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Bijlage 2d

Constructietekeningen
en berekeningen opstijgpunten

Constructieberekening fundaties OSP

Project:
Randstad 380kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	19-07-2013	Eerste uitgave
01	06-08-2013	Definitief. Tweede uitgave
02	04-10-2013	T.b.v. 3e uitgave
03.01	01-11-2013	T.b.v. 4e uitgave

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1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

BAM heeft op 8 juli 2013 het contract ondertekend met TenneT voor het ontwerp en realiseren van perceel 2. Het voorliggende document is onderdeel van het Definitief Ontwerp en behandelt de fundaties van de OSP. Dit betreft niet de masten welke ter plaatse van een OSP zijn gelokaliseerd. Deze zijn berekend in een afzonderlijk document evenals de funderingspalen.

1.1. GERELATEERDE DOCUMENTEN

R3N-OWN-0001 Ontwerpnota Systeem Noordring
R3N-OWR-0007 Constructieberekening mastfundaties type F
R3N-OWR-0008 Ontwerpberekening paalfundering mastfundaties
R3N-OWR-0033 Bepaling belastingen mastfundaties
R3N-OWR-0039 Bemalingsadvies beheersgebied Rijnland
R3N-OWR-0040 Bemalingsadvies beheersgebied Schieland en de Krimpenerwaard

1.2. OPENSTAANDE PUNTEN

De volgende punten dienen in een latere fase nader uitgewerkt te worden:

- Aarding
- Temperatuur invloeden op fundering
- Model verbeteren d.m.v. dummy elementen aan bovenzijde palen
- Invloed krimp op fundering
- Optimalisatie wapening
- Optimalisatie palen
- Detailontwerp prefab beton

1.3. REVISIEBEHEER

Dit is de vierde uitgave, oliedrukhuisje toegevoegd

2. UITGANGSPUNTEN EN EISEN

2.1. UITGANGSPUNTEN

Voor de OSP worden enkel de fundering van de volgende onderdelen beschouwd:

- het veldhuisje, prefab betonbak op 4 palen, alleen bij 380 kV OSP
- oliedrukhuisje, prefab betonbak op 4 palen (bij mast 109)
- fundering t.b.v. de eindsluitingen ontworpen. Hiervoor is eerst meer grondonderzoek nodig.

2.2. GEHANTEERDE NORMEN

- Eurocode serie NEN-EN-1990 tm 1997
- NEN-EN50341

2.3. GEVOLGKLASSE EN ONTWERPLEVENSDUUR

De veldfundaties vallen in gevolgklasse CC2 (voorheen veiligheidsklasse 3). De ontwerplevensduur is 50 jaar.

2.4. EISEN

De eisen zoals vermeld in ontwerpnota R3N-OWN-0001 §3 zijn gehanteerd bij het ontwerp.

2.5. VERMOEIING

De aan te leggen fundamenten worden gedimensioneerd op een vermoeiingsbelasting. De wisseling van belasting komt uit wind. Het aantal en de grote van de wisselingen gedurende 50 jaar is bepaald conform de ROK. De toetsingsprocedure van de constructie conform NEN-EN 1992-1-1:2005.

2.6. MATERIAALGEGEVENS

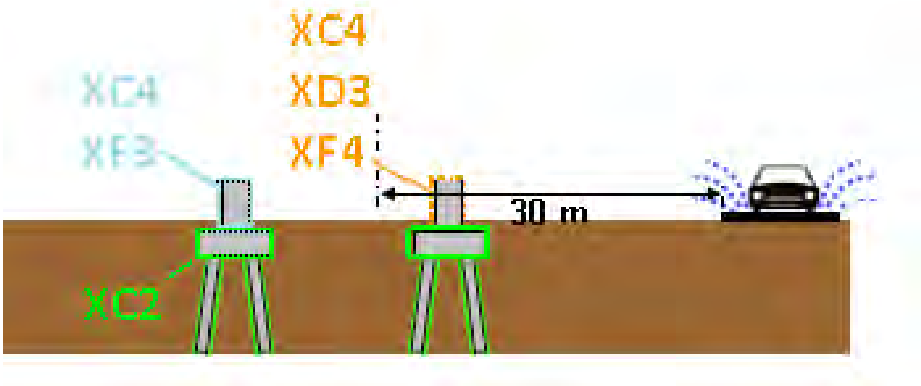
In onderstaande paragrafen worden de gehanteerde materiaaleigenschappen benoemd. Betonkwaliteiten Voor het constructief beton worden bij de detaillering de volgende sterkteklassen aangehouden. Bij gescheurd beton wordt in eerste instantie gerekend met $E_{betron;gescheurd}$ = 1/3 $E_{beton;ongescheurd}$.

Onderdeel	Sterkteklasse	Elasticiteitsmodulus [N/mm²]		
		ongescheurd	Gescheurd lage E	Gescheurd matige E
in het werk gestort gewapend beton:	C30/37	31.000	11.000	22.000
geprefabriceerd voorgespannen beton (palen):	C45/55	36.000		

Tabel 2.1-1 Betonkwaliteiten

2.6.1. MILIEUKLASSE

Voor de betondelen welke meer dan 1,0 m onder maaiveld liggen geldt milieuklasse XC2
Voor de hoger gelegen betondelen is de milieuklasse afhankelijk van de aanwezigheid van openbare wegen. De wegen naar de OSP's zullen niet gestrooid worden en bovendien nauwelijks bereden worden, waardoor het wegspatten van water met dooizouten niet aan de orde is. De afstanden in onderstaande schets geldt voor snelwegen, bij ander wegen zou deze eventueel kleiner kunnen.



2.6.2. BETONDEKKING

Betondekking conform NEN EN 1992-1-1:2011

$$c_{min} = \max \{c_{min,b}; c_{min,dur} + \Delta c_{dur,\gamma} - \Delta c_{dur,st} - \Delta c_{dur,add}; 10 \text{ mm}\} \quad (4.2)$$

waarin:

$c_{min,b}$	is de minimumdekking op basis van de aanhechtingseisen, zie 4.4.1.2 (3);
$c_{min,dur}$	is de minimumdekking op basis van de milieu-omstandigheden, zie 4.4.1.2 (5);
$\Delta c_{dur,\gamma}$	is een aanvullende veiligheidsmarge, zie 4.4.1.2 (6);
$\Delta c_{dur,st}$	is een reductie van de minimumdekking bij gebruik van roestvast staal, zie 4.4.1.2 (7);
$\Delta c_{dur,add}$	is een reductie van de minimumdekking bij gebruik van aanvullende bescherming, zie 4.4.1.2 (8).

De verwachting is dat $c_{min;b}$ maatgevend wordt. Deze waarde is afhankelijk van de staafdiameter, welke nog niet bekend is. Betondekking wordt in UO bepaald.

2.6.3. STAALKWALITEITEN

Voor het wapeningsstaal worden de volgende staalkwaliteiten aangehouden:

Omschrijving	Kwaliteit
betonstaal (staven)	B500 B

Tabel 2.6.3 Staalkwaliteiten

3. BELASTINGEN

De belastingen zijn gegeven door TenneT.

3.1. VELDHUISJE

In het veldhuisje wordt gerekend met een last van 10 kN/m^2 op de vloer. (aanname)

3.2. OLIEDRUKHUISJE

In het veldhuisje wordt gerekend met een last van 10 kN/m^2 op de vloer. (aanname)

3.3. PILONEN

Hoge piloon met afspanning 380kV en bliksemdraad

Afspanning 380kV en BL.draad

Componentbelasting

Fg = Te bepalen door leverancier

Fw = verwerkt in Fv en Fg

Bliksemdraad belasting Geleiderbelasting

Fv(bl) =	4	kN	(Uplift)
Fh(bl) =	6.5	kN	
Fd(bl) =	1.6	kN	

Geleiderbelasting

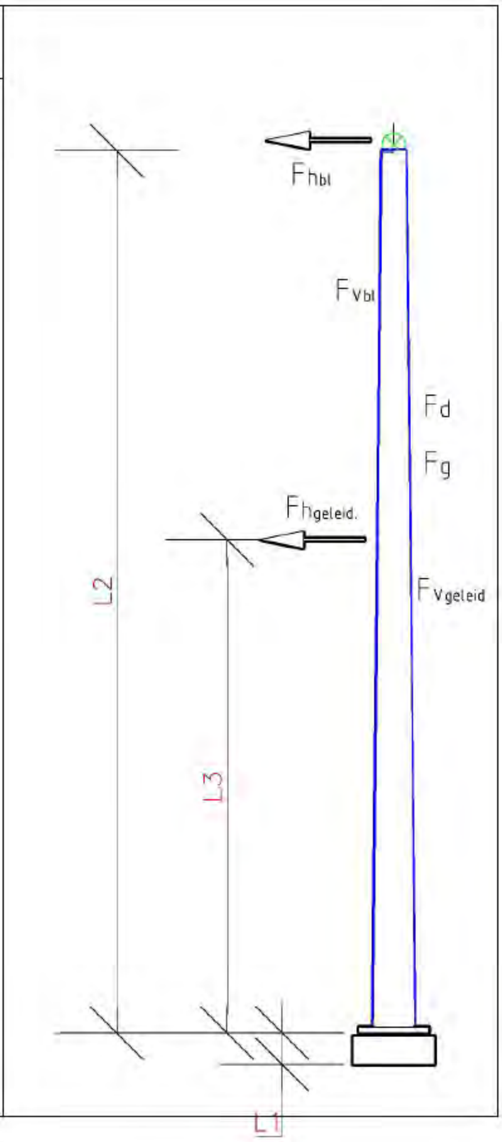
Fv(gl) =	17.4	kN	(Uplift)
Fh(gl) =	28.0	kN	
Fd(gl) =	8.5	kN	

Maatvoering

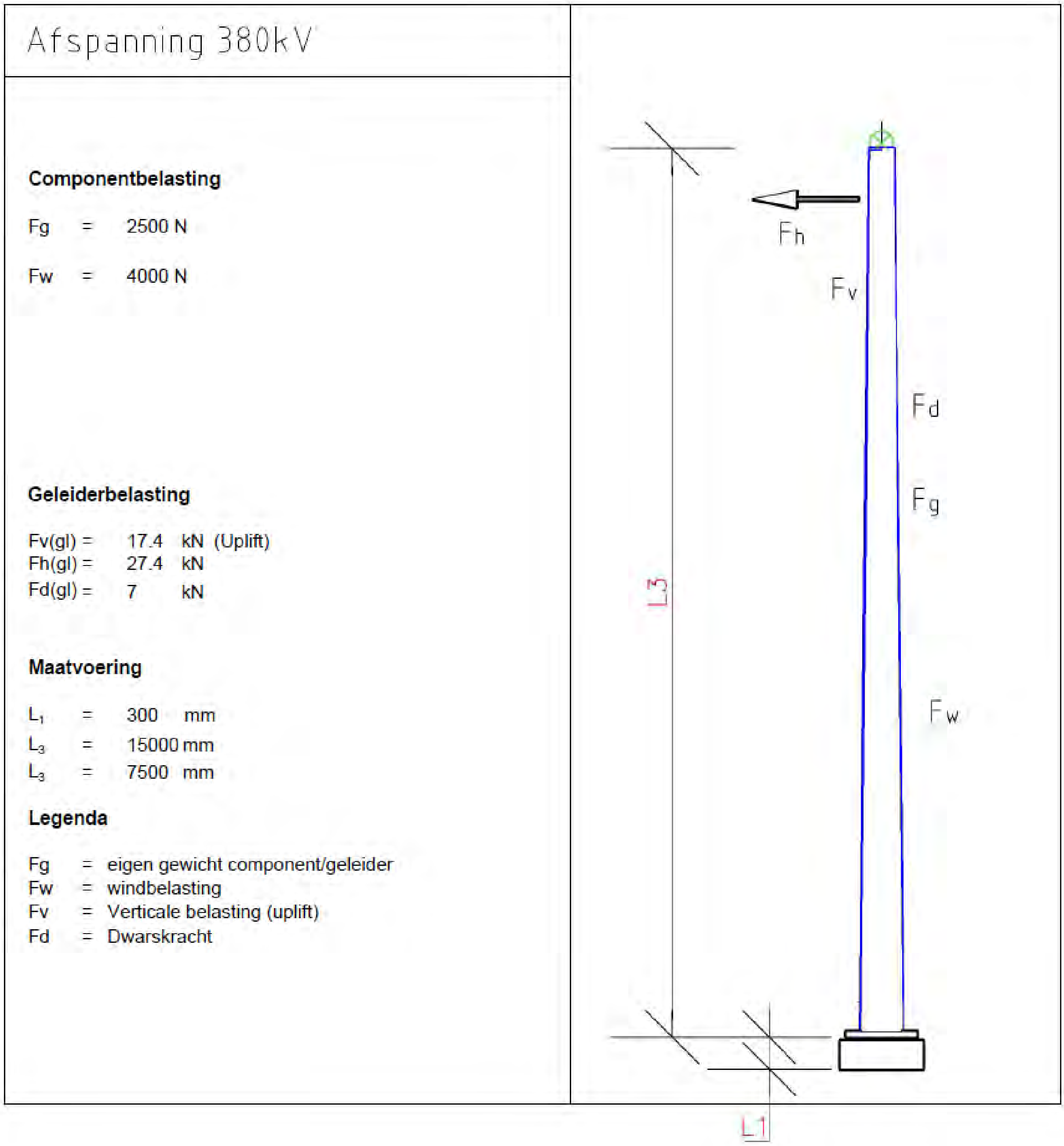
L_1	=	300	mm
L_2	=	15000	mm
L_3	=	7500	mm

Legenda

Fg = eigen gewicht component/geleider
Fw = windbelasting
Fv = Verticale belasting (uplift)
Fd = Dwarskracht



Piloon met afspanning 380 kV

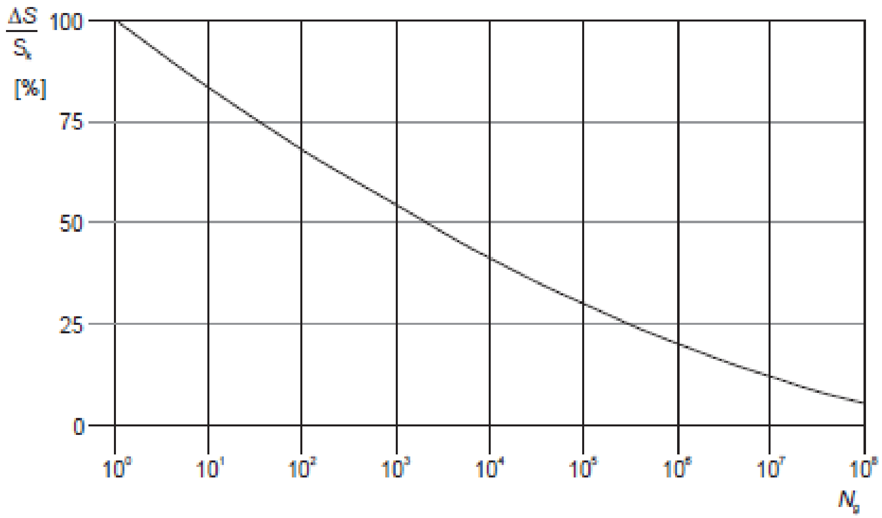


3.4. WISSELENDE BELASTINGEN EN VERMOEIING

Door de wisselende belastingen van wind dient belasting door vermoeiing te worden meegenomen. Bij vermoeiing is het aantal wisselingen en de grootte van de wisseling van belang. In de NEN-EN 1991-1-4:2005 is in bijlage B.3 een figuur opgenomen waarin de verhouding tussen de grootte van de windlast en het aantal keren dat deze optreedt weergegeven.

B.3 Aantal belastingen voor dynamische respons

(1) Figuur B.3 geeft het aantal keren N_g dat de waarden ΔS van een windeffect worden bereikt of overschreden gedurende een periode van 50 jaar. ΔS wordt uitgedrukt in percentage van de waarde S_k, waar S_k het effect is van een windbelasting met een herhalingstijd van 50 jaar.



Figuur B.3 — Aantal windvlaagbelastingen N_g voor een effect $\Delta S/S_k$ gedurende een herhalingstijd van 50 jaar

De relatie wordt omschreven met de volgende uitdrukking

$$\frac{\Delta S}{S_k} = 0{,}7 \cdot (\log(N_g))^2 - 17{,}4 \cdot \log(N_g) + 100 \qquad \text{(B.9)}$$

Bij vermoeiing wordt bij een bepaald spanningsniveau het aantal wisselingen op dit spanningsniveau bepaald en vervolgens wordt dit vergeleken met het aantal toelaatbare wisselingen op dat spanningsniveau. Door dit voor de voorkomende spanningsniveaus te doen is de weerstand tegen vermoeiing te controleren.

In de ROK van RWS is bovenstaande verdeling gediscretiseerd tot onderstaande tabel:

Tabel 5-1: Aantal wisselingen per windbelasting (referentieperiode 50 jaar)

$\Delta S / S_k$ (%)	n
100	1
98	1
90	8
75	90
61	900
48	9000
36	90000
25	900000
16	9000000
9	90000000

Van beton en wapeningsstaal is bekend hoeveel wisselingen bij een bepaald spanningsniveau toelaatbaar zijn. S_K is de spanning met een herhalingstijd van 50 jaar (de spanning waarop de constructie ontworpen is).

Met bovenstaande gegevens is te bepalen welke maximale spanning t.g.v. wind eens in de 50 jaar toelaatbaar is opdat de constructie ook voldoende weerstand tegen vermoeiing heeft.

Wapening

De totale schade van de belastingen dient volgens de beschadigingsregel van Miner kleiner dan 1 te zijn.

De toetsingsprocedure per wisseling conform NEN-EN 1992-1-1:2005, §6.8.4:
Voor de wapening is gekeken naar de toelaatbare spanning voor:

- Rechte staven
- Staven gebogen met een doordiameter 2,5*D
- Gelaste staven

Er volgt (zie berekening hieronder) dat voor gewone rechte staven er geen beperking is, echter gebogen of gelaste staven hebben de volgende spanningsbeperking

Buigdoorn 2,5ø → 244 N/mm^2
Buigdoorn 5ø → 283 N/mm^2
Gelaste staven → 317 N/mm^2

Omdat bij de toetsing van vermoeiing een ULS toestand met veiligheid 1,0 wordt getoetst, is de spanning altijd minimaal een factor van ca. 1,3 lager dan de normale ULS toestanden.

Bij een toelaatbare spanning van 435 N/mm^2 in ULS volgt bij toetsing op vermoeiing een spanning van maximaal 335 N/mm^2. De toelaatbare spanningen bij vermoeiing zijn nog iets lager. Hier dient in de detaillering rekening mee gehouden te worden. Een toetsing achteraf zal volstaan.

Rechte staven

maximale gebruiksspanning			435	
Toelaatbare spanningswisseling bij N* wisselingen			162,5	
		k1	5	
		k2	9	
		N*	1,00E+06	

aantal wisselingen [-]	ROK dS/S [-]	Wisseling spanning wapening [N/mm2]	Toelaatbaar aantal wisselingen [-]	Schade [-]
1	100	435	7275	0,000137
1	98	426	8048	0,000124
8	90	392	12320	0,000649
90	75	326	30656	0,002936
900	61	265	86133	0,010449
9000	48	209	285505	0,031523
90000	36	157	1394937	0,064519
900000	25	109	37137862	0,024234
9000000	16	70	2061565470	0,004366
90000000	9	39	365674259232	0,000246
			Totale schade	**0,139183665**

Staven gebogen met doorndiameter 2,5*D

maximale gebruiksspanning			244	
Toelaatbare spanningswisseling bij N* wisselingen			67,4	
		k1	5	
		k2	9	
		N*	1,00E+06	

aantal wisselingen [-]	ROK dS/S [-]	Wisseling spanning wapening [N/mm2]	Toelaatbaar aantal wisselingen [-]	Schade [-]
1	100	244	1613	0,000620
1	98	239	1784	0,000560
8	90	220	2731	0,002929
90	75	183	6796	0,013243
900	61	149	19095	0,047134
9000	48	117	63292	0,142197
90000	36	88	266714	0,337440
900000	25	61	2466861	0,364836
9000000	16	39	136938283	0,065723
90000000	9	22	24289699180	0,003705
			Totale schade	**0,978388484**

Staven gebogen met doorndiameter 5*D

maximale gebruiksspanning			283	
Toelaatbare spanningswisseling bij N* wisselingen			78,0	
		k1	5	
		k2	9	
		N*	1,00E+06	

aantal wisselingen [-]	ROK dS/S [-]	Wisseling spanning wapening [N/mm2]	Toelaatbaar aantal wisselingen [-]	Schade [-]
1	100	283	1591	0,000629
1	98	277	1760	0,000568
8	90	255	2694	0,002970
90	75	212	6702	0,013428
900	61	173	18832	0,047792
9000	48	136	62422	0,144181
90000	36	102	263044	0,342148
900000	25	71	2406099	0,374050
9000000	16	45	133565305	0,067383
90000000	9	25	23691410595	0,003799
			Totale schade	**0,996946687**

Gelaste staven

maximale gebruiksspanning			317	
Toelaatbare spanningswisseling bij N* wisselingen			58,5	
		k1	3	
		k2	5	
		N*	1,00E+07	

aantal wisselingen [-]	ROK dS/S [-]	Wisseling spanning wapening [N/mm2]	Toelaatbaar aantal wisselingen [-]	Schade [-]
1	100	317	62848	0,000016
1	98	311	66775	0,000015
8	90	285	86211	0,000093
90	75	238	148972	0,000604
900	61	193	276886	0,003250
9000	48	152	568285	0,015837
90000	36	114	1347046	0,066813
900000	25	79	4022257	0,223755
9000000	16	51	20411885	0,440920
90000000	9	29	362468668	0,248297
			Totale schade	**0,999600179**

4. BELASTINGCOMBINATIES

Belastingcombinaties conform NENEN 50341-3-15 paragraph 4.2, table 4.2.11/NL.1, 4.2.11/NL.3 en 4.2.11/NL.4

Table 4.2.11/NL.1 - Partial factor and combination factor (ultimate limit state)

Load case and temperature	Value for γ_G, γ_Q, χ_Q and γ_A for the ultimate limit state				
	γ_G 1)	γ_Q or χ_Q 3)			γ_A
Loads	G_K	Q_{PK}	Q_{WK}	Q_{iK}	A_k
1a Wind, 10° C	1,2	-	1,5	-	-
1b Wind, - 20 °C	1,2	-	0,3	-	-
2 Not relevant	-	-	-	-	-
3 Wind+ice, - 5 °C	1,2		0,45	1,5	
4 Construction/maintenance + 5 °C	1,2	1,5	0,3	-	
5a Torsional, + 10 °C	1,0	1,0 2)	-	-	1,0
5b Not relevant	-	-	-	-	-
6 Permanent, + 10 °C	1,35	-	-	-	-
7 Special, + 10 °C	1,0	-	-	-	1,0

1) If permanent loads have a positive effect on the structural forces e.g. uplift forces on foundation γ_G = 0,9.
2) Only the load at the end of the crossarm, see 4.2.6.
3) $\chi_Q = \chi_0 - \gamma_Q$, with reference to ENV 1991-1 "Basis of Design".

Table 4.2.11/NL.3 - Partial factor and combination factor (special limit state)

Load case and temperature	Value for γ_G, γ_Q, χ_Q and γ_A for the ultimate limit state during specific circumstances				
	γ_G [1)]	γ_Q or χ_Q [4) ,5)]			γ_A
Loads	G_K	Q_{PK}	Q_{WK}	Q_{iK}	A_K
1a Wind, 10° C 1b Wind, - 20° C	1,2 1,2	- -	0,78 0,24	- -	- -
3 Wind+ice - 5° C	1,2	-	0,36	0,34 0,12	-
4 Construction/maintenanc e + 5° C	1,2	1,2	0,24	-	-

1) If permanent loads have a positive effect on the structural forces e.g. uplift forces on foundation γ_G = 0,9.
2) For ice region B.
3) For ice region C.
4) $\chi_Q = \chi_O \gamma_Q$, with reference to ENV 1991-1 “Basis of Design”.
5) γ_Q = 1,2, based on the assumption that the specific circumstances exist during a period of maximum 1 year.

Table 4.2.11/NL.4 - Partial factor and combination factor (serviceability limit state)

Load case and temperature	Value for γ_G, γ_Q, χ_Q and γ_A for the serviceability limit state				
	γ_G	γ_Q or χ_Q			γ_A
Loads	G_K	Q_{PK}	Q_{WK}	Q_{iK}	A_K
1a Wind, 10° C 1b Wind, - 20° C	1,0 1,0	- -	1,0 0,2	- -	- -
3 Wind+ice - 5° C	1,0	-	0,3	1,0	-
4 Construction/maintenanc e + 5° C	1,0	1,0	0,2	-	-

De gegeven last uit de lijnen zijn niet nader gespecificeerd. De volgende combinaties worden gebruikt voor de fundaties van de pilonen. Voor de oliedruk en veldhuisjes worden de combinaties uit de eurocode gevolgd, behorende bij CC2.

		Permanente last	Var last uit lijn	Windbelasting	
1. Fund..Comb.	ULS	1,35			
2. Fund. Comb.	ULS	1,2	1,5	0,45	
3. Karakteristiek	SLS	1,0	1,0	0,3	
4. Frequent	SLS	1,0	1,0	0,3	

5. BEREKENING FUNDATIES

5.1. FUNDATIE VELDHUISJE

De veldhuisjes bestaan uit een prefab betonconstructie welke op 4 poeren wordt geplaatst.
De prefab word door de leverancier berekend.

Paalbelasting:

Eigen gewicht huisje		
Vloer, d=180 mm, 0,18 * 5 * 3 * 24 =	64,8 kN	
Wanden d=110+70 mm, 2 * (5 + 3) * 3 * 0,18 * 24 =	207,4 kN	
dak, d=160 mm, 0,16 * 5 * 3 * 24 =	57,6 kN	
Variabele belasting op vloer 10 kN/m^2, 5*3*10=		150 kN
Windbelasting 1,0 kN/m^2 , 5*3*1*(3/2) / 2,4 =		10 kN (trek/druk)

Totale paalbelasting (1,2 * 330 + 1,5 * 150) / 4 + 1,5 * 0,2 * 10 / 2 = 160 kN / paal

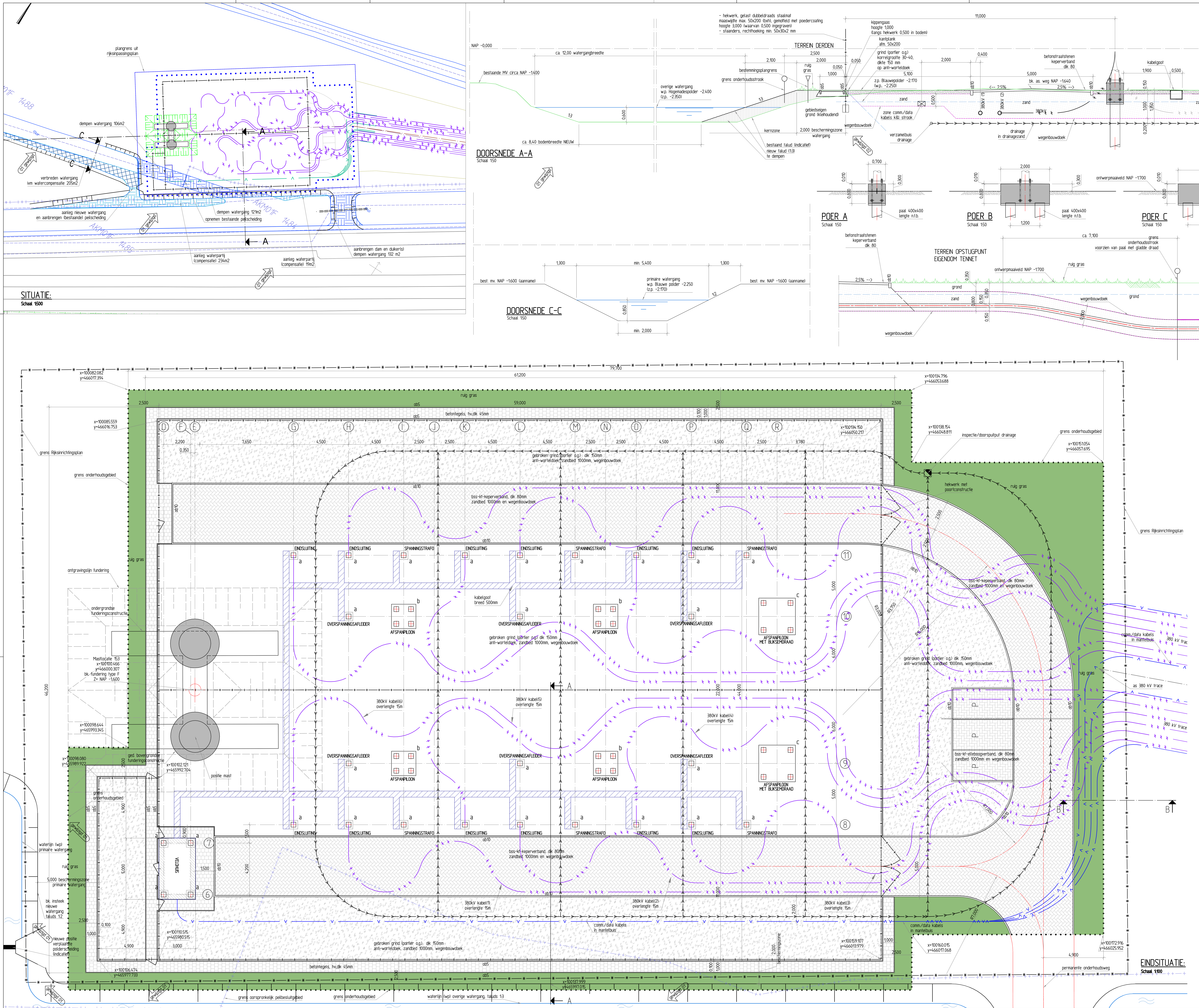
5.2. FUNDATIE OLIEDRUKHUISJE

De oliedrukhuisjes bestaan uit een prefab betonconstructie welke op 4 poeren wordt geplaatst.
De prefab word door de leverancier berekend.

Paalbelasting:

Eigen gewicht huisje		
Vloer, d=180 mm, 0,18 * 6 * 7 * 24 =	181,5 kN	
Wanden d=110+70 mm, 2 * (6 + 7) * 3 * 0,18 * 24 =	337,0 kN	
dak, d=160 mm, 0,16 * 6 * 7 * 24 =	161,3 kN	
Variabele belasting op vloer 10 kN/m^2, 6*7*10=		420 kN
Windbelasting 1,0 kN/m^2 , 7*3*1*(3/2) / 5,5 =		5,7 kN (trek/druk)
Wind verwaarloosbaar		

Totale paalbelasting (1,2 * 680 + 1,5 * 420) / 4 =370 kN / paal



VERKLARING - ALGEMEEN

- Bestaande topografie
- As stramienlijnen palenplan
- Waterlijn
- As toegangsweg
- Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bls_Zuid_Ringvaart_1305.DWG (Tennet) (MKP00C 565)
- Plangrens uit rijksinpassingsplan
- Peilbesluitgrens Hoogheemraadschap Rijnland

VERKLARING - LEIDINGWERK:

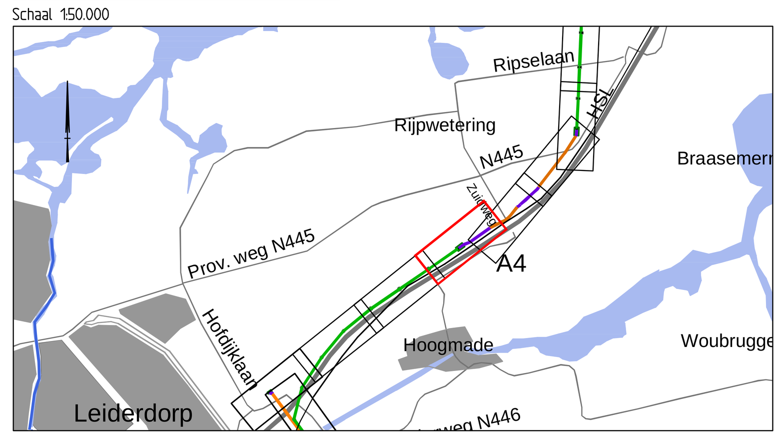
- Aanbrengen kabel 380 kV
- Aanbrengen drainage
- Aanbrengen mantelbuis tbv. glasvezel data/signaalkabel
- Aanbrengen afvoerbuis drainage naar open water
- Aanbrengen kabelgoot

VERKLARING - CIVIEL:

- Aanbrengen hekwerk, gelast dubbeldraads staalmat
- Toekomstige grens onderhoudsgebied
- Aanbrengen grind (porfier o.g.) korrelgrootte 30-40, dikte 150 mm op anti-worteldoek en zandbed
- Aanbrengen betonstraatstenen, keperverband, keiformaat dik 80, op zandbed en doek
- Aanbrengen betontegels 300x300mm, dik 45 mm op zandbed en doek
- Aanbrengen groenstrook met ruig gras
- Aanbrengen zandbed

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000



OPMERKINGEN:

- Maten in meters tenzij anders aangegeven.
- Hoogtematen in meters ten opzichte van N.A.P.

Wijzigingen rev. 05
- watertaluds, waterlijn en vlakken oppervlaktewater aangepast;
- onderhoudsgrens aangepast
- doorsnede A-A aangepast en doorsnede C-C toegevoegd

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bam COFELY FABRICOM GDF SUEZ
Randstad 380kV Noordring

		Controleur	Vrijgegeven door
		P. de Jager	E. Duwel
05	watergangen aangepast	31-07-2014	R.G.J. Caspers
04	Zie wijzigingspijlen en opm.	04-04-2014	R.G.J. Caspers
03	Zie opmerkingen	01-11-2013	W. Vissers
Rev.	Wijziging	Datum	Naam

Omschrijving: Definitief Ontwerp Opstijgpunten Inrichting OSP 5 bij mast 153

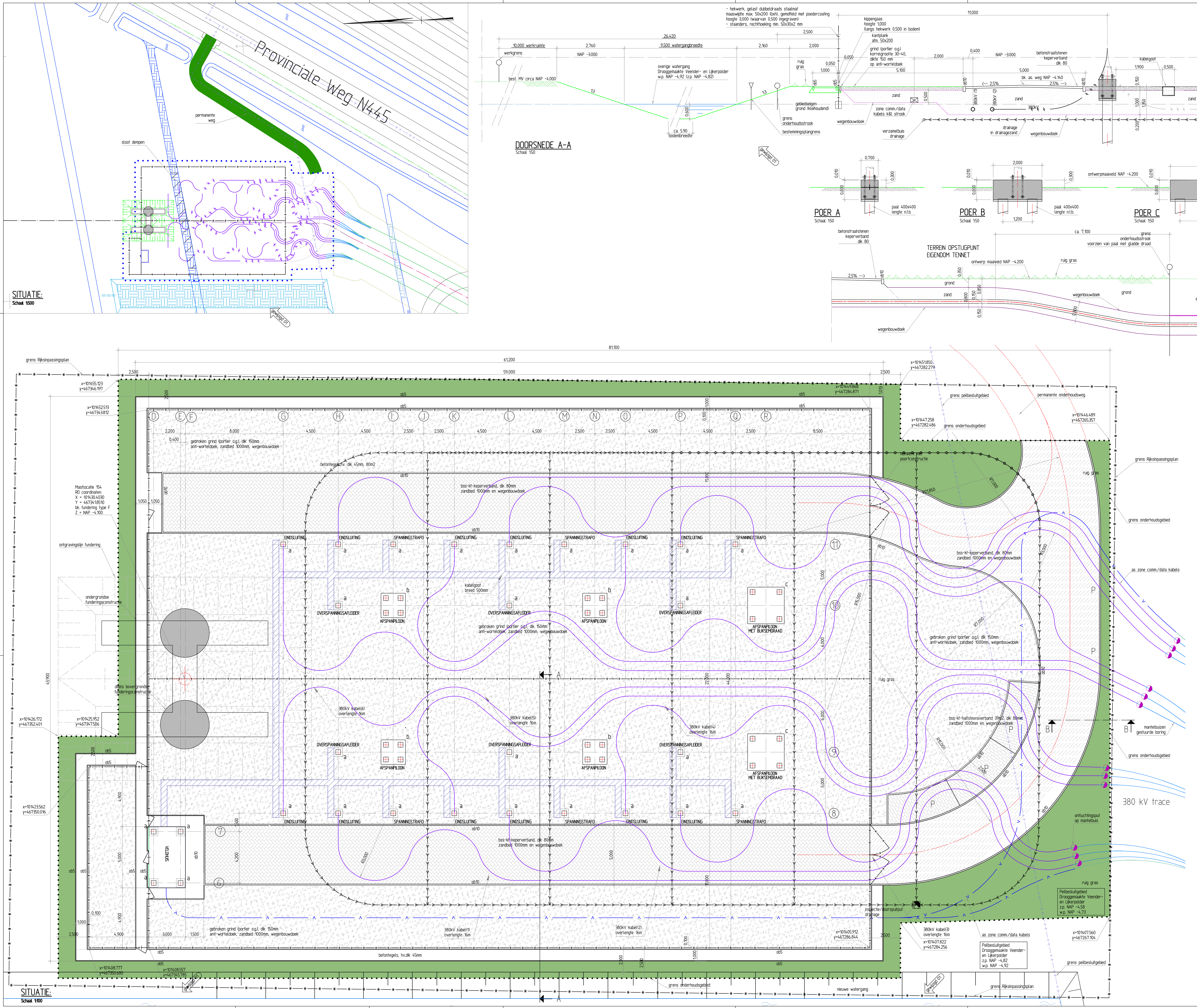
Projekt: Randstad 380kV Noordring

Schaal: 1:50 / 1:100 / 1:500 — Formaat: A0
Naam: R.G.J. Caspers — Datum: 19-07-2013

TenneT Taking power further

Tekeningnummer: R3N-TEK-0040 blad 001

AutoCAD filename::
Systnr:



VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- MKP00C 565 — Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bls_Zuid_Ringvaart_1305.DWG (Tennet)
- Plangrens uit rijksinpassingsplan
- As stramienlijnen palenplan
- As toegangsweg
- Peilbesluitgrens Hoogheemraadschap Rijnland

VERKLARING - LEIDINGWERK:

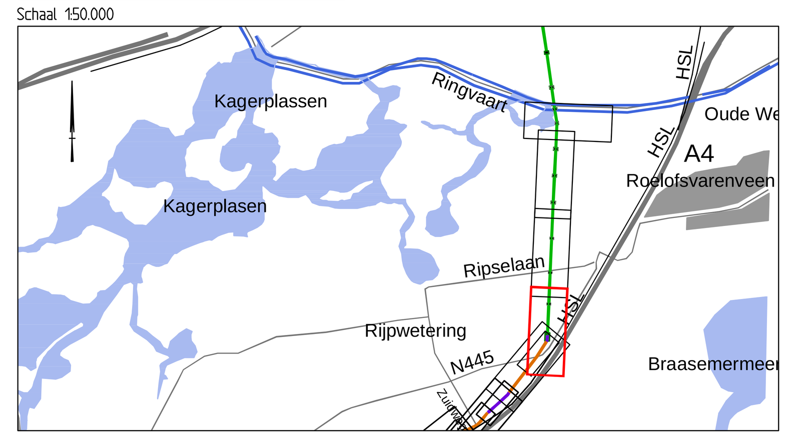
- Aanbrengen kabel 380 kV
- Aanbrengen mantelbuis tbv. glasvezel data/signaalkabel
- Aanbrengen ontluchtingsput op mantelbuis
- Aanbrengen kabelgoot
- Aanbrengen drainage

VERKLARING - CIVIEL:

- Aanbrengen hekwerk, gelast dubbeldraads staalmat
- Toekomstige grens onderhoudsgebied
- Aanbrengen grind (porfier o.g.) korrelgrootte 30-40, dikte 150 mm op anti-worteldoek en zandbed
- Aanbrengen betonstraatstenen, keperverband, keiformaat dik 80, op zandbed en doek
- Aanbrengen betontegels 300x300mm, dik 45 mm op zandbed en doek
- Aanbrengen groenstrook met ruig gras
- Aanbrengen zandbed

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000



OPMERKINGEN:

- Maten in meters tenzij anders aangegeven.
- Hoogtematen in meters ten opzichte van N.A.P.

Wijzigingen rev. 05:
- Positie watertaluds, waterlijn aangepast
- doorsnede A-A aangepast
- grens onderhoudsgebied aangepast

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Randstad 380kV Noordring

Controleur: P. de Jager
Vrijgegeven door: E. Duwel

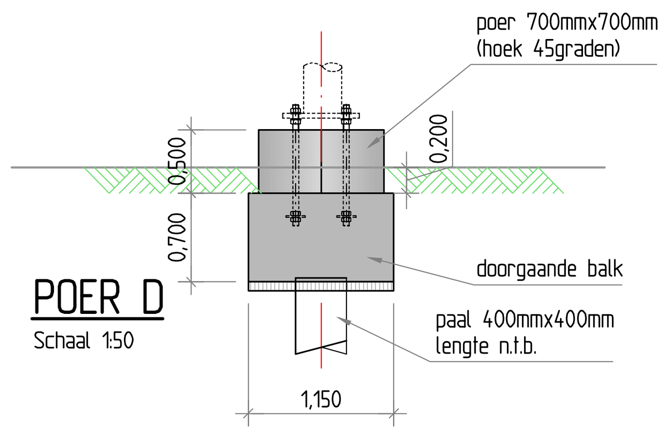
Omschrijving: Definitief Ontwerp Opstijgpunten Inrichting OSP 4 bij mast 154

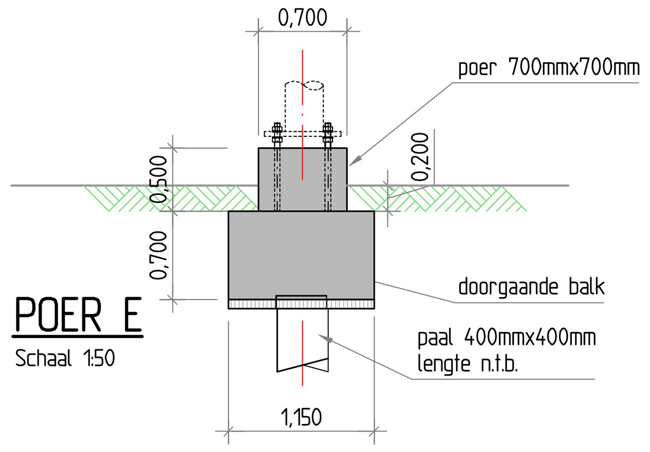
Rev.	Wijziging	Datum	Naam
05	Watergang aangepast	31-07-2014	R.G.J. Caspers
04	Zie wijzigingspijlen en opm.	04-04-2014	R.G.J. Caspers
03	Zie opmerkingen	01-11-2013	W. Vissers

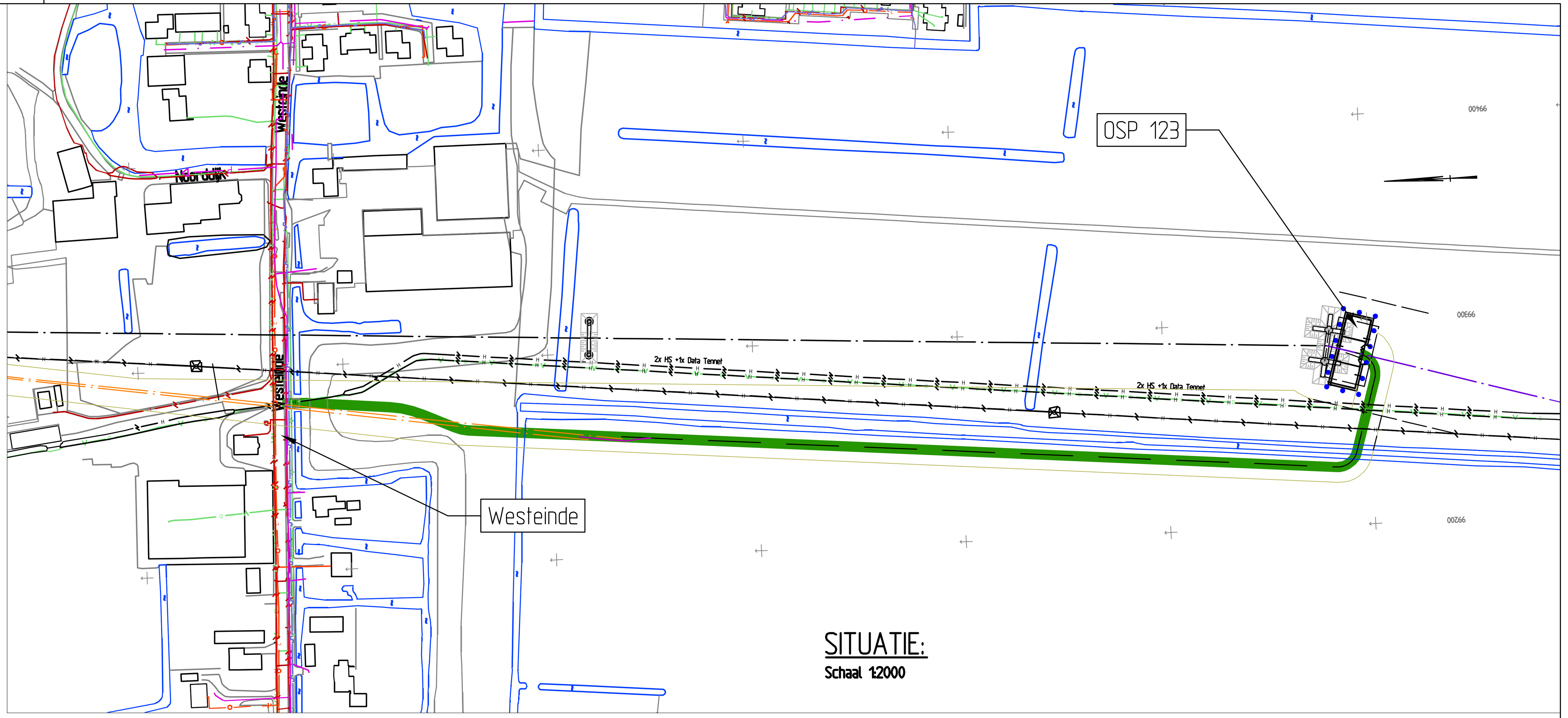
Schaal: 1:50 / 1:100 / 1:500
Formaat: A0
Projekt: Randstad 380kV Noordring
Naam: R.G.J. Caspers
Datum: 29-07-2013

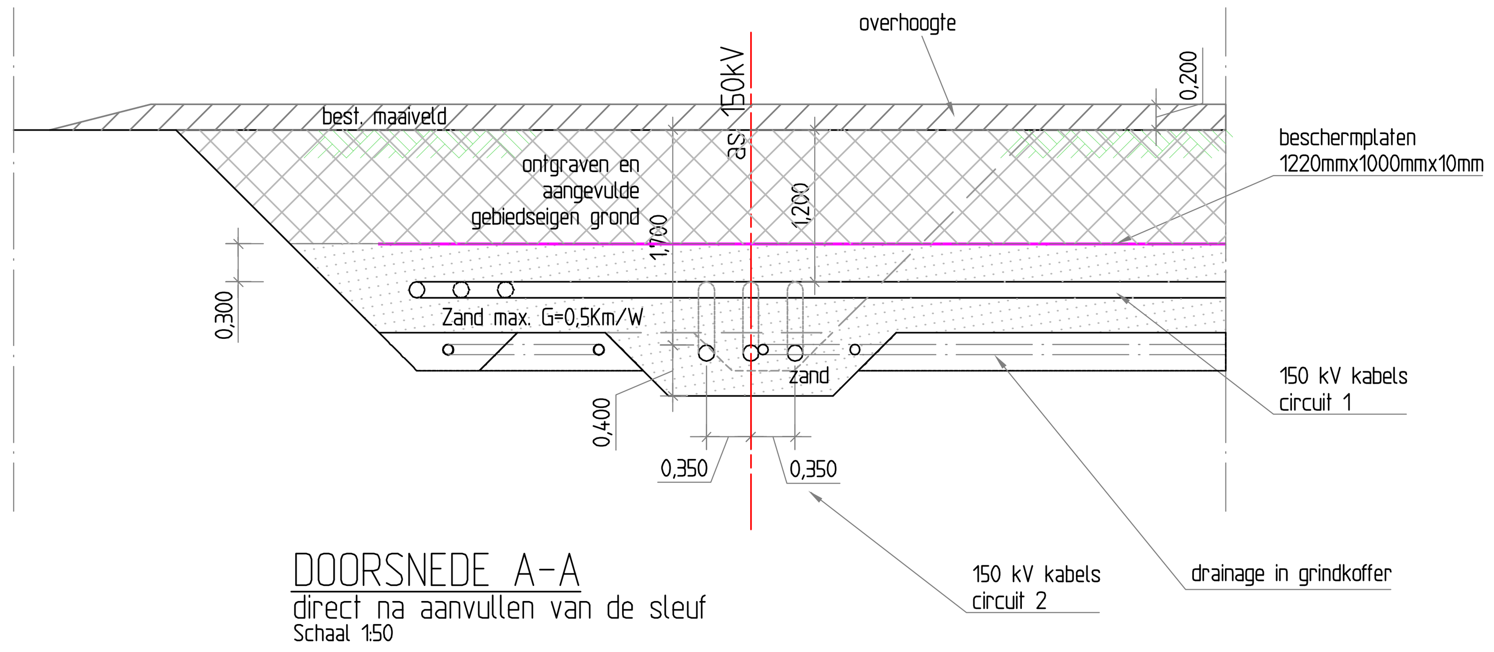
TenneT Taking power further

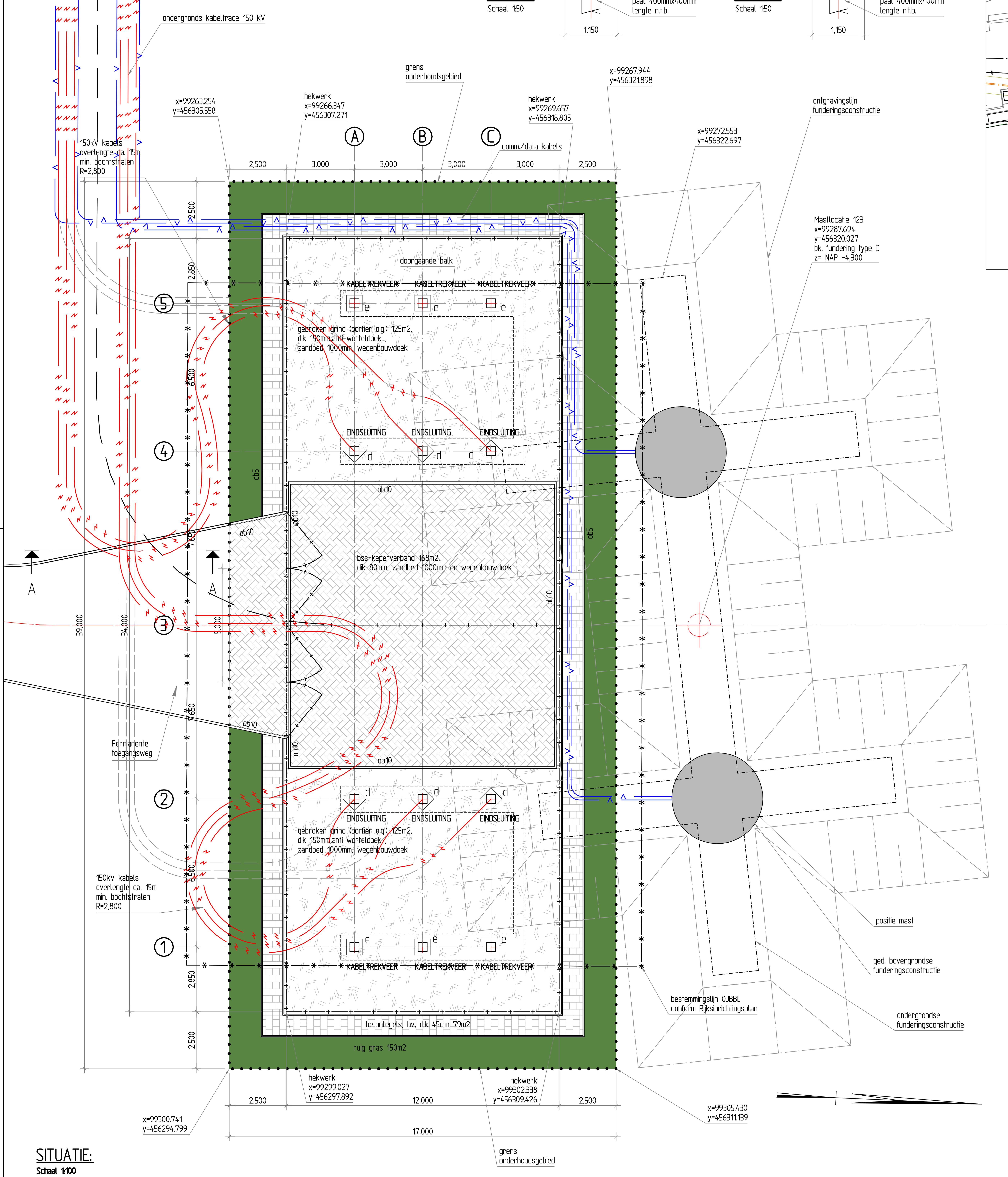
Tekeningnummer: R3N-TEK-0039 blad 001
AutoCAD filename::
Systnr:











VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bls_Zuid_Ringvaart_130SDWG (Tennet) (MKP00C 565)
- Plangrens OSP uit rijksinpassingsplan
- As stramienlijnen palenplan
- As toegangsweg
- Toekomstige grens onderhoudsgebied

VERKLARING - LEIDINGWERK:

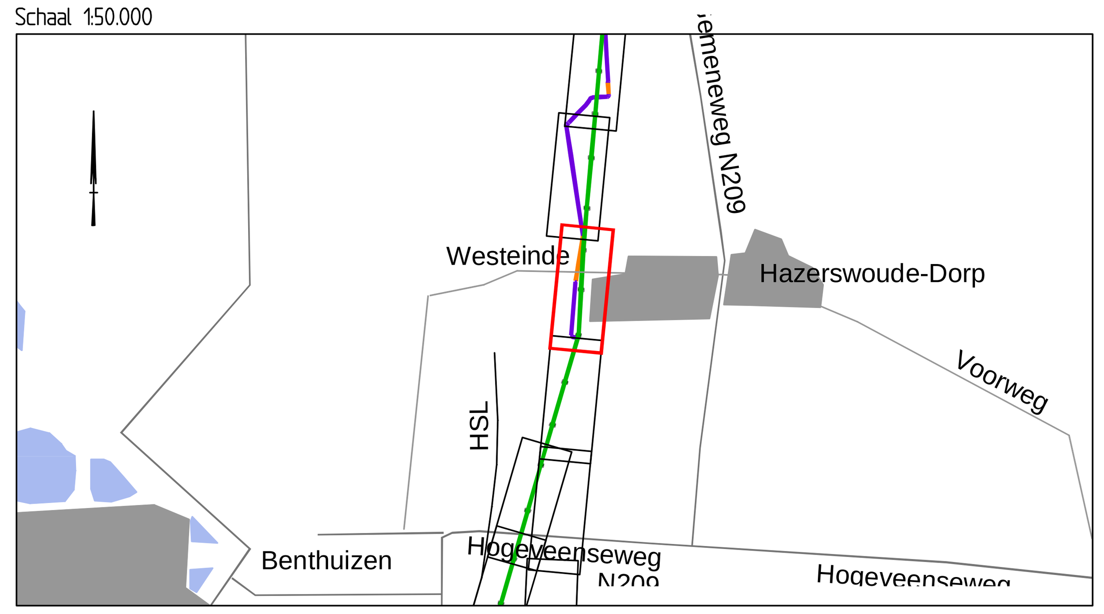
- Aanbrengen kabel 150 kV, incl. overlengte
- Aanbrengen mantelbuis tbv. glasvezel data/signaalkabel
- Schematische ligging kabel 150 kV zonder overlengte

VERKLARING - CIVIEL:

- Aanbrengen hekwerk, gelast dubbeldraads staalmat
- Aanbrengen grind (porfier o.g.) korrelgrootte 30-40, dikte 150 mm op anti-worteldoek en zandbed
- Aanbrengen betonstraatstenen, keperverband, keiformaat dik 80, op zandbed en doek
- Aanbrengen betontegels 300x300mm, dik 45 mm op zandbed en doek
- Aanbrengen groenstrook met ruig gras
- Aanbrengen zandbed

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000



OPMERKINGEN:

wijzigingen rev 03:

- Minimale buigstralen van de 150 kV kabels zijn aangepast naar 2,80 m.
- Bestemmingsplangrens OJBBL, conform Rijksinpassingsplan is weergegeven.
- Ligging secundaire kabels aangepast.
- Hoogteligging bk. mastfundatie mast 123

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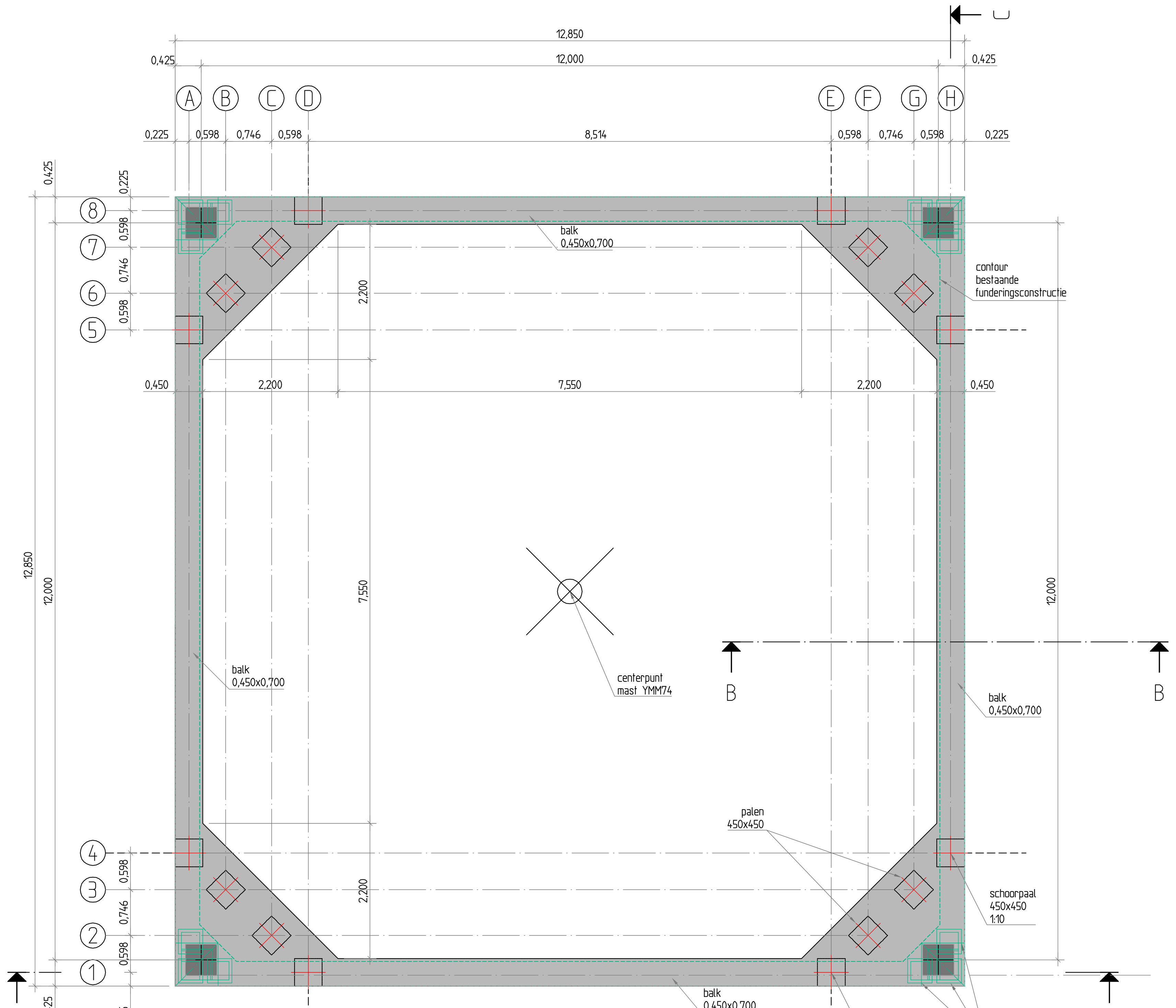
Randstad 380kV Noordrring

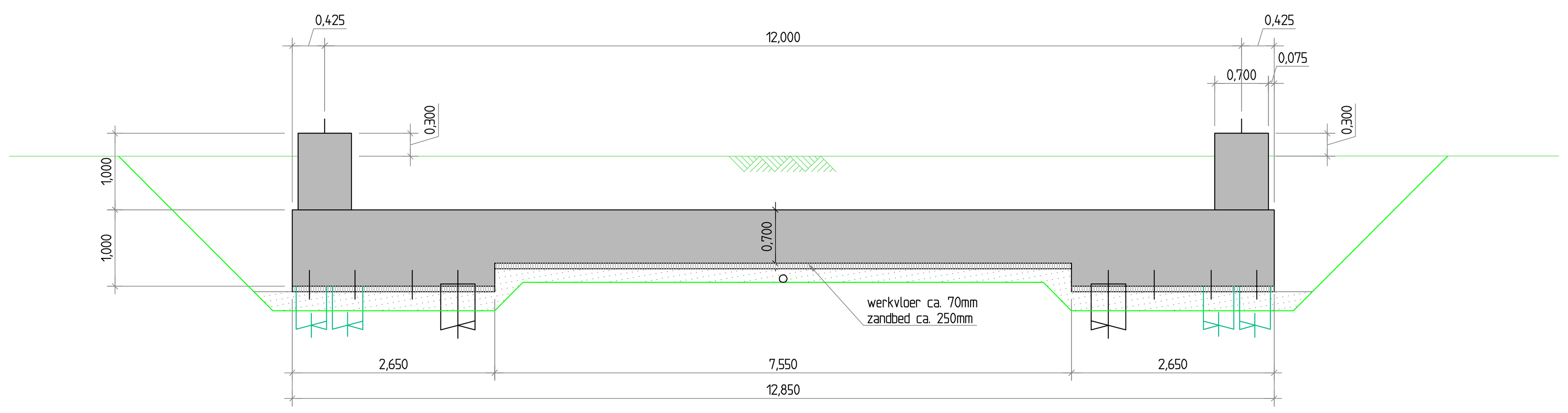
Rev.	Wijziging	Datum	Naam
03	kabels en best.plangrens	31-01-2014	RGJ Caspers
02	zie opmerkingen	04-10-2013	RGJ Caspers
01	diverse	06-08-2013	RGJ Caspers

Controleur	P. de Jager
Vrijgegeven door	E.Duwel
Omschrijving	Ondergrondse infra Opstijgpunten Inrichting OSP bij mast 123
Schaal	1:50/1:100/1:500
Formaat	A1
Naam	R.G.J. Caspers
Datum	19-07-2013
Projekt	Randstad 380kV Noordring
Tekeningnummer	R3N-TEK-0041 blad 001
AutoCAD filename	
Systnr.	

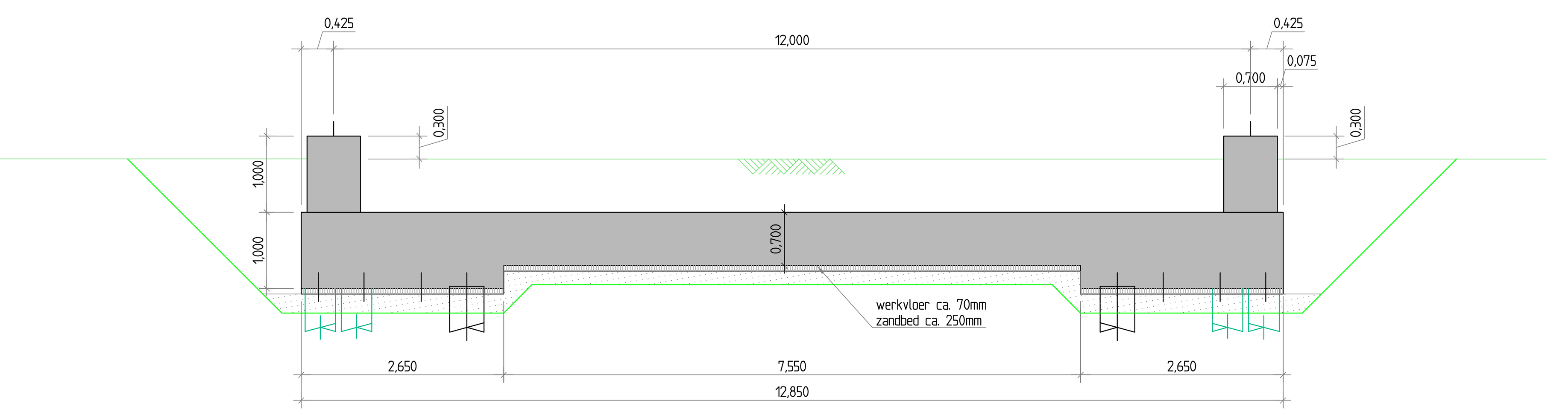
TenneT Taking power further



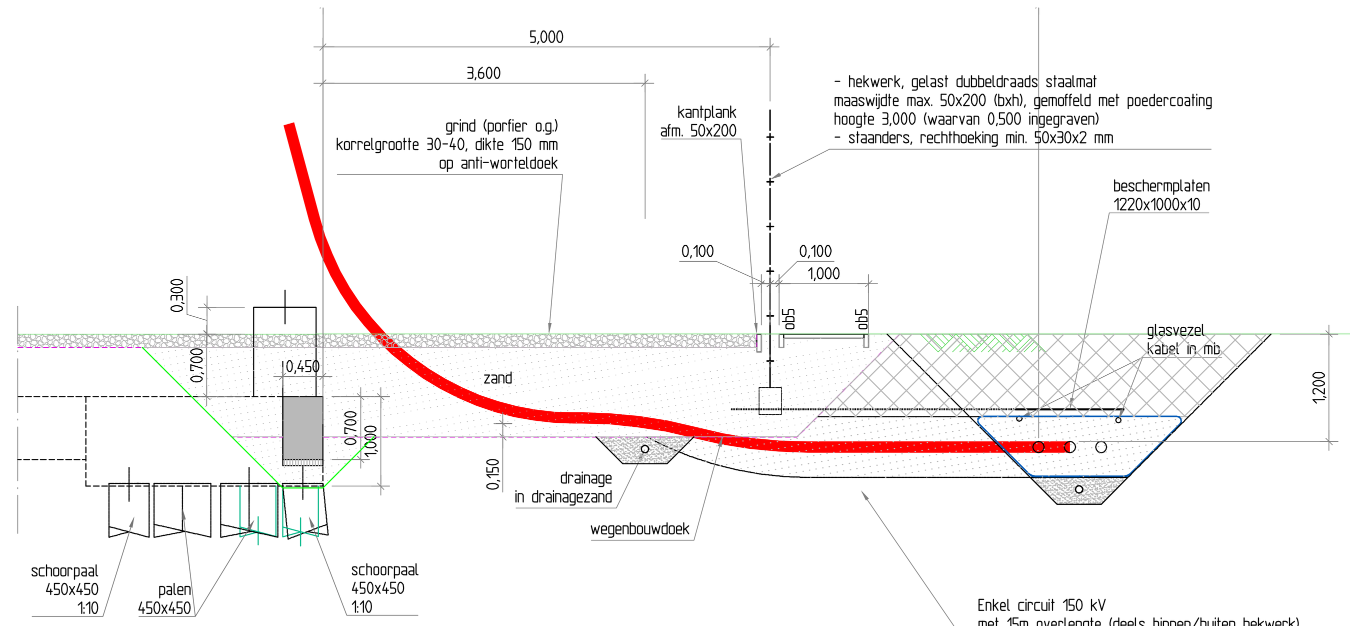
BOVENAANZICHT
Schaal 1:50



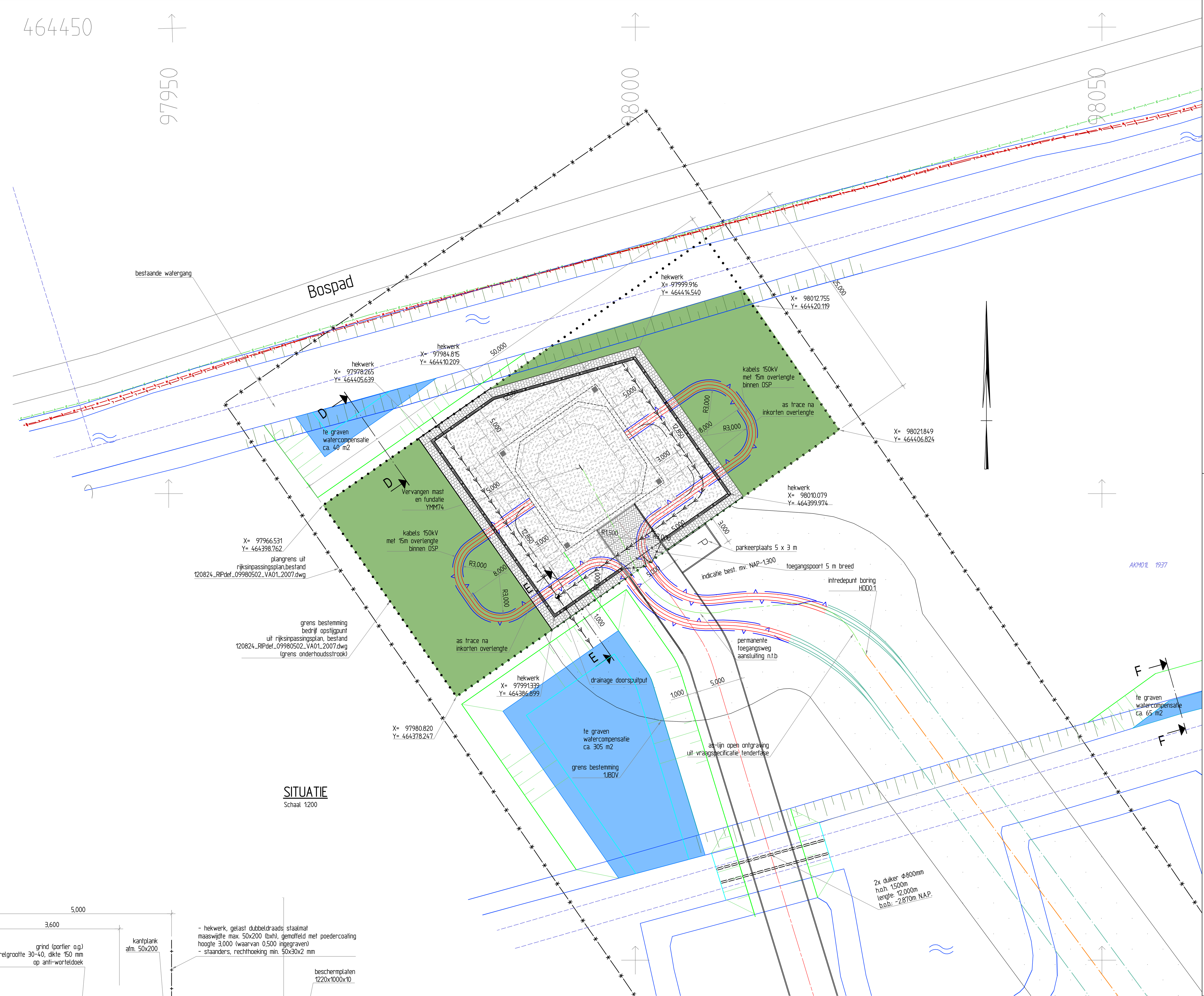
DOORSNEDE A-A
Schaal 1:50



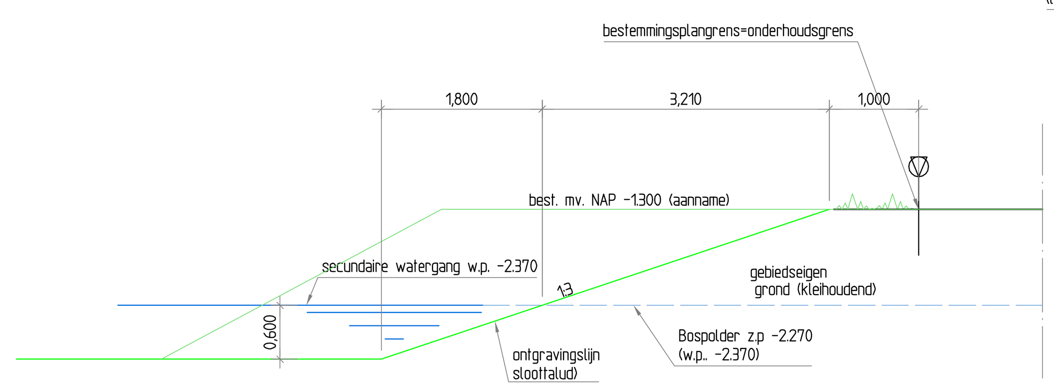
DOORSNEDE C-C
Schaal 1:50



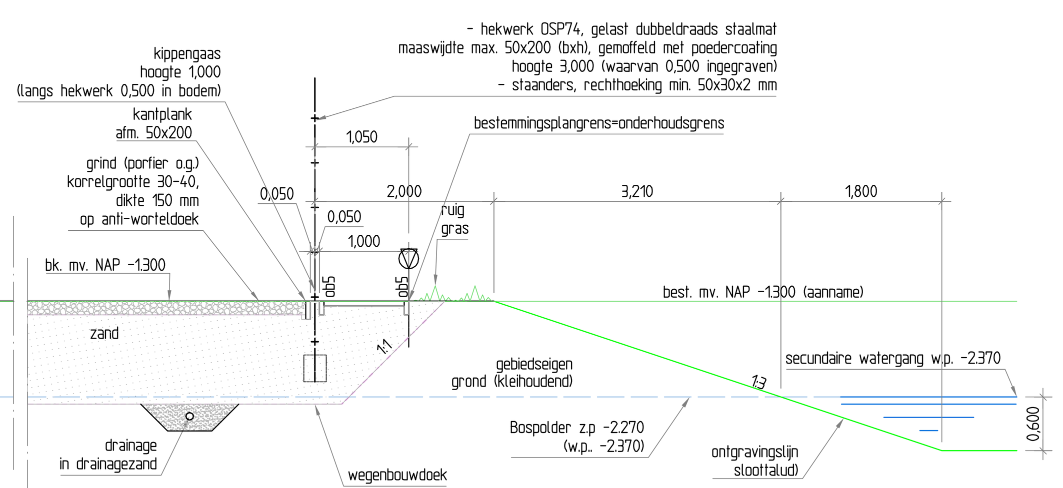
DOORSNEDE B-B
Schaal 1:50



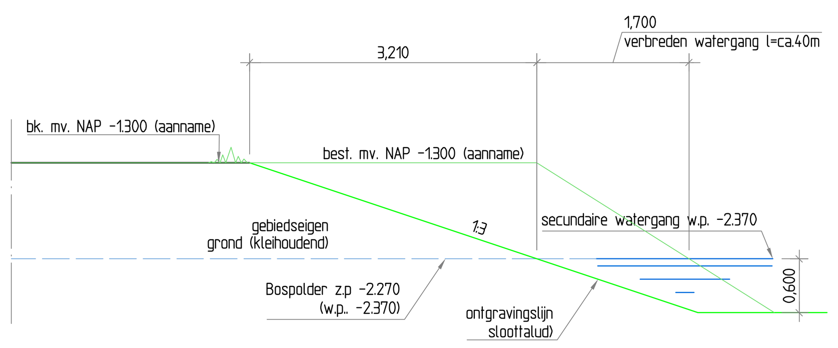
SITUATIE
Schaal 1:200



DOORSNEDE D-D
Schaal 1:50



DOORSNEDE E-E
Schaal 1:50



DOORSNEDE F-F
Schaal 1:50

VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- MKP00C 565 — Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bls_Zuid_Ringvaart_1305.DWG (Tennet)
- Plangrens uit rijksinpassingsplan

VERKLARING - LEIDINGWERK:

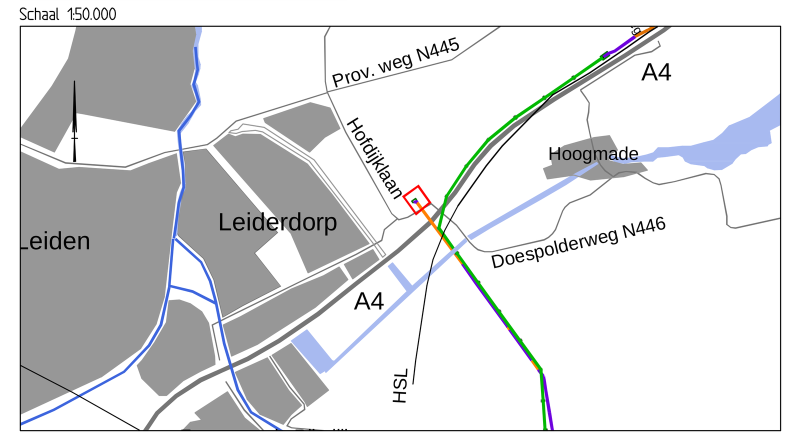
- Aanbrengen kabel 150 kV
- Aanbrengen mantelbuis tbv. glasvezel data/signaalkabel
- Te verwijderen bovengrondse trace 150 kV
- Aanbrengen gestuurde boring 150 kV

VERKLARING - KLIC

GASLEIDING	DRAINAGE PUT
GAS — GASLEIDING GASUNIE	PERSLEIDING RIOOLPUT
GASLEIDING HD	PERSLEIDING POMPPUT
GASLEIDING LD	GEMAAL
WATERLEIDING	MANTELBUIS
WARMTENET	GLASVEZEL
KOUDENET	CAI
CHEMIE	DATA
BRANDSTOF TRANSPORTLEIDING	HOOGSPANNING
RIOLERING TRANSPORTLEIDING	MIDDENSPANNING
HEMELWATER TRANSPORTLEIDING	LAAGSPANNING
VUILWATER TRANSPORTLEIDING	VRI (VERKEERSREGELINSTALLATIE)
DRAINAGE	OV (OPENBARE VERLICHTING)
PERSLEIDING	PRORAIL OVERIG
VACUUMLEIDING	KABELKOKER
DUIKER	KABELTRACÉ VERVALLEN
STRAATKOLK	GESTUURDE BORING DERDEN
TROTTOIRKOLK	ZINKER
HWA PUT	1234 — GEULNUMMER
HWA POMPPUT	TERREINKAST
VWA PUT	TRANSFORMATORSTATION
VWA POMPPUT	LICHTMAST

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000



OPMERKINGEN:

Positie bestaande funderingsconstructie in het werk vast te stellen.

Toe te passen palen: beton 450mm x 450mm, lengte n.t.b.

Toe te passen betonwerk;
- Betonkwaliteit C35/45, milieuklasse XC2
- Wapeningsstaal kwaliteit B500B

Wijzigingen versie 03
Watergangen aangepast, ligging permanente toegangsweg gewijzigd, doorsneden toegevoegd

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Randstad 380kV Noordring

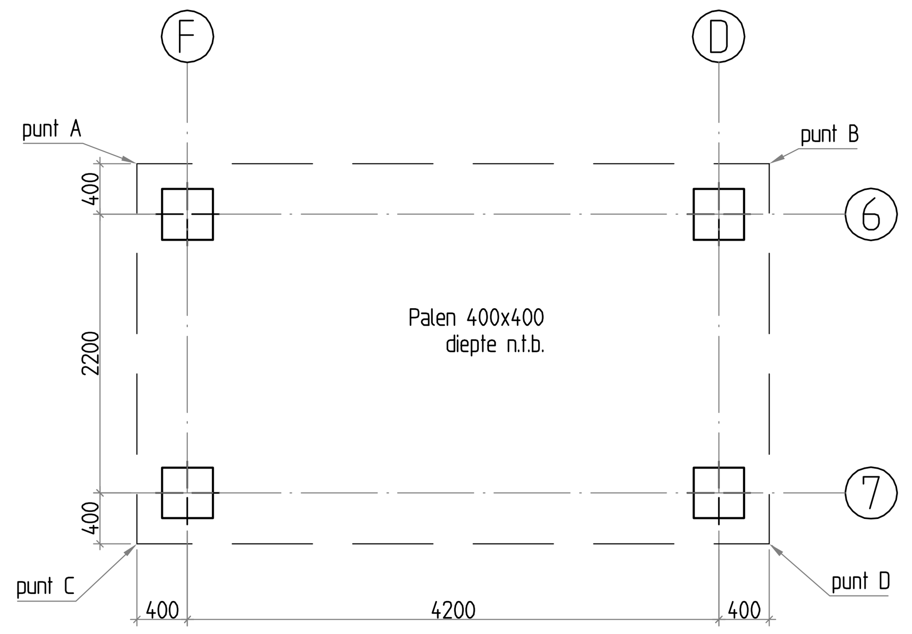
			P. de Jager Controleur	E. Duwel Vrijgegeven door
Omschrijving: Definitief Ontwerp Opstijgpunten Inrichting OSP bij mast YMM74	03	Watergangen+ doorsneden	30-07-2014	R.G.J. Caspers
	02	watercompensatie, drainage	13-11-2013	R.G.J. Caspers
	01	zie opmerkingen	04-10-2013	RGJ Caspers
	Rev.	Wijziging	Datum	Naam
Projekt: Randstad 380kV Noordring	Schaal:	1:50 / 1:200	Formaat: A0	
	Naam:	R.G.J. Caspers	Datum: 06-08-2013	

TenneT Taking power further

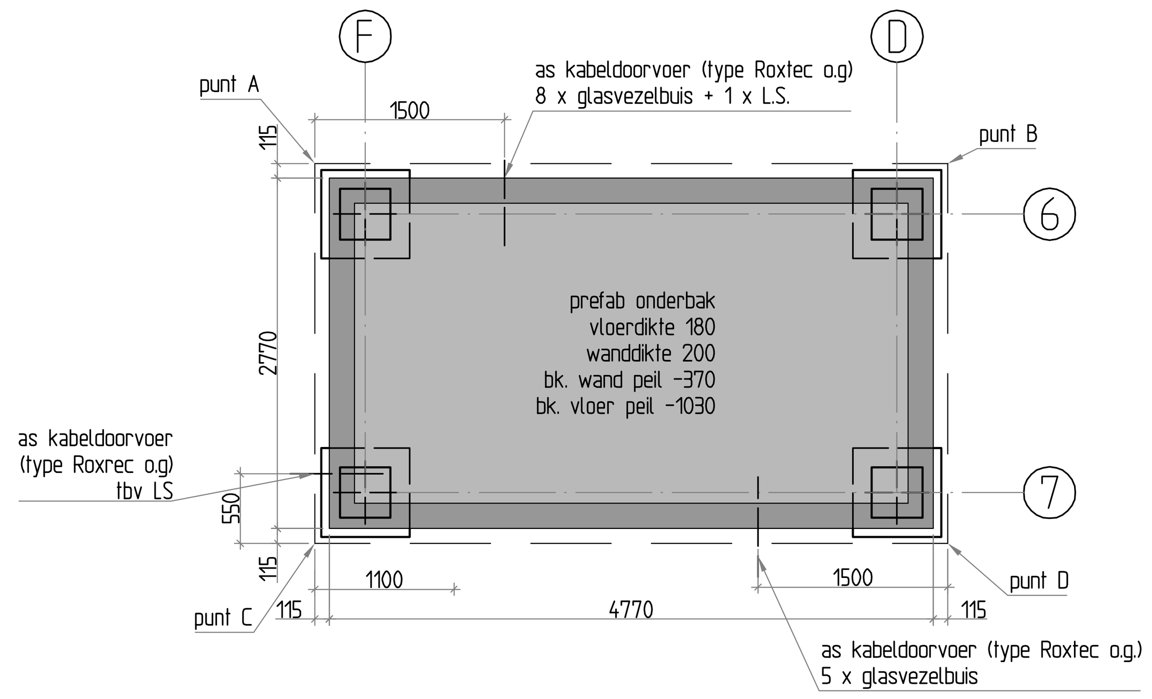
Tekeningnummer: R3N-TEK-0083 blad 001

AutoCAD filename::

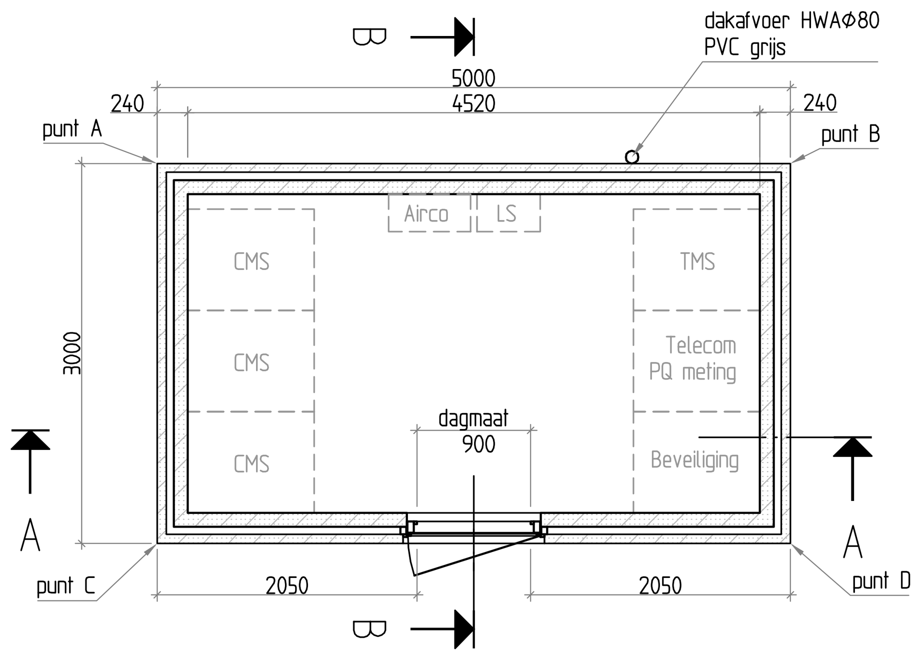
Systnr:



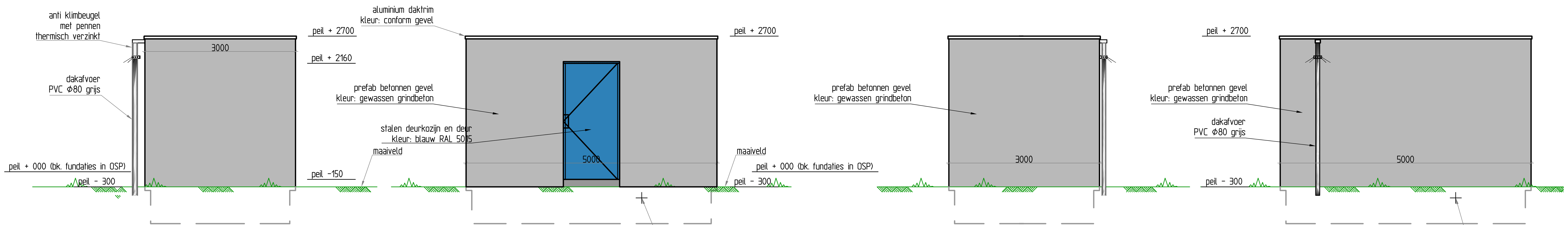
PALENPLAN



BOVENAANZICHT FUNDERING



BOVENAANZICHT WANDEN

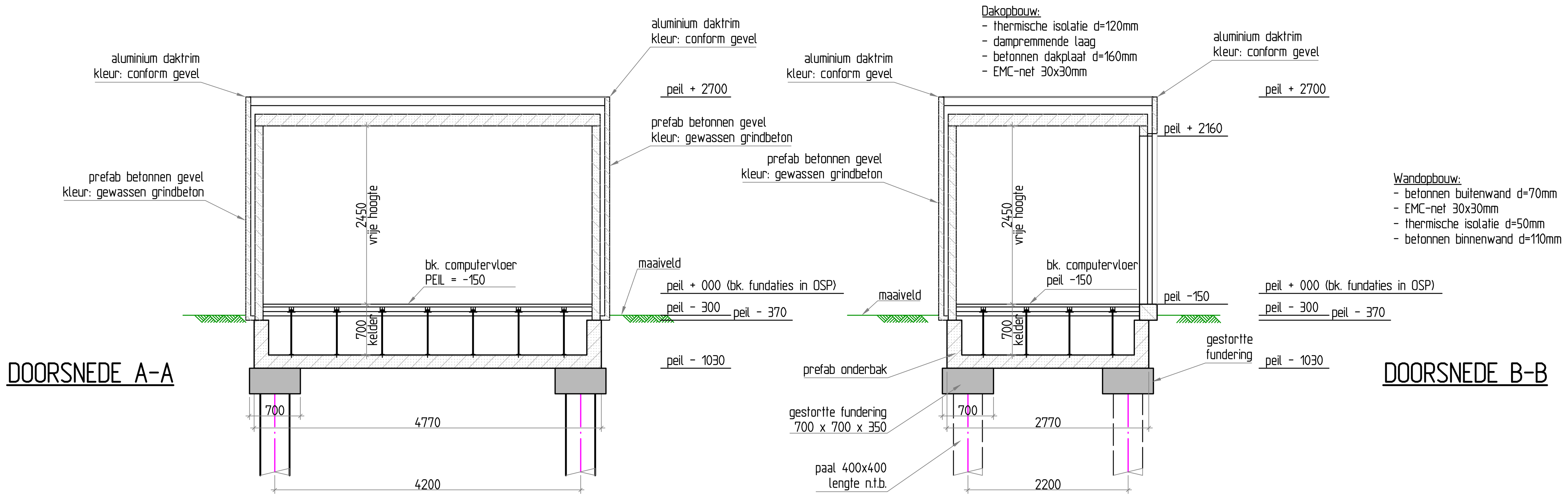


AANZICHT
Zuidgevel OSP4
Oostgevel OSP5

AANZICHT
Oostgevel OSP4
Noordgevel OSP5

AANZICHT
Noordgevel OSP4
Westgevel OSP5

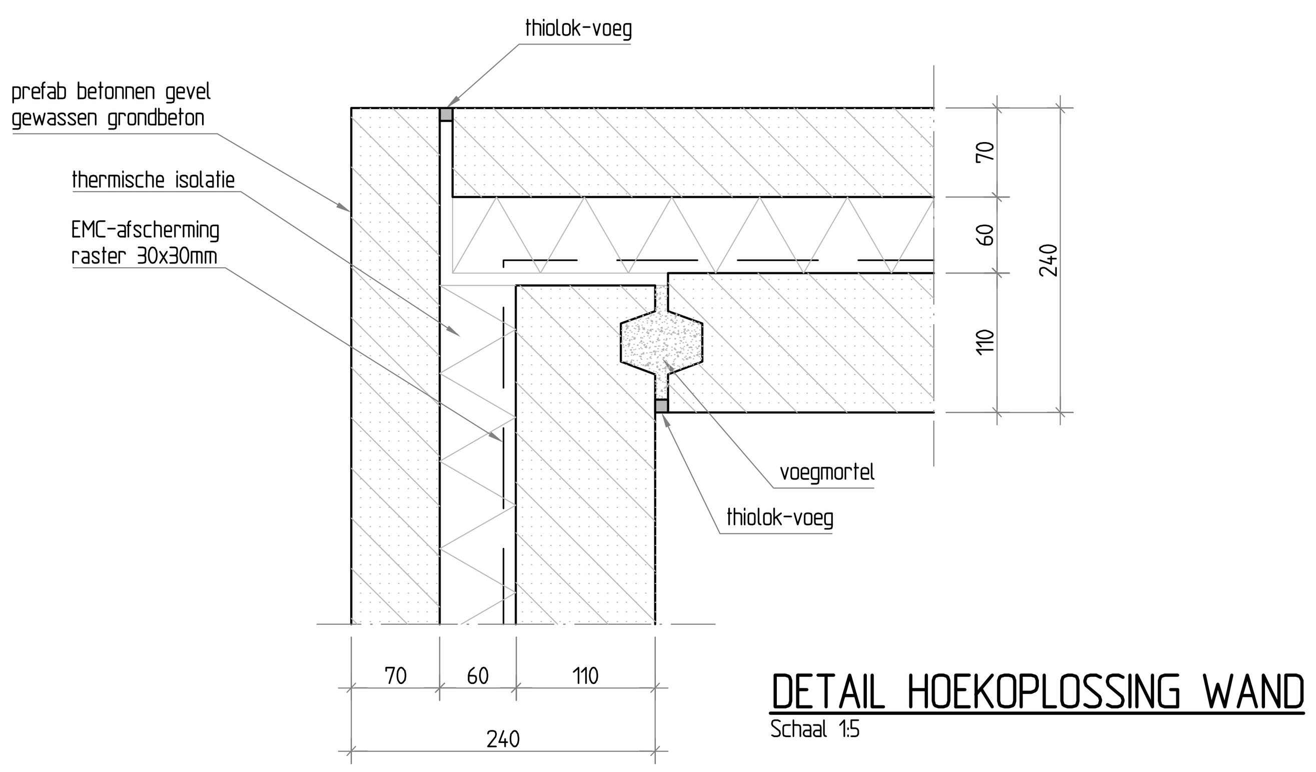
AANZICHT
Westgevel OSP4
Zuidgevel OSP5



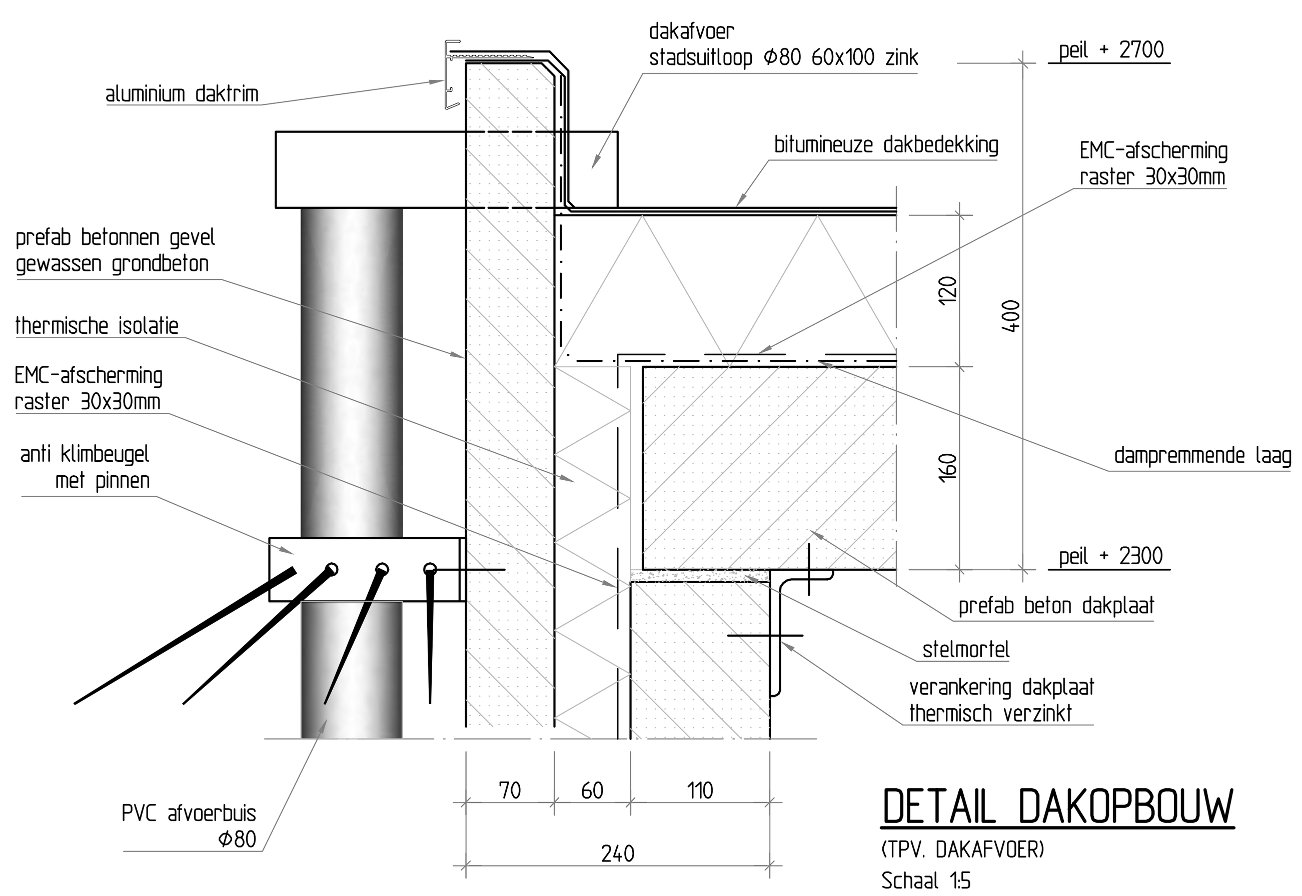
DOORSNEDE A-A

DOORSNEDE B-B

Wandopbouw:
- betonnen buitenwand d=70mm
- EMC-net 30x30mm
- thermische isolatie d=50mm
- betonnen binnenwand d=110mm



DETAIL HOEKOPLOSSING WAND
Schaal 1:5

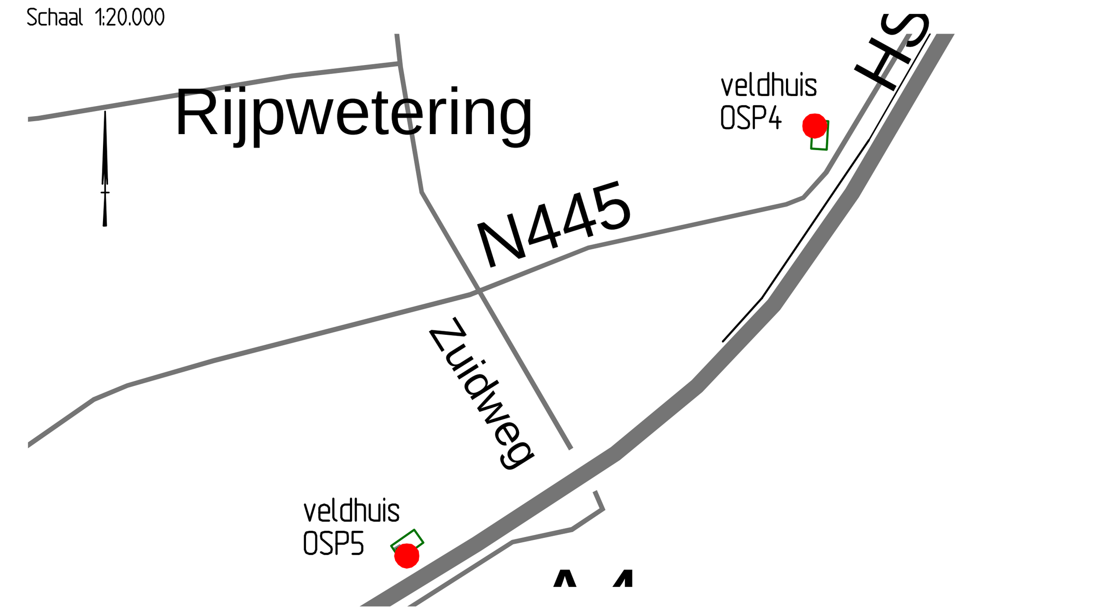


DETAIL DAKOPBOUW
(TPV. DAKAFVOER)
Schaal 1:5

COORDINATEN HOEKPUNTEN

Opstijgpunt 4		
punt A	X=101418.313	Y=467342.344
punt B	X=101413.318	Y=467342.568
punt C	X=101418.447	Y=467345.341
punt D	X=101413.452	Y=467345.565
Opstijgpunt 5		
punt A	X=100107.365	Y=465990.367
punt B	X=100110.201	Y=465986.249
punt C	X=100104.895	Y=465988.666
punt D	X=100107.730	Y=465984.548

TOPOGRAFISCH FRAGMENT
Schaal 1:20.000



OPMERKINGEN:
- Maatvoering in millimeters
- Hoogteligging bovenkant funderingen OSP nader vast te stellen.

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Randstad 380kV Noordring

P. de Jager	A. Hogenboom
Controleur	Vrijgegeven door

Omschrijving: Definitief Ontwerp
Opstijgpunten
Veldhuis OSP4 en OSP5

Rev.	Wijziging	Datum	Naam
03			
02	isometr. projectie verw.	01-11-2013	R.G.J. Caspers
01	zie onder opmerkingen	04-10-2013	R.G.J. Caspers

Schaal: 1:5 / 1:50 | Formaat: A1
Naam: R.G.J. Caspers | Datum: 06-08-2013

Projekt: Randstad 380kV Noordring

TenneT Taking power further

Tekeningnummer: R3N-TEK-0084 blad 001
AutoCAD filename::
Systnr:

Ontwerprapport zettingen OSP's

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	10-07-2013	Eerste uitgave
01	6-08-2013	Tekstuele verbeteringen + bijlage 1 aangepast
02	3-10-2013	Aanpassingen t.g.v. nieuwe grondonderzoek, verwerking opmerkingen opdrachtgever
03	05-02-2014	Bijlagen toegevoegd DC

Documentnummer: R3N-OWR-0011

Opsteller	*Controleur*	*Vrijgever*
A. Daddah Adviseur Geotechniek	P. de Jager Ontwerpmanager	Erik Duwel Project Manager

Distributie

Naam	Bedrijf
Extern	
Guido Volman	TenneT TSO
Intern	
Erik Duwel	BAM
Pieter de Jager	BAM
Eric van Rooijen	BAM
Rob Bakker	BAM
Erwin ten Cate	BAM
Michael Desmet	Cofely Fabricom
Hein Pijnappel	Mott MacDonald

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Neem bij twijfel over de geldende versie contact op met de documentbeheerder.

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1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

BAM heeft op 8 juli 2013 het contract ondertekend met TenneT voor het ontwerp en realiseren van perceel 2. Het voorliggende document is onderdeel van het Definitief Ontwerp en behandelt de zettingen ter plaatse van de OSP’s (opstijgpunten) van Perceel 2.

2. UITGANGSPUNTEN GEOTECHNIEK

In de onderstaande paragrafen zijn de voor het ontwerp relevante uitgangspunten gegeven.

2.1. ALGEMEEN

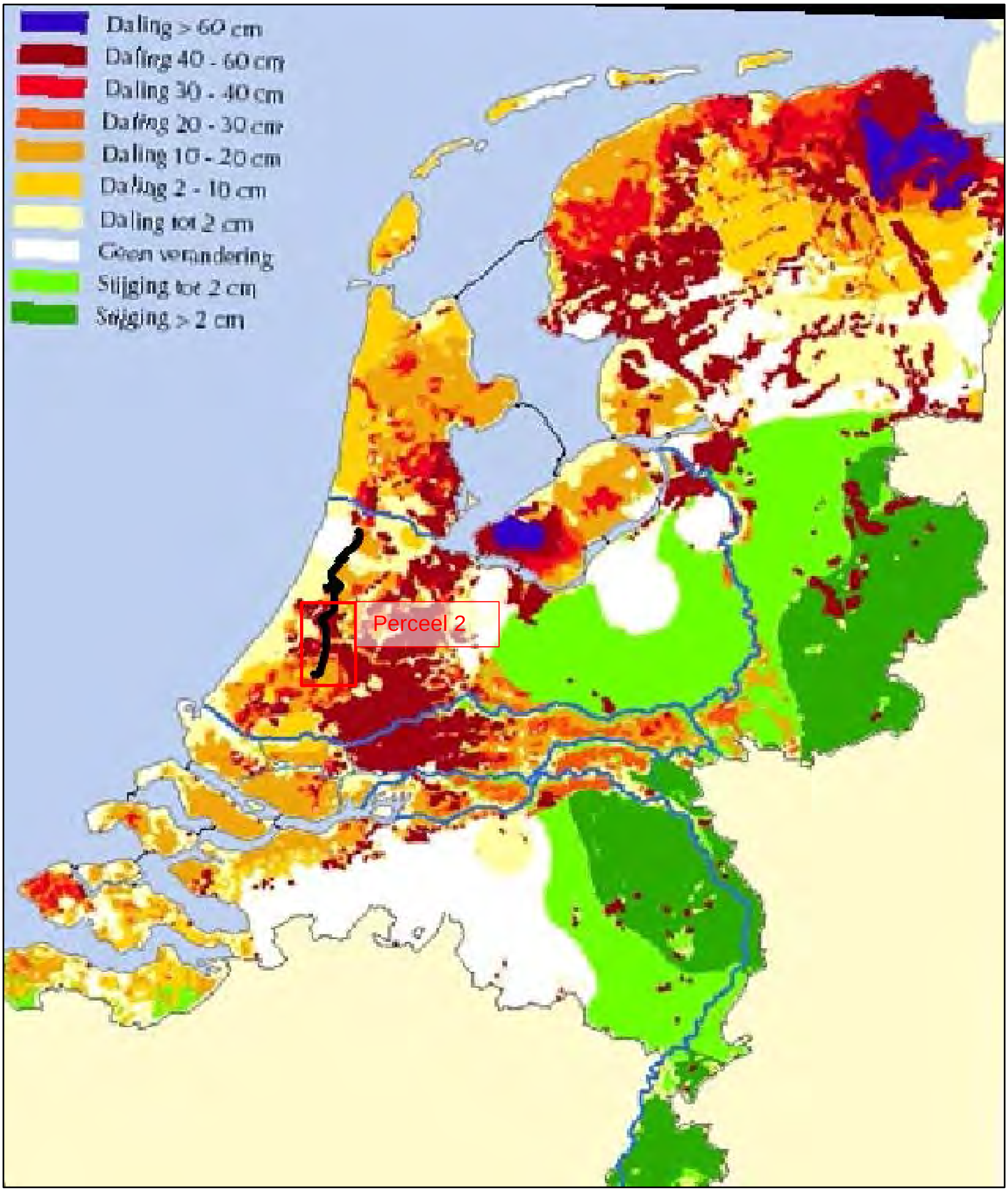
Voor de uitvoering van de berekening zijn de volgende gegevens en uitgangspunten gehanteerd:

- CUR-publicatie 162 'Construeren met grond'. Civieltechnisch Centrum Uitvoering Research en Regelgeving, november 1992;
- NEN 9997-1: Geotechnisch ontwerp van constructies – Deel 1: Algemene regels, december 2012;
- Situatietekeningen en dwarsprofielen van het ondergrondse tracé;
- Grondonderzoek en laboratoriumonderzoek uitgevoerd door FUGRO. Het grondonderzoek en het laboratoriumonderzoek zijn gedurende verschillende nota's van inlichtingen beschikbaar gesteld;
- De aangehouden geometrie voor de berekeningen is overgenomen uit de dwarsprofielen;
- De berekeningen zijn uitgevoerd met representatieve waarden van de grondparameters conform Paragraaf 2.2;
- Voor zand in het cunet en ophoging zijn de volgende grondparameters conform tabel 2.b van NEN 9997-1 gehanteerd (γ_{nat} = 18 kN/m^3, γ_{sat} = 20 kN/m^3, φ = 32,50, c = 0 kN/m^2);
- De geometrie van de OSP's is conform de tekening met tekeningnummer 32995543-OSZZ-08-E0201, d.d. 31-05-2013;
- Bij de OSP's wordt 1,15 m ontgraven, waarop 1,0 m zand en 0,15 m grind wordt aangebracht;
- De aangebrachte zand in cunet en boven maaiveld dient goed verdicht te worden;
- De zettingen zijn berekend over een periode van 30 jaar;
- De restzettingseis bedraagt 0,10 m in 30 jaar na oplevering (nota van inlichtingen 2 en 12);
- Zettingen zullen de eerste 5 jaar na oplevering worden gemonitord.

Grote delen van Nederland worden gekenmerkt door een langzame, natuurlijke daling van de bodem. De kaart in figuur 1 (bron: www.geofoon.nl) toont de verwachte bodemdaling tot het jaar 2050 t.o.v. 1995 en is opgesteld door RWS, NAM en TNO. In deze kaart zijn de effecten van geologische processen en de gevolgen van menselijke activiteit, zoals peilaanpassingen en aardgaswinning, bij elkaar opgeteld.

De verwachte bodemdaling op de projectlocatie blijkt op de meeste gebieden maximaal 0,10 m in 30 jaar te bedragen. Op gebieden waar een dikke veenlaag aan het oppervlak voorkomt kan de bodemdaling maximaal 0,20 m in 30 jaar bedragen.

Aangezien binnen en buiten de projectlocatie vergelijkbare bodemdaling wordt verwacht, wordt deze voor het verdere ontwerp niet beschouwd.



Figuur 1 Kaart algemene bodemdaling Nederland (1995-2050, bron: Rijkswaterstaat, NAM en TNO)

De kaart in figuur 2 toont de ondiepe geologie (toplaag) in het gebied aan (voorkomende grondlagen aan het oppervlak).

Figuur 2 Geologie t.p.v. Perceel 2 (bron: grondwaterkaart van Nederland, grondsoortenkaart Nederland)

Gezien de bodemopbouw wordt eveneens verwacht dat het grootste gedeelte van deze bodemdaling in de diepe holocene lagen (onder ontgravingsniveau) plaats vindt. Hierdoor wordt het aandeel van de algemene bodemdaling in de totale zettingen binnen en buiten het sleuftracé dezelfde. Op basis hiervan is algemene bodemdaling buiten beschouwing gelaten.

Wel zullen een paar meetpunten buiten het invloedsgebied van het tracé worden geplaatst om de bodemdaling te meten.

Beïnvloeding van eventueel aanwezige objecten en leidingen is niet in deze rapportage meegenomen.

2.2. BODEMOPBOUW EN GRONDPARAMETERS

Op basis van het uitgevoerde grondonderzoek zijn geotechnische lengteprofielen opgesteld. Deze zijn in bijlage 1 bijgevoegd.

Op basis van de opgestelde geotechnische lengteprofielen zijn bodemprofielen afgeleid die maatgevend zijn voor subsystemen (definitieve wegen, OSP's en sleuven) in perceel 2. De aangetroffen grondlagen met de gehanteerde laag representatieve waarden van de grondparameters zijn in tabel 1 weergegeven.
De grondparameters zijn gebaseerd op ervaringsgetallen (project verbreding A4 Burgerveen-Leiden, grondparameters aardebaan Noord en Zuid), beschikbare laboratoriumonderzoek en tabel 2.b van NEN

9997-1. De afleiding van de grondparameters uit de laboratoriumonderzoek is in de rapportage R3N-OWR-0043-01 Geotechnisch basisrapport gegeven.

Tabel 1 Aangetroffen grondlagen met de aangehouden laag representatieve waarden van de grondparameters

grondlaag	γ_{nat} [kN/m³]	γ_{sat} [kN/m³]	ϕ' [°]	c' [kN/m²]	c_v [m²/s]	C'_p [-]	C_p [-]	C'_s [-]	C_s [-]	POP [kN/m²]
toplaag-A4 (N)	16	16	25	2	4,0E-07	15	65	200	275	10
Toplaag veen	13	13	17,5	2	7,7E-08	6,5	31	16	145	10
zand kleiig-A4 (N)	17,5	19	27,5	0	5,5E-06	200	400	-	-	-
veen-A4 (Z)	10,5	10,5	15	2	3,0E-08	5,7	33,2	22,8	114	10
klei humeus-A4 (N)*	13,2	13,2	18,9	2,6	7,7E-08	6,5	31	16	145	10
klei siltig-A4 (N)*	15,4	15,4	22,4	3,0	9,4E-08	13,8	56,7	89,8	257	10
klei zandig-A4 (N)	17,4	17,4	25	4,3	2,0E-07	28,7	70,6	195,9	321	10
basisveen-A4 (N)	10,8	10,8	15	2	4,7E-08	7,2	51,4	27,6	111	10
pleistoceen-A4 (N)	18	20	32,5	0	-	600	1800	-	-	-

γ_{nat}	representatieve waarde van het volumiek gewicht van de grondlaag met natuurlijke watergehalte
γ_{sat}	representatieve waarde van het volumiek gewicht van de verzadigde grondlaag
φ'	hoek van inwendige wrijving
c'	cohesie
c_v	verticale consolidatiecoëfficiënt
C'_p	primaire samendrukkingsconstante boven de grensspanning
C_p	primaire samendrukkingsconstante onder de grensspanning
C'_s	secundaire samendrukkingsconstante boven de grensspanning
C_s	secundaire samendrukkingsconstante onder de grensspanning
POP	Pre Overburden Pressure (voorconsolidatie spanning)
*	De volumieke gewichten en sterkteparameters van deze lagen zijn uit laboratoriumonderzoek afgeleid (zie rapport R3N-OWR-0043-01 Geotechnisch basisrapport)

2.3. PROGRAMMATUUR

Ten behoeve van de berekeningen is de volgende computerprogramma gebruikt:

- 2-D computerprogramma D-Settlement, versie 9.3 (build 2.2) uitgaande van het model NEN-Koppejan en met het consolidatiemodel Darcy t.b.v. de zettingsberekeningen.

2.4. FASERING

De volgende fasering is aangehouden:

1. verwijderen teelaardelaag
2. ontgraven cunet waar nodig
3. aanbrengen doek (folie) waar nodig
4. plaatsen zakbaken
5. aanvullen cunet met zand en een laag grind
6. na 365 dagen OSP's afwerken

2.5. BEMALING

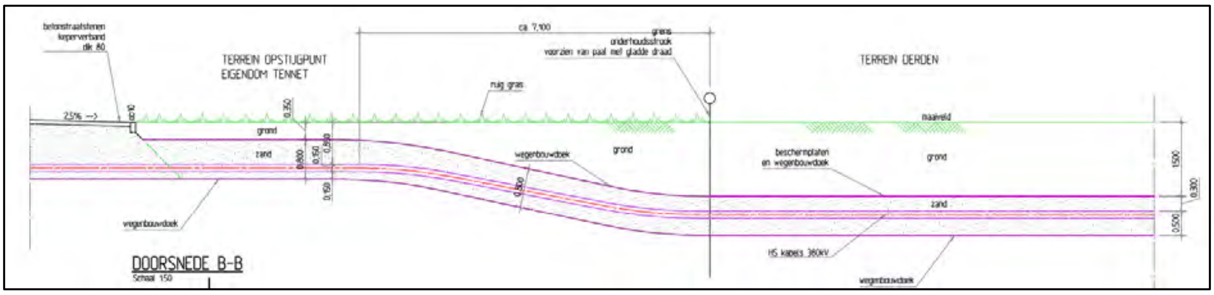
In de uitvoeringsfase worden de OSP's droog gehouden door middel van sleufbemaling. Waar opbarsten van de bodem wordt verwacht zal een spanningsbemaling in de tussenzandlaag/diepe zandlaag plaats moeten vinden. Dit aspect wordt in de geohydrologische rapportages (R3N-OWR-0039-02 Bemalingsadvies Rijnland en R3N-OWR-0040-02 Bemalingsadvies Schieland) beschouwd.

2.6. BEREKENINGSMETHODE

Ten aanzien van de zettingsberekeningen worden hier de volgende punten aangegeven:

- Zettingen zijn berekend volgens de methode NEN-Koppejan met het consolidatiemodel Darcy;
- Gezien de verwachte zettingen (kleiner dan laagdikte) wordt met lineaire rek gerekend;
- Bij de berekeningen wordt spanningsspreiding volgens de methode Buisman toegepast;
- De berekeningen van de zetting zijn uitgevoerd t.p.v. de maatgevende dwarsprofielen. Waar grote variatie in bodemopbouw aanwezig is, is deze variatie in de profielen verwerkt;
- Bij zettingsberekeningen op basis van laboratoriumonderzoek is het gebruikelijk rekening te houden met een onnauwkeurigheid van ± 30% in de berekende zettingen. Omdat ter plaatse van het tracé geen laboratoriumonderzoek beschikbaar is, is conform CROW publicatie 204 (Betrouwbaarheid van zettingsprognoses) van een onnauwkeurigheid van ± 50% in de berekende zettingen uitgegaan;
- Het modeleren van een grondverbetering (vervangen van een materiaal met een ander) wordt boven water in model als gewichtsverschil aangegeven en onder water als gewichtsverschil + 10 (zie ook D-Settlement manual: ground improvement).

De zettingsanalyse van de OSP's bestaat uit de berekening van een aantal maatgevende dwarsprofielen.
De ontgraven cunetten voor de OSP's worden met zand opgevuld en wordt daarna een laag grind aangebracht. Het aangebrachte zand en grind dient goed verdicht te worden.
De geometrie van de OSP is in figuur 3 grafisch weergegeven.



Figuur 3 Geometrie OSP

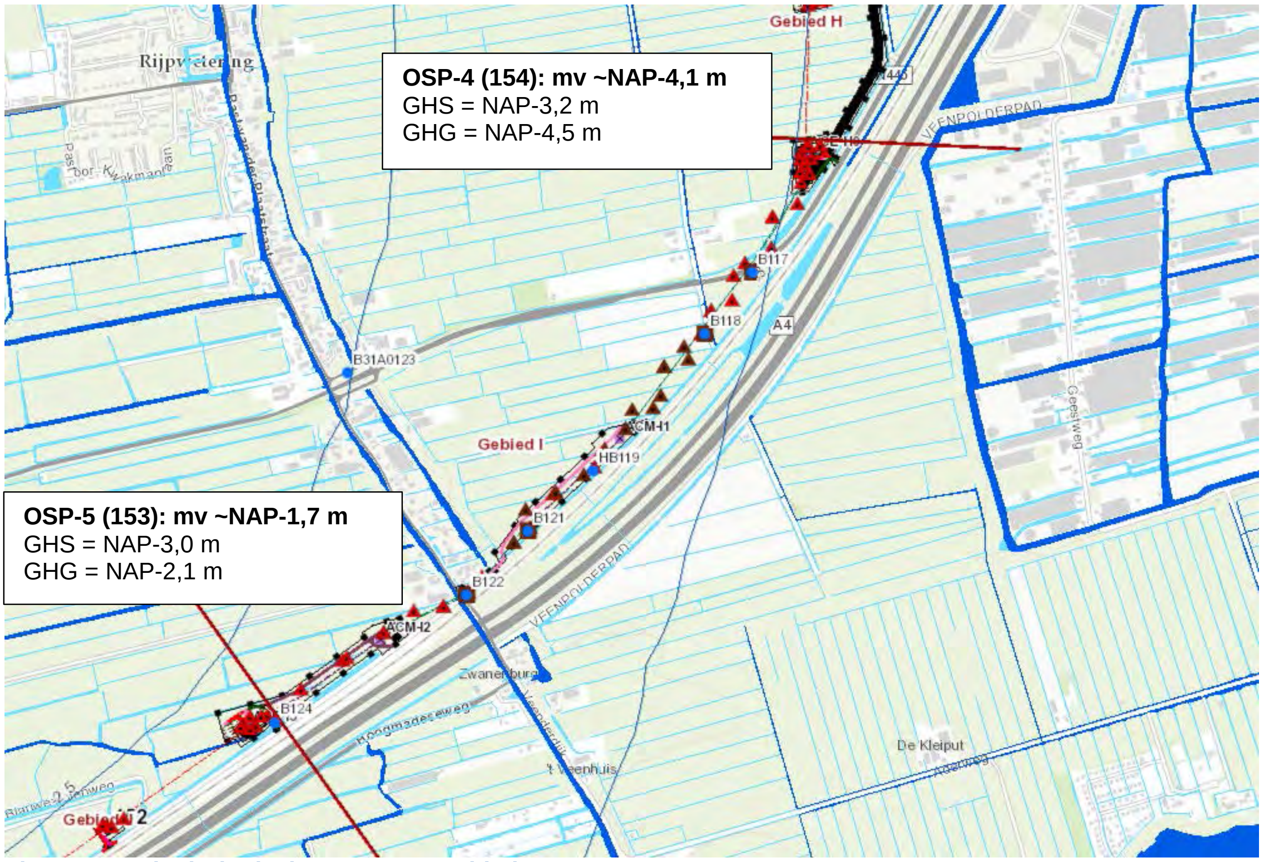
3. UITGANGSPUNTEN HYDROLOGIE

Een samenvatting van de geohydrologische gegevens (gemiddeld hoogste stijghoogtes en gemiddeld hoogste grondwater) is in tabel 2 weergegeven. Deze gegevens zijn conform de geohydrologische rapporten R3N-OWR-0039-02 Bemalingsadvies Rijnland en R3N-OWR-0040-02 Bemalingsadvies Schieland. De grafische weergaven van de gebieden met daarin aangegeven de geohydrologische gegevens zijn in figuur 4 t/m figuur 7 weergegeven.

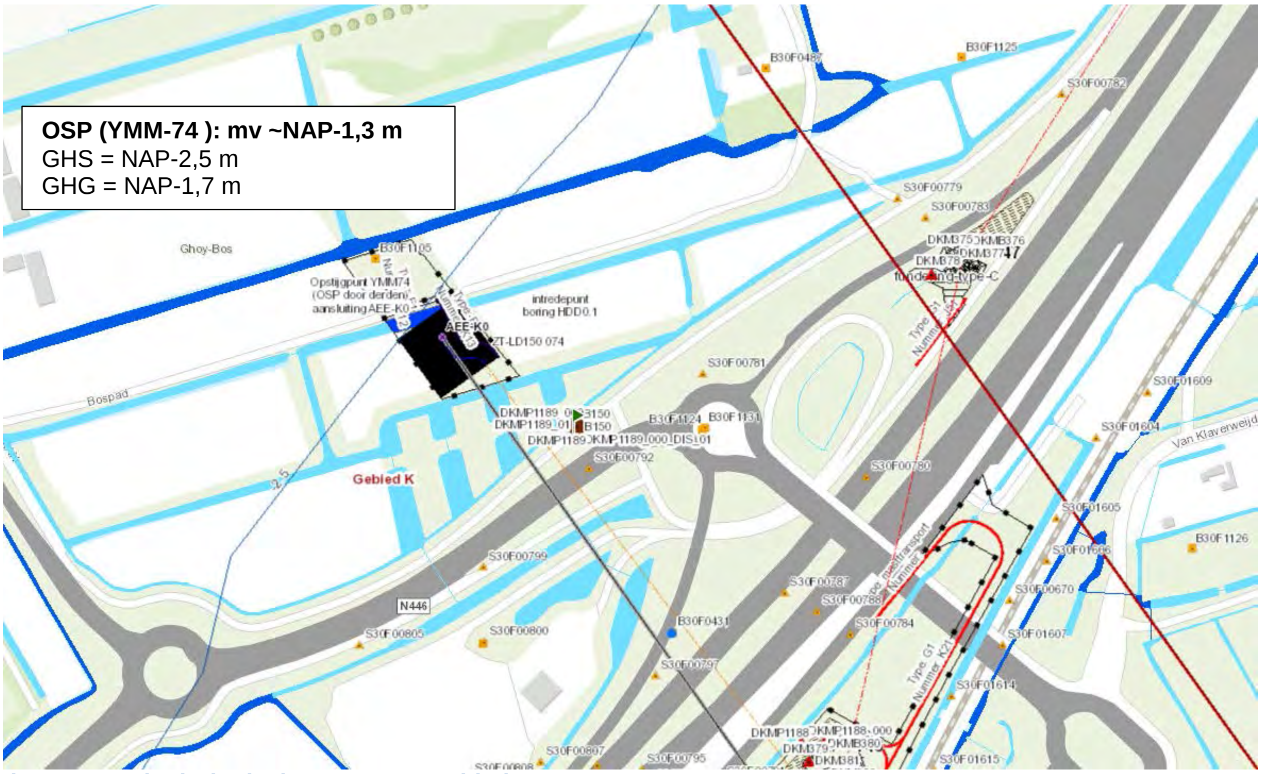
Tabel 2 Geohydrologische gegevens

Locatie (SBS code)	Beschrijving	Stijghoogte (GHS)* [m NAP]	Grondwaterstand (GHG)** [m NAP]
OSP154	OSP Provinciale weg	-3,2	-4,5
OSP153	OSP Zuidweg	-3,0	-2,1
OSP YMM-74	OSP Hoogmade	-2,5	-1,7
OSP123	OSP Westeinde	-4,2	-5,1
OSP109	OSP Kruisweg	-5,0	-4,6
*	GHS: Gemiddeld Hoogste Stijghoogte		
**	GHG: Gemiddeld Hoogste Grondwaterstand		

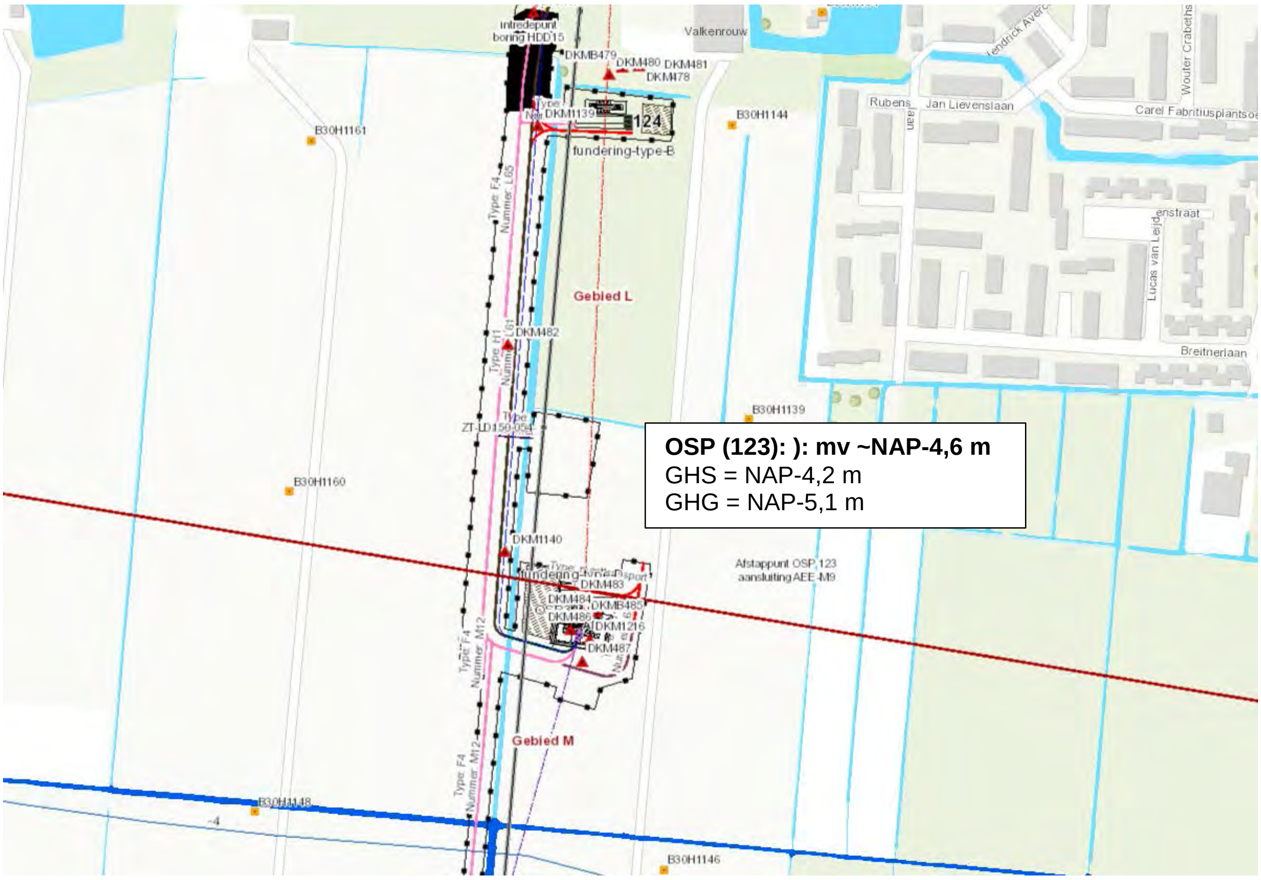
Voor de berekeningen zijn de in tabel 2 weergegeven grondwaterstanden en stijghoogtes gehanteerd.



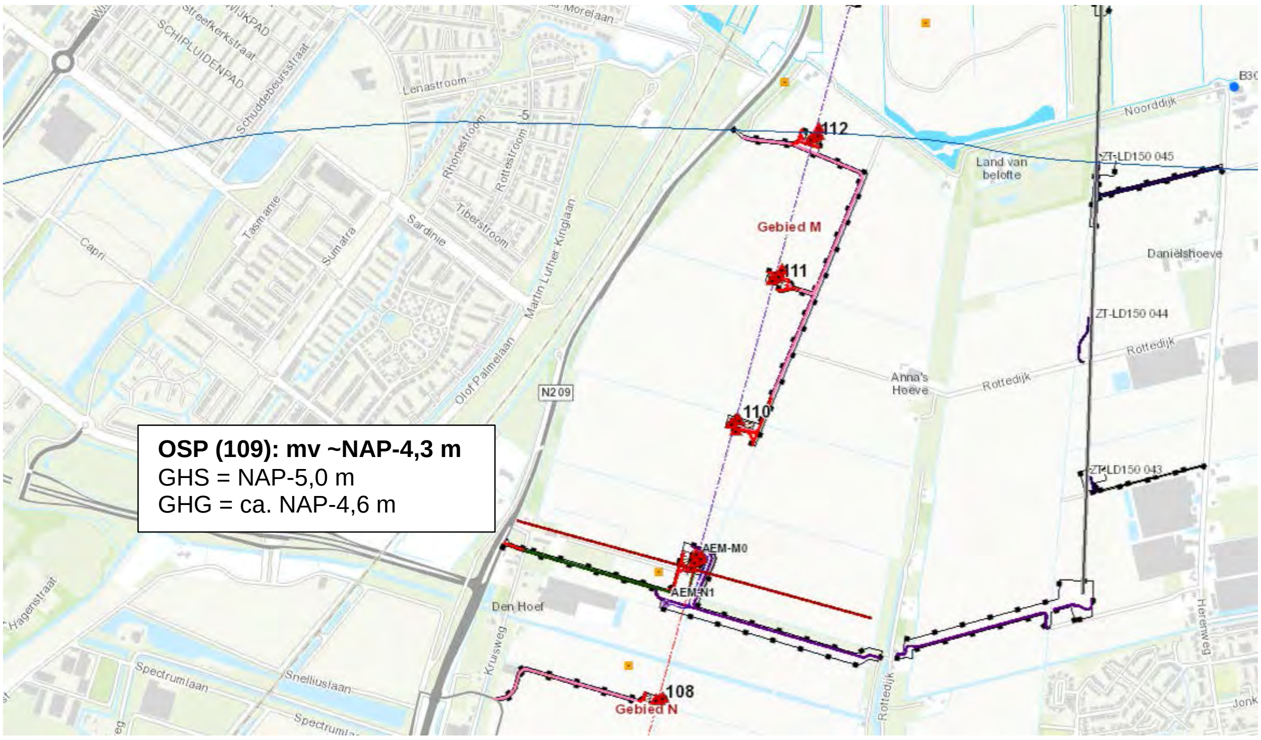
Figuur 4 Geohydrologische gegevens gebieden OSP154 en OSP153



Figuur 5 Geohydrologische gegevens gebied OSP YMM-74



Figuur 6 Geohydrologische gegevens gebied OSP 123



Figuur 7 Geohydrologische gegevens gebied OSP109

4. RESULTATEN ZETTINGEN

4.1. RESULTATEN ZETTINGEN OSP'S

Met inachtneming van de uitgangspunten en de gegevens van voorgaande hoofdstukken zijn zettingsberekeningen uitgevoerd. De zettingsberekeningen zijn gemaakt ter plaatse van de volgende dwarsprofielen:

- Dwarsprofiel bij OSP154;
- Dwarsprofiel bij OSP153 ;
- Dwarsprofiel bij OSP YMM-74;
- Dwarsprofiel bij OSP123;
- Dwarsprofiel bij OSP109.

Het doel van de berekeningen is:

- Het bepalen van de te verwachte zetting;
- Het bepalen van het verloop van de zettingen in de tijd.

Een samenvatting van de berekende zettingen na 30 jaar is in tabel 3 weergegeven. De geometrie van de ophogingen en maatgevende zettingslijnen (midden sleuf of grootste zetting bij variabele profiel) zijn in figuur 8 t/m figuur 17 weergegeven. De totale berekeningsresultaten zijn in bijlage 2 bijgevoegd.

Tabel 3 Resultaten zettingen OSP's

Locatie	Zetting 30 jaar* [m]	Restzetting na 1 jaar bij grootste zetting [m]	Restzetting na 5 jaar bij grootste zetting**** [m]	Toetsing zetting na 5 jaar** bij grootste zetting [%]
OSP 154 (Provinciale weg)***	0,28 à 0,34	0,08	0,07	80 %, restzetting klein dus voldoet
OSP 153 (Zuidweg)***	0,26 à 0,30	0,07	0,07	77 %, restzetting klein dus voldoet
OSP YMM-74 (Hoogmade)***	0,29	0,08	0,07	76 %, restzetting klein dus voldoet
OSP 123 (Westeinde)***	0,11	0,06	0,02	82 %, restzetting klein dus voldoet
OSP 109 (Kruisweg)***	0,07	0,02	0,005	92 %, restzetting klein dus voldoet

* Aan de rand van de ophoging is de zetting minder. De variabele zetting geldt bij grote OSP's (heterogene ondergrond)

** Toetsing zetting: zetting na 5 jaar/eindzetting. Deze dient minimaal 80 % te bedragen

*** In de berekeningen is uitgegaan dat na een voorbelastingsperiode (bouwperiode) van 1 jaar de ophoging op het huidig maaiveldniveau wordt afgewerkt (overhoogte t.o.v. huidig maaiveld verwijderen)

**** Zwel bij Darcy duurt erg lang, hetgeen niet helemaal correct is. Verwacht wordt dat zwel snel plaats vindt waardoor de restzetting kleiner zal zijn na 5 jaar

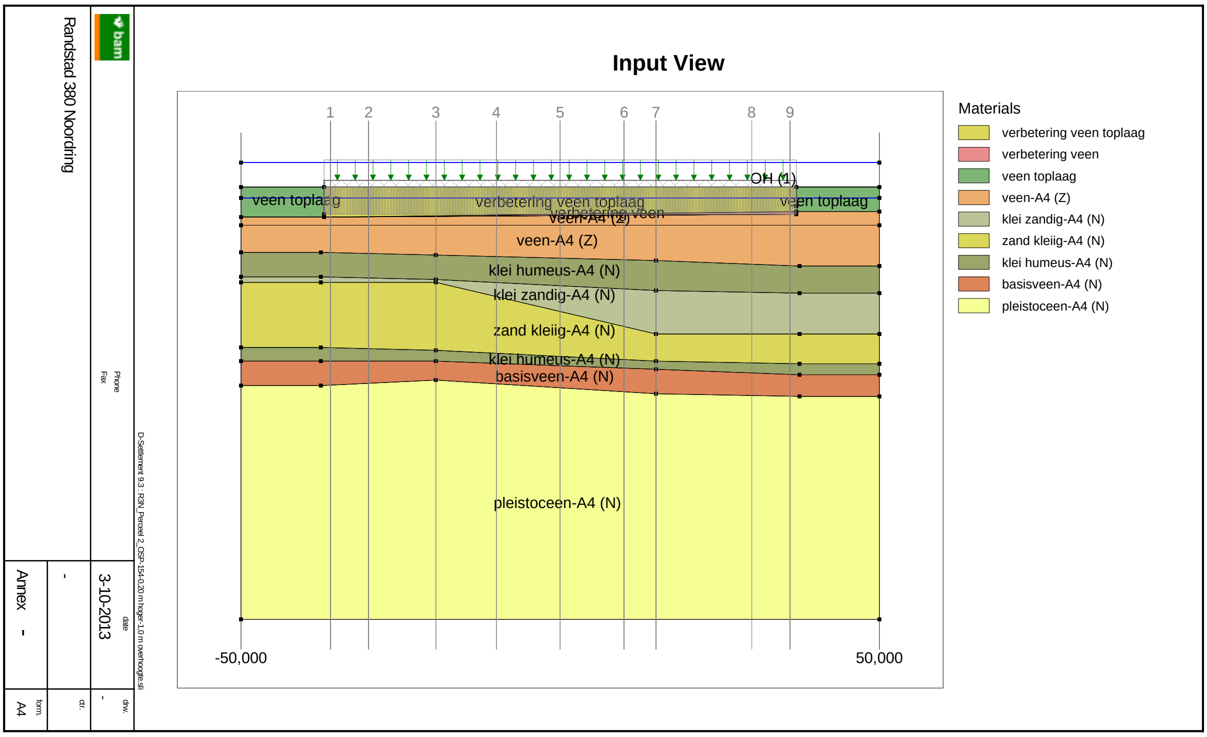
Uitgaande van een onnauwkeurigheid in de zettingen van 50% worden de volgende eindzettingen gevonden:

- Dwarsprofiel bij OSP154: 0,14 tot 0,17 m à 0,40 tot 0,51 m;
- Dwarsprofiel bij OSP153: 0,13 tot 0,15 m à 0,39 tot 0,45 m;
- Dwarsprofiel bij OSP YMM-74: 0,15 m à 0,44 m;
- Dwarsprofiel bij OSP123: 0,06 m à 0,17 m;
- Dwarsprofiel bij OSP109: 0,04 m à 0,11 m.

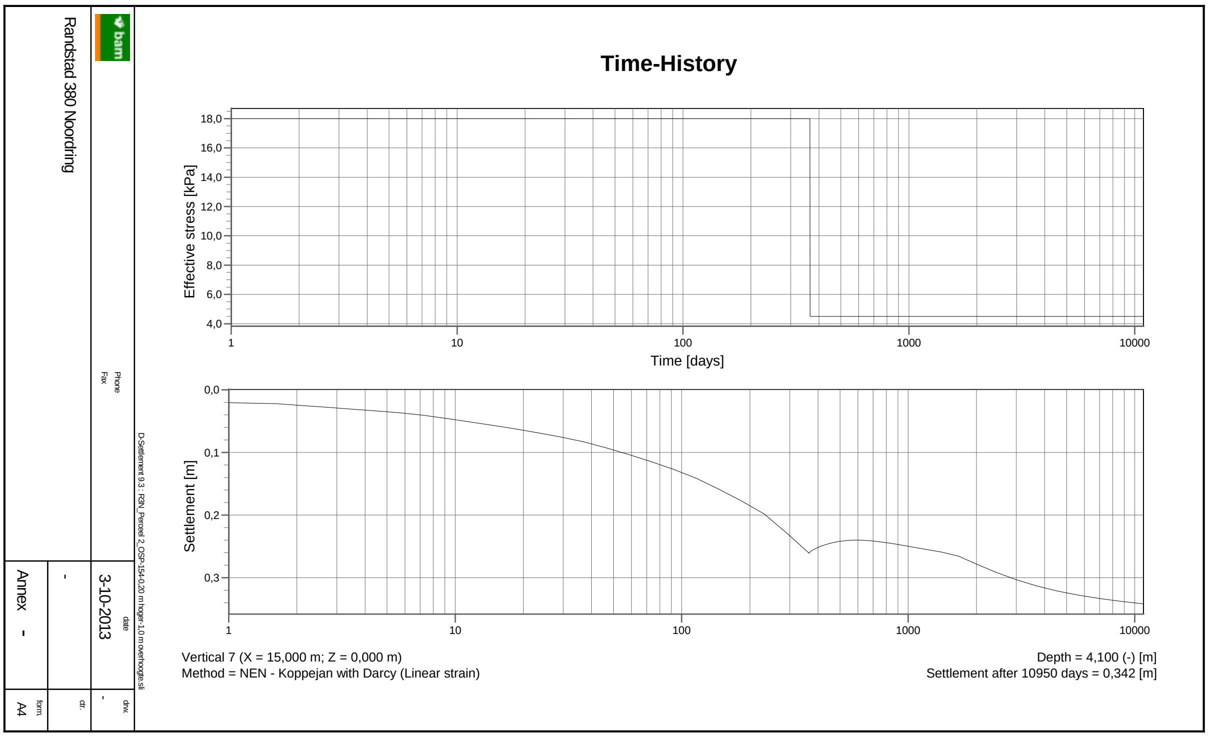
Uit de berekeningsresultaten volgen de onderstaande maatregelen:

- OSP154: 0,2 m hoger aanleggen, overhoogte: 1,0 m;
- OSP153: 0,2 m hoger aanleggen, overhoogte: 1,0 m;
- OSP YMM-74: 0,2 m hoger aanleggen, overhoogte: 1,0 m;

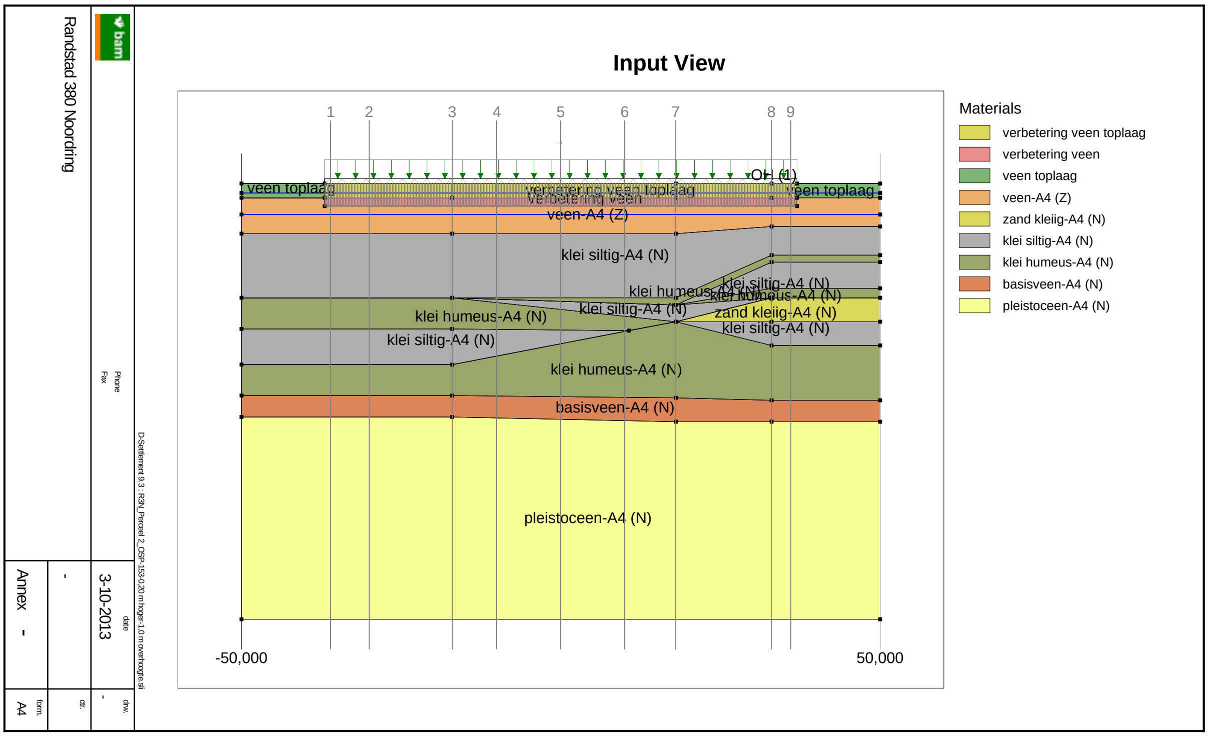
- OSP123: overhoogte: 0,10 m ter compensatie van verwachte zetting;
- OSP109: overhoogte: 0,10 m ter compensatie van verwachte zetting.



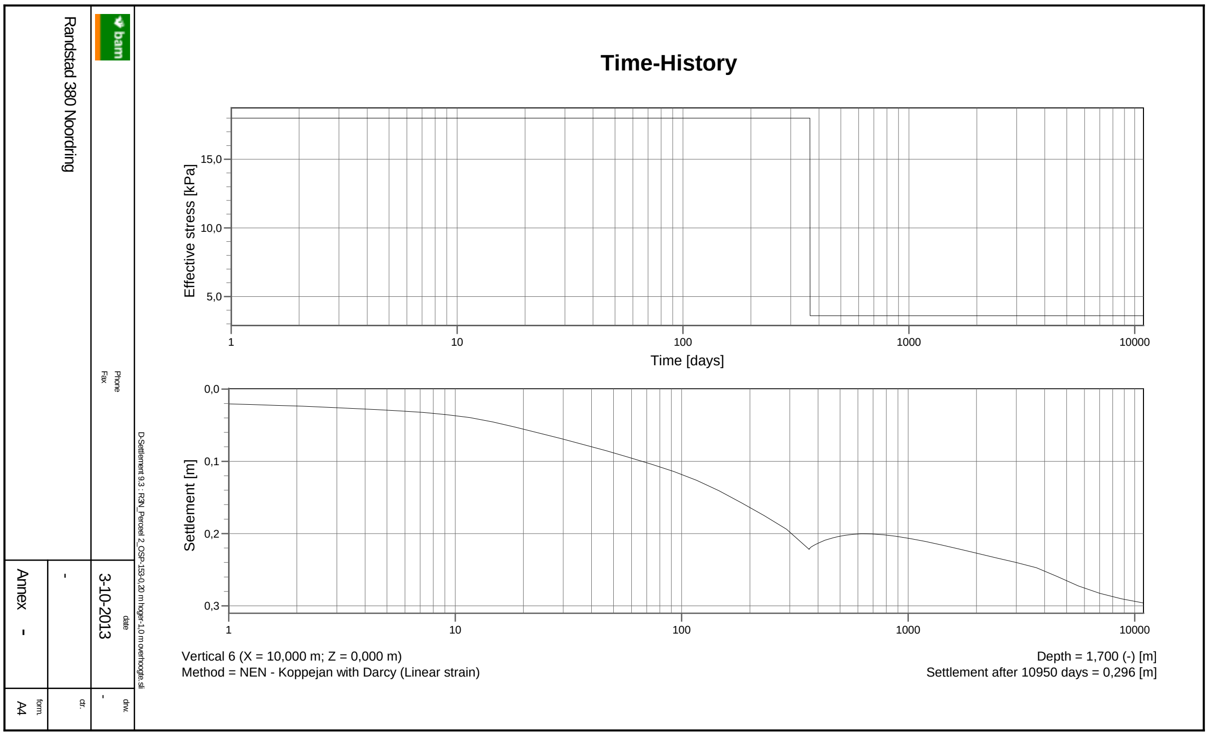
Figuur 8 Geometrie dwarsprofiel OSP 154



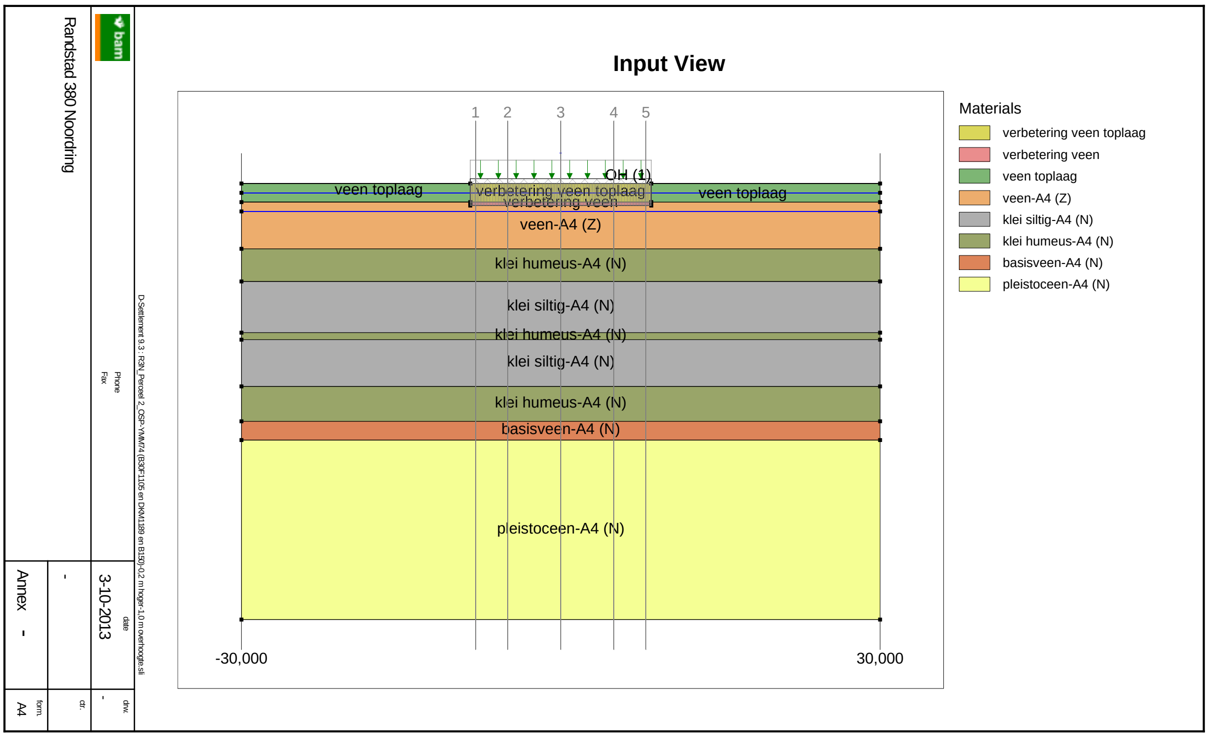
Figuur 9 Verloop zettingen dwarsprofiel OSP 154



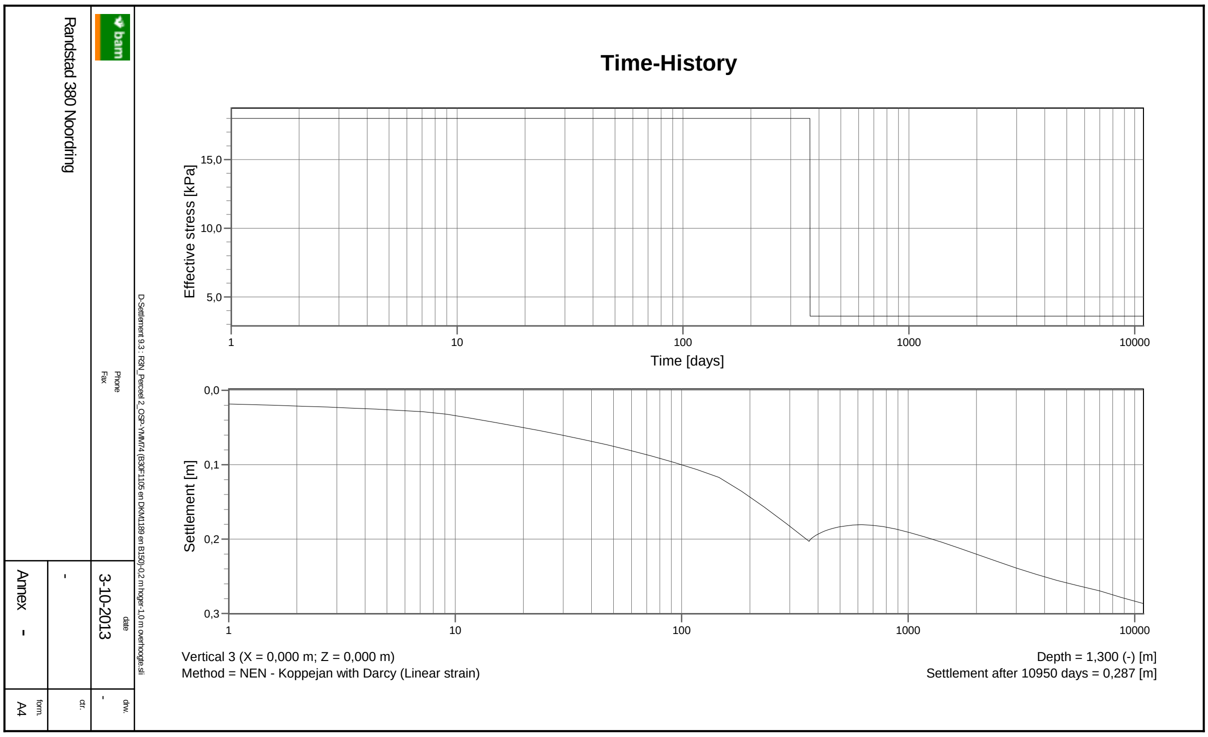
Figuur 10 Geometrie dwarsprofiel OSP 153



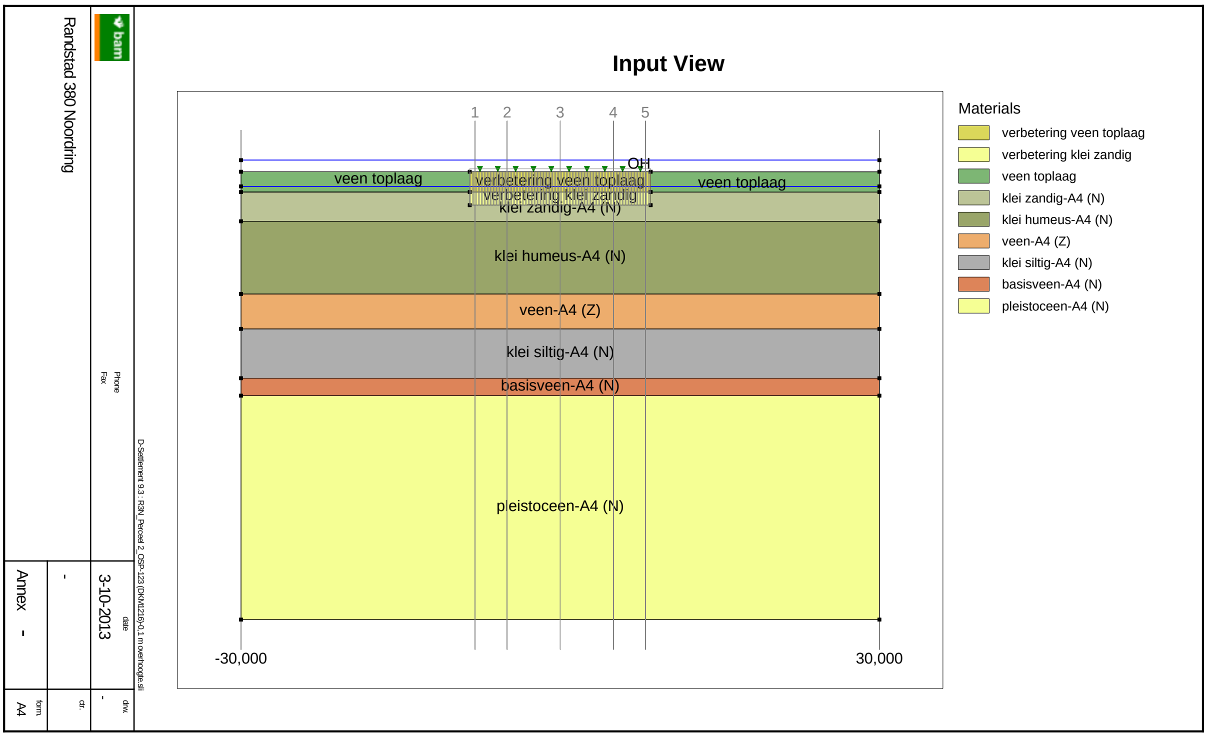
Figuur 11 Verloop zettingen dwarsprofiel OSP 153



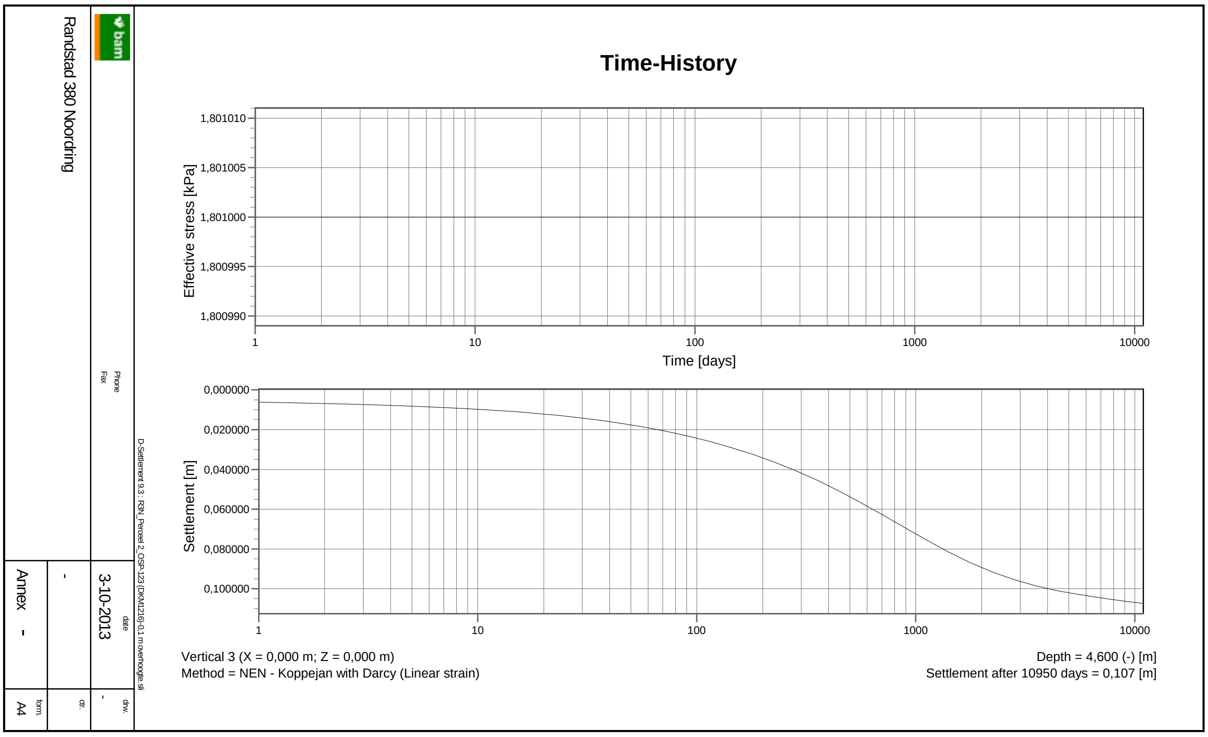
Figuur 12 Geometrie dwarsprofiel OSP YMM-74



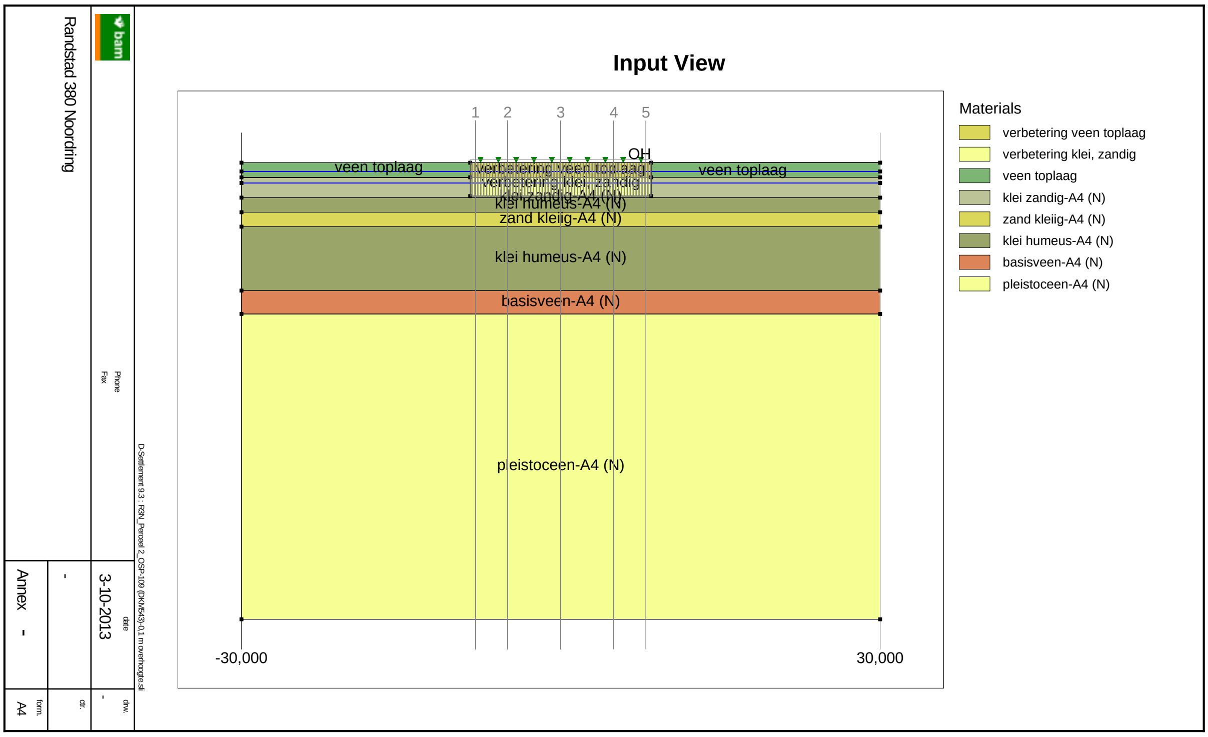
Figuur 13 Verloop zettingen dwarsprofiel OSP YMM-74



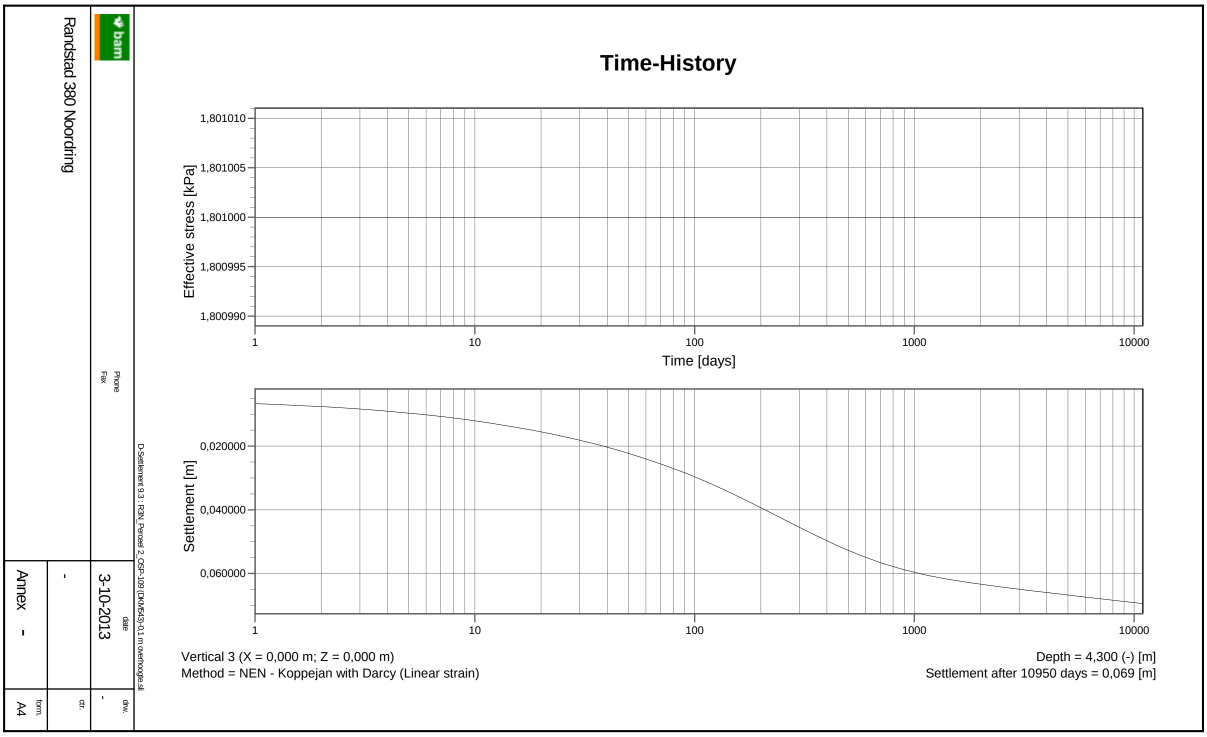
Figuur 14 Geometrie dwarsprofiel OSP 123



Figuur 15 Verloop zettingen dwarsprofiel OSP 123



Figuur 16 Geometrie dwarsprofiel OSP 109



Figuur 17 Verloop zettingen dwarsprofiel OSP 109

4.2. CONCLUSIES EN ADVIES

Op basis van de berekende zettingen kunnen de volgende conclusies worden getrokken:

- Voor de berekeningen is uitgegaan van een onnauwkeurigheid in de zettingen van 50%;
- Eindzettingen OSP's:
- Dwarsprofiel bij OSP154: 0,14 tot 0,17 m à 0,40 tot 0,51 m;
- Dwarsprofiel bij OSP153: 0,13 tot 0,15 m à 0,39 tot 0,45 m;
- Dwarsprofiel bij OSP YMM-74: 0,15 m à 0,44 m;
- Dwarsprofiel bij OSP123: 0,06 m à 0,17 m;
- Dwarsprofiel bij OSP109: 0,04 m à 0,11 m;
- Restzettingen na 365 dagen: kleiner dan de restzettingseis van 0,10 m;
- Na 5 jaar na oplevering is meer dan 80 % zetting opgetreden en/of is de restzetting klein (< 0,07 m).

De onderstaande maatregelen zijn t.p.v. de OSP's nodig:

- OSP154: 0,2 m hoger aanleggen, overhoogte: 1,0 m;
- OSP153: 0,2 m hoger aanleggen, overhoogte: 1,0 m;
- OSP YMM-74: 0,2 m hoger aanleggen, overhoogte: 1,0 m;
- OSP123: overhoogte: 0,10 m ter compensatie van verwachte zetting;
- OSP109: overhoogte: 0,10 m ter compensatie van verwachte zetting.

De zettingen worden door middel van monitoring gecontroleerd.

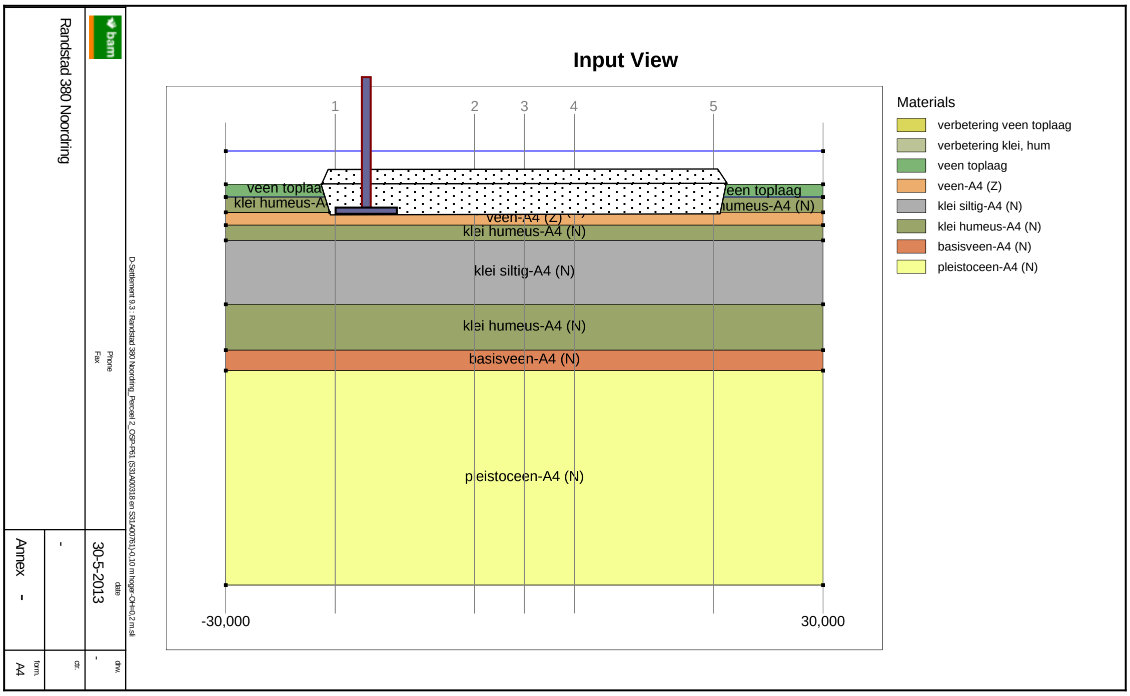
Geadviseerd wordt om na het graven van het cunet van de OSP's zo snel mogelijk daarna aan te vullen met zand om eventuele zwel (dat daarna zakt en dus tot extra zetting leidt) te beperken.

Geadviseerd wordt om na de voorbelastingsperiode de overhoogte t.o.v. het huidig maaiveld te verwijderen.

5. MONITORING

5.1. ZAKBAKEN

Tijdens de uitvoering van de werkzaamheden worden zakbaken in het cunet van de OSP's geplaatst. Gezien de aangetroffen bodemopbouw wordt geadviseerd om minimaal 2 zakbaken per OSP te plaatsen. Een schematische weergave van de locatie van een zakbaak is in figuur 18 weergegeven.



Figuur 18 Locatie zakbaak in het cunet van de OSP (aanvulling)

Met behulp van de meetgegevens kunnen de berekeningen van de zettingen worden gevalideerd. De zakbaken dienen conform de onderstaande specificaties te worden gemeten.

Nulmeting

De nulmeting wordt uitgevoerd na plaatsing van de zakbaak en kort voor het aanbrengen van de eerste ophoging. Tijdens deze meting dient het volgende gemeten te worden:
nr, datum, tijd, X, Y, Z, lengte, hoogte plaat

waarin:
nr: nummer zakbaak
datum: datum van meting
tijd: tijd van meting
X,Y: RD coördinaten zakbaak
Z: hoogte bovenkant buis t.o.v. NAP
lengte: lengte van de buis gemeten vanaf de voetplaat
hoogte plaat: bovenkant afdekplaat t.o.v. NAP

Herhaalmetingen

Tijdens de herhaalmetingen dient het volgende gemeten te worden:
nr, datum, tijd, X, Y, Z, lengte, mv
waarin:
mv: is hoogte maaiveld bij zakbaken t.o.v. NAP

Opgemerkt wordt hierbij dat bij elke verlenging van de zakbaken de hoogte hiervan vóór en na het ophogen gemeten dienen te worden.

Meetschema
De zakbaken dienen bij voorkeur volgens onderstaand schema te worden gemeten.

Tijdens ophogen	Minimaal twee keer per week en na elke ophoogslag
Na ophogen tot 3 maanden	Minimaal elke week
Vanaf 3 maanden tot ½ jaar	Minimaal elke 2 weken
Vanaf ½ jaar en verder	Minimaal elke 4 weken

Meetnauwkeurigheid
De metingen dienen te worden uitgevoerd met een meetnauwkeurigheid van 5 mm.

Uitvoering
De zakbaken zijn onder de voetplaat voorzien van een stalen buis met een lengte van ongeveer 0,2 m. Bij plaatsing wordt de stalenbuis de grond ingeduwd waardoor de voetplaat op het maaiveld komt. De stalen buis zorgt voor de stabiliteit van de zakbaken.

5.2. WATERSPANNINGSMETERS

Locaties
De waterspanningsmeters worden geplaatst ter plaatse van de OSP's. Er wordt 1 spanningsmeter per OSP geplaatst.
Gezien de bodemopbouw en de maatgevende grondwaterstanden worden de waterspanningsmeters op circa 2,0 m –mv geplaatst. Dit betekent het volgende:

- OSP154: waterspanningsmeter op NAP-6,0 m;
- OSP153: waterspanningsmeter op NAP-4,0 m;
- OSP YMM-74: waterspanningsmeter op NAP-5,0 m;
- OSP123: waterspanningsmeter op NAP-7,0 m;
- Ter plaatse van OSP109 is de ondergrond zandig en de zettingen gering. Er hoeft daar geen waterspanningsmeter te worden geplaatst.

Plaatsing
Tijdens het plaatsen van de waterspanningsmeter worden de volgende gegevens genoteerd:
nr, datum, tijd, X, Y, diepte, mv, barometer, meting

waarin:
nr: nummer waterspanningsmeter
datum: datum van meting
tijd: tijd van meting
X,Y: RD coördinaten waterspanningsmeter
diepte: diepte filter tov NAP
mv: is hoogte maaveld tov NAP
barometer: luchtdruk in millibar
meting: meetwaarde in millibar

Nulmeting
Ongeveer 2 weken voor het aanbrengen van de eerste zandlaag worden de waterspanningsmeters geplaatst. Na 1 week worden 3 nulmetingen uitgevoerd. Tijdens de nulmeting dient het volgende gemeten te worden:
nr, datum, tijd, barometer, meting

Herhaalmetingen
Tijdens de herhaalmetingen worden de waterspanningsmeters conform de nulmeting gemeten.

Opgemerkt wordt dat er geen stangen op maaiveld blijven zodat het dieper zakken van het filter alleen uit controleberekeningen kan worden bepaald.

Meetschema

De waterspanningsmeters dienen bij voorkeur volgens onderstaand schema te worden gemeten.

Tijdens ophogen	Minimaal twee keer per week en na elke ophoogslag
Na ophogen tot 3 maanden	Minimaal elke week
Vanaf 3 maanden tot ½ jaar	Minimaal elke 2 weken
Vanaf ½ jaar en verder	Minimaal elke 4 weken

Uitvoering

De waterspanningsmeters worden met een voertuig geplaatst en blijven na de werkzaamheden in de grond achter. Na het op diepte drukken van de waterspanningsmeters wordt de stang getrokken en blijft alleen de meetkabel achter in de grond. Deze wordt naar de zijkant, buiten de ophoging geleid, en zichtbaar gemarkeerd.

Indien een waterspanningsmeter tijdens de uitvoering ernstig wordt beschadigd of er is reden om aan te nemen dat de meting niet meer betrouwbaar is, dient deze te worden vervangen.

Referenties

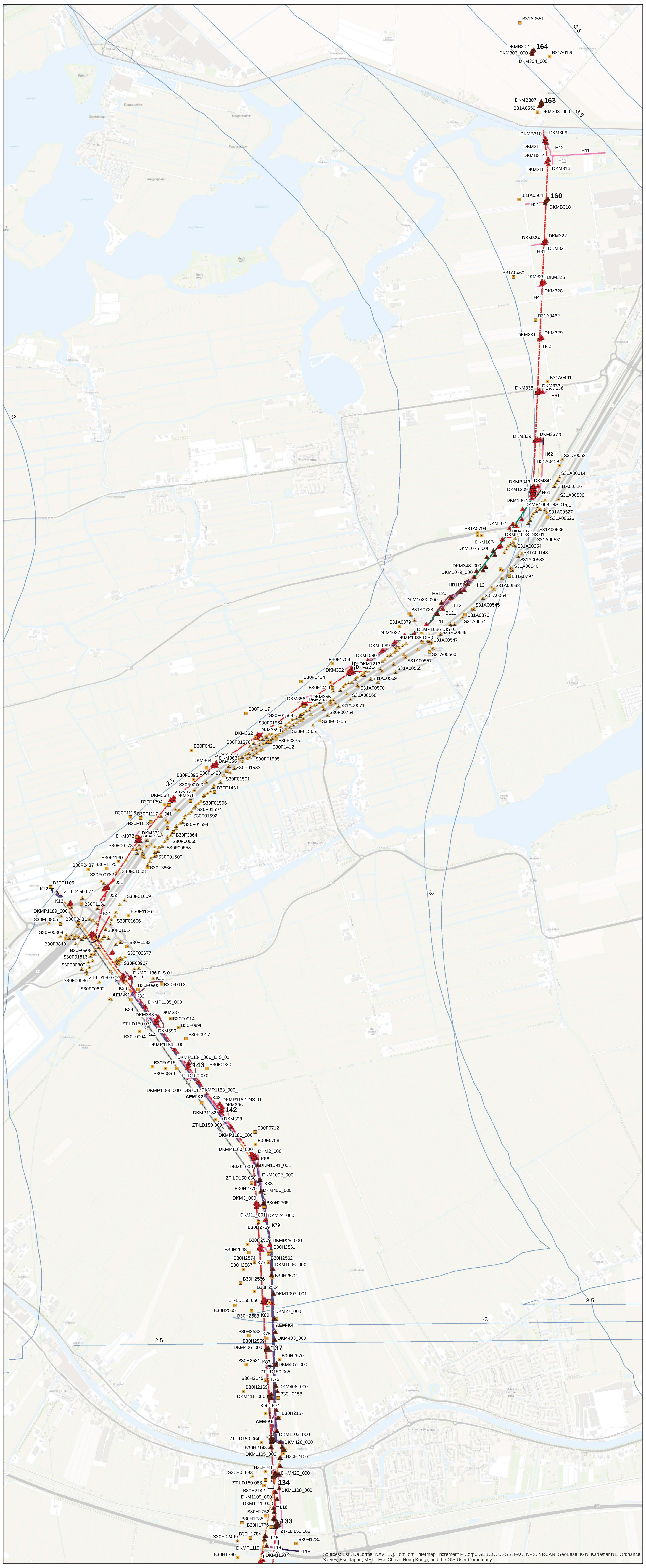
1. NEN-EN 1990:2002, Grondslagen van het constructief ontwerp.
2. NEN-EN 1993, Ontwerp en berekening van staalconstructies.
3. NEN-EN 1997-1:2012, Geotechnisch ontwerp – Deel 1: Algemene regels.
4. CUR 162, Construeren met grond.
5. CUR 166, Damwandconstructies, deel 1 en 2, 5e druk.
6. CUR 2003-7, Bepaling geotechnische parameters.
7. CROW publicatie 204, Betrouwbaarheid van zettingsprognoses.
8. Nota van inlichtingen nummer 2, 10 december 2012.
9. Nota van inlichtingen nummer 12, 29 maart 2013.
10. Kabels, Specifiek programma van eisen, project R380-Noordring, R380 12 0239, versie 1.2, 11 april 2012.
11. Achtergrondrapport Archeologie, bodem & water - MER Noordring Randstad, definitief versie 2.0, 12 april 2012.
12. Gegevens uit de gebundelde informatie (polderpeilen, stijghoogte,…) uit de GIS omgeving: http://gis.baminfraconsult.nl/apps/001103_Randstad380Noord/.
13. Fugro, Geotechnisch onderzoek (sonderingen) project R380 Noordring-Zuid, 1010-0117-003, oktober-december 2012, januari en februari 2013.
14. Fugro, Laboratoriumrapportages (boringen met peilbuizen) project R380 Noordring-Zuid, 1010-0117-003, december 2012-maart 2013.
15. Hoogheemraadschap van Rijnland, Waterstructuurvisie Haarlemmermeerpolder, 22 september 2010.
16. TNO, Grondwaterkaart van Nederland nummers 24 en 25. Delft: TNO, 1979.
17. www.dinoloket.nl.

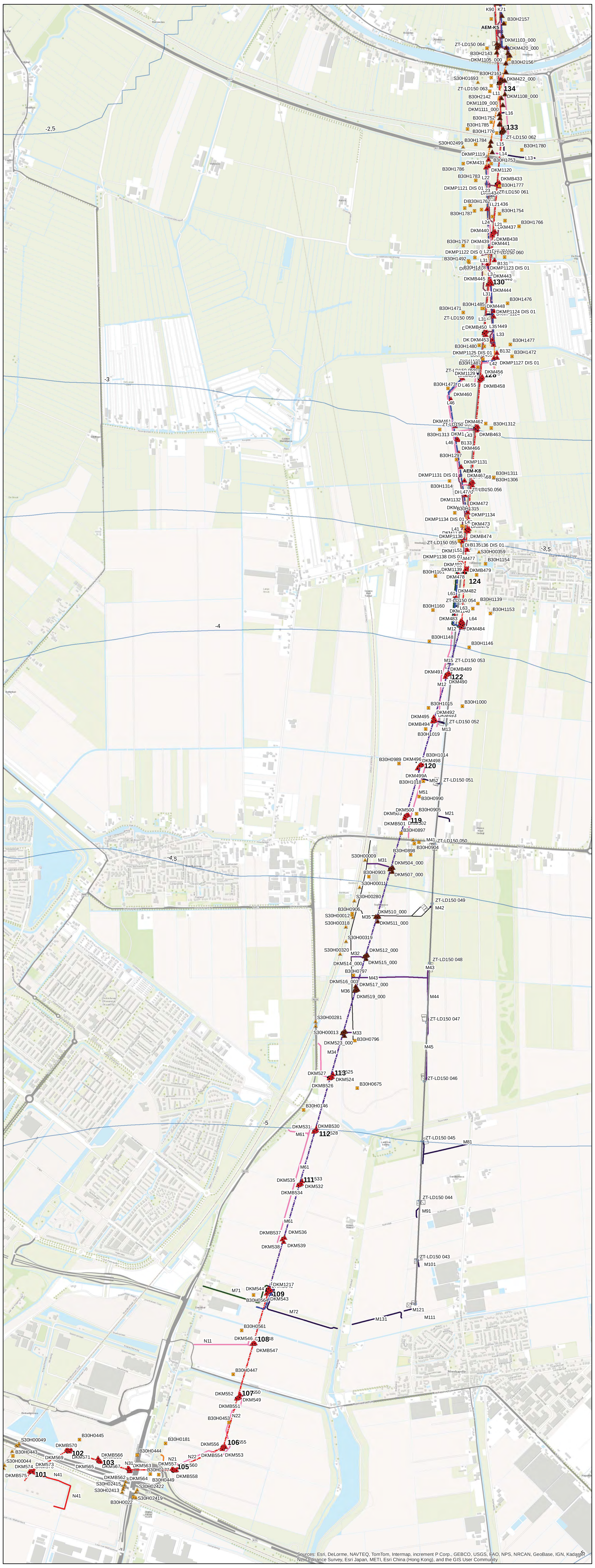
6. BIJLAGEN

Bijlage 1 Geotechnische lengteprofielen

Bijlage 2 Resultaten zettingsberekeningen OSP's

BIJLAGE 1 GEOTECHNISCHE LENGTEPROFIELEN





Legenda

- Dino Sonderingen
- Dino Boringen
- Zesde levering 29-03-2013
- Zevende levering
- Achtste levering 05-07-2013 Fugro
- Sonderingen CPT 30-08-2013 Fugro
- Labaratorium reslutaten 30-08-2013 Fugro
- Sonderingen kabelsleuf 30-08-2013 Fugro
- Sonderingen mast 138 - 141 (30-08-2013) Fugro

Tracé

LAYER

- 0
- kl-nw-150kV boring
- kl-nw-150kV open ontgraving
- kl-nw-150kV_open_ontgraving_gewijzigde_ligging
- kl-nw-380kV boring
- kl-nw-380kV bovengronds - combi
- kl-nw-380kV bovengronds - solo
- kl-nw-380kV open ontgraving
- kl-nw-380kV-boring-gewijzigde-ligging
- kw-nw-mastfundaties
- Moflocaties
- Mastfundaties
- Tracé
- Masten

Bouwwegen

LAYER

- af-nw-bm_200
- gk-nw-damwand
- kd-nw-bm_2000
- vh-nw-toegangsweg-H1-zonder-zettingsbeperkende-maatregelen
- vh-td-bouwweg-F1-rijplaten-lengterichting-op-bestaand-mv
- vh-td-bouwweg-F2-rijplaten-lengterichting-op-zandbed-en-doek
- vh-td-bouwweg-F3-rijplaten-dwarsrichting-op zand-en-doek
- vh-td-bouwweg-F4-rijplaten-lengterichting-op-houtsnippers-in-doek
- vh-td-bouwweg-F5-rijplaten-dwarsrichting-op-houtsnippers-in-doek
- vh-td-bouwweg-G1-fundering-doek-zand-doek
- vh-td-bouwweg-G2-fundering-doek-op-bestaande-verharding

Zones

Layer

- Zone: Gestuurde boring
- Zone: Open ontgraving
- Zone: Werkgebied mast
- Zone: Afbraak mastkop
- Zone: Afbraak mastlichaam
- Zone: Haspelopstelplaats
- Zone: Kraan
- Zone: Trek remstation

Contact: gis@baminfraconsult.nl

LEGENDA

LOCATIE SONDERING

Combining Knowledge and Experience

bam | COFELY FABRICOM GDF SUEZ

Randstad 380kV Noordring

		Controleur: P. de Jager	Vrijgegeven door: A. Hogenboom
Omschrijving: Definitief, Overzichtstekening, Geotechnisch lengteprofiel	Rev.	Wijziging	Datum	Naam
	03			
	02			
	01			
Projekt: Randstad 380kV Noordring	Schaal: 1:5000	Formaat: A0.9		
	Naam: E.J.M. van Tol	Datum: 02-10-2013		

TENNET Taking power further

Tekeningnummer: R3N-TEK-0116 blad 001

AutoCAD filename::

Systnr:

VOOR VERVOLG ZIE BLAD 1 VAN 7

LEGENDA

▽ LOCATIE SONDERING

Combining Knowledge and Experience

Randstad 380kV Noordring

		P. de Jager	A. Hogenboom
		Controleur	Vrijgegeven door
03			
02			
01			
Rev.	Wijziging	Datum	Naam

Omschrijving: Definitief
Overzichtstekening
Geotechnisch lengteprofiel

Projekt: Randstad 380kV Noordring

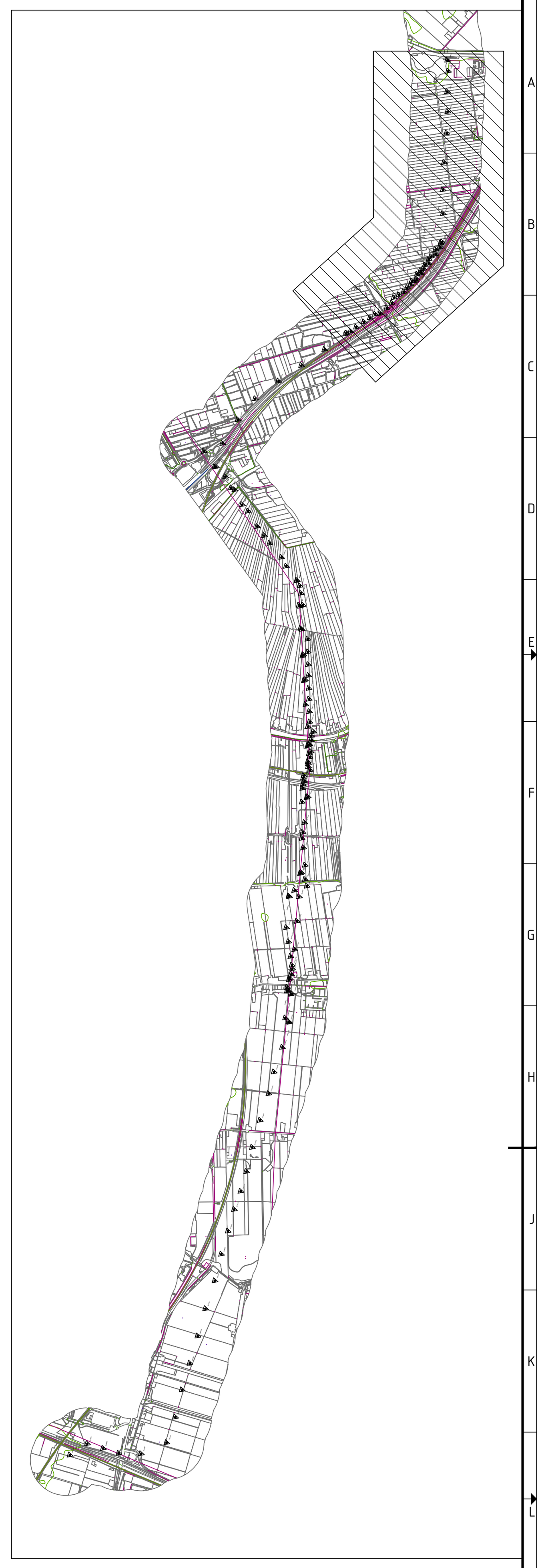
Schaal: VERT 1:200, HOR 1:1000 | Formaat: A0.9

Naam: E.J.M. van Tol | Datum: 02-10-2013

Taking power further

Tekeningnummer: R3N-TEK-0116 blad 002

AutoCAD filename:: | Systnr:



LEGENDA

- ZAND PLEISTOCEEN, LOKAAL SILTIG
- ZAND SILTIG KLEÏG
- BASISVEEN
- VEEN (LOKAAL VEENDIJK, TOPLAAG)
- KLEI SILTIG, LOKAAL ZANDIG
- KLEI HUMEUS, LOKAAL ZANDIG
- KLEI ZANDIG
- KLEI SILTIG, DIEP / LEEM, LOKAAL VENIG

Combining Knowledge and Experience
bam | COFELY FABRICOM GDF SUEZ
Randstad 380kV Noordring

		P. de Jager Controleur	A. Hogenboom Vrijgegeven door
03			
02			
01			
Rev.	Wijziging	Datum	Naam

Definitief

Omschrijving: Geotechnisch lengteprofiel

Projekt: Randstad 380kV Noordring

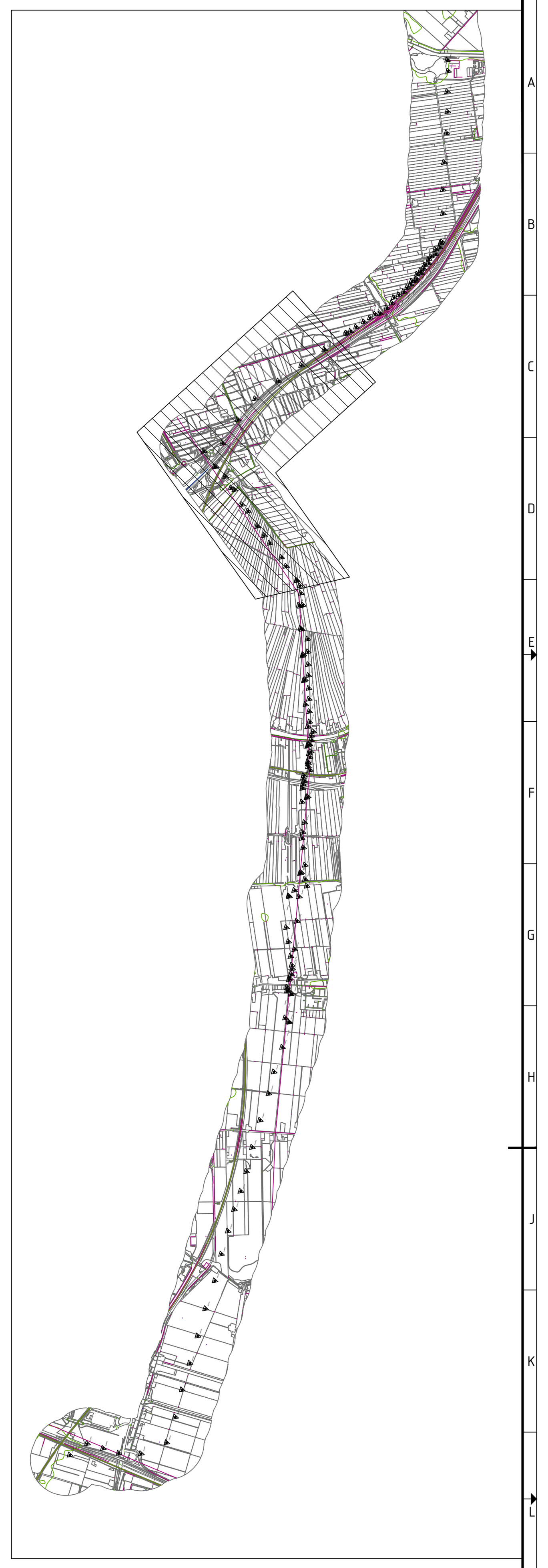
Schaal: VERT 1:200, HOR 1:1000 — Formaat: A0.9
Naam: E.J.M. van Tol — Datum: 02-10-2013

TenneT — Taking power further

Tekeningnummer: R3N-TEK-0116 blad 003

AutoCAD filename:

Systnr:



LEGENDA

- ZAND PLEISTOCEEN, LOKAAL SILTIG
- ZAND SILTIG KLEIÏG
- BASISVEEN
- VEEN (LOKAAL VEENDIJK, TOPLAAG)
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- KLEI HUMEUS, LOKAAL ZANDIG
- KLEI ZANDIG
- KLEI SILTIG, DIEP / LEEM, LOKAAL VENIG

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02			
01			
Rev.	Wijziging	Datum	Naam

Definitief

Omschrijving: Geotechnisch lengteprofiel

Projekt: Randstad 380kV Noordring

Schaal: VERT 1:200, HOR 1:1000 | Formaat: A0.9

Naam: E.J.M. van Tol | Datum: 02-10-2013

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Tekeningnummer: R3N-TEK-0116 blad 004

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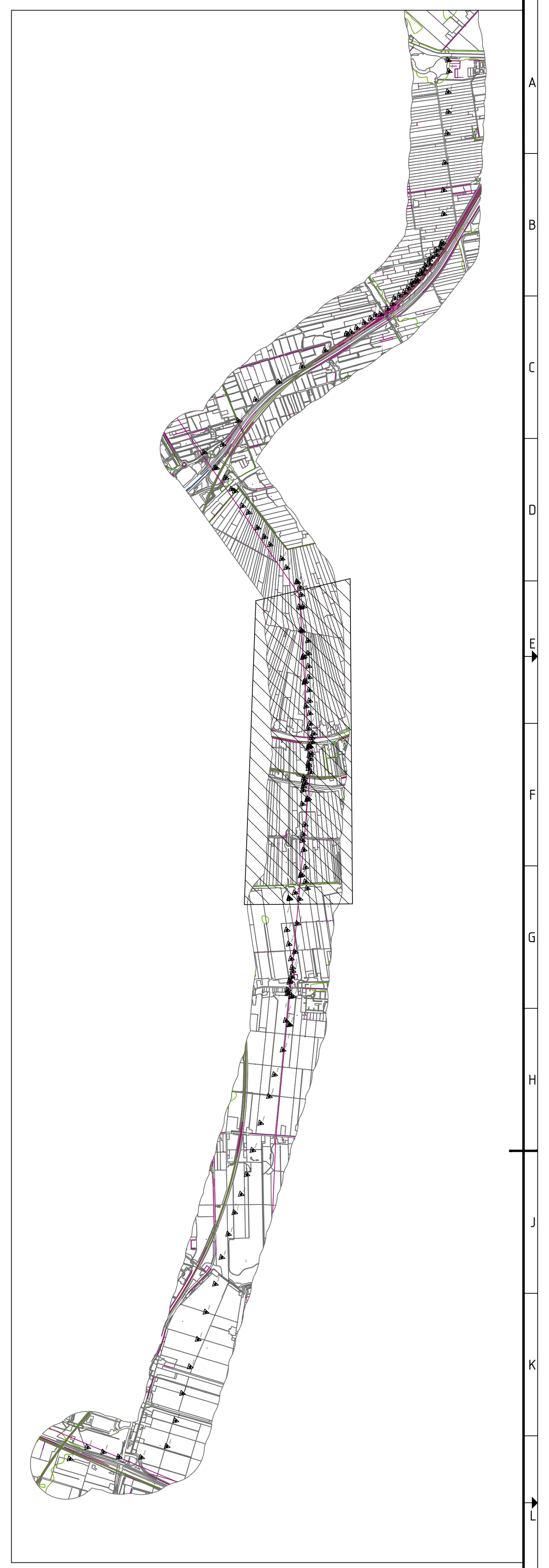

LEGENDA

- ZAND PLEISTOCEEN, LOKAAL SILTIG
- ZAND SILTIG KLEIÏG
- BASISVEEN
- VEEN (LOKAAL VEENDIJK, TOPLAAG)
- KLEI SILTIG, LOKAAL ZANDIG
- KLEI HUMEUS, LOKAAL ZANDIG
- KLEI ZANDIG
- KLEI SILTIG, DIEP / LEEM, LOKAAL VENIG

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Randstad 380kV Noordring

		P. de Jager	A. Hogenboom
		Controleur	Vrijgegeven door
03			
02			
01			
Rev.	Wijziging	Datum	Naam

Definitief

Omschrijving: Geotechnisch lengteprofiel

Projekt: Randstad 380kV Noordring

Schaal: VERT 1:200, HOR 1:1000 | Formaat: A0.9

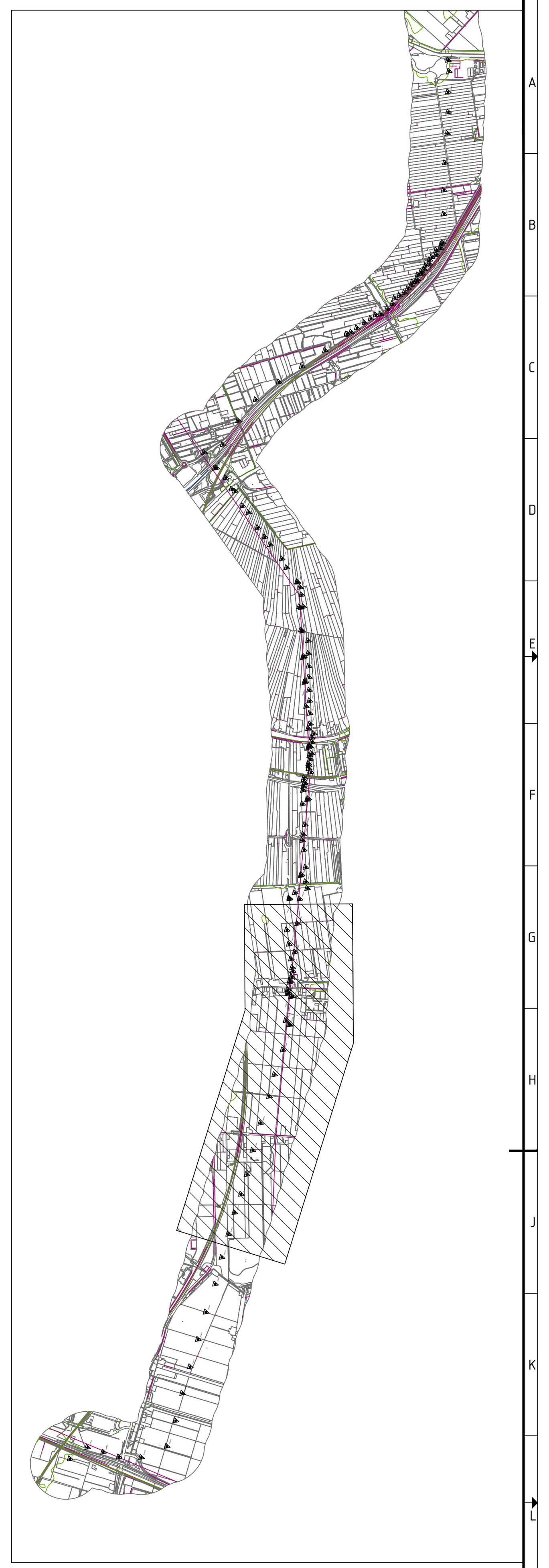
Naam: E.J.M. van Tol | Datum: 02-10-2013

TENNET Taking power further

Tekeningnummer: R3N-TEK-0116 blad 005

AutoCAD filename::

Systnr:



LEGENDA

- ZAND PLEISTOCEEN, LOKAAL SILTIG
- ZAND SILTIG KLEIÏG
- BASISVEEN
- VEEN (LOKAAL VEENDIJK, TOPLAAG)
- KLEI SILTIG, LOKAAL ZANDIG
- KLEI HUMEUS, LOKAAL ZANDIG
- KLEI ZANDIG
- KLEI SILTIG, DIEP / LEEM, LOKAAL VENIG

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Randstad 380kV Noordring

		P. de Jager Controleur	A. Hogenboom Vrijgegeven door
03			
02			
01			
Rev.	Wijziging	Datum	Naam

Definitief

Omschrijving: Geotechnisch lengteprofiel

Projekt: Randstad 380kV Noordring

Schaal: VERT 1:200, HOR 1:1000 | Formaat: A0.9

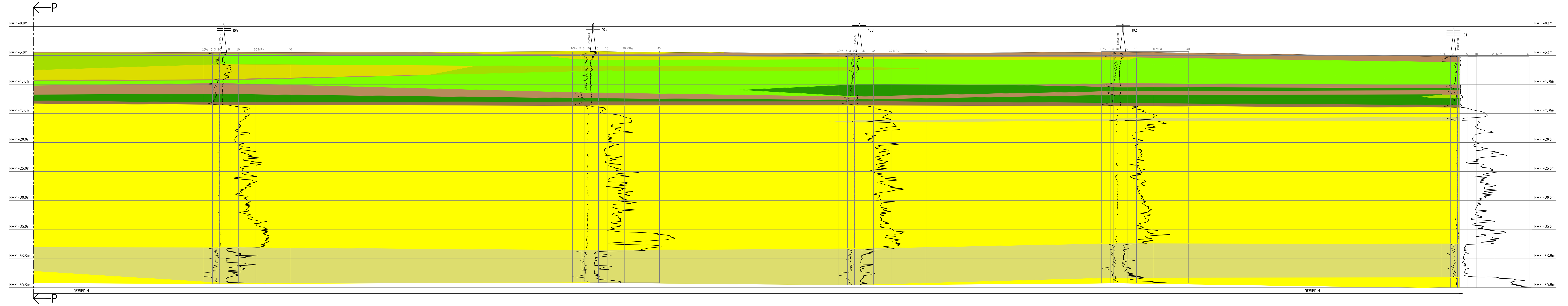
Naam: E.J.M. van Tol | Datum: 02-10-2013

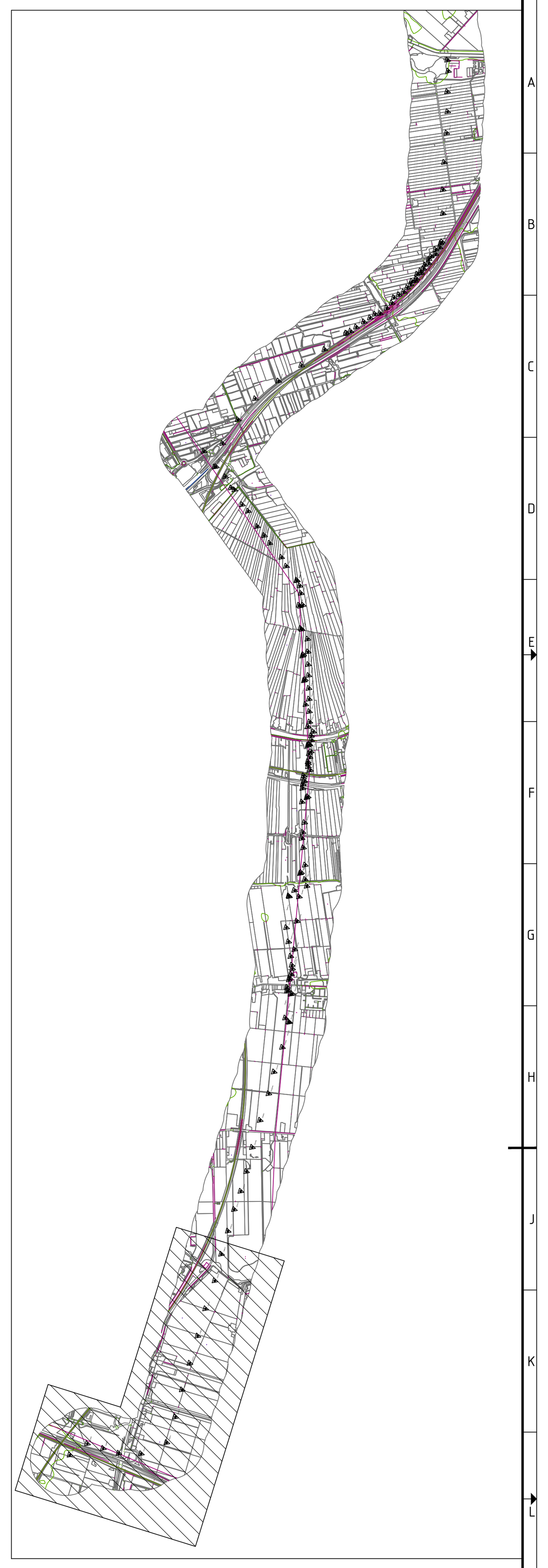
TenneT Taking power further

Tekeningnummer: R3N-TEK-0116 blad 006

AutoCAD filename:: | Systnr:

VOOR VERVOLG ZIE BLAD 6 VAN 7





LEGENDA

- ZAND PLEISTOCEEN, LOKAAL SILTIG
- ZAND SILTIG KLEIÏG
- BASISVEEN
- VEEN (LOKAAL VEENDIJK, TOPLAAG)
- KLEI SILTIG, LOKAAL ZANDIG
- KLEI HUMEUS, LOKAAL ZANDIG
- KLEI ZANDIG
- KLEI SILTIG, DIEP / LEEM, LOKAAL VENIG

Combining Knowledge and Experience
bam COFELY FABRICOM GDF SUEZ
Randstad 380kV Noordring

		P. de Jager Controleur	A. Hogenboom Vrijgegeven door
Definitief	03		
	02		
Omschrijving: Geotechnisch lengteprofiel	01		
	Rev. Wijziging	Datum	Naam
	Schaal: VERT 1:200, HOR 1:1000	Formaat: A0.9	
Projekt: Randstad 380kV Noordring	Naam: E.J.M. van Tol	Datum: 02-10-2013	
TenneT Taking power further	Tekeningnummer: R3N-TEK-0116 blad 007		
	AutoCAD filename:	Systnr:	

BIJLAGE 2 RESULTATEN ZETTINGSBEREKENINGEN OSP'S

Report for D-Settlement 9.3

Settlement Calculations
Developed by Deltares

Company:	BAM Infratechniek
Date of report:	3-10-2013
Time of report:	2:51:14
Date of calculation:	3-10-2013
Time of calculation:	2:50:59
Filename:	C:\..\OSP's\R3N_Perceel 2_OSP-154-0,20 m hoger-1,0 m overhoogte
Project identification:	Randstad 380 Noordring

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2 Echo of the Input

2.1 Layer Boundaries

Boundary number	Co-ordinates [m]				
12 - X -	-50,000	-37,000	37,000	50,000	
12 - Y -	-4,100	-4,100	-4,100	-4,100	
11 - X -	-50,000	-37,000	-37,000	-37,000	37,000
11 - Y -	-5,200	-5,200	-5,100	-4,100	-4,100
11 - X -	50,000				
11 - Y -	-4,100				
10 - X -	-50,000	-37,000	37,000	37,000	37,000
10 - Y -	-5,200	-5,200	-5,000	-4,800	-4,100
10 - X -	50,000				
10 - Y -	-4,100				
9 - X -	-50,000	-37,000	37,000	37,000	37,000
9 - Y -	-5,200	-5,200	-5,100	-5,000	-4,800
9 - X -	37,000	50,000			
9 - Y -	-4,100	-4,100			
8 - X -	-50,000	-37,000	37,000	37,000	50,000
8 - Y -	-5,200	-5,200	-5,100	-5,000	-5,000
7 - X -	-50,000	50,000			
7 - Y -	-5,500	-5,500			
6 - X -	-50,000	-37,500	-19,500	15,000	37,500
6 - Y -	-6,500	-6,500	-6,600	-6,800	-7,000
6 - X -	50,000				
6 - Y -	-7,000				
5 - X -	-50,000	-37,500	-19,500	15,000	37,500
5 - Y -	-7,400	-7,400	-7,500	-7,900	-8,000
5 - X -	50,000				
5 - Y -	-8,000				
4 - X -	-50,000	-37,500	-19,500	15,000	37,500
4 - Y -	-7,600	-7,600	-7,600	-9,500	-9,500
4 - X -	50,000				
4 - Y -	-9,500				
3 - X -	-50,000	-37,500	-19,500	15,000	37,500
3 - Y -	-10,000	-10,000	-10,100	-10,500	-10,600
3 - X -	50,000				
3 - Y -	-10,600				
2 - X -	-50,000	-37,500	-19,500	15,000	37,500
2 - Y -	-10,500	-10,500	-10,500	-10,800	-11,000
2 - X -	50,000				
2 - Y -	-11,000				
1 - X -	-50,000	-37,500	-19,500	15,000	37,500
1 - Y -	-11,400	-11,400	-11,200	-11,700	-11,800
1 - X -	50,000				
1 - Y -	-11,800				
0 - X -	-50,000	50,000			
0 - Y -	-20,000	-20,000			

2.2 PL Lines

PL line number	Co-ordinates [m]				
1 - X -	-50,000	50,000			
1 - Y -	-4,500	-4,500			
2 - X -	-50,000	50,000			
2 - Y -	-3,200	-3,200			

2.3 General Data

Soil model:	Koppejan
Consolidation model:	Darcy
Strain model:	Linear
Groundwater level:	Initial determined by PL-line number 1

Unit weight of water:	10,00 [kN/m³]
Stress distribution	
- Soil:	Buisman
- Loads:	Simulate
End of consolidation:	10950,00 [days]
No maintain profile	
Pc (initial):	Variable parallel to the initial effective stress
Pc (per step):	Automatic increased to the final effective stresses
Creep rate reference time:	1,000 [days]
No imaginary surface	
With submerging	
(only for non uniform loads)	
- Iteration stop criterium :	0,10 [m]
Load column width	
- Non-Uniform Loads :	1,00 [m]
- Trapezoidal Loads :	1,00 [m]

2.4 Soil Profiles

Layer number	Material name	PL-line top	PL-line bottom
12	veen toplaag	1	1
11	verbetering veen top...	1	1
10	verbetering veen	1	1
9	veen toplaag	1	1
8	veen-A4 (Z)	1	1
7	veen-A4 (Z)	1	1
6	klei humeus-A4 (N)	99	99
5	klei zandig-A4 (N)	99	99
4	zand kleiig-A4 (N)	99	99
3	klei humeus-A4 (N)	99	99
2	basisveen-A4 (N)	99	99
1	pleistoceen-A4 (N)	2	2

2.5 Soil Properties

Layer number	Drained	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
12	No	13,00	13,00
11	Yes	13,00	13,00
10	Yes	10,50	10,50
9	No	13,00	13,00
8	No	10,50	10,50
7	No	10,50	10,50
6	No	13,20	13,20
5	No	17,40	17,40
4	No	17,50	19,00
3	No	13,20	13,20
2	No	10,80	10,80
1	Yes	18,00	20,00

Layer number	Storage type	Vert. consolid. coefficient Cv [m²/s]	Vertical permeability [m/s]	Permeability strain mod. [m/s]	Initial vertical permeability [m/s]
12	Vert. cons.	7,70E-08	-	-	-
11	Vert. cons.	-	-	-	-
10	Vert. cons.	-	-	-	-
9	Vert. cons.	7,70E-08	-	-	-
8	Vert. cons.	3,00E-08	-	-	-
7	Vert. cons.	3,00E-08	-	-	-
6	Vert. cons.	7,70E-08	-	-	-
5	Vert. cons.	2,00E-07	-	-	-
4	Vert. cons.	5,50E-06	-	-	-
3	Vert. cons.	7,70E-08	-	-	-
2	Vert. cons.	4,70E-08	-	-	-
1	Vert. cons.	-	-	-	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
12	-	10,00	-
11	-	-	1,00
10	-	-	1,00
9	-	10,00	-
8	-	10,00	-
7	-	10,00	-
6	-	10,00	-
5	-	10,00	-
4	-	-	1,00
3	-	10,00	-
2	-	10,00	-
1	-	-	1,00

Layer	Primary compr. coeff.		Secular compr. coef.		Swell constants	
number	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
12	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
11	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
10	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
9	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
8	3,32E+01	5,70E+00	1,14E+02	2,28E+01	3,32E+01	2,28E+01
7	3,32E+01	5,70E+00	1,14E+02	2,28E+01	3,32E+01	2,28E+01
6	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
5	7,06E+01	2,87E+01	3,21E+02	1,95E+02	7,06E+01	1,95E+02
4	4,00E+02	2,00E+02	1,00E+09	1,00E+09	4,00E+02	1,00E+09
3	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
2	5,14E+01	7,20E+00	1,11E+02	2,76E+01	5,14E+01	2,76E+01
1	1,80E+03	6,00E+02	1,00E+09	1,00E+09	1,00E+09	1,00E+09

2.6 Non-Uniform Loads

Load number	Time [days]	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
1	0	5,00	17,00
2	0	0,00	10,00
3	0	18,00	20,00
4	0	18,00	20,00

Load number	Co-ordinates [m]					
1 - X -	-37,00	-37,00	37,00	37,00		
1 - Y -	-4,10	-5,10	-5,10	-4,10		
2 - X -	-37,00	37,00				
2 - Y -	-4,10	-4,10				
3 - X -	-37,00	-37,00	37,00	37,00		
3 - Y -	-4,10	-3,85	-3,85	-4,10		
4 - X -	-37,00	-37,00	37,00	37,00		
4 - Y -	-4,10	-3,10	-3,10	-4,10		

2.7 Verticals

Vertical number	X co-ordinates [m]				
1 - 5	-36,000	-30,000	-19,500	-10,000	0,000
6 - 9	10,000	15,000	30,000	36,000	

Discretisation = 100

3 Results per Vertical

3.1 Results for Vertical 1 (X = -36,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,178
-4,200	5,800	-4,200	4,500	0,177
-4,300	7,099	-4,300	4,499	0,175
-4,400	8,394	-4,400	4,494	0,174
-4,500	9,683	-4,500	4,483	0,174
-4,600	9,964	-4,500	4,464	0,173
-4,649	10,097	-4,500	4,451	0,173
-4,700	10,235	-4,500	4,435	0,172
-4,800	10,496	-4,500	4,396	0,172
-4,900	10,750	-4,500	4,350	0,171
-5,000	10,997	-4,500	4,297	0,170
-5,100	17,795	-4,500	10,795	0,170
-5,197	18,027	-4,500	10,736	0,169
-5,197	18,027	-4,500	10,735	0,169
-5,198	18,027	-4,500	10,735	0,169
-5,199	18,027	-4,500	10,735	0,169
-5,199	18,027	-4,500	10,735	0,169
-5,349	18,004	-4,500	10,636	0,148
-5,500	17,966	-4,500	10,522	0,131
-5,500	17,966	-4,500	10,522	0,131
-6,004	17,660	-4,500	9,964	0,088
-6,508	17,240	-4,500	9,293	0,062
-6,508	17,240	-4,500	9,293	0,062
-6,958	16,954	-4,380	8,766	0,042
-7,408	16,768	-4,260	8,341	0,024
-7,408	16,768	-4,260	8,341	0,024
-7,504	17,143	-4,234	8,262	0,022
-7,600	17,522	-4,209	8,187	0,021
-7,600	17,522	-4,209	8,187	0,021
-8,204	20,951	-4,048	7,790	0,019
-8,804	24,455	-3,888	7,494	0,018
-9,408	28,051	-3,727	7,264	0,017
-10,008	31,671	-3,567	7,084	0,016
-10,008	31,671	-3,567	7,084	0,016
-10,254	31,739	-3,501	7,020	0,014
-10,500	31,812	-3,436	6,962	0,011
-10,500	31,812	-3,436	6,962	0,011
-10,942	30,894	-3,318	6,869	0,009
-11,383	29,988	-3,200	6,787	0,003
-11,383	29,988	-3,200	6,787	0,003
-12,092	36,960	-3,200	6,676	0,003
-13,092	46,834	-3,200	6,550	0,002
-14,092	56,735	-3,200	6,451	0,002
-15,092	66,655	-3,200	6,371	0,001
-15,692	72,614	-3,200	6,330	0,001
-16,400	79,654	-3,200	6,286	0,001
-17,400	89,601	-3,200	6,233	0,001
-18,400	99,555	-3,200	6,188	0,000
-19,400	109,516	-3,200	6,149	0,000
-20,000	115,495	-3,200	6,127	0,000

3.2 Results for Vertical 2 (X = -30,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,276
-4,200	5,800	-4,200	4,500	0,274
-4,300	7,100	-4,300	4,500	0,273
-4,400	8,400	-4,400	4,500	0,272
-4,500	9,700	-4,500	4,500	0,271
-4,600	10,000	-4,500	4,500	0,271
-4,641	10,122	-4,500	4,500	0,270
-4,700	10,300	-4,500	4,500	0,270
-4,800	10,600	-4,500	4,500	0,269
-4,900	10,900	-4,500	4,500	0,268
-5,000	11,200	-4,500	4,500	0,268
-5,100	18,219	-4,500	11,219	0,267
-5,181	18,462	-4,500	11,219	0,266
-5,181	18,462	-4,500	11,219	0,266
-5,186	18,464	-4,500	11,219	0,266
-5,191	18,467	-4,500	11,219	0,266
-5,191	18,467	-4,500	11,219	0,266
-5,345	18,544	-4,500	11,218	0,243
-5,500	18,620	-4,500	11,218	0,223
-5,500	18,620	-4,500	11,218	0,223
-6,021	18,876	-4,500	11,213	0,172
-6,542	19,126	-4,500	11,202	0,132
-6,542	19,126	-4,500	11,202	0,132
-6,992	19,326	-4,377	11,187	0,098
-7,442	19,519	-4,255	11,165	0,065
-7,442	19,519	-4,255	11,165	0,065
-7,521	19,884	-4,233	11,161	0,064
-7,600	20,249	-4,212	11,156	0,062
-7,600	20,250	-4,212	11,156	0,062
-8,221	24,098	-4,043	11,107	0,060
-8,821	27,801	-3,879	11,043	0,058
-9,442	31,615	-3,710	10,960	0,056
-10,042	35,286	-3,547	10,864	0,055
-10,042	35,286	-3,547	10,864	0,055
-10,271	35,355	-3,485	10,824	0,049
-10,500	35,423	-3,422	10,783	0,042
-10,500	35,423	-3,422	10,783	0,042
-10,908	34,560	-3,311	10,704	0,027
-11,317	33,692	-3,200	10,622	0,005
-11,317	33,693	-3,200	10,622	0,005
-12,058	40,952	-3,200	10,465	0,004
-13,058	50,732	-3,200	10,245	0,003
-14,058	60,510	-3,200	10,023	0,002
-15,058	70,293	-3,200	9,806	0,002
-15,658	76,167	-3,200	9,680	0,002
-16,400	83,432	-3,200	9,529	0,001
-17,400	93,239	-3,200	9,336	0,001
-18,400	103,058	-3,200	9,154	0,000
-19,400	112,889	-3,200	8,985	0,000
-20,000	118,793	-3,200	8,889	0,000

3.3 Results for Vertical 3 (X = -19,50 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,286
-4,200	5,800	-4,200	4,500	0,285
-4,300	7,100	-4,300	4,500	0,283
-4,400	8,400	-4,400	4,500	0,282
-4,500	9,700	-4,500	4,500	0,282

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	10,000	-4,500	4,500	0,281
-4,626	10,079	-4,500	4,500	0,281
-4,700	10,300	-4,500	4,500	0,280
-4,800	10,600	-4,500	4,500	0,279
-4,900	10,900	-4,500	4,500	0,279
-5,000	11,200	-4,500	4,500	0,278
-5,100	18,245	-4,500	11,245	0,277
-5,153	18,403	-4,500	11,245	0,277
-5,153	18,403	-4,500	11,245	0,277
-5,165	18,409	-4,500	11,245	0,277
-5,176	18,415	-4,500	11,245	0,277
-5,176	18,415	-4,500	11,245	0,277
-5,338	18,496	-4,500	11,245	0,252
-5,500	18,577	-4,500	11,245	0,231
-5,500	18,577	-4,500	11,245	0,231
-6,050	18,852	-4,500	11,245	0,178
-6,600	19,127	-4,500	11,245	0,135
-6,600	19,127	-4,500	11,245	0,135
-7,050	19,294	-4,373	11,245	0,101
-7,500	19,462	-4,246	11,244	0,067
-7,500	19,462	-4,246	11,244	0,067
-7,550	19,691	-4,232	11,244	0,066
-7,600	19,919	-4,217	11,244	0,065
-7,600	19,919	-4,217	11,244	0,065
-8,250	23,931	-4,034	11,242	0,062
-8,850	27,632	-3,864	11,239	0,061
-9,500	31,641	-3,680	11,235	0,059
-10,100	35,339	-3,511	11,229	0,058
-10,100	35,339	-3,511	11,229	0,058
-10,300	35,412	-3,454	11,226	0,050
-10,500	35,484	-3,398	11,224	0,042
-10,500	35,484	-3,398	11,224	0,042
-10,850	34,769	-3,299	11,219	0,027
-11,200	34,054	-3,200	11,213	0,005
-11,200	34,054	-3,200	11,213	0,005
-12,000	42,038	-3,200	11,196	0,004
-13,000	52,010	-3,200	11,168	0,003
-14,000	61,974	-3,200	11,132	0,003
-15,000	71,931	-3,200	11,089	0,002
-15,600	77,900	-3,200	11,059	0,002
-16,400	85,856	-3,200	11,014	0,001
-17,400	95,794	-3,200	10,952	0,001
-18,400	105,725	-3,200	10,883	0,001
-19,400	115,651	-3,200	10,809	0,000
-20,000	121,603	-3,200	10,761	0,000

3.4 Results for Vertical 4 (X = -10,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,302
-4,200	5,800	-4,200	4,500	0,301
-4,300	7,100	-4,300	4,500	0,300
-4,400	8,400	-4,400	4,500	0,299
-4,500	9,700	-4,500	4,500	0,298
-4,600	10,000	-4,500	4,500	0,297
-4,614	10,041	-4,500	4,500	0,297
-4,700	10,300	-4,500	4,500	0,296
-4,800	10,600	-4,500	4,500	0,296
-4,900	10,900	-4,500	4,500	0,295
-5,000	11,200	-4,500	4,500	0,294

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-5,100	18,274	-4,500	11,274	0,294
-5,127	18,355	-4,500	11,274	0,293
-5,127	18,355	-4,500	11,274	0,293
-5,145	18,364	-4,500	11,274	0,293
-5,164	18,373	-4,500	11,274	0,293
-5,164	18,373	-4,500	11,274	0,293
-5,332	18,457	-4,500	11,274	0,268
-5,500	18,541	-4,500	11,274	0,246
-5,500	18,541	-4,500	11,274	0,246
-6,078	18,830	-4,500	11,274	0,194
-6,655	19,118	-4,500	11,274	0,148
-6,655	19,118	-4,500	11,274	0,148
-7,133	19,321	-4,367	11,274	0,112
-7,610	19,523	-4,235	11,273	0,076
-7,610	19,523	-4,235	11,273	0,076
-7,867	20,709	-4,164	11,273	0,070
-8,123	21,895	-4,092	11,273	0,064
-8,123	21,895	-4,092	11,273	0,064
-8,667	25,277	-3,941	11,273	0,062
-9,167	28,388	-3,803	11,272	0,061
-9,710	31,769	-3,652	11,271	0,060
-10,210	34,880	-3,513	11,270	0,059
-10,210	34,880	-3,513	11,270	0,059
-10,396	34,958	-3,461	11,269	0,052
-10,583	35,037	-3,410	11,268	0,045
-10,583	35,037	-3,410	11,268	0,045
-10,960	34,290	-3,305	11,267	0,029
-11,338	33,542	-3,200	11,266	0,005
-11,338	33,542	-3,200	11,266	0,005
-12,069	40,850	-3,200	11,262	0,004
-13,069	50,842	-3,200	11,254	0,004
-14,069	60,833	-3,200	11,245	0,003
-15,069	70,820	-3,200	11,232	0,002
-15,669	76,811	-3,200	11,223	0,002
-16,400	84,109	-3,200	11,210	0,001
-17,400	94,088	-3,200	11,189	0,001
-18,400	104,064	-3,200	11,164	0,001
-19,400	114,035	-3,200	11,135	0,000
-20,000	120,016	-3,200	11,116	0,000

3.5 Results for Vertical 5 (X = 0,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,319
-4,200	5,800	-4,200	4,500	0,317
-4,300	7,100	-4,300	4,500	0,316
-4,400	8,400	-4,400	4,500	0,315
-4,500	9,700	-4,500	4,500	0,314
-4,600	10,000	-4,500	4,500	0,313
-4,700	10,300	-4,500	4,500	0,313
-4,800	10,600	-4,500	4,500	0,312
-4,900	10,900	-4,500	4,500	0,311
-5,000	11,200	-4,500	4,500	0,311
-5,100	18,303	-4,500	11,303	0,310
-5,100	18,303	-4,500	11,303	0,310
-5,125	18,315	-4,500	11,303	0,310
-5,150	18,328	-4,500	11,303	0,309
-5,150	18,328	-4,500	11,303	0,309
-5,325	18,415	-4,500	11,303	0,283
-5,500	18,502	-4,500	11,303	0,261

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-5,500	18,502	-4,500	11,303	0,261
-6,107	18,805	-4,500	11,303	0,210
-6,713	19,108	-4,500	11,303	0,162
-6,713	19,108	-4,500	11,303	0,162
-7,220	19,348	-4,362	11,302	0,123
-7,726	19,588	-4,224	11,302	0,085
-7,726	19,588	-4,224	11,302	0,085
-8,200	21,803	-4,095	11,302	0,074
-8,674	24,018	-3,965	11,302	0,064
-8,674	24,019	-3,965	11,302	0,064
-9,500	29,201	-3,740	11,301	0,062
-10,326	34,383	-3,515	11,300	0,060
-10,326	34,383	-3,515	11,300	0,060
-10,498	34,465	-3,468	11,300	0,055
-10,670	34,546	-3,422	11,300	0,048
-10,670	34,546	-3,422	11,300	0,048
-11,076	33,762	-3,311	11,299	0,031
-11,483	32,979	-3,200	11,298	0,005
-11,483	32,979	-3,200	11,298	0,005
-12,141	39,564	-3,200	11,296	0,004
-13,141	49,560	-3,200	11,291	0,004
-14,141	59,554	-3,200	11,286	0,003
-15,141	69,546	-3,200	11,278	0,002
-15,741	75,540	-3,200	11,272	0,002
-16,400	82,120	-3,200	11,265	0,001
-17,400	92,107	-3,200	11,252	0,001
-18,400	102,091	-3,200	11,236	0,001
-19,400	112,073	-3,200	11,218	0,000
-20,000	118,060	-3,200	11,205	0,000

3.6 Results for Vertical 6 (X = 10,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,334
-4,200	5,800	-4,200	4,500	0,333
-4,300	7,100	-4,300	4,500	0,331
-4,400	8,400	-4,400	4,500	0,331
-4,500	9,700	-4,500	4,500	0,330
-4,586	9,959	-4,500	4,500	0,329
-4,600	10,000	-4,500	4,500	0,329
-4,700	10,300	-4,500	4,500	0,328
-4,800	10,600	-4,500	4,500	0,328
-4,900	10,900	-4,500	4,500	0,327
-5,000	11,200	-4,500	4,500	0,326
-5,073	11,419	-4,500	4,500	0,326
-5,073	11,419	-4,500	4,500	0,326
-5,100	18,263	-4,500	11,330	0,326
-5,105	18,265	-4,500	11,330	0,325
-5,136	18,281	-4,500	11,330	0,325
-5,136	18,281	-4,500	11,330	0,325
-5,318	18,371	-4,500	11,330	0,298
-5,500	18,462	-4,500	11,330	0,276
-5,500	18,462	-4,500	11,330	0,276
-6,136	18,778	-4,500	11,330	0,226
-6,771	19,095	-4,500	11,330	0,175
-6,771	19,095	-4,500	11,330	0,175
-7,307	19,375	-4,356	11,330	0,133
-7,842	19,655	-4,213	11,330	0,093
-7,842	19,655	-4,213	11,330	0,093
-8,533	22,920	-4,028	11,329	0,077

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-9,225	26,184	-3,843	11,328	0,065
-9,225	26,184	-3,843	11,328	0,065
-9,833	30,032	-3,680	11,327	0,063
-10,442	33,879	-3,517	11,325	0,062
-10,442	33,879	-3,517	11,325	0,062
-10,599	33,961	-3,475	11,324	0,057
-10,757	34,043	-3,433	11,324	0,051
-10,757	34,043	-3,433	11,324	0,051
-11,192	33,224	-3,316	11,322	0,033
-11,628	32,406	-3,200	11,319	0,005
-11,628	32,406	-3,200	11,319	0,005
-12,614	42,261	-3,200	11,313	0,004
-13,614	52,252	-3,200	11,303	0,003
-14,614	62,240	-3,200	11,291	0,003
-15,614	72,224	-3,200	11,276	0,002
-15,814	74,221	-3,200	11,272	0,002
-16,800	84,064	-3,200	11,253	0,001
-17,800	94,040	-3,200	11,230	0,001
-18,800	104,013	-3,200	11,202	0,000
-19,800	113,982	-3,200	11,171	0,000
-20,000	115,975	-3,200	11,164	0,000

3.7 Results for Vertical 7 (X = 15,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,342
-4,200	5,800	-4,200	4,500	0,340
-4,300	7,100	-4,300	4,500	0,339
-4,400	8,400	-4,400	4,500	0,338
-4,500	9,700	-4,500	4,500	0,337
-4,580	9,939	-4,500	4,500	0,337
-4,600	10,000	-4,500	4,500	0,336
-4,700	10,300	-4,500	4,500	0,336
-4,800	10,600	-4,500	4,500	0,335
-4,900	10,900	-4,500	4,500	0,334
-5,000	11,200	-4,500	4,500	0,334
-5,059	11,378	-4,500	4,500	0,333
-5,059	11,378	-4,500	4,500	0,333
-5,095	11,396	-4,500	4,500	0,333
-5,100	18,241	-4,500	11,343	0,333
-5,130	18,256	-4,500	11,343	0,333
-5,130	18,256	-4,500	11,343	0,333
-5,315	18,348	-4,500	11,343	0,305
-5,500	18,440	-4,500	11,343	0,282
-5,500	18,440	-4,500	11,343	0,282
-6,150	18,762	-4,500	11,342	0,233
-6,800	19,086	-4,500	11,342	0,181
-6,800	19,086	-4,500	11,342	0,181
-7,350	19,385	-4,354	11,341	0,138
-7,900	19,685	-4,208	11,340	0,096
-7,900	19,685	-4,208	11,340	0,096
-8,700	23,481	-3,996	11,338	0,079
-9,500	27,277	-3,783	11,335	0,065
-9,500	27,277	-3,783	11,335	0,065
-10,000	30,448	-3,651	11,332	0,064
-10,500	33,618	-3,518	11,329	0,063
-10,500	33,618	-3,518	11,329	0,063
-10,650	33,699	-3,478	11,327	0,058
-10,800	33,780	-3,439	11,326	0,053
-10,800	33,780	-3,439	11,326	0,053

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-11,250	32,943	-3,319	11,322	0,034
-11,700	32,106	-3,200	11,317	0,005
-11,700	32,106	-3,200	11,317	0,005
-12,650	41,594	-3,200	11,305	0,004
-13,650	51,576	-3,200	11,288	0,003
-14,650	61,554	-3,200	11,265	0,003
-15,650	71,527	-3,200	11,238	0,002
-15,850	73,520	-3,200	11,232	0,002
-16,800	82,988	-3,200	11,200	0,001
-17,800	92,949	-3,200	11,161	0,001
-18,800	102,905	-3,200	11,116	0,000
-19,800	112,855	-3,200	11,067	0,000
-20,000	114,845	-3,200	11,056	0,000

3.8 Results for Vertical 8 (X = 30,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,334
-4,200	5,800	-4,200	4,500	0,332
-4,300	7,100	-4,300	4,500	0,331
-4,400	8,400	-4,400	4,500	0,330
-4,500	9,700	-4,500	4,500	0,329
-4,559	9,878	-4,500	4,500	0,329
-4,600	10,000	-4,500	4,500	0,328
-4,700	10,300	-4,500	4,500	0,328
-4,800	10,600	-4,500	4,500	0,327
-4,900	10,900	-4,500	4,500	0,326
-5,000	11,200	-4,500	4,500	0,326
-5,019	11,257	-4,500	4,500	0,325
-5,019	11,257	-4,500	4,500	0,325
-5,064	11,279	-4,500	4,500	0,325
-5,100	18,117	-4,500	11,320	0,325
-5,109	18,122	-4,500	11,320	0,325
-5,109	18,122	-4,500	11,320	0,325
-5,305	18,218	-4,500	11,319	0,295
-5,500	18,314	-4,500	11,318	0,272
-5,500	18,314	-4,500	11,318	0,272
-6,217	18,661	-4,500	11,310	0,220
-6,933	18,997	-4,499	11,289	0,163
-6,933	18,997	-4,499	11,289	0,163
-7,450	19,235	-4,360	11,263	0,124
-7,967	19,462	-4,222	11,226	0,085
-7,967	19,462	-4,222	11,226	0,085
-8,733	22,997	-4,015	11,149	0,068
-9,500	26,505	-3,809	11,045	0,055
-9,500	26,505	-3,809	11,045	0,055
-10,033	29,784	-3,666	10,958	0,054
-10,567	33,053	-3,522	10,861	0,053
-10,567	33,053	-3,522	10,861	0,053
-10,750	33,111	-3,473	10,826	0,049
-10,933	33,169	-3,424	10,790	0,044
-10,933	33,169	-3,424	10,790	0,044
-11,350	32,298	-3,312	10,704	0,028
-11,767	31,423	-3,200	10,616	0,005
-11,767	31,423	-3,200	10,616	0,005
-12,683	40,388	-3,200	10,414	0,004
-13,683	50,164	-3,200	10,190	0,003
-14,683	59,942	-3,200	9,968	0,002
-15,683	69,727	-3,200	9,753	0,002
-15,883	71,686	-3,200	9,712	0,002

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-16,800	80,667	-3,200	9,527	0,001
-17,800	90,476	-3,200	9,336	0,001
-18,800	100,298	-3,200	9,157	0,000
-19,800	110,132	-3,200	8,991	0,000
-20,000	112,100	-3,200	8,959	0,000

3.9 Results for Vertical 9 (X = 36,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,100	4,501	-4,100	4,500	0,210
-4,200	5,800	-4,200	4,500	0,209
-4,300	7,099	-4,300	4,499	0,207
-4,400	8,394	-4,400	4,494	0,206
-4,500	9,683	-4,500	4,483	0,206
-4,551	9,828	-4,500	4,474	0,205
-4,600	9,964	-4,500	4,464	0,205
-4,700	10,235	-4,500	4,435	0,204
-4,800	10,496	-4,500	4,396	0,204
-4,900	10,750	-4,500	4,350	0,203
-5,000	10,997	-4,500	4,297	0,202
-5,003	11,003	-4,500	4,295	0,202
-5,003	11,003	-4,500	4,295	0,202
-5,052	11,000	-4,500	4,267	0,202
-5,100	17,614	-4,500	10,857	0,202
-5,101	17,614	-4,500	10,856	0,202
-5,101	17,614	-4,500	10,856	0,202
-5,301	17,588	-4,500	10,731	0,174
-5,500	17,540	-4,500	10,584	0,152
-5,500	17,540	-4,500	10,584	0,152
-6,243	17,027	-4,500	9,701	0,109
-6,987	16,488	-4,500	8,790	0,070
-6,987	16,488	-4,500	8,790	0,070
-7,490	16,272	-4,364	8,325	0,049
-7,993	16,162	-4,227	7,965	0,032
-7,993	16,162	-4,227	7,965	0,032
-8,747	19,301	-4,024	7,567	0,021
-9,500	22,553	-3,820	7,281	0,012
-9,500	22,553	-3,820	7,281	0,012
-10,047	25,834	-3,672	7,120	0,011
-10,593	29,143	-3,524	6,988	0,010
-10,593	29,143	-3,524	6,988	0,010
-10,790	29,199	-3,471	6,946	0,010
-10,987	29,257	-3,418	6,907	0,010
-10,987	29,257	-3,418	6,907	0,010
-11,390	28,415	-3,309	6,833	0,009
-11,793	27,581	-3,200	6,767	0,003
-11,793	27,582	-3,200	6,767	0,003
-12,697	36,491	-3,200	6,643	0,003
-13,697	46,383	-3,200	6,534	0,002
-14,697	56,296	-3,200	6,447	0,002
-15,697	66,224	-3,200	6,376	0,001
-15,897	68,211	-3,200	6,363	0,001
-16,800	77,192	-3,200	6,311	0,001
-17,800	87,142	-3,200	6,261	0,001
-18,800	97,099	-3,200	6,218	0,000
-19,800	107,062	-3,200	6,180	0,000
-20,000	109,055	-3,200	6,173	0,000

4 Settlements

4.1 Settlements

Vertical number	X co-ordinate [m]	Z co-ordinate [m]	Surface level [m]	Settlement [m]
1	-36,00	0,00	-4,10	0,178
2	-30,00	0,00	-4,10	0,276
3	-19,50	0,00	-4,10	0,286
4	-10,00	0,00	-4,10	0,302
5	0,00	0,00	-4,10	0,319
6	10,00	0,00	-4,10	0,334
7	15,00	0,00	-4,10	0,342
8	30,00	0,00	-4,10	0,334
9	36,00	0,00	-4,10	0,210

4.2 Residual Times

Vertical number	Time [days]	Settlement [m]	Part of final settlement [%]	Residual settlements [m]
1	365	0,183	102,718	-0,005
2	365	0,240	87,067	0,036
3	365	0,249	87,063	0,037
4	365	0,253	83,816	0,049
5	365	0,257	80,646	0,062
6	365	0,260	77,666	0,075
7	365	0,261	76,275	0,081
8	365	0,253	75,755	0,081
9	365	0,188	89,362	0,022

5 Warnings and errors

List of non-fatal warnings and errors generated during calculation.

1 Model Koppejan is not ideal for unloading (e.g. load removal, temporary dewatering, gradual submerging). If As is much larger than Cs', unloading will yield almost no effect on creep. Switch to the NEN-Bjerrum or abc Isotache model for improved predictions.

2 Non-uniform load [1]: Co-ordinate is below surface (2)

3 Non-uniform load [1]: Co-ordinate is below surface (3)

End of Report

Report for D-Settlement 9.3

Settlement Calculations
Developed by Deltares

Company:	BAM Infratechniek
Date of report:	3-10-2013
Time of report:	2:50:30
Date of calculation:	3-10-2013
Time of calculation:	2:50:15
Filename:	C:\..\OSP's\R3N_Perceel 2_OSP-153-0,20 m hoger-1,0 m overhoogte
Project identification:	Randstad 380 Noordring

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2 Echo of the Input

2.1 Layer Boundaries

Boundary number	Co-ordinates [m]				
17 - X -	-50,000	-37,000	18,000	33,000	37,000
17 - Y -	-1,700	-1,700	-1,700	-1,700	-1,700
17 - X -	50,000				
17 - Y -	-1,700				
16 - X -	-50,000	-37,000	-37,000	18,000	33,000
16 - Y -	-2,300	-2,300	-1,700	-1,700	-1,700
16 - X -	37,000	50,000			
16 - Y -	-1,700	-1,700			
15 - X -	-50,000	-37,000	-17,000	18,000	33,000
15 - Y -	-2,300	-2,300	-2,300	-2,300	-2,300
15 - X -	37,000	37,000	50,000		
15 - Y -	-2,300	-1,700	-1,700		
14 - X -	-50,000	-37,000	-37,000	37,000	37,000
14 - Y -	-2,300	-2,300	-2,650	-2,650	-2,300
14 - X -	37,000	50,000			
14 - Y -	-1,700	-1,700			
13 - X -	-50,000	-37,000	-37,000	37,000	37,000
13 - Y -	-2,300	-2,300	-2,650	-2,650	-2,300
13 - X -	50,000				
13 - Y -	-2,300				
12 - X -	-50,000	-17,000	18,000	33,000	50,000
12 - Y -	-3,800	-3,800	-3,800	-3,500	-3,500
11 - X -	-50,000	-17,000	18,000	33,000	50,000
11 - Y -	-6,500	-6,500	-6,500	-4,700	-4,700
10 - X -	-50,000	-17,000	18,000	33,000	50,000
10 - Y -	-6,500	-6,500	-6,800	-5,000	-5,000
9 - X -	-50,000	-17,000	18,000	33,000	50,000
9 - Y -	-6,500	-6,500	-6,800	-6,100	-6,100
8 - X -	-50,000	-17,000	18,000	33,000	50,000
8 - Y -	-6,500	-6,500	-6,800	-6,500	-6,500
7 - X -	-50,000	-17,000	18,000	33,000	50,000
7 - Y -	-6,500	-6,500	-7,500	-6,500	-6,500
6 - X -	-50,000	-17,000	10,632	18,000	33,000
6 - Y -	-7,800	-7,800	-7,879	-7,500	-6,500
6 - X -	50,000				
6 - Y -	-6,500				
5 - X -	-50,000	-17,000	10,632	18,000	33,000
5 - Y -	-9,300	-9,300	-7,879	-7,500	-6,500
5 - X -	50,000				
5 - Y -	-6,500				
4 - X -	-50,000	-17,000	10,632	18,000	33,000
4 - Y -	-9,300	-9,300	-7,879	-7,500	-7,500
4 - X -	50,000				
4 - Y -	-7,500				
3 - X -	-50,000	-17,000	10,632	18,000	33,000
3 - Y -	-9,300	-9,300	-7,879	-7,500	-8,500
3 - X -	50,000				
3 - Y -	-8,500				
2 - X -	-50,000	-17,000	18,000	33,000	50,000
2 - Y -	-10,600	-10,600	-10,700	-10,800	-10,800
1 - X -	-50,000	-17,000	18,000	33,000	50,000
1 - Y -	-11,500	-11,500	-11,700	-11,700	-11,700
0 - X -	-50,000	50,000			
0 - Y -	-20,000	-20,000			

2.2 PL Lines

PL line number	Co-ordinates [m]				
1 - X -	-50,000	50,000			

PL line number	Co-ordinates [m]				
1 - Y -	-2,100	-2,100			
2 - X -	-50,000	50,000			
2 - Y -	-3,000	-3,000			

2.3 General Data

Soil model:	Koppejan
Consolidation model:	Darcy
Strain model:	Linear
Groundwater level:	Initial determined by PL-line number 1
Unit weight of water:	10,00 [kN/m³]
Stress distribution	
- Soil:	Buisman
- Loads:	Simulate
End of consolidation:	10950,00 [days]
No maintain profile	
Pc (initial):	Variable parallel to the initial effective stress
Pc (per step):	Automatic increased to the final effective stresses
Creep rate reference time:	1,000 [days]
No imaginary surface	
With submerging	
(only for non uniform loads)	
- Iteration stop criterium :	0,10 [m]
Load column width	
- Non-Uniform Loads :	1,00 [m]
- Trapezoidal Loads :	1,00 [m]

2.4 Soil Profiles

Layer number	Material name	PL-line top	PL-line bottom
17	veen toplaag	1	1
16	verbetering veen top...	1	1
15	verbetering veen	1	1
14	veen toplaag	1	1
13	veen-A4 (Z)	1	1
12	klei siltig-A4 (N)	99	99
11	klei humeus-A4 (N)	99	99
10	klei siltig-A4 (N)	99	99
9	klei humeus-A4 (N)	99	99
8	klei siltig-A4 (N)	99	99
7	klei humeus-A4 (N)	99	99
6	klei siltig-A4 (N)	99	99
5	zand kleiig-A4 (N)	99	99
4	klei siltig-A4 (N)	99	99
3	klei humeus-A4 (N)	99	99
2	basisveen-A4 (N)	99	99
1	pleistoceen-A4 (N)	2	2

2.5 Soil Properties

Layer number	Drained	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
17	No	13,00	13,00
16	Yes	13,00	13,00
15	Yes	10,50	10,50
14	No	13,00	13,00
13	No	10,50	10,50
12	No	15,40	15,40
11	No	13,20	13,20
10	No	15,40	15,40
9	No	13,20	13,20
8	No	15,40	15,40
7	No	13,20	13,20
6	No	15,40	15,40

Layer number	Drained	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
5	No	17,50	19,00
4	No	15,40	15,40
3	No	13,20	13,20
2	No	10,80	10,80
1	Yes	18,00	20,00

Layer number	Storage type	Vert. consolid. coefficient Cv [m²/s]	Vertical permeability [m/s]	Permeability strain mod. [m/s]	Initial vertical permeability [m/s]
17	Vert. cons.	7,70E-08	-	-	-
16	Vert. cons.	-	-	-	-
15	Vert. cons.	-	-	-	-
14	Vert. cons.	7,70E-08	-	-	-
13	Vert. cons.	3,00E-08	-	-	-
12	Vert. cons.	9,40E-08	-	-	-
11	Vert. cons.	7,70E-08	-	-	-
10	Vert. cons.	9,40E-08	-	-	-
9	Vert. cons.	7,70E-08	-	-	-
8	Vert. cons.	9,40E-08	-	-	-
7	Vert. cons.	7,70E-08	-	-	-
6	Vert. cons.	9,40E-08	-	-	-
5	Vert. cons.	5,50E-06	-	-	-
4	Vert. cons.	9,40E-08	-	-	-
3	Vert. cons.	7,70E-08	-	-	-
2	Vert. cons.	4,70E-08	-	-	-
1	Vert. cons.	-	-	-	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
17	-	10,00	-
16	-	-	1,00
15	-	-	1,00
14	-	10,00	-
13	-	10,00	-
12	-	10,00	-
11	-	10,00	-
10	-	10,00	-
9	-	10,00	-
8	-	10,00	-
7	-	10,00	-
6	-	10,00	-
5	-	-	1,00
4	-	10,00	-
3	-	10,00	-
2	-	10,00	-
1	-	-	1,00

Layer number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
17	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
16	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
15	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
14	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
13	3,32E+01	5,70E+00	1,14E+02	2,28E+01	3,32E+01	2,28E+01
12	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
11	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
10	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
9	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
8	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
7	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
6	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
5	4,00E+02	2,00E+02	1,00E+09	1,00E+09	4,00E+02	1,00E+09
4	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01

Layer number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
3	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
2	5,14E+01	7,20E+00	1,11E+02	2,76E+01	5,14E+01	2,76E+01
1	1,80E+03	6,00E+02	1,00E+09	1,00E+09	1,00E+09	1,00E+09

2.6 Non-Uniform Loads

Load number	Time [days]	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
1	0	5,00	17,00
2	0	7,50	19,50
3	0	0,00	10,00
4	0	18,00	20,00
5	0	18,00	20,00

Load number	Co-ordinates [m]					
1 - X -	-37,00	-37,00	37,00	37,00		
1 - Y -	-1,70	-2,30	-2,30	-1,70		
2 - X -	-37,00	-37,00	37,00	37,00		
2 - Y -	-2,30	-2,65	-2,65	-2,30		
3 - X -	-37,00	37,00				
3 - Y -	-1,70	-1,70				
4 - X -	-37,00	-37,00	37,00	37,00		
4 - Y -	-1,70	-1,50	-1,50	-1,70		
5 - X -	-37,00	-37,00	37,00	37,00		
5 - Y -	-1,70	-0,70	-0,70	-1,70		

2.7 Verticals

Vertical number	X co-ordinates [m]				
1 - 5	-36,000	-30,000	-17,000	-10,000	0,000
6 - 9	10,000	18,000	33,000	36,000	

Discretisation = 100

3 Results per Vertical

3.1 Results for Vertical 1 (X = -36,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,182
-1,800	4,900	-1,800	3,600	0,181
-1,900	6,199	-1,900	3,599	0,180
-2,000	7,495	-2,000	3,595	0,179
-2,100	8,787	-2,100	3,587	0,178
-2,200	9,071	-2,100	3,571	0,177
-2,300	13,109	-2,100	7,309	0,176
-2,300	13,109	-2,100	7,309	0,176
-2,400	13,128	-2,100	7,278	0,176
-2,475	13,138	-2,100	7,251	0,175
-2,500	13,140	-2,100	7,240	0,175
-2,600	13,144	-2,100	7,194	0,174
-2,650	16,467	-2,100	10,492	0,174
-2,650	16,467	-2,100	10,492	0,174
-2,700	16,463	-2,100	10,463	0,166
-3,000	16,382	-2,100	10,235	0,126
-3,225	16,254	-2,100	9,996	0,104
-3,800	15,785	-2,099	9,243	0,072
-3,800	15,786	-2,099	9,243	0,072
-4,450	19,284	-2,175	8,474	0,057
-5,150	23,277	-2,257	7,872	0,047
-5,800	27,148	-2,332	7,474	0,039
-6,500	31,432	-2,414	7,162	0,033
-6,500	31,432	-2,414	7,162	0,033
-7,150	34,052	-2,490	6,943	0,025
-7,800	36,720	-2,566	6,771	0,019
-7,800	36,720	-2,566	6,771	0,019
-8,550	41,492	-2,654	6,614	0,014
-9,300	46,297	-2,742	6,490	0,010
-9,300	46,297	-2,742	6,490	0,010
-9,950	49,049	-2,818	6,401	0,005
-10,600	51,816	-2,894	6,325	0,004
-10,600	51,816	-2,894	6,325	0,004
-11,050	52,659	-2,947	6,279	0,004
-11,500	53,507	-3,000	6,237	0,002
-11,500	53,508	-3,000	6,237	0,002
-12,000	58,466	-3,000	6,196	0,002
-12,550	63,924	-3,000	6,154	0,002
-13,550	73,859	-3,000	6,089	0,001
-14,550	83,804	-3,000	6,034	0,001
-15,550	93,758	-3,000	5,988	0,001
-15,750	95,749	-3,000	5,979	0,001
-16,250	100,729	-3,000	5,959	0,001
-16,800	106,208	-3,000	5,938	0,001
-17,800	116,174	-3,000	5,904	0,000
-18,800	126,144	-3,000	5,874	0,000
-19,800	136,116	-3,000	5,846	0,000
-20,000	138,111	-3,000	5,841	0,000

3.2 Results for Vertical 2 (X = -30,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,261
-1,800	4,900	-1,800	3,600	0,260
-1,900	6,200	-1,900	3,600	0,258
-2,000	7,500	-2,000	3,600	0,258
-2,100	8,800	-2,100	3,600	0,257
-2,200	9,100	-2,100	3,600	0,256
-2,300	13,292	-2,100	7,492	0,255
-2,300	13,292	-2,100	7,492	0,255
-2,400	13,342	-2,100	7,492	0,254
-2,475	13,380	-2,100	7,492	0,254
-2,500	13,392	-2,100	7,492	0,254
-2,600	13,442	-2,100	7,492	0,253
-2,650	16,792	-2,100	10,817	0,252
-2,650	16,792	-2,100	10,817	0,252
-2,700	16,816	-2,100	10,817	0,244
-3,000	16,960	-2,099	10,816	0,201
-3,225	17,068	-2,099	10,814	0,177
-3,800	17,343	-2,099	10,807	0,135
-3,800	17,343	-2,099	10,807	0,135
-4,450	21,591	-2,174	10,790	0,115
-5,150	26,151	-2,255	10,756	0,100
-5,800	30,368	-2,331	10,707	0,088
-6,500	34,888	-2,413	10,632	0,078
-6,500	34,888	-2,413	10,632	0,078
-7,150	37,638	-2,488	10,544	0,061
-7,800	40,373	-2,564	10,439	0,047
-7,800	40,373	-2,564	10,439	0,047
-8,550	45,166	-2,652	10,301	0,039
-9,300	49,948	-2,741	10,152	0,033
-9,300	49,948	-2,741	10,152	0,033
-9,950	52,655	-2,817	10,016	0,025
-10,600	55,361	-2,893	9,877	0,021
-10,600	55,361	-2,893	9,877	0,021
-11,050	56,157	-2,947	9,780	0,015
-11,500	56,954	-3,000	9,684	0,003
-11,500	56,954	-3,000	9,684	0,003
-12,000	61,849	-3,000	9,579	0,003
-12,550	67,234	-3,000	9,464	0,003
-13,550	77,033	-3,000	9,263	0,002
-14,550	86,842	-3,000	9,072	0,002
-15,550	96,663	-3,000	8,893	0,001
-15,750	98,628	-3,000	8,858	0,001
-16,250	103,544	-3,000	8,774	0,001
-16,800	108,955	-3,000	8,685	0,001
-17,800	118,802	-3,000	8,532	0,001
-18,800	128,659	-3,000	8,389	0,000
-19,800	138,527	-3,000	8,257	0,000
-20,000	140,501	-3,000	8,231	0,000

3.3 Results for Vertical 3 (X = -17,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,282
-1,800	4,900	-1,800	3,600	0,280
-1,900	6,200	-1,900	3,600	0,279
-2,000	7,500	-2,000	3,600	0,278
-2,100	8,800	-2,100	3,600	0,277
-2,200	9,100	-2,100	3,600	0,276
-2,300	13,330	-2,100	7,530	0,276

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-2,300	13,330	-2,100	7,530	0,276
-2,400	13,380	-2,100	7,530	0,275
-2,475	13,418	-2,100	7,530	0,274
-2,500	13,430	-2,100	7,530	0,274
-2,600	13,480	-2,100	7,530	0,273
-2,650	16,830	-2,100	10,855	0,273
-2,650	16,830	-2,100	10,855	0,273
-2,700	16,854	-2,100	10,855	0,264
-3,000	16,999	-2,099	10,855	0,222
-3,225	17,108	-2,099	10,855	0,198
-3,800	17,389	-2,098	10,855	0,156
-3,800	17,389	-2,098	10,855	0,156
-4,450	21,654	-2,174	10,854	0,136
-5,150	26,246	-2,255	10,853	0,120
-5,800	30,510	-2,331	10,852	0,108
-6,500	35,102	-2,412	10,850	0,097
-6,500	35,102	-2,412	10,850	0,097
-7,150	37,938	-2,488	10,846	0,079
-7,800	40,773	-2,564	10,842	0,062
-7,800	40,773	-2,564	10,842	0,062
-8,550	45,696	-2,652	10,835	0,053
-9,300	50,619	-2,740	10,825	0,046
-9,300	50,619	-2,740	10,825	0,046
-9,950	53,452	-2,817	10,815	0,034
-10,600	56,284	-2,893	10,802	0,027
-10,600	56,284	-2,893	10,802	0,027
-11,050	57,167	-2,947	10,792	0,019
-11,500	58,051	-3,000	10,781	0,004
-11,500	58,051	-3,000	10,781	0,004
-12,000	63,037	-3,000	10,767	0,003
-12,550	68,520	-3,000	10,750	0,003
-13,550	78,484	-3,000	10,714	0,002
-14,550	88,442	-3,000	10,672	0,002
-15,550	98,395	-3,000	10,625	0,002
-15,750	100,384	-3,000	10,614	0,001
-16,250	105,358	-3,000	10,588	0,001
-16,800	110,827	-3,000	10,557	0,001
-17,800	120,767	-3,000	10,497	0,001
-18,800	130,703	-3,000	10,433	0,000
-19,800	140,634	-3,000	10,364	0,000
-20,000	142,620	-3,000	10,350	0,000

3.4 Results for Vertical 4 (X = -10,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,286
-1,800	4,900	-1,800	3,600	0,284
-1,900	6,200	-1,900	3,600	0,283
-2,000	7,500	-2,000	3,600	0,282
-2,100	8,800	-2,100	3,600	0,281
-2,200	9,100	-2,100	3,600	0,281
-2,300	13,338	-2,100	7,538	0,280
-2,300	13,338	-2,100	7,538	0,280
-2,400	13,388	-2,100	7,538	0,279
-2,475	13,425	-2,100	7,538	0,279
-2,500	13,438	-2,100	7,538	0,278
-2,600	13,488	-2,100	7,538	0,278
-2,650	16,838	-2,100	10,863	0,277
-2,650	16,838	-2,100	10,863	0,277
-2,700	16,862	-2,100	10,863	0,269

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-3,000	17,007	-2,099	10,863	0,226
-3,225	17,116	-2,099	10,863	0,202
-3,800	17,397	-2,098	10,863	0,160
-3,800	17,397	-2,098	10,863	0,160
-4,450	21,658	-2,174	10,863	0,140
-5,150	26,247	-2,254	10,862	0,124
-5,800	30,508	-2,330	10,862	0,112
-6,500	35,097	-2,411	10,861	0,101
-6,500	35,097	-2,411	10,861	0,101
-6,530	35,228	-2,414	10,861	0,100
-6,560	35,359	-2,418	10,861	0,099
-6,560	35,359	-2,418	10,861	0,099
-6,630	35,818	-2,426	10,861	0,098
-6,700	36,277	-2,434	10,861	0,097
-6,700	36,277	-2,434	10,861	0,097
-7,260	38,718	-2,499	10,860	0,082
-7,820	41,160	-2,564	10,858	0,067
-7,820	41,160	-2,564	10,858	0,067
-8,380	44,836	-2,629	10,857	0,061
-8,940	48,512	-2,695	10,854	0,055
-8,940	48,512	-2,695	10,854	0,055
-9,780	52,176	-2,793	10,849	0,039
-10,620	55,841	-2,891	10,843	0,027
-10,620	55,841	-2,891	10,843	0,027
-11,080	56,748	-2,946	10,839	0,019
-11,540	57,656	-3,000	10,834	0,004
-11,540	57,656	-3,000	10,834	0,004
-12,040	62,651	-3,000	10,828	0,003
-12,570	67,943	-3,000	10,821	0,003
-13,570	77,928	-3,000	10,806	0,002
-14,570	87,908	-3,000	10,786	0,002
-15,570	97,885	-3,000	10,763	0,002
-15,770	99,880	-3,000	10,758	0,001
-16,270	104,867	-3,000	10,745	0,001
-16,800	110,152	-3,000	10,730	0,001
-17,800	120,120	-3,000	10,698	0,001
-18,800	130,085	-3,000	10,663	0,000
-19,800	140,045	-3,000	10,623	0,000
-20,000	142,037	-3,000	10,615	0,000

3.5 Results for Vertical 5 (X = 0,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,291
-1,800	4,900	-1,800	3,600	0,289
-1,900	6,200	-1,900	3,600	0,288
-2,000	7,500	-2,000	3,600	0,287
-2,100	8,800	-2,100	3,600	0,286
-2,200	9,100	-2,100	3,600	0,286
-2,300	13,346	-2,100	7,546	0,285
-2,300	13,346	-2,100	7,546	0,285
-2,400	13,396	-2,100	7,546	0,284
-2,475	13,433	-2,100	7,546	0,283
-2,500	13,446	-2,100	7,546	0,283
-2,600	13,496	-2,100	7,546	0,282
-2,650	16,846	-2,100	10,871	0,282
-2,650	16,846	-2,100	10,871	0,282
-2,700	16,870	-2,100	10,871	0,274
-3,000	17,014	-2,099	10,871	0,231
-3,225	17,123	-2,099	10,871	0,207

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-3,800	17,403	-2,098	10,871	0,164
-3,800	17,403	-2,098	10,871	0,164
-4,450	21,658	-2,173	10,871	0,145
-5,150	26,240	-2,253	10,871	0,128
-5,800	30,496	-2,328	10,871	0,116
-6,500	35,079	-2,408	10,870	0,106
-6,500	35,079	-2,408	10,870	0,106
-6,573	35,396	-2,416	10,870	0,103
-6,646	35,713	-2,425	10,870	0,101
-6,646	35,713	-2,425	10,870	0,101
-6,816	36,826	-2,444	10,870	0,099
-6,986	37,939	-2,464	10,870	0,097
-6,986	37,939	-2,464	10,870	0,097
-7,417	39,817	-2,513	10,869	0,085
-7,849	41,695	-2,563	10,869	0,074
-7,849	41,695	-2,563	10,869	0,074
-8,137	43,587	-2,597	10,868	0,071
-8,426	45,479	-2,630	10,868	0,068
-8,426	45,479	-2,630	10,868	0,068
-8,937	47,707	-2,689	10,866	0,057
-9,537	50,321	-2,759	10,865	0,045
-10,049	52,550	-2,818	10,863	0,035
-10,649	55,166	-2,888	10,860	0,028
-10,649	55,166	-2,888	10,860	0,028
-11,123	56,101	-2,944	10,858	0,020
-11,597	57,037	-3,000	10,855	0,004
-11,597	57,037	-3,000	10,855	0,004
-12,097	62,034	-3,000	10,851	0,003
-12,599	67,044	-3,000	10,847	0,003
-13,599	77,034	-3,000	10,838	0,002
-14,599	87,022	-3,000	10,826	0,002
-15,599	97,008	-3,000	10,812	0,002
-15,799	99,005	-3,000	10,808	0,001
-16,299	103,996	-3,000	10,800	0,001
-16,800	109,001	-3,000	10,790	0,001
-17,800	118,980	-3,000	10,770	0,001
-18,800	128,956	-3,000	10,745	0,000
-19,800	138,929	-3,000	10,718	0,000
-20,000	140,923	-3,000	10,712	0,000

3.6 Results for Vertical 6 (X = 10,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,296
-1,800	4,900	-1,800	3,600	0,294
-1,900	6,200	-1,900	3,600	0,293
-2,000	7,500	-2,000	3,600	0,292
-2,100	8,800	-2,100	3,600	0,291
-2,200	9,100	-2,100	3,600	0,291
-2,300	13,354	-2,100	7,554	0,290
-2,300	13,354	-2,100	7,554	0,290
-2,400	13,404	-2,100	7,554	0,289
-2,475	13,442	-2,100	7,554	0,289
-2,500	13,454	-2,100	7,554	0,288
-2,600	13,504	-2,100	7,554	0,288
-2,650	16,854	-2,100	10,879	0,287
-2,650	16,854	-2,100	10,879	0,287
-2,700	16,878	-2,100	10,879	0,279
-3,000	17,021	-2,099	10,879	0,236
-3,225	17,129	-2,099	10,879	0,212

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-3,800	17,408	-2,098	10,879	0,169
-3,800	17,408	-2,098	10,879	0,169
-4,450	21,656	-2,172	10,879	0,150
-5,150	26,230	-2,251	10,878	0,134
-5,800	30,478	-2,325	10,877	0,122
-6,500	35,054	-2,405	10,876	0,111
-6,500	35,054	-2,405	10,876	0,111
-6,616	35,556	-2,418	10,876	0,107
-6,731	36,058	-2,431	10,876	0,104
-6,731	36,058	-2,431	10,876	0,104
-7,001	37,824	-2,462	10,875	0,100
-7,271	39,589	-2,493	10,875	0,097
-7,271	39,589	-2,493	10,875	0,097
-7,574	40,904	-2,527	10,874	0,089
-7,877	42,219	-2,562	10,873	0,082
-7,877	42,219	-2,562	10,873	0,082
-7,894	42,332	-2,564	10,873	0,082
-7,912	42,444	-2,566	10,873	0,081
-7,912	42,444	-2,566	10,873	0,081
-8,594	45,410	-2,645	10,870	0,066
-9,294	48,453	-2,725	10,866	0,051
-9,977	51,422	-2,804	10,861	0,037
-10,677	54,467	-2,885	10,856	0,028
-10,677	54,467	-2,885	10,856	0,028
-11,166	55,426	-2,942	10,851	0,020
-11,654	56,387	-3,000	10,845	0,004
-11,654	56,387	-3,000	10,845	0,004
-12,627	66,103	-3,000	10,832	0,003
-13,627	76,086	-3,000	10,815	0,002
-14,627	86,066	-3,000	10,795	0,002
-15,627	96,042	-3,000	10,771	0,002
-15,827	98,037	-3,000	10,766	0,001
-16,800	107,738	-3,000	10,738	0,001
-17,800	117,705	-3,000	10,706	0,001
-18,800	127,669	-3,000	10,670	0,000
-19,800	137,629	-3,000	10,630	0,000
-20,000	139,620	-3,000	10,621	0,000

3.7 Results for Vertical 7 (X = 18,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,293
-1,800	4,900	-1,800	3,600	0,292
-1,900	6,200	-1,900	3,600	0,290
-2,000	7,500	-2,000	3,600	0,289
-2,100	8,800	-2,100	3,600	0,289
-2,200	9,100	-2,100	3,600	0,288
-2,300	13,348	-2,100	7,548	0,287
-2,300	13,348	-2,100	7,548	0,287
-2,400	13,398	-2,100	7,548	0,286
-2,475	13,436	-2,100	7,548	0,286
-2,500	13,448	-2,100	7,548	0,286
-2,600	13,498	-2,100	7,548	0,285
-2,650	16,848	-2,100	10,873	0,284
-2,650	16,848	-2,100	10,873	0,284
-2,700	16,872	-2,100	10,873	0,276
-3,000	17,015	-2,099	10,873	0,233
-3,225	17,123	-2,099	10,873	0,209
-3,800	17,401	-2,098	10,872	0,167
-3,800	17,402	-2,098	10,872	0,167

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,450	21,644	-2,171	10,870	0,147
-5,150	26,213	-2,250	10,868	0,131
-5,800	30,455	-2,324	10,866	0,119
-6,500	35,023	-2,403	10,862	0,108
-6,500	35,023	-2,403	10,862	0,108
-6,650	35,672	-2,420	10,861	0,104
-6,800	36,322	-2,437	10,860	0,099
-6,800	36,322	-2,437	10,860	0,099
-7,150	38,606	-2,477	10,857	0,095
-7,500	40,891	-2,517	10,854	0,091
-7,500	40,891	-2,517	10,854	0,091
-8,300	44,353	-2,608	10,845	0,072
-9,100	47,816	-2,699	10,833	0,054
-9,900	51,279	-2,791	10,818	0,038
-10,700	54,740	-2,883	10,798	0,028
-10,700	54,740	-2,883	10,798	0,028
-11,200	55,709	-2,941	10,784	0,020
-11,700	56,679	-3,000	10,769	0,004
-11,700	56,679	-3,000	10,769	0,004
-12,650	66,144	-3,000	10,734	0,003
-13,650	76,102	-3,000	10,692	0,002
-14,650	86,053	-3,000	10,643	0,002
-15,650	95,998	-3,000	10,588	0,001
-15,850	97,986	-3,000	10,576	0,001
-16,800	107,428	-3,000	10,518	0,001
-17,800	117,361	-3,000	10,451	0,001
-18,800	127,290	-3,000	10,380	0,000
-19,800	137,215	-3,000	10,305	0,000
-20,000	139,199	-3,000	10,289	0,000

3.8 Results for Vertical 8 (X = 33,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,222
-1,800	4,900	-1,800	3,600	0,221
-1,900	6,200	-1,900	3,600	0,219
-2,000	7,500	-2,000	3,600	0,218
-2,100	8,800	-2,100	3,600	0,218
-2,200	9,100	-2,100	3,600	0,217
-2,300	13,224	-2,100	7,424	0,216
-2,300	13,224	-2,100	7,424	0,216
-2,400	13,274	-2,100	7,424	0,215
-2,475	13,311	-2,100	7,423	0,215
-2,500	13,323	-2,100	7,423	0,215
-2,600	13,373	-2,100	7,423	0,214
-2,650	16,722	-2,100	10,747	0,213
-2,650	16,722	-2,100	10,747	0,213
-2,700	16,747	-2,100	10,747	0,205
-3,000	16,890	-2,100	10,742	0,162
-3,075	16,925	-2,100	10,740	0,153
-3,500	17,117	-2,100	10,721	0,111
-3,500	17,117	-2,100	10,721	0,111
-4,100	20,956	-2,165	10,662	0,093
-4,700	24,749	-2,231	10,558	0,079
-4,700	24,749	-2,231	10,558	0,079
-4,850	25,359	-2,248	10,524	0,073
-5,000	25,968	-2,264	10,488	0,067
-5,000	25,968	-2,264	10,488	0,067
-5,550	29,386	-2,324	10,334	0,058
-6,100	32,778	-2,385	10,153	0,051

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-6,100	32,778	-2,385	10,153	0,051
-6,300	33,568	-2,406	10,083	0,046
-6,500	34,355	-2,428	10,011	0,042
-6,500	34,355	-2,428	10,011	0,042
-7,000	39,221	-2,483	9,828	0,041
-7,500	44,085	-2,538	9,643	0,040
-7,500	44,085	-2,538	9,643	0,040
-8,000	47,152	-2,593	9,461	0,037
-8,500	50,225	-2,648	9,285	0,033
-8,500	50,225	-2,648	9,285	0,033
-9,050	52,404	-2,708	9,100	0,027
-9,650	54,793	-2,774	8,910	0,020
-10,200	56,995	-2,835	8,747	0,015
-10,800	59,409	-2,901	8,582	0,012
-10,800	59,409	-2,901	8,582	0,012
-11,250	60,149	-2,950	8,466	0,010
-11,700	60,897	-3,000	8,357	0,003
-11,700	60,897	-3,000	8,357	0,003
-12,650	70,186	-3,000	8,146	0,002
-13,650	79,991	-3,000	7,951	0,002
-14,650	89,819	-3,000	7,779	0,001
-15,650	99,667	-3,000	7,627	0,001
-15,850	101,638	-3,000	7,598	0,001
-16,800	111,012	-3,000	7,472	0,001
-17,800	120,893	-3,000	7,353	0,000
-18,800	130,787	-3,000	7,247	0,000
-19,800	140,690	-3,000	7,150	0,000
-20,000	142,672	-3,000	7,132	0,000

3.9 Results for Vertical 9 (X = 36,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,700	3,601	-1,700	3,600	0,172
-1,800	4,900	-1,800	3,600	0,170
-1,900	6,199	-1,900	3,599	0,169
-2,000	7,495	-2,000	3,595	0,168
-2,100	8,787	-2,100	3,587	0,167
-2,200	9,071	-2,100	3,571	0,167
-2,300	13,092	-2,100	7,292	0,166
-2,300	13,092	-2,100	7,292	0,166
-2,400	13,111	-2,100	7,261	0,165
-2,475	13,121	-2,100	7,233	0,165
-2,500	13,123	-2,100	7,223	0,164
-2,600	13,127	-2,100	7,177	0,164
-2,650	16,450	-2,100	10,475	0,163
-2,650	16,450	-2,100	10,475	0,163
-2,700	16,446	-2,100	10,446	0,155
-3,000	16,367	-2,100	10,218	0,115
-3,075	16,331	-2,100	10,145	0,107
-3,500	16,029	-2,100	9,631	0,071
-3,500	16,029	-2,100	9,631	0,071
-4,100	19,146	-2,166	8,850	0,057
-4,700	22,416	-2,231	8,222	0,047
-4,700	22,416	-2,231	8,222	0,047
-4,850	22,931	-2,248	8,093	0,044
-5,000	23,455	-2,264	7,973	0,041
-5,000	23,455	-2,264	7,973	0,041
-5,550	26,658	-2,325	7,603	0,035
-6,100	29,948	-2,385	7,319	0,029
-6,100	29,948	-2,385	7,319	0,029

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-6,300	30,721	-2,407	7,232	0,027
-6,500	31,501	-2,429	7,153	0,024
-6,500	31,501	-2,429	7,153	0,024
-7,000	36,376	-2,484	6,980	0,024
-7,500	41,282	-2,539	6,837	0,023
-7,500	41,282	-2,539	6,837	0,023
-8,000	44,411	-2,593	6,717	0,021
-8,500	47,558	-2,648	6,615	0,018
-8,500	47,558	-2,648	6,615	0,018
-9,050	49,826	-2,709	6,520	0,014
-9,650	52,317	-2,775	6,431	0,009
-10,200	54,611	-2,835	6,361	0,005
-10,800	57,124	-2,901	6,295	0,004
-10,800	57,124	-2,901	6,295	0,004
-11,250	57,936	-2,950	6,251	0,003
-11,700	58,751	-3,000	6,211	0,002
-11,700	58,751	-3,000	6,211	0,002
-12,650	68,178	-3,000	6,138	0,002
-13,650	78,115	-3,000	6,075	0,001
-14,650	88,061	-3,000	6,021	0,001
-15,650	98,015	-3,000	5,975	0,001
-15,850	100,007	-3,000	5,967	0,001
-16,800	109,470	-3,000	5,930	0,001
-17,800	119,436	-3,000	5,896	0,000
-18,800	129,406	-3,000	5,866	0,000
-19,800	139,379	-3,000	5,839	0,000
-20,000	141,374	-3,000	5,834	0,000

4 Settlements

4.1 Settlements

Vertical number	X co-ordinate [m]	Z co-ordinate [m]	Surface level [m]	Settlement [m]
1	-36,00	0,00	-1,70	0,182
2	-30,00	0,00	-1,70	0,261
3	-17,00	0,00	-1,70	0,282
4	-10,00	0,00	-1,70	0,286
5	0,00	0,00	-1,70	0,291
6	10,00	0,00	-1,70	0,296
7	18,00	0,00	-1,70	0,293
8	33,00	0,00	-1,70	0,222
9	36,00	0,00	-1,70	0,172

4.2 Residual Times

Vertical number	Time [days]	Settlement [m]	Part of final settlement [%]	Residual settlements [m]
1	365	0,169	92,868	0,013
2	365	0,214	81,750	0,048
3	365	0,220	78,185	0,061
4	365	0,221	77,214	0,065
5	365	0,221	76,105	0,070
6	365	0,222	74,927	0,074
7	365	0,221	75,377	0,072
8	365	0,202	91,088	0,020
9	365	0,171	99,339	0,001

5 Warnings and errors

List of non-fatal warnings and errors generated during calculation.

1 Model Koppejan is not ideal for unloading (e.g. load removal, temporary dewatering, gradual submerging). If As is much larger than Cs', unloading will yield almost no effect on creep. Switch to the NEN-Bjerrum or abc Isotache model for improved predictions.

2 Non-uniform load [1]: Co-ordinate is below surface (2)

3 Non-uniform load [1]: Co-ordinate is below surface (3)

4 Non-uniform load [2]: Co-ordinate is below surface (1)

5 Non-uniform load [2]: Co-ordinate is below surface (2)

6 Non-uniform load [2]: Co-ordinate is below surface (3)

7 Non-uniform load [2]: Co-ordinate is below surface (4)

End of Report

Report for D-Settlement 9.3

Settlement Calculations
Developed by Deltares

Company:	BAM Infratechniek
Date of report:	3-10-2013
Time of report:	2:51:53
Date of calculation:	3-10-2013
Time of calculation:	2:51:39
Filename:	C:\..\R3N_Perceel 2_OSP-YMM74 (B30F1105 en DKM1189 en B150)-0,2 m hoger-1,0 m overhoogte
Project identification:	Randstad 380 Noordring

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2 Echo of the Input

2.1 Layer Boundaries

Boundary number	Co-ordinates [m]				
12 - X -	-30,000	-8,500	8,500	30,000	
12 - Y -	-1,300	-1,300	-1,300	-1,300	
11 - X -	-30,000	-8,500	-8,500	8,500	30,000
11 - Y -	-2,100	-2,100	-1,300	-1,300	-1,300
10 - X -	-30,000	-8,500	8,500	8,500	30,000
10 - Y -	-2,100	-2,100	-2,100	-1,300	-1,300
9 - X -	-30,000	-8,500	-8,500	8,500	8,500
9 - Y -	-2,100	-2,100	-2,250	-2,250	-2,100
9 - X -	8,500	30,000			
9 - Y -	-1,300	-1,300			
8 - X -	-30,000	-8,500	-8,500	8,500	8,500
8 - Y -	-2,100	-2,100	-2,250	-2,250	-2,100
8 - X -	30,000				
8 - Y -	-2,100				
7 - X -	-30,000	30,000			
7 - Y -	-4,100	-4,100			
6 - X -	-30,000	30,000			
6 - Y -	-5,500	-5,500			
5 - X -	-30,000	30,000			
5 - Y -	-7,700	-7,700			
4 - X -	-30,000	30,000			
4 - Y -	-8,000	-8,000			
3 - X -	-30,000	30,000			
3 - Y -	-10,000	-10,000			
2 - X -	-30,000	30,000			
2 - Y -	-11,500	-11,500			
1 - X -	-30,000	30,000			
1 - Y -	-12,300	-12,300			
0 - X -	-30,000	30,000			
0 - Y -	-20,000	-20,000			

2.2 PL Lines

PL line number	Co-ordinates [m]				
1 - X -	-30,000	30,000			
1 - Y -	-1,700	-1,700			
2 - X -	-30,000	30,000			
2 - Y -	-2,500	-2,500			

2.3 General Data

Soil model:	Koppejan
Consolidation model:	Darcy
Strain model:	Linear
Groundwater level:	Initial determined by PL-line number 1
Unit weight of water:	10,00 [kN/m³]
Stress distribution	
- Soil:	Buisman
- Loads:	Simulate
End of consolidation:	10950,00 [days]
No maintain profile	
Pc (initial):	Variable parallel to the initial effective stress
Pc (per step):	Automatic increased to the final effective stresses
Creep rate reference time:	1,000 [days]
No imaginary surface	
With submerging	
(only for non uniform loads)	
- Iteration stop criterium :	0,10 [m]
Load column width	

- Non-Uniform Loads :	1,00 [m]
- Trapezoidal Loads :	1,00 [m]

2.4 Soil Profiles

Layer number	Material name	PL-line top	PL-line bottom
12	veen toplaag	1	1
11	verbetering veen top...	1	1
10	verbetering veen	1	1
9	veen toplaag	1	1
8	veen-A4 (Z)	1	1
7	klei humeus-A4 (N)	99	99
6	klei siltig-A4 (N)	99	99
5	klei humeus-A4 (N)	99	99
4	klei siltig-A4 (N)	99	99
3	klei humeus-A4 (N)	99	99
2	basisveen-A4 (N)	99	99
1	pleistoceen-A4 (N)	2	2

2.5 Soil Properties

Layer number	Drained	Unit weight Unsaturated [kN/m³]	Unit weight Saturated [kN/m³]
12	No	13,00	13,00
11	Yes	13,00	13,00
10	Yes	10,50	10,50
9	No	13,00	13,00
8	No	10,50	10,50
7	No	13,20	13,20
6	No	15,40	15,40
5	No	13,20	13,20
4	No	15,40	15,40
3	No	13,20	13,20
2	No	10,80	10,80
1	Yes	18,00	20,00

Layer number	Storage type	Vert. consolid. coefficient Cv [m²/s]	Vertical permeability [m/s]	Permeability strain mod. [m/s]	Initial vertical permeability [m/s]
12	Vert. cons.	7,70E-08	-	-	-
11	Vert. cons.	-	-	-	-
10	Vert. cons.	-	-	-	-
9	Vert. cons.	7,70E-08	-	-	-
8	Vert. cons.	3,00E-08	-	-	-
7	Vert. cons.	7,70E-08	-	-	-
6	Vert. cons.	9,40E-08	-	-	-
5	Vert. cons.	7,70E-08	-	-	-
4	Vert. cons.	9,40E-08	-	-	-
3	Vert. cons.	7,70E-08	-	-	-
2	Vert. cons.	4,70E-08	-	-	-
1	Vert. cons.	-	-	-	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
12	-	10,00	-
11	-	-	1,00
10	-	-	1,00
9	-	10,00	-
8	-	10,00	-
7	-	10,00	-
6	-	10,00	-
5	-	10,00	-
4	-	10,00	-
3	-	10,00	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
2	-	10,00	-
1	-	-	1,00

Layer	Primary compr. coeff.		Secular compr. coef.		Swell constants	
number	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
12	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
11	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
10	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
9	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
8	3,32E+01	5,70E+00	1,14E+02	2,28E+01	3,32E+01	2,28E+01
7	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
6	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
5	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
4	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
3	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
2	5,14E+01	7,20E+00	1,11E+02	2,76E+01	5,14E+01	2,76E+01
1	1,80E+03	6,00E+02	1,00E+09	1,00E+09	1,00E+09	1,00E+09

2.6 Non-Uniform Loads

Load number	Time	Unit weight	
	[days]	Unsaturated [kN/m³]	Saturated [kN/m³]
1	0	5,00	17,00
2	0	7,50	19,50
3	0	0,00	10,00
4	0	18,00	20,00
5	0	18,00	20,00

Load number	Co-ordinates [m]					
1 - X -	-8,50	-8,50	8,50	8,50		
1 - Y -	-1,30	-2,10	-2,10	-1,30		
2 - X -	-8,50	-8,50	8,50	8,50		
2 - Y -	-2,10	-2,25	-2,25	-2,10		
3 - X -	-8,50	8,50				
3 - Y -	-1,30	-1,30				
4 - X -	-8,50	-8,50	8,50	8,50		
4 - Y -	-1,30	-1,10	-1,10	-1,30		
5 - X -	-8,50	-8,50	8,50	8,50		
5 - Y -	-1,30	-0,30	-0,30	-1,30		

2.7 Verticals

Vertical number	X co-ordinates [m]				
1 - 5	-8,000	-5,000	0,000	5,000	8,000

Discretisation = 100

3 Results per Vertical

3.1 Results for Vertical 1 (X = -8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,300	3,601	-1,300	3,600	0,172
-1,400	4,899	-1,400	3,599	0,170
-1,500	6,187	-1,500	3,587	0,169
-1,600	7,448	-1,600	3,548	0,168
-1,700	8,680	-1,700	3,480	0,167
-1,800	8,891	-1,700	3,391	0,166
-1,900	9,092	-1,700	3,292	0,166
-2,000	9,293	-1,700	3,193	0,165
-2,100	14,644	-1,700	8,244	0,164
-2,100	14,644	-1,700	8,244	0,164
-2,175	14,614	-1,700	8,177	0,164
-2,200	14,604	-1,700	8,154	0,164
-2,250	16,007	-1,700	9,532	0,163
-2,250	16,007	-1,700	9,532	0,163
-2,300	15,978	-1,700	9,480	0,157
-2,500	15,769	-1,699	9,177	0,136
-3,175	14,689	-1,698	7,775	0,107
-4,100	14,124	-1,696	6,765	0,068
-4,100	14,124	-1,696	6,765	0,068
-4,800	16,667	-1,764	6,389	0,048
-5,500	19,351	-1,832	6,153	0,036
-5,500	19,351	-1,832	6,153	0,036
-6,100	23,031	-1,890	6,010	0,029
-6,600	26,125	-1,939	5,916	0,025
-7,100	29,235	-1,988	5,839	0,022
-7,700	32,982	-2,046	5,760	0,018
-7,700	32,982	-2,046	5,760	0,018
-7,850	33,591	-2,061	5,742	0,016
-8,000	34,201	-2,076	5,725	0,015
-8,000	34,201	-2,076	5,725	0,015
-9,000	40,480	-2,174	5,622	0,009
-10,000	46,776	-2,273	5,531	0,005
-10,000	46,776	-2,273	5,531	0,005
-10,750	49,850	-2,346	5,467	0,001
-11,500	52,927	-2,420	5,404	0,001
-11,500	52,927	-2,420	5,404	0,001
-11,900	53,612	-2,460	5,370	0,001
-12,300	54,297	-2,500	5,337	0,002
-12,300	54,297	-2,500	5,337	0,002
-13,150	62,724	-2,500	5,264	0,001
-14,150	72,637	-2,500	5,177	0,001
-15,150	82,547	-2,500	5,087	0,001
-16,150	92,455	-2,500	4,995	0,001
-17,000	100,875	-2,500	4,915	0,000
-18,000	110,780	-2,500	4,820	0,000
-19,000	120,683	-2,500	4,723	0,000
-20,000	130,586	-2,500	4,626	0,000

3.2 Results for Vertical 2 (X = -5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,300	3,601	-1,300	3,600	0,261

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,400	4,900	-1,400	3,600	0,260
-1,500	6,200	-1,500	3,600	0,258
-1,600	7,500	-1,600	3,600	0,257
-1,700	8,800	-1,700	3,600	0,257
-1,800	9,100	-1,700	3,600	0,256
-1,900	9,399	-1,700	3,599	0,255
-2,000	9,699	-1,700	3,599	0,254
-2,100	15,292	-1,700	8,892	0,254
-2,100	15,292	-1,700	8,892	0,254
-2,175	15,329	-1,700	8,891	0,253
-2,200	15,341	-1,700	8,891	0,253
-2,250	16,790	-1,700	10,315	0,253
-2,250	16,790	-1,700	10,315	0,253
-2,300	16,810	-1,700	10,315	0,245
-2,500	16,891	-1,698	10,311	0,218
-3,175	17,152	-1,695	10,269	0,167
-4,100	17,416	-1,691	10,107	0,114
-4,100	17,416	-1,691	10,107	0,114
-4,800	20,119	-1,758	9,895	0,083
-5,500	22,772	-1,826	9,629	0,059
-5,500	22,772	-1,826	9,629	0,059
-6,100	26,346	-1,884	9,381	0,050
-6,600	29,321	-1,933	9,170	0,044
-7,100	32,301	-1,982	8,962	0,038
-7,700	35,886	-2,041	8,719	0,033
-7,700	35,886	-2,041	8,719	0,033
-7,850	36,454	-2,055	8,660	0,031
-8,000	37,023	-2,070	8,601	0,029
-8,000	37,023	-2,070	8,601	0,029
-9,000	43,043	-2,169	8,231	0,021
-10,000	49,104	-2,269	7,892	0,015
-10,000	49,104	-2,269	7,892	0,015
-10,750	52,013	-2,344	7,657	0,008
-11,500	54,939	-2,418	7,435	0,007
-11,500	54,939	-2,418	7,435	0,007
-11,900	55,552	-2,459	7,321	0,007
-12,300	56,171	-2,500	7,211	0,002
-12,300	56,171	-2,500	7,211	0,002
-13,150	64,446	-2,500	6,986	0,002
-14,150	74,196	-2,500	6,736	0,001
-15,150	83,960	-2,500	6,500	0,001
-16,150	93,736	-2,500	6,276	0,001
-17,000	102,055	-2,500	6,095	0,001
-18,000	111,851	-2,500	5,891	0,000
-19,000	121,657	-2,500	5,697	0,000
-20,000	131,472	-2,500	5,512	0,000

3.3 Results for Vertical 3 (X = 0,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,300	3,601	-1,300	3,600	0,287
-1,400	4,900	-1,400	3,600	0,285
-1,500	6,200	-1,500	3,600	0,284
-1,600	7,500	-1,600	3,600	0,283
-1,700	8,800	-1,700	3,600	0,282
-1,800	9,100	-1,700	3,600	0,281
-1,900	9,400	-1,700	3,600	0,281
-2,000	9,700	-1,700	3,600	0,280
-2,100	15,343	-1,700	8,943	0,279
-2,100	15,343	-1,700	8,943	0,279

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-2,175	15,381	-1,700	8,943	0,279
-2,200	15,393	-1,700	8,943	0,278
-2,250	16,843	-1,700	10,368	0,278
-2,250	16,843	-1,700	10,368	0,278
-2,300	16,863	-1,700	10,368	0,270
-2,500	16,947	-1,698	10,368	0,244
-3,175	17,242	-1,694	10,363	0,194
-4,100	17,646	-1,690	10,343	0,137
-4,100	17,646	-1,690	10,343	0,137
-4,800	20,525	-1,758	10,309	0,102
-5,500	23,386	-1,825	10,252	0,075
-5,500	23,386	-1,825	10,252	0,075
-6,100	27,136	-1,884	10,180	0,065
-6,600	30,246	-1,932	10,104	0,057
-7,100	33,343	-1,981	10,013	0,051
-7,700	37,042	-2,040	9,885	0,045
-7,700	37,042	-2,040	9,885	0,045
-7,850	37,634	-2,054	9,850	0,042
-8,000	38,225	-2,069	9,814	0,039
-8,000	38,225	-2,069	9,814	0,039
-9,000	44,349	-2,168	9,545	0,031
-10,000	50,446	-2,268	9,241	0,023
-10,000	50,446	-2,268	9,241	0,023
-10,750	53,348	-2,343	8,997	0,016
-11,500	56,244	-2,418	8,745	0,013
-11,500	56,244	-2,418	8,745	0,013
-11,900	56,838	-2,459	8,610	0,010
-12,300	57,433	-2,500	8,473	0,002
-12,300	57,433	-2,500	8,473	0,002
-13,150	65,645	-2,500	8,185	0,002
-14,150	75,311	-2,500	7,851	0,002
-15,150	84,988	-2,500	7,528	0,001
-16,150	94,678	-2,500	7,218	0,001
-17,000	102,926	-2,500	6,966	0,001
-18,000	112,644	-2,500	6,684	0,000
-19,000	122,377	-2,500	6,417	0,000
-20,000	132,126	-2,500	6,166	0,000

3.4 Results for Vertical 4 (X = 5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,300	3,601	-1,300	3,600	0,261
-1,400	4,900	-1,400	3,600	0,260
-1,500	6,200	-1,500	3,600	0,258
-1,600	7,500	-1,600	3,600	0,257
-1,700	8,800	-1,700	3,600	0,257
-1,800	9,100	-1,700	3,600	0,256
-1,900	9,399	-1,700	3,599	0,255
-2,000	9,699	-1,700	3,599	0,254
-2,100	15,292	-1,700	8,892	0,254
-2,100	15,292	-1,700	8,892	0,254
-2,175	15,329	-1,700	8,891	0,253
-2,200	15,341	-1,700	8,891	0,253
-2,250	16,790	-1,700	10,315	0,253
-2,250	16,790	-1,700	10,315	0,253
-2,300	16,810	-1,700	10,315	0,245
-2,500	16,891	-1,698	10,311	0,218
-3,175	17,152	-1,695	10,269	0,167
-4,100	17,416	-1,691	10,107	0,114
-4,100	17,416	-1,691	10,107	0,114

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,800	20,119	-1,758	9,895	0,083
-5,500	22,772	-1,826	9,629	0,059
-5,500	22,772	-1,826	9,629	0,059
-6,100	26,346	-1,884	9,381	0,050
-6,600	29,321	-1,933	9,170	0,044
-7,100	32,301	-1,982	8,962	0,038
-7,700	35,886	-2,041	8,719	0,033
-7,700	35,886	-2,041	8,719	0,033
-7,850	36,454	-2,055	8,660	0,031
-8,000	37,023	-2,070	8,601	0,029
-8,000	37,023	-2,070	8,601	0,029
-9,000	43,043	-2,169	8,231	0,021
-10,000	49,104	-2,269	7,892	0,015
-10,000	49,104	-2,269	7,892	0,015
-10,750	52,013	-2,344	7,657	0,008
-11,500	54,939	-2,418	7,435	0,007
-11,500	54,939	-2,418	7,435	0,007
-11,900	55,552	-2,459	7,321	0,007
-12,300	56,171	-2,500	7,211	0,002
-12,300	56,171	-2,500	7,211	0,002
-13,150	64,446	-2,500	6,986	0,002
-14,150	74,196	-2,500	6,736	0,001
-15,150	83,960	-2,500	6,500	0,001
-16,150	93,736	-2,500	6,276	0,001
-17,000	102,055	-2,500	6,095	0,001
-18,000	111,851	-2,500	5,891	0,000
-19,000	121,657	-2,500	5,697	0,000
-20,000	131,472	-2,500	5,512	0,000

3.5 Results for Vertical 5 (X = 8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-1,300	3,601	-1,300	3,600	0,172
-1,400	4,899	-1,400	3,599	0,170
-1,500	6,187	-1,500	3,587	0,169
-1,600	7,448	-1,600	3,548	0,168
-1,700	8,680	-1,700	3,480	0,167
-1,800	8,891	-1,700	3,391	0,166
-1,900	9,092	-1,700	3,292	0,166
-2,000	9,293	-1,700	3,193	0,165
-2,100	14,644	-1,700	8,244	0,164
-2,100	14,644	-1,700	8,244	0,164
-2,175	14,614	-1,700	8,177	0,164
-2,200	14,604	-1,700	8,154	0,164
-2,250	16,007	-1,700	9,532	0,163
-2,250	16,007	-1,700	9,532	0,163
-2,300	15,978	-1,700	9,480	0,157
-2,500	15,769	-1,699	9,177	0,136
-3,175	14,689	-1,698	7,775	0,107
-4,100	14,124	-1,696	6,765	0,068
-4,100	14,124	-1,696	6,765	0,068
-4,800	16,667	-1,764	6,389	0,048
-5,500	19,351	-1,832	6,153	0,036
-5,500	19,351	-1,832	6,153	0,036
-6,100	23,031	-1,890	6,010	0,029
-6,600	26,125	-1,939	5,916	0,025
-7,100	29,235	-1,988	5,839	0,022
-7,700	32,982	-2,046	5,760	0,018
-7,700	32,982	-2,046	5,760	0,018
-7,850	33,591	-2,061	5,742	0,016

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-8,000	34,201	-2,076	5,725	0,015
-8,000	34,201	-2,076	5,725	0,015
-9,000	40,480	-2,174	5,622	0,009
-10,000	46,776	-2,273	5,531	0,005
-10,000	46,776	-2,273	5,531	0,005
-10,750	49,850	-2,346	5,467	0,001
-11,500	52,927	-2,420	5,404	0,001
-11,500	52,927	-2,420	5,404	0,001
-11,900	53,612	-2,460	5,370	0,001
-12,300	54,297	-2,500	5,337	0,002
-12,300	54,297	-2,500	5,337	0,002
-13,150	62,724	-2,500	5,264	0,001
-14,150	72,637	-2,500	5,177	0,001
-15,150	82,547	-2,500	5,087	0,001
-16,150	92,455	-2,500	4,995	0,001
-17,000	100,875	-2,500	4,915	0,000
-18,000	110,780	-2,500	4,820	0,000
-19,000	120,683	-2,500	4,723	0,000
-20,000	130,586	-2,500	4,626	0,000

4 Settlements

4.1 Settlements

Vertical number	X co-ordinate [m]	Z co-ordinate [m]	Surface level [m]	Settlement [m]
1	-8,00	0,00	-1,30	0,172
2	-5,00	0,00	-1,30	0,261
3	0,00	0,00	-1,30	0,287
4	5,00	0,00	-1,30	0,261
5	8,00	0,00	-1,30	0,172

4.2 Residual Times

Vertical number	Time [days]	Settlement [m]	Part of final settlement [%]	Residual settlements [m]
1	365	0,138	80,238	0,034
2	365	0,192	73,537	0,069
3	365	0,203	70,820	0,084
4	365	0,192	73,537	0,069
5	365	0,138	80,238	0,034

5 Warnings and errors

List of non-fatal warnings and errors generated during calculation.

1 Model Koppejan is not ideal for unloading (e.g. load removal, temporary dewatering, gradual submerging). If As is much larger than Cs', unloading will yield almost no effect on creep. Switch to the NEN-Bjerrum or abc Isotache model for improved predictions.

2 Non-uniform load [1]: Co-ordinate is below surface (2)

3 Non-uniform load [1]: Co-ordinate is below surface (3)

4 Non-uniform load [2]: Co-ordinate is below surface (1)

5 Non-uniform load [2]: Co-ordinate is below surface (2)

6 Non-uniform load [2]: Co-ordinate is below surface (3)

7 Non-uniform load [2]: Co-ordinate is below surface (4)

End of Report

Report for D-Settlement 9.3

Settlement Calculations
Developed by Deltares

Company: BAM Infratechniek

Date of report: 3-10-2013
Time of report: 2:49:45

Date of calculation: 3-10-2013
Time of calculation: 2:49:33

Filename: C:\..\OSP's\R3N_Perceel 2_OSP-123 (DKM1216)-0,1 m overhoogte

Project identification: Randstad 380 Noordring

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2 Echo of the Input

2.1 Layer Boundaries

Boundary number	Co-ordinates [m]				
10 - X -	-30,000	-8,500	8,500	30,000	
10 - Y -	-4,600	-4,600	-4,600	-4,600	
9 - X -	-30,000	-8,500	-8,500	8,500	30,000
9 - Y -	-5,300	-5,300	-4,600	-4,600	-4,600
8 - X -	-30,000	-8,500	8,500	8,500	30,000
8 - Y -	-5,300	-5,300	-5,300	-4,600	-4,600
7 - X -	-30,000	-8,500	-8,500	8,500	8,500
7 - Y -	-5,300	-5,300	-5,750	-5,750	-5,300
7 - X -	8,500	30,000			
7 - Y -	-4,600	-4,600			
6 - X -	-30,000	-8,500	-8,500	8,500	8,500
6 - Y -	-5,300	-5,300	-5,750	-5,750	-5,300
6 - X -	30,000				
6 - Y -	-5,300				
5 - X -	-30,000	30,000			
5 - Y -	-6,300	-6,300			
4 - X -	-30,000	30,000			
4 - Y -	-8,800	-8,800			
3 - X -	-30,000	30,000			
3 - Y -	-10,000	-10,000			
2 - X -	-30,000	30,000			
2 - Y -	-11,700	-11,700			
1 - X -	-30,000	30,000			
1 - Y -	-12,300	-12,300			
0 - X -	-30,000	30,000			
0 - Y -	-20,000	-20,000			

2.2 PL Lines

PL line number	Co-ordinates [m]				
1 - X -	-30,000	30,000			
1 - Y -	-5,100	-5,100			
2 - X -	-30,000	30,000			
2 - Y -	-4,200	-4,200			

2.3 General Data

Soil model:	Koppejan
Consolidation model:	Darcy
Strain model:	Linear
Groundwater level:	Initial determined by PL-line number 1
Unit weight of water:	10,00 [kN/m³]
Stress distribution	
- Soil:	Buisman
- Loads:	Simulate
End of consolidation:	10950,00 [days]
No maintain profile	
Pc (initial):	Variable parallel to the initial effective stress
Pc (per step):	Automatic increased to the final effective stresses
Creep rate reference time:	1,000 [days]
No imaginary surface	
With submerging	
(only for non uniform loads)	
- Iteration stop criterium :	0,10 [m]
Load column width	
- Non-Uniform Loads :	1,00 [m]
- Trapezoidal Loads :	1,00 [m]

2.4 Soil Profiles

Layer number	Material name	PL-line top	PL-line bottom
10	veen toplaag	1	1
9	verbetering veen top...	1	1
8	verbetering klei zandig	1	1
7	veen toplaag	1	1
6	klei zandig-A4 (N)	1	1
5	klei humeus-A4 (N)	1	1
4	veen-A4 (Z)	99	99
3	klei siltig-A4 (N)	99	99
2	basisveen-A4 (N)	99	99
1	pleistoceen-A4 (N)	2	2

2.5 Soil Properties

Layer number	Drained	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
10	No	13,00	13,00
9	Yes	13,00	13,00
8	Yes	17,40	17,40
7	No	13,00	13,00
6	No	17,40	17,40
5	No	13,20	13,20
4	No	10,50	10,50
3	No	15,40	15,40
2	No	10,80	10,80
1	Yes	18,00	20,00

Layer number	Storage type	Vert. consolid. coefficient Cv [m²/s]	Vertical permeability [m/s]	Permeability strain mod. [m/s]	Initial vertical permeability [m/s]
10	Vert. cons.	7,70E-08	-	-	-
9	Vert. cons.	-	-	-	-
8	Vert. cons.	-	-	-	-
7	Vert. cons.	7,70E-08	-	-	-
6	Vert. cons.	2,00E-07	-	-	-
5	Vert. cons.	7,70E-08	-	-	-
4	Vert. cons.	3,00E-08	-	-	-
3	Vert. cons.	9,40E-08	-	-	-
2	Vert. cons.	4,70E-08	-	-	-
1	Vert. cons.	-	-	-	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
10	-	10,00	-
9	-	-	1,00
8	-	-	1,00
7	-	10,00	-
6	-	10,00	-
5	-	10,00	-
4	-	10,00	-
3	-	10,00	-
2	-	10,00	-
1	-	-	1,00

Layer number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
10	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
9	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
8	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
7	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
6	7,06E+01	2,87E+01	3,21E+02	1,95E+02	7,06E+01	1,95E+02

Layer number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
5	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
4	3,32E+01	5,70E+00	1,14E+02	2,28E+01	3,32E+01	2,28E+01
3	5,67E+01	1,38E+01	2,57E+02	8,98E+01	5,67E+01	8,98E+01
2	5,14E+01	7,20E+00	1,11E+02	2,76E+01	5,14E+01	2,76E+01
1	1,80E+03	6,00E+02	1,00E+09	1,00E+09	1,00E+09	1,00E+09

2.6 Non-Uniform Loads

Load number	Time	Unit weight	
		Unsaturated	Saturated
	[days]	[kN/m³]	[kN/m³]
1	0	5,00	17,00
2	0	1,00	13,00
3	0	0,00	10,00
4	0	18,00	20,00

Load number	Co-ordinates [m]					
1 - X -	-8,50	-8,50	8,50	8,50		
1 - Y -	-4,60	-5,30	-5,30	-4,60		
2 - X -	-8,50	-8,50	8,50	8,50		
2 - Y -	-5,30	-5,75	-5,75	-5,30		
3 - X -	-8,50	8,50				
3 - Y -	-4,60	-4,60				
4 - X -	-8,50	-8,50	8,50	8,50		
4 - Y -	-4,60	-4,50	-4,50	-4,60		

2.7 Verticals

Vertical number	X co-ordinates [m]				
1 - 5	-8,000	-5,000	0,000	5,000	8,000

Discretisation = 100

3 Results per Vertical

3.1 Results for Vertical 1 (X = -8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	1,801	-4,600	1,800	0,073
-4,700	3,099	-4,700	1,799	0,072
-4,800	4,393	-4,800	1,793	0,072
-4,900	5,674	-4,900	1,774	0,072
-4,950	6,309	-4,950	1,759	0,072
-5,000	6,940	-5,000	1,740	0,071
-5,100	8,195	-5,100	1,695	0,071
-5,200	8,446	-5,100	1,646	0,071
-5,300	12,745	-5,100	5,645	0,071
-5,300	12,745	-5,100	5,645	0,071
-5,400	13,436	-5,100	5,596	0,071
-5,500	14,118	-5,100	5,538	0,070
-5,525	14,285	-5,100	5,520	0,070
-5,600	14,774	-5,100	5,454	0,070
-5,750	17,056	-5,100	6,626	0,070
-5,750	17,056	-5,100	6,626	0,070
-6,025	18,695	-5,100	6,230	0,067
-6,300	20,318	-5,100	5,818	0,064
-6,300	20,318	-5,100	5,818	0,064
-6,950	21,687	-5,100	5,107	0,052
-7,550	23,242	-5,100	4,743	0,044
-8,200	25,082	-5,100	4,503	0,036
-8,800	26,855	-5,100	4,356	0,029
-8,800	26,855	-5,100	4,356	0,029
-9,400	25,505	-4,946	4,249	0,023
-10,000	24,181	-4,791	4,167	0,015
-10,000	24,181	-4,791	4,167	0,015
-10,850	26,496	-4,573	4,078	0,010
-11,700	28,829	-4,354	4,006	0,006
-11,700	28,829	-4,354	4,006	0,006
-12,000	28,275	-4,277	3,984	0,003
-12,300	27,723	-4,200	3,963	0,001
-12,300	27,723	-4,200	3,963	0,001
-13,150	36,167	-4,200	3,907	0,001
-14,150	46,105	-4,200	3,845	0,001
-15,150	56,045	-4,200	3,785	0,000
-16,150	65,984	-4,200	3,724	0,000
-17,000	74,432	-4,200	3,672	0,000
-18,000	84,370	-4,200	3,610	0,000
-19,000	94,305	-4,200	3,545	0,000
-20,000	104,240	-4,200	3,480	0,000

3.2 Results for Vertical 2 (X = -5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	1,801	-4,600	1,800	0,102
-4,700	3,100	-4,700	1,800	0,101
-4,800	4,400	-4,800	1,800	0,101
-4,900	5,700	-4,900	1,800	0,101
-4,950	6,350	-4,950	1,800	0,101
-5,000	7,000	-5,000	1,800	0,101
-5,100	8,300	-5,100	1,800	0,101

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-5,200	8,600	-5,100	1,800	0,100
-5,300	12,997	-5,100	5,897	0,100
-5,300	12,997	-5,100	5,897	0,100
-5,400	13,737	-5,100	5,897	0,100
-5,500	14,476	-5,100	5,896	0,100
-5,525	14,661	-5,100	5,896	0,100
-5,600	15,216	-5,100	5,896	0,099
-5,750	17,674	-5,100	7,244	0,099
-5,750	17,674	-5,100	7,244	0,099
-6,025	19,703	-5,100	7,239	0,095
-6,300	21,728	-5,100	7,229	0,092
-6,300	21,728	-5,100	7,229	0,092
-6,950	23,757	-5,100	7,178	0,077
-7,550	25,587	-5,100	7,088	0,065
-8,200	27,525	-5,100	6,947	0,053
-8,800	29,286	-5,100	6,788	0,043
-8,800	29,286	-5,100	6,788	0,043
-9,400	27,870	-4,946	6,614	0,033
-10,000	26,449	-4,791	6,436	0,022
-10,000	26,449	-4,791	6,436	0,022
-10,850	28,607	-4,573	6,189	0,015
-11,700	30,779	-4,354	5,956	0,008
-11,700	30,779	-4,354	5,956	0,008
-12,000	30,169	-4,277	5,878	0,005
-12,300	29,562	-4,200	5,802	0,001
-12,300	29,562	-4,200	5,802	0,001
-13,150	37,856	-4,200	5,596	0,001
-14,150	47,634	-4,200	5,374	0,001
-15,150	57,428	-4,200	5,168	0,001
-16,150	67,236	-4,200	4,976	0,000
-17,000	75,583	-4,200	4,823	0,000
-18,000	85,412	-4,200	4,652	0,000
-19,000	95,251	-4,200	4,491	0,000
-20,000	105,097	-4,200	4,337	0,000

3.3 Results for Vertical 3 (X = 0,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	1,801	-4,600	1,800	0,107
-4,700	3,100	-4,700	1,800	0,107
-4,800	4,400	-4,800	1,800	0,106
-4,900	5,700	-4,900	1,800	0,106
-4,950	6,350	-4,950	1,800	0,106
-5,000	7,000	-5,000	1,800	0,106
-5,100	8,300	-5,100	1,800	0,106
-5,200	8,600	-5,100	1,800	0,106
-5,300	13,011	-5,100	5,911	0,106
-5,300	13,011	-5,100	5,911	0,106
-5,400	13,751	-5,100	5,911	0,105
-5,500	14,491	-5,100	5,911	0,105
-5,525	14,676	-5,100	5,911	0,105
-5,600	15,231	-5,100	5,911	0,105
-5,750	17,691	-5,100	7,261	0,104
-5,750	17,691	-5,100	7,261	0,104
-6,025	19,725	-5,100	7,260	0,101
-6,300	21,759	-5,100	7,260	0,098
-6,300	21,759	-5,100	7,260	0,098
-6,950	23,834	-5,100	7,255	0,083
-7,550	25,743	-5,100	7,244	0,070
-8,200	27,800	-5,100	7,222	0,058

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-8,800	29,687	-5,100	7,189	0,048
-8,800	29,687	-5,100	7,189	0,048
-9,400	28,397	-4,946	7,142	0,036
-10,000	27,093	-4,791	7,080	0,025
-10,000	27,093	-4,791	7,080	0,025
-10,850	29,383	-4,573	6,966	0,017
-11,700	31,646	-4,354	6,824	0,010
-11,700	31,646	-4,354	6,824	0,010
-12,000	31,059	-4,277	6,768	0,005
-12,300	30,470	-4,200	6,710	0,001
-12,300	30,470	-4,200	6,710	0,001
-13,150	38,792	-4,200	6,532	0,001
-14,150	48,567	-4,200	6,307	0,001
-15,150	58,332	-4,200	6,072	0,001
-16,150	68,094	-4,200	5,834	0,000
-17,000	76,393	-4,200	5,633	0,000
-18,000	86,163	-4,200	5,403	0,000
-19,000	95,941	-4,200	5,181	0,000
-20,000	105,728	-4,200	4,968	0,000

3.4 Results for Vertical 4 (X = 5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	1,801	-4,600	1,800	0,102
-4,700	3,100	-4,700	1,800	0,101
-4,800	4,400	-4,800	1,800	0,101
-4,900	5,700	-4,900	1,800	0,101
-4,950	6,350	-4,950	1,800	0,101
-5,000	7,000	-5,000	1,800	0,101
-5,100	8,300	-5,100	1,800	0,101
-5,200	8,600	-5,100	1,800	0,100
-5,300	12,997	-5,100	5,897	0,100
-5,300	12,997	-5,100	5,897	0,100
-5,400	13,737	-5,100	5,897	0,100
-5,500	14,476	-5,100	5,896	0,100
-5,525	14,661	-5,100	5,896	0,100
-5,600	15,216	-5,100	5,896	0,099
-5,750	17,674	-5,100	7,244	0,099
-5,750	17,674	-5,100	7,244	0,099
-6,025	19,703	-5,100	7,239	0,095
-6,300	21,728	-5,100	7,229	0,092
-6,300	21,728	-5,100	7,229	0,092
-6,950	23,757	-5,100	7,178	0,077
-7,550	25,587	-5,100	7,088	0,065
-8,200	27,525	-5,100	6,947	0,053
-8,800	29,286	-5,100	6,788	0,043
-8,800	29,286	-5,100	6,788	0,043
-9,400	27,870	-4,946	6,614	0,033
-10,000	26,449	-4,791	6,436	0,022
-10,000	26,449	-4,791	6,436	0,022
-10,850	28,607	-4,573	6,189	0,015
-11,700	30,779	-4,354	5,956	0,008
-11,700	30,779	-4,354	5,956	0,008
-12,000	30,169	-4,277	5,878	0,005
-12,300	29,562	-4,200	5,802	0,001
-12,300	29,562	-4,200	5,802	0,001
-13,150	37,856	-4,200	5,596	0,001
-14,150	47,634	-4,200	5,374	0,001
-15,150	57,428	-4,200	5,168	0,001
-16,150	67,236	-4,200	4,976	0,000

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-17,000	75,583	-4,200	4,823	0,000
-18,000	85,412	-4,200	4,652	0,000
-19,000	95,251	-4,200	4,491	0,000
-20,000	105,097	-4,200	4,337	0,000

3.5 Results for Vertical 5 (X = 8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,600	1,801	-4,600	1,800	0,073
-4,700	3,099	-4,700	1,799	0,072
-4,800	4,393	-4,800	1,793	0,072
-4,900	5,674	-4,900	1,774	0,072
-4,950	6,309	-4,950	1,759	0,072
-5,000	6,940	-5,000	1,740	0,071
-5,100	8,195	-5,100	1,695	0,071
-5,200	8,446	-5,100	1,646	0,071
-5,300	12,745	-5,100	5,645	0,071
-5,300	12,745	-5,100	5,645	0,071
-5,400	13,436	-5,100	5,596	0,071
-5,500	14,118	-5,100	5,538	0,070
-5,525	14,285	-5,100	5,520	0,070
-5,600	14,774	-5,100	5,454	0,070
-5,750	17,056	-5,100	6,626	0,070
-5,750	17,056	-5,100	6,626	0,070
-6,025	18,695	-5,100	6,230	0,067
-6,300	20,318	-5,100	5,818	0,064
-6,300	20,318	-5,100	5,818	0,064
-6,950	21,687	-5,100	5,107	0,052
-7,550	23,242	-5,100	4,743	0,044
-8,200	25,082	-5,100	4,503	0,036
-8,800	26,855	-5,100	4,356	0,029
-8,800	26,855	-5,100	4,356	0,029
-9,400	25,505	-4,946	4,249	0,023
-10,000	24,181	-4,791	4,167	0,015
-10,000	24,181	-4,791	4,167	0,015
-10,850	26,496	-4,573	4,078	0,010
-11,700	28,829	-4,354	4,006	0,006
-11,700	28,829	-4,354	4,006	0,006
-12,000	28,275	-4,277	3,984	0,003
-12,300	27,723	-4,200	3,963	0,001
-12,300	27,723	-4,200	3,963	0,001
-13,150	36,167	-4,200	3,907	0,001
-14,150	46,105	-4,200	3,845	0,001
-15,150	56,045	-4,200	3,785	0,000
-16,150	65,984	-4,200	3,724	0,000
-17,000	74,432	-4,200	3,672	0,000
-18,000	84,370	-4,200	3,610	0,000
-19,000	94,305	-4,200	3,545	0,000
-20,000	104,240	-4,200	3,480	0,000

4 Settlements

4.1 Settlements

Vertical number	X co-ordinate [m]	Z co-ordinate [m]	Surface level [m]	Settlement [m]
1	-8,00	0,00	-4,60	0,073
2	-5,00	0,00	-4,60	0,102
3	0,00	0,00	-4,60	0,107
4	5,00	0,00	-4,60	0,102
5	8,00	0,00	-4,60	0,073

4.2 Residual Times

Vertical number	Time [days]	Settlement [m]	Part of final settlement [%]	Residual settlements [m]
1	365	0,032	43,938	0,041
2	365	0,044	42,856	0,058
3	365	0,046	42,885	0,061
4	365	0,044	42,856	0,058
5	365	0,032	43,938	0,041

5 Warnings and errors

List of non-fatal warnings and errors generated during calculation.

1 Model Koppejan is not ideal for unloading (e.g. load removal, temporary dewatering, gradual submerging). If As is much larger than Cs', unloading will yield almost no effect on creep. Switch to the NEN-Bjerrum or abc Isotache model for improved predictions.

2 Non-uniform load [1]: Co-ordinate is below surface (2)

3 Non-uniform load [1]: Co-ordinate is below surface (3)

4 Non-uniform load [2]: Co-ordinate is below surface (1)

5 Non-uniform load [2]: Co-ordinate is below surface (2)

6 Non-uniform load [2]: Co-ordinate is below surface (3)

7 Non-uniform load [2]: Co-ordinate is below surface (4)

End of Report

Report for D-Settlement 9.3

Settlement Calculations
Developed by Deltares

Company: BAM Infratechniek

Date of report: 3-10-2013
Time of report: 2:48:45

Date of calculation: 3-10-2013
Time of calculation: 2:47:54

Filename: C:\..\OSP's\R3N_Perceel 2_OSP-109 (DKM543)-0,1 m overhoogte

Project identification: Randstad 380 Noordring

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2 Echo of the Input

2.1 Layer Boundaries

Boundary number	Co-ordinates [m]				
10 - X -	-30,000	-8,500	8,500	30,000	
10 - Y -	-4,300	-4,300	-4,300	-4,300	
9 - X -	-30,000	-8,500	-8,500	8,500	30,000
9 - Y -	-4,800	-4,800	-4,300	-4,300	-4,300
8 - X -	-30,000	-8,500	8,500	8,500	30,000
8 - Y -	-4,800	-4,800	-4,800	-4,300	-4,300
7 - X -	-30,000	-8,500	-8,500	8,500	8,500
7 - Y -	-4,800	-4,800	-5,450	-5,450	-4,800
7 - X -	8,500	30,000			
7 - Y -	-4,300	-4,300			
6 - X -	-30,000	-8,500	-8,500	8,500	8,500
6 - Y -	-4,800	-4,800	-5,450	-5,450	-4,800
6 - X -	30,000				
6 - Y -	-4,800				
5 - X -	-30,000	30,000			
5 - Y -	-5,500	-5,500			
4 - X -	-30,000	30,000			
4 - Y -	-6,000	-6,000			
3 - X -	-30,000	30,000			
3 - Y -	-6,500	-6,500			
2 - X -	-30,000	30,000			
2 - Y -	-8,700	-8,700			
1 - X -	-30,000	30,000			
1 - Y -	-9,500	-9,500			
0 - X -	-30,000	30,000			
0 - Y -	-20,000	-20,000			

2.2 PL Lines

PL line number	Co-ordinates [m]				
1 - X -	-30,000	30,000			
1 - Y -	-4,600	-4,600			
2 - X -	-30,000	30,000			
2 - Y -	-5,000	-5,000			

2.3 General Data

Soil model:	Koppejan
Consolidation model:	Darcy
Strain model:	Linear
Groundwater level:	Initial determined by PL-line number 1
Unit weight of water:	10,00 [kN/m³]
Stress distribution	
- Soil:	Buisman
- Loads:	Simulate
End of consolidation:	10950,00 [days]
No maintain profile	
Pc (initial):	Variable parallel to the initial effective stress
Pc (per step):	Automatic increased to the final effective stresses
Creep rate reference time:	1,000 [days]
No imaginary surface	
With submerging	
(only for non uniform loads)	
- Iteration stop criterium :	0,10 [m]
Load column width	
- Non-Uniform Loads :	1,00 [m]
- Trapezoidal Loads :	1,00 [m]

2.4 Soil Profiles

Layer number	Material name	PL-line top	PL-line bottom
10	veen toplaag	1	1
9	verbetering veen top...	1	1
8	verbetering klei, zan...	1	1
7	veen toplaag	1	1
6	klei zandig-A4 (N)	1	1
5	klei humeus-A4 (N)	1	1
4	zand kleiig-A4 (N)	1	1
3	klei humeus-A4 (N)	99	99
2	basisveen-A4 (N)	99	99
1	pleistoceen-A4 (N)	2	2

2.5 Soil Properties

Layer number	Drained	Unit weight	
		Unsaturated [kN/m³]	Saturated [kN/m³]
10	No	13,00	13,00
9	Yes	13,00	13,00
8	Yes	17,40	17,40
7	No	13,00	13,00
6	No	17,40	17,40
5	No	13,20	13,20
4	No	17,50	19,00
3	No	13,20	13,20
2	No	10,80	10,80
1	Yes	18,00	20,00

Layer number	Storage type	Vert. consolid. coefficient Cv [m²/s]	Vertical permeability [m/s]	Permeability strain mod. [m/s]	Initial vertical permeability [m/s]
10	Vert. cons.	7,70E-08	-	-	-
9	Vert. cons.	-	-	-	-
8	Vert. cons.	-	-	-	-
7	Vert. cons.	7,70E-08	-	-	-
6	Vert. cons.	2,00E-07	-	-	-
5	Vert. cons.	7,70E-08	-	-	-
4	Vert. cons.	5,50E-06	-	-	-
3	Vert. cons.	7,70E-08	-	-	-
2	Vert. cons.	4,70E-08	-	-	-
1	Vert. cons.	-	-	-	-

Layer number	Precons. pressure [kN/m²]	POP [kN/m²]	OCR [-]
10	-	10,00	-
9	-	-	1,00
8	-	-	1,00
7	-	10,00	-
6	-	10,00	-
5	-	10,00	-
4	-	-	1,00
3	-	10,00	-
2	-	10,00	-
1	-	-	1,00

Layer number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
10	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
9	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
8	8,00E+02	2,00E+02	1,00E+05	1,00E+05	1,00E+09	1,00E+09
7	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
6	7,06E+01	2,87E+01	3,21E+02	1,95E+02	7,06E+01	1,95E+02

Layer	Primary compr. coeff.		Secular compr. coef.		Swell constants	
number	Cp [-]	Cp' [-]	Cs [-]	Cs' [-]	Ap [-]	As [-]
5	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
4	4,00E+02	2,00E+02	1,00E+09	1,00E+09	4,00E+02	1,00E+09
3	3,10E+01	6,50E+00	1,45E+02	1,60E+01	3,10E+01	1,60E+01
2	5,14E+01	7,20E+00	1,11E+02	2,76E+01	5,14E+01	2,76E+01
1	1,80E+03	6,00E+02	1,00E+09	1,00E+09	1,00E+09	1,00E+09

2.6 Non-Uniform Loads

Load number	Time	Unit weight	
		Unsaturated	Saturated
	[days]	[kN/m³]	[kN/m³]
1	0	5,00	17,00
2	0	1,00	13,00
3	0	0,00	10,00
4	0	18,00	20,00

Load number	Co-ordinates [m]					
1 - X -	-8,50	-8,50	8,50	8,50		
1 - Y -	-4,30	-4,80	-4,80	-4,30		
2 - X -	-8,50	-8,50	8,50	8,50		
2 - Y -	-4,80	-5,45	-5,45	-4,80		
3 - X -	-8,50	8,50				
3 - Y -	-4,30	-4,30				
4 - X -	-8,50	-8,50	8,50	8,50		
4 - Y -	-4,30	-4,20	-4,20	-4,30		

2.7 Verticals

Vertical number	X co-ordinates [m]				
1 - 5	-8,000	-5,000	0,000	5,000	8,000

Discretisation = 100

3 Results per Vertical

3.1 Results for Vertical 1 (X = -8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,300	1,801	-4,300	1,800	0,050
-4,400	3,099	-4,400	1,799	0,049
-4,500	4,393	-4,500	1,793	0,049
-4,550	5,035	-4,550	1,785	0,049
-4,600	5,674	-4,600	1,774	0,049
-4,700	5,940	-4,600	1,740	0,048
-4,800	9,197	-4,600	4,697	0,048
-4,800	9,197	-4,600	4,697	0,048
-4,900	9,887	-4,600	4,647	0,048
-5,000	10,567	-4,600	4,587	0,047
-5,100	11,227	-4,600	4,507	0,047
-5,125	11,388	-4,600	4,483	0,047
-5,200	11,866	-4,600	4,406	0,047
-5,300	12,491	-4,600	4,291	0,047
-5,450	15,374	-4,600	6,064	0,046
-5,450	15,374	-4,600	6,064	0,046
-5,475	15,530	-4,600	6,035	0,046
-5,500	15,686	-4,600	6,006	0,046
-5,500	15,686	-4,600	6,006	0,046
-5,750	16,201	-4,600	5,721	0,039
-6,000	16,687	-4,600	5,407	0,033
-6,000	16,687	-4,600	5,407	0,033
-6,250	18,647	-4,600	5,117	0,032
-6,500	20,662	-4,600	4,882	0,032
-6,500	20,662	-4,600	4,882	0,032
-7,100	22,998	-4,680	4,498	0,024
-7,600	25,065	-4,747	4,299	0,018
-8,100	27,192	-4,813	4,159	0,013
-8,700	29,790	-4,893	4,037	0,007
-8,700	29,790	-4,893	4,037	0,007
-9,100	30,581	-4,947	3,974	0,004
-9,500	31,382	-5,000	3,922	0,001
-9,500	31,382	-5,000	3,922	0,001
-10,250	38,802	-5,000	3,842	0,001
-11,250	48,719	-5,000	3,759	0,001
-12,250	58,651	-5,000	3,691	0,001
-13,250	68,591	-5,000	3,631	0,000
-14,250	78,533	-5,000	3,573	0,000
-14,750	83,505	-5,000	3,545	0,000
-15,500	90,963	-5,000	3,503	0,000
-16,500	100,906	-5,000	3,446	0,000
-17,500	110,847	-5,000	3,387	0,000
-18,500	120,787	-5,000	3,327	0,000
-19,500	130,726	-5,000	3,266	0,000
-20,000	135,694	-5,000	3,234	0,000

3.2 Results for Vertical 2 (X = -5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,300	1,801	-4,300	1,800	0,068
-4,400	3,100	-4,400	1,800	0,067
-4,500	4,400	-4,500	1,800	0,067

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,550	5,050	-4,550	1,800	0,066
-4,600	5,700	-4,600	1,800	0,066
-4,700	6,000	-4,600	1,800	0,066
-4,800	9,331	-4,600	4,831	0,066
-4,800	9,331	-4,600	4,831	0,066
-4,900	10,071	-4,600	4,831	0,066
-5,000	10,811	-4,600	4,831	0,065
-5,100	11,550	-4,600	4,830	0,065
-5,125	11,735	-4,600	4,830	0,065
-5,200	12,290	-4,600	4,830	0,065
-5,300	13,029	-4,600	4,829	0,064
-5,450	16,087	-4,600	6,777	0,064
-5,450	16,087	-4,600	6,777	0,064
-5,475	16,272	-4,600	6,777	0,064
-5,500	16,456	-4,600	6,776	0,063
-5,500	16,456	-4,600	6,776	0,063
-5,750	17,250	-4,600	6,770	0,056
-6,000	18,040	-4,600	6,760	0,048
-6,000	18,040	-4,600	6,760	0,048
-6,250	20,275	-4,600	6,745	0,048
-6,500	22,504	-4,600	6,724	0,047
-6,500	22,504	-4,600	6,724	0,047
-7,100	25,146	-4,680	6,646	0,035
-7,600	27,320	-4,747	6,553	0,027
-8,100	29,472	-4,813	6,439	0,019
-8,700	32,037	-4,893	6,284	0,011
-8,700	32,037	-4,893	6,284	0,011
-9,100	32,781	-4,947	6,174	0,006
-9,500	33,524	-5,000	6,064	0,001
-9,500	33,524	-5,000	6,064	0,001
-10,250	40,818	-5,000	5,858	0,001
-11,250	50,558	-5,000	5,598	0,001
-12,250	60,319	-5,000	5,359	0,001
-13,250	70,100	-5,000	5,140	0,001
-14,250	79,899	-5,000	4,939	0,000
-14,750	84,804	-5,000	4,844	0,000
-15,500	92,168	-5,000	4,708	0,000
-16,500	101,997	-5,000	4,537	0,000
-17,500	111,836	-5,000	4,376	0,000
-18,500	121,683	-5,000	4,223	0,000
-19,500	131,539	-5,000	4,079	0,000
-20,000	136,469	-5,000	4,009	0,000

3.3 Results for Vertical 3 (X = 0,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,300	1,801	-4,300	1,800	0,069
-4,400	3,100	-4,400	1,800	0,069
-4,500	4,400	-4,500	1,800	0,068
-4,550	5,050	-4,550	1,800	0,068
-4,600	5,700	-4,600	1,800	0,068
-4,700	6,000	-4,600	1,800	0,068
-4,800	9,337	-4,600	4,837	0,068
-4,800	9,337	-4,600	4,837	0,068
-4,900	10,077	-4,600	4,837	0,067
-5,000	10,817	-4,600	4,837	0,067
-5,100	11,557	-4,600	4,837	0,067
-5,125	11,742	-4,600	4,837	0,067
-5,200	12,297	-4,600	4,837	0,067
-5,300	13,037	-4,600	4,837	0,066

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-5,450	16,097	-4,600	6,787	0,066
-5,450	16,097	-4,600	6,787	0,066
-5,475	16,282	-4,600	6,787	0,066
-5,500	16,467	-4,600	6,787	0,065
-5,500	16,467	-4,600	6,787	0,065
-5,750	17,267	-4,600	6,787	0,057
-6,000	18,066	-4,600	6,786	0,050
-6,000	18,066	-4,600	6,786	0,050
-6,250	20,314	-4,600	6,784	0,050
-6,500	22,562	-4,600	6,782	0,049
-6,500	22,562	-4,600	6,782	0,049
-7,100	25,274	-4,680	6,774	0,037
-7,600	27,527	-4,747	6,760	0,028
-8,100	29,773	-4,813	6,740	0,020
-8,700	32,457	-4,893	6,704	0,011
-8,700	32,457	-4,893	6,704	0,011
-9,100	33,279	-4,947	6,673	0,006
-9,500	34,095	-5,000	6,635	0,001
-9,500	34,095	-5,000	6,635	0,001
-10,250	41,507	-5,000	6,547	0,001
-11,250	51,357	-5,000	6,397	0,001
-12,250	61,177	-5,000	6,217	0,001
-13,250	70,975	-5,000	6,015	0,001
-14,250	80,760	-5,000	5,800	0,000
-14,750	85,649	-5,000	5,689	0,000
-15,500	92,983	-5,000	5,523	0,000
-16,500	102,762	-5,000	5,302	0,000
-17,500	112,545	-5,000	5,085	0,000
-18,500	122,337	-5,000	4,877	0,000
-19,500	132,137	-5,000	4,677	0,000
-20,000	137,040	-5,000	4,580	0,000

3.4 Results for Vertical 4 (X = 5,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,300	1,801	-4,300	1,800	0,068
-4,400	3,100	-4,400	1,800	0,067
-4,500	4,400	-4,500	1,800	0,067
-4,550	5,050	-4,550	1,800	0,066
-4,600	5,700	-4,600	1,800	0,066
-4,700	6,000	-4,600	1,800	0,066
-4,800	9,331	-4,600	4,831	0,066
-4,800	9,331	-4,600	4,831	0,066
-4,900	10,071	-4,600	4,831	0,066
-5,000	10,811	-4,600	4,831	0,065
-5,100	11,550	-4,600	4,830	0,065
-5,125	11,735	-4,600	4,830	0,065
-5,200	12,290	-4,600	4,830	0,065
-5,300	13,029	-4,600	4,829	0,064
-5,450	16,087	-4,600	6,777	0,064
-5,450	16,087	-4,600	6,777	0,064
-5,475	16,272	-4,600	6,777	0,064
-5,500	16,456	-4,600	6,776	0,063
-5,500	16,456	-4,600	6,776	0,063
-5,750	17,250	-4,600	6,770	0,056
-6,000	18,040	-4,600	6,760	0,048
-6,000	18,040	-4,600	6,760	0,048
-6,250	20,275	-4,600	6,745	0,048
-6,500	22,504	-4,600	6,724	0,047
-6,500	22,504	-4,600	6,724	0,047

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-7,100	25,146	-4,680	6,646	0,035
-7,600	27,320	-4,747	6,553	0,027
-8,100	29,472	-4,813	6,439	0,019
-8,700	32,037	-4,893	6,284	0,011
-8,700	32,037	-4,893	6,284	0,011
-9,100	32,781	-4,947	6,174	0,006
-9,500	33,524	-5,000	6,064	0,001
-9,500	33,524	-5,000	6,064	0,001
-10,250	40,818	-5,000	5,858	0,001
-11,250	50,558	-5,000	5,598	0,001
-12,250	60,319	-5,000	5,359	0,001
-13,250	70,100	-5,000	5,140	0,001
-14,250	79,899	-5,000	4,939	0,000
-14,750	84,804	-5,000	4,844	0,000
-15,500	92,168	-5,000	4,708	0,000
-16,500	101,997	-5,000	4,537	0,000
-17,500	111,836	-5,000	4,376	0,000
-18,500	121,683	-5,000	4,223	0,000
-19,500	131,539	-5,000	4,079	0,000
-20,000	136,469	-5,000	4,009	0,000

3.5 Results for Vertical 5 (X = 8,00 m; Z = 0,00 m)

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-4,300	1,801	-4,300	1,800	0,050
-4,400	3,099	-4,400	1,799	0,049
-4,500	4,393	-4,500	1,793	0,049
-4,550	5,035	-4,550	1,785	0,049
-4,600	5,674	-4,600	1,774	0,049
-4,700	5,940	-4,600	1,740	0,048
-4,800	9,197	-4,600	4,697	0,048
-4,800	9,197	-4,600	4,697	0,048
-4,900	9,887	-4,600	4,647	0,048
-5,000	10,567	-4,600	4,587	0,047
-5,100	11,227	-4,600	4,507	0,047
-5,125	11,388	-4,600	4,483	0,047
-5,200	11,866	-4,600	4,406	0,047
-5,300	12,491	-4,600	4,291	0,047
-5,450	15,374	-4,600	6,064	0,046
-5,450	15,374	-4,600	6,064	0,046
-5,475	15,530	-4,600	6,035	0,046
-5,500	15,686	-4,600	6,006	0,046
-5,500	15,686	-4,600	6,006	0,046
-5,750	16,201	-4,600	5,721	0,039
-6,000	16,687	-4,600	5,407	0,033
-6,000	16,687	-4,600	5,407	0,033
-6,250	18,647	-4,600	5,117	0,032
-6,500	20,662	-4,600	4,882	0,032
-6,500	20,662	-4,600	4,882	0,032
-7,100	22,998	-4,680	4,498	0,024
-7,600	25,065	-4,747	4,299	0,018
-8,100	27,192	-4,813	4,159	0,013
-8,700	29,790	-4,893	4,037	0,007
-8,700	29,790	-4,893	4,037	0,007
-9,100	30,581	-4,947	3,974	0,004
-9,500	31,382	-5,000	3,922	0,001
-9,500	31,382	-5,000	3,922	0,001
-10,250	38,802	-5,000	3,842	0,001
-11,250	48,719	-5,000	3,759	0,001
-12,250	58,651	-5,000	3,691	0,001

Depth [m]	Effective Stress [kPa]	Hydraulic head [m]	Loading [kPa]	Settlement [m]
-13,250	68,591	-5,000	3,631	0,000
-14,250	78,533	-5,000	3,573	0,000
-14,750	83,505	-5,000	3,545	0,000
-15,500	90,963	-5,000	3,503	0,000
-16,500	100,906	-5,000	3,446	0,000
-17,500	110,847	-5,000	3,387	0,000
-18,500	120,787	-5,000	3,327	0,000
-19,500	130,726	-5,000	3,266	0,000
-20,000	135,694	-5,000	3,234	0,000

4 Settlements

4.1 Settlements

Vertical number	X co-ordinate [m]	Z co-ordinate [m]	Surface level [m]	Settlement [m]
1	-8,00	0,00	-4,30	0,050
2	-5,00	0,00	-4,30	0,068
3	0,00	0,00	-4,30	0,069
4	5,00	0,00	-4,30	0,068
5	8,00	0,00	-4,30	0,050

4.2 Residual Times

Vertical number	Time [days]	Settlement [m]	Part of final settlement [%]	Residual settlements [m]
1	365	0,035	71,083	0,014
2	365	0,047	69,774	0,020
3	365	0,048	69,694	0,021
4	365	0,047	69,774	0,020
5	365	0,035	71,083	0,014

5 Warnings and errors

List of non-fatal warnings and errors generated during calculation.

1 Model Koppejan is not ideal for unloading (e.g. load removal, temporary dewatering, gradual submerging). If As is much larger than Cs', unloading will yield almost no effect on creep. Switch to the NEN-Bjerrum or abc Isotache model for improved predictions.

2 Non-uniform load [1]: Co-ordinate is below surface (2)

3 Non-uniform load [1]: Co-ordinate is below surface (3)

4 Non-uniform load [2]: Co-ordinate is below surface (1)

5 Non-uniform load [2]: Co-ordinate is below surface (2)

6 Non-uniform load [2]: Co-ordinate is below surface (3)

7 Non-uniform load [2]: Co-ordinate is below surface (4)

End of Report

Ontwerpberekening mast 74, 150 kV-lijn Zoetermeer-Leiden

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	06-08-2013	Eerste versie
01	13-11-2013	Toevoegen van aanzichttekeningen
02	25-04-2014	Aanpassing berekening: Afdaling met 2 ipv 3 circuits

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Beheer

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1. INLEIDING

De komende jaren werken het ministerie van Economische Zaken en TenneT aan de aanleg van een nieuwe 380 kV hoogspanningsverbinding in de Randstad. De nieuwe verbinding stelt de voorziening van elektriciteit in de Randstad veilig.

Het ontwerptracé van de nieuwe Randstad 380 kV verbinding is sinds eind 2008 bekend. De plannen gaan uit van twee ringen, tussen Wateringen en Zoetermeer (de Zuidring) en tussen Zoetermeer en Beverwijk (de Noordring). Eind 2012 heeft Tennet de aanbesteding opgestart voor het gedeelte van de Noordring tussen station Vijfhuizen en Bleiswijk. Het contract is opgedeeld in twee percelen, waarbij de grens ligt bij Zuidelijke Ringvaart. Dit document heeft betrekking op perceel 2 (het zuidelijke gedeelte).

BAM heeft op 8 juli 2013 het contract ondertekend met TenneT voor het ontwerp en realiseren van perceel 2. Het voorliggende document is onderdeel van het Definitief Ontwerp en behandelt de ontwerpberekening van mast 74.

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2. ONTWERP BEREKENING

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Mastcontrole

Onderwerp	:	Ontwerpberekening mast 74, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr :	:	13039140509
Opgesteld	:	M. Glegola
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	16-Apr-2014
D&C documentnr.	:	B.14015

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	16-Apr-14	Ontwerpberekening	M. Glegola	J.Hollaar	J.Hollaar

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1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een ontwerpberekening voor mast nr.74 in de 150 kV-lijn Zoetermeer -Leiden. Mast 74 moet opnieuw ontworpen worden, omdat vanaf Zoetermeer tot aan deze mast de lijn verkabelt wordt.
Mast 74 wordt dan een eindmast met tafelconstructie t.b.v. de eindafsluitingen.
De berekeningen worden uitgevoerd conform de vigerende norm NEN-EN-50341-1 en 3.
Voor de geleiderbelasting vanuit de bliksemdraden wordt ijsgebied A aangehouden, conform afspraak (aanvullende eis van TenneT), zoals vermeld in: "Lijnen; Standaard programma van eisen; PVE.05.000;25 november 2010; versie 1.0".

1.2 Normen en tekeningen en documenten en andere uitgangspunten

Tekeningen Cofely Fabricom:

mast nr.74 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
50600	Masttype DD
WK1783,2	wegkaart kruising rijksweg 4A
BV 65-1-1 Blad-1	Klapper op de wegkaarten
AALG0059033	Volgorde, klokgetallen en kleuren van de fasen
BV065-2	Lengteprofiel

Normen:

NEN-EN 50341-1 : 2001
NEN-EN 50341-3 : 2001

Andere uitgangspunten:

Fundatiehoogte 0,50 m boven maaiveld.

1.3 Nadere bepalingen

De geleiderbelastingen en de benodigde verzwaringen van de mastconstructies worden berekend volgens NEN-EN 50341-1 en 3 met spanningscontroles volgens EC-3.

De mastconstructie wordt 3D doorgerekend.

Voor de mastconstructie zal een maximum totaalspanning van 100% worden gehanteerd.

Er is gerekend dat er geen antenne-opstellingen in de te controleren mastconstructie aanwezig zijn.

De berekening is uitgevoerd met het rekenpakket Scia LTA programma 2012

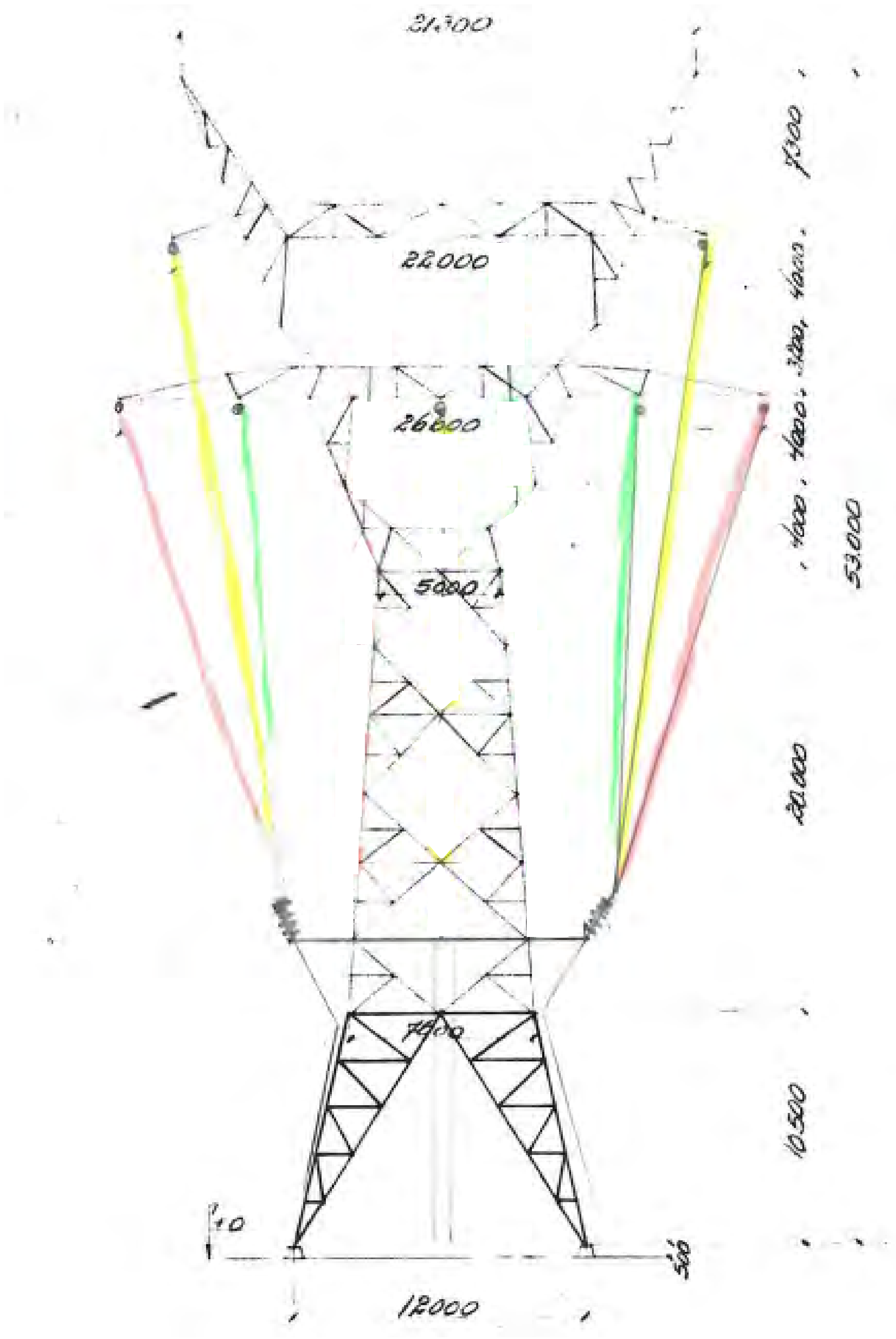
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A.
Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000;
25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

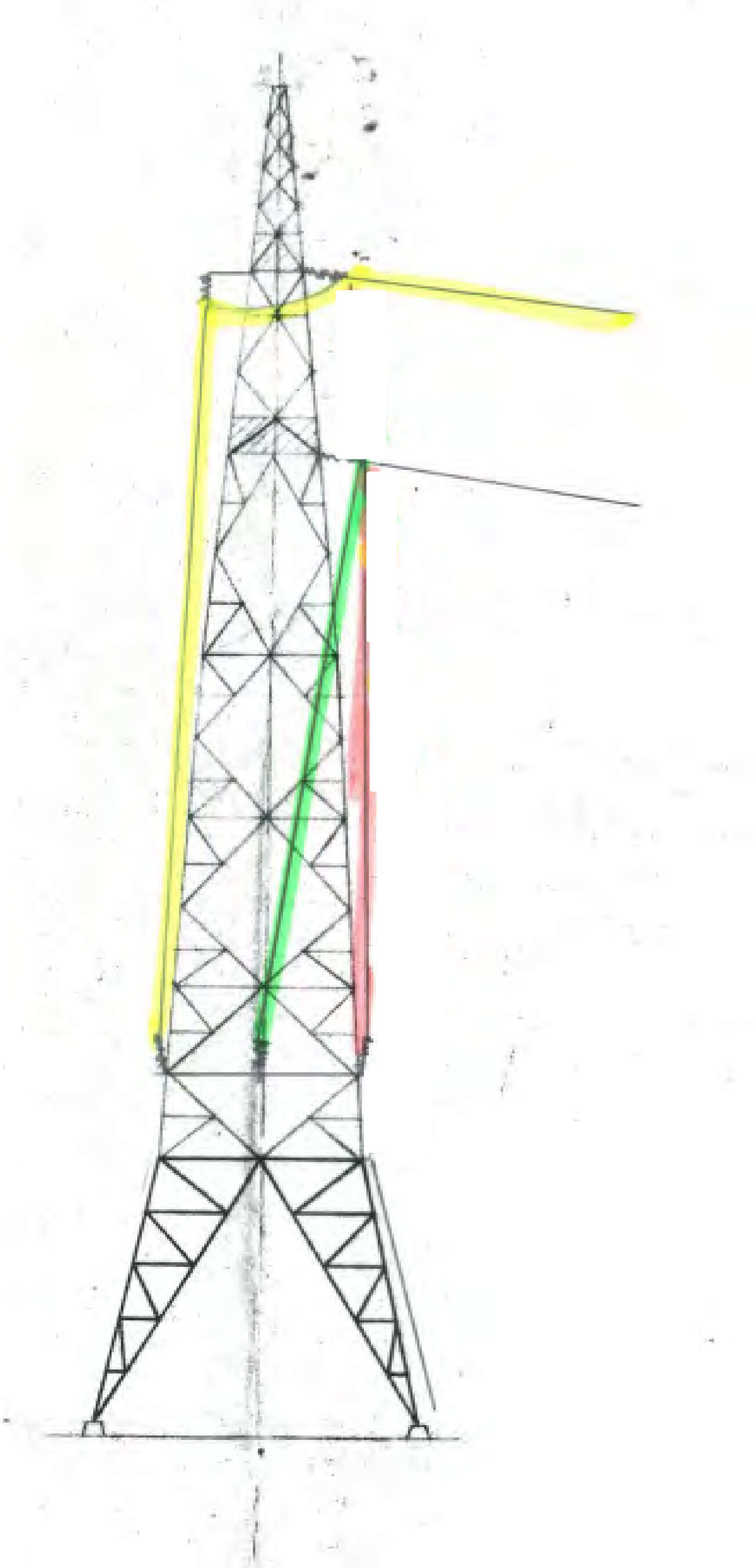
Materiaal randen	:	S355
Materiaal diagonalen	:	S355
Materiaal bouten		8.8

1.5 Overzicht mast

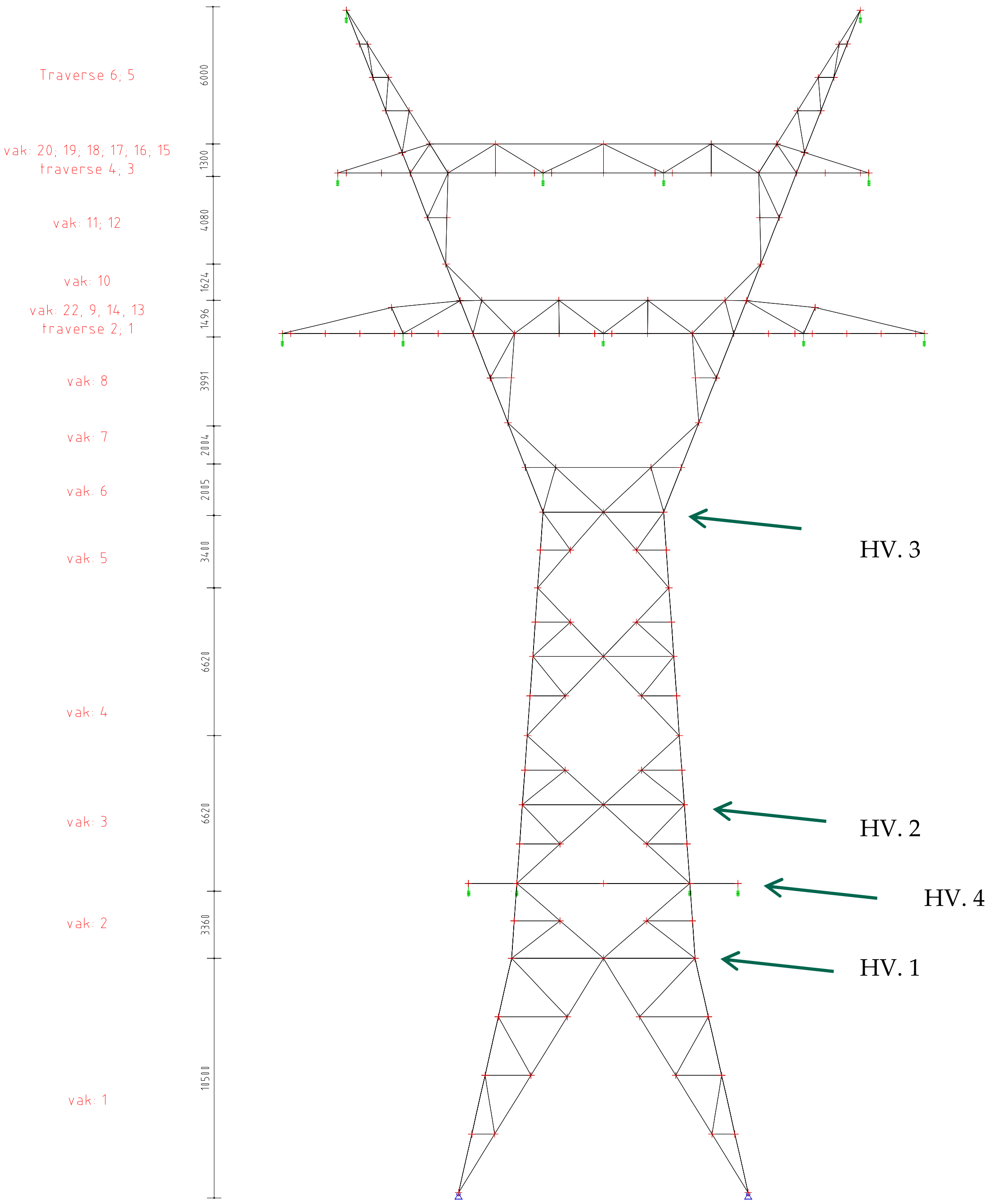
1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam



1.5.3 Overzicht vakindelingen



2 Ontwerpgegevens mast

2.1 Ontwerpcode

De berekening is gebaseerd op NEN-en 50341-1 en -3-15
Bovengrondse hoogspanningslijnen.

2.2 Ontwerpgegevens

Lijnhoek	-	0°	
Windgebied	-	II	
Bebouwing	-	onbebouwd	
IJsgebied bliksemdraden	-	**A**	
IJsgebied fasedraden	-	B	
Toeslag eigengewicht	-	20%	
Totale hoogte van de mast	-	53,0 m	*)
Hoogte traverse 1	-	38,5 m	*)
Hoogte traverse 2	-	45,7 m	*)

Hoogte voet boven maaiveld	-	0,5 m	
Veldlengten	-	0,0/395,15 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	1,0	
Boutklasse	-	8.8	
Materiaal mastranden	-	S355	
Materiaal overige mast	-	S355	
	-		

*) t.o.v. bovenzijde fundatiepoer

2.3 Geleidergegevens

		Br 50	CU 185
		Bliksemdraad	fasedraad
Eigen gewicht	N/m	4,43	16,62
Doorsnede	mm2	48,36	181,6
Diameter	mm	9	17,5
Elasticiteitsmod.	N/mm2	130000	130000
Lin. Uitzettingsc.	1/°C	0,000017	0,000017
Breeksterkte	N	28390,7	72760,5

2.4 Gegevens isolatoren

Dubbele afspanning

lengte isolatorketting 2 m
totale gewicht afspanning per zijde 2,5 kN
diameter isolator schaal 255 mm (voor wind 2/3*255mm =170mm)

2.5 Mastbelastingen uit geleiders

Voor belastingen uit de geleiders wordt verwezen naar bijlage A van dit rapport.

2.6 Aanvullende belastingen

2.6.1 Aflopers naar eindsluitingen

e.g. geleider	=30*16.62*0.001	=	0,5	kN
wind // en ⊥	=30/(0.5*395)*3.31	=	0,50	kN
wind 45°	=0.5*(2)^0.5*0,50	=	0,36	kN

deze belastingen toevoegen aan berekende geleiderbelastingen voorzijde mast

2.6.2 Belastingen t.p.v. tafelconstructie

e.g.

e.g. eindsluitingen + OSA's (6x)	=1+1.5	=	2,5	kN
e.g. kabels (6x)	=31*0.1662	=	5,15	kN
e.g. div. kabelondersteuningen (6x)	=1.5	=	1,5	kN
e.g. totaal (6x)	=2,5+5,15+1,5	=	9,15	kN

windbelasting // lijn

h gem.	21 m	windgebied	II	pw	=	1,12	kN/m2
kabels en kabelgoot	=1*1.2*1,12*0.1*16				=	2,2	kN
	=1*2*1,12*0.3*7				=	4,7	kN
eindsl. + OSA's	=1*1.2*1,12*2.1*0.3				=	0,8	kN
	=1*1.2*1,12*2.1*0.3				=	0,8	kN
wind // lijn totaal (6x)			=2,2+4,7+0,8+0,8		=	8,5	kN

windbelasting ⊥ lijn

h gem.	21 m	windgebied	II	pw	=	1,12	kN/m2
kabels en kabelgoot	=1*1.2*1,12*0.1*16				=	2,2	kN
	=1*2*1,12*0.6*7				=	9,4	kN
eindsl. + OSA's	=1*1.2*1,12*2.1*0.3				=	0,8	kN
	0				=	0,0	kN
wind ⊥ lijn totaal (6x)			=2,2+9,4+0,8+0,0		=	12,4	kN

windbelasting 45°

$Fw_{45°} = 0{,}5 \cdot \sqrt{2} \cdot F_{w//} + 0{,}5 \cdot \sqrt{2} \cdot F_{w\perp}$

$F_{w//}$ = 6,0 kN

$F_{w\perp}$ = 8,8 kN

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	8.8
Staalkwaliteit	S355
Toeslag eigengewicht	20%
Referentie periode	50 jaar

Voor verdere gegevens wordt verwezen naar hoofstuk 2.0

3.2 Berekening met behulp van computerprogramma

SCIA - ESA-Engineer - LTA

Voor de berekening van de mastconstructie wordt verwezen naar bijlage B van dit rapport.

3.3 Berekening geleiderafstanden onderling tpv de isolator aan de ondertraverse

Windstil weer:

Onderlinge afstand geleiders

$a_{so} \geq 0{,}6 * \sqrt{(sag_{10°C} + l_{is})} + D_{pp}$

$sag_{10°C}$	=	6,07	m	t.p.v. de isolator geen doorhang
l_{is}	=	0	m	i.v.m. afspanning
D_{pp}	=	1,12	m	tabel 5.3.5 NL1: $U90_{\%}$ = 550 kV
$a_{so} \geq$	=	2,6	m	=0,6*wortel(6,07+0)+max(1,12;1,44)
a	= ≈	2,9	m	
UC	=	**0,89**	ok	=2,6/2,9

3.4 Berekening van geleider-afstanden tot mast

geleiderafstand tot mast

a_{so} = k + uizwaai wind; of D_{el}

k	=	1,0		EN 50341-3-15 par. 5.4.3 NL3
$Uitzw._{wind}$	=	0		i.v.m. afspanning
D_{el}	=	0,97	m	tabel 5.3.5 NL1: $U90_{\%}$ = 550 kV
a_{so}	=	1,0	m	=MAX((1,0+0),0,97)
a	= ≈	2,81	m	
UC	=	**0,36**	ok	0

3.5 Berekening van geleider-afstanden tot klimweg

geleiderafstand tot klimweg
$a_{so} = 1{,}6 + 1{,}1 * D_{el}$

D_{el}	=	0,55	m	tabel 5.3.5 NL3: 170 kV+earthfault factor <1,3
a_{so}	=	2,21	m	=1.6+1.1*0,55
a	= ≈	2,21	m	
UC	=	**1**	ok	=2,21/2,21

4 Fundatie

4.1 Algemeen

Voor fundatiebelastingen zie Bijlage B:(maximale belastingen per knoop en Resultante op fundatie).
Deze belastingen zijn opgesteld en weergegeven conform NEN-EN 50341-1 en 3 november 2001; Bovengrondse hoogspanningslijnen.

Per fundatie-belastingweergave is dit opgegeven inclusief combinatie- en belastingfactoren.

Aan de hand van de bovengenoemde belastinggegevens en de sonderinggegevens kan de fundatie berekend worden.

4.2 Fundatie belastingen

Reacties

Lineaire berekening, Extreem : Knoop
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn1/N1	sp1aLF-p/30	**-76,87**	**-80,86**	**-327,12**	0,00	0,00	0,00
Sn1/N1	1a/1	**659,95**	**462,90**	**2455,41**	0,00	0,00	0,00
Sn1/N1	1a/31	444,46	242,05	1565,28	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/32	**-657,74**	**459,70**	**2442,93**	0,00	0,00	0,00
Sn2/N3	sp1aLF-p/33	**76,93**	**-78,47**	**-321,34**	0,00	0,00	0,00
Sn2/N3	1a/31	-444,47	241,87	1565,30	**0,00**	**0,00**	**0,00**
Sn3/N7	sp1aLF/34	**-155,70**	**-161,01**	**636,08**	0,00	0,00	0,00
Sn3/N7	1a-p/2	**577,96**	**385,26**	**-2144,46**	0,00	0,00	0,00
Sn3/N7	1a/31	353,02	151,43	-1211,06	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/35	**-572,96**	**384,65**	**-2131,58**	0,00	0,00	0,00
Sn4/N6	sp1aLF/36	**154,37**	**-159,93**	**630,15**	0,00	0,00	0,00
Sn4/N6	1a/31	-353,02	151,25	-1211,04	**0,00**	**0,00**	**0,00**

Resultante

Lineaire berekening, Extreem : Globaal
Selectie : Alle
Klasse : All UGT

BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1a/21	497,01	786,60	708,48	-33316,11	13899,54	112,41
1a/20	-485,75	786,60	708,48	-33316,11	-13426,90	-113,94
1a/18	0,00	1276,55	708,48	-47277,17	0,02	-21,24
sp1aLF/37	0,00	-238,76	708,48	6747,30	0,02	12,14
3/38	-144,93	880,41	760,95	-39186,16	-4456,55	-29,74
3-p/24	144,93	1087,59	531,36	-44916,81	4456,58	29,71
sp1aLF-p/39	0,00	-238,76	531,36	6770,60	0,02	12,14
sp3LF/3	153,16	317,49	743,46	-13724,51	4811,79	2886,17
sp3RF/7	-150,46	391,81	708,48	-16557,19	-4698,33	-2886,54

Centraalpunt:

X [m]	Y [m]	Z [m]
0,000	0,000	0,000

Resultante op Fundering

Lineaire berekening, Extreem : Nee
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aLF-p/30	Sn1/N1	Rx	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Rx	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
sp1aLF-p/30	Sn1/N1	Ry	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Ry	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
sp1aLF-p/30	Sn1/N1	Rz	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Rz	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
1a/32	Sn2/N3	Rx	658,24	950,92	-137,23	1,04	-657,74	25,62	686,27
sp1aLF-p/33	Sn2/N3	Rx	275,61	1107,16	118,79	3,89	76,93	264,66	1072,30
sp1aLF-p/40	Sn2/N3	Ry	246,49	404,99	-116,44	-1,30	-233,67	-78,47	-321,34
1a/41	Sn2/N3	Ry	513,51	2496,31	161,46	4,76	-228,85	459,70	2442,93
sp1aLF-p/40	Sn2/N3	Rz	246,49	404,99	-116,44	-1,30	-233,67	-78,47	-321,34
1a/41	Sn2/N3	Rz	513,51	2496,31	161,46	4,76	-228,85	459,70	2442,93
sp1aLF/34	Sn3/N7	Rx	223,98	801,72	-179,04	-3,44	-155,70	-161,01	-769,80
1a-p/2	Sn3/N7	Rx	694,59	784,32	-11,31	-0,52	577,96	385,26	-364,28
sp1aLF/34	Sn3/N7	Ry	223,98	801,72	-179,04	-3,44	-155,70	-161,01	-769,80
1a-p/2	Sn3/N7	Ry	694,59	784,32	-11,31	-0,52	577,96	385,26	-364,28
1a-p/42	Sn3/N7	Rz	161,79	2150,56	-66,67	-13,25	150,36	-59,74	-2144,46
sp1aLF/43	Sn3/N7	Rz	243,07	680,94	5,62	2,62	154,23	187,88	636,08
1a-p/35	Sn4/N6	Rx	575,87	2208,00	50,76	-3,70	-572,96	-57,84	-2131,58
sp1aLF/36	Sn4/N6	Rx	178,12	654,84	-105,07	3,54	154,37	88,87	630,15
sp1aLF/44	Sn4/N6	Ry	300,34	825,75	77,17	-2,56	-254,22	-159,93	-769,19
1a-p/45	Sn4/N6	Ry	413,93	559,00	-23,32	-0,91	-152,91	384,65	-375,69
1a-p/35	Sn4/N6	Rz	575,87	2208,00	50,76	-3,70	-572,96	-57,84	-2131,58
sp1aLF/36	Sn4/N6	Rz	178,12	654,84	-105,07	3,54	154,37	88,87	630,15

4.3 Berekening Fundatie

De berekening van de fundatie, met de gegevens zoals de sonderingen, is een op zichzelf staande berekening, welke niet valt onder de scope van deze opdracht.

5 Controleberekeningen van ankers en voetplaat

Controle volgens NEN-EN 1993-1-8

Krachten	:	$F_{x,Ed}$	=	660	kN	$F_{tot,Ed}$	=	806 kN	=(660^2+463^2)^0.5
		$F_{y,Ed}$	=	463	kN				
		$F_{t,Ed}$	=	2455	kN				
		$F_{c,Ed}$	=	2144	kN				

Gegevens :	- voetplaat	b	=	500	mm	
		h	=	500	mm	
		t	=	50	mm	
- ankers : 4 x M48 ;		l_v	=	850	mm	gerolde draad
f_{ub} = 800 N/mm2 ;		γ_{m2}	=	1,25	[-]	
f_{yb} = 640 N/mm2 ;		k_2	=	0,9	[-]	
A_s = 1473 mm2		α_v	=	0,6	[-]	
		α_{bc}	=	0,248	[-]	
	reductiefactor i.v.m. gesneden draad		=	1,00	[-]	

5.1 Controle van ankerdoorsnede :

(tabel 3.4 trekweerstand)

$F_{t,Rd}$ = $(k_2 \cdot f_{ub} \cdot A_s)/\gamma_{m2} \cdot$ 1,00 = 848 [kN]

$F_{t,Ed}$ = $F_{t,Ed}/n$ = 614 [kN]

UC : **$F_{t,Ed}$ / $F_{t,Rd}$** ≤ **1**

614 / 848 = 0,72 ≤ 1 verbinding voldoet

(tabel 3.4 afschuifweerstand)

$F_{1,vb,Rd}$ = $(\alpha_v \cdot f_{ub} \cdot A)/\gamma_{M2} \cdot$ 1,00 = 566 [kN]

(formule 6.2)

$F_{2,vb,Rd}$ = $(\alpha_{bc} \cdot f_{ub} \cdot A)/\gamma_{M2} \cdot$ 1,00 = 234 [kN]

(kleinste waarde van F1,vb,Rd en F2,vb,Rd)

$F_{vb,Rd}$ = 234 [kN]

$F_{v,Ed}$ = $F_{tot,Ed}/n$ = 202 [kN]

UC : **$F_{v,Ed}$ / $F_{v,Rd}$** ≤ **1**

202 / 233,8 = 0,86 ≤ 1 verbinding voldoet

5.2 Controle van voetplaat :

f_y = 355 N/mm2

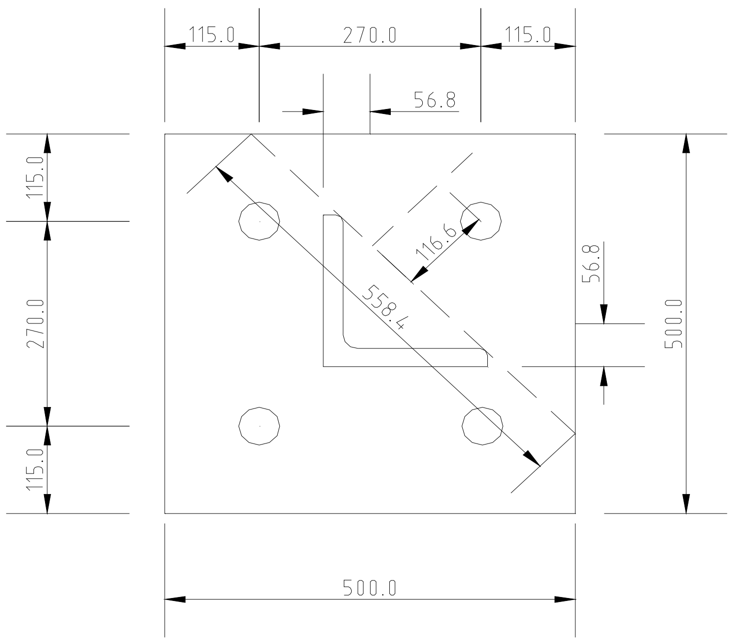
$M_{p,Rd}$ = $0{,}1667 \cdot l_{eff} \cdot t_f\text{\textasciicircum}2 \cdot f_y/\gamma_{m0}$ = 82,6 [kNm] ; $l_{eff,min}$ = 558 mm

t_f = 50 mm

$M_{p,Ed}$ = $F_{t,Ed} \cdot m$ = 71,6 [kNm] ; m = 117 mm

UC : $\mathbf{M_{p,Ed} / M_{p,Rd}}$ ≤ **1**

71,6 / 82,6 = 0,87 ≤ **1** voetplaat voldoet



6 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:
(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

6.1 Overzicht spanningniveau's

Vak	Staaf type	Doorsnede	Staalkwal. N/mm^2	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	slankheid	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per;sd}$ (kN)	U.C
Vak 1	randen	H200/200/24	Fe510	2180	2180	M 30	8,8	6	56	**0,90**	-2322,88	**0,95**	2117,60	**0,77**	0,00	**n.v.t.**
Vak 1	diagonalen	H150/150/13	Fe510	2450	2450	M 30	8,8	3	89	**0,80**	-518,92	**0,83**	465,24	**0,68**	0,00	**n.v.t.**
Vak 1	1e hor.knikverkorter	H70/70/7	Fe510	2957	2957	M 16	8,8	1	219	**0,38**	-23,20	**0,78**	23,20	**0,16**	1,50	**0,37**
Vak 1	1e hor.knikverkorter pootverband	H100/100/10	Fe510	4180	4180	M 16	8,8	1	216	**0,09**	-5,31	**0,09**	5,31	**0,02**	1,50	**0,18**
Vak 1	1e schuine knikverkorter	H80/80/8	Fe510	3460	3460	M 16	8,8	1	224	**0,47**	-28,53	**0,76**	28,53	**0,14**	0,00	**n.v.t.**
Vak 1	2e hor.knikverkorter	H60/60/6	Fe510	2197	2197	M 16	8,8	1	190	**0,44**	-23,20	**0,85**	23,20	**0,23**	1,50	**0,44**
Vak 1	2e hor.knikverkorter pootverband	H70/70/7	Fe510	3110	3110	M 16	8,8	1	230	**0,09**	-5,31	**0,20**	5,31	**0,04**	1,50	**0,39**
Vak 1	2e schuine knikverkorter	H80/80/8	Fe510	2765	2765	M 16	8,8	1	179	**0,58**	-34,98	**0,66**	34,98	**0,17**	0,00	**n.v.t.**
Vak 1	3e hor.knikverkorter	H50/50/5	Fe510	1437	1437	M 16	8,8	1	150	**0,50**	-23,20	**0,86**	23,20	**0,36**	1,50	**0,50**
Vak 1	3e hor.knikverkorter pootverband	H50/50/5	Fe510	2035	2035	M 16	8,8	1	212	**0,11**	-5,31	**0,34**	5,31	**0,08**	1,50	**0,71**
Vak 1	3e schuine knikverkorter	H80/80/8	Fe510	2357	2357	M 16	8,8	1	153	**0,88**	-53,20	**0,79**	53,20	**0,26**	0,00	**n.v.t.**
Vak 1	4e schuine knikverkorter	H100/100/10	Fe510	2149	2149	M 24	8,8	2	111	**0,79**	-215,09	**0,80**	215,09	**0,68**	0,00	**n.v.t.**
Vak 1	schuine knikverkorter pootverband	H120/120/12	Fe510	5580	5580	M 16	8,8	1	240	**0,16**	-8,63	**0,12**	8,63	**0,02**	0,00	**n.v.t.**
Vak 2	randen	H200/200/24	Fe510	1687	1687	M 30	8,8	6	43	**0,85**	-2204,61	**0,80**	2035,98	**0,74**	0,00	**n.v.t.**
Vak 2	diagonalen	H180/180/15	Fe510	4860	2430	M 30	8,8	4	96	**0,77**	-665,70	**0,88**	606,42	**0,64**	0,00	**n.v.t.**
Vak 2	hor.knikverkorter	H60/60/6	Fe510	1859	1859	M 16	8,8	1	161	**0,37**	-22,05	**0,63**	22,05	**0,21**	1,50	**0,00**
Vak 2	schuine knikverkorter	H70/70/7	Fe510	2450	2450	M 16	8,8	1	182	**0,27**	-16,00	**0,41**	15,98	**0,11**	0,00	**n.v.t.**
Vak 3	randen	H200/200/24	Fe510	1768	1768	M 30	8,8	6	46	**0,88**	-2282,72	**0,85**	2116,92	**0,77**	0,00	**n.v.t.**
Vak 3	diagonalen	H150/90/10	Fe510	4962	2481	M 24	8,8	2	128	**0,82**	-223,26	**0,81**	215,42	**0,55**	0,00	**n.v.t.**
Vak 3	horizontale knikverkorter	H60/60/6	Fe510	1636	1636	M 16	8,8	1	142	**0,38**	-22,80	**0,55**	22,80	**0,22**	1,50	**0,00**
Vak 3	schuine knikverkorter	H60/60/6	Fe510	2270	2270	M 16	8,8	1	197	**0,35**	-21,25	**0,82**	16,86	**0,16**	0,00	**n.v.t.**
Vak 4	randen	H200/200/20	Fe510	1784	1784	M 30	8,8	6	46	**0,75**	-1933,35	**0,85**	1771,74	**0,76**	0,00	**n.v.t.**
Vak 4	diagonalen	H150/90/10	Fe510	4755	2378	M 24	8,8	3	123	**0,64**	-253,20	**0,87**	261,60	**0,57**	0,00	**n.v.t.**
Vak 4	horizontale knikverkorter	H50/50/5	Fe510	1427	1427	M 16	8,8	1	149	**0,53**	-19,33	**0,71**	19,33	**0,36**	1,50	**0,49**
Vak 4	horizontaal	H70/70/7	Fe510	2920	2920	M 16	8,8	1	216	**0,22**	-13,15	**0,44**	13,48	**0,09**	1,50	**0,37**
Vak 4	schuine knikverkorter	H60/60/6	Fe510	2190	2190	M 16	8,8	1	190	**0,36**	-21,41	**0,78**	21,40	**0,21**	0,00	**n.v.t.**
Vak 5	randen	H200/200/18	Fe510	1707	1707	M 30	8,8	4	45	**0,81**	-1402,83	**0,71**	1264,79	**0,63**	0,00	**n.v.t.**
Vak 5	diagonalen	H150/100/10	Fe510	4360	2180	M 24	8,8	3	101	**0,80**	-325,89	**0,80**	309,04	**0,64**	0,00	**n.v.t.**
Vak 5	horizontale knikverkorter	H50/50/5	Fe510	1250	1250	M 16	8,8	1	130	**0,38**	-14,02	**0,44**	14,02	**0,26**	1,50	**0,43**
Vak 5	schuine knikverkorter	H60/60/6	Fe510	2050	2050	M 16	8,8	1	177	**0,43**	-25,70	**0,85**	25,70	**0,25**	0,00	**n.v.t.**
Vak 6 en 7	randen	H200/200/18	Fe510	2140	2140	M 30	8,8	4	57	**0,83**	-1423,00	**0,80**	1307,76	**0,66**	0,00	**n.v.t.**
Vak 6,7	diagonalen v.v en a.v	H150/150/14	Fe510	5642	2816	M 24	8,8	3	126	**0,83**	-339,33	**0,82**	309,49	**0,39**	0,00	**n.v.t.**
Vak 6,7	diagonalen l.z.v en r.z.v	H150/150/14	Fe510	4764	2382	M 24	8,8	3	106	**0,79**	-322,84	**0,60**	318,35	**0,40**	0,00	**n.v.t.**
Vak 6,7	horizontaal v.v a.v	H130/130/12	Fe510	3949	3949	M 16	8,8	2	160	**0,51**	-61,81	**0,24**	43,49	**0,09**	1,50	**0,09**
Vak 6,7	hor. knikverkorters	H60/60/6	Fe510	1252	1252	M 16	8,8	1	108	**0,57**	-30,46	**0,53**	34,33	**0,33**	1,50	**0,25**
Vak 6	schuine knikverkorter v.v en a.v	H100/100/8	Fe510	2076	2076	M 16	8,8	2	119	**0,69**	-83,68	**0,46**	61,79	**0,28**	0,00	**n.v.t.**
Vak 6	schuine knikverkorter l.z.v en r.z.v	H60/60/8	Fe510	2571	2571	M 16	8,8	1	223	**0,38**	-23,08	**0,83**	20,34	**0,15**	0,00	**n.v.t.**

Vak	Staaf type	Doorsnede	Staalkwal. N/mm²	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	slankheid	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per;sd}$ (kN)	U.C
Vak 8	randen	H160/160/15	Fe510	2141	2141	M 30	8,8	3	70	**0,68**	-882,81	**0,84**	708,79	**0,55**	0,00	**n.v.t.**
Vak 8	diagonalen v.v en a.v.	H120/120/12	Fe510	4017	2019	M 24	8,8	3	110	**0,70**	-249,87	**0,70**	282,84	**0,52**	0,00	**n.v.t.**
Vak 8	diagonalen l.z.v en r.z.v.	H150/150/15	Fe510	4760	2380	M 24	8,8	4	104	**0,89**	-480,69	**0,79**	472,63	**0,54**	0,00	**n.v.t.**
Vak 8	hor. knikverkortes	H50/50/5	Fe510	879	879	M 16	8,8	1	92	**0,32**	-13,47	**0,29**	16,98	**0,06**	1,50	**0,30**
Vak 8	hor. verbanden l.z.v en r.z.v.	H100/100/10	Fe510	4252	4252	M 16	8,8	1	220	**0,26**	-12,80	**0,22**	15,80	**0,05**	1,50	**0,18**
Vak 8	schuine knikverkortes	H70/70/7	Fe510	2231	2231	M 16	8,8	1	165	**0,68**	-35,62	**0,78**	40,97	**0,28**	0,00	**n.v.t.**
Vak 9,14,13	bovenrand	H130/130/12	Fe510	3680	3680	M 24	8,8	3	149	**0,70**	-219,74	**0,77**	285,79	**0,49**	0,00	**n.v.t.**
Vak 9,14,13	diagonalen ondervlak	H80/80/8	Fe510	2550	2550	M 16	8,8	2	165	**0,52**	-62,66	**0,61**	60,96	**0,32**	0,00	**n.v.t.**
Vak 9,14,13	diagonalen ondervlak S322,323,293,294	H50/50/8	Fe510	1135	1135	M 16	8,8	1	118	**0,71**	-42,97	**0,81**	17,88	**0,17**	0,00	**n.v.t.**
Vak 9,14,13	diagonalen v.v en a.v. S226,224,239,241	H100/100/10	Fe510	2380	2380	M 20	8,8	2	123	**0,85**	-144,99	**0,61**	160,48	**0,43**	0,00	**n.v.t.**
Vak 9,14,13	diagonalen v.v en a.v. S242,225,227,240	H100/100/10	Fe510	2373	2373	M 20	8,8	2	123	**0,87**	-163,19	**0,68**	138,58	**0,37**	0,00	**n.v.t.**
Vak 9,14,13	hor. verbanden S 215,220,222,214,219,221	H55/55/5	Fe510	2305	2350	M 16	8,8	1	227	**0,05**	-2,75	**0,18**	2,43	**0,03**	0,00	**n.v.t.**
Vak 10	randen	H160/160/15	Fe510	1760	1760	M 24	8,8	3	57	**0,88**	-713,37	**0,59**	602,21	**0,44**	0,00	**n.v.t.**
Vak 10	diagonalen v.v en a.v.	H120/120/12	Fe510	4412	2206	M 24	8,8	3	121	**0,68**	-212,82	**0,69**	275,21	**0,51**	0,00	**n.v.t.**
Vak 10	diagonalen l.z.v en r.z.v.	H90/90/9	Fe510	2264	2264	M 24	8,8	2	130	**0,46**	-124,91	**0,69**	123,80	**0,49**	0,00	**n.v.t.**
Vak 10	horizontaal l.z.v en r.z.v	H100/100/12	Fe510	3507	1713	M 24	8,8	2	116	**0,80**	-203,15	**0,75**	217,19	**0,58**	1,50	**0,06**
Vak 10	hor. knikverkortes l.z.v en r.z.v	H50/50/5	Fe510	1616	1616	M 16	8,8	1	168	**0,38**	-20,00	**0,87**	20,00	**0,07**	1,50	**0,56**
Vak 10	schuine knikverkorters	H120/80/10	Fe510	1544	1544	M 24	8,8	3	90	**0,65**	-264,28	**0,79**	231,99	**0,63**	0,00	**n.v.t.**
Vak 11,12	randen	H120/120/12	Fe510	2220	2220	M 24	8,8	2	95	**0,67**	-362,77	**0,82**	329,31	**0,42**	0,00	**n.v.t.**
Vak 11,12	diagonalen v.v en a.v.	H120/120/10	Fe510	4098	2080	M 24	8,8	2	122	**0,49**	-132,16	**0,57**	116,27	**0,33**	0,00	**n.v.t.**
Vak 11,12	diagonalen l.z.v en r.z.v.	H120/120/10	Fe510	2652	2652	M 24	8,8	2	123	**0,83**	-225,26	**0,85**	216,55	**0,61**	0,00	**n.v.t.**
Vak 11,12	hor. knikverkorters	H60/60/6	Fe510	2536	2536	M 16	8,8	1	220	**0,06**	-3,13	**0,15**	3,86	**0,01**	1,50	**0,51**
Vak 11,12	schuine knikverkorters	H50/50/5	Fe510	2179	2179	M 16	8,8	1	227	**0,18**	-7,94	**0,56**	9,32	**0,03**	0,00	**n.v.t.**
Vak 15,20	randen S361,372,413,425	H100/100/10	Fe510	970	970	M 24	8,8	2	50	**0,67**	-180,96	**0,33**	140,49	**0,44**	0,00	**n.v.t.**
Vak 15,20	diagonalen v.v en a.v S155,153,141,139	H65/65/8	Fe510	1506	1506	M 20	8,8	2	121	**0,59**	-98,43	**0,78**	110,49	**0,62**	0,00	**n.v.t.**
Vak 15,20	diagonalen S131,132,145,144	H80/80/8	Fe510	1541	1541	M 20	8,8	2	100	**0,63**	-119,48	**0,62**	111,68	**0,49**	0,00	**n.v.t.**
Vak 15,20	diagonalenondervlak (S180;181;87;198)	H50/50/5	Fe510	1451	1451	M 16	8,8	1	151	**0,29**	-14,39	**0,54**	13,63	**0,21**	1,50	**0,50**
Vak 15,20	diagonalen l.z.v en r.z.v. S23,24,87,86;94t/m97	H50/50/5	Fe510	1850	1850	M 16	8,8	1	193	**0,29**	-14,39	**0,77**	13,63	**0,21**	0,00	**n.v.t.**
Vak 15,20	horizonatalen l.z.v r.z.v (S25;88;98;211;212)	H50/50/5	Fe510	2163	2163	M 16	8,8	1	225	**0,28**	-9,55	**0,66**	13,06	**0,20**	1,50	**0,75**
Vak 19,18,17,16	bovenrand	H120/120/12	Fe510	4465	4465	M 16	8,8	3	192	**0,82**	-114,17	**0,61**	148,80	**0,28**	0,00	**n.v.t.**
Vak 19,18,17,16	diagonalen ondervlak (S182,184,185,183,178,179,206,207,201,203,200,202)	H80/80/10	Fe510	1523	1523	M 20	8,8	1	99	**0,86**	-81,34	**0,61**	79,39	**0,34**	0,00	**n.v.t.**
Vak 19,18,17,16	diagonalen ondervlak (S186,187,205,204)	H50/50/6	Fe510	1297	1297	M 16	8,8	1	135	**0,56**	-31,00	**0,86**	31,00	**0,40**	0,00	**n.v.t.**
Vak 19,18,17,16	diagonalen v.v en a.v. (S100,S107,S111,S118)	H90/90/9	Fe510	2364	2364	M 16	8,8	2	136	**0,60**	-69,35	**0,41**	30,11	**0,12**	0,00	**n.v.t.**
Vak 19,18,17,16	diagonalen v.v en a.v. (S101,S109,S112,S120)	H65/65/6	Fe510	2364	2364	M 16	8,8	2	192	**0,60**	-34,01	**0,68**	66,89	**0,60**	0,00	**n.v.t.**
Vak 19,18,17,16	diagonalen v.v en a.v. (S102,S110,S113,S126)	H90/90/9	Fe510	2819	2819	M 16	8,8	1	162	**0,84**	-50,60	**0,65**	47,27	**0,09**	0,00	**n.v.t.**
Vak 19,18,17,16	verticale diagonalen v.v en a.v.	H50/50/5	Fe510	1700	1700	M 16	8,8	1	177	**0,06**	-3,00	**0,14**	3,22	**0,01**	0,00	**n.v.t.**
HV 1	randen	H150/150/14	Fe510	3800	3800	M 24	8,8	3	132	**0,79**	-322,32	**0,72**	285,38	**0,36**	1,50	**0,05**
HV 1	diagonalen	H130/130/12	Fe510	5374	5374	M 16	8,8	2	217	**0,83**	-100,50	**0,62**	91,65	**0,19**	1,50	**0,12**
HV 1	kruis	H110/110/10	Fe510	7600	3800	M 16	8,8	1	235	**0,03**	-1,73	**0,03**	0,80	**0,00**	1,50	**0,28**
HV 2	randen	H80/80/8	Fe510	3350	3350	M 16	8,8	1	217	**0,24**	-7,06	**0,18**	14,39	**0,07**	1,50	**0,28**
HV 2	diagonalen	H110/110/10	Fe510	4741	4741	M 16	8,8	2	229	**0,16**	-19,11	**0,18**	18,79	**0,06**	1,50	**0,18**
HV 3	randen	H150/150/14	Fe510	2500	2500	M 30	8,8	3	87	**0,86**	-556,83	**0,78**	512,92	**0,66**	1,50	**0,03**
HV 3	diagonalen	H100/100/10	Fe510	3536	3536	M 20	8,8	1	183	**0,73**	-68,26	**0,85**	66,69	**0,21**	1,50	**0,15**
HV 3	kruis	H70/70/7	Fe510	5000	2500	M 16	8,8	1	236	**0,04**	-2,25	**0,09**	1,29	**0,01**	1,50	**0,63**
HV 4	diagonalen	H110/110/12	Fe510	5065	5065	M 16	8,8	1	238	**0,45**	-21,98	**0,32**	26,96	**0,06**	1,50	**0,15**
HV 4	kruis en koppelstaven	H100/100/10	Fe510	7163	3582	M 16	8,8	1	236	**0,31**	-18,24	**0,35**	18,39	**0,05**	1,50	**0,31**

Vak	Staaf type	Doorsnede	Staalkwal. N/mm²	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	slankheid	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per.;sd}$ (kN)	U.C
Traverse 1 en 2	bovenrand	H110/110/10	Fe510	4732	4732	M 16	8,8	3	228	**0,39**	0,00	**0,00**	69,92	**0,18**	0,00	**n.v.t.**
Traverse 1 en 2	diagonalen (S232,236,254,448)	H65/65/6	Fe510	2811	2811	M 16	8,8	2	228	**0,50**	-11,00	**0,29**	56,00	**0,50**	0,00	**n.v.t.**
Traverse 1 en 2	diagonalen (S233,255,296,297,217,218,229,237)	H50/50/5	Fe510	1778	1778	M 16	8,8	1	185	**0,18**	-10,69	**0,54**	2,07	**0,03**	0,00	**n.v.t.**
Traverse 1 en 2	diagonalen onderrand (S287,316)	H70/70/5	Fe510	3013	1500	M 16	8,8	1	170	**0,05**	-3,00	**0,12**	1,00	**0,01**	1,50	**0,75**
Traverse 1 en 2	diagonalen onderrand (S307,273,274,275,278,279,280,302,303,304,308,309)	H60/60/8	Fe510	1300	1300	M 20	8,8	1	113	**0,69**	-60,33	**0,86**	57,64	**0,46**	0,00	**n.v.t.**
Traverse 1 en 2	diagonalen onderrand (S313,314,285,284)	H60/60/8	Fe510	1400	1400	M 24	8,8	1	121	**0,53**	-50,00	**0,78**	45,00	**0,41**	0,00	**n.v.t.**
Traverse 1 en 2	diagonalen onderrand (S317,466,288,465)	H90/90/9	Fe510	2270	2270	M 20	8,8	1	131	**0,83**	-77,71	**0,75**	77,75	**0,31**	0,00	**n.v.t.**
Traverse 3 en 4	bovenrand	H80/80/8	Fe510	2880	2880	M 16	8,8	2	187	**0,35**	0,00	**0,00**	42,00	**0,22**	0,00	**n.v.t.**
Traverse 3 en 4	onderrand	H60/60/8	Fe510	1340	1340	M 16	8,8	1	116	**0,88**	-53,16	**0,79**	49,25	**0,36**	0,00	**n.v.t.**
Traverse 3 en 4	onderrand S193,191,170,168	H50/50/5	Fe510	1200	1200	M 24	8,8	1	125	**0,79**	-25,19	**0,74**	27,22	**0,56**	0,00	**n.v.t.**
Traverse 5 en 6	randen	H100/100/10	Fe510	2008	2008	M 24	8,8	2	104	**0,66**	-179,99	**0,62**	141,92	**0,45**	0,00	**n.v.t.**
Traverse 5 en 6	bovenrand	H65/50/6	Fe510	1726	1726	M 16	8,8	2	164	**0,34**	-22,95	**0,41**	37,99	**0,39**	0,00	**n.v.t.**
Traverse 5 en 6	diagonalen v.v en a.v.	H50/50/5	Fe510	1911	1911	M 16	8,8	1	199	**0,08**	-4,89	**0,28**	1,86	**0,01**	0,00	**n.v.t.**
Traverse 5 en 6	diagonalen l.z.v en r.z.v	H50/50/6	Fe510	1092	1092	M 16	8,8	1	114	**0,68**	-34,81	**0,79**	37,51	**0,48**	0,00	**n.v.t.**
Traverse 5 en 6	diagonalen l.z.v en r.z.v (S71,S73,S10,S8)	H60/60/6	Fe510	2162	2162	M 16	8,8	1	187	**0,39**	-23,36	**0,83**	23,73	**0,23**	0,00	**n.v.t.**

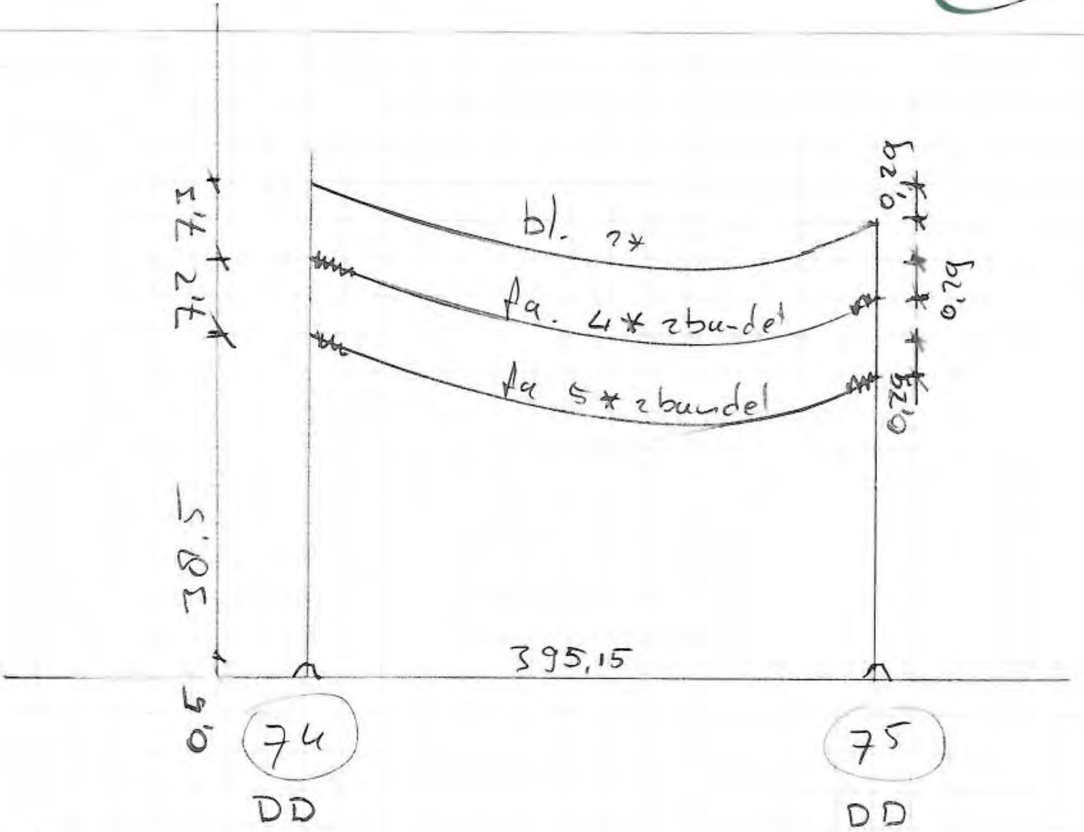
Bijlage A Geleiderbelastingen

Dossier/File 13.039

Order P13056

Pagina/Page

D&C ENGINEERING
design and construct



fasedraad: Cu 185

ijsgebied : B
windgebied : II
EDS : 33,7 %

bliksemdraad: Cu 50

ijsgebied : A
windgebied : II
EDS : 36,6

Revisie/Revision	0	A	B	C	D	E	F
Datum/Date							
Naam/Name							
Gecontroleerd/Checked							
Goedgekeurd/Approved							

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn	: 150 kV-lijn Zoetermeer - Leiden
Masttype	: eindmast
Mastnaam	: type DD
Mastnummer	: 74
Windgebied	: II
Bebouwing	: Onbebouwd
IJsgebied	: A
Referentie periode	: 50 jaar

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	180		180
Maximum lijnhoek	[graden]	180		180
Veldlengte	[m]	0		395
Vaklengte	[m]		395	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

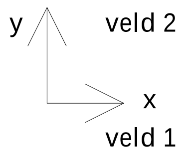
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	bliksemdraad
Geleidersoort + plaats	:	bliksemdr. ondertrav
Geleiders veld 1 en 2	:	Br 50
Eigen gewicht draad	[N/m] :	4.43
Draaddoorsnede	[mm²] :	48.36
Draaddiameter	[mm] :	9
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	0.000017
Breekbelasting draad	[N] :	28390.7
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	36.6
Hoogte draadbevestiging	[m] :	53.5

Eigen gewicht isolator	[kN] :	0	0
Lengte isolator	[m] :	0	0
Diameter isolatorschaal	[mm] :	0	0
Hoogte isolator boven maaiveld	[m] :	53.5	53.5
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	0	-0.29

Mastnummer	:	74
Draadnummer	:	1
Geleidersoort + plaats	:	bliksemdr. ondertrav
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	198.80

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		0.00	- 0.88	0.00	0.00
Qijs;rep		0.00	- 2.99	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	1.70	0.00	0.00
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.00	0.85	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.00	0.85	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.00
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	1.70	0.00	0.00
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.00	0.85	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.00	0.85	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.00
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	9.90	0.00	0.00
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.00	4.95	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.00	4.95	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	9.90	0.00	0.00
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.00	4.95	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.00	4.95	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.00

Mastnummer	:	74
Draadnummer	:	1
Geleidersoort + plaats	:	bliksemdr. ondertrav
Geleiders veld 1 en 2	:	Br 50

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	20.50	20.50
	0°	0.00	0.00	9.47	9.47
	45°	0.00	0.00	16.56	16.56
	-45°	0.00	0.00	16.56	16.56
jTrep bij combinatie (1b)	90°	0.00	0.00	11.40	11.40
	0°	0.00	0.00	10.47	10.47
	45°	0.00	0.00	10.95	10.95
	-45°	0.00	0.00	10.95	10.95
jTrep bij combinatie (3)	90°	0.00	0.00	41.38	41.38
	0°	0.00	0.00	34.46	34.46
	45°	0.00	0.00	38.21	38.21
	-45°	0.00	0.00	38.21	38.21
jTrep bij combinatie (4)	90°	0.00	0.00	10.52	10.52
	0°	0.00	0.00	9.62	9.62
	45°	0.00	0.00	10.09	10.09
	-45°	0.00	0.00	10.09	10.09
jTrep bij combinatie (5a)	90°	0.00		7.90	
jTrep bij combinatie (6)	90°	0.00		10.66	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	12.58	12.58
	0°	0.00	0.00	9.47	9.47
	45°	0.00	0.00	11.17	11.17
	-45°	0.00	0.00	11.17	11.17
jTrep bij combinatie (1b)	90°	0.00	0.00	11.00	11.00
	0°	0.00	0.00	10.47	10.47
	45°	0.00	0.00	10.74	10.74
	-45°	0.00	0.00	10.74	10.74
jTrep bij combinatie (3)	90°	0.00	0.00	22.41	22.41
	0°	0.00	0.00	8.82	8.82
	45°	0.00	0.00	17.41	17.41
	-45°	0.00	0.00	17.41	17.41
jTrep bij combinatie (4)	90°	0.00	0.00	10.15	10.15
	0°	0.00	0.00	9.62	9.62
	45°	0.00	0.00	9.89	9.89
	-45°	0.00	0.00	9.89	9.89

KARAKTERISTIEKE GEGEVENS :

Naam hoogspanningslijn	:	150 kV-lijn Zoetermeer - Leiden
Masttype	:	eindmast
Mastnaam	:	type DD
Mastnummer	:	74
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	B
Referentie periode	:	50 jaar

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	180
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	0	395
Vaklengte	[m]	395	

* Belastingcombinaties en -factoren: NEN-EN 50341 -1 t/m -3, nov. 2001

* Berekend worden de "Ultimate Limit State" belastingcombinaties, (table 4.2.11/NL.1)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting
(5a) Permanente belasting met torsie
(6) Permanente belasting

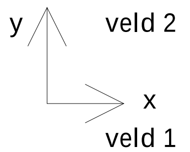
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(1a) Permanente belasting met extreme windbelasting
(1b) Permanente belasting met extreme koude
(3) Permanente belasting met extreme ijsbelasting
(4) Permanente belasting met onderhoudsbelasting

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel:

y = lijnrichting



INVOERGEGEVENS VOOR DRAAD No.: 1

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. ondertrav.
Geleiders veld 1 en 2	:	CU 185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm²] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	33.7
Hoogte draadbevestiging	[m] :	39

Eigen gewicht isolator	[kN] :	0	2.5
Lengte isolator	[m] :	0	2
Diameter isolatorschaal	[mm] :	0	170
Hoogte isolator boven maaiveld	[m] :	39	39
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	0	-0.29

INVOERGEGEVENS VOOR DRAAD No.: 2

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. boventrav.
Geleiders veld 1 en 2	:	CU 185
Eigen gewicht draad	[N/m] :	16.62
Draaddoorsnede	[mm²] :	181.6
Draaddiameter	[mm] :	17.5
Elasticiteitsmodulus	[N/mm²] :	130000
Uitzettingscoëfficiënt	[1/°C] :	.000017
Breekbelasting draad	[N] :	72760.5
Maximum percentage breekbelasting	[%] :	100
EDS percentage breekbelasting	[%] :	33.7
Hoogte draadbevestiging	[m] :	46.2

Eigen gewicht isolator	[kN] :	0	2.5
Lengte isolator	[m] :	0	2
Diameter isolatorschaal	[mm] :	0	170
Hoogte isolator boven maaiveld	[m] :	46.2	46.2
Hoogte verschil draadbevestiging (aangrenzende minus beschouwende mast) (hoger = positief)	[m] :	0	-.29

Mastnummer	:	74
Draadnummer	:	1
Geleidersoort + plaats	:	fasedr. ondertrav.
Geleiders veld 1 en 2	:	CU 185
Veldlengte voor gewicht [m]	:	198.58

BELASTING COMPONENTEN [kN]		GELEIDER VELD 1	GELEIDER VELD 2	ISOLATOR VELD 1	ISOLATOR VELD 2
Grep		0.00	- 3.31	0.00	- 2.50
Qijs;rep		0.00	- 1.50	0.00	0.00
Qonderhoud;rep		0.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	2.67	0.00	0.55
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.55
Qw;rep 45 graden (+y, +x),	x	0.00	1.33	0.00	0.39
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.39
Qw;rep 45 graden (-y, +x),	x	0.00	1.33	0.00	0.39
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.39
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	2.67	0.00	0.55
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.55
Qw;rep 45 graden (+y, +x),	x	0.00	1.33	0.00	0.39
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.39
Qw;rep 45 graden (-y, +x),	x	0.00	1.33	0.00	0.39
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	6.82	0.00	0.55
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.55
Qw;rep 45 graden (+y, +x),	x	0.00	3.41	0.00	0.39
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.39
Qw;rep 45 graden (-y, +x),	x	0.00	3.41	0.00	0.39
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	6.82	0.00	0.55
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.55
Qw;rep 45 graden (+y, +x),	x	0.00	3.41	0.00	0.39
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.39
Qw;rep 45 graden (-y, +x),	x	0.00	3.41	0.00	0.39
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.39

Mastnummer	:	74
Draadnummer	:	1
Geleidersoort + plaats	:	fasedr. ondertrav.
Geleiders veld 1 en 2	:	CU 185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	40.70	40.70
	0°	0.00	0.00	29.69	29.69
	45°	0.00	0.00	35.78	35.78
	-45°	0.00	0.00	35.78	35.78
jTrep bij combinatie (1b)	90°	0.00	0.00	32.61	32.61
	0°	0.00	0.00	32.03	32.03
	45°	0.00	0.00	32.32	32.32
	-45°	0.00	0.00	32.32	32.32
jTrep bij combinatie (3)	90°	0.00	0.00	49.73	49.73
	0°	0.00	0.00	45.23	45.23
	45°	0.00	0.00	47.56	47.56
	-45°	0.00	0.00	47.56	47.56
jTrep bij combinatie (4)	90°	0.00	0.00	37.61	37.61
	0°	0.00	0.00	37.02	37.02
	45°	0.00	0.00	37.32	37.32
	-45°	0.00	0.00	37.32	37.32
jTrep bij combinatie (5a)	90°	0.00		24.74	
jTrep bij combinatie (6)	90°	0.00		33.40	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	32.29	32.29
	0°	0.00	0.00	29.69	29.69
	45°	0.00	0.00	31.02	31.02
	-45°	0.00	0.00	31.02	31.02
jTrep bij combinatie (1b)	90°	0.00	0.00	32.37	32.37
	0°	0.00	0.00	32.03	32.03
	45°	0.00	0.00	32.20	32.20
	-45°	0.00	0.00	32.20	32.20
jTrep bij combinatie (3)	90°	0.00	0.00	36.61	36.61
	0°	0.00	0.00	32.54	32.54
	45°	0.00	0.00	34.66	34.66
	-45°	0.00	0.00	34.66	34.66
jTrep bij combinatie (4)	90°	0.00	0.00	36.21	36.21
	0°	0.00	0.00	35.84	35.84
	45°	0.00	0.00	36.03	36.03
	-45°	0.00	0.00	36.03	36.03

Mastnummer	:	74
Draadnummer	:	2
Geleidersoort + plaats	:	fasedr. boventrav.
Geleiders veld 1 en 2	:	CU 185
Veldlengte voor gewicht [m]	:	198.58

BELASTING COMPONENTEN [kN]		GELEIDER		ISOLATOR	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		0.00	- 3.31	0.00	- 2.50
Qijs;rep		0.00	- 1.50	0.00	0.00
Qonderhoud;rep		0.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	2.86	0.00	0.57
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.57
Qw;rep 45 graden (+y, +x),	x	0.00	1.43	0.00	0.40
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.40
Qw;rep 45 graden (-y, +x),	x	0.00	1.43	0.00	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.40
BIJ MAXIMUM LIJNHOEKEN-					
Qw;rep loodrecht lijn,	x	0.00	2.86	0.00	0.57
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.57
Qw;rep 45 graden (+y, +x),	x	0.00	1.43	0.00	0.40
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.40
Qw;rep 45 graden (-y, +x),	x	0.00	1.43	0.00	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	7.31	0.00	0.57
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.57
Qw;rep 45 graden (+y, +x),	x	0.00	3.65	0.00	0.40
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.40
Qw;rep 45 graden (-y, +x),	x	0.00	3.65	0.00	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	0.00	7.31	0.00	0.57
Qw;rep loodrecht lijn,	y	0.00	0.00	0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	0.00	0.00	0.00
Qw;rep in lijnrichting,	y	0.00	0.00	0.00	0.57
Qw;rep 45 graden (+y, +x),	x	0.00	3.65	0.00	0.40
Qw;rep 45 graden (+y, +x),	y	0.00	0.00	0.00	0.40
Qw;rep 45 graden (-y, +x),	x	0.00	3.65	0.00	0.40
Qw;rep 45 graden (-y, +x),	y	0.00	0.00	0.00	-0.40

Mastnummer : 74
Draadnummer : 2
Geleidersoort + plaats : fasedr. boventrav.
Geleiders veld 1 en 2 : CU 185

DRAADTREKKRACHTEN - "Ultimate Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.1)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	42.00	42.00
	0°	0.00	0.00	29.69	29.69
	45°	0.00	0.00	36.56	36.56
	-45°	0.00	0.00	36.56	36.56
jTrep bij combinatie (1b)	90°	0.00	0.00	32.69	32.69
	0°	0.00	0.00	32.03	32.03
	45°	0.00	0.00	32.36	32.36
	-45°	0.00	0.00	32.36	32.36
jTrep bij combinatie (3)	90°	0.00	0.00	50.34	50.34
	0°	0.00	0.00	45.23	45.23
	45°	0.00	0.00	47.89	47.89
	-45°	0.00	0.00	47.89	47.89
jTrep bij combinatie (4)	90°	0.00	0.00	37.70	37.70
	0°	0.00	0.00	37.02	37.02
	45°	0.00	0.00	37.36	37.36
	-45°	0.00	0.00	37.36	37.36
jTrep bij combinatie (5a)	90°	0.00		24.74	
jTrep bij combinatie (6)	90°	0.00		33.40	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4.2.11/NL.3)

		VELD 1		VELD 2	
	Hoek t.o.v. lijnrichting	Min.lijnhoek	Max.lijnhoek	Min.lijnhoek	Max.lijnhoek
jTrep bij combinatie (1a)	90°	0.00	0.00	32.65	32.65
	0°	0.00	0.00	29.69	29.69
	45°	0.00	0.00	31.21	31.21
	-45°	0.00	0.00	31.21	31.21
jTrep bij combinatie (1b)	90°	0.00	0.00	32.43	32.43
	0°	0.00	0.00	32.03	32.03
	45°	0.00	0.00	32.23	32.23
	-45°	0.00	0.00	32.23	32.23
jTrep bij combinatie (3)	90°	0.00	0.00	37.16	37.16
	0°	0.00	0.00	32.54	32.54
	45°	0.00	0.00	34.96	34.96
	-45°	0.00	0.00	34.96	34.96
jTrep bij combinatie (4)	90°	0.00	0.00	36.26	36.26
	0°	0.00	0.00	35.84	35.84
	45°	0.00	0.00	36.06	36.06
	-45°	0.00	0.00	36.06	36.06

Bijlage B Berekening Mast

Project	150 kV lijn Leiden - Zoetermeer
Versie	Scia Engineer 13.1.64
Projectbestandsnaam	Esa3-18-7_2fasen.esa
Project bestandspad	H:\Projecten\13.039 Fabricom vervangen mast 74 150 kV-lijn Leiden-Zoetermeer\1303914509, noodmast P74 etc\02 - Documenten\Mast 74(2fase)\Scia\
Functionaliteit	Niet lineariteit Stabiliteit (Algemene knikvorm) Klimaatlasten Staal Oude stijl document
Nationale Bijlage	Nederlandse NEN-EN NA
Onderdeel	Berekening Mast 74N
Omschrijving	Ontwerpberekening
Auteur	JH
Datum	09.04.2013
Constructie	Algemeen XYZ
Nationale norm	EC - EN

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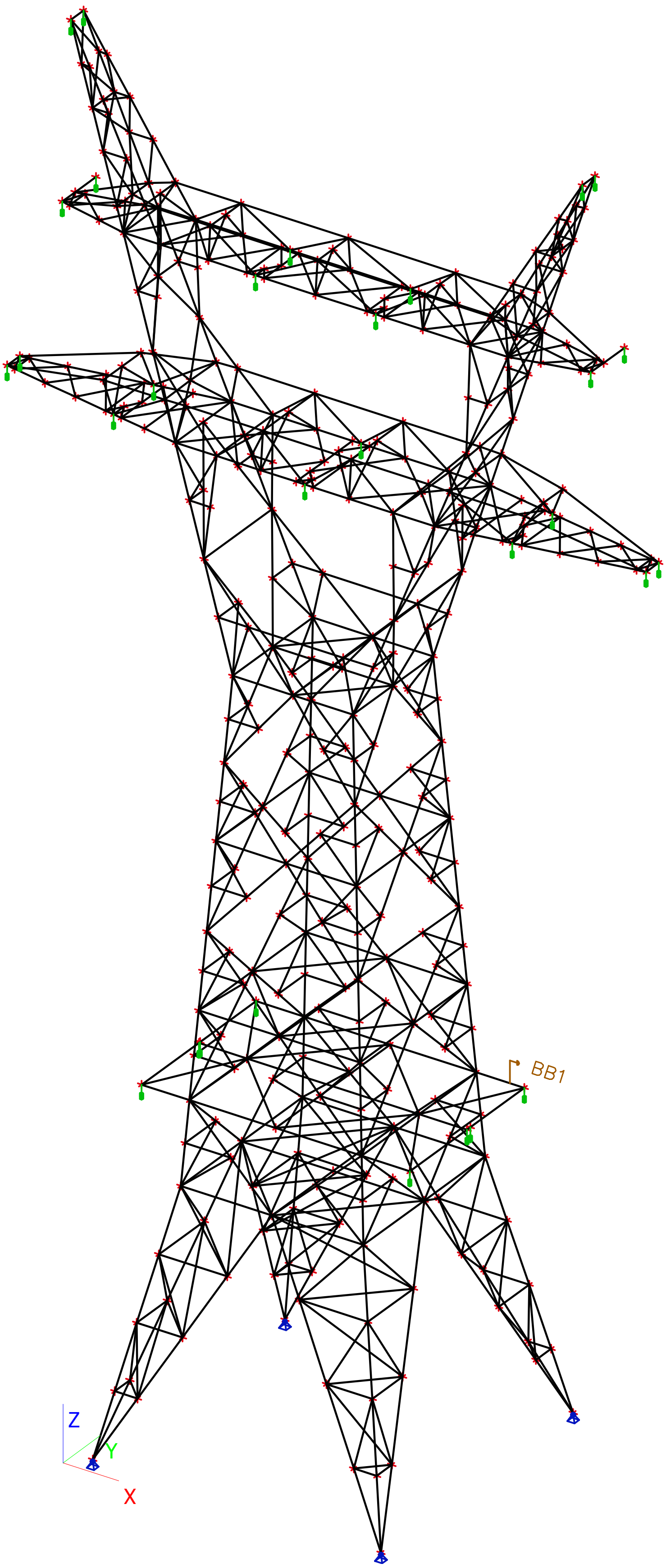
2. Overzicht rekenmodel



3. Knoop

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K1	-8,904	-0,682	49,980
K2	-9,553	0,000	49,980
K3	-10,100	-0,541	51,489
K5	-9,553	0,682	49,980
K7	-10,100	0,541	51,489
K9	-9,553	-0,682	49,980
K13	-9,014	0,821	48,490
K15	-8,333	0,000	46,609
K17	-9,014	-0,821	48,490
K21	-9,764	0,543	51,470
K24	-8,905	0,682	49,980
K28	-8,045	0,821	48,490
K29	-8,333	0,996	46,609
K31	-9,764	-0,543	51,470
K38	-8,045	-0,821	48,490
K39	-8,333	-0,996	46,609
K43	-8,004	-1,081	45,700
K47	-7,279	0,000	43,700
K55	-7,279	-1,268	43,700
K56	-7,279	1,268	43,700
K61	-5,929	1,616	39,971
K63	-5,397	-1,753	38,500
K65	-5,929	-1,616	39,971
K67	-5,938	0,000	39,994
K69	-3,952	2,126	34,509
K70	-5,397	0,000	38,500
K71	-4,678	1,939	36,515
K72	-4,676	1,060	36,510
K75	-3,952	-2,126	34,509
K77	-4,678	-1,939	36,515
K78	-4,676	-1,060	36,510
K81	4,678	1,939	36,515
K82	3,814	1,939	36,514
K83	3,677	1,753	38,500
K86	-1,974	2,323	32,501
K87	1,974	2,323	32,501
K88	-1,974	-2,323	32,501
K89	1,974	-2,323	32,501
K90	-3,226	2,313	32,505
K91	-2,500	2,500	30,500
K93	0,000	2,500	30,500
K95	-3,226	1,063	32,505
K99	-2,500	0,000	30,500
K102	-2,500	-2,500	30,500
K103	-3,226	-1,063	32,505
K104	-3,226	-2,313	32,505
K109	0,000	-2,500	30,500
K111	3,226	2,313	32,505
K112	2,500	2,500	30,500
K115	8,904	0,682	49,980
K116	9,553	0,000	49,980
K117	8,904	-0,682	49,980
K118	10,100	-0,541	51,489
K120	9,553	0,682	49,980
K122	10,100	0,541	51,489
K124	9,553	-0,682	49,980
K128	9,014	0,821	48,490
K130	8,333	0,000	46,609
K132	9,014	-0,821	48,490
K136	9,764	0,543	51,470
K143	8,045	0,821	48,490
K144	8,333	0,996	46,609
K146	9,764	-0,543	51,470
K153	8,045	-0,821	48,490
K154	8,333	-0,997	46,609
K156	8,004	1,081	45,700

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K158	8,004	-1,081	45,700
K162	7,279	0,000	43,700
K170	7,279	-1,268	43,700
K171	7,279	1,268	43,700
K173	-7,185	0,001	47,000
K176	6,434	-1,080	45,700
K177	7,185	0,001	47,000
K186	-2,498	1,081	45,700
K190	-4,465	1,081	45,700
K191	-4,465	0,000	47,000
K194	-4,465	-1,081	45,700
K198	-6,435	-1,081	45,700
K201	-2,498	-1,081	45,700
K205	4,465	0,960	47,000
K206	6,435	1,081	45,700
K207	2,498	1,081	45,700
K211	4,465	1,081	45,700
K212	4,465	0,000	47,000
K215	4,465	-1,081	45,700
K217	4,465	-0,960	47,000
K219	6,435	-1,081	45,700
K222	2,498	-1,081	45,700
K224	0,000	1,081	45,700
K226	0,000	0,000	47,000
K227	0,000	-1,081	45,700
K233	-7,185	0,960	47,000
K235	-7,185	-0,960	47,000
K243	-6,480	1,268	43,700
K245	-6,480	-1,268	43,700
K254	-11,000	-0,400	45,700
K256	-10,647	0,400	53,000
K261	7,185	0,960	47,000
K264	11,000	0,400	45,700
K267	7,185	-0,960	47,000
K269	6,480	1,268	43,700
K271	6,480	-1,268	43,700
K282	11,000	-0,400	45,700
K284	10,647	0,400	53,000
K291	-3,677	1,753	38,500
K294	-5,042	1,614	39,996
K298	5,929	1,616	39,971
K301	5,397	1,753	38,500
K302	5,042	1,614	39,996
K306	-5,042	-1,614	39,996
K307	-3,677	-1,753	38,500
K311	-9,194	-0,811	45,700
K312	-10,645	0,481	45,700
K314	-9,194	0,811	45,700
K315	-10,645	-0,481	45,700
K325	-10,647	-0,400	53,000
K329	-2,145	-1,081	45,700
K332	-2,145	1,081	45,700
K335	-6,435	1,081	45,700
K337	-4,471	-1,081	45,700
K339	-2,861	1,081	45,700
K343	-2,861	-1,081	45,700
K345	-2,145	0,000	45,700
K352	9,194	-0,811	45,700
K353	10,645	0,481	45,700
K355	9,194	0,811	45,700
K356	10,645	-0,481	45,700
K372	2,855	1,081	45,700
K376	2,855	-1,081	45,700
K378	2,145	0,000	45,700
K382	2,145	-1,081	45,700
K384	2,145	1,081	45,700

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K388	-8,004	1,081	45,700
K394	-1,837	1,753	38,500
K395	-1,840	0,000	39,996
K396	1,837	1,753	38,500
K397	1,840	0,000	39,996
K400	-8,778	-0,008	39,672
K401	-8,297	-1,256	38,500
K403	-8,297	1,256	38,500
K404	-1,837	-1,753	38,500
K406	1,837	-1,753	38,500
K408	-1,840	-1,614	39,996
K409	-1,840	1,614	39,996
K410	1,840	-1,614	39,996
K411	1,840	1,614	39,996
K414	0,000	1,753	38,500
K420	-13,297	0,400	38,500
K423	-8,778	1,174	39,672
K424	13,297	0,400	38,500
K426	8,297	1,256	38,500
K428	8,778	1,174	39,672
K429	-13,297	-0,400	38,500
K433	-8,778	-1,174	39,672
K434	0,000	-1,753	38,500
K438	3,677	-1,753	38,500
K444	5,397	-1,753	38,500
K447	5,397	0,000	38,500
K448	4,676	1,060	36,510
K451	3,226	1,063	32,505
K456	3,952	-2,126	34,509
K458	13,297	-0,400	38,500
K459	5,929	-1,616	39,971
K460	8,297	-1,256	38,500
K462	8,778	-1,174	39,672
K469	4,678	-1,939	36,515
K470	4,676	-1,060	36,510
K473	-3,677	0,000	38,500
K493	-11,512	0,706	38,500
K494	-12,942	-0,461	38,500
K495	-10,082	0,951	38,500
K496	-11,512	-0,706	38,500
K497	-8,652	1,196	38,500
K498	-10,082	-0,951	38,500
K504	-12,942	0,461	38,500
K507	-8,652	-1,196	38,500
K515	-7,942	0,000	38,500
K519	-7,942	-1,317	38,500
K520	-7,942	1,317	38,500
K521	-6,838	-1,506	38,500
K522	-6,838	1,506	38,500
K527	3,677	0,000	38,500
K531	0,352	0,000	38,500
K532	-0,358	-0,886	38,500
K534	0,352	-1,753	38,500
K538	8,778	-0,008	39,672
K544	-0,358	1,753	38,500
K545	-0,358	-1,753	38,500
K546	5,938	0,000	39,994
K550	11,512	-0,706	38,500
K551	12,942	0,461	38,500
K552	10,082	-0,951	38,500
K553	11,512	0,706	38,500
K554	8,652	-1,196	38,500
K555	10,082	0,951	38,500
K561	12,942	-0,461	38,500
K564	8,652	1,196	38,500
K572	7,942	0,000	38,500

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 74N
Omschrijving	Ontwerpberekening
Nationale norm	EC - EN
Auteur	JH

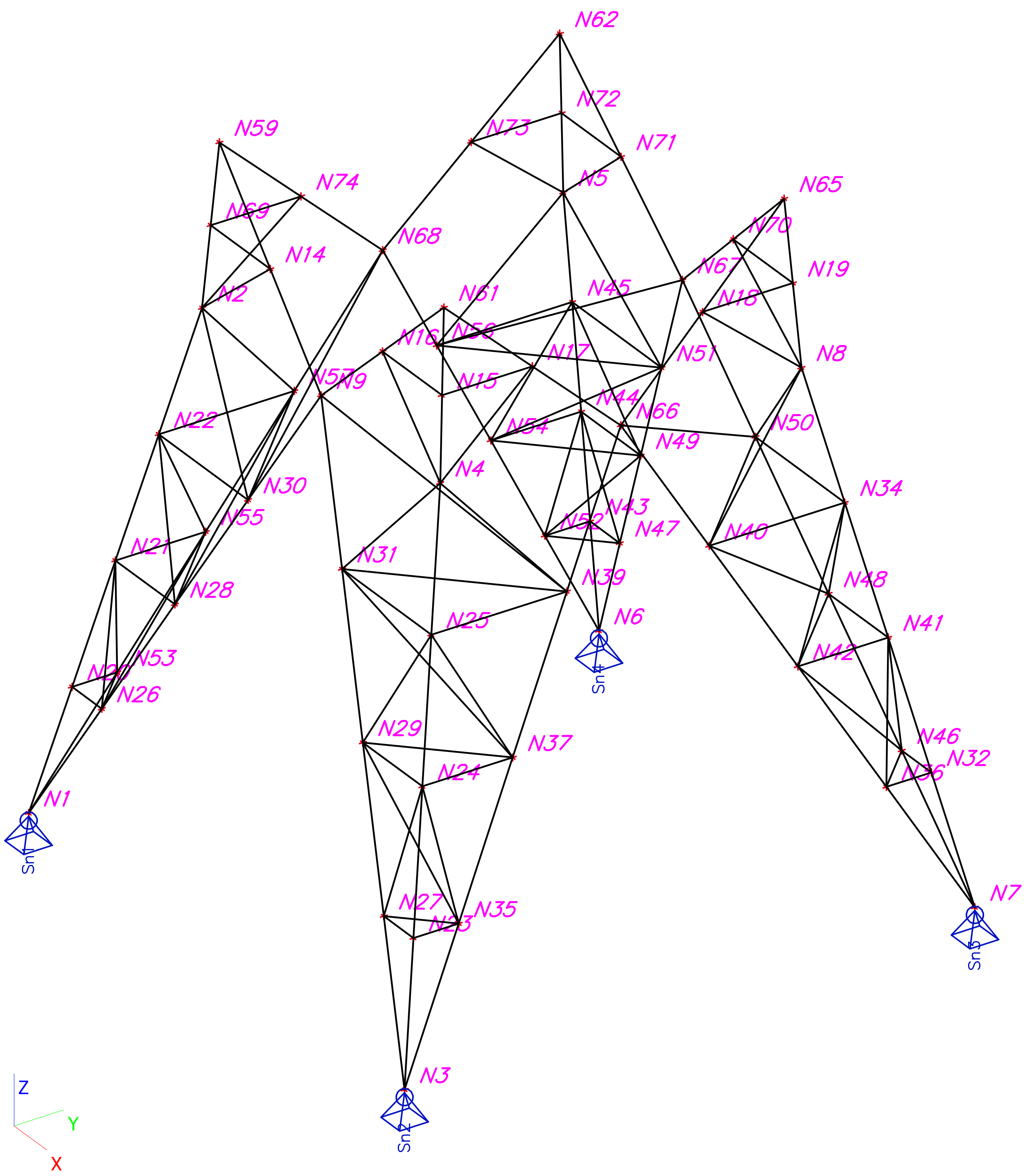
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K576	7,942	1,317	38,500
K577	7,942	-1,317	38,500
K578	6,837	1,506	38,500
K579	6,837	-1,506	38,500
K589	-0,358	0,886	38,500
K591	0,352	1,753	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
K621	6,526	1,462	41,620
K622	6,527	-1,462	41,621
K623	-4,465	0,960	47,000
N1	-6,000	-6,000	0,000
N2	-3,800	-3,800	10,500
N3	6,000	-6,000	0,000
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N6	-6,000	6,000	0,000
N7	6,000	6,000	0,000
N8	3,800	3,800	10,500
N20	-5,450	-5,450	2,625
N21	-4,900	-4,900	5,250
N22	-4,350	-4,350	7,875
N23	5,450	-5,450	2,625
N24	4,900	-4,900	5,250
N25	4,350	-4,350	7,875
N26	-4,500	-5,450	2,625
N27	4,500	-5,450	2,625
N28	-3,000	-4,900	5,250
N29	3,000	-4,900	5,250
N30	-1,500	-4,350	7,875
N31	1,500	-4,350	7,875
N32	5,450	5,450	2,625
N34	4,350	4,350	7,875
N35	5,450	-4,500	2,625
N36	5,450	4,500	2,625
N37	4,900	-3,000	5,250
N39	4,350	-1,500	7,875
N40	4,350	1,500	7,875
N41	4,900	4,900	5,250
N42	4,900	3,000	5,250
N43	-5,450	5,450	2,625
N44	-4,900	4,900	5,250
N45	-4,350	4,350	7,875
N46	4,500	5,450	2,625
N47	-4,500	5,450	2,625
N48	3,000	4,900	5,250
N49	-3,000	4,900	5,250
N50	1,500	4,350	7,875
N51	-1,500	4,350	7,875
N52	-5,450	4,500	2,625
N53	-5,450	-4,500	2,625
N54	-4,900	3,000	5,250
N55	-4,900	-3,000	5,250
N56	-4,350	1,500	7,875
N57	-4,350	-1,500	7,875
N59	-3,582	-3,582	13,860
N61	3,582	-3,582	13,860
N62	-3,582	3,582	13,860
N65	3,582	3,582	13,860
N9	0,000	-3,800	10,500
N66	3,800	0,000	10,500

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N67	0,000	3,800	10,500
N68	-3,800	0,000	10,500
N69	-3,691	-3,691	12,180
N14	-1,791	-3,691	12,180
N15	3,691	-3,691	12,180
N16	1,791	-3,691	12,180
N17	3,691	-1,791	12,180
N18	3,691	1,791	12,180
N19	3,691	3,691	12,180
N70	1,791	3,691	12,180
N71	-1,791	3,691	12,180
N72	-3,691	3,691	12,180
N73	-3,691	1,791	12,180
N74	-3,691	-1,791	12,180
N76	-3,151	-3,151	20,480
N78	3,151	-3,151	20,480
N79	-3,151	3,151	20,480
N82	3,151	3,151	20,480
N83	-3,353	-3,353	17,382
N84	3,353	-3,353	17,382
N85	3,353	3,353	17,382
N86	-3,353	3,353	17,382
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-3,467	15,621
N98	-1,791	-3,467	15,621
N99	1,576	-3,252	18,931
N100	3,252	-3,252	18,931
N101	3,252	-1,576	18,931
N102	3,252	1,575	18,931
N33	3,252	3,252	18,931
N103	1,576	3,252	18,931
N104	-1,576	3,252	18,931
N105	-3,252	3,252	18,931
N106	-3,252	1,575	18,931
N38	-3,252	-1,576	18,931
N107	-3,252	-3,252	18,931
N108	-1,576	-3,252	18,931
N114	-2,720	-2,721	27,100
N116	2,721	-2,721	27,100
N117	-2,720	2,720	27,100
N120	2,721	2,720	27,100
N121	-2,920	-2,920	24,033
N122	2,920	-2,920	24,033
N123	2,920	2,920	24,033
N124	-2,920	2,920	24,033
N125	1,576	-3,036	22,256
N126	3,036	-3,036	22,256
N127	3,036	-1,576	22,256
N128	3,036	1,575	22,256
N129	3,036	3,035	22,256
N130	1,576	3,035	22,256
N131	-1,576	3,035	22,256
N132	-3,036	3,035	22,256
N133	-3,036	1,575	22,256
N134	-3,036	-1,576	22,256
N135	-3,036	-3,036	22,256
N136	-1,576	-3,036	22,256

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N137	1,361	-2,821	25,566
N138	2,821	-2,821	25,566
N139	2,821	-1,361	25,566
N140	2,821	1,360	25,566
N141	2,821	2,820	25,566
N142	1,361	2,820	25,566
N143	-1,360	2,820	25,566
N144	-2,820	2,820	25,566
N145	-2,820	1,360	25,566
N146	-2,820	-1,361	25,566
N147	-2,820	-2,821	25,566
N148	-1,360	-2,821	25,566
N149	2,920	0,000	24,033
N150	0,000	2,920	24,033
N151	-2,920	0,000	24,033
N152	0,000	-2,920	24,033
N156	2,500	-2,500	30,500
N165	-2,610	-2,611	28,800
N166	-1,360	-2,611	28,800
N167	1,360	-2,611	28,800
N168	2,610	-2,611	28,800
N169	2,610	-1,361	28,800
N170	2,610	1,360	28,800
N171	2,610	2,610	28,800
N172	1,361	2,610	28,800
N173	-1,360	2,610	28,800
N174	-2,610	2,610	28,800
N175	-2,610	1,360	28,800
N176	-2,610	-1,361	28,800
K624	-0,358	0,000	38,500
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,464	-0,960	47,000
K628	3,952	2,126	34,509
K629	-3,814	-1,939	36,515
K630	-3,814	1,939	36,515
N12	0,000	0,000	10,500
N183	0,000	0,000	30,500
N184	0,000	-3,353	17,382
N185	-3,353	0,000	17,382
N186	0,000	3,353	17,382
N187	3,353	0,000	17,382
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
N196	11,000	1,700	45,700
K631	-11,000	0,400	45,700
K632	-11,000	1,700	45,700
K634	-5,582	-3,582	13,860
K635	-5,582	3,582	13,860
K641	5,582	-3,582	13,860
K642	5,582	3,582	13,860
K643	-3,582	0,000	13,860
K644	0,000	3,582	13,860
K645	3,582	0,000	13,860
K646	0,000	-3,582	13,860
K647	-5,582	0,000	13,860
K648	5,582	0,000	13,860
K651	-5,582	0,080	13,860
K652	5,582	0,212	13,860
K656	-0,003	-1,320	38,500
K657	2,500	-0,541	45,700
K658	-2,503	-0,541	45,700
K659	8,297	-0,598	38,500
K660	-8,297	-0,598	38,500

4. Knoopnummers

4.1. Knoopnummers steunpunten



5. 1D-staaf

Naam	Doorsnede	Lengte [m]	Type	Laag
S1	CS22 - HFLeq60x60x6	0,941	Balk (80)	CrossArm6
S2	CS11 - L50X5	1,862	Kolom (100)	CrossArm6
S3	CS11 - L50X5	2,018	Kolom (100)	CrossArm6
S4	CS11 - L50X5	1,862	Kolom (100)	CrossArm6
S5	CS11 - L50X5	2,018	Kolom (100)	CrossArm6
S6	CS11 - L50X5	1,364	Balk (80)	CrossArm6
S7	CS11 - L50X5	2,184	Kolom (100)	CrossArm6
S8	CS88 - L60X6	2,162	Kolom (100)	CrossArm6
S9	CS11 - L50X5	2,184	Kolom (100)	CrossArm6
S10	CS88 - L60X6	2,162	Kolom (100)	CrossArm6
S11	CS7 - L50X5	1,511	Kolom (100)	CrossArm6
S12	CS7 - L50X5	0,336	Balk (80)	CrossArm6
S13	CS7 - L50X5	1,501	Kolom (100)	CrossArm6
S14	CS7 - L50X5	0,649	Balk (80)	CrossArm6
S15	CS7 - L50X5	1,911	Kolom (100)	CrossArm6
S16	CS7 - L50X5	0,969	Balk (80)	CrossArm6
S17	CS7 - L50X5	1,511	Kolom (100)	CrossArm6
S18	CS7 - L50X5	0,336	Balk (80)	CrossArm6
S19	CS7 - L50X5	1,501	Kolom (100)	CrossArm6
S20	CS7 - L50X5	0,649	Balk (80)	CrossArm6
S21	CS7 - L50X5	1,911	Kolom (100)	CrossArm6
S22	CS7 - L50X5	0,969	Balk (80)	CrossArm6
S23	CS4 - L50X5	1,450	Kolom (100)	Vak20
S24	CS4 - L50X5	1,451	Kolom (100)	Vak20
S25	CS4 - L50X5	1,993	Balk (80)	Vak20
S26	CS96 - L120X10	2,386	Kolom (100)	Vak11
S27	CS96 - L120X10	2,652	Kolom (100)	Vak11
S28	CS96 - L120X10	2,386	Kolom (100)	Vak11
S29	CS96 - L120X10	2,651	Kolom (100)	Vak11
S30	CS4 - L50X5	2,536	Balk (80)	Vak11
S31	CS93 - L90X9	2,265	Kolom (100)	Vak10
S33	CS4 - L50X5	1,616	Balk (80)	Vak10
S34	CS93 - L90X9	2,366	Kolom (100)	Vak10
S35	CS4 - L50X5	1,616	Balk (80)	Vak10
S36	CS93 - L90X9	2,265	Kolom (100)	Vak10
S37	CS91 - L150X15	4,747	Kolom (100)	Vak8
S38	CS4 - L50X5	0,879	Balk (80)	Vak8
S40	CS91 - L150X15	4,747	Kolom (100)	Vak8
S41	CS4 - L50X5	0,879	Balk (80)	Vak8
S42	CS92 - L70X7	2,227	Kolom (100)	Vak8
S43	CS4 - L50X5	0,864	Balk (80)	Vak8
S44	CS92 - L70X7	2,231	Kolom (100)	Vak8
S46	CS86 - L130X12	3,949	Balk (80)	Vak6
S47	CS86 - L130X12	3,949	Balk (80)	Vak6
S48	CS88 - L60X6	1,252	Balk (80)	Vak6
S49	CS84 - L100X8	2,076	Kolom (100)	Vak6
S51	CS85 - L60X8	2,571	Kolom (100)	Vak6
S52	CS88 - L60X6	1,250	Balk (80)	Vak6
S53	CS83 - L120X12	2,382	Kolom (100)	Vak7
S54	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak8
S55	CS85 - L60X8	2,571	Kolom (100)	Vak6
S56	CS88 - L60X6	1,250	Balk (80)	Vak6
S57	CS88 - L60X6	1,252	Balk (80)	Vak6
S58	CS83 - L120X12	2,382	Kolom (100)	Vak7
S60	CS88 - L60X6	1,252	Balk (80)	Vak6
S61	CS84 - L100X8	2,076	Kolom (100)	Vak6
S63	CS22 - HFLeq60x60x6	0,941	Balk (80)	CrossArm5
S64	CS22 - HFLeq60x60x6	0,941	Balk (80)	CrossArm5
S65	CS12 - L50X5	1,862	Kolom (100)	CrossArm5
S66	CS12 - L50X5	2,018	Kolom (100)	CrossArm5
S67	CS12 - L50X5	1,862	Kolom (100)	CrossArm5
S68	CS12 - L50X5	2,018	Kolom (100)	CrossArm5
S69	CS12 - L50X5	1,364	Balk (80)	CrossArm5
S70	CS12 - L50X5	2,184	Kolom (100)	CrossArm5
S71	CS88 - L60X6	2,162	Kolom (100)	CrossArm5
S72	CS12 - L50X5	2,184	Kolom (100)	CrossArm5
S73	CS88 - L60X6	2,162	Kolom (100)	CrossArm5

Naam	Doorsnede	Lengte [m]	Type	Laag
S74	CS7 - L50X5	1,511	Kolom (100)	CrossArm5
S75	CS7 - L50X5	0,336	Balk (80)	CrossArm5
S76	CS7 - L50X5	1,501	Kolom (100)	CrossArm5
S77	CS7 - L50X5	0,649	Balk (80)	CrossArm5
S78	CS7 - L50X5	1,911	Kolom (100)	CrossArm5
S79	CS7 - L50X5	0,969	Balk (80)	CrossArm5
S80	CS7 - L50X5	1,511	Kolom (100)	CrossArm5
S81	CS7 - L50X5	0,336	Balk (80)	CrossArm5
S82	CS7 - L50X5	1,501	Kolom (100)	CrossArm5
S83	CS7 - L50X5	0,649	Balk (80)	CrossArm5
S84	CS7 - L50X5	1,911	Kolom (100)	CrossArm5
S85	CS7 - L50X5	0,969	Balk (80)	CrossArm5
S86	CS4 - L50X5	1,450	Kolom (100)	Vak15
S87	CS4 - L50X5	1,451	Kolom (100)	Vak15
S88	CS4 - L50X5	1,993	Balk (80)	Vak15
S89	CS96 - L120X10	2,386	Kolom (100)	Vak12
S90	CS96 - L120X10	2,652	Kolom (100)	Vak12
S91	CS96 - L120X10	2,386	Kolom (100)	Vak12
S92	CS96 - L120X10	2,651	Kolom (100)	Vak12
S93	CS4 - L50X5	2,536	Balk (80)	Vak12
S94	CS22 - HFLeq60x60x6	1,851	Kolom (100)	Vak20
S95	CS22 - HFLeq60x60x6	1,849	Kolom (100)	Vak20
S96	CS22 - HFLeq60x60x6	1,850	Kolom (100)	Vak15
S97	CS22 - HFLeq60x60x6	1,849	Kolom (100)	Vak15
S98	CS4 - L50X5	1,920	Balk (80)	Vak20
S99	CS4 - L50X5	1,920	Balk (80)	Vak15
S100	CS24 - ISEA100/100/6	2,364	Kolom (100)	Vak19
S101	CS98 - L50X6	2,361	Kolom (100)	Vak18
S102	CS93 - L90X9	2,818	Balk (80)	Vak18
S103	CS4 - L50X5	1,691	Kolom (100)	Vak19
S104	CS4 - L50X5	1,306	Kolom (100)	Vak19
S105	CS4 - L50X5	1,691	Kolom (100)	Vak19
S106	CS4 - L50X5	1,920	Balk (80)	Vak19
S107	CS24 - ISEA100/100/6	2,364	Kolom (100)	Vak19
S108	CS4 - L50X5	1,306	Kolom (100)	Vak19
S109	CS98 - L50X6	2,360	Kolom (100)	Vak18
S110	CS93 - L90X9	2,819	Balk (80)	Vak18
S111	CS24 - ISEA100/100/6	2,363	Kolom (100)	Vak16
S112	CS98 - L50X6	2,361	Kolom (100)	Vak17
S113	CS93 - L90X9	2,819	Balk (80)	Vak17
S114	CS4 - L50X5	1,691	Kolom (100)	Vak17
S115	CS4 - L50X5	1,306	Kolom (100)	Vak17
S116	CS4 - L50X5	1,691	Kolom (100)	Vak17
S117	CS4 - L50X5	1,920	Balk (80)	Vak17
S118	CS24 - ISEA100/100/6	2,363	Kolom (100)	Vak16
S119	CS4 - L50X5	1,306	Kolom (100)	Vak17
S120	CS98 - L50X6	2,361	Kolom (100)	Vak17
S121	CS4 - L50X5	1,306	Kolom (100)	Vak18
S122	CS4 - L50X5	1,691	Kolom (100)	Vak18
S123	CS4 - L50X5	1,691	Kolom (100)	Vak18
S124	CS4 - L50X5	1,920	Balk (80)	Vak18
S125	CS4 - L50X5	1,306	Kolom (100)	Vak18
S126	CS93 - L90X9	2,819	Balk (80)	Vak17
S127	CS97 - L100X10	2,720	Balk (80)	Vak16
S128	CS97 - L100X10	2,720	Balk (80)	Vak16
S129	CS4 - L50X5	1,213	Balk (80)	Vak20
S130	CS4 - L50X5	2,880	Balk (80)	CrossArm4
S131	CS95 - L80X8	1,541	Kolom (100)	Vak20
S132	CS95 - L80X8	1,541	Kolom (100)	Vak20
S133	CS7 - L50X5	0,799	Balk (80)	Vak11
S134	CS7 - L50X5	0,800	Balk (80)	Vak11
S135	CS96 - L120X10	4,098	Kolom (100)	Vak11
S136	CS7 - L50X5	2,179	Kolom (100)	Vak11
S137	CS4 - L50X5	1,213	Balk (80)	Vak20
S138	CS4 - L50X5	2,880	Balk (80)	CrossArm4
S139	CS93 - L90X9	1,506	Kolom (100)	Vak20
S140	CS96 - L120X10	4,099	Kolom (100)	Vak11
S141	CS93 - L90X9	1,506	Kolom (100)	Vak20
S142	CS4 - L50X5	1,213	Balk (80)	Vak15

Naam	Doorsnede	Lengte [m]	Type	Laag
S143	CS4 - L50X5	2,880	Balk (80)	CrossArm3
S144	CS95 - L80X8	1,541	Kolom (100)	Vak15
S145	CS95 - L80X8	1,541	Kolom (100)	Vak15
S146	CS7 - L50X5	0,800	Balk (80)	Vak12
S147	CS7 - L50X5	0,800	Balk (80)	Vak12
S148	CS96 - L120X10	4,098	Kolom (100)	Vak12
S149	CS7 - L50X5	2,179	Kolom (100)	Vak12
S150	CS7 - L50X5	2,179	Kolom (100)	Vak12
S151	CS4 - L50X5	1,213	Balk (80)	Vak15
S152	CS4 - L50X5	2,880	Balk (80)	CrossArm3
S153	CS93 - L90X9	1,506	Kolom (100)	Vak15
S154	CS96 - L120X10	4,099	Kolom (100)	Vak12
S155	CS93 - L90X9	1,506	Kolom (100)	Vak15
S156	CS93 - L90X9	2,264	Kolom (100)	Vak10
S159	CS34 - UNP120	0,888	Balk (80)	Vak10
S160	CS34 - UNP120	0,888	Balk (80)	Vak10
S161	CS86 - L130X12	3,202	Balk (80)	Vak13
S162	CS25 - HFLue120x80x8	1,544	Kolom (100)	Vak10
S164	CS25 - HFLue120x80x8	1,544	Kolom (100)	Vak10
S166	CS34 - UNP120	0,888	Balk (80)	Vak10
S167	CS28 - ISEA55/55/5	1,943	Balk (80)	CrossArm4
S168	CS11 - L50X5	2,235	Balk (80)	CrossArm4
S169	CS28 - ISEA55/55/5	1,943	Balk (80)	CrossArm4
S170	CS11 - L50X5	2,235	Balk (80)	CrossArm4
S171	CS101 - UNP140	3,073	Balk (80)	CrossArm4
S172	CS101 - UNP140	3,073	Balk (80)	CrossArm4
S173	CS30 - UNP140	0,961	Balk (80)	CrossArm4
S175	CS11 - L50X5	0,800	Balk (80)	CrossArm6
S176	CS82 - L180X18	2,140	Kolom (100)	Vak6
S177	CS82 - L180X18	2,140	Kolom (100)	Vak6
S178	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak18
S179	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak18
S180	CS28 - ISEA55/55/5	2,672	Balk (80)	Vak20
S181	CS28 - ISEA55/55/5	2,671	Balk (80)	Vak20
S182	CS15 - HFLeq60x60x5	2,921	Balk (80)	Vak19
S183	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak18
S184	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak19
S185	CS15 - HFLeq60x60x5	2,692	Balk (80)	Vak18
S186	CS98 - L50X6	1,297	Balk (80)	Vak18
S187	CS98 - L50X6	1,297	Balk (80)	Vak18
S188	CS30 - UNP140	2,163	Balk (80)	Vak18
S189	CS30 - UNP140	2,163	Balk (80)	Vak18
S190	CS28 - ISEA55/55/5	1,943	Balk (80)	CrossArm3
S191	CS11 - L50X5	2,235	Balk (80)	CrossArm3
S192	CS28 - ISEA55/55/5	1,943	Balk (80)	CrossArm3
S193	CS11 - L50X5	2,235	Balk (80)	CrossArm3
S194	CS101 - UNP140	3,073	Balk (80)	CrossArm3
S195	CS101 - UNP140	3,073	Balk (80)	CrossArm3
S196	CS30 - UNP140	0,961	Balk (80)	CrossArm3
S198	CS28 - ISEA55/55/5	2,672	Balk (80)	Vak15
S199	CS28 - ISEA55/55/5	2,672	Balk (80)	Vak15
S200	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak16
S201	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak17
S202	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak16
S203	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak17
S204	CS98 - L50X6	1,294	Balk (80)	Vak17
S205	CS98 - L50X6	1,294	Balk (80)	Vak17
S206	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak17
S207	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak17
S208	CS30 - UNP140	2,163	Balk (80)	Vak17
S209	CS30 - UNP140	2,163	Balk (80)	Vak17
S210	CS101 - UNP140	1,569	Balk (80)	Vak15
S211	CS4 - L50X5	2,163	Balk (80)	Vak15
S212	CS4 - L50X5	2,163	Balk (80)	Vak20
S213	CS101 - UNP140	1,569	Balk (80)	Vak15
S214	CS4 - L50X5	2,305	Kolom (100)	Vak9
S215	CS4 - L50X5	2,305	Kolom (100)	Vak14
S216	CS4 - L50X5	2,348	Balk (80)	CrossArm2
S217	CS4 - L50X5	1,778	Kolom (100)	CrossArm2

Naam	Doorsnede	Lengte [m]	Type	Laag
S218	CS4 - L50X5	1,790	Kolom (100)	CrossArm2
S219	CS4 - L50X5	2,305	Kolom (100)	Vak9
S220	CS4 - L50X5	2,305	Kolom (100)	Vak14
S221	CS4 - L50X5	3,227	Balk (80)	Vak9
S222	CS4 - L50X5	3,227	Balk (80)	Vak14
S223	CS4 - L50X5	2,348	Balk (80)	CrossArm1
S224	CS26 - HFLeq100x100x8	2,376	Kolom (100)	Vak14
S225	CS41 - ISEA120/120/8	2,373	Kolom (100)	Vak9
S226	CS26 - HFLeq100x100x8	2,376	Kolom (100)	Vak14
S227	CS41 - ISEA120/120/8	2,373	Kolom (100)	Vak13
S228	CS40 - ISUA65/50/5	4,732	Balk (80)	CrossArm2
S229	CS4 - L50X5	1,269	Kolom (100)	CrossArm2
S230	CS40 - ISUA65/50/5	2,898	Balk (80)	CrossArm2
S231	CS40 - ISUA65/50/5	4,732	Balk (80)	CrossArm1
S232	CS4 - L50X5	2,810	Kolom (100)	CrossArm1
S233	CS4 - L50X5	1,269	Kolom (100)	CrossArm1
S234	CS40 - ISUA65/50/5	2,898	Balk (80)	CrossArm1
S235	CS40 - ISUA65/50/5	4,732	Balk (80)	CrossArm2
S236	CS4 - L50X5	2,811	Kolom (100)	CrossArm2
S237	CS4 - L50X5	1,269	Kolom (100)	CrossArm2
S238	CS40 - ISUA65/50/5	2,898	Balk (80)	CrossArm2
S239	CS26 - HFLeq100x100x8	2,376	Kolom (100)	Vak14
S240	CS41 - ISEA120/120/8	2,373	Kolom (100)	Vak9
S241	CS26 - HFLeq100x100x8	2,376	Kolom (100)	Vak14
S242	CS41 - ISEA120/120/8	2,373	Kolom (100)	Vak13
S243	CS93 - L90X9	2,366	Kolom (100)	Vak10
S244	CS4 - L50X5	1,616	Balk (80)	Vak10
S245	CS93 - L90X9	2,366	Kolom (100)	Vak10
S247	CS4 - L50X5	0,879	Balk (80)	Vak8
S248	CS92 - L70X7	2,227	Kolom (100)	Vak8
S249	CS85 - L60X8	2,571	Kolom (100)	Vak6
S250	CS88 - L60X6	1,250	Balk (80)	Vak6
S252	CS91 - L150X15	4,747	Kolom (100)	Vak8
S253	CS40 - ISUA65/50/5	4,732	Balk (80)	CrossArm1
S254	CS4 - L50X5	2,810	Kolom (100)	CrossArm1
S255	CS4 - L50X5	1,269	Kolom (100)	CrossArm1
S256	CS40 - ISUA65/50/5	2,898	Balk (80)	CrossArm1
S257	CS4 - L50X5	1,616	Balk (80)	Vak10
S258	CS34 - UNP120	0,888	Balk (80)	Vak10
S259	CS86 - L130X12	3,201	Balk (80)	Vak9
S260	CS4 - L50X5	0,879	Balk (80)	Vak8
S263	CS95 - L80X8	2,542	Balk (80)	Vak9
S264	CS95 - L80X8	2,294	Balk (80)	Vak14
S265	CS95 - L80X8	2,456	Balk (80)	Vak9
S266	CS95 - L80X8	2,542	Balk (80)	Vak9
S267	CS95 - L80X8	2,294	Balk (80)	Vak14
S268	CS43 - ISEA70/70/5	3,507	Balk (80)	Vak9
S269	CS44 - UNP200	1,840	Balk (80)	Vak9
S270	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak10
S273	CS94 - L60X8	1,845	Balk (80)	CrossArm2
S274	CS94 - L60X8	2,188	Balk (80)	CrossArm2
S275	CS94 - L60X8	2,579	Balk (80)	CrossArm2
S278	CS94 - L60X8	1,845	Balk (80)	CrossArm2
S279	CS94 - L60X8	2,188	Balk (80)	CrossArm2
S280	CS94 - L60X8	2,579	Balk (80)	CrossArm2
S282	CS44 - UNP200	0,921	Balk (80)	CrossArm2
S283	CS30 - UNP140	2,391	Balk (80)	CrossArm2
S284	CS94 - L60X8	1,390	Balk (80)	CrossArm2
S285	CS94 - L60X8	1,390	Balk (80)	CrossArm2
S286	CS30 - UNP140	2,634	Balk (80)	CrossArm2
S287	CS43 - ISEA70/70/5	3,013	Balk (80)	CrossArm2
S288	CS93 - L90X9	3,988	Balk (80)	CrossArm2
S289	CS44 - UNP200	8,015	Balk (80)	CrossArm1
S290	CS95 - L80X8	2,456	Balk (80)	Vak13
S291	CS95 - L80X8	2,542	Balk (80)	Vak13
S292	CS95 - L80X8	2,298	Balk (80)	Vak14
S293	CS4 - L50X5	1,135	Balk (80)	Vak14
S294	CS4 - L50X5	1,121	Balk (80)	Vak14
S295	CS44 - UNP200	8,015	Balk (80)	CrossArm1

Naam	Doorsnede	Lengte [m]	Type	Laag
S296	CS4 - L50X5	1,778	Kolom (100)	CrossArm1
S297	CS4 - L50X5	1,790	Kolom (100)	CrossArm1
S298	CS36 - ISEA70/70/5	3,507	Balk (80)	Vak10
S299	CS44 - UNP200	3,507	Balk (80)	Vak14
S300	CS93 - L90X9	2,265	Kolom (100)	Vak10
S301	CS92 - L70X7	2,227	Kolom (100)	Vak8
S302	CS94 - L60X8	1,845	Balk (80)	CrossArm1
S303	CS94 - L60X8	2,188	Balk (80)	CrossArm1
S304	CS94 - L60X8	2,579	Balk (80)	CrossArm1
S307	CS94 - L60X8	1,845	Balk (80)	CrossArm1
S308	CS94 - L60X8	2,188	Balk (80)	CrossArm1
S309	CS94 - L60X8	2,579	Balk (80)	CrossArm1
S311	CS44 - UNP200	0,921	Balk (80)	CrossArm1
S312	CS30 - UNP140	2,391	Balk (80)	CrossArm1
S313	CS94 - L60X8	1,390	Balk (80)	CrossArm1
S314	CS94 - L60X8	1,391	Balk (80)	CrossArm1
S315	CS30 - UNP140	2,634	Balk (80)	CrossArm1
S316	CS43 - ISEA70/70/5	3,013	Balk (80)	CrossArm1
S317	CS93 - L90X9	3,988	Balk (80)	CrossArm1
S318	CS95 - L80X8	2,456	Balk (80)	Vak13
S319	CS95 - L80X8	2,542	Balk (80)	Vak13
S320	CS95 - L80X8	2,298	Balk (80)	Vak14
S321	CS43 - ISEA70/70/5	3,507	Balk (80)	Vak13
S322	CS4 - L50X5	1,135	Balk (80)	Vak14
S323	CS4 - L50X5	1,121	Balk (80)	Vak14
S324	CS44 - UNP200	3,507	Balk (80)	Vak14
S328	CS25 - HFLue120x80x8	1,544	Kolom (100)	Vak10
S330	CS4 - L50X5	0,864	Balk (80)	Vak8
S331	CS92 - L70X7	2,231	Kolom (100)	Vak8
S332	CS90 - L120X12	4,017	Kolom (100)	Vak8
S333	CS85 - L60X8	2,571	Kolom (100)	Vak6
S334	CS88 - L60X6	1,250	Balk (80)	Vak6
S335	CS88 - L60X6	1,252	Balk (80)	Vak6
S336	CS84 - L100X8	2,076	Kolom (100)	Vak6
S337	CS83 - L120X12	2,382	Kolom (100)	Vak7
S340	CS44 - UNP200	8,015	Balk (80)	CrossArm1
S341	CS82 - L180X18	2,140	Kolom (100)	Vak6
S342	CS82 - L180X18	2,140	Kolom (100)	Vak6
S343	CS12 - L50X5	0,800	Balk (80)	CrossArm5
S345	CS35 - L150x150x14	2,816	Balk (80)	Vak6
S346	CS35 - L150x150x14	2,825	Balk (80)	Vak7
S347	CS35 - L150x150x14	2,816	Balk (80)	Vak6
S349	CS35 - L150x150x14	2,816	Balk (80)	Vak6
S350	CS35 - L150x150x14	2,825	Balk (80)	Vak7
S351	CS35 - L150x150x14	2,816	Balk (80)	Vak6
S352	CS35 - L150x150x14	2,825	Balk (80)	Vak7
C1	CS2 - L200X24	10,951	Kolom (100)	Vak1
C2	CS2 - L200X24	10,951	Kolom (100)	Vak1
C4	CS2 - L200X24	10,951	Kolom (100)	Vak1
C3	CS2 - L200X24	10,951	Kolom (100)	Vak1
B9	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B14	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B16	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B18	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
SB2	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB5	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB18	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB21	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB34	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB37	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB6	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB9	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB22	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB38	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB41	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB25	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB10	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB13	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB26	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1

Naam	Doorsnede	Lengte [m]	Type	Laag
SB29	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB42	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB45	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB14	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB1	CS4 - L50X5	0,950	vertikaal windverband (0)	Vak1
SB30	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB17	CS62 - L60/6	1,900	vertikaal windverband (0)	Vak1
SB46	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB33	CS61 - L70/7	2,850	vertikaal windverband (0)	Vak1
SB16	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB32	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB48	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB15	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB31	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB47	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB12	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB28	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB44	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB11	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB27	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB43	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB8	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB24	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB40	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB7	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB23	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB39	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB4	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB20	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB36	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
SB3	CS59 - L100/10	2,712	vertikaal windverband (0)	Vak1
SB19	CS60 - L80/8	3,003	vertikaal windverband (0)	Vak1
SB35	CS60 - L80/8	3,533	vertikaal windverband (0)	Vak1
B89	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B90	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B91	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
B92	CS3 - HFLeq150x150x12	12,292	vakwerkdiagonaal (90)	Vak1
C5	CS5 - HFLeq200x200x20	3,374	Kolom (100)	Vak2
C6	CS5 - HFLeq200x200x20	3,374	Kolom (100)	Vak2
C7	CS5 - HFLeq200x200x20	3,374	Kolom (100)	Vak2
C8	CS5 - HFLeq200x200x20	3,374	Kolom (100)	Vak2
B8	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B10	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B12	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B93	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
SB49	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB50	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB51	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB52	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB53	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB54	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB55	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB56	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB57	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB58	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB59	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB60	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB61	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB62	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
SB63	CS63 - L60/6	1,900	vertikaal windverband (0)	Vak2
SB64	CS65 - L70X7	2,621	vertikaal windverband (0)	Vak2
B31	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B32	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B33	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
B34	CS100 - L160X15	4,916	vakwerkdiagonaal (90)	Vak2
C9	CS5 - HFLeq200x200x20	6,648	Kolom (100)	Vak3
C10	CS5 - HFLeq200x200x20	6,648	Kolom (100)	Vak3
C11	CS5 - HFLeq200x200x20	6,648	Kolom (100)	Vak3
C12	CS5 - HFLeq200x200x20	6,648	Kolom (100)	Vak3

Naam	Doorsnede	Lengte [m]	Type	Laag
B94	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B95	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B22	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B26	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B30	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B96	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B97	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B35	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
SB65	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB66	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB67	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB68	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB69	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB70	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB71	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB72	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB73	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB74	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB75	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB76	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB77	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB78	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB79	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB80	CS66 - L60X6	2,356	vertikaal windverband (0)	Vak3
SB81	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB82	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB83	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB84	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB85	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB86	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB87	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB88	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB89	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB90	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB91	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB92	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB93	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB94	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
SB95	CS66 - L60X6	2,360	vertikaal windverband (0)	Vak3
SB96	CS67 - L60X6	1,676	vertikaal windverband (0)	Vak3
B73	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B74	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B75	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B76	CS68 - ISUA150/90/10	9,452	vakwerkdiagonaal (90)	Vak3
B77	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B78	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B79	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
B80	CS80 - L60X6	3,353	vertikaal windverband (0)	HorVerb2
C13	CS13 - HFLeq200x200x18	6,648	Kolom (100)	Vak4
C14	CS13 - HFLeq200x200x18	6,648	Kolom (100)	Vak4
C15	CS13 - HFLeq200x200x18	6,648	Kolom (100)	Vak4
C16	CS13 - HFLeq200x200x18	6,648	Kolom (100)	Vak4
B98	CS70 - ISUA150/90/10	8,859	vakwerkdiagonaal (90)	Vak4
B99	CS70 - ISUA150/90/10	8,860	vakwerkdiagonaal (90)	Vak4
B100	CS70 - ISUA150/90/10	8,860	vakwerkdiagonaal (90)	Vak4
B101	CS70 - ISUA150/90/10	8,859	vakwerkdiagonaal (90)	Vak4
B102	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B103	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B104	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B105	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
SB97	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB98	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB99	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB100	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB101	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB102	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB103	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB104	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB105	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4

Naam	Doorsnede	Lengte [m]	Type	Laag
SB106	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB107	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB108	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB109	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB110	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB111	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB112	CS71 - L60X6	2,231	vertikaal windverband (0)	Vak4
SB113	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB114	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB115	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB116	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB117	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB118	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB119	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB120	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB121	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB122	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB123	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB124	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB125	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB126	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
SB127	CS71 - L60X6	2,190	vertikaal windverband (0)	Vak4
SB128	CS69 - L50X5	1,460	vertikaal windverband (0)	Vak4
B106	CS70 - ISUA150/90/10	8,859	vakwerkdiagonaal (90)	Vak4
B107	CS70 - ISUA150/90/10	8,859	vakwerkdiagonaal (90)	Vak4
B108	CS70 - ISUA150/90/10	8,860	vakwerkdiagonaal (90)	Vak4
B109	CS70 - ISUA150/90/10	8,860	vakwerkdiagonaal (90)	Vak4
B110	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B111	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B112	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
B113	CS81 - L60X6	2,920	vertikaal windverband (0)	Vak4
C17	CS13 - HFLeq200x200x18	3,414	Kolom (100)	Vak5
C18	CS13 - HFLeq200x200x18	3,414	Kolom (100)	Vak5
C19	CS13 - HFLeq200x200x18	3,414	Kolom (100)	Vak5
C20	CS13 - HFLeq200x200x18	3,414	Kolom (100)	Vak5
B114	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B115	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B116	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B117	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
SB129	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB130	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB131	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB132	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB133	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB134	CS72 - L60X6	2,049	vertikaal windverband (0)	Vak5
SB135	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB136	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB137	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB138	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB139	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB140	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB141	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB142	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
SB143	CS20 - L50X5	1,250	vertikaal windverband (0)	Vak5
SB144	CS72 - L60X6	2,050	vertikaal windverband (0)	Vak5
B36	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B37	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B38	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
B39	CS73 - L150X100X10	4,360	vakwerkdiagonaal (90)	Vak5
S355	CS82 - L180X18	2,140	Kolom (100)	Vak7
S356	CS89 - L160X15	2,141	Kolom (100)	Vak8
S359	CS90 - L120X12	2,220	Kolom (100)	Vak11
S360	CS90 - L120X12	2,135	Kolom (100)	Vak11
S361	CS97 - L100X10	0,970	Kolom (100)	Vak20
S362	CS97 - L100X10	1,591	Kolom (100)	CrossArm6
S363	CS97 - L100X10	1,611	Kolom (100)	CrossArm6
S364	CS97 - L100X10	1,613	Kolom (100)	CrossArm6
S365	CS82 - L180X18	2,140	Kolom (100)	Vak7
S366	CS89 - L160X15	2,141	Kolom (100)	Vak8

Naam	Doorsnede	Lengte [m]	Type	Laag
S367	CS89 - L160X15	2,119	Kolom (100)	Vak8
S368	CS89 - L160X15	1,570	Kolom (100)	Vak10
S369	CS89 - L160X15	1,761	Kolom (100)	Vak10
S370	CS90 - L120X12	2,220	Kolom (100)	Vak11
S371	CS90 - L120X12	2,135	Kolom (100)	Vak11
S372	CS97 - L100X10	0,970	Kolom (100)	Vak20
S373	CS97 - L100X10	2,008	Kolom (100)	CrossArm6
S374	CS97 - L100X10	1,591	Kolom (100)	CrossArm6
S375	CS97 - L100X10	1,611	Kolom (100)	CrossArm6
S376	CS97 - L100X10	1,613	Kolom (100)	CrossArm6
S377	CS90 - L120X12	2,030	Balk (80)	Vak10
S378	CS90 - L120X12	2,206	Balk (80)	Vak10
S379	CS90 - L120X12	2,030	Balk (80)	Vak10
S380	CS90 - L120X12	2,205	Balk (80)	Vak10
S381	CS90 - L120X12	2,030	Balk (80)	Vak10
S382	CS90 - L120X12	2,206	Balk (80)	Vak10
S383	CS90 - L120X12	2,030	Balk (80)	Vak10
S384	CS90 - L120X12	2,205	Balk (80)	Vak10
S386	CS44 - UNP200	1,840	Balk (80)	Vak9
S387	CS44 - UNP200	1,837	Balk (80)	Vak14
S388	CS44 - UNP200	1,837	Balk (80)	Vak14
S389	CS44 - UNP200	1,840	Balk (80)	Vak13
S390	CS44 - UNP200	1,720	Balk (80)	Vak13
S391	CS44 - UNP200	1,481	Balk (80)	CrossArm2
S392	CS44 - UNP200	1,811	Balk (80)	CrossArm2
S393	CS44 - UNP200	1,451	Balk (80)	CrossArm2
S394	CS44 - UNP200	1,451	Balk (80)	CrossArm2
S395	CS44 - UNP200	0,360	Balk (80)	CrossArm2
S385	CS44 - UNP200	1,720	Balk (80)	Vak9
S396	CS44 - UNP200	1,461	Balk (80)	CrossArm2
S397	CS92 - L70X7	2,227	Balk (80)	Vak8
S398	CS89 - L160X15	2,119	Balk (80)	Vak8
S399	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak10
S400	CS95 - L80X8	2,456	Balk (80)	Vak9
S401	CS93 - L90X9	2,366	Balk (80)	Vak10
S402	CS89 - L160X15	1,570	Balk (80)	Vak10
S403	CS90 - L120X12	1,999	Kolom (100)	Vak8
S404	CS91 - L150X15	2,367	Kolom (100)	Vak8
S405	CS83 - L120X12	2,382	Kolom (100)	Vak6
S408	CS89 - L160X15	2,119	Kolom (100)	Vak8
S409	CS89 - L160X15	1,571	Kolom (100)	Vak10
S410	CS89 - L160X15	1,760	Kolom (100)	Vak10
S411	CS90 - L120X12	2,221	Kolom (100)	Vak12
S412	CS90 - L120X12	2,135	Kolom (100)	Vak12
S413	CS97 - L100X10	0,970	Kolom (100)	Vak15
S414	CS97 - L100X10	2,008	Kolom (100)	CrossArm5
S415	CS97 - L100X10	1,591	Kolom (100)	CrossArm5
S416	CS97 - L100X10	1,611	Kolom (100)	CrossArm5
S417	CS97 - L100X10	1,613	Kolom (100)	CrossArm5
S418	CS82 - L180X18	2,140	Kolom (100)	Vak7
S419	CS89 - L160X15	2,141	Kolom (100)	Vak8
S420	CS89 - L160X15	2,119	Kolom (100)	Vak8
S421	CS89 - L160X15	1,571	Kolom (100)	Vak10
S422	CS89 - L160X15	1,761	Kolom (100)	Vak10
S423	CS90 - L120X12	2,220	Kolom (100)	Vak12
S424	CS90 - L120X12	2,135	Kolom (100)	Vak12
S425	CS97 - L100X10	0,970	Kolom (100)	Vak15
S426	CS97 - L100X10	2,008	Kolom (100)	CrossArm5
S427	CS97 - L100X10	1,591	Kolom (100)	CrossArm5
S428	CS97 - L100X10	1,611	Kolom (100)	CrossArm5
S429	CS97 - L100X10	1,613	Kolom (100)	CrossArm5
S430	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak8
S431	CS82 - L180X18	2,140	Balk (80)	Vak7
S432	CS89 - L160X15	2,141	Balk (80)	Vak8
S433	CS90 - L120X12	2,019	Balk (80)	Vak8
S434	CS83 - L120X12	2,383	Balk (80)	Vak7
S435	CS91 - L150X15	2,380	Balk (80)	Vak8
S436	CS35 - L150x150x14	2,825	Balk (80)	Vak7
S437	CS101 - UNP140	1,970	Balk (80)	Vak16

	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 74N
	Omschrijving	Ontwerpberekening
	Nationale norm	EC - EN
	Auteur	JH

Naam	Doorsnede	Lengte [m]	Type	Laag
S438	CS101 - UNP140	1,610	Balk (80)	Vak17
S439	CS101 - UNP140	0,357	Balk (80)	Vak17
S440	CS101 - UNP140	0,353	Balk (80)	Vak17
S441	CS101 - UNP140	2,145	Balk (80)	Vak17
S442	CS101 - UNP140	2,145	Balk (80)	Vak18
S443	CS101 - UNP140	0,353	Balk (80)	Vak18
S444	CS101 - UNP140	0,364	Balk (80)	Vak18
S445	CS101 - UNP140	1,604	Balk (80)	Vak18
S446	CS101 - UNP140	1,970	Balk (80)	Vak19
S447	CS101 - UNP140	1,568	Balk (80)	Vak20
S448	CS4 - L50X5	2,810	Balk (80)	CrossArm2
S449	CS22 - HFLeq60x60x6	0,941	Balk (80)	CrossArm6
S450	CS4 - L50X5	0,864	Balk (80)	Vak8
S451	CS90 - L120X12	2,019	Balk (80)	Vak8
S452	CS90 - L120X12	1,998	Balk (80)	Vak8
S453	CS4 - L50X5	0,864	Balk (80)	Vak8
S454	CS90 - L120X12	2,019	Balk (80)	Vak8
S455	CS90 - L120X12	1,998	Balk (80)	Vak8
S456	CS7 - L50X5	2,179	Balk (80)	Vak11
S457	CS25 - HFLue120x80x8	1,544	Balk (80)	Vak10
S458	CS92 - L70X7	2,231	Balk (80)	Vak8
S459	CS92 - L70X7	2,231	Balk (80)	Vak8
S460	CS84 - L100X8	2,076	Balk (80)	Vak6
S461	CS4 - L50X5	1,503	Balk (80)	Vak14
S462	CS4 - L50X5	1,503	Balk (80)	Vak14
S463	CS4 - L50X5	1,503	Balk (80)	Vak9
S464	CS4 - L50X5	1,503	Balk (80)	Vak9
S465	CS93 - L90X9	3,988	Balk (80)	CrossArm2
S466	CS93 - L90X9	3,988	Balk (80)	CrossArm1
B7	CS75 - L150X14	7,600	Balk (80)	HorVerb1
B118	CS75 - L150X14	7,600	Balk (80)	HorVerb1
B119	CS75 - L150X14	7,600	Balk (80)	HorVerb1
B120	CS75 - L150X14	7,600	Balk (80)	HorVerb1
B11	CS39 - ISEA130/130/10	5,374	vakwerkdiagonaal (90)	HorVerb1
B121	CS39 - ISEA130/130/10	5,374	vakwerkdiagonaal (90)	HorVerb1
B13	CS39 - ISEA130/130/10	5,374	vakwerkdiagonaal (90)	HorVerb1
B122	CS39 - ISEA130/130/10	5,374	vakwerkdiagonaal (90)	HorVerb1
B123	CS46 - ISEA70/70/5	7,600	vakwerkdiagonaal (90)	HorVerb1
B17	CS46 - ISEA70/70/5	3,800	vakwerkdiagonaal (90)	HorVerb1
B124	CS46 - ISEA70/70/5	3,800	vakwerkdiagonaal (90)	HorVerb1
B129	CS79 - L100X12	3,536	vakwerkdiagonaal (90)	HorVerb3
B130	CS79 - L100X12	3,536	vakwerkdiagonaal (90)	HorVerb3
B131	CS79 - L100X12	3,535	vakwerkdiagonaal (90)	HorVerb3
B132	CS79 - L100X12	3,536	vakwerkdiagonaal (90)	HorVerb3
B133	CS77 - L60X8	5,000	vakwerkdiagonaal (90)	HorVerb3
B134	CS77 - L60X8	2,500	vakwerkdiagonaal (90)	HorVerb3
B135	CS77 - L60X8	2,500	vakwerkdiagonaal (90)	HorVerb3
S467	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S468	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S469	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S470	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S471	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S472	CS78 - L150X14	2,500	Balk (80)	HorVerb3
S473	CS78 - L150X14	2,501	Balk (80)	HorVerb3
S474	CS78 - L150X14	2,499	Balk (80)	HorVerb3
S475	CS51 - L70X7	4,741	Balk (80)	HorVerb2
S476	CS51 - L70X7	4,741	Balk (80)	HorVerb2
S477	CS51 - L70X7	4,741	Balk (80)	HorVerb2
S478	CS51 - L70X7	4,741	Balk (80)	HorVerb2
S479	CS83 - L120X12	2,382	Kolom (100)	Vak6
S480	CS83 - L120X12	2,382	Kolom (100)	Vak6
S481	CS83 - L120X12	2,382	Kolom (100)	Vak6
S482	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm5
S483	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm5
S484	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm6
S485	CS21 - ISUA65/50/6	6,950	Kolom (100)	CrossArm6
S486	CS97 - L100X10	2,008	Kolom (100)	CrossArm6
S487	CS89 - L160X15	1,761	Balk (80)	Vak10
S488	CS86 - L130X12	3,202	Balk (80)	Vak9

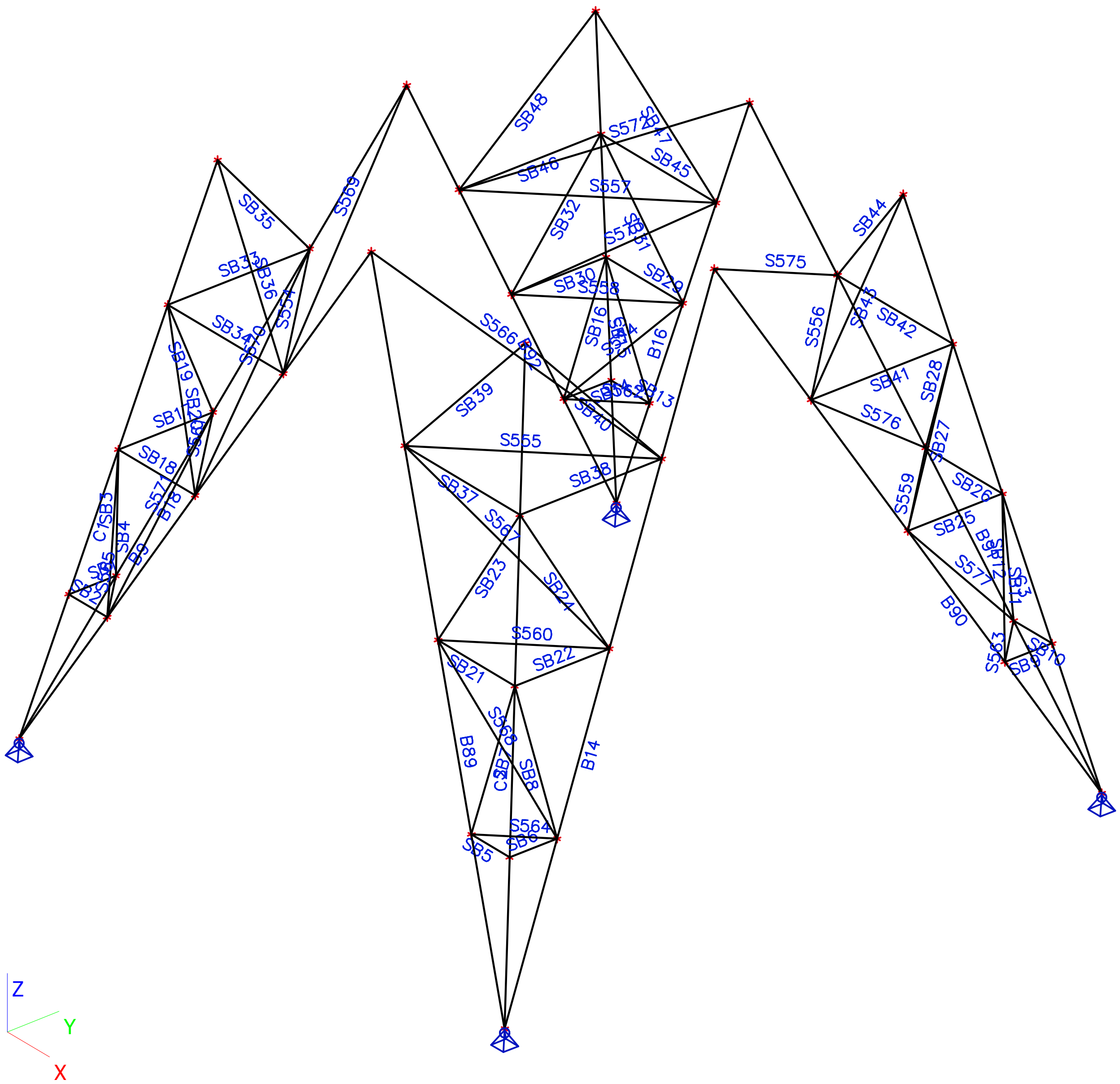
Naam	Doorsnede	Lengte [m]	Type	Laag
S489	CS86 - L130X12	3,680	Balk (80)	Vak14
S490	CS86 - L130X12	3,680	Balk (80)	Vak14
S491	CS86 - L130X12	3,202	Balk (80)	Vak13
S492	CS44 - UNP200	3,560	Balk (80)	Vak13
S493	CS44 - UNP200	3,674	Balk (80)	Vak14
S494	CS101 - UNP140	1,970	Balk (80)	Vak16
S495	CS101 - UNP140	4,465	Balk (80)	Vak17
S496	CS101 - UNP140	4,465	Balk (80)	Vak18
S497	CS101 - UNP140	1,568	Balk (80)	Vak20
S498	CS101 - UNP140	1,970	Balk (80)	Vak19
S499	CS97 - L100X10	4,465	Balk (80)	Vak17
S500	CS97 - L100X10	2,721	Balk (80)	Vak19
S501	CS97 - L100X10	4,464	Balk (80)	Vak18
S502	CS97 - L100X10	4,465	Balk (80)	Vak17
S503	CS97 - L100X10	2,721	Balk (80)	Vak19
S504	CS97 - L100X10	4,464	Balk (80)	Vak18
S505	CS30 - UNP140	1,300	Balk (80)	CrossArm3
S508	CS30 - UNP140	0,800	Balk (80)	CrossArm3
S509	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm3
S510	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm3
S511	CS30 - UNP140	0,800	Balk (80)	CrossArm4
S512	CS30 - UNP140	1,300	Balk (80)	CrossArm4
S513	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S514	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S515	CS52 - UNP280	7,163	Balk (80)	HorVerb4
S516	CS52 - UNP280	7,163	Balk (80)	HorVerb4
S517	CS52 - UNP280	7,163	Balk (80)	HorVerb4
S518	CS52 - UNP280	2,000	Balk (80)	HorVerb4
S519	CS52 - UNP280	2,000	Balk (80)	HorVerb4
S523	CS52 - UNP280	2,000	Balk (80)	HorVerb4
S524	CS52 - UNP280	2,000	Balk (80)	HorVerb4
S525	CS52 - UNP280	7,163	Balk (80)	HorVerb4
S526	CS59 - L100/10	5,065	Balk (80)	HorVerb4
S527	CS59 - L100/10	5,065	Balk (80)	HorVerb4
S528	CS59 - L100/10	5,065	Balk (80)	HorVerb4
S529	CS59 - L100/10	5,065	Balk (80)	HorVerb4
S530	CS59 - L100/10	7,163	Balk (80)	HorVerb4
S531	CS59 - L100/10	2,000	Balk (80)	HorVerb4
S532	CS59 - L100/10	2,000	Balk (80)	HorVerb4
S533	CS59 - L100/10	7,163	Balk (80)	HorVerb4
S535	CS59 - L100/10	4,102	Balk (80)	HorVerb4
S536	CS59 - L100/10	4,102	Balk (80)	HorVerb4
S537	CS59 - L100/10	4,102	Balk (80)	HorVerb4
S538	CS59 - L100/10	4,102	Balk (80)	HorVerb4
S541	CS57 - HEA280	3,582	Balk (80)	HorVerb4
S542	CS57 - HEA280	3,582	Balk (80)	HorVerb4
S545	CS57 - HEA280	3,582	Balk (80)	HorVerb4
S546	CS57 - HEA280	3,582	Balk (80)	HorVerb4
S547	CS44 - UNP200	1,720	Balk (80)	Vak9
S548	CS38 - HFLeq80x80x8	0,799	Balk (80)	CrossArm2
S549	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm2
S550	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm2
S551	CS38 - HFLeq80x80x8	0,799	Balk (80)	CrossArm1
S552	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm1
S553	CS38 - HFLeq80x80x8	0,931	Balk (80)	CrossArm1
S554	CS53 - L60X6	4,031	Balk (80)	Vak1
S555	CS53 - L60X6	4,031	Balk (80)	Vak1
S556	CS53 - L60X6	4,031	Balk (80)	Vak1
S557	CS53 - L60X6	4,031	Balk (80)	Vak1
S558	CS54 - L60X6	2,687	Balk (80)	Vak1
S559	CS54 - L60X6	2,687	Balk (80)	Vak1
S560	CS54 - L60X6	2,687	Balk (80)	Vak1
S561	CS54 - L60X6	2,687	Balk (80)	Vak1
S562	CS55 - L50X5	1,344	Balk (80)	Vak1
S563	CS55 - L50X5	1,344	Balk (80)	Vak1
S564	CS55 - L50X5	1,344	Balk (80)	Vak1
S565	CS55 - L50X5	1,344	Balk (80)	Vak1
S566	CS56 - L70X7	5,577	Balk (80)	Vak1
S567	CS56 - L70X7	4,503	Balk (80)	Vak1

Naam	Doorsnede	Lengte [m]	Type	Laag
S568	CS56 - L70X7	3,613	Balk (80)	Vak1
S569	CS56 - L70X7	5,577	Balk (80)	Vak1
S570	CS56 - L70X7	4,503	Balk (80)	Vak1
S571	CS56 - L70X7	3,613	Balk (80)	Vak1
S572	CS56 - L70X7	5,577	Balk (80)	Vak1
S573	CS56 - L70X7	4,503	Balk (80)	Vak1
S574	CS56 - L70X7	3,613	Balk (80)	Vak1
S575	CS56 - L70X7	5,577	Balk (80)	Vak1
S576	CS56 - L70X7	4,503	Balk (80)	Vak1
S577	CS56 - L70X7	3,613	Balk (80)	Vak1
S578	CS4 - L50X5	0,434	Balk (80)	Vak1
S579	CS4 - L50X5	0,560	Balk (80)	Vak1
S580	CS98 - L50X6	0,541	Balk (80)	Vak1
S581	CS98 - L50X6	0,647	Balk (80)	Vak1
S582	CS98 - L50X6	0,541	Balk (80)	Vak1
S583	CS98 - L50X6	0,649	Balk (80)	Vak1
S584	CS94 - L60X8	0,659	Balk (80)	CrossArm1
S585	CS94 - L60X8	0,802	Balk (80)	CrossArm1
S586	CS94 - L60X8	0,659	Balk (80)	CrossArm2
S587	CS94 - L60X8	0,802	Balk (80)	CrossArm2

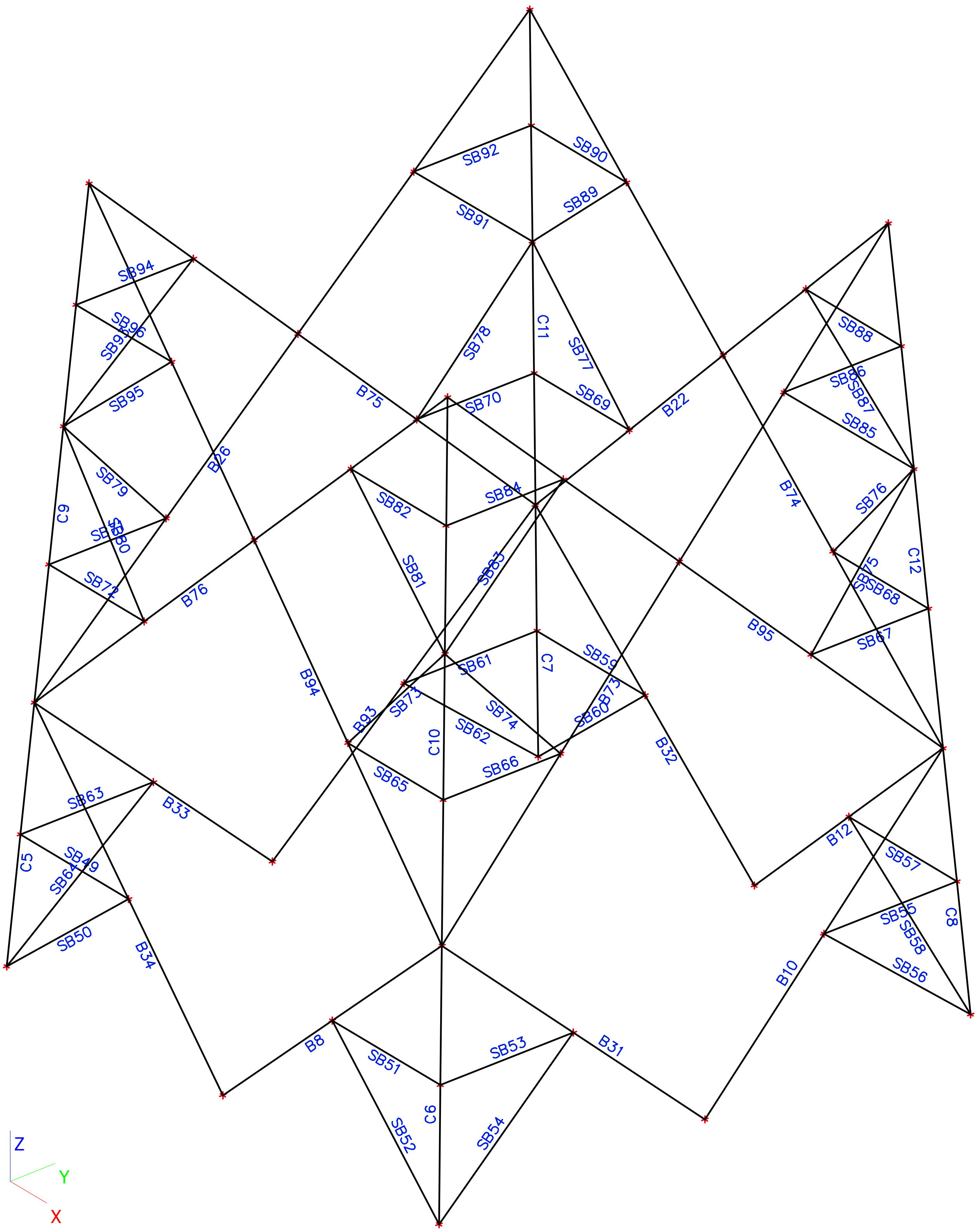
D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 74N
	Omschrijving	Ontwerpberekening
	Nationale norm	EC - EN
	Auteur	JH

6. Staafnummers mastlichaam

6.1. Vak 1



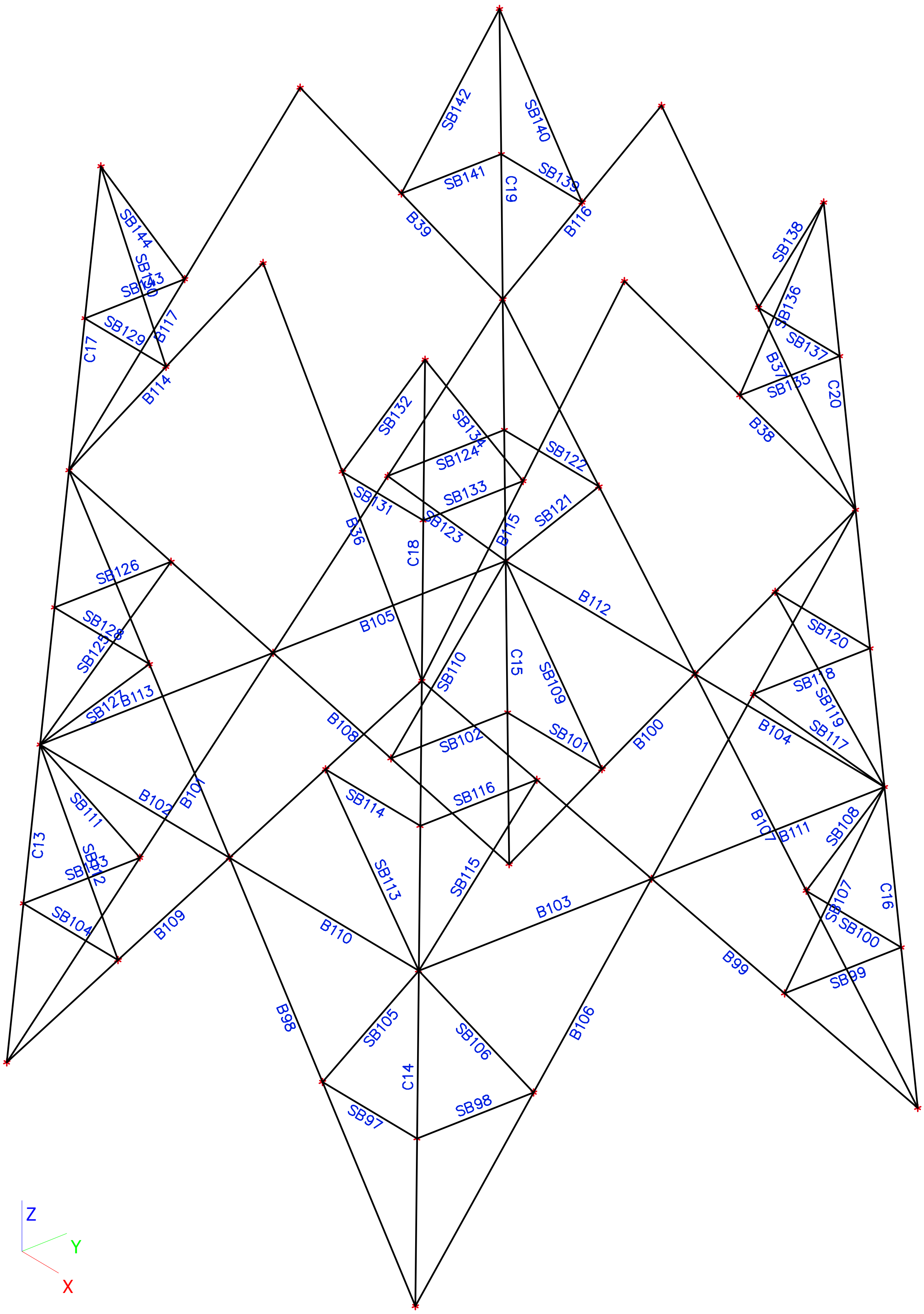
6.2. Vak 2 + 3



SB92
SB90
SB91
SB89
SB94
SB96
SB95
SB78
C11
SB77
SB70
SB69
B75
B22
SB88
SB87
SB85
B26
SB79
C9
SB80
SB72
B76
SB82
SB84
SB81
SB83
B74
SB76
C12
SB68
SB67
B95
SB61
C7
SB59
B73
SB60
B94
B93
SB74
SB62
C10
SB66
SB65
B32
SB63
B33
C5
SB49
SB64
SB50
B34
B12
SB57
SB58
C8
SB56
B10
B8
SB51
SB53
B31
C6
SB52
SB54
Z
Y
X

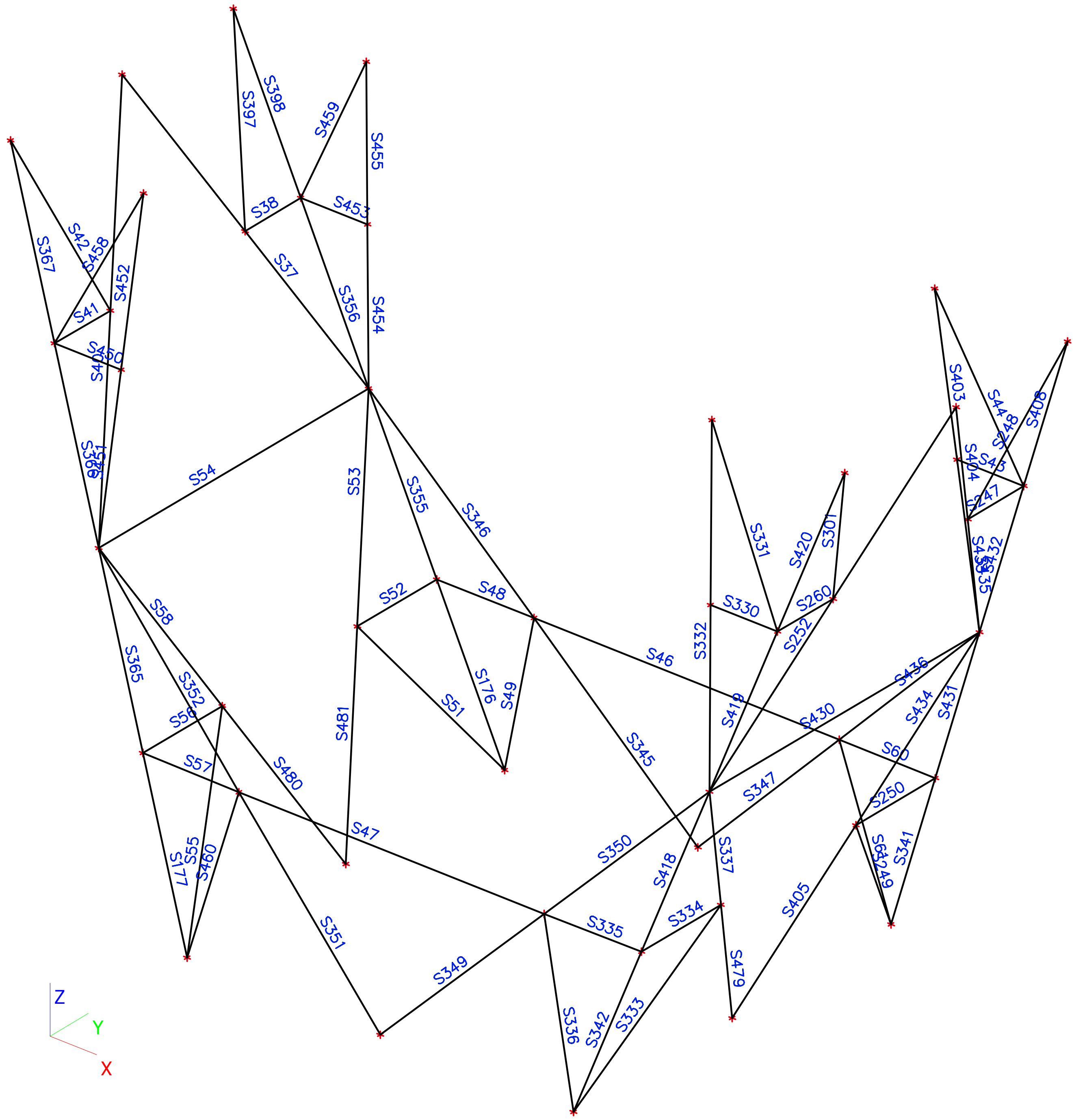
	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 74N
	Omschrijving	Ontwerpberekening
	Nationale norm	EC - EN
	Auteur	JH

6.3. Vak 4 + 5



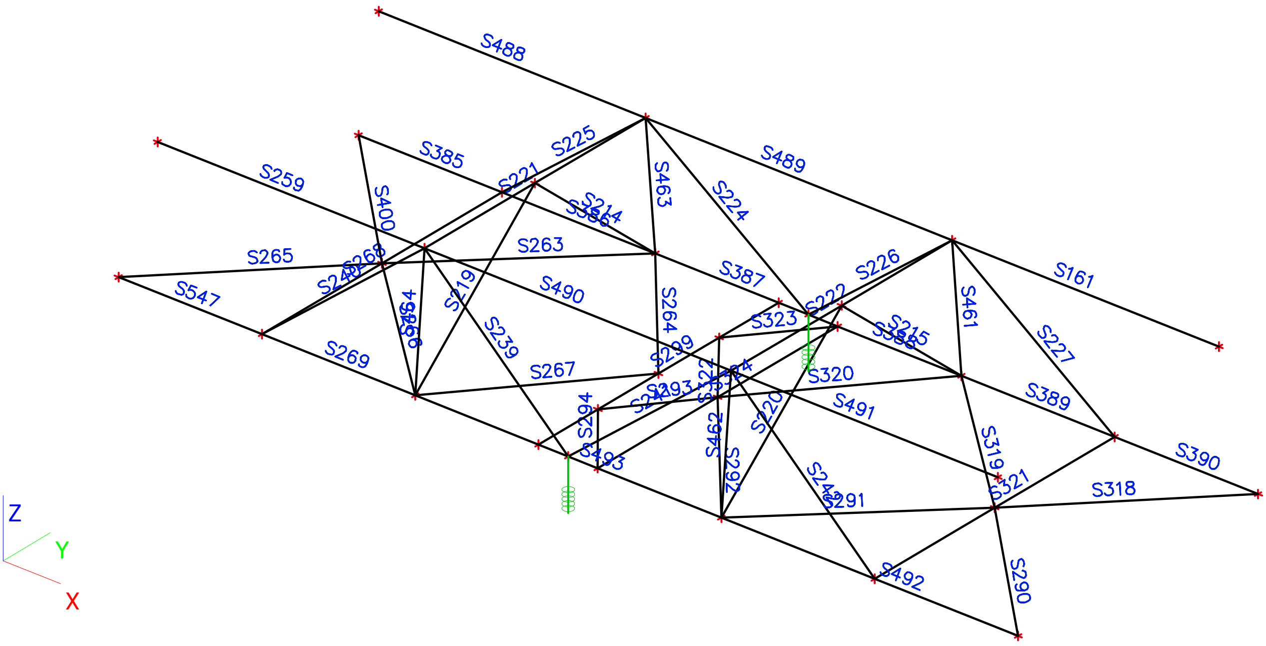
D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 74N
	Omschrijving	Ontwerpberekening
	Nationale norm	EC - EN
	Auteur	JH

6.4. Vak 6 + 7 + 8

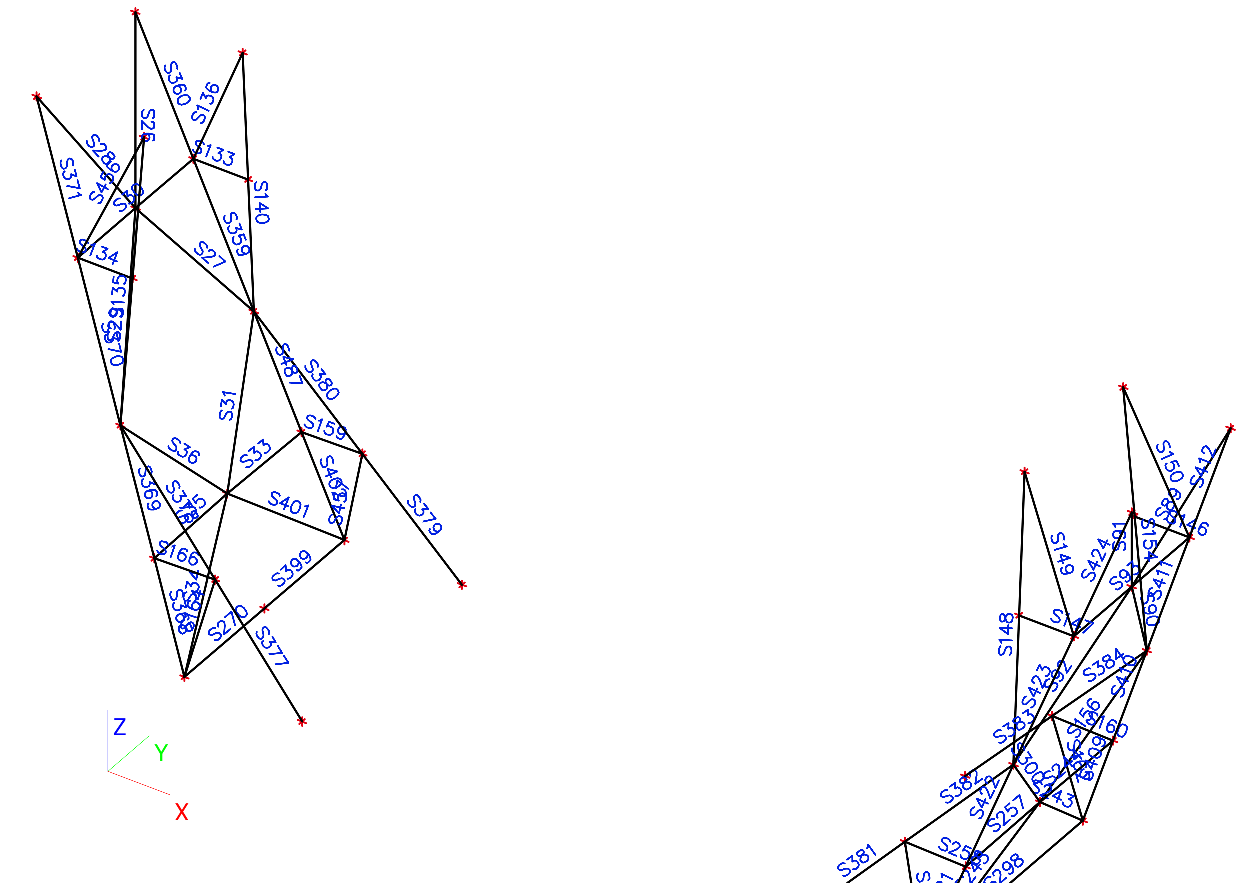


	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 74N
	Omschrijving	Ontwerpberekening
	Nationale norm	EC - EN
	Auteur	JH

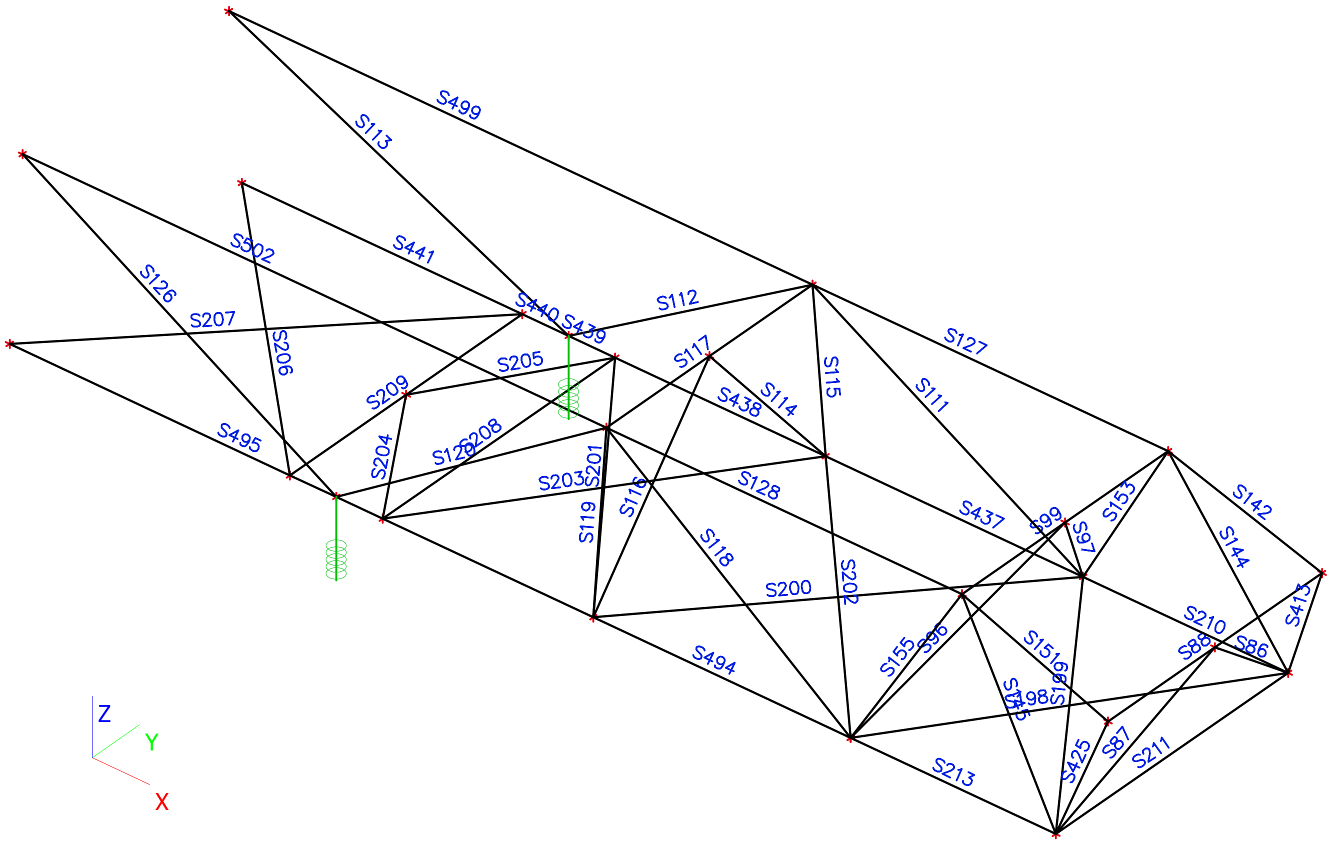
6.5. Vak 9 + 13 + 14 + 21



6.6. Vak 10 + 11 + 12

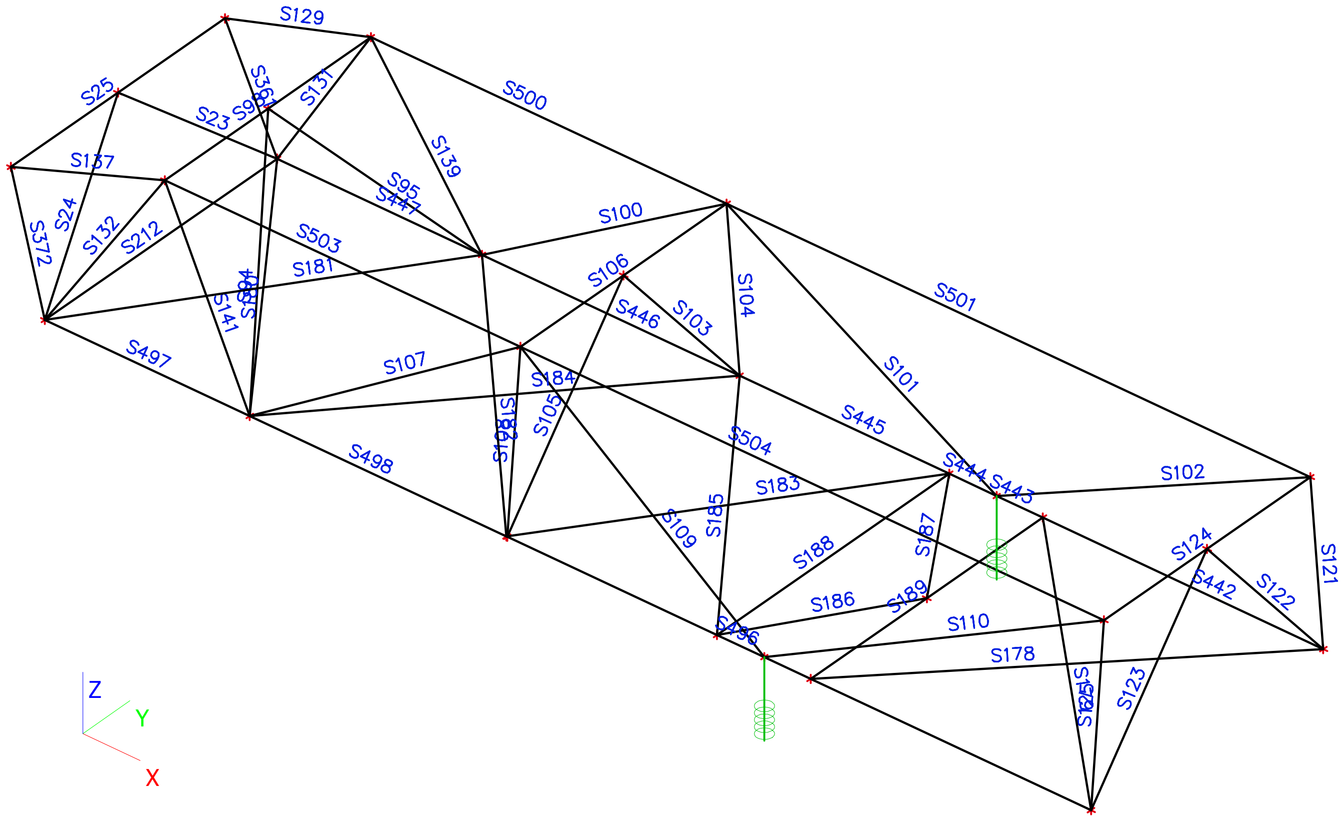


6.7. Vak 15 - 17



S499
S113
S502
S441
S126
S207
S206
S440
S439
S112
S127
S205
S117
S115
S209
S114
S438
S111
S495
S204
S120
S208
S203
S201
S116
S128
S119
S437
S99
S153
S142
S97
S118
S144
S200
S202
S155
S96
S210
S413
S151
S88
S86
S494
S99
S498
S45
S425
S87
S211
S213
Z
Y
X

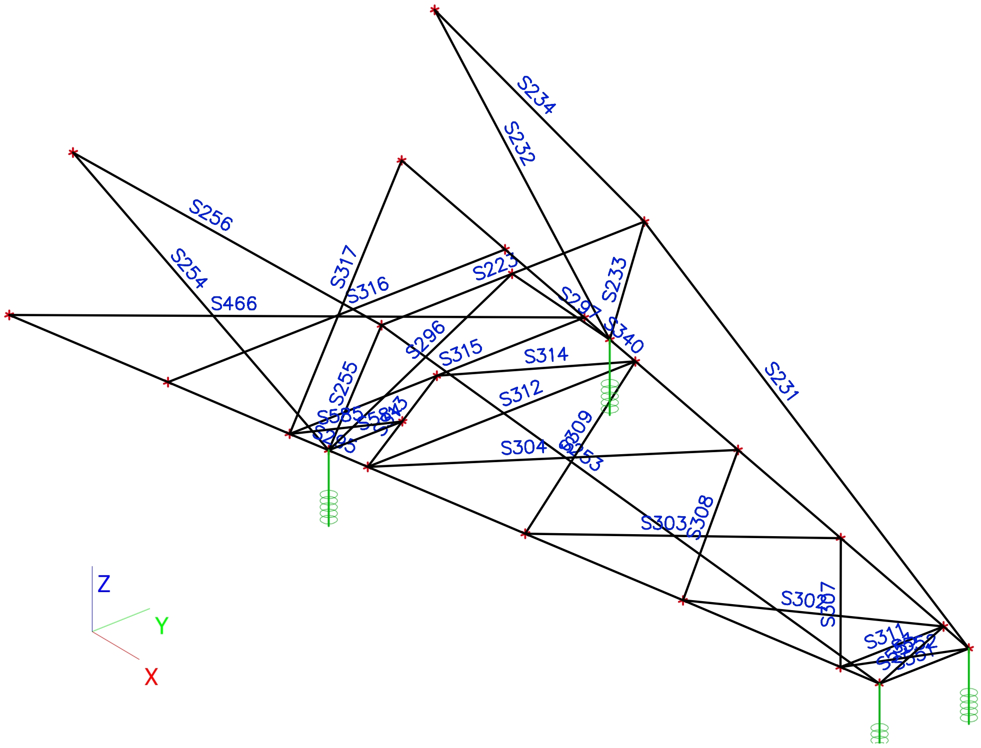
6.8. Vak 18 - 20



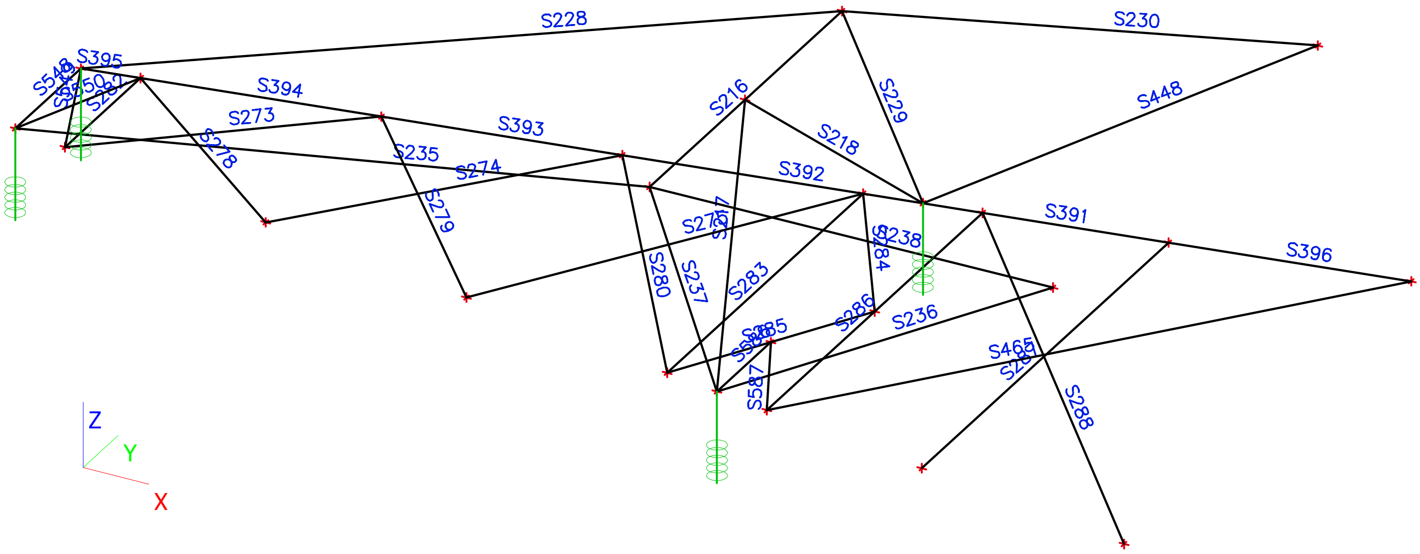
S129
S25
S131
S500
S23
S137
S139
S95
S24
S132
S212
S372
S100
S503
S181
S106
S446
S103
S104
S141
S501
S497
S107
S184
S101
S445
S504
S498
S183
S102
S185
S109
S188
S187
S121
S124
S442
S122
S186
S189
S110
S178
S123
Z
Y
X

7. Staafnummers traverses

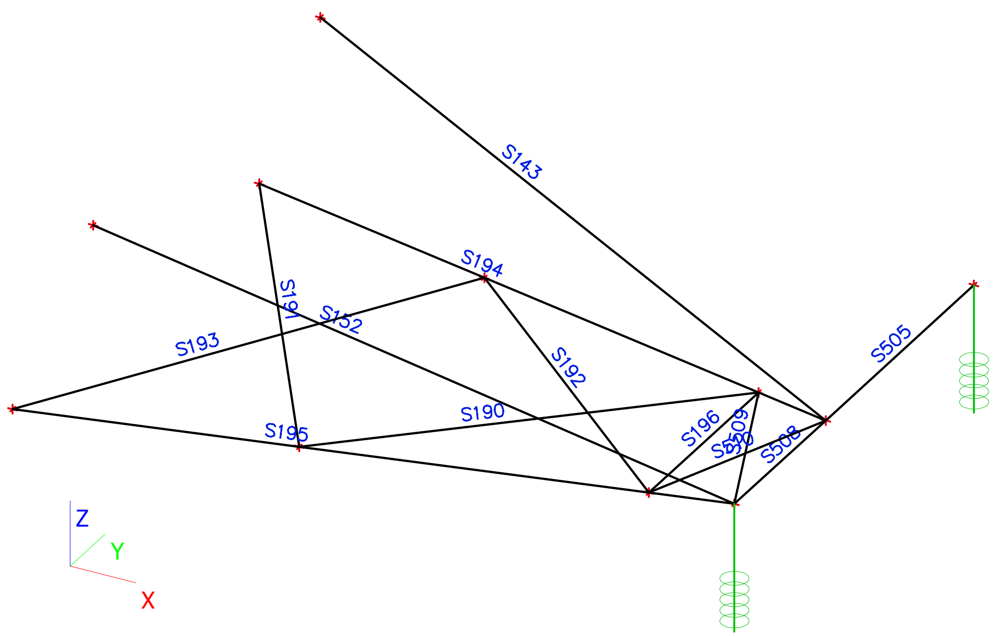
7.1. Traverse 1



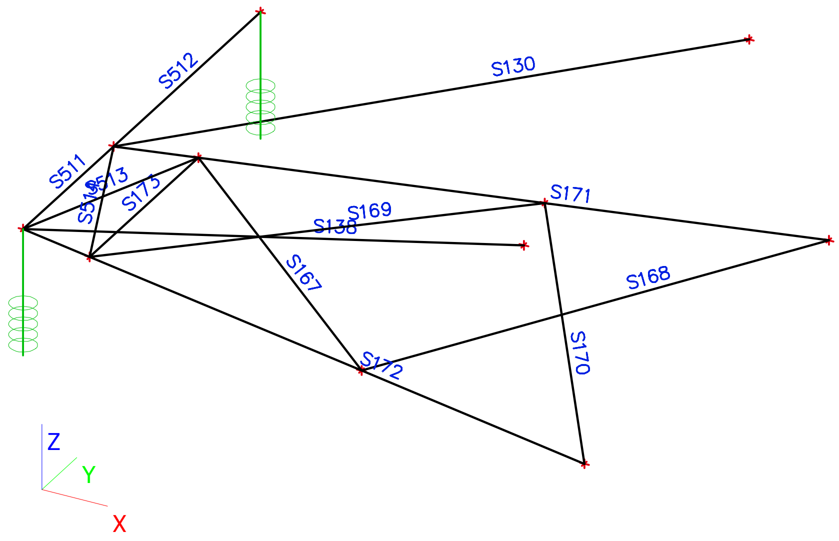
7.2. Traverse 2



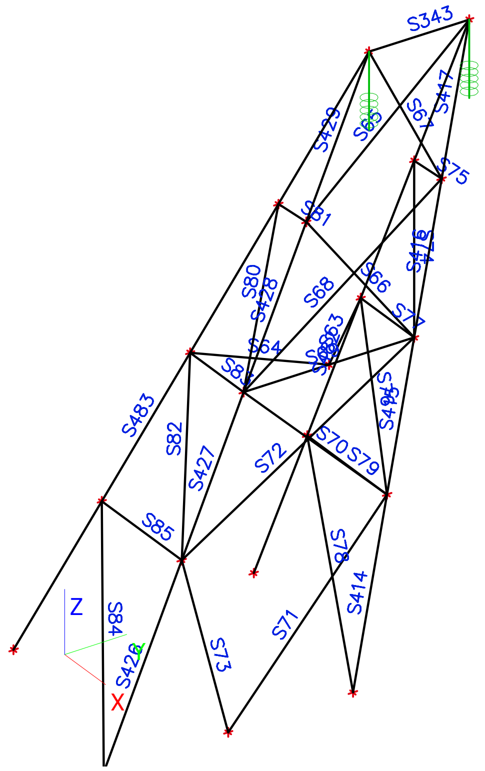
7.3. Traverse 3



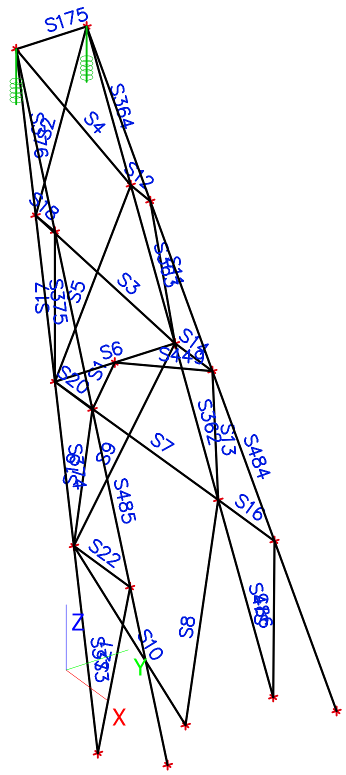
7.4. Traverse 4



7.5. Traverse 5

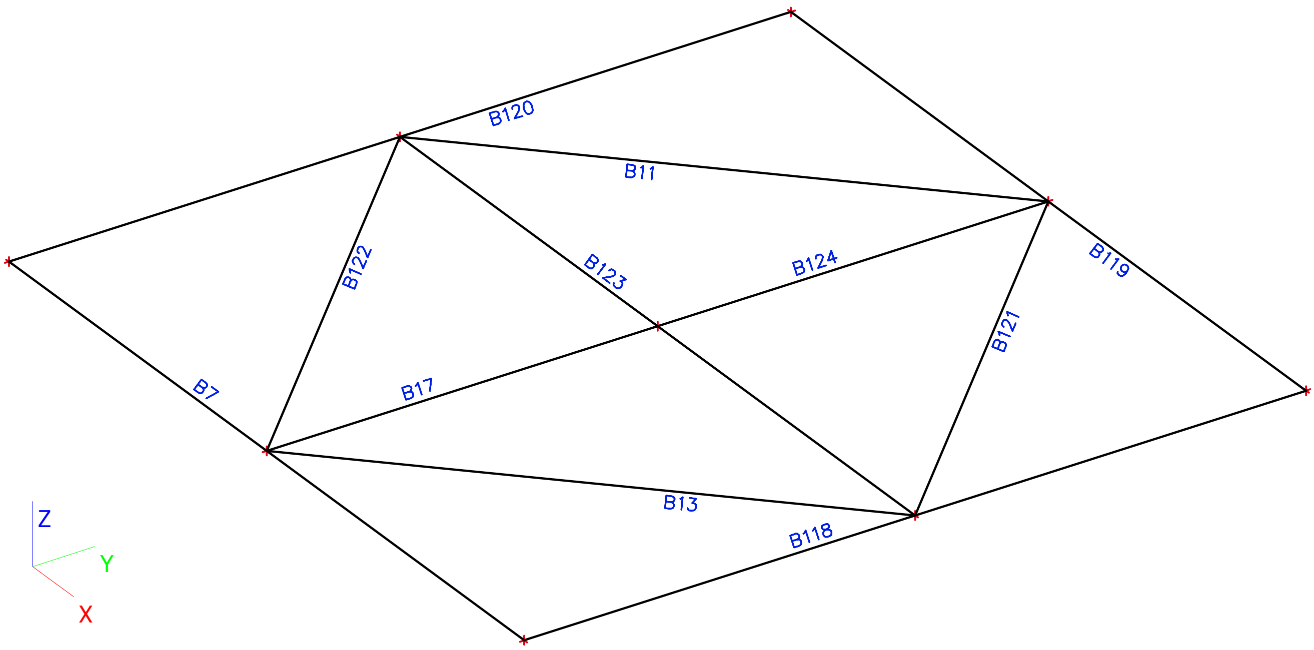


7.6. Traverse 6

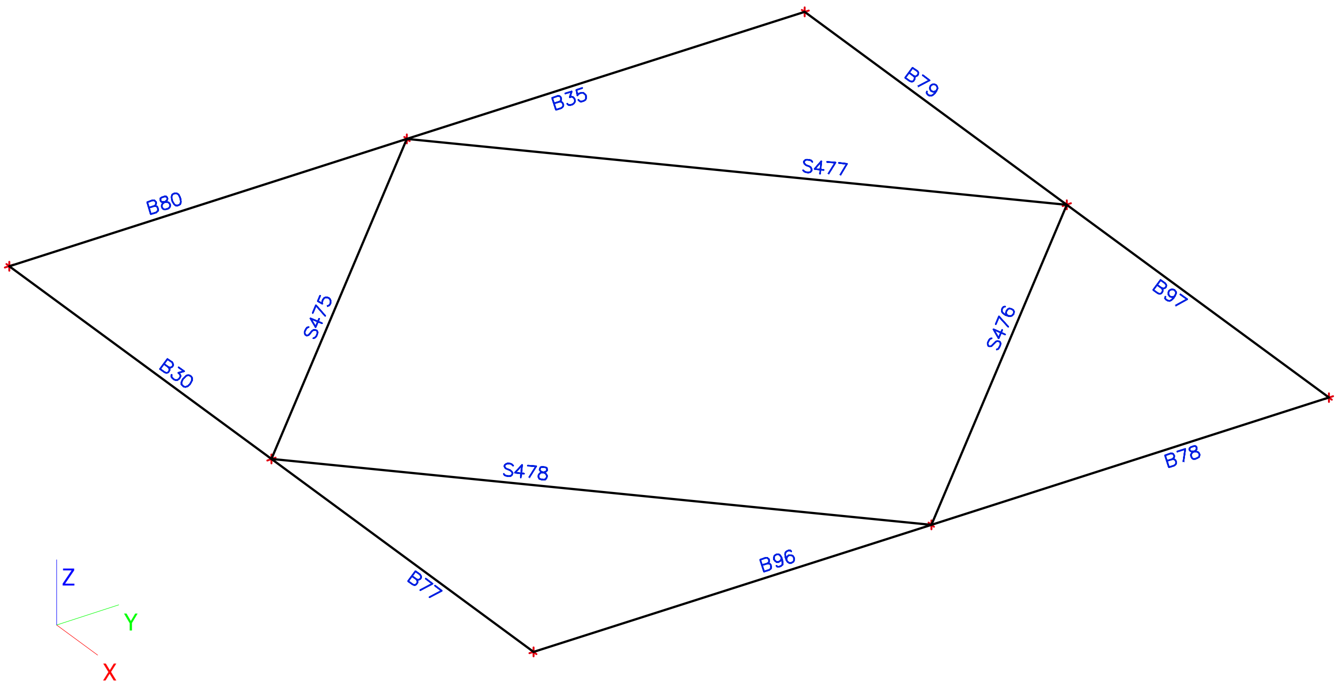


8. Staafnummers horizontale verbanden

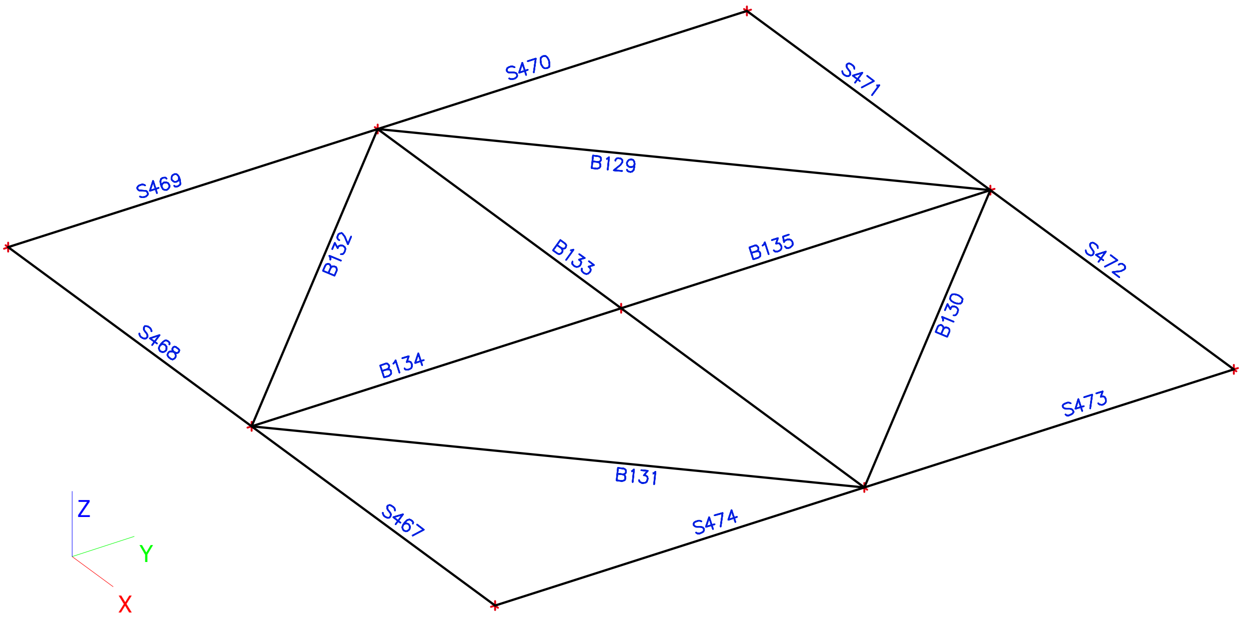
8.1. Horizontaal verband 1



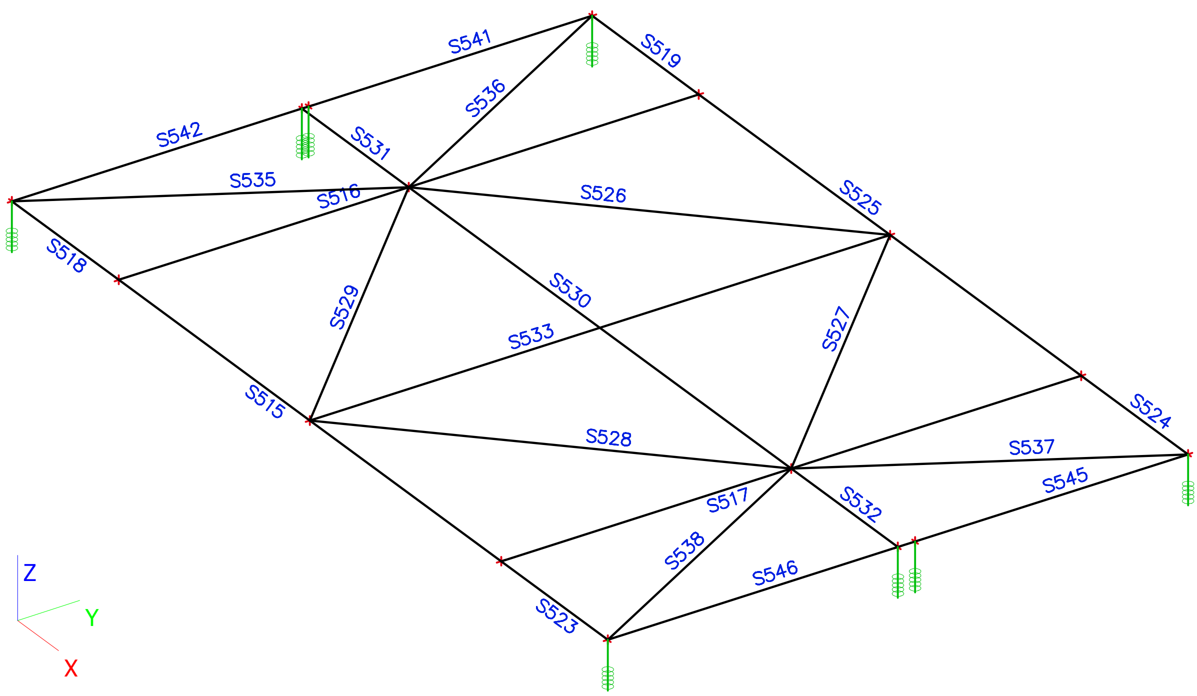
8.2. Horizontaal verband 2



8.3. Horizontaal verband 3



8.4. Horizontaal verband 4



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
6T	self weight of tower	Permanent	Perm	Eigen gewicht		-Z		
6C	self weight of conductor	Permanent	Perm	Standaard				
W_x-y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_y+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x-	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
W_x+	Wind	Variabel	LTA WIND	Statisch	Standaard		Kort	Geen
WI_x+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y-	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Ice	Ice	Variabel	Ice	Statisch	Standaard		Kort	Geen
4M	Maintenance	Variabel	Maint	Statisch	Onderhoudslasten			Geen
4C0	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C1	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C2	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C3	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C4	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C5	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C6	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C7	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C8	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C9	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C10	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C11	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
SBS	SBS-load	Variabel	SBS	Statisch	Knikverkorterlasten			Geen
Tuls-1a	Conductor tension	Permanent	CT	Standaard				
Tuls-1b	Conductor tension	Permanent	CT	Standaard				
Tuls-3	Conductor tension	Permanent	CT	Standaard				
Tuls-4	Conductor tension	Permanent	CT	Standaard				
Tuls-6	Conductor tension	Permanent	CT	Standaard				
Tsls-1a-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-LR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RF	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1a-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-1b-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-3-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tsls-4-RR	Conductor tension	Variabel	sls	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2		Variabel	5a_CI2	Statisch	Standaard		Kort	Geen
Tuls-5a_CI1		Variabel	5a_CI1	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3		Variabel	5a_CI3	Statisch	Standaard		Kort	Geen
Tuls-5a_CI5		Variabel	5a_CI5	Statisch	Standaard		Kort	Geen
Tuls-5a_CI6		Variabel	5a_CI6	Statisch	Standaard		Kort	Geen
Tuls-5a_CI7		Variabel	5a_CI7	Statisch	Standaard		Kort	Geen
Tuls-5a_CI8		Variabel	5a_CI8	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19		Variabel	5a_CI19	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11		Variabel	5a_CI11	Statisch	Standaard		Kort	Geen
Tuls-5a_CI9		Variabel	5a_CI9	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13		Variabel	5a_CI13	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15		Variabel	5a_CI15	Statisch	Standaard		Kort	Geen

Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
Tuls-5a_CI17		Variabel	5a_CI17	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21		Variabel	5a_CI21	Statisch	Standaard		Kort	Geen
4C12		Variabel	Construction	Statisch	Standaard		Kort	Geen
4C13		Variabel	Construction	Statisch	Standaard		Kort	Geen

10. Combinaties

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
1a	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
1b	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-1a - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-3 - Conductor tension	1,00
4	Maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4	Maintenance	Omhullende - uiterst	4C11 - Construction	1,50
6	Permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35
			Tuls-6 - Conductor tension	1,00
1a-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	1,50
			W_x+y- - Wind	1,50
			W_x-y- - Wind	1,50
			W_x+y+ - Wind	1,50
			W_y- - Wind	1,50
			W_y+ - Wind	1,50
			W_x- - Wind	1,50
			W_x+ - Wind	1,50
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
1b-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-1a - Conductor tension	1,00
3-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,50
			WI_x+ - WindIce	0,45
			WI_x- - WindIce	0,45
			WI_x+y+ - WindIce	0,45
			WI_x+y- - WindIce	0,45
			WI_x-y+ - WindIce	0,45
			WI_x-y- - WindIce	0,45
			WI_y+ - WindIce	0,45
			WI_y- - WindIce	0,45
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-3 - Conductor tension	1,00
4-p	Maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,30
			W_x+y- - Wind	0,30
			W_x-y- - Wind	0,30
			W_x+y+ - Wind	0,30
			W_y- - Wind	0,30
			W_y+ - Wind	0,30
			W_x- - Wind	0,30
			W_x+ - Wind	0,30
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tuls-4 - Conductor tension	1,00
			4C0 - Construction	1,50
			4C1 - Construction	1,50
			4C2 - Construction	1,50
			4C3 - Construction	1,50
			4C4 - Construction	1,50
			4C5 - Construction	1,50
			4C6 - Construction	1,50
			4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
sp1aLF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aLF	wind;10	Omhullende - uiterst	W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aR	wind;10	Omhullende - uiterst	W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aLF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aLR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aRR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1aF-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aF-p	wind;10	Omhullende - uiterst	W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LR - Conductor tension	1,00
			Tsls-1a-RR - Conductor tension	1,00
sp1aR-p	wind;10	Omhullende - uiterst	W_x-y+ - Wind	0,78
			W_x+y- - Wind	0,78
			W_x-y- - Wind	0,78
			W_x+y+ - Wind	0,78
			W_y- - Wind	0,78
			W_y+ - Wind	0,78
			W_x- - Wind	0,78
			W_x+ - Wind	0,78
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1a-LF - Conductor tension	1,00
			Tsls-1a-RF - Conductor tension	1,00
sp1bLF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRR	wind;-20	Omhullende - uiterst	6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bLF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bLR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF-p	wind;-20	Omhullende - uiterst	Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bRR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp1bF-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LR - Conductor tension	1,00
			Tsls-1b-RR - Conductor tension	1,00
sp1bR-p	wind;-20	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-1b-LF - Conductor tension	1,00
			Tsls-1b-RF - Conductor tension	1,00
sp3LF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3LR	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LR	wind+ice	Omhullende - uiterst	Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3LF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LF-p	wind+ice	Omhullende - uiterst	WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3LR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RF-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3RR-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp3F-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LR - Conductor tension	1,00
			Tsls-3-RR - Conductor tension	1,00
sp3R-p	wind+ice	Omhullende - uiterst	Ice - Ice	1,00
			WI_x+ - WindIce	0,36
			WI_x- - WindIce	0,36
			WI_x+y+ - WindIce	0,36

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3R-p	wind+ice	Omhullende - uiterst	WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36
			WI_x-y- - WindIce	0,36
			WI_y+ - WindIce	0,36
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			Tsls-3-LF - Conductor tension	1,00
			Tsls-3-RF - Conductor tension	1,00
sp4LF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4LR	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4RF	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4RF	maintenance	Omhullende - uiterst	W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4RR	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
sp4F	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F	maintenance	Omhullende - uiterst	4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4R	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,44
			6C - self weight of conductor	1,20
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
sp4LF-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4LR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LR-p	maintenance	Omhullende - uiterst	4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4RF-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4RR-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00
sp4F-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F-p	maintenance	Omhullende - uiterst	W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00
			Tsls-4-RR - Conductor tension	1,00
sp4R-p	maintenance	Omhullende - uiterst	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24
			W_x-y- - Wind	0,24
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24
			W_y+ - Wind	0,24
			W_x- - Wind	0,24
			W_x+ - Wind	0,24
			6T - self weight of tower	1,08
			6C - self weight of conductor	0,90
			4C0 - Construction	1,20
			4C1 - Construction	1,20
			4C2 - Construction	1,20
			4C3 - Construction	1,20
			4C4 - Construction	1,20
			4C5 - Construction	1,20
			4C6 - Construction	1,20
			4C7 - Construction	1,20
			4C8 - Construction	1,20
			4C9 - Construction	1,20
			4C10 - Construction	1,20
			4C11 - Construction	1,20
			Tsls-4-LF - Conductor tension	1,00
			Tsls-4-RF - Conductor tension	1,00

11. Resultaten

11.1. Interne krachten in staaf

Interne krachten in staaf

Lineaire berekening, Extreem : Staaf, Systeem : Hoofd
Selectie : Alle
Klasse : All UGT

Staaf	css	BG	dx [m]	N [kN]
S1	CS22 - HFLeq60x60x6	1a/30	0,000	**-0,54**
S1	CS22 - HFLeq60x60x6	1a-p/17	0,941	**0,39**
S2	CS11 - L50X5	3/16	0,000	**-34,21**
S2	CS11 - L50X5	sp1aLF/31	1,862	**0,72**
S3	CS11 - L50X5	sp1aLF/31	0,000	**-0,98**
S3	CS11 - L50X5	3/23	2,018	**22,51**
S4	CS11 - L50X5	sp3LF/32	0,000	**-1,19**
S4	CS11 - L50X5	3-p/10	1,862	**37,51**
S5	CS11 - L50X5	3-p/5	0,000	**-23,82**
S5	CS11 - L50X5	sp1aLF/31	2,018	**0,94**
S6	CS11 - L50X5	1a-p/2	0,000	**-1,00**
S6	CS11 - L50X5	1a/33	0,000	**1,44**
S7	CS11 - L50X5	sp1aLF/34	0,000	**-2,05**
S7	CS11 - L50X5	3-p/24	2,184	**17,58**
S8	CS88 - L60X6	3-p/24	0,000	**-22,72**
S8	CS88 - L60X6	sp1aLF/34	2,162	**2,96**
S9	CS11 - L50X5	3/27	0,000	**-17,75**
S9	CS11 - L50X5	sp1aLF-p/35	2,184	**1,29**
S10	CS88 - L60X6	sp1aLF-p/35	0,000	**-2,51**
S10	CS88 - L60X6	3/27	2,162	**23,73**
S11	CS7 - L50X5	1a/36	1,511	**-1,58**
S11	CS7 - L50X5	1a-p/37	0,000	**1,26**
S12	CS7 - L50X5	1a-p/37	0,000	**-0,44**
S12	CS7 - L50X5	1a/1	0,336	**0,46**
S13	CS7 - L50X5	1a/36	1,501	**-2,45**
S13	CS7 - L50X5	1a-p/37	0,000	**0,95**
S14	CS7 - L50X5	1a-p/37	0,000	**-0,47**
S14	CS7 - L50X5	1a/36	0,649	**1,22**
S15	CS7 - L50X5	1a/36	1,911	**-2,43**
S15	CS7 - L50X5	1a-p/37	0,000	**0,96**
S16	CS7 - L50X5	1a-p/37	0,000	**-0,60**
S16	CS7 - L50X5	1a/36	0,969	**1,48**
S17	CS7 - L50X5	3/25	1,511	**-4,89**
S17	CS7 - L50X5	sp3LF-p/38	0,000	**0,81**
S18	CS7 - L50X5	sp3LF-p/38	0,000	**-0,38**
S18	CS7 - L50X5	3/25	0,336	**1,86**
S19	CS7 - L50X5	1a/1	1,501	**-2,91**
S19	CS7 - L50X5	1a-p/39	0,000	**1,50**
S20	CS7 - L50X5	1a-p/37	0,000	**-0,58**
S20	CS7 - L50X5	1a/1	0,649	**1,37**
S21	CS7 - L50X5	1a/36	1,911	**-2,18**
S21	CS7 - L50X5	1a-p/39	0,000	**0,69**
S22	CS7 - L50X5	1a-p/39	0,969	**-0,56**
S22	CS7 - L50X5	1a/1	0,000	**1,48**
S23	CS4 - L50X5	sp3LF/40	0,000	**-5,83**
S23	CS4 - L50X5	3-p/10	1,450	**13,51**
S24	CS4 - L50X5	3-p/41	0,000	**-13,40**
S24	CS4 - L50X5	sp3LF/42	1,451	**6,23**
S25	CS4 - L50X5	sp3LF/43	0,000	**-9,55**
S25	CS4 - L50X5	sp1aLF-p/44	0,997	**-1,65**
S26	CS96 - L120X10	3/9	0,000	**-225,26**
S26	CS96 - L120X10	sp1aLF-p/35	2,386	**29,94**
S27	CS96 - L120X10	sp1aLF/45	0,000	**-30,51**
S27	CS96 - L120X10	3-p/24	2,652	**178,68**
S28	CS96 - L120X10	sp1aLF/45	0,000	**-32,91**
S28	CS96 - L120X10	3-p/24	2,386	**212,98**
S29	CS96 - L120X10	3/9	0,000	**-193,52**
S29	CS96 - L120X10	sp1aLF-p/35	2,651	**26,52**

Staaf	css	BG	dx [m]	N [kN]
S30	CS4 - L50X5	sp3RF-p/12	2,536	**-0,74**
S30	CS4 - L50X5	3/9	0,000	**3,86**
S31	CS93 - L90X9	1a-p/17	0,000	**-124,91**
S31	CS93 - L90X9	sp1aLF/45	2,265	**21,64**
S33	CS4 - L50X5	1a/1	0,000	**-6,45**
S33	CS4 - L50X5	sp1aLF-p/44	1,616	**0,54**
S34	CS93 - L90X9	1a-p/2	0,000	**-114,32**
S34	CS93 - L90X9	sp1aLF/45	2,366	**31,52**
S35	CS4 - L50X5	sp3LF/43	0,000	**-19,52**
S35	CS4 - L50X5	3-p/24	1,616	**-3,05**
S36	CS93 - L90X9	sp1aLF/46	0,000	**-20,62**
S36	CS93 - L90X9	1a/47	2,265	**123,80**
S37	CS91 - L150X15	sp1aLF/31	0,000	**-92,99**
S37	CS91 - L150X15	3-p/5	2,380	**466,49**
S38	CS4 - L50X5	3-p/10	0,878	**-5,31**
S38	CS4 - L50X5	sp1aLF/46	0,000	**1,51**
S40	CS91 - L150X15	3/22	0,000	**-480,69**
S40	CS91 - L150X15	sp1aLF-p/48	2,380	**90,37**
S41	CS4 - L50X5	sp1aLF-p/49	0,879	**-2,77**
S41	CS4 - L50X5	3/9	0,000	**16,98**
S42	CS92 - L70X7	3/9	0,000	**-21,59**
S42	CS92 - L70X7	sp1aLF-p/49	2,227	**4,17**
S43	CS4 - L50X5	sp1aRF/50	0,864	**-0,92**
S43	CS4 - L50X5	1a-p/37	0,000	**2,59**
S44	CS92 - L70X7	1a-p/37	0,000	**-35,62**
S44	CS92 - L70X7	sp1aRF/50	2,231	**15,74**
S46	CS86 - L130X12	sp1aLF-p/51	0,000	**-2,67**
S46	CS86 - L130X12	3/27	0,000	**43,49**
S47	CS86 - L130X12	3/6	0,000	**-61,81**
S47	CS86 - L130X12	sp1aLF-p/51	0,000	**-7,50**
S48	CS88 - L60X6	3-p/24	0,000	**-9,10**
S48	CS88 - L60X6	sp1aLF/34	1,252	**3,78**
S49	CS84 - L100X8	sp1aLF/52	0,000	**-6,81**
S49	CS84 - L100X8	3-p/5	2,076	**44,13**
S51	CS85 - L60X8	sp1aLF/46	0,000	**-4,00**
S51	CS85 - L60X8	1a-p/37	2,571	**15,70**
S52	CS88 - L60X6	1a-p/37	1,250	**-12,70**
S52	CS88 - L60X6	sp1aLF/46	0,000	**2,65**
S53	CS83 - L120X12	3/16	2,382	**-309,98**
S53	CS83 - L120X12	sp1aLF-p/44	0,000	**62,83**
S54	CS37 - HFLeq75x75x8	1a-p/53	0,000	**-12,80**
S54	CS37 - HFLeq75x75x8	1a/21	0,000	**11,98**
S55	CS85 - L60X8	3/6	0,000	**-23,08**
S55	CS85 - L60X8	sp1aLF-p/51	2,571	**2,24**
S56	CS88 - L60X6	sp1aLF-p/51	1,250	**-2,38**
S56	CS88 - L60X6	3/6	0,000	**21,05**
S57	CS88 - L60X6	sp1aLF-p/48	0,000	**-2,85**
S57	CS88 - L60X6	3/6	1,252	**34,33**
S58	CS83 - L120X12	sp1aLF/54	2,382	**-70,71**
S58	CS83 - L120X12	3-p/10	0,000	**299,43**
S60	CS88 - L60X6	3-p/5	0,000	**-30,46**
S60	CS88 - L60X6	sp1aLF/52	1,252	**5,80**
S61	CS84 - L100X8	sp1aLF/52	0,000	**-9,42**
S61	CS84 - L100X8	3-p/5	2,076	**61,76**
S63	CS22 - HFLeq60x60x6	1a/18	0,000	**-0,53**
S63	CS22 - HFLeq60x60x6	1a-p/55	0,941	**0,47**

Staaf	css	BG	dx [m]	N [kN]
S64	CS22 - HFLeq60x60x6	1a/30	0,000	**-0,53**
S64	CS22 - HFLeq60x60x6	1a-p/17	0,941	**0,37**
S65	CS12 - L50X5	3/14	0,000	**-34,81**
S65	CS12 - L50X5	sp1aRF-p/56	1,862	**0,74**
S66	CS12 - L50X5	sp1aRF/57	0,000	**-1,07**
S66	CS12 - L50X5	3-p/5	2,018	**22,12**
S67	CS12 - L50X5	sp3LF/43	0,000	**-1,11**
S67	CS12 - L50X5	3-p/24	1,862	**37,01**
S68	CS12 - L50X5	3-p/5	0,000	**-24,25**
S68	CS12 - L50X5	sp1aRF/57	2,018	**1,08**
S69	CS12 - L50X5	1a-p/39	1,364	**-0,64**
S69	CS12 - L50X5	1a/1	1,364	**1,67**
S70	CS12 - L50X5	sp1aLF/46	0,000	**-1,92**
S70	CS12 - L50X5	3-p/10	2,184	**17,45**
S71	CS88 - L60X6	3-p/10	0,000	**-23,36**
S71	CS88 - L60X6	sp1aLF/52	2,162	**3,37**
S72	CS12 - L50X5	3/16	0,000	**-18,03**
S72	CS12 - L50X5	sp1aRF-p/58	2,184	**1,43**
S73	CS88 - L60X6	sp1aRF/59	0,000	**-2,94**
S73	CS88 - L60X6	3/16	2,162	**22,71**
S74	CS7 - L50X5	sp1aRF/60	1,511	**-1,40**
S74	CS7 - L50X5	1a-p/61	0,000	**1,45**
S75	CS7 - L50X5	1a-p/2	0,000	**-0,60**
S75	CS7 - L50X5	sp1aRF/59	0,336	**0,44**
S76	CS7 - L50X5	1a/33	1,501	**-2,83**
S76	CS7 - L50X5	1a-p/2	0,000	**1,81**
S77	CS7 - L50X5	1a-p/61	0,000	**-0,79**
S77	CS7 - L50X5	1a/47	0,649	**1,25**
S78	CS7 - L50X5	1a/33	1,911	**-2,64**
S78	CS7 - L50X5	1a-p/61	0,000	**0,44**
S79	CS7 - L50X5	1a-p/2	0,000	**-0,43**
S79	CS7 - L50X5	1a/33	0,485	**1,80**
S80	CS7 - L50X5	3/14	1,511	**-3,40**
S80	CS7 - L50X5	sp3RF-p/62	0,000	**0,51**
S81	CS7 - L50X5	sp3RF-p/62	0,000	**-0,24**
S81	CS7 - L50X5	3/14	0,336	**1,29**
S82	CS7 - L50X5	1a/47	1,501	**-2,31**
S82	CS7 - L50X5	1a-p/61	0,000	**1,29**
S83	CS7 - L50X5	1a-p/61	0,000	**-0,66**
S83	CS7 - L50X5	1a/47	0,649	**1,14**
S84	CS7 - L50X5	1a/47	1,911	**-2,90**
S84	CS7 - L50X5	1a-p/61	0,000	**0,79**
S85	CS7 - L50X5	1a-p/61	0,969	**-0,43**
S85	CS7 - L50X5	1a/47	0,000	**1,85**
S86	CS4 - L50X5	sp3RF/63	0,000	**-5,55**
S86	CS4 - L50X5	3-p/41	1,450	**13,63**
S87	CS4 - L50X5	3-p/10	0,000	**-14,39**
S87	CS4 - L50X5	sp3LF/40	1,451	**4,84**
S88	CS4 - L50X5	sp3RF/63	0,000	**-8,42**
S88	CS4 - L50X5	4-p/64	0,000	**-1,80**
S89	CS96 - L120X10	3/23	0,000	**-218,41**
S89	CS96 - L120X10	sp1aLF-p/65	2,386	**28,60**
S90	CS96 - L120X10	sp1aLF/46	0,000	**-30,05**
S90	CS96 - L120X10	3-p/10	2,652	**183,40**
S91	CS96 - L120X10	sp1aLF/46	0,000	**-31,18**
S91	CS96 - L120X10	3-p/10	2,386	**216,55**
S92	CS96 - L120X10	3/23	0,000	**-186,14**
S92	CS96 - L120X10	sp1aLF-p/65	2,651	**24,31**
S93	CS4 - L50X5	3-p/26	2,536	**-3,13**
S93	CS4 - L50X5	3/14	0,000	**1,53**
S94	CS22 - HFLeq60x60x6	1a/18	0,000	**-4,95**
S94	CS22 - HFLeq60x60x6	1a-p/55	1,851	**4,44**
S95	CS22 - HFLeq60x60x6	1a/30	0,000	**-4,62**

Staaf	css	BG	dx [m]	N [kN]
S95	CS22 - HFLeq60x60x6	1a-p/17	1,849	**4,77**
S96	CS22 - HFLeq60x60x6	1a/18	0,000	**-3,25**
S96	CS22 - HFLeq60x60x6	1a-p/55	1,850	**2,66**
S97	CS22 - HFLeq60x60x6	1a/30	0,000	**-2,93**
S97	CS22 - HFLeq60x60x6	1a-p/17	1,849	**3,00**
S98	CS4 - L50X5	1a/18	1,920	**-2,81**
S98	CS4 - L50X5	1a-p/17	0,000	**2,82**
S99	CS4 - L50X5	1a/18	1,920	**-1,90**
S99	CS4 - L50X5	1a-p/17	0,000	**1,70**
S100	CS24 - ISEA100/100/6	1a/21	2,364	**-45,84**
S100	CS24 - ISEA100/100/6	1a-p/53	0,000	**27,46**
S101	CS98 - L50X6	1a-p/53	0,000	**-31,29**
S101	CS98 - L50X6	1a/21	2,361	**42,55**
S102	CS93 - L90X9	1a/21	2,818	**-49,53**
S102	CS93 - L90X9	1a-p/53	0,000	**39,13**
S103	CS4 - L50X5	1a/30	0,000	**-1,96**
S103	CS4 - L50X5	1a-p/17	1,691	**2,09**
S104	CS4 - L50X5	sp1aLF-p/66	0,000	**0,25**
S104	CS4 - L50X5	1a/30	1,306	**1,97**
S105	CS4 - L50X5	1a/18	0,000	**-2,28**
S105	CS4 - L50X5	1a-p/55	1,691	**1,78**
S106	CS4 - L50X5	1a/18	1,920	**-1,51**
S106	CS4 - L50X5	1a-p/17	0,000	**1,26**
S107	CS24 - ISEA100/100/6	1a/21	2,364	**-69,35**
S107	CS24 - ISEA100/100/6	1a-p/53	0,000	**13,55**
S108	CS4 - L50X5	1a-p/55	0,000	**-0,33**
S108	CS4 - L50X5	sp3LF/42	1,306	**1,77**
S109	CS98 - L50X6	1a-p/53	0,000	**-16,57**
S109	CS98 - L50X6	1a/21	2,360	**66,89**
S110	CS93 - L90X9	1a/21	2,819	**-50,60**
S110	CS93 - L90X9	1a-p/53	0,000	**43,62**
S111	CS24 - ISEA100/100/6	1a/20	2,363	**-43,17**
S111	CS24 - ISEA100/100/6	1a-p/19	0,000	**30,11**
S112	CS98 - L50X6	1a-p/19	0,000	**-34,01**
S112	CS98 - L50X6	1a/20	2,361	**39,82**
S113	CS93 - L90X9	1a/20	2,819	**-46,27**
S113	CS93 - L90X9	1a-p/19	0,000	**42,47**
S114	CS4 - L50X5	1a/30	0,000	**-2,38**
S114	CS4 - L50X5	1a-p/17	1,691	**2,53**
S115	CS4 - L50X5	1a-p/17	0,000	**0,07**
S115	CS4 - L50X5	1a/30	1,306	**2,27**
S116	CS4 - L50X5	1a/18	0,000	**-2,73**
S116	CS4 - L50X5	1a-p/55	1,691	**2,20**
S117	CS4 - L50X5	1a/18	1,920	**-1,80**
S117	CS4 - L50X5	1a-p/17	0,000	**1,54**
S118	CS24 - ISEA100/100/6	1a/20	2,363	**-66,41**
S118	CS24 - ISEA100/100/6	1a-p/19	0,000	**16,49**
S119	CS4 - L50X5	1a-p/55	0,000	**-0,63**
S119	CS4 - L50X5	sp1aLF/67	1,306	**1,77**
S120	CS98 - L50X6	1a-p/19	0,000	**-19,53**
S120	CS98 - L50X6	1a/20	2,361	**63,86**
S121	CS4 - L50X5	sp1aLF-p/66	1,306	**0,09**
S121	CS4 - L50X5	1a/30	0,000	**3,22**
S122	CS4 - L50X5	1a/30	0,000	**-2,98**
S122	CS4 - L50X5	1a-p/17	1,691	**2,29**
S123	CS4 - L50X5	1a/18	0,000	**-2,48**
S123	CS4 - L50X5	1a-p/55	1,691	**2,78**

Staaf	css	BG	dx [m]	N [kN]
S124	CS4 - L50X5	1a/30	0,960	**-1,94**
S124	CS4 - L50X5	1a-p/55	0,960	**1,73**
S125	CS4 - L50X5	1a-p/55	1,306	**-1,28**
S125	CS4 - L50X5	sp1aLF/67	0,000	**2,09**
S126	CS93 - L90X9	1a/20	2,819	**-46,97**
S126	CS93 - L90X9	1a-p/19	0,000	**47,27**
S127	CS97 - L100X10	1a-p/2	0,000	**-114,17**
S127	CS97 - L100X10	1a/33	0,000	**94,48**
S128	CS97 - L100X10	1a-p/19	0,000	**-72,72**
S128	CS97 - L100X10	1a/47	0,000	**142,43**
S129	CS4 - L50X5	1a-p/37	1,213	**8,04**
S129	CS4 - L50X5	4/68	0,000	**26,07**
S130	CS4 - L50X5	sp1aLF-p/69	2,880	**9,40**
S130	CS4 - L50X5	4/70	0,000	**25,73**
S131	CS95 - L80X8	1a/47	1,541	**-116,75**
S131	CS95 - L80X8	1a-p/19	0,000	**73,11**
S132	CS95 - L80X8	1a/33	1,541	**-89,17**
S132	CS95 - L80X8	1a-p/19	0,000	**111,68**
S133	CS7 - L50X5	sp1aLF/71	0,799	**-0,23**
S133	CS7 - L50X5	3-p/41	0,000	**0,49**
S134	CS7 - L50X5	3/72	0,800	**-0,22**
S134	CS7 - L50X5	sp1aLF-p/73	0,000	**0,08**
S135	CS96 - L120X10	1a/1	0,000	**-132,16**
S135	CS96 - L120X10	1a-p/39	4,098	**61,15**
S136	CS7 - L50X5	3-p/41	2,179	**-3,26**
S136	CS7 - L50X5	sp1aLF/45	0,000	**1,63**
S137	CS4 - L50X5	4-p/74	1,213	**13,62**
S137	CS4 - L50X5	3/25	0,000	**43,49**
S138	CS4 - L50X5	4-p/74	2,880	**13,46**
S138	CS4 - L50X5	3/25	0,000	**41,73**
S139	CS93 - L90X9	1a-p/19	0,000	**-70,90**
S139	CS93 - L90X9	1a/20	1,506	**104,80**
S140	CS96 - L120X10	1a/21	0,000	**-87,62**
S140	CS96 - L120X10	1a-p/37	4,099	**109,69**
S141	CS93 - L90X9	1a-p/2	0,000	**-98,43**
S141	CS93 - L90X9	1a/33	1,506	**66,73**
S142	CS4 - L50X5	1a-p/2	1,213	**6,05**
S142	CS4 - L50X5	4/75	0,000	**25,37**
S143	CS4 - L50X5	sp1aRF-p/76	2,880	**9,46**
S143	CS4 - L50X5	4/75	0,000	**25,81**
S144	CS95 - L80X8	1a/1	1,541	**-119,48**
S144	CS95 - L80X8	1a-p/39	0,000	**73,94**
S145	CS95 - L80X8	1a/21	1,541	**-93,93**
S145	CS95 - L80X8	1a-p/37	0,000	**107,73**
S146	CS7 - L50X5	sp1aRF-p/77	0,000	**-0,08**
S146	CS7 - L50X5	1a/20	0,800	**0,23**
S147	CS7 - L50X5	3/25	0,800	**-0,66**
S147	CS7 - L50X5	sp1aRF-p/78	0,000	**0,05**
S148	CS96 - L120X10	1a/47	0,000	**-125,82**
S148	CS96 - L120X10	1a-p/19	4,098	**65,81**
S149	CS7 - L50X5	sp1aLF-p/65	2,179	**-0,50**
S149	CS7 - L50X5	3/79	0,000	**4,34**
S150	CS7 - L50X5	3-p/26	2,179	**-8,13**
S150	CS7 - L50X5	sp1aLF/46	0,000	**2,54**
S151	CS4 - L50X5	4-p/80	1,213	**12,94**
S151	CS4 - L50X5	3/14	0,000	**41,36**
S152	CS4 - L50X5	4-p/81	2,880	**13,38**
S152	CS4 - L50X5	3/14	0,000	**41,60**
S153	CS93 - L90X9	1a-p/39	0,000	**-66,90**
S153	CS93 - L90X9	1a/21	1,506	**110,49**
S154	CS96 - L120X10	1a/33	0,000	**-81,71**
S154	CS96 - L120X10	1a-p/19	4,099	**116,27**
S155	CS93 - L90X9	1a-p/37	0,000	**-96,19**
S155	CS93 - L90X9	1a/36	1,506	**68,80**
S156	CS93 - L90X9	3-p/10	0,000	**-116,18**
S156	CS93 - L90X9	sp1aLF/46	2,264	**19,24**
S159	CS34 - UNP120	1a-p/37	0,888	**5,50**

Staaf	css	BG	dx [m]	N [kN]
S159	CS34 - UNP120	sp4RF/82	0,000	**28,33**
S160	CS34 - UNP120	1a-p/2	0,888	**-3,56**
S160	CS34 - UNP120	sp4LF/83	0,000	**27,30**
S161	CS86 - L130X12	sp1aRF-p/77	0,000	**-171,38**
S161	CS86 - L130X12	1a/20	0,000	**270,14**
S162	CS25 - HFLue120x80x8	sp1aRF/84	0,000	**-160,11**
S162	CS25 - HFLue120x80x8	1a-p/53	1,544	**220,59**
S164	CS25 - HFLue120x80x8	1a/20	0,000	**-259,76**
S164	CS25 - HFLue120x80x8	sp1aLF-p/73	1,544	**134,76**
S166	CS34 - UNP120	1a-p/39	0,888	**67,92**
S166	CS34 - UNP120	3/25	0,000	**145,46**
S167	CS28 - ISEA55/55/5	3/9	0,000	**-53,18**
S167	CS28 - ISEA55/55/5	sp1aLF-p/35	1,554	**-0,12**
S168	CS11 - L50X5	sp1aLF-p/49	2,235	**-0,01**
S168	CS11 - L50X5	3/9	0,000	**27,22**
S169	CS28 - ISEA55/55/5	sp3LF/85	0,000	**-3,59**
S169	CS28 - ISEA55/55/5	3-p/41	0,000	**48,95**
S170	CS11 - L50X5	3-p/41	0,000	**-25,02**
S170	CS11 - L50X5	sp3LF/85	2,235	**2,04**
S171	CS101 - UNP140	sp4LF/86	0,000	**-23,23**
S171	CS101 - UNP140	3-p/24	0,000	**119,29**
S172	CS101 - UNP140	3/14	0,000	**-171,86**
S172	CS101 - UNP140	sp4LF-p/87	2,709	**-12,86**
S173	CS30 - UNP140	1a-p/53	0,000	**-2,97**
S173	CS30 - UNP140	sp3LF/88	0,961	**2,74**
S175	CS11 - L50X5	sp3LF/42	0,400	**-0,21**
S175	CS11 - L50X5	3-p/41	0,000	**19,78**
S176	CS82 - L180X18	sp1aLF/46	0,000	**-287,22**
S176	CS82 - L180X18	3-p/10	2,140	**1307,76**
S177	CS82 - L180X18	3/23	0,000	**-1406,53**
S177	CS82 - L180X18	sp1aLF-p/65	2,140	**172,16**
S178	CS15 - HFLeq60x60x5	sp3LF-p/38	0,000	**-10,47**
S178	CS15 - HFLeq60x60x5	sp3RF/89	0,000	**10,44**
S179	CS15 - HFLeq60x60x5	sp3RF/89	0,000	**-9,63**
S179	CS15 - HFLeq60x60x5	sp3LF-p/38	0,000	**9,22**
S180	CS28 - ISEA55/55/5	sp1aLF/52	0,000	**-13,87**
S180	CS28 - ISEA55/55/5	1a-p/17	0,000	**79,63**
S181	CS28 - ISEA55/55/5	1a-p/17	0,000	**-77,89**
S181	CS28 - ISEA55/55/5	sp1aLF/52	0,000	**13,81**
S182	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**-11,63**
S182	CS15 - HFLeq60x60x5	1a-p/17	0,000	**78,21**
S183	CS15 - HFLeq60x60x5	1a-p/17	0,000	**-69,75**
S183	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**9,16**
S184	CS15 - HFLeq60x60x5	1a-p/17	0,000	**-80,24**
S184	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**11,59**
S185	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**-9,10**
S185	CS15 - HFLeq60x60x5	1a-p/17	0,000	**70,60**
S186	CS98 - L50X6	1a-p/17	0,649	**-87,45**
S186	CS98 - L50X6	sp1aLF/52	0,649	**11,47**

Staaf	css	BG	dx [m]	N [kN]
S187	CS98 - L50X6	sp1aLF/46	0,432	**-6,21**
S187	CS98 - L50X6	1a-p/37	0,000	**34,98**
S188	CS30 - UNP140	sp1aLF/34	0,000	**-4,93**
S188	CS30 - UNP140	1a-p/2	0,721	**28,36**
S189	CS30 - UNP140	sp1aLF/46	0,000	**-9,53**
S189	CS30 - UNP140	1a-p/17	0,000	**56,28**
S190	CS28 - ISEA55/55/5	3/23	0,000	**-52,76**
S190	CS28 - ISEA55/55/5	sp1aRF-p/58	0,777	**-0,14**
S191	CS11 - L50X5	sp1aRF-p/58	2,235	**-0,01**
S191	CS11 - L50X5	3/23	0,000	**26,98**
S192	CS28 - ISEA55/55/5	sp3LF/90	1,943	**-3,53**
S192	CS28 - ISEA55/55/5	3-p/26	0,000	**49,26**
S193	CS11 - L50X5	3-p/26	0,000	**-25,20**
S193	CS11 - L50X5	sp3RF/89	2,235	**2,00**
S194	CS101 - UNP140	sp4LF/91	0,814	**-23,32**
S194	CS101 - UNP140	3-p/10	0,000	**119,36**
S195	CS101 - UNP140	3/25	0,000	**-171,57**
S195	CS101 - UNP140	sp4LF-p/92	1,220	**-12,80**
S196	CS30 - UNP140	1a-p/19	0,000	**-3,14**
S196	CS30 - UNP140	sp1aLF/93	0,961	**2,74**
S198	CS28 - ISEA55/55/5	sp1aLF/52	0,000	**-13,08**
S198	CS28 - ISEA55/55/5	1a-p/17	0,000	**77,97**
S199	CS28 - ISEA55/55/5	1a-p/17	0,000	**-76,57**
S199	CS28 - ISEA55/55/5	sp1aLF/52	0,000	**13,06**
S200	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**-12,05**
S200	CS15 - HFLeq60x60x5	1a-p/17	0,000	**79,39**
S201	CS15 - HFLeq60x60x5	1a-p/17	0,000	**-70,05**
S201	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**9,20**
S202	CS15 - HFLeq60x60x5	1a-p/17	2,924	**-81,34**
S202	CS15 - HFLeq60x60x5	sp1aLF/52	2,924	**12,21**
S203	CS15 - HFLeq60x60x5	sp1aLF/52	0,000	**-9,16**
S203	CS15 - HFLeq60x60x5	1a-p/17	0,000	**70,59**
S204	CS98 - L50X6	1a-p/17	0,647	**-87,28**
S204	CS98 - L50X6	sp1aLF/52	0,647	**11,45**
S205	CS98 - L50X6	sp1aLF/45	0,431	**-6,50**
S205	CS98 - L50X6	1a-p/2	0,000	**35,89**
S206	CS15 - HFLeq60x60x5	sp3RF-p/62	0,000	**-10,47**
S206	CS15 - HFLeq60x60x5	sp3LF/85	0,000	**10,44**
S207	CS15 - HFLeq60x60x5	sp3LF/85	0,000	**-9,62**
S207	CS15 - HFLeq60x60x5	sp3RF-p/62	1,142	**9,23**
S208	CS30 - UNP140	sp1aLF/46	0,000	**-4,88**
S208	CS30 - UNP140	1a-p/37	0,000	**27,89**
S209	CS30 - UNP140	sp1aLF/45	0,000	**-9,69**
S209	CS30 - UNP140	1a-p/2	0,000	**57,55**
S210	CS101 - UNP140	sp1aLF/45	0,000	**-42,85**
S210	CS101 - UNP140	1a-p/19	0,000	**166,55**
S211	CS4 - L50X5	1a-p/53	0,000	**-6,10**
S211	CS4 - L50X5	1a/21	0,000	**11,42**
S212	CS4 - L50X5	1a-p/19	0,000	**-5,02**
S212	CS4 - L50X5	1a/20	0,000	**13,06**
S213	CS101 - UNP140	3/14	0,000	**-195,53**
S213	CS101 - UNP140	sp1aLF-p/94	0,000	**29,28**

Staaf	css	BG	dx [m]	N [kN]
S214	CS4 - L50X5	1a/30	0,000	**-2,65**
S214	CS4 - L50X5	1a-p/17	2,305	**2,43**
S215	CS4 - L50X5	1a/30	0,000	**-2,63**
S215	CS4 - L50X5	1a-p/17	2,305	**2,41**
S216	CS4 - L50X5	1a/30	0,000	**-1,79**
S216	CS4 - L50X5	1a-p/55	1,166	**0,89**
S217	CS4 - L50X5	1a-p/17	1,778	**-1,25**
S217	CS4 - L50X5	1a/30	0,000	**1,98**
S218	CS4 - L50X5	1a/30	1,790	**-2,19**
S218	CS4 - L50X5	1a-p/17	0,000	**1,11**
S219	CS4 - L50X5	1a/18	0,000	**-2,75**
S219	CS4 - L50X5	1a-p/55	2,305	**2,33**
S220	CS4 - L50X5	1a/18	0,000	**-2,73**
S220	CS4 - L50X5	1a-p/55	2,305	**2,31**
S221	CS4 - L50X5	1a/18	1,614	**-2,15**
S221	CS4 - L50X5	1a-p/17	0,403	**1,75**
S222	CS4 - L50X5	1a/18	1,614	**-2,14**
S222	CS4 - L50X5	1a-p/17	0,000	**1,74**
S223	CS4 - L50X5	1a/30	0,000	**-1,89**
S223	CS4 - L50X5	1a-p/55	1,166	**0,93**
S224	CS26 - HFLeq100x100x8	1a-p/53	2,376	**-131,74**
S224	CS26 - HFLeq100x100x8	1a/21	0,000	**151,95**
S225	CS41 - ISEA120/120/8	1a/21	0,000	**-142,41**
S225	CS41 - ISEA120/120/8	1a-p/53	2,373	**128,22**
S226	CS26 - HFLeq100x100x8	1a-p/19	2,376	**-142,29**
S226	CS26 - HFLeq100x100x8	1a/20	0,000	**141,44**
S227	CS41 - ISEA120/120/8	1a/20	0,000	**-132,50**
S227	CS41 - ISEA120/120/8	1a-p/19	2,373	**138,58**
S228	CS40 - ISUA65/50/5	sp1aLF-p/94	4,732	**5,05**
S228	CS40 - ISUA65/50/5	4/95	0,000	**13,61**
S229	CS4 - L50X5	4/95	1,269	**-2,39**
S229	CS4 - L50X5	sp1aLF-p/96	0,000	**-0,95**
S230	CS40 - ISUA65/50/5	sp1aLF-p/97	2,898	**5,07**
S230	CS40 - ISUA65/50/5	4/98	0,000	**14,21**
S231	CS40 - ISUA65/50/5	sp1aLF-p/65	4,732	**5,05**
S231	CS40 - ISUA65/50/5	4/99	0,000	**13,62**
S232	CS4 - L50X5	sp1aRF-p/76	2,810	**5,60**
S232	CS4 - L50X5	1a/33	0,000	**14,18**
S233	CS4 - L50X5	4/99	1,269	**-2,44**
S233	CS4 - L50X5	sp1aLF-p/65	0,000	**-0,93**
S234	CS40 - ISUA65/50/5	sp1aLF-p/35	2,898	**5,11**
S234	CS40 - ISUA65/50/5	4/100	0,000	**14,33**
S235	CS40 - ISUA65/50/5	3-p/41	4,732	**37,42**
S235	CS40 - ISUA65/50/5	3/9	0,000	**67,59**
S236	CS4 - L50X5	1a-p/39	2,811	**29,14**
S236	CS4 - L50X5	3/25	0,000	**55,75**
S237	CS4 - L50X5	3/9	1,269	**-10,64**
S237	CS4 - L50X5	1a-p/61	0,000	**-5,90**
S238	CS40 - ISUA65/50/5	1a-p/39	2,898	**38,32**
S238	CS40 - ISUA65/50/5	3/23	0,000	**69,90**
S239	CS26 - HFLeq100x100x8	1a-p/53	2,376	**-134,21**

Staaf	css	BG	dx [m]	N [kN]
S239	CS26 - HFLeq100x100x8	1a/21	0,000	**160,48**
S240	CS41 - ISEA120/120/8	1a/21	0,000	**-163,19**
S240	CS41 - ISEA120/120/8	1a-p/53	2,373	**116,96**
S241	CS26 - HFLeq100x100x8	1a-p/19	2,376	**-144,99**
S241	CS26 - HFLeq100x100x8	1a/20	0,000	**149,79**
S242	CS41 - ISEA120/120/8	1a/20	0,000	**-152,96**
S242	CS41 - ISEA120/120/8	1a-p/19	2,373	**127,04**
S243	CS93 - L90X9	sp1aLF/45	0,000	**-28,16**
S243	CS93 - L90X9	1a-p/2	2,366	**116,18**
S244	CS4 - L50X5	3/16	0,000	**-10,85**
S244	CS4 - L50X5	sp1aLF-p/65	1,616	**-0,25**
S245	CS93 - L90X9	3-p/10	0,000	**-103,59**
S245	CS93 - L90X9	sp1aLF/46	2,366	**25,08**
S247	CS4 - L50X5	3-p/10	0,879	**-13,47**
S247	CS4 - L50X5	sp1aRF/50	0,000	**4,77**
S248	CS92 - L70X7	sp1aRF/50	0,000	**-5,63**
S248	CS92 - L70X7	3-p/10	2,227	**18,13**
S249	CS85 - L60X8	sp1aLF/52	0,000	**-4,46**
S249	CS85 - L60X8	3-p/5	2,571	**20,34**
S250	CS88 - L60X6	3-p/5	1,250	**-19,28**
S250	CS88 - L60X6	sp1aLF/52	0,000	**3,66**
S252	CS91 - L150X15	3/22	0,000	**-472,15**
S252	CS91 - L150X15	sp1aRF/57	4,747	**52,69**
S253	CS40 - ISUA65/50/5	3-p/10	4,732	**37,46**
S253	CS40 - ISUA65/50/5	3/101	0,000	**67,66**
S254	CS4 - L50X5	1a-p/61	2,810	**28,81**
S254	CS4 - L50X5	3/9	0,000	**55,71**
S255	CS4 - L50X5	3/101	1,269	**-10,69**
S255	CS4 - L50X5	1a-p/37	0,000	**-5,84**
S256	CS40 - ISUA65/50/5	1a-p/2	2,898	**38,22**
S256	CS40 - ISUA65/50/5	3/72	0,000	**69,92**
S257	CS4 - L50X5	sp3RF/11	0,000	**-18,40**
S257	CS4 - L50X5	1a-p/2	1,616	**-3,32**
S258	CS34 - UNP120	1a-p/61	0,888	**63,61**
S258	CS34 - UNP120	3/14	0,000	**131,73**
S259	CS86 - L130X12	1a-p/53	0,000	**-207,93**
S259	CS86 - L130X12	sp1aLF/102	0,000	**257,48**
S260	CS4 - L50X5	sp1aLF-p/35	0,879	**0,77**
S260	CS4 - L50X5	3/9	0,000	**11,47**
S263	CS95 - L80X8	sp3RF-p/103	0,000	**-62,66**
S263	CS95 - L80X8	sp3LF/104	0,000	**36,02**
S264	CS95 - L80X8	sp3LF/3	0,000	**-31,71**
S264	CS95 - L80X8	sp3RF-p/12	0,000	**56,31**
S265	CS95 - L80X8	sp3RF-p/103	0,000	**-61,45**
S265	CS95 - L80X8	sp3LF/104	0,000	**35,35**
S266	CS95 - L80X8	sp3LF/32	0,000	**-36,31**
S266	CS95 - L80X8	sp3RF-p/28	0,000	**60,96**
S267	CS95 - L80X8	sp3RF-p/12	0,000	**-55,93**
S267	CS95 - L80X8	sp3LF/3	0,000	**32,30**
S268	CS43 - ISEA70/70/5	1a/21	2,192	**-1,37**
S268	CS43 - ISEA70/70/5	1a-p/53	0,000	**1,30**
S269	CS44 - UNP200	1a/21	0,000	**-300,17**
S269	CS44 - UNP200	sp1aLF-p/105	0,000	**39,03**
S270	CS36 - ISEA70/70/5	sp1aLF-p/48	0,000	**-33,63**
S270	CS36 - ISEA70/70/5	3/6	0,000	**217,19**
S273	CS94 - L60X8	sp1aLF/31	0,000	**-4,26**

Staaf	css	BG	dx [m]	N [kN]
S273	CS94 - L60X8	3-p/24	0,000	**57,38**
S274	CS94 - L60X8	sp1aLF-p/48	0,000	**-0,66**
S274	CS94 - L60X8	3/6	0,000	**34,81**
S275	CS94 - L60X8	sp1aLF/31	0,000	**-2,33**
S275	CS94 - L60X8	3-p/5	1,105	**23,23**
S278	CS94 - L60X8	3/6	0,000	**-60,03**
S278	CS94 - L60X8	sp1aLF-p/48	0,000	**0,71**
S279	CS94 - L60X8	3-p/5	0,000	**-33,93**
S279	CS94 - L60X8	sp1aLF/31	0,000	**3,20**
S280	CS94 - L60X8	3/6	0,000	**-24,55**
S280	CS94 - L60X8	sp1aLF-p/48	0,000	**1,18**
S282	CS44 - UNP200	3-p/41	0,461	**-9,98**
S282	CS44 - UNP200	sp3LF/42	0,000	**3,35**
S283	CS30 - UNP140	sp1aLF-p/44	1,594	**0,12**
S283	CS30 - UNP140	3/23	0,000	**26,00**
S284	CS94 - L60X8	3-p/5	0,000	**-44,90**
S284	CS94 - L60X8	sp1aLF/31	0,000	**2,54**
S285	CS94 - L60X8	sp1aLF/31	0,695	**-2,68**
S285	CS94 - L60X8	3-p/5	0,695	**44,91**
S286	CS30 - UNP140	1a-p/2	0,000	**-18,24**
S286	CS30 - UNP140	3/9	1,317	**64,68**
S287	CS43 - ISEA70/70/5	1a-p/17	0,000	**-0,57**
S287	CS43 - ISEA70/70/5	sp1aLF/52	0,000	**0,48**
S288	CS93 - L90X9	3/9	0,000	**-74,61**
S288	CS93 - L90X9	sp1aLF-p/35	3,988	**2,50**
S289	CS44 - UNP200	3/9	0,000	**-394,24**
S289	CS44 - UNP200	sp1aLF-p/49	2,943	**-26,67**
S290	CS95 - L80X8	3-p/5	0,000	**-36,69**
S290	CS95 - L80X8	sp1aRF/57	1,637	**11,42**
S291	CS95 - L80X8	sp1aRF/59	2,179	**-10,36**
S291	CS95 - L80X8	3-p/24	0,000	**38,74**
S292	CS95 - L80X8	3-p/41	0,000	**-36,67**
S292	CS95 - L80X8	sp1aRF/106	2,298	**7,68**
S293	CS4 - L50X5	sp3RF-p/62	0,000	**-18,54**
S293	CS4 - L50X5	sp3LF/85	0,000	**16,89**
S294	CS4 - L50X5	3-p/10	0,000	**-42,97**
S294	CS4 - L50X5	sp3RF-p/62	0,560	**17,88**
S295	CS44 - UNP200	3/23	0,000	**-392,55**
S295	CS44 - UNP200	sp1aRF-p/58	2,942	**-25,46**
S296	CS4 - L50X5	1a-p/17	1,778	**-1,44**
S296	CS4 - L50X5	1a/30	0,000	**2,07**
S297	CS4 - L50X5	1a/30	1,790	**-2,34**
S297	CS4 - L50X5	1a-p/17	0,000	**1,26**
S298	CS36 - ISEA70/70/5	3-p/5	0,000	**-203,15**
S298	CS36 - ISEA70/70/5	3/6	1,753	**209,61**
S299	CS44 - UNP200	sp3LF/85	1,753	**-27,30**
S299	CS44 - UNP200	sp3RF-p/62	1,753	**65,32**
S300	CS93 - L90X9	sp1aLF/45	0,000	**-18,75**
S300	CS93 - L90X9	1a/1	2,265	**123,54**
S301	CS92 - L70X7	3/9	0,000	**-15,78**
S301	CS92 - L70X7	sp1aLF-p/35	2,227	**-1,18**
S302	CS94 - L60X8	3/6	0,000	**-60,33**
S302	CS94 - L60X8	sp1aRF-p/56	0,369	**1,29**
S303	CS94 - L60X8	3-p/10	0,000	**-33,86**
S303	CS94 - L60X8	sp1aRF/57	1,094	**3,09**
S304	CS94 - L60X8	3/6	0,000	**-24,35**
S304	CS94 - L60X8	sp1aRF-p/56	0,000	**0,85**
S307	CS94 - L60X8	sp1aRF/57	0,000	**-5,06**
S307	CS94 - L60X8	3-p/10	0,000	**57,64**
S308	CS94 - L60X8	sp1aRF-p/56	0,000	**-1,02**
S308	CS94 - L60X8	3/6	2,188	**34,99**
S309	CS94 - L60X8	sp1aRF/57	0,000	**-2,27**
S309	CS94 - L60X8	3-p/5	0,000	**23,17**
S311	CS44 - UNP200	3-p/26	0,000	**-10,00**

Staaf	css	BG	dx [m]	N [kN]
S311	CS44 - UNP200	sp3RF/89	0,000	**3,37**
S312	CS30 - UNP140	sp1aLF-p/35	0,000	**0,06**
S312	CS30 - UNP140	3/9	2,391	**26,06**
S313	CS94 - L60X8	sp1aLF/52	0,000	**-2,52**
S313	CS94 - L60X8	3-p/5	0,000	**44,74**
S314	CS94 - L60X8	3-p/5	0,000	**-44,81**
S314	CS94 - L60X8	sp1aLF/52	0,927	**2,38**
S315	CS30 - UNP140	1a-p/37	1,317	**-15,69**
S315	CS30 - UNP140	3/23	0,000	**67,69**
S316	CS43 - ISEA70/70/5	1a-p/53	0,000	**-0,40**
S316	CS43 - ISEA70/70/5	sp3RF/89	3,013	**0,40**
S317	CS93 - L90X9	sp1aRF/50	0,000	**-10,02**
S317	CS93 - L90X9	3-p/26	2,901	**74,97**
S318	CS95 - L80X8	sp1aRF/59	2,456	**-9,95**
S318	CS95 - L80X8	3-p/24	0,000	**38,99**
S319	CS95 - L80X8	3-p/5	0,000	**-37,04**
S319	CS95 - L80X8	sp1aRF/57	0,000	**11,13**
S320	CS95 - L80X8	sp3RF/107	0,000	**-8,73**
S320	CS95 - L80X8	3-p/10	0,000	**33,31**
S321	CS43 - ISEA70/70/5	1a/20	0,000	**-1,44**
S321	CS43 - ISEA70/70/5	1a-p/19	3,507	**1,44**
S322	CS4 - L50X5	sp3LF-p/29	0,000	**-16,39**
S322	CS4 - L50X5	sp3RF/11	0,000	**15,84**
S323	CS4 - L50X5	sp3RF/11	0,000	**-14,57**
S323	CS4 - L50X5	sp3LF-p/29	0,000	**16,25**
S324	CS44 - UNP200	sp3LF-p/29	0,000	**-13,32**
S324	CS44 - UNP200	3-p/26	1,753	**51,84**
S328	CS25 - HFLue120x80x8	1a/21	0,000	**-264,28**
S328	CS25 - HFLue120x80x8	sp1aRF-p/78	1,544	**133,69**
S330	CS4 - L50X5	1a/1	0,864	**-9,65**
S330	CS4 - L50X5	sp1aRF-p/58	0,000	**1,94**
S331	CS92 - L70X7	sp1aRF/59	0,000	**-9,20**
S331	CS92 - L70X7	1a/1	2,231	**20,23**
S332	CS90 - L120X12	sp1aRF-p/78	0,000	**-179,18**
S332	CS90 - L120X12	1a/21	4,017	**282,84**
S333	CS85 - L60X8	1a/47	0,000	**-17,84**
S333	CS85 - L60X8	sp1aLF-p/35	2,571	**1,70**
S334	CS88 - L60X6	sp1aLF-p/35	1,250	**-1,73**
S334	CS88 - L60X6	1a/47	0,000	**13,63**
S335	CS88 - L60X6	sp1aRF-p/58	0,000	**-1,51**
S335	CS88 - L60X6	3/79	1,252	**10,70**
S336	CS84 - L100X8	3/6	0,000	**-64,18**
S336	CS84 - L100X8	sp1aLF-p/51	2,076	**-6,64**
S337	CS83 - L120X12	sp1aRF/59	2,382	**-48,23**
S337	CS83 - L120X12	3-p/24	0,000	**305,38**
S340	CS44 - UNP200	sp1aLF/52	1,462	**-28,50**
S340	CS44 - UNP200	3-p/5	1,462	**260,77**
S341	CS82 - L180X18	sp1aLF/45	0,000	**-285,99**
S341	CS82 - L180X18	1a-p/2	2,140	**1289,24**
S342	CS82 - L180X18	3/9	0,000	**-1423,00**
S342	CS82 - L180X18	sp1aLF-p/35	2,140	**160,33**
S343	CS12 - L50X5	sp3RF-p/62	0,000	**-0,35**
S343	CS12 - L50X5	3/14	0,000	**20,48**
S345	CS35 - L(ARC)150x150x14	sp1aLF-p/108	0,000	**-216,63**
S345	CS35 - L(ARC)150x150x14	1a/21	2,816	**253,51**
S346	CS35 - L(ARC)150x150x14	sp1aLF-p/108	0,000	**-199,78**
S346	CS35 - L(ARC)150x150x14	1a/21	2,825	**300,21**
S347	CS35 - L(ARC)150x150x14	sp1aRF-p/77	0,000	**-222,26**
S347	CS35 - L(ARC)150x150x14	1a/21	2,816	**245,00**

Staaf	css	BG	dx [m]	N [kN]
S349	CS35 - L(ARC)150x150x14	1a/21	0,000	**-264,73**
S349	CS35 - L(ARC)150x150x14	sp1aRF-p/78	2,816	**222,74**
S350	CS35 - L(ARC)150x150x14	1a/21	0,000	**-327,91**
S350	CS35 - L(ARC)150x150x14	sp1aRF-p/78	2,825	**195,30**
S351	CS35 - L(ARC)150x150x14	1a/20	0,000	**-256,13**
S351	CS35 - L(ARC)150x150x14	sp1aLF-p/73	2,816	**227,97**
S352	CS35 - L(ARC)150x150x14	1a/20	0,000	**-339,33**
S352	CS35 - L(ARC)150x150x14	sp1aLF-p/73	2,825	**199,53**
C1	CS2 - L200X24	1a/1	5,476	**-2322,88**
C1	CS2 - L200X24	sp1aLF-p/65	10,951	**327,60**
C2	CS2 - L200X24	1a/47	5,476	**-2310,57**
C2	CS2 - L200X24	sp1aLF-p/35	10,951	**321,31**
C4	CS2 - L200X24	sp1aLF/46	0,000	**-525,09**
C4	CS2 - L200X24	1a-p/37	10,951	**2104,69**
C3	CS2 - L200X24	sp1aLF/45	0,000	**-531,28**
C3	CS2 - L200X24	1a-p/2	10,951	**2117,60**
B9	CS3 - HFLeq150x150x12	3/9	6,146	**-517,18**
B9	CS3 - HFLeq150x150x12	sp1aRF-p/56	6,146	**56,01**
B14	CS3 - HFLeq150x150x12	sp1aLF/34	9,219	**-148,95**
B14	CS3 - HFLeq150x150x12	3-p/41	6,146	**419,58**
B16	CS3 - HFLeq150x150x12	sp1aRF/57	9,219	**-111,97**
B16	CS3 - HFLeq150x150x12	3-p/24	3,073	**464,00**
B18	CS3 - HFLeq150x150x12	sp1aRF/84	0,000	**-130,09**
B18	CS3 - HFLeq150x150x12	3-p/26	9,219	**416,78**
SB2	CS4 - L50X5	sp3LF/109	0,000	**-4,43**
SB2	CS4 - L50X5	sp3RF-p/110	0,000	**4,00**
SB5	CS4 - L50X5	sp3RF/111	0,000	**-4,70**
SB5	CS4 - L50X5	sp3LF-p/112	0,000	**3,59**
SB18	CS62 - L(CSN)60/6	1a/47	0,000	**-2,28**
SB18	CS62 - L(CSN)60/6	sp1aRF-p/113	0,000	**-1,12**
SB21	CS62 - L(CSN)60/6	sp1aLF/46	0,000	**-2,29**
SB21	CS62 - L(CSN)60/6	1a-p/37	0,000	**3,48**
SB34	CS61 - L(CSN)70/7	sp1aLF/31	0,000	**-2,82**
SB34	CS61 - L(CSN)70/7	1a-p/17	0,000	**-0,76**
SB37	CS61 - L(CSN)70/7	sp1aRF/59	0,000	**-3,00**
SB37	CS61 - L(CSN)70/7	sp3LF-p/114	0,000	**-1,28**
SB6	CS4 - L50X5	sp1aLF/52	0,000	**-1,81**
SB6	CS4 - L50X5	3-p/115	0,000	**14,16**
SB9	CS4 - L50X5	3/6	0,000	**-13,88**
SB9	CS4 - L50X5	sp1aLF-p/51	0,000	**1,13**
SB22	CS62 - L(CSN)60/6	sp1aLF/45	0,000	**-1,88**
SB22	CS62 - L(CSN)60/6	3-p/15	0,000	**0,02**
SB38	CS61 - L(CSN)70/7	sp1aLF/102	0,000	**-3,31**
SB38	CS61 - L(CSN)70/7	sp3RF-p/116	0,000	**-1,47**
SB41	CS61 - L(CSN)70/7	sp3RF/107	0,000	**-3,28**

Staaf	css	BG	dx [m]	N [kN]
SB41	CS61 - L(CSN)70/7	sp3LF-p/117	0,000	**-1,54**
SB25	CS62 - L(CSN)60/6	1a/1	0,000	**-5,97**
SB25	CS62 - L(CSN)60/6	sp1aLF-p/65	0,000	**-0,24**
SB10	CS4 - L50X5	sp3LF/118	0,000	**-4,68**
SB10	CS4 - L50X5	sp3RF-p/116	0,000	**3,91**
SB13	CS4 - L50X5	sp3RF/7	0,000	**-4,30**
SB13	CS4 - L50X5	sp3LF-p/8	0,000	**4,20**
SB26	CS62 - L(CSN)60/6	sp1aLF/54	0,000	**-2,09**
SB26	CS62 - L(CSN)60/6	1a-p/37	0,000	**-0,89**
SB29	CS62 - L(CSN)60/6	1a/47	0,000	**-6,07**
SB29	CS62 - L(CSN)60/6	sp1aLF-p/35	0,000	**-0,30**
SB42	CS61 - L(CSN)70/7	1a/18	0,000	**-3,71**
SB42	CS61 - L(CSN)70/7	sp1aRF-p/56	0,000	**-1,72**
SB45	CS61 - L(CSN)70/7	sp3RF/119	0,000	**-3,19**
SB45	CS61 - L(CSN)70/7	sp1aLF-p/44	0,000	**-1,44**
SB14	CS4 - L50X5	3/6	0,000	**-14,71**
SB14	CS4 - L50X5	sp1aLF-p/51	0,000	**1,20**
SB1	CS4 - L50X5	sp1aLF/52	0,000	**-1,69**
SB1	CS4 - L50X5	3-p/115	0,000	**13,30**
SB30	CS62 - L(CSN)60/6	3/23	0,000	**-3,11**
SB30	CS62 - L(CSN)60/6	sp1aLF-p/65	0,000	**-1,19**
SB17	CS62 - L(CSN)60/6	sp1aLF/45	0,000	**-2,25**
SB17	CS62 - L(CSN)60/6	1a-p/2	0,000	**3,47**
SB46	CS61 - L(CSN)70/7	sp3LF/109	0,000	**-3,46**
SB46	CS61 - L(CSN)70/7	sp1aRF-p/77	0,000	**-1,68**
SB33	CS61 - L(CSN)70/7	sp3RF/120	0,000	**-3,41**
SB33	CS61 - L(CSN)70/7	sp3LF-p/121	0,000	**-1,60**
SB16	CS59 - L(CSN)100/10	sp1aLF-p/51	0,000	**-0,88**
SB16	CS59 - L(CSN)100/10	3/22	2,712	**26,15**
SB32	CS60 - L(CSN)80/8	sp1aRF-p/122	0,000	**1,76**
SB32	CS60 - L(CSN)80/8	sp1aLF/102	3,003	**4,13**
SB48	CS60 - L(CSN)80/8	sp1aRF-p/77	0,000	**2,72**
SB48	CS60 - L(CSN)80/8	1a/47	3,533	**5,46**
SB15	CS59 - L(CSN)100/10	sp1aLF-p/35	0,000	**-3,63**
SB15	CS59 - L(CSN)100/10	1a/47	2,712	**21,86**
SB31	CS60 - L(CSN)80/8	3-p/10	0,000	**-0,92**
SB31	CS60 - L(CSN)80/8	sp1aLF/46	3,003	**3,98**
SB47	CS60 - L(CSN)80/8	sp1aLF-p/35	0,000	**2,30**
SB47	CS60 - L(CSN)80/8	3/27	3,533	**6,77**
SB12	CS59 - L(CSN)100/10	sp1aRF-p/58	0,000	**-3,27**
SB12	CS59 - L(CSN)100/10	1a/1	2,712	**11,41**
SB28	CS60 - L(CSN)80/8	3-p/5	0,000	**0,08**

Staaf	css	BG	dx [m]	N [kN]
SB28	CS60 - L(CSN)80/8	sp1aLF/52	3,003	**3,89**
SB44	CS60 - L(CSN)80/8	sp1aLF-p/51	0,000	**2,58**
SB44	CS60 - L(CSN)80/8	1a/18	3,533	**5,81**
SB11	CS59 - L(CSN)100/10	sp1aLF-p/65	0,000	**-3,43**
SB11	CS59 - L(CSN)100/10	3/16	2,712	**32,06**
SB27	CS60 - L(CSN)80/8	1a-p/2	0,000	**0,95**
SB27	CS60 - L(CSN)80/8	sp1aRF/59	3,003	**4,14**
SB43	CS60 - L(CSN)80/8	sp1aLF-p/65	0,000	**2,47**
SB43	CS60 - L(CSN)80/8	1a/1	3,533	**6,44**
SB8	CS59 - L(CSN)100/10	3-p/123	0,000	**-22,11**
SB8	CS59 - L(CSN)100/10	sp1aLF/46	2,712	**5,11**
SB24	CS60 - L(CSN)80/8	sp1aRF-p/77	0,000	**1,82**
SB24	CS60 - L(CSN)80/8	sp1aLF/124	3,003	**4,15**
SB40	CS60 - L(CSN)80/8	1a-p/37	0,000	**1,91**
SB40	CS60 - L(CSN)80/8	sp1aLF/102	3,533	**4,73**
SB7	CS59 - L(CSN)100/10	1a-p/37	0,000	**-18,97**
SB7	CS59 - L(CSN)100/10	sp1aLF/46	2,712	**6,17**
SB23	CS60 - L(CSN)80/8	sp1aLF-p/35	0,000	**1,96**
SB23	CS60 - L(CSN)80/8	3/9	3,003	**6,91**
SB39	CS60 - L(CSN)80/8	3-p/123	0,000	**-0,08**
SB39	CS60 - L(CSN)80/8	sp1aLF/46	3,533	**4,38**
SB4	CS59 - L(CSN)100/10	1a-p/2	0,000	**-7,10**
SB4	CS59 - L(CSN)100/10	sp1aLF/34	2,712	**7,66**
SB20	CS60 - L(CSN)80/8	sp1aLF-p/51	0,000	**2,16**
SB20	CS60 - L(CSN)80/8	3/6	3,003	**5,98**
SB36	CS60 - L(CSN)80/8	1a-p/17	0,000	**1,13**
SB36	CS60 - L(CSN)80/8	sp1aLF/52	3,533	**4,36**
SB3	CS59 - L(CSN)100/10	3-p/15	0,000	**-29,58**
SB3	CS59 - L(CSN)100/10	sp1aLF/45	2,712	**6,10**
SB19	CS60 - L(CSN)80/8	sp1aLF-p/44	0,000	**1,64**
SB19	CS60 - L(CSN)80/8	1a/1	3,003	**4,85**
SB35	CS60 - L(CSN)80/8	1a-p/2	0,000	**0,70**
SB35	CS60 - L(CSN)80/8	sp1aLF/45	3,533	**4,68**
B89	CS3 - HFLeq150x150x12	3/23	6,146	**-518,92**
B89	CS3 - HFLeq150x150x12	sp1aLF-p/48	6,146	**82,70**
B90	CS3 - HFLeq150x150x12	3/14	9,219	**-485,50**
B90	CS3 - HFLeq150x150x12	sp1aLF-p/73	3,073	**104,37**
B91	CS3 - HFLeq150x150x12	sp1aLF/31	9,219	**-138,96**

Staaf	css	BG	dx [m]	N [kN]
B91	CS3 - HFLeq150x150x12	3-p/10	3,073	**465,24**
B92	CS3 - HFLeq150x150x12	3/25	9,219	**-487,60**
B92	CS3 - HFLeq150x150x12	sp1aRF-p/78	3,073	**85,83**
C5	CS5 - HFLeq200x200x20	1a/1	0,000	**-2204,61**
C5	CS5 - HFLeq200x200x20	sp1aLF-p/65	3,374	**320,45**
C6	CS5 - HFLeq200x200x20	1a/47	0,000	**-2192,64**
C6	CS5 - HFLeq200x200x20	sp1aLF-p/35	3,374	**314,42**
C7	CS5 - HFLeq200x200x20	sp1aLF/46	0,000	**-481,88**
C7	CS5 - HFLeq200x200x20	1a-p/37	3,374	**2023,66**
C8	CS5 - HFLeq200x200x20	sp1aLF/45	0,000	**-488,01**
C8	CS5 - HFLeq200x200x20	1a-p/2	3,374	**2035,98**
B8	CS100 - L160X15	1a/1	0,000	**-665,70**
B8	CS100 - L160X15	sp1aLF-p/65	4,916	**78,04**
B10	CS100 - L160X15	1a/47	0,000	**-348,62**
B10	CS100 - L160X15	sp1aRF-p/113	4,916	**126,89**
B12	CS100 - L160X15	sp1aLF/46	0,000	**-132,56**
B12	CS100 - L160X15	1a-p/37	4,916	**599,53**
B93	CS100 - L160X15	1a/1	0,000	**-352,94**
B93	CS100 - L160X15	sp1aLF-p/44	4,916	**141,06**
SB49	CS63 - L(CSN)60/6	sp1aLF/45	0,000	**-14,46**
SB49	CS63 - L(CSN)60/6	1a-p/2	0,000	**3,46**
SB50	CS65 - L70X7	1a-p/2	0,000	**-5,12**
SB50	CS65 - L70X7	sp1aLF/45	2,621	**9,11**
SB51	CS63 - L(CSN)60/6	sp1aLF/46	0,000	**-14,42**
SB51	CS63 - L(CSN)60/6	1a-p/37	0,000	**3,29**
SB52	CS65 - L70X7	1a-p/37	0,000	**-5,00**
SB52	CS65 - L70X7	sp1aLF/46	2,621	**8,92**
SB53	CS63 - L(CSN)60/6	sp1aLF-p/35	0,000	**-1,21**
SB53	CS63 - L(CSN)60/6	1a/47	0,000	**16,16**
SB54	CS65 - L70X7	1a/47	0,000	**-14,88**
SB54	CS65 - L70X7	sp1aLF-p/35	2,621	**0,32**
SB55	CS63 - L(CSN)60/6	1a-p/2	0,000	**-13,32**
SB55	CS63 - L(CSN)60/6	sp1aLF/45	0,000	**4,20**
SB56	CS65 - L70X7	sp1aLF/45	0,000	**-4,75**
SB56	CS65 - L70X7	1a-p/2	2,621	**10,46**
SB57	CS63 - L(CSN)60/6	1a/1	0,000	**-23,84**
SB57	CS63 - L(CSN)60/6	sp1aLF-p/65	0,000	**-6,00**
SB58	CS65 - L70X7	sp1aLF-p/65	0,000	**2,64**
SB58	CS65 - L70X7	1a/1	2,621	**16,80**
SB59	CS63 - L(CSN)60/6	1a/47	0,000	**-23,69**
SB59	CS63 - L(CSN)60/6	sp1aLF-p/35	0,000	**-6,09**
SB60	CS65 - L70X7	sp1aLF-p/35	0,000	**2,64**
SB60	CS65 - L70X7	1a/47	2,621	**16,47**
SB61	CS63 - L(CSN)60/6	1a-p/37	0,000	**-13,25**
SB61	CS63 - L(CSN)60/6	sp1aLF/46	0,000	**4,24**
SB62	CS65 - L70X7	sp1aLF/46	0,000	**-4,66**
SB62	CS65 - L70X7	1a-p/37	2,621	**10,64**
SB63	CS63 - L(CSN)60/6	sp1aLF-p/65	0,000	**-1,24**

Staaf	css	BG	dx [m]	N [kN]
SB63	CS63 - L(CSN)60/6	1a/1	0,000	**16,21**
SB64	CS65 - L70X7	1a/1	0,000	**-14,93**
SB64	CS65 - L70X7	sp1aLF-p/65	2,621	**0,22**
B31	CS100 - L160X15	sp1aRF/59	2,458	**-193,64**
B31	CS100 - L160X15	1a-p/2	2,458	**294,96**
B32	CS100 - L160X15	sp1aLF/45	0,000	**-134,36**
B32	CS100 - L160X15	1a-p/2	4,916	**606,42**
B33	CS100 - L160X15	sp1aLF/54	2,458	**-204,07**
B33	CS100 - L160X15	1a-p/37	2,458	**295,82**
B34	CS100 - L160X15	1a/47	0,000	**-664,93**
B34	CS100 - L160X15	sp1aLF-p/35	4,916	**79,61**
C9	CS5 - HFLeq200x200x20	1a/1	1,768	**-2282,72**
C9	CS5 - HFLeq200x200x20	sp1aLF-p/65	3,536	**310,07**
C10	CS5 - HFLeq200x200x20	1a/47	1,768	**-2267,14**
C10	CS5 - HFLeq200x200x20	sp1aLF-p/35	3,536	**302,58**
C11	CS5 - HFLeq200x200x20	sp1aLF/46	0,000	**-467,97**
C11	CS5 - HFLeq200x200x20	1a-p/37	3,536	**2103,50**
C12	CS5 - HFLeq200x200x20	sp1aLF/45	0,000	**-474,27**
C12	CS5 - HFLeq200x200x20	1a-p/2	3,536	**2116,92**
B94	CS68 - ISUA150/90/10	sp3RF/11	7,240	**-223,26**
B94	CS68 - ISUA150/90/10	sp3LF-p/29	7,240	**200,27**
B95	CS68 - ISUA150/90/10	sp1aRF/59	2,514	**-87,64**
B95	CS68 - ISUA150/90/10	1a-p/2	2,514	**209,41**
B22	CS68 - ISUA150/90/10	sp3RF/89	5,028	**-193,82**
B22	CS68 - ISUA150/90/10	sp3LF/109	9,452	**212,09**
B26	CS68 - ISUA150/90/10	sp3RF/125	2,514	**-222,21**
B26	CS68 - ISUA150/90/10	sp1aLF-p/48	5,028	**92,75**
B30	CS80 - L60X6	sp1aLF-p/51	3,353	**1,86**
B30	CS80 - L60X6	3/6	0,000	**14,39**
B96	CS80 - L60X6	sp3LF/118	3,353	**-3,96**
B96	CS80 - L60X6	sp3RF-p/116	0,000	**2,17**
B97	CS80 - L60X6	3-p/5	2,980	**-7,06**
B97	CS80 - L60X6	sp1aLF/52	0,000	**5,35**
B35	CS80 - L60X6	sp3LF/109	3,353	**-3,99**
B35	CS80 - L60X6	sp3RF-p/110	0,000	**2,10**
SB65	CS67 - L60X6	sp1aRF-p/56	0,000	**4,00**
SB65	CS67 - L60X6	3/6	0,000	**29,40**
SB66	CS67 - L60X6	sp3LF/118	0,000	**-8,62**
SB66	CS67 - L60X6	sp3RF-p/116	0,000	**11,41**
SB67	CS67 - L60X6	sp3RF/111	0,000	**-12,51**
SB67	CS67 - L60X6	sp3LF-p/112	0,000	**6,84**
SB68	CS67 - L60X6	3-p/24	0,000	**-8,83**
SB68	CS67 - L60X6	sp1aRF/57	0,000	**16,57**
SB69	CS67 - L60X6	3-p/10	0,000	**-8,90**
SB69	CS67 - L60X6	sp1aLF/31	0,000	**17,67**
SB70	CS67 - L60X6	sp3LF/109	0,000	**-12,31**
SB70	CS67 - L60X6	sp3RF-p/110	0,000	**6,72**
SB71	CS67 - L60X6	sp3RF/7	0,000	**-8,38**
SB71	CS67 - L60X6	sp3LF-p/8	0,000	**11,23**
SB72	CS67 - L60X6	sp1aLF-p/48	0,000	**2,89**
SB72	CS67 - L60X6	3/6	0,000	**29,54**
SB73	CS66 - L60X6	3/6	0,000	**-21,32**
SB73	CS66 - L60X6	sp1aRF-p/56	2,356	**-2,32**
SB74	CS66 - L60X6	sp3RF-p/116	0,000	**-8,29**

Staaf	css	BG	dx [m]	N [kN]
SB74	CS66 - L60X6	sp3LF/118	2,356	**6,61**
SB75	CS66 - L60X6	sp1aLF-p/44	0,000	**-4,41**
SB75	CS66 - L60X6	sp3RF/111	2,356	**9,93**
SB76	CS66 - L60X6	sp1aRF/57	0,000	**-10,89**
SB76	CS66 - L60X6	3-p/24	2,356	**8,41**
SB77	CS66 - L60X6	sp1aLF/31	0,000	**-11,74**
SB77	CS66 - L60X6	3-p/10	2,356	**8,18**
SB78	CS66 - L60X6	sp3RF-p/110	0,000	**-4,25**
SB78	CS66 - L60X6	sp3LF/109	2,356	**9,82**
SB79	CS66 - L60X6	sp3LF-p/8	0,000	**-7,97**
SB79	CS66 - L60X6	sp3RF/7	2,356	**6,45**
SB80	CS66 - L60X6	3/6	0,000	**-21,72**
SB80	CS66 - L60X6	sp1aLF-p/48	2,356	**-1,48**
SB81	CS66 - L60X6	1a/47	0,000	**-19,64**
SB81	CS66 - L60X6	sp1aLF-p/35	2,360	**2,16**
SB82	CS67 - L60X6	sp1aLF-p/35	0,000	**-3,11**
SB82	CS67 - L60X6	3/9	0,000	**26,30**
SB83	CS66 - L60X6	1a/47	0,000	**-15,13**
SB83	CS66 - L60X6	sp1aLF-p/35	2,360	**1,52**
SB84	CS67 - L60X6	sp1aLF-p/35	0,000	**-2,60**
SB84	CS67 - L60X6	1a/47	0,000	**18,28**
SB85	CS66 - L60X6	sp1aLF/45	0,000	**-4,14**
SB85	CS66 - L60X6	1a-p/2	2,360	**13,15**
SB86	CS67 - L60X6	1a-p/2	0,000	**-16,47**
SB86	CS67 - L60X6	sp1aLF/45	0,000	**4,75**
SB87	CS66 - L60X6	sp1aLF/45	0,000	**-4,29**
SB87	CS66 - L60X6	1a-p/2	2,360	**17,49**
SB88	CS67 - L60X6	1a-p/2	0,000	**-24,51**
SB88	CS67 - L60X6	sp1aLF/45	0,000	**4,79**
SB89	CS66 - L60X6	sp1aLF/46	0,000	**-4,05**
SB89	CS66 - L60X6	1a-p/37	2,360	**17,40**
SB90	CS67 - L60X6	3-p/10	0,000	**-24,25**
SB90	CS67 - L60X6	sp1aLF/46	0,000	**4,71**
SB91	CS66 - L60X6	sp1aLF/46	0,000	**-4,31**
SB91	CS66 - L60X6	1a-p/37	2,360	**12,71**
SB92	CS67 - L60X6	1a-p/37	0,000	**-16,65**
SB92	CS67 - L60X6	sp1aLF/46	0,000	**4,70**
SB93	CS66 - L60X6	1a/1	0,000	**-15,41**
SB93	CS66 - L60X6	sp1aLF-p/65	2,360	**1,80**
SB94	CS67 - L60X6	sp1aLF-p/65	0,000	**-2,67**
SB94	CS67 - L60X6	1a/1	0,000	**18,43**
SB95	CS66 - L60X6	1a/1	0,000	**-19,89**
SB95	CS66 - L60X6	sp1aLF-p/65	2,360	**2,00**
SB96	CS67 - L60X6	sp1aLF-p/65	0,000	**-3,19**
SB96	CS67 - L60X6	3/23	0,000	**26,36**
B73	CS68 - ISUA150/90/10	1a/18	0,000	**-217,99**
B73	CS68 - ISUA150/90/10	sp1aRF-p/56	5,028	**77,61**
B74	CS68 - ISUA150/90/10	sp3LF/85	5,028	**-193,29**
B74	CS68 - ISUA150/90/10	sp3RF/111	9,452	**213,61**
B75	CS68 - ISUA150/90/10	sp1aLF/54	2,514	**-102,69**
B75	CS68 - ISUA150/90/10	sp3RF-p/28	5,028	**215,42**
B76	CS68 - ISUA150/90/10	sp3LF/3	7,240	**-221,26**
B76	CS68 - ISUA150/90/10	sp3RF-p/12	7,240	**198,39**
B77	CS80 - L60X6	sp1aLF-p/51	0,000	**1,81**
B77	CS80 - L60X6	3/6	2,980	**13,95**
B78	CS80 - L60X6	sp3RF/111	0,000	**-4,09**
B78	CS80 - L60X6	sp3LF-p/112	3,353	**1,72**
B79	CS80 - L60X6	3-p/5	0,000	**-6,96**
B79	CS80 - L60X6	sp1aLF/52	3,353	**5,20**
B80	CS80 - L60X6	sp3RF/7	0,000	**-4,00**
B80	CS80 - L60X6	sp3LF-p/8	3,353	**2,07**

Staaf	css	BG	dx [m]	N [kN]
C13	CS13 - HFLeq200x200x18	1a/1	1,784	**-1933,35**
C13	CS13 - HFLeq200x200x18	sp1aLF-p/65	6,648	**242,20**
C14	CS13 - HFLeq200x200x18	1a/47	1,784	**-1916,36**
C14	CS13 - HFLeq200x200x18	sp1aLF-p/35	6,648	**232,76**
C15	CS13 - HFLeq200x200x18	sp1aLF/46	0,000	**-399,17**
C15	CS13 - HFLeq200x200x18	1a-p/37	6,648	**1765,74**
C16	CS13 - HFLeq200x200x18	sp1aLF/45	0,000	**-402,98**
C16	CS13 - HFLeq200x200x18	1a-p/2	6,648	**1771,74**
B98	CS70 - ISUA150/90/10	sp3RF-p/12	6,807	**-252,96**
B98	CS70 - ISUA150/90/10	sp3LF/3	6,807	**261,40**
B99	CS70 - ISUA150/90/10	sp1aRF-p/56	2,377	**-74,27**
B99	CS70 - ISUA150/90/10	1a/18	6,807	**249,27**
B100	CS70 - ISUA150/90/10	sp3RF/111	4,755	**-250,12**
B100	CS70 - ISUA150/90/10	sp3LF-p/38	8,860	**244,00**
B101	CS70 - ISUA150/90/10	1a-p/17	0,000	**-247,59**
B101	CS70 - ISUA150/90/10	sp1aLF/31	6,807	**100,13**
B102	CS81 - L60X6	sp1aLF-p/51	2,920	**-1,29**
B102	CS81 - L60X6	3/6	0,000	**13,48**
B103	CS81 - L60X6	1a-p/19	2,920	**-3,47**
B103	CS81 - L60X6	1a/20	0,000	**2,91**
B104	CS81 - L60X6	3-p/5	2,920	**-13,04**
B104	CS81 - L60X6	sp1aLF/52	0,000	**1,54**
B105	CS81 - L60X6	1a-p/53	2,920	**-2,22**
B105	CS81 - L60X6	1a/21	0,000	**4,04**
SB97	CS69 - L50X5	sp1aLF-p/51	0,000	**-2,48**
SB97	CS69 - L50X5	3/6	0,000	**27,23**
SB98	CS69 - L50X5	sp1aLF-p/73	0,000	**-5,42**
SB98	CS69 - L50X5	1a/20	0,000	**9,65**
SB99	CS69 - L50X5	1a-p/19	0,000	**-7,84**
SB99	CS69 - L50X5	sp1aLF/34	0,000	**6,76**
SB100	CS69 - L50X5	3-p/5	0,000	**-25,74**
SB100	CS69 - L50X5	sp1aLF/52	0,000	**3,81**
SB101	CS69 - L50X5	3-p/5	0,000	**-25,74**
SB101	CS69 - L50X5	sp1aLF/52	0,000	**3,96**
SB102	CS69 - L50X5	1a-p/53	0,000	**-7,63**
SB102	CS69 - L50X5	sp1aRF/84	0,000	**6,77**
SB103	CS69 - L50X5	sp1aRF-p/78	0,000	**-5,18**
SB103	CS69 - L50X5	1a/21	0,000	**9,91**
SB104	CS69 - L50X5	sp1aLF-p/51	0,000	**-2,63**
SB104	CS69 - L50X5	3/6	0,000	**27,33**
SB105	CS71 - L60X6	3/6	0,000	**-21,44**
SB105	CS71 - L60X6	sp1aLF-p/51	2,231	**2,43**
SB106	CS71 - L60X6	1a/47	0,000	**-8,49**
SB106	CS71 - L60X6	sp1aLF-p/73	2,231	**4,44**
SB107	CS71 - L60X6	sp1aLF/34	0,000	**-4,76**
SB107	CS71 - L60X6	1a-p/19	2,231	**7,49**
SB108	CS71 - L60X6	sp1aLF/52	0,000	**-2,70**
SB108	CS71 - L60X6	3-p/5	2,231	**21,27**
SB109	CS71 - L60X6	sp1aLF/52	0,000	**-2,67**
SB109	CS71 - L60X6	3/22	2,231	**21,19**
SB110	CS71 - L60X6	sp1aRF/84	0,000	**-4,79**
SB110	CS71 - L60X6	1a-p/37	2,231	**7,57**
SB111	CS71 - L60X6	1a/21	0,000	**-8,22**
SB111	CS71 - L60X6	sp1aRF-p/78	2,231	**4,33**
SB112	CS71 - L60X6	3/6	0,000	**-21,86**

Staaf	css	BG	dx [m]	N [kN]
SB112	CS71 - L60X6	sp1aLF-p/48	2,231	**2,49**
SB113	CS71 - L60X6	3/9	0,000	**-19,69**
SB113	CS71 - L60X6	sp1aLF-p/35	2,190	**1,75**
SB114	CS69 - L50X5	sp1aLF-p/35	0,000	**-2,22**
SB114	CS69 - L50X5	3/9	0,000	**23,21**
SB115	CS71 - L60X6	1a/47	0,000	**-16,93**
SB115	CS71 - L60X6	sp1aLF-p/35	2,190	**1,89**
SB116	CS69 - L50X5	sp1aLF-p/35	0,000	**-2,70**
SB116	CS69 - L50X5	1a/47	0,000	**19,21**
SB117	CS71 - L60X6	sp1aLF/45	0,000	**-4,68**
SB117	CS71 - L60X6	1a-p/2	2,190	**14,95**
SB118	CS69 - L50X5	1a-p/2	0,000	**-17,12**
SB118	CS69 - L50X5	sp1aLF/45	0,000	**5,11**
SB119	CS71 - L60X6	sp1aLF/45	0,000	**-4,00**
SB119	CS71 - L60X6	3-p/24	2,190	**16,89**
SB120	CS69 - L50X5	3-p/24	0,000	**-21,13**
SB120	CS69 - L50X5	sp1aLF/45	0,000	**4,03**
SB121	CS71 - L60X6	sp1aLF/46	0,000	**-3,92**
SB121	CS71 - L60X6	3-p/10	2,190	**17,07**
SB122	CS69 - L50X5	3-p/10	0,000	**-20,90**
SB122	CS69 - L50X5	sp1aLF/46	0,000	**3,96**
SB123	CS71 - L60X6	sp1aLF/54	0,000	**-5,09**
SB123	CS71 - L60X6	1a-p/37	2,190	**14,63**
SB124	CS69 - L50X5	1a-p/37	0,000	**-17,44**
SB124	CS69 - L50X5	sp1aLF/54	0,000	**5,82**
SB125	CS71 - L60X6	1a/1	0,000	**-17,39**
SB125	CS71 - L60X6	sp1aLF-p/44	2,190	**2,46**
SB126	CS69 - L50X5	sp1aLF-p/44	0,000	**-3,56**
SB126	CS69 - L50X5	1a/1	0,000	**19,25**
SB127	CS71 - L60X6	3/23	0,000	**-19,60**
SB127	CS71 - L60X6	sp1aLF-p/65	2,190	**1,66**
SB128	CS69 - L50X5	sp1aLF-p/65	0,000	**-2,29**
SB128	CS69 - L50X5	3/23	0,000	**23,34**
B106	CS70 - ISUA150/90/10	1a-p/17	0,000	**-243,15**
B106	CS70 - ISUA150/90/10	sp1aRF/59	6,807	**81,61**
B107	CS70 - ISUA150/90/10	sp3LF/109	4,754	**-250,72**
B107	CS70 - ISUA150/90/10	sp3RF-p/62	8,859	**246,52**
B108	CS70 - ISUA150/90/10	sp1aLF-p/48	2,377	**-92,41**
B108	CS70 - ISUA150/90/10	1a/18	6,807	**252,19**
B109	CS70 - ISUA150/90/10	sp3LF-p/29	6,807	**-253,20**
B109	CS70 - ISUA150/90/10	sp3RF/11	6,807	**261,60**
B110	CS81 - L60X6	sp1aLF-p/51	0,000	**-1,36**
B110	CS81 - L60X6	3/6	2,920	**13,33**
B111	CS81 - L60X6	1a-p/19	0,000	**-2,56**
B111	CS81 - L60X6	1a/20	2,920	**3,62**
B112	CS81 - L60X6	3/22	0,000	**-13,15**
B112	CS81 - L60X6	sp1aLF-p/51	2,920	**1,46**
B113	CS81 - L60X6	1a-p/53	0,000	**-3,28**
B113	CS81 - L60X6	1a/21	2,920	**3,01**
C17	CS13 - HFLeq200x200x18	3/23	1,707	**-1402,83**
C17	CS13 - HFLeq200x200x18	sp1aLF-p/65	3,414	**151,34**
C18	CS13 - HFLeq200x200x18	3/9	1,707	**-1398,51**
C18	CS13 - HFLeq200x200x18	sp1aLF-p/35	3,414	**140,15**
C19	CS13 - HFLeq200x200x18	sp1aLF/46	0,000	**-279,63**
C19	CS13 - HFLeq200x200x18	3-p/10	3,414	**1264,79**
C20	CS13 - HFLeq200x200x18	sp1aLF/45	0,000	**-279,77**

Staaf	css	BG	dx [m]	N [kN]
C20	CS13 - HFLeq200x200x18	3-p/24	3,414	**1262,91**
B114	CS73 - L150X100X10	sp3LF/3	2,180	**-324,70**
B114	CS73 - L150X100X10	sp3RF-p/12	4,360	**293,38**
B115	CS73 - L150X100X10	3/9	0,000	**-302,39**
B115	CS73 - L150X100X10	sp1aRF-p/56	4,360	**83,73**
B116	CS73 - L150X100X10	sp3RF/89	2,180	**-288,91**
B116	CS73 - L150X100X10	sp3LF-p/38	4,360	**309,04**
B117	CS73 - L150X100X10	sp3RF/125	2,180	**-306,33**
B117	CS73 - L150X100X10	sp1aLF-p/48	4,360	**106,35**
SB129	CS20 - L50X5	sp1aLF-p/48	0,000	**-5,24**
SB129	CS20 - L50X5	3/6	0,000	**23,19**
SB130	CS72 - L60X6	3/6	0,000	**-20,13**
SB130	CS72 - L60X6	sp1aLF-p/48	2,050	**5,25**
SB131	CS20 - L50X5	sp1aRF-p/56	0,000	**-4,03**
SB131	CS20 - L50X5	3/6	0,000	**23,00**
SB132	CS72 - L60X6	3/6	0,000	**-19,74**
SB132	CS72 - L60X6	sp1aRF-p/56	2,050	**4,23**
SB133	CS20 - L50X5	sp1aLF-p/73	0,000	**-6,06**
SB133	CS20 - L50X5	sp3RF/11	0,000	**9,04**
SB134	CS72 - L60X6	sp3RF/11	0,000	**-7,36**
SB134	CS72 - L60X6	sp1aLF-p/73	2,049	**5,37**
SB135	CS20 - L50X5	sp3RF-p/62	0,000	**-6,79**
SB135	CS20 - L50X5	sp3LF/85	0,000	**7,82**
SB136	CS72 - L60X6	sp3LF/85	0,000	**-5,89**
SB136	CS72 - L60X6	sp3RF-p/62	2,050	**6,32**
SB137	CS20 - L50X5	3-p/5	0,000	**-21,02**
SB137	CS20 - L50X5	sp1aRF/57	1,250	**5,85**
SB138	CS72 - L60X6	sp1aRF/57	0,000	**-4,97**
SB138	CS72 - L60X6	3-p/5	2,050	**19,03**
SB139	CS20 - L50X5	3-p/5	0,000	**-20,98**
SB139	CS20 - L50X5	sp1aLF/31	1,250	**6,96**
SB140	CS72 - L60X6	sp1aLF/31	0,000	**-5,80**
SB140	CS72 - L60X6	3-p/5	2,050	**18,98**
SB141	CS20 - L50X5	sp3LF-p/38	0,000	**-6,86**
SB141	CS20 - L50X5	sp3RF/89	0,000	**7,90**
SB142	CS72 - L60X6	sp1aRF/84	0,000	**-6,10**
SB142	CS72 - L60X6	sp3LF-p/38	2,050	**6,32**
SB143	CS20 - L50X5	sp1aRF-p/78	0,000	**-6,07**
SB143	CS20 - L50X5	sp3LF/3	0,000	**9,25**
SB144	CS72 - L60X6	sp3LF/3	0,000	**-7,38**
SB144	CS72 - L60X6	sp1aRF-p/78	2,050	**5,45**
B36	CS73 - L150X100X10	sp3RF/11	2,180	**-325,89**
B36	CS73 - L150X100X10	sp3LF-p/29	4,360	**296,27**
B37	CS73 - L150X100X10	sp3LF/85	2,180	**-287,41**
B37	CS73 - L150X100X10	sp3RF-p/62	4,360	**308,72**
B38	CS73 - L150X100X10	sp1aRF/59	2,180	**-99,33**
B38	CS73 - L150X100X10	3-p/24	2,180	**290,69**
B39	CS73 - L150X100X10	sp1aLF/54	2,180	**-122,03**
B39	CS73 - L150X100X10	sp3RF-p/28	4,360	**298,94**
S355	CS82 - L180X18	sp1aLF/46	0,000	**-285,68**
S355	CS82 - L180X18	3-p/10	2,140	**1307,41**
S356	CS89 - L160X15	sp1aLF/34	0,000	**-184,79**
S356	CS89 - L160X15	3-p/24	2,141	**692,72**
S359	CS90 - L120X12	sp1aLF/45	0,000	**-57,77**

Staaf	css	BG	dx [m]	N [kN]
S359	CS90 - L120X12	3-p/24	2,220	**326,28**
S360	CS90 - L120X12	sp1aLF/45	0,000	**-58,19**
S360	CS90 - L120X12	3-p/24	2,135	**329,31**
S361	CS97 - L100X10	sp1aLF/54	0,000	**-13,64**
S361	CS97 - L100X10	3-p/5	0,970	**140,28**
S362	CS97 - L100X10	sp1aLF/46	0,000	**-7,58**
S362	CS97 - L100X10	3-p/10	1,591	**110,21**
S363	CS97 - L100X10	sp1aLF/46	0,000	**-4,12**
S363	CS97 - L100X10	3-p/10	1,611	**79,59**
S364	CS97 - L100X10	sp1aLF/46	0,000	**-2,51**
S364	CS97 - L100X10	3-p/10	1,613	**28,40**
S365	CS82 - L180X18	3/23	0,000	**-1395,54**
S365	CS82 - L180X18	sp1aLF-p/65	2,140	**173,17**
S366	CS89 - L160X15	3/9	0,000	**-843,83**
S366	CS89 - L160X15	sp1aLF-p/49	2,141	**56,18**
S367	CS89 - L160X15	3/9	0,000	**-870,37**
S367	CS89 - L160X15	sp1aLF-p/49	2,119	**66,55**
S368	CS89 - L160X15	3/23	0,000	**-702,80**
S368	CS89 - L160X15	sp1aLF-p/65	1,571	**30,25**
S369	CS89 - L160X15	3/23	0,000	**-662,07**
S369	CS89 - L160X15	sp1aLF-p/65	1,761	**50,57**
S370	CS90 - L120X12	3/9	0,000	**-349,50**
S370	CS90 - L120X12	sp1aLF-p/49	2,220	**32,24**
S371	CS90 - L120X12	3/9	0,000	**-356,39**
S371	CS90 - L120X12	sp1aLF-p/49	2,135	**32,76**
S372	CS97 - L100X10	3/25	0,000	**-180,84**
S372	CS97 - L100X10	sp3LF-p/38	0,970	**10,61**
S373	CS97 - L100X10	3/25	0,000	**-179,92**
S373	CS97 - L100X10	sp3LF-p/126	2,008	**11,81**
S374	CS97 - L100X10	3/25	0,000	**-148,78**
S374	CS97 - L100X10	sp3LF-p/38	1,591	**14,72**
S375	CS97 - L100X10	3/25	0,000	**-112,52**
S375	CS97 - L100X10	sp3LF-p/126	1,611	**13,66**
S376	CS97 - L100X10	3/25	0,000	**-64,31**
S376	CS97 - L100X10	sp3LF-p/126	1,613	**13,41**
S377	CS90 - L120X12	sp1aLF-p/73	0,000	**-121,35**
S377	CS90 - L120X12	1a/20	2,030	**261,34**
S378	CS90 - L120X12	1a-p/53	0,000	**-78,52**
S378	CS90 - L120X12	1a/21	2,206	**105,19**
S379	CS90 - L120X12	1a-p/19	0,000	**-212,82**
S379	CS90 - L120X12	sp1aLF/34	2,030	**152,66**
S380	CS90 - L120X12	1a-p/53	0,000	**-97,05**
S380	CS90 - L120X12	1a/21	2,205	**97,20**
S381	CS90 - L120X12	sp1aRF-p/78	0,000	**-119,06**
S381	CS90 - L120X12	1a/21	2,030	**275,21**
S382	CS90 - L120X12	1a-p/19	0,000	**-71,34**
S382	CS90 - L120X12	1a/47	2,206	**112,68**
S383	CS90 - L120X12	1a-p/53	0,000	**-201,51**
S383	CS90 - L120X12	sp1aRF/84	2,030	**160,12**
S384	CS90 - L120X12	1a-p/19	0,000	**-91,77**
S384	CS90 - L120X12	1a/20	2,205	**93,25**
S386	CS44 - UNP200	sp1aLF-p/94	0,000	**-59,20**
S386	CS44 - UNP200	1a/20	0,000	**260,80**
S387	CS44 - UNP200	sp1aRF-p/77	1,479	**-77,05**
S387	CS44 - UNP200	1a/20	0,000	**218,66**
S388	CS44 - UNP200	sp1aLF-p/65	0,352	**-56,78**
S388	CS44 - UNP200	1a/21	0,352	**231,49**
S389	CS44 - UNP200	sp1aLF-p/65	1,840	**-57,97**
S389	CS44 - UNP200	1a/21	0,000	**269,24**
S390	CS44 - UNP200	sp1aLF/45	0,000	**-67,27**
S390	CS44 - UNP200	1a-p/2	0,000	**307,28**
S391	CS44 - UNP200	sp1aLF/52	0,000	**-27,11**
S391	CS44 - UNP200	3-p/5	0,000	**258,10**
S392	CS44 - UNP200	sp1aLF/34	0,000	**-17,24**
S392	CS44 - UNP200	3-p/24	0,000	**221,32**
S393	CS44 - UNP200	sp1aLF/34	0,000	**-14,24**
S393	CS44 - UNP200	3-p/24	0,000	**148,66**

Staaf	css	BG	dx [m]	N [kN]
S394	CS44 - UNP200	sp4LF/127	0,000	**-10,52**
S394	CS44 - UNP200	3-p/15	0,000	**81,00**
S395	CS44 - UNP200	sp4LF/127	0,000	**-11,11**
S395	CS44 - UNP200	3-p/24	0,000	**9,32**
S385	CS44 - UNP200	sp1aLF/128	0,430	**-64,19**
S385	CS44 - UNP200	1a-p/37	0,000	**302,94**
S396	CS44 - UNP200	sp1aLF/52	0,000	**-27,12**
S396	CS44 - UNP200	3-p/5	0,731	**258,10**
S397	CS92 - L70X7	sp1aLF/52	2,227	**-1,39**
S397	CS92 - L70X7	3-p/5	0,000	**8,85**
S398	CS89 - L160X15	sp1aLF/34	2,119	**-192,45**
S398	CS89 - L160X15	3-p/24	0,000	**708,79**
S399	CS36 - ISEA70/70/5	3-p/5	0,000	**-198,25**
S399	CS36 - ISEA70/70/5	sp1aLF/31	0,000	**48,80**
S400	CS95 - L80X8	sp3LF/32	0,000	**-34,96**
S400	CS95 - L80X8	sp3RF-p/28	0,000	**60,25**
S401	CS93 - L90X9	sp1aLF/46	0,000	**-27,94**
S401	CS93 - L90X9	1a-p/37	2,366	**107,25**
S402	CS89 - L160X15	sp1aLF/46	0,000	**-130,65**
S402	CS89 - L160X15	3-p/10	1,570	**597,47**
S403	CS90 - L120X12	1a/20	0,000	**-223,89**
S403	CS90 - L120X12	sp1aRF-p/77	1,999	**193,00**
S404	CS91 - L150X15	sp1aRF/57	0,000	**-53,75**
S404	CS91 - L150X15	3-p/5	2,367	**456,03**
S405	CS83 - L120X12	3/22	2,382	**-322,84**
S405	CS83 - L120X12	sp1aRF-p/56	0,000	**36,39**
S408	CS89 - L160X15	sp1aRF/50	0,000	**-182,80**
S408	CS89 - L160X15	3-p/10	2,119	**691,07**
S409	CS89 - L160X15	sp1aLF/45	0,000	**-125,82**
S409	CS89 - L160X15	3-p/24	1,571	**581,96**
S410	CS89 - L160X15	sp1aLF/45	0,000	**-117,59**
S410	CS89 - L160X15	3-p/24	1,760	**585,30**
S411	CS90 - L120X12	sp1aRF/50	0,000	**-53,22**
S411	CS90 - L120X12	3-p/10	2,221	**315,20**
S412	CS90 - L120X12	sp1aRF/50	0,000	**-53,94**
S412	CS90 - L120X12	3-p/26	2,135	**321,86**
S413	CS97 - L100X10	sp1aRF/59	0,000	**-14,12**
S413	CS97 - L100X10	3-p/5	0,970	**140,42**
S414	CS97 - L100X10	sp1aLF/52	0,000	**-12,68**
S414	CS97 - L100X10	3-p/5	2,008	**141,92**
S415	CS97 - L100X10	sp1aRF/59	0,000	**-8,00**
S415	CS97 - L100X10	3-p/24	1,591	**110,19**
S416	CS97 - L100X10	sp4LF/129	0,000	**-5,46**
S416	CS97 - L100X10	3-p/24	1,611	**78,97**
S417	CS97 - L100X10	sp4LF/129	0,000	**-4,39**
S417	CS97 - L100X10	3-p/24	1,613	**27,85**
S418	CS82 - L180X18	3/9	0,000	**-1419,73**
S418	CS82 - L180X18	sp1aLF-p/35	2,140	**161,97**
S419	CS89 - L160X15	3/23	0,000	**-869,02**
S419	CS89 - L160X15	sp1aRF-p/58	2,141	**61,82**
S420	CS89 - L160X15	3/23	0,000	**-882,81**
S420	CS89 - L160X15	sp1aRF-p/58	2,119	**69,33**
S421	CS89 - L160X15	3/9	0,000	**-713,37**
S421	CS89 - L160X15	sp1aLF-p/35	1,571	**24,91**
S422	CS89 - L160X15	3/9	0,000	**-677,93**
S422	CS89 - L160X15	sp1aLF-p/35	1,761	**44,96**
S423	CS90 - L120X12	3/23	0,000	**-359,99**
S423	CS90 - L120X12	sp1aRF-p/58	2,220	**30,36**
S424	CS90 - L120X12	3/23	0,000	**-362,77**
S424	CS90 - L120X12	sp1aLF-p/65	2,135	**30,93**
S425	CS97 - L100X10	3/14	0,000	**-180,97**
S425	CS97 - L100X10	sp3RF-p/62	0,970	**11,24**
S426	CS97 - L100X10	3/14	0,000	**-179,50**
S426	CS97 - L100X10	sp3RF-p/62	2,008	**12,17**
S427	CS97 - L100X10	3/14	0,000	**-149,25**
S427	CS97 - L100X10	sp3LF-p/130	1,591	**14,89**

Staaf	css	BG	dx [m]	N [kN]
S428	CS97 - L100X10	3/14	0,000	**-114,62**
S428	CS97 - L100X10	sp3LF-p/130	1,611	**14,19**
S429	CS97 - L100X10	3/14	0,000	**-66,60**
S429	CS97 - L100X10	sp3LF-p/130	1,613	**13,97**
S430	CS37 - HFLeq75x75x8	1a-p/19	0,000	**-8,45**
S430	CS37 - HFLeq75x75x8	1a/20	0,000	**15,80**
S431	CS82 - L180X18	sp1aLF/45	0,000	**-283,24**
S431	CS82 - L180X18	1a-p/2	2,140	**1283,16**
S432	CS89 - L160X15	sp1aRF/50	0,000	**-172,51**
S432	CS89 - L160X15	3-p/10	2,141	**666,20**
S433	CS90 - L120X12	1a/20	0,000	**-224,69**
S433	CS90 - L120X12	sp1aRF-p/77	2,019	**192,59**
S434	CS83 - L120X12	3/9	2,383	**-304,00**
S434	CS83 - L120X12	sp1aRF-p/56	0,000	**34,27**
S435	CS91 - L150X15	sp1aRF/57	0,000	**-59,18**
S435	CS91 - L150X15	3-p/5	2,380	**472,63**
S436	CS35 - L(ARC)150x150x14	sp1aRF/84	2,825	**-208,31**
S436	CS35 - L(ARC)150x150x14	1a/20	0,000	**309,49**
S437	CS101 - UNP140	sp1aLF-p/105	0,000	**-40,61**
S437	CS101 - UNP140	1a/21	0,000	**130,41**
S438	CS101 - UNP140	1a-p/37	0,000	**-116,00**
S438	CS101 - UNP140	1a/36	0,000	**67,41**
S439	CS101 - UNP140	1a-p/37	0,000	**-164,97**
S439	CS101 - UNP140	sp1aLF/46	0,000	**55,44**
S440	CS101 - UNP140	1a-p/17	0,000	**-127,89**
S440	CS101 - UNP140	sp1aLF/52	0,000	**40,01**
S441	CS101 - UNP140	1a-p/17	0,000	**-129,09**
S441	CS101 - UNP140	sp1aLF/52	0,000	**40,87**
S442	CS101 - UNP140	1a-p/17	0,000	**-129,17**
S442	CS101 - UNP140	sp1aLF/52	0,000	**40,91**
S443	CS101 - UNP140	1a-p/17	0,000	**-128,04**
S443	CS101 - UNP140	sp1aLF/52	0,000	**40,09**
S444	CS101 - UNP140	1a-p/2	0,000	**-170,71**
S444	CS101 - UNP140	sp1aLF/45	0,000	**57,89**
S445	CS101 - UNP140	1a-p/2	0,000	**-120,02**
S445	CS101 - UNP140	1a/33	0,000	**71,90**
S446	CS101 - UNP140	sp1aLF-p/73	0,000	**-42,94**
S446	CS101 - UNP140	1a/33	0,000	**126,29**
S447	CS101 - UNP140	sp1aLF/128	0,000	**-43,58**
S447	CS101 - UNP140	1a-p/53	0,000	**159,40**
S448	CS4 - L50X5	sp1aLF-p/69	2,810	**5,75**
S448	CS4 - L50X5	4/98	0,000	**14,07**
S449	CS22 - HFLeq60x60x6	1a/18	0,941	**-0,44**
S449	CS22 - HFLeq60x60x6	1a-p/55	0,000	**0,42**
S450	CS4 - L50X5	1a/47	0,000	**-2,82**
S450	CS4 - L50X5	sp1aLF-p/49	0,000	**0,64**
S451	CS90 - L120X12	sp1aLF-p/73	0,000	**-182,13**
S451	CS90 - L120X12	1a/20	2,019	**249,92**
S452	CS90 - L120X12	sp1aLF-p/73	0,000	**-181,62**
S452	CS90 - L120X12	1a/20	1,998	**250,37**
S453	CS4 - L50X5	sp1aLF/34	0,000	**-2,93**
S453	CS4 - L50X5	1a-p/2	0,000	**7,63**
S454	CS90 - L120X12	1a/21	0,000	**-249,87**
S454	CS90 - L120X12	sp1aLF-p/108	2,019	**186,00**
S455	CS90 - L120X12	1a/21	0,000	**-248,78**
S455	CS90 - L120X12	sp1aLF/71	1,998	**186,32**
S456	CS7 - L50X5	sp1aLF-p/35	0,000	**-0,86**
S456	CS7 - L50X5	3/14	2,179	**10,05**
S457	CS25 - HFLue120x80x8	sp1aLF/71	1,544	**-153,87**
S457	CS25 - HFLue120x80x8	1a-p/19	0,000	**231,99**
S458	CS92 - L70X7	sp1aLF-p/49	2,231	**-13,22**

Staaf	css	BG	dx [m]	N [kN]
S458	CS92 - L70X7	1a/47	0,000	**40,97**
S459	CS92 - L70X7	1a-p/2	2,231	**-21,75**
S459	CS92 - L70X7	sp1aLF/34	0,000	**11,43**
S460	CS84 - L100X8	3/6	2,076	**-83,68**
S460	CS84 - L100X8	sp1aLF-p/51	0,000	**-6,02**
S461	CS4 - L50X5	1a-p/37	0,000	**-8,21**
S461	CS4 - L50X5	sp1aRF/84	1,503	**4,60**
S462	CS4 - L50X5	sp1aRF-p/58	0,000	**-3,23**
S462	CS4 - L50X5	1a/1	1,503	**10,83**
S463	CS4 - L50X5	1a-p/2	0,000	**-8,44**
S463	CS4 - L50X5	sp1aLF/34	1,503	**4,16**
S464	CS4 - L50X5	sp1aLF-p/73	0,000	**-2,25**
S464	CS4 - L50X5	1a/47	1,503	**10,76**
S465	CS93 - L90X9	sp1aLF/34	3,263	**-9,96**
S465	CS93 - L90X9	3-p/24	0,000	**77,75**
S466	CS93 - L90X9	3/23	0,000	**-77,71**
S466	CS93 - L90X9	sp1aLF-p/65	0,000	**2,40**
B7	CS75 - L150X14	1a/1	0,000	**-322,32**
B7	CS75 - L150X14	sp1aLF-p/65	0,000	**38,66**
B118	CS75 - L150X14	1a/47	0,000	**-311,89**
B118	CS75 - L150X14	1a-p/2	3,800	**285,38**
B119	CS75 - L150X14	sp1aLF/45	0,000	**-76,54**
B119	CS75 - L150X14	1a-p/2	0,000	**284,03**
B120	CS75 - L150X14	1a/1	3,800	**-312,62**
B120	CS75 - L150X14	1a-p/37	0,000	**284,26**
B11	CS39 - ISEA130/130/10	sp1aLF/46	0,000	**-22,09**
B11	CS39 - ISEA130/130/10	1a-p/37	0,000	**90,37**
B121	CS39 - ISEA130/130/10	sp1aLF/45	0,000	**-22,60**
B121	CS39 - ISEA130/130/10	1a-p/2	0,000	**91,65**
B13	CS39 - ISEA130/130/10	1a/47	0,000	**-99,72**
B13	CS39 - ISEA130/130/10	sp1aLF-p/35	0,000	**13,74**
B122	CS39 - ISEA130/130/10	1a/1	0,000	**-100,50**
B122	CS39 - ISEA130/130/10	sp1aLF-p/65	0,000	**13,95**
B123	CS46 - ISEA70/70/5	sp3LF/32	0,000	**-1,35**
B123	CS46 - ISEA70/70/5	sp3RF-p/4	3,800	**-0,79**
B17	CS46 - ISEA70/70/5	3/23	0,000	**-1,54**
B17	CS46 - ISEA70/70/5	sp3RF-p/131	0,000	**-1,04**
B124	CS46 - ISEA70/70/5	sp3LF/3	0,000	**-1,69**
B124	CS46 - ISEA70/70/5	sp3RF-p/28	0,000	**-1,16**
B129	CS79 - L100X12	sp3RF/89	0,000	**-65,39**
B129	CS79 - L100X12	sp3LF-p/38	0,000	**63,31**
B130	CS79 - L100X12	sp3LF/85	0,000	**-65,70**
B130	CS79 - L100X12	sp3RF-p/62	0,000	**63,33**
B131	CS79 - L100X12	sp3RF/11	0,000	**-68,26**
B131	CS79 - L100X12	sp3LF-p/29	0,000	**66,36**
B132	CS79 - L100X12	sp3LF/3	0,000	**-68,13**
B132	CS79 - L100X12	sp3RF-p/12	0,000	**66,69**
B133	CS77 - L60X8	sp3LF/13	0,000	**-2,25**
B133	CS77 - L60X8	sp3RF-p/4	2,500	**-1,13**
B134	CS77 - L60X8	sp3RF-p/4	0,000	**0,69**
B134	CS77 - L60X8	3/14	0,000	**1,29**
B135	CS77 - L60X8	sp3RF-p/4	0,000	**0,56**
B135	CS77 - L60X8	sp3LF/13	0,000	**1,12**
S467	CS78 - L150X14	3/9	0,000	**-556,83**
S467	CS78 - L150X14	sp1aLF-p/35	0,000	**63,85**
S468	CS78 - L150X14	3/23	0,000	**-555,71**

Staaf	css	BG	dx [m]	N [kN]
S468	CS78 - L150X14	sp1aLF-p/65	0,000	**69,49**
S469	CS78 - L150X14	sp1aLF-p/65	0,000	**-6,78**
S469	CS78 - L150X14	1a/1	0,000	**46,39**
S470	CS78 - L150X14	1a-p/37	0,000	**-43,42**
S470	CS78 - L150X14	sp1aLF/46	0,000	**10,99**
S471	CS78 - L150X14	sp1aLF/46	0,000	**-113,37**
S471	CS78 - L150X14	3-p/10	0,000	**512,92**
S472	CS78 - L150X14	sp1aLF/45	0,000	**-114,09**
S472	CS78 - L150X14	1a-p/2	0,000	**510,54**
S473	CS78 - L150X14	1a-p/2	0,000	**-43,21**
S473	CS78 - L150X14	sp1aLF/45	0,000	**10,33**
S474	CS78 - L150X14	sp1aLF-p/35	0,000	**-7,03**
S474	CS78 - L150X14	1a/47	0,000	**46,30**
S475	CS51 - L70X7	sp3LF/3	0,000	**-19,03**
S475	CS51 - L70X7	sp3RF-p/12	0,000	**18,68**
S476	CS51 - L70X7	sp3LF/3	0,000	**-19,04**
S476	CS51 - L70X7	sp3RF-p/12	0,000	**18,75**
S477	CS51 - L70X7	sp3RF/7	0,000	**-19,11**
S477	CS51 - L70X7	sp3LF-p/8	0,000	**18,61**
S478	CS51 - L70X7	sp3RF/7	0,000	**-18,92**
S478	CS51 - L70X7	sp3LF-p/8	0,000	**18,78**
S479	CS83 - L120X12	sp1aRF/59	2,382	**-47,33**
S479	CS83 - L120X12	3-p/24	0,000	**317,27**
S480	CS83 - L120X12	sp1aLF/54	2,382	**-72,21**
S480	CS83 - L120X12	3-p/10	0,000	**318,35**
S481	CS83 - L120X12	3/16	2,382	**-321,87**
S481	CS83 - L120X12	sp1aLF-p/44	0,000	**62,85**
S482	CS21 - ISUA65/50/6	1a-p/2	0,000	**-6,03**
S482	CS21 - ISUA65/50/6	1a/33	1,726	**11,62**
S483	CS21 - ISUA65/50/6	3-p/41	1,726	**-22,77**
S483	CS21 - ISUA65/50/6	3/14	1,726	**37,98**
S484	CS21 - ISUA65/50/6	1a-p/37	0,000	**-5,57**
S484	CS21 - ISUA65/50/6	1a/36	1,726	**10,32**
S485	CS21 - ISUA65/50/6	3-p/26	5,177	**-22,95**
S485	CS21 - ISUA65/50/6	3/25	1,726	**37,07**
S486	CS97 - L100X10	sp1aLF/52	0,000	**-11,91**
S486	CS97 - L100X10	3-p/5	2,008	**141,22**
S487	CS89 - L160X15	sp1aLF/46	0,000	**-122,67**
S487	CS89 - L160X15	3-p/10	1,761	**602,21**
S488	CS86 - L130X12	sp1aLF-p/108	0,000	**-161,82**
S488	CS86 - L130X12	1a/21	0,000	**285,79**
S489	CS86 - L130X12	sp1aLF-p/66	0,000	**3,72**
S489	CS86 - L130X12	3/132	0,000	**66,77**
S490	CS86 - L130X12	3-p/133	0,000	**-18,81**
S490	CS86 - L130X12	sp3LF/134	0,000	**63,41**
S491	CS86 - L130X12	1a-p/19	0,000	**-219,74**
S491	CS86 - L130X12	sp3RF/11	0,000	**253,78**
S492	CS44 - UNP200	3/14	0,000	**-384,07**
S492	CS44 - UNP200	sp1aLF-p/94	1,720	**40,15**
S493	CS44 - UNP200	1a/21	2,195	**-265,70**
S493	CS44 - UNP200	sp1aRF-p/78	1,837	**75,78**
S494	CS101 - UNP140	1a-p/53	0,000	**-122,41**
S494	CS101 - UNP140	1a/21	0,000	**64,03**
S495	CS101 - UNP140	1a-p/39	2,855	**-73,04**
S495	CS101 - UNP140	1a/1	2,498	**223,05**
S496	CS101 - UNP140	1a-p/61	0,000	**-65,19**
S496	CS101 - UNP140	1a/47	1,604	**214,54**
S497	CS101 - UNP140	3/25	0,000	**-200,25**
S497	CS101 - UNP140	sp1aLF-p/105	0,000	**26,13**
S498	CS101 - UNP140	1a-p/19	0,000	**-127,42**
S498	CS101 - UNP140	1a/47	1,964	**136,75**

Staaf	css	BG	dx [m]	N [kN]
S499	CS97 - L100X10	1a/1	0,000	**-66,48**
S499	CS97 - L100X10	1a-p/39	0,000	**27,34**
S500	CS97 - L100X10	1a-p/37	0,000	**-109,48**
S500	CS97 - L100X10	1a/21	0,389	**94,05**
S501	CS97 - L100X10	1a/47	1,488	**-63,29**
S501	CS97 - L100X10	1a-p/61	0,000	**24,14**
S502	CS97 - L100X10	sp3LF/90	0,000	**-50,21**
S502	CS97 - L100X10	1a-p/37	0,000	**44,21**
S503	CS97 - L100X10	1a-p/39	0,000	**-69,38**
S503	CS97 - L100X10	1a/21	0,000	**148,80**
S504	CS97 - L100X10	1a/33	0,000	**-55,00**
S504	CS97 - L100X10	1a-p/2	0,000	**47,35**
S505	CS30 - UNP140	1a/18	0,000	**-1,50**
S505	CS30 - UNP140	1a-p/55	1,300	**1,50**
S508	CS30 - UNP140	sp1aLF-p/105	0,000	**-0,34**
S508	CS30 - UNP140	3/101	0,000	**44,86**
S509	CS36 - ISEA70/70/5	sp1aRF/50	0,000	**-1,96**
S509	CS36 - ISEA70/70/5	3-p/26	0,000	**52,17**
S510	CS36 - ISEA70/70/5	3/14	0,000	**-42,10**
S510	CS36 - ISEA70/70/5	sp1aRF-p/113	0,950	**0,89**
S511	CS30 - UNP140	sp1aLF-p/73	0,000	**-0,33**
S511	CS30 - UNP140	3/72	0,400	**44,85**
S512	CS30 - UNP140	1a/18	0,000	**-1,50**
S512	CS30 - UNP140	1a-p/55	1,300	**1,50**
S513	CS36 - ISEA70/70/5	sp1aLF/34	0,000	**-1,95**
S513	CS36 - ISEA70/70/5	3-p/41	0,000	**52,20**
S514	CS36 - ISEA70/70/5	3/25	0,000	**-42,07**
S514	CS36 - ISEA70/70/5	sp1aLF-p/44	0,000	**0,90**
S515	CS52 - UNP280	sp1aLF-p/51	3,582	**-36,53**
S515	CS52 - UNP280	3/6	3,582	**503,31**
S516	CS52 - UNP280	1a-p/53	0,000	**-105,28**
S516	CS52 - UNP280	1a/21	0,000	**158,74**
S517	CS52 - UNP280	1a-p/19	0,000	**-110,69**
S517	CS52 - UNP280	1a/33	0,000	**153,51**
S518	CS52 - UNP280	1a/47	0,000	**-24,28**
S518	CS52 - UNP280	1a-p/61	0,000	**21,78**
S519	CS52 - UNP280	1a/33	0,000	**-24,29**
S519	CS52 - UNP280	1a-p/2	0,000	**21,79**
S523	CS52 - UNP280	1a/1	0,000	**-25,55**
S523	CS52 - UNP280	1a-p/39	0,000	**23,05**
S524	CS52 - UNP280	1a/36	0,000	**-25,56**
S524	CS52 - UNP280	1a-p/37	0,000	**23,05**
S525	CS52 - UNP280	3-p/5	3,582	**-453,91**
S525	CS52 - UNP280	sp1aLF/52	3,582	**81,84**
S526	CS59 - L(CSN)100/10	sp1aRF-p/78	0,000	**-10,97**
S526	CS59 - L(CSN)100/10	sp1aLF/102	0,000	**11,91**
S527	CS59 - L(CSN)100/10	sp1aLF-p/73	0,000	**-10,99**
S527	CS59 - L(CSN)100/10	sp1aRF/106	0,000	**11,91**
S528	CS59 - L(CSN)100/10	sp1aRF-p/77	0,000	**-10,51**
S528	CS59 - L(CSN)100/10	sp1aLF/71	0,000	**11,71**
S529	CS59 - L(CSN)100/10	sp1aLF-p/108	0,000	**-10,52**
S529	CS59 - L(CSN)100/10	sp1aRF/84	0,000	**11,71**
S530	CS59 - L(CSN)100/10	1a-p/19	0,000	**1,00**
S530	CS59 - L(CSN)100/10	3/9	0,000	**1,60**

Staaf	css	BG	dx [m]	N [kN]
S531	CS59 - L(CSN)100/10	1a-p/53	0,000	**-18,23**
S531	CS59 - L(CSN)100/10	1a/21	0,000	**18,39**
S532	CS59 - L(CSN)100/10	1a-p/19	0,000	**-18,24**
S532	CS59 - L(CSN)100/10	1a/20	0,000	**18,39**
S533	CS59 - L(CSN)100/10	3/9	0,000	**-0,27**
S533	CS59 - L(CSN)100/10	1a-p/19	0,000	**-0,12**
S535	CS59 - L(CSN)100/10	1a-p/55	0,000	**-19,68**
S535	CS59 - L(CSN)100/10	1a/18	0,000	**24,65**
S536	CS59 - L(CSN)100/10	1a-p/17	0,000	**-19,67**
S536	CS59 - L(CSN)100/10	1a/30	0,000	**24,66**
S537	CS59 - L(CSN)100/10	1a-p/17	0,000	**-21,98**
S537	CS59 - L(CSN)100/10	1a/30	0,746	**26,18**
S538	CS59 - L(CSN)100/10	1a-p/55	0,000	**-21,20**
S538	CS59 - L(CSN)100/10	1a/18	0,373	**26,96**
S541	CS57 - HEA280	1a/33	0,000	**-11,24**
S541	CS57 - HEA280	1a-p/2	0,000	**6,07**
S542	CS57 - HEA280	1a/47	0,000	**-11,24**
S542	CS57 - HEA280	1a-p/61	0,000	**6,06**
S545	CS57 - HEA280	1a/36	0,000	**-11,14**
S545	CS57 - HEA280	1a-p/37	0,000	**5,97**
S546	CS57 - HEA280	1a/1	0,000	**-11,14**
S546	CS57 - HEA280	1a-p/39	0,000	**5,97**
S547	CS44 - UNP200	3/25	0,000	**-394,89**
S547	CS44 - UNP200	sp1aLF-p/65	0,860	**0,93**
S548	CS38 - HFLeq80x80x8	sp1aLF-p/48	0,799	**-0,38**
S548	CS38 - HFLeq80x80x8	3/23	0,000	**38,13**
S549	CS38 - HFLeq80x80x8	3/6	0,000	**-36,33**
S549	CS38 - HFLeq80x80x8	sp1aLF-p/48	0,000	**0,86**
S550	CS38 - HFLeq80x80x8	sp1aLF/31	0,931	**-3,13**
S550	CS38 - HFLeq80x80x8	3-p/24	0,000	**62,06**
S551	CS38 - HFLeq80x80x8	sp1aRF-p/113	0,799	**0,02**
S551	CS38 - HFLeq80x80x8	3/9	0,000	**37,95**
S552	CS38 - HFLeq80x80x8	3/6	0,000	**-36,84**
S552	CS38 - HFLeq80x80x8	sp1aRF-p/56	0,931	**1,78**
S553	CS38 - HFLeq80x80x8	sp1aRF/57	0,000	**-3,68**
S553	CS38 - HFLeq80x80x8	3-p/10	0,000	**62,24**
S554	CS53 - L60X6	sp1aLF/45	0,000	**-0,76**
S554	CS53 - L60X6	1a-p/2	0,000	**0,69**
S555	CS53 - L60X6	sp1aLF/46	0,000	**-0,75**
S555	CS53 - L60X6	1a-p/37	0,000	**0,72**
S556	CS53 - L60X6	1a/1	0,000	**-1,70**
S556	CS53 - L60X6	sp1aLF-p/65	0,000	**-0,24**

Staaf	css	BG	dx [m]	N [kN]
S557	CS53 - L60X6	1a/47	0,000	**-1,72**
S557	CS53 - L60X6	sp1aLF-p/35	0,000	**-0,24**
S558	CS54 - L60X6	sp3LF/3	0,000	**-1,29**
S558	CS54 - L60X6	sp3RF-p/12	0,000	**0,45**
S559	CS54 - L60X6	sp1aLF/52	0,000	**-0,78**
S559	CS54 - L60X6	3-p/115	0,000	**2,37**
S560	CS54 - L60X6	sp3LF/85	0,000	**-1,33**
S560	CS54 - L60X6	sp3RF-p/62	0,000	**0,35**
S561	CS54 - L60X6	3/6	0,000	**-3,27**
S561	CS54 - L60X6	sp1aLF-p/51	0,000	**-0,11**
S562	CS55 - L50X5	3/27	0,000	**-8,49**
S562	CS55 - L50X5	sp1aLF-p/35	0,000	**1,14**
S563	CS55 - L50X5	1a/1	0,000	**-5,48**
S563	CS55 - L50X5	sp1aLF-p/65	0,000	**1,24**
S564	CS55 - L50X5	sp1aLF/46	0,000	**-1,32**
S564	CS55 - L50X5	3-p/123	0,000	**8,40**
S565	CS55 - L50X5	sp1aLF/45	0,000	**-1,39**
S565	CS55 - L50X5	1a-p/2	0,000	**5,28**
S566	CS56 - L70X7	3/9	5,577	**-1,84**
S566	CS56 - L70X7	sp1aLF/46	0,000	**0,23**
S567	CS56 - L70X7	sp1aLF/46	4,503	**-0,31**
S567	CS56 - L70X7	1a/47	0,000	**1,48**
S568	CS56 - L70X7	3/6	3,613	**-14,42**
S568	CS56 - L70X7	sp1aLF-p/51	0,000	**1,16**
S569	CS56 - L70X7	1a/1	5,577	**-0,88**
S569	CS56 - L70X7	sp1aLF/34	0,000	**0,37**
S570	CS56 - L70X7	sp1aLF/34	4,503	**-0,42**
S570	CS56 - L70X7	1a/1	0,000	**0,78**
S571	CS56 - L70X7	sp1aRF/135	3,613	**-4,83**
S571	CS56 - L70X7	sp1aLF-p/44	0,000	**3,97**
S572	CS56 - L70X7	sp1aLF/46	5,577	**-0,41**
S572	CS56 - L70X7	3/27	0,000	**1,64**
S573	CS56 - L70X7	1a/47	4,503	**-1,40**
S573	CS56 - L70X7	sp1aLF/46	0,000	**0,37**
S574	CS56 - L70X7	sp1aLF/52	3,613	**-2,38**
S574	CS56 - L70X7	3-p/5	0,000	**13,07**
S575	CS56 - L70X7	sp1aRF/59	5,577	**-0,52**
S575	CS56 - L70X7	1a/1	0,000	**0,72**
S576	CS56 - L70X7	1a/1	4,503	**-0,75**
S576	CS56 - L70X7	sp1aRF/59	0,000	**0,44**
S577	CS56 - L70X7	sp3RF/11	3,613	**-5,28**
S577	CS56 - L70X7	sp1aLF-p/73	0,000	**3,66**
S578	CS4 - L50X5	sp1aLF/34	0,000	**-2,50**
S578	CS4 - L50X5	3-p/24	0,000	**66,46**
S579	CS4 - L50X5	3-p/24	0,000	**-42,24**
S579	CS4 - L50X5	sp1aLF/34	0,280	**1,59**
S580	CS98 - L50X6	sp1aRF/57	0,541	**-6,32**
S580	CS98 - L50X6	3-p/5	0,000	**82,90**
S581	CS98 - L50X6	1a-p/2	0,000	**-55,06**
S581	CS98 - L50X6	sp1aRF/59	0,000	**9,51**
S582	CS98 - L50X6	sp1aLF/31	0,000	**-6,32**
S582	CS98 - L50X6	3-p/5	0,000	**83,21**
S583	CS98 - L50X6	1a-p/37	0,000	**-54,00**
S583	CS98 - L50X6	sp1aLF/54	0,000	**9,67**
S584	CS94 - L60X8	sp1aLF-p/51	0,000	**-1,77**
S584	CS94 - L60X8	3/27	0,000	**81,83**
S585	CS94 - L60X8	3/27	0,000	**-49,50**
S585	CS94 - L60X8	sp1aLF-p/51	0,000	**1,03**
S586	CS94 - L60X8	sp1aLF-p/48	0,000	**-1,56**
S586	CS94 - L60X8	3/16	0,000	**81,69**
S587	CS94 - L60X8	3/23	0,000	**-49,37**
S587	CS94 - L60X8	sp1aLF-p/48	0,401	**0,89**

11.2. Reacties

Lineaire berekening, Extreem : Knoop
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn1/N1	sp1aLF-p/65	**-76,87**	**-80,86**	**-327,12**	0,00	0,00	0,00
Sn1/N1	1a/1	**659,95**	**462,90**	**2455,41**	0,00	0,00	0,00
Sn1/N1	1a/136	444,46	242,05	1565,28	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/47	**-657,74**	**459,70**	**2442,93**	0,00	0,00	0,00
Sn2/N3	sp1aLF-p/35	**76,93**	**-78,47**	**-321,34**	0,00	0,00	0,00
Sn2/N3	1a/136	-444,47	241,87	1565,30	**0,00**	**0,00**	**0,00**
Sn3/N7	sp1aLF/45	**-155,70**	**-161,01**	**636,08**	0,00	0,00	0,00
Sn3/N7	1a-p/2	**577,96**	**385,26**	**-2144,46**	0,00	0,00	0,00
Sn3/N7	1a/136	353,02	151,43	-1211,06	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/37	**-572,96**	**384,65**	**-2131,58**	0,00	0,00	0,00
Sn4/N6	sp1aLF/46	**154,37**	**-159,93**	**630,15**	0,00	0,00	0,00
Sn4/N6	1a/136	-353,02	151,25	-1211,04	**0,00**	**0,00**	**0,00**

11.3. Resultante op Fundering

Lineaire berekening, Extreem : Nee
Selectie : Alle
Klasse : All UGT

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aLF-p/65	Sn1/N1	Rx	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Rx	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
sp1aLF-p/65	Sn1/N1	Ry	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Ry	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
sp1aLF-p/65	Sn1/N1	Rz	111,56	345,62	1,45	-2,93	-76,87	-80,86	-327,12
1a/1	Sn1/N1	Rz	806,11	2584,34	170,05	3,05	659,95	462,90	2455,41
1a/47	Sn2/N3	Rx	658,24	950,92	-137,23	1,04	-657,74	25,62	686,27
sp1aLF-p/35	Sn2/N3	Rx	275,61	1107,16	118,79	3,89	76,93	264,66	1072,30
sp1aLF-p/69	Sn2/N3	Ry	246,49	404,99	-116,44	-1,30	-233,67	-78,47	-321,34
1a/36	Sn2/N3	Ry	513,51	2496,31	161,46	4,76	-228,85	459,70	2442,93
sp1aLF-p/69	Sn2/N3	Rz	246,49	404,99	-116,44	-1,30	-233,67	-78,47	-321,34
1a/36	Sn2/N3	Rz	513,51	2496,31	161,46	4,76	-228,85	459,70	2442,93
sp1aLF/45	Sn3/N7	Rx	223,98	801,72	-179,04	-3,44	-155,70	-161,01	-769,80
1a-p/2	Sn3/N7	Rx	694,59	784,32	-11,31	-0,52	577,96	385,26	-364,28
sp1aLF/45	Sn3/N7	Ry	223,98	801,72	-179,04	-3,44	-155,70	-161,01	-769,80
1a-p/2	Sn3/N7	Ry	694,59	784,32	-11,31	-0,52	577,96	385,26	-364,28
1a-p/39	Sn3/N7	Rz	161,79	2150,56	-66,67	-13,25	150,36	-59,74	-2144,46
sp1aLF/137	Sn3/N7	Rz	243,07	680,94	5,62	2,62	154,23	187,88	636,08
1a-p/37	Sn4/N6	Rx	575,87	2208,00	50,76	-3,70	-572,96	-57,84	-2131,58
sp1aLF/46	Sn4/N6	Rx	178,12	654,84	-105,07	3,54	154,37	88,87	630,15
sp1aLF/124	Sn4/N6	Ry	300,34	825,75	77,17	-2,56	-254,22	-159,93	-769,19
1a-p/61	Sn4/N6	Ry	413,93	559,00	-23,32	-0,91	-152,91	384,65	-375,69
1a-p/37	Sn4/N6	Rz	575,87	2208,00	50,76	-3,70	-572,96	-57,84	-2131,58
sp1aLF/46	Sn4/N6	Rz	178,12	654,84	-105,07	3,54	154,37	88,87	630,15

11.4. Controle rand tafelconstructie

11.4.1. Controle rand tafelconstructie UNP

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - randen tafelconstr
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S525	**7,163 m**	**UNP280**	**S 355**	**3/22**	**0,72 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	355,0	MPa
Uiterste sterkte fu	490,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	22,00
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	39,11

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,67
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,56

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp
Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-447,68	kN
Vy,Ed	0,18	kN
Vz,Ed	3,05	kN
T,Ed	0,00	kNm
My,Ed	-13,30	kNm
Mz,Ed	-0,41	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	5,3300e-03	m^2
Nc,Rd	1892,15	kN
Eenheidscontrole	0,24	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,0	MPa
Tau,Rd	205,0	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.
Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	2,8500e-03	m^2
Vpl,y,Rd	584,13	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	2,8550e-03	m^2
Vpl,z,Rd	585,16	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	5,3200e-04	m^3
Mpl,y,Rd	188,86	kNm
Eenheidscontrole	0,07	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	1,1083e-04	m^3
Mpl,z,Rd	39,35	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	1892,15	kN
Mpl,y,Rd	188,86	kNm

Mpl,z,Rd	39,35	kNm

Eenheidscontrole (6.2) = 0,24 + 0,07 + 0,01 = 0,32 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	22,00
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	39,11

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,67
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,56

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	7.163	3.582	m
lef/lsys k	0.82	0.78	
Kniklengte Lcr	5.909	2.786	m
Kritische Euler belastingen Ncr	3727.42	1065.39	kN
Slankheid	54.44	101.83	
Relatieve slankheid Lambda	0.71	1.33	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.72	0.38	
Knikweerstand Nb,Rd	1356.57	710.14	kN

Tabel van waarden		
A	5.3300e-03	m^2
Knikweerstand Nb,Rd	710.14	kN
Eenheidscontrole	0.63	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	3.582	m
Ncr,T	2192.11	kN
Ncr,TF	1831.79	kN
Relatieve slankheid Lambda,T	1.02	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	5.3300e-03	m^2
Reductie factor Chi	0.53	
Knikweerstand Nb,Rd	1003.81	kN
Eenheidscontrole	0.45	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	4.4800e-04	m^3
Elastisch critisch moment Mcr	218.06	kNm
Relatieve slankheid Lambda,LT	0.85	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	3.582	m
k	1.00	
kw	1.00	
C1	1.46	
C2	0.04	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.651	
kyz	0.551	
kzy	0.934	
kzz	0.551	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	5.3300e-03	m^2
Wy	4.4800e-04	m^3
Wz	5.7200e-05	m^3
NRk	1892.15	kN
My,Rk	159.04	kNm
Mz,Rk	20.31	kNm
My,Ed	-13.30	kNm
Mz,Ed	-0.41	kNm
Interactie Methode 2		
Psi y	0.992	
Psi z	-0.552	
Cmy	0.570	
Cmz	0.400	
CmLT	0.728	

Eenheidscontrole (6.61) = 0.33 + 0.05 + 0.01 = 0.40
Eenheidscontrole (6.62) = 0.63 + 0.08 + 0.01 = 0.72

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	25.000

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.4.2. Controle rand tafelconstructie HEA

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - zijranden tafelconstr
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S542	3,582 m	HEA280	S 355	1a/20	0,08 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	355,0	MPa
Uiterste sterkte fu	490,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	24,50
Grenswaarde klasse 1	57,57
Grenswaarde klasse 2	66,30
Grenswaarde klasse 3	92,92

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	8,62
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,28

=> Uitkragende flenzen klasse 3
=> Doorsnede geclassificeerd als klasse 3 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-8,24	kN
Vy,Ed	0,19	kN
Vz,Ed	-5,60	kN
T,Ed	0,00	kNm
My,Ed	26,96	kNm
Mz,Ed	-0,69	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	9,7300e-03	m^2
Nc,Rd	3454,15	kN
Eenheidscontrole	0,00	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,0	MPa
Tau,Rd	205,0	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	7,5360e-03	m^2
Vpl,y,Rd	1544,57	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	3,1780e-03	m^2
Vpl,z,Rd	651,36	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,y,min	1,0100e-03	m^3
Mel,y,Rd	358,55	kNm
Eenheidscontrole	0,08	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,z,min	3,4000e-04	m^3
Mel,z,Rd	120,70	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.9.2 en formule (6.42)

Normaalspanningen		
Vezel	13	
Sigma,N,Ed	0,8	MPa
Sigma,My,Ed	26,6	MPa
Sigma,Mz,Ed	2,0	MPa
Sigma,tot,Ed	29,5	MPa
Eenheidscontrole	0,08	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m

Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	24,50
Grenswaarde klasse 1	57,57
Grenswaarde klasse 2	66,30
Grenswaarde klasse 3	92,92

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	8,62
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,28

=> Uitkragende flenzen klasse 3
=> Doorsnede geclassificeerd als klasse 3 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	7.163	3.582	m
lef/lsys k	1.00	1.00	
Kniklengte Lcr	7.163	3.581	m
Kritische Euler belastingen Ncr	5534.10	7695.40	kN
Slankheid	60.37	51.19	
Relatieve slankheid Lambda	0.79	0.67	
Limiet slankheid Lambda,0	0.20	0.20	

De slankheid of de normaalkracht is van die aard dat een Buigingsknikcontrole niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.1.2(4)

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.0100e-03	m^3
Elastisch critisch moment Mcr	1908.70	kNm
Relatieve slankheid Lambda,LT	0.43	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	3.582	m
k	1.00	
kw	1.00	
C1	1.63	
C2	0.04	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.901	
kyz	0.601	
kzy	0.721	
kzz	0.601	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	9.7300e-03	m^2
Wy	1.0100e-03	m^3
Wz	3.4000e-04	m^3
NRk	3454.15	kN
My,Rk	358.55	kNm
Mz,Rk	120.70	kNm
My,Ed	26.96	kNm
Mz,Ed	-0.69	kNm
Interactie Methode 2		
Psi y	1.000	
Psi z	0.000	
Cmy	0.900	
Cmz	0.600	
CmLT	0.651	

Eenheidscontrole (6.61) = 0.00 + 0.07 + 0.00 = 0.07
Eenheidscontrole (6.62) = 0.00 + 0.05 + 0.00 = 0.06

Plooicontrole

in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	30.500

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5. Controle UNP profilen

11.5.1. Traverse 3,4 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - traverse 3,4 - onderrand
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S195	**3,073 m**	**UNP140**	**S 355**	**3/25**	**0,51 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	355,0	MPa
Uiterste sterkte fu	490,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	14,29
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	39,65

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,30
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,66

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp
Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-171,57	kN
Vy,Ed	0,06	kN
Vz,Ed	1,52	kN
T,Ed	-0,01	kNm
My,Ed	-3,20	kNm
Mz,Ed	-0,14	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,0400e-03	m^2
Nc,Rd	724,20	kN
Eenheidscontrole	0,24	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	2,3	MPa
Tau,Rd	205,0	MPa
Eenheidscontrole	0,01	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.
Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	245,95	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	207,01	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	36,49	kNm
Eenheidscontrole	0,09	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	10,05	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	724,20	kN
Mpl,y,Rd	36,49	kNm
Mpl,z,Rd	10,05	kNm

Eenheidscontrole (6.2) = 0,24 + 0,09 + 0,01 = 0,34 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	14,29
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	39,65

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,30
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,66

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	3.073	1.220	m
lef/lsys k	0.98	0.65	
Kniklengte Lcr	3.016	0.795	m
Kritische Euler belastingen Ncr	1378.33	2058.64	kN
Slankheid	55.39	45.32	
Relatieve slankheid Lambda	0.72	0.59	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.71	0.79	
Knikweerstand Nb,Rd	513.64	571.73	kN

Tabel van waarden		
A	2.0400e-03	m^2
Knikweerstand Nb,Rd	513.64	kN
Eenheidscontrole	0.33	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.220	m
Ncr,T	1601.13	kN
Ncr,TF	952.15	kN
Relatieve slankheid Lambda,T	0.87	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.0400e-03	m^2
Reductie factor Chi	0.62	
Knikweerstand Nb,Rd	446.87	kN
Eenheidscontrole	0.38	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	

Kip Parameters		
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	109.70	kNm
Relatieve slankheid Lambda,LT	0.53	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.220	m
k	1.00	
kw	1.00	
C1	1.35	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.565	
kyz	0.881	
kzy	0.984	
kzz	0.881	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.0400e-03	m^2
Wy	8.6400e-05	m^3
Wz	1.4800e-05	m^3
NRk	724.20	kN
My,Rk	30.67	kNm
Mz,Rk	5.25	kNm
My,Ed	-3.20	kNm
Mz,Ed	-0.14	kNm
Interactie Methode 2		
Psi y	-0.020	
Psi z	0.491	
Cmy	0.493	
Cmz	0.796	
CmLT	0.822	

Eenheidscontrole (6.61) = 0.33 + 0.06 + 0.02 = 0.42

Eenheidscontrole (6.62) = 0.38 + 0.10 + 0.02 = 0.51

Plooicontrole

in knikveld 1

Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

EC 3

11.5.2. Traverse 3,4 - Staaf S505,512,508,511

Lineaire berekening, Extreem : Doorsnede

Selectie : Benoemde selectie - traverse 3,4 - staaf S505,512,508,511

Klasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S505	**1,300 m**	**UNP140**	**S 235**	**1a/21**	**0,51 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	0,00	kN
Vy,Ed	-1,50	kN
Vz,Ed	1,49	kN

Interne krachten	Berekende	Eenheid
T,Ed	0,00	kNm
My,Ed	-1,75	kNm
Mz,Ed	1,95	kNm

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	162,81	kN
Eenheidscontrole	0,01	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	137,03	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	24,16	kNm
Eenheidscontrole	0,07	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	6,65	kNm
Eenheidscontrole	0,29	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	479,40	kN
Mpl,y,Rd	24,16	kNm
Mpl,z,Rd	6,65	kNm

Eenheidscontrole (6.2) = 0,00 + 0,07 + 0,29 = 0,37 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	136.39	kNm
Relatieve slankheid Lambda,LT	0.39	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.300	m
k	1.00	
kw	1.00	
C1	1.83	
C2	0.02	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.661	
kyz	0.760	
kzy	1.000	
kzz	0.760	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.0400e-03	m^2
Wy	8.6400e-05	m^3
Wz	1.4800e-05	m^3
NRk	479.40	kN
My,Rk	20.30	kNm

Tabel van waarden		
Mz,Rk	3.48	kNm
My,Ed	-1.75	kNm
Mz,Ed	1.95	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.661	
Cmz	0.760	
CmLT	0.661	

Eenheidscontrole (6.61) = 0.00 + 0.06 + 0.43 = 0.48
Eenheidscontrole (6.62) = 0.00 + 0.09 + 0.43 = 0.51

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.3. Vak 19,18,17,16 - onderrand voorvlak

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 9,13,14 - onderrand voorvlak
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S547	**1,720 m**	**UNP200**	**S 235**	**1a/21**	**0,85 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	49,70

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,94

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-379,48	kN
Vy,Ed	-0,34	kN
Vz,Ed	4,95	kN
T,Ed	0,00	kNm
My,Ed	-6,94	kNm
Mz,Ed	0,39	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	3,2200e-03	m^2
Nc,Rd	756,70	kN

Eenheidscontrole	0,50	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,3	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,02	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,13	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,03	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,50 + 0,13 + 0,03 = 0,66 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m

Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	49,70

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,94

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	1.720	1.720	m
lef/lsys k	0.89	0.60	
Kniklengte Lcr	1.523	1.035	m
Kritische Euler belastingen Ncr	17070.51	2862.57	kN

Knikparameters	yy	zz	
Slankheid	19.77	48.28	
Relatieve slankheid Lambda	0.21	0.51	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.99	0.84	
Knikweerstand Nb,Rd	752.63	631.88	kN

Tabel van waarden		
A	3.2200e-03	m^2
Knikweerstand Nb,Rd	631.88	kN
Eenheidscontrole	0.60	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.720	m
Ncr,T	2048.86	kN
Ncr,TF	1987.07	kN
Relatieve slankheid Lambda,T	0.62	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	3.2200e-03	m^2
Reductie factor Chi	0.78	
Knikweerstand Nb,Rd	586.60	kN
Eenheidscontrole	0.65	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	265.18	kNm
Relatieve slankheid Lambda,LT	0.41	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	1.99	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.558	
kyz	0.908	
kzy	0.944	
kzz	0.908	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	3.2200e-03	m^2
Wy	1.9100e-04	m^3
Wz	2.7000e-05	m^3
NRk	756.70	kN
My,Rk	44.88	kNm
Mz,Rk	6.35	kNm
My,Ed	-6.94	kNm
Mz,Ed	0.39	kNm
Interactie Methode 2		
Psi y	-0.150	
Psi z	-0.464	
Cmy	0.525	
Cmz	0.766	
CmLT	0.525	

Eenheidscontrole (6.61) = 0.50 + 0.09 + 0.06 = 0.65
Eenheidscontrole (6.62) = 0.65 + 0.15 + 0.06 = 0.85

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.4. Vak 19,18,17,16 - onderrand achtervlak

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 19,18,17,19 - onderrand achtervlak
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S442	**2,145 m**	**UNP140**	**S 355**	**1a-p/17**	**0,47 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	355,0	MPa
Uiterste sterkte fu	490,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	14,29
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	37,74

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,30
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,21

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-129,17	kN
Vy,Ed	-0,09	kN
Vz,Ed	1,03	kN
T,Ed	0,00	kNm
My,Ed	-1,26	kNm
Mz,Ed	0,01	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	2,0400e-03	m^2
Nc,Rd	724,20	kN
Eenheidscontrole	0,18	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,0	MPa
Tau,Rd	205,0	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	245,95	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	207,01	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	36,49	kNm
Eenheidscontrole	0,03	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	10,05	kNm
Eenheidscontrole	0,00	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	724,20	kN
Mpl,y,Rd	36,49	kNm
Mpl,z,Rd	10,05	kNm

Eenheidscontrole (6.2) = 0,18 + 0,03 + 0,00 = 0,21 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	14,29
Grenswaarde klasse 1	26,85
Grenswaarde klasse 2	30,92
Grenswaarde klasse 3	37,74

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,30
Grenswaarde klasse 1	7,32
Grenswaarde klasse 2	8,14
Grenswaarde klasse 3	11,21

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	2.498	2.145	m
lef/lsys k	0.98	0.73	
Kniklengte Lcr	2.443	1.571	m
Kritische Euler belastingen Ncr	2100.88	526.62	kN
Slankheid	44.86	89.60	
Relatieve slankheid Lambda	0.59	1.17	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.79	0.45	
Knikweerstand Nb,Rd	574.28	323.73	kN

Tabel van waarden		
A	2.0400e-03	m^2
Knikweerstand Nb,Rd	323.73	kN
Eenheidscontrole	0.40	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	2.145	m
Ncr,T	1181.68	kN
Ncr,TF	945.58	kN
Relatieve slankheid Lambda,T	0.88	
Limiet slankheid Lambda,0	0.20	

Tabel van waarden		
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.0400e-03	m^2
Reductie factor Chi	0.62	
Knikweerstand Nb,Rd	445.51	kN
Eenheidscontrole	0.29	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	99.41	kNm
Relatieve slankheid Lambda,LT	0.56	
Relatieve slankheid Lambda,T	0.44	
Relatieve slankheid Lambda,EXTRA	1.00	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	2.145	m
k	1.00	
kw	1.00	
C1	2.51	
C2	0.06	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.432	
kyz	1.032	
kzy	0.867	
kzz	1.032	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.0400e-03	m^2
Wy	8.6400e-05	m^3
Wz	1.4800e-05	m^3
NRk	724.20	kN
My,Rk	30.67	kNm
Mz,Rk	5.25	kNm
My,Ed	-1.26	kNm
Mz,Ed	-0.19	kNm
Interactie Methode 2		
Psi y	-0.528	
Psi z	-0.045	
Cmy	0.400	
Cmz	0.833	
CmLT	0.400	

Eenheidscontrole (6.61) = 0.22 + 0.02 + 0.04 = 0.28
Eenheidscontrole (6.62) = 0.40 + 0.04 + 0.04 = 0.47

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.5. Vak 19,18,17,16 - staaf S280,188

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 19.18,17,16- staaf S280,188
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S188	**2,163 m**	**UNP140**	**S 235**	**1a/1**	**0,06 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 1.081 m

Interne krachten	Berekende	Eenheid
N,Ed	28,27	kN
Vy,Ed	0,00	kN
Vz,Ed	0,00	kN
T,Ed	0,00	kNm
My,Ed	0,13	kNm
Mz,Ed	0,00	kNm

Trekcontrole
Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	2,0400e-03	m^2
Npl,Rd	479,40	kN
Nu,Rd	528,77	kN
Nt,Rd	479,40	kN
Eenheidscontrole	0,06	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	24,16	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	479,40	kN
Mpl,y,Rd	24,16	kNm
Mpl,z,Rd	6,65	kNm

Eenheidscontrole (6.2) = 0,06 + 0,01 + 0,00 = 0,06 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	44.26	kNm
Relatieve slankheid Lambda,LT	0.68	
Relatieve slankheid Lambda,T	0.32	
Relatieve slankheid Lambda,EXTRA	1.00	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	2.163	m
k	1.00	
kw	1.00	
C1	1.13	
C2	0.45	
C3	0.53	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.6. Vak 19,18,17,16 - staaf S209,189

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 19.18,17,16- staaf S209,189

Klasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S209	**2,163 m**	**UNP140**	**S 235**	**1a/1**	**0,15 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 1.081 m

Interne krachten	Berekende	Eenheid
N,Ed	57,40	kN
Vy,Ed	0,12	kN
Vz,Ed	0,05	kN
T,Ed	0,00	kNm
My,Ed	0,19	kNm
Mz,Ed	0,13	kNm

Trekcontrole

Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	2,0400e-03	m^2
Npl,Rd	479,40	kN
Nu,Rd	528,77	kN
Nt,Rd	479,40	kN
Eenheidscontrole	0,12	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,5	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	162,81	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	137,03	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	24,16	kNm
Eenheidscontrole	0,01	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	6,65	kNm
Eenheidscontrole	0,02	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	479,40	kN
Mpl,y,Rd	24,16	kNm
Mpl,z,Rd	6,65	kNm

Eenheidscontrole (6.2) = 0,12 + 0,01 + 0,02 = 0,15 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.

Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 2,163 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	14,29
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	42,00

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,30
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	14,00

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp
Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	137.09	kNm
Relatieve slankheid Lambda,LT	0.38	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.081	m
k	1.00	
kw	1.00	
C1	1.42	
C2	0.09	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)
Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.7. Traverse 1,2 - onderrand

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - traverse 1,2 - onderrand
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S289	8,015 m	UNP200	S 235	3/9	0,95 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	48,61

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	14,12

=> Uitkragende flenzen klasse 1

=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 2.582 m

Interne krachten	Berekende	Eenheid
N,Ed	-394,21	kN
Vy,Ed	0,40	kN
Vz,Ed	1,49	kN
T,Ed	0,03	kNm
My,Ed	-4,95	kNm
Mz,Ed	0,67	kNm

Drukcontrole

Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	3,2200e-03	m^2
Nc,Rd	756,70	kN
Eenheidscontrole	0,52	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	3,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,02	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,01	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,09	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,05	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,52 + 0,09 + 0,05 = 0,67 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.

Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp

Beslissende positie voor stabiliteitsclassificatie: 0,000 m

Classificatie van interne drukonderdelen

Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	49,44

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	14,14

=> Uitkragende flenzen klasse 1

=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	2.943	1.120	m
lef/lsys k	0.98	0.97	
Kniklengte Lcr	2.884	1.083	m
Kritische Euler belastingen Ncr	4761.00	2614.52	kN
Slankheid	37.44	50.52	
Relatieve slankheid Lambda	0.40	0.54	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.90	0.82	
Knikweerstand Nb,Rd	679.53	621.64	kN

Tabel van waarden		
A	3.2200e-03	m^2
Knikweerstand Nb,Rd	621.64	kN
Eenheidscontrole	0.63	-

Torsieknikcontrole

Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.120	m
Ncr,T	3255.98	kN
Ncr,TF	2556.33	kN
Relatieve slankheid Lambda,T	0.54	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	3.2200e-03	m^2
Reductie factor Chi	0.82	
Knikweerstand Nb,Rd	619.00	kN
Eenheidscontrole	0.64	-

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	301.15	kNm
Relatieve slankheid Lambda,LT	0.39	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.120	m
k	1.00	
kw	1.00	
C1	1.17	
C2	0.00	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging

Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)

Interactie Methode 2

Tabel van waarden		
kyy	0.839	

Tabel van waarden		
kyz	0.884	
kzy	0.973	
kzz	0.884	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	3.2200e-03	m^2
Wy	1.9100e-04	m^3
Wz	2.7000e-05	m^3
NRk	756.70	kN
My,Rk	44.88	kNm
Mz,Rk	6.35	kNm
My,Ed	-10.18	kNm
Mz,Ed	0.67	kNm
Interactie Methode 2		
Psi y	0.461	
Psi z	0.334	
Cmy	0.737	
Cmz	0.733	
CmLT	0.883	

Eenheidscontrole (6.61) = 0.58 + 0.19 + 0.09 = 0.86
Eenheidscontrole (6.62) = 0.64 + 0.22 + 0.09 = 0.95

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.8. Traverse 1,2 - staaf S283,312

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - traverse 1.2 - staaf S283,312
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S312	**2,391 m**	**UNP140**	**S 235**	**3/14**	**0,07 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...
Kritische controle op positie 1.196 m

Interne krachten	Berekende	Eenheid
N,Ed	26,02	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,04	kN
T,Ed	0,02	kNm
My,Ed	0,18	kNm
Mz,Ed	0,06	kNm

Trekcontrole
Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	2,0400e-03	m^2
Npl,Rd	479,40	kN
Nu,Rd	528,77	kN
Nt,Rd	479,40	kN
Eenheidscontrole	0,05	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	3,3	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,02	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	162,81	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	137,03	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	24,16	kNm
Eenheidscontrole	0,01	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	6,65	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	479,40	kN
Mpl,y,Rd	24,16	kNm
Mpl,z,Rd	6,65	kNm

Eenheidscontrole (6.2) = 0,05 + 0,01 + 0,01 = 0,07 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Kipcontrole

Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	39.38	kNm
Relatieve slankheid Lambda,LT	0.72	
Relatieve slankheid Lambda,T	0.28	
Relatieve slankheid Lambda,EXTRA	1.00	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	2.391	m
k	1.00	
kw	1.00	
C1	1.13	
C2	0.38	
C3	0.53	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Plooicontrole

in knikveld 1

Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.9. Traverse 1,2 - staaf S283,312

Lineaire berekening, Extreem : Doorsnede

Selectie : Benoemde selectie - traverse 1.2 - staaf S283,312
Klasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S312	2,391 m	UNP140	S 235	3/14	0,07 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 1.196 m

Interne krachten	Berekende	Eenheid
N,Ed	26,02	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,04	kN
T,Ed	0,02	kNm
My,Ed	0,18	kNm
Mz,Ed	0,06	kNm

Trekcontrole

Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	2,0400e-03	m^2
Npl,Rd	479,40	kN
Nu,Rd	528,77	kN
Nt,Rd	479,40	kN
Eenheidscontrole	0,05	-

Torsiecontrole

Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	3,3	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,02	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,2000e-03	m^2
Vpl,y,Rd	162,81	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,0100e-03	m^2
Vpl,z,Rd	137,03	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	1,0280e-04	m^3
Mpl,y,Rd	24,16	kNm
Eenheidscontrole	0,01	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	2,8300e-05	m^3
Mpl,z,Rd	6,65	kNm
Eenheidscontrole	0,01	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	479,40	kN
Mpl,y,Rd	24,16	kNm
Mpl,z,Rd	6,65	kNm

Eenheidscontrole (6.2) = 0,05 + 0,01 + 0,01 = 0,07 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	39.38	kNm
Relatieve slankheid Lambda,LT	0.72	
Relatieve slankheid Lambda,T	0.28	
Relatieve slankheid Lambda,EXTRA	1.00	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	2.391	m
k	1.00	
kw	1.00	
C1	1.13	
C2	0.38	
C3	0.53	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	17.143

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

EC 3

11.5.10. Vak 9,13,14 - onderrand voorvlak

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 9,13,14 - onderrand voorvlak
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S547	**1,720 m**	**UNP200**	**S 235**	**1a/21**	**0,85 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2

Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	49,70

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,94

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	-379,48	kN
Vy,Ed	-0,34	kN
Vz,Ed	4,95	kN
T,Ed	0,00	kNm
My,Ed	-6,94	kNm
Mz,Ed	0,39	kNm

Drukcontrole
Volgens EN 1993-1-1 artikel 6.2.4 en formule (6.9)

A	3,2200e-03	m^2
Nc,Rd	756,70	kN
Eenheidscontrole	0,50	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,3	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,02	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,13	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,03	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,50 + 0,13 + 0,03 = 0,66 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,000 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	49,70

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00

Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,94

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Knikparameters	yy	zz	
Zijd. flex. type	geschoord	geschoord	
Systeemlengte L	1.720	1.720	m
lef/lsys k	0.89	0.60	
Kniklengte Lcr	1.523	1.035	m
Kritische Euler belastingen Ncr	17070.51	2862.57	kN
Slankheid	19.77	48.28	
Relatieve slankheid Lambda	0.21	0.51	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.99	0.84	
Knikweerstand Nb,Rd	752.63	631.88	kN

Tabel van waarden		
A	3.2200e-03	m^2
Knikweerstand Nb,Rd	631.88	kN
Eenheidscontrole	0.60	-

Torsieknikcontrole
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Tabel van waarden		
Torsieknik lengte	1.720	m
Ncr,T	2048.86	kN
Ncr,TF	1987.07	kN
Relatieve slankheid Lambda,T	0.62	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	3.2200e-03	m^2
Reductie factor Chi	0.78	
Knikweerstand Nb,Rd	586.60	kN
Eenheidscontrole	0.65	-

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	265.18	kNm
Relatieve slankheid Lambda,LT	0.41	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	1.99	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Controle druk en buiging
Volgens artikel EN 1993-1-1 : 6.3.3. en formule (6.61), (6.62)
Interactie Methode 2

Tabel van waarden		
kyy	0.558	
kyz	0.908	
kzy	0.944	
kzz	0.908	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	3.2200e-03	m^2
Wy	1.9100e-04	m^3
Wz	2.7000e-05	m^3
NRk	756.70	kN
My,Rk	44.88	kNm
Mz,Rk	6.35	kNm
My,Ed	-6.94	kNm
Mz,Ed	0.39	kNm
Interactie Methode 2		
Psi y	-0.150	
Psi z	-0.464	
Cmy	0.525	
Cmz	0.766	

Tabel van waarden		
CmLT	0.525	

Eenheidscontrole (6.61) = 0.50 + 0.09 + 0.06 = 0.65
Eenheidscontrole (6.62) = 0.65 + 0.15 + 0.06 = 0.85

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.11. Vak 9,13,14 - onderrand achtervlak

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 9,13,14 - onderrand achtervlak
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S390	1,720 m	UNP200	S 235	1a-p/19	0,54 -

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 0.000 m

Interne krachten	Berekende	Eenheid
N,Ed	301,16	kN
Vy,Ed	0,27	kN
Vz,Ed	-5,79	kN
T,Ed	0,00	kNm
My,Ed	6,51	kNm
Mz,Ed	-0,29	kNm

Trekcontrole
Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	3,2200e-03	m^2
Npl,Rd	756,70	kN
Nu,Rd	834,62	kN
Nt,Rd	756,70	kN
Eenheidscontrole	0,40	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,0	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,02	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,12	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,02	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,40 + 0,12 + 0,02 = 0,54 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	317.81	kNm
Relatieve slankheid Lambda,LT	0.38	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	2.38	
C2	0.01	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

11.5.12. Vak 9,13,14 - staaf S299

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 9,13,14 - staaf S299
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S299	**3,507 m**	**UNP200**	**S 235**	**3-p/26**	**0,15 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	42,15

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	25,97

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor doorsnede-ontwerp
Kritische controle op positie 3.507 m

Interne krachten	Berekende	Eenheid
N,Ed	49,27	kN
Vy,Ed	-1,10	kN
Vz,Ed	-0,71	kN
T,Ed	0,00	kNm
My,Ed	-0,07	kNm
Mz,Ed	-1,00	kNm

Trekcontrole
Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	3,2200e-03	m^2
Npl,Rd	756,70	kN
Nu,Rd	834,62	kN
Nt,Rd	756,70	kN
Eenheidscontrole	0,07	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,0	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.
Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,00	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,08	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,07 + 0,00 + 0,08 = 0,15 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 3,073 m

Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	43,17

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78
Grenswaarde klasse 1	12,58
Grenswaarde klasse 2	13,98
Grenswaarde klasse 3	42,12

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	729.15	kNm
Relatieve slankheid Lambda,LT	0.25	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	0.867	m
k	1.00	
kw	1.00	
C1	1.83	
C2	0.03	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.

De staaf voldoet aan de stabiliteitscontrole.

EC 3

11.5.13. Vak 9,13,14 - staaf S324

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - vak 9,13,14 - staaf S324
Klasse : All UGT

EN 1993-1-1 Norm Controle
Nationale bijlage: Nederlandse NEN-EN NA

Staaf S324	**3,507 m**	**UNP200**	**S 235**	**3-p/10**	**0,14 -**

Partiële veiligheidsfactoren	
Gamma M0 voor weerstand van doorsneden	1,00
Gamma M1 voor weerstand tegen instabiliteit	1,00
Gamma M2 voor weerstand van netto-doorsneden	1,25

Materiaal		
Vloeisterkte fy	235,0	MPa
Uiterste sterkte fu	360,0	MPa
Bouwwijze	Gewalst	

...::DOORSNEDE CONTROLE::...

Kritische controle op positie 3.507 m

Interne krachten	Berekende	Eenheid
N,Ed	51,81	kN
Vy,Ed	0,70	kN
Vz,Ed	-0,61	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,93	kNm

Trekcontrole
Volgens EN 1993-1-1 artikel 6.2.3 en formule (6.5)

A	3,2200e-03	m^2
Npl,Rd	756,70	kN
Nu,Rd	834,62	kN
Nt,Rd	756,70	kN
Eenheidscontrole	0,07	-

Torsiecontrole
Volgens EN 1993-1-1 artikel 6.2.7 en formule (6.23)

Tau,t,Ed	0,1	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: De eenheidscontrole voor torsie is lager dan de grenswaarde van 0,05. Hierdoor wordt torsie beschouwd als niet-significant en wordt deze genegeerd in de gecombineerde controles.

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,y,Rd	234,04	kN
Eenheidscontrole	0,00	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.17)

Eta	1,20	
Av	1,7250e-03	m^2
Vpl,z,Rd	234,04	kN
Eenheidscontrole	0,00	-

Controle buigend moment voor My
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,y	2,2800e-04	m^3
Mpl,y,Rd	53,58	kNm
Eenheidscontrole	0,00	-

Controle buigend moment voor Mz
Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.13)

Wpl,z	5,2850e-05	m^3
Mpl,z,Rd	12,42	kNm
Eenheidscontrole	0,08	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1 en formule (6.2)

Npl,Rd	756,70	kN
Mpl,y,Rd	53,58	kNm
Mpl,z,Rd	12,42	kNm

Eenheidscontrole (6.2) = 0,07 + 0,00 + 0,08 = 0,14 -

Opmerking: Er is geen specifieke interactieformule volgens EN 1993-1-1 artikel 6.2.9.1 van toepassing.
Daarom wordt de plastisch lineaire som volgens EN 1993-1-1 artikel 6.2.1(7) getoetst.
Opmerking: Aangezien de afschuifkrachten minder dan de helft van de plastische afschuifweerstanden bedragen, wordt het effect ervan op de momentweerstanden genegeerd.
De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Classificatie voor staafknikontwerp
Beslissende positie voor stabiliteitsclassificatie: 0,438 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	18,12
Grenswaarde klasse 1	71,86
Grenswaarde klasse 2	82,75
Grenswaarde klasse 3	71,08

=> Interne drukonderdelen klasse 1
Classificatie van uitkragende flenzen
Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,78

Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	14,80

=> Uitkragende flenzen klasse 1
=> Doorsnede geclassificeerd als klasse 1 voor staafknikontwerp

Kipcontrole
Volgens artikel EN 1993-1-1 : 6.3.2.1. en formule (6.54)

Kip Parameters		
Methode voor kipcurve	Art. 6.3.2.2.	
Wy	1.9100e-04	m^3
Elastisch critisch moment Mcr	189.53	kNm
Relatieve slankheid Lambda,LT	0.49	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.753	m
k	1.00	
kw	1.00	
C1	1.46	
C2	0.08	
C3	1.00	

De slankheid of het buigend moment is van die aard dat een kiptoetsing niet dient uitgevoerd te worden volgens EN 1993-1-1 artikel 6.3.2.2(4)

Plooicontrole
in knikveld 1
Volgens artikel EN 1993-1-5 : 5. & 7.1. en formule (5.10) & (7.1)

Tabel van waarden	
hw/t	20.824

De slankheid van het lijf is van die aard dat de Plooicontrole niet dient uitgevoerd te worden.
De staaf voldoet aan de stabiliteitscontrole.
EC 3

Bijlage C Controle staven mastlichaam

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2322,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2117,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/24* [*1]

h	=	*200*	mm	I_y	=	*33306649*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*235176*	mm^3
t_f	=	*24*	mm	$W_{y;el;eff.2}$	=	*570556*	mm^3
y_s	=	*58,4*	mm	i_y	=	*60,6*	mm
A_{bruto}	=	*9059*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2180*	mm	No. bolts / end / flange	=	*6*	(Per flange !)
$L_{v;cr}$	=	*2180*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*65*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*20*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,77** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **56** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,95** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,90** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,44** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,95 = 95%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-518,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*465,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/13* (*1)

h	=	*150*	mm	I_y	=	*6526542*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*64864*	mm^3
t_f	=	*13*	mm	$W_{y;el;eff.2}$	=	*165432*	mm^3
y_s	=	*39,5*	mm	i_y	=	*43,0*	mm
A_{bruto}	=	*3528*	mm^2	i_v	=	*27,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2450*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2450*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **89** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,83** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,80** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 1* *1e hor.knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2957*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2957*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2957*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,37** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **219** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,64** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,78** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,31** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *1e hor.knikverkorter pootverband*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-5,3*	kN	*Combined forces diagonal:*				
Tension: N_{Sd}	=	*5,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4180*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*4180*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a{*}L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*4180*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,02**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,18**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**216**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,07**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,09**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,09**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,08**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,18 = 18%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *1e schuine knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-28,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*28,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80*	mm	I_y	=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3460*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3460*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **224** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,76** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,47** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,34** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,76 = 76%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *2e hor.knikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-23,2	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	23,2	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H60/60/6 (*1)

h	=	60	mm	I_y	=	227925	mm^4
b	=	60	mm	$W_{y;el;eff.1}$	=	5285	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	13507	mm^3
y_s	=	16,9	mm	i_y	=	18,2	mm
A_{bruto}	=	691	mm^2	i_v	=	11,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510	Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2197	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$	=	2197	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	2197	mm	Edge distance bolt e2	=	30	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	5	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,23**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,44**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**190**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,67**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,85**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,38**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,44**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *2e hor.knikverkorter pootverband*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-5,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*5,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3110*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3110*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3110*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,04** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,39** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **230** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,16** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,20** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,08** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,39 = 39%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *2e schuine knikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-35,0*	kN	***Combined forces diagonal:***				
Tension: N_{Sd}	=	*35,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)		=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)		=	*0*	kN
Angle profile :		*H80/80/8*	(*1)					
h	=	*80*	mm	I_y		=	*722469*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$		=	*12576*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$		=	*32038*	mm^3
y_s	=	*22,6*	mm	i_y		=	*24,3*	mm
A_{bruto}	=	*1227*	mm^2	i_v		=	*15,4*	mm
Material :								
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress	$f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$	=	*2765*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2765*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,17** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **179** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,66** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,66 = 66%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *3e hor.knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1437*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1437*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1437*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,50** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **150** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,86** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,50** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1* *3e hor.knikverkorter pootverband*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-5,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*5,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2035*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2035*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2035*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,08** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,71** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **212** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,27** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,34** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,11** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,71 = 71%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 1 - schuine knikverkorter pootverband- controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-8,6*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*8,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/12* (*1)

h	=	*120*	mm	I_y	=	*3676666*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0*	mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5580*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5580*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*60*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,02** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **240** < 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,10** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,12** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,16** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,16 = 16%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003   File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2*   *randen*

Memberforces :   (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2204,6*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*2036,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile :   *H200/200/24* (*1)

h	=	*200*	mm	I_y	=	*33306649*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*235176*	mm^3
t_f	=	*24*	mm	$W_{y;el;eff.2}$	=	*570556*	mm^3
y_s	=	*58,4*	mm	i_y	=	*60,6*	mm
A_{bruto}	=	*9059*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1687*	mm	No. bolts / end / flange	=	*6*	(Per flange !)
$L_{v;cr}$	=	*1687*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*20*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,74** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **43** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,85** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) :   **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-665,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*606,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H180/180/15* [*1]

h	=	*180*	mm	I_y	=	*12141472*	mm^4
b	=	*180*	mm	$W_{y;el;eff.1}$	=	*102915*	mm^3
t_f	=	*15*	mm	$W_{y;el;eff.2}$	=	*262974*	mm^3
y_s	=	*46,2*	mm	i_y	=	*50,5*	mm
A_{bruto}	=	*4769*	mm^2	i_v	=	*32,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4860*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2430*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*90*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,64**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**96**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,88**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,77**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,50**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,88 = 88%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *hor.knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*22,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1859*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1859*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,21** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **161** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,47** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,63** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,37** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,63 = 63%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		D&C ENGINEERING
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 2* *schuine knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-16,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2450*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2450*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,11** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **182** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,31** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,41** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,27** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,22** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,41 = 41%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2282,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2116,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/24* (*1)

h	=	*200*	mm	I_y	=	*33306649*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*235176*	mm^3
t_f	=	*24*	mm	$W_{y;el;eff.2}$	=	*570556*	mm^3
y_s	=	*58,4*	mm	i_y	=	*60,6*	mm
A_{bruto}	=	*9059*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1768*	mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*1768*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*20*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,77**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**46**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,85**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,44**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-223,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*215,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/90/10* (*1)

h	=	*150*	mm	I_y	=	*5331436*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*41125*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*261873*	mm^3
y_s	=	*20,4*	mm	i_y	=	*48,0*	mm
A_{bruto}	=	*2315*	mm^2	i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4962*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2481*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,55**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**128**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,81**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,82**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,62**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *horizontale knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*22,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* [(*1)]

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1636*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1636*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,22** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,39** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,55** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,36** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] **:** **$U.C_{max}$ = 0,55 = 55%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 3* *schuine knikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-21,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2270*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2270*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **197** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,82** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,27** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1933,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1771,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/20* (*1)

h	=	*200*	mm	I_y	=	*28505852*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*199111*	mm^3
t_f	=	*20*	mm	$W_{y;el;eff.2}$	=	*501562*	mm^3
y_s	=	*56,8*	mm	i_y	=	*61,1*	mm
A_{bruto}	=	*7635*	mm^2	i_v	=	*38,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784*	mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*1784*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*20*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,76** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,85** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-253,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*261,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/90/10* (*1)

h	=	*150*	mm	I_y	=	*5331436*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*41125*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*261873*	mm^3
y_s	=	*20,4*	mm	i_y	=	*48,0*	mm
A_{bruto}	=	*2315*	mm^2	i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4755*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2378*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,57**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**123**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,87**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,64**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,51**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,87 = 87%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check section: *Vak 4* *horizontale knikverkorter*

Memberforces :		**(Attention! pressure = "-" and tension ="+")**				
Compression: N_{Sd}	=	*-19,3* kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*19,3* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/5* (*1)				
h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm
Material :						
Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:						
$L_{y;cr}$	=	*1427* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1427* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1427* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,49** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **149** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,71** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,32** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,71 = 71%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *horizontaal*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-13,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*13,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H70/70/7* (*1)					
h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2920*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2920*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2920*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,37** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **216** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,36** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,44** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,21** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,44 = 44%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 4* *schuine knikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-21,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*21,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* [*1]

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2190*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2190*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,21**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**190**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,62**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,78**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,36**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,34**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] **:** **$U.C_{max}$ = 0,78 = 78%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-1402,8* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*1264,8* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/18* (*1)

h	=	*200* mm	I_y	=	*22802204*	mm^4
b	=	*200* mm	$W_{y;el;eff.1}$	=	*166578*	mm^3
t_f	=	*18* mm	$W_{y;el;eff.2}$	=	*422051*	mm^3
y_s	=	*54,0* mm	i_y	=	*58,7*	mm
A_{bruto}	=	*6618* mm^2	i_v	=	*37,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1707* mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*1707* mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*65*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*18* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,63**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**45**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,71**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,81**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,44**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-325,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*309,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/100/10* (*1)

h	=	*150*	mm	I_y	=	*5516683*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*43563*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*236120*	mm^3
y_s	=	*23,4*	mm	i_y	=	*47,8*	mm
A_{bruto}	=	*2418*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2180*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **101** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,87** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,80** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,87 = 87%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *horizontale knikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-14,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*14,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm	I_y	=	*109643*	mm^4
b	=	*50* mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5* mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0* mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480* mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1250* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1250* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1250* mm	Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*5* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,43** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,44** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,38** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,44 = 44%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 5* *schuine knikverkorter*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-25,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*25,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2050*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2050*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,25** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **177** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6 en 7* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1423,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1307,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H200/200/18* (*1)

h	=	*200*	mm	I_y	=	*22802204*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*166578*	mm^3
t_f	=	*18*	mm	$W_{y;el;eff.2}$	=	*422051*	mm^3
y_s	=	*54,0*	mm	i_y	=	*58,7*	mm
A_{bruto}	=	*6618*	mm^2	i_v	=	*37,5*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe510* — Permissible stress $f_{y;d}$ = *355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2140*	mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*2140*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*100*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*20*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,66** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **57** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,45** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6,7* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-339,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*309,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*7942873*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*75811*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*192046*	mm^3
y_s	=	*41,4*	mm	i_y	=	*44,8*	mm
A_{bruto}	=	*3951*	mm^2	i_v	=	*28,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5642*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2816*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,39**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**126**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,82**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,83**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,43**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6,7* *diagonalen l.z.v en r.z.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-322,8*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*318,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*7942873*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*75811*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*192046*	mm^3
y_s	=	*41,4*	mm	i_y	=	*44,8*	mm
A_{bruto}	=	*3951*	mm^2	i_v	=	*28,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4764*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2382*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **106** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,60** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,44** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6,7* *horizontaal v.v a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-61,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*43,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4355063*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*48239*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*122351*	mm^3
y_s	=	*35,6*	mm	i_y	=	*38,6*	mm
A_{bruto}	=	*2919*	mm^2	i_v	=	*24,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3949*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*3949*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3949*	mm	Edge distance bolt e2	=	*65*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,09** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **160** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,51** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,27** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,51 = 51%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6,7* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-30,5*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*34,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H60/60/6* (*1)					
h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1252*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1252*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1252*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,25** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **108** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,33** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,53** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,57** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,54** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,57 = 57%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorter v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-83,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*61,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/8* (*1)

h	=	*100*	mm	I_y	=	*1032450*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*16122*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*41542*	mm^3
y_s	=	*24,9*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1389*	mm^2	i_v	=	*17,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2076*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2076*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,46** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,54** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 6* *schuine knikverkorter l.z.v en r.z.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-23,1*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*20,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2571*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2571*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,15**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**223**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,69**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,83**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,38**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,24**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-882,8	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	708,8	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H160/160/15 (*1)

h	=	160	mm	I_y	=	10400567	mm^4
b	=	160	mm	$W_{y;el;eff.1}$	=	92851	mm^3
t_f	=	15	mm	$W_{y;el;eff.2}$	=	235093	mm^3
y_s	=	44,2	mm	i_y	=	47,9	mm
A_{bruto}	=	4525	mm^2	i_v	=	30,7	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510	Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	2141	mm	No. bolts / end / flange	=	3	(Per flange !)
$L_{v;cr}$	=	2141	mm	Type of bolts M / "	=	30	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	65	mm
$a{*}L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	100	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	80	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	2	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	15	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **70** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,84** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,42** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-249,9*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*282,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/12* (*1)

h	=	*120*	mm	I_y	=	*3676666*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0*	mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2019*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*60*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,52** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **110** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,70** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,46** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,70 = 70%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *diagonalen l.z.v en r.z.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-480,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*472,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : H150/150/15 (*1)

h	=	*150*	mm	I_y	=	*8980519*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*83519*	mm^3
t_f	=	*15*	mm	$W_{y;el;eff.2}$	=	*211438*	mm^3
y_s	=	*42,5*	mm	i_y	=	*45,7*	mm
A_{bruto}	=	*4302*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4760*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2380*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **104** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,89** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,46** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,89 = 89%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. knikverkortes*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-13,5*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*17,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*879*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*879*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*879*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,30** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **92** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,16** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,29** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,28** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,32** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,32 = 32%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *hor. verbanden l.z.v en r.z.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-12,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*15,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4252*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*4252*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*4252*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,05**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,18**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**220**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,18**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,22**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,26**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,19**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,26 = 26%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 8* *schuine knikverkortes*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-35,6*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*41,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2231*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2231*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,28**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**165**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,78**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,68**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,55**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-219,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*285,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4355063*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*48239*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*122351*	mm^3
y_s	=	*35,6*	mm	i_y	=	*38,6*	mm
A_{bruto}	=	*2919*	mm^2	i_v	=	*24,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3680*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*3680*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*65*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,49** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **149** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,77** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,70** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,46** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,77 = 77%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 diagonalen ondervlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-62,7*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*61,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80* mm	I_y	=	*722469*	mm^4
b	=	*80* mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6* mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227* mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2550*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2550*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,32**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**165**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,52**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,41**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,61 = 61%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 diagonalen ondervlak S322,323,293,294*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-43,0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*17,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/8* (*1)					
h	=	*50*	mm	I_y	=	*162828*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*4684*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*10685*	mm^3
y_s	=	*15,2*	mm	i_y	=	*14,8*	mm
A_{bruto}	=	*741*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1135*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1135*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,17**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**118**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,81**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,71**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,38**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,81 = 81%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 diagonalen v.v en a.v. S226,224,239,241*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-145,0*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*160,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2380*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2380*	mm	Type of bolts	M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*40*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,43**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**123**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,85**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,65**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 diagonalen v.v en a.v. S242,225,227,240*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-163,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*138,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,37**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**123**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,68**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,87**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,56**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,87 = 87%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 9,14,13 hor. verbanden S 215,220,222,214,219,221*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-2,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*2,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H55/55/5* (*1)

h	=	*55*	mm	I_y	=	*134440*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*3540*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9068*	mm^3
y_s	=	*14,8*	mm	i_y	=	*16,1*	mm
A_{bruto}	=	*517*	mm^2	i_v	=	*10,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2305*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2350*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*27,5*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,03	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	227	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,15	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,18	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,05	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,05	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,18 = 18%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-713,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*602,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H160/160/15* (*1)

h	=	*160*	mm	I_y	=	*10400567*	mm^4
b	=	*160*	mm	$W_{y;el;eff.1}$	=	*92851*	mm^3
t_f	=	*15*	mm	$W_{y;el;eff.2}$	=	*235093*	mm^3
y_s	=	*44,2*	mm	i_y	=	*47,9*	mm
A_{bruto}	=	*4525*	mm^2	i_v	=	*30,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1760*	mm	No. bolts / end / flange	=	*3*	**(Per flange !)**
$L_{v;cr}$	=	*1760*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,44**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**57**	**< 120**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,42**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-212,8*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*275,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/12* (*1)

h	=	*120*	mm	I_y	=	*3676666*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0*	mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4412*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2206*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*60*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*15*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,51** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **121** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,68** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,44** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *diagonalen l.z.v en r.z.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-124,9*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*123,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2264*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2264*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,49** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,46** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,69 = 69%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *horizontaal l.z.v en r.z.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-203,2*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*217,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/12* (*1)

h	=	*100*	mm	I_y	=	*2066880*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*29124*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*71193*	mm^3
y_s	=	*29,0*	mm	i_y	=	*30,2*	mm
A_{bruto}	=	*2271*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3507*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1713*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*1713*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,58**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,06**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**116**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,75**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,80**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,52**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,80 = 80%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *hor. knikverkortes l.z.v en r.z.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-20,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*20,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1616*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1616*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*1616*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,07**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,56**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**168**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,67**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,87**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,33**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,38**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,87 = 87%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 10* *schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-264,3	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	232,0	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H120/80/10 (*1)

h	=	120	mm	I_y	=	2755303	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	27409	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	141480	mm^3
y_s	=	19,5	mm	i_y	=	38,0	mm
A_{bruto}	=	1913	mm^2	i_v	=	17,1	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510	Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1544	mm	No. bolts / end / flange	=	3	
$L_{v;cr}$	=	1544	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	55	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	80	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	40	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,63** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **90** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,58** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11,12* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd} =	*-362,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd} =	*329,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/12* (*1)

h	=	*120* mm	I_y	=	*3676666*	mm^4
b	=	*120* mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12* mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0* mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754* mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2220* mm	No. bolts / end / flange	=	*2*	**(Per flange !)**
$L_{v;cr}$	=	*2220* mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*60*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*2* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** < 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** < 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **95** < 120

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** < 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** < 1

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** < 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,67** < 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** < 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: Vak 11,12 diagonalen v.v en a.v.

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-132,2	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	116,3	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H120/120/10 (*1)

h	=	120	mm	I_y	=	2399837	mm^4
b	=	120	mm	$W_{y;el;eff.1}$	=	30497	mm^3
t_f	=	10	mm	$W_{y;el;eff.2}$	=	78074	mm^3
y_s	=	30,7	mm	i_y	=	33,6	mm
A_{bruto}	=	2125	mm^2	i_v	=	21,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510		Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	4098	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	2080	mm	Type of bolts M / "	=	24	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	55	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	80	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	60	mm
Position perpendicular force	=	1	(⅂=1, ⅃=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	12	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **122** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,49** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,57 = 57%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11,12* *diagonalen l.z.v en r.z.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-225,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*216,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/10* (*1)

h	=	*120*	mm	I_y	=	*2399837*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*30497*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*78074*	mm^3
y_s	=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}	=	*2125*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2652*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2652*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*60*	mm
Position perpendicular force	=	*2*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,61** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,85** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,63** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 74

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11,12* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-3,1*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*3,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	=	*60*	mm	I_y	=	*227925*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*5285*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*13507*	mm^3
y_s	=	*16,9*	mm	i_y	=	*18,2*	mm
A_{bruto}	=	*691*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2536*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2536*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=		mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*2536*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,51**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**220**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,12**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,15**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,06**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,06**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,51 = 51%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 11,12* *schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd} = *-7,9* kN

Tension: N_{Sd} = *9,3* kN

$F_{perpend.;s;d}$ = *0* kN

Combined forces diagonal:

$N_{comb1;c;s;d}$ (min. Compr. or tension) = *0* kN

$N_{comb2;c;s;d}$ (max. compression) = *0* kN

Angle profile : *H50/50/5* (*1)

h	=	*50* mm		I_y	=	*109643* mm^4
b	=	*50* mm		$W_{y;el;eff.1}$	=	*3049* mm^3
t_f	=	*5* mm		$W_{y;el;eff.2}$	=	*7811* mm^3
y_s	=	*14,0* mm		i_y	=	*15,1* mm
A_{bruto}	=	*480* mm^2		i_v	=	*9,6* mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe510* Permissible stress $f_{y;d}$ = *355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2179* mm	No. bolts / end / flange	=	*1*
$L_{v;cr}$	=	*2179* mm	Type of bolts M / "	=	*16*
L_{tot} (with comb. buckling)	=	mm	End distance bolt e1	=	*35* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*80* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **227** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,46** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,56** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,18** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,56 = 56%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 15,20* *randen S361,372,413,425*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-181,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*140,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*970* mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$	=	*970* mm	Type of bolts	M / "	=	*24*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*55* mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*80* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*50* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*10* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,44** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **50** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,33** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,67** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,48** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,67 = 67%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: Vak 15,20 diagonalen v.v en a.v S155,153,141,139

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-98,4*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*110,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/8* [(*1)]

h	=	*65*	mm	I_y	=	*374895*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*8128*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*19858*	mm^3
y_s	=	*18,9*	mm	i_y	=	*19,5*	mm
A_{bruto}	=	*985*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1506*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1506*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*32,5*	mm
Position perpendicular force	=	*1*	(˥=1, ˩=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,62** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **121** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,78** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,59** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,57** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,78 = 78%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 15,20* *diagonalen S131,132,145,144*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-119,5* kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*111,7* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80* mm	I_y	=	*722469*	mm^4
b	=	*80* mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6* mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227* mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe510* Permissible stress $f_{y;d}$ = *355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1541* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*1541* mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,49**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**100**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,62**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,63**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,56**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,63 = 63%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003   File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 15,20* *diagonalen l.z.v en r.z.v. S23,24,87,86;94t/m97*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	*-14,4*	kN	***Combined forces diagonal:***				
Tension:	N_{Sd} =	*13,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$ =	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [(*1)]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1850*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1850*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,21**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**193**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,77**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,24**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,29**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **U.C$_{max}$ = 0,77 = 77%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 15,20 horizonatalen l.z.v r.z.v (S25;88;98;211;212)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd} =	-9,6	kN	*Combined forces diagonal:*			
Tension:	N_{Sd} =	13,1	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$ =	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H50/50/5 [*1]

h =	50	mm	I_y	=	109643	mm^4
b =	50	mm	$W_{y;el;eff.1}$	=	3049	mm^3
t_f =	5	mm	$W_{y;el;eff.2}$	=	7811	mm^3
y_s =	14,0	mm	i_y	=	15,1	mm
A_{bruto} =	480	mm^2	i_v	=	9,6	mm

Material :

Mat. qual. Fe360 / Fe510 =	Fe510	Permissible stress $f_{y;d}$ =	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$ =	2163	mm	No. bolts / end / flange	=	1	
$L_{v;cr}$ =	2163	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling) =	0	mm	End distance bolt e1	=	35	mm
a*L_{tot} (with comb. buckling) =	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$ =	2163	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force =	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile? =	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate =	8	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,75** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **225** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,66** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,28** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,75 = 75%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-114,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*148,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H120/120/12* (*1)

h	=	*120*	mm	I_y	=	*3676666*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*42735*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*108247*	mm^3
y_s	=	*34,0*	mm	i_y	=	*36,5*	mm
A_{bruto}	=	*2754*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4465*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*4465*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,28**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**192**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,61**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,82**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,45**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,82 = 82%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *diagonalen ondervlak (S182,184,185,183,178,179,206,207,201,203,200,202)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-81,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*79,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H70/70/9*	(*1)				
h	=	*70*	mm	I_y	=	*524666*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*10605*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*25562*	mm^3
y_s	=	*20,5*	mm	i_y	=	*21,0*	mm
A_{bruto}	=	*1188*	mm^2	i_v	=	*13,5*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1523*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1523*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*9*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,45**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**113**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,55**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,88**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,86**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,71**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *diagonalen ondervlak (S186,187,205,204)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-31,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*31,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/6* (*1)

h	=	*50*	mm	I_y	=	*128406*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s	=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}	=	*569*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1297*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1297*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,40**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**135**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,59**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,86**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,51**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,56**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *diagonalen v.v en a.v. (S100,S107,S111,S118)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-69,4*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*30,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H90/90/9* (*1)					
h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2364*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2364*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **136** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,60 = 60%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *diagonalen v.v en a.v. (S101,S109,S112,S120)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-34,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*66,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/6* (*1)

h	=	*65*	mm	I_y	=	*272781*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*6032*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*15400*	mm^3
y_s	=	*17,7*	mm	i_y	=	*19,2*	mm
A_{bruto}	=	*737*	mm^2	i_v	=	*12,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2364*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2364*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,60** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **192** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,68** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,55** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,68 = 68%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *diagonalen v.v en a.v. (S102,S110,S113,S126)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-50,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*47,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	90 mm	I_y	=	1158332	mm^4
b	=	90 mm	$W_{y;el;eff.1}$	=	17927	mm^3
t_f	=	9 mm	$W_{y;el;eff.2}$	=	45626	mm^3
y_s	=	25,4 mm	i_y	=	27,3	mm
A_{bruto}	=	1552 mm^2	i_v	=	17,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2819* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	80	mm
Position perpendicular force	=	*1* (⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **162** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,65** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,56** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,84 = 84%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Vak 19,18,17,16* *verticale diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-3,0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*3,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1700*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1700*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,01**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**177**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,11**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,14**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,05**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,06**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,14 = 14%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Order :	P13057	**Dossier** : 13.059	**Berekening** : B.13089
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HV 1* *randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-322,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*285,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H150/150/14* [*1]

h	=	*150*	mm	I_y	=	*7942873*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*75811*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*192046*	mm^3
y_s	=	*41,4*	mm	i_y	=	*44,8*	mm
A_{bruto}	=	*3951*	mm^2	i_v	=	*28,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*3800*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,05** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **132** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,72** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,79 = 79%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *diagonalen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-100,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4355063*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*48239*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*122351*	mm^3
y_s	=	*35,6*	mm	i_y	=	*38,6*	mm
A_{bruto}	=	*2919*	mm^2	i_v	=	*24,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5374*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*5374*	mm	Type of bolts	M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt	s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*5374*	mm	Edge distance bolt	e2	=	*65*	mm
Position perpendicular force	=	*1*	(⅂=1, ⅃=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2		=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,19** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,12** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **217** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,52** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 — File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 1* *kruis*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-1,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*0,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/10* (*1)

h	=	*110*	mm	I_y	=	*2145337*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*28311*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*71930*	mm^3
y_s	=	*29,8*	mm	i_y	=	*32,4*	mm
A_{bruto}	=	*2043*	mm^2	i_v	=	*20,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*7600*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*7600*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,00	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,28	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	235	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,03	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,03	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,03	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,01	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$** = 0,28 = 28%

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-7,1	kN	**Combined forces diagonal:**			
Tension:	N_{Sd}	=	14,4	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
	$F_{perpend.;s;d}$	=	1,5	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H80/80/8 (*1)

h	=	80	mm	I_y	=	722469	mm^4
b	=	80	mm	$W_{y;el;eff.1}$	=	12576	mm^3
t_f	=	8	mm	$W_{y;el;eff.2}$	=	32038	mm^3
y_s	=	22,6	mm	i_y	=	24,3	mm
A_{bruto}	=	1227	mm^2	i_v	=	15,4	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510		Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	3350	mm	No. bolts / end / flange		=	1	
$L_{v;cr}$	=	3350	mm	Type of bolts	M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt	e1	=	35	mm
$a*L_{tot}$ (with comb. buckling)	=	0	mm	Centre-centre spacing bolt	s1	=	50	mm
$L_{perpendicular\ force}$	=	3350	mm	Edge distance bolt	e2	=	40	mm
Position perpendicular force	=	1	(⎤=1, ⎦=2)	Boltquality	4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads		=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2		=	1	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,28** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **217** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,18** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,23** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,28 = 28%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 2* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-19,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/10* (*1)

h	=	*110*	mm	I_y	=	*2145337*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*28311*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*71930*	mm^3
y_s	=	*29,8*	mm	i_y	=	*32,4*	mm
A_{bruto}	=	*2043*	mm^2	i_v	=	*20,7*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4741*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*4741*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*4741*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,06**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,18**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**229**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,18**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,16**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,14**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,18 = 18%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 3* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-556,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*512,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H150/150/14*	(*1)				
h	=	*150*	mm	I_y	=	*7942873*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*75811*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*192046*	mm^3
y_s	=	*41,4*	mm	i_y	=	*44,8*	mm
A_{bruto}	=	*3951*	mm^2	i_v	=	*28,7*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*30*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*65*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*100*	mm
$L_{perpendicular force}$	=	*2500*	mm	Edge distance bolt e2	=	*75*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,66**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,03**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**87**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,78**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,86**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,61**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 3* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-68,3*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*66,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	***0***	kN
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	***0***	kN
Angle profile :		***H100/100/10*** (*1)					
h	=	***100***	mm	I_y	=	***1766764***	mm^4
b	=	***100***	mm	$W_{y;el;eff.1}$	=	***24615***	mm^3
t_f	=	***10***	mm	$W_{y;el;eff.2}$	=	***62597***	mm^3
y_s	=	***28,2***	mm	i_y	=	***30,4***	mm
A_{bruto}	=	***1915***	mm^2	i_v	=	***19,3***	mm
Material :							
Mat. qual. Fe360 / Fe510	=	***Fe510***		Permissible stress $f_{y;d}$	=	***355,0***	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*3536*	mm	No. bolts / end / flange	=	***1***	
$L_{v;cr}$	=	*3536*	mm	Type of bolts M / "	=	***20***	
L_{tot} (with comb. buckling)	=	***0***	mm	End distance bolt e1	=	***40***	mm
$a*L_{tot}$ (with comb. buckling)	=	***0***	mm	Centre-centre spacing bolt s1	=	***80***	mm
$L_{perpendicular\ force}$	=	*3536*	mm	Edge distance bolt e2	=	***50***	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,21**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**0,15**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**183**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,66**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,85**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,73**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,54**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,85 = 85%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 3* *kruis*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/7* (*1)

h	=	*70*	mm	I_y	=	*422977*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*8411*	mm^3
t_f	=	*7*	mm	$W_{y;el;eff.2}$	=	*21457*	mm^3
y_s	=	*19,7*	mm	i_y	=	*21,2*	mm
A_{bruto}	=	*940*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*5000*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,63** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **236** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,07** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,09** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,04** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,02** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) **:** **$U.C_{max}$ = 0,63 = 63%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 4* *kruis en koppelstaven*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-18,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,4*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*7163*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3582*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*7163*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⅂=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*12*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,05	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,31	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	236	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,28	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,35	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,31	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,17	< 1

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,35 = 35%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *HV 4* *diagonalen*

Memberforces : (**Attention! pressure = "-" and tension ="+"**)

Compression: N_{Sd}	=	*-22,0*	kN	***Combined forces diagonal:***				
Tension: N_{Sd}	=	*27,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN	
$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN	

Angle profile : *H110/110/12* (*1)

h	=	*110*	mm	I_y	=	*2798302*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*35661*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*88748*	mm^3
y_s	=	*31,5*	mm	i_y	=	*33,4*	mm
A_{bruto}	=	*2511*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5065*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*5065*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*5065*	mm	Edge distance bolt e2	=	*55*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **238** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,27** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,32** **< 1**

6 - Check stress with combined buckling of two sections:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,45** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,25** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,45 = 45%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*69,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H110/110/10* (*1)

h	=	*110*	mm	I_y	=	*2145337*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*28311*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*71930*	mm^3
y_s	=	*29,8*	mm	i_y	=	*32,4*	mm
A_{bruto}	=	*2043*	mm^2	i_v	=	*20,7*	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe510* — Permissible stress $f_{y;d}$ = *355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4732* mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$	=	*4732* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	*35* mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	*55* mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,18**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**228**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,39**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,31**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2)**:** **$U.C_{max}$ = 0,39 = 39%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2* *diagonalen (S232,236,254,448)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-11,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*56,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H65/65/6* [(*1)]

h	=	*65*	mm	I_y	=	*272781*	mm^4
b	=	*65*	mm	$W_{y;el;eff.1}$	=	*6032*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*15400*	mm^3
y_s	=	*17,7*	mm	i_y	=	*19,2*	mm
A_{bruto}	=	*737*	mm^2	i_v	=	*12,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2811*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2811*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*32,5*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,50**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**228**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,29**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,46**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,50**	**< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,50 = 50%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Traverse 1 en 2* *diagonalen (S233,255,296,297,217,218,229,237)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-10,7*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*2,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* [*1]

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1778*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1778*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,03	< 1
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	n.v.t.	< 1
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	185	< 200 or 240
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,42	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,54	< 1
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,18	< 1
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,15	< 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,54 = 54%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2* *diagonalen onderrand (S287,316)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-3,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H70/70/5* [*1]

h	=	*70*	mm	I_y	=	*177913*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*4264*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*11124*	mm^3
y_s	=	*16,0*	mm	i_y	=	*17,7*	mm
A_{bruto}	=	*570*	mm^2	i_v	=	*11,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3013*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1500*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*3013*	mm	Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	0,01	< 1

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	0,75	< 1

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	170	< 200 or 240

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	0,09	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	0,12	< 1

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	n.v.t.	< 1
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	n.v.t.	< 1

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	0,05	< 1

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	0,04	< 1

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,75 = 75%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal le File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2 diagonalen onderrand (S307,273,274,275,278,279,280,302,303,304,308,309)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-60,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*57,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1300*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1300*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,46**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**113**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,54**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,86**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,64**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,69**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,86 = 86%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2* *diagonalen onderrand (S313,314,285,284)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-50,0*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*45,0*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1400*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1400*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,41**	**< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$	=	**121**	**< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,78**	**< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,37**	**< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,53**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,78 = 78%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 1 en 2* *diagonalen onderrand (S317,466,288,465)*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-77,7*	kN	*Combined forces diagonal:*			
Tension:	N_{Sd}	=	*77,8*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H90/90/9* (*1)

h	=	*90*	mm	I_y	=	*1158332*	mm^4
b	=	*90*	mm	$W_{y;el;eff.1}$	=	*17927*	mm^3
t_f	=	*9*	mm	$W_{y;el;eff.2}$	=	*45626*	mm^3
y_s	=	*25,4*	mm	i_y	=	*27,3*	mm
A_{bruto}	=	*1552*	mm^2	i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2270*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2270*	mm	Type of bolts M / "	=	*20*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*40*	mm
a^*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,31** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **131** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,75** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,83** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,79** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*0,0* kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*42,0* kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0* kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/8* (*1)

h	=	*80* mm	I_y	=	*722469*	mm^4
b	=	*80* mm	$W_{y;el;eff.1}$	=	*12576*	mm^3
t_f	=	*8* mm	$W_{y;el;eff.2}$	=	*32038*	mm^3
y_s	=	*22,6* mm	i_y	=	*24,3*	mm
A_{bruto}	=	*1227* mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880* mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2880* mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt e1	=	*35*	mm
a^*L_{tot} (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1* no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8* mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,22**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**187**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,00**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,35**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,28**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,35 = 35%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 3 en 4* *onderrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-53,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*49,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/8* (*1)

h	=	*60*	mm	I_y	=	*291532*	mm^4
b	=	*60*	mm	$W_{y;el;eff.1}$	=	*6890*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*16481*	mm^3
y_s	=	*17,7*	mm	i_y	=	*18,0*	mm
A_{bruto}	=	*903*	mm^2	i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1340*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1340*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*30*	mm
Position perpendicular force	=	*1*	(⎤=1, ⎦=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,36**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**116**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,79**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,88**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,58**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,88 = 88%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Traverse 3 en 4* *onderrand S193,191,170,168*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-25,2*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*27,2*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/5* (*1)

h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1200*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1200*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
a*L_{tot} (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :			
$UC_1 = N_{Ed} / N_{t.Rd}$	=	**0,56**	**< 1**
2 - Check perpendicular force on member :			
$UC_2 = M_{Ed} / M_{c.Rd}$	=	**n.v.t.**	**< 1**
3 - Check of the member slenderness :			
$UC_3 = C_{max;buc} / C_{perm}$	=	**125**	**< 200 or 240**
4 - Check stress in member due to compression without excentricity:			
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
5 - Check stress in member due to compression with excentricity:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**0,50**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**0,74**	**< 1**
6 - Check stress with combined buckling of two sections:			
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$	=	**n.v.t.**	**< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$	=	**n.v.t.**	**< 1**
7 - Check shear stress boltconnection:			
$UC_7 = F_{v;Ed} / F_{v;Rd}$	=	**0,20**	**< 1**
8 - Check bearing stress boltconnection:			
$UC_8 = F_{b;Ed} / F_{b;Rd}$	=	**0,79**	**< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,79 = 79%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-180,0*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*141,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H100/100/10* (*1)

h	=	*100*	mm	I_y	=	*1766764*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*24615*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*62597*	mm^3
y_s	=	*28,2*	mm	i_y	=	*30,4*	mm
A_{bruto}	=	*1915*	mm^2	i_v	=	*19,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2008*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2008*	mm	Type of bolts M / "	=	*24*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*55*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*80*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*50*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **104** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,66** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,47** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) **:** **$U.C_{max}$ = 0,66 = 66%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509		**Berekening :**	B.14015
Project : 150 kV lijn Leiden - Zoetermeer			
Part : mast 74			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	-23,0	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	38,0	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	0	kN
$F_{perpend.;s;d}$	=	0	kN	$N_{comb2;c;s;d}$ (max. compression)	=	0	kN

Angle profile : H65/50/6 (*1)

h	=	65	mm	I_y	=	271004	mm^4
b	=	50	mm	$W_{y;el;eff.1}$	=	5202	mm^3
t_f	=	6	mm	$W_{y;el;eff.2}$	=	21006	mm^3
y_s	=	12,9	mm	i_y	=	20,3	mm
A_{bruto}	=	658	mm^2	i_v	=	10,5	mm

Material :

Mat. qual. Fe360 / Fe510	=	Fe510		Permissible stress $f_{y;d}$	=	355,0	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	1726	mm	No. bolts / end / flange	=	2	
$L_{v;cr}$	=	1726	mm	Type of bolts M / "	=	16	
L_{tot} (with comb. buckling)	=	0	mm	End distance bolt e1	=	35	mm
a^*L_{tot} (with comb. buckling)	=	0	mm	Centre-centre spacing bolt s1	=	50	mm
$L_{perpendicular\ force}$	=	0	mm	Edge distance bolt e2	=	25	mm
Position perpendicular force	=	1	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	8,8	
Column profile?	=	1	no=1, yes=2	Rolled screw threads	=	1	
Thickness tie plate	=	6	mm	Dubble strap joint no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **164** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,32** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,34** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,41 = 41%**

(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6* *diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression: N_{Sd}	=	*-4,9*	kN	*Combined forces diagonal:*			
Tension: N_{Sd}	=	*1,9*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN
Angle profile :		*H50/50/5* [*1]					
h	=	*50*	mm	I_y	=	*109643*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3049*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*7811*	mm^3
y_s	=	*14,0*	mm	i_y	=	*15,1*	mm
A_{bruto}	=	*480*	mm^2	i_v	=	*9,6*	mm
Material :							
Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2
Geometry section and bolts:							
$L_{y;cr}$	=	*1911*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1911*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular force}$	=	*0*	mm	Edge distance bolt e2	=	*80*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **199** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,22** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,28** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,08** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,06** **< 1**

Remarks:

The maximum increase of stress or totalstress is[*2] : **$U.C_{max}$ = 0,28 = 28%**

[*1] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[*2] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14015
Project :	150 kV lijn Leiden - Zoetermeer		
Part :	mast 74		

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6* *diagonalen l.z.v en r.z.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression: N_{Sd}	=	*-34,8*	kN	***Combined forces diagonal:***			
Tension: N_{Sd}	=	*37,5*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/50/6* [(*1)]

h	=	*50*	mm	I_y	=	*128406*	mm^4
b	=	*50*	mm	$W_{y;el;eff.1}$	=	*3612*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*8883*	mm^3
y_s	=	*14,5*	mm	i_y	=	*15,0*	mm
A_{bruto}	=	*569*	mm^2	i_v	=	*9,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*	Permissible stress $f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1092*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1092*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*50*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt e2	=	*25*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality 4.6/5.6/8.8/10.9	=	*8,8*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,48** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **114** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,79** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,62** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,68** **< 1**

Remarks:

The maximum increase of stress or totalstress is[(*2)] : **$U.C_{max}$ = 0,79 = 79%**

[(*1)] Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

[(*2)] The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14015
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 74

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003 File prEN 1993-1-1.revB.xls d.d. 2-32012, JG

Check section: *Traverse 5 en 6* *diagonalen l.z.v en r.z.v (S71,S73,S10,S8)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,7*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*0*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H60/60/6* (*1)

h	= 60 mm		I_y	=	227925	mm^4
b	= 60 mm		$W_{y;el;eff.1}$	=	5285	mm^3
t_f	= 6 mm		$W_{y;el;eff.2}$	=	13507	mm^3
y_s	= 16,9 mm		i_y	=	18,2	mm
A_{bruto}	= 691 mm^2		i_v	=	11,5	mm

Material :

Mat. qual. Fe360 / Fe510 = *Fe510* Permissible stress $f_{y;d}$ = 355,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2162* mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$	=	*2162* mm	Type of bolts	M / "	=	*16*
L_{tot} (with comb. buckling)	=	*0* mm	End distance bolt	e1	=	35 mm
$a*L_{tot}$ (with comb. buckling)	=	*0* mm	Centre-centre spacing bolt	s1	=	50 mm
$L_{perpendicular\ force}$	=	*0* mm	Edge distance bolt	e2	=	30 mm
Position perpendicular force	=	*1* (⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*8,8*
Column profile?	=	*1* no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate	=	*6* mm	Dubble strap joint no=1, yes=2		=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **187** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 1**

6 - Check stress with combined buckling of two sections:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **n.v.t.** **< 1**

7 - Check shear stress boltconnection:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,39** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

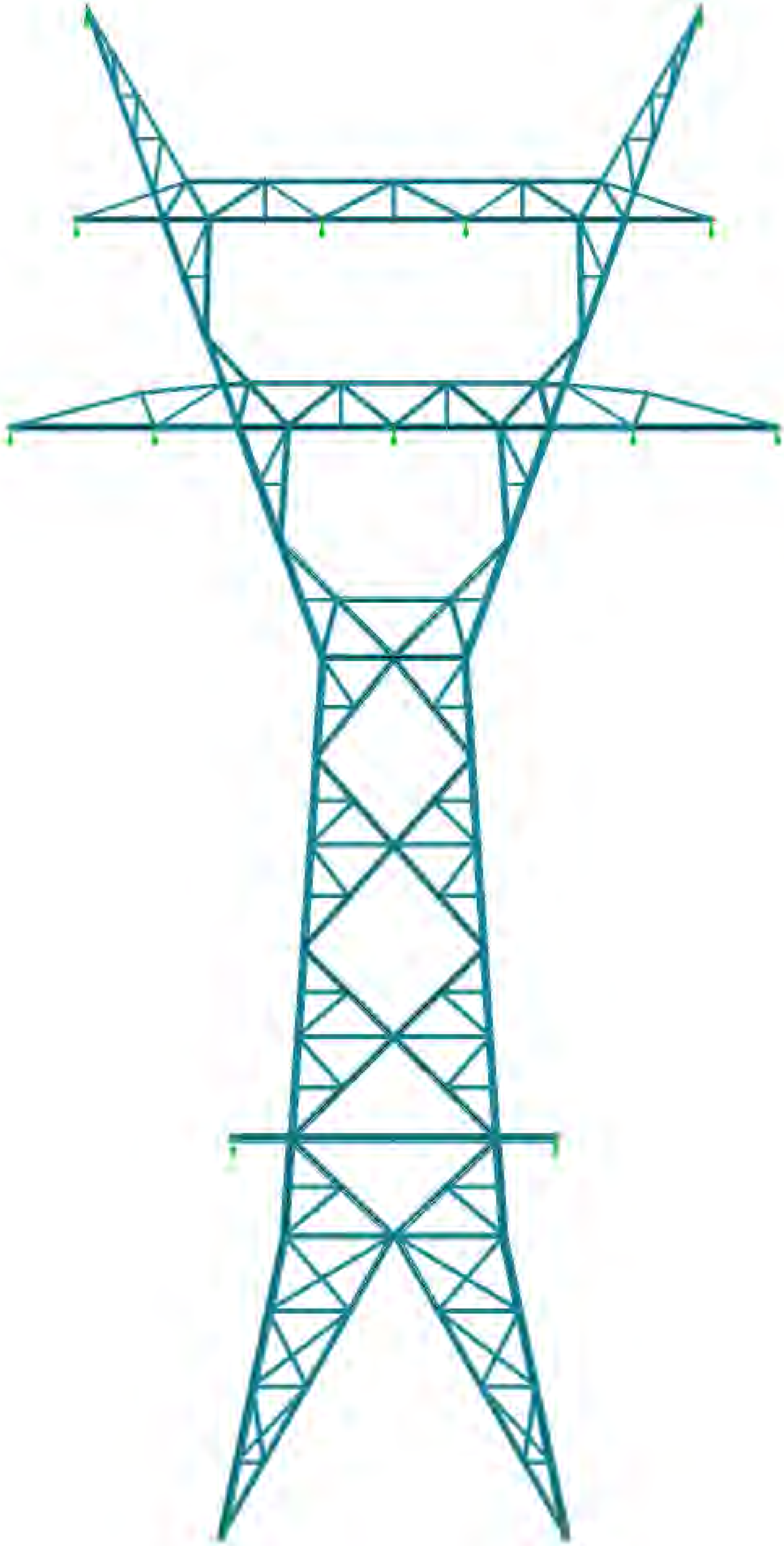
The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,83 = 83%**

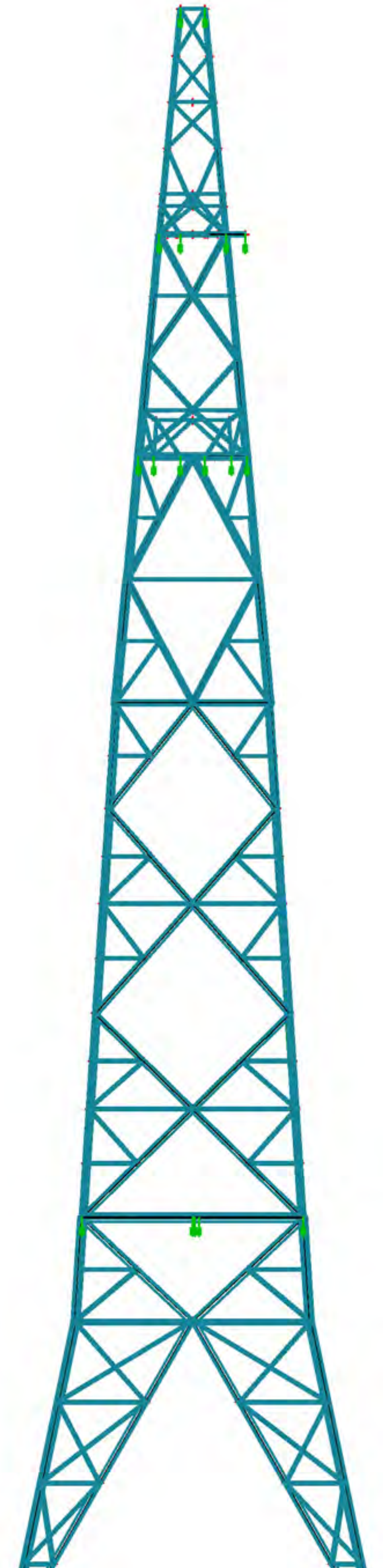
(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

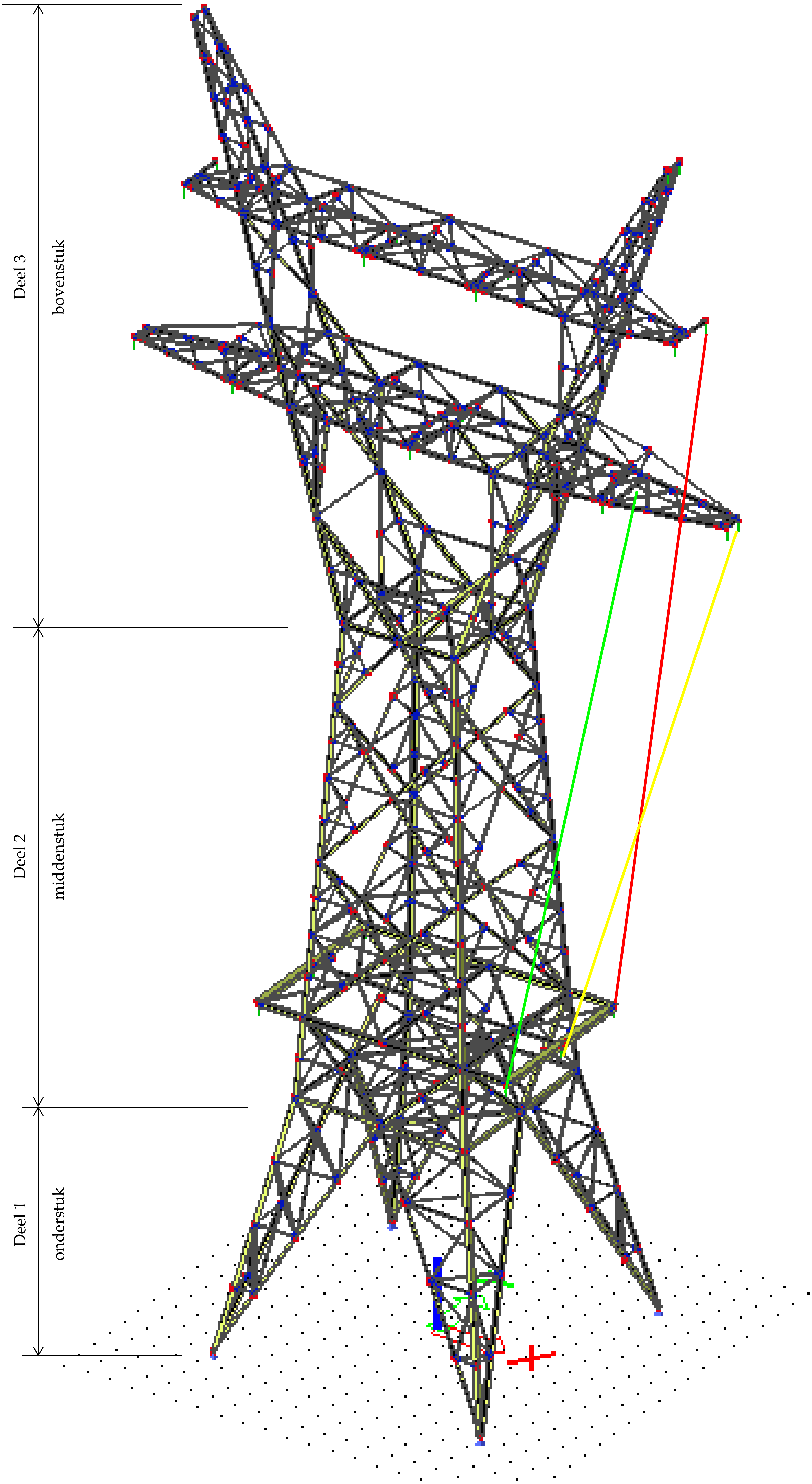
(*2) The total stress or increase of stress has been related to the permissible stress.

Revision :	0	A	B	C	D	E	F
Date :	9-apr-2013						
Name :	M.Glegola						
Checked :	J. Hollaar						

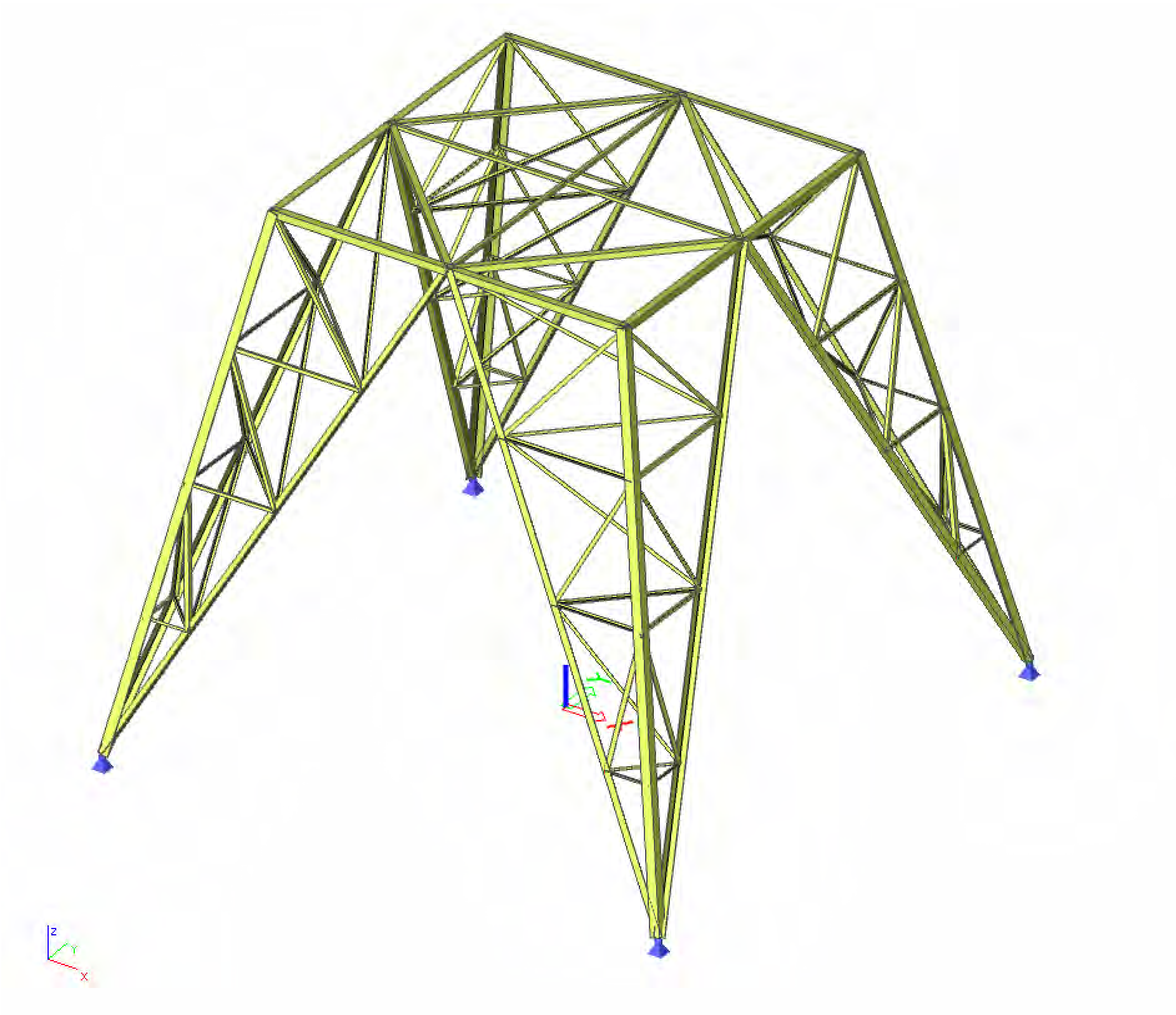
3. BIJLAGE: AANZICHTTEKENINGEN



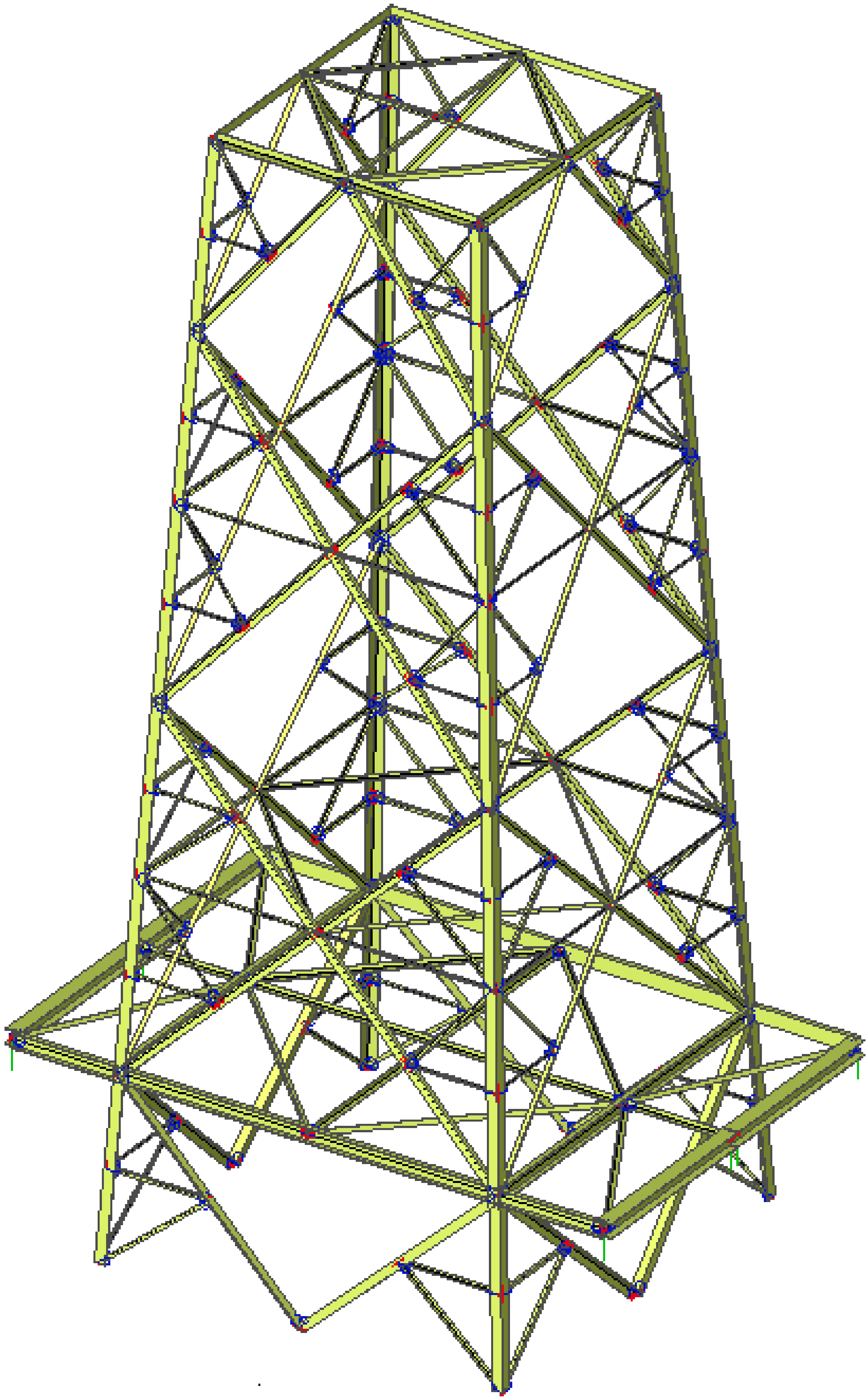




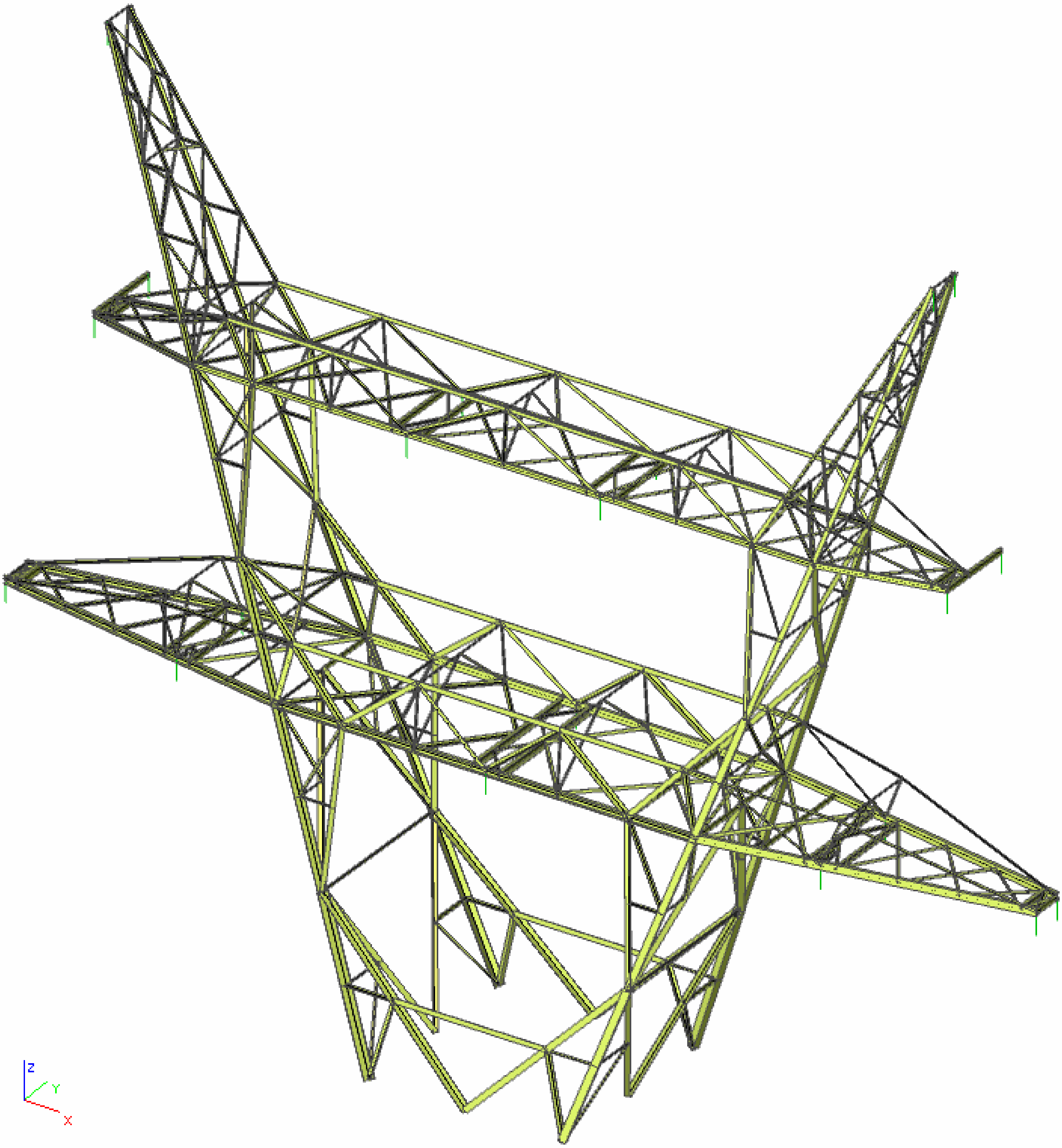
Figuur 1: Mast 74 -overzicht



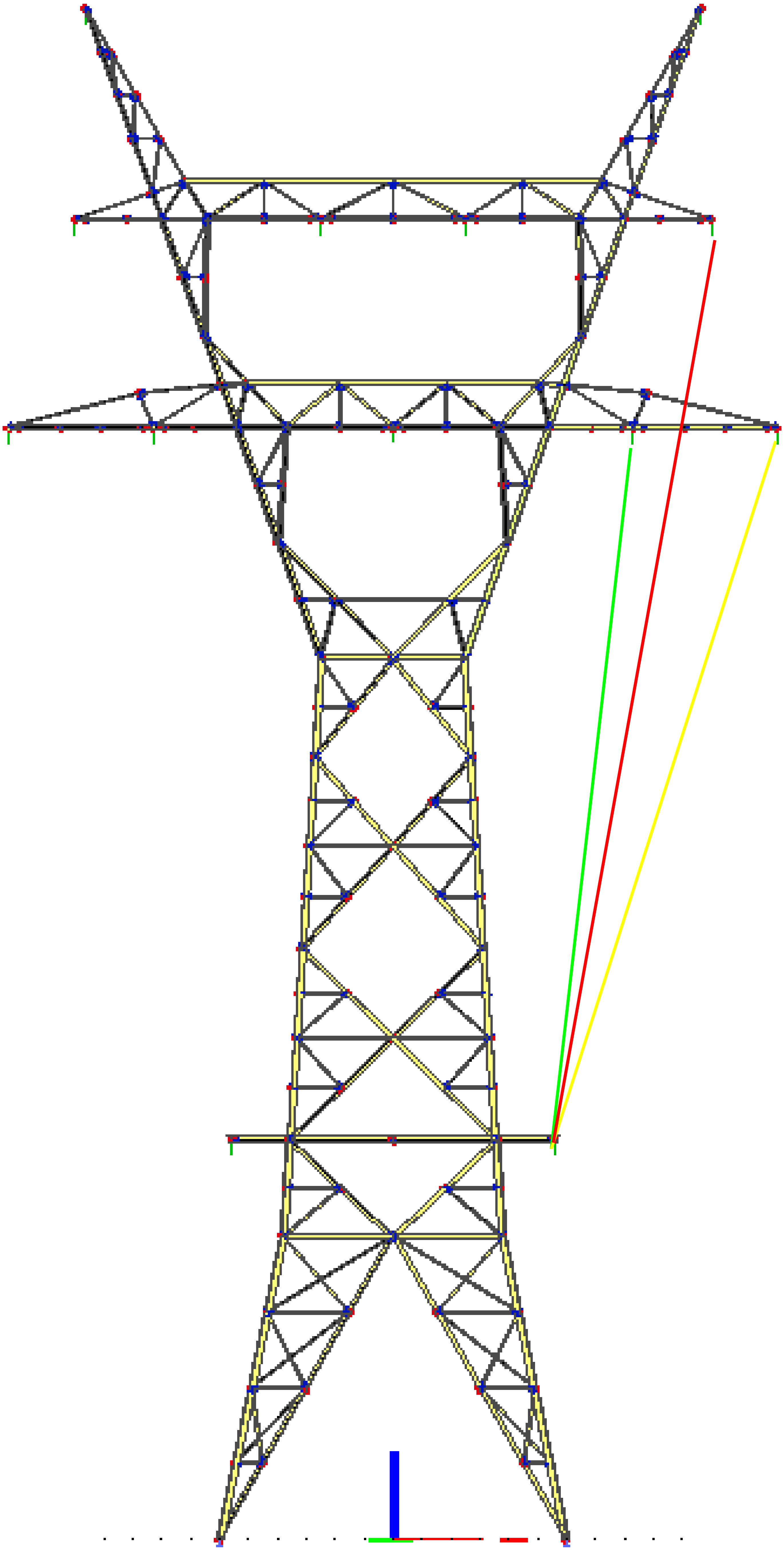
Figuur 2: Mast 74 – Deel1 :onderstuk



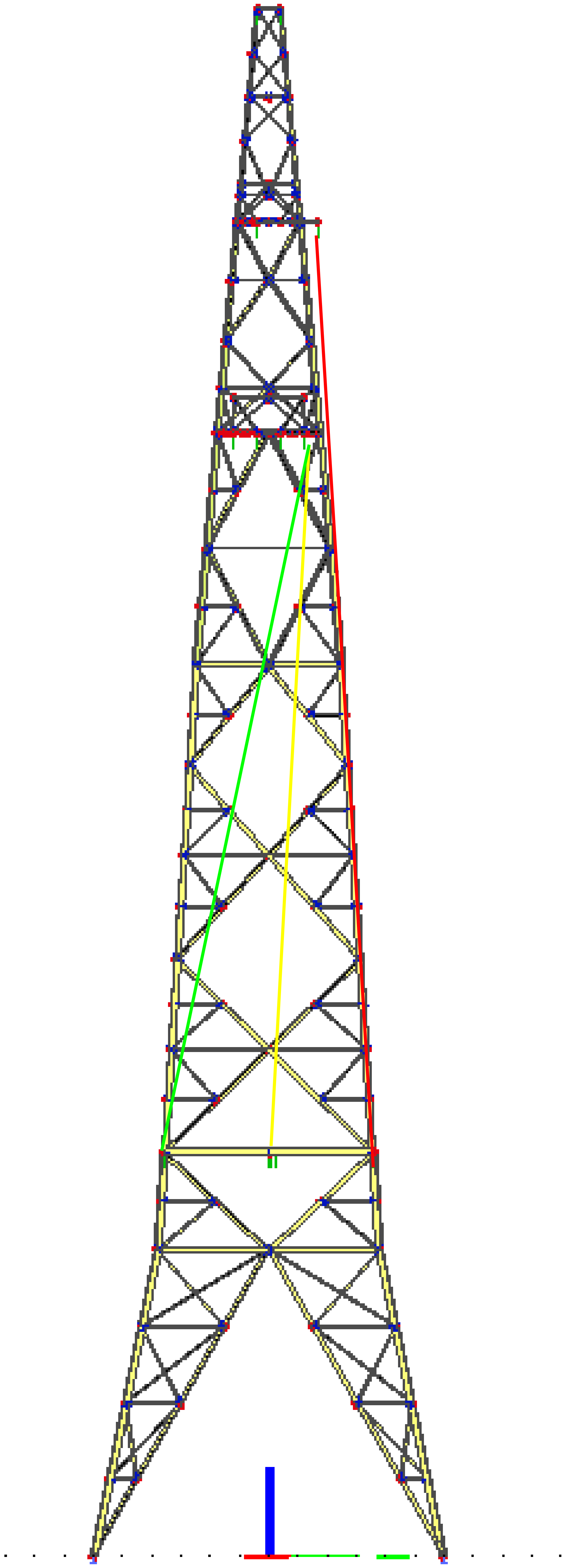
Figuur 3: Mast 74 – Deel2 : middenstuk



Figuur 4: Mast 74 – Deel3 : bovenstuk



Figuur 5: Mast 74 – voorvlak



Figuur 6: Mast 74 – zijvlak