

Slope stability

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Appendix

1. Input receipt

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1. GENERAL

A bridge foundation is evaluated using three different methods:

- General bearing capacity equation ("Allmänna bärihetsekvationen")
- Circular slipe surface using SLOPE/W using ultimate limit safety.
- Slope stability analysis using FEM-software.

Summary of safety factors (SF):

Method	SF	Page	Remark
General bearing capacity equation	0.56	8	"Allmänna bärihetsekvationen"
Circular slipe surface	1.17	12	SLOPE/W
Slope stability analysis	1.19	29	FEM-software

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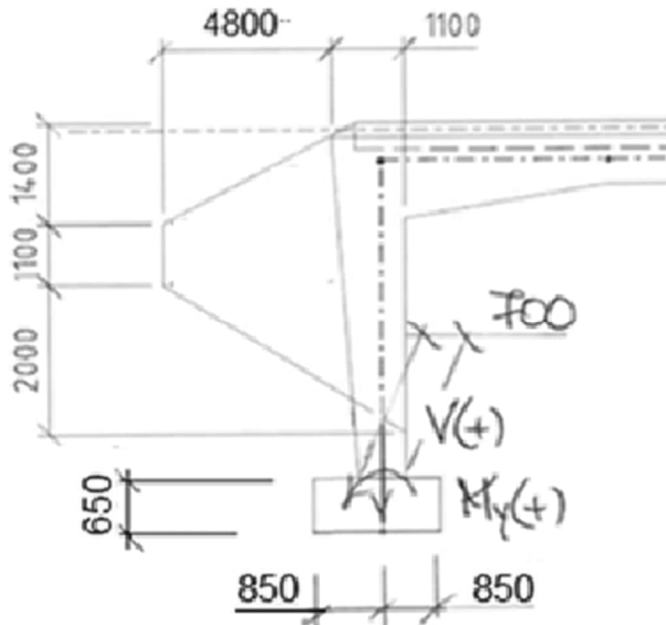
Ground waterlevel: +20.3 → +22.0

Geotechnical parameters:

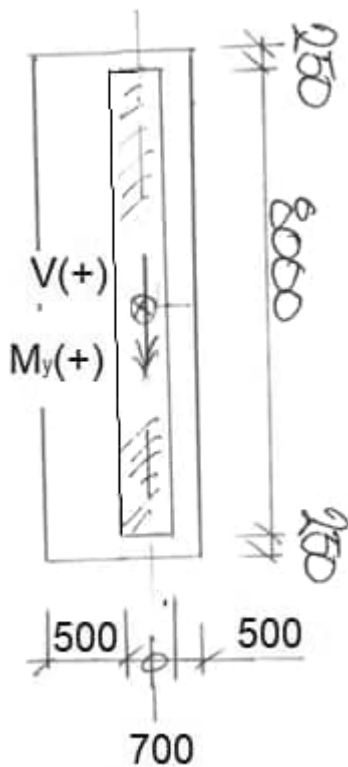
Material	Level	ρ	ρ'	ϕ_k	E_k
"Sprängsten"	20.3-19.8	18	11	45	50
"Siltig sand"	19.8-15.0	20	11	38	35
"Morän"	15.0-13.0	20	11	39	45
"Berg"	13.0	-	-	-	-
-	m	kN/m ³	kN/m ³	deg	MPa

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1.2 GEOMETRY



ELEVATION



PLAN

Bottom slab

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1.3 DESIGN LOAD EFFECT

$$V_d = 3566kN$$

$$H_{xd} = 1570kN$$

$$H_{yd} = 39kN$$

$$M_{xd} = 386kNm$$

$$M_{yd} = 21kNm$$

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2. GEOTECHNICAL BEARING CAPACITY EQUATION

General bearing capacity equation is determined using SS-EN 1997-1 annex D & TRVINFRA-002300 section 9.2.1.2.1 (“Allmänna bärlighetsekvationen”).

$$e_x = -\frac{M_{yd}}{V_d} = -\frac{21kNm}{3566kN} = -0.01m$$

$$e_y = \frac{M_{xd}}{V_d} = \frac{386kNm}{3566kN} = 0.11m$$

$$B_{ef} = 2 \cdot (0.85m - 0.01m) = 1.69m$$

$$L_{ef} = 8.5m - 2 \cdot 0.11m = 8.28m$$

$$\Rightarrow \sigma_{sd} = \frac{3566kN}{1.69m \cdot 8.28m} = 255kPa$$

$$\varphi_d = a \tan\left(\frac{\tan 38^\circ}{1.30}\right) = 31^\circ$$

$$H_d = \sqrt{1570^2 + 39^2}kN = 1571kN$$

$$\mu_d = \frac{1570kN}{3566kN} = 0.44$$

$$\theta = a \sin\left(\frac{1570kN}{1571kN}\right) = 89^\circ$$

$$\mu_{d.till} = \frac{\tan 31^\circ}{1.0} = 0.60$$

$$m_b = \frac{2 + \frac{1.69m}{8.28m}}{1 + \frac{1.69m}{8.28m}} = 1.83$$

$$m_l = \frac{2 + \frac{8.28m}{1.69m}}{1 + \frac{8.28m}{1.69m}} = 1.16$$

$$m_\theta = 1.16 \cdot \cos^2 89^\circ + 1.83 \cdot \sin^2 89^\circ = 1.83$$

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$$\text{Since } B_{ef} > |h_w| = 1.7 \text{ m} \rightarrow \gamma_{ef} = 11 \frac{kN}{m^3}$$

$$N_q = \frac{1 + \sin 31^\circ}{1 - \sin 31^\circ} \cdot e^{\pi \cdot \tan 31^\circ} = 20.6$$

$$d_q = 1 + 0.35 \cdot \frac{1.0m}{1.69m} = 1.21$$

$$s_q = 1 + \frac{1.69m}{8.20m} \cdot \sin 31^\circ = 1.10$$

$$i_q = \left(1 - \frac{1571kN}{3566kN}\right)^{1.83} = 0.35$$

$$b_q = 1.00$$

$$g_q = 1 - \sin 2 \cdot 0^\circ = 1.0$$

$$q = 11 \frac{kN}{m^3} \cdot 1.0m = 11kPa$$

$$R_q = 11kPa \cdot 20.6 \cdot 1.21 \cdot 1.10 \cdot 0.35 \cdot 1.0 \cdot 1.0 \cdot \frac{1.69m \cdot 8.28m}{1.0} = 1464kN$$

$$N_\gamma = 2 \cdot (20.6 - 1) \cdot \tan 31^\circ = 23.6$$

$$s_\gamma = 1 - 0.3 \cdot \frac{1.69m}{8.29m} = 0.94$$

$$i_\gamma = \left(1 - \frac{1571kN}{3566kN}\right)^{1.83+1} = 0.19$$

$$g_\gamma = 1.0$$

$$R_\gamma = 0.5 \cdot 11 \frac{kN}{m^3} \cdot 1.69m \cdot 23.6 \cdot 1.0 \cdot 0.94 \cdot 0.19 \cdot 1.0 \cdot 1.0 \cdot \frac{1.69m \cdot 8.28m}{1.0} = 556kN$$

$$R_d = 1464kN + 556kN = 2020kN$$

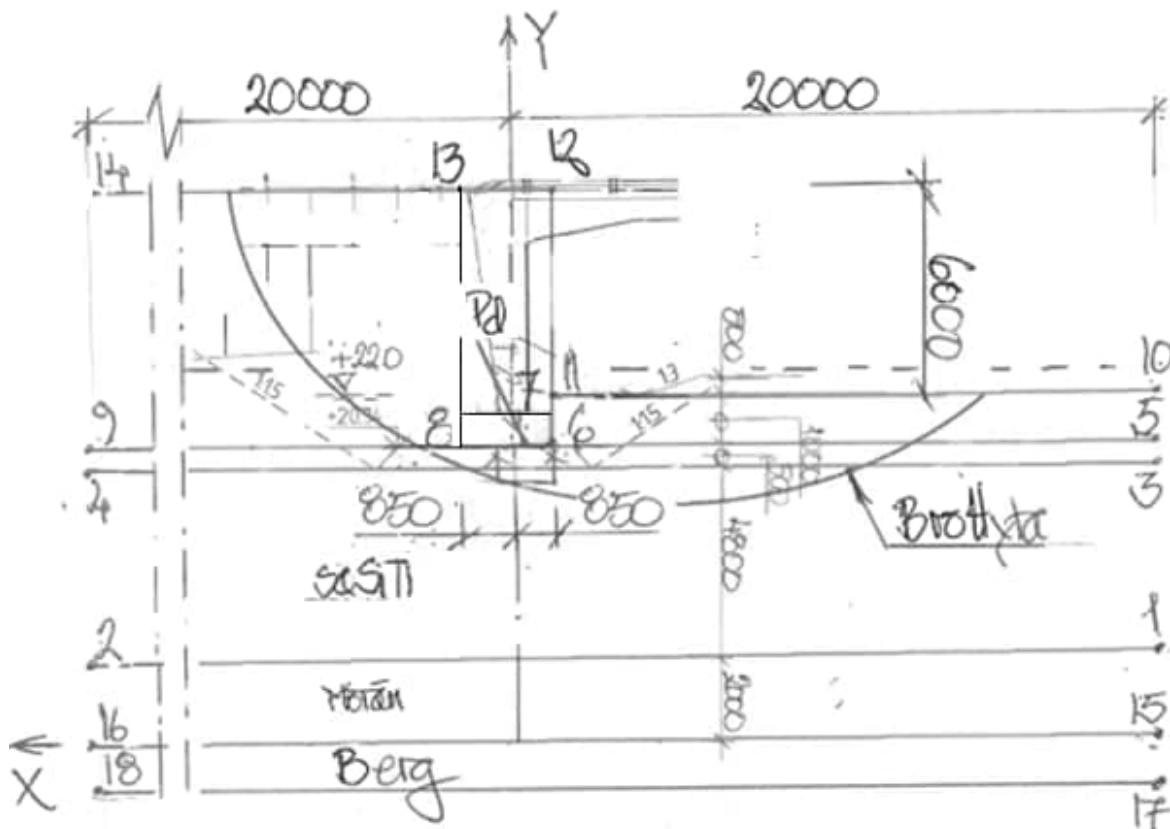
$$\Rightarrow \sigma_{Rd} = \frac{2020kN}{1.69m \cdot 8.28m} = 144kPa$$

$$FS = \frac{\sigma_{Rd}}{\sigma_{Sd}} = \frac{144kPa}{255kPa} = 0.56 \ll 1.00 \rightarrow \text{resistance not OK!}$$

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3. CIRCULAR SLIPE SURFACE

Circular slipe surface safety is determined using SLOPE/W for ultimate limit (ULS).



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3.1 Design load

Horizontal earth pressure is included on the safe side in both the point load and the driving load in the slip surface. In this check, the point load is reduced by a load corresponding to the horizontal earth pressure.

Point load

$$V_d = 3566 \text{ kN} \quad : \text{ see page 6}$$

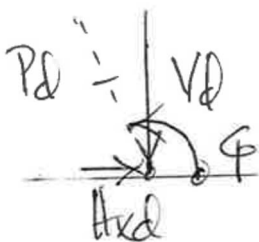
$$L_{ef} = 8.28 \text{ m} \quad : \text{ see page 6}$$

$$H_{x,earth} = 515 \text{ kN}$$

$$H_{xd,red} = H_{xd} - \psi \gamma_{earth} \cdot H_{x,earth} = 1570 \text{ kN} - 1.45 \cdot 515 \text{ kN} = 823 \text{ kN}$$

$$\Rightarrow P_d = \frac{\sqrt{H_{xd,red}^2 + V_d^2}}{L_{ef}} = 440 \frac{\text{kN}}{\text{m}}$$

$$\phi = \arctan\left(\frac{H_{xd,red}}{V_d}\right) = 13 \text{ deg}$$



Load acts at point X = 0.01 m & Y = 7.3 m.

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3.2 Circular slice surface analysis

SLOPE/W Analysis

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File Information

File Version: 10.01
Revision Number: 61
Date: 2024-02-16
Time: 12:09:31
Tool Version: 10.1.1.18972
File Name: Support 1 – High water level.gsz

Point Loads

Point Load 1

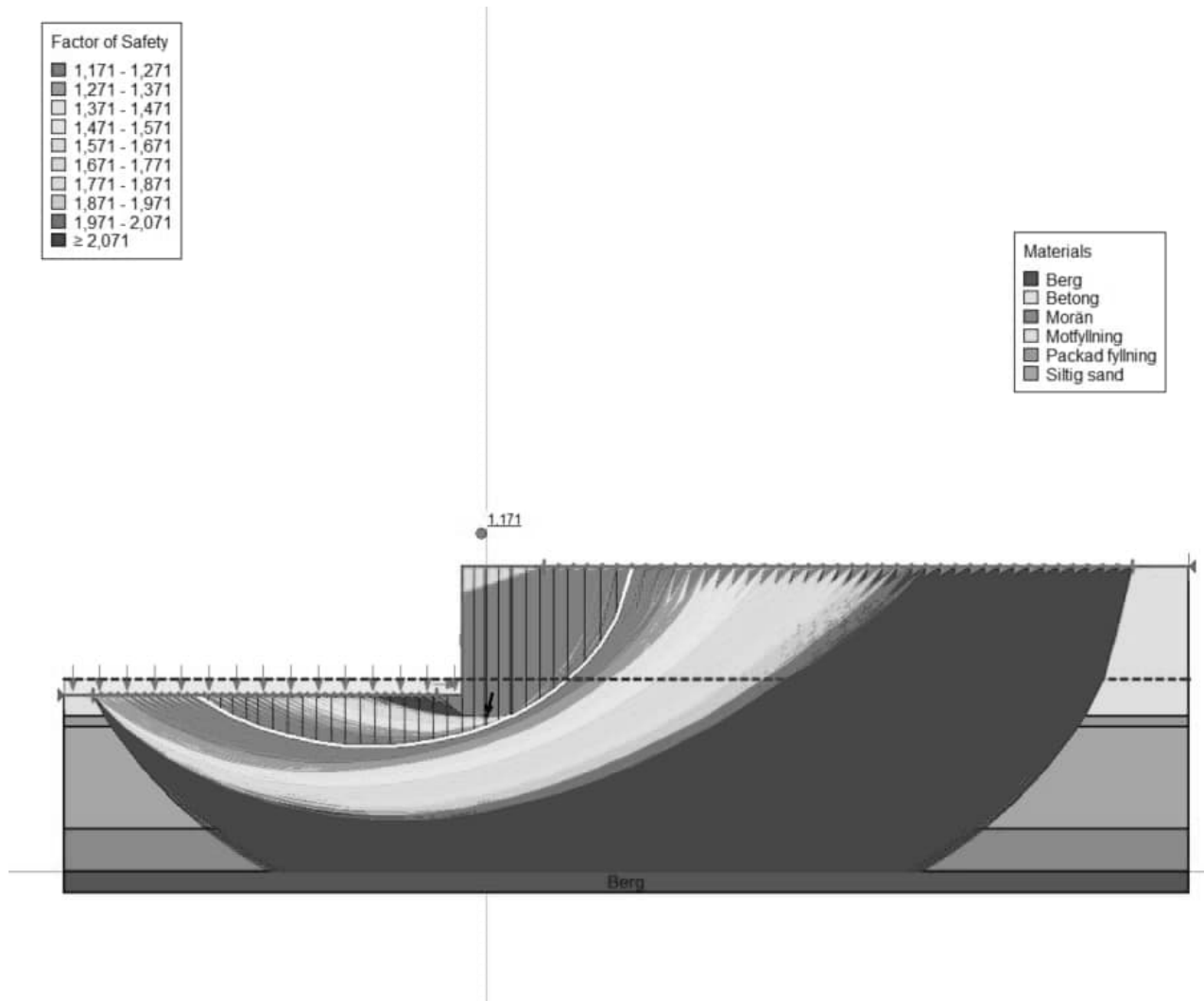
Coordinate: (0,01; 7,3) m
Magnitude: 440 kN
Direction: 77 °

Critical Slip Surface

Slip Surface: 320
Factor of Safety: 1,177
Volume: 52,186449 m³
Weight: 797,12575 kN
Resisting Moment: 6 059,5194 kN·m
Activating Moment: 5 147,92 kN·m
Resisting Force: 521,47615 kN
Activating Force: 442,82632 kN
Slip Rank: 1 of 1 271 slip surfaces
Exit: (-10,966572; 8,3) m
Entry: (4,9139805; 14,3) m
Radius: 9,3887103 m
Center: (-4,4444447; 15,053498) m

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Most critical slip surface #320 :



$$FS = \frac{\tau_{Rd}}{\tau_{sd}} = 1.17 > 1.00 \rightarrow \text{resistance OK!}$$

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4. SLOPE STABILITY ANALYSIS

4.1 GENERAL

Used software LUSAS v23.

Soil & abutment are modelled using 2D triangular quadric plain strain elements (TNP6).

LUSAS has function *Phi-c Reduction* performs a safety factor analysis on nonlinear material.

Plastic load model *Modified Mohr-Coulomb* (MMC) to define both soil and concrete.

LUSAS has function *Branch Analysis* that enables performing several analyses within same model. This capability is used to perform a safety factor analysis on nonlinear material.

To model concrete abutment a fictitious soil material is chosen. A cohesion material with very high cohesion (2 MPa) is used.

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4.2 SYSTEM ANALYSIS

4.2.1 Safety factor analysis

Safety factor analysis is performed using function *Phi-c Reduction* with starting values seen below.

Phi-c Reduction ✕

	Value
Starting value for safety factor	1,1
Minimum change in safety factor	0,01
Maximum number of steps to use	40

Name (1)

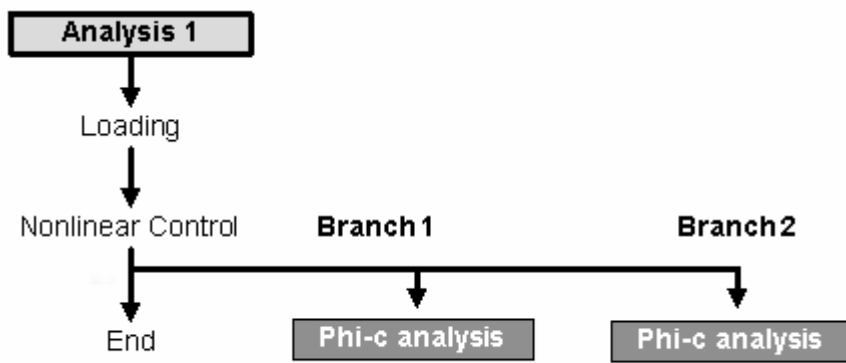
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4.2.3 Branch Analysis

Branch Analysis seen below is used within same model.

Branch 1: Soil

Branch 2: Soil + Surface load



Schematic sketch

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4.2.4 Nonlinear analysis

Nonlinear analysis is performed using increments using Newton_Raphson numerical procedure. These *Incrementation* as chosen to be performed *Manual* seen convergence generally more stable, see chosen parameters in dialogue box.

Nonlinear & Transient

Incrementation

Nonlinear

Incrementation: Manual

Starting load factor: 0,1

Max change in load factor: 0,0

Max total load factor: 1,0

Adjust load based on convergence

Iterations per increment: 4

Time domain

Initial time step: []

Total response time: []

Automatic time stepping

Solution strategy

Same as previous loadcase

Max number of iterations: 12

Residual force norm: 0,1

Displacement norm: 1,0

Incremental LUSAS file output

Same as previous loadcase

Output file: 1

Plot file: 1

Restart file: 0

Max number of saved restarts: 0

Log file: 1

History file: 1

Max number of iterations:

For each load increment if convergence is not achieved.

Residual force norm:

The limit for the sum of the squares of all residual forces as a percentage of the sum of the squares of all external forces, including reactions (rdnm). By default only translation degrees of freedom are considered. So for a value of 0.1 the convergence of the solution at each load increment will be achieved when the out of balance forces are as less than 0.1% of the reactions.

Displacement norm:

The limit for the sum of the squares of the iterative displacements as a percentage of the sum of the squares of the incremental displacements (DTNRM). Only translation degrees of freedom are considered

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4.3 STATIC SYSTEM

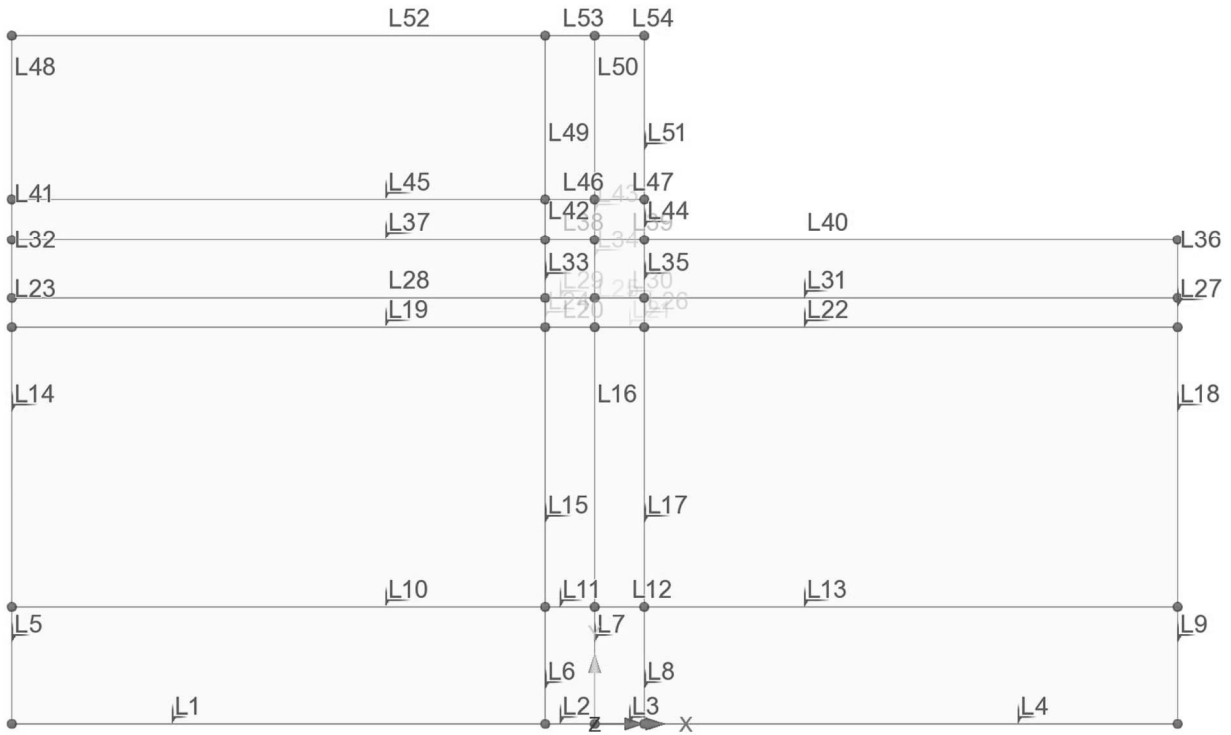
4.3.1 Geometry

Points:

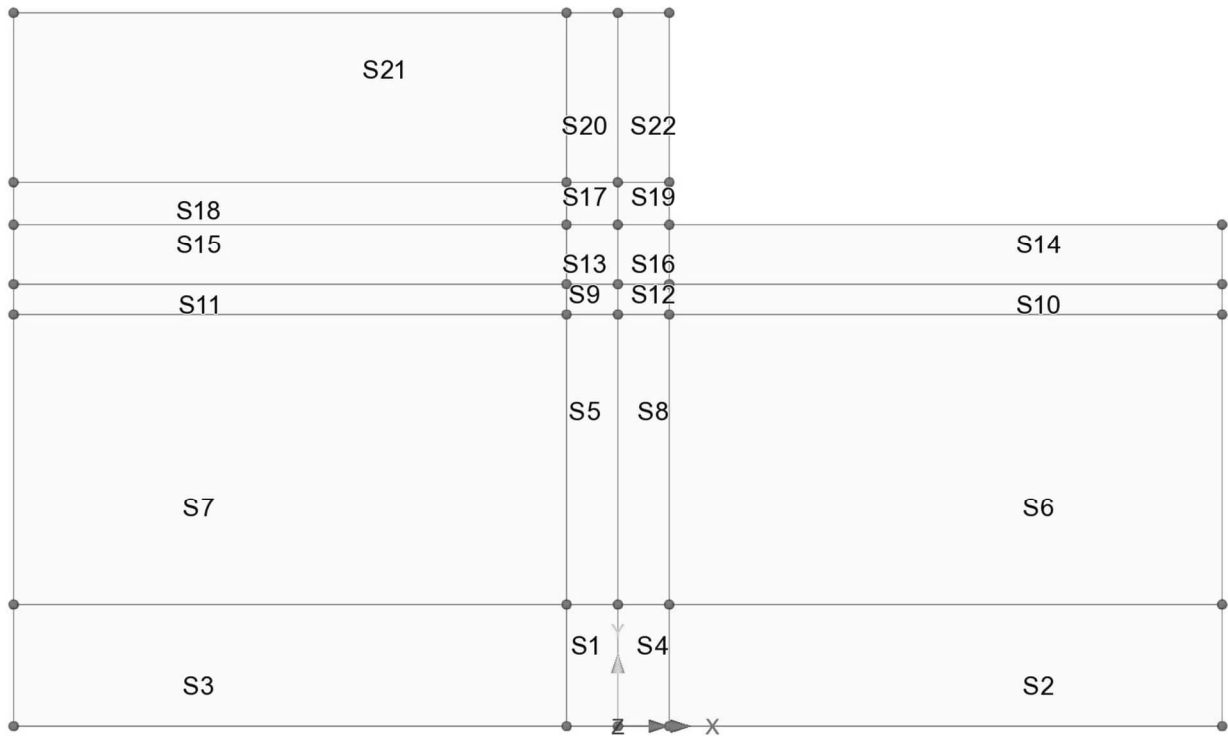


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Lines:

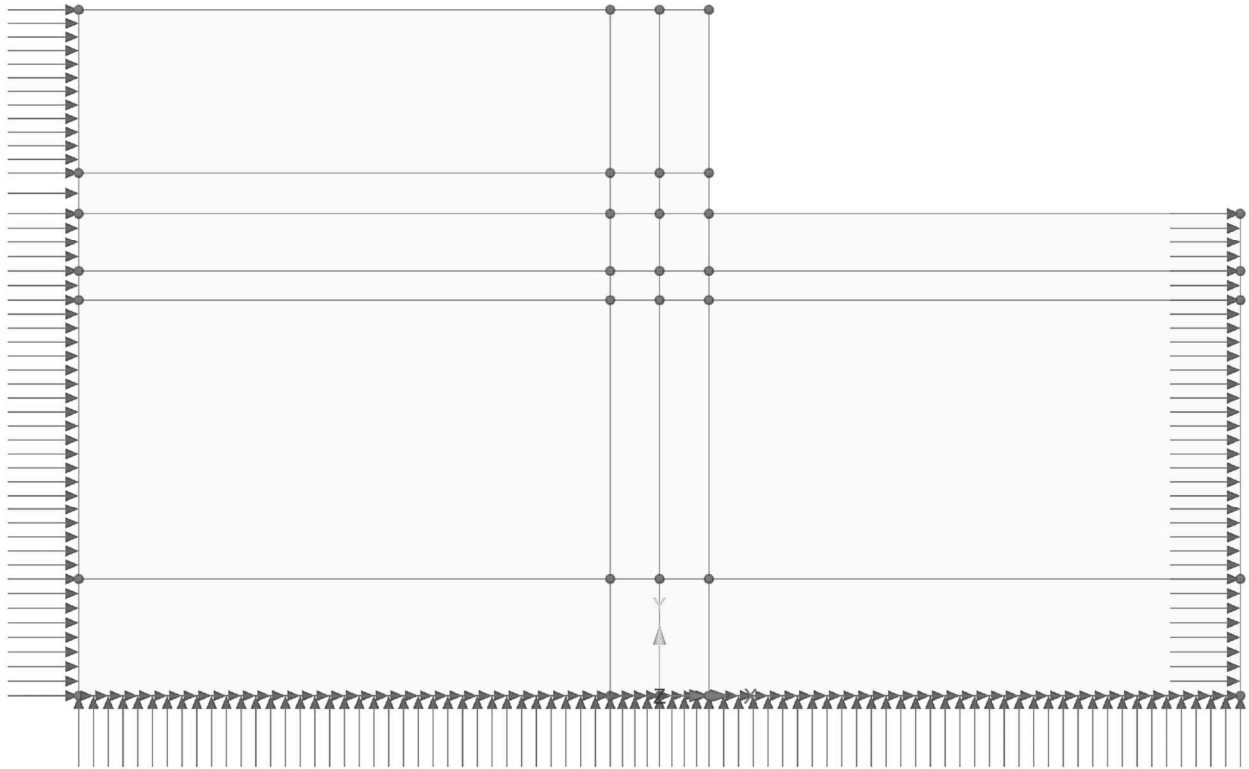


Surface:



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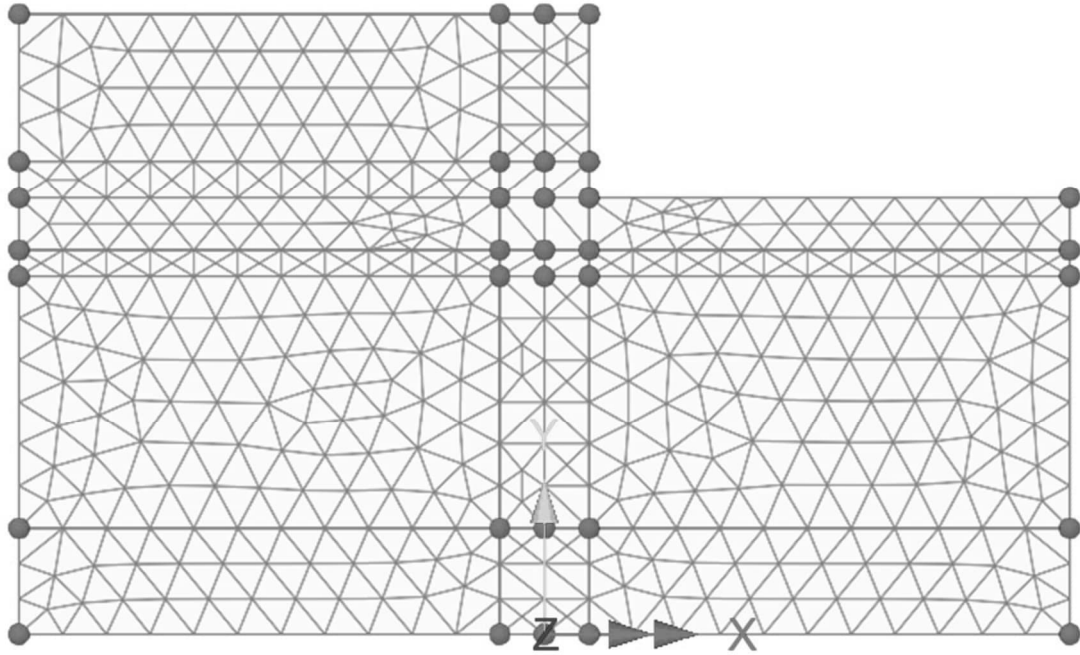
4.3.2 Boundary



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4.3.3 MESH: Beam element (BMI2)

Soil & foundation are modelled as seen below.

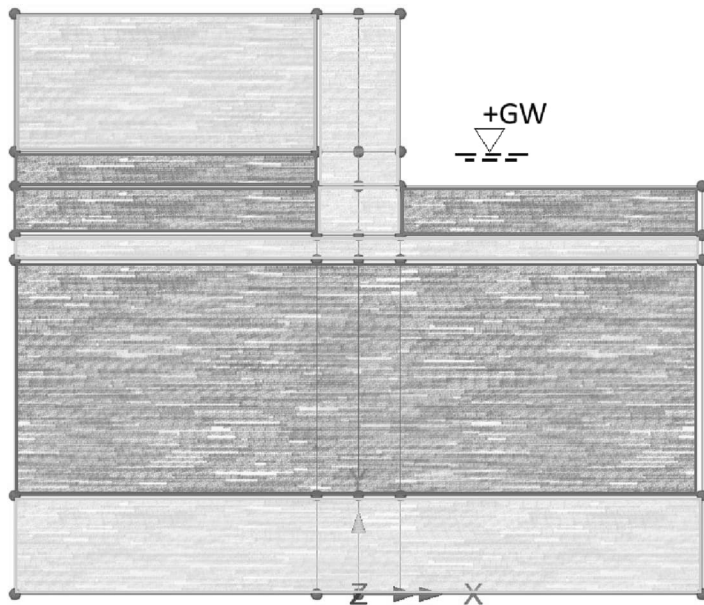



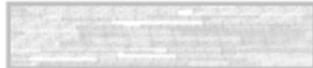
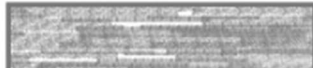



Name	Element size	Irregular mesh
TNP6	0.8 m	Yes

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4.3.4 Material

All materials are isotropic plastic material using *Modified Mohr-Coulomb* as seen below.



	Concrete
	"Motfyllning"
	"Motfyllning-HW"
	"Packad fyllning-HW"
	"Siltig sand-HW"
	"Morän-HW"

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Elastic properties:

Material	Below GW	Mass density	v	E-modulus
Concrete	-	0.5 ^{1.)}	0,3	34000
"Motfyllning"	No	2.0	0,3	50
"Motfyllning - HW"	Yes	1.1	0,3	50
"Packad fyllning - HW"	Yes	1.1	0,3	50
"Siltig sand - HW"	Yes	1.1	0,3	35
"Moran - HW"	Yes	1.1	0,3	45
-	-	ton/m ³	-	MPa

1.) Fictitious density.

Plastic properties (incl. K_0 initialisation):

Material	Plastic modell	ϕ friktion	ϕ dilation	c_u	$\sigma_{t, cut-off}$	$\sigma_{c, cut-off}$	K_0
Concrete	Modified Mohr Coulomb ^{2.)}	0	0	$2 \cdot 10^3$	-	-	1.0 ^{4.)}
"Motfyllning"	Modified Mohr Coulomb ^{3.)}	38	38	0	0	109	1.0 ^{4.)}
"Motfyllning - HW"	Modified Mohr Coulomb ^{3.)}	38	38	0	0	109	1.0 ^{4.)}
"Packad fyllning - HW"	Modified Mohr Coulomb ^{3.)}	38	38	0	0	109	1.0 ^{4.)}
"Siltig sand – HW"	Modified Mohr Coulomb ^{3.)}	31	31	0	0	109	1.0 ^{4.)}
"Moran - HW"	Modified Mohr Coulomb ^{3.)}	32	32	0	0	0	1.0 ^{4.)}
-	-	deg	deg	kPa	kPa	kPa	-

2.) No cut-off due to compression or tension stress.

3.) Rankine using cut-off stress at $\sigma_{t, cut-off}$ and $\sigma_{c, cut-off}$

4.) When non-linear analysis starts, initially K_0 is applied.
($K_0 = 1.0 \rightarrow \sigma_h = \sigma_v$ which is considered on safe side).

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4.4 LOADS

4.4.1 Soil weight (Gravity)

Soil weight is determined material density.

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4.4.2 Surfaced load

Surface load is defined as a global distributed load.

The vertical load is reduced due fictious weight of concrete.

$$V_d = 3566kN \quad : \text{ see page 6}$$

$$H_{xd} = 1570kN \quad : \text{ see page 6}$$

$$H_{x.earth} = 515kN \quad : \text{ see page 10}$$

$$B = 1.70m \quad : \text{ see page 5}$$

$$L_{ef} = 8.28m \quad : \text{ see page 8}$$

$$H_{xd.red} = H_{xd} - \psi\gamma_{earth} \cdot H_{x.earth} = 1570kN - 1.45 \cdot 515kN = 823kN$$

$$\rightarrow Px = \frac{H_{xd.red}}{B \cdot L_{ef}} = \frac{823kN}{1.70m \cdot 8.28m} = -60 \frac{kN}{m^2}$$

$$V_{d.red} = V_d - B \cdot H = 3566kN - 1.70m \cdot 4.5m \cdot 5 \frac{kN}{m^3} = 3528kN$$

$$\rightarrow Py = -\frac{V_{d.red}}{B \cdot L_{ef}} = -\frac{3528kN}{1.70m \cdot 8.28m} = -250 \frac{kN}{m^2}$$

$$P_d = \sqrt{Px^2 + Py^2} = 257 \frac{kN}{m^2}$$

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Global Distributed ✕

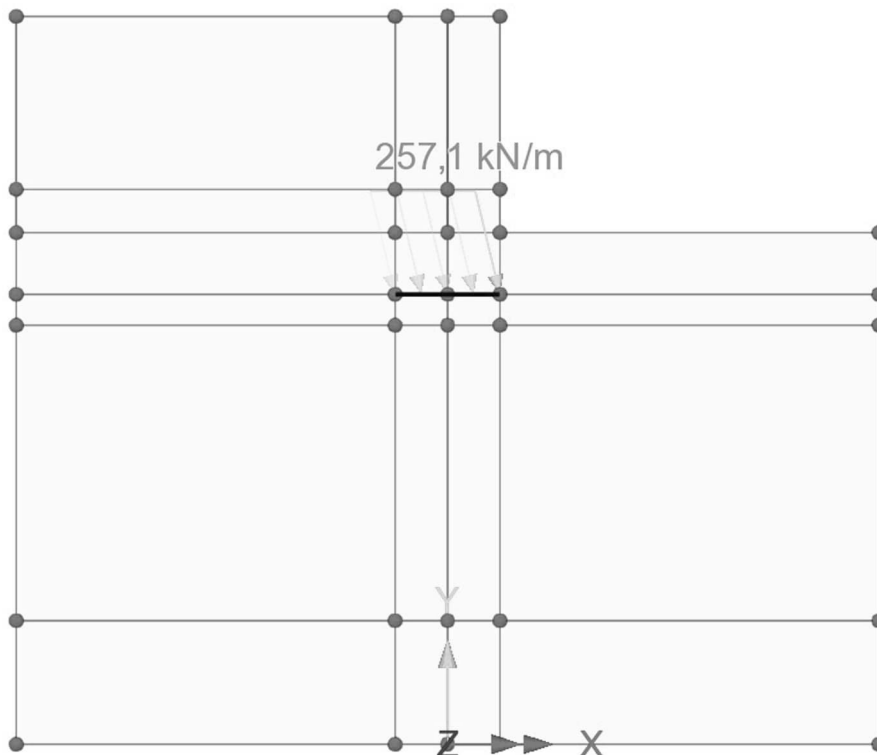
Analysis category

Total
 Per unit length
 Per unit area

Component	Value
X Direction	60,0
Y Direction	-250,0

Name (1)

$$P_d = \sqrt{Px^2 + Py^2} = 257 \frac{kN}{m^2}$$



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4.4 RESULTS (LUSAS)

4.4.1 Branch 1: Soil

→ Safety factor FS = 1.98

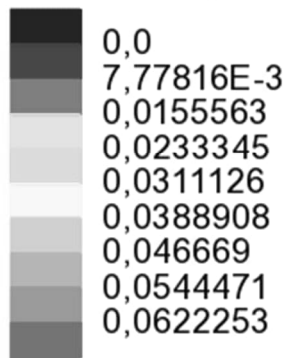
Analysis: Branch 1: Soil

Loadcase: 2:Loadcase 2, 12:Increment 12 SF=1.976

Results file: s8_rev2~Branch 1_ Soil.mys

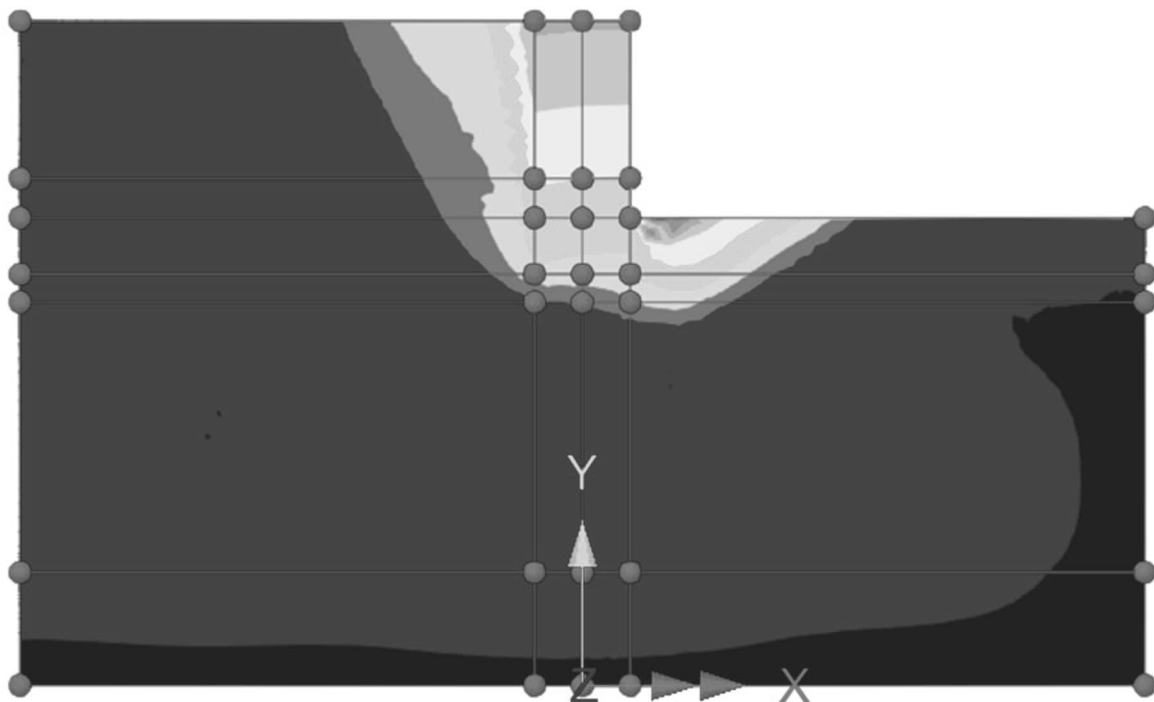
Entity: Displacement

Component (Nodal): RSLT (Units: m)



Maximum 0,0700035 at node 1261

Minimum 0,0 at node 1



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Scale: 1: 166,573

Zoom: 56,7427

Eye: (0,0; 0,0; 1,0)

Nonlinear analysis

Analysis: Branch 1: Soil

Loadcase: 2:Loadcase 2, 12:Increment 12 SF=1.976

Results file: s8_rev2~Branch 1_Soil.mys

Maximum displacement 0,0700035 at node 1261

Deformation exaggeration: 14,2769

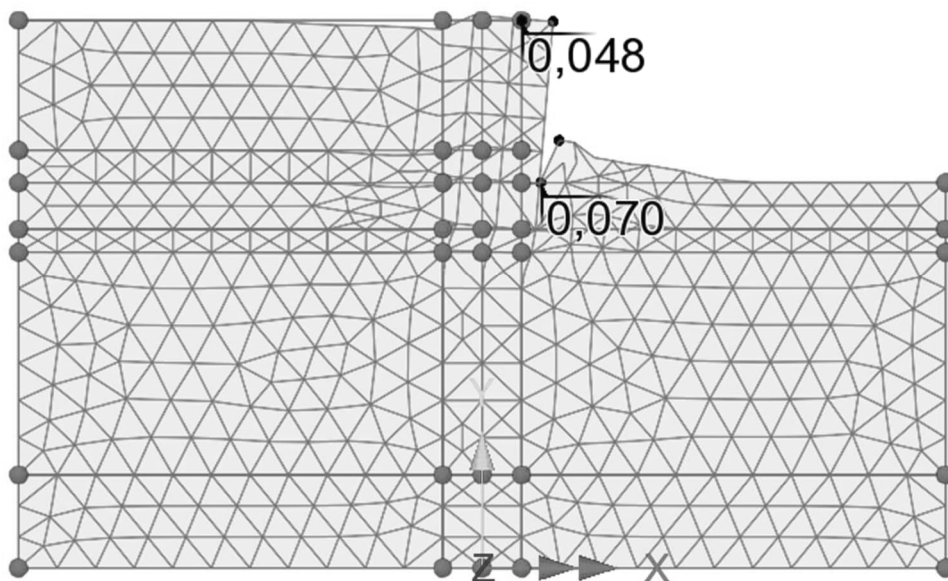
Peak/value entity: Displacement

Peak/value component: RSLT (Units: m)

Peak range(%): 100,0

Peak/value maximum 0,0700035 at node 1261

Peak/value minimum 0,0 at node 1

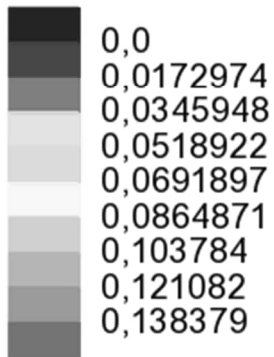


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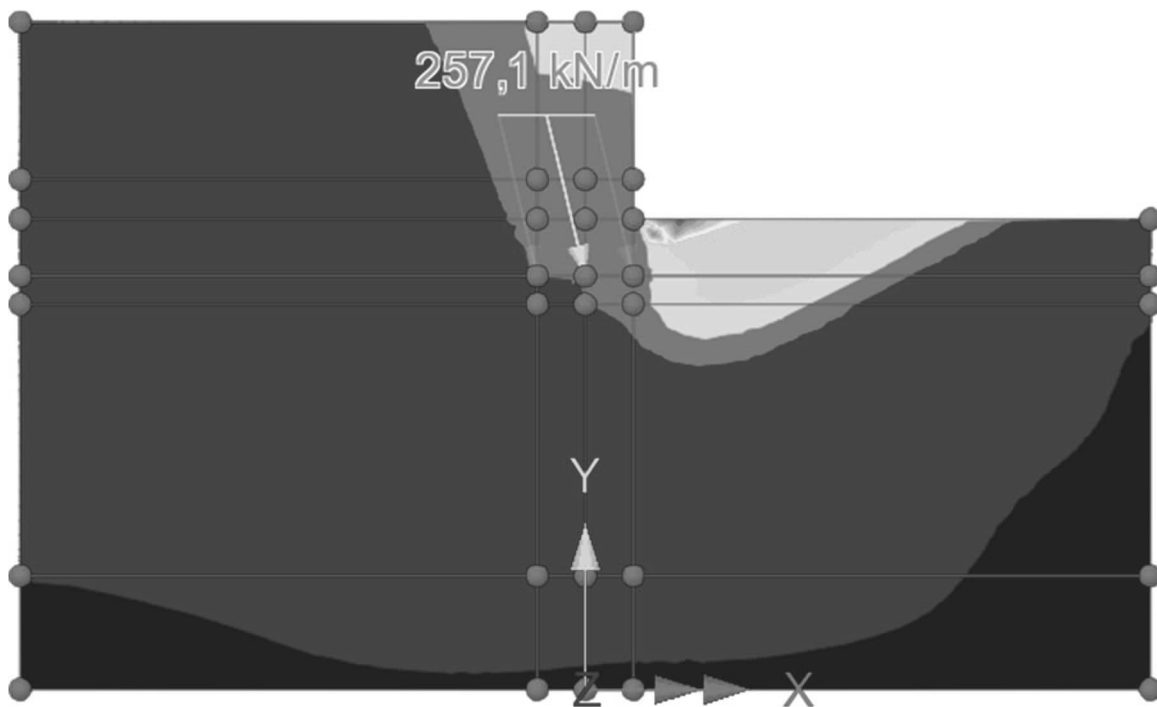
4.4.2 Branch 2: Soil + Surface load

→ Safety factor FS = 1.19

Analysis: Branch 2: Soil + surface load
 Loadcase: 3:Loadcase 3, 14:Increment 14 SF=1.185
 Results file: s8_rev2~Branch 2_ Soil + surface load.mys
 Entity: Displacement
 Component (Nodal): RSLT (Units: m)



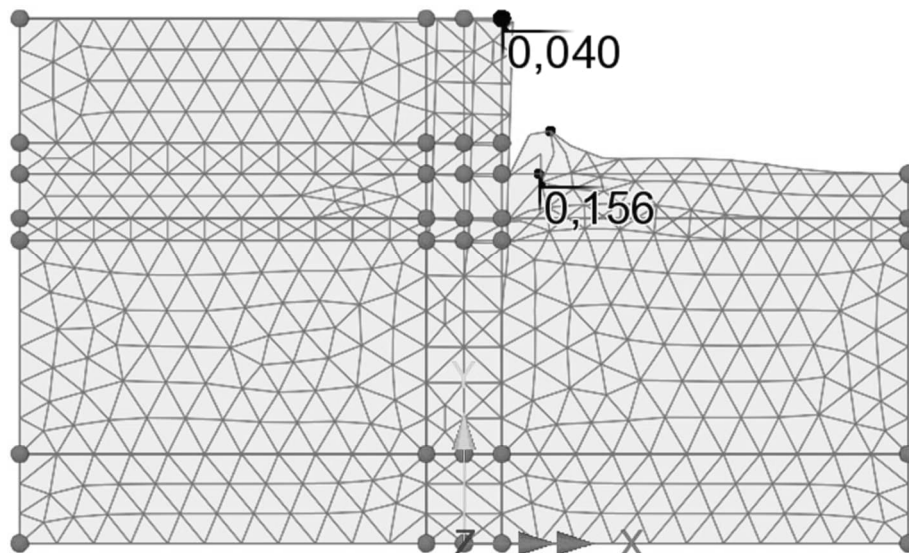
Maximum 0,155677 at node 1260
 Minimum 0,0 at node 1



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Scale: 1: 166,573
 Zoom: 56,7427
 Eye: (0,0; 0,0; 1,0)
 Nonlinear analysis
 Analysis: Branch 2: Soil + surface load
 Loadcase: 3:Loadcase 3, 14:Increment 14 SF=1.185
 Results file: s8_rev2~Branch 2_Soil + surface load.mys
 Maximum displacement 0,155677 at node 1260
 Deformation exaggeration: 6,41994

Peak/value entity: Displacement
 Peak/value component: RSLT (Units: m)
 Peak range(%): 100,0
 Peak/value maximum 0,155677 at node 1260
 Peak/value minimum 0,0 at node 1



Title: Input receipt

LUSAS version:23.0-1c3
Model Units: kN,m,t,s,C
Report Units: kN,m,t,s,C

Model Title:
Model File: s8

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1. Phi-c reduction

Attribute: 1 Title: Ph-c1

Sub Type = Phi-c reduction

Starting value: 1.1
 Minimum change in safety factor: 0.01
 Maximum number of steps in use: 60

2. Branch

Attribute: 1 Title: Branch 1: Soil

Sub Type = Branch

Analysis: Analysis 1

Attribute: 2 Title: Branch 2: Soil + surface load

Sub Type = Branch

Analysis: Analysis 1

3. Analysis

Analysis	Type	Branch	Phi-c reduction
1	Nonlinear & Transient	None	None
1	Nonlinear & Transient	1	Ph-c1
1	Nonlinear & Transient	2	Ph-c1

4. Points

Point	X coordinate	Y coordinate	Z coordinate
1	-10,0	0,0	0,0
2	-0,9	0,0	0,0
3	0,0	0,0	0,0
4	0,9	0,0	0,0
5	10,0	0,0	0,0
6	-10,0	2,0	0,0
7	-0,9	2,0	0,0
8	0,0	2,0	0,0
9	0,9	2,0	0,0
10	10,0	2,0	0,0
11	-10,0	6,8	0,0
12	-0,9	6,8	0,0
13	0,0	6,8	0,0
14	0,9	6,8	0,0
15	10,0	6,8	0,0
16	-10,0	7,3	0,0
17	-0,9	7,3	0,0
18	0,0	7,3	0,0
19	0,9	7,3	0,0
20	10,0	7,3	0,0
21	-10,0	8,3	0,0
22	-0,9	8,3	0,0
23	0,0	8,3	0,0
24	0,9	8,3	0,0
25	10,0	8,3	0,0
26	-10,0	9,0	0,0
27	-0,9	9,0	0,0
28	0,0	9,0	0,0
29	0,9	9,0	0,0
30	-10,0	11,8	0,0
31	-0,9	11,8	0,0
32	0,0	11,8	0,0
33	0,9	11,8	0,0

5. Lines

Line	Points	Line	Points
1	2;1	2	3;2
3	3;4	4	4;5
5	1;6	6	7;2
7	3;8	8	9;4
9	5;10	10	6;7
11	8;7	12	8;9
13	10;9	14	6;11
15	12;7	16	8;13
17	14;9	18	10;15
19	11;12	20	13;12
21	13;14	22	15;14
23	11;16	24	17;12
25	13;18	26	19;14
27	15;20	28	16;17
29	18;17	30	18;19
31	20;19	32	16;21
33	22;17	34	18;23
35	24;19	36	20;25
37	21;22	38	23;22
39	23;24	40	25;24
41	21;26	42	27;22
43	23;28	44	29;24
45	26;27	46	28;27
47	28;29	48	26;30
49	31;27	50	28;32
51	33;29	52	30;31
53	32;31	54	32;33

6. Surfaces

Surface	Lines	Surface	Lines
1	7;11;6;2	2	9;13;8;4
3	5;1;6;10	4	7;3;8;12
5	16;20;15;11	6	18;22;17;13
7	14;10;15;19	8	16;12;17;21
9	25;29;24;20	10	27;31;26;22
11	23;19;24;28	12	25;21;26;30
13	34;38;33;29	14	36;40;35;31
15	32;28;33;37	16	34;30;35;39
17	43;46;42;38	18	41;37;42;45
19	43;39;44;47	20	50;53;49;46
21	48;45;49;52	22	50;47;51;54

7. Mesh

Attribute: 1 Title: TPN6 1,0 m

Sub Type = Surface Mesh Element Type = TPN6

Property

Element size

Quadrilateral element angle limit

Size multiplier

edge deviation

Element defined by name

Single feature joint

Symbol

size

quadAngle

sizeMultiplier

edgeDeviation

DefinedByName

isSingleFtrJnt

Value

0,8

30,0

1,1

0,0

false

Assignment to Surfaces:

1T22

8. Material

Attribute: 2 Title: Motfylling
Sub Type = Isotropic Material
Assigned in: Analysis 1

Property

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol	Value
E	50000,0
nu	0,3
rho	2,0
type_8	"Rankine"
frc	38,0
dil	38,0
dmpFct	0,0
CSngle	0,0
QmaxSngle	0,0
QminSngle	1000000000,0
type_6	"elastic"
model	"Elastic"
calcVoid	false
Eko	0,0
Ko	1,0

Assignment to Surfaces:
 21

Attribute: 3 Title: Packad fyllning - HW
Sub Type = Isotropic Material
Assigned in: Analysis 1

Property

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol	Value
E	50000,0
nu	0,3
rho	1,1
type_8	"Rankine"
frc	38,0
dil	38,0
dmpFct	0,0
CSngle	0,0
QmaxSngle	0,0
QminSngle	1000000000,0
type_6	"elastic"
model	"Elastic"
calcVoid	false
Eko	0,0
Ko	1,0

Assignment to Surfaces:
 9T12

Attribute: 4 Title: Motfylling- HW**Sub Type = Isotropic Material****Assigned in: Analysis 1****Property**

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol

E
 nu
 rho
 type_8
 frc
 dil
 dmpFct
 CSngle
 QmaxSngle
 QminSngle
 type_6
 model
 calcVoid
 Eko
 Ko

Value

50000,0
 0,3
 1,1
 "Rankine"
 38,0
 38,0
 0,0
 0,0
 0,0
 1000000000,0
 "elastic"
 "Elastic"
 false
 0,0
 0,5

Assignment to Surfaces:

14;15;18

Attribute: 6 Title: Concrete**Sub Type = Isotropic Material****Assigned in: Analysis 1****Property**

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol

E
 nu
 rho
 type_8
 frc
 dil
 dmpFct
 CSngle
 QmaxSngle
 QminSngle
 type_6
 model
 calcVoid
 Eko
 Ko

Value

34000000,0
 0,3
 0,5
 "No cut-off"
 0,0
 0,0
 0,0
 2000,0
 0,0
 0,0
 0,0
 "elastic"
 "Elastic"
 false
 0,0
 1,0

Assignment to Surfaces:

13;16;17;19;20;22

Attribute: 7 Title: Siltig sand - HW**Sub Type = Isotropic Material****Assigned in: Analysis 1****Property**

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol

E
 nu
 rho
 type_8
 frc
 dil
 dmpFct
 CSngle
 QmaxSngle
 QminSngle
 type_6
 model
 calcVoid
 Eko
 Ko

Value

35000,0
 0,3
 1,1
 "Rankine"
 31,0
 31,0
 0,0
 0,0
 0,0
 0,0
 1000000000,0
 "elastic"
 "Elastic"
 false
 0,0
 1,0

Assignment to Surfaces:

5T8

Attribute: 8 Title: Moran - HW**Sub Type = Isotropic Material****Assigned in: Analysis 1****Property**

Young's modulus
 Poisson's ratio
 Density
 Type
 Friction angle
 Dilation angle
 Damping factor
 Single cohesion value
 Single tensile value
 Single compressive value
 Type
 Model
 Calculate initial void ratio
 Young's modulus for Ko
 Coefficient of lateral earth pressure

Symbol

E
 nu
 rho
 type_8
 frc
 dil
 dmpFct
 CSngle
 QmaxSngle
 QminSngle
 type_6
 model
 calcVoid
 Eko
 Ko

Value

45000,0
 0,3
 1,1
 "Rankine"
 32,0
 32,0
 0,0
 0,0
 0,0
 1000000000,0
 "elastic"
 "Elastic"
 false
 0,0
 1,0

Assignment to Surfaces:

1T4

9. Supports

Attribute: 1 Title: Fixed in X
Sub Type = Structural Support
Assigned in: Analysis 1

Property

Translation in X
 Translation in Y
 Rotation about Z
 Pore pressure

Symbol

U
 V
 THZ
 pore

Value

"R"
 "F"
 "F"
 "C"

Assignment to Lines:
 5;9;14;18;23;27;32;36;41;48

Attribute: 2 Title: Fixed in XY
Sub Type = Structural Support
Assigned in: Analysis 1

Property

Translation in X
 Translation in Y
 Rotation about Z
 Pore pressure

Symbol

U
 V
 THZ
 pore

Value

"R"
 "R"
 "F"
 "C"

Assignment to Lines:
 1T4

10. Loading**Attribute: 1 Title: Surface loading****Sub Type = Global Distributed Load****Property**

Attribute type
 X Direction
 Y Direction
 Z Direction
 Moment about X axis
 Moment about Y axis
 Moment about Z axis
 Moment about hinge nodes
 Pore pressure flux
 Keep global

Symbol

type
 WX
 WY
 WZ
 MX
 MY
 MZ
 Hinge
 pwp
 keepGlobal

Value

"Length"
 60,0
 -250,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 false

Loadcase ID: 1 Title: Loadcase 1 Factor = 1.0**Assignment to Lines:**

29;30

Gravity (when chosen) is applied as a body force of $-9,8\text{m/s}^2$ in the Y direction

11. Loadcases

Loadcase	Gravity	Loading	Analysis	Branch
1	On	-	Analysis 1	None
2	On	-	Analysis 1	Branch 1: Soil
3	On	1: Surface loading	Analysis 1	Branch 2: Soil + surface load