Bijlagen: Draaiboek calamiteiten SomPop 2023

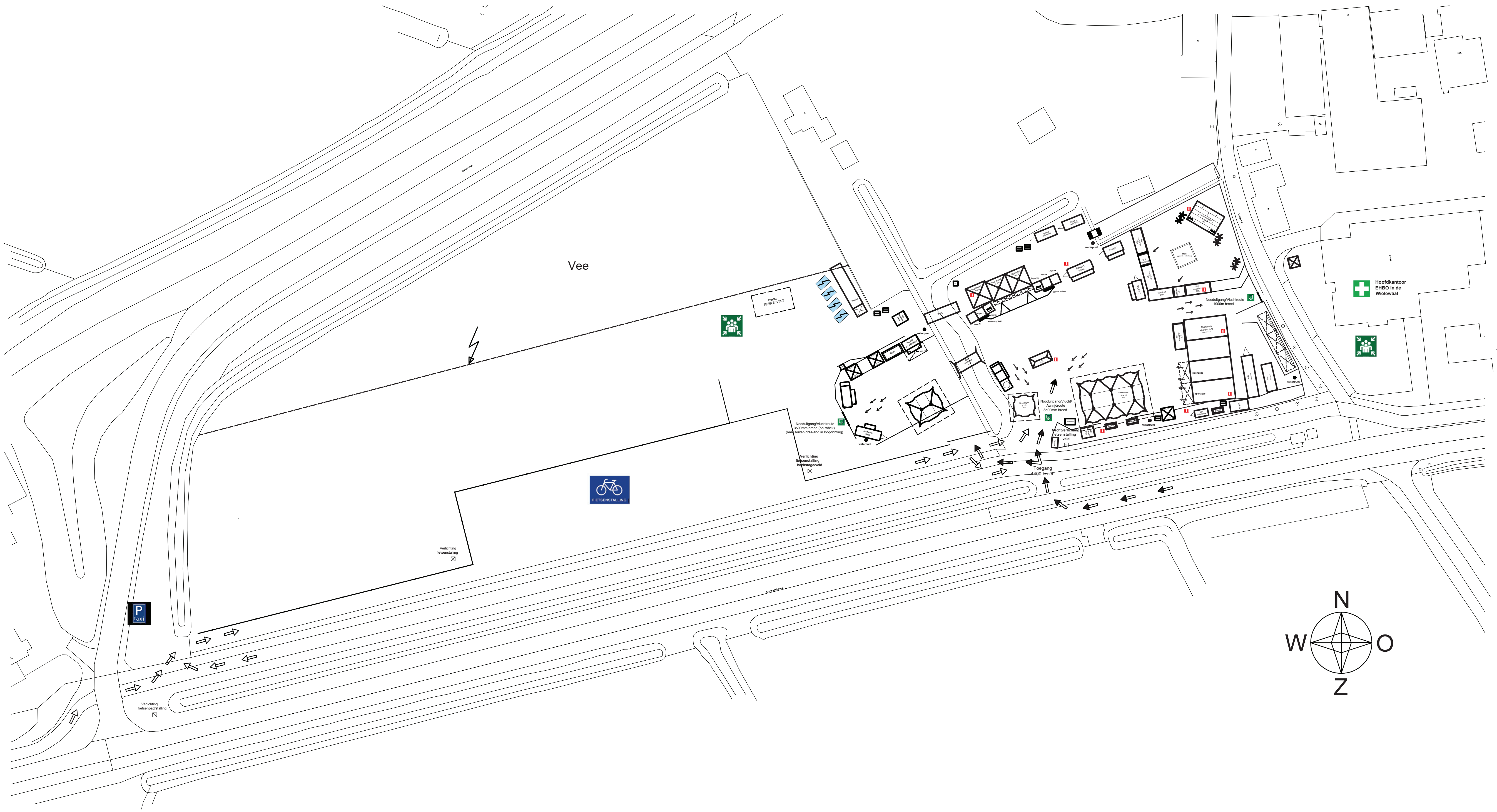
Stichting SomPop

KVK: 71064109

Zaterdag 1 juli 12.00 u : 00:00 u

Locatie: De Waal

Inhoudsopgave bijlagen:



entree bezoekers

vluchtroute

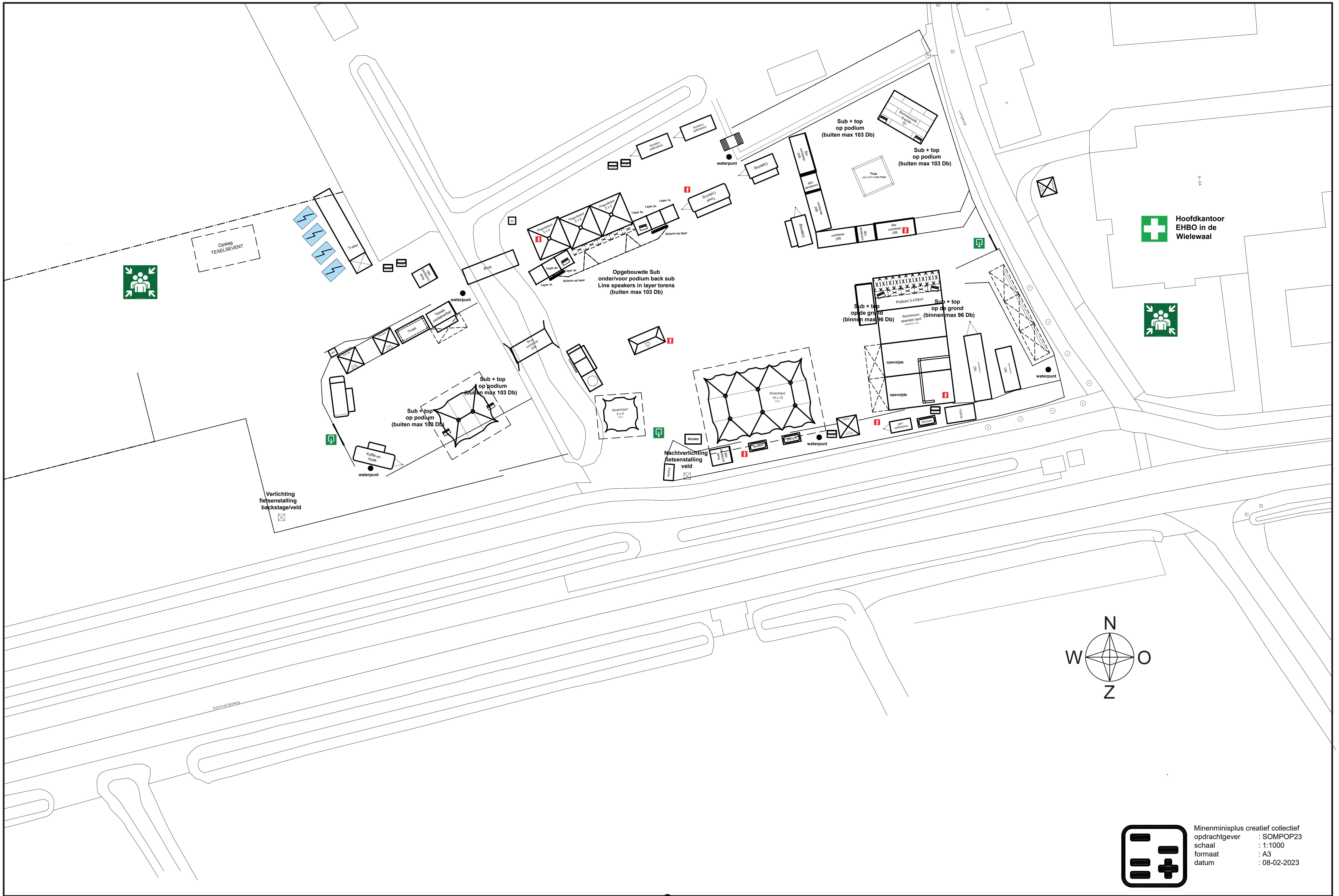
aanrijdroute hulpdiensten

nooduitgang

lichtmast 4st. lamp verstelbaar in schijnrichting

Minenminisplus creatief collectief

opdrachtgever	: SOMPOP23
schaal	: 1:1000
formaat	: A3
datum	: 08-02-2023


Opslag
TEXELSEVENT
Trailer
waterpunt
Sub + top
op podium
(buiten max 103 Db)
Opgebouwde Sub
onder/voor podium back sub
Line speakers in layer torens
(buiten max 103 Db)
Layer 1x
Layer 2x
Layer 3x
Catering
Truss
Stretchtent
10 x 15
Stretchtent
5 x 5
Koffie en
Koek
Munten
Nachtverlichting
fietsenstalling
veld
Verlichting
fietsenstalling
backstage/veld
Sub + top
op de grond
(binnen max 96 Db)
Podium 3 x10m1
Aluminium
spanten tent
openzijde
WC
Hoofdkantoor
EHBO in de
Wielewaal
N
W
O
Z
Minenminisplus creatief collectief
opdrachtgever : SOMPOP23
schaal : 1:1000
formaat : A3
datum : 08-02-2023

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nooduitgang

lichtmast 4st. lampen verstelbaar in schijnrichting

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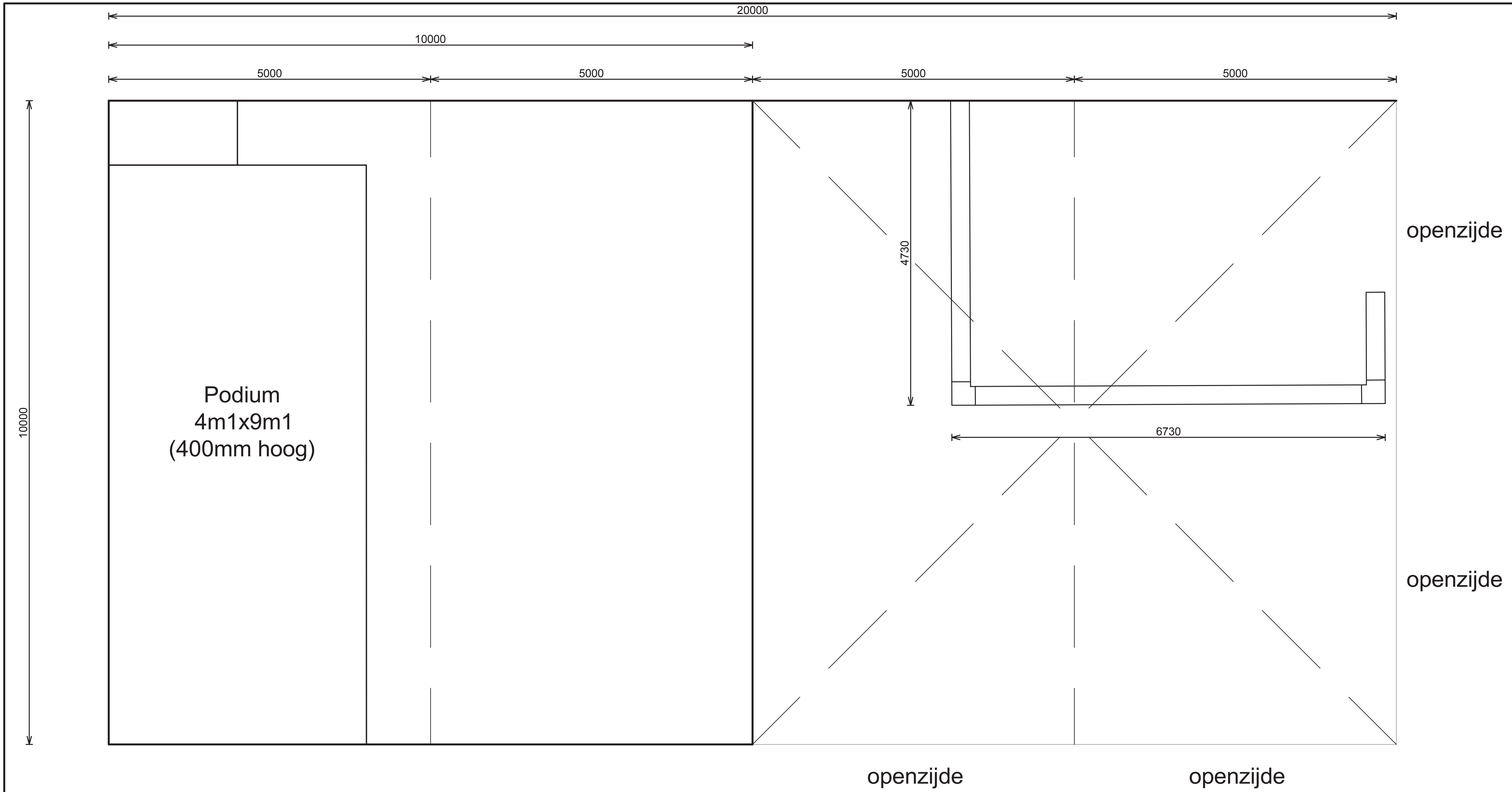


Alu. spantentent 10m1 x 20m1 (Texelsevent)
Waarvan achterste deel (bar) 10m1 x 10m1 dient als overkapping

Draaiboek op- en afbouw Sompop 2023

Vrijdag 23 Juni 2023	
Wanneer en wat	**Wie**
10:00 Grasmaaien	Hans Witte
12:00 Rijplaten plaatsen	Dros Grondverzet
14:00 Toilet units plaatsen en aansluiten	Texels event
16:00 Vloerplaten back stage tent plaatsen	Texels event

Zaterdag 24 Juni 2023	
Wanneer en wat	**Wie**

Zondag 25 Juni 2023	
Wanneer en wat	**Wie**
19:00 Veld uitzetten met rood wit lint	Bestuur
19:00 Backstage tent plaatsen	Bestuur
19:00 Trailer met materialen plaatsen	Bestuur

Maandag 26 Juni 2023	
Wanneer en wat	**Wie**
9:00 Aggregaten plaatsen	Paal 17 / Texel Catering
10:00 Alu tenthal plaatsen TX Bierboet	Texelsevent
11:00 Vuilcontainers plaatsen	Tatenhoven BV
12:00 Vloerplaten hoofdbar leggen	Texelsevent
13:00 Waterpunten aanleggen	VTI / Rob Slik
14;00 Brug back stage + containerbrug plaatsen	Marcel Bakker
15:00 Container CIV plaatsen	Marcel Bakker
16:00 Texels containerbar plaatsen en afstellen.	Marcel Bakker
16:00 Zand Waal 17 laten brengen.	Texelsun/Loonbedrijf Smit

Dinsdag 27 Juni 2023	
Wanneer en wat	**Wie**
10:00 Stroomplan uitvoeren	Texelsevent
12:00 Stretchtent Waal 17 plaatsen	Paal 17
19:00 Hekken plaatsen festivalterrein	Vrijwilligers
19:00 Hekken plaatsen fietsenstalling	Vrijwilligers

Woensdag 28 Juni 2023	
Wanneer en wat	**Wie**
10:00 Main stage plaatsen	Eventury
12:00 Catering wagens plaatsen	Texel Catering
14:00 Stretchtent Texels kwartier plaatsen.	Paal 17
19:00 Layer geluidstorens plaatsen	Vrijwilligers
19:00 Verlichting / Priklicht kabels ophangen.	Vrijwilligers
20:00 Banieren in layher ophangen	Vrijwilligers

Donderdag 29 Juni 2023	
Wanneer en wat	**Wie**
12:00 Munten wagen plaatsen.	Texel Catering
19:00 Doeken op bouwhekken taywrappen.	Vrijwilligers
19:00 Picknicktafels uitklappen en plaatsen.	Vrijwilligers

Draaiboek op- en afbouw Sompop 2023

Vrijdag 30 Juni 2023	
Wanneer en wat	**Wie**
9:00 Geluid hoofdpodium installeren	Rikus Kloosterhuis TAPE
9:00 Licht Hoofdpodium installeren	Ronald van Bommel TAPE
12:00 Catering bar units plaatsen	Texel Catering
12:00 FOH plaatsen.	Rikus Kloosterhuis TAPE

Zaterdag 1 Juli 2023	
Wanneer en wat	**Wie**
9:00 Geluid Waal 17 plaatsen.	Bakker Geluid
9:00 Briefing bestuur	Bestuur
10:00 Geluid TX Bierboet plaatsen.	Bakker Geluid
10:00 Briefing met security + EHBO	Bestuur
11:00 Briefing met barpersoneel	Bestuur
12:00 Aanvang festival	
Elk uur op festivaldag bestuurs meeting	Bestuur
Toiletten worden schoongehouden door Cleaning Texel	Cleaning Texel
0:00 Einde festivalterrein verlichten met bouwlampen	Bestuur
0:15 Mannetje security rondje de Waal	Security
0:30 Festival terrein aanharken	Bestuur
0:30 Start verwijderen geluid en licht apparatuur	Rikus/Ronald TAPE

Zondag 2 Juli 2023	
Wanneer en wat	**Wie**
10:00 Verwijderen catering apparatuur, snackwagens en munten kar.	Texel Catering
10:30 Verwijderen restant geluid en lichtapparatuur.	Rikus/Ronald TAPE
10:30 Verwijderen verlichting (priklicht).	Vrijwilligers
11:00 Hekken festivalterrein verwijderen.	Vrijwilligers
12:00 Hekken Fietsen stalling verwijderen.	Vrijwilligers
13:00 Stretch tent Paal 17 afbreken.	Paal 17
14:00 Generatoren en stroomplan verwijderen.	Texelsevent

Maandag 3 Juli 2023	
Wanneer en wat	**Wie**
9:00 Verwijderen Hoofdpodium	Texelsevent
9:00 Vuilcontainer 1 afvoeren naar Hamster	Tatenhoven BV
9:00 Aluminium tenthal 10 x 20 meter afbreken.	Texelsevent
10:00 Verwijderen stretchtent slechtweervoorziening	Paal 12
11:00 Containerbar Texels verwijderen	Marcel Bakker
12:00 Brug backstage verwijderen	Marcel Bakker
19:00 Zand Waal17 verwijderen	TexelSun/Loonbedrijf Smit
19:00 Verwijderen backstage tent	Bestuur

Dinsdag 4 Juli 2023	
Wanneer en wat	**Wie**
9:00 Puntjes op de i	Bestuur
9:30 Vuilcontainer 2 afvoeren naar hamster	Tatenhove BV
10:00 Stalen rijplaten verwijderen	Dros Grondverzet
17:00 Gras inzaaien	Hans Witte

Draaiboek op- en afbouw Sompop 2023

Woensdag 5 Juli 2023	
Wanneer en wat	**Wie**
Uitloopdag voor als er iets onvoorziens tegenzit, zoals bijvoorbeeld het weer.	

Donderdag 6 Juli 2023	
Wanneer en wat	**Wie**
Uitloopdag voor als er iets onvoorziens tegenzit, zoals bijvoorbeeld het weer.	

Voorlopig programma Sompop 2023.

TEXELS MAINSTAGE	
13:00 - 14:00	MOODBORED
14:00 - 15:00	
15:00 - 16:00	INGE LAMBOO
16:00 - 17:00	
17:00 - 18:00	SACHEE
18:00 - 19:00	
19:00 - 20:00	BABY'S BERSERK
20:00 - 21:00	
21:00 - 22:00	BARE JAMS
22:00 - 23:00	
23:00 - 24:00	BEATFOOT

TX BIERBOET	
14:00 - 15:00	TX BIERPROEVEN & POP QUIZ
15:00 - 16:00	TX BIERPROEVEN & POP QUIZ
16:00 - 17:30	SOMPOP SILENT DISCO
17:30 - 18:00	CORRY KONINGS
18:00 – 19:00	DJ's moeten nog worden bevestigd
19:00 - 20:15	DJ's moeten nog worden bevestigd
20:15 - 21:00	LIVE MUZIEK
21:00 - 22:00	90's PARTY
22:00 - 23:00	LIVE MUZIEK
23:00 - 24:00	90's PARTY

WAAL 17	
12:00 – 14:00	DJ's moeten nog worden bevestigd
14:00 – 16:00	DJ's moeten nog worden bevestigd
16:00 – 17:00	DJ's moeten nog worden bevestigd
17:00 – 18:30	DJ's moeten nog worden bevestigd
18:30 – 20:00	DJ's moeten nog worden bevestigd
20:00– 22:00	DJ's moeten nog worden bevestigd
22:00 – 24:00	DJ's moeten nog worden bevestigd

TEXELS KWARTIER	
14:00 - 15:00	DJ's moeten nog worden bevestigd
15:00 - 16:00	DJ's moeten nog worden bevestigd
16:00 - 17:00	DJ's moeten nog worden bevestigd
17:00 - 18:00	DJ's moeten nog worden bevestigd
18:00 - 19:00	DJ's moeten nog worden bevestigd
19:00 - 20:00	DJ's moeten nog worden bevestigd
20:00 - 21:00	DJ's moeten nog worden bevestigd
21:00 - 22:00	DJ's moeten nog worden bevestigd
22:00 - 23:00	DJ's moeten nog worden bevestigd
23:00 - 24:00	DJ's moeten nog worden bevestigd

BUSSEL ENGINEERING

Ing. M.M. van Bussel
[redacted]

Project: Sompop 2022
Statische Berekeningen

Projekt: Geluidstoren en containeropstelling

Datum: 01-02-2022

Opdrachtgever: Sompop
Yvo Witte
[redacted]

Opmerking Voor de opstelling geldt een windlastbeperking;
boven 8 Bft (20,7 m/sec.) dient de omgeving te worden
ontruimd en de geluidstoren extra gezekerd.
Ballast geluidstoren: 3300 kg
Ballast gestapelde containers: 2 x 1250 kg
Ballast losse container: 850 kg

Michiel van Bussel

[redacted]

Inhoud

Toegepaste rekensoftware:
Matrix Frame 6.10

1 Ontwerpuitgangspunten

1.1 Algemeen

Als uitgangspunt wordt toegepast de EuroCode normering.

Van toepassing zijnde normen en voorschriften in algemene zin en voorzover van toepassing:

- NEN-EN 1990+NB Eurocode Grondslagen van het constructief ontwerp
- NEN-EN 1991+NB Eurocode 1 Belastingen op constructies
- NEN-EN 1993+NB Eurocode 3 Ontwerp en berekening van staalconstructies
- NEN-EN 1997+NB Eurocode 7 Geotechnisch ontwerp

1.2 Veiligheidsklasse

Gebruiksklasse:	Tijdelijke constructie
Gevolgklasse:	CC2

Specifiek voor de objecten van het SompopFestival:

UGT: Permanente belasting	γ;f;g;ongunstig	1,1	UGT Permanente belasting γ;f;g;gunstig	0,9
UGT: Veranderlijke belasting	γ;f;q	1,5		
UGT: Sneeuw belasting	γ;f;q	1,5		

Belastingcombinaties in de uiterste grenstoestanden (UGT) worden aangenomen volgens art. 6.4.3 van de NEN-EN 1990.
Belastingcombinaties in de bruikbaarheidsgrenstoestanden (BGT) worden aangenomen volgens art. 6.5.3 van de NEN-EN 1990.

1.3 Belastingen

Optredende belastingen:

1.3.1 Sneeuwbelasting nvt

1.3.2 Variabele belasting nvt

1.3.3 Gewicht/ afmeting constructiedelen

Zeecontainers 20ft	6,06 x 2,44 x (h)2,59 meter
Ledig gewicht:	2030 kg
Laadgewicht	28450 kg
Layher-allround	volgens specs Layher

1.3.4 Windbelasting

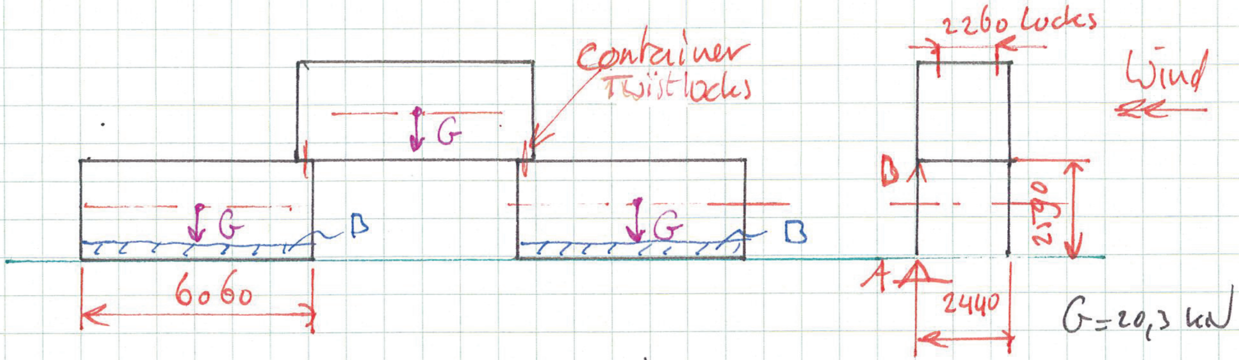
vb1 = 20,7 m/sec

h = 6m pw = 0,42 kN/m^2

(Co1=1;Cfr=0,04;C1=0,85;CsCd=0,9)

2.1 Containers

Zie tekening bijlage 1



Oppervlakte: 47,1 m² ($3 \times 15{,}7$ m²)
Aangrijphoogte wind: $(2 \times 15{,}7 \times 1{,}3) + (15{,}7 \times 3{,}89) = 47{,}1 \times h_a$

$h_a = 2{,}16$ m.

$c_p = 1{,}3$ (druk: 0,8 zuiging −0,5) $\qquad P_w = 0{,}42$ kN/m² (6m)

Kantelmoment t.o.v. A:

$M_{rep} = P_w \cdot A \cdot c_p \cdot h_a = 0{,}42 \times 47{,}1 \times 1{,}3 \times 2{,}16 = 55{,}5$ kNm.

$M_{ed} = \gamma_q \times M_{rep} = 1{,}5 \times 55{,}5 = 83{,}3$ kNm.

Weerstandsmoment t.o.v. A (kantelen)

$Mq_{rep} = (G + B) \times 1{,}22 \qquad Mq_{ed} = \gamma_g \times Mq_{rep} = 0{,}9 \times Mq_{rep}$

$Mq_{ed} \geq 83{,}3$ kNm $\qquad (3 \times 20{,}3 + B) \times 1{,}22 \times 0{,}9 \geq 83{,}3$

$B \geq 15$ kN

Zie ook § 2.1.3.

2.12 Bevestiging containerlock

Hoekpunten: Twistlocks

Uit Germanische Lloyd: Rules for Classification and Construction
Shiptechnology
Ch. 20 — Stowage and Lashing Containers.

Twistlock trekbelasting: SWL - 250 kN

Check:

Kantelen om "B"

$Med_B = 1{,}5 \times 0{,}42 \times 15{,}7 \times 1{,}3 \times 1{,}3 = 16{,}7$ kNm

$Fed_{lock} = \frac{16{,}7}{2{,}26} = 7{,}4$ kN/2 locks $\rightarrow$ voldoet ruim

2.13 Verschuiven

Dwarskracht:

$Fed = 0{,}42 \times 47{,}1 \times 1{,}3 \times 1{,}5 = 38{,}6$ kN

$f = 0{,}5$ (zand/staal)

Voorwaarde: $(G + \text{Ballast}) \times 0{,}5 \times 0{,}9 \geq 38{,}6$

$G = 3 \times 20{,}3 = 60{,}9$ kN

$(60{,}9 + \text{Ballast}) \times 0{,}45 \geq 38{,}6$ Ballast $\geq 24{,}9$ kN

Ballast per container: $\geq$ 1250 kg.

2.2 Losse container

$G = 20{,}3$ kN

Windbelasting: $M_{ed} = 0{,}42 \times 15{,}7 \times 1{,}3 \times 1{,}3 \times 1{,}5 = 16{,}7$ kNm

$F_{ed} = 0{,}42 \times 15{,}7 \times 1{,}3 \times 1{,}3 = 12{,}9$ kN

Weerstand tegen kantelen

$(20{,}3 + \text{Ballast}) \times 1{,}22 \times 0{,}9 \geq 16{,}7$ Ballast $= -5$ kN → eigen gewicht voldoet

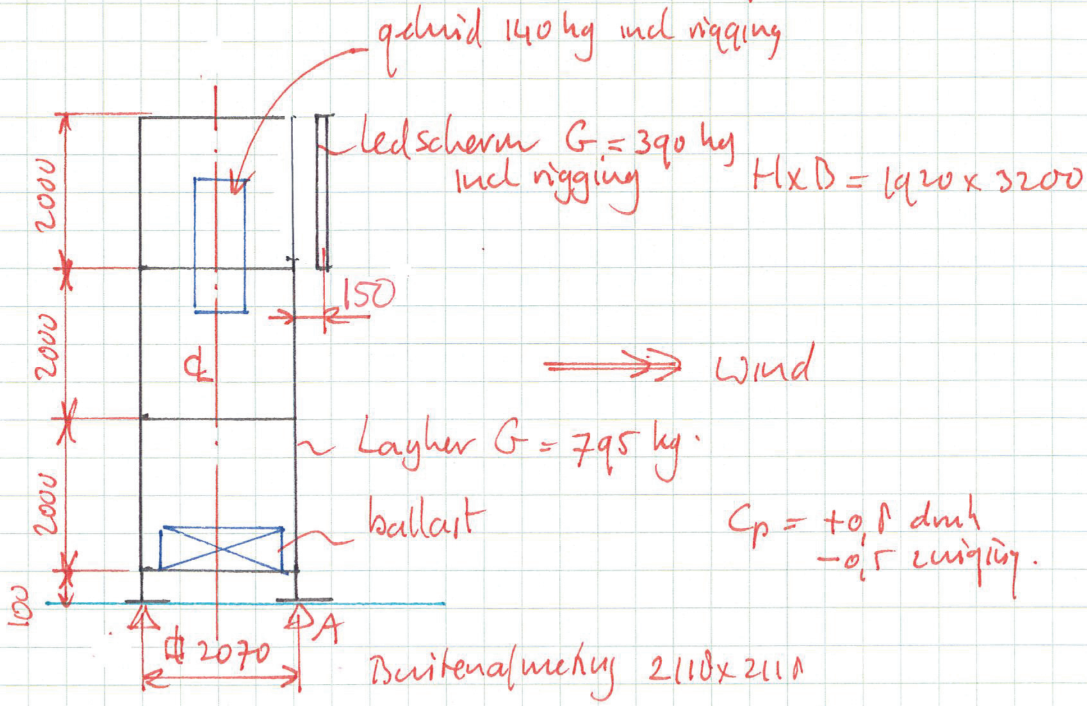
Weerstand tegen verschuiven

$(20{,}3 + \text{Ballast}) \times 0{,}5 \times 0{,}9 \geq 12{,}9$ Ballast $\geq 8{,}4$ kN (840 kg)

Ballast in container: ≥ 850 kg

2.2 Geluidstoren

2.2.1 Stabiliteit



Rondom windbreekgaas ; doorlaat 20%.
Ledscherm te beschouwen als ondoordringbaar

Aangegeven windrichting bepalend.

Kantelmoment t.o.v. A :

$$M_{rep(a)} = p_w \cdot A \cdot c_p \cdot h_z = 0{,}42 \times 2{,}12 \times 4 \times 1{,}3 \times 2{,}1 \times 0{,}8 + 0{,}42 \times 1{,}92 \times 3{,}2 \times 1{,}3 \times 5{,}1$$

$$= 24{,}9 \text{ kNm}$$

$$M_{ed(a)} = 1{,}5 \times 24{,}9 = 37{,}3 \text{ kNm.}$$

Weerstandsmoment t.o.v. A

$$Mw_{ed} \geq 40{,}2 \qquad 0{,}9 \times (\text{Ballast} + G_{layher} + G_{geluid}) \times 1{,}035$$

$$- 1{,}1 \times 3{,}9 \times 0{,}15 \geq 37{,}3$$

$$0{,}9 \times 1{,}035\,(\text{Ballast} + 7{,}95 + 1{,}4) - 0{,}64 \geq 37{,}3$$

Ballast $\geq 31{,}4$ kN (3,2 ton)

Fundering

Toelaatbare gronddruk: 60 kN/m² *

Max belasting bij windbelasting 7 Bft (bpv A): 15 kN/poot

Drukverdelende plaat aan te brengen: ≥ 0,5x0,5 m

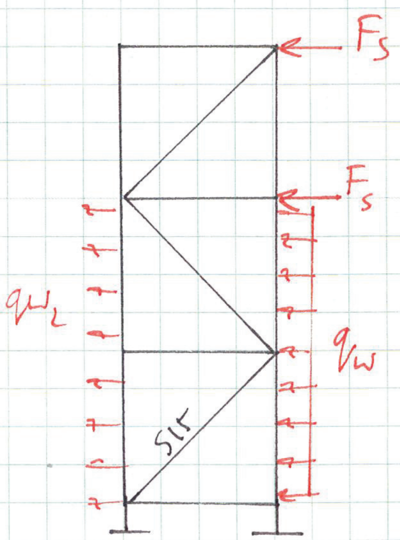
(voldoende dikte/sterkte)

* geldt voor klei/zand grond.

checken op locatie, anders grondverbeterende maatregelen noodzakelijk.

2.2.1 Sterkte

Zie bijlage 2, Matrixberekening.



F_s: belasting lichtscherm

$= (0,42 \times 1,92 \times 3,4 \times 1,3)/4 = 0,89$ kN

q_w = windbelasting:

$q_{w_1} = 0,42 \times 0,8 \times 2,12/2 = 0,36$ kN/m

$q_{w_2} = 0,42 \times 0,5 \times 2,12/2 = 0,22$ kN/m

Schoor 515 maatgevend (trek/druk) $N_{ed} = 7,59$ kN

Layher K2000+ toegestane rozetbelasting $N_{Rd} = 17,9$ kN

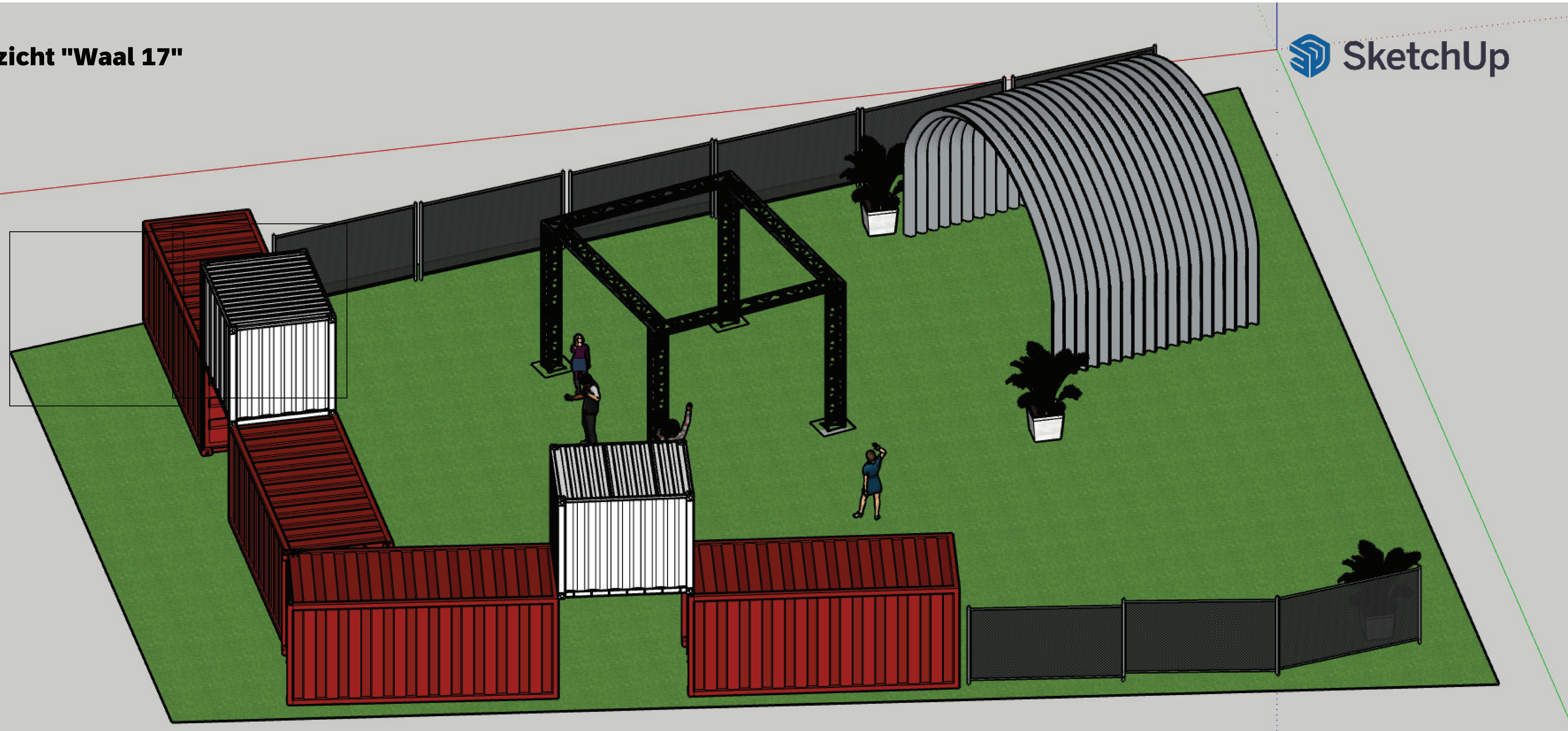
$UC = 0,42 \rightarrow$ voldoet

Spindelbelasting: $F_{rd} = 32,1$ kN (minimaal)

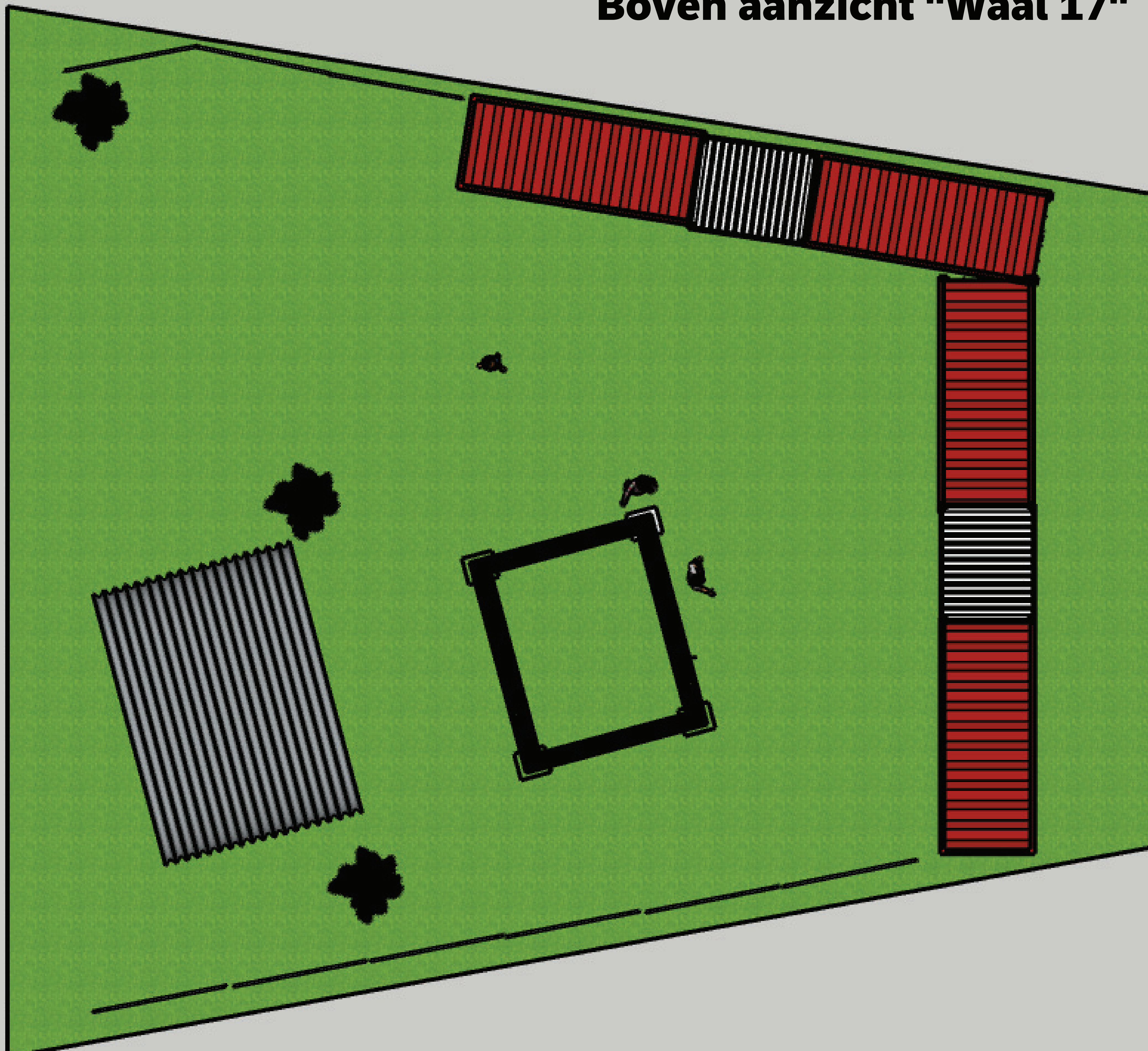
$UC = \frac{15}{32,1} = 0,47 \rightarrow$ voldoet

BIJLAGE 1

Overzicht "Waal 17"



Boven aanzicht "Waal 17"

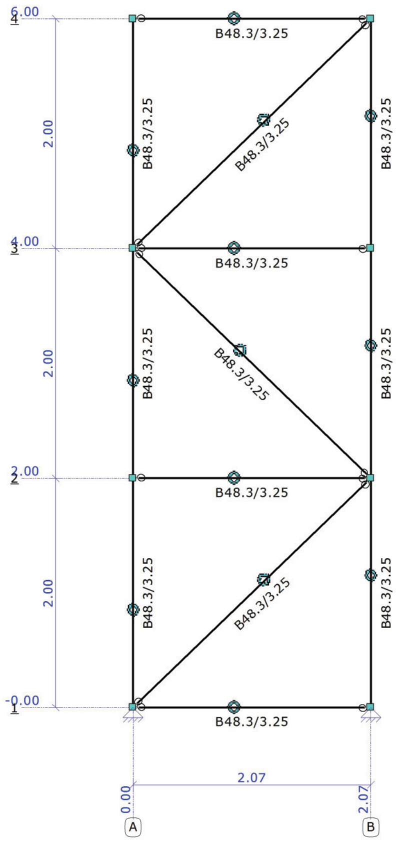


BUSSEL ENGINEERING

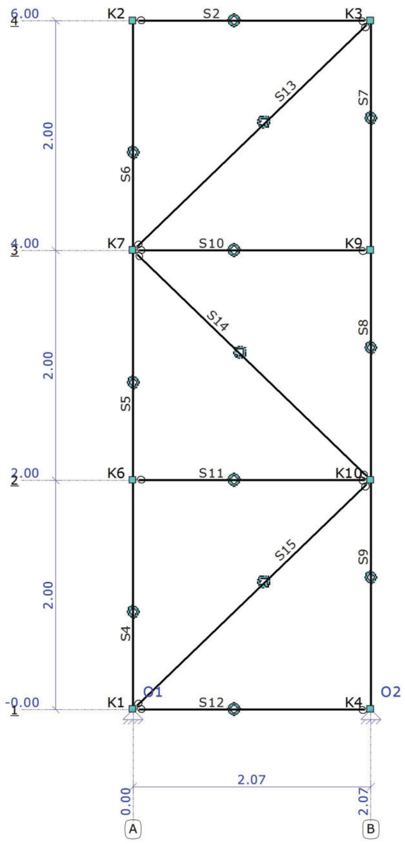
BIJLAGE 2

Projectnaam	Sompop 2022	Projectnummer	SP-001C
Omschrijving		Constructeur	Ing. M.M. v Bussel
Opdrachtgever	Y.Witte	Eenheden	m, kN, kNm
Bestand	C:\Users\Bussel Engineering\Desktop\Actueel\Sompop\SP-001C.mxf		

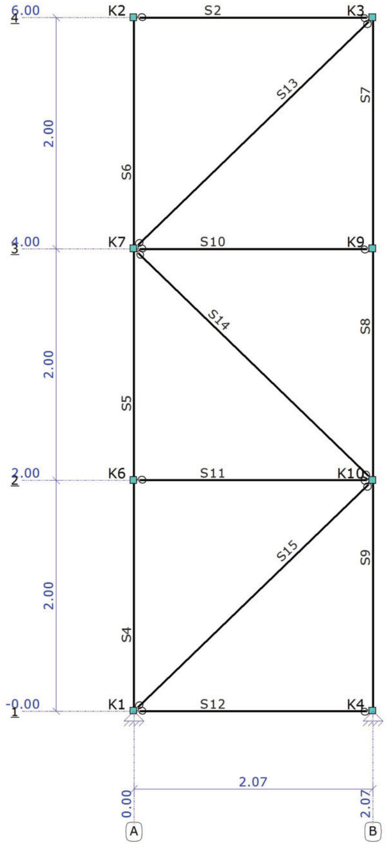
AFB. GEOMETRIE LIGGER



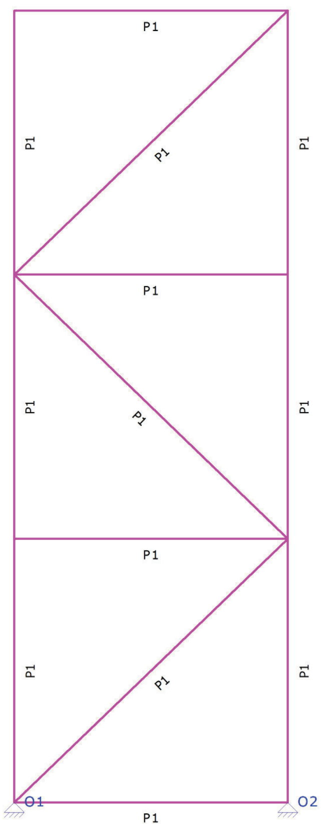
AFB. GEOMETRIE RAAMWERK



AFB. GEOMETRIE 1 STAVEN EN KNOPEN



AFB. GEOMETRIE 2 STAVEN EN KNOPEN



STAVEN

Staaf	Knoop B	Knoop E	X-B	Z-B	X-E	Z-E	Lengte	Profiel	Positie
S2	K2	K3	0,000	-6,000	2,070	-6,000	2,070	P1	0,000 - L(2,070)
S4	K1	K6	0,000	0,000	0,000	-2,000	2,000	P1	0,000 - L(2,000)
S5	K6	K7	0,000	-2,000	0,000	-4,000	2,000	P1	0,000 - L(2,000)
S6	K7	K2	0,000	-4,000	0,000	-6,000	2,000	P1	0,000 - L(2,000)
S7	K3	K9	2,070	-6,000	2,070	-4,000	2,000	P1	0,000 - L(2,000)
S8	K9	K10	2,070	-4,000	2,070	-2,000	2,000	P1	0,000 - L(2,000)
S9	K10	K4	2,070	-2,000	2,070	0,000	2,000	P1	0,000 - L(2,000)
S10	K7	K9	0,000	-4,000	2,070	-4,000	2,070	P1	0,000 - L(2,070)
S11	K6	K10	0,000	-2,000	2,070	-2,000	2,070	P1	0,000 - L(2,070)
S12	K1	K4	0,000	0,000	2,070	0,000	2,070	P1	0,000 - L(2,070)
S13	K3	K7	2,070	-6,000	0,000	-4,000	2,878	P1	0,000 - L(2,878)
S14	K7	K10	0,000	-4,000	2,070	-2,000	2,878	P1	0,000 - L(2,878)
S15	K10	K1	2,070	-2,000	0,000	0,000	2,878	P1	0,000 - L(2,878)
-	-	-	m	m	m	m	m	-	-

PROFIELEN

Profiel	Profielnaam	Oppervlakte	Iy	Materiaal	Hoek
P1	B48.3/3.25	4.5997e-04	1.1730e-07	S355NH/NLH(EN 10219-1)	0,0
-	-	m2	m4	-	°

MATERIALEN

Materiaal	Dichtheid	E-Modulus	Uitzettingcoeff
S355NH/NLH(EN10219-1)	78.50	2.1000e+08	12.0000e-06
-	kN/m3	kN/m2	C°m

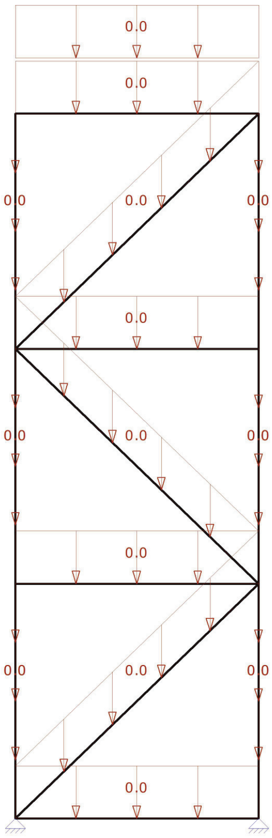
SCHARNIEREN

Staaf	Positie	Oplegg.	Scharnier X	Z	Yr
S10	0,000	A2	Vast	Vast	20.00
	L(2,070)	A2	Vast	Vast	20.00
S11	0,000	A2	Vast	Vast	20.00
	L(2,070)	A2	Vast	Vast	20.00
S12	0,000	A2	Vast	Vast	20.00
	L(2,070)	A2	Vast	Vast	20.00
S13	0,000	A2	Vast	Vast	20.00
	L(2,878)	A2	Vast	Vast	20.00
S14	0,000	A2	Vast	Vast	20.00
	L(2,878)	A2	Vast	Vast	20.00
S15	0,000	A2	Vast	Vast	20.00
	L(2,878)	A2	Vast	Vast	20.00
S2	0,000	A2	Vast	Vast	20.00
	L(2,070)	A2	Vast	Vast	20.00
S4	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
S5	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
S6	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
S7	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
S8	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
S9	0,000	A1	Vast	Vast	Vast
	L(2,000)	A1	Vast	Vast	Vast
-	**m**	**-**	**kN/m**	**kN/m**	**kNm/rad**

OPLEGGINGEN

Oplegging	Object	Positie	X	Z	Yr	HoekYr
O1	K1	0,000	Vast	Vast	Vrij	0
O2	K4	0,000	Vast	Vast	Vrij	0
-	**-**	**m**	**kN/m**	**kN/m**	**kNm/rad**	**°**

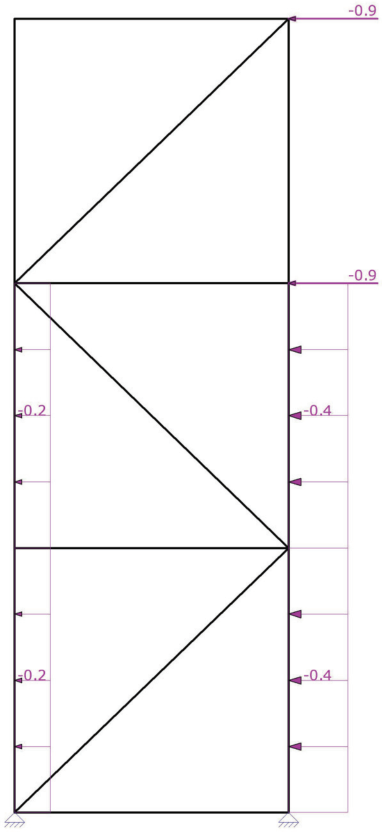
B.G.1: PERMANENTE BELASTING



B.G.1: PERMANENTE BELASTING

Type	Beginwaarde	Eindwaarde	Beginafstand	Eindafstand	Richting	Staaf of knoop
B.G.1: Permanente Belasting						
qG	0,04 (1.00x)	0,04 (1.00x)	0,000	2,070(L)	Z"	S2
qG	0,04 (1.00x)	0,04 (1.00x)	0,000	2,000(L)	Z"	S4-S9
qG	0,04 (1.00x)	0,04 (1.00x)	0,000	2,070(L)	Z"	S2,S10-S12
qG	0,04 (1.00x)	0,04 (1.00x)	0,000	2,000(L)	Z"	S4-S9
qG	0,04 (1.00x)	0,04 (1.00x)	0,000	2,878(L)	Z"	S13-S15
Som lasten	**X: 0,00**	**kN Z: 1,55**	**kN**			
-	**-**	**-**	**m**	**m**	**- -**	

B.G.2: WINDBELASTING VAN LINKS



B.G.2: WINDBELASTING VAN LINKS

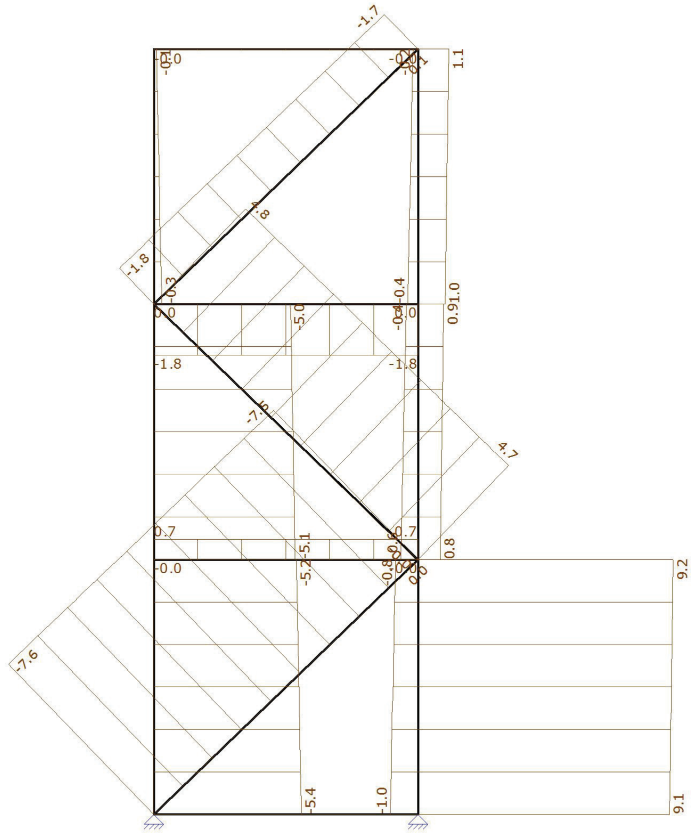
Type	Beginwaarde	Eindwaarde	Beginafstand	Eindafstand	Richting	Staaf of knoop
B.G.2: Windbelasting van links						
N	-0,89				X	K3,K9
q	-0,36	-0,36	0,000	2,000(L)	X	S8-S9
q	-0,22	-0,22	0,000	2,000(L)	X	S4-S5
Som lasten	**X: -4,10**	**kN Z: 0,00**	**kN**			
-	**-**	**-**	**m**	**m**	**-**	**-**

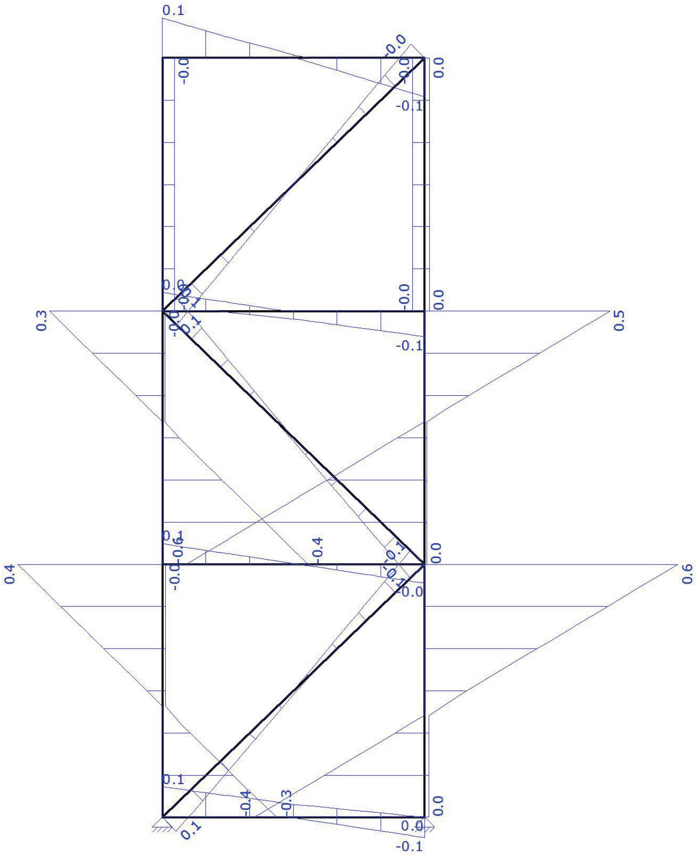
FUNDAMENTEEL BELASTINGSCOMBINATIES (TABEL)

B.G.	Omschrijving	Fu.C.1	Fu.C.2	Fu.C.3	Fu.C.4
B.G.1	Permanente Belasting	1.20	0.90	1.35	0.90
B.G.2	Windbelasting van links	1.50	1.50	-	-

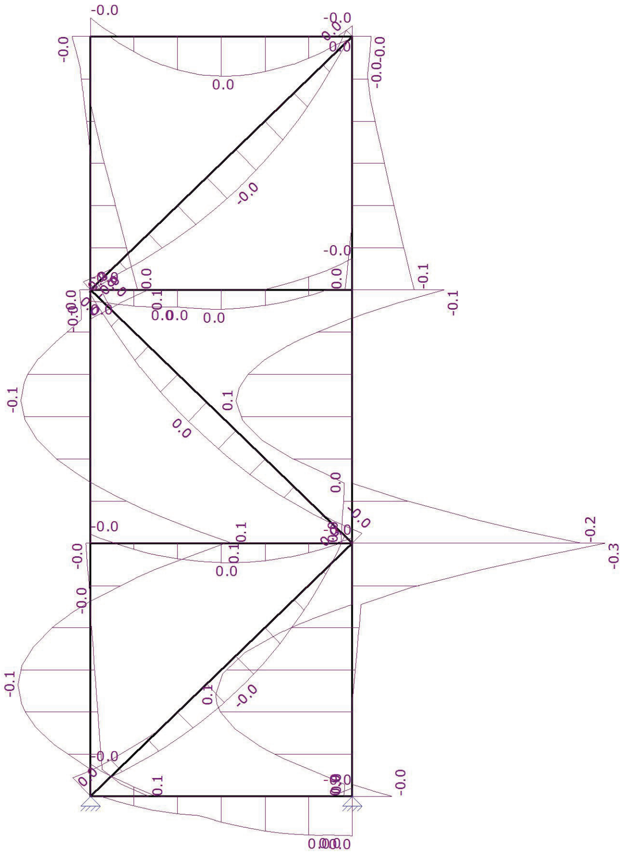
ANALYSE INSTELLINGEN

Lineaire Elastische Analyse uitgevoerd





AFB. FU.C. MOMENT (MY) OMHULLENDE — Fundamenteel Belastingscombinaties

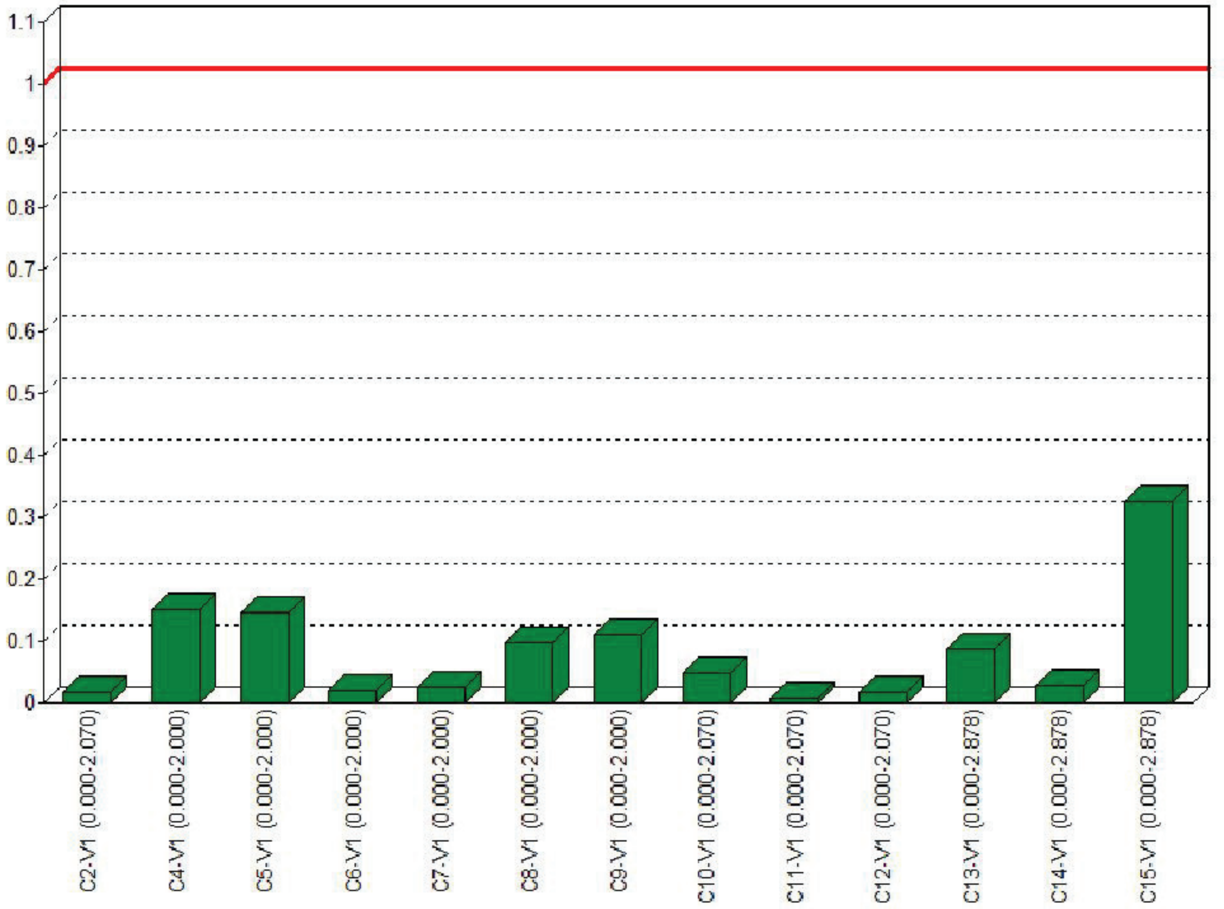


UNITY CHECK NEN-EN1993-1-1:2016/NB:2016

Veld	Toetsing	Combinatie	Artikel	UC max
C2-V1 (0.000-2.070)	Doorsnede	Fu.C.3	NEN-EN1993-1-1(NB.33)	0,02
C2-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C2-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C2-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,02
C2-V1 (0.000-2.070)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C4-V1 (0.000-2.000)	Doorsnede	Fu.C.2	NEN-EN1993-1-1(NB.33)	0,06
C4-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,12
C4-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,12
C4-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,15
C4-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C5-V1 (0.000-2.000)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(NB.33)	0,06
C5-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,11
C5-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,11
C5-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,15
C5-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C6-V1 (0.000-2.000)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(NB.33)	0,02
C6-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,01
C6-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,01
C6-V1 (0.000-2.000)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,02
C6-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C7-V1 (0.000-2.000)	Doorsnede	Fu.C.2	NEN-EN1993-1-1(NB.33)	0,03
C7-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,01
C7-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,01

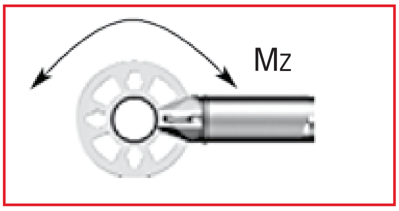
Veld	Toetsing	Combinatie	Artikel	UC max
C7-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,01
C7-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C8-V1 (0.000-2.000)	Doorsnede	Fu.C.2	NEN-EN1993-1-1(NB.33)	0,10
C8-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,01
C8-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,01
C8-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,02
C8-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C9-V1 (0.000-2.000)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(NB.33)	0,11
C9-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,02
C9-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,02
C9-V1 (0.000-2.000)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,02
C9-V1 (0.000-2.000)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C10-V1 (0.000-2.070)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(NB.33)	0,01
C10-V1 (0.000-2.070)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,04
C10-V1 (0.000-2.070)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,04
C10-V1 (0.000-2.070)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,05
C10-V1 (0.000-2.070)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C11-V1 (0.000-2.070)	Doorsnede	Fu.C.3	NEN-EN1993-1-1(NB.33)	0,01
C11-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C11-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C11-V1 (0.000-2.070)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,01
C11-V1 (0.000-2.070)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C12-V1 (0.000-2.070)	Doorsnede	Fu.C.2	NEN-EN1993-1-1(6.12)	0,02
C12-V1 (0.000-2.070)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C13-V1 (0.000-2.878)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(NB.33)	0,01
C13-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,08
C13-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,08
C13-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,09
C13-V1 (0.000-2.878)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C14-V1 (0.000-2.878)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(6.5)	0,03
C14-V1 (0.000-2.878)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C14-V1 (0.000-2.878)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.46)	0,00
C14-V1 (0.000-2.878)	Stabiliteit	Fu.C.3	NEN-EN1993-1-1(6.61&6.62)	0,01
C14-V1 (0.000-2.878)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00
C15-V1 (0.000-2.878)	Doorsnede	Fu.C.1	NEN-EN1993-1-1(6.9)	0,05
C15-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,32
C15-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.46)	0,32
C15-V1 (0.000-2.878)	Stabiliteit	Fu.C.1	NEN-EN1993-1-1(6.61&6.62)	0,32
C15-V1 (0.000-2.878)	Kiptoetsing	Fu.C.4	NEN-EN1993-1-1(6.54)	0,00

AFB. STAAL UC DIAGRAM



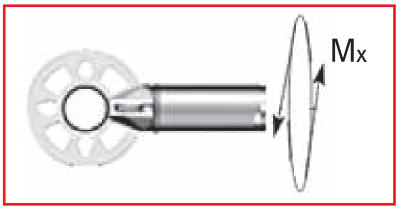
Variant II K 2000+ Lightweight

Torsiekracht om de staander



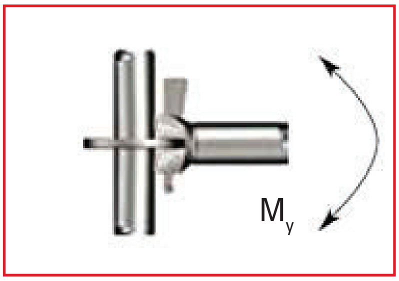
$M_{z,Rd}$ = ± 37,2 kNcm
$M_{z,Rd}$ = ± 37,2 kNcm
$M_{z, Rd}$ = ± 40,1 kNcm

Torsiekracht om de as van de ligger



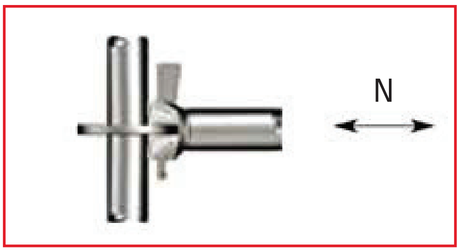
$M_{x,Rd}$ = ± 52,9 kNcm
$M_{x,Rd}$ = ± 52,5 kNcm

Hoekstijfheid



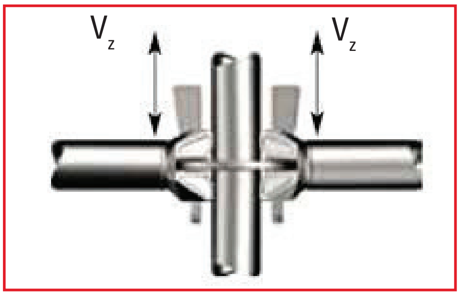
Buigmoment
$M_{y,Rd}$ = ± 68,0 kNcm
$M_{y,Rd}$ = ± 101,0 kNcm
$M_{y,Rd}$ = ± 120,0 kNcm

Normaalkracht



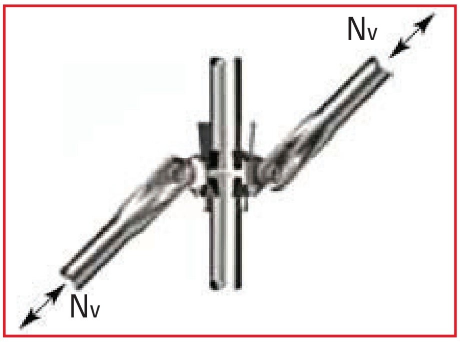
N_{Rd} = ± 22,7 kN (Buisligger)
N_{Rd} = ± 31,0 kN (Buisligger)
N_{Rd} = ± 35,1 kN (Buisligger)

Verticale dwarskracht



Verticale dwarskracht **enkele aansluiting**
$V_{z,Rd}$ = ± 17,4 kN $V_{z,Rd}$ = ± 26,4 kN
$V_{z,Rd}$ = ± 31,7 kN
Verticale dwarskracht **rozetaansluiting**
$\sum V_{z,Rd}$ = ± 69,5 kN $\sum V_{z,Rd}$ = ± 105,6 kN
$\sum V_{z,Rd}$ = ± 117,0 kN

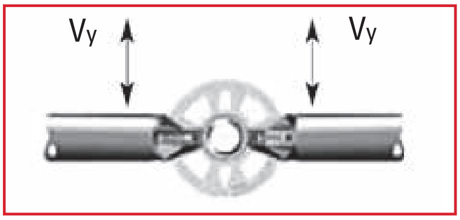
Diagonaalkracht



$N_{V,Rd}$ = ± 8,4 kN
$N_{V,Rd}$ = ± 17,9 kN
$N_{V,Rd}$ = ± 17,9 kN

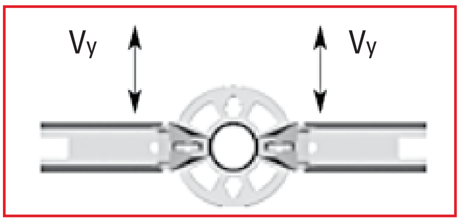
Zie voor de gespecificeerde gebruiksbelastingen tabel 15 en 17 op pagina 14.

Horizontale dwarskracht (Buisligger)



$V_{y,Rd}$ = ± 6,7 kN $V_{y,Rd}$ = ± 10,0 kN $V_{y,Rd}$ = ± 16,6 kN

Horizontale dwarskracht (U-ligger)



$V_{y,Rd}$ = ± 5,9 kN $V_{y,Rd}$ = ± 5,9 kN $V_{y,Rd}$ = ± 16,6 kN

BUSSEL ENGINEERING

Ing. M.M. van Bussel
[redacted]

Project: Sompop 2022
Statische Berekeningen

Projekt: Geluidstoren en containeropstelling
Aanvullende berekening

Datum: 25-03-2022. *aanvulling op rapport 01-02-2022*

Opdrachtgever: Sompop
Yvo Witte
[redacted]

Opmerking Bijgaand de ballastberekening voor de torens met alleen geluid, en alleen een lichtscherm.

Michiel van Bussel

[redacted]

1 Zie rapport pag 8

Nu zonder ledscherm.

Kantelmoment: $M_{ed} = \underset{\gamma_q}{1{,}5} \times \underset{A}{2{,}12 \times 6} \times \underset{c_p}{1{,}3} \times \underset{h_c}{3} \times \underset{c_0}{0{,}8} \times \underset{p_w}{0{,}42} = \underset{kNm}{25}$

Weerstandsmoment t.o.v. A:

$M_{Wed} \geq 25$

$0{,}9 \times (\text{Ballast} + G_{laghen} + G_{geluid}) \times 1{,}035 \geq 25$

$0{,}9 \times 1{,}035\,(\text{Ballast} + 7{,}95 + 1{,}4) \geq 25$

Ballast $\geq$ 17,5 kN (1750 kg)

2 Toren met alleen led-scherm

$\Rightarrow$ Ballast 3340 kg. (Geluid zoals nu in rapport vervangen door ballast)

Content: **Tent book (according to NEN-EN 8020-41:2012)**

Owner Tent book: **Tentations bvba**

Tent system: **Bonga 10x15m stretchtent**

Manufacturer: **Tentations bvba, Bonga Carpas SL**

Document code: **17.02.00509.1**

Author: **ir. Nikie van Veen**

Date: **28.02.2017**

Tent system: Bonga 10x15m stretchtent

Document code: 17.02.00509.1

Owner Tent book: Tentations bvba
[redacted]
www.bongastretchtent.com

Manufacturer: Tentations bvba, Bonga Carpas SL

Engineering and composer Tent book: Tentech BV
Ontwerp en advies voor lichtgewicht bouwen
[redacted]
www.tentech.nl

Date: 28.02.2017

[redacted]

Author: ir. Nikie van Veen

[redacted]

Authorized by: ir. Rogier Houtman

Valid until: 28.02.2022

This report is drafted by Tentech BV commissioned by Tentations bvba.

For questions / comments about the calculations or about a Bonga Stretchtent that us used / built, please contact Tentations bvba.

A. Introduction

Tentations bvba has developed a stretchtent under the product name Bonga. The tent is made of a stretchable membrane, which allows a freedom of form as there is not a pre-described shape necessary. Depending on the location, variations can be made with the number, length and placement of poles and ties. This results in a custom made cover at each new location.

The freedom of form is created by the stretchable property of the membrane; the desired shape is obtained by "stretching" an initially flat membrane. The disadvantage of this form-flexibility is the difficulty in researching and arranging all possible configurations in a static analysis.
The structural calculation in this report shows the static analysis of the 10x15m dimension, where a configuration is considered which has all sides open.

This document contains the data required for a tent book according to EN 13782 bundled and presented for the Bonga 10x15m stretchtent of Tentations bvba.

This tent book includes

- Ownership data;
- Drawings of the different variants of the tent, including dimensions, indications of elements and required anchoring.
- Permitted live load;
- Maximum wind speeds (according to EN 1991-1-4:2005);
- Structural analysis (according to EN 13782:2015);
- Material certificates (strength properties and fire properties).

Utrecht, 28.02.2017,

ir. Nikie van Veen

B. **Contents**

C. Codes and standards

The following codes are used:

- EN 13782: Temporary Structures – Tents - Safety
- EN 1990: Basis of structural Design
- EN 1991: Actions on structures
  Part 1-4: General actions - wind actions
- EN 1999: Design of aluminum structures
  Part 1-1: General rules

D. Summary

Manufacturer	Tentations bvba Molenstraat 124 BE-9032 Gent t +32 (0)477 930 739 alexandermasyn@gmail.com www.bongastretchtent.com	Bonga Carpas S.L. Venta Nova 80 43894 (Camarles), Tarragona Catalunya Spain
Main dimensions:	Width: Length: Side height: Max height:	10 m 15 m 2.2m / 2.7m 4 m
	Center poles (4 / 3.5m): Perimeter poles (2.7 / 2.2m):	Ø60 x 3.1mm [AL 6061 T6] Ø40 x 2mm [AL 6061 T6]
	For pw = 345 N/m² Ties, attachment: Storm belt:	 min. Breaking load 750 kg [PES] min. Breaking load 1450 kg [PES]
	For pw = 500 N/m² Ties, attachment: Storm belt:	 min. Breaking load 1200 kg [PES] min. Breaking load 2000 kg [PES]

User defined load:	It is allowed to apply max. 10 kg of decoration, sound or light equipment per center pole. The load should be applied centric.
Snow load:	A snow load of 0.1 kN/m² (4cm) according the French CTS.
Wind load:	Point of departure: geometry without side walls. The calculation is primarily based on a wind pressure of p_w = 500 N/m², according to EN 13782 par. 7.4.2.2. However, a reduced wind pressure of pw = 300 N/m² may be applied in the case of tents with a width of 10 m or less and a height of 5 m or less. The wind pressure can be recalculated to the corresponding wind speeds for Europe (not country specific), shown in the following table:

Above the limit values shown below the strength and/or stability of the structure is not guaranteed. Explanation of the shown table can be found in chapter G.

Pw = 345 N/m² For a Proflexx fabric, BL fabric clamp ≥ 374 kg, Anchor Leff ≥ 500mm

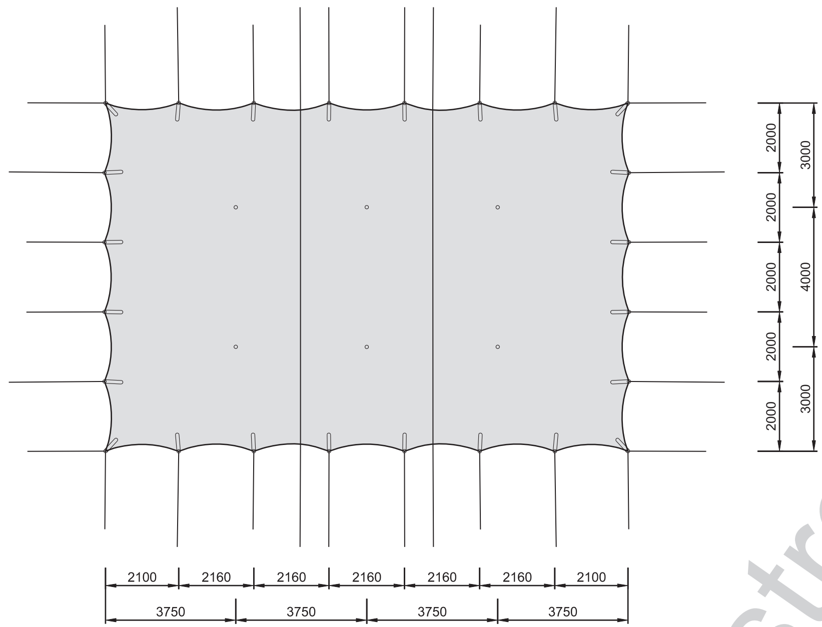
Out of order:	Coast	Flattened, open area	Rural	Village	City
A. Beaufort (indicative)	> 6 Bft	> 6 Bft	> 7 Bft	> 8 Bft	> 8 Bft
B. 10 minutes average wind speed:	> 14.9 m/s	> 15.7 m/s	> 17.5 m/s	> 20.8 m/s	> 21.7 m/s
C. Peak wind speed (gust):	> 85 km/h	> 85 km/h	> 85 km/h	> 85 km/h	> 85 km/h

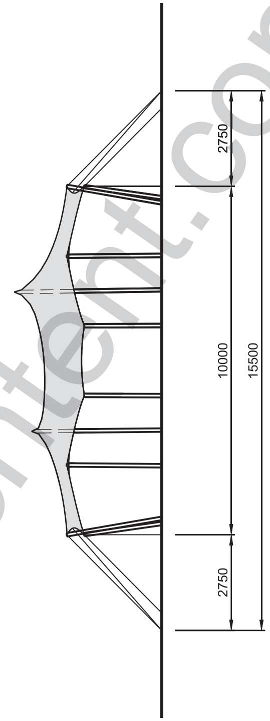
Pw = 500 N/m² For a Triflexx fabric, BL fabric clamp ≥ 674 kg, Anchor Leff ≥ 700mm

Out of order:	Coast	Flattened, open area	Rural	Village	City
A. Beaufort (indicative)	> 7 Bft	> 7 Bft	> 8 Bft	> 9 Bft	> 9 Bft
B. 10 minutes average wind speed:	> 17.9 m/s	> 18.9 m/s	> 21.1 m/s	> 25.0 m/s	> 26.1 m/s
C. Peak wind speed (gust):	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h

Given values are limit values, m/s values are 10 min averages measured on a 10m heigth at the closest weather station; wind in Beaufort (BFT) are indicative values.

Anchoring:	Based on dense, non-cohesive soil (e.g. sandy soils). Anchor: **T-profile 25x25mm**	
	Pw = 345 N/m²	**Pw = 500 N/m²**
	minimal depth of penetration = **500 mm** **1 anchor** per tie attachment **2 anchors** per side of the storm belt	minimal depth of penetration = **700 mm** **1 anchor** per tie attachment **2 anchors** per side of the storm belt





Tent wordt volgens deze tekening opgebouwd op Sompop 2020

Pw = 345 N/m² For a Proflexx fabric, BL fabric clamp = 374 kg, Anchor Leff = 500mm

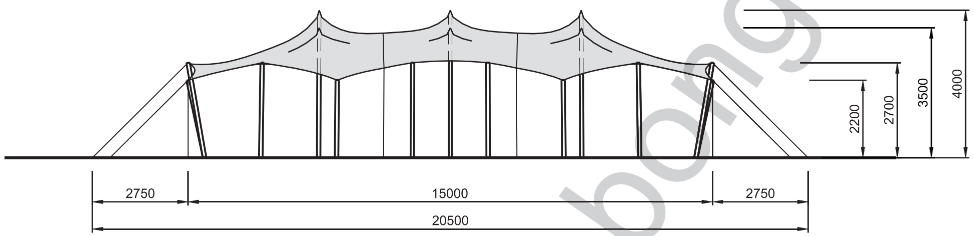
Out of order:	Coast	Flattened, open area	Rural	Village	City
A. Beaufort (indicative)	> 6 Bft	> 6 Bft	> 7 Bft	> 8 Bft	> 8 Bft
B. 10 minutes average wind speed:	> 14,9 m/s	> 15,7 m/s	> 17,5 m/s	> 20,8 m/s	> 21,7 m/s
C. Peak wind speed (gust):	> 85 km/h	> 85 km/h	> 85 km/h	> 85 km/h	> 85 km/h

Pw = 500 N/m² For a Triflexx fabric, BL fabric clamp = 674 kg, Anchor Leff = 700mm

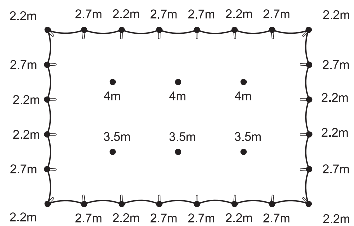
Out of order:	Coast	Flattened, open area	Rural	Village	City
A. Beaufort (indicative)	> 7 Bft	> 7 Bft	> 8 Bft	> 9 Bft	> 9 Bft
B. 10 minutes average wind speed:	> 17.9 m/s	> 18.9 m/s	> 21.1 m/s	> 25.0 m/s	> 26.1 m/s
C. Peak wind speed (gust):	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h

TOP VIEW
[1:150]

SIDE VIEW
[1:150]



FRONT VIEW
[1:150]



POLE HEIGHT DIAGRAM
[1:300]

POLES		
Center poles:	Ø60x3.1mm [EN-AW 6061 T6]	
Perimeter poles:	Ø40x2mm [EN-AW 6061 T6]	
BANDEN	pw = 345 N/m²	pw = 500 N/m²
Ties, attachment [PES]	BL > 750 daN	BL > 1200 daN
Storm belt [PES]	BL > 1450 daN	BL > 2000 daN
ANCHORS	pw = 345 N/m²	pw = 500 N/m²
for dense, non cohesive soil		
T-profiel 25x25mm	Leff = 500 mm	Leff = 700 mm
per attachment tie:	1 anchor	1 anchor
per side of the storm tie:	2 anchors	2 anchors

EDITOR:	DATE:	FILENAME:
NV	24.11.16	1607304_UF_01

F. Important terms and conditions

This document applies to the built construction if the following principles and conditions are met:

- The used materials, parts and sections (membrane, poles, ties, anchoring) are in accordance with this document;
- The dimensions of the built structure match the dimensions stated in this document;
- Parts (poles, ties, anchors) may not be removed;
- Obstacles should be placed at least 0.5m from the membrane (measured perpendicular to the fabric);
- The tent will be closed for public access when strong winds occur (see summary, part wind load);
- The anchorage is based on dense, non-cohesive soil. When the tent is built on a different soil, extra anchorage should be provided or anchorage test should be conducted.
- Only decorations, music- and light installations of less than 10 kg per pole, can be attached to the structure;
- A snow load of 0.1 kN/m^2 (4cm) is taken into account, according to the French CTS.
- The possibility of a center pole to fall over due to the lifting of the fabric, should be prevented at all times. Therefore the 3.5m high poles require additional security against falling over.

G. Wind speeds

G.1 Allowable wind speeds

Wind can be expressed in different ways:

- 10 minutes average wind speed – an average wind speed measured for 10 minutes in a 10m height in an open terrain (EN 1991-1-4 terrain category II).
- Peak wind speed – a short term maximum gust of wind with a certain speed, depending on the height. Often given in km/h

The wind pressure that is used for the calculation for a tent, is determining for the strength of the tent. Therefore it is important that the wind speed is determined correctly to check if the wind pressure is exceeded.

In the structural analysis a wind pressure 0.50 kN/m^2 at 4m is used. For certain elements, a reduced wind pressure of 0.345 N/m^2 is necessary. According to EN 13782, a wind pressure of 0.30 kN/m^2 may be applied in the case of tents with a width ≤ 10 m or less and a height ≤ 5m.

The wind speeds given below are limit values and correspond to a wind pressure of **0.50 kN/m^2** at **4m** height, which is valid for the use of the below stated elements. Above the given wind speed values the strength and/or stability of the structure is not guaranteed to be safe.

Pw = 500 N/m² For a Triflexx fabric, BL fabric clamp ≥ 674 kg, Anchor Leff ≥ 700mm

Out of order:	Coast *1	Flattened, open area *2	Rural *3	Village *4	City * 5
A. Beaufort (indicative)	> 7 Bft	> 7 Bft	> 8 Bft	> 9 Bft	> 9 Bft
B. 10 minutes average wind speed:	> 17.9 m/s	> 18.9 m/s	> 21.1 m/s	> 25.0 m/s	> 26.1 m/s
C. Peak wind speed (gust):	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h	> 102 km/h

1. *Coast means: Sea or coastal area with wind coming from open sea.*
2. *Flattened, open area means: Lakes of flat and horizontal areas with negligible vegetation and without obstacles.*
3. *Rural means: Area with low vegetation like grass and free standing obstacles (trees, buildings) with an in between distance of at least 20 times the obstacle height.*
4. *Village means: Areas with regular vegetation or buildings or free standing obstacles with an in between distance of less than 20 times the obstacle height (like villages, suburban areas, permanent forests)*
5. *City means: Areas where at least 15% of the surface is covered with building with an average height of more than 15m.*

The given values above (A, B and C) can be measured in different ways and can be used independently:

A. This is an indicative Beaufort scale which belongs to the 10 minutes average wind speed. This values has to come from the closest meteostation.
B. 10 min average wind speed at 10 meter height in an open terrain, this value should come from the closest meteostation.
C. Peak wind speed, this value should be measured at the highest point of the tent.

G.2 Wind speed calculation

The maximum wind speed is converted into a basic wind speed for a coastal area, flattened/open area, rural area, village and city according to EN 1991-1-4. Terrain roughness is taken according to the recommended general values for the different terrain categories for Europe. (not country specific)

Wind pressure according to EN13782	$P_{w;EN13782}$	= 500 N/m²
Reduced wind pressure	$P_{w;red}$	= 345 N/m²

Peak wind speed at 4m height

Equation:

$$500 = {}^{1}/_{2} \times \rho \times v^2 = {}^{1}/_{2} \times 1.25 \times v^2 \rightarrow v = 28.3\ m/s \rightarrow \pm 102\ km/h$$

Eq. 4.10 UNI-EN 1991-1-4 Basic wind pressure

$$345 = {}^{1}/_{2} \times \rho \times v^2 = {}^{1}/_{2} \times 1.25 \times v^2 \rightarrow v = 23.5\ m/s \rightarrow \pm 85\ km/h$$

Eq. 4.10 UNI-EN 1991-1-4 Basic wind pressure

Wind speed coastal area at 10m height (Europe) – Tent height = 4m

$$K_r = 0.19 \times \left(\frac{z_0}{0.05}\right)^{0.07} = 0.19 \times \left(\frac{0.003}{0.05}\right)^{0.07} = 0.156$$

Eq. 4.5 UNI-EN 1991-1-4 Terrain factor for coastal area

$$C_r = K_r \times \ln\left(\frac{z}{z_0}\right) = 0.156 \times \ln\left(\frac{4}{0.003}\right) = 1.123$$

Eq. 4.4 UNI-EN 1991-1-4 Roughness factor at 4m height $Z = 4 > Z_{min} = 1$

$$V_m = C_r \times V_b = 1.123 \times V_b$$

Eq. 4.3 UNI-EN 1991-1-4 Average wind speed at height

$$\sigma_v = K_r \times V_b = 0.156 \times V_b$$

Eq. 4.6 UNI-EN 1991-1-4 Standard deviation of turbulence

$$L_v = \frac{\sigma_v}{V_m} = \frac{0.156 \times V_b}{1.123 \times V_b} = 0.139$$

Eq. 4.7 UNI-EN 1991-1-4 Turbulence intensity

$$Q_p = (1 + 7 \times L_v) \times {}^{1}/_{2} \times \rho \times {V_m}^2 = 1.554 \times {V_b}^2$$

Eq. 4.8 UNI-EN 1991-1-4 Extreme wind pressure

Equation:

$$500 = 1.554 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 17.9\ m/s$$

Characteristic wind speed

$$345 = 1.554 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 14.9\ m/s$$

Characteristic wind speed

Wind speed flattened, open area at 10m height (Europe) – Tent height = 4m

$$K_r = 0.19 \times \left(\frac{z_0}{0.05}\right)^{0.07} = 0.19 \times \left(\frac{0.01}{0.05}\right)^{0.07} = 0.170$$

Eq. 4.5 UNI-EN 1991-1-4
Terrain factor for coastal area

$$C_r = K_r \times \ln\left(\frac{z}{z_0}\right) = 0.170 \times \ln\left(\frac{4}{0.01}\right) = 1.017$$

Eq. 4.4 UNI-EN 1991-1-4
Roughness factor at 4m height
$Z = 4 > Z_{min} = 1$

$$V_m = C_r \times V_b = 1.017 \times V_b$$

Eq. 4.3 UNI-EN 1991-1-4
Average wind speed at height

$$\sigma_v = K_r \times V_b = 0.170 \times V_b$$

Eq. 4.6 UNI-EN 1991-1-4
Standard deviation of turbulence

$$L_v = \frac{\sigma_v}{V_m} = \frac{0.170 \times V_b}{1.017 \times V_b} = 0.167$$

Eq. 4.7 UNI-EN 1991-1-4
Turbulence intensity

$$Q_p = (1 + 7 \times L_v) \times {}^1/_2 \times \rho \times V_m{}^2 = 1.402 \times V_b{}^2$$

Eq. 4.8 UNI-EN 1991-1-4
Extreme wind pressure

Equation:

$$500 = 1.402 \times V_b{}^2 \rightarrow solving\ gives \rightarrow V_b = 18.9\ m/s$$

Characteristic wind speed

$$345 = 1.402 \times V_b{}^2 \rightarrow solving\ gives \rightarrow V_b = 15.7\ m/s$$

Characteristic wind speed

Wind speed rural area at 10m height (Europe) – Tent height = 4m

$$K_r = 0.19 \times \left(\frac{z_0}{0.05}\right)^{0.07} = 0.19 \times \left(\frac{0.05}{0.05}\right)^{0.07} = 0.190$$

Eq. 4.5 UNI-EN 1991-1-4
Terrain factor for coastal area

$$C_r = K_r \times \ln\left(\frac{z}{z_0}\right) = 0.190 \times \ln\left(\frac{4}{0.05}\right) = 0.833$$

Eq. 4.4 UNI-EN 1991-1-4
Roughness factor at 4m height
$Z = 4 > Z_{min} = 2$

$$V_m = C_r \times V_b = 0.833 \times V_b$$

Eq. 4.3 UNI-EN 1991-1-4
Average wind speed at height

$$\sigma_v = K_r \times V_b = 0.190 \times V_b$$

Eq. 4.6 UNI-EN 1991-1-4
Standard deviation of turbulence

$$L_v = \frac{\sigma_v}{V_m} = \frac{0.190 \times V_b}{0.833 \times V_b} = 0.228$$

Eq. 4.7 UNI-EN 1991-1-4
Turbulence intensity

$$Q_p = (1 + 7 \times L_v) \times {}^1/_2 \times \rho \times V_m{}^2 = 1.125 \times V_b{}^2$$

Eq. 4.8 UNI-EN 1991-1-4
Extreme wind pressure

Equation:

$$500 = 1.125 \times V_b{}^2 \rightarrow solving\ gives \rightarrow V_b = 21.1\ m/s$$

Characteristic wind speed

$$345 = 1.125 \times V_b{}^2 \rightarrow solving\ gives \rightarrow V_b = 17.5\ m/s$$

Characteristic wind speed

Wind speed village at 10m height (Europe) – Tent height = 4m

$$K_r = 0.19 \times \left(\frac{z_0}{0.05}\right)^{0.07} = 0.19 \times \left(\frac{0.3}{0.05}\right)^{0.07} = 0.215$$

Eq. 4.5 UNI-EN 1991-1-4
Terrain factor for coastal area

$$C_r = K_r \times \ln\left(\frac{z}{z_0}\right) = 0.215 \times \ln\left(\frac{5}{0.3}\right) = 0.606$$

Eq. 4.4 UNI-EN 1991-1-4
Roughness factor at 4m height
$Z = Z_{min} = 5$

$$V_m = C_r \times V_b = 0.606 \times V_b$$

Eq. 4.3 UNI-EN 1991-1-4
Average wind speed at height

$$\sigma_v = K_r \times V_b = 0.215 \times V_b$$

Eq. 4.6 UNI-EN 1991-1-4
Standard deviation of turbulence

$$L_v = \frac{\sigma_v}{V_m} = \frac{0.606 \times V_b}{0.215 \times V_b} = 0.355$$

Eq. 4.7 UNI-EN 1991-1-4
Turbulence intensity

$$Q_p = (1 + 7 \times L_v) \times {}^{1}/_{2} \times \rho \times {V_m}^2 = 0.801 \times {V_b}^2$$

Eq. 4.8 UNI-EN 1991-1-4
Extreme wind pressure

Equation:

$$500 = 0.801 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 25.0\ m/s$$

Characteristic wind speed

$$345 = 0.801 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 20.8\ m/s$$

Characteristic wind speed

Wind speed city at 10m height (Europe) – Tent height = 4m

$$K_r = 0.19 \times \left(\frac{z_0}{0.05}\right)^{0.07} = 0.19 \times \left(\frac{1}{0.05}\right)^{0.07} = 0.234$$

Eq. 4.5 UNI-EN 1991-1-4
Terrain factor for coastal area

$$C_r = K_r \times \ln\left(\frac{z}{z_0}\right) = 0.234 \times \ln\left(\frac{10}{1}\right) = 0.540$$

Eq. 4.4 UNI-EN 1991-1-4
Roughness factor at 4m height
$Z = Z_{min} = 10$

$$V_m = C_r \times V_b = 0.540 \times V_b$$

Eq. 4.3 UNI-EN 1991-1-4
Average wind speed at height

$$\sigma_v = K_r \times V_b = 0.234 \times V_b$$

Eq. 4.6 UNI-EN 1991-1-4
Standard deviation of turbulence

$$L_v = \frac{\sigma_v}{V_m} = \frac{0.540 \times V_b}{0.234 \times V_b} = 0.434$$

Eq. 4.7 UNI-EN 1991-1-4
Turbulence intensity

$$Q_p = (1 + 7 \times L_v) \times {}^{1}/_{2} \times \rho \times {V_m}^2 = 0.735 \times {V_b}^2$$

Eq. 4.8 UNI-EN 1991-1-4
Extreme wind pressure

Equation:

$$500 = 0.735 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 26.1\ m/s$$

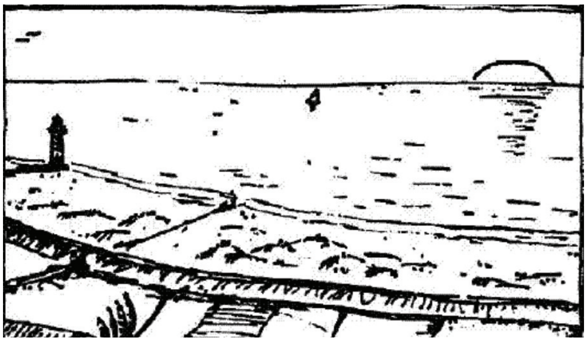
Characteristic wind speed

$$345 = 0.735 \times {V_b}^2 \rightarrow solving\ gives \rightarrow V_b = 21.7\ m/s$$

Characteristic wind speed

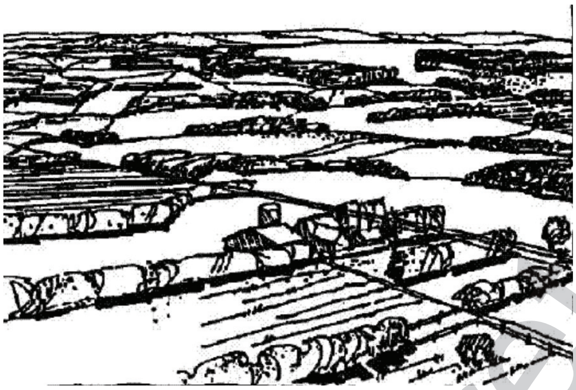
Terrain categories:

0: Coastal area:

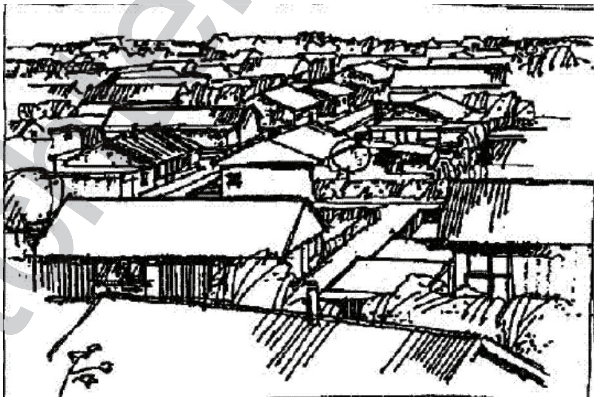


I: Flattened, open area:

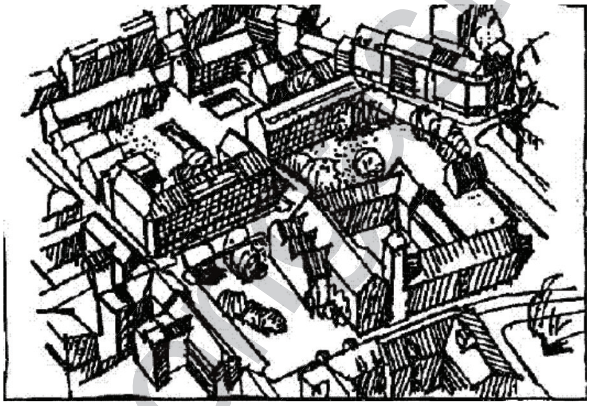
II: Rural area:



III: Village



IV: City



H. **Static Analysis**

H.1. Project description

H.1.1 Description

The principle of a stretch tent is based on a rectangular piece of stretchable fabric.The membrane is supported by poles, both at the edge and in the field. The perimeter poles are stabilized by ties. Besides, it is also possible to tie down the edge of the membrane directly to the ground. There is a freedom in positioning the poles and therewith a freeform design can be obtained.

The disadvantage of this form-flexibility is the difficulty in researching and arranging all possible configurations in a static analysis. The structural calculation in this report shows the static analysis of the 10x15m dimension, where a configuration is considered which has all sides open.

Paragraph H.1.2 shows the geometry of the analyzed 10x15m configuration. Main dimensions, position of poles, ties and anchors can be found in Chapter E.*

** The analyzed geometry contains 6 main poles with a height of 4m. One row of main poles is lowered to 3.5 meters for the standard set-up to improve the drainage. This does not have disadvantageous consequences for the resulting forces and is therefore allowed as long as the 3.5m poles are secured against falling over.*

H.1.2 Geometry

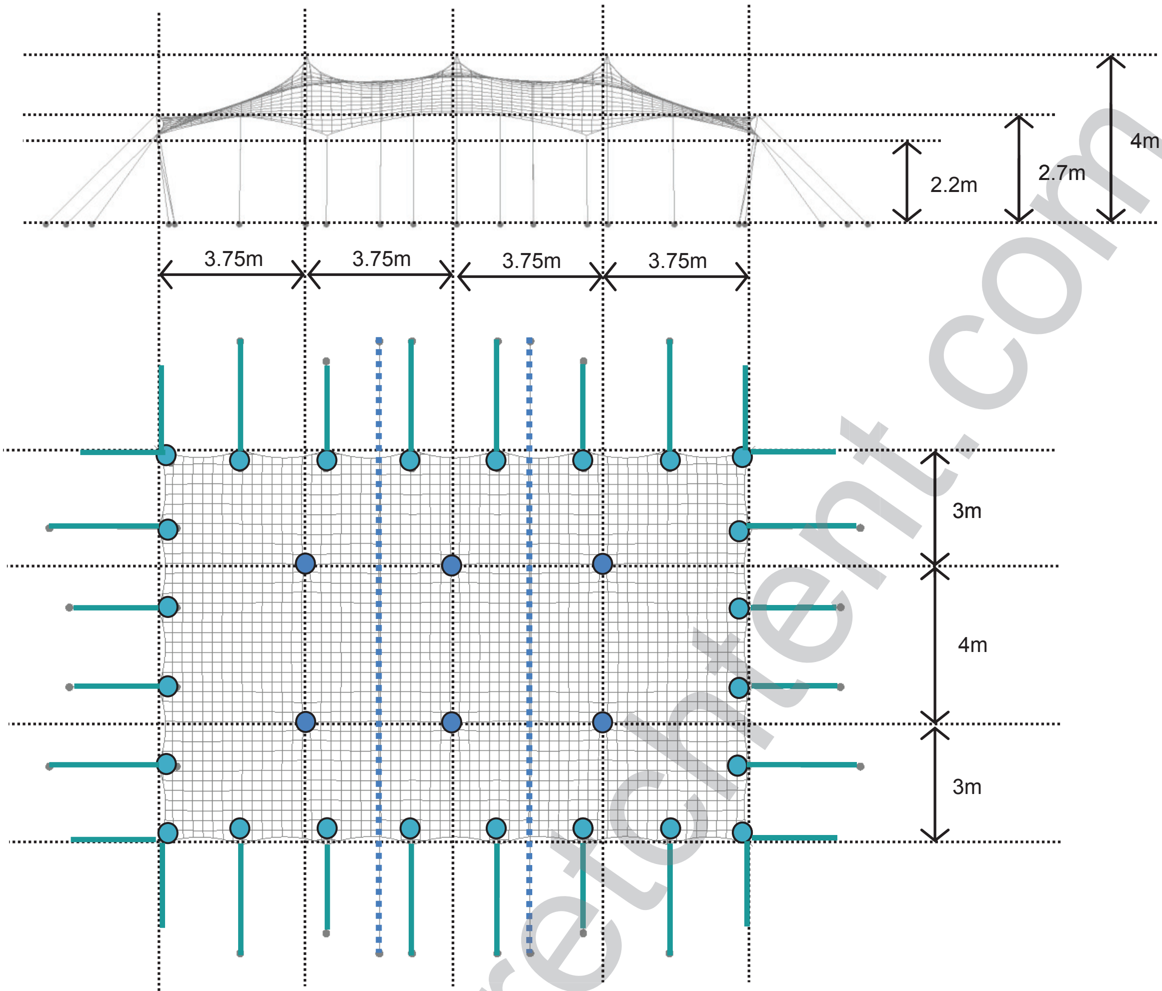


Figure 1: Configuration 'floating, dimension 10x15m

H.2. Materials and cross sections

H.2.1 Materials

H.2.1.1 Fabric

Design tensile strength	f_d	f_{tk} / γ_m	art 8.6. NEN-EN 13782
Characteristic tensile strength (warp)	$f_{tk,ketting}$		
Characteristic tensile strength (weft)	$f_{tk,inslag}$		
Material factor – global, permanent load	γ_m	2.5	tbl 4. NEN-EN13782
Material factor – global, short duration load	γ_m	2.0	tbl 4. NEN-EN13782

Table 1. Used symbols, codes and standard for fabric materials

Material	Type	Weight	$f_{rd;warp;perm}$	$f_{rd;\ weft;perm}$	$f_{rd;\ warp;short}$	$f_{rd:\ weft;short}$
PES + PU/PVC Triflexx	-	443 gr/m^2	8.14 kN/m	5.07 kN/m	10.18 kN/m	6.34 kN/m
PES + PU/PVC Proflexx	-	530 gr/m^2	4.80 kN/m	3.20 kN/m	6.00 kN/m	4.00 kN/m

Table 2. Used fabrics

H.2.1.2 Belts

Design resistance	F_{rd}	R_m / γ_m	art. 10.2 NEN-EN 13782
Characteristic tensile strength	R_m	LC x γ_{m2}	
"Lashing Capacity"	LC		Conform EN 12195 - 2
Material factor	γ_{m1}	2.0	art.10.4. NEN-EN 13782
Material factor	γ_{m2}	3.0	EN 12195 - 2

Table 3. Used material factors

Material	LC	Breaking strength R_m	F_{rd}
Tension belt, [PES] EN 12195-2	400kg 4 kN	1200 kg 12 kN	6.0 kN
Storm belt, [PES] EN 12195-2	666 kg 6.66 kN	2000 kg 20 kN	10 kN

Table 4. Used belts (storm belt)

The above specified belts are often used for the 10x15m bonga stretchtent. However, the needed breaking strengths for the reduced wind loads are lower. (see chapter D).

H.2.1.3 Aluminum

Material factor (strength)	γ_{m1}	1.1	tbl. 6.1. NEN-EN 1999-1-1
Material factor (stability)	γ_{m1}	1.1	tbl 6.1. NEN-EN 1999-1-1
Material factor (tension to fracture/connections)	γ_{m2}	1.25	tbl 2.1. NEN-EN 1999-1-1

Table 1. Used material factors

Material	Weight	E-modulus	f_y	f_u
6061 T6	2700 kg/m^3	70000 N/mm^2	240 N/mm^2	260 N/mm^2

Table 5. Used aluminum materials

H.2.2 Cross sections

Profile	Material	b mm	t mm	G kg/m^1	A mm^2	Iy mm^4	Wel;y mm^3	Wpl;y mm^3
Center pole Ø60 x 3.1mm	Al 6061 T6	60	3.1	1.50	554	224929	7498	10047
Perimeter pole 2.7m Ø40 x 2mm	Al 6061 T6	40	2.0	0.65	239	43216	2161	2891
Perimeter pole 2.2m Ø40 x 2mm	Al 6061 T6	40	2.0	0.65	239	43216	2161	2891

Table 6. Used cross sections

H.3. Calculation method

H.3.1 Modeling

The analysis of the structure is performed with the software package EASY FCS supplied by TECHNET GmbH, Berlin. This software is specially developed for structures with large deformability, such as membrane structures. The performed analysis is a full non-linear second order analysis.

The membrane structure is modeled in 3D. The membrane is modeled as a cable net structure and supported by poles. These center poles will be stabilized by the tensioned membrane. The perimeter poles are stabilized and tied down by guy ropes or tension belts, which are attached to ground anchors.

H.3.2 Structural behavior of membrane structures

The forces in a tent structure are based on the deformations of the fabric. Since the fabric is a highly deformable material, it is only possible to calculate stresses and deformations with a non-linear method. Therefore the non-linear software Easy FSC is used.

Because of the non-linearity of the calculations the partial safety factors are not applied beforehand, but afterwards. This is done to prevent that the deformations increase due to the extra partial safety factors, which has a positive effect on the occurring stresses (clarifying: a cable with a high structural height has lower horizontal reaction forces than a cable with a low structural height). In this case it is therefore unsafe to apply the partial safety factors on the load beforehand. Furthermore, the forces cannot be recalculated linearly. This has as a consequence that it is not possible to differentiate in the partial safety factors, since the different load cases are already combined to a load combination.

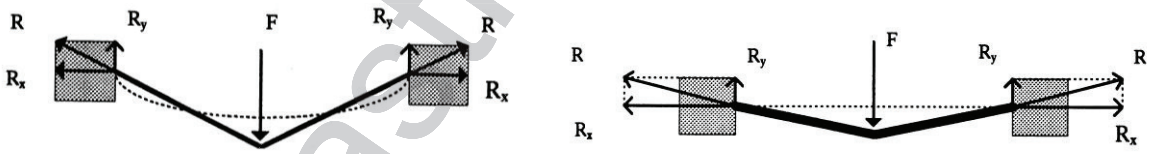


Figure 2. Reaction forces of a hanging cable.

As a membrane structure is a form-active structure, article 6.3 (4) b) of the EN-1990:2002 applies:

> *When the action effect increases less than the action, the partial factor γ_F should be applied to the action effect of the representative value of the action.*

H.3.3 Structural behavior of stretch membrane

The stretch tent is a form active structure based on the curvature principle. When the membrane is loaded, the curvature in the structure is increasing or decreasing, depending on the direction of the curvature. This change in curvature takes care of the regulation of the stresses in the fabric. The change of curvature, and thereby also the deformations, is substantial due to the flexible nature of the membrane.

The poles are supporting the fabric. The application of rounded caps at the top of the poles reduces the peak loads in the fabric. Vice versa, the fabric supports the poles in transverse direction, enabling the assumption of a 2-sided hinged pole.

H.3.4 Structural system

The modelled membrane structure is made out of an initially flat membrane. By supporting the membrane at multiple points, a smooth curved surface will be created.

The boundaries of the membrane are finished with a tunnel that has a width of 80mm. On a regular distance and in the corners reinforcing pieces (PVC fabric, 2500 N tension strength) are applied that are welded in the sew. A trapezoidal cord Ø8mm is integrated in the perimeter, which stretches with the fabric. On this tendon clamps can be applied on the places where the reinforcement is applied.

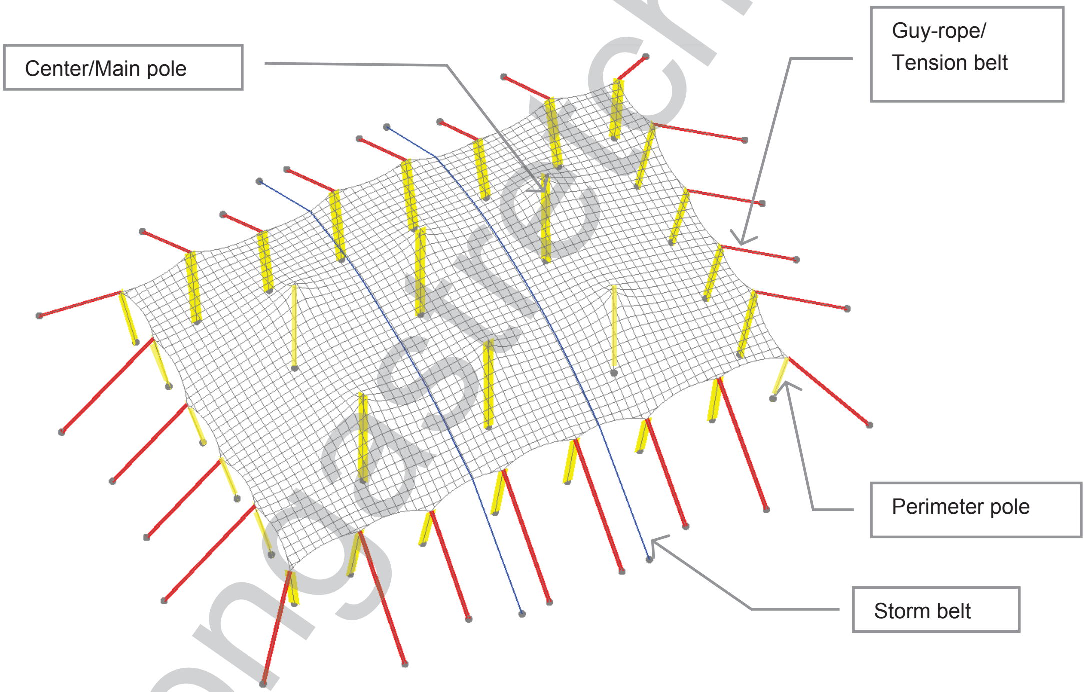


Figure 3: Structural system of the tent structure.

Remark: In the model one tension belt is accounted for in the corners. In reality there will be two.

H.3.5 Load combinations

H.3.5.1 Fundamental - Ultimate limit state

For the purpose of determination of strength and check of elements and connections.

	One variable load	Multiple variable loads
Unfavorable permanent load	$1.35 \times G + 1.5 \times Q$	$1.35 \times G + \sum 1.35 \times Q_i$
Favorable permanent load	$1.0 \times G + 1.5 \times Q$	$1.0 \times G + \sum 1.35 \times Q_i$

Table 7. Load combinations according to NEN-EN 13782

This means the following load combinations will be checked/calculated

1. 1.0 x Own weight + 1.5 x Wind load
2. 1.35 x Own weight + 1.35 x Conventional load

H.3.5.2 Safety against overturning, sliding and uplifting - Ultimate limit state

For the purpose of determination and check of needed contra weight and/or anchor pins

	One or multiple variable loads
Unfavorable permanent load	$1.1 \times G + 1.2 \times Q_{wind} + \sum 1.3 \times Q_i$
Favorable permanent load	$1.0 \times G + 1.2 \times Q_{wind} + \sum 1.3 \times Q_i$

Table 8. Load combinations according to NEN-EN 13782

This means the following load combinations will be checked/calculated

1. 1.0 x Own weight + 1.2 x Wind load

H.4. Load cases

H.4.1 Own weight

The own weight of the fabric is ≤ 0.530 kg/m^2 and is added in the software as separate load case.

H.4.2 Pretension

The structure will be pretensioned with guy ropes / tension belts. This results in a pretension in the fabric of about 0.10 kN/m^1 at the boundaries. Locally (where the side poles are attached to the fabric) higher pretensions occur due to the stretching nature of the fabric.

H.4.3 Wind

H.4.3.1 Wind pressure

Wind load according to NEN-EN 13782, 7.4.2.2:
For any other location where v_{ref} > 28 m/s*, calculations shall be provided for the tent verifying the stability and resistance with the local conditions. Special measures have to be taken. In the design calculations the necessary means shall be verified through calculation.

For v_{ref} < 28 m/s*, the wind load per unit may be evaluated applying the following minimum values given in EN 1991-1-4 with:
$C_{TEM} = 0.8$
$T_r = 10$ years
$C_d = 1$
$C_{alt} = 1$

** The stated value for wind speed is a 10-minute average, measured at 10m height.*

According to table 1 of EN 13782 article 7.4.2.2, this results in a wind pressure of 500 N/m^2 in case of tents with a height equal or less to 5m. However, a reduced wind pressure of pw = 300 N/m2 may be applied in the case of tents with a width ≤ 10 m and a height ≤ 5 m.

Due to the capacity, certain elements require a wind pressure between 300 N/m^2 < pw < 500 N/m^2 :

- Proflexx fabric, reduction factor α = 0.71, wind pressure $p_{w,red}$ = 0.355 kN/m^2
- Fabric clamps BL 374kg, reduction factor α = 0.69, wind pressure $p_{w,red}$ = 0.345 kN/m^2

However, there are replacements available (Triflexx fabric, Fabric clamps BL ≥ 674 kg) that will sustain a wind pressure of 500 N/m^2.

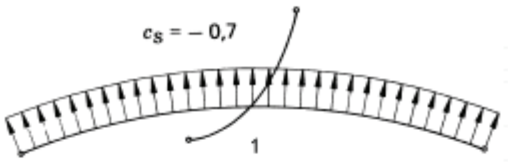
H.4.3.2 Wind shape values

Two different wind situations are reviewed for the membrane:

- The whole tent is subjected to wind suction
- The whole tent is subjected to wind pressure

Wind suction – floating configurations

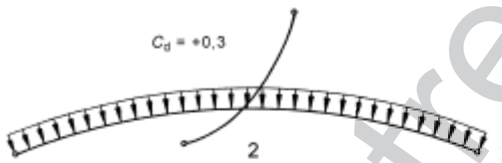
Wind shape values (C_p – values) in accordance to art.7.4.2.3 of NEN-EN 13782.



$p_{w,red}$	Factor α	$p_{w,rep}$	
500 N/m²	1	-0.7 x (1 x 0.500)	= -0.35 kN/m²
355 N/m²	0.71	-0.7 x (0.71 x 0.500)	= -0.25 kN/m²
345 N/m²	0.69	-0.7 x (0.69 x 0.500)	= -0.24 kN/m²

Wind pressure

Wind shape values (C_p – values) in accordance to art.7.4.2.3 of NEN-EN 13782.



$p_{w,red}$	Factor α	$p_{w,rep}$	
500 N/m²	1	0.3 x (1 x 0.500)	= 0.15 kN/m²
355 N/m²	0.71	0.3 x (0.71 x 0.500)	= 0.11 kN/m²
345 N/m²	0.69	0.3 x (0.69 x 0.500)	= 0.10 kN/m²

H.4.4 Conventional / snow load

Conventional load according to article 7.3 of NEN-EN 13782: The stability shall be checked with a conventional vertical load of 0,1 kN/m2. This load shall not be combined with other load cases, except self-weight. This can be seen as a snow load of 0.1 kN/m^2 (4cm) according the French CTS.

H.4.5 Snow load

According to NEN-EN 13782, article 7.4.3 it is not necessary to calculate with snow loads in the strength and stability analysis when the following terms apply:

- The tent is constructed in an area where there is no likelihood of snow or;
- Operated at a time of the year, where the likelihood of snow can be discounted or;
- Where by design or operating conditions snow settling on the tent is prevented;
- Where pre-planned operation action prevents snow from settling on the tent

This last condition may be achieved by:

- Sufficient heating equipment is installed and is ready for used and;
- Heating is started prior to snow fall and;
- Tent is heated in such a way that the whole of the roof cladding has an outside air temperature of more than +2 ˚C;
- Cladding is made and tensioned in such a way that ponding of water or any other deformation of the cladding cannot take place.

H.5. Calculation results

H.5.1 Calculated load combinations

LC1 = Pretension
LC2 = Own weight
LC3 = Wind suction
LC4 = Wind pressure
LC5 = Conventional load / Snow load

The following load combinations are taken into account:
partial safety factors are added after the static analysis (see H.3.2).

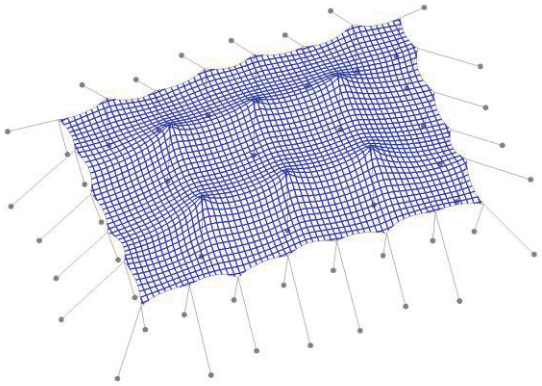
	LC 1	LC2	LC 2	LC 3	LC 4
CO 1	1 x	1 x			
CO 2	1 x	1 x	1 x		
CO 3	1 x	1 x		1 x	
CO 4	1 x	1 x			1 x

Table 9: Combinations (CO)

H.5.2 Summary of determining forces per element

In the next paragraphs the results will be determined for a full wind pressure equal to p_w = 0.5 kN/m^2 unless indicated differently.

H.5.2.1 Membrane



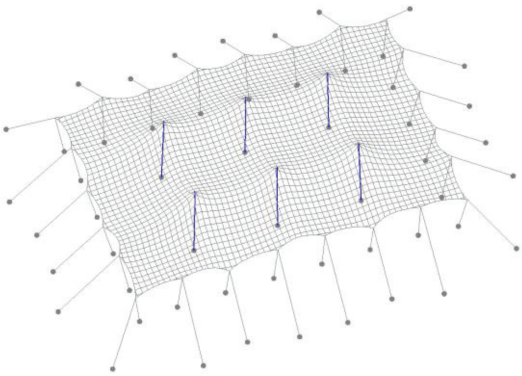
	Load combination	F_{rep}	Pag
	CO1. Own weight + pretension	0.23 kN/m	53
Max Triflexx	CO2. Own weight + pretension + wind suction	3.78 kN/m	55
Max Proflexx	CO2. RED: Own weight + pretension + wind suction	2.80 kN/m *	55
	CO3. Own weight + pretension + wind pressure	2.48 kN/m	58
	CO4. Own weight + pretension + conventional	1.78 kN/m	60

Table 10: Leading forces membrane

* the stresses exceed the maximum value of 2.80 kN/m only locally at the boundaries where the membrane is stretched.

CO2 RED and CO3 RED give stresses for a reduced wind pressure of $p_{w,red}$ = 0.355 kN/m^2.

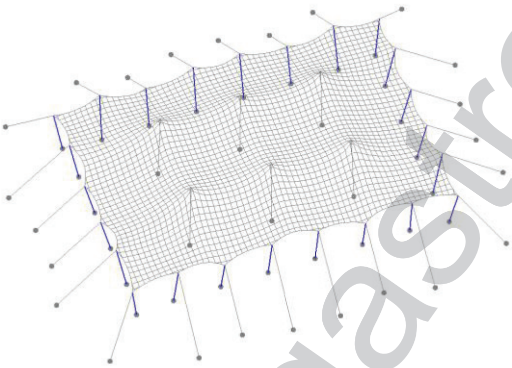
H.5.2.2 Center poles



Length		Load combination	F_{rep}	Pag.
4m		CO1. Own weight + pretension	-0.27 kN	54
		CO2. Own weight + pretension + wind suction	0 kN	57
	Max	CO3. Own weight + pretension + wind pressure	-3.49 kN	59
		CO4. Own weight + pretension + conventional	-2.45 kN	61

Table 11: Leading forces center poles

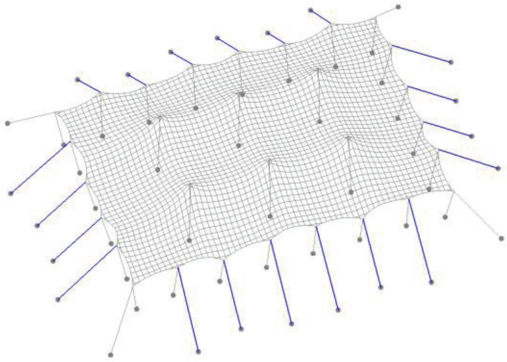
H.5.2.3 Perimeter poles



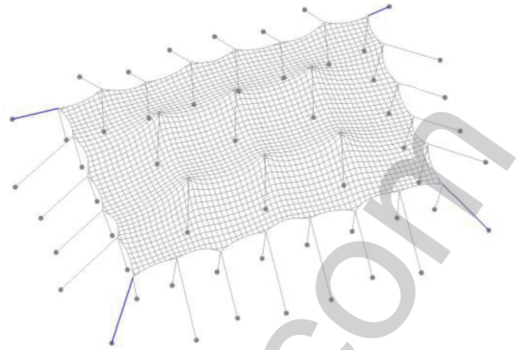
Length		Load combination	F_{rep}	Pag.
2.7 m		CO1. Own weight + pretension	-0.27 kN	54
		CO2. Own weight + pretension + wind suction	-1.12 kN	57
	Max	CO3. Own weight + pretension + wind pressure	-2.01 kN	59
		CO4. Own weight + pretension + conventional	-1.38 kN	61
2.2 m		CO1. Own weight + pretension	-0.25 kN	54
		CO2. Own weight + pretension + wind suction	-1.06 kN	57
	Max	CO3. Own weight + pretension + wind pressure	-1.15 kN	59
		CO4. Own weight + pretension + conventional	-0.82 kN	61

Table 12: Leading forces perimeter poles

H.5.2.4 Guy ropes / Tension belts



Tension belt



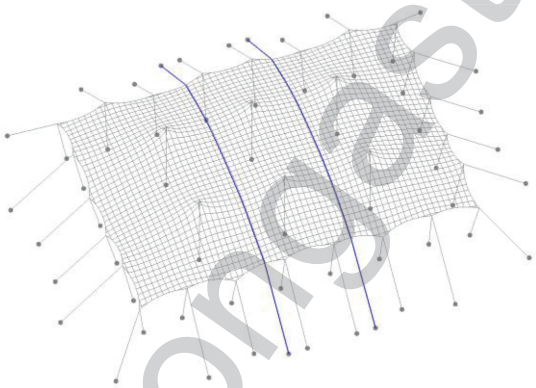
Tension belt corner

Length		Load combination	F_{rep}	Pag.
Tension belt		CO1. Own weight + pretension	0.26 kN	54
	Max	CO2. Own weight + pretension + wind suction	3.59 kN	57
		CO3. Own weight + pretension + wind pressure	1.86 kN	59
		CO4. Own weight + pretension + conventional	1.18 kN	61
Tension belt corner		CO1. Own weight + pretension	0.53 kN	54
	Max	CO2. Own weight + pretension + wind suction	3.34 kN	57
		CO3. Own weight + pretension + wind pressure	2.16 kN	59
		CO4. Own weight + pretension + conventional	1.57 kN	61

Table 13: Leading forces guy ropes

Remark: In the model one tension belt is accounted for at the corners. In reality there will be two.

H.5.2.5 Storm belts



	Load combination	F_{rep}	Pag.
Max	CO2. Own weight + pretension + wind suction	6.96 kN	57

Table 14: Leading forces reinforcements

H.6. Check elements

H.6.1 Membrane

Load combination	Element	Representative stress	Design value stress	Pag.
CO2. Own weight + pretension + wind suction	Membrane Short term load -Triflexx -	3.78 kN/m	5.67 kN/m (γ = 1.5)	28
CO2. RED Own weight + pretension + wind suction	Membrane Short term load -Proflexx -	2.80 kN/m	4.20 kN/m (γ = 1.5)	28

PES – PU/PVC, Triflexx or Proflexx fabric is used.

UC.1	**Triflexx**	**Pw = 500 N/m²**	**S_{Ed} / S_{rd} < 1**	**5.67 / 6.34 = 0.89 < 1**	**OK**
UC.2	**Proflexx**	**Pw = 355 N/m²**	**S_{Ed} / S_{rd} < 1**	**4.20 / 4.00 = 1.05 ≈ 1**	**ACCEPTABLE**

For the capacity of the membrane, see H.2.1.1- page 19

H.6.2 Center pole

Load combinations	Element	Representative force	Design value force	Pag.
CO3. Own weight + pretension + wind pressure	Center pole 4.0m	-3.49 kN	-5.24 kN (γ = 1.5)	29

Profile = CHS Ø60 x 3.1 mm
Length = ≤ 4m
Quality = EN AW-6061 T6 (EP)

The poles are considered as hinged poles; the buckling length is equivalent to the pole length.

UC.3	**Interaction (NM)**	**Pw = 500 N/m²**	**4.0m**	$\left(\frac{N_{ed}}{\chi\omega N_{rd}}\right)^{0.8} = \left(\frac{5.24}{0.069\times1\times120.9}\right)^{0.8} = 0.69 < 1$	**OK**

See Annex C.1 for elaborate check

H.6.3 Perimeter pole

Load combinations	Element	Representative force	Design value force	Pag.
CO3. Own weight + pretension + wind pressure	Perimeter pole 2.7m	-2.01 kN	-3.02 kN (γ = 1.5)	29
CO3. Own weight + pretension + wind pressure	Perimeter pole 2.2m	-1.15 kN	-1.73 kN (γ = 1.5)	29

Profile	=	CHS Ø40 x 2mm
Length	=	≤ 2.7m
Quality	=	EN AW-6061 T6 (EP)

The poles are considered as hinged poles; the buckling length is equivalent to the pole length.

UC.4	**Interaction (NM)**	**Pw = 500 N/m²**	**2.7m**	$\left(\frac{N_{ed}}{\chi\omega N_{rd}}\right)^{0.8} = \left(\frac{3.02}{0.068\times1\times52.09}\right)^{0.8} = 0.88 < 1$	**OK**

See Annex C.2 for elaborate check

UC.5	**Interaction (NM)**	**Pw = 500 N/m²**	**2.2m**	$\left(\frac{N_{ed}}{\chi\omega N_{rd}}\right)^{0.8} = \left(\frac{1.73}{0.101\times1\times52.09}\right)^{0.8} = 0.41 < 1$	**OK**

See Annex C.3 for elaborate check

H.6.4 Guy rope / Tension belt

Load combination	Element	Representative force	Design value force	Pag.
CO2. Own weight + pretension + wind suction	Tension belt	3.59 kN	5.39 kN (γ = 1.5)	30
CO2. Own weight + pretension + wind suction	Tension belt corner	3.34 / √2 = 2.36 kN *	3.54 kN (γ = 1.5)	30

* Remark: In the model one tension belt is accounted for at the corners. In reality there will be two.

The tension belts have a minimum breaking strength of 1200 kg.

UC.7	**Tension belt**	**Pw = 500 N/m²**	**F_d / F_{rd} < 1**	**5.39 / 6.0 = 0.90 < 1.0**	**OK**

For the capacity of the belt, see H.2.1.2- page 19

For a reduced wind pressure of 345 N/m² the minimal needed breaking strength is:
α x Fd x γm1 = 0.69 x 5.39 x 2.0 = 7.44 kN ≈ 750 kg

H.6.5 Storm belt

Load combination	Element	Representative force	Design value force	Pag.
CO2. Own weight + pretension + wind suction	Storm belt	6.96 kN	10.44 kN (γ = 1.5)	30

The storm belts have a minimum breaking strength of 2000 kg:

UC.8	**Storm belt**	**Pw = 500 N/m²**	**$F_d / F_{rd} < 1$**	**10.44 / 10.00 = 1.04 ≈ 1.0**	**ACCEPTABLE**

For the capacity of the storm belts, see H.2.1.2- page 19

For a reduced wind pressure of 345 N/m² the minimal needed breaking strength is:
α x Fd x γm1 = 0.69 x 10.44 x 2.0 = 14.41 kN ≈ 1450 kg

H.6.6 Fabric clamp

Load combination	Element	Representative force	Design value force	Pag.
CO2. Own weight + pretension + wind suction	Tension belt	3.59 kN	5.39 kN (γ = 1.5)	30
CO2. Own weight + pretension + wind suction	Tension belt corner	3.34 / √2 = 2.36 kN *	3.54 kN (γ = 1.5)	30

Results tensile tests clamps:

Average tensile strength	Ftm:		= 4675 N	(see Annex D)
Design value capacity	Frd = Ftk =	0.8 x 4675	= 3740 N	(Eq. 10, EN 13782)

For a reduced wind pressure of 345 N/m² the design value force is:
Fd,red = α x Fd = 0.69 x 5.39 = 3.72 kN = 372 kg

UC.9	**Fabric clamp**	**Pw = 345 N/m²**	**$F_{d,red} / F_{rd} < 1$**	**3.72/ 3.74 = 0.99 < 1.0**	**OK**

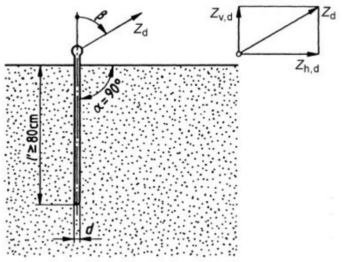
For a pressure of 500 N/m² the minimal needed average tensile strength is:
Ftm = Ftk / 0.8 = 5.39 / 0.8 = 6.74 kN = 674 kg

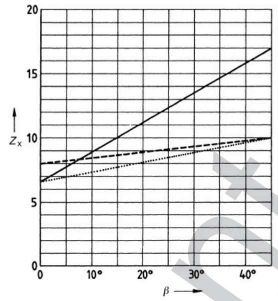
UC.10	**Fabric clamp**	**Pw = 500 N/m²**	**$F_{d,red} / F_{rd} < 1$**	**5.39/ (0.8 x 6.74) = 1.0**	**OK**

H.7. Safety against overturning, sliding and uplifting

H.7.1 Capacity anchor

Anchors of 25x25x750mm (T-profile) are used, taking into account an effective length of at least 700mm. For a reduced wind load, however, an effective length of 500mm is sufficient.





Angle of pull	Load bearing capacity *N*
$\beta = 0$	Z_d = 6,5 dl' for stiff cohesive and for dense cohesion less soils
$\beta = 0$	Z_d = 8 dl' for very stiff cohesive soils
$\beta \geq 45$	Z_d = 10 dl' for cohesive soils of at least medium to stiff consistency
$\beta \geq 45$	Z_d = 17 dl' for dense cohesion less soils
$0 < \beta < 45$	The load bearing capacity for the soil types shall be determined by interpolation

Z_d is the anchor service load (service load), in N;

$Z_{h,d}$ is the horizontal anchor service load, in N;

$Z_{v,d}$ is the vertical anchor service load, in N;

d is the anchor diameter, in cm;

l' is the depth of penetration in cm;

α is the angle of penetration;

ß is the angle of acting tensile force to the vertical

Figure 4: Taken from NEN-EN 13782: Figures 4 & 5, table 5

		T-profile 25x25x750mm		T-profile 25x25x550mm	
Angle	ß	≥ 45	°	≥ 45	°
Effective length anchor	L'	70	cm	50	cm
Diameter anchor	d	3.54	cm	3.54	cm
Anchor capacity*	Z_d	4.21	kN	3.01	kN

*Calculated under the assumption the anchor is based in dense cohesion less soil.

H.7.2 Required anchor pins

Load combination	Element	Representative force	Design value force	Pag.
CO4. Own weight + pretension + wind suction	Tension belt	3.59 kN	4.31 kN (γ = 1.2)	30
CO3. Own weight + pretension + wind suction	Tension belt corner	3.34 / √2 = 2.36 kN *	2.83 kN (γ = 1.2)	30
CO3. Own weight + pretension + wind suction	Storm belt	6.96 kN	8.35 kN (γ = 1.2)	30

* Remark: In the model one tension belt is accounted for at the corners. In reality there will be two.

Anchoring T-profile 25x25x750 mm

Tension belt	**Pw = 500 N/m²**	**F_d / F_{rd}**	**4.31 / 4.21 = 1.02**	**1 anchor / tension**
Tension belt corner	**Pw = 500 N/m²**	**F_d / F_{rd}**	**2.83 / 4.21 = 0.67**	**1 anchor/ tension belt**
Storm belt	**Pw = 500 N/m²**	**F_d / F_{rd}**	**8.35 / 4.21 = 1.98**	**2 anchors / side of the storm belt**

For a reduced wind pressure of 345 N/m2 the design values of the anchor forces are equal to:
Tension belt: Fd,red = α x Fd = 0.69 x 4.31 = 2.97 kN
Tension belt corner: Fd,red = α x Fd = 0.69 x 2.83 = 1.95 kN
Storm belt: Fd,red = α x Fd = 0.69 x 8.35 = 5.76 kN

Anchoring T-profile 25x25x550 mm

Tension belt	**Pw = 345 N/m²**	**F_d / F_{rd}**	**2.97 / 3.01 = 0.99**	**1 anchor / tension**
Tension belt corner	**Pw = 345 N/m²**	**F_d / F_{rd}**	**1.95 / 3.01 = 0.65**	**1 anchor/ tension belt**
Storm belt	**Pw = 345 N/m²**	**F_d / F_{rd}**	**5.76 / 3.01 = 1.91**	**2 anchors / side of the storm belt**

H.7.3 Anchor tests according to EN 13782

It is advised to conduct anchor tests on site.

Anchor tests should be carried out according to the following procedure:
Three anchors spread throughout the terrain should be put perpendicular into the ground. The anchors should be pulled out with the aid of a spring balance in the direction of the force acting on the anchor. The highest occurring force should be noted. The deformation of the anchor cannot be so high that the structure might become unstable or stresses become too large. The lowest of the three measured values should be used as the permissible value.

A partial safety factor of $\gamma = 1.6$ is to be applied on the ultimate limit load of the lowest test value in order to determine the load bearing capacity of the anchor.

For example:
Force in belts: Frep = 16.2 kN
$Fsd_{belt} = 1.2 \times Frep = 1.2 \times 16.2 = 19.4$ kN

The partial safety factor $\gamma = 1.6$ is applied on the ultimate limit load:
$Z_{u,d,test} > 1.6 \times Fsd = 1.6 \times 19.4 = 31.1$ kN

If for example the anchor test point out there has a minimal anchor capacity of 16 kN (1600 kg), then 2 anchors are needed: $2 \times 16 = 32$ kN $> Z_{u,d,test}$

I. Material specifications

Membrane – Technical data: Triflexx

ENDUTEX - REVESTIMENTOS TEXTEIS, SA

VIZELA / PORTUGAL

Test Results

REFERENCE: **TP 5252/A FR**

DESCRIPTION : PVC/PU DOUBLE COATED POLYESTER FABRIC

COMPOSITION : 29 % PVC
23 % PU
48 % POLYESTER

WIDTH : 220 cm

CHARACTERISTIC	RESULTS	METHOD
THICKNESS (mm)	0.61	
TOTAL MASS (g/m^2)	443	EN ISO 2286-2
FABRIC MASS (g/m^2)	196	EN ISO 2286-2
BREAKING LOAD (daN/50mm)	L.: 101.8 T.: 63.4	EN ISO 1421
BREAKING EXTENSION (%)	L.: 113 T.: 152	EN ISO 1421
BREAKING EXTENSION, 50N (%)	L.: 10 T.: 19	EN ISO 1421
TEAR STRENGTH (daN)	L.: 3.5 T.: 4.6	EN ISO 4674-1B
COATING ADHESION (daN/50mm)	3.2	EN ISO 2411

L - Along
T - Across

Date	QUALITY CONTROL
2015.10.22	Célia Sousa

Doc. 0044/DF.0

Membrane – Technical data: Proflexx

PROVISIONAL TECHNICAL DATASHEET 02

Quality **KROKUS INRY M2 (220)** **KROKU019**

Date	**5/05/2014**				
Backing	**100% Polyester**				
Coating	**100% PVC**				
Composition	**Coating**		400	g/m^2	
	Backing		130	g/m^2	
	Total		530	g/m^2	± 25 g/m²
Tensile strength	**ISO 1421 1998**	length	>60	daN/ 5 cm	
		width	>40	daN/ 5 cm	
Tear strength	**ISO 4674-01 2003**	length	>3,5	daN	
		width	>2,8	daN	
Seam resistance	**ISO 13936-1 2004**	length	>26	daN/ 5cm	
		width	>26	daN/ 5cm	
% Elongation under 30N/5cm		length	>5	%	
		width	>8	%	
Coating to fabric adhesion	**ISO 2411 2000**		>2	daN/ 5cm	
Flex resistance	**ISO 5402 1:2003**	no quality loss after 200000			
Hydrostatic head	**ISO 1420 1978**		>200 cm		
			Tight to house dust mites		
Colour fastness to light	**EN ISO 105 B02 1994**		>6		Servaco R201307360 (26/09/2013)
Flame retardancy	**NF P92-503 : 1995**		M2		**Engaged in testing**
Antibacterial	**Sanitized Clariant Benelux (Valid licence available)**				
	active ingredient = zinc pyrithione				
	According to the Biocidal Products Regulation (EU) No 528/2012, it's mandatory to communicate this to your customers				

PLASTIBERT
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Email : info@plastibert.be - www.plastibert.be
KBC Bank : 446-7145101-92 - IBAN BE 12 4667 1451 0192 - BIC : KRED BE BB
BTW BE 0405.435.551 - RPR 0405.435.551
Ger.Arr. Kortrijk

Cleaning

We recommend to clean this article with water and soap only. Cleaning products containing alcohol, solvent, bleach or abrasive products can damage this product.

Disinfecting

On request a list of approved disinfectants can be sent. Plastibert takes no responsability for damage if other products are used.

Care **ISO/FDIS 3758:2005**

Shrinkage after washing: < 6%

Antimicrobial effect can be reduced by washing

Alcohol in high concentrations might damage this article.

Other

This article is HF weldable, this should however be tested on your equipment.

Remarks

All the specifications given in this document have been tested in accredited laboratories or in our own laboratory using officially calibrated measuring equipment.

This datasheet is valid for five years after the date of publication. However, we guarantee that the item has been produced with the same ingredients and ISO-9000 procedures were strictly complied with. In the event that any modifications may have been applied during this period, all the properties were retested.

The items delivered comply with the specifications stated in this datasheet. In principle, we do not guarantee properties or characteristics that are not included in it.

Slight colour variations between deliveries are possible. We recommend that you always process items from different deliveries separately.

This item complies with the most recent REACH specifications.

IMPORTANT

This datasheet is provisional, which means we that up to now did not make enough productions to be certain of all values. Therefore we still cannot guarantee all numerical data.

APPROVAL : CEO

PLASTIBERT
Molenstraat 207 - BE - 8710 Wielsbeke - Belgium
Tel. : +32(0)56 66 52 75 - Fax. : +32(0)56 66 41 30
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Ger.Arr. Kortrijk

Membrane – Bi-axial test: Triflexx

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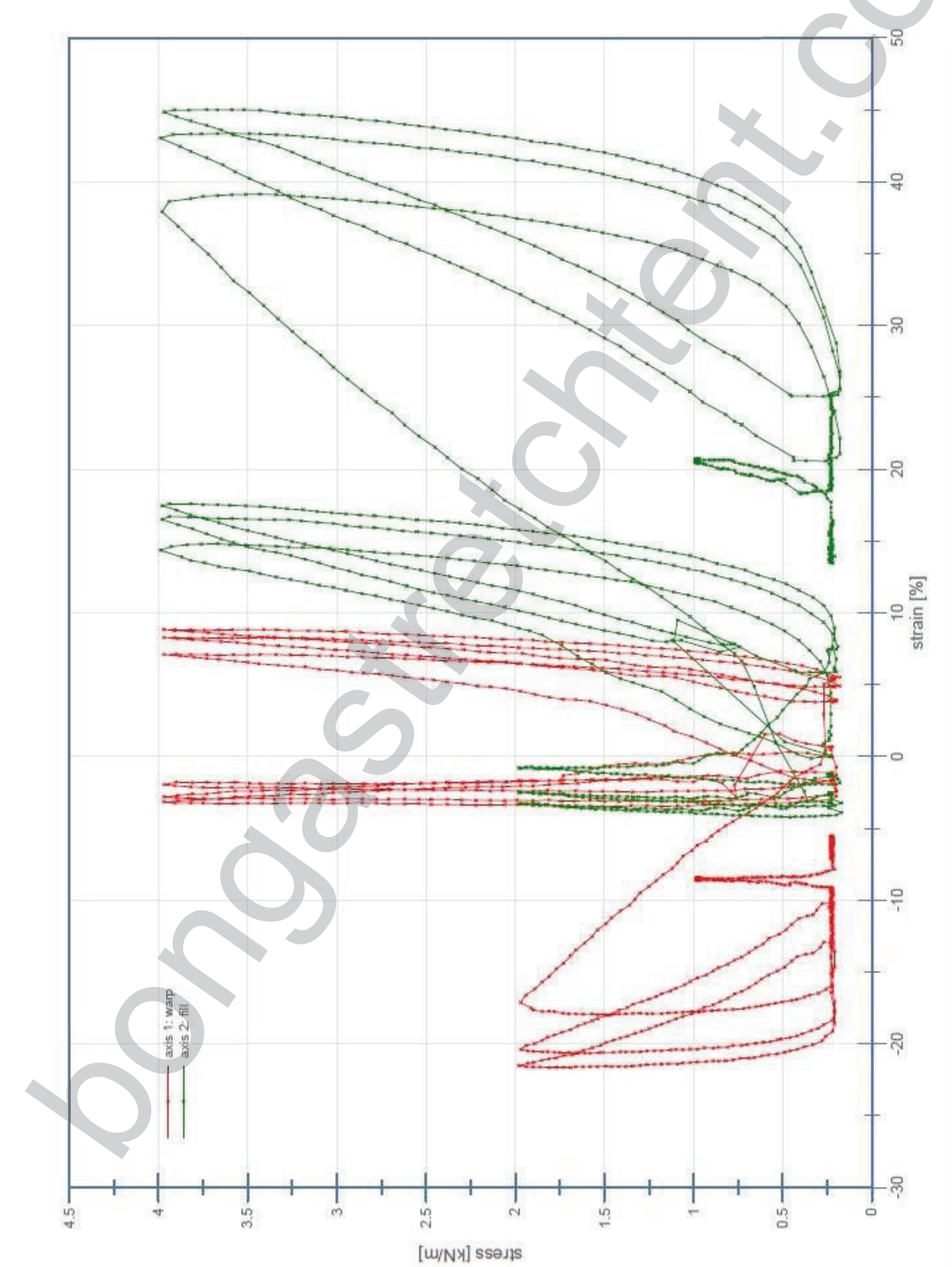
Open-Minded

Fakultät für Ingenieurwissenschaften - Abteilung Bauwissenschaften
Institut für Metall- und Leichtbau
Essener Labor für Leichte Flächentragwerke - ELLF
D-45141 Essen, Universitätsstr. 15, Tel.: +49 201 183-4223, Fax: -4276

Stress-strain diagram to biaxial tensile test

Test: TENT2616	Material: Trieflexx (alias TP 5252/A FR)



Membrane – Bi-axial test: Proflexx

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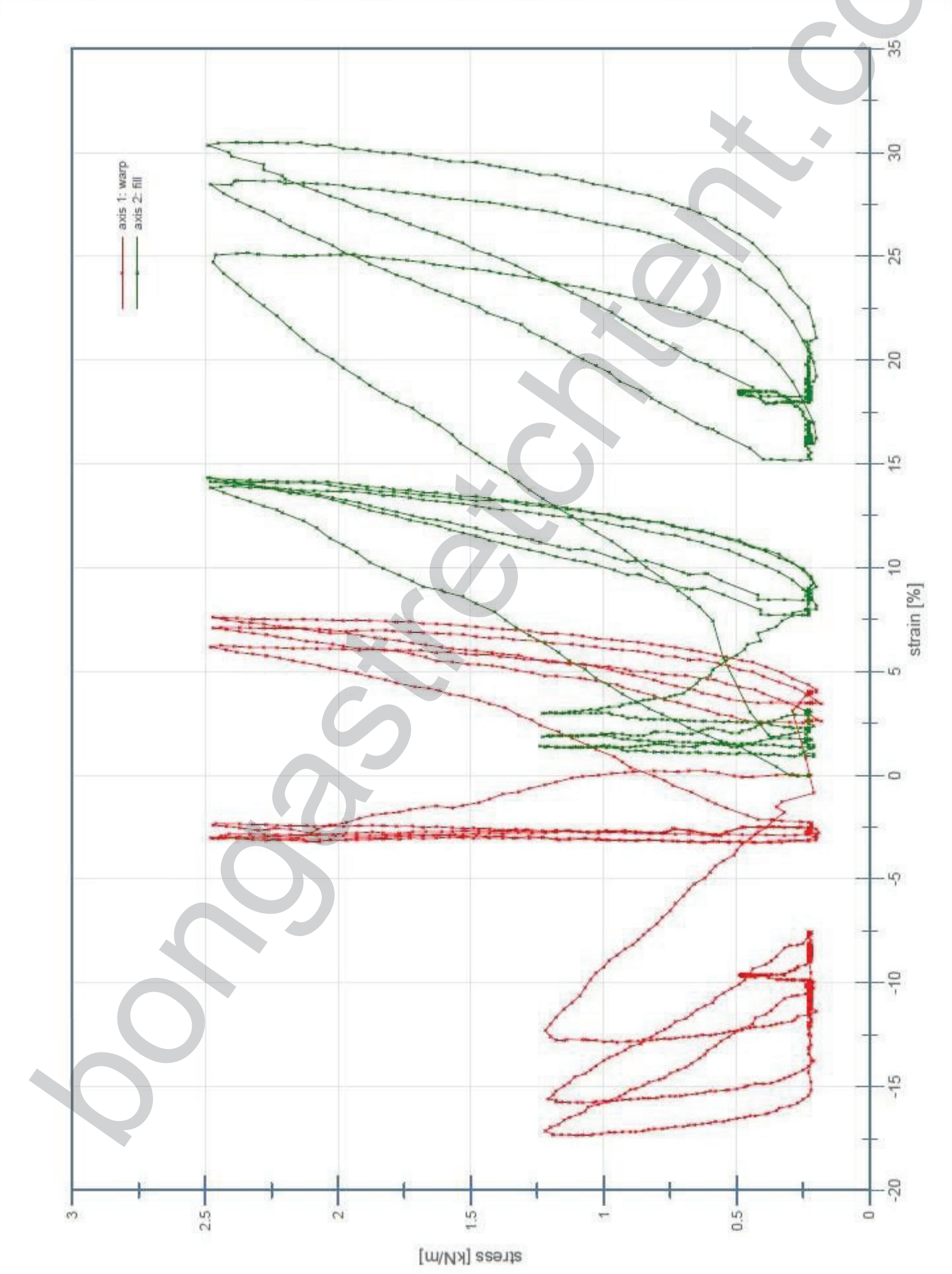
D-45141 Essen, Universitätsstr. 15, Tel.: +49 201 183-4223, Fax: -4276

Stress-strain diagram to biaxial tensile test

Test: TENT1616	Material: Proflexx (alias Krokus Inry M2)



Membrane – Fire certificate: Triflexx

IPAC acreditação L0254 Ensaios ilac-MRA

LFF - Laboratório de Fumo e Fogo
Test Report N. 31/LFF/16i

Page 1 of 4

TEST REPORT

1 - Identification

Customer: [redacted]

Address: [redacted]

Request: Fire Reaction Classification According French Standards

Material: Two side coated fabric with reference [redacted]

Request Reference: Email

Request Date: 2016-09-14

Reception Date: 2016-09-15

Test Date: 2016-09-26

Report N.: 31/LFF/16i

2 - Scope

The tests reported concern the determination of the fire reaction class for a two side coated fabric with reference [redacted] to be used on tents for events.

INEGI – Rua Dr. Roberto Frias, 400 4200-465 Porto
The presented results refer exclusively to tested specimens.

I.545.04

inegi driving science & innovation

3 - Methodology

The tests were performed as indicated in the NF P 92-503 (electric burner) issued on December 1995. The classification method was applied according to the standard NF P 92-507 issued on February 2004.

4 - Specimens

The specimens were prepared in this laboratory from a sample supplied by the customer and had the following dimensions:

Specimen	Length (mm)	Width (mm)	Thickness (mm)	Mass (g)
31/LFF/16i/01	600	182	0.7	60.4
31/LFF/16i/02	599	181	0.7	59.9
31/LFF/16i/03	601	182	0.7	60.2
31/LFF/16i/04	602	184	0.7	60.7
31/LFF/16i/05	604	181	0.7	60.5
31/LFF/16i/06	603	181	0.7	60.6
31/LFF/16i/07	603	182	0.7	59.5

Before being tested the specimens were conditioned for a period of 261 hours at 23 ± 2 °C and 50 ± 5 % relative humidity.

5 - Results and classification

Exploratory tests were performed on both faces of the material and it was found that the face 1 had worst fire reaction performance.

The tests performed on the electric burner with face 1 facing the burner and longitudinal direction, produced the following results:

Specimen	31/LFF/16i/02			31/LFF/16i/05			31/LFF/16i/06			31/LFF/16i/07		
Time of igniter actuation	B	E	D	B	E	D	B	E	D	B	E	D
20 " - 25 "	20	197	172	20	195	170	20	242	217	20	218	193
45 " - 50 "	---	---	---	---	---	---	---	---	---	---	---	---
1' 15 " - 1' 20 "	---	---	---	---	---	---	---	---	---	---	---	---
1' 45 " - 1' 50 "	---	---	---	---	---	---	---	---	---	---	---	---
2' 15 " - 2' 20 "	---	---	---	---	---	---	---	---	---	---	---	---
2' 45 " - 2' 50"	---	---	---	---	---	---	---	---	---	---	---	---
3' 15 " - 3' 20 "	---	---	---	---	---	---	---	---	---	---	---	---
3' 45 " - 3' 50 "	---	---	---	---	---	---	---	---	---	---	---	---
4' 15" - 4' 20 "	---	---	---	---	---	---	---	---	---	---	---	---
4' 45 " - 4' 50 "	---	---	---	---	---	---	---	---	---	---	---	---
Length burnt (mm)	338			333			305			318		
Width burnt (mm)	164			169			177			170		
Time of max. inflammation (s)	172			170			217			193		
Average length burnt (mm)							324					
Average width burnt (mm)							170					

B – Beginning of inflammation; E – End of inflammation; D – Duration of inflammation;

<u>In view of whole results the material must be classified as **M2.**</u>

6 - Complementary observations

During the accomplishment of the tests it was observed abundant release of gray smoke.

Porto, September 27, 2016

Responsible for testing

João Alcino Rodrigues

Technical Director of the Laboratory

inegi LFF – Laboratório de Fumo e Fogo

João Alcino Rodrigues

Membrane – Fire certificate: Proflexx

Report number: P2014-303205-010D

INDEPENDENT TEST LABORATORY
TEXTILE LAB
TESTING RESEARCH CONSULTING

Tentations bvba
Pieter Van Vynckstraat 19
9032 Gent
België

Hengelo (ov), 14-7-2014

Test specimen:	**Specimen:**	**Colour:**	**Client reference number:**
	A.	pink	Proflexx fabric for Bonga strechtent Composition : 74 % PVC + 7 % PU + 19 % PES

Examination:	**Test number:**	**Test name:**
	1.	Reaction fire tests used for flexible materials (NF P 92-503).

Results See following pages

Laboratory Quality Control

Check this report of 17-7-2014 on authenticity. Page: 1 / 2

Testing • Research • Development • Consultancy

Textile Lab, Generatorstraat 26, 7556RC Hengelo (ov), The Netherlands, Tel: +31(0)74-2491005, email: info@textilelab.nl
Chamber of commerce: 08098059, VAT nr.: 8100.03.983.B.01, Bank account; BIC/SWIFT: SNSBNL2A, IBAN: NL62SNSB0907446167

Report number: P2014-303205-010D

INDEPENDENT TEST LABORATORY
TEXTILE LAB
TESTING RESEARCH CONSULTING

Test : **1. Reaction fire tests used for flexible materials.**

Norm : NF P 92-503 (1995)
Apparatus : Electrical burner.

- Thickness of the specimens ≤ 5 mm.
- The specimens were not washed and not submitted to an accelerated ageing.
- Tested specimens: two in length direction and three in breadth direction.
- Only the front face (colour face) was tested.

Results test 1 specimen:	**Length direction**		**Breadth direction**		
A.					
Test specimen nr	1.	2.	1.	2.	
Appearance of a hole	No	No	No	No	
Maximum combustion time (s)	2'13''	1'55''	<5sec	<5sec	
Incandescent point	No	No	No	No	
Burned length (cm)	38	34	-	-	
Burned breadth (cm) (in zone > 45 cm)	-	-	-	-	
Not-burned drops and parts	No	No	No	No	
Burned drops and parts	No	No	No	No	

2. **Classification in function of FD P 92-507 (1997)**

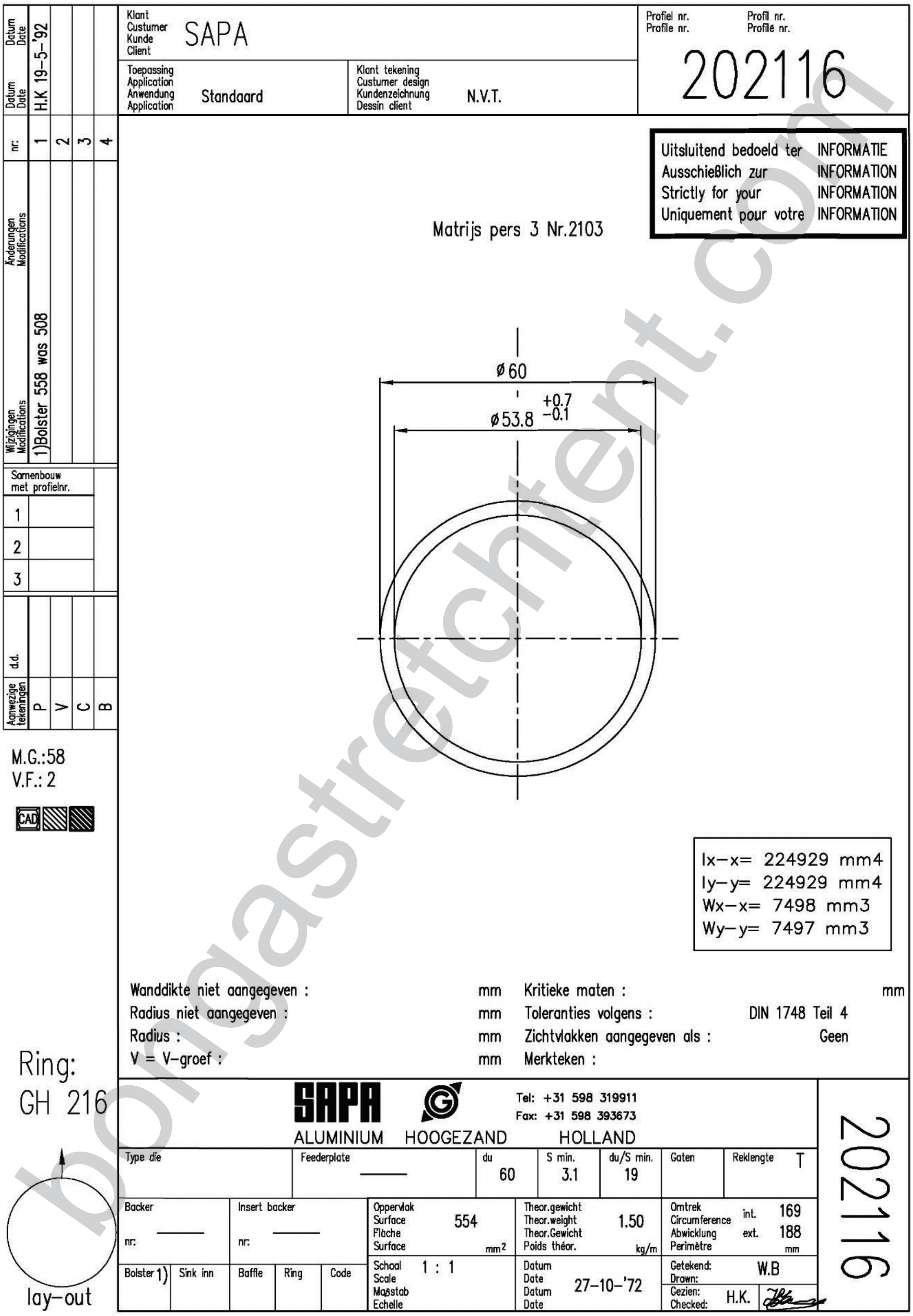
After testing in according to the standards NF P 92-503, the sample is classified as M2.

Laboratory Quality Control

Testing • Research • Development • Consultancy

Textile Lab, Generatorstraat 26, 7556RC Hengelo (ov), The Netherlands, Tel: +31(0)74-2491005, email: info@textilelab.nl
Chamber of commerce: 08098059, VAT nr.: 8100.03.983.B.01, Bank account; BIC/SWIFT: SNSBNL2A, IBAN: NL62SNSB0907446167

Poles – Cross section data



Datum	nr:	Wijzigingen
01-07-'04 H.A	1	1)Vanaf nr.8, Matr.ø320 x160 (SBNC)
	2	
	3	
	4	

Samenbouw met profielnr.

1

2

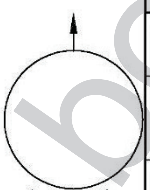
3

Aanwezige tekeningen	d.d.
P	
V	
C	
B	

M.G.:83
V.F.: 2

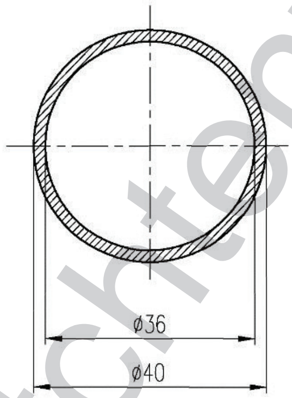
Was vroeger nr.2057

Matrijsring:
GH 216



Klant	Profiel nr.
SAPA	202122
Toepassing: Standaard — Klant tekening nr.	

Uitsluitend bedoeld ter	INFORMATIE
Ausschießlich zur	INFORMATION
Strictly for your	INFORMATION
Uniquement pour votre	INFORMATION



Ix-x= 43216 mm4
Iy-y= 43216 mm4
Wx-x= 2160 mm3
Wy-y= 2161 mm3

S = Snijpuntsmaat
Wanddikte niet aangegeven : mm — Kritieke maten : mm
Radius niet aangegeven : mm — Toleranties volgens : DIN 1748 bl.4
Radius : mm — Zichtvlakken aangegeven als : Geen
V = V-groef : mm — Merkteken :

sapa
Wij geven de toekomst **vorm**

Sapa Aluminium BV
Postadres **Postbus 102, 9600 AC Hoogezand**
Tel **0598-319911** Fax **0598-393673**

Die	Feederplate	du	S min.	du/S min.	Gaten	Reklengte
	——	40	2	20		T

Backer nr:	Insert backer nr:	Oppervlak	Theor.gewicht	Omtrek
——	——	239 mm2	0.65 kg/m	inw. 113, uitw. 126 mm

Bolster	Type	Baffle	Ring	Code	Schaal	Datum	Getekend:	Gezien:
					1 : 1	06-03-'91	K.K.Smit	H.K.

202122

J. Annexes

Annex A: Easy export of load cases

CO1. Own weight + pretension

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7971	150.40
SUM				0.0000	0.0000	-0.7971	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7971
SUM	AREA-LOADS	0.0000	0.0000	-0.7971

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	-0.7971

CO2. Own weight + pretension + wind suction

Full wind 500 N/m^2

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7969	150.36
1	WIND	-0.3500	1.00	0.0000	0.0000	49.6866	150.36
SUM				0.0000	0.0000	48.8896	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7969
SUM	WIND	0.0000	0.0000	49.6866
SUM	AREA-LOADS	0.0000	0.0000	48.8896

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	48.8896

Reduced wind 355 N/m² – factor 355 / 500 = 0.71

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7969	150.36
1	WIND	-0.3500	0.71	0.0000	0.0000	35.2775	150.36
SUM				0.0000	0.0000	34.4805	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7969
SUM	WIND	0.0000	0.0000	35.2775
SUM	AREA-LOADS	0.0000	0.0000	34.4805

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	34.4805

CO3. Own weight + pretension + wind pressure

Full wind 500 N/m²

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7971	150.40
1	WIND	0.1500	1.00	0.0000	0.0000	-21.3082	150.40
SUM				0.0000	0.0000	-22.1054	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7971
SUM	WIND	0.0000	0.0000	-21.3082
SUM	AREA-LOADS	0.0000	0.0000	-22.1054

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	-22.1054

Reduced wind 355 N/m² – factor 355 / 500 = 0.71

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7971	150.40
1	WIND	0.1500	0.71	0.0000	0.0000	-15.1289	150.40
SUM				0.0000	0.0000	-15.9260	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7971
SUM	WIND	0.0000	0.0000	-15.1289
SUM	AREA-LOADS	0.0000	0.0000	-15.9260

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	-15.9260

CO4. Own weight + pretension + conventional

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADGROUPS

LOADGROUP	LOADMODE	LOAD	FACTOR	SUM_X	SUM_Y	SUM_Z	LOADED AREA
1	SCHNEE	0.1000	1.00	0.0000	0.0000	-14.2055	142.05
1	EIGENGEWICHT	0.0053	1.00	0.0000	0.0000	-0.7971	150.40
SUM				0.0000	0.0000	-15.0026	

EXTERNAL LOADS (AREA-DEPENDENT)
ORDERED BY LOADMODES

	LOADMODE	SUM_X	SUM_Y	SUM_Z
SUM	SCHNEE	0.0000	0.0000	-14.2055
SUM	EIGENGEWICHT	0.0000	0.0000	-0.7971
SUM	AREA-LOADS	0.0000	0.0000	-15.0026

EXTERNAL LOADS: SUM OF ALL EXTERNAL LOADS

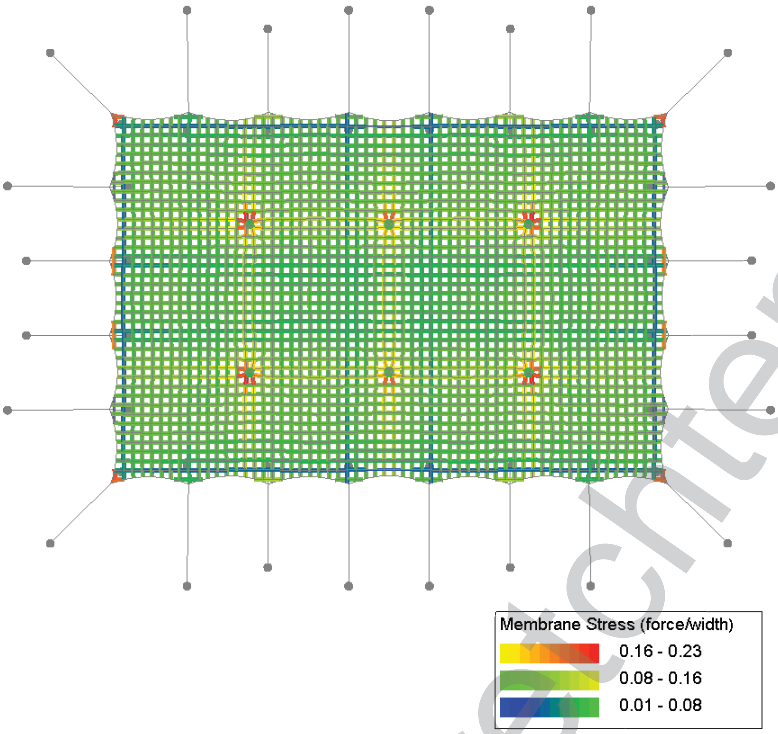
SUM_X	SUM_Y	SUM_Z
0.0000	0.0000	-15.0026

Annex B: Internal forces per load combination

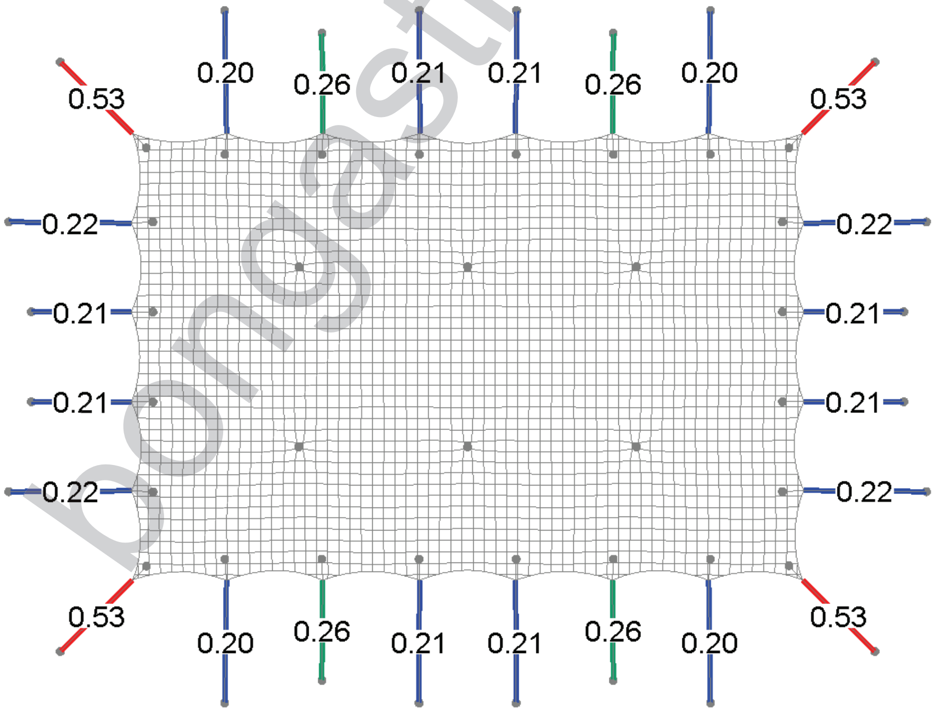
In the following paragraphs the results for a full wind pressure of p_w = 0.5 kN/m^2 are shown, unless indicated otherwise.

B.1. CO1. Own weight + pretension

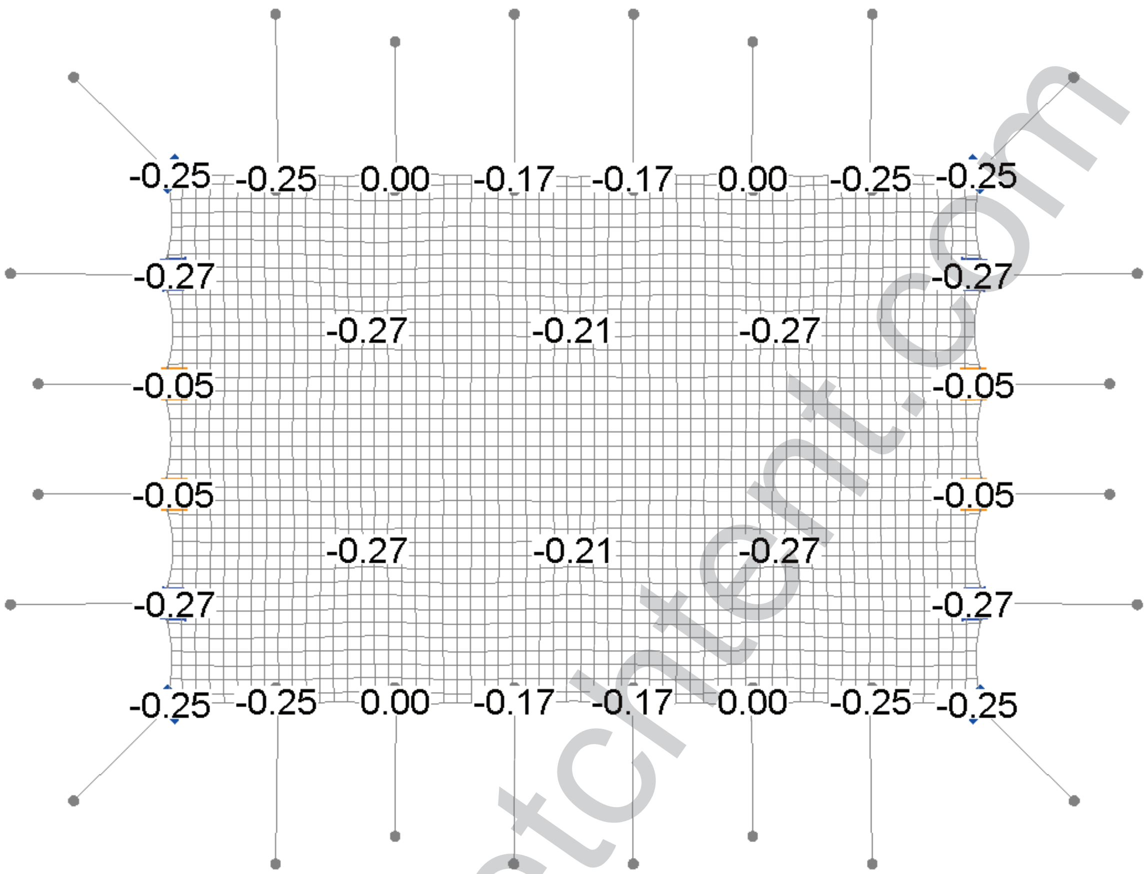
Stresses in the membrane



Forces in the tension belts



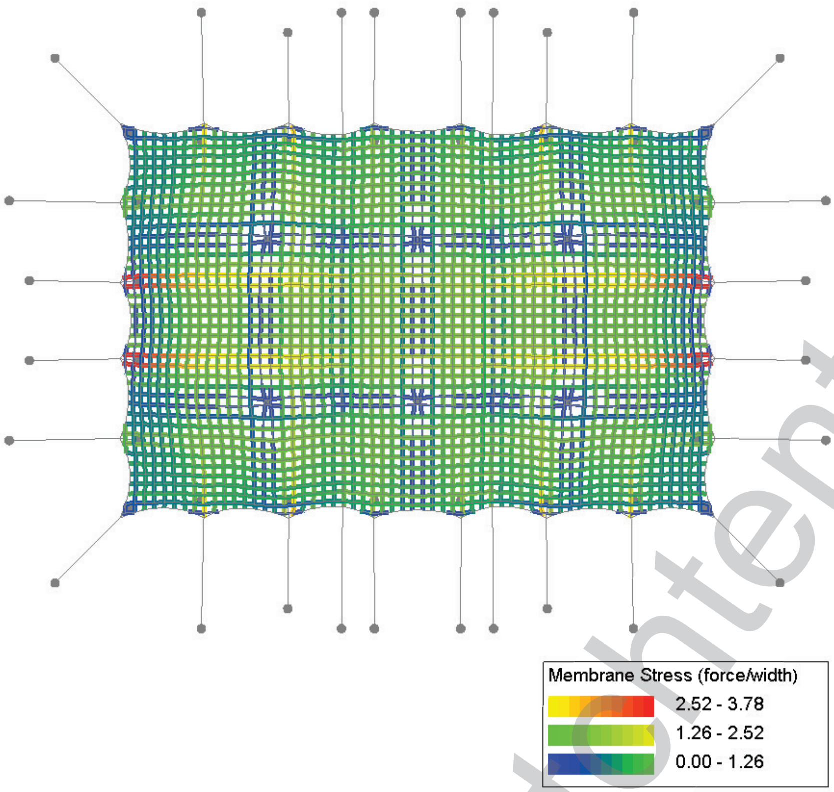
Forces in the poles



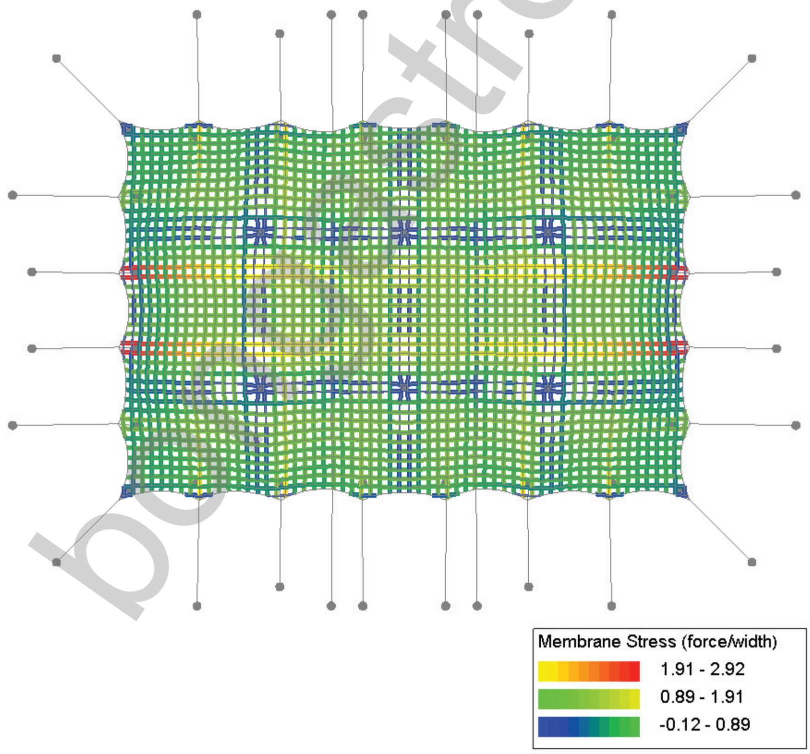
B.2. CO2. Own weight + pretension + wind suction

Stresses in the membrane

Full wind 500 N/m^2

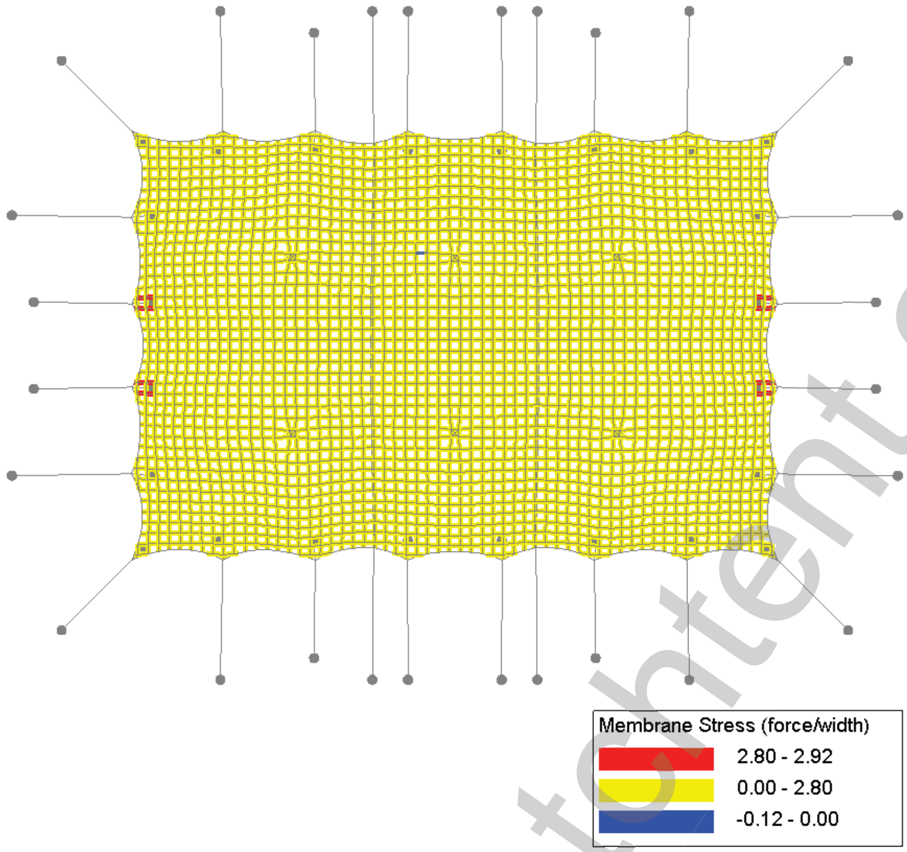


Reduced wind 355 N/m^2

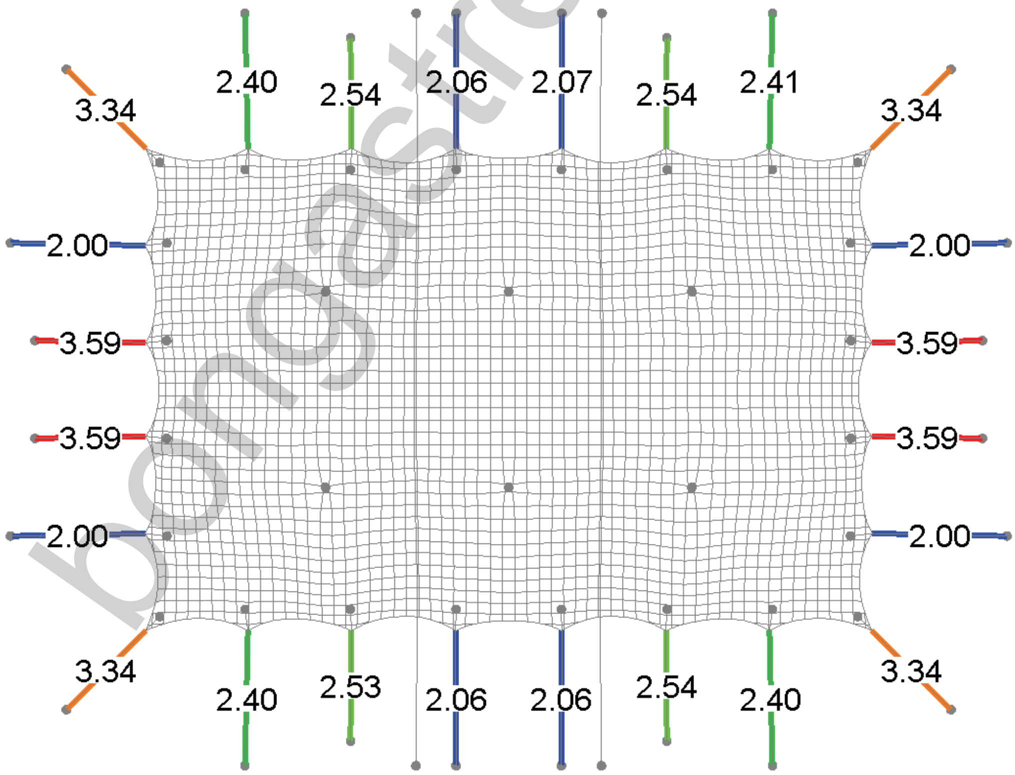


Stresses in the membrane > 2.85 kN/m

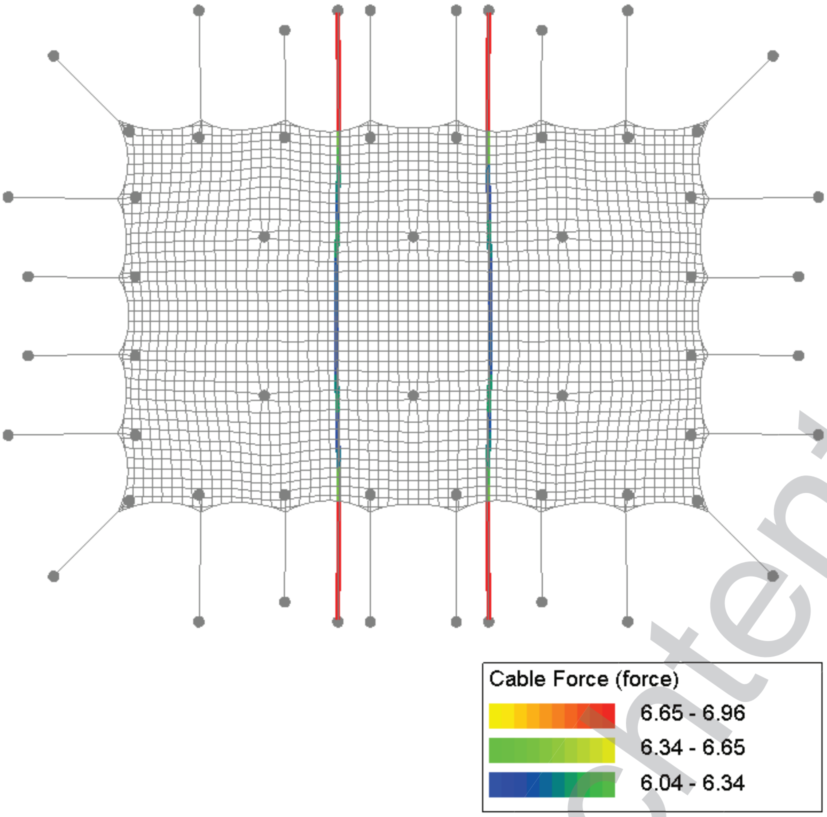
Reduced wind 355 N/m²



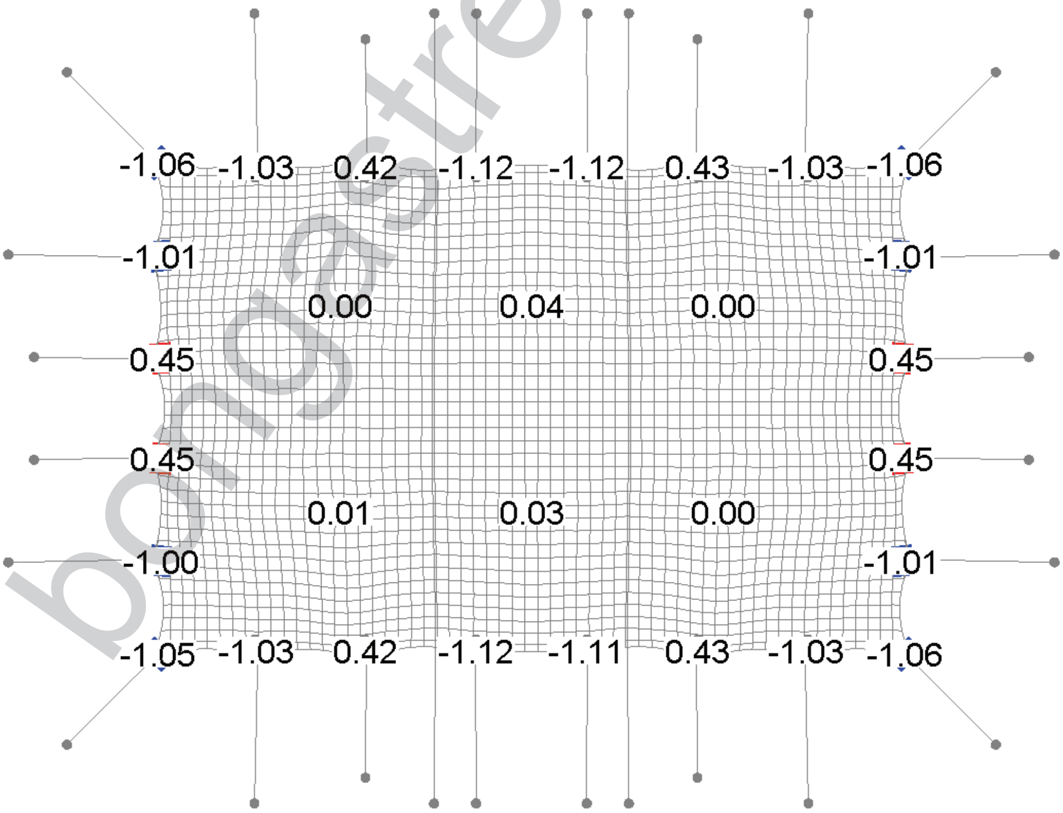
Forces in the tension belts



Forces in the storm belts

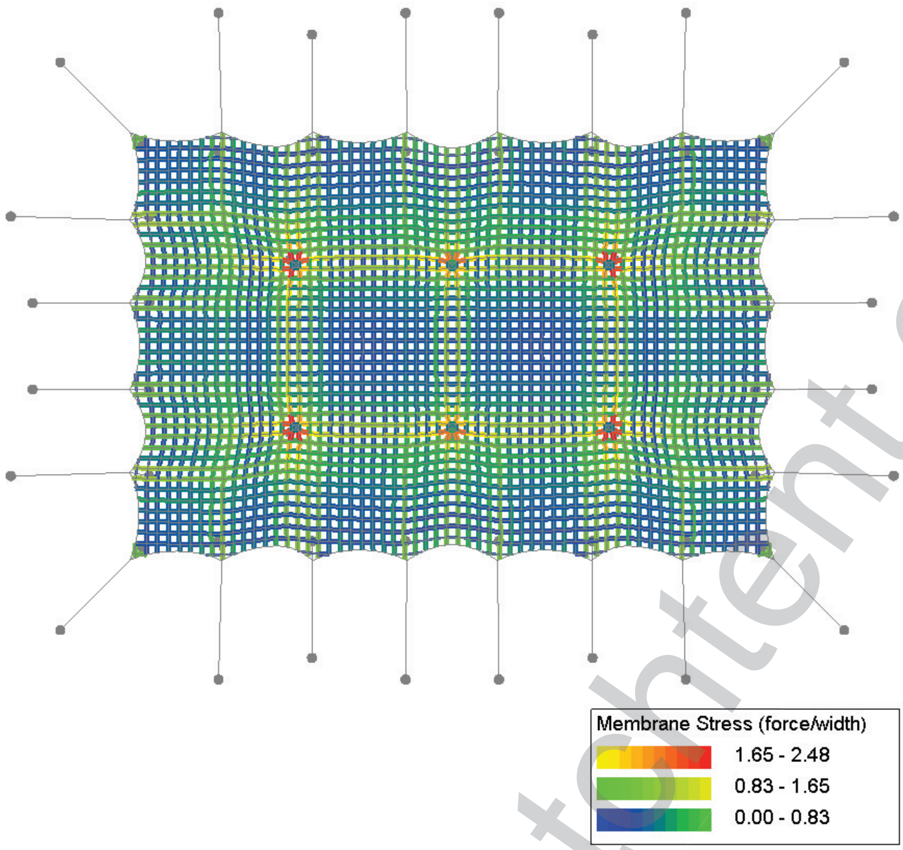


Force in the poles

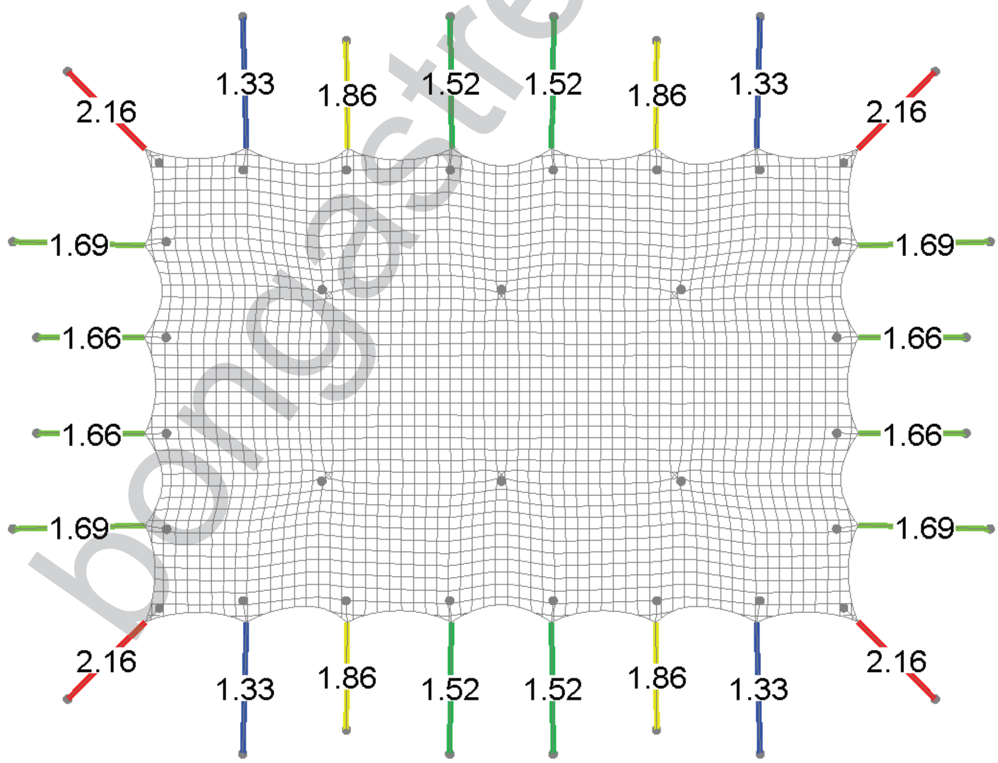


B.3. CO3. Own weight + pretension + wind pressure

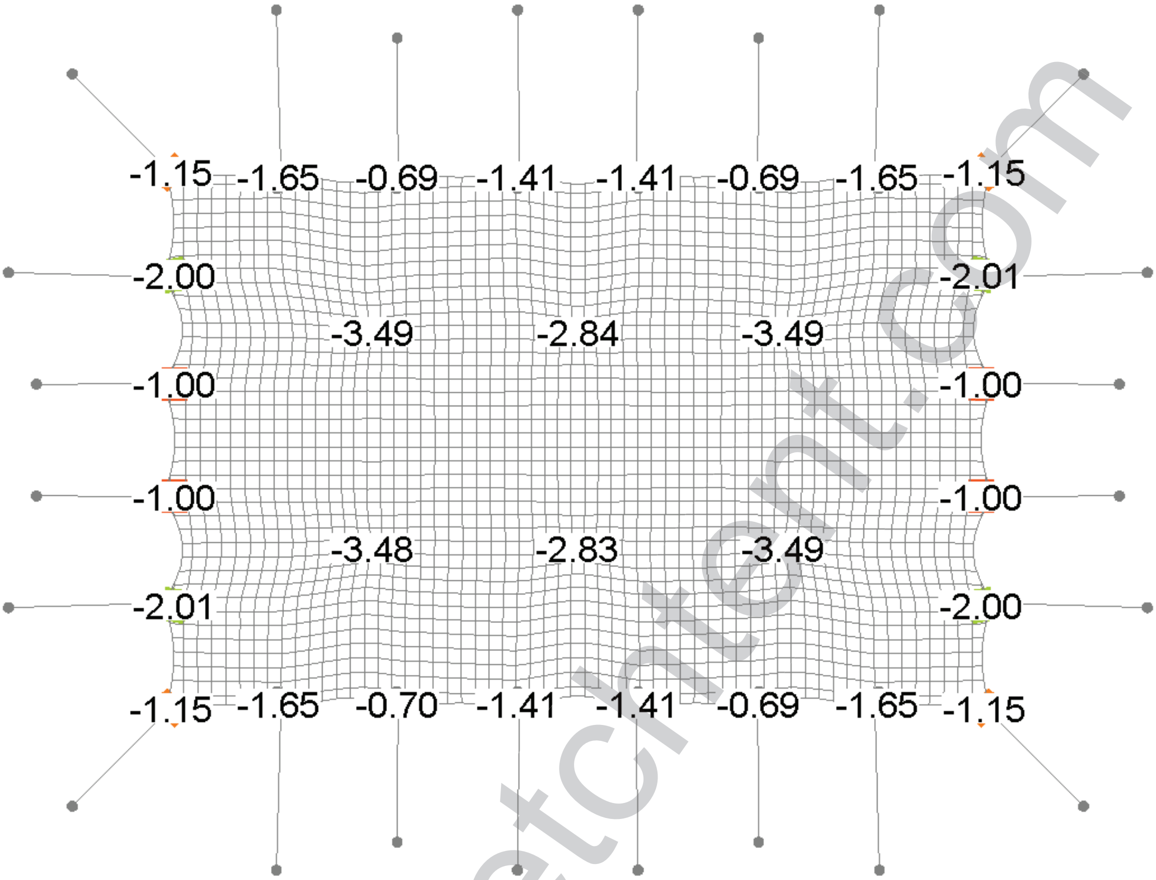
Stresses in the membrane



Forces in the tension belts

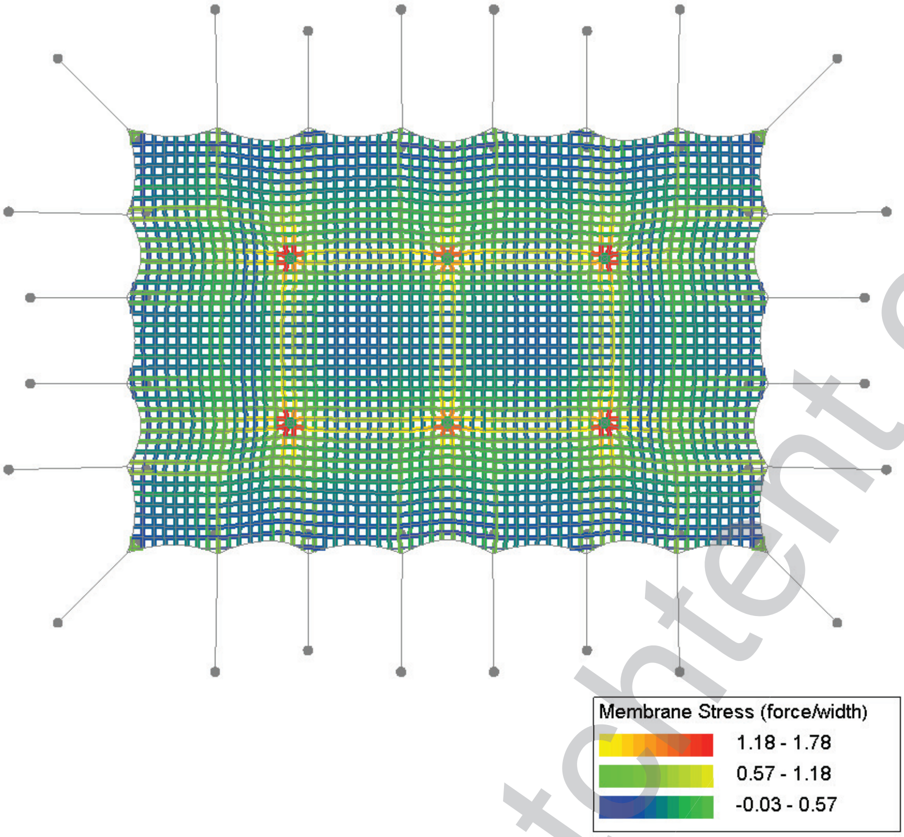


Forces in the poles

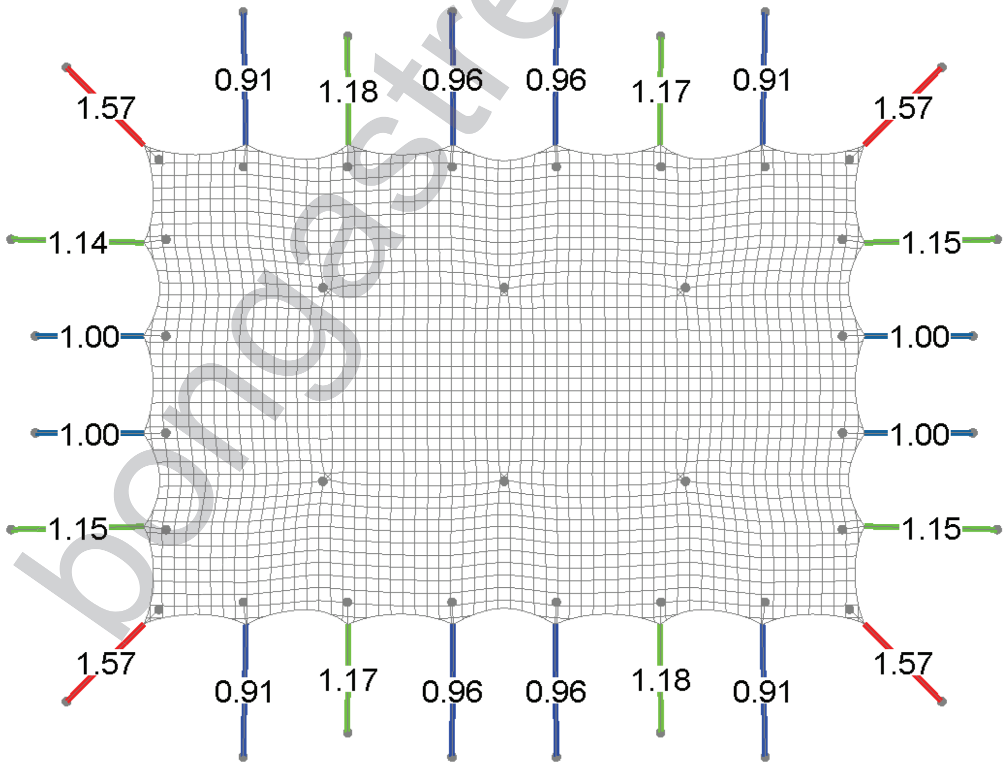


B.4. CO4. Own weight + pretension + conventional

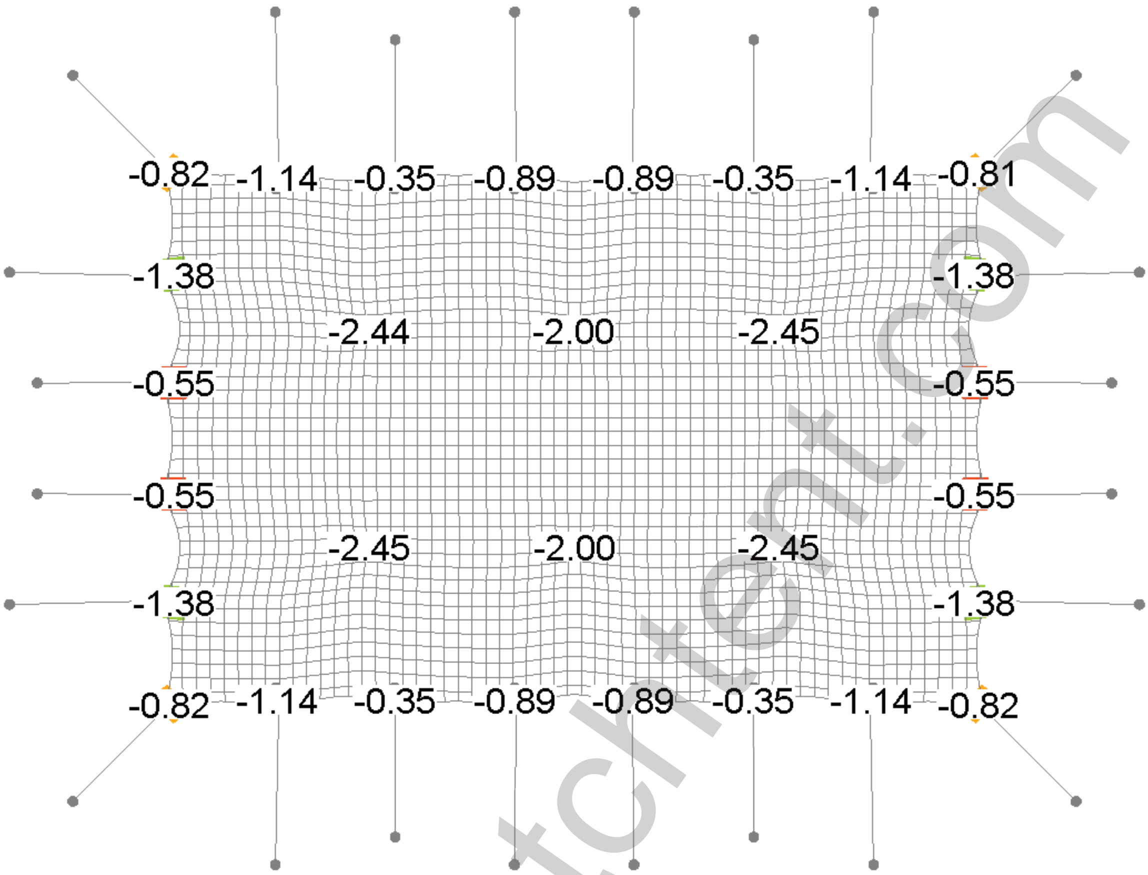
Stresses in the membrane



Forces in the tension belts



Forces in the poles



Annex C: Aluminum poles

The elaborated check of the aluminum profiles can be found on the following pages.

Annex C.1: Center pole 4m

Project:	1607304: Bonga 10x15m	Element:	Middenmast	Member:	-	Combination:	CO3	winddruk

Parameters

fo	240	N/mm^2				
fu	260	N/mm^2				
E	70000	N/mm^2				
N	5,24	kN (druk)				
My	0,00	kNm				
Mz	0,00	kNm				
Lcr;y	4000	mm				
Lcr;z	4000	mm				
Iy	224929	mm^4				
Iz	224929	mm^4				
ey	30	mm				
ex	30	mm				
Wyel	7498	mm^3				
Wypl	10047	mm^3				
Wzel	7498	mm^3				
Wzpl	10047	mm^3				
Aeff	554	mm^2				
γm1	1,1					
γm2	1,25					

classification by thickness of round tube

t	3,1	mm	
D	60	mm	
ß	13,20		eq (6.10)
ε	1,02		
class	2		table (6.2)
class overide	*Off*		

classification conditions - Table 6.2 - Slenderness parameters

	ß1	ß2	ß3
Class A	11,23	16,33	22,45
class 1		False	ß < ß1
class 2		True	ß1 < ß < ß2
class 3		False	ß2 < ß < ß3
class 4		False	ß3 < ß

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1 — eq (6.22)
2 Ned / Nu,Rd < 1 — eq (6.21)

Ned	5,24	kN
Nc,Rd	120,90	kN
Nu,Rd	115,26	kN
UC1 ✔	0,04	
UC2 ✔	0,05	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1 — eq (6.25)
2 Myed / Myu,Rd < 1 — eq (6.24)
3 Mzed / Mzc,Rd < 1 — eq (6.25)
4 Mzed / Mzu,Rd < 1 — eq (6.24)

Myed	0,00	kN	
Mzed	0,00	kN	
α;y	1,34		table (6.4)
α;z	1,34		table (6.4)
Myc,Rd	2,19	kNm	
Myu,Rd	1,56	kNm	
Mzc,Rd	2,19	kNm	
Mzu,Rd	1,56	kNm	
UC1-y	-		
UC2-y	-		
UC3-z	-		
UC4-z	-		

Checks not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left(\frac{N_{Ed}}{\omega_0 N_{Rd}}\right)^{\psi} + \left[\left(\frac{M_{y,Ed}}{\omega_0 M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{\omega_0 M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.43) - (ω0 = 1) - (ψ = 1.3)

UC	-

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1 — eq. (6.48)

Ned	5,24	kN	
BC	A		
α	0,20		table (6.6)
λ_0	0,10		table (6.6)
χ	0,07		eq. (6.50)
Φ	7,71	N	
λ	3,70		eq. (6.51)
Ncr	9712,33	(z-axis)	
Nb,Rd	8,36	kN	
UC ✔	0,63		

Buckling (Bending and Axial Force) art. (6.3.3.1)

$$\left(\frac{N_{Ed}}{\chi_{min}\,\omega_x N_{Rd}}\right)^{\psi_c} + \frac{1}{\omega_0}\left[\left(\frac{M_{y,Ed}}{M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.62) - (ω0 = 1) - (ωx = 1) - (ψ = 0.8)

UC ✔	0,69

TEN TECH

Annex C.2 Perimeter pole 2.7m

Project:	1607304: Bonga 10x15m	Element:	Randmast 2,7m	Member:	CO3	Combination:	winddruk

Parameters

fo	240	N/mm^2
fu	260	N/mm^2
E	70000	N/mm^2
N	3,02	kN (druk)
My	0,00	kNm
Mz	0,00	kNm
Lcr;y	2700	mm
Lcr;z	2700	mm
Iy	43216	mm^4
Iz	43216	mm^4
ey	20	mm
ex	20	mm
Wyel	2161	mm^3
Wypl	2891	mm^3
Wzel	2161	mm^3
Wzpl	2891	mm^3
Aeff	239	mm^2
γm1	1,1	
γm2	1,25	

classification by thickness of round tube

t	2	mm	
D	40	mm	
ß	13,42		eq (6.10)
ε	1,02		
class	2		table (6.2)
class overide		Off	

classification conditions - Table 6.2 - Slenderness parameters

	ß1	ß2	ß3
Class A	11,23	16,33	22,45
class 1		False	ß < ß1
class 2		True	ß1 < ß < ß2
class 3		False	ß2 < ß < ß3
class 4		False	ß3 < ß

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1 — eq (6.22)
2 Ned / Nu,Rd < 1 — eq (6.21)

Ned	3,02	kN
Nc,Rd	52,09	kN
Nu,Rd	49,66	kN
UC1	✓	0,06
UC2	✓	0,06

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1 — eq (6.25)
2 Myed / Myu,Rd < 1 — eq (6.24)
3 Mzed / Mzc,Rd < 1 — eq (6.25)
4 Mzed / Mzu,Rd < 1 — eq (6.24)

Myed	0,00	kN	
Mzed	0,00	kN	
α;y	1,34		table (6.4)
α;z	1,34		table (6.4)
Myc,Rd	0,63	kNm	
Myu,Rd	0,45	kNm	
Mzc,Rd	0,63	kNm	
Mzu,Rd	0,45	kNm	
UC1-y	-		
UC2-y	-		
UC3-z	-		
UC4-z	-		

Checks not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left(\frac{N_{Ed}}{\omega_0 N_{Rd}}\right)^{\psi} + \left[\left(\frac{M_{y,Ed}}{\omega_0 M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{\omega_0 M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.43) - (ω0 = 1) - (ψ = 1.3)

UC	-

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1 — eq. (6.48)

Ned	3,02	kN	
BC	A		
α	0,20		table (6.6)
λ_0	0,10		table (6.6)
χ	0,07		eq. (6.50)
Φ	7,86	N	
λ	3,74		eq. (6.51)
Ncr	4095,55	(z-axis)	
Nb,Rd	3,53	kN	
UC	✓	0,85	

Buckling (Bending and Axial Force) art. (6.3.3.1)

$$\left(\frac{N_{Ed}}{\chi_{min}\,\omega_x N_{Rd}}\right)^{\psi_c} + \frac{1}{\omega_0}\left[\left(\frac{M_{y,Ed}}{M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.62) - (ω0 = 1) - (ωx = 1) - (ψ = 0.8)

UC	✓	0,88

Annex C.3 Perimeter pole 2.2m

Project:	1607304: Bonga 10x15m	Element:	Randmast 2,2m	Member:	CO3	Combination:	winddruk

Parameters

fo	240	N/mm²
fu	260	N/mm²
E	70000	N/mm²
N	1,73	kN (druk)
My	0,00	kNm
Mz	0,00	kNm
Lcr;y	2200	mm
Lcr;z	2200	mm
Iy	43216	mm⁴
Iz	43216	mm⁴
ey	20	mm
ex	20	mm
Wyel	2161	mm³
Wypl	2891	mm³
Wzel	2161	mm³
Wzpl	2891	mm³
Aeff	239	mm²
γm1	1,1	
γm2	1,25	

classification by thickness of round tube

t	2	mm	
D	40	mm	
ß	13,42		eq (6.10)
ε	1,02		
class	2		table (6.2)
class overide	Off		

classification conditions - Table 6.2 - Slenderness parameters

	ß1	ß2	ß3
Class A	11,23	16,33	22,45
class 1		False	ß < ß1
class 2		True	ß1 < ß < ß2
class 3		False	ß2 < ß < ß3
class 4		False	ß3 < ß

Compression art. (6.2.4)

1 Ned / Nc,Rd < 1		eq (6.22)
2 Ned / Nu,Rd < 1		eq (6.21)
Ned	1,73 kN	
Nc,Rd	52,09 kN	
Nu,Rd	49,66 kN	
UC1 ✔	0,03	
UC2 ✔	0,03	

Bending Moment art. (6.2.5)

1 Myed / Myc,Rd < 1		eq (6.25)
2 Myed / Myu,Rd < 1		eq (6.24)
3 Mzed / Mzc,Rd < 1		eq (6.25)
4 Mzed / Mzu,Rd < 1		eq (6.24)
Myed	0,00 kN	
Mzed	0,00 kN	
α;y	1,34	table (6.4)
α;z	1,34	table (6.4)
Myc,Rd	0,63 kNm	
Myu,Rd	0,45 kNm	
Mzc,Rd	0,63 kNm	
Mzu,Rd	0,45 kNm	
UC1-y	-	
UC2-y	-	
UC3-z	-	
UC4-z	-	

Checks not necessary, no bending moments

Bending and Axial Force art. (6.2.9)

$$\left(\frac{N_{Ed}}{\omega_0 N_{Rd}}\right)^{\psi} + \left[\left(\frac{M_{y,Ed}}{\omega_0 M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{\omega_0 M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.43) - (ω0 = 1) - (ψ = 1.3)

UC	-

Check not necessary, no bending moments

Buckling (compression) art. (6.3.1.1)

Ned / Nb,Rd < 1		eq. (6.48)
Ned	1,73 kN	
BC	A	
α	0,20	table (6.6)
λ_0	0,10	table (6.6)
χ	0,10	eq. (6.50)
Φ	5,44 N	
λ	3,05	eq. (6.51)
Ncr	6168,71 (z-axis)	
Nb,Rd	5,24 kN	
UC ✔	0,33	

Buckling (Bending and Axial Force) art. (6.3.3.1)

$$\left(\frac{N_{Ed}}{\chi_{min}\,\omega_x N_{Rd}}\right)^{\psi_c} + \frac{1}{\omega_0}\left[\left(\frac{M_{y,Ed}}{M_{y,Rd}}\right)^{1.7} + \left(\frac{M_{z,Ed}}{M_{z,Rd}}\right)^{1.7}\right]^{0.6} \leq 1.00$$

eq. (6.62) - (ω0 = 1) - (ωx = 1) - (ψ = 0.8)

UC ✔	0,41

Annex D: Check results on fabric clamps

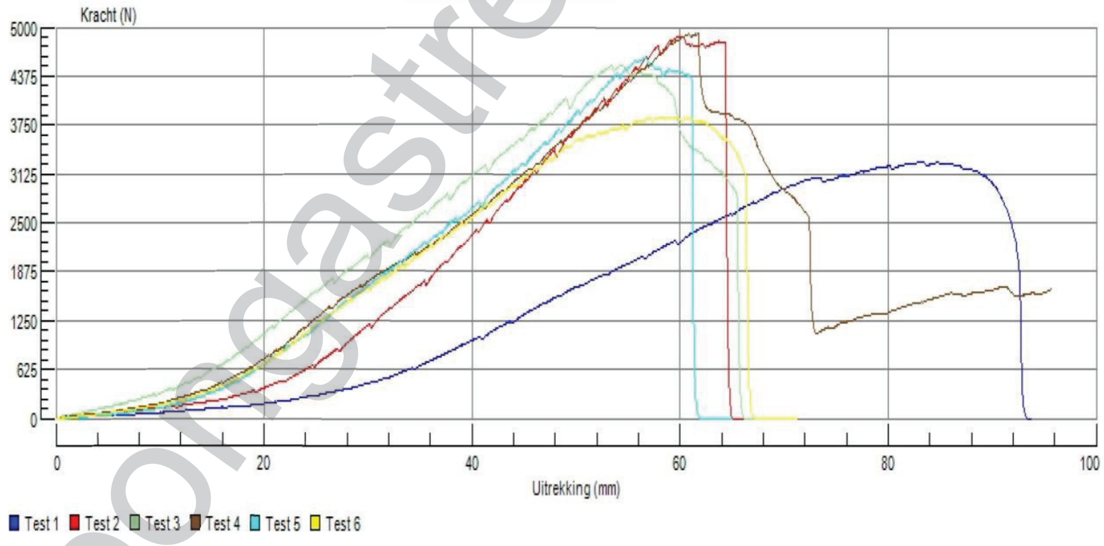
Testometric
materials testing machines

winTest™
Analysis

Ref 1 :
Ref 2 :
Ref 3 :

Machine No. : 0350-10000
Testnaam : Trektest
Test Type : Trek
Testdatum : 11-7-2016 12:18
Testsnelheid : 100.000 mm/min
Voorspanning : Uit
Breedte : 10.000 mm
Dikte : 1.000 mm
Proefstuk Lengte : 100.000 mm

Test nr.	Kracht @ Piek (N)
1	3282.000
2	4881.000
3	4511.000
4	4915.000
5	4599.000
6	3852.000
Min	3282.000
Gemiddelde	4340.000
Max.	4915.000
Standaard Deviatie	644.536
Coëfficiënt van Variatie	14.851
Onderste Vertrouwens Grens	3663.596
Boven Confidentie Limiet	5016.404



Page 1

Unit 1 Lincoln Business Park Lincoln Close,
Rochdale, Lancashire, England OL11 1NR
Tel: (44) (0)1706 654039 Fax: (44) (0)1706 646089
Email: info@testometric.co.uk website: www.testometric.co.uk

Notes:

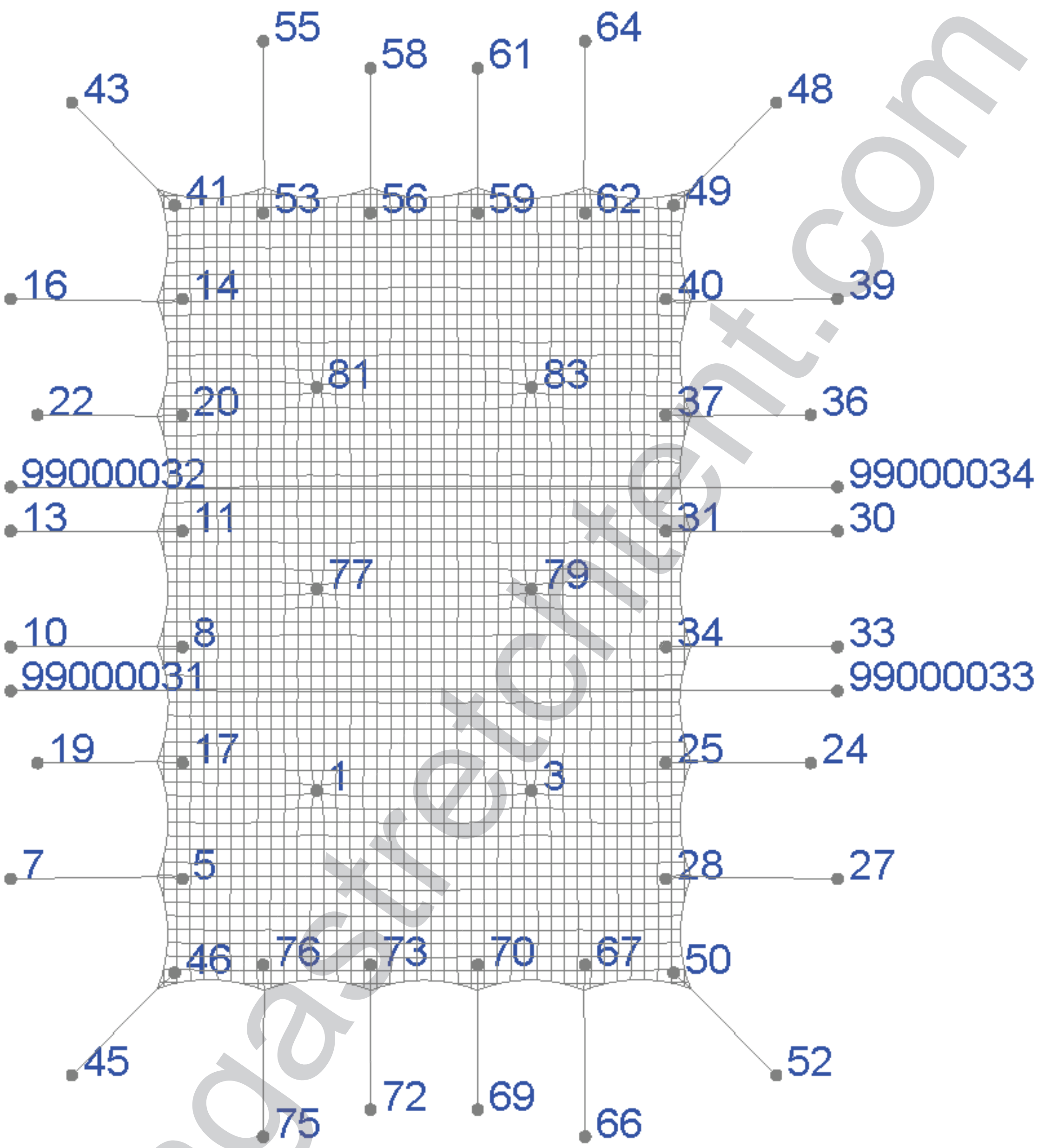
Test no.	Sample	ø tendon	Remark
1	1	6	Tendon out of clamps
2	1	11	Clamp broke
3	2	8	Clamp broke
4	3	8	Clamp cracked, tendon half out of clamp
5	4	8	Broken
6	5	8	Broke, clamp was fastened a little less tight.

- Test 1 and 2 are not representative, because a different diameter tendon is used.
- Test 6 is not representative, because the clamp was not fastened tight enough.

Conclusion

Average tensile strength at fracture for the three representative tests:
(4511 + 4915 + 4599) / 3 = 4675 N

Annex E: Easy export of reaction forces



TEN TECH

		CO1			CO2			CO3			CO4		
	Node	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz
Center pole	1	0,00	0,00	0,27	0,00	0,00	0,00	0,11	-0,10	3,48	0,06	-0,05	2,44
Center pole	3	0,00	0,00	0,27	0,00	0,00	0,00	0,11	0,10	3,48	0,06	0,05	2,44
Center pole	77	0,00	0,00	0,21	0,00	0,00	-0,04	0,00	-0,09	2,83	0,00	-0,05	2,00
Center pole	79	0,00	0,00	0,21	0,00	0,00	-0,03	0,00	0,09	2,83	0,00	0,05	2,00
Center pole	81	0,00	0,00	0,27	0,00	0,00	0,00	-0,11	-0,10	3,48	-0,06	-0,05	2,44
Center pole	83	0,00	0,00	0,27	0,00	0,00	0,00	-0,11	0,10	3,48	-0,06	0,05	2,44
Perimeter pole	5	0,00	0,04	0,24	0,02	0,16	1,02	0,05	0,27	1,63	0,02	0,19	1,12
Perimeter pole	8	0,00	0,03	0,17	0,00	0,18	1,10	0,02	0,23	1,39	0,01	0,15	0,88
Perimeter pole	11	0,00	0,03	0,17	0,00	0,18	1,10	-0,02	0,23	1,39	-0,01	0,15	0,88
Perimeter pole	14	0,00	0,04	0,24	-0,02	0,16	1,02	-0,05	0,27	1,63	-0,02	0,19	1,12
Perimeter pole	17	0,00	0,00	0,00	0,00	-0,08	-0,42	0,01	0,14	0,68	0,00	0,07	0,34
Perimeter pole	20	0,00	0,00	0,00	0,00	-0,08	-0,42	-0,01	0,14	0,68	0,00	0,07	0,34
Perimeter pole	25	0,00	0,00	0,00	0,00	0,08	-0,41	0,01	-0,14	0,68	0,00	-0,07	0,34
Perimeter pole	28	0,00	-0,04	0,24	0,02	-0,16	1,02	0,05	-0,27	1,63	0,02	-0,19	1,12
Perimeter pole	31	0,00	-0,03	0,17	0,00	-0,18	1,10	-0,02	-0,23	1,39	-0,01	-0,15	0,88
Perimeter pole	34	0,00	-0,03	0,17	0,00	-0,18	1,10	0,02	-0,23	1,39	0,01	-0,15	0,88
Perimeter pole	37	0,00	0,00	0,00	0,00	0,08	-0,42	-0,01	-0,14	0,68	0,00	-0,07	0,34
Perimeter pole	40	0,00	-0,04	0,24	-0,02	-0,16	1,02	-0,05	-0,27	1,63	-0,02	-0,19	1,12
Perimeter pole	41	0,03	0,03	0,24	0,13	0,13	1,04	0,15	0,15	1,13	0,11	0,11	0,80
Perimeter pole	46	-0,03	0,03	0,24	-0,13	0,13	1,04	-0,15	0,15	1,13	-0,11	0,11	0,80
Perimeter pole	49	0,03	-0,03	0,24	0,13	-0,13	1,04	0,15	-0,15	1,13	0,11	-0,11	0,81
Perimeter pole	50	-0,03	-0,03	0,24	-0,13	-0,13	1,04	-0,15	-0,15	1,13	-0,11	-0,11	0,80
Perimeter pole	53	0,05	0,00	0,27	0,16	-0,02	0,99	0,33	-0,06	1,98	0,23	-0,03	1,36
Perimeter pole	56	0,01	0,00	0,05	-0,08	0,01	-0,44	0,20	0,00	0,98	0,11	0,00	0,54
Perimeter pole	59	0,01	0,00	0,05	-0,08	-0,01	-0,44	0,20	0,00	0,98	0,11	0,00	0,54
Perimeter pole	62	0,05	0,00	0,27	0,16	0,02	0,99	0,33	0,06	1,98	0,23	0,03	1,36
Perimeter pole	67	-0,05	0,00	0,27	-0,16	0,02	0,99	-0,33	0,06	1,98	-0,23	0,03	1,36
Perimeter pole	70	-0,01	0,00	0,05	0,08	-0,01	-0,44	-0,20	0,00	0,98	-0,11	0,00	0,54
Perimeter pole	73	-0,01	0,00	0,05	0,08	0,01	-0,44	-0,20	0,00	0,98	-0,11	0,00	0,54
Perimeter pole	76	-0,05	0,00	0,27	-0,16	-0,02	1,00	-0,33	-0,06	1,98	-0,23	-0,03	1,36
Tension belt	7	0,00	0,14	-0,14	-0,04	1,72	-1,68	-0,03	0,95	-0,93	-0,01	0,65	-0,64
Tension belt	10	0,00	0,15	-0,15	0,00	1,47	-1,44	-0,01	1,09	-1,07	-0,01	0,68	-0,67
Tension belt	13	0,00	0,15	-0,15	0,00	1,48	-1,45	0,01	1,09	-1,07	0,01	0,68	-0,67
Tension belt	16	0,00	0,14	-0,14	0,04	1,72	-1,68	0,03	0,95	-0,93	0,01	0,65	-0,64
Tension belt	19	0,00	0,19	-0,18	-0,02	1,81	-1,77	-0,01	1,33	-1,30	0,00	0,84	-0,82
Tension belt	22	0,00	0,19	-0,18	0,02	1,82	-1,78	0,01	1,33	-1,30	0,00	0,84	-0,82
Tension belt	24	0,00	-0,19	-0,18	-0,02	-1,81	-1,77	-0,01	-1,33	-1,30	0,00	-0,84	-0,82
Tension belt	27	0,00	-0,14	-0,14	-0,04	-1,72	-1,68	-0,03	-0,95	-0,93	-0,01	-0,65	-0,64
Tension belt	30	0,00	-0,15	-0,15	0,00	-1,47	-1,44	0,01	-1,09	-1,07	0,01	-0,68	-0,67
Tension belt	33	0,00	-0,15	-0,15	0,00	-1,47	-1,44	-0,01	-1,09	-1,07	-0,01	-0,68	-0,67
Tension belt	36	0,00	-0,19	-0,18	0,02	-1,81	-1,78	0,01	-1,33	-1,30	0,00	-0,84	-0,83
Tension belt	39	0,00	-0,14	-0,14	0,04	-1,72	-1,68	0,03	-0,95	-0,93	0,01	-0,65	-0,64
Tension belt	55	0,16	0,00	-0,16	1,42	0,03	-1,40	1,20	0,04	-1,18	0,82	0,02	-0,80

		CO1			CO2			CO3			CO4		
	Node	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz	Fx	Fy	Fz
Tension belt	58	0,15	0,00	-0,15	2,57	0,05	-2,50	1,19	0,00	-1,17	0,71	0,00	-0,70
Tension belt	61	0,15	0,00	-0,15	2,57	-0,05	-2,51	1,19	0,00	-1,17	0,71	0,00	-0,70
Tension belt	64	0,16	0,00	-0,16	1,43	-0,03	-1,40	1,20	-0,04	-1,18	0,82	-0,02	-0,80
Tension belt	66	-0,16	0,00	-0,16	-1,43	-0,03	-1,40	-1,20	-0,04	-1,18	-0,82	-0,02	-0,80
Tension belt	69	-0,15	0,00	-0,15	-2,57	-0,05	-2,50	-1,19	0,00	-1,17	-0,71	0,00	-0,70
Tension belt	72	-0,15	0,00	-0,15	-2,57	0,05	-2,51	-1,19	0,00	-1,17	-0,71	0,00	-0,70
Tension belt	75	-0,16	0,00	-0,16	-1,43	0,03	-1,40	-1,20	0,04	-1,18	-0,82	0,02	-0,80
Tension belt corner	43	0,27	0,27	-0,37	1,70	1,70	-2,32	1,09	1,10	-1,50	0,79	0,80	-1,10
Tension belt corner	45	-0,27	0,27	-0,37	-1,70	1,70	-2,32	-1,09	1,10	-1,50	-0,79	0,80	-1,10
Tension belt corner	48	0,27	-0,27	-0,37	1,70	-1,70	-2,32	1,09	-1,10	-1,50	0,79	-0,80	-1,10
Tension belt corner	52	-0,27	-0,27	-0,37	-1,70	-1,70	-2,32	-1,09	-1,10	-1,50	-0,79	-0,80	-1,09
Storm belt	99000031				-0,05	5,40	-4,39						
Storm belt	99000032				0,06	5,39	-4,38						
Storm belt	99000033				-0,05	-5,40	-4,39						
Storm belt	99000034				0,05	-5,39	-4,38						

BESLUIT VAN GEDEPUTEERDE STATEN VAN NOORD-HOLLAND

Betreft : Ontheffing paragraaf 4.2.1 Omgevingsverordening
Zaaknummer : OD.366143.
Ontheffinghouder : Stichting Sompop
Locatie : Langwaal 9, De Waal, gemeente Texel

VERZONDEN 16 MEI 2022

INHOUDSOPGAVE

Ontheffing ingevolge paragraaf 4.2.1 van de Omgevingsverordening (stiltegebieden)

A. Ontheffing

1. Onderwerp aanvraag
Stichting Sompop organiseert sinds 2004 jaarlijks een kleinschalig muziekfestival in het dorp De Waal, te Texel. Het muziekfestival wordt jaarlijks op de eerste zaterdag van juli gehouden, van 12:00 uur tot 24:00 uur. Stichting Sompop is voornemens om dit festival in de jaren 2022 tot en met 2026 wederom te organiseren. Dit komt neer op de volgende data:
- Zaterdag 2 juli 2022
- Zaterdag 1 juli 2023
- Zaterdag 6 juli 2024
- Zaterdag 5 juli 2025
- Zaterdag 4 juli 2026

Er is ruimte voor maximaal 2000 bezoekers. De verwachting is dat er 1750 bezoekers zullen komen. De opbouw van het muziekfestival begint circa acht dagen van te voren, en het terrein wordt uiterlijk drie dagen na het festival weer opgeleverd. Het muziekfestival zal worden gehouden vlak naast de dorpskern van De Waal, op het voetbalveld naast het voormalige schoolgebouw. Tijdens het muziekfestival is het ook voor bezoekers mogelijk om met de boswachter mee te gaan op excursie naar het nieuw aangelegde natuurgebied Waalenburg. Het dorp De Waal en omgeving zijn onderdeel van het stiltegebied 'Texel-Oost'.

De geluidsinstallatie staat op het festivalterrein aan de Langwaal 9 te de Waal in de gemeente Texel. Bezoekers maken gebruik van bestaande parkeervoorzieningen. Er worden additionele parkeervoorzieningen beschikbaar gesteld op de Camping De Waal, echter naar verwachting zal het merendeel van de bezoekers te voet of per fiets komen. Het muziekfestival wordt aangesloten op bestaande infrastructuur (water, elektra en overige). Tijdens het evenement zullen extra toiletten en bijbehorende voorzieningen worden geplaatst.

2. Besluit

Wij besluiten op grond van artikel 4.27 van de Omgevingsverordening NH2020 aan Stichting Sompop een ontheffing te verlenen voor het houden van het muziekfestival Sompop aan de Langwaal 9, kadastraal TEL00N1242, De Waal, te gemeente Texel conform aanvraag, binnen de begrenzing van het stiltegebied 'Texel-Oost'.

Deze ontheffing is geldig vanaf de datum van verzending tot en met 15 juli 2026.

3. Procedure

Uniforme openbare voorbereidingsprocedure

Deze aanvraag is behandeld met toepassing van afdeling 3.4 van de Algemene wet bestuursrecht (Awb). Op 14 februari 2022 hebben wij van Stichting Sompop (hierna: aanvrager) een aanvraag ontvangen voor een ontheffing ingevolge paragraaf 4.2.1 van de Omgevingsverordening NH2020. Op 23 februari 2022, 24 februari 2022, en 25 februari 2022 hebben wij aanvullende gegevens van de aanvrager ontvangen.

Het ontwerpbesluit heeft van 28 maart 2022 tot en met 9 mei 2022 ter inzage gelegen.

4. Ingediende zienswijzen

Gedurende de periode van terinzagelegging van het ontwerp van dit besluit hebben belanghebbenden schriftelijk of mondeling zienswijzen over het besluit naar voren kunnen brengen.

Er zijn geen zienswijzen ontvangen.

5. Wijzigingen ten opzichte van ontwerpbesluit

Er zijn geen inhoudelijke wijzigingen ten opzichte van het ontwerpbesluit.

B. Voorschriften en beperkingen aan de ontheffing

Wij verbinden aan deze ontheffing de volgende voorschriften en beperkingen:

1. De houder van de ontheffing dient ervoor zorg te dragen dat aan alle binnen de ontheven werkzaamheden werkzame personen, waaronder het personeel van derden, een toereikende schriftelijke instructie is verstrekt die is gericht op het voorkomen en uitsluiten van handelingen die tot gevolg (kunnen) hebben dat de aan de ontheffing verbonden voorschriften worden overtreden.
2. Deze ontheffing kan uitsluitend gebruikt worden door (medewerkers van) de ontheffinghouder of in opdracht van de ontheffinghouder handelende (rechts-)personen. De ontheffinghouder blijft daarbij verantwoordelijk en aansprakelijk voor de juiste naleving van deze ontheffing.
3. U dient de ingebruikname van de geluidsinstallatie minimaal twee dagen van tevoren te melden aan Omgevingsdienst Noord-Holland noord, onder vermelding van het zaaknummer, middels de postbus van de ODNHN: postbus@odnhn.nl
4. De geluidsinstallatie en bijbehorende speakers dienen op het festivalterrein te staan en gericht te zijn naar het muziekterrein.
5. Tijdens de op- en afbouwwerkzaamheden wordt er geen gebruik gemaakt van versterkt geluid. Het kortstondig testen van de geluidsinstallatie tijdens de opbouwwerkzaamheden is wel toegestaan.
6. Conform aanvraag dienen maximaal de volgende speakers en installatie te worden gebruikt:
   a. 20 db technology line array T4 units
   b. 4 db technology active sub speakers DVA S20
   c. 2 x Nexo PS15 speaker, controller en versterker
   d. 2 the box 12"active monitor
   e. 5 HK 15"active monitor/top
   f. 1 HK 18'sub
7. Het gebruik van geluidsapparatuur/speakers conform voorschrift 6 is gedurende het muziekfestival Sompop beperkt tot één zaterdag in juli per jaar (vanaf 12:00 uur t/m 24:00 uur).
8. Alle door of namens gedeputeerde staten gegeven aanwijzingen dienen onverwijld te worden opgevolgd.

Het niet naleven van deze voorschriften en beperkingen kan, naast eventuele intrekking van de ontheffing, strafvervolging tot gevolg hebben. Indien u de activiteiten waarvoor deze ontheffing is afgegeven wijzigt dient u contact met de Omgevingsdienst Noord-Holland Noord op te nemen zodat de gewijzigde activiteiten getoetst kunnen worden aan paragraaf 4.2.1 van de Omgevingsverordening NH2020.

C. Overwegingen en toetsingen

C1. Omgevingsverordening NH 2020
Bevoegdheid tot ontheffingverlening
Op grond van artikel 1.2, eerste en tweede lid, van de Wet milieubeheer hebben provinciale staten ter bescherming van het milieu een Omgevingsverordening NH2020 vastgesteld inzake het voorkomen of beperken van geluidhinder in bij de Omgevingsverordening NH2020 aangewezen gebieden.

Op grond van artikel 4.19 van de Omgevingsverordening NH2020 zijn de milieubeschermingsgebieden categorie stilte aangewezen. Op grond daarvan is het stiltegebied 'Texel-Oost' aangewezen. De relevante kaarten zijn digitaal beschikbaar via de website van de Provincie Noord-Holland.

Ingevolge artikel 4.21, lid 1 van de Omgevingsverordening NH2020 is het in een stiltegebied onder meer verboden om een toestel te gebruiken, indien daardoor de ervaring van de natuurlijke geluiden kan worden verstoord. Ingevolge artikel 4.27 van de Omgevingsverordening NH2020 is het mogelijk om van dat verbod ontheffing te verkrijgen.

C2. Beoordelingskader
Artikel 6.56 van de Omgevingsverordening NH2020 stelt het volgende over richtwaarden geluidsniveau geluidsbronnen in eén stiltegebied: Als richtwaarde voor het maximaal toelaatbare geluidsniveau vanwege een geluidsbron die binnen het werkingsgebied stiltegebieden is gesitueerd en geen onderdeel uitmaakt van eén inrichting, geldt een geluidsniveau van 35 dB(A) LAeq,24h op 50 meter van de geluidsbron. Deze richtwaarden gelden niet voor activiteiten waarvoor een ontheffing als bedoeld in artikel 4.27 is verleend.

Artikel 4.27 van de Omgevingsverordening NH2020 luidt:
1. Gedeputeerde Staten kunnen in het werkingsgebied stiltegebieden per genummerd stiltegebied voor in totaal 12 activiteiten per kalenderjaar, waarbij elke activiteit een maximale tijdstuur van 24 uur heeft, ontheffing verlenen van de verboden gesteld in de artikelen 4.21 tot et met 4.24 indien het belang om de natuurlijke geluiden in het werkingsgebied stiltegebieden te ervaren dan wel het belang van de heersende natuurlijke rust in dat gebied zich daartegen niet verzet.
2. Een ontheffingsaanvraag wordt in elk geval getoetst aan de volgende criteria:
   a. nut en noodzaak;
   b. plaats van de activiteit en mate van verstoring; en
   c. tijdsduur en periode waarbinnen de activiteit zich afspeelt.
3. Gedeputeerde Staten kunnen een ontheffing van de in de artikelen 4.21 tot en met 4.24 vervatte verboden intrekken, indien het belang van de heersende natuurlijke rust in dat gebied dat vereist.
4. Gedeputeerde Staten kunnen regels stellen over de wijze van indienen van het in het eerste lid bedoelde verzoek en de daarbij aan te leveren gegevens. Het verzoek wordt digitaal via een webformulier ingediend.

Voor de beoordeling van de aanvraag hebben wij gebruik gemaakt van de volgende bij de aanvraag ingediende gegevens en informatiebronnen:
- Aanvraagformulier ontheffing stiltegebieden d.d. 14 februari 2022;
- Bij de aanvraag bijgevoegde documenten:
  - Tekening positie geluidsinstallatie Model
  - Luchtfoto locatie Sompop
- E-mail van de aanvrager van 23 februari 2022, inclusief :
  - Afschrift van de Evenementenvergunningaanvraag Sompop
- E-mail van de aanvrager van 24 februari 2022 met nadere toelichting geluidsinstallaties.
- E-mail van de aanvrager van 25 februari 2022 met nadere toelichting data festival 2023 t/m 2026.

Daarnaast hebben wij gebruik gemaakt van de volgende bronnen:
- Viewer Omgevingsverordening NH2020;
- Omgevingsverordening NH2020, november 2020;
- Omgevingsregeling NH2020, november 2020.

Inhoudelijke beoordeling aanvraag
Op basis van de verkregen informatie hebben wij de aangevraagde activiteit getoetst aan de volgende criteria:
a. nut en noodzaak;
b. plaats van de activiteit en mate van verstoring; en
c. tijdsduur en periode waarbinnen de activiteit zich afspeelt.

a. Nut en noodzaak
Conform de aanvraag is het muziekfestival Sompop ter verbinding van de bewoners van het dorp De Waal. Het dorp De Waal is met 285 inwoners het kleinste dorp van Texel. Het muziekfestival zorgt jaarlijks voor binding en saamhorigheid in het dorp. Doordat het dorp geen winkels, school of andere bindende factoren heeft is het muziekfestival van groot belang voor het behoud van het dorpsgevoel. Het muziekfestival zorgt, naast de binding binnen het dorp, ook voor binding met de rest van Texel. Menige Texelaar bezoekt het jaarlijkse muziekfestival en vele bezoekers zien het als een jaarlijkse reünie. Het muziekfestival wordt jaarlijks georganiseerd op de Langwaal 9 en kan niet plaatsvinden zonder versterkt geluid.

De verstoring van de ervaring van de natuurlijke geluiden in het stiltegebied 'Texel-Oost' als gevolg van het muziekfestival Sompop is beperkt tot één dag per jaar, zijnde de eerste zaterdag in de maand juli, van 12:00 uur tot en met 24:00 uur.

De evenementen op de kalender van Texel zijn zeer divers en trekken ieder voor zich andere bezoekers. Met de initiatiefnemer zijn wij van mening dat een jaarlijks muziekfestival als Sompop een plaats heeft op Texel. Muziekevenementen, ook die van de variant Sompop, maken onderdeel uit van de totaalbeleving die Texel biedt en wil bieden. Recreatie, verantwoord vermengd met natuur en natuurbeleving in al zijn vormen. Dat is ook zoals Texel zich presenteert. Texel ontvangt een diversiteit aan toeristen, nationaal en internationaal, 's zomers in grote aantallen. Deze toeristen komen zowel voor natuur als voor vermaak. Vanuit die optiek is het naar ons oordeel te rechtvaardigen wanneer er op Texel een aantal evenementen worden georganiseerd die niet strikt staan in het teken van natuur- (en stilte-)beleving alleen. Er is ook plaats voor evenementen die op zeer beperkte schaal, beperkt in ruimte zowel als in tijd, de stiltebeleving doorkruisen. Het is ook daarvoor dat de beperkte ontheffingsmogelijkheid van de stilteregels in de Omgevingsverordening NH2020 is opgenomen. Het betreft een mogelijkheid tot ontheffing die juist voor situaties en plekken als Texel van groot belang is. De "rem" zit in de beperkingen die aan de ontheffingsmogelijkheid zijn verbonden. Maximaal 12 keer per jaar. Maximaal voor een aantal uren.

Sompop is een muziekevenement op Texel waarvoor een ontheffingsplicht aan de orde is in het kader van de in de Omgevingsverordening NH2020 en bijbehorende omgevingsregeling NH2020 van stiltegebieden. De kwaliteit 'stilte' van het stiltegebied 'Texel-Oost' blijft naar onze mening door de tijdelijke aard (eenmaal per jaar en voor een beperkt aantal uren) gewaarborgd.

Gelet op het hiervoor overwogene zijn wij van mening dat het belang van de heersende natuurlijke rust in het stiltegebied 'Texel-Oost' zich niet verzet tegen het afgeven van deze ontheffing waarmee het muziekevenement Sompop doorgang kan vinden. Wij zijn van mening het muziekevenement Sompop de in artikel 4.27, lid 2 van de Omgevingsverordening NH2020 opgenomen toets van nut en noodzaak doorstaat.

b. Plaats van de activiteit en mate van verstoring
Plaats van de activiteit
De locatie van het in de zomerperiode gehouden muziekfestival Sompop bevindt zich op het voetbalveld naast het voormalige schoolgebouw gelegen aan de Langwaal 9, De Waal, de gemeente Texel. De geluidsinstallatie is gesitueerd op het festivalterrein dat gelegen is binnen de stiltegebied 'Texel-Oost', zoals weergegeven in bijlage 1 bij dit besluit.

Mate van verstoring
De geluidsverstoring vindt plaats tijdens muzikale optredens met versterkt geluid waarbij op voorhand het hoogste geluidsniveau op een afstand van 50 meter meer dan 35 dB(A) LAeq,1h bedraagt dit varieert van 95 dB(A) tot en met 103 dB(A) afhankelijk van de locatie van de speakers en terrein.

Conform aanvraag worden er de volgende speakers geplaatst:

- 20 db technology line array T4 units
- 4 db technology active sub speakers DVA S20
- 2 x Nexo PS15 speaker, controller en versterker
- 2 the box 12"active monitor
- 5 HK 15"active monitor/top
- 1 HK 18'sub

De geluidsinstallaties staan gericht op het festivalterrein en in de tent worden geluidsabsorberende doeken opgehangen, zoals weergegeven in bijlage 2 bij dit besluit.

c. Tijdsduur en de periode waarbinnen de activiteit zich afspeelt
In een stiltegebied kan ingevolge artikel 4.27, lid 1 van de Omgevingsverordening ontheffing worden verleend voor in totaal maximaal 12 activiteiten per kalenderjaar, elk met een maximale tijdsduur van 24 uur.

De beschrijving van de activiteiten wordt verwoord in de aanvraag (zie onderwerp onder A) en getoetst in de bijbehorende stukken. Per jaar worden de muziekoptredens tijden het muziekfestival Sompop beperkt tot één dag, zijnde de eerste zaterdag in de maand juli, van 12:00 uur tot 24:00 uur, in totaal 12 uur. De tijdsduur van het gebruik van de geluidsinstallatie blijft binnen de maximale tijdsduur van in totaal 24 uur.

De kwaliteit 'stilte' van het stiltegebied 'Texel-Oost' blijft door de tijdelijke aard en omvang van het muziekfestival Sompop binnen de aangevraagde periode (eenmaal per jaar en voor een beperkt aantal uren) gewaarborgd.

Conclusie
Gelet op de aanvraag en gelet op de voorgaande overwegingen concluderen wij dat de aanvraag voldoet aan het in de Omgevingsverordening NH2020 opgenomen beoordelingskader. Wij zijn van oordeel dat het belang van de heersende natuurlijke rust in het stiltegebied 'Texel-Oost' zich niet verzet tegen de afgifte van de gevraagde ontheffing waardoor wij de gevraagde ontheffing kunnen afgeven. Deze conclusie geldt nadrukkelijk onder de door ons gestelde voorwaarden en beperkingen.

D. Overige wet- en regelgeving
Deze aanvraag heeft betrekking op een activiteit waarvoor mogelijk ook op grond van andere wet- en regelgeving een besluit nodig is.

E. Kennisgeving
Van dit besluit zal conform artikel 3:44 Awb door ons kennis worden gegeven op de website www.officielebekendmakingen.nl.

Meer informatie
Voor meer informatie neemt u contact op met de Omgevingsdienst Noord-Holland Noord (OD NHN) via 088-10 21 300. Wij verzoeken hierbij het zaaknummer te vermelden.

Hoogachtend,

Gedeputeerde Staten van Noord-Holland,
namens dezen,

[redacted]

E. Langereis
Afdelingsmanager Regulering Leefomgeving
Omgevingsdienst Noord-Holland Noord (OD NHN)

Bijlagen:
- Bijlage 1: Locatie plangebied
- Bijlage 2: Locaties te realiseren geluidsinstallaties

Kopie aan:
- Afdeling Toezicht en Handhaving (OD NHN)
- Gemeente Texel

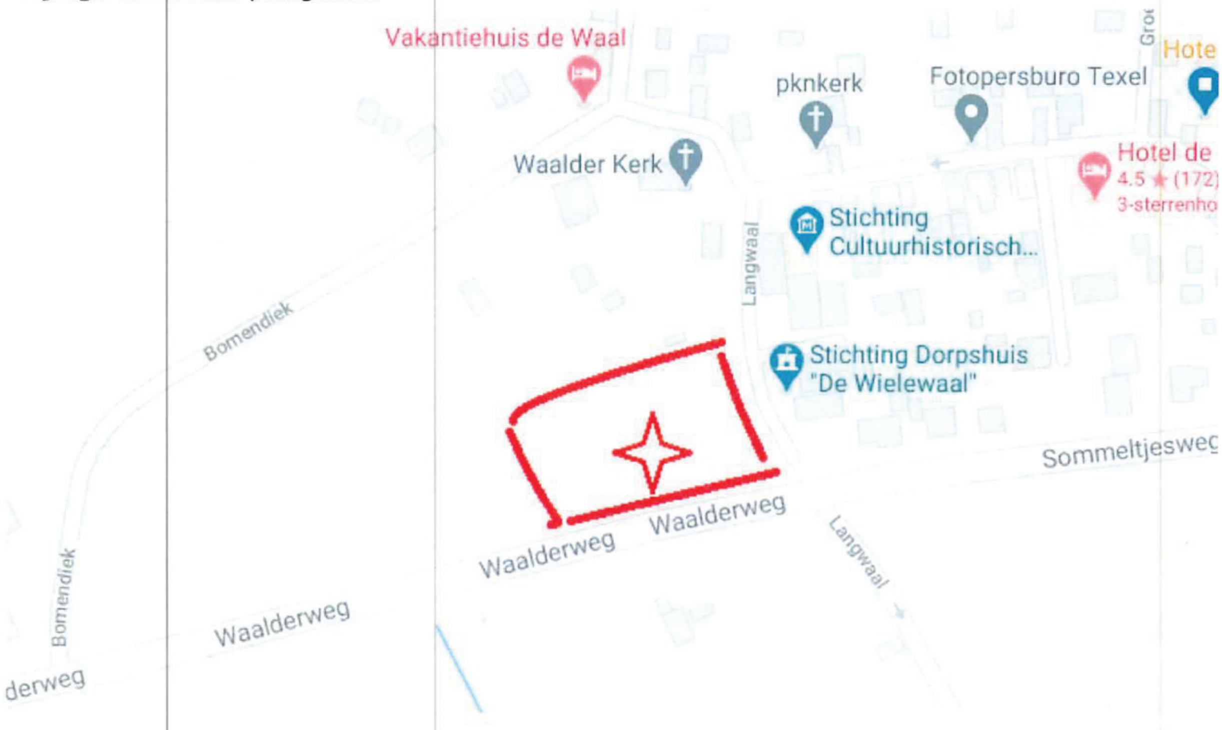
Rechtsbescherming
U en andere belanghebbenden kunnen binnen 6 weken, gerekend vanaf de dag na de datum waarop dit besluit ter inzage is gelegd, een beroepschrift indienen bij de Rechtbank Noord-Holland, Sectie bestuursrecht, Postbus 1621, 2003 BR Haarlem.

Het beroepschrift moet in ieder geval het volgende bevatten:
- uw naam, adres, postcode en woonplaats;
- de datum;
- over welke beschikking het gaat (u kunt het beste een kopie van dit besluit bijsluiten);
- de redenen waarom u het niet eens bent met het besluit;
- uw handtekening.

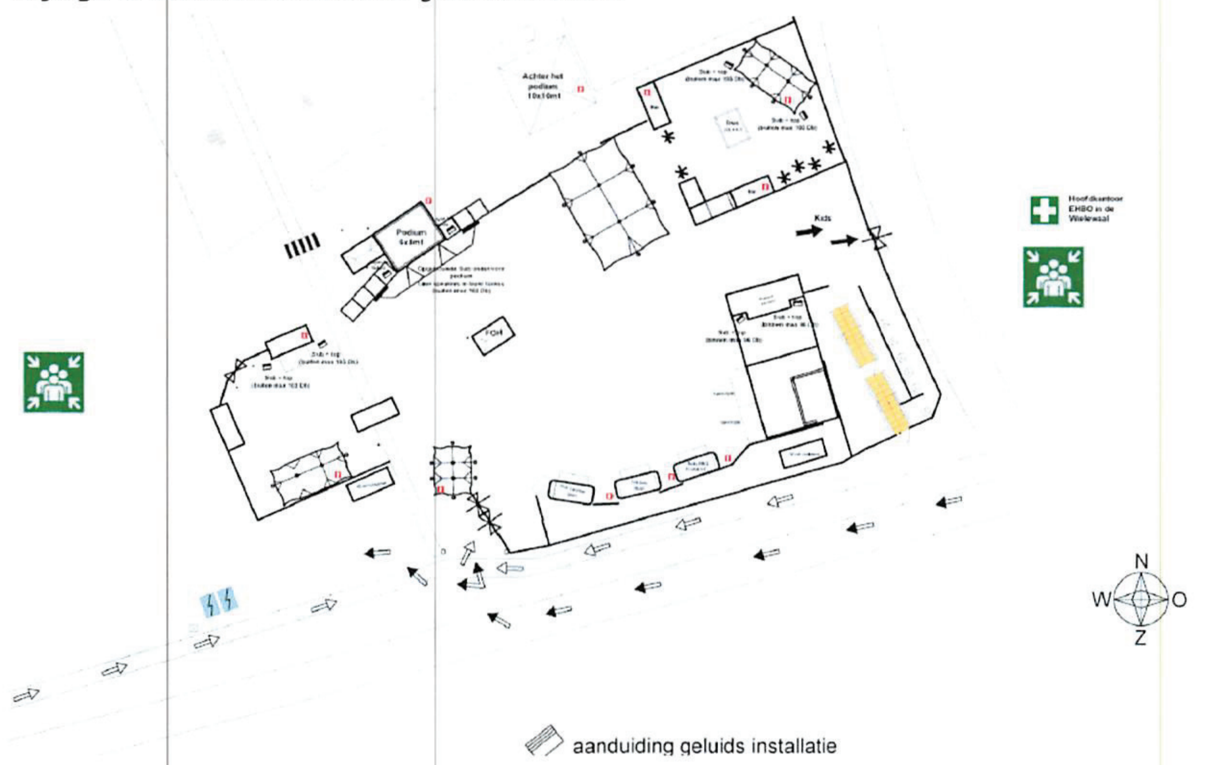
U kunt het beroepschrift ook digitaal indienen bij de rechtbank via http://loket.rechtspraak.nl/bestuursrecht. Daarvoor moet u wel beschikken over een elektronische handtekening (DigiD). Voor meer informatie verwijzen wij naar www.rechtspraak.nl.

Het indienen van een beroepschrift schorst de werking van het besluit niet. Indien onverwijlde spoed dit vereist, kunt u tijdens de beroepsprocedure de voorzieningenrechter van de rechtbank vragen een voorlopige voorziening te treffen. Voor de behandeling van dit verzoek en het beroep wordt griffierecht geheven.

Bijlage 1: Locatie plangebied



Bijlage 2: Locaties te realiseren geluidsinstallatie



odnhn.nl

Bureau ir. M. Klijnstra

civiel ingenieursbureau

Deventerweg 9
7245 AW Laren

tel: (0573) 40 20 46
fax: (0573) 40 23 58

Laren	03 juni 2022 14 juni 2022
Project:	**Kiosk Paal 12 Den Hoorn - Texel**
opdrachtgever:	Norel Hallenbouw Te Apeldoorn
Berekening	**Stat berekening Romneyloods**
Bijlagen:	Bijlage A Bijlage B Bijlage C Bijlage D
constructeur:	M. Klijnstra
projectnr:	**22063**

Bureau Ir M. Klijnstra
civiel ingenieursbureau

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Inhoudsopgave

1 Inleiding

Deze rapportage betreft de statische berekening van de bovenvermelde romneyloods. Bij het uitvoeren van de berekening wordt gebruik gemaakt van software. De software is deels van eigenhand en van struct4u. De berekening wordt uitgevoerd m.b.v. de euro-code met daarbij toegevoegd de NPR 8020-51:2013 (Evenementen – Podiumconstructies Belastingen en constructieve uitgangspunten)

2 Uitgangspunten

2.1 Situatie

Deze statische berekening betreft twee situatie's

Romneyloods als podium (evenement) waarbij een windbelasting van 7 Bft nog toelaatbaar is.
Bij een hogere windbelasting dient de hal en de omgeving ontruimd te worden.
De afmeting bedraagt L x B = 5.00 x 7.50 m (hoogte is 3.50 m).
De loods heeft één open kopgevel

Romneyloods met een permanent gebruik als kiosk
De loods met gesloten kopgevels heeft een afmeting L x B = 10.00 x 7.50 m (hoogte is 3.50 m)

2.2 Bouwkundig

Tekening:	opgesteld door Norel hallenbouw te Apeldoorn
Project:	kiosk Paal 12
	Enginering t.b.v. levering bouwpakket type Romneyloods
Bladen:	SO-1 en DET-1
d.d.:	30-05-2022

2.3 Constructief

belastingsfactoren UGT

podium	perm	$\gamma = 1 / 1.1$	
	wind	$\gamma = 1.2$	(NPR)
kiosk	perm	$\gamma = 1 / 1.1$	
	wind	$\gamma = 1.35$	(NEN-EN…)

Belastingen

Permanant golfplaat $g = .05\ kN/m^2$

Wind

podium	periode	1 mei tot 1 november	(NPR 8020)
	wind	winddruk 0.35 kN/m^2	
		(windsnelheid/windpiek ca. 15 / 24 m/s)	
kiosk	periode	gehele jaar met referentie periode van 5 jaar	
	wind	winddruk 1.51 x 0.85 = 1.30 kN/m^2 (NEN-EN 1991-1-4..)	
factoren	open kopgevel	$\mu = 1.3$	in loods
	gesloten ,,	$\mu = 1.3$	op wand
	zijgevel	volgens fig. 7.27 NEN-EN 1991-1-4	
		voor de kromme met Re > 107	

Sneeuw

podium	periode	1 mei tot 1 november	geen sneeuwbelasting
kiosk	bij sneeuw dan demonteren		,, ,,

2.4 Materialen

Tenzij anders vermeld

staal	walsprofielen	S235JR
hout	sterkte klasse	C24
ankers	keilbouten	

3 Podium

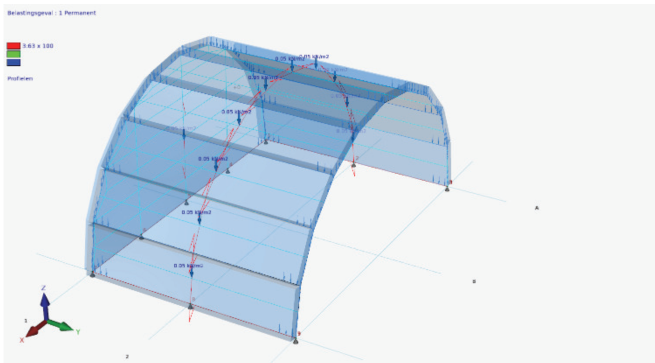
3.1 Algemeen

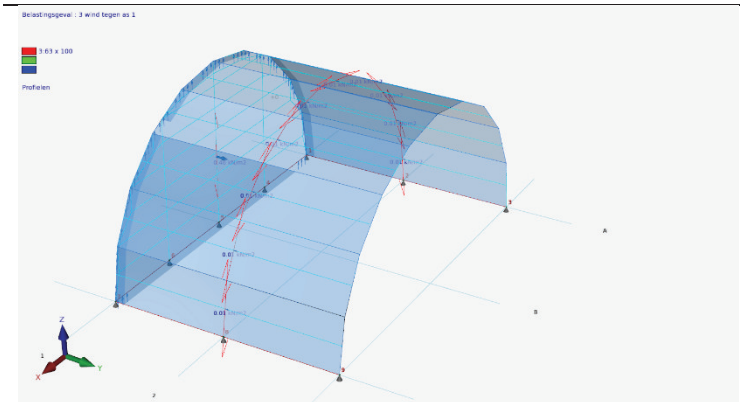
De berekening wordt uitgevoerd m.b.v. een 3D-rekenpakket waarin het mogelijk is de verdeelde belastingen volgens § 4 in te geven.

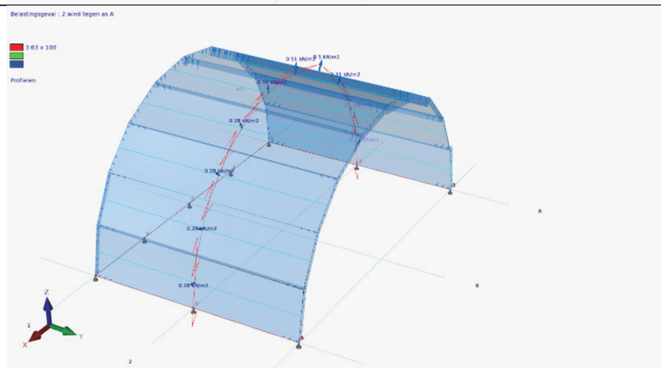
3.2 Belastingen

De aangegeven belasting zijn

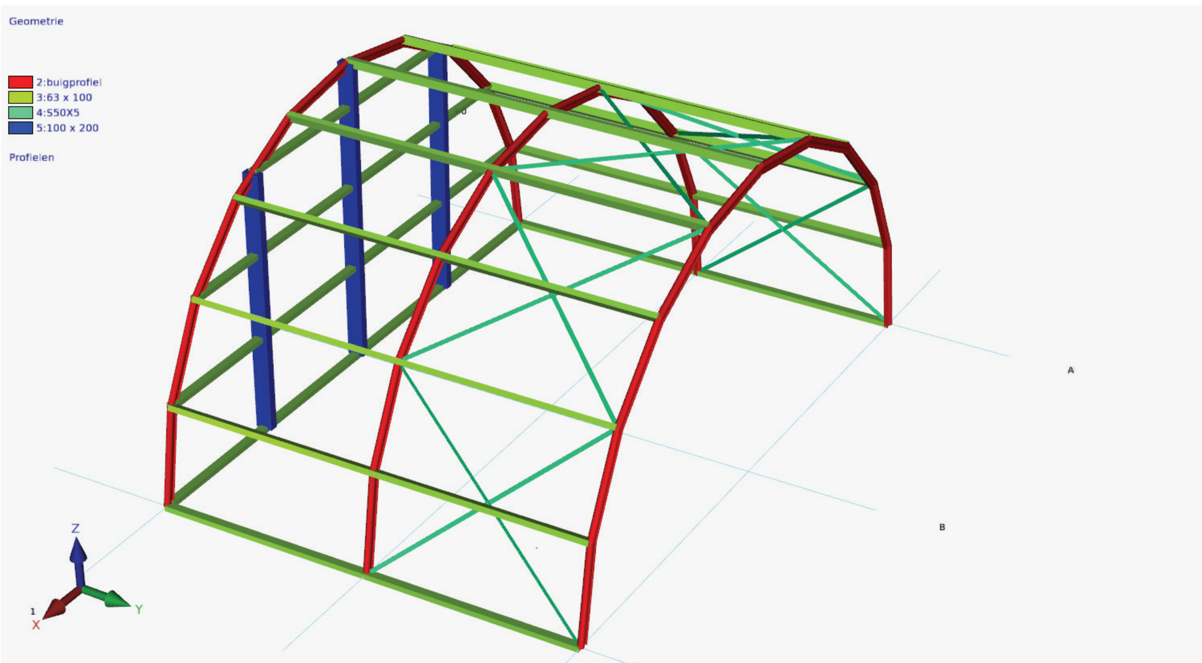
rechts	permanent
onder	wind tegen as 1
rechts-onder	wind tegen as A





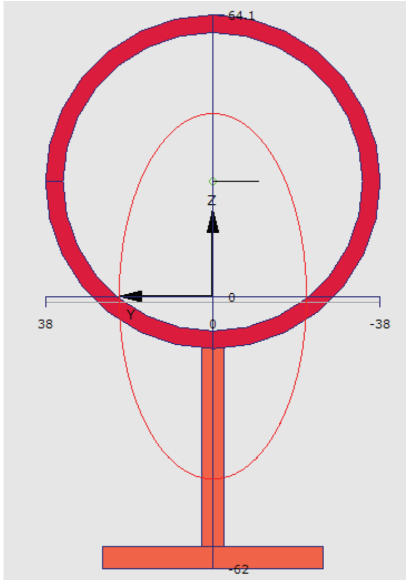


3.3 Resultaat



Het aangegeven materiaal “buisprofiel” is een combinatie van een buis Ø76,1x4 met een T50-profiel

zoals hiernaast is aangegeven



3.4 Berekening

De resultaten van de berekening voor het podium zijn in bijlage A weergegeven

De resultaten zijn gesplitst in spanten
windverbanden
gordingen
wandregels
selectie (bepalende staven per doorsnede)
spant as 2

4 Kiosk

4.1 Algemeen

In tegenstelling tot het podium,waarbij gebruikgemaakt is van de NPR 8020-51. Wordt de belasting voorde kiosk bepaald volgens de NEN-EN met een referentie periode van 5 jaar

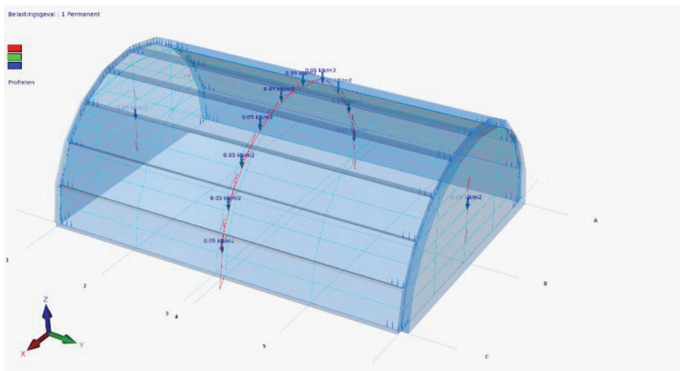
4.2 Belastingen

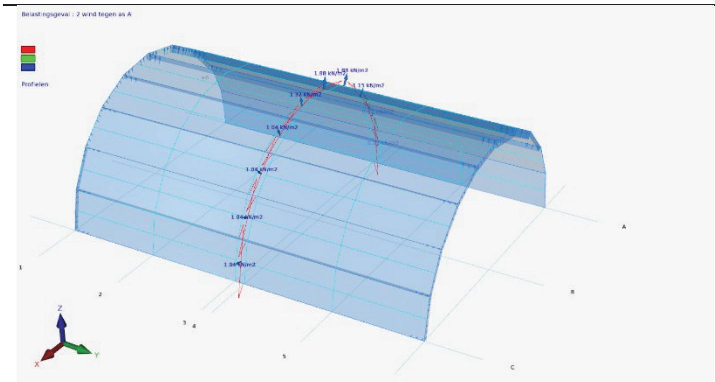
De aangegeven belasting zijn

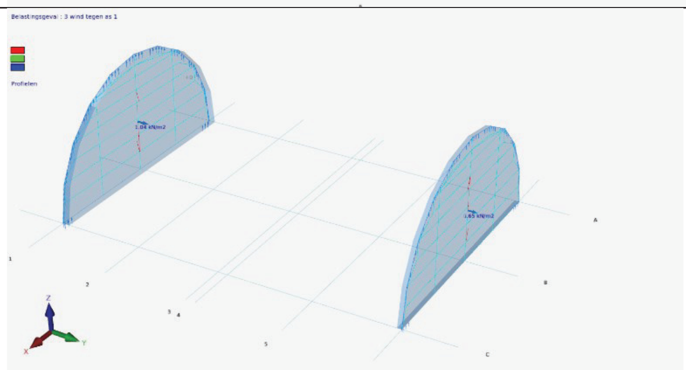
rechts permanent

onder wind tegen as A

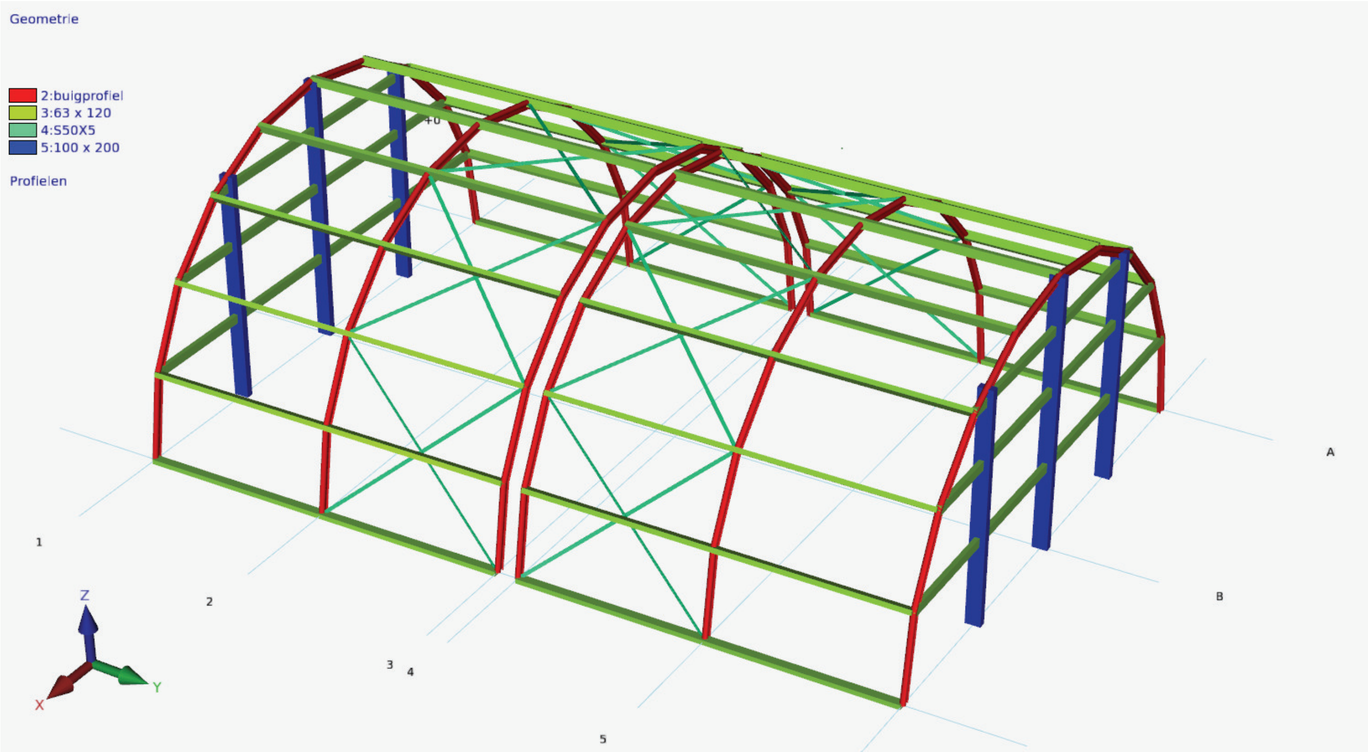
rechts-onder wind tegen as 1

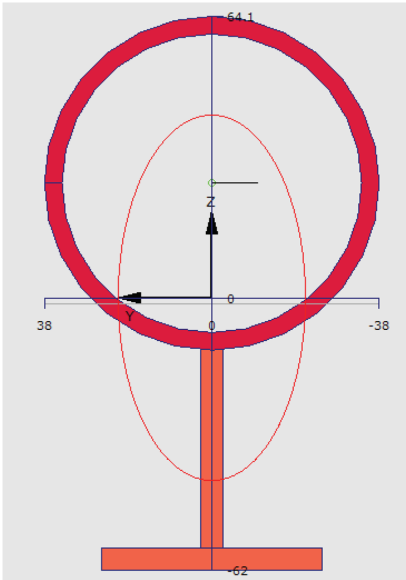






4.3 Resultaat





Het aangegeven materiaal “buisprofiel” is een combinatie van een buis Ø76,1x4 met een T50-profiel

zoals hiernaast is aangegeven

4.4 Berekening

De resultaten van de berekening voor het podium zijn in bijlage B weergegeven

De resultaten zijn gesplitst in spanten
windverbanden
gordingen
wandregels
selectie (bepalende staven per doorsnede)
spant as 5

5 Onderbouw

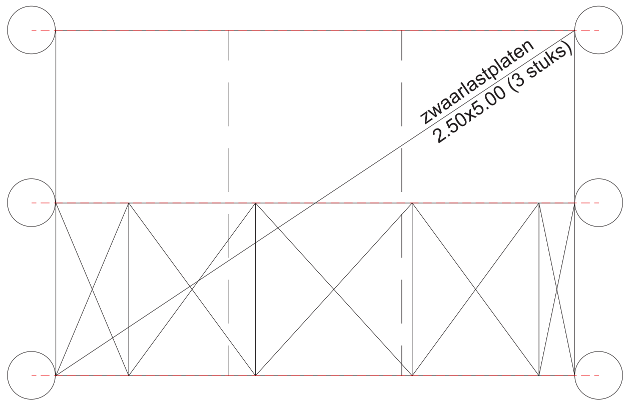
5.1 Podium

Het podium wordt gefundeerd op zwaarlastvloer delen (LxB =5.00x2.50 m) met een eigen gewicht $g = 2.56$ kN/m^2

De belasting belastingen zijn;

knoop [-]	Fx [kN]	Fy [kN]	Fhor [kN]	Fz [kN]
9	2.00	0.00	2.00	5.30
9	1.00	3.00	3.16	-4.63
8	1.00	3.30	3.45	-1.85

Het contra gewicht voor de trekbelasting op de fundatie wordt uitgevoerd door zgn. paddenstoelen met een eigengewicht van 848 kg (= 8.5 kN). T.p.v. de spanten een paddenstoel met over de spanten spanbanden SWL5000 kg (gecertificeerd)



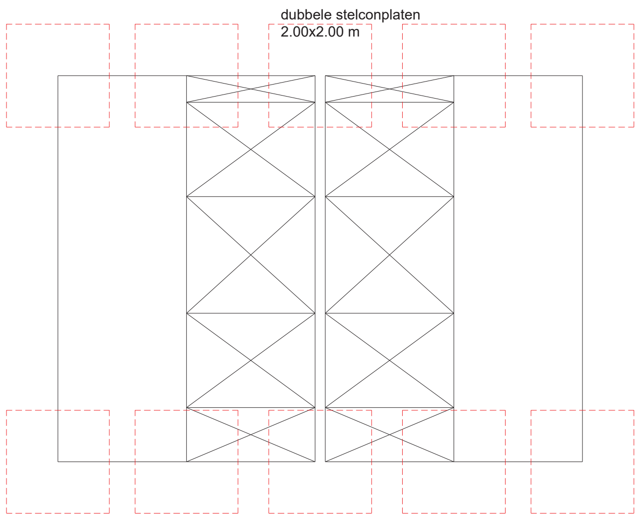
5.2 Kiosk

Het podium wordt gefundeerd op dubbele stelconplaten (L x B = 2.00x2.00 m) met een gewicht G = 2.00x2.00x0.10x2 x 25 = 20 kN per dubbele plaat

De belasting belastingen zijn;

knoop [-]	Fx [kN]	Fy [kN]	Fhor [kN]	Fz [kN]
15	4	1	4	10
17	1.4	1.3	2	**-13**
4	4.5	7.9	9	6.4
5	8.3	7.7	**11**	**-12**

De maximale trekkracht F = 13 kN (< 20 kN oke)



5.3 Ankers

(berekening zie bijlage)

Anker

Systeem	fischer Segmentanker FAZ II
Anker	Segment anker FAZ II 10/10, Elektrolytisch verzinkt staal
Verankeringsdiepte	48 mm
Berekeningsgegevens	Ankerdimensionering in Beton volgens European Technical Assessment ETA-05/0069, Optie 1, Afgegeven op 24-4-2020

6 Resultaat

Podium — Het podium is gedimensiomeerd voor

Windgebied	1	
Terreincategorie	kuststrook	
Windlastbeperking	tot en met 7 Bft	
	(wind- en pieksnelheid	15 / 24 m/s)

Kioks — De kiosk is gedimensiomeerd volgends de NEN-EN met

Tijdelijke bebouwing	(5 jr)	
Windgebied	1	
Terreincategorie	kuststrook	
	(windsnelheid	29.5 m/s)

7 Bijlage

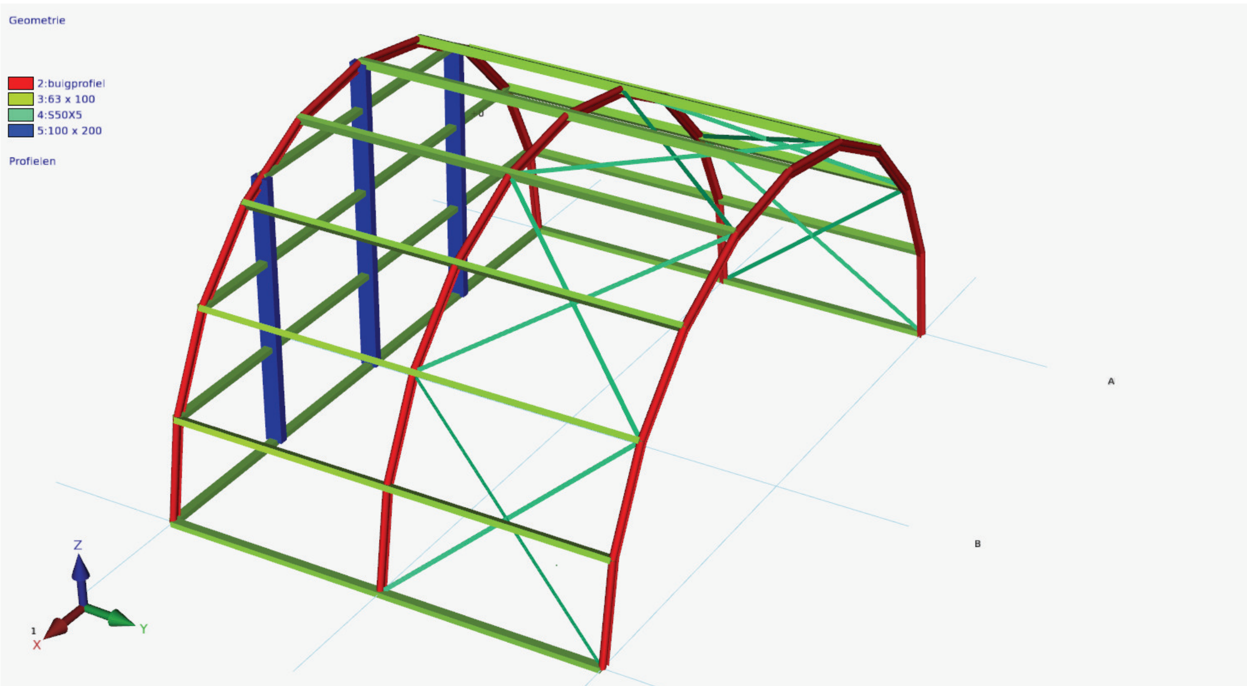
Podium	bovenbouw	Bijlage A
	Onderbouw	C
Kiosk	bovenbouw	Bijlage B
	Onderbouw	D

projectnr: **22063**

datum: 10-06-2022

Project: **Kiosk Paal 12 te Den Hoorn - Texel**

bijlage **Podium** Bijlage A = bovenbouw
Bijlage C = reactie + ankers



Bestand :....22063\berekening\2022-06-11\podium.xfem

Inhoudsopgave

1.Invoergegevens spanten

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

1.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
1	0	0	0	A	A	A			
2	0	2500	0	A	A	A			
7	7330	0	0	A	A	A			
8	7330	2500	0	A	A	A			
10	179	0	1133						
11	179	2500	1133						
13	7151	0	1133						
14	7151	2500	1133						
16	700	0	2154						
17	700	2500	2154						
19	6630	0	2154						
20	6630	2500	2154						
22	1511	0	2965						
23	1511	2500	2965						
25	5819	0	2965						
26	5819	2500	2965						
28	1832.5	0	3129.1						
29	5497.5	0	3129.1						
30	2532	0	3486						
31	2532	2500	3486						
33	4798	0	3486						
34	4798	2500	3486						
36	3665	0	3665						
37	3665	2500	3665						

1.2 STAVEN

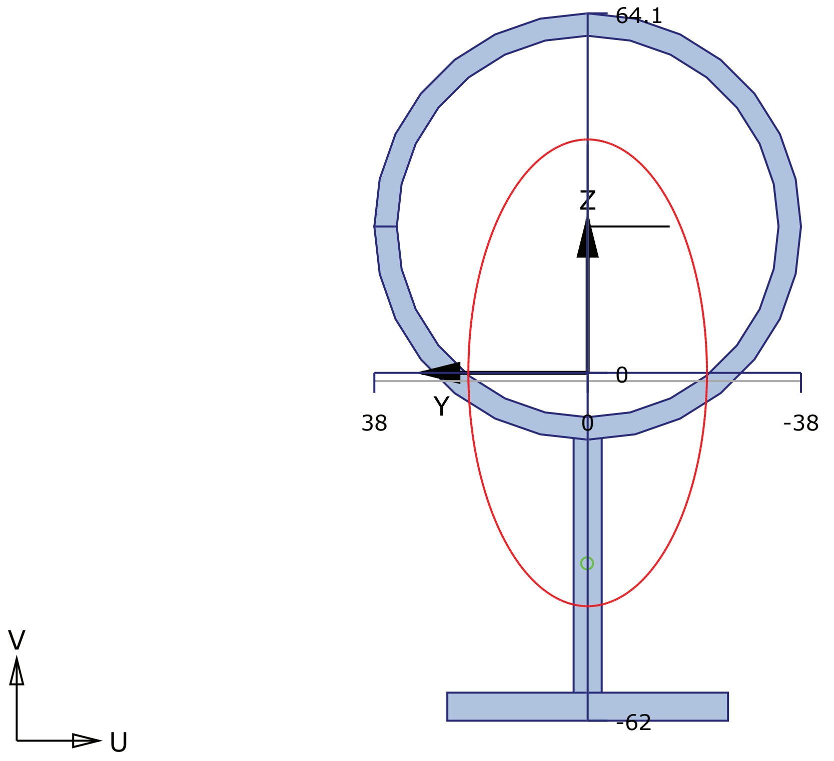
Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
6	1	10	aaaaaa	aaaaaa	buigprofiel	1147
7	2	11	aaaaaa	aaaaaa	buigprofiel	1147
9	13	7	aaaaaa	aaaaaa	buigprofiel	1147
10	14	8	aaaaaa	aaaaaa	buigprofiel	1147
22	10	16	aaaaaa	aaaaaa	buigprofiel	1146
23	11	17	aaaaaa	aaaaaa	buigprofiel	1146
25	19	13	aaaaaa	aaaaaa	buigprofiel	1146
26	20	14	aaaaaa	aaaaaa	buigprofiel	1146
33	16	22	aaaaaa	aaaaaa	buigprofiel	1147
34	17	23	aaaaaa	aaaaaa	buigprofiel	1147
36	25	19	aaaaaa	aaaaaa	buigprofiel	1147
37	26	20	aaaaaa	aaaaaa	buigprofiel	1147
47	22	30	aaaaaa	aaaaaa	buigprofiel	1146
48	23	31	aaaaaa	aaaaaa	buigprofiel	1146
50	33	25	aaaaaa	aaaaaa	buigprofiel	1146
51	34	26	aaaaaa	aaaaaa	buigprofiel	1146
59	30	36	aaaaaa	aaaaaa	buigprofiel	1147
60	31	37	aaaaaa	aaaaaa	buigprofiel	1147

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
62	36	33	aaaaaa	aaaaaa	buigprofiel	1147
63	37	34	aaaaaa	aaaaaa	buigprofiel	1147

1.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
2	buigprofiel	11.0	210000	1.397E3	1.1801E6	2.4179E6	6.3091E5

buigprofiel



Invoergegevens

1:S50X5
Staalsoort S235
Elasticiteitsmodulus E = 210000 N/mm ^{2}
Coördinaten (u,v) u = 0.0 mm v = -60.2 mm
Hoek hoek = -90.0 graden
Breedte b = 50.0 mm
Flensdikte tf = 5.0 mm

2:S50X5(COPY)
Staalsoort S235
Elasticiteitsmodulus E = 210000 N/mm ^{2}
Coördinaten (u,v) u = 0.0 mm v = -85.6 mm
Hoek hoek = -180.0 graden
Breedte b = 50.0 mm
Flensdikte tf = 5.0 mm

3:HFCHS761X4

Staalsoort	S235					
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}			
Coördinaten (u,v)	u	=	0.0 mm	v	=	0.0 mm
Hoek	hoek	=	-180.0 graden			
Hoogte	h	=	76.0 mm			
Flensdikte	tf	=	4.0 mm			

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	38.0 mm	z_{max}	=	62.0 mm
Minimale coördinaat	y_{min}	=	-38.0 mm	z_{min}	=	-64.1 mm
Zwaartelijn	z_{s}	=	0.0 mm	y_{s}	=	0.0 mm
Oppervlak / Gewicht	A	=	1397.2 mm ^{2}	G	=	11.0 kg/m
Statisch moment	S_{y}	=	24809 mm ^{3}	S_{z}	=	11967 mm ^{3}
Traagheidsmoment	I_{x}	=	1180116 mm ^{4}			
Traagheidsmoment	I_{y}	=	2417861 mm ^{4}	I_{z}	=	630910 mm ^{4}
Traagheidsstraal	i_{y}	=	41.6 mm	i_{z}	=	21.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	37727 mm ^{3}	$W_{z;el}$	=	16603 mm ^{3}
Centrifugaalmoment	C_{yz}	=	2 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	2417861 mm ^{4}	I_{min}	=	630910 mm ^{4}
Traagheidsstraal	i_{max}	=	41.6 mm	i_{min}	=	21.2 mm
Halveringslijn	z_{h}	=	1.5 mm	y_{h}	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	49593 mm ^{3}	$W_{z;pl}$	=	23935 mm ^{3}

1.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

1.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

1.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
6	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	1	0	1147
6	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	1	0	1147
7	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	2	0	1147
9	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	13	0	1147
9	G-Z	q	-0.004 kN/m	0.000 kN/m	0.0	0.0	13	0	1147
10	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	14	0	1147
22	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	10	0	1146
22	G-Z	q	0.000 kN/m	-0.012 kN/m	0.0	0.0	10	0	1146
23	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	11	0	1146
25	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	19	0	1146
25	G-Z	q	-0.012 kN/m	0.000 kN/m	0.0	0.0	19	0	1146
26	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	20	0	1146
33	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	16	0	1147
33	G-Z	q	0.000 kN/m	-0.014 kN/m	0.0	0.0	16	0	1147
34	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	17	0	1147
36	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	25	0	1147

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
36	G-Z	q	-0.014 kN/m	0.000 kN/m	0.0	0.0	25	0	1147
37	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	26	0	1147
47	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	22	0	1146
47	G-Z	q	0.000 kN/m	-0.008 kN/m	0.0	0.0	22	361	785
47	G-Z	q	-0.018 kN/m	-0.022 kN/m	0.0	0.0	22	0	361
48	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	23	0	1146
50	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	33	0	1146
50	G-Z	q	-0.008 kN/m	0.000 kN/m	0.0	0.0	33	0	785
50	G-Z	q	-0.022 kN/m	-0.018 kN/m	0.0	0.0	33	785	361
51	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	34	0	1146
59	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	30	0	1147
59	G-Z	q	-0.009 kN/m	-0.013 kN/m	0.0	0.0	30	0	1147
60	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	31	0	1147
62	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	36	0	1147
62	G-Z	q	-0.013 kN/m	-0.009 kN/m	0.0	0.0	36	0	1147
63	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	37	0	1147

1.6 BELASTINGSGEVAL 2 wind tegen as A

1.7 BELASTINGSGEVAL 3 wind tegen as 1

1.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
6	G-Y	q	0.000 kN/m	0.041 kN/m	0.0	0.0	1	0	1147
9	G-Y	q	0.041 kN/m	0.000 kN/m	0.0	0.0	13	0	1147
22	G-Y	q	0.000 kN/m	0.107 kN/m	0.0	0.0	10	0	1146
25	G-Y	q	0.107 kN/m	0.000 kN/m	0.0	0.0	19	0	1146
33	G-Y	q	0.000 kN/m	0.132 kN/m	0.0	0.0	16	0	1147
36	G-Y	q	0.132 kN/m	0.000 kN/m	0.0	0.0	25	0	1147
47	G-Y	q	0.166 kN/m	0.200 kN/m	0.0	0.0	22	0	361
47	G-Y	q	0.000 kN/m	0.073 kN/m	0.0	0.0	22	361	785
50	G-Y	q	0.200 kN/m	0.166 kN/m	0.0	0.0	33	785	361
50	G-Y	q	0.073 kN/m	0.000 kN/m	0.0	0.0	33	0	785
59	G-Y	q	0.081 kN/m	0.122 kN/m	0.0	0.0	30	0	1147
62	G-Y	q	0.122 kN/m	0.081 kN/m	0.0	0.0	36	0	1147

1.8 BELASTINGSGEVAL 4 wind tegen as 3

1.8.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
6	G-Y	q	0.000 kN/m	-0.041 kN/m	0.0	0.0	1	0	1147
9	G-Y	q	-0.041 kN/m	0.000 kN/m	0.0	0.0	13	0	1147
22	G-Y	q	0.000 kN/m	-0.107 kN/m	0.0	0.0	10	0	1146
25	G-Y	q	-0.107 kN/m	0.000 kN/m	0.0	0.0	19	0	1146
33	G-Y	q	0.000 kN/m	-0.132 kN/m	0.0	0.0	16	0	1147
36	G-Y	q	-0.132 kN/m	0.000 kN/m	0.0	0.0	25	0	1147
47	G-Y	q	-0.166 kN/m	-0.200 kN/m	0.0	0.0	22	0	361
47	G-Y	q	0.000 kN/m	-0.073 kN/m	0.0	0.0	22	361	785
50	G-Y	q	-0.200 kN/m	-0.166 kN/m	0.0	0.0	33	785	361
50	G-Y	q	-0.073 kN/m	0.000 kN/m	0.0	0.0	33	0	785

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
59	G-Y	q	-0.081 kN/m	-0.122 kN/m	0.0	0.0	30	0	1147
62	G-Y	q	-0.122 kN/m	-0.081 kN/m	0.0	0.0	36	0	1147

2.Berekeningsresultaten spanten

2.1 UITERSTE GRENSTOESTANDEN (UGT)

2.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

2.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
6	2	1		-0.040	0.010	**0.181**	0.000	0.000	0.000
	3	1		**0.938**	**-0.052**	-0.001	0.000	0.000	0.000
	4	1		**-0.720**	**0.054**	**-0.004**	0.000	0.000	0.000
	2	10		0.176	-0.010	**-0.159**	0.000	**-0.195**	0.011
	3	10		**-0.802**	**0.024**	0.023	0.000	0.013	**-0.049**
	4	10		**0.857**	**-0.026**	**0.026**	0.000	**0.017**	**0.051**
7	1	2		**1.899**	-0.001	-0.343	0.000	0.000	0.000
	2	2		**-0.869**	0.010	**0.740**	0.000	0.000	0.000
	3	2		0.782	**-0.017**	0.133	0.000	0.000	0.000
	4	2		0.600	**0.020**	**-1.157**	0.000	0.000	0.000
	1	11		**-1.765**	0.001	0.365	0.000	0.408	-0.001
	2	11		**1.003**	-0.010	**-0.719**	0.000	**-0.835**	0.011
	3	11		-0.648	**0.017**	-0.111	0.000	-0.140	**-0.020**
	4	11		-0.466	**-0.020**	**1.178**	0.000	**1.341**	**0.023**
9	1	13		0.802	0.001	**0.023**	0.000	**-0.013**	0.001
	2	13		-0.040	-0.005	**0.179**	0.000	**-0.193**	-0.005
	3	13		**0.802**	**0.024**	0.023	0.000	-0.013	**0.049**
	4	13		**-0.857**	**-0.026**	0.026	0.000	-0.017	**-0.051**
	1	7		-0.938	-0.001	**-0.001**	0.000	0.000	0.000
	2	7		-0.097	0.005	**-0.157**	0.000	0.000	0.000
	3	7		**-0.938**	**-0.052**	-0.001	0.000	0.000	0.000
	4	7		**0.720**	**0.054**	-0.004	0.000	0.000	0.000
10	1	14		**1.765**	0.001	0.365	0.000	-0.408	0.001
	2	14		**-1.963**	-0.005	0.071	0.000	-0.069	-0.005
	3	14		0.648	**0.017**	**-0.112**	0.000	**0.140**	**0.020**
	4	14		0.466	**-0.020**	**1.178**	0.000	**-1.340**	**-0.023**
	1	8		**-1.899**	-0.001	-0.343	0.000	0.000	0.000
	2	8		**1.829**	0.005	-0.050	0.000	0.000	0.000
	3	8		-0.782	**-0.017**	**0.133**	0.000	0.000	0.000
	4	8		-0.601	**0.020**	**-1.157**	0.000	0.000	0.000
22	2	10		-0.343	-0.001	**-0.052**	0.003	**0.195**	-0.011

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
22	3	10		**0.667**	**0.090**	0.041	**-0.015**	-0.013	**0.046**
	4	10		**-0.902**	**-0.107**	**0.044**	**0.016**	**-0.017**	**-0.049**
	1		744	-0.667	-0.001	0.000	0.000	**0.002**	-0.002
	3		744	-0.667	0.120	0.000	0.015	**0.002**	0.028
	2	16		0.471	0.001	**0.117**	-0.003	**-0.098**	0.009
	3	16		**-0.540**	**-0.163**	0.024	**0.015**	0.003	**0.084**
	4	16		**1.029**	**0.180**	**0.021**	**-0.016**	**0.004**	**-0.102**
23	1	11		**1.593**	-0.001	0.099	0.000	-0.408	0.001
	2	11		**-1.198**	-0.002	**-0.096**	0.003	**0.835**	-0.011
	3	11		0.383	**0.139**	0.205	**-0.006**	0.140	**0.019**
	4	11		0.365	**-0.159**	**0.467**	**0.007**	**-1.341**	**-0.022**
	1	17		**-1.472**	0.001	-0.038	0.000	0.329	-0.002
	2	17		**1.319**	0.002	**0.158**	-0.003	**-0.689**	0.009
	3	17		-0.263	**-0.139**	-0.144	**0.006**	-0.340	**0.140**
	4	17		-0.244	**0.159**	**-0.405**	**-0.007**	**0.841**	**-0.160**
25	1	19		0.540	0.001	**0.024**	0.000	-0.003	0.002
	2	19		-0.282	-0.003	**-0.029**	-0.002	**-0.121**	-0.009
	3	19		**0.540**	**-0.163**	0.024	**0.015**	**-0.003**	**-0.084**
	4	19		**-1.029**	**0.180**	0.021	**-0.016**	-0.004	**0.102**
	1		402	-0.540	0.001	0.000	0.000	**0.002**	-0.002
	3		402	-0.540	-0.120	0.000	-0.015	**0.002**	0.028
	1	13		-0.667	-0.001	**0.041**	0.000	**0.013**	-0.001
	2	13		0.155	0.003	**0.094**	0.002	**0.193**	0.005
	3	13		**-0.667**	**0.090**	0.041	**-0.015**	0.013	**-0.046**
	4	13		**0.902**	**-0.107**	0.044	**0.016**	0.017	**0.049**
26	1	20		**1.472**	0.001	**-0.038**	0.000	-0.329	0.002
	2	20		**-2.312**	-0.003	-0.101	-0.002	0.082	-0.009
	3	20		0.262	**-0.139**	-0.144	**0.006**	**0.341**	**-0.140**
	4	20		0.245	**0.159**	**-0.405**	**-0.007**	**-0.841**	**0.160**
	1	14		**-1.593**	-0.001	**0.099**	0.000	0.408	-0.001
	2	14		**2.192**	0.003	0.162	0.002	0.069	0.005
	3	14		-0.383	**0.139**	0.205	**-0.006**	**-0.140**	**-0.019**
	4	14		-0.365	**-0.159**	**0.466**	**0.007**	**1.340**	**0.022**
33	1	16		0.408	0.003	**0.048**	-0.001	-0.003	0.002
	2	16		-0.479	-0.005	**-0.076**	0.006	**0.098**	-0.008
	3	16		**0.408**	**-0.120**	0.048	**0.012**	-0.003	**-0.085**
	4	16		**-0.892**	**0.151**	0.023	**-0.016**	**-0.004**	**0.102**
	4		276	0.892	0.145	0.000	0.016	**-0.001**	-0.061
	1		559	-0.408	0.003	0.000	0.001	**0.011**	0.000
	1	22		-0.306	-0.003	**0.054**	0.001	**0.005**	0.001
	2	22		0.582	0.005	**0.178**	-0.006	**0.046**	0.003
	3	22		**-0.306**	**0.030**	0.054	**-0.012**	0.005	**-0.019**
	4	22		**0.995**	**-0.060**	0.079	**0.016**	0.034	**0.035**
34	2	17		-2.534	-0.004	**-0.607**	0.006	**0.689**	-0.007
	3	17		**1.725**	**-0.195**	-0.267	**0.037**	0.340	**-0.135**
	4	17		**-2.764**	**0.232**	**0.563**	**-0.042**	**-0.841**	**0.154**
	2	23		2.630	0.004	**0.703**	-0.006	0.059	0.003
	3	23		**-1.629**	**0.195**	0.363	**-0.037**	**0.022**	**-0.090**
	4	23		**2.860**	**-0.232**	**-0.467**	**0.042**	**0.256**	**0.108**
36	1	25		0.306	-0.003	0.054	0.001	**-0.005**	-0.001
	2	25		-0.403	0.003	**-0.048**	-0.004	-0.007	-0.004
	3	25		**0.306**	**0.030**	0.054	**-0.012**	-0.005	**0.019**
	4	25		**-0.995**	**-0.061**	**0.079**	**0.016**	**-0.034**	**-0.035**
	1		589	-0.306	-0.003	0.000	-0.001	**0.011**	0.000
	4		871	0.995	-0.145	0.000	-0.016	**-0.001**	-0.061

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
36	2	19		0.300	-0.003	**0.150**	0.004	**0.121**	0.008
	3	19		**-0.408**	**-0.120**	0.048	**0.012**	**0.003**	**0.085**
	4	19		**0.892**	**0.151**	**0.023**	**-0.016**	0.004	**-0.102**
37	2	26		-2.516	0.004	0.008	-0.004	**0.129**	-0.004
	3	26		**1.629**	**0.195**	**0.363**	**-0.037**	-0.022	**0.090**
	4	26		**-2.859**	**-0.232**	**-0.467**	**0.042**	**-0.256**	**-0.108**
	2		84	2.516	0.003	0.000	0.004	**0.129**	0.004
	3	20		**-1.725**	**-0.195**	**-0.267**	**0.037**	**-0.341**	**0.135**
	4	20		**2.763**	**0.232**	**0.563**	**-0.042**	**0.841**	**-0.154**
47	2	22		-0.631	-0.017	0.236	**0.007**	**-0.046**	-0.001
	3	22		0.257	**-0.783**	-0.056	0.005	-0.005	0.022
	4	22		**-1.095**	**0.763**	**0.291**	-0.005	-0.034	-0.039
	2	28		0.631	-0.017	0.191	**-0.007**	0.031	-0.005
	4	28		**1.095**	0.682	0.246	0.005	0.063	0.299
	2	28		0.669	-0.017	**-0.206**	-0.007	0.031	-0.005
	3	28		-0.408	0.516	0.108	-0.005	-0.033	**-0.291**
	4	28		1.084	-0.536	-0.102	0.005	**0.063**	**0.299**
	2	30		0.712	0.017	**0.291**	-0.007	**0.163**	-0.018
	4	30		**1.128**	0.570	0.187	**0.005**	0.051	-0.131
48	2	23		-2.550	-0.018	**-0.311**	0.007	-0.059	-0.001
	3	23		**1.561**	**0.158**	-0.041	**0.008**	**-0.022**	**0.098**
	4	23		**-3.209**	**-0.177**	**0.908**	**-0.007**	**-0.256**	**-0.116**
	2	31		2.612	0.018	**0.431**	-0.007	**0.481**	-0.019
	3	31		**-1.500**	**-0.158**	0.162	**-0.008**	0.139	**0.082**
	4	31		**3.270**	**0.177**	**-0.787**	**0.007**	**-0.707**	**-0.091**
50	2	33		-0.852	0.007	0.108	**-0.005**	0.040	0.006
	4	33		**-1.128**	0.570	**0.187**	0.005	**-0.051**	0.131
	2	29		0.852	0.007	0.022	0.005	**0.091**	0.000
	2	29		0.546	0.007	**-0.247**	**0.005**	0.091	0.000
	3	29		-0.364	-0.516	-0.108	0.005	-0.033	**-0.291**
	3	29		-0.234	**0.704**	0.101	0.005	-0.033	-0.291
	4	29		**1.128**	0.536	0.102	-0.005	0.062	**0.299**
	4	29		1.118	**-0.682**	-0.246	-0.005	0.062	0.299
	2	25		0.523	-0.007	**0.292**	0.005	0.007	0.002
	3	25		-0.257	**-0.783**	-0.056	0.005	0.005	-0.022
	4	25		1.095	**0.763**	0.291	-0.005	0.034	0.038
51	2	34		-2.702	0.008	**0.163**	-0.005	0.013	0.006
	3	34		**1.499**	**-0.158**	0.162	**-0.008**	**-0.139**	**-0.082**
	4	34		**-3.270**	**0.177**	**-0.787**	**0.007**	**0.707**	**0.091**
	2	26		2.641	-0.008	**-0.042**	0.005	**-0.129**	0.002
	3	26		**-1.561**	**0.158**	-0.041	**0.008**	0.022	**-0.097**
	4	26		**3.208**	**-0.177**	**0.908**	**-0.007**	**0.256**	**0.116**
59	2	30		-0.738	0.007	**0.240**	0.001	**-0.163**	0.020
	3	30		**0.322**	**-0.404**	**0.024**	**0.043**	**0.018**	**-0.116**
	4	30		**-1.155**	**0.422**	0.133	**-0.045**	-0.051	**0.123**
	3		186	-0.322	-0.385	0.000	-0.043	**0.020**	0.042
	4		1033	1.155	0.298	0.000	0.045	**0.018**	0.252
	2	36		0.761	-0.007	**-0.092**	-0.001	**-0.027**	-0.012
	3	36		**-0.299**	**0.264**	**0.124**	**-0.043**	**0.039**	**-0.273**
	4	36		**1.178**	**-0.282**	0.015	**0.045**	-0.018	**0.285**
60	2	31		-2.738	0.007	0.159	0.000	**-0.481**	0.020
	3	31		**1.745**	**-0.246**	**-0.026**	**0.033**	-0.139	**-0.075**
	4	31		**-4.478**	**0.270**	**0.165**	**-0.035**	**0.707**	**0.084**
	1		679	-1.082	0.005	0.000	0.001	**0.255**	0.002
	2	37		2.759	-0.007	-0.025	0.000	**0.375**	-0.012

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
60	3	37		**-1.724**	**0.246**	**0.161**	**-0.033**	0.247	**-0.208**
	4	37		**4.499**	**-0.270**	**-0.030**	**0.035**	**-0.814**	**0.221**
62	2	36		-0.892	0.004	0.086	-0.003	**0.027**	0.011
	3	36		**0.299**	**0.264**	**0.124**	**-0.043**	**-0.039**	**0.273**
	4	36		**-1.178**	**-0.282**	**0.015**	**0.045**	0.018	**-0.285**
	4		114	1.178	-0.298	0.000	-0.045	**0.018**	0.252
	2		659	0.892	0.004	0.000	0.003	**0.055**	-0.009
	2	33		0.869	-0.004	0.062	0.003	**-0.040**	-0.007
	3	33		**-0.322**	**-0.404**	**0.024**	**0.043**	-0.018	**0.116**
	4	33		**1.155**	**0.422**	**0.133**	**-0.045**	**0.051**	**-0.123**
63	2	37		-2.868	0.004	**0.407**	-0.003	**-0.375**	0.011
	3	37		**1.724**	**0.246**	0.161	**-0.033**	-0.247	**0.208**
	4	37		**-4.499**	**-0.270**	**-0.031**	**0.035**	**0.814**	**-0.221**
	1		468	-1.061	-0.005	0.000	-0.001	**0.255**	0.002
	2	34		2.847	-0.004	**-0.273**	0.003	-0.013	-0.007
	3	34		**-1.745**	**-0.246**	-0.027	**0.033**	**0.139**	**0.075**
	4	34		**4.478**	**0.270**	**0.165**	**-0.035**	**-0.707**	**-0.084**

2.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
6	buigprofiel	4	1	6.2.5	0.01
		2	1	6.2.5	0.02
		2	1	6.2.8	0.02
		4	1	6.2.8	0.01
		2	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.01
		2	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.01
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.01
7	buigprofiel	1	1	6.2.4	0.01
		4	1	6.2.5	0.12
		4	1	6.2.6	0.01
		4	1	6.2.8	0.12
		4	1	6.2.8	0.00
		4	1	6.2.9.1	0.12
		4	1	6.2.9.1	0.00
		4	1	6.2.9.1	0.12
		1	1	6.3.1.1	0.01
		4	1	6.3.3	0.12
		8	1	Doorbuiging	0.04
		8	1	Doorbuiging	0.06
9	buigprofiel	4	1	6.2.5	0.01
		2	1	6.2.5	0.02

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
9	buigprofiel	2	1	6.2.8	0.02
		4	1	6.2.8	0.01
		2	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.01
		2	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.01
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.01
10	buigprofiel	2	1	6.2.3	0.01
		1	1	6.2.4	0.01
		4	1	6.2.5	0.12
		4	1	6.2.6	0.01
		4	1	6.2.8	0.12
		4	1	6.2.8	0.00
		4	1	6.2.9.1	0.12
		4	1	6.2.9.1	0.00
		4	1	6.2.9.1	0.12
		1	1	6.3.1.1	0.01
		4	1	6.3.3	0.12
		8	1	Doorbuiging	0.04
		8	1	Doorbuiging	0.06
22	buigprofiel	4	1	6.2.5	0.02
		2	1	6.2.5	0.02
		2	1	6.2.8	0.02
		4	1	6.2.8	0.02
		2	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.01
23	buigprofiel	4	1	6.2.5	0.12
		4	1	6.2.5	0.03
		4	1	6.2.8	0.12
		4	1	6.2.8	0.03
		4	1	6.2.9.1	0.12
		4	1	6.2.9.1	0.03
		4	1	6.2.9.1	0.12
		1	1	6.3.1.1	0.01
		4	1	6.3.3	0.14
		8	1	Doorbuiging	0.07
		8	1	Doorbuiging	0.09
25	buigprofiel	4	1	6.2.5	0.02
		2	1	6.2.5	0.02
		2	1	6.2.8	0.02
		4	1	6.2.8	0.02
		2	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.01
26	buigprofiel	2	1	6.2.3	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
26	buigprofiel	4	1	6.2.5	0.12
		4	1	6.2.5	0.03
		4	1	6.2.8	0.12
		4	1	6.2.8	0.03
		4	1	6.2.9.1	0.12
		4	1	6.2.9.1	0.03
		4	1	6.2.9.1	0.12
		1	1	6.3.1.1	0.01
		4	1	6.3.3	0.14
		8	1	Doorbuiging	0.07
		8	1	Doorbuiging	0.09
33	buigprofiel	4	1	6.2.5	0.02
		2	1	6.2.5	0.01
		2	1	6.2.8	0.01
		4	1	6.2.8	0.02
		2	1	6.2.9.1	0.01
		4	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.00
34	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.01
		4	1	6.2.5	0.07
		4	1	6.2.5	0.03
		2	1	6.2.6	0.01
		4	1	6.2.8	0.07
		4	1	6.2.8	0.03
		4	1	6.2.9.1	0.07
		4	1	6.2.9.1	0.03
		4	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.06
		8	1	Doorbuiging	0.03
		8	1	Doorbuiging	0.04
36	buigprofiel	4	1	6.2.5	0.02
		2	1	6.2.5	0.01
		2	1	6.2.8	0.01
		4	1	6.2.8	0.02
		2	1	6.2.9.1	0.01
		4	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.02
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.00
37	buigprofiel	4	1	6.2.3	0.01
		4	1	6.2.5	0.07
		4	1	6.2.5	0.03
		4	1	6.2.6	0.01
		4	1	6.2.8	0.07
		4	1	6.2.8	0.03
		4	1	6.2.9.1	0.07
		4	1	6.2.9.1	0.03
		4	1	6.2.9.1	0.10

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
37	buigprofiel	3	1	6.3.1.1	0.01
		3	1	6.3.3	0.06
		8	1	Doorbuiging	0.03
		8	1	Doorbuiging	0.04
47	buigprofiel	4	1	6.2.5	0.05
		2	1	6.2.5	0.01
		3	1	6.2.6	0.01
		2	1	6.2.8	0.01
		4	1	6.2.8	0.05
		2	1	6.2.9.1	0.01
		4	1	6.2.9.1	0.05
		4	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.04
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.00
48	buigprofiel	4	1	6.2.3	0.01
		4	1	6.2.5	0.06
		4	1	6.2.5	0.02
		4	1	6.2.6	0.01
		4	1	6.2.8	0.06
		4	1	6.2.8	0.02
		4	1	6.2.9.1	0.06
		4	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.04
		8	1	Doorbuiging	0.01
		8	1	Doorbuiging	0.02
50	buigprofiel	4	1	6.2.5	0.05
		2	1	6.2.5	0.01
		3	1	6.2.6	0.01
		2	1	6.2.8	0.01
		4	1	6.2.8	0.05
		2	1	6.2.9.1	0.01
		4	1	6.2.9.1	0.05
		4	1	6.2.9.1	0.06
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.04
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.01
51	buigprofiel	4	1	6.2.3	0.01
		4	1	6.2.5	0.06
		4	1	6.2.5	0.02
		4	1	6.2.6	0.01
		4	1	6.2.8	0.06
		4	1	6.2.8	0.02
		4	1	6.2.9.1	0.06
		4	1	6.2.9.1	0.02
		4	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.03
		8	1	Doorbuiging	0.01
		8	1	Doorbuiging	0.02
59	buigprofiel	4	1	6.2.5	0.05
		2	1	6.2.5	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
59	buigprofiel	2	1	6.2.8	0.01
		4	1	6.2.8	0.05
		2	1	6.2.9.1	0.01
		4	1	6.2.9.1	0.05
		4	1	6.2.9.1	0.05
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.05
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.00
60	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.01
		4	1	6.2.5	0.07
		4	1	6.2.5	0.04
		4	1	6.2.8	0.07
		4	1	6.2.8	0.04
		4	1	6.2.9.1	0.07
		4	1	6.2.9.1	0.04
		4	1	6.2.9.1	0.11
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.06
		8	1	Doorbuiging	0.05
		8	1	Doorbuiging	0.06
62	buigprofiel	4	1	6.2.5	0.05
		4	1	6.2.8	0.00
		4	1	6.2.8	0.05
		2	1	6.2.9.1	0.00
		4	1	6.2.9.1	0.05
		4	1	6.2.9.1	0.05
		3	1	6.3.1.1	0.00
		3	1	6.3.3	0.05
		6	1	Doorbuiging	0.00
		6	1	Doorbuiging	0.00
63	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.01
		4	1	6.2.5	0.07
		4	1	6.2.5	0.04
		4	1	6.2.8	0.07
		4	1	6.2.8	0.04
		4	1	6.2.9.1	0.07
		4	1	6.2.9.1	0.04
		4	1	6.2.9.1	0.11
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.06
		8	1	Doorbuiging	0.05
		8	1	Doorbuiging	0.06
Maximale waarden					
23	buigprofiel	4	1	6.3.3	0.14

2.3 BEREKENING VAN UNITY CHECKS

2.3.1 Staaf 23 - BUIGPROFIEL

Buigend moment **art. 6.2.5**

Combinatie: 4 x=0 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.467 kN
Mx=-0.007 kNm My=-1.341 kNm Mz=0.022 kNm

$$M_{y,c,Rd} = M_{pl,y,Rd} = \frac{W_{pl,y}\ f_y}{\gamma_{M0}} = \frac{49592.8 \times 235}{1.00} \times 10^{-6} = 11.654 \text{ kNm} \quad (6.13)$$

$$\frac{M_{y,Ed}}{M_{y,c,Rd}} = \frac{1.341}{11.654} = 0.12 < 1,0 \quad (6.12)$$

Buigend moment **art. 6.2.5**

Combinatie: 4 x=1146 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.405 kN
Mx=-0.007 kNm My=-0.841 kNm Mz=-0.16 kNm

$$M_{z,c,Rd} = M_{pl,z,Rd} = \frac{W_{pl,z}\ f_y}{\gamma_{M0}} = \frac{23934.5 \times 235}{1.00} \times 10^{-6} = 5.625 \text{ kNm} \quad (6.13)$$

$$\frac{M_{z,Ed}}{M_{z,c,Rd}} = \frac{0.160}{5.625} = 0.03 < 1,0 \quad (6.12)$$

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 4 x=0 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.467 kN
Mx=-0.007 kNm My=-1.341 kNm Mz=0.022 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\,)}{\gamma_{M0}} = \frac{821.2 \times (235/\sqrt{3}\,)}{1.00} \times 10^{-3} = 111.4 \text{ kN} \quad (6.18)$$

$V_{z,Ed} = 0.467$ kN < $V_{z,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 4 x=1146 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.405 kN
Mx=-0.007 kNm My=-0.841 kNm Mz=-0.16 kNm

$$V_{c,y,Rd} = V_{pl,y,Rd} = \frac{A_v\ (f_y / \sqrt{3}\,)}{\gamma_{M0}} = \frac{821.2 \times (235/\sqrt{3}\,)}{1.00} \times 10^{-3} = 111.4 \text{ kN} \quad (6.18)$$

$V_{y,Ed} = 0.159$ kN < $V_{y,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 4 x=0 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.467 kN
Mx=-0.007 kNm My=-1.341 kNm Mz=0.022 kNm

$$M_{N,Rd} = M_{pl,Rd}\ (1 - \left((N_{Ed} / N_{pl,Rd}) \right)^2) = 11.7\ (1 - \left((0.4 / 328.3) \right)^2) = 11.654 \text{ kNm} \quad (6.32)$$

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} = \frac{1.341}{11.654} = 0.12 < 1,0 \quad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 4 x=1146 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.405 kN
Mx=-0.007 kNm My=-0.841 kNm Mz=-0.16 kNm

$$M_{N,Rd} = M_{pl,Rd}\ (1 - \left((N_{Ed} / N_{pl,Rd}) \right)^2) = 5.6\ (1 - \left((0.4 / 328.3) \right)^2) = 5.625 \text{ kNm} \quad (6.32)$$

$$\frac{M_{z,Ed}}{M_{N,z,Rd}} = \frac{0.160}{5.625} = 0.03 < 1,0 \quad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 4 x=0 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.467 kN
Mx=-0.007 kNm My=-1.341 kNm Mz=0.022 kNm

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}} \right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}} \right)^{\beta} = \left(\frac{1.341}{11.654} \right)^{1} + \left(\frac{0.022}{5.625} \right)^{1} = 0.12 < 1,0 \quad (6.41)$$

Knikstabiliteit **art. 6.3.1.1**

Combinatie: 1 x=0 mm Nx=1.593 kN Vy=-0.001 kN Vz=0.099 kN
Mx=0 kNm My=-0.408 kNm Mz=0.001 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z} \frac{1}{\lambda_1} = \frac{1146}{21.2} \frac{1}{93.9} = 0.574 \quad (6.50)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0,5\ [1 + \alpha\ (\lambda_z - 0,2) + \lambda_z^2] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \quad (6.49)$$

$$N_{b,Rd} = \frac{\chi_z A f_y}{\gamma_{M1}} = \frac{0.8 \times 1397.2 \times 235}{1.00} \times 10^{-3} = 262.9 \text{ kN} \quad (6.47)$$

$$\frac{N_{Ed}}{N_{b,Rd}} = \frac{1.6}{262.9} = 0.01 < 1,0 \quad (6.46)$$

Prismatische, op buiging en druk belaste staven **art. 6.3.3**

Combinatie: 4 x=0 mm Nx=-0.365 kN Vy=-0.159 kN Vz=0.467 kN
Mx=-0.007 kNm My=-1.341 kNm Mz=0.022 kNm

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_y = \frac{L_{cr,y}}{i_y}\frac{1}{\lambda_1} = \frac{1146}{41.6}\frac{1}{93.9} = 0.293 \qquad (6.50)$$

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{y\text{-}y}$ c $\alpha = 0.49$

$$\Phi_y = 0{,}5\,[1 + \alpha\ (\lambda_y - 0{,}2) + \lambda_y^2] = 0{,}5 \times [1 + 0.49 \times (0.293 - 0{,}2) + 0.293^2] = 0.566$$

$$\chi_y = \frac{1}{\Phi_y + \sqrt{\Phi_y^2 - \lambda_y^2}} = \frac{1}{0.566 + \sqrt{0.566^2 - 0.293^2}} = 0.953 \qquad (6.49)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0{,}5\,[1 + \alpha\ (\lambda_z - 0{,}2) + \lambda_z^2] = 0{,}5 \times [1 + 0.49 \times (0.574 - 0{,}2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$$N_{Rk} = f_y\ A = 235 \times 1397 \times 10^{-3} = 328.3 \text{ kN}$$

$$M_{y,Rk} = f_y\ W_{pl,y} = 235 \times 49593 \times 10^{-6} = 11.7 \text{ kNm}$$

$$M_{z,Rk} = f_y\ W_{pl,z} = 235 \times 23935 \times 10^{-6} = 5.6 \text{ kNm}$$

$$\frac{N_{Ed}}{\frac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy}\frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz}\frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.61)$$

$$\frac{0.365}{\frac{0.953 \times 328.342}{1.00}} + 1 \times \frac{1.341}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.16}{\frac{5.625}{1.00}} = 0.14 < 1 \qquad (6.61)$$

$$\frac{N_{Ed}}{\frac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy}\frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz}\frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.62)$$

$$\frac{0.365}{\frac{0.801 \times 328.342}{1.00}} + 1 \times \frac{1.341}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.16}{\frac{5.625}{1.00}} = 0.14 < 1 \qquad (6.62)$$

Doorbuiging

Combinatie: 8 x=551.3 mm Nx=-0.427 kN Vy=-0.132 kN Vz=0.369 kN
Mx=-0.006 kNm My=-0.938 kNm Mz=-0.055 kNm

Lokale knoopverplaatsingen d_{z1} = -0.2 mm d_{z2} = -0.6 mm

$w_{eind,z} = w_z - w_{Zeeg,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|0.3|}{1146 / 250} = \frac{|0.3|}{4.6} = 0.07 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|0.3|}{1146 / 333} = \frac{|0.3|}{3.4} = 0.09 < 1.0$$

3.Invoergegevens windverbanden

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

3.1 KNOPEN

Knoop-	Coördinaten			Opleggingen					
nummer	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
2	0	2500	0	A	A	A			
3	0	5000	0	A	A	A			
8	7330	2500	0	A	A	A			
9	7330	5000	0	A	A	A			
17	700	2500	2154						
18	700	5000	2154						
20	6630	2500	2154						
21	6630	5000	2154						
31	2532	2500	3486						
32	2532	5000	3486						
34	4798	2500	3486						
35	4798	5000	3486						

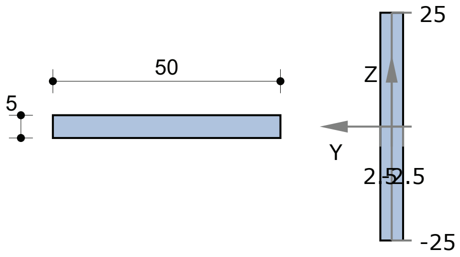
3.2 STAVEN

Staaf-	Knoop		Staafaansluitingen		Profiel	Lengte
nummer	van	naar	begin	begin		[mm]
12	18	2	paa___	aaa___	S50X5	3373
13	3	17	paa___	aaa___	S50X5	3373
14	21	8	paa___	aaa___	S50X5	3373
15	9	20	paa___	aaa___	S50X5	3373
39	31	18	paa___	aaa___	S50X5	3373
40	17	32	paa___	aaa___	S50X5	3373
41	34	21	paa___	aaa___	S50X5	3373
42	20	35	paa___	aaa___	S50X5	3373
55	35	31	paa___	aaa___	S50X5	3374
56	32	34	paa___	aaa___	S50X5	3374

3.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
4	S50X5	2.0	210000	2.5E2	1.952E3	5.2083E4	5.21E2

S50X5



Materiaalgegevens

Staalsoort	S235	(Warmgewalst)	
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	2.5 mm	z_{max}	=	25.0 mm
Minimale coördinaat	y_{min}	=	-2.5 mm	z_{min}	=	-25.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	250.0 mm ^{2}	G	=	2.0 kg/m
Statisch moment	S_y	=	1563 mm ^{3}	S_z	=	156 mm ^{3}
Traagheidsmoment	I_x	=	1952 mm ^{4}			
Traagheidsmoment	I_y	=	52083 mm ^{4}	I_z	=	521 mm ^{4}
Traagheidsstraal	i_y	=	14.4 mm	i_z	=	1.4 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	2083 mm ^{3}	$W_{z;el}$	=	208 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	52083 mm ^{4}	I_{min}	=	521 mm ^{4}
Traagheidsstraal	i_{max}	=	14.4 mm	i_{min}	=	1.4 mm
Halveringslijn	z_h	=	0.0 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	3125 mm ^{3}	$W_{z;pl}$	=	313 mm ^{3}

3.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

3.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

3.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
12	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	18	0	3373
13	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	3	0	3373
14	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	21	0	3373
15	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	9	0	3373
39	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	31	0	3373
40	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	17	0	3373
41	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	34	0	3373
42	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	20	0	3373
55	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	35	0	3374

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
56	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	32	0	3374

3.6 BELASTINGSGEVAL 2 wind tegen as A

3.7 BELASTINGSGEVAL 3 wind tegen as 1

3.8 BELASTINGSGEVAL 4 wind tegen as 3

4.Berekeningsresultaten windverbanden

4.1 UITERSTE GRENSTOESTANDEN (UGT)

4.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

4.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
12	2	18		-1.774	**0.001**	**0.027**	0.000	0.000	0.000
	3	18		**-4.454**	**-0.004**	**0.028**	0.000	0.000	0.000
	4	18		**-0.023**	0.000	0.027	0.000	0.000	0.000
	2		1687	1.774	0.000	0.000	0.000	**0.023**	0.000
	4		1687	0.023	0.000	0.000	0.000	**0.023**	0.000
	2	2		1.728	**-0.001**	**0.028**	0.000	0.000	0.000
	3	2		**4.409**	**0.004**	**0.027**	0.000	0.000	0.000
	4	2		**-0.023**	0.000	0.027	0.000	0.000	0.000
13	2	3		-1.752	**-0.001**	**0.028**	0.000	0.000	0.000
	3	3		**0.023**	0.000	0.027	0.000	0.000	0.000
	4	3		**-4.023**	**0.003**	**0.027**	0.000	0.000	0.000
	2		1687	1.752	0.000	0.000	0.000	**0.023**	0.000
	4		1687	4.023	0.000	0.000	0.000	**0.023**	0.000
	2	17		1.797	**0.001**	**0.027**	0.000	0.000	0.000
	3	17		**0.023**	0.000	0.027	0.000	0.000	0.000
	4	17		**4.068**	**-0.003**	**0.028**	0.000	0.000	0.000
14	3	21		**-4.455**	**0.004**	**0.028**	0.000	0.000	0.000
	4	21		**-0.023**	0.000	**0.027**	0.000	0.000	0.000
	2		1687	0.091	0.000	0.000	0.000	**0.023**	0.000
	4		1687	0.023	0.000	0.000	0.000	**0.023**	0.000
	3	8		**4.409**	**-0.004**	**0.027**	0.000	0.000	0.000
	4	8		**-0.023**	0.000	**0.027**	0.000	0.000	0.000
15	3	9		**0.023**	0.000	**0.027**	0.000	0.000	0.000
	4	9		**-4.023**	**-0.003**	**0.027**	0.000	0.000	0.000
	2		1687	-0.023	0.000	0.000	0.000	**0.023**	0.000
	4		1687	4.023	0.000	0.000	0.000	**0.023**	0.000
	3	20		**0.023**	0.000	**0.027**	0.000	0.000	0.000
	4	20		**4.069**	**0.003**	**0.028**	0.000	0.000	0.000
39	2	31		-0.110	0.000	**0.033**	0.000	0.000	0.000
	3	31		**-0.014**	0.000	0.033	0.000	0.000	0.000
	4	31		**-2.411**	**0.002**	**0.030**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
39	2		1687	0.110	0.000	0.000	0.000	**0.028**	0.000
	3		1687	0.014	0.000	0.000	0.000	**0.028**	0.000
	2	18		0.082	0.000	**0.033**	0.000	0.000	0.000
	3	18		**-0.014**	0.000	0.033	0.000	0.000	0.000
	4	18		**2.383**	**-0.002**	**0.035**	0.000	0.000	0.000
40	1	17		0.009	0.000	**0.033**	0.000	0.000	0.000
	2	17		**0.021**	0.000	0.033	0.000	0.000	0.000
	3	17		**-2.590**	**-0.002**	**0.035**	0.000	0.000	0.000
	1		1687	-0.009	0.000	0.000	0.000	**0.028**	0.000
	2		1687	-0.021	0.000	0.000	0.000	**0.028**	0.000
	1	32		0.019	0.000	**0.033**	0.000	0.000	0.000
	2	32		**0.007**	0.000	0.033	0.000	0.000	0.000
	3	32		**2.618**	**0.002**	**0.030**	0.000	0.000	0.000
41	2	34		-0.237	**0.033**	0.000	0.000	0.000	0.000
	3	34		**-0.014**	0.033	0.000	0.000	0.000	0.000
	4	34		**-2.411**	**0.030**	**0.002**	0.000	0.000	0.000
	3		1687	0.014	0.000	0.000	0.000	0.000	**0.028**
	4		1687	2.411	0.000	0.000	0.000	0.000	**0.028**
	2	21		0.209	**0.033**	0.000	0.000	0.000	0.000
	3	21		**-0.014**	0.033	0.000	0.000	0.000	0.000
	4	21		**2.383**	**0.035**	**-0.002**	0.000	0.000	0.000
42	2	20		-0.237	0.000	**0.033**	0.000	0.000	0.000
	3	20		**-2.590**	**0.002**	**0.035**	0.000	0.000	0.000
	4	20		**0.014**	0.000	0.033	0.000	0.000	0.000
	1		1687	-0.009	0.000	0.000	0.000	**0.028**	0.000
	3		1687	2.590	0.000	0.000	0.000	**0.028**	0.000
	2	35		0.265	0.000	**0.033**	0.000	0.000	0.000
	3	35		**2.618**	**-0.002**	**0.030**	0.000	0.000	0.000
	4	35		**0.014**	0.000	0.033	0.000	0.000	0.000
55	2	35		**0.029**	0.036	0.000	0.000	0.000	0.000
	3	35		-0.474	**0.035**	0.000	0.000	0.000	0.000
	4	35		**-0.902**	**0.037**	0.000	0.000	0.000	0.000
	1		1687	0.624	0.000	0.000	0.000	0.000	**0.030**
	4		1687	0.902	0.000	0.000	0.000	0.000	**0.030**
	2	31		**-0.029**	0.036	0.000	0.000	0.000	0.000
	3	31		0.474	**0.036**	0.000	0.000	0.000	0.000
	4	31		**0.902**	**0.035**	0.000	0.000	0.000	0.000
56	3	32		-0.474	0.000	**0.035**	0.000	0.000	0.000
	4	32		**-0.902**	0.000	**0.037**	0.000	0.000	0.000
	1		1687	0.624	0.000	0.000	0.000	**0.030**	0.000
	4		1687	0.902	0.000	0.000	0.000	**0.030**	0.000
	3	34		0.474	0.000	**0.036**	0.000	0.000	0.000
	4	34		**0.902**	0.000	**0.035**	0.000	0.000	0.000

4.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
12	S50X5	3	1	6.2.3	0.08
13	S50X5	4	1	6.2.3	0.07
14	S50X5	3	1	6.2.3	0.08
15	S50X5	4	1	6.2.3	0.07
39	S50X5	4	1	6.2.3	0.04
40	S50X5	3	1	6.2.3	0.04
41	S50X5	4	1	6.2.3	0.04
42	S50X5	3	1	6.2.3	0.04
55	S50X5	4	1	6.2.3	0.02
56	S50X5	4	1	6.2.3	0.02
Maximale waarden					
14	S50X5	3	1	6.2.3	0.08

4.3 BEREKENING VAN UNITY CHECKS

4.3.1 Staaf 14 - S50X5

Axiale trek **art. 6.2.3**

Combinatie: 3 x=0 mm Nx=4.455 kN Vy=0 kN Vz=0.027 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

$$N_{pl,Rd} = \frac{A\,f_y}{\gamma_{M0}} = \frac{250 \times 235}{1.00} \times 10^{-3} = 58.8 \text{ kN} \qquad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{4.5}{58.8} = 0.08 < 1,0 \qquad (6.5)$$

5.Invoergegevens gordingen

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s^2

5.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
1	0	0	0	A	A	A			
2	0	2500	0	A	A	A			
3	0	5000	0	A	A	A			
4	1832.5	0	0	A	A	A			
5	3665	0	0	A	A	A			
6	5497.5	0	0	A	A	A			
7	7330	0	0	A	A	A			
8	7330	2500	0	A	A	A			
9	7330	5000	0	A	A	A			
10	179	0	1133						
11	179	2500	1133						
12	179	5000	1133						
13	7151	0	1133						
14	7151	2500	1133						
15	7151	5000	1133						
16	700	0	2154						
17	700	2500	2154						
18	700	5000	2154						
19	6630	0	2154						
20	6630	2500	2154						
21	6630	5000	2154						
22	1511	0	2965						
23	1511	2500	2965						
24	1511	5000	2965						
25	5819	0	2965						
26	5819	2500	2965						
27	5819	5000	2965						
28	1832.5	0	3129.1						
29	5497.5	0	3129.1						
30	2532	0	3486						
31	2532	2500	3486						
32	2532	5000	3486						
33	4798	0	3486						
34	4798	2500	3486						
35	4798	5000	3486						
36	3665	0	3665						
37	3665	2500	3665						
38	3665	5000	3665						
39	1832.5	0	1133						
40	3665	0	1133						
41	5497.5	0	1133						
42	1832.5	0	2154						
43	3665	0	2154						
44	5497.5	0	2154						
45	3665	0	3129.1						

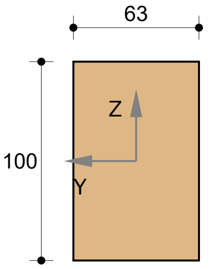
5.2 STAVEN

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
1	1	2	aaa___	aaa___	63 x 100	2500
2	2	3	aaa___	aaa___	63 x 100	2500
4	7	8	aaa___	aaa___	63 x 100	2500
5	8	9	aaa___	aaa___	63 x 100	2500
16	10	11	aaa___	aaa___	63 x 100	2500
17	11	12	aaa___	aaa___	63 x 100	2500
18	13	14	aaa___	aaa___	63 x 100	2500
19	14	15	aaa___	aaa___	63 x 100	2500
29	16	17	aaa___	aaa___	63 x 100	2500
30	17	18	aaa___	aaa___	63 x 100	2500
31	19	20	aaa___	aaa___	63 x 100	2500
32	20	21	aaa___	aaa___	63 x 100	2500
43	22	23	aaa___	aaa___	63 x 100	2500
44	23	24	aaa___	aaa___	63 x 100	2500
45	25	26	aaa___	aaa___	63 x 100	2500
46	26	27	aaa___	aaa___	63 x 100	2500
53	30	31	aaa___	aaa___	63 x 100	2500
54	31	32	aaa___	aaa___	63 x 100	2500
57	33	34	aaa___	aaa___	63 x 100	2500
58	34	35	aaa___	aaa___	63 x 100	2500
65	36	37	aaa___	aaa___	63 x 100	2500
66	37	38	aaa___	aaa___	63 x 100	2500
67	10	39	aaa___	aaa___	63 x 100	1654
68	39	40	aaa___	aaa___	63 x 100	1832
69	40	41	aaa___	aaa___	63 x 100	1832
70	41	13	aaa___	aaa___	63 x 100	1654
71	1	4	aaa___	aaa___	63 x 100	1832
72	4	5	aaa___	aaa___	63 x 100	1832
73	5	6	aaa___	aaa___	63 x 100	1832
74	6	7	aaa___	aaa___	63 x 100	1832
75	16	42	aaa___	aaa___	63 x 100	1133
76	42	43	aaa___	aaa___	63 x 100	1832
77	43	44	aaa___	aaa___	63 x 100	1832
78	44	19	aaa___	aaa___	63 x 100	1133
80	29	45	aaa___	aaa___	63 x 100	1832
81	45	28	aaa___	aaa___	63 x 100	1832

5.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
3	63 x 100	2.4	11000	6.3E3	1.1109E7	5.25E6	2.0837E6

63 x 100



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60 k_h = 1.08
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		26.03	15.18	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	12.01	7.01	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	16.02	9.34	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	18.02	10.51	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean} =	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$ =	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$ =	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$ =	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean} =	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max} =	31.5 mm	z_{max}	=	50.0 mm
Minimale coördinaat	y_{min} =	-31.5 mm	z_{min}	=	-50.0 mm
Zwaartelijn	z_s =	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A =	6300.0 mm ^{2}	G	=	2.4 kg/m
Statisch moment	S_y =	78750 mm ^{3}	S_z	=	49613 mm ^{3}
Traagheidsmoment	I_x =	11109023 mm ^{4}			
Traagheidsmoment	I_y =	5250000 mm ^{4}	I_z	=	2083725 mm ^{4}
Traagheidsstraal	i_y =	28.9 mm	i_z	=	18.2 mm
Elastisch weerstandsmoment	$W_{y;el}$ =	105000 mm ^{3}	$W_{z;el}$	=	66150 mm ^{3}
Centrifugaalmoment	C_{yz} =	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max} =	5250000 mm ^{4}	I_{min}	=	2083725 mm ^{4}
Traagheidsstraal	i_{max} =	28.9 mm	i_{min}	=	18.2 mm

5.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

5.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

5.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	1	0	2500
1	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	1	0	2500
2	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	2	0	2500
2	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	2	0	2500
4	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	7	0	2500
4	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	7	0	2500
5	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	8	0	2500
5	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	8	0	2500
16	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	10	0	2500
16	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	10	0	2500
16	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	10	0	2500
17	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	11	0	2500
17	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	11	0	2500
17	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	11	0	2500
18	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	13	0	2500
18	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	13	0	2500
18	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	13	0	2500
19	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	14	0	2500
19	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	14	0	2500
19	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	14	0	2500
29	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	16	0	2500
29	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	16	0	2500
29	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	16	0	2500
30	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	17	0	2500
30	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	17	0	2500
30	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	17	0	2500
31	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	19	0	2500
31	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	19	0	2500
31	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	19	0	2500
32	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	20	0	2500
32	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	20	0	2500
32	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	20	0	2500
43	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	22	0	2500
43	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	22	0	2500
43	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	22	0	2500
44	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	23	0	2500
44	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	23	0	2500
44	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	23	0	2500
45	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	25	0	2500
45	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	25	0	2500
45	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	25	0	2500
46	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	26	0	2500
46	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	26	0	2500
46	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	26	0	2500
53	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	30	0	2500
53	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	30	0	2500
53	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	30	0	2500
54	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	31	0	2500
54	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	31	0	2500
54	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	31	0	2500
57	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	33	0	2500
57	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	33	0	2500
57	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	33	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
58	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	34	0	2500
58	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	34	0	2500
58	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	34	0	2500
65	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	36	0	2500
65	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	36	0	2500
65	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	36	0	2500
66	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	37	0	2500
66	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	37	0	2500
66	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	37	0	2500
67	G-Z	q	0.000 kN/m	-0.026 kN/m	0.0	0.0	10	0	521
67	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	10	0	1654
67	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	10	0	1654
67	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	10	521	1133
68	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	39	0	1832
68	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	39	0	1832
68	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	39	0	1832
69	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	40	0	1832
69	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	40	0	1832
69	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	40	0	1832
70	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	41	0	1654
70	G-Z	q	-0.026 kN/m	0.000 kN/m	0.0	0.0	41	1133	521
70	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	41	0	1654
70	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	41	0	1133
71	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	1	0	1832
71	G-Z	q	0.000 kN/m	-0.028 kN/m	0.0	0.0	1	0	179
71	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	1	179	1654
72	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	4	0	1832
72	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	4	0	1832
73	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	5	0	1832
73	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	5	0	1832
74	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	6	0	1832
74	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	6	0	1654
74	G-Z	q	-0.028 kN/m	0.000 kN/m	0.0	0.0	6	1654	179
75	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	16	0	1133
75	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	16	0	1133
75	G-Z	q	0.000 kN/m	-0.020 kN/m	0.0	0.0	16	0	811
75	G-Z	q	-0.020 kN/m	-0.024 kN/m	0.0	0.0	16	811	322
76	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	42	0	1832
76	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	42	0	1832
76	G-Z	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	42	0	1832
77	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	43	0	1832
77	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	43	0	1832
77	G-Z	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	43	0	1832
78	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	44	0	1133
78	G-Z	q	-0.024 kN/m	-0.020 kN/m	0.0	0.0	44	0	322
78	G-Z	q	-0.020 kN/m	0.000 kN/m	0.0	0.0	44	322	811
78	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	44	0	1133
80	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	29	0	1832
80	G-Z	q	0.000 kN/m	-0.009 kN/m	0.0	0.0	29	0	699
80	G-Z	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	29	0	1832
80	G-Z	q	-0.009 kN/m	-0.013 kN/m	0.0	0.0	29	699	1133
81	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	45	0	1832
81	G-Z	q	-0.013 kN/m	-0.009 kN/m	0.0	0.0	45	0	1133
81	G-Z	q	-0.009 kN/m	0.000 kN/m	0.0	0.0	45	1133	699
81	G-Z	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	45	0	1832

5.6 BELASTINGSGEVAL 2 wind tegen as A

5.6.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	L-Y	q	-0.030 kN/m	-0.030 kN/m	0.0	0.0	1	0	2500
1	L-Z	q	0.187 kN/m	0.187 kN/m	0.0	0.0	1	0	2500
2	L-Y	q	-0.030 kN/m	-0.030 kN/m	0.0	0.0	2	0	2500
2	L-Z	q	0.187 kN/m	0.187 kN/m	0.0	0.0	2	0	2500
4	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	7	0	2500
4	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	7	0	2500
5	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	8	0	2500
5	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	8	0	2500
16	L-Y	q	-0.030 kN/m	-0.030 kN/m	0.0	0.0	10	0	2500
16	L-Z	q	-0.187 kN/m	-0.187 kN/m	0.0	0.0	10	0	2500
16	L-Y	q	-0.009 kN/m	-0.009 kN/m	0.0	0.0	10	0	2500
16	L-Z	q	0.057 kN/m	0.057 kN/m	0.0	0.0	10	0	2500
17	L-Y	q	-0.030 kN/m	-0.030 kN/m	0.0	0.0	11	0	2500
17	L-Z	q	-0.187 kN/m	-0.187 kN/m	0.0	0.0	11	0	2500
17	L-Y	q	-0.009 kN/m	-0.009 kN/m	0.0	0.0	11	0	2500
17	L-Z	q	0.057 kN/m	0.057 kN/m	0.0	0.0	11	0	2500
18	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	13	0	2500
18	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	13	0	2500
18	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	13	0	2500
18	L-Z	q	0.158 kN/m	0.158 kN/m	0.0	0.0	13	0	2500
19	L-Z	q	0.158 kN/m	0.158 kN/m	0.0	0.0	14	0	2500
19	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	14	0	2500
19	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	14	0	2500
19	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	14	0	2500
29	L-Z	q	0.176 kN/m	0.176 kN/m	0.0	0.0	16	0	2500
29	L-Z	q	0.057 kN/m	0.057 kN/m	0.0	0.0	16	0	2500
29	L-Y	q	0.009 kN/m	0.009 kN/m	0.0	0.0	16	0	2500
29	L-Y	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	16	0	2500
30	L-Z	q	0.057 kN/m	0.057 kN/m	0.0	0.0	17	0	2500
30	L-Y	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	17	0	2500
30	L-Z	q	0.176 kN/m	0.176 kN/m	0.0	0.0	17	0	2500
30	L-Y	q	0.009 kN/m	0.009 kN/m	0.0	0.0	17	0	2500
31	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	19	0	2500
31	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	19	0	2500
31	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	19	0	2500
31	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	19	0	2500
32	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	20	0	2500
32	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	20	0	2500
32	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	20	0	2500
32	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	20	0	2500
43	L-Z	q	0.283 kN/m	0.283 kN/m	0.0	0.0	22	0	2500
43	L-Y	q	-0.045 kN/m	-0.045 kN/m	0.0	0.0	22	0	2500
43	L-Y	q	0.028 kN/m	0.028 kN/m	0.0	0.0	22	0	2500
43	L-Z	q	0.176 kN/m	0.176 kN/m	0.0	0.0	22	0	2500
44	L-Z	q	0.176 kN/m	0.176 kN/m	0.0	0.0	23	0	2500
44	L-Y	q	-0.045 kN/m	-0.045 kN/m	0.0	0.0	23	0	2500
44	L-Z	q	0.283 kN/m	0.283 kN/m	0.0	0.0	23	0	2500
44	L-Y	q	0.028 kN/m	0.028 kN/m	0.0	0.0	23	0	2500
45	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	25	0	2500
45	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	25	0	2500
45	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	25	0	2500
45	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	25	0	2500
46	L-Y	q	0.025 kN/m	0.025 kN/m	0.0	0.0	26	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
46	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	26	0	2500
46	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	26	0	2500
46	L-Z	q	0.159 kN/m	0.159 kN/m	0.0	0.0	26	0	2500
53	L-Z	q	0.283 kN/m	0.283 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	0.045 kN/m	0.045 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	-0.046 kN/m	-0.046 kN/m	0.0	0.0	30	0	2500
53	L-Z	q	0.289 kN/m	0.289 kN/m	0.0	0.0	30	0	2500
54	L-Z	q	0.283 kN/m	0.283 kN/m	0.0	0.0	31	0	2500
54	L-Y	q	-0.046 kN/m	-0.046 kN/m	0.0	0.0	31	0	2500
54	L-Z	q	0.289 kN/m	0.289 kN/m	0.0	0.0	31	0	2500
54	L-Y	q	0.045 kN/m	0.045 kN/m	0.0	0.0	31	0	2500
57	L-Z	q	0.158 kN/m	0.158 kN/m	0.0	0.0	33	0	2500
57	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	33	0	2500
57	L-Z	q	0.204 kN/m	0.204 kN/m	0.0	0.0	33	0	2500
57	L-Y	q	0.032 kN/m	0.032 kN/m	0.0	0.0	33	0	2500
58	L-Z	q	0.158 kN/m	0.158 kN/m	0.0	0.0	34	0	2500
58	L-Y	q	-0.025 kN/m	-0.025 kN/m	0.0	0.0	34	0	2500
58	L-Y	q	0.032 kN/m	0.032 kN/m	0.0	0.0	34	0	2500
58	L-Z	q	0.204 kN/m	0.204 kN/m	0.0	0.0	34	0	2500
65	L-Y	q	-0.032 kN/m	-0.032 kN/m	0.0	0.0	36	0	2500
65	L-Z	q	0.204 kN/m	0.204 kN/m	0.0	0.0	36	0	2500
65	L-Z	q	0.289 kN/m	0.289 kN/m	0.0	0.0	36	0	2500
65	L-Y	q	0.046 kN/m	0.046 kN/m	0.0	0.0	36	0	2500
66	L-Z	q	0.289 kN/m	0.289 kN/m	0.0	0.0	37	0	2500
66	L-Y	q	0.046 kN/m	0.046 kN/m	0.0	0.0	37	0	2500
66	L-Z	q	0.204 kN/m	0.204 kN/m	0.0	0.0	37	0	2500
66	L-Y	q	-0.032 kN/m	-0.032 kN/m	0.0	0.0	37	0	2500

5.7 BELASTINGSGEVAL 3 wind tegen as 1

5.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	1	0	2500
2	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	2	0	2500
4	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	7	0	2500
5	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	8	0	2500
16	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	10	0	2500
16	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	10	0	2500
17	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	11	0	2500
17	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	11	0	2500
18	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	13	0	2500
18	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	13	0	2500
19	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	14	0	2500
19	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	14	0	2500
29	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	16	0	2500
29	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	16	0	2500
30	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	17	0	2500
30	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	17	0	2500
31	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	19	0	2500
31	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	19	0	2500
32	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	20	0	2500
32	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	20	0	2500
43	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	22	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
43	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	22	0	2500
44	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	23	0	2500
44	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	23	0	2500
45	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	25	0	2500
45	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	25	0	2500
46	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	26	0	2500
46	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	26	0	2500
53	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	30	0	2500
53	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	30	0	2500
54	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	31	0	2500
54	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	31	0	2500
57	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	33	0	2500
57	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	33	0	2500
58	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	34	0	2500
58	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	34	0	2500
65	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	36	0	2500
65	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	36	0	2500
66	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	37	0	2500
66	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	37	0	2500
67	G-Y	q	0.000 kN/m	0.235 kN/m	0.0	0.0	10	0	521
67	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	10	521	1133
67	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	10	0	1654
68	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	39	0	1832
68	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	39	0	1832
69	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	40	0	1832
69	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	40	0	1832
70	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	41	0	1654
70	G-Y	q	0.235 kN/m	0.000 kN/m	0.0	0.0	41	1133	521
70	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	41	0	1133
71	G-Y	q	0.000 kN/m	0.261 kN/m	0.0	0.0	1	0	179
71	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	1	179	1654
72	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	4	0	1832
73	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	5	0	1832
74	G-Y	q	0.261 kN/m	0.000 kN/m	0.0	0.0	6	1654	179
74	G-Y	q	0.261 kN/m	0.261 kN/m	0.0	0.0	6	0	1654
75	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	16	0	1133
75	G-Y	q	0.187 kN/m	0.224 kN/m	0.0	0.0	16	811	322
75	G-Y	q	0.000 kN/m	0.187 kN/m	0.0	0.0	16	0	811
76	G-Y	q	0.224 kN/m	0.224 kN/m	0.0	0.0	42	0	1832
76	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	42	0	1832
77	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	43	0	1832
77	G-Y	q	0.224 kN/m	0.224 kN/m	0.0	0.0	43	0	1832
78	G-Y	q	0.235 kN/m	0.235 kN/m	0.0	0.0	44	0	1133
78	G-Y	q	0.224 kN/m	0.187 kN/m	0.0	0.0	44	0	322
78	G-Y	q	0.187 kN/m	0.000 kN/m	0.0	0.0	44	322	811
80	G-Y	q	0.224 kN/m	0.224 kN/m	0.0	0.0	29	0	1832
80	G-Y	q	0.082 kN/m	0.123 kN/m	0.0	0.0	29	699	1133
80	G-Y	q	0.000 kN/m	0.082 kN/m	0.0	0.0	29	0	699
81	G-Y	q	0.224 kN/m	0.224 kN/m	0.0	0.0	45	0	1832
81	G-Y	q	0.082 kN/m	0.000 kN/m	0.0	0.0	45	1133	699
81	G-Y	q	0.123 kN/m	0.082 kN/m	0.0	0.0	45	0	1133

5.8 BELASTINGSGEVAL 4 wind tegen as 3

5.8.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	1	0	2500
1	L-Z	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	1	0	2500
2	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	2	0	2500
2	L-Z	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	2	0	2500
4	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	7	0	2500
4	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	7	0	2500
5	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	8	0	2500
5	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	8	0	2500
16	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	10	0	2500
16	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	10	0	2500
16	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	10	0	2500
16	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	10	0	2500
17	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	11	0	2500
17	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	11	0	2500
17	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	11	0	2500
17	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	11	0	2500
18	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	13	0	2500
18	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	13	0	2500
18	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	13	0	2500
18	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	13	0	2500
19	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	14	0	2500
19	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	14	0	2500
19	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	14	0	2500
19	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	14	0	2500
29	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	16	0	2500
29	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	16	0	2500
29	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	16	0	2500
29	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	16	0	2500
30	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	17	0	2500
30	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	17	0	2500
30	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	17	0	2500
30	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	17	0	2500
31	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	19	0	2500
31	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	19	0	2500
31	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	19	0	2500
31	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	19	0	2500
32	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	20	0	2500
32	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	20	0	2500
32	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	20	0	2500
32	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	20	0	2500
43	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	22	0	2500
43	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	22	0	2500
43	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	22	0	2500
43	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	22	0	2500
44	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	23	0	2500
44	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	23	0	2500
44	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	23	0	2500
44	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	23	0	2500
45	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	25	0	2500
45	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	25	0	2500
45	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	25	0	2500
45	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	25	0	2500
46	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	26	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
46	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	26	0	2500
46	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	26	0	2500
46	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	26	0	2500
53	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	30	0	2500
53	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	30	0	2500
54	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	31	0	2500
54	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	31	0	2500
54	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	31	0	2500
54	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	31	0	2500
57	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	33	0	2500
57	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	33	0	2500
57	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	33	0	2500
57	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	33	0	2500
58	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	34	0	2500
58	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	34	0	2500
58	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	34	0	2500
58	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	34	0	2500
65	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	36	0	2500
65	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	36	0	2500
65	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	36	0	2500
65	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	36	0	2500
66	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	37	0	2500
66	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	37	0	2500
66	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	37	0	2500
66	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	37	0	2500
67	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	10	0	1654
67	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	10	521	1133
67	G-Y	q	0.000 kN/m	-0.235 kN/m	0.0	0.0	10	0	521
68	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	39	0	1832
68	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	39	0	1832
69	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	40	0	1832
69	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	40	0	1832
70	G-Y	q	-0.235 kN/m	0.000 kN/m	0.0	0.0	41	1133	521
70	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	41	0	1133
70	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	41	0	1654
71	G-Y	q	0.000 kN/m	-0.261 kN/m	0.0	0.0	1	0	179
71	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	1	179	1654
72	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	4	0	1832
73	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	5	0	1832
74	G-Y	q	-0.261 kN/m	-0.261 kN/m	0.0	0.0	6	0	1654
74	G-Y	q	-0.261 kN/m	0.000 kN/m	0.0	0.0	6	1654	179
75	G-Y	q	-0.187 kN/m	-0.224 kN/m	0.0	0.0	16	811	322
75	G-Y	q	0.000 kN/m	-0.187 kN/m	0.0	0.0	16	0	811
75	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	16	0	1133
76	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	42	0	1832
76	G-Y	q	-0.224 kN/m	-0.224 kN/m	0.0	0.0	42	0	1832
77	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	43	0	1832
77	G-Y	q	-0.224 kN/m	-0.224 kN/m	0.0	0.0	43	0	1832
78	G-Y	q	-0.224 kN/m	-0.187 kN/m	0.0	0.0	44	0	322
78	G-Y	q	-0.187 kN/m	0.000 kN/m	0.0	0.0	44	322	811
78	G-Y	q	-0.235 kN/m	-0.235 kN/m	0.0	0.0	44	0	1133
80	G-Y	q	-0.224 kN/m	-0.224 kN/m	0.0	0.0	29	0	1832
80	G-Y	q	-0.082 kN/m	-0.123 kN/m	0.0	0.0	29	699	1133
80	G-Y	q	0.000 kN/m	-0.082 kN/m	0.0	0.0	29	0	699

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
81	G-Y	q	-0.082 kN/m	0.000 kN/m	0.0	0.0	45	1133	699
81	G-Y	q	-0.123 kN/m	-0.082 kN/m	0.0	0.0	45	0	1133
81	G-Y	q	-0.224 kN/m	-0.224 kN/m	0.0	0.0	45	0	1832

6.Berekeningsresultaten gordingen

6.1 UITERSTE GRENSTOESTANDEN (UGT)

6.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

6.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
1	2	1		0.000	**0.116**	**-0.280**	0.000	0.000	0.000
	3	1		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	1		0.000	**0.010**	**0.391**	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	**-0.175**	**0.073**
	4		1250	0.000	0.000	0.000	0.000	**0.244**	0.006
	2	2		0.000	**0.116**	**-0.280**	0.000	0.000	0.000
	3	2		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	2		0.000	**0.010**	**0.391**	0.000	0.000	0.000
2	2	2		0.000	**0.116**	**-0.280**	0.000	0.000	0.000
	3	2		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	2		0.000	**0.010**	**0.391**	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	**-0.175**	**0.073**
	4		1250	0.000	0.000	0.000	0.000	**0.244**	0.006
	2	3		0.000	**0.116**	**-0.280**	0.000	0.000	0.000
	3	3		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	3		0.000	**0.010**	**0.391**	0.000	0.000	0.000
4	1	7		0.000	**0.072**	0.000	0.000	0.000	0.000
	2	7		0.000	0.034	**-0.238**	0.000	0.000	0.000
	3	7		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	7		0.000	**0.010**	**-0.391**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.045**
	2		1250	0.000	0.000	0.000	0.000	**-0.149**	0.021
	4		1250	0.000	0.000	0.000	0.000	**-0.244**	0.006
	2	8		0.000	0.034	**-0.238**	0.000	0.000	0.000
	3	8		**-0.009**	**0.072**	0.000	0.000	0.000	0.000
	4	8		0.000	**0.010**	**-0.391**	0.000	0.000	0.000
5	1	8		0.000	**0.072**	0.000	0.000	0.000	0.000
	2	8		0.000	0.034	**-0.238**	0.000	0.000	0.000
	3	8		**-0.009**	0.072	0.000	0.000	0.000	0.000
	4	8		0.000	**0.010**	**-0.391**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.045**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
5	2		1250	0.000	0.000	0.000	0.000	**-0.149**	0.021
	4		1250	0.000	0.000	0.000	0.000	**-0.244**	0.006
	2	9		0.000	0.034	**-0.238**	0.000	0.000	0.000
	3	9		**-0.009**	**0.072**	0.000	0.000	0.000	0.000
	4	9		0.000	**0.010**	**-0.391**	0.000	0.000	0.000
16	2	10		0.011	**-0.048**	**0.230**	0.000	0.000	0.000
	3	10		**0.312**	**-0.106**	0.034	0.000	0.000	0.000
	4	10		**-0.293**	-0.106	**-0.747**	0.000	0.000	0.000
	2		1250	-0.011	0.000	0.000	0.000	0.144	**-0.030**
	4		1250	0.293	0.000	0.000	0.000	**-0.467**	-0.066
	1	11		0.000	**-0.106**	0.034	0.000	0.000	0.000
	2	11		-0.011	**-0.048**	**0.230**	0.000	0.000	0.000
	3	11		**-0.347**	-0.106	0.034	0.000	0.000	0.000
	4	11		**0.293**	-0.106	**-0.747**	0.000	0.000	0.000
17	1	11		0.001	**-0.106**	0.034	0.000	0.000	0.000
	2	11		0.022	**-0.048**	**0.230**	0.000	0.000	0.000
	3	11		**0.191**	-0.106	0.035	0.000	0.000	0.000
	4	11		**-0.114**	-0.106	**-0.747**	0.000	0.000	0.000
	2		1250	-0.022	0.000	0.000	0.000	**0.144**	-0.030
	4		1250	0.114	0.000	0.000	0.000	**-0.467**	-0.066
	2	12		-0.022	**-0.048**	**0.230**	0.000	0.000	0.000
	3	12		**-0.225**	**-0.106**	0.034	0.000	0.000	0.000
	4	12		**0.114**	-0.106	**-0.747**	0.000	0.000	0.000
18	1	13		0.000	0.106	**0.034**	0.000	0.000	0.000
	2	13		0.002	**0.106**	-0.441	0.000	0.000	0.000
	3	13		**0.312**	**0.106**	0.034	0.000	0.000	0.000
	4	13		**-0.293**	0.106	**-0.747**	0.000	0.000	0.000
	4		1250	0.293	0.000	0.000	0.000	**-0.467**	**0.066**
	1	14		0.000	**0.106**	0.034	0.000	0.000	0.000
	3	14		**-0.347**	0.106	**0.034**	0.000	0.000	0.000
	4	14		**0.293**	**0.106**	**-0.747**	0.000	0.000	0.000
19	1	14		0.001	**0.106**	0.034	0.000	0.000	0.000
	3	14		**0.191**	0.106	**0.035**	0.000	0.000	0.000
	4	14		**-0.114**	**0.106**	**-0.747**	0.000	0.000	0.000
	1		1250	-0.001	0.000	0.000	0.000	0.021	**0.066**
	3		1250	-0.191	0.000	0.000	0.000	**0.021**	0.066
	4		1250	0.114	0.000	0.000	0.000	**-0.467**	0.066
	1	15		-0.001	0.106	**0.034**	0.000	0.000	0.000
	2	15		-0.004	**0.106**	-0.441	0.000	0.000	0.000
	3	15		**-0.225**	**0.106**	0.034	0.000	0.000	0.000
	4	15		**0.114**	0.106	**-0.747**	0.000	0.000	0.000
29	1	16		-0.004	-0.090	**0.065**	0.000	0.000	0.000
	2	16		0.003	**-0.062**	-0.283	0.000	0.000	0.000
	3	16		**0.502**	**-0.090**	0.065	0.000	0.000	0.000
	4	16		**-0.550**	-0.090	**-0.717**	0.000	0.000	0.000
	2		1250	-0.003	0.000	0.000	0.000	-0.177	**-0.038**
	3		1250	-0.502	0.000	0.000	0.000	0.041	**-0.056**
	4		1250	0.550	0.000	0.000	0.000	**-0.448**	-0.056
	1	17		0.004	**-0.090**	0.065	0.000	0.000	0.000
	2	17		-0.003	**-0.062**	-0.283	0.000	0.000	0.000
	3	17		**-0.536**	-0.090	**0.065**	0.000	0.000	0.000
	4	17		**0.550**	-0.089	**-0.716**	0.000	0.000	0.000
30	1	17		**-0.002**	-0.090	0.065	0.000	0.000	0.000
	2	17		1.315	**-0.061**	-0.283	0.000	0.000	0.000
	3	17		**2.801**	-0.088	**0.069**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
30	4	17		2.057	**-0.091**	**-0.719**	0.000	0.000	0.000
	2		1250	-1.315	0.000	0.000	0.000	-0.177	**-0.038**
	3		1250	-2.801	0.000	0.000	0.000	**0.041**	-0.056
	4		1250	-2.057	0.000	0.000	0.000	**-0.448**	-0.056
	1	18		**0.002**	-0.090	**0.065**	0.000	0.000	0.000
	2	18		-1.315	**-0.062**	-0.283	0.000	0.000	0.000
	3	18		**-2.836**	**-0.092**	0.062	0.000	0.000	0.000
	4	18		-2.057	-0.088	**-0.713**	0.000	0.000	0.000
31	1	19		-0.004	0.090	**0.065**	0.000	0.000	0.000
	2	19		0.006	**0.090**	-0.410	0.000	0.000	0.000
	3	19		**0.502**	**0.090**	0.065	0.000	0.000	0.000
	4	19		**-0.550**	0.090	**-0.717**	0.000	0.000	0.000
	3		1250	-0.502	0.000	0.000	0.000	0.041	**0.056**
	4		1250	0.550	0.000	0.000	0.000	**-0.448**	0.056
	1	20		0.004	**0.090**	0.065	0.000	0.000	0.000
	3	20		**-0.536**	0.090	**0.065**	0.000	0.000	0.000
	4	20		**0.550**	**0.089**	**-0.716**	0.000	0.000	0.000
32	1	20		**-0.002**	0.090	0.065	0.000	0.000	0.000
	3	20		**2.802**	**0.088**	**0.069**	0.000	0.000	0.000
	4	20		2.057	**0.091**	**-0.719**	0.000	0.000	0.000
	1		1250	0.002	0.000	0.000	0.000	0.041	**0.056**
	3		1250	-2.802	0.000	0.000	0.000	**0.041**	0.056
	4		1250	-2.057	0.000	0.000	0.000	**-0.448**	0.056
	1	21		**0.002**	0.090	**0.065**	0.000	0.000	0.000
	3	21		**-2.836**	**0.092**	0.062	0.000	0.000	0.000
	4	21		-2.057	**0.088**	**-0.713**	0.000	0.000	0.000
43	1	22		0.004	-0.065	**0.090**	0.000	0.000	0.000
	2	22		0.012	**-0.040**	-0.598	0.000	0.000	0.000
	3	22		**0.753**	-0.065	0.090	0.000	0.000	0.000
	4	22		**-0.702**	**-0.066**	**-0.692**	0.000	0.000	0.000
	2		1250	-0.012	0.000	0.000	0.000	-0.374	**-0.025**
	4		1250	0.702	0.000	0.000	0.000	**-0.432**	-0.041
	1	23		-0.004	**-0.065**	0.090	0.000	0.000	0.000
	2	23		-0.012	**-0.040**	-0.598	0.000	0.000	0.000
	3	23		**-0.788**	-0.065	**0.090**	0.000	0.000	0.000
	4	23		**0.702**	-0.065	**-0.692**	0.000	0.000	0.000
44	1	23		0.010	-0.065	**0.090**	0.000	0.000	0.000
	2	23		0.026	**-0.040**	-0.598	0.000	0.000	0.000
	3	23		**0.435**	-0.065	0.090	0.000	0.000	0.000
	4	23		**-0.293**	**-0.065**	**-0.692**	0.000	0.000	0.000
	2		1250	-0.026	0.000	0.000	0.000	-0.374	**-0.025**
	4		1250	0.293	0.000	0.000	0.000	**-0.432**	-0.041
	2	24		-0.026	**-0.040**	-0.598	0.000	0.000	0.000
	3	24		**-0.470**	-0.066	**0.090**	0.000	0.000	0.000
	4	24		**0.293**	**-0.066**	**-0.692**	0.000	0.000	0.000
45	1	25		0.004	**0.065**	**0.090**	0.000	0.000	0.000
	3	25		**0.753**	0.065	0.090	0.000	0.000	0.000
	4	25		**-0.702**	**0.066**	**-0.692**	0.000	0.000	0.000
	1		1250	-0.004	0.000	0.000	0.000	0.056	**0.041**
	4		1250	0.702	0.000	0.000	0.000	**-0.432**	0.041
	2	26		-0.003	**0.065**	-0.386	0.000	0.000	0.000
	3	26		**-0.788**	0.065	**0.090**	0.000	0.000	0.000
	4	26		**0.702**	**0.065**	**-0.692**	0.000	0.000	0.000
46	1	26		0.010	0.065	**0.090**	0.000	0.000	0.000
	2	26		0.007	**0.065**	-0.386	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
46	3	26		**0.435**	**0.065**	0.090	0.000	0.000	0.000
	4	26		**-0.293**	0.065	**-0.692**	0.000	0.000	0.000
	1		1250	-0.010	0.000	0.000	0.000	0.056	**0.041**
	4		1250	0.293	0.000	0.000	0.000	**-0.432**	0.041
	1	27		-0.010	**0.065**	0.090	0.000	0.000	0.000
	3	27		**-0.470**	0.066	**0.090**	0.000	0.000	0.000
	4	27		**0.293**	**0.066**	**-0.692**	0.000	0.000	0.000
53	2	30		-0.023	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	30		**0.955**	-0.034	**0.106**	0.000	0.000	0.000
	4	30		**-0.992**	**-0.035**	-0.675	0.000	0.000	0.000
	1		1250	0.006	0.000	0.000	0.000	**0.066**	-0.021
	2		1250	0.023	0.000	0.000	0.000	-0.470	**-0.021**
	1	31		0.006	**-0.034**	**0.106**	0.000	0.000	0.000
	2	31		0.023	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	31		**-0.989**	-0.034	0.105	0.000	0.000	0.000
	4	31		**0.992**	-0.034	-0.677	0.000	0.000	0.000
54	1	31		0.449	-0.034	**0.106**	0.000	0.000	0.000
	2	31		**0.001**	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	31		**1.744**	-0.033	0.103	0.000	0.000	0.000
	4	31		1.008	**-0.035**	-0.674	0.000	0.000	0.000
	2		1250	-0.001	0.000	0.000	0.000	**-0.470**	**-0.021**
	2	32		**-0.001**	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	32		**-1.778**	**-0.035**	**0.108**	0.000	0.000	0.000
57	2	33		-0.003	**0.024**	-0.438	0.000	0.000	0.000
	3	33		**0.955**	0.034	**0.106**	0.000	0.000	0.000
	4	33		**-0.992**	**0.035**	**-0.675**	0.000	0.000	0.000
	1		1250	0.006	0.000	0.000	0.000	**0.066**	0.021
	2		1250	0.003	0.000	0.000	0.000	-0.274	**0.015**
	4		1250	0.992	0.000	0.000	0.000	**-0.422**	0.021
	1	34		0.006	**0.034**	**0.106**	0.000	0.000	0.000
	2	34		0.003	**0.024**	-0.438	0.000	0.000	0.000
	3	34		**-0.989**	0.034	0.105	0.000	0.000	0.000
	4	34		**0.992**	0.034	**-0.677**	0.000	0.000	0.000
58	1	34		0.449	0.034	**0.106**	0.000	0.000	0.000
	2	34		**0.159**	**0.024**	-0.438	0.000	0.000	0.000
	3	34		**1.744**	0.033	0.103	0.000	0.000	0.000
	4	34		1.008	**0.035**	**-0.674**	0.000	0.000	0.000
	2		1250	-0.159	0.000	0.000	0.000	-0.274	**0.015**
	4		1250	-1.008	0.000	0.000	0.000	**-0.422**	0.021
	2	35		**-0.159**	**0.024**	-0.438	0.000	0.000	0.000
	3	35		**-1.778**	**0.035**	**0.108**	0.000	0.000	0.000
	4	35		-1.008	0.034	**-0.677**	0.000	0.000	0.000
65	2	36		0.003	**-0.020**	-0.628	0.000	0.000	0.000
	3	36		**1.008**	0.000	**0.112**	0.000	0.000	0.000
	4	36		**-0.971**	0.000	**-0.669**	0.000	0.000	0.000
	2		1250	-0.003	0.000	0.000	0.000	-0.393	**-0.013**
	3		1250	-1.008	0.000	0.000	0.000	**0.069**	0.000
	4		1250	0.971	0.000	0.000	0.000	**-0.419**	0.000
	1	37		-0.008	0.000	**0.111**	0.000	0.000	0.000
	2	37		-0.003	**-0.020**	-0.628	0.000	0.000	0.000
	3	37		**-1.043**	0.000	0.111	0.000	0.000	0.000
	4	37		**0.971**	0.000	**-0.672**	0.000	0.000	0.000
66	1	37		0.017	0.000	**0.111**	0.000	0.000	0.000
	2	37		0.006	**-0.020**	-0.628	0.000	0.000	0.000
	3	37		**0.552**	0.000	0.110	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
66	4	37		**-0.432**	0.000	**-0.672**	0.000	0.000	0.000
	2		1250	-0.006	0.000	0.000	0.000	-0.393	**-0.013**
	3		1250	-0.552	0.000	0.000	0.000	**0.069**	0.000
	4		1250	0.432	0.000	0.000	0.000	**-0.419**	0.000
	2	38		-0.006	**-0.020**	-0.628	0.000	0.000	0.000
	3	38		**-0.586**	0.000	**0.112**	0.000	0.000	0.000
	4	38		**0.432**	0.000	**-0.670**	0.000	0.000	0.000
67	1	10		-0.119	**0.064**	0.000	0.000	0.000	0.000
	2	10		**0.129**	**0.064**	0.000	0.000	0.000	0.000
	3	10		-0.119	0.064	**0.426**	0.000	0.000	0.000
	4	10		**-0.403**	0.064	**-0.426**	0.000	0.000	0.000
	2		836	-0.129	0.000	0.000	0.000	0.000	**0.028**
	4		836	0.403	0.000	-0.002	0.000	-0.197	**0.028**
	3		840	0.119	0.000	0.000	0.000	**0.197**	0.028
	4		840	0.403	0.000	0.000	0.000	**-0.197**	0.028
	1	39		0.119	**0.070**	0.000	0.000	0.000	0.000
	2	39		**-0.129**	**0.070**	0.000	0.000	0.000	0.000
	3	39		0.119	0.070	**0.484**	0.000	0.000	0.000
	4	39		**0.403**	0.070	**-0.483**	0.000	0.000	0.000
68	2	39		**0.033**	**0.078**	0.000	0.000	0.000	0.000
	3	39		-0.114	0.078	**0.545**	0.000	0.000	0.000
	4	39		**-0.401**	**0.078**	**-0.545**	0.000	0.000	0.000
	1		916	0.114	0.000	0.000	0.000	0.000	**0.036**
	2		916	-0.033	0.000	0.000	0.000	0.000	**0.036**
	2	40		**-0.033**	**0.078**	0.000	0.000	0.000	0.000
	3	40		0.114	0.078	**0.545**	0.000	0.000	0.000
	4	40		**0.401**	**0.078**	**-0.544**	0.000	0.000	0.000
69	2	40		**-0.042**	**0.078**	0.000	0.000	0.000	0.000
	3	40		-0.114	0.078	**0.545**	0.000	0.000	0.000
	4	40		**-0.401**	**0.078**	**-0.544**	0.000	0.000	0.000
	1		916	0.114	0.000	0.000	0.000	0.000	**0.036**
	2		916	0.042	0.000	0.000	0.000	0.000	**0.036**
	2	41		**0.042**	**0.078**	0.000	0.000	0.000	0.000
	3	41		0.114	0.078	**0.545**	0.000	0.000	0.000
	4	41		**0.401**	**0.078**	**-0.545**	0.000	0.000	0.000
70	1	41		**-0.119**	**0.070**	0.000	0.000	0.000	0.000
	2	41		-0.128	**0.070**	0.000	0.000	0.000	0.000
	3	41		-0.119	0.070	**0.484**	0.000	0.000	0.000
	4	41		**-0.403**	0.070	**-0.483**	0.000	0.000	0.000
	3		814	0.119	0.000	0.000	0.000	**0.197**	0.028
	4		814	0.403	0.000	0.000	0.000	**-0.197**	0.028
	1		818	0.119	0.000	0.000	0.000	0.000	**0.028**
	2		818	0.128	0.000	0.000	0.000	0.000	**0.028**
	1	13		**0.119**	**0.064**	0.000	0.000	0.000	0.000
	2	13		0.128	**0.064**	0.000	0.000	0.000	0.000
	3	13		0.119	0.064	**0.426**	0.000	0.000	0.000
	4	13		**0.403**	0.064	**-0.426**	0.000	0.000	0.000
71	2	1		0.000	**0.050**	0.000	0.000	0.000	0.000
	3	1		0.000	0.050	**0.259**	0.000	0.000	0.000
	4	1		0.000	**0.050**	**-0.259**	0.000	0.000	0.000
	2		918	0.000	0.000	0.000	0.000	0.000	**0.024**
	4		918	0.000	0.000	0.000	0.000	-0.130	**0.024**
	3		919	0.000	0.000	0.000	0.000	**0.130**	0.024
	4		919	0.000	0.000	0.000	0.000	**-0.130**	0.024
	2	4		0.000	**0.052**	0.000	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
71	3	4		0.000	0.052	**0.286**	0.000	0.000	0.000
	4	4		0.000	**0.052**	**-0.286**	0.000	0.000	0.000
72	1	4		0.000	**0.052**	0.000	0.000	0.000	0.000
	3	4		0.000	0.052	**0.287**	0.000	0.000	0.000
	4	4		0.000	0.052	**-0.287**	0.000	0.000	0.000
	1		916	0.000	0.000	0.000	0.000	0.000	**0.024**
	1	5		0.000	**0.052**	0.000	0.000	0.000	0.000
	3	5		0.000	0.052	**0.287**	0.000	0.000	0.000
	4	5		0.000	0.052	**-0.287**	0.000	0.000	0.000
73	1	5		0.000	**0.052**	0.000	0.000	0.000	0.000
	3	5		0.000	0.052	**0.287**	0.000	0.000	0.000
	4	5		0.000	0.052	**-0.287**	0.000	0.000	0.000
	1		916	0.000	0.000	0.000	0.000	0.000	**0.024**
	1	6		0.000	**0.052**	0.000	0.000	0.000	0.000
	3	6		0.000	0.052	**0.287**	0.000	0.000	0.000
	4	6		0.000	0.052	**-0.287**	0.000	0.000	0.000
74	1	6		0.000	**0.052**	0.000	0.000	0.000	0.000
	2	6		0.000	**0.052**	0.000	0.000	0.000	0.000
	3	6		0.000	0.052	**0.286**	0.000	0.000	0.000
	4	6		0.000	0.052	**-0.286**	0.000	0.000	0.000
	3		913	0.000	0.000	0.000	0.000	**0.130**	0.024
	4		913	0.000	0.000	0.000	0.000	**-0.130**	0.024
	1		915	0.000	0.000	0.000	0.000	0.000	**0.024**
	2		915	0.000	0.000	0.000	0.000	0.000	**0.024**
	1	7		0.000	**0.050**	0.000	0.000	0.000	0.000
	2	7		0.000	**0.050**	0.000	0.000	0.000	0.000
	3	7		0.000	0.050	**0.260**	0.000	0.000	0.000
	4	7		0.000	0.050	**-0.260**	0.000	0.000	0.000
75	1	16		**0.012**	0.036	0.000	0.000	0.000	0.000
	2	16		-0.089	**0.036**	0.000	0.000	0.000	0.000
	3	16		0.012	0.036	**0.218**	0.000	0.000	0.000
	4	16		**-0.434**	**0.036**	**-0.219**	0.000	0.000	0.000
	2		586	0.089	0.000	0.000	0.000	0.000	**0.011**
	4		586	0.434	0.000	-0.005	0.000	-0.070	**0.011**
	3		598	-0.012	-0.001	0.000	0.000	**0.070**	0.011
	4		598	0.434	-0.001	0.000	0.000	**-0.070**	0.011
	1	42		**-0.012**	0.042	0.000	0.000	0.000	0.000
	2	42		0.089	**0.042**	0.000	0.000	0.000	0.000
	3	42		-0.012	0.042	**0.271**	0.000	0.000	0.000
	4	42		**0.434**	**0.042**	**-0.270**	0.000	0.000	0.000
76	1	42		**0.006**	**0.074**	0.000	0.000	0.000	0.000
	3	42		0.006	0.074	**0.505**	0.000	0.000	0.000
	4	42		**-0.433**	**0.074**	**-0.505**	0.000	0.000	0.000
	1		916	-0.006	0.000	0.000	0.000	0.000	**0.034**
	2		916	0.104	0.000	0.000	0.000	0.000	**0.034**
	1	43		**-0.006**	**0.074**	0.000	0.000	0.000	0.000
	3	43		-0.006	0.074	**0.505**	0.000	0.000	0.000
	4	43		**0.433**	**0.074**	**-0.504**	0.000	0.000	0.000
77	1	43		**0.006**	**0.074**	0.000	0.000	0.000	0.000
	3	43		0.006	0.074	**0.505**	0.000	0.000	0.000
	4	43		**-0.433**	**0.074**	**-0.504**	0.000	0.000	0.000
	1		916	-0.006	0.000	0.000	0.000	0.000	**0.034**
	2		916	0.193	0.000	0.000	0.000	0.000	**0.034**
	3		916	-0.006	0.000	0.000	0.000	**0.231**	0.034
	4		916	0.433	0.000	0.000	0.000	**-0.231**	0.034

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
77	1	44		**-0.006**	**0.074**	0.000	0.000	0.000	0.000
	3	44		-0.006	0.074	**0.505**	0.000	0.000	0.000
	4	44		**0.433**	**0.074**	**-0.505**	0.000	0.000	0.000
78	1	44		**0.012**	0.042	0.000	0.000	0.000	0.000
	2	44		-0.220	**0.042**	0.000	0.000	0.000	0.000
	3	44		0.012	**0.042**	**0.271**	0.000	0.000	0.000
	4	44		**-0.434**	0.042	**-0.270**	0.000	0.000	0.000
	3		534	-0.012	0.001	0.000	0.000	**0.070**	0.011
	4		534	0.434	0.001	0.000	0.000	**-0.070**	0.011
	1		546	-0.012	0.000	0.000	0.000	0.000	**0.011**
	2		546	0.220	0.000	0.000	0.000	0.000	**0.011**
	1	19		**-0.012**	0.036	0.000	0.000	0.000	0.000
	2	19		0.220	**0.036**	0.000	0.000	0.000	0.000
	3	19		-0.012	**0.036**	**0.218**	0.000	0.000	0.000
	4	19		**0.434**	0.036	**-0.219**	0.000	0.000	0.000
80	2	29		**0.062**	**0.055**	0.000	0.000	0.000	0.000
	3	29		-0.058	0.055	**-0.313**	0.000	0.000	0.000
	4	29		**-0.190**	**0.055**	**0.313**	0.000	0.000	0.000
	1		931	0.058	0.000	0.000	0.000	0.000	**0.026**
	2		931	-0.062	0.000	0.000	0.000	0.000	**0.026**
	3		940	0.058	-0.001	0.000	0.000	**-0.156**	0.026
	4		940	0.190	-0.001	0.000	0.000	**0.156**	0.026
	2	45		**-0.062**	**0.059**	0.000	0.000	0.000	0.000
	3	45		0.058	0.059	**-0.355**	0.000	0.000	0.000
	4	45		**0.190**	**0.059**	**0.354**	0.000	0.000	0.000
81	1	45		**-0.058**	**0.059**	0.000	0.000	0.000	0.000
	3	45		-0.058	0.059	**-0.355**	0.000	0.000	0.000
	4	45		**-0.190**	**0.059**	**0.354**	0.000	0.000	0.000
	3		892	0.058	0.001	0.000	0.000	**-0.156**	0.026
	4		892	0.190	0.001	0.000	0.000	**0.156**	0.026
	2		902	0.122	0.000	0.000	0.000	0.000	**0.026**
	4		902	0.190	0.000	-0.004	0.000	0.156	**0.026**
	1	28		**0.058**	**0.055**	0.000	0.000	0.000	0.000
	3	28		0.058	0.055	**-0.313**	0.000	0.000	0.000
	4	28		**0.190**	**0.055**	**0.313**	0.000	0.000	0.000

6.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
1	63 x 100	3	6.1.2	0.00
		4	6.1.6	0.14
		4	6.1.7	0.03
		3	6.2.3	0.03
		4	6.3.3	0.14
2	63 x 100	3	6.1.2	0.00
		4	6.1.6	0.14

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
2	63 x 100	4	6.1.7	0.03
		3	6.2.3	0.03
		4	6.3.3	0.14
4	63 x 100	3	6.1.2	0.00
		4	6.1.6	0.14
		4	6.1.7	0.03
		3	6.2.3	0.03
		4	6.3.3	0.14
5	63 x 100	3	6.1.2	0.00
		4	6.1.6	0.14
		4	6.1.7	0.03
		3	6.2.3	0.03
		4	6.3.3	0.14
16	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.31
		2	6.2.4	0.10
		2	6.3.2	0.10
		4	6.3.3	0.27
17	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.30
		2	6.2.4	0.10
		2	6.3.2	0.10
		4	6.3.3	0.27
18	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.31
		2	6.2.4	0.19
		2	6.3.2	0.19
		4	6.3.3	0.27
19	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.30
		2	6.2.4	0.19
		2	6.3.2	0.19
		4	6.3.3	0.27
29	63 x 100	4	6.1.2	0.01
		3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.30
		2	6.2.4	0.12
		2	6.3.2	0.12
		4	6.3.3	0.26
30	63 x 100	1	6.1.2	0.00
		3	6.1.4	0.03
		4	6.1.7	0.06
		1	6.2.3	0.09
		4	6.2.4	0.29
		4	6.3.2	0.36
		1	6.3.3	0.20
31	63 x 100	4	6.1.2	0.01

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
31	63 x 100	3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.30
		2	6.2.4	0.18
		2	6.3.2	0.18
		4	6.3.3	0.26
32	63 x 100	1	6.1.2	0.00
		3	6.1.4	0.03
		4	6.1.7	0.06
		1	6.2.3	0.09
		4	6.2.4	0.29
		4	6.3.2	0.36
		1	6.3.3	0.20
43	63 x 100	4	6.1.2	0.01
		3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.28
		2	6.2.4	0.23
		2	6.3.2	0.23
		4	6.3.3	0.25
44	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.27
		2	6.2.4	0.23
		2	6.3.2	0.23
		4	6.3.3	0.25
45	63 x 100	4	6.1.2	0.01
		3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.28
		2	6.2.4	0.16
		2	6.3.2	0.16
		4	6.3.3	0.25
46	63 x 100	4	6.1.2	0.00
		3	6.1.4	0.00
		4	6.1.7	0.06
		4	6.2.3	0.27
		2	6.2.4	0.16
		2	6.3.2	0.16
		4	6.3.3	0.25
53	63 x 100	4	6.1.2	0.02
		3	6.1.4	0.01
		2	6.1.7	0.06
		2	6.2.3	0.28
		3	6.2.4	0.05
		3	6.3.2	0.10
		2	6.3.3	0.27
54	63 x 100	3	6.1.4	0.02
		2	6.1.7	0.06
		2	6.2.4	0.28
		4	6.3.2	0.28
		2	6.3.3	0.14
57	63 x 100	4	6.1.2	0.02
		3	6.1.4	0.01
		4	6.1.7	0.06

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
57	63 x 100	4	6.2.3	0.27
		3	6.2.4	0.05
		3	6.3.2	0.10
		4	6.3.3	0.24
58	63 x 100	3	6.1.4	0.02
		4	6.1.7	0.06
		4	6.2.4	0.25
		4	6.3.2	0.28
		4	6.3.3	0.12
65	63 x 100	4	6.1.2	0.02
		3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.26
		2	6.2.4	0.23
		2	6.3.2	0.23
		4	6.3.3	0.24
66	63 x 100	4	6.1.2	0.01
		3	6.1.4	0.01
		4	6.1.7	0.06
		4	6.2.3	0.25
		2	6.2.4	0.23
		2	6.3.2	0.23
		4	6.3.3	0.24
67	63 x 100	4	6.1.2	0.01
		2	6.1.4	0.00
		3	6.1.7	0.04
		4	6.2.3	0.13
		2	6.2.4	0.02
		2	6.3.2	0.03
		7		0.16
68	63 x 100	4	6.1.2	0.01
		2	6.1.4	0.00
		3	6.1.7	0.05
		4	6.2.3	0.17
		2	6.2.4	0.03
		2	6.3.2	0.03
		4	6.3.3	0.14
		7		0.23
69	63 x 100	4	6.1.2	0.01
		4	6.1.7	0.05
		4	6.2.3	0.17
		3	6.3.3	0.14
		7		0.23
70	63 x 100	4	6.1.2	0.01
		3	6.1.7	0.04
		4	6.2.3	0.13
		7		0.16
71	63 x 100	3	6.1.6	0.09
		4	6.1.7	0.02
		3	6.3.3	0.07
		7		0.12
72	63 x 100	4	6.1.6	0.09
		4	6.1.7	0.02
		3	6.3.3	0.08
		7		0.12
73	63 x 100	3	6.1.6	0.09

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
73	63 x 100	3 1 7	6.1.7 6.3.3	0.02 0.11 0.12
74	63 x 100	3 4 3 7	6.1.6 6.1.7 6.3.3	0.09 0.02 0.07 0.12
75	63 x 100	4 1 3 4 3 3 8	6.1.2 6.1.4 6.1.7 6.2.3 6.2.4 6.3.2	0.01 0.00 0.02 0.05 0.05 0.05 0.04
76	63 x 100	4 1 4 4 3 3 3 8	6.1.2 6.1.4 6.1.7 6.2.3 6.2.4 6.3.2 6.3.3	0.01 0.00 0.04 0.16 0.15 0.15 0.13 0.21
77	63 x 100	4 1 4 4 3 3 4 8	6.1.2 6.1.4 6.1.7 6.2.3 6.2.4 6.3.2 6.3.3	0.01 0.00 0.04 0.16 0.15 0.15 0.13 0.21
78	63 x 100	4 1 3 4 3 3 8	6.1.2 6.1.4 6.1.7 6.2.3 6.2.4 6.3.2	0.01 0.00 0.02 0.05 0.05 0.05 0.04
80	63 x 100	4 2 3 4 2 2 4 8	6.1.2 6.1.4 6.1.7 6.2.3 6.2.4 6.3.2 6.3.3	0.00 0.00 0.03 0.11 0.02 0.02 0.09 0.14
81	63 x 100	4 3 4 4 8	6.1.2 6.1.7 6.2.3 6.3.3	0.00 0.03 0.11 0.09 0.14
Maximale waarden				
32	63 x 100	4	6.3.2	0.36

6.3 BEREKENING VAN UNITY CHECKS

6.3.1 Staaf 32 - 63 x 100 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting **art. 6.1.2**

Combinatie: 1 x=0 mm Nx=0.002 kN Vy=0.09 kN Vz=0.065 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{1.6}{6300} = 0 \text{ N/mm}^2 < f_{t,0,d} = 6.5 \text{ N/mm}^2 \quad (6.1)$$

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 3 x=0 mm Nx=-2.802 kN Vy=0.09 kN Vz=0.065 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{2801.6}{6300} = 0.4 \text{ N/mm}^2 < f_{c,0,d} = 14.5 \text{ N/mm}^2 \quad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 4 x=2500 mm Nx=-2.057 kN Vy=-0.09 kN Vz=0.716 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{716.1 \times 78750}{63 \times 5250000} = 0.2 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \quad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 1 x=1250 mm Nx=0.002 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.041 kNm Mz=0.056 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{2}{6300} = 0 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.041 \times 10^6}{105 \times 10^3} = 0.4 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.056 \times 10^6}{66 \times 10^3} = 0.8 \text{ N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{6.5} + \frac{0.4}{11.1} + 0.7 \times \frac{0.8}{13.2} = 0.08 < 1.00 \quad (6.17)$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{6.5} + 0.7 \times \frac{0.4}{11.1} + \frac{0.8}{13.2} = 0.09 < 1.00 \quad (6.18)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 4 x=1250 mm Nx=-2.057 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-0.448 kNm Mz=0.056 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{2057}{6300} = 0.3 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.448 \times 10^6}{105 \times 10^3} = 4.3 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.056 \times 10^6}{66 \times 10^3} = 0.8 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.3}{14.5}\right)^2 + \frac{4.3}{16.6} + 0.7 \times \frac{0.8}{19.8} = 0.29 < 1.00 \qquad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.3}{14.5}\right)^2 + 0.7 \times \frac{4.3}{16.6} + \frac{0.8}{19.8} = 0.22 < 1.00 \qquad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 4 x=1250 mm Nx=-2.057 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-0.448 kNm Mz=0.056 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{2500}{28.9} = 86.60 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{86.60}{\pi}\sqrt{\frac{21.0}{7400}} = 1.469 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}{}^2 = 0{,}5 \times (1 + 0.2 \times (1.469 - 0{,}3) + 1.469^2 = 1.70 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y{}^2 - \lambda_{rel,y}{}^2}} = \frac{1}{1.70 + \sqrt{1.70^2 - 1.47^2}} = 0.39 \qquad (6.25)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}{}^2 = 0{,}5 \times (1 + 0.2 \times (2.331 - 0{,}3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z{}^2 - \lambda_{rel,z}{}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{2057}{6300} = 0.3 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.448 \times 10^6}{105 \times 10^3} = 4.3 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.056 \times 10^6}{66 \times 10^3} = 0.8 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\ f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.3}{0.39 \times 14.5} + \frac{4.3}{16.6} + 0.7 \times \frac{0.8}{19.8} = 0.34 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\ f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.3}{0.17 \times 14.5} + 0.7 \times \frac{4.3}{16.6} + \frac{0.8}{19.8} = 0.36 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 1 x=1250 mm Nx=0.002 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.041 kNm Mz=0.056 kNm

Belastingsduurklasse : Blijvend

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 2500 = 2250$ mm

$$\sigma_{m,crit} = \frac{0,78\ b^2}{h\ l_{ef}} E_{0,05} = \frac{0,78 \times 63^2}{100 \times 2250} \times 7400 = 101.8 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{101.8}} = 0.486 < 0.75 \qquad \rightarrow k_{crit} = 1,00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.041 \times 10^6}{105 \times 10^3} = 0.4 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{2057}{6300} = 0.3 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.331 - 0,3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{0.4}{1.00 \times 11.1}\right)^2 + \frac{0.3}{0.17 \times 9.7} = 0.20 < 1.00 \qquad (6.35)$$

7.Invoergegevens wandstijlen

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

7.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
4	1832.5	0	0	A	A	A			
5	3665	0	0	A	A	A			
6	5497.5	0	0	A	A	A			
28	1832.5	0	3129.1						
29	5497.5	0	3129.1						
36	3665	0	3665						
39	1832.5	0	1133						
40	3665	0	1133						
41	5497.5	0	1133						
42	1832.5	0	2154						
43	3665	0	2154						
44	5497.5	0	2154						
45	3665	0	3129.1						

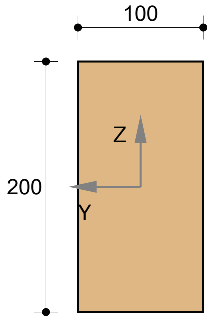
7.2 STAVEN

Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
20	4	28	aaa___	aaa___	100 x 200	3129
21	6	29	aaa___	aaa___	100 x 200	3129
28	5	36	aaa___	aaa___	100 x 200	3665

7.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
5	100 x 200	8.4	11000	2E4	3.7867E8	6.6667E7	1.6667E7

100 x 200



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60
Elasticiteitsmodulus	E = 11000 N/mm^2

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		24.00	14.00	0.40	21.00	2.50	4.00 N/mm^2
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.08	6.46	0.15	9.69	1.15	1.85 N/mm^2
Middellang	0.80(0.65)	14.77	8.62	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	16.62	9.69	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m^3	ρ_k	=	350 kg/m^3
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm^2	$E_{90,mean}$	=	370 N/mm^2
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm^2	$E_{90,fin}$	=	231 N/mm^2
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm^2	$E_{0,d}$	=	8462 N/mm^2
Afschuifmodulus	G_{mean}	=	690 N/mm^2	$G_{0,05}$	=	460 N/mm^2

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	50.0 mm	z_{max}	=	100.0 mm
Minimale coördinaat	y_{min}	=	-50.0 mm	z_{min}	=	-100.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	20000.0 mm^2	G	=	8.4 kg/m
Statisch moment	S_y	=	500000 mm^3	S_z	=	250000 mm^3
Traagheidsmoment	I_x	=	378666667 mm^4			
Traagheidsmoment	I_y	=	66666667 mm^4	I_z	=	16666667 mm^4
Traagheidsstraal	i_y	=	57.7 mm	i_z	=	28.9 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	666667 mm^3	$W_{z;el}$	=	333333 mm^3
Centrifugaalmoment	C_{yz}	=	0 mm^3	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	66666667 mm^4	I_{min}	=	16666667 mm^4
Traagheidsstraal	i_{max}	=	57.7 mm	i_{min}	=	28.9 mm

7.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

7.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

7.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
20	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	4	0	3129
21	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	6	0	3129
28	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	5	0	3665

7.6 BELASTINGSGEVAL 2 wind tegen as A

7.7 BELASTINGSGEVAL 3 wind tegen as 1

7.8 BELASTINGSGEVAL 4 wind tegen as 3

8.Berekeningsresultaten wandstijlen

8.1 UITERSTE GRENSTOESTANDEN (UGT)

8.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

8.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
20	3	4		**0.867**	0.002	-0.897	0.000	0.000	0.000
	1	39		-0.866	0.002	0.000	0.000	0.000	**0.002**
	2	39		-0.242	**-0.066**	0.000	0.000	0.000	-0.074
	2	39		0.008	0.030	0.000	0.000	0.000	**-0.074**
	3	39		**-0.867**	0.002	-0.899	0.000	-1.018	0.002
	3	39		-0.616	-0.004	0.131	0.000	**-1.018**	0.002
	4	39		-0.057	0.000	-0.131	0.000	**1.018**	0.002
	2	42		0.216	**0.045**	0.000	0.000	0.000	-0.044
	3	42		-0.408	0.002	**0.907**	0.000	-0.885	-0.002
	4	42		0.151	-0.002	**-0.907**	0.000	0.884	0.002
	2	28		**0.305**	-0.045	0.000	0.000	0.000	0.000
	3	28		-0.320	-0.002	**-0.907**	0.000	0.000	0.000
21	3	6		**0.866**	-0.002	-0.897	0.000	0.000	0.000
	2	41		-0.242	**-0.063**	0.000	0.000	0.000	-0.071
	2	41		0.008	0.023	0.000	0.000	0.000	**-0.071**
	3	41		**-0.866**	-0.002	-0.899	0.000	-1.018	-0.002
	3	41		-0.616	0.004	0.131	0.000	**-1.018**	-0.002
	4	41		-0.057	0.000	-0.131	0.000	**1.018**	-0.002
	1	44		-0.408	-0.002	0.000	0.000	0.000	**0.002**
	2	44		0.216	**0.050**	0.000	0.000	0.000	-0.048
	3	44		-0.408	-0.002	**0.907**	0.000	-0.885	0.002
	4	44		0.151	0.002	**-0.907**	0.000	0.884	-0.002
	2	29		**0.304**	-0.050	0.000	0.000	0.000	0.000
	3	29		-0.320	0.002	**-0.907**	0.000	0.000	0.000
28	3	5		**1.018**	0.000	-1.271	0.000	0.000	0.000
	2	40		-0.119	0.014	0.000	0.000	0.000	**-0.070**
	3	40		**-1.018**	0.000	-1.275	0.000	-1.444	0.000
	2	43		0.121	**0.103**	0.000	0.000	0.000	-0.056
	3	43		-0.759	0.000	-0.183	0.000	**-1.631**	0.000
	4	43		-0.224	0.000	0.183	0.000	**1.628**	0.000
	2	45		0.121	**0.103**	0.000	0.000	0.000	0.044

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
28	2	45		0.328	**-0.082**	0.000	0.000	0.000	**0.044**
	3	45		-0.312	0.000	**1.537**	0.000	-0.824	0.000
	4	45		0.223	0.000	**-1.535**	0.000	0.823	0.000
	2	36		**0.376**	0.082	0.000	0.000	0.000	0.000
	3	36		-0.264	0.000	**-1.537**	0.000	0.000	0.000

8.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
20	100 x 200	2	6.1.2	0.00
		1	6.1.4	0.00
		3	6.1.7	0.02
		2	6.2.3	0.01
		3	6.2.4	0.09
		3	6.3.2	0.10
		3	6.3.3	0.02
		7		0.12
21	100 x 200	2	6.1.2	0.00
		1	6.1.4	0.00
		3	6.1.7	0.02
		2	6.2.3	0.01
		3	6.2.4	0.09
		3	6.3.2	0.10
		3	6.3.3	0.02
		7		0.12
28	100 x 200	2	6.1.2	0.00
		1	6.1.4	0.01
		3	6.1.7	0.04
		4	6.2.3	0.11
		3	6.2.4	0.15
		3	6.3.2	0.15
		3	6.3.3	0.04
		7		0.23
Maximale waarden				
28	100 x 200	7		0.23

8.3 BEREKENING VAN UNITY CHECKS

8.3.1 Staaf 28 - 100 x 200 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting art. 6.1.2

Combinatie: 2 x=3665 mm Nx=0.328 kN Vy=-0.082 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{327.8}{20000} = 0 \text{ N/mm}^2 < f_{t,0,d} = 9.7 \text{ N/mm}^2 \quad (6.1)$$

Druk evenwijdig aan de vezelrichting art. 6.1.4

Combinatie: 1 x=0 mm Nx=-1.017 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1017.3}{20000} = 0.1 \text{ N/mm}^2 < f_{c,0,d} = 9.7 \text{ N/mm}^2 \quad (6.2)$$

Afschuiving art. 6.1.7

Combinatie: 3 x=3631.5 mm Nx=-0.312 kN Vy=0 kN Vz=1.537 kN
Mx=0 kNm My=-0.051 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{1537.3 \times 500000}{100 \times 66666667} = 0.1 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \quad (6.13)$$

Gecombineerde buig- en axiale trekspanningen art. 6.2.3

Combinatie: 4 x=2641.6 mm Nx=0.017 kN Vy=0 kN Vz=-0.826 kN
Mx=0 kNm My=1.225 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{17}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.225 \times 10^6}{667 \times 10^3} = 1.8 \text{ N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} = \frac{0.0}{9.7} + \frac{1.8}{16.6} = 0.11 < 1.00 \quad (6.17)$$

Gecombineerde buig- en axiale drukspanningen art. 6.2.4

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{759}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{t,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} = \left(\frac{0.0}{14.5}\right)^2 + \frac{2.4}{16.6} = 0.15 < 1.00 \quad (6.19)$$

Kolommen onderworpen aan druk of aan druk en buiging art. 6.3.2

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{3665}{57.7} = 63.48 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{63.48}{\pi}\sqrt{\frac{21.0}{7400}} = 1.076 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_y = 0,5(1 + \beta_c(\lambda_{rel,y} - 0,3) + \lambda_{rel,y}^2 = 0,5 \times (1 + 0.2 \times (1.076 - 0,3) + 1.076^2 = 1.16 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.16 + \sqrt{1.16^2 - 1.08^2}} = 0.63 \qquad (6.25)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.153 - 0,3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{759}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.63 \times 14.5} + \frac{2.4}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.15 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\, f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.20 \times 14.5} + 0.7 \times \frac{2.4}{16.6} + \frac{0.0}{18.0} = 0.12 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 3665 = 3299$ mm

$$\sigma_{m,crit} = \frac{0,78\, b^2}{h\, l_{ef}} E_{0,05} = \frac{0,78 \times 100^2}{200 \times 3299} \times 7400 = 87.5 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{87.5}} = 0.524 < 0.75 \qquad \rightarrow k_{crit} = 1,00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1018}{20000} = 0.1 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.153 - 0,3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{2.4}{1.00 \times 16.6}\right)^2 + \frac{0.1}{0.20 \times 14.5} = 0.04 < 1.00 \qquad (6.35)$$

Combinatie: 7 x=1832.5 mm   Nx=-0.69 kN Vy=0 kN Vz=-0.153 kN
Mx=0 kNm My=-1.31 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Lokale knoopverplaatsingen d_{z1} = 0 mm d_{z2} = 0 mm

$w_{eind,z} = w_z + k_{def}\ w_{BGT\ Quasi\text{-}blijvend,z} = 2.5 + 0.6 \times 0 = 2.5$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|2.5|}{3665 / 250} = \frac{|2.5|}{14.7} = 0.17 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = 2.5 - 0 = 2.5$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|2.5|}{3665 / 333} = \frac{|2.5|}{11} = 0.23 < 1.0$$

9.Invoergegevens selectie

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

9.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
3	0	5000	0	A	A	A			
5	3665	0	0	A	A	A			
8	7330	2500	0	A	A	A			
9	7330	5000	0	A	A	A			
12	179	5000	1133						
15	7151	5000	1133						
18	700	5000	2154						
21	6630	5000	2154						
24	1511	5000	2965						
27	5819	5000	2965						
30	2532	0	3486						
31	2532	2500	3486						
32	2532	5000	3486						
35	4798	5000	3486						
36	3665	0	3665						
38	3665	5000	3665						
40	3665	0	1133						
43	3665	0	2154						
45	3665	0	3129.1						

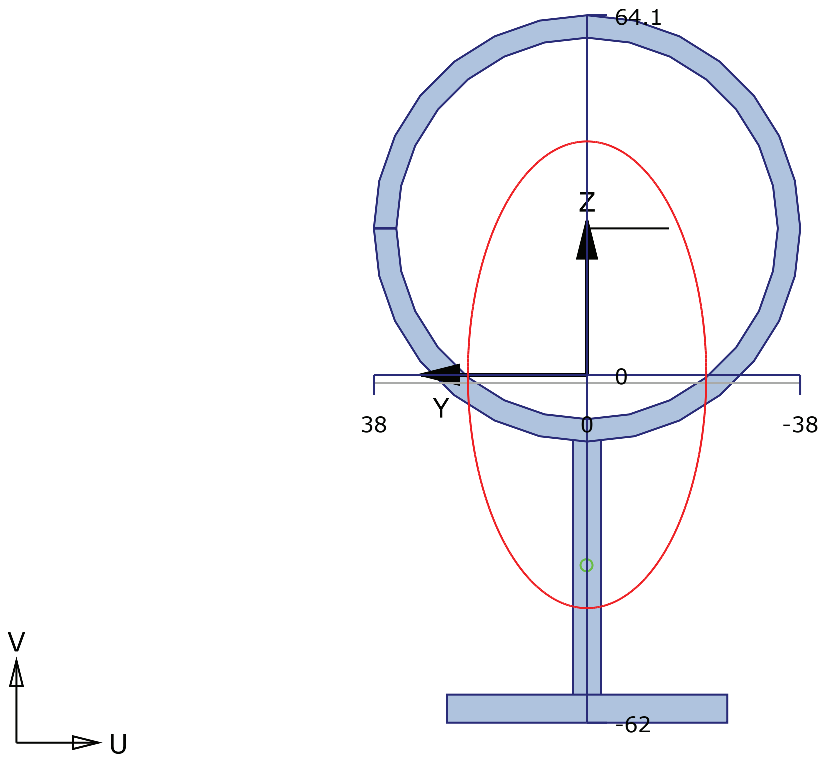
9.2 STAVEN

Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
8	3	12	aaaaaa	aaaaaa	buigprofiel	1147
11	15	9	aaaaaa	aaaaaa	buigprofiel	1147
14	21	8	paa___	aaa___	S50X5	3373
24	12	18	aaaaaa	aaaaaa	buigprofiel	1146
27	21	15	aaaaaa	aaaaaa	buigprofiel	1146
28	5	36	aaa___	aaa___	100 x 200	3665
35	18	24	aaaaaa	aaaaaa	buigprofiel	1147
38	27	21	aaaaaa	aaaaaa	buigprofiel	1147
49	24	32	aaaaaa	aaaaaa	buigprofiel	1146
52	35	27	aaaaaa	aaaaaa	buigprofiel	1146
53	30	31	aaa___	aaa___	63 x 100	2500
61	32	38	aaaaaa	aaaaaa	buigprofiel	1147
64	38	35	aaaaaa	aaaaaa	buigprofiel	1147

9.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
2	buigprofiel	11.0	210000	1.397E3	1.1801E6	2.4179E6	6.3091E5
3	63 x 100	2.4	11000	6.3E3	1.1109E7	5.25E6	2.0837E6
4	S50X5	2.0	210000	2.5E2	1.952E3	5.2083E4	5.21E2
5	100 x 200	8.4	11000	2E4	3.7867E8	6.6667E7	1.6667E7

buigprofiel



Invoergegevens

1:S50X5

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-60.2 mm
Hoek		hoek	=	-90.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

2:S50X5(COPY)

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-85.6 mm
Hoek		hoek	=	-180.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

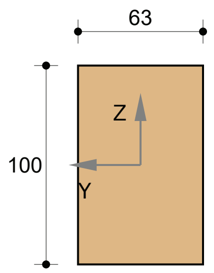
3:HFCHS761X4

Staalsoort	S235					
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}			
Coördinaten (u,v)	u	=	0.0 mm	v	=	0.0 mm
Hoek	hoek	=	-180.0 graden			
Hoogte	h	=	76.0 mm			
Flensdikte	tf	=	4.0 mm			

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	38.0 mm	z_{max}	=	62.0 mm
Minimale coördinaat	y_{min}	=	-38.0 mm	z_{min}	=	-64.1 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	1397.2 mm ^{2}	G	=	11.0 kg/m
Statisch moment	S_y	=	24809 mm ^{3}	S_z	=	11967 mm ^{3}
Traagheidsmoment	I_x	=	1180116 mm ^{4}			
Traagheidsmoment	I_y	=	2417861 mm ^{4}	I_z	=	630910 mm ^{4}
Traagheidsstraal	i_y	=	41.6 mm	i_z	=	21.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	37727 mm ^{3}	$W_{z;el}$	=	16603 mm ^{3}
Centrifugaalmoment	C_{yz}	=	2 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	2417861 mm ^{4}	I_{min}	=	630910 mm ^{4}
Traagheidsstraal	i_{max}	=	41.6 mm	i_{min}	=	21.2 mm
Halveringslijn	z_h	=	1.5 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	49593 mm ^{3}	$W_{z;pl}$	=	23935 mm ^{3}

63 x 100



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60 k_h = 1.08
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

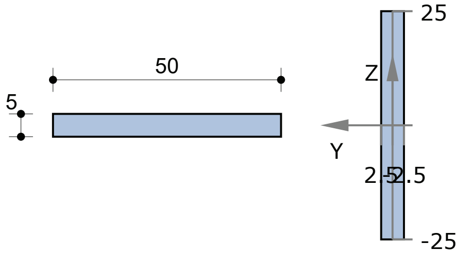
		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		26.03	15.18	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	12.01	7.01	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	16.02	9.34	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	18.02	10.51	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	=	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	31.5 mm	z_{max}	=	50.0 mm
Minimale coördinaat	y_{min}	=	-31.5 mm	z_{min}	=	-50.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	6300.0 mm ^{2}	G	=	2.4 kg/m
Statisch moment	S_y	=	78750 mm ^{3}	S_z	=	49613 mm ^{3}
Traagheidsmoment	I_x	=	11109023 mm ^{4}			
Traagheidsmoment	I_y	=	5250000 mm ^{4}	I_z	=	2083725 mm ^{4}
Traagheidsstraal	i_y	=	28.9 mm	i_z	=	18.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	105000 mm ^{3}	$W_{z;el}$	=	66150 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	5250000 mm ^{4}	I_{min}	=	2083725 mm ^{4}
Traagheidsstraal	i_{max}	=	28.9 mm	i_{min}	=	18.2 mm

S50X5



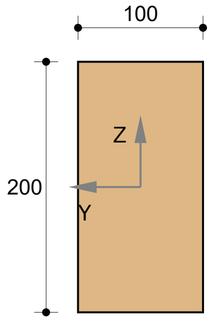
Materiaalgegevens

Staalsoort	S235	(Warmgewalst)	
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	2.5 mm	z_{max}	=	25.0 mm
Minimale coördinaat	y_{min}	=	-2.5 mm	z_{min}	=	-25.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	250.0 mm ^{2}	G	=	2.0 kg/m
Statisch moment	S_y	=	1563 mm ^{3}	S_z	=	156 mm ^{3}
Traagheidsmoment	I_x	=	1952 mm ^{4}			
Traagheidsmoment	I_y	=	52083 mm ^{4}	I_z	=	521 mm ^{4}
Traagheidsstraal	i_y	=	14.4 mm	i_z	=	1.4 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	2083 mm ^{3}	$W_{z;el}$	=	208 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	52083 mm ^{4}	I_{min}	=	521 mm ^{4}
Traagheidsstraal	i_{max}	=	14.4 mm	i_{min}	=	1.4 mm
Halveringslijn	z_h	=	0.0 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	3125 mm ^{3}	$W_{z;pl}$	=	313 mm ^{3}

100 x 200



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		24.00	14.00	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.08	6.46	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	14.77	8.62	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	16.62	9.69	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	= 420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	= 11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	= 6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	= 7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	= 690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	= 50.0 mm	z_{max}	=	100.0 mm
Minimale coördinaat	y_{min}	= -50.0 mm	z_{min}	=	-100.0 mm
Zwaartelijn	z_s	= 0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	= 20000.0 mm ^{2}	G	=	8.4 kg/m
Statisch moment	S_y	= 500000 mm ^{3}	S_z	=	250000 mm ^{3}
Traagheidsmoment	I_x	= 378666667 mm ^{4}			
Traagheidsmoment	I_y	= 66666667 mm ^{4}	I_z	=	16666667 mm ^{4}
Traagheidsstraal	i_y	= 57.7 mm	i_z	=	28.9 mm
Elastisch weerstandsmoment	$W_{y;el}$	= 666667 mm ^{3}	$W_{z;el}$	=	333333 mm ^{3}
Centrifugaalmoment	C_{yz}	= 0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	= 66666667 mm ^{4}	I_{min}	=	16666667 mm ^{4}
Traagheidsstraal	i_{max}	= 57.7 mm	i_{min}	=	28.9 mm

9.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

9.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

9.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
8	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	3	0	1147
11	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	15	0	1147
14	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	21	0	3373
24	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	12	0	1146
27	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	21	0	1146
28	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	5	0	3665
35	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	18	0	1147
38	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	27	0	1147
49	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	24	0	1146
52	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	35	0	1146
53	G-Z	q	-0.023 kN/m	-0.023 kN/m	0.0	0.0	30	0	2500
53	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	30	0	2500
53	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	30	0	2500
61	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	32	0	1147
64	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	38	0	1147

9.6 BELASTINGSGEVAL 2 wind tegen as A

9.6.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
53	L-Z	q	0.283 kN/m	0.283 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	0.045 kN/m	0.045 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	-0.046 kN/m	-0.046 kN/m	0.0	0.0	30	0	2500
53	L-Z	q	0.289 kN/m	0.289 kN/m	0.0	0.0	30	0	2500

9.7 BELASTINGSGEVAL 3 wind tegen as 1

9.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
53	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	30	0	2500
53	G-Y	q	0.006 kN/m	0.006 kN/m	0.0	0.0	30	0	2500

9.8 BELASTINGSGEVAL 4 wind tegen as 3

9.8.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
53	L-Z	q	0.261 kN/m	0.261 kN/m	0.0	0.0	30	0	2500
53	L-Z	q	0.260 kN/m	0.260 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	0.041 kN/m	0.041 kN/m	0.0	0.0	30	0	2500
53	L-Y	q	-0.041 kN/m	-0.041 kN/m	0.0	0.0	30	0	2500

10.Berekeningsresultaten selectie

10.1 UITERSTE GRENSTOESTANDEN (UGT)

10.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

10.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
8	2	3		0.455	0.001	**0.272**	0.000	0.000	0.000
	3	3		**5.424**	**-0.033**	**-1.139**	0.000	0.000	0.000
	4	3		**-2.146**	**0.004**	0.196	0.000	0.000	0.000
	2	12		-0.321	-0.001	**-0.251**	0.000	**-0.300**	0.001
	3	12		**-5.290**	**0.033**	**1.160**	0.000	**1.333**	**-0.040**
	4	12		**2.280**	**-0.004**	-0.174	0.000	-0.211	**0.004**
11	3	15		**5.290**	**0.034**	**1.160**	0.000	**-1.333**	**0.040**
	4	15		**-2.280**	**-0.004**	**-0.174**	0.000	**0.211**	**-0.004**
	3	9		**-5.424**	**-0.034**	**-1.139**	0.000	0.000	0.000
	4	9		**2.146**	**0.004**	**0.196**	0.000	0.000	0.000
14	3	21		**-4.455**	**0.004**	**0.028**	0.000	0.000	0.000
	4	21		**-0.023**	0.000	**0.027**	0.000	0.000	0.000
	2		1687	0.091	0.000	0.000	0.000	**0.023**	0.000
	4		1687	0.023	0.000	0.000	0.000	**0.023**	0.000
	3	8		**4.409**	**-0.004**	**0.027**	0.000	0.000	0.000
	4	8		**-0.023**	0.000	**0.027**	0.000	0.000	0.000
24	1	12		1.167	0.000	**0.082**	0.000	-0.294	0.001
	2	12		0.216	0.023	0.103	0.000	**0.300**	-0.001
	3	12		**5.290**	**0.192**	**0.486**	**-0.012**	**-1.333**	**0.038**
	4	12		**-2.444**	**-0.110**	0.180	**0.001**	0.211	**-0.004**
	1	18		-1.046	0.000	**-0.020**	0.000	0.236	-0.001
	2	18		-0.096	-0.023	-0.042	0.000	**-0.383**	0.027
	3	18		**-5.169**	**-0.192**	**-0.425**	**0.012**	**0.811**	**0.179**
	4	18		**2.564**	**0.110**	-0.119	**-0.001**	-0.382	**-0.124**
27	1	21		1.046	0.000	**-0.020**	0.000	-0.236	0.001
	3	21		**5.169**	**-0.192**	**-0.425**	**0.012**	**-0.811**	**-0.179**
	4	21		**-2.565**	**0.110**	-0.119	**-0.001**	**0.382**	**0.124**
	1	15		-1.167	0.000	**0.082**	0.000	0.294	-0.001
	3	15		**-5.290**	**0.192**	**0.486**	**-0.012**	**1.333**	**-0.038**
	4	15		**2.444**	**-0.110**	0.180	**0.001**	**-0.211**	**0.004**
28	3	5		**1.018**	0.000	-1.271	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
28	2	40		-0.119	0.014	0.000	0.000	0.000	**-0.070**
	3	40		**-1.018**	0.000	-1.275	0.000	-1.444	0.000
	2	43		0.121	**0.103**	0.000	0.000	0.000	-0.056
	3	43		-0.759	0.000	-0.183	0.000	**-1.631**	0.000
	4	43		-0.224	0.000	0.183	0.000	**1.628**	0.000
	2	45		0.121	**0.103**	0.000	0.000	0.000	0.044
	2	45		0.328	**-0.082**	0.000	0.000	0.000	**0.044**
	3	45		-0.312	0.000	**1.537**	0.000	-0.824	0.000
	4	45		0.223	0.000	**-1.535**	0.000	0.823	0.000
	2	36		**0.376**	0.082	0.000	0.000	0.000	0.000
	3	36		-0.264	0.000	**-1.537**	0.000	0.000	0.000
35	2	18		-1.062	-0.030	-0.254	0.009	**0.383**	-0.026
	3	18		**2.006**	**-0.257**	**0.519**	**0.043**	**-0.811**	**-0.174**
	4	18		**-1.138**	**0.169**	**-0.290**	**-0.037**	0.382	**0.118**
	2	24		1.158	0.030	0.350	-0.009	**-0.037**	-0.008
	3	24		**-1.910**	**0.257**	**-0.423**	**-0.043**	**0.267**	**-0.124**
	4	24		**1.234**	**-0.169**	**0.386**	**0.037**	0.005	**0.074**
38	3	27		**1.910**	**0.258**	**-0.423**	**-0.043**	**-0.267**	**0.124**
	4	27		**-1.234**	**-0.169**	**0.386**	**0.037**	**-0.005**	**-0.074**
	3	21		**-2.006**	**-0.258**	**0.519**	**0.043**	**0.811**	**0.174**
	4	21		**1.138**	**0.169**	**-0.290**	**-0.037**	**-0.382**	**-0.118**
49	2	24		-1.126	-0.004	**-0.106**	**0.006**	**0.037**	0.011
	3	24		**1.635**	**0.212**	**0.892**	0.003	**-0.267**	**0.132**
	4	24		**-1.227**	**-0.124**	-0.075	**-0.012**	-0.005	**-0.082**
	2	32		1.188	0.004	**0.226**	**-0.006**	0.152	-0.015
	3	32		**-1.574**	**-0.212**	**-0.771**	-0.003	**-0.690**	**0.110**
	4	32		**1.289**	**0.124**	0.196	**0.012**	**0.159**	**-0.061**
52	2	35		-1.044	0.002	0.018	**-0.005**	0.010	0.003
	3	35		**1.574**	**-0.212**	**-0.772**	-0.003	**0.690**	**-0.110**
	4	35		**-1.289**	**0.123**	**0.196**	**0.012**	**-0.159**	**0.061**
	2		166	1.044	0.002	0.000	0.005	**0.012**	-0.002
	2	27		0.982	-0.002	0.103	**0.005**	0.039	-0.001
	3	27		**-1.636**	**0.212**	**0.892**	0.003	**0.267**	**-0.132**
	4	27		**1.228**	**-0.123**	**-0.075**	**-0.012**	**0.005**	**0.082**
53	2	30		-0.023	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	30		**0.955**	-0.034	**0.106**	0.000	0.000	0.000
	4	30		**-0.992**	**-0.035**	-0.675	0.000	0.000	0.000
	1		1250	0.006	0.000	0.000	0.000	**0.066**	-0.021
	2		1250	0.023	0.000	0.000	0.000	-0.470	**-0.021**
	1	31		0.006	**-0.034**	**0.106**	0.000	0.000	0.000
	2	31		0.023	**-0.033**	**-0.752**	0.000	0.000	0.000
	3	31		**-0.989**	-0.034	0.105	0.000	0.000	0.000
	4	31		**0.992**	-0.034	-0.677	0.000	0.000	0.000
61	1	32		**0.893**	-0.009	0.053	0.001	0.168	-0.006
	2	32		**-1.217**	0.002	0.086	0.001	-0.152	0.016
	3	32		-0.014	**-0.293**	**0.196**	**0.037**	**0.690**	**-0.103**
	4	32		-0.717	**0.216**	**-0.088**	**-0.030**	**-0.159**	**0.054**
	1		452	-0.893	-0.009	0.000	-0.001	**0.180**	0.003
	2		737	1.217	0.002	0.000	-0.001	**-0.121**	-0.015
	1	38		**-0.872**	0.009	0.081	-0.001	-0.152	-0.003
	2	38		**1.238**	-0.002	0.048	-0.001	0.131	-0.014
	3	38		0.035	**0.293**	**-0.062**	**-0.037**	**-0.839**	**-0.233**
	4	38		0.739	**-0.216**	**0.222**	**0.030**	**0.337**	**0.193**
64	1	38		**0.872**	0.009	0.081	-0.001	0.152	0.003
	2	38		**-1.281**	0.008	0.190	-0.004	-0.131	0.013

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
64	3	38		-0.035	**0.293**	**-0.062**	**-0.037**	**0.839**	**0.233**
	4	38		-0.739	**-0.216**	**0.222**	**0.030**	**-0.337**	**-0.193**
	1		695	-0.872	0.009	0.000	0.001	**0.180**	0.003
	1	35		**-0.893**	-0.009	0.053	0.001	-0.168	0.006
	2	35		**1.259**	-0.008	-0.056	0.004	-0.010	-0.004
	3	35		0.014	**-0.293**	**0.196**	**0.037**	**-0.690**	**0.103**
	4	35		0.717	**0.216**	**-0.088**	**-0.030**	**0.159**	**-0.054**

10.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
8	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.11
		3	1	6.2.8	0.01
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.14
		7	1	Doorbuiging	0.04
		7	1	Doorbuiging	0.05
11	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.11
		3	1	6.2.8	0.01
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.14
		7	1	Doorbuiging	0.04
		7	1	Doorbuiging	0.05
14	S50X5	3	1	6.2.3	0.08
24	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.03
		3	1	6.2.8	0.11
		3	1	6.2.8	0.03

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
24	buigprofiel	3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.17
		7	1	Doorbuiging	0.06
		7	1	Doorbuiging	0.09
27	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.03
		3	1	6.2.8	0.11
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.17
		7	1	Doorbuiging	0.06
		7	1	Doorbuiging	0.09
35	buigprofiel	3	1	6.2.4	0.01
		3	1	6.2.5	0.07
		3	1	6.2.5	0.03
		3	1	6.2.8	0.07
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.11
		7	1	Doorbuiging	0.03
		7	1	Doorbuiging	0.04
38	buigprofiel	3	1	6.2.4	0.01
		3	1	6.2.5	0.03
		3	1	6.2.5	0.07
		3	1	6.2.8	0.07
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.11
		7	1	Doorbuiging	0.03
		7	1	Doorbuiging	0.04
49	buigprofiel	3	1	6.2.5	0.02
		3	1	6.2.5	0.06
		3	1	6.2.6	0.01
		3	1	6.2.8	0.06
		3	1	6.2.8	0.02
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		7	1	Doorbuiging	0.01
		7	1	Doorbuiging	0.02

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
52	buigprofiel	3	1	6.2.5	0.06
		3	1	6.2.5	0.02
		3	1	6.2.6	0.01
		3	1	6.2.8	0.06
		3	1	6.2.8	0.02
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		7	1	Doorbuiging	0.01
		7	1	Doorbuiging	0.02
61	buigprofiel	3	1	6.2.5	0.07
		3	1	6.2.5	0.04
		3	1	6.2.8	0.07
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.11
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		7	1	Doorbuiging	0.05
		7	1	Doorbuiging	0.06
64	buigprofiel	3	1	6.2.5	0.07
		3	1	6.2.5	0.04
		3	1	6.2.8	0.07
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.11
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		7	1	Doorbuiging	0.05
		7	1	Doorbuiging	0.06
Maximale waarden					
14	S50X5	3	1	6.2.3	0.08
24	buigprofiel	3	1	6.3.3	0.17

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
28	100 x 200	2	6.1.2	0.00
		1	6.1.4	0.01
		3	6.1.7	0.04
		4	6.2.3	0.11
		3	6.2.4	0.15
		3	6.3.2	0.15
		3	6.3.3	0.04
		7		0.23
53	63 x 100	4	6.1.2	0.02
		3	6.1.4	0.01
		2	6.1.7	0.06
		2	6.2.3	0.28
		3	6.2.4	0.05
		3	6.3.2	0.10
		2	6.3.3	0.27

Staaf-nummer	Profiel	Combinatie nummer	Artikel	U.C.
Maximale waarden				
28	100 x 200	7		0.23
53	63 x 100	2	6.2.3	0.28

10.3 BEREKENING VAN UNITY CHECKS

10.3.1 Staaf 14 - S50X5

Axiale trek **art. 6.2.3**

Combinatie: 3 x=0 mm Nx=4.455 kN Vy=0 kN Vz=0.027 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

$$N_{pl,Rd} = \frac{A\, f_y}{\gamma_{M0}} = \frac{250 \times 235}{1.00} \times 10^{-3} = 58.8 \text{ kN} \quad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{4.5}{58.8} = 0.08 < 1,0 \quad (6.5)$$

10.3.2 Staaf 24 - BUIGPROFIEL

Axiale trek **art. 6.2.3**

Combinatie: 4 x=0 mm Nx=2.444 kN Vy=-0.111 kN Vz=0.18 kN
Mx=-0.001 kNm My=0.211 kNm Mz=0.004 kNm

$$N_{pl,Rd} = \frac{A\, f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.3 \text{ kN} \quad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{2.4}{328.3} = 0.01 < 1,0 \quad (6.5)$$

Axiale druk **art. 6.2.4**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$N_{c,Rd} = \frac{A\, f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.342 \text{ kN} \quad (6.10)$$

$$\frac{N_{Ed}}{N_{c,Rd}} = \frac{5.3}{328.3} = 0.02 < 1,0 \quad (6.9)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$M_{y,c,Rd} = M_{pl,y,Rd} = \frac{W_{pl,y}\, f_y}{\gamma_{M0}} = \frac{49592.8 \times 235}{1.00} \times 10^{-6} = 11.654 \text{ kNm} \quad (6.13)$$

$$\frac{M_{y,Ed}}{M_{y,c,Rd}} = \frac{1.333}{11.654} = 0.11 < 1,0 \quad (6.12)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$M_{z,c,Rd} = M_{pl,z,Rd} = \frac{W_{pl,z}\ f_y}{\gamma_{M0}} = \frac{23934.5 \times 235}{1.00} \times 10^{-6} = 5.625 \text{ kNm} \quad (6.13)$$

$$\frac{M_{z,Ed}}{M_{z,c,Rd}} = \frac{0.179}{5.625} = 0.03 < 1{,}0 \quad (6.12)$$

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/\ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \quad (6.18)$$

$V_{z,Ed}$ = 0.486 kN < $V_{z,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$V_{c,y,Rd} = V_{pl,y,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/\ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \quad (6.18)$$

$V_{y,Ed}$ = 0.189 kN < $V_{y,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$M_{N,Rd} = M_{pl,Rd}\ \left(1 - \left(\ (N_{Ed}\ / N_{pl,Rd}\ )\ \right)^2\ \right) = 11.7\ \left(1 - \left(\ (5.3 / 328.3)\ \right)^2\ \right) = 11.651 \text{ kNm} \quad (6.32)$$

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} = \frac{1.333}{11.651} = 0.11 < 1{,}0 \quad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$M_{N,Rd} = M_{pl,Rd} \left(1 - \left((N_{Ed} / N_{pl,Rd}) \right)^2 \right) = 5.6 \left(1 - \left((5.3 / 328.3) \right)^2 \right) = 5.623 \text{ kNm} \qquad (6.32)$$

$$\frac{M_{z,Ed}}{M_{N,z,Rd}} = \frac{0.179}{5.623} = 0.03 < 1{,}0 \qquad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} = \left(\frac{1.333}{11.651}\right)^{1} + \left(\frac{0.038}{5.623}\right)^{1} = 0.12 < 1{,}0 \qquad (6.41)$$

Knikstabiliteit **art. 6.3.1.1**

Combinatie: 3 x=0 mm Nx=5.29 kN Vy=0.192 kN Vz=0.486 kN
Mx=-0.012 kNm My=-1.333 kNm Mz=0.038 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z} \frac{1}{\lambda_1} = \frac{1146}{21.2} \frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0{,}5 [1 + \alpha (\lambda_z - 0{,}2) + \lambda_z^2] = 0{,}5 \times [1 + 0.49 \times (0.574 - 0{,}2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$$N_{b,Rd} = \frac{\chi_z A f_y}{\gamma_{M1}} = \frac{0.8 \times 1397.2 \times 235}{1.00} \times 10^{-3} = 262.9 \text{ kN} \qquad (6.47)$$

$$\frac{N_{Ed}}{N_{b,Rd}} = \frac{5.3}{262.9} = 0.02 < 1{,}0 \qquad (6.46)$$

Prismatische, op buiging en druk belaste staven **art. 6.3.3**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_y = \frac{L_{cr,y}}{i_y} \frac{1}{\lambda_1} = \frac{1146}{41.6} \frac{1}{93.9} = 0.293 \qquad (6.50)$$

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z} \frac{1}{\lambda_1} = \frac{1146}{21.2} \frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{y\text{-}y}$ c $\alpha = 0.49$

$$\Phi_y = 0{,}5 [1 + \alpha (\lambda_y - 0{,}2) + \lambda_y^2] = 0{,}5 \times [1 + 0.49 \times (0.293 - 0{,}2) + 0.293^2] = 0.566$$

$$\chi_y = \frac{1}{\Phi_y + \sqrt{\Phi_y^2 - \lambda_y^2}} = \frac{1}{0.566 + \sqrt{0.566^2 - 0.293^2}} = 0.953 \qquad (6.49)$$

Knikkromme $_{z\text{-}z}$ c α = 0.49

$$\Phi_z = 0{,}5\,[1 + \alpha\,(\lambda_z - 0{,}2) + \lambda_z^2] = 0{,}5 \times [1 + 0.49 \times (0.574 - 0{,}2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$N_{Rk} = f_y\, A = 235 \times 1397 \times 10^{-3} = 328.3$ kN

$M_{y,Rk} = f_y\, W_{pl,y} = 235 \times 49593 \times 10^{-6} = 11.7$ kNm

$M_{z,Rk} = f_y\, W_{pl,z} = 235 \times 23935 \times 10^{-6} = 5.6$ kNm

$$\frac{N_{Ed}}{\frac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \frac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.61)$$

$$\frac{5.29}{\frac{0.953 \times 328.342}{1.00}} + 1 \times \frac{1.333}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.179}{\frac{5.625}{1.00}} = 0.16 < 1 \qquad (6.61)$$

$$\frac{N_{Ed}}{\frac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \frac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.62)$$

$$\frac{5.29}{\frac{0.801 \times 328.342}{1.00}} + 1 \times \frac{1.333}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.179}{\frac{5.625}{1.00}} = 0.17 < 1 \qquad (6.62)$$

Doorbuiging

Combinatie: 7 x=550.2 mm Nx=-4.496 kN Vy=0.158 kN Vz=0.384 kN
Mx=0.01 kNm My=-0.913 kNm Mz=0.055 kNm

Lokale knoopverplaatsingen d_{z1} = 0.2 mm d_{z2} = 0.7 mm

$w_{eind,z} = w_z - w_{Zeeg,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|0.3|}{1146 / 250} = \frac{|0.3|}{4.6} = 0.06 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|0.3|}{1146 / 333} = \frac{|0.3|}{3.4} = 0.09 < 1.0$$

10.3.3 Staaf 28 - 100 x 200 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting **art. 6.1.2**

Combinatie: 2 x=3665 mm Nx=0.328 kN Vy=-0.082 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{327.8}{20000} = 0 \text{ N/mm}^2 < f_{t,0,d} = 9.7 \text{ N/mm}^2 \quad (6.1)$$

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 1 x=0 mm Nx=-1.017 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1017.3}{20000} = 0.1 \text{ N/mm}^2 < f_{c,0,d} = 9.7 \text{ N/mm}^2 \quad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 3 x=3631.5 mm Nx=-0.312 kN Vy=0 kN Vz=1.537 kN
Mx=0 kNm My=-0.051 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{1537.3 \times 500000}{100 \times 66666667} = 0.1 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \quad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 4 x=2641.6 mm Nx=0.017 kN Vy=0 kN Vz=-0.826 kN
Mx=0 kNm My=1.225 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{17}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.225 \times 10^6}{667 \times 10^3} = 1.8 \text{ N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} = \frac{0.0}{9.7} + \frac{1.8}{16.6} = 0.11 < 1.00 \quad (6.17)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{759}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{t,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} = \left(\frac{0.0}{14.5}\right)^2 + \frac{2.4}{16.6} = 0.15 < 1.00 \quad (6.19)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{3665}{57.7} = 63.48 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{63.48}{\pi}\sqrt{\frac{21.0}{7400}} = 1.076 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_y = 0,5(1 + \beta_c(\lambda_{rel,y} - 0,3) + \lambda_{rel,y}^2 = 0,5 \times (1 + 0.2 \times (1.076 - 0,3) + 1.076^2 = 1.16 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.16 + \sqrt{1.16^2 - 1.08^2}} = 0.63 \qquad (6.25)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.153 - 0,3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{759}{20000} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.63 \times 14.5} + \frac{2.4}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.15 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\, f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.20 \times 14.5} + 0.7 \times \frac{2.4}{16.6} + \frac{0.0}{18.0} = 0.12 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 3 x=2154 mm Nx=-0.759 kN Vy=0 kN Vz=-0.183 kN
Mx=0 kNm My=-1.631 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 3665 = 3299$ mm

$$\sigma_{m,crit} = \frac{0,78\, b^2}{h\, l_{ef}} E_{0,05} = \frac{0,78 \times 100^2}{200 \times 3299} \times 7400 = 87.5 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{87.5}} = 0.524 < 0.75 \qquad \rightarrow k_{crit} = 1,00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{1.631 \times 10^6}{667 \times 10^3} = 2.4 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1018}{20000} = 0.1 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \text{ x } (1 + 0.2 \text{ x } (2.153 - 0,3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{2.4}{1.00 \text{ x } 16.6}\right)^2 + \frac{0.1}{0.20 \text{ x } 14.5} = 0.04 < 1.00 \qquad (6.35)$$

Combinatie: 7 x=1832.5 mm Nx=-0.69 kN Vy=0 kN Vz=-0.153 kN
Mx=0 kNm My=-1.31 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Lokale knoopverplaatsingen d_{z1} = 0 mm d_{z2} = 0 mm

$w_{eind,z} = w_z + k_{def}\ w_{BGT\ Quasi\text{-}blijvend,z}$ = 2.5 + 0.6 x 0 = 2.5 mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|2.5|}{3665 / 250} = \frac{|2.5|}{14.7} = 0.17 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z}$ = 2.5 - 0 = 2.5 mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|2.5|}{3665 / 333} = \frac{|2.5|}{11} = 0.23 < 1.0$$

10.3.4 Staaf 53 - 63 x 100 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting **art. 6.1.2**

Combinatie: 4 x=0 mm Nx=0.992 kN Vy=-0.034 kN Vz=-0.676 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{991.7}{6300} = 0.2 \text{ N/mm}^2 < f_{t,0,d} = 9.7 \text{ N/mm}^2 \qquad (6.1)$$

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 3 x=0 mm Nx=-0.955 kN Vy=-0.034 kN Vz=0.106 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{954.6}{6300} = 0.2 \text{ N/mm}^2 < f_{c,0,d} = 14.5 \text{ N/mm}^2 \qquad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 2 x=0 mm Nx=0.023 kN Vy=-0.033 kN Vz=-0.752 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{752.1 \times 78750}{63 \times 5250000} = 0.2\ \text{N/mm}^2 < f_{v,d} = 2.8\ \text{N/mm}^2 \quad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 2 x=1250 mm Nx=0.023 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-0.47 kNm Mz=-0.021 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{23}{6300} = 0\ \text{N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.470 \times 10^6}{105 \times 10^3} = 4.5\ \text{N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.021 \times 10^6}{66 \times 10^3} = 0.3\ \text{N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{9.7} + \frac{4.5}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.28 < 1.00 \quad (6.17)$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{9.7} + 0.7 \times \frac{4.5}{16.6} + \frac{0.3}{19.8} = 0.20 < 1.00 \quad (6.18)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 3 x=1250 mm Nx=-0.955 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.066 kNm Mz=-0.021 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{955}{6300} = 0.2\ \text{N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.066 \times 10^6}{105 \times 10^3} = 0.6\ \text{N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.021 \times 10^6}{66 \times 10^3} = 0.3\ \text{N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.2}{14.5}\right)^2 + \frac{0.6}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.05 < 1.00 \quad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.2}{14.5}\right)^2 + 0.7 \times \frac{0.6}{16.6} + \frac{0.3}{19.8} = 0.04 < 1.00 \quad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 3 x=1250 mm Nx=-0.955 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.066 kNm Mz=-0.021 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{2500}{28.9} = 86.60 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{86.60}{\pi}\sqrt{\frac{21.0}{7400}} = 1.469 \quad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \quad (6.22)$$

$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}^2 = 0{,}5 \times (1 + 0.2 \times (1.469 - 0{,}3) + 1.469^2 = 1.70$ (6.27)

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.70 + \sqrt{1.70^2 - 1.47^2}} = 0.39 \quad (6.25)$$

$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.331 - 0{,}3) + 2.331^2 = 3.42$ (6.28)

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \quad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{955}{6300} = 0.2 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.066 \times 10^6}{105 \times 10^3} = 0.6 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.021 \times 10^6}{66 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.2}{0.39 \times 14.5} + \frac{0.6}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.08 < 1.00 \quad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\, f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.2}{0.17 \times 14.5} + 0.7 \times \frac{0.6}{16.6} + \frac{0.3}{19.8} = 0.10 < 1.00 \quad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 2 x=1250 mm   Nx=0.023 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-0.47 kNm Mz=-0.021 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 2500 = 2250$ mm

$$\sigma_{m,crit} = \frac{0{,}78\, b^2}{h\, l_{ef}} E_{0,05} = \frac{0{,}78 \times 63^2}{100 \times 2250} \times 7400 = 101.8 \text{ N/mm}^2 \quad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{101.8}} = 0.486 < 0.75 \qquad \rightarrow k_{crit} = 1{,}00 \quad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.470 \times 10^6}{105 \times 10^3} = 4.5 \text{ N/mm}^2$$

$\sigma_{m,y,d} = 4.5 \text{ N/mm}^2 < k_{crit}\, f_{m,d} = 1.00 \times 16.6 = 16.6 \text{ N/mm}^2$ (6.33)

11.Invoergegevens spant as 3

Gehanteerde normen: : NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

11.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
3	0	5000	0	A	A	A			
9	7330	5000	0	A	A	A			
12	179	5000	1133						
15	7151	5000	1133						
18	700	5000	2154						
21	6630	5000	2154						
24	1511	5000	2965						
27	5819	5000	2965						
32	2532	5000	3486						
35	4798	5000	3486						
38	3665	5000	3665						

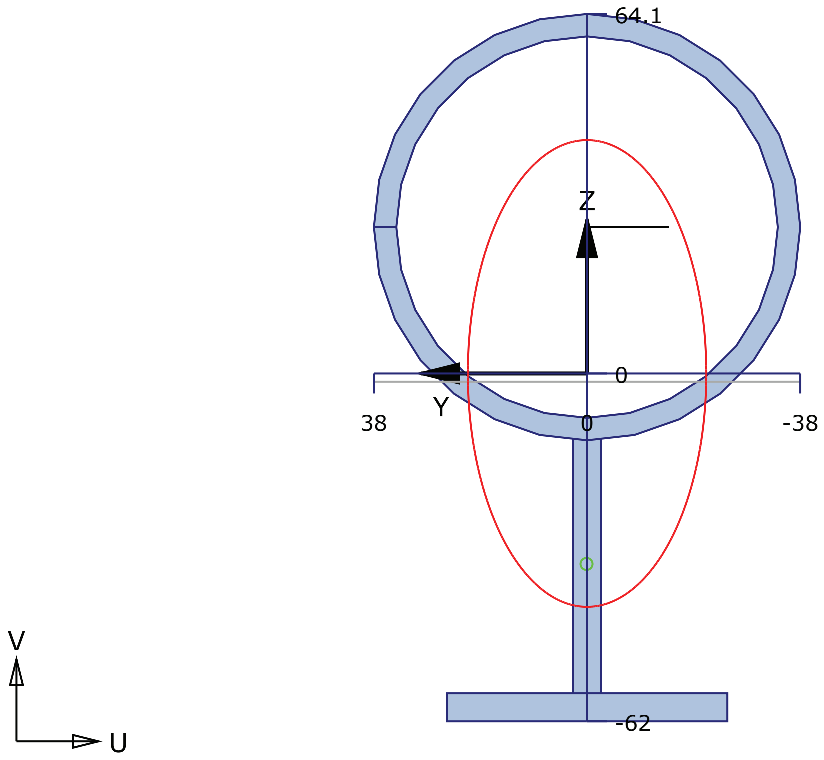
11.2 STAVEN

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
8	3	12	aaaaaa	aaaaaa	buigprofiel	1147
11	15	9	aaaaaa	aaaaaa	buigprofiel	1147
24	12	18	aaaaaa	aaaaaa	buigprofiel	1146
27	21	15	aaaaaa	aaaaaa	buigprofiel	1146
35	18	24	aaaaaa	aaaaaa	buigprofiel	1147
38	27	21	aaaaaa	aaaaaa	buigprofiel	1147
49	24	32	aaaaaa	aaaaaa	buigprofiel	1146
52	35	27	aaaaaa	aaaaaa	buigprofiel	1146
61	32	38	aaaaaa	aaaaaa	buigprofiel	1147
64	38	35	aaaaaa	aaaaaa	buigprofiel	1147

11.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
2	buigprofiel	11.0	210000	1.397E3	1.1801E6	2.4179E6	6.3091E5

buigprofiel



Invoergegevens

1:S50X5

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-60.2 mm
Hoek		hoek	=	-90.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

2:S50X5(COPY)

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-85.6 mm
Hoek		hoek	=	-180.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

3:HFCHS761X4

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	0.0 mm
Hoek		hoek	=	-180.0 graden			
Hoogte		h	=	76.0 mm			
Flensdikte		tf	=	4.0 mm			

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	38.0 mm	z_{max}	=	62.0 mm
Minimale coördinaat	y_{min}	=	-38.0 mm	z_{min}	=	-64.1 mm

Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	1397.2 mm^2	G	=	11.0 kg/m
Statisch moment	S_y	=	24809 mm^3	S_z	=	11967 mm^3
Traagheidsmoment	I_x	=	1180116 mm^4			
Traagheidsmoment	I_y	=	2417861 mm^4	I_z	=	630910 mm^4
Traagheidsstraal	i_y	=	41.6 mm	i_z	=	21.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	37727 mm^3	$W_{z;el}$	=	16603 mm^3
Centrifugaalmoment	C_{yz}	=	2 mm^3	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	2417861 mm^4	I_{min}	=	630910 mm^4
Traagheidsstraal	i_{max}	=	41.6 mm	i_{min}	=	21.2 mm
Halveringslijn	z_h	=	1.5 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	49593 mm^3	$W_{z;pl}$	=	23935 mm^3

11.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00
4	wind tegen as 3	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 702 kg.

11.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

11.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
8	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	3	0	1147
11	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	15	0	1147
24	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	12	0	1146
27	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	21	0	1146
35	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	18	0	1147
38	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	27	0	1147
49	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	24	0	1146
52	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	35	0	1146
61	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	32	0	1147
64	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	38	0	1147

11.6 BELASTINGSGEVAL 2 wind tegen as A

11.7 BELASTINGSGEVAL 3 wind tegen as 1

11.8 BELASTINGSGEVAL 4 wind tegen as 3

12.Berekeningsresultaten spant as 3

12.1 UITERSTE GRENSTOESTANDEN (UGT)

12.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

12.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
8	2	3		0.455	0.001	**0.272**	0.000	0.000	0.000
	3	3		**5.424**	**-0.033**	**-1.139**	0.000	0.000	0.000
	4	3		**-2.146**	**0.004**	0.196	0.000	0.000	0.000
	2	12		-0.321	-0.001	**-0.251**	0.000	**-0.300**	0.001
	3	12		**-5.290**	**0.033**	**1.160**	0.000	**1.333**	**-0.040**
	4	12		**2.280**	**-0.004**	-0.174	0.000	-0.211	**0.004**
11	3	15		**5.290**	**0.034**	**1.160**	0.000	**-1.333**	**0.040**
	4	15		**-2.280**	**-0.004**	**-0.174**	0.000	**0.211**	**-0.004**
	3	9		**-5.424**	**-0.034**	**-1.139**	0.000	0.000	0.000
	4	9		**2.146**	**0.004**	**0.196**	0.000	0.000	0.000
24	1	12		1.167	0.000	**0.082**	0.000	-0.294	0.001
	2	12		0.216	0.023	0.103	0.000	**0.300**	-0.001
	3	12		**5.290**	**0.192**	**0.486**	**-0.012**	**-1.333**	**0.038**
	4	12		**-2.444**	**-0.110**	0.180	**0.001**	0.211	**-0.004**
	1	18		-1.046	0.000	**-0.020**	0.000	0.236	-0.001
	2	18		-0.096	-0.023	-0.042	0.000	**-0.383**	0.027
	3	18		**-5.169**	**-0.192**	**-0.425**	**0.012**	**0.811**	**0.179**
	4	18		**2.564**	**0.110**	-0.119	**-0.001**	-0.382	**-0.124**
27	1	21		1.046	0.000	**-0.020**	0.000	-0.236	0.001
	3	21		**5.169**	**-0.192**	**-0.425**	**0.012**	**-0.811**	**-0.179**
	4	21		**-2.565**	**0.110**	-0.119	**-0.001**	**0.382**	**0.124**
	1	15		-1.167	0.000	**0.082**	0.000	0.294	-0.001
	3	15		**-5.290**	**0.192**	**0.486**	**-0.012**	**1.333**	**-0.038**
	4	15		**2.444**	**-0.110**	0.180	**0.001**	**-0.211**	**0.004**
35	2	18		-1.062	-0.030	-0.254	0.009	**0.383**	-0.026
	3	18		**2.006**	**-0.257**	**0.519**	**0.043**	**-0.811**	**-0.174**
	4	18		**-1.138**	**0.169**	**-0.290**	**-0.037**	0.382	**0.118**
	2	24		1.158	0.030	0.350	-0.009	**-0.037**	-0.008
	3	24		**-1.910**	**0.257**	**-0.423**	**-0.043**	**0.267**	**-0.124**
	4	24		**1.234**	**-0.169**	**0.386**	**0.037**	0.005	**0.074**
38	3	27		**1.910**	**0.258**	**-0.423**	**-0.043**	**-0.267**	**0.124**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
38	4	27		**-1.234**	**-0.169**	**0.386**	**0.037**	**-0.005**	**-0.074**
	3	21		**-2.006**	**-0.258**	**0.519**	**0.043**	**0.811**	**0.174**
	4	21		**1.138**	**0.169**	**-0.290**	**-0.037**	**-0.382**	**-0.118**
49	2	24		-1.126	-0.004	**-0.106**	**0.006**	**0.037**	0.011
	3	24		**1.635**	**0.212**	**0.892**	0.003	**-0.267**	**0.132**
	4	24		**-1.227**	**-0.124**	-0.075	**-0.012**	-0.005	**-0.082**
	2	32		1.188	0.004	**0.226**	**-0.006**	0.152	-0.015
	3	32		**-1.574**	**-0.212**	**-0.771**	-0.003	**-0.690**	**0.110**
	4	32		**1.289**	**0.124**	0.196	**0.012**	**0.159**	**-0.061**
52	2	35		-1.044	0.002	0.018	**-0.005**	0.010	0.003
	3	35		**1.574**	**-0.212**	**-0.772**	-0.003	**0.690**	**-0.110**
	4	35		**-1.289**	**0.123**	**0.196**	**0.012**	**-0.159**	**0.061**
	2		166	1.044	0.002	0.000	0.005	**0.012**	-0.002
	2	27		0.982	-0.002	0.103	**0.005**	0.039	-0.001
	3	27		**-1.636**	**0.212**	**0.892**	0.003	**0.267**	**-0.132**
	4	27		**1.228**	**-0.123**	**-0.075**	**-0.012**	**0.005**	**0.082**
61	1	32		**0.893**	-0.009	0.053	0.001	0.168	-0.006
	2	32		**-1.217**	0.002	0.086	0.001	-0.152	0.016
	3	32		-0.014	**-0.293**	**0.196**	**0.037**	**0.690**	**-0.103**
	4	32		-0.717	**0.216**	**-0.088**	**-0.030**	**-0.159**	**0.054**
	1		452	-0.893	-0.009	0.000	-0.001	**0.180**	0.003
	2		737	1.217	0.002	0.000	-0.001	**-0.121**	-0.015
	1	38		**-0.872**	0.009	0.081	-0.001	-0.152	-0.003
	2	38		**1.238**	-0.002	0.048	-0.001	0.131	-0.014
	3	38		0.035	**0.293**	**-0.062**	**-0.037**	**-0.839**	**-0.233**
	4	38		0.739	**-0.216**	**0.222**	**0.030**	**0.337**	**0.193**
64	1	38		**0.872**	0.009	0.081	-0.001	0.152	0.003
	2	38		**-1.281**	0.008	0.190	-0.004	-0.131	0.013
	3	38		-0.035	**0.293**	**-0.062**	**-0.037**	**0.839**	**0.233**
	4	38		-0.739	**-0.216**	**0.222**	**0.030**	**-0.337**	**-0.193**
	1		695	-0.872	0.009	0.000	0.001	**0.180**	0.003
	1	35		**-0.893**	-0.009	0.053	0.001	-0.168	0.006
	2	35		**1.259**	-0.008	-0.056	0.004	-0.010	-0.004
	3	35		0.014	**-0.293**	**0.196**	**0.037**	**-0.690**	**0.103**
	4	35		0.717	**0.216**	**-0.088**	**-0.030**	**0.159**	**-0.054**

12.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
8	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.11
		3	1	6.2.8	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
8	buigprofiel	3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.14
		7	1	Doorbuiging	0.04
		7	1	Doorbuiging	0.05
11	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.11
		3	1	6.2.8	0.01
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.14
		7	1	Doorbuiging	0.04
		7	1	Doorbuiging	0.05
24	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.03
		3	1	6.2.8	0.11
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.17
		7	1	Doorbuiging	0.06
		7	1	Doorbuiging	0.09
27	buigprofiel	4	1	6.2.3	0.01
		3	1	6.2.4	0.02
		3	1	6.2.5	0.11
		3	1	6.2.5	0.03
		3	1	6.2.8	0.11
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.02
		3	1	6.3.3	0.17
		7	1	Doorbuiging	0.06
		7	1	Doorbuiging	0.09
35	buigprofiel	3	1	6.2.4	0.01
		3	1	6.2.5	0.07
		3	1	6.2.5	0.03
		3	1	6.2.8	0.07
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
35	buigprofiel	3	1	6.3.3	0.11
		7	1	Doorbuiging	0.03
		7	1	Doorbuiging	0.04
38	buigprofiel	3	1	6.2.4	0.01
		3	1	6.2.5	0.03
		3	1	6.2.5	0.07
		3	1	6.2.8	0.07
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.11
		7	1	Doorbuiging	0.03
		7	1	Doorbuiging	0.04
49	buigprofiel	3	1	6.2.5	0.02
		3	1	6.2.5	0.06
		3	1	6.2.6	0.01
		3	1	6.2.8	0.06
		3	1	6.2.8	0.02
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		7	1	Doorbuiging	0.01
		7	1	Doorbuiging	0.02
52	buigprofiel	3	1	6.2.5	0.06
		3	1	6.2.5	0.02
		3	1	6.2.6	0.01
		3	1	6.2.8	0.06
		3	1	6.2.8	0.02
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.08
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		7	1	Doorbuiging	0.01
		7	1	Doorbuiging	0.02
61	buigprofiel	3	1	6.2.5	0.07
		3	1	6.2.5	0.04
		3	1	6.2.8	0.07
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.11
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		7	1	Doorbuiging	0.05
		7	1	Doorbuiging	0.06
64	buigprofiel	3	1	6.2.5	0.07
		3	1	6.2.5	0.04
		3	1	6.2.8	0.07
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.04

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
64	buigprofiel	3	1	6.2.9.1	0.11
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		7	1	Doorbuiging	0.05
		7	1	Doorbuiging	0.06
Maximale waarden					
24	buigprofiel	3	1	6.3.3	0.17

12.3 BEREKENING VAN UNITY CHECKS

12.3.1 Staaf 24 - BUIGPROFIEL

Axiale trek **art. 6.2.3**

Combinatie: 4 x=0 mm Nx=2.444 kN Vy=-0.111 kN Vz=0.18 kN
Mx=-0.001 kNm My=0.211 kNm Mz=0.004 kNm

$$N_{pl,Rd} = \frac{A\,f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.3 \text{ kN} \quad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{2.4}{328.3} = 0.01 < 1,0 \quad (6.5)$$

Axiale druk **art. 6.2.4**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$N_{c,Rd} = \frac{A\,f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.342 \text{ kN} \quad (6.10)$$

$$\frac{N_{Ed}}{N_{c,Rd}} = \frac{5.3}{328.3} = 0.02 < 1,0 \quad (6.9)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$M_{y,c,Rd} = M_{pl,y,Rd} = \frac{W_{pl,y}\,f_y}{\gamma_{M0}} = \frac{49592.8 \times 235}{1.00} \times 10^{-6} = 11.654 \text{ kNm} \quad (6.13)$$

$$\frac{M_{y,Ed}}{M_{y,c,Rd}} = \frac{1.333}{11.654} = 0.11 < 1,0 \quad (6.12)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$M_{z,c,Rd} = M_{pl,z,Rd} = \frac{W_{pl,z}\,f_y}{\gamma_{M0}} = \frac{23934.5 \times 235}{1.00} \times 10^{-6} = 5.625 \text{ kNm} \quad (6.13)$$

$$\frac{M_{z,Ed}}{M_{z,c,Rd}} = \frac{0.179}{5.625} = 0.03 < 1,0 \quad (6.12)$$

Buiging en dwarskracht art. 6.2.8

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{z,Ed} = 0.486 \text{ kN} < V_{z,pl,Rd}\ / 2 = 111.415 /2 = 55.708 \text{ kN}$

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en dwarskracht art. 6.2.8

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$V_{c,y,Rd} = V_{pl,y,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{y,Ed} = 0.189 \text{ kN} < V_{y,pl,Rd}\ / 2 = 111.415 /2 = 55.708 \text{ kN}$

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en normaalkracht art. 6.2.9

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$M_{N,Rd} = M_{pl,Rd}\ \left(1 - \left((N_{Ed}\ / N_{pl,Rd}) \right)^2 \right) = 11.7 \left(1 - \left((5.3 / 328.3) \right)^2 \right) = 11.651 \text{ kNm} \qquad (6.32)$$

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} = \frac{1.333}{11.651} = 0.11 < 1,0 \qquad (6.31)$$

Buiging en normaalkracht art. 6.2.9

Combinatie: 3 x=1146 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.424 kN
Mx=0.012 kNm My=-0.811 kNm Mz=0.179 kNm

$$M_{N,Rd} = M_{pl,Rd}\ \left(1 - \left((N_{Ed}\ / N_{pl,Rd}) \right)^2 \right) = 5.6 \left(1 - \left((5.3 / 328.3) \right)^2 \right) = 5.623 \text{ kNm} \qquad (6.32)$$

$$\frac{M_{z,Ed}}{M_{N,z,Rd}} = \frac{0.179}{5.623} = 0.03 < 1,0 \qquad (6.31)$$

Buiging en normaalkracht art. 6.2.9

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} = \left(\frac{1.333}{11.651}\right)^{1} + \left(\frac{0.038}{5.623}\right)^{1} = 0.12 < 1,0 \qquad (6.41)$$

Knikstabiliteit art. 6.3.1.1

Combinatie: 3 x=0 mm Nx=5.29 kN Vy=0.192 kN Vz=0.486 kN
Mx=-0.012 kNm My=-1.333 kNm Mz=0.038 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0,5\,[1 + \alpha\ (\lambda_z - 0,2) + \lambda_z^{2}] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^{2}] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^{2} - \lambda_z^{2}}} = \frac{1}{0.757 + \sqrt{0.757^{2} - 0.574^{2}}} = 0.801 \qquad (6.49)$$

$$N_{b,Rd} = \frac{\chi_z\, A\, f_y}{\gamma_{M1}} = \frac{0.8 \times 1397.2 \times 235}{1.00} \times 10^{-3} = 262.9 \text{ kN} \qquad (6.47)$$

$$\frac{N_{Ed}}{N_{b,Rd}} = \frac{5.3}{262.9} = 0.02 < 1,0 \qquad (6.46)$$

Prismatische, op buiging en druk belaste staven art. 6.3.3

Combinatie: 3 x=0 mm Nx=-5.29 kN Vy=0.189 kN Vz=0.486 kN
Mx=0.012 kNm My=-1.333 kNm Mz=-0.038 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_y = \frac{L_{cr,y}}{i_y}\frac{1}{\lambda_1} = \frac{1146}{41.6}\frac{1}{93.9} = 0.293 \qquad (6.50)$$

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{y\text{-}y}$ c $\alpha = 0.49$

$$\Phi_y = 0,5\,[1 + \alpha\ (\lambda_y - 0,2) + \lambda_y^{2}] = 0,5 \times [1 + 0.49 \times (0.293 - 0,2) + 0.293^{2}] = 0.566$$

$$\chi_y = \frac{1}{\Phi_y + \sqrt{\Phi_y^{2} - \lambda_y^{2}}} = \frac{1}{0.566 + \sqrt{0.566^{2} - 0.293^{2}}} = 0.953 \qquad (6.49)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0,5\,[1 + \alpha\ (\lambda_z - 0,2) + \lambda_z^{2}] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^{2}] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^{2} - \lambda_z^{2}}} = \frac{1}{0.757 + \sqrt{0.757^{2} - 0.574^{2}}} = 0.801 \qquad (6.49)$$

$N_{Rk} = f_y\ A = 235 \times 1397 \times 10^{-3} = 328.3$ kN

$M_{y,Rk} = f_y\ W_{pl,y} = 235 \times 49593 \times 10^{-6} = 11.7$ kNm

$M_{z,Rk} = f_y\ W_{pl,z} = 235 \times 23935 \times 10^{-6} = 5.6$ kNm

$$\frac{N_{Ed}}{\frac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \frac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.61)$$

$$\frac{5.29}{\frac{0.953 \times 328.342}{1.00}} + 1 \times \frac{1.333}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.179}{\frac{5.625}{1.00}} = 0.16 < 1 \qquad (6.61)$$

$$\frac{N_{Ed}}{\frac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \frac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.62)$$

$$\frac{5.29}{\frac{0.801 \times 328.342}{1.00}} + 1 \times \frac{1.333}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.179}{\frac{5.625}{1.00}} = 0.17 < 1 \qquad (6.62)$$

Doorbuiging

Combinatie: 7 x=550.2 mm Nx=-4.496 kN Vy=0.158 kN Vz=0.384 kN
Mx=0.01 kNm My=-0.913 kNm Mz=0.055 kNm

Lokale knoopverplaatsingen $d_{z1} = 0.2$ mm $d_{z2} = 0.7$ mm

$w_{eind,z} = w_z - w_{Zeeg,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|0.3|}{1146 / 250} = \frac{|0.3|}{4.6} = 0.06 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = 0.3 - 0 = 0.3$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|0.3|}{1146 / 333} = \frac{|0.3|}{3.4} = 0.09 < 1.0$$

Bestand :....22063\berekening\2022-06-11\podium.xfem

Inhoudsopgave

1.Berekeningsresultaten stelconplaat

1.1 UITERSTE GRENSTOESTANDEN (UGT)

1.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 3	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.10				
2	1.00 x 1.10	1.00 x 1.20			
3	1.00 x 1.10		1.00 x 1.20		
4	1.00 x 1.10			1.00 x 1.20	

1.1.2 Omhullende reactiekrachten

Knoop-nummer	Comb. nummer	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	2	**-0.465**	0.010	0.155			
	3	0.147	**-0.320**	**1.048**			
	4	**0.283**	**0.314**	**-0.652**			
2	1	0.635	-0.001	**2.001**			
	2	**-1.792**	-1.288	-1.592			
	3	-0.925	**-3.319**	**-1.858**			
	4	**2.018**	**0.020**	0.468			
3	3	**1.971**	**-0.042**	**5.287**			
	4	**-0.973**	**3.003**	**-4.627**			
4	1	**0.002**	0.000	0.971			
	2	**-0.066**	0.000	**0.346**			
	3	0.002	**-1.469**	**0.971**			
	4	0.002	**1.470**	0.412			
5	2	**-0.062**	0.000	**0.482**			
	3	0.000	**-1.844**	**1.122**			
	4	0.000	**1.844**	0.587			
6	2	**-0.063**	0.000	**0.347**			
	3	-0.002	**-1.469**	**0.971**			
	4	**-0.002**	**1.470**	0.412			
7	1	**-0.147**	-0.001	1.048			
	2	**-0.408**	0.005	0.155			
	3	-0.147	**-0.320**	**1.048**			
	4	-0.283	**0.314**	**-0.652**			
8	1	-0.635	-0.001	**2.001**			
	3	**0.925**	**-3.319**	**-1.858**			
	4	**-2.018**	**0.020**	0.468			
9	3	**-1.972**	**-0.042**	**5.287**			
	4	**0.973**	**3.003**	**-4.627**			
Minimale / maximale waarden							
8	4	**-2.018**					
2	4	**2.018**					

Knoop-nummer	Comb. nummer	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
8	3		**-3.319**				
9	4		**3.003**				
9	4			**-4.627**			
9	3			**5.287**			

Kiosk Paal 12 (Romneyloods PODIUM) , Den Hoorn - Texel

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Ontwerp specificaties

Anker

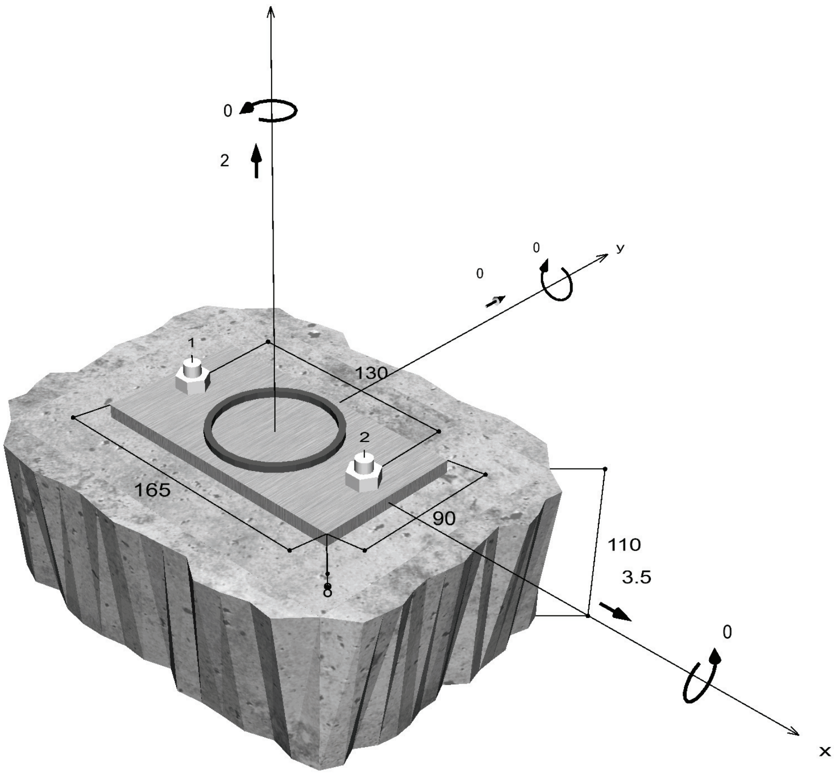
Systeem	fischer Segmentanker FAZ II
Anker	Segment anker FAZ II 10/10, Elektrolytisch verzinkt staal
Verankeringsdiepte	40 mm
Berekeningsgegevens	Ankerdimensionering in Beton volgens European Technical Assessment ETA-05/0069, Optie 1, Afgegeven op 24-4-2020

Geometrie / Belastingen

mm, kN, kNm

Rekenwaarden (inclusief veiligheidsfactoren aan de belastingzijde)

Statische belasting



Niet op schaal

Kiosk Paal 12 (Romneyloods PODIUM) , Den Hoorn - Texel

Gegevens

Ontwerpmethode	Ontwerp methode EN 1992-4:2017 Mechanische ankers
Ondergrond	C20/25, EN 206
Betonsituatie	Gescheurd, Droog boorgat
Wapening	Geen of normale wapening. Zonder randwapening. Met Splijtwapening
Boormethode	Hamerboren
Installatie	Doorsteek montage
Ruimte in doorvoergat	Doorvoergat niet gevult
Belasting type	Statisch
Afstand montage	Geen Buiging
Ankerplaat afmetingen	165 mm x 90 mm x 8 mm
Profiel type	Cirkelvormig buisprofiel (76,1 x 4)

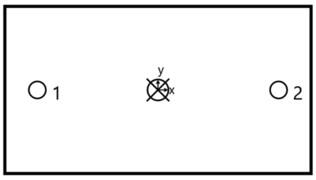
Rekenwaarde van de belastingen *)

#	N_{Ed} kN	$V_{Ed,x}$ kN	$V_{Ed,y}$ kN	$M_{Ed,x}$ kNm	$M_{Ed,y}$ kNm	$M_{T,Ed}$ kNm	Belasting type
1	2.00	3.50	0.00	0.00	0.00	0.00	Statisch

*) Inclusief benodigde veiligheidsfactoren voor de belasting

Resulterende ankerkracht

Anker nr.	Trekkracht kN	Dwarskracht kN	Dwarskracht x kN	Dwarskracht y kN
1	1.00	1.75	1.75	0.00
2	1.00	1.75	1.75	0.00



Max. betondrukspanning :	0.00 ‰
Max. betondrukspanning :	0.0 N/mm²
Resultante trekkracht :	2.00 kN , X/Y positie (0 / 0)
Resultante drukkracht :	0.00 kN , X/Y positie (0 / 0)

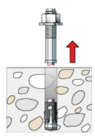
Opneembare rekenwaarde trekkracht

Berekening	Belasting kN	Capaciteit kN	Uitnutting β_N %
Staalbreuk *	1.00	18.87	5.3
Uittrekken *	1.00	8.67	11.5
Betonkegel breuk	1.00	5.81	**17.2**

* Maatgevende anker

Staalbreuk

$$N_{Ed} \leq \frac{N_{Rk,s}}{\gamma_{Ms}}$$ **($N_{Rd,s}$)**



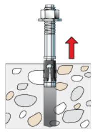
Kiosk Paal 12 (Romneyloods PODIUM) , Den Hoorn - Texel

$N_{Rk,s}$ kN	γ_{Ms}	$N_{Rd,s}$ kN	N_{Ed} kN	$\beta_{N,s}$ %
28.30	1.50	18.87	1.00	5.3

Anker nr.	$\beta_{N,s}$ %	Groep N°	Maatgevende Beta
1	5.3	1	$\beta_{N,s;1}$
2	5.3	2	$\beta_{N,s;2}$

Uittrekken

$$N_{Ed} \leq \frac{N_{Rk,p}}{\gamma_{Mp}} \quad (\mathbf{N_{Rd,p}})$$



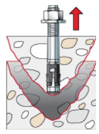
$N_{Rk,p}$ kN	Ψ_c	γ_{Mp}	$N_{Rd,p}$ kN	N_{Ed} kN	$\beta_{N,p}$ %
13.00	1.000	1.50	8.67	1.00	11.5

De gegeven Psi, c-factor is mogelijk bepaald door interpolatie.

Anker nr.	$\beta_{N,p}$ %	Groep N°	Maatgevende Beta
1, 2	11.5	1	$\beta_{N,p;1}$

Betonkegel breuk

$$N_{Ed} \leq \frac{N_{Rk,c}}{\gamma_{Mc}} \quad (\mathbf{N_{Rd,c}})$$



$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Vergelijking (7.1)

$$N_{Rk,c} = 8.71kN \cdot \frac{14{,}400mm^2}{14{,}400mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 8.71kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{20.0N/mm^2} \cdot \left(40mm\right)^{1.5} = 8.71kN$$ Vergelijking (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{60mm}\right) = 1.000 \leq 1$$ Vergelijking (7.4)

$$\Psi_{re,N} = 1.000$$ Vergelijking (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Longrightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Vergelijking (7.6)

$$\Psi_{ec,Nx} = \frac{1}{1 + \frac{2 \cdot 0mm}{120mm}} = 1.000 \leq 1 \qquad \Psi_{ec,Ny} = \frac{1}{1 + \frac{2 \cdot 0mm}{120mm}} = 1.000 \leq 1$$

$$\Psi_{M,N} = 1.00 \geq 1$$ Vergelijking (7.7)

Kiosk Paal 12 (Romneyloods PODIUM) , Den Hoorn - Texel

$N_{Rk,c}$ kN	γ_{Mc}	$N_{Rd,c}$ kN	N_{Ed} kN	$\beta_{N,c}$ %
8.71	1.50	5.81	1.00	17.2

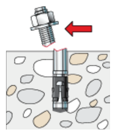
Anker nr.	$\beta_{N,c}$ %	Groep N°	Maatgevende Beta
1	17.2	1	$\beta_{N,c;1}$
2	17.2	2	$\beta_{N,c;2}$

Opneembare dwarskracht

Berekening	Belasting kN	Capaciteit kN	Uitnutting β_V %
Staalbreuk zonder hefboomsarm *	1.75	17.12	10.2
Beton achteruitbreken	1.75	15.10	**11.6**

* Maatgevende anker

Staalbreuk zonder hefboomsarm



$$V_{Ed} \leq \frac{V_{Rk,s}}{\gamma_{Ms}} \qquad (\mathbf{V_{Rd,s}})$$

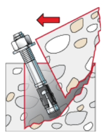
$$V_{Rk,s} = k_7 \cdot V^0_{Rk,s} = 1.00 \cdot 21.40kN = 21.40kN$$

Vergelijking (7.35)/(7.36)

$V_{Rk,s}$ kN	γ_{Ms}	$V_{Rd,s}$ kN	V_{Ed} kN	β_{Vs} %
21.40	1.25	17.12	1.75	10.2

Anker nr.	β_{Vs} %	Groep N°	Maatgevende Beta
1	10.2	1	$\beta_{Vs;1}$
2	10.2	2	$\beta_{Vs;2}$

Beton achteruitbreken



$$V_{Ed} \leq \frac{V_{Rk,cp}}{\gamma_{Mc}} \qquad (\mathbf{V_{Rd,cp}})$$

$$V_{Rk,cp} = k_8 \cdot N_{Rk,c} = 2.6 \cdot 8.71kN = 22.65kN$$

Vergelijking (7.39a)

$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$

Vergelijking (7.1)

Kiosk Paal 12 (Romneyloods PODIUM) , Den Hoorn - Texel

$$N_{Rk,c} = 8.71kN \cdot \frac{14{,}400mm^2}{14{,}400mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 8.71kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{20.0N/mm^2} \cdot \left(40mm\right)^{1.5} = 8.71kN$$ Vergelijking (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{60mm}\right) = 1.000 \leq 1$$ Vergelijking (7.4)

$$\Psi_{re,N} = 1.000$$ Vergelijking (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Vergelijking (7.6)

$$\Psi_{M,N} = 1.00 \geq 1$$ Vergelijking (7.7)

$V_{Rk,cp}$ kN	γ_{Mc}	$V_{Rd,cp}$ kN	V_{Ed} kN	$\beta_{V,cp}$ %
22.65	1.50	15.10	1.75	11.6

Anker nr.	$\beta_{V,cp}$ %	Groep N°	Maatgevende Beta
1	11.6	1	$\beta_{V,cp;1}$
2	11.6	2	$\beta_{V,cp;2}$

Uitnutting van trek- en dwarskrachten

Trekkrachten	Uitnutting βN %
Staalbreuk *	5.3
Uittrekken *	11.5
Betonkegel breuk	**17.2**

Dwarskrachten	Uitnutting βV %
Staalbreuk zonder hefboomsarm *	10.2
Beton achteruitbreken	**11.6**

* Maatgevende anker

Gecombineerde trek- en drukkracht

Uitnutting van het staal

$$\beta_{N.s} = \beta_{N,s;1} = 0.05 \leq 1$$
$$\beta_{V.s} = \beta_{Vs;1} = 0.10 \leq 1$$
$$\beta_N^2 + \beta_V^2 = \beta_{N,s;1}^2 + \beta_{Vs;1}^2 = 0.01 \leq 1$$ Vergelijking (7.55)

Uitnutting van beton

$$\beta_{N,c} = \beta_{N,c;2} = 0.17 \leq 1$$
$$\beta_{V.cp} = \beta_{V,cp;1} = 0.12 \leq 1$$
$$\beta_N^{1.5} + \beta_V^{1.5} = \beta_{N,c;1}^{1.5} + \beta_{V,cp;1}^{1.5} = 0.11 \leq 1$$ Vergelijking (7.56)

Berekening succesvol

Informatie betreffende de ankerplaat

Ankerplaat details

Ankerplaat dikte zonder berekening gekozen t = 8 mm

Profiel type Cirkelvormig buisprofiel (76,1 x 4)

Technische opmerkingen

Het overbrengen van de belasting op het beton wordt gecontroleerd voor de uiterste grenstoestand. Hierdoor zullen de controles voor het betonnen bouwdeel uitgevoerd moeten worden. Ter verificatie moeten de gegevens uit de huidige rekenmethode worden gehanteerd.

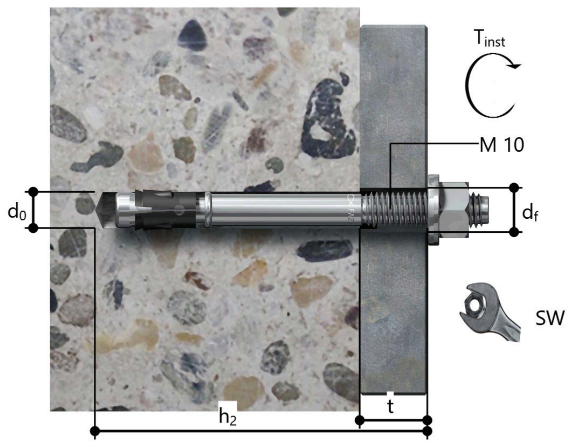
Montage gegevens

Anker

Systeem	**fischer Segmentanker FAZ II**		
Anker	Segment anker FAZ II 10/10, Elektrolytisch verzinkt staal	Artikel 94981	
Accessoires	Blaasbalg ABG	Artikel 89300	
	Quattric II 10/100/165	Artikel 549923	

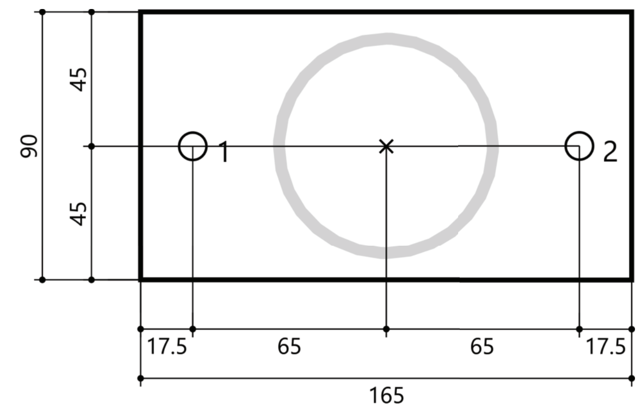
Installatie details

Draad diameter	M 10
Boor diameter	d_0 = 10 mm
Boorgat diepte	h_2 = 87 mm
Verankeringsdiepte	h_{ef} = 40 mm
Boordiepte	h_{nom} = 52 mm
Boormethode	Hamerboren
Boorgat reiniging	Boorgat met blaasbalg uitblazen.
Installatie	Doorsteek montage
Ruimte in doorvoergat	Doorvoergat niet gevult
Aandraaimoment	T_{inst} = 45.0 Nm
Sleutelwijdte	17 mm
Ankerplaat dikte	t = 8 mm
t fix	t_{fix} = 8 mm
Tfix,max	$t_{fix,\ max}$ = 30 mm



Ankerplaat details

Voetplaat materiaal	Niet beschikbaar
Ankerplaat dikte	t = 8 mm
Doorvoergat in ankerplaat	d_f=12 mm



Bijlage

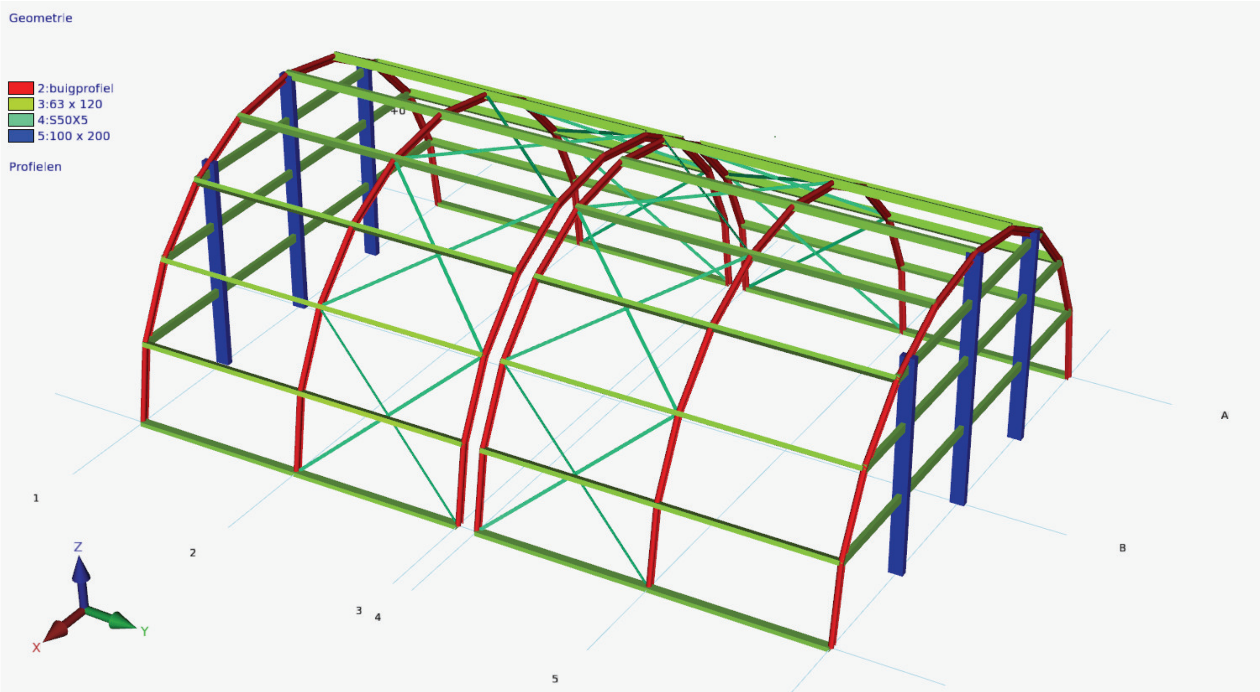
Profiel type	Cirkelvormig buisprofiel (76,1 x 4)

Anker coördinaten

Anker nr.	x mm	y mm
1	-65	0
2	65	0

projectnr:	**22063**
datum:	10-06-2022
Project:	**Kiosk Paal 12 te Den Hoorn - Texel**

bijlage **Kiosk** Bijlage B = bovenbouw
Bijlage D = reactie



Bestand :....22063\berekening\2022-06-11\kiosk.xfem

Inhoudsopgave

1.Invoergegevens spanten

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

1.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
1	0	0	0	A	A	A			
2	0	2500	0	A	A	A			
3	0	5000	0	A	A	A			
4	0	5280	0	A	A	A			
5	0	7780	0	A	A	A			
6	0	10280	0	A	A	A			
13	7330	0	0	A	A	A			
14	7330	2500	0	A	A	A			
15	7330	5000	0	A	A	A			
16	7330	5280	0	A	A	A			
17	7330	7780	0	A	A	A			
18	7330	10280	0	A	A	A			
23	179	0	1133						
24	179	2500	1133						
25	179	5000	1133						
26	179	5280	1133						
27	179	7780	1133						
28	179	10280	1133						
31	7151	0	1133						
32	7151	2500	1133						
33	7151	5000	1133						
34	7151	5280	1133						
35	7151	7780	1133						
36	7151	10280	1133						
41	700	0	2154						
42	700	2500	2154						
43	700	5000	2154						
44	700	5280	2154						
45	700	7780	2154						
46	700	10280	2154						
49	6630	0	2154						
50	6630	2500	2154						
51	6630	5000	2154						
52	6630	5280	2154						
53	6630	7780	2154						
54	6630	10280	2154						
59	1511	0	2965						
60	1511	2500	2965						
61	1511	5000	2965						
62	1511	5280	2965						
63	1511	7780	2965						
64	1511	10280	2965						
67	5819	0	2965						
68	5819	2500	2965						
69	5819	5000	2965						
70	5819	5280	2965						

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
71	5819	7780	2965						
72	5819	10280	2965						
73	1832.5	0	3129.1						
74	1832.5	10280	3129.1						
75	5497.5	0	3129.1						
76	5497.5	10280	3129.1						
77	2532	0	3486						
78	2532	2500	3486						
79	2532	5000	3486						
80	2532	5280	3486						
81	2532	7780	3486						
82	2532	10280	3486						
83	4798	0	3486						
84	4798	2500	3486						
85	4798	5000	3486						
86	4798	5280	3486						
87	4798	7780	3486						
88	4798	10280	3486						
89	3665	0	3665						
90	3665	2500	3665						
91	3665	5000	3665						
92	3665	5280	3665						
93	3665	7780	3665						
94	3665	10280	3665						

1.2 STAVEN

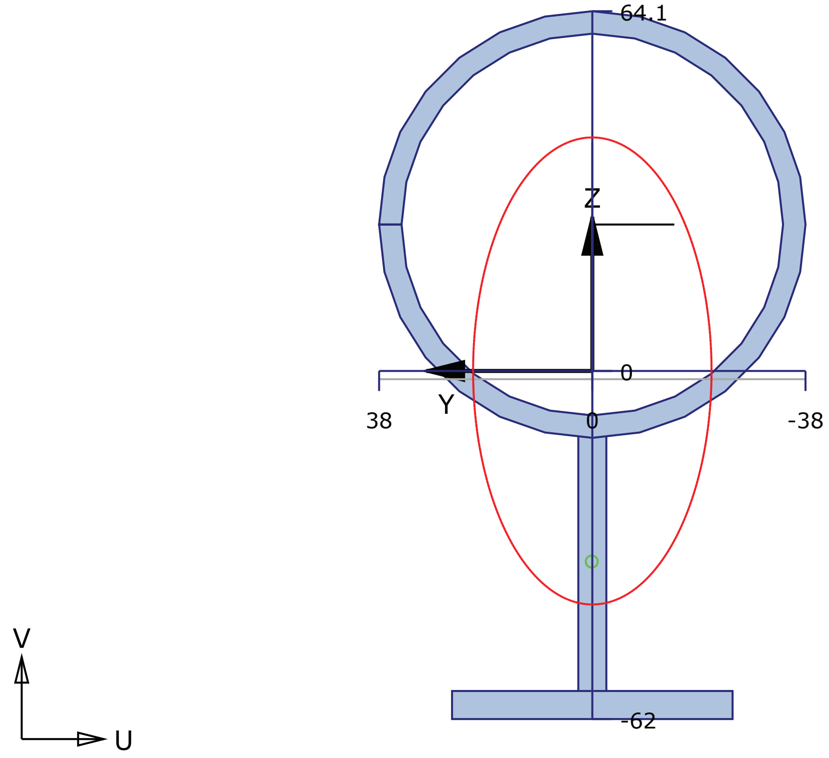
Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
13	1	23	aaaaaa	aaaaaa	buigprofiel	1147
14	2	24	aaaaaa	aaaaaa	buigprofiel	1147
15	3	25	aaaaaa	aaaaaa	buigprofiel	1147
16	4	26	aaaaaa	aaaaaa	buigprofiel	1147
17	5	27	aaaaaa	aaaaaa	buigprofiel	1147
18	6	28	aaaaaa	aaaaaa	buigprofiel	1147
19	31	13	aaaaaa	aaaaaa	buigprofiel	1147
20	32	14	aaaaaa	aaaaaa	buigprofiel	1147
21	33	15	aaaaaa	aaaaaa	buigprofiel	1147
22	34	16	aaaaaa	aaaaaa	buigprofiel	1147
23	35	17	aaaaaa	aaaaaa	buigprofiel	1147
24	36	18	aaaaaa	aaaaaa	buigprofiel	1147
53	23	41	aaaaaa	aaaaaa	buigprofiel	1146
54	24	42	aaaaaa	aaaaaa	buigprofiel	1146
55	25	43	aaaaaa	aaaaaa	buigprofiel	1146
56	26	44	aaaaaa	aaaaaa	buigprofiel	1146
57	27	45	aaaaaa	aaaaaa	buigprofiel	1146
58	28	46	aaaaaa	aaaaaa	buigprofiel	1146
59	49	31	aaaaaa	aaaaaa	buigprofiel	1146
60	50	32	aaaaaa	aaaaaa	buigprofiel	1146
61	51	33	aaaaaa	aaaaaa	buigprofiel	1146
62	52	34	aaaaaa	aaaaaa	buigprofiel	1146
63	53	35	aaaaaa	aaaaaa	buigprofiel	1146
64	54	36	aaaaaa	aaaaaa	buigprofiel	1146
83	41	59	aaaaaa	aaaaaa	buigprofiel	1147
84	42	60	aaaaaa	aaaaaa	buigprofiel	1147
85	43	61	aaaaaa	aaaaaa	buigprofiel	1147
86	44	62	aaaaaa	aaaaaa	buigprofiel	1147

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
87	45	63	aaaaaa	aaaaaa	buigprofiel	1147
88	46	64	aaaaaa	aaaaaa	buigprofiel	1147
89	67	49	aaaaaa	aaaaaa	buigprofiel	1147
90	68	50	aaaaaa	aaaaaa	buigprofiel	1147
91	69	51	aaaaaa	aaaaaa	buigprofiel	1147
92	70	52	aaaaaa	aaaaaa	buigprofiel	1147
93	71	53	aaaaaa	aaaaaa	buigprofiel	1147
94	72	54	aaaaaa	aaaaaa	buigprofiel	1147
119	59	77	aaaaaa	aaaaaa	buigprofiel	1146
120	60	78	aaaaaa	aaaaaa	buigprofiel	1146
121	61	79	aaaaaa	aaaaaa	buigprofiel	1146
122	62	80	aaaaaa	aaaaaa	buigprofiel	1146
123	63	81	aaaaaa	aaaaaa	buigprofiel	1146
124	64	82	aaaaaa	aaaaaa	buigprofiel	1146
125	83	67	aaaaaa	aaaaaa	buigprofiel	1146
126	84	68	aaaaaa	aaaaaa	buigprofiel	1146
127	85	69	aaaaaa	aaaaaa	buigprofiel	1146
128	86	70	aaaaaa	aaaaaa	buigprofiel	1146
129	87	71	aaaaaa	aaaaaa	buigprofiel	1146
130	88	72	aaaaaa	aaaaaa	buigprofiel	1146
143	77	89	aaaaaa	aaaaaa	buigprofiel	1147
144	78	90	aaaaaa	aaaaaa	buigprofiel	1147
145	79	91	aaaaaa	aaaaaa	buigprofiel	1147
146	80	92	aaaaaa	aaaaaa	buigprofiel	1147
147	81	93	aaaaaa	aaaaaa	buigprofiel	1147
148	82	94	aaaaaa	aaaaaa	buigprofiel	1147
149	89	83	aaaaaa	aaaaaa	buigprofiel	1147
150	90	84	aaaaaa	aaaaaa	buigprofiel	1147
151	91	85	aaaaaa	aaaaaa	buigprofiel	1147
152	92	86	aaaaaa	aaaaaa	buigprofiel	1147
153	93	87	aaaaaa	aaaaaa	buigprofiel	1147
154	94	88	aaaaaa	aaaaaa	buigprofiel	1147

1.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
2	buigprofiel	11.0	210000	1.397E3	1.1801E6	2.4179E6	6.3091E5

buigprofiel



Invoergegevens

1:S50X5

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-60.2 mm
Hoek		hoek	=	-90.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

2:S50X5(COPY)

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-85.6 mm
Hoek		hoek	=	-180.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

3:HFCHS761X4

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	0.0 mm
Hoek		hoek	=	-180.0 graden			
Hoogte		h	=	76.0 mm			
Flensdikte		tf	=	4.0 mm			

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	38.0 mm	z_{max}	=	62.0 mm
Minimale coördinaat	y_{min}	=	-38.0 mm	z_{min}	=	-64.1 mm

Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	1397.2 mm ^{2}	G	=	11.0 kg/m
Statisch moment	S_y	=	24809 mm ^{3}	S_z	=	11967 mm ^{3}
Traagheidsmoment	I_x	=	1180116 mm ^{4}			
Traagheidsmoment	I_y	=	2417861 mm ^{4}	I_z	=	630910 mm ^{4}
Traagheidsstraal	i_y	=	41.6 mm	i_z	=	21.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	37727 mm ^{3}	$W_{z;el}$	=	16603 mm ^{3}
Centrifugaalmoment	C_{yz}	=	2 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	2417861 mm ^{4}	I_{min}	=	630910 mm ^{4}
Traagheidsstraal	i_{max}	=	41.6 mm	i_{min}	=	21.2 mm
Halveringslijn	z_h	=	1.5 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	49593 mm ^{3}	$W_{z;pl}$	=	23935 mm ^{3}

1.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

1.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

1.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
13	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	1	0	1147
13	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	1	0	1147
14	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	2	0	1147
15	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	3	0	1147
16	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	4	0	1147
17	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	5	0	1147
18	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	6	0	1147
18	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	6	0	1147
19	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	31	0	1147
19	G-Z	q	-0.004 kN/m	0.000 kN/m	0.0	0.0	31	0	1147
20	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	32	0	1147
21	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	33	0	1147
22	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	34	0	1147
23	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	35	0	1147
24	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	36	0	1147
24	G-Z	q	-0.004 kN/m	0.000 kN/m	0.0	0.0	36	0	1147
53	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	23	0	1146
53	G-Z	q	0.000 kN/m	-0.012 kN/m	0.0	0.0	23	0	1146
54	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	24	0	1146
55	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	25	0	1146
56	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	26	0	1146
57	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	27	0	1146
58	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	28	0	1146
58	G-Z	q	0.000 kN/m	-0.012 kN/m	0.0	0.0	28	0	1146
59	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	49	0	1146
59	G-Z	q	-0.012 kN/m	0.000 kN/m	0.0	0.0	49	0	1146
60	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	50	0	1146
61	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	51	0	1146
62	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	52	0	1146

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
63	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	53	0	1146
64	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	54	0	1146
64	G-Z	q	-0.012 kN/m	0.000 kN/m	0.0	0.0	54	0	1146
83	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	41	0	1147
83	G-Z	q	0.000 kN/m	-0.014 kN/m	0.0	0.0	41	0	1147
84	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	42	0	1147
85	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	43	0	1147
86	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	44	0	1147
87	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	45	0	1147
88	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	46	0	1147
88	G-Z	q	0.000 kN/m	-0.014 kN/m	0.0	0.0	46	0	1147
89	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	67	0	1147
89	G-Z	q	-0.014 kN/m	0.000 kN/m	0.0	0.0	67	0	1147
90	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	68	0	1147
91	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	69	0	1147
92	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	70	0	1147
93	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	71	0	1147
94	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	72	0	1147
94	G-Z	q	-0.014 kN/m	0.000 kN/m	0.0	0.0	72	0	1147
119	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	59	0	1146
119	G-Z	q	-0.004 kN/m	-0.012 kN/m	0.0	0.0	59	361	785
120	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	60	0	1146
121	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	61	0	1146
122	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	62	0	1146
123	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	63	0	1146
124	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	64	0	1146
124	G-Z	q	-0.004 kN/m	-0.012 kN/m	0.0	0.0	64	361	785
124	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	64	0	361
125	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	83	0	1146
125	G-Z	q	-0.004 kN/m	0.000 kN/m	0.0	0.0	83	785	361
125	G-Z	q	-0.012 kN/m	-0.004 kN/m	0.0	0.0	83	0	785
126	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	84	0	1146
127	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	85	0	1146
128	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	86	0	1146
129	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	87	0	1146
130	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	88	0	1146
130	G-Z	q	-0.012 kN/m	-0.004 kN/m	0.0	0.0	88	0	785
143	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	77	0	1147
143	G-Z	q	-0.013 kN/m	-0.017 kN/m	0.0	0.0	77	0	1147
144	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	78	0	1147
145	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	79	0	1147
146	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	80	0	1147
147	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	81	0	1147
148	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	82	0	1147
148	G-Z	q	-0.013 kN/m	-0.017 kN/m	0.0	0.0	82	0	1147
149	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	89	0	1147
149	G-Z	q	-0.017 kN/m	-0.013 kN/m	0.0	0.0	89	0	1147
150	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	90	0	1147
151	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	91	0	1147
152	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	92	0	1147
153	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	93	0	1147
154	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	94	0	1147
154	G-Z	q	-0.017 kN/m	-0.013 kN/m	0.0	0.0	94	0	1147

1.6 BELASTINGSGEVAL 2 wind tegen as A

1.7 BELASTINGSGEVAL 3 wind tegen as 1

1.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
13	G-Y	q	0.000 kN/m	0.092 kN/m	0.0	0.0	1	0	1147
18	G-Y	q	0.000 kN/m	0.057 kN/m	0.0	0.0	6	0	1147
19	G-Y	q	0.092 kN/m	0.000 kN/m	0.0	0.0	31	0	1147
24	G-Y	q	0.057 kN/m	0.000 kN/m	0.0	0.0	36	0	1147
53	G-Y	q	0.000 kN/m	0.241 kN/m	0.0	0.0	23	0	1146
58	G-Y	q	0.000 kN/m	0.151 kN/m	0.0	0.0	28	0	1146
59	G-Y	q	0.241 kN/m	0.000 kN/m	0.0	0.0	49	0	1146
64	G-Y	q	0.151 kN/m	0.000 kN/m	0.0	0.0	54	0	1146
83	G-Y	q	0.000 kN/m	0.298 kN/m	0.0	0.0	41	0	1147
88	G-Y	q	0.000 kN/m	0.186 kN/m	0.0	0.0	46	0	1147
89	G-Y	q	0.298 kN/m	0.000 kN/m	0.0	0.0	67	0	1147
94	G-Y	q	0.186 kN/m	0.000 kN/m	0.0	0.0	72	0	1147
119	G-Y	q	0.076 kN/m	0.241 kN/m	0.0	0.0	59	361	785
124	G-Y	q	0.047 kN/m	0.151 kN/m	0.0	0.0	64	361	785
124	G-Y	q	0.000 kN/m	0.047 kN/m	0.0	0.0	64	0	361
125	G-Y	q	0.076 kN/m	0.000 kN/m	0.0	0.0	83	785	361
125	G-Y	q	0.241 kN/m	0.076 kN/m	0.0	0.0	83	0	785
130	G-Y	q	0.151 kN/m	0.047 kN/m	0.0	0.0	88	0	785
143	G-Y	q	0.268 kN/m	0.360 kN/m	0.0	0.0	77	0	1147
148	G-Y	q	0.167 kN/m	0.225 kN/m	0.0	0.0	82	0	1147
149	G-Y	q	0.360 kN/m	0.268 kN/m	0.0	0.0	89	0	1147
154	G-Y	q	0.225 kN/m	0.167 kN/m	0.0	0.0	94	0	1147

2.Berekeningsresultaten spanten

2.1 UITERSTE GRENSTOESTANDEN (UGT)

2.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		

2.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
13	1	1		**1.110**	0.011	0.000	0.000	0.000	0.000
	2	1		**-2.963**	**0.053**	**0.780**	0.000	0.000	0.000
	3	1		0.983	**-0.100**	0.000	0.000	0.000	0.000
	1	23		**-0.958**	-0.011	**0.024**	0.000	**0.014**	0.013
	2	23		**3.098**	**-0.053**	**-0.759**	0.000	**-0.876**	**0.060**
	3	23		-0.849	**0.029**	0.022	0.000	0.013	**-0.088**
14	1	2		**2.248**	-0.030	**-0.405**	**0.002**	**0.004**	-0.039
	2	2		**-6.791**	**0.057**	**3.893**	-0.015	-0.067	**-0.014**
	3	2		-0.686	**-0.066**	0.812	**-0.031**	**-0.097**	**-0.085**
	1	24		**-2.099**	0.030	**0.428**	**-0.002**	**0.476**	**0.005**
	2	24		**6.923**	**-0.057**	**-3.872**	0.015	**-4.299**	**0.078**
	3	24		0.818	**0.066**	-0.792	**0.031**	-0.821	0.009
15	1	3		1.594	-0.033	-0.288	**0.001**	**0.004**	-0.042
	2	3		**-0.288**	**0.003**	**1.699**	-0.015	0.073	**-0.015**
	3	3		**10.648**	**-0.182**	**-2.544**	**-0.028**	**0.686**	**-0.166**
	1	25		-1.445	0.033	0.311	**-0.001**	0.341	0.005
	2	25		**0.420**	**-0.003**	**-1.678**	0.015	**-2.008**	**0.019**
	3	25		**-10.516**	**0.182**	**2.565**	**0.028**	**2.293**	**-0.046**
16	1	4		**1.452**	**0.032**	**-0.251**	-0.001	-0.012	**0.042**
	2	4		-0.367	-0.004	**1.724**	**0.015**	**0.062**	0.015
	3	4		**-0.387**	**-0.037**	0.702	**-0.021**	**-0.648**	**-0.038**
	1	26		**-1.304**	**-0.032**	**0.274**	0.001	**0.314**	-0.006
	2	26		0.499	0.004	**-1.703**	**-0.015**	**-2.024**	**-0.019**
	3	26		**0.519**	**0.037**	-0.681	**0.021**	-0.145	**-0.005**
17	1	5		2.121	**0.029**	-0.367	-0.001	0.004	**0.039**
	2	5		**-6.858**	**-0.058**	**3.920**	**0.015**	**-0.068**	0.014
	3	5		**7.650**	-0.016	**-1.622**	**-0.018**	**0.059**	**0.004**
	1	27		-1.972	**-0.029**	0.391	0.001	0.433	**-0.006**
	2	27		**6.990**	**0.058**	**-3.899**	**-0.015**	**-4.327**	**-0.079**
	3	27		**-7.519**	0.016	**1.643**	**0.018**	**1.842**	-0.025
18	1	6		**1.110**	**-0.012**	0.000	0.000	0.000	0.000
	2	6		**-2.963**	-0.053	**0.780**	0.000	0.000	0.000
	3	6		0.983	**-0.096**	0.000	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
18	1	28		**-0.958**	**0.012**	**0.024**	0.000	**0.014**	**-0.014**
	2	28		**3.098**	**0.053**	**-0.759**	0.000	**-0.876**	-0.060
	3	28		-0.849	0.051	0.022	0.000	0.013	**-0.093**
19	1	31		**0.958**	**-0.011**	0.024	0.000	-0.014	**-0.013**
	2	31		**-2.332**	-0.010	**0.741**	0.000	**-0.832**	-0.012
	3	31		0.849	**0.029**	**0.022**	0.000	**-0.013**	**0.088**
	1	13		**-1.110**	**0.011**	0.000	0.000	0.000	0.000
	2	13		**2.197**	0.010	**-0.720**	0.000	0.000	0.000
	3	13		-0.983	**-0.100**	0.000	0.000	0.000	0.000
20	1	32		**2.102**	0.030	**0.430**	**-0.002**	**-0.477**	**-0.005**
	2	32		**-12.652**	**-0.026**	-0.535	**0.041**	0.595	**-0.054**
	3	32		-0.818	**0.066**	**-0.791**	0.031	**0.820**	-0.010
	1	14		**-2.250**	-0.030	**-0.406**	**0.002**	**-0.004**	0.039
	2	14		**12.521**	**0.026**	0.556	**-0.041**	0.034	**0.026**
	3	14		0.687	**-0.066**	**0.812**	-0.031	**0.097**	**0.085**
21	1	33		1.445	0.033	0.310	**-0.001**	-0.344	-0.005
	2	33		**-4.928**	**-0.011**	**0.186**	**0.036**	**-0.151**	**-0.038**
	3	33		**10.530**	**0.181**	**2.566**	0.028	**-2.298**	**0.045**
	1	15		-1.594	-0.033	-0.286	**0.001**	**0.001**	0.042
	2	15		**4.797**	**0.011**	**-0.165**	**-0.036**	-0.037	**0.026**
	3	15		**-10.662**	**-0.181**	**-2.545**	-0.028	**-0.682**	**0.166**
22	1	34		**1.293**	**-0.033**	**0.278**	0.001	**-0.314**	0.005
	2	34		**-5.015**	0.011	0.165	**-0.036**	-0.132	**0.038**
	3	34		-0.527	**0.038**	**-0.677**	**0.021**	**0.144**	**0.005**
	1	16		**-1.442**	**0.033**	**-0.255**	-0.001	0.007	**-0.043**
	2	16		**4.884**	-0.011	-0.144	**0.036**	**-0.032**	-0.026
	3	16		0.395	**-0.038**	**0.698**	**-0.021**	**0.644**	**0.038**
23	1	35		1.937	**-0.030**	0.394	0.001	-0.436	**0.005**
	2	35		**-12.750**	**0.027**	**-0.559**	**-0.041**	**0.622**	**0.055**
	3	35		**7.478**	0.016	**1.644**	**0.018**	**-1.843**	0.025
	1	17		-2.085	**0.030**	-0.370	-0.001	-0.004	**-0.039**
	2	17		**12.618**	**-0.027**	**0.580**	**0.041**	**0.034**	-0.026
	3	17		**-7.610**	-0.016	**-1.623**	**-0.018**	**-0.059**	**-0.004**
24	1	36		**0.958**	0.012	0.024	0.000	-0.014	0.014
	2	36		**-2.332**	**0.011**	**0.741**	0.000	**-0.832**	**0.012**
	3	36		0.849	**0.051**	**0.022**	0.000	**-0.013**	**0.093**
	1	18		**-1.110**	-0.012	0.000	0.000	0.000	0.000
	2	18		**2.197**	**-0.011**	**-0.720**	0.000	0.000	0.000
	3	18		-0.983	**-0.096**	0.000	0.000	0.000	0.000
53	1	23		**0.796**	**-0.024**	**0.045**	0.004	**-0.014**	-0.013
	2	23		**-3.579**	-0.002	**-0.224**	**0.019**	**0.876**	**-0.057**
	3	23		0.705	**0.153**	0.039	**-0.027**	-0.013	**0.084**
	1		723	-0.796	-0.024	0.000	-0.004	**0.002**	-0.005
	3		723	-0.705	0.226	0.000	0.027	**0.002**	0.044
	1	41		**-0.655**	**0.024**	0.027	-0.004	**0.004**	**-0.015**
	2	41		**3.704**	0.002	**0.288**	**-0.019**	**-0.580**	0.057
	3	41		-0.580	**-0.339**	**0.024**	**0.027**	0.003	**0.161**
54	1	24		**1.888**	-0.014	**0.121**	0.003	**-0.476**	**-0.004**
	2	24		**-7.833**	**-0.015**	**0.408**	**0.010**	**4.299**	**-0.079**
	3	24		-1.235	**0.264**	0.388	**-0.026**	0.821	-0.018
	1	42		**-1.754**	0.014	**-0.052**	-0.003	**0.377**	**-0.012**
	2	42		**7.951**	**0.015**	**-0.347**	**-0.010**	**-4.704**	0.067
	3	42		1.353	**-0.264**	-0.328	**0.026**	-1.231	**0.322**
55	1	25		1.350	**-0.013**	**0.091**	**0.003**	-0.341	-0.004
	2	25		**-0.945**	0.130	**0.902**	-0.008	**2.008**	**-0.023**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
55	3	25		**10.686**	**0.390**	0.768	**-0.041**	**-2.293**	**0.035**
	1	43		-1.216	**0.013**	**-0.022**	**-0.003**	0.276	**-0.011**
	2	43		**1.064**	-0.130	**-0.841**	0.008	**-3.003**	0.172
	3	43		**-10.568**	**-0.390**	-0.708	**0.041**	**1.450**	**0.400**
56	1	26		**1.204**	0.013	**0.082**	-0.003	**-0.314**	0.005
	2	26		**-1.028**	**-0.131**	**0.901**	**0.008**	**2.024**	**0.023**
	3	26		-0.811	**0.173**	0.433	**-0.021**	0.145	**-0.002**
	1	44		**-1.070**	-0.013	**-0.013**	0.003	**0.260**	0.010
	2	44		**1.146**	**0.131**	**-0.840**	**-0.008**	**-3.018**	**-0.174**
	3	44		0.929	**-0.173**	-0.372	**0.021**	-0.606	**0.201**
57	1	27		1.756	**0.014**	**0.117**	**-0.003**	-0.433	**0.005**
	2	27		**-7.905**	0.015	0.412	-0.010	**4.327**	**0.080**
	3	27		**7.445**	**0.233**	**0.659**	**-0.025**	**-1.842**	0.019
	1	45		-1.622	**-0.014**	**-0.049**	**0.003**	0.338	0.011
	2	45		**8.024**	-0.015	-0.352	0.010	**-4.738**	**-0.068**
	3	45		**-7.326**	**-0.233**	**-0.598**	**0.025**	**1.122**	**0.243**
58	1	28		**0.796**	0.023	**0.045**	**-0.004**	**-0.014**	**0.013**
	2	28		**-3.579**	**0.002**	**-0.224**	-0.019	**0.876**	0.057
	3	28		0.705	**0.166**	0.039	**-0.029**	-0.013	**0.089**
	3		723	-0.705	0.212	0.000	0.029	**0.002**	0.042
	1		723	-0.796	0.023	0.000	0.004	**0.002**	0.004
	1	46		**-0.655**	-0.023	0.027	**0.004**	**0.004**	0.014
	2	46		**3.704**	**-0.002**	**0.288**	0.019	**-0.580**	**-0.057**
	3	46		-0.580	**-0.283**	**0.024**	**0.029**	0.003	**0.146**
59	1	49		**0.655**	**0.024**	**0.027**	**-0.004**	-0.004	**0.015**
	2	49		**-2.473**	-0.025	**-0.151**	-0.004	**-0.620**	-0.040
	3	49		0.580	**-0.339**	0.024	**0.027**	**-0.003**	**-0.162**
	1		423	-0.655	0.024	0.000	0.004	**0.002**	-0.004
	3		423	-0.580	-0.226	0.000	-0.027	**0.002**	0.044
	1	31		**-0.796**	**-0.024**	0.045	**0.004**	0.014	**0.013**
	2	31		**2.348**	0.025	**0.215**	0.004	**0.832**	0.011
	3	31		-0.705	**0.153**	**0.039**	**-0.027**	**0.013**	**-0.084**
60	1	50		**1.757**	**0.014**	**-0.052**	**-0.003**	**-0.379**	**0.012**
	2	50		**-13.151**	0.005	**-0.343**	0.022	1.047	-0.062
	3	50		-1.354	**-0.264**	-0.327	**0.026**	**1.229**	**-0.323**
	1	32		**-1.891**	**-0.014**	**0.120**	**0.003**	**0.477**	**0.004**
	2	32		**13.032**	-0.005	**0.404**	-0.022	-0.595	**0.065**
	3	32		1.235	**0.264**	0.388	**-0.026**	**-0.820**	0.019
61	1	51		1.216	**0.013**	**-0.024**	**-0.003**	-0.278	**0.011**
	2	51		**-5.165**	-0.028	-0.144	0.022	**0.061**	-0.081
	3	51		**10.581**	**-0.391**	**-0.711**	**0.041**	**-1.451**	**-0.401**
	1	33		-1.350	**-0.013**	**0.092**	**0.003**	0.344	0.004
	2	33		**5.046**	0.028	0.204	-0.022	**0.151**	**0.047**
	3	33		**-10.700**	**0.391**	**0.771**	**-0.041**	**2.298**	**-0.034**
62	1	52		**1.062**	-0.013	**-0.007**	0.003	**-0.268**	-0.010
	2	52		**-5.254**	**0.029**	-0.137	**-0.022**	0.072	**0.082**
	3	52		-0.936	**-0.173**	**-0.366**	**0.021**	**0.599**	**-0.201**
	1	34		**-1.196**	0.013	**0.075**	-0.003	**0.314**	-0.005
	2	34		**5.135**	**-0.029**	0.197	**0.022**	0.132	**-0.047**
	3	34		0.818	**0.173**	**0.427**	**-0.021**	**-0.144**	**0.002**
63	1	53		1.589	-0.014	**-0.035**	0.003	-0.357	-0.011
	2	53		**-13.251**	**-0.006**	-0.336	**-0.022**	**1.066**	**0.063**
	3	53		**7.289**	**-0.233**	**-0.585**	**0.025**	**-1.139**	**-0.243**
	1	35		-1.723	0.014	**0.103**	-0.003	0.436	**-0.005**
	2	35		**13.132**	**0.006**	0.397	**0.022**	**-0.622**	**-0.065**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
63	3	35		**-7.407**	**0.233**	**0.645**	**-0.025**	**1.843**	-0.019
64	1	54		**0.655**	-0.024	**0.027**	0.004	-0.004	-0.014
	2	54		**-2.473**	**0.025**	**-0.151**	**0.004**	**-0.620**	**0.040**
	3	54		0.581	**-0.283**	0.024	**0.029**	**-0.003**	**-0.146**
	1		423	-0.655	-0.024	0.000	-0.004	**0.002**	0.004
	3		423	-0.581	-0.212	0.000	-0.029	**0.002**	0.042
	1	36		**-0.796**	0.024	0.045	-0.004	0.014	-0.013
	2	36		**2.348**	**-0.025**	**0.215**	**-0.004**	**0.832**	**-0.011**
	3	36		-0.706	**0.166**	**0.039**	**-0.029**	**0.013**	**-0.089**
83	1	41		**0.496**	**0.010**	**0.056**	**-0.001**	**-0.004**	**0.015**
	2	41		**-3.584**	-0.035	**-0.548**	**0.035**	**0.580**	-0.048
	3	41		0.441	**-0.264**	0.049	0.024	-0.003	**-0.162**
	3		580	-0.441	-0.206	0.000	-0.024	**0.011**	0.020
	1		580	-0.496	0.010	0.000	0.001	**0.013**	-0.009
	1	59		**-0.383**	**-0.010**	0.058	**0.001**	0.004	-0.003
	2	59		**3.684**	**0.035**	**0.649**	**-0.035**	**0.103**	**0.013**
	3	59		-0.340	0.033	**0.051**	-0.024	**0.003**	**-0.054**
84	1	42		1.365	**0.008**	**0.323**	**-0.001**	**-0.377**	**0.012**
	2	42		**-13.172**	-0.045	**-3.925**	0.031	**4.704**	-0.061
	3	42		**2.464**	**-0.444**	-0.987	**0.074**	1.231	**-0.315**
	1	60		-1.258	**-0.008**	**-0.217**	**0.001**	**0.066**	-0.003
	2	60		**13.266**	0.045	**4.019**	-0.031	**-0.235**	**0.027**
	3	60		**-2.370**	**0.444**	1.082	**-0.074**	-0.039	**-0.203**
85	1	43		0.979	**0.003**	0.248	**-0.001**	-0.276	**0.011**
	2	43		**-6.219**	-0.194	**-2.116**	0.045	**3.003**	-0.166
	3	43		**3.750**	**-0.561**	**0.774**	**0.084**	**-1.450**	**-0.393**
	1	61		-0.873	**-0.003**	-0.142	**0.001**	0.052	**-0.007**
	2	61		**6.313**	0.194	**2.211**	-0.045	**-0.538**	-0.046
	3	61		**-3.656**	**0.561**	**-0.679**	**-0.084**	**0.604**	**-0.263**
86	1	44		0.903	-0.003	**0.250**	0.000	**-0.260**	-0.010
	2	44		**-6.265**	**0.196**	**-2.118**	**-0.045**	**3.018**	**0.168**
	3	44		**1.446**	**-0.263**	-0.425	**0.042**	0.606	**-0.198**
	1	62		-0.796	0.003	**-0.144**	0.000	**0.033**	0.007
	2	62		**6.359**	**-0.196**	**2.212**	**0.045**	**-0.551**	**0.046**
	3	62		**-1.352**	**0.263**	0.519	**-0.042**	-0.063	**-0.106**
87	2	45		**-13.238**	**0.046**	**-3.942**	**-0.031**	**4.738**	**0.062**
	3	45		**2.813**	**-0.334**	**0.708**	**0.051**	**-1.122**	**-0.239**
	1	63		-1.161	0.007	-0.200	-0.001	0.046	**0.003**
	2	63		**13.332**	**-0.046**	**4.036**	**0.031**	**-0.251**	-0.027
	3	63		**-2.719**	**0.334**	**-0.614**	**-0.051**	**0.356**	**-0.150**
88	1	46		**0.496**	-0.009	**0.056**	0.000	**-0.004**	-0.014
	2	46		**-3.584**	**0.035**	**-0.548**	**-0.035**	**0.580**	**0.049**
	3	46		0.440	**-0.222**	0.049	**0.017**	-0.003	**-0.148**
	3		579	-0.440	-0.186	0.000	-0.017	**0.011**	0.026
	1		580	-0.496	-0.009	0.000	0.000	**0.013**	0.009
	1	64		**-0.383**	0.009	0.058	0.000	0.004	**0.004**
	2	64		**3.684**	**-0.035**	**0.649**	**0.035**	**0.103**	-0.013
	3	64		-0.340	**0.077**	**0.051**	**-0.017**	**0.003**	**-0.052**
89	1	67		**0.383**	**-0.010**	**0.058**	**0.001**	-0.004	0.003
	2	67		**-2.240**	0.009	**-0.447**	-0.016	**-0.050**	**-0.029**
	3	67		0.340	**0.034**	0.051	**-0.024**	**-0.003**	**0.055**
	1		567	-0.383	-0.010	0.000	-0.001	**0.013**	-0.009
	3		568	-0.340	0.207	0.000	0.024	**0.011**	0.020
	1	49		**-0.496**	**0.010**	0.056	**-0.001**	0.004	**-0.015**
	2	49		**2.139**	-0.009	**0.548**	0.016	**0.620**	0.037

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
89	3	49		-0.441	**-0.265**	**0.049**	**0.024**	**0.003**	**0.162**
90	1	68		1.260	**-0.008**	**-0.217**	0.001	**-0.068**	0.003
	2	68		**-13.764**	0.027	0.595	**0.002**	**0.474**	**-0.047**
	3	68		**2.374**	**0.447**	**1.083**	**-0.075**	0.037	**0.205**
	1	50		-1.367	**0.008**	**0.323**	-0.001	**0.379**	**-0.012**
	2	50		**13.670**	-0.027	-0.501	**-0.002**	-1.047	0.066
	3	50		**-2.469**	**-0.447**	**-0.989**	**0.075**	**-1.229**	**0.315**
91	1	69		0.873	**-0.003**	-0.142	**0.001**	**-0.053**	0.007
	2	69		**-6.062**	0.052	**0.294**	-0.004	-0.207	**-0.029**
	3	69		**3.657**	**0.564**	**-0.681**	**-0.085**	**-0.604**	**0.265**
	1	51		-0.979	**0.003**	0.249	**-0.001**	0.278	**-0.011**
	2	51		**5.968**	-0.052	**-0.200**	0.004	**-0.061**	0.084
	3	51		**-3.751**	**-0.564**	**0.775**	**0.085**	**1.451**	**0.394**
92	1	70		0.787	0.003	**-0.135**	-0.001	-0.051	**-0.007**
	2	70		**-6.136**	**-0.053**	0.301	**0.004**	**-0.203**	0.029
	3	70		**1.341**	**0.262**	**0.526**	**-0.042**	**0.049**	**0.105**
	1	52		-0.893	-0.003	**0.241**	0.001	**0.268**	0.010
	2	52		**6.041**	**0.053**	-0.207	**-0.004**	-0.072	**-0.084**
	3	52		**-1.435**	**-0.262**	**-0.431**	**0.042**	**-0.599**	**0.198**
93	1	71		1.163	0.008	-0.205	**-0.001**	-0.059	**-0.003**
	2	71		**-13.847**	**-0.027**	**0.605**	-0.002	**0.483**	0.048
	3	71		**2.719**	**0.333**	**-0.618**	**-0.051**	**-0.368**	**0.149**
	1	53		-1.269	-0.008	0.312	**0.001**	0.357	0.012
	2	53		**13.753**	**0.027**	**-0.511**	0.002	**-1.066**	**-0.066**
	3	53		**-2.814**	**-0.333**	**0.712**	**0.051**	**1.139**	**0.239**
94	1	72		**0.383**	0.010	**0.058**	0.000	-0.004	**-0.003**
	2	72		**-2.240**	**-0.009**	**-0.447**	**0.016**	**-0.050**	0.029
	3	72		0.340	**0.077**	0.051	**-0.018**	**-0.003**	**0.052**
	3		567	-0.340	0.185	0.000	0.018	**0.011**	0.026
	1		567	-0.383	0.010	0.000	0.000	**0.013**	0.009
	1	54		**-0.496**	-0.010	0.056	0.000	0.004	0.015
	2	54		**2.139**	**0.009**	**0.548**	**-0.016**	**0.620**	**-0.037**
	3	54		-0.441	**-0.221**	**0.049**	**0.018**	**0.003**	**0.148**
119	2	59		**-2.882**	-0.113	**0.589**	**0.037**	**-0.103**	-0.002
	3	59		0.307	-1.801	-0.072	0.006	-0.003	**0.058**
	2	73		2.882	-0.110	0.554	-0.037	**0.104**	-0.038
	3	73		-0.307	**-1.802**	-0.110	-0.006	-0.036	-0.709
	2	73		**3.907**	-0.111	**-1.150**	**-0.037**	0.104	-0.038
	3	73		-0.415	**1.224**	0.115	-0.006	-0.036	**-0.709**
	1	77		-0.415	-0.004	-0.031	**0.002**	-0.023	0.001
	2	77		**3.952**	0.115	**1.239**	**-0.037**	**0.833**	-0.125
	3	77		-0.371	-1.392	-0.028	-0.006	-0.021	**0.307**
120	1	60		1.007	0.004	**0.354**	**-0.002**	**-0.066**	0.003
	2	60		**-12.175**	**-0.130**	**-2.374**	**0.037**	**0.235**	**-0.016**
	3	60		**2.482**	**0.383**	-0.510	0.008	0.039	**0.216**
	1	78		-0.939	-0.004	**-0.220**	**0.002**	**-0.264**	0.002
	2	78		**12.235**	**0.130**	**2.493**	**-0.037**	**2.457**	**-0.117**
	3	78		**-2.422**	**-0.383**	0.629	-0.008	0.619	**0.217**
121	1	61		0.725	0.014	0.284	**-0.003**	-0.052	**0.007**
	2	61		**-5.721**	**-0.030**	**-1.280**	**0.029**	**0.538**	0.058
	3	61		**3.212**	**0.478**	**1.667**	-0.001	**-0.604**	**0.276**
	1	79		-0.657	-0.014	-0.150	**0.003**	-0.197	0.009
	2	79		**5.782**	**0.030**	**1.398**	**-0.029**	**0.971**	**-0.085**
	3	79		**-3.151**	**-0.478**	**-1.549**	0.001	**-1.254**	**0.265**
122	1	62		0.652	**-0.012**	**0.262**	0.003	**-0.033**	-0.006

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
122	2	62		**-5.765**	0.031	**-1.295**	**-0.029**	**0.551**	**-0.058**
	3	62		**1.391**	**0.209**	-0.183	**0.007**	0.063	**0.114**
	1	80		-0.583	**0.012**	**-0.128**	-0.003	**-0.190**	**-0.008**
	2	80		**5.825**	-0.031	**1.414**	**0.029**	**0.976**	0.086
	3	80		**-1.331**	**-0.209**	0.302	**-0.007**	0.216	**0.123**
123	1	63		0.920	**-0.003**	0.309	0.001	-0.046	**-0.003**
	2	63		**-12.232**	0.131	**-2.410**	**-0.038**	**0.251**	0.016
	3	63		**2.290**	**0.278**	**1.210**	**0.002**	**-0.356**	**0.159**
	1	81		-0.852	**0.003**	-0.175	-0.001	-0.232	**-0.001**
	2	81		**12.292**	-0.131	**2.529**	**0.038**	**2.481**	0.118
	3	81		**-2.229**	**-0.278**	**-1.091**	**-0.002**	**-0.971**	**0.157**
124	2	64		**-2.883**	0.115	**0.589**	**-0.038**	**-0.103**	0.002
	3	64		0.307	**-1.100**	-0.072	0.000	-0.003	**0.055**
	2	74		2.883	0.111	0.553	0.038	**0.104**	0.038
	2	74		**3.907**	0.112	**-1.150**	**0.038**	0.104	0.038
	3	74		-0.415	**0.802**	0.115	0.000	-0.036	**-0.451**
	1	82		-0.415	0.003	-0.031	**-0.001**	-0.023	0.000
	2	82		**3.952**	-0.116	**1.239**	0.038	**0.833**	0.126
	3	82		-0.371	-0.907	-0.028	0.000	-0.020	**0.213**
125	2	83		**-4.472**	0.030	**0.598**	**-0.024**	0.159	0.006
	3	83		0.371	**-1.399**	-0.028	-0.006	0.021	-0.308
	1	75		-0.322	-0.004	0.124	-0.002	**-0.040**	-0.002
	2	75		**4.472**	0.025	0.512	0.024	**0.595**	0.013
	2	75		3.099	0.025	**-1.769**	**0.024**	0.595	**0.013**
	3	75		-0.371	-1.230	-0.115	0.006	-0.036	**-0.712**
	3	75		-0.287	**1.796**	0.110	0.006	-0.036	-0.712
	2	67		3.079	-0.029	**1.809**	**0.024**	0.050	**0.022**
	3	67		-0.307	**-1.813**	-0.072	0.006	0.003	-0.059
126	1	84		0.941	-0.004	**-0.221**	**0.002**	**0.263**	**-0.002**
	2	84		**-13.699**	**0.048**	**1.217**	**-0.013**	**-0.785**	-0.007
	3	84		**2.426**	**-0.385**	0.629	-0.008	-0.622	**-0.218**
	1	68		-1.009	0.004	**0.355**	**-0.002**	**0.068**	-0.003
	2	68		**13.639**	**-0.048**	**-1.098**	**0.013**	**-0.474**	**0.046**
	3	68		**-2.487**	**0.385**	-0.510	0.008	-0.037	**-0.218**
127	1	85		0.657	-0.014	-0.150	**0.003**	0.197	**-0.009**
	2	85		**-6.101**	**0.012**	**0.411**	**-0.012**	**-0.599**	-0.019
	3	85		**3.152**	**-0.481**	**-1.550**	0.001	**1.255**	**-0.266**
	1	69		-0.725	0.014	0.284	**-0.003**	**0.053**	-0.007
	2	69		**6.040**	**-0.012**	**-0.293**	**0.012**	0.207	**0.026**
	3	69		**-3.213**	**0.481**	**1.669**	-0.001	**0.604**	**-0.278**
128	1	86		0.577	**0.013**	**-0.117**	-0.003	**0.160**	0.009
	2	86		**-6.169**	-0.012	**0.441**	**0.013**	**-0.628**	**0.020**
	3	86		**1.322**	**-0.206**	0.311	**-0.008**	-0.241	**-0.122**
	1	70		-0.646	**-0.013**	**0.251**	0.003	0.051	**0.006**
	2	70		**6.108**	0.012	**-0.322**	**-0.013**	**0.203**	-0.026
	3	70		**-1.383**	**0.206**	-0.193	**0.008**	**-0.049**	**-0.113**
129	1	87		0.852	**0.004**	-0.180	-0.002	0.224	0.002
	2	87		**-13.775**	-0.048	**1.252**	**0.013**	**-0.815**	**0.007**
	3	87		**2.229**	**-0.276**	**-1.095**	**-0.003**	**0.963**	**-0.155**
	1	71		-0.920	**-0.004**	0.314	0.002	0.059	**0.003**
	2	71		**13.715**	0.048	**-1.133**	**-0.013**	**-0.483**	-0.046
	3	71		**-2.289**	**0.276**	**1.214**	**0.003**	**0.368**	**-0.158**
130	2	88		**-4.472**	-0.030	**0.598**	**0.024**	0.159	-0.006
	3	88		0.371	**-0.903**	-0.028	-0.001	0.021	-0.211
	1	76		-0.322	0.004	0.123	0.001	**-0.040**	**0.002**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
130	2	76		**4.472**	-0.025	0.512	-0.024	**0.595**	-0.014
	2	76		3.098	-0.026	**-1.769**	**-0.024**	0.595	-0.014
	3	76		-0.371	-0.797	-0.115	0.001	-0.036	**-0.449**
	3	76		-0.288	**1.094**	0.110	0.001	-0.036	-0.449
	1	72		-0.344	-0.004	-0.081	0.001	0.004	**0.003**
	2	72		3.079	0.029	**1.809**	**-0.024**	0.050	-0.023
	3	72		-0.307	**-1.093**	-0.072	0.001	0.003	-0.055
143	1	77		**0.364**	0.004	0.024	-0.001	**0.023**	-0.002
	2	77		**-3.955**	**0.063**	**1.028**	**-0.003**	**-0.833**	**0.131**
	3	77		0.325	**-1.041**	**0.021**	**0.101**	0.021	**-0.290**
	3		161	-0.325	-0.982	0.000	-0.101	**0.022**	0.127
	1		167	-0.364	0.004	0.000	0.001	**0.025**	0.003
	1	89		**-0.337**	-0.004	**0.145**	0.001	**0.046**	**0.007**
	2	89		**3.979**	**-0.063**	**-0.878**	**0.003**	**-0.259**	-0.058
	3	89		-0.301	**0.555**	0.129	**-0.101**	0.041	**-0.640**
144	1	78		1.284	0.004	**0.086**	**-0.001**	**0.264**	-0.002
	2	78		**-13.234**	**0.069**	0.011	-0.001	**-2.457**	**0.123**
	3	78		**2.591**	**-0.588**	**-0.160**	**0.075**	-0.619	**-0.204**
	2		378	13.234	0.069	0.000	0.001	**-2.449**	-0.097
	1		665	-1.284	0.004	0.000	0.001	**0.292**	0.005
	1	90		-1.260	-0.004	**0.063**	**0.001**	**-0.277**	**0.007**
	2	90		**13.255**	**-0.069**	0.121	0.001	**2.483**	-0.043
	3	90		**-2.570**	**0.588**	**0.292**	**-0.075**	0.881	**-0.476**
145	1	79		**1.040**	-0.009	0.056	0.000	0.197	-0.010
	2	79		**-6.376**	**0.025**	**-0.179**	0.001	**-0.971**	**0.090**
	3	79		-1.044	**-0.670**	**0.364**	**0.081**	**1.254**	**-0.252**
	1		436	-1.040	-0.009	0.000	0.000	**0.210**	0.006
	1	91		**-1.017**	0.009	0.092	0.000	-0.177	0.000
	2	91		**6.397**	**-0.025**	**0.311**	-0.001	**1.236**	-0.061
	3	91		1.065	**0.670**	**-0.232**	**-0.081**	**-1.594**	**-0.515**
146	1	80		0.948	**0.008**	**0.057**	0.000	**0.190**	**0.008**
	2	80		**-6.427**	-0.026	**-0.182**	**-0.001**	**-0.976**	-0.091
	3	80		**2.016**	**-0.347**	-0.133	**0.045**	-0.216	**-0.115**
	1		444	-0.948	0.008	0.000	0.000	**0.203**	-0.005
	1	92		-0.924	**-0.008**	**0.091**	0.000	**-0.171**	0.001
	2	92		**6.447**	0.026	**0.314**	**0.001**	**1.244**	**0.061**
	3	92		**-1.995**	**0.347**	0.265	**-0.045**	0.445	**-0.285**
147	1	81		**1.188**	**-0.005**	0.098	0.001	0.232	**0.001**
	2	81		**-13.289**	-0.070	**0.017**	**0.001**	**-2.481**	-0.124
	3	81		0.149	**-0.408**	**0.226**	**0.051**	**0.971**	**-0.148**
	2		434	13.289	-0.070	0.000	-0.001	**-2.470**	0.094
	1		758	-1.188	-0.005	0.000	-0.001	**0.269**	-0.005
	1	93		**-1.165**	**0.005**	0.051	-0.001	-0.259	-0.007
	2	93		**13.310**	0.070	**0.115**	**-0.001**	**2.499**	**0.044**
	3	93		-0.128	**0.408**	**-0.094**	**-0.051**	**-1.155**	**-0.320**
148	1	82		**0.364**	**-0.005**	0.024	**0.001**	**0.023**	**0.001**
	2	82		**-3.955**	-0.064	**1.028**	0.003	**-0.833**	-0.132
	3	82		0.324	**-0.685**	**0.021**	**0.066**	0.020	**-0.202**
	3		162	-0.324	-0.648	0.000	-0.066	**0.022**	0.094
	1		168	-0.364	-0.005	0.000	-0.001	**0.025**	-0.001
	1	94		**-0.337**	**0.005**	**0.145**	**-0.001**	**0.046**	-0.006
	2	94		**3.979**	0.064	**-0.878**	-0.003	**-0.259**	**0.058**
	3	94		-0.301	**0.382**	0.129	**-0.066**	0.041	**-0.419**
149	1	89		**0.337**	**-0.004**	**0.145**	**0.001**	**-0.046**	**-0.007**
	2	89		**-4.421**	0.039	**-0.011**	-0.021	**0.259**	0.054

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
149	3	89		0.301	**0.557**	0.129	**-0.101**	-0.041	**0.640**
	1		980	-0.337	-0.004	0.000	-0.001	**0.025**	0.003
	3		986	-0.301	0.983	0.000	0.101	**0.022**	0.128
	1	83		**-0.364**	**0.004**	0.024	**-0.001**	-0.023	0.002
	2	83		**4.397**	-0.039	**0.161**	0.021	**-0.159**	**-0.013**
	3	83		-0.325	**-1.042**	**0.021**	**0.101**	**-0.021**	**0.291**
150	1	90		1.260	**-0.004**	**0.062**	**0.001**	**0.277**	**-0.007**
	2	90		**-13.657**	0.049	**1.580**	-0.014	**-2.483**	0.041
	3	90		**2.571**	**0.589**	0.289	**-0.075**	-0.881	**0.476**
	1		475	-1.260	-0.004	0.000	-0.001	**0.292**	0.005
	1	84		-1.284	**0.004**	**0.087**	**-0.001**	**-0.263**	**0.002**
	2	84		**13.636**	-0.049	**-1.448**	0.014	**0.785**	0.002
	3	84		**-2.591**	**-0.589**	-0.158	**0.075**	0.622	**0.205**
151	1	91		**1.017**	**0.009**	0.092	0.000	0.177	0.000
	2	91		**-6.532**	0.069	**0.623**	-0.018	**-1.236**	0.058
	3	91		-1.065	**0.671**	**-0.231**	**-0.081**	**1.594**	**0.515**
	1		709	-1.017	0.009	0.000	0.000	**0.209**	0.006
	1	85		**-1.040**	**-0.009**	0.057	0.000	-0.197	**0.010**
	2	85		**6.511**	-0.069	**-0.491**	0.018	**0.599**	0.015
	3	85		1.044	**-0.671**	**0.363**	**0.081**	**-1.255**	**0.253**
152	1	92		0.929	-0.009	**0.065**	0.000	**0.171**	-0.001
	2	92		**-6.579**	**-0.069**	**0.604**	**0.018**	**-1.244**	**-0.059**
	3	92		**1.999**	**0.345**	0.243	**-0.045**	-0.445	**0.285**
	1		498	-0.929	-0.009	0.000	0.000	**0.187**	-0.004
	1	86		-0.952	0.009	**0.084**	0.000	**-0.160**	-0.009
	2	86		**6.558**	**0.069**	**-0.472**	**-0.018**	**0.628**	**-0.015**
	3	86		**-2.020**	**-0.345**	-0.111	**0.045**	0.241	**0.113**
153	1	93		**1.166**	0.004	0.044	-0.001	0.259	0.007
	2	93		**-13.711**	**-0.049**	**1.569**	**0.014**	**-2.499**	**-0.042**
	3	93		0.129	**0.407**	**-0.101**	**-0.050**	**1.155**	**0.320**
	1		338	-1.166	0.004	0.000	0.001	**0.267**	-0.005
	1	87		**-1.190**	-0.004	0.105	0.001	-0.224	-0.002
	2	87		**13.690**	**0.049**	**-1.437**	**-0.014**	**0.815**	**-0.002**
	3	87		-0.150	**-0.407**	**0.233**	**0.050**	**-0.963**	**0.147**
154	1	94		**0.337**	0.004	**0.145**	-0.001	**-0.046**	0.006
	2	94		**-4.421**	**-0.039**	**-0.011**	**0.021**	**0.259**	**-0.055**
	3	94		0.301	**0.380**	0.129	**-0.066**	-0.041	**0.419**
	1		980	-0.337	0.004	0.000	0.001	**0.025**	-0.002
	3		986	-0.301	0.647	0.000	0.066	**0.022**	0.093
	1	88		**-0.364**	-0.004	0.024	0.001	-0.023	**-0.002**
	2	88		**4.397**	**0.039**	**0.161**	**-0.021**	**-0.159**	0.014
	3	88		-0.324	**-0.684**	**0.021**	**0.066**	**-0.021**	**0.200**

2.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
13	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.02
		2	1	6.2.5	0.08
		2	1	6.2.6	0.01
		2	1	6.2.8	0.08
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
14	buigprofiel	2	1	6.2.3	0.02
		1	1	6.2.4	0.01
		3	1	6.2.5	0.02
		2	1	6.2.5	0.37
		2	1	6.2.6	0.03
		2	1	6.2.8	0.37
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.37
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.38
		1	1	6.3.1.1	0.01
		1	1	6.3.3	0.06
		5	1	Doorbuiging	0.11
		5	1	Doorbuiging	0.15
15	buigprofiel	3	1	6.2.4	0.03
		3	1	6.2.5	0.03
		3	1	6.2.5	0.20
		3	1	6.2.6	0.02
		3	1	6.2.8	0.20
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.20
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.21
		3	1	6.3.1.1	0.04
		3	1	6.3.3	0.27
		5	1	Doorbuiging	0.05
		5	1	Doorbuiging	0.07
16	buigprofiel	1	1	6.2.5	0.01
		2	1	6.2.5	0.17
		2	1	6.2.6	0.02
		2	1	6.2.8	0.17
		1	1	6.2.8	0.01
		2	1	6.2.9.1	0.17
		1	1	6.2.9.1	0.01
		2	1	6.2.9.1	0.18
		1	1	6.3.1.1	0.01
		1	1	6.3.3	0.04
		5	1	Doorbuiging	0.05
		5	1	Doorbuiging	0.07
17	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.02
		2	1	6.2.5	0.01
		2	1	6.2.5	0.37

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
17	buigprofiel	2	1	6.2.6	0.03
		2	1	6.2.8	0.37
		2	1	6.2.8	0.01
		2	1	6.2.9.1	0.37
		2	1	6.2.9.1	0.01
		2	1	6.2.9.1	0.39
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.19
		5	1	Doorbuiging	0.11
		5	1	Doorbuiging	0.15
18	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.08
		3	1	6.2.5	0.02
		2	1	6.2.6	0.01
		2	1	6.2.8	0.08
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
19	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.02
		2	1	6.2.5	0.07
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.07
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
20	buigprofiel	2	1	6.2.3	0.04
		1	1	6.2.4	0.01
		3	1	6.2.5	0.07
		3	1	6.2.5	0.02
		3	1	6.2.6	0.01
		3	1	6.2.8	0.07
		3	1	6.2.8	0.02
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.07
		1	1	6.3.1.1	0.01
		1	1	6.3.3	0.06
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02
21	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.03
		3	1	6.2.5	0.20
		3	1	6.2.5	0.03
		3	1	6.2.6	0.02
		3	1	6.2.8	0.20

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
21	buigprofiel	3	1	6.2.8	0.03
		3	1	6.2.9.1	0.20
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.21
		3	1	6.3.1.1	0.04
		3	1	6.3.3	0.27
		6	1	Doorbuiging	0.05
		6	1	Doorbuiging	0.06
22	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.5	0.06
		1	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.06
		1	1	6.2.8	0.01
		3	1	6.2.9.1	0.06
		1	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.04
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.02
23	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.02
		3	1	6.2.5	0.16
		2	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.16
		2	1	6.2.8	0.01
		3	1	6.2.9.1	0.16
		2	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.19
		6	1	Doorbuiging	0.05
		6	1	Doorbuiging	0.07
24	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.02
		2	1	6.2.5	0.07
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.07
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.02
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
53	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.08
		3	1	6.2.5	0.03
		2	1	6.2.8	0.08
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.09

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
53	buigprofiel	1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.04
		5	1	Doorbuiging	0.05
54	buigprofiel	2	1	6.2.3	0.02
		1	1	6.2.4	0.01
		2	1	6.2.5	0.40
		3	1	6.2.5	0.06
		2	1	6.2.8	0.40
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.40
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.42
		1	1	6.3.1.1	0.01
		1	1	6.3.3	0.05
		5	1	Doorbuiging	0.23
		5	1	Doorbuiging	0.31
55	buigprofiel	3	1	6.2.4	0.03
		2	1	6.2.5	0.26
		3	1	6.2.5	0.07
		2	1	6.2.6	0.01
		2	1	6.2.8	0.26
		3	1	6.2.8	0.07
		2	1	6.2.9.1	0.26
		3	1	6.2.9.1	0.07
		2	1	6.2.9.1	0.29
		3	1	6.3.1.1	0.04
		3	1	6.3.3	0.31
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.17
56	buigprofiel	2	1	6.2.5	0.26
		3	1	6.2.5	0.04
		2	1	6.2.6	0.01
		2	1	6.2.8	0.26
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.26
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.29
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.03
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.17
57	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.02
		2	1	6.2.5	0.41
		3	1	6.2.5	0.04
		3	1	6.2.6	0.01
		2	1	6.2.8	0.41
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.41
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.42
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.23
		5	1	Doorbuiging	0.24
		5	1	Doorbuiging	0.31

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
58	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.08
		3	1	6.2.5	0.03
		2	1	6.2.8	0.08
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.04
		5	1	Doorbuiging	0.05
59	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.03
		2	1	6.2.5	0.07
		2	1	6.2.8	0.07
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.07
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.04
		5	1	Doorbuiging	0.05
60	buigprofiel	2	1	6.2.3	0.04
		1	1	6.2.4	0.01
		3	1	6.2.5	0.11
		3	1	6.2.5	0.06
		3	1	6.2.8	0.11
		3	1	6.2.8	0.06
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.16
		1	1	6.3.1.1	0.01
		1	1	6.3.3	0.05
		6	1	Doorbuiging	0.05
		6	1	Doorbuiging	0.07
61	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.03
		3	1	6.2.5	0.20
		3	1	6.2.5	0.07
		3	1	6.2.6	0.01
		3	1	6.2.8	0.20
		3	1	6.2.8	0.07
		3	1	6.2.9.1	0.20
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.20
		3	1	6.3.1.1	0.04
		3	1	6.3.3	0.31
		6	1	Doorbuiging	0.10
		6	1	Doorbuiging	0.13
62	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.5	0.05
		3	1	6.2.5	0.04
		3	1	6.2.8	0.05
		3	1	6.2.8	0.04

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
62	buigprofiel	3	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.03
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02
63	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.02
		3	1	6.2.5	0.16
		3	1	6.2.5	0.04
		3	1	6.2.6	0.01
		3	1	6.2.8	0.16
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.16
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.23
		6	1	Doorbuiging	0.08
		6	1	Doorbuiging	0.11
64	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.03
		2	1	6.2.5	0.07
		2	1	6.2.8	0.07
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.07
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.04
		5	1	Doorbuiging	0.05
83	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.05
		3	1	6.2.5	0.03
		2	1	6.2.6	0.01
		2	1	6.2.8	0.05
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
84	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.40
		3	1	6.2.5	0.06
		2	1	6.2.6	0.04
		2	1	6.2.8	0.40
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.40
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.42

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
84	buigprofiel	3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.18
85	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01
		2	1	6.2.5	0.26
		3	1	6.2.5	0.07
		3	1	6.2.6	0.01
		2	1	6.2.6	0.02
		2	1	6.2.8	0.26
		3	1	6.2.8	0.07
		2	1	6.2.9.1	0.26
		3	1	6.2.9.1	0.07
		2	1	6.2.9.1	0.29
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.21
		5	1	Doorbuiging	0.09
		5	1	Doorbuiging	0.12
86	buigprofiel	2	1	6.2.3	0.02
		2	1	6.2.5	0.26
		3	1	6.2.5	0.04
		2	1	6.2.6	0.02
		2	1	6.2.8	0.26
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.26
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.29
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		5	1	Doorbuiging	0.09
		5	1	Doorbuiging	0.13
87	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.41
		3	1	6.2.5	0.04
		2	1	6.2.6	0.04
		2	1	6.2.8	0.41
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.41
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.42
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.15
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.18
88	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.03
		2	1	6.2.5	0.05
		2	1	6.2.6	0.01
		2	1	6.2.8	0.05
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
88	buigprofiel	3	1	6.3.3	0.03
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
89	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.03
		2	1	6.2.5	0.05
		2	1	6.2.8	0.05
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.02
90	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		3	1	6.2.5	0.11
		3	1	6.2.5	0.06
		3	1	6.2.6	0.01
		3	1	6.2.8	0.11
		3	1	6.2.8	0.06
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.06
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		5	1	Doorbuiging	0.04
		5	1	Doorbuiging	0.05
91	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01
		3	1	6.2.5	0.12
		3	1	6.2.5	0.07
		3	1	6.2.6	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.12
		3	1	6.2.8	0.07
		3	1	6.2.9.1	0.12
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.19
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.21
		6	1	Doorbuiging	0.06
		6	1	Doorbuiging	0.07
92	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.5	0.04
		3	1	6.2.5	0.05
		3	1	6.2.8	0.05
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.09
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.09
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
93	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		3	1	6.2.5	0.10
		3	1	6.2.5	0.04
		3	1	6.2.6	0.01
		3	1	6.2.8	0.10
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.10
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.14
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.15
		6	1	Doorbuiging	0.04
		6	1	Doorbuiging	0.06
94	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.03
		2	1	6.2.5	0.05
		2	1	6.2.8	0.05
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.06
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.03
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.02
119	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.13
		2	1	6.2.5	0.07
		3	1	6.2.6	0.02
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.13
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.13
		3	1	6.2.9.1	0.13
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.08
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
120	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.21
		3	1	6.2.5	0.04
		2	1	6.2.6	0.02
		2	1	6.2.8	0.21
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.23
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.10
		5	1	Doorbuiging	0.06
		5	1	Doorbuiging	0.08
121	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
121	buigprofiel	3	1	6.2.5	0.11
		3	1	6.2.5	0.05
		3	1	6.2.6	0.02
		3	1	6.2.8	0.11
		3	1	6.2.8	0.05
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.15
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02
122	buigprofiel	2	1	6.2.3	0.02
		2	1	6.2.5	0.08
		3	1	6.2.5	0.02
		2	1	6.2.6	0.01
		2	1	6.2.8	0.08
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.10
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.05
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.01
123	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.21
		3	1	6.2.5	0.03
		2	1	6.2.6	0.02
		2	1	6.2.8	0.21
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.23
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.12
		5	1	Doorbuiging	0.06
		5	1	Doorbuiging	0.08
124	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.07
		3	1	6.2.5	0.08
		2	1	6.2.6	0.01
		3	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.08
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.08
		2	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.05
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
125	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.13
		2	1	6.2.5	0.05

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
125	buigprofiel	3	1	6.2.6	0.02
		2	1	6.2.6	0.02
		2	1	6.2.8	0.05
		3	1	6.2.8	0.13
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.13
		3	1	6.2.9.1	0.13
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.08
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
126	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.07
		3	1	6.2.5	0.04
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.09
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.10
		6	1	Doorbuiging	0.01
		6	1	Doorbuiging	0.02
127	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01
		3	1	6.2.5	0.11
		3	1	6.2.5	0.05
		3	1	6.2.6	0.02
		3	1	6.2.8	0.11
		3	1	6.2.8	0.05
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
128	buigprofiel	2	1	6.2.3	0.02
		2	1	6.2.5	0.05
		3	1	6.2.5	0.02
		2	1	6.2.8	0.05
		3	1	6.2.8	0.02
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.02
		2	1	6.2.9.1	0.06
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.05
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
129	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		3	1	6.2.5	0.08
		3	1	6.2.5	0.03
		3	1	6.2.6	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
129	buigprofiel	3	1	6.2.8	0.08
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.11
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.12
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02
130	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.05
		3	1	6.2.5	0.08
		2	1	6.2.6	0.02
		3	1	6.2.6	0.01
		2	1	6.2.8	0.05
		3	1	6.2.8	0.08
		2	1	6.2.9.1	0.05
		3	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.08
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.05
		5	1	Doorbuiging	0.02
		5	1	Doorbuiging	0.03
143	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.11
		2	1	6.2.5	0.07
		3	1	6.2.6	0.01
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.11
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.12
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.12
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
144	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.21
		3	1	6.2.5	0.08
		3	1	6.2.6	0.01
		2	1	6.2.8	0.21
		3	1	6.2.8	0.08
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.08
		2	1	6.2.9.1	0.23
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.17
145	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.5	0.14
		3	1	6.2.5	0.09
		3	1	6.2.6	0.01
		3	1	6.2.8	0.14

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
145	buigprofiel	3	1	6.2.8	0.09
		3	1	6.2.9.1	0.14
		3	1	6.2.9.1	0.09
		3	1	6.2.9.1	0.23
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		6	1	Doorbuiging	0.08
		6	1	Doorbuiging	0.10
146	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01
		2	1	6.2.5	0.11
		3	1	6.2.5	0.05
		2	1	6.2.8	0.11
		3	1	6.2.8	0.05
		2	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.05
		2	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.10
		5	1	Doorbuiging	0.05
		5	1	Doorbuiging	0.07
147	buigprofiel	2	1	6.2.3	0.04
		2	1	6.2.5	0.21
		3	1	6.2.5	0.06
		2	1	6.2.8	0.21
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.24
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.16
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.17
148	buigprofiel	2	1	6.2.3	0.01
		3	1	6.2.5	0.07
		2	1	6.2.5	0.07
		3	1	6.2.6	0.01
		2	1	6.2.6	0.01
		2	1	6.2.8	0.07
		3	1	6.2.8	0.07
		2	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.07
		2	1	6.2.9.1	0.09
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.08
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
149	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.02
		3	1	6.2.5	0.11
		3	1	6.2.6	0.01
		2	1	6.2.8	0.02
		3	1	6.2.8	0.11
		2	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.12

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
149	buigprofiel	1	1	6.3.1.1	0.00
		3	1	6.3.3	0.12
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
150	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.21
		3	1	6.2.5	0.08
		2	1	6.2.6	0.01
		3	1	6.2.6	0.01
		2	1	6.2.8	0.21
		3	1	6.2.8	0.08
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.08
		2	1	6.2.9.1	0.22
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.17
		5	1	Doorbuiging	0.08
		5	1	Doorbuiging	0.11
151	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.5	0.14
		3	1	6.2.5	0.09
		2	1	6.2.6	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.14
		3	1	6.2.8	0.09
		3	1	6.2.9.1	0.14
		3	1	6.2.9.1	0.09
		3	1	6.2.9.1	0.23
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.02
		6	1	Doorbuiging	0.08
		6	1	Doorbuiging	0.10
152	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.01
		2	1	6.2.5	0.11
		3	1	6.2.5	0.05
		2	1	6.2.6	0.01
		2	1	6.2.8	0.11
		3	1	6.2.8	0.05
		2	1	6.2.9.1	0.11
		3	1	6.2.9.1	0.05
		2	1	6.2.9.1	0.12
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.10
		5	1	Doorbuiging	0.05
		5	1	Doorbuiging	0.06
153	buigprofiel	2	1	6.2.3	0.04
		2	1	6.2.5	0.21
		3	1	6.2.5	0.06
		2	1	6.2.6	0.01
		2	1	6.2.8	0.21
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.22

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
153	buigprofiel	1	1	6.3.1.1	0.00
		1	1	6.3.3	0.03
		5	1	Doorbuiging	0.08
		5	1	Doorbuiging	0.11
154	buigprofiel	2	1	6.2.3	0.01
		2	1	6.2.5	0.02
		3	1	6.2.5	0.07
		3	1	6.2.6	0.01
		2	1	6.2.8	0.02
		3	1	6.2.8	0.07
		2	1	6.2.9.1	0.02
		3	1	6.2.9.1	0.07
		3	1	6.2.9.1	0.08
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.08
		5	1	Doorbuiging	0.01
		5	1	Doorbuiging	0.02
Maximale waarden					
57	buigprofiel	2	1	6.2.9.1	0.42

2.3 BEREKENING VAN UNITY CHECKS

2.3.1 Staaf 57 - BUIGPROFIEL

Axiale trek art. 6.2.3

Combinatie: 2 x=0 mm Nx=7.905 kN Vy=0.01 kN Vz=0.388 kN
Mx=0.01 kNm My=4.327 kNm Mz=-0.08 kNm

$$N_{pl,Rd} = \frac{A f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.3 \text{ kN} \quad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{7.9}{328.3} = 0.02 < 1,0 \quad (6.5)$$

Axiale druk art. 6.2.4

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$N_{c,Rd} = \frac{A f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.342 \text{ kN} \quad (6.10)$$

$$\frac{N_{Ed}}{N_{c,Rd}} = \frac{7.4}{328.3} = 0.02 < 1,0 \quad (6.9)$$

Buigend moment art. 6.2.5

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$M_{y,c,Rd} = M_{pl,y,Rd} = \frac{W_{pl,y}\ f_y}{\gamma_{M0}} = \frac{49592.8 \times 235}{1.00} \times 10^{-6} = 11.654 \text{ kNm} \quad (6.13)$$

$$\frac{M_{y,Ed}}{M_{y,c,Rd}} = \frac{4.738}{11.654} = 0.41 < 1,0 \qquad (6.12)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$M_{z,c,Rd} = M_{pl,z,Rd} = \frac{W_{pl,z}\ f_y}{\gamma_{M0}} = \frac{23934.5 \times 235}{1.00} \times 10^{-6} = 5.625 \text{ kNm} \qquad (6.13)$$

$$\frac{M_{z,Ed}}{M_{z,c,Rd}} = \frac{0.243}{5.625} = 0.04 < 1,0 \qquad (6.12)$$

Dwarskracht (afschuiving) **art. 6.2.6**

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$$\frac{V_{z,Ed}}{V_{c,z,Rd}} = \frac{0.7}{111.4} = 0.01 < 1,0 \qquad (6.17)$$

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{z,Ed}$ = 0.328 kN < $V_{z,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$V_{c,y,Rd} = V_{pl,y,Rd} = \frac{A_v\ (f_y / \sqrt{3}\ )}{\gamma_{M0}} = \frac{821.2 \times (235/ \sqrt{3}\ )}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{y,Ed}$ = 0.228 kN < $V_{y,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$M_{N,Rd} = M_{pl,Rd}\left(1 - \left((N_{Ed} / N_{pl,Rd})\right)^2\right) = 11.7\left(1 - \left((7.9 / 328.3)\right)^2\right) = 11.648 \text{ kNm} \quad (6.32)$$

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} = \frac{4.738}{11.648} = 0.41 < 1,0 \quad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$M_{N,Rd} = M_{pl,Rd}\left(1 - \left((N_{Ed} / N_{pl,Rd})\right)^2\right) = 5.6\left(1 - \left((7.4 / 328.3)\right)^2\right) = 5.622 \text{ kNm} \quad (6.32)$$

$$\frac{M_{z,Ed}}{M_{N,z,Rd}} = \frac{0.243}{5.622} = 0.04 < 1,0 \quad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} = \left(\frac{4.738}{11.648}\right)^{1} + \left(\frac{0.068}{5.621}\right)^{1} = 0.42 < 1,0 \quad (6.41)$$

Knikstabiliteit **art. 6.3.1.1**

Combinatie: 3 x=0 mm Nx=7.445 kN Vy=0.233 kN Vz=0.659 kN
Mx=-0.025 kNm My=-1.842 kNm Mz=0.019 kNm

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \quad (6.50)$$

Knikkromme $_{z\text{-}z}$ c α = 0.49

$$\Phi_z = 0,5\left[1 + \alpha\,(\lambda_z - 0,2) + \lambda_z^2\right] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \quad (6.49)$$

$$N_{b,Rd} = \frac{\chi_z A f_y}{\gamma_{M1}} = \frac{0.8 \times 1397.2 \times 235}{1.00} \times 10^{-3} = 262.9 \text{ kN} \quad (6.47)$$

$$\frac{N_{Ed}}{N_{b,Rd}} = \frac{7.4}{262.9} = 0.03 < 1,0 \quad (6.46)$$

Prismatische, op buiging en druk belaste staven **art. 6.3.3**

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_y = \frac{L_{cr,y}}{i_y} \frac{1}{\lambda_1} = \frac{1146}{41.6} \frac{1}{93.9} = 0.293 \qquad (6.50)$$

$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}} = \pi \sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z} \frac{1}{\lambda_1} = \frac{1146}{21.2} \frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{y\text{-}y}$ c α = 0.49

$$\Phi_y = 0{,}5\,[1 + \alpha\ (\lambda_y - 0{,}2) + \lambda_y^2] = 0{,}5 \times [1 + 0.49 \times (0.293 - 0{,}2) + 0.293^2] = 0.566$$

$$\chi_y = \frac{1}{\Phi_y + \sqrt{\Phi_y^2 - \lambda_y^2}} = \frac{1}{0.566 + \sqrt{0.566^2 - 0.293^2}} = 0.953 \qquad (6.49)$$

Knikkromme $_{z\text{-}z}$ c α = 0.49

$$\Phi_z = 0{,}5\,[1 + \alpha\ (\lambda_z - 0{,}2) + \lambda_z^2] = 0{,}5 \times [1 + 0.49 \times (0.574 - 0{,}2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$$N_{Rk} = f_y\ A = 235 \times 1397 \times 10^{-3} = 328.3 \text{ kN}$$

$$M_{y,Rk} = f_y\ W_{pl,y} = 235 \times 49593 \times 10^{-6} = 11.7 \text{ kNm}$$

$$M_{z,Rk} = f_y\ W_{pl,z} = 235 \times 23935 \times 10^{-6} = 5.6 \text{ kNm}$$

$$\frac{N_{Ed}}{\dfrac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \dfrac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\dfrac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.61)$$

$$\frac{7.445}{\dfrac{0.953 \times 328.342}{1.00}} + 1 \times \frac{1.842}{1 \times \dfrac{11.654}{1.00}} + 1 \times \frac{0.243}{\dfrac{5.625}{1.00}} = 0.23 < 1 \qquad (6.61)$$

$$\frac{N_{Ed}}{\dfrac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy} \frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt} \dfrac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz} \frac{M_{z,Ed} + \Delta M_{z,Ed}}{\dfrac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.62)$$

$$\frac{7.445}{\dfrac{0.801 \times 328.342}{1.00}} + 1 \times \frac{1.842}{1 \times \dfrac{11.654}{1.00}} + 1 \times \frac{0.243}{\dfrac{5.625}{1.00}} = 0.23 < 1 \qquad (6.62)$$

Doorbuiging

Combinatie: 5 x=578.2 mm Nx=5.644 kN Vy=0.01 kN Vz=0.277 kN
Mx=0.008 kNm My=3.342 kNm Mz=-0.055 kNm

Lokale knoopverplaatsingen d_{z1} = -9.5 mm d_{z2} = -12.1 mm

$w_{eind,z} = w_z - w_{Zeeg,z} = -1.1 - 0 = -1.1$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|-1.1|}{1146 / 250} = \frac{|-1.1|}{4.6} = 0.24 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = -1.1 - 0 = -1.1$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|-1.1|}{1146 / 333} = \frac{|-1.1|}{3.4} = 0.31 < 1.0$$

3.Invoergegevens windverbanden

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s^2

3.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
2	0	2500	0	A	A	A			
3	0	5000	0	A	A	A			
4	0	5280	0	A	A	A			
5	0	7780	0	A	A	A			
14	7330	2500	0	A	A	A			
15	7330	5000	0	A	A	A			
16	7330	5280	0	A	A	A			
17	7330	7780	0	A	A	A			
42	700	2500	2154						
43	700	5000	2154						
44	700	5280	2154						
45	700	7780	2154						
50	6630	2500	2154						
51	6630	5000	2154						
52	6630	5280	2154						
53	6630	7780	2154						
78	2532	2500	3486						
79	2532	5000	3486						
80	2532	5280	3486						
81	2532	7780	3486						
84	4798	2500	3486						
85	4798	5000	3486						
86	4798	5280	3486						
87	4798	7780	3486						

3.2 STAVEN

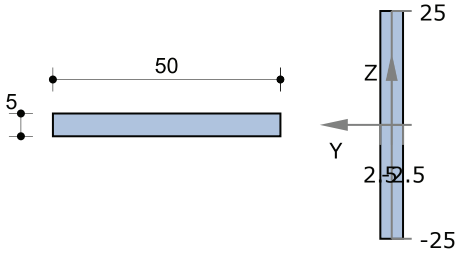
Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
25	43	2	paa___	aaa___	S50X5	3373
26	3	42	paa___	aaa___	S50X5	3373
27	45	4	paa___	aaa___	S50X5	3373
28	5	44	paa___	aaa___	S50X5	3373
29	51	14	paa___	aaa___	S50X5	3373
30	15	50	paa___	aaa___	S50X5	3373
31	17	52	paa___	aaa___	S50X5	3373
32	53	16	paa___	aaa___	S50X5	3373
95	78	43	paa___	aaa___	S50X5	3373
96	42	79	paa___	aaa___	S50X5	3373
97	44	81	paa___	aaa___	S50X5	3373
98	80	45	paa___	aaa___	S50X5	3373
99	50	85	paa___	aaa___	S50X5	3373
100	84	51	paa___	aaa___	S50X5	3373
101	52	87	paa___	aaa___	S50X5	3373
102	86	53	paa___	aaa___	S50X5	3373
135	85	78	paa___	aaa___	S50X5	3374

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
136	79	84	paa___	aaa___	S50X5	3374
137	81	86	paa___	aaa___	S50X5	3374
138	87	80	paa___	aaa___	S50X5	3374

3.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
4	S50X5	2.0	210000	2.5E2	1.952E3	5.2083E4	5.21E2

S50X5



Materiaalgegevens

Staalsoort	S235	(Warmgewalst)			
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}		

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	2.5 mm	z_{max}	=	25.0 mm
Minimale coördinaat	y_{min}	=	-2.5 mm	z_{min}	=	-25.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	250.0 mm ^{2}	G	=	2.0 kg/m
Statisch moment	S_y	=	1563 mm ^{3}	S_z	=	156 mm ^{3}
Traagheidsmoment	I_x	=	1952 mm ^{4}			
Traagheidsmoment	I_y	=	52083 mm ^{4}	I_z	=	521 mm ^{4}
Traagheidsstraal	i_y	=	14.4 mm	i_z	=	1.4 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	2083 mm ^{3}	$W_{z;el}$	=	208 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	52083 mm ^{4}	I_{min}	=	521 mm ^{4}
Traagheidsstraal	i_{max}	=	14.4 mm	i_{min}	=	1.4 mm
Halveringslijn	z_h	=	0.0 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	3125 mm ^{3}	$W_{z;pl}$	=	313 mm ^{3}

3.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

3.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

3.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
25	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	43	0	3373
26	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	3	0	3373
29	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	51	0	3373
30	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	15	0	3373
95	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	78	0	3373
96	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	42	0	3373
98	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	80	0	3373
99	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	50	0	3373
100	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	84	0	3373
135	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	85	0	3374
136	G-Z	q	-0.019 kN/m	-0.019 kN/m	0.0	0.0	79	0	3374

3.6 BELASTINGSGEVAL 2 wind tegen as A

3.7 BELASTINGSGEVAL 3 wind tegen as 1

4.Berekeningsresultaten windverbanden

4.1 UITERSTE GRENSTOESTANDEN (UGT)

4.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		

4.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
25	1	43		**-0.025**	0.000	**0.030**	0.000	0.000	0.000
	2	43		**-10.389**	**0.034**	**0.013**	0.000	0.000	0.000
	3	43		-9.965	**-0.015**	0.028	0.000	0.000	0.000
	1		1687	0.025	0.000	0.000	0.000	**0.026**	0.000
	2		1687	10.389	0.000	0.000	0.000	**0.023**	0.000
	1	2		**-0.025**	0.000	0.030	0.000	0.000	0.000
	2	2		**10.344**	**-0.034**	**0.041**	0.000	0.000	0.000
	3	2		9.920	**0.015**	**0.026**	0.000	0.000	0.000
26	2	3		**-10.511**	**-0.048**	**0.043**	0.000	0.000	0.000
	3	3		**0.022**	0.000	**0.027**	0.000	0.000	0.000
	1		1687	0.043	0.000	0.000	0.000	**0.026**	0.000
	2		1687	10.511	0.000	0.000	0.000	**0.023**	0.000
	1	42		0.094	0.000	**0.030**	0.000	0.000	0.000
	2	42		**10.555**	**0.048**	**0.011**	0.000	0.000	0.000
	3	42		**0.022**	0.000	0.027	0.000	0.000	0.000
27	1	45		**-0.069**	0.000	0.000	0.000	0.000	0.000
	2	45		**-10.602**	**0.049**	**-0.016**	0.000	0.000	0.000
	3	45		-6.319	**-0.007**	**0.001**	0.000	0.000	0.000
	1	4		**0.069**	0.000	0.000	0.000	0.000	0.000
	2	4		**10.602**	**-0.049**	**0.016**	0.000	0.000	0.000
	3	4		6.319	**0.007**	**-0.001**	0.000	0.000	0.000
28	2	5		**-10.436**	**-0.035**	**0.014**	0.000	0.000	0.000
	2	44		**10.436**	**0.035**	**-0.014**	0.000	0.000	0.000
29	1	51		**-0.025**	0.000	**0.030**	0.000	0.000	0.000
	2	51		-1.681	0.002	**0.028**	0.000	0.000	0.000
	3	51		**-9.983**	**0.015**	0.028	0.000	0.000	0.000
	1		1687	0.025	0.000	0.000	0.000	**0.026**	0.000
	2		1687	1.681	0.000	0.000	0.000	**0.023**	0.000
	1	14		**-0.025**	0.000	**0.030**	0.000	0.000	0.000
	3	14		**9.939**	**-0.015**	**0.026**	0.000	0.000	0.000
30	1	15		-0.044	0.000	**0.030**	0.000	0.000	0.000
	2	15		**-1.262**	**-0.001**	**0.027**	0.000	0.000	0.000
	3	15		**0.022**	0.000	0.027	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
30	1		1687	0.044	0.000	0.000	0.000	**0.026**	0.000
	2		1687	1.262	0.000	0.000	0.000	**0.023**	0.000
	1	50		0.095	0.000	**0.030**	0.000	0.000	0.000
	2	50		**1.307**	**0.001**	0.027	0.000	0.000	0.000
	3	50		**0.022**	0.000	**0.027**	0.000	0.000	0.000
31	2	17		**-1.732**	**-0.002**	**-0.001**	0.000	0.000	0.000
	2	52		**1.732**	**0.002**	**0.001**	0.000	0.000	0.000
32	1	53		**-0.067**	0.000	0.000	0.000	0.000	0.000
	3	53		**-6.306**	**0.007**	**0.001**	0.000	0.000	0.000
	1	16		**0.067**	0.000	0.000	0.000	0.000	0.000
	3	16		**6.306**	**-0.007**	**-0.001**	0.000	0.000	0.000
95	1	78		**0.014**	0.000	0.036	0.000	0.000	0.000
	2	78		**-2.021**	**0.001**	**0.040**	0.000	0.000	0.000
	3	78		-0.014	0.000	**0.032**	0.000	0.000	0.000
	1		1687	-0.014	0.000	0.000	0.000	**0.031**	0.000
	3		1687	0.014	0.000	0.000	0.000	**0.027**	0.000
	1	43		**-0.045**	0.000	**0.036**	0.000	0.000	0.000
	2	43		**1.993**	**-0.001**	**0.025**	0.000	0.000	0.000
96	1	42		**0.016**	0.000	0.036	0.000	0.000	0.000
	2	42		-1.305	-0.003	**0.030**	0.000	0.000	0.000
	3	42		**-6.123**	**-0.010**	**0.043**	0.000	0.000	0.000
	1		1687	-0.016	0.000	0.000	0.000	**0.031**	0.000
	3		1687	6.123	0.000	0.000	0.000	**0.027**	0.000
	1	79		**0.016**	0.000	**0.036**	0.000	0.000	0.000
	3	79		**6.151**	**0.010**	**0.022**	0.000	0.000	0.000
97	1	44		**0.024**	0.000	0.000	0.000	0.000	0.000
	2	44		-2.044	-0.001	**-0.007**	0.000	0.000	0.000
	3	44		**-3.816**	**-0.004**	**0.005**	0.000	0.000	0.000
	1	81		**-0.024**	0.000	0.000	0.000	0.000	0.000
	2	81		2.044	0.001	**0.007**	0.000	0.000	0.000
	3	81		**3.816**	**0.004**	**-0.005**	0.000	0.000	0.000
98	1	80		-0.016	0.000	**0.036**	0.000	0.000	0.000
	2	80		**-1.364**	**0.003**	0.035	0.000	0.000	0.000
	3	80		**-0.014**	0.000	**0.032**	0.000	0.000	0.000
	1		1687	0.016	0.000	0.000	0.000	**0.031**	0.000
	3		1687	0.014	0.000	0.000	0.000	**0.027**	0.000
	1	45		**-0.016**	0.000	**0.036**	0.000	0.000	0.000
	2	45		**1.337**	**-0.003**	**0.029**	0.000	0.000	0.000
99	1	50		**0.016**	0.000	0.036	0.000	0.000	0.000
	2	50		-0.818	0.001	**0.031**	0.000	0.000	0.000
	3	50		**-6.130**	**0.010**	**0.043**	0.000	0.000	0.000
	1		1687	-0.016	0.000	0.000	0.000	**0.031**	0.000
	3		1687	6.130	0.000	0.000	0.000	**0.027**	0.000
	1	85		**0.016**	0.000	**0.036**	0.000	0.000	0.000
	3	85		**6.158**	**-0.010**	**0.022**	0.000	0.000	0.000
100	1	84		**0.012**	**0.036**	0.000	0.000	0.000	0.000
	2	84		**-0.656**	0.034	0.000	0.000	0.000	0.000
	3	84		-0.014	**0.032**	0.000	0.000	0.000	0.000
	1		1687	-0.012	0.000	0.000	0.000	0.000	**0.031**
	2		1687	0.656	0.000	0.000	0.000	0.000	**0.027**
	1	51		**-0.043**	**0.036**	0.000	0.000	0.000	0.000
	2	51		**0.628**	**0.031**	0.000	0.000	0.000	0.000
101	1	52		**0.029**	0.000	0.000	0.000	0.000	0.000
	2	52		-0.646	0.000	**-0.001**	0.000	0.000	0.000
	3	52		**-3.806**	**0.004**	**0.005**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
101	1	87		**-0.029**	0.000	0.000	0.000	0.000	0.000
	2	87		0.646	0.000	**0.001**	0.000	0.000	0.000
	3	87		**3.806**	**-0.004**	**-0.005**	0.000	0.000	0.000
102	2	86		**-0.836**	**0.001**	**0.001**	0.000	0.000	0.000
	2	53		**0.836**	**-0.001**	**-0.001**	0.000	0.000	0.000
135	1	85		**-0.748**	**0.040**	0.000	0.000	0.000	0.000
	3	85		-0.209	**0.035**	0.000	0.000	0.000	0.000
	1		1687	0.748	0.000	0.000	0.000	0.000	**0.033**
	2		1687	0.000	0.000	0.000	0.000	0.000	**0.030**
	1	78		**0.748**	**0.040**	0.000	0.000	0.000	0.000
	2	78		0.000	**0.035**	0.000	0.000	0.000	0.000
136	1	79		**-0.747**	0.000	**0.040**	0.000	0.000	0.000
	2	79		**-0.101**	0.000	0.035	0.000	0.000	0.000
	3	79		-0.203	0.000	**0.035**	0.000	0.000	0.000
	1		1687	0.747	0.000	0.000	0.000	**0.033**	0.000
	2		1687	0.101	0.000	0.000	0.000	**0.030**	0.000
	1	84		**0.747**	0.000	**0.040**	0.000	0.000	0.000
	2	84		**0.101**	0.000	**0.035**	0.000	0.000	0.000
137	3	81		**-1.032**	0.000	**-0.002**	0.000	0.000	0.000
	3	86		**1.032**	0.000	**0.002**	0.000	0.000	0.000
138	2	87		**-0.100**	0.000	0.000	0.000	0.000	0.000
	3	87		**-1.027**	0.000	**-0.002**	0.000	0.000	0.000
	2	80		**0.100**	0.000	0.000	0.000	0.000	0.000
	3	80		**1.027**	0.000	**0.002**	0.000	0.000	0.000

4.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
25	S50X5	2	1	6.2.3	0.18
26	S50X5	2	1	6.2.3	0.18
27	S50X5	2	1	6.2.3	0.18
28	S50X5	2	1	6.2.3	0.18
29	S50X5	3	1	6.2.3	0.17
30	S50X5	2	1	6.2.3	0.02
31	S50X5	2	1	6.2.3	0.03
32	S50X5	3	1	6.2.3	0.11
95	S50X5	2	1	6.2.3	0.03
96	S50X5	3	1	6.2.3	0.10
97	S50X5	3	1	6.2.3	0.06
98	S50X5	2	1	6.2.3	0.02
99	S50X5	3	1	6.2.3	0.10
100	S50X5	2	1	6.2.3	0.01
101	S50X5	3	1	6.2.3	0.06
102	S50X5	2	1	6.2.3	0.01
135	S50X5	1	1	6.2.3	0.01
136	S50X5	1	1	6.2.3	0.01

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
137	S50X5	3	1	6.2.3	0.02
138	S50X5	3	1	6.2.3	0.02
Maximale waarden					
27	S50X5	2	1	6.2.3	0.18

4.3 BEREKENING VAN UNITY CHECKS

4.3.1 Staaf 27 - S50X5

Axiale trek **art. 6.2.3**

Combinatie: 2 x=0 mm Nx=10.602 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

$$N_{pl,Rd} = \frac{A\ f_y}{\gamma_{M0}} = \frac{250 \times 235}{1.00} \times 10^{-3} = 58.8 \text{ kN} \qquad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{10.6}{58.8} = 0.18 < 1{,}0 \qquad (6.5)$$

5.Invoergegevens gordingen

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

5.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
1	0	0	0	A	A	A			
2	0	2500	0	A	A	A			
3	0	5000	0	A	A	A			
4	0	5280	0	A	A	A			
5	0	7780	0	A	A	A			
6	0	10280	0	A	A	A			
13	7330	0	0	A	A	A			
14	7330	2500	0	A	A	A			
15	7330	5000	0	A	A	A			
16	7330	5280	0	A	A	A			
17	7330	7780	0	A	A	A			
18	7330	10280	0	A	A	A			
23	179	0	1133						
24	179	2500	1133						
25	179	5000	1133						
26	179	5280	1133						
27	179	7780	1133						
28	179	10280	1133						
31	7151	0	1133						
32	7151	2500	1133						
33	7151	5000	1133						
34	7151	5280	1133						
35	7151	7780	1133						
36	7151	10280	1133						
41	700	0	2154						
42	700	2500	2154						
43	700	5000	2154						
44	700	5280	2154						
45	700	7780	2154						
46	700	10280	2154						
49	6630	0	2154						
50	6630	2500	2154						
51	6630	5000	2154						
52	6630	5280	2154						
53	6630	7780	2154						
54	6630	10280	2154						
56	1832.5	10280	2965						
59	1511	0	2965						
60	1511	2500	2965						
61	1511	5000	2965						
62	1511	5280	2965						
63	1511	7780	2965						
64	1511	10280	2965						
67	5819	0	2965						
68	5819	2500	2965						
69	5819	5000	2965						

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
70	5819	5280	2965						
71	5819	7780	2965						
72	5819	10280	2965						
77	2532	0	3486						
78	2532	2500	3486						
79	2532	5000	3486						
80	2532	5280	3486						
81	2532	7780	3486						
82	2532	10280	3486						
83	4798	0	3486						
84	4798	2500	3486						
85	4798	5000	3486						
86	4798	5280	3486						
87	4798	7780	3486						
88	4798	10280	3486						
89	3665	0	3665						
90	3665	2500	3665						
91	3665	5000	3665						
92	3665	5280	3665						
93	3665	7780	3665						
94	3665	10280	3665						

5.2 STAVEN

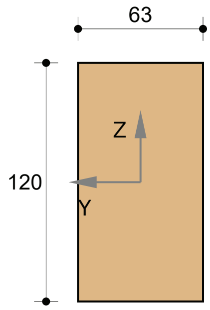
Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
1	1	2	aaa___	aaa___	63 x 120	2500
2	2	3	aaa___	aaa___	63 x 120	2500
4	4	5	aaa___	aaa___	63 x 120	2500
5	5	6	aaa___	aaa___	63 x 120	2500
8	13	14	aaa___	aaa___	63 x 120	2500
9	14	15	aaa___	aaa___	63 x 120	2500
11	16	17	aaa___	aaa___	63 x 120	2500
12	17	18	aaa___	aaa___	63 x 120	2500
41	23	24	aaa___	aaa___	63 x 120	2500
42	24	25	aaa___	aaa___	63 x 120	2500
43	26	27	aaa___	aaa___	63 x 120	2500
44	27	28	aaa___	aaa___	63 x 120	2500
45	31	32	aaa___	aaa___	63 x 120	2500
46	32	33	aaa___	aaa___	63 x 120	2500
47	34	35	aaa___	aaa___	63 x 120	2500
48	35	36	aaa___	aaa___	63 x 120	2500
75	41	42	aaa___	aaa___	63 x 120	2500
76	42	43	aaa___	aaa___	63 x 120	2500
77	44	45	aaa___	aaa___	63 x 120	2500
78	45	46	aaa___	aaa___	63 x 120	2500
79	49	50	aaa___	aaa___	63 x 120	2500
80	50	51	aaa___	aaa___	63 x 120	2500
81	52	53	aaa___	aaa___	63 x 120	2500
82	53	54	aaa___	aaa___	63 x 120	2500
104	64	56	aaa___	aaa___	63 x 120	322
111	59	60	aaa___	aaa___	63 x 120	2500
112	60	61	aaa___	aaa___	63 x 120	2500
113	62	63	aaa___	aaa___	63 x 120	2500
114	63	64	aaa___	aaa___	63 x 120	2500
115	67	68	aaa___	aaa___	63 x 120	2500
116	68	69	aaa___	aaa___	63 x 120	2500

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
117	70	71	aaa___	aaa___	63 x 120	2500
118	71	72	aaa___	aaa___	63 x 120	2500
131	77	78	aaa___	aaa___	63 x 120	2500
132	78	79	aaa___	aaa___	63 x 120	2500
133	80	81	aaa___	aaa___	63 x 120	2500
134	81	82	aaa___	aaa___	63 x 120	2500
139	83	84	aaa___	aaa___	63 x 120	2500
140	84	85	aaa___	aaa___	63 x 120	2500
141	86	87	aaa___	aaa___	63 x 120	2500
142	87	88	aaa___	aaa___	63 x 120	2500
155	89	90	aaa___	aaa___	63 x 120	2500
156	90	91	aaa___	aaa___	63 x 120	2500
157	92	93	aaa___	aaa___	63 x 120	2500
158	93	94	aaa___	aaa___	63 x 120	2500

5.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
3	63 x 120	3.2	11000	7.56E3	4.0509E7	9.072E6	2.5005E6

63 x 120



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60 k_h = 1.05
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		25.10	14.64	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.58	6.76	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	15.44	9.01	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	17.37	10.13	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean} =	420 kg/m ^{3}	ρ_k =	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$ =	11000 N/mm ^{2}	$E_{90,mean}$ =	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$ =	6875 N/mm ^{2}	$E_{90,fin}$ =	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$ =	7400 N/mm ^{2}	$E_{0,d}$ =	8462 N/mm ^{2}
Afschuifmodulus	G_{mean} =	690 N/mm ^{2}	$G_{0,05}$ =	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	31.5 mm	z_{max}	=	60.0 mm
Minimale coördinaat	y_{min}	=	-31.5 mm	z_{min}	=	-60.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	7560.0 mm ^{2}	G	=	3.2 kg/m
Statisch moment	S_y	=	113400 mm ^{3}	S_z	=	59535 mm ^{3}
Traagheidsmoment	I_x	=	40509164 mm ^{4}			
Traagheidsmoment	I_y	=	9072000 mm ^{4}	I_z	=	2500470 mm ^{4}
Traagheidsstraal	i_y	=	34.6 mm	i_z	=	18.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	151200 mm ^{3}	$W_{z;el}$	=	79380 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	9072000 mm ^{4}	I_{min}	=	2500470 mm ^{4}
Traagheidsstraal	i_{max}	=	34.6 mm	i_{min}	=	18.2 mm

5.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

5.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

5.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	1	0	2500
1	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	1	0	2500
2	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	2	0	2500
2	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	2	0	2500
4	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	4	0	2500
4	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	4	0	2500
5	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	5	0	2500
5	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	5	0	2500
8	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	13	0	2500
8	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	13	0	2500
9	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	14	0	2500
9	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	14	0	2500
11	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	16	0	2500
11	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	16	0	2500
12	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	17	0	2500
12	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	17	0	2500
41	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	23	0	2500
41	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	23	0	2500
41	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	23	0	2500
42	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	24	0	2500
42	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	24	0	2500
42	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	24	0	2500
43	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	26	0	2500
43	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	26	0	2500
43	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	26	0	2500
44	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	27	0	2500
44	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	27	0	2500
44	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	27	0	2500
45	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	31	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
45	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	31	0	2500
45	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	31	0	2500
46	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	32	0	2500
46	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	32	0	2500
46	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	32	0	2500
47	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	34	0	2500
47	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	34	0	2500
47	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	34	0	2500
48	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	35	0	2500
48	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	35	0	2500
48	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	35	0	2500
75	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	41	0	2500
75	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	41	0	2500
75	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	41	0	2500
76	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	42	0	2500
76	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	42	0	2500
76	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	42	0	2500
77	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	44	0	2500
77	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	44	0	2500
77	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	44	0	2500
78	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	45	0	2500
78	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	45	0	2500
78	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	45	0	2500
79	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	49	0	2500
79	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	49	0	2500
79	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	49	0	2500
80	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	50	0	2500
80	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	50	0	2500
80	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	50	0	2500
81	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	52	0	2500
81	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	52	0	2500
81	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	52	0	2500
82	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	53	0	2500
82	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	53	0	2500
82	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	53	0	2500
104	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	64	0	322
104	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	64	0	322
104	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	64	0	322
111	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	59	0	2500
111	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	59	0	2500
111	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	59	0	2500
112	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	60	0	2500
112	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	60	0	2500
112	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	60	0	2500
113	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	62	0	2500
113	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	62	0	2500
113	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	62	0	2500
114	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	63	0	2500
114	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	63	0	2500
114	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	63	0	2500
115	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	67	0	2500
115	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	67	0	2500
115	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	67	0	2500
116	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	68	0	2500
116	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	68	0	2500
116	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	68	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
117	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	70	0	2500
117	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	70	0	2500
117	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	70	0	2500
118	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	71	0	2500
118	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	71	0	2500
118	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	71	0	2500
131	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	77	0	2500
131	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	77	0	2500
131	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	77	0	2500
132	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	78	0	2500
132	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	78	0	2500
132	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	78	0	2500
133	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	80	0	2500
133	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	80	0	2500
133	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	80	0	2500
134	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	81	0	2500
134	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	81	0	2500
134	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	81	0	2500
139	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	83	0	2500
139	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	83	0	2500
139	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	83	0	2500
140	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	84	0	2500
140	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	84	0	2500
140	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	84	0	2500
141	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	86	0	2500
141	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	86	0	2500
141	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	86	0	2500
142	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	87	0	2500
142	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	87	0	2500
142	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	87	0	2500
155	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	89	0	2500
155	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	89	0	2500
155	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	89	0	2500
156	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	90	0	2500
156	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	90	0	2500
156	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	90	0	2500
157	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	92	0	2500
157	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	92	0	2500
157	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	92	0	2500
158	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	93	0	2500
158	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	93	0	2500
158	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	93	0	2500

5.6 BELASTINGSGEVAL 2 wind tegen as A

5.6.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
1	L-Z	q	0.153 kN/m	0.153 kN/m	0.0	0.0	1	0	2500
1	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	1	0	2500
2	L-Z	q	0.153 kN/m	0.153 kN/m	0.0	0.0	2	0	2500
2	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	2	0	2500
4	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	4	0	2500
4	L-Z	q	0.153 kN/m	0.153 kN/m	0.0	0.0	4	0	2500
5	L-Z	q	0.153 kN/m	0.153 kN/m	0.0	0.0	5	0	2500
5	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	5	0	2500
8	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	13	0	2500
8	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	13	0	2500
9	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	14	0	2500
9	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	14	0	2500
11	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	16	0	2500
11	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	16	0	2500
12	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	17	0	2500
12	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	17	0	2500
41	L-Y	q	0.024 kN/m	0.024 kN/m	0.0	0.0	23	0	2500
41	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	23	0	2500
41	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	23	0	2500
41	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	23	0	2500
42	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	24	0	2500
42	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	24	0	2500
42	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	24	0	2500
42	L-Y	q	0.024 kN/m	0.024 kN/m	0.0	0.0	24	0	2500
43	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	26	0	2500
43	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	26	0	2500
43	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	26	0	2500
43	L-Y	q	0.024 kN/m	0.024 kN/m	0.0	0.0	26	0	2500
44	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	27	0	2500
44	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	27	0	2500
44	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	27	0	2500
44	L-Y	q	0.024 kN/m	0.024 kN/m	0.0	0.0	27	0	2500
45	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	31	0	2500
45	L-Y	q	0.094 kN/m	0.094 kN/m	0.0	0.0	31	0	2500
45	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	31	0	2500
45	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	31	0	2500
46	L-Y	q	0.094 kN/m	0.094 kN/m	0.0	0.0	32	0	2500
46	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	32	0	2500
46	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	32	0	2500
46	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	32	0	2500
47	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	34	0	2500
47	L-Y	q	0.094 kN/m	0.094 kN/m	0.0	0.0	34	0	2500
47	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	34	0	2500
47	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	34	0	2500
48	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	35	0	2500
48	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	35	0	2500
48	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	35	0	2500
48	L-Y	q	0.094 kN/m	0.094 kN/m	0.0	0.0	35	0	2500
75	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	41	0	2500
75	L-Y	q	-0.103 kN/m	-0.103 kN/m	0.0	0.0	41	0	2500
75	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	41	0	2500
75	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	41	0	2500
76	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	42	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
76	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	42	0	2500
76	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	42	0	2500
76	L-Y	q	-0.103 kN/m	-0.103 kN/m	0.0	0.0	42	0	2500
77	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	44	0	2500
77	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	44	0	2500
77	L-Y	q	-0.103 kN/m	-0.103 kN/m	0.0	0.0	44	0	2500
77	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	44	0	2500
78	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	45	0	2500
78	L-Y	q	-0.024 kN/m	-0.024 kN/m	0.0	0.0	45	0	2500
78	L-Y	q	-0.103 kN/m	-0.103 kN/m	0.0	0.0	45	0	2500
78	L-Z	q	-0.153 kN/m	-0.153 kN/m	0.0	0.0	45	0	2500
79	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	49	0	2500
79	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	49	0	2500
79	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	49	0	2500
79	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	49	0	2500
80	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	50	0	2500
80	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	50	0	2500
80	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	50	0	2500
80	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	50	0	2500
81	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	52	0	2500
81	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	52	0	2500
81	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	52	0	2500
81	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	52	0	2500
82	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	53	0	2500
82	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	53	0	2500
82	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	53	0	2500
82	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	53	0	2500
111	L-Y	q	0.103 kN/m	0.103 kN/m	0.0	0.0	59	0	2500
111	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	59	0	2500
111	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	59	0	2500
111	L-Y	q	-0.168 kN/m	-0.168 kN/m	0.0	0.0	59	0	2500
112	L-Y	q	0.103 kN/m	0.103 kN/m	0.0	0.0	60	0	2500
112	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	60	0	2500
112	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	60	0	2500
112	L-Y	q	-0.168 kN/m	-0.168 kN/m	0.0	0.0	60	0	2500
113	L-Y	q	0.103 kN/m	0.103 kN/m	0.0	0.0	62	0	2500
113	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	62	0	2500
113	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	62	0	2500
113	L-Y	q	-0.168 kN/m	-0.168 kN/m	0.0	0.0	62	0	2500
114	L-Y	q	0.103 kN/m	0.103 kN/m	0.0	0.0	63	0	2500
114	L-Z	q	0.651 kN/m	0.651 kN/m	0.0	0.0	63	0	2500
114	L-Y	q	-0.168 kN/m	-0.168 kN/m	0.0	0.0	63	0	2500
114	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	63	0	2500
115	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	67	0	2500
115	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	67	0	2500
115	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	67	0	2500
115	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	67	0	2500
116	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	68	0	2500
116	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	68	0	2500
116	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	68	0	2500
116	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	68	0	2500
117	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	70	0	2500
117	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	70	0	2500
117	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	70	0	2500
117	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	70	0	2500
118	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	71	0	2500

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
118	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	71	0	2500
118	L-Y	q	0.093 kN/m	0.093 kN/m	0.0	0.0	71	0	2500
118	L-Y	q	-0.093 kN/m	-0.093 kN/m	0.0	0.0	71	0	2500
131	L-Y	q	-0.169 kN/m	-0.169 kN/m	0.0	0.0	77	0	2500
131	L-Y	q	0.169 kN/m	0.169 kN/m	0.0	0.0	77	0	2500
131	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	77	0	2500
131	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	77	0	2500
132	L-Y	q	-0.169 kN/m	-0.169 kN/m	0.0	0.0	78	0	2500
132	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	78	0	2500
132	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	78	0	2500
132	L-Y	q	0.169 kN/m	0.169 kN/m	0.0	0.0	78	0	2500
133	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	80	0	2500
133	L-Y	q	0.169 kN/m	0.169 kN/m	0.0	0.0	80	0	2500
133	L-Y	q	-0.169 kN/m	-0.169 kN/m	0.0	0.0	80	0	2500
133	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	80	0	2500
134	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	81	0	2500
134	L-Y	q	-0.169 kN/m	-0.169 kN/m	0.0	0.0	81	0	2500
134	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	81	0	2500
134	L-Y	q	0.169 kN/m	0.169 kN/m	0.0	0.0	81	0	2500
139	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	83	0	2500
139	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	83	0	2500
139	L-Y	q	0.119 kN/m	0.119 kN/m	0.0	0.0	83	0	2500
139	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	83	0	2500
140	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	84	0	2500
140	L-Y	q	0.119 kN/m	0.119 kN/m	0.0	0.0	84	0	2500
140	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	84	0	2500
140	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	84	0	2500
141	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	86	0	2500
141	L-Y	q	0.119 kN/m	0.119 kN/m	0.0	0.0	86	0	2500
141	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	86	0	2500
141	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	86	0	2500
142	L-Y	q	-0.094 kN/m	-0.094 kN/m	0.0	0.0	87	0	2500
142	L-Z	q	0.589 kN/m	0.589 kN/m	0.0	0.0	87	0	2500
142	L-Y	q	0.119 kN/m	0.119 kN/m	0.0	0.0	87	0	2500
142	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	87	0	2500
155	L-Y	q	0.168 kN/m	0.168 kN/m	0.0	0.0	89	0	2500
155	L-Y	q	-0.118 kN/m	-0.118 kN/m	0.0	0.0	89	0	2500
155	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	89	0	2500
155	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	89	0	2500
156	L-Y	q	-0.118 kN/m	-0.118 kN/m	0.0	0.0	90	0	2500
156	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	90	0	2500
156	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	90	0	2500
156	L-Y	q	0.168 kN/m	0.168 kN/m	0.0	0.0	90	0	2500
157	L-Y	q	0.168 kN/m	0.168 kN/m	0.0	0.0	92	0	2500
157	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	92	0	2500
157	L-Y	q	-0.118 kN/m	-0.118 kN/m	0.0	0.0	92	0	2500
157	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	92	0	2500
158	L-Y	q	-0.118 kN/m	-0.118 kN/m	0.0	0.0	93	0	2500
158	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	93	0	2500
158	L-Y	q	0.168 kN/m	0.168 kN/m	0.0	0.0	93	0	2500
158	L-Z	q	0.748 kN/m	0.748 kN/m	0.0	0.0	93	0	2500

5.7 BELASTINGSGEVAL 3 wind tegen as 1

5.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
104	G-Y	q	0.000 kN/m	0.053 kN/m	0.0	0.0	64	0	322
104	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	64	0	322

6.Berekeningsresultaten gordingen

6.1 UITERSTE GRENSTOESTANDEN (UGT)

6.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		

6.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
1	2	1		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	1		0.000	**0.081**	0.000	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	**-0.161**	**0.076**
	3		1250	0.000	0.000	0.000	0.000	0.000	**0.050**
	2	2		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	2		0.000	**0.081**	0.000	0.000	0.000	0.000
2	2	2		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	2		0.000	**0.081**	0.000	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	**-0.161**	0.076
	3		1250	0.000	0.000	0.000	0.000	0.000	**0.050**
	2	3		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	3		0.000	**0.081**	0.000	0.000	0.000	0.000
4	2	4		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	4		0.000	**0.081**	0.000	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	-0.161	**0.076**
	3		1250	0.000	0.000	0.000	0.000	0.000	**0.050**
	2	5		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	5		0.000	**0.081**	0.000	0.000	0.000	0.000
5	2	5		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	5		0.000	**0.081**	0.000	0.000	0.000	0.000
	2		1250	0.000	0.000	0.000	0.000	**-0.161**	**0.076**
	3		1250	0.000	0.000	0.000	0.000	0.000	**0.050**
	2	6		0.000	**0.122**	**-0.258**	0.000	0.000	0.000
	3	6		0.000	**0.081**	0.000	0.000	0.000	0.000
8	1	13		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	13		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.057**
	2		1250	0.000	0.000	0.000	0.000	-0.621	**-0.048**
	1	14		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	14		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
9	1	14		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	14		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.057**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
9	2		1250	0.000	0.000	0.000	0.000	**-0.621**	**-0.048**
	1	15		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	15		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
11	1	16		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	16		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.057**
	2		1250	0.000	0.000	0.000	0.000	**-0.621**	-0.048
	1	17		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	17		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
12	1	17		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	17		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	0.000	**0.057**
	2		1250	0.000	0.000	0.000	0.000	**-0.621**	-0.048
	1	18		0.000	**0.091**	0.000	0.000	0.000	0.000
	2	18		0.000	**-0.076**	**-0.994**	0.000	0.000	0.000
41	1	23		**0.035**	**-0.128**	0.042	0.000	0.000	0.000
	2	23		0.055	**-0.114**	**0.553**	0.000	0.000	0.000
	3	23		**0.902**	-0.114	**0.036**	0.000	0.000	0.000
	3		1250	-0.902	0.000	0.000	0.000	0.023	**-0.071**
	1	24		**-0.035**	**-0.128**	0.042	0.000	0.000	0.000
	2	24		-0.055	-0.114	**0.553**	0.000	0.000	0.000
	3	24		**-0.902**	**-0.113**	**0.038**	0.000	0.000	0.000
42	1	24		**0.020**	**-0.128**	0.042	0.000	0.000	0.000
	2	24		0.127	-0.114	**0.553**	0.000	0.000	0.000
	3	24		**0.572**	**-0.113**	**0.038**	0.000	0.000	0.000
	1		1250	-0.020	0.000	0.000	0.000	0.026	**-0.080**
	2		1250	-0.127	0.000	0.000	0.000	**0.346**	-0.071
	3		1250	-0.572	0.000	0.000	0.000	**0.023**	-0.071
	1	25		**-0.020**	**-0.128**	0.042	0.000	0.000	0.000
	2	25		-0.127	**-0.114**	**0.553**	0.000	0.000	0.000
	3	25		**-0.572**	-0.114	**0.035**	0.000	0.000	0.000
43	1	26		0.020	**-0.128**	0.042	0.000	0.000	0.000
	2	26		**0.128**	-0.114	**0.553**	0.000	0.000	0.000
	3	26		**-0.211**	**-0.114**	**0.037**	0.000	0.000	0.000
	3		1250	0.211	0.000	0.000	0.000	**0.023**	-0.071
	1	27		-0.020	**-0.128**	0.042	0.000	0.000	0.000
	2	27		**-0.128**	-0.114	**0.553**	0.000	0.000	0.000
	3	27		**0.211**	**-0.114**	**0.037**	0.000	0.000	0.000
44	1	27		0.035	**-0.128**	0.042	0.000	0.000	0.000
	2	27		**0.055**	-0.114	**0.553**	0.000	0.000	0.000
	3	27		**-0.460**	**-0.113**	**0.038**	0.000	0.000	0.000
	1		1250	-0.035	0.000	0.000	0.000	0.026	**-0.080**
	2		1250	-0.055	0.000	0.000	0.000	**0.346**	-0.071
	3		1250	0.460	0.000	0.000	0.000	0.023	**-0.071**
	1	28		-0.035	**-0.128**	0.042	0.000	0.000	0.000
	2	28		**-0.055**	**-0.114**	**0.553**	0.000	0.000	0.000
	3	28		**0.460**	-0.114	**0.036**	0.000	0.000	0.000
45	1	31		0.035	**0.128**	**0.042**	0.000	0.000	0.000
	2	31		**-0.014**	**0.113**	**-1.951**	0.000	0.000	0.000
	3	31		**0.902**	0.114	0.036	0.000	0.000	0.000
	1		1250	-0.035	0.000	0.000	0.000	**0.026**	0.080
	2		1250	0.014	0.000	0.000	0.000	-1.219	**0.071**
	1	32		-0.035	**0.128**	**0.042**	0.000	0.000	0.000
	2	32		**0.014**	0.114	**-1.951**	0.000	0.000	0.000
	3	32		**-0.902**	**0.113**	0.038	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
46	1	32		0.020	**0.128**	**0.042**	0.000	0.000	0.000
	2	32		**0.017**	0.113	**-1.951**	0.000	0.000	0.000
	3	32		**0.572**	**0.113**	0.038	0.000	0.000	0.000
	1		1250	-0.020	0.000	0.000	0.000	0.026	**0.080**
	2		1250	-0.017	0.000	0.000	0.000	**-1.219**	**0.071**
	1	33		-0.020	**0.128**	**0.042**	0.000	0.000	0.000
	2	33		**-0.017**	**0.114**	**-1.951**	0.000	0.000	0.000
	3	33		**-0.572**	0.114	0.035	0.000	0.000	0.000
47	1	34		**0.020**	**0.128**	**0.042**	0.000	0.000	0.000
	2	34		0.018	**0.114**	**-1.951**	0.000	0.000	0.000
	3	34		**-0.211**	0.114	0.037	0.000	0.000	0.000
	1		1250	-0.020	0.000	0.000	0.000	**0.026**	0.080
	2		1250	-0.018	0.000	0.000	0.000	**-1.219**	**0.071**
	1	35		**-0.020**	**0.128**	**0.042**	0.000	0.000	0.000
	2	35		-0.018	**0.113**	**-1.951**	0.000	0.000	0.000
	3	35		**0.211**	0.114	0.037	0.000	0.000	0.000
48	1	35		**0.035**	**0.128**	**0.042**	0.000	0.000	0.000
	2	35		-0.014	0.114	**-1.951**	0.000	0.000	0.000
	3	35		**-0.460**	**0.113**	0.038	0.000	0.000	0.000
	1		1250	-0.035	0.000	0.000	0.000	0.026	**0.080**
	2		1250	0.014	0.000	0.000	0.000	**-1.219**	0.071
	1	36		**-0.035**	**0.128**	**0.042**	0.000	0.000	0.000
	2	36		0.014	**0.113**	**-1.951**	0.000	0.000	0.000
	3	36		**0.460**	0.114	0.036	0.000	0.000	0.000
75	1	41		**-0.034**	**-0.109**	**0.079**	0.000	0.000	0.000
	2	41		0.032	**0.118**	**-0.771**	0.000	0.000	0.000
	3	41		**1.155**	-0.097	0.069	0.000	0.000	0.000
	1		1250	0.034	0.000	0.000	0.000	**0.050**	-0.068
	2		1250	-0.032	0.000	0.000	0.000	**-0.482**	0.074
	1	42		**0.034**	**-0.109**	**0.079**	0.000	0.000	0.000
	2	42		-0.032	**0.118**	**-0.771**	0.000	0.000	0.000
	3	42		**-1.155**	-0.096	0.071	0.000	0.000	0.000
76	1	42		**-0.006**	**-0.109**	0.079	0.000	0.000	0.000
	2	42		**8.844**	**0.125**	**-0.758**	0.000	0.000	0.000
	3	42		6.420	-0.088	**0.088**	0.000	0.000	0.000
	1		1250	0.006	0.000	0.000	0.000	**0.050**	**-0.068**
	2		1250	-8.844	0.000	0.000	0.000	-0.482	**0.074**
	1	43		**0.006**	**-0.109**	**0.079**	0.000	0.000	0.000
	2	43		**-8.844**	**0.111**	**-0.784**	0.000	0.000	0.000
77	1	44		**-0.003**	**-0.109**	**0.079**	0.000	0.000	0.000
	2	44		**8.920**	**0.111**	**-0.784**	0.000	0.000	0.000
	1		1250	0.003	0.000	0.000	0.000	**0.050**	-0.068
	2		1250	-8.920	0.000	0.000	0.000	**-0.482**	0.074
	1	45		**0.003**	**-0.109**	**0.079**	0.000	0.000	0.000
	2	45		**-8.920**	**0.125**	**-0.758**	0.000	0.000	0.000
78	1	45		-0.032	**-0.109**	**0.079**	0.000	0.000	0.000
	2	45		**0.033**	**0.118**	**-0.771**	0.000	0.000	0.000
	3	45		**-0.850**	-0.096	0.071	0.000	0.000	0.000
	1		1250	0.032	0.000	0.000	0.000	0.050	**-0.068**
	2		1250	-0.033	0.000	0.000	0.000	-0.482	**0.074**
	1	46		0.032	**-0.109**	**0.079**	0.000	0.000	0.000
	2	46		**-0.033**	**0.118**	**-0.771**	0.000	0.000	0.000
	3	46		**0.850**	-0.097	0.069	0.000	0.000	0.000
79	1	49		**-0.034**	**0.109**	**0.079**	0.000	0.000	0.000
	2	49		0.034	**0.096**	**-1.917**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
79	3	49		**1.157**	0.097	0.069	0.000	0.000	0.000
	1		1250	0.034	0.000	0.000	0.000	**0.050**	0.068
	2		1250	-0.034	0.000	0.000	0.000	-1.198	**0.060**
	1	50		**0.034**	**0.109**	**0.079**	0.000	0.000	0.000
	2	50		-0.034	**0.096**	**-1.917**	0.000	0.000	0.000
	3	50		**-1.157**	0.096	0.071	0.000	0.000	0.000
80	1	50		**-0.004**	**0.109**	0.079	0.000	0.000	0.000
	2	50		1.625	0.095	**-1.916**	0.000	0.000	0.000
	3	50		**6.431**	**0.088**	**0.088**	0.000	0.000	0.000
	1		1250	0.004	0.000	0.000	0.000	0.050	**0.068**
	2		1250	-1.625	0.000	0.000	0.000	-1.198	**0.060**
	1	51		**0.004**	**0.109**	**0.079**	0.000	0.000	0.000
	2	51		-1.625	**0.097**	**-1.919**	0.000	0.000	0.000
	3	51		**-6.431**	0.105	0.053	0.000	0.000	0.000
81	1	52		**-0.005**	**0.109**	**0.079**	0.000	0.000	0.000
	2	52		1.680	0.097	**-1.919**	0.000	0.000	0.000
	3	52		**3.259**	**0.094**	0.076	0.000	0.000	0.000
	1		1250	0.005	0.000	0.000	0.000	**0.050**	0.068
	2		1250	-1.680	0.000	0.000	0.000	**-1.198**	0.060
	1	53		**0.005**	**0.109**	**0.079**	0.000	0.000	0.000
	2	53		-1.680	**0.095**	**-1.915**	0.000	0.000	0.000
	3	53		**-3.259**	0.099	0.064	0.000	0.000	0.000
82	1	53		-0.034	**0.109**	**0.079**	0.000	0.000	0.000
	2	53		**0.034**	**0.096**	**-1.917**	0.000	0.000	0.000
	3	53		**-0.850**	0.096	0.071	0.000	0.000	0.000
	1		1250	0.034	0.000	0.000	0.000	0.050	**0.068**
	2		1250	-0.034	0.000	0.000	0.000	**-1.198**	0.060
	1	54		0.034	**0.109**	**0.079**	0.000	0.000	0.000
	2	54		**-0.034**	**0.096**	**-1.917**	0.000	0.000	0.000
	3	54		**0.850**	0.097	0.069	0.000	0.000	0.000
104	1	64		-0.031	0.000	**0.010**	0.000	0.000	0.000
	2	64		**-0.925**	**0.001**	**0.009**	0.000	0.000	0.000
	3	64		**-0.030**	**-0.061**	0.009	0.000	0.000	0.000
	1		162	0.031	0.000	0.000	0.000	**0.001**	0.000
	3		162	0.030	-0.001	0.000	0.000	**0.001**	-0.005
	3		163	0.030	0.000	0.000	0.000	0.001	**-0.005**
	1	56		0.031	0.000	**0.011**	0.000	0.000	0.000
	2	56		**0.925**	-0.001	0.010	0.000	0.000	0.000
	3	56		**0.030**	**-0.065**	**0.009**	0.000	0.000	0.000
111	1	59		**0.006**	**-0.079**	**0.109**	0.000	0.000	0.000
	2	59		0.079	**0.039**	**-2.799**	0.000	0.000	0.000
	3	59		**1.866**	-0.071	0.097	0.000	0.000	0.000
	1		1250	-0.006	0.000	0.000	0.000	**0.068**	-0.050
	2		1250	-0.079	0.000	0.000	0.000	**-1.749**	0.024
	1	60		**-0.006**	**-0.079**	**0.109**	0.000	0.000	0.000
	2	60		-0.079	**0.039**	**-2.798**	0.000	0.000	0.000
	3	60		**-1.866**	-0.069	0.097	0.000	0.000	0.000
112	1	60		**0.010**	**-0.079**	**0.109**	0.000	0.000	0.000
	2	60		0.164	**0.039**	**-2.799**	0.000	0.000	0.000
	3	60		**1.039**	-0.068	0.097	0.000	0.000	0.000
	1		1250	-0.010	0.000	0.000	0.000	**0.068**	**-0.050**
	2		1250	-0.164	0.000	0.000	0.000	**-1.749**	0.024
	1	61		**-0.010**	**-0.079**	**0.109**	0.000	0.000	0.000
	2	61		-0.164	**0.039**	**-2.798**	0.000	0.000	0.000
	3	61		**-1.039**	-0.072	0.097	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
113	1	62		0.010	**-0.079**	**0.109**	0.000	0.000	0.000
	2	62		**0.165**	**0.039**	**-2.798**	0.000	0.000	0.000
	3	62		**-0.472**	-0.071	0.097	0.000	0.000	0.000
	1		1250	-0.010	0.000	0.000	0.000	**0.068**	-0.050
	2		1250	-0.165	0.000	0.000	0.000	-1.749	**0.024**
	1	63		-0.010	**-0.079**	**0.109**	0.000	0.000	0.000
	2	63		**-0.165**	**0.039**	**-2.799**	0.000	0.000	0.000
	3	63		**0.472**	-0.070	0.097	0.000	0.000	0.000
114	1	63		0.006	**-0.079**	**0.109**	0.000	0.000	0.000
	2	63		**0.080**	**0.039**	**-2.798**	0.000	0.000	0.000
	3	63		**-1.084**	-0.069	0.097	0.000	0.000	0.000
	1		1250	-0.006	0.000	0.000	0.000	0.068	**-0.050**
	2		1250	-0.080	0.000	0.000	0.000	-1.749	**0.024**
	1	64		-0.006	**-0.079**	**0.109**	0.000	0.000	0.000
	2	64		**-0.080**	**0.039**	**-2.799**	0.000	0.000	0.000
	3	64		**1.084**	-0.071	0.097	0.000	0.000	0.000
115	1	67		**0.006**	**0.079**	**0.109**	0.000	0.000	0.000
	2	67		0.019	**0.071**	**-1.891**	0.000	0.000	0.000
	3	67		**1.877**	0.071	0.097	0.000	0.000	0.000
	1		1250	-0.006	0.000	0.000	0.000	**0.068**	0.050
	3		1250	-1.877	0.000	0.000	0.000	0.060	**0.044**
	1	68		**-0.006**	**0.079**	**0.109**	0.000	0.000	0.000
	2	68		-0.019	0.071	**-1.891**	0.000	0.000	0.000
	3	68		**-1.877**	**0.069**	0.097	0.000	0.000	0.000
116	1	68		**0.010**	**0.079**	**0.109**	0.000	0.000	0.000
	2	68		0.040	0.071	**-1.891**	0.000	0.000	0.000
	3	68		**1.045**	**0.068**	0.097	0.000	0.000	0.000
	1		1250	-0.010	0.000	0.000	0.000	**0.068**	**0.050**
	2		1250	-0.040	0.000	0.000	0.000	**-1.182**	0.044
	3		1250	-1.045	0.000	0.000	0.000	0.060	**0.044**
	1	69		**-0.010**	**0.079**	**0.109**	0.000	0.000	0.000
	2	69		-0.040	**0.071**	**-1.891**	0.000	0.000	0.000
	3	69		**-1.045**	0.072	0.097	0.000	0.000	0.000
117	1	70		0.010	**0.079**	**0.109**	0.000	0.000	0.000
	2	70		**0.041**	0.071	**-1.891**	0.000	0.000	0.000
	3	70		**-0.468**	**0.071**	0.097	0.000	0.000	0.000
	1		1250	-0.010	0.000	0.000	0.000	**0.068**	**0.050**
	2		1250	-0.041	0.000	0.000	0.000	**-1.182**	0.044
	1	71		-0.010	**0.079**	**0.109**	0.000	0.000	0.000
	2	71		**-0.041**	0.071	**-1.891**	0.000	0.000	0.000
	3	71		**0.468**	**0.070**	0.097	0.000	0.000	0.000
118	1	71		0.006	**0.079**	**0.109**	0.000	0.000	0.000
	2	71		**0.020**	0.071	**-1.891**	0.000	0.000	0.000
	3	71		**-1.077**	**0.069**	0.097	0.000	0.000	0.000
	1		1250	-0.006	0.000	0.000	0.000	0.068	**0.050**
	2		1250	-0.020	0.000	0.000	0.000	**-1.182**	0.044
	3		1250	1.077	0.000	0.000	0.000	0.060	**0.044**
	1	72		-0.006	**0.079**	**0.109**	0.000	0.000	0.000
	2	72		**-0.020**	**0.071**	**-1.891**	0.000	0.000	0.000
	3	72		**1.077**	0.071	0.097	0.000	0.000	0.000
131	1	77		-0.001	**-0.042**	**0.128**	0.000	0.000	0.000
	2	77		**-0.178**	**-0.037**	**-3.479**	0.000	0.000	0.000
	3	77		**2.433**	-0.038	0.116	0.000	0.000	0.000
	1		1250	0.001	0.000	0.000	0.000	**0.080**	-0.026
	3		1250	-2.433	0.000	0.000	0.000	0.071	**-0.023**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
131	1	78		0.001	**-0.042**	**0.128**	0.000	0.000	0.000
	2	78		**0.178**	-0.038	**-3.479**	0.000	0.000	0.000
	3	78		**-2.433**	**-0.036**	0.111	0.000	0.000	0.000
132	1	78		**0.531**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	78		1.108	-0.036	**-3.481**	0.000	0.000	0.000
	3	78		**3.559**	**-0.032**	0.102	0.000	0.000	0.000
	1		1250	-0.531	0.000	0.000	0.000	**0.080**	-0.026
	2		1250	-1.108	0.000	0.000	0.000	**-2.174**	-0.023
	3		1250	-3.559	0.000	0.000	0.000	0.071	**-0.023**
	1	79		**-0.531**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	79		-1.108	**-0.038**	**-3.477**	0.000	0.000	0.000
	3	79		**-3.559**	-0.041	0.125	0.000	0.000	0.000
133	1	80		**0.494**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	80		1.132	-0.038	**-3.477**	0.000	0.000	0.000
	3	80		**1.316**	**-0.036**	0.111	0.000	0.000	0.000
	1		1250	-0.494	0.000	0.000	0.000	0.080	**-0.026**
	2		1250	-1.132	0.000	0.000	0.000	**-2.174**	-0.023
	3		1250	-1.316	0.000	0.000	0.000	0.071	**-0.023**
	1	81		**-0.494**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	81		-1.132	**-0.036**	**-3.481**	0.000	0.000	0.000
	3	81		**-1.316**	-0.038	0.116	0.000	0.000	0.000
134	1	81		**-0.001**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	81		-0.180	-0.038	**-3.479**	0.000	0.000	0.000
	3	81		**-1.593**	**-0.036**	0.111	0.000	0.000	0.000
	1		1250	0.001	0.000	0.000	0.000	0.080	**-0.026**
	2		1250	0.180	0.000	0.000	0.000	**-2.174**	-0.023
	3		1250	1.593	0.000	0.000	0.000	0.071	**-0.023**
	1	82		**0.001**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	82		0.180	**-0.037**	**-3.480**	0.000	0.000	0.000
	3	82		**1.593**	-0.038	0.116	0.000	0.000	0.000
139	1	83		**-0.001**	**0.042**	**0.128**	0.000	0.000	0.000
	2	83		0.009	**-0.005**	**-2.141**	0.000	0.000	0.000
	3	83		**2.441**	0.038	0.116	0.000	0.000	0.000
	1		1250	0.001	0.000	0.000	0.000	**0.080**	0.026
	2		1250	-0.009	0.000	0.000	0.000	**-1.338**	-0.003
	1	84		**0.001**	**0.042**	**0.128**	0.000	0.000	0.000
	2	84		-0.009	**-0.005**	**-2.142**	0.000	0.000	0.000
	3	84		**-2.441**	0.036	0.111	0.000	0.000	0.000
140	1	84		**0.532**	**0.042**	**0.128**	0.000	0.000	0.000
	2	84		0.561	**-0.006**	**-2.142**	0.000	0.000	0.000
	3	84		**3.566**	0.032	0.102	0.000	0.000	0.000
	1		1250	-0.532	0.000	0.000	0.000	**0.080**	0.026
	2		1250	-0.561	0.000	0.000	0.000	**-1.338**	-0.003
	1	85		**-0.532**	**0.042**	**0.128**	0.000	0.000	0.000
	2	85		-0.561	**-0.005**	**-2.141**	0.000	0.000	0.000
	3	85		**-3.566**	0.041	0.125	0.000	0.000	0.000
141	1	86		**0.493**	**0.042**	**0.128**	0.000	0.000	0.000
	2	86		0.563	**-0.005**	**-2.141**	0.000	0.000	0.000
	3	86		**1.316**	0.036	0.111	0.000	0.000	0.000
	1		1250	-0.493	0.000	0.000	0.000	0.080	**0.026**
	2		1250	-0.563	0.000	0.000	0.000	-1.338	**-0.003**
	1	87		**-0.493**	**0.042**	**0.128**	0.000	0.000	0.000
	2	87		-0.563	**-0.006**	**-2.142**	0.000	0.000	0.000
	3	87		**-1.316**	0.038	0.116	0.000	0.000	0.000
142	1	87		0.000	**0.042**	**0.128**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
142	2	87		**0.009**	**-0.005**	**-2.142**	0.000	0.000	0.000
	3	87		**-1.586**	0.036	0.111	0.000	0.000	0.000
	1		1250	0.000	0.000	0.000	0.000	**0.080**	**0.026**
	2		1250	-0.009	0.000	0.000	0.000	-1.338	**-0.003**
	1	88		0.000	**0.042**	**0.128**	0.000	0.000	0.000
	2	88		**-0.009**	**-0.005**	**-2.141**	0.000	0.000	0.000
	3	88		**1.586**	0.038	0.116	0.000	0.000	0.000
155	1	89		**0.009**	0.000	**0.135**	0.000	0.000	0.000
	2	89		0.023	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	89		**2.519**	0.000	0.124	0.000	0.000	0.000
	1		1250	-0.009	0.000	0.000	0.000	**0.084**	0.000
	2		1250	-0.023	0.000	0.000	0.000	-1.837	**-0.053**
	1	90		**-0.009**	0.000	**0.135**	0.000	0.000	0.000
	2	90		-0.023	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	90		**-2.519**	0.000	0.115	0.000	0.000	0.000
156	1	90		**0.017**	0.000	**0.135**	0.000	0.000	0.000
	2	90		0.043	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	90		**1.342**	0.000	0.113	0.000	0.000	0.000
	1		1250	-0.017	0.000	0.000	0.000	**0.084**	0.000
	2		1250	-0.043	0.000	0.000	0.000	**-1.837**	-0.053
	1	91		**-0.017**	0.000	**0.135**	0.000	0.000	0.000
	2	91		-0.043	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	91		**-1.342**	0.000	0.126	0.000	0.000	0.000
157	1	92		0.016	0.000	**0.135**	0.000	0.000	0.000
	2	92		**0.044**	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	92		**-0.692**	0.000	0.122	0.000	0.000	0.000
	1		1250	-0.016	0.000	0.000	0.000	**0.084**	0.000
	2		1250	-0.044	0.000	0.000	0.000	-1.837	**-0.053**
	1	93		-0.016	0.000	**0.135**	0.000	0.000	0.000
	2	93		**-0.044**	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	93		**0.692**	0.000	0.117	0.000	0.000	0.000
158	1	93		0.008	0.000	**0.135**	0.000	0.000	0.000
	2	93		**0.023**	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	93		**-1.507**	0.000	0.116	0.000	0.000	0.000
	1		1250	-0.008	0.000	0.000	0.000	**0.084**	0.000
	2		1250	-0.023	0.000	0.000	0.000	**-1.837**	-0.053
	1	94		-0.008	0.000	**0.135**	0.000	0.000	0.000
	2	94		**-0.023**	**-0.085**	**-2.940**	0.000	0.000	0.000
	3	94		**1.507**	0.000	0.123	0.000	0.000	0.000

6.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

6.3 BEREKENING VAN UNITY CHECKS

6.3.1 Staaf 132 - 63 x 120 (C24 Klimaatklasse:1)

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 3 x=0 mm Nx=-3.559 kN Vy=-0.037 kN Vz=0.114 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{3559.4}{7560} = 0.5 \text{ N/mm}^2 < f_{c,0,d} = 14.5 \text{ N/mm}^2 \qquad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 2 x=2500 mm Nx=-1.108 kN Vy=0.037 kN Vz=3.479 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{3479.1 \times 113400}{63 \times 9072000} = 0.7 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \qquad (6.13)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 2 x=1250 mm Nx=-1.108 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1108}{7560} = 0.1 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.023 \times 10^6}{79 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.1}{14.5}\right)^2 + \frac{14.4}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.88 < 1.00 \qquad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.1}{14.5}\right)^2 + 0.7 \times \frac{14.4}{16.6} + \frac{0.3}{19.8} = 0.62 < 1.00 \qquad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 2 x=1250 mm Nx=-1.108 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{2500}{34.6} = 72.17 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{72.17}{\pi}\sqrt{\frac{21.0}{7400}} = 1.224 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}^2 = 0{,}5 \times (1 + 0.2 \times (1.224 - 0{,}3) + 1.224^2 = 1.34 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.34 + \sqrt{1.34^2 - 1.22^2}} = 0.53 \qquad (6.25)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.331 - 0{,}3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1108}{7560} = 0.1 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.023 \times 10^6}{79 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\ f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{0.53 \times 14.5} + \frac{14.4}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.89 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\ f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{0.17 \times 14.5} + 0.7 \times \frac{14.4}{16.6} + \frac{0.3}{19.8} = 0.68 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 2 x=1250 mm Nx=-1.108 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 2500 = 2250$ mm

$$\sigma_{m,crit} = \frac{0{,}78\ b^2}{h\ l_{ef}} E_{0,05} = \frac{0{,}78 \times 63^2}{120 \times 2250} \times 7400 = 84.8 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{84.8}} = 0.532 < 0.75 \qquad \rightarrow k_{crit} = 1{,}00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{3559}{7560} = 0.5 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.331 - 0{,}3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{14.4}{1.00 \times 16.6}\right)^2 + \frac{0.5}{0.17 \times 14.5} = 0.94 < 1.00 \qquad (6.35)$$

7.Invoergegevens wandstijlen

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

7.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
7	1832.5	0	0	A	A	A			
8	1832.5	10280	0	A	A	A			
9	3665	0	0	A	A	A			
10	3665	10280	0	A	A	A			
11	5497.5	0	0	A	A	A			
12	5497.5	10280	0	A	A	A			
19	1832.5	0	1133						
20	1832.5	10280	1133						
21	5497.5	0	1133						
22	5497.5	10280	1133						
23	179	0	1133						
28	179	10280	1133						
29	3665	0	1133						
30	3665	10280	1133						
31	7151	0	1133						
36	7151	10280	1133						
37	1832.5	0	2154						
38	1832.5	10280	2154						
39	5497.5	0	2154						
40	5497.5	10280	2154						
41	700	0	2154						
46	700	10280	2154						
47	3665	0	2154						
48	3665	10280	2154						
49	6630	0	2154						
54	6630	10280	2154						
55	1832.5	0	2965						
56	1832.5	10280	2965						
57	5497.5	0	2965						
58	5497.5	10280	2965						
59	1511	0	2965						
65	3665	0	2965						
66	3665	10280	2965						
67	5819	0	2965						
72	5819	10280	2965						
73	1832.5	0	3129.1						
74	1832.5	10280	3129.1						
75	5497.5	0	3129.1						
76	5497.5	10280	3129.1						
89	3665	0	3665						
94	3665	10280	3665						

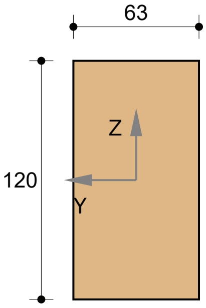
7.2 STAVEN

Staaf-nummer	Knoop van	Knoop naar	Staafaansluitingen begin	Staafaansluitingen begin	Profiel	Lengte [mm]
33	23	19	aaa___	aaa___	63 x 120	1654
34	28	20	aaa___	aaa___	63 x 120	1654
35	19	29	aaa___	aaa___	63 x 120	1832
36	20	30	aaa___	aaa___	63 x 120	1832
37	29	21	aaa___	aaa___	63 x 120	1832
38	30	22	aaa___	aaa___	63 x 120	1832
39	21	31	aaa___	aaa___	63 x 120	1654
40	22	36	aaa___	aaa___	63 x 120	1654
49	7	73	aaa___	aaa___	100 x 200	3129
50	8	74	aaa___	aaa___	100 x 200	3129
51	11	75	aaa___	aaa___	100 x 200	3129
52	12	76	aaa___	aaa___	100 x 200	3129
65	9	89	aaa___	aaa___	100 x 200	3665
66	10	94	aaa___	aaa___	100 x 200	3665
67	37	41	aaa___	aaa___	63 x 120	1133
68	38	46	aaa___	aaa___	63 x 120	1133
69	47	37	aaa___	aaa___	63 x 120	1832
70	48	38	aaa___	aaa___	63 x 120	1832
71	39	47	aaa___	aaa___	63 x 120	1832
72	40	48	aaa___	aaa___	63 x 120	1832
73	49	39	aaa___	aaa___	63 x 120	1133
74	54	40	aaa___	aaa___	63 x 120	1133
103	55	59	aaa___	aaa___	63 x 120	322
105	65	55	aaa___	aaa___	63 x 120	1832
106	66	56	aaa___	aaa___	63 x 120	1832
107	57	65	aaa___	aaa___	63 x 120	1832
108	58	66	aaa___	aaa___	63 x 120	1832
109	67	57	aaa___	aaa___	63 x 120	322
110	72	58	aaa___	aaa___	63 x 120	322

7.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
3	63 x 120	3.2	11000	7.56E3	4.0509E7	9.072E6	2.5005E6
5	100 x 200	8.4	11000	2E4	3.7867E8	6.6667E7	1.6667E7

63 x 120



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60 k_h = 1.05
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

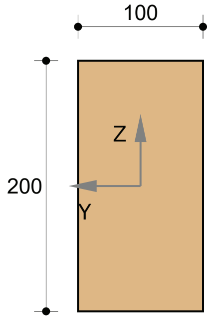
		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		25.10	14.64	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.58	6.76	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	15.44	9.01	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	17.37	10.13	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	=	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	31.5 mm	z_{max}	=	60.0 mm
Minimale coördinaat	y_{min}	=	-31.5 mm	z_{min}	=	-60.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	7560.0 mm ^{2}	G	=	3.2 kg/m
Statisch moment	S_y	=	113400 mm ^{3}	S_z	=	59535 mm ^{3}
Traagheidsmoment	I_x	=	40509164 mm ^{4}			
Traagheidsmoment	I_y	=	9072000 mm ^{4}	I_z	=	2500470 mm ^{4}
Traagheidsstraal	i_y	=	34.6 mm	i_z	=	18.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	151200 mm ^{3}	$W_{z;el}$	=	79380 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	9072000 mm ^{4}	I_{min}	=	2500470 mm ^{4}
Traagheidsstraal	i_{max}	=	34.6 mm	i_{min}	=	18.2 mm

100 x 200



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		24.00	14.00	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.08	6.46	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	14.77	8.62	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	16.62	9.69	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	=	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	50.0 mm	z_{max}	=	100.0 mm
Minimale coördinaat	y_{min}	=	-50.0 mm	z_{min}	=	-100.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	20000.0 mm ^{2}	G	=	8.4 kg/m
Statisch moment	S_y	=	500000 mm ^{3}	S_z	=	250000 mm ^{3}
Traagheidsmoment	I_x	=	378666667 mm ^{4}			
Traagheidsmoment	I_y	=	66666667 mm ^{4}	I_z	=	16666667 mm ^{4}
Traagheidsstraal	i_y	=	57.7 mm	i_z	=	28.9 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	666667 mm ^{3}	$W_{z;el}$	=	333333 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	66666667 mm ^{4}	I_{min}	=	16666667 mm ^{4}
Traagheidsstraal	i_{max}	=	57.7 mm	i_{min}	=	28.9 mm

7.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

7.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

7.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
33	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	23	0	1654
33	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	23	0	1654
33	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	23	521	1133
33	G-Z	q	0.000 kN/m	-0.026 kN/m	0.0	0.0	23	0	521
34	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	28	0	1654
34	G-Z	q	0.000 kN/m	-0.026 kN/m	0.0	0.0	28	0	521
34	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	28	521	1133
34	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	28	0	1654
35	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	19	0	1832
35	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	19	0	1832
35	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	19	0	1832
36	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	20	0	1832
36	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	20	0	1832
36	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	20	0	1832
37	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	29	0	1832
37	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	29	0	1832
37	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	29	0	1832
38	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	30	0	1832
38	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	30	0	1832
38	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	30	0	1832
39	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	21	0	1654
39	G-Z	q	-0.026 kN/m	0.000 kN/m	0.0	0.0	21	1133	521
39	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	21	0	1133
39	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	21	0	1654
40	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	22	0	1654
40	G-Z	q	-0.026 kN/m	0.000 kN/m	0.0	0.0	22	1133	521
40	G-Z	q	-0.028 kN/m	-0.028 kN/m	0.0	0.0	22	0	1654
40	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	22	0	1133
49	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	7	0	3129
50	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	8	0	3129
51	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	11	0	3129
52	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	12	0	3129
65	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	9	0	3665
66	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	10	0	3665
67	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	37	0	1133
67	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	37	0	1133
67	G-Z	q	-0.020 kN/m	0.000 kN/m	0.0	0.0	37	322	811
67	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	37	0	322
68	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	38	0	1133
68	G-Z	q	-0.020 kN/m	0.000 kN/m	0.0	0.0	38	322	811
68	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	38	0	1133
68	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	38	0	322
69	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	47	0	1832
69	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	47	0	1832
69	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	47	0	1832
70	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	48	0	1832
70	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	48	0	1832
70	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	48	0	1832
71	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	39	0	1832
71	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	39	0	1832
71	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	39	0	1832
72	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	40	0	1832
72	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	40	0	1832

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
72	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	40	0	1832
73	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	49	0	1133
73	G-Z	q	0.000 kN/m	-0.020 kN/m	0.0	0.0	49	0	811
73	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	49	811	322
73	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	49	0	1133
74	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	54	0	1133
74	G-Z	q	-0.026 kN/m	-0.026 kN/m	0.0	0.0	54	0	1133
74	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	54	811	322
74	G-Z	q	0.000 kN/m	-0.020 kN/m	0.0	0.0	54	0	811
103	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	55	0	322
103	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	55	0	322
103	G-Z	q	-0.004 kN/m	0.000 kN/m	0.0	0.0	55	0	322
105	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	65	0	1832
105	G-Z	q	-0.018 kN/m	-0.004 kN/m	0.0	0.0	65	0	1832
105	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	65	0	1832
106	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	66	0	1832
106	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	66	0	1832
106	G-Z	q	-0.018 kN/m	-0.004 kN/m	0.0	0.0	66	0	1832
107	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	57	0	1832
107	G-Z	q	-0.004 kN/m	-0.018 kN/m	0.0	0.0	57	0	1832
107	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	57	0	1832
108	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	58	0	1832
108	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	58	0	1832
108	G-Z	q	-0.004 kN/m	-0.018 kN/m	0.0	0.0	58	0	1832
109	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	67	0	322
109	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	67	0	322
109	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	67	0	322
110	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	72	0	322
110	G-Z	q	-0.020 kN/m	-0.020 kN/m	0.0	0.0	72	0	322
110	G-Z	q	0.000 kN/m	-0.004 kN/m	0.0	0.0	72	0	322

7.6 BELASTINGSGEVAL 2 wind tegen as A

7.7 BELASTINGSGEVAL 3 wind tegen as 1

7.7.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
33	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	23	521	1133
33	G-Y	q	0.589 kN/m	0.589 kN/m	0.0	0.0	23	0	1654
33	G-Y	q	0.000 kN/m	0.531 kN/m	0.0	0.0	23	0	521
34	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	28	521	1133
34	G-Y	q	0.000 kN/m	0.332 kN/m	0.0	0.0	28	0	521
34	G-Y	q	0.368 kN/m	0.368 kN/m	0.0	0.0	28	0	1654
35	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	19	0	1832
35	G-Y	q	0.589 kN/m	0.589 kN/m	0.0	0.0	19	0	1832
36	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	20	0	1832
36	G-Y	q	0.368 kN/m	0.368 kN/m	0.0	0.0	20	0	1832
37	G-Y	q	0.589 kN/m	0.589 kN/m	0.0	0.0	29	0	1832
37	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	29	0	1832
38	G-Y	q	0.368 kN/m	0.368 kN/m	0.0	0.0	30	0	1832
38	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	30	0	1832
39	G-Y	q	0.531 kN/m	0.000 kN/m	0.0	0.0	21	1133	521
39	G-Y	q	0.589 kN/m	0.589 kN/m	0.0	0.0	21	0	1654

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
39	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	21	0	1133
40	G-Y	q	0.332 kN/m	0.000 kN/m	0.0	0.0	22	1133	521
40	G-Y	q	0.368 kN/m	0.368 kN/m	0.0	0.0	22	0	1654
40	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	22	0	1133
67	G-Y	q	0.422 kN/m	0.000 kN/m	0.0	0.0	37	322	811
67	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	37	0	1133
67	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	37	0	322
68	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	38	0	1133
68	G-Y	q	0.264 kN/m	0.000 kN/m	0.0	0.0	38	322	811
68	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	38	0	322
69	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	47	0	1832
69	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	47	0	1832
70	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	48	0	1832
70	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	48	0	1832
71	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	39	0	1832
71	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	39	0	1832
72	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	40	0	1832
72	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	40	0	1832
73	G-Y	q	0.000 kN/m	0.422 kN/m	0.0	0.0	49	0	811
73	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	49	811	322
73	G-Y	q	0.531 kN/m	0.531 kN/m	0.0	0.0	49	0	1133
74	G-Y	q	0.332 kN/m	0.332 kN/m	0.0	0.0	54	0	1133
74	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	54	811	322
74	G-Y	q	0.000 kN/m	0.264 kN/m	0.0	0.0	54	0	811
103	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	55	0	322
103	G-Y	q	0.085 kN/m	0.000 kN/m	0.0	0.0	55	0	322
105	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	65	0	1832
105	G-Y	q	0.364 kN/m	0.085 kN/m	0.0	0.0	65	0	1832
106	G-Y	q	0.228 kN/m	0.053 kN/m	0.0	0.0	66	0	1832
106	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	66	0	1832
107	G-Y	q	0.085 kN/m	0.364 kN/m	0.0	0.0	57	0	1832
107	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	57	0	1832
108	G-Y	q	0.053 kN/m	0.228 kN/m	0.0	0.0	58	0	1832
108	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	58	0	1832
109	G-Y	q	0.422 kN/m	0.422 kN/m	0.0	0.0	67	0	322
109	G-Y	q	0.000 kN/m	0.085 kN/m	0.0	0.0	67	0	322
110	G-Y	q	0.000 kN/m	0.053 kN/m	0.0	0.0	72	0	322
110	G-Y	q	0.264 kN/m	0.264 kN/m	0.0	0.0	72	0	322

8.Berekeningsresultaten wandstijlen

8.1 UITERSTE GRENSTOESTANDEN (UGT)

8.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		

8.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
33	1	23		**-0.148**	0.000	**0.078**	0.000	0.000	0.000
	2	23		**0.684**	0.000	0.070	0.000	0.000	0.000
	3	23		-0.132	**-1.083**	**0.069**	0.000	0.000	0.000
	1		835	0.148	0.000	0.000	0.000	**0.035**	0.000
	2		835	-0.684	0.000	0.000	0.000	**0.031**	0.000
	3		840	0.132	0.000	0.000	0.000	0.031	**-0.501**
	1	19		**0.148**	0.000	**0.085**	0.000	0.000	0.000
	2	19		**-0.684**	0.000	**0.075**	0.000	0.000	0.000
	3	19		0.132	**-1.230**	0.075	0.000	0.000	0.000
34	1	28		**-0.148**	0.000	**0.078**	0.000	0.000	0.000
	2	28		**0.684**	0.000	0.070	0.000	0.000	0.000
	3	28		-0.132	**-0.677**	**0.069**	0.000	0.000	0.000
	1		835	0.148	0.000	0.000	0.000	**0.035**	0.000
	2		835	-0.684	0.000	0.000	0.000	**0.031**	0.000
	3		840	0.132	0.000	0.000	0.000	0.031	**-0.313**
	1	20		**0.148**	0.000	**0.085**	0.000	0.000	0.000
	2	20		**-0.684**	0.000	**0.075**	0.000	0.000	0.000
	3	20		0.132	**-0.769**	0.075	0.000	0.000	0.000
35	1	19		**-0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	19		**0.342**	0.000	0.084	0.000	0.000	0.000
	3	19		-0.128	**-1.386**	**0.084**	0.000	0.000	0.000
	1		916	0.143	0.000	0.000	0.000	**0.044**	0.000
	3		916	0.128	0.000	0.000	0.000	**0.039**	-0.635
	1	29		**0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	29		**-0.342**	0.000	**0.084**	0.000	0.000	0.000
	3	29		0.128	**-1.385**	0.084	0.000	0.000	0.000
36	1	20		**-0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	20		**0.342**	0.000	0.084	0.000	0.000	0.000
	3	20		-0.128	**-0.866**	**0.084**	0.000	0.000	0.000
	1		916	0.143	0.000	0.000	0.000	**0.044**	0.000
	3		916	0.128	0.000	0.000	0.000	**0.039**	-0.397
	1	30		**0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	30		**-0.342**	0.000	**0.084**	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
36	3	30		0.128	**-0.866**	0.084	0.000	0.000	0.000
37	1	29		**-0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	29		**0.054**	0.000	0.084	0.000	0.000	0.000
	3	29		-0.128	**-1.385**	**0.084**	0.000	0.000	0.000
	1		916	0.143	0.000	0.000	0.000	**0.044**	0.000
	3		916	0.128	0.000	0.000	0.000	**0.039**	-0.635
	1	21		**0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	21		**-0.054**	0.000	**0.084**	0.000	0.000	0.000
	3	21		0.128	**-1.386**	0.084	0.000	0.000	0.000
38	1	30		**-0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	30		**0.054**	0.000	0.084	0.000	0.000	0.000
	3	30		-0.128	**-0.866**	**0.084**	0.000	0.000	0.000
	1		916	0.143	0.000	0.000	0.000	**0.044**	0.000
	3		916	0.128	0.000	0.000	0.000	**0.039**	-0.397
	1	22		**0.143**	0.000	**0.095**	0.000	0.000	0.000
	2	22		**-0.054**	0.000	**0.084**	0.000	0.000	0.000
	3	22		0.128	**-0.866**	0.084	0.000	0.000	0.000
39	1	21		-0.148	0.000	**0.085**	0.000	0.000	0.000
	2	21		**-0.263**	0.000	**0.075**	0.000	0.000	0.000
	3	21		**-0.132**	**-1.230**	0.075	0.000	0.000	0.000
	3		814	0.132	0.000	0.000	0.000	0.031	**-0.501**
	1		819	0.148	0.000	0.000	0.000	**0.035**	0.000
	3		819	0.132	0.007	0.000	0.000	**0.031**	-0.501
	1	31		0.148	0.000	**0.078**	0.000	0.000	0.000
	2	31		**0.263**	0.000	0.070	0.000	0.000	0.000
	3	31		**0.132**	**-1.083**	**0.069**	0.000	0.000	0.000
40	1	22		-0.148	0.000	**0.085**	0.000	0.000	0.000
	2	22		**-0.263**	0.000	**0.075**	0.000	0.000	0.000
	3	22		**-0.132**	**-0.769**	0.075	0.000	0.000	0.000
	3		814	0.132	0.000	0.000	0.000	0.031	**-0.313**
	1		819	0.148	0.000	0.000	0.000	**0.035**	0.000
	3		819	0.132	0.004	0.000	0.000	**0.031**	-0.313
	1	36		0.148	0.000	**0.078**	0.000	0.000	0.000
	2	36		**0.263**	0.000	0.070	0.000	0.000	0.000
	3	36		**0.132**	**-0.677**	**0.069**	0.000	0.000	0.000
49	2	7		**-1.347**	**-0.289**	-0.001	0.000	0.000	0.000
	2	19		1.607	0.055	0.000	0.000	-0.001	**-0.324**
	3	19		-0.886	0.001	**-2.292**	0.000	-2.597	0.002
	3	19		-0.626	-0.003	0.327	0.000	**-2.597**	0.002
	2	55		1.819	**0.356**	0.000	0.000	0.000	0.020
	2	55		**1.960**	-0.123	0.000	0.000	0.000	**0.020**
	3	55		-0.273	0.011	**3.026**	0.000	-0.496	-0.002
	2	73		**1.975**	0.122	0.002	0.000	0.000	0.000
	3	73		-0.258	-0.011	**-3.025**	0.000	0.000	0.000
50	2	8		**-1.346**	**-0.289**	0.001	0.000	0.000	0.000
	2	20		1.606	0.055	0.000	0.000	**0.001**	**-0.324**
	3	20		-0.887	0.001	**-1.433**	0.000	-1.623	0.002
	3	20		-0.627	-0.003	0.204	0.000	**-1.623**	0.002
	2	56		1.818	**0.356**	0.000	0.000	0.000	0.020
	2	56		**1.959**	-0.123	0.000	0.000	0.000	**0.020**
	3	56		-0.274	0.011	**1.891**	0.000	-0.310	-0.002
	2	74		**1.974**	0.122	-0.002	0.000	0.000	0.000
	3	74		-0.259	-0.011	**-1.891**	0.000	0.000	0.000
51	2	11		**-2.010**	**-0.281**	-0.001	0.000	0.000	0.000
	2	21		2.270	0.038	0.000	0.000	0.000	**-0.314**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
51	3	21		-0.887	-0.001	**-2.292**	0.000	-2.597	-0.002
	3	21		-0.627	0.003	0.327	0.000	**-2.597**	-0.002
	2	39		2.481	**0.310**	0.000	0.000	0.000	-0.275
	1	57		-0.466	0.001	0.000	0.000	0.000	**0.002**
	2	57		**2.622**	0.145	0.000	0.000	0.000	-0.024
	3	57		-0.274	-0.011	**3.025**	0.000	-0.496	0.002
	2	75		**2.637**	-0.147	0.001	0.000	0.000	0.000
	3	75		-0.259	0.011	**-3.025**	0.000	0.000	0.000
52	2	12		**-2.010**	**-0.281**	0.001	0.000	0.000	0.000
	2	22		2.270	0.038	0.000	0.000	0.000	**-0.314**
	3	22		-0.886	-0.001	**-1.433**	0.000	-1.623	-0.002
	3	22		-0.625	0.003	0.204	0.000	**-1.623**	-0.002
	2	40		2.482	**0.310**	0.000	0.000	0.000	-0.275
	1	58		-0.465	0.001	0.000	0.000	0.000	**0.002**
	2	58		**2.623**	0.145	0.000	0.000	0.000	-0.024
	3	58		-0.273	-0.011	**1.891**	0.000	-0.310	0.002
	2	76		**2.638**	-0.147	-0.001	0.000	0.000	0.000
	3	76		-0.258	0.011	**-1.891**	0.000	0.000	0.000
65	2	9		**-1.732**	**-0.279**	-0.002	0.000	0.000	0.000
	2	29		2.001	0.010	0.000	0.000	0.000	**-0.312**
	3	29		-1.059	0.000	**-3.218**	0.000	-3.646	0.000
	2	47		2.244	**0.560**	0.000	0.000	0.000	-0.302
	3	47		-0.790	0.000	-0.442	0.000	**-4.098**	0.000
	2	65		2.244	**0.560**	0.000	0.000	0.000	0.152
	2	65		**2.444**	-0.218	0.000	0.000	0.000	**0.152**
	3	65		-0.347	0.000	**3.632**	0.000	-2.543	0.000
	2	89		**2.506**	0.217	0.002	0.000	0.000	0.000
	3	89		-0.285	0.000	**-3.631**	0.000	0.000	0.000
66	2	10		**-1.732**	**-0.279**	0.002	0.000	0.000	0.000
	2	30		2.001	0.010	0.000	0.000	0.000	**-0.312**
	3	30		-1.059	0.000	**-2.012**	0.000	-2.279	0.000
	2	48		2.244	**0.560**	0.000	0.000	0.000	-0.302
	3	48		-0.790	0.000	-0.276	0.000	**-2.561**	0.000
	2	66		2.244	**0.560**	0.000	0.000	0.000	0.152
	2	66		**2.444**	-0.218	0.000	0.000	0.000	**0.152**
	3	66		-0.347	0.000	**2.270**	0.000	-1.589	0.000
	2	94		**2.506**	0.217	-0.002	0.000	0.000	0.000
	3	94		-0.285	0.000	**-2.269**	0.000	0.000	0.000
67	1	37		0.010	0.000	**0.051**	0.000	0.000	0.000
	2	37		**0.165**	0.000	**0.045**	0.000	0.000	0.000
	3	37		**0.007**	**0.673**	0.045	0.000	0.000	0.000
	3		536	-0.007	0.000	0.001	0.000	0.012	**0.177**
	1		549	-0.010	0.000	0.000	0.000	**0.014**	0.000
	2		549	-0.165	0.000	0.000	0.000	**0.012**	0.000
	1	41		-0.010	0.000	**0.046**	0.000	0.000	0.000
	2	41		**-0.165**	0.000	0.040	0.000	0.000	0.000
	3	41		**-0.007**	**0.552**	**0.040**	0.000	0.000	0.000
68	1	38		0.010	0.000	**0.051**	0.000	0.000	0.000
	2	38		**0.165**	0.000	**0.045**	0.000	0.000	0.000
	3	38		**0.007**	**0.421**	0.045	0.000	0.000	0.000
	3		536	-0.007	0.000	0.001	0.000	0.012	**0.111**
	1		549	-0.010	0.000	0.000	0.000	**0.014**	0.000
	2		549	-0.165	0.000	0.000	0.000	**0.012**	0.000
	1	46		-0.010	0.000	**0.046**	0.000	0.000	0.000
	2	46		**-0.165**	0.000	0.040	0.000	0.000	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
68	3	46		**-0.007**	**0.345**	**0.040**	0.000	0.000	0.000
69	1	47		**0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	47		**-0.138**	0.000	0.076	0.000	0.000	0.000
	3	47		0.005	**1.178**	**0.076**	0.000	0.000	0.000
	1		916	-0.008	0.000	0.000	0.000	**0.039**	0.000
	3		916	-0.005	0.000	0.000	0.000	**0.035**	0.540
	1	37		**-0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	37		**0.138**	0.000	**0.076**	0.000	0.000	0.000
	3	37		-0.005	**1.178**	0.076	0.000	0.000	0.000
70	1	48		**0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	48		**-0.138**	0.000	0.076	0.000	0.000	0.000
	3	48		0.005	**0.736**	**0.076**	0.000	0.000	0.000
	1		916	-0.008	0.000	0.000	0.000	**0.039**	0.000
	3		916	-0.005	0.000	0.000	0.000	**0.035**	0.337
	1	38		**-0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	38		**0.138**	0.000	**0.076**	0.000	0.000	0.000
	3	38		-0.005	**0.736**	0.076	0.000	0.000	0.000
71	1	39		**0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	39		**-0.691**	0.000	0.076	0.000	0.000	0.000
	3	39		0.005	**1.178**	**0.076**	0.000	0.000	0.000
	1		916	-0.008	0.000	0.000	0.000	**0.039**	0.000
	3		916	-0.005	0.000	0.000	0.000	**0.035**	0.540
	1	47		**-0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	47		**0.691**	0.000	**0.076**	0.000	0.000	0.000
	3	47		-0.005	**1.178**	0.076	0.000	0.000	0.000
72	1	40		**0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	40		**-0.691**	0.000	0.076	0.000	0.000	0.000
	3	40		0.005	**0.736**	**0.076**	0.000	0.000	0.000
	1		916	-0.008	0.000	0.000	0.000	**0.039**	0.000
	2		916	0.691	0.000	0.000	0.000	**0.035**	0.000
	1	48		**-0.008**	0.000	**0.086**	0.000	0.000	0.000
	2	48		**0.691**	0.000	**0.076**	0.000	0.000	0.000
	3	48		-0.005	**0.736**	0.076	0.000	0.000	0.000
73	1	49		**0.010**	0.000	**0.046**	0.000	0.000	0.000
	2	49		**-0.966**	0.001	0.041	0.000	0.000	0.000
	3	49		0.007	**0.552**	**0.040**	0.000	0.000	0.000
	1		583	-0.010	0.000	0.000	0.000	**0.014**	0.000
	3		583	-0.007	0.015	0.000	0.000	**0.012**	0.177
	3		597	-0.007	0.000	-0.001	0.000	0.012	**0.177**
	1	39		**-0.010**	0.000	**0.051**	0.000	0.000	0.000
	2	39		**0.966**	**-0.001**	**0.044**	0.000	0.000	0.000
	3	39		-0.007	**0.673**	0.045	0.000	0.000	0.000
74	1	54		**0.010**	0.000	**0.046**	0.000	0.000	0.000
	2	54		**-0.966**	**-0.001**	0.041	0.000	0.000	0.000
	3	54		0.007	**0.345**	**0.040**	0.000	0.000	0.000
	1		583	-0.010	0.000	0.000	0.000	**0.014**	0.000
	3		583	-0.007	0.009	0.000	0.000	**0.012**	0.111
	3		597	-0.007	0.000	-0.001	0.000	0.012	**0.111**
	1	40		**-0.010**	0.000	**0.051**	0.000	0.000	0.000
	2	40		**0.966**	0.001	**0.044**	0.000	0.000	0.000
	3	40		-0.007	**0.421**	0.045	0.000	0.000	0.000
103	1	55		-0.031	0.000	**0.011**	0.000	0.000	0.000
	2	55		**-0.925**	**-0.001**	0.010	0.000	0.000	0.000
	3	55		**-0.030**	**0.104**	**0.009**	0.000	0.000	0.000
	3		158	0.030	0.000	0.000	0.000	0.001	**0.008**

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
103	1		160	0.031	0.000	0.000	0.000	**0.001**	0.000
	3		160	0.030	-0.001	0.000	0.000	**0.001**	0.008
	1	59		0.031	0.000	**0.010**	0.000	0.000	0.000
	2	59		**0.925**	0.001	**0.009**	0.000	0.000	0.000
	3	59		**0.030**	**0.098**	0.009	0.000	0.000	0.000
105	1	65		-0.045	0.000	**0.072**	0.000	0.000	0.000
	2	65		**-0.446**	0.000	0.064	0.000	0.000	0.000
	3	65		**-0.042**	**0.857**	**0.064**	0.000	0.000	0.000
	3		884	0.042	0.000	0.001	0.000	0.028	**0.367**
	1		900	0.045	0.000	0.000	0.000	**0.032**	0.000
	3		900	0.042	-0.014	0.000	0.000	**0.028**	0.367
	1	55		0.045	0.000	**0.067**	0.000	0.000	0.000
	2	55		**0.446**	0.000	**0.059**	0.000	0.000	0.000
	3	55		**0.042**	**0.742**	0.059	0.000	0.000	0.000
106	1	66		-0.045	0.000	**0.072**	0.000	0.000	0.000
	2	66		**-0.446**	0.000	0.064	0.000	0.000	0.000
	3	66		**-0.042**	**0.536**	**0.064**	0.000	0.000	0.000
	3		884	0.042	0.000	0.001	0.000	0.028	**0.229**
	1		900	0.045	0.000	0.000	0.000	**0.032**	0.000
	3		900	0.042	-0.009	0.000	0.000	**0.028**	0.229
	1	56		0.045	0.000	**0.067**	0.000	0.000	0.000
	2	56		**0.446**	0.000	**0.059**	0.000	0.000	0.000
	3	56		**0.042**	**0.464**	0.059	0.000	0.000	0.000
107	1	57		**-0.045**	0.000	**0.067**	0.000	0.000	0.000
	2	57		**0.332**	0.000	**0.059**	0.000	0.000	0.000
	3	57		-0.042	**0.742**	0.059	0.000	0.000	0.000
	1		933	0.045	0.000	0.000	0.000	**0.032**	0.000
	2		933	-0.332	0.000	0.000	0.000	**0.028**	0.000
	3		949	0.042	0.000	-0.001	0.000	0.028	**0.367**
	1	65		**0.045**	0.000	**0.072**	0.000	0.000	0.000
	2	65		**-0.332**	0.000	0.064	0.000	0.000	0.000
	3	65		0.042	**0.857**	**0.064**	0.000	0.000	0.000
108	1	58		**-0.045**	0.000	**0.067**	0.000	0.000	0.000
	2	58		**0.332**	0.000	**0.059**	0.000	0.000	0.000
	3	58		-0.042	**0.464**	0.059	0.000	0.000	0.000
	1		933	0.045	0.000	0.000	0.000	**0.032**	0.000
	2		933	-0.332	0.000	0.000	0.000	**0.028**	0.000
	3		949	0.042	0.000	-0.001	0.000	0.028	**0.229**
	1	66		**0.045**	0.000	**0.072**	0.000	0.000	0.000
	2	66		**-0.332**	0.000	0.064	0.000	0.000	0.000
	3	66		0.042	**0.535**	**0.064**	0.000	0.000	0.000
109	1	67		**-0.031**	0.000	**0.010**	0.000	0.000	0.000
	2	67		**0.497**	0.000	**0.009**	0.000	0.000	0.000
	3	67		-0.030	**0.098**	0.009	0.000	0.000	0.000
	1		162	0.031	0.000	0.000	0.000	**0.001**	0.000
	2		162	-0.497	0.000	0.000	0.000	**0.001**	0.000
	3		163	0.030	0.000	0.000	0.000	0.001	**0.008**
	1	57		**0.031**	0.000	**0.011**	0.000	0.000	0.000
	2	57		**-0.497**	0.000	0.010	0.000	0.000	0.000
	3	57		0.030	**0.104**	**0.009**	0.000	0.000	0.000
110	1	72		**-0.031**	0.000	**0.010**	0.000	0.000	0.000
	2	72		**0.496**	0.000	**0.009**	0.000	0.000	0.000
	3	72		-0.030	**0.061**	0.009	0.000	0.000	0.000
	1		162	0.031	0.000	0.000	0.000	**0.001**	0.000
	2		162	-0.496	0.000	0.000	0.000	**0.001**	0.000

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
110	3		163	0.030	0.000	0.000	0.000	0.001	**0.005**
	1	58		**0.031**	0.000	**0.011**	0.000	0.000	0.000
	2	58		**-0.496**	0.000	0.010	0.000	0.000	0.000
	3	58		0.030	**0.065**	**0.009**	0.000	0.000	0.000

8.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

8.3 BEREKENING VAN UNITY CHECKS

8.3.1 Staaf 35 - 63 x 120 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting **art. 6.1.2**

Combinatie: 1 x=0 mm Nx=0.143 kN Vy=0 kN Vz=0.095 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{143.4}{7560} = 0 \text{ N/mm}^2 < f_{t,0,d} = 6.5 \text{ N/mm}^2 \quad (6.1)$$

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 2 x=0 mm Nx=-0.342 kN Vy=0 kN Vz=0.084 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{341.7}{7560} = 0 \text{ N/mm}^2 < f_{c,0,d} = 14.5 \text{ N/mm}^2 \quad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 3 x=0 mm Nx=0.128 kN Vy=-1.385 kN Vz=0.084 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_{d} = \frac{V_{y,Ed}\ S}{b\ Iz} = \frac{1385.5 \times 59535}{120 \times 2500470} = 0.3 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \quad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 3 x=916.2 mm Nx=0.128 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.039 kNm Mz=-0.635 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{128}{7560} = 0 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.039 \times 10^6}{151 \times 10^3} = 0.3 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.635 \times 10^6}{79 \times 10^3} = 8 \text{ N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{9.7} + \frac{0.3}{16.6} + 0.7 \times \frac{8.0}{19.8} = 0.30 < 1.00 \qquad (6.17)$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{9.7} + 0.7 \times \frac{0.3}{16.6} + \frac{8.0}{19.8} = 0.42 < 1.00 \qquad (6.18)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 2 x=916.2 mm Nx=-0.342 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.039 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{342}{7560} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.039 \times 10^6}{151 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{t,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} = \left(\frac{0.0}{14.5}\right)^2 + \frac{0.3}{16.6} = 0.02 < 1.00 \qquad (6.19)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 2 x=916.2 mm Nx=-0.342 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.039 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{1832}{34.6} = 52.89 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{52.89}{\pi}\sqrt{\frac{21.0}{7400}} = 0.897 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{1832}{18.2} = 100.73 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{100.73}{\pi}\sqrt{\frac{21.0}{7400}} = 1.708 \qquad (6.22)$$

$$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}^2 = 0{,}5 \times (1 + 0.2 \times (0.897 - 0{,}3) + 0.897^2 = 0.96 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{0.96 + \sqrt{0.96^2 - 0.90^2}} = 0.76 \qquad (6.25)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (1.708 - 0{,}3) + 1.708^2 = 2.10 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{2.10 + \sqrt{2.10^2 - 1.71^2}} = 0.30 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{342}{7560} = 0 \text{ N/mm}^2 \qquad \sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.039 \times 10^6}{151 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.76 \times 14.5} + \frac{0.3}{16.6} + 0.7 \times \frac{0.0}{19.8} = 0.02 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\ f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.30 \times 14.5} + 0.7 \times \frac{0.3}{16.6} + \frac{0.0}{19.8} = 0.02 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 1 x=916.2 mm Nx=0.143 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.044 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 1832 = 1649$ mm

$$\sigma_{m,crit} = \frac{0{,}78\ b^2}{h\ l_{ef}} E_{0{,}05} = \frac{0{,}78 \times 63^2}{120 \times 1649} \times 7400 = 115.8 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{115.8}} = 0.455 < 0.75 \qquad \rightarrow k_{crit} = 1{,}00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.044 \times 10^6}{151 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = 0.3 \text{ N/mm}^2 < k_{crit}\ f_{m,d} = 1.00 \times 11.1 = 11.1 \text{ N/mm}^2 \qquad (6.33)$$

Combinatie: 5 x=915.4 mm Nx=-0.229 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0.036 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Lokale knoopverplaatsingen $d_{z1} = 1.8$ mm $d_{z2} = 1.8$ mm

$w_{eind,z} = w_z + k_{def}\ w_{BGT\ Quasi\text{-}blijvend,z} = -0.1 + 0.6 \times 0 = -0.1$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|-0.1|}{1832 / 250} = \frac{|-0.1|}{7.3} = 0.02 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = -0.1 - 0 = -0.1$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|-0.1|}{1832 / 333} = \frac{|-0.1|}{5.5} = 0.02 < 1.0$$

8.3.2 Staaf 65 - 100 x 200 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting **art. 6.1.2**

Combinatie: 2 x=3665 mm Nx=2.444 kN Vy=-0.218 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{2444.0}{20000} = 0.1 \text{ N/mm}^2 < f_{t,0,d} = 9.7 \text{ N/mm}^2 \qquad (6.1)$$

Druk evenwijdig aan de vezelrichting **art. 6.1.4**

Combinatie: 1 x=0 mm Nx=-1.191 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1191.1}{20000} = 0.1 \text{ N/mm}^2 < f_{c,0,d} = 9.7 \text{ N/mm}^2 \qquad (6.2)$$

Afschuiving **art. 6.1.7**

Combinatie: 3 x=3665 mm Nx=-0.347 kN Vy=0 kN Vz=3.632 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{3632.2 \times 500000}{100 \times 66666667} = 0.3 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \qquad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 2 x=1133 mm Nx=1.732 kN Vy=-0.275 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=-0.312 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{1732}{20000} = 0.1 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.000 \times 10^6}{667 \times 10^3} = 0 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.312 \times 10^6}{333 \times 10^3} = 0.9 \text{ N/mm}^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{9.7} + \frac{0.0}{16.6} + 0.7 \times \frac{0.9}{18.0} = 0.05 < 1.00 \qquad (6.17)$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{9.7} + 0.7 \times \frac{0.0}{16.6} + \frac{0.9}{18.0} = 0.06 < 1.00 \qquad (6.18)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{790}{20000} = 0 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.000 \times 10^6}{333 \times 10^3} = 0 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.0}{14.5}\right)^2 + \frac{6.1}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.37 < 1.00 \qquad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.0}{14.5}\right)^2 + 0.7 \times \frac{6.1}{16.6} + \frac{0.0}{18.0} = 0.26 < 1.00 \qquad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{3665}{57.7} = 63.48 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{63.48}{\pi}\sqrt{\frac{21.0}{7400}} = 1.076 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}^2 = 0{,}5 \times (1 + 0.2 \times (1.076 - 0{,}3) + 1.076^2 = 1.16 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.16 + \sqrt{1.16^2 - 1.08^2}} = 0.63 \qquad (6.25)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.153 - 0{,}3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{790}{20000} = 0 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.000 \times 10^6}{333 \times 10^3} = 0 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.63 \times 14.5} + \frac{6.1}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.37 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\, f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.20 \times 14.5} + 0.7 \times \frac{6.1}{16.6} + \frac{0.0}{18.0} = 0.27 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 3665 = 3299$ mm

$$\sigma_{m,crit} = \frac{0{,}78\, b^2}{h\, l_{ef}} E_{0,05} = \frac{0{,}78 \times 100^2}{200 \times 3299} \times 7400 = 87.5 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{87.5}} = 0.524 < 0.75 \qquad \rightarrow k_{crit} = 1{,}00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1059}{20000} = 0.1 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.153 - 0,3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{6.1}{1.00 \times 16.6}\right)^2 + \frac{0.1}{0.20 \times 14.5} = 0.16 < 1.00 \qquad (6.35)$$

Combinatie: 6 x=1832.5 mm Nx=-0.73 kN Vy=0 kN Vz=-0.328 kN
Mx=0 kNm My=-2.93 kNm Mz=0 kNm

Belastingsduurklasse : Kort

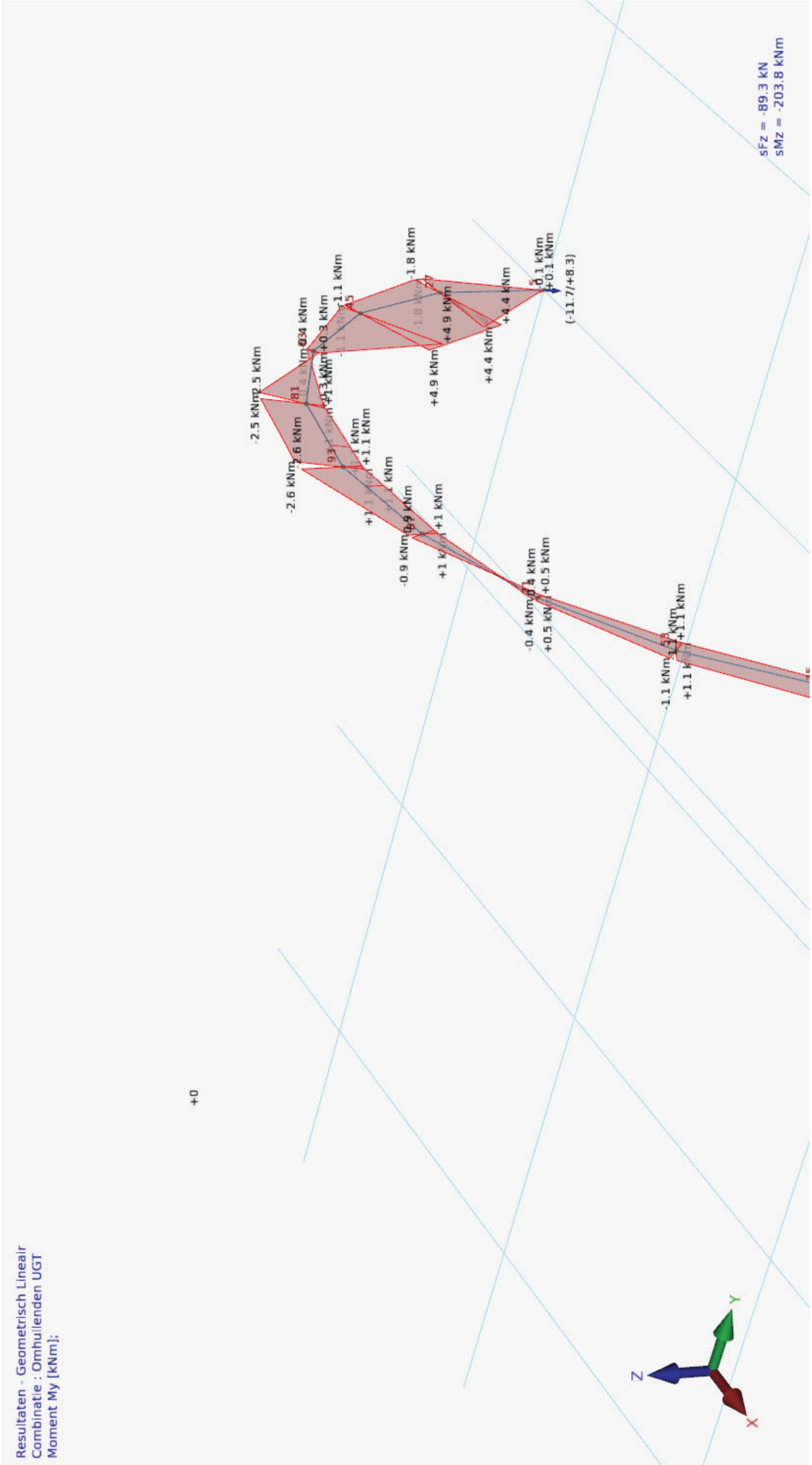
Lokale knoopverplaatsingen d_{z1} = 0 mm d_{z2} = 6.8 mm

$w_{eind,z} = w_z + k_{def}\ w_{BGT\ Quasi\text{-}blijvend,z}$ = 5.6 + 0.6 x 0 = 5.6 mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|5.6|}{3665 / 250} = \frac{|5.6|}{14.7} = 0.38 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z}$ = 5.6 - 0 = 5.6 mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|5.6|}{3665 / 333} = \frac{|5.6|}{11} = 0.51 < 1.0$$


sFz = -89.3 kN
sMz = -203.8 kNm
Resultaten - Geometrisch Lineair
Combinatie : Omhullenden UGT
Moment My [kNm];
-2.5 kNm
-2.6 kNm
-1.8 kNm
+4.9 kNm
+4.4 kNm
-1.1 kNm
-0.1 kNm
+0.1 kNm
(-11.7/+8.3)
-0.9 kNm
+1 kNm
-0.4 kNm
+0.5 kNm
-1.1 kNm
+1.1 kNm
+0
X
Y
Z

9.Invoergegevens selectie

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s ^{2}

9.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
4	0	5280	0	A	A	A			
9	3665	0	0	A	A	A			
29	3665	0	1133						
45	700	7780	2154						
47	3665	0	2154						
65	3665	0	2965						
80	2532	5280	3486						
81	2532	7780	3486						
89	3665	0	3665						

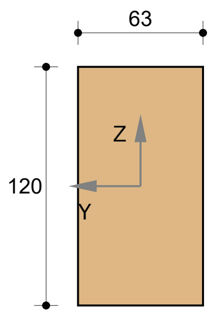
9.2 STAVEN

Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
27	45	4	paa___	aaa___	S50X5	3373
65	9	89	aaa___	aaa___	100 x 200	3665
133	80	81	aaa___	aaa___	63 x 120	2500

9.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
3	63 x 120	3.2	11000	7.56E3	4.0509E7	9.072E6	2.5005E6
4	S50X5	2.0	210000	2.5E2	1.952E3	5.2083E4	5.21E2
5	100 x 200	8.4	11000	2E4	3.7867E8	6.6667E7	1.6667E7

63 x 120



Materiaalgegevens
Sterkteklasse C24
Klimaatklasse 1
Materiaaltype Gezaagd hout γ_M = 1.30 k_{def} = 0.60 k_h = 1.05
Elasticiteitsmodulus E = 11000 N/mm ^{2}

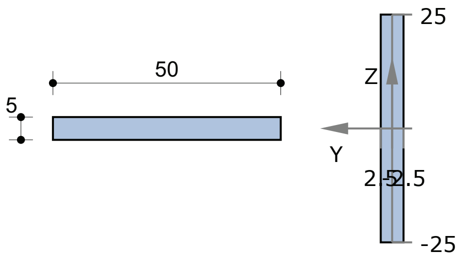
		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		25.10	14.64	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.58	6.76	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	15.44	9.01	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	17.37	10.13	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	=	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	31.5 mm	z_{max}	=	60.0 mm
Minimale coördinaat	y_{min}	=	-31.5 mm	z_{min}	=	-60.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	7560.0 mm ^{2}	G	=	3.2 kg/m
Statisch moment	S_y	=	113400 mm ^{3}	S_z	=	59535 mm ^{3}
Traagheidsmoment	I_x	=	40509164 mm ^{4}			
Traagheidsmoment	I_y	=	9072000 mm ^{4}	I_z	=	2500470 mm ^{4}
Traagheidsstraal	i_y	=	34.6 mm	i_z	=	18.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	151200 mm ^{3}	$W_{z;el}$	=	79380 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	9072000 mm ^{4}	I_{min}	=	2500470 mm ^{4}
Traagheidsstraal	i_{max}	=	34.6 mm	i_{min}	=	18.2 mm

S50X5



Materiaalgegevens

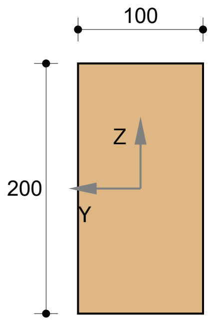
Staalsoort	S235	(Warmgewalst)	
Elasticiteitsmodulus	E	=	210000 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	2.5 mm	z_{max}	=	25.0 mm
Minimale coördinaat	y_{min}	=	-2.5 mm	z_{min}	=	-25.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	250.0 mm ^{2}	G	=	2.0 kg/m
Statisch moment	S_y	=	1563 mm ^{3}	S_z	=	156 mm ^{3}
Traagheidsmoment	I_x	=	1952 mm ^{4}			
Traagheidsmoment	I_y	=	52083 mm ^{4}	I_z	=	521 mm ^{4}
Traagheidsstraal	i_y	=	14.4 mm	i_z	=	1.4 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	2083 mm ^{3}	$W_{z;el}$	=	208 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	52083 mm ^{4}	I_{min}	=	521 mm ^{4}
Traagheidsstraal	i_{max}	=	14.4 mm	i_{min}	=	1.4 mm

Halveringslijn	z_h	=	0.0 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	3125 mm ^{3}	$W_{z;pl}$	=	313 mm ^{3}

100 x 200



Materiaalgegevens

Sterkteklasse	C24
Klimaatklasse	1
Materiaaltype	Gezaagd hout γ_M = 1.30 k_{def} = 0.60
Elasticiteitsmodulus	E = 11000 N/mm ^{2}

		$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$
		24.00	14.00	0.40	21.00	2.50	4.00N/mm ^{2}
Belastingsduurklasse	k_{mod}	$f_{m,d}$	$f_{t,0,d}$	$f_{t,90,d}$	$f_{c,0,d}$	$f_{c,90,d}$	$f_{v,d}$
Blijvend	0.60(0.50)	11.08	6.46	0.15	9.69	1.15	1.85N/mm ^{2}
Middellang	0.80(0.65)	14.77	8.62	0.20	12.92	1.54	2.46
Kort	0.90(0.80)	16.62	9.69	0.25	14.54	1.73	2.77

Volumieke massa	ρ_{mean}	=	420 kg/m ^{3}	ρ_k	=	350 kg/m ^{3}
Elasticiteitsmodulus	$E_{0,mean}$	=	11000 N/mm ^{2}	$E_{90,mean}$	=	370 N/mm ^{2}
Elasticiteitsmodulus (kruip)	$E_{0,fin}$	=	6875 N/mm ^{2}	$E_{90,fin}$	=	231 N/mm ^{2}
Elasticiteitsmodulus	$E_{0,05}$	=	7400 N/mm ^{2}	$E_{0,d}$	=	8462 N/mm ^{2}
Afschuifmodulus	G_{mean}	=	690 N/mm ^{2}	$G_{0,05}$	=	460 N/mm ^{2}

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	50.0 mm	z_{max}	=	100.0 mm
Minimale coördinaat	y_{min}	=	-50.0 mm	z_{min}	=	-100.0 mm
Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	20000.0 mm ^{2}	G	=	8.4 kg/m
Statisch moment	S_y	=	500000 mm ^{3}	S_z	=	250000 mm ^{3}
Traagheidsmoment	I_x	=	378666667 mm ^{4}			
Traagheidsmoment	I_y	=	66666667 mm ^{4}	I_z	=	16666667 mm ^{4}
Traagheidsstraal	i_y	=	57.7 mm	i_z	=	28.9 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	666667 mm ^{3}	$W_{z;el}$	=	333333 mm ^{3}
Centrifugaalmoment	C_{yz}	=	0 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	66666667 mm ^{4}	I_{min}	=	16666667 mm ^{4}
Traagheidsstraal	i_{max}	=	57.7 mm	i_{min}	=	28.9 mm

9.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

9.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

9.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
65	G-Z	q	-0.082 kN/m	-0.082 kN/m	0.0	0.0	9	0	3665
133	G-Z	q	-0.031 kN/m	-0.031 kN/m	0.0	0.0	80	0	2500
133	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	80	0	2500
133	G-Z	q	-0.029 kN/m	-0.029 kN/m	0.0	0.0	80	0	2500

9.6 BELASTINGSGEVAL 2 wind tegen as A

9.6.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
133	L-Z	q	1.064 kN/m	1.064 kN/m	0.0	0.0	80	0	2500
133	L-Y	q	0.169 kN/m	0.169 kN/m	0.0	0.0	80	0	2500
133	L-Y	q	-0.169 kN/m	-0.169 kN/m	0.0	0.0	80	0	2500
133	L-Z	q	1.065 kN/m	1.065 kN/m	0.0	0.0	80	0	2500

9.7 BELASTINGSGEVAL 3 wind tegen as 1

10.Berekeningsresultaten selectie

10.1 UITERSTE GRENSTOESTANDEN (UGT)

10.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		

10.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
27	1	45		**-0.069**	0.000	0.000	0.000	0.000	0.000
	2	45		**-10.602**	**0.049**	**-0.016**	0.000	0.000	0.000
	3	45		-6.319	**-0.007**	**0.001**	0.000	0.000	0.000
	1	4		**0.069**	0.000	0.000	0.000	0.000	0.000
	2	4		**10.602**	**-0.049**	**0.016**	0.000	0.000	0.000
	3	4		6.319	**0.007**	**-0.001**	0.000	0.000	0.000
65	2	9		**-1.732**	**-0.279**	-0.002	0.000	0.000	0.000
	2	29		2.001	0.010	0.000	0.000	0.000	**-0.312**
	3	29		-1.059	0.000	**-3.218**	0.000	-3.646	0.000
	2	47		2.244	**0.560**	0.000	0.000	0.000	-0.302
	3	47		-0.790	0.000	-0.442	0.000	**-4.098**	0.000
	2	65		2.244	**0.560**	0.000	0.000	0.000	0.152
	2	65		**2.444**	-0.218	0.000	0.000	0.000	**0.152**
	3	65		-0.347	0.000	**3.632**	0.000	-2.543	0.000
	2	89		**2.506**	0.217	0.002	0.000	0.000	0.000
	3	89		-0.285	0.000	**-3.631**	0.000	0.000	0.000
133	1	80		**0.494**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	80		1.132	-0.038	**-3.477**	0.000	0.000	0.000
	3	80		**1.316**	**-0.036**	0.111	0.000	0.000	0.000
	1		1250	-0.494	0.000	0.000	0.000	0.080	**-0.026**
	2		1250	-1.132	0.000	0.000	0.000	**-2.174**	-0.023
	3		1250	-1.316	0.000	0.000	0.000	0.071	**-0.023**
	1	81		**-0.494**	**-0.042**	**0.128**	0.000	0.000	0.000
	2	81		-1.132	**-0.036**	**-3.481**	0.000	0.000	0.000
	3	81		**-1.316**	-0.038	0.116	0.000	0.000	0.000

10.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
27	S50X5	2	1	6.2.3	0.18
		Maximale waarden			
27	S50X5	2	1	6.2.3	0.18

10.3 BEREKENING VAN UNITY CHECKS

10.3.1 Staaf 27 - S50X5

Axiale trek art. 6.2.3

Combinatie: 2 x=0 mm Nx=10.602 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

$$N_{pl,Rd} = \frac{A f_y}{\gamma_{M0}} = \frac{250 \times 235}{1.00} \times 10^{-3} = 58.8 \text{ kN} \qquad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{10.6}{58.8} = 0.18 < 1,0 \qquad (6.5)$$

10.3.2 Staaf 65 - 100 x 200 (C24 Klimaatklasse:1)

Trek evenwijdig aan de vezelrichting art. 6.1.2

Combinatie: 2 x=3665 mm Nx=2.444 kN Vy=-0.218 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{t,Ed}}{A} = \frac{2444.0}{20000} = 0.1 \text{ N/mm}^2 < f_{t,0,d} = 9.7 \text{ N/mm}^2 \qquad (6.1)$$

Druk evenwijdig aan de vezelrichting art. 6.1.4

Combinatie: 1 x=0 mm Nx=-1.191 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Blijvend

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1191.1}{20000} = 0.1 \text{ N/mm}^2 < f_{c,0,d} = 9.7 \text{ N/mm}^2 \qquad (6.2)$$

Afschuiving art. 6.1.7

Combinatie: 3 x=3665 mm Nx=-0.347 kN Vy=0 kN Vz=3.632 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{3632.2 \times 500000}{100 \times 66666667} = 0.3\ N/mm^2 < f_{v,d} = 2.8\ N/mm^2 \qquad (6.13)$$

Gecombineerde buig- en axiale trekspanningen **art. 6.2.3**

Combinatie: 2 x=1133 mm Nx=1.732 kN Vy=-0.275 kN Vz=0 kN
Mx=0 kNm My=0 kNm Mz=-0.312 kNm

Belastingsduurklasse : Kort

$$\sigma_{t,0,d} = \frac{N_{c,Ed}}{A} = \frac{1732}{20000} = 0.1\ N/mm^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{0.000 \times 10^6}{667 \times 10^3} = 0\ N/mm^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.312 \times 10^6}{333 \times 10^3} = 0.9\ N/mm^2$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{9.7} + \frac{0.0}{16.6} + 0.7 \times \frac{0.9}{18.0} = 0.05 < 1.00 \qquad (6.17)$$

$$\frac{\sigma_{t,0,d}}{f_{t,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{9.7} + 0.7 \times \frac{0.0}{16.6} + \frac{0.9}{18.0} = 0.06 < 1.00 \qquad (6.18)$$

Gecombineerde buig- en axiale drukspanningen **art. 6.2.4**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{790}{20000} = 0\ N/mm^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1\ N/mm^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.000 \times 10^6}{333 \times 10^3} = 0\ N/mm^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.0}{14.5}\right)^2 + \frac{6.1}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.37 < 1.00 \qquad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.0}{14.5}\right)^2 + 0.7 \times \frac{6.1}{16.6} + \frac{0.0}{18.0} = 0.26 < 1.00 \qquad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging **art. 6.3.2**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{3665}{57.7} = 63.48 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{63.48}{\pi}\sqrt{\frac{21.0}{7400}} = 1.076 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_y = 0{,}5(1 + \beta_c(\lambda_{rel,y} - 0{,}3) + \lambda_{rel,y}^2 = 0{,}5 \times (1 + 0.2 \times (1.076 - 0{,}3) + 1.076^2 = 1.16 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.16 + \sqrt{1.16^2 - 1.08^2}} = 0.63 \qquad (6.25)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.153 - 0{,}3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{790}{20000} = 0 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.000 \times 10^6}{333 \times 10^3} = 0 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\ f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.63 \times 14.5} + \frac{6.1}{16.6} + 0.7 \times \frac{0.0}{18.0} = 0.37 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\ f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.0}{0.20 \times 14.5} + 0.7 \times \frac{6.1}{16.6} + \frac{0.0}{18.0} = 0.27 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging **art. 6.3.3**

Combinatie: 3 x=2154 mm Nx=-0.79 kN Vy=0 kN Vz=-0.442 kN
Mx=0 kNm My=-4.098 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0 Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 3665 = 3299$ mm

$$\sigma_{m,crit} = \frac{0{,}78\ b^2}{h\ l_{ef}} E_{0,05} = \frac{0{,}78 \times 100^2}{200 \times 3299} \times 7400 = 87.5 \text{ N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{87.5}} = 0.524 < 0.75 \qquad \rightarrow k_{crit} = 1{,}00 \qquad (6.30)(6.34)$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{4.098 \times 10^6}{667 \times 10^3} = 6.1 \text{ N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1059}{20000} = 0.1 \text{ N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{3665}{28.9} = 126.96 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{126.96}{\pi}\sqrt{\frac{21.0}{7400}} = 2.153 \qquad (6.22)$$

$$k_z = 0{,}5(1 + \beta_c(\lambda_{rel,z} - 0{,}3) + \lambda_{rel,z}^2 = 0{,}5 \times (1 + 0.2 \times (2.153 - 0{,}3) + 2.153^2 = 3.00 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.00 + \sqrt{3.00^2 - 2.15^2}} = 0.20 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{6.1}{1.00 \times 16.6}\right)^2 + \frac{0.1}{0.20 \times 14.5} = 0.16 < 1.00 \qquad (6.35)$$

Combinatie: 6 x=1832.5 mm   Nx=-0.73 kN Vy=0 kN Vz=-0.328 kN
Mx=0 kNm My=-2.93 kNm Mz=0 kNm

Belastingsduurklasse : Kort

Lokale knoopverplaatsingen d_{z1} = 0 mm d_{z2} = 6.8 mm

$$w_{eind,z} = w_z + k_{def}\ w_{BGT\ Quasi\text{-}blijvend,z} = 5.6 + 0.6 \times 0 = 5.6 \text{ mm}$$

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|5.6|}{3665 / 250} = \frac{|5.6|}{14.7} = 0.38 < 1.0$$

$$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = 5.6 - 0 = 5.6 \text{ mm}$$

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|5.6|}{3665 / 333} = \frac{|5.6|}{11} = 0.51 < 1.0$$

10.3.3 Staaf 133 - 63 x 120 (C24 Klimaatklasse:1)

Druk evenwijdig aan de vezelrichting art. 6.1.4

Combinatie: 3 x=0 mm   Nx=-1.316 kN Vy=-0.037 kN Vz=0.114 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1316.4}{7560} = 0.2 \text{ N/mm}^2 < f_{c,0,d} = 14.5 \text{ N/mm}^2 \qquad (6.2)$$

Afschuiving art. 6.1.7

Combinatie: 2 x=0 mm   Nx=-1.132 kN Vy=-0.037 kN Vz=-3.479 kN
Mx=0 kNm My=0 kNm Mz=0 kNm

Belastingsduurklasse : Kort

$$\tau_d = \frac{V_{z,Ed}\ S}{b\ Iy} = \frac{3479.1 \times 113400}{63 \times 9072000} = 0.7 \text{ N/mm}^2 < f_{v,d} = 2.8 \text{ N/mm}^2 \qquad (6.13)$$

Gecombineerde buig- en axiale drukspanningen art. 6.2.4

Combinatie: 2 x=1250 mm   Nx=-1.132 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1132}{7560} = 0.1 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.023 \times 10^6}{79 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.1}{14.5}\right)^2 + \frac{14.4}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.88 < 1.00 \qquad (6.19)$$

$$\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \left(\frac{0.1}{14.5}\right)^2 + 0.7 \times \frac{14.4}{16.6} + \frac{0.3}{19.8} = 0.62 < 1.00 \qquad (6.20)$$

Kolommen onderworpen aan druk of aan druk en buiging art. 6.3.2

Combinatie: 2 x=1250 mm Nx=-1.132 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

$$\lambda_y = \frac{L_{cr,y}}{i_y} = \frac{2500}{34.6} = 72.17 \qquad \lambda_{rel,y} = \frac{\lambda_y}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{72.17}{\pi}\sqrt{\frac{21.0}{7400}} = 1.224 \qquad (6.21)$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_y = 0,5(1 + \beta_c(\lambda_{rel,y} - 0,3) + \lambda_{rel,y}^2 = 0,5 \times (1 + 0.2 \times (1.224 - 0,3) + 1.224^2 = 1.34 \qquad (6.27)$$

$$k_{c,y} = \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel,y}^2}} = \frac{1}{1.34 + \sqrt{1.34^2 - 1.22^2}} = 0.53 \qquad (6.25)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.331 - 0,3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1132}{7560} = 0.1 \text{ N/mm}^2$$

$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4 \text{ N/mm}^2 \qquad \sigma_{m,z,d} = \frac{M_{z,Ed}}{W_z} = \frac{0.023 \times 10^6}{79 \times 10^3} = 0.3 \text{ N/mm}^2$$

$$\frac{\sigma_{c,0,d}}{k_{c,y}\, f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{0.53 \times 14.5} + \frac{14.4}{16.6} + 0.7 \times \frac{0.3}{19.8} = 0.90 < 1.00 \qquad (6.23)$$

$$\frac{\sigma_{c,0,d}}{k_{c,z}\, f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} = \frac{0.1}{0.17 \times 14.5} + 0.7 \times \frac{14.4}{16.6} + \frac{0.3}{19.8} = 0.68 < 1.00 \qquad (6.24)$$

Liggers onderworpen aan druk of aan druk en buiging art. 6.3.3

Combinatie: 2 x=1250 mm Nx=-1.132 kN Vy=0 kN Vz=0 kN
Mx=0 kNm My=-2.174 kNm Mz=-0.023 kNm

Belastingsduurklasse : Kort

Aantal kipsteunen: 0

Op twee steunpunten: Gelijkmatig verdeelde belasting

$\rightarrow l_{ef} = 0.9 \times l = 0.9 \times 2500 = 2250$ mm

$$\sigma_{m,crit} = \frac{0,78\ b^2}{h\ l_{ef}} E_{0,05} = \frac{0,78 \times 63^2}{120 \times 2250} \times 7400 = 84.8\ \text{N/mm}^2 \qquad (6.32)$$

$$\lambda_{rel,m} = \sqrt{\frac{f_{m,k}}{\sigma_{m,crit}}} = \sqrt{\frac{24}{84.8}} = 0.532 < 0.75 \qquad \rightarrow k_{crit} = 1,00 \qquad (6.30)(6.34)$$

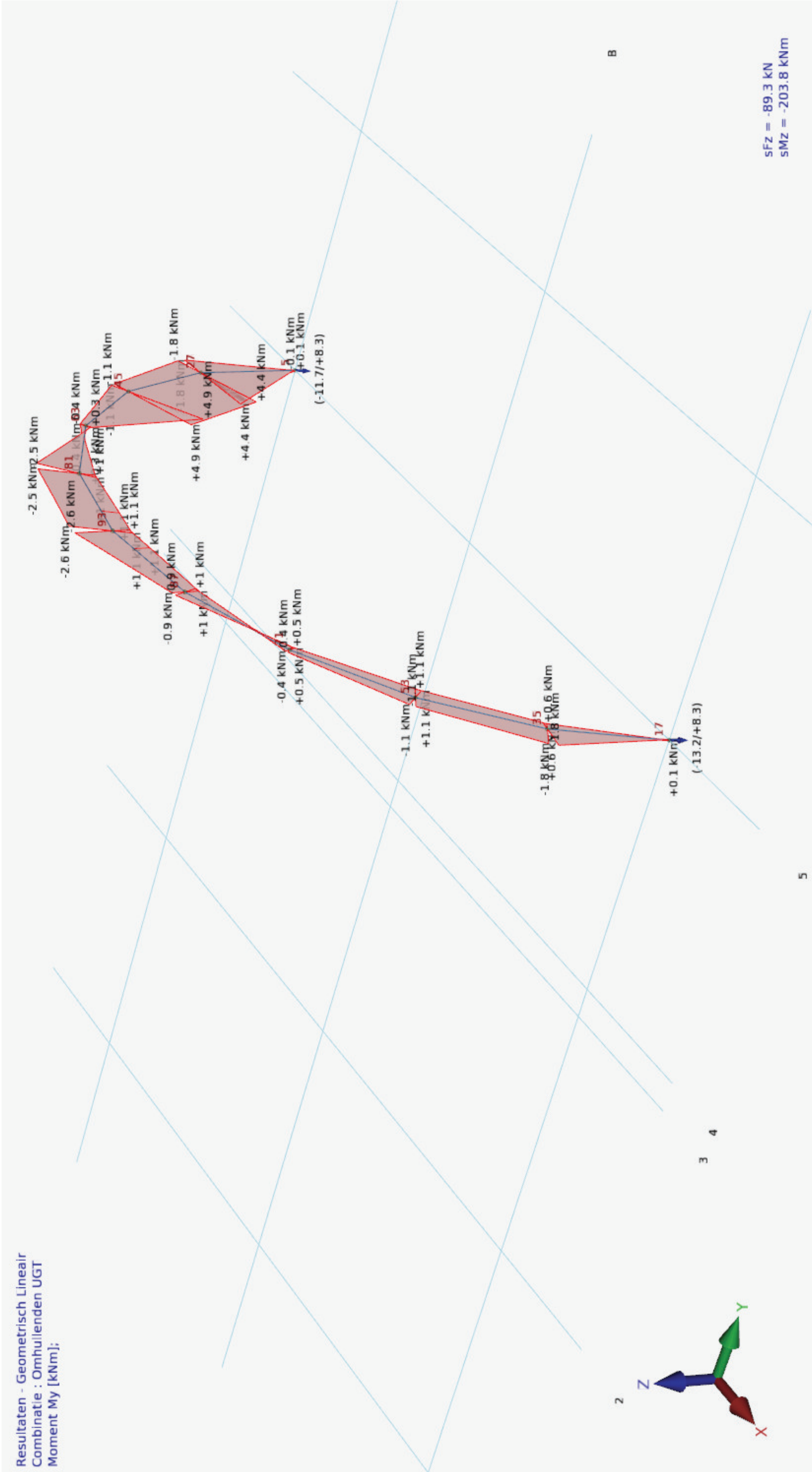
$$\sigma_{m,y,d} = \frac{M_{y,Ed}}{W_y} = \frac{2.174 \times 10^6}{151 \times 10^3} = 14.4\ \text{N/mm}^2 \qquad \sigma_{c,0,d} = \frac{N_{c,Ed}}{A} = \frac{1316}{7560} = 0.2\ \text{N/mm}^2$$

$$\lambda_z = \frac{L_{cr,z}}{i_z} = \frac{2500}{18.2} = 137.46 \qquad \lambda_{rel,z} = \frac{\lambda_z}{\pi}\sqrt{\frac{f_{c,0,k}}{E_{0,005}}} = \frac{137.46}{\pi}\sqrt{\frac{21.0}{7400}} = 2.331 \qquad (6.22)$$

$$k_z = 0,5(1 + \beta_c(\lambda_{rel,z} - 0,3) + \lambda_{rel,z}^2 = 0,5 \times (1 + 0.2 \times (2.331 - 0,3) + 2.331^2 = 3.42 \qquad (6.28)$$

$$k_{c,z} = \frac{1}{k_z + \sqrt{k_z^2 - \lambda_{rel,z}^2}} = \frac{1}{3.42 + \sqrt{3.42^2 - 2.33^2}} = 0.17 \qquad (6.26)$$

$$\left(\frac{\sigma_{m,d}}{k_{crit}\ f_{m,d}}\right)^2 + \frac{\sigma_{c,d}}{k_{c,d}\ f_{c,0,d}} = \left(\frac{14.4}{1.00 \times 16.6}\right)^2 + \frac{0.2}{0.17 \times 14.5} = 0.82 < 1.00 \qquad (6.35)$$


Resultaten - Geometrisch Lineair
Combinatie : Omhullenden UGT
Moment My [kNm];
sFz = -89.3 kN
sMz = -203.8 kNm

11.Invoergegevens spant as 5

Gehanteerde normen: : NEN-EN 1992-1-1+C1:2011/NB:2016+A1:2020 nl
NEN-EN 1993-1-1+C2+A1/NB:2016 nl
NEN-EN 1995-1-1+C1+A1:2011/NB:2013 nl
Gevolgklasse : CC1

Zwaartekrachtversnelling g : 9.81 m/s^2

11.1 KNOPEN

Knoop-nummer	Coördinaten			Opleggingen					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
5	0	7780	0	A	A	A			
17	7330	7780	0	A	A	A			
27	179	7780	1133						
35	7151	7780	1133						
45	700	7780	2154						
53	6630	7780	2154						
63	1511	7780	2965						
71	5819	7780	2965						
81	2532	7780	3486						
87	4798	7780	3486						
93	3665	7780	3665						

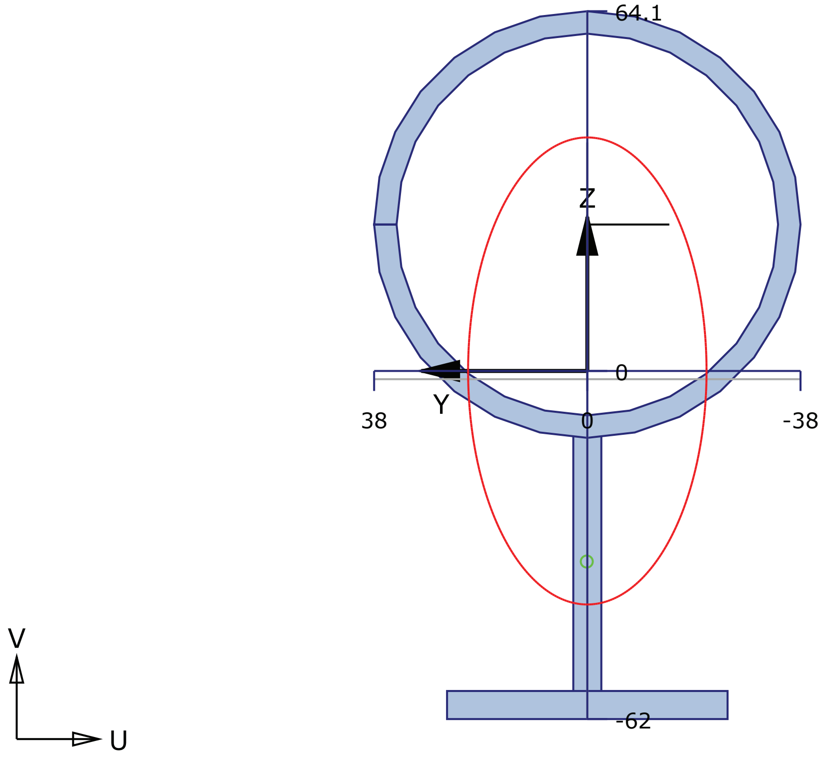
11.2 STAVEN

Staaf-nummer	Knoop		Staafaansluitingen		Profiel	Lengte [mm]
	van	naar	begin	begin		
17	5	27	aaaaaa	aaaaaa	buigprofiel	1147
23	35	17	aaaaaa	aaaaaa	buigprofiel	1147
57	27	45	aaaaaa	aaaaaa	buigprofiel	1146
63	53	35	aaaaaa	aaaaaa	buigprofiel	1146
87	45	63	aaaaaa	aaaaaa	buigprofiel	1147
93	71	53	aaaaaa	aaaaaa	buigprofiel	1147
123	63	81	aaaaaa	aaaaaa	buigprofiel	1146
129	87	71	aaaaaa	aaaaaa	buigprofiel	1146
147	81	93	aaaaaa	aaaaaa	buigprofiel	1147
153	93	87	aaaaaa	aaaaaa	buigprofiel	1147

11.3 PROFIELEN

Profiel-nummer	Naam	Gewicht [kg/m]	E [N/mm²]	A [mm²]	Ix [mm4]	Iy [mm4]	Iz [mm4]
2	buigprofiel	11.0	210000	1.397E3	1.1801E6	2.4179E6	6.3091E5

buigprofiel



Invoergegevens

1:S50X5

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-60.2 mm
Hoek		hoek	=	-90.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

2:S50X5(COPY)

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	-85.6 mm
Hoek		hoek	=	-180.0 graden			
Breedte		b	=	50.0 mm			
Flensdikte		tf	=	5.0 mm			

3:HFCHS761X4

Staalsoort	S235						
Elasticiteitsmodulus		E	=	210000 N/mm ^{2}			
Coördinaten (u,v)		u	=	0.0 mm	v	=	0.0 mm
Hoek		hoek	=	-180.0 graden			
Hoogte		h	=	76.0 mm			
Flensdikte		tf	=	4.0 mm			

Doorsnedegegevens

Maximale coördinaat	y_{max}	=	38.0 mm	z_{max}	=	62.0 mm
Minimale coördinaat	y_{min}	=	-38.0 mm	z_{min}	=	-64.1 mm

Zwaartelijn	z_s	=	0.0 mm	y_s	=	0.0 mm
Oppervlak / Gewicht	A	=	1397.2 mm ^{2}	G	=	11.0 kg/m
Statisch moment	S_y	=	24809 mm ^{3}	S_z	=	11967 mm ^{3}
Traagheidsmoment	I_x	=	1180116 mm ^{4}			
Traagheidsmoment	I_y	=	2417861 mm ^{4}	I_z	=	630910 mm ^{4}
Traagheidsstraal	i_y	=	41.6 mm	i_z	=	21.2 mm
Elastisch weerstandsmoment	$W_{y;el}$	=	37727 mm ^{3}	$W_{z;el}$	=	16603 mm ^{3}
Centrifugaalmoment	C_{yz}	=	2 mm ^{3}	hoek	=	0.00 graden
Traagheidsmoment	I_{max}	=	2417861 mm ^{4}	I_{min}	=	630910 mm ^{4}
Traagheidsstraal	i_{max}	=	41.6 mm	i_{min}	=	21.2 mm
Halveringslijn	z_h	=	1.5 mm	y_h	=	0.0 mm
Plastisch weerstandsmoment	$W_{y;pl}$	=	49593 mm ^{3}	$W_{z;pl}$	=	23935 mm ^{3}

11.4 BELASTINGSGEVALLEN

Nr.	Omschrijving	Type	ψ0	ψ1	ψ2
1	Permanent	Permanent incl. eigen gewicht	1.00	1.00	1.00
2	wind tegen as A	Wind	0.00	0.20	0.00
3	wind tegen as 1	Wind	0.00	0.20	0.00

Totaal eigen gewicht: : 2132 kg.

11.5 BELASTINGSGEVAL 1 Permanent INCL. eigen gewicht

11.5.1 Staafbelastingen

Staaf-	Belasting						Afstand van		
nummer	Richting	Type	q1	q2	Hoek	Exc.	Knoop	a [mm]	L [mm]
17	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	5	0	1147
23	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	35	0	1147
57	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	27	0	1146
63	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	53	0	1146
87	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	45	0	1147
93	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	71	0	1147
123	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	63	0	1146
129	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	87	0	1146
147	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	81	0	1147
153	G-Z	q	-0.108 kN/m	-0.108 kN/m	0.0	0.0	93	0	1147

11.6 BELASTINGSGEVAL 2 wind tegen as A

11.7 BELASTINGSGEVAL 3 wind tegen as 1

12.Berekeningsresultaten spant as 5

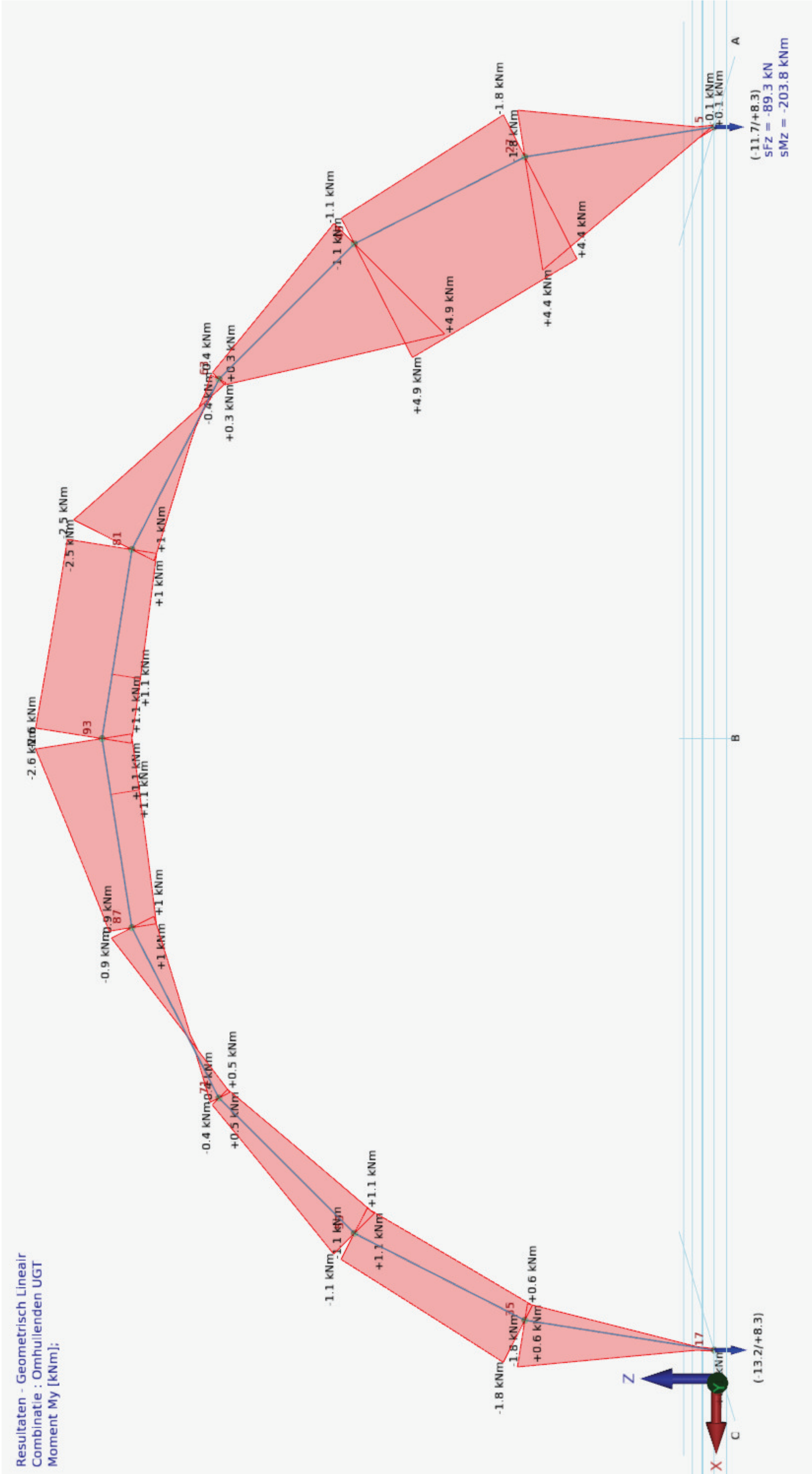
12.1 UITERSTE GRENSTOESTANDEN (UGT)

12.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3		
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		


Resultaten - Geometrisch Lineair
Combinatie : Omhullenden UGT
Moment My [kNm];
(-11.7/+8.3)
sFz = -89.3 kN
sMz = -203.8 kNm
(-13.2/+8.3)
+4.9 kNm
+4.4 kNm
-1.8 kNm
-1.1 kNm
-2.5 kNm
-2.6 kNm
-0.9 kNm
+1.1 kNm
+0.6 kNm

12.1.2 Omhullende staafkrachten

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
17	1	5		2.121	**0.029**	-0.367	-0.001	0.004	**0.039**
	2	5		**-6.858**	**-0.058**	**3.920**	**0.015**	**-0.068**	0.014
	3	5		**7.650**	-0.016	**-1.622**	**-0.018**	**0.059**	**0.004**
	1	27		-1.972	**-0.029**	0.391	0.001	0.433	**-0.006**
	2	27		**6.990**	**0.058**	**-3.899**	**-0.015**	**-4.327**	**-0.079**
	3	27		**-7.519**	0.016	**1.643**	**0.018**	**1.842**	-0.025
23	1	35		1.937	**-0.030**	0.394	0.001	-0.436	**0.005**
	2	35		**-12.750**	**0.027**	**-0.559**	**-0.041**	**0.622**	**0.055**
	3	35		**7.478**	0.016	**1.644**	**0.018**	**-1.843**	0.025
	1	17		-2.085	**0.030**	-0.370	-0.001	-0.004	**-0.039**
	2	17		**12.618**	**-0.027**	**0.580**	**0.041**	**0.034**	-0.026
	3	17		**-7.610**	-0.016	**-1.623**	**-0.018**	**-0.059**	**-0.004**
57	1	27		1.756	**0.014**	**0.117**	**-0.003**	-0.433	**0.005**
	2	27		**-7.905**	0.015	0.412	-0.010	**4.327**	**0.080**
	3	27		**7.445**	**0.233**	**0.659**	**-0.025**	**-1.842**	0.019
	1	45		-1.622	**-0.014**	**-0.049**	**0.003**	0.338	0.011
	2	45		**8.024**	-0.015	-0.352	0.010	**-4.738**	**-0.068**
	3	45		**-7.326**	**-0.233**	**-0.598**	**0.025**	**1.122**	**0.243**
63	1	53		1.589	-0.014	**-0.035**	0.003	-0.357	-0.011
	2	53		**-13.251**	**-0.006**	-0.336	**-0.022**	**1.066**	**0.063**
	3	53		**7.289**	**-0.233**	**-0.585**	**0.025**	**-1.139**	**-0.243**
	1	35		-1.723	0.014	**0.103**	-0.003	0.436	**-0.005**
	2	35		**13.132**	**0.006**	0.397	**0.022**	**-0.622**	**-0.065**
	3	35		**-7.407**	**0.233**	**0.645**	**-0.025**	**1.843**	-0.019
87	2	45		**-13.238**	**0.046**	**-3.942**	**-0.031**	**4.738**	**0.062**
	3	45		**2.813**	**-0.334**	**0.708**	**0.051**	**-1.122**	**-0.239**
	1	63		-1.161	0.007	-0.200	-0.001	0.046	**0.003**
	2	63		**13.332**	**-0.046**	**4.036**	**0.031**	**-0.251**	-0.027
	3	63		**-2.719**	**0.334**	**-0.614**	**-0.051**	**0.356**	**-0.150**
93	1	71		1.163	0.008	-0.205	**-0.001**	-0.059	**-0.003**
	2	71		**-13.847**	**-0.027**	**0.605**	-0.002	**0.483**	0.048
	3	71		**2.719**	**0.333**	**-0.618**	**-0.051**	**-0.368**	**0.149**
	1	53		-1.269	-0.008	0.312	**0.001**	0.357	0.012
	2	53		**13.753**	**0.027**	**-0.511**	0.002	**-1.066**	**-0.066**
	3	53		**-2.814**	**-0.333**	**0.712**	**0.051**	**1.139**	**0.239**
123	1	63		0.920	**-0.003**	0.309	0.001	-0.046	**-0.003**
	2	63		**-12.232**	0.131	**-2.410**	**-0.038**	**0.251**	0.016
	3	63		**2.290**	**0.278**	**1.210**	**0.002**	**-0.356**	**0.159**
	1	81		-0.852	**0.003**	-0.175	-0.001	-0.232	**-0.001**
	2	81		**12.292**	-0.131	**2.529**	**0.038**	**2.481**	0.118
	3	81		**-2.229**	**-0.278**	**-1.091**	**-0.002**	**-0.971**	**0.157**
129	1	87		0.852	**0.004**	-0.180	-0.002	0.224	0.002
	2	87		**-13.775**	-0.048	**1.252**	**0.013**	**-0.815**	**0.007**
	3	87		**2.229**	**-0.276**	**-1.095**	**-0.003**	**0.963**	**-0.155**
	1	71		-0.920	**-0.004**	0.314	0.002	0.059	**0.003**
	2	71		**13.715**	0.048	**-1.133**	**-0.013**	**-0.483**	-0.046
	3	71		**-2.289**	**0.276**	**1.214**	**0.003**	**0.368**	**-0.158**
147	1	81		**1.188**	**-0.005**	0.098	0.001	0.232	**0.001**
	2	81		**-13.289**	-0.070	**0.017**	**0.001**	**-2.481**	-0.124
	3	81		0.149	**-0.408**	**0.226**	**0.051**	**0.971**	**-0.148**
	2		434	13.289	-0.070	0.000	-0.001	**-2.470**	0.094
	1		758	-1.188	-0.005	0.000	-0.001	**0.269**	-0.005

Staaf-nummer	Comb. nummer	Knoop-nummer	x-lokaal [mm]	Nx-lokaal [kN]	Vy-lokaal [kN]	Vz-lokaal [kN]	Mx-lokaal [kNm]	My-lokaal [kNm]	Mz-lokaal [kNm]
147	1	93		**-1.165**	**0.005**	0.051	-0.001	-0.259	-0.007
	2	93		**13.310**	0.070	**0.115**	**-0.001**	**2.499**	**0.044**
	3	93		-0.128	**0.408**	**-0.094**	**-0.051**	**-1.155**	**-0.320**
153	1	93		**1.166**	0.004	0.044	-0.001	0.259	0.007
	2	93		**-13.711**	**-0.049**	**1.569**	**0.014**	**-2.499**	**-0.042**
	3	93		0.129	**0.407**	**-0.101**	**-0.050**	**1.155**	**0.320**
	1		338	-1.166	0.004	0.000	0.001	**0.267**	-0.005
	1	87		**-1.190**	-0.004	0.105	0.001	-0.224	-0.002
	2	87		**13.690**	**0.049**	**-1.437**	**-0.014**	**0.815**	**-0.002**
	3	87		-0.150	**-0.407**	**0.233**	**0.050**	**-0.963**	**0.147**

12.2 EN1993 TOETSINGEN / EN1995 TOETSINGEN

De toetsing van de staalprofielen in de uiterste grenstoestand volgens EN 1993-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.3.2. De toetsing van de houtprofielen in de uiterste grenstoestand volgens EN 1995-1-1 is gebaseerd op een geometrische niet-lineaire krachtsverdeling (tweede orde analyse) inclusief de gegeven imperfecties volgens art.5.4.4.

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
17	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.02
		2	1	6.2.5	0.01
		2	1	6.2.5	0.37
		2	1	6.2.6	0.03
		2	1	6.2.8	0.37
		2	1	6.2.8	0.01
		2	1	6.2.9.1	0.37
		2	1	6.2.9.1	0.01
		2	1	6.2.9.1	0.39
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.19
		5	1	Doorbuiging	0.11
		5	1	Doorbuiging	0.15
23	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.02
		3	1	6.2.5	0.16
		2	1	6.2.5	0.01
		3	1	6.2.6	0.01
		3	1	6.2.8	0.16
		2	1	6.2.8	0.01
		3	1	6.2.9.1	0.16
		2	1	6.2.9.1	0.01
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.19
		6	1	Doorbuiging	0.05
		6	1	Doorbuiging	0.07
57	buigprofiel	2	1	6.2.3	0.02
		3	1	6.2.4	0.02
		2	1	6.2.5	0.41
		3	1	6.2.5	0.04

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
57	buigprofiel	3	1	6.2.6	0.01
		2	1	6.2.8	0.41
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.41
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.42
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.23
		5	1	Doorbuiging	0.24
		5	1	Doorbuiging	0.31
63	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.02
		3	1	6.2.5	0.16
		3	1	6.2.5	0.04
		3	1	6.2.6	0.01
		3	1	6.2.8	0.16
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.16
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.16
		3	1	6.3.1.1	0.03
		3	1	6.3.3	0.23
		6	1	Doorbuiging	0.08
		6	1	Doorbuiging	0.11
87	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.41
		3	1	6.2.5	0.04
		2	1	6.2.6	0.04
		2	1	6.2.8	0.41
		3	1	6.2.8	0.04
		2	1	6.2.9.1	0.41
		3	1	6.2.9.1	0.04
		2	1	6.2.9.1	0.42
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.15
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.18
93	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		3	1	6.2.5	0.10
		3	1	6.2.5	0.04
		3	1	6.2.6	0.01
		3	1	6.2.8	0.10
		3	1	6.2.8	0.04
		3	1	6.2.9.1	0.10
		3	1	6.2.9.1	0.04
		3	1	6.2.9.1	0.14
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.15
		6	1	Doorbuiging	0.04
		6	1	Doorbuiging	0.06
123	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		2	1	6.2.5	0.21
		3	1	6.2.5	0.03

Staaf-nummer	Profiel	Combinatie nummer	Klasse	Artikel	U.C.
123	buigprofiel	2	1	6.2.6	0.02
		2	1	6.2.8	0.21
		3	1	6.2.8	0.03
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.03
		2	1	6.2.9.1	0.23
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.12
		5	1	Doorbuiging	0.06
		5	1	Doorbuiging	0.08
129	buigprofiel	2	1	6.2.3	0.04
		3	1	6.2.4	0.01
		3	1	6.2.5	0.08
		3	1	6.2.5	0.03
		3	1	6.2.6	0.01
		3	1	6.2.8	0.08
		3	1	6.2.8	0.03
		3	1	6.2.9.1	0.08
		3	1	6.2.9.1	0.03
		3	1	6.2.9.1	0.11
		3	1	6.3.1.1	0.01
		3	1	6.3.3	0.12
		6	1	Doorbuiging	0.02
		6	1	Doorbuiging	0.02
147	buigprofiel	2	1	6.2.3	0.04
		2	1	6.2.5	0.21
		3	1	6.2.5	0.06
		2	1	6.2.8	0.21
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.24
		1	1	6.3.1.1	0.00
		3	1	6.3.3	0.16
		5	1	Doorbuiging	0.13
		5	1	Doorbuiging	0.17
153	buigprofiel	2	1	6.2.3	0.04
		2	1	6.2.5	0.21
		3	1	6.2.5	0.06
		2	1	6.2.6	0.01
		2	1	6.2.8	0.21
		3	1	6.2.8	0.06
		2	1	6.2.9.1	0.21
		3	1	6.2.9.1	0.06
		2	1	6.2.9.1	0.22
		1	1	6.3.1.1	0.00
		1	1	6.3.3	0.03
		5	1	Doorbuiging	0.08
		5	1	Doorbuiging	0.11
Maximale waarden					
57	buigprofiel	2	1	6.2.9.1	0.42

12.3 BEREKENING VAN UNITY CHECKS

12.3.1 Staaf 57 - BUIGPROFIEL

Axiale trek **art. 6.2.3**

Combinatie: 2 x=0 mm Nx=7.905 kN Vy=0.01 kN Vz=0.388 kN
Mx=0.01 kNm My=4.327 kNm Mz=-0.08 kNm

$$N_{pl,Rd} = \frac{A\, f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.3 \text{ kN} \qquad (6.6)$$

$$\frac{N_{Ed}}{N_{t,Rd}} = \frac{7.9}{328.3} = 0.02 < 1,0 \qquad (6.5)$$

Axiale druk **art. 6.2.4**

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$N_{c,Rd} = \frac{A\, f_y}{\gamma_{M0}} = \frac{1397.2 \times 235}{1.00} \times 10^{-3} = 328.342 \text{ kN} \qquad (6.10)$$

$$\frac{N_{Ed}}{N_{c,Rd}} = \frac{7.4}{328.3} = 0.02 < 1,0 \qquad (6.9)$$

Buigend moment **art. 6.2.5**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$M_{y,c,Rd} = M_{pl,y,Rd} = \frac{W_{pl,y}\, f_y}{\gamma_{M0}} = \frac{49592.8 \times 235}{1.00} \times 10^{-6} = 11.654 \text{ kNm} \qquad (6.13)$$

$$\frac{M_{y,Ed}}{M_{y,c,Rd}} = \frac{4.738}{11.654} = 0.41 < 1,0 \qquad (6.12)$$

Buigend moment **art. 6.2.5**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$M_{z,c,Rd} = M_{pl,z,Rd} = \frac{W_{pl,z}\, f_y}{\gamma_{M0}} = \frac{23934.5 \times 235}{1.00} \times 10^{-6} = 5.625 \text{ kNm} \qquad (6.13)$$

$$\frac{M_{z,Ed}}{M_{z,c,Rd}} = \frac{0.243}{5.625} = 0.04 < 1,0 \qquad (6.12)$$

Dwarskracht (afschuiving) **art. 6.2.6**

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\, (f_y / \sqrt{3})}{\gamma_{M0}} = \frac{821.2 \times (235/\sqrt{3})}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$$\frac{V_{z,Ed}}{V_{c,z,Rd}} = \frac{0.7}{111.4} = 0.01 < 1{,}0 \qquad (6.17)$$

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$V_{c,z,Rd} = V_{pl,z,Rd} = \frac{A_v\ (f_y / \sqrt{3}\,)}{\gamma_{M0}} = \frac{821.2 \times (235/\sqrt{3}\,)}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{z,Ed}$ = 0.328 kN < $V_{z,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en dwarskracht **art. 6.2.8**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$V_{c,y,Rd} = V_{pl,y,Rd} = \frac{A_v\ (f_y / \sqrt{3}\,)}{\gamma_{M0}} = \frac{821.2 \times (235/\sqrt{3}\,)}{1.00} \times 10^{-3} = 111.4 \text{ kN} \qquad (6.18)$$

$V_{y,Ed}$ = 0.228 kN < $V_{y,pl,Rd}$ / 2 = 111.415 /2 = 55.708 kN

Het effect van de dwarskracht op de momentweerstand hoeft niet in rekening te worden gebracht. (2)

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$M_{N,Rd} = M_{pl,Rd}\ \left(1 - \left((N_{Ed} / N_{pl,Rd})\right)^2\right) = 11.7\ \left(1 - \left((7.9 / 328.3)\right)^2\right) = 11.648 \text{ kNm} \qquad (6.32)$$

$$\frac{M_{y,Ed}}{M_{N,y,Rd}} = \frac{4.738}{11.648} = 0.41 < 1{,}0 \qquad (6.31)$$

Buiging en normaalkracht **art. 6.2.9**

Combinatie: 3 x=1146 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.598 kN
Mx=0.025 kNm My=-1.122 kNm Mz=0.243 kNm

$$M_{N,Rd} = M_{pl,Rd}\ \left(1 - \left((N_{Ed} / N_{pl,Rd})\right)^2\right) = 5.6\ \left(1 - \left((7.4 / 328.3)\right)^2\right) = 5.622 \text{ kNm} \qquad (6.32)$$

$$\frac{M_{z,Ed}}{M_{N,z,Rd}} = \frac{0.243}{5.622} = 0.04 < 1{,}0 \qquad (6.31)$$

Buiging en normaalkracht art. 6.2.9

Combinatie: 2 x=1146 mm Nx=7.905 kN Vy=0.01 kN Vz=0.328 kN
Mx=0.01 kNm My=4.738 kNm Mz=-0.068 kNm

$$\left(\frac{M_{y,Ed}}{M_{N,y,Rd}}\right)^{\alpha} + \left(\frac{M_{z,Ed}}{M_{N,z,Rd}}\right)^{\beta} = \left(\frac{4.738}{11.648}\right)^{1} + \left(\frac{0.068}{5.621}\right)^{1} = 0.42 < 1,0 \qquad (6.41)$$

Knikstabiliteit art. 6.3.1.1

Combinatie: 3 x=0 mm Nx=7.445 kN Vy=0.233 kN Vz=0.659 kN
Mx=-0.025 kNm My=-1.842 kNm Mz=0.019 kNm

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0,5\,[1 + \alpha\,(\lambda_z - 0,2) + \lambda_z^2] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$$N_{b,Rd} = \frac{\chi_z A f_y}{\gamma_{M1}} = \frac{0.8 \times 1397.2 \times 235}{1.00} \times 10^{-3} = 262.9 \text{ kN} \qquad (6.47)$$

$$\frac{N_{Ed}}{N_{b,Rd}} = \frac{7.4}{262.9} = 0.03 < 1,0 \qquad (6.46)$$

Prismatische, op buiging en druk belaste staven art. 6.3.3

Combinatie: 3 x=0 mm Nx=-7.445 kN Vy=0.228 kN Vz=0.658 kN
Mx=0.025 kNm My=-1.842 kNm Mz=-0.019 kNm

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_y = \frac{L_{cr,y}}{i_y}\frac{1}{\lambda_1} = \frac{1146}{41.6}\frac{1}{93.9} = 0.293 \qquad (6.50)$$

$$\lambda_1 = \pi\sqrt{\frac{E}{f_y}} = \pi\sqrt{\frac{210000}{235}} = 93.9 \qquad \lambda_z = \frac{L_{cr,z}}{i_z}\frac{1}{\lambda_1} = \frac{1146}{21.2}\frac{1}{93.9} = 0.574 \qquad (6.50)$$

Knikkromme $_{y\text{-}y}$ c $\alpha = 0.49$

$$\Phi_y = 0,5\,[1 + \alpha\,(\lambda_y - 0,2) + \lambda_y^2] = 0,5 \times [1 + 0.49 \times (0.293 - 0,2) + 0.293^2] = 0.566$$

$$\chi_y = \frac{1}{\Phi_y + \sqrt{\Phi_y^2 - \lambda_y^2}} = \frac{1}{0.566 + \sqrt{0.566^2 - 0.293^2}} = 0.953 \qquad (6.49)$$

Knikkromme $_{z\text{-}z}$ c $\alpha = 0.49$

$$\Phi_z = 0,5\,[1 + \alpha\,(\lambda_z - 0,2) + \lambda_z^2] = 0,5 \times [1 + 0.49 \times (0.574 - 0,2) + 0.574^2] = 0.757$$

$$\chi_z = \frac{1}{\Phi_z + \sqrt{\Phi_z^2 - \lambda_z^2}} = \frac{1}{0.757 + \sqrt{0.757^2 - 0.574^2}} = 0.801 \qquad (6.49)$$

$N_{Rk} = f_y\ A = 235 \times 1397 \times 10^{-3} = 328.3$ kN

$M_{y,Rk} = f_y\ W_{pl,y} = 235 \times 49593 \times 10^{-6} = 11.7$ kNm

$M_{z,Rk} = f_y\ W_{pl,z} = 235 \times 23935 \times 10^{-6} = 5.6$ kNm

$$\frac{N_{Ed}}{\frac{\chi_y N_{Rk}}{\gamma_{M1}}} + k_{yy}\frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{yz}\frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.61)$$

$$\frac{7.445}{\frac{0.953 \times 328.342}{1.00}} + 1 \times \frac{1.842}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.243}{\frac{5.625}{1.00}} = 0.23 < 1 \qquad (6.61)$$

$$\frac{N_{Ed}}{\frac{\chi_z N_{Rk}}{\gamma_{M1}}} + k_{zy}\frac{M_{y,Ed} + \Delta M_{y,Ed}}{\chi_{Lt}\frac{M_{y,Rk}}{\gamma_{M1}}} + k_{zz}\frac{M_{z,Ed} + \Delta M_{z,Ed}}{\frac{M_{z,Rk}}{\gamma_{M1}}} = \qquad (6.62)$$

$$\frac{7.445}{\frac{0.801 \times 328.342}{1.00}} + 1 \times \frac{1.842}{1 \times \frac{11.654}{1.00}} + 1 \times \frac{0.243}{\frac{5.625}{1.00}} = 0.23 < 1 \qquad (6.62)$$

Doorbuiging

Combinatie: 5 x=578.2 mm — Nx=5.644 kN Vy=0.01 kN Vz=0.277 kN
Mx=0.008 kNm My=3.342 kNm Mz=-0.055 kNm

Lokale knoopverplaatsingen $d_{z1} = -9.5$ mm $d_{z2} = -12.1$ mm

$w_{eind,z} = w_z - w_{Zeeg,z} = -1.1 - 0 = -1.1$ mm

$$\frac{|w_{eind,z}|}{w_{eind,z,max}} = \frac{|-1.1|}{1146 / 250} = \frac{|-1.1|}{4.6} = 0.24 < 1.0$$

$w_{bijk.,z} = w_z - w_{BGT\ Blijvend,z} = -1.1 - 0 = -1.1$ mm

$$\frac{|w_{bijk.,z}|}{w_{bijk.,z,max}} = \frac{|-1.1|}{1146 / 333} = \frac{|-1.1|}{3.4} = 0.31 < 1.0$$

Bestand :....22063\berekening\2022-06-11\kiosk.xfem

Inhoudsopgave

1.Berekeningsresultaten

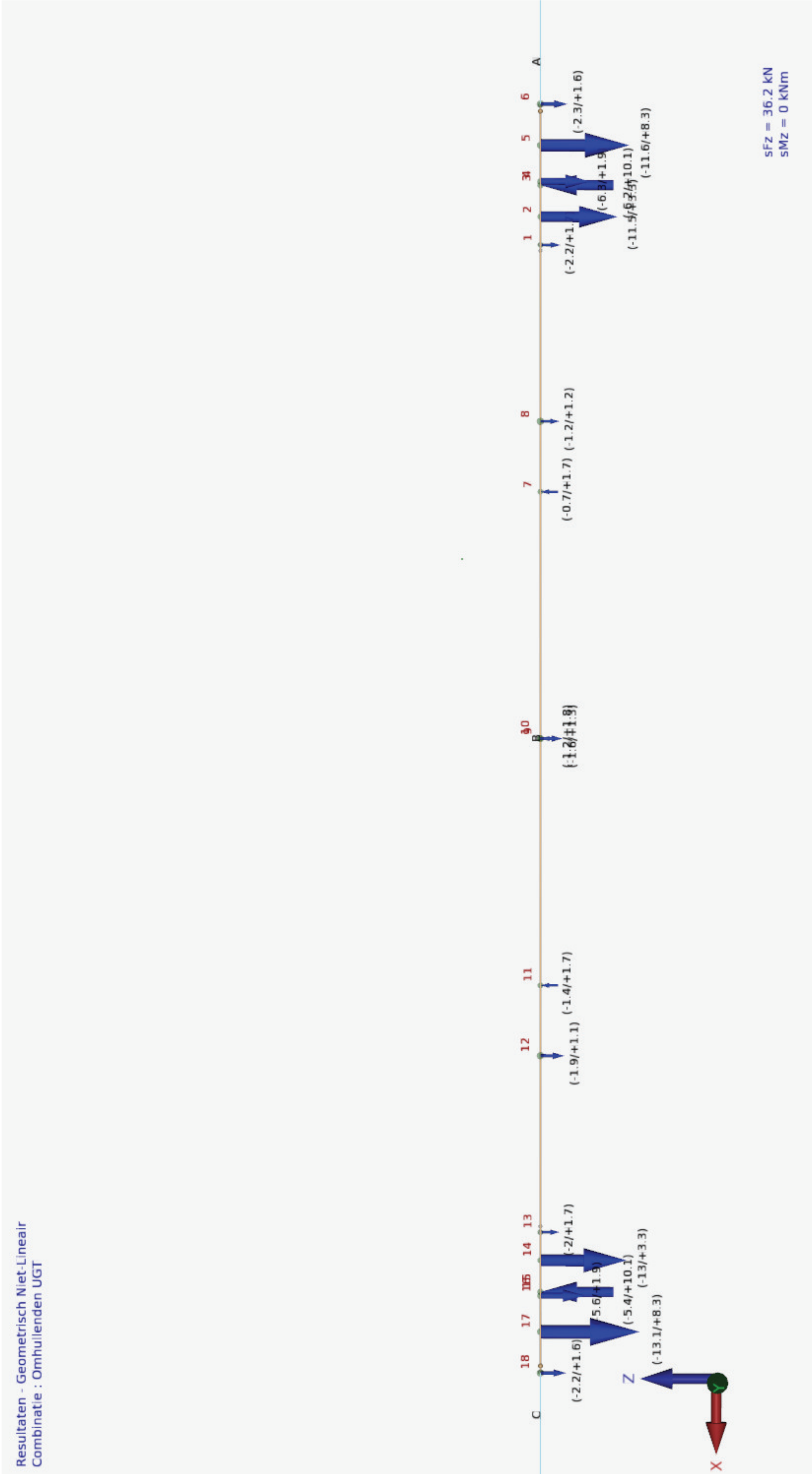
1.1 UITERSTE GRENSTOESTANDEN (UGT)

1.1.1 Belastingscombinaties

(GNL) Geometrisch niet-lineaire krachtsverdeling

Combinatie nummer	Omschrijving	Type
1	Permanent	UGT
2	wind tegen as A	UGT
3	wind tegen as 1	UGT
4	wind tegen as 6	UGT

Combinatie nummer	Belasting (ψ x γ)				
	1	2	3	4	
1	1.00 x 1.22				
2	1.00 x 1.08	1.00 x 1.35			
3	1.00 x 1.08		1.00 x 1.35		
4	1.00 x 1.08			1.00 x 1.35	


Resultaten - Geometrisch Niet-Lineair
Combinatie : Omhullenden UGT
sFz = 36.2 kN
sMz = 0 kNm
(-2.3/+1.6)
(-11.6/+8.3)
(-0.7/+1.7)
(-1.2/+1.2)
(-1.4/+1.7)
(-1.9/+1.1)
(-5.4/+10.1)
(-13/+3.3)
(-13.1/+8.3)
(-2.2/+1.6)

1.1.2 Omhullende reactiekrachten

Knoop-nummer	Comb. nummer	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	1	0.173	0.011	**1.745**			
	2	**-1.695**	**0.053**	**-2.155**			
	3	0.147	**-0.605**	1.538			
	4	**0.655**	0.007	-0.364			
2	1	0.749	-0.030	**3.338**			
	2	**-8.211**	**-7.624**	**-11.482**			
	4	**1.683**	**-0.020**	-2.895			
3	2	**-4.441**	**7.806**	**-6.166**			
	3	**3.980**	**-0.182**	**10.056**			
4	1	0.461	-0.018	**1.875**			
	2	**-4.493**	**-7.857**	**-6.317**			
	4	**0.806**	**-0.013**	-1.248			
5	2	**-8.263**	**7.675**	**-11.623**			
	3	**2.799**	**-0.016**	**8.320**			
6	1	0.173	-0.012	**1.556**			
	2	**-1.695**	-0.053	**-2.322**			
	3	0.157	**-0.411**	1.383			
	4	**0.655**	**-0.008**	-0.531			
7	1	0.002	0.000	**1.697**			
	2	**-0.289**	**-0.001**	**-0.728**			
	3	0.001	**-3.950**	1.504			
	4	**0.002**	0.000	0.848			
8	1	0.002	0.000	**1.151**			
	2	**-0.289**	**0.001**	**-1.212**			
	3	0.001	**-2.469**	1.021			
	4	**0.002**	0.000	0.364			
9	1	0.000	0.000	**1.759**			
	2	**-0.279**	**-0.002**	**-1.229**			
	3	0.000	**-4.565**	1.562			
10	1	0.000	0.000	**1.315**			
	2	**-0.279**	**0.002**	**-1.623**			
	3	0.000	**-2.853**	1.168			
11	1	-0.002	0.000	**1.698**			
	2	**-0.281**	-0.001	**-1.391**			
	3	**-0.001**	**-3.950**	1.505			
12	1	-0.002	0.000	**1.150**			
	2	**-0.281**	0.001	**-1.876**			
	3	**-0.002**	**-2.469**	1.020			
13	1	-0.173	**0.011**	**1.745**			
	2	**-2.131**	0.010	**-1.986**			
	3	**-0.147**	**-0.604**	1.538			
14	1	-0.751	-0.030	**3.341**			
	2	-1.440	-1.203	**-12.970**			
	3	**2.971**	**-7.451**	-5.880			
	4	**-1.684**	**-0.020**	-2.893			
15	1	**-0.520**	0.019	2.051			
	2	-1.055	**0.963**	**-5.390**			
	3	**-3.983**	**-0.181**	**10.070**			
16	1	-0.464	-0.017	**1.865**			
	2	**-1.006**	-1.015	**-5.552**			
	3	**1.847**	**-4.712**	-3.271			
	4	-0.808	**-0.012**	-1.258			

Knoop-nummer	Comb. nummer	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
17	1	**-0.690**	0.030	3.144			
	2	-1.386	**1.257**	**-13.143**			
	3	**-2.794**	**-0.016**	**8.280**			
18	1	-0.173	-0.012	**1.556**			
	2	**-2.131**	-0.011	**-2.153**			
	3	**-0.157**	**-0.411**	1.383			
	4	-0.655	**-0.008**	-0.531			
Minimale / maximale waarden							
5	2	**-8.263**					
3	3	**3.980**					
4	2		**-7.857**				
3	2		**7.806**				
17	2			**-13.143**			
15	3			**10.070**			

Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

fischer Benelux B.V
[redacted]
www.fischer.nl

Ontwerp specificaties

Anker

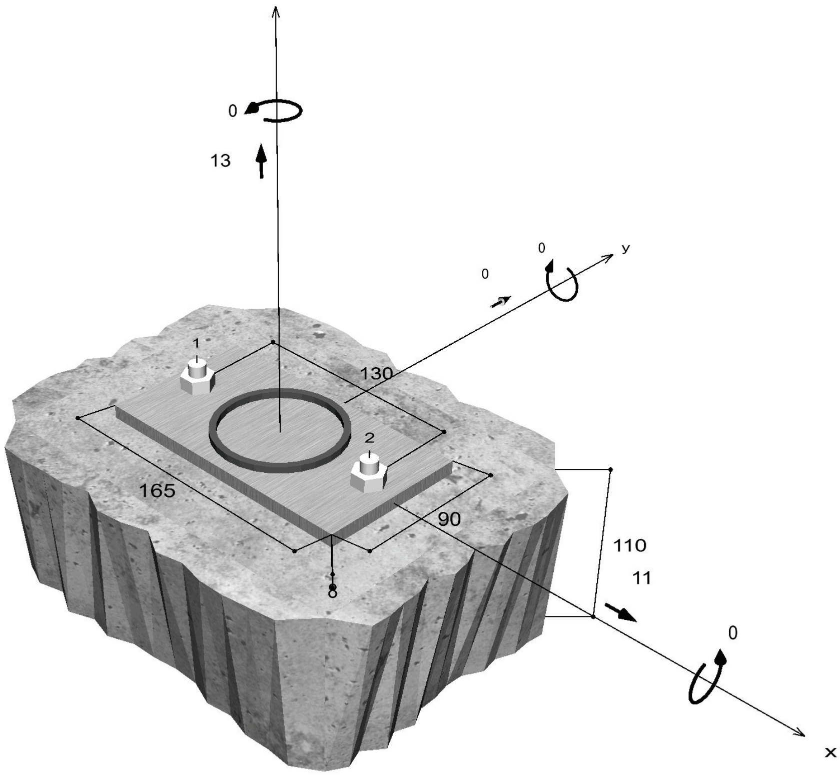
Systeem	fischer Segmentanker FAZ II
Anker	Segment anker FAZ II 10/10, Elektrolytisch verzinkt staal
Verankeringsdiepte	48 mm
Berekeningsgegevens	Ankerdimensionering in Beton volgens European Technical Assessment ETA-05/0069, Optie 1, Afgegeven op 24-4-2020

Geometrie / Belastingen

mm, kN, kNm

Rekenwaarden (inclusief veiligheidsfactoren aan de belastingzijde)

Statische belasting



Niet op schaal

Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

Gegevens

Ontwerpmethode	Ontwerp methode EN 1992-4:2017 Mechanische ankers
Ondergrond	C20/25, EN 206
Betonsituatie	Gescheurd, Droog boorgat
Wapening	Geen of normale wapening. Zonder randwapening. Met Splijtwapening
Boormethode	Hamerboren
Installatie	Doorsteek montage
Ruimte in doorvoergat	Doorvoergat niet gevult
Belasting type	Statisch
Afstand montage	Geen Buiging
Ankerplaat afmetingen	165 mm x 90 mm x 8 mm
Profiel type	Cirkelvormig buisprofiel (76,1 x 4)

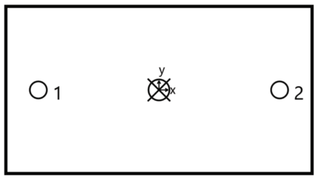
Rekenwaarde van de belastingen *)

#	N_{Ed} kN	$V_{Ed,x}$ kN	$V_{Ed,y}$ kN	$M_{Ed,x}$ kNm	$M_{Ed,y}$ kNm	$M_{T,Ed}$ kNm	Belasting type
1	13.00	11.00	0.00	0.00	0.00	0.00	Statisch

*) Inclusief benodigde veiligheidsfactoren voor de belasting

Resulterende ankerkracht

Anker nr.	Trekkracht kN	Dwarskracht kN	Dwarskracht x kN	Dwarskracht y kN
1	6.50	5.50	5.50	0.00
2	6.50	5.50	5.50	0.00



Max. betondrukspanning :	0.00 ‰	
Max. betondrukspanning :	0.0 N/mm²	
Resultante trekkracht :	13.00 kN ,	X/Y positie (0 / 0)
Resultante drukkracht :	0.00 kN ,	X/Y positie (0 / 0)

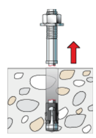
Opneembare rekenwaarde trekkracht

Berekening	Belasting kN	Capaciteit kN	Uitnutting β_N %
Staalbreuk *	6.50	18.87	34.5
Uittrekken *	6.50	8.67	75.0
Betonkegel breuk	13.00	14.53	**89.5**

* Maatgevende anker

Staalbreuk

$$N_{Ed} \leq \frac{N_{Rk,s}}{\gamma_{Ms}} \quad (N_{Rd,s})$$



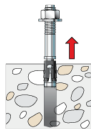
Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

$N_{Rk,s}$ kN	γ_{Ms}	$N_{Rd,s}$ kN	N_{Ed} kN	$\beta_{N,s}$ %
28.30	1.50	18.87	6.50	34.5

Anker nr.	$\beta_{N,s}$ %	Groep N°	Maatgevende Beta
1	34.5	1	$\beta_{N,s;1}$
2	34.5	2	$\beta_{N,s;2}$

Uittrekken

$$N_{Ed} \leq \frac{N_{Rk,p}}{\gamma_{Mp}} \quad (\mathbf{N_{Rd,p}})$$



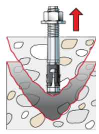
$N_{Rk,p}$ kN	Ψ_c	γ_{Mp}	$N_{Rd,p}$ kN	N_{Ed} kN	$\beta_{N,p}$ %
13.00	1.000	1.50	8.67	6.50	75.0

De gegeven Psi, c-factor is mogelijk bepaald door interpolatie.

Anker nr.	$\beta_{N,p}$ %	Groep N°	Maatgevende Beta
1, 2	75.0	1	$\beta_{N,p;1}$

Betonkegel breuk

$$N_{Ed} \leq \frac{N_{Rk,c}}{\gamma_{Mc}} \quad (\mathbf{N_{Rd,c}})$$



$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Vergelijking (7.1)

$$N_{Rk,c} = 11.45kN \cdot \frac{39{,}456mm^2}{20{,}736mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 21.79kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{20.0N/mm^2} \cdot \left(48mm\right)^{1.5} = 11.45kN$$ Vergelijking (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{72mm}\right) = 1.000 \leq 1$$ Vergelijking (7.4)

$$\Psi_{re,N} = 1.000$$ Vergelijking (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Longrightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Vergelijking (7.6)

$$\Psi_{ec,Nx} = \frac{1}{1 + \frac{2 \cdot 0mm}{144mm}} = 1.000 \leq 1 \qquad \Psi_{ec,Ny} = \frac{1}{1 + \frac{2 \cdot 0mm}{144mm}} = 1.000 \leq 1$$

$$\Psi_{M,N} = 1.00 \geq 1$$ Vergelijking (7.7)

Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

$N_{Rk,c}$ kN	γ_{Mc}	$N_{Rd,c}$ kN	N_{Ed} kN	$\beta_{N,c}$ %
21.79	1.50	14.53	13.00	89.5

Anker nr.	$\beta_{N,c}$ %	Groep N°	Maatgevende Beta
1, 2	89.5	1	$\beta_{N,c;1}$

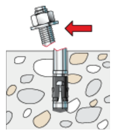
Opneembare dwarskracht

Berekening	Belasting kN	Capaciteit kN	Uitnutting β_V %
Staalbreuk zonder hefboomsarm *	5.50	17.12	**32.1**
Beton achteruitbreken	11.00	37.77	29.1

* Maatgevende anker

Staalbreuk zonder hefboomsarm

$$V_{Ed} \leq \frac{V_{Rk,s}}{\gamma_{Ms}} \quad (\mathbf{V_{Rd,s}})$$



$$V_{Rk,s} = k_7 \cdot V^0_{Rk,s} = 1.00 \cdot 21.40kN = 21.40kN$$

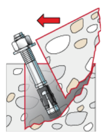
Vergelijking (7.35)/(7.36)

$V_{Rk,s}$ kN	γ_{Ms}	$V_{Rd,s}$ kN	V_{Ed} kN	β_{Vs} %
21.40	1.25	17.12	5.50	32.1

Anker nr.	β_{Vs} %	Groep N°	Maatgevende Beta
1	32.1	1	$\beta_{Vs;1}$
2	32.1	2	$\beta_{Vs;2}$

Beton achteruitbreken

$$V_{Ed} \leq \frac{V_{Rk,cp}}{\gamma_{Mc}} \quad (\mathbf{V_{Rd,cp}})$$



$$V_{Rk,cp} = k_8 \cdot N_{Rk,c} = 2.6 \cdot 21.79kN = 56.65kN$$

Vergelijking (7.39a)

$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$

Vergelijking (7.1)

$$N_{Rk,c} = 11.45kN \cdot \frac{39{,}456mm^2}{20{,}736mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 21.79kN$$

Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h^{1.5}_{ef} = 7.7 \cdot \sqrt{20.0N/mm^2} \cdot \left(48mm\right)^{1.5} = 11.45kN$$ Vergelijking (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{72mm}\right) = 1.000 \leq 1$$ Vergelijking (7.4)

$$\Psi_{re,N} = 1.000$$ Vergelijking (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Vergelijking (7.6)

$$\Psi_{M,N} = 1.00 \geq 1$$ Vergelijking (7.7)

$V_{Rk,cp}$ kN	γ_{Mc}	$V_{Rd,cp}$ kN	V_{Ed} kN	$\beta_{V,cp}$ %
56.65	1.50	37.77	11.00	29.1

Anker nr.	$\beta_{V,cp}$ %	Groep N°	Maatgevende Beta
1, 2	29.1	1	$\beta_{V,cp;1}$

Uitnutting van trek- en dwarskrachten

Trekkrachten	Uitnutting βN %
Staalbreuk *	34.5
Uittrekken *	75.0
Betonkegel breuk	**89.5**

* Maatgevende anker

Dwarskrachten	Uitnutting βV %
Staalbreuk zonder hefboomsarm *	**32.1**
Beton achteruitbreken	29.1

Gecombineerde trek- en drukkracht

Uitnutting van het staal

$$\beta_{N.s} = \beta_{N,s;2} = 0.34 \leq 1$$
$$\beta_{V.s} = \beta_{Vs;1} = 0.32 \leq 1$$
$$\beta_N^2 + \beta_V^2 = \beta_{N,s;2}^2 + \beta_{Vs;2}^2 = 0.22 \leq 1$$

Vergelijking (7.55)

Uitnutting van beton

Berekening succesvol

$$\beta_{N.c} = \beta_{N,c;1} = 0.89 \leq 1$$
$$\beta_{V.cp} = \beta_{V,cp;1} = 0.29 \leq 1$$
$$\frac{\beta_N + \beta_V}{1.2} = \frac{\beta_{N,c;1} + \beta_{V,cp;1}}{1.2} = 0.99 \leq 1$$

Vergelijking (7.57)

Informatie betreffende de ankerplaat

Ankerplaat details

Ankerplaat dikte zonder berekening gekozen t = 8 mm

Profiel type Cirkelvormig buisprofiel (76,1 x 4)

Technische opmerkingen

Het overbrengen van de belasting op het beton wordt gecontroleerd voor de uiterste grenstoestand. Hierdoor zullen de controles voor het betonnen bouwdeel uitgevoerd moeten worden. Ter verificatie moeten de gegevens uit de huidige rekenmethode worden gehanteerd.

Kiosk Paal 12 (Romneyloods KIOSK) , Den Hoorn - Texel

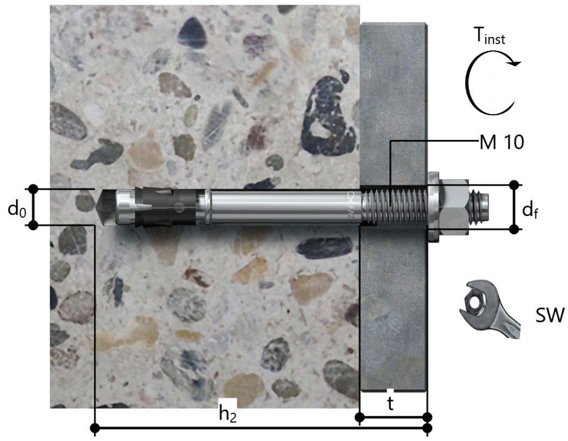
Montage gegevens

Anker

Systeem	**fischer Segmentanker FAZ II**		
Anker	Segment anker FAZ II 10/10, Elektrolytisch verzinkt staal	Artikel 94981	
Accessoires	Blaasbalg ABG Quattric II 10/100/165	Artikel 89300 Artikel 549923	

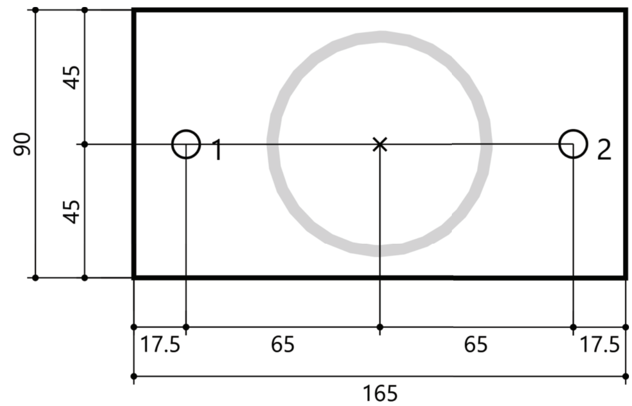
Installatie details

Draad diameter	M 10
Boor diameter	d_0 = 10 mm
Boorgat diepte	h_2 = 87 mm
Verankeringsdiepte	h_{ef} = 48 mm
Boordiepte	h_{nom} = 60 mm
Boormethode	Hamerboren
Boorgat reiniging	Boorgat met blaasbalg uitblazen.
Installatie	Doorsteek montage
Ruimte in doorvoergat	Doorvoergat niet gevult
Aandraaimoment	T_{inst} = 45.0 Nm
Sleutelwijdte	17 mm
Ankerplaat dikte	t = 8 mm
t fix	t_{fix} = 8 mm
Tfix,max	$t_{fix,\ max}$ = 22 mm



Ankerplaat details

Voetplaat materiaal	Niet beschikbaar
Ankerplaat dikte	t = 8 mm
Doorvoergat in ankerplaat	d_f=12 mm



Bijlage

Profiel type	Cirkelvormig buisprofiel (76,1 x 4)

Anker coördinaten

Anker nr.	x mm	y mm
1	-65	0
2	65	0