

**Berekening draagconstructies
Verbouw Sterrenwacht
tot appartementen
te Roden**



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Bijlage A
computeruitvoer raamwerk

1.0 Belastingen / uitgangspunten:

Algemeen :	Berekening vlgs NEN -EN-1990			
Gevolgklasse:	CC1b			
Ontwerp levensduur klasse	3	(50 jaar)		
<u>Platdak:</u>				
mastiek , 2 laags	0,20			
e.g balk+ beschot	0,30			
e.g plafond	0,15	kN/m2		
	<u>0,65</u>			
e.g zonnepanelen+ballast	0,30	kN/m2		
e.g betonvloer , dikte 100 mm	2,50	kN/m2		
afw	1,00			
	<u>3,50</u>	kN/m2		
e.g zonnepanelen+ballast	0,30	kN/m2		
veranderlijke bel. =	1,00	kN/m2	(psi=0)	
pwrep=0,65 kN/m2				
gebied III, onbebouwd				
Terreincategorie II				
<u>1e verdiepingsvloer:</u>				
e.g betonvloer , dikte 170 mmn:	4,25	kN/m2		
afw	1,00			
	<u>5,25</u>	kN/m2		
veranderlijke bel. =	2,25	kN/m2	(psi=0,4)	
veranderlijke bel. =	0,70	kN/m2	(psi=0,5)	h<2,0 m
<u>beganegrondvloer: (nieuw)</u>				
e.g systeemvloer	2,50	kN/m2		
afwerking, 70 mm	1,40			
	<u>3,90</u>			
veranderlijke bel. =	2,25	kN/m2	(psi=0,4)	
<u>beganegrondvloer: (bestaand)</u>				
e.g betonvloer, dikte 150 mm	3,75	kN/m2		
afwerking	0,60			
	<u>4,35</u>			
veranderlijke bel. bestaand=	3,00	kN/m2	(psi=0,4)	
(zie best. beggrvloer tek.)	5,00	kN/m2	(psi=0,4)	
	8,00	kN/m2	(psi=0,4)	
	10,00	kN/m2	(psi=0,4)	
Stutplan volgens opgave aannemer				
Stalen liggersop spanning aanbrengen mbv hardhourten wiggen, daarna ondersabelen met krimparme specie				

Tabel 4: Belastingfactoren ULS, Nieuwbouw (STR/GEO en buitengewoon)

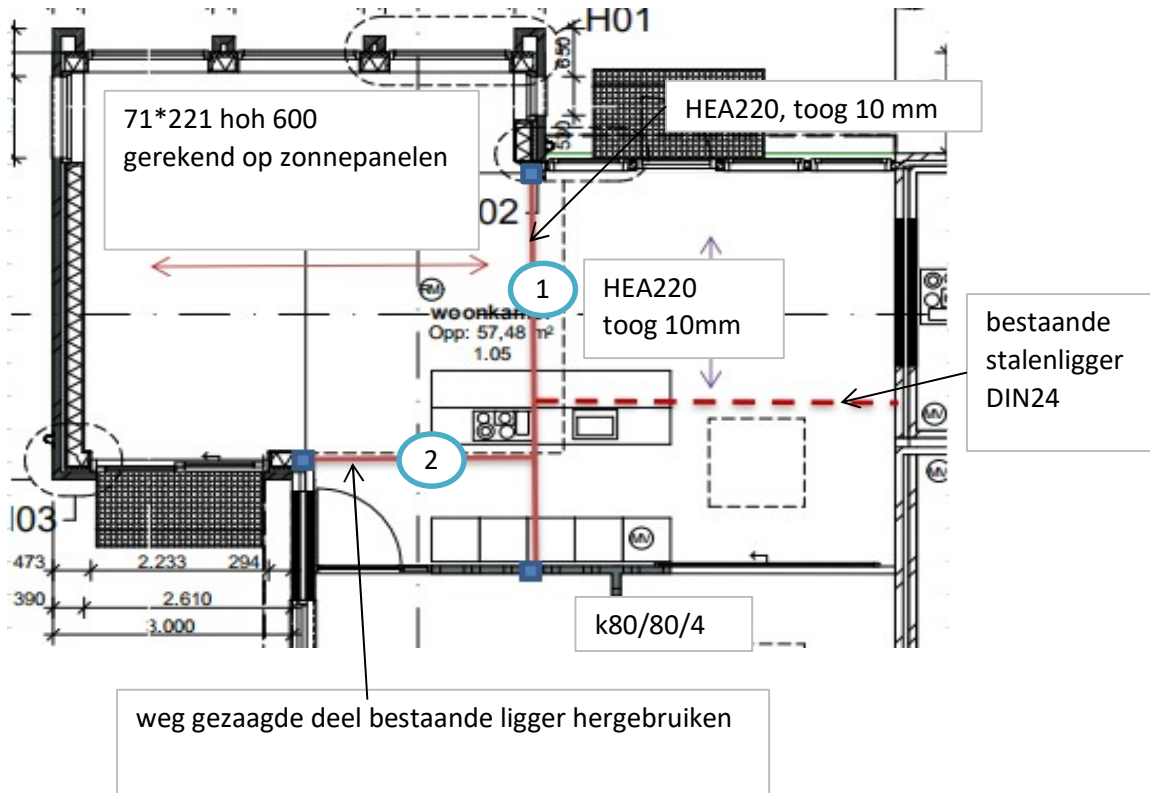
Belastingcombinatie	Permanente belasting		dominant veranderlijke belasting	overige veranderlijke belastingen	buitenge wone belasting
	on-gunstig	gunstig			
STR/GEO (6.10a)					
Gevolgklasse 1	1,20	0,9	$1,35\Psi_0$	$1,35 \Psi_0$	-
Gevolgklasse 2	1,35	0,9	$1,50\Psi_0$	$1,50 \Psi_0$	-
Gevolgklasse 3	1,50	0,9	$1,65\Psi_0$	$1,65 \Psi_0$	-
STR/GEO (6.10b)					
Gevolgklasse 1	1,10	0,9	1,35	$1,35 \Psi_0$	-
Gevolgklasse 2	1,20	0,9	1,50	$1,50 \Psi_0$	-
Gevolgklasse 3	1,30	0,9	1,65	$1,65 \Psi_0$	-
Buitengewoon (6.11)					
alle gevolgklassen	1,0	1,0	1,0		1,0

Tabel A1.1 — Waarden van de ψ -factoren voor gebouwen

Belasting	ψ_0	ψ_1	ψ_2
Voorgeschreven belastingen in gebouwen, categorie			
Categorie A: woon- en verblijfsruimtes	0,4	0,5	0,3
Categorie B: kantoorruimtes	0,5	0,5	0,3

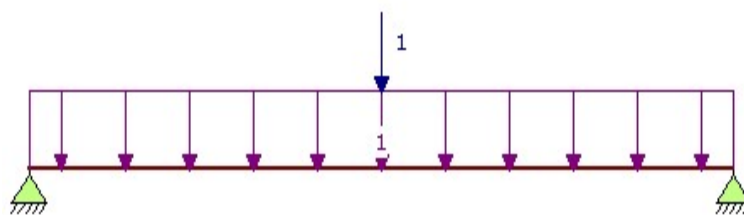
2.0 Constructies:

2.1 Appartement 1:



Onderslagen:

Ligger 1:



$$l < 5.4 \text{ m}$$

bel. :

plattendak:	$5,5/2 \cdot 0,95$	=	2,61	$5,5/2 \cdot 1,0$	=	2,75 kN/m
lw	$1 \cdot 1,0$	=	1,00			
e.g.		=	0,35			2,75
			3,96			

qd=	$1,2 \cdot 4,0$	+	$1,35 \cdot 0,4 \cdot 2,75$	=	6,2 kN/m
	$1,1 \cdot 4,0$	+	$1,35 \cdot 2,75$	=	8,1 kN/m

Frep= 0,0 kN

$F_d = 4,6/2 \cdot 3,2 \cdot (0,95 \cdot 1,1 + 0,56 \cdot 1,35) = 13,3 \text{ kN}$

bestaande ligger

Md= $0,125 \cdot q_d \cdot l^2 + 1/4 \cdot F_d \cdot l = 40,6 \text{ kNm}$

toepassen:

IPE270

toog 10 mm

Wy=

429 cm³

Iy=

5790 cm⁴

Av=

2209 mm²

toets M:

 $\sigma_d = M_{Ed}/W$

=

95 N/mm²<f_u=235 N/mm²u_c= 0,40

toets V:

 $\tau_d = V_{Ed}/A_v$

=

13 N/mm²<235/W₃=136 N/mm²u_c= 0,09

doorbuiging:

u_{tot}

=

 $5/384 (ql^4/EI) + Pl^3/(48EI)$

=

0,009 m

<0,004 lt:

21,6 mm

u_{bijk}

=

0,005 m

<0,002 lt:

10,8 mm

R_{rep}

=

10,7

7,4 kN

R_{dmax}

=

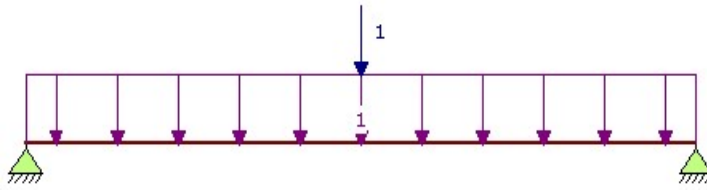
28,4 kN

kolom k80/80/4

plat dak:

balklagen:

71*271 hoh 600



Belastingen:

$$q_{eg} = 0,6 \cdot (0,65 + 0,30) = 0,57 \text{ kN/m}$$

$$q_{ver} = 0,6 \cdot 1,00 = 0,60$$

$$F_g = R_{gligger1} = - \text{ kN}$$

$$F_q = R_{qligger1} = - \text{ kN}$$

$$(6.10a) \quad q_d = 1,2 \cdot q_{eg} + 1,35 \cdot 0,4 \cdot q_{ver} = 1,01 \text{ kN/m}$$

$$(6.10b) \quad q_d = 1,1 \cdot q_{eg} + 1,35 \cdot q_{ver} = 1,44$$

$$(6.10a) \quad F_d = 1,35 \cdot F_g + 1,5 \cdot 0,4 \cdot F_q = - \text{ kN}$$

$$(6.10b) \quad F_d = 1,2 \cdot F_g + 1,5 \cdot F_q = -$$

Inwendige krachten:

$$V_{ed} = 0,5 \cdot q_{dmax} \cdot l + F_d / 2 = 3,95 \text{ kN}$$

$$M_{ed} = 1/8 q_{dmax} \cdot l^2 + 1/4 \cdot F \cdot l = 5,43 \text{ kNm}$$

lt	5,5	m
b	71	mm
h	271	mm
Wy	869	cm ³
Iy	11776	cm ⁴
klimateklasse	2	
f _{m;0;rep}	18,0	N/mm ²
f _{V;0;rep}	2,0	N/mm ²
E _{0;ser;rep}	9000	N/mm ²
K _{mod;sterkte}	0,65	
k _m	0,7	
K _h	0,89	
k _{cr}	0,67	
k _{def}	0,80	
ψ ₀	1,00	
ψ ₂	0,80	
Y _m	1,35	
f _{V;0;d}	1,0	
f _{m;0;u;d(kd)}	7,70	N/mm ²
u _{eind} = 0,004 * lt	22	mm
u _{bijk} = 0,003 * lt	16,5	mm

eis:

τ _{y,d} = V _{ed} / (b * h) =	0,21	N/mm ²	<	1,0	N/mm ²	voldoet
σ _{m,y,d} = M / W =	6,25	N/mm ²	<	7,70	N/mm ²	voldoet
u _{eind} = u _{instg} * (1 + k _{def}) + u _{instq} * (1 + k _{deψ2})	22,6	mm	<	22	mm	voldoet
u _{instg} = 5/384 * q _g * l ⁴ / (EI + F _{gl} (3)/48EI =	6,4	mm				
u _{instq} = 5/384 * q _q * l ⁴ / EI =	6,7	mm				
u _{bijk} = u _{eind} - u _{instq} =	15,9	mm	<	16,5	mm	voldoet

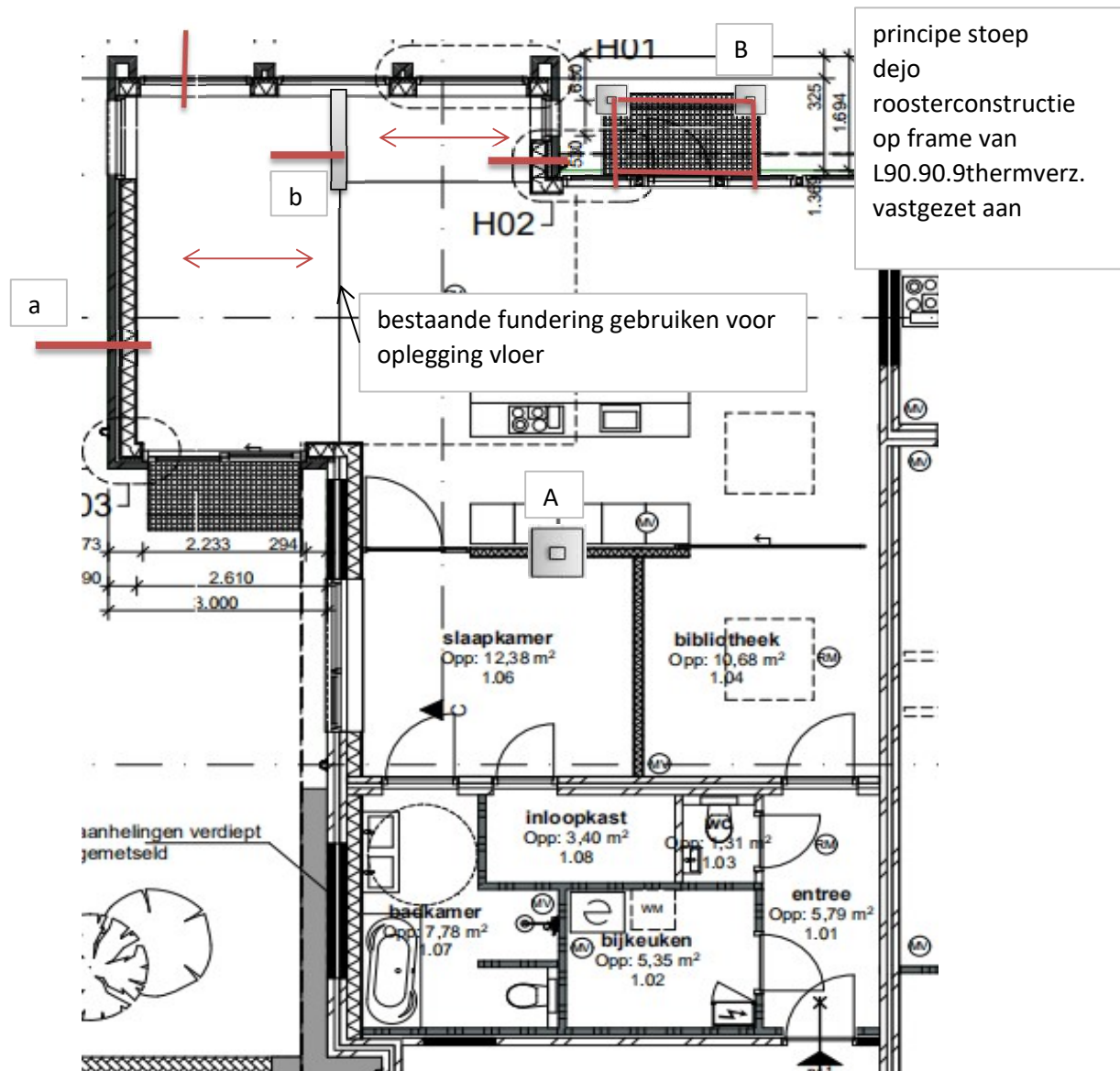
balklaag voorzien van inverband gelegd underlayment 18mm

balklaag vastzetten aan aangelaste stripjes 4*40 lg 250 hoh 600 aan de stalen liggers van de spanten.

Fundering :

Fundering op staal, hierbij is het risico op zettingen voor rekening van de opdrachtgever.

Uitgangspunt is een vaste zandlaag van voldoende dikte (min. 1,0 m) waarop gefundeerd wordt max rekenwaarde van de gronddruk 50 kN/m², gronddekking op de stroken,



Aanlegdiepte fundering als bestaand = 1,55 m- Vloerpeil
fundering uitvoeren met rib , als bestaand

strook a:

spreidingbreedte	0,60	m					
max.bel.	mw.:	3,5*4,0	=	14,0			
	dak :	2,7/2*0,95	=	1,3			
	beg.gr.vl:	2,7/2*3,90	=	5,3	2,7/2*2,25	=	$\frac{3,0}{3,0}$
	e.g. :		=	4,0			
				24,5 kN/m			

$$\sigma_{gr;d} = F_d/A =$$

52

kN/m²

strook b: (en overige stroken)

aanlegbreedte 0,60 m

m.w: 1,0*4,0

max.bel. beg.gr.vl: 2,7*3,90

e.g. :

$$= \begin{array}{|l} 4,0 \\ 10,5 \\ 4,0 \end{array} \begin{array}{l} \\ 2,7*2,25 \\ \end{array}$$

$$= \frac{4,0}{18,5} \text{ kN/m}$$

$$= \frac{6,1}{6,1}$$

$$\sigma_{gr;d} = Fd/A = 48 \text{ kN/m}^2$$

Stiep A:spreidingsbreedte 0,70 * 0,70 m²

max.bel. Rkol

e.g. :

$$= \begin{array}{|l} 10,7 \\ 4,0 \end{array}$$

$$= \frac{4,0}{14,7} \text{ kN}$$

$$\frac{7,4}{7,4}$$

$$\sigma_{gr;d} = Fd/A = 53 \text{ kN/m}^2$$

Poer B:spreidingsbreedte 0,35 * 0,35 m²

max.bel. Rligger

e.g. :

$$= \begin{array}{|l} 0,3 \\ 3,0 \end{array}$$

$$= \frac{3,0}{3,3} \text{ kN}$$

$$\frac{1,6}{1,6}$$

$$\sigma_{gr;d} = Fd/A = 47 \text{ kN/m}^2$$

Algemeen:

C20/25; milk XC4

betondekking= 35 mm

werkvloer 50 mm; C10/15

B500A

Vloer:

vloer/stiep dikte= 150 mm

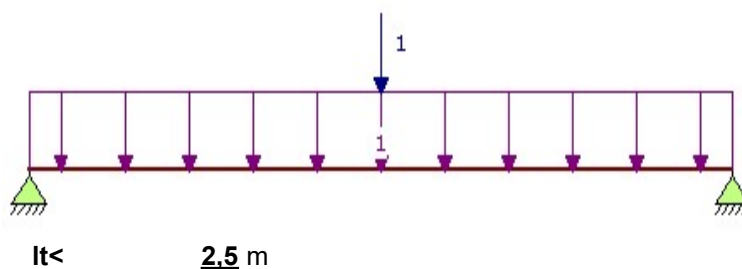
b ≤ 750 mm $M/bd^2 = 0,5*75(0,75/2)^2 / (1,0*0,110*0,110) = 380 \Rightarrow w_o = w_{min} = 0,15\%$ A_{min} = 240 mm²

toepassen kruisnet rond 6-150 onder

 $v_{Edmax} = 0,75/2*75*1e3 / (110*1000) = 0,24 \text{ N/mm}^2 < 0,49 \text{ N/mm}^2$, acc.

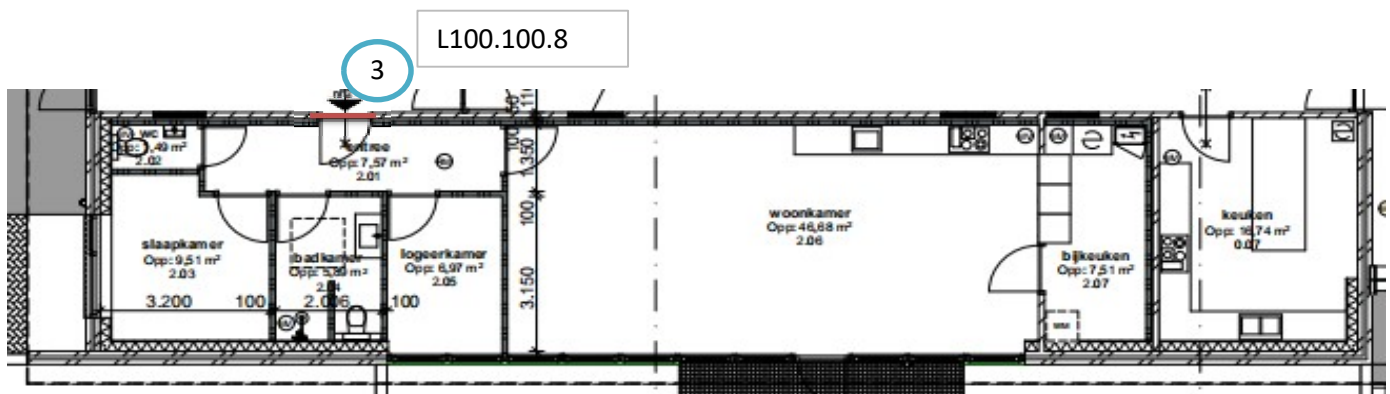
geen dwarskracht wapening nodig

fundering uitvoeren met rib , als bestaand

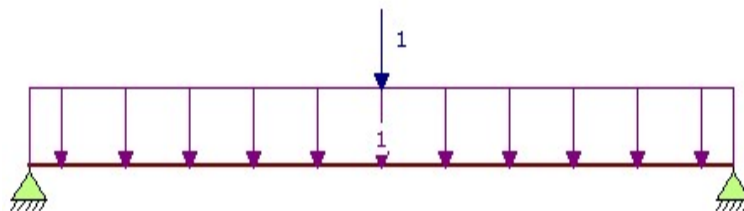
frame Stoep:**Ligger a:**

bel. :				
rooster:	1,0/2*0,15		$= \frac{0,08}{0,20} \left \begin{array}{l} 1,0/2*2,50 \\ 0,28 \text{ kN/m} \end{array} \right.$	$= \frac{1,25}{1,25}$
e.g.				
qd=	1,2*		0,3 + 1,35*0,4*	1,25 = 1,0
	1,1*		0,3 + 1,35*	1,25 = 2,0
Frep=		0,0 kN		kN/m
Fd=		0,0 kN		
bestaande ligger				
Md=	0,125*	qd*I"+	1/4*Fd*I=	1,6 kNm
toepassen:			Wy: 18 cm ³	
L90.90.9			ly= 116 cm ⁴	
thermisch verz.			Av= 2063 mm ²	
toets M:				
$\sigma_d = M_{Ed}/W$	=		86 N/mm ² < f _u =235 N/mm ²	uc= 0,37
toets V:				
$\tau_d = V_{Ed}/A_v$	=		1 N/mm ² < 235/W ³ = 136 N/mm ²	uc= 0,01
doorbuiging:				
U _{tot}	=	5/384 (q _l l ⁴ /EI)+Pl ³ /(48EI)		
	=	0,003 m	<0,004 lt=	10,0 mm
u _{bijk}	=	0,003 m	<0,002 lt=	5,0 mm
R _{rep}	=		0,3 1,6 kN	
R _{dmax}	=		2,5 kN	

2.2 Appartement 2:



onderslag 3:



$$l_t < 1,2 \text{ m}$$

bel. :

dak:	$8,8/2 \cdot 0,95$	=	4,18	$8,8/2 \cdot 1,0$	=	4,40
m.w:	$0,5 \cdot 2,0$	=	1,00		=	0,00 kN/m
e.g.		=	0,50			
			<u>5,68</u>			4,40

qd=	$1,2^*$	5,7 +	$1,35 \cdot 0,4^*$	4,40	=	9,2 kN/m
	$1,1^*$	5,7 +	$1,35^*$	4,40	=	12,2 kN/m

Fd= 0,0 kN

Md=	$0,125 \cdot qd \cdot l^2 +$	$1/4 \cdot Fd \cdot l =$	2,2	kNm
Ddmax=	$0,5 \cdot qd \cdot l + Fd/2 =$		7,3	kN

opl= 100mm

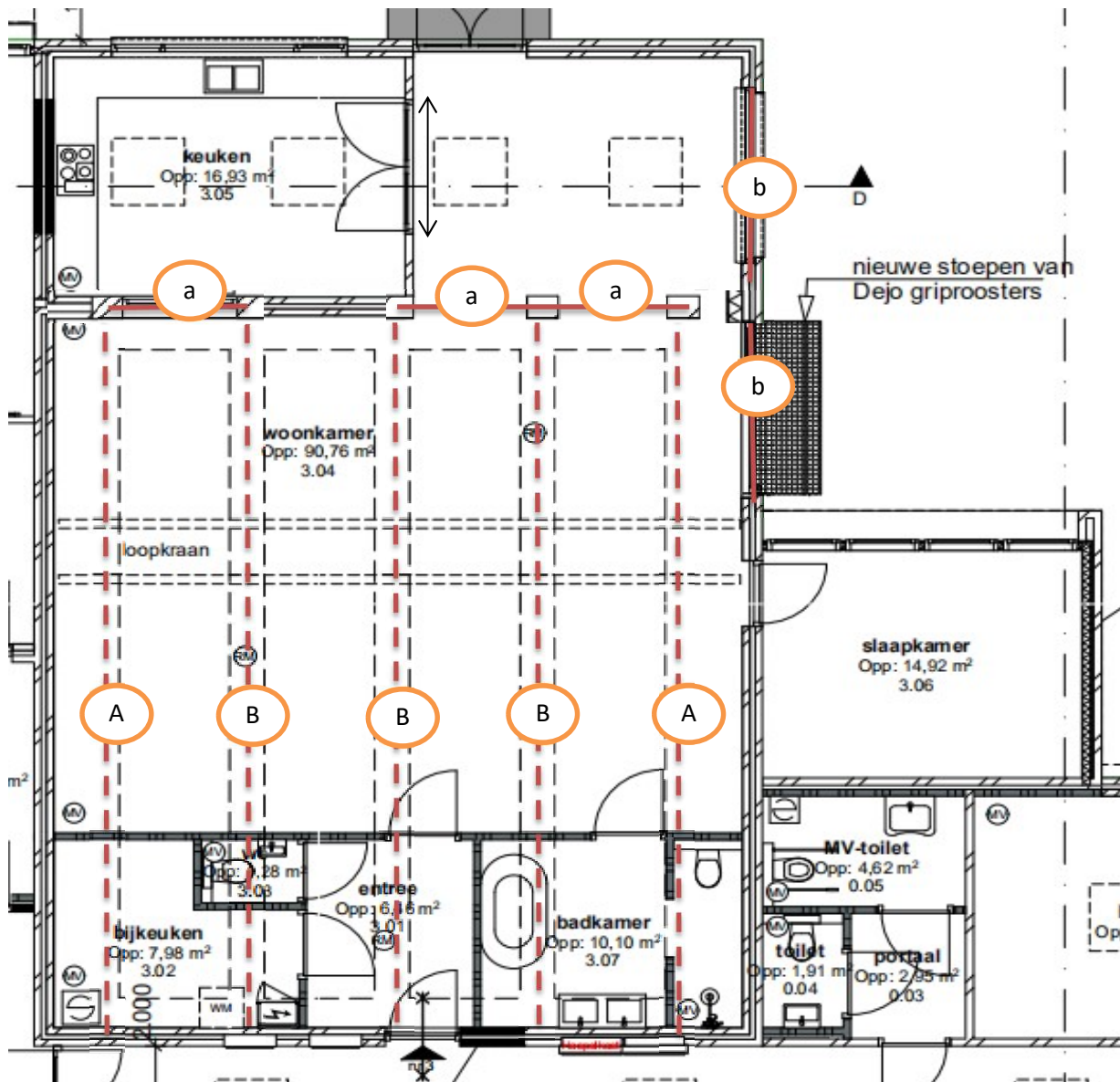
toepassen:	Wy=	19,9 cm ³
L100.100.8	ly=	145 cm ⁴
	Av=	900 mm ²

toets M:			
$\sigma_d = M_{Ed}/W$	=	110 N/mm ²	< $f_u = 235 \text{ N/mm}^2$
toets V:			
$\tau_d = V_{Ed}/A_v$	=	8 N/mm ²	< $235/W3 = 136 \text{ N/mm}^2$
			uc= 0,47

doorbuiging:			
utot	=	$5/384 (q l^4 / EI) + P l^3 / (48 EI)$	
	=	0,001 m	< 0,004 lt: 4,8 mm
ubijk	=	0,000 m	< 0,001 lt: 1,2 mm

raveling daklicht uitvoeren als bestaande daklichten

2.3 Appartement 3:



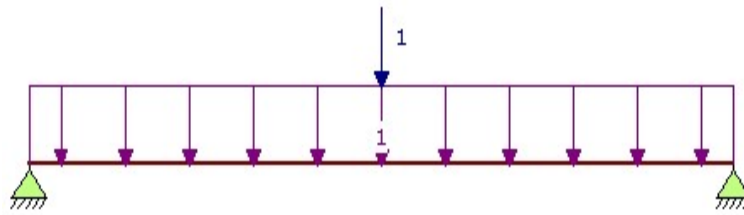
a

2*L100.100.8 ,opl=100 mm

b

2*L150.100.10, opl=150 mm
tpv buitenblad thermisch verz.

Onderslagen:
Ligger A bestaand:



$$l_t < \underline{11} \text{ m}$$

bel. :

daklichtconstr	$3,0 \cdot 0,50$	=	$1,50$	$2,0/2 \cdot 0,56$	=	$0,56 \text{ kN/m}$
dak:	$1/2 \cdot 0,65$	=	$0,33$	$1/2 \cdot 0,56$	=	$0,28$
e.g.	din28	=	$\frac{1,05}{2,88}$			$0,84$

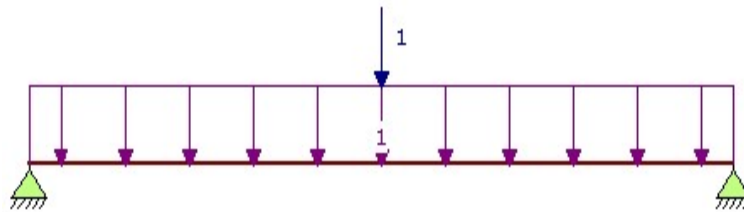
Frep= kraanbaan

$$8,0/2 \cdot 1,5 = 6,0 \text{ kN}$$

excl. hijslast

$$R_{rep} = 15,8 \quad 4,6 \text{ kN}$$

Ligger B bestaand:



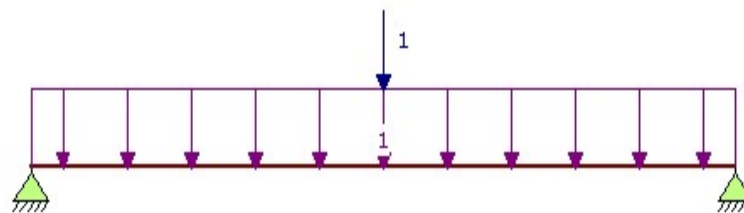
$$l_t < \underline{11} \text{ m}$$

bel. :

daklichtconstr	$4,4 \cdot 0,50$	=	$2,20$	$4,0/2 \cdot 0,56$	=	$1,12 \text{ kN/m}$
e.g.	din28	=	$\frac{1,05}{3,25}$			$1,12$

$$R_{rep} = 17,9 \quad 6,2 \text{ kN}$$

onderslag a:



$$l_t < \underline{1,6} \text{ m}$$

bel. :

dak:	$(3,80/2+0,70)*0,95$	=	2,47	$(3,8/2+0,70)*1,0$	=	2,60
m.w:	$1,35*2,0$	=	2,70		=	0,00 kN/m
e.g.		=	0,50		=	2,60
			5,67			

qd=	$1,2*$	5,7 +	$1,35*0,4*$	2,60	=	8,2 kN/m
	$1,1*$	5,7 +	$1,35*$	2,60	=	9,7 kN/m

F_{rep}= 0,0 kN
F_d= 0,0 kN

M _d =	$0,125* qd*l^2+$	$1/4*F_d*l=$	3,1	kNm
D _{dmax} =	$0,5*qd*l=$		7,8	kN

opl= 100mm

toepassen:
2*L100.100.8

W _y =	19,9	cm ³
I _y =	145	cm ⁴
A _v =	800	mm ²

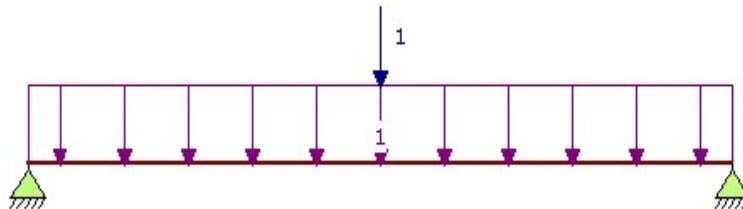
toets M:
 $\sigma_d = MEd/W$ = 157 N/mm² < f_u=235 N/mm² uc= 0,67

toets V:
 $\tau_d = VEd/A_v$ = 10 N/mm² < 235/W3= 136 N/mm² uc= 0,07

doorbuiging:

U _{tot}	=	$5/384 (ql^4/EI)+Pl^3/(48EI)$	
	=	0,002 m	<0,004 lt: 6,4 mm
U _{bijk}	=	0,000 m	<0,001 lt: 1,6 mm

onderslag b:



l_t < 2,75 m

bel. :

dak:	$0,6/2*0,95$	=	0,29	$0,6/2*1,0$	=	0,30
m.w:	$1,55*2,0$	=	3,10		=	0,00 kN/m
e.g.		=	0,50		=	0,30
			3,89			

qd=	$1,2*$	3,9 +	$1,35*0,4*$	0,30	=	4,8 kN/m
	$1,1*$	3,9 +	$1,35*$	0,30	=	4,7 kN/m

F_{rep}= 0,0 kN
F_d= 0,0 kN

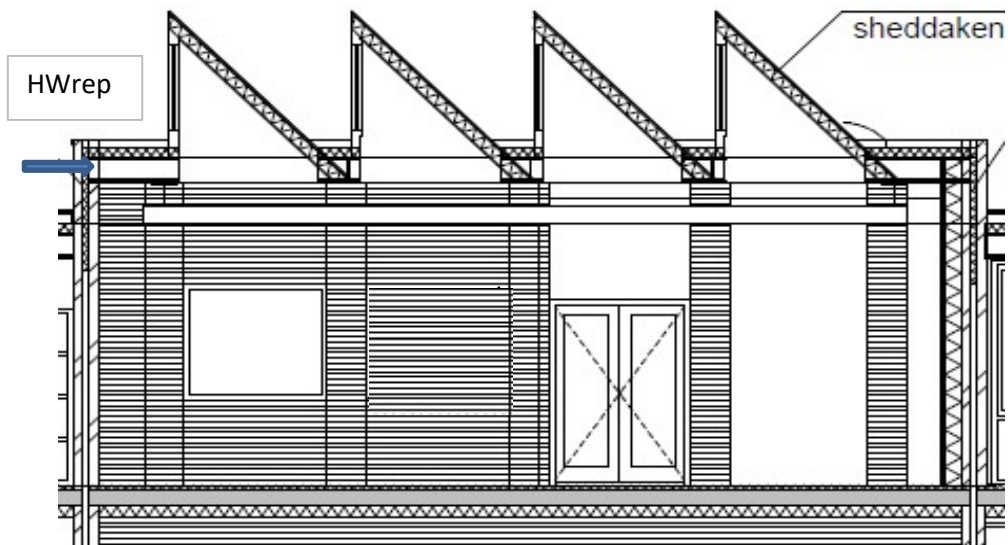
M _d =	$0,125* qd*l^2+$	$1/4*F_d*l=$	4,4	kNm
D _{dmax} =	$0,5*qd*l=$		6,4	kN

opl= 150mm

toepassen:
2*L150.100.10 (bi/bu)
(buiten therm.verz.)

W _y =	54	cm ³
I _y =	552	cm ⁴
A _v =	1400	mm ²

toets M:				
$\sigma_d = M_{Ed}/W$	=	82 N/mm ²	< $f_u = 235$ N/mm ²	uc= 0,35
toets V:				
$\tau_d = V_{Ed}/A_v$	=	5 N/mm ²	< $235/W_3 = 136$ N/mm ²	uc= 0,03
doorbuiging:				
U_{tot}	=	$5/384 (q_l^4/EI) + Pl^3/(48EI)$		
	=	0,002 m	< 0,004 lt:	11,0 mm
U_{bijk}	=	0,000 m	< 0,001 lt:	2,8 mm

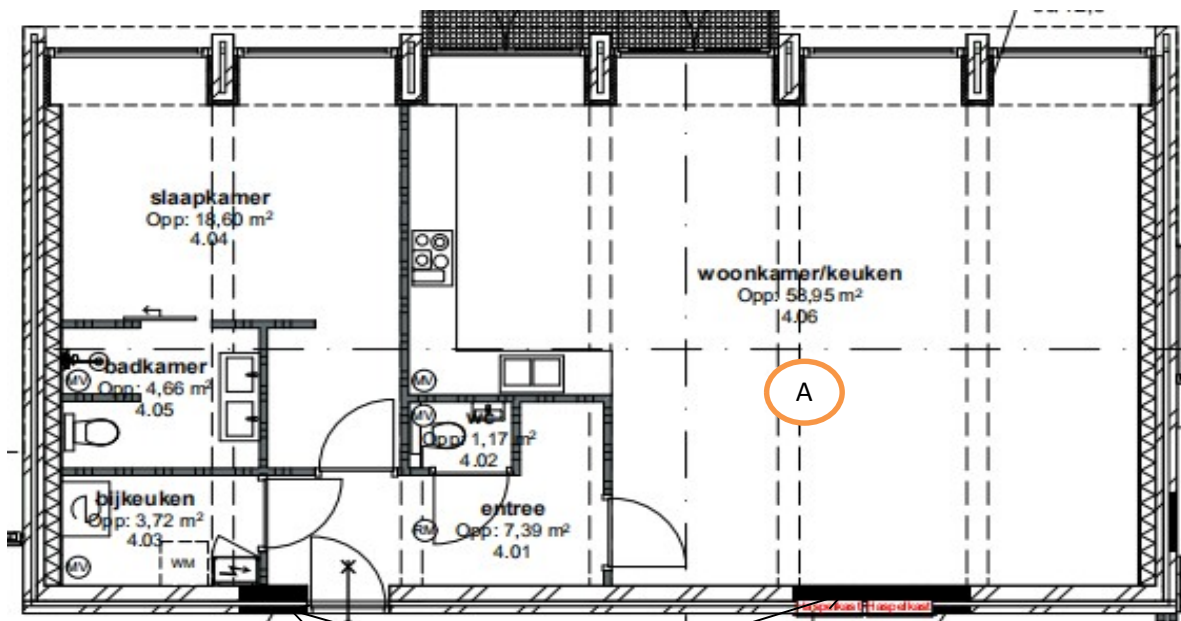


wind belasting op de kap en muur:

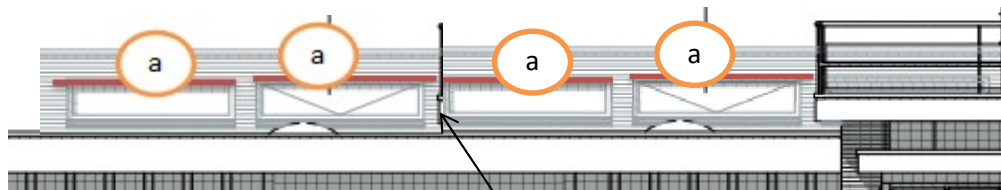
$$H_{wrep} = 4/2 \cdot (11+4)/2 \cdot 0,65 + 1,7 \cdot (2 \cdot 0,8 + 0,6 \cdot 0,8) \cdot 11/2 \cdot 0,65 = 22,4 \quad \text{kN}$$

berekening vlgs. bijlage A
controle metselwerk

2.4 Appartement 4:



bestaande betonlatei
handhaven

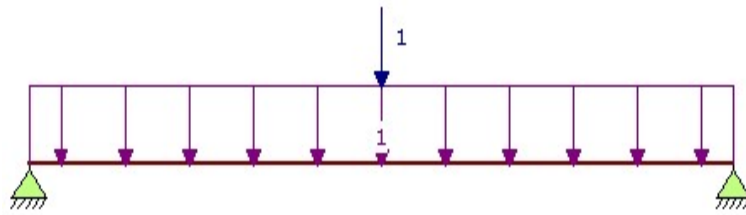


breedte penant minimaal 320 mm

a

L100.100.8 ,opl=100 mm
horizontaal vastzetten aan dakvloer
aan binnenzijde m.w. weghalen tot o.k. dak

Onderslagen:
Ligger A bestaand:
5 stuks



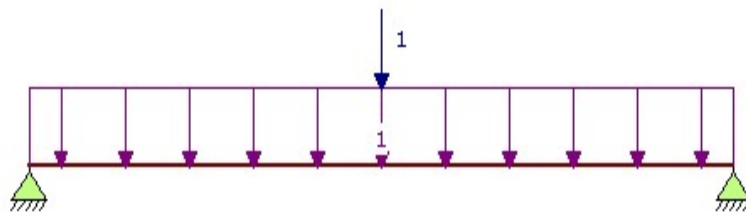
$$l_t < \underline{7,8 \text{ m}}$$

bel. :

dak:	$4,75/2 \cdot 3,80$	=	$9,03$	$4,75/2 \cdot 1,00$	=	$\frac{2,38}{2,38}$
e.g.	$0,22 \cdot 0,50 \cdot 25$	=	$\frac{2,75}{11,78}$			

Frep=	0,0 kN		
Rrep	=	45,9	9,3 kN

onderslag a:
tpv buitenblad



$$l_t < \underline{2,35 \text{ m}}$$

bel. :

m.w:	$0,5 \cdot 4,0$	=	$\frac{2,00}{0,50}$	=	$\frac{0,00 \text{ kN/m}}{0,00}$
e.g.		=	$\frac{0,50}{2,50}$		

qd=	$1,2 \cdot 2,5 + 1,35 \cdot 0,4 \cdot 0,00$	=	3,0 kN/m
	$1,1 \cdot 2,5 + 1,35 \cdot 0,00$	=	2,8 kN/m

Frep=	0,0 kN
Fd=	0,0 kN

Md=	$0,125 \cdot qd \cdot l^2 + 1/4 \cdot Fd \cdot l$	=	2,1 kNm
Ddmax=	$0,5 \cdot qd \cdot l$	=	7,8 kN

opl= 150mm

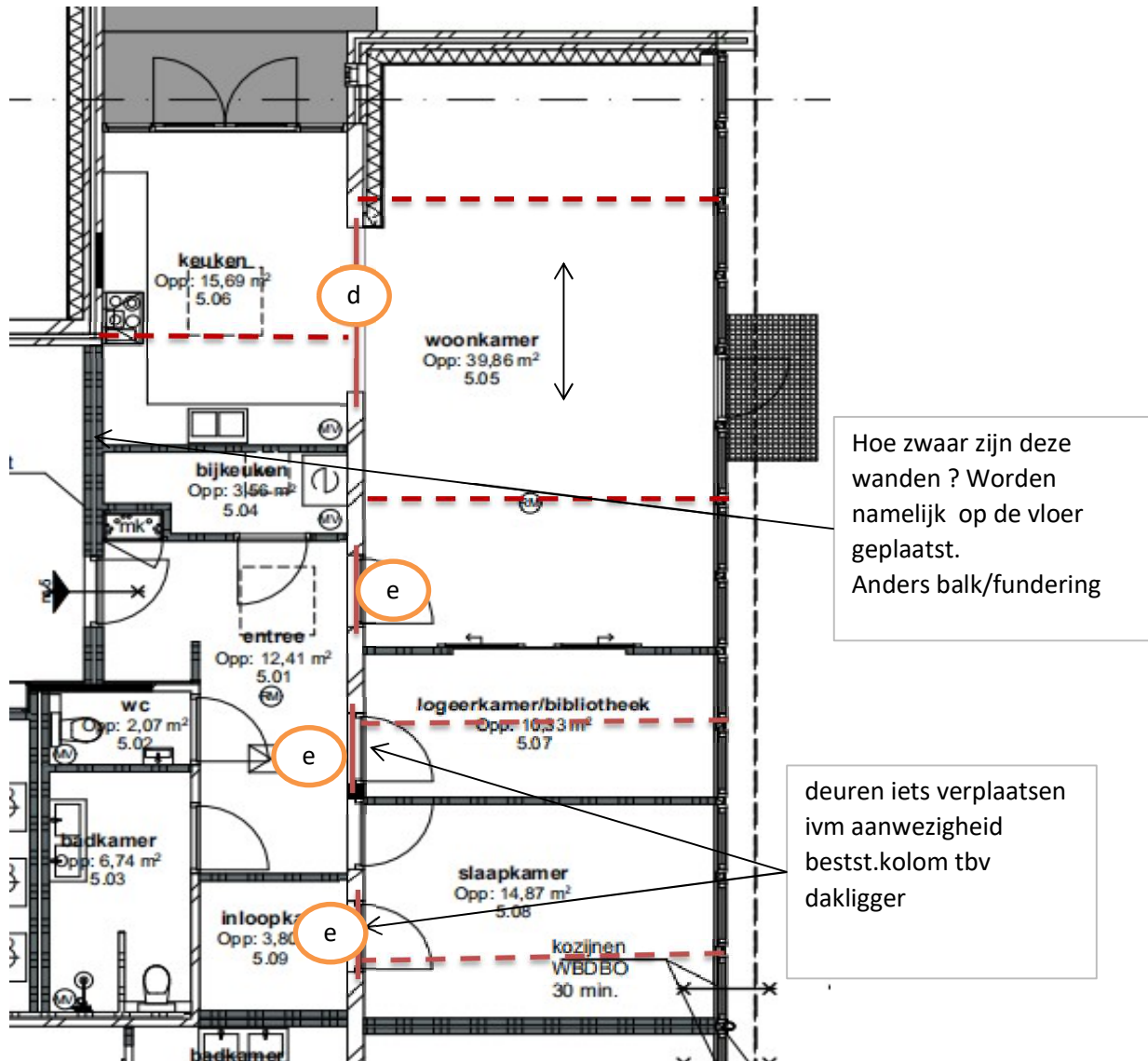
toepassen:	Wy=	19,9 cm ³
L100.100.8	ly=	145 cm ⁴
therm.verz.	Av=	800 mm ²

toets M:	$\sigma_d = M_{Ed}/W$	=	104 N/mm ²	<fu=235 N/mm ²	uc=	0,44
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toets V:	$\tau_d = V_{Ed}/A_v$	=	10 N/mm ²	<235/W3=136 N/mm ²	uc=	0,07
----------	-----------------------	---	----------------------	-------------------------------	-----	------

doorbuiging:	u_{tot}	=	$5/384 (q l^4/EI) + P l^3/(48EI)$		
		=	0,003 m	<0,004 lt:	9,4 mm
	u_{bijk}	=	0,000 m	<0,001 lt:	2,4 mm

2.5 Appartement 5:



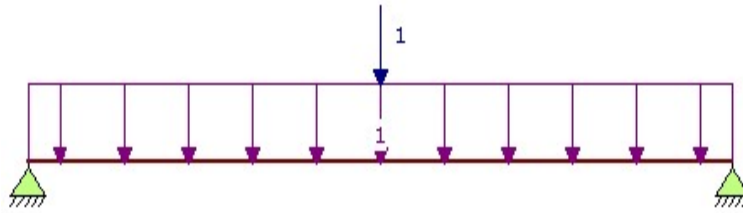
raveling daklicht uitvoeren als bestaande daklichten

d

HEA180, opl=150 mm

e

HEA160, opl=100 mm
(praktisch)
of betonlatei 150*185
of tot aan dak weghalen en deur voorzien van bovenlicht

onderslag d:

$$l_t < \underline{2,6} \text{ m}$$

bel. :

dak:	$1,2/2 \cdot 0,95$	=	$0,57$	$1,2/2 \cdot 1,0$	=	$0,60$
m.w:	$0,5 \cdot 4,0$	=	$2,00$		=	$0,00 \text{ kN/m}$
e.g.		=	$0,50$		=	$0,60$
			$3,07$			

qd=	$1,2^*$	$3,1 +$	$1,35^*0,4^*$	$0,60$	=	$4,0 \text{ kN/m}$
	$1,1^*$	$3,1 +$	$1,35^*$	$0,60$	=	$4,2 \text{ kN/m}$

Fdbestdakt.

$$= 3,5/2 \cdot 8,5/2 \cdot (1,1 \cdot 0,95 + 1,35 \cdot 0,56) \quad 13,4 \text{ kN}$$

$$Md = 0,125 \cdot qd \cdot l^2 + 1/4 \cdot Fd \cdot l = 12,2 \text{ kNm}$$

$$Ddmax = 0,5 \cdot qd \cdot l + Fd/2 = 12,1 \text{ kN}$$

opl= 150mm

toepassen:

HEA180

$$Wy = 294 \text{ cm}^3$$

$$ly = 2510 \text{ cm}^4$$

$$Av = 1452 \text{ mm}^2$$

toets M:

$$\sigma_d = M_{Ed}/W = 42 \text{ N/mm}^2 < f_u = 235 \text{ N/mm}^2 \quad uc = 0,18$$

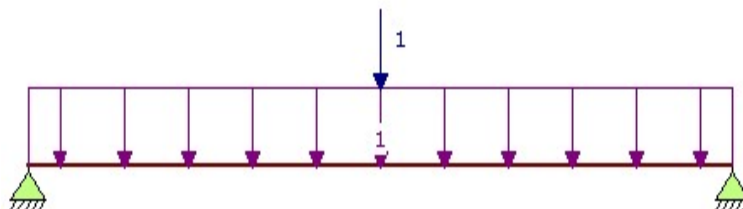
toets V:

$$\tau_d = V_{Ed}/A_v = 8 \text{ N/mm}^2 < 235/W^3 = 136 \text{ N/mm}^2 \quad uc = 0,06$$

doorbuiging:

$$u_{tot} = 5/384 (q l^4 / EI) + P l^3 / (48 EI) = 0,001 \text{ m} < 0,004 \text{ lt} \quad 10,4 \text{ mm}$$

$$u_{bijk} = 0,001 \text{ m} < 0,001 \text{ lt} \quad 2,6 \text{ mm}$$

onderslag e:

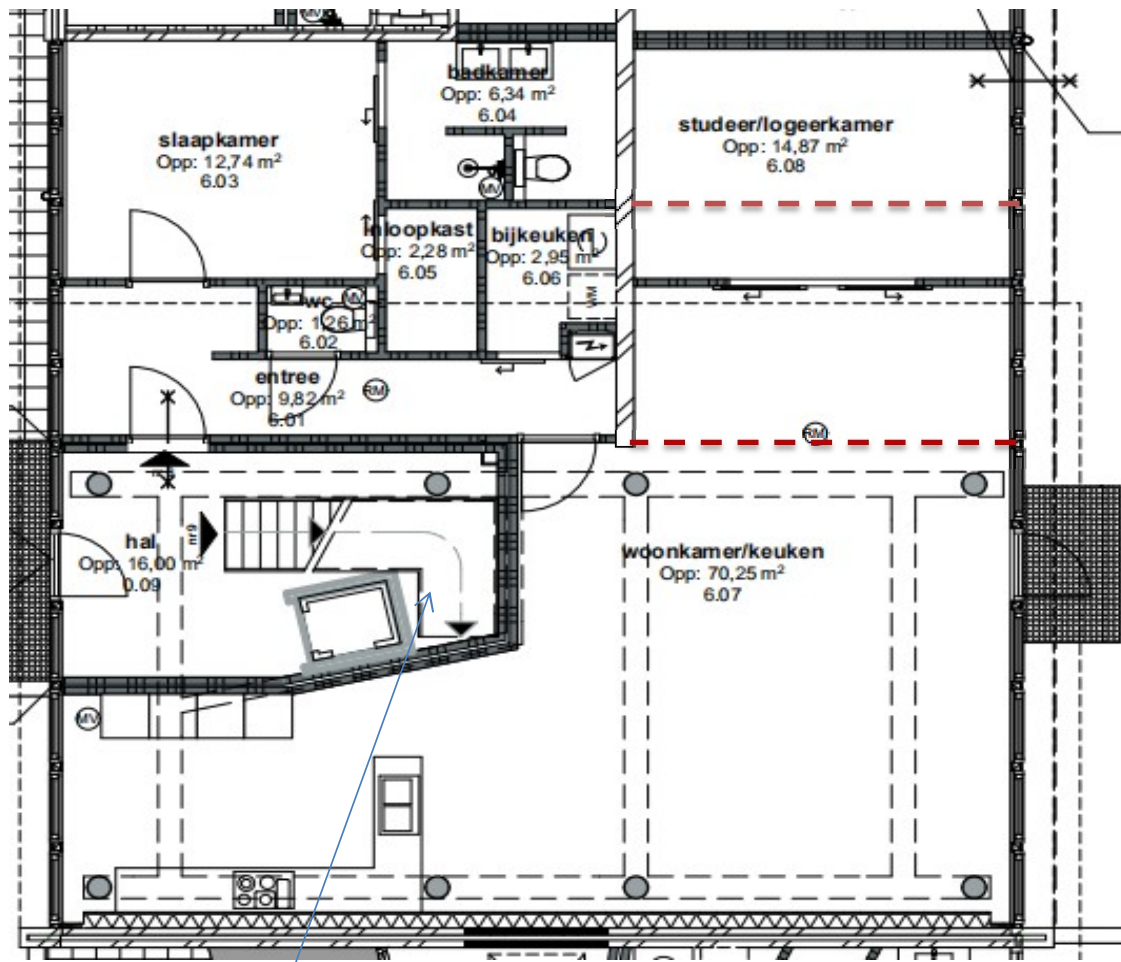
$$l_t < \underline{1,2} \text{ m}$$

bel. :

dak:	$1,2/2 \cdot 0,95$	=	$0,57$	$1,2/2 \cdot 1,0$	=	$0,60$
m.w:	$0,5 \cdot 4,0$	=	$2,00$		=	$0,00 \text{ kN/m}$
e.g.		=	$0,50$		=	$0,60$
			$3,07$			

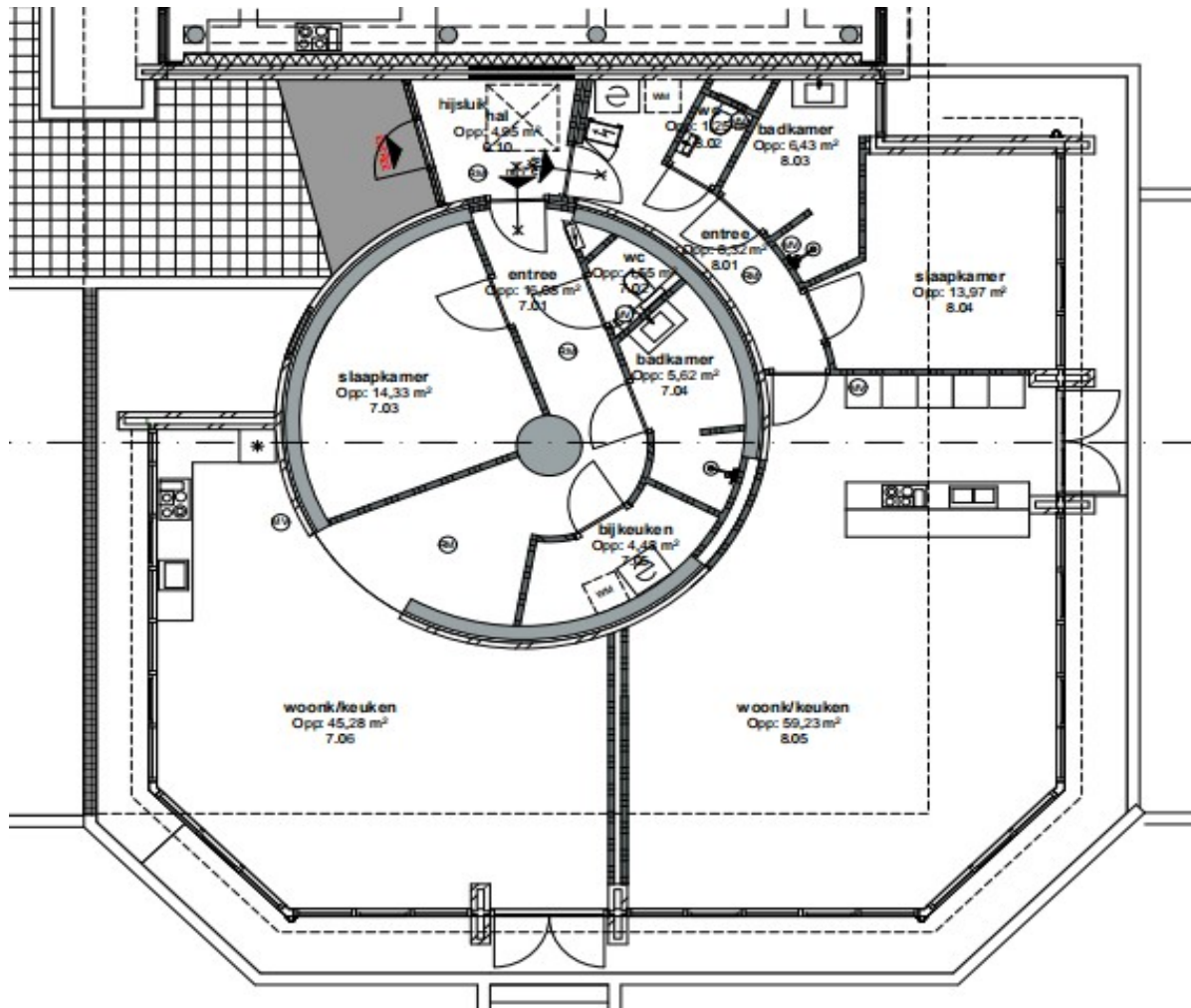
qd=	1,2*	3,1 +	1,35*0,4*	0,60 =	4,0	kN/m
	1,1*	3,1 +	1,35*	0,60 =	4,2	kN/m
Fd=	0,0 kN					
Md=	0,125* qd*I"+	1/4*Fd*I=	0,8	kNm		
Ddmax=	0,5*qd*I+Fd/2=		2,5	kN		
				opl= 100mm		
toepassen:		Wy=	220	cm3		
HEA160		ly=	1673	cm4		
(praktisch)		Av=	1324	mm2		
of betonlatei 150*185						
of tot aan dak weghalen en deur voorzien van bovenlicht						
toets M:						
σd=MEd/W	=	3 N/mm2	<fu=235 N/mm2	uc=	0,01	
toets V:						
τd=VEd/Av	=	2 N/mm2	<235/W3=			
			136 N/mm2	uc=	0,01	
doorbuiging:						
Utot	=	5/384 (qI4/EI)+Pl3/(48EI)				
	=	0,000 m	<0,004 lt:		4,8 mm	
Ubijk	=	0,000 m	<0,001 lt:		1,2 mm	

2.6 Appartement 6:



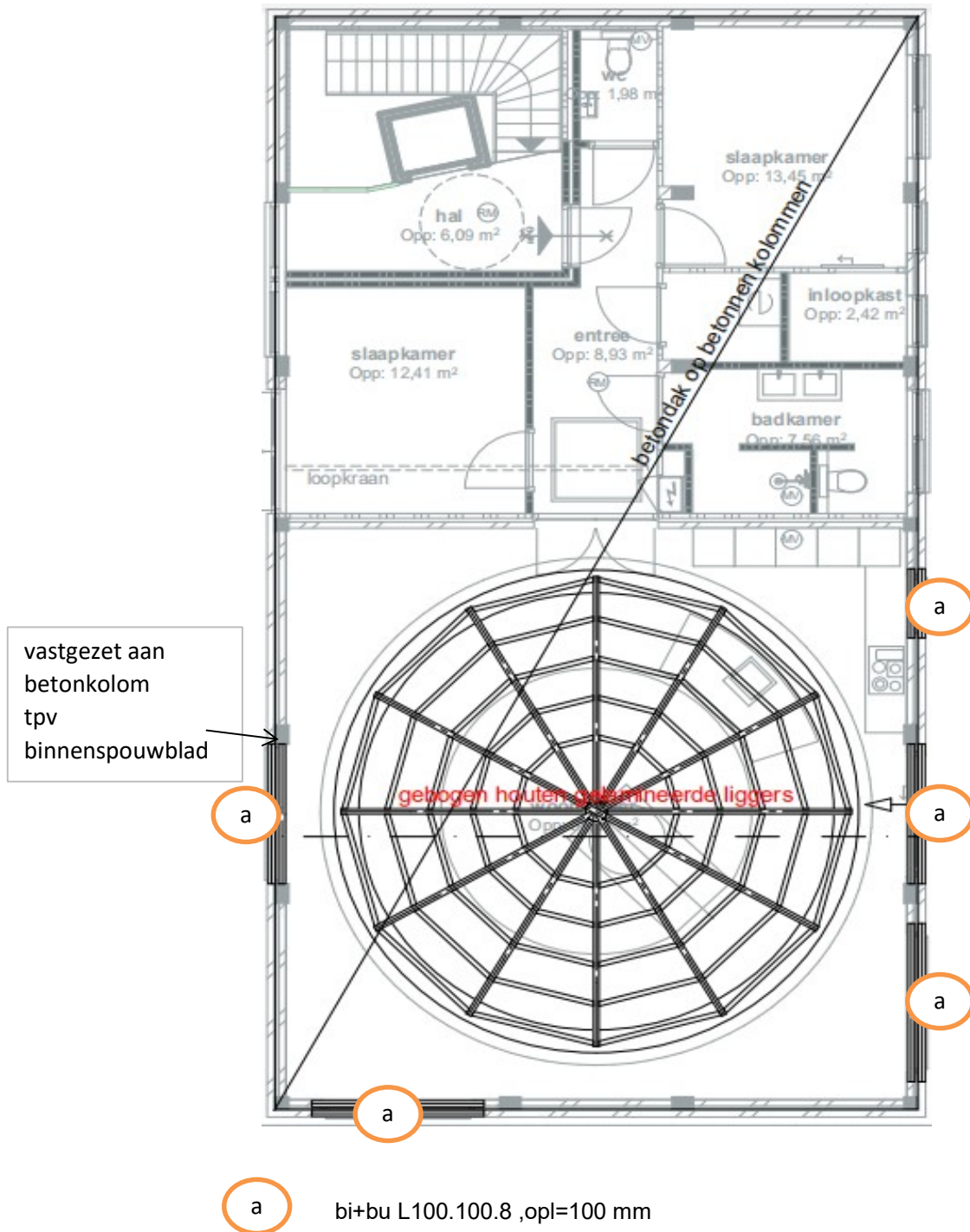
trap en lift constructie volgens
opgave leverancier, e.e.a ter
goedkeuring

4.0 Appartement 7:



trap en lift constructie volgens
opgave leverancier, e.e.a ter
goedkeuring

2.8 Appartement 9:



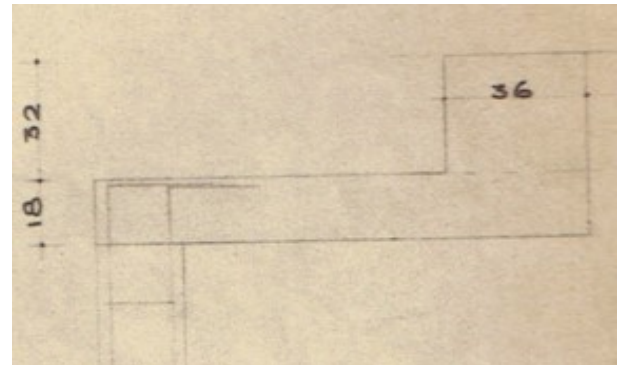
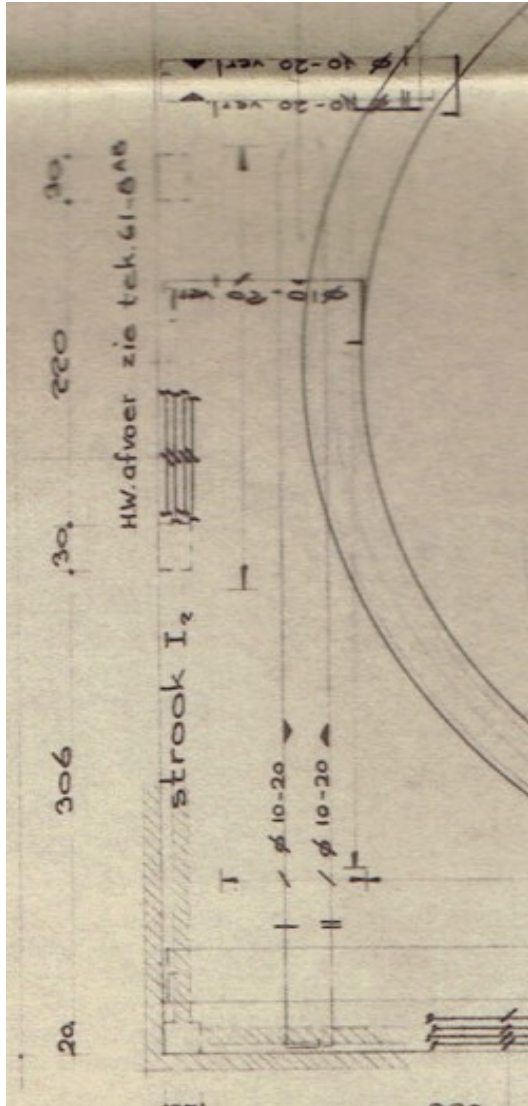
Gewicht gebogen spanten/ gordingen en afwerking max. 50 kg/m² e.e.a volgens opgave leverancier gelamineerde liggers, incl. bevestiging

Controle dakvloer:

$$A_{tot} = 1/4 * 22/7 * 7,50 * 7,50 = 44 \text{ m}^2$$

Max. gew. langs de rand:

$$R_d = 44 * (1,1 * (0,50 + 0,50) + 1,35 * 0,50) / ((22/7 * 7,5) + 1,1 * 0,36 * 0,46 * 25) = 7,87 \text{ kN/m}$$



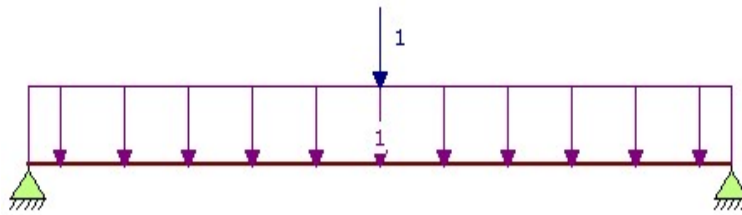
vloerdikte 180 mm

$$M_{dmaxdwarsricht} = 7,87 * 1,0 = 7,87 \text{ kNm/m}$$

$$M/bd^2 = 7,87 / (1,0 * 0,15 * 0,15) = 350 \Rightarrow w_o = w_{min} = 0,15 \% \Rightarrow A_b = 225 \text{ mm}^2/\text{m}$$

$A_a = 393 \text{ mm}^2/\text{m}$, ruim voldoende

onderslag a:
tpv buitenblad



$$l_t < \underline{2.25} \text{ m}$$

bel. :

m.w:	$0,5 \cdot 4,0$	=	$2,00$	= $\frac{0,00}{0,00} \text{ kN/m}$
e.g.		=	$0,50$	
			$2,50$	

qd=	$1,2^*$	$2,5 +$	$1,35 \cdot 0,4^*$	$0,00 = 3,0 \text{ kN/m}$
	$1,1^*$	$2,5 +$	$1,35^*$	$0,00 = 2,8 \text{ kN/m}$

F_{rep}= 0,0 kN

F_d= 0,0 kN

M _d =	$0,125 \cdot q_d \cdot l^2 +$	$1/4 \cdot F_d \cdot l =$	$1,9 \text{ kNm}$
D _{dmax} =	$0,5 \cdot q_d \cdot l =$		$7,8 \text{ kN}$

opl= 150mm

toepassen:

L100.100.8

therm.verz.

W _y =	$19,9 \text{ cm}^3$
I _y =	145 cm^4
A _v =	800 mm^2

toets M:

$\sigma_d = M_{Ed} / W$	=	95 N/mm^2	$< f_u = 235 \text{ N/mm}^2$	uc=	$0,41$
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toets V:

$\tau_d = V_{Ed} / A_v$	=	10 N/mm^2	$< 235 / W_3 =$		
			136 N/mm^2	uc=	$0,07$

doorbuiging:

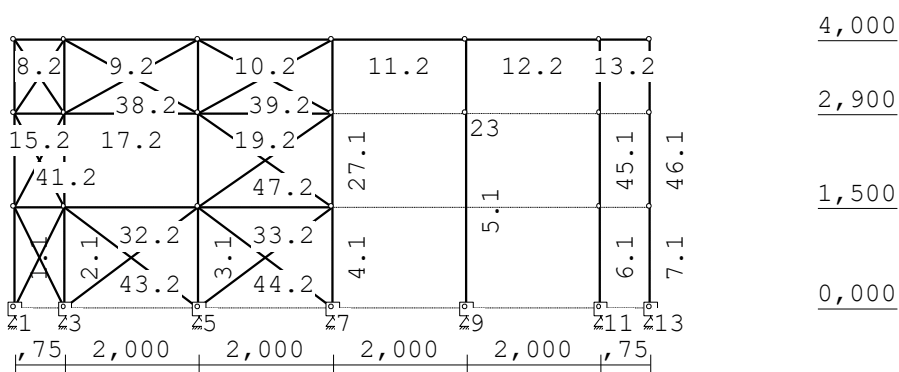
u _{tot}	=	$5/384 (q_l l^4 / EI) + Pl^3 / (48EI)$	
	=	$0,003 \text{ m}$	$< 0,004 l_t: \quad 9,0 \text{ mm}$
u _{bijk}	=	$0,000 \text{ m}$	$< 0,001 l_t: \quad 2,3 \text{ mm}$

Bijlage A: Technosoft Raamwerken release 6.17a

11 jul 2020

Project...: Verbouw Sterrewacht Roden
 Onderdeel: Stabiliteit app.3
 Dimensies: kN;m;rad (tenzij anders aangegeven)
 Datum....: 9/7/2020
 Bestand...: c:\users\jan\b&cadvies47112018b\rodensterrenwacht09032020\
 spanta.rww

Theorie voor de bepaling van de krachtsverdeling: Geometrisch lineair.
 Gunstige werking van de permanente belasting wordt automatisch verwerkt.

GEOMETRIE**STRAMIENLIJNEN**

Nr.	X	Z-min	Z-max
1	0.000	0.000	4.000
2	0.750	0.000	4.000
3	2.750	0.000	4.000
4	4.750	0.000	4.000
5	6.750	0.000	4.000
6	8.750	0.000	4.000
7	9.500	0.000	4.000

NIVEAUS

Nr.	Z	X-min	X-max
1	0.000	0.000	9.500
2	1.500	0.000	9.500
3	2.900	0.000	9.500
4	4.000	0.000	9.500

MATERIALEN

Mt	Omschrijving	E-modulus [N/mm2]	S.M.	Pois.	Uitz. coëff
1	C12/15	5944	25.0	0.20	1.0000e-05

MATERIALEN vervolg

Mt	Omschrijving	Cement	Kruipfac.	Toeslag	Rho [kg/m3]
1	C12/15		3.56	Normaal	2400

PROFIELEN [mm]

Prof.	Omschrijving	Materiaal	Oppervlak	Traagheid	Vormf.
1	B*H 320*430	1:C12/15	1.3760e+05	2.1202e+09	0.00
2	B*H 200*300	1:C12/15	6.0000e+04	4.5000e+08	0.00

PROFIELEN vervolg [mm]

Prof.	Staaftype	Breedte	Hoogte	e	Type	b1	h1	b2	h2
1	0:Normaal	320	430	215.0	0:RH				
2	0:Normaal	200	300	150.0	0:RH				
3	0:Normaal	100	100	27.4					
4	0:Normaal	16	16	8.0					

KNOPEN

Knoop	X	Z	Knoop	X	Z
1	0.000	0.000	6	2.750	4.000
2	0.000	4.000	7	4.750	0.000
3	0.750	0.000	8	4.750	4.000
4	0.750	4.000	9	6.750	0.000
5	2.750	0.000	10	6.750	4.000
11	8.750	0.000	16	0.750	2.900
12	8.750	4.000	17	2.750	2.900
13	9.500	0.000	18	4.750	2.900
14	9.500	4.000	19	0.000	1.500
15	0.000	2.900	20	0.750	1.500
21	2.750	1.500	26	8.750	1.500
22	4.750	1.500	27	9.500	1.500

23 6.750 2.900
 24 8.750 2.900
 25 9.500 2.900

STAVEN

St.	ki	kj	Profiel	Aansl.i	Aansl.j	Lengte	Opm.
1	1	19	1:B*H 320*430	NDM	NDM	1.500	
2	3	20	1:B*H 320*430	NDM	NDM	1.500	
3	5	21	1:B*H 320*430	NDM	NDM	1.500	
4	7	22	1:B*H 320*430	NDM	NDM	1.500	
5	9	23	1:B*H 320*430	NDM	NDM	2.900	
6	11	26	1:B*H 320*430	NDM	NDM	1.500	
7	13	27	1:B*H 320*430	NDM	NDM	1.500	
8	2	4	2:B*H 200*300	NDM	NDM	0.750	
9	4	6	2:B*H 200*300	NDM	NDM	2.000	
10	6	8	2:B*H 200*300	NDM	NDM	2.000	
11	8	10	2:B*H 200*300	NDM	NDM	2.000	
12	10	12	2:B*H 200*300	NDM	NDM	2.000	
13	12	14	2:B*H 200*300	NDM	NDM	0.750	
14	15	2	1:B*H 320*430	NDM	NDM	1.100	
15	15	16	2:B*H 200*300	NDM	NDM	0.750	
16	16	4	1:B*H 320*430	NDM	NDM	1.100	
17	16	17	2:B*H 200*300	NDM	NDM	2.000	
18	17	6	1:B*H 320*430	NDM	NDM	1.100	
19	17	18	2:B*H 200*300	NDM	NDM	2.000	
20	18	8	1:B*H 320*430	NDM	NDM	1.100	
21	19	15	1:B*H 320*430	NDM	NDM	1.400	
22	19	20	2:B*H 200*300	NDM	NDM	0.750	
23	20	16	1:B*H 320*430	NDM	NDM	1.400	
24	20	21	2:B*H 200*300	NDM	NDM	2.000	
25	21	17	1:B*H 320*430	NDM	NDM	1.400	
26	21	22	2:B*H 200*300	NDM	NDM	2.000	
27	22	18	1:B*H 320*430	NDM	NDM	1.400	
28	16	2	2:B*H 200*300	NDM	NDM	1.331	
29	20	15	2:B*H 200*300	NDM	NDM	1.588	
30	3	19	2:B*H 200*300	NDM	NDM	1.677	
31	17	4	2:B*H 200*300	NDM	NDM	2.283	
32	5	20	2:B*H 200*300	NDM	NDM	2.500	
33	7	21	2:B*H 200*300	NDM	NDM	2.500	
34	18	6	2:B*H 200*300	NDM	NDM	2.283	
35	23	10	1:B*H 320*430	NDM	NDM	1.100	
36	24	12	1:B*H 320*430	NDM	NDM	1.100	
37	25	14	1:B*H 320*430	NDM	NDM	1.100	
38	16	6	2:B*H 200*300	NDM	NDM	2.283	
39	17	8	2:B*H 200*300	NDM	NDM	2.283	
40	15	4	2:B*H 200*300	NDM	NDM	1.331	
41	19	16	2:B*H 200*300	NDM	NDM	1.588	
42	1	20	2:B*H 200*300	NDM	NDM	1.677	
43	3	21	2:B*H 200*300	NDM	NDM	2.500	
44	5	22	2:B*H 200*300	NDM	NDM	2.500	
45	26	24	1:B*H 320*430	NDM	NDM	1.400	
46	27	25	1:B*H 320*430	NDM	NDM	1.400	
47	21	18	2:B*H 200*300	NDM	NDM	2.441	
48	17	22	2:B*H 200*300	NDM	NDM	2.441	

VASTE STEUNPUNTEN

Nr.	knoop	Kode	XZR	1=vast	0=vrij	Hoek
1	1	111				0.00
2	3	111				0.00
3	5	111				0.00
4	7	111				0.00
5	9	111				0.00
6	11	111				0.00
7	13	111				0.00

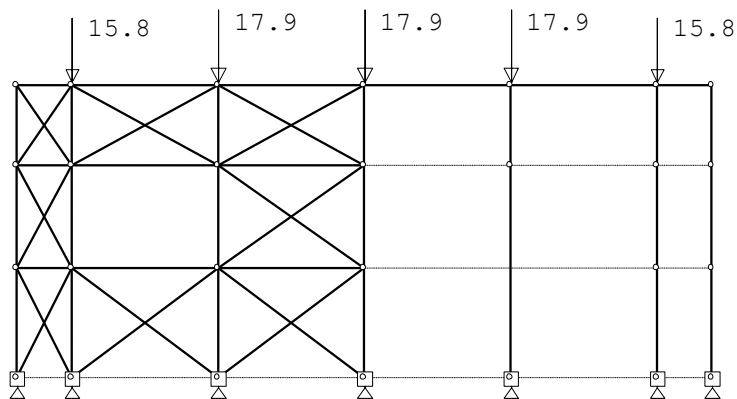
BELASTINGGEVALLEN

B.G.	Omschrijving	Type
1	permanent EGZ=-1.00	1 Permanente belasting
2	veranderlijk EGZ=0.00	1 Permanente belasting
3	e.g. spant EGZ=-1.00	1 Permanente belasting
4	windbelasting v.rechts, dr EGZ=0.00	1 Permanente belasting

BELASTINGEN

B.G:1 permanent

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

**KNOOPBELASTINGEN**

B.G:1 permanent

Last	Knoop	Richting	waarde
1	4	Z	-15.800
2	12	Z	-15.800
3	6	Z	-17.900
4	8	Z	-17.900
5	10	Z	-17.900

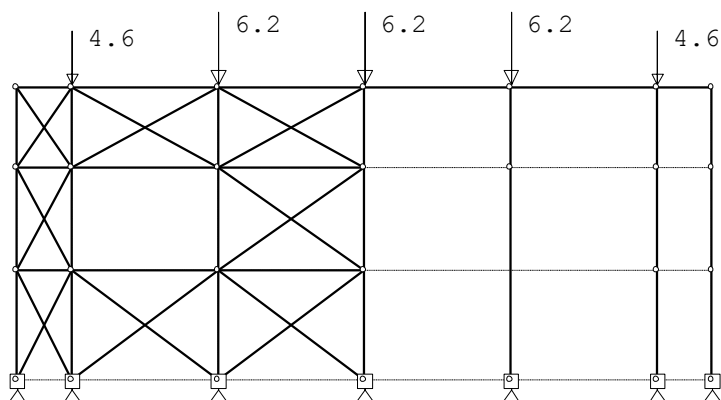
REACTIES

B.G:1 permanent

Kn.	X	Z	M
1	5.05	33.42	0.36
3	2.82	40.38	-0.08
5	0.09	52.47	-0.06
7	-7.25	52.95	-0.30
9	-0.05	34.89	-0.11
11	-0.34	29.68	-0.50
13	-0.31	16.14	-0.45
	0.00	259.93	: Som van de reacties
	0.00	-259.93	: Som van de belastingen

BELASTINGEN

B.G:2 veranderlijk

**KNOOPBELASTINGEN**

B.G:2 veranderlijk

Last	Knoop	Richting	waarde
1	4	Z	-4.600
2	12	Z	-4.600
3	6	Z	-6.200
4	8	Z	-6.200
5	10	Z	-6.200

Project...: Verbouw Sterrewacht Roden
Onderdeel: Stabiliteit app.3

REACTIES

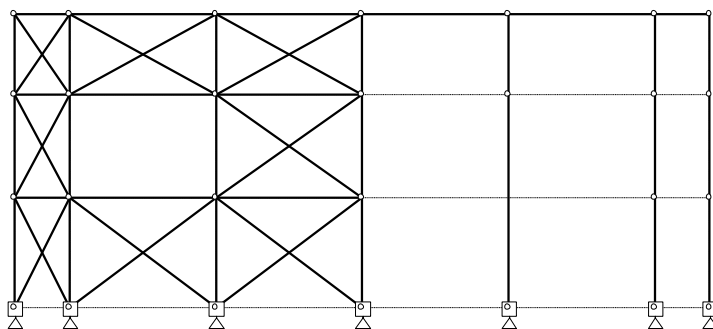
B.G:2 veranderlijk

Kn.	X	Z	M
1	0.42	2.03	0.05
3	0.42	2.81	0.02
5	0.14	5.32	-0.02
7	-0.81	6.83	-0.09
9	-0.01	6.21	-0.03
11	-0.08	4.04	-0.11
13	-0.08	0.56	-0.12
	0.00	27.80	: Som van de reacties
	0.00	-27.80	: Som van de belastingen

BELASTINGEN

B.G:3 e.g. spant

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

**REACTIES**

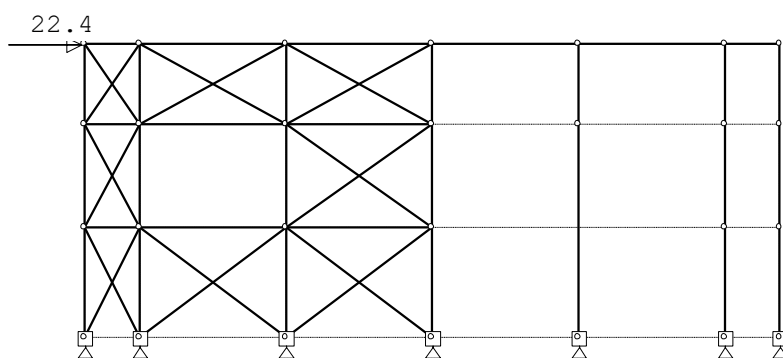
B.G:3 e.g. spant

Kn.	X	Z	M
1	3.64	26.41	0.20
3	1.63	31.21	-0.17
5	-0.23	36.83	-0.01
7	-4.88	33.20	-0.05
9	-0.02	16.90	-0.04
11	-0.10	15.85	-0.14
13	-0.03	14.23	-0.05
	0.00	174.63	: Som van de reacties
	0.00	-174.63	: Som van de belastingen

Project...: Verbouw Sterrewacht Roden
Onderdeel: Stabiliteit app.3

BELASTINGEN

B.G:4 windbelasting v.rechts, druk + zuig

**KNOOPBELASTINGEN**

B.G:4 windbelasting v.rechts, druk + zuig

Last	Knoop	Richting	waarde
1	2	X	22.400

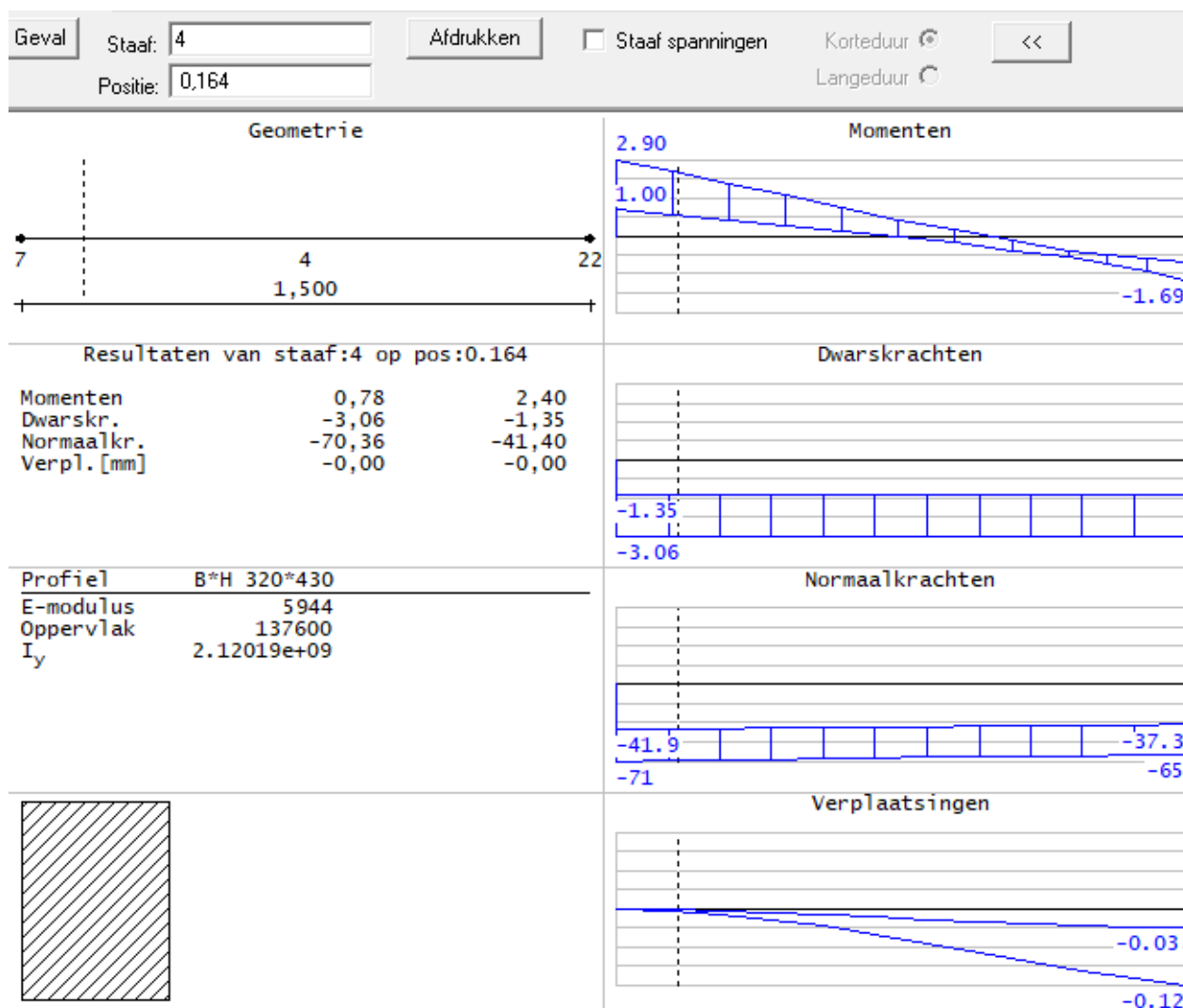
REACTIES

B.G:4 windbelasting v.rechts, druk + zuig

Kn.	X	Z	M
1	-1.71	-16.73	-0.83
3	-5.23	0.18	-0.73
5	-9.23	-1.74	-0.78
7	-5.37	17.96	-1.22
9	-0.31	0.13	-0.69
11	-0.30	-0.76	-0.68
13	-0.25	0.97	-0.61
	-22.40	0.00	: Som van de reacties
	22.40	0.00	: Som van de belastingen

BELASTINGCOMBINATIES

BC	Type
1	Fund. 1.20 $G_{k,1}$
2	Fund. 1.10 $G_{k,1}$
3	Fund. 1.10 $G_{k,1}$ + 1.35 $G_{k,2}$
4	Fund. 0.90 $G_{k,1}$
5	Fund. 0.90 $G_{k,1}$ + 1.35 $G_{k,4}$
6	Fund. 1.10 $G_{k,1}$ + 1.35 $G_{k,4}$
7	Kar. 1.00 $G_{k,1}$ + 1.00 $G_{k,2}$
8	Kar. 1.00 $G_{k,1}$
9	Freq. 1.00 $G_{k,1}$
10	Kar. 1.00 $G_{k,1}$ + 1.00 $G_{k,4}$
11	Blij. 1.00 $G_{k,1}$



$$\sigma_{bd;max} = 2,9^e6 / (1/6 * 320 * 430 * 430) - 41,9^e3 / (320 * 430) = 0,0 \text{ N/mm}^2 < 0,17 \text{ N/mm}^2$$

STAAFKRACHTEN											
Fundamentele combinatie											
St.	Kn.	Pos.	NXi/NXj			DZi/DZj			MYi/MYj		
			Min	BC	Max	Min	BC	Max	Min	BC	Max
1	1		-28.22	1	-2.37	5	0.28	5	0.98	3	-0.72
1	0.736		-25.18	1	-0.09	5	0.28	5	0.98	3	0.00
1	19		-22.03	1	2.27	5	0.28	5	0.98	3	0.55
2	3		-36.52	6	-25.60	4	0.18	5	0.63	3	-0.40
2	0.638		-34.11	6	-23.63	4	0.18	5	0.63	3	0.00
2	20		-30.84	6	-20.96	4	0.18	5	0.63	3	0.41
3	5		-55.61	3	-36.91	5	-0.42	5	0.27	1	-0.05
3	0.183		-54.92	3	-36.35	5	-0.42	5	0.27	1	0.00
3	21		-49.94	3	-32.27	5	-0.42	5	0.27	1	0.26
4	7		-70.98	6	-41.91	4	-3.06	6	-1.35	4	1.00
4	0.741		-68.17	6	-39.61	4	-3.06	6	-1.35	4	0.00
4	0.971		-67.30	6	-38.90	4	-3.06	6	-1.35	4	-0.41
4	22		-65.30	6	-37.26	4	-3.06	6	-1.35	4	-1.69
5	9		-46.77	3	-31.40	4	-0.47	6	-0.05	4	0.10
5	2.240		-38.29	3	-24.47	4	-0.47	6	-0.05	4	-0.00
5	2.243		-38.28	3	-24.46	4	-0.47	6	-0.05	4	-0.00
5	23		-35.79	3	-22.42	4	-0.47	6	-0.05	4	-0.31
6	11		-38.10	3	-25.68	5	-0.79	6	-0.31	4	0.45
6	1.449		-32.62	3	-21.19	5	-0.79	6	-0.31	4	0.00

6	26	-32.42	3	-21.04	5	-0.79	6	-0.31	4	-0.02	1	0.29	5
7	13	-19.37	1	-14.53	4	-0.68	6	-0.28	4	0.40	4	1.32	6
7	1.460	-13.54	6	-10.01	4	-0.68	6	-0.28	4	0.00	4	0.33	6
7	27	-13.39	6	-9.88	4	-0.68	6	-0.28	4	-0.02	3	0.30	5
8	2	-25.56	5	0.23	3	-1.42	3	-0.34	5	-0.24	5	0.39	3
8	0.251	-25.56	5	0.23	3	-1.01	3	0.00	5	-0.28	5	0.08	3
8	0.332	-25.56	5	0.23	3	-0.88	3	0.11	5	-0.27	5	0.01	3
8	0.334	-25.56	5	0.23	3	-0.87	3	0.11	5	-0.27	6	0.00	3
8	0.339	-25.56	5	0.23	3	-0.87	3	0.12	5	-0.27	6	-0.00	3
8	0.653	-25.56	5	0.23	3	-0.35	3	0.54	5	-0.19	6	-0.09	4
8	0.708	-25.56	5	0.23	3	-0.26	3	0.62	5	-0.21	3	-0.10	4
8	4	-25.56	5	0.23	3	-0.19	3	0.69	6	-0.22	3	-0.09	4
9	4	-12.98	6	-1.48	4	-1.74	1	-0.95	5	-0.06	5	0.48	1
9	0.332	-12.98	6	-1.48	4	-1.15	1	-0.50	5	-0.30	5	-0.00	1
9	0.750	-12.98	6	-1.48	4	-0.39	1	0.07	5	-0.45	6	-0.24	4
9	0.968	-12.98	6	-1.48	4	0.00	1	0.36	5	-0.41	6	-0.27	4
9	1.467	-12.98	6	-1.48	4	0.67	4	1.18	6	-0.14	1	-0.00	5
9	1.610	-12.98	6	-1.48	4	0.87	4	1.42	6	-0.00	3	0.16	6
9	6	-12.98	6	-1.48	4	1.39	4	2.06	6	0.45	4	0.84	6
10	6	-3.29	6	-1.05	4	-1.78	1	-1.33	4	0.40	4	0.53	1
10	0.357	-3.29	6	-1.05	4	-1.13	1	-0.85	4	-0.00	3	0.04	6
10	0.399	-3.29	6	-1.05	4	-1.06	1	-0.79	4	-0.04	3	-0.00	5
10	0.987	-3.29	6	-1.05	4	-0.01	6	0.01	3	-0.34	1	-0.24	5
10	0.994	-3.29	6	-1.05	4	0.00	5	0.02	3	-0.34	1	-0.24	5
10	1.589	-3.29	6	-1.05	4	0.80	5	1.08	1	-0.02	1	-0.00	5
10	1.605	-3.29	6	-1.05	4	0.82	5	1.11	1	-0.00	1	0.01	5
10	8	-3.29	6	-1.05	4	1.36	5	1.82	1	0.43	4	0.58	1
11	8	-1.93	6	-0.63	4	-1.67	1	-0.80	5	-0.08	5	0.50	1
11	0.370	-1.93	6	-0.63	4	-1.01	1	-0.30	5	-0.29	5	-0.00	1
11	0.653	-1.93	6	-0.63	4	-0.50	1	0.08	5	-0.35	6	-0.16	4
11	0.929	-1.93	6	-0.63	4	0.00	1	0.45	5	-0.29	6	-0.21	4
11	1.281	-1.93	6	-0.63	4	0.48	4	1.03	6	-0.17	1	-0.00	5
11	1.487	-1.93	6	-0.63	4	0.75	4	1.38	6	-0.00	1	0.22	5
11	10	-1.93	6	-0.63	4	1.45	4	2.22	6	0.56	4	1.14	6
12	10	-1.46	6	-0.59	4	-1.95	1	-1.19	5	0.21	5	0.65	1
12	0.197	-1.46	6	-0.59	4	-1.59	1	-0.92	5	-0.00	5	0.30	1
12	0.409	-1.46	6	-0.59	4	-1.21	1	-0.63	5	-0.16	5	-0.00	1
12	1.002	-1.46	6	-0.59	4	-0.14	1	0.17	5	-0.40	1	-0.30	4
12	1.082	-1.46	6	-0.59	4	-0.00	3	0.28	5	-0.41	1	-0.28	5
12	1.558	-1.46	6	-0.59	4	0.64	4	1.06	6	-0.21	3	-0.00	5
12	1.780	-1.46	6	-0.59	4	0.94	4	1.43	6	-0.00	3	0.24	6
12	12	-1.46	6	-0.59	4	1.24	4	1.79	6	0.26	4	0.60	6
13	12	-0.68	6	-0.28	4	1.13	4	2.69	6	-1.09	6	-0.53	4
13	0.361	-0.68	6	-0.28	4	1.62	4	3.29	6	-0.05	3	-0.00	5
13	0.380	-0.68	6	-0.28	4	1.65	4	3.32	6	0.00	3	0.06	5
13	14	-0.68	6	-0.28	4	2.14	4	3.93	6	0.70	4	1.40	6
14	15	-6.26	1	0.70	5	-1.00	5	0.10	1	0.16	4	0.92	6
14	0.614	-3.73	1	2.60	5	-1.00	5	0.10	1	0.20	4	0.31	6
14	0.677	-3.47	1	2.80	5	-1.00	5	0.10	1	0.21	4	0.32	3
14	0.883	-2.62	1	3.44	5	-1.00	5	0.10	1	0.00	5	0.34	3
14	2	-1.76	3	4.11	5	-1.00	5	0.10	1	-0.22	5	0.35	3
15	15	2.99	4	4.56	6	-1.05	3	0.35	5	-0.35	5	0.23	3
15	0.285	2.99	4	4.56	6	-0.58	3	0.74	5	-0.20	6	-0.00	3
15	0.447	2.99	4	4.56	6	-0.31	3	0.96	5	-0.07	6	-0.05	4
15	0.455	2.99	4	4.56	6	-0.30	3	0.97	5	-0.08	3	-0.05	4
15	0.508	2.99	4	4.56	6	-0.21	3	1.04	5	-0.09	3	-0.00	5
15	0.637	2.99	4	4.56	6	0.00	3	1.23	6	-0.10	3	0.14	5
15	16	2.99	4	4.56	6	0.19	3	1.42	6	-0.09	3	0.29	5
16	16	-25.79	3	-11.19	5	0.24	5	1.14	1	-0.30	6	-0.22	4
16	0.219	-24.97	3	-10.51	5	0.24	5	1.14	1	-0.21	6	0.00	3
16	1.059	-21.79	3	-7.91	5	0.24	5	1.14	1	0.00	5	0.91	3
16	4	-21.63	3	-7.79	5	0.24	5	1.14	1	0.01	5	0.96	1
17	16	-0.41	5	2.75	3	-1.81	1	-0.66	5	-0.31	5	0.59	1
17	0.407	-0.41	5	2.75	3	-1.08	1	-0.11	5	-0.46	5	-0.00	1
17	0.581	-0.41	5	2.75	3	-0.77	1	0.13	5	-0.49	6	-0.12	4
17	1.006	-0.41	5	2.75	3	-0.01	3	0.70	5	-0.34	6	-0.24	4

17	1.319	-0.41	5	2.75	3	0.42	4	1.22	6	-0.24	1	-0.00	5
17	1.613	-0.41	5	2.75	3	0.82	4	1.70	6	-0.00	3	0.39	6
17	17	-0.41	5	2.75	3	1.34	4	2.34	6	0.42	4	1.17	6
18	17	-36.07	3	-23.18	4	-0.19	6	-0.07	4	-0.42	5	0.10	3
18	0.587	-33.84	3	-21.36	4	-0.19	6	-0.07	4	-0.52	6	0.00	3
18	6	-31.90	3	-19.78	4	-0.19	6	-0.07	4	-0.62	6	-0.05	4
19	17	-0.87	5	4.39	3	-1.79	1	-1.07	5	0.13	5	0.54	1
19	0.134	-0.87	5	4.39	3	-1.55	1	-0.89	5	-0.00	5	0.32	1
19	0.370	-0.87	5	4.39	3	-1.13	1	-0.57	5	-0.17	5	-0.00	1
19	0.832	-0.87	5	4.39	3	-0.30	1	0.05	5	-0.35	6	-0.25	4
19	0.903	-0.87	5	4.39	3	-0.17	1	0.14	5	-0.35	6	-0.26	4
19	0.997	-0.87	5	4.39	3	0.00	1	0.27	5	-0.35	1	-0.26	4
19	1.457	-0.87	5	4.39	3	0.62	4	1.03	6	-0.16	1	-0.00	5
19	1.623	-0.87	5	4.39	3	0.85	4	1.31	6	-0.00	1	0.17	5
19	18	-0.87	5	4.39	3	1.35	4	1.93	6	0.41	4	0.78	6
20	18	-36.70	3	-23.20	5	-1.61	6	-0.95	4	0.50	5	0.76	1
20	0.359	-35.34	3	-22.09	5	-1.61	6	-0.95	4	0.00	5	0.31	1
20	0.604	-34.41	3	-21.33	5	-1.61	6	-0.95	4	-0.34	5	0.00	3
20	8	-32.54	3	-19.80	5	-1.61	6	-0.95	4	-1.14	6	-0.47	4
21	19	-16.80	1	-1.08	5	-0.25	5	0.42	3	0.06	4	0.82	6
21	1.202	-11.89	3	2.64	5	-0.25	5	0.42	3	0.40	4	0.59	6
21	1.391	-11.17	3	3.22	5	-0.25	5	0.42	3	0.46	4	0.67	3
21	15	-11.14	3	3.25	5	-0.25	5	0.42	3	0.46	5	0.68	3
22	19	1.13	5	6.11	3	-1.24	3	0.24	5	-0.21	5	0.33	3
22	0.352	1.13	5	6.11	3	-0.66	3	0.71	5	-0.05	6	-0.00	3
22	0.391	1.13	5	6.11	3	-0.59	3	0.76	5	-0.03	1	-0.02	4
22	0.416	1.13	5	6.11	3	-0.55	3	0.80	5	-0.04	3	-0.00	5
22	20	1.13	5	6.11	3	-0.00	3	1.27	6	-0.13	3	0.34	5
23	20	-31.75	3	-22.76	4	-1.59	5	0.81	3	-0.29	1	1.50	5
23	0.366	-30.36	3	-21.63	4	-1.59	5	0.81	3	0.00	1	0.92	5
23	0.757	-28.88	3	-20.42	4	-1.59	5	0.81	3	0.23	4	0.35	6
23	0.786	-28.77	3	-20.33	4	-1.59	5	0.81	3	0.25	4	0.37	3
23	0.944	-28.17	3	-19.84	4	-1.59	5	0.81	3	0.00	5	0.50	3
23	16	-26.45	3	-18.43	4	-1.59	5	0.81	3	-0.73	5	0.87	3
24	20	2.04	4	3.41	6	-1.84	1	-0.71	5	-0.18	5	0.65	1
24	0.466	2.04	4	3.41	6	-1.00	1	-0.09	5	-0.37	6	-0.00	3
24	0.619	2.04	4	3.41	6	-0.72	1	0.12	5	-0.39	6	-0.11	4
24	0.970	2.04	4	3.41	6	-0.10	3	0.59	5	-0.29	6	-0.21	4
24	1.006	2.04	4	3.41	6	-0.04	3	0.64	5	-0.29	1	-0.22	4
24	1.020	2.04	4	3.41	6	-0.01	3	0.66	5	-0.29	1	-0.21	5
24	1.269	2.04	4	3.41	6	0.34	4	1.07	6	-0.23	1	-0.00	5
24	1.592	2.04	4	3.41	6	0.77	4	1.61	6	-0.00	3	0.39	6
24	21	2.04	4	3.41	6	1.32	4	2.28	6	0.43	4	1.19	6
25	21	-49.60	3	-34.31	4	-2.27	5	0.58	1	-0.38	1	1.50	5
25	0.654	-47.12	3	-32.28	4	-2.27	5	0.58	1	-0.00	1	0.02	5
25	0.657	-47.11	3	-32.27	4	-2.27	5	0.58	1	0.00	1	0.02	3
25	0.661	-47.10	3	-32.26	4	-2.27	5	0.58	1	0.00	4	0.02	3
25	17	-44.30	3	-29.97	4	-2.27	5	0.58	1	-1.67	5	0.43	1
26	21	4.17	4	8.33	6	-1.75	1	-0.89	5	-0.03	5	0.53	1
26	0.371	4.17	4	8.33	6	-1.09	1	-0.39	5	-0.27	5	-0.00	1
26	0.717	4.17	4	8.33	6	-0.46	1	0.08	5	-0.36	6	-0.20	4
26	0.934	4.17	4	8.33	6	-0.07	1	0.37	5	-0.33	6	-0.24	4
26	0.974	4.17	4	8.33	6	0.00	1	0.42	5	-0.33	1	-0.25	4
26	1.351	4.17	4	8.33	6	0.51	4	1.05	6	-0.20	1	-0.00	5
26	1.577	4.17	4	8.33	6	0.81	4	1.42	6	-0.00	1	0.24	5
26	22	4.17	4	8.33	6	1.39	4	2.12	6	0.47	4	0.99	6
27	22	-48.17	6	-32.55	4	-1.68	6	-0.90	4	0.51	4	0.90	6
27	0.534	-46.15	6	-30.90	4	-1.68	6	-0.90	4	0.00	5	0.04	1
27	0.571	-46.01	6	-30.78	4	-1.68	6	-0.90	4	-0.05	5	0.00	1
27	18	-42.88	6	-28.22	4	-1.68	6	-0.90	4	-1.45	6	-0.75	4
28	16	-7.53	6	-1.34	4	0.48	5	0.84	1	-0.21	1	0.02	5
28	0.305	-7.11	6	-1.00	4	0.25	5	0.53	1	0.00	1	0.13	5
28	0.666	-6.62	6	-0.60	4	-0.03	5	0.17	3	0.09	4	0.19	6
28	0.827	-6.40	6	-0.42	4	-0.15	5	0.02	3	0.10	4	0.18	6
28	1.296	-5.79	5	0.14	1	-0.59	6	-0.36	4	0.00	5	0.05	3
28	2	-5.75	5	0.19	1	-0.62	6	-0.38	4	-0.02	5	0.03	3

Project.: Verbouw Sterrewacht Roden
Onderdeel: Stabiliteit app.3

STAAFKRACHTEN			Fundamentele combinatie											
St.	Kn.	Pos.	NXi/NXj			DZi/DZj			MYi/MYj					
			Min	BC	Max	BC	Min	BC	Max	BC	Min	BC	Max	BC
29	20		-8.72	6	-3.64	4	0.62	5	0.96	1	-0.35	1	-0.11	5
29		0.191	-8.45	6	-3.41	4	0.50	5	0.80	1	-0.19	1	0.00	5
29		0.463	-8.05	6	-3.09	4	0.33	5	0.57	1	0.00	1	0.11	5
29		1.002	-7.27	6	-2.45	4	-0.02	5	0.13	3	0.14	4	0.23	6
29		1.134	-7.07	6	-2.29	4	-0.10	5	0.03	3	0.14	4	0.22	6
29	15		-6.41	6	-1.75	4	-0.46	6	-0.29	4	0.07	5	0.13	3
30	3		-8.19	1	-6.15	4	0.64	5	0.95	1	-0.41	1	-0.12	5
30		0.211	-7.85	1	-5.89	4	0.51	5	0.78	1	-0.23	1	0.00	5
30		0.593	-7.24	1	-5.43	4	0.28	5	0.47	1	0.00	3	0.15	6
30		1.081	-6.45	1	-4.84	4	-0.01	5	0.09	3	0.10	4	0.24	6
30		1.177	-6.30	1	-4.72	4	-0.07	5	0.02	3	0.11	4	0.24	6
30	19		-5.49	1	-4.12	4	-0.44	6	-0.30	4	0.03	4	0.11	6
31	17		-18.13	6	-2.33	4	1.46	4	2.05	6	-1.03	6	-0.60	4
31		0.519	-17.72	6	-1.99	4	0.85	4	1.30	6	-0.16	6	0.00	4
31		0.679	-17.59	6	-1.89	4	0.66	4	1.07	6	0.00	5	0.16	1
31		1.234	-17.15	6	-1.53	4	0.00	4	0.27	6	0.30	4	0.40	1
31		1.251	-17.14	6	-1.52	4	-0.03	1	0.25	5	0.30	4	0.40	1
31		1.420	-17.00	6	-1.41	4	-0.29	1	0.05	5	0.28	4	0.42	6
31		1.949	-16.58	6	-1.06	4	-1.13	1	-0.58	5	0.00	4	0.22	6
31		2.244	-16.35	6	-0.87	4	-1.59	1	-0.93	5	-0.40	1	0.00	5
31	4		-16.32	6	-0.85	4	-1.65	1	-0.97	5	-0.46	1	-0.04	5
32	5		-12.99	6	-4.01	4	1.44	4	1.92	1	-0.91	6	-0.67	4
32		0.601	-12.40	6	-3.52	4	0.79	4	1.10	6	-0.01	3	0.00	4
32		0.608	-12.39	6	-3.52	4	0.79	4	1.09	6	0.00	3	0.01	1
32		1.337	-11.67	6	-2.93	4	0.00	4	0.13	6	0.29	4	0.45	6
32		1.437	-11.57	6	-2.85	4	-0.15	1	0.02	5	0.29	4	0.46	6
32		2.072	-10.94	6	-2.33	4	-1.06	1	-0.66	5	0.00	4	0.19	6
32		2.313	-10.70	6	-2.14	4	-1.41	1	-0.92	5	-0.30	1	0.00	5
32	20		-10.52	6	-1.99	4	-1.68	1	-1.12	5	-0.59	1	-0.19	5
33	7		-16.64	6	-7.59	4	1.49	4	1.99	1	-0.97	1	-0.73	4
33		0.607	-16.04	6	-7.10	4	0.84	4	1.12	6	-0.04	3	0.00	5
33		0.642	-16.00	6	-7.07	4	0.80	4	1.07	6	0.00	3	0.03	6
33		1.381	-15.27	6	-6.47	4	0.00	4	0.09	6	0.30	4	0.46	6
33		1.452	-15.20	6	-6.41	4	-0.10	1	0.02	5	0.30	4	0.47	6
33		2.133	-14.53	6	-5.86	4	-1.08	1	-0.72	5	0.00	4	0.16	6
33		2.329	-14.33	6	-5.71	4	-1.36	1	-0.93	5	-0.24	1	0.00	5
33	21		-14.16	6	-5.57	4	-1.61	1	-1.11	5	-0.49	1	-0.18	5
34	18		-8.75	6	-3.03	4	1.42	4	1.89	1	-0.76	6	-0.56	4
34		0.495	-8.36	6	-2.71	4	0.83	4	1.11	1	-0.07	6	0.00	4
34		0.579	-8.29	6	-2.65	4	0.73	4	0.98	1	0.00	5	0.09	1
34		1.199	-7.80	6	-2.25	4	0.00	4	0.04	3	0.25	5	0.39	1
34		1.223	-7.78	6	-2.23	4	-0.04	1	0.00	3	0.25	5	0.39	1
34		1.868	-7.27	6	-1.81	4	-1.06	1	-0.76	5	0.00	5	0.06	3
34		1.934	-7.21	6	-1.77	4	-1.16	1	-0.84	5	-0.06	6	0.00	3
34	6		-6.94	6	-1.54	4	-1.71	1	-1.25	5	-0.54	1	-0.40	4
35	23		-35.79	3	-22.42	4	-0.47	6	-0.05	4	-0.31	6	-0.03	4
35	10		-31.63	3	-19.02	4	-0.47	6	-0.05	4	-0.83	6	-0.08	4
36	24		-27.13	3	-16.70	5	-0.79	6	-0.31	4	-0.82	6	-0.45	4
36	12		-22.96	3	-13.30	5	-0.79	6	-0.31	4	-1.68	6	-0.79	4
37	25		-8.09	6	-5.55	4	-0.68	6	-0.28	4	-0.65	6	-0.40	4
37	14		-3.93	6	-2.14	4	-0.68	6	-0.28	4	-1.40	6	-0.70	4
38	16		-3.73	3	2.88	5	-1.91	1	-1.08	5	0.10	5	0.79	1
38		0.096	-3.65	3	2.94	5	-1.76	1	-0.97	5	-0.00	5	0.61	1
38		0.541	-3.30	3	3.23	5	-1.05	1	-0.44	5	-0.32	6	-0.00	3
38		0.968	-2.96	3	3.51	5	-0.38	1	0.06	5	-0.45	6	-0.24	4
38		1.209	-2.77	3	3.66	5	-0.03	3	0.35	5	-0.41	6	-0.28	4
38		1.734	-2.35	3	4.00	5	0.62	4	1.11	6	-0.16	3	-0.00	5
38		1.914	-2.21	3	4.12	5	0.83	4	1.37	6	-0.00	3	0.20	6

Project...: Verbouw Sterrewacht Roden
Onderdeel: Stabiliteit app.3

STAAFKRACHTEN			Fundamentele combinatie											
St.	Kn.	Pos.	NXi/NXj			DZi/DZj				MYi/MYj				
			Min	BC	Max	BC	Min	BC	Max	BC	Min	BC	Max	BC
38	6		-1.91	3	4.36	5	1.27	4	1.90	6	0.41	4	0.80	6
39	17		-1.97	3	-0.86	5	-1.89	1	-1.30	5	0.39	5	0.75	1
39		0.359	-1.69	3	-0.63	5	-1.32	1	-0.87	5	-0.00	5	0.17	3
39		0.513	-1.57	3	-0.53	5	-1.08	1	-0.69	5	-0.12	6	-0.00	3
39		1.115	-1.09	3	-0.14	5	-0.14	3	0.02	5	-0.39	6	-0.28	4
39		1.164	-1.05	3	-0.11	5	-0.08	3	0.08	5	-0.38	6	-0.29	4
39		1.197	-1.02	3	-0.08	5	-0.03	3	0.12	5	-0.38	1	-0.29	4
39		1.836	-0.51	3	0.33	5	0.75	4	1.04	6	-0.08	3	-0.00	5
39		1.918	-0.45	3	0.39	5	0.85	4	1.16	6	-0.00	3	0.08	6
39	8		-0.16	3	0.64	6	1.28	4	1.71	1	0.41	4	0.60	6
40	15		-6.87	3	-3.24	5	-0.81	1	-0.45	5	0.00	5	0.32	3
40		0.003	-6.87	3	-3.24	5	-0.81	1	-0.45	5	-0.00	5	0.31	3
40		0.617	-6.03	3	-2.55	5	-0.22	3	0.02	5	-0.13	6	-0.00	3
40		0.632	-6.01	3	-2.53	5	-0.21	3	0.03	5	-0.13	6	-0.00	3
40		0.801	-5.78	3	-2.34	5	-0.05	3	0.16	5	-0.12	6	-0.02	4
40		1.044	-5.45	3	-2.07	5	0.17	3	0.38	6	-0.06	6	-0.00	4
40		1.185	-5.25	3	-1.92	5	0.29	4	0.51	6	-0.00	5	0.04	1
40	4		-5.05	3	-1.75	5	0.40	4	0.65	6	0.07	5	0.11	1
41	19		-9.81	3	-0.21	5	-0.92	6	-0.64	4	0.29	4	0.49	6
41		0.675	-8.83	3	0.60	5	-0.39	6	-0.21	4	-0.00	4	0.04	6
41		0.816	-8.62	3	0.76	5	-0.28	6	-0.12	4	-0.03	1	-0.00	5
41		1.008	-8.35	3	0.99	5	-0.13	6	0.00	4	-0.05	1	-0.04	4
41		1.021	-8.33	3	1.01	5	-0.13	5	0.01	1	-0.05	1	-0.04	4
41		1.180	-8.09	3	1.20	5	-0.02	5	0.15	1	-0.06	6	-0.03	4
41		1.341	-7.86	3	1.39	5	0.08	5	0.28	1	-0.05	6	-0.00	4
41	16		-7.50	3	1.68	5	0.24	5	0.49	1	-0.01	5	0.10	1
42	1		-12.91	1	-5.44	5	-0.75	1	-0.55	5	0.20	4	0.35	6
42		0.477	-12.20	3	-4.87	5	-0.37	1	-0.26	5	-0.00	4	0.12	6
42		0.906	-11.56	3	-4.35	5	-0.03	3	0.00	5	-0.08	1	0.06	5
42		0.936	-11.52	3	-4.31	5	-0.01	3	0.02	5	-0.08	1	0.06	5
42		1.404	-10.83	3	-3.75	5	0.28	4	0.38	1	-0.00	3	0.14	6
42	20		-10.43	3	-3.42	5	0.45	4	0.60	1	0.10	4	0.26	6
43	3		-8.56	3	2.07	5	-1.91	1	-1.32	5	0.62	5	0.91	1
43		0.622	-7.95	3	2.57	5	-1.02	1	-0.65	5	-0.00	4	0.01	3
43		0.635	-7.93	3	2.58	5	-1.00	1	-0.64	5	-0.01	1	-0.00	3
43		1.225	-7.35	3	3.06	5	-0.15	3	0.00	5	-0.35	1	-0.19	5
43		1.330	-7.25	3	3.14	5	-0.02	3	0.11	5	-0.36	1	-0.18	5
43		1.816	-6.77	3	3.54	5	0.53	4	0.75	6	-0.19	1	-0.00	5
43		2.047	-6.54	3	3.73	5	0.77	4	1.06	6	-0.00	3	0.18	6
43	21		-6.09	3	4.09	5	1.26	4	1.69	1	0.47	4	0.79	6
44	5		-5.36	3	2.92	5	-2.01	1	-1.49	5	0.76	4	1.01	1
44		0.659	-4.71	3	3.46	5	-1.06	1	-0.77	5	-0.00	4	0.07	6
44		0.749	-4.62	3	3.53	5	-0.93	1	-0.68	5	-0.09	1	-0.00	5
44		1.375	-4.00	3	4.04	5	-0.05	3	0.00	5	-0.39	1	-0.21	5
44		1.397	-3.98	3	4.05	5	-0.02	3	0.02	5	-0.39	1	-0.21	5
44		2.002	-3.38	3	4.54	5	0.65	4	0.87	1	-0.13	3	-0.00	5
44		2.151	-3.23	3	4.66	5	0.81	4	1.09	1	-0.00	3	0.12	6
44	22		-2.88	3	4.95	5	1.19	4	1.59	1	0.36	4	0.55	6
45	26		-32.42	3	-21.04	5	-0.79	6	-0.31	4	-0.02	1	0.29	5
45		0.400	-30.91	3	-19.80	5	-0.79	6	-0.31	4	-0.21	3	0.00	5
45	24		-27.13	3	-16.70	5	-0.79	6	-0.31	4	-0.82	6	-0.45	4
46	27		-13.39	6	-9.88	4	-0.68	6	-0.28	4	-0.02	3	0.30	5
46		0.488	-11.54	6	-8.37	4	-0.68	6	-0.28	4	-0.23	3	0.00	5
46	25		-8.09	6	-5.55	4	-0.68	6	-0.28	4	-0.65	6	-0.40	4
47	21		-2.96	3	7.77	5	-1.98	1	-1.39	5	0.55	5	0.92	1
47		0.492	-2.50	3	8.16	5	-1.26	1	-0.84	5	-0.00	5	0.13	3
47		0.611	-2.38	3	8.25	5	-1.08	1	-0.71	5	-0.10	6	-0.00	3
47		1.346	-1.69	3	8.82	5	-0.03	3	0.10	5	-0.42	1	-0.31	4
47		2.015	-1.05	3	9.33	5	0.74	4	1.01	6	-0.11	3	-0.00	5
47		2.127	-0.95	3	9.42	5	0.86	4	1.16	6	-0.00	3	0.11	6

Project...: Verbouw Sterrewacht Roden
Onderdeel: Stabiliteit app.3

STAAFKRACHTEN

Fundamentele combinatie

St.	Kn.	Pos.	NXi/NXj				DZi/DZj				MYi/MYj			
			Min BC		Max BC		Min BC		Max BC		Min BC		Max BC	
47	18		-0.65	3	9.66	5	1.21	4	1.62	1	0.35	4	0.54	6
48	17		-14.26	6	-2.08	4	-1.61	1	-1.07	5	0.20	5	0.47	1
48		0.211	-14.46	6	-2.24	4	-1.29	1	-0.84	5	-0.00	5	0.16	1
48		0.349	-14.59	6	-2.35	4	-1.09	1	-0.68	5	-0.10	5	-0.00	1
48		1.089	-15.29	6	-2.92	4	0.00	1	0.14	5	-0.40	1	-0.30	4
48		1.721	-15.89	6	-3.41	4	0.70	4	0.99	6	-0.11	1	-0.00	5
48		1.829	-15.99	6	-3.49	4	0.82	4	1.14	6	-0.00	1	0.10	5
48	22		-16.57	6	-3.97	4	1.50	4	1.99	1	0.71	4	1.05	6

REACTIES

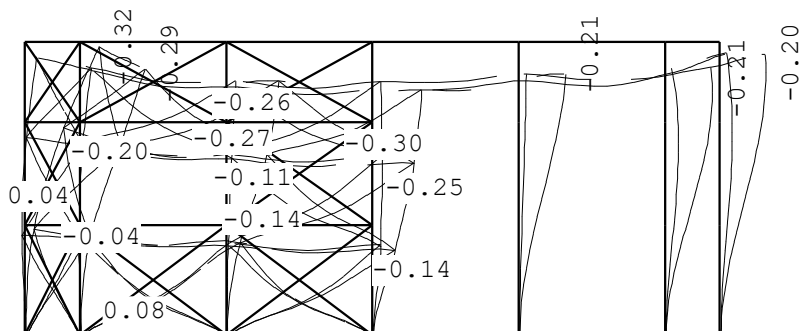
Fundamentele combinatie

Kn.	X-min	X-max	Z-min	Z-max	M-min	M-max
1	2.23	6.12	7.48	40.10	-0.79	0.47
3	-4.52	3.67	36.34	48.46	-1.08	-0.06
5	-12.39	0.28	44.87	64.90	-1.11	-0.05
7	-15.22	-6.53	47.65	82.49	-1.98	-0.27
9	-0.47	-0.05	31.40	46.77	-1.05	-0.10
11	-0.79	-0.31	25.68	38.10	-1.46	-0.45
13	-0.68	-0.28	14.53	19.37	-1.32	-0.40

OMHULLENDE VAN DE KARAKTERISTIEKE COMBINATIES**VERPLAATSINGEN**

[mm]

Karakteristieke combinatie

**OMHULLENDE VAN DE BLIJVENDE COMBINATIES****VERPLAATSINGEN**

[mm]

Blijvende combinatie

