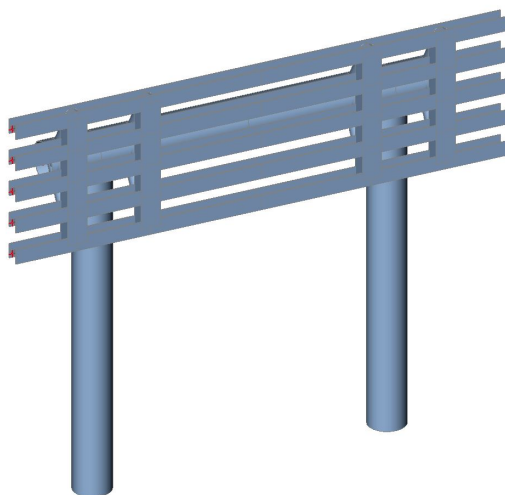


## Controle stabiliteit geleidewerken SCIA model

## 1. Rekenmodel



## 2. Inhoudsopgave

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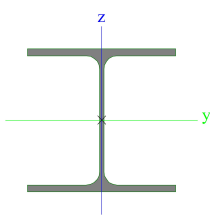
## 3. Constructie

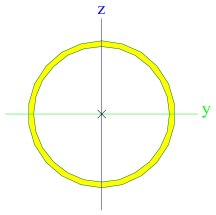
### 3.1. Materialen

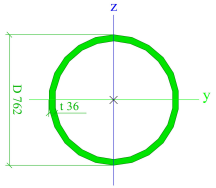
| Staal                                        |                                                                                    |
|----------------------------------------------|------------------------------------------------------------------------------------|
| S355                                         |                                                                                    |
| Thermisch uitz. [m/mK]                       | 0,00                                                                               |
| Massa eenheid [kg/m <sup>3</sup> ]           | 7850,0                                                                             |
| E-mod [MPa]                                  | 2,1000e+05                                                                         |
| Poisson - nu                                 | 0.3                                                                                |
| Onafhankelijke G-modulus                     | ×                                                                                  |
| G-mod [MPa]                                  | 8,0769e+04                                                                         |
| Log. decrement (niet-uniforme demping enkel) | 0.025                                                                              |
| Kleur                                        |   |
| Therm. exp. (brand) [m/mK]                   | 0,00                                                                               |
| Specifieke hitte [J/gK]                      | 6,0000e-01                                                                         |
| Thermische geleiding [W/mK]                  | 4,5000e+01                                                                         |
| Fu [MPa]                                     | 510,0                                                                              |
| Fy [MPa]                                     | 355,0                                                                              |
| Staal                                        |                                                                                    |
| S460                                         |                                                                                    |
| Thermisch uitz. [m/mK]                       | 0,00                                                                               |
| Massa eenheid [kg/m <sup>3</sup> ]           | 7850,0                                                                             |
| E-mod [MPa]                                  | 2,1000e+05                                                                         |
| Poisson - nu                                 | 0.3                                                                                |
| Onafhankelijke G-modulus                     | ×                                                                                  |
| G-mod [MPa]                                  | 8,0769e+04                                                                         |
| Log. decrement (niet-uniforme demping enkel) | 0.025                                                                              |
| Kleur                                        |  |
| Therm. exp. (brand) [m/mK]                   | 0,00                                                                               |
| Specifieke hitte [J/gK]                      | 6,0000e-01                                                                         |
| Thermische geleiding [W/mK]                  | 4,5000e+01                                                                         |
| Fu [MPa]                                     | 550,0                                                                              |
| Fy [MPa]                                     | 460,0                                                                              |

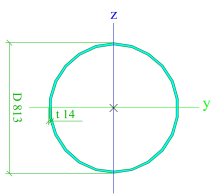
| Verklaring van symbolen                      |                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Log. decrement (niet-uniforme demping enkel) | Deze materiaal dempingseigenschap is enkel toegepast in het geval van het niet-uniform is demping is geactiveerd voor dynamische analyse (zie project functionaliteit). Gelieve op te merken, dat niet-uniforme demping een specifieke licentie benodigd, welke geen deel uit maakt van het standaard dynamische pakket. |

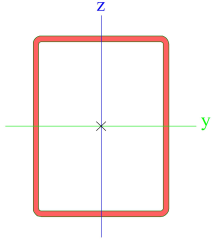
### 3.2. Doorsneden

| CS1                |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| Type               | HEA300                                                                              |
| Vormnorm           | 1 - I-doorsnede                                                                     |
| Vorm type          | Dunwandig                                                                           |
| Onderdeelmateriaal | S355                                                                                |
| Bouwwijze          | gewalst                                                                             |
| Afbeelding         |  |
| CS2                |                                                                                     |
| Type               | CHSCF323.9/12.5                                                                     |
| Vormnorm           | 3 - Cirkelvormige holle                                                             |
| Vorm type          | Dunwandig                                                                           |

|                    |                                                                                   |
|--------------------|-----------------------------------------------------------------------------------|
| Onderdeelmateriaal | S355                                                                              |
| Bouwwijze          | koudgevormd                                                                       |
| Afbeelding         |  |

|                    |                                                                                   |
|--------------------|-----------------------------------------------------------------------------------|
| <b>CS3</b>         |                                                                                   |
| Type               | Buis                                                                              |
| Uitgebreid         | 762; 36                                                                           |
| Vorm type          | Dikke wanden                                                                      |
| Onderdeelmateriaal | S460                                                                              |
| Bouwwijze          | Algemeen                                                                          |
| Afbeelding         |  |

|                    |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| <b>CS4</b>         |                                                                                     |
| Type               | Buis                                                                                |
| Uitgebreid         | 813; 14                                                                             |
| Vorm type          | Dikke wanden                                                                        |
| Onderdeelmateriaal | S355                                                                                |
| Bouwwijze          | Algemeen                                                                            |
| Afbeelding         |  |

|                    |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| <b>CS5</b>         |                                                                                     |
| Type               | RHS400/300/12.5                                                                     |
| Vormnorm           | 2 - Rechthoekige                                                                    |
| Vorm type          | Dunwandig                                                                           |
| Onderdeelmateriaal | S355                                                                                |
| Bouwwijze          | gewalst                                                                             |
| Afbeelding         |  |

| Verklaring van symbolen |                                                                                                                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vormnorm                | h - Hoogte<br>b - Flensbreedte<br>t - Flensdikte<br>s - Lijfdikte<br>r - Straal bij flensbasis<br>r1 - Straal bij flensvoet<br>a - Flenshelling<br>W - Interne boutafstand<br>wm - Welving van eenheid bij flensvoet |

### 3.3. Knopen

| Naam | Coördinaat X [m] | Coördinaat Y [m] | Coördinaat Z [m] | Naam | Coördinaat X [m] | Coördinaat Y [m] | Coördinaat Z [m] |
|------|------------------|------------------|------------------|------|------------------|------------------|------------------|
| K1   | 0,000            | 0,000            | -0,040           | K24  | 7,250            | 0,000            | 1,910            |
| K2   | 0,000            | 0,000            | 0,610            | K25  | 7,250            | 0,000            | 2,560            |
| K3   | 0,000            | 0,000            | 1,260            | K26  | 8,750            | 0,000            | -0,040           |
| K4   | 0,000            | 0,000            | 1,910            | K27  | 8,750            | 0,000            | 0,610            |
| K5   | 0,000            | 0,000            | 2,560            | K28  | 8,750            | 0,000            | 1,260            |
| K6   | 1,250            | 0,000            | -0,040           | K29  | 8,750            | 0,000            | 1,910            |
| K7   | 1,250            | 0,000            | 0,610            | K30  | 8,750            | 0,000            | 2,560            |
| K8   | 1,250            | 0,000            | 1,260            | K31  | 10,000           | 0,000            | -0,040           |
| K9   | 1,250            | 0,000            | 1,910            | K32  | 10,000           | 0,000            | 0,610            |
| K10  | 1,250            | 0,000            | 2,560            | K33  | 10,000           | 0,000            | 1,260            |
| K11  | 2,750            | 0,000            | -0,040           | K34  | 10,000           | 0,000            | 1,910            |
| K12  | 2,750            | 0,000            | 0,610            | K35  | 10,000           | 0,000            | 2,560            |
| K13  | 2,750            | 0,000            | 1,260            | K36  | 2,000            | 0,800            | 1,260            |
| K14  | 2,750            | 0,000            | 1,910            | K37  | 8,000            | 0,800            | 1,260            |
| K15  | 2,750            | 0,000            | 2,560            | K38  | 2,000            | 0,800            | -5,760           |
| K16  | 5,000            | 0,000            | -0,040           | K39  | 8,000            | 0,800            | -5,760           |
| K17  | 5,000            | 0,000            | 0,610            | K40  | 1,000            | 0,800            | 1,260            |
| K18  | 5,000            | 0,000            | 1,260            | K41  | 1,250            | 0,800            | 1,260            |
| K19  | 5,000            | 0,000            | 1,910            | K42  | 2,750            | 0,800            | 1,260            |
| K20  | 5,000            | 0,000            | 2,560            | K43  | 5,000            | 0,800            | 1,260            |
| K21  | 7,250            | 0,000            | -0,040           | K44  | 7,250            | 0,800            | 1,260            |
| K22  | 7,250            | 0,000            | 0,610            | K45  | 8,750            | 0,800            | 1,260            |
| K23  | 7,250            | 0,000            | 1,260            | K46  | 9,000            | 0,800            | 1,260            |

### 3.4. Staven

| Naam | Doorsnede            | Materiaal | Lengte [m] | Beginknoop | Eindknoop | Type         |
|------|----------------------|-----------|------------|------------|-----------|--------------|
| S1   | CS1 - HEA300         | S355      | 1,250      | K5         | K10       | Algemeen (0) |
| S2   | CS1 - HEA300         | S355      | 1,500      | K10        | K15       | Algemeen (0) |
| S3   | CS1 - HEA300         | S355      | 2,250      | K15        | K20       | Algemeen (0) |
| S4   | CS1 - HEA300         | S355      | 2,250      | K20        | K25       | Algemeen (0) |
| S5   | CS1 - HEA300         | S355      | 1,500      | K25        | K30       | Algemeen (0) |
| S6   | CS1 - HEA300         | S355      | 1,250      | K30        | K35       | Algemeen (0) |
| S7   | CS1 - HEA300         | S355      | 1,250      | K4         | K9        | Algemeen (0) |
| S8   | CS1 - HEA300         | S355      | 1,500      | K9         | K14       | Algemeen (0) |
| S9   | CS1 - HEA300         | S355      | 2,250      | K14        | K19       | Algemeen (0) |
| S10  | CS1 - HEA300         | S355      | 2,250      | K19        | K24       | Algemeen (0) |
| S11  | CS1 - HEA300         | S355      | 1,500      | K24        | K29       | Algemeen (0) |
| S12  | CS1 - HEA300         | S355      | 1,250      | K29        | K34       | Algemeen (0) |
| S13  | CS1 - HEA300         | S355      | 1,250      | K3         | K8        | Algemeen (0) |
| S14  | CS1 - HEA300         | S355      | 1,500      | K8         | K13       | Algemeen (0) |
| S15  | CS1 - HEA300         | S355      | 2,250      | K13        | K18       | Algemeen (0) |
| S16  | CS1 - HEA300         | S355      | 2,250      | K18        | K23       | Algemeen (0) |
| S17  | CS1 - HEA300         | S355      | 1,500      | K23        | K28       | Algemeen (0) |
| S18  | CS1 - HEA300         | S355      | 1,250      | K28        | K33       | Algemeen (0) |
| S19  | CS1 - HEA300         | S355      | 1,250      | K2         | K7        | Algemeen (0) |
| S20  | CS1 - HEA300         | S355      | 1,500      | K7         | K12       | Algemeen (0) |
| S21  | CS1 - HEA300         | S355      | 2,250      | K12        | K17       | Algemeen (0) |
| S22  | CS1 - HEA300         | S355      | 2,250      | K17        | K22       | Algemeen (0) |
| S23  | CS1 - HEA300         | S355      | 1,500      | K22        | K27       | Algemeen (0) |
| S24  | CS1 - HEA300         | S355      | 1,250      | K27        | K32       | Algemeen (0) |
| S25  | CS1 - HEA300         | S355      | 1,250      | K1         | K6        | Algemeen (0) |
| S26  | CS1 - HEA300         | S355      | 1,500      | K6         | K11       | Algemeen (0) |
| S27  | CS1 - HEA300         | S355      | 2,250      | K11        | K16       | Algemeen (0) |
| S28  | CS1 - HEA300         | S355      | 2,250      | K16        | K21       | Algemeen (0) |
| S29  | CS1 - HEA300         | S355      | 1,500      | K21        | K26       | Algemeen (0) |
| S30  | CS1 - HEA300         | S355      | 1,250      | K26        | K31       | Algemeen (0) |
| S31  | CS3 - Buis (762; 36) | S460      | 7,020      | K39        | K37       | Algemeen (0) |
| S32  | CS3 - Buis (762; 36) | S460      | 7,020      | K38        | K36       | Algemeen (0) |
| S33  | CS4 - Buis (813; 14) | S355      | 0,250      | K40        | K41       | Algemeen (0) |
| S34  | CS4 - Buis (813; 14) | S355      | 0,750      | K41        | K36       | Algemeen (0) |
| S35  | CS4 - Buis (813; 14) | S355      | 0,750      | K36        | K42       | Algemeen (0) |
| S36  | CS4 - Buis (813; 14) | S355      | 2,250      | K42        | K43       | Algemeen (0) |

| Naam | Doorsnede             | Materiaal | Lengte [m] | Beginknoop | Eindknoop | Type         |
|------|-----------------------|-----------|------------|------------|-----------|--------------|
| S37  | CS4 - Buis (813; 14)  | S355      | 2,250      | K43        | K44       | Algemeen (0) |
| S38  | CS4 - Buis (813; 14)  | S355      | 0,750      | K44        | K37       | Algemeen (0) |
| S39  | CS4 - Buis (813; 14)  | S355      | 0,750      | K37        | K45       | Algemeen (0) |
| S40  | CS4 - Buis (813; 14)  | S355      | 0,250      | K45        | K46       | Algemeen (0) |
| S51  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K6         | K7        | Algemeen (0) |
| S52  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K7         | K8        | Algemeen (0) |
| S53  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K8         | K9        | Algemeen (0) |
| S54  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K9         | K10       | Algemeen (0) |
| S55  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K11        | K12       | Algemeen (0) |
| S56  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K12        | K13       | Algemeen (0) |
| S57  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K13        | K14       | Algemeen (0) |
| S58  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K14        | K15       | Algemeen (0) |
| S63  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K21        | K22       | Algemeen (0) |
| S64  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K22        | K23       | Algemeen (0) |
| S65  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K23        | K24       | Algemeen (0) |
| S66  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K24        | K25       | Algemeen (0) |
| S67  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K26        | K27       | Algemeen (0) |
| S68  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K27        | K28       | Algemeen (0) |
| S69  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K28        | K29       | Algemeen (0) |
| S70  | CS5 - RHS400/300/12.5 | S355      | 0,650      | K29        | K30       | Algemeen (0) |
| S71  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K41        | K6        | Algemeen (0) |
| S72  | CS2 - CHSCF323.9/12.5 | S355      | 0,800      | K41        | K8        | Algemeen (0) |
| S73  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K41        | K10       | Algemeen (0) |
| S83  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K45        | K26       | Algemeen (0) |
| S84  | CS2 - CHSCF323.9/12.5 | S355      | 0,800      | K45        | K28       | Algemeen (0) |
| S85  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K45        | K30       | Algemeen (0) |
| S86  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K42        | K11       | Algemeen (0) |
| S87  | CS2 - CHSCF323.9/12.5 | S355      | 0,800      | K42        | K13       | Algemeen (0) |
| S88  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K42        | K15       | Algemeen (0) |
| S92  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K44        | K25       | Algemeen (0) |
| S93  | CS2 - CHSCF323.9/12.5 | S355      | 0,800      | K44        | K23       | Algemeen (0) |
| S94  | CS2 - CHSCF323.9/12.5 | S355      | 1,526      | K44        | K21       | Algemeen (0) |

### 3.5. Knoopondersteuning

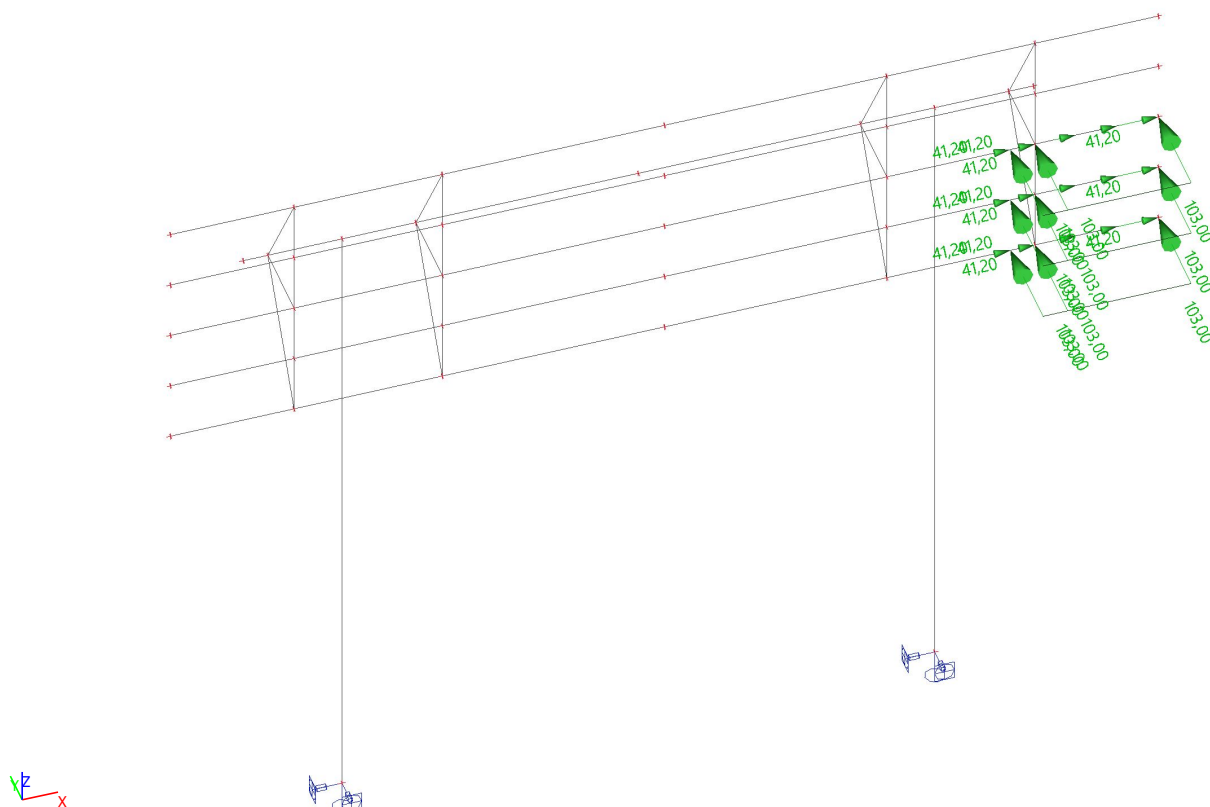
| Naam | Knoop | Systeem | X      | Y      | Z    | Rx     | Ry     | Rz   | Stijfheid X [MN/m] | Stijfheid Y [MN/m] | Stijfheid Rx [MNm/rad] | Stijfheid Ry [MNm/rad] |
|------|-------|---------|--------|--------|------|--------|--------|------|--------------------|--------------------|------------------------|------------------------|
| Sn1  | K38   | GCS     | Verend | Verend | Vast | Verend | Verend | Vrij | 1,2710e+01         | 1,2710e+01         | 1,8033e+02             | 1,8033e+02             |
| Sn2  | K39   | GCS     | Verend | Verend | Vast | Verend | Verend | Vrij | 3,8500e+00         | 3,8500e+00         | 7,8760e+01             | 7,8760e+01             |

## 4. Belasting

### 4.1. Belastingsgevallen

#### 4.1.1. Belastingsgevallen - BG1

| Naam | Omschrijving Spec | Actie type Belastingtype | Lastgroep |
|------|-------------------|--------------------------|-----------|
| BG1  |                   | Permanent Standaard      | LG1       |

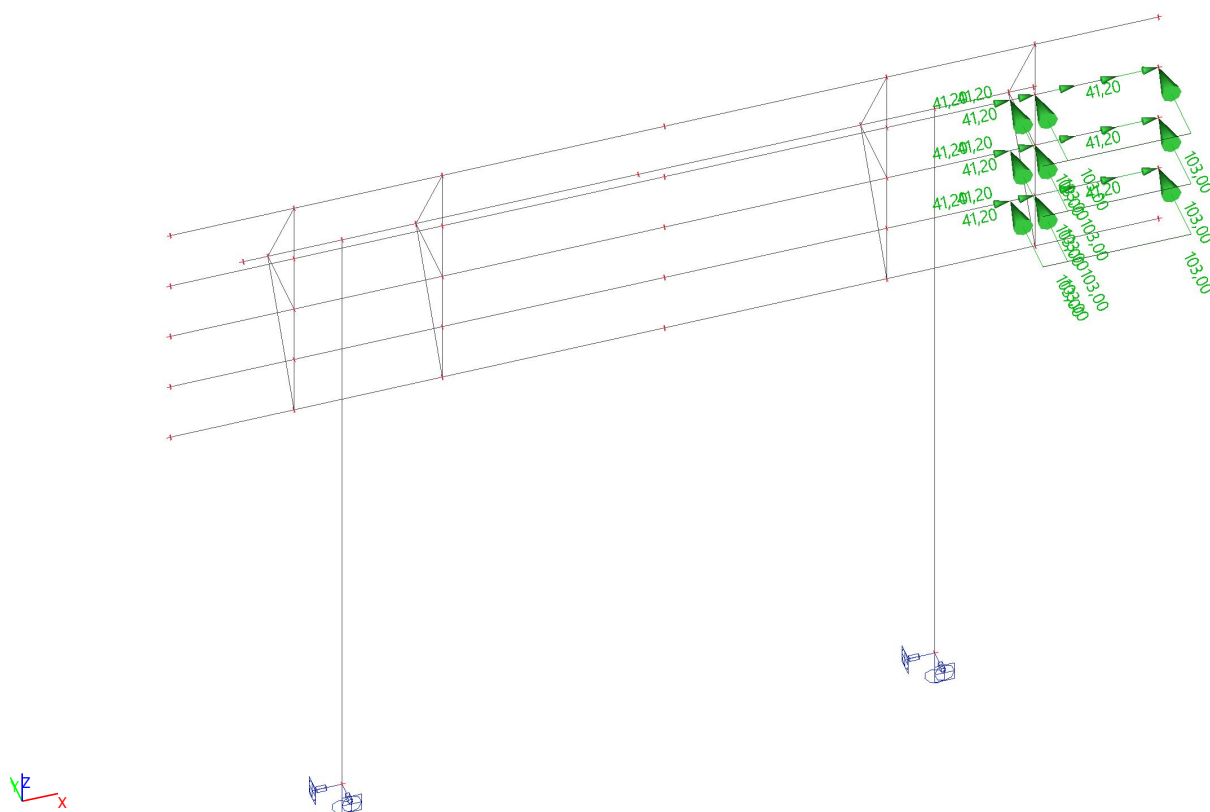


#### 4.1.1.1. Lijnlast

| Naam       | Staaf           | Type    | Rich        | Waarde - P <sub>1</sub><br>[kN/m] | Pos x <sub>1</sub><br>[m] | Coör   | Oors        | Exc ey<br>[m] |
|------------|-----------------|---------|-------------|-----------------------------------|---------------------------|--------|-------------|---------------|
|            | Belastingsgeval | Systeem | Verdeling   | Waarde - P <sub>2</sub><br>[kN/m] | Pos x <sub>2</sub><br>[m] | Loc    |             | Exc ez<br>[m] |
| Lijnlast7  | S30             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast8  | S24             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast9  | S18             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast10 | S30             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast11 | S24             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast12 | S18             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast19 | S29             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast20 | S23             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast21 | S17             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast34 | S29             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast35 | S23             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast36 | S17             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG1             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |

#### 4.1.2. Belastingsgevallen - BG2

| Naam | Omschrijving | Actie type             | Lastgroep |
|------|--------------|------------------------|-----------|
|      | Spec         | Belastingtype          |           |
| BG2  |              | Permanent<br>Standaard | LG1       |



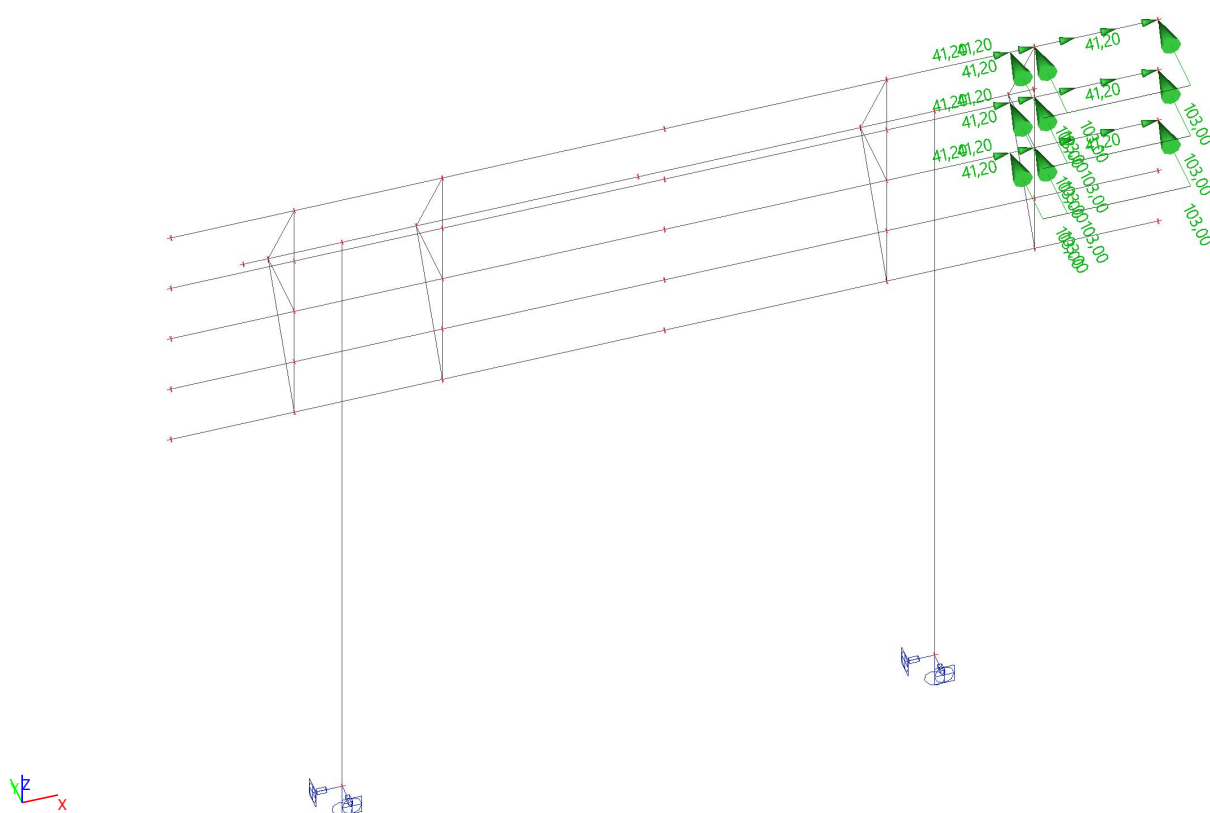
##### 4.1.2.1. Lijnlast

| Naam       | Staaft          | Type    | Rich        | Waarde - P <sub>1</sub><br>[kN/m] | Pos x <sub>1</sub><br>[m] | Coör   | Oors        | Exc ey<br>[m] |
|------------|-----------------|---------|-------------|-----------------------------------|---------------------------|--------|-------------|---------------|
|            | Belastingsgeval | Systeem | Verdeling   | Waarde - P <sub>2</sub><br>[kN/m] | Pos x <sub>2</sub><br>[m] | Loc    |             | Exc ez<br>[m] |
| Lijnlast4  | S12             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast5  | S18             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast6  | S24             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast13 | S24             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast14 | S18             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast15 | S12             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast22 | S23             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast23 | S17             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast24 | S11             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast31 | S23             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast32 | S17             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |

| Naam       | Staaf           | Type    | Rich        | Waarde - P <sub>1</sub><br>[kN/m] | Pos x <sub>1</sub><br>[m] | Coör   | Oors        | Exc ey<br>[m] |
|------------|-----------------|---------|-------------|-----------------------------------|---------------------------|--------|-------------|---------------|
|            | Belastingsgeval | Systeem | Verdeling   | Waarde - P <sub>2</sub><br>[kN/m] | Pos x <sub>2</sub><br>[m] | Loc    |             | Exc ez<br>[m] |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast33 | S11             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG2             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |

#### 4.1.3. Belastingsgevallen - BG3

| Naam | Omschrijving | Actie type             | Lastgroep |
|------|--------------|------------------------|-----------|
|      | Spec         | Belastingtype          |           |
| BG3  |              | Permanent<br>Standaard | LG1       |



##### 4.1.3.1. Lijnlast

| Naam       | Staaf           | Type    | Rich        | Waarde - P <sub>1</sub><br>[kN/m] | Pos x <sub>1</sub><br>[m] | Coör   | Oors        | Exc ey<br>[m] |
|------------|-----------------|---------|-------------|-----------------------------------|---------------------------|--------|-------------|---------------|
|            | Belastingsgeval | Systeem | Verdeling   | Waarde - P <sub>2</sub><br>[kN/m] | Pos x <sub>2</sub><br>[m] | Loc    |             | Exc ez<br>[m] |
| Lijnlast1  | S6              | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast2  | S12             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast3  | S18             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast16 | S6              | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast17 | S12             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |
| Lijnlast18 | S18             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf begin | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 1,250                     | Lengte |             | 0,000         |

| Naam       | Staaf           | Type    | Rich        | Waarde - P <sub>1</sub><br>[kN/m] | Pos x <sub>1</sub><br>[m] | Coör   | Oors        | Exc ey<br>[m] |
|------------|-----------------|---------|-------------|-----------------------------------|---------------------------|--------|-------------|---------------|
|            | Belastingsgeval | Systeem | Verdeling   | Waarde - P <sub>2</sub><br>[kN/m] | Pos x <sub>2</sub><br>[m] | Loc    |             | Exc ez<br>[m] |
| Lijnlast25 | S17             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast26 | S11             | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast27 | S5              | Kracht  | Y           | 103,00                            | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast28 | S5              | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast29 | S11             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |
| Lijnlast30 | S17             | Kracht  | X           | 41,20                             | 0,000                     | Abso   | Vanaf einde | 0,000         |
|            | BG3             | LCS     | Gelijkmatig |                                   | 0,250                     | Lengte |             | 0,000         |

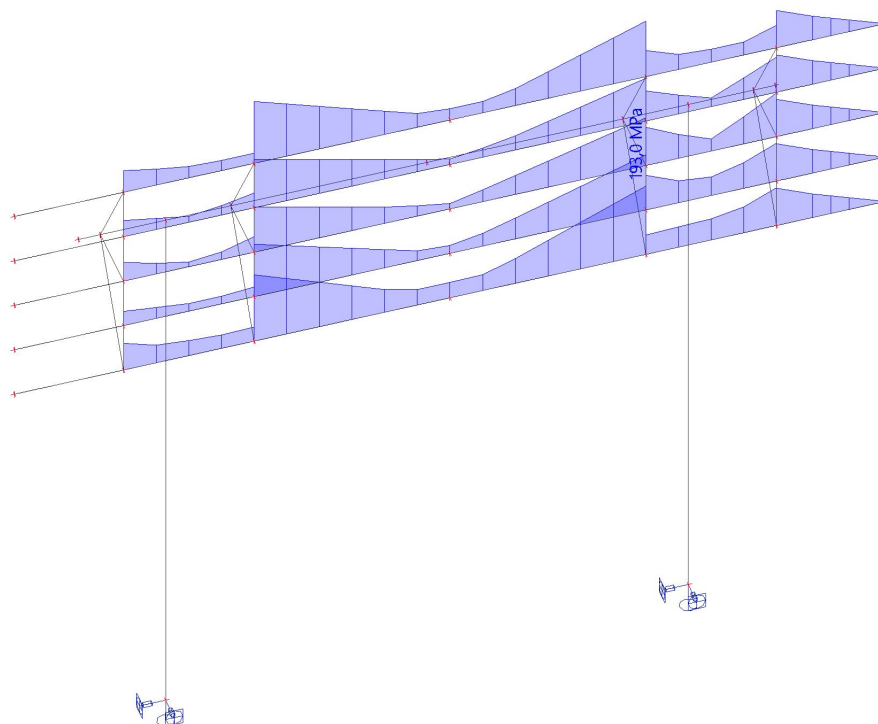
## 4.2. Resultaatklassen

| Naam | Lijst |
|------|-------|
| RC1  | BG1   |
|      | BG2   |
|      | BG3   |

## 5. Resultaten

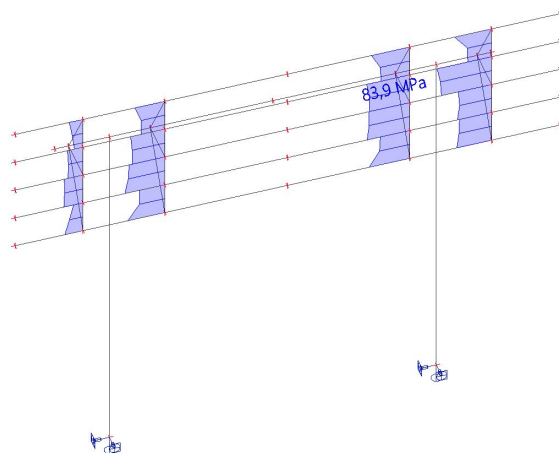
### 5.1. Spanningen in gordingen

Waardes:  $\sigma_E$   
Lineaire berekening  
Klasse: RC1  
Assenstelsel: Hoofd  
Extreme 1D: Globaal  
Selectie: S1..S30



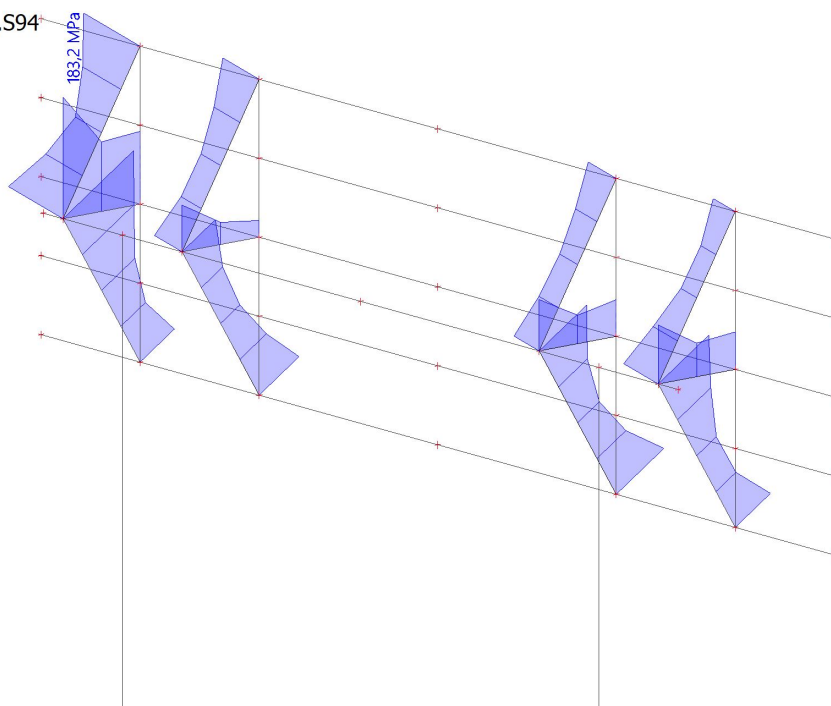
## 5.2. Spanningen in kokers

Waardes:  $\sigma_E$   
Lineaire berekening  
Klasse: RC1  
Assenstelsel: Hoofd  
Extreme 1D: Globaal  
Selectie: S51..S58, S63..S70



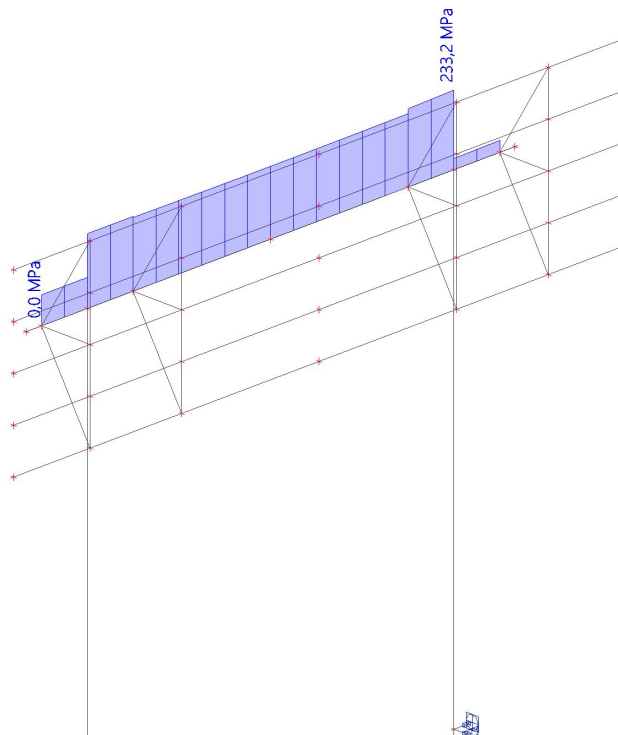
## 5.3. Spanningen in connectie

Waardes:  $\sigma_E$   
Lineaire berekening  
Klasse: RC1  
Assenstelsel: Hoofd  
Extreme 1D: Globaal  
Selectie: S71..S73, S83..S88, S92..S94



## 5.4. Spanningen in liggerbuis

Waardes:  $\sigma_E$   
Lineaire berekening  
Klasse: RC1  
Assenstelsel: Hoofd  
Extreme 1D: Globaal  
Selectie: S33..S40



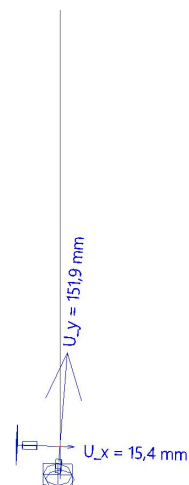
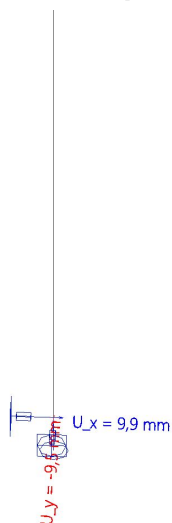
## 5.5. Verplaatsing opleggingen

Lineaire berekening  
Belastingsgeval: BG2  
Extreem: Globaal  
Selectie: K38, K39

| Naam | BG  | $U_x$<br>[mm] | $U_y$<br>[mm] | $U_z$<br>[mm] | $\Phi_x$<br>[mrad] | $\Phi_y$<br>[mrad] | $\Phi_z$<br>[mrad] | $U_{total}$<br>[mm] |
|------|-----|---------------|---------------|---------------|--------------------|--------------------|--------------------|---------------------|
| K39  | BG2 | 15,4          | 151,9         | 0,0           | -30,6              | 1,1                | 58,0               | 152,7               |
| K38  | BG2 | 9,9           | -9,5          | 0,0           | -4,7               | 1,7                | 57,0               | 13,8                |

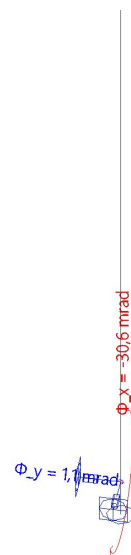
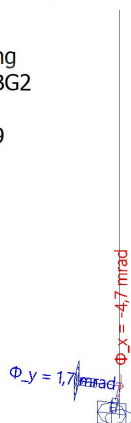
### 5.5.1. Verplaatsing van knopen; $U_x$ ; $U_y$

Waardes:  $U_x$ ,  $U_y$   
Lineaire berekening  
Belastingsgeval: BG2  
Extreem: Globaal  
Selectie: K38, K39



### 5.5.2. Verplaatsing van knopen; $\Phi_x$ ; $\Phi_y$

Waardes:  $\Phi_x$ ,  $\Phi_y$   
Lineaire berekening  
Belastingsgeval: BG2  
Extreem: Globaal  
Selectie: K38, K39



## 5.6. Krachten oplettingen

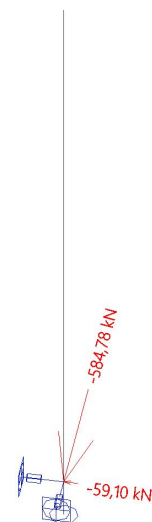
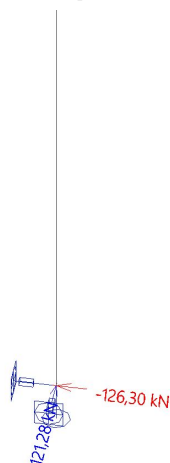
Lineaire berekening  
Belastingsgeval: BG2  
Systeem: Globaal  
Extreem: Globaal  
Selectie: Alle

### Knoopreacties

| Naam    | BG  | R <sub>x</sub><br>[kN] | R <sub>y</sub><br>[kN] | R <sub>z</sub><br>[kN] | M <sub>x</sub><br>[kNm] | M <sub>y</sub><br>[kNm] | M <sub>z</sub><br>[kNm] | e <sub>x</sub><br>[mm] | e <sub>y</sub><br>[mm] |
|---------|-----|------------------------|------------------------|------------------------|-------------------------|-------------------------|-------------------------|------------------------|------------------------|
| Sn2/K39 | BG2 | -59,10                 | -584,78                | 152,11                 | 2408,56                 | -85,85                  | 0,00                    | 15834,0                | -564,4                 |
| Sn1/K38 | BG2 | -126,30                | 121,28                 | -152,11                | 845,21                  | -302,98                 | 0,00                    | -5556,5                | 1991,8                 |

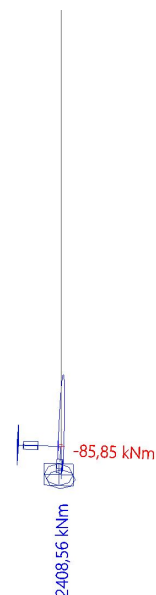
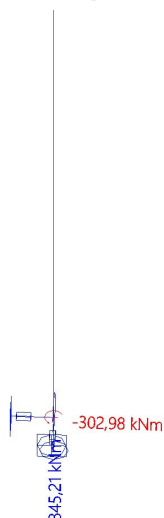
### 5.6.1. Reacties; R<sub>x</sub>; R<sub>y</sub>

Waardes: R<sub>x</sub>, R<sub>y</sub>  
Lineaire berekening  
Belastingsgeval: BG2  
Systeem: Globaal  
Extreem: Globaal  
Selectie: Alle



## 5.6.2. Reacties; $M_x$ ; $M_y$

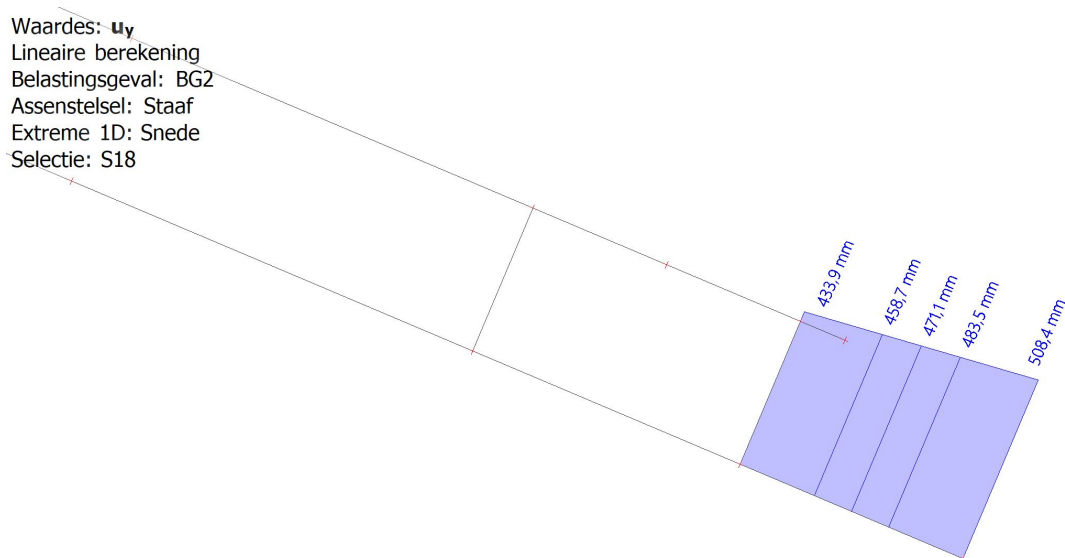
Waardes:  $M_x$ ,  $M_y$   
Lineaire berekening  
Belastingsgeval: BG2  
Systeem: Globaal  
Extreem: Globaal  
Selectie: Alle



## 5.7. Verplaatsing plek aanvaring

### 5.7.1. 1D-ervormingen; $u_y$

Waardes:  $u_y$   
Lineaire berekening  
Belastingsgeval: BG2  
Assenstelsel: Staaf  
Extreme 1D: Snede  
Selectie: S18



## Controle stabiliteit geleidewerken D-Sheet Piling modellen

## Report for D-Sheet Piling 18.2

Design of Diaphragm and Sheet Pile Walls  
Developed by Deltares



Company: Antea Group

Date of report: 29-9-2020

Time of report: 13:13:53

Report with version: 18.2.1.20477

Date of calculation: 9/29/2020

Time of calculation: 12:06:27 PM

Calculated with version: 18.2.1.20477

File name: P:\..\Werkmap\04. Dsheet\6. GW 2.0\S3\S3\_right\_low\1601373975 0000

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## 2 Summary

### 2.1 Overview of Maxima

| Displacement<br>[mm] | Moment<br>[kNm] | Shear force<br>[kN] | Mob. perc.<br>moment<br>[%] | Mob. perc.<br>resistance<br>[%] |
|----------------------|-----------------|---------------------|-----------------------------|---------------------------------|
| 152,4                | -3901,95        | 882,20              | 0,0                         | 30,9                            |

### 3 Input Data

#### 3.1 General Input Data

Model Single pile; Pile loaded by forces  
Unit weight of water 9,81 kN/m<sup>3</sup>

#### 3.2 Pile Properties

Length 12,00 m  
Level top side -6,00 m  
Number of sections 1

##### 3.2.1 General properties

| Section name | From [m] | To [m] | Material type | Diameter [m] |
|--------------|----------|--------|---------------|--------------|
| 762x36       | -18,00   | -6,00  | Steel         | 0,76         |

##### 3.2.2 Stiffness EI (elastic behaviour)

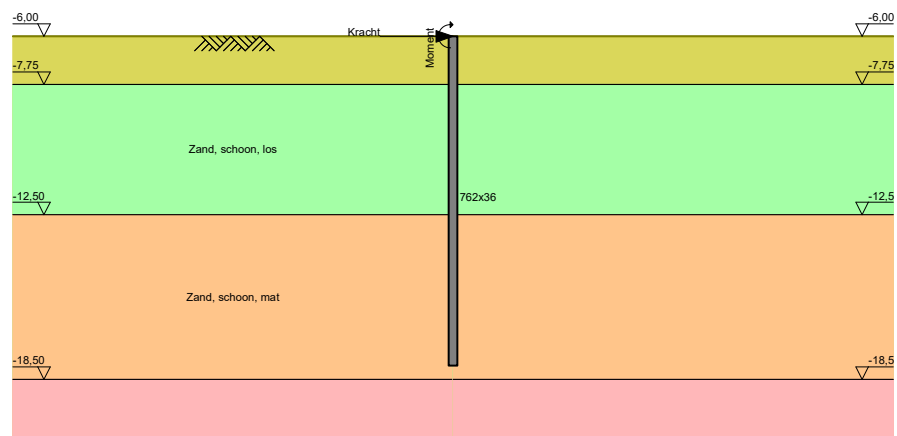
| Section name | Elastic stiffness EI [kNm <sup>2</sup> ] | Red. factor on EI [-] | Corrected elas. stiffness EI [kNm <sup>2</sup> ] | Note to reduction factor |
|--------------|------------------------------------------|-----------------------|--------------------------------------------------|--------------------------|
| 762x36       | 1,1007E+06                               | 1,00                  | 1,1007E+06                                       |                          |

##### 3.2.3 Maximum allowable moments

| Section name | Mr;char;el [kNm] | Modification factor [-] | Material factor [-] | Red. factor allow. moment [-] | Mr;d;el [kNm] |
|--------------|------------------|-------------------------|---------------------|-------------------------------|---------------|
| 762x36       | 0,00             | 1,00                    | 1,00                | 1,00                          | 0,00          |

#### 3.3 Outline

##### Outline



### 3.4 Horizontal Forces

| Name   | Level<br>[m] | Load<br>[kN] |
|--------|--------------|--------------|
| Kracht | -6,00        | 585,53       |

### 3.5 Moments

| Name   | Level<br>[m] | Moment<br>[kNm] |
|--------|--------------|-----------------|
| Moment | -6,00        | -2424,67        |

### 3.6 Water Level

Water level: -0,29 [m]

### 3.7 Surface

Surface level: -6,00 [m]

### 3.8 Soil Material Properties

| Layer name         | Level<br>[m] | Unit weight                   |                              | Cohesion<br>[kN/m <sup>2</sup> ] | Friction angle<br>phi<br>[°] | Brinch Hansen used |
|--------------------|--------------|-------------------------------|------------------------------|----------------------------------|------------------------------|--------------------|
|                    |              | Unsat<br>[kN/m <sup>3</sup> ] | Sat.<br>[kN/m <sup>3</sup> ] |                                  |                              |                    |
| Klei, schoon, mat  | 0,00         | 17,00                         | 17,00                        | 31,30                            | 0,00                         | Yes                |
| Zand, schoon, l... | -7,75        | 17,00                         | 19,00                        | 0,00                             | 26,20                        | Yes                |
| Zand, schoon, ...  | -12,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |
| Zand, schoon, ...  | -18,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |
| Zand, schoon, ...  | -23,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |

| Layer name         | Level<br>[m] | Earth pressure coefficients |                |                | Additional pore pressure    |                                |
|--------------------|--------------|-----------------------------|----------------|----------------|-----------------------------|--------------------------------|
|                    |              | Active<br>[-]               | Neutral<br>[-] | Passive<br>[-] | Top<br>[kN/m <sup>2</sup> ] | Bottom<br>[kN/m <sup>2</sup> ] |
| Klei, schoon, mat  | 0,00         | 0,00                        | 0,00           | 0,01           | 0,00                        | 0,00                           |
| Zand, schoon, l... | -7,75        | 0,00                        | 0,00           | 6,84           | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -12,50       | 0,00                        | 0,00           | 10,48          | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -18,50       | 0,00                        | 0,00           | 11,57          | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -23,50       | 0,00                        | 0,00           | 18,71          | 0,00                        | 0,00                           |

### 3.9 Soil Material Properties calculated using Brinch Hansen

| Layer name         | Level<br>[m] | Fictive cohesion<br>[kN/m <sup>2</sup> ] |
|--------------------|--------------|------------------------------------------|
| Klei, schoon, mat  | 0,00         | 1082,45                                  |
| Zand, schoon, l... | -7,75        | 0,00                                     |
| Zand, schoon, ...  | -12,50       | 0,00                                     |
| Zand, schoon, ...  | -18,50       | 0,00                                     |
| Zand, schoon, ...  | -23,50       | 0,00                                     |

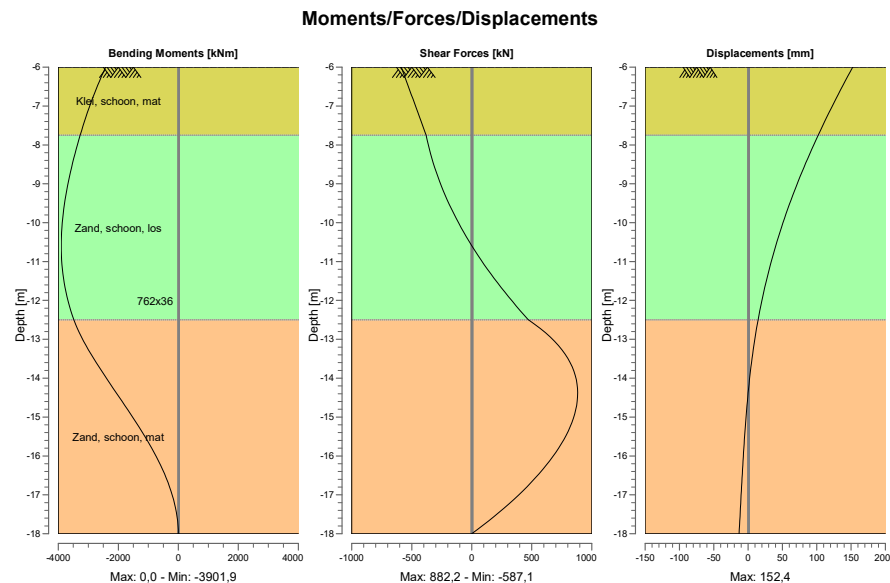
### 3.10 Modulus of Subgrade Reaction

| Layer name         | Level<br>[m] | Ménard used | E-Mod Ménard<br>[kN/m <sup>2</sup> ] | Soil type Ménard | Branch 1                    |                                |
|--------------------|--------------|-------------|--------------------------------------|------------------|-----------------------------|--------------------------------|
|                    |              |             |                                      |                  | Top<br>[kN/m <sup>3</sup> ] | Bottom<br>[kN/m <sup>3</sup> ] |
| Klei, schoon, mat  | 0,00         | Yes         | 5769,00                              | Clay             | 15317,93                    | 15317,93                       |
| Zand, schoon, l... | -7,75        | Yes         | 9231,00                              | Sand             | 38924,70                    | 38924,70                       |
| Zand, schoon, ...  | -12,50       | Yes         | 10462,00                             | Sand             | 44115,50                    | 44115,50                       |
| Zand, schoon, ...  | -18,50       | Yes         | 11077,00                             | Sand             | 46708,79                    | 46708,79                       |
| Zand, schoon, ...  | -23,50       | Yes         | 12308,00                             | Sand             | 51899,60                    | 51899,60                       |

## 4 Calculation Results

Number of iterations: 6

### 4.1 Charts of Moments, Forces and Displacements

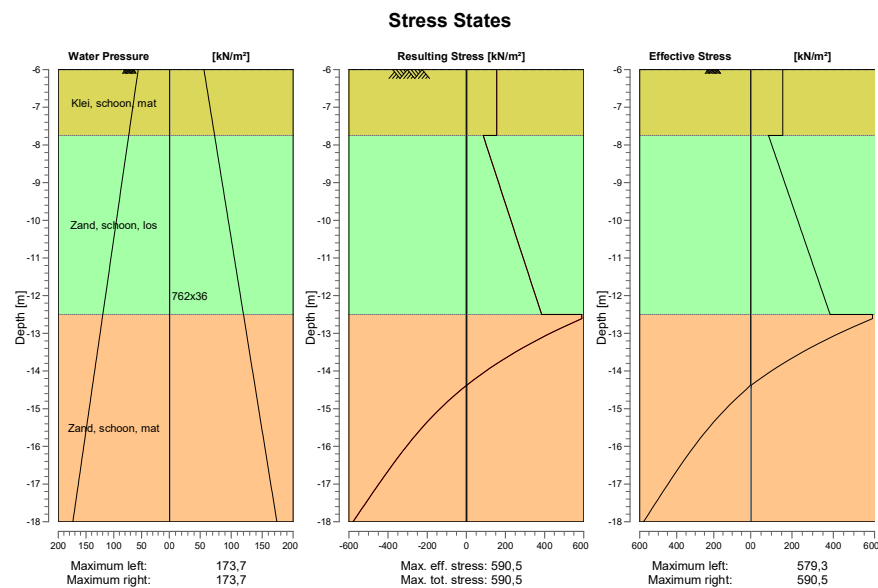


### 4.2 Moments, Forces and Displacements

| Segment number | Level [m] | Moment [kNm]    | Shear force [kN] | Displacement [mm] |
|----------------|-----------|-----------------|------------------|-------------------|
| 1              | -6,00     | -2424,67        | -587,07          | <b>152,4</b>      |
| 1              | -6,58     | -2746,99        | -518,01          | 134,7             |
| 2              | -6,58     | -2746,99        | -518,01          | 134,7             |
| 2              | -7,17     | -3029,02        | -448,94          | 117,9             |
| 3              | -7,17     | -3029,02        | -448,94          | 117,9             |
| 3              | -7,75     | -3270,75        | -379,86          | 102,1             |
| 4              | -7,75     | -3270,75        | -379,86          | 102,1             |
| 4              | -8,34     | -3483,05        | -332,45          | 87,0              |
| 5              | -8,34     | -3483,05        | -332,45          | 87,0              |
| 5              | -8,94     | -3662,19        | -268,15          | 73,0              |
| 6              | -8,94     | -3662,19        | -268,15          | 73,0              |
| 6              | -9,53     | -3798,13        | -186,95          | 60,2              |
| 7              | -9,53     | -3798,13        | -186,95          | 60,2              |
| 7              | -10,13    | -3880,84        | -88,85           | 48,6              |
| 8              | -10,13    | -3880,84        | -88,85           | 48,6              |
| 8              | -10,72    | <b>-3900,30</b> | 26,14            | 38,2              |
| 9              | -10,72    | <b>-3900,30</b> | 26,14            | 38,2              |
| 9              | -11,31    | -3846,46        | 158,03           | 29,1              |
| 10             | -11,31    | -3846,46        | 158,03           | 29,1              |
| 10             | -11,91    | -3709,29        | 306,81           | 21,2              |
| 11             | -11,91    | -3709,29        | 306,81           | 21,2              |
| 11             | -12,50    | -3478,77        | 472,49           | 14,5              |
| 12             | -12,50    | -3478,80        | 473,14           | 14,5              |
| 12             | -13,05    | -3155,14        | 689,59           | 9,3               |
| 13             | -13,05    | -3155,14        | 689,56           | 9,3               |
| 13             | -13,60    | -2736,35        | 819,91           | 4,9               |

| Segment number         | Level [m] | Moment [kNm]    | Shear force [kN] | Displacement [mm] |
|------------------------|-----------|-----------------|------------------|-------------------|
| 14                     | -13,60    | -2736,35        | 819,86           | 4,9               |
| 14                     | -14,15    | -2266,67        | <b>876,97</b>    | 1,3               |
| 15                     | -14,15    | -2266,67        | 876,94           | 1,3               |
| 15                     | -14,70    | -1782,78        | 873,51           | -1,6              |
| 16                     | -14,70    | -1782,78        | 873,48           | -1,6              |
| 16                     | -15,25    | -1315,03        | 819,81           | -4,1              |
| 17                     | -15,25    | -1315,03        | 819,79           | -4,1              |
| 17                     | -15,80    | -888,76         | 723,74           | -6,2              |
| 18                     | -15,80    | -888,76         | 723,72           | -6,2              |
| 18                     | -16,35    | -525,65         | 590,90           | -8,1              |
| 19                     | -16,35    | -525,65         | 590,89           | -8,1              |
| 19                     | -16,90    | -244,85         | 424,89           | -9,8              |
| 20                     | -16,90    | -244,85         | 424,89           | -9,8              |
| 20                     | -17,45    | -63,99          | 227,66           | -11,5             |
| 21                     | -17,45    | -63,99          | 227,66           | -11,5             |
| 21                     | -18,00    | 0,00            | 0,00             | -13,1             |
| Max                    |           | <b>-3900,30</b> | <b>876,97</b>    | <b>152,4</b>      |
| Max, minor nodes incl. |           | -3901,95        | 882,20           | 152,4             |

### 4.3 Charts of Stresses



### 4.4 Stresses

| Node number | Level [m] | Left                     |                      |           |          | Right                    |                      |           |          |
|-------------|-----------|--------------------------|----------------------|-----------|----------|--------------------------|----------------------|-----------|----------|
|             |           | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* [%] | Mob* [%] | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* [%] | Mob* [%] |
| 1           | -6,00     | 0,00                     | 56,02                | A         |          | 155,36                   | 56,02                | P         |          |
| 1           | -6,58     | 0,00                     | 61,74                | A         |          | 155,38                   | 61,74                | P         |          |
| 2           | -6,58     | 0,00                     | 61,74                | A         |          | 155,38                   | 61,74                | P         |          |
| 2           | -7,17     | 0,00                     | 67,46                | A         |          | 155,40                   | 67,46                | P         |          |
| 3           | -7,17     | 0,00                     | 67,46                | A         |          | 155,40                   | 67,46                | P         |          |
| 3           | -7,75     | 0,00                     | 73,18                | A         |          | 155,42                   | 73,18                | P         |          |
| 4           | -7,75     | 0,00                     | 73,18                | A         |          | 86,11                    | 73,18                | P         |          |
| 4           | -8,34     | 0,00                     | 79,01                | A         |          | 123,46                   | 79,01                | P         |          |
| 5           | -8,34     | 0,00                     | 79,01                | A         |          | 123,46                   | 79,01                | P         |          |

| Node number | Level [m] | Left                     |                      |       |          | Right                    |                      |       |          |
|-------------|-----------|--------------------------|----------------------|-------|----------|--------------------------|----------------------|-------|----------|
|             |           | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* | Mob* [%] | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* | Mob* [%] |
| 5           | -8,94     | 0,00                     | 84,83                | A     |          | 160,80                   | 84,83                | P     |          |
| 6           | -8,94     | 0,00                     | 84,83                | A     |          | 160,80                   | 84,83                | P     |          |
| 6           | -9,53     | 0,00                     | 90,66                | A     |          | 198,14                   | 90,66                | P     |          |
| 7           | -9,53     | 0,00                     | 90,66                | A     |          | 198,14                   | 90,66                | P     |          |
| 7           | -10,13    | 0,00                     | 96,48                | A     |          | 235,49                   | 96,48                | P     |          |
| 8           | -10,13    | 0,00                     | 96,48                | A     |          | 235,49                   | 96,48                | P     |          |
| 8           | -10,72    | 0,00                     | 102,31               | A     |          | 272,83                   | 102,31               | P     |          |
| 9           | -10,72    | 0,00                     | 102,31               | A     |          | 272,83                   | 102,31               | P     |          |
| 9           | -11,31    | 0,00                     | 108,13               | A     |          | 310,18                   | 108,13               | P     |          |
| 10          | -11,31    | 0,00                     | 108,13               | A     |          | 310,18                   | 108,13               | P     |          |
| 10          | -11,91    | 0,00                     | 113,96               | A     |          | 347,52                   | 113,96               | P     |          |
| 11          | -11,91    | 0,00                     | 113,96               | A     |          | 347,52                   | 113,96               | P     |          |
| 11          | -12,50    | 0,00                     | 119,78               | A     |          | 384,86                   | 119,78               | P     |          |
| 12          | -12,50    | 0,00                     | 119,78               | A     |          | 589,39                   | 119,78               | P     |          |
| 12          | -13,05    | 0,00                     | 125,18               | A     |          | 409,77                   | 125,18               | -     | 63       |
| 13          | -13,05    | 0,00                     | 125,18               | A     |          | 409,77                   | 125,18               | -     | 63       |
| 13          | -13,60    | 0,00                     | 130,57               | A     |          | 218,01                   | 130,57               | -     | 31       |
| 14          | -13,60    | 0,00                     | 130,57               | A     |          | 218,01                   | 130,57               | -     | 31       |
| 14          | -14,15    | 0,00                     | 135,97               | A     |          | 59,38                    | 135,97               | -     | 8        |
| 15          | -14,15    | 0,00                     | 135,97               | A     |          | 59,38                    | 135,97               | -     | 8        |
| 15          | -14,70    | 71,79                    | 141,36               | -     | 9        | 0,00                     | 141,36               | A     |          |
| 16          | -14,70    | 71,79                    | 141,36               | -     | 9        | 0,00                     | 141,36               | A     |          |
| 16          | -15,25    | 181,33                   | 146,76               | -     | 21       | 0,00                     | 146,76               | A     |          |
| 17          | -15,25    | 181,33                   | 146,76               | -     | 21       | 0,00                     | 146,76               | A     |          |
| 17          | -15,80    | 274,89                   | 152,15               | -     | 29       | 0,00                     | 152,15               | A     |          |
| 18          | -15,80    | 274,89                   | 152,15               | -     | 29       | 0,00                     | 152,15               | A     |          |
| 18          | -16,35    | 357,60                   | 157,55               | -     | 36       | 0,00                     | 157,55               | A     |          |
| 19          | -16,35    | 357,60                   | 157,55               | -     | 36       | 0,00                     | 157,55               | A     |          |
| 19          | -16,90    | 433,86                   | 162,94               | -     | 41       | 0,00                     | 162,94               | A     |          |
| 20          | -16,90    | 433,86                   | 162,94               | -     | 41       | 0,00                     | 162,94               | A     |          |
| 20          | -17,45    | 507,04                   | 168,34               | -     | 45       | 0,00                     | 168,34               | A     |          |
| 21          | -17,45    | 507,04                   | 168,34               | -     | 45       | 0,00                     | 168,34               | A     |          |
| 21          | -18,00    | 579,34                   | 173,74               | -     | 49       | 0,00                     | 173,74               | A     |          |

\*

Stat

Status (A=active, P=passive, Number is branche, 0 is unloading)

Mob

Percentage passive mobilized

**End of Report**

## Report for D-Sheet Piling 18.2

Design of Diaphragm and Sheet Pile Walls  
Developed by Deltares



Company: Antea Group

Date of report: 10/2/2020  
Time of report: 9:14:48 AM  
Report with version: 18.2.1.20477

Date of calculation: 9/29/2020  
Time of calculation: 12:06:29 PM  
Calculated with version: 18.2.1.20477

File name: C:\..\Werkmap\04. Dsheet\6. GW 2.0\S3\S3\_right\_low\1601373975 0001

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## 2 Summary

### 2.1 Overview of Maxima

| Displacement<br>[mm] | Moment<br>[kNm] | Shear force<br>[kN] | Mob. perc.<br>moment<br>[%] | Mob. perc.<br>resistance<br>[%] |
|----------------------|-----------------|---------------------|-----------------------------|---------------------------------|
| 13,6                 | -1012,32        | 184,94              | 0,0                         | 7,5                             |

### 3 Input Data

#### 3.1 General Input Data

Model Single pile; Pile loaded by forces  
Unit weight of water 9,81 kN/m<sup>3</sup>

#### 3.2 Pile Properties

Length 12,00 m  
Level top side -6,00 m  
Number of sections 1

##### 3.2.1 General properties

| Section name | From<br>[m] | To<br>[m] | Material type | Diameter<br>[m] |
|--------------|-------------|-----------|---------------|-----------------|
| 762x36       | -18,00      | -6,00     | Steel         | 0,76            |

##### 3.2.2 Stiffness EI (elastic behaviour)

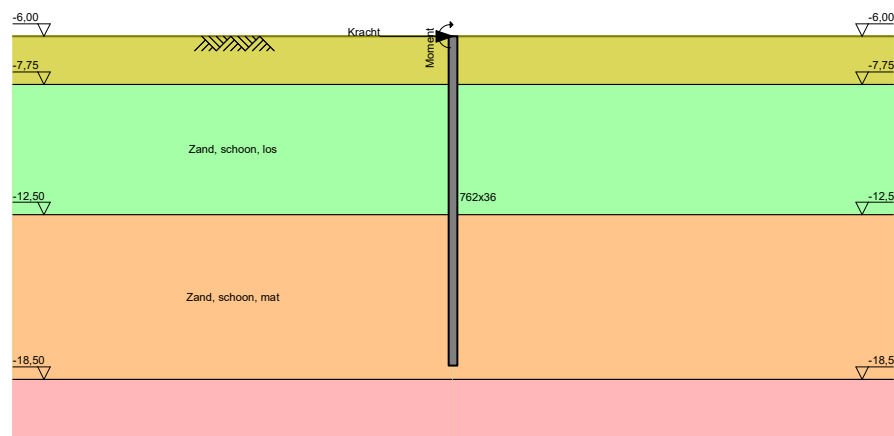
| Section name | Elastic stiffness EI<br>[kNm <sup>2</sup> ] | Red. factor on EI<br>[-] | Corrected elas. stiffness EI<br>[kNm <sup>2</sup> ] | Note to reduction factor |
|--------------|---------------------------------------------|--------------------------|-----------------------------------------------------|--------------------------|
| 762x36       | 1,1007E+06                                  | 1,00                     | 1,1007E+06                                          |                          |

##### 3.2.3 Maximum allowable moments

| Section name | Mr;char;el<br>[kNm] | Modification factor<br>[-] | Material factor<br>[-] | Red. factor allow. moment<br>[-] | Mr;d;el<br>[kNm] |
|--------------|---------------------|----------------------------|------------------------|----------------------------------|------------------|
| 762x36       | 0,00                | 1,00                       | 1,00                   | 1,00                             | 0,00             |

#### 3.3 Outline

##### Outline



### 3.4 Horizontal Forces

| Name   | Level<br>[m] | Load<br>[kN] |
|--------|--------------|--------------|
| Kracht | -6,00        | 172,80       |

### 3.5 Moments

| Name   | Level<br>[m] | Moment<br>[kNm] |
|--------|--------------|-----------------|
| Moment | -6,00        | -881,88         |

### 3.6 Water Level

Water level: -0,29 [m]

### 3.7 Surface

Surface level: -6,00 [m]

### 3.8 Soil Material Properties

| Layer name         | Level<br>[m] | Unit weight                   |                              | Cohesion<br>[kN/m <sup>2</sup> ] | Friction angle<br>phi<br>[°] | Brinch Hansen used |
|--------------------|--------------|-------------------------------|------------------------------|----------------------------------|------------------------------|--------------------|
|                    |              | Unsat<br>[kN/m <sup>3</sup> ] | Sat.<br>[kN/m <sup>3</sup> ] |                                  |                              |                    |
| Klei, schoon, mat  | 0,00         | 17,00                         | 17,00                        | 31,30                            | 0,00                         | Yes                |
| Zand, schoon, l... | -7,75        | 17,00                         | 19,00                        | 0,00                             | 26,20                        | Yes                |
| Zand, schoon, ...  | -12,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |
| Zand, schoon, ...  | -18,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |
| Zand, schoon, ...  | -23,50       | 18,00                         | 20,00                        | 0,00                             | 28,50                        | Yes                |

| Layer name         | Level<br>[m] | Earth pressure coefficients |                |                | Additional pore pressure    |                                |
|--------------------|--------------|-----------------------------|----------------|----------------|-----------------------------|--------------------------------|
|                    |              | Active<br>[-]               | Neutral<br>[-] | Passive<br>[-] | Top<br>[kN/m <sup>2</sup> ] | Bottom<br>[kN/m <sup>2</sup> ] |
| Klei, schoon, mat  | 0,00         | 0,00                        | 0,00           | 0,01           | 0,00                        | 0,00                           |
| Zand, schoon, l... | -7,75        | 0,00                        | 0,00           | 6,84           | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -12,50       | 0,00                        | 0,00           | 10,48          | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -18,50       | 0,00                        | 0,00           | 11,57          | 0,00                        | 0,00                           |
| Zand, schoon, ...  | -23,50       | 0,00                        | 0,00           | 18,71          | 0,00                        | 0,00                           |

### 3.9 Soil Material Properties calculated using Brinch Hansen

| Layer name         | Level<br>[m] | Fictive cohesion<br>[kN/m <sup>2</sup> ] |
|--------------------|--------------|------------------------------------------|
| Klei, schoon, mat  | 0,00         | 1082,45                                  |
| Zand, schoon, l... | -7,75        | 0,00                                     |
| Zand, schoon, ...  | -12,50       | 0,00                                     |
| Zand, schoon, ...  | -18,50       | 0,00                                     |
| Zand, schoon, ...  | -23,50       | 0,00                                     |

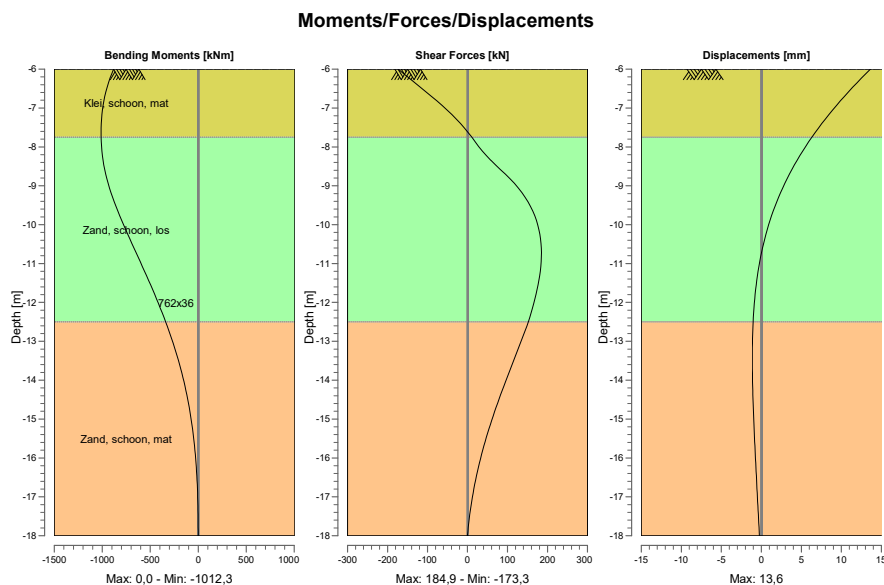
### 3.10 Modulus of Subgrade Reaction

| Layer name         | Level<br>[m] | Ménard used | E-Mod Ménard<br>[kN/m <sup>2</sup> ] | Soil type Ménard | Branch 1                    |                                |
|--------------------|--------------|-------------|--------------------------------------|------------------|-----------------------------|--------------------------------|
|                    |              |             |                                      |                  | Top<br>[kN/m <sup>3</sup> ] | Bottom<br>[kN/m <sup>3</sup> ] |
| Klei, schoon, mat  | 0,00         | Yes         | 5769,00                              | Clay             | 15317,93                    | 15317,93                       |
| Zand, schoon, l... | -7,75        | Yes         | 9231,00                              | Sand             | 38924,70                    | 38924,70                       |
| Zand, schoon, ...  | -12,50       | Yes         | 10462,00                             | Sand             | 44115,50                    | 44115,50                       |
| Zand, schoon, ...  | -18,50       | Yes         | 11077,00                             | Sand             | 46708,79                    | 46708,79                       |
| Zand, schoon, ...  | -23,50       | Yes         | 12308,00                             | Sand             | 51899,60                    | 51899,60                       |

## 4 Calculation Results

Number of iterations: 4

### 4.1 Charts of Moments, Forces and Displacements

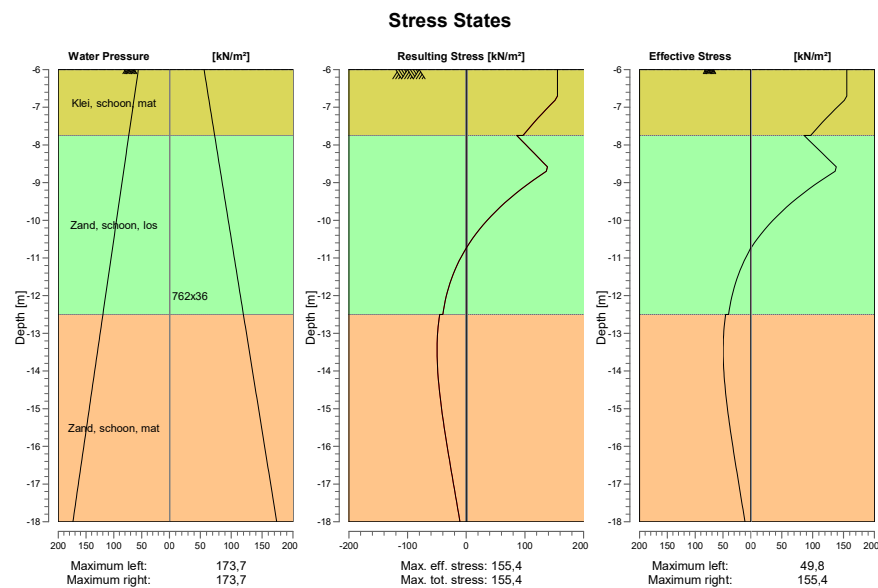


### 4.2 Moments, Forces and Displacements

| Segment number | Level [m] | Moment [kNm]    | Shear force [kN] | Displacement [mm] |
|----------------|-----------|-----------------|------------------|-------------------|
| 1              | -6,00     | -881,88         | -173,25          | <b>13,6</b>       |
| 1              | -6,58     | -962,80         | -104,19          | 10,9              |
| 2              | -6,58     | -962,81         | -104,10          | 10,9              |
| 2              | -7,17     | -1004,00        | -39,26           | 8,4               |
| 3              | -7,17     | -1003,99        | -39,24           | 8,4               |
| 3              | -7,75     | <b>-1011,56</b> | 10,86            | 6,3               |
| 4              | -7,75     | <b>-1011,56</b> | 10,85            | 6,3               |
| 4              | -8,34     | -991,88         | 58,26            | 4,5               |
| 5              | -8,34     | -991,89         | 58,35            | 4,5               |
| 5              | -8,94     | -939,58         | 117,14           | 2,9               |
| 6              | -8,94     | -939,57         | 117,21           | 2,9               |
| 6              | -9,53     | -856,92         | 157,56           | 1,7               |
| 7              | -9,53     | -856,92         | 157,54           | 1,7               |
| 7              | -10,13    | -756,29         | 178,61           | 0,7               |
| 8              | -10,13    | -756,29         | 178,60           | 0,7               |
| 8              | -10,72    | -647,74         | <b>184,94</b>    | 0,0               |
| 9              | -10,72    | -647,74         | 184,93           | 0,0               |
| 9              | -11,31    | -538,81         | 180,50           | -0,5              |
| 10             | -11,31    | -538,81         | 180,49           | -0,5              |
| 10             | -11,91    | -434,86         | 168,65           | -0,8              |
| 11             | -11,91    | -434,86         | 168,64           | -0,8              |
| 11             | -12,50    | -339,47         | 152,12           | -1,0              |
| 12             | -12,50    | -339,47         | 152,11           | -1,0              |
| 12             | -13,05    | -261,21         | 132,20           | -1,1              |
| 13             | -13,05    | -261,21         | 132,20           | -1,1              |
| 13             | -13,60    | -194,21         | 111,40           | -1,1              |

| Segment number         | Level [m] | Moment [kNm] | Shear force [kN] | Displacement [mm] |
|------------------------|-----------|--------------|------------------|-------------------|
| 14                     | -13,60    | -194,21      | 111,40           | -1,1              |
| 14                     | -14,15    | -138,62      | 90,87            | -1,1              |
| 15                     | -14,15    | -138,62      | 90,87            | -1,1              |
| 15                     | -14,70    | -94,05       | 71,45            | -1,0              |
| 16                     | -14,70    | -94,05       | 71,45            | -1,0              |
| 16                     | -15,25    | -59,71       | 53,74            | -0,9              |
| 17                     | -15,25    | -59,71       | 53,74            | -0,9              |
| 17                     | -15,80    | -34,55       | 38,12            | -0,8              |
| 18                     | -15,80    | -34,55       | 38,12            | -0,8              |
| 18                     | -16,35    | -17,35       | 24,84            | -0,7              |
| 19                     | -16,35    | -17,35       | 24,84            | -0,7              |
| 19                     | -16,90    | -6,78        | 14,02            | -0,5              |
| 20                     | -16,90    | -6,78        | 14,02            | -0,5              |
| 20                     | -17,45    | -1,46        | 5,74             | -0,4              |
| 21                     | -17,45    | -1,46        | 5,74             | -0,4              |
| 21                     | -18,00    | 0,00         | 0,00             | -0,2              |
| Max                    |           | -1011,56     | 184,94           | 13,6              |
| Max, minor nodes incl. |           | -1012,32     | 184,94           | 13,6              |

### 4.3 Charts of Stresses



### 4.4 Stresses

| Node number | Level [m] | Left                     |                      |           |          | Right                    |                      |           |          |
|-------------|-----------|--------------------------|----------------------|-----------|----------|--------------------------|----------------------|-----------|----------|
|             |           | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* [%] | Mob* [%] | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* [%] | Mob* [%] |
| 1           | -6,00     | 0,00                     | 56,02                | A         |          | 155,36                   | 56,02                | P         |          |
| 1           | -6,58     | 0,00                     | 61,74                | A         |          | 155,38                   | 61,74                | P         |          |
| 2           | -6,58     | 0,00                     | 61,74                | A         |          | 155,38                   | 61,74                | P         |          |
| 2           | -7,17     | 0,00                     | 67,46                | A         |          | 129,42                   | 67,46                | -         | 83       |
| 3           | -7,17     | 0,00                     | 67,46                | A         |          | 129,42                   | 67,46                | -         | 83       |
| 3           | -7,75     | 0,00                     | 73,18                | A         |          | 96,75                    | 73,18                | -         | 62       |
| 4           | -7,75     | 0,00                     | 73,18                | A         |          | 86,11                    | 73,18                | P         |          |
| 4           | -8,34     | 0,00                     | 79,01                | A         |          | 123,46                   | 79,01                | P         |          |
| 5           | -8,34     | 0,00                     | 79,01                | A         |          | 123,46                   | 79,01                | P         |          |

| Node number | Level [m] | Left                     |                      |       |          | Right                    |                      |       |          |
|-------------|-----------|--------------------------|----------------------|-------|----------|--------------------------|----------------------|-------|----------|
|             |           | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* | Mob* [%] | Effective stress [kN/m²] | Water stress [kN/m²] | Stat* | Mob* [%] |
| 5           | -8,94     | 0,00                     | 84,83                | A     |          | 114,09                   | 84,83                | -     | 71       |
| 6           | -8,94     | 0,00                     | 84,83                | A     |          | 114,09                   | 84,83                | -     | 71       |
| 6           | -9,53     | 0,00                     | 90,66                | A     |          | 66,06                    | 90,66                | -     | 33       |
| 7           | -9,53     | 0,00                     | 90,66                | A     |          | 66,06                    | 90,66                | -     | 33       |
| 7           | -10,13    | 0,00                     | 96,48                | A     |          | 28,69                    | 96,48                | -     | 12       |
| 8           | -10,13    | 0,00                     | 96,48                | A     |          | 28,69                    | 96,48                | -     | 12       |
| 8           | -10,72    | 0,00                     | 102,31               | A     |          | 0,75                     | 102,31               | -     |          |
| 9           | -10,72    | 0,00                     | 102,31               | A     |          | 0,75                     | 102,31               | -     |          |
| 9           | -11,31    | 19,12                    | 108,13               | -     | 6        | 0,00                     | 108,13               | A     |          |
| 10          | -11,31    | 19,12                    | 108,13               | -     | 6        | 0,00                     | 108,13               | A     |          |
| 10          | -11,91    | 32,27                    | 113,96               | -     | 9        | 0,00                     | 113,96               | A     |          |
| 11          | -11,91    | 32,27                    | 113,96               | -     | 9        | 0,00                     | 113,96               | A     |          |
| 11          | -12,50    | 39,99                    | 119,78               | -     | 10       | 0,00                     | 119,78               | A     |          |
| 12          | -12,50    | 45,32                    | 119,78               | -     | 8        | 0,00                     | 119,78               | A     |          |
| 12          | -13,05    | 49,10                    | 125,18               | -     | 8        | 0,00                     | 125,18               | A     |          |
| 13          | -13,05    | 49,10                    | 125,18               | -     | 8        | 0,00                     | 125,18               | A     |          |
| 13          | -13,60    | 49,71                    | 130,57               | -     | 7        | 0,00                     | 130,57               | A     |          |
| 14          | -13,60    | 49,71                    | 130,57               | -     | 7        | 0,00                     | 130,57               | A     |          |
| 14          | -14,15    | 47,94                    | 135,97               | -     | 6        | 0,00                     | 135,97               | A     |          |
| 15          | -14,15    | 47,94                    | 135,97               | -     | 6        | 0,00                     | 135,97               | A     |          |
| 15          | -14,70    | 44,49                    | 141,36               | -     | 5        | 0,00                     | 141,36               | A     |          |
| 16          | -14,70    | 44,49                    | 141,36               | -     | 5        | 0,00                     | 141,36               | A     |          |
| 16          | -15,25    | 39,89                    | 146,76               | -     | 5        | 0,00                     | 146,76               | A     |          |
| 17          | -15,25    | 39,89                    | 146,76               | -     | 5        | 0,00                     | 146,76               | A     |          |
| 17          | -15,80    | 34,55                    | 152,15               | -     | 4        | 0,00                     | 152,15               | A     |          |
| 18          | -15,80    | 34,55                    | 152,15               | -     | 4        | 0,00                     | 152,15               | A     |          |
| 18          | -16,35    | 28,78                    | 157,55               | -     | 3        | 0,00                     | 157,55               | A     |          |
| 19          | -16,35    | 28,78                    | 157,55               | -     | 3        | 0,00                     | 157,55               | A     |          |
| 19          | -16,90    | 22,80                    | 162,94               | -     | 2        | 0,00                     | 162,94               | A     |          |
| 20          | -16,90    | 22,80                    | 162,94               | -     | 2        | 0,00                     | 162,94               | A     |          |
| 20          | -17,45    | 16,73                    | 168,34               | -     | 1        | 0,00                     | 168,34               | A     |          |
| 21          | -17,45    | 16,73                    | 168,34               | -     | 1        | 0,00                     | 168,34               | A     |          |
| 21          | -18,00    | 10,64                    | 173,74               | -     | 1        | 0,00                     | 173,74               | A     |          |

\*

Stat

Mob

Status (A=active, P=passive, Number is branche, 0 is unloading)

Percentage passive mobilized

**End of Report**