# Analysis of micropile

## Input data

### Project

Date : 30.10.2015

### Settings

Standard - safety factors

### Micropiles

Verification of stem bearing capacity : geometric method (Euler)
Verification of root bearing capacity : Lizzi theory
Verification methodology : Safety factors (ASD)

| Safety factors | | | |
|---|---|---|---|
| Permanent design situation | | | |
| Safety factor for critical force : | $SF_f$ = | 1,50 | [–] |
| Safety factor for section resistance : | $SF_s$ = | 1,50 | [–] |
| Safety factor for root bearing capacity : | $SF_r$ = | 1,50 | [–] |

### Soil parameters

**Gravelly silt, consistency firm**

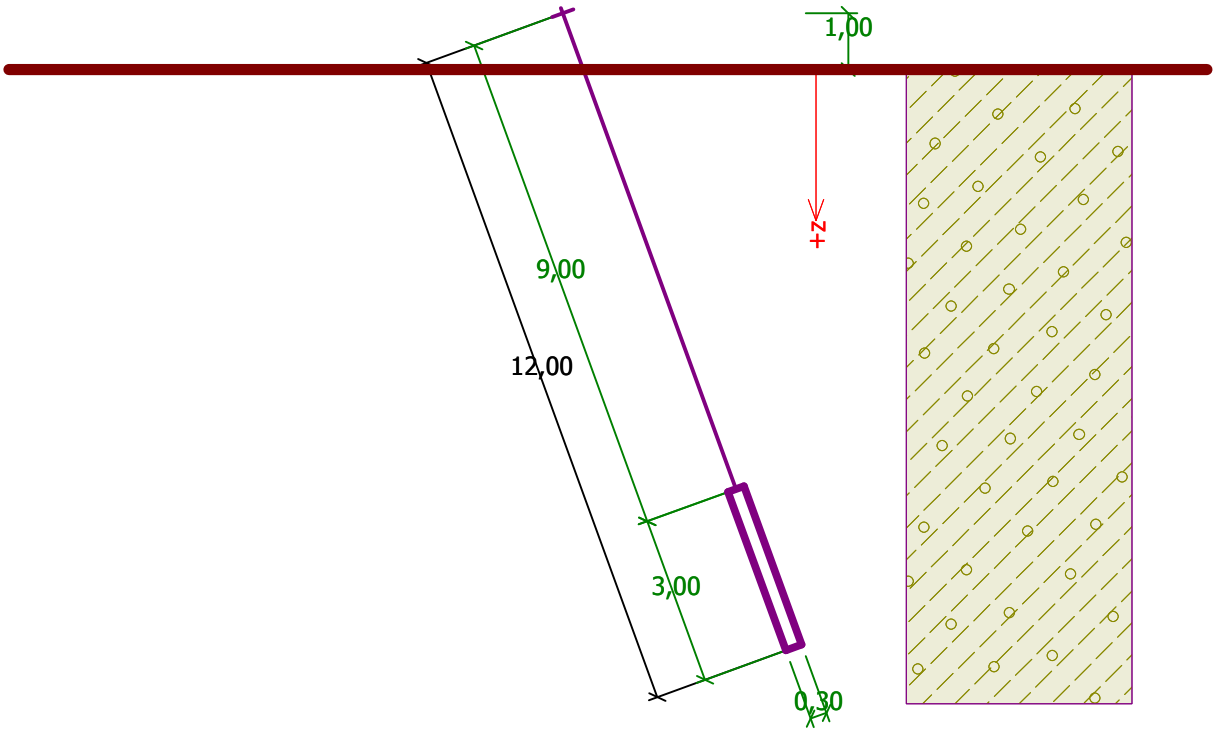
Unit weight : $\gamma$ = 19,01 kN/m3
Angle of internal friction : $\varphi_{ef}$ = 29,00 °
Cohesion of soil : $c_{ef}$ = 5,99 kPa
Saturated unit weight : $\gamma_{sat}$ = 19,01 kN/m3

### Geometry

Diameter = 121,0 mm
Thickness of web-section = 7,0 mm

Free length of pile l = 9,00 m
Root length $l_r$ = 3,00 m
Diameter of root $d_r$ = 0,30 m
Pile inclination from vertical $\alpha$ = 20,00 °
Pile head offset $l_a$ = 1,00 m

| Name : Geometry | Stage - analysis : 1 - 0 |
|---|---|




## Material parameters of structure:

**Cement mixture**
Specified characteristic compressive strength = 20,00 MPa
Elastic modulus $E_b$ = 29000,00 MPa

**Steel**
Specified characteristic strength of steel = 210,00 MPa
Elastic modulus $E_s$ = 210000,00 MPa

## Geological profile and assigned soils

| No. | Layer [m] | Assigned soil | Pattern |
|---|---|---|---|
| 1 | - | Gravelly silt, consistency firm | |

## Load

| No. | Load new | Load change | Name | Force N [kN] | Moment M [kNm] |
|---|---|---|---|---|---|
| 1 | Yes | | Force No. 1 | 120,00 | 9,50 |

# Verification No. 1

## Cross-section check -calculation no. 1

**Calculation with corrosion effect**
Intended durability t = 50 [year]
Soil type: native soils

**Internal stability check: geometric method (Euler)**
calculation of section effective length - bearing (hinged-hinged).

Modulus of subsoil reaction $E_p$ = 0,89 MN/m$^3$
Calculate number of halfwaves n = 1,93

Effective length $l_{cr}$ = 3,83 m

Critical normal force $N_{cr}$ = 644,04 kN
Maximal normal force $N_{max}$ = 120,00 kN

Safety factor = 5,37 > 1,50
**Internal stability of micropile section is SATISFACTORY**

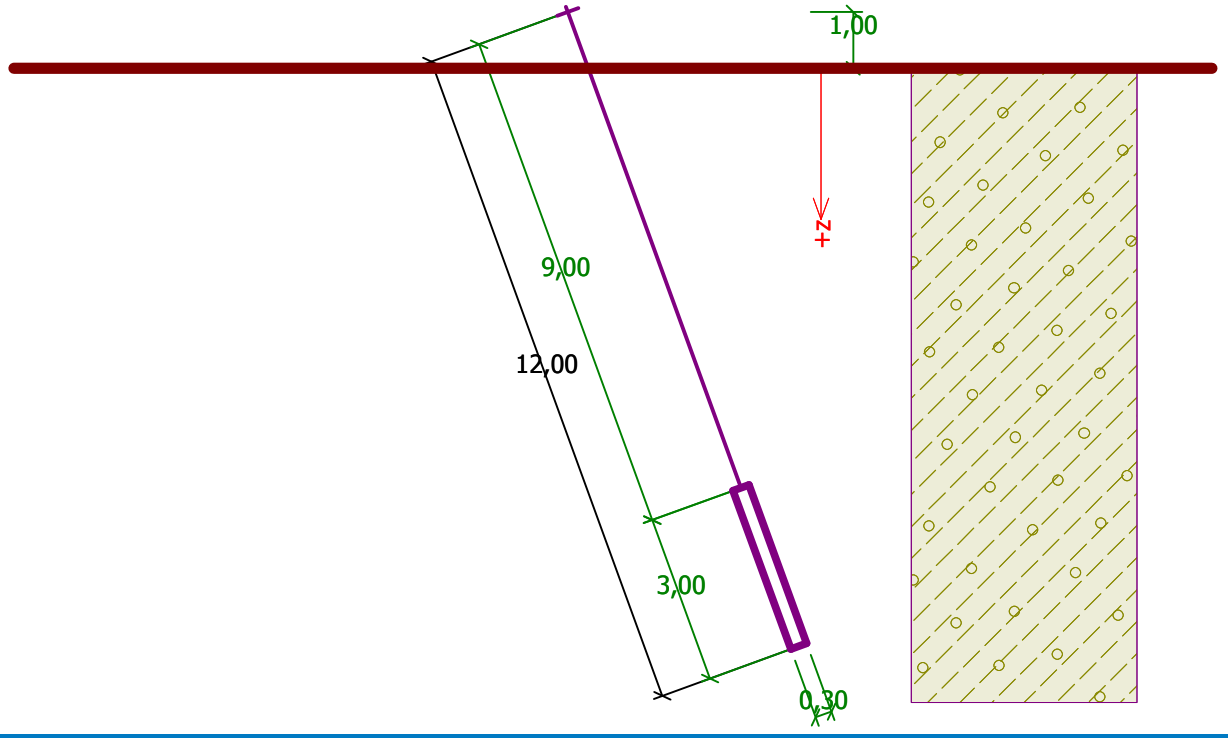
**Verification of coupled section bearing capacity:**

| | | | |
|---|---|---|---|
| Area of ideal cross-section | $A_i$ = | 3,52E+03 | mm$^2$ |
| Moment of inertia of ideal cross-section | $J_i$ = | 4,57E+06 | mm$^4$ |
| Beam slenderness | $\lambda$ = | 106,460 | |
| Buckling coefficient | $\kappa$ = | 0,502 | |
| Location of neutral axis | = | -35,2 | mm |

Stress in steel = 138,18 MPa
Design strength of steel = 210,00 MPa

Safety factor = 1,52 > 1,50
**Coupled section of micropile is SATISFACTORY**

**Name : Section calculation** | **Stage - analysis : 1 - 1**




## Verification No. 1

### Root verification - calculation number 1

Calculation method - Lizzi theory.
Coefficient of root diameter influence = 0,80
Average limit skin friction $q_{sav}$ = 120,00 kPa

**Verification of compressive micropile**
Shaft resistance $R_s$ = 271,43 kN

Maximal normal force $N_{max}$ = 120,00 kN

Safety factor = 2,26 > 1,50
**Vertical bearing capacity of micropile is SATISFACTORY**

| Name : Calculation root | Stage - analysis : 1 - 1 |
|---|---|