



# IBZ



Raadgevend  
Ingenieursburo

## Raadgevende

## Ingenieurs

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### **Controle Berekening**

Sporthal de Voordam  
Controle draagkracht bestaand dak op extra  
belasting uit zonnepanelen

16-0225

D1001



**Hout**  
**Staal**  
**Beton**  
**Funderingen**





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Omschrijving:

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Projectomschrijving:

Sporthal de Voordam  
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Projectnummer:

16-0225

Documentnummer:

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Berekend:

ing. L.H.B. Koopman  
*direct: 0548-631913*

Paraaf:

Gecontroleerd:

Paraaf:

## ***Algemene voorwaarden IBZ Ingenieursburo van der Zwan B.V.***

### **Artikel 1 Algemeen.**

In de Algemene Voorwaarden wordt verstaan onder:

- a. opdrachtgever: de partij die opdracht geeft;
- b. het adviesbureau: IBZ Ingenieursburo van der Zwan B.V.

### **Artikel 2 Toepasselijkheid.**

- 2.1 Deze Algemene Voorwaarden zijn van toepassing op alle aanbiedingen en overeenkomsten tussen het adviesbureau en opdrachtgever zulks met uitsluiting van eventuele algemene voorwaarden van opdrachtgever. Wijzigingen in deze voorwaarden dienen door beide partijen uitdrukkelijk en schriftelijk te zijn bevestigd.
- 2.2 De regeling van de verhouding tussen opdrachtgever en adviserend ingenieursbureau R.V.O.I. 2001 zijn naast deze Algemene Voorwaarden van toepassing op alle onze aanbiedingen en met ons gesloten overeenkomsten.
- 2.3 De R.V.O.I. is gedeponereerd ter griffie van de Arrondissementsrechtbank te 's-Gravenhage op 29 juni 2001. De opdrachtgever die niet op de hoogte is van de inhoud van de R.V.O.I. wordt op verzoek een exemplaar toegezonden.
- 2.4 In geval van strijdigheid tussen deze Algemene Voorwaarden en de R.V.O.I. prevaleren deze Algemene Voorwaarden.
- 2.5 Alle door de opdrachtgever gestelde voorwaarden, welke met de Algemene Voorwaarden van het adviesbureau en de R.V.O.I. in strijd zijn, zijn op aanbiedingen van en overeenkomsten met het adviesbureau niet van toepassing.
- 2.6 Indien een opdracht namens de opdrachtgever wordt verstrekt door een derde, dan staat die derde er voor in dat de opdrachtgever van deze voorwaarden kennis heeft genomen en aanvaardt, bij gebreke waarvan de derde aan voorwaarden is gebonden als ware hij zelf opdrachtgever. In dat geval zijn zowel opdrachtgever als derde, jegens het adviesbureau hoofdelijk aansprakelijk voor alle verplichtingen uit de overeenkomst en deze Algemene Voorwaarden voortvloeiende.

### **Artikel 3 Vrijwaring door opdrachtgever.**

- 3.1 Opdrachtgever is verplicht het adviesbureau te vrijwaren voor alle aanspraken van derden, voortvloeiende uit of verband houdende met de uitvoering van de werkzaamheden van het adviesbureau.

### **Artikel 4 Aansprakelijkheid van het adviesbureau.**

- 4.1 Het adviesbureau zal de opdracht goed en zorgvuldig uitvoeren, behartigt de belangen van de opdrachtgever naar zijn beste weten en verricht zijn diensten naar beste kunnen. Indien een fout wordt gemaakt doordat de opdrachtgever aan het adviesbureau onjuiste of onvolledige informatie heeft verstrekt, is het adviesbureau voor de daardoor ontstane schade niet aansprakelijk. Indien de opdrachtgever aantoont dat hij schade heeft geleden door een fout van het adviesbureau, die bij zorgvuldig handelen zou zijn vermeden, is het adviesbureau voor die schade slechts aansprakelijk tot maximaal het bedrag van het honorarium voor de desbetreffende opdracht, tenzij er aan de zijde van het adviesbureau sprake is van opzet of daarmee gelijk te stellen grove nalatigheid.
- 4.2 Voor het overige geldt ten aanzien van de aansprakelijkheid art. 16 van de R.V.O.I. 2001.

### **Artikel 5 Onderbreking opdracht.**

- 5.1 Indien de startdatum van de werkzaamheden van het adviesbureau en/of de bouwwerkzaamheden meer dan drie maanden opschuiven, na het sluiten van de overeenkomst, wordt dit beschouwd als onderbreking van de opdracht als bedoeld in art. 15 van de R.V.O.I. 2001. In dat geval worden de werkzaamheden van het adviesbureau afgesloten en afgerekend, naar de stand van de werkzaamheden. In afwijking van het bepaalde in art. 15 van de R.V.O.I. 2001 zal bij voortgang van de werkzaamheden van het adviesbureau opnieuw worden geoffreerd en dient terzake een nieuwe overeenkomst te worden gesloten.

### **Artikel 6 Betaling.**

- 6.1 Betaling door de opdrachtgever dient, zonder aftrek, korting of schuldverrekening, te geschieden binnen de overeengekomen termijn, doch in geen geval later dan veertien dagen na factuurdatum. Betaling dient te geschieden door middel van storting ten gunste van een door het adviesbureau aan te wijzen bankrekening. Het eindbedrag van de factuur zal worden verhoogd met een kredietbeperkingstoeslag van 2 procent. Deze toeslag mag bij betaling binnen de overeengekomen termijn worden afgetrokken, mits alle vorige facturen zijn voldaan.
- 6.2 Indien de opdrachtgever niet binnen de onder lid 6.1 genoemde termijn heeft betaald, is het adviesbureau gerechtigd, nadat de opdrachtgever ten minste een maal is aangemaand te betalen, zonder nadere ingebrekestelling en onverminderd de overige rechten van het adviesbureau, vanaf de vervaldag de opdrachtgever de wettelijke rente in rekening te brengen tot op de datum van algehele voldoening.
- 6.3 Alle in redelijkheid gemaakte gerechtelijke en buitengerechtelijke (incasso-)kosten, die het adviesbureau maakt als gevolg van de niet-nakoming door de opdrachtgever van diens betalingsverplichtingen, komen ten laste van de opdrachtgever.
- 6.4 Indien de financiële positie of het betalingsgedrag van de opdrachtgever naar het oordeel van het adviesbureau daartoe aanleiding geeft, is het adviesbureau gerechtigd van opdrachtgever te verlangen, dat deze onverwijld (aanvullende) zekerheid stelt in een door het adviesbureau te bepalen vorm. Indien de opdrachtgever nalaat de verlangde zekerheid te stellen, is het adviesbureau gerechtigd, onverminderd de overige rechten, de verdere uitvoering van de overeenkomst onmiddellijk op te schorten en is al hetgeen de opdrachtgever aan het adviesbureau uit welke hoofde dan ook verschuldigd direct opeisbaar.

### **Artikel 7 Interpretaties en gebruik van rapportages.**

- 7.1 Het adviesbureau is in geen enkel opzicht aansprakelijk voor door anderen gegeven interpretaties van rapportages.
- 7.2 Het is de opdrachtgever uitdrukkelijk verboden de resultaten van het onderzoek en de in dat kader door het adviesbureau verstrekte gegevens, werkwijzen, adviezen en andere geestesproducten van het adviesbureau, een en ander in de ruimste zin des woord, al dan niet met inschakeling van derden te verveelvoudigen, te openbaren of te exploiteren, zonder schriftelijke toestemming.

### **Artikel 8 Toepasselijk recht.**

- 8.1 Op alle overeenkomsten tussen de opdrachtgever en het adviesbureau is Nederlands recht van toepassing. Verschillen van mening tussen de opdrachtgever en het adviesbureau zullen zoveel mogelijk langs minnelijke weg worden opgelost. Indien een verschil van mening niet langs minnelijke weg is opgelost, wordt geacht een geschil te bestaan.
- 8.2 Alle geschillen, daaronder begrepen die welke door slechts één der partijen als zodanig worden beschouwd, welke tussen de opdrachtgever en het adviesbureau mochten ontstaan in verband met de opdracht of enige overeenkomst die daarvan een uitvloeisel is, zullen met uitsluiting van de gewone rechter uitsluitend en in hoogste instantie worden beslecht door arbitrage overeenkomstig het Reglement van de Commissie van Geschillen, vastgesteld door het Hoofdbestuur van het Koninklijk Instituut van Ingenieurs, zoals dat reglement ter griffie van de Arrondissementsrechtbank te 's-Gravenhage zal zijn gedeponereerd op de dag waarop het geschil aanhangig wordt gemaakt.
- 8.3 Een overeenkomstig lid 2 van dit artikel en het aldaar genoemde Reglement benoemd scheidsrecht oordeelt als goede man(nen) naar billijkheid.
- 8.4 Waar in dit artikel wordt gesproken van de opdrachtgever respectievelijk het adviesbureau worden rechtverkrigenden van de opdrachtgever respectievelijk het adviesbureau daaronder begrepen.

***Inhoudsopgave***

|                                                         |    |
|---------------------------------------------------------|----|
| Algemeen.....                                           | 5  |
| Materialen .....                                        | 6  |
| Overzichten.....                                        | 7  |
| Overzichtstekening .....                                | 7  |
| Berekeningen.....                                       | 8  |
| Controle balkaag pos B1.....                            | 8  |
| Controle balkaag pos B2.....                            | 12 |
| Controle balklaag pos B3.....                           | 15 |
| Controle balkaag pos B4.....                            | 18 |
| Controle balklaag pos B5.....                           | 21 |
| Controle balklaag pos B6.....                           | 24 |
| Controle balklaag pos B7.....                           | 27 |
| Controle stalen lateien en balken.....                  | 30 |
| Controle Dakdeel C en D.....                            | 32 |
| Bijlagen .....                                          | 33 |
| Bijlage A Technosoft berekening spanten as 5 t/m 8..... | 33 |

## Projectomschrijving: Sporthal de Voordam

### Algemeen

Alle opdrachten worden aanvaard en uitgevoerd volgens de R.V.O.I. 2001, zoals gedeponeerd bij de arrondissementsrechtbank te 's-Gravenhage op 29 juni 2001 (een samenvatting van hoofdstukken is bij ons kantoor opvraagbaar)

### Bij de berekening is uitgegaan van de volgende normen, tekeningen en aannames:

|             |                                                                    |
|-------------|--------------------------------------------------------------------|
| NEN-EN 1990 | Eurocode 0 - Grondslagen van het constructief ontwerp              |
| NEN-EN 1991 | Eurocode 1 - Ontwerp en berekening van belastingen op constructies |
| NEN-EN 1992 | Eurocode 2 - Ontwerp en berekening van betonconstructies           |
| NEN-EN 1993 | Eurocode 3 - Ontwerp en berekening van staalconstructies           |
| NEN-EN 1994 | Eurocode 4 - Ontwerp en berekening van staal-betonconstructies     |
| NEN-EN 1995 | Eurocode 5 - Ontwerp en berekening van houtconstructies            |
| NEN-EN 1996 | Eurocode 6 - Ontwerp en berekening van metselwerkconstructies      |
| NEN-EN 1997 | Eurocode 7 - Geotechnisch ontwerp                                  |

Indien nodig, wordt er tevens gebruik gemaakt van richtlijnen c.q. rapporten

### De berekeningen zijn uitgevoerd op basis van de aan ons verstrekte gegevens, namelijk:

|                                                     |                 |
|-----------------------------------------------------|-----------------|
| Berekening IBZ; 04-0434                             | d.d. 22-10-2004 |
| Aanvullende berekening IBZ; 04-0435                 | d.d. 27-10-2004 |
| Diverse tekeningen uit archief gemeente Hellendoorn | d.d.            |
|                                                     | d.d.            |

### Toepassingsgebied van het bouwwerk is als volgt ingedeeld:

|                         |                 |                                                                                                 |
|-------------------------|-----------------|-------------------------------------------------------------------------------------------------|
| Gebouwcategorie         | :               | C) bijeenkomstruimtes                                                                           |
| Ontwerplevensduur       | :               | 50 jaar                                                                                         |
| Gevolgsklasse           | :               | CC1                                                                                             |
| Betrouwbaarheidsklasse  | :               | RC1                                                                                             |
| Betrouwbaarheidsindex b | :               | 3,3                                                                                             |
|                         | K <sub>FI</sub> | : 0,9 (factor voor vermenigvuldiging met g-factoren alleen in groep B bij ongunstige situaties) |

### Belastingcombinaties (conform NEN-EN 1990):

vergelijking 6.10: te gebruiken bij groep A & groep C

$$\sum_{j \geq 1} \gamma_{G,j} G_{k,j} + \gamma_P P + \gamma_{Q,1} Q_{k,1} + \sum_{i > 1} \gamma_{Q,i} \psi_{0,i} Q_{k,i} \quad \text{vergelijking 6.10}$$

vergelijking 6.10a en 6.10b: te gebruiken bij groep B

$$\left\{ \begin{array}{l} \sum_{j \geq 1} \gamma_{G,j} G_{k,j} + \gamma_P P + \gamma_{Q,1} \psi_{0,1} Q_{k,1} + \sum_{i > 1} \gamma_{Q,i} \psi_{0,i} Q_{k,i} \\ \sum_{j \geq 1} \xi_j \gamma_{G,j} G_{k,j} + \gamma_P P + \gamma_{Q,1} Q_{k,1} + \sum_{i > 1} \gamma_{Q,i} \psi_{0,i} Q_{k,i} \end{array} \right. \quad \begin{array}{l} \text{vergelijking 6.10a} \\ \text{vergelijking 6.10b} \end{array}$$

### Fundamentele combinaties ULS

|     |   |                                            |
|-----|---|--------------------------------------------|
| EQU | : | Combinaties bij verlies van evenwicht      |
| STR | : | Combinaties bij constructieve berekeningen |
| GEO | : | Combinaties bij geotechnische berekeningen |

### g-factoren:

|                   |   |                              |                    |                  |                    |
|-------------------|---|------------------------------|--------------------|------------------|--------------------|
| EQU (Groep A)     | : | $g_{Gj,sup} = 1,10$          | $g_{Gj,inf} = 0,9$ | $g_{Q,i} = 1,50$ | vergelijking 6.10  |
| STR/GEO (Groep B) | : | $g_{Gj,sup} = 1,22$          | $g_{Gj,inf} = 0,9$ | $g_{Q,i} = 1,35$ | vergelijking 6.10a |
|                   |   | $g_{Gj,sup} \times z = 1,08$ | $g_{Gj,inf} = 0,9$ | $g_{Q,i} = 1,35$ | vergelijking 6.10b |
| STR/GEO (Groep C) | : | $g_{Gj,sup} = 1,00$          | $g_{Gj,inf} = 1,0$ | $g_{Q,i} = 1,30$ | vergelijking 6.10  |

**Projectomschrijving: Sporthal de Voordam****Materialen***Beton*

|                |   |                       |             |                        |
|----------------|---|-----------------------|-------------|------------------------|
| Betonkwaliteit | : | C20/25                | $f'_{cd} =$ | 13,3 N/mm <sup>2</sup> |
| Milieuklasse   | : | XC2 Nat, zelden droog | $f_{ck} =$  | 20,0 N/mm <sup>2</sup> |
| Wapeningsstaal | : | B500B                 | $f_{yd} =$  | 435 N/mm <sup>2</sup>  |

*Staal*

|                |   |            |            |                       |            |                       |
|----------------|---|------------|------------|-----------------------|------------|-----------------------|
| Walsprofielen  | : | S 235      | $f_y =$    | 235 N/mm <sup>2</sup> | $f_u =$    | 360 N/mm <sup>2</sup> |
| Kokerprofielen | : | S 275      | $f_y =$    | 275 N/mm <sup>2</sup> | $f_u =$    | 430 N/mm <sup>2</sup> |
| Bouten         | : | 8.8 gerold | $f_{yb} =$ | 640 N/mm <sup>2</sup> | $f_{ub} =$ | 800 N/mm <sup>2</sup> |
| Ankerbouten    | : | 4.6 gerold | $f_{yb} =$ | 240 N/mm <sup>2</sup> | $f_{ub} =$ | 400 N/mm <sup>2</sup> |

(voor ankerbouten geldt; maximaal 8.8 bij afschuiving)

*Hout*

|               |   |     |
|---------------|---|-----|
| Houtkwaliteit | : | C18 |
|---------------|---|-----|

*Steen*

|                 |   |                                                                               |
|-----------------|---|-------------------------------------------------------------------------------|
| Steensoort      | : | Kalkzandsteen blokken CS12 Genormaliseerde druksterkte = 12 N/mm <sup>2</sup> |
| Mortelkwaliteit | : | Metselmortel 7,5 N/mm <sup>2</sup> (representatieve druksterkte)              |

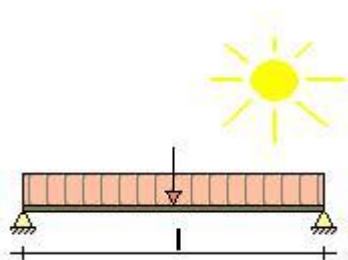
*Grond*

|                |   |                                                                                       |
|----------------|---|---------------------------------------------------------------------------------------|
| Grondsoort     | : | Zand, Schoon, Matig                                                                   |
| $q_{droog}$    | : | 18,0 kN/m <sup>3</sup>                                                                |
| $q_{sat}$      | : | 20,0 kN/m <sup>3</sup>                                                                |
| $q_c$          | : | 15,0 MPa                                                                              |
| $f'$           | : | 32,5 °                                                                                |
| $c'$           | : | 0,0 kPa                                                                               |
| Uitgangspunt   | : | Gedraineerde toestand, grenstoestand 1A                                               |
| Conusweerstand | : | minimaal 4,0 MPa (= 40kg/cm <sup>2</sup> ) !!! Let op, in het werk te controleren !!! |



**Controle Balklaag pos B1 Dakdeel A**Belasting uit zonnepanelen 18 kg/m<sup>2</sup> gerekend wordt met 20 kg/m<sup>2</sup>**PROFIELGEGEVENS: R71X171**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 12141 mm <sup>2</sup>    |
| Hoogte               | h                   | 171 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 3460e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1504e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1437e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 2958e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 5100e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |                |         |                           |         |       |
|--------------------------|----------------|---------|---------------------------|---------|-------|
| Klimaatklasse            |                | I       |                           | Gamma;M | 1.30  |
|                          | k;h            | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |                |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c         | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |                | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |                | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| l <sub>sys</sub>         |                | 4.100 m | Beschot kwaliteit         |         | C18   |
| h <sub>oh</sub> afstand  | L <sub>t</sub> | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |                | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |                | Ja      |                           |         |       |
| Stootbelasting           |                | Nee     |                           |         |       |
| Reductiefactor spreiding |                | 0.77    |                           |         |       |

**GEWICHTS BEREKENING****Wind**

|                   |                                                               |                                                                                                |                        |
|-------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------|
| Q <sub>p1</sub>   | Pieksnelheids druk (Q <sub>p</sub> voor referentieperiode 50) | NEN-EN1991-1-4#4(Z=3.20,Terrein=Bebouwd, Regio=3,C0=1.00)                                      | 0.48 kN/m <sup>2</sup> |
| C <sub>sCd1</sub> | Constructie factor (C <sub>sCd</sub> )                        | NEN-EN1991-1-4#6(b=35.00,h=3.20,h1=3.20,D elta=1.00,N1x=5.00,Terrein=Bebouwd,Regio=3, C0=1.00) | 0.85                   |
| C <sub>pe1</sub>  | Druk coefficient (C <sub>pe</sub> )                           | NEN-EN1991-1-4#7.2(Dak=Plat,Zone=F)                                                            | -1.80                  |
| C <sub>pi1</sub>  | Druk coefficient (C <sub>pi</sub> )                           | EN1991-1-4#7.2.9(C <sub>pe</sub> =-0.50,Openingen=0.00, Over=False)                            | -0.30                  |

**Windzuiging**

|                  |                                     |                                                                   |       |
|------------------|-------------------------------------|-------------------------------------------------------------------|-------|
| C <sub>pe1</sub> | Druk coefficient (C <sub>pe</sub> ) | NEN-EN1991-1-4#7.2(Dak=Plat,Zone=F,Eerst=False)                   | -1.80 |
| C <sub>pi1</sub> | Druk coefficient (C <sub>pi</sub> ) | EN1991-1-4#7.2.9(C <sub>pe</sub> =0.80,Openingen=0.00, Over=True) | 0.20  |

**BELASTINGEN****CPROB**

|            |                                       |                              |      |
|------------|---------------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                         | 0.08 kN/m <sup>2</sup>       |      |
|            | Isolatie+dakbedekking                 | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                               | 0.10 kN/m <sup>2</sup>       |      |
|            | Zonnepanelen                          | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                         | <b>0.53 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                                   | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2       | 0.00; 0.00; 0.00             |      |
|            | Q;k                                   | 2.00 kN                      |      |
| Wind       | Winddruk (C <sub>sCd</sub> = 0.85)    | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging (C <sub>sCd</sub> = 0.85) | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p <sub>sneeuw</sub>                   | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dh <sub>w</sub>                | 0.030 m                      |      |

Bijzonder Bijzonder; Fbijz 0.00 kN  
 Bijzonder; pbijz 0.00 kN/m<sup>2</sup>

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                               |                                      |                         |
|--------|-----------------------------------------------|--------------------------------------|-------------------------|
| Fu.C.1 | $p = + yG * G_{rep}$                          | $= + 1.35 * 0.53 =$                  | 0.71 kN/m <sup>2</sup>  |
| Fu.C.2 | $p = + yG * G_{rep}$                          | $= + 0.90 * 0.53 =$                  | 0.47 kN/m <sup>2</sup>  |
| Fu.C.3 | $p = + yG * G_{rep} + yQ * Q_{rep}$           | $= + 1.20 * 0.53 + 1.50 * 1.00 =$    | 2.13 kN/m <sup>2</sup>  |
| Fu.C.4 | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.20 * 0.53 + 1.50 * 0.20 =$    | 0.93 kN/m <sup>2</sup>  |
| Fu.C.5 | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 0.90 * 0.53 + 1.50 * (-0.81) =$ | -0.74 kN/m <sup>2</sup> |
| Fu.C.6 | $p = + yG * G_{rep} + yQ * Q_{sneeuw}$        | $= + 1.20 * 0.53 + 1.50 * 1.00 =$    | 2.13 kN/m <sup>2</sup>  |
| Fu.C.7 | $p = + yG * G_{rep} + yQ * Q_{water}$         | $= + 1.20 * 0.53 + 1.50 * 0.36 =$    | 1.17 kN/m <sup>2</sup>  |
| Fu.C.8 | $p = + yG * G_{rep}$                          | $= + 1.20 * 0.53 =$                  | 0.63 kN/m <sup>2</sup>  |
|        | $F = + yQ * F_{rep}$                          | $= + 1.50 * 2.00 =$                  | 3.00 kN                 |
| Bi.C.1 | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.53 =$                  | 0.53 kN/m <sup>2</sup>  |
| Bi.C.2 | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.00 * 0.53 + 0.20 * 0.20 =$    | 0.57 kN/m <sup>2</sup>  |
| Bi.C.3 | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 1.00 * 0.53 + 0.20 * (-0.81) =$ | 0.36 kN/m <sup>2</sup>  |

**MAATGEVENDE SNEDEKRACHTEN**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.89  | 0.91  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.59  | 0.61  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.67  | 2.73  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.17  | 1.20  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.92 | -0.95 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.67  | 2.73  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.46  | 1.50  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.79  | 3.18  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.66  | 0.67  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.71  | 0.73  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.46  | 0.47  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**MAX UC SNEDEKRACHT**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 0.91  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.61  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 2.73  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 1.20  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.95 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 2.73  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 1.50  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 3.18  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.67  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 0.73  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.47  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**REKENSTERKTE**

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**REKENSPANNING**

| Comb.  | sigma;m,y,d | sigma;m,z,d | tau;v,y,d | tau;v,z,d | sigma;c(t),0,d |
|--------|-------------|-------------|-----------|-----------|----------------|
| Fu.C.1 | 2.63        | 0.00        | 0.00      | 0.00      | 0.00           |
| Fu.C.2 | 1.75        | 0.00        | 0.00      | 0.00      | 0.00           |

|        |                   |                   |                   |                   |                   |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.3 | 7.90              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 3.46              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 2.74              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 7.90              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 4.33              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 9.19              | 0.00              | 0.00              | 0.14              | 0.00              |
| Bi.C.1 | 1.95              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.10              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.35              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.629 / 8.308 + 0.7 x 0 / 9.648   | 0.32 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.752 / 8.308 + 0.7 x 0 / 9.648   | 0.21 Ok |
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 7.896 / 11.077 + 0.7 x 0 / 12.864 | 0.71 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.462 / 12.462 + 0.7 x 0 / 14.472 | 0.28 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.74 / 12.462 + 0.7 x 0 / 14.472  | 0.22 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 7.896 / 12.462 + 0.7 x 0 / 14.472 | 0.63 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.332 / 12.462 + 0.7 x 0 / 14.472 | 0.35 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 9.187 / 11.077 + 0.7 x 0 / 12.864 | 0.83 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.143 / 2.092                  | 0.07 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.947 / 8.308 + 0.7 x 0 / 9.648   | 0.23 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.097 / 12.462 + 0.7 x 0 / 14.472 | 0.17 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.348 / 12.462 + 0.7 x 0 / 14.472 | 0.11 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                        |                                    |                         |
|-----------|----------------------------------------|------------------------------------|-------------------------|
| Ka.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.53 =                  | 0.53 kN/m <sup>2</sup>  |
| Ka.C.2    | p = + yG * G_rep + yQ * Q_rep          | = + 1.00 * 0.53 + 1.00 * 1.00 =    | 1.53 kN/m <sup>2</sup>  |
| Ka.C.3    | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.53 + 1.00 * 0.20 =    | 0.73 kN/m <sup>2</sup>  |
| Ka.C.4    | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 1.00 * 0.53 + 1.00 * (-0.81) = | -0.28 kN/m <sup>2</sup> |
| Ka.C.5    | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.00 * 0.53 + 1.00 * 1.00 =    | 1.53 kN/m <sup>2</sup>  |
| Ka.C.6    | p = + yG * G_rep + yQ * Q_water        | = + 1.00 * 0.53 + 1.00 * 0.36 =    | 0.88 kN/m <sup>2</sup>  |
| Qu.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.53 =                  | 0.53 kN/m <sup>2</sup>  |
| Ka.C.(w1) | p = + yG * G_rep                       | = + 1.00 * 0.53 =                  | 0.53 kN/m <sup>2</sup>  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |                          |                    |                |                           |
|-----------|----------------|--------------------------|--------------------|----------------|---------------------------|
| L/250     | Limiet w;max   | 16.4 mm                  | L/250              | Limiet w;2+w;3 | 16.4 mm                   |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm <sup>2</sup> | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm <sup>2</sup> |
|           |                |                          | E-Mod/E;0;ser;d;cr |                | 0.60                      |
| Ka.C.(w1) | w;1            | 4.4 mm                   | w;c                |                | 0.0 mm                    |
| Qu.C.1    | w;2            | 2.7 mm                   |                    |                |                           |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 7.1   | 7.1   | 2.7     | 0.43      | 0.16        |
| Ka.C.2 | 8.4  | 15.5  | 15.5  | 11.1    | 0.95      | 0.68        |
| Ka.C.3 | 1.7  | 8.8   | 8.8   | 4.4     | 0.54      | 0.27        |
| Ka.C.4 | -6.8 | 0.3   | 0.3   | -4.2    | 0.02      | 0.25        |
| Ka.C.5 | 8.4  | 15.5  | 15.5  | 11.1    | 0.95      | 0.68        |
| Ka.C.6 | 3.0  | 10.1  | 10.1  | 5.7     | 0.62      | 0.35        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 3.18 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 4.4 mm  |
| Qu.C.1    | w;2            | 2.7 mm  |
| Ka.C.2    | w;3            | 8.4 mm  |
|           | w;tot          | 15.5 mm |
|           | w;max          | 15.5 mm |
|           | w;2+w;3        | 11.1 mm |
|           | Limiet w;max   | 16.4 mm |
|           | Limiet w;2+w;3 | 16.4 mm |
|           | UC(w;max)      | 0.95    |
|           | UC(w;2+w;3)    | 0.68    |

**UITGEVOERDE CONTROLES**

|               |                                      |                                   |         |
|---------------|--------------------------------------|-----------------------------------|---------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.468 / 2.092                  | 0.22 Ok |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 9.187 / 11.077 + 0.7 x 0 / 12.864 | 0.83 Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 15.5 / 16.4                       | 0.95 Ok |

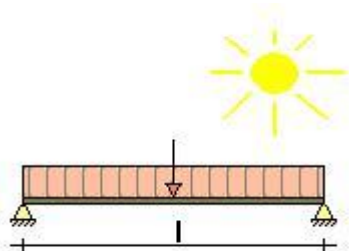
|            |                   |                   |    |
|------------|-------------------|-------------------|----|
| <b>IBZ</b> | projectnr: 160225 | datum: 26.05.2016 | 11 |
|------------|-------------------|-------------------|----|

*Ligger gecontroleerd op sterkte en doorbuiging*  
*Ligger Ok*

Balklaag 71x171C18 hoh 610 voldoet op  
extra belasting 20 kg/m<sup>2</sup>

**Controle Balklaag pos B2 Dakdeel B**Belasting uit zonnepanelen  $18 \text{ kg/m}^2$  gerekend wordt met  $20 \text{ kg/m}^2$ **PROFIELGEGEVENS: R71X196**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 13916 mm <sup>2</sup>    |
| Hoogte               | h                   | 196 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 4546e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1803e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1647e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 4455e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 5846e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |                |         |                           |         |       |
|--------------------------|----------------|---------|---------------------------|---------|-------|
| Klimaatklasse            |                | I       |                           | Gamma;M | 1.30  |
|                          | k;h            | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |                |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c         | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |                | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |                | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| l <sub>sys</sub>         |                | 5.200 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | L <sub>t</sub> | 0.400 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |                | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |                | Ja      |                           |         |       |
| Stootbelasting           |                | Nee     |                           |         |       |
| Reductiefactor spreiding |                | 0.60    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.13 kN/m <sup>2</sup>       |      |
|            | Isolatie+bedekking              | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                   | <b>0.73 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p_sneeuw                        | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dh <sub>w</sub>          | 0.030 m                      |      |
| Bijzonder  | Bijzonder; F <sub>bijz</sub>    | 0.00 kN                      |      |
|            | Bijzonder; p <sub>bijz</sub>    | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                                              |                                    |                         |
|--------|--------------------------------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.35 * 0.73 =                  | 0.99 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G <sub>rep</sub>                                  | = + 0.90 * 0.73 =                  | 0.66 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>rep</sub>          | = + 1.20 * 0.73 + 1.50 * 1.00 =    | 2.38 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.20 * 0.73 + 1.50 * 0.20 =    | 1.18 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_zuiging</sub> | = + 0.90 * 0.73 + 1.50 * (-0.81) = | -0.56 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>sneeuw</sub>       | = + 1.20 * 0.73 + 1.50 * 1.00 =    | 2.38 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>water</sub>        | = + 1.20 * 0.73 + 1.50 * 0.38 =    | 1.45 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G <sub>rep</sub>                                  | = + 1.20 * 0.73 =                  | 0.88 kN/m <sup>2</sup>  |
|        | F = + yQ * F <sub>rep</sub>                                  | = + 1.50 * 2.00 =                  | 3.00 kN                 |

|        |                                               |                                      |                        |
|--------|-----------------------------------------------|--------------------------------------|------------------------|
| Bi.C.1 | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.73 =$                  | 0.73 kN/m <sup>2</sup> |
| Bi.C.2 | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.00 * 0.73 + 0.20 * 0.20 =$    | 0.77 kN/m <sup>2</sup> |
| Bi.C.3 | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 1.00 * 0.73 + 0.20 * (-0.81) =$ | 0.57 kN/m <sup>2</sup> |

**MAATGEVENDE SNEDEKRACHTEN**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 1.03  | 1.34  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.69  | 0.89  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.47  | 3.22  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.23  | 1.60  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.58 | -0.75 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.47  | 3.22  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.51  | 1.97  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.91  | 3.54  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.76  | 0.99  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.80  | 1.04  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.59  | 0.77  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**MAX UC SNEDEKRACHT**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 1.34  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.89  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 3.22  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 1.60  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.75 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 3.22  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 1.97  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 0.90  | 3.54  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.99  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 1.04  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.77  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**REKENSTERKTE**

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**REKENSPPANNING**

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 2.94              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 1.96              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 7.08              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 3.51              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 1.65              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 7.08              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 4.33              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 7.79              | 0.00              | 0.00              | 0.10              | 0.00              |
| Bi.C.1 | 2.18              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.30              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.70              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.94 / 8.308 + 0.7 x 0 / 9.648    | 0.35 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.96 / 8.308 + 0.7 x 0 / 9.648    | 0.24 Ok |
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 7.078 / 11.077 + 0.7 x 0 / 12.864 | 0.64 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.509 / 12.462 + 0.7 x 0 / 14.472 | 0.28 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.654 / 12.462 + 0.7 x 0 / 14.472 | 0.13 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 7.078 / 12.462 + 0.7 x 0 / 14.472 | 0.57 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.326 / 12.462 + 0.7 x 0 / 14.472 | 0.35 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 7.786 / 11.077 + 0.7 x 0 / 12.864 | 0.70 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.097 / 2.092                  | 0.05 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.178 / 8.308 + 0.7 x 0 / 9.648   | 0.26 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.297 / 12.462 + 0.7 x 0 / 14.472 | 0.18 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.696 / 12.462 + 0.7 x 0 / 14.472 | 0.14 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                        |                                    |              |
|-----------|----------------------------------------|------------------------------------|--------------|
| Ka.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.73 =                  | 0.73 kN/m^2  |
| Ka.C.2    | p = + yG * G_rep + yQ * Q_rep          | = + 1.00 * 0.73 + 1.00 * 1.00 =    | 1.73 kN/m^2  |
| Ka.C.3    | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.73 + 1.00 * 0.20 =    | 0.93 kN/m^2  |
| Ka.C.4    | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 1.00 * 0.73 + 1.00 * (-0.81) = | -0.08 kN/m^2 |
| Ka.C.5    | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.00 * 0.73 + 1.00 * 1.00 =    | 1.73 kN/m^2  |
| Ka.C.6    | p = + yG * G_rep + yQ * Q_water        | = + 1.00 * 0.73 + 1.00 * 0.38 =    | 1.12 kN/m^2  |
| Qu.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.73 =                  | 0.73 kN/m^2  |
| Ka.C.(w1) | p = + yG * G_rep                       | = + 1.00 * 0.73 =                  | 0.73 kN/m^2  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |               |                    |                |                |
|-----------|----------------|---------------|--------------------|----------------|----------------|
| L/250     | Limiet w;max   | 20.8 mm       | L/250              | Limiet w;2+w;3 | 20.8 mm        |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm^2 | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm^2 |
|           |                |               | E-Mod/E;0;ser;d;cr |                | 0.60           |
| Ka.C.(w1) | w;1            | 7.0 mm        | w;c                |                | 0.0 mm         |
| Qu.C.1    | w;2            | 4.2 mm        |                    |                |                |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 11.1  | 11.1  | 4.2     | 0.53      | 0.20        |
| Ka.C.2 | 9.5  | 20.6  | 20.6  | 13.7    | 0.99      | 0.66        |
| Ka.C.3 | 1.9  | 13.0  | 13.0  | 6.1     | 0.63      | 0.29        |
| Ka.C.4 | -7.7 | 3.4   | 3.4   | -3.5    | 0.17      | 0.17        |
| Ka.C.5 | 9.5  | 20.6  | 20.6  | 13.7    | 0.99      | 0.66        |
| Ka.C.6 | 3.6  | 14.8  | 14.8  | 7.8     | 0.71      | 0.38        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 0.90 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 3.54 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 7.0 mm  |
| Qu.C.1    | w;2            | 4.2 mm  |
| Ka.C.2    | w;3            | 9.5 mm  |
|           | w;tot          | 20.6 mm |
|           | w;max          | 20.6 mm |
|           | w;2+w;3        | 13.7 mm |
|           | Limiet w;max   | 20.8 mm |
|           | Limiet w;2+w;3 | 20.8 mm |
|           | UC(w;max)      | 0.99    |
|           | UC(w;2+w;3)    | 0.66    |

**UITGEVOERDE CONTROLES**

|               |                                      |                                   |         |
|---------------|--------------------------------------|-----------------------------------|---------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.422 / 2.092                  | 0.20 Ok |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 7.786 / 11.077 + 0.7 x 0 / 12.864 | 0.70 Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 20.6 / 20.8                       | 0.99 Ok |

**Ligger gecontroleerd op sterkte en doorbuiging****Ligger Ok**

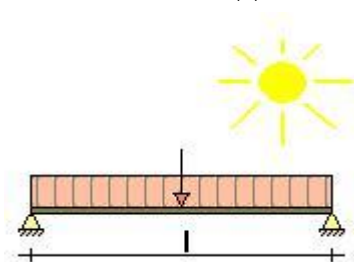
Balklaag 71x196 C18 hoh 406 voldoet op extra belasting 20 kg/m<sup>2</sup>

**Controle Balklaag pos B3 Dakdeel B**

Belasting uit zonnepanelen  $18 \text{ kg/m}^2$  gerekend wordt met  $20 \text{ kg/m}^2$

**PROFIELGEGEVENS: R59X156**

|                      |          |                          |                  |         |                          |
|----------------------|----------|--------------------------|------------------|---------|--------------------------|
| Breedte              | b        | 59 mm                    | Oppervlak        | A       | 9204 mm <sup>2</sup>     |
| Hoogte               | h        | 156 mm                   |                  |         |                          |
| Weerstandsmoment     | Wy       | 2393e+02 mm <sup>3</sup> | Traagheidsmoment | Itor    | 8124e+03 mm <sup>4</sup> |
| Weerstandsmoment     | Wz       | 9051e+01 mm <sup>3</sup> | Traagheidsmoment | Iy      | 1867e+04 mm <sup>4</sup> |
|                      |          |                          | Traagheidsmoment | Iz      | 2670e+03 mm <sup>4</sup> |
| Sterkte klasse       |          | C18                      |                  |         |                          |
|                      | f,m,0,k  | 18.0 N/mm <sup>2</sup>   |                  | f,c,0,k | 18.0 N/mm <sup>2</sup>   |
|                      | f,t,0,k  | 11.0 N/mm <sup>2</sup>   |                  | f,v,0,k | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E;0;mean | 9000.0 N/mm <sup>2</sup> |                  | G;mean  | 560.0 N/mm <sup>2</sup>  |



|                          |        |         |                           |         |       |
|--------------------------|--------|---------|---------------------------|---------|-------|
| Klimaatklasse            |        | I       |                           | Gamma;M | 1.30  |
|                          | k;h    | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |        |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |        | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |        | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| Isys                     |        | 3.400 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | Lt     | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |        | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |        | Ja      |                           |         |       |
| Stootbelasting           |        | Nee     |                           |         |       |
| Reductiefactor spreiding |        | 0.77    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.06 kN/m <sup>2</sup>       |      |
|            | Isolatie+ dakbedekking          | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                   | <b>0.66 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p_sneeuw                        | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dhw                      | 0.030 m                      |      |
| Bijzonder  | Bijzonder; Fbijz                | 0.00 kN                      |      |
|            | Bijzonder; pbijz                | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                        |                                    |                         |
|--------|----------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G_rep                       | = + 1.35 * 0.66 =                  | 0.89 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G_rep                       | = + 0.90 * 0.66 =                  | 0.59 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G_rep + yQ * Q_rep          | = + 1.20 * 0.66 + 1.50 * 1.00 =    | 2.29 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.20 * 0.66 + 1.50 * 0.20 =    | 1.09 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 0.90 * 0.66 + 1.50 * (-0.81) = | -0.62 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.20 * 0.66 + 1.50 * 1.00 =    | 2.29 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G_rep + yQ * Q_water        | = + 1.20 * 0.66 + 1.50 * 0.35 =    | 1.31 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G_rep                       | = + 1.20 * 0.66 =                  | 0.79 kN/m <sup>2</sup>  |
|        | F = + yQ * F_rep                       | = + 1.50 * 2.00 =                  | 3.00 kN                 |
| Bi.C.1 | p = + yG * G_rep                       | = + 1.00 * 0.66 =                  | 0.66 kN/m <sup>2</sup>  |

|        |                                              |                                     |                        |
|--------|----------------------------------------------|-------------------------------------|------------------------|
| Bi.C.2 | $p = +yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= +1.00 * 0.66 + 0.20 * 0.20 =$    | 0.70 kN/m <sup>2</sup> |
| Bi.C.3 | $p = +yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= +1.00 * 0.66 + 0.20 * (-0.81) =$ | 0.50 kN/m <sup>2</sup> |

## MAATGEVENDE SNEDEKRACHTEN

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.92  | 0.78  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.61  | 0.52  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.37  | 2.02  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.13  | 0.96  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.65 | -0.55 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.37  | 2.02  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.36  | 1.16  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.82  | 2.66  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.68  | 0.58  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.72  | 0.61  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.51  | 0.44  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

## MAX UC SNEDEKRACHT

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 0.78  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.52  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 2.02  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 0.96  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.55 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 2.02  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 1.16  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 2.66  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.58  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 0.61  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.44  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

## REKENSTERKTE

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 10.01             | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 10.01             | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 13.35             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 13.35             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 10.01             | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 15.02             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

## REKENSPANNING

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 3.27              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 2.18              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 8.43              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 4.01              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 2.30              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 8.43              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 4.84              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 11.12             | 0.00              | 0.00              | 0.19              | 0.00              |
| Bi.C.1 | 2.42              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.57              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.82              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

## UC DOORSNEDE PER BELASTINGSCOMBINATIE

|        |                             |                                   |              |
|--------|-----------------------------|-----------------------------------|--------------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.269 / 8.308 + 0.7 x 0 / 10.012  | 0.39 Ok      |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.179 / 8.308 + 0.7 x 0 / 10.012  | 0.26 Ok      |
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.434 / 11.077 + 0.7 x 0 / 13.35  | 0.76 Ok      |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.014 / 12.462 + 0.7 x 0 / 15.018 | 0.32 Ok      |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.296 / 12.462 + 0.7 x 0 / 15.018 | 0.18 Ok      |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.434 / 12.462 + 0.7 x 0 / 15.018 | 0.68 Ok      |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.843 / 12.462 + 0.7 x 0 / 15.018 | 0.39 Ok      |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 11.12 / 11.077 + 0.7 x 0 / 13.35  | 1.00 Niet Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.188 / 2.092                  | 0.09 Ok      |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.421 / 8.308 + 0.7 x 0 / 10.012  | 0.29 Ok      |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.569 / 12.462 + 0.7 x 0 / 15.018 | 0.21 Ok      |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.825 / 12.462 + 0.7 x 0 / 15.018 | 0.15 Ok      |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                               |                                      |                         |
|-----------|-----------------------------------------------|--------------------------------------|-------------------------|
| Ka.C.1    | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.66 =$                  | 0.66 kN/m <sup>2</sup>  |
| Ka.C.2    | $p = + yG * G_{rep} + yQ * Q_{rep}$           | $= + 1.00 * 0.66 + 1.00 * 1.00 =$    | 1.66 kN/m <sup>2</sup>  |
| Ka.C.3    | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.00 * 0.66 + 1.00 * 0.20 =$    | 0.86 kN/m <sup>2</sup>  |
| Ka.C.4    | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 1.00 * 0.66 + 1.00 * (-0.81) =$ | -0.15 kN/m <sup>2</sup> |
| Ka.C.5    | $p = + yG * G_{rep} + yQ * Q_{sneeuw}$        | $= + 1.00 * 0.66 + 1.00 * 1.00 =$    | 1.66 kN/m <sup>2</sup>  |
| Ka.C.6    | $p = + yG * G_{rep} + yQ * Q_{water}$         | $= + 1.00 * 0.66 + 1.00 * 0.35 =$    | 1.01 kN/m <sup>2</sup>  |
| Qu.C.1    | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.66 =$                  | 0.66 kN/m <sup>2</sup>  |
| Ka.C.(w1) | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.66 =$                  | 0.66 kN/m <sup>2</sup>  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |                          |                    |                |                           |
|-----------|----------------|--------------------------|--------------------|----------------|---------------------------|
| L/250     | Limiet w;max   | 13.6 mm                  | L/250              | Limiet w;2+w;3 | 13.6 mm                   |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm <sup>2</sup> | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm <sup>2</sup> |
|           |                |                          | E-Mod/E;0;ser;d;cr |                | 0.60                      |
| Ka.C.(w1) | w;1            | 4.2 mm                   | w;c                |                | 0.0 mm                    |
| Qu.C.1    | w;2            | 2.5 mm                   |                    |                |                           |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 6.6   | 6.6   | 2.5     | 0.49      | 0.18        |
| Ka.C.2 | 6.3  | 13.0  | 13.0  | 8.8     | 0.95      | 0.65        |
| Ka.C.3 | 1.3  | 7.9   | 7.9   | 3.8     | 0.58      | 0.28        |
| Ka.C.4 | -5.1 | 1.5   | 1.5   | -2.6    | 0.11      | 0.19        |
| Ka.C.5 | 6.3  | 13.0  | 13.0  | 8.8     | 0.95      | 0.65        |
| Ka.C.6 | 2.2  | 8.9   | 8.9   | 4.7     | 0.65      | 0.35        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 2.66 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 4.2 mm  |
| Qu.C.1    | w;2            | 2.5 mm  |
| Ka.C.2    | w;3            | 6.3 mm  |
|           | w;tot          | 13.0 mm |
|           | w;max          | 13.0 mm |
|           | w;2+w;3        | 8.8 mm  |
|           | Limiet w;max   | 13.6 mm |
|           | Limiet w;2+w;3 | 13.6 mm |
|           | UC(w;max)      | 0.95    |
|           | UC(w;2+w;3)    | 0.65    |

**UITGEVOERDE CONTROLES**

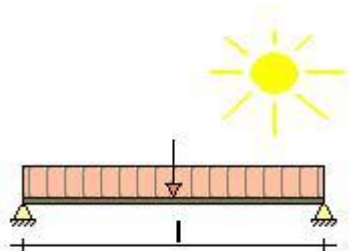
|               |                                      |                                  |              |
|---------------|--------------------------------------|----------------------------------|--------------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.622 / 2.092                 | 0.30 Ok      |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 11.12 / 11.077 + 0.7 x 0 / 13.35 | 1.00 Niet Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 13.0 / 13.6                      | 0.95 Ok      |

**Ligger gecontroleerd op sterkte en doorbuiging****Ligger Niet Ok**

Balklaag 59x156 C18 hoh 610 voldoet op extra belasting 20 kg/m<sup>2</sup>

**Controle Balklaag pos B4 Dakdeel B**Belasting uit zonnepanelen  $18 \text{ kg/m}^2$  gerekend wordt met  $20 \text{ kg/m}^2$ **PROFIELGEGEVENS: R71X196**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 13916 mm <sup>2</sup>    |
| Hoogte               | h                   | 196 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 4546e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1803e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1647e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 4455e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 5846e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |                |         |                           |         |       |
|--------------------------|----------------|---------|---------------------------|---------|-------|
| Klimaatklasse            |                | I       |                           | Gamma;M | 1.30  |
|                          | k;h            | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |                |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c         | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |                | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |                | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| l <sub>sys</sub>         |                | 4.600 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | L <sub>t</sub> | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |                | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |                | Ja      |                           |         |       |
| Stootbelasting           |                | Nee     |                           |         |       |
| Reductiefactor spreiding |                | 0.77    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.09 kN/m <sup>2</sup>       |      |
|            | Isolatie+ dakbedekking          | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaale</b>                  | <b>0.69 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p <sub>sneeuw</sub>             | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dh <sub>w</sub>          | 0.030 m                      |      |
| Bijzonder  | Bijzonder; F <sub>bijz</sub>    | 0.00 kN                      |      |
|            | Bijzonder; p <sub>bijz</sub>    | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                                              |                                    |                         |
|--------|--------------------------------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.35 * 0.69 =                  | 0.93 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G <sub>rep</sub>                                  | = + 0.90 * 0.69 =                  | 0.62 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>rep</sub>          | = + 1.20 * 0.69 + 1.50 * 1.00 =    | 2.33 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.20 * 0.69 + 1.50 * 0.20 =    | 1.13 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_zuiging</sub> | = + 0.90 * 0.69 + 1.50 * (-0.81) = | -0.60 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>sneeuw</sub>       | = + 1.20 * 0.69 + 1.50 * 1.00 =    | 2.33 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>water</sub>        | = + 1.20 * 0.69 + 1.50 * 0.37 =    | 1.39 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G <sub>rep</sub>                                  | = + 1.20 * 0.69 =                  | 0.83 kN/m <sup>2</sup>  |
|        | F = + yQ * F <sub>rep</sub>                                  | = + 1.50 * 2.00 =                  | 3.00 kN                 |

|        |                                               |                                      |                        |
|--------|-----------------------------------------------|--------------------------------------|------------------------|
| Bi.C.1 | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.69 =$                  | 0.69 kN/m <sup>2</sup> |
| Bi.C.2 | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.00 * 0.69 + 0.20 * 0.20 =$    | 0.73 kN/m <sup>2</sup> |
| Bi.C.3 | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 1.00 * 0.69 + 0.20 * (-0.81) =$ | 0.52 kN/m <sup>2</sup> |

## MAATGEVENDE SNEDEKRACHTEN

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 1.30  | 1.50  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.87  | 1.00  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 3.26  | 3.75  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.58  | 1.82  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.84 | -0.96 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 3.26  | 3.75  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.94  | 2.24  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 4.16  | 3.99  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.96  | 1.11  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 1.02  | 1.17  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.74  | 0.85  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

## MAX UC SNEDEKRACHT

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 1.50  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 1.00  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 3.75  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 1.82  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.96 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 3.75  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 2.24  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 3.99  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 1.11  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 1.17  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.85  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

## REKENSTERKTE

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

## REKENSPPANNING

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 3.29              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 2.19              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 8.25              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 3.99              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 2.12              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 8.25              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 4.92              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 8.78              | 0.00              | 0.00              | 0.12              | 0.00              |
| Bi.C.1 | 2.44              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.58              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.86              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.29 / 8.308 + 0.7 x 0 / 9.648    | 0.40 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.194 / 8.308 + 0.7 x 0 / 9.648   | 0.26 Ok |
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.252 / 11.077 + 0.7 x 0 / 12.864 | 0.74 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.993 / 12.462 + 0.7 x 0 / 14.472 | 0.32 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.119 / 12.462 + 0.7 x 0 / 14.472 | 0.17 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.252 / 12.462 + 0.7 x 0 / 14.472 | 0.66 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.919 / 12.462 + 0.7 x 0 / 14.472 | 0.39 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.776 / 11.077 + 0.7 x 0 / 12.864 | 0.79 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.125 / 2.092                  | 0.06 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.437 / 8.308 + 0.7 x 0 / 9.648   | 0.29 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.579 / 12.462 + 0.7 x 0 / 14.472 | 0.21 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.862 / 12.462 + 0.7 x 0 / 14.472 | 0.15 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                        |                                    |                         |
|-----------|----------------------------------------|------------------------------------|-------------------------|
| Ka.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.69 =                  | 0.69 kN/m <sup>2</sup>  |
| Ka.C.2    | p = + yG * G_rep + yQ * Q_rep          | = + 1.00 * 0.69 + 1.00 * 1.00 =    | 1.69 kN/m <sup>2</sup>  |
| Ka.C.3    | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.69 + 1.00 * 0.20 =    | 0.89 kN/m <sup>2</sup>  |
| Ka.C.4    | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 1.00 * 0.69 + 1.00 * (-0.81) = | -0.12 kN/m <sup>2</sup> |
| Ka.C.5    | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.00 * 0.69 + 1.00 * 1.00 =    | 1.69 kN/m <sup>2</sup>  |
| Ka.C.6    | p = + yG * G_rep + yQ * Q_water        | = + 1.00 * 0.69 + 1.00 * 0.37 =    | 1.06 kN/m <sup>2</sup>  |
| Qu.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.69 =                  | 0.69 kN/m <sup>2</sup>  |
| Ka.C.(w1) | p = + yG * G_rep                       | = + 1.00 * 0.69 =                  | 0.69 kN/m <sup>2</sup>  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |                          |                    |                |                           |
|-----------|----------------|--------------------------|--------------------|----------------|---------------------------|
| L/250     | Limiet w;max   | 18.4 mm                  | L/250              | Limiet w;2+w;3 | 18.4 mm                   |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm <sup>2</sup> | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm <sup>2</sup> |
|           |                |                          | E-Mod/E;0;ser;d;cr |                | 0.60                      |
| Ka.C.(w1) | w;1            | 6.1 mm                   | w;c                |                | 0.0 mm                    |
| Qu.C.1    | w;2            | 3.7 mm                   |                    |                |                           |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 9.7   | 9.7   | 3.7     | 0.53      | 0.20        |
| Ka.C.2 | 8.9  | 18.6  | 18.6  | 12.5    | 1.01      | 0.68        |
| Ka.C.3 | 1.8  | 11.5  | 11.5  | 5.4     | 0.63      | 0.30        |
| Ka.C.4 | -7.2 | 2.6   | 2.6   | -3.5    | 0.14      | 0.19        |
| Ka.C.5 | 8.9  | 18.6  | 18.6  | 12.5    | 1.01      | 0.68        |
| Ka.C.6 | 3.3  | 13.1  | 13.1  | 7.0     | 0.71      | 0.38        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 3.99 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 6.1 mm  |
| Qu.C.1    | w;2            | 3.7 mm  |
| Ka.C.2    | w;3            | 8.9 mm  |
|           | w;tot          | 18.6 mm |
|           | w;max          | 18.6 mm |
|           | w;2+w;3        | 12.5 mm |
|           | Limiet w;max   | 18.4 mm |
|           | Limiet w;2+w;3 | 18.4 mm |
|           | UC(w;max)      | 1.01    |
|           | UC(w;2+w;3)    | 0.68    |

**UITGEVOERDE CONTROLES**

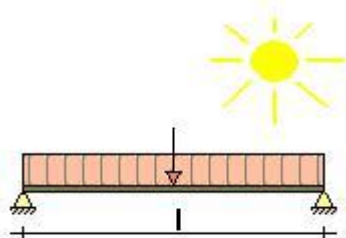
|               |                                      |    |                                   |              |
|---------------|--------------------------------------|----|-----------------------------------|--------------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz | 0.448 / 2.092                     | 0.21 Ok      |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          |    | 8.776 / 11.077 + 0.7 x 0 / 12.864 | 0.79 Ok      |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) |    | 18.6 / 18.4                       | 1.01 Niet Ok |

**Ligger gecontroleerd op sterkte en doorbuiging****Ligger Niet Ok**

Balklaag 71x196 C18 hoh 610 voldoet op extra belasting 20 kg/m<sup>2</sup>

**Controle Balklaag pos B5 Dakdeel B****PROFIELGEGEVENS: R71X171**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 12141 mm <sup>2</sup>    |
| Hoogte               | h                   | 171 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 3460e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1504e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1437e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 2958e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 5100e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |        |         |                           |         |       |
|--------------------------|--------|---------|---------------------------|---------|-------|
| Klimaatklasse            |        | I       |                           | Gamma;M | 1.30  |
|                          | k;h    | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |        |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |        | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |        | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| l <sub>sys</sub>         |        | 4.000 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | Lt     | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |        | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |        | Ja      |                           |         |       |
| Stootbelasting           |        | Nee     |                           |         |       |
| Reductiefactor spreiding |        | 0.77    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.08 kN/m <sup>2</sup>       |      |
|            | Isolatie + dakebdekking         | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                   | <b>0.68 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p <sub>sneeuw</sub>             | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dh <sub>w</sub>          | 0.030 m                      |      |
| Bijzonder  | Bijzonder; F <sub>bijz</sub>    | 0.00 kN                      |      |
|            | Bijzonder; p <sub>bijz</sub>    | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                                              |                                    |                         |
|--------|--------------------------------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.35 * 0.68 =                  | 0.91 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G <sub>rep</sub>                                  | = + 0.90 * 0.68 =                  | 0.61 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>rep</sub>          | = + 1.20 * 0.68 + 1.50 * 1.00 =    | 2.31 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.20 * 0.68 + 1.50 * 0.20 =    | 1.11 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_zuiging</sub> | = + 0.90 * 0.68 + 1.50 * (-0.81) = | -0.61 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>sneeuw</sub>       | = + 1.20 * 0.68 + 1.50 * 1.00 =    | 2.31 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>water</sub>        | = + 1.20 * 0.68 + 1.50 * 0.36 =    | 1.36 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G <sub>rep</sub>                                  | = + 1.20 * 0.68 =                  | 0.81 kN/m <sup>2</sup>  |
|        | F = + yQ * F <sub>rep</sub>                                  | = + 1.50 * 2.00 =                  | 3.00 kN                 |
| Bi.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.00 * 0.68 =                  | 0.68 kN/m <sup>2</sup>  |
| Bi.C.2 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.00 * 0.68 + 0.20 * 0.20 =    | 0.72 kN/m <sup>2</sup>  |

$$\text{Bi.C.3} \quad p = + yG * G_{\text{rep}} + yQ * Q_{\text{wind\_zuiging}} = + 1.00 * 0.68 + 0.20 * (-0.81) = 0.51 \text{ kN/m}^2$$

**MAATGEVENDE SNEDEKRACHTEN**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 1.11  | 1.11  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.74  | 0.74  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.82  | 2.82  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.36  | 1.36  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.74 | -0.74 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.82  | 2.82  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.65  | 1.65  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.99  | 3.30  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.82  | 0.82  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.87  | 0.87  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.63  | 0.63  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**MAX UC SNEDEKRACHT**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 1.11  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.74  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 2.82  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 1.36  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.74 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 2.82  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 1.65  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 3.30  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.82  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 0.87  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.63  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**REKENSTERKTE**

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**REKENSPANNING**

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 3.22              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 2.14              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 8.15              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 3.92              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 2.14              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 8.15              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 4.78              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 9.54              | 0.00              | 0.00              | 0.14              | 0.00              |
| Bi.C.1 | 2.38              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.52              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.81              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                 |         |
|--------|-----------------------------|---------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.216 / 8.308 + 0.7 x 0 / 9.648 | 0.39 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.144 / 8.308 + 0.7 x 0 / 9.648 | 0.26 Ok |

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.151 / 11.077 + 0.7 x 0 / 12.864 | 0.74 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.92 / 12.462 + 0.7 x 0 / 14.472  | 0.31 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.14 / 12.462 + 0.7 x 0 / 14.472  | 0.17 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.151 / 12.462 + 0.7 x 0 / 14.472 | 0.65 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 4.778 / 12.462 + 0.7 x 0 / 14.472 | 0.38 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 9.543 / 11.077 + 0.7 x 0 / 12.864 | 0.86 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.143 / 2.092                  | 0.07 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.382 / 8.308 + 0.7 x 0 / 9.648   | 0.29 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.523 / 12.462 + 0.7 x 0 / 14.472 | 0.20 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.811 / 12.462 + 0.7 x 0 / 14.472 | 0.15 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                        |                                    |              |
|-----------|----------------------------------------|------------------------------------|--------------|
| Ka.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.68 =                  | 0.68 kN/m^2  |
| Ka.C.2    | p = + yG * G_rep + yQ * Q_rep          | = + 1.00 * 0.68 + 1.00 * 1.00 =    | 1.68 kN/m^2  |
| Ka.C.3    | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.68 + 1.00 * 0.20 =    | 0.88 kN/m^2  |
| Ka.C.4    | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 1.00 * 0.68 + 1.00 * (-0.81) = | -0.13 kN/m^2 |
| Ka.C.5    | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.00 * 0.68 + 1.00 * 1.00 =    | 1.68 kN/m^2  |
| Ka.C.6    | p = + yG * G_rep + yQ * Q_water        | = + 1.00 * 0.68 + 1.00 * 0.36 =    | 1.04 kN/m^2  |
| Qu.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.68 =                  | 0.68 kN/m^2  |
| Ka.C.(w1) | p = + yG * G_rep                       | = + 1.00 * 0.68 =                  | 0.68 kN/m^2  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |               |                    |                |                |
|-----------|----------------|---------------|--------------------|----------------|----------------|
| L/250     | Limiet w;max   | 16.0 mm       | L/250              | Limiet w;2+w;3 | 16.0 mm        |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm^2 | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm^2 |
|           |                |               | E-Mod/E;0;ser;d;cr |                | 0.60           |
| Ka.C.(w1) | w;1            | 5.2 mm        | w;c                |                | 0.0 mm         |
| Qu.C.1    | w;2            | 3.1 mm        |                    |                |                |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 8.3   | 8.3   | 3.1     | 0.52      | 0.19        |
| Ka.C.2 | 7.6  | 15.9  | 15.9  | 10.7    | 0.99      | 0.67        |
| Ka.C.3 | 1.5  | 9.8   | 9.8   | 4.6     | 0.61      | 0.29        |
| Ka.C.4 | -6.2 | 2.1   | 2.1   | -3.1    | 0.13      | 0.19        |
| Ka.C.5 | 7.6  | 15.9  | 15.9  | 10.7    | 0.99      | 0.67        |
| Ka.C.6 | 2.8  | 11.0  | 11.0  | 5.9     | 0.69      | 0.37        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 3.30 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 5.2 mm  |
| Qu.C.1    | w;2            | 3.1 mm  |
| Ka.C.2    | w;3            | 7.6 mm  |
|           | w;tot          | 15.9 mm |
|           | w;max          | 15.9 mm |
|           | w;2+w;3        | 10.7 mm |
|           | Limiet w;max   | 16.0 mm |
|           | Limiet w;2+w;3 | 16.0 mm |
|           | UC(w;max)      | 0.99    |
|           | UC(w;2+w;3)    | 0.67    |

**UITGEVOERDE CONTROLES**

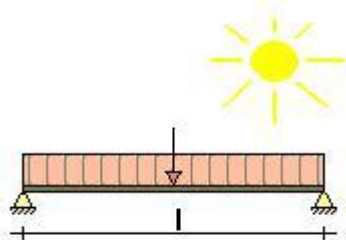
|               |                                      |                                   |         |
|---------------|--------------------------------------|-----------------------------------|---------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.493 / 2.092                  | 0.24 Ok |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 9.543 / 11.077 + 0.7 x 0 / 12.864 | 0.86 Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 15.9 / 16.0                       | 0.99 Ok |

**Ligger gecontroleerd op sterkte en doorbuiging**  
**Ligger Ok**

Balklaag 71x171 C18 hoh 610 voldoet op  
 extra belasting 20 kg/m²

**Controle Balklaag pos B6 Dakdeel B****PROFIELGEGEVENS: R71X146**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 10366 mm <sup>2</sup>    |
| Hoogte               | h                   | 146 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 2522e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1209e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1227e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 1841e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 4355e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |        |         |                           |         |       |
|--------------------------|--------|---------|---------------------------|---------|-------|
| Klimaatklasse            |        | I       |                           | Gamma;M | 1.30  |
|                          | k;h    | 1.01    | I (Permanent)             | k;mod   | 0.60  |
|                          |        |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |        | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |        | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| l <sub>sys</sub>         |        | 3.000 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | Lt     | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |        | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |        | Ja      |                           |         |       |
| Stootbelasting           |        | Nee     |                           |         |       |
| Reductiefactor spreiding |        | 0.77    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.06 kN/m <sup>2</sup>       |      |
|            | Isolatie + dakbedekking         | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                   | <b>0.66 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p <sub>sneeuw</sub>             | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dhw                      | 0.030 m                      |      |
| Bijzonder  | Bijzonder; F <sub>bijz</sub>    | 0.00 kN                      |      |
|            | Bijzonder; p <sub>bijz</sub>    | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                                              |                                    |                         |
|--------|--------------------------------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.35 * 0.66 =                  | 0.90 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G <sub>rep</sub>                                  | = + 0.90 * 0.66 =                  | 0.60 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>rep</sub>          | = + 1.20 * 0.66 + 1.50 * 1.00 =    | 2.30 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.20 * 0.66 + 1.50 * 0.20 =    | 1.10 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_zuiging</sub> | = + 0.90 * 0.66 + 1.50 * (-0.81) = | -0.62 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>sneeuw</sub>       | = + 1.20 * 0.66 + 1.50 * 1.00 =    | 2.30 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>water</sub>        | = + 1.20 * 0.66 + 1.50 * 0.33 =    | 1.29 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G <sub>rep</sub>                                  | = + 1.20 * 0.66 =                  | 0.80 kN/m <sup>2</sup>  |
|        | F = + yQ * F <sub>rep</sub>                                  | = + 1.50 * 2.00 =                  | 3.00 kN                 |
| Bi.C.1 | p = + yG * G <sub>rep</sub>                                  | = + 1.00 * 0.66 =                  | 0.66 kN/m <sup>2</sup>  |
| Bi.C.2 | p = + yG * G <sub>rep</sub> + yQ * Q <sub>wind_druk</sub>    | = + 1.00 * 0.66 + 0.20 * 0.20 =    | 0.70 kN/m <sup>2</sup>  |

$$\text{Bi.C.3} \quad p = + yG * G_{\text{rep}} + yQ * Q_{\text{wind\_zuiging}}$$

$$= + 1.00 * 0.66 + 0.20 * (-0.81) =$$

$$0.50 \text{ kN/m}^2$$

**MAATGEVENDE SNEDEKRACHTEN**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.82  | 0.62  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.55  | 0.41  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.10  | 1.58  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.01  | 0.75  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.56 | -0.42 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.10  | 1.58  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.18  | 0.89  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.73  | 2.28  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.61  | 0.46  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.64  | 0.48  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.46  | 0.34  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**MAX UC SNEDEKRACHT**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 0.62  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.41  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 1.58  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 0.75  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.42 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 1.58  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 0.89  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 2.28  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.46  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 0.48  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.34  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**REKENSTERKTE**

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.35              | 9.65              | 5.10              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.35              | 9.65              | 5.10              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.14             | 12.86             | 6.81              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.14             | 12.86             | 6.81              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.35              | 9.65              | 5.10              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.53             | 14.47             | 7.66              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**REKENSPANNING**

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 2.44              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 1.63              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 6.25              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 2.99              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 1.68              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 6.25              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 3.52              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 9.05              | 0.00              | 0.00              | 0.17              | 0.00              |
| Bi.C.1 | 1.81              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 1.92              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.37              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                 |         |
|--------|-----------------------------|---------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.441 / 8.353 + 0.7 x 0 / 9.648 | 0.29 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.627 / 8.353 + 0.7 x 0 / 9.648 | 0.19 Ok |

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 6.253 / 11.137 + 0.7 x 0 / 12.864 | 0.56 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.989 / 12.529 + 0.7 x 0 / 14.472 | 0.24 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.678 / 12.529 + 0.7 x 0 / 14.472 | 0.13 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 6.253 / 12.529 + 0.7 x 0 / 14.472 | 0.50 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.52 / 12.529 + 0.7 x 0 / 14.472  | 0.28 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 9.046 / 11.137 + 0.7 x 0 / 12.864 | 0.81 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.167 / 2.092                  | 0.08 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.808 / 8.353 + 0.7 x 0 / 9.648   | 0.22 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.917 / 12.529 + 0.7 x 0 / 14.472 | 0.15 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.367 / 12.529 + 0.7 x 0 / 14.472 | 0.11 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                        |                                    |              |
|-----------|----------------------------------------|------------------------------------|--------------|
| Ka.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.66 =                  | 0.66 kN/m^2  |
| Ka.C.2    | p = + yG * G_rep + yQ * Q_rep          | = + 1.00 * 0.66 + 1.00 * 1.00 =    | 1.66 kN/m^2  |
| Ka.C.3    | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.66 + 1.00 * 0.20 =    | 0.86 kN/m^2  |
| Ka.C.4    | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 1.00 * 0.66 + 1.00 * (-0.81) = | -0.15 kN/m^2 |
| Ka.C.5    | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.00 * 0.66 + 1.00 * 1.00 =    | 1.66 kN/m^2  |
| Ka.C.6    | p = + yG * G_rep + yQ * Q_water        | = + 1.00 * 0.66 + 1.00 * 0.33 =    | 0.99 kN/m^2  |
| Qu.C.1    | p = + yG * G_rep                       | = + 1.00 * 0.66 =                  | 0.66 kN/m^2  |
| Ka.C.(w1) | p = + yG * G_rep                       | = + 1.00 * 0.66 =                  | 0.66 kN/m^2  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |               |                    |                |                |
|-----------|----------------|---------------|--------------------|----------------|----------------|
| L/250     | Limiet w;max   | 12.0 mm       | L/250              | Limiet w;2+w;3 | 12.0 mm        |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm^2 | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm^2 |
|           |                |               | E-Mod/E;0;ser;d;cr |                | 0.60           |
| Ka.C.(w1) | w;1            | 2.6 mm        | w;c                |                | 0.0 mm         |
| Qu.C.1    | w;2            | 1.5 mm        |                    |                |                |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 4.1   | 4.1   | 1.5     | 0.34      | 0.13        |
| Ka.C.2 | 3.9  | 8.0   | 8.0   | 5.4     | 0.67      | 0.45        |
| Ka.C.3 | 0.8  | 4.9   | 4.9   | 2.3     | 0.41      | 0.19        |
| Ka.C.4 | -3.1 | 1.0   | 1.0   | -1.6    | 0.08      | 0.13        |
| Ka.C.5 | 3.9  | 8.0   | 8.0   | 5.4     | 0.67      | 0.45        |
| Ka.C.6 | 1.3  | 5.4   | 5.4   | 2.8     | 0.45      | 0.24        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 2.28 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 2.6 mm  |
| Qu.C.1    | w;2            | 1.5 mm  |
| Ka.C.2    | w;3            | 3.9 mm  |
|           | w;tot          | 8.0 mm  |
|           | w;max          | 8.0 mm  |
|           | w;2+w;3        | 5.4 mm  |
|           | Limiet w;max   | 12.0 mm |
|           | Limiet w;2+w;3 | 12.0 mm |
|           | UC(w;max)      | 0.67    |
|           | UC(w;2+w;3)    | 0.45    |

**UITGEVOERDE CONTROLES**

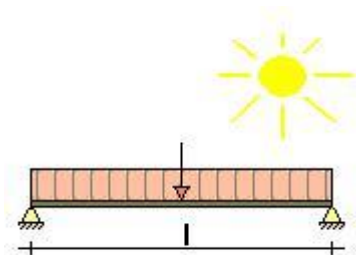
|               |                                      |                                   |         |
|---------------|--------------------------------------|-----------------------------------|---------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.54 / 2.092                   | 0.26 Ok |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 9.046 / 11.137 + 0.7 x 0 / 12.864 | 0.81 Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 8.0 / 12.0                        | 0.67 Ok |

**Ligger gecontroleerd op sterkte en doorbuiging**  
**Ligger Ok**

Balklaag 71x146 C18 hoh 610 voldoet op  
 extra belasting 20 kg/m<sup>2</sup>

**Controle Balklaag pos B7 Dakdeel B****PROFIELGEGEVENS: R71X171**

|                      |                     |                          |                  |                    |                          |
|----------------------|---------------------|--------------------------|------------------|--------------------|--------------------------|
| Breedte              | b                   | 71 mm                    | Oppervlak        | A                  | 12141 mm <sup>2</sup>    |
| Hoogte               | h                   | 171 mm                   |                  |                    |                          |
| Weerstandsmoment     | Wy                  | 3460e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>tor</sub>   | 1504e+04 mm <sup>4</sup> |
| Weerstandsmoment     | Wz                  | 1437e+02 mm <sup>3</sup> | Traagheidsmoment | I <sub>y</sub>     | 2958e+04 mm <sup>4</sup> |
|                      |                     |                          | Traagheidsmoment | I <sub>z</sub>     | 5100e+03 mm <sup>4</sup> |
| Sterkte klasse       |                     | C18                      |                  |                    |                          |
|                      | f <sub>m,0,k</sub>  | 18.0 N/mm <sup>2</sup>   |                  | f <sub>c,0,k</sub> | 18.0 N/mm <sup>2</sup>   |
|                      | f <sub>t,0,k</sub>  | 11.0 N/mm <sup>2</sup>   |                  | f <sub>v,0,k</sub> | 3.4 N/mm <sup>2</sup>    |
| Elasticiteitsmodulus | E <sub>0;mean</sub> | 9000.0 N/mm <sup>2</sup> |                  | G <sub>mean</sub>  | 560.0 N/mm <sup>2</sup>  |



|                          |        |         |                           |         |       |
|--------------------------|--------|---------|---------------------------|---------|-------|
| Klimaatklasse            |        | I       |                           | Gamma;M | 1.30  |
|                          | k;h    | 1.00    | I (Permanent)             | k;mod   | 0.60  |
|                          |        |         | II (Lange termijn)        | k;mod   | 0.70  |
|                          | Beta;c | 0.2     | III (Middellange termijn) | k;mod   | 0.80  |
| Ontwerplevensduur        |        | 50 Jaar | IV (Korte termijn)        | k;mod   | 0.90  |
| Betrouwbaarheidsklasse   |        | 2       | V (Onmiddellijk)          | k;mod   | 1.10  |
| Isys                     |        | 3.600 m | Beschot kwaliteit         |         | C18   |
| hoh afstand              | Lt     | 0.610 m | Beschot dikte             |         | 18 mm |
| Zeeg                     |        | 0 mm    |                           |         |       |
| Doorbuigingen beschouwen |        | Ja      |                           |         |       |
| Stootbelasting           |        | Nee     |                           |         |       |
| Reductiefactor spreiding |        | 0.77    |                           |         |       |

**BELASTINGEN****CPROB**

|            |                                 |                              |      |
|------------|---------------------------------|------------------------------|------|
| Permanent  | Eigen gewicht                   | 0.08 kN/m <sup>2</sup>       |      |
|            | Isolatie+dakbedekking           | 0.15 kN/m <sup>2</sup>       |      |
|            | beschot                         | 0.10 kN/m <sup>2</sup>       |      |
|            | plafond                         | 0.15 kN/m <sup>2</sup>       |      |
|            | zonnepanelen                    | 0.20 kN/m <sup>2</sup>       |      |
|            | <b>Totaal</b>                   | <b>0.68 kN/m<sup>2</sup></b> |      |
| Opgelegd   | q;k                             | 1.00 kN/m <sup>2</sup>       | 1.00 |
|            | psi (-)_0; psi (-)_1; psi (-)_2 | 0.00; 0.00; 0.00             |      |
|            | Q;k                             | 2.00 kN                      |      |
| Wind       | Winddruk                        | 0.20 kN/m <sup>2</sup>       | 1.00 |
|            | Windzuiging                     | -0.81 kN/m <sup>2</sup>      |      |
| Sneeuw     | p_sneeuw                        | 1.00 kN/m <sup>2</sup>       | 1.00 |
| Regenwater | Niveau dhw                      | 0.030 m                      |      |
| Bijzonder  | Bijzonder; Fbijz                | 0.00 kN                      |      |
|            | Bijzonder; pbijz                | 0.00 kN/m <sup>2</sup>       |      |

**BELASTINGSCOMBINATIES VOOR UITERSTE GRENSTOESTAND (610A + 6.10B)**

|        |                                        |                                    |                         |
|--------|----------------------------------------|------------------------------------|-------------------------|
| Fu.C.1 | p = + yG * G_rep                       | = + 1.35 * 0.68 =                  | 0.91 kN/m <sup>2</sup>  |
| Fu.C.2 | p = + yG * G_rep                       | = + 0.90 * 0.68 =                  | 0.61 kN/m <sup>2</sup>  |
| Fu.C.3 | p = + yG * G_rep + yQ * Q_rep          | = + 1.20 * 0.68 + 1.50 * 1.00 =    | 2.31 kN/m <sup>2</sup>  |
| Fu.C.4 | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.20 * 0.68 + 1.50 * 0.20 =    | 1.11 kN/m <sup>2</sup>  |
| Fu.C.5 | p = + yG * G_rep + yQ * Q_wind_zuiging | = + 0.90 * 0.68 + 1.50 * (-0.81) = | -0.61 kN/m <sup>2</sup> |
| Fu.C.6 | p = + yG * G_rep + yQ * Q_sneeuw       | = + 1.20 * 0.68 + 1.50 * 1.00 =    | 2.31 kN/m <sup>2</sup>  |
| Fu.C.7 | p = + yG * G_rep + yQ * Q_water        | = + 1.20 * 0.68 + 1.50 * 0.34 =    | 1.32 kN/m <sup>2</sup>  |
| Fu.C.8 | p = + yG * G_rep                       | = + 1.20 * 0.68 =                  | 0.81 kN/m <sup>2</sup>  |
|        | F = + yQ * F_rep                       | = + 1.50 * 2.00 =                  | 3.00 kN                 |
| Bi.C.1 | p = + yG * G_rep                       | = + 1.00 * 0.68 =                  | 0.68 kN/m <sup>2</sup>  |
| Bi.C.2 | p = + yG * G_rep + yQ * Q_wind_druk    | = + 1.00 * 0.68 + 0.20 * 0.20 =    | 0.72 kN/m <sup>2</sup>  |

$$\text{Bi.C.3} \quad p = + yG * G_{\text{rep}} + yQ * Q_{\text{wind\_zuiging}}$$

$$= + 1.00 * 0.68 + 0.20 * (-0.81) =$$

$$0.51 \text{ kN/m}^2$$

**MAATGEVENDE SNEDEKRACHTEN**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 1.00  | 0.90  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.67  | 0.60  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 2.54  | 2.28  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 1.22  | 1.10  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | -0.67 | -0.60 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 2.54  | 2.28  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 1.45  | 1.31  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 3.89  | 2.88  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.74  | 0.67  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.79  | 0.71  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.56  | 0.51  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**MAX UC SNEDEKRACHT**

| Comb.  | Nc;Ed, Nt;Ed | Vy;Ed | Vz;Ed | My;Ed | Mz;Ed |
|--------|--------------|-------|-------|-------|-------|
| Fu.C.1 | 0.00         | 0.00  | 0.00  | 0.90  | 0.00  |
| Fu.C.2 | 0.00         | 0.00  | 0.00  | 0.60  | 0.00  |
| Fu.C.3 | 0.00         | 0.00  | 0.00  | 2.28  | 0.00  |
| Fu.C.4 | 0.00         | 0.00  | 0.00  | 1.10  | 0.00  |
| Fu.C.5 | 0.00         | 0.00  | 0.00  | -0.60 | 0.00  |
| Fu.C.6 | 0.00         | 0.00  | 0.00  | 2.28  | 0.00  |
| Fu.C.7 | 0.00         | 0.00  | 0.00  | 1.31  | 0.00  |
| Fu.C.8 | 0.00         | 0.00  | 1.16  | 2.88  | 0.00  |
| Bi.C.1 | 0.00         | 0.00  | 0.00  | 0.67  | 0.00  |
| Bi.C.2 | 0.00         | 0.00  | 0.00  | 0.71  | 0.00  |
| Bi.C.3 | 0.00         | 0.00  | 0.00  | 0.51  | 0.00  |
|        | kN           | kN    | kN    | kNm   | kNm   |

**REKENSTERKTE**

| Comb.  | Belasting duurklasse      | f;m,y,d           | f;m,z,d           | f;t,0,d           | f;c,0,d           | f;v,0,d           |
|--------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.2 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Fu.C.3 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Fu.C.4 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.5 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.6 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.7 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Fu.C.8 | III (Middellange termijn) | 11.08             | 12.86             | 6.77              | 11.08             | 2.09              |
| Bi.C.1 | I (Permanent)             | 8.31              | 9.65              | 5.08              | 8.31              | 1.57              |
| Bi.C.2 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
| Bi.C.3 | IV (Korte termijn)        | 12.46             | 14.47             | 7.62              | 12.46             | 2.35              |
|        |                           | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**REKENSPANNING**

| Comb.  | sigma;m,y,d       | sigma;m,z,d       | tau;v,y,d         | tau;v,z,d         | sigma;c(t),0,d    |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Fu.C.1 | 2.60              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.2 | 1.74              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.3 | 6.60              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.4 | 3.18              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.5 | 1.73              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.6 | 6.60              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.7 | 3.77              | 0.00              | 0.00              | 0.00              | 0.00              |
| Fu.C.8 | 8.33              | 0.00              | 0.00              | 0.14              | 0.00              |
| Bi.C.1 | 1.93              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.2 | 2.04              | 0.00              | 0.00              | 0.00              | 0.00              |
| Bi.C.3 | 1.47              | 0.00              | 0.00              | 0.00              | 0.00              |
|        | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> | N/mm <sup>2</sup> |

**UC DOORSNEDE PER BELASTINGSCOMBINATIE**

|        |                             |                                 |         |
|--------|-----------------------------|---------------------------------|---------|
| Fu.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.605 / 8.308 + 0.7 x 0 / 9.648 | 0.31 Ok |
| Fu.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.737 / 8.308 + 0.7 x 0 / 9.648 | 0.21 Ok |

|        |                             |                                   |         |
|--------|-----------------------------|-----------------------------------|---------|
| Fu.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 6.602 / 11.077 + 0.7 x 0 / 12.864 | 0.60 Ok |
| Fu.C.4 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.175 / 12.462 + 0.7 x 0 / 14.472 | 0.25 Ok |
| Fu.C.5 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.733 / 12.462 + 0.7 x 0 / 14.472 | 0.14 Ok |
| Fu.C.6 | NEN-EN1995-1-1#6.1.6 (6.11) | 6.602 / 12.462 + 0.7 x 0 / 14.472 | 0.53 Ok |
| Fu.C.7 | NEN-EN1995-1-1#6.1.6 (6.11) | 3.775 / 12.462 + 0.7 x 0 / 14.472 | 0.30 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.6 (6.11) | 8.331 / 11.077 + 0.7 x 0 / 12.864 | 0.75 Ok |
| Fu.C.8 | NEN-EN1995-1-1#6.1.7 (6.13) | Vz 0.143 / 2.092                  | 0.07 Ok |
| Bi.C.1 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.93 / 8.308 + 0.7 x 0 / 9.648    | 0.23 Ok |
| Bi.C.2 | NEN-EN1995-1-1#6.1.6 (6.11) | 2.044 / 12.462 + 0.7 x 0 / 14.472 | 0.16 Ok |
| Bi.C.3 | NEN-EN1995-1-1#6.1.6 (6.11) | 1.467 / 12.462 + 0.7 x 0 / 14.472 | 0.12 Ok |

**BELASTINGSCOMBINATIES VOOR BRUIKBAARHEIDSGRENSTOESTAND**

|           |                                               |                                      |                         |
|-----------|-----------------------------------------------|--------------------------------------|-------------------------|
| Ka.C.1    | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.68 =$                  | 0.68 kN/m <sup>2</sup>  |
| Ka.C.2    | $p = + yG * G_{rep} + yQ * Q_{rep}$           | $= + 1.00 * 0.68 + 1.00 * 1.00 =$    | 1.68 kN/m <sup>2</sup>  |
| Ka.C.3    | $p = + yG * G_{rep} + yQ * Q_{wind\_druk}$    | $= + 1.00 * 0.68 + 1.00 * 0.20 =$    | 0.88 kN/m <sup>2</sup>  |
| Ka.C.4    | $p = + yG * G_{rep} + yQ * Q_{wind\_zuiging}$ | $= + 1.00 * 0.68 + 1.00 * (-0.81) =$ | -0.13 kN/m <sup>2</sup> |
| Ka.C.5    | $p = + yG * G_{rep} + yQ * Q_{sneeuw}$        | $= + 1.00 * 0.68 + 1.00 * 1.00 =$    | 1.68 kN/m <sup>2</sup>  |
| Ka.C.6    | $p = + yG * G_{rep} + yQ * Q_{water}$         | $= + 1.00 * 0.68 + 1.00 * 0.34 =$    | 1.02 kN/m <sup>2</sup>  |
| Qu.C.1    | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.68 =$                  | 0.68 kN/m <sup>2</sup>  |
| Ka.C.(w1) | $p = + yG * G_{rep}$                          | $= + 1.00 * 0.68 =$                  | 0.68 kN/m <sup>2</sup>  |

**UC DOORBUIGINGEN PER BELASTINGSCOMBINATIE**

|           |                |                          |                    |                |                           |
|-----------|----------------|--------------------------|--------------------|----------------|---------------------------|
| L/250     | Limiet w;max   | 14.4 mm                  | L/250              | Limiet w;2+w;3 | 14.4 mm                   |
| E;mean    | E;0;ser;d;inst | 9000.0 N/mm <sup>2</sup> | E;mean / Kdef      | E;0;ser;d;cr   | 15000.0 N/mm <sup>2</sup> |
|           |                |                          | E-Mod/E;0;ser;d;cr |                | 0.60                      |
| Ka.C.(w1) | w;1            | 3.4 mm                   | w;c                |                | 0.0 mm                    |
| Qu.C.1    | w;2            | 2.0 mm                   |                    |                |                           |

| Comb.  | w;3  | w;tot | w;max | w;2+w;3 | UC(w;max) | UC(w;2+w;3) |
|--------|------|-------|-------|---------|-----------|-------------|
| Ka.C.1 | 0.0  | 5.4   | 5.4   | 2.0     | 0.38      | 0.14        |
| Ka.C.2 | 5.0  | 10.4  | 10.4  | 7.0     | 0.72      | 0.49        |
| Ka.C.3 | 1.0  | 6.4   | 6.4   | 3.0     | 0.45      | 0.21        |
| Ka.C.4 | -4.1 | 1.4   | 1.4   | -2.0    | 0.09      | 0.14        |
| Ka.C.5 | 5.0  | 10.4  | 10.4  | 7.0     | 0.72      | 0.49        |
| Ka.C.6 | 1.7  | 7.1   | 7.1   | 3.7     | 0.49      | 0.26        |
|        | mm   | mm    | mm    | mm      |           |             |

**MAATGEVENDE KRACHTEN (FU.C.8)**

|               |       |          |
|---------------|-------|----------|
| Normaalkracht | Nt;Ed | 0.00 kN  |
| Dwarskracht   | Vy;Ed | 0.00 kN  |
| Dwarskracht   | Vz;Ed | 1.16 kN  |
| Torsie        | Mx;Ed | 0.00 kNm |
| Moment        | My;Ed | 2.88 kNm |
| Moment        | Mz;Ed | 0.00 kNm |

**MAATGEVENDE DOORBUIGINGEN (KA.C.2)**

|           |                |         |
|-----------|----------------|---------|
| Ka.C.(w1) | w;1            | 3.4 mm  |
| Qu.C.1    | w;2            | 2.0 mm  |
| Ka.C.2    | w;3            | 5.0 mm  |
|           | w;tot          | 10.4 mm |
|           | w;max          | 10.4 mm |
|           | w;2+w;3        | 7.0 mm  |
|           | Limiet w;max   | 14.4 mm |
|           | Limiet w;2+w;3 | 14.4 mm |
|           | UC(w;max)      | 0.72    |
|           | UC(w;2+w;3)    | 0.49    |

**UITGEVOERDE CONTROLES**

|               |                                      |                                   |         |
|---------------|--------------------------------------|-----------------------------------|---------|
| Doorsnede     | NEN-EN1995-1-1#6.1.7 (6.13)          | Vz 0.481 / 2.092                  | 0.23 Ok |
| Doorsnede     | NEN-EN1995-1-1#6.1.6 (6.11)          | 8.331 / 11.077 + 0.7 x 0 / 12.864 | 0.75 Ok |
| Doorbuigingen | NEN-EN1995#7.2 NEN-EN1990#A1.4.3 (4) | 10.4 / 14.4                       | 0.72 Ok |

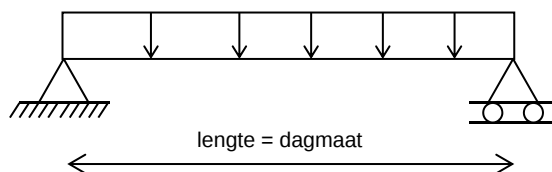
**Ligger gecontroleerd op sterkte en doorbuiging**  
**Ligger Ok**

Balklaag 71x171 C18 hoh 610 voldoet op  
 extra belasting 20 kg/m<sup>2</sup>

[illegible]

**Overzicht lateien**

|                         |        |                   |
|-------------------------|--------|-------------------|
| Staalspanning $f_s =$   | 235    | N/mm <sup>2</sup> |
| E-modulus $E_s =$       | 210000 | N/mm <sup>2</sup> |
| metzelwerk $f_{rep} =$  | 4,5    | N/mm <sup>2</sup> |
| $f_m = f_{rep} / q_m =$ | 2,50   | N/mm <sup>2</sup> |



| Profiel:     |                                                                       |        |             | Resultaten:      |                  |                      | Doorbuiging: |                      |                       |                  |                      |                   |                       |             |  |
|--------------|-----------------------------------------------------------------------|--------|-------------|------------------|------------------|----------------------|--------------|----------------------|-----------------------|------------------|----------------------|-------------------|-----------------------|-------------|--|
| Latei nummer | Positie latei                                                         | Lengte | PROFIEL     | M <sub>s,d</sub> | R <sub>s,d</sub> | S <sub>s,d</sub>     | Zeeg         | U <sub>bij,max</sub> | U <sub>eind,max</sub> | U <sub>bij</sub> | U <sub>bij,max</sub> | U <sub>eind</sub> | U <sub>eind,max</sub> | Opleglengte |  |
|              |                                                                       | [m]    |             | [kNm]            | [kN]             | [N/mm <sup>2</sup> ] | [mm]         | ... x L              | ... x L               | [mm]             | [mm]                 | [mm]              | [mm]                  | [mm]        |  |
| 1            | bi                                                                    | 5,0    | unp200      | 21,3             |                  | 111,3                |              | 0,004                | 0,004                 | 6,0              | 20,4                 | 10,5              | 20,4                  | ###         |  |
| 10           | bi                                                                    | 2,5    | L150/100/10 | 8,2              | 12,6             | 152,0                |              | 0,002                | 0,002                 | 1,6              | 5,2                  | 3,8               | 5,2                   | 250         |  |
| 10           | bu                                                                    | 2,5    | L150/100/10 | 2,5              | 3,8              | 46,3                 |              | 0,002                | 0,002                 | 0,0              | 5,2                  | 1,1               | 5,2                   | 250         |  |
| 11           | bi                                                                    | 5,1    | HEA180      | 49,4             | 38,0             | 167,9                | 10           | 0,004                | 0,004                 | 11,3             | 20,8                 | 9,2               | 20,8                  | 250         |  |
| 12           | bi                                                                    | 3,0    | HEA100      | 11,8             | 15,3             | 161,9                |              | 0,004                | 0,004                 | 7,0              | 12,4                 | 11,7              | 12,4                  | 250         |  |
| 13           | bi                                                                    | 5,7    | HEA180      | 44,7             | 30,8             | 152,1                | 10           | 0,004                | 0,004                 | 12,6             | 23,2                 | 11,6              | 23,2                  | 250         |  |
| 14           | bi                                                                    | 5,3    | HEA180      | 32,6             | 24,1             | 110,7                | 10           | 0,004                | 0,004                 | 7,9              | 21,6                 | 3,7               | 21,6                  | 250         |  |
| 15           | bi                                                                    | 5,7    | HEA180      | 43,5             | 30,0             | 148,0                | 10           | 0,004                | 0,004                 | 12,2             | 23,2                 | 11,1              | 23,2                  | 250         |  |
| 16           | bi                                                                    | 5,3    | HEA180      | 37,7             | 27,9             | 128,3                | 10           | 0,004                | 0,004                 | 9,2              | 21,6                 | 5,8               | 21,6                  | 250         |  |
| 17           | bi                                                                    | 5,7    | HEA180      | 37,6             | 25,9             | 127,8                | 10           | 0,004                | 0,004                 | 10,5             | 23,2                 | 8,2               | 23,2                  | 250         |  |
| 18           | bi                                                                    | 5,3    | HEA180      | 32,6             | 24,1             | 110,7                | 10           | 0,004                | 0,004                 | 7,9              | 21,6                 | 3,7               | 21,6                  | 250         |  |
| 20           | bi                                                                    | 5,7    | HEA180      | 43,5             | 30,0             | 148,0                | 10           | 0,004                | 0,004                 | 12,2             | 23,2                 | 11,1              | 23,2                  | 250         |  |
| 13           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 14           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 15           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 16           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 17           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 18           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 19           | Stalen Lateien/balken voldoen op extra belasting 20 kg/m <sup>2</sup> |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 20           | Stalen Lateien/balken voldoen op extra belasting 20 kg/m <sup>2</sup> |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 21           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 22           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 23           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 24           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 25           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 26           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 27           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 28           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 29           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |
| 30           |                                                                       |        |             |                  |                  |                      |              |                      |                       |                  |                      |                   |                       |             |  |

## Dakdeel C en D

belasting ten gevolge van eigengewicht op de spanten as 3 t/m 10  
 Huidge aanwezige Permanente dakbelasting  $40 \text{ kg/m}^2 = 0.40 \text{ kN/m}^2$   
 $q_{\text{eg}} = 1.1 \times 0.40 \times 4.9 = 2.15 \text{ kN/m}^1$   
 Toename permanente belasting als gevolg van plaatsing zonnepanelen:  
 zonnepanelen gewicht  $20 \text{ kg/m}^2$

$$q_{\text{eg}} = 1.1 \times (0.40 + 0.20) \times 4.90 = 3.23 \text{ kN/m}^1$$

### Controle dakligger IPE600 (staaf 2 en 3)

Maximale staalspanning volgens berekening IBZ d.d. 16-06-2004 met  
 wijziging A d.d. 22-10-2004

Staalspanning  $\sigma_{x,E,d} = 195 \text{ N/mm}^2$

Toename staalspanning als gevolg van extra belasting panelen

$$\sigma_{x,E,d} = 195 \times 3.23 / 2.15 = 292 \text{ N/mm}^2 > 235 \text{ N/mm}^2$$

UC =  $292 / 235 = 1.25 > 1.0$  voldoet niet

***IPE600 heeft niet voldoende draagvermogen***

### Controle dakligger HEA180 (staaf 7)

Maximale staalspanning volgens berekening IBZ d.d. 16-06-2004 met  
 wijziging A d.d. 22-10-2004

Staalspanning  $\sigma_{x,E,d} = 157 \text{ N/mm}^2$

Toename staalspanning als gevolg van extra belasting panelen

$$\sigma_{x,E,d} = 157 \times 3.23 / 2.15 = 236 \text{ N/mm}^2 > 235 \text{ N/mm}^2$$

UC =  $236 / 235 = 1.01 > 1.0$  voldoet niet

***HEA180 heeft niet voldoende draagvermogen***

### Controle dakligger IPE500 (staaf 11)

Maximale staalspanning volgens berekening IBZ d.d. 16-06-2004 met  
 wijziging A d.d. 22-10-2004

Staalspanning  $\sigma_{x,E,d} = 179 \text{ N/mm}^2$

Toename staalspanning als gevolg van extra belasting panelen

$$\sigma_{x,E,d} = 179 \times 3.23 / 2.15 = 268 \text{ N/mm}^2 > 235 \text{ N/mm}^2$$

UC =  $268 / 235 = 1.14 > 1.0$  voldoet niet

***IPE500 heeft niet voldoende draagvermogen***

#### TOETSING SPANNINGEN

| Staaft | Mat | BC | Sit | Kl | Plaats | Norm | Artikel | Formule  | Hoogste toetsing          | Opm. |
|--------|-----|----|-----|----|--------|------|---------|----------|---------------------------|------|
| nr.    |     |    |     |    |        |      |         |          | U.C. [N/mm <sup>2</sup> ] |      |
| 1      | 2   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-2) | 0.536                     | 126  |
| 2      | 1   | 6  | 1   | 1  | Staaft | 6771 | 12.2    | (12.2-3) | 0.884                     | 208  |
| 3      | 1   | 6  | 1   | 1  | Staaft | 6771 | 12.2    | (12.2-3) | 0.884                     | 208  |
| 5-4    | 2   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-1) | 0.974                     | 229  |
| 6      | 5   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-2) | 0.967                     | 227  |
| 7      | 2   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-2) | 0.668                     | 157  |
| 9-8    | 3   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-2) | 0.816                     | 192  |
| 10     | 3   | 2  | 1   | 1  | Staaft | 6771 | 12.2    | (12.2-3) | 0.093                     | 22   |
| 11     | 4   | 6  | 1   | 1  | Staaft | 6771 | 12.3.1  | (12.3-2) | 0.760                     | 179  |
| 12     | 3   | 6  | 1   | 1  | Staaft | 6771 | 12.2    | (12.2-3) | 0.659                     | 155  |

## **Conclusie:**

***Er kunnen geen zonnepanelen geplaatst worden op dakdeel C en D***

***De verticale vervormingen zullen ook toenemen maar zij hier niet getoetst***

Ingenieursburo IBZ bv

Blad:27

TS/Raamwerken

Rel:3.61 27 okt 2004

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

Dimensies: kN/m;rad (tenzij anders aangegeven)

Datum....: 05/05/2004

Bestand...: f:\0434\ts\portaalspant as 5.rww

Belastingbreedte.: 4.900

Toegepaste norm.: TGB 1990

Rekenmodel.....: 1e-orde-elastisch.

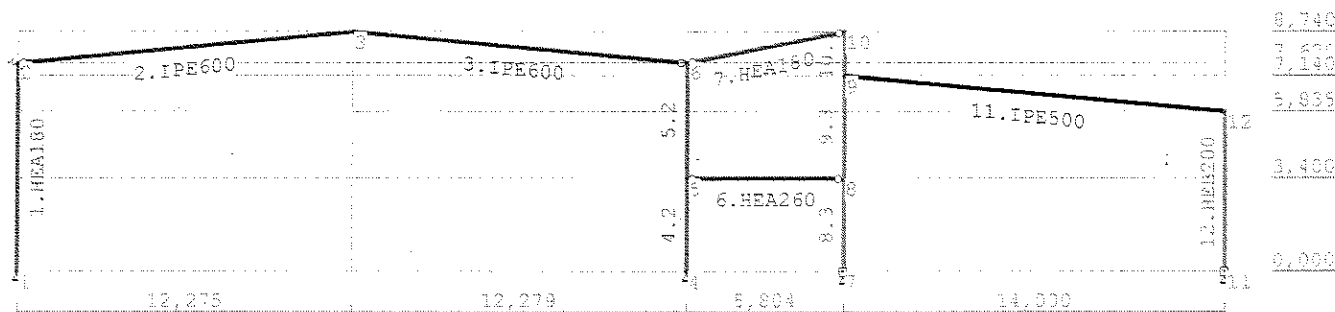
Theorie voor de bepaling van de krachtsverdeling:

Geometrisch lineair.

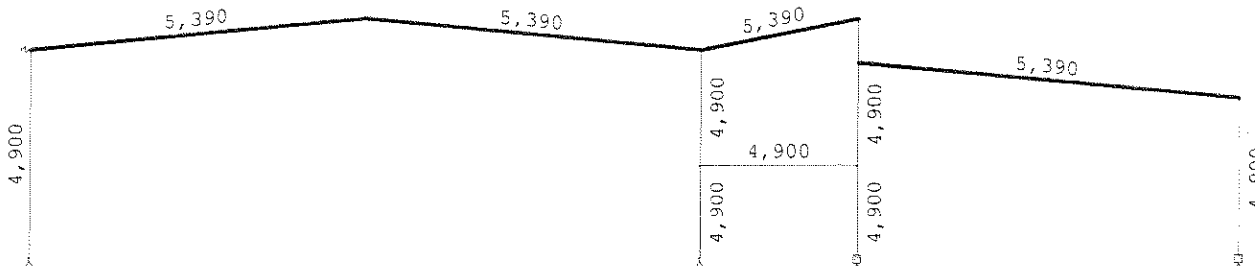
Fysisch lineair.

Gunstige werking van de permanente belasting wordt automatisch verwerkt

## GEOMETRIE



## BELASTINGBREEDTEN



## STRAMIENLIJNEN

| Nr. | X      | Z-min | Z-max |
|-----|--------|-------|-------|
| 1   | -4.910 | 0.000 | 8.740 |
| 2   | 7.365  | 0.000 | 8.740 |
| 3   | 19.644 | 0.000 | 8.740 |
| 4   | 25.448 | 0.000 | 8.740 |
| 5   | 39.448 | 0.000 | 8.740 |

## NIVEAUS

| Nr. | Z     | X-min  | X-max  |
|-----|-------|--------|--------|
| 1   | 0.000 | -4.910 | 39.448 |
| 2   | 7.620 | -4.910 | 39.448 |
| 3   | 8.740 | -4.910 | 39.448 |
| 4   | 7.140 | -4.910 | 39.448 |
| 5   | 5.835 | -4.910 | 39.448 |
| 6   | 3.400 | -4.910 | 39.448 |

## MATERIALEN

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

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**PROFIELEN [mm]**

| Prof. | Omschrijving | Materiaal | Oppervlak   | Traagheid   | Vormf. |
|-------|--------------|-----------|-------------|-------------|--------|
| 1     | IPE600       | 1:S235    | 1.5600e+004 | 9.2080e+008 | 0.00   |
| 2     | HEA180       | 1:S235    | 4.5300e+003 | 2.5100e+007 | 0.00   |
| 3     | HEB200       | 1:S235    | 7.8100e+003 | 5.6960e+007 | 0.00   |
| 4     | IPE500       | 1:S235    | 1.1550e+004 | 4.8200e+008 | 0.00   |
| 5     | HEA260       | 1:S235    | 8.6800e+003 | 1.0460e+008 | 0.00   |

**PROFIELEN vervolg [mm]**

| Prof. | Staaftype | Breedte | Hoogte | e     | Type | b1 | h1 | b2 | h2 |
|-------|-----------|---------|--------|-------|------|----|----|----|----|
| 1     | 0:Normaal | 220     | 600    | 300.0 |      |    |    |    |    |
| 2     | 0:Normaal | 180     | 171    | 85.5  |      |    |    |    |    |
| 3     | 0:Normaal | 200     | 200    | 100.0 |      |    |    |    |    |
| 4     | 0:Normaal | 200     | 500    | 250.0 |      |    |    |    |    |
| 5     | 0:Normaal | 260     | 250    | 125.0 |      |    |    |    |    |

**KNOPEN**

| Knoop | X      | Z     | Knoop | X      | Z     |
|-------|--------|-------|-------|--------|-------|
| 1     | -4.910 | 0.000 | 6     | 19.644 | 7.620 |
| 2     | -4.910 | 7.620 | 7     | 25.448 | 0.000 |
| 3     | 7.360  | 8.740 | 8     | 25.448 | 3.400 |
| 4     | 19.644 | 0.000 | 9     | 25.448 | 7.140 |
| 5     | 19.644 | 3.400 | 10    | 25.448 | 8.740 |
| 11    | 39.448 | 0.000 |       |        |       |
| 12    | 39.448 | 5.835 |       |        |       |

**STAVEN**

| St. | kl | kj | Profiel  | Aansl.i | Aansl.j | Lengte Opm. |
|-----|----|----|----------|---------|---------|-------------|
| 1   | 1  | 2  | 2:HEA180 | NDM     | NDM     | 7.620       |
| 2   | 2  | 3  | 1:IPE600 | NDV2000 | NDM     | 12.321      |
| 3   | 3  | 6  | 1:IPE600 | NDM     | NDV2000 | 12.335      |
| 4   | 5  | 4  | 2:HEA180 | NDM     | NDM     | 3.400       |
| 5   | 6  | 5  | 2:HEA180 | NDM     | NDM     | 4.220       |
| 6   | 5  | 8  | 5:HEA260 | ND-     | ND-     | 5.804       |
| 7   | 6  | 10 | 2:HEA180 | ND-     | ND-     | 5.911       |
| 8   | 8  | 7  | 3:HEB200 | NDM     | NDM     | 3.400       |
| 9   | 9  | 8  | 3:HEB200 | NDM     | NDM     | 3.740       |
| 10  | 10 | 9  | 3:HEB200 | NDM     | NDM     | 1.600       |
| 11  | 9  | 12 | 4:IPE500 | NDM     | NDM     | 14.061      |
| 12  | 12 | 11 | 3:HEB200 | NDM     | NDM     | 5.835       |

**VASTE STEUNPUNTEN**

| Nr. | knoop | Kode | XZR | 1=vast | 0=vrij |
|-----|-------|------|-----|--------|--------|
| 1   | 1     | 110  |     |        |        |
| 2   | 4     | 110  |     |        |        |
| 3   | 7     | 111  |     |        |        |
| 4   | 11    | 111  |     |        |        |

**VEREN**

| Veer | Knoop | Richting    | Veerwaarde  | Ondergrens | Bovengrens |
|------|-------|-------------|-------------|------------|------------|
| 1    | 2     | 1:X-transl. | 1.0000e+003 | 0.000      | 0.000      |

**BELASTINGBREEDTEN**

| Staaft | Breedte-i | Breedte-j | Staaft | Breedte-i | Breedte-j |
|--------|-----------|-----------|--------|-----------|-----------|
| 1      | 4.900     | 4.900     | 6      | 4.900     | 4.900     |
| 2      | 5.390     | 5.390     | 7      | 5.390     | 5.390     |
| 3      | 5.390     | 5.390     | 8      | 4.900     | 4.900     |
| 4      | 4.900     | 4.900     | 9      | 4.900     | 4.900     |
| 5      | 4.900     | 4.900     | 10     | 4.900     | 4.900     |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**BELASTINGBREEDTEN**

| Staal Breedte-i | Breedte-j | Staal Breedte-i | Breedte-j |
|-----------------|-----------|-----------------|-----------|
| 11              | 5.390     | 5.390           |           |
| 12              | 4.900     | 4.900           |           |

**BELASTINGCOMBINATIE GENERATOR ALGEMEEN**

Gebruikte norm.....: NEN 6702 december 2001  
 Gebouw type .....: Sportfunctie.  
 Veiligheidsklasse.....: 3 Referentieperiode: 50  
 Gegeneerde belastinggevallen.: Wind van links  
                                       : Wind van rechts  
                                       : Sneeuw  
 Gebouwhoogte.....: 8.740  
 Niveau hoogte aansl. terrein...: 0.000

**WINDBELASTINGEN**

8.6.2 Berekening Pw  
 Wind gebied in nederland: III  
 Terrein bebouwing.....: bebouwd

8.6.2.4 Gemiddelde dwarsafmeting (b). 44.000

Factoren volgens bijlage A1 tabel 10

|                                           | onbebouwd        | bebouwd |
|-------------------------------------------|------------------|---------|
| Wrijvingssnelh. $u^*$ [m/s]:              | 2.250            | 2.600   |
| Ruwheidslengte $z_0$ ...[m]:              | 0.300            | 0.700   |
| Verpl.hoogte $d_w$ ....[m]:               | 0.000            | 3.500   |
| Factor k .....[-]:                        | 1.000            | 0.900   |
| Stuwdruk $p_w$ .....[kN/m <sup>2</sup> ]: | 0.455 op hoogte: | 8.740   |

8.6.3 Berekening Cdim:

|                           | links loodrecht | rechts |
|---------------------------|-----------------|--------|
| Verticale afmeting h [m]: | 8.740           | 8.740  |
| Gemiddelde breedte b [m]: | 44.000          | 44.000 |
| Geeft een Cdim.....:      | 0.901           | 0.901  |

Geen openingen.

Dit geeft de volgende vormfactoren Cpi bij:

Wind van links.....: 0.30 en -0.30  
 Wind van loodrecht.....: 0.30 en -0.30  
 Wind van rechts.....: 0.30 en -0.30

8.6.4.5 Vormfactor voor windwrijving Cf: 0.020

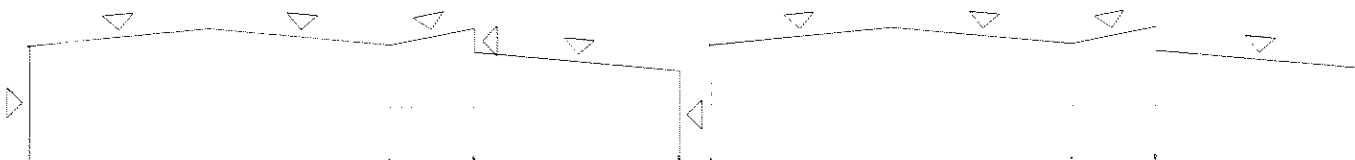
**STAFTYPEN**

| Type             | staven     |
|------------------|------------|
| 1:Vloer.         | : 6        |
| 4:Wand / kolom.  | : 4,5,8,9  |
| 5:Linker gevel.  | : 1        |
| 6:Rechter gevel. | : 10,12    |
| 7:Dak.           | : 2,3,7,11 |

**LASTVELDEN**

Wind staven

Sneeuw staven



Project.: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

## Wind indexen

| Index | Cdim  | Cindex | Pw breedte  | Qw    | Hoek(en)   |  |
|-------|-------|--------|-------------|-------|------------|--|
| Qw1   | 0.901 | 0.300  | 0.455 4.900 | 0.603 | -90.0 90.0 |  |
| Qw2   | 0.901 | 0.800  | 0.455 4.900 | 1.608 | 90.0       |  |
| Qw3   | 0.901 | 0.300  | 0.455 5.390 | 0.663 | -10.9 10.9 |  |
| Qw4   | 0.901 | 0.700  | 0.455 5.390 | 1.548 | 5.2 10.9   |  |
| Qw5   | 0.901 | 0.400  | 0.455 5.390 | 0.884 | -5.3 5.3   |  |
| Qw6   | 0.901 | 0.020  | 0.455 5.390 | 0.044 | -5.2 5.3   |  |
| Qw7   | 0.901 | 0.400  | 0.455 4.900 | 0.804 | -90.0      |  |
| Qw8   | 0.901 | 0.686  | 0.455 5.390 | 1.517 | -10.9      |  |

## Sneeuw indexen

| Index art | Ci    | Psn  | red. posfac | breedte | Qs    | Hoek |
|-----------|-------|------|-------------|---------|-------|------|
| Qs1 b)    | 0.800 | 0.70 | 1.00        | 5.390   | 3.018 | 5.2  |
| Qs2 c)    | 0.800 | 0.70 | 1.00        | 5.390   | 3.018 | 8.1  |
| Qs3 c)    | 1.015 | 0.70 | 1.00        | 5.390   | 3.830 | 8.1  |
| Qs4 b)    | 0.800 | 0.70 | 1.00        | 5.390   | 3.018 | 5.3  |

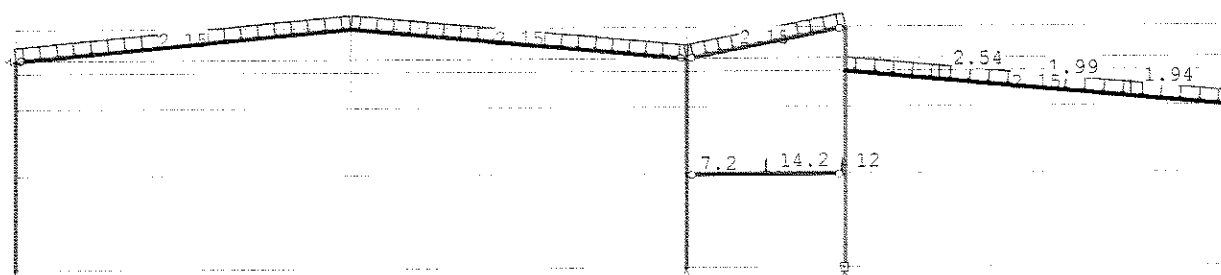
## BELASTINGGEVALLEN

| B.G. | Omschrijving                | Type | e.g.X | e.g.Z |
|------|-----------------------------|------|-------|-------|
| 1    | Permanente belasting        | 1    | 0.00  | -1.00 |
| 2    | Knik                        | 0    | 0.00  | 0.00  |
| 3    | Veranderlijk                | 2    | 0.00  | 0.00  |
| 4    | Wind van links overdruk A   | 8    | 0.00  | 0.00  |
| 5    | Wind van links onderdruk A  | 7    | 0.00  | 0.00  |
| 6    | Wind van rechts overdruk A  | 12   | 0.00  | 0.00  |
| 7    | Wind van rechts onderdruk A | 11   | 0.00  | 0.00  |
| 8    | Sneeuw A                    | 22   | 0.00  | 0.00  |

## BELASTINGEN

B.G:1 Permanente belasting

Eigengewicht alle staven. Richting:↓



## STAAFBELASTINGEN

B.G:1 Permanente belasting

| Last | Staaft | Type          | q1/p/m  | q2     | A      | B     | psi | psi-t | Opm |
|------|--------|---------------|---------|--------|--------|-------|-----|-------|-----|
| 1    | 2      | 1:QZLokaal    | -2.150  | -2.150 | 0.000  | 0.000 |     |       |     |
| 2    | 3      | 1:QZLokaal    | -2.150  | -2.150 | 0.000  | 0.000 |     |       |     |
| 3    | 7      | 1:QZLokaal    | -2.150  | -2.150 | 0.000  | 0.000 |     |       |     |
| 4    | 11     | 1:QZLokaal    | -2.150  | -2.150 | 0.000  | 0.000 |     |       |     |
| 5    | 6      | 8:PZLokaal    | -7.200  |        | 0.000  |       |     |       |     |
| 6    | 6      | 8:PZLokaal    | -14.200 |        | 2.900  |       |     |       |     |
| 7    | 6      | 8:PZLokaal    | -12.000 |        | 5.700  |       |     |       |     |
| 8    | 11     | 10:PZGepro.j. | -2.540  |        | 3.500  |       |     |       |     |
| 9    | 11     | 10:PZGepro.j. | -1.990  |        | 7.000  |       |     |       |     |
| 10   | 11     | 10:PZGepro.j. | -1.940  |        | 10.500 |       |     |       |     |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

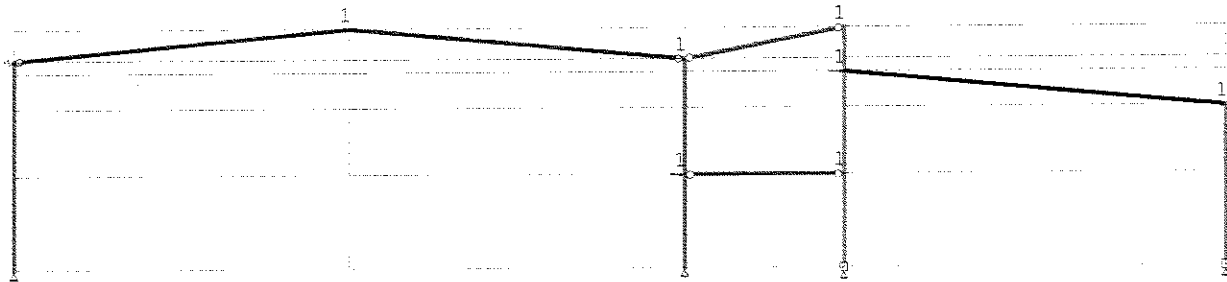
**REACTIES**

B.G:1 Permanente belasting

| Kn. | X     | Z       | M                        |
|-----|-------|---------|--------------------------|
| 1   | 1.40  | 43.97   |                          |
| 2   | 5.70  |         |                          |
| 4   | 2.38  | 68.71   |                          |
| 7   | -1.61 | 56.19   | -2.45                    |
| 11  | -7.48 | 29.72   | -16.62                   |
|     | 0.40  | 198.59  | : Som van de reacties    |
|     | -0.40 | -198.59 | : Som van de belastingen |

**BELASTINGEN**

B.G:2 Knik

**KNOOPBELASTINGEN**

B.G:2 Knik

| Last | Knoop | Richting | waarde |
|------|-------|----------|--------|
| 1    | 3     | X        | 1.000  |
| 2    | 5     | X        | 1.000  |
| 3    | 6     | X        | 1.000  |
| 4    | 8     | X        | 1.000  |
| 5    | 9     | X        | 1.000  |
| 6    | 10    | X        | 1.000  |
| 7    | 12    | X        | 1.000  |

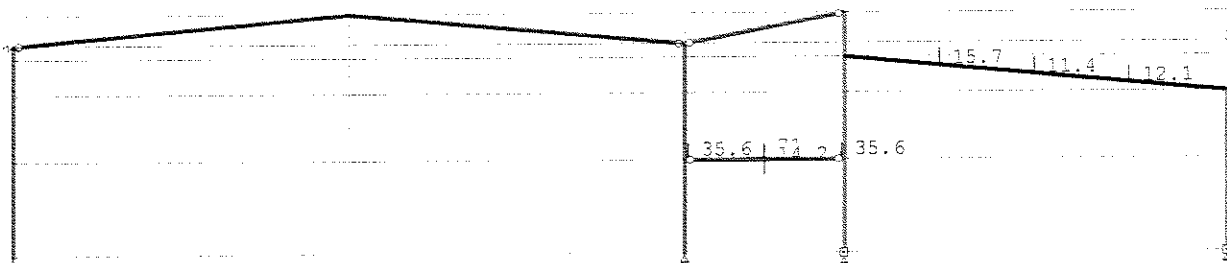
**REACTIES**

B.G:2 Knik

| Kn. | X     | Z     | M                        |
|-----|-------|-------|--------------------------|
| 1   | -0.04 | -0.08 |                          |
| 2   | -2.86 |       |                          |
| 4   | -0.08 | -0.11 |                          |
| 7   | -2.22 | -0.43 | -6.02                    |
| 11  | -1.80 | 0.61  | -5.60                    |
|     | -7.00 | 0.00  | : Som van de reacties    |
|     | 7.00  | 0.00  | : Som van de belastingen |

**BELASTINGEN**

B.G:3 Veranderlijk

**STAAFBELASTINGEN**

B.G:3 Veranderlijk

| Last | Staat | Type          | q1/p/m  | q2 | A     | B | psi  | psi-t | Opm |
|------|-------|---------------|---------|----|-------|---|------|-------|-----|
| 1    | 6     | 8:PZLokaal    | -35.600 |    | 0.100 |   | 0.25 | 1.00  |     |
| 2    | 6     | 8:PZLokaal    | -71.000 |    | 2.900 |   | 0.25 | 1.00  |     |
| 3    | 6     | 8:PZLokaal    | -35.600 |    | 5.700 |   | 0.25 | 1.00  |     |
| 4    | 6     | 9:PXLokaal    | -14.200 |    | 2.900 |   | 0.25 | 1.00  |     |
| 5    | 11    | 10:PZGepro.j. | -15.700 |    | 3.500 |   | 1.00 | 1.00  |     |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**STAAFBELASTINGEN**

B.G:3 Veranderlijk

| Last | Staat | Type         | q1/p/m  | q2     | A    | B    | psi | psi-t | Opm |
|------|-------|--------------|---------|--------|------|------|-----|-------|-----|
| 6    | 11    | 10:PZGeproj. | -11.400 | 7.000  | 1.00 | 1.00 |     |       |     |
| 7    | 11    | 10:PZGeproj. | -12.100 | 10.500 | 1.00 | 1.00 |     |       |     |

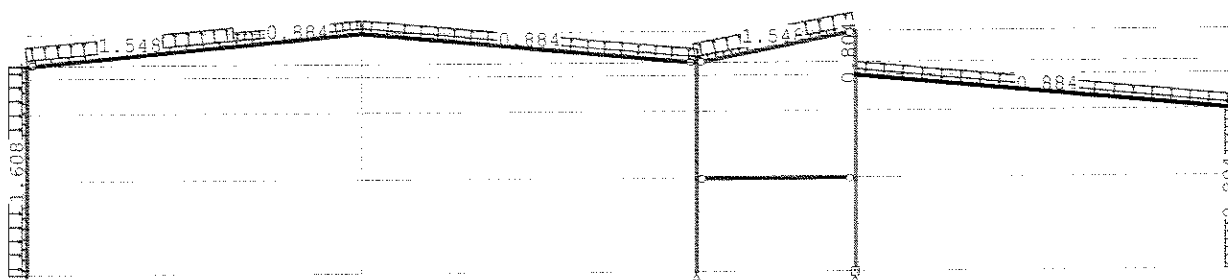
**REACTIES**

B.G:3 Veranderlijk

| Kn. | X      | Z       | M                        |
|-----|--------|---------|--------------------------|
| 1   | 0.02   | -0.10   |                          |
| 2   | 1.85   |         |                          |
| 4   | 2.15   | 71.16   |                          |
| 7   | 11.69  | 92.29   | 27.53                    |
| 11  | -1.50  | 18.05   | 1.62                     |
|     | 14.20  | 181.40  | : Som van de reacties    |
|     | -14.20 | -181.40 | : Som van de belastingen |

**BELASTINGEN**

B.G:4 Wind van links overdruk A

**STAAFBELASTINGEN**

B.G:4 Wind van links overdruk A

| Staat | Type       | Index | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|-------|------------|-------|--------|--------|-------|-------|------|-------|-----|
| 1     | 1:QZLokaal | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1     | 1:QZLokaal | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2     | 1:QZLokaal | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2     | 1:QZLokaal | Qw4   | 1.548  | 1.548  | 0.000 | 4.701 | 0.00 | 1.00  |     |
| 2     | 1:QZLokaal | Qw5   | 0.884  | 0.884  | 7.620 | 0.000 | 0.00 | 1.00  |     |
| 2     | 2:QXLokaal | Qw6   | 0.044  | 0.044  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3     | 1:QZLokaal | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3     | 1:QZLokaal | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3     | 2:QXLokaal | Qw6   | 0.044  | 0.044  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7     | 1:QZLokaal | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7     | 1:QZLokaal | Qw4   | 1.548  | 1.548  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10    | 1:QZLokaal | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10    | 1:QZLokaal | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11    | 1:QZLokaal | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11    | 1:QZLokaal | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12    | 1:QZLokaal | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12    | 1:QZLokaal | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |

**REACTIES**

B.G:4 Wind van links overdruk A

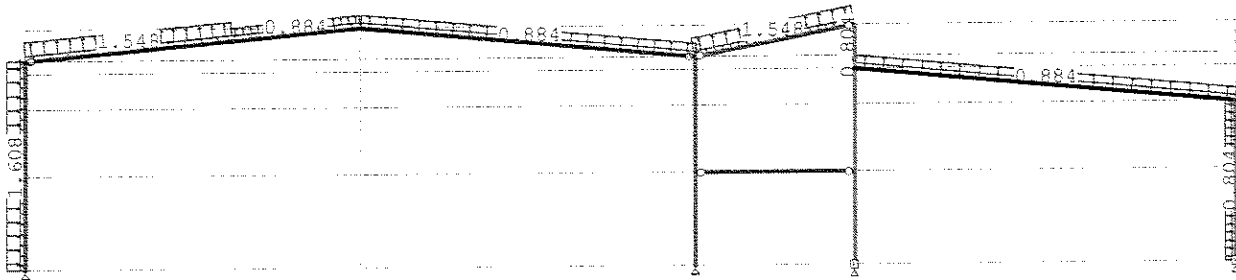
| Kn. | X      | Z      | M                        |
|-----|--------|--------|--------------------------|
| 1   | -4.18  | -23.12 |                          |
| 2   | -8.09  |        |                          |
| 4   | -1.04  | -26.85 |                          |
| 7   | -0.99  | -16.52 | -5.14                    |
| 11  | -4.00  | -11.04 | -6.16                    |
|     | -18.29 | -77.54 | : Som van de reacties    |
|     | 18.29  | 77.54  | : Som van de belastingen |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**BELASTINGEN**

B.G:5 Wind van links onderdruk A

**STAAFBELASTINGEN**

B.G:5 Wind van links onderdruk A

| Staat Type    | Index | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|---------------|-------|--------|--------|-------|-------|------|-------|-----|
| 1 1:QZLokaal  | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1 1:QZLokaal  | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw4   | 1.548  | 1.548  | 0.000 | 4.701 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 7.620 | 0.000 | 0.00 | 1.00  |     |
| 2 2:QXLokaal  | Qw6   | 0.044  | 0.044  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 2:QXLokaal  | Qw6   | 0.044  | 0.044  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw4   | 1.548  | 1.548  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10 1:QZLokaal | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10 1:QZLokaal | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12 1:QZLokaal | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12 1:QZLokaal | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |

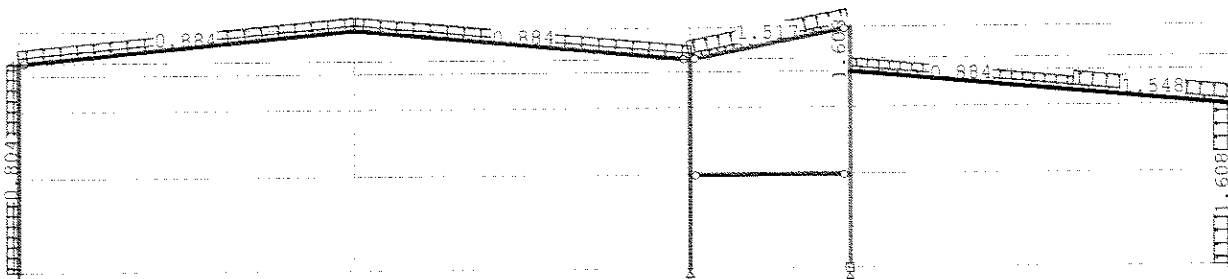
**REACTIES**

B.G:5 Wind van links onderdruk A

| Kn. | X      | Z      | M                        |
|-----|--------|--------|--------------------------|
| 1   | -7.72  | -6.76  |                          |
| 2   | -6.36  |        |                          |
| 4   | 0.00   | -5.67  |                          |
| 7   | -1.35  | -5.93  | -5.14                    |
| 11  | -2.84  | -0.33  | -7.72                    |
|     | -18.27 | -18.69 | : Som van de reacties    |
|     | 18.27  | 18.69  | : Som van de belastingen |

**BELASTINGEN**

B.G:6 Wind van rechts overdruk A

**STAAFBELASTINGEN**

B.G:6 Wind van rechts overdruk A

| Staat Type    | Index | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|---------------|-------|--------|--------|-------|-------|------|-------|-----|
| 12 1:QZLokaal | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12 1:QZLokaal | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw5   | 0.884  | 0.884  | 0.000 | 5.896 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw4   | 1.548  | 1.548  | 8.165 | 0.000 | 0.00 | 1.00  |     |
| 11 2:QXLokaal | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

## STAAFBELASTINGEN

B.G:6 Wind van rechts overdruk A

| Staaft Type   | Index | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|---------------|-------|--------|--------|-------|-------|------|-------|-----|
| 10 1:QZLokaal | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10 1:QZLokaal | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw8   | 1.517  | 1.517  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 2:QXLokaal  | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw3   | 0.663  | 0.663  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 2:QXLokaal  | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1 1:QZLokaal  | Qw1   | 0.603  | 0.603  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1 1:QZLokaal  | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |

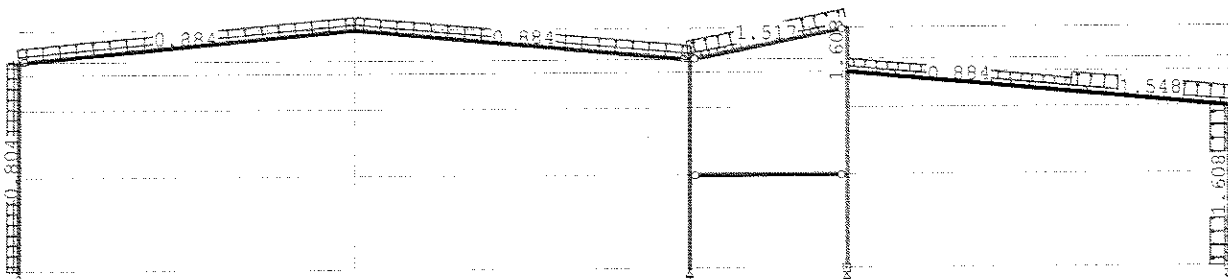
## REACTIES

B.G:6 Wind van rechts overdruk A

| Kn. | X      | Z      | M                        |
|-----|--------|--------|--------------------------|
| 1   | 4.20   | -18.96 |                          |
| 2   | 3.86   |        |                          |
| 4   | -1.31  | -25.73 |                          |
| 7   | 2.84   | -15.51 | 8.51                     |
| 11  | 10.36  | -16.08 | 22.14                    |
|     | 19.96  | -76.28 | : Som van de reacties    |
|     | -19.96 | 76.28  | : Som van de belastingen |

## BELASTINGEN

B.G:7 Wind van rechts onderdruk A



## STAAFBELASTINGEN

B.G:7 Wind van rechts onderdruk A

| Staaft Type   | Index | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|---------------|-------|--------|--------|-------|-------|------|-------|-----|
| 12 1:QZLokaal | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 12 1:QZLokaal | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw5   | 0.884  | 0.884  | 0.000 | 5.896 | 0.00 | 1.00  |     |
| 11 1:QZLokaal | Qw4   | 1.548  | 1.548  | 8.165 | 0.000 | 0.00 | 1.00  |     |
| 11 2:QXLokaal | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10 1:QZLokaal | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 10 1:QZLokaal | Qw2   | -1.608 | -1.608 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 1:QZLokaal  | Qw8   | 1.517  | 1.517  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 2:QXLokaal  | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw3   | -0.663 | -0.663 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 1:QZLokaal  | Qw5   | 0.884  | 0.884  | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 2 2:QXLokaal  | Qw6   | -0.044 | -0.044 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1 1:QZLokaal  | Qw1   | -0.603 | -0.603 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 1 1:QZLokaal  | Qw7   | 0.804  | 0.804  | 0.000 | 0.000 | 0.00 | 1.00  |     |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

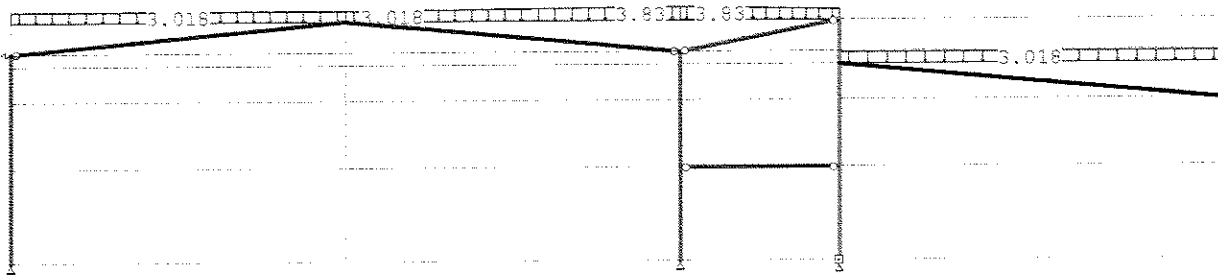
**REACTIES**

B.G:7 Wind van rechts onderdruk A

| Kn. | X      | Z      | M                        |
|-----|--------|--------|--------------------------|
| 1   | 0.67   | -2.60  |                          |
| 2   | 5.59   |        |                          |
| 4   | -0.27  | -4.55  |                          |
| 7   | 2.48   | -4.92  | 8.51                     |
| 11  | 11.52  | -5.36  | 20.58                    |
|     | 19.98  | -17.43 | : Som van de reacties    |
|     | -19.98 | 17.43  | : Som van de belastingen |

**BELASTINGEN**

B.G:8 Sneeuw A

**STAAFBELASTINGEN**

B.G:8 Sneeuw A

| Staaft Type    | Index   | q1/p/m | q2     | A     | B     | psi  | psi-t | Opm |
|----------------|---------|--------|--------|-------|-------|------|-------|-----|
| 2 3:QZgeProj.  | Qs1     | -3.018 | -3.018 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 3 3:QZgeProj.  | Qs2 Qs3 | -3.018 | -3.830 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 7 3:QZgeProj.  | Qs3 Qs2 | -3.830 | -3.018 | 0.000 | 0.000 | 0.00 | 1.00  |     |
| 11 3:QZgeProj. | Qs4     | -3.018 | -3.018 | 0.000 | 0.000 | 0.00 | 1.00  |     |

**REACTIES**

B.G:8 Sneeuw A

| Kn. | X     | Z       | M                        |
|-----|-------|---------|--------------------------|
| 1   | 1.31  | 37.68   |                          |
| 2   | 5.52  |         |                          |
| 4   | 2.01  | 52.06   |                          |
| 7   | -2.09 | 29.00   | -4.15                    |
| 11  | -6.75 | 22.49   | -15.57                   |
|     | 0.00  | 141.23  | : Som van de reacties    |
|     | 0.00  | -141.23 | : Som van de belastingen |

**BELASTINGCOMBINATIES**

| BC Type  | BG Gen. | Factor | BG Gen. | Factor | BG Gen. | Factor | BG Gen. | Factor |
|----------|---------|--------|---------|--------|---------|--------|---------|--------|
| 1 Fund.  | 1 Perm  | 1.20   | 3 Extr  | 1.50   |         |        |         |        |
| 2 Fund.  | 1 Perm  | 1.20   | 5 Extr  | 1.50   | 3 Extr  | 1.50   |         |        |
| 3 Fund.  | 1 Perm  | 1.20   | 4 Extr  | 1.50   | 3 Extr  | 1.50   |         |        |
| 4 Fund.  | 1 Perm  | 1.20   | 7 Extr  | 1.50   | 3 Extr  | 1.50   |         |        |
| 5 Fund.  | 1 Perm  | 1.20   | 6 Extr  | 1.50   | 3 Extr  | 1.50   |         |        |
| 6 Fund.  | 1 Perm  | 1.20   | 8 Extr  | 1.50   | 3 Extr  | 1.50   |         |        |
| 7 Fund.  | 1 Perm  | 1.35   |         |        |         |        |         |        |
| 8 Inc.   | 1 Perm  | 1.00   | 3 Extr  | 1.00   |         |        |         |        |
| 9 Inc.   | 1 Perm  | 1.00   | 5 Extr  | 1.00   | 3 Extr  | 1.00   |         |        |
| 10 Inc.  | 1 Perm  | 1.00   | 4 Extr  | 1.00   | 3 Extr  | 1.00   |         |        |
| 11 Inc.  | 1 Perm  | 1.00   | 7 Extr  | 1.00   | 3 Extr  | 1.00   |         |        |
| 12 Inc.  | 1 Perm  | 1.00   | 6 Extr  | 1.00   | 3 Extr  | 1.00   |         |        |
| 13 Inc.  | 1 Perm  | 1.00   | 8 Extr  | 1.00   | 3 Extr  | 1.00   |         |        |
| 14 Perm. | 1 Perm  | 1.00   |         |        |         |        |         |        |

Project...: 04-0434/lk

Onderdeel: Hoofdspann as 5 t/m 8

**GUNSTIGE WERKING PERMANENTE BELASTINGEN**

BC Staven met gunstige werking

- 1 Geen
- 2 2,3,7,11
- 3 2,3,7,11
- 4 2,3,7,11
- 5 2,3,7,11
- 6 Geen
- 7 Geen

**REACTIES**

B.C:1 Sterkte

| Kn. | X      | Z       | M                        |
|-----|--------|---------|--------------------------|
| 1   | 1.71   | 52.62   |                          |
| 2   | 9.62   |         |                          |
| 4   | 6.07   | 189.18  |                          |
| 7   | 15.60  | 205.86  | 38.36                    |
| 11  | -11.23 | 62.74   | -17.52                   |
|     | 21.78  | 510.41  | : Som van de reacties    |
|     | -21.78 | -510.41 | : Som van de belastingen |

**REACTIES**

B.C:2 Sterkte

| Kn. | X-min  | X-max  | Z-min  | Z-max  | M-min  | M-max  |
|-----|--------|--------|--------|--------|--------|--------|
| 1   | -10.29 | -9.87  | 30.10  | 42.48  |        |        |
| 2   | -1.63  | 0.08   |        |        |        |        |
| 4   | 5.36   | 6.08   | 165.83 | 180.68 |        |        |
| 7   | 13.57  | 14.06  | 187.97 | 196.96 | 30.64  | 31.38  |
| 11  | -15.49 | -13.25 | 54.41  | 62.25  | -29.11 | -24.12 |

**REACTIES**

B.C:3 Sterkte

| Kn. | X-min  | X-max  | Z-min  | Z-max  | M-min  | M-max  |
|-----|--------|--------|--------|--------|--------|--------|
| 1   | -4.99  | -4.56  | 5.56   | 17.94  |        |        |
| 2   | -4.22  | -2.51  |        |        |        |        |
| 4   | 3.81   | 4.52   | 134.05 | 148.90 |        |        |
| 7   | 14.12  | 14.60  | 172.08 | 181.08 | 30.64  | 31.38  |
| 11  | -17.22 | -14.98 | 38.34  | 46.18  | -26.76 | -21.78 |

**REACTIES**

B.C:4 Sterkte

| Kn. | X-min | X-max | Z-min  | Z-max  | M-min | M-max |
|-----|-------|-------|--------|--------|-------|-------|
| 1   | 2.29  | 2.71  | 36.34  | 48.72  |       |       |
| 2   | 16.29 | 18.00 |        |        |       |       |
| 4   | 4.96  | 5.67  | 167.51 | 182.36 |       |       |
| 7   | 19.32 | 19.80 | 189.49 | 198.48 | 51.12 | 51.86 |
| 11  | 6.05  | 8.29  | 46.86  | 54.70  | 13.34 | 18.33 |

**REACTIES**

B.C:5 Sterkte

| Kn. | X-min | X-max | Z-min  | Z-max  | M-min | M-max |
|-----|-------|-------|--------|--------|-------|-------|
| 1   | 7.59  | 8.01  | 11.80  | 24.18  |       |       |
| 2   | 13.70 | 15.41 |        |        |       |       |
| 4   | 3.40  | 4.12  | 135.74 | 150.59 |       |       |
| 7   | 19.87 | 20.35 | 173.60 | 182.60 | 51.12 | 51.86 |
| 11  | 4.31  | 6.55  | 30.79  | 38.63  | 15.69 | 20.67 |

**REACTIES**

B.C:6 Sterkte

| Kn. | X      | Z       | M                        |
|-----|--------|---------|--------------------------|
| 1   | 3.68   | 109.14  |                          |
| 2   | 17.89  |         |                          |
| 4   | 9.08   | 267.28  |                          |
| 7   | 12.47  | 249.36  | 32.13                    |
| 11  | -21.35 | 96.48   | -40.88                   |
|     | 21.78  | 722.26  | : Som van de reacties    |
|     | -21.78 | -722.26 | : Som van de belastingen |

Project.: 04-0434/lk

Onderdeel: Hoofdspann as 5 t/m 8

## REACTIES

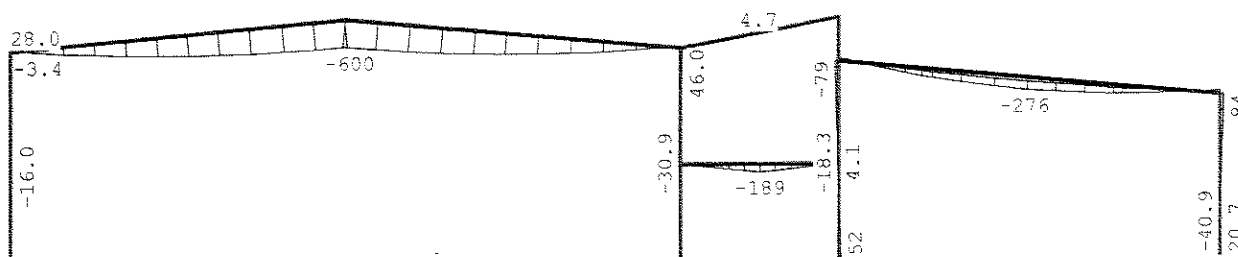
B.C:7 Sterkte

| Kn. | X      | Z       | M                        |
|-----|--------|---------|--------------------------|
| 1   | 1.89   | 59.36   |                          |
| 2   | 7.70   |         |                          |
| 4   | 3.21   | 92.75   |                          |
| 7   | -2.17  | 75.86   | -3.30                    |
| 11  | -10.09 | 40.12   | -22.44                   |
|     | 0.54   | 268.10  | : Som van de reacties    |
|     | -0.54  | -268.10 | : Som van de belastingen |

## OMHULLENDE VAN DE FUNDAMENTELE COMBINATIES

## MOMENTEN

Fundamentele combinatie



## STAAFKRACHTEN

Fundamentele combinatie

| St. | Kn. | Pos.  | NXi/NXj |    |        | Dzi/DZj |         |     | MYi/MYj |    |         |
|-----|-----|-------|---------|----|--------|---------|---------|-----|---------|----|---------|
|     |     |       | Min     | BC | Max    | Min     | BC      | Max | Min     | BC | Max     |
| 1   | 1   |       | -109.14 | 6  | -5.56  | 3       | -10.29  | 2   | 8.01    | 5  | 0.00    |
| 1   | 2   | 0.054 | -108.26 | 6  | -4.68  | 3       | -3.48   | 2   | 3.68    | 5  | -14.13  |
| 1   | 3   | 1.02  | -107.82 | 6  | -4.24  | 3       | -0.31   | 3   | 3.68    | 6  | -15.95  |
| 1   | 3   | 4.75  | -107.66 | 6  | -4.08  | 3       | 0.25    | 3   | 3.68    | 6  | -15.72  |
| 1   | 3   | 7.95  | -107.52 | 6  | -3.94  | 3       | -0.42   | 5   | 3.68    | 6  | -15.15  |
| 1   | 4   | 0.83  | -107.40 | 6  | -3.82  | 3       | -1.03   | 5   | 3.68    | 6  | -14.36  |
| 1   | 4   | 1.07  | -107.39 | 6  | -3.81  | 3       | -1.08   | 5   | 3.76    | 2  | -14.27  |
| 1   | 6   | 6.14  | -106.32 | 6  | -2.74  | 3       | -6.37   | 5   | 12.07   | 2  | -0.00   |
| 1   | 6   | 9.51  | -106.18 | 6  | -2.60  | 3       | -7.08   | 5   | 13.19   | 2  | 1.77    |
| 1   | 7   | 1.92  | -106.07 | 6  | -2.49  | 3       | -7.59   | 5   | 13.99   | 2  | 0.00    |
| 1   | 2   |       | -105.89 | 6  | -2.31  | 3       | -8.49   | 5   | 15.41   | 2  | -3.45   |
| 2   | 2   |       | -31.11  | 6  | -2.48  | 3       | -103.49 | 6   | -2.09   | 3  | -3.45   |
| 2   | 2   | 3.78  | -29.81  | 6  | -2.40  | 3       | -83.20  | 6   | -2.77   | 3  | -193.97 |
| 2   | 5   | 9.77  | -27.86  | 6  | -2.28  | 3       | -52.49  | 6   | -3.79   | 3  | -438.10 |
| 2   | 12  | 1.27  | -24.52  | 6  | -2.07  | 3       | -1.05   | 3   | 1.41    | 4  | -599.53 |
| 2   | 3   |       | -24.41  | 6  | -2.07  | 3       | -0.92   | 3   | 2.13    | 4  | -599.37 |
| 3   | 3   |       | -24.31  | 6  | -1.87  | 3       | -2.80   | 2   | -0.00   | 5  | -599.37 |
| 3   | 0   | 3.27  | -24.48  | 6  | -1.92  | 3       | -1.72   | 2   | 0.60    | 7  | -599.82 |
| 3   | 1   | 7.92  | -25.29  | 6  | -2.17  | 3       | 0.00    | 3   | 12.66   | 6  | -590.57 |
| 3   | 11  | 2.37  | -30.97  | 6  | -3.74  | 3       | 6.71    | 3   | 99.28   | 6  | -68.81  |
| 3   | 11  | 9.29  | -31.42  | 6  | -3.85  | 3       | 7.21    | 3   | 105.97  | 6  | -0.00   |
| 3   | 6   |       | -31.68  | 6  | -3.92  | 3       | 7.50    | 3   | 109.92  | 6  | 5.55    |
| 4   | 5   |       | -265.83 | 6  | -91.12 | 7       | 3.21    | 7   | 9.08    | 6  | -30.88  |
| 4   | 4   |       | -267.28 | 6  | -92.75 | 7       | 3.21    | 7   | 9.08    | 6  | -0.00   |
| 5   | 6   |       | -137.51 | 6  | -4.28  | 3       | -18.22  | 6   | -4.06   | 5  | 5.55    |
| 5   | 1   | 3.68  | -138.09 | 6  | -4.86  | 3       | -18.22  | 6   | -4.06   | 5  | 0.00    |
| 5   | 2   | 8.22  | -138.71 | 6  | -5.48  | 3       | -18.22  | 6   | -4.06   | 5  | -6.49   |
| 5   | 5   |       | -139.31 | 6  | -6.08  | 3       | -18.22  | 6   | -4.06   | 5  | -30.88  |
| 6   | 5   |       | -27.31  | 6  | -7.46  | 5       | -117.88 | 1   | -12.55  | 7  | 0.00    |
| 6   | 2   | 9.00  | -27.31  | 6  | -7.46  | 5       | -62.11  | 1   | -9.88   | 7  | -188.89 |
| 6   | 2   | 9.00  | -11.02  | 7  | 13.84  | 5       | 9.29    | 7   | 61.43   | 1  | -188.89 |
| 6   | 8   |       | -11.02  | 7  | 13.84  | 5       | 28.16   | 7   | 131.61  | 1  | -0.00   |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

## STAAFKRACHTEN

Fundamentele combinatie

| St. | Kn.    | Pos. | NXi/NXj |    |        | DZi/DZj |        |    | MYi/MYj |    |         |    |        |    |
|-----|--------|------|---------|----|--------|---------|--------|----|---------|----|---------|----|--------|----|
|     |        |      | Min     | BC | Max    | BC      | Min    | BC | Max     | BC | Min     | BC | Max    | BC |
| 7   | 6      |      | -8.63   | 4  | 2.33   | 3       | -24.08 | 6  | 3.15    | 3  | 0.00    | 6  | 0.00   | 3  |
| 7   | 2.919  |      | -8.39   | 4  | 2.51   | 3       | -0.12  | 7  | 0.04    | 3  | -34.73  | 6  | 4.66   | 3  |
| 7   | 2.923  |      | -8.39   | 4  | 2.51   | 3       | -0.11  | 7  | 0.03    | 3  | -34.73  | 6  | 4.66   | 3  |
| 7   | 2.956  |      | -8.39   | 4  | 2.51   | 3       | 0.00   | 7  | 0.29    | 6  | -34.73  | 6  | 4.66   | 3  |
| 7   | 10     |      | -8.15   | 4  | 2.69   | 3       | -3.15  | 3  | 22.92   | 6  | -0.00   | 6  | 0.00   | 3  |
| 8   | 8      |      | -246.86 | 6  | -73.05 | 7       | -2.17  | 7  | 20.35   | 5  | -18.27  | 3  | 4.08   | 7  |
| 8   | 0.867  |      | -247.50 | 6  | -73.76 | 7       | -2.17  | 7  | 20.35   | 5  | -5.61   | 3  | 2.20   | 7  |
| 8   | 1.251  |      | -247.78 | 6  | -74.08 | 7       | -2.17  | 7  | 20.35   | 5  | 0.00    | 3  | 9.61   | 4  |
| 8   | 1.333  |      | -247.84 | 6  | -74.15 | 7       | -2.17  | 7  | 20.35   | 5  | 1.19    | 3  | 11.18  | 4  |
| 8   | 1.879  |      | -248.24 | 6  | -74.60 | 7       | -2.17  | 7  | 20.35   | 5  | 0.00    | 7  | 21.73  | 4  |
| 8   | 7      |      | -249.36 | 6  | -75.86 | 7       | -2.17  | 7  | 20.35   | 5  | -3.30   | 7  | 51.86  | 4  |
| 9   | 9      |      | -112.50 | 6  | -35.23 | 3       | 2.03   | 3  | 18.48   | 6  | -79.40  | 6  | -25.85 | 3  |
| 9   | 3.279  |      | -114.91 | 6  | -37.64 | 3       | 2.03   | 3  | 18.48   | 6  | -20.54  | 4  | -0.00  | 7  |
| 9   | 8      |      | -115.25 | 6  | -37.98 | 3       | 2.03   | 3  | 18.48   | 6  | -18.27  | 3  | 4.08   | 7  |
| 10  | 10     |      | -22.14  | 6  | 2.69   | 5       | -8.96  | 4  | 3.24    | 3  | -0.00   | 4  | -0.00  | 3  |
| 10  | 0.351  |      | -22.40  | 6  | 2.44   | 5       | -7.80  | 4  | 2.50    | 3  | -2.94   | 4  | 1.01   | 3  |
| 10  | 9      |      | -23.32  | 6  | 1.52   | 5       | -8.18  | 2  | 4.38    | 5  | -12.70  | 2  | 5.08   | 5  |
| 11  | 9      |      | -16.33  | 6  | 1.44   | 5       | -91.09 | 6  | -32.44  | 7  | 20.95   | 7  | 69.42  | 6  |
| 11  | 0.613  |      | -16.65  | 6  | 1.43   | 5       | -86.09 | 6  | -29.91  | 7  | -0.00   | 2  | 23.76  | 5  |
| 11  | 1.229  |      | -16.97  | 6  | 1.42   | 5       | -81.07 | 6  | -27.37  | 7  | -36.38  | 6  | -0.00  | 5  |
| 11  | 7.000  |      | -22.44  | 6  | -1.03  | 5       | -9.63  | 5  | -0.18   | 7  | -275.82 | 6  | -93.21 | 7  |
| 11  | 7.000  |      | -24.25  | 6  | -2.78  | 5       | 2.50   | 7  | 12.52   | 2  | -275.82 | 6  | -93.21 | 7  |
| 11  | 8.680  |      | -25.12  | 6  | -2.80  | 5       | 9.42   | 7  | 25.55   | 6  | -244.39 | 6  | -83.19 | 7  |
| 11  | 10.500 |      | -26.06  | 6  | -2.81  | 5       | 8.39   | 5  | 40.39   | 6  | -184.39 | 6  | -59.22 | 7  |
| 11  | 10.500 |      | -27.96  | 6  | -4.66  | 5       | 19.53  | 7  | 60.78   | 6  | -184.39 | 6  | -59.22 | 7  |
| 11  | 12.348 |      | -28.92  | 6  | -4.68  | 5       | 27.15  | 7  | 75.84   | 6  | -58.17  | 6  | -16.10 | 7  |
| 11  | 12.916 |      | -29.22  | 6  | -4.68  | 5       | 26.82  | 5  | 80.48   | 6  | -22.23  | 5  | -0.00  | 7  |
| 11  | 13.752 |      | -29.65  | 6  | -4.69  | 5       | 26.35  | 5  | 87.29   | 6  | 0.00    | 5  | 56.37  | 6  |
| 11  | 12     |      | -29.81  | 6  | -4.69  | 5       | 26.17  | 5  | 89.81   | 6  | 8.11    | 5  | 83.71  | 6  |
| 12  | 12     |      | -92.18  | 6  | -26.49 | 5       | -21.35 | 6  | -2.24   | 5  | 8.11    | 5  | 83.71  | 6  |
| 12  | 1.489  |      | -93.28  | 6  | -27.59 | 5       | -21.35 | 6  | -0.00   | 5  | 6.43    | 5  | 51.91  | 6  |
| 12  | 2.838  |      | -94.27  | 6  | -28.58 | 5       | -21.35 | 6  | 2.03    | 5  | 7.81    | 5  | 23.11  | 6  |
| 12  | 3.466  |      | -94.73  | 6  | -29.04 | 5       | -21.35 | 6  | 2.98    | 5  | 1.47    | 7  | 9.71   | 6  |
| 12  | 3.612  |      | -94.84  | 6  | -29.15 | 5       | -21.35 | 6  | 3.20    | 5  | 0.00    | 7  | 9.83   | 5  |
| 12  | 11     |      | -96.48  | 6  | -30.79 | 5       | -21.35 | 6  | 8.29    | 4  | -40.88  | 6  | 20.67  | 5  |

## REACTIES

Fundamentele combinatie

| Kn. | X-min  | X-max | Z-min | Z-max  | M-min  | M-max |
|-----|--------|-------|-------|--------|--------|-------|
| 1   | -10.29 | 8.01  | 5.56  | 109.14 |        |       |
| 2   | -4.22  | 18.00 |       |        |        |       |
| 4   | 3.21   | 9.08  | 92.75 | 267.28 |        |       |
| 7   | -2.17  | 20.35 | 75.86 | 249.36 | -3.30  | 51.86 |
| 11  | -21.35 | 8.29  | 30.79 | 96.48  | -40.88 | 20.67 |

TS/Raamwerken

Rel:3.61 27 okt 2004

Project.: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**STAALPROFIELEN - ALGEMENE GEGEVENS**

Stabiliteit: Classificatie gehele constructie: Ongeschoord  
 Belastinggeval m.b.t. bepaling kniklengte: 2=Knik  
 Aanpassing inkl. parameter C : Nee

Tweede-orde-effect:  
 Aan te houden verhouding  $n/(n-1)$   
 voor steunmomenten en verplaatsingen: 1.10

Doorbuiging en verplaatsing:  
 Aantal bouwlagen: 1  
 Gebouwtype: Overig  
 Toel. horiz. verplaatsing gehele gebouw:  $h/300$   
 Kleinste gevelhoogte [m]: 0.0

**MATERIAAL**

| Mat nr. | Profielnaam | Vloeisp. [N/mm <sup>2</sup> ] | Productie methode | Min. drsn. klasse |
|---------|-------------|-------------------------------|-------------------|-------------------|
| 1       | IPE600      | 235                           | Gewalst           | 1                 |
| 2       | HEA180      | 235                           | Gewalst           | 1                 |
| 3       | HEB200      | 235                           | Gewalst           | 1                 |
| 4       | IPE500      | 235                           | Gewalst           | 1                 |
| 5       | HEA260      | 235                           | Gewalst           | 1                 |

**KNIKSTABILITEIT**

| Staafl | $l_{sys}$ [m] | Classif. y sterke as | $l_{knik,y}$ [m] | Extra        |                      | $l_{knik,z}$ [m] | Extra        |  |
|--------|---------------|----------------------|------------------|--------------|----------------------|------------------|--------------|--|
|        |               |                      |                  | aanp. y [kN] | Classif. z zwakke as |                  | aanp. z [kN] |  |
| 1      | 7.620         | Geschoord            | 7.620            | 0.0          | Geschoord            | 7.620            | 0.0          |  |
| 2      | 12.321        | Geschoord            | 12.321           | 0.0          | Geschoord            | 6.200            | 0.0          |  |
| 3      | 12.335        | Geschoord            | 12.335           | 0.0          | Geschoord            | 6.200            | 0.0          |  |
| 5-4    | 7.620         | Geschoord            | 7.620            | 0.0          | Geschoord            | 3.400            | 0.0          |  |
| 6      | 5.804         | Geschoord            | 5.804            | 0.0          | Geschoord            | 5.804            | 0.0          |  |
| 7      | 5.911         | Geschoord            | 5.911            | 0.0          | Geschoord            | 5.911            | 0.0          |  |
| 9-8    | 7.140         | Ongeschoord          | 7.171            | 0.0          | Geschoord            | 7.140            | 0.0          |  |
| 10     | 1.600         | Ongeschoord          | 4.697            | 0.0          | Geschoord            | 1.600            | 0.0          |  |
| 11     | 14.061        | Ongeschoord          | 17.407           | 0.0          | Geschoord            | 4.600            | 0.0          |  |
| 12     | 5.835         | Ongeschoord          | 6.238            | 0.0          | Geschoord            | 5.835            | 0.0          |  |

**KIPSTABILITEIT**

| Staafl | Plts. aangr. | l gaffel [m] | Kipsteunafstanden [m] |         |
|--------|--------------|--------------|-----------------------|---------|
|        |              |              |                       |         |
| 1      | 1.0*h        | boven:       | 7.62                  | 7.620   |
|        |              | onder:       | 7.62                  | 7.620   |
| 2      | 1.0*h        | boven:       | 12.32                 | 4*3,08  |
|        |              | onder:       | 12.32                 | 12.321  |
| 3      | 1.0*h        | boven:       | 12.33                 | 4*3,084 |
|        |              | onder:       | 12.33                 | 12.335  |
| 5-4    | 0.5*h        | boven:       | 7.62                  | 7.620   |
|        |              | onder:       | 7.62                  | 7.620   |
| 6      | 1.0*h        | boven:       | 5.80                  | 2*2,902 |
|        |              | onder:       | 5.80                  | 2*2,902 |
| 7      | 1.0*h        | boven:       | 5.91                  | 5.911   |
|        |              | onder:       | 5.91                  | 5.911   |
| 9-8    | 1.0*h        | boven:       | 7.14                  | 7.140   |
|        |              | onder:       | 7.14                  | 7.140   |
| 10     | 1.0*h        | boven:       | 1.60                  | 1.600   |
|        |              | onder:       | 1.60                  | 1.600   |
| 11     | 1.0*h        | boven:       | 14.06                 | 3*4,687 |
|        |              | onder:       | 14.06                 | 14.061  |
| 12     | 1.0*h        | boven:       | 5.84                  | 5.835   |
|        |              | onder:       | 5.84                  | 5.835   |

Project...: 04-0434/lk

Onderdeel: Hoofdspant as 5 t/m 8

**TOETSING SPANNINGEN**

| Staafr | Mat | BC | Sit | Kl | Plaats | Norm | Artikel | Formule | Hoogste toetsing          | Opm. |
|--------|-----|----|-----|----|--------|------|---------|---------|---------------------------|------|
| nr.    |     |    |     |    |        |      |         |         | U.C. [N/mm <sup>2</sup> ] |      |

|     |   |   |   |   |        |      |        |          |       |     |
|-----|---|---|---|---|--------|------|--------|----------|-------|-----|
| 1   | 2 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-2) | 0.536 | 126 |
| 2   | 1 | 6 | 1 | 1 | Staafr | 6771 | 12.2   | (12.2-3) | 0.884 | 208 |
| 3   | 1 | 6 | 1 | 1 | Staafr | 6771 | 12.2   | (12.2-3) | 0.884 | 208 |
| 5-4 | 2 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-1) | 0.974 | 229 |
| 6   | 5 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-2) | 0.967 | 227 |
| 7   | 2 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-2) | 0.668 | 157 |
| 9-8 | 3 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-2) | 0.816 | 192 |
| 10  | 3 | 2 | 1 | 1 | Staafr | 6771 | 12.2   | (12.2-3) | 0.093 | 22  |
| 11  | 4 | 6 | 1 | 1 | Staafr | 6771 | 12.3.1 | (12.3-2) | 0.760 | 179 |
| 12  | 3 | 6 | 1 | 1 | Staafr | 6771 | 12.2   | (12.2-3) | 0.659 | 155 |

**TOETSING DOORBUIGING**

| Staafr | Soort | Mtg | Lengte | Overst | Zeeg | u <sub>rot</sub> | BC | Sit | u    | Toelaatbaar |
|--------|-------|-----|--------|--------|------|------------------|----|-----|------|-------------|
|        |       |     | [m]    | I      | J    | [mm]             |    |     | [mm] | [mm] *1     |

|    |       |    |       |   |   |           |    |        |        |               |
|----|-------|----|-------|---|---|-----------|----|--------|--------|---------------|
| 2  | Dak   | ss | 12.32 | N | N | 0.0-160.7 | 13 | 1 Eind | -160.7 | -98.6 2*0.004 |
|    |       | ss |       |   |   |           | 13 | 1 Bijk | -77.3  | -98.6 2*0.004 |
| 3  | Dak   | ss | 12.33 | N | N | 0.0-160.2 | 13 | 1 Eind | -160.2 | -98.7 2*0.004 |
|    |       | ss |       |   |   |           | 13 | 1 Bijk | -76.9  | -98.7 2*0.004 |
| 6  | Vloer | db | 5.80  | N | N | 0.0 -18.8 | 9  | 1 Eind | -18.8  | ±23.2 0.004   |
|    |       | db |       |   |   |           | 9  | 1 Bijk | -15.2  | ±17.4 0.003   |
| 7  | Dak   | db | 5.91  | N | N | 0.0 -19.2 | 13 | 1 Eind | -19.2  | -23.6 0.004   |
|    |       | db |       |   |   |           | 13 | 1 Bijk | -11.0  | -23.6 0.004   |
| 11 | Dak   | db | 14.06 | N | N | 0.0 -40.9 | 13 | 1 Eind | -40.9  | -56.2 0.004   |
|    |       | db |       |   |   |           | 13 | 1 Bijk | -26.6  | -56.2 0.004   |

**TOETSING HORIZONTALE VERPLAATSING**

| Staafr | BC | Sit | Lengte | u <sub>eind</sub> | Toelaatbaar |
|--------|----|-----|--------|-------------------|-------------|
|        |    |     | [m]    | [mm]              | [mm] [h/l]  |

|     |    |   |       |       |          |
|-----|----|---|-------|-------|----------|
| 1   | 13 | 1 | 7.620 | 15.8  | 25.4 300 |
| 5-4 | 13 | 1 | 7.620 | -14.6 | 25.4 300 |
| 9-8 | 11 | 1 | 7.140 | 12.6  | 23.8 300 |
| 10  | 13 | 1 | 1.600 | -14.4 | 5.3 300  |
| 12  | 12 | 1 | 5.835 | 11.4  | 19.4 300 |

**TOETSING HOR. VERPLAATSING GLOBAAL**

Er is een maximale horizontale verplaatsing van 0.0146 [m] gevonden bij knoop 6 en combinatie 13; belastingsituatie 1 (combinatietype 2). Bij een hoogte van 7.620 [m] levert dit h / 522 (toel.: h / 300).