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Projectnummer

**16-054**

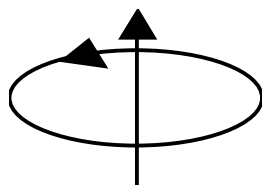
# Statische berekening

## Uitbreiding tussenhal GOMA te Hengelo

Opdrachtgever GOMA Beheer B.V.  
Ruurloseweg 80a  
7255 MA Hengelo (Gld)

Architect T2 Ontwerp & Advies B.V.  
Kruisbergseweg 9  
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Constructie Adviesburo  
**Te Boekhorst**

't Goor 47

7071 PC Ulft

## Inhoudsopgave

| Hoofdgroep     | Omschrijving                                                           | pagina |
|----------------|------------------------------------------------------------------------|--------|
| Belastingen    | Gewichten en belastingen van de constructie bouwdelen                  | 4      |
| Staal          | Detailberekening windverband (1e windbok op as A) - Koppeling Strip    | 16     |
| Staal          | Detailberekening windverband (2e windbok op as F) - Koppeling Strip    | 19     |
| Staal          | Detailberekening windverband (Windbok achtergevel (1 velds)) - Koppeli | 23     |
| Staal          | Detailberekening windverband (Windbok achtergevel (1 velds)) - Koppeli | 26     |
| Staal          | Noodoverstortberekening - NO_DV_1                                      | 29     |
| Staal          | UNP t.b.v. windbelasting - UNP_Kozijnen                                | 31     |
| Grondmechanica | Poer 1 t/m 5 - P                                                       | 32     |
| Grondmechanica | Poerberekening - P_1                                                   | 33     |
| Grondmechanica | Poerberekening - P_2                                                   | 35     |
| Grondmechanica | Poerberekening - P_3                                                   | 39     |
| Grondmechanica | Poerberekening - P_4                                                   | 43     |
| Grondmechanica | Poerberekening - P_5                                                   | 45     |

Bijlagen: Constructie overzicht en bijlagen TechnoSoft

**EUROCODES****Eurocode 0: Grondslagen van het constructief ontwerp**

NEN-EN 1990 Eurocode : Grondslagen van het constructief ontwerp

NEN 6702:2007 Technische grondslagen voor bouwconstructies-TGB 1990-Belastingen en vervormingen

NEN 6702:2007/C1 Correctieblad op NEN 6702

**Eurocode 1: Belastingen op constructies**

NEN-EN 1991-1-1 Volumieke gewichten

NEN-EN 1991-1-2 Belasting bij brand

NEN-EN 1991-1-3 Sneeuwbelasting

NEN-EN 1991-1-4 Windbelasting

NEN-EN 1991-1-5 Thermische belasting

NEN-EN 1991-1-7 Buitengewone belastingen

**Eurocode 2: Betonconstructies**

NEN-EN 1992-1-1 Algemene regels en regels voor gebouwen

NEN-EN 1992-1-2 Ontwerp en berekening van constructies bij brand

**Eurocode 3: Staalconstructies**

NEN-EN 1993-1-1 Algemene regels en regels voor gebouwen

NEN-EN 1993-1-2 Ontwerp en berekening van constructies bij brand

NEN-EN 1993-1-8 Ontwerp en berekening van verbindingen

NEN-EN 1993-1-10 Materiaalbaarheid en eigenschappen

**Eurocode 4: Staal-betonconstructies**

NEN-EN 1994-1-1 Algemene regels en regels voor gebouwen

NEN-EN 1994-1-2 Ontwerp en berekening van constructies bij brand

**Eurocode 5: Houtconstructies**

NEN-EN 1995-1-1 Algemene regels en regels voor gebouwen

NEN-EN 1995-1-2 Ontwerp en berekening van constructies bij brand

**Eurocode 6: Constructies van metselwerk**

NEN-EN 1996-1-1 Gemeenschappelijke regels voor constructies

NEN-EN 1995-1-2 Gemeenschappelijke regels voor constructies

**Eurocode 7: Geotechnisch ontwerp****Eurocode 8: Ontwerp en berekening van aardbevingsbestendige constructies****Eurocode 9: Ontwerp en berekening van aluminiumconstructies**

En de bijbehorende Nationale Bijlage

(In het rapport aangegeven als NB )

**Eenheden**

NEN 999 Het internationale Stelsel van Eenheden (SI)

Het bouwwerk staat in:

Plaats Hengelo

Gemeente Bronckhorst

Provincie Gelderland

Windgebied 3

|                                                      |    |           |
|------------------------------------------------------|----|-----------|
| NEN-EN 1990 Grondslagen van het constructief ontwerp | NB | Tabel 6-1 |
|------------------------------------------------------|----|-----------|

## Ontwerplevensduur

| klasse | jaren | toepassing                                                 | Tabel 2-1 |
|--------|-------|------------------------------------------------------------|-----------|
| 2      | 15    | Land en -tuinbouw, industriegebouw van 1 of 2 verdiepingen |           |

$$F_t = F_{t0} * (1 + ((1 - y_1) / 9) * \ln(t / t_{50})) \quad \ln(t / t_{50}) = -1,20$$

## Waarden van de y-factoren voor gebouwen

Algemeen

| Categorie | y <sub>0</sub> | y <sub>1</sub> | y <sub>2</sub> | Belasting     | Tabel A1-1 |
|-----------|----------------|----------------|----------------|---------------|------------|
| E         | 1,0            | 0,9            | 0,8            | opslagruimtes |            |

## Rekenwaarden van belastingen(EQU)(Groep A)

Statisch evenwicht

| Blijvende belastingen |                       | Veranderlijke belastingen |                    | Tabel A1-2A             |
|-----------------------|-----------------------|---------------------------|--------------------|-------------------------|
| Vergelijk.            | Ongunstig             | Gunstig                   | Overheersende      | Overige                 |
| 6.10                  | G <sub>kj,sub</sub> * | G <sub>kj,inf</sub> *     | Q <sub>k,1</sub> * | Q <sub>k,j</sub> *      |
|                       | 1,1                   | 0,9                       | 1,35               | 1,35 * y <sub>0,j</sub> |

UGT

## Rekenwaarden van belastingen(STR/GEO)(Groep B)

Elementen/Geotechnisch

| Blijvende belastingen |                       | Veranderlijke belastingen |                    | Tabel A1-2B             |
|-----------------------|-----------------------|---------------------------|--------------------|-------------------------|
| Vergelijk.            | Ongunstig             | Gunstig                   | Overheersende      | Overige                 |
| 6.10a                 | G <sub>kj,sub</sub> * | G <sub>kj,inf</sub> *     | Q <sub>k,1</sub> * | Q <sub>k,j</sub> *      |
| 6.10b                 | 1,22                  | 0,9                       | 1,35               | 1,35 * y <sub>0,j</sub> |
|                       | 1,1                   | 0,9                       |                    | 1,35 * y <sub>0,j</sub> |

UGT

## Rekenwaarden van belastingen(STR/GEO)(Groep C)

Elementen/Geotechnisch

| Blijvende belastingen |                       | Veranderlijke belastingen |                    | Tabel A1-2C                       |
|-----------------------|-----------------------|---------------------------|--------------------|-----------------------------------|
| Vergelijk.            | Ongunstig             | Gunstig                   | Overheersende      | Overige                           |
| 6.10                  | G <sub>kj,sub</sub> * | G <sub>kj,inf</sub> *     | Q <sub>k,1</sub> * | y <sub>0,j</sub> Q <sub>k,j</sub> |
|                       | 1,0                   | 1,0                       | 1,30               | 1,30 * y <sub>0,j</sub>           |

UGT

## Rekenwaarden van belastingen voor gebruik in belastingcombinaties

| Combinatie     | Blijvende belastingen G <sub>d</sub> |                     | Veranderlijke belastingen Q <sub>d</sub> |                                     | Tabel A4 |
|----------------|--------------------------------------|---------------------|------------------------------------------|-------------------------------------|----------|
|                | Ongunstig                            | Gunstig             | Overheersende                            | Overige                             |          |
| Karakteristiek | G <sub>kj,sub</sub>                  | G <sub>kj,inf</sub> | Q <sub>k,1</sub>                         | Q <sub>k,i</sub> y <sub>0,j</sub>   |          |
| Frequent       | G <sub>kj,sub</sub>                  | G <sub>kj,inf</sub> | Q <sub>k,1</sub> * y <sub>1,1</sub>      | Q <sub>k,i</sub> * y <sub>2,i</sub> |          |
| Quasi-blijvend | G <sub>kj,sub</sub>                  | G <sub>kj,inf</sub> | Q <sub>k,1</sub> * y <sub>2,1</sub>      | Q <sub>k,i</sub> * y <sub>2,i</sub> |          |

BGT

| factor voor belastingen |     | Betrouwbaarheidsklasse |                               | Tabel B3 |
|-------------------------|-----|------------------------|-------------------------------|----------|
| K <sub>FI</sub>         | 0,9 | RC1                    | Industriegebouw (1 of 2 verd) |          |

kruip y<sub>k</sub> = 0,6  
 anders y<sub>k</sub> = 1,0

unity check voldoet aangegeven met 0,99 UC ≤ 1  
 unity check voldoet niet aangegeven met 1,01 UC > 1

codes

| Beton  | grijze kopregel | Staal | blauwe kopregel | Hout  | gele kopregel | Metselwerk |
|--------|-----------------|-------|-----------------|-------|---------------|------------|
| Bb     | balk            | Ssp   | spant           | sp    | sporen        | md muurdam |
| Bko    | kolom           | St    | balk            | b     | balk          |            |
| pons   | pons            | Kolom | kolom           | ko    | kolommen      |            |
| V      | vloer           | Opl   | oplegging       | hsb   | hsbwanden     |            |
| W      | wand            | L     | lateien         | rb    | raveelbalk    |            |
| prefab | prefab          | O_    | onderslag       | ob    | onderslag     |            |
| F      | fundering       | L_    | ligger          | M     | muurplaat     |            |
| plaat  | plaat           | W_    | dakverband      | G     | gordingen     |            |
| poer   | poer            | B_    | windbok         | K     | keper         |            |
| Ke     | kelder          | D_    | drukker         | Spant | spant         |            |
|        |                 |       |                 | N     | nokgording    | A afdracht |

**Brand en Stabiliteit**

Alle (direct of indirect) vloerdragende stalen onderdelen 60 min. brandwerend bekleder

De stabiliteit van het gebouw wordt verzorgd door:  
Windverbanden in de gevel en het dakvlak.

**Gewichten en belastingen van de constructie bouwdelen****Begane grond 1 1**

Peilmaat :

**0**

180 Vloer op zand 180mm

$$= 4,32 \text{ kN/m}^2$$

$$G_k = 4,32 \text{ kN/m}^2$$

geen scheidingswanden 0,00 +

$$\psi_0 = 0,99999$$

Opgelegde belasting 3 =

$$q_k = 20,0 \text{ kN/m}^2$$

$$\psi_1 = 0,9$$

Puntlast op 0,5m \* 0,5m

$$Q_k = 75,0 \text{ kN}$$

$$\psi_2 = 0,8$$

**Platdak 1 14****Staaldak**

$$\text{Dakbedekking} = 0,047 \text{ kN/m}^2$$

$$\text{Isolatie (PIR 80 mm)} = 0,024 \text{ kN/m}^2$$

$$\text{Geprofileerde warmdakplaat SAB 106R+/750 P3-ZZ} = 0,089 \text{ kN/m}^2 \quad (\text{min. 0,75 mm dik})$$

$$\text{Verbanden} = 0,030 \text{ kN/m}^2$$

$$\text{Cannalurevulling} = 0,060 \text{ kN/m}^2$$

$$G_k = 0,250 \text{ kN/m}^2$$

$$\text{Opgelegde belasting pers.} = 1,00 \text{ kN/m}^2 \quad (\text{over } 10 \text{ m}^2)$$

|            |                   |                             |      |      |            |                |  |
|------------|-------------------|-----------------------------|------|------|------------|----------------|--|
| tabel NB.1 | Windgebied III    | basiswindsnelheid $v_{b,0}$ | =    | 24,5 | m/s        |                |  |
|            | Gebouwhoogte: $z$ | =                           | 7,37 | m    | $z_0$ in m | $z_{min}$ in m |  |
|            | Terreincategorie: | Bebouwd gebied              |      |      | 0,500      | 7              |  |

$$[4.8] \quad q_p(z) = (1+7 \cdot I_v(z)) * 0,50 * \rho * v_m^2(z) = 0,49 \text{ kN/m}^2$$

$$\text{Gebouwbreedte} = 108 \text{ m}$$

$$\text{Gebouwdiepte} = 40 \text{ m}$$

**Dakconstructie**

$$\text{Dakhelling} = 1,000^\circ$$

In grondvlak

$$G_k = 0,25 \text{ kN/m}^2$$

$$q_k = 0,56 \text{ kN/m}^2$$

$$= 0,56 \text{ kN/m}^2$$

[5.1]

**s(1)**

Tabel 7.2

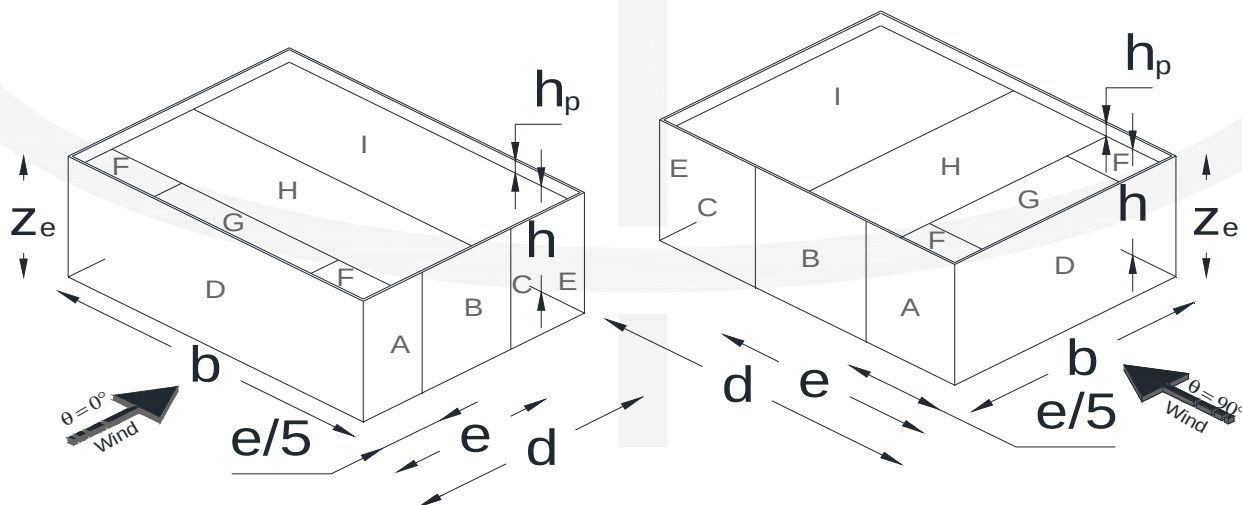
Wind

 $\Theta = 0^\circ$  $\Theta = 0^\circ$  $\Theta = 90^\circ$  $\Theta = 90^\circ$ 

| $C_{pe,10}$ | a | $C_{pe,1}$ | $C_{pe,10}$ | b | $C_{pe,1}$ | $C_{pe,10}$ | a | $C_{pe,1}$ | b | $C_{pe,10}$ | $C_{pe,1}$ |
|-------------|---|------------|-------------|---|------------|-------------|---|------------|---|-------------|------------|
| -1,20       | F | -1,80      | -1,20       | F | -1,80      | -1,20       | F | -1,80      | F | -1,20       | -1,80      |
| -0,80       | G | -1,40      | -0,80       | G | -1,40      | -0,80       | G | -1,40      | G | -0,80       | -1,40      |
| -0,70       | H | -1,20      | -0,70       | H | -1,20      | -0,70       | H | -1,20      | H | -0,70       | -1,20      |
| 0,20        | I | -0,20      | -0,20       | I | -0,50      | 0,20        | I | -0,20      | I | -0,20       | -0,50      |

hoogte

$$= 7,37 \text{ m}$$



Tabel 7.5

Wind Gevel

| $C_{pe,10}$ |   | $C_{pe,1}$ |
|-------------|---|------------|
| -1,20       | A | -1,40      |
| -0,80       | B | -1,10      |
| -0,50       | C | -0,50      |
| 0,80        | D | 1,00       |
| -0,50       | E | -0,50      |

hoogte

$$= 7,37 \text{ m}$$

Gevel: Glad (bijvoorbeeld staal of glad beton)

$$\text{Wrijving} = C_{fr} * q_p(z_e) = 0,01 * 0,49 = 0,0049 \text{ kN/m}^2$$

$$\text{Borstwering} = 1170$$

**Sneeuwophoping**

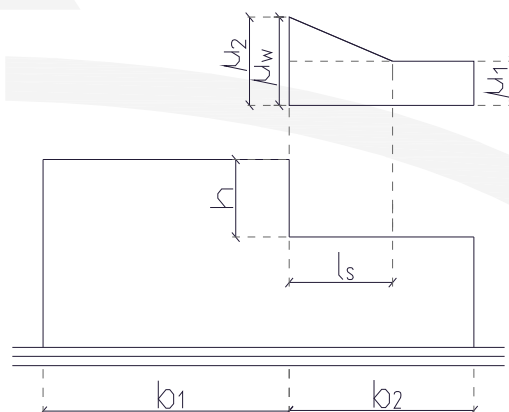
Peilmaat :

**6200**

Permanent

 $G_k = 0,00 \text{ kN/m}^2$ 

|                            |   |                        |
|----------------------------|---|------------------------|
| $s_n$                      | = | 0,53                   |
| $b_1$                      | = | 25880 mm               |
| $b_2$                      | = | 19995 mm               |
| $h$                        | = | 975 mm                 |
| $\alpha$                   | = | $1^\circ$              |
| $\alpha_{\text{lage dak}}$ | = | $1^\circ$              |
| $\mu_1$                    | = | 0,80                   |
| $\mu_s$                    | = | 0,00                   |
| $\mu_w$                    | = | 3,71                   |
| $\mu_2$                    | = | 3,71                   |
| $l_s$                      | = | 5000 mm                |
| $sn_1$                     | = | 0,42 kN/m <sup>2</sup> |
| $sn_2$                     | = | 1,95 kN/m <sup>2</sup> |



Veranderlijke belasting

 $q_k = 1,95 \text{ kN/m}^2$  $\psi_0 = 0$  $\psi_1 = 0$  $\psi_2 = 0$ **Gevel\_205\_7**

Binnendoos isolatie buitenplaat

 $0,25 \text{ kN/m}^2$

## Kolomvoetplaat 4 ankers

## Kolomvoet

## Krachten:

|           |   |          |
|-----------|---|----------|
| $N_{min}$ | = | -75,0 kN |
| $N_{max}$ | = | 190,6 kN |
| $V_{Ed}$  | = | 7,9 kN   |
| $M_{Ed}$  | = | 1,6 kNm  |

Een drukzone en een trekzone (basisgeval 2)

HE180A

Staalkwaliteit: S 235

## Voetplaat:

|       |   |                  |
|-------|---|------------------|
| $x1$  | = | 0 mm             |
| $x2$  | = | 0 mm             |
| $y1$  | = | 0 mm             |
| $y2$  | = | 0 mm             |
| $h_k$ | = | 171 mm           |
| $b_k$ | = | 180 mm           |
| $b_v$ | = | 180 mm           |
| $l_v$ | = | 171 mm           |
| $t_p$ | = | 10 mm            |
| $p1$  | = | 90 mm (// lijf)  |
| $p2$  | = | 90 mm (// flens) |

## Betonkwaliteit:

|            |   |                      |
|------------|---|----------------------|
| Poer/stiep | = | C20/25               |
| $f_{ck}$   | = | 20 N/mm <sup>2</sup> |
| $f_{cd}$   | = | 13 N/mm <sup>2</sup> |

## Stiep:

|            |   |                      |
|------------|---|----------------------|
| $b_s$      | = | 300 mm               |
| $l_s$      | = | 300 mm               |
| $h_s$      | = | 500 mm               |
| stelruimte | = | 30 mm (ondersabelen) |
| $\beta_j$  | = | 0,67                 |

|           |   |        |                         |                             |   |          |                     |
|-----------|---|--------|-------------------------|-----------------------------|---|----------|---------------------|
| $Z_T$     | = | 45 mm  | $(h_a - t_f)$           | $e$                         | = | 8,3 mm   | $(M_{Ed} / N_{Ed})$ |
| $Z_I$     | = | 162 mm | $(0,5 * p_{ankerfst.})$ | $M_{Ed} / Z_{II}$           | = | 12,5 mm  |                     |
| $Z_{II}$  | = | 126 mm | $(0,5 * Z_I + Z_T)$     | $N_{t;Ed;2 \text{ ankers}}$ | = | -50,0 kN |                     |
| $Z_{III}$ | = | 90 mm  | $(2 * Z_T)$             | $N_{c;Ed}$                  | = | 77,3 kN  |                     |

|          |   |                                     |   |                        |       |   |      |
|----------|---|-------------------------------------|---|------------------------|-------|---|------|
| $f_{jd}$ | = | $\beta_j * k_d * f_{cd}$            | = | 15,2 N/mm <sup>2</sup> | $k_d$ | = | 1,71 |
| $c$      | = | $t * (f_{yd} / (3 * f_{jd}))^{0,5}$ | = | 22,7 mm                |       |   |      |

## Drukoppervlak op de stiep

|            |   |                      |
|------------|---|----------------------|
| $A_{c0;1}$ | = | 5801 mm <sup>2</sup> |
| $A_{c0;2}$ | = | 5483 mm <sup>2</sup> |
| $A_{c0;3}$ | = | 5801 mm <sup>2</sup> |

## Drukoppervlak op fundatienivo

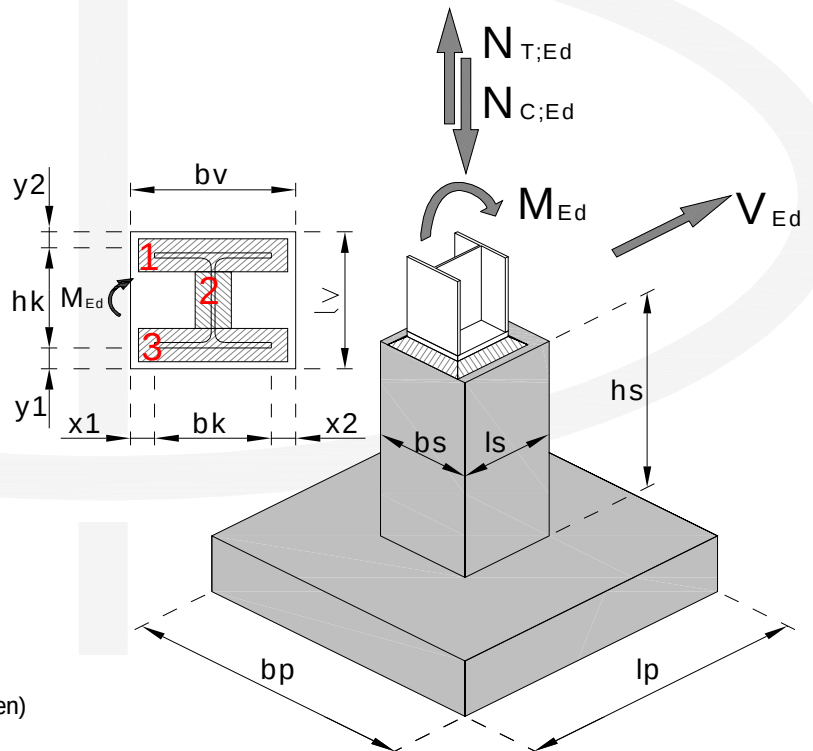
|            |   |       |
|------------|---|-------|
| $A_{c1;1}$ | = | 9669  |
| $A_{c1;2}$ | = | 16448 |
| $A_{c1;3}$ | = | 9669  |

(drukzijde moment)

|                  |   |          |                         |
|------------------|---|----------|-------------------------|
| $F_{C;Rd;1+2+3}$ | = | 259,0 kN | 11,16 N/mm <sup>2</sup> |
| $F_{C;Rd;1}$     | = | 88,0 kN  | 13,32 N/mm <sup>2</sup> |

0,74 UC ≤ 1

0,88 UC ≤ 1





## Splijtwapening drukzijde

$$F_c / A_{c0} < f_{cd} \quad F_c / A_{pr,fl} = 13,32 \text{ N/mm}^2 > f_{cd} = 13,30 \text{ N/mm}^2$$

$$F_c / A_{c1} < 5 \text{ N/mm}^2 \quad F_c / A_{c1} = 2,12 \text{ N/mm}^2 \leq 5,00 \text{ N/mm}^2$$

Geen splijtwapening nodig voor de drukzijde.

## Splijtwapening

$$F_{Ed} = \text{n.v.t.} \quad \text{kN}$$

$$F_s = \text{n.v.t.} \quad \text{kN}$$

$$A_{ben.} = \text{n.v.t.} \quad \text{mm}^2$$

Staven = n.v.t. st.

## Controle ankers op trek

Sterkteklasse anker: 4.6

Draad conform NEN-EN 1090

Gekozen stekeinden: M 16

$$f_{y;d;rep} = 240 \text{ N/mm}^2 \quad N_{t;Ed;2 \text{ ankers}} = 50,0 \text{ kN}$$

$$f_{ub;rep} = 400 \text{ N/mm}^2 \quad f_{ck} = 20 \text{ N/mm}^2$$

$$A_s = 157 \text{ mm}^2 \quad \eta_2 = 1,00$$

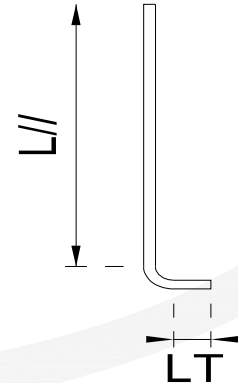
$$Y_{M2} = 1,25 \quad \sigma_{y;d} = 159,3 \text{ N/mm}^2$$

$$n_{trek} = 2 \text{ st.} \quad c_{dekking} = 60 \text{ mm}$$

$$d = 16 \text{ mm} \quad k_{randafst.} = 1,24$$

$$F_{T;RD;ank.} = (0,9 * F_{ub} * A_s) / Y_{M2} \quad L_{//} = 331 \text{ mm}$$

$$F_{T;RD;ank.} = 45,2 \text{ kN} \quad L_T = 50 \text{ mm}$$



$$bv = 180 \text{ mm} \quad \lambda_1 = 0,45 \text{ mm}$$

$$e = 45 \text{ mm} \quad \lambda_2 = 0,32 \text{ mm}$$

$$p1 = 90 \text{ mm} \quad \alpha = 5,47$$

$$p2 = 90 \text{ mm}$$

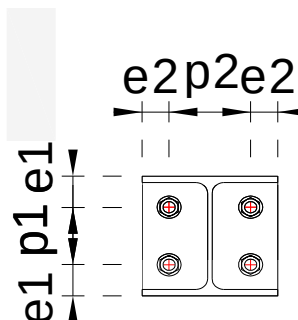
$$m = 37 \text{ mm}$$

$$m2 = 26 \text{ mm}$$

$$n = 45,00 \text{ mm}$$

$$a_{las} = 4 \text{ mm}$$

$$f_y = 235 \text{ N/mm}^2$$

5,474 = Eindwaarde voor  $\alpha$ 

$$l_{eff,nc} = 298 \text{ mm}$$

$$M_{pl;1-2;Rd} = 2,7 \text{ kNm (plastisch moment voor bezwijkmodel 1 en 2)}$$

$$F_{T;1;Rd} = 119,1 \text{ kN (} F_{t,max} \text{ model 1 op één T-stuk, dus twee ankers, wrikkrachten niet beschouwd)}$$

$$F_{T;2;Rd} = 54,8 \text{ kN (} F_{t,max} \text{ model 2 op één T-stuk, dus twee ankers, inclusief wrikkrachten)}$$

$$F_{T;Rd} = 90,4 \text{ kN (} F_{t,max} \text{ model 3 op één T-stuk, dus twee ankers, er zijn geen wrikkrachten)}$$

$$Pons = 260,6 \text{ kN}$$

$$N_{t;Ed;2 \text{ ankers}} = 50,0 \text{ kN (} F_{t,max,optredend} \text{ op twee ankers)}$$

0,91 UC ≤ 1

## Dwarskracht

$$F_{v;Rd} = 245,3 \text{ kN}$$

$$N_{t;Ed;2 \text{ ankers}} / F_{v;Rd} = 0,20 < 0,50$$

Geen interactie tussen moment en dwarskracht.

## Controle anker op afschuiving

$$V_{Ed} = 7,9 \text{ kN} \quad f_{y;b;rep} = 240 \text{ N/mm}^2$$

$$\text{Sterkteklasse anker} = 4.6 \quad f_{ub;rep} = 400 \text{ N/mm}^2$$

$$\text{Gekozen stekeinden} = M 16 \quad f_{ub} = 360 \text{ N/mm}^2$$

$$A_s = 157 \text{ mm}^2 \quad F_{2,vb;Rd} = (a_b * F_{ub} * A_s) / Y_{M2}$$

$$Y_{M2} = 1,25 \quad F_{2,vb;Rd} = 18,5 \text{ kN}$$

$$n = 4 \text{ st.} \quad F_{v;Rd} = 74,0 \text{ kN}$$

0,11 UC ≤ 1

**Algemene gegevens**

|            |   |          |                       |   |         |             |
|------------|---|----------|-----------------------|---|---------|-------------|
| breedte    | = | 22850 mm | spantafstand          | = | 4570 mm |             |
| diepte     | = | 19920 mm | drukkers h.o.h.       | = | 4980 mm | (grondvlak) |
| hoogte     | = | 6200 mm  | borstwering ( $h_p$ ) | = | 1170 mm |             |
| dakhelling | = | 0,91 °   | afschot               | = | 159 mm  |             |
| isolatie   | = | 120 mm   | dakbedekking          | = | 4 mm    |             |
| kim        | = | 80 mm    | dakplaat              | = | 106 mm  |             |

Aantal stramien:

|                      |       |            |
|----------------------|-------|------------|
| Verticale stramien   | 6 st. | (5 velden) |
| Horizontale stramien | 5 st. | (4 velden) |

**Windkracht t.b.v. gevelverband****Dwarsstabiliteit**Windbelasting  $Q = 0^\circ$ 

| Gevels       | breedte |   | hoogte |   | stuwdruk |   | c    |   |      |            |
|--------------|---------|---|--------|---|----------|---|------|---|------|------------|
| voor         | 22,85   | * | 7,37   | * | 0,49     | * | 0,80 | / | 1,68 | = 39,03 kN |
| borstwering  | 22,85   | * | 1,17   | * | 0,49     | * | 0,50 | / | 0,91 | = 7,13 kN  |
| achter       | 22,85   | * | 7,37   | * | 0,49     | * | 0,50 | / | 1,68 | = 24,39 kN |
| borstwering  | 22,85   | * | 1,17   | * | 0,49     | * | 0,80 | / | 0,91 | = 11,41 kN |
| wrijving gvl | 19,92   | * | 7,37   | * | 0,49     | * | 0,01 | / | 1,68 | = 0,43 kN  |
| borstwering  | 19,92   | * | 1,17   | * | 0,49     | * | 0,01 | / | 0,91 | = 0,12 kN  |

| Dak      | breedte |   | diepte |   | stuwdruk |   | c    |   |      |           |
|----------|---------|---|--------|---|----------|---|------|---|------|-----------|
| Wrijving | 22,85   | * | 19,92  | * | 0,49     | * | 0,01 | / | 2,00 | = 1,11 kN |

|                           |   |       |   |      |   |           |
|---------------------------|---|-------|---|------|---|-----------|
| Totaal ter hoogte dakvlak | = | 84,17 | * | 1,35 | = | 113,63 kN |
| 1 <sup>e</sup> windbok    | = | 11,43 | * | 4,97 | = | 56,82 kN  |
| 2 <sup>e</sup> windbok    | = | 11,43 | * | 4,97 | = | 56,82 kN  |

Invoeren in TechnoSoft = 42,09 kN

|        | breedte (m) |   | kracht (kN) |   |         |
|--------|-------------|---|-------------|---|---------|
| As A   |             |   | 0,74        |   | (gevel) |
| As A-B | 4,90        | * | 4,91        | = | 24,05   |
| As B-C | 4,90        | * | 4,91        | = | 24,05   |
| As C-D | 4,35        | * | 4,91        | = | 21,35   |
| As D-E | 4,35        | * | 4,91        | = | 21,35   |
| As E-F | 4,35        | * | 4,91        | = | 21,35   |
| As F   |             |   | 0,74        |   | (gevel) |

|        |   |      |   |        |   |           |
|--------|---|------|---|--------|---|-----------|
| 112,15 | + | 1,48 | = | totaal | = | 113,63 kN |
|--------|---|------|---|--------|---|-----------|

### Analyse normaalkrachten dakverbandstaven langsijde

| Overzicht windverbanden |   |       |    | Drukkers hoh | Windverband | Bouten |
|-------------------------|---|-------|----|--------------|-------------|--------|
| Windverband As A-B      | = | 78,67 | kN | 4,98         | L60/60/6    | 2 M16  |
| Windverband As B-C      | = | 44,93 | kN | 4,98         | L50/50/5    | 2 M16  |
| Windverband As C-D      | = | 17,76 | kN | 4,98         | L50/50/5    | 2 M16  |
| Windverband As D-E      | = | 46,11 | kN | 4,98         | L50/50/5    | 2 M16  |
| Windverband As E-F      | = | 74,45 | kN | 4,98         | L60/60/6    | 2 M16  |

|               |   |       |   |      |            |       |   |       |     |
|---------------|---|-------|---|------|------------|-------|---|-------|-----|
| Randdrukker   |   |       |   |      |            |       | = | 55,17 | kN  |
| Tussendrukker |   |       |   |      | 1 x w.v.b. |       | = | 11,68 | kN  |
| $M_{y;Ed}$    | = | 0,125 | * | 5,12 | *          | 24,01 | = | 15,38 | kNm |
| $M_{z;Ed}$    | = | 0,125 | * | 1,62 | *          | 24,01 | = | 4,86  | kNm |

### Profiel tussendrukker

CF RHS 70x70x3

Staalkwaliteit: S 235

### 3-6.3.1 Knikstabiliteit

TD\_hb

$$N_{Ed} = 11,7 \text{ kN}$$

$$L = 4900 \text{ mm}$$

Doorsnede in klasse: 1

Buisprofielen Koudgevormd

Knik om de as: Elke as  
Knikkromme: cInperfectiefactor  $\alpha = 0,49$ Statisch systeem: Boven en onder een scharnier,  
uiteinden kunnen niet ten opzichte van elkaar horizontaal verplaatsten.

$$L_{cr} (=L) = 4900 \text{ mm}$$

$$N_{cr} = \frac{\pi^2 * E_d * I_{y/z}}{L_{cr}^2}$$

$$N_{cr} = \frac{9,87 * 210000 * 574900}{24010000} = 50 \text{ kN}$$

$$\lambda = (A * f_y / N_{cr})^{0,5}$$

$$\lambda = 1,92$$

$$\Phi = 0,5 * (1 + \alpha * (\lambda - 0,2) + \lambda^2)$$

$$\Phi = 2,77$$

$$X = 1 / (\Phi + (\Phi^2 - \lambda^2)^{0,5}) \leq 1,00$$

$$X = 0,21 \leq 1,00$$

$$X = 0,21$$

$$N_{b,Rd} = X * A * f_y / \gamma_{M1}$$

$$N_{b,Rd} = 38,5 \text{ kN}$$

$$N_{Ed} / N_{b,Rd} = 0,30 \text{ UC} \leq 1$$

**Profiel randdrukker**

CF RHS 120x120x4

Staalkwaliteit: S 235

**3-6.2.9 Buiging en normaalkracht in de sterke richting**

RD\_hb

$$N_{pl,Rd} = 426,5 \text{ kN}$$

$$N_{Ed} \leq 0,25 * N_{pl,Rd} \quad 55,17 \leq 106,6$$

$$N_{Ed} \leq 0,5 * h_w * t_w * f_y / \gamma_{M0} \quad 55,17 \leq 52,6$$

Voldoet

Effect normaalkracht moet worden meegenomen!  
Er is geen rekening gehouden met gataftrek.

$$M_{pl,y,Rd} = W_{pl} * f_y / \gamma_{M0} = 78330,0 * 235 / 1 = 18,41 \text{ kNm}$$

$$n = N_{Ed} / N_{pl,Rd} = 55,2 / 426,5 = 0,13$$

$$a = (A - 2 * b * t_f) / A \leq 0,5$$

$$a = 855,0 / 1815,0 \leq 0,5 = 0,47$$

$$M_{N,y,Rd} = M_{pl,y,Rd} * (1 - n) / (1 - 0,5 * a) \leq M_{pl,y,Rd}$$

$$M_{N,y,Rd} = 18,41 * 0,87 / 0,76 \leq 18,41$$

$$M_{N,y,Rd} = 18,41 \text{ kNm}$$

$$M_{Ed} / M_{N,Rd} = 0,84 \text{ UC} \leq 1$$

## 3-6.3.1 Knikstabiliteit sterke richting

RD\_hb

Doorsnede in klasse: 1

Buisprofielen Koudgevormd

Knik om de as: Elke as

Knikkromme: c

Inperfectiefactor  $\alpha$  = 0,49

Statisch systeem: Boven en onder een scharnier,  
uiteinden kunnen niet ten opzichte van elkaar horizontaal verplaatsten.

 $L_{cr}$  (=L) = 4900 mm

$$N_{cr} = \frac{\pi^2 * E_d * I_{y/z}}{L_{cr}^2}$$

$$N_{cr} = \frac{9,87 * 210000 * 4022000}{24010000} = 347 \text{ kN}$$

$$\lambda = (A * f_y / N_{cr})^{0,5}$$

$$\lambda = 1,11$$

$$\Phi = 0,5 * (1 + \alpha * (\lambda - 0,2) + \lambda^2)$$

$$\Phi = 1,34$$

$$X = 1 / (\Phi + (\Phi^2 - \lambda^2)^{0,5}) \leq 1,00$$

$$X = 0,48 \leq 1,00$$

$$X = 0,48$$

$$N_{b,Rd} = X * A * f_y / \gamma_{M1}$$

$$N_{b,Rd} = 204,7 \text{ kN}$$

$$N_{Ed} / N_{b,Rd} = 0,27 \text{ UC} \leq 1$$

## 3-6.2.9 Buiging en normaalkracht in de zwakke richting

RD\_hb

$$N_{pl;Rd} = 426,5 \text{ kN}$$

$$N_{Ed} \leq h_w * t_w * f_y / \gamma_{M0} \quad 55,1731246 \leq 105,28$$

Effect normaalkracht hoeft niet worden meegenomen, zie 6.2.5 buiging!

Er is geen rekening gehouden met gataftrek.

$$M_{pl;z;Rd} = W_{pl} * f_y / \gamma_{M0} = 18,41 \text{ kNm}$$

$$n = N_{Ed} / N_{pl;Rd} = 55,2 / 426,5 = 0,13$$

$$a = (A - 2 * b * t_f) / A \leq 0,5 = 0,47$$

$$M_{N;z;Rd} = M_{pl;z;Rd} = 18,41 \text{ kNm}$$

$$M_{Ed} / M_{N;Rd} = 0,26 \text{ UC} \leq 1$$

[6.37]

## 3-6.3.1 Knikstabiliteit zwakke richting

RD\_hb

Doorsnede in klasse: 1

Buisprofielen Koudgevormd

Knik om de as: Elke as  
Knikkromme: cInperfectiefactor  $\alpha$  = 0,49Statisch systeem: Boven en onder een scharnier,  
uiteinden kunnen niet ten opzichte van elkaar horizontaal verplaatsten. $L_{cr}$  (=L) = 4900 mm

$$N_{cr} = \frac{\pi^2 * E_d * I_{y/z}}{L_{cr}^2}$$

$$N_{cr} = \frac{9,87 * 210000 * 4022000}{24010000} = 347 \text{ kN}$$

$$\lambda = (A * f_y / N_{cr})^{0,5}$$

$$\lambda = 1,11$$

$$\Phi = 0,5 * (1 + \alpha * (\lambda - 0,2) + \lambda^2)$$

$$\Phi = 1,34$$

$$X = 1 / (\Phi + (\Phi^2 - \lambda^2)^{0,5}) \leq 1,00$$

$$X = 0,48 \leq 1,00$$

$$X = 0,48$$

$$N_{b,Rd} = X * A * f_y / \gamma_{M1}$$

$$N_{b,Rd} = 204,7 \text{ kN}$$

$$N_{Ed} / N_{b,Rd} = 0,27 \text{ UC} \leq 1$$

RD\_hb

## 3-6.2.9 Tweeassige buiging

Doorsnede in klasse: 1

L = 4900 mm

 $M_{y,Ed}$  = 15,4 kNm  $n$  = 0,13 $M_{z,Ed}$  = 4,9 kNm  $\alpha$  = 2,00 $N_{Ed}$  = 55,2 kN  $\beta$  = 2,00

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} \alpha + \frac{M_{z,Ed}}{M_{N,z,Rd}} \beta = 0,77$$

$$0,77 \text{ UC} \leq 1$$



**Krachten windbok**

1e windbok op as A

|                |               |                |   |       |
|----------------|---------------|----------------|---|-------|
| Profiel        | 80 * 8        | e <sub>1</sub> | = | 45 mm |
|                |               | e <sub>2</sub> | = | 40 mm |
| Schetsplaat    | 150 * 150 * 8 | e <sub>1</sub> | = | 45 mm |
|                |               | e <sub>2</sub> | = | 75 mm |
| Gekozen bouten | 2 * M16 (8.8) | h.o.h.         | = | 70 mm |

Maatgevend: Afschuiving van de bouten  
 Hoekbout schetsplaat

0,79 UC ≤ 1

0,40 UC ≤ 1

1e windbok op as A (1 velds)

|                        |   |      |    |
|------------------------|---|------|----|
| h                      | = | 6200 | mm |
| b                      | = | 4600 | mm |
| L <sub>windverb.</sub> | = | 7720 | mm |

|             |   |                     |
|-------------|---|---------------------|
| Kolom       | = | 76,6 kN (druk/trek) |
| Hor. ligger | = | 56,8 kN             |
| Windbok     | = | 95,4 kN             |

Zonder veiligheid

56,7 kN

42,1 kN

70,6 kN

2e windbok op as F

|                |               |                |   |       |
|----------------|---------------|----------------|---|-------|
| Profiel        | 80 * 8        | e <sub>1</sub> | = | 45 mm |
|                |               | e <sub>2</sub> | = | 40 mm |
| Schetsplaat    | 150 * 150 * 8 | e <sub>1</sub> | = | 45 mm |
|                |               | e <sub>2</sub> | = | 75 mm |
| Gekozen bouten | 2 * M16 (8.8) | h.o.h.         | = | 70 mm |

Maatgevend: Afschuiving van de bouten  
 Hoekbout schetsplaat

0,75 UC ≤ 1

0,38 UC ≤ 1

2e windbok op as F (1 velds)

|                        |   |      |    |
|------------------------|---|------|----|
| h                      | = | 6200 | mm |
| b                      | = | 4980 | mm |
| L <sub>windverb.</sub> | = | 7952 | mm |

|             |   |                     |
|-------------|---|---------------------|
| Kolom       | = | 70,7 kN (druk/trek) |
| Hor. ligger | = | 56,8 kN             |
| Windbok     | = | 90,7 kN             |

Zonder veiligheid

52,4 kN

42,1 kN

67,2 kN

**Detailberekening windverband (1e windbok op as A)****Koppeling Strip**

$$N_{t,Ed} = 95 \text{ kN}$$

Gekozen bouten 2 \* M16

Bouten: (8.8)

$$A_{bout} = 201 \text{ mm}^2$$

$$f_y = 235 \text{ N/mm}^2 \quad (S235)$$

$$A_{s,bout} = 157 \text{ mm}^2$$

$$f_u = 360 \text{ N/mm}^2$$

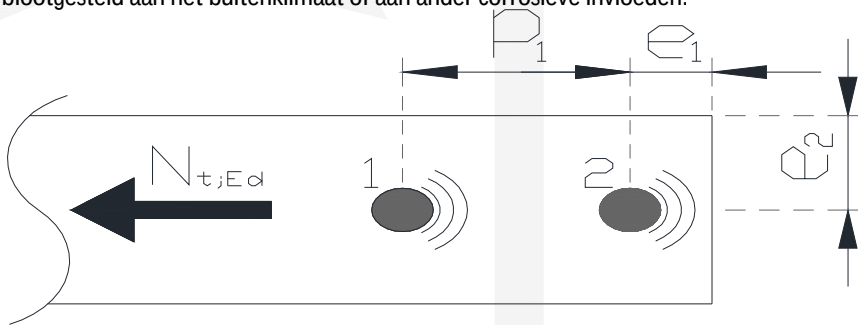
$$d_0 = 18 \text{ mm}$$

$$f_{y,b} = 640 \text{ N/mm}^2$$

$$p_1 = 70 \text{ mm}$$

$$f_{u,b} = 800 \text{ N/mm}^2$$

Staal blootgesteld aan het buitenklimaat of aan ander corrosieve invloeden.

**Schetsplaat**

Afmeting: 150 \* 150 \* 8

$$e_1 = 45 \text{ mm}$$

$$A = 1200 \text{ mm}^2$$

$$e_2 = 75 \text{ mm}$$

$$A_{netto} = 1056 \text{ mm}^2$$

Bruto doorsnede:

$$N_{pl,Rd} = \frac{A * f_y}{\gamma_{M0}} = 282,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl,Rd} = \frac{0,9 * A_{net} * f_u}{\gamma_{M2}} = 273,7 \text{ kN}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b,p1,Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b,p2,Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

$$F_{b,Rd} = 169,0 \text{ kN}$$

**Bouten**

Afschuiving bouten:

Afschuifvlak door de draad van de bout.

$$\alpha_v = 0,6$$

$$F_{v,Rd} = \frac{\alpha_v * f_{ub} * A_s}{\gamma_{M2}} = 60,3 \text{ kN (per bout)}$$

**Strip**

$$\begin{aligned}
 \text{Afmeting:} &= 80 * 8 & e_1 &= 45 \text{ mm} \\
 A &= 640 \text{ mm}^2 & e_2 &= 40 \text{ mm} \\
 A_{\text{netto}} &= 496 \text{ mm}^2
 \end{aligned}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b;p1;Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b;p2;Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$F_{b;Rd} = 169,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl;Rd} = \frac{0,9 * A_{\text{net}} * f_u}{\gamma_{M2}} = 128,6 \text{ kN}$$

Bruto doorsnede:

$$N_{pl;Rd} = \frac{A * f_y}{\gamma_{M0}} = 150,4 \text{ kN}$$

Alternatief: rondstaal (uitgaande van dezelfde UC als de hiervoor berekende strip)

$$\begin{aligned}
 A_{\text{ben.}} &= 547,1 \text{ mm}^2 \\
 \emptyset_{\text{min}} &= 26,4 \text{ mm} & \emptyset_{\text{toeg}} &= 27 \text{ mm}
 \end{aligned}$$

**Overzicht**

|                            |   |          |
|----------------------------|---|----------|
| Brutodoorsnede schetsplaat | = | 282,0 kN |
| Nettadoorsnede schetsplaat | = | 273,7 kN |
| Stuik bouten schetsplaat   | = | 169,0 kN |
| Afschuiving van de bouten  | = | 120,6 kN |
| Stuik bouten Strip         | = | 169,0 kN |
| Nettadoorsnede Strip       | = | 128,6 kN |
| Brutodoorsnede Strip       | = | 150,4 kN |

$$N_{t;Ed} = 95 \text{ kN}$$

$$N_{E;Rd} = 121 \text{ kN}$$

$$0,79 \text{ UC} \leq 1$$

**Hoekbout schetsplaat****Toetsing op stuik**

$$N_{t,Ed} = 95 \text{ kN}$$

Gekozen bout 2 \* M16

Bouten: (8.8)

$$d_0 = 18 \text{ mm}$$

$$f_u = 360 \text{ N/mm}^2$$

$$t_{\text{schetspl.}} = 8 \text{ mm}$$

$$f_{u;b} = 800 \text{ N/mm}^2$$

$$h_{\text{windbok}} = 6200 \text{ mm}$$

$$b_{\text{windbok}} = 4980 \text{ mm}$$

$$\alpha_{\text{windverb.}} = 51^\circ$$

$$F_{Ed} = 48 \text{ kN}$$

$$F_{h,Ed} = 30 \text{ kN}$$

$$F_{v,Ed} = 37 \text{ kN}$$

$$e_1 = 60 \text{ mm}$$

$$e_2 = 60 \text{ mm}$$

Stuik schetsplaat horizontaal

$$\alpha_{b,h} = \frac{e_1}{\frac{3 * d_0}{2,8 * e_2}} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{d_0}{1,7} \leq 2,5 = 2,5$$

$$F_{b,h;Rd} = \frac{k_1 * \alpha_{b,h} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$0,32 \text{ UC} \leq 1$$

Stuik schetsplaat verticaal

$$\alpha_{b,v} = \frac{e_2}{\frac{3 * d_0}{2,8 * e_2}} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{d_0}{1,7} \leq 2,5 = 2,5$$

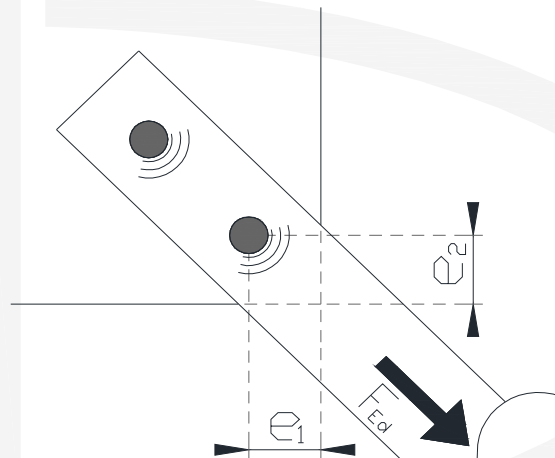
$$F_{b,v;Rd} = \frac{k_1 * \alpha_{b,v} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$0,40 \text{ UC} \leq 1$$

Toetsing met de elliptische methode

Wordt niet geëist in de Eurocode!

$$(UC_h^2 + UC_v^2)^{0,5} = 0,52 \text{ UC} \leq 1$$



**Detailberekening windverband (2e windbok op as F)****Koppeling Strip**

$$N_{t,Ed} = 91 \text{ kN}$$

Gekozen bouten 2 \* M16

Bouten: (8.8)

$$A_{bout} = 201 \text{ mm}^2$$

$$f_y = 235 \text{ N/mm}^2 \quad (S235)$$

$$A_{s,bout} = 157 \text{ mm}^2$$

$$f_u = 360 \text{ N/mm}^2$$

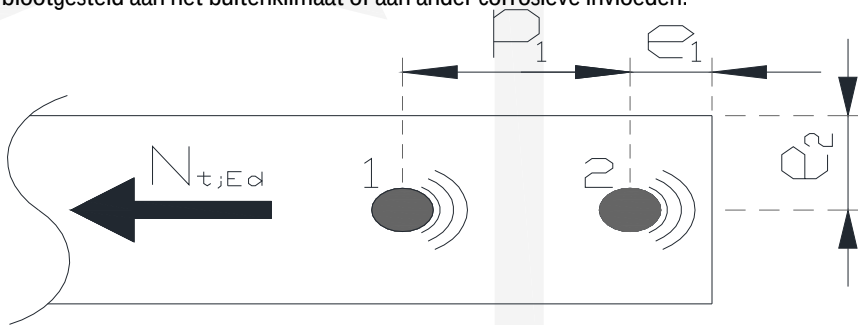
$$d_0 = 18 \text{ mm}$$

$$f_{y,b} = 640 \text{ N/mm}^2$$

$$p_1 = 70 \text{ mm}$$

$$f_{u,b} = 800 \text{ N/mm}^2$$

Staal blootgesteld aan het buitenklimaat of aan ander corrosieve invloeden.

**Schetsplaat**

Afmeting: 150 \* 150 \* 8

$$e_1 = 45 \text{ mm}$$

$$A = 1200 \text{ mm}^2$$

$$e_2 = 75 \text{ mm}$$

$$A_{netto} = 1056 \text{ mm}^2$$

Bruto doorsnede:

$$N_{pl,Rd} = \frac{A * f_y}{\gamma_{M0}} = 282,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl,Rd} = \frac{0,9 * A_{net} * f_u}{\gamma_{M2}} = 273,7 \text{ kN}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b,p1,Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b,p2,Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

$$F_{b,Rd} = 169,0 \text{ kN}$$

**Bouten**

Afschuiving bouten:

Afschuifvlak door de draad van de bout.

$$\alpha_v = 0,6$$

$$F_{v,Rd} = \frac{\alpha_v * f_{ub} * A_s}{\gamma_{M2}} = 60,3 \text{ kN (per bout)}$$

**Strip**

$$\begin{aligned}
 \text{Afmeting:} &= 80 * 8 & e_1 &= 45 \text{ mm} \\
 A &= 640 \text{ mm}^2 & e_2 &= 40 \text{ mm} \\
 A_{\text{netto}} &= 496 \text{ mm}^2
 \end{aligned}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b;p1;Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b;p2;Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$F_{b;Rd} = 169,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl;Rd} = \frac{0,9 * A_{\text{net}} * f_u}{\gamma_{M2}} = 128,6 \text{ kN}$$

Bruto doorsnede:

$$N_{pl;Rd} = \frac{A * f_y}{\gamma_{M0}} = 150,4 \text{ kN}$$

Alternatief: rondstaal (uitgaande van dezelfde UC als de hiervoor berekende strip)

$$\begin{aligned}
 A_{\text{ben.}} &= 547,1 \text{ mm}^2 \\
 \emptyset_{\text{min}} &= 26,4 \text{ mm} & \emptyset_{\text{toeg}} &= 27 \text{ mm}
 \end{aligned}$$

**Overzicht**

|                            |   |          |
|----------------------------|---|----------|
| Brutodoorsnede schetsplaat | = | 282,0 kN |
| Nettadoorsnede schetsplaat | = | 273,7 kN |
| Stuik bouten schetsplaat   | = | 169,0 kN |
| Afschuiving van de bouten  | = | 120,6 kN |
| Stuik bouten Strip         | = | 169,0 kN |
| Nettadoorsnede Strip       | = | 128,6 kN |
| Brutodoorsnede Strip       | = | 150,4 kN |

$$N_{t;Ed} = 91 \text{ kN}$$

$$N_{E;Rd} = 121 \text{ kN}$$

$$0,75 \text{ UC} \leq 1$$

**Hoekbout schetsplaat****Toetsing op stuik**

$$N_{t,Ed} = 91 \text{ kN}$$

Gekozen bout 2 \* M16

Bouten: (8.8)

$$d_0 = 18 \text{ mm}$$

$$f_u = 360 \text{ N/mm}^2$$

$$t_{\text{schetspl.}} = 8 \text{ mm}$$

$$f_{u;b} = 800 \text{ N/mm}^2$$

$$h_{\text{windbok}} = 6200 \text{ mm}$$

$$b_{\text{windbok}} = 4980 \text{ mm}$$

$$\alpha_{\text{windverb.}} = 51^\circ$$

$$F_{Ed} = 45 \text{ kN}$$

$$F_{h,Ed} = 28 \text{ kN}$$

$$F_{v,Ed} = 35 \text{ kN}$$

$$e_1 = 60 \text{ mm}$$

$$e_2 = 60 \text{ mm}$$

Stuik schetsplaat horizontaal

$$\alpha_{b,h} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

$$F_{b,h;Rd} = \frac{k_1 * \alpha_{b,h} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$0,31 \text{ UC} \leq 1$$

Stuik schetsplaat verticaal

$$\alpha_{b,v} = \frac{e_2}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

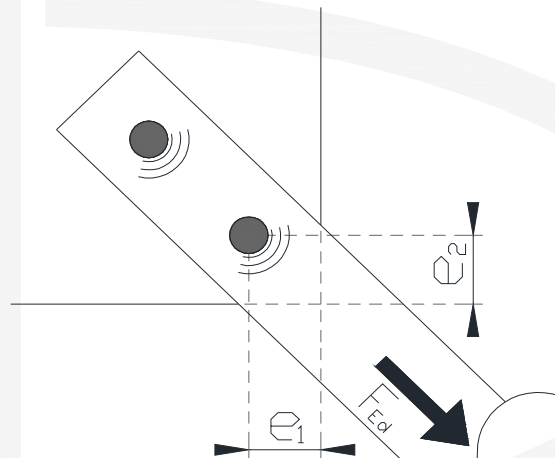
$$F_{b,v;Rd} = \frac{k_1 * \alpha_{b,v} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$0,38 \text{ UC} \leq 1$$

Toetsing met de elliptische methode

Wordt niet geëist in de Eurocode!

$$(UC_h^2 + UC_v^2)^{0,5} = 0,49 \text{ UC} \leq 1$$



**Krachten windbok voor- en achtergevel**Windbelasting  $Q = 90^\circ$ 

| Gevels       | breedte |   | hoogte |   | stuwdruk |   | c    |   |      |   |          |
|--------------|---------|---|--------|---|----------|---|------|---|------|---|----------|
| voor         | 19,92   | * | 7,37   | * | 0,49     | * | 0,80 | / | 1,68 | = | 34,03 kN |
| borstwering  | 19,92   | * | 1,17   | * | 0,49     | * | 0,50 | / | 0,91 | = | 6,22 kN  |
| achter       | 19,92   | * | 7,37   | * | 0,49     | * | 0,50 | / | 1,68 | = | 21,27 kN |
| borstwering  | 19,92   | * | 1,17   | * | 0,49     | * | 0,80 | / | 0,91 | = | 9,95 kN  |
| wrijving gvl | 22,85   | * | 7,37   | * | 0,49     | * | 0,01 | / | 1,68 | = | 0,49 kN  |
| borstwering  | 22,85   | * | 1,17   | * | 0,49     | * | 0,01 | / | 0,91 | = | 0,14 kN  |

| Dak      | breedte |   | diepte |   | stuwdruk |   | c    |   |      |   |         |
|----------|---------|---|--------|---|----------|---|------|---|------|---|---------|
| Wrijving | 22,85   | * | 19,92  | * | 0,49     | * | 0,01 | / | 2,00 | = | 1,11 kN |

Totaal ter hoogte dakvlak = 73,82 \* 1,35 = 99,66 kN  
 Op te nemen per gevel = 49,83 kN per gevel

Windbok voorgevel

|                |                |        |   |       |
|----------------|----------------|--------|---|-------|
| Profiel        | 80 * 8         | $e_1$  | = | 45 mm |
|                |                | $e_2$  | = | 40 mm |
| Schetsplaat    | 150 * 150 * 10 | $e_1$  | = | 45 mm |
|                |                | $e_2$  | = | 75 mm |
| Gekozen bouten | 2 * M16 (8.8)  | h.o.h. | = | 70 mm |

Maatgevend: Afschuiving van de bouten  
 Hoekbout schetsplaat

0,66  $UC \leq 1$   
 0,27  $UC \leq 1$

Windbok voorgevel (1 velds)

1 windbok

|                 |   |         |             |   |                     |
|-----------------|---|---------|-------------|---|---------------------|
| h               | = | 6200 mm | Kolom       | = | 62,0 kN (druk/trek) |
| b               | = | 4980 mm | Hor. ligger | = | 49,8 kN             |
| $L_{windverb.}$ | = | 7952 mm | Windbok     | = | 79,6 kN             |

Zonder veiligheid  
 46,0 kN  
 36,9 kN  
 58,9 kN

Windbok achtergevel

|                |                |        |   |       |
|----------------|----------------|--------|---|-------|
| Profiel        | 80 * 8         | $e_1$  | = | 45 mm |
|                |                | $e_2$  | = | 40 mm |
| Schetsplaat    | 150 * 150 * 10 | $e_1$  | = | 45 mm |
|                |                | $e_2$  | = | 75 mm |
| Gekozen bouten | 2 * M16 (8.8)  | h.o.h. | = | 70 mm |

Maatgevend: Afschuiving van de bouten  
 Hoekbout schetsplaat

0,66  $UC \leq 1$   
 0,27  $UC \leq 1$

Windbok achtergevel (1 velds)

1 windbok

|                 |   |         |             |   |                     |
|-----------------|---|---------|-------------|---|---------------------|
| h               | = | 6200 mm | Kolom       | = | 62,0 kN (druk/trek) |
| b               | = | 4980 mm | Hor. ligger | = | 49,8 kN             |
| $L_{windverb.}$ | = | 7952 mm | Windbok     | = | 79,6 kN             |

Zonder veiligheid  
 46,0 kN  
 36,9 kN  
 58,9 kN



**Detailberekening windverband (Windbok achtergevel (1 velds))****Koppeling Strip**

$$N_{t,Ed} = 80 \text{ kN}$$

Gekozen bouten 2 \* M16

Bouten: (8.8)

$$A_{bout} = 201 \text{ mm}^2$$

$$f_y = 235 \text{ N/mm}^2 \quad (S235)$$

$$A_{s,bout} = 157 \text{ mm}^2$$

$$f_u = 360 \text{ N/mm}^2$$

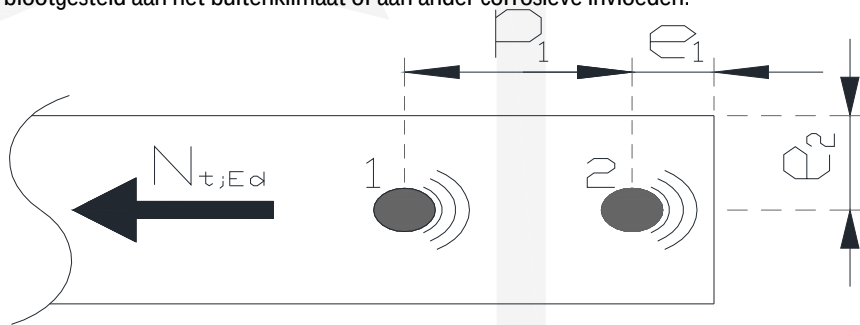
$$d_0 = 18 \text{ mm}$$

$$f_{y,b} = 640 \text{ N/mm}^2$$

$$p_1 = 70 \text{ mm}$$

$$f_{u,b} = 800 \text{ N/mm}^2$$

Staal blootgesteld aan het buitenklimaat of aan ander corrosieve invloeden.

**Schetsplaat**

$$\text{Afmeting: } 150 * 150 * 10$$

$$e_1 = 45 \text{ mm}$$

$$A = 1500 \text{ mm}^2$$

$$e_2 = 75 \text{ mm}$$

$$A_{netto} = 1320 \text{ mm}^2$$

Bruto doorsnede:

$$N_{pl,Rd} = \frac{A * f_y}{\gamma_{M0}} = 352,5 \text{ kN}$$

Netto doorsnede:

$$N_{pl,Rd} = \frac{0,9 * A_{net} * f_u}{\gamma_{M2}} = 342,1 \text{ kN}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b,p1,Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b,p2,Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 96,0 \text{ kN}$$

$$F_{b,Rd} = 211,2 \text{ kN}$$

**Bouten**

Afschuiving bouten:

Afschuifvlak door de draad van de bout.

$$\alpha_v = 0,6$$

$$F_{v,Rd} = \frac{\alpha_v * f_{ub} * A_s}{\gamma_{M2}} = 60,3 \text{ kN (per bout)}$$

**Strip**

$$\begin{aligned}
 \text{Afmeting:} & \quad 80 * 8 & e_1 & = & 45 \text{ mm} \\
 A & = & 640 \text{ mm}^2 & e_2 & = & 40 \text{ mm} \\
 A_{\text{netto}} & = & 496 \text{ mm}^2
 \end{aligned}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b,p1;Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u,b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b,p2;Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$F_{b;Rd} = 169,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl;Rd} = \frac{0,9 * A_{\text{net}} * f_u}{\gamma_{M2}} = 128,6 \text{ kN}$$

Bruto doorsnede:

$$N_{pl;Rd} = \frac{A * f_y}{\gamma_{M0}} = 150,4 \text{ kN}$$

Alternatief: rondstaal (uitgaande van dezelfde UC als de hiervoor berekende strip)

$$\begin{aligned}
 A_{\text{ben.}} & = & 547,1 \text{ mm}^2 \\
 \emptyset_{\text{min}} & = & 26,4 \text{ mm} & \emptyset_{\text{toeg}} & = & 27 \text{ mm}
 \end{aligned}$$

**Overzicht**

|                            |   |          |
|----------------------------|---|----------|
| Brutodoorsnede schetsplaat | = | 352,5 kN |
| Nettadoorsnede schetsplaat | = | 342,1 kN |
| Stuik bouten schetsplaat   | = | 211,2 kN |
| Afschuiving van de bouten  | = | 120,6 kN |
| Stuik bouten Strip         | = | 169,0 kN |
| Nettadoorsnede Strip       | = | 128,6 kN |
| Brutodoorsnede Strip       | = | 150,4 kN |

$$N_{t;Ed} = 80 \text{ kN}$$

$$N_{E;Rd} = 121 \text{ kN}$$

$$0,66 \text{ UC} \leq 1$$

**Hoekbout schetsplaat****Toetsing op stuik**

$$N_{t,Ed} = 80 \text{ kN}$$

Gekozen bout 2 \* M16

Bouten: (8.8)

$$d_0 = 18 \text{ mm}$$

$$f_u = 360 \text{ N/mm}^2$$

$$t_{\text{schetspl.}} = 10 \text{ mm}$$

$$f_{u;b} = 800 \text{ N/mm}^2$$

$$h_{\text{windbok}} = 6200 \text{ mm}$$

$$b_{\text{windbok}} = 4980 \text{ mm}$$

$$\alpha_{\text{windverb.}} = 51^\circ$$

$$F_{Ed} = 40 \text{ kN}$$

$$F_{h,Ed} = 25 \text{ kN}$$

$$F_{v,Ed} = 31 \text{ kN}$$

$$e_1 = 60 \text{ mm}$$

$$e_2 = 60 \text{ mm}$$

Stuik schetsplaat horizontaal

$$\alpha_{b,h} = \frac{e_1}{\frac{3 * d_0}{2,8 * e_2}} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{d_0}{1,7} \leq 2,5 = 2,5$$

$$F_{b,h;Rd} = \frac{k_1 * \alpha_{b,h} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

$$0,22 \text{ UC} \leq 1$$

Stuik schetsplaat verticaal

$$\alpha_{b,v} = \frac{e_2}{\frac{3 * d_0}{2,8 * e_2}} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{d_0}{1,7} \leq 2,5 = 2,5$$

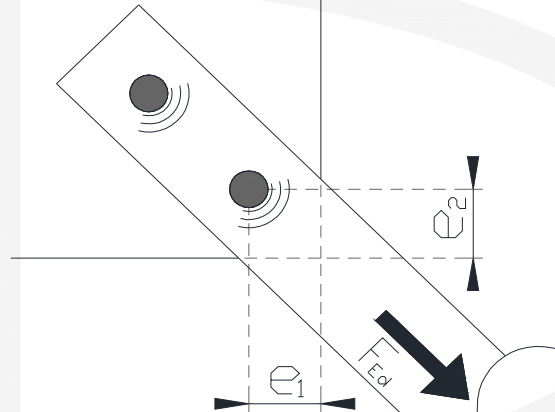
$$F_{b,v;Rd} = \frac{k_1 * \alpha_{b,v} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

$$0,27 \text{ UC} \leq 1$$

Toetsing met de elliptische methode

Wordt niet geëist in de Eurocode!

$$(UC_h^2 + UC_v^2)^{0,5} = 0,35 \text{ UC} \leq 1$$



**Detailberekening windverband (Windbok achtergevel (1 velds))****Koppeling Strip**

$$N_{t;Ed} = 80 \text{ kN}$$

Gekozen bouten 2 \* M16

Bouten: (8.8)

$$A_{\text{bout}} = 201 \text{ mm}^2$$

$$f_y = 235 \text{ N/mm}^2 \quad (\text{S235})$$

$$A_{s;\text{bout}} = 157 \text{ mm}^2$$

$$f_u = 360 \text{ N/mm}^2$$

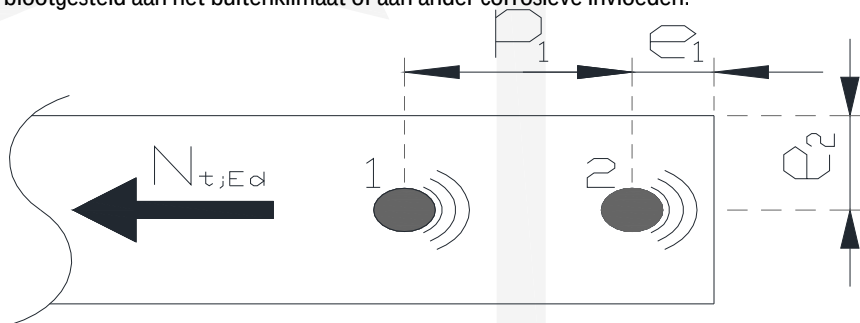
$$d_0 = 18 \text{ mm}$$

$$f_{y;b} = 640 \text{ N/mm}^2$$

$$p_1 = 70 \text{ mm}$$

$$f_{u;b} = 800 \text{ N/mm}^2$$

Staal blootgesteld aan het buitenklimaat of aan ander corrosieve invloeden.

**Schetsplaat**

$$\text{Afmeting: } 150 * 150 * 10$$

$$e_1 = 45 \text{ mm}$$

$$A = 1500 \text{ mm}^2$$

$$e_2 = 75 \text{ mm}$$

$$A_{\text{netto}} = 1320 \text{ mm}^2$$

Bruto doorsnede:

$$N_{pl;Rd} = \frac{A * f_y}{\gamma_{M0}} = 352,5 \text{ kN}$$

Netto doorsnede:

$$N_{pl;Rd} = \frac{0,9 * A_{\text{net}} * f_u}{\gamma_{M2}} = 342,1 \text{ kN}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b;1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b;p1;Rd} = \frac{k_1 * \alpha_{b;1} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

Bout 2:

$$\alpha_{b;2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b;p2;Rd} = \frac{k_1 * \alpha_{b;2} * f_u * d * t}{\gamma_{M2}} = 96,0 \text{ kN}$$

$$F_{b;Rd} = 211,2 \text{ kN}$$

**Bouten**

Afschuiving bouten:

Afschuifvlak door de draad van de bout.

$$\alpha_v = 0,6$$

$$F_{v;Rd} = \frac{\alpha_v * f_{ub} * A_s}{\gamma_{M2}} = 60,3 \text{ kN (per bout)}$$

**Strip**

$$\begin{aligned}
 \text{Afmeting:} &= 80 * 8 & e_1 &= 45 \text{ mm} \\
 A &= 640 \text{ mm}^2 & e_2 &= 40 \text{ mm} \\
 A_{\text{netto}} &= 496 \text{ mm}^2
 \end{aligned}$$

Stuik door de boutsteel:

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

Bout 1:

$$\alpha_{b,1} = \frac{p_1}{3 * d_0} - \frac{1}{4} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 0,833$$

$$F_{b;p1;Rd} = \frac{k_1 * \alpha_{b,1} * f_u * d * t}{\gamma_{M2}} = 76,8 \text{ kN}$$

Bout 2:

$$\alpha_{b,2} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$F_{b;p2;Rd} = \frac{k_1 * \alpha_{b,2} * f_u * d * t}{\gamma_{M2}} = 92,2 \text{ kN}$$

$$F_{b;Rd} = 169,0 \text{ kN}$$

Netto doorsnede:

$$N_{pl;Rd} = \frac{0,9 * A_{\text{net}} * f_u}{\gamma_{M2}} = 128,6 \text{ kN}$$

Bruto doorsnede:

$$N_{pl;Rd} = \frac{A * f_y}{\gamma_{M0}} = 150,4 \text{ kN}$$

Alternatief: rondstaal (uitgaande van dezelfde UC als de hiervoor berekende strip)

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 A_{\text{ben.}} &= 547,1 \text{ mm}^2 \\
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 \end{aligned}$$

**Overzicht**

|                            |   |          |
|----------------------------|---|----------|
| Brutodoorsnede schetsplaat | = | 352,5 kN |
| Nettadoorsnede schetsplaat | = | 342,1 kN |
| Stuik bouten schetsplaat   | = | 211,2 kN |
| Afschuiving van de bouten  | = | 120,6 kN |
| Stuik bouten Strip         | = | 169,0 kN |
| Nettadoorsnede Strip       | = | 128,6 kN |
| Brutodoorsnede Strip       | = | 150,4 kN |

$$N_{t;Ed} = 80 \text{ kN}$$

$$N_{E;Rd} = 121 \text{ kN}$$

$$0,66 \text{ UC} \leq 1$$

**Hoekbout schetsplaat****Toetsing op stuik**

$$N_{t,Ed} = 80 \text{ kN}$$

Gekozen bout 2 \* M16

Bouten: (8.8)

$$d_0 = 18 \text{ mm}$$

$$f_u = 360 \text{ N/mm}^2$$

$$t_{\text{schetspl.}} = 10 \text{ mm}$$

$$f_{u;b} = 800 \text{ N/mm}^2$$

$$h_{\text{windbok}} = 6200 \text{ mm}$$

$$b_{\text{windbok}} = 4980 \text{ mm}$$

$$\alpha_{\text{windverb.}} = 51^\circ$$

$$F_{Ed} = 40 \text{ kN}$$

$$F_{h,Ed} = 25 \text{ kN}$$

$$F_{v,Ed} = 31 \text{ kN}$$

$$e_1 = 60 \text{ mm}$$

$$e_2 = 60 \text{ mm}$$

Stuik schetsplaat horizontaal

$$\alpha_{b,h} = \frac{e_1}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

$$F_{b,h;Rd} = \frac{k_1 * \alpha_{b,h} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

$$0,22 \text{ UC} \leq 1$$

Stuik schetsplaat verticaal

$$\alpha_{b,v} = \frac{e_2}{3 * d_0} \leq \frac{f_{u;b}}{f_u} \leq 1,0 = 1,000$$

$$k_1 = \frac{2,8 * e_2}{d_0} - 1,7 \leq 2,5 = 2,5$$

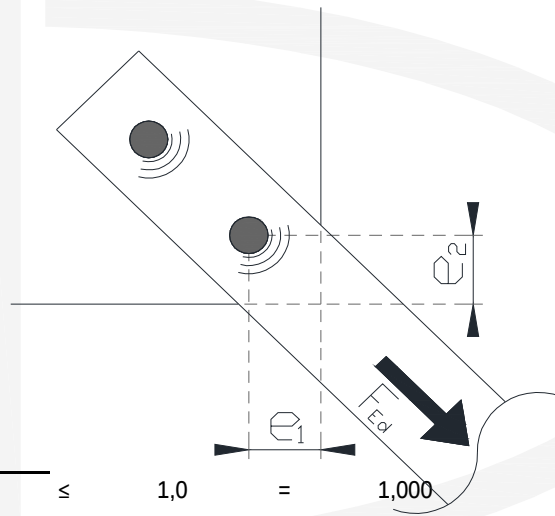
$$F_{b,v;Rd} = \frac{k_1 * \alpha_{b,v} * f_u * d * t}{\gamma_{M2}} = 115,2 \text{ kN}$$

$$0,27 \text{ UC} \leq 1$$

Toetsing met de elliptische methode

Wordt niet geëist in de Eurocode!

$$(UC_h^2 + UC_v^2)^{0,5} = 0,35 \text{ UC} \leq 1$$



## Noodoverstortberekening

NO\_DV\_1

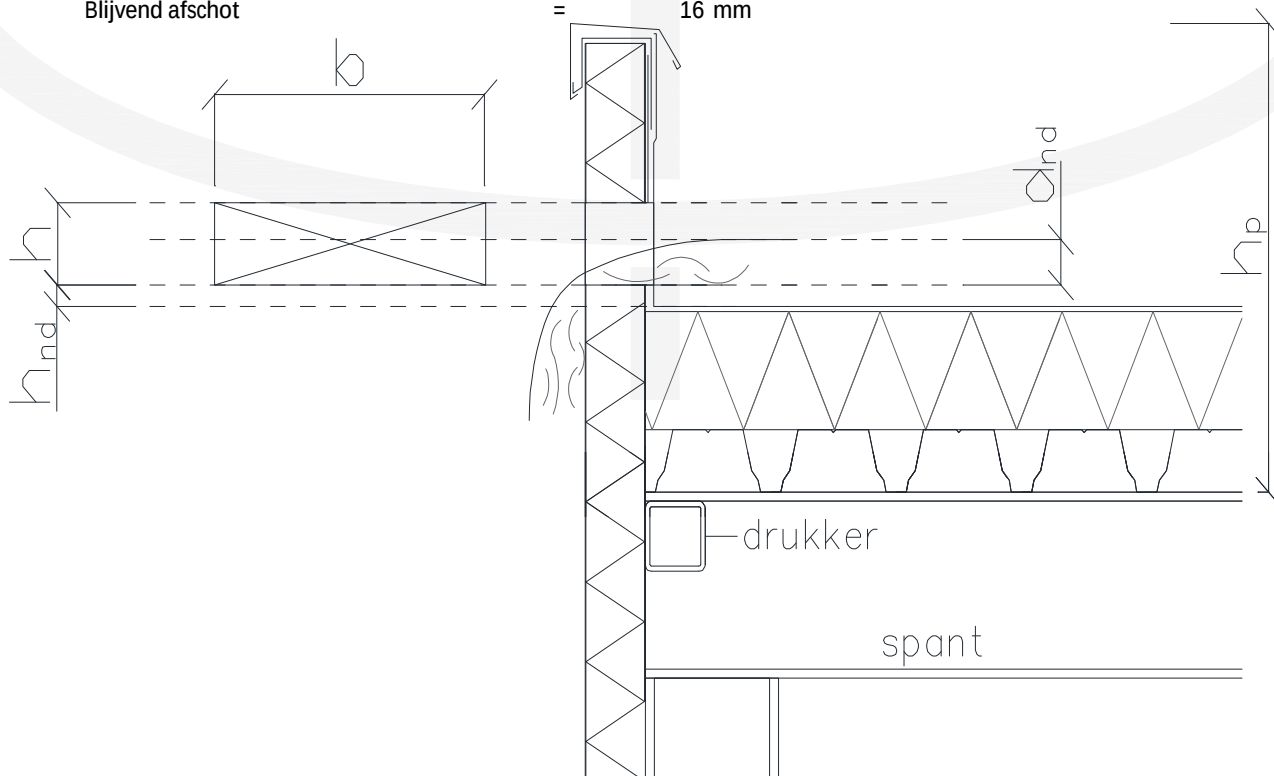
Spuwers (b \* h) 1200 \* 100 mm

Lengte dakvlak = 27760 mm  
 Breedte dakvlak = 21650 mm  
 Spantafstand = 4900 mm  
 Breedte watervlak = 27760 mm  
 Regenintensiteit  $i_r$  =  $0,047 \cdot 10^{-3} \text{ m/s}$

0 st. bestaand  
 1 st. bij plaatsen  
 1 st. per zijde

Belasting dient als vrije belasting te worden beschouwd.  
 Nemen in eerste instantie een geschatte belasting.

Hoogte noodafvoer boven dak ( $h_{nd}$ ) = 25 mm  
 Waterhoogte boven afvoer ( $d_{nd}$ ) = 57 mm  
 Doorbuiging dakplaat = 20 mm  
 Doorbuiging spant = 87 mm  
 Zeeg midden = 260 mm  
 Blijvend afschot = 16 mm



|                 |   |                         |                                          |
|-----------------|---|-------------------------|------------------------------------------|
| a) $Q_{wa;rep}$ | = | 0,941 kN/m <sup>2</sup> | op laatste meter dakplaat voor de afvoer |
| b) $Q_{wa;rep}$ | = | 0,781 kN/m <sup>2</sup> | op de meter voor a                       |
| c) $Q_{wa;rep}$ | = | 0,621 kN/m <sup>2</sup> | op de meter voor b                       |
| d) $Q_{wa;rep}$ | = | 0,461 kN/m <sup>2</sup> | op de meter voor c                       |
| e) $Q_{wa;rep}$ | = | 0,301 kN/m <sup>2</sup> | op de meter voor d                       |

|                                            |                 |               |                    |
|--------------------------------------------|-----------------|---------------|--------------------|
| <b>Gevelkolommen in de zwakke richting</b> | <b>Lengte =</b> | <b>6,20 m</b> | <b>(t.b.v. TS)</b> |
|--------------------------------------------|-----------------|---------------|--------------------|

$$\begin{aligned}
 q_d &= 0,49 * 1,62 * 4,98 = 3,93 \text{ kN/m}^1 \\
 M_{Ed} &= 0,13 * 3,93 * 38,44 = 18,90 \text{ kNm} \\
 V_{Ed} &= 0,50 * 3,93 * 6,20 = 12,19 \text{ kN}
 \end{aligned}$$

|                                         |                 |               |                    |
|-----------------------------------------|-----------------|---------------|--------------------|
| <b>Gevelliger in de zwakke richting</b> | <b>Lengte =</b> | <b>4,98 m</b> | <b>(t.b.v. TS)</b> |
|-----------------------------------------|-----------------|---------------|--------------------|

$$\begin{aligned}
 q_d &= 0,49 * 1,62 * 3,10 = 2,45 \text{ kN/m}^1 \\
 M_{Ed} &= 0,13 * 2,45 * 24,80 = 7,59 \text{ kNm} \\
 V_{Ed} &= 0,50 * 2,45 * 4,98 = 6,10 \text{ kN}
 \end{aligned}$$

|                                 |                     |
|---------------------------------|---------------------|
| <b>UNP t.b.v. windbelasting</b> | <b>UNP_Kozijnen</b> |
|---------------------------------|---------------------|

$$\begin{aligned}
 \text{Overspanning} &= 5000 \text{ mm} \\
 \text{Belastingbreedte} &= 2000 \text{ mm} \\
 \text{Stuwdruk} &= 0,49 \text{ mm} \\
 C_{pe} &= 1,2 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 M_{Ed} &= 0,125 * 0,8 * 2,000 * 25,000 = 4,94 \text{ kNm} \\
 V_{Ed} &= 0,5 * 0,8 * 2,000 * 5,000 = 3,95 \text{ kN}
 \end{aligned}$$



### Staalprofiel

UNP140

Staalkwaliteit: S 235

### 3-6.2.8 Buiging en dwarskracht

UNP\_Kozijnen

$$M_{Ed} = 4,9 \text{ kNm}$$

$$V_{Ed} = 3,9 \text{ kN}$$

Doorsnede in klasse: 1

Wanneer gaat het profiel vloeien:

$$V_{pl,Rd} = A_v * (f_y / 3^{0,5}) / \gamma_{M0}$$

$$V_{pl,Rd} = 1010,0 * 235 / 1,73 / 1,0 = 137,0 \text{ kN}$$

$$V_{Ed} < 0,5 * V_{pl,Rd}$$

$$3,9 < 68,5$$

Conclusie Invloed dwarskracht op de momentweerstand mag worden verwaarloosd

$$\rho = ((2 * V_{Ed} / V_{pl,Rd}) - 1)^2$$

$$\rho = 0,89$$

Reductie vloeigrens: 1,00

Vloeigrens: 235,0

Gaten voor verbindingen mogen worden verwaarloosd als geldt voor de op trek belaste flens:

$$\frac{A_{f,net} * 0,9 * f_u}{\gamma_{M2}} \geq \frac{a_f * f_y}{\gamma_{M0}}$$

$$\frac{600 * 0,9 * 360}{1,25} \geq \frac{600 * 235}{1,0}$$

$$155520 \geq 141000$$

Conclusie: Gaten in de flens mogen worden verwaarloosd, alle gaten dienen te worden gevuld met bevestigingsmiddelen.

$$M_{Ed} / M_{c,Rd} \leq 1$$

$$M_{c,Rd} = W_{pl} * \text{ger. } f_y / \gamma_{M0}$$

$$M_{c,Rd} = 103000 * 235,0 / 1 = 24,21 \text{ kNm}$$

$$M_{c,Rd} = 24,21 \text{ kNm}$$

$$M_{Ed} / M_{c,Rd} = 0,20 \text{ UC} \leq 1$$

Poer 1 t/m 5

P

|          | kracht (kN) | Poerafmeting (mm) |        |       | Wapeningsnetten     |                     | Aanleg-<br>diepte | Grond-<br>dekking |
|----------|-------------|-------------------|--------|-------|---------------------|---------------------|-------------------|-------------------|
|          |             | breedte           | lengte | dikte | onder               | boven               |                   |                   |
| Druk P_1 | 128,59      | 800               | 800    | 200   | 1 x # $\phi$ 8-150  |                     | -700              | 500               |
| Druk P_2 | 190,63      | 1500              | 1500   | 200   | 1 x # $\phi$ 10-150 | 1 x # $\phi$ 10-150 | -700              | 500               |
| Trek P_2 | -62,04      | 1500              | 1500   | 200   | 1 x # $\phi$ 10-150 | 1 x # $\phi$ 10-150 | -700              | 500               |
| Druk P_3 | 92,00       | 1500              | 1500   | 200   | 1 x # $\phi$ 10-150 | 1 x # $\phi$ 10-150 | -700              | 500               |
| Trek P_3 | -75,00      | 1500              | 1500   | 200   | 1 x # $\phi$ 10-150 | 1 x # $\phi$ 10-150 | -700              | 500               |
| Druk P_4 | 26,78       | 600               | 600    | 200   | 1 x # $\phi$ 8-150  |                     | -700              | 500               |
| Druk P_5 | 92,00       | 400               | 4900   | 900   | 1 x # $\phi$ 8-150  | 1 x # $\phi$ 8-150  | -700              | 700               |
| Trek P_5 | -75,00      | 400               | 4900   | 900   | 1 x # $\phi$ 8-150  | 1 x # $\phi$ 8-150  | -700              | 700               |

**Poerberekening****P\_1****Belasting**

|                                    |      |   |                          |   |           |   |                  |
|------------------------------------|------|---|--------------------------|---|-----------|---|------------------|
| Belasting uit staalkolommen totaal |      |   | reactie spant TechnoSoft | = | 128,59 kN |   |                  |
| Opstorting                         | 0,05 | * | 25                       | * | 1,08      | = | 1,22 kN          |
| Plaat                              | 0,13 | * | 25                       | * | 1,08      | = | 3,46 kN          |
|                                    |      |   |                          |   |           | = | <u>133,26 kN</u> |

**Afmeting beton**

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 800     | 800    | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |

\*\* stiephoogte in het werk controleren.

**Uitgangspunten berekening van de fundering:**

|                                    |   |          |                              |                          |
|------------------------------------|---|----------|------------------------------|--------------------------|
| funderingsdikte                    | = | 200 mm   |                              |                          |
| aanlegdiepte t.o.v. Peil           | = | -700 mm  |                              |                          |
| gronddekking t.o.v. o.k. fundering | = | 500 mm   | $q'$                         | = 7,65 kN/m <sup>2</sup> |
| laagdikte grondvervanging          | = | 0 mm     | $\gamma_\phi$                | = 1,15                   |
| hoogste waterstand t.o.v. peil     | = | -1500 mm | $\gamma_{\text{vervanging}}$ | = 19,5                   |
| Helling onderzijde fundering a     | = | 0,0 °    | $\phi'_{\text{vervanging}}$  | = 37,5                   |

**het draagvermogen:**

|            |                                                     | $\phi'$ | $c'$  | $\gamma'$ | $\gamma'_{\text{nat}}$ |                   |
|------------|-----------------------------------------------------|---------|-------|-----------|------------------------|-------------------|
| grond      | zand schoon matig                                   | 28,26   | 0     | 16,20     | 6,20                   | kN/m <sup>3</sup> |
| $N_q$      | = $e^{\pi \tan \phi'} * \tan^2(45^\circ + \phi'/2)$ |         | 5,41  | * 2,80    | =                      | 15,15             |
| $N_c$      | = $(N_q - 1) * \cot \phi'$                          |         | 14,15 | * 1,86    | =                      | 26,32             |
| $N_\gamma$ | = $2(N_q - 1) * \tan \phi'$                         |         | 28,30 | * 0,54    | =                      | 15,21             |

**de helling van de onderzijde van de fundering**

|       |   |                                        |   |      |               |
|-------|---|----------------------------------------|---|------|---------------|
| $b_q$ | = | $b_y = (1 - \alpha \tan \phi')^2$      |   | =    | 1,00          |
| $b_c$ | = | $b_q - ((1 - b_q) / (N_c \tan \phi'))$ | = | 1,00 | - 0,00 = 1,00 |

**de vorm van de fundering (stroken  $L' = \infty$ ):**

|             |   |                            |  |      |
|-------------|---|----------------------------|--|------|
| $s_q$       | = | $1 + \sin \phi' * (B'/L')$ |  | 1,00 |
| $s_c$       | = | $1 + 0,2 * (B'/L')$        |  | 1,00 |
| $s_\lambda$ | = | $1 - 0,3 * (B'/L')$        |  | 1,00 |

**de helling van de belasting door de horizontale belasting H (voor  $H = 0$ ):**

|       |   |                                       |  |      |
|-------|---|---------------------------------------|--|------|
| $i_q$ | = | $[1 - H/(V + A'c' \cot \phi')]^m$     |  | 1,00 |
| $i_c$ | = | $i_q - (1 - i_q) / (N_c \tan \phi')$  |  | 1,00 |
| $i_y$ | = | $[1 - H/(V + A'c' \cot \phi')]^{m+1}$ |  | 1,00 |
| $m$   | = | $m_B = [2 + (B'/L')] / [1 + (B'/L')]$ |  | 2,00 |
| $m$   | = | $m_L = [2 + (L'/B')] / [1 + (L'/B')]$ |  | 1,00 |

|     |     |       |                       |                          |                   |
|-----|-----|-------|-----------------------|--------------------------|-------------------|
| B'  | L'  | dikte | $F_{\text{req}}$ (kN) | $\sigma_{\text{gr,max}}$ |                   |
| 800 | 800 | 200   | 147,35                | 235,03                   | kN/m <sup>2</sup> |

Berekening poer:

$$\begin{aligned} \text{Toelaatbare gronddruk} &= 0,235 \text{ N/mm}^2 & (\sigma_{gr,max}) \\ \text{Toelaatbare betondruk} &= 13,3 \text{ N/mm}^2 & (C20/25) \end{aligned}$$

$$\begin{aligned} \text{Optredende gronddruk} &= 0,21 \leq 0,24 \text{ N/mm}^2 & 0,89 \text{ UC} \leq 1 \\ \text{Optredende betondruk} &= 1,48 \leq 13,30 \text{ N/mm}^2 & 0,11 \text{ UC} \leq 1 \end{aligned}$$

Buigend moment in de plaat

$$\begin{aligned} A_{s,prov} &= 335 \text{ mm}^2 & 1 \text{ F } 8-150-150 & (B500B) \\ A_{s,req} &= 291 \text{ mm}^2 & \text{Dekking} &= 50 \text{ mm} \\ M_{optr.} &= 16,7 \text{ kNm} & & 0,87 \text{ UC} \leq 1 \end{aligned}$$

Pons door de plaat

$$\text{Rechthoekige lastvlak} = c_1 * c_2 = 300 * 300 \text{ mm}$$

$$\begin{aligned} h &= 200 \text{ mm} & d_y &= 146 \text{ mm} \\ \phi_{wapening} &= 8 \text{ mm} & d_z &= 138 \text{ mm} \\ c &= 50 \text{ mm} & d_{eff} &= 142 \text{ mm} \\ u_1 &= 2984 \text{ mm} & u_0 &= 1200 \text{ mm} \\ V_{Ed} &= \beta * V_{Ed} / (u_1 * d_{eff}) & &= 0,36 \text{ N/mm}^2 & b = 1,15 \\ k &= 1 + (200/d)^{0,5} \leq 2 & &= 2,00 \\ V_{min} &= 0,035 * k^{3/2} * f_{ck1/2} & &= 0,44 \text{ N/mm}^2 \\ V_{Rd;c} &= 0,12 * k * (100 * \rho_1 * f_{ck})^{1/3} > V_{min} & &= 0,76 \text{ N/mm}^2 \\ V_{Ed;0} &= \beta * V_{Ed} / (u_0 * d_{eff}) & &= 0,90 \text{ N/mm}^2 \\ V_{Rd;max} &= 0,2 * f_{ck} * (1 - f_{ck} / 250) & &= 3,68 \text{ N/mm}^2 \end{aligned}$$

Er hoeft geen ponswapening te worden toegepast.

Betonafmetingen en sterkteklasse voldoen.

$$\begin{aligned} 0,47 \text{ UC} \leq 1 \\ 0,24 \text{ UC} \leq 1 \end{aligned}$$

## Poerberekening

P. 2

## Belasting

|                                    |      |   |                          |   |           |   |                  |
|------------------------------------|------|---|--------------------------|---|-----------|---|------------------|
| Belasting uit staalkolommen totaal |      |   | reactie spant TechnoSoft | = | 190,63 kN |   |                  |
| Opstorting                         | 0,05 | * | 25                       | * | 1,08      | = | 1,22 kN          |
| Plaat                              | 0,45 | * | 25                       | * | 1,08      | = | 12,15 kN         |
|                                    |      |   |                          |   |           | = | <u>203,99 kN</u> |

## Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 1500    | 1500   | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |

\*\* stiephoogte in het werk controleren.

## Uitgangspunten berekening van de fundering:

|                                    |   |          |                              |                          |
|------------------------------------|---|----------|------------------------------|--------------------------|
| funderingsdikte                    | = | 200 mm   |                              |                          |
| aanlegdiepte t.o.v. Peil           | = | -700 mm  |                              |                          |
| gronddekking t.o.v. o.k. fundering | = | 500 mm   | $q'$                         | = 7,65 kN/m <sup>2</sup> |
| laagdikte grondvervanging          | = | 0 mm     | $\gamma_{\phi}$              | = 1,15                   |
| hoogste waterstand t.o.v. peil     | = | -1500 mm | $\gamma_{\text{vervanging}}$ | = 19,5                   |
| Helling onderzijde fundering a     | = | 0,0 °    | $\phi'_{\text{vervanging}}$  | = 37,5                   |

## het draagvermogen:

|              |                                                     | $\phi'$ | $c'$  | $\gamma'$ | $\gamma'_{\text{nat}}$ |                   |
|--------------|-----------------------------------------------------|---------|-------|-----------|------------------------|-------------------|
| grond        | zand schoon matig                                   | 28,26   | 0     | 16,20     | 6,20                   | kN/m <sup>3</sup> |
| $N_q$        | = $e^{\pi \tan \phi'} * \tan^2(45^\circ + \phi'/2)$ |         | 5,41  | * 2,80    | =                      | 15,15             |
| $N_c$        | = $(N_q - 1) * \cot \phi'$                          |         | 14,15 | * 1,86    | =                      | 26,32             |
| $N_{\gamma}$ | = $2(N_q - 1) * \tan \phi'$                         |         | 28,30 | * 0,54    | =                      | 15,21             |

## de helling van de onderzijde van de fundering

|       |   |                                        |   |      |               |
|-------|---|----------------------------------------|---|------|---------------|
| $b_q$ | = | $b_y = (1 - \alpha \tan \phi')^2$      |   | =    | 1,00          |
| $b_c$ | = | $b_q - ((1 - b_q) / (N_c \tan \phi'))$ | = | 1,00 | - 0,00 = 1,00 |

de vorm van de fundering (stroken  $L' = \infty$ ):

|               |   |                            |  |      |
|---------------|---|----------------------------|--|------|
| $s_q$         | = | $1 + \sin \phi' * (B'/L')$ |  | 1,00 |
| $s_c$         | = | $1 + 0,2 * (B'/L')$        |  | 1,00 |
| $s_{\lambda}$ | = | $1 - 0,3 * (B'/L')$        |  | 1,00 |

de helling van de belasting door de horizontale belasting H (voor  $H = 0$ ):

|       |   |                                       |  |      |
|-------|---|---------------------------------------|--|------|
| $i_q$ | = | $[1 - H/(V + A'c' \cot \phi')]^m$     |  | 1,00 |
| $i_c$ | = | $i_q - (1 - i_q) / (N_c \tan \phi')$  |  | 1,00 |
| $i_y$ | = | $[1 - H/(V + A'c' \cot \phi')]^{m+1}$ |  | 1,00 |
| $m$   | = | $m_B = [2 + (B'/L')] / [1 + (B'/L')]$ |  | 2,00 |
| $m$   | = | $m_L = [2 + (L'/B')] / [1 + (L'/B')]$ |  | 1,00 |

| B'   | L'   | dikte | $F_{\text{req}}$ (kN) | $\sigma_{\text{gr,max}}$ |                   |
|------|------|-------|-----------------------|--------------------------|-------------------|
| 1500 | 1500 | 200   | 589,88                | 266,97                   | kN/m <sup>2</sup> |

Berekening poer:

$$\begin{aligned} \text{Toelaatbare gronddruk} &= 0,267 \text{ N/mm}^2 & (\sigma_{gr,max}) \\ \text{Toelaatbare betondruk} &= 13,3 \text{ N/mm}^2 & (C20/25) \end{aligned}$$

$$\begin{aligned} \text{Optredende gronddruk} &= 0,09 \leq 0,27 \text{ N/mm}^2 & 0,34 \text{ UC} \leq 1 \\ \text{Optredende betondruk} &= 2,27 \leq 13,30 \text{ N/mm}^2 & 0,17 \text{ UC} \leq 1 \end{aligned}$$

Buigend moment in de plaat

$$\begin{aligned} A_{s,prov} &= 524 \text{ mm}^2 & 1 \text{ F } 10-150-150 & (B500B) \\ A_{s,req} &= 449 \text{ mm}^2 & \text{Dekking} &= 50 \text{ mm} \\ M_{optr.} &= 25,5 \text{ kNm} & & 0,86 \text{ UC} \leq 1 \end{aligned}$$

Pons door de plaat

$$\text{Rechthoekige lastvlak} = c_1 * c_2 = 300 * 300 \text{ mm}$$

$$\begin{aligned} h &= 200 \text{ mm} & d_y &= 145 \text{ mm} \\ \phi_{wapening} &= 10 \text{ mm} & d_z &= 135 \text{ mm} \\ c &= 50 \text{ mm} & d_{eff} &= 140 \text{ mm} \\ u_1 &= 2959 \text{ mm} & u_0 &= 1200 \text{ mm} \\ V_{Ed} &= \beta * V_{Ed} / (u_1 * d_{eff}) & &= 0,57 \text{ N/mm}^2 & b = 1,15 \\ k &= 1 + (200/d)^{0,5} \leq 2 & &= 2,00 \\ V_{min} &= 0,035 * k^{3/2} * f_{ck1/2} & &= 0,44 \text{ N/mm}^2 \\ V_{Rd;c} &= 0,12 * k * (100 * \rho_1 * f_{ck})^{1/3} > V_{min} & &= 0,76 \text{ N/mm}^2 \\ V_{Ed;0} &= \beta * V_{Ed} / (u_0 * d_{eff}) & &= 1,40 \text{ N/mm}^2 \\ V_{Rd;max} &= 0,2 * f_{ck} * (1 - f_{ck} / 250) & &= 3,68 \text{ N/mm}^2 \end{aligned}$$

Er hoeft geen ponswapening te worden toegepast.

Betonafmetingen en sterkteklasse voldoen.

$$\begin{aligned} 0,74 \text{ UC} \leq 1 \\ 0,38 \text{ UC} \leq 1 \end{aligned}$$

### Poerberekening (trek)

#### Belasting

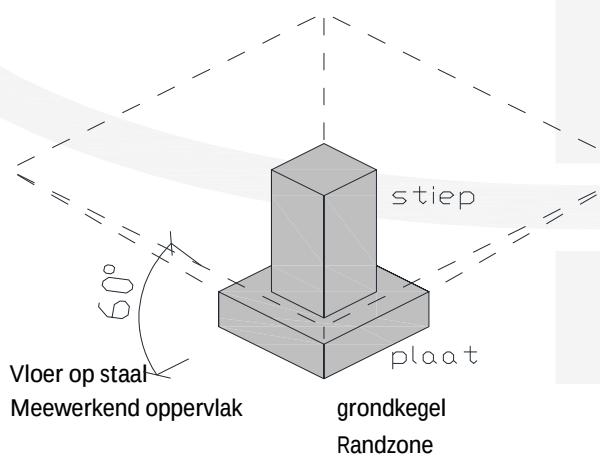
|                                    |       |   |                          |   |                   |   |                  |
|------------------------------------|-------|---|--------------------------|---|-------------------|---|------------------|
| Belasting uit staalkolommen (min.) |       |   | reactie spant technosoft | = | -62,04 kN         |   |                  |
| Opstorting                         | 0,045 | * | 25                       | * | 0,9               | = | 1,01 kN          |
| Plaat                              | 0,450 | * | 25                       | * | 0,9               | = | 10,13 kN         |
|                                    |       |   |                          |   | $F_{d,min;excn.}$ | = | <u>-50,90 kN</u> |

|                    |       |   |    |   |                      |   |                 |
|--------------------|-------|---|----|---|----------------------|---|-----------------|
| Vloer op staal     | 0,18  | * | 25 | * | 6,39                 | = | 28,77 kN        |
| Grondpakket actief | 2,214 | * | 18 | * | 0,9                  | = | 35,87 kN        |
|                    |       |   |    |   | $F_{d;min;tgw.trek}$ | = | <u>13,73 kN</u> |

Controle maximale trek: 13,73  $\geq$  0,00 Akkoord!

#### Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 1500    | 1500   | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |



|                |   |                            |
|----------------|---|----------------------------|
| $\tan(60)$     | = | 1,732                      |
| Bovenbelasting | = | 700 mm                     |
| $A_b$          | = | 4,32 m <sup>2</sup>        |
| $A_g$          | = | 2,25 m <sup>2</sup>        |
| $Kegel_{tot}$  | = | 2,259 m <sup>3</sup>       |
| Stiep          | = | 0,045 m <sup>3</sup>       |
| Grond          | = | <u>2,214 m<sup>3</sup></u> |

$$\begin{aligned}
 &= 4,32 \text{ m}^2 \\
 &= 2,08 \text{ m}^2 \\
 &= \underline{\underline{6,39 \text{ m}^2}} = 28,77 \text{ kN}
 \end{aligned}$$

## Bepaling momentcapaciteit

Maximaal toelaatbare gronddruk

$$= 0,267 \text{ N/mm}^2 \quad (\sigma_{gr,max})$$

Grondspanning t.g.v. bovenbelasting

$$= F / A = 13682 / 2250000 = 0,006 \text{ N/mm}^2$$

$$\begin{aligned} b &= 68,3 \text{ mm} \\ \text{excentr.} &= 727,2 \text{ mm} \\ M_{u;d} &= 9,95 \text{ kNm} \end{aligned}$$

$$\begin{aligned} F_{h,max} &= 0,0 \text{ kN} \\ \text{arm} &= 0,0 \text{ m} \\ M_{Ed} &= 0,0 \text{ kNm} \end{aligned}$$

## Controle momentcapaciteit

$$9,95 \geq 0,0 \quad \text{Akkoord!}$$

## Wapening

$$\text{Plaatdikte} = 200 \text{ mm} \quad (\text{C20/25})$$

$$\text{Toelaatbare betondruk} = 13,3 \text{ N/mm}^2$$

$$d = 50 \text{ mm} \quad \sigma_{gr,max}$$

$$f_{ctm} = 2,21 \text{ N/mm}^2$$

## Onderwapening

1 F 10-150-150

$$\rho_{min} = 0,13 \% \quad A_{s,min} = 65 \text{ mm}^2$$

$$\rho_{max} = 1,03 \% \quad A_{s,max} = 515 \text{ mm}^2$$

$$M_{Ed} = 74,54 \text{ kNm} \quad A_{s,ben} = 3808 \text{ mm}^2$$

$$A_{s,req} = 515 \text{ mm}^2 \quad A_{s,prov} = 524 \text{ mm}^2$$

$$0,98 \quad UC \leq 1$$

## Bovenwapening

1 F 10-150-150

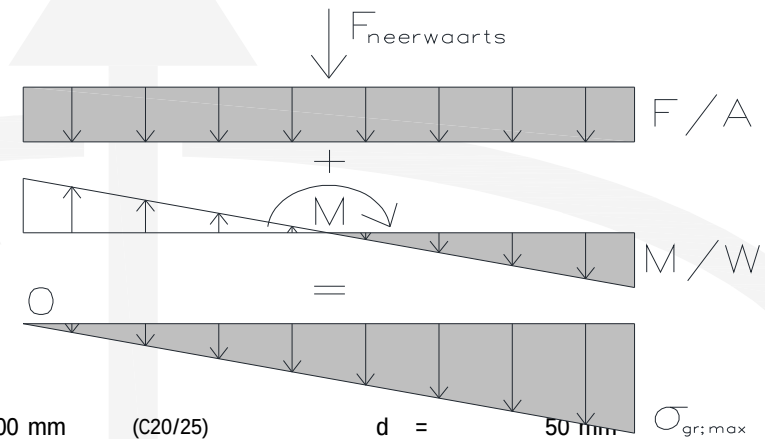
$$\rho_{min} = 0,13 \% \quad A_{s,min} = 65 \text{ mm}^2$$

$$\rho_{max} = 1,03 \% \quad A_{s,max} = 515 \text{ mm}^2$$

$$M_{Ed} = 6,90 \text{ kNm} \quad A_{s,ben} = 352 \text{ mm}^2$$

$$A_{s,req} = 352 \text{ mm}^2 \quad A_{s,prov} = 524 \text{ mm}^2$$

$$0,67 \quad UC \leq 1$$





**Poerberekening****P\_3****Belasting**

|                                    |      |   |                          |   |          |   |                  |
|------------------------------------|------|---|--------------------------|---|----------|---|------------------|
| Belasting uit staalkolommen totaal |      |   | reactie spant TechnoSoft | = | 92,00 kN |   |                  |
| Opstorting                         | 0,05 | * | 25                       | * | 1,08     | = | 1,22 kN          |
| Plaat                              | 0,45 | * | 25                       | * | 1,08     | = | 12,15 kN         |
|                                    |      |   |                          |   |          | = | <u>105,37 kN</u> |

**Afmeting beton**

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 1500    | 1500   | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |

\*\* stiephoogte in het werk controleren.

**Uitgangspunten berekening van de fundering:**

|                                    |   |          |                              |                          |
|------------------------------------|---|----------|------------------------------|--------------------------|
| funderingsdikte                    | = | 200 mm   |                              |                          |
| aanlegdiepte t.o.v. Peil           | = | -700 mm  |                              |                          |
| gronddekking t.o.v. o.k. fundering | = | 500 mm   | $q'$                         | = 7,65 kN/m <sup>2</sup> |
| laagdikte grondvervanging          | = | 0 mm     | $\gamma_{\phi}$              | = 1,15                   |
| hoogste waterstand t.o.v. peil     | = | -1500 mm | $\gamma_{\text{vervanging}}$ | = 19,5                   |
| Helling onderzijde fundering a     | = | 0,0 °    | $\phi'_{\text{vervanging}}$  | = 37,5                   |

**het draagvermogen:**

|              |                                                     | $\phi'$ | $c'$  | $\gamma'$ | $\gamma'_{\text{nat}}$ |                   |
|--------------|-----------------------------------------------------|---------|-------|-----------|------------------------|-------------------|
| grond        | zand schoon matig                                   | 28,26   | 0     | 16,20     | 6,20                   | kN/m <sup>3</sup> |
| $N_q$        | = $e^{\pi \tan \phi'} * \tan^2(45^\circ + \phi'/2)$ |         | 5,41  | * 2,80    | =                      | 15,15             |
| $N_c$        | = $(N_q - 1) * \cot \phi'$                          |         | 14,15 | * 1,86    | =                      | 26,32             |
| $N_{\gamma}$ | = $2(N_q - 1) * \tan \phi'$                         |         | 28,30 | * 0,54    | =                      | 15,21             |

**de helling van de onderzijde van de fundering**

|       |   |                                        |   |      |               |
|-------|---|----------------------------------------|---|------|---------------|
| $b_q$ | = | $b_y = (1 - \alpha \tan \phi')^2$      |   | =    | 1,00          |
| $b_c$ | = | $b_q - ((1 - b_q) / (N_c \tan \phi'))$ | = | 1,00 | - 0,00 = 1,00 |

**de vorm van de fundering (stroken  $L' = \infty$ ):**

|               |   |                            |  |      |
|---------------|---|----------------------------|--|------|
| $s_q$         | = | $1 + \sin \phi' * (B'/L')$ |  | 1,00 |
| $s_c$         | = | $1 + 0,2 * (B'/L')$        |  | 1,00 |
| $s_{\lambda}$ | = | $1 - 0,3 * (B'/L')$        |  | 1,00 |

**de helling van de belasting door de horizontale belasting H (voor  $H = 0$ ):**

|       |   |                                       |  |      |
|-------|---|---------------------------------------|--|------|
| $i_q$ | = | $[1 - H/(V + A'c' \cot \phi')]^m$     |  | 1,00 |
| $i_c$ | = | $i_q - (1 - i_q) / (N_c \tan \phi')$  |  | 1,00 |
| $i_y$ | = | $[1 - H/(V + A'c' \cot \phi')]^{m+1}$ |  | 1,00 |
| $m$   | = | $m_B = [2 + (B'/L')] / [1 + (B'/L')]$ |  | 2,00 |
| $m$   | = | $m_L = [2 + (L'/B')] / [1 + (L'/B')]$ |  | 1,00 |

|      |      |       |                       |                          |                   |
|------|------|-------|-----------------------|--------------------------|-------------------|
| B'   | L'   | dikte | $F_{\text{req}}$ (kN) | $\sigma_{\text{gr,max}}$ |                   |
| 1500 | 1500 | 200   | 589,88                | 266,97                   | kN/m <sup>2</sup> |

Berekening poer:

$$\begin{aligned} \text{Toelaatbare gronddruk} &= 0,267 \text{ N/mm}^2 & (\sigma_{gr,max}) \\ \text{Toelaatbare betondruk} &= 13,3 \text{ N/mm}^2 & (C20/25) \end{aligned}$$

$$\begin{aligned} \text{Optredende gronddruk} &= 0,05 \leq 0,27 \text{ N/mm}^2 & 0,18 \text{ UC} \leq 1 \\ \text{Optredende betondruk} &= 1,17 \leq 13,30 \text{ N/mm}^2 & 0,09 \text{ UC} \leq 1 \end{aligned}$$

Buigend moment in de plaat

$$\begin{aligned} A_{s,prov} &= 524 \text{ mm}^2 & 1 \text{ F } 10-150-150 & (B500B) \\ A_{s,req} &= 232 \text{ mm}^2 & \text{Dekking} &= 50 \text{ mm} \\ M_{optr.} &= 13,2 \text{ kNm} & & 0,44 \text{ UC} \leq 1 \end{aligned}$$

Pons door de plaat

$$\begin{aligned} \text{Rechthoekige lastvlak} &= c_1 * c_2 = 300 * 300 \text{ mm} \\ h &= 200 \text{ mm} & d_y &= 145 \text{ mm} \\ \phi_{wapening} &= 10 \text{ mm} & d_z &= 135 \text{ mm} \\ c &= 50 \text{ mm} & d_{eff} &= 140 \text{ mm} \\ u_1 &= 2959 \text{ mm} & u_0 &= 1200 \text{ mm} \\ V_{Ed} &= \beta * V_{Ed} / (u_1 * d_{eff}) & &= 0,29 \text{ N/mm}^2 & b = 1,15 \\ k &= 1 + (200/d)^{0,5} \leq 2 & &= 2,00 \\ V_{min} &= 0,035 * k^{3/2} * f_{ck1/2} & &= 0,44 \text{ N/mm}^2 \\ V_{Rd;c} &= 0,12 * k * (100 * \rho_1 * f_{ck})^{1/3} > V_{min} & &= 0,76 \text{ N/mm}^2 \\ V_{Ed;0} &= \beta * V_{Ed} / (u_0 * d_{eff}) & &= 0,72 \text{ N/mm}^2 \\ V_{Rd;max} &= 0,2 * f_{ck} * (1 - f_{ck} / 250) & &= 3,68 \text{ N/mm}^2 \end{aligned}$$

Er hoeft geen ponswapening te worden toegepast.

Betonafmetingen en sterkteklasse voldoen.

$$\begin{aligned} 0,38 \text{ UC} \leq 1 \\ 0,20 \text{ UC} \leq 1 \end{aligned}$$

### Poerberekening (trek)

#### Belasting

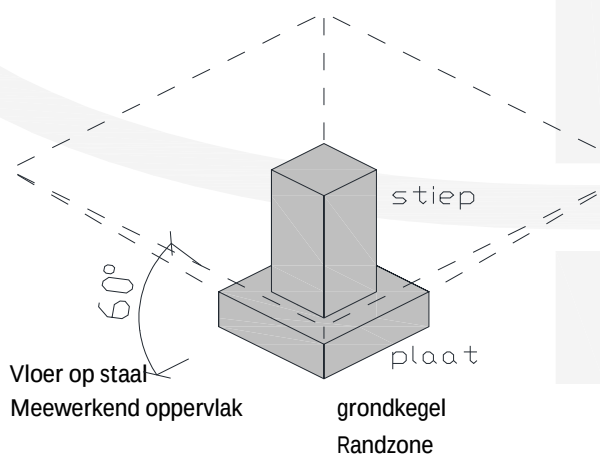
|                                    |       |   |                          |   |                   |   |                  |
|------------------------------------|-------|---|--------------------------|---|-------------------|---|------------------|
| Belasting uit staalkolommen (min.) |       |   | reactie spant technosoft | = | -75,00 kN         |   |                  |
| Opstorting                         | 0,045 | * | 25                       | * | 0,9               | = | 1,01 kN          |
| Plaat                              | 0,450 | * | 25                       | * | 0,9               | = | 10,13 kN         |
|                                    |       |   |                          |   | $F_{d,min;excn.}$ | = | <u>-63,86 kN</u> |

|                    |       |   |    |   |                      |   |                |
|--------------------|-------|---|----|---|----------------------|---|----------------|
| Vloer op staal     | 0,18  | * | 25 | * | 6,39                 | = | 28,77 kN       |
| Grondpakket actief | 2,214 | * | 18 | * | 0,9                  | = | 35,87 kN       |
|                    |       |   |    |   | $F_{d;min;tgw.trek}$ | = | <u>0,77 kN</u> |

Controle maximale trek: 0,77  $\geq$  0,00 Akkoord!

#### Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 1500    | 1500   | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |



|                |   |                            |
|----------------|---|----------------------------|
| $\tan(60)$     | = | 1,732                      |
| Bovenbelasting | = | 700 mm                     |
| $A_b$          | = | 4,32 m <sup>2</sup>        |
| $A_g$          | = | 2,25 m <sup>2</sup>        |
| $Kegel_{tot}$  | = | 2,259 m <sup>3</sup>       |
| Stiep          | = | 0,045 m <sup>3</sup>       |
| Grond          | = | <u>2,214 m<sup>3</sup></u> |

$$\begin{aligned}
 &= 4,32 \text{ m}^2 \\
 &= 2,08 \text{ m}^2 \\
 &= \underline{\underline{6,39 \text{ m}^2}} = 28,77 \text{ kN}
 \end{aligned}$$

## Bepaling momentcapaciteit

Maximaal toelaatbare grondruk

$$= 0,267 \text{ N/mm}^2 \quad (\sigma_{gr;max})$$

Grondspanning t.g.v. bovenbelasting

$$= F / A = 708 / 2250000 = 0,000 \text{ N/mm}^2$$

$$\begin{aligned} b &= 3,5 \text{ mm} \\ \text{excentr.} &= 748,8 \text{ mm} \\ M_{u;d} &= 0,53 \text{ kNm} \end{aligned}$$

$$\begin{aligned} F_{h,max} &= 0,0 \text{ kN} \\ \text{arm} &= 0,0 \text{ m} \\ M_{Ed} &= 0,0 \text{ kNm} \end{aligned}$$

## Controle momentcapaciteit

$$0,53 \geq 0,0 \quad \text{Akkoord!}$$

## Wapening

$$\text{Plaatdikte} = 200 \text{ mm} \quad (\text{C20/25})$$

$$\text{Toelaatbare betondruk} = 13,3 \text{ N/mm}^2$$

$$d = 50 \text{ mm} \quad \sigma_{gr;max}$$

$$f_{ctm} = 2,21 \text{ N/mm}^2$$

## Onderwapening

1 F 10-150-150

$$\rho_{min} = 0,13 \% \quad A_{s,min} = 65 \text{ mm}^2$$

$$\rho_{max} = 1,03 \% \quad A_{s,max} = 515 \text{ mm}^2$$

$$M_{Ed} = 64,46 \text{ kNm} \quad A_{s;ben} = 3293 \text{ mm}^2$$

$$A_{s;req} = 515 \text{ mm}^2 \quad A_{s;prov} = 524 \text{ mm}^2$$

$$0,98 \quad UC \leq 1$$

## Bovenwapening

1 F 10-150-150

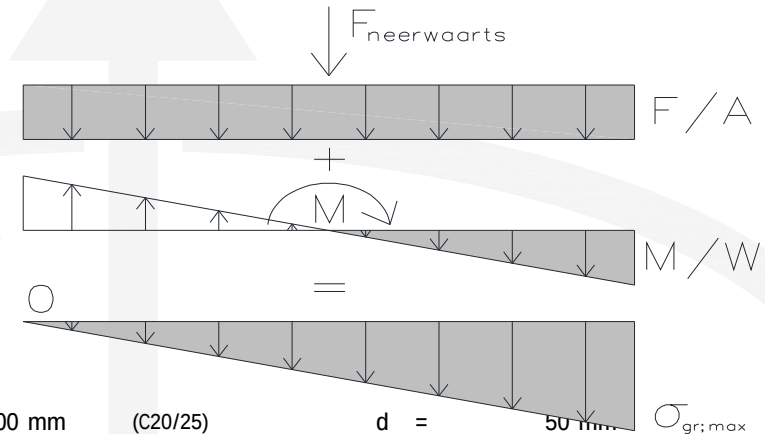
$$\rho_{min} = 0,13 \% \quad A_{s,min} = 65 \text{ mm}^2$$

$$\rho_{max} = 1,03 \% \quad A_{s,max} = 515 \text{ mm}^2$$

$$M_{Ed} = 6,90 \text{ kNm} \quad A_{s;ben} = 352 \text{ mm}^2$$

$$A_{s;req} = 352 \text{ mm}^2 \quad A_{s;prov} = 524 \text{ mm}^2$$

$$0,67 \quad UC \leq 1$$



## Poerberekening

P\_4

## Belasting

|                                    |      |   |                          |   |          |   |                 |
|------------------------------------|------|---|--------------------------|---|----------|---|-----------------|
| Belasting uit staalkolommen totaal |      |   | reactie spant TechnoSoft | = | 26,78 kN |   |                 |
| Opstorting                         | 0,05 | * | 25                       | * | 1,08     | = | 1,22 kN         |
| Plaat                              | 0,07 | * | 25                       | * | 1,08     | = | 1,94 kN         |
|                                    |      |   |                          |   |          | = | <u>29,94 kN</u> |

## Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 600     | 600    | 200   |
| Gekozen poerafmeting  | (in mm) | 300     | 300    | 500   |

\*\* stiephoogte in het werk controleren.

## Uitgangspunten berekening van de fundering:

|                                    |   |          |                              |                          |
|------------------------------------|---|----------|------------------------------|--------------------------|
| funderingsdikte                    | = | 200 mm   |                              |                          |
| aanlegdiepte t.o.v. Peil           | = | -700 mm  |                              |                          |
| gronddekking t.o.v. o.k. fundering | = | 500 mm   | $q'$                         | = 7,65 kN/m <sup>2</sup> |
| laagdikte grondvervanging          | = | 0 mm     | $\gamma_\phi$                | = 1,15                   |
| hoogste waterstand t.o.v. peil     | = | -1500 mm | $\gamma_{\text{vervanging}}$ | = 19,5                   |
| Helling onderzijde fundering a     | = | 0,0 °    | $\phi'_{\text{vervanging}}$  | = 37,5                   |

## het draagvermogen:

|            |                                                     | $\phi'$ | $c'$  | $\gamma'$ | $\gamma'_{\text{nat}}$ |                   |
|------------|-----------------------------------------------------|---------|-------|-----------|------------------------|-------------------|
| grond      | zand schoon matig                                   | 28,26   | 0     | 16,20     | 6,20                   | kN/m <sup>3</sup> |
| $N_q$      | = $e^{\pi \tan \phi'} * \tan^2(45^\circ + \phi'/2)$ |         | 5,41  | *         | 2,80                   | = 15,15           |
| $N_c$      | = $(N_q - 1) * \cot \phi'$                          |         | 14,15 | *         | 1,86                   | = 26,32           |
| $N_\gamma$ | = $2(N_q - 1) * \tan \phi'$                         |         | 28,30 | *         | 0,54                   | = 15,21           |

## de helling van de onderzijde van de fundering

|       |   |                                        |  |  |   |      |
|-------|---|----------------------------------------|--|--|---|------|
| $b_q$ | = | $b_y = (1 - \alpha \tan \phi')^2$      |  |  | = | 1,00 |
| $b_c$ | = | $b_q - ((1 - b_q) / (N_c \tan \phi'))$ |  |  | = | 1,00 |

de vorm van de fundering (stroken  $L' = \infty$ ):

|             |   |                            |  |  |  |      |
|-------------|---|----------------------------|--|--|--|------|
| $s_q$       | = | $1 + \sin \phi' * (B'/L')$ |  |  |  | 1,00 |
| $s_c$       | = | $1 + 0,2 * (B'/L')$        |  |  |  | 1,00 |
| $s_\lambda$ | = | $1 - 0,3 * (B'/L')$        |  |  |  | 1,00 |

de helling van de belasting door de horizontale belasting H (voor  $H = 0$ ):

|       |   |                                       |  |  |  |      |
|-------|---|---------------------------------------|--|--|--|------|
| $i_q$ | = | $[1 - H/(V + A'c' \cot \phi')]^m$     |  |  |  | 1,00 |
| $i_c$ | = | $i_q - (1 - i_q) / (N_c \tan \phi')$  |  |  |  | 1,00 |
| $i_y$ | = | $[1 - H/(V + A'c' \cot \phi')]^{m+1}$ |  |  |  | 1,00 |
| $m$   | = | $m_B = [2 + (B'/L')] / [1 + (B'/L')]$ |  |  |  | 2,00 |
| $m$   | = | $m_L = [2 + (L'/B')] / [1 + (L'/B')]$ |  |  |  | 1,00 |

|     |     |       |                       |                          |                   |
|-----|-----|-------|-----------------------|--------------------------|-------------------|
| B'  | L'  | dikte | $F_{\text{req}}$ (kN) | $\sigma_{\text{gr,max}}$ |                   |
| 600 | 600 | 200   | 78,23                 | 222,12                   | kN/m <sup>2</sup> |

Berekening poer:

$$\begin{aligned} \text{Toelaatbare gronddruk} &= 0,222 \text{ N/mm}^2 & (\sigma_{gr,max}) \\ \text{Toelaatbare betondruk} &= 13,3 \text{ N/mm}^2 & (C20/25) \end{aligned}$$

$$\begin{aligned} \text{Optredende gronddruk} &= 0,08 \leq 0,22 \text{ N/mm}^2 & 0,37 \text{ UC} \leq 1 \\ \text{Optredende betondruk} &= 0,33 \leq 13,30 \text{ N/mm}^2 & 0,03 \text{ UC} \leq 1 \end{aligned}$$

Buigend moment in de plaat

$$\begin{aligned} A_{s,prov} &= 335 \text{ mm}^2 & 1 \text{ F } 8-150-150 & (B500B) \\ A_{s,req} &= 65 \text{ mm}^2 & \text{Dekking} &= 50 \text{ mm} \\ M_{optr.} &= 3,7 \text{ kNm} & & 0,20 \text{ UC} \leq 1 \end{aligned}$$

Pons door de plaat

$$\text{Rechthoekige lastvlak} = c_1 * c_2 = 300 * 300 \text{ mm}$$

$$\begin{aligned} h &= 200 \text{ mm} & d_y &= 146 \text{ mm} \\ \phi_{wapening} &= 8 \text{ mm} & d_z &= 138 \text{ mm} \\ c &= 50 \text{ mm} & d_{eff} &= 142 \text{ mm} \\ u_1 &= 2984 \text{ mm} & u_0 &= 1200 \text{ mm} \\ V_{Ed} &= \beta * V_{Ed} / (u_1 * d_{eff}) & &= 0,08 \text{ N/mm}^2 & b = 1,15 \\ k &= 1 + (200/d)^{0,5} \leq 2 & &= 2,00 \\ V_{min} &= 0,035 * k^{3/2} * f_{ck1/2} & &= 0,44 \text{ N/mm}^2 \\ V_{Rd;c} &= 0,12 * k * (100 * \rho_1 * f_{ck})^{1/3} > V_{min} & &= 0,76 \text{ N/mm}^2 \\ V_{Ed;0} &= \beta * V_{Ed} / (u_0 * d_{eff}) & &= 0,20 \text{ N/mm}^2 \\ V_{Rd;max} &= 0,2 * f_{ck} * (1 - f_{ck} / 250) & &= 3,68 \text{ N/mm}^2 \end{aligned}$$

Er hoeft geen ponswapening te worden toegepast.

Betonafmetingen en sterkteklasse voldoen.

$$\begin{aligned} 0,11 \text{ UC} \leq 1 \\ 0,05 \text{ UC} \leq 1 \end{aligned}$$

## Poerberekening

P. 5

## Belasting

|                                    |      |   |                          |   |          |   |                  |
|------------------------------------|------|---|--------------------------|---|----------|---|------------------|
| Belasting uit staalkolommen totaal |      |   | reactie spant TechnoSoft | = | 92,00 kN |   |                  |
| Opstorting                         | 0,00 | * | 25                       | * | 1,08     | = | 0,00 kN          |
| Plaat                              | 1,76 | * | 25                       | * | 1,08     | = | 47,63 kN         |
|                                    |      |   |                          |   |          | = | <u>139,63 kN</u> |

## Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 400     | 4900   | 900   |
| Gekozen poerafmeting  | (in mm) | 400     | 4900   | 0     |

\*\* stiephoogte in het werk controleren.

## Uitgangspunten berekening van de fundering:

|                                    |   |          |                              |                           |
|------------------------------------|---|----------|------------------------------|---------------------------|
| funderingsdikte                    | = | 900 mm   |                              |                           |
| aanlegdiepte t.o.v. Peil           | = | -700 mm  |                              |                           |
| gronddekking t.o.v. o.k. fundering | = | 700 mm   | $q'$                         | = 10,71 kN/m <sup>2</sup> |
| laagdikte grondvervanging          | = | 0 mm     | $\gamma_{\phi}$              | = 1,15                    |
| hoogste waterstand t.o.v. peil     | = | -1500 mm | $\gamma_{\text{vervanging}}$ | = 19,5                    |
| Helling onderzijde fundering a     | = | 0,0 °    | $\phi'_{\text{vervanging}}$  | = 37,5                    |

## het draagvermogen:

|              |                                                     | $\phi'$ | $c'$  | $\gamma'$ | $\gamma'_{\text{nat}}$ |                   |
|--------------|-----------------------------------------------------|---------|-------|-----------|------------------------|-------------------|
| grond        | zand schoon matig                                   | 28,26   | 0     | 16,20     | 6,20                   | kN/m <sup>3</sup> |
| $N_q$        | = $e^{\pi \tan \phi'} * \tan^2(45^\circ + \phi'/2)$ |         | 5,41  | * 2,80    | =                      | 15,15             |
| $N_c$        | = $(N_q - 1) * \cot \phi'$                          |         | 14,15 | * 1,86    | =                      | 26,32             |
| $N_{\gamma}$ | = $2(N_q - 1) * \tan \phi'$                         |         | 28,30 | * 0,54    | =                      | 15,21             |

## de helling van de onderzijde van de fundering

|       |   |                                        |   |      |               |
|-------|---|----------------------------------------|---|------|---------------|
| $b_q$ | = | $b_y = (1 - \alpha \tan \phi')^2$      |   | =    | 1,00          |
| $b_c$ | = | $b_q - ((1 - b_q) / (N_c \tan \phi'))$ | = | 1,00 | - 0,00 = 1,00 |

de vorm van de fundering (stroken  $L' = \infty$ ):

|               |   |                            |  |      |
|---------------|---|----------------------------|--|------|
| $s_q$         | = | $1 + \sin \phi' * (B'/L')$ |  | 1,00 |
| $s_c$         | = | $1 + 0,2 * (B'/L')$        |  | 1,00 |
| $s_{\lambda}$ | = | $1 - 0,3 * (B'/L')$        |  | 1,00 |

de helling van de belasting door de horizontale belasting H (voor  $H = 0$ ):

|       |   |                                       |  |      |
|-------|---|---------------------------------------|--|------|
| $i_q$ | = | $[1 - H/(V + A'c' \cot \phi')]^m$     |  | 1,00 |
| $i_c$ | = | $i_q - (1 - i_q) / (N_c \tan \phi')$  |  | 1,00 |
| $i_y$ | = | $[1 - H/(V + A'c' \cot \phi')]^{m+1}$ |  | 1,00 |
| $m$   | = | $m_B = [2 + (B'/L')] / [1 + (B'/L')]$ |  | 2,00 |
| $m$   | = | $m_L = [2 + (L'/B')] / [1 + (L'/B')]$ |  | 1,00 |

|     |      |       |                       |                          |                   |
|-----|------|-------|-----------------------|--------------------------|-------------------|
| B'  | L'   | dikte | $F_{\text{req}}$ (kN) | $\sigma_{\text{gr,max}}$ |                   |
| 400 | 4900 | 900   | 421,07                | 216,59                   | kN/m <sup>2</sup> |

Berekening poer:

$$\begin{aligned} \text{Toelaatbare gronddruk} &= 0,217 \text{ N/mm}^2 & (\sigma_{gr,max}) \\ \text{Toelaatbare betondruk} &= 13,3 \text{ N/mm}^2 & (C20/25) \end{aligned}$$

$$\begin{aligned} \text{Optredende gronddruk} &= 0,07 \leq 0,22 \text{ N/mm}^2 & 0,33 \text{ UC} \leq 1 \\ \text{Optredende betondruk} &= 0,07 \leq 13,30 \text{ N/mm}^2 & 0,01 \text{ UC} \leq 1 \end{aligned}$$

Buigend moment in de plaat

$$\begin{aligned} A_{s,prov} &= 452 \text{ mm}^2 & 4 \text{ F } 12 & (\text{B500B}) & \text{on+bo net} \\ A_{s,req} &= 4 \text{ mm}^2 & \text{Dekking} &= 50 \text{ mm} \\ M_{optr.} &= 1,4 \text{ kNm} & & & 0,01 \text{ UC} \leq 1 \end{aligned}$$

Pons door de plaat

$$\text{Rechthoekige lastvlak} = c_1 * c_2 = 400 * 4900 \text{ mm}$$

$$\begin{aligned} h &= 900 \text{ mm} & d_y &= 846 \text{ mm} \\ \phi_{wapening} &= 8 \text{ mm} & d_z &= 838 \text{ mm} \\ c &= 50 \text{ mm} & d_{eff} &= 842 \text{ mm} \\ u_1 &= 21181 \text{ mm} & u_0 &= 10600 \text{ mm} \\ V_{Ed} &= \beta * V_{Ed} / (u_1 * d_{eff}) & &= 0,01 \text{ N/mm}^2 & b = 1,15 \\ k &= 1 + (200/d)^{0,5} \leq 2 & &= 1,49 \\ V_{min} &= 0,035 * k^{3/2} * f_{ck1/2} & &= 0,28 \text{ N/mm}^2 \\ V_{Rd;c} &= 0,12 * k * (100 * \rho_1 * f_{ck})^{1/3} > V_{min} & &= 0,66 \text{ N/mm}^2 \\ V_{Ed;0} &= \beta * V_{Ed} / (u_0 * d_{eff}) & &= 0,02 \text{ N/mm}^2 \\ V_{Rd;max} &= 0,2 * f_{ck} * (1 - f_{ck} / 250) & &= 3,68 \text{ N/mm}^2 \end{aligned}$$

Er hoeft geen ponswapening te worden toegepast.

Betonafmetingen en sterkteklasse voldoen.

$$\begin{aligned} 0,01 \text{ UC} &\leq 1 \\ 0,00 \text{ UC} &\leq 1 \end{aligned}$$



### Poerberekening (trek)

#### Belasting

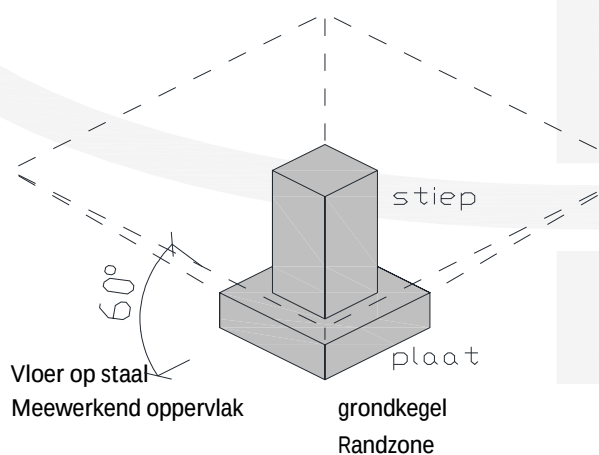
|                                    |       |   |                          |   |                   |   |                  |
|------------------------------------|-------|---|--------------------------|---|-------------------|---|------------------|
| Belasting uit staalkolommen (min.) |       |   | reactie spant technosoft | = | -75,00 kN         |   |                  |
| Opstorting                         | 0,000 | * | 25                       | * | 0,9               | = | 0,00 kN          |
| Plaat                              | 1,764 | * | 25                       | * | 0,9               | = | 39,69 kN         |
|                                    |       |   |                          |   | $F_{d,min;excn.}$ | = | <u>-35,31 kN</u> |

|                    |       |   |    |   |                      |   |                |
|--------------------|-------|---|----|---|----------------------|---|----------------|
| Vloer op staal     | 0,18  | * | 25 | * | 4,61                 | = | 20,75 kN       |
| Grondpakket actief | 1,372 | * | 18 | * | 0,9                  | = | 22,23 kN       |
|                    |       |   |    |   | $F_{d,min;tgw.trek}$ | = | <u>7,66 kN</u> |

Controle maximale trek: 7,66  $\geq$  0,00 Akkoord!

#### Afmeting beton

|                       |         | breedte | lengte | dikte |
|-----------------------|---------|---------|--------|-------|
| Gekozen plaatafmeting | (in mm) | 400     | 4900   | 900   |
| Gekozen poerafmeting  | (in mm) | 400     | 4900   | 0     |



|                |   |                            |
|----------------|---|----------------------------|
| $\tan(60)$     | = | 1,732                      |
| Bovenbelasting | = | 700 mm                     |
| $A_b$          | = | 1,96 m <sup>2</sup>        |
| $A_g$          | = | 1,96 m <sup>2</sup>        |
| $Kegel_{tot}$  | = | 1,372 m <sup>3</sup>       |
| Stiep          | = | 0,000 m <sup>3</sup>       |
| Grond          | = | <u>1,372 m<sup>3</sup></u> |

$$\begin{aligned}
 &= 1,96 \text{ m}^2 \\
 &= 2,65 \text{ m}^2 \\
 &= \underline{\underline{4,61 \text{ m}^2}} = 20,75 \text{ kN}
 \end{aligned}$$

## Bepaling momentcapaciteit

Maximaal toelaatbare grondruk

$$= 0,217 \text{ N/mm}^2 \quad (\sigma_{gr;max})$$

Grondspanning t.g.v. bovenbelasting

$$= F / A = 7626 / 1960000 = 0,004 \text{ N/mm}^2$$

$$\begin{aligned} b &= 176,0 \text{ mm} \\ \text{excentr.} &= 2391,3 \text{ mm} \\ M_{u;d} &= 18,24 \text{ kNm} \end{aligned}$$

$$\begin{aligned} F_{h,max} &= 0,0 \text{ kN} \\ \text{arm} &= 0,0 \text{ m} \\ M_{Ed} &= 0,0 \text{ kNm} \end{aligned}$$

## Controle momentcapaciteit

$$18,24 \geq 0,0 \quad \text{Akkoord!}$$

## Wapening

$$\text{Plaatdikte} = 900 \text{ mm} \quad (\text{C20/25})$$

$$\text{Toelaatbare betondruk} = 13,3 \text{ N/mm}^2$$

$$d = 846 \text{ mm} \quad \sigma_{gr;max}$$

$$f_{ctm} = 2,21 \text{ N/mm}^2$$

## Onderwapening

4 F 12

$$\rho_{min} = 0,13 \%$$

$$A_{s,min} = 69 \text{ mm}^2$$

$$\rho_{max} = 1,03 \%$$

$$A_{s,max} = 8714 \text{ mm}^2$$

$$M_{Ed} = 18,24 \text{ kNm}$$

$$A_{s;ben} = 55 \text{ mm}^2$$

$$A_{s;req} = 69 \text{ mm}^2$$

$$A_{s;prov} = 452 \text{ mm}^2$$

on+bo net

$$0,15 \text{ UC} \leq 1$$

## Bovenwapening

4 F 12

$$\rho_{min} = 0,13 \%$$

$$A_{s,min} = 429 \text{ mm}^2$$

$$\rho_{max} = 1,03 \%$$

$$A_{s,max} = 8714 \text{ mm}^2$$

$$M_{Ed} = 113,77 \text{ kNm}$$

$$A_{s;ben} = 344 \text{ mm}^2$$

$$A_{s;req} = 429 \text{ mm}^2$$

$$A_{s;prov} = 452 \text{ mm}^2$$

on+bo net

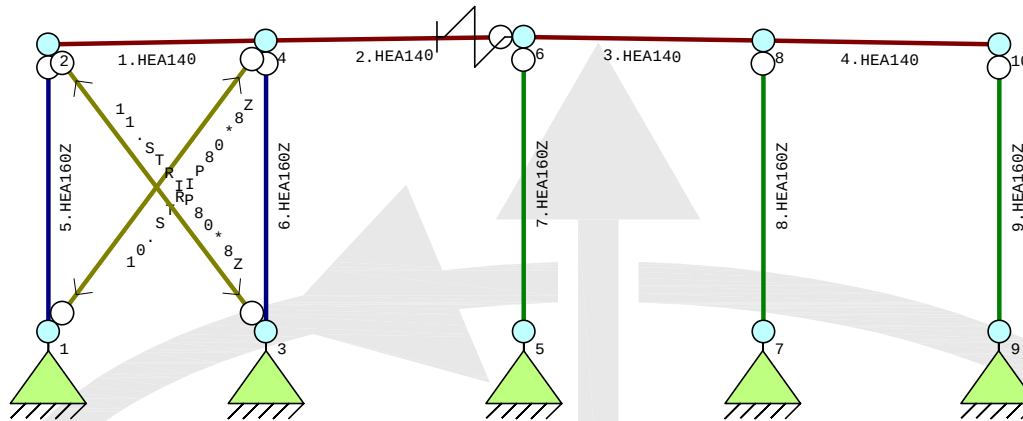
$$0,95 \text{ UC} \leq 1$$

Gunstige werking van de permanente belasting wordt automatisch verwerkt

## Toegepaste normen volgens Eurocode met Nederlandse NB

|             |                      |         |             |
|-------------|----------------------|---------|-------------|
| Belastingen | NEN-EN 1990:2002     | C2:2010 | NB:2011(nl) |
|             | NEN-EN 1991-1-1:2002 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-3:2003 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-4:2005 | C2:2011 | NB:2011(nl) |
|             | NEN-EN 1993-1-1:2006 | C2:2009 | NB:2011(nl) |
| Staal       |                      |         |             |

## GEOMETRIE



## MATERIALEN

| Mt | Omschrijving | E-modulus[N/mm2] | S.M. | Pois. | Uitz. coëff |
|----|--------------|------------------|------|-------|-------------|
| 1  | S235         | 210000           | 78.5 | 0.30  | 1.2000e-005 |

## PROFIELEN [mm]

| Prof. | Omschrijving | Materiaal | Oppervlak   | Traagheid   | Vormf. |
|-------|--------------|-----------|-------------|-------------|--------|
| 1     | HEA140       | 1:S235    | 3.1420e+003 | 1.0330e+007 | 0.00   |
| 2     | HEA160Z      | 1:S235    | 3.8800e+003 | 6.1600e+006 | 0.00   |
| 3     | STRIP80*8Z   | 1:S235    | 6.4000e+002 | 3.4133e+005 | 0.00   |
| 4     | HEA160Z      | 1:S235    | 3.8800e+003 | 6.1600e+006 | 0.00   |

**PROFIELEN** vervolg [mm]

| Prof. | Staaftype | Breedte | Hoogte | e    | Type | b1 | h1 | b2 | h2 |
|-------|-----------|---------|--------|------|------|----|----|----|----|
| 1     | 0:Normaal | 140     | 133    | 66.5 |      |    |    |    |    |
| 2     | 0:Normaal | 160     | 152    | 80.0 |      |    |    |    |    |
| 3     | 1:Trek    | 80      | 8      | 40.0 |      |    |    |    |    |
| 4     | 0:Normaal | 160     | 152    | 80.0 |      |    |    |    |    |

## PROFIELVORMEN [mm]

|   |            |                                                                                     |
|---|------------|-------------------------------------------------------------------------------------|
| 1 | HEA140     |  |
| 2 | HEA160Z    |  |
| 3 | STRIP80*8Z |  |
| 4 | HEA160Z    |  |

## KNOPEN

| Knoop | X     | Z     | Knoop | X      | Z     |
|-------|-------|-------|-------|--------|-------|
| 1     | 0.000 | 0.000 | 6     | 9.885  | 6.133 |
| 2     | 0.000 | 5.974 | 7     | 14.865 | 0.000 |
| 3     | 4.525 | 0.000 | 8     | 14.865 | 6.053 |
| 4     | 4.525 | 6.047 | 9     | 19.770 | 0.000 |
| 5     | 9.885 | 0.000 | 10    | 19.770 | 5.974 |

## STAVEN

| St. | ki | kj | Profiel      | Aansl.i | Aansl.j | Lengte Opm. |
|-----|----|----|--------------|---------|---------|-------------|
| 1   | 2  | 4  | 1:HEA140     | NDM     | NDM     | 4.526       |
| 2   | 4  | 6  | 1:HEA140     | NDM     | ND      | 5.361       |
| 3   | 6  | 8  | 1:HEA140     | NDM     | NDM     | 4.981       |
| 4   | 8  | 10 | 1:HEA140     | NDM     | NDM     | 4.906       |
| 5   | 1  | 2  | 4:HEA160Z    | NDM     | ND      | 5.974       |
| 6   | 3  | 4  | 4:HEA160Z    | NDM     | ND      | 6.047       |
| 7   | 5  | 6  | 2:HEA160Z    | NDM     | ND      | 6.133       |
| 8   | 7  | 8  | 2:HEA160Z    | NDM     | ND      | 6.053       |
| 9   | 9  | 10 | 2:HEA160Z    | NDM     | ND      | 5.974       |
| 10  | 1  | 4  | 3:STRIP80*8Z | ND      | ND      | 7.553       |
| 11  | 3  | 2  | 3:STRIP80*8Z | ND      | ND      | 7.494       |

## VASTE STEUNPUNTEN

| Nr. knoop | Kode | XZR | 1=vast 0=vrij | Hoek |
|-----------|------|-----|---------------|------|
| 1         | 1    | 110 |               | 0.00 |
| 2         | 3    | 110 |               | 0.00 |
| 3         | 5    | 110 |               | 0.00 |
| 4         | 7    | 110 |               | 0.00 |
| 5         | 9    | 110 |               | 0.00 |

## VEREN

| Veer | Knoop | Richting    | Hoek | Veerwaarde | Type    | Ondergrens | Bovengrens |
|------|-------|-------------|------|------------|---------|------------|------------|
| 1    | 6     | 1:X-transl. | 0.00 | 1.000e+001 | Normaal | -1.000     | 1.000      |

## BELASTINGGENERATIE ALGEMEEN.

|                             |       |                         |      |
|-----------------------------|-------|-------------------------|------|
| Betrouwbaarheidsklasse..... | 1     | Referentieperiode.....  | 15   |
| Gebouwhoogte.....           | 22.85 | Gebouwhoogte.....       | 6.13 |
| Niveau aansl.terrein.....   | 0.00  | E.g. scheid.w. [kN/m2]: | 0.00 |

## WIND

|                                  |                                    |
|----------------------------------|------------------------------------|
| Terrein categorie ...[4.3.2]...  | Bebouwd                            |
| Windgebied .....                 | 3 Vb,0 ..[4.2]..... 24.500         |
| Referentie periode wind.....     | 15.00 Vb(p) ..[4.2]..... 22.397    |
| K .....                          | 0.280 n ....[4.2]..... 0.500       |
| Positie spant in het gebouw..... | 0.000 Kr ....[4.3.2]..... 0.223    |
| z0 .....                         | 0.500 Zmin ..[4.3.2]..... 7.000    |
| Co wind van links ..[4.3.3]...   | 1.000 Co wind van rechts.... 1.000 |
| Co wind loodrecht ..[4.3.3]...   | 1.000                              |
| Cpi wind van links ..[7.2.9]...  | 0.200 -0.300                       |
| Cpi windloodrecht ...[7.2.9]...  | 0.200 -0.300                       |
| Cpi wind van rechts ..[7.2.9]... | 0.200 -0.300                       |
| Cfr windwrijving ....[7.5].....  | 0.040                              |

## SNEEUW

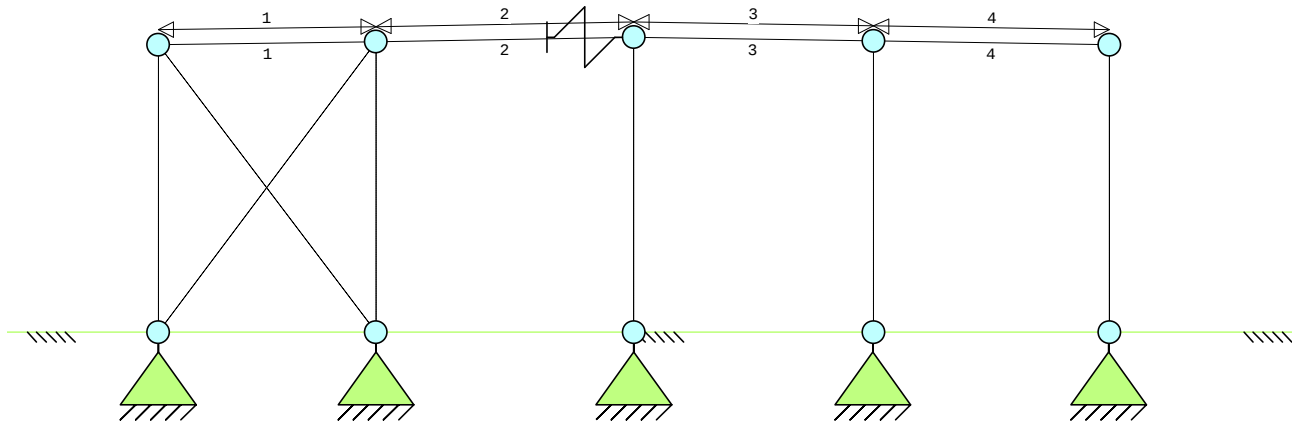
|                                |      |
|--------------------------------|------|
| Sneeuwbelasting (sk) 50 jaar : | 0.70 |
| Sneeuwbelasting (sn) n jaar :  | 0.53 |

## STAAFTYPEN

| Type             | staven  |
|------------------|---------|
| 4:Wand / kolom.  | : 6-8   |
| 5:Linker gevel.  | : 5     |
| 6:Rechter gevel. | : 9     |
| 7:Dak.           | : 1-4   |
| 9:Open.          | : 10,11 |

**LASTVELDEN**

Veranderlijke belastingen door personen

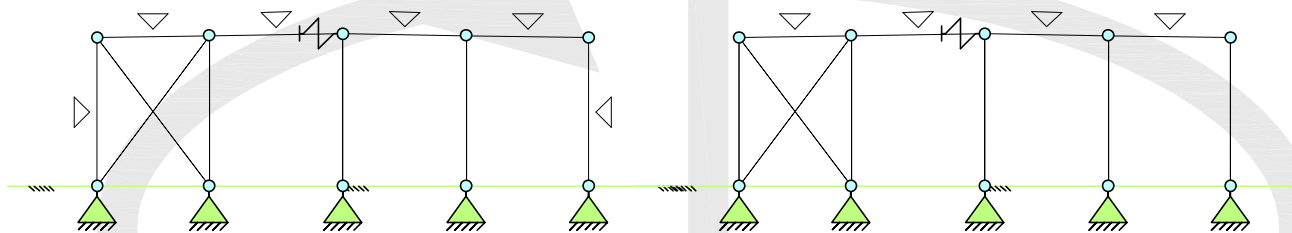
**LASTVELDEN**

| Nr | Balk | Veld | Gebruiksfunctie                                         | Psi-t |
|----|------|------|---------------------------------------------------------|-------|
| 1  | 1-4  | 1-1  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |
| 2  | 1-4  | 2-2  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |
| 3  | 1-4  | 3-3  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |
| 4  | 1-4  | 4-4  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |

**LASTVELDEN**

Wind staven

Sneeuw staven

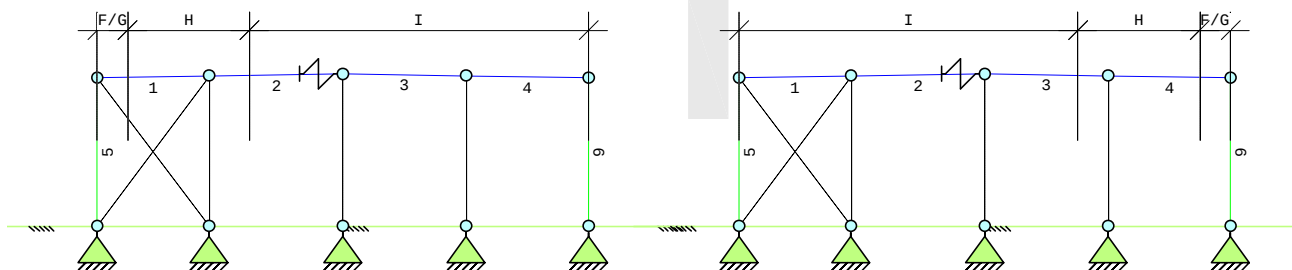
**WIND DAKTYPES**

| Nr. | Staaftype    | reductie bij<br>wind van links | reductie bij<br>wind van Rechts | Cpe volgens art: |
|-----|--------------|--------------------------------|---------------------------------|------------------|
| 1   | 5 Gevel      | 1.000                          | 1.000                           | 7.2.2            |
| 2   | 1-4 Plat dak | 1.000                          | 1.000                           | 7.2.3            |
| 3   | 9 Gevel      | 1.000                          | 1.000                           | 7.2.2            |

**WIND ZONES**

Wind van links

Wind van rechts

**WIND VAN LINKS ZONES**

| Nr. | Staaftype | Positie | Lengte | Zone |
|-----|-----------|---------|--------|------|
| 1   | 5         | 0.000   | 5.974  | D    |
| 2   | 1-4       | 0.000   | 1.227  | F/G  |
| 3   | 1-4       | 1.227   | 4.906  | H    |
| 4   | 1-4       | 6.133   | 13.637 | I    |
| 5   | 9         | 0.000   | 5.974  | E    |

**WIND VAN RECHTS ZONES**

| Nr. | Staaftype | Positie | Lengte | Zone |
|-----|-----------|---------|--------|------|
| 1   | 9         | 0.000   | 5.974  | D    |
| 2   | 1-4       | 0.000   | 1.227  | F/G  |
| 3   | 1-4       | 1.227   | 4.906  | H    |
| 4   | 1-4       | 6.133   | 13.637 | I    |
| 5   | 5         | 0.000   | 5.974  | E    |

**Wind indexen**

| Index | CsCd | Cpe/Cpi | qp    | breedte | reductie | Qw     | Zone | Hoek(en) |
|-------|------|---------|-------|---------|----------|--------|------|----------|
| Qw1   |      | 0.300   | 0.397 | 2.450   |          | -0.291 |      |          |
| Qw2   |      | -0.300  | 0.397 | 2.450   |          | 0.291  |      |          |
| Qw3   | 1.00 | 0.800   | 0.397 | 2.450   |          | -0.777 | D    |          |
| Qw4   | 1.00 | -1.800  | 0.397 | 2.450   |          | 1.749  | F    | 0.9      |
| Qw5   | 1.00 | -0.700  | 0.397 | 2.450   |          | 0.680  | H    | 0.9      |
| Qw6   | 1.00 | -0.200  | 0.397 | 2.450   |          | 0.194  | I    | 0.9      |
| Qw7   | 1.00 | 0.500   | 0.397 | 2.450   |          | -0.486 | E    |          |
| Qw8   |      | -0.200  | 0.397 | 2.450   |          | 0.194  |      |          |
| Qw9   |      | 0.200   | 0.397 | 2.450   |          | -0.194 |      |          |
| Qw10  | 1.00 | 0.200   | 0.397 | 2.450   |          | -0.194 | I    | 0.9      |
| Qw11  | 1.00 | -0.800  | 0.397 | 2.450   |          | 0.777  | D    |          |
| Qw12  | 1.00 | -0.500  | 0.397 | 2.450   |          | 0.486  | E    |          |
| Qw13  | 1.00 | -1.200  | 0.397 | 2.450   |          | 1.166  |      |          |
| Qw14  | 1.00 | 1.200   | 0.397 | 2.450   |          | -1.166 |      |          |
| Qw15  | 1.00 | -1.200  | 0.397 | 1.227   |          | 0.584  |      | 0.9      |
| Qw16  | 1.00 | -1.800  | 0.397 | 1.227   |          | 0.876  |      | 0.9      |
| Qw17  | 1.00 | -0.700  | 0.397 | 1.223   |          | 0.340  |      | 0.9      |
| Qw18  | 1.00 | -0.500  | 0.397 | 2.450   |          | 0.486  |      |          |
| Qw19  | 1.00 | 0.500   | 0.397 | 2.450   |          | -0.486 |      |          |
| Qw20  | 1.00 | 0.200   | 0.397 | 2.450   |          | -0.194 |      | 0.9      |
| Qw21  | 1.00 | -0.200  | 0.397 | 2.450   |          | 0.194  |      | 0.9      |

**Sneeuw indexen**

| Index | art   | $\mu$ | $s_k$ | red. | posfac | breedte | $Q_s$ | hoek |
|-------|-------|-------|-------|------|--------|---------|-------|------|
| Qs1   | 5.3.2 | 0.800 | 0.53  | 1.00 |        | 2.450   | 1.030 | 0.9  |
| Qs2   | 5.3.2 | 0.800 | 0.53  | 1.00 |        | 2.450   | 1.030 | 0.9  |
| Qs3   | 5.3.2 | 0.800 | 0.53  | 1.00 |        | 2.450   | 1.030 | 0.9  |
| Qs4   | 5.3.2 | 0.800 | 0.53  | 1.00 |        | 2.450   | 1.030 | 0.9  |

**BELASTINGGEVALLEN**

| B.G. | Omschrijving                   | Type                   |
|------|--------------------------------|------------------------|
|      | 1 Permanent EGZ=-1.00          | 1 Permanente belasting |
| g    | 2 Ver. bel. pers. ed. (p_rep)  | 2                      |
| g    | 3 Ver. bel. pers. ed. (F_rep)  | 3                      |
| g*   | 4 Wind van links onderdruk A   | 7                      |
| g*   | 5 Wind van links overdruk A    | 8                      |
| g*   | 6 Wind van links onderdruk B   | 9                      |
| g*   | 7 Wind van links overdruk B    | 10                     |
| g*   | 8 Wind van rechts onderdruk A  | 11                     |
| g*   | 9 Wind van rechts overdruk A   | 12                     |
| g*   | 10 Wind van rechts onderdruk B | 13                     |
| g*   | 11 Wind van rechts overdruk B  | 14                     |
| g    | 12 Wind loodrecht onderdruk A  | 15                     |
| g    | 13 Wind loodrecht overdruk A   | 16                     |
| g    | 14 Wind loodrecht onderdruk B  | 45                     |
| g    | 15 Wind loodrecht overdruk B   | 46                     |
| g    | 16 Sneeuw A                    | 22                     |
|      | 17 Knik                        | 0 Onbekend             |

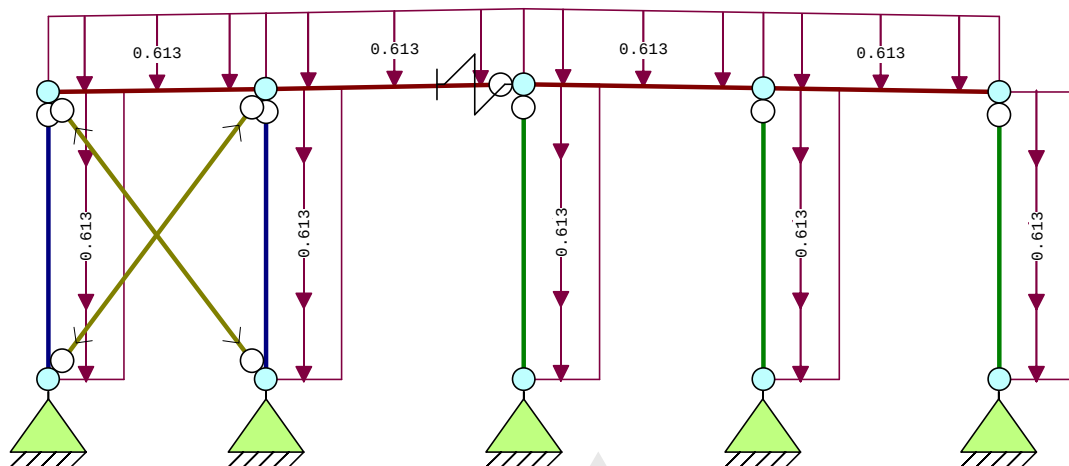
g = gegenereerd belastinggeval

\* = belastinggeval bevat 1 of meer handmatig toegevoegde en/of gewijzigde lasten

## BELASTINGEN

B.G:1 Permanent

Eigen gewicht van alle staven is meegenomen in berekening. Richting:↓



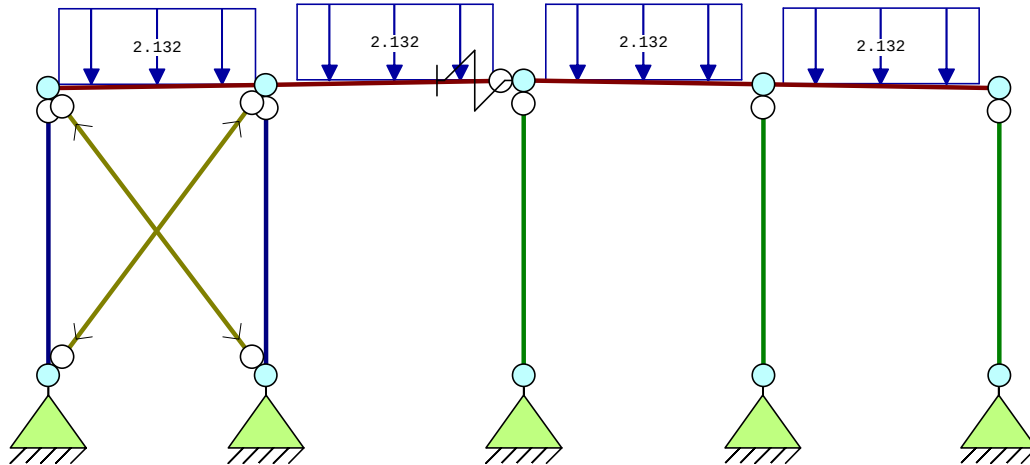
## STAAFBELASTINGEN

B.G:1 Permanent

| Staf | Type       | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|--------|-------|-------|-------|----------|----------|----------|
| 1    | 5:QZGloaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 2    | 5:QZGloaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 3    | 5:QZGloaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 4    | 5:QZGloaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 5    | 2:QXLokaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 6    | 2:QXLokaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 7    | 2:QXLokaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 8    | 2:QXLokaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |
| 9    | 2:QXLokaal | -0.61  | -0.61 | 0.000 | 0.000 |          |          |          |

## BELASTINGEN

B.G:2 Ver. bel. pers. ed. (p\_rep)



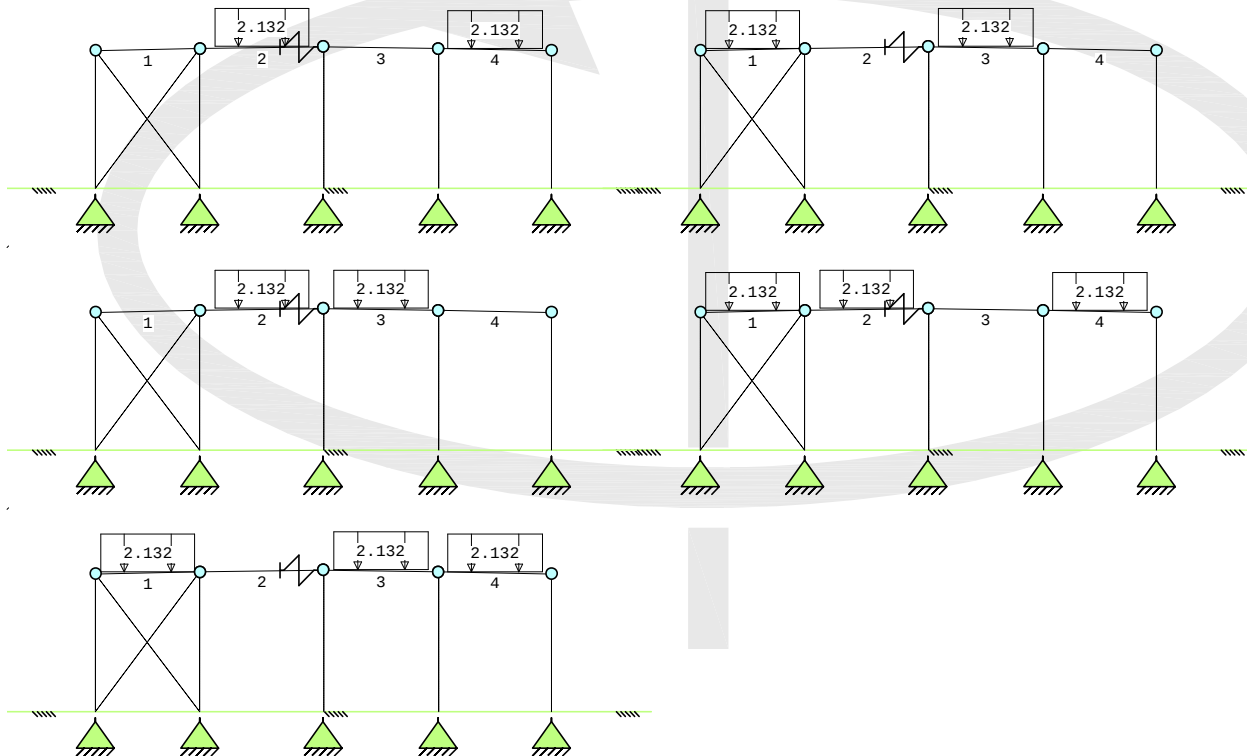
## STAAFBELASTINGEN

B.G:2 Ver. bel. pers. ed. (p\_rep)

| Staaf | Type        | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|-------------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 3:QZgeProj. | -2.13  | -2.13 | 0.222 | 0.222 | 0.0      | 0.0      | 0.0      |
| 2     | 3:QZgeProj. | -2.13  | -2.13 | 0.639 | 0.639 | 0.0      | 0.0      | 0.0      |
| 3     | 3:QZgeProj. | -2.13  | -2.13 | 0.449 | 0.449 | 0.0      | 0.0      | 0.0      |
| 4     | 3:QZgeProj. | -2.13  | -2.13 | 0.412 | 0.412 | 0.0      | 0.0      | 0.0      |

## VERANDERLIJKE BELASTING SITUATIES

B.G:2 Ver. bel. pers. ed. (p\_rep)



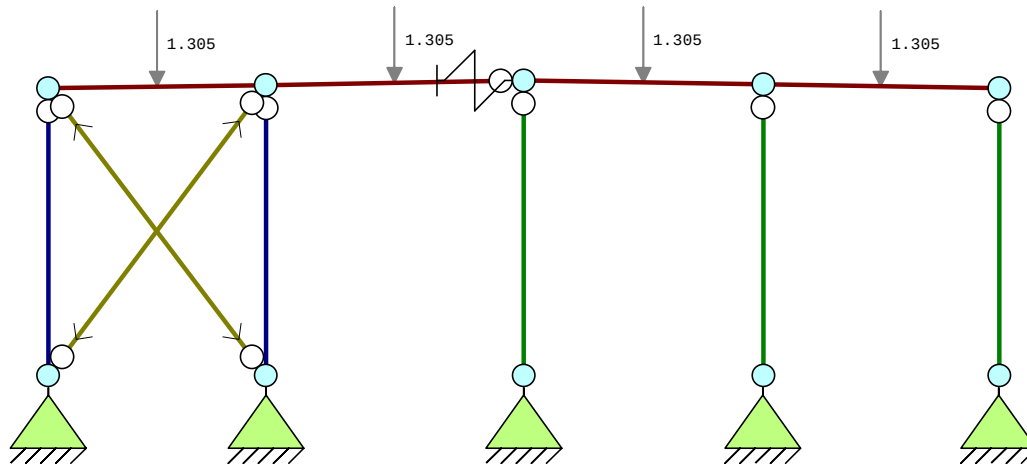
## VERANDERLIJKE BELASTING SITUATIES

| Nr Lastvelden extreem | Lastvelden momentaan |
|-----------------------|----------------------|
| 1 2, 4                |                      |
| 2 1, 3                |                      |
| 3 2, 3                |                      |
| 4 1, 2, 4             |                      |
| 5 1, 3, 4             |                      |



## BELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)



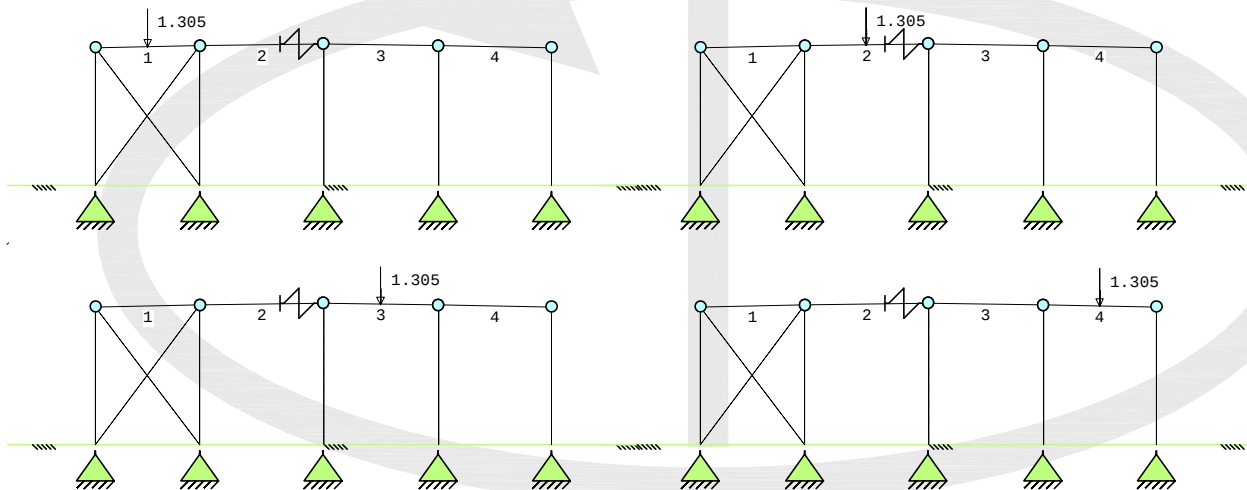
## STAAFBELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)

| Staal | Type         | q1/p/m | q2 | A     | B | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|--------------|--------|----|-------|---|----------|----------|----------|
| 1     | 10:PZGeproj. | -1.30  |    | 2.263 |   | 0.0      | 0.0      | 0.0      |
| 2     | 10:PZGeproj. | -1.30  |    | 2.680 |   | 0.0      | 0.0      | 0.0      |
| 3     | 10:PZGeproj. | -1.30  |    | 2.490 |   | 0.0      | 0.0      | 0.0      |
| 4     | 10:PZGeproj. | -1.30  |    | 2.453 |   | 0.0      | 0.0      | 0.0      |

## VERANDERLIJKE BELASTING SITUATIES

B.G:3 Ver. bel. pers. ed. (F-rep)

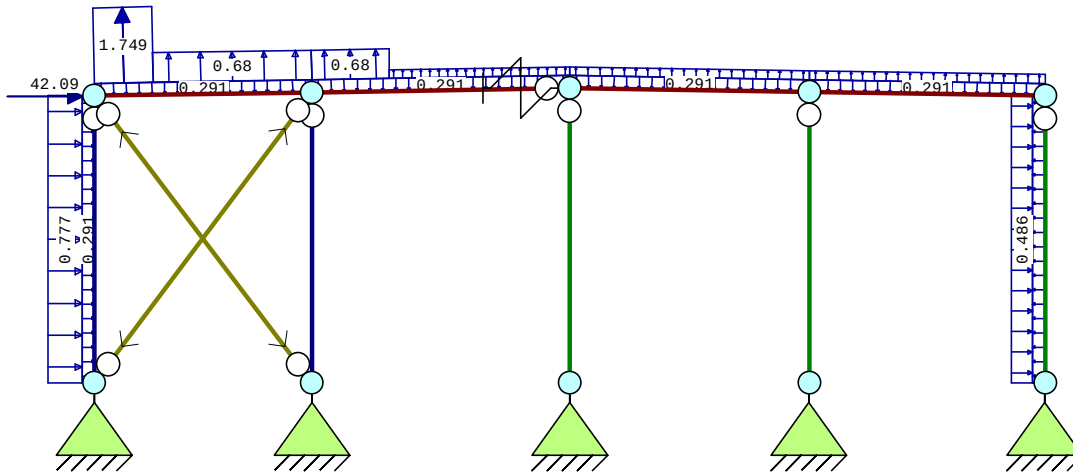


## VERANDERLIJKE BELASTING SITUATIES

| Nr | Lastvelden extreem | Lastvelden momentaan |
|----|--------------------|----------------------|
| 1  | 1                  |                      |
| 2  | 2                  |                      |
| 3  | 3                  |                      |
| 4  | 4                  |                      |

## BELASTINGEN

B.G:4 Wind van links onderdruk A



## KNOOPBELASTINGEN

B.G:4 Wind van links onderdruk A

| Last Knoop | Richting | waarde | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------------|----------|--------|----------|----------|----------|------|
| 1          | 2 X      | 42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

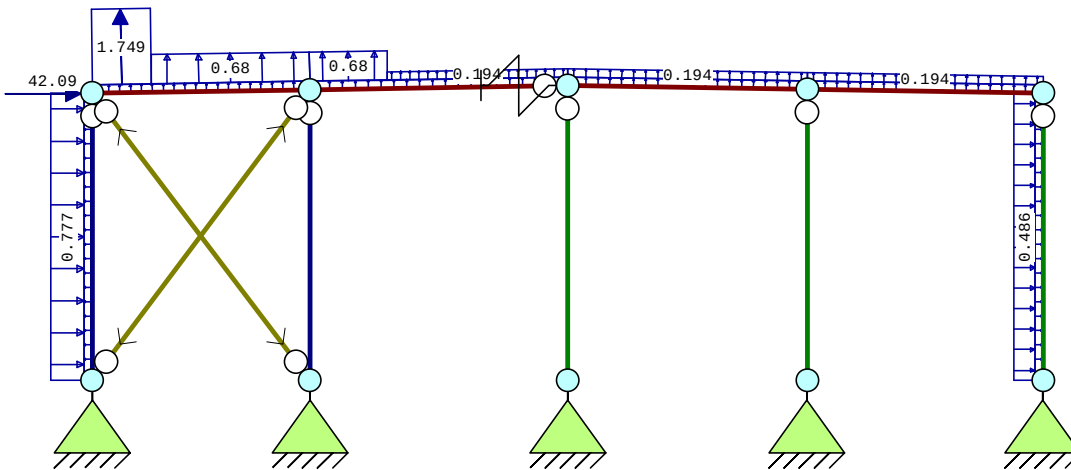
## STAAFBELASTINGEN

B.G:4 Wind van links onderdruk A

| Staf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5    | 1:QZLokaal | Qw3   | -0.78  | -0.78 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 0.000 | 3.299 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 1.227 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 1.608 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw7   | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:5 Wind van links overdruk A


**KNOOPBELASTINGEN**

B.G:5 Wind van links overdruk A

| Last | Knoop | Richting | waarde | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|--------|----------|----------|----------|------|
| 1    | 2     | X        | 42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

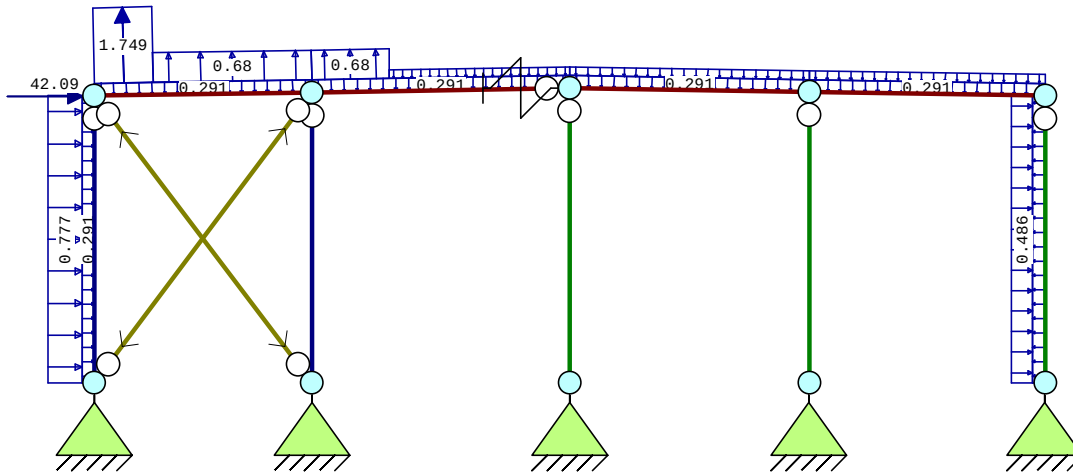
**STAAFBELASTINGEN**

B.G:5 Wind van links overdruk A

| Staaf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw3   | -0.78  | -0.78 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 0.000 | 3.299 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 1.227 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 1.608 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw7   | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:6 Wind van links onderdruk B



## KNOOPBELASTINGEN

B.G:6 Wind van links onderdruk B

| Last Knoop | Richting | waarde | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------------|----------|--------|----------|----------|----------|------|
| 1          | 2 X      | 42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

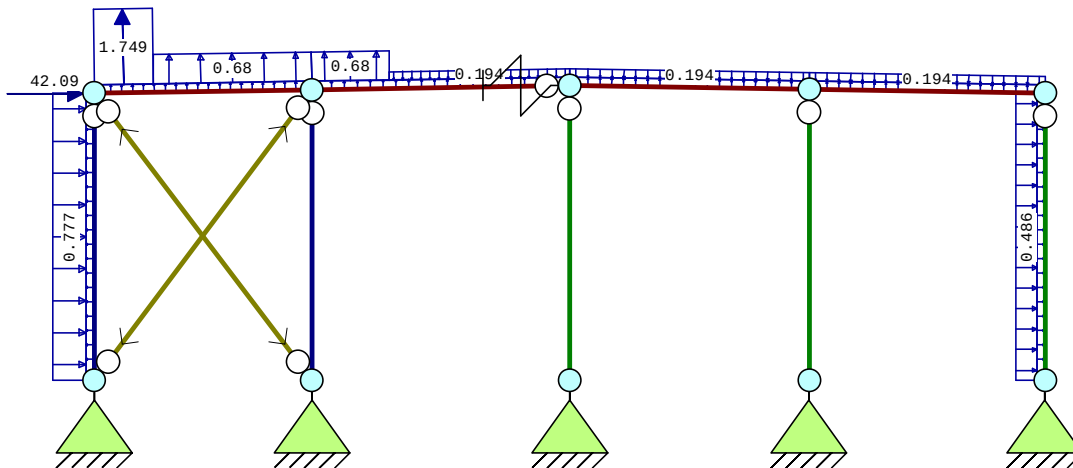
## STAAFBELASTINGEN

B.G:6 Wind van links onderdruk B

| Staf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5    | 1:QZLokaal | Qw3   | -0.78  | -0.78 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 0.000 | 3.299 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 1.227 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 1.608 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw7   | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:7 Wind van links overdruk B



## KNOOPBELASTINGEN

B.G:7 Wind van links overdruk B

| Last | Knoop | Richting | waarde | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|--------|----------|----------|----------|------|
| 1    | 2     | X        | 42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

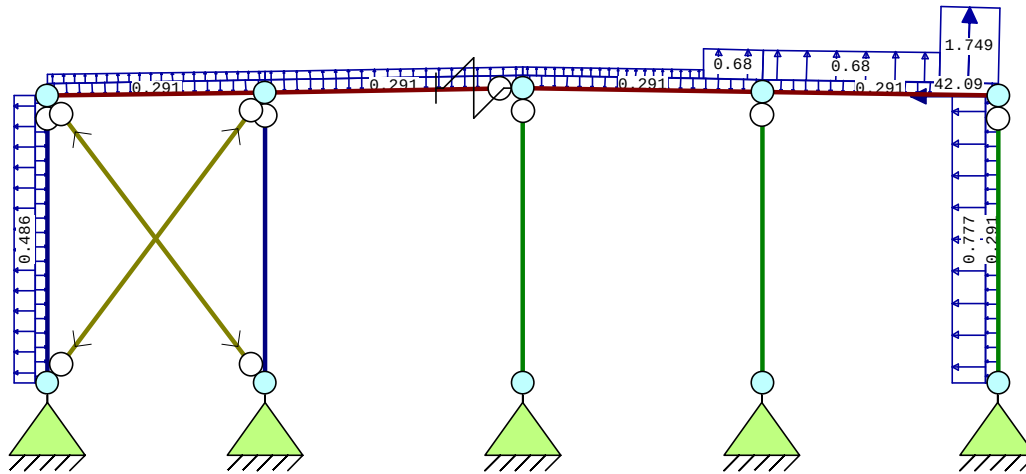
## STAAFBELASTINGEN

B.G:7 Wind van links overdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw3   | -0.78  | -0.78 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 0.000 | 3.299 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 1.227 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 1.608 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw7   | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:8 Wind van rechts onderdruk A



## KNOOPBELASTINGEN

B.G:8 Wind van rechts onderdruk A

| Last Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------------|----------|---------|----------|----------|----------|------|
| 1          | 10 X     | -42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

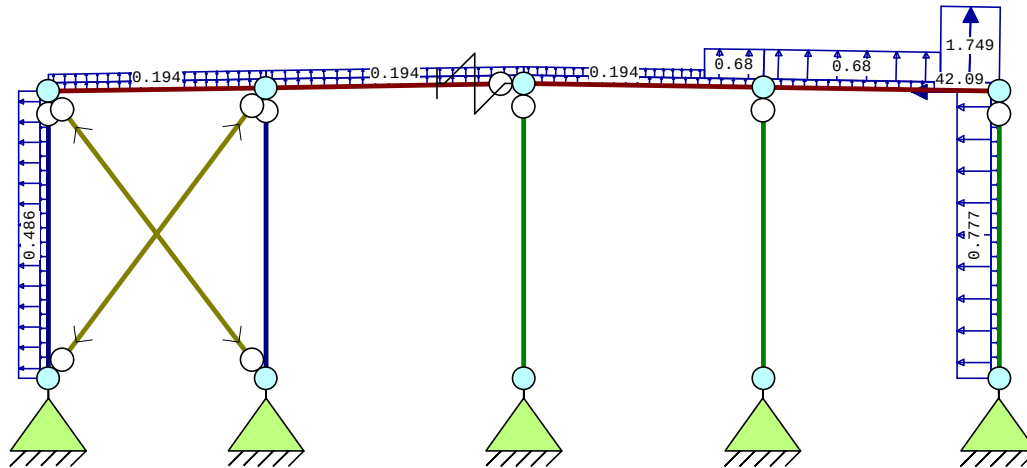
## STAAFBELASTINGEN

B.G:8 Wind van rechts onderdruk A

| Staf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw11  | 0.78   | 0.78  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 3.679 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 3.752 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 1.228 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5    | 1:QZLokaal | Qw12  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:9 Wind van rechts overdruk A



## KNOOPBELASTINGEN

B.G:9 Wind van rechts overdruk A

| Last Knoop Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opn. |
|---------------------|---------|----------|----------|----------|------|
| 1 10 X              | -42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

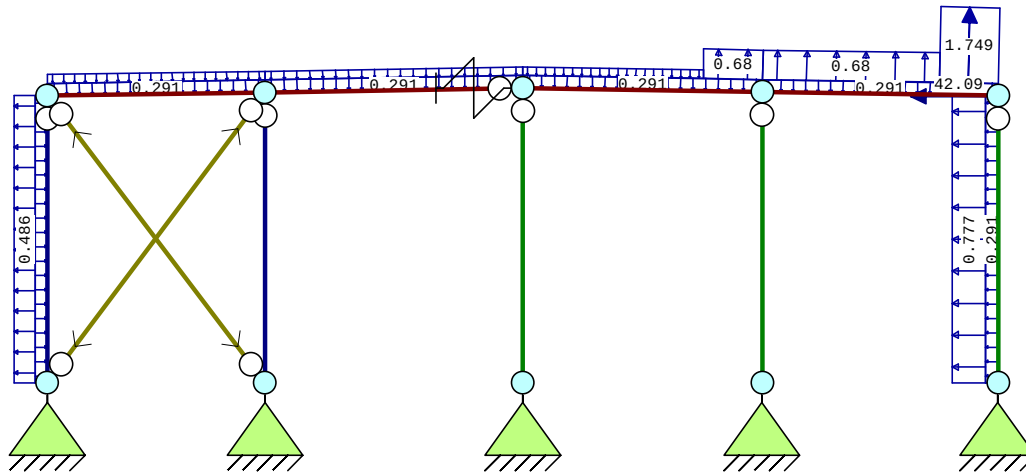
## STAAFBELASTINGEN

B.G:9 Wind van rechts overdruk A

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw11  | 0.78   | 0.78  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 3.679 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 3.752 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 1.228 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw6   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw12  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:10 Wind van rechts onderdruk B



## KNOOPBELASTINGEN

B.G:10 Wind van rechts onderdruk B

| Last Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------------|----------|---------|----------|----------|----------|------|
| 1          | 10 X     | -42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

## STAAFBELASTINGEN

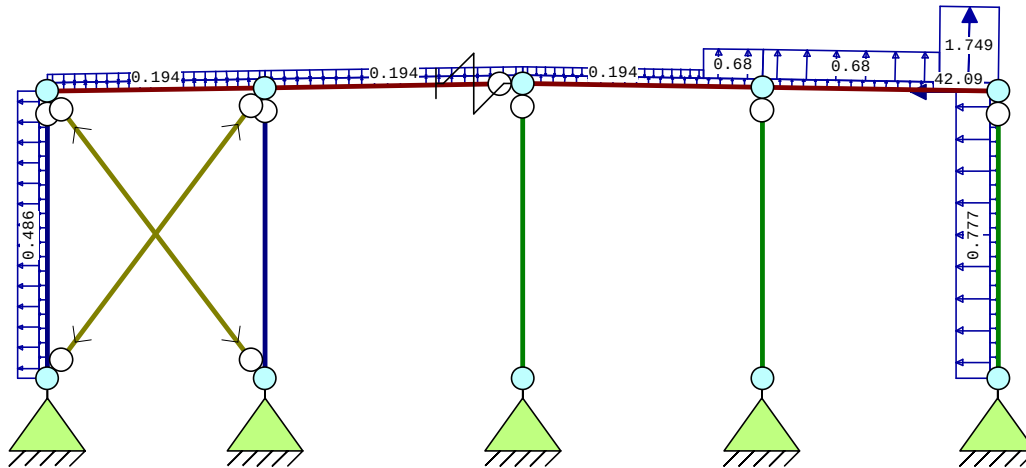
B.G:10 Wind van rechts onderdruk B

| Staf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9    | 1:QZLokaal | Qw11  | 0.78   | 0.78  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 3.679 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 3.752 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 1.228 | 0.0      | 0.2      | 0.0      |
| 2    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1    | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5    | 1:QZLokaal | Qw12  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |



## BELASTINGEN

B.G:11 Wind van rechts overdruk B



## KNOOPBELASTINGEN

B.G:11 Wind van rechts overdruk B

| Last Knoop Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opn. |
|---------------------|---------|----------|----------|----------|------|
| 1 10 X              | -42.090 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

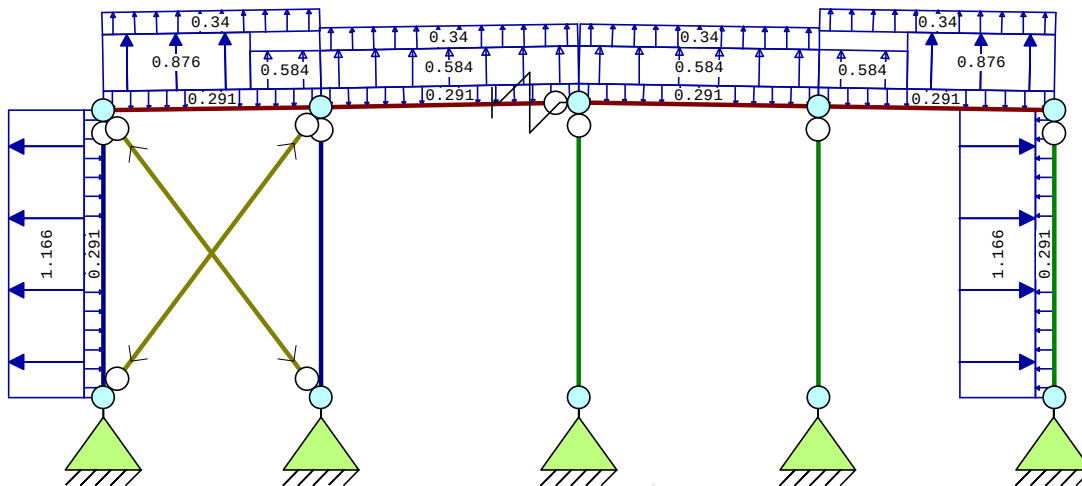
## STAAFBELASTINGEN

B.G:11 Wind van rechts overdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw11  | 0.78   | 0.78  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw4   | 1.75   | 1.75  | 3.679 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 0.000 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 0.68   | 0.68  | 3.752 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 1.228 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw10  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw12  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:12 Wind loodrecht onderdruk A



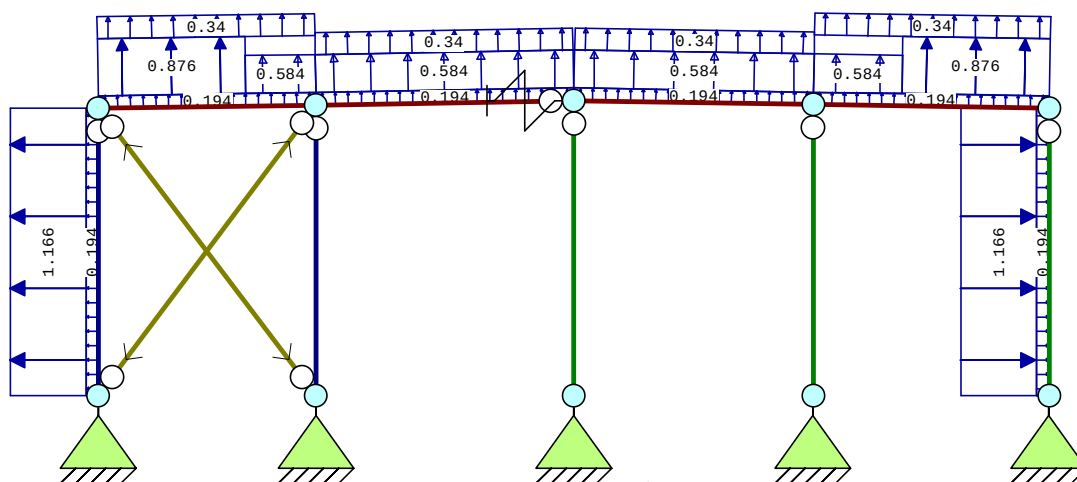
## STAAFBELASTINGEN

B.G:12 Wind loodrecht onderdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw13  | 1.17   | 1.17  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw14  | -1.17  | -1.17 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 3.067 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw16  | 0.88   | 0.88  | 0.000 | 1.459 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw16  | 0.88   | 0.88  | 1.839 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 3.067 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:13 Wind loodrecht overdruk A



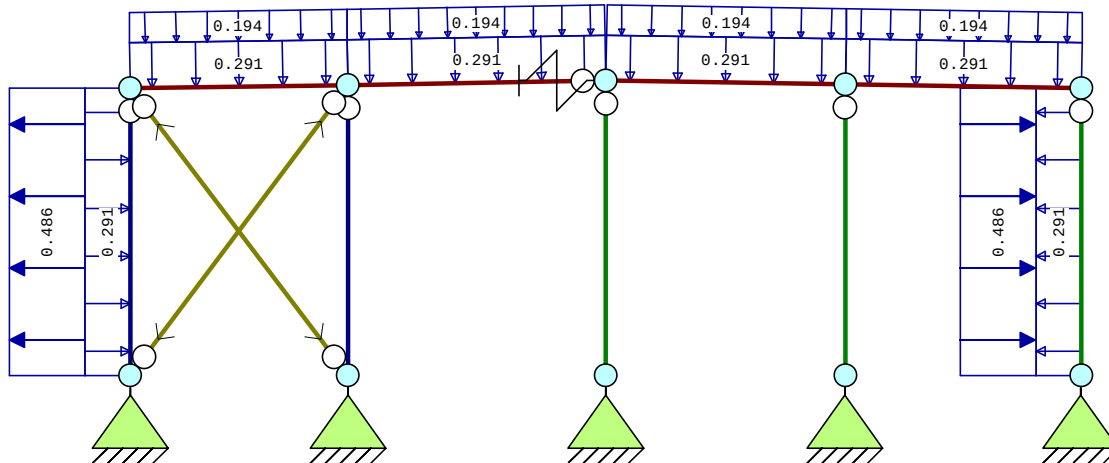
## STAAFBELASTINGEN

B.G:13 Wind loodrecht overdruk A

| Staaf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw13  | 1.17   | 1.17  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw14  | -1.17  | -1.17 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 3.067 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw16  | 0.88   | 0.88  | 0.000 | 1.459 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw16  | 0.88   | 0.88  | 1.839 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw15  | 0.58   | 0.58  | 0.000 | 3.067 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw17  | 0.34   | 0.34  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:14 Wind loodrecht onderdruk B



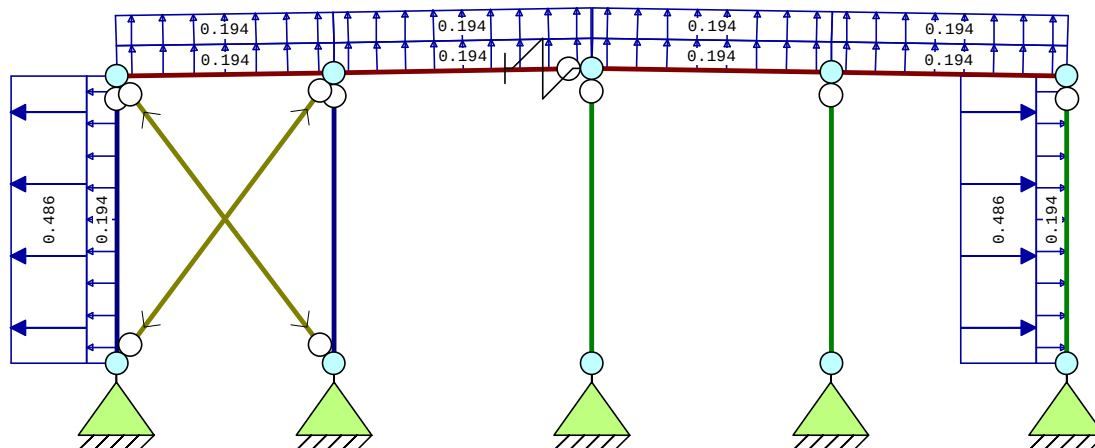
## STAAFBELASTINGEN

B.G:14 Wind loodrecht onderdruk B

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.29  | -0.29 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw2   | 0.29   | 0.29  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5     | 1:QZLokaal | Qw18  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9     | 1:QZLokaal | Qw19  | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw20  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw20  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw20  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw20  | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:15 Wind loodrecht overdruk B



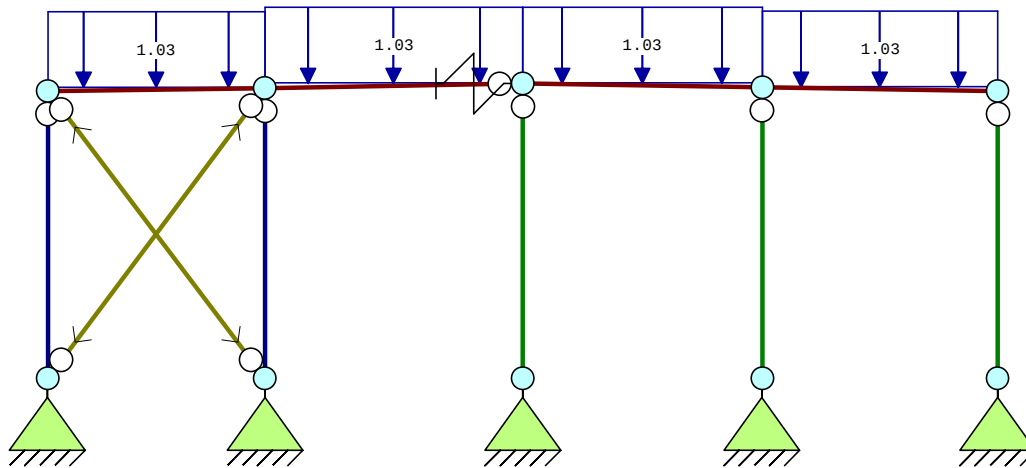
## STAAFBELASTINGEN

B.G:15 Wind loodrecht overdruk B

| Staaftype | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-----------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 5         | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1         | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3         | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4         | 1:QZLokaal | Qw8   | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9         | 1:QZLokaal | Qw9   | -0.19  | -0.19 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 5         | 1:QZLokaal | Qw18  | 0.49   | 0.49  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 9         | 1:QZLokaal | Qw19  | -0.49  | -0.49 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1         | 1:QZLokaal | Qw21  | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw21  | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3         | 1:QZLokaal | Qw21  | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4         | 1:QZLokaal | Qw21  | 0.19   | 0.19  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:16 Sneeuw A



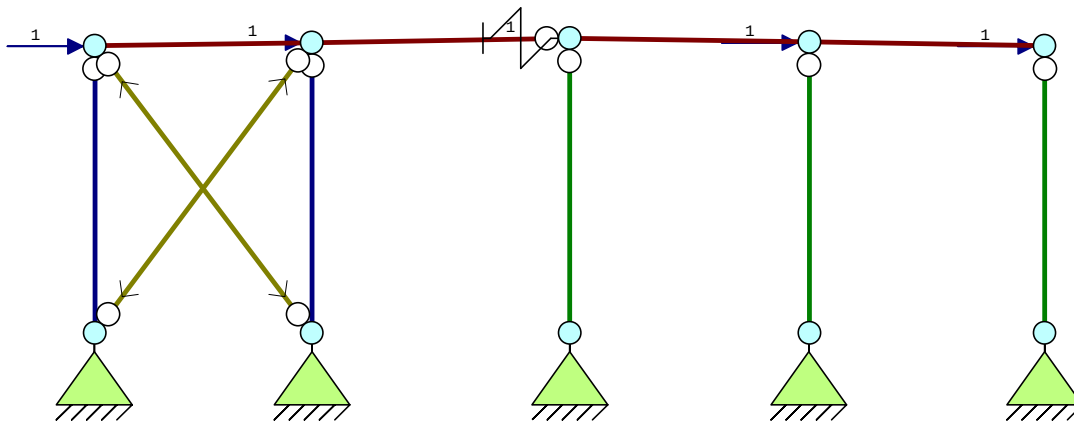
## STAAFBELASTINGEN

B.G:16 Sneeuw A

| Staat | Type        | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|-------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 3:QZgeProj. | Qs1   | -1.03  | -1.03 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 3:QZgeProj. | Qs2   | -1.03  | -1.03 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 3:QZgeProj. | Qs3   | -1.03  | -1.03 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 3:QZgeProj. | Qs4   | -1.03  | -1.03 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:17 Knik



## KNOOPBELASTINGEN

B.G:17 Knik

| Last | Knoop | Richting | waarde | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|-------|----------|--------|----------|----------|----------|
| 1    | 2     | X        | 1.000  |          |          |          |
| 2    | 4     | X        | 1.000  |          |          |          |
| 3    | 6     | X        | 1.000  |          |          |          |
| 4    | 8     | X        | 1.000  |          |          |          |
| 5    | 10    | X        | 1.000  |          |          |          |

# **BELASTINGCOMBINATIES**

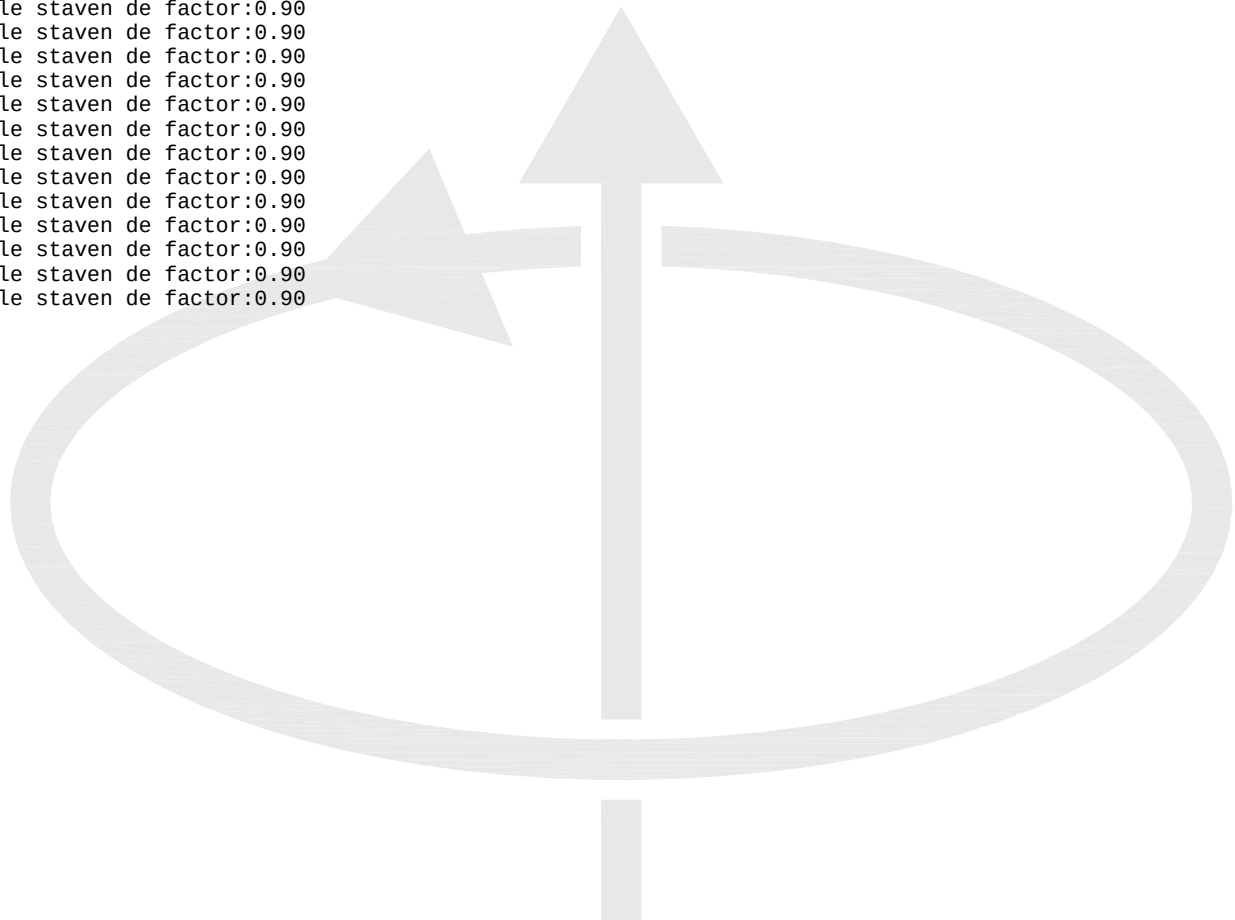
| BC | Type  | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor |
|----|-------|----|------|--------|----|------|--------|----|------|--------|----|------|--------|
| 1  | Fund. | 1  | Perm | 1.22   |    |      |        |    |      |        |    |      |        |
| 2  | Fund. | 1  | Perm | 0.90   |    |      |        |    |      |        |    |      |        |
| 3  | Fund. | 1  | Perm | 1.08   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 4  | Fund. | 1  | Perm | 1.08   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 5  | Fund. | 1  | Perm | 1.08   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 6  | Fund. | 1  | Perm | 1.08   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 7  | Fund. | 1  | Perm | 1.08   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 8  | Fund. | 1  | Perm | 1.08   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 9  | Fund. | 1  | Perm | 1.08   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 10 | Fund. | 1  | Perm | 1.08   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 11 | Fund. | 1  | Perm | 1.08   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 12 | Fund. | 1  | Perm | 1.08   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 13 | Fund. | 1  | Perm | 1.08   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 14 | Fund. | 1  | Perm | 1.08   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 15 | Fund. | 1  | Perm | 1.08   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 16 | Fund. | 1  | Perm | 1.08   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 17 | Fund. | 1  | Perm | 1.08   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 18 | Fund. | 1  | Perm | 0.90   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 19 | Fund. | 1  | Perm | 0.90   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 20 | Fund. | 1  | Perm | 0.90   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 21 | Fund. | 1  | Perm | 0.90   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 22 | Fund. | 1  | Perm | 0.90   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 23 | Fund. | 1  | Perm | 0.90   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 24 | Fund. | 1  | Perm | 0.90   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 25 | Fund. | 1  | Perm | 0.90   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 26 | Fund. | 1  | Perm | 0.90   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 27 | Fund. | 1  | Perm | 0.90   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 28 | Fund. | 1  | Perm | 0.90   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 29 | Fund. | 1  | Perm | 0.90   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 30 | Fund. | 1  | Perm | 0.90   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 31 | Fund. | 1  | Perm | 0.90   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 32 | Fund. | 1  | Perm | 0.90   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 33 | Kar.  | 1  | Perm | 1.00   | 2  | Extr | 1.00   |    |      |        |    |      |        |
| 34 | Kar.  | 1  | Perm | 1.00   | 3  | Extr | 1.00   |    |      |        |    |      |        |
| 35 | Kar.  | 1  | Perm | 1.00   | 4  | Extr | 1.00   |    |      |        |    |      |        |
| 36 | Kar.  | 1  | Perm | 1.00   | 5  | Extr | 1.00   |    |      |        |    |      |        |
| 37 | Kar.  | 1  | Perm | 1.00   | 6  | Extr | 1.00   |    |      |        |    |      |        |
| 38 | Kar.  | 1  | Perm | 1.00   | 7  | Extr | 1.00   |    |      |        |    |      |        |
| 39 | Kar.  | 1  | Perm | 1.00   | 8  | Extr | 1.00   |    |      |        |    |      |        |
| 40 | Kar.  | 1  | Perm | 1.00   | 9  | Extr | 1.00   |    |      |        |    |      |        |
| 41 | Kar.  | 1  | Perm | 1.00   | 10 | Extr | 1.00   |    |      |        |    |      |        |
| 42 | Kar.  | 1  | Perm | 1.00   | 11 | Extr | 1.00   |    |      |        |    |      |        |
| 43 | Kar.  | 1  | Perm | 1.00   | 12 | Extr | 1.00   |    |      |        |    |      |        |
| 44 | Kar.  | 1  | Perm | 1.00   | 13 | Extr | 1.00   |    |      |        |    |      |        |
| 45 | Kar.  | 1  | Perm | 1.00   | 14 | Extr | 1.00   |    |      |        |    |      |        |
| 46 | Kar.  | 1  | Perm | 1.00   | 15 | Extr | 1.00   |    |      |        |    |      |        |
| 47 | Kar.  | 1  | Perm | 1.00   | 16 | Extr | 1.00   |    |      |        |    |      |        |
| 48 | Quas. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 49 | Freq. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 50 | Freq. | 1  | Perm | 1.00   | 4  | psi1 | 1.00   |    |      |        |    |      |        |
| 51 | Freq. | 1  | Perm | 1.00   | 5  | psi1 | 1.00   |    |      |        |    |      |        |
| 52 | Freq. | 1  | Perm | 1.00   | 6  | psi1 | 1.00   |    |      |        |    |      |        |
| 53 | Freq. | 1  | Perm | 1.00   | 7  | psi1 | 1.00   |    |      |        |    |      |        |
| 54 | Freq. | 1  | Perm | 1.00   | 8  | psi1 | 1.00   |    |      |        |    |      |        |
| 55 | Freq. | 1  | Perm | 1.00   | 9  | psi1 | 1.00   |    |      |        |    |      |        |
| 56 | Freq. | 1  | Perm | 1.00   | 10 | psi1 | 1.00   |    |      |        |    |      |        |
| 57 | Freq. | 1  | Perm | 1.00   | 11 | psi1 | 1.00   |    |      |        |    |      |        |
| 58 | Freq. | 1  | Perm | 1.00   | 12 | psi1 | 1.00   |    |      |        |    |      |        |
| 59 | Freq. | 1  | Perm | 1.00   | 13 | psi1 | 1.00   |    |      |        |    |      |        |
| 60 | Freq. | 1  | Perm | 1.00   | 14 | psi1 | 1.00   |    |      |        |    |      |        |
| 61 | Freq. | 1  | Perm | 1.00   | 15 | psi1 | 1.00   |    |      |        |    |      |        |
| 62 | Freq. | 1  | Perm | 1.00   | 16 | psi1 | 1.00   |    |      |        |    |      |        |
| 63 | Blij. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |



## GUNSTIGE WERKING PERMANENTE BELASTINGEN

BC Staven met gunstige werking

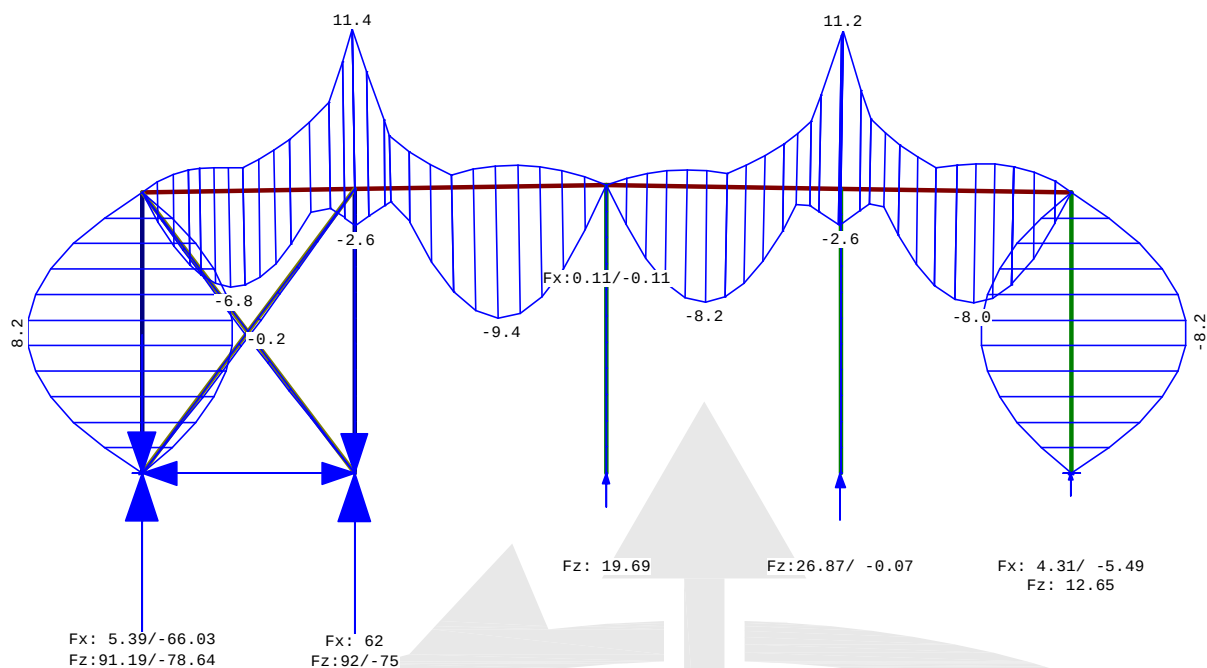
1 Geen  
 2 Alle staven de factor:0.90  
 3 Geen  
 4 Geen  
 5 Geen  
 6 Geen  
 7 Geen  
 8 Geen  
 9 Geen  
 10 Geen  
 11 Geen  
 12 Geen  
 13 Geen  
 14 Geen  
 15 Geen  
 16 Geen  
 17 Geen  
 18 Alle staven de factor:0.90  
 19 Alle staven de factor:0.90  
 20 Alle staven de factor:0.90  
 21 Alle staven de factor:0.90  
 22 Alle staven de factor:0.90  
 23 Alle staven de factor:0.90  
 24 Alle staven de factor:0.90  
 25 Alle staven de factor:0.90  
 26 Alle staven de factor:0.90  
 27 Alle staven de factor:0.90  
 28 Alle staven de factor:0.90  
 29 Alle staven de factor:0.90  
 30 Alle staven de factor:0.90  
 31 Alle staven de factor:0.90  
 32 Alle staven de factor:0.90



# OMHULLENDE VAN DE FUNDAMENTELE COMBINATIES

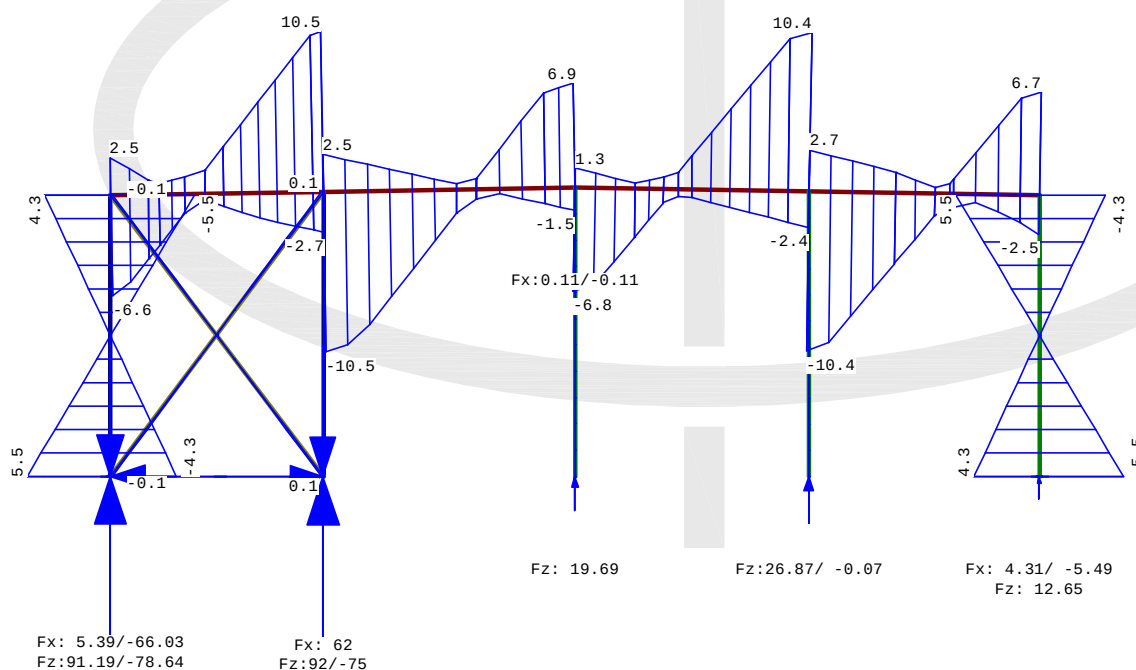
## MOMENTEN

Fundamentele combinatie



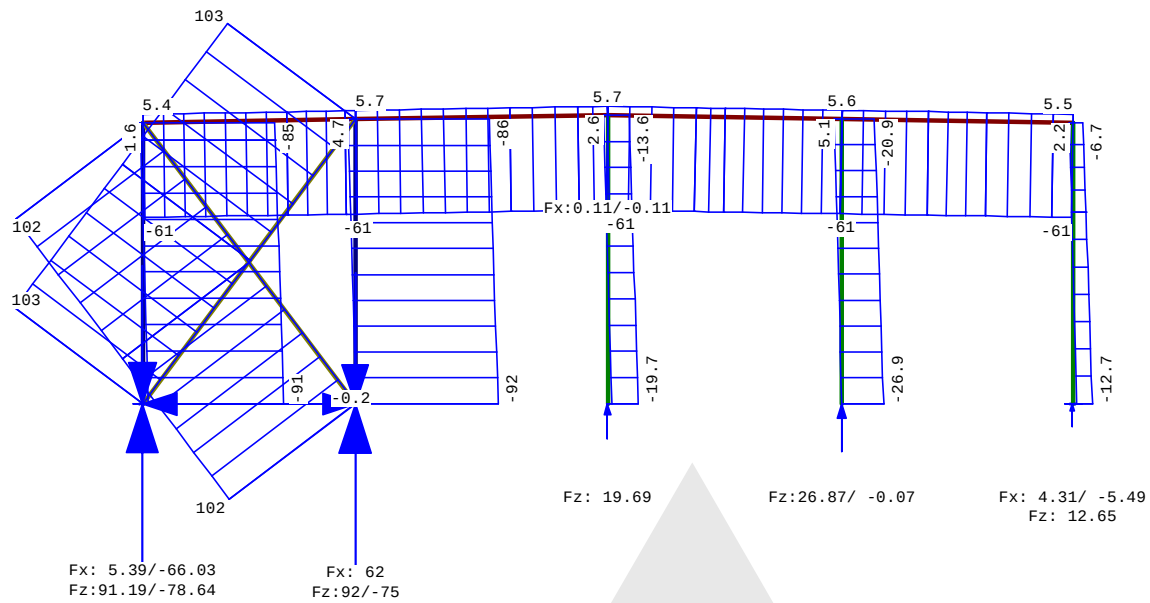
## DWARSKRACHTEN

Fundamentele combinatie



**NORMAALKRACHTEN**

Fundamentele combinatie



# STAAFKRACHTEN

## Fundamentele combinatie

| St. | Kn.   | Pos. | NXi/NXj |     | DZi/DZj |     | MYi/MYj |     |
|-----|-------|------|---------|-----|---------|-----|---------|-----|
|     |       |      | Min     | Max | Min     | Max | Min     | Max |
| 1   | 2     |      | -61.12  | 5   | -6.60   | 3   | 0.00    | 3   |
| 1   | 1.032 |      | -61.11  | 5   | -3.31   | 3   | -5.37   | 3   |
| 1   | 1.691 |      | -61.10  | 20  | -0.82   | 18  | -6.73   | 3   |
| 1   | 1.902 |      | -61.10  | 20  | -0.48   | 19  | -6.82   | 3   |
| 1   | 2.014 |      | -61.09  | 20  | -0.39   | 19  | -6.79   | 3   |
| 1   | 2.154 |      | -61.09  | 20  | -0.55   | 29  | -6.69   | 3   |
| 1   | 3.717 |      | -61.07  | 20  | -2.06   | 29  | -0.71   | 18  |
| 1   | 4     |      | -61.06  | 20  | -2.65   | 29  | -2.62   | 29  |
| 2   | 4     |      | -61.01  | 11  | -10.48  | 3   | -2.62   | 29  |
| 2   | 0.926 |      | -61.00  | 11  | -8.79   | 3   | -0.65   | 29  |
| 2   | 2.063 |      | -60.98  | 11  | -4.47   | 3   | -7.41   | 3   |
| 2   | 2.836 |      | -60.97  | 11  | -1.52   | 3   | -9.25   | 3   |
| 2   | 3.074 |      | -60.97  | 11  | -0.79   | 3   | -9.35   | 3   |
| 2   | 3.344 |      | -60.96  | 26  | -0.56   | 18  | -9.22   | 3   |
| 2   | 3.712 |      | -60.96  | 26  | -0.27   | 18  | -8.58   | 3   |
| 2   | 6     |      | -60.94  | 26  | -1.48   | 29  | 0.00    | 3   |
| 3   | 6     |      | -61.05  | 26  | -6.76   | 3   | 0.00    | 3   |
| 3   | 1.281 |      | -61.07  | 26  | -3.17   | 3   | -6.90   | 3   |
| 3   | 1.777 |      | -61.07  | 26  | -1.29   | 3   | -8.00   | 3   |
| 3   | 2.115 |      | -61.08  | 11  | -0.53   | 19  | -8.22   | 3   |
| 3   | 2.303 |      | -61.08  | 11  | -0.39   | 19  | -8.15   | 3   |
| 3   | 2.563 |      | -61.08  | 11  | -0.58   | 29  | -7.84   | 3   |
| 3   | 4.102 |      | -61.11  | 11  | -1.71   | 29  | -0.82   | 18  |
| 3   | 8     |      | -61.12  | 11  | -2.36   | 29  | -2.61   | 29  |
| 4   | 8     |      | -61.06  | 24  | -10.44  | 3   | -2.61   | 29  |
| 4   | 0.836 |      | -61.07  | 24  | -8.44   | 3   | -0.60   | 29  |
| 4   | 2.030 |      | -61.08  | 24  | -3.90   | 3   | -6.79   | 3   |
| 4   | 2.680 |      | -61.09  | 24  | -1.42   | 3   | -7.95   | 3   |
| 4   | 2.825 |      | -61.09  | 24  | -1.10   | 3   | -7.99   | 3   |
| 4   | 3.044 |      | -61.10  | 24  | -0.90   | 3   | -7.90   | 3   |
| 4   | 3.073 |      | -61.10  | 24  | -0.87   | 3   | -7.88   | 3   |
| 4   | 3.515 |      | -61.10  | 9   | -0.53   | 18  | -7.09   | 3   |
| 4   | 10    |      | -61.12  | 9   | -2.55   | 27  | -0.00   | 3   |
| 5   | 1     |      | -90.98  | 11  | -4.31   | 5   | 0.00    | 5   |
| 5   | 2.987 |      | -88.02  | 11  | 0.00    | 5   | -6.44   | 5   |
| 5   | 2     |      | -85.06  | 11  | -5.49   | 14  | 0.00    | 5   |
| 6   | 3     |      | -91.96  | 7   | 0.00    | 6   | 0.00    | 6   |
| 6   | 4     |      | -85.96  | 7   | 0.00    | 6   | 0.00    | 6   |
| 7   | 5     |      | -19.69  | 3   | 0.00    | 5   | 0.00    | 5   |
| 7   | 6     |      | -13.62  | 3   | 0.00    | 5   | 0.00    | 5   |
| 8   | 7     |      | -26.87  | 3   | 0.00    | 12  | 0.00    | 12  |
| 8   | 8     |      | -20.87  | 3   | 0.00    | 12  | 0.00    | 12  |
| 9   | 9     |      | -12.65  | 3   | -5.49   | 14  | 0.00    | 14  |
| 9   | 2.987 |      | -9.69   | 3   | 0.00    | 14  | -8.19   | 14  |
| 9   | 10    |      | -6.73   | 3   | -4.31   | 11  | 0.00    | 14  |
| 10  | 1     |      | -0.00   | 14  | -0.12   | 5   | 0.00    | 5   |
| 10  | 3.776 |      | 0.00    | 1   | 0.00    | 5   | -0.23   | 5   |
| 10  | 4     |      | 0.00    | 1   | 0.00    | 1   | -0.00   | 5   |
| 11  | 3     |      | -0.16   | 16  | 0.00    | 1   | 0.00    | 1   |
| 11  | 3.747 |      | 0.00    | 1   | 0.00    | 1   | 0.00    | 1   |
| 11  | 2     |      | 0.00    | 1   | -0.12   | 9   | 0.00    | 1   |

# REACTIES

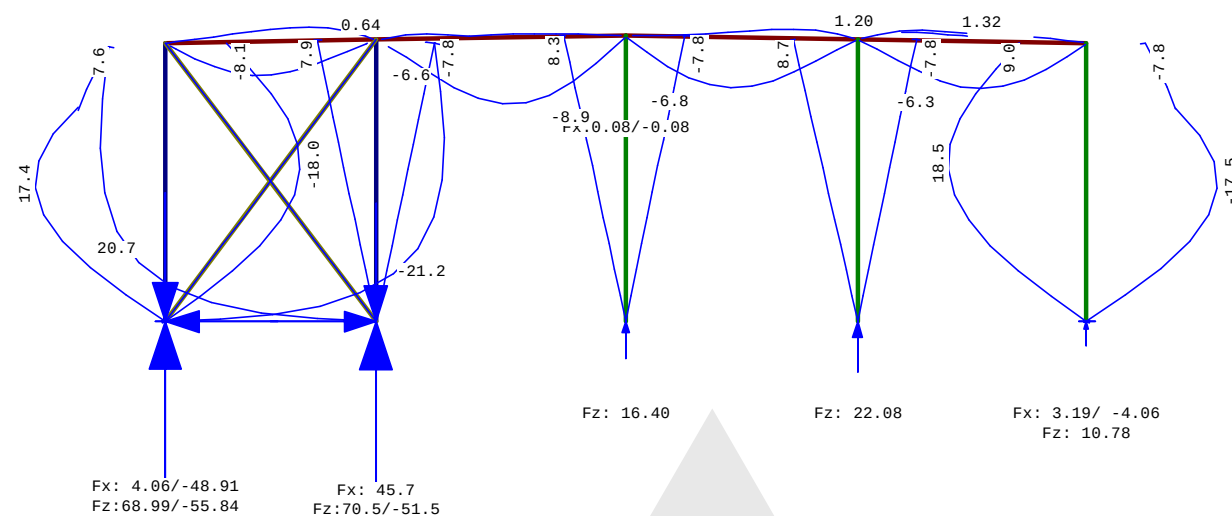
## Fundamentele combinatie

| Kn. | X-min  | X-max | Z-min  | Z-max | M-min | M-max |
|-----|--------|-------|--------|-------|-------|-------|
| 1   | -66.03 | 5.39  | -78.64 | 91.19 |       |       |
| 3   | 0.00   | 61.71 | -74.56 | 92.16 |       |       |
| 5   | 0.00   | 0.00  | 2.46   | 19.69 |       |       |
| 6   | -0.11  | 0.11  |        |       |       |       |
| 7   | 0.00   | 0.00  | -0.07  | 26.87 |       |       |
| 9   | -5.49  | 4.31  | 2.74   | 12.65 |       |       |

## OMHULLENDE VAN DE KARAKTERISTIEKE COMBINATIES

VERPLAATSINGEN [mm]

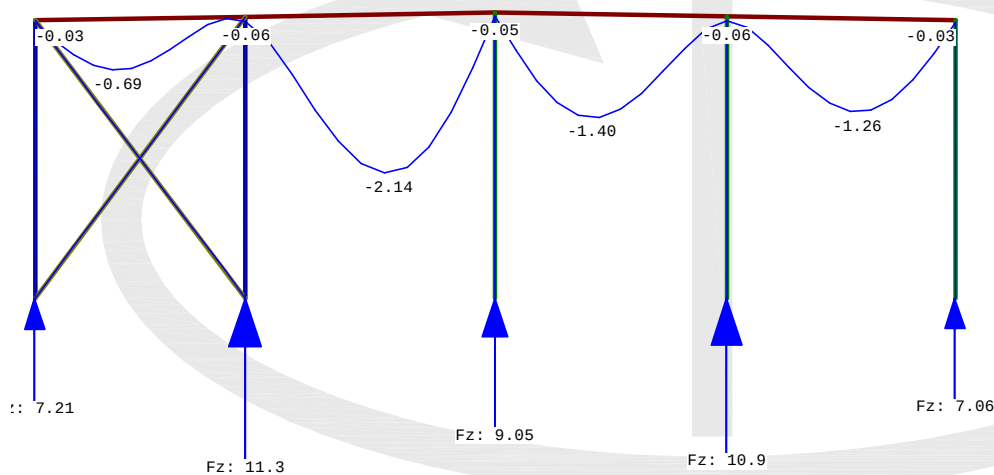
Karakteristieke combinatie



## OMHULLENDE VAN DE BLIJVENDE COMBINATIES

VERPLAATSINGEN [mm]

Blijvende combinatie



## REACTIES

Blijvende combinatie

| Kn. | X     | Z     | M |
|-----|-------|-------|---|
| 1   | -0.00 | 7.21  |   |
| 3   | -0.00 | 11.27 |   |
| 5   | 0.00  | 9.05  |   |
| 6   | -0.00 |       |   |
| 7   | 0.00  | 10.86 |   |
| 9   | 0.00  | 7.06  |   |

## STAALPROFIELEN - ALGEMENE GEGEVENS

|                              |                                            |             |
|------------------------------|--------------------------------------------|-------------|
| Stabiliteit:                 | Classificatie gehele constructie:          | Ongeschoord |
|                              | Belastinggeval m.b.t. bepaling kniklengte: | 17=Knik     |
|                              | Aanpassing inkl. parameter C :             | Steunpunten |
| Tweede-orde-effect:          |                                            |             |
|                              | Aan te houden verhouding $n/(n-1)$         |             |
|                              | voor steunmomenten en verplaatsingen:      | 1.10        |
| Doorbuiging en verplaatsing: |                                            |             |
|                              | Aantal bouwlagen:                          | 1           |
|                              | Gebouwtype:                                | Industrieel |
|                              | Toel. horiz. verplaatsing gehele gebouw:   | h/150       |
|                              | Kleinste gevelhoogte [m]:                  | 6.2         |

## MATERIAAL

| Mat nr. | Profielnaam | Vloeisp. [N/mm <sup>2</sup> ] | Productie methode | Min. drsn. klasse |
|---------|-------------|-------------------------------|-------------------|-------------------|
| 1       | HEA140      | 235                           | Gewalst           | 1                 |
| 2       | HEA160Z     | 235                           | Gewalst           | 1                 |
| 3       | STRIP80*8Z  | 235                           | Gewalst           | 1                 |
| 4       | HEA160Z     | 235                           | Gewalst           | 1                 |

Partiële veiligheidsfactoren:

Gamma M;0 : 1.00 Gamma M;1 : 1.00

## KNIKSTABILITEIT

| Staafl | $l_{sys}$ [m] | Classif. y<br>sterke as | $l_{knik;y}$ [m] | Extra           |                         | $l_{knik;z}$ [m] | Extra           |  |
|--------|---------------|-------------------------|------------------|-----------------|-------------------------|------------------|-----------------|--|
|        |               |                         |                  | aanp. y<br>[kN] | Classif. z<br>zwakke as |                  | aanp. z<br>[kN] |  |
| 1      | 4.526         | Geschoord               | 4.526            | 0.0             | Geschoord               | 4.526            | 0.0             |  |
| 2      | 5.361         | Geschoord               | 5.361            | 0.0             | Geschoord               | 5.361            | 0.0             |  |
| 3      | 4.981         | Geschoord               | 4.981            | 0.0             | Geschoord               | 4.981            | 0.0             |  |
| 4      | 4.906         | Geschoord               | 4.906            | 0.0             | Geschoord               | 4.906            | 0.0             |  |
| 5      | 5.974         | Geschoord               | 5.974            | 0.0             | Geschoord               | 5.974            | 0.0             |  |
| 6      | 6.047         | Geschoord               | 6.047            | 0.0             | Geschoord               | 6.047            | 0.0             |  |
| 7      | 6.133         | Geschoord               | 6.133            | 0.0             | Geschoord               | 6.133            | 0.0             |  |
| 8      | 6.053         | Geschoord               | 6.053            | 0.0             | Geschoord               | 6.053            | 0.0             |  |
| 9      | 5.974         | Geschoord               | 5.974            | 0.0             | Geschoord               | 5.974            | 0.0             |  |
| 10     | 7.553         | Geschoord               | 7.553            | 0.0             | Geschoord               | 7.553            | 0.0             |  |
| 11     | 7.494         | Geschoord               | 7.494            | 0.0             | Geschoord               | 7.494            | 0.0             |  |

## KIPSTABILITEIT

| Staafl | Plts. aangr. |        | l gaffel [m] | Kipsteunafstanden [m] |
|--------|--------------|--------|--------------|-----------------------|
| 1      | 1.0*h        | boven: | 4.53         | 4.526                 |
|        |              | onder: | 4.53         | 4.526                 |

## KIPSTABILITEIT

| Staafl | Plts. aangr. |        | l gaffel [m] | Kipsteunafstanden [m] |
|--------|--------------|--------|--------------|-----------------------|
| 2      | 1.0*h        | boven: | 5.36         | 5.361                 |
|        |              | onder: | 5.36         | 5.361                 |
| 3      | 1.0*h        | boven: | 4.98         | 4.981                 |
|        |              | onder: | 4.98         | 4.981                 |
| 4      | 1.0*h        | boven: | 4.91         | 4.906                 |
|        |              | onder: | 4.91         | 4.906                 |
| 5      | 1.0*h        | boven: | 5.97         | 5.974                 |
|        |              | onder: | 5.97         | 5.974                 |
| 6      | 1.0*h        | boven: | 6.05         | 6.047                 |
|        |              | onder: | 6.05         | 6.047                 |
| 7      | 1.0*h        | boven: | 6.13         | 6.133                 |
|        |              | onder: | 6.13         | 6.133                 |
| 8      | 1.0*h        | boven: | 6.05         | 6.053                 |
|        |              | onder: | 6.05         | 6.053                 |
| 9      | 0.0*h        | boven: | 5.97         | 5.974                 |
|        |              | onder: | 5.97         | 5.974                 |
| 10     | 1.0*h        | boven: | 7.55         | 7.553                 |
|        |              | onder: | 7.55         | 7.553                 |
| 11     | 1.0*h        | boven: | 7.49         | 7.494                 |
|        |              | onder: | 7.49         | 7.494                 |

**KRACHTEN UIT HET VLAK**

| Staaft | Mbegin<br>[kNm] | Mmidden<br>[kNm] | Meinde<br>[kNm] | Vbegin<br>[kN] | Vtpv<br>[kN] | Mmax<br>[kN] | Veinde<br>[kN] | Mx<br>[kNm] |
|--------|-----------------|------------------|-----------------|----------------|--------------|--------------|----------------|-------------|
| 1      | 0.0             | 7.6              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |
| 2      | 0.0             | 7.6              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |
| 3      | 0.0             | 7.6              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |
| 4      | 0.0             | 7.6              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |
| 5      | 0.0             | 9.4              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |
| 6      | 0.0             | 18.9             | 0.0             | 12.2           | 0.0          | 12.2         | 0.0            |             |
| 7      | 0.0             | 18.9             | 0.0             | 12.2           | 0.0          | 12.2         | 0.0            |             |
| 8      | 0.0             | 18.9             | 0.0             | 12.2           | 0.0          | 12.2         | 0.0            |             |
| 9      | 0.0             | 9.4              | 0.0             | 6.1            | 0.0          | 6.1          | 0.0            |             |

**TOETSING SPANNINGEN**

| Staaft | Mat | BC | Sit | Kl | Plaats | Norm    | Artikel | Formule | Hoogste toetsing<br>U.C. [N/mm <sup>2</sup> ] | Opm. |
|--------|-----|----|-----|----|--------|---------|---------|---------|-----------------------------------------------|------|
| 1      | 11  | 1  | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.811                                         | 191  |
| 2      | 11  | 1  | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.923                                         | 217  |
| 3      | 11  | 1  | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.841                                         | 198  |
| 4      | 11  | 1  | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.803                                         | 189  |
| 5      | 4   | 12 | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.703                                         | 165  |
| 6      | 4   | 7  | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.723                                         | 170  |
| 7      | 2   | 3  | 3   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.476                                         | 112  |
| 8      | 2   | 3  | 5   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.497                                         | 117  |
| 9      | 2   | 14 | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.466                                         | 110  |
| 10     | 3   | 6  | 1   | 1  | Einde  | EN3-1-1 | 6.2.1   | N+D     | 0.687                                         | 162  |
| 11     | 3   | 10 | 1   | 1  | Einde  | EN3-1-1 | 6.2.1   | N+D     | 0.682                                         | 160  |

Opmerkingen:

[ 46 ] T.b.v. kip is een equivalente Q-last berekend.

[ 47 ] Bij verlopende normaalkracht wordt de grootste drukkracht genomen.

[ 76 ] Toetsing van kipstabiliteit voor dit profieltype is niet voorzien.

**TOETSING DOORBUIGING**

| Staaft | Soort | Mtg | Lengte<br>[m] | Overst<br>I J | Zeeg<br>[mm] | U <sub>e o t</sub><br>[mm] | BC | Sit    | u<br>[mm] | Toelaatbaar<br>[mm] | *l    |
|--------|-------|-----|---------------|---------------|--------------|----------------------------|----|--------|-----------|---------------------|-------|
| 1      | Dak   | db  | 4.53          | N N           | 0.0          | -4.9                       | 33 | 5 Eind | -4.9      | -18.1               | 0.004 |
|        |       | db  |               |               |              |                            | 33 | 5 Bijk | -4.2      | -18.1               | 0.004 |
| 2      | Dak   | db  | 5.36          | N N           | 0.0          | -9.7                       | 33 | 1 Eind | -9.7      | -21.4               | 0.004 |
|        |       | db  |               |               |              |                            | 33 | 1 Bijk | -7.4      | -21.4               | 0.004 |
| 3      | Dak   | db  | 4.98          | N N           | 0.0          | -7.3                       | 33 | 2 Eind | -7.3      | -19.9               | 0.004 |
|        |       | db  |               |               |              |                            | 33 | 2 Bijk | -5.8      | -19.9               | 0.004 |
| 4      | Dak   | db  | 4.91          | N N           | 0.0          | -6.9                       | 33 | 4 Eind | -6.9      | -19.6               | 0.004 |
|        |       | db  |               |               |              |                            | 33 | 4 Bijk | -5.6      | -19.6               | 0.004 |

**TOETSING HORIZONTALE VERPLAATSING**

| Staaft | BC | Sit | Lengte<br>[m] | U <sub>e i n d</sub><br>[mm] | Toelaatbaar<br>[mm] | [h/] |
|--------|----|-----|---------------|------------------------------|---------------------|------|
| 5      | 44 | 1   | 5.974         | 19.2                         | 39.8                | 150  |
| 6      | 39 | 1   | 6.047         | 8.7                          | 40.3                | 150  |
| 7      | 39 | 1   | 6.133         | 9.1                          | 40.9                | 150  |
| 8      | 39 | 1   | 6.053         | 9.5                          | 40.4                | 150  |
| 9      | 44 | 1   | 5.974         | -19.2                        | 39.8                | 150  |

**TOETSING HOR. VERPLAATSING GLOBAAL**

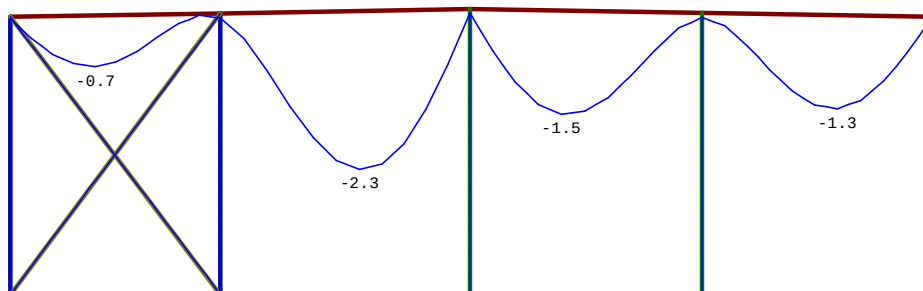
Er is een maximale horizontale verplaatsing van -0.0091 [m] gevonden

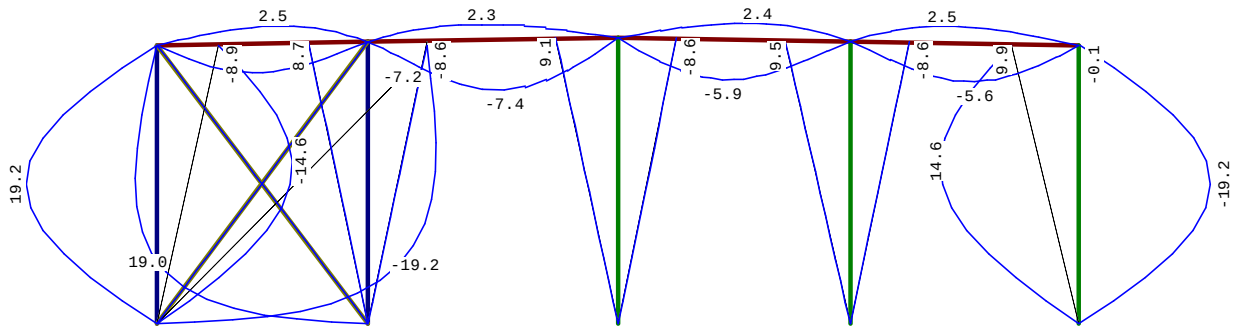
bij knoop 6 en combinatie 39; belastingsituatie 1 (combinatietype 2).

Bij een hoogte van 6.133 [m] levert dit h / 671 (toel.: h / 150).

**VERVORMINGEN w1**

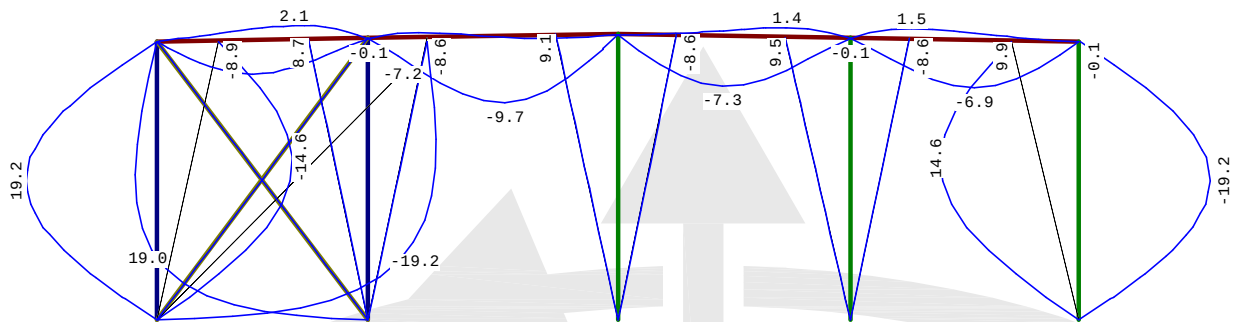
Blijvende combinatie





**VERVORMINGEN** **w<sub>max</sub>**

Karakteristieke combinatie



**DOORBUIGINGEN**

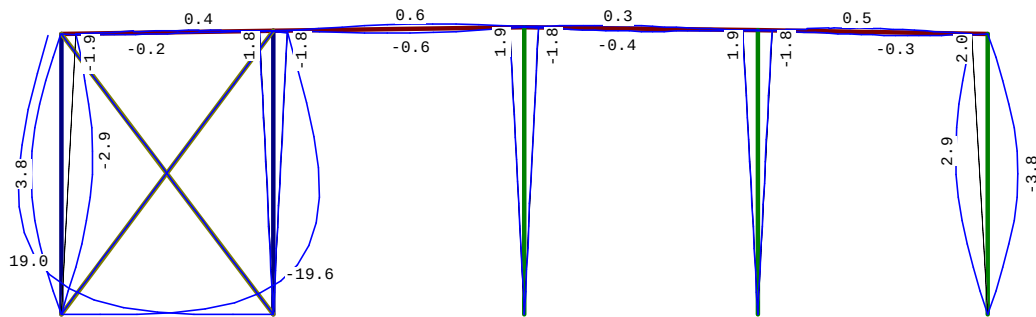
Karakteristieke combinatie

| Nr. | staven | Zijde | positie<br>[m] | $l_{rep}$<br>[mm] | $w_1$<br>[mm] | $w_2$<br>[mm] | $W_{bij}$<br>[mm] | $W_{tot}$<br>[mm] | $w_c$<br>[mm] | $w_{max}$<br>[mm] |
|-----|--------|-------|----------------|-------------------|---------------|---------------|-------------------|-------------------|---------------|-------------------|
| 1   | 1      | Neg.  | 2.036          | 4526              | -0.7          | -4.3          | 1065              | -4.9              | -4.9          | 918               |
| 1   | 1      | Pos.  | 2.490          | 4526              | -0.6          | 2.5           | 1791              | 2.0               | 2.0           | 2308              |
| 2   | 2      | Neg.  | 2.907          | 5361              | -2.3          | -7.4          | 726               | -9.7              | -9.7          | 554               |
| 2   | 2      | Pos.  | 2.437          | 5361              | -2.2          | 2.3           | 2343              | 0.1               | 0.1           | 38927             |
| 3   | 3      | Neg.  | 2.263          | 4981              | -1.5          | -5.9          | 849               | -7.3              | -7.3          | 681               |
| 3   | 3      | Pos.  | 2.989          | 4981              | -1.2          | 2.4           | 2037              | 1.2               | 1.2           | 4053              |
| 4   | 4      | Neg.  | 2.680          | 4906              | -1.3          | -5.6          | 879               | -6.9              | -6.9          | 712               |
| 4   | 4      | Pos.  | 1.962          | 4906              | -1.1          | 2.5           | 1990              | 1.4               | 1.4           | 3552              |
| 10  | 10     | Neg.  | 3.776          | 7553              |               | -19.6         | 386               | -19.6             | -19.6         | 386               |
| 11  | 11     | Pos.  | 3.997          | 7494              |               | 19.0          | 394               | 19.0              | 19.0          | 394               |

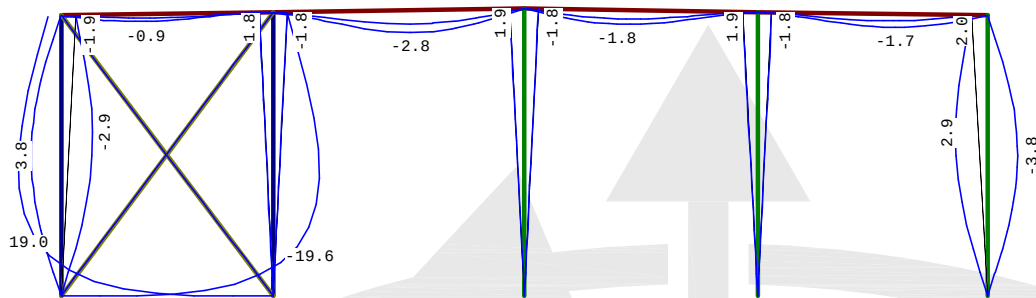


## VERVORMINGEN Wb1j

Frequente combinatie

**VERVORMINGEN**  $W_{\max}$ 

Frequente combinatie



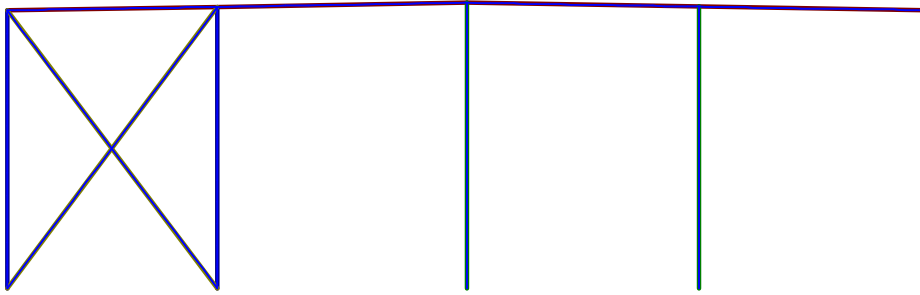
## DOORBUIGINGEN

Frequente combinatie

| Nr. | staven | Zijde | positie | $l_{rep}$<br>[mm] | $w_1$<br>[mm] | $w_2$<br>[mm] | -- $w_{bij}$ --<br>[mm][lrep/] | $w_{tot}$<br>[mm] | $w_c$<br>[mm] | -- $w_{max}$ --<br>[mm][lrep/] |
|-----|--------|-------|---------|-------------------|---------------|---------------|--------------------------------|-------------------|---------------|--------------------------------|
| 1   | 1      | Neg.  | 1.810   | 4526              | -0.7          |               | -0.2 26565                     | -0.9              |               | -0.9 5134                      |
| 2   | 2      | Neg.  | 2.924   | 5361              | -2.3          |               | -0.6 9740                      | -2.8              |               | -2.8 1883                      |
| 2   | 2      | Pos.  | 2.924   | 5361              | -2.3          |               | 0.6 9658                       | -1.7              |               | -1.7 3077                      |
| 3   | 3      | Neg.  | 1.992   | 4981              | -1.5          |               | -0.4 14044                     | -1.8              |               | -1.8 2715                      |
| 4   | 4      | Neg.  | 2.944   | 4906              | -1.3          |               | -0.3 15285                     | -1.7              |               | -1.7 2955                      |
| 4   | 4      | Pos.  | 2.453   | 4906              | -1.3          |               | 0.5 9260                       | -0.8              |               | -0.8 6467                      |
| 10  | 10     | Neg.  | 3.776   | 7553              |               | -19.6         | 386                            | -19.6             | -19.6         | 386                            |
| 11  | 11     | Pos.  | 3.997   | 7494              |               | 19.0          | 394                            | 19.0              | 19.0          | 394                            |

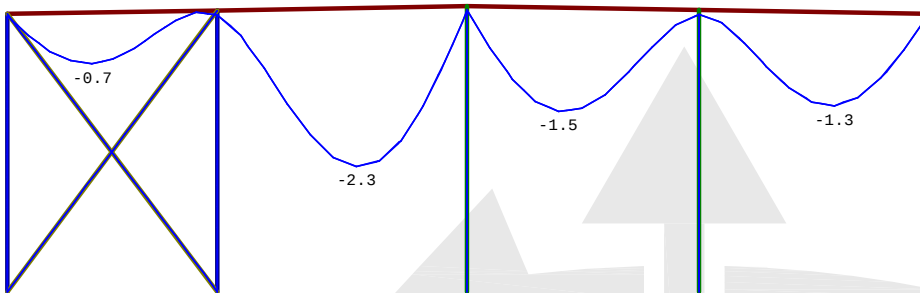
## VERVORMINGEN $w_{bij}$

Quasi-blijvende combinatie



## VERVORMINGEN $w_{max}$

Quasi-blijvende combinatie



## DOORBUIGINGEN

Quasi-blijvende combinatie

| Nr. | staven | Zijde | positie<br>[m] | $l_{rep}$<br>[mm] | $w_1$<br>[mm] | $w_2$<br>[mm] | $w_{bij}$<br>[mm] | $l_{rep}$ | $w_{tot}$<br>[mm] | $w_c$<br>[mm] | $w_{max}$<br>[mm] | $l_{rep}$ |
|-----|--------|-------|----------------|-------------------|---------------|---------------|-------------------|-----------|-------------------|---------------|-------------------|-----------|
| 1   | 1      | Neg.  | 1.810          | 4526              | -0.7          |               |                   |           | -0.7              | -0.7          | 6364              |           |
| 2   | 2      | Neg.  | 2.924          | 5361              | -2.3          |               |                   |           | -2.3              | -2.3          | 2334              |           |
| 3   | 3      | Neg.  | 1.992          | 4981              | -1.5          |               |                   |           | -1.5              | -1.5          | 3365              |           |
| 4   | 4      | Neg.  | 2.944          | 4906              | -1.3          |               |                   |           | -1.3              | -1.3          | 3663              |           |

Velden met een  $w_{bij}$  en  $w_{max} < l_{rep}/9999$  zijn niet afgedrukt

## HORIZONTALE VERPLAATSING

Quasi-blijvende combinatie

Alle vervormingen zijn kleiner dan  $l_{rep}/9999$  of  $h/9999$

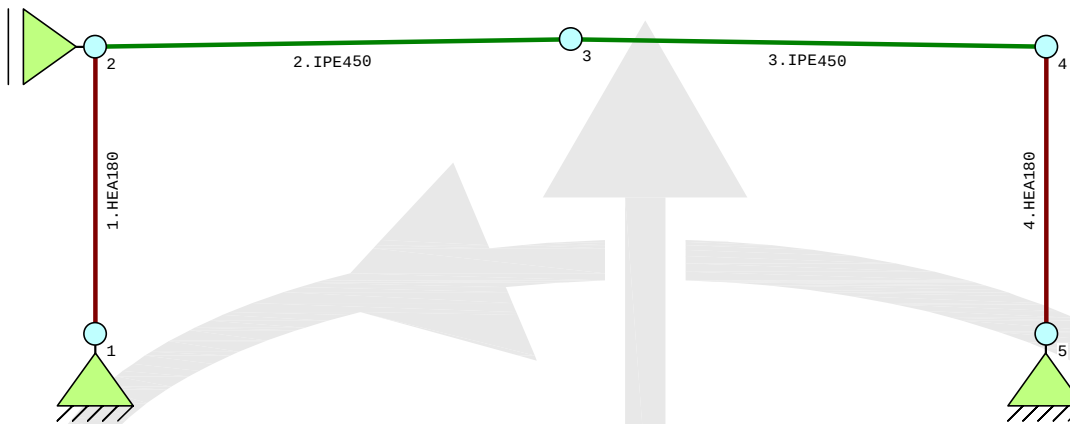
Belastingbreedte.: 4.900  
 Rekenmodel.....: 1e-orde-elastisch.  
 Theorie voor de bepaling van de krachtsverdeling:  
 Geometrisch lineair.  
 Fysisch lineair.

Gunstige werking van de permanente belasting wordt automatisch verwerkt

### Toegepaste normen volgens Eurocode met Nederlandse NB

|             |                      |         |             |
|-------------|----------------------|---------|-------------|
| Belastingen | NEN-EN 1990:2002     | C2:2010 | NB:2011(nl) |
|             | NEN-EN 1991-1-1:2002 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-3:2003 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-4:2005 | C2:2011 | NB:2011(nl) |
| Staal       | NEN-EN 1993-1-1:2006 | C2:2009 | NB:2011(nl) |
|             | NEN-EN 1993-1-8:2006 | C2:2009 | NB:2011(nl) |

### GEOMETRIE



### MATERIALEN

| Mt | Omschrijving | E-modulus[N/mm2] | S.M. | Pois. | Uitz. coëff |
|----|--------------|------------------|------|-------|-------------|
| 1  | S235         | 210000           | 78.5 | 0.30  | 1.2000e-005 |

### PROFIELEN [mm]

| Prof. | Omschrijving | Materiaal | Oppervlak   | Traagheid   | Vormf. |
|-------|--------------|-----------|-------------|-------------|--------|
| 1     | HEA180       | 1:S235    | 4.5300e+003 | 2.5100e+007 | 0.00   |
| 2     | IPE450       | 1:S235    | 9.8800e+003 | 3.3740e+008 | 0.00   |

### PROFIELEN vervolg [mm]

| Prof. | Staaftype | Breedte | Hoogte | e     | Type | b1 | h1 | b2 | h2 |
|-------|-----------|---------|--------|-------|------|----|----|----|----|
| 1     | 0:Normaal | 180     | 171    | 85.5  |      |    |    |    |    |
| 2     | 0:Normaal | 190     | 450    | 225.0 |      |    |    |    |    |

### PROFIELVORMEN [mm]

1 HEA180



2 IPE450



### KNOPEN

| Knoop | X      | Z     |
|-------|--------|-------|
| 1     | 0.000  | 0.000 |
| 2     | 0.000  | 5.975 |
| 3     | 9.885  | 6.133 |
| 4     | 19.770 | 5.975 |
| 5     | 19.770 | 0.000 |

**STAVEN**

| St. | ki | kj | Profiel  | Aansl.i | Aansl.j | Lengte | Opm. |
|-----|----|----|----------|---------|---------|--------|------|
| 1   | 1  | 2  | 1:HEA180 | NDM     | NDM     | 5.975  |      |
| 2   | 2  | 3  | 2:IPE450 | NDM     | NDM     | 9.886  |      |
| 3   | 3  | 4  | 2:IPE450 | NDM     | NDM     | 9.886  |      |
| 4   | 4  | 5  | 1:HEA180 | NDM     | NDM     | 5.975  |      |

**VASTE STEUNPUNTEN**

| Nr. | knoop | Kode | XZR 1=vast 0=vrij | Hoek |
|-----|-------|------|-------------------|------|
| 1   | 1     | 110  |                   | 0.00 |
| 2   | 2     | 100  |                   | 0.00 |
| 3   | 5     | 110  |                   | 0.00 |

**BELASTINGGENERATIE ALGEMEEN.**

|                             |       |                         |      |
|-----------------------------|-------|-------------------------|------|
| Betrouwbaarheidsklasse..... | 1     | Referentieperiode.....  | 15   |
| Gebouwdiepte.....           | 22.85 | Gebouwhoogte.....       | 7.37 |
| Niveau aansl.terrein.....   | 0.00  | E.g. scheid.w. [kN/m2]: | 1.20 |

**WIND**

|                                  |            |                        |        |  |
|----------------------------------|------------|------------------------|--------|--|
| Terrein categorie ...[4.3.2]...  | Bebouwd    |                        |        |  |
| Windgebied .....                 | 3          | Vb,0 ..[4.2].....      | 24.500 |  |
| Referentie periode wind.....     | 15.00      | Vb(p) ..[4.2].....     | 22.397 |  |
| K .....                          | [4.2]..... | n ....[4.2].....       | 0.500  |  |
| Positie spant in het gebouw....  | 4.900      | Kr ....[4.3.2].....    | 0.223  |  |
| z0 .....                         | [4.3.2]... | Zmin ..[4.3.2].....    | 7.000  |  |
| Co wind van links ..[4.3.3]...   | 1.000      | Co wind van rechts.... | 1.000  |  |
| Co wind loodrecht ..[4.3.3]...   | 1.000      |                        |        |  |
| Cpi wind van links ..[7.2.9]...  | 0.200      | -0.300                 |        |  |
| Cpi windloodrecht ...[7.2.9]...  | 0.200      | -0.300                 |        |  |
| Cpi wind van rechts ..[7.2.9]... | 0.200      | -0.300                 |        |  |
| Cfr windwrijving ....[7.5].....  | 0.040      |                        |        |  |

**SNEEUW**

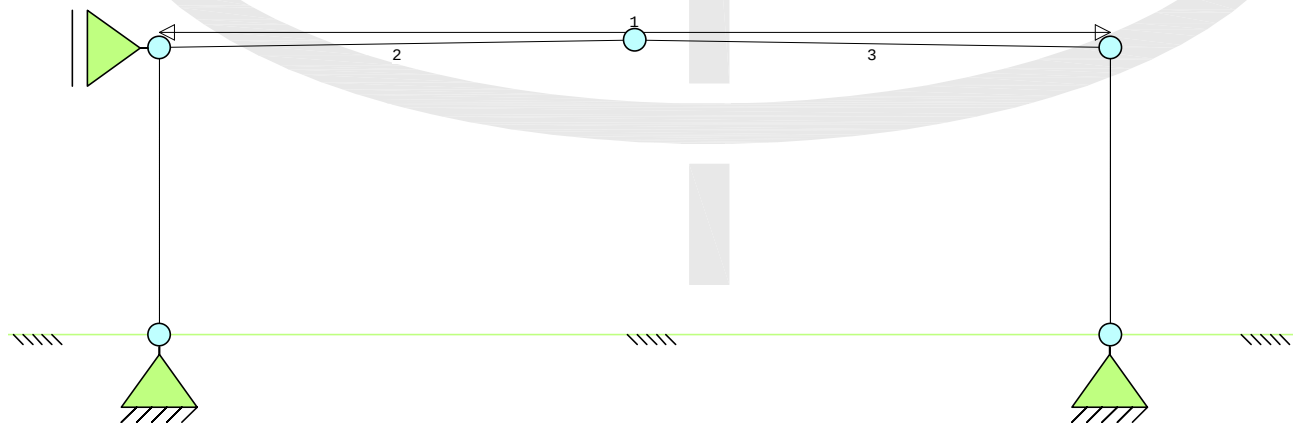
|                                |      |
|--------------------------------|------|
| Sneeuwbelasting (sk) 50 jaar : | 0.70 |
| Sneeuwbelasting (sn) n jaar :  | 0.53 |

**STAAFTYPEN**

| Type             | staven |
|------------------|--------|
| 5:Linker gevel.  | : 1    |
| 6:Rechter gevel. | : 4    |
| 7:Dak.           | : 2,3  |

**LASTVELDEN**

Veranderlijke belastingen door personen

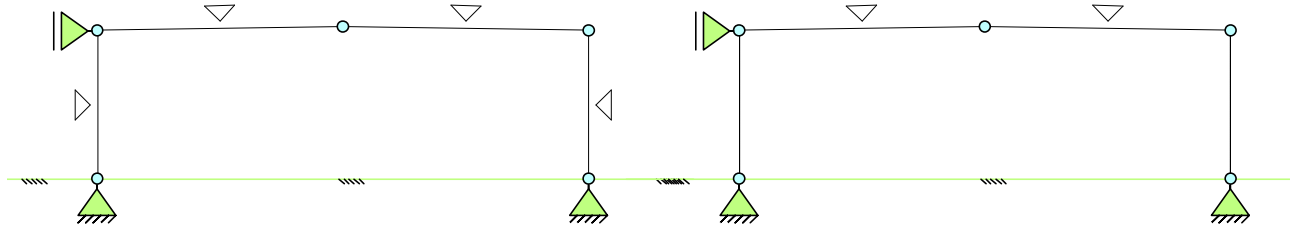

**LASTVELDEN**

| Nr | Balk | Veld | Gebruiksfunctie                                         | Psi-t |
|----|------|------|---------------------------------------------------------|-------|
| 1  | 2-3  | 2-3  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |

## LASTVELDEN

Wind staven

Sneeuw staven



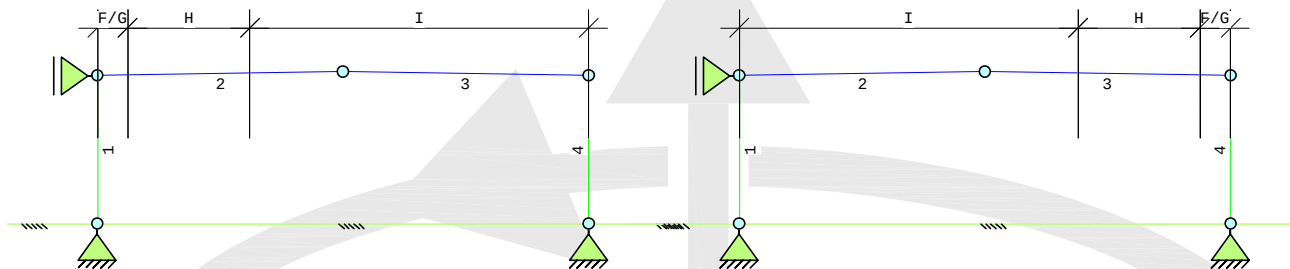
## WIND DAKTYPES

| Nr. | Staaft Type  | reductie bij<br>wind van links | reductie bij<br>wind van Rechts | Cpe volgens art: |
|-----|--------------|--------------------------------|---------------------------------|------------------|
| 1   | 1 Gevel      | 1.000                          | 1.000                           | 7.2.2            |
| 2   | 2-3 Plat dak | 1.000                          | 1.000                           | 7.2.3            |
| 3   | 4 Gevel      | 1.000                          | 1.000                           | 7.2.2            |

## WIND ZONES

Wind van links

Wind van rechts



## WIND VAN LINKS ZONES

| Nr. | Staaft | Positie | Lengte | Zone |
|-----|--------|---------|--------|------|
| 1   | 1      | 0.000   | 5.975  | D    |
| 2   | 2-3    | 0.000   | 1.227  | F/G  |
| 3   | 2-3    | 1.227   | 4.906  | H    |
| 4   | 2-3    | 6.133   | 13.637 | I    |
| 5   | 4      | 0.000   | 5.975  | E    |

## WIND VAN RECHTS ZONES

| Nr. | Staaft | Positie | Lengte | Zone |
|-----|--------|---------|--------|------|
| 1   | 4      | 0.000   | 5.975  | D    |
| 2   | 2-3    | 0.000   | 1.227  | F/G  |
| 3   | 2-3    | 1.227   | 4.906  | H    |
| 4   | 2-3    | 6.133   | 13.637 | I    |
| 5   | 1      | 0.000   | 5.975  | E    |

## Wind indexen

| Index | CsCd | Cpe/Cpi | qp    | breedte | reductie | Qw Zone | Hoek(en) |
|-------|------|---------|-------|---------|----------|---------|----------|
| Qw1   |      | 0.300   | 0.406 | 4.900   |          | -0.598  |          |
| Qw2   | 1.00 | 0.800   | 0.406 | 4.900   |          | -1.593  | D        |
| Qw3   | 1.00 | -1.800  | 0.406 | 0.616   |          | 0.451   | F        |
| Qw4   | 1.00 | -1.200  | 0.406 | 4.284   |          | 2.089   | G        |
| Qw5   | 1.00 | -0.700  | 0.406 | 4.900   |          | 1.394   | H        |
| Qw6   | 1.00 | -0.200  | 0.406 | 4.900   |          | 0.398   | I        |
| Qw7   | 1.00 | -0.500  | 0.406 | 4.900   |          | 0.996   | E        |
| Qw8   |      | -0.200  | 0.406 | 4.900   |          | 0.398   |          |
| Qw9   | 1.00 | 0.200   | 0.406 | 4.900   |          | -0.398  | I        |
| Qw10  | 1.00 | -1.200  | 0.406 | 0.498   |          | 0.243   |          |
| Qw11  | 1.00 | -0.800  | 0.406 | 4.402   |          | 1.431   |          |
| Qw12  | 1.00 | -0.700  | 0.406 | 4.900   |          | 1.394   |          |
| Qw13  | 1.00 | -0.500  | 0.406 | 4.900   |          | 0.996   |          |
| Qw14  | 1.00 | 0.200   | 0.406 | 4.900   |          | -0.398  |          |
| Qw15  | 1.00 | -0.200  | 0.406 | 4.900   |          | 0.398   |          |

## Sneeuw indexen

| Index | art   | $\mu$ | $s_k$ | red. posfac | breedte | $Q_s$ | hoek |
|-------|-------|-------|-------|-------------|---------|-------|------|
| Qs1   | 5.3.2 | 0.800 | 0.53  | 1.00        | 4.900   | 2.060 | 0.9  |

# **BELASTINGGEVALLEN**

| B.G. | Omschrijving                   | Type                   |
|------|--------------------------------|------------------------|
| 1    | Permanent EGZ=-1.00            | 1 Permanente belasting |
| g    | 2 Ver. bel. pers. ed. (p_rep)  | 2                      |
| g    | 3 Ver. bel. pers. ed. (F_rep)  | 3                      |
| g*   | 4 Wind van links onderdruk A   | 7                      |
| g*   | 5 Wind van links overdruk A    | 8                      |
| g*   | 6 Wind van links onderdruk B   | 9                      |
| g*   | 7 Wind van links overdruk B    | 10                     |
| g*   | 8 Wind van rechts onderdruk A  | 11                     |
| g*   | 9 Wind van rechts overdruk A   | 12                     |
| g*   | 10 Wind van rechts onderdruk B | 13                     |
| g*   | 11 Wind van rechts overdruk B  | 14                     |
| g    | 12 Wind loodrecht onderdruk A  | 15                     |
| g    | 13 Wind loodrecht overdruk A   | 16                     |
| g*   | 14 Wind loodrecht onderdruk B  | 45                     |
| g    | 15 Wind loodrecht overdruk B   | 46                     |
| g*   | 16 Sneeuw A                    | 22                     |

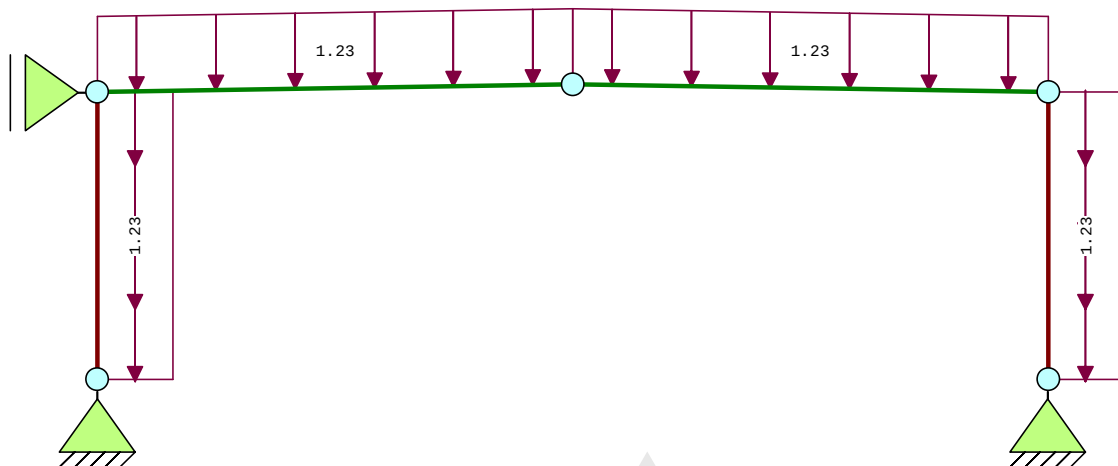
g = gegenereerd belastinggeval

\* = belastinggeval bevat 1 of meer handmatig toegevoegde en/of gewijzigde lasten

## BELASTINGEN

B.G:1 Permanent

Eigen gewicht van alle staven is meegenomen in berekening. Richting:↓



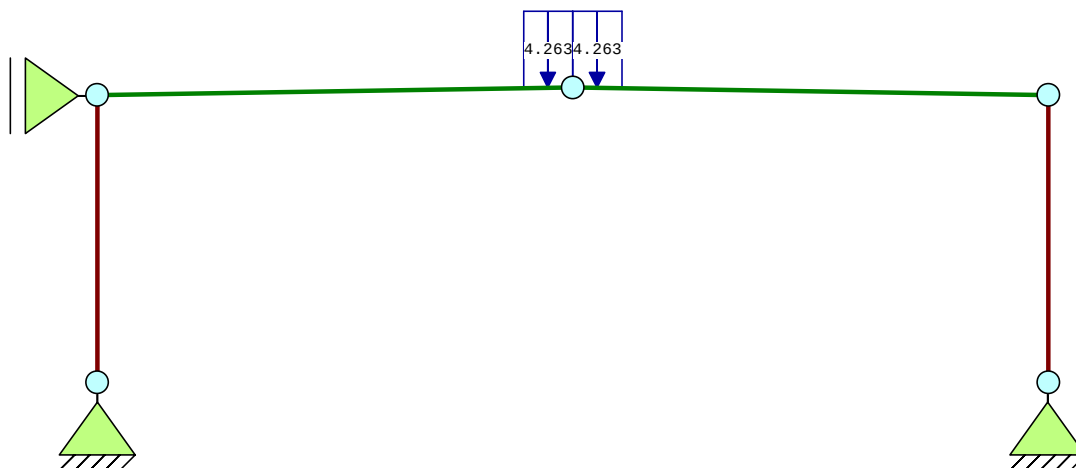
## STAAFBELASTINGEN

B.G:1 Permanent

| Staf | Type       | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|------|------------|--------|-------|-------|-------|----------|----------|----------|
| 2    | 5:QZGloaal | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |
| 3    | 5:QZGloaal | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |
| 1    | 2:QXLokaal | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |
| 4    | 2:QXLokaal | 1.23   | 1.23  | 0.000 | 0.000 |          |          |          |

**BELASTINGEN**

B.G:2 Ver. bel. pers. ed. (p\_rep)

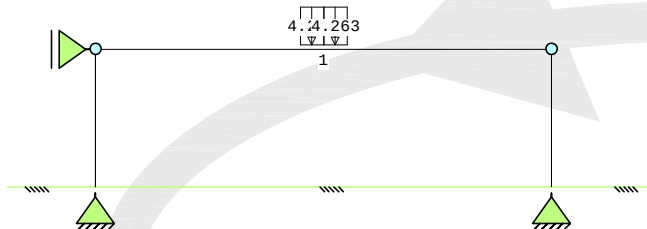

**STAAFBELASTINGEN**

B.G:2 Ver. bel. pers. ed. (p\_rep)

| Staaftype | Type        | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-----------|-------------|--------|-------|-------|-------|----------|----------|----------|
| 2         | 3:QZgeProj. | -4.26  | -4.26 | 8.865 | 0.000 | 0.0      | 0.0      | 0.0      |
| 3         | 3:QZgeProj. | -4.26  | -4.26 | 0.000 | 8.865 | 0.0      | 0.0      | 0.0      |

**VERANDERLIJKE BELASTING SITUATIES**

B.G:2 Ver. bel. pers. ed. (p\_rep)

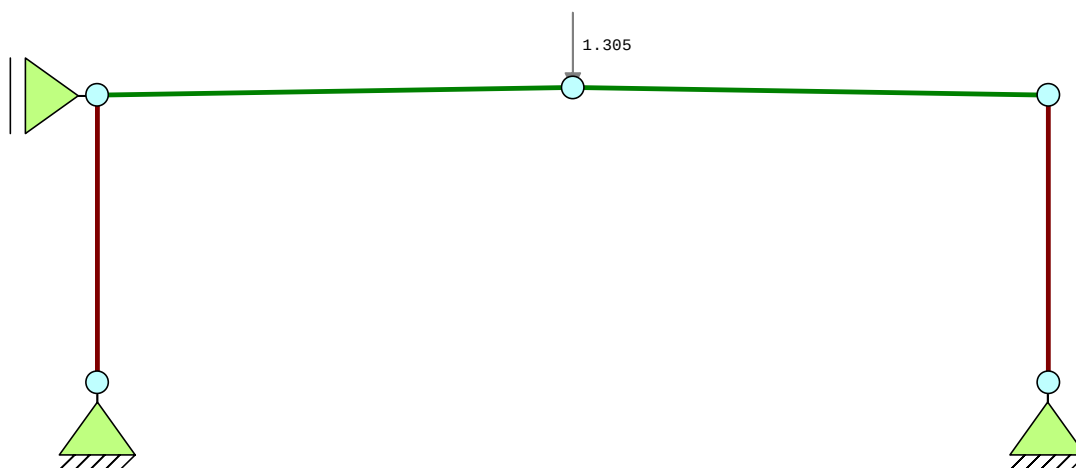

**VERANDERLIJKE BELASTING SITUATIES**

| Nr | Lastvelden extreem | Lastvelden momentaan |
|----|--------------------|----------------------|
| 1  | 1                  |                      |



## BELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)



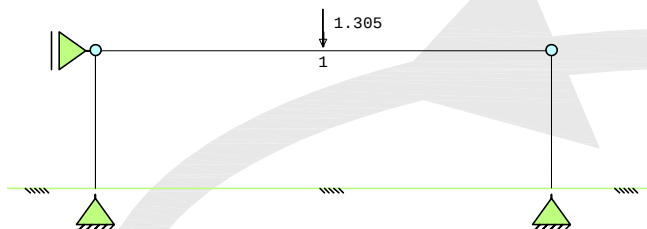
## STAAFBELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)

| Staat | Type         | q1/p/m | q2    | A | B | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|--------------|--------|-------|---|---|----------|----------|----------|
| 2     | 10:PZGeproj. | -1.30  | 9.886 |   |   | 0.0      | 0.0      | 0.0      |

## VERANDERLIJKE BELASTING SITUATIES

B.G:3 Ver. bel. pers. ed. (F-rep)

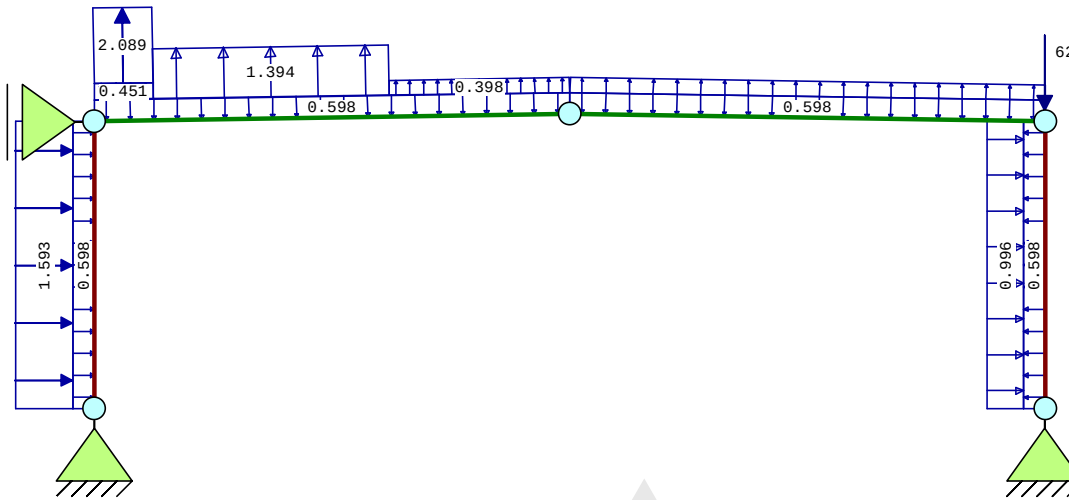


## VERANDERLIJKE BELASTING SITUATIES

| Nr | Lastvelden extreem | Lastvelden momentaan |
|----|--------------------|----------------------|
| 1  | 1                  |                      |

**BELASTINGEN**

B.G:4 Wind van links onderdruk A

**KNOOPBELASTINGEN**

B.G:4 Wind van links onderdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

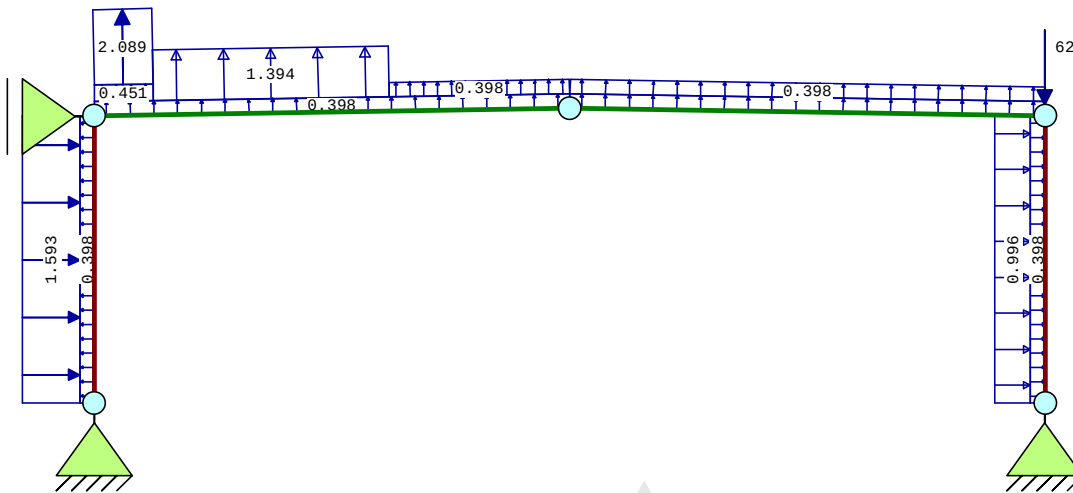
**STAAFBELASTINGEN**

B.G:4 Wind van links onderdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:5 Wind van links overdruk A


**KNOOPBELASTINGEN**

B.G:5 Wind van links overdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

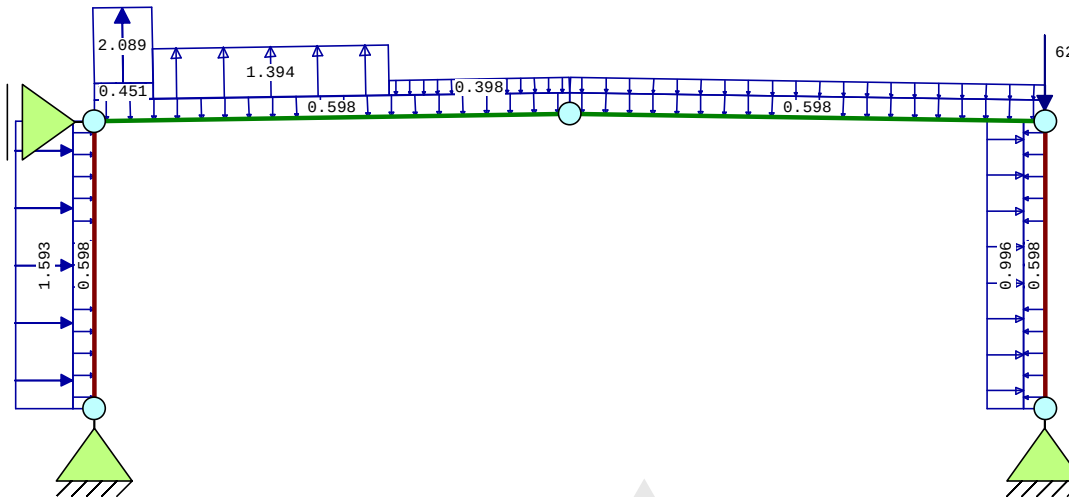
**STAAFBELASTINGEN**

B.G:5 Wind van links overdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:6 Wind van links onderdruk B

**KNOOPBELASTINGEN**

B.G:6 Wind van links onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

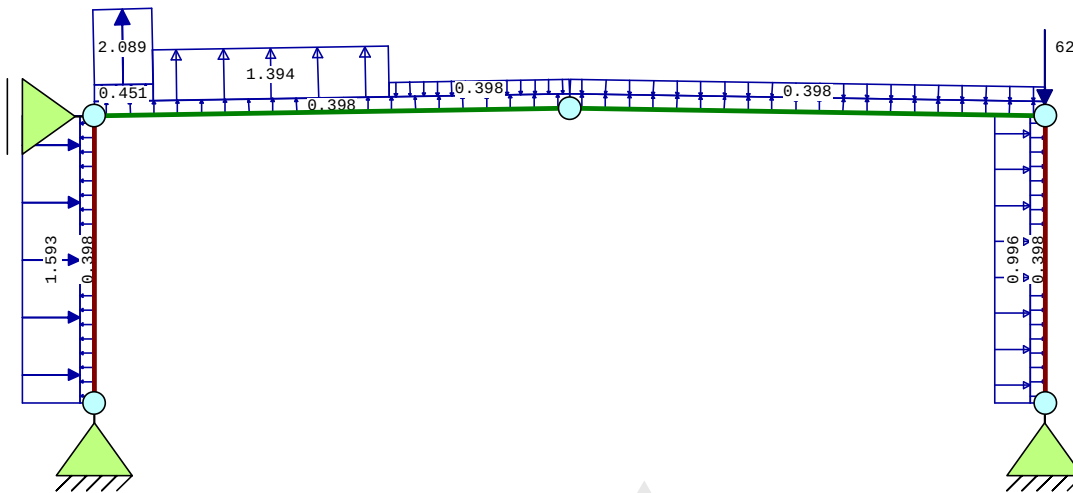
**STAAFBELASTINGEN**

B.G:6 Wind van links onderdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:7 Wind van links overdruk B



## KNOOPBELASTINGEN

B.G:7 Wind van links overdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

## Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

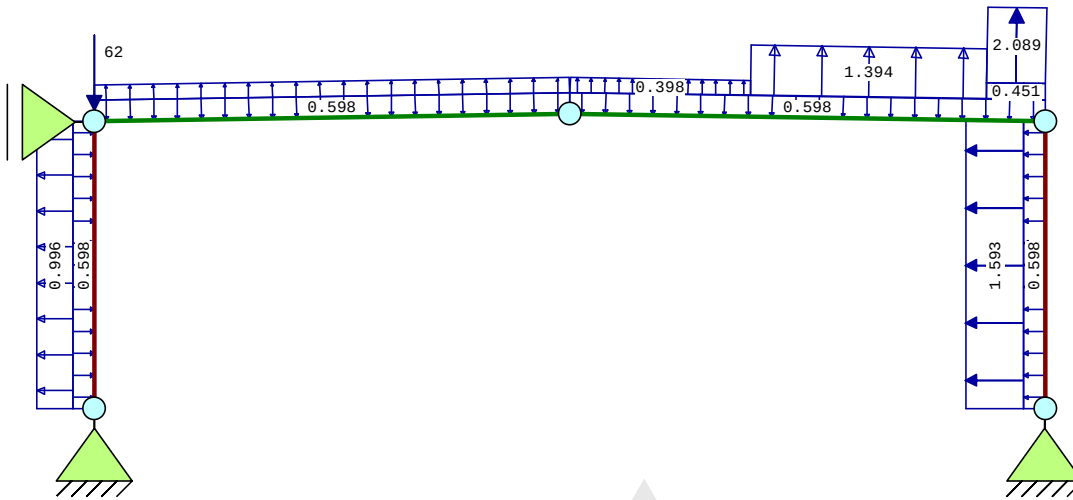
## STAAFBELASTINGEN

B.G:7 Wind van links overdruk B

| Staaftype | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-----------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1         | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3         | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4         | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1         | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2         | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3         | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4         | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:8 Wind van rechts onderdruk A

**KNOOPBELASTINGEN**

B.G:8 Wind van rechts onderdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

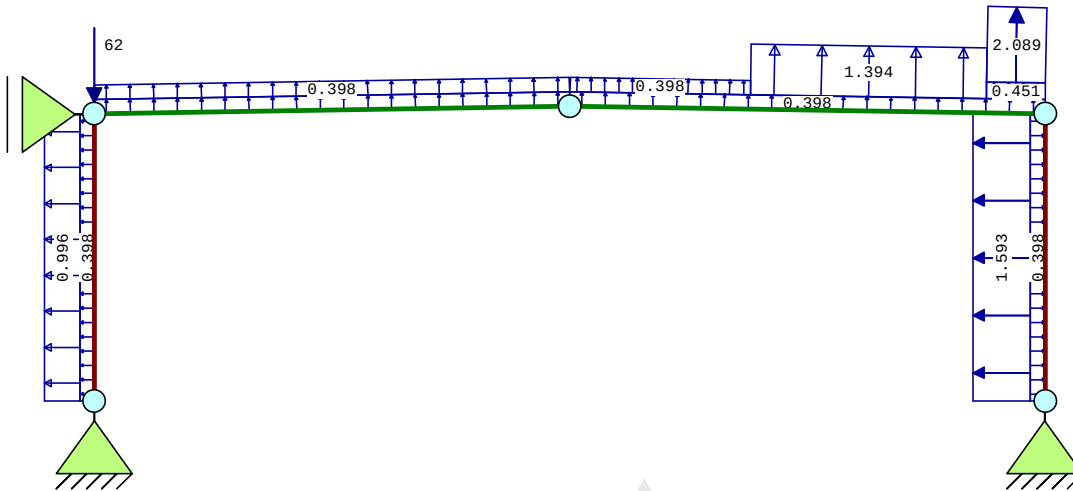
**STAAFBELASTINGEN**

B.G:8 Wind van rechts onderdruk A

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:9 Wind van rechts overdruk A


**KNOOPBELASTINGEN**

B.G:9 Wind van rechts overdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

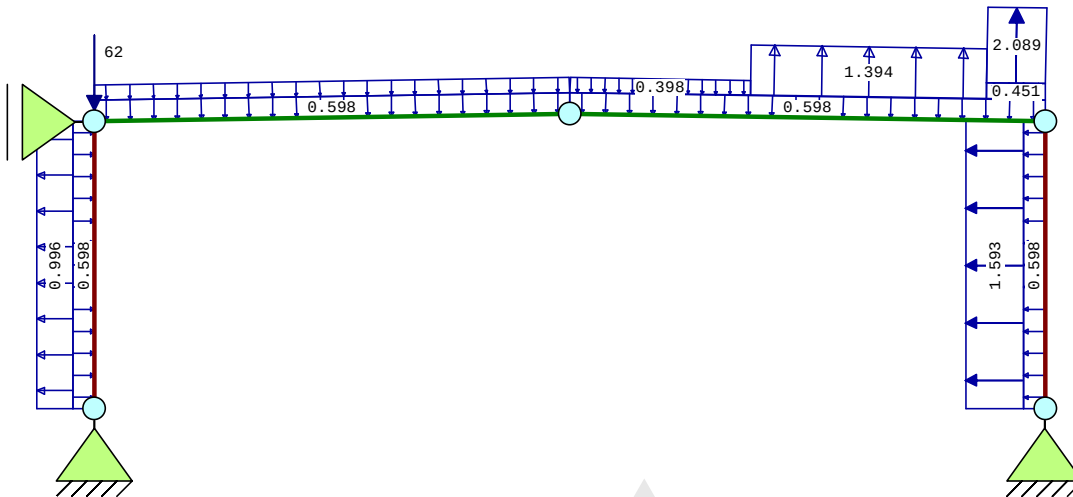
**STAAFBELASTINGEN**

B.G:9 Wind van rechts overdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:10 Wind van rechts onderdruk B

**KNOOPBELASTINGEN**

B.G:10 Wind van rechts onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

**STAAFBELASTINGEN**

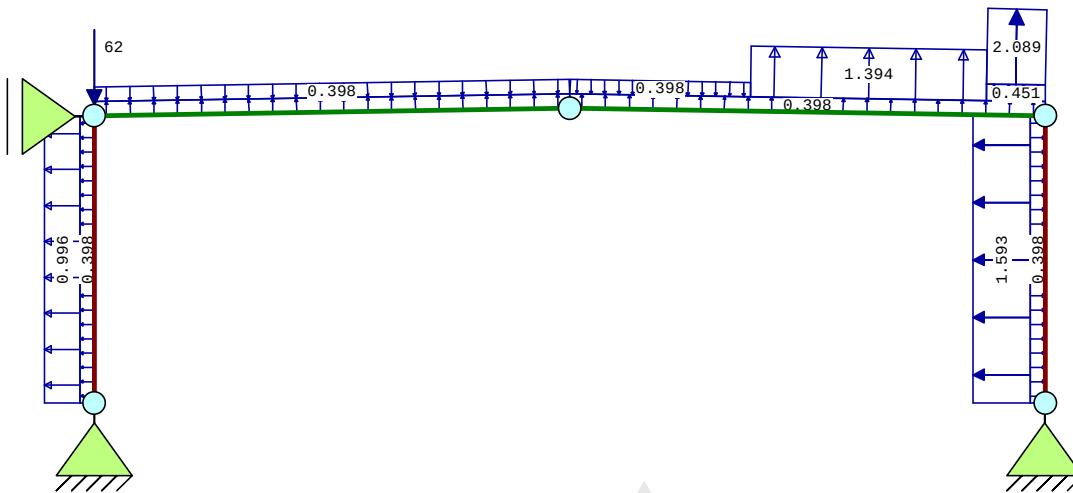
B.G:10 Wind van rechts onderdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |



**BELASTINGEN**

B.G:11 Wind van rechts overdruk B


**KNOOPBELASTINGEN**

B.G:11 Wind van rechts overdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

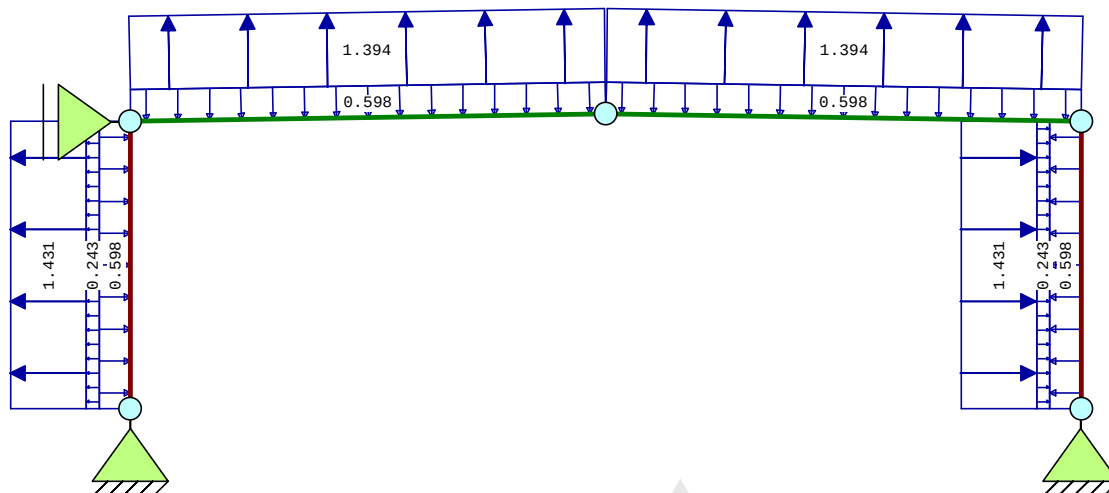
**STAAFBELASTINGEN**

B.G:11 Wind van rechts overdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw2   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw3   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw7   | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:12 Wind loodrecht onderdruk A

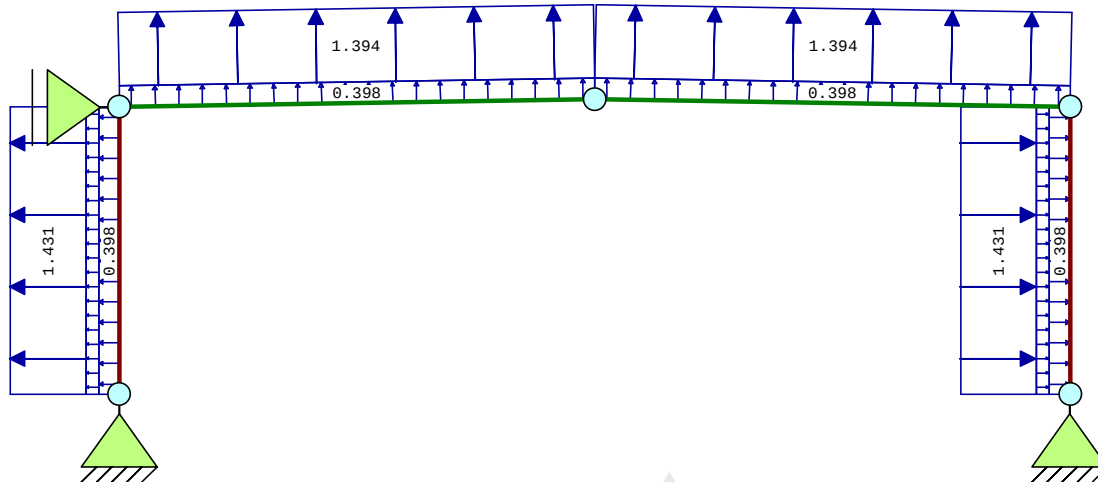
**STAAFBELASTINGEN**

B.G:12 Wind loodrecht onderdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw10  | 0.24   | 0.24  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw11  | 1.43   | 1.43  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw10  | 0.24   | 0.24  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw11  | 1.43   | 1.43  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw12  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw12  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:13 Wind loodrecht overdruk A



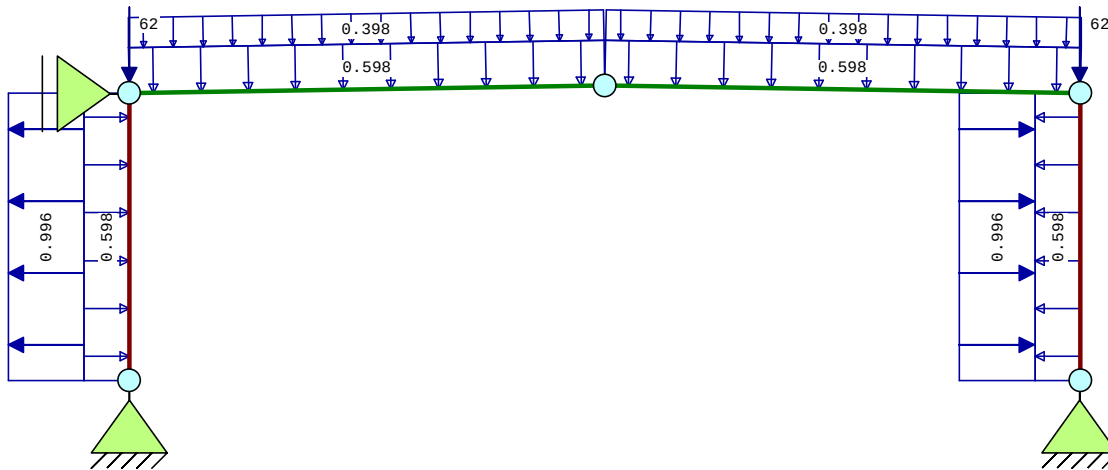
## STAAFBELASTINGEN

B.G:13 Wind loodrecht overdruk A

| Staal | Type       | Index | q1/p/m | q2   | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw10  | 0.24   | 0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw11  | 1.43   | 1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw10  | 0.24   | 0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw11  | 1.43   | 1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw12  | 1.39   | 1.39 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw12  | 1.39   | 1.39 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

**KNOOPBELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |
| 2    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

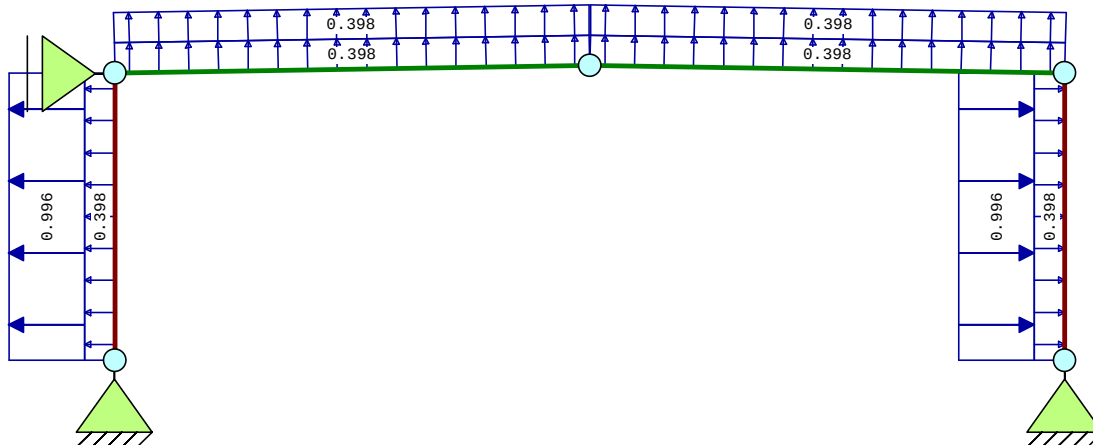
**STAAFBELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw14  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw14  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:15 Wind loodrecht overdruk B



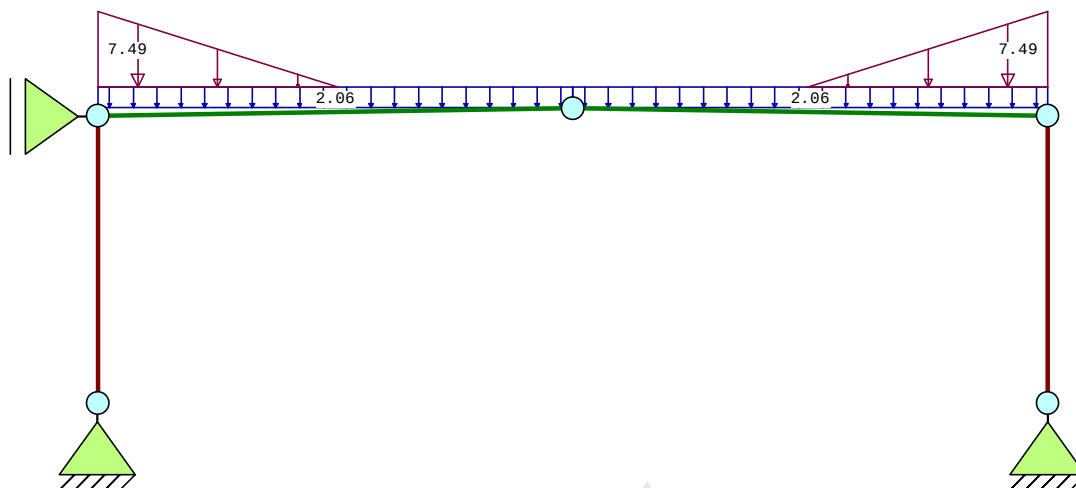
## STAAFBELASTINGEN

B.G:15 Wind loodrecht overdruk B

| Staat | Type       | Index | q1/p/m | q2   | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw8   | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 4     | 1:QZLokaal | Qw13  | 1.00   | 1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw15  | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw15  | 0.40   | 0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:16 Sneeuw A



## STAAFBELASTINGEN

B.G:16 Sneeuw A

| Staal | Type        | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|-------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 2     | 3:QZgeProj. | *     | -7.49  | 0.00  | 0.000 | 4.885 | 0.0      | 0.2      | 0.0      |
| 3     | 3:QZgeProj. | *     | 0.00   | -7.49 | 4.885 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 3:QZgeProj. | Qs1   | -2.06  | -2.06 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 3:QZgeProj. | Qs1   | -2.06  | -2.06 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

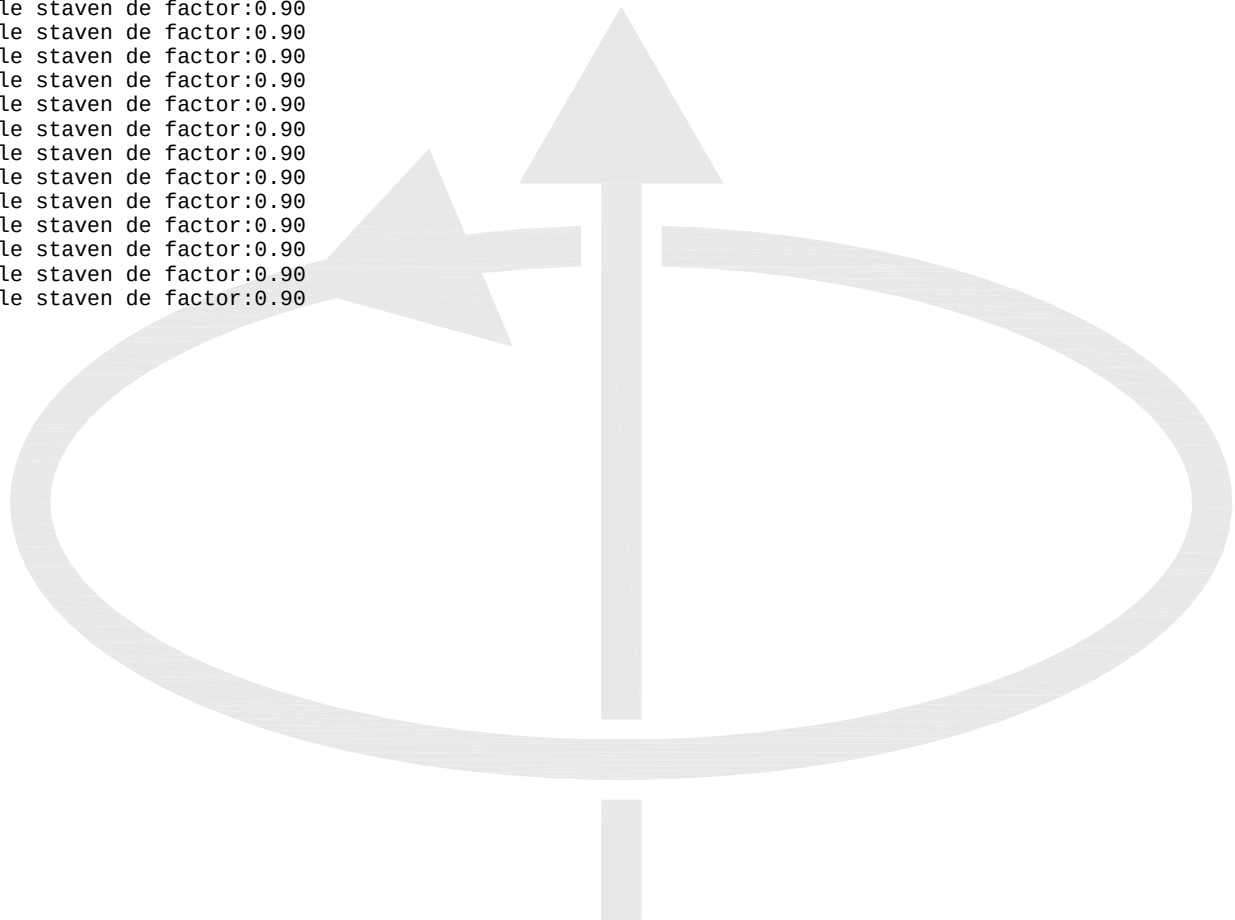
# **BELASTINGCOMBINATIES**

| BC Type  | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor |
|----------|----|------|--------|----|------|--------|----|------|--------|----|------|--------|
| 1 Fund.  | 1  | Perm | 1.22   |    |      |        |    |      |        |    |      |        |
| 2 Fund.  | 1  | Perm | 0.90   |    |      |        |    |      |        |    |      |        |
| 3 Fund.  | 1  | Perm | 1.08   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 4 Fund.  | 1  | Perm | 1.08   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 5 Fund.  | 1  | Perm | 1.08   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 6 Fund.  | 1  | Perm | 1.08   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 7 Fund.  | 1  | Perm | 1.08   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 8 Fund.  | 1  | Perm | 1.08   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 9 Fund.  | 1  | Perm | 1.08   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 10 Fund. | 1  | Perm | 1.08   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 11 Fund. | 1  | Perm | 1.08   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 12 Fund. | 1  | Perm | 1.08   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 13 Fund. | 1  | Perm | 1.08   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 14 Fund. | 1  | Perm | 1.08   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 15 Fund. | 1  | Perm | 1.08   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 16 Fund. | 1  | Perm | 1.08   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 17 Fund. | 1  | Perm | 1.08   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 18 Fund. | 1  | Perm | 0.90   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 19 Fund. | 1  | Perm | 0.90   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 20 Fund. | 1  | Perm | 0.90   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 21 Fund. | 1  | Perm | 0.90   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 22 Fund. | 1  | Perm | 0.90   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 23 Fund. | 1  | Perm | 0.90   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 24 Fund. | 1  | Perm | 0.90   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 25 Fund. | 1  | Perm | 0.90   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 26 Fund. | 1  | Perm | 0.90   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 27 Fund. | 1  | Perm | 0.90   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 28 Fund. | 1  | Perm | 0.90   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 29 Fund. | 1  | Perm | 0.90   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 30 Fund. | 1  | Perm | 0.90   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 31 Fund. | 1  | Perm | 0.90   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 32 Fund. | 1  | Perm | 0.90   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 33 Kar.  | 1  | Perm | 1.00   | 2  | Extr | 1.00   |    |      |        |    |      |        |
| 34 Kar.  | 1  | Perm | 1.00   | 3  | Extr | 1.00   |    |      |        |    |      |        |
| 35 Kar.  | 1  | Perm | 1.00   | 4  | Extr | 1.00   |    |      |        |    |      |        |
| 36 Kar.  | 1  | Perm | 1.00   | 5  | Extr | 1.00   |    |      |        |    |      |        |
| 37 Kar.  | 1  | Perm | 1.00   | 6  | Extr | 1.00   |    |      |        |    |      |        |
| 38 Kar.  | 1  | Perm | 1.00   | 7  | Extr | 1.00   |    |      |        |    |      |        |
| 39 Kar.  | 1  | Perm | 1.00   | 8  | Extr | 1.00   |    |      |        |    |      |        |
| 40 Kar.  | 1  | Perm | 1.00   | 9  | Extr | 1.00   |    |      |        |    |      |        |
| 41 Kar.  | 1  | Perm | 1.00   | 10 | Extr | 1.00   |    |      |        |    |      |        |
| 42 Kar.  | 1  | Perm | 1.00   | 11 | Extr | 1.00   |    |      |        |    |      |        |
| 43 Kar.  | 1  | Perm | 1.00   | 12 | Extr | 1.00   |    |      |        |    |      |        |
| 44 Kar.  | 1  | Perm | 1.00   | 13 | Extr | 1.00   |    |      |        |    |      |        |
| 45 Kar.  | 1  | Perm | 1.00   | 14 | Extr | 1.00   |    |      |        |    |      |        |
| 46 Kar.  | 1  | Perm | 1.00   | 15 | Extr | 1.00   |    |      |        |    |      |        |
| 47 Kar.  | 1  | Perm | 1.00   | 16 | Extr | 1.00   |    |      |        |    |      |        |
| 48 Quas. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 49 Freq. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 50 Freq. | 1  | Perm | 1.00   | 4  | psi1 | 1.00   |    |      |        |    |      |        |
| 51 Freq. | 1  | Perm | 1.00   | 5  | psi1 | 1.00   |    |      |        |    |      |        |
| 52 Freq. | 1  | Perm | 1.00   | 6  | psi1 | 1.00   |    |      |        |    |      |        |
| 53 Freq. | 1  | Perm | 1.00   | 7  | psi1 | 1.00   |    |      |        |    |      |        |
| 54 Freq. | 1  | Perm | 1.00   | 8  | psi1 | 1.00   |    |      |        |    |      |        |
| 55 Freq. | 1  | Perm | 1.00   | 9  | psi1 | 1.00   |    |      |        |    |      |        |
| 56 Freq. | 1  | Perm | 1.00   | 10 | psi1 | 1.00   |    |      |        |    |      |        |
| 57 Freq. | 1  | Perm | 1.00   | 11 | psi1 | 1.00   |    |      |        |    |      |        |
| 58 Freq. | 1  | Perm | 1.00   | 12 | psi1 | 1.00   |    |      |        |    |      |        |
| 59 Freq. | 1  | Perm | 1.00   | 13 | psi1 | 1.00   |    |      |        |    |      |        |
| 60 Freq. | 1  | Perm | 1.00   | 14 | psi1 | 1.00   |    |      |        |    |      |        |
| 61 Freq. | 1  | Perm | 1.00   | 15 | psi1 | 1.00   |    |      |        |    |      |        |
| 62 Freq. | 1  | Perm | 1.00   | 16 | psi1 | 1.00   |    |      |        |    |      |        |
| 63 Blij. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |

## GUNSTIGE WERKING PERMANENTE BELASTINGEN

### BC Staven met gunstige werking

1 Geen  
 2 Alle staven de factor:0.90  
 3 Geen  
 4 Geen  
 5 Geen  
 6 Geen  
 7 Geen  
 8 Geen  
 9 Geen  
 10 Geen  
 11 Geen  
 12 Geen  
 13 Geen  
 14 Geen  
 15 Geen  
 16 Geen  
 17 Geen  
 18 Alle staven de factor:0.90  
 19 Alle staven de factor:0.90  
 20 Alle staven de factor:0.90  
 21 Alle staven de factor:0.90  
 22 Alle staven de factor:0.90  
 23 Alle staven de factor:0.90  
 24 Alle staven de factor:0.90  
 25 Alle staven de factor:0.90  
 26 Alle staven de factor:0.90  
 27 Alle staven de factor:0.90  
 28 Alle staven de factor:0.90  
 29 Alle staven de factor:0.90  
 30 Alle staven de factor:0.90  
 31 Alle staven de factor:0.90  
 32 Alle staven de factor:0.90

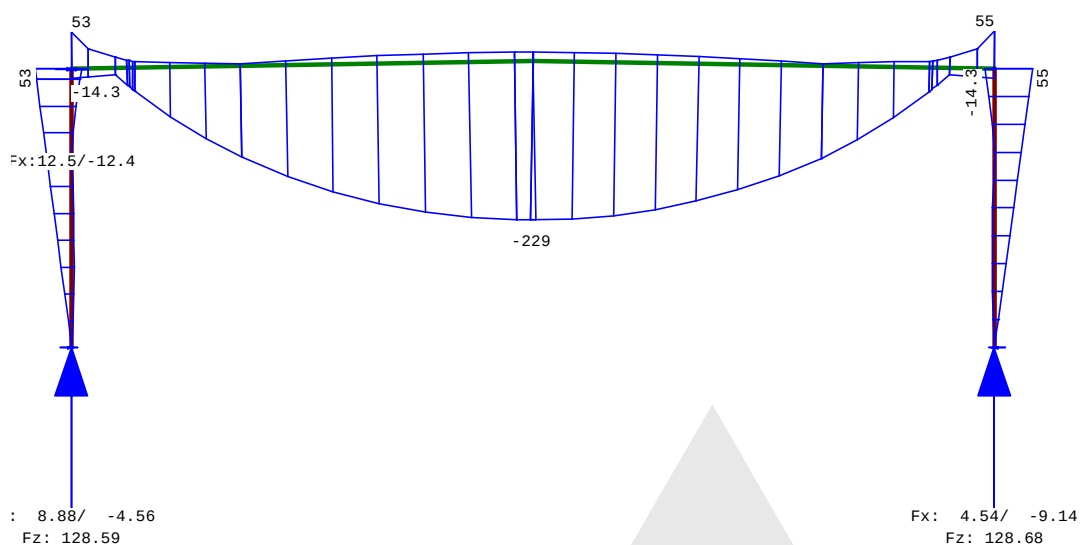




## OMHULLENDE VAN DE FUNDAMENTELE COMBINATIES

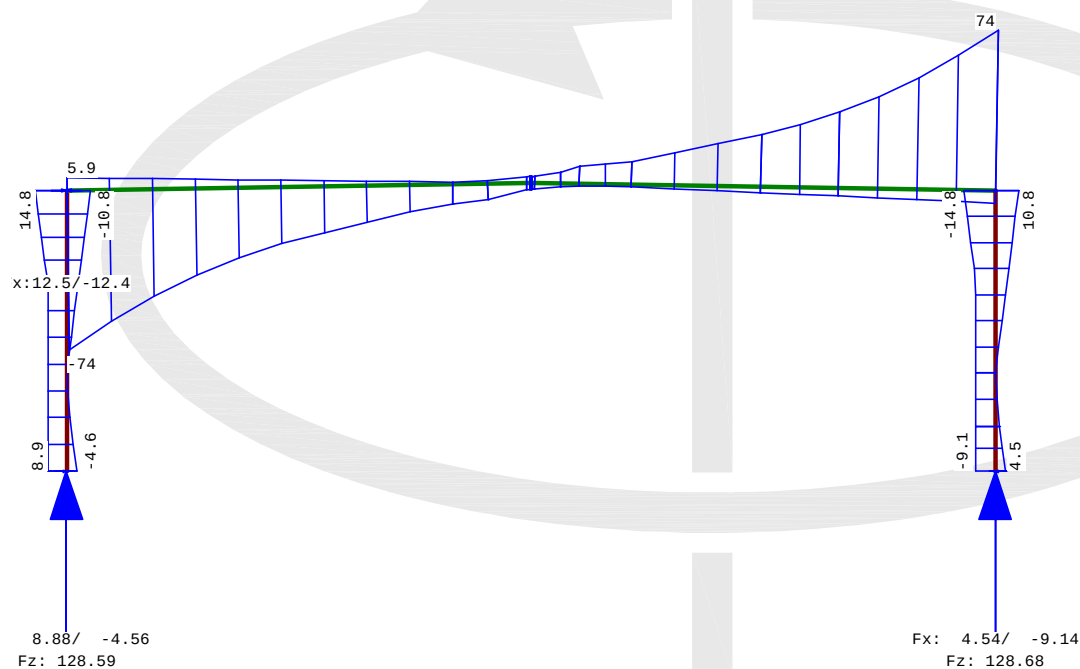
### MOMENTEN

Fundamentele combinatie



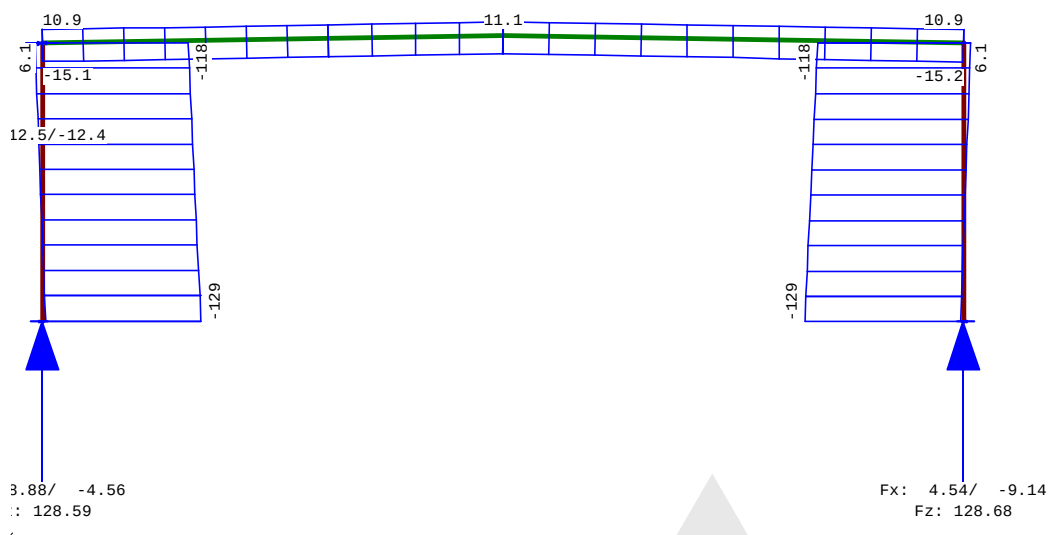
### DWARSKRACHTEN

Fundamentele combinatie



**NORMAALKRACHTEN**

Fundamentele combinatie



# STAAFKRACHTEN

## Fundamentele combinatie

| St. | Kn.   | Pos. | NXi/NXj    |          | DZi/DZj   |          | MYi/MYj    |          |
|-----|-------|------|------------|----------|-----------|----------|------------|----------|
|     |       |      | Min BC     | Max BC   | Min BC    | Max BC   | Min BC     | Max BC   |
| 1   | 1     |      | -128.59 15 | -2.45 29 | -4.56 20  | 8.88 17  | 0.00 20    | 0.00 17  |
| 1   | 1.542 |      | -125.95 15 | -0.25 29 | -0.74 21  | 8.88 17  | -3.52 20   | 13.69 17 |
| 1   | 1.987 |      | -125.18 15 | 0.38 29  | -0.02 21  | 8.88 17  | -3.22 20   | 17.64 17 |
| 1   | 1.999 |      | -125.16 15 | 0.40 29  | 0.00 21   | 8.88 17  | -3.22 21   | 17.75 17 |
| 1   | 2.084 |      | -125.02 15 | 0.52 29  | 0.14 21   | 8.88 17  | -3.22 21   | 18.50 17 |
| 1   | 3.985 |      | -121.76 15 | 3.24 29  | -5.18 29  | 8.88 17  | -0.04 21   | 35.38 17 |
| 1   | 3.998 |      | -121.74 15 | 3.25 29  | -5.22 29  | 8.91 7   | -0.00 21   | 35.49 17 |
| 1   | 4.168 |      | -121.45 15 | 3.50 29  | -5.69 29  | 9.42 7   | 0.57 21    | 37.00 17 |
| 1   | 4.266 |      | -121.28 15 | 3.64 29  | -5.97 29  | 9.71 7   | 0.00 29    | 37.88 17 |
| 1   | 2     |      | -118.35 15 | 6.07 29  | -10.75 29 | 14.76 7  | -14.28 29  | 53.04 17 |
| 2   | 2     |      | -15.08 11  | 10.85 29 | -73.95 17 | 5.90 29  | -14.28 29  | 53.04 17 |
| 2   | 0.923 |      | -15.05 11  | 10.88 29 | -60.91 17 | 5.33 29  | -9.10 29   | 15.99 7  |
| 2   | 3.603 |      | -14.95 11  | 10.96 29 | -32.83 17 | 3.69 29  | -131.43 17 | 2.99 21  |
| 2   | 8.208 |      | -14.80 11  | 11.09 29 | -9.39 3   | 0.85 29  | -221.98 17 | 13.44 29 |
| 2   | 9.593 |      | -14.75 11  | 11.13 29 | -3.89 7   | 2.55 27  | -228.42 17 | 14.03 29 |
| 2   | 9.841 |      | -14.74 11  | 11.14 29 | -3.09 8   | 3.06 26  | -228.57 17 | 14.01 29 |
| 2   | 3     |      | -14.74 11  | 11.14 29 | -3.00 23  | 3.22 11  | -228.57 17 | 14.00 29 |
| 3   | 3     |      | -14.83 11  | 11.14 29 | -2.95 7   | 2.85 27  | -228.56 17 | 14.00 29 |
| 3   | 0.013 |      | -14.83 11  | 11.14 29 | -2.90 22  | 2.87 12  | -228.56 17 | 14.00 29 |
| 3   | 0.286 |      | -14.84 11  | 11.13 29 | -2.33 23  | 3.75 11  | -228.38 17 | 14.03 29 |
| 3   | 1.519 |      | -14.88 11  | 11.09 29 | -0.76 21  | 9.13 3   | -222.95 17 | 13.56 29 |
| 3   | 6.205 |      | -15.05 11  | 10.96 29 | -3.64 29  | 32.38 17 | -132.97 17 | 3.25 29  |
| 3   | 8.941 |      | -15.14 11  | 10.88 29 | -5.32 29  | 60.78 17 | -9.02 32   | 16.10 11 |
| 3   | 4     |      | -15.17 11  | 10.85 29 | -5.91 29  | 74.11 17 | -14.33 29  | 54.64 17 |
| 4   | 4     |      | -118.45 15 | 6.08 29  | -14.84 11 | 10.76 29 | -14.33 29  | 54.64 17 |
| 4   | 1.714 |      | -121.39 15 | 3.63 29  | -9.77 11  | 5.96 29  | 0.00 29    | 38.97 17 |
| 4   | 1.798 |      | -121.53 15 | 3.51 29  | -9.52 11  | 5.73 29  | 0.49 29    | 38.20 17 |
| 4   | 1.926 |      | -121.75 15 | 3.33 29  | -9.14 11  | 5.37 29  | 0.06 25    | 37.03 17 |
| 4   | 1.944 |      | -121.78 15 | 3.31 29  | -9.14 17  | 5.32 29  | -0.00 25   | 36.87 17 |
| 4   | 3.886 |      | -125.11 15 | 0.53 29  | -9.14 17  | -0.12 29 | -3.27 25   | 19.10 17 |
| 4   | 3.959 |      | -125.23 15 | 0.43 29  | -9.14 17  | 0.00 25  | -3.28 25   | 18.43 17 |
| 4   | 4.064 |      | -125.41 15 | 0.28 29  | -9.14 17  | 0.17 25  | -3.27 25   | 17.48 17 |
| 4   | 4.441 |      | -126.06 15 | -0.26 29 | -9.14 17  | 0.78 25  | -3.48 24   | 14.03 17 |
| 4   | 5     |      | -128.68 15 | -2.45 29 | -9.14 17  | 4.54 24  | 0.00 24    | 0.00 17  |

# REACTIES

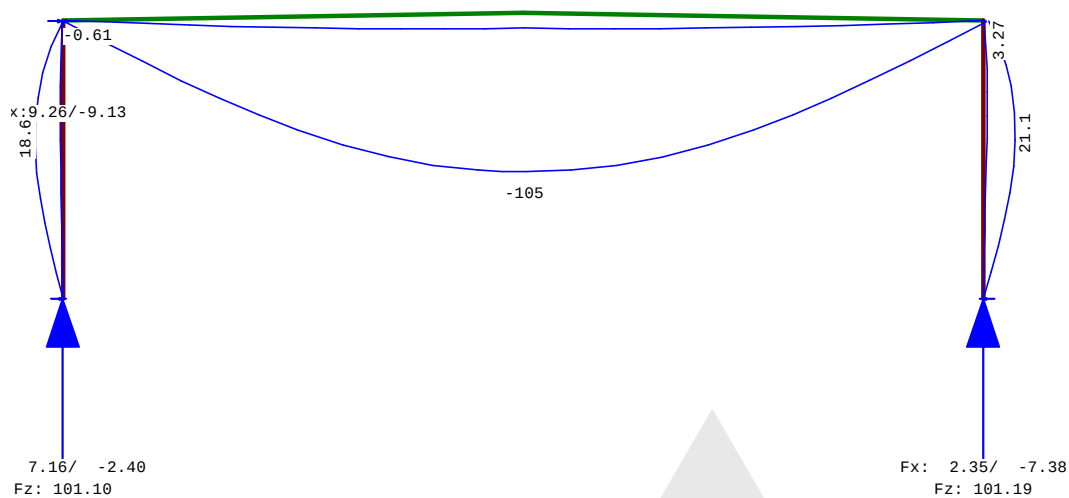
## Fundamentele combinatie

| Kn. | X-min  | X-max | Z-min | Z-max  | M-min | M-max |
|-----|--------|-------|-------|--------|-------|-------|
| 1   | -4.56  | 8.88  | 2.45  | 128.59 |       |       |
| 2   | -12.36 | 12.47 |       |        |       |       |
| 5   | -9.14  | 4.54  | 2.45  | 128.68 |       |       |

## OMHULLENDE VAN DE KARAKTERISTIEKE COMBINATIES

VERPLAATSINGEN [mm]

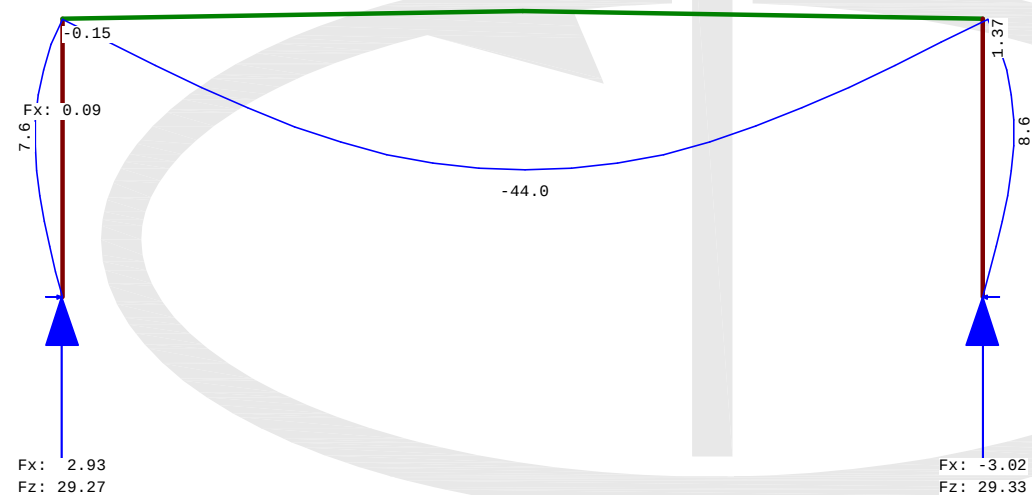
Karakteristieke combinatie



## OMHULLENDE VAN DE BLIJVENDE COMBINATIES

VERPLAATSINGEN [mm]

Blijvende combinatie



## REACTIES

Blijvende combinatie

| Kn. | X     | Z     | M |
|-----|-------|-------|---|
| 1   | 2.93  | 29.27 |   |
| 2   | 0.09  |       |   |
| 5   | -3.02 | 29.33 |   |

## STAALPROFIELEN - ALGEMENE GEGEVENS

|                                                |             |
|------------------------------------------------|-------------|
| Stabiliteit: Classificatie gehele constructie: | Geschoord   |
| Doorbuiging en verplaatsing:                   |             |
| Aantal bouwlagen:                              | 1           |
| Gebouwtype:                                    | Industrieel |
| Toel. horiz. verplaatsing gehele gebouw:       | h/150       |
| Kleinste gevelhoogte [m]:                      | 6.2         |

## MATERIAAL

| Mat nr. | Profielnaam | Vloeijsp. [N/mm <sup>2</sup> ] | Productie methode | Min. drsn. klasse |
|---------|-------------|--------------------------------|-------------------|-------------------|
| 1       | HEA180      | 235                            | Gewalst           | 1                 |
| 2       | IPE450      | 235                            | Gewalst           | 1                 |

Partiële veiligheidsfactoren:  
Gamma M;0 : 1.00 Gamma M;1 : 1.00

## KNIKSTABILITEIT

| Staaft | $l_{sys}$ [m] | Classif. y sterke as | $l_{knik,y}$ [m] | Extra aanp. y [kN] | Classif. z zwakke as | $l_{knik,z}$ [m] | Extra aanp. z [kN] |
|--------|---------------|----------------------|------------------|--------------------|----------------------|------------------|--------------------|
| 1      | 5.975         | Geschoord            | 5.975            | 0.0                | Geschoord            | 5.975            | 0.0                |
| 2-3    | 19.773        | Geschoord            | 19.773           | 0.0                | Geschoord            | 4.980*           | 0.0                |
| 4      | 5.975         | Geschoord            | 5.975            | 0.0                | Geschoord            | 5.975            | 0.0                |

\* Door gebruiker gedefinieerde kniklengte

## KIPSTABILITEIT

| Staaft | Plts. aangr. | l gaffel [m]                 | Kipsteunafstanden [m]              |
|--------|--------------|------------------------------|------------------------------------|
| 1      | 1.0*h        | boven: 5.97<br>onder: 5.97   | 5.975<br>5.975                     |
| 2-3    | 1.0*h        | boven: 19.77<br>onder: 19.77 | 4,9065;4,98;4,98;4,906<br>2*9.8865 |
| 4      | 1.0*h        | boven: 5.97<br>onder: 5.97   | 5.975<br>5.975                     |

## TOETSING SPANNINGEN

| Staaft nr. | Mat | BC | Sit | Kl | Plaats | Norm    | Artikel | Formule | Hoogste toetsing U.C. [N/mm <sup>2</sup> ] | Opm.   |
|------------|-----|----|-----|----|--------|---------|---------|---------|--------------------------------------------|--------|
| 1          | 1   | 17 | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.880                                      | 207 47 |
| 2-3        | 2   | 17 | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.851                                      | 200 46 |
| 4          | 1   | 17 | 1   | 1  | Staaft | EN3-1-1 | 6.3.3   | (6.62)  | 0.900                                      | 212 47 |

Opmerkingen:

[ 46] T.b.v. kip is een equivalente Q-last berekend.

[ 47] Bij verloopende normaalkracht wordt de grootste drukkracht genomen.

## TOETSING DOORBUIGING

| Staaft | Soort | Mtg | Lengte [m] | Overst I | Zeeg J | $U_{tot}$ [mm] | BC | Sit    | u [mm] | Toelaatbaar [mm] | *l    |
|--------|-------|-----|------------|----------|--------|----------------|----|--------|--------|------------------|-------|
| 2-3    | Dak   | db  | 19.77      | N        | N      | 40.0-104.7     | 47 | 1 Eind | -64.7  | -79.1            | 0.004 |
|        |       | db  |            |          |        |                | 47 | 1 Bijk | -60.8  | -79.1            | 0.004 |

## TOETSING HORIZONTALE VERPLAATSING

| Staaft | BC | Sit | Lengte [m] | $U_{ind}$ [mm] | Toelaatbaar [mm] | [h/] |
|--------|----|-----|------------|----------------|------------------|------|
| 1      | 47 | 1   | 5.975      | 18.6           | 39.8             | 150  |
| 4      | 47 | 1   | 5.975      | -19.8          | 39.8             | 150  |

## TOETSING HOR. VERPLAATSING GLOBAAL

Er is een maximale horizontale verplaatsing van 0.0016 [m] gevonden bij knoop 3 en combinatie 47; belastingssituatie 1 (combinatietype 2). Bij een hoogte van 6.133 [m] levert dit h /3750 (toel.: h / 150).

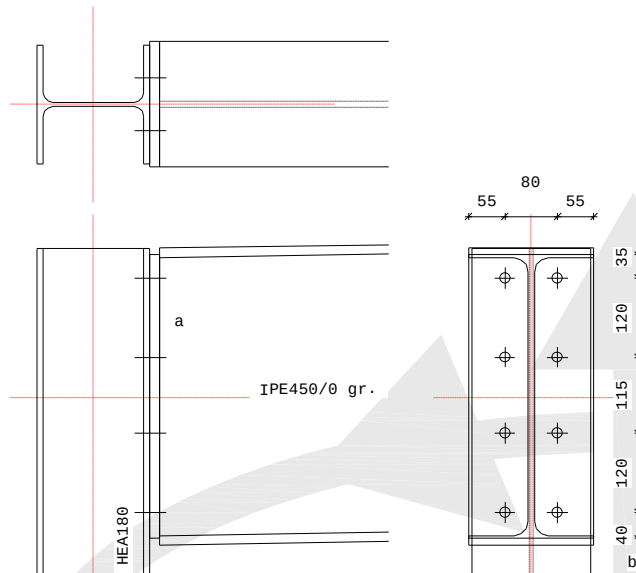
## Waarschuwing

Verbinding: 1:Voetpl:1 is nog niet ontworpen!

# VERBINDINGEN - BASISGEGEVENS

## Knie:1

|                                                                   |                    |
|-------------------------------------------------------------------|--------------------|
| Verbindingstype                                                   | Knie Gebout        |
| Knopen                                                            | 2,4                |
| Rekenwaarde vloeispanning $f_{y;d}$ platen                        | 235                |
| Hoek basis doorgaand profiel t.o.v. globale as (linksom positief) | 270                |
| Classificatie constructie                                         | Geschoord          |
| Classificatie lijf doorgaand profiel                              | Geschoord          |
| Afschuiving kolomlijf actief?                                     | Ja                 |
| Rekenmodel gebruikt bij de mechanicaresultaten                    | 1e orde elastisch  |
| Statisch systeem                                                  | Statisch onbepaald |
| Verbinding t.p.v. plastisch scharnier                             | Ja                 |
| Alternatieve methode T-stuk volgens EN 1993-1-8 tabel 6.2         | Ja                 |



## LEGENDA

| Onderdeel  | Afmetingen | Aantal Lassen (d=dubb. hoeklas) |
|------------|------------|---------------------------------|
| a Kopplaat | 190x430-15 | 1 $a_w=5d$ $a_f=7d$             |
| b Bout     | 8*M16 8.8  | 1                               |

## PROFIELEN

|               | Naam   | Lengte | Prod.meth. | Exc | Hoek | $f_{y;d}$ |
|---------------|--------|--------|------------|-----|------|-----------|
| Kolom         | HEA180 | 5975   | Gewalst    | 0   | 270  | 235       |
| Rechterlijger | IPE450 | 19772  | Gewalst    | 1   | 0    | 235       |
| Kolom boven   |        | 226    |            |     |      |           |

## PROFIELGEGEVENS [mm]

| PROFIELGEGEVENS [mm] |       |                  |      | Gewalst | Klasse 1 | HEA180            |         |                  |           |
|----------------------|-------|------------------|------|---------|----------|-------------------|---------|------------------|-----------|
| h :                  | 171.0 | i <sub>y</sub> : | 74.4 | A :     | 4530.0   | W <sub>ey</sub> : | 293.6E3 | I <sub>y</sub> : | 2510.0E4  |
| b :                  | 180.0 | i <sub>z</sub> : | 45.2 |         |          | W <sub>ez</sub> : | 102.7E3 | I <sub>z</sub> : | 925.0E4   |
| t <sub>w</sub> :     | 6.0   | r :              | 15.0 |         |          | W <sub>py</sub> : | 324.8E3 | I <sub>t</sub> : | 14.9E4    |
| t <sub>f</sub> :     | 9.5   |                  |      |         |          | W <sub>pz</sub> : | 156.4E3 | I <sub>w</sub> : | 60210.9E6 |

## PROFIELGEGEVENS [mm]

| PROFIELGEGEVENS [mm] |       |                  |       |     | Gewalst | Klasse 1          | IPE450   |                  |            |
|----------------------|-------|------------------|-------|-----|---------|-------------------|----------|------------------|------------|
| h :                  | 450.0 | i <sub>y</sub> : | 184.8 | A : | 9880.0  | W <sub>ey</sub> : | 1500.0E3 | I <sub>y</sub> : | 33740.0E4  |
| b :                  | 190.0 | i <sub>z</sub> : | 41.2  |     |         | W <sub>ez</sub> : | 176.4E3  | I <sub>z</sub> : | 1676.0E4   |
| t <sub>w</sub> :     | 9.4   | r :              | 21.0  |     |         | W <sub>py</sub> : | 1702.0E3 | I <sub>t</sub> : | 66.7E4     |
| t <sub>f</sub> :     | 14.6  |                  |       |     |         | W <sub>pz</sub> : | 276.4E3  | I <sub>w</sub> : | 791005.1E6 |

## PLATEN

|          | Plaats | $h$ | $b$ | $t$  | Exc | $a_w$            | $a_f$            | $a_e$ | Hoek | Las | $f_{y;d}$ |
|----------|--------|-----|-----|------|-----|------------------|------------------|-------|------|-----|-----------|
| Kopplaat | Rechts | 430 | 190 | 15.0 | 1   | $\Delta\Delta 5$ | $\Delta\Delta 7$ |       |      |     | 235       |

$\Delta$  = Enkele stompe of hoeklas of dubbele hoeklas met slechts 1 las effectief  
 $\Delta\Delta$  = Dubbele hoeklas

**BOUTEN**  $d_n$  kwal hoh milieu lengte v (vanaf onderkant)

Rechts M16 8.8 80 Niet-corr. 34 40;160;275;395

**BOUTGEGEVENS**

$d_n$   $d_g$  slr  $d_{kop}$   $t_{kop}$   $d_{moer}$   $t_{moer}$  A  $A_s$   $\gamma_m$   $f_{ybd}$   $f_{tbd}$  Draad  
16.0 18.0 33.3 24.0 10.0 24.0 13.0 201.1 156.7 1.25 640 800 Gerold

**KRACHTEN** Normaalkr. Dwarskr. Moment

Kn:2 BC:17 Sit:1

Onder 74.10 -8.88 -53.04  
Rechts 10.33 73.95 53.04

**BEZWIJKKRACHTEN**

Kn:2 BC:17 Sit:1

Onderdeel  $F_{Rd}$  Formule  $b_{eff}$  Rechts

Afschuiving kolomlijf 177.30 (6.7)  $A_{vc} = 1452$  omega=0.65 beta=1.00  
Trek kolomlijf 235.83 (6.15) 246.2  
Druk kolomlijf 148.41 (6.9) 152.0 Drukpunt 0.00  
Plooi kolomlijf 148.41 (6.9) 152.0 kwc=0.90  $l_{rel}=0.71$   
Trek liggerlijf 685.65 (6.22) 306.3  
Drukzone ligger kopplaat 909.36 (6.21)  
Trek bout 90.26  
Trek boutrij 180.52

Let op: De normaalkracht is verwerkt in bovengenoemde bezwijkkrachten.

Dwarskrachtcapaciteiten:

Stuik kolomflens 875.52 (6.7)  
Stuik kopplaat 1260.80 (6.7)  
Afsch.cap. bouten na red. trek 410.71 (6.7)

**STIJFHEID**

Kn:2 BC:17 Sit:1

Maatgevend criterium: Afschuifzone kolomlijf

Rechts

| Verh. | $M_{v,Rd}/Verh.$ | Arm | $S_j$ | $\phi$  |
|-------|------------------|-----|-------|---------|
| 1.0   | 55.70            | 343 | 7588  | 0.00734 |
| 1.2   | 46.42            | 343 | 12414 | 0.00374 |
| 1.5   | 37.13            | 343 | 22677 | 0.00164 |

Bij een moment  $M_{v,Ed}=53.04$  geldt een stijfheid  $S_j=8970$ .

De in mechanica gebruikte stijfheid is oneindig (als in NDM).

**TOETSING VERBINDING**

Kn:2 BC:17 Sit:1

| Artikel | $M_{v,Ed}$ | $M_{v,Rd}$ | Z   | $V_{wp,Ed}$ | $V_{wp,Rd}$ | Toetsing |
|---------|------------|------------|-----|-------------|-------------|----------|
| 6.2.7.1 | 53.04      | 55.70      |     |             |             | 0.95     |
| 6.2.6.1 |            |            | 375 | -8.88       | 177.30      | 0.05     |

Let op: Normaalkrachten in eindigende profielen zijn verwerkt in de bezwijk- en/of de boutrijkrachten. De conservatieve toetsingsformule van EN 1993-1-8 art. 6.2.7.1 (3) is niet gebruikt.

**TOETSING PROFIEL EN AFSCHUIVING**

Kn:2 BC:17 Sit:1

| Plaats | Profiel | Artikel | Formule       | Toetsing |
|--------|---------|---------|---------------|----------|
| Onder  | HEA180  | EN3-1-1 | 6.2.10 (6.31) | 0.69     |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.69     |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.69     |
|        |         | EN3-1-1 | 6.2.6 (6.17)  | 0.05     |
|        |         | EN3-1-1 | 6.2.4 (6.9)   | 0.07     |
|        |         | EN3-1-1 | 6.2.1 N+D     | 0.11     |
| Rechts | IPE450  | EN3-1-1 | 6.2.10 (6.31) | 0.13     |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.13     |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.13     |
|        |         | EN3-1-1 | 6.2.6 (6.17)  | 0.11     |
|        |         | EN3-1-1 | 6.2.1 N+D     | 0.11     |
|        |         | EN3-1-8 | T.3.4         | 0.18     |

**MOMENTCLASSIFICATIE** EN3-1-8 art.5.2.3

Kn:2 BC:17 Sit:1

| Plaats | $M_{v,Rd}$ | $M_{v,Rd,ligger}$ | Classificatie       |
|--------|------------|-------------------|---------------------|
| Rechts | 55.70      | 399.97            | Niet volledig sterk |

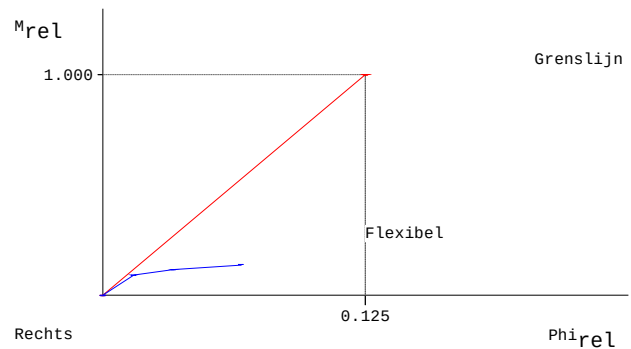
**STIJFHEIDSClassificatie** EN3-1-8 art.5.2.2

Kn:2 BC:17 Sit:1

| Plaats | Punt | Grenswaarden |           | Actuele waarden |           | Classificatie |
|--------|------|--------------|-----------|-----------------|-----------|---------------|
|        |      | $\Phi_{rel}$ | $m_{rel}$ | $\Phi_{rel}$    | $m_{rel}$ |               |
| Rechts | 1    | 0.000        | 0.000     | 0.000           | 0.000     | Flexibel      |
|        | 2    | 0.125        | 1.000     | 0.015           | 0.093     |               |
|        | 3    | 0.125        | 1.000     | 0.033           | 0.116     |               |
|        | 4    | 0.125        | 1.000     | 0.066           | 0.139     |               |

**M-PHI DIAGRAM** EN3-1-8 fig. 5.4 Geschoord

Kn:2 BC:17 Sit:1

**KRACHTEN** Normaalkr. Dwarskr. Moment

Kn:4 BC:17 Sit:1

|       |       |        |        |
|-------|-------|--------|--------|
| Onder | 74.26 | 9.14   | 54.64  |
| Links | 10.33 | -74.11 | -54.64 |

**BEZWIJKKRACHTEN**

Kn:4 BC:17 Sit:1

| Onderdeel                                                              | $F_{Rd}$      | Formule | $b_{eff}$ | Links                   |
|------------------------------------------------------------------------|---------------|---------|-----------|-------------------------|
| Afschuiving kolomlijf                                                  | 177.30 (6.7)  |         |           |                         |
| Trek kolomlijf                                                         | 235.83 (6.15) |         | 246.2     |                         |
| Druk kolomlijf                                                         | 144.57 (6.9)  |         | 152.0     | Drukpunt 0.00           |
| Plooi kolomlijf                                                        | 144.57 (6.9)  |         | 152.0     | kwc=0.88 $l_{rel}=0.71$ |
| Trek liggerlijf                                                        | 685.65 (6.22) |         | 306.3     |                         |
| Drukzone ligger kopplaat                                               | 909.36 (6.21) |         |           |                         |
| Trek bout                                                              | 90.26         |         |           |                         |
| Trek boutrij                                                           | 180.52        |         |           |                         |
| Let op: De normaalkracht is verwerkt in bovengenoemde bezwijkkrachten. |               |         |           |                         |
| Dwarskrachtcapaciteiten:                                               |               |         |           |                         |
| Stuik kolomflens                                                       | 875.52 (6.7)  |         |           |                         |
| Stuik kopplaat                                                         | 1260.80 (6.7) |         |           |                         |
| Afsch.cap. bouten na red. trek                                         | 412.54 (6.7)  |         |           |                         |

**STIJFHEID**

Kn:4 BC:17 Sit:1

Maatgevend criterium: Afschuifzone kolomlijf

| Verh. | $M_{v,Rd}/Verh.$ | Arm | $S_j$ | $\phi$  |
|-------|------------------|-----|-------|---------|
| 1.0   | 54.65            | 343 | 7588  | 0.00720 |
| 1.2   | 45.54            | 343 | 12414 | 0.00367 |
| 1.5   | 36.43            | 343 | 22677 | 0.00161 |

Bij een moment  $M_{v,Ed}=54.64$  geldt een stijfheid  $S_j=7592$ .

De in mechanica gebruikte stijfheid is oneindig (als in NDM).

**TOETSING VERBINDING**

Kn:4 BC:17 Sit:1

| Artikel | $M_{v,Ed}$ | $M_{v,Rd}$ | Z   | $V_{wp,Ed}$ | $V_{wp,Rd}$ | Toetsing |
|---------|------------|------------|-----|-------------|-------------|----------|
| 6.2.7.1 | -54.64     | 54.65      |     |             |             | 1.00     |
| 6.2.6.1 |            |            | 378 | 9.14        | 177.30      | 0.05     |

Let op: Normaalkrachten in eindigende profielen zijn verwerkt in de bezwijk- en/of de boutrijkrachten. De conservatieve toetsingsformule van EN 1993-1-8 art. 6.2.7.1 (3) is niet gebruikt.

**TOETSING PROFIELN EN AFSCHUIVING**

Kn:4 BC:17 Sit:1

| Plaats | Profiel | Artikel | Formule       | Toetsing |
|--------|---------|---------|---------------|----------|
| Onder  | HEA180  | EN3-1-1 | 6.2.10 (6.31) | 0.72     |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.72     |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.72     |
|        |         | EN3-1-1 | 6.2.6 (6.17)  | 0.05     |
|        |         | EN3-1-1 | 6.2.4 (6.9)   | 0.07     |
|        |         | EN3-1-1 | 6.2.1 N+D     | 0.12     |
| Links  | IPE450  | EN3-1-1 | 6.2.10 (6.31) | 0.14     |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.14     |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.14     |
|        |         | EN3-1-1 | 6.2.6 (6.17)  | 0.11     |
|        |         | EN3-1-1 | 6.2.1 N+D     | 0.11     |
|        |         | EN3-1-8 | T.3.4         | 0.18     |

**MOMENTCLASSIFICATIE** EN3-1-8 art.5.2.3

Kn:4 BC:17 Sit:1

| Plaats | $M_{v,Rd}$ | $M_{v,Rd, ligger}$ | Classificatie       |
|--------|------------|--------------------|---------------------|
| Links  | 54.65      | 399.97             | Niet volledig sterk |



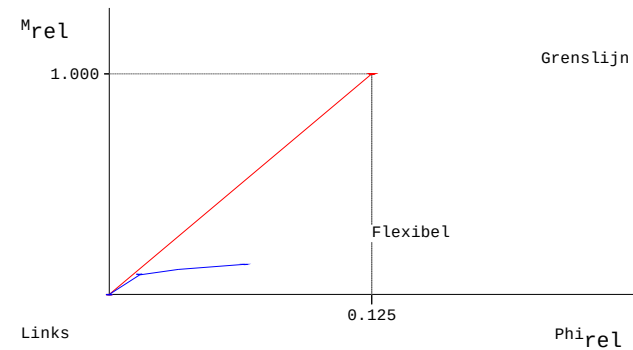
**STIJFHEIDSClassificatie** EN3-1-8 art.5.2.2

Kn:4 BC:17 Sit:1

| Plaats | Punt | Grenswaarden |           | Actuele waarden |           | Classificatie |
|--------|------|--------------|-----------|-----------------|-----------|---------------|
|        |      | $\Phi_{rel}$ | $m_{rel}$ | $\Phi_{rel}$    | $m_{rel}$ |               |
| Links  | 1    | 0.000        | 0.000     | 0.000           | 0.000     | Flexibel      |
|        | 2    | 0.125        | 1.000     | 0.014           | 0.091     |               |
|        | 3    | 0.125        | 1.000     | 0.033           | 0.114     |               |
|        | 4    | 0.125        | 1.000     | 0.065           | 0.137     |               |

**M-PHI DIAGRAM** EN3-1-8 fig. 5.4 Geschoord

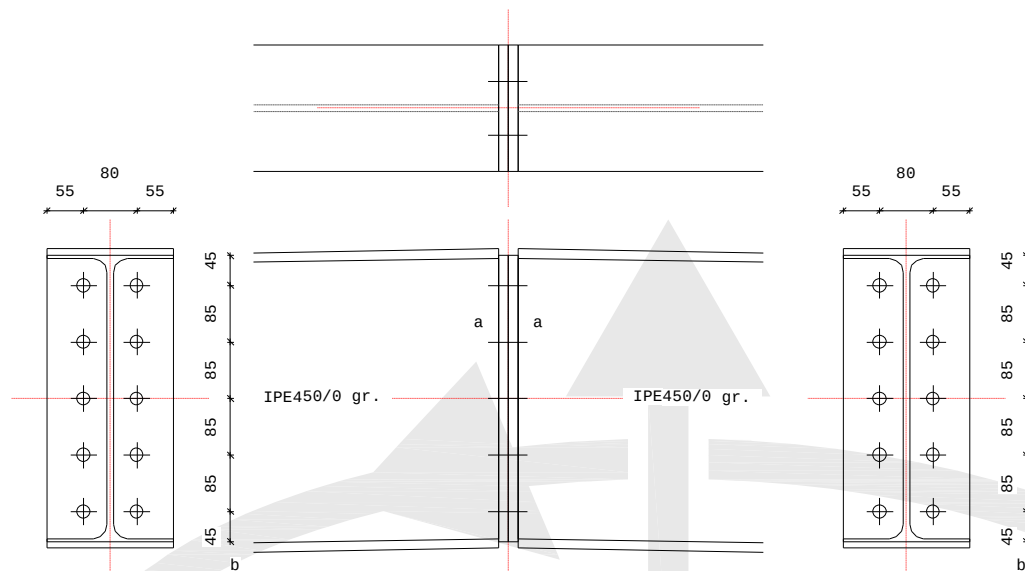
Kn:4 BC:17 Sit:1



## VERBINDINGEN - BASISGEGEVENS

## Stuk:1

|                                                                   |                    |
|-------------------------------------------------------------------|--------------------|
| Verbindingstype                                                   | Stuk Gebout        |
| Knoop                                                             | 3                  |
| Rekenwaarde vloeispanning $f_y$ ; d platen                        | 235                |
| Hoek basis doorgaand profiel t.o.v. globale as (linksom positief) | 270                |
| Classificatie constructie                                         | Geschoord          |
| Verbinding symmetrisch?                                           | Nee                |
| Rekenmodel gebruikt bij de mechanicaresultaten                    | 1e orde elastisch  |
| Statisch systeem                                                  | Statisch onbepaald |
| Verbinding t.p.v. plastisch scharnier                             | Ja                 |
| Alternatieve methode T-stuk volgens EN 1993-1-8 tabel 6.2         | Ja                 |



### LEGENDA

| Onderdeel  | Afmetingen | Aantal | Lassen (d=dubb. hoeklas) |
|------------|------------|--------|--------------------------|
| a Kopplaat | 190x430-15 | 2      | aw=5d af=7d              |
| b Bout     | 10*M20 8.8 | 2      |                          |

### PROFIELEN

| PROFIELEN     | Naam   | Lengte | Prod.meth. | Exc | Hoek | $f_y ; d$ |
|---------------|--------|--------|------------|-----|------|-----------|
| Rechterligger | IPE450 | 19772  | Gewalst    | 0   | 0    | 235       |
| Linkerligger  | IPE450 | 19772  | Gewalst    | 0   | 0    | 235       |

### PROFIELGEGEVENS [mm]

| Gewalst               | Klasse 1               | IPE450                      |
|-----------------------|------------------------|-----------------------------|
| h : 450.0             | i <sub>y</sub> : 184.8 | A : 9880.0                  |
| b : 190.0             | i <sub>z</sub> : 41.2  | W <sub>ey</sub> : 1500.0E3  |
| t <sub>w</sub> : 9.4  | r : 21.0               | W <sub>ez</sub> : 176.4E3   |
| t <sub>f</sub> : 14.6 |                        | W <sub>py</sub> : 1702.0E3  |
|                       |                        | I <sub>y</sub> : 33740.0E4  |
|                       |                        | I <sub>z</sub> : 1676.0E4   |
|                       |                        | I <sub>t</sub> : 66.7E4     |
|                       |                        | W <sub>pz</sub> : 276.4E3   |
|                       |                        | I <sub>w</sub> : 791005.1E6 |

### PLATEN

| Plaats   | h      | b   | t   | Exc  | a <sub>w</sub> | a <sub>f</sub> | a <sub>e</sub> | Hoek | Las | $f_y$ ; d |
|----------|--------|-----|-----|------|----------------|----------------|----------------|------|-----|-----------|
| Kopplaat | Rechts | 430 | 190 | 15.0 | 0              | ΔΔ5            | ΔΔ7            |      |     | 235       |
| Kopplaat | Links  | 430 | 190 | 15.0 | 0              | ΔΔ5            | ΔΔ7            |      |     | 235       |

Δ = Enkele stompe of hoeklas of dubbele hoeklas met slechts 1 las effectief

ΔΔ = Dubbele hoeklas

### BOUTEN

| BOU TEN | d <sub>n</sub> | kw  | hoh | milieu     | lengte | v (vanaf onderkant) |
|---------|----------------|-----|-----|------------|--------|---------------------|
| Rechts  | M20            | 8.8 | 80  | Niet-corr. | 45     | 45;130;215;300;385  |
| Links   | M20            | 8.8 | 80  | Niet-corr. | 45     | 45;130;215;300;385  |

### BOUTGEGEVENS

| d <sub>n</sub> | d <sub>g</sub> | slr  | d <sub>kop</sub> | t <sub>kop</sub> | d <sub>moer</sub> | t <sub>moer</sub> | A     | A <sub>s</sub> | γ <sub>m</sub> | f <sub>ybd</sub> | f <sub>tbd</sub> | Draad  |
|----------------|----------------|------|------------------|------------------|-------------------|-------------------|-------|----------------|----------------|------------------|------------------|--------|
| 20.0           | 22.0           | 41.6 | 30.0             | 13.0             | 30.0              | 16.0              | 314.2 | 244.8          | 1.25           | 640              | 800              | Gerold |

### KRACHTEN

| <b>KRACHTEN</b> | Normaalkr. | Dwarskr. | Moment  |
|-----------------|------------|----------|---------|
| Links           | 9.14       | -0.23    | 228.56  |
| Rechts          | 9.14       | 0.07     | -228.56 |

Kn:3 BC:17 Sit:1

## BEZWIJKKRACHTEN

| Onderdeel                                                              | $F_{Rd}$      | Formule | $b_{eff}$ | Kn:3 BC:17 Sit:1<br>Rechts |
|------------------------------------------------------------------------|---------------|---------|-----------|----------------------------|
| Drukpunt 430.00                                                        |               |         |           |                            |
| Trek liggerlijf                                                        | 983.86 (6.22) |         | 441.2     |                            |
| Drukzone ligger kopplaat                                               | 909.36 (6.21) |         |           |                            |
| Trek bout                                                              | 141.00        |         |           |                            |
| Trek boutrij                                                           | 282.01        |         |           |                            |
| Let op: De normaalkracht is verwerkt in bovengenoemde bezwijkkrachten. |               |         |           |                            |
| Dwarskrachtcapaciteiten:                                               |               |         |           |                            |
| Stuik kopplaat                                                         | 2022.55       |         |           |                            |
| Afsch.cap. bouten na red. trek                                         | 558.33        |         |           |                            |

## STIJFHEID

Maatgevend criterium: Trekzone kopplaat

| Verh. | $M_{v,Rd}/Verh.$ | Arm | $S_j$         | $\phi$  | Kn:3 BC:17 Sit:1<br>Rechts |
|-------|------------------|-----|---------------|---------|----------------------------|
| 1.0   | 211.53           | 302 | <b>154826</b> | 0.00137 |                            |
| 1.2   | 176.27           | 302 | 253300        | 0.00070 |                            |
| 1.5   | 141.02           | 302 | 462692        | 0.00030 |                            |

Bij een moment  $M_v, Ed=228.56$  geldt een stijfheid  $S_j=154826$ .  
De in mechanica gebruikte stijfheid is oneindig (als in NDM).

## BEZWIJKKRACHTEN

| Onderdeel                                                              | $F_{Rd}$      | Formule | $b_{eff}$ | Kn:3 BC:17 Sit:1<br>Links |
|------------------------------------------------------------------------|---------------|---------|-----------|---------------------------|
| Drukpunt 430.00                                                        |               |         |           |                           |
| Trek liggerlijf                                                        | 983.86 (6.22) |         | 441.2     |                           |
| Drukzone ligger kopplaat                                               | 909.36 (6.21) |         |           |                           |
| Trek bout                                                              | 141.00        |         |           |                           |
| Trek boutrij                                                           | 282.01        |         |           |                           |
| Let op: De normaalkracht is verwerkt in bovengenoemde bezwijkkrachten. |               |         |           |                           |
| Dwarskrachtcapaciteiten:                                               |               |         |           |                           |
| Stuik kopplaat                                                         | 2022.55       |         |           |                           |
| Afsch.cap. bouten na red. trek                                         | 558.33        |         |           |                           |

## STIJFHEID

Maatgevend criterium: Trekzone kopplaat

| Verh. | $M_{v,Rd}/Verh.$ | Arm | $S_j$         | $\phi$  | Kn:3 BC:17 Sit:1<br>Links |
|-------|------------------|-----|---------------|---------|---------------------------|
| 1.0   | 211.53           | 302 | <b>154826</b> | 0.00137 |                           |
| 1.2   | 176.27           | 302 | 253300        | 0.00070 |                           |
| 1.5   | 141.02           | 302 | 462692        | 0.00030 |                           |

Bij een moment  $M_v, Ed=228.56$  geldt een stijfheid  $S_j=154826$ .  
De in mechanica gebruikte stijfheid is oneindig (als in NDM).

## TOETSING VERBINDING

| Artikel | $M_{v,Ed}$ | $M_{v,Rd}$ | Z | $V_{wp,Ed}$ | $V_{wp,Rd}$ | Toetsing    | Kn:3 BC:17 Sit:1 |
|---------|------------|------------|---|-------------|-------------|-------------|------------------|
| 6.2.7.1 | -228.56    | 211.53     |   |             |             | <b>1.08</b> |                  |
| 6.2.7.1 | 228.56     | 211.53     |   |             |             | <b>1.08</b> |                  |

Let op: Normaalkrachten in eindigende profielen zijn verwerkt in de bezwijk-  
en/of de boutrijkrachten. De conservatieve toetsingsformule van  
EN 1993-1-8 art. 6.2.7.1 (3) is niet gebruikt.

## TOETSING PROFIEL EN AFSCHUIVING

| Plaats | Profiel | Artikel | Formule       | Toetsing | Kn:3 BC:17 Sit:1 |
|--------|---------|---------|---------------|----------|------------------|
| Rechts | IPE450  | EN3-1-1 | 6.2.10 (6.31) | 0.57     |                  |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.57     |                  |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.57     |                  |
| Links  | IPE450  | EN3-1-1 | 6.2.10 (6.31) | 0.57     |                  |
|        |         | EN3-1-1 | 6.2.8 (6.30)  | 0.57     |                  |
|        |         | EN3-1-1 | 6.2.5 (6.12y) | 0.57     |                  |

## MOMENTCLASSIFICATIE EN3-1-8 art.5.2.3

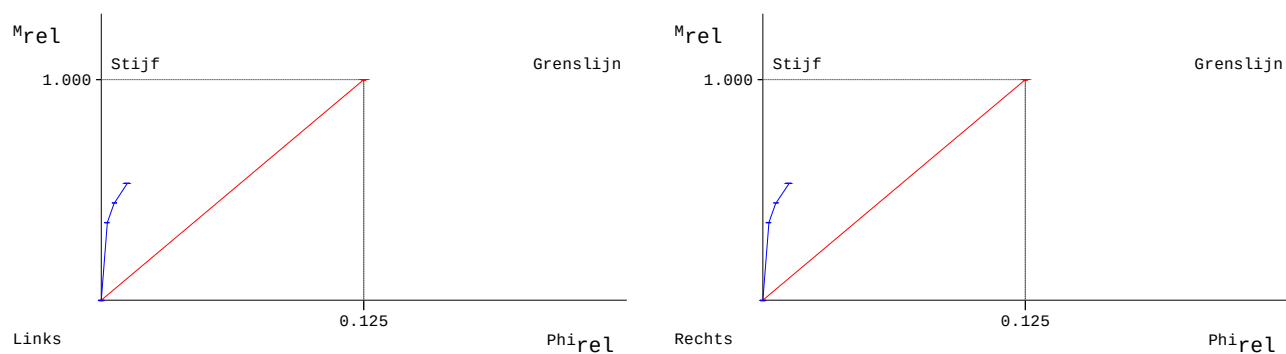
| Plaats | $M_{v,Rd}$ | $M_{v,Rd, ligger}$ | Classificatie       | Kn:3 BC:17 Sit:1 |
|--------|------------|--------------------|---------------------|------------------|
| Rechts | 211.53     | 399.97             | Niet volledig sterk |                  |
| Links  | 211.53     | 399.97             | Niet volledig sterk |                  |

## STIJFHEIDSCCLASSIFICATIE EN3-1-8 art.5.2.2

| Plaats | Punt | Grenswaarden |           | Actuele waarden |           | Classificatie |
|--------|------|--------------|-----------|-----------------|-----------|---------------|
|        |      | $\Phi_{rel}$ | $m_{rel}$ | $\Phi_{rel}$    | $m_{rel}$ |               |
| Rechts | 1    | 0.000        | 0.000     | 0.000           | 0.000     | Stijf         |
|        | 2    | 0.125        | 1.000     | 0.003           | 0.353     |               |
|        | 3    | 0.125        | 1.000     | 0.006           | 0.441     |               |
|        | 4    | 0.125        | 1.000     | 0.012           | 0.529     |               |
| Links  | 1    | 0.000        | 0.000     | 0.000           | 0.000     | Stijf         |
|        | 2    | 0.125        | 1.000     | 0.003           | 0.353     |               |
|        | 3    | 0.125        | 1.000     | 0.006           | 0.441     |               |
|        | 4    | 0.125        | 1.000     | 0.012           | 0.529     |               |

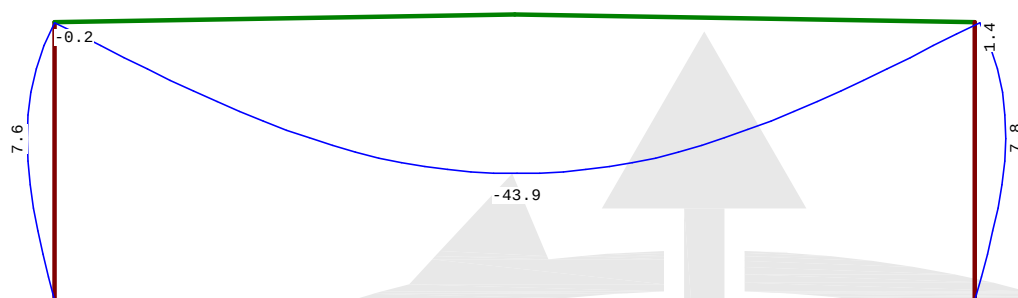
**M-PHI DIAGRAM** EN3-1-8 fig. 5.4 Geschoord

Kn:3 BC:17 Sit:1



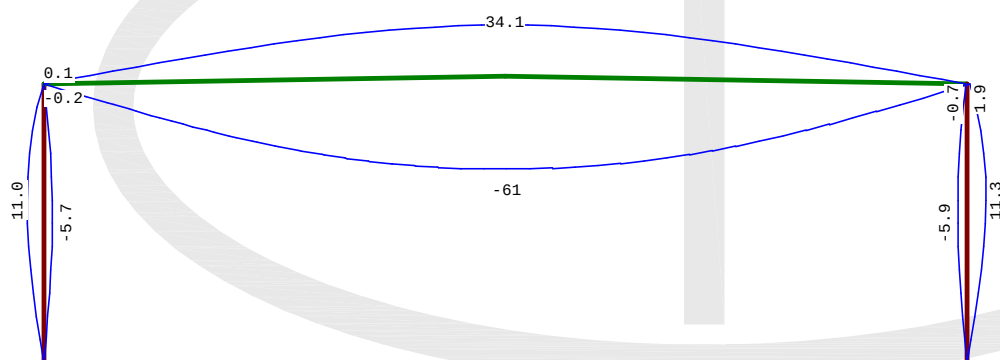
**VERVORMINGEN w1**

Blijvende combinatie



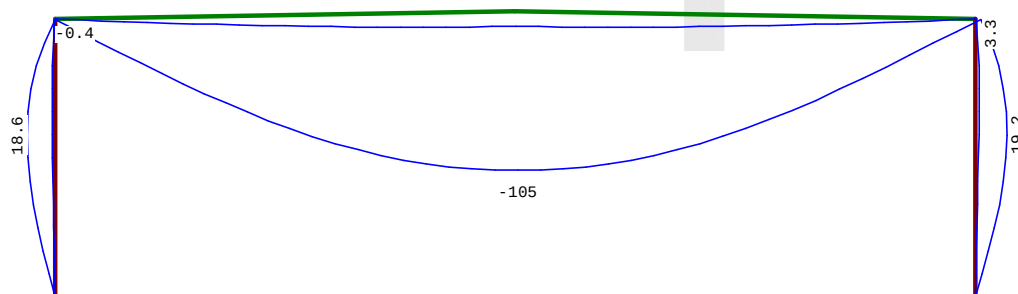
**VERVORMINGEN wbij**

Karakteristieke combinatie



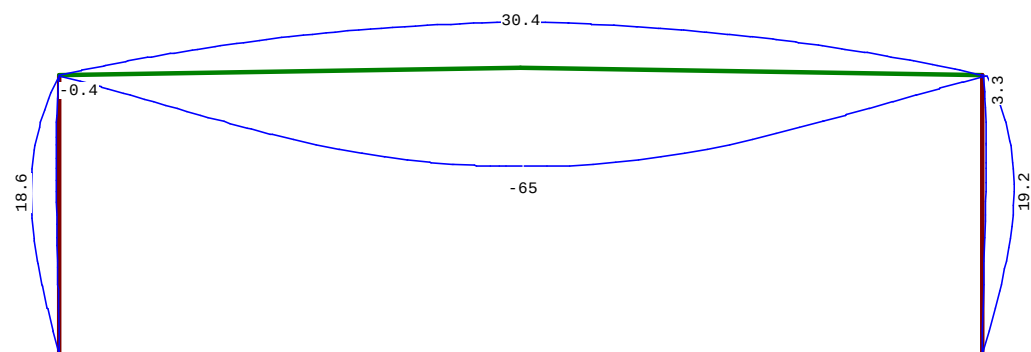
**VERVORMINGEN Wtot**

Karakteristieke combinatie



**VERVORMINGEN Wmax**

Karakteristieke combinatie

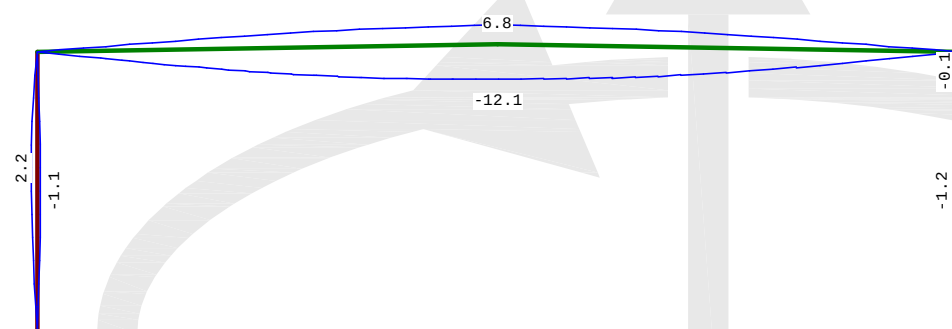
**DOORBUIGINGEN**

Karakteristieke combinatie

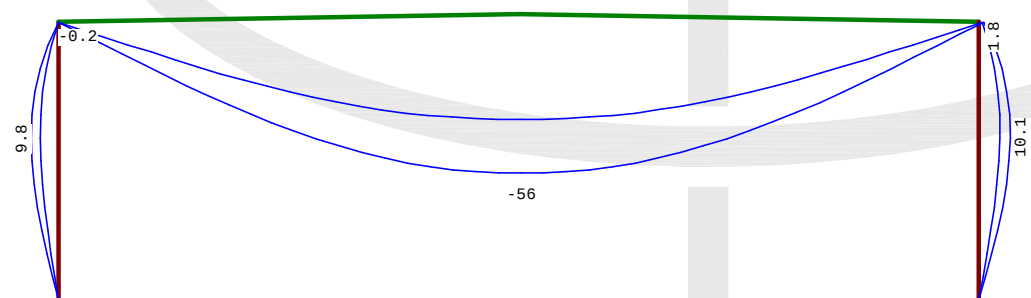
| Nr. | staven | Zijde | positie | $l_{rep}$ | $W_1$ | $W_2$ | $W_{bij}$ | $W_{tot}$ | $W_c$ | $W_{max}$ |
|-----|--------|-------|---------|-----------|-------|-------|-----------|-----------|-------|-----------|
|     |        |       | [m]     | [mm]      | [mm]  | [mm]  | [mm]      | [mm]      | [mm]  | [mm]      |
| 2   | 2-3    | Neg.  | 9.886   | 19773     | -43.9 | -60.8 | 325       | -105      | 40.0  | -64.7     |
| 2   | 2-3    | Pos.  | 9.886   | 19773     | -43.9 | 34.1  | 579       | -9.6      | 40.0  | 30.4      |
|     |        |       |         |           |       |       |           |           |       | 306       |
|     |        |       |         |           |       |       |           |           |       | 650       |

**VERVORMINGEN Wbij**

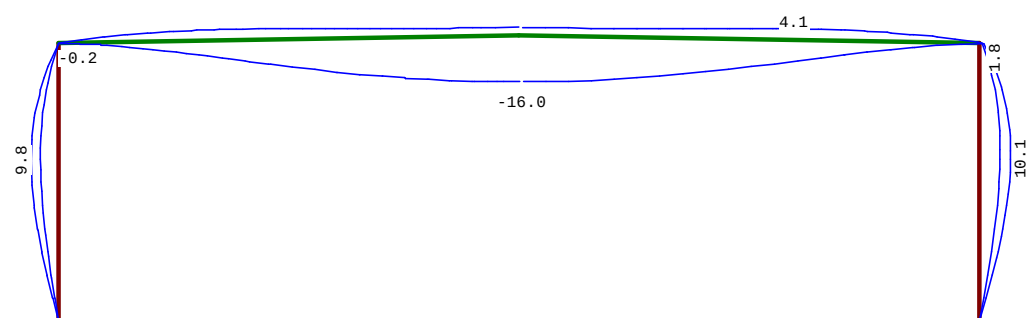
Frequente combinatie

**VERVORMINGEN Wtot**

Frequente combinatie

**VERVORMINGEN Wmax**

Frequente combinatie



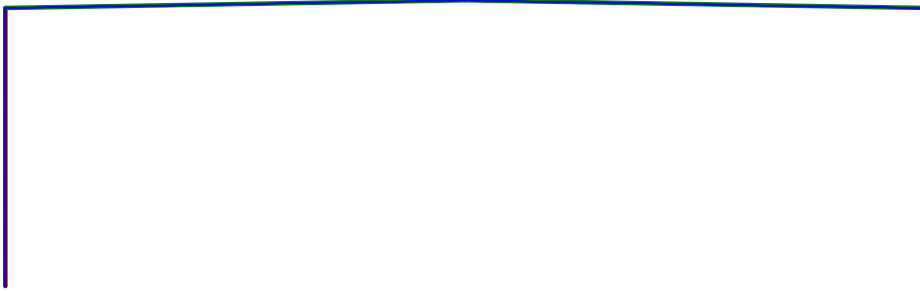
**DOORBUIGINGEN**

Frequente combinatie

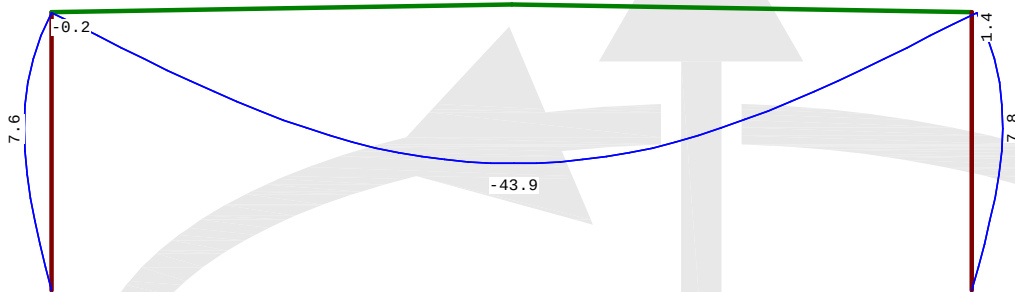
| Nr. | staven | Zijde | positie | $l_{rep}$ | $W_1$ | $W_2$ | $W_{bij}$ | $W_{tot}$ | $W_c$ | $W_{max}$ |
|-----|--------|-------|---------|-----------|-------|-------|-----------|-----------|-------|-----------|
|     |        |       | [m]     | [mm]      | [mm]  | [mm]  | [mm]      | [mm]      | [mm]  | [mm]      |
| 2   | 2-3    | Neg.  | 9.886   | 19773     | -43.9 | -12.1 | 1627      | -56.0     | 40.0  | -16.0     |
| 2   | 2-3    | Pos.  | 9.886   | 19773     | -43.9 | 6.8   | 2897      | -36.9     | 40.0  | 3.1       |

**VERVORMINGEN  $W_{bij}$** 

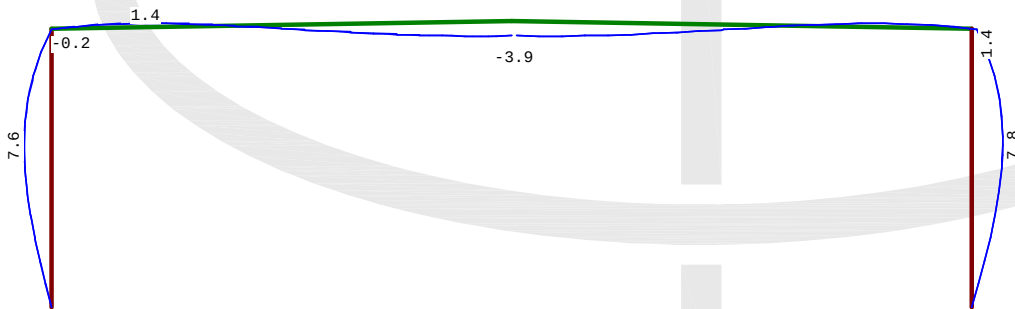
Quasi-blijvende combinatie


**VERVORMINGEN  $W_{tot}$** 

Quasi-blijvende combinatie


**VERVORMINGEN  $W_{max}$** 

Quasi-blijvende combinatie


**DOORBUIGINGEN**

Quasi-blijvende combinatie

| Nr. | staven | Zijde | positie | $l_{rep}$ | $W_1$ | $W_2$ | $W_{bij}$ | $W_{tot}$ | $W_c$ | $W_{max}$ |
|-----|--------|-------|---------|-----------|-------|-------|-----------|-----------|-------|-----------|
|     |        |       | [m]     | [mm]      | [mm]  | [mm]  | [mm]      | [mm]      | [mm]  | [mm]      |
| 2   | 2-3    | Neg.  | 9.886   | 19773     | -43.8 | -43.8 | 40.0      | -3.8      | 5156  |           |

**HORIZONTALE VERPLAATSING**

Quasi-blijvende combinatie

| Nr. | staven | Zijde | $h$  | $W_1$ | $W_2$ | $W_3$ | $W_{tot}$ |
|-----|--------|-------|------|-------|-------|-------|-----------|
|     |        |       | [mm] | [mm]  | [mm]  | [mm]  | [h/]      |
| 3   | 4      | Neg.  | 5975 | -1.4  | -1.4  | 4358  |           |

Kolommen met een  $W_{tot} < h/9999$  zijn niet afgedrukt

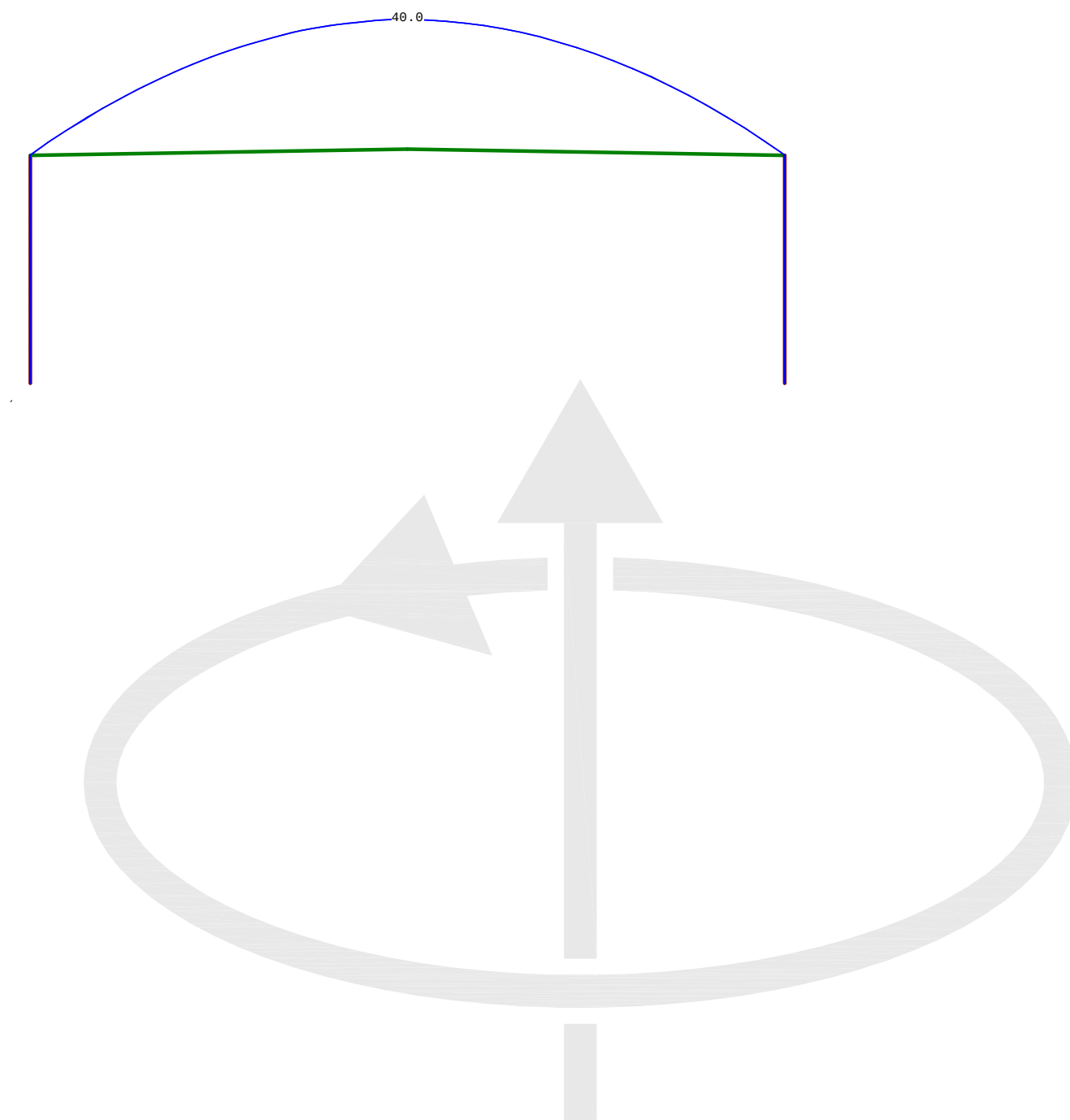
**TOTALE HORIZONTALE VERPLAATSING**

Quasi-blijvende combinatie

| knoop | Zijde | $h$  | $W_1$ | $W_2$ | $W_3$ | $W_{tot}$ |
|-------|-------|------|-------|-------|-------|-----------|
|       |       | [mm] | [mm]  | [mm]  | [mm]  | [h/]      |
| 4     | Pos.  | 5975 | 1.4   | 1.4   | 4358  |           |

**ZEEG wc**

---



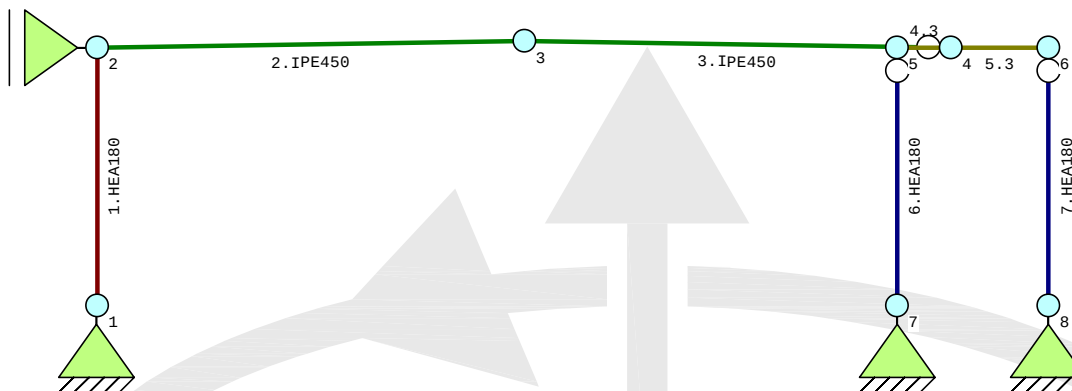
Belastingbreedte.: 4.900  
 Rekenmodel.....: 1e-orde-elastisch.  
 Theorie voor de bepaling van de krachtsverdeling:  
 Geometrisch lineair.  
 Fysisch lineair.

Gunstige werking van de permanente belasting wordt automatisch verwerkt

### Toegepaste normen volgens Eurocode met Nederlandse NB

|             |                      |         |             |
|-------------|----------------------|---------|-------------|
| Belastingen | NEN-EN 1990:2002     | C2:2010 | NB:2011(nl) |
|             | NEN-EN 1991-1-1:2002 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-3:2003 | C1:2009 | NB:2011(nl) |
|             | NEN-EN 1991-1-4:2005 | C2:2011 | NB:2011(nl) |
| Staal       | NEN-EN 1993-1-1:2006 | C2:2009 | NB:2011(nl) |

### GEOMETRIE



### MATERIALEN

| Mt | Omschrijving | E-modulus[N/mm2] | S.M. | Pois. | Uitz. coëff |
|----|--------------|------------------|------|-------|-------------|
| 1  | S235         | 210000           | 78.5 | 0.30  | 1.2000e-005 |

### PROFIELEN [mm]

| Prof. | Omschrijving | Materiaal | Oppervlak   | Traagheid   | Vormf. |
|-------|--------------|-----------|-------------|-------------|--------|
| 1     | HEA180       | 1:S235    | 4.5300e+003 | 2.5100e+007 | 0.00   |
| 2     | IPE450       | 1:S235    | 9.8800e+003 | 3.3740e+008 | 0.00   |
| 3     | HEA200       | 1:S235    | 5.3800e+003 | 3.6920e+007 | 0.00   |
| 4     | HEA180       | 1:S235    | 4.5300e+003 | 2.5100e+007 | 0.00   |

### PROFIELEN vervolg [mm]

| Prof. | Staaftype | Breedte | Hoogte | e     | Type | b1 | h1 | b2 | h2 |
|-------|-----------|---------|--------|-------|------|----|----|----|----|
| 1     | 0:Normaal | 180     | 171    | 85.5  |      |    |    |    |    |
| 2     | 0:Normaal | 190     | 450    | 225.0 |      |    |    |    |    |
| 3     | 0:Normaal | 200     | 190    | 95.0  |      |    |    |    |    |
| 4     | 0:Normaal | 180     | 171    | 85.5  |      |    |    |    |    |

### PROFIELVORMEN [mm]

1 HEA180



2 IPE450



3 HEA200



4 HEA180





## KNOPEN

| Knoop | X      | Z     | Knoop | X      | Z     |
|-------|--------|-------|-------|--------|-------|
| 1     | 0.000  | 0.000 | 6     | 22.020 | 5.975 |
| 2     | 0.000  | 5.975 | 7     | 18.520 | 0.000 |
| 3     | 9.885  | 6.133 | 8     | 22.020 | 0.000 |
| 4     | 19.770 | 5.975 |       |        |       |
| 5     | 18.520 | 5.975 |       |        |       |

## STAVEN

| St. | ki | kj | Profiel  | Aansl.i | Aansl.j | Lengte Opm. |
|-----|----|----|----------|---------|---------|-------------|
| 1   | 1  | 2  | 1:HEA180 | NDM     | NDM     | 5.975       |
| 2   | 2  | 3  | 2:IPE450 | NDM     | NDM     | 9.886       |
| 3   | 3  | 4  | 2:IPE450 | NDM     | ND      | 9.886       |
| 4   | 4  | 5  | 3:HEA200 | NDM     | NDM     | 1.250       |
| 5   | 4  | 6  | 3:HEA200 | NDM     | NDM     | 2.250       |
| 6   | 7  | 5  | 4:HEA180 | NDM     | ND      | 5.975       |
| 7   | 8  | 6  | 4:HEA180 | NDM     | ND      | 5.975       |

## VASTE STEUNPUNTEN

| Nr. knoop | Kode | XZR | 1=vast 0=vrij | Hoek |
|-----------|------|-----|---------------|------|
| 1         | 1    | 110 |               | 0.00 |
| 2         | 2    | 100 |               | 0.00 |
| 3         | 7    | 110 |               | 0.00 |
| 4         | 8    | 110 |               | 0.00 |

## BELASTINGGENERATIE ALGEMEEN.

|                             |       |                         |      |
|-----------------------------|-------|-------------------------|------|
| Betrouwbaarheidsklasse..... | 1     | Referentieperiode.....  | 15   |
| Gebouwdiepte.....           | 22.85 | Gebouwhoogte.....       | 7.37 |
| Niveau aansl.terrein.....   | 0.00  | E.g. scheid.w. [kN/m2]: | 1.20 |

## WIND

|                                  |              |                        |        |
|----------------------------------|--------------|------------------------|--------|
| Terrein categorie ...[4.3.2]...  |              | Bebouwd                |        |
| Windgebied .....                 | 3            | Vb,0 ..[4.2].....      | 24.500 |
| Referentie periode wind.....     | 15.00        | Vb(p) ..[4.2].....     | 22.397 |
| K .....                          | [4.2].....   | n ....[4.2].....       | 0.500  |
| Positie spant in het gebouw....  | 4.900        | Kr ....[4.3.2].....    | 0.223  |
| z0 .....                         | [4.3.2]..... | Zmin ..[4.3.2].....    | 7.000  |
| Co wind van links ..[4.3.3]...   | 1.000        | Co wind van rechts.... | 1.000  |
| Co wind loodrecht ..[4.3.3]...   | 1.000        |                        |        |
| Cpi wind van links ..[7.2.9]...  | 0.200        | -0.300                 |        |
| Cpi windloodrecht ...[7.2.9]...  | 0.200        | -0.300                 |        |
| Cpi wind van rechts ..[7.2.9]... | 0.200        | -0.300                 |        |
| Cfr windwrijving ....[7.5].....  | 0.040        |                        |        |

## SNEEUW

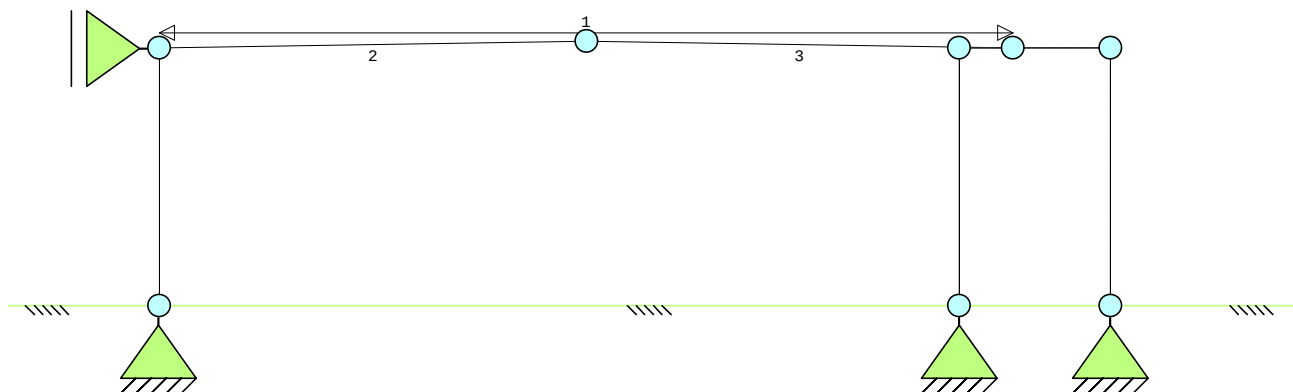
|                                |      |
|--------------------------------|------|
| Sneeuwbelasting (sk) 50 jaar : | 0.70 |
| Sneeuwbelasting (sn) n jaar :  | 0.53 |

## STAAFTYPEN

| Type             | staven |
|------------------|--------|
| 5:Linker gevel.  | : 1    |
| 6:Rechter gevel. | : 6,7  |
| 7:Dak.           | : 2,3  |
| 9:Open.          | : 4,5  |

## LASTVELDEN

Veranderlijke belastingen door personen



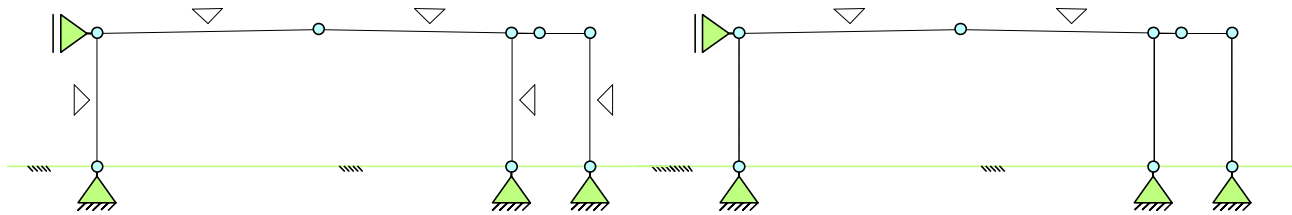
## LASTVELDEN

| Nr | Balk | Veld | Gebruiksfunctie                                         | Psi-t |
|----|------|------|---------------------------------------------------------|-------|
| 1  | 2-4  | 2-3  | Dak niet toegankelijk voor dagelijks gebruik. Tabel 6.9 | 0.87  |

## LASTVELDEN

Wind staven

Sneeuw staven



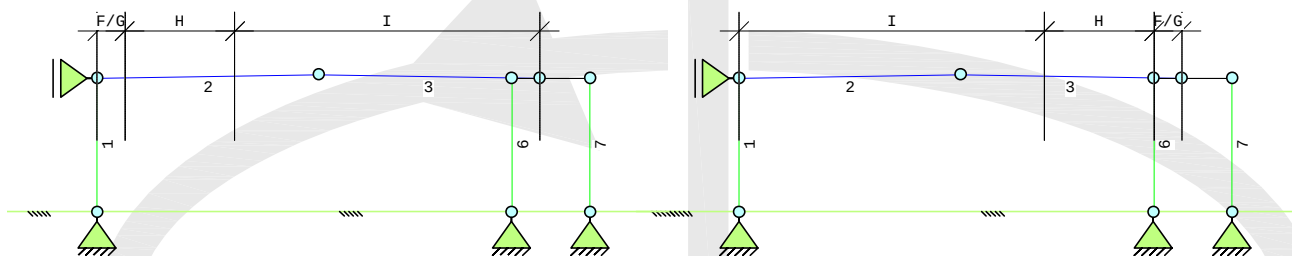
## WIND DAKTYPES

| Nr. | Staaft Type  | reductie bij wind van links | reductie bij wind van Rechts | Cpe volgens art: |
|-----|--------------|-----------------------------|------------------------------|------------------|
| 1   | 1 Gevel      | 1.000                       | 1.000                        | 7.2.2            |
| 2   | 2-3 Plat dak | 1.000                       | 1.000                        | 7.2.3            |
| 3   | 6 Gevel      | 1.000                       | 1.000                        | 7.2.2            |
| 4   | 7 Gevel      | 1.000                       | 1.000                        | 7.2.2            |

## WIND ZONES

Wind van links

Wind van rechts



## WIND VAN LINKS ZONES

## WIND VAN RECHTS ZONES

| Nr. | Staaft | Positie | Lengte | Zone | Nr. | Staaft | Positie | Lengte | Zone |
|-----|--------|---------|--------|------|-----|--------|---------|--------|------|
| 1   | 1      | 0.000   | 5.975  | D    | 1   | 7      | 0.000   | 5.975  | D    |
| 2   | 2-3    | 0.000   | 1.227  | F/G  | 2   | 6      | 0.000   | 5.975  | D    |
| 3   | 2-3    | 1.227   | 4.906  | H    | 3   | 2-3    | 0.000   | 1.227  | F/G  |
| 4   | 2-3    | 6.133   | 13.637 | I    | 4   | 2-3    | 1.227   | 4.906  | H    |
| 5   | 6      | 0.000   | 5.975  | E    | 5   | 2-3    | 6.133   | 13.637 | I    |
| 6   | 7      | 0.000   | 5.975  | E    | 6   | 1      | 0.000   | 5.975  | E    |

## Wind indexen

| Index | CsCd | Cpe/Cpi | qp    | breedte | reductie | Qw     | Zone | Hoek(en) |
|-------|------|---------|-------|---------|----------|--------|------|----------|
| Qw1   |      | 0.300   | 0.406 | 4.900   |          | -0.598 |      |          |
| Qw2   |      | -0.300  | 0.406 | 4.900   |          | 0.598  |      |          |
| Qw3   | 1.00 | 0.800   | 0.406 | 4.900   |          | -1.593 | D    |          |
| Qw4   | 1.00 | -1.800  | 0.406 | 0.616   |          | 0.451  | F    | 0.9      |
| Qw5   | 1.00 | -1.200  | 0.406 | 4.284   |          | 2.089  | G    | 0.9      |
| Qw6   | 1.00 | -0.700  | 0.406 | 4.900   |          | 1.394  | H    | 0.9      |
| Qw7   | 1.00 | -0.200  | 0.406 | 4.900   |          | 0.398  | I    | 0.9      |
| Qw8   | 1.00 | 0.500   | 0.406 | 4.900   |          | -0.996 | E    |          |
| Qw9   |      | -0.200  | 0.406 | 4.900   |          | 0.398  |      |          |
| Qw10  |      | 0.200   | 0.406 | 4.900   |          | -0.398 |      |          |
| Qw11  | 1.00 | 0.200   | 0.406 | 4.900   |          | -0.398 | I    | 0.9      |
| Qw12  | 1.00 | -0.800  | 0.406 | 4.900   |          | 1.593  | D    |          |
| Qw13  | 1.00 | -0.500  | 0.406 | 4.900   |          | 0.996  | E    |          |
| Qw14  | 1.00 | -1.200  | 0.406 | 0.498   |          | 0.243  |      |          |
| Qw15  | 1.00 | -0.800  | 0.406 | 4.402   |          | 1.431  |      |          |
| Qw16  | 1.00 | 1.200   | 0.406 | 0.498   |          | -0.243 |      |          |
| Qw17  | 1.00 | 0.800   | 0.406 | 4.402   |          | -1.431 |      |          |
| Qw18  | 1.00 | -0.700  | 0.406 | 4.900   |          | 1.394  |      | 0.9      |
| Qw19  | 1.00 | -0.500  | 0.406 | 4.900   |          | 0.996  |      |          |
| Qw20  | 1.00 | 0.500   | 0.406 | 4.900   |          | -0.996 |      |          |
| Qw21  | 1.00 | 0.200   | 0.406 | 4.900   |          | -0.398 |      | 0.9      |
| Qw22  | 1.00 | -0.200  | 0.406 | 4.900   |          | 0.398  |      | 0.9      |

### Sneeuw indexen

| Index | art   | $\mu$ | $s_k$ | red. posfac | breedte | $Q_s$ | hoek |
|-------|-------|-------|-------|-------------|---------|-------|------|
| Qs1   | 5.3.2 | 0.800 | 0.53  | 1.00        | 4.900   | 2.060 | 0.9  |

### BELASTINGGEVALLEN

| B.G. | Omschrijving                   | Type                   |
|------|--------------------------------|------------------------|
|      | 1 Permanent EGZ=-1.00          | 1 Permanente belasting |
| g    | 2 Ver. bel. pers. ed. (p_rep)  | 2                      |
| g    | 3 Ver. bel. pers. ed. (F_rep)  | 3                      |
| g*   | 4 Wind van links onderdruk A   | 7                      |
| g*   | 5 Wind van links overdruk A    | 8                      |
| g*   | 6 Wind van links onderdruk B   | 9                      |
| g*   | 7 Wind van links overdruk B    | 10                     |
| g*   | 8 Wind van rechts onderdruk A  | 11                     |
| g*   | 9 Wind van rechts overdruk A   | 12                     |
| g*   | 10 Wind van rechts onderdruk B | 13                     |
| g*   | 11 Wind van rechts overdruk B  | 14                     |
| g    | 12 Wind loodrecht onderdruk A  | 15                     |
| g    | 13 Wind loodrecht overdruk A   | 16                     |
| g*   | 14 Wind loodrecht onderdruk B  | 45                     |
| g    | 15 Wind loodrecht overdruk B   | 46                     |
| g*   | 16 Sneeuw A                    | 22                     |

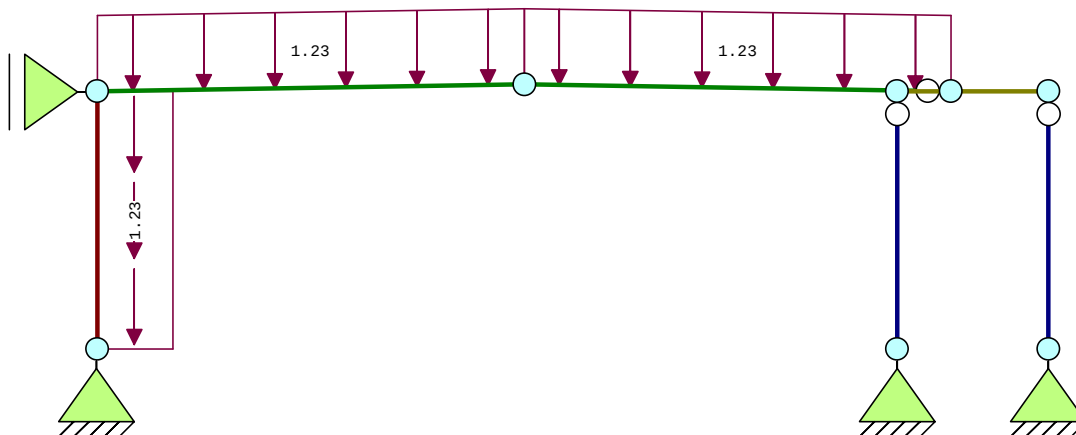
g = gegenereerd belastinggeval

\* = belastinggeval bevat 1 of meer handmatig toegevoegde en/of gewijzigde lasten

## BELASTINGEN

B.G:1 Permanent

Eigen gewicht van alle staven is meegenomen in berekening. Richting:↓



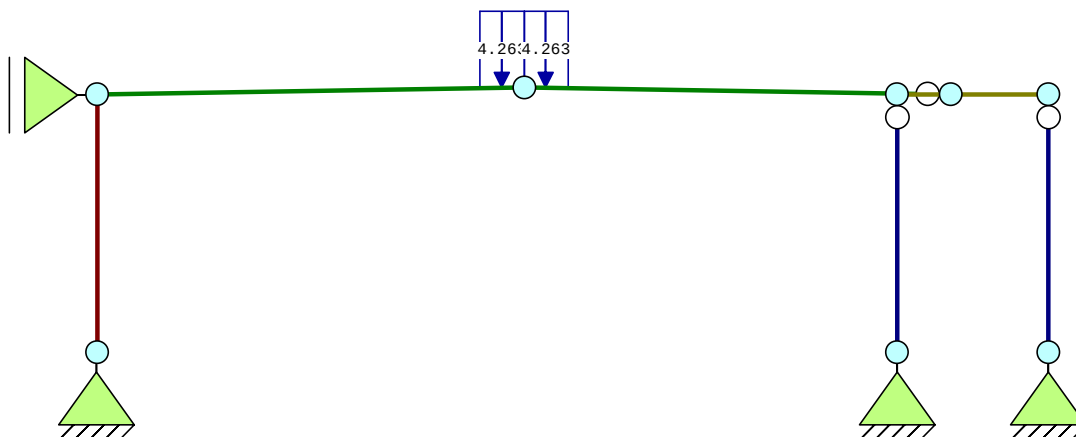
## STAAFBELASTINGEN

B.G:1 Permanent

| Staaft | Type        | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|--------|-------------|--------|-------|-------|-------|----------|----------|----------|
| 2      | 5:QZGlobaal | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |
| 3      | 5:QZGlobaal | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |
| 1      | 2:QXLokaal  | -1.23  | -1.23 | 0.000 | 0.000 |          |          |          |

## BELASTINGEN

B.G:2 Ver. bel. pers. ed. (p\_rep)



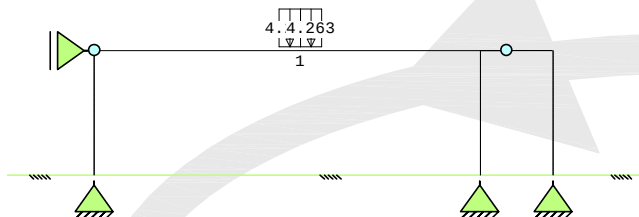
## STAAFBELASTINGEN

B.G:2 Ver. bel. pers. ed. (p\_rep)

| Staat | Type        | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|-------------|--------|-------|-------|-------|----------|----------|----------|
| 2     | 3:QZgeProj. | -4.26  | -4.26 | 8.865 | 0.000 | 0.0      | 0.0      | 0.0      |
| 3     | 3:QZgeProj. | -4.26  | -4.26 | 0.000 | 8.865 | 0.0      | 0.0      | 0.0      |

## VERANDERLIJKE BELASTING SITUATIES

B.G:2 Ver. bel. pers. ed. (p\_rep)

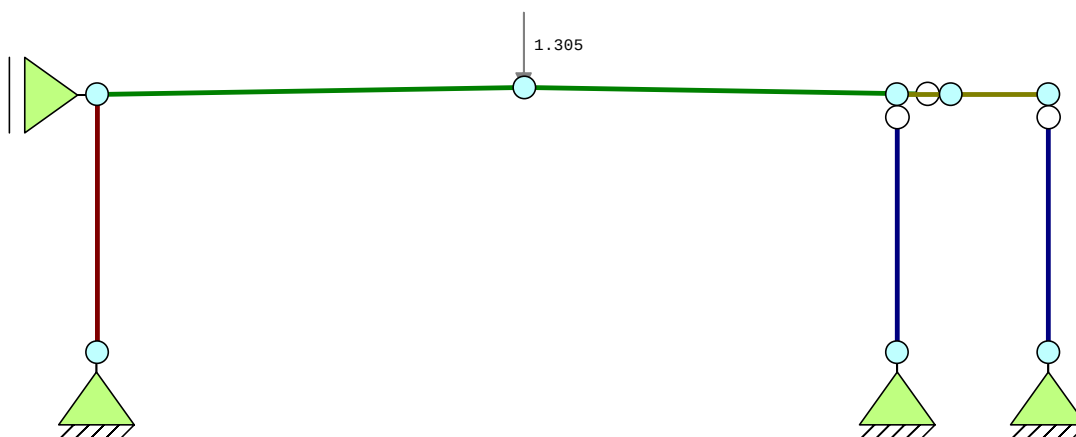


## VERANDERLIJKE BELASTING SITUATIES

| Nr | Lastvelden extreem | Lastvelden momentaan |
|----|--------------------|----------------------|
| 1  | 1                  |                      |

## BELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)



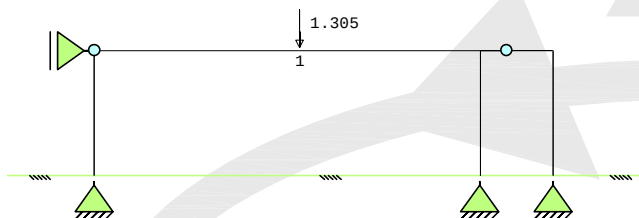
## STAAFBELASTINGEN

B.G:3 Ver. bel. pers. ed. (F-rep)

| Staaftype | Type         | q1/p/m | q2    | A | B | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-----------|--------------|--------|-------|---|---|----------|----------|----------|
| 2         | 10:PZGeproj. | -1.30  | 9.886 |   |   | 0.0      | 0.0      | 0.0      |

## VERANDERLIJKE BELASTING SITUATIES

B.G:3 Ver. bel. pers. ed. (F-rep)

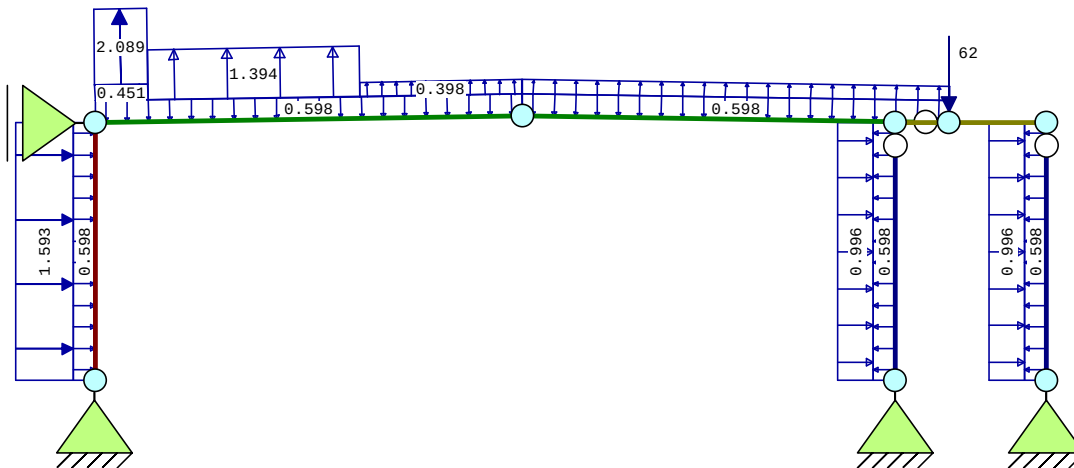


## VERANDERLIJKE BELASTING SITUATIES

| Nr | Lastvelden extreem | Lastvelden momentaan |
|----|--------------------|----------------------|
| 1  | 1                  |                      |

## BELASTINGEN

B.G:4 Wind van links onderdruk A



## KNOOPBELASTINGEN

B.G:4 Wind van links onderdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

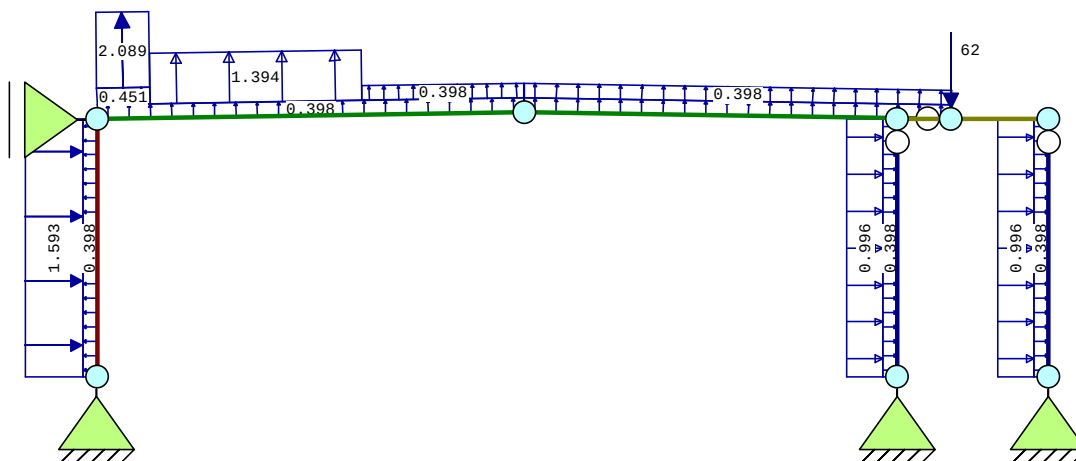
## STAAFBELASTINGEN

B.G:4 Wind van links onderdruk A

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw3   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:5 Wind van links overdruk A

**KNOOPBELASTINGEN**

B.G:5 Wind van links overdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

**STAAFBELASTINGEN**

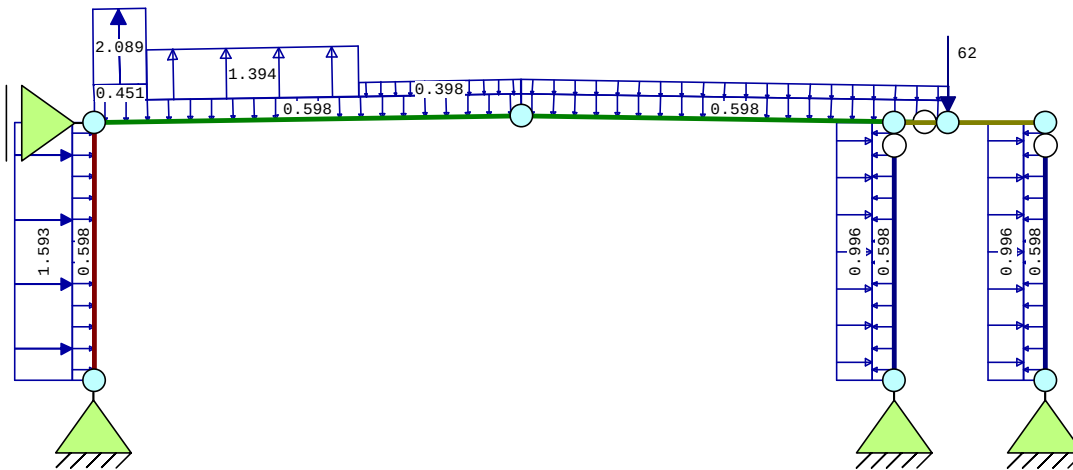
B.G:5 Wind van links overdruk A

| Staafl | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|--------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6      | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7      | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1      | 1:QZLokaal | Qw3   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3      | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6      | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7      | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |



**BELASTINGEN**

B.G:6 Wind van links onderdruk B

**KNOOPBELASTINGEN**

B.G:6 Wind van links onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

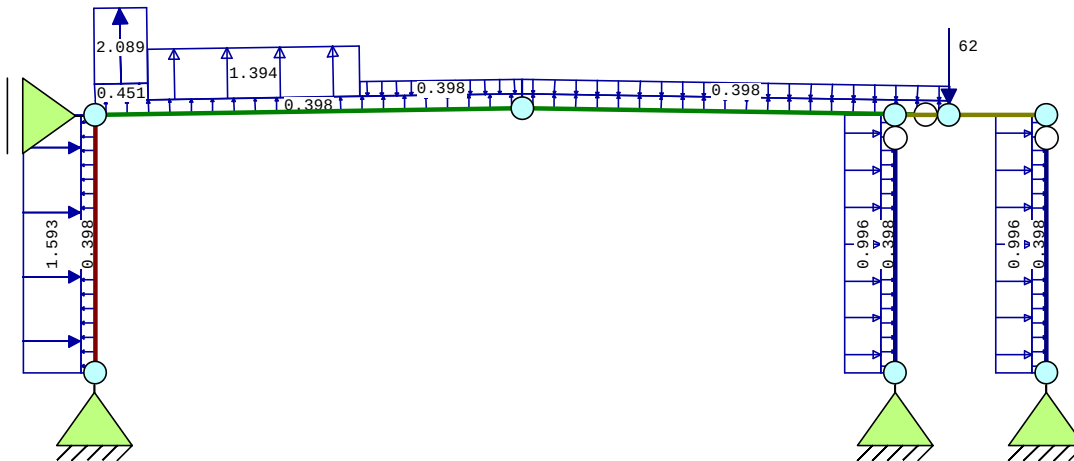
**STAAFBELASTINGEN**

B.G:6 Wind van links onderdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw3   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:7 Wind van links overdruk B

**KNOOPBELASTINGEN**

B.G:7 Wind van links overdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

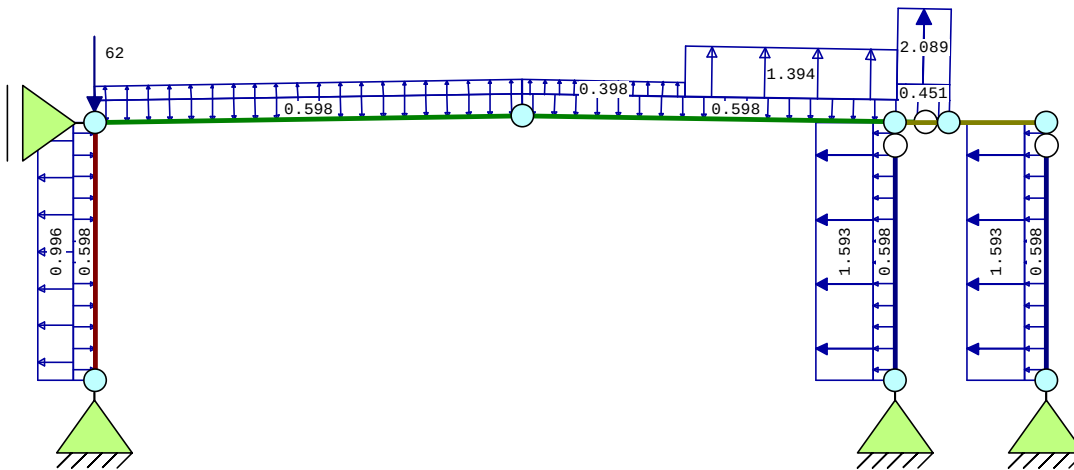
**STAAFBELASTINGEN**

B.G:7 Wind van links overdruk B

| Staafl | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|--------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3      | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6      | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7      | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1      | 1:QZLokaal | Qw3   | -1.59  | -1.59 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 0.000 | 8.660 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 1.227 | 3.752 | 0.0      | 0.2      | 0.0      |
| 2      | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 6.134 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3      | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6      | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7      | 1:QZLokaal | Qw8   | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:8 Wind van rechts onderdruk A


**KNOOPBELASTINGEN**

B.G:8 Wind van rechts onderdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

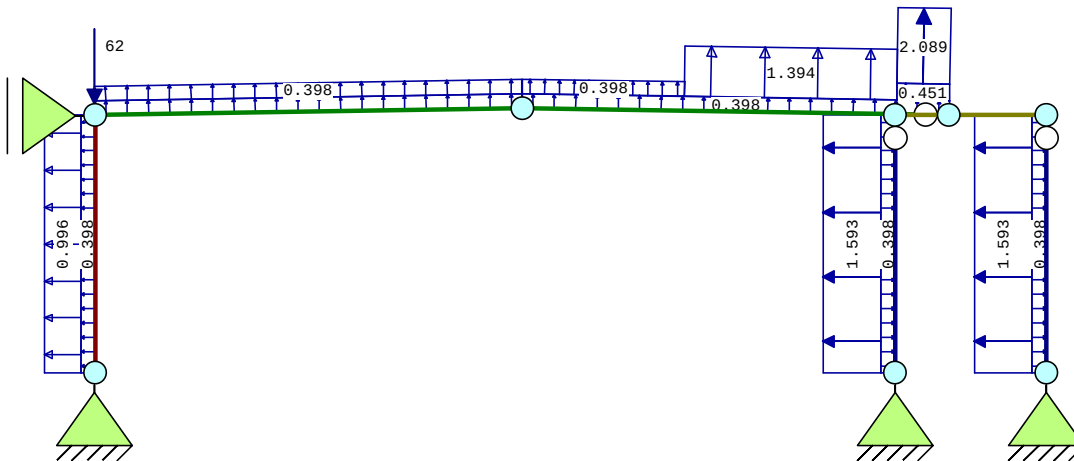
**STAAFBELASTINGEN**

B.G:8 Wind van rechts onderdruk A

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:9 Wind van rechts overdruk A

**KNOOPBELASTINGEN**

B.G:9 Wind van rechts overdruk A

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

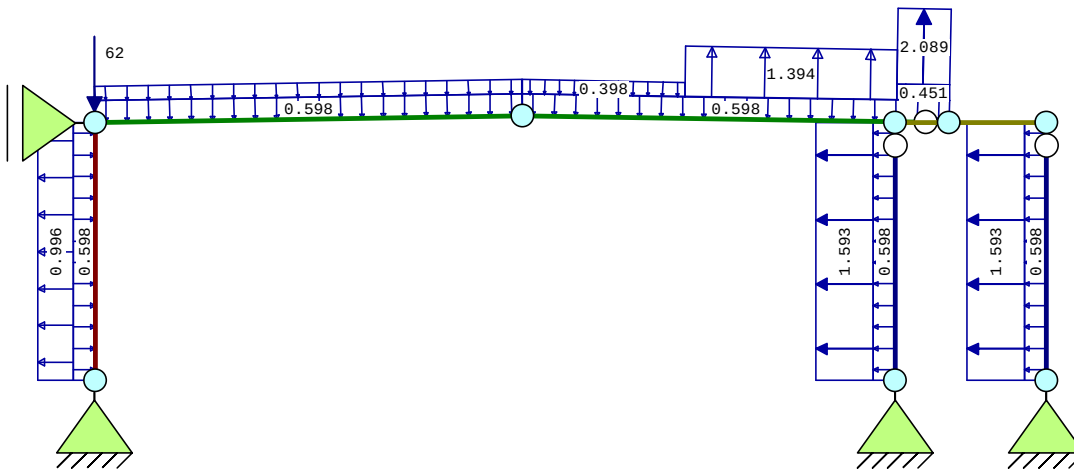
**STAAFBELASTINGEN**

B.G:9 Wind van rechts overdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw7   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:10 Wind van rechts onderdruk B

**KNOOPBELASTINGEN**

B.G:10 Wind van rechts onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

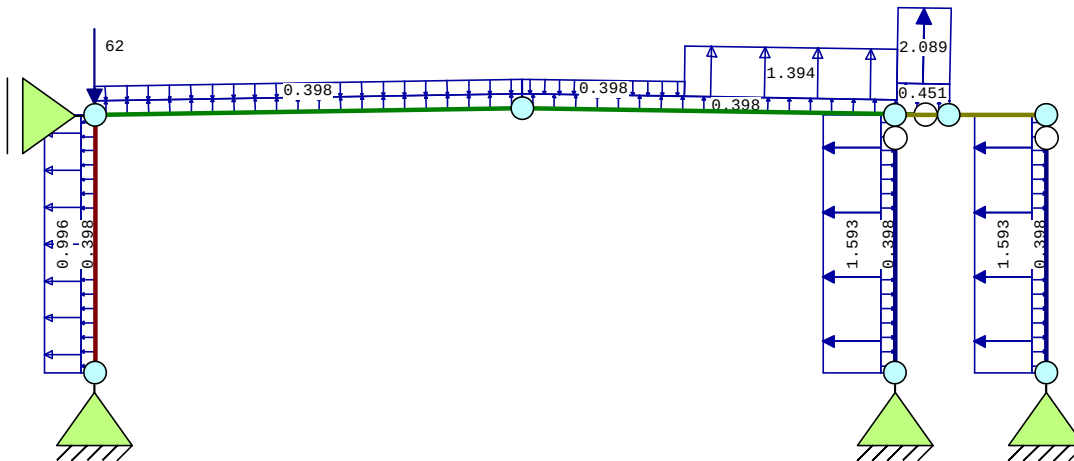
**STAAFBELASTINGEN**

B.G:10 Wind van rechts onderdruk B

| Staat | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:11 Wind van rechts overdruk B

**KNOOPBELASTINGEN**

B.G:11 Wind van rechts overdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

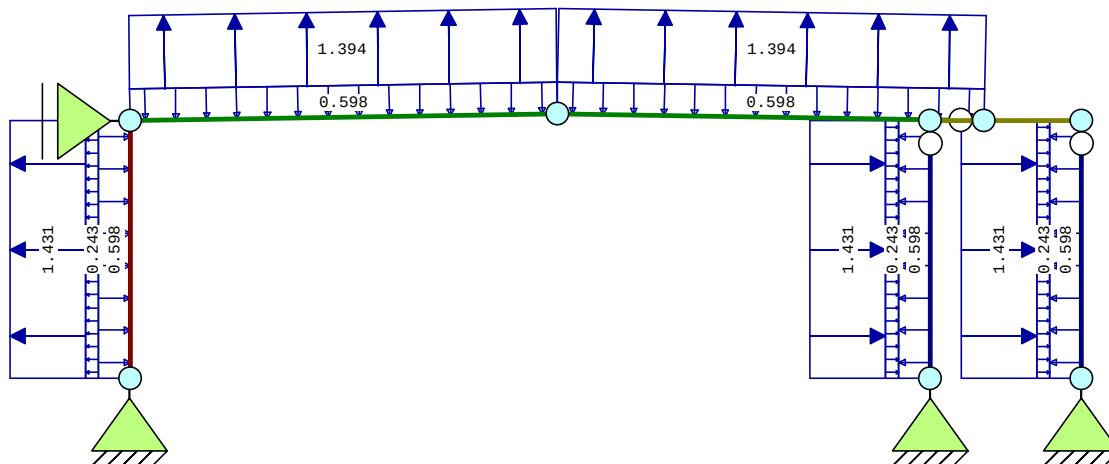
**STAAFBELASTINGEN**

B.G:11 Wind van rechts overdruk B

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw12  | 1.59   | 1.59  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw4   | 0.45   | 0.45  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw5   | 2.09   | 2.09  | 8.660 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw6   | 1.39   | 1.39  | 3.752 | 1.227 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 6.134 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw11  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw13  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:12 Wind loodrecht onderdruk A

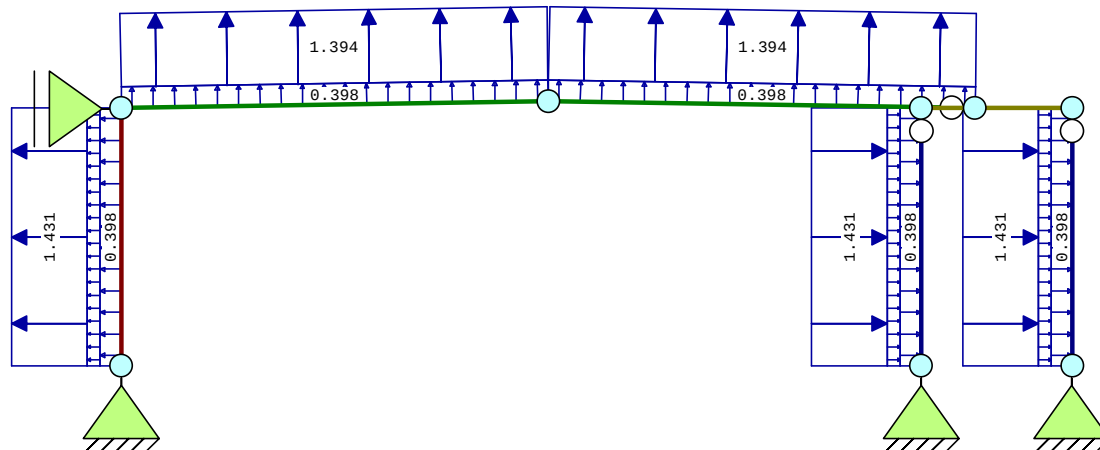
**STAAFBELASTINGEN**

B.G:12 Wind loodrecht onderdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw14  | 0.24   | 0.24  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw15  | 1.43   | 1.43  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw16  | -0.24  | -0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw17  | -1.43  | -1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw16  | -0.24  | -0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw17  | -1.43  | -1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw18  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw18  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:13 Wind loodrecht overdruk A

**STAAFBELASTINGEN**

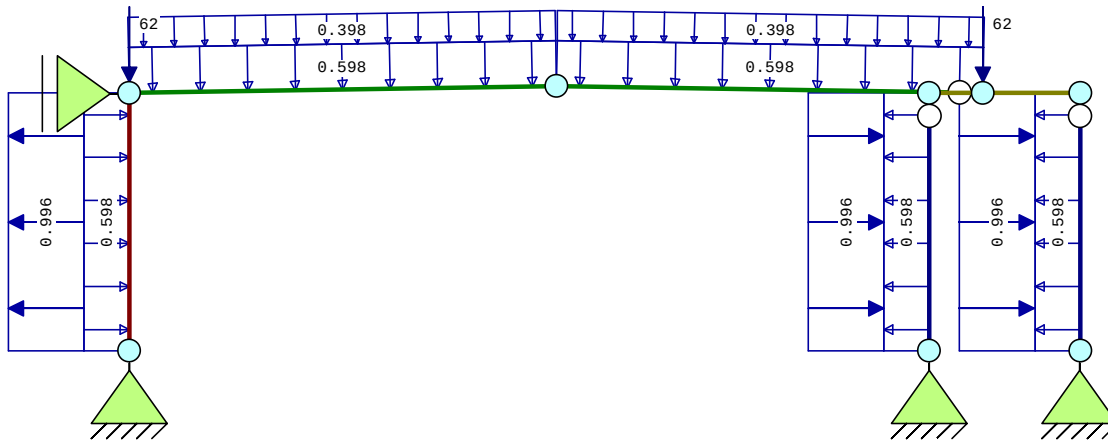
B.G:13 Wind loodrecht overdruk A

| Staal | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw14  | 0.24   | 0.24  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw15  | 1.43   | 1.43  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw16  | -0.24  | -0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw17  | -1.43  | -1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw16  | -0.24  | -0.24 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw17  | -1.43  | -1.43 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw18  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw18  | 1.39   | 1.39  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |



**BELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

**KNOOPBELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

| Last | Knoop | Richting | waarde  | $\psi_0$ | $\psi_1$ | $\psi_2$ | Opm. |
|------|-------|----------|---------|----------|----------|----------|------|
| 1    | 2     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |
| 2    | 4     | Z        | -62.000 | 0.0      | 0.2      | 0.0      | *    |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

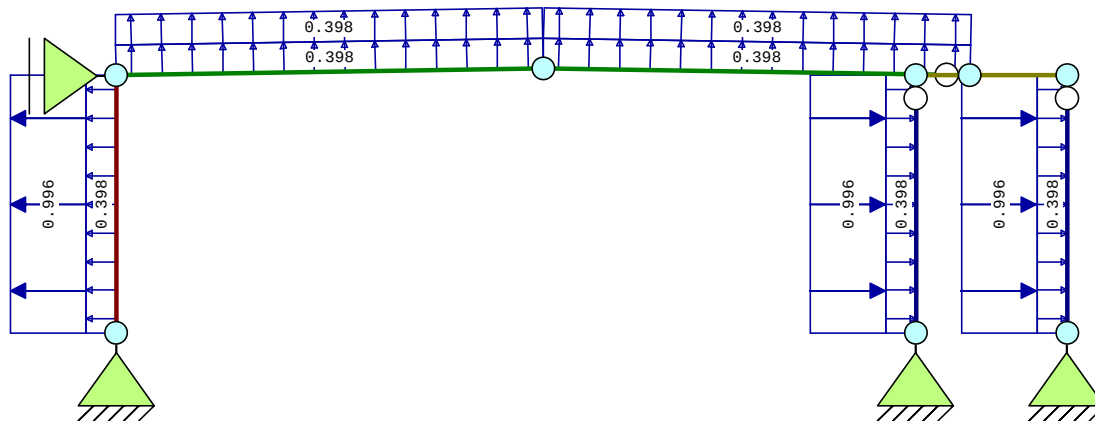
**STAAFBELASTINGEN**

B.G:14 Wind loodrecht onderdruk B

| Staaf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw1   | -0.60  | -0.60 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw2   | 0.60   | 0.60  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw19  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw20  | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw20  | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw21  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw21  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

**BELASTINGEN**

B.G:15 Wind loodrecht overdruk B

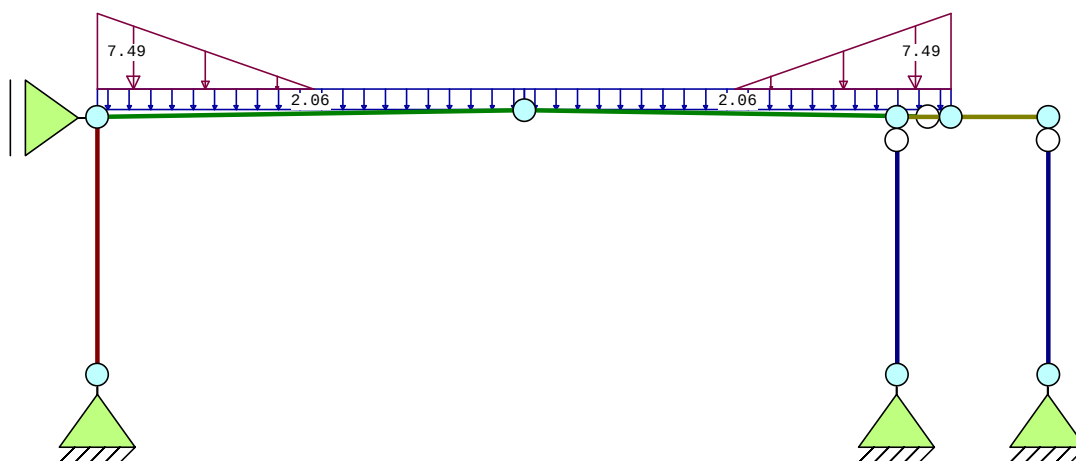
**STAAFBELASTINGEN**

B.G:15 Wind loodrecht overdruk B

| Staaf | Type       | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 1     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw9   | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw10  | -0.40  | -0.40 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 1     | 1:QZLokaal | Qw19  | 1.00   | 1.00  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 6     | 1:QZLokaal | Qw20  | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 7     | 1:QZLokaal | Qw20  | -1.00  | -1.00 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 1:QZLokaal | Qw22  | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 1:QZLokaal | Qw22  | 0.40   | 0.40  | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

## BELASTINGEN

B.G:16 Sneeuw A



## STAAFBELASTINGEN

B.G:16 Sneeuw A

| Staat | Type        | Index | q1/p/m | q2    | A     | B     | $\psi_0$ | $\psi_1$ | $\psi_2$ |
|-------|-------------|-------|--------|-------|-------|-------|----------|----------|----------|
| 2     | 3:QZgeProj. | *     | -7.49  | 0.00  | 0.000 | 4.885 | 0.0      | 0.2      | 0.0      |
| 3     | 3:QZgeProj. | *     | 0.00   | -7.49 | 4.885 | 0.000 | 0.0      | 0.2      | 0.0      |
| 2     | 3:QZgeProj. | Qs1   | -2.06  | -2.06 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |
| 3     | 3:QZgeProj. | Qs1   | -2.06  | -2.06 | 0.000 | 0.000 | 0.0      | 0.2      | 0.0      |

Opmerkingen

[\*] Deze belasting is handmatig toegevoegd of gewijzigd.

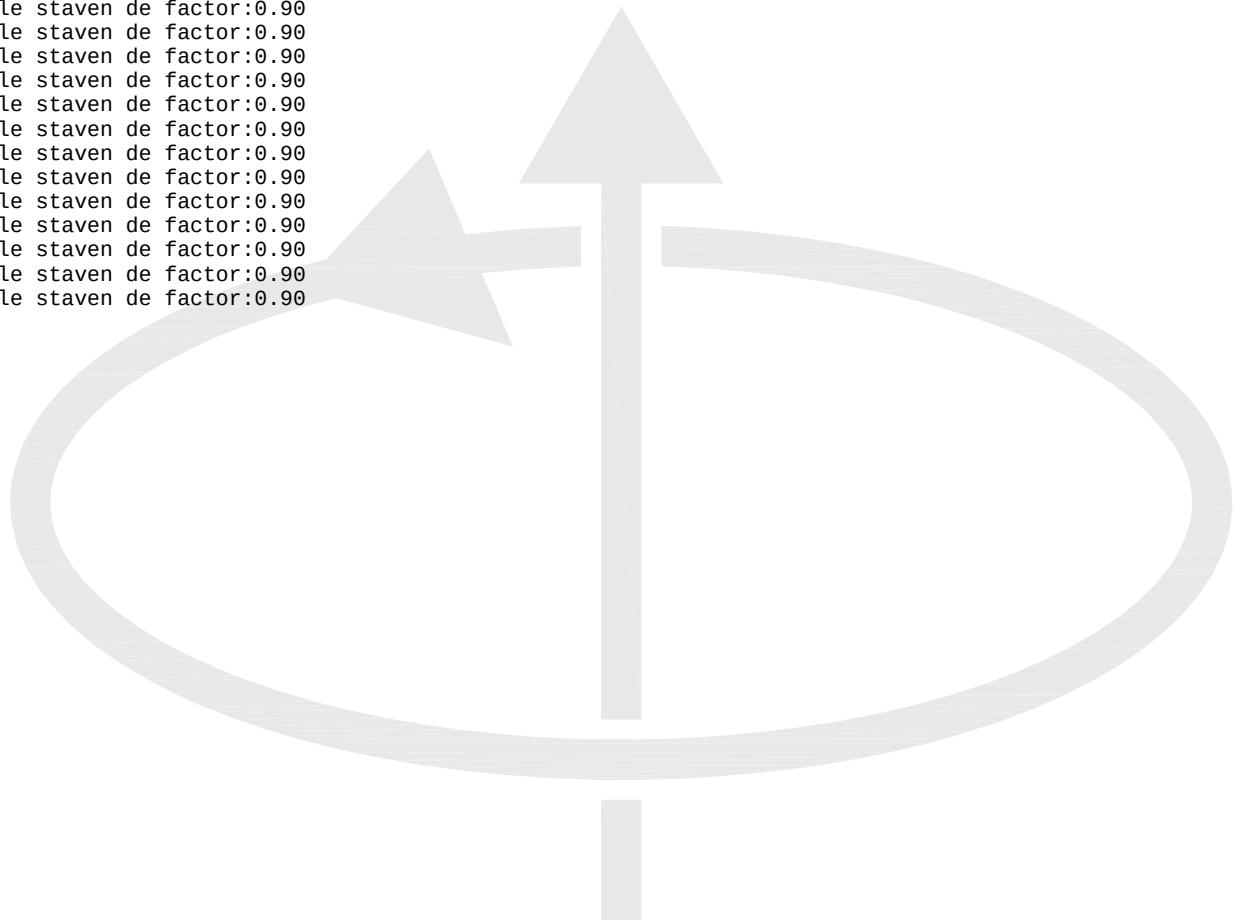
# **BELASTINGCOMBINATIES**

| BC | Type  | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor | BG | Gen. | Factor |
|----|-------|----|------|--------|----|------|--------|----|------|--------|----|------|--------|
| 1  | Fund. | 1  | Perm | 1.22   |    |      |        |    |      |        |    |      |        |
| 2  | Fund. | 1  | Perm | 0.90   |    |      |        |    |      |        |    |      |        |
| 3  | Fund. | 1  | Perm | 1.08   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 4  | Fund. | 1  | Perm | 1.08   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 5  | Fund. | 1  | Perm | 1.08   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 6  | Fund. | 1  | Perm | 1.08   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 7  | Fund. | 1  | Perm | 1.08   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 8  | Fund. | 1  | Perm | 1.08   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 9  | Fund. | 1  | Perm | 1.08   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 10 | Fund. | 1  | Perm | 1.08   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 11 | Fund. | 1  | Perm | 1.08   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 12 | Fund. | 1  | Perm | 1.08   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 13 | Fund. | 1  | Perm | 1.08   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 14 | Fund. | 1  | Perm | 1.08   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 15 | Fund. | 1  | Perm | 1.08   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 16 | Fund. | 1  | Perm | 1.08   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 17 | Fund. | 1  | Perm | 1.08   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 18 | Fund. | 1  | Perm | 0.90   | 2  | Extr | 1.35   |    |      |        |    |      |        |
| 19 | Fund. | 1  | Perm | 0.90   | 3  | Extr | 1.35   |    |      |        |    |      |        |
| 20 | Fund. | 1  | Perm | 0.90   | 4  | Extr | 1.35   |    |      |        |    |      |        |
| 21 | Fund. | 1  | Perm | 0.90   | 5  | Extr | 1.35   |    |      |        |    |      |        |
| 22 | Fund. | 1  | Perm | 0.90   | 6  | Extr | 1.35   |    |      |        |    |      |        |
| 23 | Fund. | 1  | Perm | 0.90   | 7  | Extr | 1.35   |    |      |        |    |      |        |
| 24 | Fund. | 1  | Perm | 0.90   | 8  | Extr | 1.35   |    |      |        |    |      |        |
| 25 | Fund. | 1  | Perm | 0.90   | 9  | Extr | 1.35   |    |      |        |    |      |        |
| 26 | Fund. | 1  | Perm | 0.90   | 10 | Extr | 1.35   |    |      |        |    |      |        |
| 27 | Fund. | 1  | Perm | 0.90   | 11 | Extr | 1.35   |    |      |        |    |      |        |
| 28 | Fund. | 1  | Perm | 0.90   | 12 | Extr | 1.35   |    |      |        |    |      |        |
| 29 | Fund. | 1  | Perm | 0.90   | 13 | Extr | 1.35   |    |      |        |    |      |        |
| 30 | Fund. | 1  | Perm | 0.90   | 14 | Extr | 1.35   |    |      |        |    |      |        |
| 31 | Fund. | 1  | Perm | 0.90   | 15 | Extr | 1.35   |    |      |        |    |      |        |
| 32 | Fund. | 1  | Perm | 0.90   | 16 | Extr | 1.35   |    |      |        |    |      |        |
| 33 | Kar.  | 1  | Perm | 1.00   | 2  | Extr | 1.00   |    |      |        |    |      |        |
| 34 | Kar.  | 1  | Perm | 1.00   | 3  | Extr | 1.00   |    |      |        |    |      |        |
| 35 | Kar.  | 1  | Perm | 1.00   | 4  | Extr | 1.00   |    |      |        |    |      |        |
| 36 | Kar.  | 1  | Perm | 1.00   | 5  | Extr | 1.00   |    |      |        |    |      |        |
| 37 | Kar.  | 1  | Perm | 1.00   | 6  | Extr | 1.00   |    |      |        |    |      |        |
| 38 | Kar.  | 1  | Perm | 1.00   | 7  | Extr | 1.00   |    |      |        |    |      |        |
| 39 | Kar.  | 1  | Perm | 1.00   | 8  | Extr | 1.00   |    |      |        |    |      |        |
| 40 | Kar.  | 1  | Perm | 1.00   | 9  | Extr | 1.00   |    |      |        |    |      |        |
| 41 | Kar.  | 1  | Perm | 1.00   | 10 | Extr | 1.00   |    |      |        |    |      |        |
| 42 | Kar.  | 1  | Perm | 1.00   | 11 | Extr | 1.00   |    |      |        |    |      |        |
| 43 | Kar.  | 1  | Perm | 1.00   | 12 | Extr | 1.00   |    |      |        |    |      |        |
| 44 | Kar.  | 1  | Perm | 1.00   | 13 | Extr | 1.00   |    |      |        |    |      |        |
| 45 | Kar.  | 1  | Perm | 1.00   | 14 | Extr | 1.00   |    |      |        |    |      |        |
| 46 | Kar.  | 1  | Perm | 1.00   | 15 | Extr | 1.00   |    |      |        |    |      |        |
| 47 | Kar.  | 1  | Perm | 1.00   | 16 | Extr | 1.00   |    |      |        |    |      |        |
| 48 | Quas. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 49 | Freq. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |
| 50 | Freq. | 1  | Perm | 1.00   | 4  | psi1 | 1.00   |    |      |        |    |      |        |
| 51 | Freq. | 1  | Perm | 1.00   | 5  | psi1 | 1.00   |    |      |        |    |      |        |
| 52 | Freq. | 1  | Perm | 1.00   | 6  | psi1 | 1.00   |    |      |        |    |      |        |
| 53 | Freq. | 1  | Perm | 1.00   | 7  | psi1 | 1.00   |    |      |        |    |      |        |
| 54 | Freq. | 1  | Perm | 1.00   | 8  | psi1 | 1.00   |    |      |        |    |      |        |
| 55 | Freq. | 1  | Perm | 1.00   | 9  | psi1 | 1.00   |    |      |        |    |      |        |
| 56 | Freq. | 1  | Perm | 1.00   | 10 | psi1 | 1.00   |    |      |        |    |      |        |
| 57 | Freq. | 1  | Perm | 1.00   | 11 | psi1 | 1.00   |    |      |        |    |      |        |
| 58 | Freq. | 1  | Perm | 1.00   | 12 | psi1 | 1.00   |    |      |        |    |      |        |
| 59 | Freq. | 1  | Perm | 1.00   | 13 | psi1 | 1.00   |    |      |        |    |      |        |
| 60 | Freq. | 1  | Perm | 1.00   | 14 | psi1 | 1.00   |    |      |        |    |      |        |
| 61 | Freq. | 1  | Perm | 1.00   | 15 | psi1 | 1.00   |    |      |        |    |      |        |
| 62 | Freq. | 1  | Perm | 1.00   | 16 | psi1 | 1.00   |    |      |        |    |      |        |
| 63 | Blij. | 1  | Perm | 1.00   |    |      |        |    |      |        |    |      |        |

## GUNSTIGE WERKING PERMANENTE BELASTINGEN

### BC Staven met gunstige werking

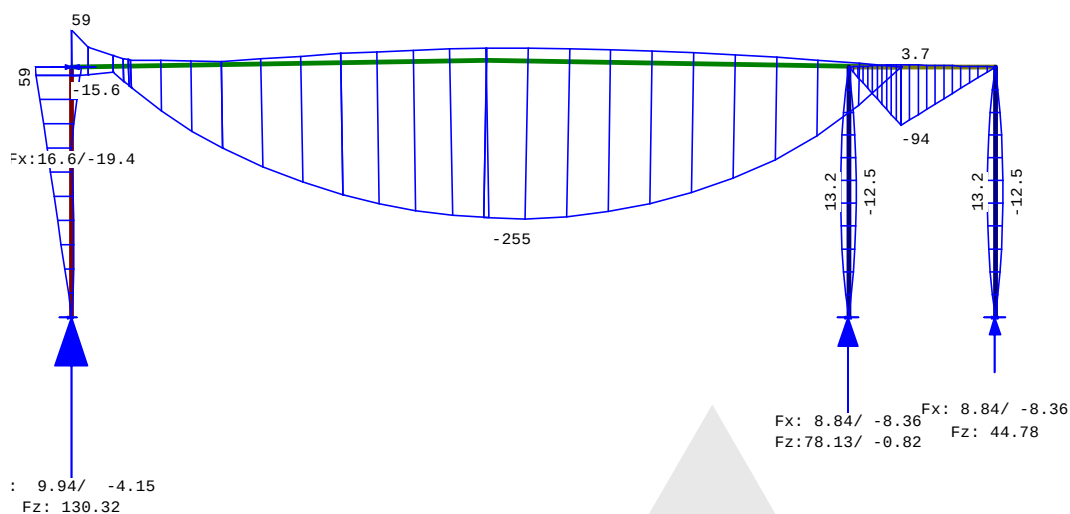
1 Geen  
 2 Alle staven de factor:0.90  
 3 Geen  
 4 Geen  
 5 Geen  
 6 Geen  
 7 Geen  
 8 Geen  
 9 Geen  
 10 Geen  
 11 Geen  
 12 Geen  
 13 Geen  
 14 Geen  
 15 Geen  
 16 Geen  
 17 Geen  
 18 Alle staven de factor:0.90  
 19 Alle staven de factor:0.90  
 20 Alle staven de factor:0.90  
 21 Alle staven de factor:0.90  
 22 Alle staven de factor:0.90  
 23 Alle staven de factor:0.90  
 24 Alle staven de factor:0.90  
 25 Alle staven de factor:0.90  
 26 Alle staven de factor:0.90  
 27 Alle staven de factor:0.90  
 28 Alle staven de factor:0.90  
 29 Alle staven de factor:0.90  
 30 Alle staven de factor:0.90  
 31 Alle staven de factor:0.90  
 32 Alle staven de factor:0.90



# OMHULLENDE VAN DE FUNDAMENTELE COMBINATIES

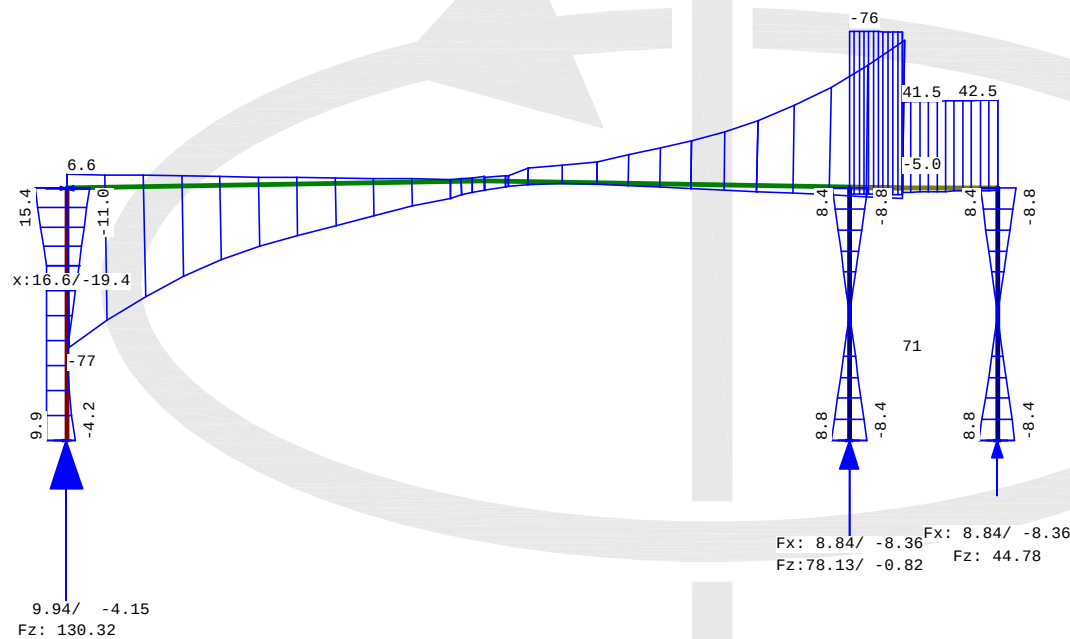
## MOMENTEN

Fundamentele combinatie



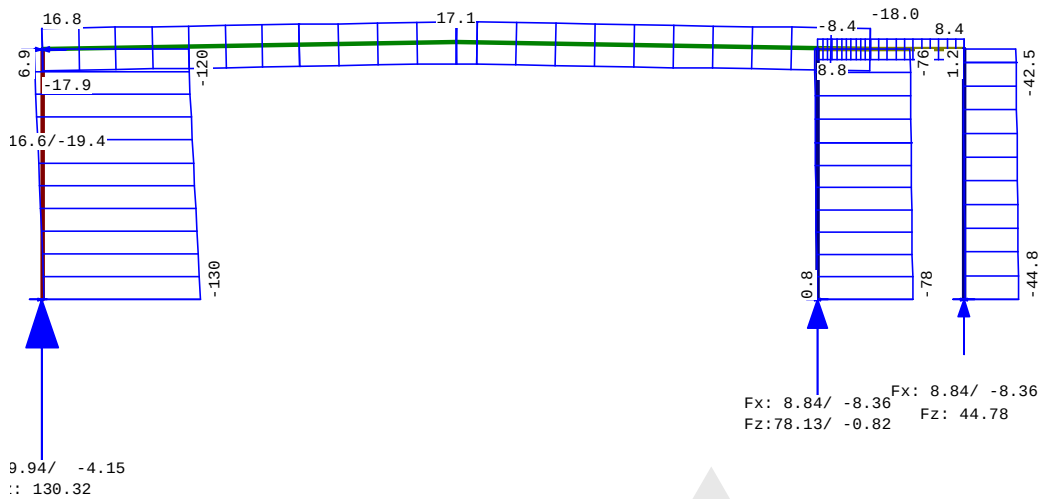
## DWARSKRACHTEN

Fundamentele combinatie



**NORMAALKRACHTEN**

Fundamentele combinatie

**STAAFKRACHTEN**

Fundamentele combinatie

| St. | Kn.   | Pos. | NXi/NXj |     | DZi/DZj |     | MYi/MYj |     |
|-----|-------|------|---------|-----|---------|-----|---------|-----|
|     |       |      | Min     | Max | Min     | Max | Min     | Max |
| 1   | 1     |      | -130.32 | 15  | -1.66   | 29  | -4.15   | 20  |
| 1   | 1.403 |      | -127.91 | 15  | 0.34    | 29  | -0.84   | 21  |
| 1   | 1.562 |      | -127.64 | 15  | 0.57    | 29  | -0.58   | 21  |
| 1   | 1.922 |      | -127.02 | 15  | 1.08    | 29  | 0.00    | 21  |
| 1   | 2.006 |      | -126.88 | 15  | 1.20    | 29  | 0.14    | 21  |
| 1   | 3.844 |      | -123.73 | 15  | 3.82    | 29  | -5.01   | 29  |
| 1   | 4.012 |      | -123.45 | 15  | 4.06    | 29  | -5.48   | 29  |
| 1   | 4.108 |      | -123.28 | 15  | 4.20    | 29  | -5.75   | 29  |
| 1   | 4.133 |      | -123.24 | 15  | 4.24    | 29  | -5.82   | 29  |
| 1   | 2     |      | -120.08 | 15  | 6.87    | 29  | -10.97  | 29  |
| 2   | 2     |      | -17.94  | 11  | 16.83   | 29  | -77.18  | 17  |
| 2   | 0.981 |      | -17.91  | 11  | 16.86   | 29  | -63.38  | 17  |
| 2   | 3.558 |      | -17.82  | 11  | 16.93   | 29  | -36.41  | 17  |
| 2   | 9.071 |      | -17.63  | 11  | 17.09   | 29  | -7.96   | 3   |
| 2   | 3     |      | -17.60  | 11  | 17.11   | 29  | -4.39   | 7   |
| 3   | 3     |      | -17.63  | 26  | 17.09   | 14  | -4.29   | 7   |
| 3   | 0.607 |      | -17.65  | 11  | 17.07   | 29  | -2.20   | 22  |
| 3   | 1.727 |      | -17.69  | 11  | 17.04   | 29  | -0.42   | 21  |
| 3   | 2.036 |      | -17.70  | 11  | 17.03   | 29  | -0.19   | 21  |
| 3   | 4     |      | -17.97  | 11  | 16.80   | 29  | -5.02   | 29  |
| 4   | 4     |      | -8.36   | 29  | 8.84    | 9   | -75.26  | 15  |
| 4   | 5     |      | -8.36   | 29  | 8.84    | 9   | -75.83  | 15  |
| 5   | 4     |      | -8.84   | 9   | 8.36    | 29  | -2.08   | 29  |
| 5   | 6     |      | -8.84   | 9   | 8.36    | 29  | -1.22   | 29  |
| 6   | 7     |      | -78.13  | 15  | 0.82    | 29  | -8.36   | 14  |
| 6   | 2.988 |      | -76.98  | 15  | 1.78    | 29  | 0.00    | 14  |
| 6   | 5     |      | -75.83  | 15  | 2.73    | 29  | -8.84   | 9   |
| 7   | 8     |      | -44.78  | 15  | -0.69   | 29  | -8.36   | 14  |
| 7   | 2.988 |      | -43.63  | 15  | 0.27    | 29  | 0.00    | 14  |
| 7   | 6     |      | -42.49  | 15  | 1.22    | 29  | -8.84   | 9   |

**REACTIES**

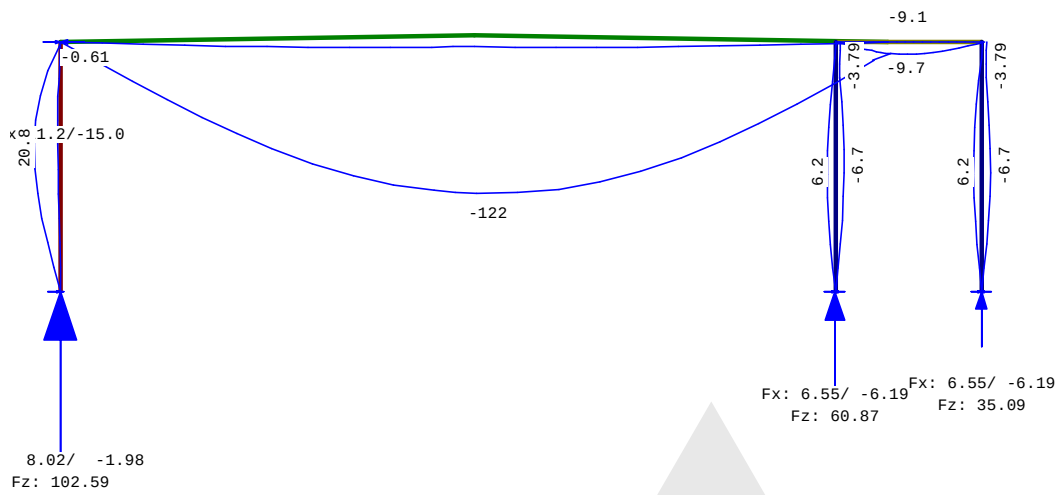
Fundamentele combinatie

| Kn. | X-min  | X-max | Z-min | Z-max  | M-min | M-max |
|-----|--------|-------|-------|--------|-------|-------|
| 1   | -4.15  | 9.94  | 1.66  | 130.32 |       |       |
| 2   | -19.38 | 16.57 |       |        |       |       |
| 7   | -8.36  | 8.84  | -0.82 | 78.13  |       |       |
| 8   | -8.36  | 8.84  | 0.69  | 44.78  |       |       |

## OMHULLENDE VAN DE KARAKTERISTIEKE COMBINATIES

VERPLAATSINGEN [mm]

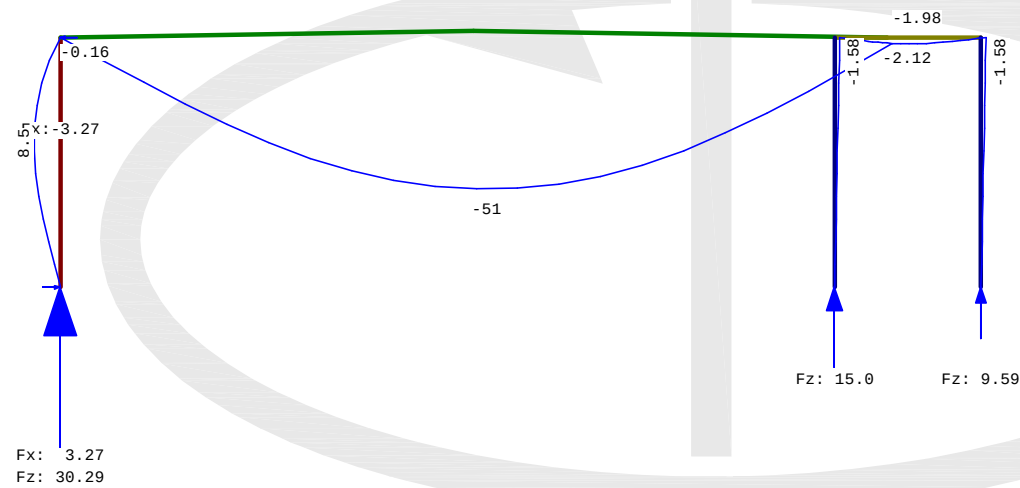
Karakteristieke combinatie



## OMHULLENDE VAN DE BLIJVENDE COMBINATIES

VERPLAATSINGEN [mm]

Blijvende combinatie



## REACTIES

Blijvende combinatie

| Kn. | X     | Z     | M |
|-----|-------|-------|---|
| 1   | 3.27  | 30.29 |   |
| 2   | -3.27 |       |   |
| 7   | 0.00  | 14.97 |   |
| 8   | 0.00  | 9.59  |   |



## STAALPROFIELEN - ALGEMENE GEGEVENS

|                                                |             |
|------------------------------------------------|-------------|
| Stabiliteit: Classificatie gehele constructie: | Geschoord   |
| Doorbuiging en verplaatsing:                   |             |
| Aantal bouwlagen:                              | 1           |
| Gebouwtype:                                    | Industrieel |
| Toel. horiz. verplaatsing gehele gebouw:       | h/150       |
| Kleinste gevelhoogte [m]:                      | 6.2         |

## MATERIAAL

| Mat nr. | Profielnaam | Vloeisp. [N/mm <sup>2</sup> ] | Productie methode | Min. drsn. klasse |
|---------|-------------|-------------------------------|-------------------|-------------------|
| 1       | HEA180      | 235                           | Gewalst           | 1                 |
| 2       | IPE450      | 235                           | Gewalst           | 1                 |
| 3       | HEA200      | 235                           | Gewalst           | 1                 |
| 4       | HEA180      | 235                           | Gewalst           | 1                 |

Partiële veiligheidsfactoren:

Gamma M;0 : 1.00 Gamma M;1 : 1.00

## KNIKSTABILITEIT

| Staal | $l_{sys}$ [m] | Classif. y | $l_{knik,y}$ [m] | Extra aanp. y [kN] | Classif. z | $l_{knik,z}$ [m] | Extra aanp. z [kN] |
|-------|---------------|------------|------------------|--------------------|------------|------------------|--------------------|
| 1     | 5.975         | Geschoord  | 5.975            | 0.0                | Geschoord  | 5.975            | 0.0                |
| 2-3   | 19.773        | Geschoord  | 19.773           | 0.0                | Geschoord  | 4.980*           | 0.0                |
| 4     | 1.250         | Geschoord  | 1.250            | 0.0                | Geschoord  | 1.250            | 0.0                |
| 5     | 2.250         | Geschoord  | 2.250            | 0.0                | Geschoord  | 2.250            | 0.0                |
| 6     | 5.975         | Geschoord  | 5.975            | 0.0                | Geschoord  | 5.975            | 0.0                |

7 5.975 Geschoord 5.975 0.0 Geschoord 5.975 0.0  
 \* Door gebruiker gedefinieerde kniklengte

## KIPSTABILITEIT

| Staal | Plts. aangr. | l gaffel [m]                 | Kipsteunafstanden [m]           |
|-------|--------------|------------------------------|---------------------------------|
| 1     | 1.0*h        | boven: 5.97<br>onder: 5.97   | 5.975 5.975                     |
| 2-3   | 1.0*h        | boven: 19.77<br>onder: 19.77 | 4,9065;4,98;4,98;4,906 2*9.8865 |
| 4     | 0.0*h        | boven: 1.25<br>onder: 1.25   | 1.250 1.250                     |
| 5     | 1.0*h        | boven: 2.25<br>onder: 2.25   | 2.250 2.250                     |
| 6     | 0.0*h        | boven: 5.97<br>onder: 5.97   | 5.975 5.975                     |
| 7     | 0.0*h        | boven: 5.97<br>onder: 5.97   | 5.975 5.975                     |

## TOETSING SPANNINGEN

| Staal nr. | Mat | BC | Sit | Kl | Plaats | Norm    | Artikel | Formule | Hoogste toetsing U.C. [N/mm <sup>2</sup> ] | Opm. |
|-----------|-----|----|-----|----|--------|---------|---------|---------|--------------------------------------------|------|
| 1         | 1   | 17 | 1   | 1  | Staal  | EN3-1-1 | 6.3.3   | (6.62)  | 0.965 227                                  | 47   |
| 2-3       | 2   | 17 | 1   | 1  | Staal  | EN3-1-1 | 6.3.3   | (6.62)  | 0.951 223                                  | 46   |
| 4         | 3   | 15 | 1   | 1  | Begin  | EN3-1-1 | 6.2.10  | (6.31)  | 0.936 220                                  |      |
| 5         | 3   | 15 | 1   | 1  | Begin  | EN3-1-1 | 6.2.10  | (6.31)  | 0.936 220                                  |      |
| 6         | 4   | 8  | 1   | 1  | Staal  | EN3-1-1 | 6.3.3   | (6.62)  | 0.293 69                                   | 47   |
| 7         | 4   | 8  | 1   | 1  | Staal  | EN3-1-1 | 6.3.3   | (6.62)  | 0.215 51                                   | 47   |

Opmerkingen:

[ 46] T.b.v. kip is een equivalente Q-last berekend.

[ 47] Bij verloopende normaalkracht wordt de grootste drukkracht genomen.

## TOETSING DOORBUIGING

| Staal | Soort | Mtg | Lengte [m] | Overst I | Zeeg J | U <sub>tot</sub> [mm] | BC | Sit    | u [mm] | Toelaatbaar [mm] | *l      |
|-------|-------|-----|------------|----------|--------|-----------------------|----|--------|--------|------------------|---------|
| 2-3   | Dak   | db  | 19.77      | N        | N      | 40.0-118.7            | 47 | 1 Eind | -78.7  | -79.1            | 0.004   |
|       |       | db  |            |          |        |                       | 47 | 1 Bijk | -69.1  | -79.1            | 0.004   |
| 4     | Dak   | ss  | 1.25       | N        | J      | 0.0 -8.8              | 45 | 1 Eind | -8.8   | -10.0            | 2*0.004 |
|       |       | ss  |            |          |        |                       | 45 | 1 Bijk | -6.9   | -10.0            | 2*0.004 |
| 5     | Dak   | ss  | 2.25       | N        | J      | 0.0 -9.0              | 45 | 1 Eind | -9.0   | -18.0            | 2*0.004 |
|       |       | ss  |            |          |        |                       | 45 | 1 Bijk | -7.0   | -18.0            | 2*0.004 |

# TOETSING HORIZONTALE VERPLAATSING

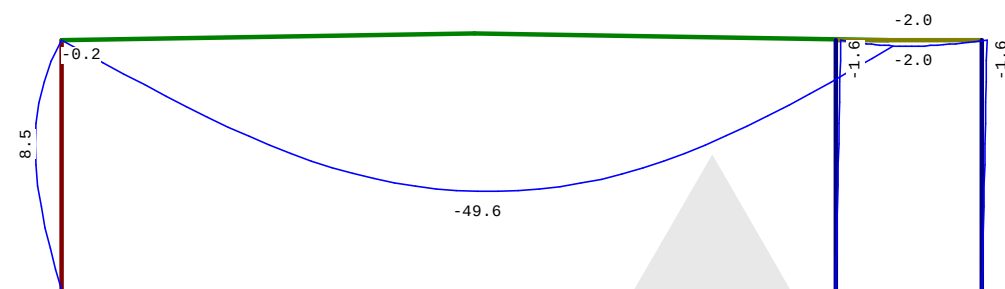
| Staafl | BC | Sit | Lengte<br>[m] | U <sub>e i n d</sub><br>[mm] | Toelaatbaar<br>[mm] | [h/] |
|--------|----|-----|---------------|------------------------------|---------------------|------|
| 1      | 47 | 1   | 5.975         | 20.8                         | 39.8                | 150  |
| 6      | 39 | 1   | 5.975         | 6.9                          | 39.8                | 150  |
| 7      | 39 | 1   | 5.975         | 6.9                          | 39.8                | 150  |

# TOETSING HOR. VERPLAATSING GLOBAAL

Er is een maximale horizontale verplaatsing van 0.0019 [m] gevonden bij knoop 3 en combinatie 47; belastingsituatie 1 (combinatietype 2). Bij een hoogte van 6.133 [m] levert dit h / 3166 (toel.: h / 150).

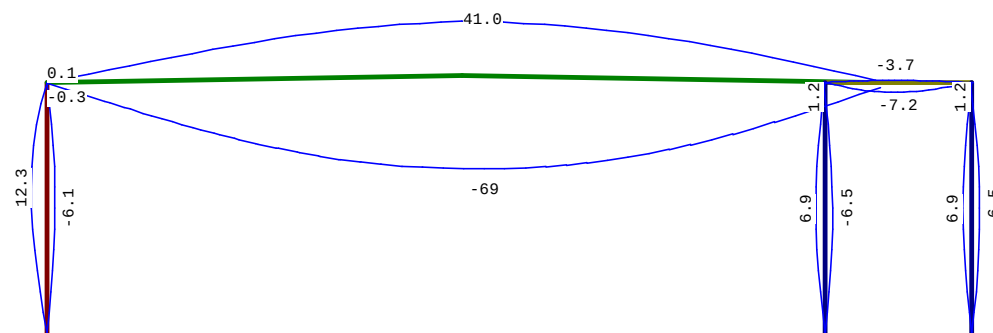
# VERVORMINGEN w1

Blijvende combinatie



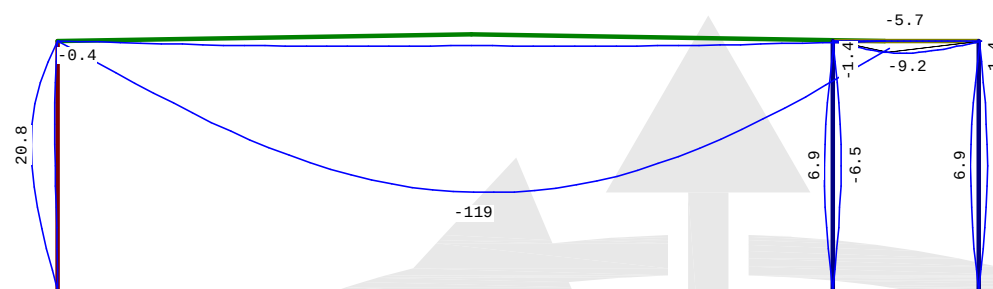
## VERVORMINGEN $W_{bij}$

Karakteristieke combinatie



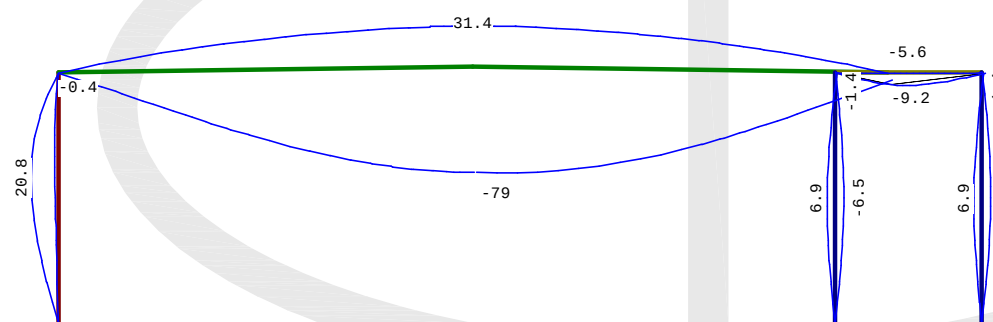
## VERVORMINGEN $W_{tot}$

Karakteristieke combinatie



## VERVORMINGEN $W_{max}$

Karakteristieke combinatie



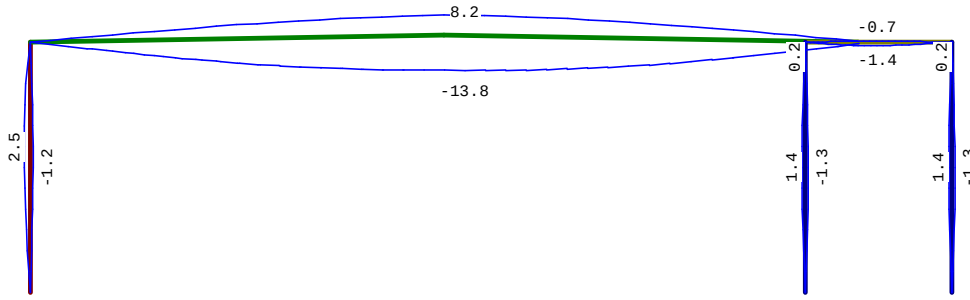
## DOORBUIGINGEN

Karakteristieke combinatie

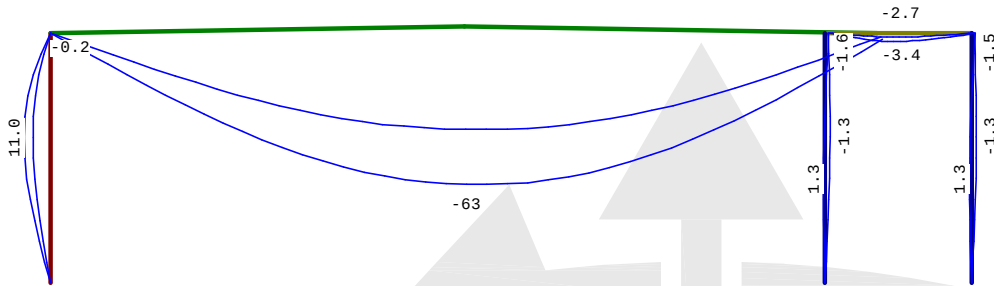
| Nr. | staven | Zijde | positie<br>[m] | $l_{rep}$<br>[mm] | $W_1$<br>[mm] | $W_2$<br>[mm] | $W_{bij}$<br>[mm] | $W_{tot}$<br>[mm] | $W_c$<br>[mm] | $W_{max}$<br>[mm] |      |
|-----|--------|-------|----------------|-------------------|---------------|---------------|-------------------|-------------------|---------------|-------------------|------|
| 2   | 2-3    | Neg.  | 10.375         | 19773             | -49.5         | -69.0         | 287               | -119              | 39.9          | -78.7             | 251  |
| 2   | 2-3    | Pos.  | 10.381         | 19773             | -49.5         | 41.0          | 483               | -8.6              | 39.9          | 31.3              | 631  |
| 3   | 4      | Neg.  | /              | 2500              | -1.9          | -6.9          | 363               | -8.8              |               | -8.8              | 284  |
| 3   | 4      | Pos.  | /              | 2500              | -1.9          | 1.6           | 1572              | -0.3              |               | -0.3              | 7711 |
| 4   | 5      | Neg.  | 1.125          | 2250              | -0.6          | -2.2          | 1001              | -2.9              |               | -2.9              | 781  |
| 4   | 5      | Pos.  | /              | 4500              | 1.9           | 7.0           | 641               | 9.0               |               | 9.0               | 502  |

**VERVORMINGEN  $W_{bij}$** 

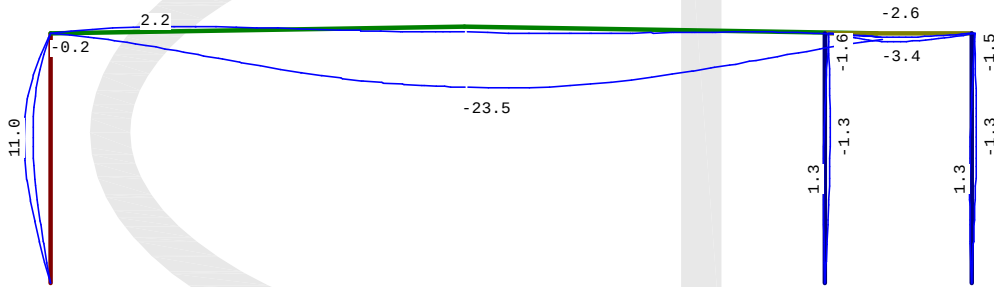
Frequente combinatie


**VERVORMINGEN  $W_{tot}$** 

Frequente combinatie


**VERVORMINGEN  $W_{max}$** 

Frequente combinatie

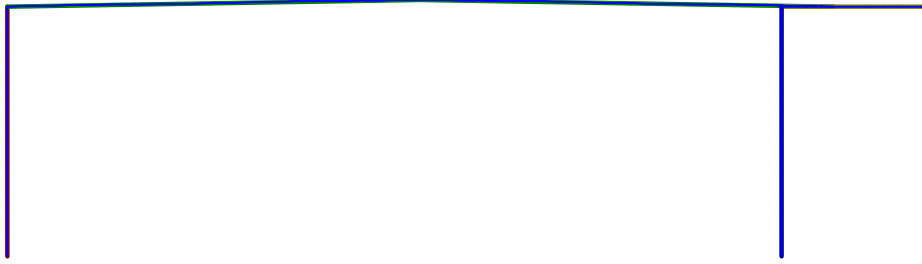

**DOORBUIGINGEN**

Frequente combinatie

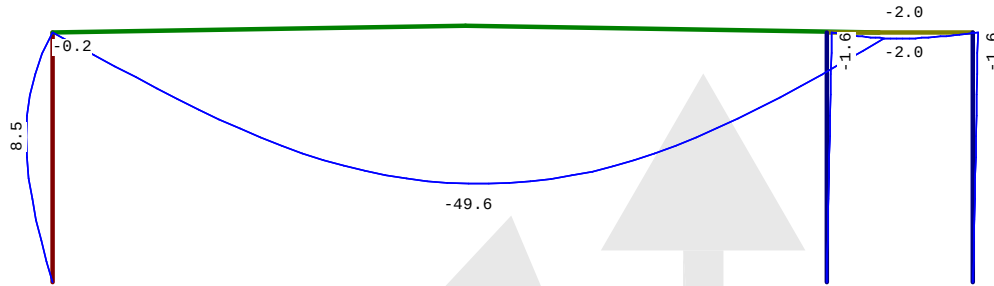
| Nr. | staven | Zijde | positie<br>[m] | $l_{rep}$<br>[mm] | $W_1$<br>[mm] | $W_2$<br>[mm] | $W_{bij}$<br>[mm] | $l_{rep}/$<br>[mm] | $W_{tot}$<br>[mm] | $W_c$<br>[mm] | $W_{max}$<br>[mm] | $l_{rep}/$<br>[mm] |
|-----|--------|-------|----------------|-------------------|---------------|---------------|-------------------|--------------------|-------------------|---------------|-------------------|--------------------|
| 2   | 2-3    | Neg.  | 10.375         | 19773             | -49.5         | -13.8         | 1431              | -63.4              | 39.9              | -23.5         | 841               |                    |
| 2   | 2-3    | Pos.  | 10.381         | 19773             | -49.5         | 8.2           | 2414              | -41.3              | 39.9              | -1.4          | 13757             |                    |
| 2   | 2-3    | Pos.  | 2.471          | 19773             | -18.2         | 2.9           | 6775              | -15.3              | 17.5              | 2.2           | 8859              |                    |
| 3   | 4      | Neg.  | /              | 2500              | -1.9          | -1.4          | 1814              | -3.3               |                   | -3.3          | 759               |                    |
| 3   | 4      | Pos.  | /              | 2500              | -1.9          | 0.3           | 7860              | -1.6               |                   | -1.6          | 1566              |                    |
| 4   | 5      | Neg.  | 1.125          | 2250              | -0.6          | -0.4          | 5006              | -1.1               |                   | -1.1          | 2077              |                    |
| 4   | 5      | Pos.  | /              | 4500              | 1.9           | 1.4           | 3206              | 3.4                |                   | 3.4           | 1342              |                    |

**VERVORMINGEN  $W_{bij}$** 

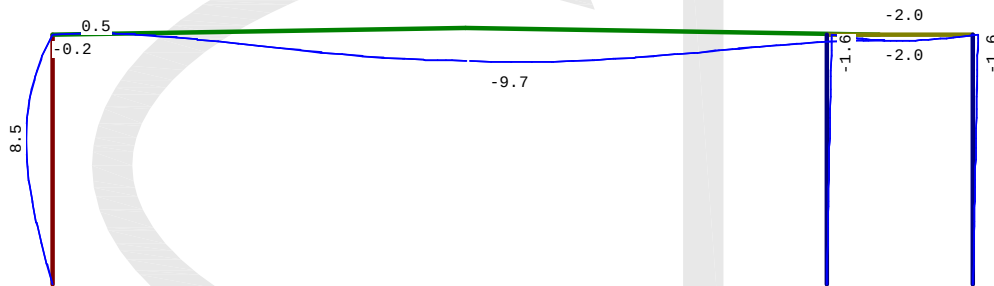
Quasi-blijvende combinatie

**VERVORMINGEN  $W_{tot}$** 

Quasi-blijvende combinatie

**VERVORMINGEN  $W_{max}$** 

Quasi-blijvende combinatie

**DOORBUIGINGEN**

Quasi-blijvende combinatie

| Nr. | staven | Zijde | positie | $l_{rep}$ | $w_1$ | $w_2$ | $W_{bij}$ | $W_{tot}$ | $w_c$ | $W_{max}$ |
|-----|--------|-------|---------|-----------|-------|-------|-----------|-----------|-------|-----------|
|     |        |       | [m]     | [mm]      | [mm]  | [mm]  | [mm]      | [mm]      | [mm]  | [mm]      |
| 2   | 2-3    | Neg.  | 9.886   | 19773     | -49.6 |       |           | -49.6     | 40.0  | -9.6      |
| 3   | 4      | Neg.  | /       | 2500      | -1.9  |       |           | -1.9      |       | -1.9      |
| 3   | 4      | Pos.  | 0.625   | 1250      | 0.2   |       |           | 0.2       |       | 0.2       |
| 4   | 5      | Neg.  | 0.450   | 2250      | -0.5  |       |           | -0.5      |       | -0.5      |
| 4   | 5      | Pos.  | /       | 4500      | 1.9   |       |           | 1.9       |       | 1.9       |

**HORIZONTALE VERPLAATSING**

Quasi-blijvende combinatie

| Nr. | staven | Zijde | h    | $w_1$ | $w_2$ | $w_3$ | $W_{tot}$ |
|-----|--------|-------|------|-------|-------|-------|-----------|
|     |        |       | [mm] | [mm]  | [mm]  | [mm]  | [h/]      |
| 5   | 6      | Neg.  | 5975 | -1.6  |       |       | -1.6      |
| 6   | 7      | Neg.  | 5975 | -1.6  |       |       | -1.6      |

Kolommen met een  $W_{tot} < h/9999$  zijn niet afgedrukt**TOTALE HORIZONTALE VERPLAATSING**

Quasi-blijvende combinatie

| knoop | Zijde | h    | $w_1$ | $w_2$ | $w_3$ | $W_{tot}$ |
|-------|-------|------|-------|-------|-------|-----------|
|       |       | [mm] | [mm]  | [mm]  | [mm]  | [h/]      |
| 4     | Pos.  | 5975 | 1.6   |       |       | 1.6       |

ZEEG wc

