Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

form. A4

Annex

D-Settlement 18.2 - Current Situation.sli

# Input View

Project Delta

Light Weigh road construction

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Annex

D-Settlement 18.2 : Current Situation.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:51:08 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 28-1-2019 |
| Time of calculation: | 15:16:17 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Current Situation |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 5 - X - | 0,000 | 30,000 | | | |
| 5 - Y - | 0,000 | 0,000 | | | |
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | -6,000 | -6,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -12,000 | -12,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -16,000 | -16,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -22,000 | -22,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -25,000 | -25,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,100 | -0,100 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 5 | Clay weak siltig | 1 | 1 |
| 4 | Clay Siltig | 1 | 1 |
| 3 | Sand weak siltig | 1 | 1 |
| 2 | Sand semarang | 1 | 1 |
| 1 | Coarse sand | 0 | 0 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 5 | No | 13,00 | 14,00 |
| 4 | No | 16,00 | 17,00 |
| 3 | No | 18,00 | 20,00 |
| 2 | No | 17,00 | 19,00 |

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 1 | No | 17,00 | 19,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 5 | Vert. cons. | 1,00E+07 | - | - | - |
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 5 | - | - | 1,00 |
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 5 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 4 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 3 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 2 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |
| 1 | 1,80E+03 | 6,00E+02 | 1,00E+09 | 1,00E+09 | 1,80E+03 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,28 | 0,00 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m;  Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| 0,000 | 28,501 | 0,000 | 28,500 | 0,743 |
| -0,100 | 29,800 | -0,100 | 28,500 | 0,725 |
| -0,200 | 30,200 | -0,100 | 28,500 | 0,711 |
| -0,300 | 30,600 | -0,100 | 28,500 | 0,698 |
| -0,400 | 31,000 | -0,100 | 28,500 | 0,686 |
| -0,500 | 31,400 | -0,100 | 28,500 | 0,675 |
| -0,600 | 31,800 | -0,100 | 28,500 | 0,664 |
| -0,700 | 32,200 | -0,100 | 28,500 | 0,654 |
| -0,800 | 32,600 | -0,100 | 28,500 | 0,644 |
| -0,900 | 33,000 | -0,100 | 28,500 | 0,635 |
| -1,000 | 33,400 | -0,100 | 28,500 | 0,626 |
| -2,000 | 37,400 | -0,100 | 28,500 | 0,549 |
| -3,000 | 41,400 | -0,100 | 28,500 | 0,490 |
| -4,000 | 45,400 | -0,100 | 28,500 | 0,440 |
| -5,000 | 49,400 | -0,100 | 28,500 | 0,397 |
| -6,000 | 53,400 | -0,100 | 28,500 | 0,360 |
| -6,000 | 53,400 | -0,100 | 28,500 | 0,360 |
| -7,000 | 60,400 | -0,100 | 28,500 | 0,279 |
| -8,000 | 67,400 | -0,100 | 28,500 | 0,211 |
| -9,000 | 74,400 | -0,100 | 28,500 | 0,151 |
| -10,000 | 81,400 | -0,100 | 28,500 | 0,099 |
| -11,000 | 88,400 | -0,100 | 28,500 | 0,051 |
| -12,000 | 95,400 | -0,100 | 28,500 | 0,008 |
| -12,000 | 95,400 | -0,100 | 28,500 | 0,008 |
| -13,000 | 105,400 | -0,100 | 28,500 | 0,008 |
| -14,000 | 115,400 | -0,100 | 28,500 | 0,007 |
| -15,000 | 125,400 | -0,100 | 28,500 | 0,007 |
| -16,000 | 135,400 | -0,100 | 28,500 | 0,006 |
| -16,000 | 135,400 | -0,100 | 28,500 | 0,006 |
| -17,000 | 144,400 | -0,100 | 28,500 | 0,005 |
| -18,000 | 153,400 | -0,100 | 28,500 | 0,004 |
| -19,000 | 162,400 | -0,100 | 28,500 | 0,003 |
| -20,500 | 175,900 | -0,100 | 28,500 | 0,002 |
| -22,000 | 189,400 | -0,100 | 28,500 | 0,000 |
| -22,000 | 408,400 | -22,000 | 28,500 | 0,000 |
| -23,500 | 436,900 | -23,500 | 28,500 | 0,000 |
| -25,000 | 465,400 | -25,000 | 28,500 | 0,000 |

# 4 Settlements

## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | 0,00 | 0,743 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,553 | 74,489 | 0,190 |
| | 10 | 0,596 | 80,280 | 0,147 |
| | 100 | 0,652 | 87,812 | 0,091 |
| | 1000 | 0,710 | 95,604 | 0,033 |
| | 2000 | 0,728 | 97,957 | 0,015 |
| | 3000 | 0,738 | 99,334 | 0,005 |
| | 3650 | 0,743 | 100,000 | 0,000 |

# End of Report

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone

Fax

date 30-1-2019

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Annex

D-Settlement 18.2 : Bamboo_chips.sli

# Input View

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Annex

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

form. A4

D-Settlement 18.2 : Bamboo_chips.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:51:27 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 28-1-2019 |
| Time of calculation: | 15:13:32 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Bamboo_chips |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 5 - X - | 0,000 | 30,000 | | | |
| 5 - Y - | -0,300 | -0,300 | | | |
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | -6,000 | -6,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -12,000 | -12,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -16,000 | -16,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -22,000 | -22,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -25,000 | -25,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,310 | -0,310 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 5 | Clay weak siltig | 1 | 1 |
| 4 | Clay Siltig | 1 | 1 |
| 3 | Sand weak siltig | 1 | 1 |
| 2 | Sand semarang | 1 | 1 |
| 1 | Coarse sand | 0 | 0 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 5 | No | 13,00 | 14,00 |
| 4 | No | 16,00 | 17,00 |
| 3 | No | 18,00 | 20,00 |
| 2 | No | 17,00 | 19,00 |

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 1 | No | 17,00 | 19,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 5 | Vert. cons. | 1,00E+07 | - | - | - |
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 5 | - | - | 1,00 |
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 5 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 4 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 3 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 2 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |
| 1 | 1,80E+03 | 6,00E+02 | 1,00E+09 | 1,00E+09 | 1,80E+03 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,20 | -0,30 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m; Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| -0,300 | 19,901 | -0,300 | 19,900 | 0,616 |
| -0,310 | 20,030 | -0,310 | 19,900 | 0,614 |
| -0,400 | 20,390 | -0,310 | 19,900 | 0,596 |
| -0,500 | 20,790 | -0,310 | 19,900 | 0,580 |
| -0,600 | 21,190 | -0,310 | 19,900 | 0,567 |
| -0,700 | 21,590 | -0,310 | 19,900 | 0,554 |
| -0,800 | 21,990 | -0,310 | 19,900 | 0,543 |
| -0,900 | 22,390 | -0,310 | 19,900 | 0,532 |
| -1,000 | 22,790 | -0,310 | 19,900 | 0,522 |
| -1,100 | 23,190 | -0,310 | 19,900 | 0,513 |
| -1,200 | 23,590 | -0,310 | 19,900 | 0,504 |
| -1,300 | 23,990 | -0,310 | 19,900 | 0,496 |
| -2,250 | 27,790 | -0,310 | 19,900 | 0,431 |
| -3,150 | 31,390 | -0,310 | 19,900 | 0,384 |
| -4,000 | 34,790 | -0,310 | 19,900 | 0,348 |
| -5,000 | 38,790 | -0,310 | 19,900 | 0,312 |
| -6,000 | 42,790 | -0,310 | 19,900 | 0,281 |
| -6,000 | 42,790 | -0,310 | 19,900 | 0,281 |
| -7,000 | 49,790 | -0,310 | 19,900 | 0,216 |
| -8,000 | 56,790 | -0,310 | 19,900 | 0,162 |
| -9,000 | 63,790 | -0,310 | 19,900 | 0,115 |
| -10,000 | 70,790 | -0,310 | 19,900 | 0,075 |
| -11,000 | 77,790 | -0,310 | 19,900 | 0,039 |
| -12,000 | 84,790 | -0,310 | 19,900 | 0,006 |
| -12,000 | 84,790 | -0,310 | 19,900 | 0,006 |
| -13,000 | 94,790 | -0,310 | 19,900 | 0,006 |
| -14,000 | 104,790 | -0,310 | 19,900 | 0,005 |
| -15,000 | 114,790 | -0,310 | 19,900 | 0,005 |
| -16,000 | 124,790 | -0,310 | 19,900 | 0,005 |
| -16,000 | 124,790 | -0,310 | 19,900 | 0,005 |
| -17,000 | 133,790 | -0,310 | 19,900 | 0,004 |
| -18,000 | 142,790 | -0,310 | 19,900 | 0,003 |
| -19,000 | 151,790 | -0,310 | 19,900 | 0,002 |
| -20,500 | 165,290 | -0,310 | 19,900 | 0,001 |
| -22,000 | 178,790 | -0,310 | 19,900 | 0,000 |
| -22,000 | 395,690 | -22,000 | 19,900 | 0,000 |
| -23,500 | 424,190 | -23,500 | 19,900 | 0,000 |
| -25,000 | 452,690 | -25,000 | 19,900 | 0,000 |

# 4 Settlements

## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | -0,30 | 0,616 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,459 | 74,445 | 0,158 |
| | 10 | 0,495 | 80,246 | 0,122 |
| | 100 | 0,541 | 87,791 | 0,075 |
| | 1000 | 0,589 | 95,597 | 0,027 |
| | 2000 | 0,604 | 97,954 | 0,013 |
| | 3000 | 0,612 | 99,333 | 0,004 |
| | 3650 | 0,616 | 100,000 | 0,000 |

# End of Report

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

form. A4

Annex

D-Settlement 18.2 : Lava_stones.sli

# Input View

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

form. A4

Annex

D-Settlement 18.2 : Lava_stones.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:50:49 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 30-1-2019 |
| Time of calculation: | 09:43:19 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Lava_stones |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 5 - X - | 0,000 | 30,000 | | | |
| 5 - Y - | -0,300 | -0,300 | | | |
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | -6,000 | -6,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -12,000 | -12,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -16,000 | -16,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -22,000 | -22,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -25,000 | -25,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,310 | -0,310 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 5 | Clay weak siltig | 1 | 1 |
| 4 | Clay Siltig | 1 | 1 |
| 3 | Sand weak siltig | 1 | 1 |
| 2 | Sand semarang | 1 | 1 |
| 1 | Coarse sand | 0 | 0 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 5 | No | 13,00 | 14,00 |
| 4 | No | 16,00 | 17,00 |
| 3 | No | 18,00 | 20,00 |
| 2 | No | 17,00 | 19,00 |

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 1 | No | 17,00 | 19,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 5 | Vert. cons. | 1,00E+07 | - | - | - |
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 5 | - | - | 1,00 |
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 5 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 4 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 3 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 2 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |
| 1 | 1,80E+03 | 6,00E+02 | 1,00E+09 | 1,00E+09 | 1,80E+03 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,25 | -0,30 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m; Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| -0,300 | 24,701 | -0,300 | 24,700 | 0,709 |
| -0,310 | 24,830 | -0,310 | 24,700 | 0,706 |
| -0,400 | 25,190 | -0,310 | 24,700 | 0,688 |
| -0,500 | 25,590 | -0,310 | 24,700 | 0,671 |
| -0,600 | 25,990 | -0,310 | 24,700 | 0,656 |
| -0,700 | 26,390 | -0,310 | 24,700 | 0,643 |
| -0,800 | 26,790 | -0,310 | 24,700 | 0,631 |
| -0,900 | 27,190 | -0,310 | 24,700 | 0,619 |
| -1,000 | 27,590 | -0,310 | 24,700 | 0,609 |
| -1,100 | 27,990 | -0,310 | 24,700 | 0,598 |
| -1,200 | 28,390 | -0,310 | 24,700 | 0,589 |
| -1,300 | 28,790 | -0,310 | 24,700 | 0,579 |
| -2,250 | 32,590 | -0,310 | 24,700 | 0,507 |
| -3,150 | 36,190 | -0,310 | 24,700 | 0,454 |
| -4,000 | 39,590 | -0,310 | 24,700 | 0,412 |
| -5,000 | 43,590 | -0,310 | 24,700 | 0,370 |
| -6,000 | 47,590 | -0,310 | 24,700 | 0,334 |
| -6,000 | 47,590 | -0,310 | 24,700 | 0,334 |
| -7,000 | 54,590 | -0,310 | 24,700 | 0,258 |
| -8,000 | 61,590 | -0,310 | 24,700 | 0,194 |
| -9,000 | 68,590 | -0,310 | 24,700 | 0,138 |
| -10,000 | 75,590 | -0,310 | 24,700 | 0,090 |
| -11,000 | 82,590 | -0,310 | 24,700 | 0,047 |
| -12,000 | 89,590 | -0,310 | 24,700 | 0,007 |
| -12,000 | 89,590 | -0,310 | 24,700 | 0,007 |
| -13,000 | 99,590 | -0,310 | 24,700 | 0,007 |
| -14,000 | 109,590 | -0,310 | 24,700 | 0,006 |
| -15,000 | 119,590 | -0,310 | 24,700 | 0,006 |
| -16,000 | 129,590 | -0,310 | 24,700 | 0,006 |
| -16,000 | 129,590 | -0,310 | 24,700 | 0,006 |
| -17,000 | 138,590 | -0,310 | 24,700 | 0,004 |
| -18,000 | 147,590 | -0,310 | 24,700 | 0,004 |
| -19,000 | 156,590 | -0,310 | 24,700 | 0,003 |
| -20,500 | 170,090 | -0,310 | 24,700 | 0,001 |
| -22,000 | 183,590 | -0,310 | 24,700 | 0,000 |
| -22,000 | 400,490 | -22,000 | 24,700 | 0,000 |
| -23,500 | 428,990 | -23,500 | 24,700 | 0,000 |
| -25,000 | 457,490 | -25,000 | 24,700 | 0,000 |

# 4 Settlements

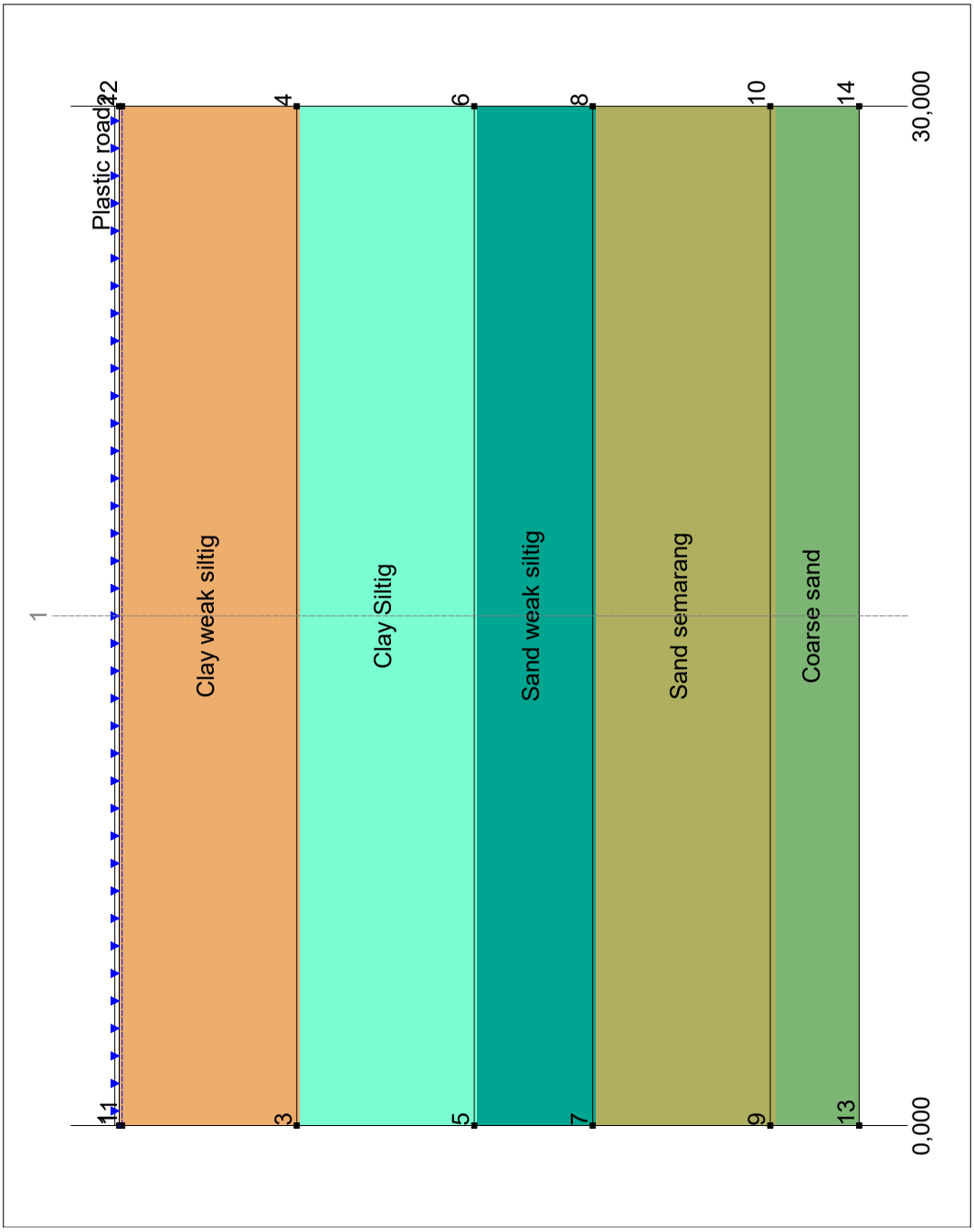
## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | -0,30 | 0,709 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,528 | 74,466 | 0,181 |
| | 10 | 0,569 | 80,262 | 0,140 |
| | 100 | 0,623 | 87,801 | 0,087 |
| | 1000 | 0,678 | 95,600 | 0,031 |
| | 2000 | 0,695 | 97,955 | 0,014 |
| | 3000 | 0,704 | 99,333 | 0,005 |
| | 3650 | 0,709 | 100,000 | 0,000 |

# End of Report




D-Settlement 18.2 : Plastic road.sli

| | | |
|---|---|---|
| Phone<br>Fax | date<br>30-1-2019 | drw.<br>TO |
| Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang | | ctr. |
| | Annex | form.<br>A4 |

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

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Annex

D-Settlement 18.2 - Plastic road.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:50:08 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 28-1-2019 |
| Time of calculation: | 14:14:16 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Plastic road |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | 0,000 | 0,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -6,000 | -6,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -12,000 | -12,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -16,000 | -16,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -22,000 | -22,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,100 | -0,100 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 4 | Clay weak siltig | 1 | 1 |
| 3 | Clay Siltig | 1 | 1 |
| 2 | Sand weak siltig | 1 | 1 |
| 1 | Sand semarang | 1 | 1 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 4 | No | 13,00 | 14,00 |
| 3 | No | 16,00 | 17,00 |
| 2 | No | 18,00 | 20,00 |
| 1 | No | 17,00 | 19,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 4 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 3 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 2 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 1 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,15 | 0,00 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m; Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| 0,000 | 15,001 | 0,000 | 15,000 | 0,480 |
| -0,100 | 16,300 | -0,100 | 15,000 | 0,465 |
| -0,200 | 16,700 | -0,100 | 15,000 | 0,454 |
| -0,300 | 17,100 | -0,100 | 15,000 | 0,444 |
| -0,400 | 17,500 | -0,100 | 15,000 | 0,435 |
| -0,500 | 17,900 | -0,100 | 15,000 | 0,426 |
| -0,600 | 18,300 | -0,100 | 15,000 | 0,418 |
| -0,700 | 18,700 | -0,100 | 15,000 | 0,410 |
| -0,800 | 19,100 | -0,100 | 15,000 | 0,403 |
| -0,900 | 19,500 | -0,100 | 15,000 | 0,396 |
| -1,000 | 19,900 | -0,100 | 15,000 | 0,389 |
| -2,000 | 23,900 | -0,100 | 15,000 | 0,335 |
| -3,000 | 27,900 | -0,100 | 15,000 | 0,295 |
| -4,000 | 31,900 | -0,100 | 15,000 | 0,263 |
| -5,000 | 35,900 | -0,100 | 15,000 | 0,235 |
| -6,000 | 39,900 | -0,100 | 15,000 | 0,212 |
| -6,000 | 39,900 | -0,100 | 15,000 | 0,212 |
| -7,000 | 46,900 | -0,100 | 15,000 | 0,163 |
| -8,000 | 53,900 | -0,100 | 15,000 | 0,122 |
| -9,000 | 60,900 | -0,100 | 15,000 | 0,087 |
| -10,000 | 67,900 | -0,100 | 15,000 | 0,056 |
| -11,000 | 74,900 | -0,100 | 15,000 | 0,029 |
| -12,000 | 81,900 | -0,100 | 15,000 | 0,004 |
| -12,000 | 81,900 | -0,100 | 15,000 | 0,004 |
| -13,000 | 91,900 | -0,100 | 15,000 | 0,004 |
| -14,000 | 101,900 | -0,100 | 15,000 | 0,004 |
| -15,000 | 111,900 | -0,100 | 15,000 | 0,003 |
| -16,000 | 121,900 | -0,100 | 15,000 | 0,003 |
| -16,000 | 121,900 | -0,100 | 15,000 | 0,003 |
| -17,000 | 130,900 | -0,100 | 15,000 | 0,003 |
| -18,000 | 139,900 | -0,100 | 15,000 | 0,002 |
| -19,000 | 148,900 | -0,100 | 15,000 | 0,001 |
| -20,500 | 162,400 | -0,100 | 15,000 | 0,001 |
| -22,000 | 175,900 | -0,100 | 15,000 | 0,000 |

# 4 Settlements

## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | 0,00 | 0,480 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,357 | 74,423 | 0,123 |
| | 10 | 0,385 | 80,229 | 0,095 |
| | 100 | 0,422 | 87,781 | 0,059 |
| | 1000 | 0,459 | 95,593 | 0,021 |
| | 2000 | 0,470 | 97,952 | 0,010 |
| | 3000 | 0,477 | 99,332 | 0,003 |
| | 3650 | 0,480 | 100,000 | 0,000 |

# End of Report

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone

Fax

date 30-1-2019

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Annex

D-Settlement 18.2: Plastic road_Bambochips.sli

# Input View

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

dnw. TO

ctr.

form. A4

Annex

D-Settlement 18.2: Plastic road_Bambochips.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:49:02 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 30-1-2019 |
| Time of calculation: | 09:45:58 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Plastic road_Bambochips |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 5 - X - | 0,000 | 30,000 | | | |
| 5 - Y - | -0,900 | -0,900 | | | |
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | -6,000 | -6,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -12,000 | -12,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -16,000 | -16,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -22,000 | -22,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -25,000 | -25,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,910 | -0,910 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 5 | Clay weak siltig | 1 | 1 |
| 4 | Clay Siltig | 1 | 1 |
| 3 | Sand weak siltig | 1 | 1 |
| 2 | Sand semarang | 1 | 1 |
| 1 | Coarse sand | 0 | 0 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 5 | No | 13,00 | 14,00 |
| 4 | No | 16,00 | 17,00 |
| 3 | No | 18,00 | 20,00 |
| 2 | No | 17,00 | 19,00 |

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 1 | No | 17,00 | 18,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 5 | Vert. cons. | 1,00E+07 | - | - | - |
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 5 | - | - | 1,00 |
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 5 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 4 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 3 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 2 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |
| 1 | 1,80E+03 | 6,00E+02 | 1,00E+09 | 1,00E+09 | 1,80E+03 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,18 | -0,90 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m; Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| -0,900 | 18,201 | -0,900 | 18,200 | 0,578 |
| -0,910 | 18,330 | -0,910 | 18,200 | 0,576 |
| -1,000 | 18,690 | -0,910 | 18,200 | 0,559 |
| -1,100 | 19,090 | -0,910 | 18,200 | 0,543 |
| -1,200 | 19,490 | -0,910 | 18,200 | 0,530 |
| -1,300 | 19,890 | -0,910 | 18,200 | 0,518 |
| -1,400 | 20,290 | -0,910 | 18,200 | 0,507 |
| -1,500 | 20,690 | -0,910 | 18,200 | 0,497 |
| -1,600 | 21,090 | -0,910 | 18,200 | 0,487 |
| -1,700 | 21,490 | -0,910 | 18,200 | 0,478 |
| -1,800 | 21,890 | -0,910 | 18,200 | 0,470 |
| -1,900 | 22,290 | -0,910 | 18,200 | 0,462 |
| -2,650 | 25,290 | -0,910 | 18,200 | 0,411 |
| -3,450 | 28,490 | -0,910 | 18,200 | 0,369 |
| -4,400 | 32,290 | -0,910 | 18,200 | 0,329 |
| -5,400 | 36,290 | -0,910 | 18,200 | 0,293 |
| -6,000 | 38,690 | -0,910 | 18,200 | 0,275 |
| -6,000 | 38,690 | -0,910 | 18,200 | 0,275 |
| -7,000 | 45,690 | -0,910 | 18,200 | 0,210 |
| -8,000 | 52,690 | -0,910 | 18,200 | 0,156 |
| -9,000 | 59,690 | -0,910 | 18,200 | 0,111 |
| -10,000 | 66,690 | -0,910 | 18,200 | 0,072 |
| -11,000 | 73,690 | -0,910 | 18,200 | 0,037 |
| -12,000 | 80,690 | -0,910 | 18,200 | 0,006 |
| -12,000 | 80,690 | -0,910 | 18,200 | 0,006 |
| -13,000 | 90,690 | -0,910 | 18,200 | 0,005 |
| -14,000 | 100,690 | -0,910 | 18,200 | 0,005 |
| -15,000 | 110,690 | -0,910 | 18,200 | 0,005 |
| -16,000 | 120,690 | -0,910 | 18,200 | 0,004 |
| -16,000 | 120,690 | -0,910 | 18,200 | 0,004 |
| -17,000 | 129,690 | -0,910 | 18,200 | 0,003 |
| -18,000 | 138,690 | -0,910 | 18,200 | 0,003 |
| -19,000 | 147,690 | -0,910 | 18,200 | 0,002 |
| -20,500 | 161,190 | -0,910 | 18,200 | 0,001 |
| -22,000 | 174,690 | -0,910 | 18,200 | 0,000 |
| -22,000 | 385,590 | -22,000 | 18,200 | 0,000 |
| -23,500 | 412,590 | -23,500 | 18,200 | 0,000 |
| -25,000 | 439,590 | -25,000 | 18,200 | 0,000 |

# 4 Settlements

## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | -0,90 | 0,578 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,431 | 74,452 | 0,148 |
| | 10 | 0,464 | 80,252 | 0,114 |
| | 100 | 0,508 | 87,795 | 0,071 |
| | 1000 | 0,553 | 95,598 | 0,025 |
| | 2000 | 0,567 | 97,954 | 0,012 |
| | 3000 | 0,575 | 99,333 | 0,004 |
| | 3650 | 0,578 | 100,000 | 0,000 |

# End of Report

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone

Fax

date 30-1-2019

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form. A4

Annex

D-Settlement 18.2 : Water_buffercrates.sli

# Input View

Project Delta

Light Weigh road construction

Kubro Marker Semarang

Phone
Fax

date 30-1-2019

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Annex

D-Settlement 18.2 - Water_buffercrates.sli

# Depth-History




Vertical 1 (X = 15,000 m; Z = 0,000 m)
Method = NEN - Koppejan with Darcy (Linear strain)

Time = 3650,000[days]

# Report for D-Settlement 18.2

Settlement Calculations
Developed by Deltares

| | |
|---|---|
| Date of report: | 30-1-2019 |
| Time of report: | 09:48:30 |
| Report with version: | 18.2.1.20481 |
| Date of calculation: | 30-1-2019 |
| Time of calculation: | 09:47:27 |
| Calculated with version: | 18.2.1.20481 |
| File name: | D:\Project Delta\Water_buffercrates |
| Project identification: | Project Delta<br>Light Weigh road construction<br>Kubro Marker Semarang |

# 1 Table of Contents

# 2 Echo of the Input

## 2.1 Layer Boundaries

| Boundary number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 5 - X - | 0,000 | 30,000 | | | |
| 5 - Y - | -0,700 | -0,700 | | | |
| 4 - X - | 0,000 | 30,000 | | | |
| 4 - Y - | -6,000 | -6,000 | | | |
| 3 - X - | 0,000 | 30,000 | | | |
| 3 - Y - | -12,000 | -12,000 | | | |
| 2 - X - | 0,000 | 30,000 | | | |
| 2 - Y - | -16,000 | -16,000 | | | |
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -22,000 | -22,000 | | | |
| 0 - X - | 0,000 | 30,000 | | | |
| 0 - Y - | -25,000 | -25,000 | | | |

## 2.2 Pl-lines

| Pl-line number | Co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 - X - | 0,000 | 30,000 | | | |
| 1 - Y - | -0,710 | -0,710 | | | |

## 2.3 General Data

| | |
|---|---|
| Soil model: | Koppejan |
| Consolidation model: | Darcy |
| Strain model: | Linear |
| Groundwater level: | Initial determined by Pl-line number 1 |
| Unit weight of water: | 10,00 [kN/m³] |
| Stress distribution | |
| - Soil: | Buisman |
| - Loads: | None |
| End of consolidation: | 3650,00 [days] |
| No maintain profile | |
| Pc (initial): | Variable parallel to the initial effective stress |
| Pc (per step): | Automatic increased to the final effective stresses |
| Creep rate reference time: | 1,000 [days] |
| No imaginary surface | |
| No submerging | |
| Load column width | |
| - Non-Uniform Loads : | 1,00 [m] |
| - Trapeziform Loads : | 1,00 [m] |

## 2.4 Soil Profiles

| Layer number | Material name | Pl-line top | Pl-line bottom |
|---|---|---|---|
| 5 | Clay weak siltig | 1 | 1 |
| 4 | Clay Siltig | 1 | 1 |
| 3 | Sand weak siltig | 1 | 1 |
| 2 | Sand semarang | 1 | 1 |
| 1 | sand coarse | 0 | 0 |

## 2.5 Soil Properties

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 5 | No | 13,00 | 14,00 |
| 4 | No | 16,00 | 17,00 |
| 3 | No | 18,00 | 20,00 |
| 2 | No | 17,00 | 19,00 |

| Layer number | Drained | Unit weight | |
|---|---|---|---|
| | | Unsaturated [kN/m³] | Saturated [kN/m³] |
| 1 | No | 17,00 | 19,00 |

| Layer number | Storage type | Vert. consolid. coefficient Cv [m²/s] | Vertical permeability [m/s] | Permeability strain mod. [-] | Initial vertical permeability [m/s] |
|---|---|---|---|---|---|
| 5 | Vert. cons. | 1,00E+07 | - | - | - |
| 4 | Vert. cons. | 1,00E+07 | - | - | - |
| 3 | Vert. cons. | 1,00E+07 | - | - | - |
| 2 | Vert. cons. | 1,00E+07 | - | - | - |
| 1 | Vert. cons. | 1,00E+07 | - | - | - |

| Layer number | Precons. pressure [kN/m²] | POP [kN/m²] | OCR [-] |
|---|---|---|---|
| 5 | - | - | 1,00 |
| 4 | - | - | 1,00 |
| 3 | - | - | 1,00 |
| 2 | - | - | 1,00 |
| 1 | - | - | 1,00 |

| Layer number | Primary compr. coeff. | | Secular compr. coef. | | Swell constants | |
|---|---|---|---|---|---|---|
| | Cp [-] | Cp' [-] | Cs [-] | Cs' [-] | Ap [-] | As [-] |
| 5 | 5,00E+01 | 3,00E+01 | 3,40E+02 | 2,70E+02 | 5,00E+01 | 2,70E+02 |
| 4 | 5,90E+01 | 1,20E+01 | 2,40E+02 | 1,10E+02 | 5,90E+01 | 1,10E+02 |
| 3 | 3,00E+02 | 5,50E+02 | 1,00E+09 | 1,00E+09 | 3,00E+02 | 1,00E+09 |
| 2 | 6,00E+02 | 2,00E+02 | 1,00E+09 | 1,00E+09 | 6,00E+02 | 1,00E+09 |
| 1 | 1,80E+03 | 6,00E+02 | 1,00E+09 | 1,00E+09 | 1,80E+03 | 1,00E+09 |

## 2.6 Uniform Loads

| Load number | Time [days] | Magnitude [kN/m³] | Height [m] | Y-app. [m] |
|---|---|---|---|---|
| 1 | 0 | 100,00 | 0,23 | -0,70 |

## 2.7 Verticals

| Vertical number | X co-ordinates [m] | | | | |
|---|---|---|---|---|---|
| 1 | 15,000 | | | | |

Discretisation = 100

# 3 Results per Vertical

## 3.1 Results for Vertical 1 (X = 15,00 m;  Z = 0,00 m)

| Depth [m] | Effective Stress [kPa] | Hydraulic head [m] | Loading [kPa] | Settlement [m] |
|---|---|---|---|---|
| -0,700 | 23,301 | -0,700 | 23,300 | 0,681 |
| -0,710 | 23,430 | -0,710 | 23,300 | 0,678 |
| -0,800 | 23,790 | -0,710 | 23,300 | 0,660 |
| -0,900 | 24,190 | -0,710 | 23,300 | 0,643 |
| -1,000 | 24,590 | -0,710 | 23,300 | 0,629 |
| -1,100 | 24,990 | -0,710 | 23,300 | 0,616 |
| -1,200 | 25,390 | -0,710 | 23,300 | 0,604 |
| -1,300 | 25,790 | -0,710 | 23,300 | 0,593 |
| -1,400 | 26,190 | -0,710 | 23,300 | 0,582 |
| -1,500 | 26,590 | -0,710 | 23,300 | 0,572 |
| -1,600 | 26,990 | -0,710 | 23,300 | 0,563 |
| -1,700 | 27,390 | -0,710 | 23,300 | 0,554 |
| -2,550 | 30,790 | -0,710 | 23,300 | 0,490 |
| -3,350 | 33,990 | -0,710 | 23,300 | 0,442 |
| -4,200 | 37,390 | -0,710 | 23,300 | 0,401 |
| -5,200 | 41,390 | -0,710 | 23,300 | 0,359 |
| -6,000 | 44,590 | -0,710 | 23,300 | 0,330 |
| -6,000 | 44,590 | -0,710 | 23,300 | 0,330 |
| -7,000 | 51,590 | -0,710 | 23,300 | 0,253 |
| -8,000 | 58,590 | -0,710 | 23,300 | 0,190 |
| -9,000 | 65,590 | -0,710 | 23,300 | 0,135 |
| -10,000 | 72,590 | -0,710 | 23,300 | 0,087 |
| -11,000 | 79,590 | -0,710 | 23,300 | 0,045 |
| -12,000 | 86,590 | -0,710 | 23,300 | 0,007 |
| -12,000 | 86,590 | -0,710 | 23,300 | 0,007 |
| -13,000 | 96,590 | -0,710 | 23,300 | 0,007 |
| -14,000 | 106,590 | -0,710 | 23,300 | 0,006 |
| -15,000 | 116,590 | -0,710 | 23,300 | 0,006 |
| -16,000 | 126,590 | -0,710 | 23,300 | 0,005 |
| -16,000 | 126,590 | -0,710 | 23,300 | 0,005 |
| -17,000 | 135,590 | -0,710 | 23,300 | 0,004 |
| -18,000 | 144,590 | -0,710 | 23,300 | 0,003 |
| -19,000 | 153,590 | -0,710 | 23,300 | 0,003 |
| -20,500 | 167,090 | -0,710 | 23,300 | 0,001 |
| -22,000 | 180,590 | -0,710 | 23,300 | 0,000 |
| -22,000 | 393,490 | -22,000 | 23,300 | 0,000 |
| -23,500 | 421,990 | -23,500 | 23,300 | 0,000 |
| -25,000 | 450,490 | -25,000 | 23,300 | 0,000 |

# 4 Settlements

## 4.1 Settlements

| Vertical number | X co-ordinate [m] | Z co-ordinate [m] | Surface level [m] | Settlement [m] |
|---|---|---|---|---|
| 1 | 15,00 | 0,00 | -0,70 | 0,681 |

## 4.2 Residual Times

| Vertical number | Time [days] | Settlement [m] | Part of final settlement [%] | Residual settlements [m] |
|---|---|---|---|---|
| 1 | 1 | 0,507 | 74,470 | 0,174 |
| | 10 | 0,546 | 80,266 | 0,134 |
| | 100 | 0,598 | 87,804 | 0,083 |
| | 1000 | 0,651 | 95,601 | 0,030 |
| | 2000 | 0,667 | 97,956 | 0,014 |
| | 3000 | 0,676 | 99,334 | 0,005 |
| | 3650 | 0,681 | 100,000 | 0,000 |

# End of Report