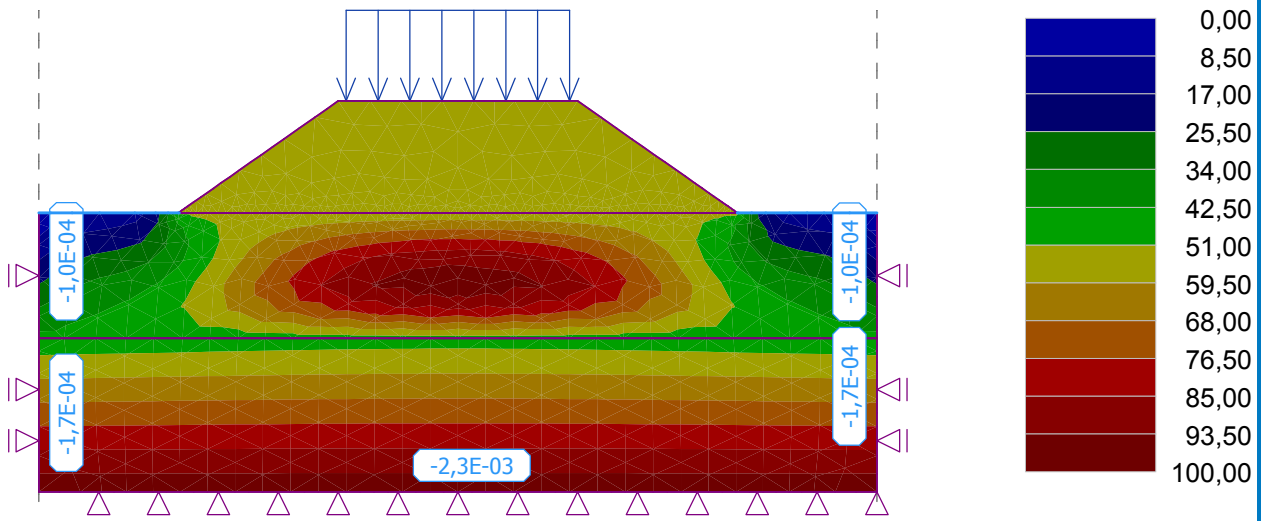


Name : Analysis

Stage : 4

Results : overall; variable : Pore pressure u; range : <0,00; 100,00> kPa

ΣQ [m³/day/m]



Extremes (Stress)

Displacements (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [m]	8,23	-1,75	-80,6	-8,18	-1,69	80,6
Displacements z [m]	11,02	0,00	-49,6	0,00	2,91	124,8

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma z, tot. [kPa]	-15,00	0,00	-0,31	-1,00	-10,00	260,97
Sigma z, eff. [kPa]	-10,00	0,00	-39,27	-1,00	-10,00	160,97
Sigma x, tot. [kPa]	0,12	0,18	-156,35	-1,00	-10,00	167,27
Sigma x, eff. [kPa]	0,12	0,18	-209,23	-1,31	4,00	77,14
Tau xz [kPa]	7,04	2,07	-49,08	-7,04	2,07	47,48

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	-15,00	-4,96	0,10	-0,98	-3,78	6,86

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	-13,51	-10,00	100,00

Calculated total inflow / outflow

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 4		-1,0E-04
Line flow No. 7		-1,0E-04
Line flow No. 8		-1,7E-04
Line flow No. 9		-2,3E-03



Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 10		-1,7E-04
Total	0,0E+00	-2,9E-03

Input data (Stage of construction 5)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Active	Sypanina
2		Active	Jílovitá zemina
3		Active	Písčitá hlína

Line supports

No.	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 10	fixed	free
A2	Yes		Mesh line No. 8	fixed	free
A3	Yes		Mesh line No. 12	fixed	free
A4	Yes		Mesh line No. 5	fixed	free
A5	Yes		Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Line flows

No.	Location	Boundary type
1	Mesh line No. 1	impermeable
2	Mesh line No. 2	impermeable
3	Mesh line No. 3	impermeable
4	Mesh line No. 5	permeable
5	Mesh line No. 6	impermeable
6	Mesh line No. 7	impermeable
7	Mesh line No. 8	permeable
8	Mesh line No. 10	permeable
9	Mesh line No. 11	permeable
10	Mesh line No. 12	permeable

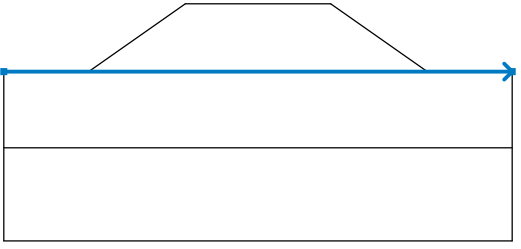


Surcharge

No.	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope α [°]	Magnitude		
	new	change		z [m] / x ₁ [m]	x [m] / z ₁ [m]	l [m] / x ₂ [m]	b [m] / z ₂ [m]		q, q ₁ , f, F	q ₂	unit
1	No	No	strip	on interface	x = -4,00	l = 8,00		0,00	20,00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

Consolidation

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial division of time step : 100
 Solution error tolerance : 0,0100
 Equilibrium error tolerance : 0,0100
 Respect material interfaces : no

Newton - Raphson

Relaxation factor of calculation step : 2
 Maximum number of relaxations of calculation step : 2

Line search

Solution method : iterate no
 Line search limit - minimum : 0,100
 Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
 Change of permeability matrix : after each iteration
 Max. number of iterations for one calc. step : 20
 Pore pressure error : 0,0100
 Equilibrium state error : 0,0100
 Respect material interfaces : no

Results (Stage of construction 5)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Stage time attained = 365,00000 day

Overall attained time = 406,00000 day

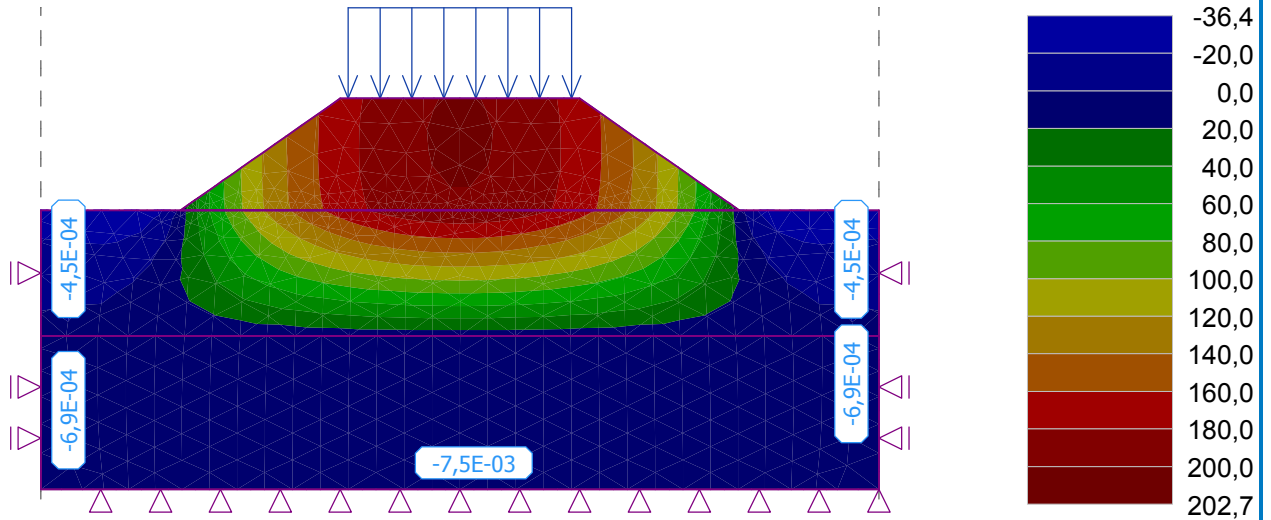


Name : Analysis

Stage : 5

Results : overall; variable : Settlement d z; range : <-36,4; 202,7> mm

ΣQ [m³/day/m]



Extremes (Stress)

Displacements (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [m]	9,76	-1,15	-71,0	-9,17	-1,59	71,2
Displacements z [m]	12,50	0,00	-36,4	0,00	2,91	202,7

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma z, tot. [kPa]	-15,00	0,00	0,00	-1,00	-10,00	258,15
Sigma z, eff. [kPa]	10,52	0,00	-22,30	-1,00	-10,00	158,15
Sigma x, tot. [kPa]	-0,12	0,18	-164,93	-1,00	-10,00	166,40
Sigma x, eff. [kPa]	-0,12	0,18	-195,20	-1,31	4,00	131,47
Tau xz [kPa]	7,04	2,07	-64,59	-7,04	2,07	62,67

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	-15,00	-4,96	0,10	-0,98	-3,78	7,96

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	-13,51	-10,00	100,00

Calculated total inflow / outflow

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 4		-4,5E-04
Line flow No. 7		-4,5E-04
Line flow No. 8		-6,9E-04
Line flow No. 9		-7,5E-03



Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 10		-6,9E-04
Total	0,0E+00	-9,8E-03

Input data (Stage of construction 6)

Assignment and activation

No.	Region	Active / inactive	Assigned soil
1		Active	Sypanina
2		Active	Jílovitá zemina
3		Active	Písčitá hlína

Line supports

No.	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 10	fixed	free
A2	Yes		Mesh line No. 8	fixed	free
A3	Yes		Mesh line No. 12	fixed	free
A4	Yes		Mesh line No. 5	fixed	free
A5	Yes		Mesh line No. 11	fixed	fixed

A1 up to A5 - automatically generated line supports along model edges

Line flows

No.	Location	Boundary type
1	Mesh line No. 1	impermeable
2	Mesh line No. 2	impermeable
3	Mesh line No. 3	impermeable
4	Mesh line No. 5	permeable
5	Mesh line No. 6	impermeable
6	Mesh line No. 7	impermeable
7	Mesh line No. 8	permeable
8	Mesh line No. 10	permeable
9	Mesh line No. 11	permeable
10	Mesh line No. 12	permeable



Surcharge

No.	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope α [°]	Magnitude		
	new	change		z [m] / x ₁ [m]	x [m] / z ₁ [m]	l [m] / x ₂ [m]	b [m] / z ₂ [m]		q, q ₁ , f, F	q ₂	unit
1	No	No	strip	on interface	x = -4,00	l = 8,00		0,00	20,00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-15,00	0,00	15,00	0,00		

Analysis settings

Stress

Consolidation

Method : Newton - Raphson
 Stiffness matrix change : after each iteration
 Max. number of iterations for one calc. step : 100
 Initial division of time step : 100
 Solution error tolerance : 0,0100
 Equilibrium error tolerance : 0,0100
 Respect material interfaces : no

Newton - Raphson

Relaxation factor of calculation step : 2
 Maximum number of relaxations of calculation step : 2

Line search

Solution method : iterate no
 Line search limit - minimum : 0,100
 Line search limit - maximum : 1,000

Water flow

Method : Newton - Raphson
 Change of permeability matrix : after each iteration
 Max. number of iterations for one calc. step : 20
 Pore pressure error : 0,0100
 Equilibrium state error : 0,0100
 Respect material interfaces : no

Results (Stage of construction 6)

Consolidation analysis was successfully completed.

Analysis settings : **standard**

Elastic analysis.

Stage time attained = 3650,00000 day

Overall attained time = 4056,00000 day

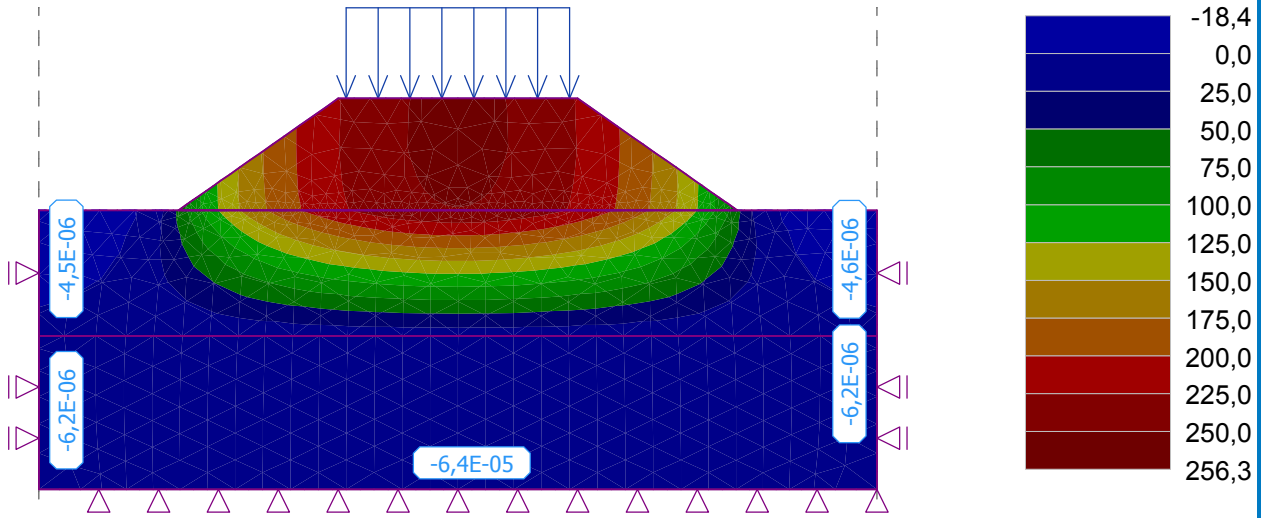


Name : Analysis

Stage : 6

Results : overall; variable : Settlement d z; range : <-18,4; 256,3> mm

ΣQ [m³/day/m]



Extremes (Stress)

Displacements (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [m]	9,20	-1,66	-62,9	-9,17	-1,59	63,1
Displacements z [m]	-15,00	0,00	-18,4	0,00	2,91	256,3

Stress (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Sigma z, tot. [kPa]	-15,00	0,00	0,00	-1,00	-10,00	258,12
Sigma z, eff. [kPa]	-15,00	0,00	0,00	-1,00	-10,00	158,12
Sigma x, tot. [kPa]	-0,12	0,18	-164,52	-1,00	-10,00	166,45
Sigma x, eff. [kPa]	-0,12	0,18	-164,55	-1,31	4,00	166,20
Tau xz [kPa]	7,04	2,07	-67,32	-7,04	2,07	65,37

Strain (extremes)

	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Epsilon eq. [%]	-15,00	-4,96	0,10	-0,98	-3,78	8,46

Pore pressures (extremes)

	Location		Max
	x [m]	z [m]	
Pore pressure u [kPa]	-13,51	-10,00	100,00

Calculated total inflow / outflow

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 4		-4,6E-06
Line flow No. 7		-4,5E-06
Line flow No. 8		-6,2E-06
Line flow No. 9		-6,4E-05



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United Kingdom

Project: Shopping center Black Rose
Geotechnics and foundation - project reports
Designer: Ing. John Williams

Location	Inflow [m ³ /day/m]	Outflow [m ³ /day/m]
Line flow No. 10		-6,2E-06
Total	0,0E+00	-8,6E-05