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Bijlage 7

Constructietekening en berekening opstijgpunten

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
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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

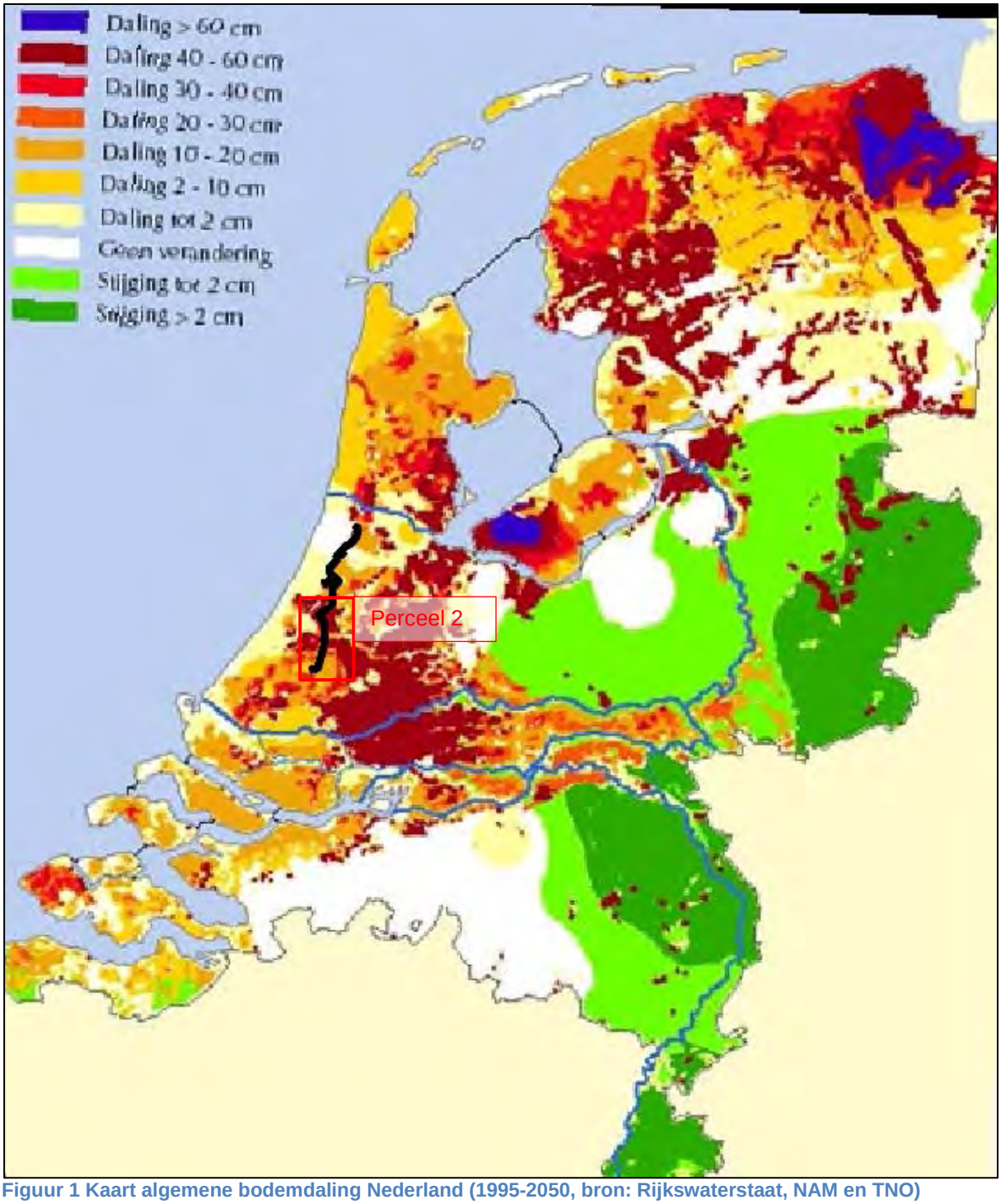
Voor de uitvoering van de berekening zijn de volgende gegevens en uitgangspunten gehanteerd:

- 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/m^3]	γ_{sat} [kN/m^3]	ϕ' [°]	c' [kN/m^2]	c_v [m^2/s]	C'$_p$ [-]	C_p [-]	C'$_s$ [-]	C_s [-]	POP [kN/m^2]
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

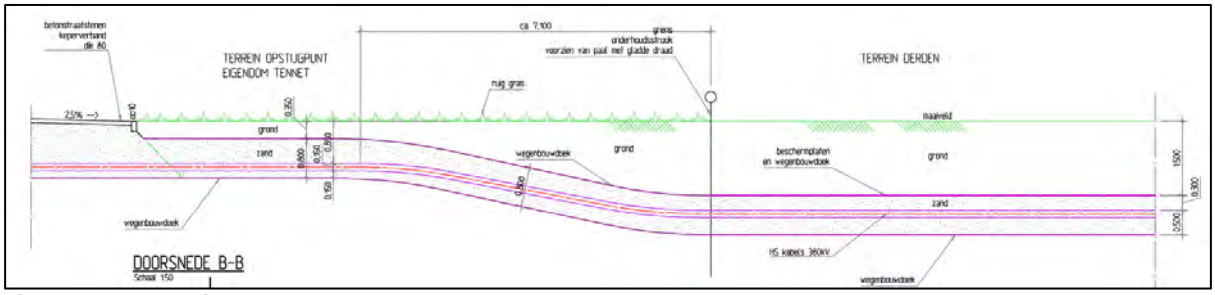
In de uitvoeringsfase worden de OSP's droog gehouden door middel van sleufbemaling. Waar opbarsten van de bodem wordt verwacht zal een spanningsbemaling in de tussenzandlaag/diepe zandlaag plaats moeten vinden. Dit aspect wordt in de geohydrologische rapportages (R3N-OWR-0039-02 Bemalingsadvies Rijnland 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 aangebracht zand en grind dient goed verdicht te worden.
De geometrie van de OSP is in figuur 3 grafisch weergegeven.



Figuur 3 Geometrie OSP

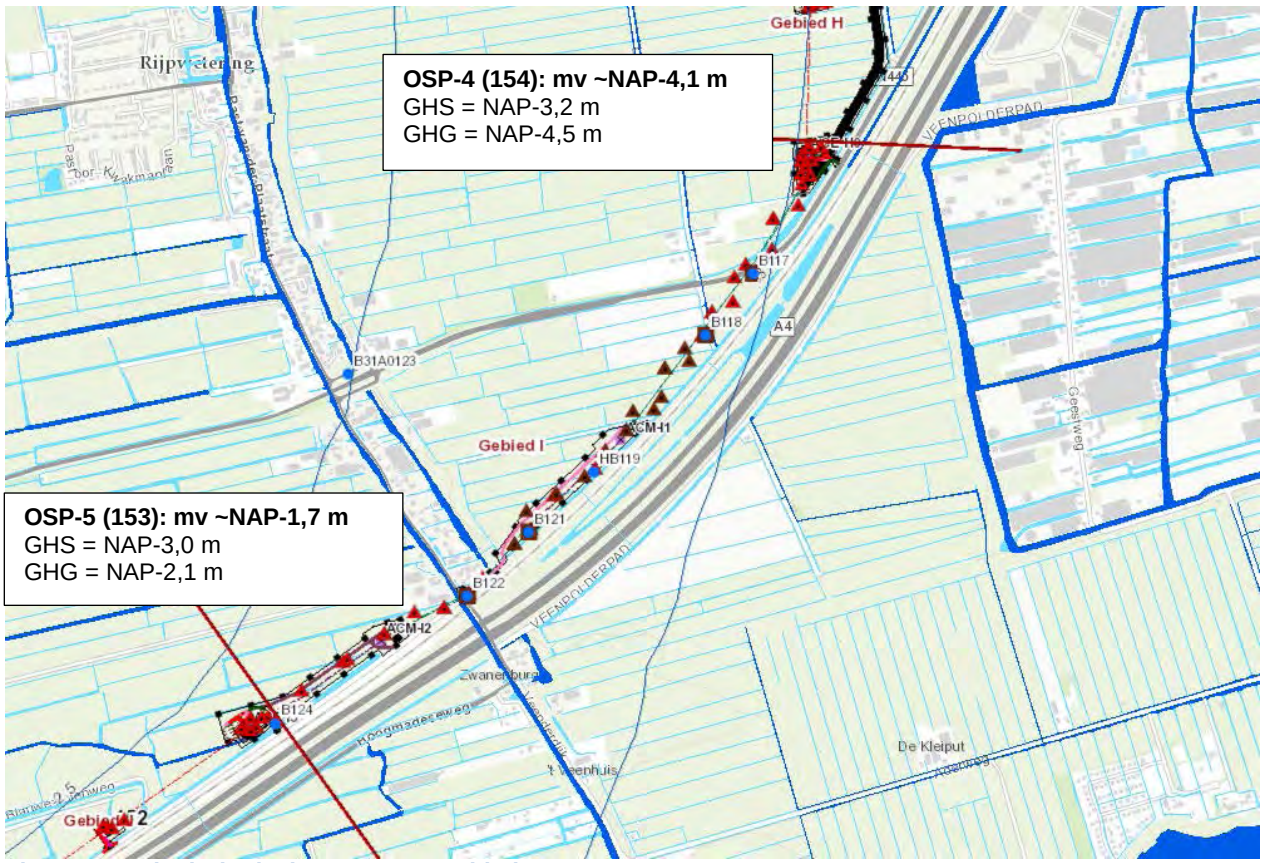
3. UITGANGSPUNTEN HYDROLOGIE

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.

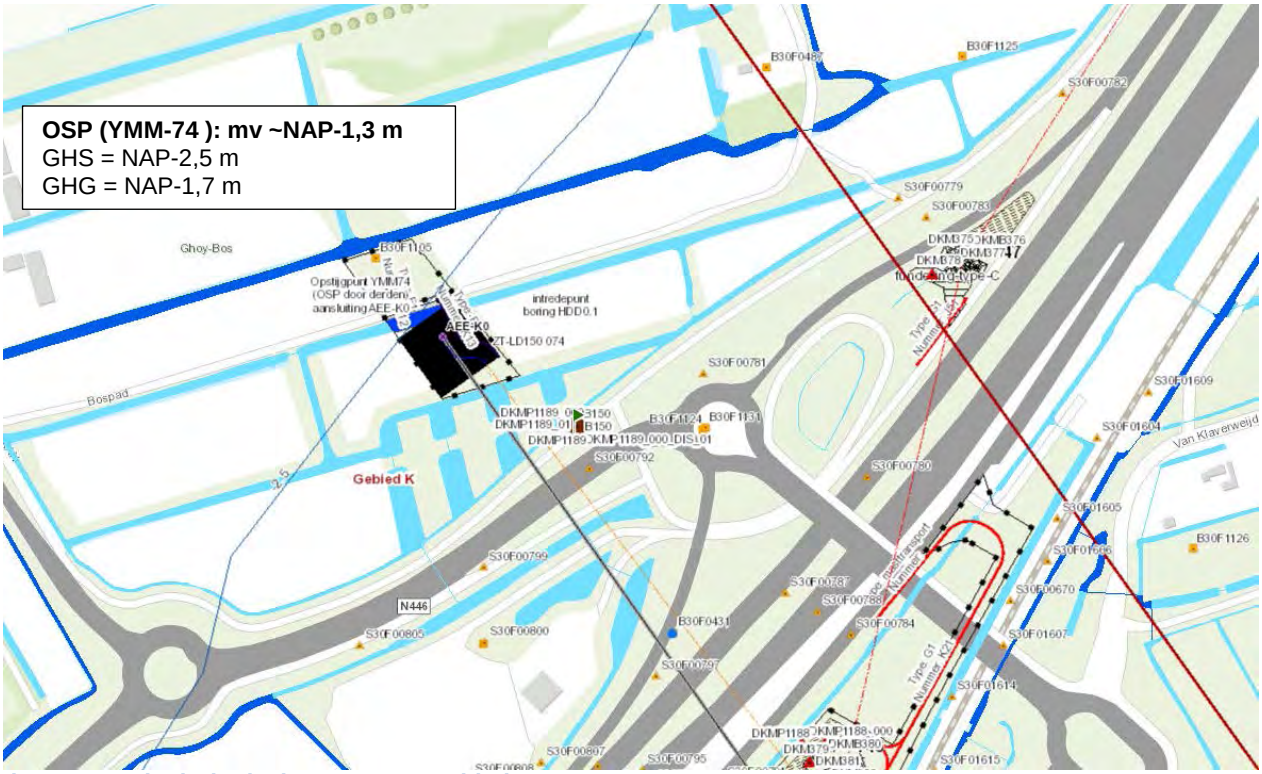
Tabel 2 Geohydrologische gegevens

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		

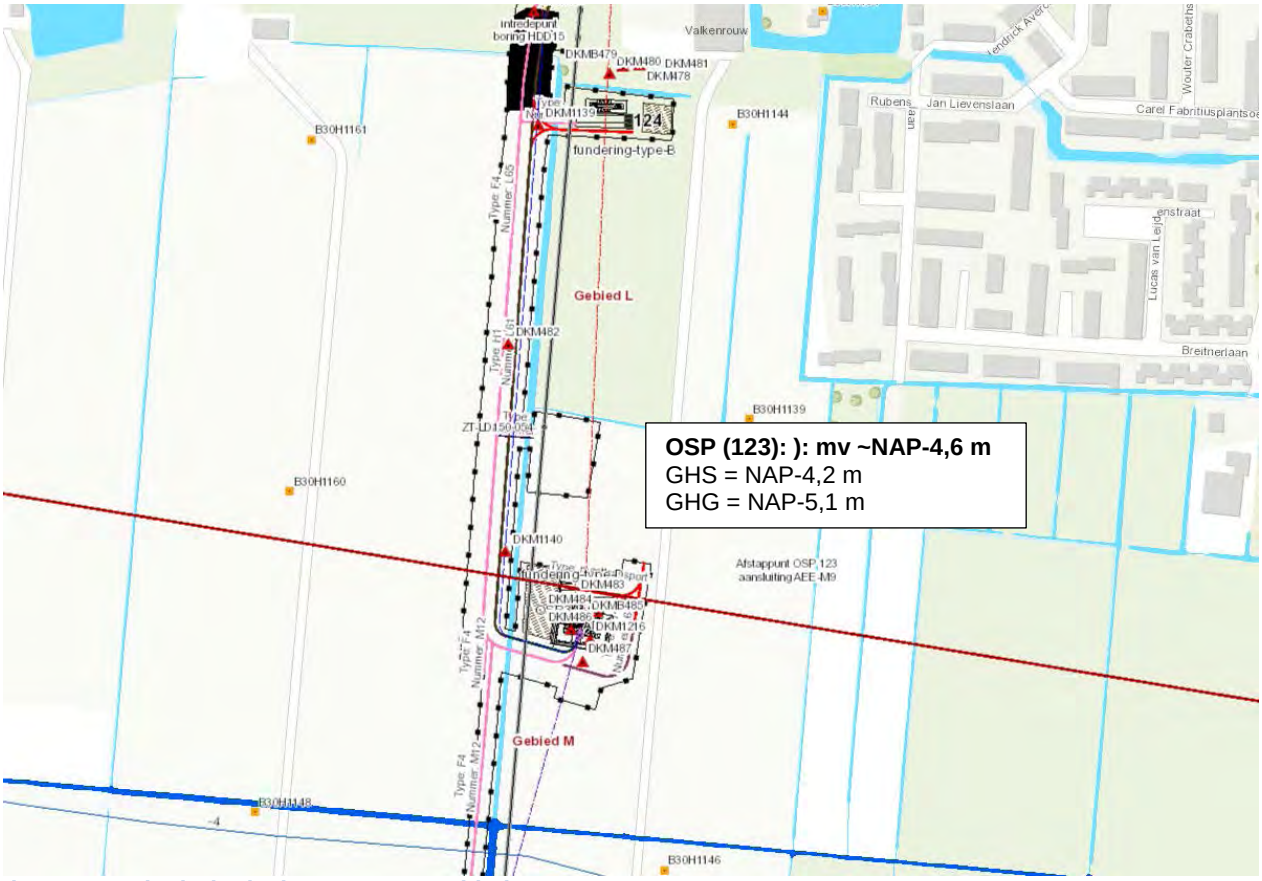
Voor de berekeningen zijn de in tabel 2 weergegeven grondwaterstanden en stijghoogtes gehanteerd.



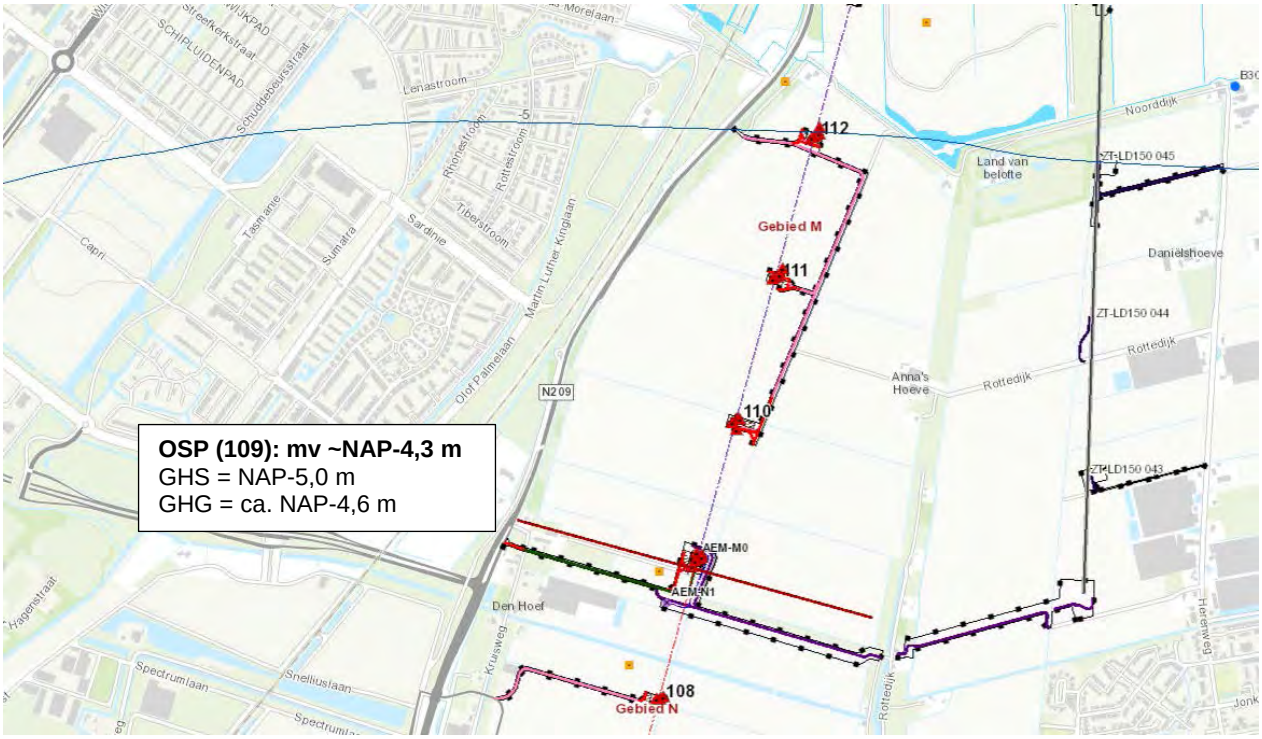
Figuur 4 Geohydrologische gegevens gebieden OSP154 en OSP153



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			

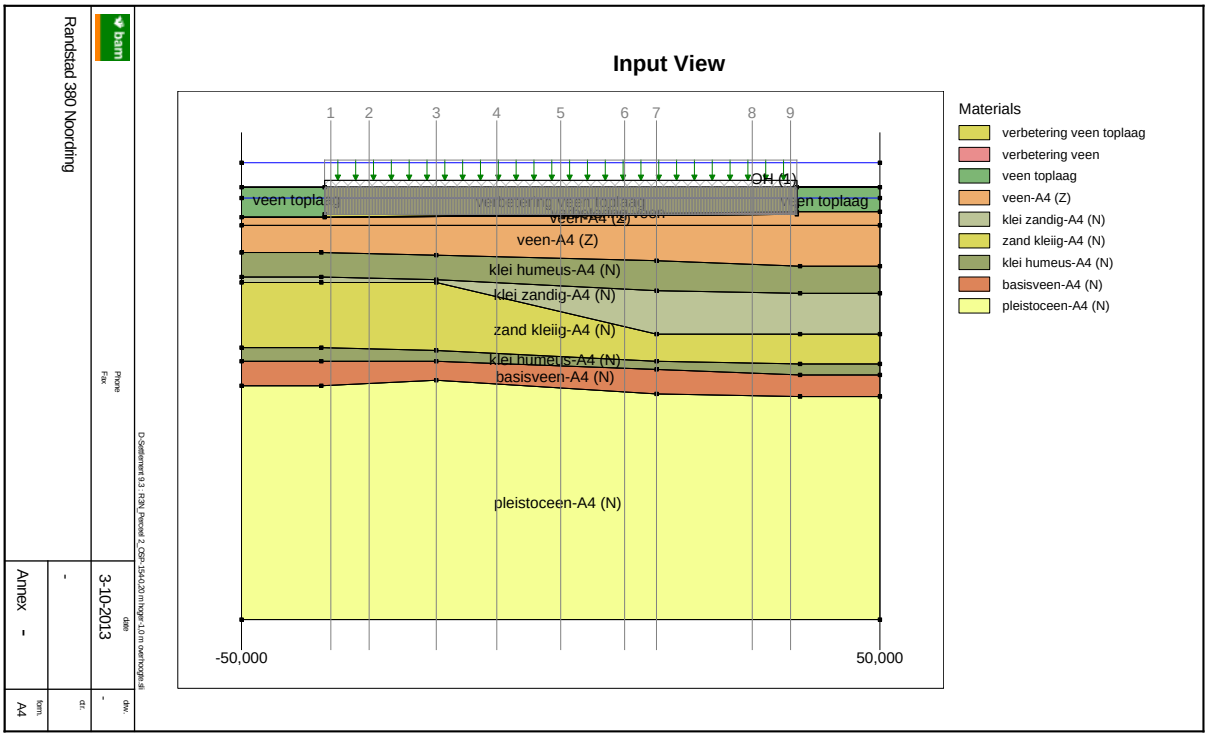
Uitgaande van een onnauwkeurigheid in de zettingen van 50% worden de volgende eindzettingen gevonden:

- 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.

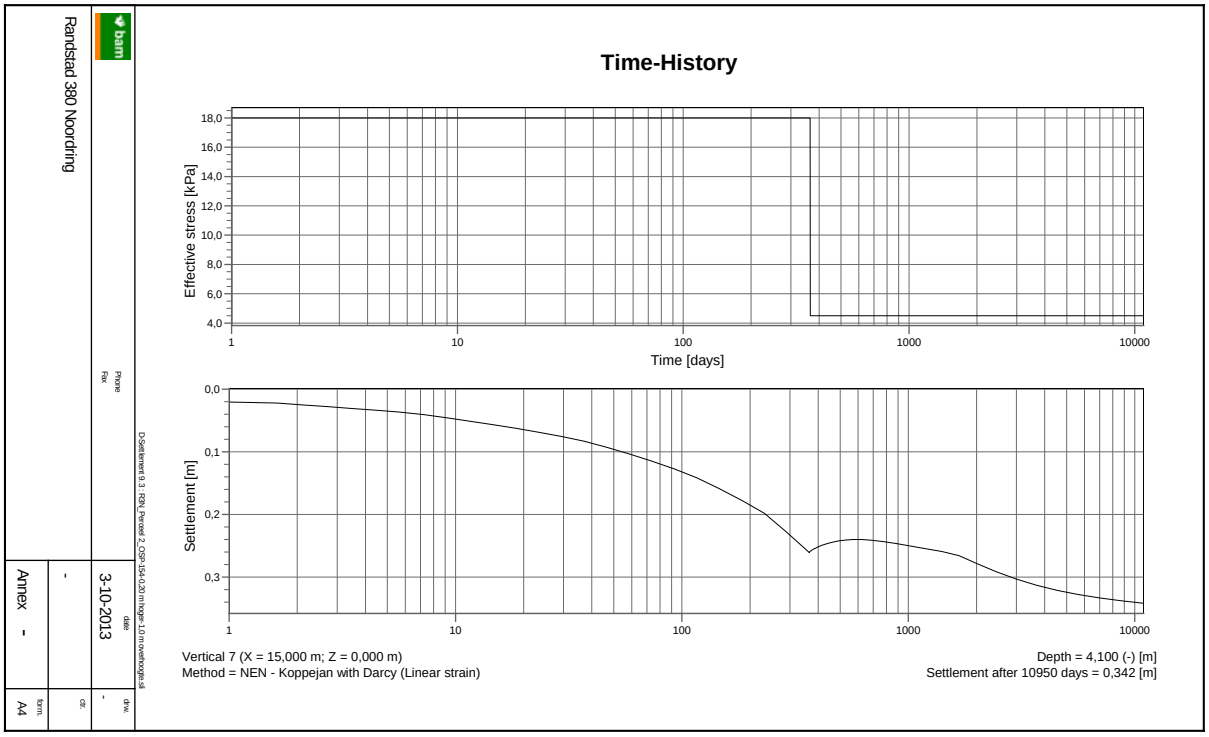
Uit de berekeningsresultaten volgen de onderstaande maatregelen:

- 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;

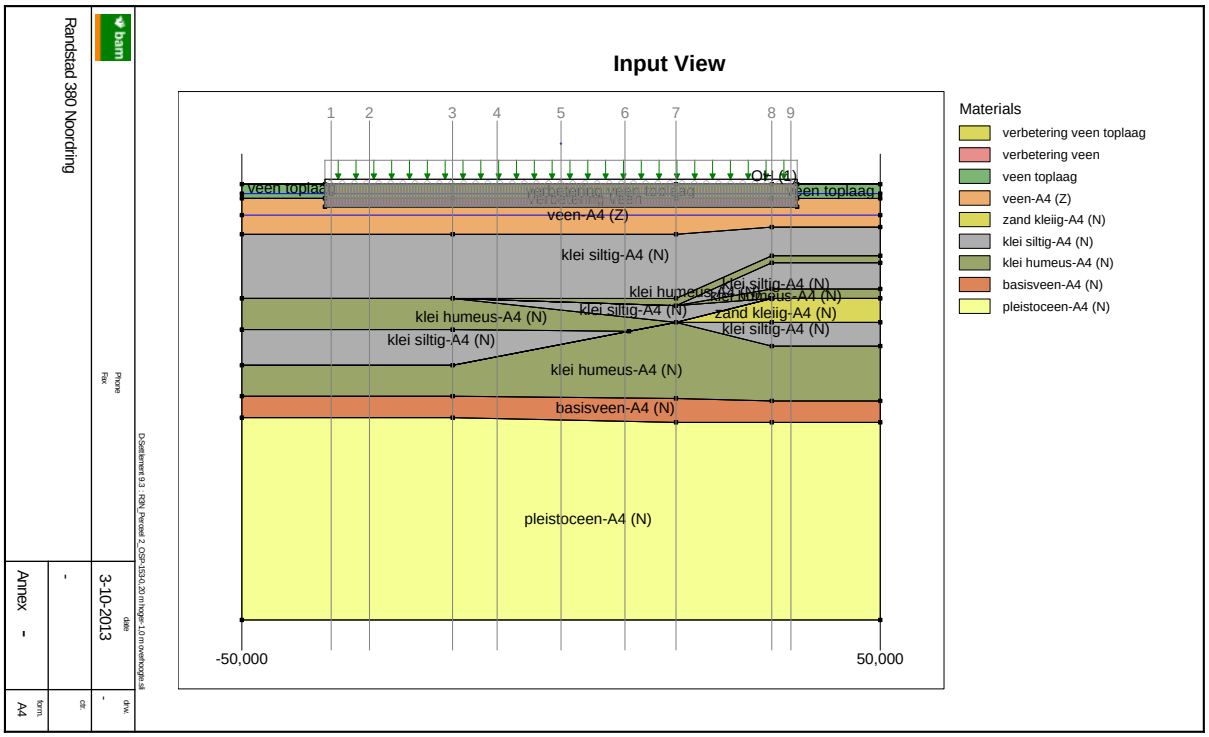
- OSP123: overhoogte: 0,10 m ter compensatie van verwachte zetting;
- OSP109: overhoogte: 0,10 m ter compensatie van verwachte zetting.



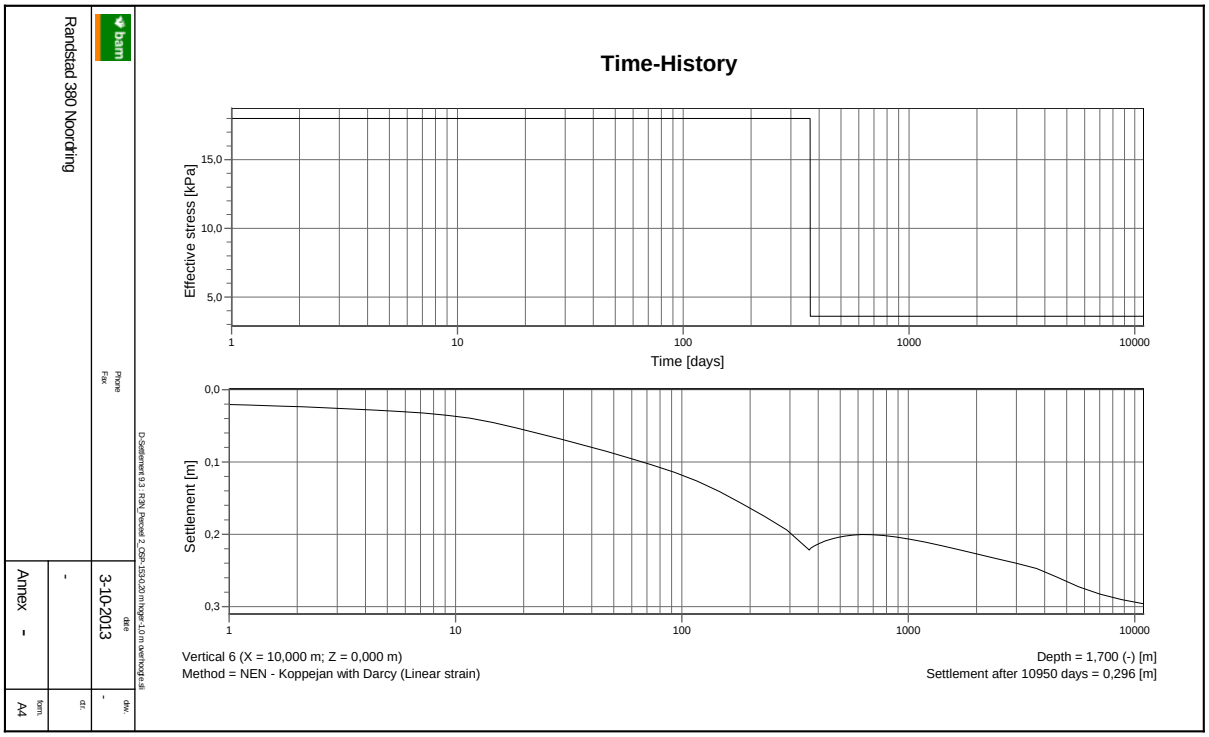
Figuur 8 Geometrie dwarsprofiel OSP 154



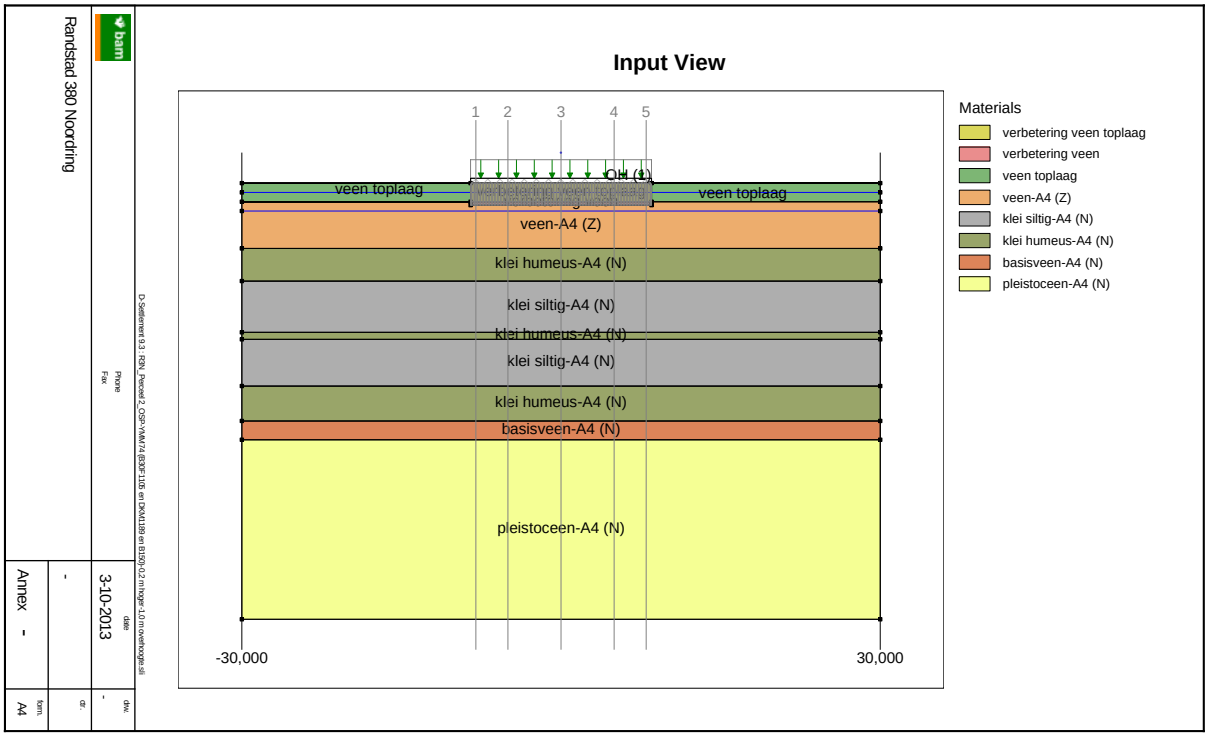
Figuur 9 Verloop zettingen dwarsprofiel OSP 154



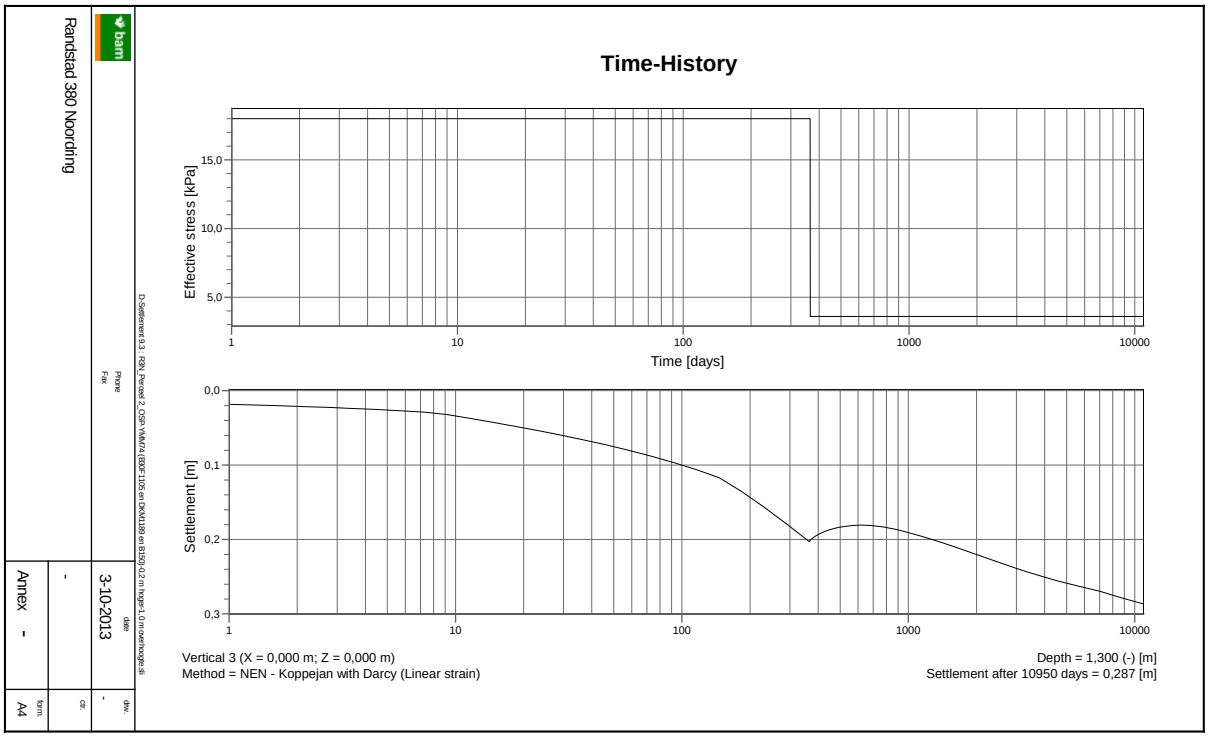
Figuur 10 Geometrie dwarsprofiel OSP 153



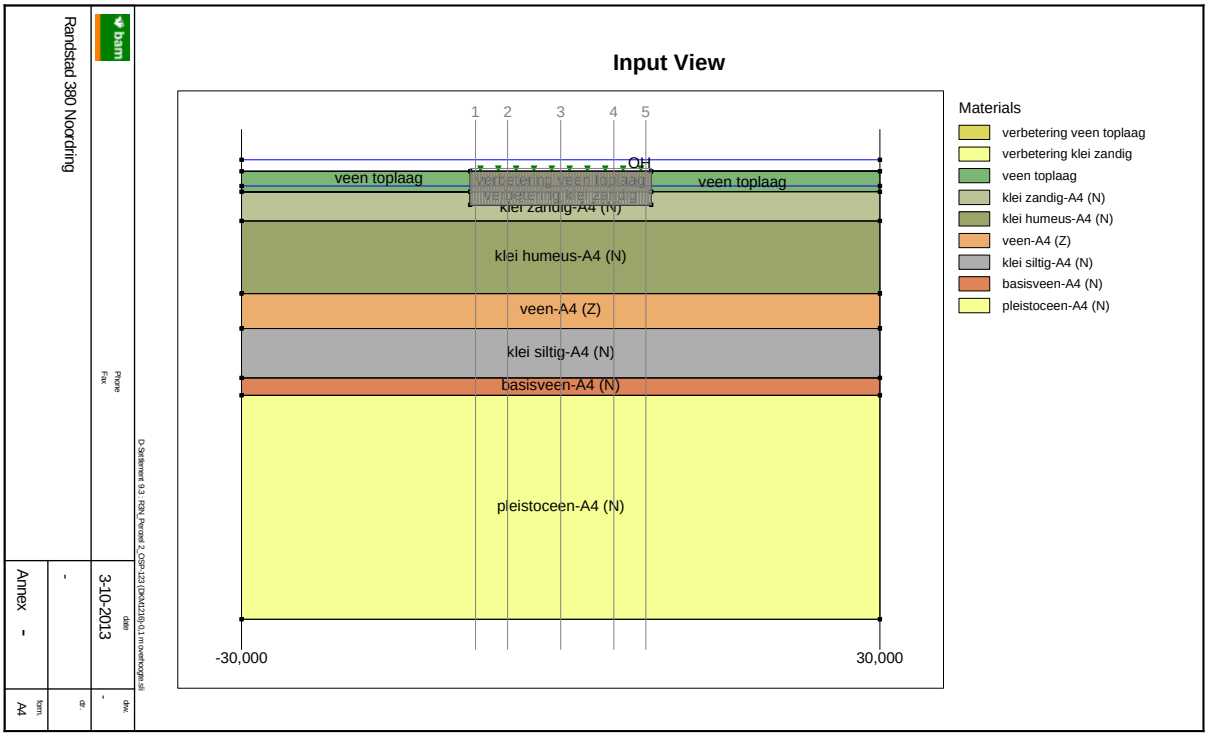
Figuur 11 Verloop zettingen dwarsprofiel OSP 153



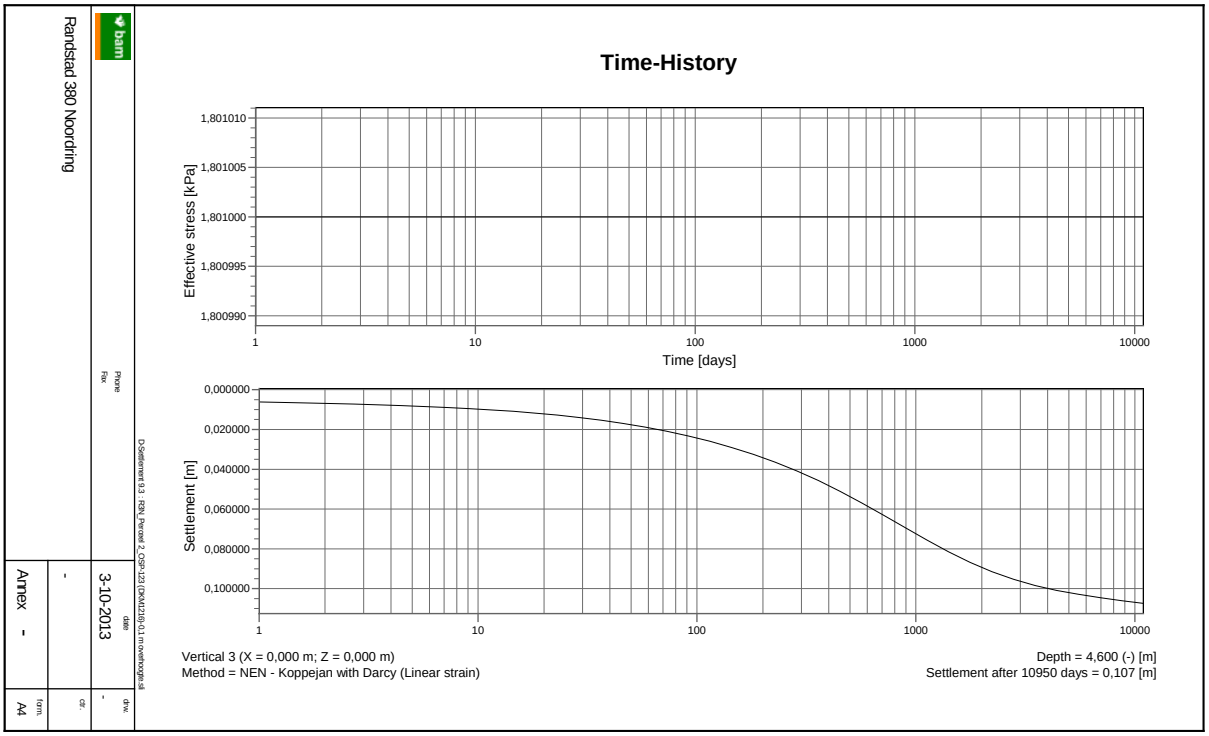
Figuur 12 Geometrie dwarsprofiel OSP YMM-74



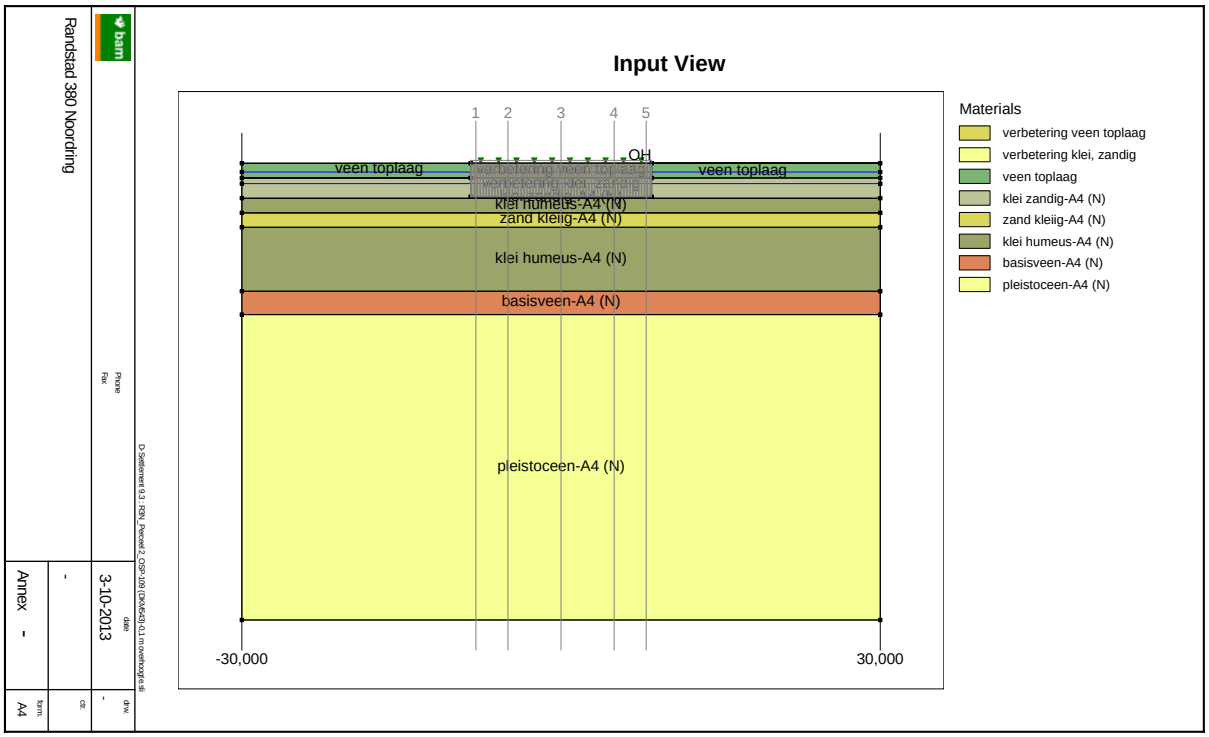
Figuur 13 Verloop zettingen dwarsprofiel OSP YMM-74



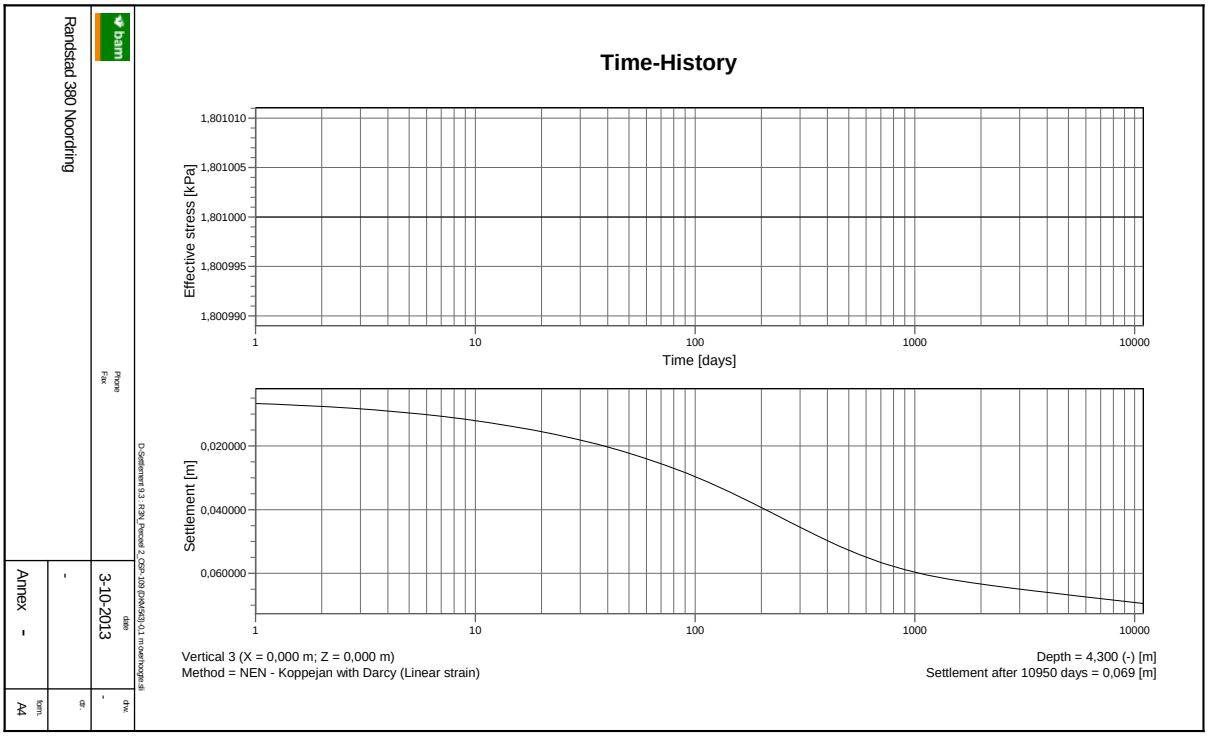
Figuur 14 Geometrie dwarsprofiel OSP 123



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.

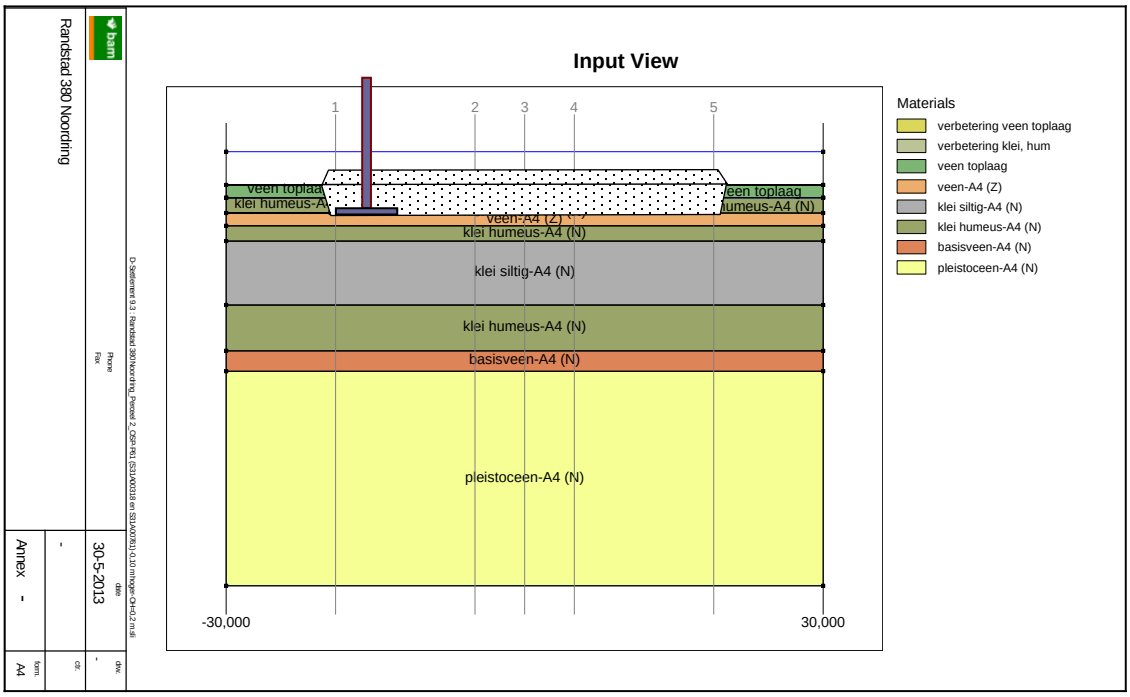
Geadviseerd wordt om na het graven van het cunet van de OSP's zo snel mogelijk daarna aan te vullen met zand om eventuele zwel (dat daarna zakt en dus tot extra zetting leidt) te beperken.

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

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15. Hoogheemraadschap van Rijnland, Waterstructuurvisie Haarlemmermeerpolder, 22 september 2010.
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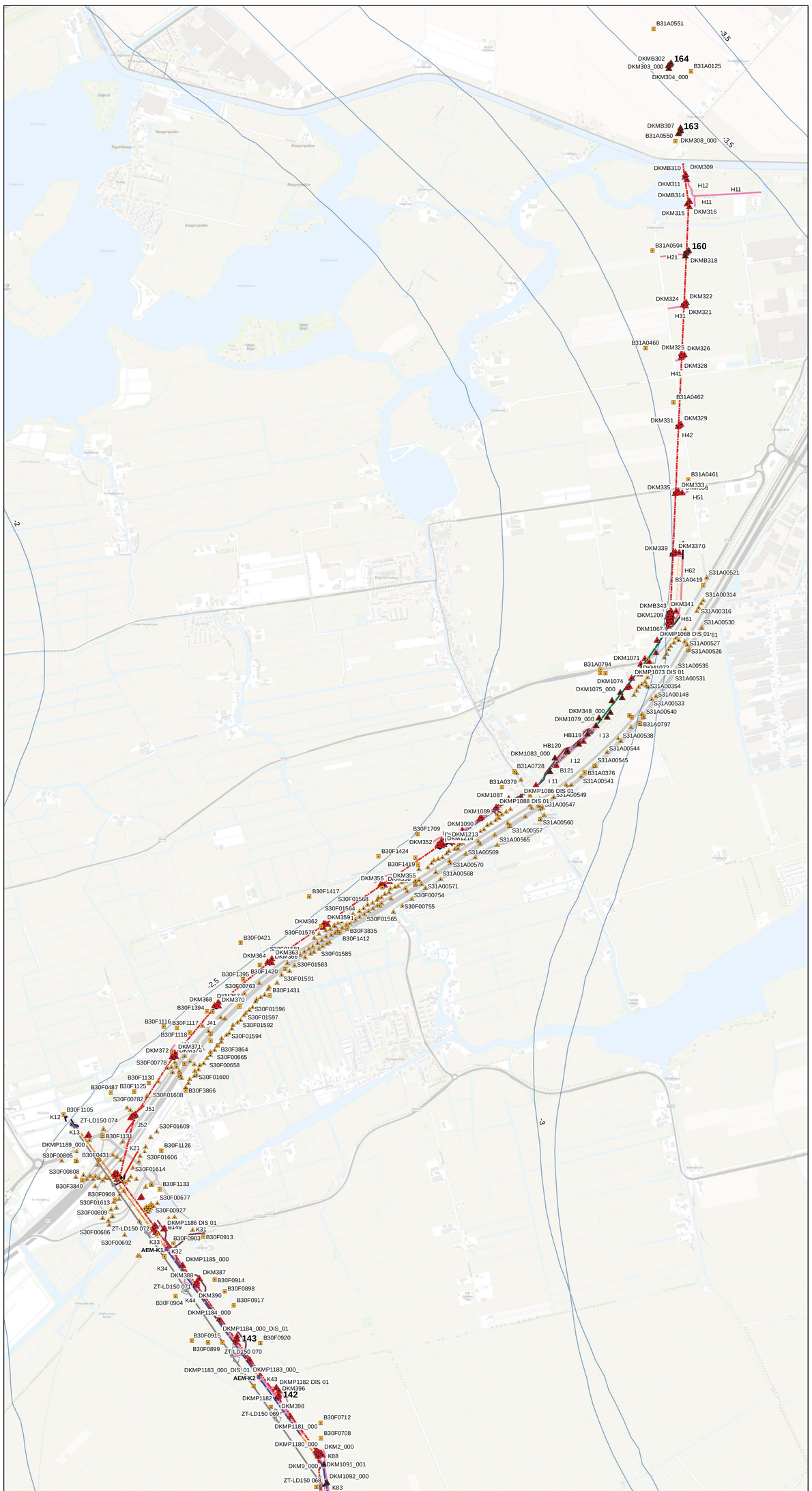
6. BIJLAGEN

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

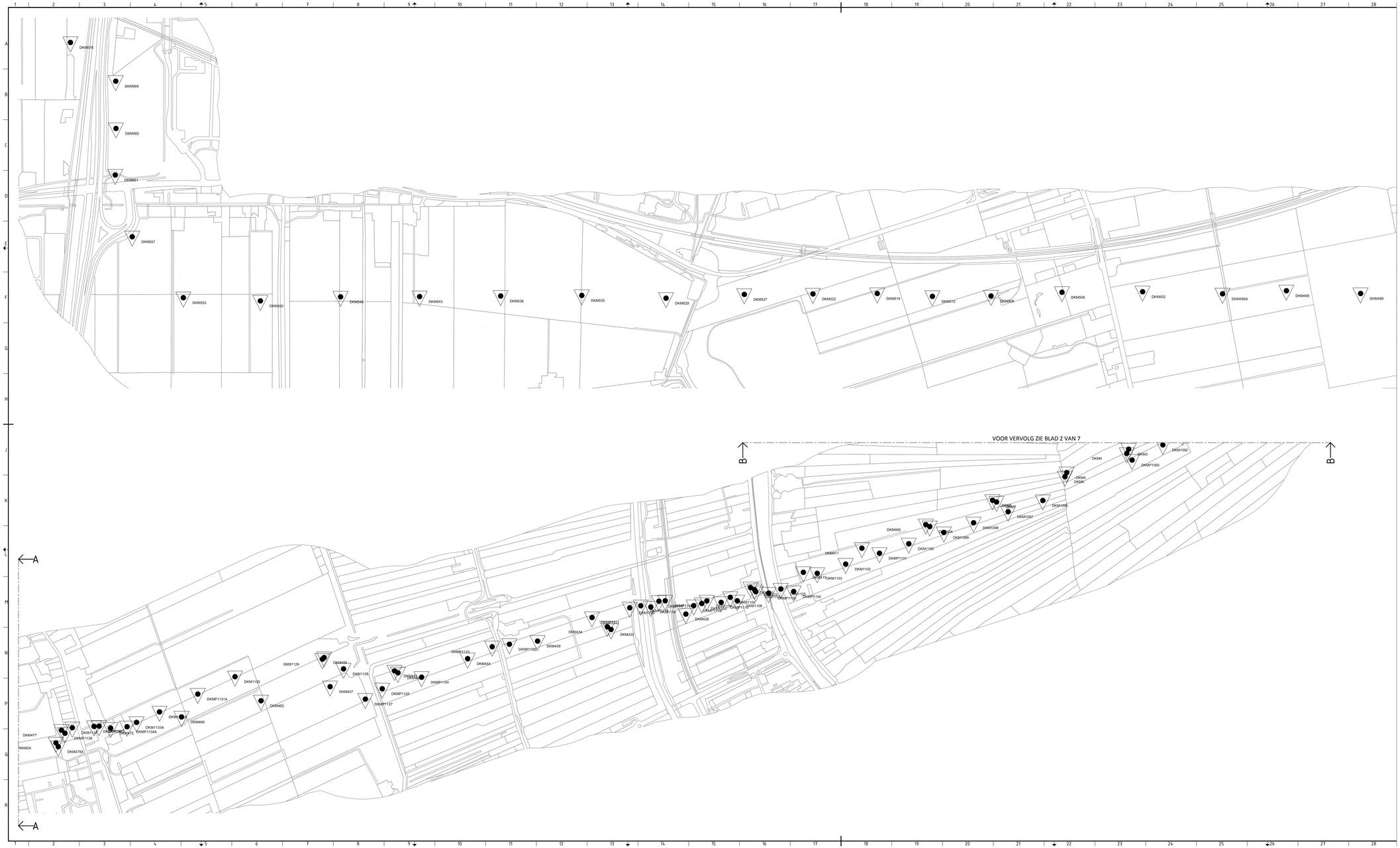
- af-nw-bm_200
- gk-nw-damwand
- kd-nw-bm_2000
- vh-nw-toegangsweg-H1-zonder-zettingsbeperkende-maatregelen
- vh-td-bouwweg-F1-rijplaten-lengterichting-op-bestaand-mv
- vh-td-bouwweg-F2-rijplaten-lengterichting-op-zandbed-en-doek
- vh-td-bouwweg-F3-rijplaten-dwarsrichting-op zand-en-doek
- vh-td-bouwweg-F4-rijplaten-lengterichting-op-houtsnippers-in-doek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

bam
Contact: gis@baminfraconsult.nl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DKM506
DKM502
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DKM488
VOOR VERVOLG ZIE BLAD 2 VAN 7
B
B
A
A
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DKM45
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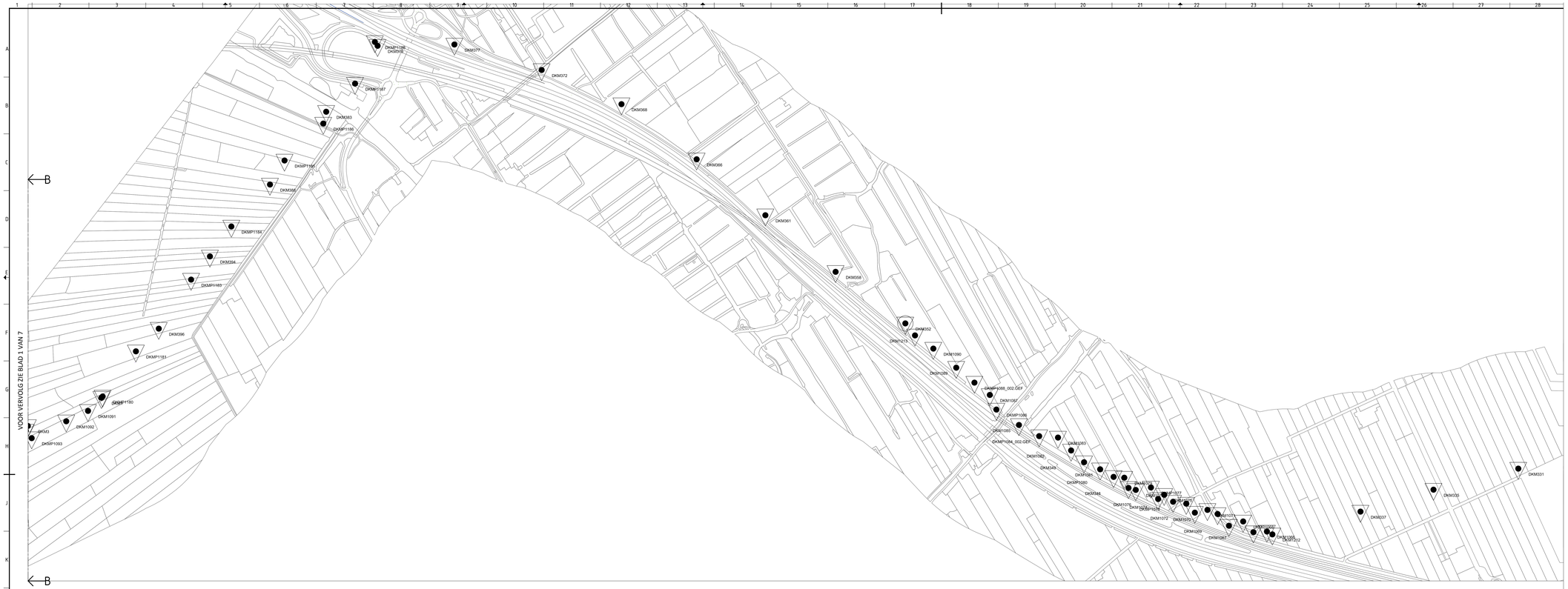

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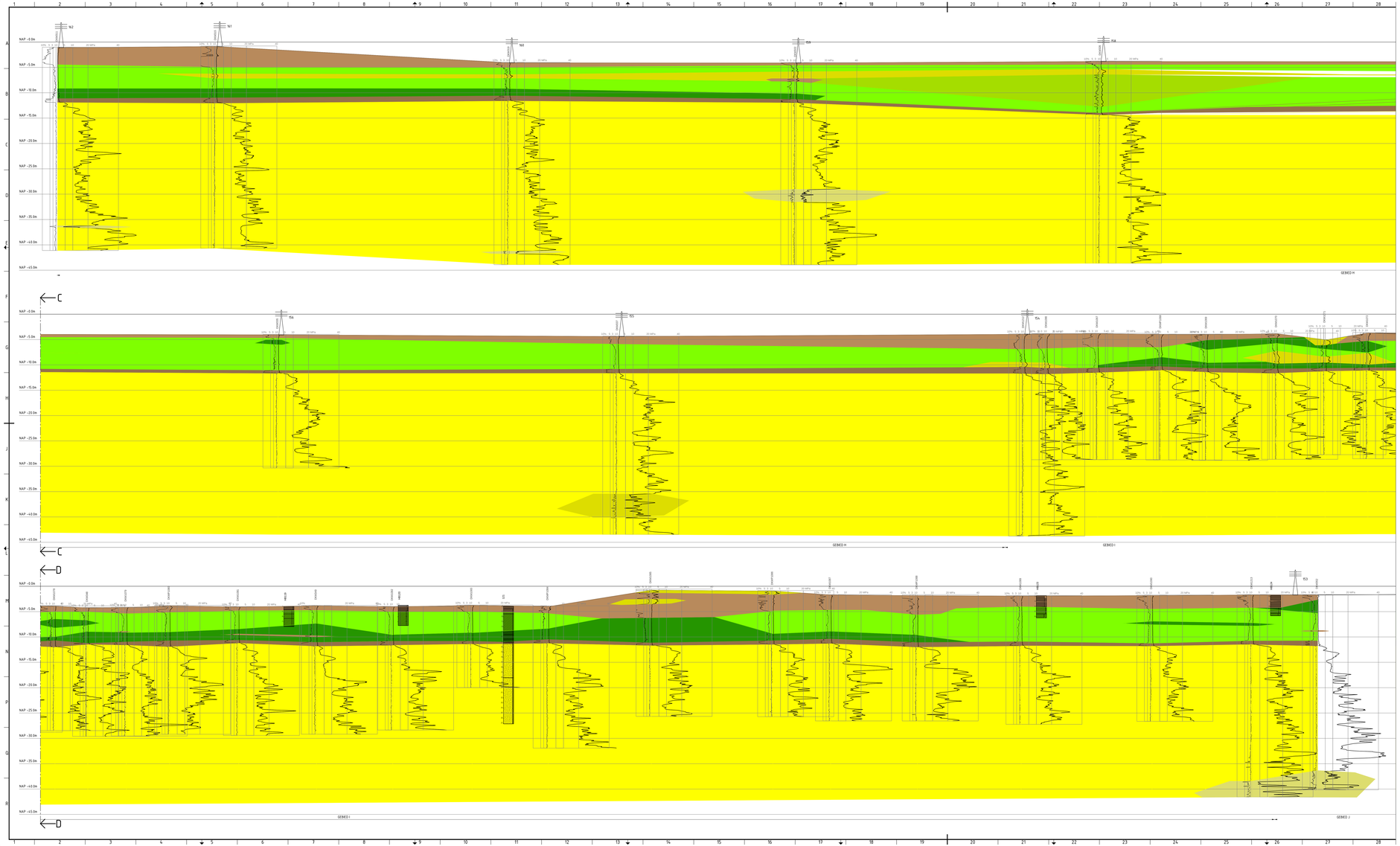
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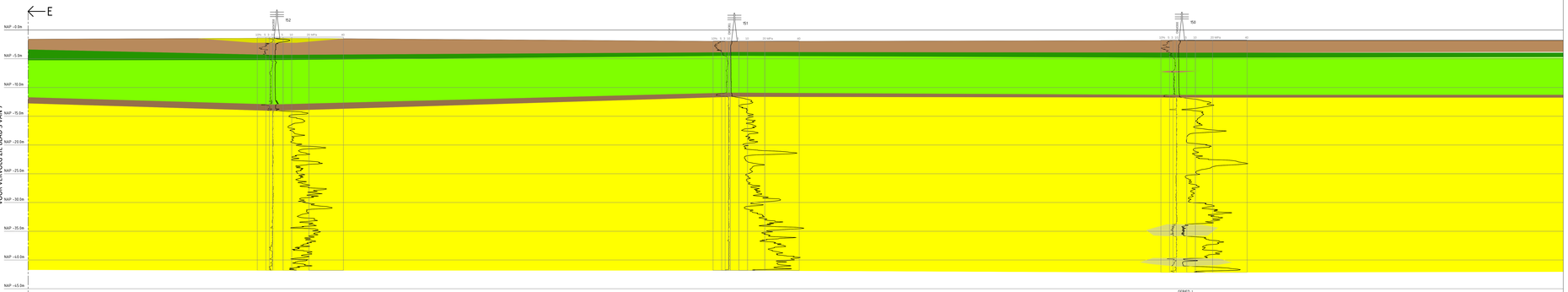

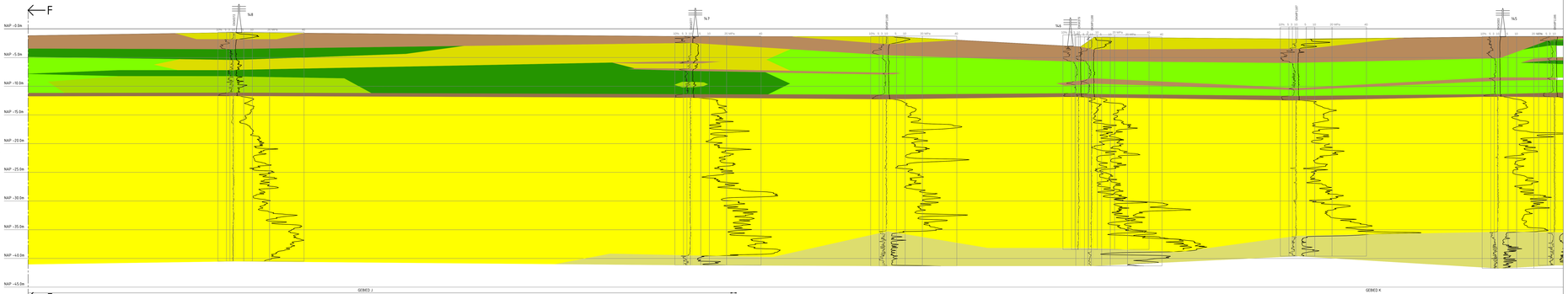

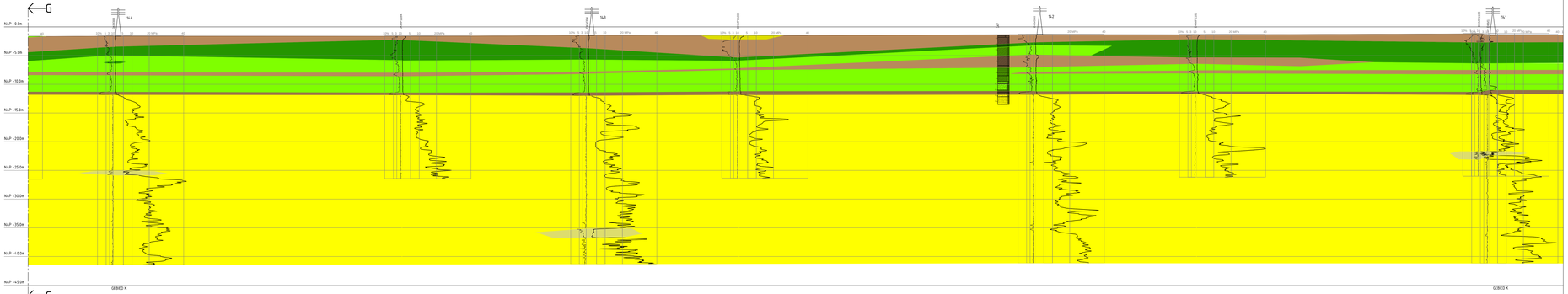

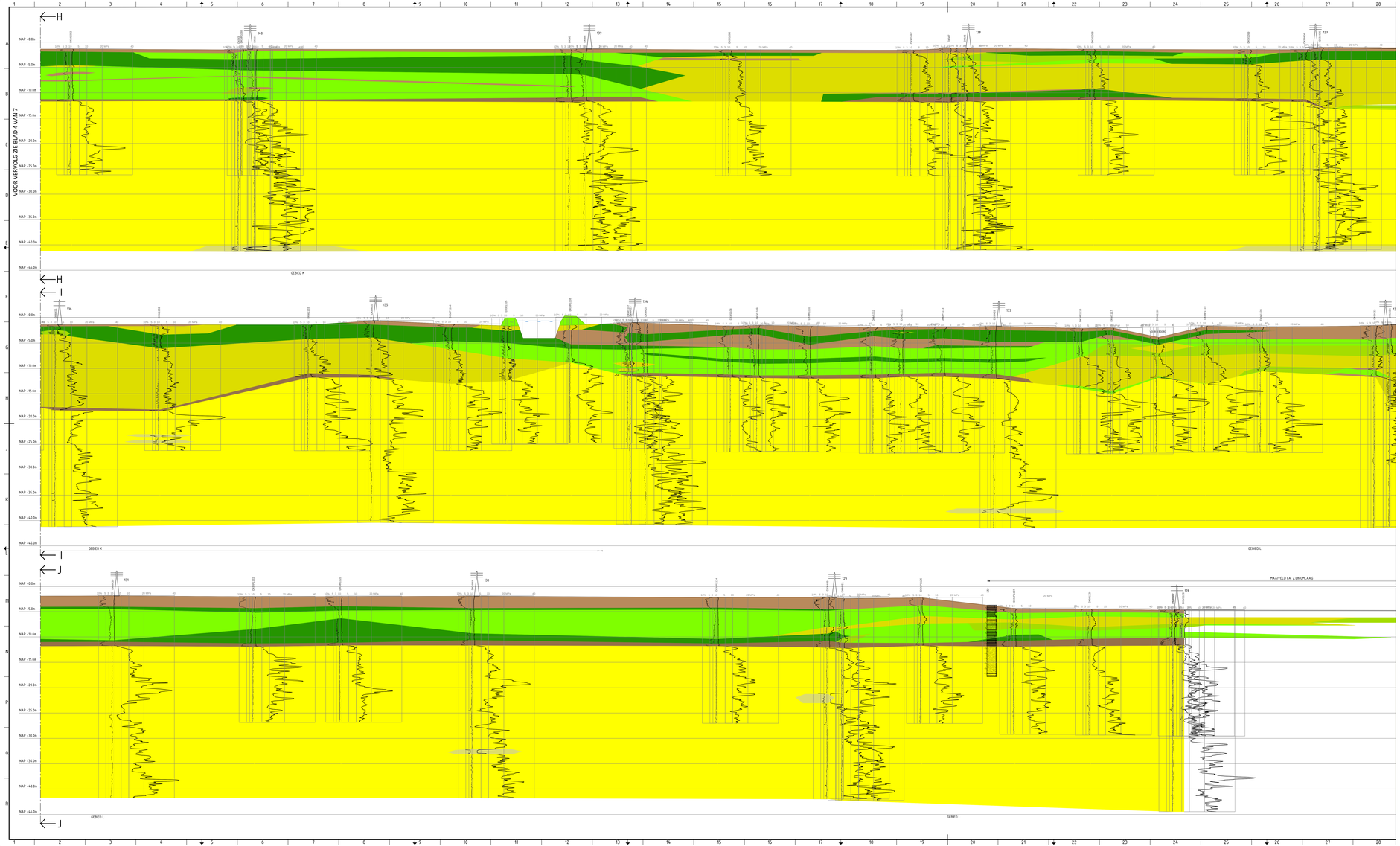
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GEMED L
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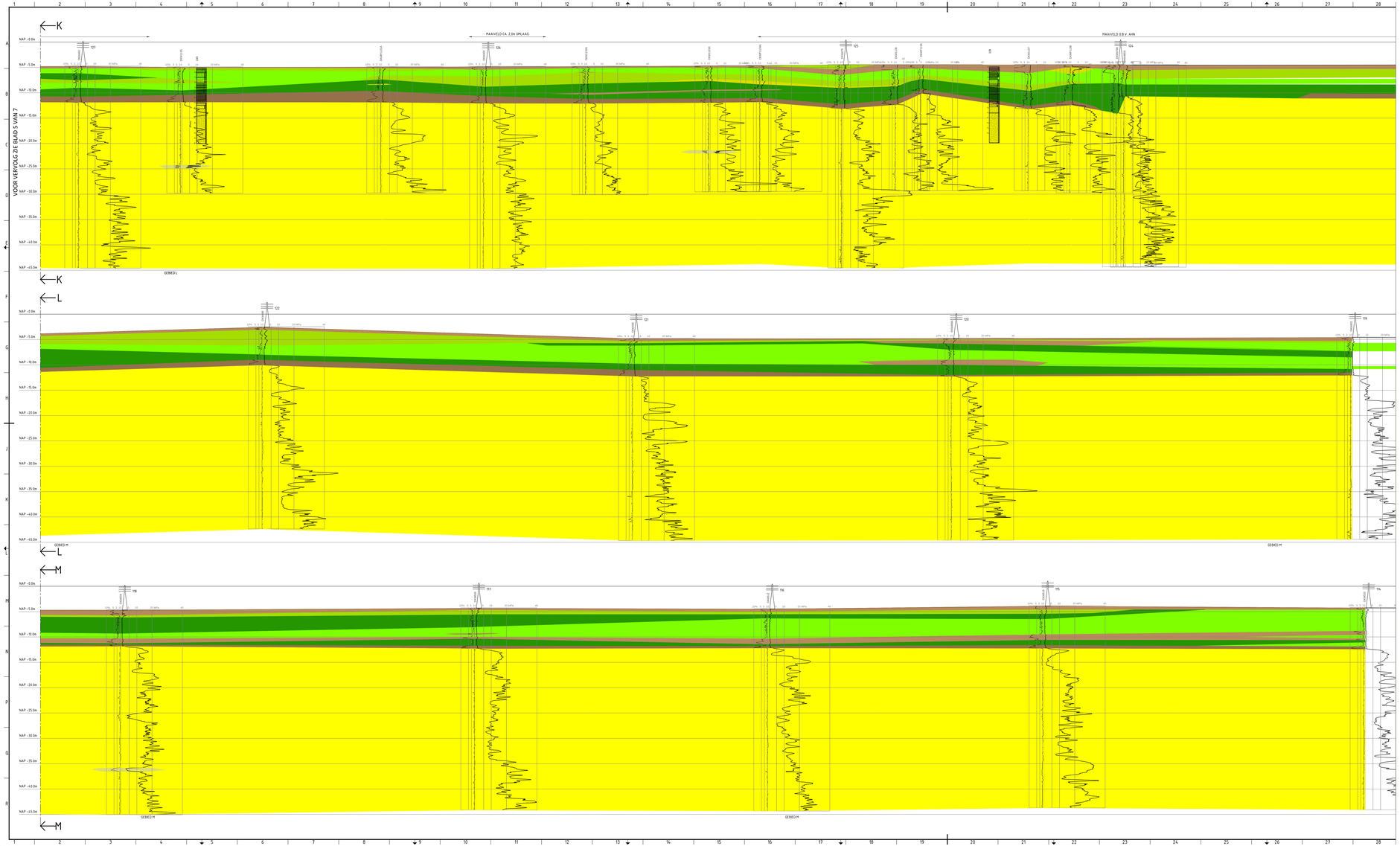

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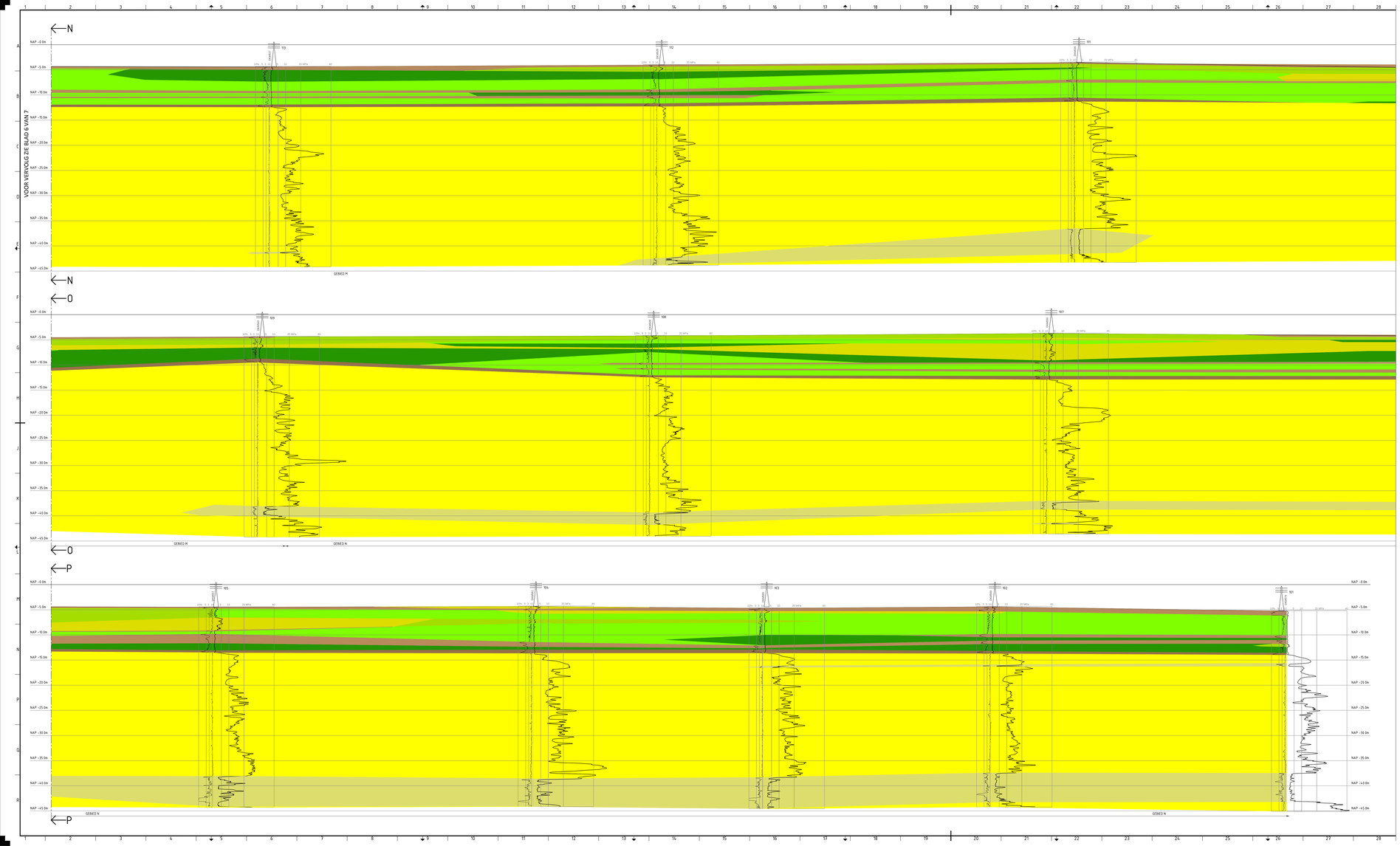
GEBIED M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113
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103
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101
GEBIED M
GEBIED N
VOOR VERVOLG ZIE BLAD 6 VAN 7

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 number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	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]	Unit weight 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	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 -	-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]	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 number	Primary compr. coeff.		Secular compr. coef.		Swell constants	
	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	
		Unsaturated	Saturated
	[days]	[kN/m³]	[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 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	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	
	[days]	Unsaturated [kN/m³]	Saturated [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

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

Documentnummer: R3N-OWR-0034

Opsteller	*Controleur*	*Vrijgever*
A.L.A. van Noort Constructeur	P. de Jager Ontwerpmanager	Arjan Hogenboom Project Manager

Distributie

Naam	Bedrijf
Extern	
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Intern	
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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

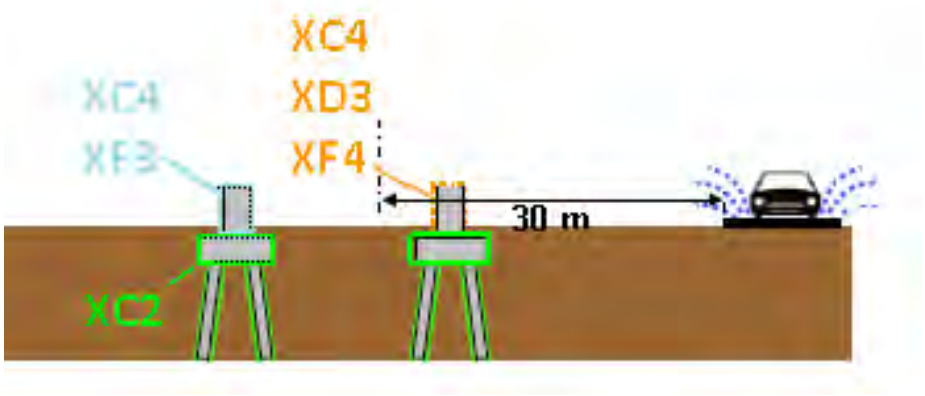
In onderstaande paragrafen worden de gehanteerde materiaaleigenschappen benoemd. Betonkwaliteiten
Voor het constructief beton worden bij de detaillering de volgende sterkteklassen aangehouden. Bij gescheurd beton wordt in eerste instantie gerekend met $E_{betron;gescheurd} = 1/3\ E_{beton;ongescheurd}$.

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

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

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

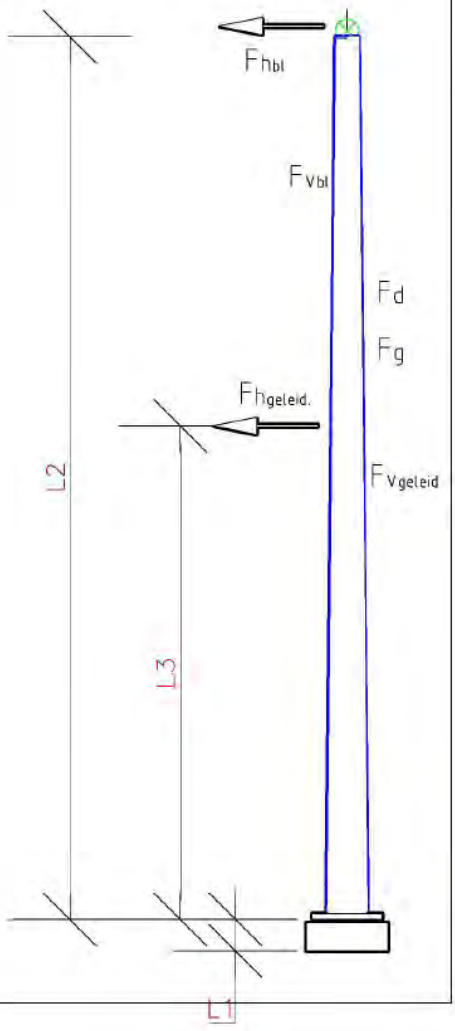
Fv(gl) = 17.4 kN (Uplift)
Fh(gl) = 28.0 kN
Fd(gl) = 8.5 kN

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

Afspanning 380kV

Componentbelasting

Fg = 2500 N

Fw = 4000 N

Geleiderbelasting

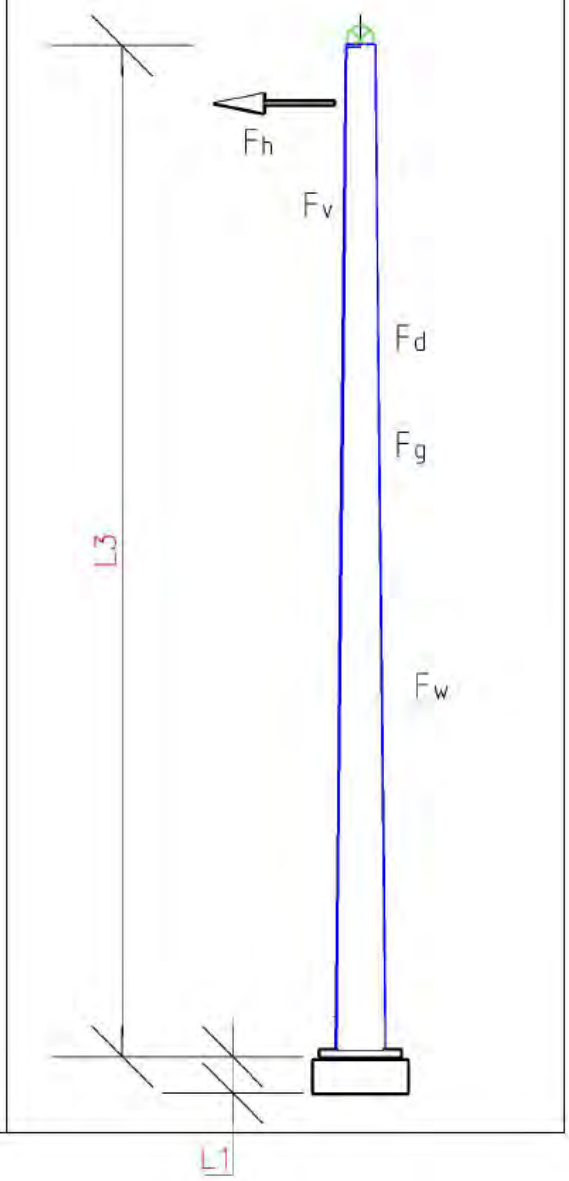
Fv(gl) = 17.4 kN (Uplift)
Fh(gl) = 27.4 kN
Fd(gl) = 7 kN

Maatvoering

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

Legenda

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

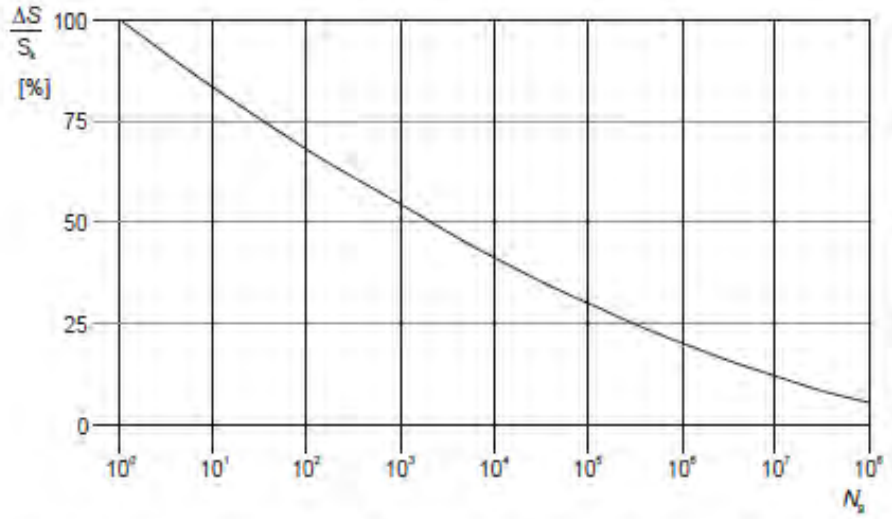


3.4. WISSELENDE BELASTINGEN EN VERMOEIING

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)

ΔS / 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	

	ROK	Wisseling spanning	Toelaatbaar aantal	
aantal wisselingen	dS/S	wapening	wisselingen	Schade
[-]	[-]	[N/mm2]	[-]	[-]
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	

	ROK	Wisseling spanning	Toelaatbaar aantal	
aantal wisselingen	dS/S	wapening	wisselingen	Schade
[-]	[-]	[N/mm2]	[-]	[-]
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	

	ROK	Wisseling spanning	Toelaatbaar aantal	
aantal wisselingen	dS/S	wapening	wisselingen	Schade
[-]	[-]	[N/mm2]	[-]	[-]
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	

	ROK	Wisseling spanning	Toelaatbaar aantal	
aantal wisselingen	dS/S	wapening	wisselingen	Schade
[-]	[-]	[N/mm2]	[-]	[-]
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 $\gamma_G = 0,9$.
[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	1,2	-	0,78	-	-
1b Wind, - 20° C	1,2	-	0,24	-	-
3 Wind+ice - 5° C	1,2	-	0,36	0,34 0,12	-
4 Construction/maintenance + 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) $\chi_Q = \chi_0 \gamma_Q$, 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	1,0	-	1,0	-	-
1b Wind, - 20° C	1,0	-	0,2	-	-
3 Wind+ice - 5° C	1,0	-	0,3	1,0	-
4 Construction/maintenance + 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

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

Documentnummer: R3N-OWR-0036

Opsteller	*Controleur*	*Vrijgever*
Michael Desmet Deputy Department Manager	Pieter de Jager Ontwerp Manager	Arjan Hogenboom Project Manager

Distributie

Naam	Bedrijf
Extern	
Guido Volman	TenneT TSO
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3. Bijlage: Aanzichttekeningen 6

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.
.

2. ONTWERP BEREKENING

D&C ENGINEERING
design and construct

Postbus 1
2950 AA Alblasserdam
Nieuwland Parc 301-302
2952 DD Alblasserdam
T +31 (0) 78 - 691 9222
E info@dcengineering.nl
w www.dcengineering.nl

Mastcontrole

Onderwerp	:	Ontwerpberekening mast 74, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Dossiernummer	:	13.039
Ordernummer	:	P13057
Opgesteld	:	J.Hollaar
Gecontroleerd	:	M. Glegola
Goedgekeurd	:	M. Glegola
Revisie	:	A
Datum	:	1-Aug-2013
D&C documentnr.	:	B.13089

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Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	5-Jul-13	Ontwerpberekening	J.Hollaar	M. Glegola	M. Glegola
A	1-Aug-13	Opmerkingen Cofely Fabricom verwerkt. Diverse spreadsheets bijlage C aangepast.	P. Damen	M. Glegola	M. Glegola

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Bijlage A	Geleiderbelastingen
Bijlage B	Berekening mast
Bijlage C	Controle staven mastlichaam

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

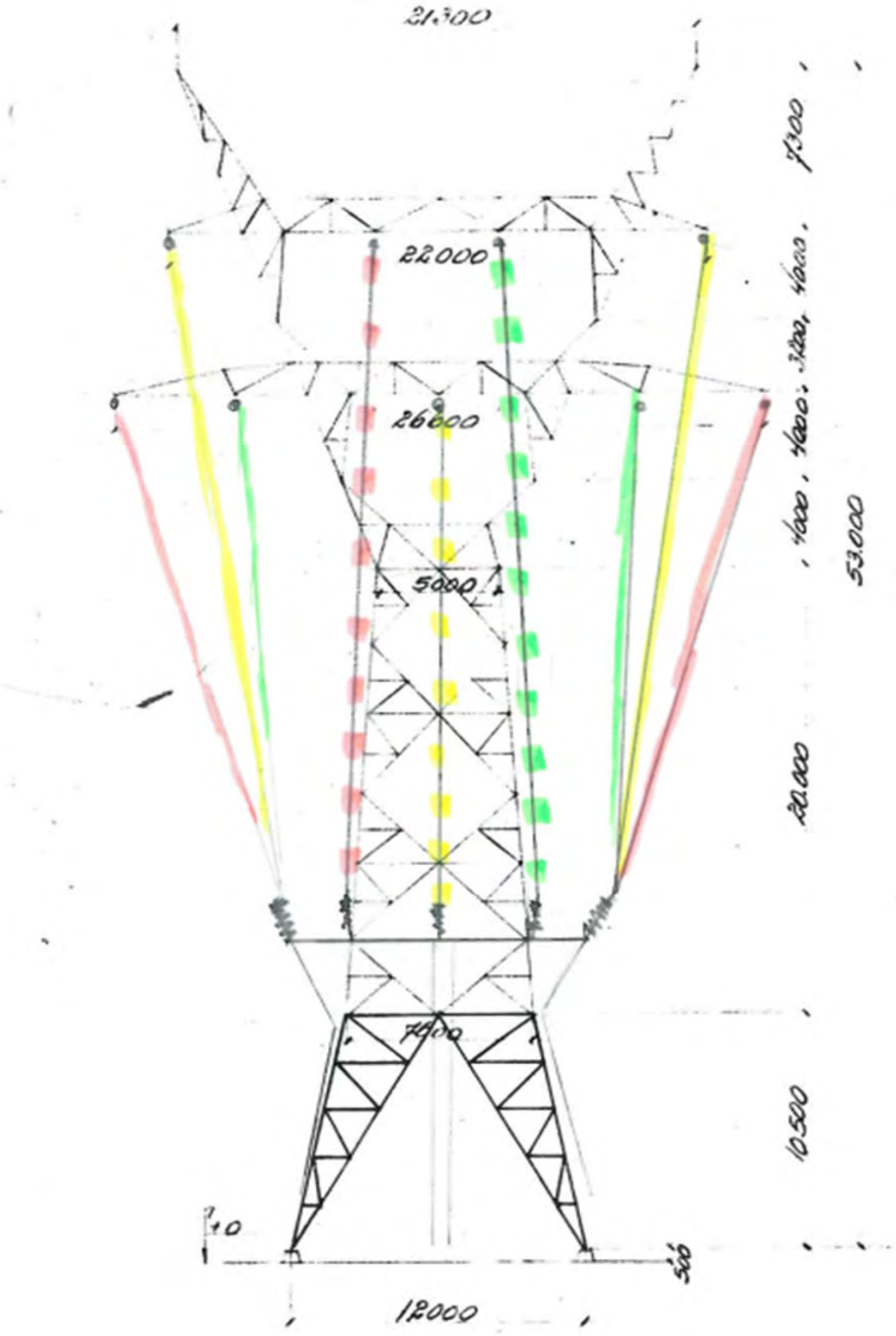
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A. Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000; 25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

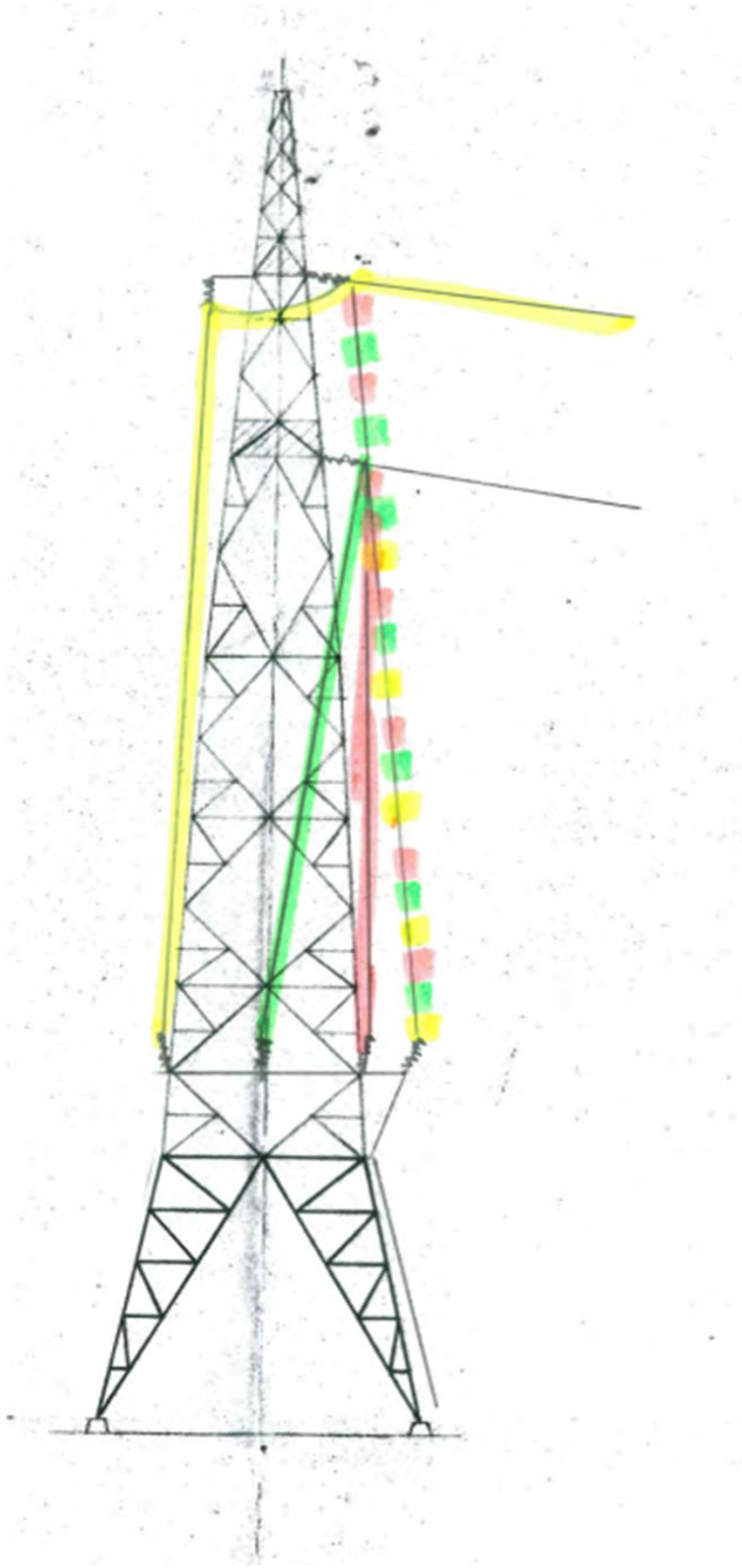
Materiaal randen	:	S355
Materiaal diagonalen	:	S355
Materiaal bouten		8.8

1.5 Overzicht mast

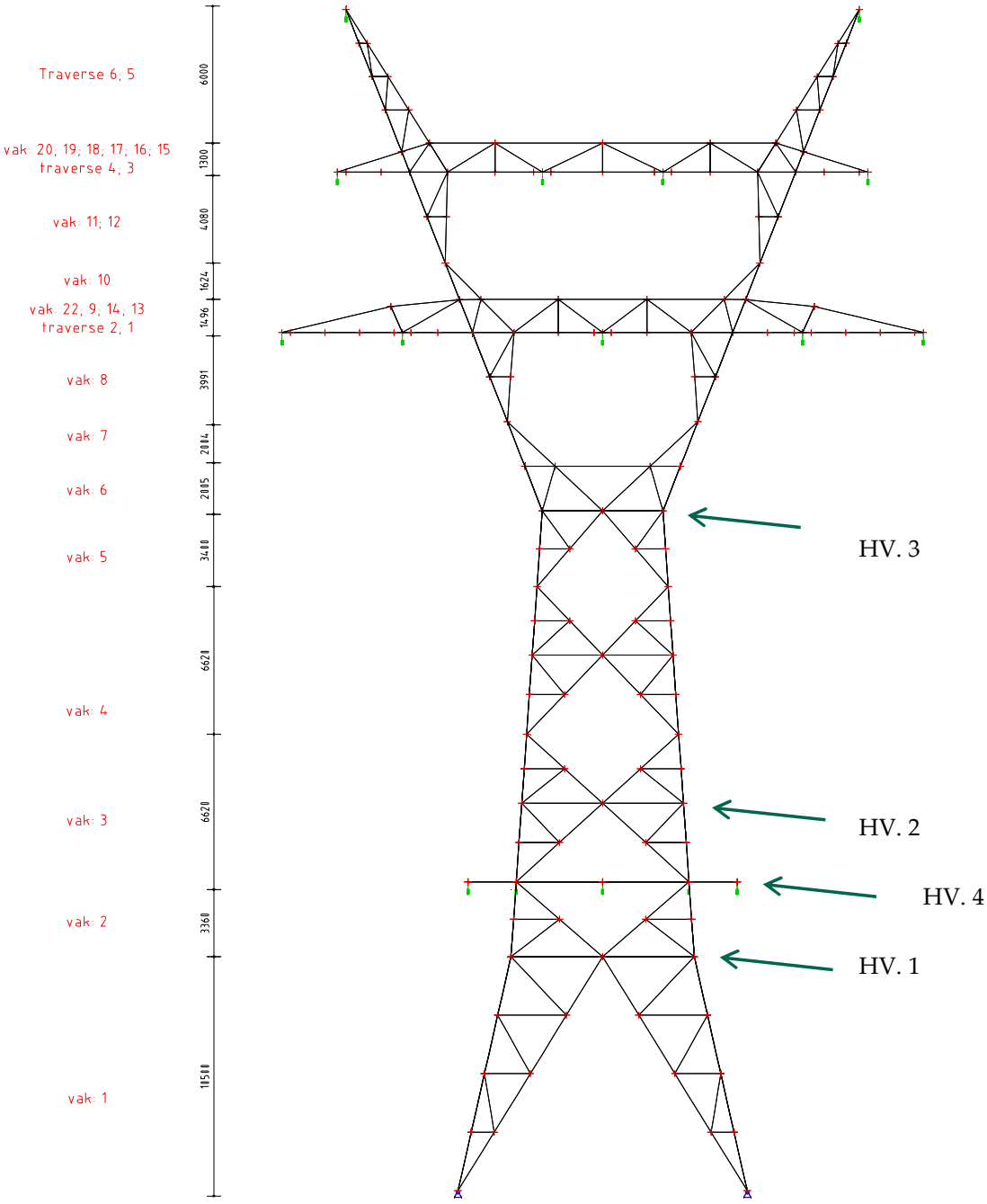
1.5.1 Overzicht voorvlak mastlichaam



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 (9x)	=1+1.5	=	2,5 kN
e.g. kabels (9x)	=31*0.1662	=	5,15 kN
e.g. div. kabelondersteuningen (9x)	=1.5	=	1,5 kN
e.g. totaal (9x)	=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 (9x)	=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 (9x)	=2,2+9,4+0,8+0,0	=	12,4 kN

windbelasting 45°

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

$F_{w//}$	=	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/7	**-82,09**	**-82,65**	**-332,14**	0,00	0,00	0,00
Sn1/N1	1a/8	**685,47**	**474,20**	**2517,89**	0,00	0,00	0,00
Sn1/N1	1a/9	450,81	245,26	1586,91	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/2	**-683,26**	**471,00**	**2505,41**	0,00	0,00	0,00
Sn2/N3	sp1aLF-p/10	**82,16**	**-80,26**	**-326,37**	0,00	0,00	0,00
Sn2/N3	1a/9	-450,81	245,08	1586,93	**0,00**	**0,00**	**0,00**
Sn3/N7	sp1aLF/11	**-160,24**	**-173,46**	**657,86**	0,00	0,00	0,00
Sn3/N7	1a-p/1	**587,41**	**400,62**	**-2183,73**	0,00	0,00	0,00
Sn3/N7	1a/9	353,29	148,22	-1210,08	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/4	**-582,41**	**400,01**	**-2170,85**	0,00	0,00	0,00
Sn4/N6	sp1aLF/12	**158,92**	**-172,38**	**651,92**	0,00	0,00	0,00
Sn4/N6	1a/9	-353,29	148,03	-1210,06	**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/13	554,88	786,60	753,69	-33563,89	14701,55	435,39
1a/14	-542,91	786,60	753,69	-33563,89	-14219,14	-432,99
1a/15	0,00	1318,83	753,69	-48110,97	0,02	-21,24
sp1aLF/16	0,00	-260,03	753,69	6794,30	0,02	12,14
3/17	157,32	871,80	806,16	-39314,60	4628,33	118,38
sp1aLR-p/18	-234,91	415,50	565,27	-20733,83	-6382,25	-140,60
sp1aLF-p/19	0,00	-260,03	565,27	6879,55	0,02	12,14
sp3LF/20	167,05	317,49	753,69	-13943,65	5004,28	2963,69
sp3RF/21	-164,18	391,81	753,69	-16804,97	-4888,46	-2963,11

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/7	Sn1/N1	Rx	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Rx	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
sp1aLF-p/7	Sn1/N1	Ry	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Ry	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
sp1aLF-p/7	Sn1/N1	Rz	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Rz	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
1a/2	Sn2/N3	Rx	683,58	955,10	-136,74	0,98	-683,26	20,75	667,04
sp1aLF-p/10	Sn2/N3	Rx	283,44	1145,38	118,15	3,92	82,16	271,27	1109,76
sp1aLF-p/22	Sn2/N3	Ry	261,04	417,92	-117,09	-1,25	-248,39	-80,26	-326,37
1a/23	Sn2/N3	Ry	518,17	2558,43	159,64	4,84	-216,02	471,00	2505,41
sp1aLF-p/22	Sn2/N3	Rz	261,04	417,92	-117,09	-1,25	-248,39	-80,26	-326,37
1a/23	Sn2/N3	Rz	518,17	2558,43	159,64	4,84	-216,02	471,00	2505,41
sp1aLF/11	Sn3/N7	Rx	236,15	824,17	-177,73	-3,34	-160,24	-173,46	-789,62
1a-p/1	Sn3/N7	Rx	711,02	781,17	-10,71	-0,46	587,41	400,62	-323,54
sp1aLF/11	Sn3/N7	Ry	236,15	824,17	-177,73	-3,34	-160,24	-173,46	-789,62
1a-p/1	Sn3/N7	Ry	711,02	781,17	-10,71	-0,46	587,41	400,62	-323,54
1a-p/24	Sn3/N7	Rz	162,34	2189,76	-74,49	-13,45	141,30	-79,92	-2183,73
sp1aLF/25	Sn3/N7	Rz	250,95	704,10	5,59	2,62	159,31	193,90	657,86
1a-p/4	Sn4/N6	Rx	587,62	2248,97	52,63	-3,69	-582,41	-78,01	-2170,85
sp1aLF/12	Sn4/N6	Rx	185,10	677,69	-104,16	3,52	158,92	94,90	651,92
sp1aLF/26	Sn4/N6	Ry	311,37	848,23	78,62	-2,53	-259,30	-172,38	-789,02
1a-p/27	Sn4/N6	Ry	425,09	541,20	-25,22	-0,79	-143,85	400,01	-334,96
1a-p/4	Sn4/N6	Rz	587,62	2248,97	52,63	-3,69	-582,41	-78,01	-2170,85
sp1aLF/12	Sn4/N6	Rz	185,10	677,69	-104,16	3,52	158,92	94,90	651,92

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 : $F_{x,Ed}$ = 685 kN $F_{tot,Ed}$ = 834 kN =(685^2+474^2)^0.5
$F_{y,Ed}$ = 474 kN
$F_{t,Ed}$ = 2518 kN
$F_{c,Ed}$ = 2183 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)
$F_{t,Rd}$ = $(k_2 * f_{ub} * A_s)/\gamma_{m2}$* 1,00 = 848 [kN]
$F_{t,Ed}$ = $F_{t,Ed}/n$ = 629 [kN]

UC : **$F_{t,Ed}$ / $F_{t,Rd}$** **≤** **1**
629 / 848 = 0,74 ≤ **1** verbinding voldoet

(tabel 3.4 afschuifweerstand)
$F_{1,vb,Rd}$ = $(\alpha_v * f_{ub} * A)/\gamma_{M2}$* 1,00 = 566 [kN]
(formule 6.2)
$F_{2,vb,Rd}$ = $(\alpha_{bc} * f_{ub} * A)/\gamma_{M2}$* 1,00 = 234 [kN]
(kleinste waarde van F1,vb,Rd en F2,vb,Rd)
$F_{vb,Rd}$ = 234 [kN]
$F_{v,Ed}$ = $F_{tot,Ed}/n$ = 208 [kN]

UC : **$F_{v,Ed}$ / $F_{v,Rd}$** **≤** **1**
208 / 233,8 = 0,89 ≤ **1** verbinding voldoet

5.2 Controle van voetplaat :

f_y = 355 N/mm2

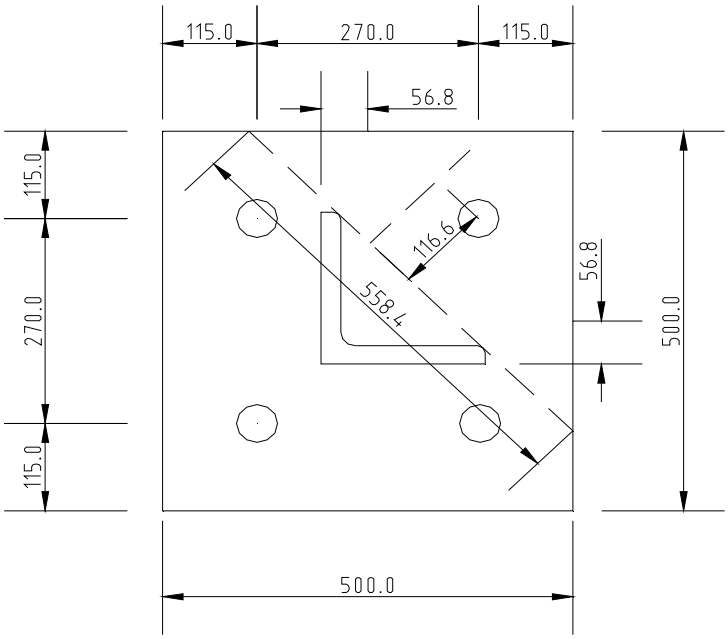
$M_{p,Rd}$ = 0,1667*l_{eff}*$t_f^{2*}f_y$/γ_{m0} = 82,6 [kNm] ; $leff_{min}$ = 558 mm

t_f = 50 mm

$M_{p,Ed}$ = $F_{t,Ed}$*m = 73,4 [kNm] ; m = 117 mm

UC : **$M_{p,Ed}$ /$M_{p,Rd}$ ≤ 1**

73,4 / 82,6 = 0,89 ≤ **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

plaats	$UC_{tot,1}$	staaftype	bouten
- vak 1 - Randstaven	89%	H200/200/24	6 M30
- vak 1 - Diagonalen	98%	H150/150/12	3 M30
- vak 1 - 1e (bovenste) horizontale knikverkorter	76%	H70/70/7	1 M16
- vak 1 - 2e horizontale knikverkorter	82%	H60/60/6	1 M16
- vak 1 - 3e en 4e horizontale knikverkorter	83%	H50/50/5	1 M16
- vak 1 - 1e (bovenste) schuine knikverkorter	76%	H80/80/8	1 M16
- vak 1 - 2e schuine knikverkorter	66%	H80/80/8	1 M16
- vak 1 - 3e schuine knikverkorter	88%	H80/80/8	1 M16
- vak 1 - 4e schuine knikverkorter	80%	H100/100/10	2 M24
- vak 1 pootverb. - 1e (bovenste) hor. knikverkorter	84%	H60/60/6	1 M16
- vak 1 pootverband - 2e hor. knikverkorter	62%	H60/60/6	1 M16
- vak 1 pootverband - 3e + 4e hor. knikverkorter	71%	H50/50/5	1 M16
- vak 1 pootverband - schuine knikverkorter	87%	H70/70/7	1 M16
- vak 2 - Randstaven	90%	H200/200/20	6 M30
- vak 2 - Diagonalen	100%	H160/160/15	4 M30
- vak 2 - Horizontale knikverkorter	66%	H60/60/6	1 M16
- vak 2 - Schuine knikverkorter	27%	H70/70/7	1 M16
- vak 3 - Randstaven	94%	H200/200/20	6 M30
- vak 3 - Diagonalen	83%	H150/90/10	2 M24
- vak 3 - Horizontale knikverkorter	57%	H60/60/6	1 M16
- vak 3 - Schuine knikverkorter	82%	H60/60/6	1 M16
- vak 4 - Randstaven	96%	H200/200/18	5 M30
- vak 4 - Diagonalen	96%	H150/90/10	2 M24
- vak 4 - Horizontale knikverk. (onder + boven)	92%	H50/50/5	1 M16
- vak 4 - Horizontale knikverkorter (midden)	75%	H60/60/6	1 M16
- vak 4 - Schuine knikverkorter	78%	H60/60/6	1 M16
- vak 5 - Randstaven	79%	H200/200/18	4 M30
- vak 5 - Diagonalen	86%	H150/100/10	3 M24
- vak 5 - Horizontale knikverkorter	64%	H50/50/5	1 M16
- vak 5 - Schuine knikverkorter	65%	H60/60/6	1 M16

plaats	$UC_{tot,1}$	staaftype	bouten
- Vak 6,7 - randen	87%	H180/180/18	4 M30
- Vak 6,7 - diagonalen v.v en a.v	74%	H150/150/14	3 M24
- Vak 6,7 - diagonalen l.z.v en r.z.v	76%	H120/120/12	2 M30
- Vak 6,7 - schuine knikverkorters v.v en a.v	75%	H100/100/8	2 M16
- Vak 6,7 - schuine knikverkorters l.z.v en r.z.v	83%	H60/60/8	1 M16
- Vak 6 - hor. knikverkorters	58%	H60/60/6	1 M16
- Vak 6 - hor. diagonalen v.v en a.v.	58%	H130/130/12	2 M16
- Vak 8 - randen	86%	H160/160/15	3 M30
- Vak 8 - diagonalen v.v en a.v	96%	H120/120/12	2 M24
- Vak 8 - diagonalen l.z.v en r.z.v	89%	H150/150/15	4 M24
- Vak 8 - schuine knikverkorters	70%	H70/70/7	1 M16
- Vak 8 - hor. knikverkorters	32%	H50/50/5	1 M16
- Vak 8 - hor. verbanden l.z.v en r.z.v	50%	H75/75/8	1 M16
- Vak 10 - randen	86%	H160/160/15	3 M24
- Vak 10 - diagonalen v.v en a.v	66%	H120/120/12	3 M24
- Vak 10 - diagonalen l.z.v en r.z.v	67%	H90/90/9	2 M24
- Vak 10 - schuine knikverkorters	85%	H120/80/8	2 M24
- Vak 10 - hor. knikverkorters l.z.v en r.z.v	87%	H50/50/5	1 M16
- Vak 11,12 - randen	80%	H120/120/12	2 M24
- Vak 11,12 - diagonalen v.v en a.v	56%	H120/120/10	2 M24
- Vak 11,12 - diagonalen l.z.v en r.z.v	83%	H120/120/10	2 M24
- Vak 11,12 - schuine knikverkorters	56%	H50/50/5	1 M16
- Vak 11,12 - hor. knikverkorters	44%	H50/50/5	1 M16

- Horizontaal verband 1 - Horizontalen	74%	H150/150/14	3 M24
- Horizontaal verband 1 - Diagonalen	92%	H130/130/10	2 M16
- Horizontaal verband 1 - Kruis	95%	H70/70/7	1 M16
- Horizontaal verband 2 - Horizontalen	67%	H60/60/6	1 M16
- Horizontaal verband 2 - Diagonalen	80%	H70/70/7	2 M16
- Horizontaal verband 3 - Horizontalen	83%	H150/150/14	3 M30
- Horizontaal verband 3 - Diagonalen	83%	H100/100/10	1 M20
- Horizontaal verband 3 - Kruis	87%	H60/60/7	1 M16
- Horizontaal verband 4 - Horizontalen	73%	UNP280	6 M20
- Horizontaal verband 4 - Diagonalen	69%	H100/100/10	1 M16
- Horizontaal verband 4 - Kruis en Koppelstaven	74%	H100/100/10	1 M16
- Horizontaal verband 4 - zijranden	8%	HE240A	2 M16

plaats	$UC_{tot,1}$	staaftype	bouten
- Traverse 1,2 - onderranden	95%	UNP 200	-
- Traverse 1,2 - bovenranden	72%	H65/50/5	3 M16
- Traverse 1,2 - diagonalen	81%	H50/50/5	2 M16
- Traverse 1,2 - diagonalen ondervlak (S 273,274,275,278,279,280,302,303,304,307,308,309)	86%	H60/60/8	1 M24
- Traverse 1,2 - diagonalen ondervlak (S 313,314,285,284)	78%	H60/60/8	1 M24
- Traverse 1,2 - diagonalen ondervlak (S 317,466,288,465)	78%	H90/90/9	1 M24
- Vak 9,13,14 - onderranden	85%	UNP 200	-
- Vak 9,13,14 - bovenranden	63%	H130/130/12	3 M24
- Vak 9,13,14 - diagonalen v.v en a.v (S 242,225,227,240)	77%	H120/120/8	3 M16
- Vak 9,13,14 - diagonalen v.v en a.v (S 226,224,239,241)	79%	H100/100/8	3 M16
- Vak 9,13,14 - diagonalen ondervlak (S 263t/m267,290,291,292,318,319,320,400)	90%	H80/80/8	1 M24
- Vak 9,13,14 - diagonalen ondervlak (S 322,323,293,294)	55%	H50/50/5	1 M16
- Vak 9,13,14 - hor diagonalen ondervlak (S 268,321)	43%	H70/70/5	1 M16
- Vak 9,13,14 - hor diagonalen ondervlak (S 298,270,399)	87%	H90/90/9	2 M24
- Vak 9,13,14 - binnen verbanden (S 215,220,222,214,219,221)	24%	H50/50/5	1 M16

plaats	$UC_{tot,1}$	staaftype	bouten
- Traverse 3,4 - onderranden	51%	UNP 140	-
- Traverse 3,4 - bovenranden	53%	H50/50/5	3 M16
- Traverse 3,4 - diagonalen ondervlak (S 167,169,180,181,198,199,190,192)	93%	H60/60/8	1 M24
- Traverse 3,4 - diagonalen ondervlak (S 193,191,170,168)	82%	H50/50/5	1 M24
- Vak 19,18,17,16 - onderranden	65%	UNP 140	-
- Vak 19,18,17,16 - bovenranden	67%	H100/100/10	3 M216
- Vak 19,18,17,16 - diagonalen v.v en a.v (S 100,107,111,118)	85%	H100/100/6	2 M16
- Vak 19,18,17,16 - diagonalen v.v en a.v (S 101,109,112,120)	89%	H50/50/6	2 M16
- Vak 19,18,17,16 - diagonalen v.v en a.v (S 102,110,113,126)	61%	H90/90/9	1 M16
- Vak 19,18,17,16- diagonalen ondervlak (S 182-185,178,179,200-203,206,207)	78%	H70/70/9	1 M24
- Vak 19,18,17,16- diagonalen ondervlak (S186,187,205,204)	85%	H50/50/6	1 M16

- Traverse 5,6 - onderranden (buitenranden)	66%	H100/100/10	2M24
- Traverse 5,6 - bovenranden	41%	H65/50/6	2 M16
- Traverse 5,6 - diagonalen v.v en a.v	28%	H50/50/5	1 M16
- Traverse 5,6 - diagonalen l.z.v en r.z.v	91%	H650/50/5	1 M16
- Traverse 5,6 - diagonalen l.z.v en r.z.v (S71,73,10,8)	83%	H60/60/6	1 M16

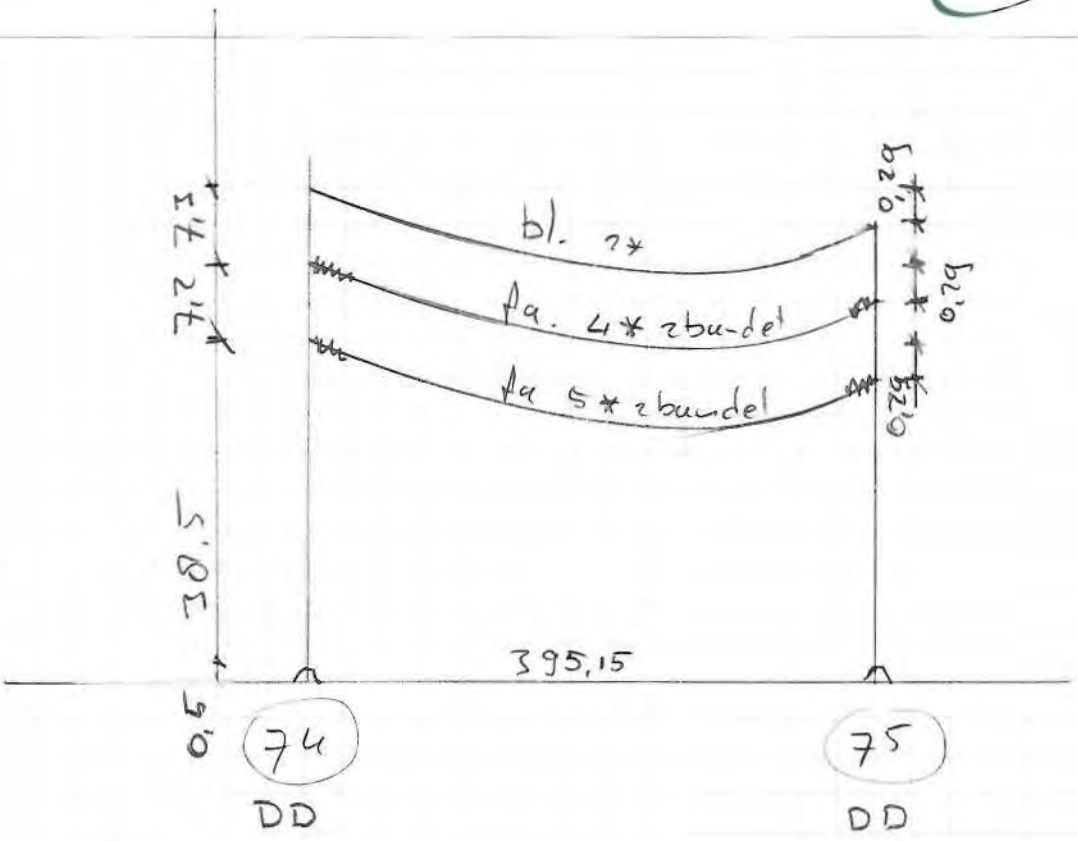
Bijlage A Geleiderbelastingen

Dossier/File 13.039

Order P17056

Pagina/Page

D&C ENGINEERING
design and construct



fasedraad: CU 185

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

bliksemdraad: CU 50

Ysgebied : 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

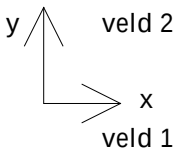
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(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

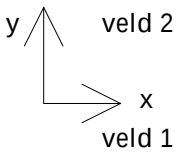
* Berekend worden de "Special Limit State" belastingcombinaties, (table 4.2.11/NL.3)

(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		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	2.67	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

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Auteur	- AD
Datum	11.07.2013
Constructie	Algemeen XYZ
Nationale norm	EC - EN

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

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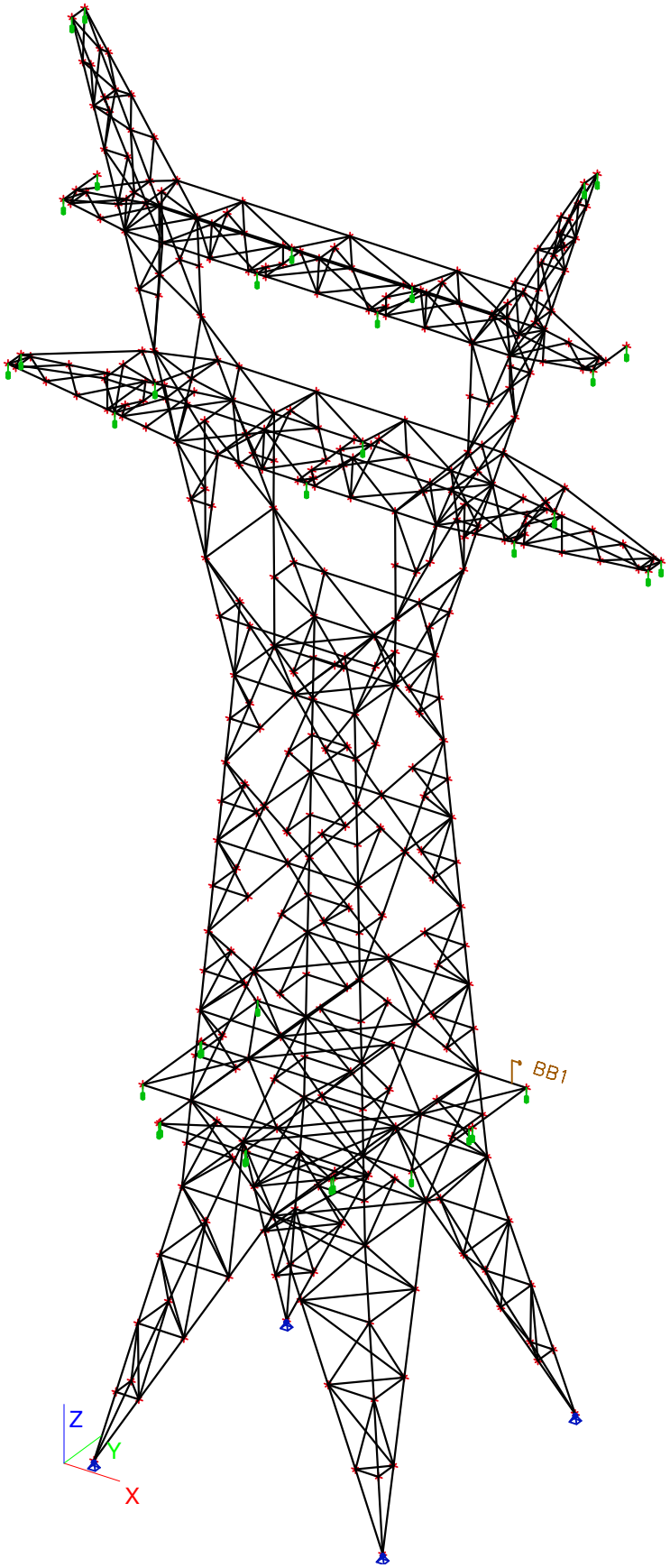
D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

2. Overzicht rekenmodel



D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

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
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
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
K576	7,942	1,317	38,500
K577	7,942	-1,317	38,500
K578	6,837	1,506	38,500

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

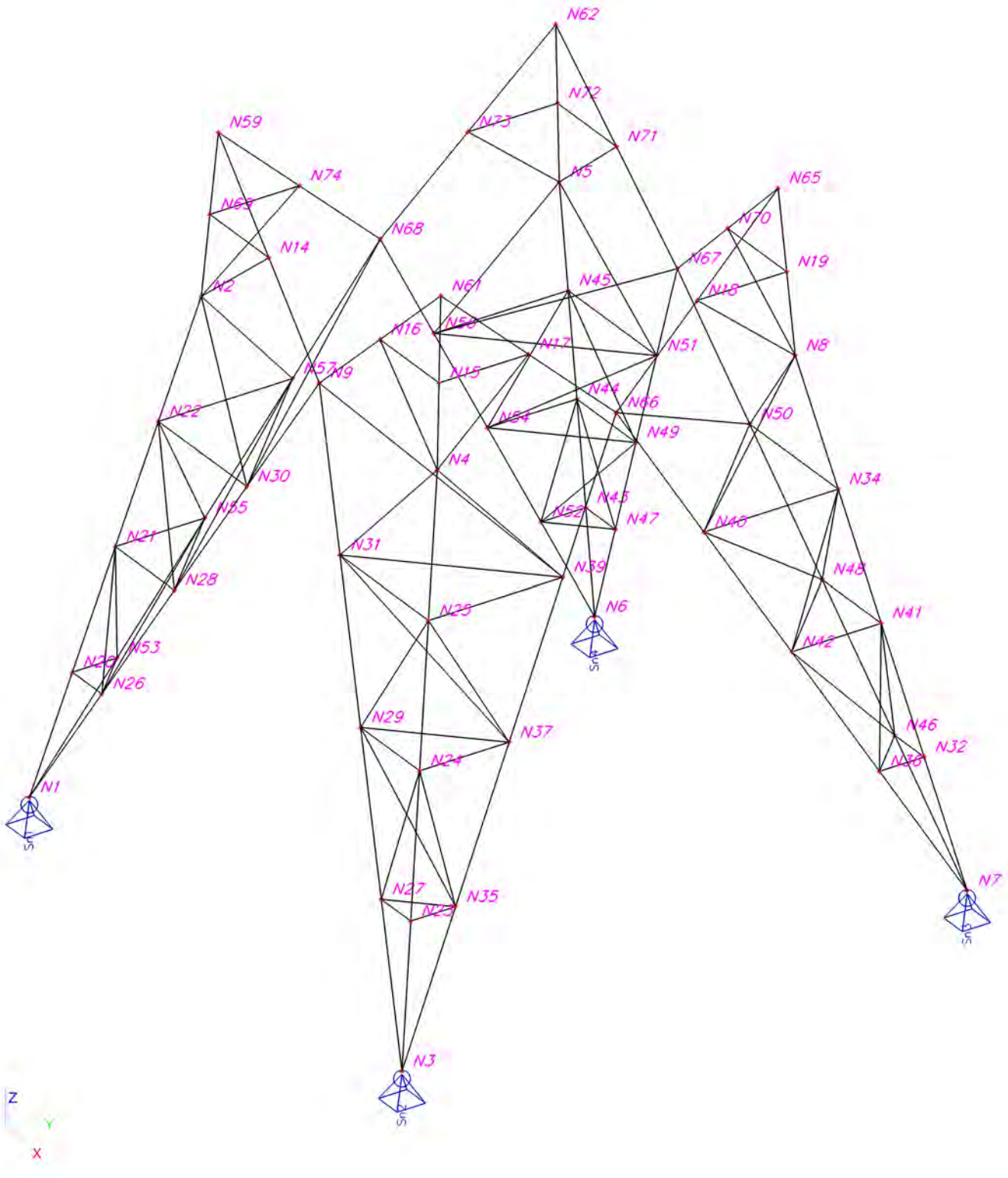
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K579	6,837	-1,506	38,500
K589	-0,358	0,886	38,500
K591	0,352	1,753	38,500
K598	5,042	-1,614	39,996
K601	3,813	-1,939	36,514
K605	3,226	-1,063	32,505
K606	3,226	-2,313	32,505
K618	10,647	-0,400	53,000
K619	-6,526	-1,462	41,620
K620	-6,526	1,462	41,620
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
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

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
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
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

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
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
K636	-3,582	-5,582	13,860
K640	3,582	-5,582	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
K649	0,000	-5,582	13,860
K651	-5,582	0,080	13,860
K652	5,582	0,212	13,860
K653	3,582	-5,456	13,860
K654	0,000	-5,505	13,860
K655	-3,582	-5,476	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



D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

5. 1D-staaf

Naam	Doorsnede	Lengte [m]
S1	CS22 - HFLeq60x60x6	0,941
S2	CS11 - L50X5	1,862
S3	CS11 - L50X5	2,018
S4	CS11 - L50X5	1,862
S5	CS11 - L50X5	2,018
S6	CS11 - L50X5	1,364
S7	CS11 - L50X5	2,184
S8	CS88 - L60X6	2,162
S9	CS11 - L50X5	2,184
S10	CS88 - L60X6	2,162
S11	CS7 - L50X5	1,511
S12	CS7 - L50X5	0,336
S13	CS7 - L50X5	1,501
S14	CS7 - L50X5	0,649
S15	CS7 - L50X5	1,911
S16	CS7 - L50X5	0,969
S17	CS7 - L50X5	1,511
S18	CS7 - L50X5	0,336
S19	CS7 - L50X5	1,501
S20	CS7 - L50X5	0,649
S21	CS7 - L50X5	1,911
S22	CS7 - L50X5	0,969
S23	CS4 - L50X5	1,450
S24	CS4 - L50X5	1,451
S25	CS4 - L50X5	1,993
S26	CS96 - L120X10	2,386
S27	CS96 - L120X10	2,652
S28	CS96 - L120X10	2,386
S29	CS96 - L120X10	2,651
S30	CS4 - L50X5	2,536
S31	CS93 - L90X9	2,265
S33	CS4 - L50X5	1,616
S34	CS93 - L90X9	2,366
S35	CS4 - L50X5	1,616
S36	CS93 - L90X9	2,265
S37	CS91 - L150X15	4,747
S38	CS4 - L50X5	0,879
S40	CS91 - L150X15	4,747
S41	CS4 - L50X5	0,879
S42	CS92 - L70X7	2,227
S43	CS4 - L50X5	0,864
S44	CS92 - L70X7	2,231
S46	CS86 - L130X12	3,949
S47	CS86 - L130X12	3,949
S48	CS88 - L60X6	1,252
S49	CS84 - L100X8	2,076
S51	CS85 - L60X8	2,571
S52	CS88 - L60X6	1,250
S53	CS83 - L120X12	2,382
S54	CS37 - HFLeq75x75x8	4,252
S55	CS85 - L60X8	2,571
S56	CS88 - L60X6	1,250
S57	CS88 - L60X6	1,252
S58	CS83 - L120X12	2,382
S60	CS88 - L60X6	1,252
S61	CS84 - L100X8	2,076
S63	CS22 - HFLeq60x60x6	0,941
S64	CS22 - HFLeq60x60x6	0,941
S65	CS12 - L50X5	1,862
S66	CS12 - L50X5	2,018
S67	CS12 - L50X5	1,862
S68	CS12 - L50X5	2,018
S69	CS12 - L50X5	1,364
S70	CS12 - L50X5	2,184
S71	CS88 - L60X6	2,162
S72	CS12 - L50X5	2,184
S73	CS88 - L60X6	2,162
S74	CS7 - L50X5	1,511
S75	CS7 - L50X5	0,336
S76	CS7 - L50X5	1,501
S77	CS7 - L50X5	0,649
S78	CS7 - L50X5	1,911
S79	CS7 - L50X5	0,969
S80	CS7 - L50X5	1,511
S81	CS7 - L50X5	0,336
S82	CS7 - L50X5	1,501
S83	CS7 - L50X5	0,649
S84	CS7 - L50X5	1,911
S85	CS7 - L50X5	0,969
S86	CS4 - L50X5	1,450
S87	CS4 - L50X5	1,451
S88	CS4 - L50X5	1,993
S89	CS96 - L120X10	2,386
S90	CS96 - L120X10	2,652
S91	CS96 - L120X10	2,386
S92	CS96 - L120X10	2,651
S93	CS4 - L50X5	2,536
S94	CS22 - HFLeq60x60x6	1,851
S95	CS22 - HFLeq60x60x6	1,849
S96	CS22 - HFLeq60x60x6	1,850
S97	CS22 - HFLeq60x60x6	1,849
S98	CS4 - L50X5	1,920
S99	CS4 - L50X5	1,920
S100	CS24 - ISEA100/100/6	2,364
S101	CS98 - L50X6	2,361
S102	CS93 - L90X9	2,818
S103	CS4 - L50X5	1,691
S104	CS4 - L50X5	1,306
S105	CS4 - L50X5	1,691
S106	CS4 - L50X5	1,920
S107	CS24 - ISEA100/100/6	2,364
S108	CS4 - L50X5	1,306
S109	CS98 - L50X6	2,360
S110	CS93 - L90X9	2,819
S111	CS24 - ISEA100/100/6	2,363
S112	CS98 - L50X6	2,361
S113	CS93 - L90X9	2,819
S114	CS4 - L50X5	1,691
S115	CS4 - L50X5	1,306
S116	CS4 - L50X5	1,691
S117	CS4 - L50X5	1,920
S118	CS24 - ISEA100/100/6	2,363
S119	CS4 - L50X5	1,306
S120	CS98 - L50X6	2,361
S121	CS4 - L50X5	1,306
S122	CS4 - L50X5	1,691
S123	CS4 - L50X5	1,691
S124	CS4 - L50X5	1,920
S125	CS4 - L50X5	1,306
S126	CS93 - L90X9	2,819
S127	CS97 - L100X10	2,720
S128	CS97 - L100X10	2,720
S129	CS4 - L50X5	1,213
S130	CS4 - L50X5	2,880
S131	CS95 - L80X8	1,541
S132	CS95 - L80X8	1,541
S133	CS7 - L50X5	0,799
S134	CS7 - L50X5	0,800
S135	CS96 - L120X10	4,098
S136	CS7 - L50X5	2,179
S137	CS4 - L50X5	1,213
S138	CS4 - L50X5	2,880
S139	CS93 - L90X9	1,506
S140	CS96 - L120X10	4,099
S141	CS93 - L90X9	1,506
S142	CS4 - L50X5	1,213
S143	CS4 - L50X5	2,880
S144	CS95 - L80X8	1,541
S145	CS95 - L80X8	1,541
S146	CS7 - L50X5	0,800
S147	CS7 - L50X5	0,800
S148	CS96 - L120X10	4,098
S149	CS7 - L50X5	2,179
S150	CS7 - L50X5	2,179
S151	CS4 - L50X5	1,213
S152	CS4 - L50X5	2,880
S153	CS93 - L90X9	1,506
S154	CS96 - L120X10	4,099
S155	CS93 - L90X9	1,506
S156	CS93 - L90X9	2,264
S159	CS34 - UNP120	0,888
S160	CS34 - UNP120	0,888
S161	CS86 - L130X12	3,202
S162	CS25 - HFLue120x80x8	1,544
S164	CS25 - HFLue120x80x8	1,544
S166	CS34 - UNP120	0,888
S167	CS28 - ISEA55/55/5	1,943
S168	CS11 - L50X5	2,235
S169	CS28 - ISEA55/55/5	1,943
S170	CS11 - L50X5	2,235
S171	CS101 - UNP140	3,073
S172	CS101 - UNP140	3,073
S173	CS30 - UNP140	0,961
S175	CS11 - L50X5	0,800
S176	CS82 - L180X18	2,140
S177	CS82 - L180X18	2,140
S178	CS15 - HFLeq60x60x5	3,046
S179	CS15 - HFLeq60x60x5	3,046
S180	CS28 - ISEA55/55/5	2,672
S181	CS28 - ISEA55/55/5	2,671
S182	CS15 - HFLeq60x60x5	2,921
S183	CS15 - HFLeq60x60x5	2,696
S184	CS15 - HFLeq60x60x5	2,925
S185	CS15 - HFLeq60x60x5	2,692
S186	CS98 - L50X6	1,297
S187	CS98 - L50X6	1,297
S188	CS30 - UNP140	2,163
S189	CS30 - UNP140	2,163
S190	CS28 - ISEA55/55/5	1,943
S191	CS11 - L50X5	2,235
S192	CS28 - ISEA55/55/5	1,943
S193	CS11 - L50X5	2,235
S194	CS101 - UNP140	3,073
S195	CS101 - UNP140	3,073
S196	CS30 - UNP140	0,961
S198	CS28 - ISEA55/55/5	2,672
S199	CS28 - ISEA55/55/5	2,672
S200	CS15 - HFLeq60x60x5	2,925
S201	CS15 - HFLeq60x60x5	2,696
S202	CS15 - HFLeq60x60x5	2,925
S203	CS15 - HFLeq60x60x5	2,696
S204	CS98 - L50X6	1,294
S205	CS98 - L50X6	1,294
S206	CS15 - HFLeq60x60x5	3,046
S207	CS15 - HFLeq60x60x5	3,046
S208	CS30 - UNP140	2,163
S209	CS30 - UNP140	2,163
S210	CS101 - UNP140	1,569
S211	CS4 - L50X5	2,163
S212	CS4 - L50X5	2,163
S213	CS101 - UNP140	1,569

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Naam	Doorsnede	Lengte [m]
S214	CS4 - L50X5	2,305
S215	CS4 - L50X5	2,305
S216	CS4 - L50X5	2,348
S217	CS4 - L50X5	1,778
S218	CS4 - L50X5	1,790
S219	CS4 - L50X5	2,305
S220	CS4 - L50X5	2,305
S221	CS4 - L50X5	3,227
S222	CS4 - L50X5	3,227
S223	CS4 - L50X5	2,348
S224	CS26 - HFLeq100x100x8	2,376
S225	CS41 - ISEA120/120/8	2,373
S226	CS26 - HFLeq100x100x8	2,376
S227	CS41 - ISEA120/120/8	2,373
S228	CS40 - ISUA65/50/5	4,732
S229	CS4 - L50X5	1,269
S230	CS40 - ISUA65/50/5	2,898
S231	CS40 - ISUA65/50/5	4,732
S232	CS4 - L50X5	2,810
S233	CS4 - L50X5	1,269
S234	CS40 - ISUA65/50/5	2,898
S235	CS40 - ISUA65/50/5	4,732
S236	CS4 - L50X5	2,811
S237	CS4 - L50X5	1,269
S238	CS40 - ISUA65/50/5	2,898
S239	CS26 - HFLeq100x100x8	2,376
S240	CS41 - ISEA120/120/8	2,373
S241	CS26 - HFLeq100x100x8	2,376
S242	CS41 - ISEA120/120/8	2,373
S243	CS93 - L90X9	2,366
S244	CS4 - L50X5	1,616
S245	CS93 - L90X9	2,366
S247	CS4 - L50X5	0,879
S248	CS92 - L70X7	2,227
S249	CS85 - L60X8	2,571
S250	CS88 - L60X6	1,250
S252	CS91 - L150X15	4,747
S253	CS40 - ISUA65/50/5	4,732
S254	CS4 - L50X5	2,810
S255	CS4 - L50X5	1,269
S256	CS40 - ISUA65/50/5	2,898
S257	CS4 - L50X5	1,616
S258	CS34 - UNP120	0,888
S259	CS86 - L130X12	3,201
S260	CS4 - L50X5	0,879
S263	CS95 - L80X8	2,542
S264	CS95 - L80X8	2,294
S265	CS95 - L80X8	2,456
S266	CS95 - L80X8	2,542
S267	CS95 - L80X8	2,294
S268	CS43 - ISEA70/70/5	3,507
S269	CS44 - UNP200	1,840
S270	CS36 - ISEA70/70/5	1,753
S273	CS94 - L60X8	1,845
S274	CS94 - L60X8	2,188
S275	CS94 - L60X8	2,579
S278	CS94 - L60X8	1,845
S279	CS94 - L60X8	2,188
S280	CS94 - L60X8	2,579
S282	CS44 - UNP200	0,921
S283	CS30 - UNP140	2,391
S284	CS94 - L60X8	1,390
S285	CS94 - L60X8	1,390
S286	CS30 - UNP140	2,634
S287	CS43 - ISEA70/70/5	3,013
S288	CS93 - L90X9	3,988
S289	CS44 - UNP200	8,015
S290	CS95 - L80X8	2,456
S291	CS95 - L80X8	2,542

Naam	Doorsnede	Lengte [m]
S292	CS95 - L80X8	2,298
S293	CS4 - L50X5	1,135
S294	CS4 - L50X5	1,121
S295	CS44 - UNP200	8,015
S296	CS4 - L50X5	1,778
S297	CS4 - L50X5	1,790
S298	CS36 - ISEA70/70/5	3,507
S299	CS44 - UNP200	3,507
S300	CS93 - L90X9	2,265
S301	CS92 - L70X7	2,227
S302	CS94 - L60X8	1,845
S303	CS94 - L60X8	2,188
S304	CS94 - L60X8	2,579
S307	CS94 - L60X8	1,845
S308	CS94 - L60X8	2,188
S309	CS94 - L60X8	2,579
S311	CS44 - UNP200	0,921
S312	CS30 - UNP140	2,391
S313	CS94 - L60X8	1,390
S314	CS94 - L60X8	1,391
S315	CS30 - UNP140	2,634
S316	CS43 - ISEA70/70/5	3,013
S317	CS93 - L90X9	3,988
S318	CS95 - L80X8	2,456
S319	CS95 - L80X8	2,542
S320	CS95 - L80X8	2,298
S321	CS43 - ISEA70/70/5	3,507
S322	CS4 - L50X5	1,135
S323	CS4 - L50X5	1,121
S324	CS44 - UNP200	3,507
S328	CS25 - HFLue120x80x8	1,544
S330	CS4 - L50X5	0,864
S331	CS92 - L70X7	2,231
S332	CS90 - L120X12	4,017
S333	CS85 - L60X8	2,571
S334	CS88 - L60X6	1,250
S335	CS88 - L60X6	1,252
S336	CS84 - L100X8	2,076
S337	CS83 - L120X12	2,382
S340	CS44 - UNP200	8,015
S341	CS82 - L180X18	2,140
S342	CS82 - L180X18	2,140
S343	CS12 - L50X5	0,800
S345	CS35 - L150x150x14	2,816
S346	CS35 - L150x150x14	2,825
S347	CS35 - L150x150x14	2,816
S349	CS35 - L150x150x14	2,816
S350	CS35 - L150x150x14	2,825
S351	CS35 - L150x150x14	2,816
S352	CS35 - L150x150x14	2,825
C1	CS2 - L200X24	10,951
C2	CS2 - L200X24	10,951
C4	CS2 - L200X24	10,951
C3	CS2 - L200X24	10,951
B9	CS3 - HFLeq150x150x12	12,292
B14	CS3 - HFLeq150x150x12	12,292
B16	CS3 - HFLeq150x150x12	12,292
B18	CS3 - HFLeq150x150x12	12,292
SB2	CS4 - L50X5	0,950
SB5	CS4 - L50X5	0,950
SB18	CS62 - L60/6	1,900
SB21	CS62 - L60/6	1,900
SB34	CS61 - L70/7	2,850
SB37	CS61 - L70/7	2,850
SB6	CS4 - L50X5	0,950
SB9	CS4 - L50X5	0,950
SB22	CS62 - L60/6	1,900
SB38	CS61 - L70/7	2,850
SB41	CS61 - L70/7	2,850

Naam	Doorsnede	Lengte [m]
SB25	CS62 - L60/6	1,900
SB10	CS4 - L50X5	0,950
SB13	CS4 - L50X5	0,950
SB26	CS62 - L60/6	1,900
SB29	CS62 - L60/6	1,900
SB42	CS61 - L70/7	2,850
SB45	CS61 - L70/7	2,850
SB14	CS4 - L50X5	0,950
SB1	CS4 - L50X5	0,950
SB30	CS62 - L60/6	1,900
SB17	CS62 - L60/6	1,900
SB46	CS61 - L70/7	2,850
SB33	CS61 - L70/7	2,850
SB16	CS59 - L100/10	2,712
SB32	CS60 - L80/8	3,003
SB48	CS60 - L80/8	3,533
SB15	CS59 - L100/10	2,712
SB31	CS60 - L80/8	3,003
SB47	CS60 - L80/8	3,533
SB12	CS59 - L100/10	2,712
SB28	CS60 - L80/8	3,003
SB44	CS60 - L80/8	3,533
SB11	CS59 - L100/10	2,712
SB27	CS60 - L80/8	3,003
SB43	CS60 - L80/8	3,533
SB8	CS59 - L100/10	2,712
SB24	CS60 - L80/8	3,003
SB40	CS60 - L80/8	3,533
SB7	CS59 - L100/10	2,712
SB23	CS60 - L80/8	3,003
SB39	CS60 - L80/8	3,533
SB4	CS59 - L100/10	2,712
SB20	CS60 - L80/8	3,003
SB36	CS60 - L80/8	3,533
SB3	CS59 - L100/10	2,712
SB19	CS60 - L80/8	3,003
SB35	CS60 - L80/8	3,533
B89	CS3 - HFLeq150x150x12	12,292
B90	CS3 - HFLeq150x150x12	12,292
B91	CS3 - HFLeq150x150x12	12,292
B92	CS3 - HFLeq150x150x12	12,292
C5	CS5 - HFLeq200x200x20	3,374
C6	CS5 - HFLeq200x200x20	3,374
C7	CS5 - HFLeq200x200x20	3,374
C8	CS5 - HFLeq200x200x20	3,374
B8	CS100 - L160X15	4,916
B10	CS100 - L160X15	4,916
B12	CS100 - L160X15	4,916
B93	CS100 - L160X15	4,916
SB49	CS63 - L60/6	1,900
SB50	CS65 - L70X7	2,621
SB51	CS63 - L60/6	1,900
SB52	CS65 - L70X7	2,621
SB53	CS63 - L60/6	1,900
SB54	CS65 - L70X7	2,621
SB55	CS63 - L60/6	1,900
SB56	CS65 - L70X7	2,621
SB57	CS63 - L60/6	1,900
SB58	CS65 - L70X7	2,621
SB59	CS63 - L60/6	1,900
SB60	CS65 - L70X7	2,621
SB61	CS63 - L60/6	1,900
SB62	CS65 - L70X7	2,621
SB63	CS63 - L60/6	1,900
SB64	CS65 - L70X7	2,621
B31	CS100 - L160X15	4,916
B32	CS100 - L160X15	4,916
B33	CS100 - L160X15	4,916
B34	CS100 - L160X15	4,916

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Naam	Doorsnede	Lengte [m]
C9	CS5 - HFLeq200x200x20	6,648
C10	CS5 - HFLeq200x200x20	6,648
C11	CS5 - HFLeq200x200x20	6,648
C12	CS5 - HFLeq200x200x20	6,648
B94	CS68 - ISUA150/90/10	9,452
B95	CS68 - ISUA150/90/10	9,452
B22	CS68 - ISUA150/90/10	9,452
B26	CS68 - ISUA150/90/10	9,452
B30	CS80 - L60X6	3,353
B96	CS80 - L60X6	3,353
B97	CS80 - L60X6	3,353
B35	CS80 - L60X6	3,353
SB65	CS67 - L60X6	1,676
SB66	CS67 - L60X6	1,676
SB67	CS67 - L60X6	1,676
SB68	CS67 - L60X6	1,676
SB69	CS67 - L60X6	1,676
SB70	CS67 - L60X6	1,676
SB71	CS67 - L60X6	1,676
SB72	CS67 - L60X6	1,676
SB73	CS66 - L60X6	2,356
SB74	CS66 - L60X6	2,356
SB75	CS66 - L60X6	2,356
SB76	CS66 - L60X6	2,356
SB77	CS66 - L60X6	2,356
SB78	CS66 - L60X6	2,356
SB79	CS66 - L60X6	2,356
SB80	CS66 - L60X6	2,356
SB81	CS66 - L60X6	2,360
SB82	CS67 - L60X6	1,676
SB83	CS66 - L60X6	2,360
SB84	CS67 - L60X6	1,676
SB85	CS66 - L60X6	2,360
SB86	CS67 - L60X6	1,676
SB87	CS66 - L60X6	2,360
SB88	CS67 - L60X6	1,676
SB89	CS66 - L60X6	2,360
SB90	CS67 - L60X6	1,676
SB91	CS66 - L60X6	2,360
SB92	CS67 - L60X6	1,676
SB93	CS66 - L60X6	2,360
SB94	CS67 - L60X6	1,676
SB95	CS66 - L60X6	2,360
SB96	CS67 - L60X6	1,676
B73	CS68 - ISUA150/90/10	9,452
B74	CS68 - ISUA150/90/10	9,452
B75	CS68 - ISUA150/90/10	9,452
B76	CS68 - ISUA150/90/10	9,452
B77	CS80 - L60X6	3,353
B78	CS80 - L60X6	3,353
B79	CS80 - L60X6	3,353
B80	CS80 - L60X6	3,353
C13	CS13 - HFLeq200x200x18	6,648
C14	CS13 - HFLeq200x200x18	6,648
C15	CS13 - HFLeq200x200x18	6,648
C16	CS13 - HFLeq200x200x18	6,648
B98	CS70 - ISUA150/90/10	8,859
B99	CS70 - ISUA150/90/10	8,860
B100	CS70 - ISUA150/90/10	8,860
B101	CS70 - ISUA150/90/10	8,859
B102	CS81 - L60X6	2,920
B103	CS81 - L60X6	2,920
B104	CS81 - L60X6	2,920
B105	CS81 - L60X6	2,920
SB97	CS69 - L50X5	1,460
SB98	CS69 - L50X5	1,460
SB99	CS69 - L50X5	1,460
SB100	CS69 - L50X5	1,460
SB101	CS69 - L50X5	1,460

Naam	Doorsnede	Lengte [m]
SB102	CS69 - L50X5	1,460
SB103	CS69 - L50X5	1,460
SB104	CS69 - L50X5	1,460
SB105	CS71 - L60X6	2,231
SB106	CS71 - L60X6	2,231
SB107	CS71 - L60X6	2,231
SB108	CS71 - L60X6	2,231
SB109	CS71 - L60X6	2,231
SB110	CS71 - L60X6	2,231
SB111	CS71 - L60X6	2,231
SB112	CS71 - L60X6	2,231
SB113	CS71 - L60X6	2,190
SB114	CS69 - L50X5	1,460
SB115	CS71 - L60X6	2,190
SB116	CS69 - L50X5	1,460
SB117	CS71 - L60X6	2,190
SB118	CS69 - L50X5	1,460
SB119	CS71 - L60X6	2,190
SB120	CS69 - L50X5	1,460
SB121	CS71 - L60X6	2,190
SB122	CS69 - L50X5	1,460
SB123	CS71 - L60X6	2,190
SB124	CS69 - L50X5	1,460
SB125	CS71 - L60X6	2,190
SB126	CS69 - L50X5	1,460
SB127	CS71 - L60X6	2,190
SB128	CS69 - L50X5	1,460
B106	CS70 - ISUA150/90/10	8,859
B107	CS70 - ISUA150/90/10	8,859
B108	CS70 - ISUA150/90/10	8,860
B109	CS70 - ISUA150/90/10	8,860
B110	CS81 - L60X6	2,920
B111	CS81 - L60X6	2,920
B112	CS81 - L60X6	2,920
B113	CS81 - L60X6	2,920
C17	CS13 - HFLeq200x200x18	3,414
C18	CS13 - HFLeq200x200x18	3,414
C19	CS13 - HFLeq200x200x18	3,414
C20	CS13 - HFLeq200x200x18	3,414
B114	CS73 - L150X100X10	4,360
B115	CS73 - L150X100X10	4,360
B116	CS73 - L150X100X10	4,360
B117	CS73 - L150X100X10	4,360
SB129	CS20 - L50X5	1,250
SB130	CS72 - L60X6	2,050
SB131	CS20 - L50X5	1,250
SB132	CS72 - L60X6	2,050
SB133	CS20 - L50X5	1,250
SB134	CS72 - L60X6	2,049
SB135	CS20 - L50X5	1,250
SB136	CS72 - L60X6	2,050
SB137	CS20 - L50X5	1,250
SB138	CS72 - L60X6	2,050
SB139	CS20 - L50X5	1,250
SB140	CS72 - L60X6	2,050
SB141	CS20 - L50X5	1,250
SB142	CS72 - L60X6	2,050
SB143	CS20 - L50X5	1,250
SB144	CS72 - L60X6	2,050
B36	CS73 - L150X100X10	4,360
B37	CS73 - L150X100X10	4,360
B38	CS73 - L150X100X10	4,360
B39	CS73 - L150X100X10	4,360
S355	CS82 - L180X18	2,140
S356	CS89 - L160X15	2,141
S359	CS90 - L120X12	2,220
S360	CS90 - L120X12	2,135
S361	CS97 - L100X10	0,970
S362	CS97 - L100X10	1,591

Naam	Doorsnede	Lengte [m]
S363	CS97 - L100X10	1,611
S364	CS97 - L100X10	1,613
S365	CS82 - L180X18	2,140
S366	CS89 - L160X15	2,141
S367	CS89 - L160X15	2,119
S368	CS89 - L160X15	1,570
S369	CS89 - L160X15	1,761
S370	CS90 - L120X12	2,220
S371	CS90 - L120X12	2,135
S372	CS97 - L100X10	0,970
S373	CS97 - L100X10	2,008
S374	CS97 - L100X10	1,591
S375	CS97 - L100X10	1,611
S376	CS97 - L100X10	1,613
S377	CS90 - L120X12	2,030
S378	CS90 - L120X12	2,206
S379	CS90 - L120X12	2,030
S380	CS90 - L120X12	2,205
S381	CS90 - L120X12	2,030
S382	CS90 - L120X12	2,206
S383	CS90 - L120X12	2,030
S384	CS90 - L120X12	2,205
S386	CS44 - UNP200	1,840
S387	CS44 - UNP200	1,837
S388	CS44 - UNP200	1,837
S389	CS44 - UNP200	1,840
S390	CS44 - UNP200	1,720
S391	CS44 - UNP200	1,481
S392	CS44 - UNP200	1,811
S393	CS44 - UNP200	1,451
S394	CS44 - UNP200	1,451
S395	CS44 - UNP200	0,360
S385	CS44 - UNP200	1,720
S396	CS44 - UNP200	1,461
S397	CS92 - L70X7	2,227
S398	CS89 - L160X15	2,119
S399	CS36 - ISEA70/70/5	1,753
S400	CS95 - L80X8	2,456
S401	CS93 - L90X9	2,366
S402	CS89 - L160X15	1,570
S403	CS90 - L120X12	1,999
S404	CS91 - L150X15	2,367
S405	CS83 - L120X12	2,382
S408	CS89 - L160X15	2,119
S409	CS89 - L160X15	1,571
S410	CS89 - L160X15	1,760
S411	CS90 - L120X12	2,221
S412	CS90 - L120X12	2,135
S413	CS97 - L100X10	0,970
S414	CS97 - L100X10	2,008
S415	CS97 - L100X10	1,591
S416	CS97 - L100X10	1,611
S417	CS97 - L100X10	1,613
S418	CS82 - L180X18	2,140
S419	CS89 - L160X15	2,141
S420	CS89 - L160X15	2,119
S421	CS89 - L160X15	1,571
S422	CS89 - L160X15	1,761
S423	CS90 - L120X12	2,220
S424	CS90 - L120X12	2,135
S425	CS97 - L100X10	0,970
S426	CS97 - L100X10	2,008
S427	CS97 - L100X10	1,591
S428	CS97 - L100X10	1,611
S429	CS97 - L100X10	1,613
S430	CS37 - HFLeq75x75x8	4,252
S431	CS82 - L180X18	2,140
S432	CS89 - L160X15	2,141
S433	CS90 - L120X12	2,019

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Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

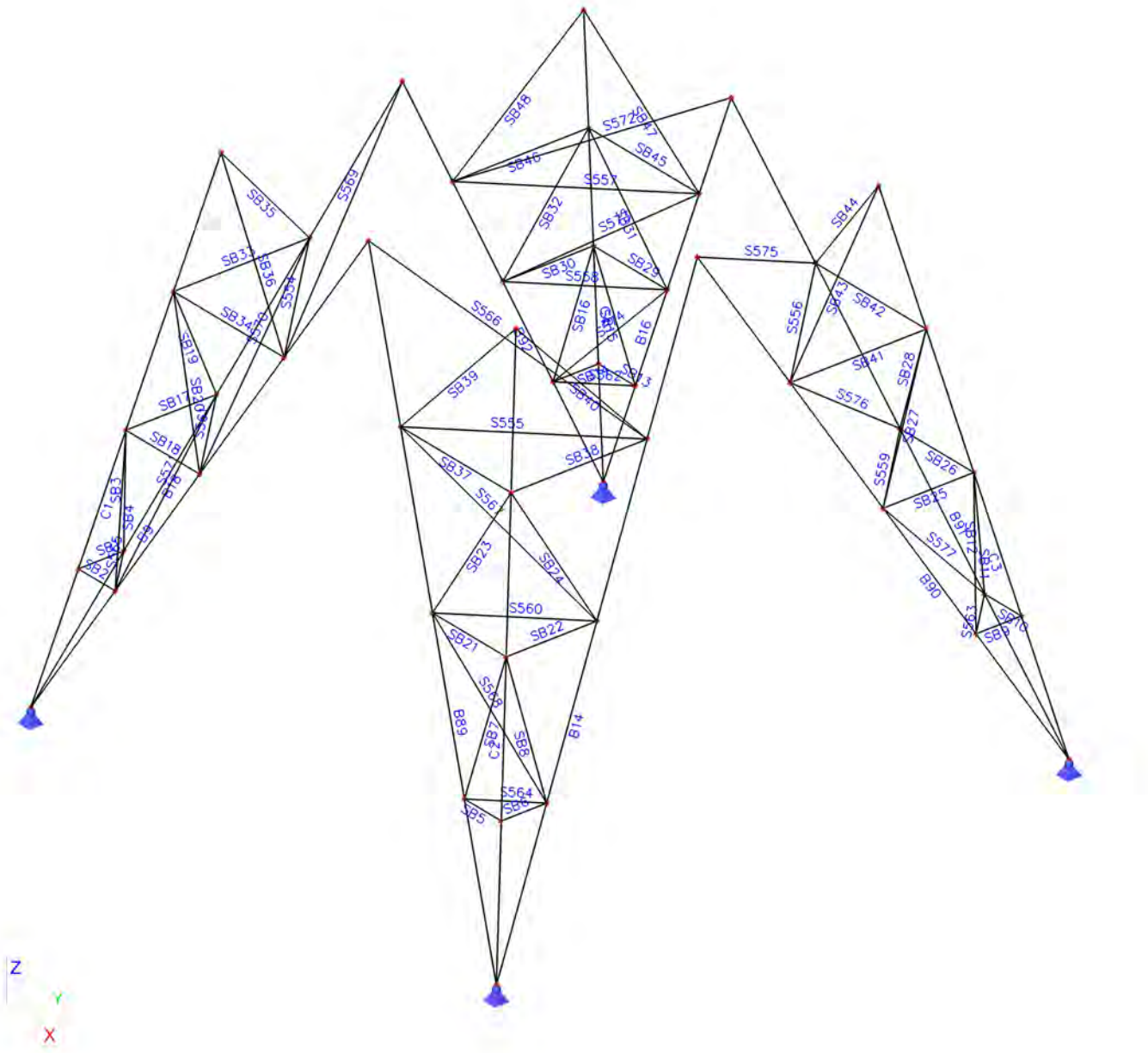
Naam	Doorsnede	Lengte [m]
S434	CS83 - L120X12	2,383
S435	CS91 - L150X15	2,380
S436	CS35 - L150x150x14	2,825
S437	CS101 - UNP140	1,970
S438	CS101 - UNP140	1,610
S439	CS101 - UNP140	0,357
S440	CS101 - UNP140	0,353
S441	CS101 - UNP140	2,145
S442	CS101 - UNP140	2,145
S443	CS101 - UNP140	0,353
S444	CS101 - UNP140	0,364
S445	CS101 - UNP140	1,604
S446	CS101 - UNP140	1,970
S447	CS101 - UNP140	1,568
S448	CS4 - L50X5	2,810
S449	CS22 - HFLeq60x60x6	0,941
S450	CS4 - L50X5	0,864
S451	CS90 - L120X12	2,019
S452	CS90 - L120X12	1,998
S453	CS4 - L50X5	0,864
S454	CS90 - L120X12	2,019
S455	CS90 - L120X12	1,998
S456	CS7 - L50X5	2,179
S457	CS25 - HFLue120x80x8	1,544
S458	CS92 - L70X7	2,231
S459	CS92 - L70X7	2,231
S460	CS84 - L100X8	2,076
S461	CS4 - L50X5	1,503
S462	CS4 - L50X5	1,503
S463	CS4 - L50X5	1,503
S464	CS4 - L50X5	1,503
S465	CS93 - L90X9	3,988
S466	CS93 - L90X9	3,988
B7	CS75 - L150X14	7,600
B118	CS75 - L150X14	7,600
B119	CS75 - L150X14	7,600
B120	CS75 - L150X14	7,600
B11	CS39 - ISEA130/130/10	5,374
B121	CS39 - ISEA130/130/10	5,374
B13	CS39 - ISEA130/130/10	5,374
B122	CS39 - ISEA130/130/10	5,374
B123	CS46 - ISEA70/70/5	7,600
B17	CS46 - ISEA70/70/5	3,800
B124	CS46 - ISEA70/70/5	3,800
B129	CS79 - L100X12	3,536
B130	CS79 - L100X12	3,536
B131	CS79 - L100X12	3,535
B132	CS79 - L100X12	3,536
B133	CS77 - L60X8	5,000
B134	CS77 - L60X8	2,500
B135	CS77 - L60X8	2,500
S467	CS78 - L150X14	2,500
S468	CS78 - L150X14	2,500
S469	CS78 - L150X14	2,500
S470	CS78 - L150X14	2,500
S471	CS78 - L150X14	2,500
S472	CS78 - L150X14	2,500
S473	CS78 - L150X14	2,501

Naam	Doorsnede	Lengte [m]
S474	CS78 - L150X14	2,499
S475	CS51 - L70X7	4,741
S476	CS51 - L70X7	4,741
S477	CS51 - L70X7	4,741
S478	CS51 - L70X7	4,741
S479	CS83 - L120X12	2,382
S480	CS83 - L120X12	2,382
S481	CS83 - L120X12	2,382
S482	CS21 - ISUA65/50/6	6,950
S483	CS21 - ISUA65/50/6	6,950
S484	CS21 - ISUA65/50/6	6,950
S485	CS21 - ISUA65/50/6	6,950
S486	CS97 - L100X10	2,008
S487	CS89 - L160X15	1,761
S488	CS86 - L130X12	3,202
S489	CS86 - L130X12	3,680
S490	CS86 - L130X12	3,680
S491	CS86 - L130X12	3,202
S492	CS44 - UNP200	3,560
S493	CS44 - UNP200	3,674
S494	CS101 - UNP140	1,970
S495	CS101 - UNP140	4,465
S496	CS101 - UNP140	4,465
S497	CS101 - UNP140	1,568
S498	CS101 - UNP140	1,970
S499	CS97 - L100X10	4,465
S500	CS97 - L100X10	2,721
S501	CS97 - L100X10	4,464
S502	CS97 - L100X10	4,465
S503	CS97 - L100X10	2,721
S504	CS97 - L100X10	4,464
S505	CS30 - UNP140	1,300
S508	CS30 - UNP140	0,800
S509	CS36 - ISEA70/70/5	0,950
S510	CS36 - ISEA70/70/5	0,950
S511	CS30 - UNP140	0,800
S512	CS30 - UNP140	1,300
S513	CS36 - ISEA70/70/5	0,950
S514	CS36 - ISEA70/70/5	0,950
S515	CS52 - UNP280	7,163
S516	CS52 - UNP280	7,163
S517	CS52 - UNP280	7,163
S518	CS52 - UNP280	2,000
S519	CS52 - UNP280	2,000
S520	CS52 - UNP280	2,000
S522	CS52 - UNP280	2,000
S523	CS52 - UNP280	2,000
S524	CS52 - UNP280	2,000
S525	CS52 - UNP280	7,163
S526	CS59 - L100/10	5,065
S527	CS59 - L100/10	5,065
S528	CS59 - L100/10	5,065
S529	CS59 - L100/10	5,065
S530	CS59 - L100/10	7,163
S531	CS59 - L100/10	2,000
S532	CS59 - L100/10	2,000
S533	CS59 - L100/10	7,163
S534	CS59 - L100/10	2,000

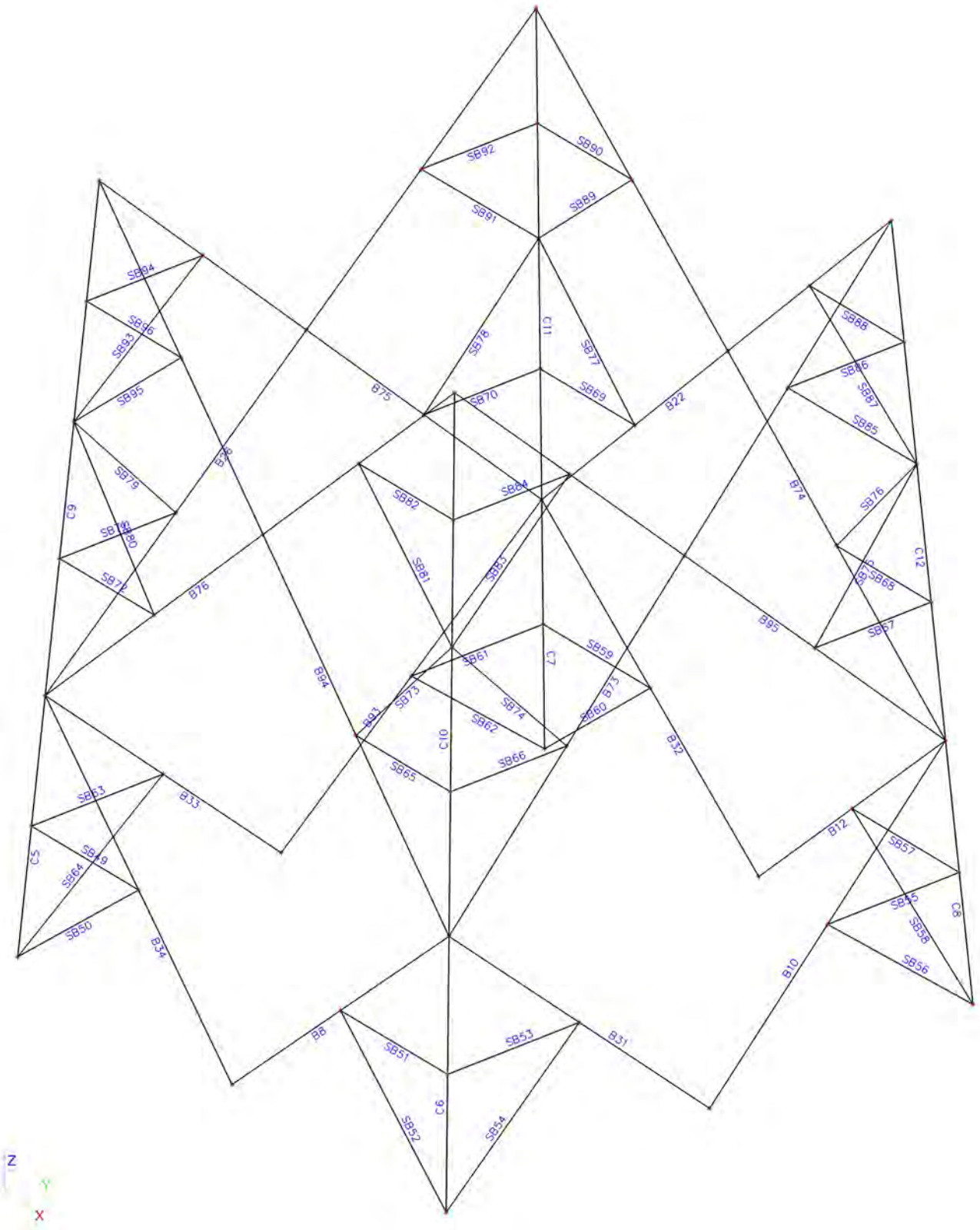
Naam	Doorsnede	Lengte [m]
S535	CS59 - L100/10	4,102
S536	CS59 - L100/10	4,102
S537	CS59 - L100/10	4,102
S538	CS59 - L100/10	4,102
S539	CS59 - L100/10	4,102
S540	CS59 - L100/10	4,102
S541	CS57 - HEA280	3,582
S542	CS57 - HEA280	3,582
S543	CS57 - HEA280	3,582
S544	CS57 - HEA280	3,582
S545	CS57 - HEA280	3,582
S546	CS57 - HEA280	3,582
S547	CS44 - UNP200	1,720
S548	CS38 - HFLeq80x80x8	0,799
S549	CS38 - HFLeq80x80x8	0,931
S550	CS38 - HFLeq80x80x8	0,931
S551	CS38 - HFLeq80x80x8	0,799
S552	CS38 - HFLeq80x80x8	0,931
S553	CS38 - HFLeq80x80x8	0,931
S554	CS53 - L60X6	4,031
S555	CS53 - L60X6	4,031
S556	CS53 - L60X6	4,031
S557	CS53 - L60X6	4,031
S558	CS54 - L60X6	2,687
S559	CS54 - L60X6	2,687
S560	CS54 - L60X6	2,687
S561	CS54 - L60X6	2,687
S562	CS55 - L50X5	1,344
S563	CS55 - L50X5	1,344
S564	CS55 - L50X5	1,344
S565	CS55 - L50X5	1,344
S566	CS56 - L70X7	5,577
S567	CS56 - L70X7	4,503
S568	CS56 - L70X7	3,613
S569	CS56 - L70X7	5,577
S570	CS56 - L70X7	4,503
S571	CS56 - L70X7	3,613
S572	CS56 - L70X7	5,577
S573	CS56 - L70X7	4,503
S574	CS56 - L70X7	3,613
S575	CS56 - L70X7	5,577
S576	CS56 - L70X7	4,503
S577	CS56 - L70X7	3,613
S578	CS4 - L50X5	0,434
S579	CS4 - L50X5	0,560
S580	CS98 - L50X6	0,541
S581	CS98 - L50X6	0,647
S582	CS98 - L50X6	0,541
S583	CS98 - L50X6	0,649
S584	CS94 - L60X8	0,659
S585	CS94 - L60X8	0,802
S586	CS94 - L60X8	0,659
S587	CS94 - L60X8	0,802

6. Staafnummers mastlichaam

6.1. Vak 1

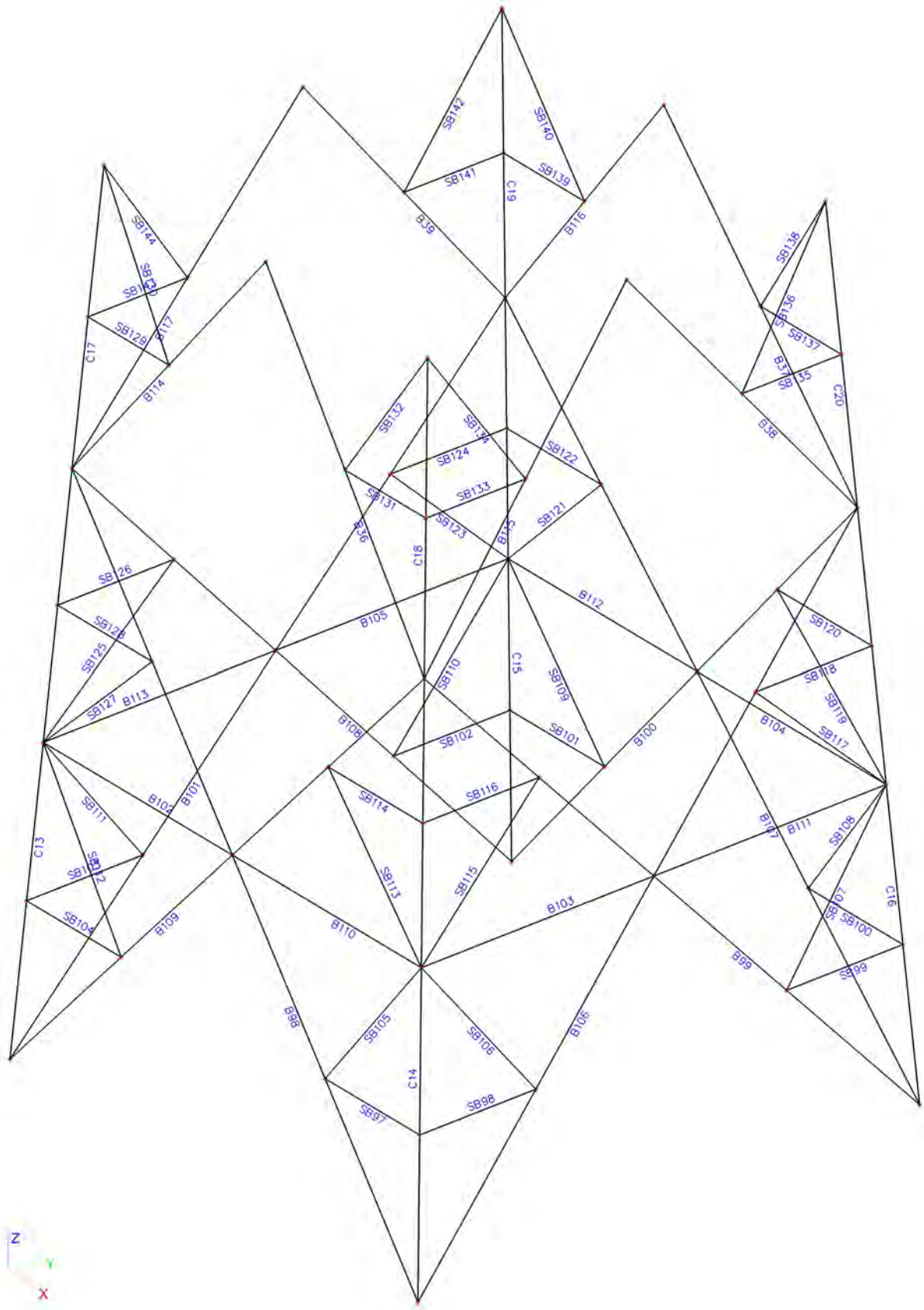


6.2. Vak 2 + 3



SB92
SB90
SB91
SB89
SB94
SB96
SB93
SB95
SB78
C11
SB77
SB69
SB70
B75
B22
SB88
SB86
SB87
SB85
B26
SB79
SB80
SB72
C9
SB82
SB84
SB81
SB83
B74
SB76
C12
SB68
SB67
B76
B95
SB61
C7
SB59
B94
SB73
SB74
SB60
B73
B93
SB62
C10
SB66
SB65
B32
SB63
B33
B12
SB57
C5
SB49
SB64
SB50
SB55
C8
SB58
SB56
B34
B10
B8
SB51
SB53
B31
C6
SB52
SB54
Z
Y
X

6.3. Vak 4 + 5



SB142
SB140
SB141
SB139
C19
B39
B116
SB144
SB129
B117
C17
B114
SB138
SB136
SB137
B37
SB135
C20
B38
SB132
SB124
SB122
SB133
SB131
SB123
B36
B115
SB121
C18
SB126
B112
B105
SB120
SB125
SB110
C15
SB109
SB118
SB127
B113
B108
SB102
SB101
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SB119
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C13
SB113
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B103
C16
SB104
B109
B110
SB100
B99
SB99
B98
SB105
SB106
B106
C14
SB97
SB98
Z
Y
X

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
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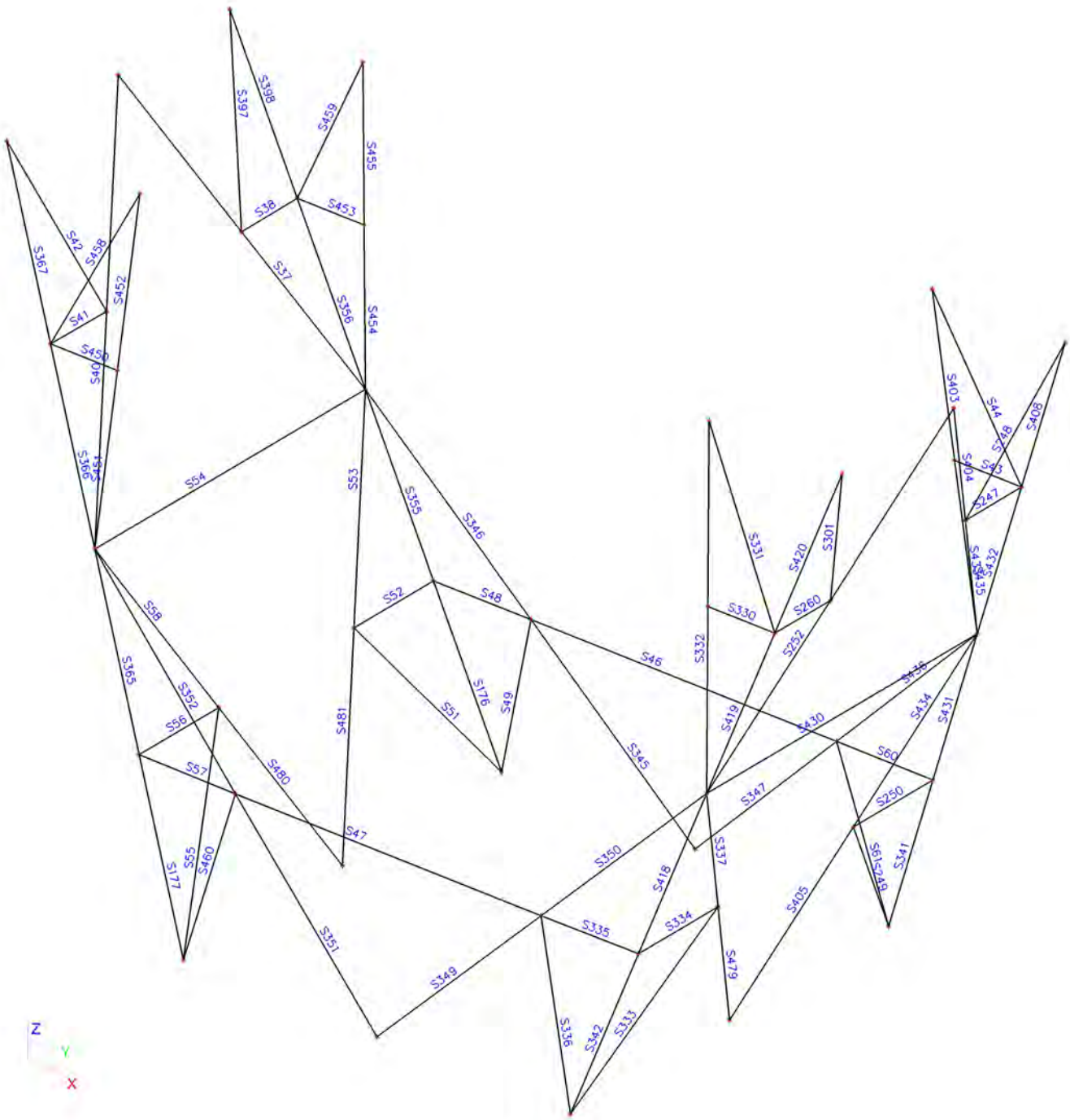
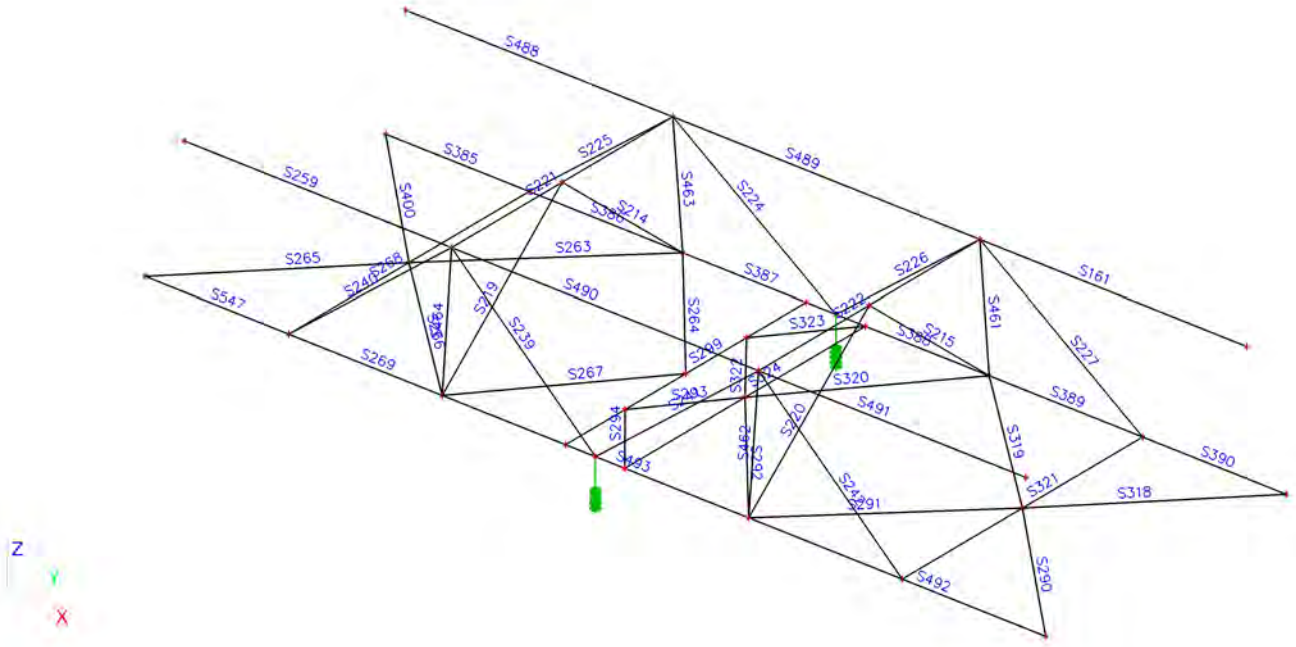
	Nationale norm	EC - EN
	Auteur	- AD

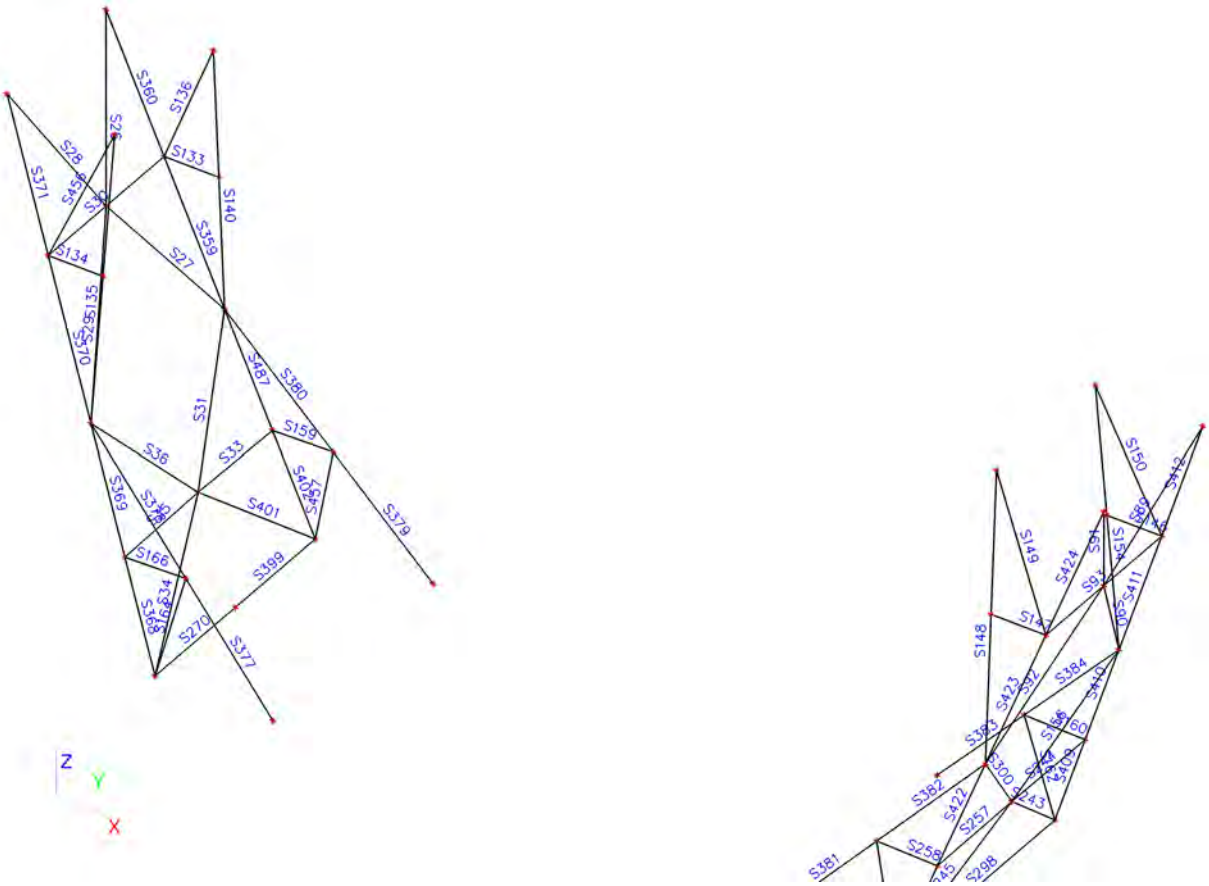
6.4. Vak 6 + 7 + 8



6.5. Vak 9 + 13 + 14 + 21



6.6. Vak 10 + 11 + 12



D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
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	Omschrijving	- ontwerpberekening
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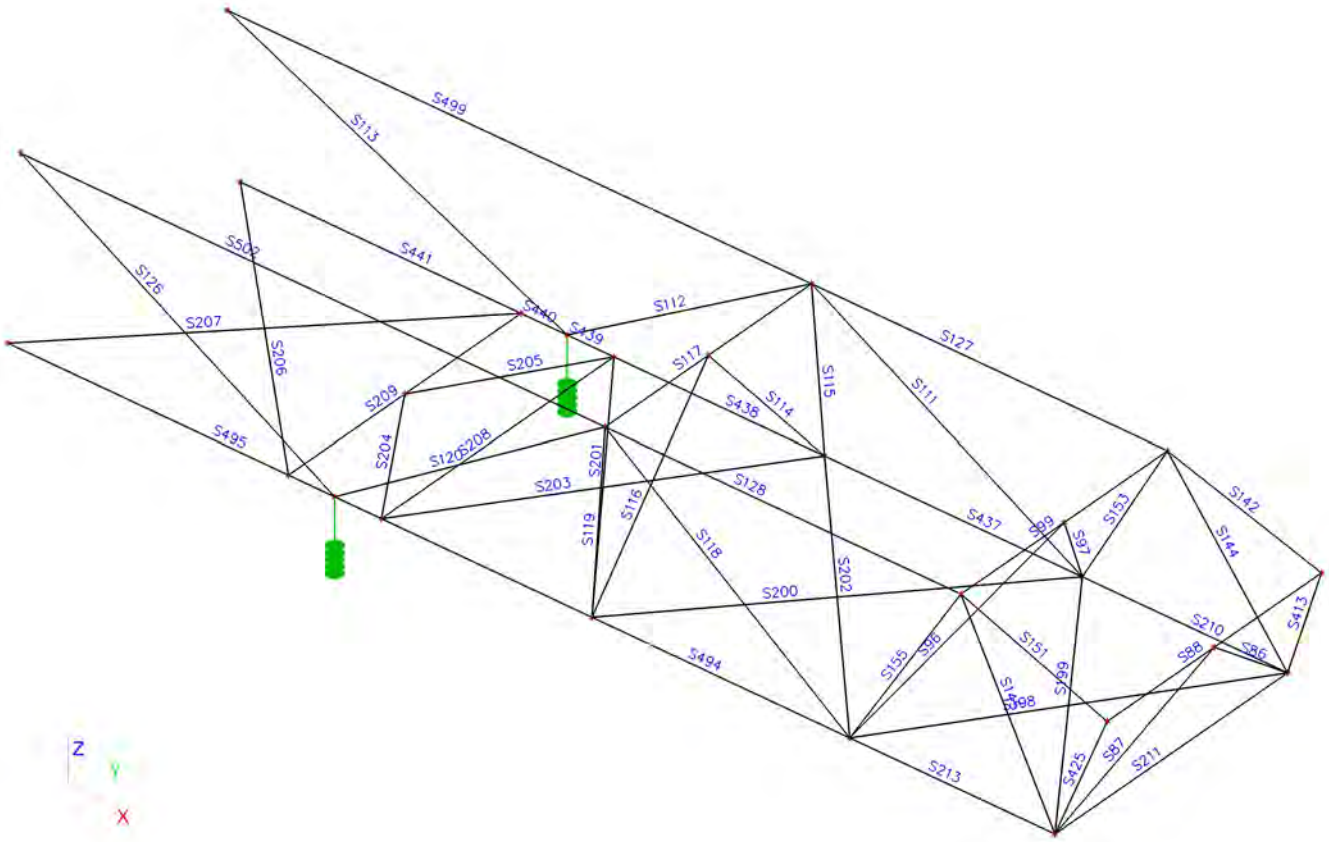
	Auteur	- AD

6.7. Vak 15 - 17



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	Omschrijving	- ontwerpberekening
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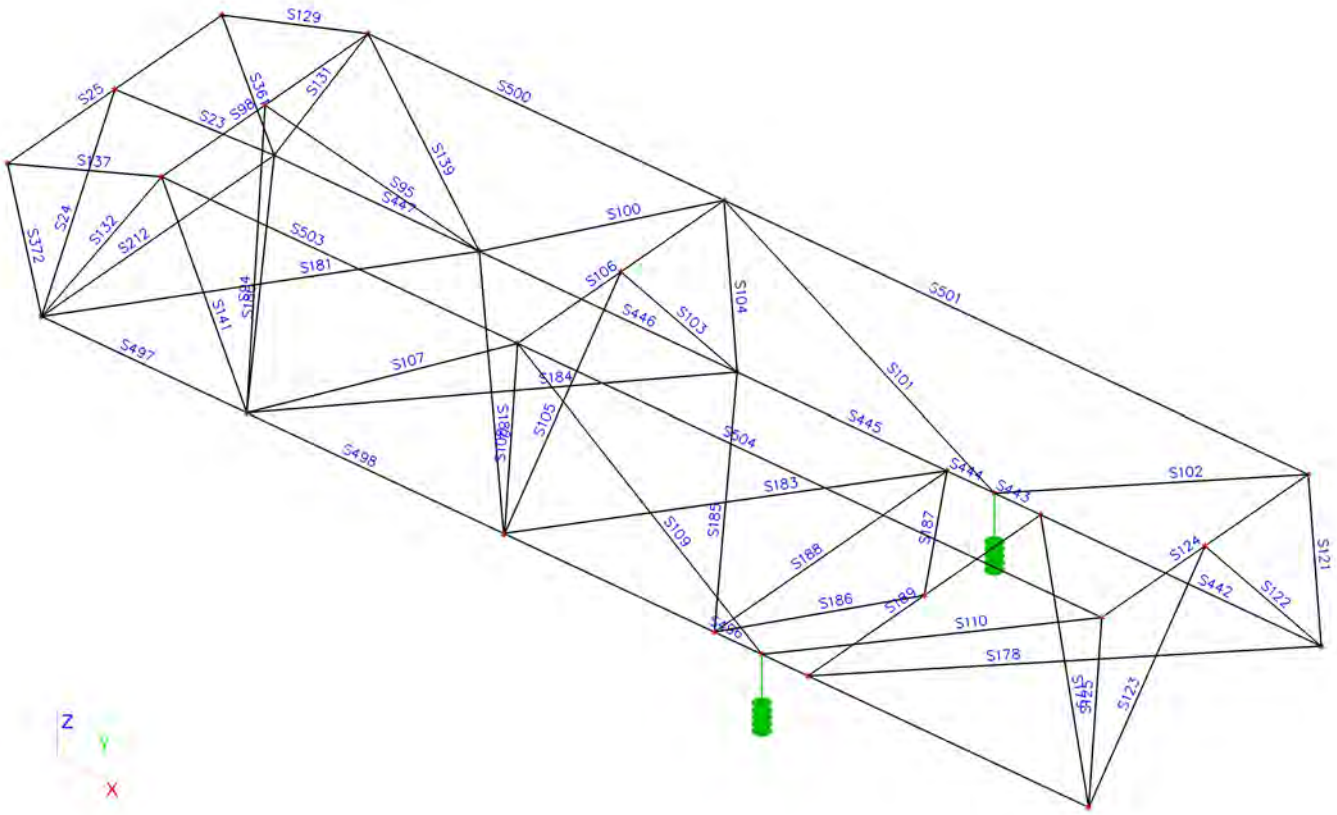
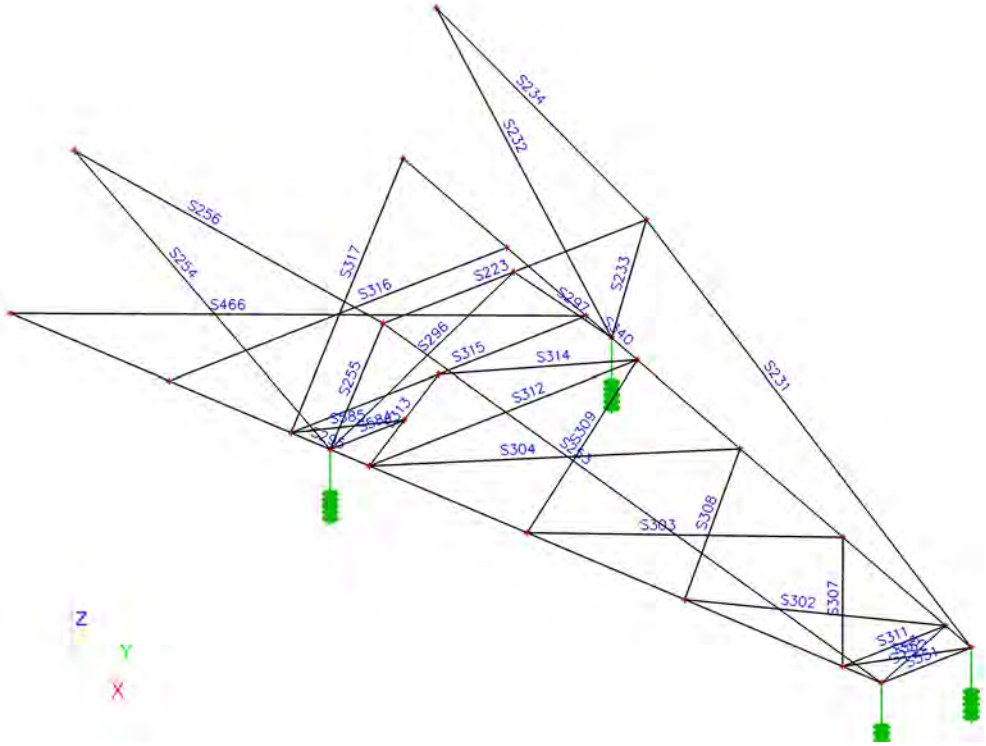
	Auteur	- AD

6.8. Vak 18 - 20

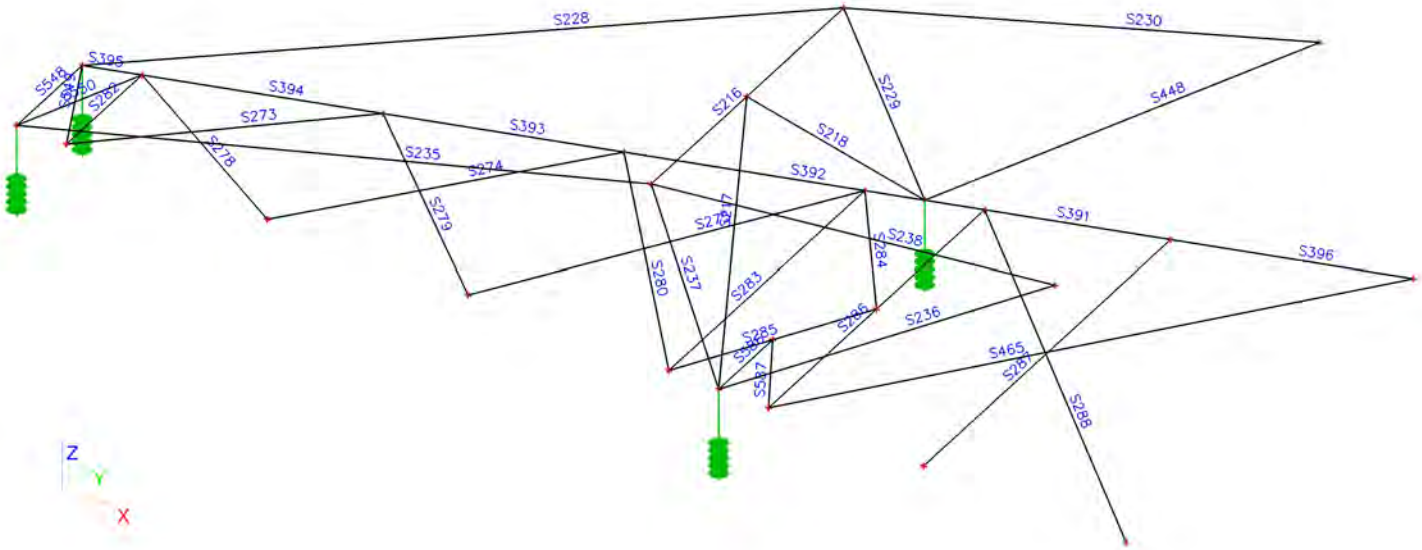


7. Staafnummers traverses

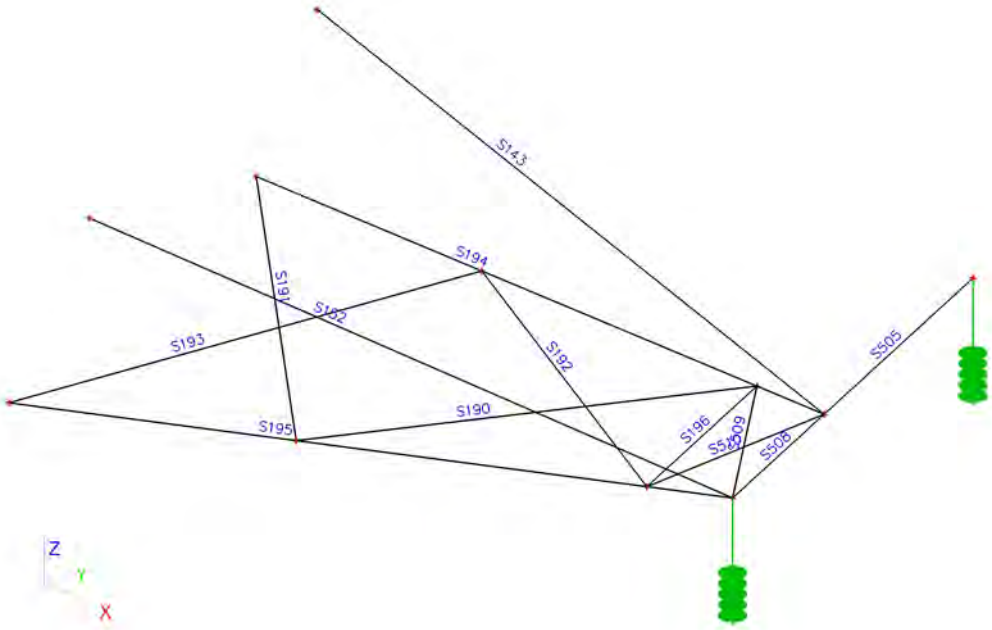
7.1. Traverse 1



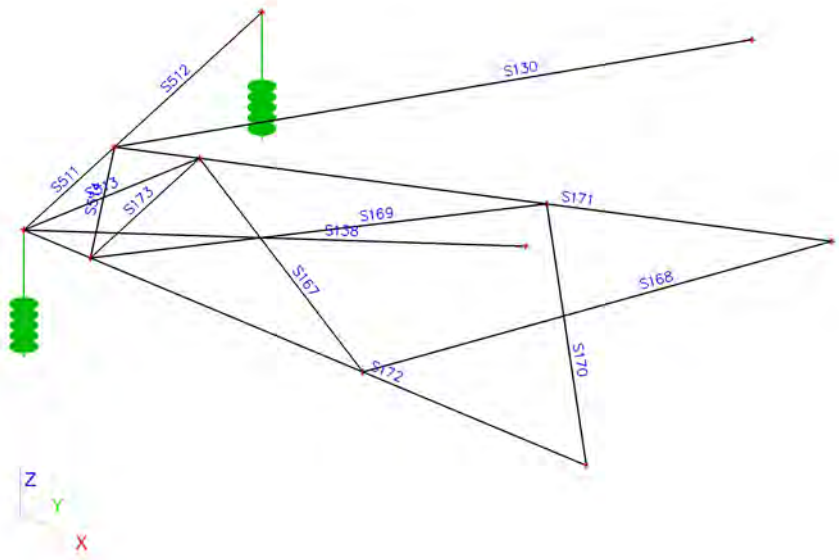
7.2. Traverse 2



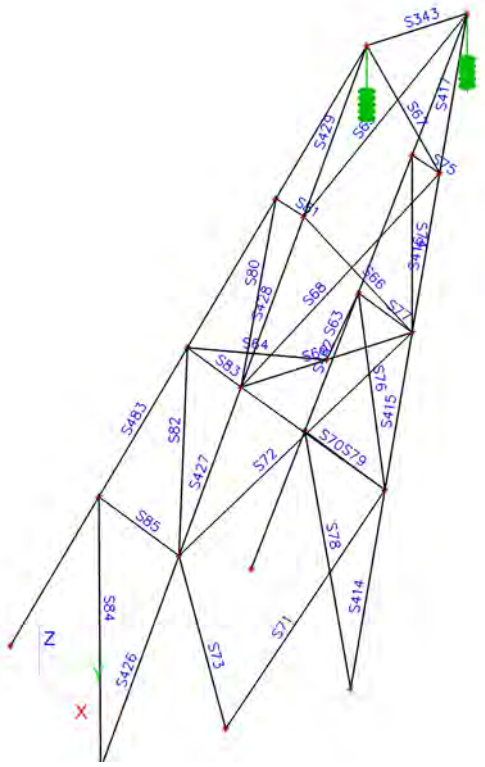
7.3. Traverse 3



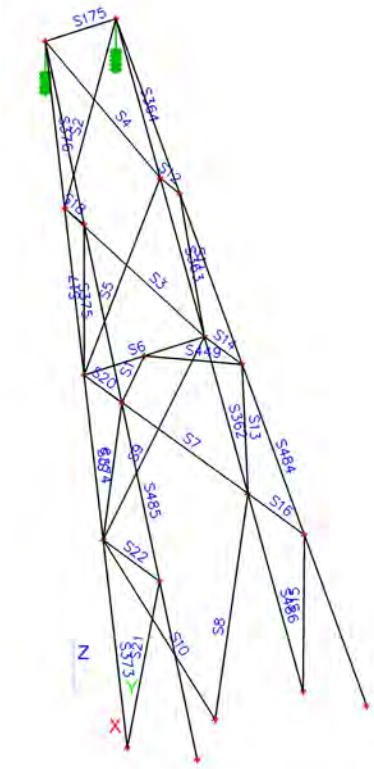
7.4. Traverse 4



7.5. Traverse 5

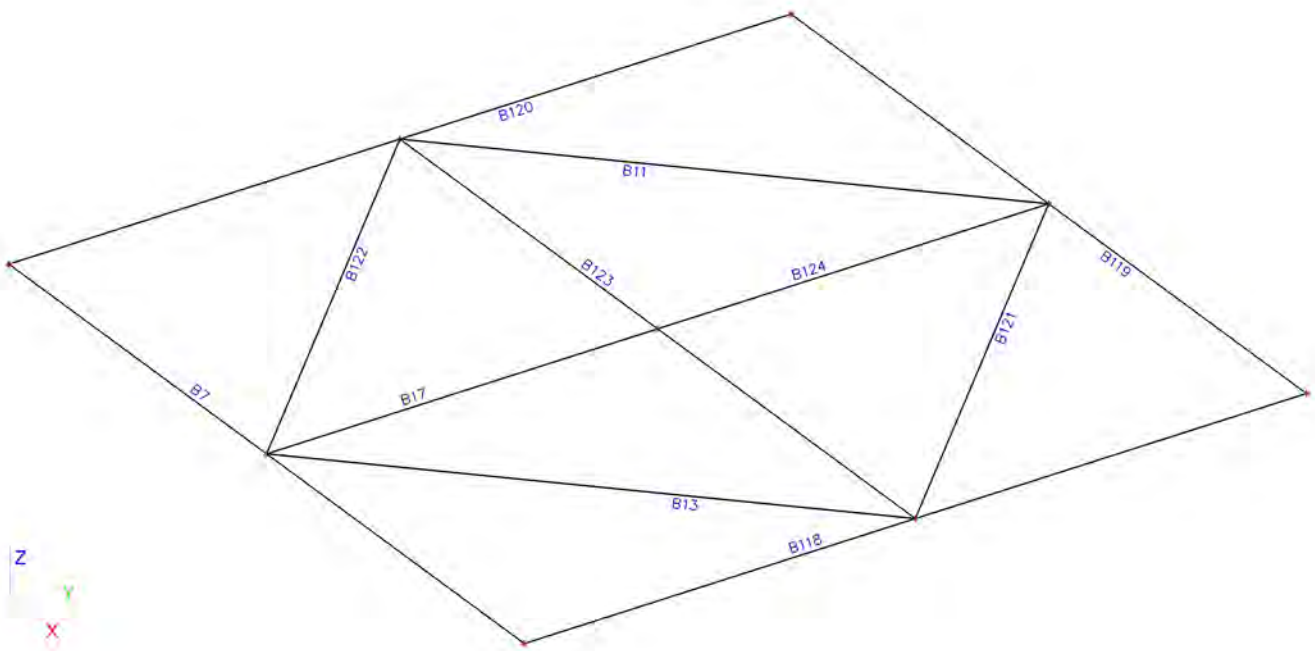


7.6. Traverse 6

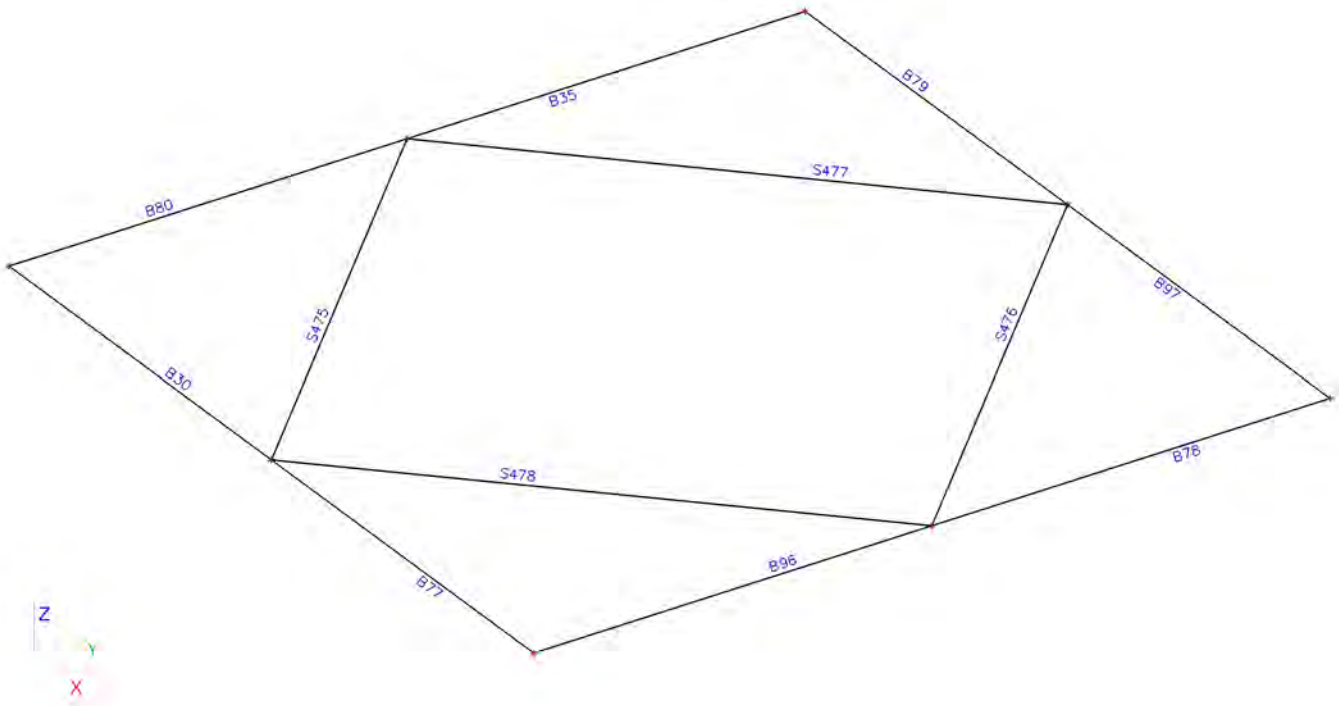


8. Staafnummers horizontale verbanden

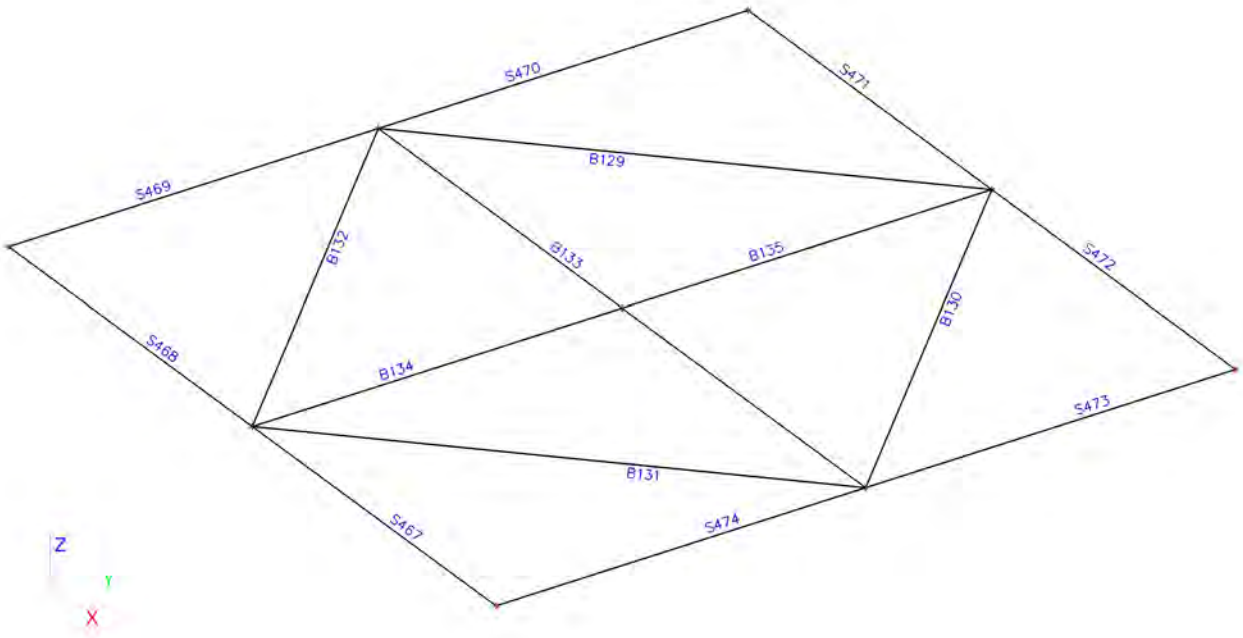
8.1. Horizontaal verband 1



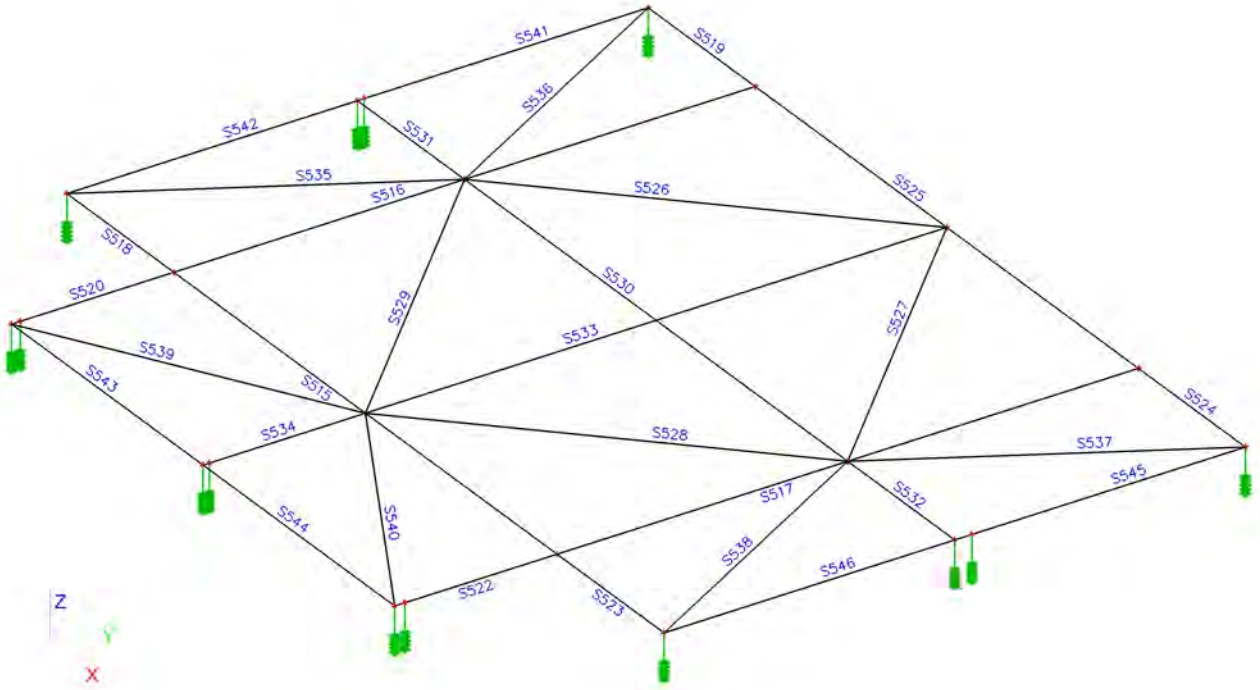
8.2. Horizontaal verband 2



8.3. Horizontaal verband 3



8.4. Horizontaal verband 4



9. Belastingsgevallen

Naam	Omschrijving	Actie type	Belastingtype	Richting	Duur
6T	self weight of tower	Permanent	Eigen gewicht	-Z	
6C	self weight of conductor	Permanent	Standaard		
W_x-y+	Wind	Variabel	Statisch		Kort
W_x+y-	Wind	Variabel	Statisch		Kort
W_x-y-	Wind	Variabel	Statisch		Kort
W_x+y+	Wind	Variabel	Statisch		Kort
W_y-	Wind	Variabel	Statisch		Kort
W_y+	Wind	Variabel	Statisch		Kort
W_x-	Wind	Variabel	Statisch		Kort
W_x+	Wind	Variabel	Statisch		Kort
WI_x+	WindIce	Variabel	Statisch		Kort
WI_x-	WindIce	Variabel	Statisch		Kort
WI_x+y+	WindIce	Variabel	Statisch		Kort
WI_x+y-	WindIce	Variabel	Statisch		Kort
WI_x-y+	WindIce	Variabel	Statisch		Kort
WI_x-y-	WindIce	Variabel	Statisch		Kort
WI_y+	WindIce	Variabel	Statisch		Kort
WI_y-	WindIce	Variabel	Statisch		Kort
Ice	Ice	Variabel	Statisch		Kort
4M	Maintenance	Variabel	Statisch		
4C0	Construction	Variabel	Statisch		Kort
4C1	Construction	Variabel	Statisch		Kort
4C2	Construction	Variabel	Statisch		Kort
4C3	Construction	Variabel	Statisch		Kort
4C4	Construction	Variabel	Statisch		Kort
4C5	Construction	Variabel	Statisch		Kort
4C6	Construction	Variabel	Statisch		Kort
4C7	Construction	Variabel	Statisch		Kort
4C8	Construction	Variabel	Statisch		Kort
4C9	Construction	Variabel	Statisch		Kort
4C10	Construction	Variabel	Statisch		Kort
4C11	Construction	Variabel	Statisch		Kort
SBS	SBS-load	Variabel	Statisch		
Tuls-1a	Conductor tension	Permanent	Standaard		
Tuls-1b	Conductor tension	Permanent	Standaard		
Tuls-3	Conductor tension	Permanent	Standaard		
Tuls-4	Conductor tension	Permanent	Standaard		
Tuls-6	Conductor tension	Permanent	Standaard		
Tsls-1a-LF	Conductor tension	Variabel	Statisch		Kort
Tsls-1b-LF	Conductor tension	Variabel	Statisch		Kort
Tsls-3-LF	Conductor tension	Variabel	Statisch		Kort
Tsls-4-LF	Conductor tension	Variabel	Statisch		Kort
Tsls-1a-LR	Conductor tension	Variabel	Statisch		Kort
Tsls-1b-LR	Conductor tension	Variabel	Statisch		Kort
Tsls-3-LR	Conductor tension	Variabel	Statisch		Kort
Tsls-4-LR	Conductor tension	Variabel	Statisch		Kort
Tsls-1a-RF	Conductor tension	Variabel	Statisch		Kort
Tsls-1b-RF	Conductor tension	Variabel	Statisch		Kort
Tsls-3-RF	Conductor tension	Variabel	Statisch		Kort
Tsls-4-RF	Conductor tension	Variabel	Statisch		Kort
Tsls-1a-RR	Conductor tension	Variabel	Statisch		Kort
Tsls-1b-RR	Conductor tension	Variabel	Statisch		Kort
Tsls-3-RR	Conductor tension	Variabel	Statisch		Kort
Tsls-4-RR	Conductor tension	Variabel	Statisch		Kort
Tuls-5a_CI2		Variabel	Statisch		Kort
Tuls-5a_CI1		Variabel	Statisch		Kort
Tuls-5a_CI3		Variabel	Statisch		Kort
Tuls-5a_CI5		Variabel	Statisch		Kort
Tuls-5a_CI6		Variabel	Statisch		Kort
Tuls-5a_CI7		Variabel	Statisch		Kort
Tuls-5a_CI8		Variabel	Statisch		Kort
Tuls-5a_CI19		Variabel	Statisch		Kort
Tuls-5a_CI11		Variabel	Statisch		Kort
Tuls-5a_CI9		Variabel	Statisch		Kort
Tuls-5a_CI13		Variabel	Statisch		Kort
Tuls-5a_CI15		Variabel	Statisch		Kort
Tuls-5a_CI17		Variabel	Statisch		Kort
Tuls-5a_CI21		Variabel	Statisch		Kort

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Naam	Omschrijving	Actie type	Belastingtype	Richting	Duur
4C12		Variabel	Statisch		Kort
4C13		Variabel	Statisch		Kort

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
			4C11 - Construction	1,50
6	Permanent	Omhullende -	6T - self weight of tower	1,35

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
6	Permanent	Omhullende - uiterst	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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aLF	wind;10	Omhullende - uiterst	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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aR	wind;10	Omhullende - uiterst	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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aF-p	wind;10	Omhullende - uiterst	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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRR	wind;-20	Omhullende - uiterst	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 -	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

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF-p	wind;-20	Omhullende -	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 -	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

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LR	wind+ice	Omhullende - uiterst	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
			WI_y- - WindIce	0,36
			6T - self weight of tower	1,08

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3LF-p	wind+ice	Omhullende - uiterst	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
			WI_x+y- - WindIce	0,36
			WI_x-y+ - WindIce	0,36

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3R-p	wind+ice	Omhullende - uiterst	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
			W_x- - Wind	0,24
			W_x+ - Wind	0,24

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4RF	maintenance	Omhullende - uiterst	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
			4C11 - Construction	1,20
			Tsls-4-LR - Conductor tension	1,00

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F	maintenance	Omhullende - uiterst	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
			4C3 - Construction	1,20
			4C4 - Construction	1,20

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LR-p	maintenance	Omhullende - uiterst	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
			W_x+y+ - Wind	0,24
			W_y- - Wind	0,24

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F-p	maintenance	Omhullende - uiterst	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

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

Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]
B7	1a/8	0,000	**-326,14**	B80	sp3LF/103	3,353	**5,43**	B118	1a/2	0,000	**-321,07**
B7	sp1aLF-p/7	0,000	**37,96**	B80	sp3RF-p/47	0,000	**-0,92**	B118	1a-p/1	3,800	**287,05**
B8	sp1aLF-p/7	4,916	**85,48**	B89	sp1aLF-p/49	6,146	**79,50**	B119	1a-p/1	0,000	**286,45**
B8	1a/8	0,000	**-699,16**	B89	3/52	6,146	**-523,85**	B119	sp1aLF/11	0,000	**-76,42**
B9	3/52	0,000	**-523,45**	B90	sp1aLF-p/71	3,073	**110,04**	B120	1a-p/4	0,000	**285,93**
B9	sp1aRF-p/56	6,146	**52,71**	B90	3/55	9,219	**-502,61**	B120	1a/8	3,800	**-321,79**
B10	sp1aRF-p/114	4,916	**125,45**	B91	3-p/34	3,073	**466,16**	B121	sp1aLF/11	0,000	**-22,39**
B10	1a/2	0,000	**-355,02**	B91	sp1aLF/31	9,219	**-138,39**	B121	1a-p/1	0,000	**92,02**
B11	1a-p/4	0,000	**90,75**	B92	sp1aRF-p/76	3,073	**91,38**	B122	sp1aLF-p/7	0,000	**13,79**
B11	sp1aLF/12	0,000	**-21,89**	B92	3/5	9,219	**-504,80**	B122	1a/8	0,000	**-102,71**
B12	sp1aLF/12	0,000	**-132,70**	B93	sp1aLF-p/45	4,916	**139,63**	B123	3/129	0,000	**-1,56**
B12	1a-p/4	4,916	**604,74**	B93	1a/8	0,000	**-359,34**	B123	1a-p/29	3,800	**-0,81**
B13	1a/2	0,000	**-101,90**	B94	sp3LF-p/108	7,240	**200,38**	B124	1a-p/54	0,000	**-1,12**
B13	sp1aLF-p/10	0,000	**13,57**	B94	sp3RF/99	7,240	**-223,28**	B124	3/52	0,000	**-1,75**
B14	3-p/42	6,146	**417,34**	B95	1a-p/1	2,514	**211,05**	B129	sp3RF/87	0,000	**-65,33**
B14	sp1aLF/69	0,000	**-132,17**	B95	sp1aRF/59	2,514	**-85,22**	B129	sp3LF-p/40	0,000	**63,36**
B16	sp1aRF/57	9,219	**-111,40**	B96	sp3RF/99	0,000	**5,58**	B130	sp3LF/83	0,000	**-65,63**
B16	3-p/38	3,073	**464,96**	B96	sp3LF-p/108	3,353	**-0,92**	B130	sp3RF-p/61	0,000	**63,38**
B17	1a-p/54	0,000	**-1,00**	B97	sp1aLF/16	0,000	**5,23**	B131	sp3RF/99	0,000	**-68,23**
B17	3/52	0,000	**-1,60**	B97	3-p/35	3,353	**-7,13**	B131	sp3LF-p/108	0,000	**66,44**
B18	sp1aRF/82	0,000	**-117,30**	B98	sp3LF/103	6,807	**261,24**	B132	sp3RF-p/47	0,000	**66,77**
B18	3-p/64	9,219	**414,59**	B98	sp3RF-p/47	6,807	**-253,05**	B132	sp3LF/103	0,000	**-68,10**
B22	sp3LF/110	9,452	**211,99**	B99	1a/15	6,807	**248,75**	B133	sp1aRF-p/130	2,500	**-1,01**
B22	sp3RF/87	5,028	**-193,90**	B99	sp1aRF-p/56	2,377	**-74,44**	B133	sp3LF/102	0,000	**-2,12**
B26	sp1aLF-p/49	5,028	**91,36**	B100	sp3RF/112	4,755	**-250,08**	B134	3/129	0,000	**1,21**
B26	1a/15	0,000	**-230,26**	B100	sp3LF-p/40	8,860	**244,06**	B134	sp1aRF-p/130	0,000	**0,61**
B30	sp1aLF-p/19	3,353	**1,38**	B101	sp1aLF/31	6,807	**99,90**	B135	sp1aRF-p/130	0,000	**0,48**
B30	3/52	0,000	**13,73**	B101	1a-p/29	0,000	**-247,93**	B135	sp3LF/102	0,000	**1,03**
B31	1a-p/1	2,458	**315,72**	B102	3/52	0,000	**13,51**	C1	sp1aLF-p/7	10,951	**318,74**
B31	sp1aRF/59	0,000	**-206,48**	B102	sp1aLF-p/19	2,920	**-1,28**	C1	1a/8	5,476	**-2357,47**
B32	sp1aLF/11	0,000	**-134,50**	B103	1a/14	0,000	**2,87**	C2	1a/2	5,476	**-2345,17**
B32	1a-p/1	4,916	**611,62**	B103	1a-p/6	2,920	**-3,51**	C2	sp1aLF-p/10	10,951	**312,44**
B33	sp1aLF/53	0,000	**-217,40**	B104	3-p/35	2,920	**-13,03**	C3	sp1aLF/11	0,000	**-531,60**
B33	1a-p/4	2,458	**316,55**	B104	sp1aLF/16	0,000	**1,54**	C3	1a-p/1	10,951	**2134,48**
B34	sp1aLF-p/10	4,916	**87,08**	B105	1a-p/3	2,920	**-2,24**	C4	sp1aLF/12	0,000	**-525,53**
B34	1a/2	0,000	**-698,41**	B105	1a/13	0,000	**4,02**	C4	1a-p/4	10,951	**2121,58**
B35	sp3RF-p/111	0,000	**2,60**	B106	1a-p/29	0,000	**-243,48**	C5	sp1aLF-p/7	3,374	**308,71**
B35	sp3LF/110	3,353	**-3,35**	B106	sp1aRF/59	6,807	**81,41**	C5	1a/8	0,000	**-2242,38**
B36	sp3RF/99	2,180	**-325,70**	B107	sp3LF/110	4,754	**-250,68**	C6	sp1aLF-p/10	3,374	**302,67**
B36	sp3LF-p/108	4,360	**296,39**	B107	sp3RF-p/61	8,859	**246,57**	C6	1a/2	0,000	**-2230,40**
B37	sp3RF-p/61	4,360	**308,70**	B108	1a/15	6,807	**251,67**	C7	1a-p/4	3,374	**2039,16**
B37	sp3LF/83	2,180	**-287,47**	B108	sp1aLF-p/49	2,377	**-92,58**	C7	sp1aLF/12	0,000	**-482,68**
B38	3-p/38	2,180	**291,01**	B109	sp3LF-p/108	6,807	**-253,29**	C8	1a-p/1	3,374	**2051,48**
B38	sp1aRF/59	2,180	**-99,12**	B109	sp3RF/99	6,807	**261,45**	C8	sp1aLF/11	0,000	**-488,82**
B39	sp3RF-p/104	4,360	**299,28**	B110	3/52	2,920	**13,35**	C9	sp1aLF-p/7	3,536	**313,50**
B39	sp1aLF/53	2,180	**-121,81**	B110	sp1aLF-p/19	0,000	**-1,35**	C9	1a/8	1,768	**-2277,76**
B73	sp1aRF-p/56	5,028	**76,22**	B111	1a/14	2,920	**3,61**	C10	sp1aLF-p/10	3,536	**305,99**
B73	1a/15	0,000	**-227,49**	B111	1a-p/6	0,000	**-2,58**	C10	1a/2	1,768	**-2262,20**
B74	sp3RF/112	9,452	**213,51**	B112	3/48	0,000	**-13,14**	C11	1a-p/4	3,536	**2104,11**
B74	sp3LF/83	5,028	**-193,36**	B112	sp1aLF-p/19	2,920	**1,46**	C11	sp1aLF/12	0,000	**-467,22**
B75	sp1aLF/53	2,514	**-100,27**	B113	1a/13	2,920	**2,97**	C12	1a-p/1	3,536	**2117,53**
B75	sp3RF-p/104	5,028	**217,62**	B113	1a-p/3	0,000	**-3,32**	C12	sp1aLF/11	0,000	**-473,52**
B76	sp3LF/103	7,240	**-221,28**	B114	sp3RF-p/47	4,360	**293,49**	C13	1a/8	1,784	**-1932,89**
B76	sp3RF-p/47	7,240	**198,50**	B114	sp3LF/103	2,180	**-324,51**	C13	sp1aLF-p/7	6,648	**242,39**
B77	sp1aLF-p/19	0,000	**1,33**	B115	sp1aRF-p/56	4,360	**83,90**	C14	1a/2	1,784	**-1915,90**
B77	3/52	3,353	**13,29**	B115	3/46	0,000	**-302,02**	C14	sp1aLF-p/10	6,648	**232,95**
B78	sp3LF-p/113	3,353	**2,22**	B116	sp3LF-p/40	4,360	**309,02**	C15	1a-p/4	6,648	**1766,14**
B78	sp3RF/112	0,000	**-3,44**	B116	sp3RF/87	2,180	**-288,97**	C15	sp1aLF/12	0,000	**-399,10**
B79	sp1aLF/16	2,980	**5,08**	B117	sp1aLF-p/49	4,360	**106,53**	C16	sp1aLF/11	0,000	**-402,91**
B79	3-p/35	0,000	**-7,04**	B117	sp3RF/123	2,180	**-305,91**	C16	1a-p/1	6,648	**1772,13**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]
C17	sp1aLF-p/7	3,414	**151,08**
C17	3/32	1,707	**-1403,25**
C18	3/46	1,707	**-1398,92**
C18	sp1aLF-p/10	3,414	**139,89**
C19	3-p/34	3,414	**1264,57**
C19	sp1aLF/12	0,000	**-279,78**
C20	3-p/38	3,414	**1262,68**
C20	sp1aLF/11	0,000	**-279,92**
S1	1a-p/29	0,941	**0,39**
S1	1a/28	0,000	**-0,54**
S2	sp1aLF/31	1,862	**0,72**
S2	3/30	0,000	**-34,21**
S3	sp1aLF/31	0,000	**-0,98**
S3	3/32	2,018	**22,51**
S4	sp3LF/33	0,000	**-1,19**
S4	3-p/34	1,862	**37,51**
S5	3-p/35	0,000	**-23,82**
S5	sp1aLF/31	2,018	**0,94**
S6	1a-p/1	0,000	**-1,00**
S6	1a/36	0,000	**1,44**
S7	3-p/38	2,184	**17,58**
S7	sp1aLF/37	0,000	**-2,05**
S8	3-p/38	0,000	**-22,72**
S8	sp1aLF/37	2,162	**2,96**
S9	3/39	0,000	**-17,75**
S9	sp1aLF-p/10	2,184	**1,29**
S10	sp1aLF-p/10	0,000	**-2,51**
S10	3/39	2,162	**23,73**
S11	1a-p/4	0,000	**1,26**
S11	1a/23	1,511	**-1,58**
S12	1a-p/4	0,000	**-0,44**
S12	1a/8	0,336	**0,46**
S13	1a/23	1,501	**-2,45**
S13	1a-p/4	0,000	**0,95**
S14	1a-p/4	0,000	**-0,47**
S14	1a/23	0,649	**1,22**
S15	1a-p/4	0,000	**0,96**
S15	1a/23	1,911	**-2,43**
S16	1a-p/4	0,000	**-0,60**
S16	1a/23	0,969	**1,48**
S17	3/5	1,511	**-4,89**
S17	sp3LF-p/40	0,000	**0,81**
S18	sp3LF-p/40	0,000	**-0,38**
S18	3/5	0,336	**1,86**
S19	1a/8	1,501	**-2,91**
S19	1a-p/24	0,000	**1,50**
S20	1a/8	0,649	**1,37**
S20	1a-p/4	0,000	**-0,58**
S21	1a/23	1,911	**-2,18**
S21	1a-p/24	0,000	**0,69**
S22	1a-p/24	0,484	**-0,56**
S22	1a/8	0,484	**1,48**
S23	sp3LF/41	0,000	**-5,83**
S23	3-p/34	1,450	**13,51**
S24	sp3LF/43	1,451	**6,23**
S24	3-p/42	0,000	**-13,40**
S25	sp3LF/44	0,000	**-9,55**
S25	sp1aLF-p/45	0,997	**-1,65**
S26	sp1aLF-p/10	2,386	**29,94**
S26	3/46	0,000	**-225,26**
S27	sp1aLF/11	0,000	**-30,51**
S27	3-p/38	2,652	**178,68**
S28	sp1aLF/11	0,000	**-32,91**
S28	3-p/38	2,386	**212,98**
S29	sp1aLF-p/10	2,651	**26,52**
S29	3/46	0,000	**-193,52**
S30	sp3RF-p/47	2,536	**-0,74**
S30	3/46	0,000	**3,86**
S31	1a-p/29	0,000	**-124,91**
S31	sp1aLF/11	2,265	**21,64**
S33	1a/8	0,000	**-6,45**
S33	sp1aLF-p/45	1,616	**0,54**
S34	sp1aLF/11	2,366	**31,52**
S34	1a-p/1	0,000	**-114,32**
S35	sp3LF/44	0,000	**-19,52**
S35	3-p/38	1,616	**-3,04**
S36	sp1aLF/12	0,000	**-20,63**
S36	1a/2	2,265	**123,80**
S37	sp1aLF/31	0,000	**-92,99**
S37	3-p/35	2,380	**466,49**
S38	3-p/34	0,878	**-5,31**
S38	sp1aLF/12	0,000	**1,51**
S40	sp1aLF-p/49	2,380	**90,37**
S40	3/48	0,000	**-480,70**
S41	sp1aLF-p/50	0,879	**-2,77**
S41	3/46	0,000	**16,98**
S42	3/46	0,000	**-21,59**
S42	sp1aLF-p/50	2,227	**4,17**
S43	sp1aRF/51	0,864	**-0,92**
S43	1a-p/4	0,000	**2,59**
S44	sp1aRF/51	2,231	**15,74**
S44	1a-p/4	0,000	**-35,62**
S46	sp1aLF-p/19	0,000	**-2,68**
S46	3/39	0,000	**43,52**
S47	3/52	0,000	**-61,98**
S47	sp1aLF-p/19	0,000	**-7,61**
S48	3-p/38	0,000	**-9,10**
S48	sp1aLF/37	1,252	**3,79**
S49	sp1aLF/16	0,000	**-6,81**
S49	3-p/35	2,076	**44,15**
S51	1a-p/4	2,571	**15,69**
S51	sp1aLF/12	0,000	**-4,00**
S52	1a-p/4	1,250	**-12,70**
S52	sp1aLF/12	0,000	**2,66**
S53	3/30	2,382	**-309,64**
S53	sp1aLF-p/45	0,000	**63,06**
S54	1a-p/3	0,000	**-12,99**
S54	1a/13	0,000	**11,87**
S55	sp1aLF-p/19	2,571	**2,23**
S55	3/52	0,000	**-23,09**
S56	sp1aLF-p/19	1,250	**-2,38**
S56	3/52	0,000	**21,06**
S57	sp1aLF-p/49	0,000	**-2,85**
S57	3/52	1,252	**34,34**
S58	sp1aLF/53	2,382	**-70,48**
S58	3-p/34	0,000	**299,74**
S60	3-p/35	0,000	**-30,45**
S60	sp1aLF/16	1,252	**5,81**
S61	3-p/35	2,076	**61,78**
S61	sp1aLF/16	0,000	**-9,42**
S63	1a/15	0,000	**-0,53**
S63	1a-p/54	0,941	**0,47**
S64	1a/28	0,000	**-0,53**
S64	1a-p/29	0,941	**0,37**
S65	3/55	0,000	**-34,81**
S65	sp1aRF-p/56	1,862	**0,74**
S66	3-p/35	2,018	**22,12**
S66	sp1aRF/57	0,000	**-1,07**
S67	sp3LF/44	0,000	**-1,11**
S67	3-p/38	1,862	**37,01**
S68	sp1aRF/57	2,018	**1,08**
S68	3-p/35	0,000	**-24,25**
S69	1a-p/24	0,682	**-0,64**
S69	1a/8	0,682	**1,67**
S70	sp1aLF/12	0,000	**-1,92**
S70	3-p/34	2,184	**17,45**
S71	sp1aLF/16	2,162	**3,37**
S71	3-p/34	0,000	**-23,36**
S72	3/30	0,000	**-18,03**
S72	sp1aRF-p/58	2,184	**1,43**
S73	sp1aRF/59	0,000	**-2,94**
S73	3/30	2,162	**22,71**
S74	sp1aRF/60	1,511	**-1,40**
S74	1a-p/27	0,000	**1,45**
S75	sp1aRF/59	0,336	**0,44**
S75	1a-p/1	0,000	**-0,60**
S76	1a/36	1,501	**-2,83**
S76	1a-p/1	0,000	**1,81**
S77	1a-p/27	0,000	**-0,79**
S77	1a/2	0,649	**1,25**
S78	1a/36	1,911	**-2,64**
S78	1a-p/27	0,000	**0,44**
S79	1a-p/1	0,000	**-0,43**
S79	1a/36	0,485	**1,80**
S80	sp3RF-p/61	0,000	**0,51**
S80	3/55	1,511	**-3,40**
S81	sp3RF-p/61	0,000	**-0,24**
S81	3/55	0,336	**1,29**
S82	1a/2	1,501	**-2,31**
S82	1a-p/27	0,000	**1,29**
S83	1a-p/27	0,000	**-0,66**
S83	1a/2	0,649	**1,14**
S84	1a-p/27	0,000	**0,79**
S84	1a/2	1,911	**-2,90**
S85	1a-p/27	0,969	**-0,43**
S85	1a/2	0,000	**1,85**
S86	sp3RF/62	0,000	**-5,55**
S86	3-p/42	1,450	**13,63**
S87	3-p/34	0,000	**-14,39**
S87	sp3LF/41	1,451	**4,84**
S88	4-p/63	0,498	**-1,80**
S88	sp3RF/62	0,000	**-8,42**
S89	sp1aLF-p/7	2,386	**28,60**
S89	3/32	0,000	**-218,41**
S90	sp1aLF/12	0,000	**-30,05**
S90	3-p/34	2,652	**183,40**
S91	sp1aLF/12	0,000	**-31,18**
S91	3-p/34	2,386	**216,55**
S92	sp1aLF-p/7	2,651	**24,31**
S92	3/32	0,000	**-186,14**
S93	3/55	0,000	**1,53**
S93	3-p/64	2,536	**-3,13**
S94	1a-p/54	1,851	**4,44**
S94	1a/15	0,000	**-4,95**
S95	1a-p/29	1,849	**4,77**
S95	1a/28	0,000	**-4,62**
S96	1a-p/54	1,850	**2,66**
S96	1a/15	0,000	**-3,25**
S97	1a-p/29	1,849	**3,00**
S97	1a/28	0,000	**-2,93**
S98	1a-p/29	0,000	**2,82**
S98	1a/15	1,920	**-2,81**
S99	1a-p/29	0,000	**1,70**
S99	1a/15	1,920	**-1,90**
S100	1a/13	2,364	**-45,84**
S100	1a-p/3	0,000	**27,46**
S101	1a/13	2,361	**42,55**
S101	1a-p/3	0,000	**-31,29**
S102	1a-p/3	0,000	**39,13**
S102	1a/13	2,818	**-49,53**
S103	1a-p/29	1,691	**2,09**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]
S103	1a/28	0,000	**-1,96**	S137	3/5	0,000	**43,49**	S175	sp3LF/43	0,400	**-0,21**
S104	1a/28	1,306	**1,97**	S137	4-p/72	1,213	**13,62**	S176	sp1aLF/12	0,000	**-287,40**
S104	sp1aLF-p/65	0,000	**0,25**	S138	3/5	0,000	**41,73**	S176	3-p/34	2,140	**1307,49**
S105	1a-p/54	1,691	**1,78**	S138	4-p/72	2,880	**13,46**	S177	3/32	0,000	**-1406,84**
S105	1a/15	0,000	**-2,28**	S139	1a/14	1,506	**104,79**	S177	sp1aLF-p/7	2,140	**171,97**
S106	1a-p/29	0,000	**1,26**	S139	1a-p/6	0,000	**-70,90**	S178	sp3RF/87	0,761	**10,44**
S106	1a/15	1,920	**-1,51**	S140	1a-p/4	4,099	**109,68**	S178	sp3LF-p/40	0,000	**-10,47**
S107	1a-p/3	0,000	**13,55**	S140	1a/13	0,000	**-87,62**	S179	sp3LF-p/40	1,904	**9,22**
S107	1a/13	2,364	**-69,35**	S141	1a/36	1,506	**66,74**	S179	sp3RF/87	0,000	**-9,63**
S108	sp3LF/43	1,306	**1,77**	S141	1a-p/1	0,000	**-98,44**	S180	sp1aLF/16	0,000	**-13,87**
S108	1a-p/54	0,000	**-0,33**	S142	4/73	0,000	**25,37**	S180	1a-p/29	0,000	**79,63**
S109	1a/13	2,360	**66,89**	S142	1a-p/1	1,213	**6,05**	S181	sp1aLF/16	0,000	**13,81**
S109	1a-p/3	0,000	**-16,57**	S143	4/73	0,000	**25,81**	S181	1a-p/29	0,763	**-77,89**
S110	1a-p/3	0,000	**43,62**	S143	sp1aRF-p/74	2,880	**9,46**	S182	1a-p/29	0,000	**78,21**
S110	1a/13	2,819	**-50,61**	S144	1a-p/24	0,000	**73,94**	S182	sp1aLF/16	0,000	**-11,63**
S111	1a-p/6	0,000	**30,11**	S144	1a/8	1,541	**-119,48**	S183	sp1aLF/16	0,000	**9,16**
S111	1a/14	2,363	**-43,17**	S145	1a-p/4	0,000	**107,73**	S183	1a-p/29	0,000	**-69,75**
S112	1a/14	2,361	**39,82**	S145	1a/13	1,541	**-93,94**	S184	sp1aLF/16	0,000	**11,59**
S112	1a-p/6	0,000	**-34,00**	S146	1a/14	0,800	**0,23**	S184	1a-p/29	0,000	**-80,24**
S113	1a-p/6	0,000	**42,47**	S146	sp1aRF-p/75	0,000	**-0,08**	S185	1a-p/29	0,000	**70,60**
S113	1a/14	2,819	**-46,27**	S147	sp1aRF-p/76	0,000	**0,05**	S185	sp1aLF/16	0,000	**-9,10**
S114	1a-p/29	1,691	**2,53**	S147	3/5	0,800	**-0,66**	S186	sp1aLF/16	0,649	**11,47**
S114	1a/28	0,000	**-2,38**	S148	1a-p/6	4,098	**65,81**	S186	1a-p/29	0,649	**-87,45**
S115	1a/28	1,306	**2,27**	S148	1a/2	0,000	**-125,82**	S187	1a-p/4	0,000	**34,98**
S115	1a-p/29	0,000	**0,07**	S149	3/77	0,000	**4,34**	S187	sp1aLF/12	0,000	**-6,21**
S116	1a-p/54	1,691	**2,20**	S149	sp1aLF-p/7	2,179	**-0,50**	S188	1a-p/1	1,081	**28,36**
S116	1a/15	0,000	**-2,73**	S150	sp1aLF/12	0,000	**2,54**	S188	sp1aLF/37	0,000	**-4,93**
S117	1a-p/29	0,000	**1,54**	S150	3-p/64	2,179	**-8,13**	S189	1a-p/29	0,721	**56,28**
S117	1a/15	1,920	**-1,80**	S151	3/55	0,000	**41,36**	S189	sp1aLF/12	0,000	**-9,53**
S118	1a-p/6	0,000	**16,50**	S151	4-p/78	1,213	**12,94**	S190	sp1aRF-p/58	1,554	**-0,14**
S118	1a/14	2,363	**-66,41**	S152	3/55	0,000	**41,60**	S190	3/32	0,000	**-52,76**
S119	sp1aLF/66	1,306	**1,77**	S152	4-p/79	2,880	**13,38**	S191	3/32	0,000	**26,98**
S119	1a-p/54	0,000	**-0,63**	S153	1a/13	1,506	**110,49**	S191	sp1aRF-p/58	2,235	**-0,01**
S120	1a/14	2,361	**63,86**	S153	1a-p/24	0,000	**-66,90**	S192	3-p/64	0,000	**49,26**
S120	1a-p/6	0,000	**-19,53**	S154	1a-p/6	4,099	**116,26**	S192	sp3LF/88	1,166	**-3,53**
S121	1a/28	0,000	**3,22**	S154	1a/36	0,000	**-81,71**	S193	sp3RF/87	1,490	**2,00**
S121	sp1aLF-p/65	1,306	**0,09**	S155	1a/23	1,506	**68,80**	S193	3-p/64	0,000	**-25,20**
S122	1a-p/29	1,691	**2,29**	S155	1a-p/4	0,000	**-96,19**	S194	3-p/34	0,000	**119,36**
S122	1a/28	0,000	**-2,98**	S156	sp1aLF/12	2,264	**19,24**	S194	sp4LF/89	0,000	**-23,32**
S123	1a-p/54	1,691	**2,78**	S156	3-p/34	0,000	**-116,18**	S195	sp4LF-p/90	1,220	**-12,80**
S123	1a/15	0,000	**-2,48**	S159	sp4RF/80	0,000	**28,33**	S195	3/5	0,000	**-171,57**
S124	1a-p/54	0,960	**1,73**	S159	1a-p/4	0,888	**5,50**	S196	sp1aLF/91	0,961	**2,74**
S124	1a/28	0,960	**-1,94**	S160	sp4LF/81	0,000	**27,30**	S196	1a-p/6	0,000	**-3,14**
S125	sp1aLF/66	0,000	**2,09**	S160	1a-p/1	0,888	**-3,56**	S198	1a-p/29	0,000	**77,97**
S125	1a-p/54	1,306	**-1,28**	S161	1a/14	0,000	**270,10**	S198	sp1aLF/16	0,000	**-13,08**
S126	1a-p/6	0,000	**47,27**	S161	sp1aRF-p/75	0,000	**-171,39**	S199	sp1aLF/16	0,000	**13,06**
S126	1a/14	2,819	**-46,97**	S162	sp1aRF/82	0,000	**-160,11**	S199	1a-p/29	0,000	**-76,57**
S127	1a/36	1,554	**94,48**	S162	1a-p/3	1,544	**220,56**	S200	1a-p/29	0,366	**79,39**
S127	1a-p/1	2,331	**-114,16**	S164	1a/14	0,000	**-259,78**	S200	sp1aLF/16	0,000	**-12,05**
S128	1a/2	0,000	**142,43**	S164	sp1aLF-p/71	1,544	**134,77**	S201	sp1aLF/16	0,000	**9,20**
S128	1a-p/6	0,000	**-72,72**	S166	3/5	0,000	**145,46**	S201	1a-p/29	0,000	**-70,05**
S129	1a-p/4	1,213	**8,04**	S166	1a-p/24	0,888	**67,92**	S202	sp1aLF/16	2,924	**12,21**
S129	4/67	0,000	**26,07**	S167	sp1aLF-p/10	1,943	**-0,12**	S202	1a-p/29	2,924	**-81,34**
S130	4/68	0,000	**25,73**	S167	3/46	0,000	**-53,18**	S203	1a-p/29	0,000	**70,59**
S130	sp1aLF-p/22	2,880	**9,40**	S168	3/46	0,000	**27,22**	S203	sp1aLF/16	0,000	**-9,16**
S131	1a-p/6	0,000	**73,11**	S168	sp1aLF-p/50	2,235	**-0,01**	S204	sp1aLF/16	0,647	**11,45**
S131	1a/2	1,541	**-116,74**	S169	3-p/42	0,000	**48,95**	S204	1a-p/29	0,647	**-87,28**
S132	1a-p/6	0,000	**111,68**	S169	sp3LF/83	0,389	**-3,59**	S205	1a-p/1	0,000	**35,89**
S132	1a/36	1,541	**-89,17**	S170	3-p/42	0,000	**-25,02**	S205	sp1aLF/11	0,431	**-6,50**
S133	3-p/42	0,000	**0,49**	S170	sp3LF/83	1,863	**2,04**	S206	sp3RF-p/61	0,000	**-10,47**
S133	sp1aLF/69	0,799	**-0,23**	S171	3-p/38	0,000	**119,29**	S206	sp3LF/83	0,761	**10,44**
S134	sp1aLF-p/71	0,000	**0,08**	S171	sp4LF/84	0,000	**-23,23**	S207	sp3RF-p/61	1,142	**9,23**
S134	3/70	0,800	**-0,22**	S172	sp4LF-p/85	2,337	**-12,86**	S207	sp3LF/83	0,000	**-9,62**
S135	1a-p/24	4,098	**61,15**	S172	3/55	0,000	**-171,86**	S208	1a-p/4	1,802	**27,89**
S135	1a/8	0,000	**-132,16**	S173	sp3LF/86	0,961	**2,74**	S208	sp1aLF/12	0,000	**-4,88**
S136	sp1aLF/11	0,000	**1,63**	S173	1a-p/3	0,000	**-2,97**	S209	1a-p/1	0,000	**57,55**
S136	3-p/42	2,179	**-3,26**	S175	3-p/42	0,000	**19,78**	S209	sp1aLF/11	0,000	**-9,69**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]
S210	1a-p/6	0,000	**166,55**	S243	sp1aLF/11	0,000	**-28,16**	S286	3/46	1,317	**64,68**
S210	sp1aLF/11	0,000	**-42,85**	S244	sp1aLF-p/7	1,616	**-0,25**	S286	1a-p/1	0,000	**-18,24**
S211	1a/13	0,721	**11,42**	S244	3/30	0,000	**-10,85**	S287	1a-p/29	0,000	**-0,57**
S211	1a-p/3	0,000	**-6,10**	S245	sp1aLF/12	2,366	**25,08**	S287	sp1aLF/16	0,000	**0,48**
S212	1a/14	2,163	**13,06**	S245	3-p/34	0,000	**-103,59**	S288	sp1aLF-p/10	3,988	**2,50**
S212	1a-p/6	0,000	**-5,02**	S247	sp1aRF/51	0,000	**4,78**	S288	3/46	0,000	**-74,61**
S213	sp1aLF-p/92	0,000	**29,28**	S247	3-p/34	0,879	**-13,47**	S289	sp1aLF-p/50	3,123	**-26,67**
S213	3/55	0,000	**-195,53**	S248	3-p/34	2,227	**18,13**	S289	3/46	0,000	**-394,24**
S214	1a-p/29	2,305	**2,43**	S248	sp1aRF/51	0,000	**-5,64**	S290	sp1aRF/57	0,409	**11,42**
S214	1a/28	0,000	**-2,65**	S249	sp1aLF/16	0,000	**-4,47**	S290	3-p/35	0,000	**-36,69**
S215	1a-p/29	2,305	**2,41**	S249	3-p/35	2,571	**20,34**	S291	3-p/38	0,000	**38,74**
S215	1a/28	0,000	**-2,63**	S250	3-p/35	1,250	**-19,28**	S291	sp1aRF/59	0,000	**-10,36**
S216	1a-p/54	1,166	**0,89**	S250	sp1aLF/16	0,000	**3,66**	S292	3-p/42	0,000	**-36,67**
S216	1a/28	0,000	**-1,79**	S252	3/48	0,000	**-472,16**	S292	sp1aRF/106	0,000	**7,68**
S217	1a-p/29	1,778	**-1,25**	S252	sp1aRF/57	4,747	**52,69**	S293	sp3LF/83	0,000	**16,89**
S217	1a/28	0,000	**1,98**	S253	3-p/34	4,732	**37,46**	S293	sp3RF-p/61	0,000	**-18,54**
S218	1a-p/29	0,000	**1,11**	S253	3/17	0,000	**67,66**	S294	sp3RF-p/61	0,560	**17,88**
S218	1a/28	1,790	**-2,19**	S254	1a-p/27	2,810	**28,81**	S294	3-p/34	0,000	**-42,97**
S219	1a-p/54	2,305	**2,33**	S254	3/46	0,000	**55,71**	S295	3/32	0,000	**-392,54**
S219	1a/15	0,000	**-2,75**	S255	1a-p/4	0,000	**-5,84**	S295	sp1aRF-p/58	2,942	**-25,46**
S220	1a-p/54	2,305	**2,31**	S255	3/17	1,269	**-10,69**	S296	1a/28	0,000	**2,07**
S220	1a/15	0,000	**-2,73**	S256	3/70	0,000	**69,92**	S296	1a-p/29	1,778	**-1,44**
S221	1a-p/29	0,000	**1,75**	S256	1a-p/1	2,898	**38,22**	S297	1a-p/29	0,000	**1,26**
S221	1a/15	1,614	**-2,15**	S257	1a-p/1	1,616	**-3,32**	S297	1a/28	1,790	**-2,34**
S222	1a-p/29	0,403	**1,74**	S257	sp3RF/99	0,000	**-18,40**	S298	3/52	1,753	**209,61**
S222	1a/15	1,614	**-2,14**	S258	3/55	0,000	**131,73**	S298	3-p/35	0,000	**-203,15**
S223	1a-p/54	1,166	**0,93**	S258	1a-p/27	0,888	**63,61**	S299	sp3RF-p/61	1,753	**65,32**
S223	1a/28	0,000	**-1,89**	S259	sp1aLF/100	0,000	**257,49**	S299	sp3LF/83	1,753	**-27,30**
S224	1a/13	0,000	**151,94**	S259	1a-p/3	0,000	**-207,95**	S300	1a/8	2,265	**123,54**
S224	1a-p/3	2,376	**-131,73**	S260	sp1aLF-p/10	0,879	**0,77**	S300	sp1aLF/11	0,000	**-18,75**
S225	1a-p/3	2,373	**128,21**	S260	3/46	0,000	**11,47**	S301	sp1aLF-p/10	2,227	**-1,18**
S225	1a/13	0,000	**-142,39**	S263	sp3LF/102	0,000	**36,02**	S301	3/46	0,000	**-15,78**
S226	1a/14	0,000	**141,43**	S263	sp3RF-p/101	0,000	**-62,66**	S302	sp1aRF-p/56	0,369	**1,29**
S226	1a-p/6	2,376	**-142,28**	S264	sp3LF/103	0,000	**-31,71**	S302	3/52	0,000	**-60,33**
S227	1a-p/6	2,373	**138,56**	S264	sp3RF-p/47	0,000	**56,31**	S303	sp1aRF/57	0,000	**3,09**
S227	1a/14	0,000	**-132,49**	S265	sp3LF/102	0,000	**35,35**	S303	3-p/34	0,000	**-33,86**
S228	4/93	0,000	**13,61**	S265	sp3RF-p/101	0,000	**-61,45**	S304	sp1aRF-p/56	0,000	**0,85**
S228	sp1aLF-p/92	4,732	**5,05**	S266	sp3RF-p/104	0,000	**60,96**	S304	3/52	0,000	**-24,35**
S229	sp1aLF-p/94	0,000	**-0,95**	S266	sp3LF/33	0,000	**-36,31**	S307	3-p/34	0,000	**57,64**
S229	4/93	1,269	**-2,39**	S267	sp3LF/103	1,147	**32,30**	S307	sp1aRF/57	0,000	**-5,06**
S230	4/96	0,000	**14,21**	S267	sp3RF-p/47	0,000	**-55,93**	S308	3/52	0,365	**34,99**
S230	sp1aLF-p/95	2,898	**5,07**	S268	1a-p/3	0,000	**1,30**	S308	sp1aRF-p/56	0,000	**-1,02**
S231	4/97	0,000	**13,62**	S268	1a/13	1,753	**-1,37**	S309	3-p/35	0,737	**23,17**
S231	sp1aLF-p/7	4,732	**5,05**	S269	1a/13	0,000	**-300,19**	S309	sp1aRF/57	0,000	**-2,27**
S232	1a/36	0,000	**14,18**	S269	sp1aLF-p/105	0,000	**39,03**	S311	sp3RF/87	0,000	**3,37**
S232	sp1aRF-p/74	2,810	**5,60**	S270	sp1aLF-p/49	0,000	**-33,63**	S311	3-p/64	0,000	**-10,00**
S233	sp1aLF-p/7	0,000	**-0,93**	S270	3/52	0,000	**217,19**	S312	3/46	2,391	**26,06**
S233	4/97	1,269	**-2,44**	S273	sp1aLF/31	0,000	**-4,26**	S312	sp1aLF-p/10	0,000	**0,06**
S234	4/98	0,000	**14,33**	S273	3-p/38	0,000	**57,38**	S313	3-p/35	0,000	**44,74**
S234	sp1aLF-p/10	2,898	**5,11**	S274	sp1aLF-p/49	0,000	**-0,66**	S313	sp1aLF/16	0,000	**-2,52**
S235	3/46	0,000	**67,59**	S274	3/52	0,000	**34,81**	S314	sp1aLF/16	0,000	**2,38**
S235	3-p/42	4,732	**37,42**	S275	3-p/35	0,000	**23,23**	S314	3-p/35	0,000	**-44,81**
S236	3/5	0,000	**55,75**	S275	sp1aLF/31	0,000	**-2,33**	S315	3/32	0,000	**67,69**
S236	1a-p/24	2,811	**29,14**	S278	3/52	0,000	**-60,03**	S315	1a-p/4	1,317	**-15,69**
S237	3/46	1,269	**-10,64**	S278	sp1aLF-p/49	1,476	**0,71**	S316	sp3RF/87	3,013	**0,40**
S237	1a-p/27	0,000	**-5,90**	S279	3-p/35	0,000	**-33,93**	S316	1a-p/3	0,000	**-0,40**
S238	1a-p/24	2,898	**38,32**	S279	sp1aLF/31	0,000	**3,20**	S317	3-p/64	1,813	**74,97**
S238	3/32	0,000	**69,90**	S280	3/52	0,000	**-24,55**	S317	sp1aRF/51	0,000	**-10,02**
S239	1a/13	0,000	**160,50**	S280	sp1aLF-p/49	0,000	**1,18**	S318	3-p/38	0,000	**38,99**
S239	1a-p/3	2,376	**-134,22**	S282	3-p/42	0,921	**-9,98**	S318	sp1aRF/59	1,228	**-9,95**
S240	1a-p/3	2,373	**116,97**	S282	sp3LF/43	0,000	**3,35**	S319	sp1aRF/57	0,000	**11,13**
S240	1a/13	0,000	**-163,20**	S283	sp1aLF-p/45	2,391	**0,12**	S319	3-p/35	0,000	**-37,04**
S241	1a/14	0,000	**149,81**	S283	3/32	0,000	**26,00**	S320	3-p/34	0,000	**33,31**
S241	1a-p/6	2,376	**-145,00**	S284	sp1aLF/31	0,000	**2,54**	S320	sp3RF/107	1,915	**-8,73**
S242	1a-p/6	2,373	**127,05**	S284	3-p/35	0,000	**-44,90**	S321	1a-p/6	3,068	**1,44**
S242	1a/14	0,000	**-152,97**	S285	3-p/35	0,695	**44,91**	S321	1a/14	0,000	**-1,44**
S243	1a-p/1	2,366	**116,18**	S285	sp1aLF/31	0,695	**-2,68**	S322	sp3RF/99	0,000	**15,84**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]
S322	sp3LF-p/108	0,000	**-16,39**
S323	sp3LF-p/108	0,000	**16,25**
S323	sp3RF/99	0,000	**-14,57**
S324	3-p/64	1,753	**51,84**
S324	sp3LF-p/108	0,000	**-13,32**
S328	sp1aRF-p/76	1,544	**133,70**
S328	1a/13	0,000	**-264,30**
S330	sp1aRF-p/58	0,000	**1,94**
S330	1a/8	0,864	**-9,65**
S331	sp1aRF/59	0,000	**-9,20**
S331	1a/8	2,231	**20,23**
S332	sp1aRF-p/76	0,000	**-179,19**
S332	1a/13	4,017	**282,86**
S333	1a/2	0,000	**-17,85**
S333	sp1aLF-p/10	2,571	**1,69**
S334	1a/2	0,000	**13,63**
S334	sp1aLF-p/10	1,250	**-1,72**
S335	sp1aRF-p/58	0,000	**-1,51**
S335	3/77	1,252	**10,70**
S336	sp1aLF-p/19	2,076	**-6,73**
S336	3/52	0,000	**-64,31**
S337	sp1aRF/59	2,382	**-48,01**
S337	3-p/38	0,000	**305,69**
S340	3-p/35	1,462	**260,77**
S340	sp1aLF/16	1,462	**-28,50**
S341	sp1aLF/11	0,000	**-286,15**
S341	1a-p/1	2,140	**1288,83**
S342	3/46	0,000	**-1423,31**
S342	sp1aLF-p/10	2,140	**160,14**
S343	3/55	0,000	**20,48**
S343	sp3RF-p/61	0,000	**-0,35**
S345	sp1aLF-p/109	0,000	**-216,66**
S345	1a/13	2,816	**253,44**
S346	sp1aLF-p/109	0,000	**-199,78**
S346	1a/13	2,825	**300,17**
S347	sp1aRF-p/75	0,000	**-222,29**
S347	1a/14	2,816	**244,92**
S349	sp1aRF-p/76	2,816	**222,89**
S349	1a/13	0,000	**-264,57**
S350	1a/13	0,000	**-327,93**
S350	sp1aRF-p/76	2,825	**195,32**
S351	sp1aLF-p/71	2,816	**228,12**
S351	1a/14	0,000	**-255,98**
S352	sp1aLF-p/71	2,825	**199,55**
S352	1a/14	0,000	**-339,36**
S355	sp1aLF/12	0,000	**-285,86**
S355	3-p/34	2,140	**1307,14**
S356	sp1aLF/37	0,000	**-184,80**
S356	3-p/38	2,141	**692,70**
S359	sp1aLF/11	0,000	**-57,76**
S359	3-p/38	2,220	**326,29**
S360	3-p/38	2,135	**329,31**
S360	sp1aLF/11	0,000	**-58,19**
S361	sp1aLF/53	0,000	**-13,64**
S361	3-p/35	0,970	**140,28**
S362	sp1aLF/12	0,000	**-7,58**
S362	3-p/34	1,591	**110,21**
S363	3-p/34	1,611	**79,59**
S363	sp1aLF/12	0,000	**-4,12**
S364	sp1aLF/12	0,000	**-2,51**
S364	3-p/34	1,613	**28,40**
S365	3/32	0,000	**-1395,85**
S365	sp1aLF-p/7	2,140	**172,97**
S366	sp1aLF-p/50	2,141	**56,19**
S366	3/46	0,000	**-843,83**
S367	3/46	0,000	**-870,37**
S367	sp1aLF-p/50	2,119	**66,56**
S368	sp1aLF-p/7	1,571	**30,25**
S368	3/32	0,000	**-702,80**
S369	sp1aLF-p/7	1,761	**50,58**
S369	3/32	0,000	**-662,07**
S370	sp1aLF-p/50	2,220	**32,24**
S370	3/46	0,000	**-349,50**
S371	sp1aLF-p/50	2,135	**32,76**
S371	3/46	0,000	**-356,39**
S372	sp3LF-p/40	0,970	**10,61**
S372	3/5	0,000	**-180,84**
S373	sp3LF-p/124	2,008	**11,81**
S373	3/5	0,000	**-179,92**
S374	3/5	0,000	**-148,78**
S374	sp3LF-p/40	1,591	**14,72**
S375	sp3LF-p/124	1,611	**13,66**
S375	3/5	0,000	**-112,52**
S376	3/5	0,000	**-64,31**
S376	sp3LF-p/124	1,613	**13,41**
S377	1a/14	2,030	**261,35**
S377	sp1aLF-p/71	0,000	**-121,36**
S378	1a/13	2,206	**105,19**
S378	1a-p/3	0,000	**-78,52**
S379	1a-p/6	0,000	**-212,78**
S379	sp1aLF/37	2,030	**152,68**
S380	1a/13	2,205	**97,21**
S380	1a-p/3	0,000	**-97,05**
S381	1a/13	2,030	**275,23**
S381	sp1aRF-p/76	0,000	**-119,07**
S382	1a/2	2,206	**112,68**
S382	1a-p/6	0,000	**-71,34**
S383	sp1aRF/82	2,030	**160,13**
S383	1a-p/3	0,000	**-201,47**
S384	1a-p/6	0,000	**-91,76**
S384	1a/14	2,205	**93,25**
S385	1a-p/4	0,000	**302,95**
S385	sp1aLF/126	0,430	**-64,17**
S386	1a/14	0,000	**260,82**
S386	sp1aLF-p/92	0,000	**-59,17**
S387	1a/14	0,000	**218,68**
S387	sp1aRF-p/75	1,479	**-77,02**
S388	1a/13	0,352	**231,51**
S388	sp1aLF-p/7	0,352	**-56,76**
S389	sp1aLF-p/7	0,000	**-57,95**
S389	1a/13	0,000	**269,25**
S390	1a-p/1	0,000	**307,29**
S390	sp1aLF/11	0,000	**-67,26**
S391	3-p/35	0,000	**258,10**
S391	sp1aLF/16	0,000	**-27,11**
S392	3-p/38	0,000	**221,32**
S392	sp1aLF/37	0,000	**-17,24**
S393	sp1aLF/37	0,000	**-14,24**
S393	3-p/38	0,000	**148,66**
S394	3-p/117	0,000	**81,00**
S394	sp4LF/125	0,000	**-10,52**
S395	3-p/38	0,000	**9,32**
S395	sp4LF/125	0,000	**-11,11**
S396	3-p/35	0,000	**258,10**
S396	sp1aLF/16	0,000	**-27,12**
S397	3-p/35	0,000	**8,85**
S397	sp1aLF/16	2,227	**-1,39**
S398	sp1aLF/37	2,119	**-192,46**
S398	3-p/38	0,000	**708,76**
S399	sp1aLF/31	0,000	**48,80**
S399	3-p/35	0,000	**-198,25**
S400	sp3RF-p/104	0,000	**60,25**
S400	sp3LF/33	0,000	**-34,96**
S401	1a-p/4	2,366	**107,25**
S401	sp1aLF/12	0,000	**-27,94**
S402	3-p/34	1,570	**597,47**
S402	sp1aLF/12	0,000	**-130,65**
S403	sp1aRF-p/75	1,999	**193,00**
S403	1a/14	0,000	**-223,86**
S404	3-p/35	2,367	**456,03**
S404	sp1aRF/57	0,000	**-53,75**
S405	sp1aRF-p/56	0,000	**36,55**
S405	3/48	2,382	**-322,45**
S408	3-p/34	2,119	**691,05**
S408	sp1aRF/51	0,000	**-182,80**
S409	3-p/38	1,571	**581,96**
S409	sp1aLF/11	0,000	**-125,83**
S410	sp1aLF/11	0,000	**-117,60**
S410	3-p/38	1,760	**585,29**
S411	3-p/34	2,221	**315,20**
S411	sp1aRF/51	0,000	**-53,22**
S412	sp1aRF/51	0,000	**-53,93**
S412	3-p/64	2,135	**321,86**
S413	sp1aRF/59	0,000	**-14,12**
S413	3-p/35	0,970	**140,42**
S414	3-p/35	2,008	**141,92**
S414	sp1aLF/16	0,000	**-12,68**
S415	sp1aRF/59	0,000	**-8,00**
S415	3-p/38	1,591	**110,19**
S416	3-p/38	1,611	**78,97**
S416	sp4LF/127	0,000	**-5,46**
S417	sp4LF/127	0,000	**-4,39**
S417	3-p/38	1,613	**27,85**
S418	3/46	0,000	**-1420,05**
S418	sp1aLF-p/10	2,140	**161,78**
S419	3/32	0,000	**-869,02**
S419	sp1aRF-p/58	2,141	**61,83**
S420	3/32	0,000	**-882,81**
S420	sp1aRF-p/58	2,119	**69,34**
S421	sp1aLF-p/10	1,571	**24,91**
S421	3/46	0,000	**-713,37**
S422	sp1aLF-p/10	1,761	**44,96**
S422	3/46	0,000	**-677,93**
S423	sp1aRF-p/58	2,220	**30,36**
S423	3/32	0,000	**-359,99**
S424	sp1aLF-p/7	2,135	**30,93**
S424	3/32	0,000	**-362,77**
S425	sp3RF-p/61	0,970	**11,24**
S425	3/55	0,000	**-180,97**
S426	sp3RF-p/61	2,008	**12,17**
S426	3/55	0,000	**-179,50**
S427	sp3LF-p/128	1,591	**14,89**
S427	3/55	0,000	**-149,25**
S428	sp3LF-p/128	1,611	**14,19**
S428	3/55	0,000	**-114,62**
S429	sp3LF-p/128	1,613	**13,97**
S429	3/55	0,000	**-66,60**
S430	1a/14	0,000	**15,68**
S430	1a-p/6	0,000	**-8,64**
S431	1a-p/1	2,140	**1282,76**
S431	sp1aLF/11	0,000	**-283,40**
S432	3-p/34	2,141	**666,19**
S432	sp1aRF/51	0,000	**-172,51**
S433	sp1aRF-p/75	2,019	**192,58**
S433	1a/14	0,000	**-224,65**
S434	sp1aRF-p/56	0,000	**34,42**
S434	3/46	2,383	**-303,66**
S435	3-p/35	2,380	**472,63**
S435	sp1aRF/57	0,000	**-59,18**
S436	1a/14	0,000	**309,44**
S436	sp1aRF/82	2,825	**-208,34**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]	Staaf	BG	dx [m]	N [kN]
S437	1a/13	0,000	**130,40**	S470	1a-p/4	0,000	**-43,39**	S504	1a-p/1	0,000	**47,35**
S437	sp1aLF-p/105	0,000	**-40,61**	S471	sp1aLF/12	0,000	**-113,44**	S504	1a/36	0,000	**-55,00**
S438	1a/23	0,000	**67,40**	S471	3-p/34	0,000	**512,80**	S505	1a/15	0,000	**-1,50**
S438	1a-p/4	0,000	**-116,00**	S472	sp1aLF/11	0,000	**-114,16**	S505	1a-p/54	1,300	**1,50**
S439	sp1aLF/12	0,000	**55,43**	S472	3-p/38	0,000	**510,37**	S508	3/17	0,000	**44,86**
S439	1a-p/4	0,000	**-164,98**	S473	1a-p/1	0,000	**-43,18**	S508	sp1aLF-p/105	0,000	**-0,34**
S440	sp1aLF/16	0,000	**40,01**	S473	sp1aLF/11	0,000	**10,34**	S509	3-p/64	0,000	**52,17**
S440	1a-p/29	0,000	**-127,90**	S474	sp1aLF-p/10	0,000	**-7,02**	S509	sp1aRF/51	0,000	**-1,96**
S441	sp1aLF/16	0,000	**40,86**	S474	1a/2	0,000	**46,33**	S510	3/55	0,000	**-42,10**
S441	1a-p/29	0,000	**-129,09**	S475	sp3RF-p/47	0,000	**18,78**	S510	sp1aRF-p/114	0,950	**0,89**
S442	sp1aLF/16	0,000	**40,90**	S475	sp3LF/103	0,000	**-19,13**	S511	3/70	0,400	**44,85**
S442	1a-p/29	0,000	**-129,18**	S476	sp3LF/103	0,000	**-19,14**	S511	sp1aLF-p/71	0,000	**-0,33**
S443	sp1aLF/16	0,000	**40,09**	S476	sp3RF-p/47	0,000	**18,85**	S512	1a/15	0,000	**-1,50**
S443	1a-p/29	0,000	**-128,05**	S477	sp3LF-p/120	0,000	**18,71**	S512	1a-p/54	1,300	**1,50**
S444	sp1aLF/11	0,000	**57,89**	S477	sp3RF/21	0,000	**-19,20**	S513	3-p/42	0,000	**52,20**
S444	1a-p/1	0,000	**-170,71**	S478	sp3RF/21	0,000	**-19,02**	S513	sp1aLF/37	0,000	**-1,95**
S445	1a/36	0,000	**71,90**	S478	sp3LF-p/120	0,000	**18,87**	S514	sp1aLF-p/45	0,000	**0,90**
S445	1a-p/1	0,000	**-120,02**	S479	sp1aRF/59	2,382	**-47,11**	S514	3/5	0,000	**-42,07**
S446	1a/36	0,000	**126,28**	S479	3-p/38	0,000	**317,58**	S515	3/52	3,582	**506,66**
S446	sp1aLF-p/71	0,000	**-42,94**	S480	sp1aLF/53	2,382	**-71,98**	S515	sp1aLF-p/19	3,582	**-34,91**
S447	1a-p/3	0,000	**159,39**	S480	3-p/34	0,000	**318,67**	S516	1a-p/24	3,582	**-104,67**
S447	sp1aLF/126	0,000	**-43,58**	S481	sp1aLF-p/45	0,000	**63,08**	S516	1a/13	0,000	**156,62**
S448	4/96	0,000	**14,07**	S481	3/30	2,382	**-321,52**	S517	1a-p/6	0,000	**-108,23**
S448	sp1aLF-p/22	2,810	**5,75**	S482	1a/36	1,726	**11,62**	S517	1a/2	3,582	**156,91**
S449	1a-p/54	0,000	**0,42**	S482	1a-p/1	0,000	**-6,03**	S518	1a-p/27	0,000	**22,17**
S449	1a/15	0,941	**-0,44**	S483	3/55	1,726	**37,98**	S518	1a/2	0,000	**-25,06**
S450	sp1aLF-p/50	0,000	**0,64**	S483	3-p/42	1,726	**-22,77**	S519	1a/36	0,000	**-24,50**
S450	1a/2	0,000	**-2,82**	S484	1a/23	1,726	**10,32**	S519	1a-p/1	0,000	**22,18**
S451	1a/14	2,019	**249,94**	S484	1a-p/4	0,000	**-5,57**	S520	1a-p/4	0,000	**21,76**
S451	sp1aLF-p/71	0,000	**-182,15**	S485	3/5	1,726	**37,07**	S520	1a/23	0,000	**-24,27**
S452	1a/14	1,998	**250,39**	S485	3-p/64	5,177	**-22,95**	S522	1a/36	0,000	**-24,28**
S452	sp1aLF-p/71	0,000	**-181,64**	S486	sp1aLF/16	0,000	**-11,91**	S522	1a-p/1	0,000	**21,77**
S453	1a-p/1	0,000	**7,63**	S486	3-p/35	2,008	**141,22**	S523	1a-p/24	0,000	**23,44**
S453	sp1aLF/37	0,000	**-2,94**	S487	3-p/34	1,761	**602,21**	S523	1a/8	0,000	**-26,33**
S454	sp1aLF-p/109	2,019	**186,00**	S487	sp1aLF/12	0,000	**-122,67**	S524	1a-p/4	0,000	**23,45**
S454	1a/13	0,000	**-249,83**	S488	1a/13	0,000	**285,75**	S524	1a/23	0,000	**-25,77**
S455	sp1aLF/69	1,998	**186,32**	S488	sp1aLF-p/109	0,000	**-161,82**	S525	3-p/35	3,582	**-455,39**
S455	1a/13	0,000	**-248,74**	S489	3/129	0,000	**66,76**	S525	sp1aLF/16	3,582	**81,52**
S456	3/55	2,179	**10,05**	S489	sp1aLF-p/65	0,000	**3,69**	S526	sp1aRF-p/76	0,000	**-12,50**
S456	sp1aLF-p/10	0,000	**-0,86**	S490	3-p/131	0,000	**-18,81**	S526	sp1aLF/100	0,000	**12,62**
S457	1a-p/6	0,000	**231,96**	S490	sp3LF/132	0,000	**63,42**	S527	sp1aLF-p/71	0,000	**-12,53**
S457	sp1aLF/69	1,544	**-153,88**	S491	1a-p/6	0,000	**-219,76**	S527	sp1aRF/106	0,000	**12,61**
S458	1a/2	0,000	**40,97**	S491	sp3RF/99	0,000	**253,79**	S528	sp1aLF/26	0,000	**11,43**
S458	sp1aLF-p/50	2,231	**-13,22**	S492	3/55	0,000	**-384,08**	S528	sp1aRF-p/114	0,000	**-8,25**
S459	sp1aLF/37	0,000	**11,43**	S492	sp1aLF-p/92	1,720	**40,15**	S529	sp1aRF/133	0,000	**11,66**
S459	1a-p/1	2,231	**-21,74**	S493	1a/13	2,195	**-265,71**	S529	sp1aLF-p/45	0,000	**-8,50**
S460	sp1aLF-p/19	0,000	**-6,11**	S493	sp1aRF-p/76	1,837	**75,78**	S530	1a/28	0,000	**2,47**
S460	3/52	2,076	**-83,82**	S494	1a/13	0,000	**64,04**	S530	1a-p/29	0,000	**0,15**
S461	sp1aRF/82	1,503	**4,60**	S494	1a-p/3	0,000	**-122,42**	S531	1a/13	0,000	**18,36**
S461	1a-p/4	0,000	**-8,21**	S495	1a/8	2,498	**223,05**	S531	1a-p/3	0,000	**-18,20**
S462	sp1aRF-p/58	0,000	**-3,23**	S495	1a-p/24	2,855	**-73,04**	S532	1a/14	0,000	**18,36**
S462	1a/8	1,503	**10,83**	S496	1a-p/27	0,000	**-65,19**	S532	1a-p/6	0,000	**-18,20**
S463	sp1aLF/37	1,503	**4,16**	S496	1a/2	1,604	**214,54**	S533	1a/15	0,000	**3,28**
S463	1a-p/1	0,000	**-8,44**	S497	sp1aLF-p/105	0,000	**26,13**	S533	1a-p/54	0,000	**-2,64**
S464	sp1aLF-p/71	0,000	**-2,25**	S497	3/5	0,000	**-200,25**	S534	1a/15	0,000	**12,63**
S464	1a/2	1,503	**10,76**	S498	1a-p/6	0,000	**-127,42**	S534	1a-p/54	0,000	**-12,48**
S465	sp1aLF/37	3,263	**-9,96**	S498	1a/2	1,964	**136,75**	S535	1a/15	0,000	**25,47**
S465	3-p/38	0,000	**77,75**	S499	1a-p/24	0,000	**27,34**	S535	1a-p/54	0,000	**-19,70**
S466	sp1aLF-p/7	0,000	**2,40**	S499	1a/8	0,372	**-66,47**	S536	1a/28	0,000	**24,12**
S466	3/32	0,000	**-77,71**	S500	1a/13	0,389	**94,05**	S536	1a-p/29	0,000	**-19,53**
S467	sp1aLF-p/10	0,000	**63,79**	S500	1a-p/4	1,555	**-109,47**	S537	1a/28	0,000	**25,64**
S467	3/46	0,000	**-556,93**	S501	1a-p/27	0,000	**24,14**	S537	1a-p/29	0,000	**-21,84**
S468	3/32	0,000	**-555,81**	S501	1a/2	2,232	**-63,29**	S538	1a/15	0,000	**27,78**
S468	sp1aLF-p/7	0,000	**69,43**	S502	1a-p/4	0,000	**44,21**	S538	1a-p/54	0,000	**-21,22**
S469	1a/8	0,000	**46,41**	S502	sp3LF/88	0,000	**-50,21**	S539	1a-p/3	0,000	**-30,49**
S469	sp1aLF-p/7	0,000	**-6,77**	S503	1a/13	0,000	**148,80**	S539	1a/13	0,000	**35,90**
S470	sp1aLF/12	0,000	**11,00**	S503	1a-p/24	0,000	**-69,38**	S540	1a/14	0,000	**35,51**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 74N
Omschrijving	- ontwerpberekening
Nationale norm	EC - EN
Auteur	- AD

Staaf	BG	dx [m]	N [kN]
S540	1a-p/6	0,373	**-30,91**
S541	1a-p/1	0,000	**6,80**
S541	1a/36	0,000	**-11,55**
S542	1a-p/27	0,000	**7,19**
S542	1a/2	0,000	**-11,94**
S543	1a-p/3	0,000	**7,86**
S543	1a/13	0,000	**-11,34**
S544	1a/14	0,000	**-11,35**
S544	1a-p/6	0,000	**7,87**
S545	1a/23	0,000	**-11,44**
S545	1a-p/4	0,000	**6,70**
S546	1a-p/24	0,000	**7,09**
S546	1a/8	0,000	**-11,84**
S547	3/5	0,000	**-394,89**
S547	sp1aLF-p/7	0,000	**0,93**
S548	3/32	0,000	**38,13**
S548	sp1aLF-p/49	0,799	**-0,38**
S549	sp1aLF-p/49	0,000	**0,86**
S549	3/52	0,000	**-36,33**
S550	3-p/38	0,000	**62,06**
S550	sp1aLF/31	0,000	**-3,13**
S551	3/46	0,000	**37,95**
S551	sp1aRF-p/114	0,799	**0,02**
S552	sp1aRF-p/56	0,931	**1,78**
S552	3/52	0,000	**-36,84**
S553	3-p/34	0,000	**62,24**
S553	sp1aRF/57	0,000	**-3,68**
S554	1a-p/1	0,000	**0,69**
S554	sp1aLF/11	0,000	**-0,73**
S555	3-p/122	0,000	**0,73**
S555	sp1aLF/12	0,000	**-0,73**
S556	sp1aLF-p/7	0,000	**-0,26**
S556	1a/8	0,000	**-1,69**
S557	sp1aLF-p/10	0,000	**-0,26**
S557	3/39	0,000	**-1,72**
S558	sp3RF-p/47	0,000	**0,46**
S558	sp3LF/103	0,000	**-1,30**
S559	3-p/116	0,000	**2,38**
S559	sp1aLF/16	0,000	**-0,74**
S560	sp3RF-p/61	0,000	**0,33**
S560	sp3LF/83	0,000	**-1,30**
S561	sp1aLF-p/7	0,000	**-0,15**
S561	3/52	0,000	**-3,30**
S562	sp1aLF-p/10	0,000	**1,09**
S562	3/39	0,000	**-8,53**
S563	sp1aLF-p/7	0,000	**1,30**
S563	1a/8	0,000	**-5,57**
S564	1a/2	0,000	**8,52**
S564	sp1aLF-p/10	0,000	**-1,30**
S565	1a-p/1	0,000	**5,26**
S565	sp1aLF/11	0,000	**-1,32**
S566	sp1aLF/12	0,000	**0,22**
S566	3/46	5,577	**-1,87**
S567	1a/2	0,000	**1,54**
S567	sp1aLF/12	4,503	**-0,32**
S568	sp1aLF-p/10	0,000	**1,18**
S568	3/46	3,613	**-14,58**
S569	sp1aLF/37	0,000	**0,35**
S569	1a/8	5,577	**-0,86**
S570	1a/8	0,000	**0,81**
S570	sp1aLF/37	4,503	**-0,42**
S571	sp1aLF-p/45	0,000	**3,90**
S571	sp1aRF/133	3,613	**-4,75**
S572	3/48	0,000	**1,65**
S572	sp1aLF/16	5,577	**-0,38**
S573	sp1aLF/12	0,000	**0,37**
S573	1a/2	4,503	**-1,41**
S574	3-p/35	0,000	**13,12**
S574	sp1aLF/16	3,613	**-2,27**
S575	1a/8	0,000	**0,73**
S575	sp1aRF/59	5,577	**-0,54**
S576	sp1aRF/59	0,000	**0,48**
S576	1a/8	4,503	**-0,78**
S577	sp1aLF-p/115	0,000	**3,77**
S577	sp1aRF/59	3,613	**-5,50**
S578	3-p/38	0,000	**66,46**
S578	sp1aLF/37	0,000	**-2,50**
S579	sp1aLF/37	0,280	**1,59**
S579	3-p/38	0,000	**-42,24**
S580	3-p/35	0,000	**82,90**
S580	sp1aRF/57	0,541	**-6,32**
S581	sp1aRF/59	0,000	**9,51**
S581	1a-p/1	0,000	**-55,06**
S582	3-p/35	0,000	**83,21**
S582	sp1aLF/31	0,541	**-6,32**
S583	sp1aLF/53	0,000	**9,67**
S583	1a-p/4	0,000	**-54,00**
S584	3/39	0,000	**81,83**
S584	sp1aLF-p/19	0,000	**-1,77**
S585	sp1aLF-p/19	0,000	**1,03**
S585	3/39	0,000	**-49,50**
S586	3/30	0,000	**81,69**
S586	sp1aLF-p/49	0,659	**-1,56**
S587	sp1aLF-p/49	0,802	**0,89**
S587	3/32	0,000	**-49,37**
SB1	3-p/116	0,000	**13,37**
SB1	sp1aLF/16	0,000	**-1,47**
SB2	sp3RF-p/111	0,000	**3,86**
SB2	sp3LF/110	0,000	**-4,31**
SB3	sp1aLF/11	2,712	**5,93**
SB3	3-p/117	0,000	**-29,91**
SB4	sp1aLF/37	2,712	**7,39**
SB4	1a-p/1	0,000	**-6,65**
SB5	sp3RF/112	0,000	**-4,59**
SB5	sp3LF-p/113	0,000	**3,45**
SB6	3-p/116	0,000	**14,24**
SB6	sp1aLF/12	0,000	**-1,60**
SB7	1a-p/4	0,000	**-18,79**
SB7	sp1aLF/12	2,712	**5,87**
SB8	3-p/122	0,000	**-22,39**
SB8	sp1aLF/12	2,712	**5,00**
SB9	sp1aLF-p/19	0,000	**0,95**
SB9	3/52	0,000	**-13,97**
SB10	sp3RF-p/119	0,000	**3,97**
SB10	sp3LF/20	0,000	**-4,67**
SB11	sp1aLF-p/7	0,000	**-3,15**
SB11	3/30	2,712	**32,19**
SB12	1a/8	2,712	**11,58**
SB12	sp1aRF-p/58	0,000	**-3,39**
SB13	sp3LF-p/120	0,000	**4,27**
SB13	sp3RF/21	0,000	**-4,29**
SB14	sp1aLF-p/19	0,000	**1,01**
SB14	3/52	0,000	**-14,80**
SB15	sp1aLF-p/10	0,000	**-3,72**
SB15	1a/2	2,712	**22,09**
SB16	sp1aLF-p/19	0,000	**-0,59**
SB16	3/48	2,712	**26,29**
SB17	1a-p/1	0,000	**3,50**
SB17	sp1aLF/11	0,000	**-2,21**
SB18	1a/2	0,000	**-2,21**
SB18	sp1aRF-p/114	0,000	**-1,11**
SB19	1a/8	3,003	**4,87**
SB19	sp1aLF-p/45	0,000	**1,66**
SB20	3/52	3,003	**5,96**
SB20	sp1aLF-p/19	0,000	**2,15**
SB21	1a-p/4	0,000	**3,57**
SB21	sp1aLF/12	0,000	**-2,22**
SB22	sp1aLF/11	0,000	**-1,86**
SB22	3-p/117	0,000	**0,02**
SB23	sp1aLF-p/10	0,000	**1,91**
SB23	3/46	3,003	**6,92**
SB24	sp1aLF/26	3,003	**4,15**
SB24	sp1aRF-p/114	0,000	**1,85**
SB25	sp1aLF-p/7	0,000	**-0,25**
SB25	1a/8	0,000	**-6,01**
SB26	1a-p/4	0,000	**-0,88**
SB26	sp1aLF/53	0,000	**-2,08**
SB27	sp1aRF/59	3,003	**4,20**
SB27	1a-p/1	0,000	**0,90**
SB28	3-p/35	0,000	**0,07**
SB28	sp1aLF/16	3,003	**3,87**
SB29	1a/2	0,000	**-6,08**
SB29	sp1aLF-p/10	0,000	**-0,31**
SB30	sp1aLF-p/7	0,000	**-1,20**
SB30	3/32	0,000	**-3,14**
SB31	3-p/35	0,000	**-0,94**
SB31	sp1aLF/12	3,003	**3,96**
SB32	sp1aLF/100	3,003	**4,16**
SB32	1a-p/4	0,000	**1,74**
SB33	sp1aRF/60	0,000	**-3,40**
SB33	sp1aLF-p/50	0,000	**-1,52**
SB34	sp1aLF/53	0,000	**-3,02**
SB34	1a-p/29	0,000	**-0,87**
SB35	sp1aLF/11	3,533	**4,62**
SB35	1a-p/1	0,000	**0,62**
SB36	sp1aLF/16	3,533	**4,53**
SB36	1a-p/29	0,000	**1,23**
SB37	sp1aLF-p/115	0,000	**-1,38**
SB37	sp1aRF/59	0,000	**-3,23**
SB38	sp1aLF/100	0,000	**-3,30**
SB38	sp1aRF-p/76	0,000	**-1,40**
SB39	3-p/122	0,000	**0,05**
SB39	sp1aLF/12	3,533	**4,50**
SB40	1a-p/3	0,000	**1,80**
SB40	sp1aLF/100	3,533	**4,72**
SB41	sp3RF/107	0,000	**-3,28**
SB41	sp3LF-p/118	0,000	**-1,54**
SB42	1a/15	0,000	**-3,77**
SB42	sp1aRF-p/56	0,000	**-1,73**
SB43	1a/8	3,533	**6,41**
SB43	sp1aLF-p/7	0,000	**2,49**
SB44	sp1aLF-p/19	0,000	**2,60**
SB44	1a/15	3,533	**5,86**
SB45	sp1aLF-p/45	0,000	**-1,47**
SB45	sp3RF/121	0,000	**-3,23**
SB46	sp1aRF-p/75	0,000	**-1,68**
SB46	sp3LF/110	0,000	**-3,45**
SB47	3/39	3,533	**6,82**
SB47	sp1aLF-p/10	0,000	**2,33**
SB48	1a/14	3,533	**5,43**
SB48	sp1aRF-p/75	0,000	**2,73**
SB49	sp1aLF/11	0,000	**-14,56**
SB49	1a-p/1	0,000	**4,35**
SB50	sp1aLF/11	2,621	**9,18**
SB50	1a-p/1	0,000	**-5,78**
SB51	1a-p/4	0,000	**4,20**
SB51	sp1aLF/12	0,000	**-14,50**
SB52	sp1aLF/12	2,621	**8,98**
SB52	1a-p/4	0,000	**-5,67**
SB53	1a-p/29	0,000	**7,65**
SB53	sp1aLF/16	0,000	**-12,03**

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Staaf	BG	dx [m]	N [kN]
SB54	sp1aLF/16	2,621	**7,35**
SB54	1a-p/29	0,000	**-8,74**
SB55	sp1aLF-p/7	0,000	**2,58**
SB55	1a/8	0,000	**-15,30**
SB56	1a-p/1	2,621	**11,81**
SB56	sp1aLF/11	0,000	**-3,60**
SB57	sp1aLF-p/7	0,000	**-6,06**
SB57	1a/8	0,000	**-23,84**
SB58	1a/8	2,621	**16,82**
SB58	sp1aLF-p/7	0,000	**2,68**
SB59	sp1aLF-p/10	0,000	**-6,16**
SB59	1a/2	0,000	**-23,69**
SB60	1a/2	2,621	**16,48**
SB60	sp1aLF-p/10	0,000	**2,68**
SB61	sp1aLF-p/10	0,000	**2,60**
SB61	1a/2	0,000	**-15,23**
SB62	1a-p/4	2,621	**11,99**
SB62	sp1aLF/12	0,000	**-3,51**
SB63	1a-p/29	0,000	**7,60**
SB63	sp1aLF/16	0,000	**-12,01**
SB64	sp1aLF/16	2,621	**7,19**
SB64	1a-p/29	0,000	**-8,67**
SB65	3/52	0,000	**29,18**
SB65	sp1aRF-p/56	0,000	**3,86**
SB66	sp3RF/99	0,000	**21,58**
SB66	sp3LF-p/108	0,000	**-0,58**
SB67	sp3LF/83	0,000	**8,51**
SB67	sp3RF-p/61	0,000	**-10,88**
SB68	sp1aRF/57	0,000	**16,51**
SB68	3-p/38	0,000	**-8,86**
SB69	sp1aLF/31	0,000	**17,61**
SB69	3-p/34	0,000	**-8,93**
SB70	sp3RF/87	0,000	**8,39**
SB70	sp3LF-p/40	0,000	**-10,67**
SB71	sp3LF/103	0,000	**21,38**
SB71	sp3RF-p/47	0,000	**-0,35**
SB72	3/52	0,000	**29,33**
SB72	sp1aLF-p/49	0,000	**2,77**
SB73	sp1aRF-p/56	2,356	**-2,23**
SB73	3/52	0,000	**-21,17**
SB74	sp3LF-p/108	2,356	**0,91**
SB74	sp3RF/99	0,000	**-15,18**
SB75	sp3RF-p/61	2,356	**8,64**
SB75	sp1aLF/37	0,000	**-5,43**
SB76	3-p/38	2,356	**8,43**
SB76	sp1aRF/57	0,000	**-10,85**
SB77	3-p/34	2,356	**8,20**
SB77	sp1aLF/31	0,000	**-11,70**
SB78	sp3LF-p/40	2,356	**8,54**
SB78	sp3RF/87	0,000	**-5,27**
SB79	sp3RF-p/47	2,356	**0,73**
SB79	sp3LF/103	0,000	**-14,86**
SB80	sp1aLF-p/49	2,356	**-1,40**
SB80	3/52	0,000	**-21,57**
SB81	sp1aLF-p/10	2,360	**1,99**
SB81	1a/2	0,000	**-19,86**
SB82	3/46	0,000	**26,60**
SB82	sp1aLF-p/10	0,000	**-2,89**
SB83	sp1aLF-p/10	2,360	**1,52**
SB83	1a/2	0,000	**-15,13**
SB84	1a/2	0,000	**18,35**
SB84	sp1aLF-p/10	0,000	**-2,54**
SB85	1a-p/1	2,360	**13,19**
SB85	sp1aLF/11	0,000	**-4,13**
SB86	sp1aLF/11	0,000	**4,72**
SB86	1a-p/1	0,000	**-16,54**
SB87	1a-p/1	2,360	**17,43**
SB87	sp1aLF/11	0,000	**-4,35**
SB88	sp1aLF/11	0,000	**4,87**
SB88	1a-p/1	0,000	**-24,43**
SB89	1a-p/4	2,360	**17,35**
SB89	sp1aLF/12	0,000	**-4,11**
SB90	sp1aLF/12	0,000	**4,79**
SB90	3-p/34	0,000	**-24,19**
SB91	1a-p/4	2,360	**12,75**
SB91	sp1aLF/12	0,000	**-4,29**
SB92	sp1aLF/12	0,000	**4,67**
SB92	1a-p/4	0,000	**-16,73**
SB93	sp1aLF-p/7	2,360	**1,80**
SB93	1a/8	0,000	**-15,41**
SB94	1a/8	0,000	**18,51**
SB94	sp1aLF-p/7	0,000	**-2,61**
SB95	sp1aLF-p/7	2,360	**1,83**
SB95	1a/8	0,000	**-20,11**
SB96	3/32	0,000	**26,66**
SB96	sp1aLF-p/7	0,000	**-2,97**
SB97	3/52	0,000	**27,28**
SB97	sp1aLF-p/19	0,000	**-2,45**
SB98	sp1aLF-p/71	0,000	**-5,53**
SB98	1a/14	0,000	**9,54**
SB99	sp1aLF/37	0,000	**6,70**
SB99	1a-p/6	0,000	**-7,92**
SB100	sp1aLF/16	0,000	**3,84**
SB100	3-p/35	0,000	**-25,71**
SB101	sp1aLF/16	0,000	**3,98**
SB101	3-p/35	0,000	**-25,71**
SB102	sp1aRF/82	0,000	**6,71**
SB102	1a-p/3	0,000	**-7,71**
SB103	1a/13	0,000	**9,81**
SB103	sp1aRF-p/76	0,000	**-5,29**
SB104	3/52	0,000	**27,38**
SB104	sp1aLF-p/19	0,000	**-2,60**
SB105	sp1aLF-p/19	2,231	**2,41**
SB105	3/52	0,000	**-21,48**
SB106	sp1aLF-p/71	2,231	**4,52**
SB106	1a/2	0,000	**-8,39**
SB107	1a-p/6	2,231	**7,55**
SB107	sp1aLF/37	0,000	**-4,72**
SB108	3-p/35	2,231	**21,24**
SB108	sp1aLF/16	0,000	**-2,72**
SB109	3/48	2,231	**21,15**
SB109	sp1aLF/16	0,000	**-2,69**
SB110	1a-p/4	2,231	**7,64**
SB110	sp1aRF/82	0,000	**-4,74**
SB111	sp1aRF-p/76	2,231	**4,41**
SB111	1a/13	0,000	**-8,14**
SB112	sp1aLF-p/49	2,231	**2,46**
SB112	3/52	0,000	**-21,90**
SB113	sp1aLF-p/10	2,190	**1,76**
SB113	3/46	0,000	**-19,68**
SB114	3/46	0,000	**23,21**
SB114	sp1aLF-p/10	0,000	**-2,23**
SB115	sp1aLF-p/10	2,190	**1,89**
SB115	1a/2	0,000	**-16,94**
SB116	1a/2	0,000	**19,23**
SB116	sp1aLF-p/10	0,000	**-2,69**
SB117	1a-p/1	2,190	**14,93**
SB117	sp1aLF/11	0,000	**-4,69**
SB118	sp1aLF/11	0,000	**5,12**
SB118	1a-p/1	0,000	**-17,08**
SB119	3-p/38	2,190	**16,90**
SB119	sp1aLF/11	0,000	**-3,99**
SB120	sp1aLF/11	0,000	**4,03**
SB120	3-p/38	0,000	**-21,14**
SB121	3-p/34	2,190	**17,08**
SB121	sp1aLF/12	0,000	**-3,91**
SB122	sp1aLF/12	0,000	**3,95**
SB122	3-p/34	0,000	**-20,91**
SB123	1a-p/4	2,190	**14,61**
SB123	sp1aLF/53	0,000	**-5,10**
SB124	sp1aLF/53	0,000	**5,84**
SB124	1a-p/4	0,000	**-17,41**
SB125	sp1aLF-p/45	2,190	**2,45**
SB125	1a/8	0,000	**-17,40**
SB126	1a/8	0,000	**19,28**
SB126	sp1aLF-p/45	0,000	**-3,55**
SB127	sp1aLF-p/7	2,190	**1,66**
SB127	3/32	0,000	**-19,59**
SB128	3/32	0,000	**23,33**
SB128	sp1aLF-p/7	0,000	**-2,29**
SB129	3/52	0,000	**23,19**
SB129	sp1aLF-p/49	0,000	**-5,23**
SB130	sp1aLF-p/49	2,050	**5,25**
SB130	3/52	0,000	**-20,14**
SB131	3/52	0,000	**23,00**
SB131	sp1aRF-p/56	0,000	**-4,02**
SB132	sp1aRF-p/56	2,050	**4,23**
SB132	3/52	0,000	**-19,74**
SB133	sp3RF/99	0,000	**9,07**
SB133	sp1aLF-p/71	0,000	**-6,03**
SB134	sp1aLF-p/71	2,049	**5,34**
SB134	sp3RF/99	0,000	**-7,38**
SB135	sp3LF/83	0,000	**7,86**
SB135	sp3RF-p/61	0,000	**-6,76**
SB136	sp3RF-p/61	2,050	**6,29**
SB136	sp3LF/83	0,000	**-5,92**
SB137	sp1aRF/57	1,250	**5,84**
SB137	3-p/35	0,000	**-21,03**
SB138	3-p/35	2,050	**19,05**
SB138	sp1aRF/57	0,000	**-4,97**
SB139	sp1aLF/31	1,250	**6,96**
SB139	3-p/35	0,000	**-20,99**
SB140	3-p/35	2,050	**18,99**
SB140	sp1aLF/31	0,000	**-5,80**
SB141	sp3RF/87	0,000	**7,94**
SB141	sp3LF-p/40	0,000	**-6,83**
SB142	sp3LF-p/40	2,050	**6,29**
SB142	sp1aRF/82	0,000	**-6,13**
SB143	sp3LF/103	0,000	**9,28**
SB143	sp1aRF-p/76	0,000	**-6,04**
SB144	sp1aRF-p/76	2,050	**5,43**
SB144	sp3LF/103	0,000	**-7,41**

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/7	**-82,09**	**-82,65**	**-332,14**	0,00	0,00	0,00
Sn1/N1	1a/8	**685,47**	**474,20**	**2517,89**	0,00	0,00	0,00
Sn1/N1	1a/9	450,81	245,26	1586,91	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/2	**-683,26**	**471,00**	**2505,41**	0,00	0,00	0,00
Sn2/N3	sp1aLF-p/10	**82,16**	**-80,26**	**-326,37**	0,00	0,00	0,00
Sn2/N3	1a/9	-450,81	245,08	1586,93	**0,00**	**0,00**	**0,00**
Sn3/N7	sp1aLF/11	**-160,24**	**-173,46**	**657,86**	0,00	0,00	0,00
Sn3/N7	1a-p/1	**587,41**	**400,62**	**-2183,73**	0,00	0,00	0,00
Sn3/N7	1a/9	353,29	148,22	-1210,08	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/4	**-582,41**	**400,01**	**-2170,85**	0,00	0,00	0,00
Sn4/N6	sp1aLF/12	**158,92**	**-172,38**	**651,92**	0,00	0,00	0,00
Sn4/N6	1a/9	-353,29	148,03	-1210,06	**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/7	Sn1/N1	Rx	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Rx	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
sp1aLF-p/7	Sn1/N1	Ry	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Ry	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
sp1aLF-p/7	Sn1/N1	Rz	116,49	351,98	0,20	-2,85	-82,09	-82,65	-332,14
1a/8	Sn1/N1	Rz	833,50	2652,26	169,67	3,02	685,47	474,20	2517,89
1a/2	Sn2/N3	Rx	683,58	955,10	-136,74	0,98	-683,26	20,75	667,04
sp1aLF-p/10	Sn2/N3	Rx	283,44	1145,38	118,15	3,92	82,16	271,27	1109,76
sp1aLF-p/22	Sn2/N3	Ry	261,04	417,92	-117,09	-1,25	-248,39	-80,26	-326,37
1a/23	Sn2/N3	Ry	518,17	2558,43	159,64	4,84	-216,02	471,00	2505,41
sp1aLF-p/22	Sn2/N3	Rz	261,04	417,92	-117,09	-1,25	-248,39	-80,26	-326,37
1a/23	Sn2/N3	Rz	518,17	2558,43	159,64	4,84	-216,02	471,00	2505,41
sp1aLF/11	Sn3/N7	Rx	236,15	824,17	-177,73	-3,34	-160,24	-173,46	-789,62
1a-p/1	Sn3/N7	Rx	711,02	781,17	-10,71	-0,46	587,41	400,62	-323,54
sp1aLF/11	Sn3/N7	Ry	236,15	824,17	-177,73	-3,34	-160,24	-173,46	-789,62
1a-p/1	Sn3/N7	Ry	711,02	781,17	-10,71	-0,46	587,41	400,62	-323,54
1a-p/24	Sn3/N7	Rz	162,34	2189,76	-74,49	-13,45	141,30	-79,92	-2183,73
sp1aLF/25	Sn3/N7	Rz	250,95	704,10	5,59	2,62	159,31	193,90	657,86
1a-p/4	Sn4/N6	Rx	587,62	2248,97	52,63	-3,69	-582,41	-78,01	-2170,85
sp1aLF/12	Sn4/N6	Rx	185,10	677,69	-104,16	3,52	158,92	94,90	651,92
sp1aLF/26	Sn4/N6	Ry	311,37	848,23	78,62	-2,53	-259,30	-172,38	-789,02
1a-p/27	Sn4/N6	Ry	425,09	541,20	-25,22	-0,79	-143,85	400,01	-334,96
1a-p/4	Sn4/N6	Rz	587,62	2248,97	52,63	-3,69	-582,41	-78,01	-2170,85
sp1aLF/12	Sn4/N6	Rz	185,10	677,69	-104,16	3,52	158,92	94,90	651,92

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

Staaf S525	**UNP280**	**S 355**	**3/48**	**0.73**

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	355.0	MPa
treksterkte fu	490.0	MPa

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Gegevens materiaal		
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 22.00 op positie 0.000 m

verhouding		
maximale verhouding	1	26.85
maximale verhouding	2	30.92
maximale verhouding	3	39.39

==> Profiel klasse 1

Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.67 op positie 0.000 m

verhouding		
maximale verhouding	1	7.32
maximale verhouding	2	8.14
maximale verhouding	3	11.50

==> Profiel klasse 1

Kritische controle op positie 0.000 m

Interne krachten		
NEd	-449.49	kN
Vy,Ed	0.15	kN
Vz,Ed	3.05	kN
TEd	0.00	kNm
My,Ed	-13.85	kNm
Mz,Ed	-0.35	kNm

Controle druk

Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	1892.15	kN
Eenheidscontrole	0.24	-

Controle afschuiving (Vy)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	507.27	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	585.16	kN
Eenheidscontrole	0.01	-

Controle buigend moment (My)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	188.86	kNm
Eenheidscontrole	0.07	-

Controle buigend moment (Mz)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	39.35	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving

Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	84.3	MPa
sigma Myy	30.9	MPa
sigma Mzz	2.2	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.0	MPa

rho 0.00 plaats 1
Eenheidscontrole 0.33 -

Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	2.802	m
Kritische Euler belastingen Ncr	3727.91	1053.47	kN
Slankheid	54.44	102.40	
Relatieve slankheid Lambda	0.71	1.34	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.72	0.37	
Knikweerstand Nb,Rd	1356.63	704.41	kN

Tabel van waarden		
A	5.3300e-03	m^2
Knikweerstand Nb,Rd	704.41	kN
Eenheidscontrole	0.64	-

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	1831.85	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	1003.83	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	149.11	kNm
Relatieve slankheid Lambda,LT	1.03	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	3.582	m
k	1.00	
kw	1.00	
C1	1.44	
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	0.670	
kyz	0.553	
kzy	0.935	
kzz	0.553	
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	-13.85	kNm
Mz,Ed	-0.35	kNm
Interactie Methode 2		
Psi y	0.992	
Psi z	-0.580	
Cmy	0.587	
Cmz	0.400	
CmLT	0.739	

Eenheidscontrole (6.61) = 0.33 + 0.06 + 0.01 = 0.40
Eenheidscontrole (6.62) = 0.64 + 0.08 + 0.01 = 0.73

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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S541	HEA280	S 355	1a/14	0.08

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	355.0	MPa
treksterkte fu	490.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 24.50 op positie 0.000 m

verhouding		
maximale verhouding	1	26.85
maximale verhouding	2	30.92
maximale verhouding	3	34.17

==> Profiel klasse 1

Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 8.62 op positie 0.000 m

verhouding		
maximale verhouding	1	7.32
maximale verhouding	2	8.14
maximale verhouding	3	11.39

==> Profiel klasse 3

Kritische controle op positie 3.582 m

Interne krachten		
NEd	-9.02	kN
Vy,Ed	-0.21	kN
Vz,Ed	5.60	kN
TEd	0.00	kNm
My,Ed	26.97	kNm
Mz,Ed	-0.76	kNm

Controle druk
Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 3.

Tabel van waarden		
Nc.Rd	3454.15	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	1594.17	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	651.36	kN
Eenheidscontrole	0.01	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 3.

Tabel van waarden		
Mc,Rd	358.55	kNm
Eenheidscontrole	0.08	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 3.

Tabel van waarden		
Mc,Rd	120.70	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	0.9	MPa
sigma Myy	26.6	MPa
sigma Mzz	2.2	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.0	MPa

rho 0.00 plaats 13
Eenheidscontrole 0.08 -
Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	7695.46	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	1909.04	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	0.400	
kzy	0.721	
kzz	0.400	
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	26.97	kNm
Mz,Ed	-0.76	kNm
Interactie Methode 2		
Psi y	1.000	
Psi z	0.000	
Cmy	0.900	
Cmz	0.400	

Tabel van waarden		
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S195	UNP140	S 355	3/5	0.51

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	355.0	MPa
treksterkte fu	490.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 14.29 op positie 0.000 m

verhouding		
maximale verhouding	1	26.85
maximale verhouding	2	30.92
maximale verhouding	3	39.65

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.30 op positie 0.000 m

verhouding		
maximale verhouding	1	7.32
maximale verhouding	2	8.14
maximale verhouding	3	11.66

==> Profiel klasse 1
Kritische controle op positie 0.000 m

Interne krachten		
NEd	-171.57	kN
Vy,Ed	0.06	kN
Vz,Ed	1.52	kN
TEd	-0.01	kNm
My,Ed	-3.20	kNm
Mz,Ed	-0.14	kNm

Controle druk
Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	724.20	kN
Eenheidscontrole	0.24	-

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

Tabel van waarden		
tau t,Rd	205.9	MPa
tau t, Ed	2.3	MPa
Eenheidscontrole	0.01	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	210.17	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	206.09	kN
Eenheidscontrole	0.01	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	36.49	kNm
Eenheidscontrole	0.09	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	10.05	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	84.1	MPa
sigma Myy	37.0	MPa
sigma Mzz	4.0	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	-1.6	MPa

rho 0.00 plaats 1
Eenheidscontrole 0.35 -

Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	2058.63	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	571.72	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.	
Wy	8.6400e-05	m^3
Elastisch critisch moment Mcr	81.12	kNm
Relatieve slankheid Lambda,LT	0.61	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S505	UNP140	S 235	1a/14	0.65

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 14.29 op positie 0.000 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00

verhouding		
maximale verhouding	3	43.80

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.30 op positie 0.000 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	21.41

==> Profiel klasse 1
Kritische controle op positie 0.000 m

Interne krachten		
NEd	0.00	kN
Vy,Ed	1.50	kN
Vz,Ed	1.49	kN
TEd	0.00	kNm
My,Ed	-1.75	kNm
Mz,Ed	-1.95	kNm

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	139.75	kN
Eenheidscontrole	0.01	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	137.03	kN
Eenheidscontrole	0.01	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	24.16	kNm
Eenheidscontrole	0.07	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	6.65	kNm
Eenheidscontrole	0.29	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1: 6.2.9.2.& 6.2.10 en formule (6.42)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	0.0	MPa
sigma Myy	-20.3	MPa
sigma Mzz	-131.3	MPa

rho 0.00 plaats 15
Eenheidscontrole 0.65 -
Staaf voldoet aan spanningscontrole !

...::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	74.38	kNm
Relatieve slankheid Lambda,LT	0.52	
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
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S547	UNP200	S 235	1a/13	0.85

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 18.12 op positie 0.000 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00
maximale verhouding	3	49.70

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.78 op positie 0.000 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	13.94

==> Profiel klasse 1

Kritische controle op positie 0.000 m

Interne krachten		
NEd	-379.49	kN
Vy,Ed	-0.34	kN
Vz,Ed	4.95	kN

Interne krachten		
TEd	0.00	kNm
My,Ed	-6.94	kNm
Mz,Ed	0.39	kNm

Controle druk
Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	756.70	kN
Eenheidscontrole	0.50	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	202.84	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	234.04	kN
Eenheidscontrole	0.02	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.13	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.03	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	117.9	MPa
sigma Myy	36.3	MPa
sigma Mzz	14.6	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	-0.3	MPa

rho	0.00	plaats	3
Eenheidscontrole		0.72	-

Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	17070.46	2862.51	kN
Slankheid	19.77	48.29	
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

Tabel van waarden		
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	133.33	kNm
Relatieve slankheid Lambda,LT	0.58	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S442	UNP140	S 355	1a-p/29	0.47

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	355.0	MPa
treksterkte fu	490.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 14.29 op positie 0.000 m

verhouding		
maximale verhouding	1	26.85
maximale verhouding	2	30.92
maximale verhouding	3	37.74

==> Profiel klasse 1

Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.30 op positie 0.000 m

verhouding		
maximale verhouding	1	7.32
maximale verhouding	2	8.14
maximale verhouding	3	11.21

==> Profiel klasse 1

Kritische controle op positie 0.000 m

Interne krachten		
NEd	-129.18	kN
Vy,Ed	-0.09	kN
Vz,Ed	1.03	kN
TEd	0.00	kNm
My,Ed	-1.26	kNm
Mz,Ed	0.01	kNm

Controle druk

Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	724.20	kN
Eenheidscontrole	0.18	-

Controle afschuiving (Vy)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	211.11	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	207.01	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	36.49	kNm
Eenheidscontrole	0.03	-

Controle buigend moment (Mz)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	10.05	kNm
Eenheidscontrole	0.00	-

Gecombineerde controle buiging, normaalkrachten afschuiving

Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	63.3	MPa
sigma Myy	14.6	MPa
sigma Mzz	0.6	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.0	MPa

rho 0.00 plaats 3
Eenheidscontrole 0.22 -
Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	526.59	kN
Slankheid	44.86	89.61	
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	323.71	kN

Tabel van waarden		
A	2.0400e-03	m^2
Knikweerstand Nb,Rd	323.71	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	
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	39.65	kNm
Relatieve slankheid Lambda,LT	0.88	
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	

Tabel van waarden		
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S188	UNP140	S 235	1a/8	0.07

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Kritische controle op positie 1.081 m

Interne krachten		
NEd	28.27	kN
Vy,Ed	0.00	kN
Vz,Ed	0.00	kN
TEd	0.00	kNm
My,Ed	0.13	kNm
Mz,Ed	0.00	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	479.40	kN
Eenheidscontrole	0.06	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	24.16	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-13.9	MPa
sigma Myy	-1.5	MPa
sigma Mzz	0.0	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.4	MPa

rho 0.00 plaats 2
Eenheidscontrole 0.07 -
Staaf voldoet aan spanningscontrole !

...::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	39.27	kNm
Relatieve slankheid Lambda,LT	0.72	
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)
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S189	UNP140	S 235	1a/15	0.16

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 14.29 op positie 1.081 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00
maximale verhouding	3	44.68

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.30 op positie 1.081 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	20.44

==> Profiel klasse 1

Kritische controle op positie 1.081 m

Interne krachten		
NEd	56.10	kN
Vy,Ed	-0.12	kN
Vz,Ed	0.05	kN
TEd	0.00	kNm
My,Ed	0.19	kNm
Mz,Ed	-0.13	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	479.40	kN
Eenheidscontrole	0.12	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	139.75	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	137.03	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	24.16	kNm
Eenheidscontrole	0.01	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	6.65	kNm
Eenheidscontrole	0.02	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-27.5	MPa
sigma Myy	-2.2	MPa
sigma Mzz	-9.1	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.5	MPa

rho	0.00	plaats	3
Eenheidscontrole		0.16	-

Staaf voldoet aan spanningscontrole !
...::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	96.28	kNm
Relatieve slankheid Lambda,LT	0.46	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.081	m
k	1.00	
kw	1.00	
C1	1.43	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S289	UNP200	S 235	3/46	0.95

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 18.12 op positie 0.000 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00
maximale verhouding	3	49.44

==> Profiel klasse 1

Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.78 op positie 0.000 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	14.14

==> Profiel klasse 1

Kritische controle op positie 2.582 m

Interne krachten		
NEd	-394.21	kN
Vy,Ed	0.40	kN
Vz,Ed	1.49	kN
TEd	0.03	kNm
My,Ed	-4.95	kNm
Mz,Ed	0.67	kNm

Controle druk

Volgens artikel EN 1993-1-1 : 6.2.4 en formule (6.9)
Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	756.70	kN
Eenheidscontrole	0.52	-

Torsiecontrole

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

Tabel van waarden		
tau t,Rd	136.3	MPa
tau t, Ed	3.2	MPa
Eenheidscontrole	0.02	-

Controle afschuiving (Vy)

Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	200.95	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)

Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	231.87	kN
Eenheidscontrole	0.01	-

Controle buigend moment (My)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.09	-

Controle buigend moment (Mz)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.05	-

Gecombineerde controle buiging, normaalkrachten afschuiving

Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	122.4	MPa
sigma Myy	25.9	MPa

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Tabel van waarden		
sigma Mzz	24.8	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	3.2	MPa

rho 0.00 plaats 3
Eenheidscontrole 0.74 -
Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	2614.69	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	621.65	kN

Tabel van waarden		
A	3.2200e-03	m^2
Knikweerstand Nb,Rd	621.65	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	257.99	kNm
Relatieve slankheid Lambda,LT	0.42	
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	
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

Tabel van waarden		
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S312	UNP140	S 235	3/46	0.07

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Kritische controle op positie 1.196 m

Interne krachten		
NEd	26.06	kN
Vy,Ed	0.00	kN
Vz,Ed	-0.05	kN
TEd	0.02	kNm
My,Ed	0.18	kNm
Mz,Ed	0.06	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	479.40	kN
Eenheidscontrole	0.05	-

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

Tabel van waarden		
tau t,Rd	136.3	MPa
tau t, Ed	3.4	MPa
Eenheidscontrole	0.02	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	138.35	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	135.66	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)

Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	24.16	kNm
Eenheidscontrole	0.01	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	6.65	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-12.8	MPa
sigma Myy	-2.1	MPa
sigma Mzz	-1.7	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	2.4	MPa

rho 0.00 plaats 1
Eenheidscontrole 0.07 -
Staaf voldoet aan spanningscontrole !
...::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	34.97	kNm
Relatieve slankheid Lambda,LT	0.76	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S312	UNP140	S 235	3/46	0.07

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Kritische controle op positie 1.196 m

Interne krachten		
NEd	26.06	kN
Vy,Ed	0.00	kN
Vz,Ed	-0.05	kN
TEd	0.02	kNm
My,Ed	0.18	kNm
Mz,Ed	0.06	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	479.40	kN
Eenheidscontrole	0.05	-

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

Tabel van waarden		
tau t,Rd	136.3	MPa
tau t, Ed	3.4	MPa
Eenheidscontrole	0.02	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	138.35	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. & 6.2.7 en formule (6.25)

Tabel van waarden		
Vc,Rd	135.66	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	24.16	kNm
Eenheidscontrole	0.01	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	6.65	kNm
Eenheidscontrole	0.01	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-12.8	MPa
sigma Myy	-2.1	MPa
sigma Mzz	-1.7	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	2.4	MPa

rho 0.00 plaats 1
Eenheidscontrole 0.07 -
Staaf voldoet aan spanningscontrole !

...::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	34.97	kNm
Relatieve slankheid Lambda,LT	0.76	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	2.391	m
k	1.00	
kw	1.00	
C1	1.13	

Mcr Parameters		
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.

Element voldoet aan stabiliteitscontrole !

Staalcontrole

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

Staaf S547	UNP200	S 235	1a/13	0.85

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)

verhouding 18.12 op positie 0.000 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00
maximale verhouding	3	49.70

==> Profiel klasse 1

Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).

verhouding 4.78 op positie 0.000 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	13.94

==> Profiel klasse 1

Kritische controle op positie 0.000 m

Interne krachten		
NEd	-379.49	kN
Vy,Ed	-0.34	kN
Vz,Ed	4.95	kN
TEd	0.00	kNm
My,Ed	-6.94	kNm
Mz,Ed	0.39	kNm

Controle druk

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

Doorsnede classificatie is 1.

Tabel van waarden		
Nc.Rd	756.70	kN
Eenheidscontrole	0.50	-

Controle afschuiving (Vy)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	202.84	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)

Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	234.04	kN
Eenheidscontrole	0.02	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.13	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.03	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	117.9	MPa
sigma Myy	36.3	MPa
sigma Mzz	14.6	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	-0.3	MPa

rho 0.00 plaats 3
Eenheidscontrole 0.72 -
Staaf voldoet aan spanningscontrole !

...::STABILITEITSCONTROLE::...

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	17070.46	2862.51	kN
Slankheid	19.77	48.29	
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	133.33	kNm
Relatieve slankheid Lambda,LT	0.58	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S390	UNP200	S 235	1a-p/6	0.59

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Kritische controle op positie 0.000 m

Interne krachten		
NEd	301.16	kN
Vy,Ed	0.27	kN
Vz,Ed	-5.79	kN
TEd	0.00	kNm
My,Ed	6.51	kNm
Mz,Ed	-0.29	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	756.70	kN
Eenheidscontrole	0.40	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	202.84	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	234.04	kN
Eenheidscontrole	0.02	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.12	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.02	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-93.5	MPa
sigma Myy	-34.1	MPa
sigma Mzz	-10.8	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.0	MPa

rho 0.00 plaats 3
Eenheidscontrole 0.59 -
Staaf voldoet aan spanningscontrole !

...::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	133.33	kNm
Relatieve slankheid Lambda,LT	0.58	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
EC 3

D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

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

Staaf S299	UNP200	S 235	3-p/64	0.22

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

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

Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 18.12 op positie 3.073 m

verhouding		
maximale verhouding	1	33.00
maximale verhouding	2	38.00
maximale verhouding	3	43.17

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.78 op positie 3.073 m

verhouding		
maximale verhouding	1	12.58
maximale verhouding	2	13.98
maximale verhouding	3	42.12

==> Profiel klasse 1

Kritische controle op positie 3.507 m

Interne krachten		
NEd	49.27	kN
Vy,Ed	-1.10	kN
Vz,Ed	-0.71	kN
TEd	0.00	kNm
My,Ed	-0.07	kNm
Mz,Ed	-1.00	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	756.70	kN
Eenheidscontrole	0.07	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	202.84	kN
Eenheidscontrole	0.01	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	234.04	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.00	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.08	-

Gecombineerde controle buiging, normaalkrachten afschuiving

Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-15.3	MPa
sigma Myy	-0.4	MPa
sigma Mzz	-37.0	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	0.0	MPa

rho 0.00 plaats 15
Eenheidscontrole 0.22 -
Staaf voldoet aan spanningscontrole !

...::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	398.62	kNm
Relatieve slankheid Lambda,LT	0.34	
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.
Element voldoet aan stabiliteitscontrole !
Staalcontrole
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

Staaf S324	UNP200	S 235	3/134	0.14

Basisgegevens EC3 : EN 1993	
Partiële veiligheidsfactor Gamma M0 voor weerstand van doorsneden	1.00
Partiële veiligheidsfactor Gamma M1 voor weerstand tegen instabiliteit	1.00
Partiële veiligheidsfactor Gamma M2 voor weerstand van netto doorsnede	1.25

Gegevens materiaal		
bezwijksterkte fy	235.0	MPa
treksterkte fu	360.0	MPa
fabricatie	gewalst	

...::DOORSNEDE CONTROLE::...
Breedte-tot-dikte verhouding voor interne drukonderdelen (EN 1993-1-1 : Tab.5.2. blad 1)
verhouding 18.12 op positie 0.438 m

verhouding		
maximale verhouding	1	71.95
maximale verhouding	2	82.86
maximale verhouding	3	81.51

==> Profiel klasse 1
Breedte-tot-dikte verhouding voor uitstekende elementen(EN 1993-1-1 : Tab.5.2. blad 2).
verhouding 4.78 op positie 0.438 m

verhouding		
maximale verhouding	1	9.00
maximale verhouding	2	10.00
maximale verhouding	3	14.83

==> Profiel klasse 1

Kritische controle op positie 1.753 m

Interne krachten		
NEd	51.72	kN
Vy,Ed	0.70	kN
Vz,Ed	-0.19	kN
TEd	0.00	kNm
My,Ed	0.88	kNm
Mz,Ed	-0.30	kNm

Controle normaalkracht
Volgens artikel EN 1993-1-1 : 6.2.3. en formule (6.5)

Tabel van waarden		
Nt.Rd	756.70	kN
Eenheidscontrole	0.07	-

Controle afschuiving (Vy)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	202.84	kN
Eenheidscontrole	0.00	-

Controle afschuiving (Vz)
Volgens artikel EN 1993-1-1 : 6.2.6. en formule (6.17)

Tabel van waarden		
Vc,Rd	234.04	kN
Eenheidscontrole	0.00	-

Controle buigend moment (My)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	53.58	kNm
Eenheidscontrole	0.02	-

Controle buigend moment (Mz)
Volgens artikel EN 1993-1-1 : 6.2.5. en formule (6.12)
Doorsnede classificatie is 1.

Tabel van waarden		
Mc,Rd	12.42	kNm
Eenheidscontrole	0.02	-

Gecombineerde controle buiging, normaalkrachten afschuiving
Volgens artikel EN 1993-1-1 : 6.2 en formule (6.1)
Doorsnede classificatie is 3.

Tabel van waarden		
sigma N	-16.1	MPa
sigma Myy	-4.6	MPa
sigma Mzz	-11.2	MPa
Tau y	0.0	MPa
Tau z	0.0	MPa
Tau t	-0.1	MPa

rho 0.00 plaats 3
Eenheidscontrole 0.14 -
Staaf voldoet aan spanningscontrole !

...::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	129.70	kNm
Relatieve slankheid Lambda,LT	0.59	
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)

D&C ENGINEERING	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 74N
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - EN
	Auteur	- AD

Tabel van waarden	
hw/t	20.824

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

Bijlage C Controle staven mastlichaam

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 1 - randen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2181,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1961,3*	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 : *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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,71** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,89** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 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) : **$U.C_{max}$ = 0,89 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project :	150 kV lijn Leiden - Zoetermeer			
Part :	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 1 - diagonalen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-513,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*453,1*	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 : *H150/150/12* (*1)

h		=	*150*	mm	I_y	=	*5220913*	mm^4
b		=	*150*	mm	$W_{y;el;eff.1}$	=	*54404*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*139703*	mm^3
y_s		=	*37,4*	mm	i_y	=	*41,0*	mm
A_{bruto}		=	*3111*	mm^2	i_v	=	*26,2*	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		=	*20*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **93** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,98** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,63** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.059	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 1 - 1e hor.knikverkorter - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-22,5***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***22,5***	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:

$L_{y;cr}$	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,76** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*22,5*	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 : *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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,22** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,37** **< 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) : **$U.C_{max}$ = 0,82 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*22,5*	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 : *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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,76** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,47** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 schuine knikverkorter - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-53,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*53,2*	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 : *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:

$L_{y;cr}$		=	*2357*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2357*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **153** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,88** **< 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) : **$U.C_{max}$ = 0,88 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - 4e schuine knikverkorter - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-215,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*215,1*	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 : *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:

$L_{y;cr}$	=	*2149*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2149*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 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) : **$U.C_{max}$ = 0,80 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - 1e hor.knikverkorter pootverband- controle*

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 : *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:

$L_{y;cr}$	=	*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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,84** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **362** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,58** **< 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) : **$U.C_{max}$ = 0,84 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 1 - 2e hor.knikverkorter pootverband- controle*

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 : *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:

$L_{y;cr}$		=	*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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,62** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **269** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 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) : **$U.C_{max}$ = 0,62 = 62%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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- controle*

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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 : *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:

$L_{y;cr}$		=	*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	=	*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		=	*5*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **414** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,81** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 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) : **$U.C_{max}$ = 0,87 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2079,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1892,1*	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 : *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:

$L_{y;cr}$	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,82** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,90** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-663,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*586,6*	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 : *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:

$L_{y;cr}$	=	*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	=	*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	=	*15*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,66** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **101** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,00** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,00 = 100%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 2 - hor.knikverkorter - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-22,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,8*	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:

$L_{y;cr}$		=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 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) : **$U.C_{max}$ = 0,66 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-8,0* 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,16** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,27** **< 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) : **$U.C_{max}$ = 0,27 = 27%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 3 - randen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2150,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1977,7*	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:

$L_{y;cr}$		=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,85** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,94** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,94 = 94%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-224,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*214,6*	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:

$L_{y;cr}$	=	*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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,62** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 3 - horizontale knikverkorter - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-23,8***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***28,9***	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:

$L_{y;cr}$	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,57** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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) : **$U.C_{max}$ = 0,57 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.059	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 3 - schuine knikverkorter - controle*

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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 - randen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-1853,6***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***1680,2***	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 : ***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:

$L_{y;cr}$		=	***1784***	mm	No. bolts / end / flange		=	***5*** **(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		=	***18***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,84** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **48** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,96** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,86** **< 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) : **$U.C_{max}$ = 0,96 = 96%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 - diagonalen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-250,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*259,3*	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 : *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		=	*2*	
$L_{v;cr}$	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,66** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,96** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,75** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - horizontale knikverkorter - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-25,1***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***26,8***	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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,92** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - horizontale knikverkorter lang- controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-12,9***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***13,3***	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:

$L_{y;cr}$	=	***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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,13** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,58** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,75** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 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) : **$U.C_{max}$ = 0,75 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 - schuine knikverkorter - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-21,4***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***20,8***	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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1365,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1228,2*	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 : *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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,62** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **45** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 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) : **$U.C_{max}$ = 0,79 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-323,1***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***307,9***	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 : ***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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-20,6***	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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,44** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,64** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,62** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,64 = 64%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-19,8***	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***18,7***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,65** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,29** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 en 7 - randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1380,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1270,0*	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 : *H180/180/18* (*1)

h		=	*180*	mm	I_y	=	*18656042*	mm^4
b		=	*180*	mm	$W_{y;el;eff.1}$	=	*144670*	mm^3
t_f		=	*18*	mm	$W_{y;el;eff.2}$	=	*365487*	mm^3
y_s		=	*51,0*	mm	i_y	=	*54,9*	mm
A_{bruto}		=	*6191*	mm^2	i_v	=	*35,0*	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	=	*90* 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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,69** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **61** **< 120**

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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,44** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 6,7 - diagonalen v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-300,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***270,0***	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 : ***H150/150/14*** (*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:

$L_{y;cr}$	=	***2816***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **98** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,47** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 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) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 6,7 - diagonalen l.z.v en r.z.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-320,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***320,0***	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 : ***H120/120/12*** (*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:

$L_{y;cr}$		=	***2382***	mm	No. bolts / end / flange		=	***2***
$L_{v;cr}$		=	***2382***	mm	Type of bolts	M / "	=	***30***
$L_{tot\ (with\ comb.\ buckling)}$		=		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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,72** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,66** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 - schuine knikverkorter v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-90,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***70,0***	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 : ***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	=	***20***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 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) : **$U.C_{max}$ = 0,75 = 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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M. Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 - schuine knikverkorter l.z.v en r.z.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-23,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***21,0***	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:

$L_{y;cr}$	=	***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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,25** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 - horizontale knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-30,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***35,0***	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	***0***	kN
	$F_{perpend.;s;d}$	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,52** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,55** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,58 = 58%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 - horizontale diagonalen v.v en a.v*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-70,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***50,0***	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 : ***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	=	***15***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,27** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,58 = 58%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 8- randen*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-900,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***700,0***	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 : ***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	=	***20***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **70** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 8 - diagonalen v.v en a.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-220,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***260,0***	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 : ***H120/120/12*** (*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		=	***2***
$L_{v;cr}$		=	***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		=	***15***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,56** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **110** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,62** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,96** **< 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) : **$U.C_{max}$ = 0,96 = 96%**

(*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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 8 - diagonalen l.z.v en r.z.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-480,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***461,0***	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 : ***H150/150/15*** (*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:

$L_{y;cr}$	=	***2380***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,53** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **82** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,45** **< 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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order	:	P13057	**Dossier** :	13.039	**Berekening** :	B.13089	
Project	:	150 kV lijn Leiden - Zoetermeer					
Part	:	mast 74N					

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 8 - schuine knikverkortes*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-32,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***36,0***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,53** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 8 - hor. knikverkortes*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-13,0***	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	=	***15***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,28** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,28** **< 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 :	15-jul-2013	30-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 8 - hor. verbanden l.z.v en r.z.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-11,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***13,0***	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 : ***H75/75/8*** (*1)

h	=	***75***	mm	I_y	=	***588737***	mm^4
b	=	***75***	mm	$W_{y;el;eff.1}$	=	***10964***	mm^3
t_f	=	***8***	mm	$W_{y;el;eff.2}$	=	***27635***	mm^3
y_s	=	***21,3***	mm	i_y	=	***22,7***	mm
A_{bruto}	=	***1147***	mm^2	i_v	=	***14,4***	mm

Material :

Mat. qual. Fe360 / Fe510	=	***Fe510***		Permissible stress	$f_{y;d}$	=	***355,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	***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
$L_{perpendicular\ force}$	=	***1252***	mm	Edge distance bolt	e2	=	***37,5***	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	=	***12***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,12** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,44** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,50** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 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) : **$U.C_{max}$ = 0,50 = 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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10- randen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-700,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***590,0***	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 : ***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		=	***20***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **57** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,86** **< 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) : **$U.C_{max}$ = 0,86 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10 - diagonalen v.v en a.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-200,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***270,0***	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 : ***H120/120/12*** (*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:

$L_{y;cr}$	=	***2206***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **95** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,44** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 l.z.v en r.z.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-120,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***120,0***	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 : ***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	=	***15***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,48** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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 :	15-jul-2013	31-jul-13					
Name :	J. Hollaar	M.Glegola					
Checked :	M. Glegola	P.Damen					

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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}	=	***-231,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***200,0***	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 : ***H120/80/8*** (*1)

h		=	***120***	mm	I_y	=	***2256520***	mm^4
b		=	***80***	mm	$W_{y;el;eff.1}$	=	***22266***	mm^3
t_f		=	***8***	mm	$W_{y;el;eff.2}$	=	***120944***	mm^3
y_s		=	***18,7***	mm	i_y	=	***38,2***	mm
A_{bruto}		=	***1549***	mm^2	i_v	=	***17,2***	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		=	***2***
$L_{v;cr}$		=	***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		=	***12***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,78** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,85** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,85** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,76** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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}	=	***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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,25** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 11,12- randen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-354,5***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***324,4***	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 : ***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		=	***20***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **95** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - diagonalen v.v en a.v.*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-102,1***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***86,3***	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***	
$L_{v;cr}$	=	***3526***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 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) : **$U.C_{max}$ = 0,56 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 11,12 - diagonalen l.z.v en r.z.v.*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-218,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*210,0*	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 : *H120/120/10* (*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	=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,59** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,83** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,61** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 11,12 - schuine knikverkorters*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-7,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,3*	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 : *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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,46** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,56** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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}	=	***3,7***	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 : ***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:

$L_{y;cr}$	=	***1270***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$	=	***1270***	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
$L_{perpendicular\ force}$	=	***1270***	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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,44** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,10** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HV 1 - horizontalen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-300,2***	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***259,8***	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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 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) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-95,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***84,6***	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 : ***H130/130/10*** (*1)

h	=	***130***	mm	I_y	=	***2630723***	mm^4
b	=	***130***	mm	$W_{y;el;eff.1}$	=	***32411***	mm^3
t_f	=	***10***	mm	$W_{y;el;eff.2}$	=	***83515***	mm^3
y_s	=	***31,5***	mm	i_y	=	***34,6***	mm
A_{bruto}	=	***2195***	mm^2	i_v	=	***22,2***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,18** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **243** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,92** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,0*	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 : *H70/70/7* (*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:

$L_{y;cr}$		=	*7600*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*7600*	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	=	*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		=	*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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,95** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **563** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,29** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 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) : **$U.C_{max}$ = 0,95 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 2 - horizontalen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-6,9*	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 : *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:

$L_{y;cr}$		=	*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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,13** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,67** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **290** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,44** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,51** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 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) : **$U.C_{max}$ = 0,67 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HV 2 - diagonalen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-19,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,9*	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 : *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:

$L_{y;cr}$		=	*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 =	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,13** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,60** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **351** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 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) : **$U.C_{max}$ = 0,80 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HV 3 - horizontalen - controle*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-537,1***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***494,2***	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 : ***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 3 - diagonalen - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-66,9***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***65,6***	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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.059	**Berekening** : B.13089
Project	:	150 kV lijn Leiden - Zoetermeer			
Part	:	mast 74N			

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-2,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,1*	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 :			*H60/60/7*	(*1)				
h		=	*60*	mm	I_y	=	*260501*	mm^4
b		=	*60*	mm	$W_{y;el;eff.1}$	=	*6099*	mm^3
t_f		=	*7*	mm	$W_{y;el;eff.2}$	=	*15066*	mm^3
y_s		=	*17,3*	mm	i_y	=	*18,1*	mm
A_{bruto}		=	*798*	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:

$L_{y;cr}$		=	*5000*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*5000*	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	=	*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		=	*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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,87** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **433** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,27** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 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) : **$U.C_{max}$ = 0,87 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.059	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-30,9***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***35,9***	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 : ***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:

$L_{y;cr}$	=	***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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,11** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,22** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **262** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,69** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,34** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.059	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - controle*

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*
$L_{v;cr}$		=	*7163*	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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **371** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,74** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,30** **< 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) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** :	B.13089	
Project	:	150 kV lijn Leiden - Zoetermeer					
Part	:	mast 74N					

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Traverse 1 en 2 - bovenrand*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*71,0*	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 : *H65/50/5* (*1)

h		=	*65*	mm	I_y	=	*230454*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s		=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}		=	*554*	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:

$L_{y;cr}$		=	*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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,72** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **449** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,51** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,72 = 72%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 1 en 2 - diagonalen*

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 : ***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:

$L_{y;cr}$		=	***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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **293** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,60** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 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}	=	*-60,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*60,0*	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:

$L_{y;cr}$	=	*1300*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1300*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,53** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 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) : **$U.C_{max}$ = 0,86 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,78** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,37** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Traverse 1 en 2 - diagonalen onderrand (S317,466,288,465)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-81,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*75,0*	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 : *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 / "	=	*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		=	*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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,53** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 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) : **$U.C_{max}$ = 0,78 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-180,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*250,0*	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 : *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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **149** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,61** **< 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) : **$U.C_{max}$ = 0,63 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - diagonalen v.v en a.v. S242,225,227,240*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-135,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*112,1*	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 : *H120/120/8* (*1)

h	=	*120*	mm	I_y	=	*1241906*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*18227*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*47505*	mm^3
y_s	=	*26,1*	mm	i_y	=	*29,0*	mm
A_{bruto}	=	*1481*	mm^2	i_v	=	*18,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe510*		Permissible stress	$f_{y;d}$	=	*355,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2373*	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	=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **128** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,77** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 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) : **$U.C_{max}$ = 0,77 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - diagonalen v.v en a.v. S226,224,239,241*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-120,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*131,0*	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 : *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:

$L_{y;cr}$		=	*2380*	mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$		=	*2380*	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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,49** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **136** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 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) : **$U.C_{max}$ = 0,79 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 9,14,13 - diagonalen ondervlak* *S263t/m,267,290,291,292,318,319,320,400*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-54,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*53,6*	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 : *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	=	*1*	
$L_{v;cr}$	=	*2550*	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	=	*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	=	*10*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,68** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,90** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,40** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - diagonalen ondervlak S322,323,293,294*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-20,1***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***18,0***	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 : ***H50/50/5*** (*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:

$L_{y;cr}$	=	***1121***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$	=	***1121***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,35** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,33** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 9,14,13 - hor. diagonalen ondervlak S268,321*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,0*	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:

$L_{y;cr}$		=	*1753*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1753*	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
$L_{perpendicular\ force}$		=	*1753*	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		=	*10*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,02** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,43** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **155** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,05** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,07** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 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) : **$U.C_{max}$ = 0,43 = 43%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - hor. diagonalen ondervlak S298,270,399*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-200,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*220,0*	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 : *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:

$L_{y;cr}$	=	*1753*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*1753*	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
$L_{perpendicular\ force}$	=	*1753*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,87** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,10** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,83** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 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) : **$U.C_{max}$ = 0,87 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 9,14,13 - binnen verbanden S 215,220,222,214,219,221*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-3,0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***3,0***	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 : ***H50/50/5*** (*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:

$L_{y;cr}$	=	***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	=	***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	=	***10***	mm	Dubble strap joint	no=1, yes=2	=	***1***	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **245** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,20** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,24** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,06** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,24 = 24%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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}	=	***43,9***	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:

$L_{y;cr}$		=	***2880***	mm	No. bolts / end / flange		=	***3***
$L_{v;cr}$		=	***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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,53** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **300** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 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) : **$U.C_{max}$ = 0,53 = 53%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Traverse 3 en 4 - onderrand S167,169,180,181,198,199,190,192*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-63,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*66,2*	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 : *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 / "	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,60** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,93** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,49** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,78** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,93 = 93%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

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}	=	*-25,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*28,1*	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:

$L_{y;cr}$		=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,57** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,21** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,82** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 19,18,17,16 - bovenrand (S127,S128,S500,S503)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-84,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*120,8*	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 : *H100/100/10* (*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:

$L_{y;cr}$		=	*2721*	mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$		=	*2721*	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		=	*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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **141** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,42** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 19,18,17,16 - bovenrand (S501,S504,S499,S502)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-47,3*	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 : *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:

$L_{y;cr}$	=	*4464*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*4464*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,08** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **231** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,26** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,20** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,49 = 49%**

(*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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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}	=	*-61,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*21,6*	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 : *H100/100/6* (*1)

h	=	*100*	mm	I_y	=	*430241*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*8157*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*21531*	mm^3
y_s	=	*20,0*	mm	i_y	=	*22,3*	mm
A_{bruto}	=	*868*	mm^2	i_v	=	*14,3*	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	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **166** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,51** **< 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) : **$U.C_{max}$ = 0,85 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 19,18,17,16 -diagonalen v.v en a.v. (S101,S109,S112,S120)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*58,7*	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 : *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:

$L_{y;cr}$		=	*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		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,72** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **246** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,89** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,49** **< 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) : **$U.C_{max}$ = 0,89 = 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 19,18,17,16 -diagonalen v.v en a.v. (S102,S110,S113,S126)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-37,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*34,7*	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 : *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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,36** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,48** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,61** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 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}	=	***-71,3***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***67,3***	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 : ***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:

$L_{y;cr}$	=	***1530***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$	=	***1530***	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?	=	***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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,53** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 19,18,17,16 -diagonalen ondervlak (S186,187,205,204)*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-30,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*30,9*	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 : *H50/50/6* (*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	=	*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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,51** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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 - 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order	:	P13057	**Dossier** :	13.039	**Berekening** :	B.13089	
Project	:	150 kV lijn Leiden - Zoetermeer					
Part	:	mast 74N					

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		=	***8***	mm	Dubble strap joint	no=1, yes=2	=	***1***

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,32** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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}	=	*-23,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,6*	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 : *H60/60/6* (*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	=	*8*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,23** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 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 :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

Order :	P13057	**Dossier** :	13.039	**Berekening** :	B.13089
Project :	150 kV lijn Leiden - Zoetermeer				
Part :	mast 74N				

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*

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 : *H50/50/5* (*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:

$L_{y;cr}$	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,57** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,91** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 1**

Remarks:

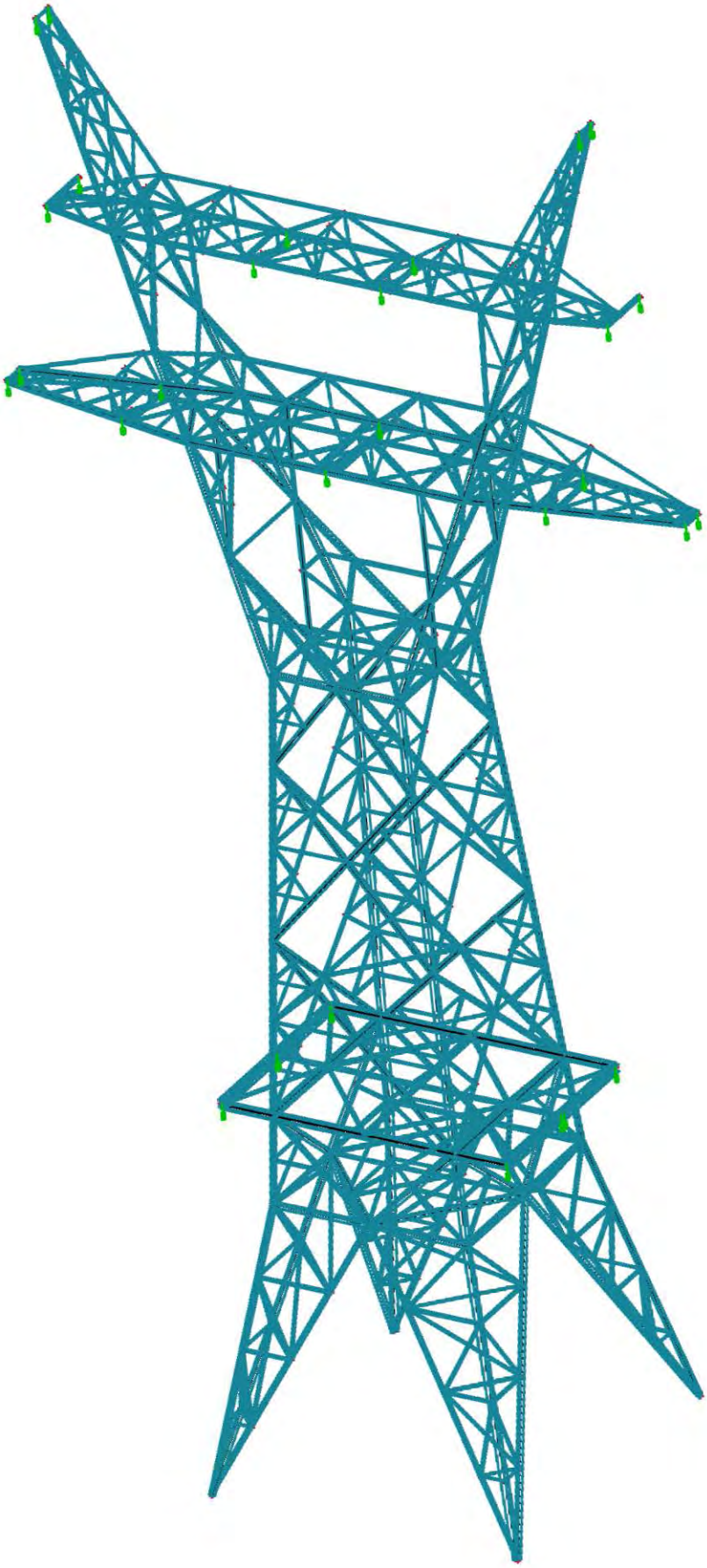
The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,91 = 91%**

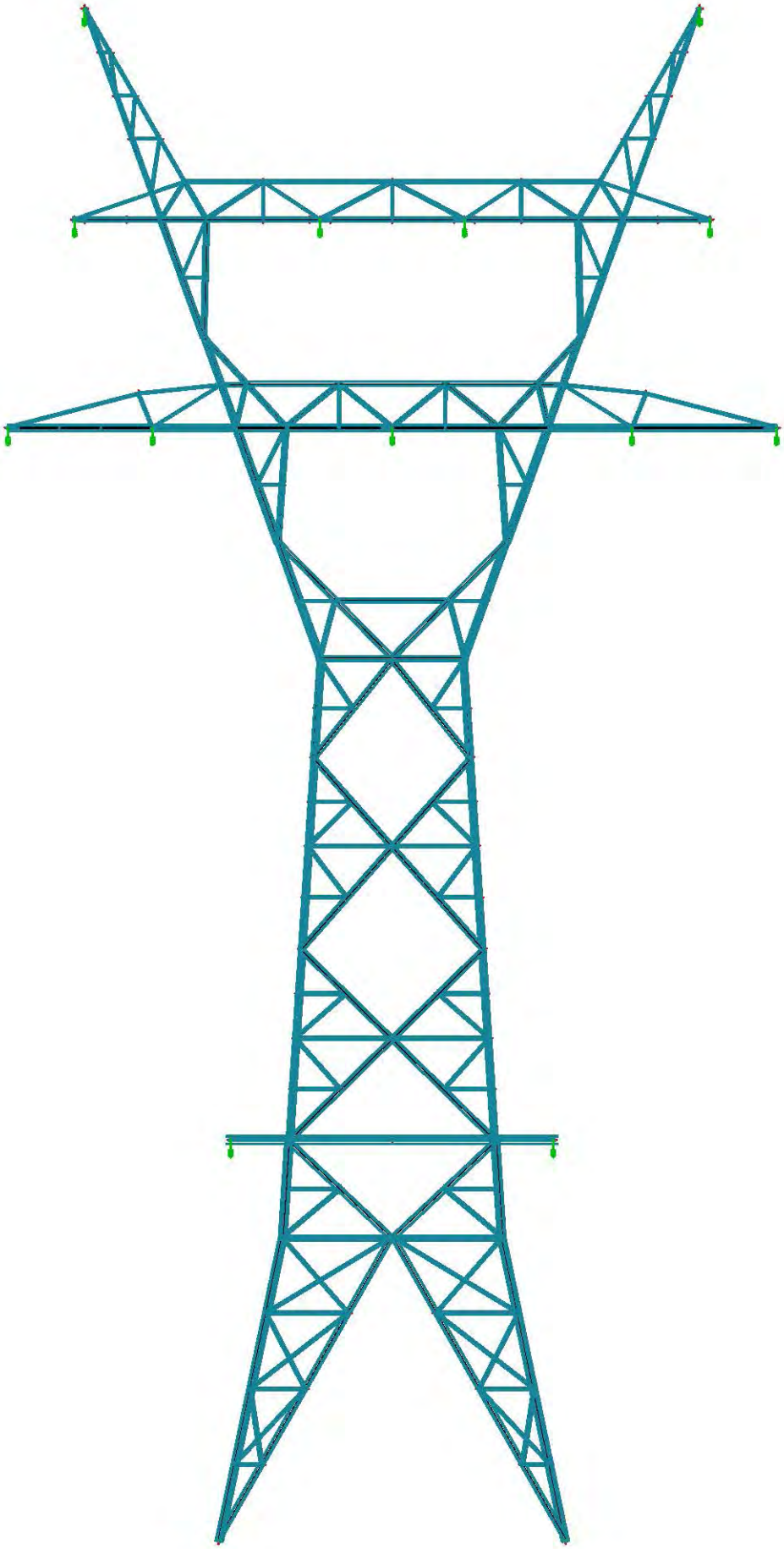
(*1) Eventually, with the checks of the stresses, the cross-section reduction method is used according to prEN 1993-1-5.

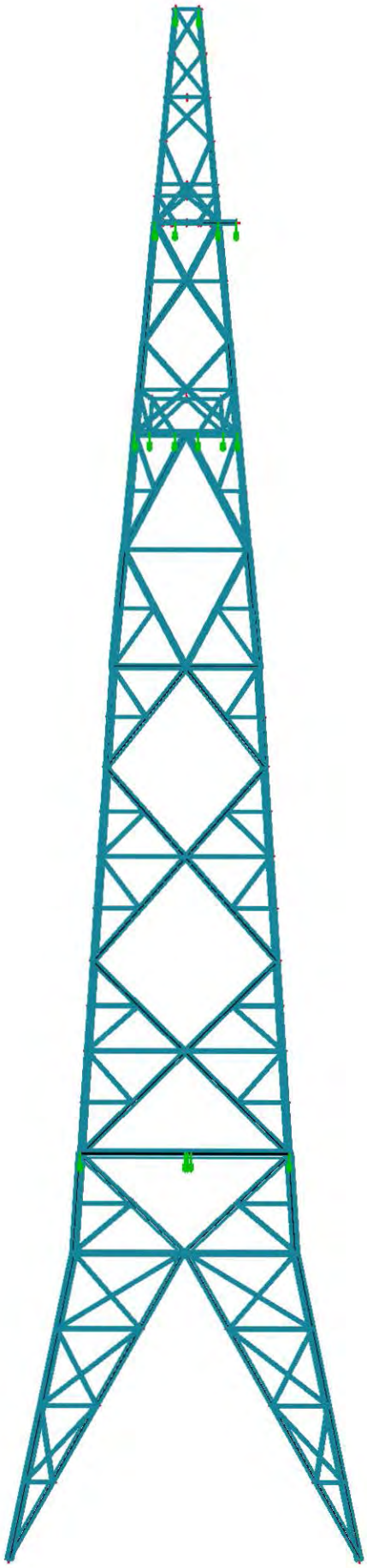
(*2) The total stress or increase of stress has been related to the permissible stress.

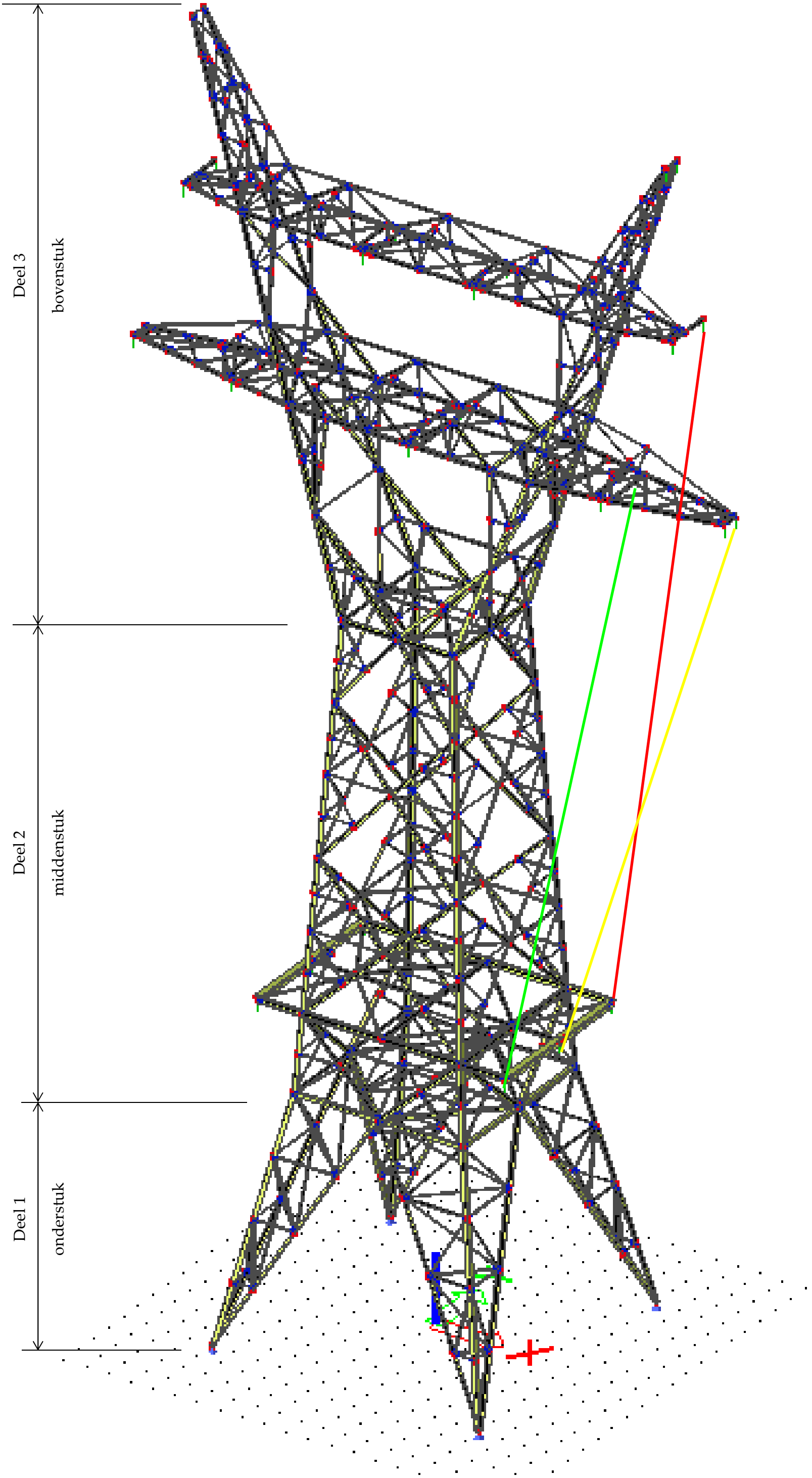
Revision :	**0**	**A**	**B**	**C**	**D**	**E**	**F**
Date :	15-jul-2013						
Name :	J. Hollaar						
Checked :	M. Glegola						

3. BIJLAGE: AANZICHTTEKENINGEN

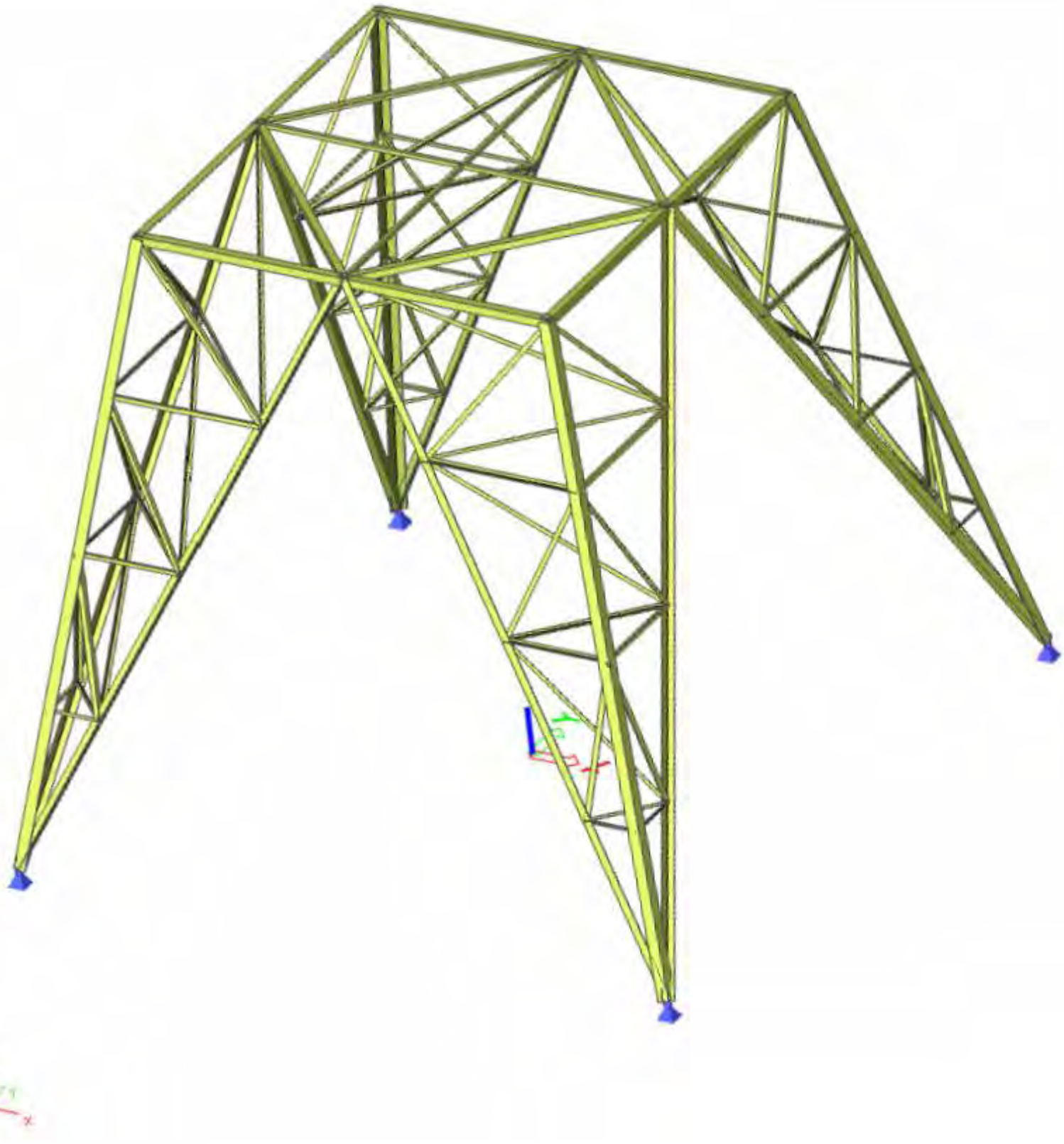




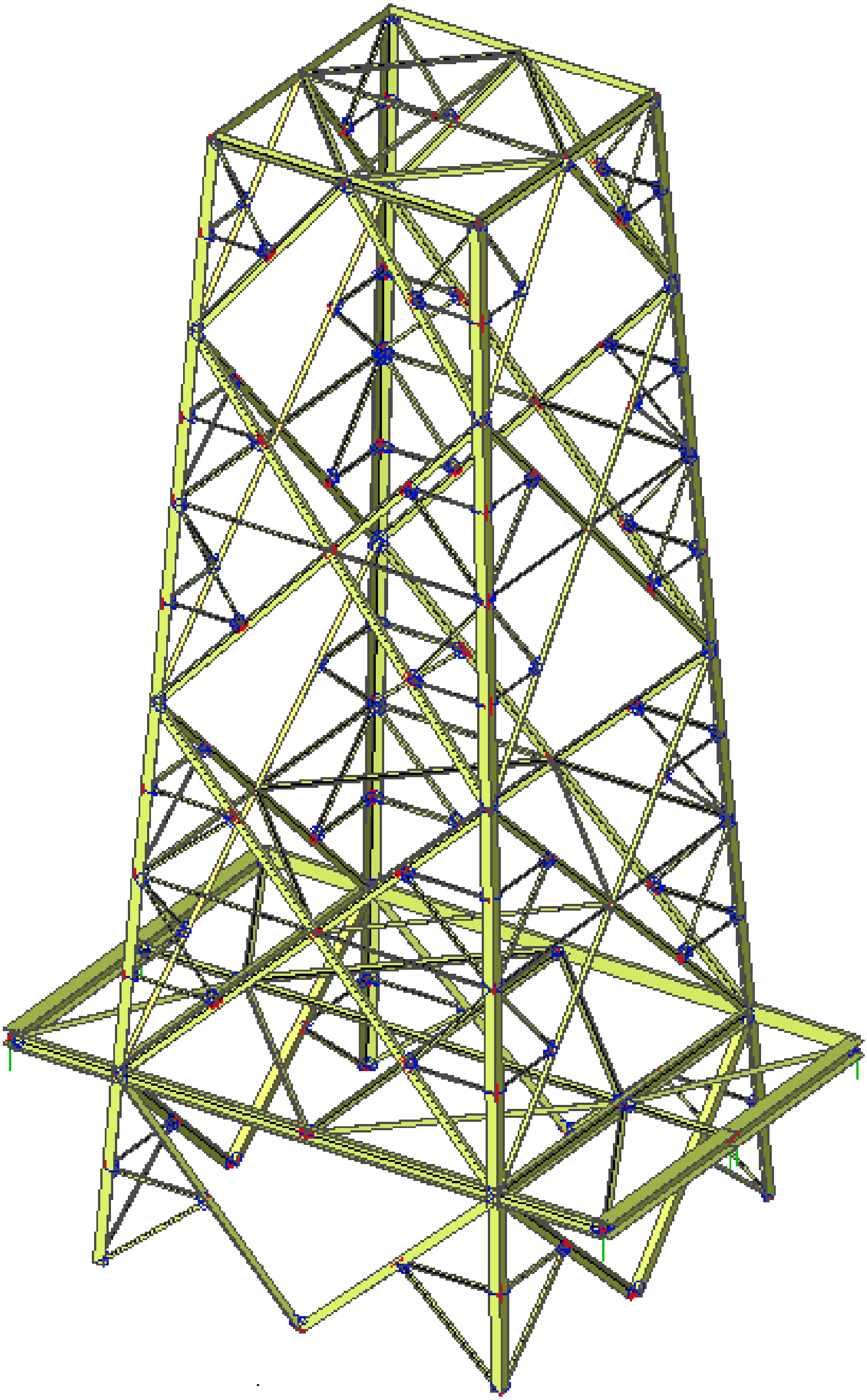




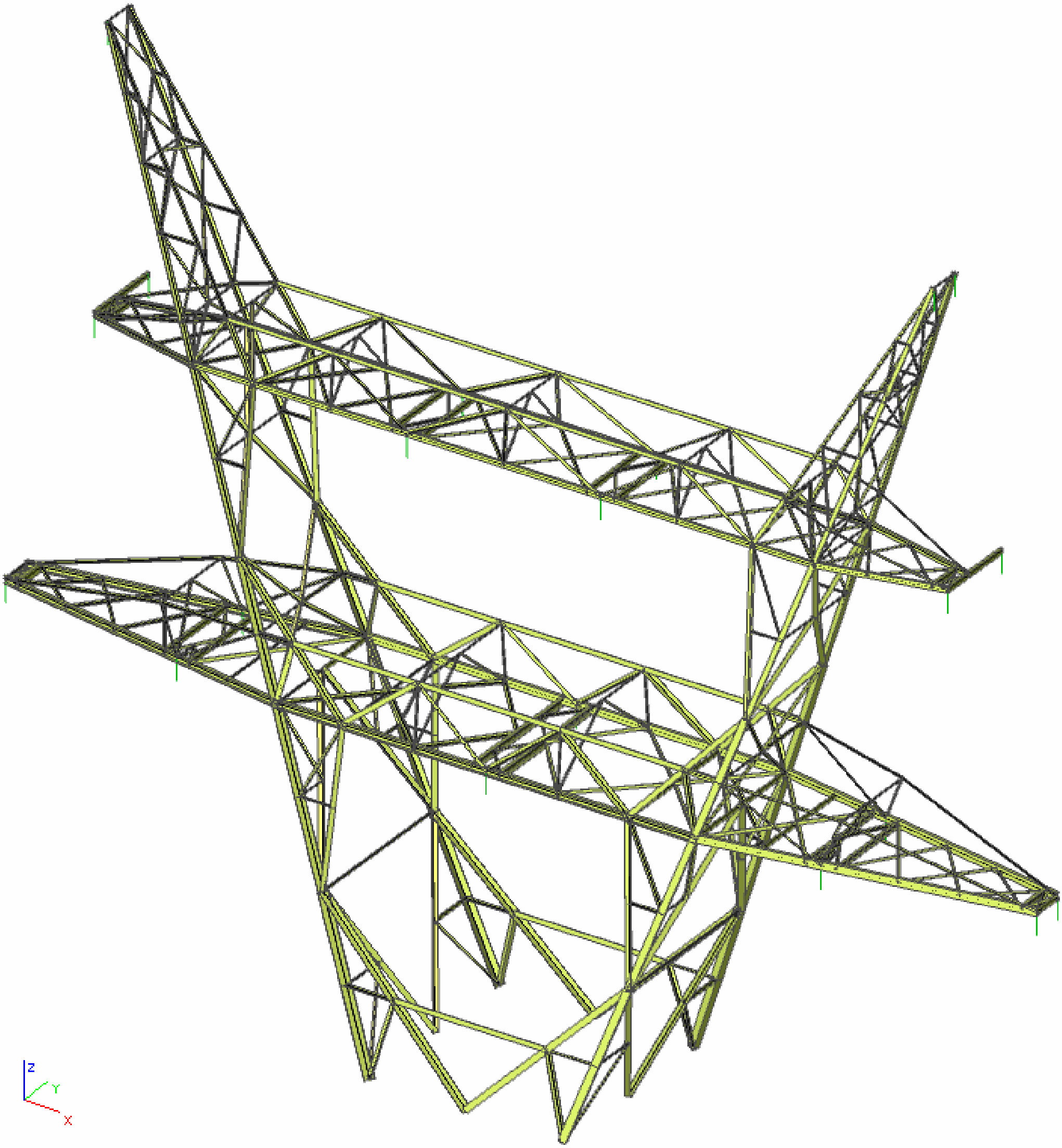
Figuur 1: Mast 74 -overzicht



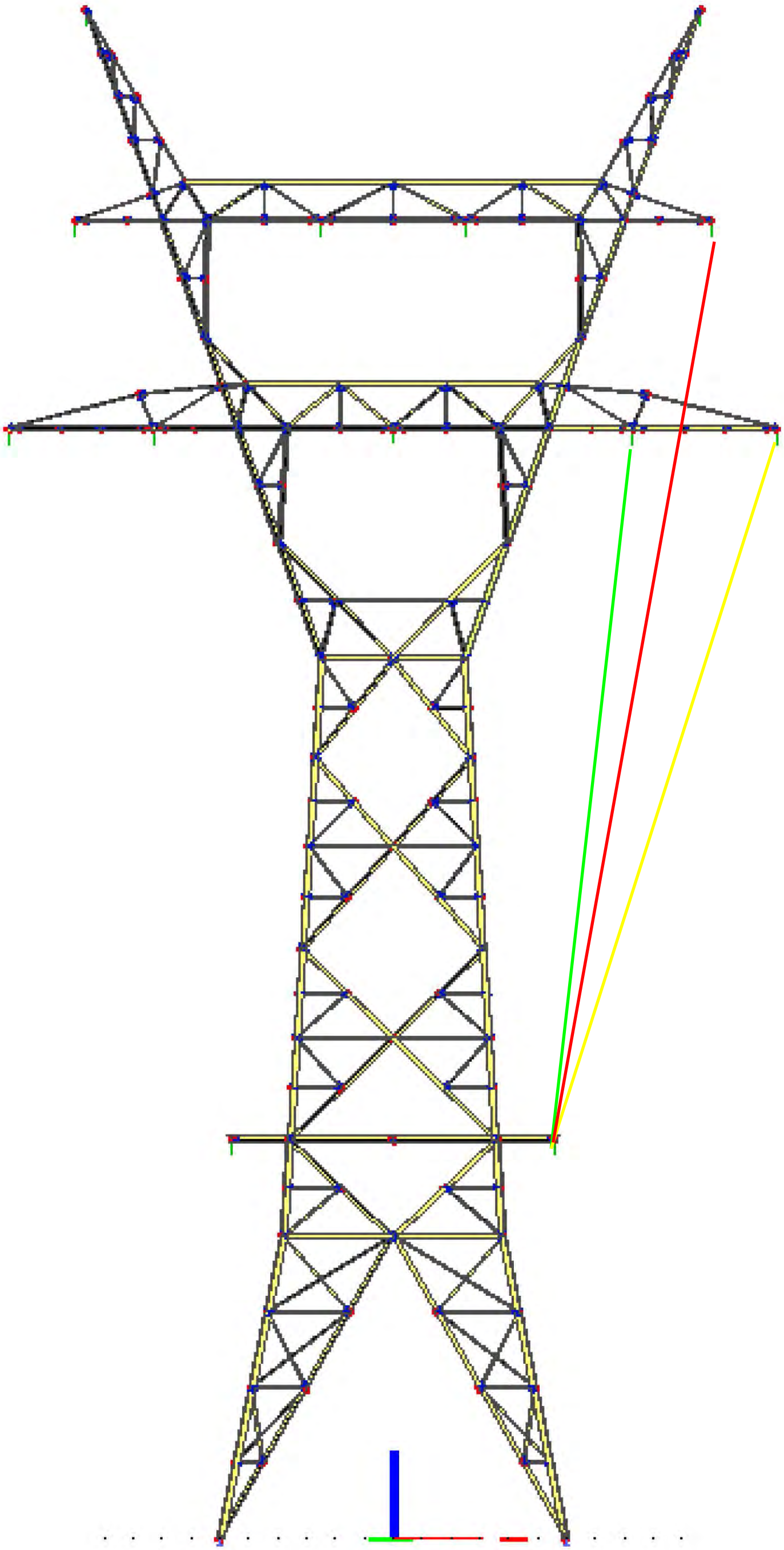
Figuur 2: Mast 74 – Deel1 :onderstuk



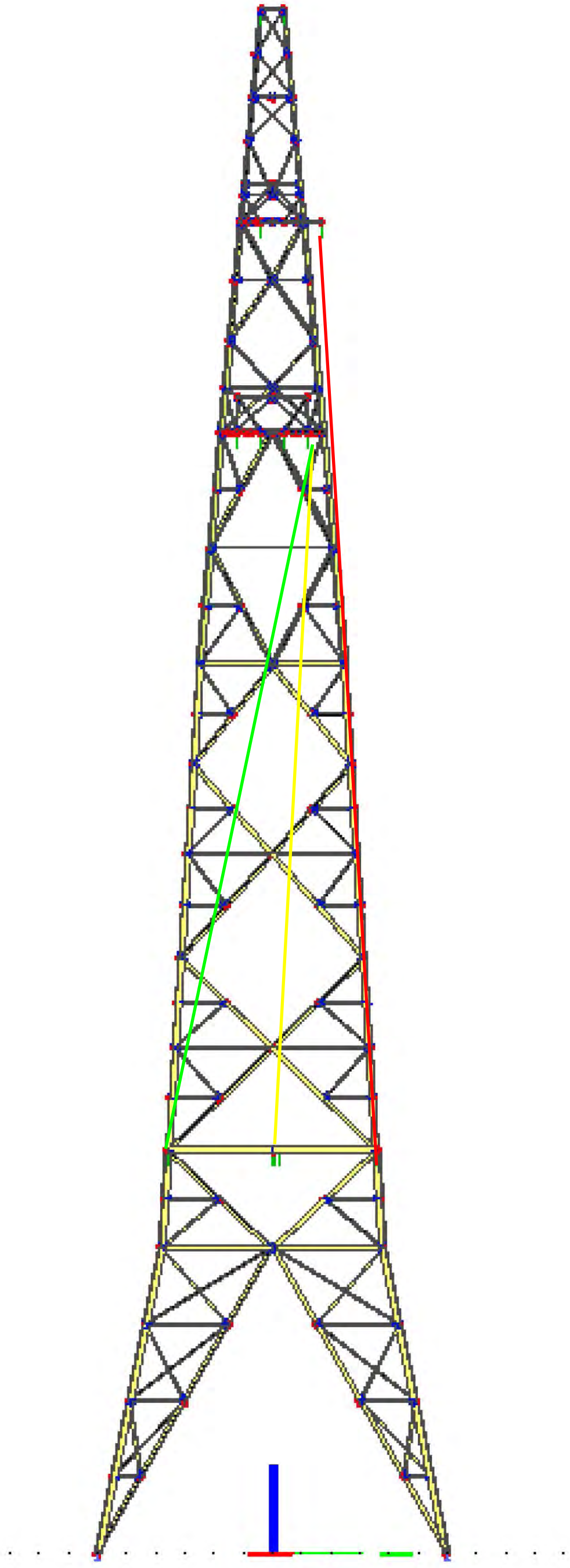
Figuur 3: Mast 74 – Deel2 : middenstuk



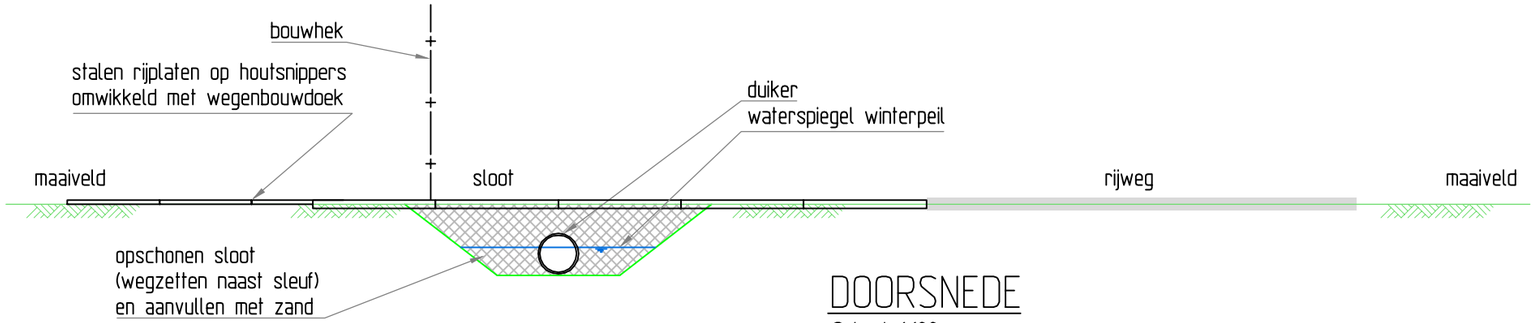
Figuur 4: Mast 74 – Deel3 : bovenstuk



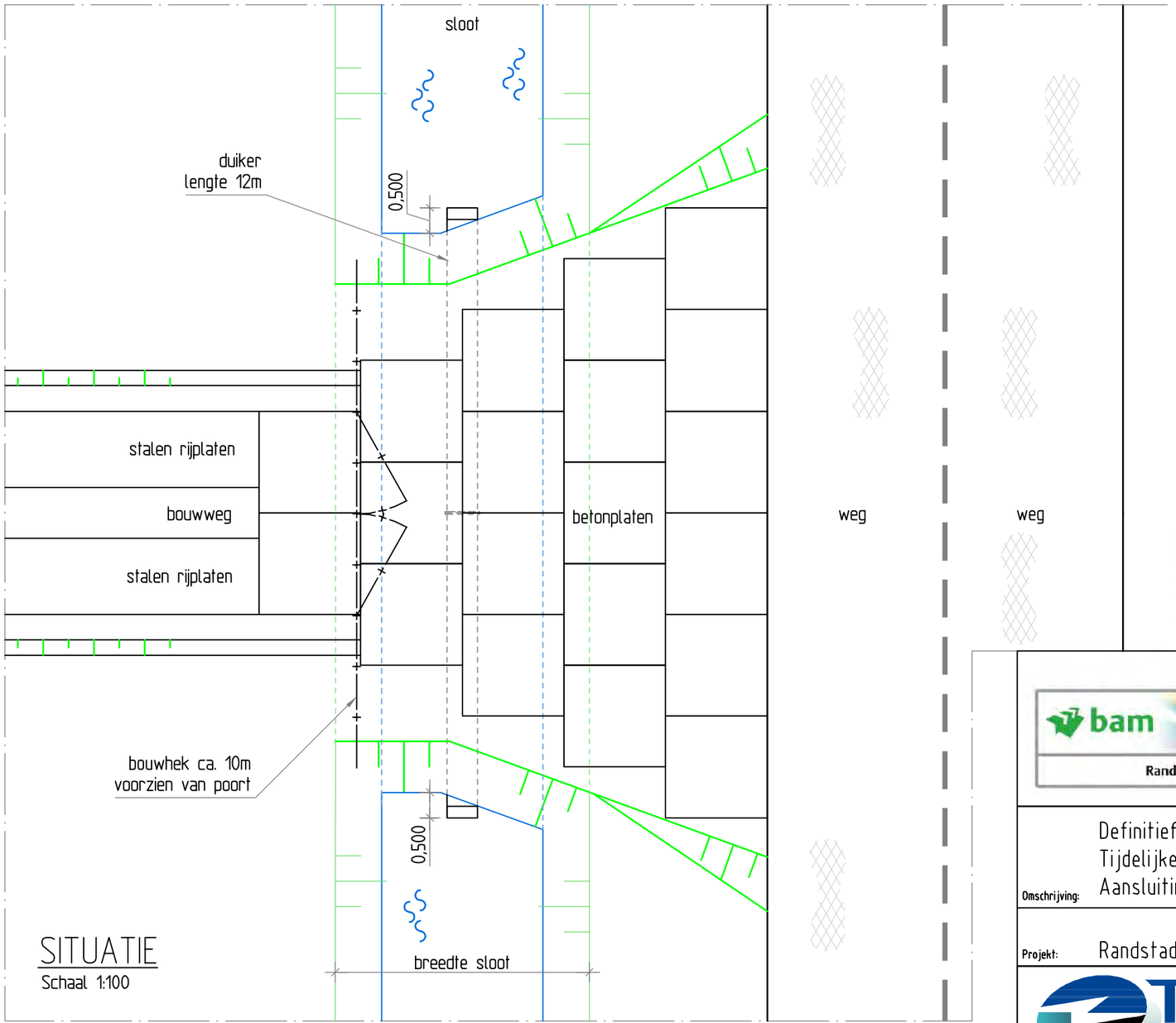
Figuur 5: Mast 74 – voorvlak



Figuur 6: Mast 74 – zijvlak



DOORSNEDE
Schaal 1:100



SITUATIE
Schaal 1:100

Uitgangspunten duiker

Beheersgebied Hoogheemraadschap Rijnland		
Breedte sloot	Diameter duiker	b.o.b.
1-4m	600mm	0,40m
4-6m	800mm	0,50m
>6m	1000mm	0,65m
Beheersgebied Hoogheemraadschap Schieland en Krimpenerwaard		
Breedte sloot	Diameter duiker	b.o.b.
<=5m	600mm	0,40m
>5m	800mm	0,53m

* b.o.b. maat gemeten vanaf winterpeil

OPMERKINGEN:
- Diameter en b.o.b. duiker afhankelijk van breedte sloot.
- B.o.b. gemeten vanaf winterpeil.
- Type buis staal of kunststof inw. gladwandig, keuze nader af te stemmen met waterbeheerder(s).

Combining Knowledge and Experience

bam COFELY FABRICOM GDF SUEZ

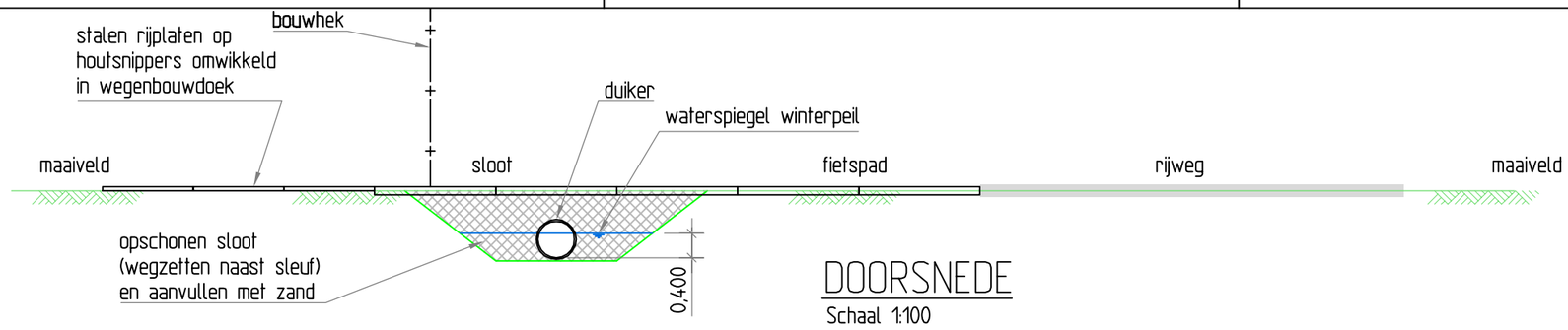
Randstad 380kV Noordring

		P. de Jager	A. Hogenboom
		Controleur	Vrijgegeven door
Omschrijving: Definitief Ontwerp Tijdelijke en permanente werkwegen Aansluiting op bestaande weg	03		
	02	Tabel toegevoegd	11-10-2013	W. Vissers
	01	Duiker aangepast	04-10-2013	W. Vissers
	Rev.	Wijziging	Datum	Naam
Projekt: Randstad 380kV Noordring	Schaal: 1:100		Formaat: A3	
	Naam: R.G.J. Caspers		Datum: 19-07-2013	

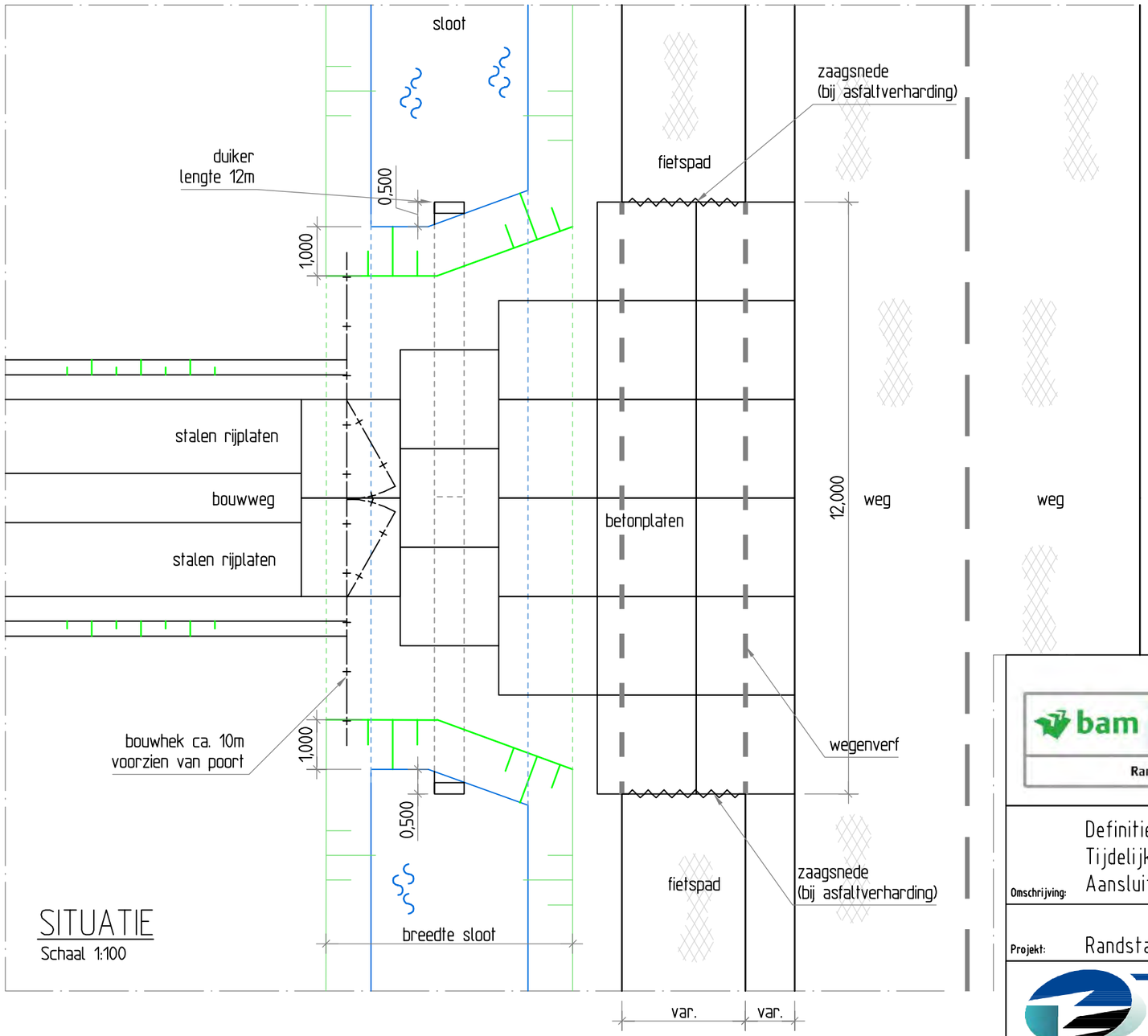
TenneT Taking power further

Tekeningnummer: R3N-TEK-0033 blad 001

AutoCAD filename:: Systnr:



DOORSNEDE
Schaal 1:100



SITUATIE
Schaal 1:100

Uitgangspunten duiker

Beheersgebied Hoogheemraadschap Rijnland		
Breedte sloot	Diameter duiker	b.o.b.
1-4m	600mm	0,40m
4-6m	800mm	0,50m
>6m	1000mm	0,65m
Beheersgebied Hoogheemraadschap Schieland en Krimpenerwaard		
Breedte sloot	Diameter duiker	b.o.b.
<=5m	600mm	0,40m
>5m	800mm	0,53m

* b.o.b. maat gemeten vanaf winterpeil

OPMERKINGEN:
- Diameter en b.o.b. duiker afhankelijk van breedte sloot.
- B.o.b. gemeten vanaf winterpeil.
- Type buis staal of kunststof inw. gladwandig, keuze nader af te stemmen met waterbeheerder(s).
- Na maken zaagsneden, verharding fietspad verwijderen en in later stadium herstellen.

Combining Knowledge and Experience

bam COFELY FABRICOM GDF SUEZ

Randstad 380kV Noordring

			P. de Jager	A. Hogenboom
			Controleur	Vrijgegeven door
Omschrijving: Definitief Ontwerp Tijdelijke en permanente werkwegen Aansluiting op bestaande weg met fietspad	03			
	02	Tabel toegevoegd	01-11-2013	W. Vissers
	01	Dam en duiker aangepast	04-10-2013	W. Vissers
	Rev.	Wijziging	Datum	Naam

Projekt: Randstad 380kV Noordring	Schaal: 1:100	Formaat: A3	
	Naam: R.G.J. Caspers	Datum: 19-07-2013	

TenneT Taking power further

Tekeningnummer: R3N-TEK-0034 blad 001

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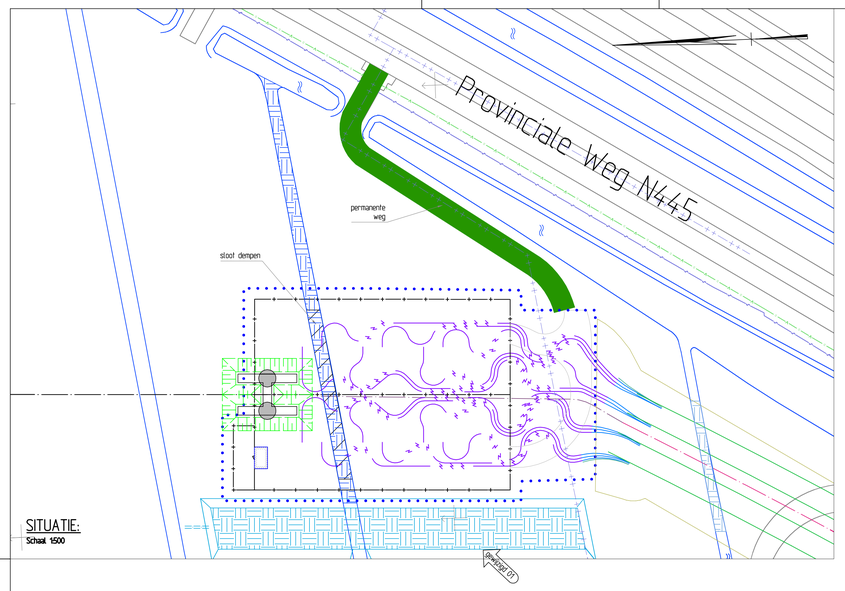
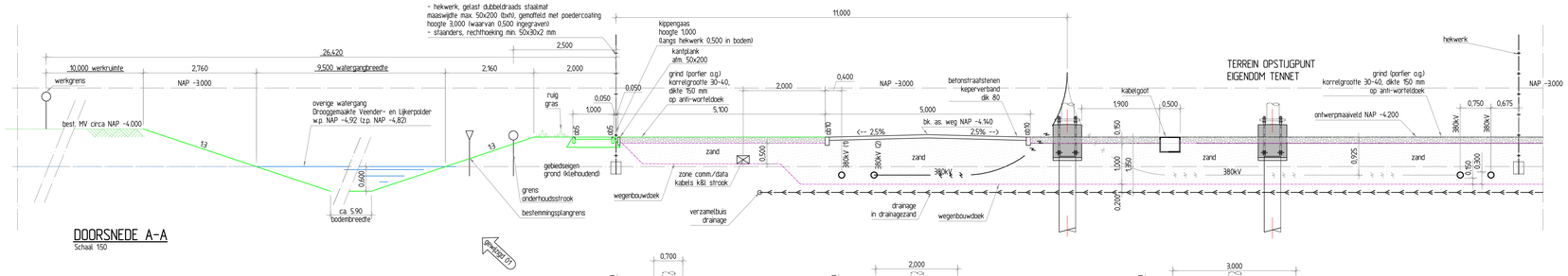
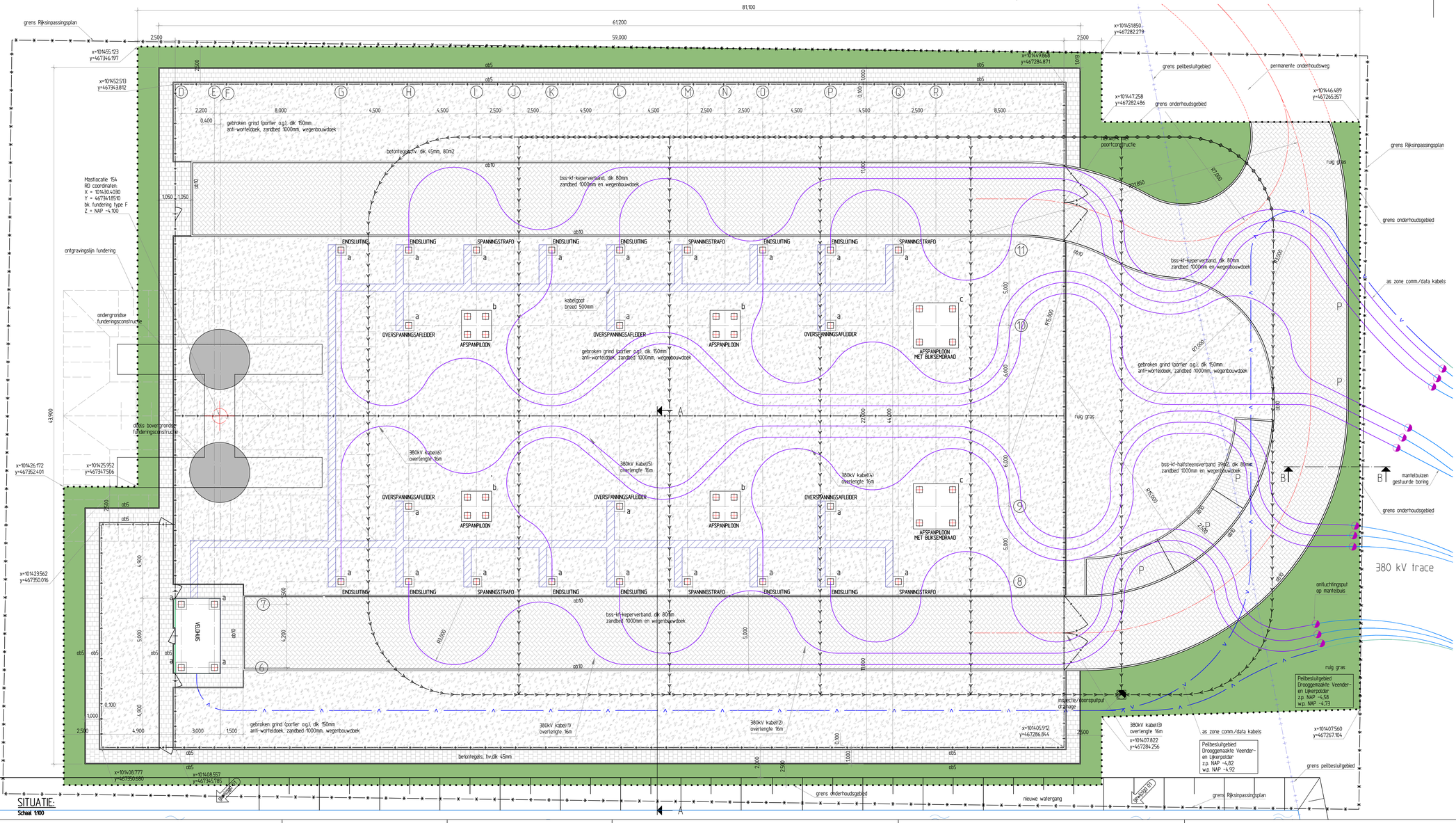


SITUATIE:
Schaal 1:500





SITUATIE:
Schaal 1:100

VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bis_Zuid_Ringvaart_1905.DWG (Tennet)
- Plangrens uit rijksinpassingsplan
- As stramienlijnen palenplan
- As toegangsweg
- Peilbesluitgrens Hoogheemraadschap Rijnland

VERKLARING - LEIDINGWERK:

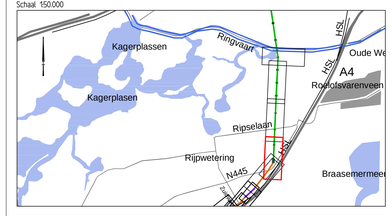
- Aanbrengen kabel 380 kV
- Aanbrengen mantelbuis ttv. glasvezel data/signaalkabel
- Aanbrengen ontluchtingsput op mantelbuis
- Aanbrengen kabelgoot
- Aanbrengen drainage

VERKLARING - CIVIEL:

- Aanbrengen hekwerk, gelast dubbeldraads staalmat
- Toekomstige grens onderhoudsgebied
- Aanbrengen grind (portier o.g.) korrelgrootte 30-40, dikte 150 mm op anti-worteldoek en zandbed
- Aanbrengen betonstraatstenen, keperverband, keifonnaat 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 waterlaluds, waterlijn aangepast
- doorsnede A-A aangepast
- grens onderhoudsgebied aangepast

Combining Knowledge and Experience
bam Civiel
COFELY FABRICOM
Randstad 380kV Noordring

		P. de Jager	E. Duvel
		Controleur	Vrijgegeven door

Definitief Ontwerp
Opstijgpunten
Inrichting OSP 4 bij mast 154

Omschrijving

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

Project: Randstad 380kV Noordring

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

Tennet — Taking power further

Tekeningnummer: R3N-TEK-0039 blad 001

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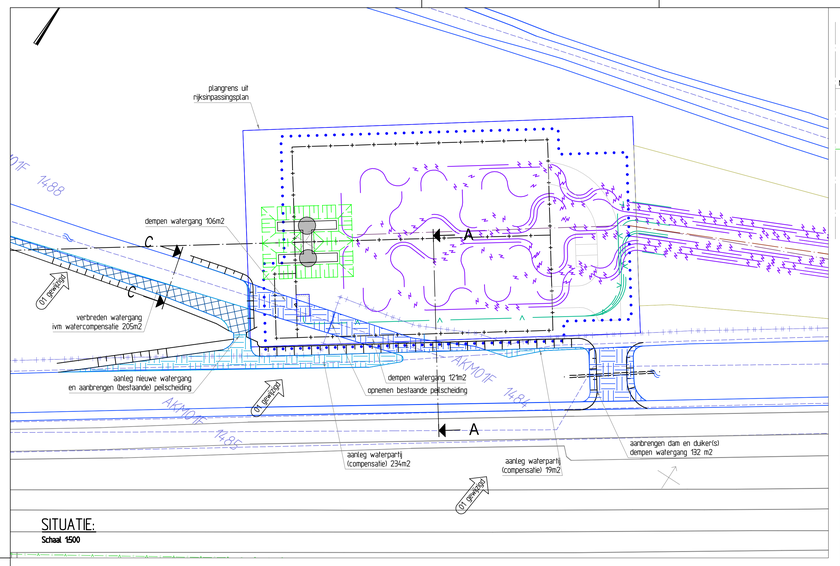

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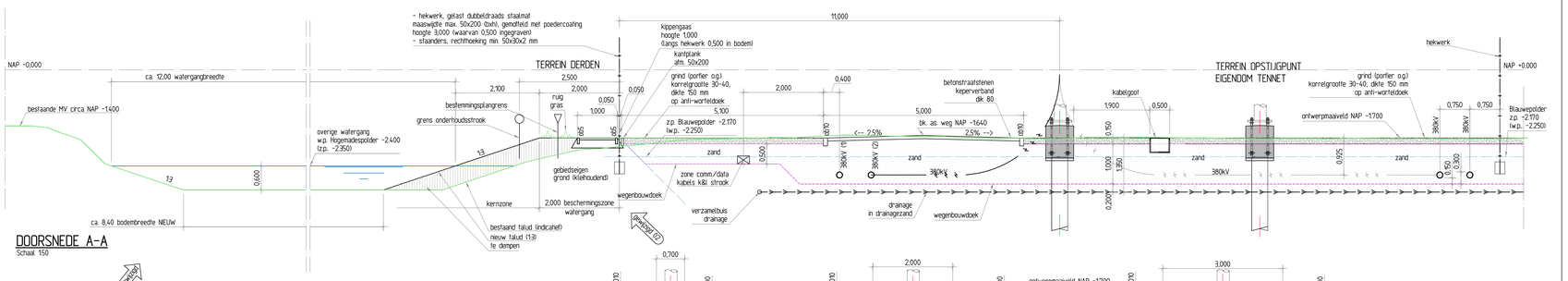
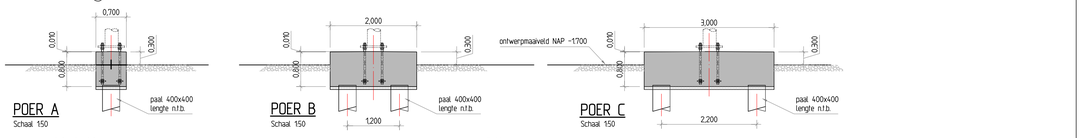


DOORSNEDE A-A

Schaal 1:50



POER A

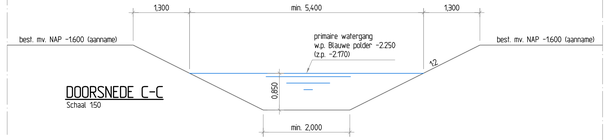
Schaal 1:50

POER B

Schaal 1:50

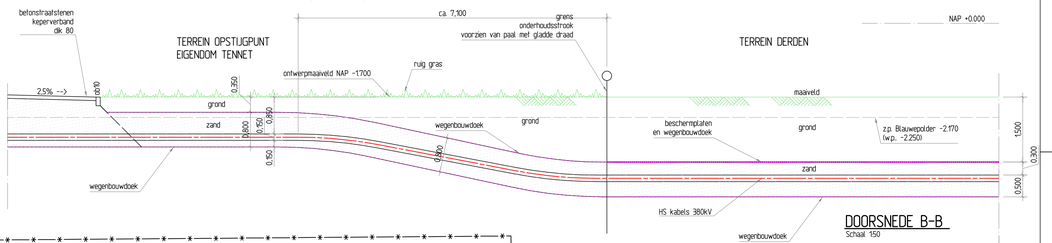
POER C

Schaal 1:50



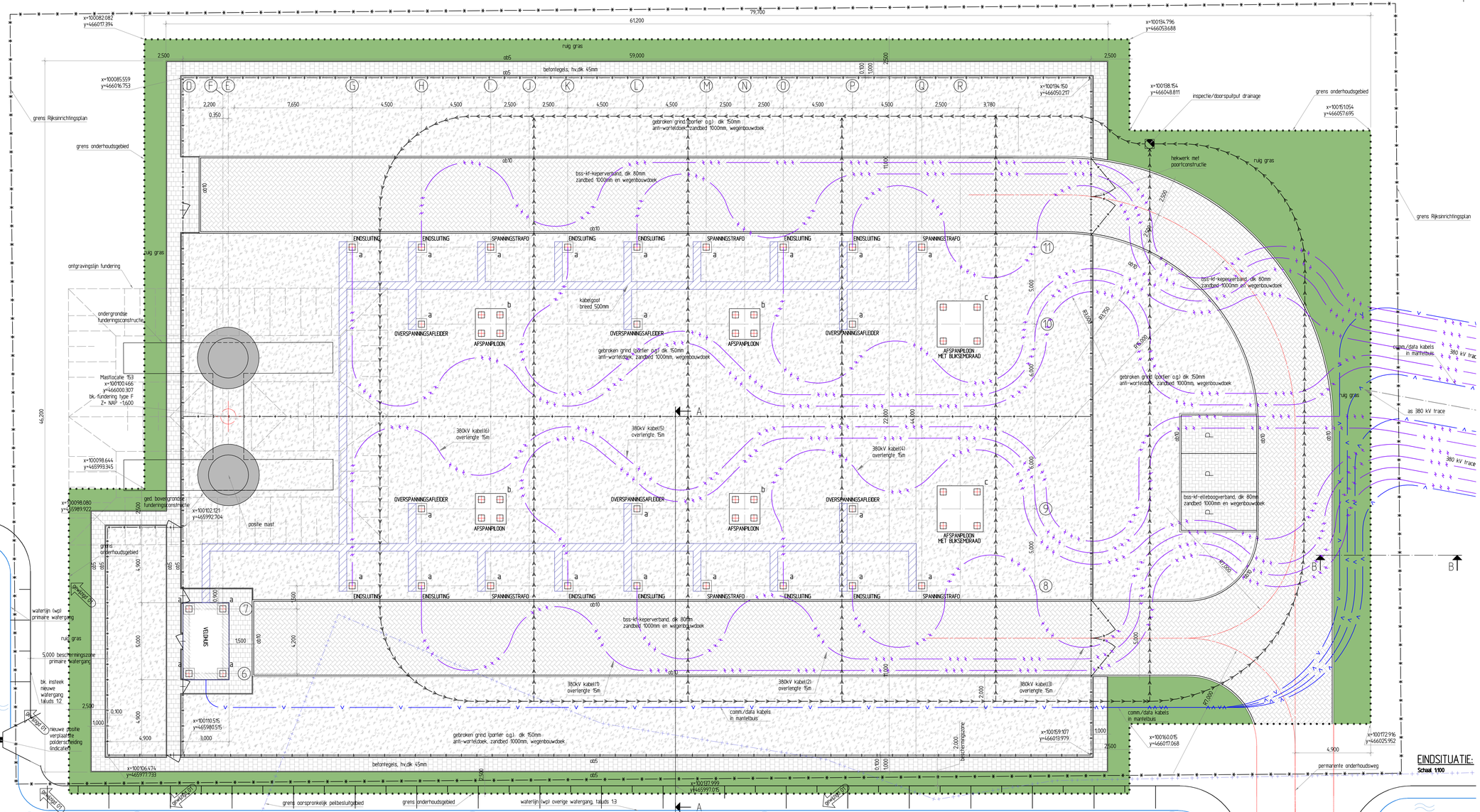
DOORSNEDE C-C

Schaal 1:50



DOORSNEDE B-B

Schaal 1:50



EINDSITUATIE:

Schaal 1:100

VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- Kadastrale grens en sectie/perceelnummer, uit bestand Kadperc_Bks_Zuid_Ringvaart_1905.DWG (Tennet) (MKP00C, 565)
- Plangrens uit rijksinpassingsplan
- As stramienlijnen palenplan
- As toegangsweg
- Peilbesluitgrens Hoogheemraadschap Rijnland

VERKLARING - LEIDINGWERK:

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

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, keformaat 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.
- Hooglematen in meters ten opzichte van NAP.

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

Combining Knowledge and Experience

bam COFELY FABRICOM

Randstad 380kV Noordring

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

Definitief Ontwerp
Opstijgpunten
Inrichting OSP 5 bij mast 153

Omschrijving

Project: 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

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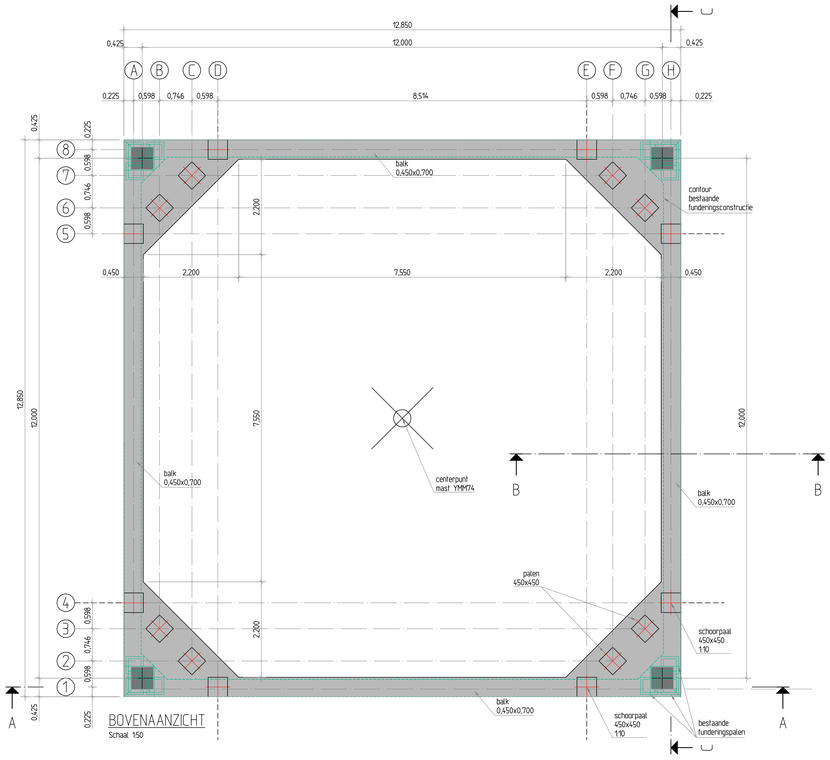
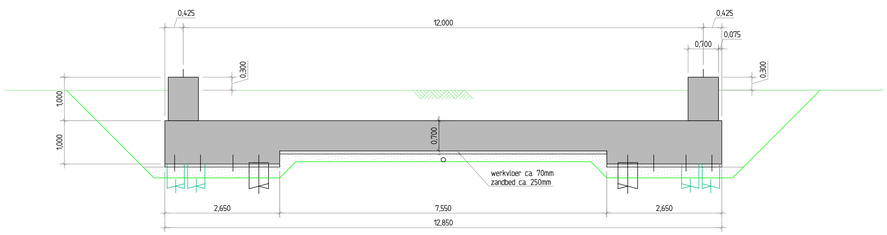
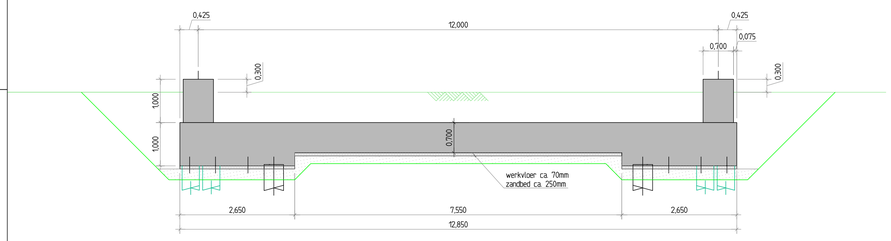


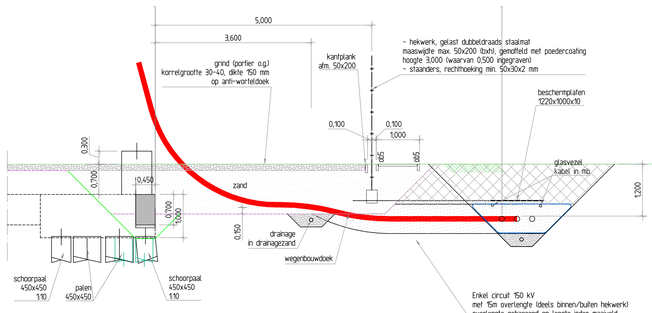
BOVENAANZICHT
Schaal 150



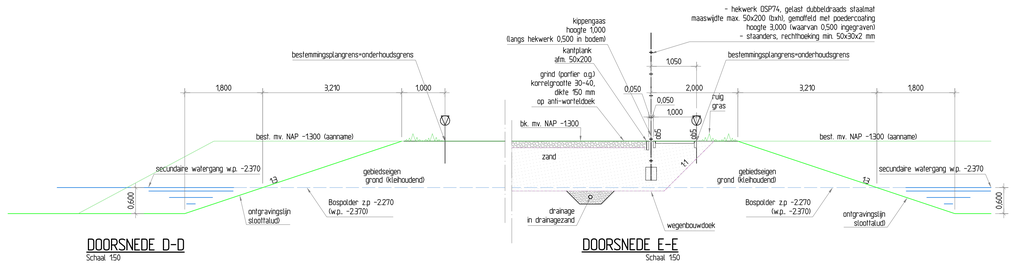
DOORSNEDE A-A
Schaal 150



DOORSNEDE C-C
Schaal 150



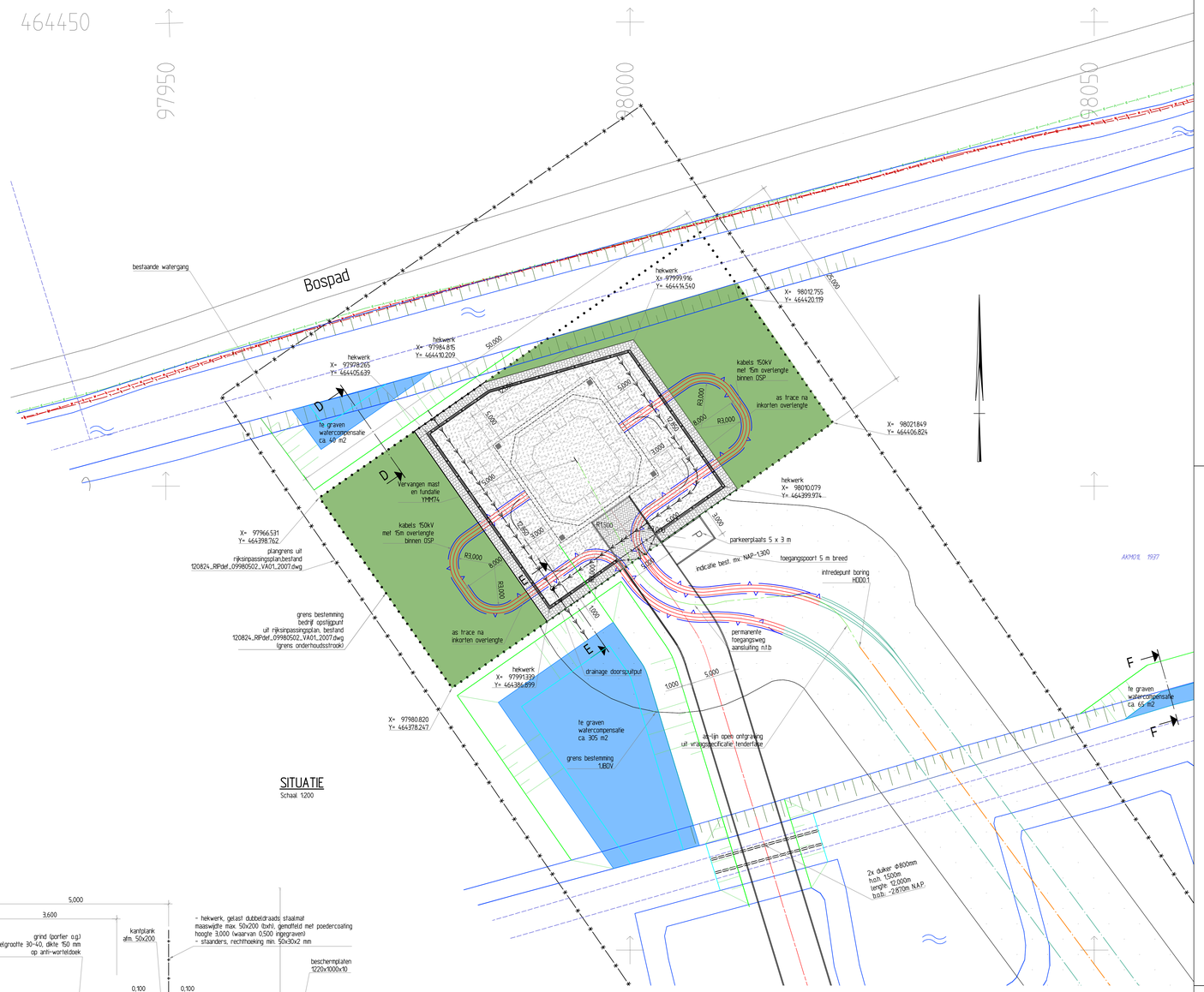
DOORSNEDE B-B
Schaal 150



DOORSNEDE D-D
Schaal 150

DOORSNEDE E-E
Schaal 150

DOORSNEDE F-F
Schaal 150



SITUATIE
Schaal 1:200

VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- Kadastrale grens en sectie/perceelnummer; uit bestand Kadperc_Bis_Zuid_Ringvaart_1905.DWG (Tennet)
- Plangrens uit rijksinpassingsplan

VERKLARING - LEIDINGWERK:

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

VERKLARING - KLIC

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

TOPOGRAFISCH FRAGMENT
Schaal 150.000

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
Waterrgangen aangepast, ligging permanente toegangsweg gewijzigd, doorsneden toegevoegd

Combining Knowledge and Experience

bam COFELY FABRICOM KITCHEN SYSTEMS

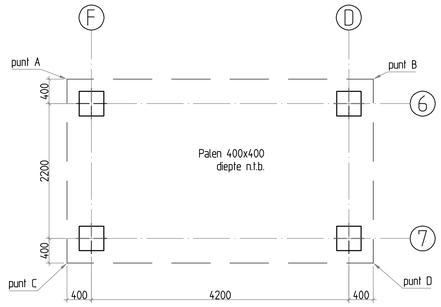
Randstad 380kV Noordring

		P. de Jager	E. Duwel
		Certificateur	Vrijgegeven door
Definitief Ontwerp Opsijpunten Inrichting OSP bij mast YMM74	03	Waterrgangen+ doorsneden	30-07-2014	R.G.J. Caspers
	02	waterrcompensatie, drainage	13-11-2013	R.G.J. Caspers
	01	zie opmerkingen	04-10-2013	RG.J.Caspers
Omschrijving:	Rev.	Wijziging	Datum	Naam
	Schaal	150 / 1200	Formaat	A0
Project: Randstad 380kV Noordring	Naam	R.G.J. Caspers	Datum	06-08-2013

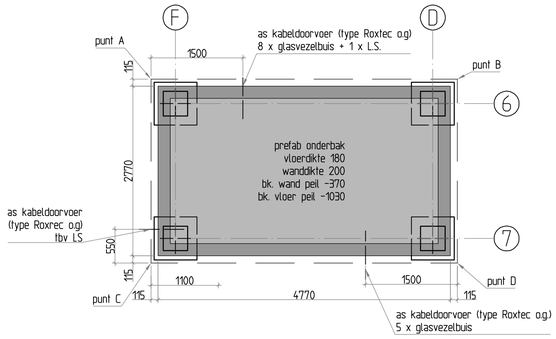
Tennet Taking power further

Tekeningnummer: R3N-TEK-0083 stad 001

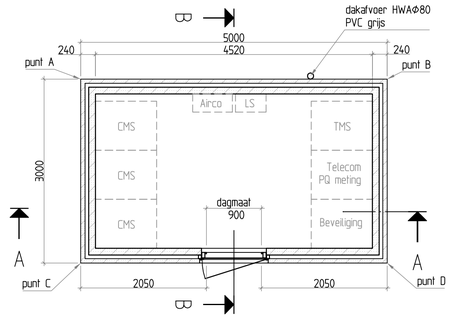
AutoCAD filenaam: Sysfor:



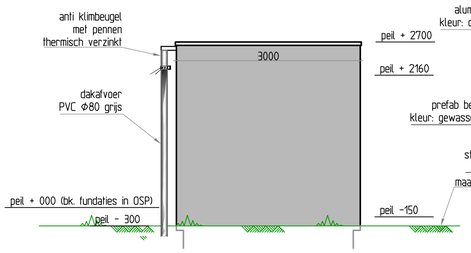
PALENPLAN



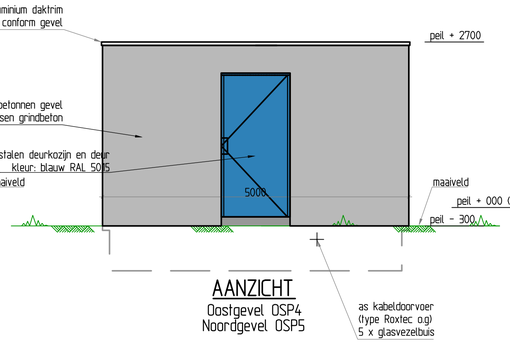
BOVENAANZICHT FUNDERING



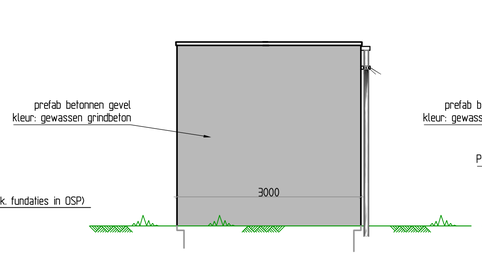
BOVENAANZICHT WANDEN



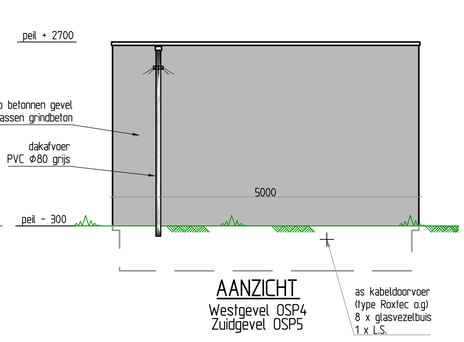
AANZICHT
Zuidgevel OSP4
Oostgevel OSP5



AANZICHT
Oostgevel OSP4
Noordgevel OSP5



AANZICHT
Noordgevel OSP4
Westgevel OSP5



AANZICHT
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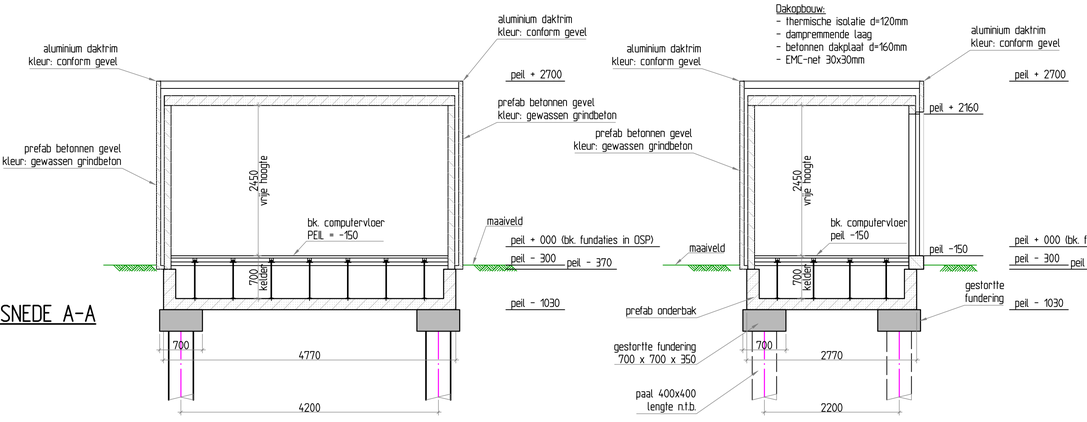
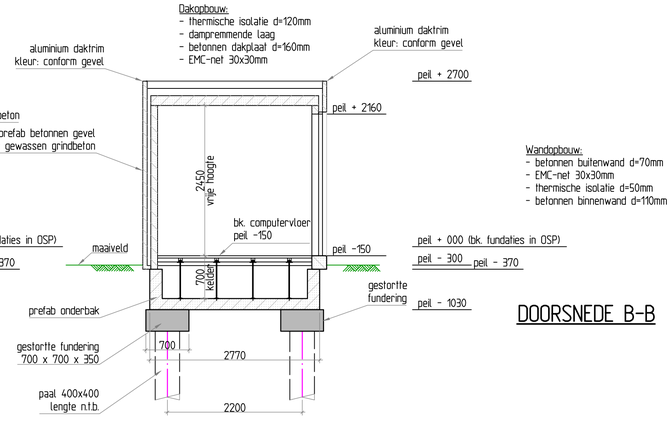
Zuidgevel OSP5
as kabeldoorvoer
(type Roxtec o.g)
8 x glasvezelbuis
1 x L.S.

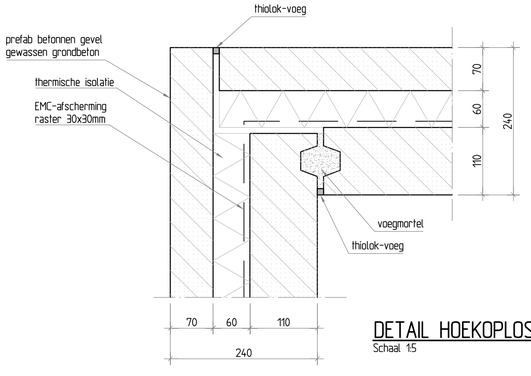


DOORSNEDE A-A

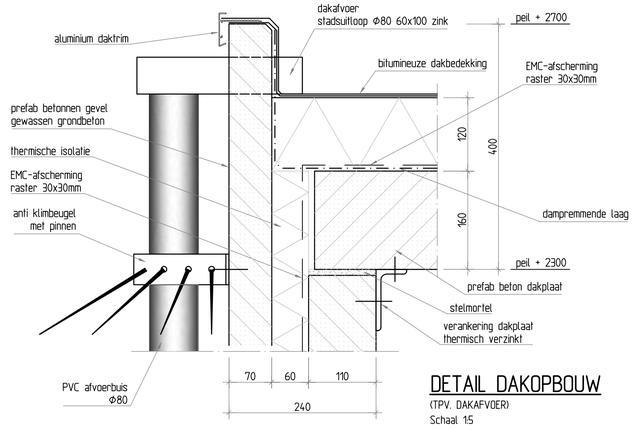


DOORSNEDE B-B

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

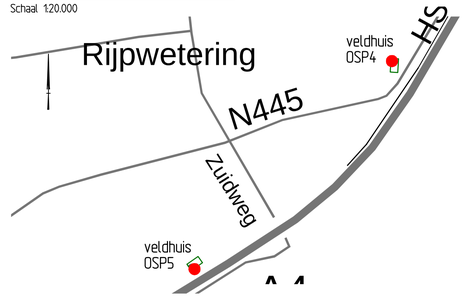
punt A	X=101418.313	Y=467342.344
punt B	X=101413.318	Y=467342.568
punt C	X=101418.447	Y=467345.341
punt D	X=101413.452	Y=467345.565

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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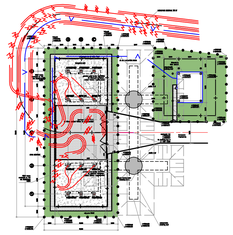
Randstad 380kV Noordring

			P. de Jager	A. Hogenboom
			Controleur	Vrijgegeven door
Omschrijving: Definitief Ontwerp Opstijgpunten Veldhuis OSP4 en OSP5	03			
	02	isometr. projectie verw.	01-11-2013	R.G.J. Caspers
	01	zie onder opmerkingen	04-10-2013	R.G.J. Caspers
	Rev.	Wijziging	Datum	Naam
	Schaal: 1:5 / 1:50		Formaat: A1	
Project: Randstad 380kV Noordring	Naam: R.G.J. Caspers		Datum: 06-08-2013	

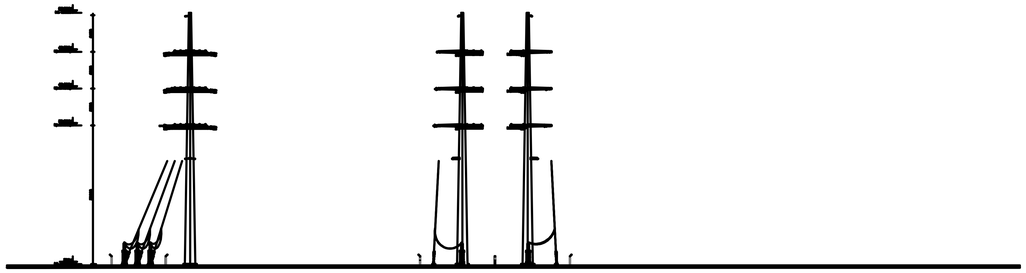
TenneT Taking power further

Tekeningnummer: R3N-TEK-0084 blad 001

AutoCAD filename: Systm:

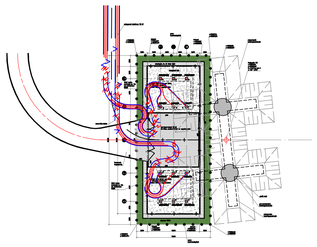


Overzicht OSP bij mast 109
Schaal 1:500

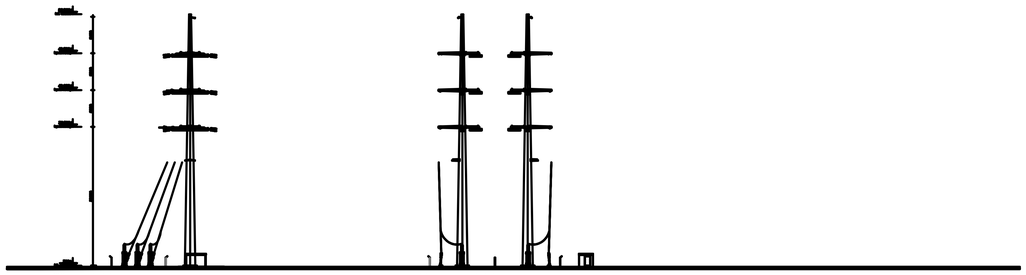


Zijaanzicht
Schaal 1:500

Vooraanzicht
Schaal 1:500

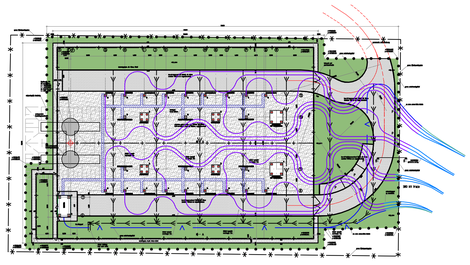


Overzicht OSP bij mast 123
Schaal 1:500

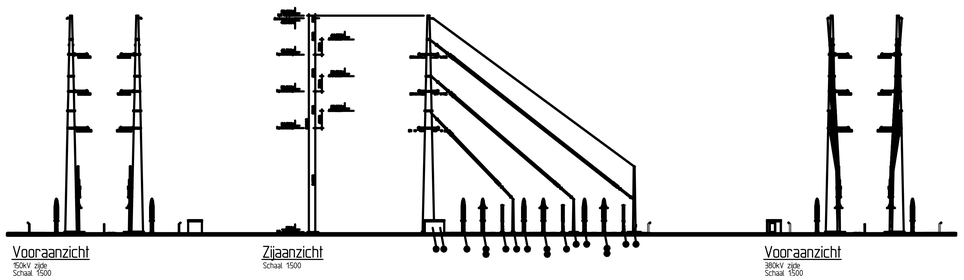


Zijaanzicht
Schaal 1:500

Vooraanzicht
Schaal 1:500



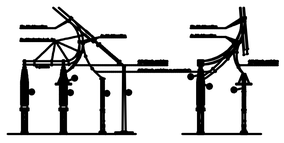
Overzicht OSP4 bij mast 154
Schaal 1:500



Vooraanzicht
150kV zijde
Schaal 1:500

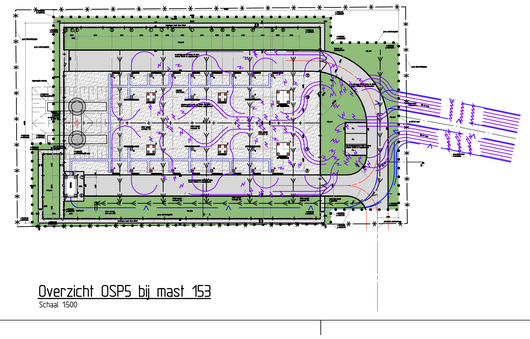
Zijaanzicht
Schaal 1:500

Vooraanzicht
380kV zijde
Schaal 1:500

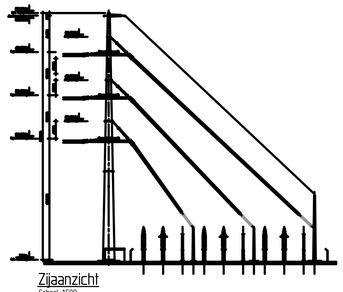


Zijaanzicht
Zakenden 380kV zijde
Schaal 1:100

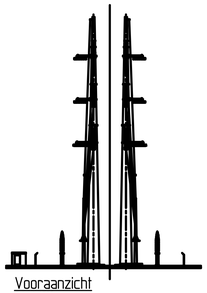
Vooraanzicht
Zakenden 380kV zijde
Schaal 1:100



Overzicht OSP5 bij mast 153
Schaal 1:500



Zijaanzicht
Schaal 1:500



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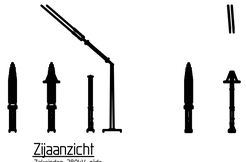
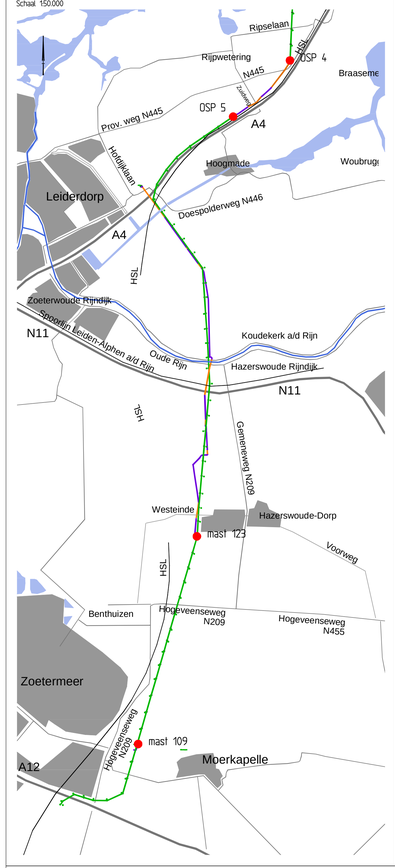


Zijaanzicht
Zakenden 380kV zijde
Schaal 1:100

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000



OPMERKINGEN:

- Overzicht: Maten in meters tenzij anders aangegeven.
- Aanzichten: Maten in millimeters tenzij anders aangegeven.
- Hooglematen in meters ten opzichte van NAP.
- Aanzichten gebaseerd op:
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  - 000.007.40 0041232 120471-M106-00-01-002_V00.pdf, versie 0, d.d. 31-08-2012;
  - 000.007.40 0041938 120471-OSP4-00-01-002_V00.pdf, versie 0, d.d. 31-08-2012;
  - 000.007.40 0041142 120471-OSP5-00-01-002_V00.pdf, versie 0, d.d. 31-08-2012;

Combining Knowledge and Experience

bam COFELY FABRICOM

Randstad 380kV Noordring

		P. de Jager	A. Hogenboom
		Getekend	Vrijgegeven door

Definitief Ontwerp
Opstijgpunten
Aanzichten opstijgpunten

Beschrijving

Rev.	Wijziging	Datum	Naam
03			
02			
01			

Schaal: 1:200/1:100 Formaat: A0

Project: Randstad 380kV Noordring

Naam: M. Vissers Datum: 01-11-2013

TenneT Taking power further

Tekeningnummer: R3N-TEK-0136 blad 001

AutoCAD filenaam: Sjabl:

Bijlage 8

Gegevens tijdelijke 150 kV verbinding

Ontwerp omleiding M74

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	14-02-2014	Eerste versie
01	04-04-2014	Aangepast aan de hand van een nieuwe versie van de overzichtstekeningen
02	25-04-2014	Toevoeging aangepaste werkmethode voor het amoveren van de omleiding

Documentnummer: R3N-OWR-0051

Opsteller	*Controleur*	*Vrijgever*
Koen Pieters Project Leider	Pieter de Jager Ontwerp Manager	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
Michaël Desmet	Cofely Fabricom
Koen Pieters	Cofely Fabricom
Hein Pijnappel	Mott McDonald

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Indien documenten worden geprint, geldt het volgende: een geregistreerde kopie is geldig vanaf de datum van uitgifte. Bij uitgifte van een document met een hoger revisienummer verliest de voorgaande versie automatisch haar geldigheid. Kopiehouders dienen het voorblad van een ongeldige versie te markeren met een diagonale lijn samen met de tekst 'vervallen'.

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

Inhoudsopgave

Referentie lijst *3*
1. Inleiding *4*
2. Drie circuit TIJDELIJKE verbinding aan mast 074 ..... *5*
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2.2. Lengteprofiel 5
2.3. Mastbeeld 6
2.4. Fundatie 6
2.5. VNB ombouwplan 7
2.6. Versterkingen M73 en M75 7
2.7. Werkmethode amoveren omleiding 8
3. Bijlagen *8*
Bijlage 1: Lengteprofiel omleiding M74 9
Bijlage 2: VNB ombouwplan 10

Referentie lijst

Ref	Document naam
[A]	R3N-TEK-0006-07 overzichtstekening blad 7 van 20 mast147-143; R3N-TEK-0123-07 overzichtstekening blad 6 van 20 mast75-74;
[B]	R3N-TEK-0182 Tijdelijke mast YMM74
[C]	R3N-PLA-0005-01 VNB Plan
[D]	R3N-PLN-0001 Planning
[E]	R3N-OWR-0055-00.01 Controle berekeningen M73 en M75

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).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

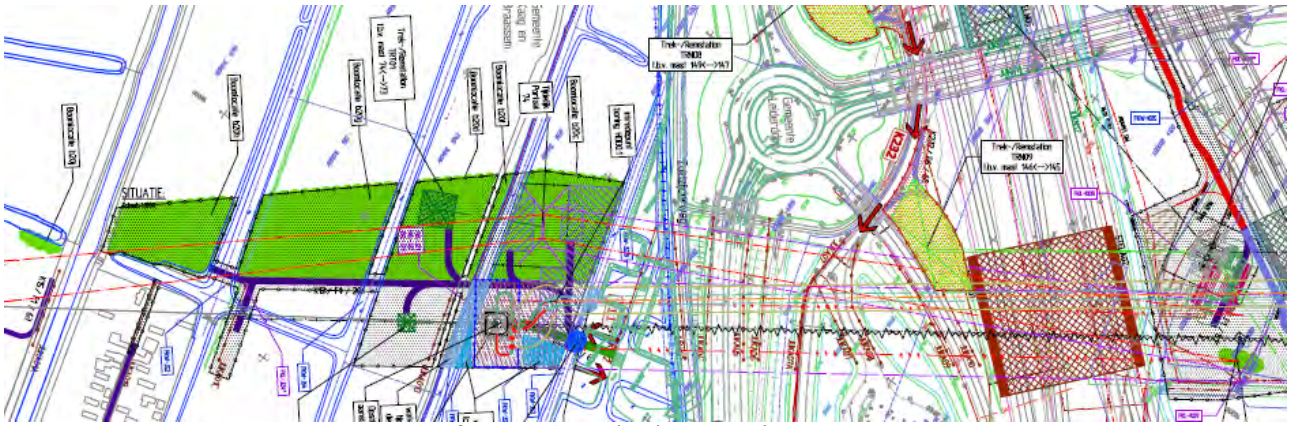
- Het ontwerp van een 3 circuit omleiding tussen mast 73 en mast 75 (150kV)

2. DRIE CIRCUIT TIJDELIJKE VERBINDING AAN MAST 074

Situatie schets: Aan mast 74 wordt de nieuwe ondergrondse 150kV lijn gekoppeld aan de bestaande 150kV luchtlijn naar Leiden. Mast 74 moet dus worden vrijgemaakt om van een half verankering te worden omgebouwd naar een OSP. De bestaande 150kV lijn zal hiervoor worden omgeleid via een tijdelijke mast aan de noordkant van oorspronkelijke lijn.

2.1. OMGEVINGSIMPACT

Voor het plaatsen van de tijdelijke mast zal er een oppervlakte van 50 x 50m moeten worden vrijgemaakt, ook onder de lijn moet er voldoende ruimte vrij zijn. Onder de lijn zal er een strook bomen moeten worden gekapt (groene zone). Zie ref [A] voor meer detail.

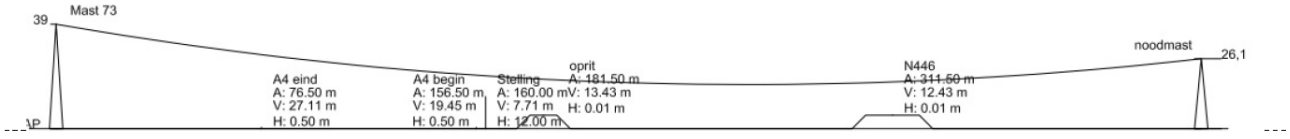


Figuur 1: Omgevingsimpact rond mast 74

Aangezien de lijnen van mast 74 naar de tijdelijke mast worden overgebracht zal het aantal beschermingen worden uitgebreid. Over de A4 (+ op-en afritten) zal er gewerkt worden met stellingen en netten. Langs de N446 wordt het aantal jukken verdubbeld en aan de volkstuintjes zullen er extra maatregelen getroffen worden.

2.2. LENGTEPROFIEL

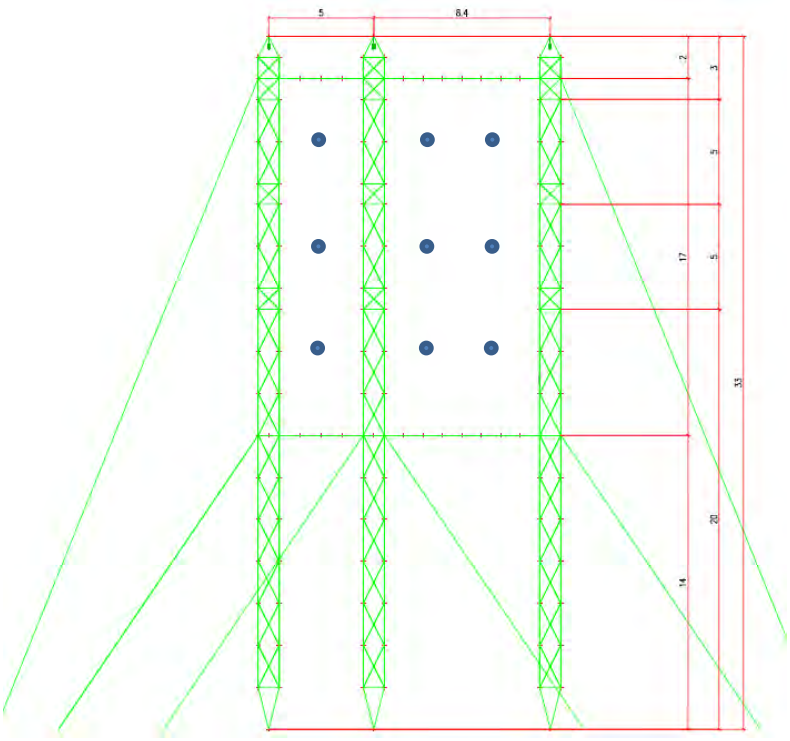
Voor de hoogte van de omleiding tussen M73 en de tijdelijke mast is er rekening gehouden met enkele bepalende obstakels: N446 (5m), Oprit A4 (5m) en de beschermingen over de A4 (12m). De kleinste tussen afstand is 7,71m wat voldoende is volgens de NEN norm. Zie bijlage 1 voor meer detail. In het portaal tijdelijke mast - M75 zullen er enkele bomen gekapt moeten worden.



Figuur 2: Lengte profiel Mast 73 – tijdelijke mast

2.3. MASTBEELD

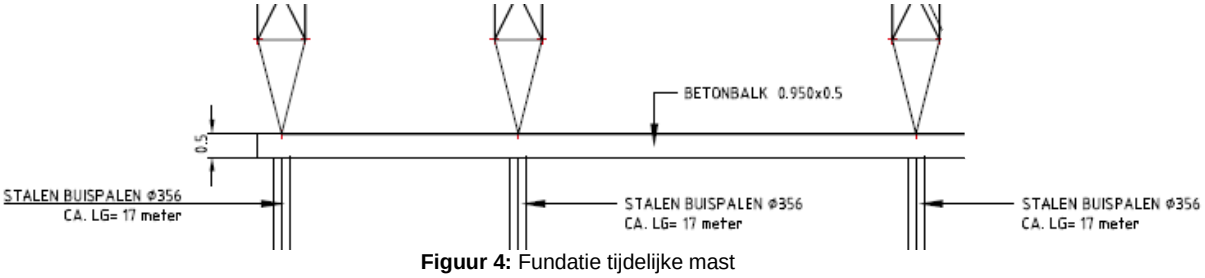
De tijdelijke mast zal bestaan uit een gesloten frame, verankerd met kabels naar de grond.
De drie circuits worden verticaal boven elkaar gemonteerd. Zie ref [B] voor een detail tekening met afmetingen. Er is voor deze opstelling gekozen met het oog op minimale onderlinge afstanden, obstakels, A4, locatie van de mast, hoek, methode van het overbrengen van de geleiders,…



Figuur 3: Mastbeeld tijdelijke mast

2.4. FUNDATIE

Als fundatie worden er 3 stalen buispalen van 17m (ϕ 356 mm) in de grond geheid met daarop een betonnen balk van 14,5 x 0,95 x 0,5m. De verbinding van het portaal naar de betonnen balk gebeurt middels ingestorte ankers. Zie ref [B] voor een overzicht.



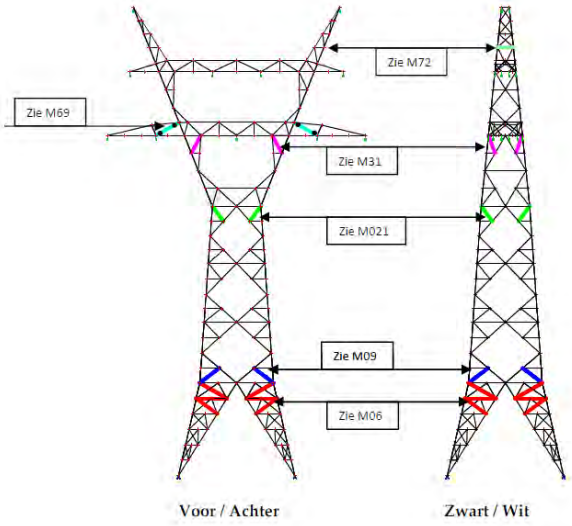
Figuur 4: Fundatie tijdelijke mast

2.5. VNB OMBOUWPLAN

De werkmethode is op zo'n manier opgesteld dat er tijdens de werken ten alle tijden 1 circuit in dienst is en 1 in stand-by. Zie bijlage 2 voor de verschillende stappen en een visuele voorstelling. Voor de algemene planning zie ref [C] en [D].

2.6. VERSTERKINGEN M73 EN M75

Door de hoek en het hoogte verschil die de omleiding naar het tijdelijk portaal te weeg brengt zullen masten 73 en 75 op verschillende plaatsen in hun structuur versterkt moeten worden.



Figuur 5: Versterkingen M55

Ook voor de fundering van masten 73 en 75 zijn er aanvullende maatregelen nodig. Bij de situatie waarbij de palen op trek komen te staan voldoen de huidige funderingen niet. Om de te grote trekspanningen op te vangen worden er extra grout ankers geplaatst. Meer details vindt u in ref [E].

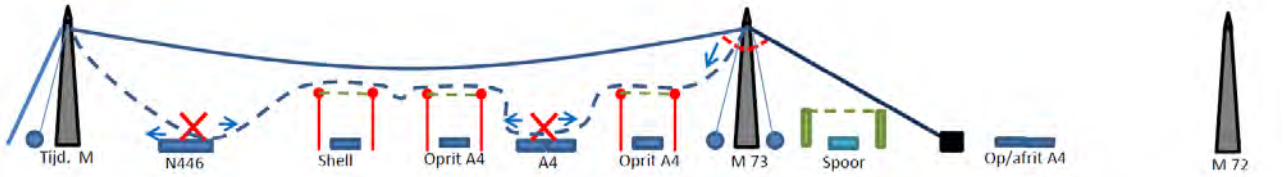
2.7. WERKMETHODE AMOVEREN OMLEIDING

Op het moment dat de ondergrondse kabels zijn geïnstalleerd zal de omleiding in zijn geheel worden verwijderd. Aangezien de geleiders tussen mast 72 en de tijdelijke mast zowel de A4 als de HSL kruist is er een aangepaste werkmethode uitgewerkt in samenspraak met de verschillende instanties.

Het amoveren zal in twee stappen verlopen. Eerst zullen de geleiders tussen M72 en M73 worden weggehaald, hiervoor worden er jukken aan weerskanten van de op en afritten geplaatst en stellingen aan de HSL, beide worden overspannen met netten. De geleiders worden één voor één gecontroleerd naar onderen gebracht en geknipt. Aangezien mast 73 niet sterk genoeg is om maar aan één kant geleiders te hebben hangen zal er voor elke verwijderde geleider een tui worden getrokken naar een ballast en zo de balans van de mast verzekeren.

Figuur 6: Fase 1 amoveren tussen M72 en M73

Voor het stuk tussen de mast 73 en het tijdelijke portaal zullen we de A4 voor enkele nachten omleiden via de op en afritten, de N446 zal tijdelijke worden gesperd. De op en afritten worden beschermd met netten zoals voorgesteld in het onderstaande schema. Wanneer de omleidingen zijn gerealiseerd worden de geleiders wederom gecontroleerd naar onderen gebracht en geknipt op verschillende plaatsen.



Figuur 7: Fase 2 amoveren tussen M73 en het tijdelijke portaal

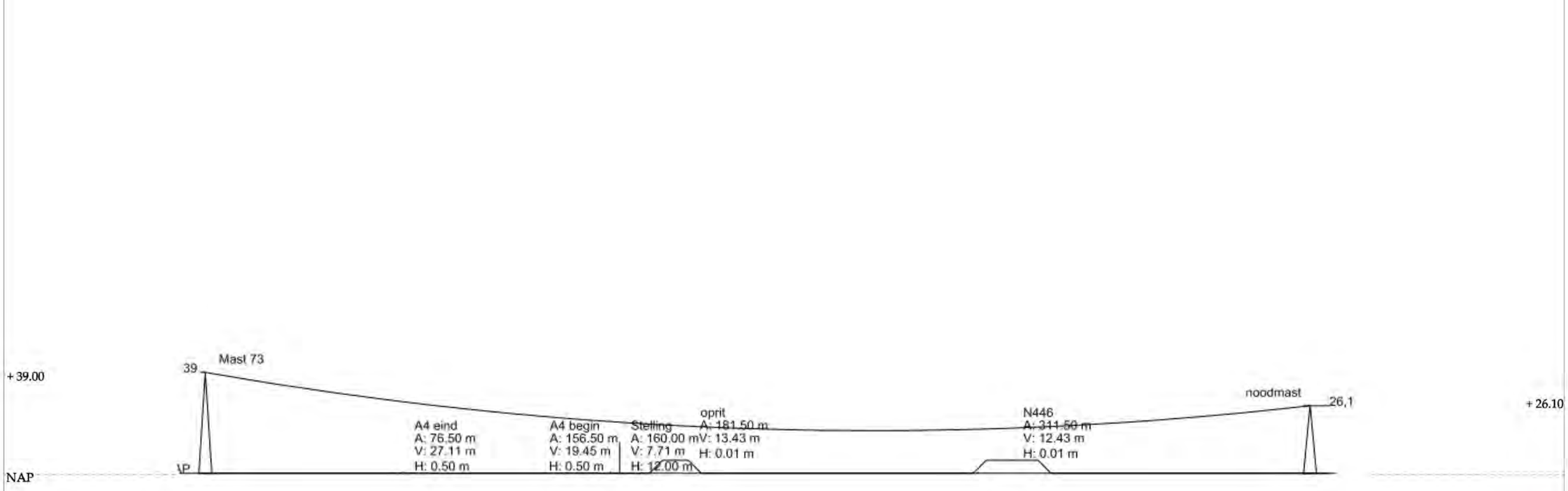
3. BIJLAGEN

Bijlage 1 Lengte profiel omleiding M74

Bijlage 2 VNB ombouwplan

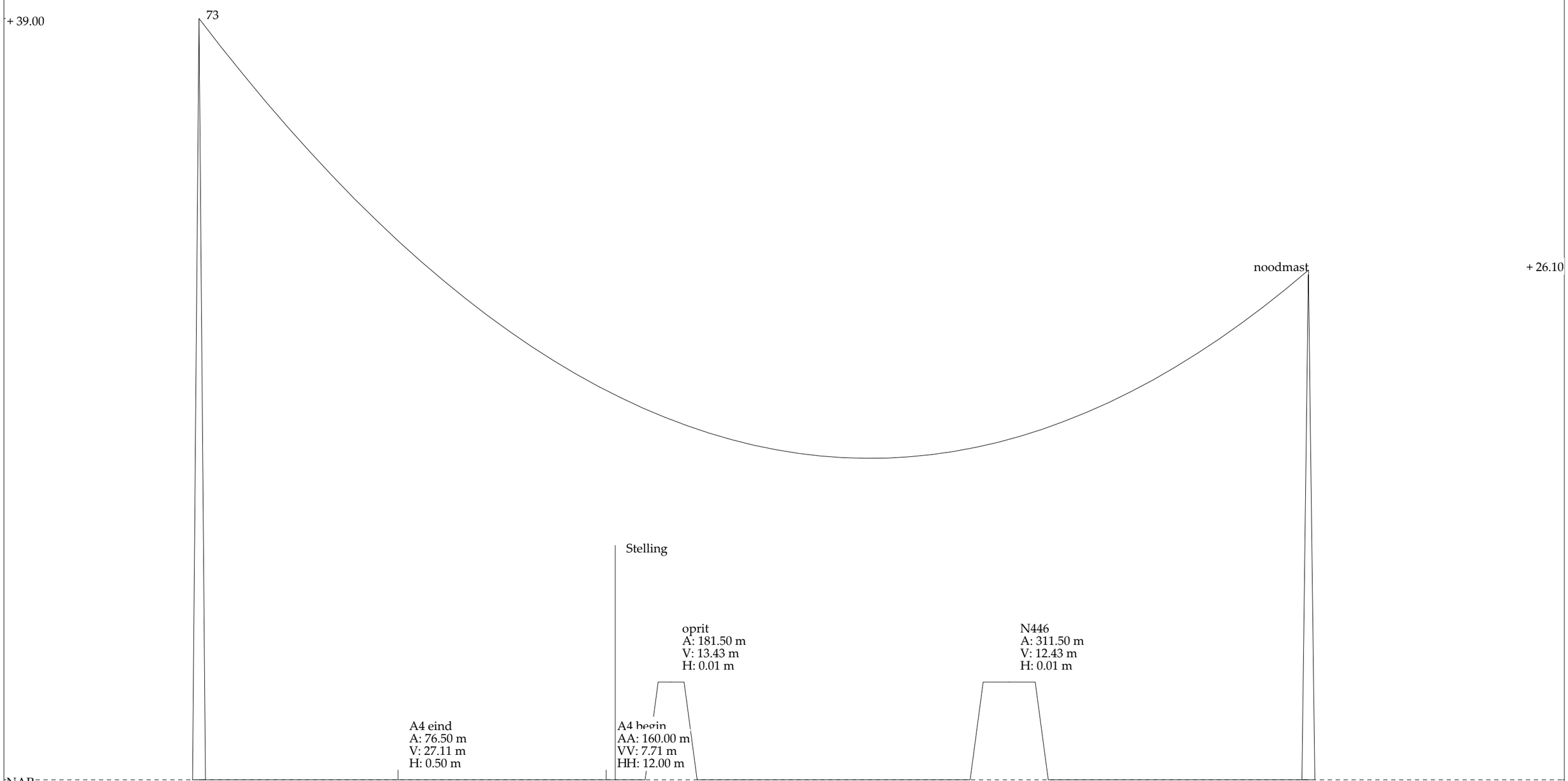
BIJLAGE 1: LENGTEPROFIEL OMLEIDING M74

Bestand:	13039a_nood_verhoogd	Geleidertype :	CU185	Temperatuur :	10 °C	Veld :	1	Lengte :	426.52 m	Sch. hor. :	1 : 1500
Vak :		Plaats :	fase ondertr	Trekkracht :	24895 N	Doorh. t.o.v. hoogste mast :			22.54 m	Sch. vert.:	1 : 1500



Naam hoogspanningslijn:		Omschrijving veld:	
Omschrijving vak:	73 - 74	73 - 74	D&C Software Zeegprogrammatuur versie 9.0

Bestand:	13039a_nood_verhoogd	Geleidertype :	CU185	Temperatuur :	10 °C	Veld :	1	Lengte :	426.52 m	Sch. hor. :	1 : 1500
Vak :		Plaats :	fase ondertr	Trekkracht :	24895 N	Doorh. t.o.v. hoogste mast :			22.54 m	Sch. vert.:	1 : 200



Naam hoogspanningslijn:		Omschrijving veld:		
Omschrijving vak:	73 - 74	73 - 74	D&C Software Zeegprogrammatuur versie 9.0	

BIJLAGE 2: VNB OMBOUWPLAN

Scenario Omleiding M74

Dag	Werk omschrijving	Schema	VNB
1	Versterken van mast lichaam M73 en M75	/	/
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	Versterken 1 kant van mast kop M73 en M75	/	Wit + Grijs
12			
13			
14			
15			
16	Versterken 2e kant van mast kop M73 en M75	/	Grijs + Zwart
17			
18			
19			
20			
21	Montage tijdelijke mast	Stap 1	/
22			
23			
24			
25			
26			
27			
28			
29			
30			
31	Afstand houders circuit wit uit portaal M73-74 en M74-75 fietsen	Stap 2	Wit + Grijs
32	Op poelie leggen van de 3 fase draden in circuit Wit		
33	Klaarmaken van de tuien		
34	Optuien Mast 75	Stap 3/4	Wit + Grijs
35	Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast)		
36	Kabels in de tijdelijke mast hijsen		
37	Overbrengen aardkabel		
38	Afwerken van verankering circuit Wit tijdelijke mast	Stap 5	Wit + Grijs
39			
40	Afstand houders circuit wit terug plaatsen		
41	Controle TenneT voor indienstname circuit Wit		Wit + Grijs
42	Afstand houders circuit Grijs uit portaal M73-74 en M74-75 fietsen	Stap 6	Zwart + Grijs
43	Op poelie leggen van de 3 fase draden in circuit Grijs		
44	Klaarmaken van de tuien		
45	Optuien Mast 75	Stap 7/8	Zwart + Grijs
46	Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast)		
47	Kabels in de tijdelijke mast hijsen		
48	Afwerken van verankering circuit Grijs tijdelijke mast	Stap 9	Zwart + Grijs
49			
50	Afstand houders circuit Grijs terug plaatsen		
51	Afstand houders circuit Zwart uit portaal M73-74 en M74-75 fietsen	Stap 10	Zwart + Grijs
52	Op poelie leggen van de 3 fase draden in circuit Zwart		
53	Klaarmaken van de tuien		
54	Optuien Mast 75	Stap 11/12	Zwart + Grijs
55	Knippen van de fase kabel Kabel naar de grond brengen en persen van verlengstuk (tussen M73 en tijdelijke mast)		
56	Kabels in de tijdelijke mast hijsen		
57	Overbrengen aardkabel		
58	Afwerken van verankering circuit Zwart tijdelijke mast	Stap 13	Zwart + Grijs
59			
60	Afstand houders circuit Zwart terug plaatsen		
61	Controle TenneT voor indienstname circuit Grijs + Zwart		Zwart + Grijs

Scenario Omleiding M74

Dag	Werk omschrijving	Schema	VNB
Terugplaatsen kabels van tijdelijke mast naar nieuwe mast 74			
1	Afstand houders circuit Zwart uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Zwart + Grijs
2	Optuien Mast 75 Overbrengen circuit zwart + aardkabel naar nieuwe mast 74 (exclusief aansluiting op OSP)		Zwart + Grijs
3			
4			
5	Afwerken van verankering circuit Zwart nieuwe mast 74		Zwart + Grijs
6			
7	Afstand houders circuit Zwart terug plaatsen		Zwart + Grijs
8	Afstand houders circuit Grijs uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Zwart + Grijs
9	Optuien Mast 75 Overbrengen circuit grijs naar nieuwe mast 74 (exclusief aansluiting op OSP)		Zwart + Grijs
10			
11			
12	Afwerken van verankering circuit Grijs nieuwe mast 74		Zwart + Grijs
13			
14	Afstand houders circuit Grijs terug plaatsen		Zwart + Grijs
15	Controle TenneT voor indienstname circuit Grijs + Zwart		Zwart + Grijs
16	Afstand houders circuit Wit uit portaal M73-tijdelijke mast en tijdelijke mast -M75 fietsen		Grijs + Wit
17	Optuien Mast 75 Overbrengen circuit wit + aardkabel naar nieuwe mast 74 (exclusief aansluiting op OSP)		Grijs + Wit
18			
19			
20	Afwerken van verankering circuit Wit nieuwe mast 74		Grijs + Wit
21			
22	Afstand houders circuit wit terug plaatsen		Grijs + Wit
23	Controle TenneT voor indienstname circuit Wit		Grijs + Wit

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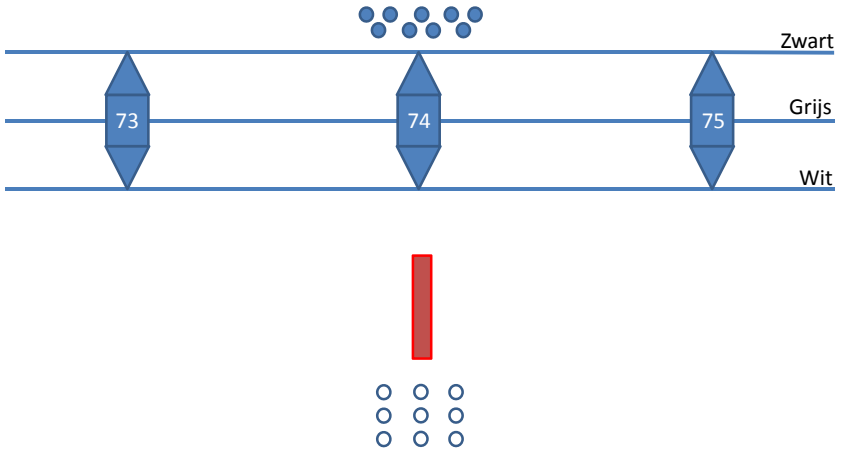
GDF SUEZ

Scenario Omleiding M74

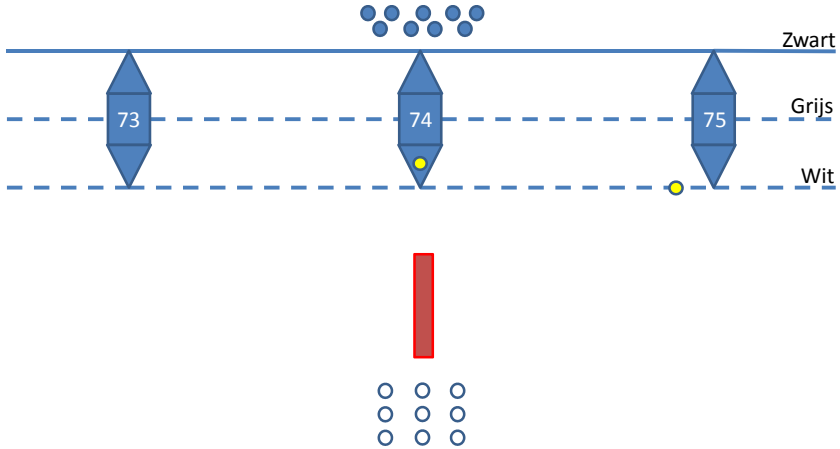
Stap 1: Montage tijdelijke mast



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

Stap 2: Voorbereiden circuit wit + eventueel versterken van M73



VNB
In dienst
Mast op/af tuien

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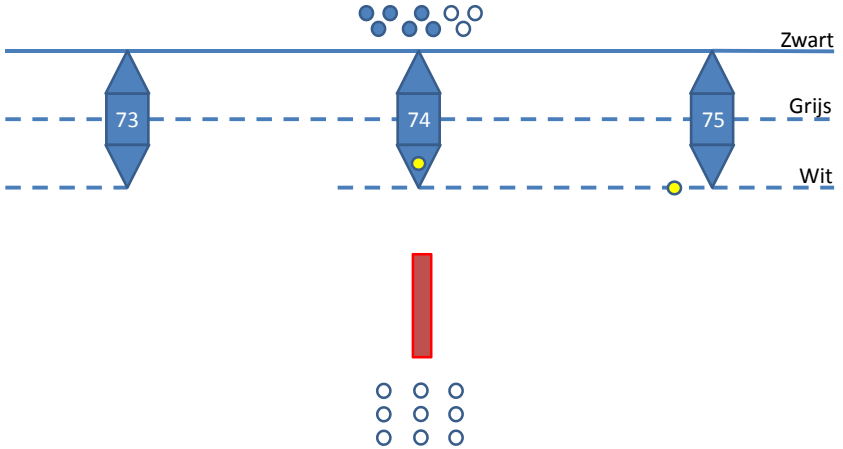
Stap 3: Knippen fase draden circuit wit



VNB
In dienst
Mast op/af tuien

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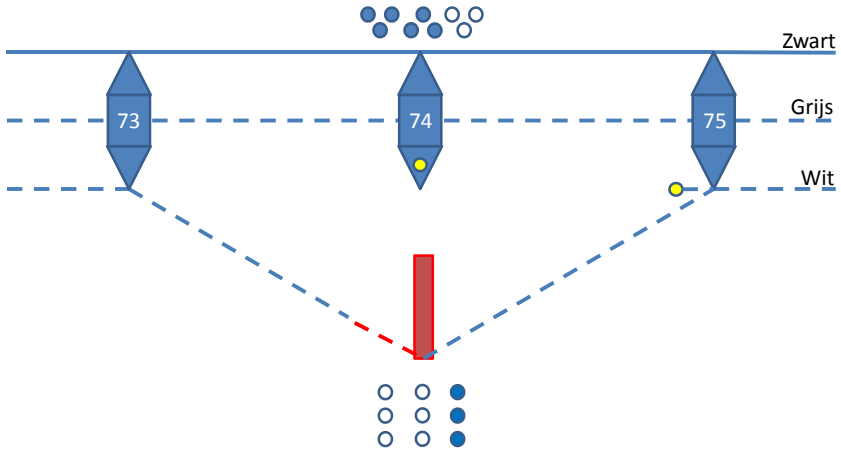
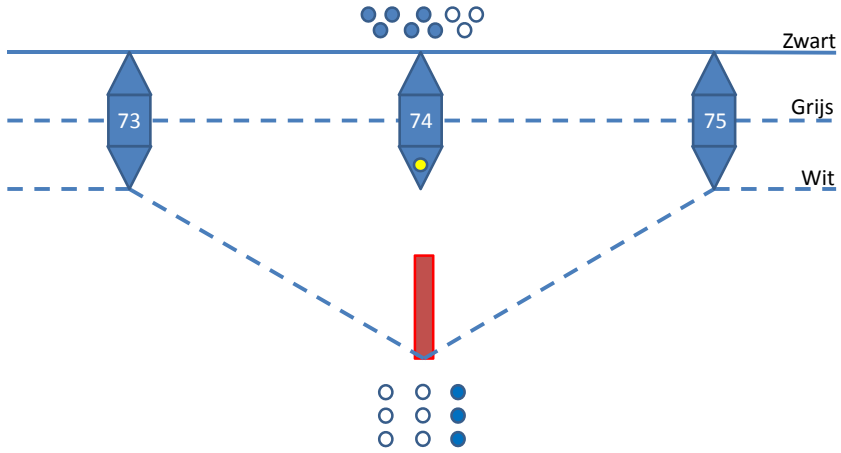
Stap 4: Overbrengen + verlengen circuit wit



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

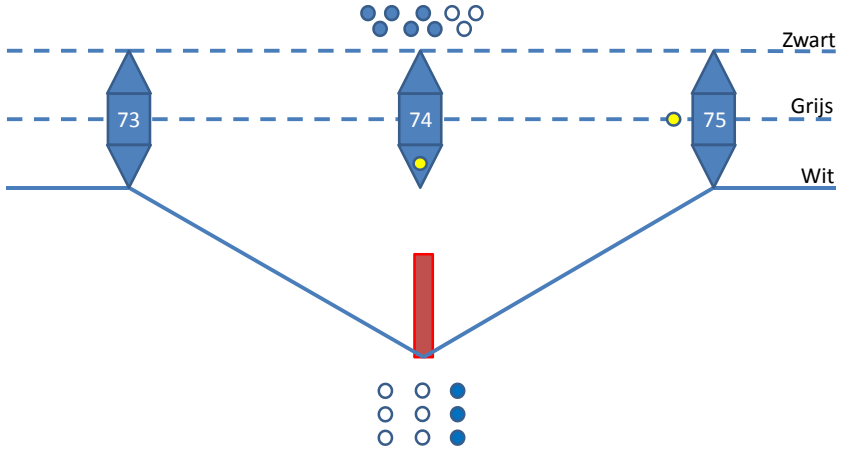
Stap 5: Afwerken circuit wit



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

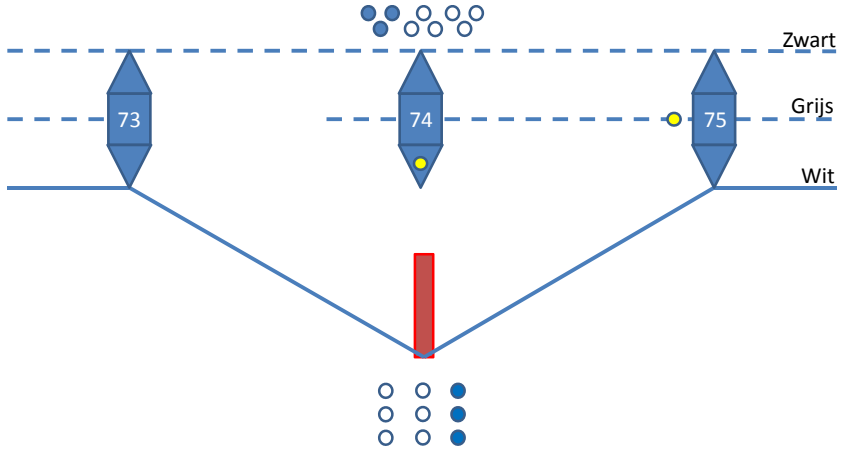
Stap 6: Voorbereiden circuit grijs + eventueel versterken van M73



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

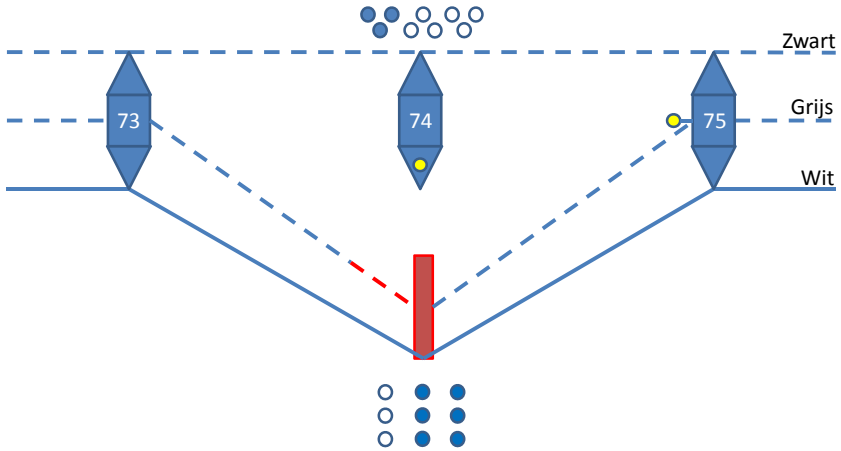
Stap 7: Knippen fase draden circuit grijs



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

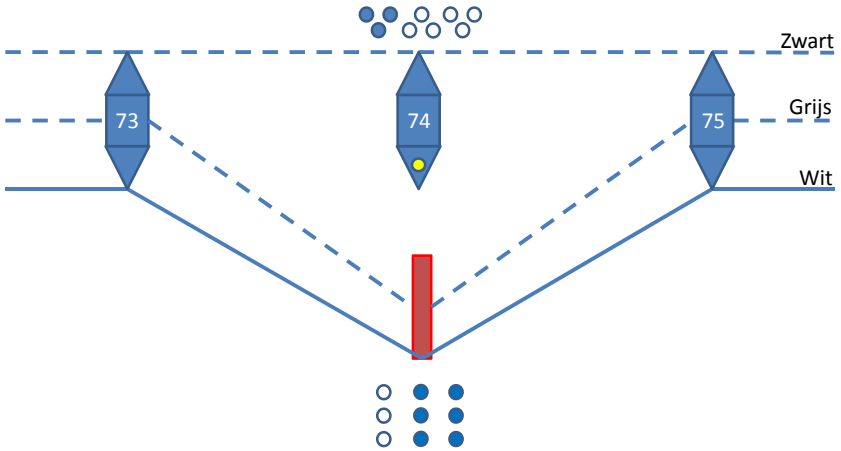
Stap 8: Overbrengen + verlengen circuit grijs



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

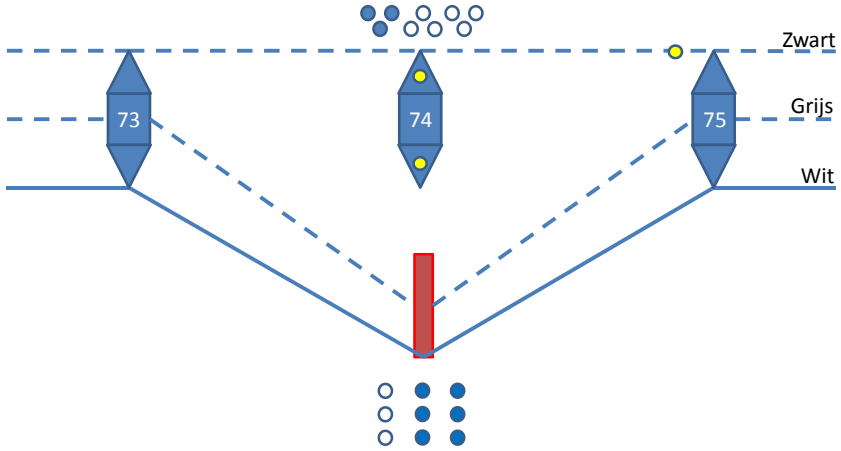
Stap 9: Afwerken circuit grijs



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

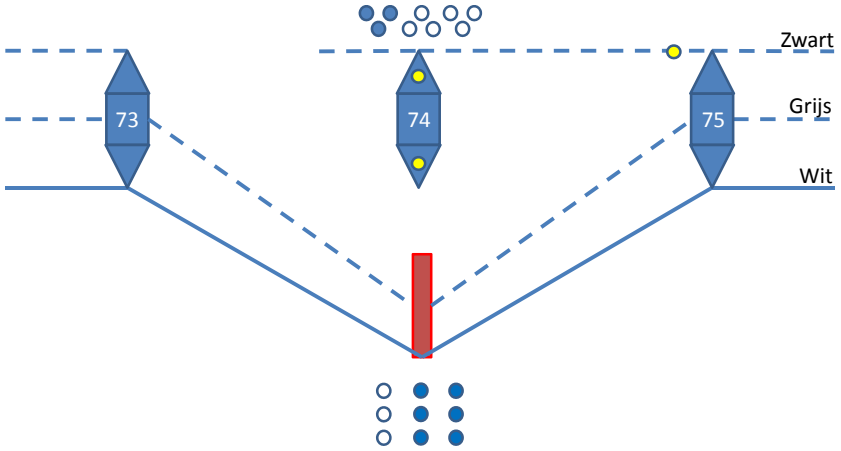
Stap 10: Voorbereiden circuit zwart + eventueel versterken van M73



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

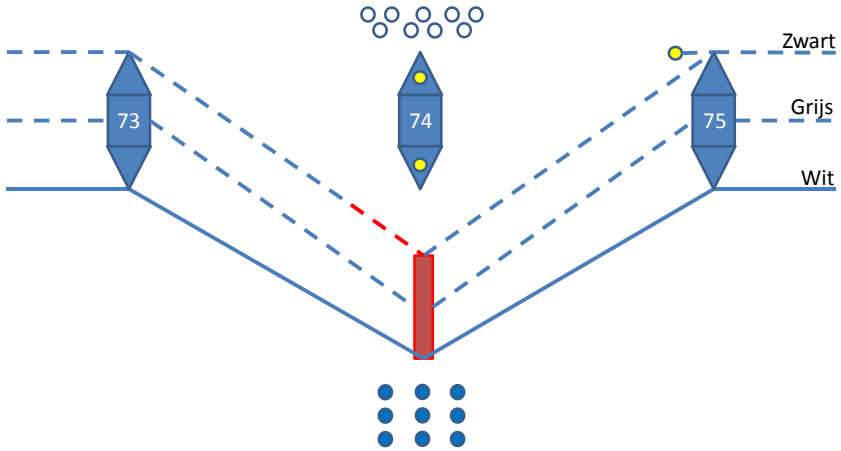
Stap 11: Knippen fase draden circuit zwart



VNB
In dienst
Mast op/af tuien

COFELY FABRICOM

Stap 12: Overbrengen + verlengen circuit zwart



VNB
In dienst
Mast op/af tuien

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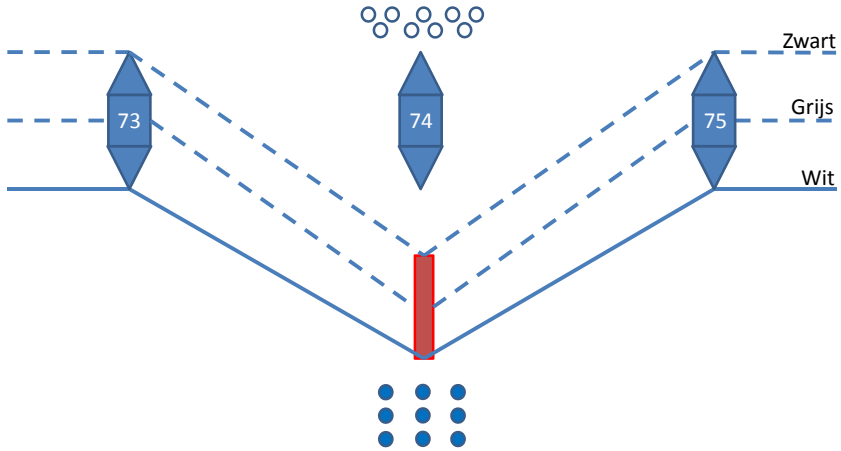
Stap 13: Afwerken circuit zwart



VNB
In dienst
Mast op/af tuien

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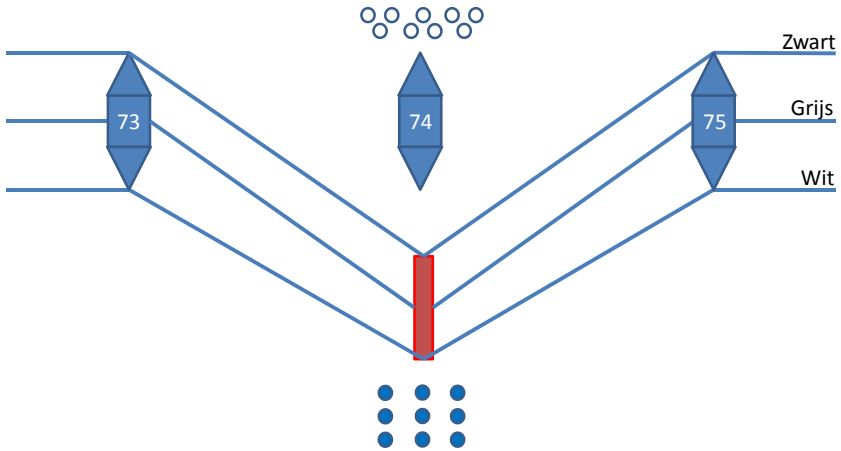
Stap 14: Omleiding in dienst



VNB
In dienst
Mast op/af tuien

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VERKLARING - ALGEMEEN

- Bestaande topografie
- Waterlijn
- Kadastrale grens en sectie/perceelnummer; uit bestand Kadperc_Bls_Zuid_Ringvaart_1905.DWG (Tennet)
- Afbreeklijn
- As-lijn
- Gemeentegrens (2010)

VERKLARING - KLIC

- Gasleiding
- Gasleiding gasunie
- Gasleiding hd
- Gasleiding ld
- Waterleiding
- Warmtenet
- Koudenet
- Chemie
- Brandstof transportleiding
- Riolering transportleiding
- Hemelwater transportleiding
- Vuilwater transportleiding
- Drainage
- Persleiding
- Vacuumleiding
- Duiker
- Straatkolk
- Trottoirkolk
- Hwa put
- Vwa put
- Drainage put
- Persleiding nivoput
- Persleiding pompput
- Gemaal
- Mantelbuis
- Glasvezel
- Cai
- Data
- Hoogspanning
- Middenspanning
- Laagspanning
- Vri (verkeersregelinstallatie)
- Ov (openbare verlichting)
- Prorail overig
- Kabelkoker
- Kabeltrace vervallen
- Gestuurde boring derden
- Zinker
- Lichtmast

VERKLARING - LEIDINGWERK:

- Aanbrengen kabel 150 kV
- Aanbrengen kabel 380 kV
- Aanbrengen las mof
- Aanbrengen ondergrondse aardingspaal verbinding met aardingskabels naar mof
- Aanbrengen bovengronds combi trace (150 kV + 380 kV)
- Aanbrengen bovengronds trace 380 kV
- Gevarenzone bestraand bovengronds kabeltrace
- Beschikbare ruimte om kabels te installeren
- Te verwijderen bovengrondse trace 150 kV
- Verwijderen kabel 150 kV
- Verwijderen kabel 150 kV (hergebruik)
- Bestaande, te handhaven kabel 150 kV
- Aanbrengen gestuurde boring 150 kV
- Aanbrengen gestuurde boring 380 kV
- Aanbrengen gestuurde boring 380 kV
- Verleggen mantelbuis met glasvezelkabel
- Ontluchtingsput met straalpot bij uiteinde mantelbuis boring 380kV
- M3-4 Infiltratiepunt retourbemaling (met nummer)

VERKLARING - CIVIEL:

K75 / F5 / 374 Nummer bouwweg (K75) / type bouweg (F5) / lengte in meters (374)

- Bouweg type F1, riplaten lengterichting op maaiveld
- Bouweg type F2, riplaten lengterichting zandbed en doek
- Bouweg type F3, riplaten dwarsrichting zandbed en doek
- Bouweg type F4, riplaten lengterichting op houtsnippers en doek
- Bouweg type F5, riplaten dwarsrichting op houtsnippers en doek
- Bouweg type G1, funderingslaag, doek, zandbed, doek
- Bouweg type G2, funderingslaag en doek op bestaande verharding
- Permanente toegangsweg type H1, klinkerverharding, straatlaag, funderingslaag en zandbed
- Indicatie voertuigbeweging mastTransport op werkterrein (bochtstralen tot R=20m)
- Tijdelijke verharding middels riplaten
- Indicatieve werkgrens
- wegafzetting (barrier)
- retourbemalingsbuizen van bron naar retourbemalingsput(ten)
- Indicatie benodigd werkterrein
- Reservering kabel-haspel-opsteiplaats
- Reservering grondopslag uit ontgravingen
- Tijdelijke verharding bouwterrein van zand met riplaten
- Tijdelijk of permanent dempen van watergang
- Bouwhek
- indicatieve ontgravingslijn voor aanleg fundering
- funderingsconstructie
- hijdraden
- hijdelijk mastportaal
- Zone opstelplaats kraan ca. 12x20m
- Zone montageplaats portaal ca. 30x30m
- Grens onderhoudsgebied opstiggunt
- Zone retourbemalingsput ca. 10x10m
- Werkruimte t.b.v. montage & trekken mantelbuizen in boringen)
- Zone kraan amoveren mast opsteiruimte ca. 12x20m
- Zone afbraak maskop ca. 15x35m
- Zone afbraak mastfichaam ca. 30x30m
- Reservering voor ketenterrein
- Aanduiding kabel/leidingkruising met bouwwegen en/of leidingtrace
- Aanduiding meerdere kabel/leidingkruisingen met bouwweg en/of leidingtrace
- Aanduiding kruising watergang met bouwweg en/of leidingtrace
- Rem-/trekstation voor te amoveren bovengrondse hoogspanningsverbinding
- Trek-/Remstation voor tijdelijk bovengrondse hoogspanningsverbinding
- Ligging buitenste bovengrondse kabel tijdelijke hoogspanningspijlers
- J41 Openbare wegaansluiting (met nr.)
- Routering bouwverkeer
- Gebied met te verwijderen bossage en/of bomen, ivm. bouwwerkzaamheden
- Gebied met te verwijderen bossage en/of bomen, ivm. zakelijk recht bovengrondse hoogspanningsverbindingen
- JUKN01 Juk voor aanbrengen van bovengrondse hoogspanningsverbinding ter afscherming van obstakels. (door derden)
- Afscherming obstakels voor aanbrengen hoogspanningsverbinding d.m.v. een net en een stellage. (door derden)
- Afscherming obstakels voor amoveren hoogspanningsverbinding d.m.v. een net en stellage.
- Afscherming obstakels voor amoveren hoogspanningsverbinding d.m.v. een net en kraanopstelling
- JUKA04 Juk voor amoveren van bovengrondse hoogspanningsverbinding ter afscherming van obstakels.
- STELN02 Stelling (lxbxh 40x5x11m) t.b.v. aanbrengen van een net over obstakels. (door derden)
- Bouweg type F6, verharding t.b.v. trek-/remstations trekrichting
- Trek-/Remstation voor nieuwe bovengrondse hoogspanningsverbinding
- Indicatie benodigd werkterrein voor de aanleg van Trek-/Remstations voor nieuwe bovengrondse hoogspanningsverbinding

TOPOGRAFISCH FRAGMENT

Schaal 1:50.000

Combining Knowledge and Experience

bam COFELY FABRICOM

Randstad 380kV Noordring

P. de Jager — Cartrekker

E.Duwel — Vrijgegeven door

Oorzaak	Nr.	Wijziging	Datum	Naam
Definitief Ontwerp Algemeen Overzichtstekening, blad 7 van 20 (mast 147-143)	10	zie wijzigingspijlen	1-8-2014	RGJ Caspers
	9	zie wijzigingspijlen	24-4-2014	RGJ Caspers
	Rev.	Wijziging	Datum	Naam

Schaal: 1:1000 — Formaat: A0

Project: Randstad 380kV Noordring — Naam: R.G.J. Caspers — Datum: 19-7-2013

TenneT Taking power further

Tekeningnummer: R3N-TEK-0006 blad 1

AutoCAD filenaam: — System:

VERKLARING - ALGEMEEN

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- Duiker
- Straatkolk
- Trottoirkolk
- Hwa put
- Vwa put
- Drainage put
- Persleiding nootput
- Persleiding pompput
- Gemaal
- Mantelbuis
- Glasvezel
- Cai
- Data
- Hoogspanning
- Middenspanning
- Laagspanning
- Vri (verkeersregelinstallatie)
- Ov (openbare verlichting)
- Prorail overig
- Kabelkoker
- Kabeltrace vervallen
- Gestuurde boring derden
- Zinker
- Lichtmast

VERKLARING - LEIDINGWERK:

- Aanbrengen kabel 150 kV
- Aanbrengen kabel 380 kV
- Aanbrengen las mof
- Aanbrengen ondergrondse aardingsput verbinding met aardingskabels naar mof
- Aanbrengen bovengronds combi trace (150 kV + 380 kV)
- Aanbrengen bovengronds trace 380 kV
- Gevarenzone bestraand bovengronds kabeltrace
- Beschikbare ruimte om kabels te installeren
- Te verwijderen bovengronde trace 150 kV
- Verwijderen kabel 150 kV
- Verwijderen kabel 150 kV (hergebruik)
- Bestaande, te handhaven kabel 150 kV
- Aanbrengen gestuurde boring 150 kV
- Aanbrengen gestuurde boring 380 kV
- Aanbrengen gestuurde boring 380 kV
- Verleggen mantelbuis met glasvezelkabel
- Ontluchtingsput met straatpot bij uiteinde mantelbuis boring 380kV
- M3-4 Inwintelpunt retourbemaling (met nummer)

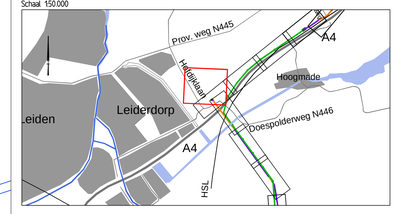
VERKLARING - CIVIEL:

K75 /F5 /374 Nummer bouwweg (K75) / type bouweg (F5) / lengte in meters (374)

- Bouweg type F1, riplaten lengterichting op maaiveld
- Bouweg type F2, riplaten lengterichting zandbed en doek
- Bouweg type F3, riplaten dwarsrichting zandbed en doek
- Bouweg type F4, riplaten lengterichting op houtsnippers en doek
- Bouweg type F5, riplaten dwarsrichting op houtsnippers en doek
- Bouweg type G1, funderingslaag, doek, zandbed, doek
- Bouweg type G2, funderingslaag en doek op bestaande verharding
- Permanente toegangsweg type H1, klinkerverharding, straatlaag, funderingslaag en zandbed
- Indicatie voertuigbeweging mastfransport op werkterrein (bochtstralen tot R=20m)
- Tijdelijke verharding middels riplaten
- Indicatieve werkgrens
- Grens onderhoudsgebied opstijgpunt
- wegafsetting (barrier)
- Zone retourbemalingsput ca. 10x10m
- retourbemalingsbuizen van bron naar retourbemalingsput(ten)
- Werkruimte t.b.v. montage & trekken mantelbuizen in boring(en)
- Indicatie benodigd werkterrein
- Reservering kabel-haspel-opstelplaats
- Zone kraan amoveren mast opstelruimte ca. 12x20m
- Reservering grondopslag uit ontgravingen
- Zone afbraak mastkop ca. 15x15m
- Tijdelijke verharding bouwterrein van zand met riplaten
- Zone afbraak mastschaam ca. 30x30m
- Tijdelijk of permanent dempen van watergang
- Reservering voor ketenterrein
- Bouwhek
- Aanduiding kabel/leidingkruising met bouwwegen en/of leidingtrace
- FKL-K07
- FKL-L11* Aanduiding meerdere kabel/leidingkruisingen met bouweg en/of leidingtrace
- FKW-K11 Aanduiding kruising watergang met bouweg en/of leidingtrace
- indicatieve ontgravingslijn voor aanleg fundering
- funderingsconstructie
- Rem-/trekstation voor te amoveren bovengrondse hoogspanningsverbinding
- Trek- /Remstation voor tijdelijk bovengrondse hoogspanningsverbinding
- Ligging buitenste bovengrondse kabel tijdelijke hoogspanningslijnen
- tuidraden tijdelijk mastportaal
- Zone opstelplaats kraan ca. 12x20m
- Zone montageplaats portaal ca. 30x30m
- J41 Openbare wegaanduiding (met nr.)
- Routering bouwverkeer
- Gebied met te verwijderen bossage en/of bomen, ivm. bouwwerkzaamheden
- Gebied met te verwijderen bossage en/of bomen, ivm zakelijk recht bovengrondse hoogspanningsverbindingen
- JUKN01 Juk voor aanbrengen van bovengrondse hoogspanningsverbinding ter afscherming van obstakels. (door derden)
- Afscherming obstakels voor aanbrengen hoogspanningsverbinding d.m.v. een net en stellage. (door derden)
- Afscherming obstakels voor amoveren hoogspanningsverbinding d.m.v. een net en stellage.
- Afscherming obstakels voor amoveren hoogspanningsverbinding d.m.v. een net en kraanopstelling
- JUKA04 Juk voor amoveren van bovengrondse hoogspanningsverbinding ter afscherming van obstakels.
- STELN02 Stelling (lxbxh 40x5x11m) t.b.v. aanbrengen van een net over obstakels. (door derden)
- Bouweg type F6, verharding t.b.v. trek-/remstations
- trekrichting
- Trek- /Remstation voor nieuwe bovengrondse hoogspanningsverbinding
- Indicatie benodigd werkterrein voor de aanleg van Trek-/Remstations voor nieuwe bovengrondse hoogspanningsverbinding

TOPOGRAFISCH FRAGMENT

Schaal 150.000



SITUATIE:

Schaal 1:1000

0 10 20 30 40 50 60 70 80 90 100 Meters

Combining Knowledge and Experience

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Randstad 380kV Noordring

	P. de Jager	E.Duvel
	Contructeur	Vrijgegeven door

Definitief Ontwerp
Algemeen
Overzichtstekening, blad 6 van 20 (mast 75-74)

Omschrijving

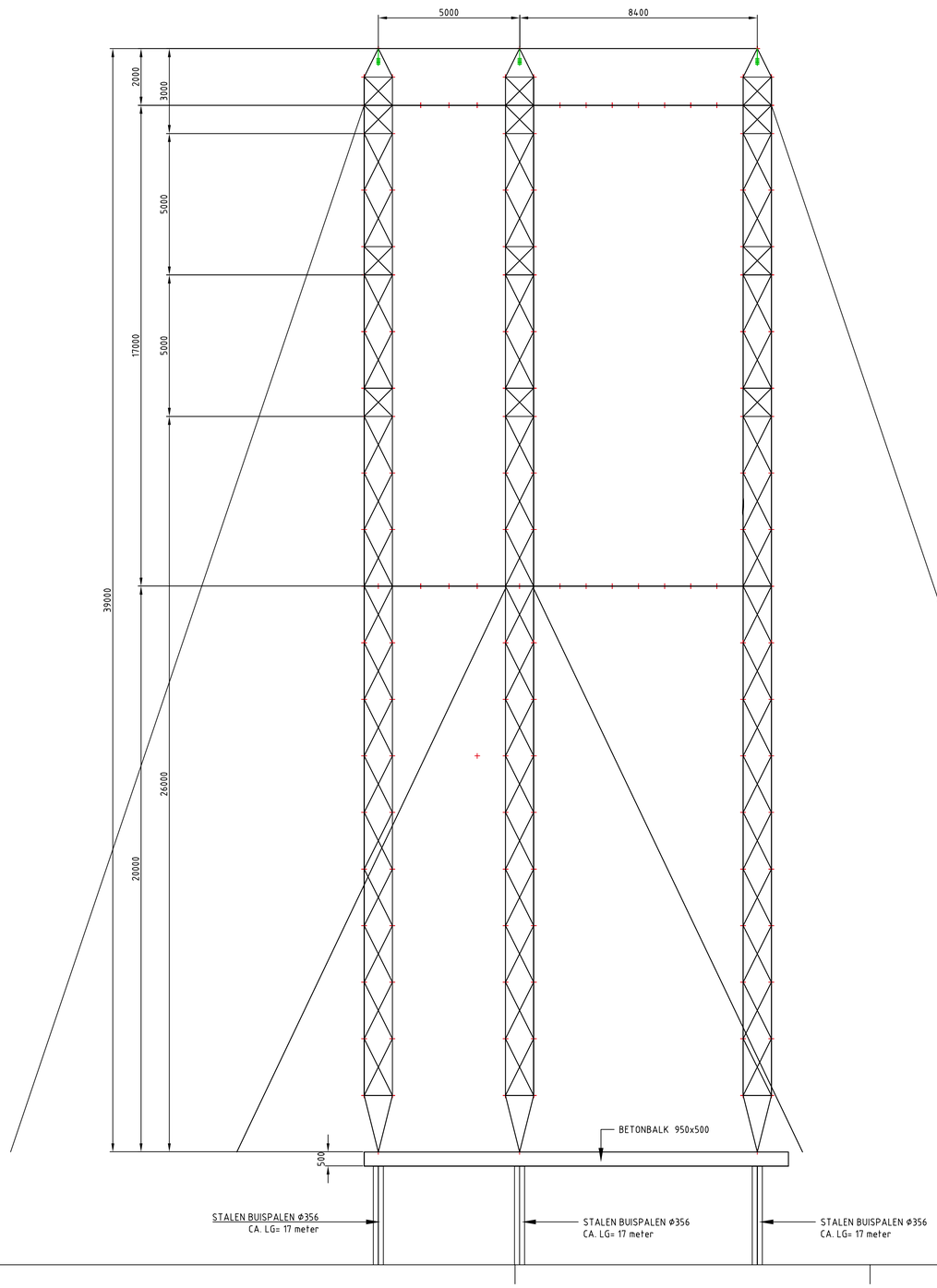
Rev.	Wijziging	Datum	Naam
10	zie wijzigingsplannen	1-8-2014	RGJ Caspers
9	zie wijzigingsplannen	24-4-2014	RGJ Caspers
Schaal	1:1000	Formaat	A0
Naam	R.G.J. Caspers	Datum	19-7-2013

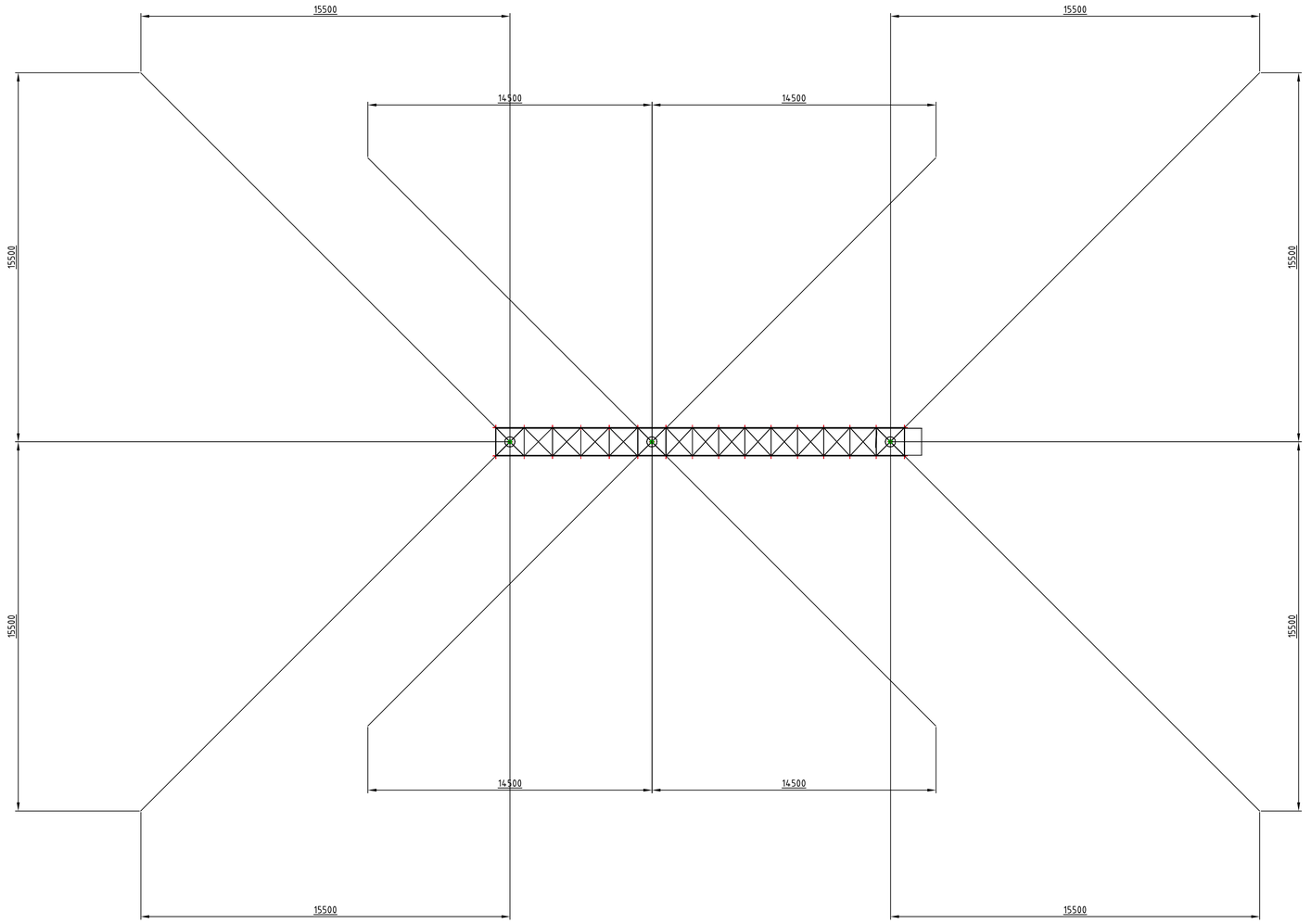
Project: Randstad 380kV Noordring

Tennet Taking power further

Tekeningnummer: R3N-TEK-0123 blad 1

AutoCAD-filenaam: Sysfile:





VERBINDING PORTAAL AAN BETONBALK MIDDELS INGESTORTE ANKERS.
AFMETINGEN EN AANTAL N.T.B.

STAAL KWALITEIT : S355

D&C DWG No: D14001 - 0300

D&C Check controle		J. Hollaar	W. van Bergen
		P. de Jager Controleur	E.Duwel Vrijgegeven door

Combining Knowledge and Experience

bam COFELY FABRICOM GOF SYEC

Randstad 380kV Noordring

D&C ENGINEERING design and construct

Omschrijving		Rev.	Wijziging	Datum	Naam
Definitief Ontwerp		03			
Mast amovatie systeem		02			
Tijdelijke mast YMM74		01			
Projekt: Randstad 380kV Noordring		Schaal: 1:150		Formaat: A1	
		Naam HWI		Datum 17-02-2014	

TenneT Taking power further

Tekeningnummer: R3N-TEK-0182 blad 001

AutoCAD filename: Syster:

VNB plan (Voorziening Niet Beschikbaar)

Project:
Randstad 380kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	18-7-2013	-
01	06-08-2013	RFA TenneT verwerkt (zijn met “rood” gemarkeerd)

Documentnummer: R3N-PLA-0005

Opsteller	*Verificateur*	*Vrijgever*
Erwin ten Cate Technisch Manager	Arjan Hogenboom Project Manager	Arjan Hogenboom Project Manager

Distributie

Naam	Bedrijf
Extern	
Guido Volman	TenneT TSO
Intern	
Arjan Hogenboom	BAM
Pieter de Jager	BAM
Eric van Rooijen	BAM
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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 de DO fase om een aanvraag te kunnen doen voor vergunningen.

2. PROJECT

In het project Randstad 380kV Noordring perceel 2 wordt 8900 meter van de nieuwe 150 kV-leiding en 1900 meter van de nieuwe 380 kV-leiding ondergronds aangebracht, waarbij 9000 meter gestuurde ondergrondse boringen worden uitgevoerd. Daarnaast worden 62 stuks funderingen voor de nieuwe masten, 2 opstijgpunten voor 380 kV en 2 afstappunten voor de 150 kV-kabels/geleiders gerealiseerd. Tevens worden 32 oude hoogspanningsmasten van de te vervangen bestaande 150 kV-geleiders geamoveerd en worden de funderingen gesloopt en verwijderd.

3. TRAJECT NOORDRING PERCEEL 2

Het traject van het project Randstad 380kV Noordring perceel 2 sluit aan op het traject van perceel 1, dat loopt vanaf het station Vijfhuizen in het noordwesten van de Haarlemmermeer, tot aan de Haarlemmer Ringvaart. Het traject van perceel 2 strekt zich uit vanaf het landschapsgebied de Hanepoel aan de Haarlemmer ringvaart bij Nieuwe Wetering naar het zuiden tot aan de autosnelweg A4, vervolgens volgt het traject de A4 aan de westelijke kant, waarbij het de Rijpwetering kruist, tot aan de afslag Hoogmade nabij Leiden.
Tot hier is het systeem alleen 380kV ondergronds en bovengronds.
Vanaf Hoogmade tot Hazerwoude Dorp zal de 150Kv ondergronds gaan en het bovengrondse systeem vervangen.
Het traject steekt hier met een 150kV boring onder de A4 door en volgt het water langs De Ruige Kade.
De 380KV verbinding gaat bovengronds over de A4 en de HSL heen.
Vervolgens buigt het traject weer naar het zuiden richting Hazerswoude-Rijndijk. Hier kruist het traject de Oude Rijn, de spoorlijn Alphen a/d Rijn – Leiden en de autoweg N11.
Vanaf hier zal 150kV en 380kV bovengronds verder gaan.
Ten westen van Hazerswoude-Dorp vervolgt het traject zich alleen bovengronds om via het terrein van golfbaan Bentwoud de A12 ten oosten van Zoetermeer over te steken en te eindigen bij het station Bleiswijk.
Bij Moerkapelle zal de bovengrondse 150kV het tracé weer verlaten en aansluiten op het bestaande ondergrondse 150KV systeem

4. RAAKVLAKKEN TBV VOORSTEL VNB

Op een aantal locatie vinden er werkzaamheden plaats om en binnen de gevaren zone van de bestaande 150kV verbinding tussen Hoogmade en Station Moerkapelle.
Dit is de bovengrondse verbinding tussen mast nrx74 en X42A.

Connect R380 is van mening dat de nauwkeurigheid en houdbaarheid van de exacte datums niet nauwkeurig genoeg is, voordat er overleg is geweest met Tennet over de locaties en situaties waarin kabels en geleiders spanningsloos dienen te worden gemaakt.
Connect R380 zal de geëiste termijn van 1 jaar respecteren.

4.1. MAST X 74

Voor de werkzaamheden tbv de noodmast YMM74 zullen er voor de combinatie geen werkzaamheden plaatsvinden waarvoor de spanning van de geleiders uitgeschakeld dient te worden.(Coordinatie door Tennet)
Nadat de noodmast(en) geplaatst is (zijn) en de geleiders verplaatst zijn van de bestaande mast YMM74 naar de noodmast(en) ,zullen de activiteiten voor de nieuwbouw van de fundatie en de vakwerkmast wel gevolgen hebben voor de spanning op het tracé (exacte invloed afhankelijk van de configuratie van de plaatsing van de noodmasten) . Het plaatsen van de noodmast(en) ,het overbrengen van de geleiders van de bestaande mast YMM74 naar de noodmasten en van de noodmasten naar de nieuwe vakwerkmast 74 en het plaatsen van de nodige beschermingen voor het overbrengen van de geleiders gebeurt door derden.
Deze zaken zullen met Tennet afgestemd moeten worden en vinden plaats in f**eb t/m april 2015**.
Voor dit specifieke geval zal Cofely fabricom GDF SUEZ een elektrisch scenario opstellen in overleg met TenneT.

4.2. HEIWERK FUNDATIE NR 146 T/M 143 EN 123/122

Voor het ondergrondse tracé tussen mast x73 en mast x68 zullen we om de hei invloeden geen invloed te laten hebben op het ondergrondse nieuwe 150kV tracé, eerst de palen voor de fundaties nr 146 t/m 141 aanbrengen.
Op een aantal locaties zal de heistelling buiten de gevarenzone staan, doch zal het valbereik binnen de hoogspanningskabels zitten (Zie bijlage 1 en 2)
Dit geld voor mast 146,145,144,143 en 123,122.
Voor deze locatie s is het wenselijk dat de spanning van de geleiders afgaat aan de Noordzijde.
Deze zaken zullen met TenneT afgestemd moeten worden en vinden plaats in f**eb en maart 2015**

4.3. BETONWERK FUNDATIES NR 146 T/M 143 EN 123/122

Nadat de 150 kV ondergronds gereed is en in gebruik is genomen zullen de fundaties voor de mastnummers 146 t/m 141 gemaakt gaan worden .
Dit kan niet na het heiwerk ivm de kritieke werkzaamheden aan het ondergrondse deel naast deze mastfundaties.
Voor de betonwerkzaamheden zal er ook equipment gebruikt worden dat buiten de gevarenzone staat maar met zijn valbereik binnen de hoogspanningslijnen komt.(zie bijlage 2)
Ook hiervoor is het wenselijk om tijdelijk de spanning van van de lijnen af te halen.
Deze zaken zullen met TenneT afgestemd moeten worden en vinden plaats in
juni en juli en maart 2015

4.4. GRONDWERK MAST FUNDATIES 144 T/M 141 EN 130

Als deze werkzaamheden plaats vinden wordt het 150 Kv deel tussen Hoogmade x74 en Hazerswoude OSP 123 in gebruik genomen.(Dit is de nieuwe ondergrondse 150kV verbinding)
Hierna zullen de fundaties van de masten worden ontgraven.
Bij het grondwerk zit de insteek van het dichtst bijzijnde talud op de volgende afstanden.
Mast 144-4,5m/mast 143-4,5m/142-4,5m/141-2,0m/130-2,0m.
Deze zaken zullen met TenneT afgestemd moeten worden en vinden plaats in juli en december 2015.

4.5. ONDERGRONDS BESTAANDE 150 KV

In sectie 8 komt het nieuwe tracé van de ondergrondse 150kV kabel binnen de 3 m gevarenzone van de bestaande 150 kV kabel.(zie bijlage 4)
In overleg zal hier de spanning van de bestaande kabel gehaald moeten worden tijdens het ontgraven en aanleggen van de nieuwe 150kV kabelverbinding.
Deze werkzaamheden zullen plaats vinden tussen april 2015 en juli 2015

4.6. ONDERGRONDS 150KV ALGEMEEN

Voor de werkzaamheden aan het ondergrondse deel van de 150kV tussen Hoogmade en OSP 123 zullen op diverse plekken de werkzaamheden in de gevaren zone plaatsvinden.
Aangezien dit werkzaamheden zijn met relatief klein en laag equipment, verwachten wij hier geen spanningsloos stellingen voor te moeten aanvragen.
Indien TenneT vindt dat de risico's te groot zijn kan besloten worden om de spanning van de kabels af te halen.
In de bijlage kan men zien waar deze locaties zijn.

4.7. AMORVEREN GELEIDERS MAST 42A T/M 74.

Om de bestaande masten en geleiders YMM42A t/m YMM73 te kunnen
Amorveren moet de spanning van de geleiders gehaald worden.
In de planning is deze datum **17 sept 2015.**
Hiervoor zal het ondergrondse 150kV deel van Hoogmade mast X74 naar Afstap 123 (Westeinde) gereed zijn en tevens het bovengrondse deel tussen de masten en 109 waarvan de geleiders door derden worden aangelegd.
De verlegging van de bestaande ondergrondse 150kV kabels van Station Moerkapelle naar Afstap 109 dient ook gereed te zijn.
De commissioning periode voor Tennet is geschat op 20 dagen van 21/8/15 t/m 16/9/2015.

5. WERKZAAMHEDEN AAN HET BESTAANDE NET MOERKAPELLE-ZOETERMEER

Om de bestaande 150kV kabel circuits die lopen tussen Zoetermeer en Station Moerkapelle aan te sluiten op de nieuwe OSP 109 zullen de kabels per circuit spanningsloos moeten worden gemaakt.(zie bijlage 3)
Omdat de circuits vrij dicht bij elkaar liggen is het niet mogelijk om alle circuits gelijktijdig in bedrijf te houden.
Het circuit wat het dichts bij de werkzaamheden aan de spanningsloze kabel ligt , zal ook spanningsloos moeten worden gemaakt.
Er zal tijdens de werkzaamheden ten allen tijden 1 circuit in bedrijf blijven.
Er zal tijdig met Tennet overleg plaats vinden hoe de spanningsloosstellingen in gepland moeten worden in combinatie met de uit te voeren werkzaamheden.

De periode waarin de werkzaamheden gefaseerd plaatsvinden is juni t/m augustus 2015

6. BESCHERMINGSMAATREGELEN NIEUWE 150 KV KABEL TRACÉ

Langs het nieuwe 150kV tracé Hoogmade- OSP 123 zal de bouwweg op een aantal plaatsen het nieuwe ondergronds tracé kruisen.
Op deze locatie zal een overbrugging en of overkluising gemaakt worden om de kabels niet te kunnen beschadiggen.
De bovenstaande kruisingen worden uitgevoerd dmv een overkluising conform tekening R3N-TEK-0032.

7. EISEN EN RICHTLIJNEN

Alle bovenstaande werkzaamheden en maatregelen vinden plaats conform de onderstaande richtlijnen:

Veiligheids Voorschriften
Voor werken in de nabijheid van ondergrondse kabelverbindingen beheerd door TenneT TSO B.V.

Veiligheid Voorschriften
Voor werken in de nabijheid van bovengrondse hoogspanningsverbindingen beheerd door TenneT TSO B.V.

8. BIJLAGEN 1T/M5

Bijlage 1 Afstanden HOH oud x- Nieuw Windrack

Bijlage 2 Teknr R3N-TEK-0006 t/m 0011 blad 0000 (overzicht kaarten**)**

Bijlage 3 Teknr R3N-TEK-0025 blad 001

Bijlage 4 Teknr R3N-TEK-0084 blad 001

Bijlage 5 Teknr R3N-TEK-0032 Typ Kruising/bescherming K&L

BIJLAGE 1

Afstanden HOH oud x- Nieuw Windrack

BIJLAGE 2

Teknr R3N-TEK-0006 t/m 0011 blad 0000 (overzicht kaarten**)**

BIJLAGE 3

Teknr R3N-TEK-0025 blad 001

BIJLAGE 4

Teknr R3N-TEK-0084 blad 001

BIJLAGE 5

Teknr R3N-TEK-0032 Typ Kruising/bescherming K&L

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Tijdelijke mast 74

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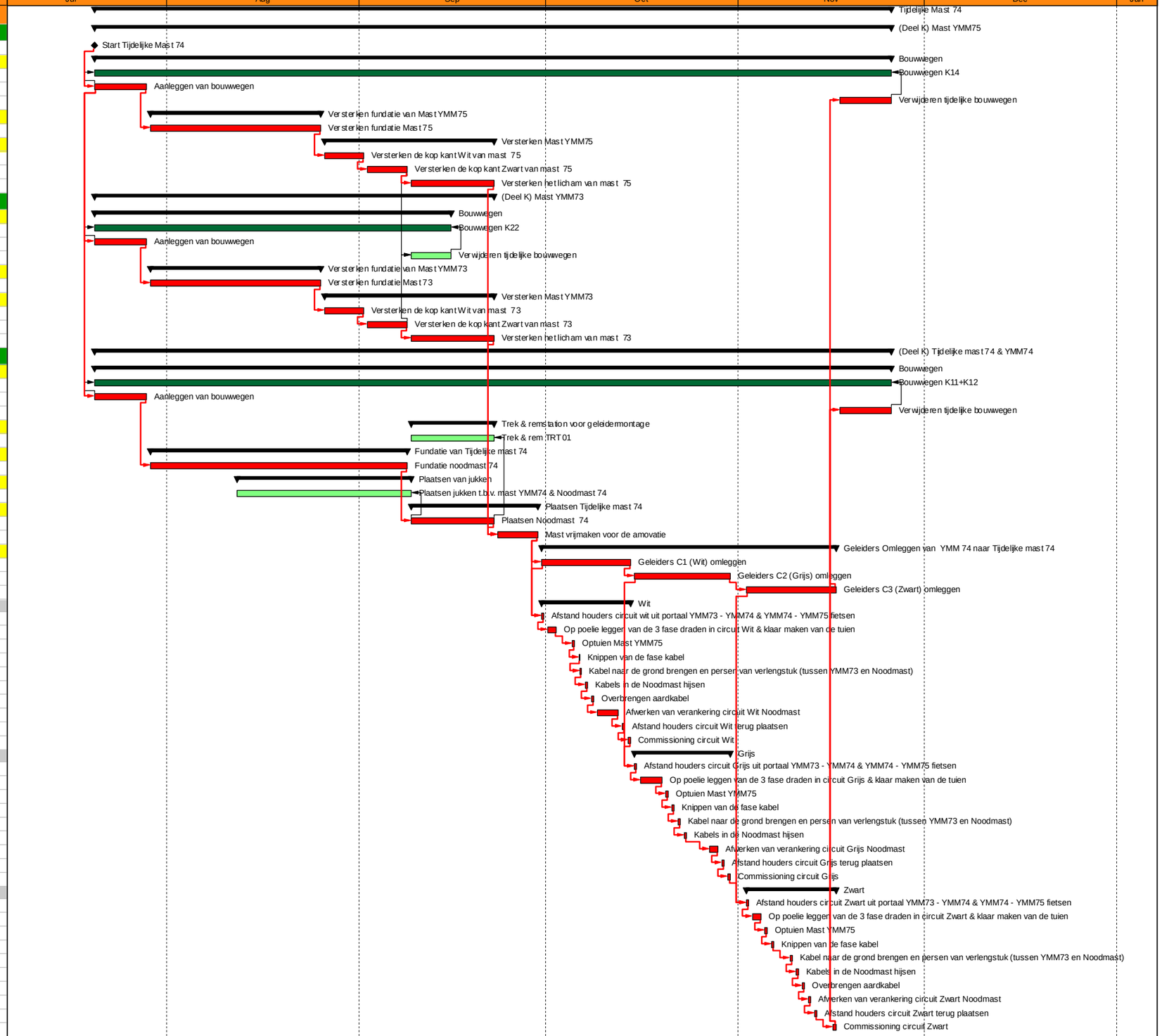
Randstad 380kV Noordring

Activity Name	Original Duration	Start	Finish	Geleiders VNB
Tijdelijke Mast 74	93.0d	20-Jul-15	25-Nov-15	
(Deel K) Mast YMM75	93.0d	20-Jul-15	25-Nov-15	
Start Tijdelijke Mast 74	0.0d	20-Jul-15*		
Bouwwegen	93.0d	20-Jul-15	25-Nov-15	
Bouwwegen K14	90.0d	20-Jul-15	25-Nov-15	
Aanleggen van bouwwegen	7.0d	20-Jul-15	28-Jul-15	
Verwijderen tijdelijke bouwwegen	5.0d	17-Nov-15	25-Nov-15	
Versterken fundatie van Mast YMM75	20.0d	29-Jul-15	25-Aug-15	
Versterken fundatie Mast 75	20.0d	29-Jul-15	25-Aug-15	
Versterken Mast YMM75	20.0d	26-Aug-15	22-Sep-15	
Versterken de kop kant Wit van mast 75	5.0d	26-Aug-15	01-Sep-15	Wit + Grijs
Versterken de kop kant Zwart van mast 75	5.0d	02-Sep-15	08-Sep-15	Zwart + Grijs
Versterken het licham van mast 75	10.0d	09-Sep-15	22-Sep-15	
(Deel K) Mast YMM73	47.0d	20-Jul-15	22-Sep-15	
Bouwwegen	42.0d	20-Jul-15	15-Sep-15	
Bouwwegen K22	42.0d	20-Jul-15	15-Sep-15	
Aanleggen van bouwwegen	7.0d	20-Jul-15	28-Jul-15	
Verwijderen tijdelijke bouwwegen	5.0d	09-Sep-15	15-Sep-15	
Versterken fundatie van Mast YMM73	20.0d	29-Jul-15	25-Aug-15	
Versterken fundatie Mast 73	20.0d	29-Jul-15	25-Aug-15	
Versterken Mast YMM73	20.0d	26-Aug-15	22-Sep-15	
Versterken de kop kant Wit van mast 73	5.0d	26-Aug-15	01-Sep-15	Wit + Grijs
Versterken de kop kant Zwart van mast 73	5.0d	02-Sep-15	08-Sep-15	Zwart + Grijs
Versterken het licham van mast 73	10.0d	09-Sep-15	22-Sep-15	
(Deel K) Tijdelijke mast 74 & YMM74	93.0d	20-Jul-15	25-Nov-15	
Bouwwegen	93.0d	20-Jul-15	25-Nov-15	
Bouwwegen K11+K12	90.0d	20-Jul-15	25-Nov-15	
Aanleggen van bouwwegen	7.0d	20-Jul-15	28-Jul-15	
Verwijderen tijdelijke bouwwegen	5.0d	17-Nov-15	25-Nov-15	
Trek & remstation voor geleidermontage	10.0d	09-Sep-15	22-Sep-15	
Trek & rem TRT 01	10.0d	09-Sep-15	22-Sep-15	
Fundatie van Tijdelijke mast 74	30.0d	29-Jul-15	08-Sep-15	
Fundatie noodmast 74	30.0d	29-Jul-15	08-Sep-15	
Plaatsen van jukken	20.0d	12-Aug-15	09-Sep-15	
Plaatsen jukken t.b.v. mast YMM74 & Noodmast 74	20.0d	12-Aug-15	09-Sep-15	
Plaatsen Tijdelijke mast 74	15.0d	09-Sep-15	29-Sep-15	
Plaatsen Noodmast 74	10.0d	09-Sep-15	22-Sep-15	
Mast vrijmaken voor de amovatie	5.0d	23-Sep-15	29-Sep-15	
Geleiders Omleggen van YMM 74 naar Tijdelijke mast 74	33.0d	30-Sep-15	16-Nov-15	
Geleiders C1 (Wit) omleggen	11.0d	30-Sep-15	14-Oct-15	
Geleiders C2 (Grijs) omleggen	11.0d	15-Oct-15	30-Oct-15	
Geleiders C3 (Zwart) omleggen	11.0d	02-Nov-15	16-Nov-15	
Wit	11.0d	30-Sep-15	14-Oct-15	
Afstand houders circuit wit uit portaal YMM73 - YMM74 & YMM74 -	1.0d	30-Sep-15	30-Sep-15	Wit + Grijs
Op poelie leggen van de 3 fase draden in circuit Wit & klaar maken	2.0d	01-Oct-15	02-Oct-15	Wit + Grijs
Optuien Mast YMM75	1.0d	05-Oct-15	05-Oct-15	Wit + Grijs
Knippen van de fase kabel	0.5d	06-Oct-15	06-Oct-15	Wit + Grijs
Kabel naar de grond brengen en persen van verlengstuk (tussen YI	0.5d	06-Oct-15	06-Oct-15	Wit + Grijs
Kabels in de Noodmast hijsen	1.0d	07-Oct-15	07-Oct-15	Wit + Grijs
Overbrengen aardkabel	1.0d	08-Oct-15	08-Oct-15	Wit + Grijs
Afwerken van verankering circuit Wit Noodmast	2.0d	09-Oct-15	12-Oct-15	Wit + Grijs
Afstand houders circuit Wit terug plaatsen	1.0d	13-Oct-15	13-Oct-15	Wit + Grijs
Commissioning circuit Wit	1.0d	14-Oct-15	14-Oct-15	
Grijs	11.0d	15-Oct-15	30-Oct-15	
Afstand houders circuit Grijs uit portaal YMM73 - YMM74 & YMM7	1.0d	15-Oct-15	15-Oct-15	Zwart + Grijs
Op poelie leggen van de 3 fase draden in circuit Grijs & klaar maker	2.0d	16-Oct-15	19-Oct-15	Zwart + Grijs
Optuien Mast YMM75	1.0d	20-Oct-15	20-Oct-15	Zwart + Grijs
Knippen van de fase kabel	1.0d	21-Oct-15	21-Oct-15	Zwart + Grijs
Kabel naar de grond brengen en persen van verlengstuk (tussen YI	1.0d	22-Oct-15	22-Oct-15	Zwart + Grijs
Kabels in de Noodmast hijsen	1.0d	23-Oct-15	23-Oct-15	Zwart + Grijs
Afwerken van verankering circuit Grijs Noodmast	2.0d	27-Oct-15	28-Oct-15	Zwart + Grijs
Afstand houders circuit Grijs terug plaatsen	1.0d	29-Oct-15	29-Oct-15	Zwart + Grijs
Commissioning circuit Grijs	1.0d	30-Oct-15	30-Oct-15	
Zwart	11.0d	02-Nov-15	16-Nov-15	
Afstand houders circuit Zwart uit portaal YMM73 - YMM74 & YMM7	1.0d	02-Nov-15	02-Nov-15	Zwart + Grijs
Op poelie leggen van de 3 fase draden in circuit Zwart & klaar make	2.0d	03-Nov-15	04-Nov-15	Zwart + Grijs
Optuien Mast YMM75	1.0d	05-Nov-15	05-Nov-15	Zwart + Grijs
Knippen van de fase kabel	1.0d	06-Nov-15	06-Nov-15	Zwart + Grijs
Kabel naar de grond brengen en persen van verlengstuk (tussen YI	1.0d	09-Nov-15	09-Nov-15	Zwart + Grijs
Kabels in de Noodmast hijsen	1.0d	10-Nov-15	10-Nov-15	Zwart + Grijs
Overbrengen aardkabel	1.0d	11-Nov-15	11-Nov-15	Zwart + Grijs
Afwerken van verankering circuit Zwart Noodmast	1.0d	12-Nov-15	12-Nov-15	Zwart + Grijs
Afstand houders circuit Zwart terug plaatsen	1.0d	13-Nov-15	13-Nov-15	Zwart + Grijs
Commissioning circuit Zwart	1.0d	16-Nov-15	16-Nov-15	



Remaining Level of Effort | Second Baseline | Critical Remaining Work | Summary
Remaining Work | Actual Work | Milestone

Date	Revision	Checked	Approved
15-Apr-14	Tijdelijke mast 74	RCH	EDW

Controle berekeningen M73 en M75

Project:
Randstad 380 kV Noordring

Opdrachtgever:
TenneT TSO

Revisie	Datum	Wijzigingen ten opzichte van vorige revisie
00	04-04-2014	Eerste versie

Documentnummer: R3N-OWR-0055

Opsteller	*Controleur*	*Vrijgever*
Koen Pieters Project Leider	Pieter de Jager Ontwerp Manager	Erik Duwel Project Manager

Distributie

Naam	Bedrijf
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Inhoudsopgave

1. Inleiding 4
2. Controle berekening mast 73 4
3. Controle berekening mast 75 5

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).

Het voorliggende document is onderdeel van het definitief ontwerp ten behoeve van de vergunningsaanvragen en behandelt:

- De controle berekeningen van M52 en M55 ten behoeven van de omleiding rond M54 en M53

.

2. CONTROLE BEREKENING MAST 73

D&C ENGINEERING
design and construct

Postbus 1
2950 AA Alblasserdam
Nieuwland Parc 301-302
2952 DD Alblasserdam
T +31 (0) 78 - 691 9222
E info@dcengineering.nl
W www.dcengineering.nl

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 73, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	S. Al Mashta
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	27-Mar-2014
D&C documentnr.	:	B.14014

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H:\Projecten\13.039 Fabricom vervangen mast 74 150 kV-lijn Leiden-Zoetermeer\1303914509, noodmast P74 etc\02 - Documenten\Mast 73\B14014_rev0.xlsx

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	27-Mar-14	Controleberekening mast 73, 150 kV-lijn Zoetermeer -Leiden	S. Al Mashta	J.Hollaar	J.Hollaar
A					

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Bijlage A	Geleiderbelastingen
Bijlage B	Berekening Mast 73; Scia Engineer
Bijlage C	Controle staven mastlichaam

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.73 in de 150 kV-lijn Zoetermeer -Leiden. Mast 73 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 74 komt een portaal waardoor de belasting op mast 73 wijzigd.
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 :

Mast nr.55 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
6775-5-E	Onderstuk HU
6775-6-D	Onderste tussenstuk HU
6775-7-E	Tweede tussenstuk HU
6775-8-E	Eerste bovenstuk HU
6775-9-D	Tweede bovenstuk HU
6775-10-E	Ondertraverse HU
6775-11-E	Bovenste traverse HU

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.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

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 2013

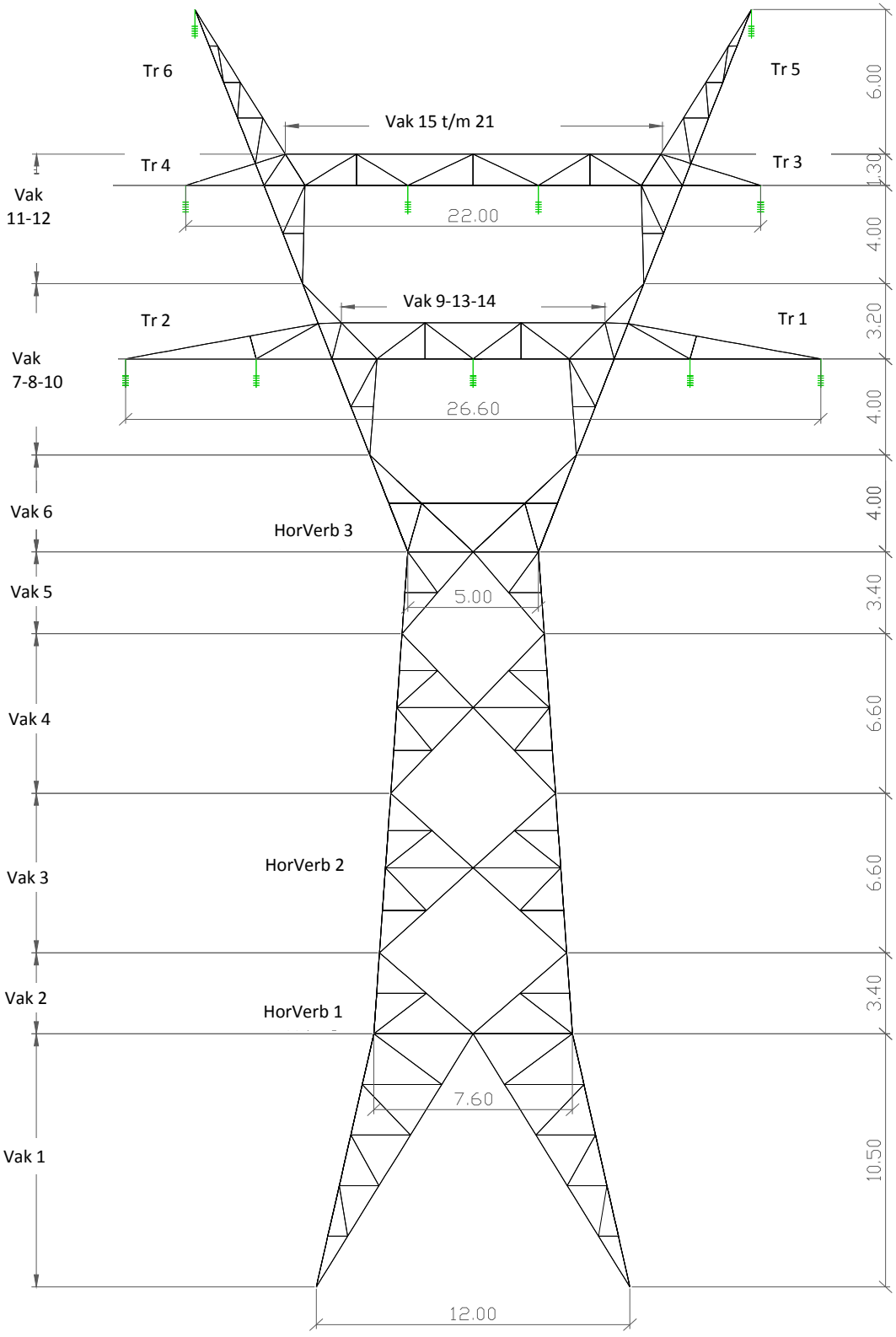
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A. Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000; 25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

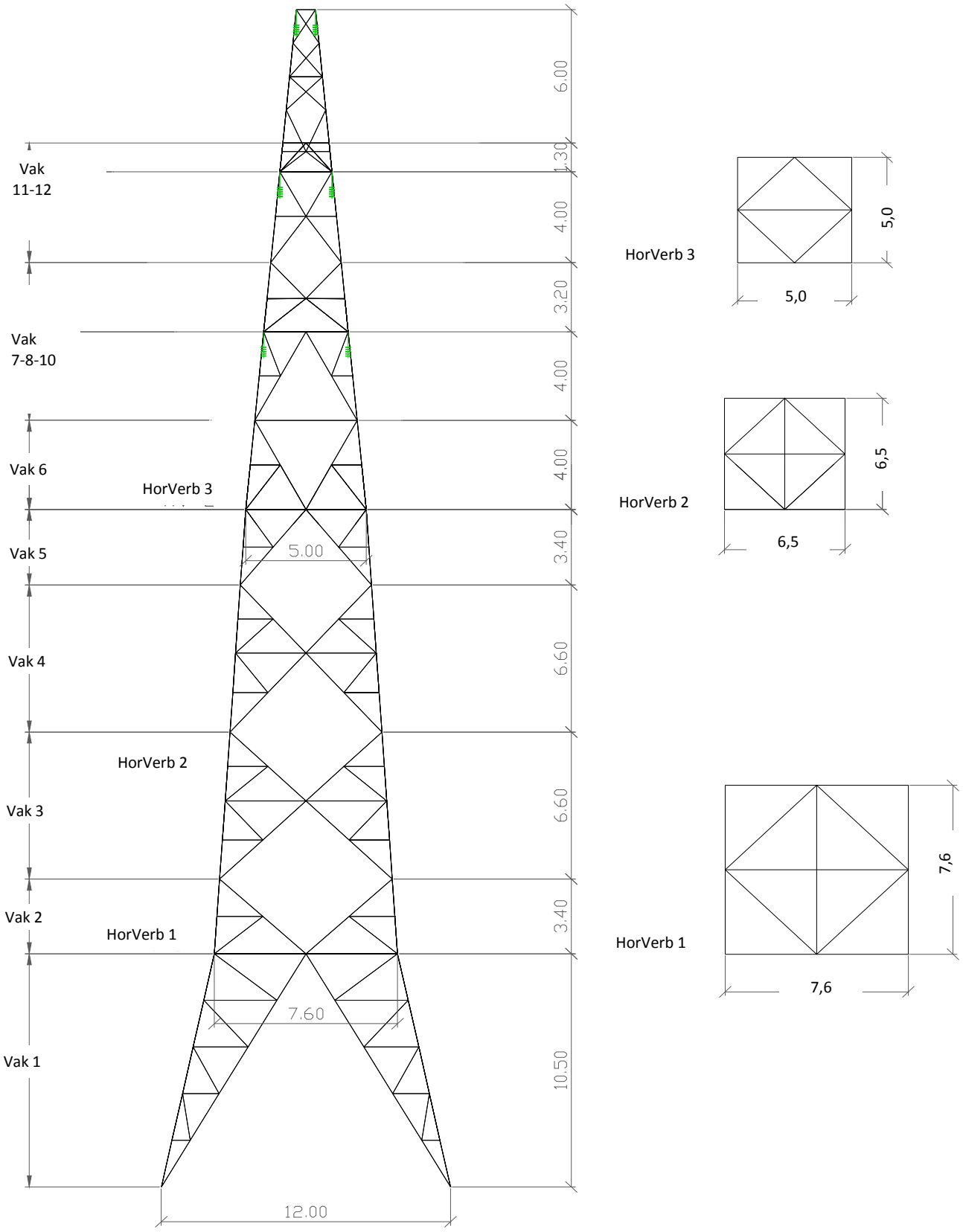
Materiaal randen	:	Fe360	(Fe510 nieuw)
Materiaal diagonalen	:	Fe360	(Fe510 nieuw)
Materiaal bouten	:	4.6	(8.8 nieuw)

1.5 Overzicht mast

1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam



2 Ontwerpgegevens mast

2.1 Ontwerpcode

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

2.2 Ontwerpgegevens

Lijnhoek	-	180° -172°	
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	-	325 - 405 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) 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.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4.6
Staalkwaliteit	S235
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.

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

11.2. Reacties

Lineaire berekening. Extreem : Globaal
Selectie : Alle
Klasse : Alle UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn4/N290	sp1aR/205	**-286,39**	227,28	1343,11	0,00	0,00	0,00
Sn2/N298	sp3F/4	**302,43**	-242,69	**1459,70**	0,00	0,00	0,00
Sn2/N298	sp1aF/215	297,48	**-247,51**	1431,70	0,00	0,00	0,00
Sn1/N246	1a/14	209,13	**229,46**	1094,45	0,00	0,00	0,00
Sn4/N290	sp3F-p/24	230,09	-175,01	**-1123,83**	0,00	0,00	0,00
Sn1/N248	1a/216	63,50	72,70	350,60	**0,00**	**0,00**	**0,00**

11.3. Resultante op Fundering

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

BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aF/217	Sn3/N306	Rz	**57,68**	1219,38	1,63	21,12	39,61	41,93	1218,01
sp1aR/218	Sn1/N248	Rx	**365,14**	1391,19	173,85	3,68	284,37	229,05	1342,42
sp1aF/219	Sn2/N298	Ry	250,35	**322,84**	126,36	-0,81	-37,60	-247,51	-203,83
sp3F/4	Sn2/N298	Rx	302,65	**1490,74**	-132,80	4,82	302,43	11,64	1459,70
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	**-179,72**	-6,90	-104,46	-105,49	-1024,63
sp1aR/218	Sn1/N248	Rx	365,14	1391,19	**173,85**	3,68	284,37	229,05	1342,42
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	-179,72	**-6,90**	-104,46	-105,49	-1024,63
sp1aF/217	Sn3/N306	Rz	57,68	1219,38	1,63	**21,12**	39,61	41,93	1218,01
sp1aR/205	Sn4/N290	Rx	289,09	346,86	-127,16	-0,66	**-286,39**	-39,45	-191,68
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	**302,43**	11,64	1459,70
sp1aF/219	Sn2/N298	Ry	250,35	322,84	126,36	-0,81	-37,60	**-247,51**	-203,83
1a/14	Sn1/N248	Ry	310,46	1137,63	-177,35	3,53	209,13	**229,46**	1094,45
sp3F-p/221	Sn4/N290	Rz	190,61	1139,88	-68,34	-5,90	-75,52	-175,01	**-1123,63**
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	302,43	11,64	**1459,70**

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 Resultaten

Uit de controleberekening van de mast volgen de volgende resultaten:

(Opmerking: De verschillende berekeningen zijn te vinden in de bijlagen B en C)

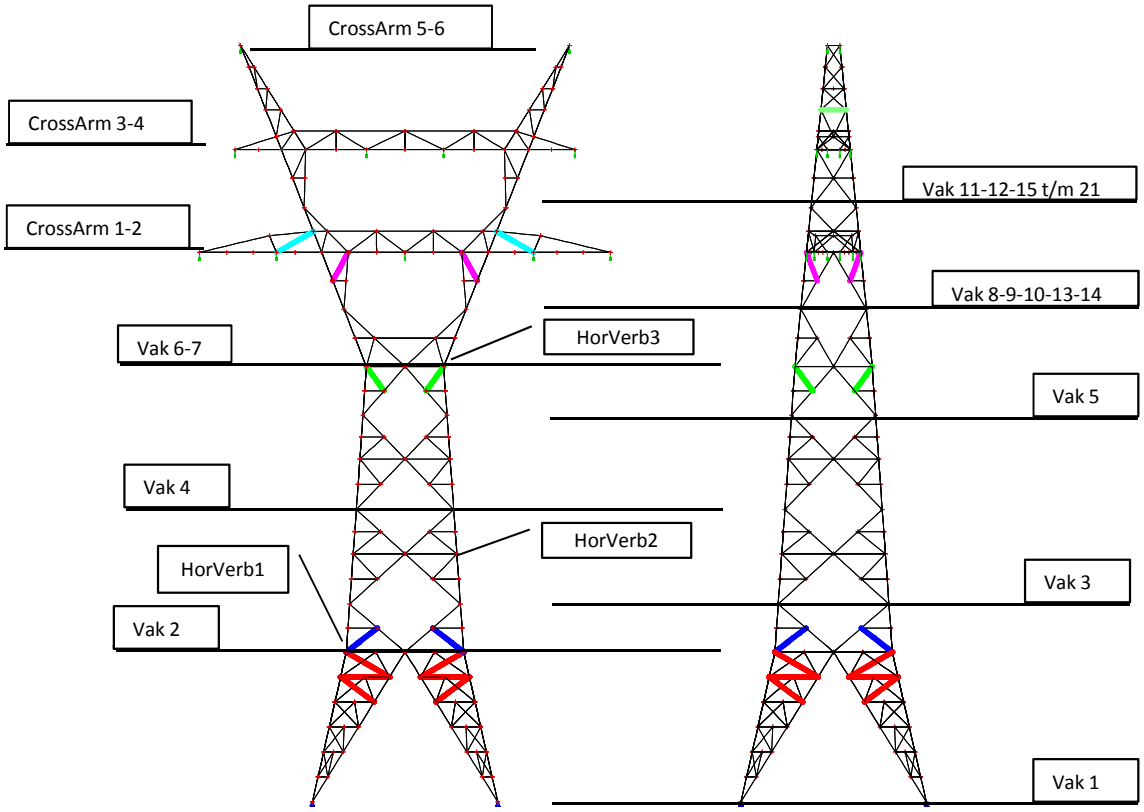
5.1 Overzicht spanningniveau's

Sheet nr.	Vak	Staaf type	Doorsnede	Staalkwal. N/mm^2	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	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	Opmerkingen
M01	Vak 1	Randen L200x200x26	H200/200/26	235	1825	1825	M 30	4,6	10	**0,79**	-1698,53	**0,84**	1393,46	**0,67**	0,00	**n.v.t.**	
M02	Vak 1	Diagonalen L130x13x12	H130/130/12	235	2048	2048	M 24	4,6	4	**1,00**	-271,75	**0,56**	256,83	**0,58**	0,00	**n.v.t.**	
M03	Vak 1	Horizontale En verticale Knikverkorters L50x50x5	H50/50/5	235	2409	2409	M 16	4,6	1	**0,08**	-2,13	**0,19**	2,13	**0,05**	1,50	**0,94**	
M04	Vak 1	Horizontale en Verticale Knikverkorters L60x60x6	H60/60/6	235	2533	2533	M 16	4,6	1	**0,46**	-13,95	**0,69**	13,95	**0,25**	1,50	**0,76**	
M05	Vak 1	Horizontale en Verticale Knikverkorters L55x55x6	H55/55/6	235	4478	4478	M 16	4,6	1	**0,10**	-3,02	**0,49**	3,02	**0,05**	1,50	**0,81**	
M06	Vak 1	Horizontale en Verticale Knikverkorters L65x65x7	H65/65/7	235	3322	3322	M 16	4,6	1	**0,79**	-23,73	1,24	23,73	**0,28**	1,50	**0,74**	Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V06
M07	Vak 2	Randen L200x200x26	H200/200/26	235	1690	1690	M 30	4,6	10	**0,73**	-1568,46	**0,76**	1291,38	**0,62**	0,00	**n.v.t.**	
M08	Vak 2	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1900	1900	M 16	4,6	1	**0,69**	-20,89	**0,85**	20,89	**0,38**	1,50	**0,69**	
M09	Vak 2	Schuine Knikverkorters L55x55x6	H55/55/6	235	2620	2620	M 16	4,6	1	**0,96**	-28,83	1,82	28,83	**0,52**	0,00	**n.v.t.**	Staven uitwisselen in L70x70x7, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V09
M10	Vak 2	Verticale verbanden L150x100x10	H150/100/10	235	4916	2458	M 24	4,6	3	**0,82**	-167,32	**0,62**	150,52	**0,42**	0,00	**n.v.t.**	
M11	Vak 3	Randen L200x200x26	H200/200/26	235	1786	1786	M 30	4,6	10	**0,68**	-1473,98	**0,72**	1210,73	**0,58**	0,00	**n.v.t.**	
M12	Vak 3	Horizontale Knikverkorters L55x55x6	H55/55/6	235	1676	1676	M 16	4,6	1	**0,29**	-8,74	**0,31**	8,74	**0,16**	1,50	**0,61**	
M13	Vak 3	Verticale Knikverkorters L55x55x6	H55/55/6	235	2360	2360	M 16	4,6	1	**0,34**	-10,16	**0,57**	10,16	**0,18**	0,00	**n.v.t.**	
M14	Vak 3	Verticale verbanden L150x100x12	H150/100/12	235	5028	2514	M 24	4,6	4	**0,73**	-181,18	**0,58**	197,44	**0,46**	0,00	**n.v.t.**	
M15	Vak 4	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	10	**0,55**	-1185,13	**0,58**	952,01	**0,46**	0,00	**n.v.t.**	
M16	Vak 4	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1460	1460	M 16	4,6	1	**0,34**	-9,47	**0,41**	9,47	**0,21**	1,50	**0,82**	
M16a	Vak 4	Horizontale staven L60x60x6	H60/60/6	235	2920	2920	M 16	4,6	1	**0,17**	-4,40	**0,27**	4,79	**0,09**	1,50	**0,88**	
M17	Vak 4	Verticale Knikverkorters L50x50x5	H50/50/5	235	2080	2080	M 16	4,6	1	**0,26**	-7,32	**0,51**	7,32	**0,16**	0,00	**n.v.t.**	
M18	Vak 4	Verticale verbanden L150x100x14	H150/100/14	235	4755	2377	M 24	4,6	4	**0,89**	-242,51	**0,63**	223,83	**0,46**	0,00	**n.v.t.**	
M19	Vak 5	Randen L200x200x20	H200/200/20	235	1784	1784	M 30	4,6	12	**0,76**	-981,56	**0,48**	769,91	**0,37**	0,00	**n.v.t.**	
M20	Vak 5	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	**0,58**	-16,33	**0,59**	16,33	**0,35**	1,50	**0,65**	
M21	Vak 5	Verticale Knikverkorters L50x50x5	H50/50/5	235	1720	1720	M 16	4,6	1	**1,05**	-29,39	1,52	29,39	**0,64**	0,00	**n.v.t.**	Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V21
M21a	Vak 5	Verticale verbanden L150x100x12	H150/100/12	235	4360	2180	M 24	4,6	5	**0,82**	-262,06	**0,71**	279,54	**0,66**	0,00	**n.v.t.**	
M22	Vak 6	Randen L200x200x16	H200/200/16	235	1784	1784	M 30	4,6	12	**0,73**	-939,90	**0,46**	764,96	**0,37**	0,00	**n.v.t.**	
M23	Vak 6	Verticale verbanden L150x100x12	H150/100/12	235	4765	2382	M 24	4,6	5	**0,58**	-195,42	**0,59**	194,50	**0,46**	0,00	**n.v.t.**	
M24	Vak 6	Horizontale Knikverkorters L50x50x5	H50/50/5	235	1250	1250	M 16	4,6	1	**0,42**	-9,75	**0,35**	11,67	**0,25**	1,50	**0,65**	
M25	Vak 6	Horizontale vrband L130x130x12	H130/130/12	235	3950	3950	M 24	4,6	2	**0,84**	-114,52	**0,48**	74,60	**0,14**	1,50	**0,12**	
M26	Vak 6	Vertical Knikverkorters L90x90x9	H90/90/9	235	2076	2076	M 24	4,6	2	**0,78**	-106,31	**0,64**	66,20	**0,34**	0,00	**n.v.t.**	
M27	Vak 6	Vertical Knikverkorters L50x50x5	H50/50/5	235	2571	2571	M 24	4,6	2	**0,10**	-14,20	**0,80**	10,49	**0,20**	0,00	**n.v.t.**	
M28	Vak 6	Verticale verbanden L180x180x16	H180/180/16	235	5642	2825	M 30	4,6	5	**0,60**	-322,86	**0,46**	301,42	**0,39**	0,00	**n.v.t.**	
M29	Vak 7-8-9-10-13-14	Randen L200x200x16	H200/200/16	235	4261	2141	M 30	4,6	6	**0,98**	-633,51	**0,37**	385,56	**0,18**	0,00	**n.v.t.**	
M30	Vak 7-8-9-10-13-14	Horizontale Knikverkorters L50x50x5	H50/50/5	235	880	880	M 16	4,6	1	**0,36**	-10,02	**0,27**	10,02	**0,22**	1,50	**0,46**	
M31	Vak 7-8-9-10-13-14	Verticale Knikverkorters L50x50x5	H50/50/5	235	2050	2050	M 16	4,6	1	**0,59**	-17,33	1,16	16,47	**0,36**	0,00	**n.v.t.**	Staven uitwisselen in L55x55x6, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V31
M32	Vak 7-8-9-10-13-14	Verticale verbanden L150x100x12	H150/100/12	235	4017	2019	M 30	4,6	4	**0,68**	-249,08	**0,62**	292,52	**0,79**	0,00	**n.v.t.**	
M33	Vak 7-8-9-10-13-14	Verticale verbanden L200x100x14	H200/100/14	235	4747	2380	M 24	4,6	5	**0,84**	-283,32	**0,62**	272,81	**0,45**	0,00	**n.v.t.**	
M34	Vak 7-8-9-10-13-14	Verticale verbanden L130x130x12	H130/130/12	235	4236	2206	M 30	4,6	3	**0,88**	-197,64	**0,55**	284,93	**0,73**	0,00	**n.v.t.**	
M35	Vak 7-8-9-10-13-14	Verticale verbanden L90x90x9	H90/90/9	235	4621	2366	M 20	4,6	2	**0,81**	-70,81	**0,74**	76,54	**0,33**	0,00	**n.v.t.**	
M36	Vak 7-8-9-10-13-14	Boven randen L160x160x15	H160/160/15	235	3680	3680	M 30	4,6	4	**0,98**	-214,88	**0,43**	346,36	**0,59**	0,00	**n.v.t.**	
M37	Vak 7-8-9-10-13-14	Horizontale verbanden L60x60x6	H60/60/6	235	3232	1616	M 16	4,6	1	**0,82**	-24,72	**1,00**	24,72	**0,34**	0,00	**n.v.t.**	
M38	Vak 7-8-9-10-13-14	Horizontale verbanden L100x10x10	H100/100/10	235	3507	3507	M 30	4,6	2	**0,68**	-110,32	**0,88**	145,43	**0,75**	0,00	**n.v.t.**	
M39	Vak 7-8-9-10-13-14	Horizontale en verticale Knikverkorters L50x50x5	H50/50/5	235	3227	3227	M 16	4,6	1	**0,12**	-3,40	**0,48**	3,40	**0,07**	0,00	**n.v.t.**	
M40	Vak 7-8-9-10-13-14	Verticale Knikverkorters L65x50x5	H65/50/5	235	1503	1503	M 20	4,6	1	**0,16**	-4,34	**0,13**	6,15	**0,15**	0,00	**n.v.t.**	
M41	Vak 7-8-9-10-13-14	Schuine verbanden L130x130x12	H130/130/12	235	2376	2376	M 24	4,6	4	**0,69**	-187,24	**0,45**	185,01	**0,44**	0,00	**n.v.t.**	
M42	Vak 7-8-9-10-13-14	Horizontale kruizen L90x90x9	H90/90/9	235	2540	2540	M 30	4,6	1	**0,79**	-47,70	**0,61**	47,51	**0,50**	0,00	**n.v.t.**	

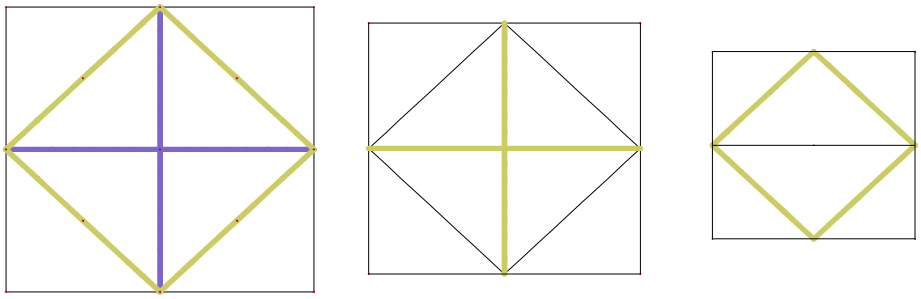
Sheet nr.	Vak	Staaf type	Doorsnede	Staalkwal. N/mm^2	Lengte (m) $L_{y;cr}$	Lengte (m) $L_{v;cr}$	Bout type	Kwalit.	Aantal bouten	Max. U.C. verbinding	Max. druk N_{Ed} (kN)	U.C	Max. trek N_{Ed} (kN)	U.C	Punt last $F_{per;sd}$ (kN)	U.C	Opmerkingen
M43	Vak 10-11-12-15-t_m 21	Randen L140x140x13	H140/140/13	235	4356	2220	M 24	4,6	8	**0,78**	-422,37	**0,25**	317,23	**0,15**	0,00	**n.v.t.**	
M44	Vak 10-11-12-15-t_m 21	Horizontale Knikverkorters L50x50x5	H50/50/5	235	2536	1268	M 16	4,6	1	**0,08**	-2,21	**0,11**	2,21	**0,05**	0,00	**n.v.t.**	
M45	Vak 10-11-12-15-t_m 21	Verticale Knikverkorters L50x50x5	H50/50/5	235	2179	2179	M 16	4,6	1	**0,13**	-3,37	**0,25**	3,56	**0,08**	0,00	**n.v.t.**	
M46	Vak 10-11-12-15-t_m 21	Verticale verbanden L150x100x10	H150/100/10	235	4099	2089	M 24	4,6	2	**0,88**	-119,40	**0,36**	93,04	**0,29**	0,00	**n.v.t.**	
M47	Vak 10-11-12-15-t_m 21	Verticale verbanden L110x110x10	H110/110/10	235	5030	2651	M 20	4,6	3	**0,91**	-128,02	**0,83**	118,97	**0,35**	0,00	**n.v.t.**	
M48	Vak 10-11-12-15-t_m 21	Boven randen L120x120x11	H120/120/11	235	4465	4465	M 24	4,6	3	**0,75**	-102,18	**0,67**	152,02	**0,41**	0,00	**n.v.t.**	
M49	Vak 10-11-12-15-t_m 21	Boven randen L60x60x6	H60/60/6	235	1213	1213	M 20	4,6	3	**0,46**	0,00	**0,00**	60,86	**0,68**	0,00	**n.v.t.**	
M50	Vak 10-11-12-15-t_m 21	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1993	1993	M 16	4,6	1	**0,46**	-13,75	**0,89**	11,11	**0,24**	1,50	**0,66**	
M51	Vak 10-11-12-15-t_m 21	Schuine verbanden L90x90x9	H90/90/9	235	1506	1506	M 24	4,6	3	**0,48**	-86,31	**0,37**	97,66	**0,42**	0,00	**n.v.t.**	
M52	Vak 10-11-12-15-t_m 21	Schuine verbanden L100x100x10	H100/100/10	235	2819	2819	M 24	4,6	3	**0,41**	-82,64	**0,50**	50,97	**0,18**	0,00	**n.v.t.**	
M53	Vak 10-11-12-15-t_m 21	Schuine verbanden L75x75x8	H75/75/8	235	2819	2819	M 24	4,6	2	**0,58**	-24,28	**0,36**	78,90	**0,52**	0,00	**n.v.t.**	
M54	Vak 10-11-12-15-t_m 21	Horizontale kruizen L60x60x6	H60/60/6	235	3100	1652	M 16	4,6	2	**0,67**	-40,40	**0,96**	39,76	**0,47**	0,00	**n.v.t.**	
M55	HorVerb1	Staven L150x150x14	H150/150/14	235	3800	3800	M 24	4,6	4	**0,84**	-227,23	**0,58**	185,17	**0,30**	1,50	**0,08**	
M56	HorVerb1	Staven L70x70x7	H70/70/7	235	5374	5374	M 20	4,6	2	**0,10**	-9,23	**0,51**	7,91	**0,07**	1,50	**1,02**	Staven uitwisselen in L150x150x10, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V56
M57	HorVerb1	Staven L75x75x8	H75/75/8	235	3800	3800	M 16	4,6	1	**0,06**	-1,81	**0,07**	1,81	**0,01**	1,50	**1,11**	Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V57
M58	HorVerb2	Staven L65x65x7	H65/65/7	235	3353	3353	M 16	4,6	1	**0,00**	0,00	**0,00**	0,00	**0,00**	1,50	**0,74**	
M59	HorVerb2	Staven L70x70x7	H70/70/7	235	4741	4741	M 20	4,6	2	**0,19**	-18,02	**0,80**	17,77	**0,16**	1,50	**0,90**	
M60	HorVerb2	Staven L60x60x6	H60/60/6	235	3353	3353	M 24	4,6	4	**0,00**	-0,27	**0,01**	0,08	**0,00**	1,50	**2,03**	Staven uitwisselen in L75x75x8, met staalkwal. S355, en bouten uitwisselen in kwal. 8.8, zie berekening sheet V60
M61	HorVerb3	Staven L150x150x14	H150/150/14	235	2500	2500	M 30	4,6	4	**0,83**	-355,69	**0,58**	292,00	**0,50**	1,50	**0,05**	
M62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	4,6	1	**1,08**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V62
M63	HorVerb3	Staven L75x75x8	H75/75/8	235	5000	5000	M 16	4,6	1	**0,02**	-0,09	**0,01**	0,59	**0,00**	1,50	**0,73**	
M64	CrossArm 1-2	Bovern Randen	H100/100/10	235	4732	4732	M 24	4,6	3	**0,42**	0,00	**0,00**	85,65	**0,30**	0,00	**n.v.t.**	
M65	CrossArm 1-2	Horiz.-vert. en schuine Knikverkort. L50x50x5	H50/50/5	235	1888	1888	M 16	4,6	1	**0,45**	-13,56	**0,82**	2,05	**0,04**	0,00	**n.v.t.**	
M66	CrossArm 1-2	Horizontale kruizen L65x65x7	H65/65/7	235	2073	1600	M 20	4,6	2	**0,51**	-45,09	**0,52**	37,23	**0,37**	0,00	**n.v.t.**	
M67	CrossArm 1-2	Horizontale kruizen L55x55x6	H55/55/6	235	2713	1600	M 16	4,6	2	**0,36**	-18,04	**0,45**	21,49	**0,29**	0,00	**n.v.t.**	
M68	CrossArm 1-2	Horizontale kruizen L80x80x8	H80/80/8	235	4190	2445	M 16	4,6	2	**0,97**	-58,73	**0,80**	36,86	**0,24**	0,00	**n.v.t.**	
M69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	4,6	2	**1,09**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	Bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V69
M70	CrossArm 3-4	Boven renden L80x80x8	H80/80/8	235	2880	2880	M 20	4,6	3	**0,43**	0,00	**0,00**	61,01	**0,36**	0,00	**n.v.t.**	
M71	CrossArm 3-4	Horizontale kruizen L60x60x6	H65/65/7	235	2347	2347	M 16	4,6	2	**0,65**	-39,39	**0,73**	32,96	**0,31**	0,00	**n.v.t.**	
M72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	3350	2008	M 20	4,6	2	**1,23**	-115,31	**1,13**	81,75	**0,54**	0,00	**n.v.t.**	Knikverkorters aanbrengen L50x50x5, en bouten uitwisselen in kwaliteit 8.8, zie berekening sheet V72
M73	CrossArm 5-6	Schuine randen L100x75x7	H100/75/7	235	6950	1726	M 20	4,6	2	**0,63**	-42,19	**0,82**	59,45	**0,41**	0,00	**n.v.t.**	
M74	CrossArm 5-6	Horizontale en schuine knikverkorters L50x50x5	H50/50/5	235	1910	1910	M 16	4,6	1	**0,10**	-2,90	**0,18**	2,90	**0,06**	1,50	**0,51**	
M75	CrossArm 5-6	Verticale verbanden1 L50x50x5	H50/50/5	235	2162	2162	M 16	4,6	1	**0,49**	-13,65	**1,00**	13,63	**0,30**	0,00	**n.v.t.**	
M76	CrossArm 5-6	Verticale verbanden2 L50x50x5	H50/50/5	235	2184	1155	M 16	4,6	1	**0,70**	-20,99	**0,95**	19,63	**0,43**	0,00	**n.v.t.**	
	Vak 9-13-14 + CrossArm1-2	Ondre randen UNP200	UNP200	Zie uitvoer computerberekening SCIA						**0,66**							
		Dwars liggers HEB200	HEB200	Zie uitvoer computerberekening SCIA						**0,11**							
	Vak 15 t_m 21 + CrossArm3-4	Ondre randen UNP180	UNP180	Zie uitvoer computerberekening SCIA						**0,44**							
		Dwars liggers HEB180	HEB180	Zie uitvoer computerberekening SCIA						**0,05**							
V06	Vak 1	Horizontale en Verticale Knikverkorters L70x70x7	H70/70/7	355	3322	3322	M 16	8,8	1	**0,39**	-23,73	**0,96**	23,73	**0,20**	1,50	**0,42**	
V09	Vak 2	Schuine Knikverkorters L70x70x7	H70/70/7	355	2620	2620	M 16	8,8	1	**0,61**	-28,83	**0,80**	28,83	**0,32**	0,00	**n.v.t.**	
V21	Vak 5	Verticale Knikverkorters L55x55x6	H55/55/6	355	1720	1720	M 16	8,8	1	**0,62**	-29,39	**0,93**	29,39	**0,38**	0,00	**n.v.t.**	
V31	Vak 7-8-9-10-13-14	Verticale Knikverkorters L55x55x6	H55/55/6	355	2050	2050	M 16	8,8	1	**0,45**	-19,39	**0,80**	17,86	**0,23**	0,00	**n.v.t.**	
V56	HorVerb1	Staven L70x70x7	H70/70/7	355	5374	5374	M 20	8,8	2	**0,12**	-17,87	**0,93**	17,61	**0,11**	1,50	**0,67**	
V57	HorVerb1	Staven L75x75x8	H75/75/8	355	3800	3800	M 16	8,8	1	**0,03**	-1,81	**0,07**	1,81	**0,01**	1,50	**0,73**	
V60	HorVerb2	Staven L75x75x8	H75/75/8	355	3353	3353	M 24	8,8	4	**0,00**	-0,27	**0,00**	0,08	**0,00**	1,50	**0,65**	
V62	HorVerb3	Staven L90x90x9	H90/90/9	235	3536	3536	M 20	8,8	1	**0,72**	-50,62	**0,99**	49,64	**0,40**	1,50	**0,31**	
V69	CrossArm 1-2	Schuine verbanden L60x60x6	H80/80/8	235	4190	2445	M 16	8,8	2	**0,74**	0,00	**0,00**	65,96	**0,42**	0,00	**n.v.t.**	
V72	CrossArm 5-6	Randen L80x80x8	H80/80/8	235	2008	2008	M 20	8,8	2	**0,99**	-115,31	**0,96**	81,75	**0,54**	0,00	**n.v.t.**	

5.2 Overzicht Verzwaring

5.2.1 Overzicht van de Mast



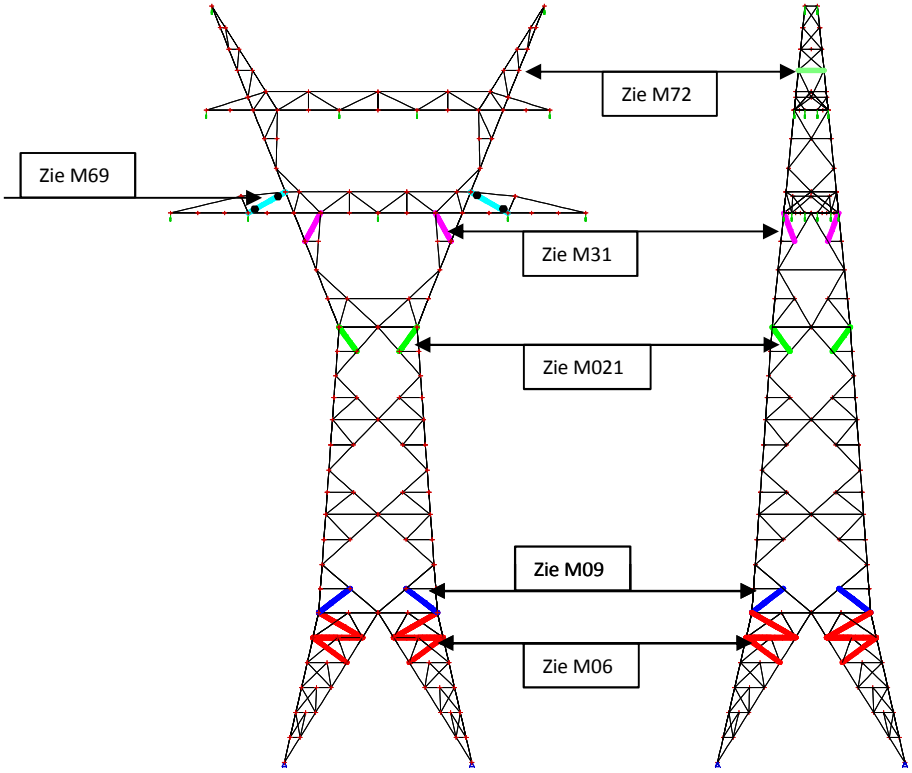
Voor / Achter **Zwart / Wit**



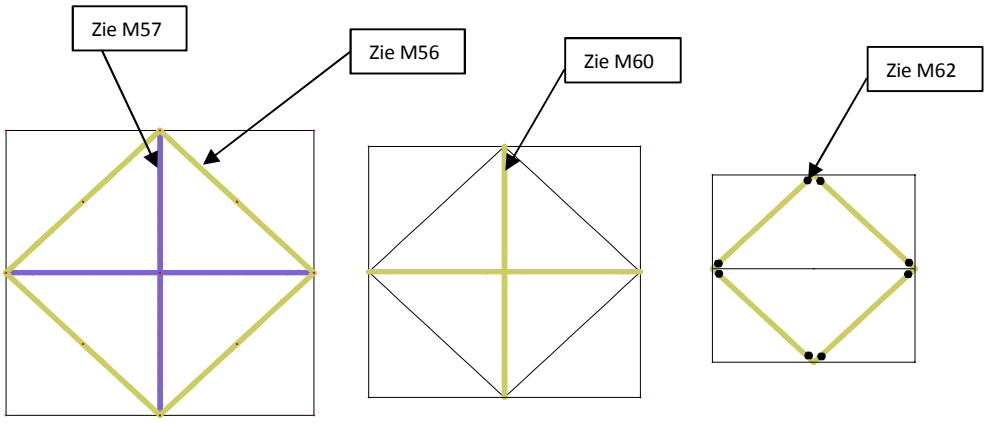
Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

5.2.2 Uit te wisselen onderdelen van de mast



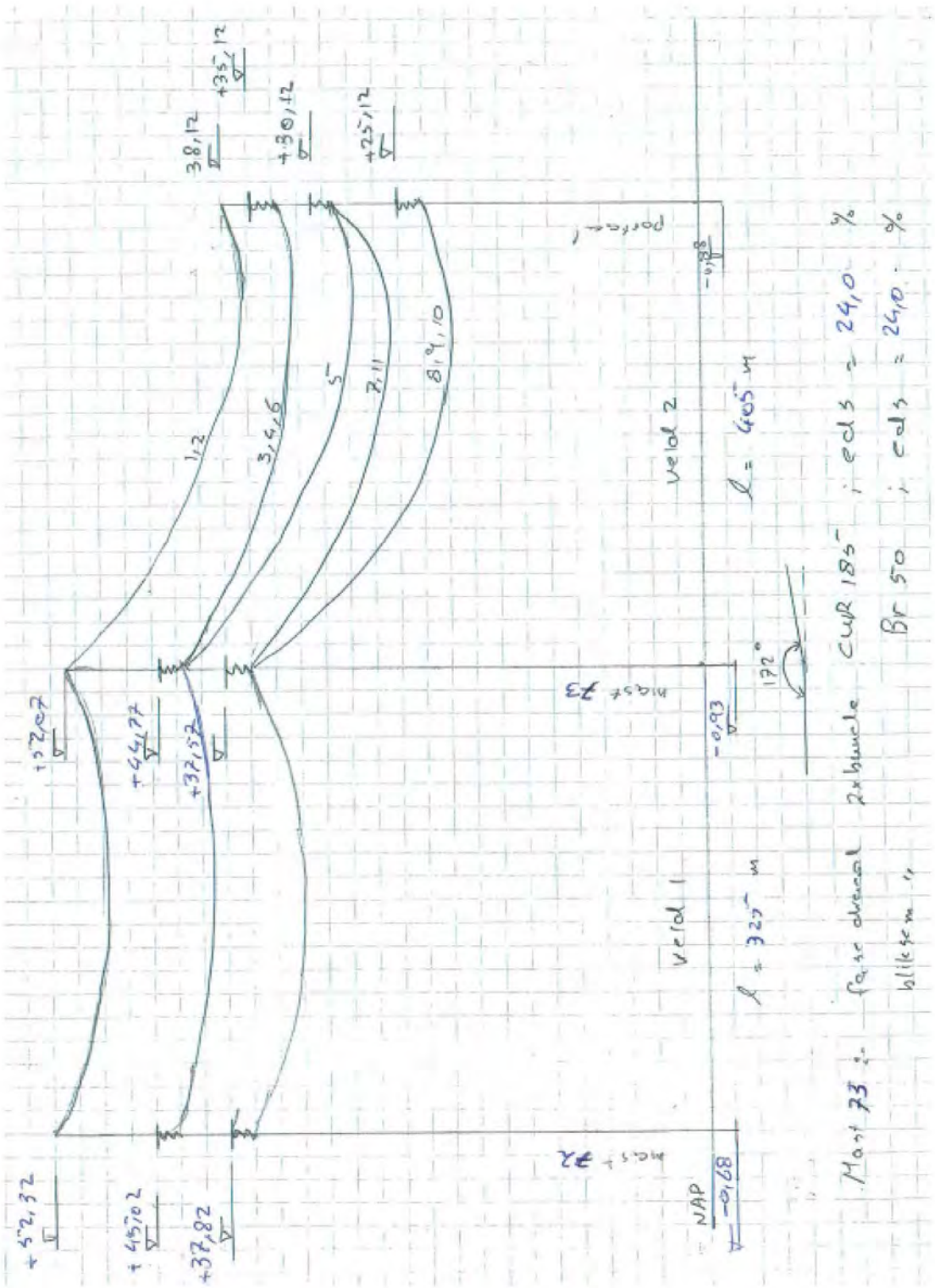
Voor / Achter **Zwart / Wit**



Bovenaanzicht Horizontale windverbanden

HorVerb1 **HorVerb2** **HorVerb3**

Bijlage A Geleiderbelastingen


Mast 73 : fase drieval 2x bundle CWR 185 ; eds = 24,0 %
bliksem " Br 50 ; eds = 24,0 %
veld 1
veld 2
mast 72
mast 73
NAP
-0,68
-0,93
-0,88
172°
1,2
3,4,6
5
7,11
8,9,10
+52,32
+45,02
+37,82
+52,07
+44,77
+37,52
38,12
+35,12
+30,12
+25,12

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	:	150 kv-Lijn Leiden-Zoetermeer
Masttype	:	hoekmast
Mastnaam	:	Mast 73 type HU
Mastnummer	:	73
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	A
Referentie periode	:	50

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	180		164
Maximum lijnhoek	[graden]	180		180
Veldlengte	[m]	325		405
Vaklengte	[m]		730	

* 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 ^ Veld 2
|
y = lijnrichting L---> x
Veld 1

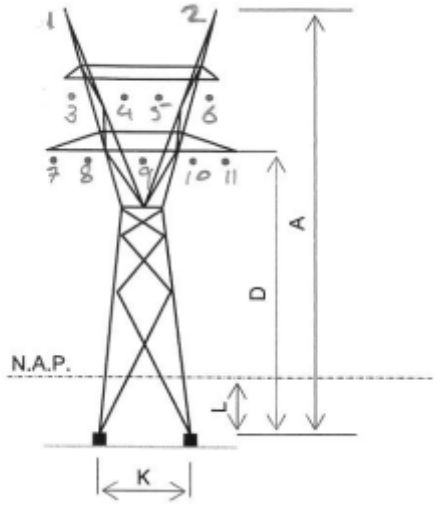
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	bliksemdraad	
Geleidersoort + plaats	:	bliksemdr. boventrav	
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] :	28390.2	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	24	
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] :		0	0
Hoogte verschil draadbevestiging	[m] :		0.25	-13.95

(aangrenzende minus beschouwende mast)

(hoger = positief)



Mastnummer	:	73
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	416.79

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 0.72	- 1.14	0.00	0.00
Qijs;rep		- 2.42	- 3.85	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.32	1.50	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.03	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.66	0.56	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.08	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.66	0.98	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.14	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.32	1.55	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	0.66	0.77	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	0.66	0.77	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	7.69	8.64	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-1.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.17	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	3.84	3.19	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	3.84	5.62	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.79	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	7.69	8.89	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	3.84	4.45	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	3.84	4.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00

Mastnummer	:	73
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
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°	17.17	17.17	17.34	17.45
	0°	8.22	8.22	8.62	8.29
	45°	13.91	13.91	12.79	14.00
	-45°	13.91	13.91	15.07	14.00
jTrep bij combinatie (1b)	90°	9.94	9.94	9.64	9.65
	0°	9.20	9.20	8.97	8.95
	45°	9.58	9.58	9.21	9.31
	-45°	9.58	9.58	9.41	9.31
jTrep bij combinatie (3)	90°	35.64	35.64	38.31	38.41
	0°	30.15	30.15	32.97	32.84
	45°	33.11	33.11	35.04	35.81
	-45°	33.11	33.11	36.56	35.81
jTrep bij combinatie (4)	90°	9.07	9.07	9.04	9.05
	0°	8.37	8.37	8.38	8.37
	45°	8.73	8.73	8.62	8.72
	-45°	8.73	8.73	8.81	8.72
jTrep bij combinatie (5a)	90°	6.85		6.91	
jTrep bij combinatie (6)	90°	9.25		9.33	

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°	10.70	10.70	10.98	11.03
	0°	8.22	8.22	8.35	8.29
	45°	9.56	9.56	9.41	9.79
	-45°	9.56	9.56	10.16	9.79
jTrep bij combinatie (1b)	90°	9.62	9.62	9.36	9.37
	0°	9.20	9.20	8.96	8.95
	45°	9.42	9.42	9.11	9.17
	-45°	9.42	9.42	9.22	9.17
jTrep bij combinatie (3)	90°	18.78	18.78	19.37	19.51
	0°	7.71	7.71	8.78	8.40
	45°	14.64	14.64	13.76	15.24
	-45°	14.64	14.64	16.57	15.24
jTrep bij combinatie (4)	90°	8.78	8.78	8.78	8.79
	0°	8.37	8.37	8.38	8.37
	45°	8.58	8.58	8.52	8.58
	-45°	8.58	8.58	8.64	8.58

Geleidersoort + plaats	:	bliksemdr. boventrav	aantal draden in bundel:	1
Geleiders veld 1 en 2	:	Br 50	Draadnummer	1,2
Veldlengte voor gewicht	[m] :	416,79		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-0,72	-1,14	0	0	**-0,72**	**-1,14**
Qijs;rep		-2,42	-3,85	0	0	**-2,42**	**-3,85**
Qonderhoud;rep		0	0			**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN -						**0,00**	**0,00**
Qw;rep loodrecht lijn,	x	1,32	1,5	0	0	**1,32**	**1,50**
Qw;rep loodrecht lijn,	y	0	-0,21	0	0	**0,00**	**-0,21**
Qw;rep in lijnrichting,	x	0	-0,03	0	0	**0,00**	**-0,03**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,66	0,56	0	0	**0,66**	**0,56**
Qw;rep 45 graden (+y, +x),	y	0	-0,08	0	0	**0,00**	**-0,08**
Qw;rep 45 graden (-y, +x),	x	0,66	0,98	0	0	**0,66**	**0,98**
Qw;rep 45 graden (-y, +x),	y	0	-0,14	0	0	**0,00**	**-0,14**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	1,32	1,55	0	0	**1,32**	**1,55**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,66	0,77	0	0	**0,66**	**0,77**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	0,66	0,77	0	0	**0,66**	**0,77**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	7,69	8,64	0	0	**7,69**	**8,64**
Qw;rep loodrecht lijn,	y	0	-1,21	0	0	**0,00**	**-1,21**
Qw;rep in lijnrichting,	x	0	-0,17	0	0	**0,00**	**-0,17**
Qw;rep in lijnrichting,	y	0	0,02	0	0	**0,00**	**0,02**
Qw;rep 45 graden (+y, +x),	x	3,84	3,19	0	0	**3,84**	**3,19**
Qw;rep 45 graden (+y, +x),	y	0	-0,45	0	0	**0,00**	**-0,45**
Qw;rep 45 graden (-y, +x),	x	3,84	5,62	0	0	**3,84**	**5,62**
Qw;rep 45 graden (-y, +x),	y	0	-0,79	0	0	**0,00**	**-0,79**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	7,69	8,89	0	0	**7,69**	**8,89**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	3,84	4,45	0	0	**3,84**	**4,45**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	3,84	4,45	0	0	**3,84**	**4,45**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	17,17	17,17	17,34	17,45	**17,17**	**17,17**	**17,34**	**17,45**
	0°	8,22	8,22	8,62	8,29				
	45°	13,91	13,91	12,79	14				
	-45°	13,91	13,91	15,07	14				
jTrep bij combinatie (1b)	90°	9,94	9,94	9,64	9,65	**9,94**	**9,94**	**9,64**	**9,65**
	0°	9,2	9,2	8,97	8,95				
	45°	9,58	9,58	9,21	9,31				
	-45°	9,58	9,58	9,41	9,31				
jTrep bij combinatie (3)	90°	35,64	35,64	38,31	38,41	**35,64**	**35,64**	**38,31**	**38,41**
	0°	30,15	30,15	32,97	32,84				
	45°	33,11	33,11	35,04	35,81				
	-45°	33,11	33,11	36,56	35,81				
jTrep bij combinatie (4)	90°	9,07	9,07	9,04	9,05	**9,07**	**9,07**	**9,04**	**9,05**
	0°	8,37	8,37	8,38	8,37				
	45°	8,73	8,73	8,62	8,72				
	-45°	8,73	8,73	8,81	8,72				
jTrep bij combinatie (5a)	90°	6,85		6,91		**6,85**		**6,91**	
jTrep bij combinatie (6)	90°	9,25		9,33		**9,25**		**9,33**	

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	10,7	10,7	10,98	11,03	**10,7**	**10,7**	**10,98**	**11,03**
	0°	8,22	8,22	8,35	8,29				
	45°	9,56	9,56	9,41	9,79				
	-45°	9,56	9,56	10,16	9,79				
jTrep bij combinatie (1b)	90°	9,62	9,62	9,36	9,37	**9,62**	**9,62**	**9,36**	**9,37**
	0°	9,2	9,2	8,96	8,95				
	45°	9,42	9,42	9,11	9,17				
	-45°	9,42	9,42	9,22	9,17				
jTrep bij combinatie (3)	90°	18,78	18,78	19,37	19,51	**18,78**	**18,78**	**19,37**	**19,51**
	0°	7,71	7,71	8,78	8,4				
	45°	14,64	14,64	13,76	15,24				
	-45°	14,64	14,64	16,57	15,24				
jTrep bij combinatie (4)	90°	8,78	8,78	8,78	8,79	**8,78**	**8,78**	**8,78**	**8,79**
	0°	8,37	8,37	8,38	8,37				
	45°	8,58	8,58	8,52	8,58				
	-45°	8,58	8,58	8,64	8,58				

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	:	150 kv-Lijn Leiden-Zoetermeer
Masttype	:	hoekmast
Mastnaam	:	Mast 73 type HU
Mastnummer	:	73
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	B
Referentie periode	:	50

		VELD 1		VELD 2
Minimum lijnhoek	[graden]	180		164
Maximum lijnhoek	[graden]	180		180
Veldlengte	[m]	325		405
Vaklengte	[m]		730	

* 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 ^ Veld 2

|

y = lijnrichting L---> x

Veld 1

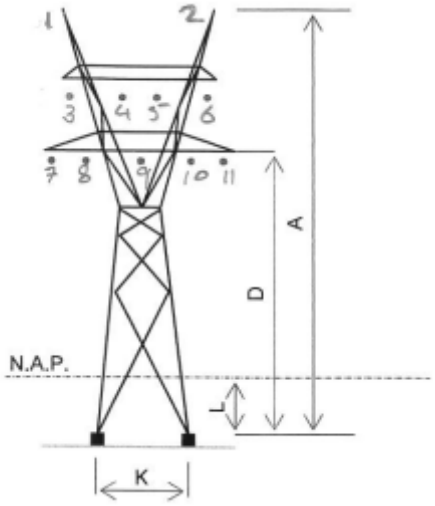
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
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	[%] :	24
Hoogte draadbevestiging	[m] :	44.7

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		46.2	46.2
Hoogte verschil draadbevestiging	[m] :		0.25	-9.65

(aangrenzende minus beschouwende mast)

(hoger = positief)



INVOERGEGEVENS VOOR DRAAD No.:2

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. boventravers	
Geleiders veld 1 en 2	:	CU185	
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	[%] :	24	
Hoogte draadbevestiging	[m] :	44.7	

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		46.2	46.2
Hoogte verschil draadbevestiging	[m] :		0.25	-14.65
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

INVOERGEGEVENS VOOR DRAAD No.:3

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. ondertravers	
Geleiders veld 1 en 2	:	CU185	
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	[%] :	24	
Hoogte draadbevestiging	[m] :	37.5	

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.25	-7.45
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

INVOERGEGEVENS VOOR DRAAD No.:4

Geleidersoort	:	Geleidersoort + plaats:fasedr. ondertravers	
Geleiders veld 1 en 2	:	CU185	
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	[%] :	24	
Hoogte draadbevestiging	[m] :	37.5	

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.25	-12.45
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

Mastnummer	:	73
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	389.23

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.81	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.73	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.39	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.34	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	0.88	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.55	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.22	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.46	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	1.23	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.23	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.11	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.86	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	2.26	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.32	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.98	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.56	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.30	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	3.15	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.15	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	73
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

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°	29.41	29.41	28.57	28.69
	0°	21.21	21.21	21.61	21.45
	45°	25.71	25.71	24.36	25.37
	-45°	25.71	25.71	26.33	25.37
jTrep bij combinatie (1b)	90°	22.95	22.95	22.64	22.65
	0°	22.53	22.53	22.30	22.29
	45°	22.74	22.74	22.42	22.47
	-45°	22.74	22.74	22.52	22.47
jTrep bij combinatie (3)	90°	36.37	36.37	36.35	36.40
	0°	32.94	32.94	33.46	33.40
	45°	34.71	34.71	34.53	34.94
	-45°	34.71	34.71	35.35	34.94
jTrep bij combinatie (4)	90°	28.37	28.37	26.69	26.70
	0°	27.92	27.92	26.32	26.31
	45°	28.15	28.15	26.45	26.51
	-45°	28.15	28.15	26.56	26.51
jTrep bij combinatie (5a)	90°	17.67		17.87	
jTrep bij combinatie (6)	90°	23.86		24.13	

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°	23.40	23.40	23.41	23.45
	0°	21.21	21.21	21.49	21.45
	45°	22.34	22.34	22.20	22.47
	-45°	22.34	22.34	22.75	22.47
jTrep bij combinatie (1b)	90°	22.79	22.79	22.51	22.52
	0°	22.53	22.53	22.30	22.29
	45°	22.66	22.66	22.37	22.40
	-45°	22.66	22.66	22.44	22.40
jTrep bij combinatie (3)	90°	26.76	26.76	26.65	26.70
	0°	23.69	23.69	24.09	24.03
	45°	25.29	25.29	25.04	25.41
	-45°	25.29	25.29	25.77	25.41
jTrep bij combinatie (4)	90°	27.15	27.15	25.89	25.90
	0°	26.86	26.86	25.65	25.65
	45°	27.01	27.01	25.74	25.77
	-45°	27.01	27.01	25.81	25.77

Mastnummer	:	73
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	402.20

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 4.03	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.83	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.31	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.33	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	0.85	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.50	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.21	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.17	2.38	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.09	1.19	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.09	1.19	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	5.92	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.83	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	2.19	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.31	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.85	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.54	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.56	6.09	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	2.78	3.05	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	2.78	3.05	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	73
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

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°	29.41	29.41	28.26	28.37
	0°	21.21	21.21	21.66	21.50
	45°	25.71	25.71	24.25	25.21
	-45°	25.71	25.71	26.12	25.21
jTrep bij combinatie (1b)	90°	22.95	22.95	22.68	22.68
	0°	22.53	22.53	22.36	22.35
	45°	22.74	22.74	22.47	22.52
	-45°	22.74	22.74	22.56	22.52
jTrep bij combinatie (3)	90°	36.37	36.37	36.27	36.32
	0°	32.94	32.94	33.55	33.49
	45°	34.71	34.71	34.55	34.94
	-45°	34.71	34.71	35.33	34.94
jTrep bij combinatie (4)	90°	28.37	28.37	26.43	26.44
	0°	27.92	27.92	26.08	26.07
	45°	28.15	28.15	26.21	26.26
	-45°	28.15	28.15	26.31	26.26
jTrep bij combinatie (5a)	90°	17.67		17.92	
jTrep bij combinatie (6)	90°	23.86		24.19	

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°	23.40	23.40	23.36	23.39
	0°	21.21	21.21	21.54	21.50
	45°	22.34	22.34	22.21	22.47
	-45°	22.34	22.34	22.73	22.47
jTrep bij combinatie (1b)	90°	22.79	22.79	22.56	22.56
	0°	22.53	22.53	22.36	22.35
	45°	22.66	22.66	22.43	22.46
	-45°	22.66	22.66	22.48	22.46
jTrep bij combinatie (3)	90°	26.76	26.76	26.57	26.61
	0°	23.69	23.69	24.15	24.10
	45°	25.29	25.29	25.04	25.39
	-45°	25.29	25.29	25.73	25.39
jTrep bij combinatie (4)	90°	27.15	27.15	25.72	25.72
	0°	26.86	26.86	25.49	25.49
	45°	27.01	27.01	25.57	25.61
	-45°	27.01	27.01	25.64	25.61

Mastnummer	:	73
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	383.52

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.71	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.68	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.19	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.31	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	0.81	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.42	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.20	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.26	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	1.13	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.13	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.60	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.79	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.07	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.29	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	3.65	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.51	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.77	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.89	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	2.89	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	73
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

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°	28.47	28.47	27.54	27.65
	0°	21.21	21.21	21.56	21.42
	45°	25.16	25.16	23.89	24.76
	-45°	25.16	25.16	25.59	24.76
jTrep bij combinatie (1b)	90°	22.89	22.89	22.56	22.57
	0°	22.53	22.53	22.27	22.27
	45°	22.71	22.71	22.38	22.42
	-45°	22.71	22.71	22.46	22.42
jTrep bij combinatie (3)	90°	35.93	35.93	35.86	35.90
	0°	32.94	32.94	33.42	33.36
	45°	34.47	34.47	34.31	34.66
	-45°	34.47	34.47	35.01	34.66
jTrep bij combinatie (4)	90°	28.31	28.31	26.75	26.75
	0°	27.92	27.92	26.43	26.43
	45°	28.12	28.12	26.54	26.59
	-45°	28.12	28.12	26.63	26.59
jTrep bij combinatie (5a)	90°	17.67		17.85	
jTrep bij combinatie (6)	90°	23.86		24.10	

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°	23.12	23.12	23.08	23.12
	0°	21.21	21.21	21.46	21.42
	45°	22.19	22.19	22.05	22.29
	-45°	22.19	22.19	22.52	22.29
jTrep bij combinatie (1b)	90°	22.75	22.75	22.45	22.46
	0°	22.53	22.53	22.27	22.27
	45°	22.64	22.64	22.34	22.36
	-45°	22.64	22.64	22.39	22.36
jTrep bij combinatie (3)	90°	26.37	26.37	26.22	26.27
	0°	23.69	23.69	24.05	24.00
	45°	25.08	25.08	24.85	25.16
	-45°	25.08	25.08	25.47	25.16
jTrep bij combinatie (4)	90°	27.11	27.11	25.93	25.93
	0°	26.86	26.86	25.73	25.72
	45°	26.99	26.99	25.80	25.83
	-45°	26.99	26.99	25.86	25.83

Mastnummer	:	73
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	396.49

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 2.70	- 3.93	- 2.50	- 2.50
Qijs;rep		- 1.22	- 1.78	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.10	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.29	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	0.77	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.36	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.19	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.02	2.16	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.01	1.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.01	1.08	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.36	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.75	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	1.98	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.28	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	3.49	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.49	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	5.17	5.52	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	2.59	2.76	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	2.59	2.76	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	73
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

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°	28.47	28.47	27.15	27.25
	0°	21.21	21.21	21.61	21.48
	45°	25.16	25.16	23.75	24.56
	-45°	25.16	25.16	25.33	24.56
jTrep bij combinatie (1b)	90°	22.89	22.89	22.59	22.60
	0°	22.53	22.53	22.33	22.33
	45°	22.71	22.71	22.42	22.46
	-45°	22.71	22.71	22.50	22.46
jTrep bij combinatie (3)	90°	35.93	35.93	35.75	35.79
	0°	32.94	32.94	33.50	33.45
	45°	34.47	34.47	34.32	34.64
	-45°	34.47	34.47	34.96	34.64
jTrep bij combinatie (4)	90°	28.31	28.31	26.47	26.47
	0°	27.92	27.92	26.18	26.18
	45°	28.12	28.12	26.28	26.33
	-45°	28.12	28.12	26.37	26.33
jTrep bij combinatie (5a)	90°	17.67		17.90	
jTrep bij combinatie (6)	90°	23.86		24.16	

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°	23.12	23.12	23.01	23.04
	0°	21.21	21.21	21.51	21.48
	45°	22.19	22.19	22.06	22.27
	-45°	22.19	22.19	22.49	22.27
jTrep bij combinatie (1b)	90°	22.75	22.75	22.49	22.50
	0°	22.53	22.53	22.33	22.33
	45°	22.64	22.64	22.39	22.41
	-45°	22.64	22.64	22.43	22.41
jTrep bij combinatie (3)	90°	26.37	26.37	26.11	26.15
	0°	23.69	23.69	24.11	24.07
	45°	25.08	25.08	24.84	25.13
	-45°	25.08	25.08	25.42	25.13
jTrep bij combinatie (4)	90°	27.11	27.11	25.74	25.75
	0°	26.86	26.86	25.56	25.55
	45°	26.99	26.99	25.62	25.65
	-45°	26.99	26.99	25.68	25.65

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	3,4,6	
Veldlengte voor gewicht [m]	:	389,23			

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-3,81	-2,5	-2,5	**-7,90**	**-10,12**
Qijs;rep		-1,22	-1,73	0	0	**-2,44**	**-3,46**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,39	0,57	0,57	**4,91**	**5,35**
Qw;rep loodrecht lijn,	y	0	-0,34	0	0	**0,00**	**-0,68**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,09	0,88	0,4	0,4	**2,58**	**2,16**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,09	1,55	0,4	0,4	**2,58**	**3,50**
Qw;rep 45 graden (-y, +x),	y	0	-0,22	-0,4	-0,4	**-0,40**	**-0,84**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,46	0,57	0,57	**4,91**	**5,49**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,09	1,23	0,4	0,4	**2,58**	**2,86**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,09	1,23	0,4	0,4	**2,58**	**2,86**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,11	0,57	0,57	**11,69**	**12,79**
Qw;rep loodrecht lijn,	y	0	-0,86	0	0	**0,00**	**-1,72**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	2,78	2,26	0,4	0,4	**5,96**	**4,92**
Qw;rep 45 graden (+y, +x),	y	0	-0,32	0,4	0,4	**0,40**	**-0,24**
Qw;rep 45 graden (-y, +x),	x	2,78	3,98	0,4	0,4	**5,96**	**8,36**
Qw;rep 45 graden (-y, +x),	y	0	-0,56	-0,4	-0,4	**-0,40**	**-1,52**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,3	0,57	0,57	**11,69**	**13,17**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,78	3,15	0,4	0,4	**5,96**	**6,70**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	2,78	3,15	0,4	0,4	**5,96**	**6,70**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,41	29,41	28,57	28,69	**58,82**	**58,82**	**57,14**	**57,38**
	0°	21,21	21,21	21,61	21,45				
	45°	25,71	25,71	24,36	25,37				
	-45°	25,71	25,71	26,33	25,37				
jTrep bij combinatie (1b)	90°	22,95	22,95	22,64	22,65	**45,9**	**45,9**	**45,28**	**45,3**
	0°	22,53	22,53	22,3	22,29				
	45°	22,74	22,74	22,42	22,47				
	-45°	22,74	22,74	22,52	22,47				
jTrep bij combinatie (3)	90°	36,37	36,37	36,35	36,4	**72,74**	**72,74**	**72,7**	**72,8**
	0°	32,94	32,94	33,46	33,4				
	45°	34,71	34,71	34,53	34,94				
	-45°	34,71	34,71	35,35	34,94				
jTrep bij combinatie (4)	90°	28,37	28,37	26,69	26,7	**56,74**	**56,74**	**53,38**	**53,4**
	0°	27,92	27,92	26,32	26,31				
	45°	28,15	28,15	26,45	26,51				
	-45°	28,15	28,15	26,56	26,51				
jTrep bij combinatie (5a)	90°	17,67		17,87		**35,34**		**35,74**	
jTrep bij combinatie (6)	90°	23,86		24,13		**47,72**		**48,26**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,4	23,4	23,41	23,45	**46,8**	**46,8**	**46,82**	**46,9**
	0°	21,21	21,21	21,49	21,45				
	45°	22,34	22,34	22,2	22,47				
	-45°	22,34	22,34	22,75	22,47				
jTrep bij combinatie (1b)	90°	22,79	22,79	22,51	22,52	**45,58**	**45,58**	**45,02**	**45,04**
	0°	22,53	22,53	22,3	22,29				
	45°	22,66	22,66	22,37	22,4				
	-45°	22,66	22,66	22,44	22,4				
jTrep bij combinatie (3)	90°	26,76	26,76	26,65	26,7	**53,52**	**53,52**	**53,3**	**53,4**
	0°	23,69	23,69	24,09	24,03				
	45°	25,29	25,29	25,04	25,41				
	-45°	25,29	25,29	25,77	25,41				
jTrep bij combinatie (4)	90°	27,15	27,15	25,89	25,9	**54,3**	**54,3**	**51,78**	**51,8**
	0°	26,86	26,86	25,65	25,65				
	45°	27,01	27,01	25,74	25,77				
	-45°	27,01	27,01	25,81	25,77				

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	5	
Veldlengte voor gewicht [m]	:	402,2			

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-4,03	-2,5	-2,5	**-7,90**	**-10,56**
Qijs;rep		-1,22	-1,83	0	0	**-2,44**	**-3,66**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,31	0,57	0,57	**4,91**	**5,19**
Qw;rep loodrecht lijn,	y	0	-0,33	0	0	**0,00**	**-0,66**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,09	0,85	0,4	0,4	**2,58**	**2,10**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,09	1,5	0,4	0,4	**2,58**	**3,40**
Qw;rep 45 graden (-y, +x),	y	0	-0,21	-0,4	-0,4	**-0,40**	**-0,82**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,17	2,38	0,57	0,57	**4,91**	**5,33**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,09	1,19	0,4	0,4	**2,58**	**2,78**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,09	1,19	0,4	0,4	**2,58**	**2,78**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	5,92	0,57	0,57	**11,69**	**12,41**
Qw;rep loodrecht lijn,	y	0	-0,83	0	0	**0,00**	**-1,66**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	2,78	2,19	0,4	0,4	**5,96**	**4,78**
Qw;rep 45 graden (+y, +x),	y	0	-0,31	0,4	0,4	**0,40**	**-0,22**
Qw;rep 45 graden (-y, +x),	x	2,78	3,85	0,4	0,4	**5,96**	**8,10**
Qw;rep 45 graden (-y, +x),	y	0	-0,54	-0,4	-0,4	**-0,40**	**-1,48**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,56	6,09	0,57	0,57	**11,69**	**12,75**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,78	3,05	0,4	0,4	**5,96**	**6,50**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	2,78	3,05	0,4	0,4	**5,96**	**6,50**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

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

	VEL	VELD 2				VELD 1		VELD 2	
	Hoe	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,41	29,41	28,26	28,37	**58,82**	**58,82**	**56,52**	**56,74**
	0°	21,21	21,21	21,66	21,5				
	45°	25,71	25,71	24,25	25,21				
	-45°	25,71	25,71	26,12	25,21				
jTrep bij combinatie (1b)	90°	22,95	22,95	22,68	22,68	**45,9**	**45,9**	**45,36**	**45,36**
	0°	22,53	22,53	22,36	22,35				
	45°	22,74	22,74	22,47	22,52				
	-45°	22,74	22,74	22,56	22,52				
jTrep bij combinatie (3)	90°	36,37	36,37	36,27	36,32	**72,74**	**72,74**	**72,54**	**72,64**
	0°	32,94	32,94	33,55	33,49				
	45°	34,71	34,71	34,55	34,94				
	-45°	34,71	34,71	35,33	34,94				
jTrep bij combinatie (4)	90°	28,37	28,37	26,43	26,44	**56,74**	**56,74**	**52,86**	**52,88**
	0°	27,92	27,92	26,08	26,07				
	45°	28,15	28,15	26,21	26,26				
	-45°	28,15	28,15	26,31	26,26				
jTrep bij combinatie (5a)	90°	17,67		17,92		**35,34**		**35,84**	
jTrep bij combinatie (6)	90°	23,86		24,19		**47,72**		**48,38**	

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,4	23,4	23,36	23,39	**46,8**	**46,8**	**46,72**	**46,78**
	0°	21,21	21,21	21,54	21,5				
	45°	22,34	22,34	22,21	22,47				
	-45°	22,34	22,34	22,73	22,47				
jTrep bij combinatie (1b)	90°	22,79	22,79	22,56	22,56	**45,58**	**45,58**	**45,12**	**45,12**
	0°	22,53	22,53	22,36	22,35				
	45°	22,66	22,66	22,43	22,46				
	-45°	22,66	22,66	22,48	22,46				
jTrep bij combinatie (3)	90°	26,76	26,76	26,57	26,61	**53,52**	**53,52**	**53,14**	**53,22**
	0°	23,69	23,69	24,15	24,1				
	45°	25,29	25,29	25,04	25,39				
	-45°	25,29	25,29	25,73	25,39				
jTrep bij combinatie (4)	90°	27,15	27,15	25,72	25,72	**54,3**	**54,3**	**51,44**	**51,44**
	0°	26,86	26,86	25,49	25,49				
	45°	27,01	27,01	25,57	25,61				
	-45°	27,01	27,01	25,64	25,61				

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	7,11
Veldlengte voor gewicht [m]	:	383,52		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-3,71	-2,5	-2,5	**-7,90**	**-9,92**
Qijs;rep		-1,22	-1,68	0	0	**-2,44**	**-3,36**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,19	0,55	0,55	**4,59**	**4,93**
Qw;rep loodrecht lijn,	y	0	-0,31	0	0	**0,00**	**-0,62**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,01	0,81	0,39	0,39	**2,41**	**2,01**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,01	1,42	0,39	0,39	**2,41**	**3,23**
Qw;rep 45 graden (-y, +x),	y	0	-0,2	-0,39	-0,39	**-0,39**	**-0,79**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,26	0,55	0,55	**4,59**	**5,07**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,01	1,13	0,39	0,39	**2,41**	**2,65**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,01	1,13	0,39	0,39	**2,41**	**2,65**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,6	0,55	0,55	**10,89**	**11,75**
Qw;rep loodrecht lijn,	y	0	-0,79	0	0	**0,00**	**-1,58**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,02	0,55	0,55	**0,55**	**0,59**
Qw;rep 45 graden (+y, +x),	x	2,59	2,07	0,39	0,39	**5,57**	**4,53**
Qw;rep 45 graden (+y, +x),	y	0	-0,29	0,39	0,39	**0,39**	**-0,19**
Qw;rep 45 graden (-y, +x),	x	2,59	3,65	0,39	0,39	**5,57**	**7,69**
Qw;rep 45 graden (-y, +x),	y	0	-0,51	-0,39	-0,39	**-0,39**	**-1,41**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,77	0,55	0,55	**10,89**	**12,09**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	2,59	2,89	0,39	0,39	**5,57**	**6,17**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	2,59	2,89	0,39	0,39	**5,57**	**6,17**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	28,47	28,47	27,54	27,65	**56,94**	**56,94**	**55,08**	**55,3**
	0°	21,21	21,21	21,56	21,42				
	45°	25,16	25,16	23,89	24,76				
	-45°	25,16	25,16	25,59	24,76				
jTrep bij combinatie (1b)	90°	22,89	22,89	22,56	22,57	**45,78**	**45,78**	**45,12**	**45,14**
	0°	22,53	22,53	22,27	22,27				
	45°	22,71	22,71	22,38	22,42				
	-45°	22,71	22,71	22,46	22,42				
jTrep bij combinatie (3)	90°	35,93	35,93	35,86	35,9	**71,86**	**71,86**	**71,72**	**71,8**
	0°	32,94	32,94	33,42	33,36				
	45°	34,47	34,47	34,31	34,66				
	-45°	34,47	34,47	35,01	34,66				
jTrep bij combinatie (4)	90°	28,31	28,31	26,75	26,75	**56,62**	**56,62**	**53,5**	**53,5**
	0°	27,92	27,92	26,43	26,43				
	45°	28,12	28,12	26,54	26,59				
	-45°	28,12	28,12	26,63	26,59				
jTrep bij combinatie (5a)	90°	17,67		17,85		**35,34**		**35,7**	
jTrep bij combinatie (6)	90°	23,86		24,1		**47,72**		**48,2**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,12	23,12	23,08	23,12	**46,24**	**46,24**	**46,16**	**46,24**
	0°	21,21	21,21	21,46	21,42				
	45°	22,19	22,19	22,05	22,29				
	-45°	22,19	22,19	22,52	22,29				
jTrep bij combinatie (1b)	90°	22,75	22,75	22,45	22,46	**45,5**	**45,5**	**44,9**	**44,92**
	0°	22,53	22,53	22,27	22,27				
	45°	22,64	22,64	22,34	22,36				
	-45°	22,64	22,64	22,39	22,36				
jTrep bij combinatie (3)	90°	26,37	26,37	26,22	26,27	**52,74**	**52,74**	**52,44**	**52,54**
	0°	23,69	23,69	24,05	24				
	45°	25,08	25,08	24,85	25,16				
	-45°	25,08	25,08	25,47	25,16				
jTrep bij combinatie (4)	90°	27,11	27,11	25,93	25,93	**54,22**	**54,22**	**51,86**	**51,86**
	0°	26,86	26,86	25,73	25,72				
	45°	26,99	26,99	25,8	25,83				
	-45°	26,99	26,99	25,86	25,83				

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	8,9,10	
Veldlengte voor gewicht [m]	:	396,49			

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-2,7	-3,93	-2,5	-2,5	**-7,90**	**-10,36**
Qijs;rep		-1,22	-1,78	0	0	**-2,44**	**-3,56**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,1	0,55	0,55	**4,59**	**4,75**
Qw;rep loodrecht lijn,	y	0	-0,29	0	0	**0,00**	**-0,58**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,01	0,77	0,39	0,39	**2,41**	**1,93**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,01	1,36	0,39	0,39	**2,41**	**3,11**
Qw;rep 45 graden (-y, +x),	y	0	-0,19	-0,39	-0,39	**-0,39**	**-0,77**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,02	2,16	0,55	0,55	**4,59**	**4,87**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,01	1,08	0,39	0,39	**2,41**	**2,55**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,01	1,08	0,39	0,39	**2,41**	**2,55**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,36	0,55	0,55	**10,89**	**11,27**
Qw;rep loodrecht lijn,	y	0	-0,75	0	0	**0,00**	**-1,50**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	2,59	1,98	0,39	0,39	**5,57**	**4,35**
Qw;rep 45 graden (+y, +x),	y	0	-0,28	0,39	0,39	**0,39**	**-0,17**
Qw;rep 45 graden (-y, +x),	x	2,59	3,49	0,39	0,39	**5,57**	**7,37**
Qw;rep 45 graden (-y, +x),	y	0	-0,49	-0,39	-0,39	**-0,39**	**-1,37**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	5,17	5,52	0,55	0,55	**10,89**	**11,59**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	2,59	2,76	0,39	0,39	**5,57**	**5,91**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	2,59	2,76	0,39	0,39	**5,57**	**5,91**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	28,47	28,47	27,15	27,25	**56,94**	**56,94**	**54,3**	**54,5**
	0°	21,21	21,21	21,61	21,48				
	45°	25,16	25,16	23,75	24,56				
	-45°	25,16	25,16	25,33	24,56				
jTrep bij combinatie (1b)	90°	22,89	22,89	22,59	22,6	**45,78**	**45,78**	**45,18**	**45,2**
	0°	22,53	22,53	22,33	22,33				
	45°	22,71	22,71	22,42	22,46				
	-45°	22,71	22,71	22,5	22,46				
jTrep bij combinatie (3)	90°	35,93	35,93	35,75	35,79	**71,86**	**71,86**	**71,5**	**71,58**
	0°	32,94	32,94	33,5	33,45				
	45°	34,47	34,47	34,32	34,64				
	-45°	34,47	34,47	34,96	34,64				
jTrep bij combinatie (4)	90°	28,31	28,31	26,47	26,47	**56,62**	**56,62**	**52,94**	**52,94**
	0°	27,92	27,92	26,18	26,18				
	45°	28,12	28,12	26,28	26,33				
	-45°	28,12	28,12	26,37	26,33				
jTrep bij combinatie (5a)	90°	17,67		17,9		**35,34**		**35,8**	
jTrep bij combinatie (6)	90°	23,86		24,16		**47,72**		**48,32**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	23,12	23,12	23,01	23,04	**46,24**	**46,24**	**46,02**	**46,08**
	0°	21,21	21,21	21,51	21,48				
	45°	22,19	22,19	22,06	22,27				
	-45°	22,19	22,19	22,49	22,27				
jTrep bij combinatie (1b)	90°	22,75	22,75	22,49	22,5	**45,5**	**45,5**	**44,98**	**45**
	0°	22,53	22,53	22,33	22,33				
	45°	22,64	22,64	22,39	22,41				
	-45°	22,64	22,64	22,43	22,41				
jTrep bij combinatie (3)	90°	26,37	26,37	26,11	26,15	**52,74**	**52,74**	**52,22**	**52,3**
	0°	23,69	23,69	24,11	24,07				
	45°	25,08	25,08	24,84	25,13				
	-45°	25,08	25,08	25,42	25,13				
jTrep bij combinatie (4)	90°	27,11	27,11	25,74	25,75	**54,22**	**54,22**	**51,48**	**51,5**
	0°	26,86	26,86	25,56	25,55				
	45°	26,99	26,99	25,62	25,65				
	-45°	26,99	26,99	25,68	25,65				

Bijlage B Berekening Mast 73; Scia Engineer

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Auteur	- SMA
Datum	28.03.2014
Constructie	Algemeen XYZ
Nationale norm	EC - ENV

Stalenprofielen op niveau 39+ en 46.2+ zijn gecontroleerd volgens EC - EN, Zie 11.4

D&C ENGINEERING design and construct	**Project**	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

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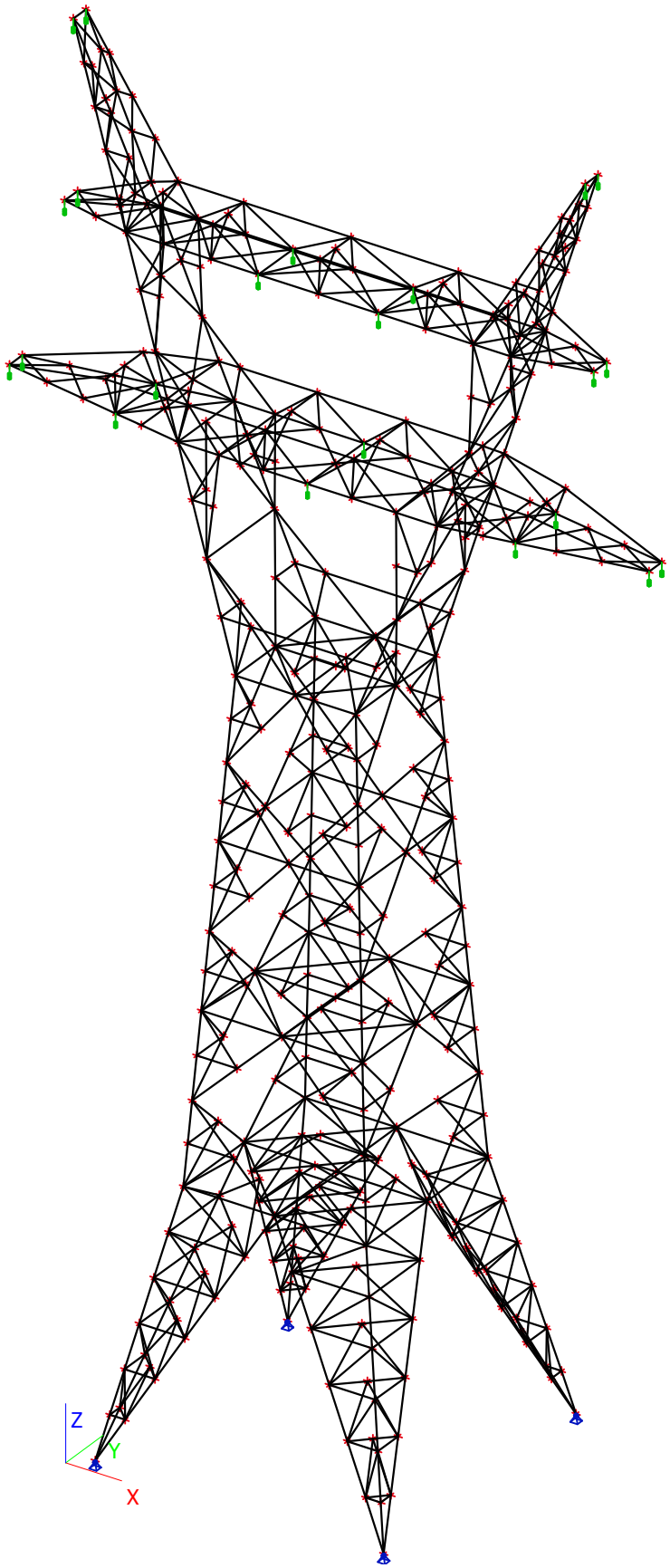
D&C ENGINEERING	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

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
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
K177	7,185	0,001	47,000
K186	-2,498	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	-9,475	-0,747	45,700
K314	-9,475	0,747	45,700
K325	-10,647	-0,400	53,000
K335	-6,435	1,081	45,700
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	-8,316	-1,253	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	8,316	1,253	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	8,316	-1,253	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	-11,540	0,701	38,500
K496	-11,540	-0,701	38,500
K521	-7,103	-1,461	38,500
K522	-7,103	1,461	38,500
K527	3,677	0,000	38,500
K531	0,000	0,000	38,500
K538	8,778	-0,008	39,672
K546	5,938	0,000	39,994
K550	11,540	-0,701	38,500
K552	9,833	-0,993	38,500
K553	11,540	0,701	38,500
K555	9,833	0,993	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
N2	-3,800	-3,800	10,500
N4	3,800	-3,800	10,500
N5	-3,800	3,800	10,500
N8	3,800	3,800	10,500
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
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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

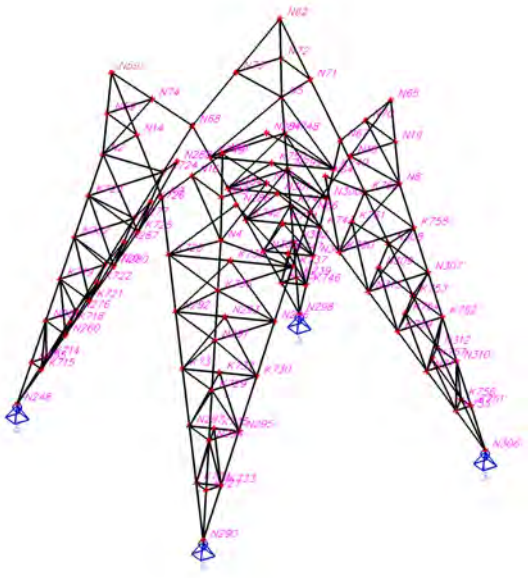
Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
N87	1,791	-3,467	15,621
N88	3,467	-3,467	15,621
N89	3,467	-1,791	15,621
N90	3,467	1,791	15,621
N91	3,467	3,467	15,621
N92	1,791	3,467	15,621
N93	-1,791	3,467	15,621
N94	-3,467	3,467	15,621
N95	-3,467	1,791	15,621
N96	-3,467	-1,791	15,621
N97	-3,467	-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
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

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
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
K625	2,500	-0,001	30,500
K626	-5,397	1,753	38,500
K627	-4,465	-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
N183	0,000	0,000	30,500
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
K631	-11,000	0,400	45,700
N247	0,000	-3,353	17,382
K705	3,353	3,353	17,382
K706	3,353	0,000	17,382
K707	3,353	-3,353	17,382
K708	-3,353	3,353	17,382
K709	0,000	3,353	17,382
K711	-3,353	-3,353	17,382
K712	-3,353	0,000	17,382
N248	-6,000	-6,000	0,000
N260	-4,000	-5,267	3,500
N261	-5,267	-5,267	3,500
N262	-4,533	-4,533	7,000
N276	-5,267	-4,000	3,500
N277	-4,533	-2,000	7,000
N280	-2,000	-4,533	7,000
N64	1,900	1,900	10,500
N284	-1,900	1,900	10,500
N286	1,900	-1,900	10,500
N287	-3,267	-3,267	7,000
N288	-1,900	-1,900	10,500
N289	0,000	0,000	10,500
K655	-5,633	-5,633	1,750
K714	-5,633	-5,000	1,750
K715	-5,000	-5,633	1,750
K718	-4,633	-4,633	3,500
K719	-4,900	-4,900	5,250
K720	-4,900	-3,000	5,250
K721	-3,000	-4,900	5,250
K722	-3,950	-3,950	5,250
K723	-4,167	-4,167	8,750
K724	-4,167	-1,000	8,750
K725	-1,000	-4,167	8,750
K726	-2,583	-2,583	8,750
N290	6,000	-6,000	0,000
K727	5,633	-5,633	1,750
K728	1,000	-4,167	8,750
N291	4,533	-4,533	7,000
N292	2,000	-4,533	7,000
N293	3,267	-3,267	7,000
K729	4,900	-4,900	5,250
K730	4,900	-3,000	5,250
K731	3,000	-4,900	5,250
K732	3,950	-3,950	5,250
N294	5,267	-5,267	3,500
N295	5,267	-4,000	3,500

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K733	5,633	-5,000	1,750
K734	5,000	-5,633	1,750
K735	4,633	-4,633	3,500
N296	4,533	-2,000	7,000
K736	4,167	-4,167	8,750
K737	4,167	-1,000	8,750
K738	2,583	-2,583	8,750
N297	4,000	-5,267	3,500
N298	-6,000	6,000	0,000
K739	-5,633	5,633	1,750
K740	-1,000	4,167	8,750
N299	-4,533	4,533	7,000
N300	-2,000	4,533	7,000
N301	-3,267	3,267	7,000
K741	-4,900	4,900	5,250
K742	-4,900	3,000	5,250
K743	-3,000	4,900	5,250
K744	-3,950	3,950	5,250
N302	-5,267	5,267	3,500
N303	-5,267	4,000	3,500
K745	-5,633	5,000	1,750
K746	-5,000	5,633	1,750
K747	-4,633	4,633	3,500
N304	-4,533	2,000	7,000
K748	-4,167	4,167	8,750
K749	-4,167	1,000	8,750
K750	-2,583	2,583	8,750
N305	-4,000	5,267	3,500
N306	6,000	6,000	0,000
K751	5,633	5,633	1,750
N307	4,533	4,533	7,000
N308	2,000	4,533	7,000
N309	3,267	3,267	7,000
K752	4,900	4,900	5,250
K753	3,000	4,900	5,250
K754	3,950	3,950	5,250
N310	5,267	5,267	3,500
N311	5,267	4,000	3,500
K755	5,633	5,000	1,750
K756	5,000	5,633	1,750
K757	4,633	4,633	3,500
K758	4,167	4,167	8,750
N312	4,000	5,267	3,500
K759	4,900	3,000	5,250
N313	4,533	2,000	7,000
K760	4,167	1,000	8,750
K761	2,583	2,583	8,750
K762	1,000	4,167	8,750
K763	0,000	0,000	17,382
K765	-7,103	0,001	38,500
K767	-9,833	-0,993	38,500
K768	-9,833	0,993	38,500
K774	7,103	0,002	38,500
K775	7,103	-1,461	38,500
K776	7,103	1,461	38,500
K780	9,475	-0,747	45,700
K781	9,475	0,747	45,700
K783	6,527	1,462	41,621
K785	6,526	-1,462	41,620
K786	-8,316	1,253	38,500
K787	-4,465	1,081	45,700

4. Knoopnummers

4.1. Knoopnummers steunpunten



5. 1D-staaf

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S2	CS12 - L50X5	1,862	Lijn	K3	K256	Kolom (100)	standaard	CrossArm6
S3	CS12 - L50X5	2,018	Lijn	K5	K3	Kolom (100)	standaard	CrossArm6
S4	CS12 - L50X5	1,862	Lijn	K7	K325	Kolom (100)	standaard	CrossArm6
S5	CS12 - L50X5	2,018	Lijn	K9	K7	Kolom (100)	standaard	CrossArm6
S6	CS12 - L50X5	1,364	Lijn	K9	K5	Balk (80)	standaard	CrossArm6
S7	CS12 - L50X5	2,184	Lijn	K13	K9	Kolom (100)	standaard	CrossArm6
S8	CS130 - L50X5	2,162	Lijn	K15	K13	Kolom (100)	standaard	CrossArm6
S9	CS12 - L50X5	2,184	Lijn	K17	K5	Kolom (100)	standaard	CrossArm6
S10	CS130 - L50X5	2,162	Lijn	K15	K17	Kolom (100)	standaard	CrossArm6
S11	CS7 - L50X5	1,511	Lijn	K21	K5	Kolom (100)	standaard	CrossArm6
S12	CS7 - L50X5	0,336	Lijn	K21	K7	Balk (80)	standaard	CrossArm6
S13	CS7 - L50X5	1,501	Lijn	K24	K13	Kolom (100)	standaard	CrossArm6
S14	CS7 - L50X5	0,649	Lijn	K24	K5	Balk (80)	standaard	CrossArm6
S15	CS7 - L50X5	1,911	Lijn	K28	K29	Kolom (100)	standaard	CrossArm6
S16	CS7 - L50X5	0,969	Lijn	K28	K13	Balk (80)	standaard	CrossArm6
S17	CS7 - L50X5	1,511	Lijn	K31	K9	Kolom (100)	standaard	CrossArm6
S18	CS7 - L50X5	0,336	Lijn	K31	K3	Balk (80)	standaard	CrossArm6
S19	CS7 - L50X5	1,501	Lijn	K1	K17	Kolom (100)	standaard	CrossArm6
S20	CS7 - L50X5	0,649	Lijn	K1	K9	Balk (80)	standaard	CrossArm6
S21	CS7 - L50X5	1,911	Lijn	K38	K39	Kolom (100)	standaard	CrossArm6
S22	CS7 - L50X5	0,969	Lijn	K38	K17	Balk (80)	standaard	CrossArm6
S23	CS151 - L50X5	1,450	Lijn	K388	K15	Kolom (100)	standaard	Vak20
S24	CS151 - L50X5	1,451	Lijn	K43	K15	Kolom (100)	standaard	Vak20
S25	CS151 - L50X5	1,993	Lijn	K39	K29	Balk (80)	standaard	Vak20
S26	CS96 - L110X10	2,386	Lijn	K47	K388	Kolom (100)	standaard	Vak11
S27	CS96 - L110X10	2,652	Lijn	K620	K47	Kolom (100)	standaard	Vak11
S28	CS96 - L110X10	2,386	Lijn	K47	K43	Kolom (100)	standaard	Vak11
S29	CS96 - L110X10	2,651	Lijn	K619	K47	Kolom (100)	standaard	Vak11
S30	CS129 - L50X5	2,536	Lijn	K55	K56	Balk (80)	standaard	Vak11
S31	CS93 - L90X9	2,265	Lijn	K67	K620	Kolom (100)	standaard	Vak10
S34	CS93 - L90X9	2,366	Lijn	K63	K67	Kolom (100)	standaard	Vak10
S35	CS125 - L60X6	3,232	Polylijn	K65	K61	Balk (80)	standaard	Vak10
S36	CS93 - L90X9	2,265	Lijn	K67	K619	Kolom (100)	standaard	Vak10
S37	CS91 - L150X15	4,747	Lijn	K69	K70	Kolom (100)	standaard	Vak7
S38	CS4 - L50X5	0,879	Lijn	K71	K72	Balk (80)	standaard	Vak7
S40	CS91 - L150X15	4,747	Lijn	K75	K70	Kolom (100)	standaard	Vak7
S41	CS4 - L50X5	0,879	Lijn	K77	K78	Balk (80)	standaard	Vak7
S42	CS92 - L50X5	2,227	Lijn	K78	K63	Kolom (100)	standaard	Vak7
S43	CS4 - L50X5	0,864	Lijn	K81	K82	Balk (80)	standaard	Vak8
S44	CS92 - L50X5	2,231	Lijn	K81	K83	Kolom (100)	standaard	Vak8
S47	CS86 - L130X12	6,452	Polylijn	K104	K606	Balk (80)	standaard	Vak6
S48	CS86 - L130X12	6,452	Polylijn	K111	K90	Balk (80)	standaard	Vak6
S49	CS84 - L90X9	2,076	Lijn	K91	K86	Kolom (100)	standaard	Vak6
S51	CS85 - L50X5	2,571	Lijn	K91	K95	Kolom (100)	standaard	Vak6
S52	CS130 - L50X5	1,250	Lijn	K90	K95	Balk (80)	standaard	Vak6
S54	CS37 - L75X8	4,252	Lijn	K75	K69	Balk (80)	standaard	Vak7
S55	CS85 - L50X5	2,571	Lijn	K102	K103	Kolom (100)	standaard	Vak6
S56	CS130 - L50X5	1,250	Lijn	K104	K103	Balk (80)	standaard	Vak6
S61	CS84 - L90X9	2,076	Lijn	K112	K87	Kolom (100)	standaard	Vak6
S65	CS12 - L50X5	1,862	Lijn	K118	K284	Kolom (100)	standaard	CrossArm5
S66	CS12 - L50X5	2,018	Lijn	K120	K118	Kolom (100)	standaard	CrossArm5
S67	CS12 - L50X5	1,862	Lijn	K122	K618	Kolom (100)	standaard	CrossArm5
S68	CS12 - L50X5	2,018	Lijn	K124	K122	Kolom (100)	standaard	CrossArm5
S69	CS12 - L50X5	1,364	Lijn	K124	K120	Balk (80)	standaard	CrossArm5
S70	CS12 - L50X5	2,184	Lijn	K128	K124	Kolom (100)	standaard	CrossArm5
S71	CS130 - L50X5	2,162	Lijn	K130	K128	Kolom (100)	standaard	CrossArm5
S72	CS12 - L50X5	2,184	Lijn	K132	K120	Kolom (100)	standaard	CrossArm5
S73	CS130 - L50X5	2,162	Lijn	K130	K132	Kolom (100)	standaard	CrossArm5
S74	CS7 - L50X5	1,511	Lijn	K136	K120	Kolom (100)	standaard	CrossArm5
S75	CS7 - L50X5	0,336	Lijn	K136	K122	Balk (80)	standaard	CrossArm5
S76	CS7 - L50X5	1,501	Lijn	K115	K128	Kolom (100)	standaard	CrossArm5
S77	CS7 - L50X5	0,649	Lijn	K115	K120	Balk (80)	standaard	CrossArm5
S78	CS7 - L50X5	1,911	Lijn	K143	K144	Kolom (100)	standaard	CrossArm5
S79	CS7 - L50X5	0,969	Lijn	K143	K128	Balk (80)	standaard	CrossArm5
S80	CS7 - L50X5	1,511	Lijn	K146	K124	Kolom (100)	standaard	CrossArm5
S81	CS7 - L50X5	0,336	Lijn	K146	K118	Balk (80)	standaard	CrossArm5
S82	CS7 - L50X5	1,501	Lijn	K117	K132	Kolom (100)	standaard	CrossArm5

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Nationale norm	EC - ENV
Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S83	CS7 - L50X5	0,649	Lijn	K117	K124	Balk (80)	standaard	CrossArm5
S84	CS7 - L50X5	1,911	Lijn	K153	K154	Kolom (100)	standaard	CrossArm5
S85	CS7 - L50X5	0,969	Lijn	K153	K132	Balk (80)	standaard	CrossArm5
S86	CS151 - L50X5	1,450	Lijn	K156	K130	Kolom (100)	standaard	Vak15
S87	CS151 - L50X5	1,451	Lijn	K158	K130	Kolom (100)	standaard	Vak15
S88	CS151 - L50X5	1,993	Lijn	K154	K144	Balk (80)	standaard	Vak15
S89	CS96 - L110X10	2,386	Lijn	K162	K156	Kolom (100)	standaard	Vak12
S90	CS96 - L110X10	2,652	Lijn	K621	K162	Kolom (100)	standaard	Vak12
S91	CS96 - L110X10	2,386	Lijn	K162	K158	Kolom (100)	standaard	Vak12
S92	CS96 - L110X10	2,651	Lijn	K622	K162	Kolom (100)	standaard	Vak12
S93	CS129 - L50X5	2,536	Lijn	K170	K171	Balk (80)	standaard	Vak12
S94	CS152 - L50X5	1,851	Lijn	K198	K173	Kolom (100)	standaard	Vak20
S95	CS152 - L50X5	1,849	Lijn	K335	K173	Kolom (100)	standaard	Vak20
S96	CS152 - L50X5	1,851	Lijn	K219	K177	Kolom (100)	standaard	Vak15
S97	CS152 - L50X5	1,849	Lijn	K206	K177	Kolom (100)	standaard	Vak15
S98	CS152 - L50X5	1,920	Lijn	K235	K233	Balk (80)	standaard	Vak20
S99	CS152 - L50X5	1,920	Lijn	K267	K261	Balk (80)	standaard	Vak15
S100	CS154 - L100X10	2,364	Lijn	K623	K335	Kolom (100)	standaard	Vak19
S101	CS155 - L75X8	2,361	Lijn	K186	K623	Kolom (100)	standaard	Vak18
S102	CS154 - L100X10	2,818	Lijn	N191	K186	Balk (80)	standaard	Vak18
S103	CS153 - L50X5	1,691	Lijn	K787	K191	Kolom (100)	standaard	Vak19
S104	CS153 - L50X5	1,306	Lijn	K787	K623	Kolom (100)	standaard	Vak19
S105	CS153 - L50X5	1,691	Lijn	K194	K191	Kolom (100)	standaard	Vak19
S107	CS154 - L100X10	2,364	Lijn	K627	K198	Kolom (100)	standaard	Vak19
S108	CS153 - L50X5	1,306	Lijn	K194	K627	Kolom (100)	standaard	Vak19
S109	CS155 - L75X8	2,361	Lijn	K201	K627	Kolom (100)	standaard	Vak18
S110	CS154 - L100X10	2,819	Lijn	N192	K201	Balk (80)	standaard	Vak18
S111	CS154 - L100X10	2,363	Lijn	K205	K206	Kolom (100)	standaard	Vak16
S112	CS155 - L75X8	2,361	Lijn	K207	K205	Kolom (100)	standaard	Vak17
S113	CS154 - L100X10	2,819	Lijn	N191	K207	Balk (80)	standaard	Vak17
S114	CS153 - L50X5	1,691	Lijn	K211	K212	Kolom (100)	standaard	Vak16
S115	CS153 - L50X5	1,306	Lijn	K211	K205	Kolom (100)	standaard	Vak16
S116	CS153 - L50X5	1,691	Lijn	K215	K212	Kolom (100)	standaard	Vak16
S118	CS154 - L100X10	2,363	Lijn	K217	K219	Kolom (100)	standaard	Vak16
S119	CS153 - L50X5	1,306	Lijn	K215	K217	Kolom (100)	standaard	Vak16
S120	CS155 - L75X8	2,361	Lijn	K222	K217	Kolom (100)	standaard	Vak17
S121	CS153 - L50X5	1,306	Lijn	N191	K224	Kolom (100)	standaard	Vak18
S122	CS153 - L50X5	1,691	Lijn	K224	K226	Kolom (100)	standaard	Vak18
S123	CS153 - L50X5	1,691	Lijn	K227	K226	Kolom (100)	standaard	Vak18
S125	CS153 - L50X5	1,306	Lijn	N192	K227	Kolom (100)	standaard	Vak18
S126	CS154 - L100X10	2,819	Lijn	N192	K222	Balk (80)	standaard	Vak17
S129	CS156 - L60X6	1,213	Lijn	K233	K29	Balk (80)	standaard	Vak20
S130	CS147 - L80X8	2,880	Lijn	K29	K631	Balk (80)	standaard	CrossArm4
S131	CS150 - L100X10	1,541	Lijn	K233	K388	Kolom (100)	standaard	Vak20
S132	CS150 - L100X10	1,541	Lijn	K235	K43	Kolom (100)	standaard	Vak20
S133	CS129 - L50X5	0,799	Lijn	K243	K56	Balk (80)	standaard	Vak11
S134	CS129 - L50X5	0,800	Lijn	K245	K55	Balk (80)	standaard	Vak11
S135	CS128 - L150X100X10	4,098	Lijn	K619	K198	Kolom (100)	standaard	Vak11
S136	CS129 - L50X5	2,179	Lijn	K335	K56	Kolom (100)	standaard	Vak11
S137	CS156 - L60X6	1,213	Lijn	K235	K39	Balk (80)	standaard	Vak20
S138	CS147 - L80X8	2,880	Lijn	K39	K254	Balk (80)	standaard	CrossArm4
S139	CS158 - L90X9	1,506	Lijn	K335	K233	Kolom (100)	standaard	Vak20
S140	CS128 - L150X100X10	4,099	Lijn	K620	K335	Kolom (100)	standaard	Vak11
S141	CS158 - L90X9	1,506	Lijn	K198	K235	Kolom (100)	standaard	Vak20
S142	CS156 - L60X6	1,213	Lijn	K261	K144	Balk (80)	standaard	Vak15
S143	CS147 - L80X8	2,880	Lijn	K144	K264	Balk (80)	standaard	CrossArm3
S144	CS150 - L100X10	1,541	Lijn	K261	K156	Kolom (100)	standaard	Vak15
S145	CS150 - L100X10	1,541	Lijn	K267	K158	Kolom (100)	standaard	Vak15
S146	CS129 - L50X5	0,800	Lijn	K269	K171	Balk (80)	standaard	Vak12
S147	CS129 - L50X5	0,800	Lijn	K271	K170	Balk (80)	standaard	Vak12
S148	CS128 - L150X100X10	4,098	Lijn	K622	K219	Kolom (100)	standaard	Vak12
S149	CS129 - L50X5	2,179	Lijn	K219	K170	Kolom (100)	standaard	Vak12
S150	CS129 - L50X5	2,179	Lijn	K206	K171	Kolom (100)	standaard	Vak12
S151	CS156 - L60X6	1,213	Lijn	K267	K154	Balk (80)	standaard	Vak15
S152	CS147 - L80X8	2,880	Lijn	K154	K282	Balk (80)	standaard	CrossArm3
S153	CS158 - L90X9	1,506	Lijn	K206	K261	Kolom (100)	standaard	Vak15
S154	CS128 - L150X100X10	4,099	Lijn	K621	K206	Kolom (100)	standaard	Vak12
S155	CS158 - L90X9	1,506	Lijn	K219	K267	Kolom (100)	standaard	Vak15
S156	CS93 - L90X9	2,264	Lijn	K546	K621	Kolom (100)	standaard	Vak10

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Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S159	CS126 - L160X15	0,888	Lijn	K294	K61	Balk (80)	standaard	Vak10
S160	CS126 - L160X15	0,888	Lijn	K302	K298	Balk (80)	standaard	Vak10
S162	CS124 - UNP200	1,544	Lijn	K302	K301	Kolom (100)	standaard	Vak10
S164	CS124 - UNP200	1,544	Lijn	K306	K63	Kolom (100)	standaard	Vak10
S166	CS126 - L160X15	0,888	Lijn	K306	K65	Balk (80)	standaard	Vak10
S167	CS148 - L60X6	1,908	Lijn	K311	K631	Balk (80)	standaard	CrossArm4
S168	CS148 - L60X6	2,347	Lijn	K388	K311	Balk (80)	standaard	CrossArm4
S169	CS148 - L60X6	1,908	Lijn	K314	K254	Balk (80)	standaard	CrossArm4
S170	CS148 - L60X6	2,347	Lijn	K43	K314	Balk (80)	standaard	CrossArm4
S171	CS149 - UNP180	3,073	Lijn	K388	K631	Balk (80)	standaard	CrossArm4
S172	CS149 - UNP180	3,073	Lijn	K43	K254	Balk (80)	standaard	CrossArm4
S175	CS160 - HEB120	0,800	Lijn	K325	K256	Balk (80)	standaard	CrossArm6
S176	CS82 - L200X16	2,140	Lijn	K91	K90	Kolom (100)	standaard	Vak6
S177	CS82 - L200X16	2,140	Lijn	K102	K104	Kolom (100)	standaard	Vak6
S178	CS148 - L60X6	3,304	Lijn	K201	K224	Balk (80)	standaard	Vak18
S179	CS148 - L60X6	3,304	Lijn	K227	K186	Balk (80)	standaard	Vak18
S180	CS148 - L60X6	2,672	Lijn	K198	K388	Balk (80)	standaard	Vak20
S181	CS148 - L60X6	2,671	Lijn	K335	K43	Balk (80)	standaard	Vak20
S182	CS148 - L60X6	2,926	Lijn	K194	K335	Balk (80)	standaard	Vak19
S183	CS148 - L60X6	2,923	Lijn	K186	K194	Balk (80)	standaard	Vak18
S184	CS148 - L60X6	2,925	Lijn	K787	K198	Balk (80)	standaard	Vak19
S185	CS148 - L60X6	2,923	Lijn	K201	K787	Balk (80)	standaard	Vak18
S189	CS146 - HEB180	2,163	Lijn	K201	K186	Balk (80)	standaard	Vak18
S190	CS148 - L60X6	1,908	Lijn	K780	K264	Balk (80)	standaard	CrossArm3
S191	CS148 - L60X6	2,347	Lijn	K156	K780	Balk (80)	standaard	CrossArm3
S192	CS148 - L60X6	1,908	Lijn	K781	K282	Balk (80)	standaard	CrossArm3
S193	CS148 - L60X6	2,347	Lijn	K158	K781	Balk (80)	standaard	CrossArm3
S194	CS149 - UNP180	3,073	Lijn	K156	K264	Balk (80)	standaard	CrossArm3
S195	CS149 - UNP180	3,073	Lijn	K158	K282	Balk (80)	standaard	CrossArm3
S198	CS148 - L60X6	2,672	Lijn	K219	K156	Balk (80)	standaard	Vak15
S199	CS148 - L60X6	2,672	Lijn	K206	K158	Balk (80)	standaard	Vak15
S200	CS148 - L60X6	2,925	Lijn	K215	K206	Balk (80)	standaard	Vak16
S201	CS148 - L60X6	2,923	Lijn	K207	K215	Balk (80)	standaard	Vak17
S202	CS148 - L60X6	2,925	Lijn	K211	K219	Balk (80)	standaard	Vak16
S203	CS148 - L60X6	2,923	Lijn	K222	K211	Balk (80)	standaard	Vak17
S206	CS148 - L60X6	3,304	Lijn	K222	K224	Balk (80)	standaard	Vak17
S207	CS148 - L60X6	3,304	Lijn	K227	K207	Balk (80)	standaard	Vak17
S209	CS146 - HEB180	2,163	Lijn	K222	K207	Balk (80)	standaard	Vak17
S211	CS4 - L50X5	2,163	Lijn	K158	K156	Balk (80)	standaard	Vak15
S212	CS4 - L50X5	2,163	Lijn	K43	K388	Balk (80)	standaard	Vak20
S214	CS140 - L50X5	2,305	Lijn	K394	K395	Kolom (100)	standaard	Vak14
S215	CS140 - L50X5	2,305	Lijn	K396	K397	Kolom (100)	standaard	Vak14
S216	CS139 - L50X5	2,348	Lijn	K433	K423	Balk (80)	standaard	CrossArm2
S217	CS139 - L50X5	1,771	Lijn	K400	K401	Kolom (100)	standaard	CrossArm2
S218	CS139 - L50X5	1,782	Lijn	K400	K786	Kolom (100)	standaard	CrossArm2
S219	CS140 - L50X5	2,305	Lijn	K404	K395	Kolom (100)	standaard	Vak14
S220	CS140 - L50X5	2,305	Lijn	K406	K397	Kolom (100)	standaard	Vak14
S223	CS139 - L50X5	2,348	Lijn	K462	K428	Balk (80)	standaard	CrossArm1
S224	CS142 - L130X12	2,376	Lijn	K409	K414	Kolom (100)	standaard	Vak14
S225	CS142 - L130X12	2,373	Lijn	K291	K409	Kolom (100)	standaard	Vak9
S226	CS142 - L130X12	2,376	Lijn	K411	K414	Kolom (100)	standaard	Vak14
S227	CS142 - L130X12	2,373	Lijn	K83	K411	Kolom (100)	standaard	Vak13
S228	CS137 - L100X10	4,732	Lijn	K423	K420	Balk (80)	standaard	CrossArm2
S229	CS139 - L50X5	1,262	Lijn	K423	K786	Kolom (100)	standaard	CrossArm2
S230	CS137 - L100X10	2,898	Lijn	K61	K423	Balk (80)	standaard	CrossArm2
S231	CS137 - L100X10	4,732	Lijn	K428	K424	Balk (80)	standaard	CrossArm1
S232	CS138 - L60X6	2,827	Lijn	K298	K426	Kolom (100)	standaard	CrossArm1
S233	CS139 - L50X5	1,262	Lijn	K428	K426	Kolom (100)	standaard	CrossArm1
S234	CS137 - L100X10	2,898	Lijn	K298	K428	Balk (80)	standaard	CrossArm1
S235	CS137 - L100X10	4,732	Lijn	K433	K429	Balk (80)	standaard	CrossArm2
S236	CS138 - L60X6	2,827	Lijn	K65	K401	Kolom (100)	standaard	CrossArm2
S237	CS139 - L50X5	1,262	Lijn	K433	K401	Kolom (100)	standaard	CrossArm2
S238	CS137 - L100X10	2,898	Lijn	K65	K433	Balk (80)	standaard	CrossArm2
S239	CS142 - L130X12	2,376	Lijn	K408	K434	Kolom (100)	standaard	Vak14
S240	CS142 - L130X12	2,373	Lijn	K307	K408	Kolom (100)	standaard	Vak9
S241	CS142 - L130X12	2,376	Lijn	K410	K434	Kolom (100)	standaard	Vak14
S242	CS142 - L130X12	2,373	Lijn	K438	K410	Kolom (100)	standaard	Vak13
S243	CS93 - L90X9	2,366	Lijn	K301	K546	Kolom (100)	standaard	Vak10
S245	CS93 - L90X9	2,366	Lijn	K444	K546	Kolom (100)	standaard	Vak10

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Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S247	CS4 - L50X5	0,878	Lijn	K81	K448	Balk (80)	standaard	Vak8
S248	CS92 - L50X5	2,227	Lijn	K448	K301	Kolom (100)	standaard	Vak8
S249	CS85 - L50X5	2,571	Lijn	K112	K451	Kolom (100)	standaard	Vak6
S250	CS130 - L50X5	1,250	Lijn	K111	K451	Balk (80)	standaard	Vak6
S252	CS91 - L150X15	4,747	Lijn	K456	K447	Kolom (100)	standaard	Vak8
S253	CS137 - L100X10	4,732	Lijn	K462	K458	Balk (80)	standaard	CrossArm1
S254	CS138 - L60X6	2,827	Lijn	K459	K460	Kolom (100)	standaard	CrossArm1
S255	CS139 - L50X5	1,262	Lijn	K462	K460	Kolom (100)	standaard	CrossArm1
S256	CS137 - L100X10	2,898	Lijn	K459	K462	Balk (80)	standaard	CrossArm1
S257	CS125 - L60X6	3,232	Polylijn	K298	K459	Balk (80)	standaard	Vak10
S258	CS126 - L160X15	0,888	Lijn	K598	K459	Balk (80)	standaard	Vak10
S260	CS4 - L50X5	0,879	Lijn	K469	K470	Balk (80)	standaard	Vak8
S263	CS143 - L90X9	2,542	Lijn	K394	K473	Balk (80)	standaard	Vak9
S264	CS143 - L90X9	2,539	Lijn	K531	K394	Balk (80)	standaard	Vak14
S265	CS143 - L90X9	2,456	Lijn	K473	K63	Balk (80)	standaard	Vak9
S266	CS143 - L90X9	2,542	Lijn	K404	K473	Balk (80)	standaard	Vak9
S267	CS143 - L90X9	2,539	Lijn	K531	K404	Balk (80)	standaard	Vak14
S268	CS145 - L50X5	3,507	Lijn	K307	K291	Balk (80)	standaard	Vak9
S273	CS136 - L65X7	2,073	Lijn	K493	K429	Balk (80)	standaard	CrossArm2
S274	CS135 - L55X6	2,405	Lijn	K768	K496	Balk (80)	standaard	CrossArm2
S275	CS135 - L55X6	2,710	Lijn	K786	K767	Balk (80)	standaard	CrossArm2
S278	CS136 - L65X7	2,073	Lijn	K496	K420	Balk (80)	standaard	CrossArm2
S279	CS135 - L55X6	2,405	Lijn	K767	K493	Balk (80)	standaard	CrossArm2
S280	CS135 - L55X6	2,711	Lijn	K401	K768	Balk (80)	standaard	CrossArm2
S283	CS132 - HEB200	2,506	Lijn	K401	K786	Balk (80)	standaard	CrossArm2
S287	CS133 - L50X5	2,922	Lijn	K521	K522	Balk (80)	standaard	CrossArm2
S288	CS134 - L80X8	2,447	Lijn	K63	K765	Balk (80)	standaard	CrossArm2
S289	CS44 - UNP200	8,015	Lijn	K63	K429	Balk (80)	standaard	CrossArm2
S290	CS143 - L90X9	2,456	Lijn	K527	K444	Balk (80)	standaard	Vak13
S291	CS143 - L90X9	2,542	Lijn	K406	K527	Balk (80)	standaard	Vak13
S292	CS143 - L90X9	2,539	Lijn	K531	K406	Balk (80)	standaard	Vak14
S295	CS44 - UNP200	8,015	Lijn	K444	K458	Balk (80)	standaard	CrossArm1
S296	CS139 - L50X5	1,771	Lijn	K538	K460	Kolom (100)	standaard	CrossArm1
S297	CS139 - L50X5	1,782	Lijn	K538	K426	Kolom (100)	standaard	CrossArm1
S298	CS36 - L100X10	3,507	Lijn	K301	K444	Balk (80)	standaard	Vak10
S300	CS93 - L90X9	2,265	Lijn	K546	K622	Kolom (100)	standaard	Vak10
S301	CS92 - L50X5	2,227	Lijn	K470	K444	Kolom (100)	standaard	Vak8
S302	CS136 - L65X7	2,073	Lijn	K550	K424	Balk (80)	standaard	CrossArm1
S303	CS135 - L55X6	2,405	Lijn	K552	K553	Balk (80)	standaard	CrossArm1
S304	CS135 - L55X6	2,711	Lijn	K460	K555	Balk (80)	standaard	CrossArm1
S307	CS136 - L65X7	2,073	Lijn	K553	K458	Balk (80)	standaard	CrossArm1
S308	CS135 - L55X6	2,405	Lijn	K555	K550	Balk (80)	standaard	CrossArm1
S309	CS135 - L55X6	2,711	Lijn	K426	K552	Balk (80)	standaard	CrossArm1
S312	CS132 - HEB200	2,506	Lijn	K426	K460	Balk (80)	standaard	CrossArm1
S318	CS143 - L90X9	2,456	Lijn	K527	K301	Balk (80)	standaard	Vak13
S319	CS143 - L90X9	2,542	Lijn	K396	K527	Balk (80)	standaard	Vak13
S320	CS143 - L90X9	2,539	Lijn	K531	K396	Balk (80)	standaard	Vak14
S321	CS145 - L50X5	3,507	Lijn	K83	K438	Balk (80)	standaard	Vak13
S324	CS144 - HEB200	3,507	Lijn	K414	K434	Balk (80)	standaard	Vak14
S328	CS124 - UNP200	1,544	Lijn	K444	K598	Kolom (100)	standaard	Vak10
S330	CS4 - L50X5	0,864	Lijn	K469	K601	Balk (80)	standaard	Vak8
S331	CS92 - L50X5	2,231	Lijn	K469	K438	Kolom (100)	standaard	Vak8
S332	CS90 - L150X100X12	4,017	Lijn	K456	K438	Kolom (100)	standaard	Vak8
S333	CS85 - L50X5	2,571	Lijn	N156	K605	Kolom (100)	standaard	Vak6
S334	CS130 - L50X5	1,250	Lijn	K606	K605	Balk (80)	standaard	Vak6
S336	CS84 - L90X9	2,076	Lijn	N156	K89	Kolom (100)	standaard	Vak6
S340	CS44 - UNP200	8,015	Lijn	K301	K424	Balk (80)	standaard	CrossArm1
S341	CS82 - L200X16	2,140	Lijn	K112	K111	Kolom (100)	standaard	Vak6
S342	CS82 - L200X16	2,140	Lijn	N156	K606	Kolom (100)	standaard	Vak6
S343	CS160 - HEB120	0,800	Lijn	K618	K284	Balk (80)	standaard	CrossArm5
S345	CS35 - L180X16	5,642	Polylijn	K93	K69	Balk (80)	standaard	Vak6
S347	CS35 - L180X16	5,642	Polylijn	K93	K628	Balk (80)	standaard	Vak6
S349	CS35 - L180X16	5,642	Polylijn	K109	K456	Balk (80)	standaard	Vak6
S351	CS35 - L180X16	5,642	Polylijn	K109	K75	Balk (80)	standaard	Vak6
C5	CS113 - L200X26	3,374	Lijn	N2	N59	Kolom (100)	standaard	Vak2
C6	CS113 - L200X26	3,374	Lijn	N4	N61	Kolom (100)	standaard	Vak2
C7	CS113 - L200X26	3,374	Lijn	N5	N62	Kolom (100)	standaard	Vak2
C8	CS113 - L200X26	3,374	Lijn	N8	N65	Kolom (100)	standaard	Vak2
B8	CS100 - L150X100X10	4,916	Lijn	N9	N61	vakwerkdiagonaal (90)	standaard	Vak2

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Omschrijving	- ontwerpberekening
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Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B10	CS100 - L150X100X10	4,916	Lijn	N66	N65	vakwerkdiagonaal (90)	standaard	Vak2
B12	CS100 - L150X100X10	4,916	Lijn	N67	N65	vakwerkdiagonaal (90)	standaard	Vak2
B93	CS100 - L150X100X10	4,916	Lijn	N68	N62	vakwerkdiagonaal (90)	standaard	Vak2
SB49	CS63 - L55X6	1,900	Lijn	N14	N69	vertikaal windverband (0)	standaard	Vak2
SB50	CS65 - L55X6	2,621	Lijn	N2	N14	vertikaal windverband (0)	standaard	Vak2
SB51	CS63 - L55X6	1,900	Lijn	N15	N16	vertikaal windverband (0)	standaard	Vak2
SB52	CS65 - L55X6	2,621	Lijn	N4	N16	vertikaal windverband (0)	standaard	Vak2
SB53	CS63 - L55X6	1,900	Lijn	N17	N15	vertikaal windverband (0)	standaard	Vak2
SB54	CS65 - L55X6	2,621	Lijn	N4	N17	vertikaal windverband (0)	standaard	Vak2
SB55	CS63 - L55X6	1,900	Lijn	N19	N18	vertikaal windverband (0)	standaard	Vak2
SB56	CS65 - L55X6	2,621	Lijn	N8	N18	vertikaal windverband (0)	standaard	Vak2
SB57	CS63 - L55X6	1,900	Lijn	N70	N19	vertikaal windverband (0)	standaard	Vak2
SB58	CS65 - L55X6	2,621	Lijn	N8	N70	vertikaal windverband (0)	standaard	Vak2
SB59	CS63 - L55X6	1,900	Lijn	N72	N71	vertikaal windverband (0)	standaard	Vak2
SB60	CS65 - L55X6	2,621	Lijn	N5	N71	vertikaal windverband (0)	standaard	Vak2
SB61	CS63 - L55X6	1,900	Lijn	N73	N72	vertikaal windverband (0)	standaard	Vak2
SB62	CS65 - L55X6	2,621	Lijn	N5	N73	vertikaal windverband (0)	standaard	Vak2
SB63	CS63 - L55X6	1,900	Lijn	N69	N74	vertikaal windverband (0)	standaard	Vak2
SB64	CS65 - L55X6	2,621	Lijn	N2	N74	vertikaal windverband (0)	standaard	Vak2
B31	CS100 - L150X100X10	4,916	Lijn	N66	N61	vakwerkdiagonaal (90)	standaard	Vak2
B32	CS100 - L150X100X10	4,916	Lijn	N67	N62	vakwerkdiagonaal (90)	standaard	Vak2
B33	CS100 - L150X100X10	4,916	Lijn	N68	N59	vakwerkdiagonaal (90)	standaard	Vak2
B34	CS100 - L150X100X10	4,916	Lijn	N9	N59	vakwerkdiagonaal (90)	standaard	Vak2
C9	CS113 - L200X26	6,648	Lijn	N59	N76	Kolom (100)	standaard	Vak3
C10	CS113 - L200X26	6,648	Lijn	N61	N78	Kolom (100)	standaard	Vak3
C11	CS113 - L200X26	6,648	Lijn	N62	N79	Kolom (100)	standaard	Vak3
C12	CS113 - L200X26	6,648	Lijn	N65	N82	Kolom (100)	standaard	Vak3
B94	CS68 - L150X100X12	9,452	Lijn	N61	N76	vakwerkdiagonaal (90)	standaard	Vak3
B95	CS68 - L150X100X12	9,452	Lijn	N65	N78	vakwerkdiagonaal (90)	standaard	Vak3
B22	CS68 - L150X100X12	9,452	Lijn	N62	N82	vakwerkdiagonaal (90)	standaard	Vak3
B26	CS68 - L150X100X12	9,452	Lijn	N59	N79	vakwerkdiagonaal (90)	standaard	Vak3
SB65	CS67 - L55X6	1,676	Lijn	N88	N87	vertikaal windverband (0)	standaard	Vak3
SB66	CS67 - L55X6	1,676	Lijn	N89	N88	vertikaal windverband (0)	standaard	Vak3
SB67	CS67 - L55X6	1,676	Lijn	N91	N90	vertikaal windverband (0)	standaard	Vak3
SB68	CS67 - L55X6	1,676	Lijn	N92	N91	vertikaal windverband (0)	standaard	Vak3
SB69	CS67 - L55X6	1,676	Lijn	N94	N93	vertikaal windverband (0)	standaard	Vak3
SB70	CS67 - L55X6	1,676	Lijn	N95	N94	vertikaal windverband (0)	standaard	Vak3
SB71	CS67 - L55X6	1,676	Lijn	N97	N96	vertikaal windverband (0)	standaard	Vak3
SB72	CS67 - L55X6	1,676	Lijn	N98	N97	vertikaal windverband (0)	standaard	Vak3
SB73	CS66 - L55X6	2,356	Lijn	N87	K707	vertikaal windverband (0)	standaard	Vak3
SB74	CS66 - L55X6	2,356	Lijn	N89	K707	vertikaal windverband (0)	standaard	Vak3
SB75	CS66 - L55X6	2,356	Lijn	N90	K705	vertikaal windverband (0)	standaard	Vak3
SB76	CS66 - L55X6	2,356	Lijn	N92	K705	vertikaal windverband (0)	standaard	Vak3
SB77	CS66 - L55X6	2,356	Lijn	N93	K708	vertikaal windverband (0)	standaard	Vak3
SB78	CS66 - L55X6	2,356	Lijn	N95	K708	vertikaal windverband (0)	standaard	Vak3
SB79	CS66 - L55X6	2,356	Lijn	N96	K711	vertikaal windverband (0)	standaard	Vak3
SB80	CS66 - L55X6	2,356	Lijn	N98	K711	vertikaal windverband (0)	standaard	Vak3
SB81	CS66 - L55X6	2,360	Lijn	K707	N99	vertikaal windverband (0)	standaard	Vak3
SB82	CS67 - L55X6	1,676	Lijn	N100	N99	vertikaal windverband (0)	standaard	Vak3
SB83	CS66 - L55X6	2,360	Lijn	K707	N101	vertikaal windverband (0)	standaard	Vak3
SB84	CS67 - L55X6	1,676	Lijn	N101	N100	vertikaal windverband (0)	standaard	Vak3
SB85	CS66 - L55X6	2,360	Lijn	K705	N102	vertikaal windverband (0)	standaard	Vak3
SB86	CS67 - L55X6	1,676	Lijn	N33	N102	vertikaal windverband (0)	standaard	Vak3
SB87	CS66 - L55X6	2,360	Lijn	K705	N103	vertikaal windverband (0)	standaard	Vak3
SB88	CS67 - L55X6	1,676	Lijn	N103	N33	vertikaal windverband (0)	standaard	Vak3
SB89	CS66 - L55X6	2,360	Lijn	K708	N104	vertikaal windverband (0)	standaard	Vak3
SB90	CS67 - L55X6	1,676	Lijn	N105	N104	vertikaal windverband (0)	standaard	Vak3
SB91	CS66 - L55X6	2,360	Lijn	K708	N106	vertikaal windverband (0)	standaard	Vak3
SB92	CS67 - L55X6	1,676	Lijn	N106	N105	vertikaal windverband (0)	standaard	Vak3
SB93	CS66 - L55X6	2,360	Lijn	K711	N38	vertikaal windverband (0)	standaard	Vak3
SB94	CS67 - L55X6	1,676	Lijn	N107	N38	vertikaal windverband (0)	standaard	Vak3
SB95	CS66 - L55X6	2,360	Lijn	K711	N108	vertikaal windverband (0)	standaard	Vak3
SB96	CS67 - L55X6	1,676	Lijn	N108	N107	vertikaal windverband (0)	standaard	Vak3
B73	CS68 - L150X100X12	9,452	Lijn	N61	N82	vakwerkdiagonaal (90)	standaard	Vak3
B74	CS68 - L150X100X12	9,452	Lijn	N65	N79	vakwerkdiagonaal (90)	standaard	Vak3
B75	CS68 - L150X100X12	9,452	Lijn	N62	N76	vakwerkdiagonaal (90)	standaard	Vak3
B76	CS68 - L150X100X12	9,452	Lijn	N59	N78	vakwerkdiagonaal (90)	standaard	Vak3
C13	CS13 - L200X20	6,648	Lijn	N76	N114	Kolom (100)	standaard	Vak4
C14	CS13 - L200X20	6,648	Lijn	N78	N116	Kolom (100)	standaard	Vak4

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Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
C15	CS13 - L200X20	6,648	Lijn	N79	N117	Kolom (100)	standaard	Vak4
C16	CS13 - L200X20	6,648	Lijn	N82	N120	Kolom (100)	standaard	Vak4
B98	CS70 - L150X100X14	8,859	Lijn	N78	N114	vakwerkdiagonaal (90)	standaard	Vak4
B99	CS70 - L150X100X14	8,860	Lijn	N82	N116	vakwerkdiagonaal (90)	standaard	Vak4
B100	CS70 - L150X100X14	8,860	Lijn	N79	N120	vakwerkdiagonaal (90)	standaard	Vak4
B101	CS70 - L150X100X14	8,859	Lijn	N76	N117	vakwerkdiagonaal (90)	standaard	Vak4
B102	CS81 - L60X6	2,920	Lijn	N152	N121	vertikaal windverband (0)	standaard	Vak4
B103	CS81 - L60X6	2,920	Lijn	N149	N122	vertikaal windverband (0)	standaard	Vak4
B104	CS81 - L60X6	2,920	Lijn	N150	N123	vertikaal windverband (0)	standaard	Vak4
B105	CS81 - L60X6	2,920	Lijn	N151	N124	vertikaal windverband (0)	standaard	Vak4
SB97	CS69 - L50X5	1,460	Lijn	N126	N125	vertikaal windverband (0)	standaard	Vak4
SB98	CS69 - L50X5	1,460	Lijn	N127	N126	vertikaal windverband (0)	standaard	Vak4
SB99	CS69 - L50X5	1,460	Lijn	N129	N128	vertikaal windverband (0)	standaard	Vak4
SB100	CS69 - L50X5	1,460	Lijn	N130	N129	vertikaal windverband (0)	standaard	Vak4
SB101	CS69 - L50X5	1,460	Lijn	N132	N131	vertikaal windverband (0)	standaard	Vak4
SB102	CS69 - L50X5	1,460	Lijn	N133	N132	vertikaal windverband (0)	standaard	Vak4
SB103	CS69 - L50X5	1,460	Lijn	N135	N134	vertikaal windverband (0)	standaard	Vak4
SB104	CS69 - L50X5	1,460	Lijn	N136	N135	vertikaal windverband (0)	standaard	Vak4
SB105	CS71 - L50X5	2,231	Lijn	N125	N122	vertikaal windverband (0)	standaard	Vak4
SB106	CS71 - L50X5	2,231	Lijn	N127	N122	vertikaal windverband (0)	standaard	Vak4
SB107	CS71 - L50X5	2,231	Lijn	N128	N123	vertikaal windverband (0)	standaard	Vak4
SB108	CS71 - L50X5	2,231	Lijn	N130	N123	vertikaal windverband (0)	standaard	Vak4
SB109	CS71 - L50X5	2,231	Lijn	N131	N124	vertikaal windverband (0)	standaard	Vak4
SB110	CS71 - L50X5	2,231	Lijn	N133	N124	vertikaal windverband (0)	standaard	Vak4
SB111	CS71 - L50X5	2,231	Lijn	N134	N121	vertikaal windverband (0)	standaard	Vak4
SB112	CS71 - L50X5	2,231	Lijn	N136	N121	vertikaal windverband (0)	standaard	Vak4
SB113	CS71 - L50X5	2,190	Lijn	N122	N137	vertikaal windverband (0)	standaard	Vak4
SB114	CS69 - L50X5	1,460	Lijn	N138	N137	vertikaal windverband (0)	standaard	Vak4
SB115	CS71 - L50X5	2,190	Lijn	N122	N139	vertikaal windverband (0)	standaard	Vak4
SB116	CS69 - L50X5	1,460	Lijn	N139	N138	vertikaal windverband (0)	standaard	Vak4
SB117	CS71 - L50X5	2,190	Lijn	N123	N140	vertikaal windverband (0)	standaard	Vak4
SB118	CS69 - L50X5	1,460	Lijn	N141	N140	vertikaal windverband (0)	standaard	Vak4
SB119	CS71 - L50X5	2,190	Lijn	N123	N142	vertikaal windverband (0)	standaard	Vak4
SB120	CS69 - L50X5	1,460	Lijn	N142	N141	vertikaal windverband (0)	standaard	Vak4
SB121	CS71 - L50X5	2,190	Lijn	N124	N143	vertikaal windverband (0)	standaard	Vak4
SB122	CS69 - L50X5	1,460	Lijn	N144	N143	vertikaal windverband (0)	standaard	Vak4
SB123	CS71 - L50X5	2,190	Lijn	N124	N145	vertikaal windverband (0)	standaard	Vak4
SB124	CS69 - L50X5	1,460	Lijn	N145	N144	vertikaal windverband (0)	standaard	Vak4
SB125	CS71 - L50X5	2,190	Lijn	N121	N146	vertikaal windverband (0)	standaard	Vak4
SB126	CS69 - L50X5	1,460	Lijn	N147	N146	vertikaal windverband (0)	standaard	Vak4
SB127	CS71 - L50X5	2,190	Lijn	N121	N148	vertikaal windverband (0)	standaard	Vak4
SB128	CS69 - L50X5	1,460	Lijn	N148	N147	vertikaal windverband (0)	standaard	Vak4
B106	CS70 - L150X100X14	8,859	Lijn	N78	N120	vakwerkdiagonaal (90)	standaard	Vak4
B107	CS70 - L150X100X14	8,859	Lijn	N82	N117	vakwerkdiagonaal (90)	standaard	Vak4
B108	CS70 - L150X100X14	8,860	Lijn	N79	N114	vakwerkdiagonaal (90)	standaard	Vak4
B109	CS70 - L150X100X14	8,860	Lijn	N76	N116	vakwerkdiagonaal (90)	standaard	Vak4
B110	CS81 - L60X6	2,920	Lijn	N122	N152	vertikaal windverband (0)	standaard	Vak4
B111	CS81 - L60X6	2,920	Lijn	N123	N149	vertikaal windverband (0)	standaard	Vak4
B112	CS81 - L60X6	2,920	Lijn	N124	N150	vertikaal windverband (0)	standaard	Vak4
B113	CS81 - L60X6	2,920	Lijn	N121	N151	vertikaal windverband (0)	standaard	Vak4
C17	CS112 - L200X20	3,414	Lijn	N114	K102	Kolom (100)	standaard	Vak5
C18	CS112 - L200X20	3,414	Lijn	N116	N156	Kolom (100)	standaard	Vak5
C19	CS112 - L200X20	3,414	Lijn	N117	K91	Kolom (100)	standaard	Vak5
C20	CS112 - L200X20	3,414	Lijn	N120	K112	Kolom (100)	standaard	Vak5
B114	CS73 - L150X100X12	4,360	Lijn	N114	K109	vakwerkdiagonaal (90)	standaard	Vak5
B115	CS73 - L150X100X12	4,360	Lijn	N116	K625	vakwerkdiagonaal (90)	standaard	Vak5
B116	CS73 - L150X100X12	4,360	Lijn	N117	K93	vakwerkdiagonaal (90)	standaard	Vak5
B117	CS73 - L150X100X12	4,360	Lijn	N114	K99	vakwerkdiagonaal (90)	standaard	Vak5
SB129	CS20 - L50X5	1,250	Lijn	N166	N165	vertikaal windverband (0)	standaard	Vak5
SB130	CS72 - L50X5	2,050	Lijn	N166	K102	vertikaal windverband (0)	standaard	Vak5
SB131	CS20 - L50X5	1,250	Lijn	N168	N167	vertikaal windverband (0)	standaard	Vak5
SB132	CS72 - L50X5	2,050	Lijn	N167	N156	vertikaal windverband (0)	standaard	Vak5
SB133	CS20 - L50X5	1,250	Lijn	N169	N168	vertikaal windverband (0)	standaard	Vak5
SB134	CS72 - L50X5	2,049	Lijn	N169	N156	vertikaal windverband (0)	standaard	Vak5
SB135	CS20 - L50X5	1,250	Lijn	N171	N170	vertikaal windverband (0)	standaard	Vak5
SB136	CS72 - L50X5	2,050	Lijn	N170	K112	vertikaal windverband (0)	standaard	Vak5
SB137	CS20 - L50X5	1,250	Lijn	N172	N171	vertikaal windverband (0)	standaard	Vak5
SB138	CS72 - L50X5	2,050	Lijn	N172	K112	vertikaal windverband (0)	standaard	Vak5
SB139	CS20 - L50X5	1,250	Lijn	N174	N173	vertikaal windverband (0)	standaard	Vak5

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Auteur	- SMA

Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
SB140	CS72 - L50X5	2,050	Lijn	N173	K91	vertikaal windverband (0)	standaard	Vak5
SB141	CS20 - L50X5	1,250	Lijn	N175	N174	vertikaal windverband (0)	standaard	Vak5
SB142	CS72 - L50X5	2,050	Lijn	N175	K91	vertikaal windverband (0)	standaard	Vak5
SB143	CS20 - L50X5	1,250	Lijn	N165	N176	vertikaal windverband (0)	standaard	Vak5
SB144	CS72 - L50X5	2,050	Lijn	N176	K102	vertikaal windverband (0)	standaard	Vak5
B36	CS73 - L150X100X12	4,360	Lijn	N116	K109	vakwerkdiagonaal (90)	standaard	Vak5
B37	CS73 - L150X100X12	4,360	Lijn	N120	K93	vakwerkdiagonaal (90)	standaard	Vak5
B38	CS73 - L150X100X12	4,360	Lijn	N120	K625	vakwerkdiagonaal (90)	standaard	Vak5
B39	CS73 - L150X100X12	4,360	Lijn	N117	K99	vakwerkdiagonaal (90)	standaard	Vak5
S355	CS82 - L200X16	2,140	Lijn	K90	K69	Kolom (100)	standaard	Vak6
S356	CS82 - L200X16	2,141	Lijn	K69	K71	Kolom (100)	standaard	Vak7
S359	CS89 - L140X13	2,220	Lijn	K620	K56	Kolom (100)	standaard	Vak11
S360	CS89 - L140X13	2,135	Lijn	K56	K388	Kolom (100)	standaard	Vak11
S361	CS89 - L140X13	0,970	Lijn	K388	K29	Kolom (100)	standaard	Vak20
S365	CS82 - L200X16	2,140	Lijn	K104	K75	Kolom (100)	standaard	Vak6
S366	CS82 - L200X16	2,141	Lijn	K75	K77	Kolom (100)	standaard	Vak7
S367	CS82 - L200X16	2,119	Lijn	K77	K63	Kolom (100)	standaard	Vak7
S368	CS82 - L200X16	1,570	Lijn	K63	K65	Kolom (100)	standaard	Vak10
S369	CS89 - L140X13	1,761	Lijn	K65	K619	Kolom (100)	standaard	Vak10
S370	CS89 - L140X13	2,220	Lijn	K55	K619	Kolom (100)	standaard	Vak11
S371	CS89 - L140X13	2,135	Lijn	K43	K55	Kolom (100)	standaard	Vak11
S372	CS89 - L140X13	0,970	Lijn	K39	K43	Kolom (100)	standaard	Vak20
S373	CS131 - L80X8	6,823	Lijn	K325	K39	Kolom (100)	standaard	CrossArm6
S377	CS122 - L130X12	4,236	Polylijn	K307	K619	Balk (80)	standaard	Vak10
S379	CS122 - L130X12	4,235	Polylijn	K291	K620	Balk (80)	standaard	Vak10
S381	CS122 - L130X12	4,236	Polylijn	K438	K622	Balk (80)	standaard	Vak10
S383	CS122 - L130X12	4,235	Polylijn	K83	K621	Balk (80)	standaard	Vak10
S386	CS44 - UNP200	3,674	Lijn	K394	K396	Balk (80)	standaard	Vak14
S395	CS44 - UNP200	8,015	Lijn	K626	K420	Balk (80)	standaard	CrossArm2
S397	CS92 - L50X5	2,227	Lijn	K626	K72	Balk (80)	standaard	Vak7
S398	CS82 - L200X16	2,119	Lijn	K626	K71	Balk (80)	standaard	Vak7
S400	CS143 - L90X9	2,456	Lijn	K626	K473	Balk (80)	standaard	Vak9
S401	CS93 - L90X9	2,366	Lijn	K626	K67	Balk (80)	standaard	Vak10
S402	CS82 - L200X16	1,570	Lijn	K626	K61	Balk (80)	standaard	Vak10
S405	CS83 - L150X100X12	4,765	Lijn	K628	K625	Kolom (100)	standaard	Vak6
S408	CS82 - L200X16	2,119	Lijn	K81	K301	Kolom (100)	standaard	Vak8
S409	CS82 - L200X16	1,571	Lijn	K301	K298	Kolom (100)	standaard	Vak10
S411	CS89 - L140X13	2,221	Lijn	K171	K621	Kolom (100)	standaard	Vak12
S412	CS89 - L140X13	2,135	Lijn	K156	K171	Kolom (100)	standaard	Vak12
S413	CS89 - L140X13	0,970	Lijn	K144	K156	Kolom (100)	standaard	Vak15
S414	CS131 - L80X8	6,823	Lijn	K284	K144	Kolom (100)	standaard	CrossArm5
S418	CS82 - L200X16	2,140	Lijn	K606	K456	Kolom (100)	standaard	Vak6
S419	CS82 - L200X16	2,141	Lijn	K456	K469	Kolom (100)	standaard	Vak8
S420	CS82 - L200X16	2,119	Lijn	K469	K444	Kolom (100)	standaard	Vak8
S421	CS82 - L200X16	1,571	Lijn	K444	K459	Kolom (100)	standaard	Vak10
S422	CS89 - L140X13	1,761	Lijn	K459	K622	Kolom (100)	standaard	Vak10
S424	CS89 - L140X13	2,135	Lijn	K170	K158	Kolom (100)	standaard	Vak12
S425	CS89 - L140X13	0,970	Lijn	K158	K154	Kolom (100)	standaard	Vak15
S426	CS131 - L80X8	6,823	Lijn	K154	K618	Kolom (100)	standaard	CrossArm5
S430	CS37 - L75X8	4,252	Lijn	K456	K628	Balk (80)	standaard	Vak8
S431	CS82 - L200X16	2,140	Lijn	K111	K628	Balk (80)	standaard	Vak6
S432	CS82 - L200X16	2,141	Lijn	K628	K81	Balk (80)	standaard	Vak8
S433	CS90 - L150X100X12	4,017	Polylijn	K628	K83	Balk (80)	standaard	Vak8
S435	CS91 - L150X15	4,747	Lijn	K628	K447	Balk (80)	standaard	Vak8
S445	CS149 - UNP180	1,970	Lijn	K787	K335	Balk (80)	standaard	Vak19
S447	CS149 - UNP180	1,568	Lijn	K335	K388	Balk (80)	standaard	Vak20
S448	CS138 - L60X6	2,827	Lijn	K61	K786	Balk (80)	standaard	CrossArm2
S450	CS4 - L50X5	0,864	Lijn	K77	K629	Balk (80)	standaard	Vak7
S451	CS90 - L150X100X12	4,017	Lijn	K75	K307	Balk (80)	standaard	Vak7
S453	CS4 - L50X5	0,864	Lijn	K71	K630	Balk (80)	standaard	Vak7
S454	CS90 - L150X100X12	4,017	Polylijn	K69	K291	Balk (80)	standaard	Vak7
S456	CS129 - L50X5	2,179	Lijn	K55	K198	Balk (80)	standaard	Vak11
S457	CS124 - UNP200	1,544	Lijn	K626	K294	Balk (80)	standaard	Vak10
S458	CS92 - L50X5	2,231	Lijn	K307	K77	Balk (80)	standaard	Vak7
S459	CS92 - L50X5	2,231	Lijn	K291	K71	Balk (80)	standaard	Vak7
S460	CS84 - L90X9	2,076	Lijn	K88	K102	Balk (80)	standaard	Vak6
S461	CS141 - L65X50X5	1,503	Lijn	K396	K411	Balk (80)	standaard	Vak14
S462	CS141 - L65X50X5	1,503	Lijn	K410	K406	Balk (80)	standaard	Vak14
S463	CS141 - L65X50X5	1,503	Lijn	K409	K394	Balk (80)	standaard	Vak14

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Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
S464	CS141 - L65X50X5	1,503	Lijn	K404	K408	Balk (80)	standaard	Vak14
S465	CS134 - L80X8	1,745	Lijn	K401	K765	Balk (80)	standaard	CrossArm2
B129	CS79 - L90X9	3,536	Lijn	K99	K93	vakwerkdiagonaal (90)	standaard	HorVerb3
B130	CS79 - L90X9	3,536	Lijn	K93	K625	vakwerkdiagonaal (90)	standaard	HorVerb3
B131	CS79 - L90X9	3,535	Lijn	K625	K109	vakwerkdiagonaal (90)	standaard	HorVerb3
B132	CS79 - L90X9	3,536	Lijn	K99	K109	vakwerkdiagonaal (90)	standaard	HorVerb3
B133	CS77 - L75X8	5,000	Polylijn	K99	K625	vakwerkdiagonaal (90)	standaard	HorVerb3
S467	CS78 - L150X14	2,500	Lijn	N156	K109	Balk (80)	standaard	HorVerb3
S468	CS78 - L150X14	2,500	Lijn	K109	K102	Balk (80)	standaard	HorVerb3
S469	CS78 - L150X14	2,500	Lijn	K102	K99	Balk (80)	standaard	HorVerb3
S470	CS78 - L150X14	2,500	Lijn	K99	K91	Balk (80)	standaard	HorVerb3
S471	CS78 - L150X14	2,500	Lijn	K91	K93	Balk (80)	standaard	HorVerb3
S472	CS78 - L150X14	2,500	Lijn	K93	K112	Balk (80)	standaard	HorVerb3
S473	CS78 - L150X14	2,501	Lijn	K112	K625	Balk (80)	standaard	HorVerb3
S474	CS78 - L150X14	2,499	Lijn	K625	N156	Balk (80)	standaard	HorVerb3
S479	CS83 - L150X100X12	4,764	Lijn	K456	K625	Kolom (100)	standaard	Vak6
S480	CS83 - L150X100X12	4,765	Lijn	K75	K99	Kolom (100)	standaard	Vak6
S481	CS83 - L150X100X12	4,765	Lijn	K69	K99	Kolom (100)	standaard	Vak6
S482	CS21 - L100X75X7	6,950	Polylijn	K284	K261	Kolom (100)	standaard	CrossArm5
S483	CS21 - L100X75X7	6,950	Lijn	K267	K618	Kolom (100)	standaard	CrossArm5
S484	CS21 - L100X75X7	6,950	Lijn	K233	K256	Kolom (100)	standaard	CrossArm6
S485	CS21 - L100X75X7	6,950	Polylijn	K325	K235	Kolom (100)	standaard	CrossArm6
S486	CS131 - L80X8	6,823	Lijn	K29	K256	Kolom (100)	standaard	CrossArm6
S487	CS89 - L140X13	1,761	Lijn	K61	K620	Balk (80)	standaard	Vak10
S488	CS127 - L160X15	3,202	Lijn	K294	K409	Balk (80)	standaard	Vak9
S491	CS127 - L160X15	3,201	Lijn	K306	K408	Balk (80)	standaard	Vak9
S497	CS149 - UNP180	1,568	Lijn	K43	K198	Balk (80)	standaard	Vak20
S501	CS157 - L120X11	2,721	Lijn	K233	K623	Balk (80)	standaard	Vak19
S503	CS157 - L120X11	2,720	Lijn	K235	K627	Balk (80)	standaard	Vak19
S508	CS146 - HEB180	0,800	Lijn	K282	K264	Balk (80)	standaard	CrossArm3
S511	CS146 - HEB180	0,800	Lijn	K254	K631	Balk (80)	standaard	CrossArm4
S526	CS59 - L70/7	4,741	Lijn	K712	K709	Balk (80)	standaard	HorVerb2
S527	CS59 - L70/7	4,741	Lijn	K709	K706	Balk (80)	standaard	HorVerb2
S528	CS59 - L70/7	4,741	Lijn	K706	N247	Balk (80)	standaard	HorVerb2
S529	CS59 - L70/7	4,741	Lijn	N247	K712	Balk (80)	standaard	HorVerb2
S533	CS121 - L60X6	3,353	Lijn	N247	K763	Balk (80)	standaard	HorVerb2
S547	CS44 - UNP200	3,674	Lijn	K406	K404	Balk (80)	standaard	Vak14
S548	CS132 - HEB200	0,799	Lijn	K429	K420	Balk (80)	standaard	CrossArm2
S551	CS132 - HEB200	0,799	Lijn	K424	K458	Balk (80)	standaard	CrossArm1
S588	CS104 - L65X7	3,353	Lijn	K707	N247	Balk (80)	standaard	HorVerb2
S589	CS104 - L65X7	3,353	Lijn	N247	K711	Balk (80)	standaard	HorVerb2
S590	CS104 - L65X7	3,353	Lijn	K705	K706	Balk (80)	standaard	HorVerb2
S591	CS104 - L65X7	3,353	Lijn	K706	K707	Balk (80)	standaard	HorVerb2
S592	CS104 - L65X7	3,353	Lijn	K708	K709	Balk (80)	standaard	HorVerb2
S593	CS104 - L65X7	3,353	Lijn	K709	K705	Balk (80)	standaard	HorVerb2
S594	CS104 - L65X7	3,353	Lijn	K711	K712	Balk (80)	standaard	HorVerb2
S595	CS104 - L65X7	3,353	Lijn	K712	K708	Balk (80)	standaard	HorVerb2
C29	CS113 - L200X26	10,951	Lijn	N248	N2	Kolom (100)	standaard	Vak1
B154	CS114 - L130X12	12,292	Lijn	N248	N9	vakwerkdiagonaal (90)	standaard	Vak1
B159	CS114 - L130X12	12,292	Lijn	N248	N68	vakwerkdiagonaal (90)	standaard	Vak1
SB241	CS115 - L60X6	1,267	Lijn	N260	N261	vertikaal windverband (0)	standaard	Vak1
SB249	CS115 - L60X6	1,267	Lijn	N261	N276	vertikaal windverband (0)	standaard	Vak1
SB250	CS115 - L60X6	2,533	Lijn	N262	N277	vertikaal windverband (0)	standaard	Vak1
SB252	CS115 - L60X6	2,533	Lijn	N280	N262	vertikaal windverband (0)	standaard	Vak1
SB259	CS115 - L60X6	2,002	Lijn	N276	K719	vertikaal windverband (0)	standaard	Vak1
SB260	CS119 - L65X7	2,809	Lijn	N277	K723	vertikaal windverband (0)	standaard	Vak1
SB261	CS119 - L65X7	2,809	Lijn	N280	K723	vertikaal windverband (0)	standaard	Vak1
SB272	CS115 - L60X6	2,002	Lijn	N260	K719	vertikaal windverband (0)	standaard	Vak1
B84	CS8 - L50X5	1,791	Lijn	N260	N276	vertikaal windverband (0)	standaard	Vak1
B85	CS120 - L55X6	3,583	Lijn	N280	N277	vertikaal windverband (0)	standaard	Vak1
B86	CS118 - L70X7	5,374	Lijn	N9	N68	vakwerkdiagonaal (90)	standaard	HorVerb1
B87	CS118 - L70X7	5,374	Lijn	N68	N67	vakwerkdiagonaal (90)	standaard	HorVerb1
B88	CS118 - L70X7	5,374	Lijn	N67	N66	vakwerkdiagonaal (90)	standaard	HorVerb1
B160	CS118 - L70X7	5,374	Lijn	N66	N9	vakwerkdiagonaal (90)	standaard	HorVerb1
B177	CS8 - L50X5	2,191	Lijn	N260	K722	vertikaal windverband (0)	standaard	Vak1
B178	CS8 - L50X5	2,191	Lijn	N276	K722	vertikaal windverband (0)	standaard	Vak1
B179	CS120 - L55X6	2,684	Lijn	N280	K726	vertikaal windverband (0)	standaard	Vak1
B180	CS120 - L55X6	2,684	Lijn	N277	K726	vertikaal windverband (0)	standaard	Vak1
B181	CS6 - L150X14	7,600	Lijn	N2	N4	Balk (80)	standaard	HorVerb1

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Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B182	CS6 - L150X14	7,600	Lijn	N4	N8	Balk (80)	standaard	HorVerb1
B183	CS6 - L150X14	7,600	Lijn	N8	N5	Balk (80)	standaard	HorVerb1
B184	CS6 - L150X14	7,600	Lijn	N5	N2	Balk (80)	standaard	HorVerb1
B185	CS117 - L75X8	3,800	Lijn	N9	N289	vakwerkdiagonaal (90)	standaard	HorVerb1
B186	CS117 - L75X8	7,600	Polylijn	N68	N66	vakwerkdiagonaal (90)	standaard	HorVerb1
B187	CS117 - L75X8	3,800	Lijn	N289	N67	vakwerkdiagonaal (90)	standaard	HorVerb1
SB273	CS115 - L60X6	0,633	Lijn	K655	K714	vertikaal windverband (0)	standaard	Vak1
SB274	CS115 - L60X6	0,633	Lijn	K715	K655	vertikaal windverband (0)	standaard	Vak1
B188	CS8 - L50X5	0,896	Lijn	K715	K714	vertikaal windverband (0)	standaard	Vak1
B189	CS8 - L50X5	2,049	Lijn	K714	K718	vertikaal windverband (0)	standaard	Vak1
B190	CS8 - L50X5	2,049	Lijn	K715	K718	vertikaal windverband (0)	standaard	Vak1
SB275	CS115 - L60X6	1,808	Lijn	K715	N261	vertikaal windverband (0)	standaard	Vak1
SB276	CS115 - L60X6	1,808	Lijn	K714	N261	vertikaal windverband (0)	standaard	Vak1
SB277	CS115 - L60X6	1,900	Lijn	K719	K720	vertikaal windverband (0)	standaard	Vak1
SB278	CS115 - L60X6	1,900	Lijn	K721	K719	vertikaal windverband (0)	standaard	Vak1
B191	CS8 - L50X5	2,687	Lijn	K721	K720	vertikaal windverband (0)	standaard	Vak1
SB279	CS115 - L60X6	2,355	Lijn	K721	N262	vertikaal windverband (0)	standaard	Vak1
SB280	CS115 - L60X6	2,355	Lijn	K720	N262	vertikaal windverband (0)	standaard	Vak1
B192	CS8 - L50X5	2,409	Lijn	K720	N287	vertikaal windverband (0)	standaard	Vak1
B193	CS8 - L50X5	2,409	Lijn	K721	N287	vertikaal windverband (0)	standaard	Vak1
B194	CS120 - L55X6	4,478	Lijn	K725	K724	vertikaal windverband (0)	standaard	Vak1
SB281	CS119 - L65X7	3,167	Lijn	K723	K724	vertikaal windverband (0)	standaard	Vak1
SB282	CS119 - L65X7	3,167	Lijn	K725	K723	vertikaal windverband (0)	standaard	Vak1
B195	CS120 - L55X6	3,002	Lijn	K725	N288	vertikaal windverband (0)	standaard	Vak1
B196	CS120 - L55X6	3,002	Lijn	K724	N288	vertikaal windverband (0)	standaard	Vak1
SB283	CS119 - L65X7	3,322	Lijn	K725	N2	vertikaal windverband (0)	standaard	Vak1
SB284	CS119 - L65X7	3,322	Lijn	K724	N2	vertikaal windverband (0)	standaard	Vak1
C30	CS113 - L200X26	10,951	Lijn	N290	N4	Kolom (100)	standaard	Vak1
B197	CS114 - L130X12	12,292	Lijn	N290	N9	vakwerkdiagonaal (90)	standaard	Vak1
B198	CS114 - L130X12	12,292	Lijn	N290	N66	vakwerkdiagonaal (90)	standaard	Vak1
SB285	CS115 - L60X6	0,633	Lijn	K727	K733	vertikaal windverband (0)	standaard	Vak1
SB286	CS115 - L60X6	0,633	Lijn	K734	K727	vertikaal windverband (0)	standaard	Vak1
B199	CS120 - L55X6	3,583	Lijn	N292	N296	vertikaal windverband (0)	standaard	Vak1
B200	CS120 - L55X6	2,684	Lijn	N292	K738	vertikaal windverband (0)	standaard	Vak1
B201	CS120 - L55X6	2,684	Lijn	N296	K738	vertikaal windverband (0)	standaard	Vak1
B202	CS120 - L55X6	4,478	Lijn	K728	K737	vertikaal windverband (0)	standaard	Vak1
SB287	CS119 - L65X7	3,167	Lijn	K728	K736	vertikaal windverband (0)	standaard	Vak1
B203	CS120 - L55X6	3,002	Lijn	K728	N286	vertikaal windverband (0)	standaard	Vak1
SB288	CS119 - L65X7	3,322	Lijn	K728	N4	vertikaal windverband (0)	standaard	Vak1
B204	CS120 - L55X6	3,002	Lijn	K737	N286	vertikaal windverband (0)	standaard	Vak1
SB289	CS115 - L60X6	2,533	Lijn	N291	N296	vertikaal windverband (0)	standaard	Vak1
SB290	CS115 - L60X6	2,533	Lijn	N292	N291	vertikaal windverband (0)	standaard	Vak1
SB291	CS115 - L60X6	2,002	Lijn	N295	K729	vertikaal windverband (0)	standaard	Vak1
SB292	CS119 - L65X7	2,809	Lijn	N292	K736	vertikaal windverband (0)	standaard	Vak1
SB293	CS115 - L60X6	2,002	Lijn	N297	K729	vertikaal windverband (0)	standaard	Vak1
B205	CS8 - L50X5	2,191	Lijn	N297	K732	vertikaal windverband (0)	standaard	Vak1
B206	CS8 - L50X5	2,191	Lijn	N295	K732	vertikaal windverband (0)	standaard	Vak1
SB294	CS115 - L60X6	1,900	Lijn	K729	K730	vertikaal windverband (0)	standaard	Vak1
SB295	CS115 - L60X6	1,900	Lijn	K731	K729	vertikaal windverband (0)	standaard	Vak1
B207	CS8 - L50X5	2,687	Lijn	K731	K730	vertikaal windverband (0)	standaard	Vak1
SB296	CS115 - L60X6	2,355	Lijn	K731	N291	vertikaal windverband (0)	standaard	Vak1
SB297	CS115 - L60X6	2,355	Lijn	K730	N291	vertikaal windverband (0)	standaard	Vak1
B208	CS8 - L50X5	2,409	Lijn	K730	N293	vertikaal windverband (0)	standaard	Vak1
B209	CS8 - L50X5	2,409	Lijn	K731	N293	vertikaal windverband (0)	standaard	Vak1
SB298	CS115 - L60X6	1,267	Lijn	N297	N294	vertikaal windverband (0)	standaard	Vak1
SB299	CS115 - L60X6	1,267	Lijn	N294	N295	vertikaal windverband (0)	standaard	Vak1
B210	CS8 - L50X5	1,791	Lijn	N297	N295	vertikaal windverband (0)	standaard	Vak1
B211	CS8 - L50X5	0,896	Lijn	K734	K733	vertikaal windverband (0)	standaard	Vak1
B212	CS8 - L50X5	2,049	Lijn	K733	K735	vertikaal windverband (0)	standaard	Vak1
B213	CS8 - L50X5	2,049	Lijn	K734	K735	vertikaal windverband (0)	standaard	Vak1
SB300	CS115 - L60X6	1,808	Lijn	K734	N294	vertikaal windverband (0)	standaard	Vak1
SB301	CS115 - L60X6	1,808	Lijn	K733	N294	vertikaal windverband (0)	standaard	Vak1
SB302	CS119 - L65X7	3,167	Lijn	K736	K737	vertikaal windverband (0)	standaard	Vak1
SB303	CS119 - L65X7	2,809	Lijn	N296	K736	vertikaal windverband (0)	standaard	Vak1
SB304	CS119 - L65X7	3,322	Lijn	K737	N4	vertikaal windverband (0)	standaard	Vak1
C31	CS113 - L200X26	10,951	Lijn	N298	N5	Kolom (100)	standaard	Vak1
B214	CS114 - L130X12	12,292	Lijn	N298	N67	vakwerkdiagonaal (90)	standaard	Vak1
B215	CS114 - L130X12	12,292	Lijn	N298	N68	vakwerkdiagonaal (90)	standaard	Vak1
SB305	CS115 - L60X6	0,633	Lijn	K739	K745	vertikaal windverband (0)	standaard	Vak1

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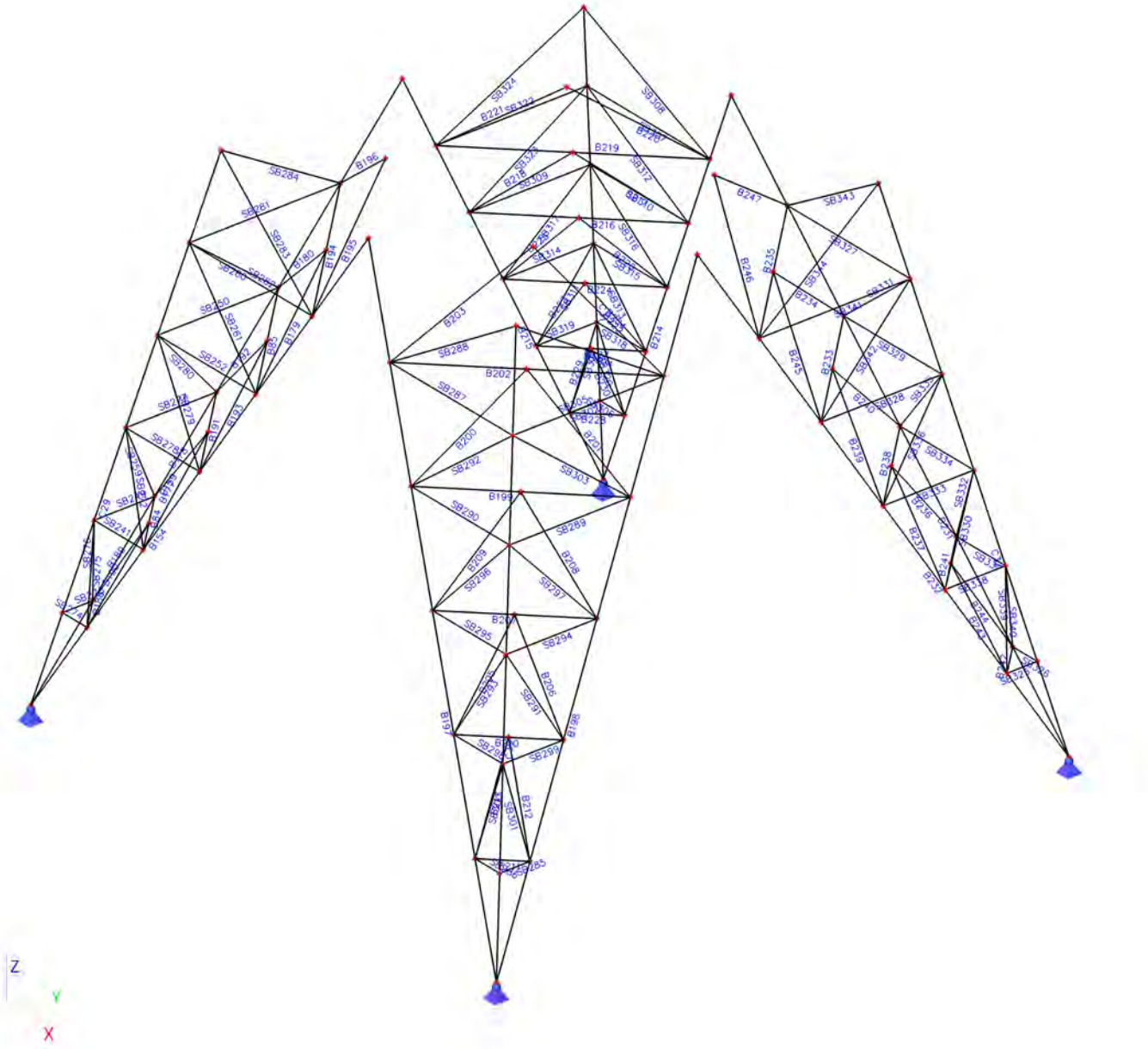
Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
SB306	CS115 - L60X6	0,633	Lijn	K746	K739	vertikaal windverband (0)	standaard	Vak1
B216	CS120 - L55X6	3,583	Lijn	N300	N304	vertikaal windverband (0)	standaard	Vak1
B217	CS120 - L55X6	2,684	Lijn	N300	K750	vertikaal windverband (0)	standaard	Vak1
B218	CS120 - L55X6	2,684	Lijn	N304	K750	vertikaal windverband (0)	standaard	Vak1
B219	CS120 - L55X6	4,478	Lijn	K740	K749	vertikaal windverband (0)	standaard	Vak1
SB307	CS119 - L65X7	3,167	Lijn	K740	K748	vertikaal windverband (0)	standaard	Vak1
B220	CS120 - L55X6	3,002	Lijn	K740	N284	vertikaal windverband (0)	standaard	Vak1
SB308	CS119 - L65X7	3,322	Lijn	K740	N5	vertikaal windverband (0)	standaard	Vak1
B221	CS120 - L55X6	3,002	Lijn	K749	N284	vertikaal windverband (0)	standaard	Vak1
SB309	CS115 - L60X6	2,533	Lijn	N299	N304	vertikaal windverband (0)	standaard	Vak1
SB310	CS115 - L60X6	2,533	Lijn	N300	N299	vertikaal windverband (0)	standaard	Vak1
SB311	CS115 - L60X6	2,002	Lijn	N303	K741	vertikaal windverband (0)	standaard	Vak1
SB312	CS119 - L65X7	2,809	Lijn	N300	K748	vertikaal windverband (0)	standaard	Vak1
SB313	CS115 - L60X6	2,002	Lijn	N305	K741	vertikaal windverband (0)	standaard	Vak1
B222	CS8 - L50X5	2,191	Lijn	N305	K744	vertikaal windverband (0)	standaard	Vak1
B223	CS8 - L50X5	2,191	Lijn	N303	K744	vertikaal windverband (0)	standaard	Vak1
SB314	CS115 - L60X6	1,900	Lijn	K741	K742	vertikaal windverband (0)	standaard	Vak1
SB315	CS115 - L60X6	1,900	Lijn	K743	K741	vertikaal windverband (0)	standaard	Vak1
B224	CS8 - L50X5	2,687	Lijn	K743	K742	vertikaal windverband (0)	standaard	Vak1
SB316	CS115 - L60X6	2,355	Lijn	K743	N299	vertikaal windverband (0)	standaard	Vak1
SB317	CS115 - L60X6	2,355	Lijn	K742	N299	vertikaal windverband (0)	standaard	Vak1
B225	CS8 - L50X5	2,409	Lijn	K742	N301	vertikaal windverband (0)	standaard	Vak1
B226	CS8 - L50X5	2,409	Lijn	K743	N301	vertikaal windverband (0)	standaard	Vak1
SB318	CS115 - L60X6	1,267	Lijn	N305	N302	vertikaal windverband (0)	standaard	Vak1
SB319	CS115 - L60X6	1,267	Lijn	N302	N303	vertikaal windverband (0)	standaard	Vak1
B227	CS8 - L50X5	1,791	Lijn	N305	N303	vertikaal windverband (0)	standaard	Vak1
B228	CS8 - L50X5	0,896	Lijn	K746	K745	vertikaal windverband (0)	standaard	Vak1
B229	CS8 - L50X5	2,049	Lijn	K745	K747	vertikaal windverband (0)	standaard	Vak1
B230	CS8 - L50X5	2,049	Lijn	K746	K747	vertikaal windverband (0)	standaard	Vak1
SB320	CS115 - L60X6	1,808	Lijn	K746	N302	vertikaal windverband (0)	standaard	Vak1
SB321	CS115 - L60X6	1,808	Lijn	K745	N302	vertikaal windverband (0)	standaard	Vak1
SB322	CS119 - L65X7	3,167	Lijn	K748	K749	vertikaal windverband (0)	standaard	Vak1
SB323	CS119 - L65X7	2,809	Lijn	N304	K748	vertikaal windverband (0)	standaard	Vak1
SB324	CS119 - L65X7	3,322	Lijn	K749	N5	vertikaal windverband (0)	standaard	Vak1
C32	CS113 - L200X26	10,951	Lijn	N306	N8	Kolom (100)	standaard	Vak1
B231	CS114 - L130X12	12,292	Lijn	N306	N67	vakwerkdiagonaal (90)	standaard	Vak1
B232	CS114 - L130X12	12,292	Lijn	N306	N66	vakwerkdiagonaal (90)	standaard	Vak1
SB325	CS115 - L60X6	0,633	Lijn	K751	K755	vertikaal windverband (0)	standaard	Vak1
SB326	CS115 - L60X6	0,633	Lijn	K756	K751	vertikaal windverband (0)	standaard	Vak1
B233	CS120 - L55X6	3,583	Lijn	N308	N313	vertikaal windverband (0)	standaard	Vak1
B234	CS120 - L55X6	2,684	Lijn	N308	K761	vertikaal windverband (0)	standaard	Vak1
B235	CS120 - L55X6	4,478	Lijn	K762	K760	vertikaal windverband (0)	standaard	Vak1
SB327	CS119 - L65X7	3,167	Lijn	K762	K758	vertikaal windverband (0)	standaard	Vak1
SB328	CS115 - L60X6	2,533	Lijn	N307	N313	vertikaal windverband (0)	standaard	Vak1
SB329	CS115 - L60X6	2,533	Lijn	N308	N307	vertikaal windverband (0)	standaard	Vak1
SB330	CS115 - L60X6	2,002	Lijn	N311	K752	vertikaal windverband (0)	standaard	Vak1
SB331	CS119 - L65X7	2,809	Lijn	N308	K758	vertikaal windverband (0)	standaard	Vak1
SB332	CS115 - L60X6	2,002	Lijn	N312	K752	vertikaal windverband (0)	standaard	Vak1
B236	CS8 - L50X5	2,191	Lijn	N312	K754	vertikaal windverband (0)	standaard	Vak1
B237	CS8 - L50X5	2,191	Lijn	N311	K754	vertikaal windverband (0)	standaard	Vak1
SB333	CS115 - L60X6	1,900	Lijn	K752	K759	vertikaal windverband (0)	standaard	Vak1
SB334	CS115 - L60X6	1,900	Lijn	K753	K752	vertikaal windverband (0)	standaard	Vak1
B238	CS8 - L50X5	2,687	Lijn	K753	K759	vertikaal windverband (0)	standaard	Vak1
SB335	CS115 - L60X6	2,355	Lijn	K753	N307	vertikaal windverband (0)	standaard	Vak1
SB336	CS115 - L60X6	2,355	Lijn	K759	N307	vertikaal windverband (0)	standaard	Vak1
B239	CS8 - L50X5	2,409	Lijn	K759	N309	vertikaal windverband (0)	standaard	Vak1
B240	CS8 - L50X5	2,409	Lijn	K753	N309	vertikaal windverband (0)	standaard	Vak1
SB337	CS115 - L60X6	1,267	Lijn	N312	N310	vertikaal windverband (0)	standaard	Vak1
SB338	CS115 - L60X6	1,267	Lijn	N310	N311	vertikaal windverband (0)	standaard	Vak1
B241	CS8 - L50X5	1,791	Lijn	N312	N311	vertikaal windverband (0)	standaard	Vak1
B242	CS8 - L50X5	0,896	Lijn	K756	K755	vertikaal windverband (0)	standaard	Vak1
B243	CS8 - L50X5	2,049	Lijn	K755	K757	vertikaal windverband (0)	standaard	Vak1
B244	CS8 - L50X5	2,049	Lijn	K756	K757	vertikaal windverband (0)	standaard	Vak1
SB339	CS115 - L60X6	1,808	Lijn	K756	N310	vertikaal windverband (0)	standaard	Vak1
SB340	CS115 - L60X6	1,808	Lijn	K755	N310	vertikaal windverband (0)	standaard	Vak1
SB341	CS119 - L65X7	3,167	Lijn	K758	K760	vertikaal windverband (0)	standaard	Vak1
SB342	CS119 - L65X7	2,809	Lijn	N313	K758	vertikaal windverband (0)	standaard	Vak1
B245	CS120 - L55X6	2,684	Lijn	N313	K761	vertikaal windverband (0)	standaard	Vak1
SB343	CS119 - L65X7	3,322	Lijn	K762	N8	vertikaal windverband (0)	standaard	Vak1

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

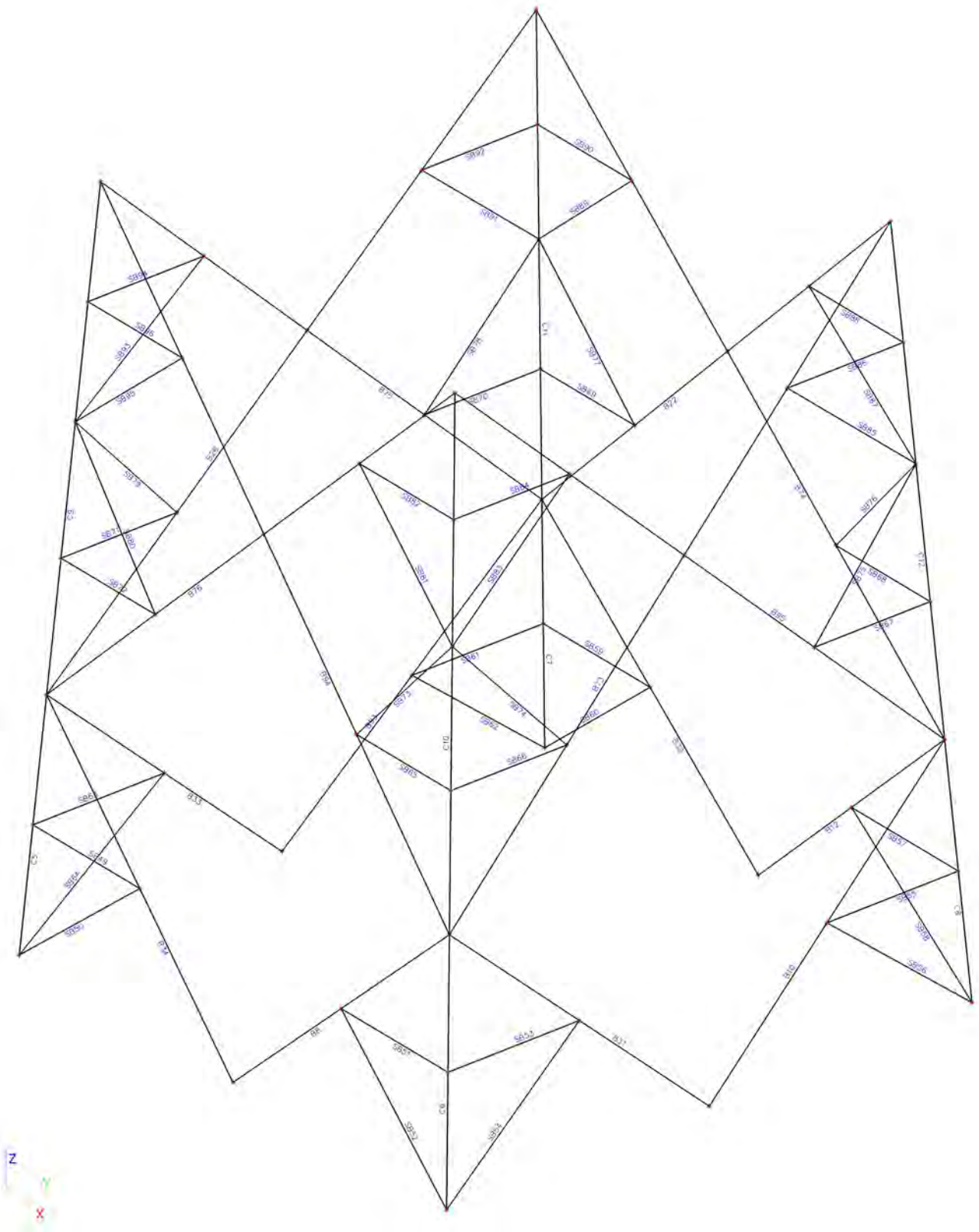
Naam	Doorsnede	Lengte [m]	Vorm	Beginknoop	Eindknoop	Type	EEM-type	Laag
B246	CS120 - L55X6	3,002	Lijn	K760	N64	vertikaal windverband (0)	standaard	Vak1
SB344	CS119 - L65X7	3,322	Lijn	K760	N8	vertikaal windverband (0)	standaard	Vak1
B247	CS120 - L55X6	3,002	Lijn	K762	N64	vertikaal windverband (0)	standaard	Vak1
S596	CS121 - L60X6	3,353	Lijn	K763	K709	Balk (80)	standaard	HorVerb2
S597	CS121 - L60X6	6,705	Lijn	K712	K706	Balk (80)	standaard	HorVerb2
S598	CS36 - L100X10	3,507	Lijn	K626	K63	Balk (80)	standaard	Vak10
S599	CS134 - L80X8	1,743	Lijn	K765	K786	Balk (80)	standaard	CrossArm2
S600	CS134 - L80X8	2,445	Lijn	K765	K626	Balk (80)	standaard	CrossArm2
S601	CS133 - L50X5	2,922	Lijn	K775	K776	Balk (80)	standaard	CrossArm1
S602	CS134 - L80X8	2,448	Lijn	K444	K774	Balk (80)	standaard	CrossArm1
S603	CS134 - L80X8	1,745	Lijn	K460	K774	Balk (80)	standaard	CrossArm1
S604	CS134 - L80X8	1,743	Lijn	K774	K426	Balk (80)	standaard	CrossArm1
S605	CS134 - L80X8	2,445	Lijn	K774	K301	Balk (80)	standaard	CrossArm1
S606	CS89 - L140X13	1,761	Lijn	K298	K783	Kolom (100)	standaard	Vak10
S607	CS89 - L140X13	2,221	Lijn	K170	K785	Kolom (100)	standaard	Vak12
S608	CS149 - UNP180	1,970	Lijn	K198	K194	Balk (80)	standaard	Vak19
S609	CS149 - UNP180	1,569	Lijn	K219	K158	Balk (80)	standaard	Vak15
S610	CS149 - UNP180	1,569	Lijn	K206	K156	Balk (80)	standaard	Vak15
S612	CS44 - UNP200	3,560	Lijn	K404	K63	Balk (80)	standaard	Vak9
S615	CS44 - UNP200	3,560	Lijn	K444	K406	Balk (80)	standaard	Vak13
S616	CS140 - L50X5	3,227	Lijn	K408	K409	Balk (80)	standaard	Vak14
S617	CS127 - L160X15	3,680	Lijn	K409	K411	Balk (80)	standaard	Vak14
S618	CS127 - L160X15	3,202	Lijn	K411	K302	Balk (80)	standaard	Vak13
S619	CS127 - L160X15	3,680	Lijn	K408	K410	Balk (80)	standaard	Vak13
S620	CS127 - L160X15	3,202	Lijn	K410	K598	Balk (80)	standaard	Vak13
S621	CS140 - L50X5	3,227	Lijn	K410	K411	Balk (80)	standaard	Vak14
S624	CS44 - UNP200	3,560	Lijn	K396	K301	Balk (80)	standaard	Vak13
S625	CS44 - UNP200	3,560	Polylijn	K626	K394	Balk (80)	standaard	Vak9
S626	CS149 - UNP180	1,970	Lijn	K215	K219	Balk (80)	standaard	Vak16
S628	CS149 - UNP180	4,465	Lijn	K194	K227	Balk (80)	standaard	Vak18
S629	CS149 - UNP180	4,465	Lijn	K227	K215	Balk (80)	standaard	Vak17
S631	CS153 - L50X5	1,920	Lijn	K627	K623	Balk (80)	standaard	Vak19
S632	CS157 - L120X11	4,465	Lijn	K627	N192	Balk (80)	standaard	Vak18
S633	CS157 - L120X11	4,465	Lijn	N192	K217	Balk (80)	standaard	Vak17
S634	CS157 - L120X11	2,720	Lijn	K217	K267	Balk (80)	standaard	Vak16
S635	CS157 - L120X11	4,464	Lijn	K623	N191	Balk (80)	standaard	Vak18
S636	CS157 - L120X11	4,465	Lijn	N191	K205	Balk (80)	standaard	Vak17
S637	CS157 - L120X11	2,720	Lijn	K205	K261	Balk (80)	standaard	Vak16
S638	CS153 - L50X5	1,920	Lijn	N192	N191	Balk (80)	standaard	Vak18
S639	CS153 - L50X5	1,920	Lijn	K217	K205	Balk (80)	standaard	Vak16
S640	CS149 - UNP180	4,465	Lijn	K224	K787	Balk (80)	standaard	Vak18
S641	CS149 - UNP180	1,970	Lijn	K206	K211	Balk (80)	standaard	Vak16
S642	CS149 - UNP180	4,465	Lijn	K211	K224	Balk (80)	standaard	Vak17

6. Staafnummers mastlichaam

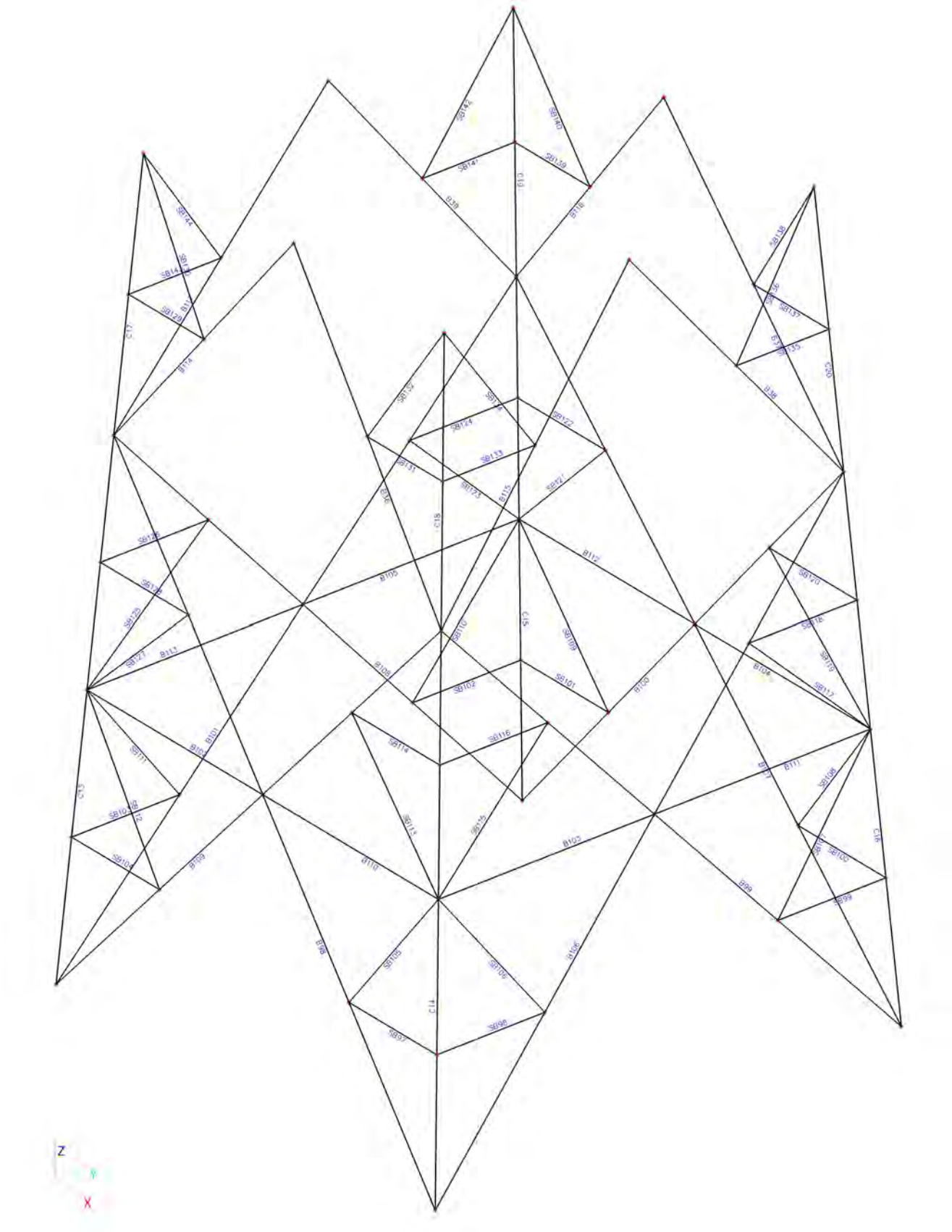
6.1. Vak 1



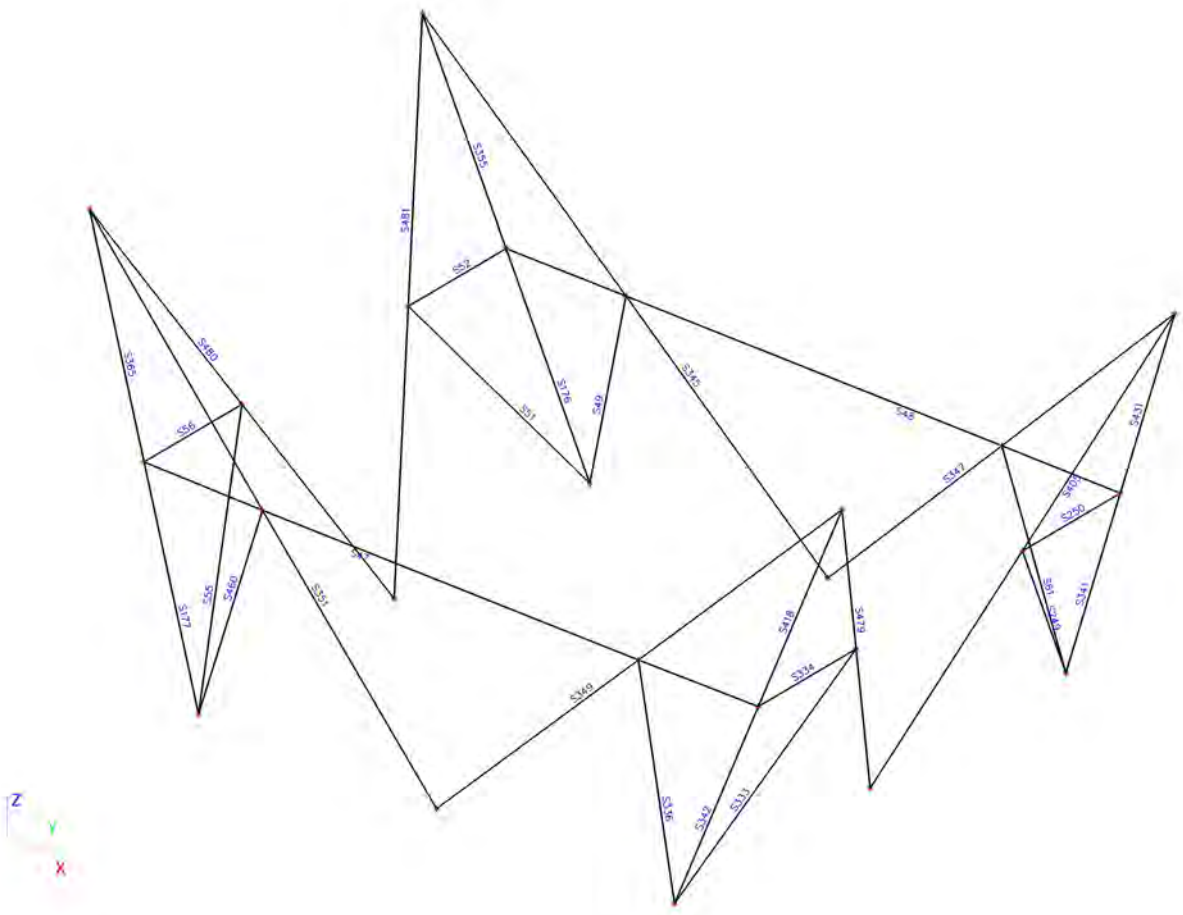
6.2. Vak 2+3



6.3. Vak 4+5

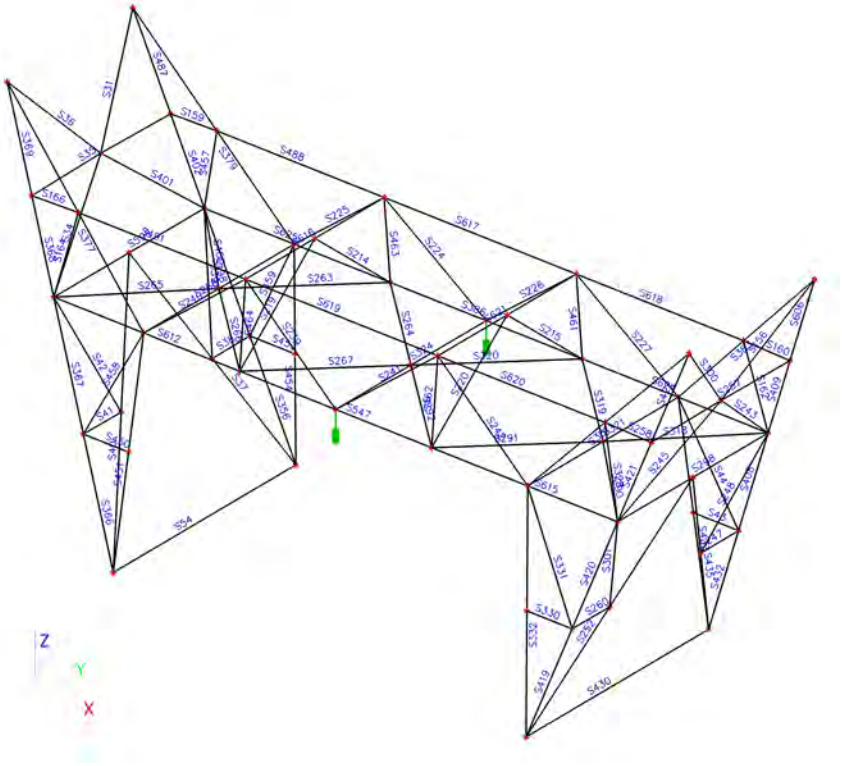


6.4. Vak 6

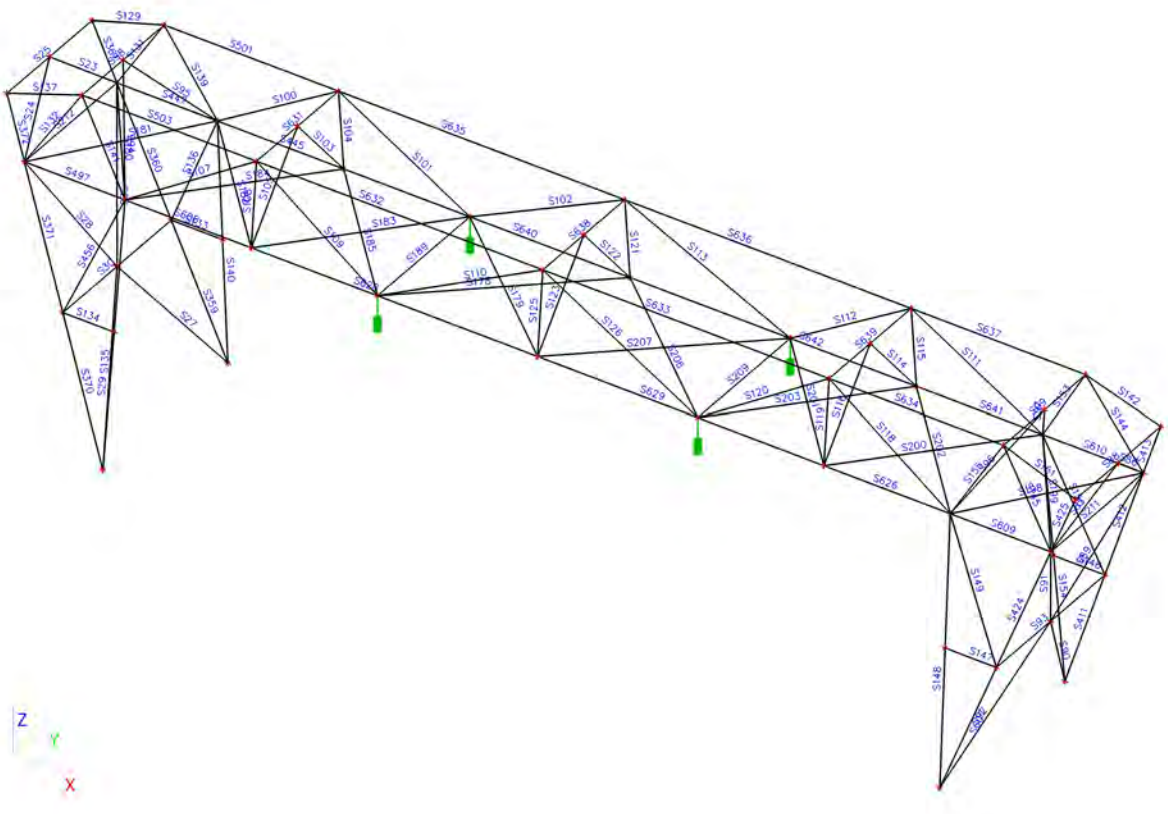


S355
S481
S52
S480
S365
S56
S176
S49
S51
S345
S48
S431
S347
S250
S341
S177
S55
S460
S351
S418
S479
S334
S349
S336
S342
S333
Z
Y
X

6.5. Vak 7+8+9+10+13+14

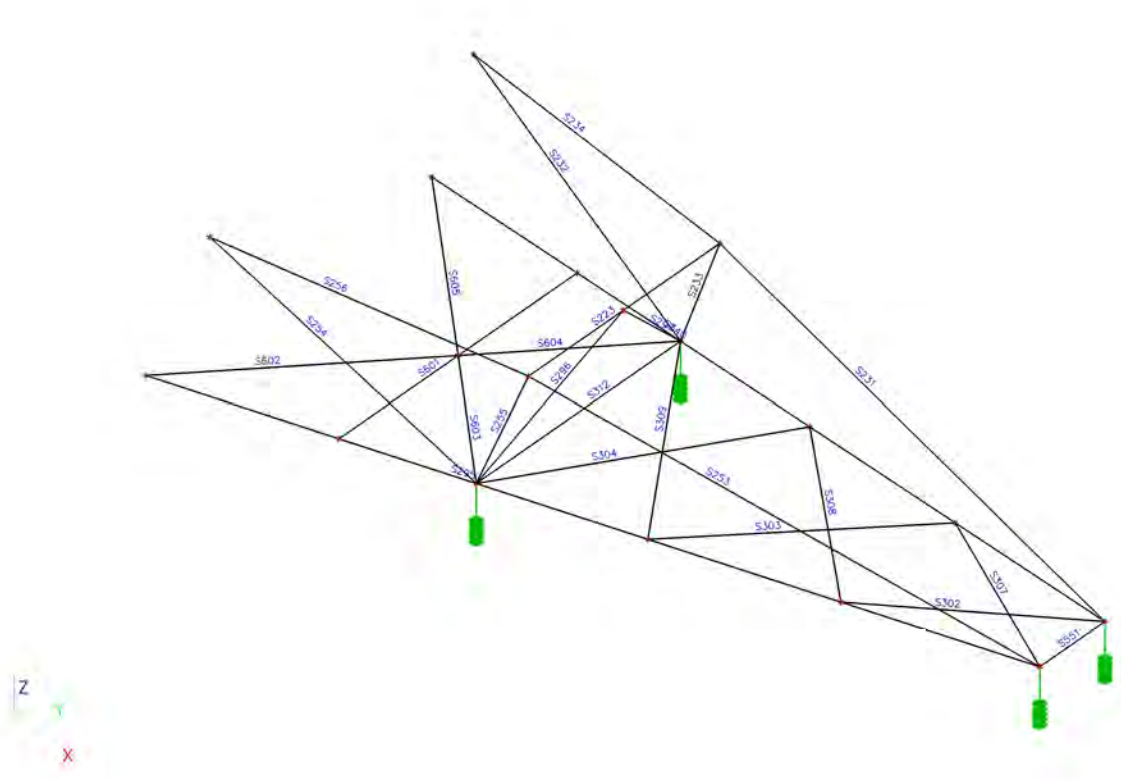


6.6. Vak 11+12+15 t/m 21

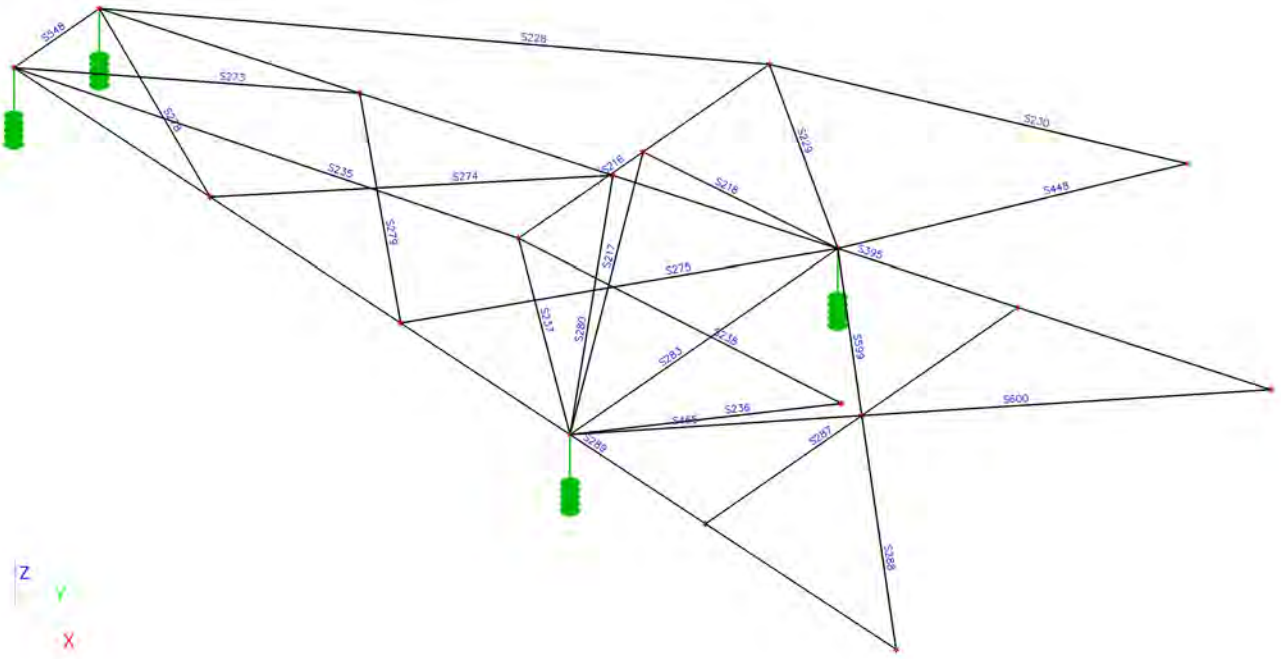


7. Staafnummers traverses

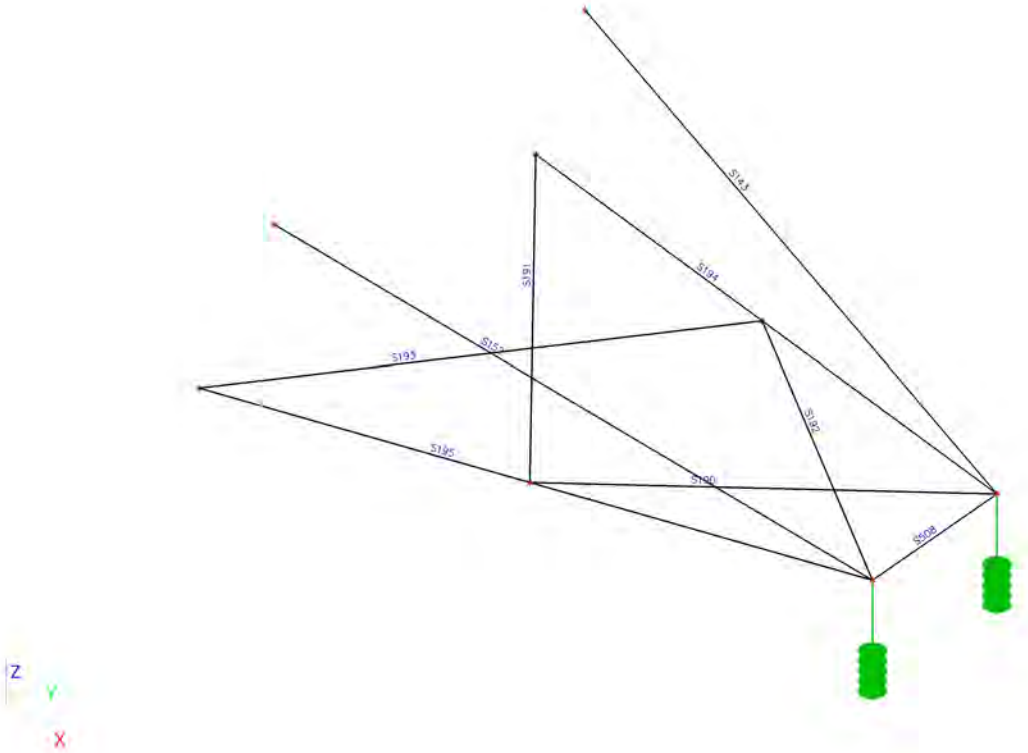
7.1. CrossArm1



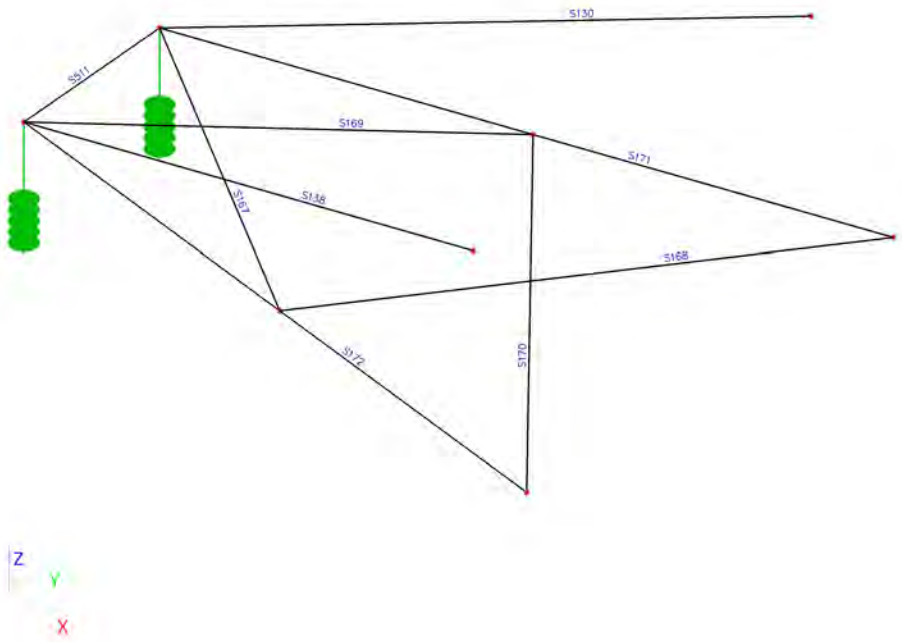
7.2. CrossArm2



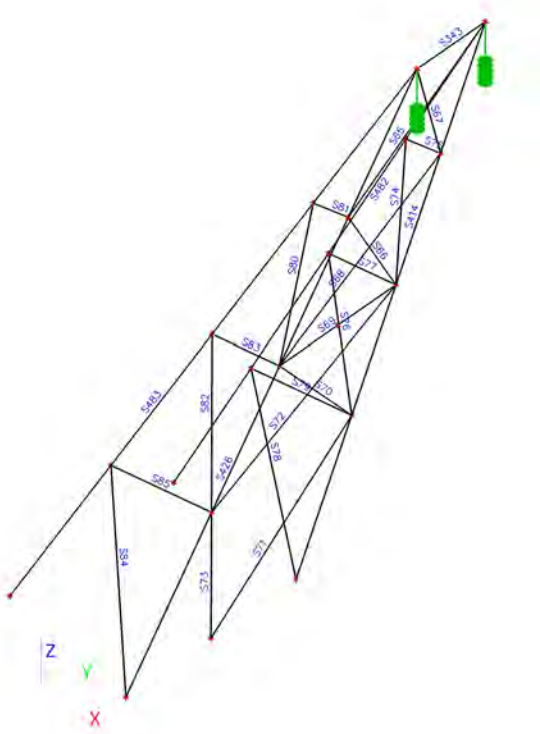
7.3. CrossArm3



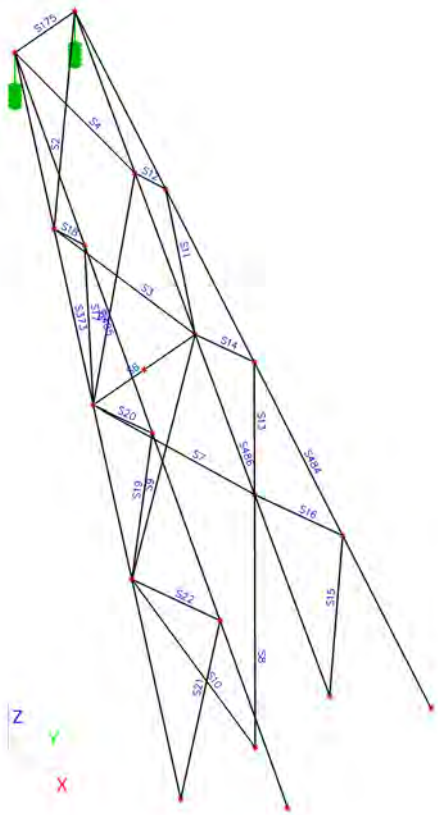
7.4. CrossArm4



7.5. CrossArm5

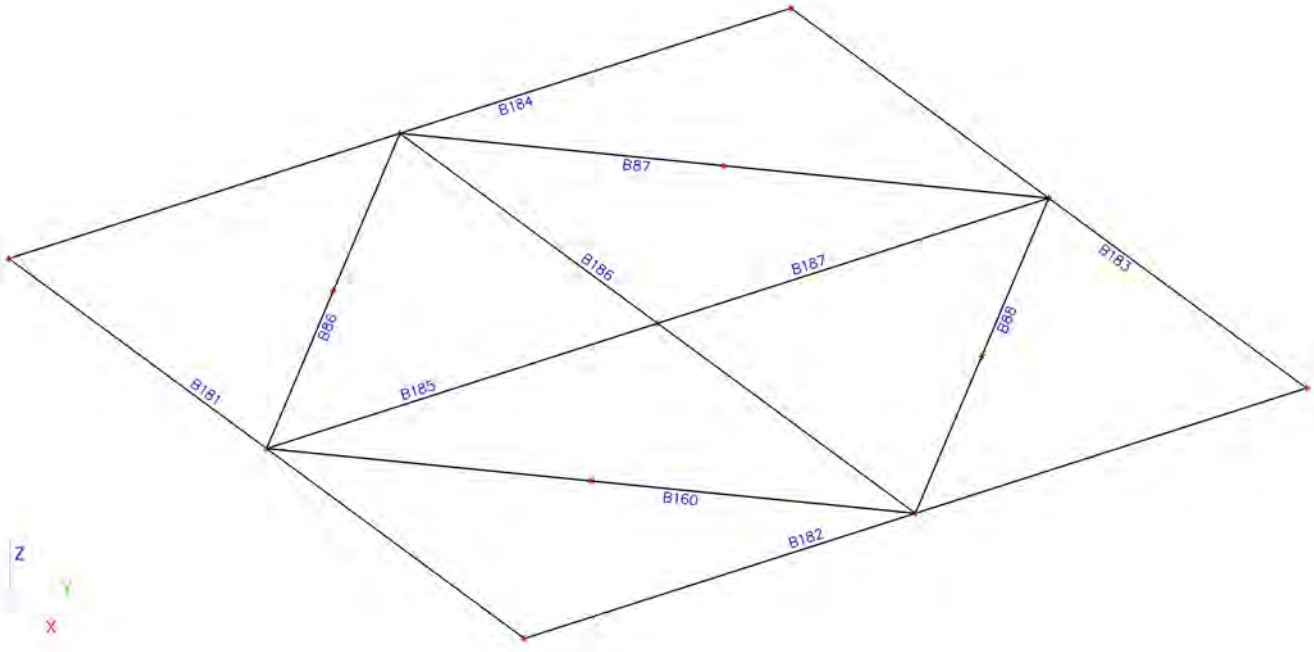


7.6. CrossArm6

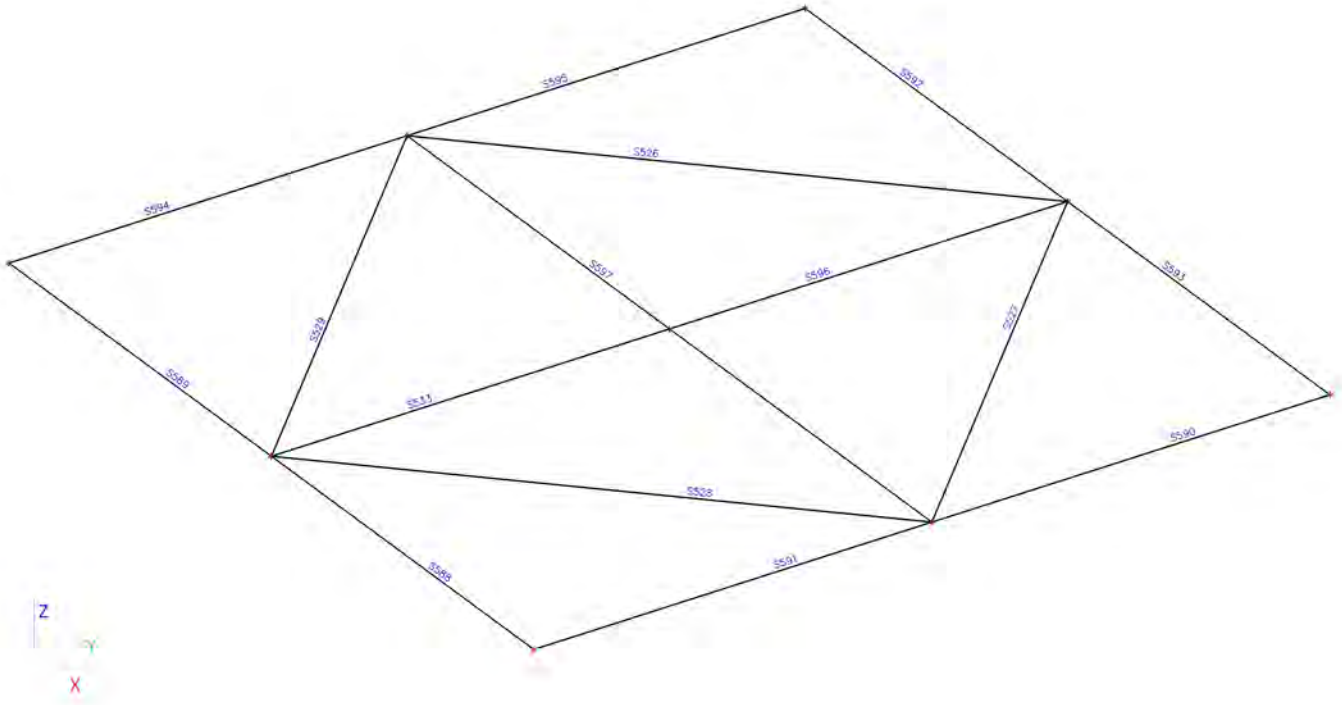


8. Staafnummers horizontale verbanden

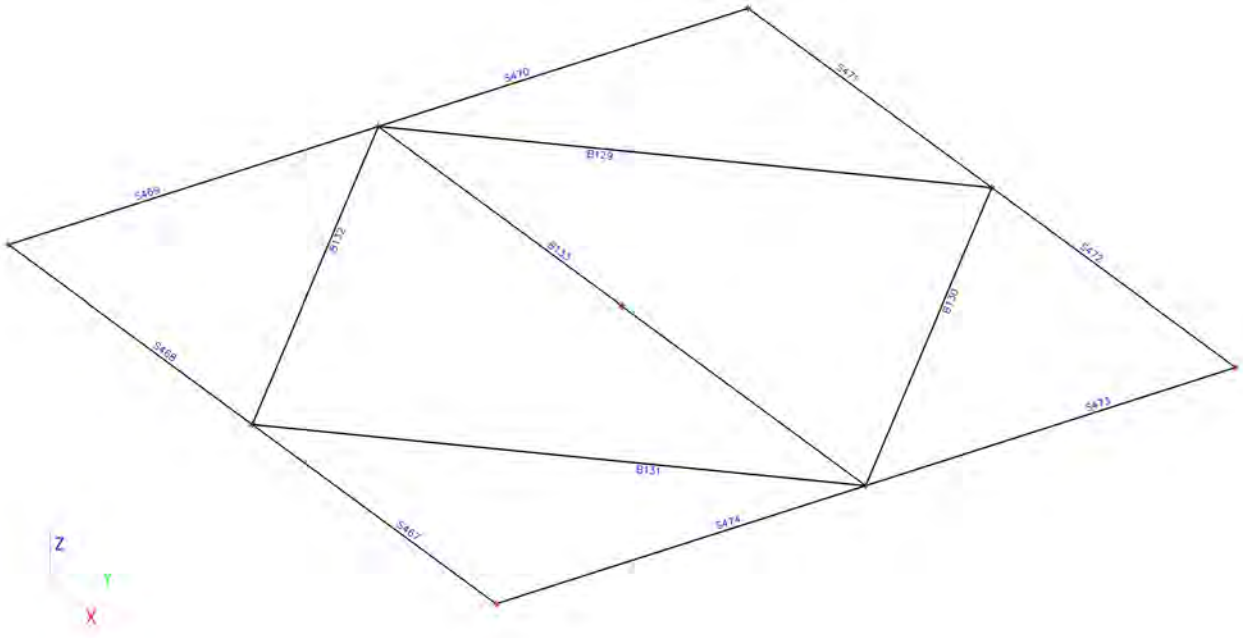
8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



8.3. Horizontaal verband 3



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
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
4C12	Construction	Variabel	Construction	Statisch	Standaard		Kort	Geen
4C13	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_CI1		Variabel	5a_CI1	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2		Variabel	5a_CI2	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3		Variabel	5a_CI3	Statisch	Standaard		Kort	Geen
Tuls-5a_CI4		Variabel	5a_CI4	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_CI9		Variabel	5a_CI9	Statisch	Standaard		Kort	Geen
Tuls-5a_CI10		Variabel	5a_CI10	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11		Variabel	5a_CI11	Statisch	Standaard		Kort	Geen
Tuls-5a_CI12		Variabel	5a_CI12	Statisch	Standaard		Kort	Geen

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Naam	Omschrijving	Actie type	Lastgroep	Belastingtype	Spec	Richting	Duur	'Master' belastingsgeval
Tuls-5a_CI14		Variabel	5a_CI14	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15		Variabel	5a_CI15	Statisch	Standaard		Kort	Geen
Tuls-5a_CI16		Variabel	5a_CI16	Statisch	Standaard		Kort	Geen
Tuls-5a_CI17		Variabel	5a_CI17	Statisch	Standaard		Kort	Geen
Tuls-5a_CI18		Variabel	5a_CI18	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19		Variabel	5a_CI19	Statisch	Standaard		Kort	Geen
Tuls-5a_CI20		Variabel	5a_CI20	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21		Variabel	5a_CI21	Statisch	Standaard		Kort	Geen
Tuls-5a_CI22		Variabel	5a_CI22	Statisch	Standaard		Kort	Geen
WI_y+	WindIce	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13		Variabel	5a_CI13	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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4	Maintenance	Omhullende - uiterst	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
			4C12 - Construction	1,50
			4C13 - 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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
4-p	Maintenance	Omhullende - uiterst	4C7 - Construction	1,50
			4C8 - Construction	1,50
			4C9 - Construction	1,50
			4C10 - Construction	1,50
			4C11 - Construction	1,50
			4C12 - Construction	1,50
			4C13 - 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
			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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aF	wind;10	Omhullende - uiterst	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
			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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1aRR-p	wind;10	Omhullende - uiterst	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
			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 -	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

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bRF	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	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-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 -	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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp1bLR-p	wind;-20	Omhullende - uiterst	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
			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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
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
			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 -	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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3R	wind+ice	Omhullende - uiterst	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
			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 -	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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp3F-p	wind+ice	Omhullende - uiterst	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
			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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LR	maintenance	Omhullende -	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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LR	maintenance	Omhullende - uiterst	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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
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
			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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F	maintenance	Omhullende -	W_x-y+ - Wind	0,24
			W_x+y- - Wind	0,24

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4F	maintenance	Omhullende - uiterst	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-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4LF-p	maintenance	Omhullende -	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

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4LF-p	maintenance	Omhullende - uiterst	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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
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
			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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4RF-p	maintenance	Omhullende -	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
			4C12 - Construction	1,20

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Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4RF-p	maintenance	Omhullende - uiterst	4C13 - Construction	1,20
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
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4F-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-RR - Conductor tension	1,00
			4C12 - Construction	1,20
			4C13 - Construction	1,20
sp4R-p	maintenance	Omhullende -	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

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Nationale norm	EC - ENV
Auteur	- SMA

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
sp4R-p	maintenance	Uitsluitende -	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
			4C12 - Construction	1,20
			4C13 - Construction	1,20

11. Resultaten

11.1. Interne krachten in staaf

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

Staaf	BG	dx [m]	N [kN]
S2	sp3R/1	0,000	**-18,60**
S2	sp3F-p/2	1,862	**17,18**
S3	sp3F-p/2	0,000	**-10,91**
S3	sp3R/3	2,018	**11,36**
S4	sp3F/4	0,000	**-18,92**
S4	sp3LR-p/5	1,862	**17,41**
S5	sp3LR-p/6	0,000	**-10,92**
S5	sp3F/4	2,018	**11,46**
S6	3-p/7	0,000	**-1,77**
S6	sp3R/8	0,000	**0,98**
S7	sp3F/9	0,000	**-8,36**
S7	sp3LR-p/10	2,184	**8,73**
S8	sp3LR-p/10	0,000	**-12,11**
S8	sp3F/9	2,162	**11,12**
S9	sp3R/8	0,000	**-8,83**
S9	sp3F-p/11	2,184	**9,03**
S10	sp3F-p/11	0,000	**-12,59**
S10	sp3R/8	2,162	**11,84**
S11	3/12	1,511	**-3,23**
S11	sp3LR-p/5	0,000	**0,48**
S12	sp3R-p/13	0,000	**-0,16**
S12	3/12	0,336	**0,81**
S13	1a/14	1,501	**-1,57**
S13	1a-p/15	0,000	**0,24**
S14	1a-p/15	0,000	**-0,13**
S14	1a/14	0,649	**0,69**
S15	1a/14	1,911	**-1,82**
S15	1a-p/15	0,000	**0,29**
S16	1a-p/15	0,000	**-0,18**
S16	1a/14	0,969	**1,15**
S17	3/12	1,511	**-2,31**
S17	1a-p/15	0,000	**0,50**
S18	sp3LF-p/16	0,000	**-0,13**
S18	3/12	0,336	**0,52**
S19	1a/17	1,501	**-1,46**
S19	1a-p/18	0,000	**0,17**
S20	1a-p/15	0,000	**-0,15**
S20	1a/14	0,649	**0,67**
S21	1a/17	1,911	**-2,12**
S21	1a-p/18	0,000	**0,37**
S22	1a-p/18	0,000	**-0,19**
S22	1a/17	0,000	**1,09**
S23	sp3LF-p/19	0,000	**-8,95**
S23	sp3R/8	1,450	**10,24**
S24	sp3LR/20	0,000	**-11,24**
S24	sp3LF-p/16	1,451	**6,94**
S25	3/21	0,997	**-13,02**
S25	sp1aR-p/22	0,000	**-3,66**
S26	sp3R/23	0,000	**-121,95**
S26	sp3F-p/24	2,386	**121,01**
S27	sp3F/25	0,000	**-95,04**
S27	sp3R-p/26	2,652	**98,88**
S28	sp3F/25	0,000	**-112,31**
S28	sp3R-p/26	2,386	**118,11**
S29	sp3R/23	0,000	**-104,10**
S29	sp3F-p/24	2,651	**103,14**
S30	sp3LR-p/5	2,536	**-0,48**
S30	sp3LF/27	1,268	**2,14**
S31	sp3R-p/26	0,000	**-69,44**
S31	sp3F/25	2,265	**65,76**

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	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S34	sp3R/28	0,000	**-65,53**
S34	sp3F-p/29	2,366	**57,16**
S35	3/12	3,232	**-23,17**
S35	sp1aLR-p/30	1,616	**-7,45**
S36	sp3F-p/24	0,000	**-72,66**
S36	sp3R/23	2,265	**72,05**
S37	sp3LF/31	0,000	**-275,81**
S37	sp3LR/32	4,747	**274,53**
S38	sp3R-p/13	0,878	**-2,41**
S38	sp3F/33	0,000	**10,11**
S40	sp3LR/32	0,000	**-285,33**
S40	sp3LF-p/34	4,747	**264,04**
S41	sp3F-p/35	0,879	**-1,62**
S41	sp3R/1	0,000	**8,70**
S42	sp3R/1	0,000	**-10,46**
S42	sp3F-p/35	2,227	**2,69**
S43	sp3RF/36	0,864	**-0,79**
S43	sp3RR-p/37	0,000	**0,51**
S44	sp3RR/38	0,000	**-13,67**
S44	sp3RF-p/39	2,231	**17,86**
S47	sp3R/40	1,252	**-116,14**
S47	sp3F-p/41	1,252	**80,08**
S48	sp3F/42	1,252	**-118,84**
S48	sp3R-p/43	1,252	**78,79**
S49	sp3F/42	0,000	**-106,84**
S49	sp3R-p/43	2,076	**67,87**
S51	sp3F/33	0,000	**-12,41**
S51	sp3R-p/13	2,571	**8,35**
S52	sp3R-p/13	1,250	**-8,13**
S52	sp3F/33	0,000	**10,96**
S54	1a/44	2,126	**-8,41**
S54	1a-p/45	0,000	**4,42**
S55	sp3R/1	0,000	**-13,53**
S55	sp3F-p/2	2,571	**8,06**
S56	sp3F-p/35	1,250	**-7,57**
S56	sp3R/1	0,000	**11,07**
S61	sp3F/42	0,000	**-109,64**
S61	sp3R-p/43	2,076	**69,23**
S65	sp3RR/38	0,000	**-18,58**
S65	sp3F-p/24	1,862	**18,02**
S66	sp3F-p/24	0,000	**-11,30**
S66	sp3RR/46	2,018	**11,38**
S67	sp3F/25	0,000	**-18,00**
S67	sp3R-p/47	1,862	**17,52**
S68	sp3R/28	0,000	**-10,97**
S68	sp3F/25	2,018	**11,18**
S69	sp3LF-p/48	0,000	**-0,86**
S69	3/49	0,000	**1,95**
S70	sp3RF/50	0,000	**-9,33**
S70	sp3R-p/51	2,184	**8,60**
S71	sp3R-p/51	0,000	**-11,93**
S71	sp3RF/50	2,162	**12,66**
S72	sp3RR/52	0,000	**-8,99**
S72	sp3F-p/29	2,184	**8,01**
S73	sp3F-p/29	0,000	**-11,06**
S73	sp3RR/52	2,162	**12,07**
S74	sp3LF/53	1,511	**-1,94**
S74	3-p/54	0,000	**1,17**
S75	3-p/54	0,000	**-0,34**
S75	sp3LF/53	0,336	**0,46**
S76	1a/55	1,501	**-1,51**
S76	1a-p/56	0,000	**0,14**
S77	1a-p/57	0,000	**-0,17**
S77	1a/58	0,649	**0,66**
S78	1a/55	1,911	**-2,09**
S78	1a-p/56	0,000	**0,45**
S79	1a-p/56	0,485	**-0,22**

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Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S79	1a/55	0,969	**1,08**
S80	sp3RR/38	1,511	**-2,17**
S80	sp3RF-p/39	0,000	**0,47**
S81	sp3F-p/59	0,000	**-0,17**
S81	sp3R/60	0,336	**0,51**
S82	1a/58	1,501	**-1,61**
S82	1a-p/57	0,000	**0,22**
S83	1a-p/57	0,000	**-0,14**
S83	1a/58	0,649	**0,69**
S84	1a/58	1,911	**-1,86**
S84	1a-p/57	0,000	**0,28**
S85	1a-p/57	0,969	**-0,23**
S85	1a/58	0,000	**1,12**
S86	sp3F-p/61	0,000	**-6,91**
S86	sp3RR/52	1,450	**10,43**
S87	sp3R/60	0,000	**-11,06**
S87	sp3RF-p/39	1,451	**9,12**
S88	sp3R/23	0,997	**-12,80**
S88	sp1aRR-p/62	0,000	**-3,67**
S89	sp3R/1	0,000	**-120,04**
S89	sp3F-p/2	2,386	**110,70**
S90	sp3F/4	0,001	**-109,41**
S90	sp3R-p/13	2,652	**98,39**
S91	sp3F/4	0,000	**-125,63**
S91	sp3R-p/63	2,386	**117,01**
S92	sp3R/1	0,000	**-103,23**
S92	sp3F-p/2	2,651	**91,87**
S93	sp3RF-p/39	1,268	**-0,93**
S93	sp3RF/64	1,268	**1,91**
S94	1a/65	0,000	**-7,82**
S94	1a-p/66	1,851	**7,18**
S95	1a/67	0,000	**-7,31**
S95	1a/65	1,849	**7,66**
S96	1a/65	0,000	**-3,81**
S96	1a-p/66	1,851	**3,56**
S97	1a/67	0,000	**-3,75**
S97	1a-p/68	1,849	**3,64**
S98	1a/65	1,680	**-4,75**
S98	1a-p/68	0,000	**4,28**
S99	1a/67	0,961	**-2,38**
S99	1a-p/68	0,000	**2,20**
S100	3/12	2,364	**-91,84**
S100	sp3LF-p/69	0,000	**-3,99**
S101	sp3R-p/13	0,000	**-1,39**
S101	3/12	2,361	**88,64**
S102	1a/44	2,818	**-65,51**
S102	sp3LF-p/69	0,000	**23,71**
S103	1a/67	0,000	**-2,62**
S103	1a-p/68	1,691	**2,25**
S104	1a-p/57	0,000	**-0,96**
S104	sp3R/60	1,306	**2,64**
S105	1a/65	0,000	**-2,42**
S105	1a-p/66	1,691	**2,43**
S107	3/12	2,364	**-77,01**
S107	1a-p/45	0,000	**1,93**
S108	1a-p/56	0,000	**-1,30**
S108	1a/55	1,306	**2,37**
S109	1a-p/45	0,000	**-7,04**
S109	3/12	2,361	**74,47**
S110	1a/44	2,819	**-61,32**
S110	1a-p/45	0,000	**26,83**
S111	sp3R/60	2,363	**-62,51**
S111	1a-p/70	0,000	**23,42**
S112	1a-p/70	0,000	**-29,79**
S112	sp3LF/53	2,361	**57,46**
S113	sp3R/8	2,819	**-31,38**
S113	1a-p/70	0,000	**58,85**

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	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S114	1a/67	0,000	**-2,77**
S114	1a-p/68	1,691	**2,65**
S115	1a-p/18	0,000	**-0,20**
S115	1a/17	1,306	**3,36**
S116	1a/65	0,000	**-2,83**
S116	1a-p/66	1,691	**2,56**
S118	sp3LF/53	2,363	**-53,78**
S118	1a-p/70	0,000	**24,01**
S119	1a-p/15	0,000	**-0,51**
S119	1a/14	1,306	**3,40**
S120	1a-p/70	0,000	**-30,58**
S120	sp3R/60	2,361	**50,35**
S121	sp1aF-p/71	1,306	**-0,75**
S121	1a/67	0,000	**3,46**
S122	1a/67	0,000	**-3,21**
S122	1a/65	1,691	**3,12**
S123	1a/65	0,000	**-3,34**
S123	1a-p/66	1,691	**3,03**
S125	1a-p/66	1,306	**-0,86**
S125	sp1aF/72	0,000	**3,38**
S126	1a/73	2,819	**-33,22**
S126	1a-p/70	0,000	**55,14**
S129	1a-p/18	1,213	**27,14**
S129	3/12	0,000	**56,70**
S130	sp3LF-p/16	2,880	**28,31**
S130	3/12	0,000	**56,45**
S131	sp3R/60	1,541	**-86,28**
S131	3-p/54	0,000	**117,50**
S132	1a/73	1,541	**-74,62**
S132	1a-p/70	0,000	**111,72**
S133	sp3LF/74	0,799	**-0,23**
S133	sp3LR-p/75	0,000	**0,14**
S134	sp3LR/76	0,800	**-0,12**
S134	sp3LF-p/77	0,000	**0,15**
S135	1a/44	0,000	**-133,73**
S135	1a-p/45	4,098	**44,55**
S136	1a-p/70	2,179	**-2,65**
S136	sp3F/78	0,000	**2,19**
S137	sp1aLR-p/30	1,213	**21,15**
S137	3/12	0,000	**44,86**
S138	sp3LR-p/5	2,880	**22,18**
S138	3/12	0,000	**44,10**
S139	1a-p/70	0,000	**-92,96**
S139	sp3R/60	1,506	**60,10**
S140	1a/44	0,000	**-130,05**
S140	1a-p/45	4,099	**48,06**
S141	1a-p/70	0,000	**-101,75**
S141	1a/73	1,506	**50,32**
S142	1a-p/57	1,213	**25,44**
S142	3/79	0,000	**54,49**
S143	sp3RF-p/39	2,880	**27,44**
S143	3/79	0,000	**55,17**
S144	3/12	1,541	**-150,94**
S144	sp3LF-p/69	0,000	**43,87**
S145	1a/44	1,541	**-134,34**
S145	sp3R-p/13	0,000	**55,30**
S146	sp3F/33	0,000	**-0,96**
S146	sp3R-p/13	0,800	**0,42**
S147	sp3RR/80	0,800	**-0,25**
S147	sp3RF-p/81	0,000	**0,07**
S148	sp3R/8	0,000	**-70,56**
S148	1a-p/70	4,098	**109,24**
S149	sp3F-p/35	2,179	**-1,79**
S149	sp3RR/80	0,000	**3,87**
S150	sp3R-p/51	2,179	**-2,35**
S150	sp3F/82	0,000	**4,07**
S151	1a-p/56	1,213	**19,94**

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Staaf	BG	dx [m]	N [kN]
S151	3/79	0,000	**42,58**
S152	sp3RR-p/83	2,880	**21,85**
S152	3/79	0,000	**42,90**
S153	1a-p/45	0,000	**-44,88**
S153	1a/44	1,506	**105,43**
S154	1a/73	0,001	**-71,35**
S154	1a-p/70	4,099	**105,67**
S155	sp3R-p/13	0,000	**-45,03**
S155	1a/44	1,506	**109,12**
S156	sp3R-p/63	0,000	**-68,70**
S156	sp3F/4	2,264	**76,17**
S159	sp1aLF-p/84	0,888	**73,34**
S159	3/85	0,000	**142,21**
S160	sp1aRF-p/86	0,888	**72,22**
S160	3/87	0,000	**140,61**
S162	1a/44	1,544	**-295,25**
S162	sp3RR-p/37	0,000	**135,91**
S164	sp3LR/76	1,544	**-191,09**
S164	1a-p/70	0,000	**244,07**
S166	sp1aLR-p/88	0,888	**60,14**
S166	3/21	0,000	**114,90**
S167	sp3R/60	0,000	**-38,95**
S167	sp3F-p/24	0,000	**33,79**
S168	sp3LF-p/89	0,000	**-15,79**
S168	sp3R/60	0,000	**18,19**
S169	sp3F/25	0,000	**-38,74**
S169	sp3LR-p/75	0,000	**32,55**
S170	sp3LR-p/75	0,000	**-15,20**
S170	sp3LF/90	0,000	**18,07**
S171	sp3F/25	0,000	**-111,51**
S171	sp3R-p/47	0,000	**41,73**
S172	sp3R/60	0,000	**-108,46**
S172	sp3F-p/24	0,000	**46,76**
S175	sp3LF-p/69	0,533	**-0,89**
S175	3/12	0,000	**37,98**
S176	sp3F/33	0,000	**-956,03**
S176	sp3R-p/13	2,140	**705,06**
S177	sp3R/1	0,000	**-883,59**
S177	sp3F-p/35	2,140	**586,13**
S178	sp3LF/91	0,000	**-9,58**
S178	sp1aLR-p/92	2,360	**6,32**
S179	sp3LR-p/93	0,000	**-6,81**
S179	sp3LF/91	0,236	**9,07**
S180	sp1aF-p/94	0,000	**-36,23**
S180	sp1aR/95	0,971	**38,04**
S181	sp1aR-p/96	0,000	**-37,13**
S181	sp1aF/97	0,000	**35,32**
S182	sp3F/25	0,000	**-36,09**
S182	sp3R-p/26	0,000	**37,97**
S183	sp3R-p/47	0,000	**-37,51**
S183	sp3F/25	0,000	**35,28**
S184	sp3R/40	0,000	**-38,97**
S184	sp3F-p/24	0,000	**36,39**
S185	sp3F-p/24	0,000	**-35,48**
S185	sp3R/60	0,000	**38,43**
S189	sp3LF/53	0,000	**-3,01**
S189	3-p/98	1,922	**72,62**
S190	sp3RR/80	0,000	**-39,07**
S190	sp3F-p/2	0,000	**30,53**
S191	sp3RF-p/99	0,000	**-14,14**
S191	sp3RR/80	0,000	**18,33**
S192	sp3F/4	0,000	**-37,78**
S192	sp3R-p/13	0,000	**32,42**
S193	sp3R-p/13	0,000	**-15,04**
S193	sp3RF/100	1,304	**17,74**
S194	sp3F/4	0,000	**-122,16**
S194	sp3R-p/13	0,000	**41,71**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S195	sp3R/1	0,000	**-108,48**
S195	sp3F-p/2	0,000	**42,94**
S198	sp3F-p/41	0,000	**-35,14**
S198	sp3R/40	0,000	**36,65**
S199	sp3R/101	0,000	**-35,84**
S199	sp3F-p/102	0,000	**37,78**
S200	sp3F/4	0,000	**-40,43**
S200	sp3R-p/63	2,194	**38,11**
S201	sp3R-p/13	0,000	**-37,44**
S201	sp3F/4	0,000	**39,55**
S202	sp3R/40	0,000	**-39,33**
S202	sp3F-p/41	0,000	**37,73**
S203	sp3F-p/2	0,000	**-36,75**
S203	sp3R/1	0,974	**38,48**
S206	sp1aLR/103	0,000	**-6,93**
S206	sp3LF-p/34	0,000	**9,64**
S207	sp3LF/104	0,000	**-9,12**
S207	sp1aLR-p/105	3,304	**7,37**
S209	sp3LF/106	0,000	**-3,06**
S209	3-p/107	0,481	**70,60**
S211	1a-p/45	0,000	**0,00**
S211	3/12	0,000	**14,74**
S212	1a-p/70	0,000	**-4,63**
S212	sp3LF/53	0,961	**10,43**
S214	1a/67	0,000	**-3,30**
S214	1a-p/68	2,305	**2,66**
S215	1a/67	0,000	**-1,87**
S215	1a-p/68	2,305	**2,09**
S216	1a/65	1,166	**-1,83**
S216	1a-p/68	0,000	**0,34**
S217	1a/65	1,771	**-1,66**
S217	1a-p/66	0,000	**1,27**
S218	1a/67	1,782	**-1,46**
S218	1a/65	0,000	**1,44**
S219	1a/65	0,000	**-2,97**
S219	1a-p/66	2,305	**2,99**
S220	1a/65	0,000	**-2,40**
S220	1a-p/66	2,305	**1,53**
S223	1a/65	1,166	**-1,80**
S223	1a-p/68	0,000	**0,37**
S224	sp3RR-p/37	2,376	**-93,44**
S224	1a/44	0,000	**210,89**
S225	1a/44	0,000	**-212,45**
S225	sp3RR-p/37	2,373	**88,29**
S226	1a-p/70	2,376	**-188,84**
S226	sp3RR/38	0,000	**120,41**
S227	sp3RR/38	0,000	**-121,99**
S227	1a-p/70	2,373	**179,39**
S228	sp3F-p/24	4,732	**39,38**
S228	3/108	0,000	**75,46**
S229	3/108	1,262	**-12,41**
S229	sp3F-p/24	0,000	**-6,65**
S230	sp3F-p/2	2,898	**40,62**
S230	3/21	0,000	**77,94**
S231	sp3F-p/2	4,732	**39,31**
S231	3/21	0,000	**75,40**
S232	sp1aRF-p/86	2,827	**31,63**
S232	3/87	0,000	**61,04**
S233	3/21	1,262	**-12,41**
S233	sp3F-p/2	0,000	**-6,64**
S234	sp3F-p/24	2,898	**40,67**
S234	3/108	0,000	**77,97**
S235	sp4R-p/109	4,732	**32,35**
S235	3/87	0,000	**60,75**
S236	sp1aLR-p/88	2,827	**26,44**
S236	3/21	0,000	**49,98**
S237	3/87	1,262	**-10,20**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S237	sp4R-p/109	0,000	**-5,60**
S238	sp4R-p/110	2,898	**33,55**
S238	3/85	0,000	**62,94**
S239	sp3LR-p/5	2,376	**-101,02**
S239	1a/44	0,000	**207,07**
S240	1a/44	0,000	**-207,77**
S240	sp3LR-p/5	2,373	**91,09**
S241	1a-p/70	2,376	**-189,36**
S241	sp3LR/76	0,000	**119,51**
S242	sp3LR/76	0,000	**-123,96**
S242	1a-p/70	2,373	**178,23**
S243	sp3F-p/2	0,000	**-56,27**
S243	sp3R/1	2,366	**68,33**
S245	sp3R/8	0,000	**-65,31**
S245	sp3F-p/11	2,366	**69,00**
S247	sp3R-p/47	0,878	**-2,30**
S247	sp3F/111	0,000	**8,26**
S248	sp3F/111	0,000	**-10,02**
S248	sp3R-p/47	2,227	**3,44**
S249	sp3F/111	0,000	**-12,02**
S249	sp3R-p/47	2,571	**9,65**
S250	sp3R-p/47	1,250	**-9,01**
S250	sp3F/111	0,000	**9,71**
S252	sp3R/40	0,000	**-254,22**
S252	sp3F-p/41	2,380	**243,39**
S253	sp4R-p/112	4,732	**32,34**
S253	3/85	0,000	**60,96**
S254	sp1aRR-p/113	2,827	**26,08**
S254	3/108	0,000	**49,12**
S255	3/85	1,262	**-10,20**
S255	sp3R-p/63	0,000	**-5,57**
S256	sp4R-p/114	2,898	**33,45**
S256	3/87	0,000	**63,04**
S257	sp3RR/38	0,000	**-21,93**
S257	sp1aRR-p/62	1,616	**-7,39**
S258	sp1aRR-p/113	0,888	**59,17**
S258	3/108	0,000	**113,43**
S260	sp3F-p/59	0,879	**-3,52**
S260	sp3R/60	0,000	**8,75**
S263	sp4LR/115	0,000	**-47,24**
S263	sp4LF-p/116	0,000	**40,59**
S264	sp4LF-p/117	0,000	**-40,31**
S264	sp4LR/118	0,000	**46,93**
S265	sp3LR/32	0,000	**-46,49**
S265	sp4LF-p/116	0,000	**40,25**
S266	sp4LF/119	0,000	**-45,06**
S266	sp4LR-p/120	0,000	**42,61**
S267	sp4LR-p/121	0,000	**-42,61**
S267	sp4LF/122	0,000	**44,35**
S268	1a-p/68	2,004	**-1,92**
S268	1a-p/68	0,000	**1,67**
S273	sp3LF/31	0,000	**-44,67**
S273	sp4LR-p/123	0,000	**37,24**
S274	sp3LF-p/34	0,000	**-18,04**
S274	sp3LR/124	0,000	**21,28**
S275	sp3LF/31	0,000	**-13,10**
S275	sp4LR-p/123	0,000	**11,31**
S278	sp3LR/124	0,000	**-44,95**
S278	sp3LF-p/34	0,000	**37,25**
S279	sp4LR-p/123	0,000	**-18,03**
S279	sp3LF/31	0,000	**21,19**
S280	sp3LR/124	0,000	**-13,14**
S280	sp3LF-p/34	0,000	**11,33**
S283	sp3LF-p/125	1,754	**6,06**
S283	3/79	0,000	**82,26**
S287	sp3F-p/59	0,975	**-0,34**
S287	sp3F/111	1,462	**0,63**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S288	sp3R/60	0,000	**-58,13**
S288	sp3F-p/24	0,000	**37,57**
S289	sp3LR/76	1,731	**-228,32**
S289	sp3LF-p/89	0,000	**84,97**
S290	sp3RR/126	0,000	**-26,69**
S290	sp4RF-p/127	0,000	**24,95**
S291	sp3RF/128	1,017	**-28,87**
S291	sp4RR-p/129	0,000	**23,03**
S292	sp4RR-p/130	0,000	**-22,83**
S292	sp4RF/131	0,000	**28,76**
S295	sp3R/1	0,000	**-227,54**
S295	sp3RF-p/99	1,731	**81,11**
S296	1a/65	1,771	**-1,68**
S296	1a-p/66	0,000	**1,24**
S297	1a/67	1,782	**-1,46**
S297	1a/65	0,000	**1,42**
S298	sp3RF-p/132	1,753	**-98,21**
S298	sp3R/23	1,753	**133,50**
S300	sp3F-p/2	0,000	**-64,06**
S300	sp3R/1	2,264	**71,00**
S301	sp3R/60	0,000	**-10,67**
S301	sp3F-p/59	2,227	**4,50**
S302	sp3RR/133	0,000	**-44,90**
S302	sp3RF-p/134	0,000	**34,75**
S303	sp4RR-p/135	0,000	**-18,02**
S303	sp3RF/128	0,240	**20,64**
S304	sp3RR/133	0,000	**-13,11**
S304	sp3RF-p/134	0,000	**10,62**
S307	sp3RF/128	0,000	**-43,59**
S307	sp4RR-p/135	0,000	**37,21**
S308	sp3RF-p/134	0,000	**-16,86**
S308	sp3RR/133	0,000	**21,25**
S309	sp3RF/128	0,000	**-12,75**
S309	sp4RR-p/135	1,232	**11,31**
S312	sp3LF-p/69	0,000	**6,22**
S312	3/12	2,005	**84,58**
S318	sp3RF/128	0,982	**-28,80**
S318	sp4RR-p/129	0,000	**23,30**
S319	sp4RR/136	0,000	**-26,95**
S319	sp4RF-p/127	0,000	**24,64**
S320	sp4RF-p/137	0,000	**-24,81**
S320	sp4RR/138	0,000	**26,71**
S321	1a/58	1,753	**-1,12**
S321	1a-p/57	3,507	**1,16**
S324	sp3R/1	0,000	**-2,38**
S324	3-p/139	1,753	**71,23**
S328	1a/44	0,000	**-291,70**
S328	sp3RF-p/81	1,544	**112,66**
S330	sp3RR/80	0,864	**-0,59**
S330	sp3RF-p/81	0,000	**0,34**
S331	sp3RF/64	0,000	**-11,73**
S331	sp3RR-p/83	2,231	**16,15**
S332	sp3LR-p/5	0,000	**-146,90**
S332	1a/44	4,017	**304,12**
S333	sp3R/60	0,000	**-11,47**
S333	sp3F-p/59	2,571	**9,42**
S334	sp3F-p/59	1,250	**-9,15**
S334	sp3R/60	0,000	**10,07**
S336	sp3R/40	0,000	**-105,27**
S336	sp3F-p/41	2,076	**68,27**
S340	sp3RF/100	0,000	**-256,33**
S340	sp3RR-p/140	1,731	**75,18**
S341	sp3F/111	0,000	**-776,92**
S341	sp3R-p/47	2,140	**704,46**
S342	sp3R/60	0,000	**-884,96**
S342	sp3F-p/59	2,140	**786,83**
S343	sp3LF-p/125	0,000	**-0,89**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S343	3/79	0,000	**36,81**
S345	sp3RR-p/37	0,000	**-201,67**
S345	sp3RF/36	2,816	**329,02**
S347	sp3RF/36	2,816	**-351,28**
S347	sp3RR-p/37	5,642	**198,66**
S349	1a/44	2,816	**-331,50**
S349	sp3LR/76	2,816	**228,59**
S351	sp3LR/76	2,816	**-236,48**
S351	1a/44	2,816	**317,53**
C5	sp3R/1	0,000	**-1498,28**
C5	sp1aF-p/141	3,374	**1057,95**
C6	sp3R/60	0,000	**-1493,89**
C6	sp3F-p/24	3,374	**1346,79**
C7	sp3F/4	0,000	**-1622,36**
C7	sp3R-p/13	3,374	**1218,88**
C8	sp3F/25	0,000	**-1322,56**
C8	sp3R-p/47	3,374	**1224,13**
B8	sp3RR/80	0,000	**-148,44**
B8	sp3RF-p/81	4,916	**130,30**
B10	sp3RR/46	0,000	**-131,98**
B10	sp3RF/50	4,916	**139,21**
B12	sp3RF/36	0,000	**-157,61**
B12	sp3RR-p/37	4,916	**131,36**
B93	sp3LR/142	0,000	**-148,51**
B93	sp3LF/143	4,916	**141,01**
SB49	sp3RF-p/39	0,000	**0,00**
SB49	sp3RR/38	0,000	**0,00**
SB50	sp3RR/133	0,000	**0,00**
SB50	1a/58	2,621	**0,12**
SB51	sp3LR/142	0,000	**0,00**
SB51	sp3LF-p/144	0,000	**0,00**
SB52	sp3LR/124	0,000	**0,00**
SB52	1a/17	2,621	**0,12**
SB53	sp3LR-p/75	0,000	**0,00**
SB53	sp3LF/74	0,000	**0,00**
SB54	sp3RR/38	0,000	**0,00**
SB54	1a/17	2,621	**0,12**
SB55	sp3LR/76	0,000	**0,00**
SB55	sp3LF-p/77	0,000	**0,00**
SB56	sp3RF/64	0,000	**0,00**
SB56	1a/14	2,621	**0,12**
SB57	sp3LR-p/6	0,000	**0,00**
SB57	sp3LF/145	0,000	**0,00**
SB58	sp3LF/90	0,000	**0,00**
SB58	1a/14	2,621	**0,12**
SB59	sp3RF/146	0,000	**0,00**
SB59	sp3RR-p/83	0,000	**0,00**
SB60	sp3RF/100	0,000	**0,00**
SB60	1a/55	2,621	**0,12**
SB61	sp3RF-p/81	0,000	**0,00**
SB61	sp3RR/80	0,000	**0,00**
SB62	sp3LF/27	0,000	**0,00**
SB62	1a/55	2,621	**0,12**
SB63	sp3RF/36	0,000	**0,00**
SB63	sp3RR-p/37	0,000	**0,00**
SB64	sp3RF/36	0,000	**0,00**
SB64	1a/58	2,621	**0,12**
B31	sp3RF-p/99	0,000	**-133,32**
B31	sp3RR/133	4,916	**135,15**
B32	sp3LF/74	0,000	**-133,35**
B32	sp3LR-p/75	4,916	**151,16**
B33	sp3LF-p/89	0,000	**-144,44**
B33	sp3LR/32	4,916	**146,74**
B34	sp3LR/76	0,000	**-143,48**
B34	sp3LF-p/77	4,916	**151,77**
C9	sp3R/1	0,000	**-1397,89**
C9	sp3F-p/2	6,648	**974,25**

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	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
C10	sp3R/60	0,000	**-1393,61**
C10	sp3F-p/24	6,648	**1247,43**
C11	sp3F/4	0,000	**-1509,75**
C11	sp3R-p/13	6,648	**1134,08**
C12	sp3F/25	0,000	**-1237,74**
C12	sp3R-p/47	6,648	**1138,42**
B94	sp3RF-p/81	5,028	**-162,11**
B94	sp3RR/80	9,452	**185,19**
B95	sp3RF/147	0,000	**-158,27**
B95	sp3RR-p/148	5,028	**148,32**
B22	sp3LR-p/75	5,028	**-184,76**
B22	sp3LF/74	9,452	**168,09**
B26	sp3LR/32	0,000	**-168,21**
B26	sp3LF-p/34	5,028	**161,83**
SB65	sp3LF-p/77	1,676	**0,00**
SB65	sp3LR/76	1,676	**0,00**
SB66	sp3RR-p/148	1,676	**0,00**
SB66	sp3RF/50	1,676	**0,00**
SB67	sp3RF-p/149	0,000	**0,00**
SB67	sp3RR/150	0,000	**0,00**
SB68	sp3LR-p/75	0,000	**0,00**
SB68	sp3LF/90	0,000	**0,00**
SB69	sp3RF-p/151	0,000	**0,00**
SB69	sp3RR/152	0,000	**0,00**
SB70	sp3LR-p/6	0,000	**0,00**
SB70	sp3LF/145	0,000	**0,00**
SB71	sp1aLF-p/153	1,676	**0,00**
SB71	sp3LR/142	1,676	**0,00**
SB72	sp3RR-p/154	1,676	**0,00**
SB72	sp3RF/155	1,676	**0,00**
SB73	1a/67	0,000	**-0,12**
SB73	sp3RR/133	2,356	**0,00**
SB74	1a/44	0,000	**-0,12**
SB74	sp3LR/76	2,356	**0,00**
SB75	sp3RR/38	0,000	**0,00**
SB75	1a/73	2,356	**0,12**
SB76	sp3RF/100	0,000	**0,00**
SB76	1a/58	2,356	**0,12**
SB77	sp3LF/90	0,000	**0,00**
SB77	1a/17	2,356	**0,12**
SB78	sp3LR/20	0,000	**0,00**
SB78	1a/44	2,356	**0,12**
SB79	1a/73	0,000	**-0,12**
SB79	sp3LF/27	2,356	**0,00**
SB80	1a/67	0,000	**-0,12**
SB80	sp3LR/124	2,356	**0,00**
SB81	1a/17	0,000	**-0,11**
SB81	sp3R/60	2,360	**0,00**
SB82	sp3LF-p/77	1,676	**0,00**
SB82	sp3LR/76	1,676	**0,00**
SB83	1a/17	0,000	**-0,11**
SB83	sp3R/23	2,360	**0,00**
SB84	sp3R/156	1,676	**0,00**
SB84	sp3F-p/102	1,676	**0,00**
SB85	sp3F/25	0,000	**0,00**
SB85	1a/55	2,360	**0,11**
SB86	sp3R/156	1,676	**0,00**
SB86	sp3F-p/102	1,676	**0,00**
SB87	sp1aLF/157	0,000	**0,00**
SB87	1a/17	2,360	**0,11**
SB88	sp1aRR/158	1,676	**0,00**
SB88	sp3RF-p/151	1,676	**0,00**
SB89	sp3RF/36	0,000	**0,00**
SB89	1a/58	2,360	**0,11**
SB90	sp3RF/159	0,000	**0,00**
SB90	sp1aRR-p/160	0,000	**0,00**
SB91	sp3F/4	0,000	**0,00**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
SB91	1a/14	2,360	**0,11**
SB92	sp3R/156	0,000	**0,00**
SB92	sp3F-p/102	0,000	**0,00**
SB93	1a/58	0,000	**-0,11**
SB93	sp3R/3	2,360	**0,00**
SB94	sp3F/161	1,676	**0,00**
SB94	sp3R-p/162	1,676	**0,00**
SB95	1a/58	0,000	**-0,11**
SB95	sp3RR/80	2,360	**0,00**
SB96	sp3LF/163	1,676	**0,00**
SB96	sp3LR-p/164	1,676	**0,00**
B73	sp3RR/126	0,000	**-153,75**
B73	sp3RF-p/134	5,028	**151,06**
B74	sp3RR-p/37	5,028	**-162,11**
B74	sp3RF/36	9,452	**196,30**
B75	sp3LF/104	0,000	**-161,61**
B75	sp3LR-p/165	5,028	**166,97**
B76	sp3LF-p/77	5,028	**-184,56**
B76	sp3LR/76	9,452	**179,89**
C13	sp3R/1	0,000	**-1112,97**
C13	sp3F-p/2	6,648	**750,59**
C14	sp3R/60	0,000	**-1110,30**
C14	sp3F-p/59	6,648	**983,67**
C15	sp3F/33	0,000	**-1201,40**
C15	sp3R-p/13	6,648	**887,93**
C16	sp3F/111	0,000	**-978,15**
C16	sp3R-p/47	6,648	**890,65**
B98	sp3LR/76	0,000	**-218,56**
B98	sp3LF-p/77	8,859	**226,42**
B99	sp3RF/147	0,000	**-168,65**
B99	sp3RR/126	8,860	**164,62**
B100	sp3RF/36	0,000	**-239,86**
B100	sp3RR-p/37	8,860	**198,61**
B101	sp3LR/32	0,000	**-187,52**
B101	sp3LF-p/144	8,859	**173,52**
B102	sp3F-p/2	2,920	**-3,40**
B102	sp3R/3	0,000	**3,86**
B103	sp3F-p/59	2,920	**-2,63**
B103	sp3R/60	0,000	**2,46**
B104	sp3R-p/26	2,920	**-3,64**
B104	sp3F/25	0,000	**3,70**
B105	sp3R-p/13	2,920	**-2,87**
B105	sp3F/33	0,000	**4,74**
SB97	sp1aLR-p/166	0,000	**0,00**
SB97	1a/44	0,000	**0,00**
SB98	sp3F/42	0,000	**0,00**
SB98	sp3R-p/43	0,000	**0,00**
SB99	sp3F-p/102	0,000	**0,00**
SB99	sp3R/156	0,000	**0,00**
SB100	1a/44	0,000	**0,00**
SB100	sp1aRR-p/160	0,000	**0,00**
SB101	1a-p/70	0,000	**0,00**
SB101	sp1aRR/158	0,000	**0,00**
SB102	sp3R/40	0,000	**0,00**
SB102	sp3F-p/41	0,000	**0,00**
SB103	sp3R-p/43	0,000	**0,00**
SB103	sp3F/42	0,000	**0,00**
SB104	sp1aLR/167	0,000	**0,00**
SB104	1a-p/70	0,000	**0,00**
SB105	sp3RR/80	0,000	**0,00**
SB105	1a/44	2,231	**0,09**
SB106	sp3F/25	0,000	**0,00**
SB106	1a/44	2,231	**0,09**
SB107	sp3R/23	0,000	**0,00**
SB107	1a/14	2,231	**0,09**
SB108	sp3RF/36	0,000	**0,00**
SB108	1a/14	2,231	**0,09**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
SB109	sp1aLF/157	0,000	**0,00**
SB109	1a/73	2,231	**0,09**
SB110	sp3R/3	0,000	**0,00**
SB110	1a/73	2,231	**0,09**
SB111	sp3F/4	0,000	**0,00**
SB111	1a/58	2,231	**0,09**
SB112	sp3LR/76	0,000	**0,00**
SB112	1a/58	2,231	**0,09**
SB113	sp3R/60	0,000	**0,00**
SB113	1a/14	2,190	**0,08**
SB114	sp1aLR/167	0,000	**0,00**
SB114	1a-p/70	0,000	**0,00**
SB115	sp3R/23	0,000	**0,00**
SB115	1a/55	2,190	**0,08**
SB116	sp3F-p/41	0,000	**0,00**
SB116	sp3R/40	0,000	**0,00**
SB117	sp3F/25	0,000	**0,00**
SB117	1a/73	2,190	**0,08**
SB118	sp3F/42	0,000	**0,00**
SB118	sp3R-p/43	0,000	**0,00**
SB119	sp1aLF/168	0,000	**0,00**
SB119	1a/58	2,190	**0,08**
SB120	1a-p/70	0,000	**0,00**
SB120	1a/73	0,000	**0,00**
SB121	sp3RF/36	0,000	**0,00**
SB121	1a/58	2,190	**0,08**
SB122	1a/44	0,000	**0,00**
SB122	sp1aRR-p/160	0,000	**0,00**
SB123	sp3F/4	0,000	**0,00**
SB123	1a/44	2,190	**0,08**
SB124	sp3R-p/43	0,000	**0,00**
SB124	sp3F/42	0,000	**0,00**
SB125	sp3R/3	0,000	**0,00**
SB125	1a/44	2,190	**0,08**
SB126	sp3R/40	0,000	**0,00**
SB126	sp3F-p/41	0,000	**0,00**
SB127	1a/44	0,000	**0,00**
SB127	1a/14	2,190	**0,08**
SB128	1a-p/45	0,000	**0,00**
SB128	1a/44	0,000	**0,00**
B106	sp3RR/46	0,000	**-166,53**
B106	sp3RF/128	8,859	**168,95**
B107	sp3LF/74	0,000	**-204,54**
B107	sp3LR-p/75	8,859	**224,78**
B108	sp3LF/104	0,000	**-182,80**
B108	sp3LR/32	8,860	**182,86**
B109	sp3RR/80	0,000	**-226,37**
B109	sp3RF-p/81	8,860	**196,88**
B110	1a/17	0,000	**0,00**
B110	sp1aLR-p/166	2,920	**0,00**
B111	1a/14	0,000	**0,00**
B111	sp3F/42	2,920	**0,00**
B112	1a/65	0,000	**0,00**
B112	1a/44	2,920	**0,00**
B113	1a/58	0,000	**0,00**
B113	sp3R/40	2,920	**0,00**
C17	sp3R/1	0,000	**-945,38**
C17	sp3F-p/2	3,414	**621,33**
C18	sp3R/60	0,000	**-942,43**
C18	sp3F-p/59	3,414	**804,18**
C19	sp3F/4	0,000	**-1002,41**
C19	sp3R-p/13	3,414	**720,68**
C20	sp3F/111	0,000	**-844,09**
C20	sp3R-p/47	3,414	**729,79**
B114	sp3LF-p/77	0,000	**-273,68**
B114	sp3LR/76	4,360	**258,81**
B115	sp3RR/126	0,000	**-202,34**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
B115	sp3RF-p/134	4,360	**201,50**
B116	sp3LR-p/75	2,180	**-271,45**
B116	sp3LF/74	4,360	**239,81**
B117	sp3LR/32	0,000	**-224,32**
B117	sp3LF-p/34	4,360	**214,31**
SB129	1a-p/45	0,000	**0,00**
SB129	1a/44	0,000	**0,00**
SB130	sp3R/60	0,000	**0,00**
SB130	1a/17	2,050	**0,09**
SB131	1a-p/45	0,000	**0,00**
SB131	1a/44	0,000	**0,00**
SB132	sp3RR/80	0,000	**0,00**
SB132	1a/58	2,050	**0,09**
SB133	sp3F-p/41	0,000	**0,00**
SB133	sp3R/40	0,000	**0,00**
SB134	sp3F/25	0,000	**0,00**
SB134	1a/14	2,049	**0,09**
SB135	sp3F-p/102	0,000	**0,00**
SB135	sp3R/156	0,000	**0,00**
SB136	sp3R/23	0,000	**0,00**
SB136	1a/17	2,050	**0,09**
SB137	1a-p/70	0,000	**0,00**
SB137	1a/44	1,250	**0,00**
SB138	sp3F/33	0,000	**0,00**
SB138	1a/55	2,050	**0,09**
SB139	sp3LR-p/169	0,000	**-12,32**
SB139	sp3LF/90	1,250	**13,58**
SB140	sp3LF/90	0,000	**-11,07**
SB140	sp3LR-p/169	2,050	**10,93**
SB141	sp3LF-p/16	0,000	**-5,02**
SB141	sp3LR/20	0,000	**10,70**
SB142	sp3LR/20	0,000	**-8,21**
SB142	sp3LF-p/16	2,050	**4,57**
SB143	sp3R-p/162	0,000	**0,00**
SB143	sp3F/161	0,000	**0,00**
SB144	sp3F/4	0,000	**0,00**
SB144	1a/55	2,050	**0,09**
B36	sp3RF-p/81	0,000	**-240,62**
B36	sp3RR/80	4,360	**268,49**
B37	sp3RR-p/37	0,000	**-239,70**
B37	sp3RF/36	4,360	**285,58**
B38	sp3RF/128	0,000	**-206,49**
B38	sp3RR-p/170	4,360	**196,50**
B39	sp3LF/31	2,180	**-216,23**
B39	sp3LR-p/171	4,360	**222,03**
S355	sp3F/33	0,000	**-954,88**
S355	sp3R-p/13	2,140	**706,55**
S356	sp3LF/90	0,000	**-540,36**
S356	sp3LR-p/169	2,141	**363,31**
S359	sp3LF/90	0,000	**-208,81**
S359	sp3LR-p/75	2,220	**177,79**
S360	sp3LF/90	0,000	**-209,20**
S360	sp3LR-p/75	2,135	**180,24**
S361	sp3F/33	0,000	**-111,55**
S361	sp3LR-p/5	0,970	**73,76**
S365	sp3R/1	0,000	**-882,76**
S365	sp3F-p/35	2,140	**587,86**
S366	sp3LR/124	0,000	**-555,09**
S366	sp3LF-p/89	2,141	**382,12**
S367	sp3LR/124	0,000	**-561,83**
S367	sp3LF-p/89	2,119	**395,22**
S368	sp3R/1	0,000	**-425,42**
S368	sp3F-p/2	1,571	**244,14**
S369	sp3R/1	0,000	**-397,38**
S369	sp3F-p/2	1,761	**263,97**
S370	sp3R/60	2,220	**-218,54**
S370	sp3LF-p/89	0,000	**186,20**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S371	sp3R/60	2,135	**-219,79**
S371	sp3LF-p/89	0,000	**188,58**
S372	sp3R/1	0,970	**-93,89**
S372	sp3F-p/35	0,000	**72,14**
S373	sp3R/1	6,823	**-92,25**
S373	sp3F-p/35	4,815	**73,09**
S377	sp3LF-p/77	0,000	**-214,20**
S377	sp3LR/76	2,030	**213,67**
S379	1a-p/70	0,000	**-201,45**
S379	sp3LF/74	2,030	**186,95**
S381	1a-p/70	2,030	**-117,58**
S381	sp3RR/80	2,030	**267,78**
S383	sp3RR-p/37	0,000	**-133,57**
S383	sp3RF/36	2,030	**306,74**
S386	sp3RF/36	0,000	**-226,72**
S386	1a-p/70	1,837	**141,96**
S395	sp3LF/90	1,731	**-236,32**
S395	sp3R-p/26	0,000	**74,94**
S397	sp3F/33	2,227	**-12,11**
S397	sp3R-p/13	0,000	**3,37**
S398	sp3LF/90	2,119	**-545,14**
S398	sp3LR-p/75	0,000	**376,11**
S400	sp3LF/31	0,000	**-44,35**
S400	sp4LR-p/120	0,000	**42,28**
S401	sp3F-p/24	0,000	**-66,03**
S401	sp3R/23	2,366	**68,75**
S402	sp3F/4	0,000	**-456,52**
S402	sp3R-p/63	1,570	**267,11**
S405	sp3RR/126	4,765	**-171,57**
S405	sp3RF/147	2,383	**172,53**
S408	sp3RF/100	0,000	**-630,07**
S408	sp3RR-p/37	2,119	**337,84**
S409	sp3F/25	0,000	**-409,54**
S409	sp3R-p/47	1,571	**266,45**
S411	sp3RF/100	2,220	**-239,09**
S411	sp3R-p/13	0,000	**162,78**
S412	sp3RF/36	2,135	**-241,40**
S412	sp3R-p/13	0,000	**165,17**
S413	sp3F/111	0,970	**-86,41**
S413	sp3R-p/47	0,000	**74,00**
S414	sp3F/111	6,823	**-84,87**
S414	sp3R-p/47	4,815	**74,89**
S418	sp3R/60	0,000	**-883,36**
S418	sp3F-p/59	2,140	**788,74**
S419	sp3RR/80	0,000	**-583,80**
S419	sp3RF-p/99	2,141	**321,55**
S420	sp3RR/80	0,000	**-593,71**
S420	sp3RF-p/99	2,119	**329,41**
S421	sp3R/60	0,000	**-423,99**
S421	sp3F-p/24	1,571	**299,84**
S422	sp3R/60	0,000	**-395,63**
S422	sp3F-p/24	1,760	**319,57**
S424	sp3RR/80	0,000	**-233,70**
S424	sp3RF-p/81	2,135	**147,65**
S425	sp3RR/38	0,000	**-93,90**
S425	sp3RF-p/39	0,970	**70,62**
S426	sp3RR/38	0,000	**-92,43**
S426	sp3F-p/59	2,008	**71,49**
S430	1a/73	0,000	**-5,50**
S430	1a-p/70	0,000	**7,62**
S431	sp3F/111	0,000	**-775,62**
S431	sp3R-p/47	2,140	**706,65**
S432	sp3RF/100	0,000	**-620,19**
S432	sp3RR-p/37	2,141	**327,66**
S433	sp3RR-p/37	0,000	**-170,40**
S433	sp3RF/36	4,017	**320,58**
S435	sp3F/42	0,000	**-251,91**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S435	sp3R-p/43	2,380	**242,27**
S445	1a-p/70	0,000	**-98,97**
S445	sp3R/60	0,000	**82,35**
S447	sp3F/33	0,000	**-157,66**
S447	sp3R-p/13	0,000	**90,43**
S448	sp1aLF-p/84	2,827	**32,38**
S448	3/85	0,000	**62,12**
S450	sp3LR/76	0,864	**-0,55**
S450	sp3LF-p/77	0,000	**0,69**
S451	sp3LF-p/77	0,000	**-271,82**
S451	sp3LR/76	4,017	**209,77**
S453	sp3LF/74	0,000	**-0,29**
S453	sp3LR-p/75	0,000	**0,30**
S454	1a-p/70	0,000	**-279,76**
S454	sp3LF/74	4,017	**174,11**
S456	sp3F-p/172	0,000	**-2,84**
S456	sp3R/8	2,179	**2,92**
S457	sp3LF/74	0,000	**-163,40**
S457	1a-p/70	1,544	**245,40**
S458	sp3LF/27	2,231	**-19,39**
S458	sp3LR-p/5	0,000	**12,99**
S459	sp3LR/20	2,231	**-17,85**
S459	sp3LF-p/16	0,000	**10,24**
S460	sp3R/40	2,076	**-107,63**
S460	sp3F-p/41	0,000	**70,14**
S461	sp3RR-p/37	0,000	**-2,85**
S461	sp3RF/36	1,503	**6,96**
S462	sp3RF-p/81	1,503	**-2,62**
S462	sp3RR/80	0,000	**6,97**
S463	sp3LR-p/75	1,503	**-2,95**
S463	sp3LF/74	0,000	**4,68**
S464	sp3LF-p/77	0,000	**-4,15**
S464	sp3R/60	1,503	**5,86**
S465	sp3LF/90	0,000	**-54,95**
S465	sp3LR-p/75	0,000	**36,22**
B129	sp3RF/173	0,000	**-50,30**
B129	sp3RR-p/174	0,000	**47,27**
B130	sp3LF/175	0,000	**-47,88**
B130	sp3LR-p/165	0,000	**48,52**
B131	sp3LR/142	0,000	**-50,39**
B131	sp3LF-p/144	0,000	**47,10**
B132	sp3RR/176	0,000	**-47,81**
B132	sp3RF-p/177	0,000	**49,75**
B133	sp3LF-p/178	2,500	**0,45**
B133	sp3LR/179	2,500	**1,29**
S467	sp3R/60	0,000	**-337,29**
S467	sp3F-p/59	0,000	**304,77**
S468	sp3R/1	0,000	**-335,76**
S468	sp3F-p/35	0,000	**222,47**
S469	sp1aF-p/141	0,000	**-18,73**
S469	sp3R/1	0,000	**28,27**
S470	sp1aR-p/22	0,000	**-22,17**
S470	sp3F/4	0,000	**31,39**
S471	sp3F/33	0,000	**-365,39**
S471	sp3R-p/13	0,000	**270,34**
S472	sp3F/111	0,000	**-292,59**
S472	sp3R-p/47	0,000	**270,31**
S473	sp3R-p/47	0,000	**-21,55**
S473	sp3F/25	0,000	**25,36**
S474	sp3F-p/24	0,000	**-24,37**
S474	sp3R/23	0,000	**27,73**
S479	sp3RF-p/134	4,764	**-172,45**
S479	sp3R/40	2,382	**171,83**
S480	sp3LF-p/180	4,765	**-188,17**
S480	sp3LR/181	2,382	**197,67**
S481	sp3LR/32	4,765	**-195,80**
S481	sp3LF/104	2,382	**189,93**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S482	3-p/54	3,498	**-48,43**
S482	sp3RR/38	5,224	**31,26**
S483	3-p/54	3,452	**-17,59**
S483	3/79	1,726	**31,00**
S484	sp3LF-p/69	3,452	**-15,04**
S484	3/12	1,726	**67,48**
S485	3-p/107	3,498	**-17,37**
S485	3/12	5,224	**31,56**
S486	sp3F/33	0,000	**-110,05**
S486	sp3LR-p/5	2,008	**74,61**
S487	sp3F/4	0,000	**-422,75**
S487	sp3R-p/63	1,761	**290,69**
S488	1a-p/45	0,000	**-87,06**
S488	1a/44	0,000	**381,05**
S491	sp3LR-p/5	0,000	**-134,56**
S491	1a/44	0,000	**361,64**
S497	sp3LR/20	0,000	**-130,25**
S497	sp3F-p/35	0,000	**69,32**
S501	sp3R-p/13	0,000	**-48,85**
S501	3/12	0,000	**177,47**
S503	1a-p/45	0,000	**-49,64**
S503	1a/44	0,000	**152,17**
S508	sp3LF-p/125	0,000	**1,15**
S508	3/87	0,800	**75,38**
S511	sp3LF-p/69	0,000	**1,15**
S511	3/85	0,000	**76,52**
S526	sp3RF/182	0,000	**-17,87**
S526	sp3LF-p/178	0,000	**16,68**
S527	sp3RR/183	0,000	**-17,10**
S527	sp3RF-p/184	0,000	**17,58**
S528	sp3RF/182	0,000	**-17,82**
S528	sp3RR-p/185	0,000	**16,81**
S529	sp3LF/143	0,000	**-16,89**
S529	sp3RF-p/184	0,000	**17,61**
S533	sp3RF/155	0,000	**-0,27**
S533	sp3RR-p/154	1,676	**-0,19**
S547	sp3RR/80	1,837	**-198,95**
S547	sp3F-p/59	0,000	**136,94**
S548	sp3LF-p/69	0,799	**1,61**
S548	3/85	0,000	**75,80**
S551	sp3LF-p/125	0,533	**1,61**
S551	3/87	0,000	**74,75**
S588	sp3F/186	0,000	**0,00**
S588	sp3LR/76	3,353	**0,00**
S589	sp3LF-p/77	3,353	**0,00**
S589	sp3R/3	0,000	**0,00**
S590	1a/44	0,000	**0,00**
S590	sp3F/25	3,353	**0,00**
S591	sp3RR-p/170	3,353	**0,00**
S591	1a/55	0,000	**0,00**
S592	sp3R/101	0,000	**0,00**
S592	sp3RF/36	3,353	**0,00**
S593	sp3RR/38	3,353	**0,00**
S593	1a/58	0,000	**0,00**
S594	1a/73	0,000	**0,00**
S594	sp3LR/142	3,353	**0,00**
S595	sp3LF/31	3,353	**0,00**
S595	1a/17	0,000	**0,00**
C29	sp3R/1	0,000	**-1569,93**
C29	sp1aF-p/141	10,951	**1093,61**
B154	sp3RR/38	0,000	**-186,43**
B154	sp3RF-p/39	12,292	**221,94**
B159	sp3RF/128	0,000	**-253,53**
B159	sp3RR-p/140	12,292	**231,80**
SB241	sp3R-p/187	0,000	**0,00**
SB241	sp3RF/159	1,267	**0,00**
SB249	sp3RR/188	1,267	**0,00**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
SB249	sp3F/9	0,000	**0,00**
SB250	sp3RR/188	2,533	**0,00**
SB250	sp3F/9	0,000	**0,00**
SB252	sp3R-p/187	0,000	**0,00**
SB252	sp3RF/159	2,533	**0,00**
SB259	1a/14	0,000	**-0,13**
SB259	sp3RR/188	2,002	**0,00**
SB260	1a/14	0,000	**-0,17**
SB260	sp3RR/188	2,809	**0,00**
SB261	1a/14	0,000	**-0,17**
SB261	sp3RF/36	2,809	**0,00**
SB272	1a/14	0,000	**-0,13**
SB272	sp3LR/20	2,002	**0,00**
B84	sp1bLF/189	0,000	**0,00**
B84	sp3RF/100	0,896	**0,00**
B85	sp4LF/190	1,791	**0,00**
B85	sp3RF/191	1,791	**0,00**
B86	sp3RR/133	0,000	**-8,71**
B86	sp3RF-p/99	0,000	**6,39**
B87	sp3RF/100	0,000	**-8,60**
B87	sp3RR-p/140	0,000	**6,79**
B88	sp3LF/90	0,000	**-8,41**
B88	sp3LR-p/169	0,000	**7,91**
B160	sp3LR/124	0,000	**-9,23**
B160	sp3LF-p/89	0,000	**7,45**
B177	1a/17	0,000	**-0,09**
B177	sp3F/42	2,191	**0,00**
B178	1a/55	0,000	**-0,09**
B178	sp3LF/53	2,191	**0,00**
B179	1a/17	0,000	**-0,12**
B179	sp3F/4	2,684	**0,00**
B180	1a/55	0,000	**-0,12**
B180	sp3R/8	2,684	**0,00**
B181	sp3R/1	0,000	**-213,71**
B181	sp3F-p/24	3,800	**188,94**
B182	sp3R/60	0,000	**-217,40**
B182	sp3F-p/59	0,000	**191,78**
B183	sp3F/4	3,800	**-231,74**
B183	sp3R-p/47	0,000	**171,09**
B184	sp3F/33	0,000	**-234,44**
B184	sp3R-p/13	0,000	**174,77**
B185	sp3LF/90	0,000	**-1,07**
B185	sp3LR-p/75	0,000	**-0,67**
B186	1a/44	3,800	**-0,96**
B186	sp3RR-p/192	0,000	**-0,62**
B187	sp3LF/90	0,000	**-1,71**
B187	sp3LR-p/75	0,000	**-1,15**
SB273	sp3RR/188	0,633	**0,00**
SB273	sp3F/9	0,000	**0,00**
SB274	sp3R-p/187	0,000	**0,00**
SB274	sp3RF/159	0,633	**0,00**
B188	sp3RR-p/37	0,896	**0,00**
B188	sp3RF/100	0,000	**0,00**
B189	1a/73	0,000	**-0,09**
B189	sp3RR-p/83	2,049	**0,00**
B190	1a/67	0,000	**-0,09**
B190	sp3LF/74	2,049	**0,00**
SB275	1a/14	0,000	**-0,13**
SB275	sp3LR/20	1,808	**0,00**
SB276	1a/14	0,000	**-0,13**
SB276	sp3RR/52	1,808	**0,00**
SB277	sp3RR/188	1,900	**0,00**
SB277	sp1aF/193	0,000	**0,00**
SB278	sp3R-p/194	0,000	**0,00**
SB278	sp3RF/159	1,900	**0,00**
B191	sp3RR-p/37	2,687	**0,00**
B191	sp3R/8	0,000	**0,00**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
SB279	1a/14	0,000	**-0,13**
SB279	sp3LR/20	2,355	**0,00**
SB280	1a/14	0,000	**-0,13**
SB280	sp3RR/188	2,355	**0,00**
B192	1a/55	0,000	**-0,09**
B192	sp3R/8	2,409	**0,00**
B193	1a/17	0,000	**-0,09**
B193	sp3F/4	2,409	**0,00**
B194	sp3RR-p/37	4,478	**0,00**
B194	sp4R/195	0,000	**0,00**
SB281	sp3RR/188	3,167	**0,00**
SB281	sp3F/9	0,000	**0,00**
SB282	sp3R-p/187	0,000	**0,00**
SB282	sp3RF/159	3,167	**0,00**
B195	1a/17	0,000	**-0,12**
B195	sp3F/4	3,002	**0,00**
B196	1a/55	0,000	**-0,12**
B196	sp3R/8	3,002	**0,00**
SB283	1a/14	0,000	**-0,17**
SB283	sp3RF/36	3,322	**0,00**
SB284	1a/14	0,000	**-0,17**
SB284	sp3RR/188	3,322	**0,00**
C30	sp3R/60	0,000	**-1565,27**
C30	sp3F-p/24	10,951	**1393,46**
B197	sp3LR/20	0,000	**-222,72**
B197	sp3LF-p/16	12,292	**159,81**
B198	sp3LF/31	0,000	**-258,65**
B198	sp3LR-p/171	12,292	**256,20**
SB285	sp3LR/181	0,633	**0,00**
SB285	sp3F/186	0,000	**0,00**
SB286	sp3RF-p/39	0,633	**0,00**
SB286	sp3F/186	0,000	**0,00**
B199	sp4RF/196	0,000	**0,00**
B199	sp3LF/175	1,791	**0,00**
B200	1a/58	0,000	**-0,12**
B200	sp3F/25	2,684	**0,00**
B201	1a/14	0,000	**-0,12**
B201	sp3LR/197	2,684	**0,00**
B202	sp1aF/198	0,000	**0,00**
B202	sp3LF/175	2,239	**0,00**
SB287	sp3RF-p/151	2,923	**0,00**
SB287	sp3RR/152	2,923	**0,00**
B203	1a/58	0,000	**-0,12**
B203	sp3F/25	3,002	**0,00**
SB288	1a/55	0,000	**-0,17**
SB288	sp3RR/38	3,322	**0,00**
B204	1a/14	0,000	**-0,12**
B204	sp3LR/197	3,002	**0,00**
SB289	sp3LR/181	2,533	**0,00**
SB289	sp3F/186	0,000	**0,00**
SB290	sp3RF-p/39	2,533	**0,00**
SB290	sp3RR/152	2,280	**0,00**
SB291	1a/55	0,000	**-0,13**
SB291	sp3LR/181	2,002	**0,00**
SB292	1a/55	0,000	**-0,17**
SB292	sp3RR/38	2,809	**0,00**
SB293	1a/55	0,000	**-0,13**
SB293	sp3RR/38	2,002	**0,00**
B205	1a/58	0,000	**-0,09**
B205	sp3F/42	2,191	**0,00**
B206	1a/14	0,000	**-0,09**
B206	1a/44	2,191	**0,00**
SB294	sp3LR/181	1,900	**0,00**
SB294	sp3F/82	0,000	**0,00**
SB295	sp3R-p/51	0,000	**0,00**
SB295	sp3RR/38	1,900	**0,00**
B207	sp1aLR/199	0,000	**0,00**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
B207	sp3LF/175	1,344	**0,00**
SB296	1a/55	0,000	**-0,13**
SB296	sp3RR/38	2,355	**0,00**
SB297	1a/55	0,000	**-0,13**
SB297	sp3LR/181	2,355	**0,00**
B208	1a/14	0,000	**-0,09**
B208	sp3LR/197	2,409	**0,00**
B209	1a/58	0,000	**-0,09**
B209	sp3F/25	2,409	**0,00**
SB298	sp3RF-p/151	1,013	**0,00**
SB298	sp3F/186	0,000	**0,00**
SB299	sp3LR/181	1,267	**0,00**
SB299	sp3F/186	0,000	**0,00**
B210	sp1aLR/199	0,000	**0,00**
B210	sp3LF/90	0,896	**0,00**
B211	sp3LR-p/75	0,896	**0,00**
B211	sp3LF/90	0,000	**0,00**
B212	1a/14	0,000	**-0,09**
B212	sp3LF/27	2,049	**0,00**
B213	1a/67	0,000	**-0,09**
B213	sp3F/33	2,049	**0,00**
SB300	1a/55	0,000	**-0,13**
SB300	sp3RR/38	1,808	**0,00**
SB301	1a/55	0,000	**-0,13**
SB301	sp3LR/200	1,808	**0,00**
SB302	sp3LR/181	3,167	**0,00**
SB302	sp3F/186	0,000	**0,00**
SB303	1a/55	0,000	**-0,17**
SB303	sp3LR/181	2,809	**0,00**
SB304	1a/55	0,000	**-0,17**
SB304	sp3LR/181	3,322	**0,00**
C31	sp3F/4	0,000	**-1698,53**
C31	sp3R-p/13	10,951	**1260,75**
B214	sp3RF/64	0,000	**-179,49**
B214	sp3RR-p/83	12,292	**201,54**
B215	sp3RR/188	0,000	**-245,09**
B215	sp3RF-p/201	12,292	**236,67**
SB305	sp3RF/128	0,633	**0,00**
SB305	sp3R/8	0,000	**0,00**
SB306	sp3F-p/11	0,000	**0,00**
SB306	sp3LF/163	0,633	**0,00**
B216	sp3RF-p/202	3,583	**0,00**
B216	sp3LF/203	0,000	**0,00**
B217	1a/14	0,000	**-0,12**
B217	sp3R/204	2,684	**0,00**
B218	1a/58	0,000	**-0,12**
B218	sp3RF/64	2,684	**0,00**
B219	sp3RF-p/202	4,478	**0,00**
B219	sp3F/25	0,000	**0,00**
SB307	sp3F-p/11	0,000	**0,00**
SB307	sp3LF/163	3,167	**0,00**
B220	1a/14	0,000	**-0,12**
B220	sp3R/204	3,002	**0,00**
SB308	1a/17	0,000	**-0,17**
SB308	sp3LF/27	3,322	**0,00**
B221	1a/58	0,000	**-0,12**
B221	sp3RF/64	3,002	**0,00**
SB309	sp3RF/128	2,533	**0,00**
SB309	sp3R/8	0,000	**0,00**
SB310	sp3F-p/11	0,000	**0,00**
SB310	sp3LF/163	2,533	**0,00**
SB311	1a/17	0,000	**-0,13**
SB311	sp3RF/128	2,002	**0,00**
SB312	1a/17	0,000	**-0,17**
SB312	sp3LF/27	2,809	**0,00**
SB313	1a/17	0,000	**-0,13**
SB313	sp3LF/27	2,002	**0,00**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
B222	1a/14	0,000	**-0,09**
B222	sp3R/156	2,191	**0,00**
B223	1a/73	0,000	**-0,09**
B223	sp3R/60	2,191	**0,00**
SB314	sp3RF/128	1,900	**0,00**
SB314	sp1aR/205	0,000	**0,00**
SB315	sp3F-p/172	0,000	**0,00**
SB315	sp3LF/163	1,900	**0,00**
B224	sp3RF-p/202	2,687	**0,00**
B224	sp4RR/206	0,000	**0,00**
SB316	1a/17	0,000	**-0,13**
SB316	sp3LF/27	2,355	**0,00**
SB317	1a/17	0,000	**-0,13**
SB317	sp3RF/128	2,355	**0,00**
B225	1a/58	0,000	**-0,09**
B225	sp3RF/64	2,409	**0,00**
B226	1a/14	0,000	**-0,09**
B226	sp3R/204	2,409	**0,00**
SB318	sp3F-p/11	0,000	**0,00**
SB318	sp3LF/163	1,267	**0,00**
SB319	sp3RF/128	1,267	**0,00**
SB319	sp3R/8	0,000	**0,00**
B227	sp3RF-p/202	1,791	**0,00**
B227	sp1aLF/207	0,000	**0,00**
B228	sp3RF-p/202	0,896	**0,00**
B228	sp3RR/52	0,000	**0,00**
B229	1a/73	0,000	**-0,09**
B229	sp3RR/152	2,049	**0,00**
B230	1a/65	0,000	**-0,09**
B230	sp3LR/179	2,049	**0,00**
SB320	1a/17	0,000	**-0,13**
SB320	sp3LF/27	1,808	**0,00**
SB321	1a/17	0,000	**-0,13**
SB321	sp3RF/100	1,808	**0,00**
SB322	sp3RF/128	3,167	**0,00**
SB322	sp3R/8	0,000	**0,00**
SB323	1a/17	0,000	**-0,17**
SB323	sp3RF/128	2,809	**0,00**
SB324	1a/17	0,000	**-0,17**
SB324	sp3RF/128	3,322	**0,00**
C32	sp3F/25	0,000	**-1387,43**
C32	sp3R-p/47	10,951	**1266,14**
B231	sp3LF/27	0,000	**-232,20**
B231	sp3LR-p/5	12,292	**180,75**
B232	sp3LR/181	0,000	**-266,25**
B232	sp3LF-p/180	12,292	**250,59**
SB325	sp3LF/31	0,633	**0,00**
SB325	sp3R/204	0,000	**0,00**
SB326	sp3F-p/29	0,000	**0,00**
SB326	sp3LR/76	0,633	**0,00**
B233	sp3LF-p/19	3,583	**0,00**
B233	sp1aLF/207	0,000	**0,00**
B234	1a/55	0,000	**-0,12**
B234	sp3R/8	2,684	**0,00**
B235	sp3LR/179	0,000	**0,00**
B235	sp3LR/208	2,239	**0,00**
SB327	sp3LF-p/19	2,680	**0,00**
SB327	sp3LR/179	2,923	**0,00**
SB328	sp3LF/31	2,533	**0,00**
SB328	sp3R/204	0,000	**0,00**
SB329	sp3F-p/29	0,000	**0,00**
SB329	sp3LR/76	2,533	**0,00**
SB330	1a/58	0,000	**-0,13**
SB330	sp3LF/31	2,002	**0,00**
SB331	1a/58	0,000	**-0,17**
SB331	sp3RF/64	2,809	**0,00**
SB332	1a/58	0,000	**-0,13**

D&C ENGINEERING design and construct	Project	- 150 kV lijn Leiden - Zoetermeer
	Onderdeel	- berekening Mast 73
	Omschrijving	- ontwerpberekening
	Nationale norm	EC - ENV
	Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
SB332	sp3RF/64	2,002	**0,00**
B236	1a/55	0,000	**-0,09**
B236	sp3R/156	2,191	**0,00**
B237	1a/17	0,000	**-0,09**
B237	1a/44	2,191	**0,00**
SB333	sp3LF/31	1,900	**0,00**
SB333	sp3R/204	0,000	**0,00**
SB334	sp3F-p/61	0,000	**0,00**
SB334	sp3LR/76	1,900	**0,00**
B238	sp3LF-p/19	2,687	**0,00**
B238	sp4F/209	0,000	**0,00**
SB335	1a/58	0,000	**-0,13**
SB335	sp3RF/64	2,355	**0,00**
SB336	1a/58	0,000	**-0,13**
SB336	sp3LF/31	2,355	**0,00**
B239	1a/17	0,000	**-0,09**
B239	sp3LF/27	2,409	**0,00**
B240	1a/55	0,000	**-0,09**
B240	sp3R/101	2,409	**0,00**
SB337	sp3F-p/29	0,000	**0,00**
SB337	sp3LR/76	1,267	**0,00**
SB338	sp3LF/31	1,267	**0,00**
SB338	sp3R/204	0,000	**0,00**
B241	sp4LF/210	0,000	**0,00**
B241	sp3LR/200	0,896	**0,00**
B242	sp3LF-p/19	0,896	**0,00**
B242	sp3LR/200	0,000	**0,00**
B243	1a/17	0,000	**-0,09**
B243	sp3LF-p/211	2,049	**0,00**
B244	1a/65	0,000	**-0,09**
B244	sp3RR/52	2,049	**0,00**
SB339	1a/58	0,000	**-0,13**
SB339	sp3RF/64	1,808	**0,00**
SB340	1a/58	0,000	**-0,13**
SB340	sp3LF/90	1,808	**0,00**
SB341	sp3LF/31	3,167	**0,00**
SB341	sp3R/204	0,000	**0,00**
SB342	1a/58	0,000	**-0,17**
SB342	sp3LF/31	2,809	**0,00**
B245	1a/17	0,000	**-0,12**
B245	sp3LF/27	2,684	**0,00**
SB343	1a/58	0,000	**-0,17**
SB343	sp3RF/64	3,322	**0,00**
B246	1a/17	0,000	**-0,12**
B246	sp3LF/27	3,002	**0,00**
SB344	1a/58	0,000	**-0,17**
SB344	sp3LF/31	3,322	**0,00**
B247	1a/55	0,000	**-0,12**
B247	sp3R/8	3,002	**0,00**
S596	sp3RF-p/81	0,000	**0,05**
S596	sp3RR/80	2,634	**0,08**
S597	sp3LR/197	0,000	**-0,11**
S597	sp3LF-p/212	6,466	**-0,07**
S598	sp3LR-p/6	0,000	**-107,54**
S598	sp3LR/142	1,753	**149,60**
S599	sp3R/60	0,000	**-57,23**
S599	sp3LF-p/89	0,000	**36,92**
S600	sp3F/25	0,000	**-55,97**
S600	sp3LR-p/75	0,000	**36,64**
S601	sp3RF-p/81	1,463	**-0,32**
S601	sp3RF/36	1,463	**0,71**
S602	sp3RR/80	0,000	**-58,25**
S602	sp3RF-p/99	0,000	**32,67**
S603	sp3F/4	0,000	**-56,46**
S603	sp3R-p/13	0,000	**35,69**
S604	sp3RR/80	0,000	**-57,84**
S604	sp3F-p/2	0,000	**31,57**

Project	- 150 kV lijn Leiden - Zoetermeer
Onderdeel	- berekening Mast 73
Omschrijving	- ontwerpberekening
Nationale norm	EC - ENV
Auteur	- SMA

Staaf	BG	dx [m]	N [kN]
S605	sp3RF/100	2,201	**-56,97**
S605	sp3R-p/13	0,000	**36,51**
S606	sp3F/25	0,000	**-375,55**
S606	sp3R-p/47	1,760	**290,19**
S607	sp3RR/80	2,220	**-231,55**
S607	sp3RF-p/99	0,000	**145,93**
S608	1a-p/70	0,000	**-98,81**
S608	1a/73	0,000	**59,05**
S609	sp3R/60	0,000	**-126,09**
S609	sp3F-p/59	0,000	**111,82**
S610	sp3F/111	0,000	**-104,70**
S610	sp3RR-p/83	0,000	**95,63**
S612	sp3R/1	1,840	**-247,26**
S612	sp3F-p/35	1,840	**95,68**
S615	sp3R/60	0,000	**-245,60**
S615	sp3F-p/59	1,720	**168,41**
S616	1a/67	0,000	**-3,22**
S616	1a-p/68	0,000	**2,13**
S617	sp4F-p/213	0,000	**-1,02**
S617	sp3R/23	0,000	**102,87**
S618	1a-p/70	0,000	**-243,73**
S618	sp3RR/38	0,000	**272,61**
S619	sp4R-p/214	0,000	**-9,82**
S619	sp3F/4	0,000	**90,99**
S620	1a-p/70	0,000	**-253,93**
S620	sp3RF/64	0,000	**225,28**
S621	1a/65	1,614	**-2,27**
S621	1a-p/66	1,614	**1,52**
S624	sp3F/111	1,840	**-229,10**
S624	1a-p/70	0,000	**143,61**
S625	sp3F/33	0,000	**-284,81**
S625	sp3R-p/13	1,720	**129,72**
S626	sp3R-p/13	0,000	**-62,24**
S626	1a/44	0,000	**118,08**
S628	1a-p/70	0,000	**-90,11**
S628	sp3R/40	1,967	**94,33**
S629	1a-p/45	2,498	**-41,74**
S629	1a/44	2,498	**113,99**
S631	1a/67	0,960	**-1,75**
S631	1a-p/66	0,960	**1,47**
S632	1a/73	0,000	**-47,65**
S632	1a-p/70	0,000	**36,58**
S633	1a/44	0,000	**-70,72**
S633	sp3R-p/13	0,000	**15,87**
S634	1a-p/70	0,000	**-110,75**
S634	sp3R/60	1,731	**95,78**
S635	sp3R/60	0,470	**-58,97**
S635	1a-p/70	0,000	**36,06**
S636	3/12	0,940	**-81,13**
S636	sp3LF-p/69	0,000	**4,04**
S637	1a-p/70	2,225	**-117,02**
S637	sp3LF/53	0,000	**95,59**
S638	1a/65	1,920	**-2,22**
S638	1a-p/68	0,000	**1,91**
S639	1a/65	1,920	**-1,88**
S639	1a-p/68	0,000	**1,62**
S640	1a-p/70	2,498	**-100,61**
S640	sp3F/42	0,000	**100,19**
S641	1a-p/45	0,000	**-39,25**
S641	1a/44	0,000	**123,53**
S642	sp3R-p/13	0,000	**-64,04**
S642	1a/44	0,000	**116,79**

11.2. Reacties

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

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn4/N290	sp1aR/205	**-286,39**	227,28	1343,11	0,00	0,00	0,00
Sn2/N298	sp3F/4	**302,43**	-242,69	**1459,70**	0,00	0,00	0,00
Sn2/N298	sp1aF/215	297,48	**-247,51**	1431,70	0,00	0,00	0,00
Sn1/N248	1a/14	209,13	**229,46**	1094,45	0,00	0,00	0,00
Sn4/N290	sp3F-p/24	230,09	-175,01	**-1123,83**	0,00	0,00	0,00
Sn1/N248	1a/216	63,50	72,70	350,60	**0,00**	**0,00**	**0,00**

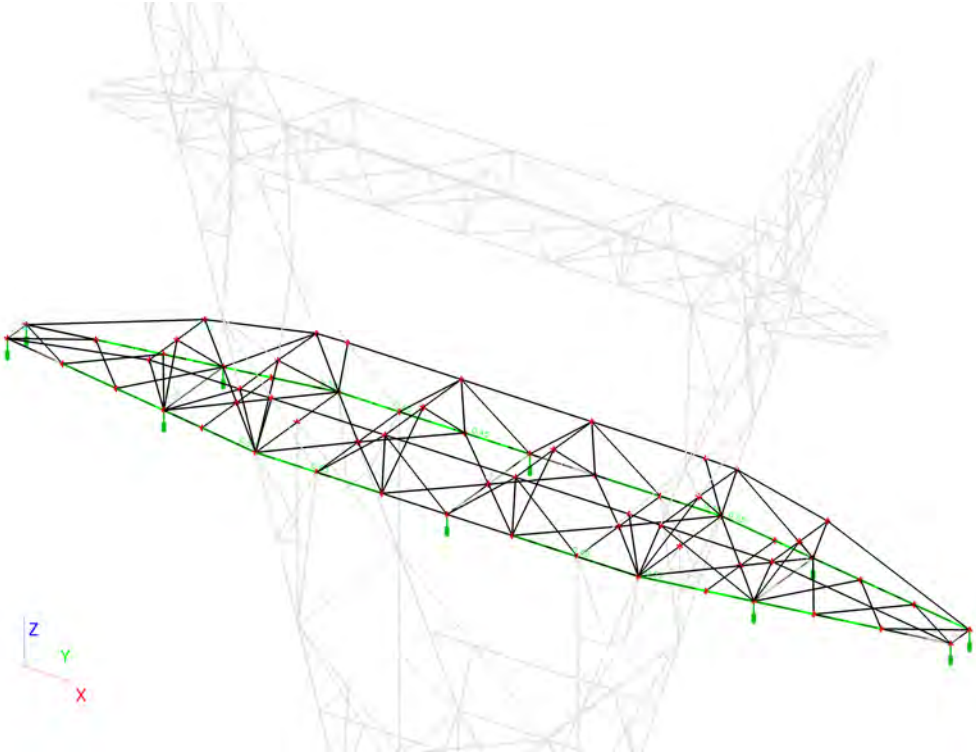
11.3. Resultante op Fundering

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

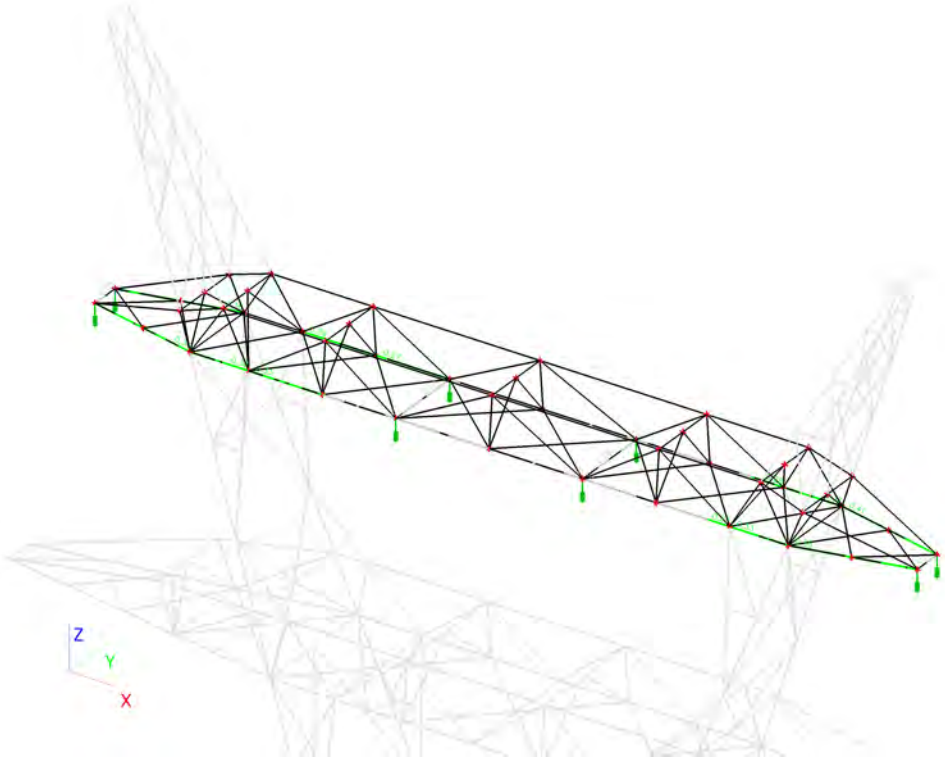
BG	Steunpunt	Extreem	horiz. component [kN]	resultante [kN]	Hoek [deg]	helling(afschot) [-]	Rx [kN]	Ry [kN]	Rz [kN]
sp1aF/217	Sn3/N306	Rz	**57,68**	1219,38	1,63	21,12	39,61	41,93	1218,01
sp1aR/218	Sn1/N248	Rx	**365,14**	1391,19	173,85	3,68	284,37	229,05	1342,42
sp1aF/219	Sn2/N298	Ry	250,35	**322,84**	126,36	-0,81	-37,60	-247,51	-203,83
sp3F/4	Sn2/N298	Rx	302,65	**1490,74**	-132,80	4,82	302,43	11,64	1459,70
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	**-179,72**	-6,90	-104,46	-105,49	-1024,63
sp1aR/218	Sn1/N248	Rx	365,14	1391,19	**173,85**	3,68	284,37	229,05	1342,42
sp1aR-p/220	Sn3/N306	Rz	148,46	1035,33	-179,72	**-6,90**	-104,46	-105,49	-1024,63
sp1aF/217	Sn3/N306	Rz	57,68	1219,38	1,63	**21,12**	39,61	41,93	1218,01
sp1aR/205	Sn4/N290	Rx	289,09	346,86	-127,16	-0,66	**-286,39**	-39,45	-191,68
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	**302,43**	11,64	1459,70
sp1aF/219	Sn2/N298	Ry	250,35	322,84	126,36	-0,81	-37,60	**-247,51**	-203,83
1a/14	Sn1/N248	Ry	310,46	1137,63	-177,35	3,53	209,13	**229,46**	1094,45
sp3F-p/221	Sn4/N290	Rz	190,61	1139,88	-68,34	-5,90	-75,52	-175,01	**-1123,83**
sp3F/4	Sn2/N298	Rx	302,65	1490,74	-132,80	4,82	302,43	11,64	**1459,70**

11.4. Controle UNP en HEB profilen

11.4.1. Staalcontrole; Algehele toetsing Vak 9+13+14+ CrossArm1+2



11.4.2. Staalcontrole; Algehele toetsing Vak 15 t/m 21 + CrossArm3+4



Bijlage C Controle staven mastlichaam

Order	:	14509	**Dossier :** 13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer		
Part	:	Mast 73		

D&C ENGINEERING design and construct

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 L200x200x26* *M01*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1698,53* kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	*1393,46* 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 : *H200/200/26* (*1)

h	=	*200* mm		I_y	=	*35603980*	mm^4	
b	=	*200* mm		$W_{y;el;eff.1}$	=	*252744*	mm^3	
t_f	=	*26* mm		$W_{y;el;eff.2}$	=	*602125*	mm^3	
y_s	=	*59,1* mm		i_y	=	*60,4*	mm	
A_{bruto}	=	*9759* mm^2		i_v	=	*38,8*	mm	

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2	

Geometry section and bolts:

$L_{y;cr}$	=	*1825* mm		No. bolts / end / flange	=	*5*	**(Per flange !)**	
$L_{v;cr}$	=	*1825* mm		Type of bolts M / "	=	*30*		
$L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm		End distance bolt e1	=	*60*	mm	
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm		Centre-centre spacing bolt s1	=	*90*	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	=	*4,6*		
Column profile?	=	*2* no=1, yes=2		Rolled screw threads	=	*1*		
Thickness tie plate	=	*16* mm		Dubble strap joint no=1, yes=2	=	*2*		

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **47** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,79** **< 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) : **$U.C_{max}$ = 0,84 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING design and construct

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 L130x13x12* *M02*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-266,25*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*256,2*	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 : *H130/130/12* (*1)

h	=	*130*	mm		I_y	=	*4721746*	mm^4
b	=	*130*	mm		$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm		$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm		i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2		i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2048*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2048*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,57** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **81** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,98** **< 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$_{max}$ = 0,98 = 98%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section:

Vak 1 Horizontale En verticale Knikverkorters L50x50x5 ***M03***

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-2,13***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***2,13***	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	=	***Fe360***		Permissible stress $f_{y;d}$	=	***235,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	***2409***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$	=	***2409***	mm	Type of bolts	M / "	=	***16***	
$L_{tot\ (with\ comb.\ buckling)}$	=	***0***	mm	End distance bolt	e1	=	***30***	mm
$a*L_{tot\ (with\ comb.\ buckling)}$	=	***0***	mm	Centre-centre spacing bolt	s1	=	***50***	mm
$L_{perpendicular\ force}$	=	***1791***	mm	Edge distance bolt	e2	=	***25***	mm
Position perpendicular force	=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,94** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **251** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,19** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,07** **< 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) **:** **$U.C_{max}$ = 0,94 = 94%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING design and construct

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 Horizontale en Verticale Knikverkorters L60x60x6* *M04*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-13,96*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*13,95*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2533*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2533*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*2533*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,69** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,41** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Horizontale en Verticale Knikverkorters L55x55x6* *M05*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-3,02*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*3,02*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4478*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*4478*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*2240*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,81** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **425** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Horizontale en Verticale Knikverkorters L65x65x7* *M06*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,73*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,73*	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 : *H65/65/7* (*1)

h		=	*65*	mm	I_y	=	*334319*	mm^4
b		=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f		=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s		=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}		=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3322*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*3322*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*3322*	mm	Edge distance bolt	e2	=	*30* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **266** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,24** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,24 = 124%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 L200x200x26* *M07*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1622,36*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1346,79*	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 : *H200/200/26* (*1)

h		=	*200*	mm	I_y	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1690*	mm	No. bolts / end / flange		=	*5* **(Per flange !)**
$L_{v;cr}$		=	*1690*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*2*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,65** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **44** **< 120**

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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,75** **< 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) : **$U.C_{max}$ = 0,79 = 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 :	27-13-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Horizontale Knikverkorters L55x55x6* *M08*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-20,89*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*20,89*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1900*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1900*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*1900*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,69** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **180** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,69** **< 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) : **$U.C_{max}$ = 0,85 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 2 Schuine Knikverkorters L55x55x6* *M09*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-28,83*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*28,83*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2620*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2620*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,52** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **249** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,55** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,82** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,96** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,86** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,82 = 182%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Verticale verbanden L150x100x10* *M10*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-157,61*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*151,77*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **114** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,78** **< 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) : **$U.C_{max}$ = 0,78 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order : 14509 **Dossier :** 13.039 **Berekening :** B.14014
Project : Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer
Part : Mast 73

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 3 Randen L200x200x26* *M11*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1509,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1247,43*	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 : *H200/200/26* (*1)

h		=	*200*	mm	I_y	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1786*	mm	No. bolts / end / flange		=	*5* (Per flange !)
$L_{v;cr}$		=	*1786*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*2*

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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **46** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,52** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Knikverkorters L55x55x6* *M12*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,74*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,74*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1676*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$		=	*1676*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50*	mm
$L_{perpendicular\ force}$		=	*1676*	mm	Edge distance bolt	e2	=	*25*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,61** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **159** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 3 Verticale Knikverkorters L55x55x6* *M13*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-12,28*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*12,28*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2356*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2356*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,68** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 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) : **$U.C_{max}$ = 0,68 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 3 Verticale verbanden L150x100x12* *M14*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-184,76*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*196,3*	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 : *H150/100/12* (*1)

h	=	*150*	mm		I_y	=	*6496055*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm		$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm		i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2		i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 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) : **$U.C_{max}$ = 0,72 = 72%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 4 Randen L200x200x20* *M15*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1201,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*983,67*	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	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1784*	mm	No. bolts / end / flange		=	*5* **(Per flange !)**
$L_{v;cr}$		=	*1784*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*2*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 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) : **$U.C_{max}$ = 0,59 = 59%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 4 Horizontale Knikverkorters L50x50x5* *M16*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	***-16,33***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***16,33***	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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0*** N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***1460***	mm	No. bolts / end / flange		=	***1***
$L_{v;cr}$		=	***1460***	mm	Type of bolts	M / "	=	***16***
$L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	End distance bolt	e1	=	***30*** mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	Centre-centre spacing bolt	s1	=	***50*** mm
$L_{perpendicular\ force}$		=	***1460***	mm	Edge distance bolt	e2	=	***25*** mm
Position perpendicular force		=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **152** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 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) : **$U.C_{max}$ = 0,76 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 Horizontale staven L60x60x6* *M16a*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-16,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,33*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* 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	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,83** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,99** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 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) : **$U.C_{max}$ = 0,99 = 99%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 Verticale Knikverkorters L50x50x5* *M17*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-24,96*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*24,96*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2080*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2080*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,54** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,36** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,69** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,89** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,69 = 169%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 4 Verticale verbanden L150x100x14* *M18*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-239,86*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*226,42*	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 : *H150/100/14* (*1)

h		=	*150*	mm	I_y	=	*7434686*	mm^4
b		=	*100*	mm	$W_{y;el;eff.1}$	=	*59460*	mm^3
t_f		=	*14*	mm	$W_{y;el;eff.2}$	=	*297816*	mm^3
y_s		=	*25,0*	mm	i_y	=	*47,3*	mm
A_{bruto}		=	*3322*	mm^2	i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4755*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*2377*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,63** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 5 Randen L200x200x20* *M19*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1002,41*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*804,18*	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	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1707*	mm	No. bolts / end / flange		=	*6* **(Per flange !)**
$L_{v;cr}$		=	*1707*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*110* 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	=	*4,6*
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*16*	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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **44** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,78** **< 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) : **$U.C_{max}$ = 0,78 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Knikverkorters L50x50x5* *M20*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-16,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,33*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* 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	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 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) : **$U.C_{max}$ = 0,65 = 65%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Verticale Knikverkorters L50x50x5* *M21*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-26,78*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*26,78*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* 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	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **213** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,43** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,77** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,96** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,77 = 177%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 5 Verticale verbanden L150x100x12* *M21a*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-273,68*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*285,58*	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 : *H150/100/12* (*1)

h	=	*150*	mm	I_y	=	*6496055*	mm^4
b	=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s	=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}	=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*2180*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 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) : **$U.C_{max}$ = 0,84 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Randen L200x200x16* *M22*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-956,03*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*788,74*	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 : *H200/200/16* (*1)

h	=	*200*	mm	I_y	=	*35603980*	mm^4
b	=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f	=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s	=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}	=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2140*	mm	No. bolts / end / flange	=	*6*	**(Per flange !)**
$L_{v;cr}$	=	*2140*	mm	Type of bolts M / "	=	*30*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*110*	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	=	*4,6*	
Column profile?	=	*2*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*16*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **55** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 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) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Verticale verbanden L150x100x12* *M23*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-195,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*197,69*	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 : *H150/100/12* (*1)

h		=	*150*	mm	I_y	=	*6496055*	mm^4
b		=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s		=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}		=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4765*	mm	No. bolts / end / flange		=	*5*
$L_{v;cr}$		=	*2382*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,46** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,59 = 59%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Horizontale Knikverkorters L50x50x5* *M24*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,15*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*11,07*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* 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	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,21** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,33** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,40** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Horizontale staaf L130x130x12* *M25*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-118,84*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*80,08*	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	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3950*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*3950*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*130* mm
$L_{perpendicular\ force}$		=	*3950*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,12** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,91** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,91 = 91%**

(*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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** b.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Vertical Knikverkorters L90x90x9* *M26*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-109,64*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*70,14*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	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 / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,36** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,66** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B,14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Vertical Knikverkorters L50x50x5* *M27*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-13,53*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,65*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2571*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2571*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **268** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
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Order	:	14509	**Dossier** :	13.039 **Berekening** :	B,14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 6 Verticale verbanden L180x180x16* *M28*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-351,28*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*329,02*	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 : *H180/180/16* (*1)

h		=	*180*	mm	I_y	=	*16824296*	mm^4
b		=	*180*	mm	$W_{y;el;eff.1}$	=	*129653*	mm^3
t_f		=	*16*	mm	$W_{y;el;eff.2}$	=	*334903*	mm^3
y_s		=	*50,2*	mm	i_y	=	*55,1*	mm
A_{bruto}		=	*5539*	mm^2	i_v	=	*35,0*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*5642*	mm	No. bolts / end / flange		=	*5*
$L_{v;cr}$		=	*2825*	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	=	*50* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,42** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*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

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Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Randen L200x200x16* *M29*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-630,07*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*395,22*	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 : *H200/200/16* (*1)

h		=	*200*	mm	I_y	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4261*	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	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*110* 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	=	*4,6*
Column profile?		=	*2*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*16*	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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **71** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,36** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 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) : **$U.C_{max}$ = 0,97 = 97%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Horizontale Knikverkorters L50x50x5* *M30*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-10,11*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,11*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*880*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*880*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*880*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,22** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,46** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,27** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 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) : **$U.C_{max}$ = 0,46 = 46%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Verticale Knikverkorters L50x50x5* *M31*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-19,39*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*17,86*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **213** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,30** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,64** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,30 = 130%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Verticale verbanden L150x100x12* *M32*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-279,78*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*320,58*	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 : *H150/100/12* (*1)

h		=	*150*	mm	I_y	=	*6496055*	mm^4
b		=	*100*	mm	$W_{y;el;eff.1}$	=	*51628*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*268690*	mm^3
y_s		=	*24,2*	mm	i_y	=	*47,5*	mm
A_{bruto}		=	*2874*	mm^2	i_v	=	*21,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4017*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*2019*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,87** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **94** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L200x100x14* *M33*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-285,33*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*274,53*	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 : *H200/100/14* (*1)

h		=	*200*	mm	I_y	=	*16541310*	mm^4
b		=	*100*	mm	$W_{y;el;eff.1}$	=	*92814*	mm^3
t_f		=	*14*	mm	$W_{y;el;eff.2}$	=	*759497*	mm^3
y_s		=	*21,8*	mm	i_y	=	*64,1*	mm
A_{bruto}		=	*4028*	mm^2	i_v	=	*21,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4747*	mm	No. bolts / end / flange		=	*5*
$L_{v;cr}$		=	*2380*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,45** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **112** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,84** **< 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) : **$U.C_{max}$ = 0,84 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B,14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Verticale verbanden L130x130x12* *M34*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-214,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*306,74*	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	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4236*	mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$		=	*2206*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,79** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **107** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,95** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,92** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Verticale verbanden L90x90x9* *M35*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-72,68*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*76,17*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4621*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2366*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **169** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Boven randen L160x160x15* *M36*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-253,93*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*381,05*	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	=	*10988350*	mm^4
b		=	*160*	mm	$W_{y;el;eff.1}$	=	*95470*	mm^3
t_f		=	*15*	mm	$W_{y;el;eff.2}$	=	*244713*	mm^3
y_s		=	*44,9*	mm	i_y	=	*48,8*	mm
A_{bruto}		=	*4606*	mm^2	i_v	=	*31,1*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3680*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*3680*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,98** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Horizontale verbanden L60x60x6* *M37*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,17*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,17*	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	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3232* mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1616* mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0* mm	End distance bolt e1	=	*30*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **178** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,93** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 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) : **$U.C_{max}$ = 0,93 = 93%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Horizontale verbanden L100x10x10* *M38*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-107,54*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*149,6*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3507*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*3507*	mm	Type of bolts	M / "	=	*30*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*60*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*90*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,77** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,67** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Horizontale en verticale Knikverkorters L50x50x5* *M39*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-3,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*3,3*	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 : *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	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3227*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*3227*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **336** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,41** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,47** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,11** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,12** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,47 = 47%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L65x50x5* *M40*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-6,97*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,97*	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 : *H65/50/5* (*1)

h		=	*65*	mm	I_y	=	*230454*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s		=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}		=	*554*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1503*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1503*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,17** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **143** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,21** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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) : **$U.C_{max}$ = 0,21 = 21%**

(*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

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Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 7-8-9-10-13-14 Schuine verbanden L130x130x12* *M41*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-212,45*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*210,89*	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	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2376*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*2376*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **94** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,78** **< 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) : **$U.C_{max}$ = 0,78 = 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

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Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Horizontale kruizen L90x90x9* *M42*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-47,24*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*46,93*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2540*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2540*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,40** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,60** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,78** **< 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

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Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Randen L140x140x13* *M43*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-422,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*319,57*	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 : *H140/140/13* (*1)

h		=	*200*	mm	I_y	=	*35603980*	mm^4
b		=	*200*	mm	$W_{y;el;eff.1}$	=	*252744*	mm^3
t_f		=	*26*	mm	$W_{y;el;eff.2}$	=	*602125*	mm^3
y_s		=	*59,1*	mm	i_y	=	*60,4*	mm
A_{bruto}		=	*9759*	mm^2	i_v	=	*38,8*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4356*	mm	No. bolts / end / flange		=	*4* **(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	=	*45* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **72** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,25** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,78** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 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

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Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Horizontale Knikverkorters L50x50x5* *M44*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,07*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,07*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2536*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1268*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 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) : **$U.C_{max}$ = 0,20 = 20%**

(*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

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Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10-11-12-15-t_m 21 Verticale Knikverkorters L50x50x5* *M45*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-4,07*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,07*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 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) : **$U.C_{max}$ = 0,31 = 31%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Verticale verbanden L150x100x10* *M46*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-133,73*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*109,24*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4099*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2089*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,99** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,99 = 99%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Verticale verbanden L110x110x10* *M47*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-125,63*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*121,01*	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	=	*2386992*	mm^4
b		=	*110*	mm	$W_{y;el;eff.1}$	=	*30108*	mm^3
t_f		=	*10*	mm	$W_{y;el;eff.2}$	=	*77703*	mm^3
y_s		=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}		=	*2115*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*5030*	mm	No. bolts / end / flange		=	*3*
$L_{v;cr}$		=	*2651*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **150** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,89** **< 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) : **$U.C_{max}$ = 0,89 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order :	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project :	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part :	Mast 73			

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 10-11-12-15-t_m 21 Boven randen L120x120x11* *M48*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-117,02*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*177,47*	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 : *H120/120/11* (*1)

h		=	*120*	mm	I_y	=	*3406399*	mm^4
b		=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f		=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s		=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}		=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,49** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10-11-12-15-t_m 21 Boven randen L60x60x6* *M49*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***0***	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***56,7***	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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***1213***	mm	No. bolts / end / flange		=	***3***	
$L_{v;cr}$		=	***1213***	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	=	***70***	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	=	***4,6***	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **105** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,40** **< 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) : **$U.C_{max}$ = 0,64 = 64%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10-11-12-15-t_m 21 Horiz.-vert. en schuine Knikverkort. L50x50x5*

Memberforces : (Attention! pressure = "-" and tension ="+") ***M50***

Compression:	N_{Sd}	=	*-13,02*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,43*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1933*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1933*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*1268*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,66** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **201** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,81** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 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) : **$U.C_{max}$ = 0,81 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Schuine verbanden L90x90x9* *M51*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-101,75*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*109,12*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1506*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*1506*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	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	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **87** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,43** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 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) : **$U.C_{max}$ = 0,54 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 10-11-12-15-t_m 21 Schuine verbanden L100x100x10* *M52*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-150,94*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,5*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2819*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	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	=	*45*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,92** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 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) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	S. Al Mahta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Schuine verbanden L75x75x8* *M53*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-30,58*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*88,64*	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 : *H75/75/8* (*1)

h		=	*75*	mm	I_y	=	*588737*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s		=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}		=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2819*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2819*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* 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	=	*45* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,58** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **195** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,50** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 10-11-12-15-t_m 21 Horizontale kruizen L60x60x6* *M54*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-40,43*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*39,55*	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		=	*Fe360*		Permissible stress	$f_{y;d}$ =	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3100*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$		=	*1652*	mm	Type of bolts	M / " =	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1 =	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1 =	*60*	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 =	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **171** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,96** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb1 Staven L150x150x14* *M55*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-234,44*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*181,78*	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	=	*8453963*	mm^4
b		=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f		=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s		=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}		=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3800*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*3800*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* mm
$L_{perpendicular\ force}$		=	*3800*	mm	Edge distance bolt	e2	=	*40* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,30** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,08** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,86** **< 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) : **$U.C_{max}$ = 0,86 = 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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb1 Staven L70x70x7* *M56*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-9,23*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,91*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*5374*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,02** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **398** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,02 = 102%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb1 Staven L75x75x8* *M57*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-1,71*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,71*	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 : *H75/75/8* (*1)

h		=	*75*	mm	I_y	=	*588737*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s		=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}		=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3800*	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	=	*30* 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	=	*40* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,11** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,06** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,07** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,03** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,11 = 111%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb2 Staven L65x65x7* *M58*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***0***	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***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 : ***H65/65/7*** (*1)

h		=	***65***	mm	I_y	=	***334319***	mm^4	
b		=	***65***	mm	$W_{y;el;eff.1}$	=	***7185***	mm^3	
t_f		=	***7***	mm	$W_{y;el;eff.2}$	=	***18103***	mm^3	
y_s		=	***18,5***	mm	i_y	=	***19,6***	mm	
A_{bruto}		=	***870***	mm^2	i_v	=	***12,5***	mm	

Material :

Mat. qual. Fe360 / Fe510		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***3353***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$		=	***3353***	mm	Type of bolts	M / "	=	***16***	
$L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	End distance bolt	e1	=	***30***	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	Centre-centre spacing bolt	s1	=	***50***	mm
$L_{perpendicular\ force}$		=	***3353***	mm	Edge distance bolt	e2	=	***30***	mm
Position perpendicular force		=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **269** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,00** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,74 = 74%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	j. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb2 Staven L70x70x7* *M59*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-17,87*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*17,61*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*4741*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,16** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,90** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **351** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,19** **< 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) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb2 Staven L60x60x6* *M60*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-0,27***	kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***0,08***	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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***3353***	mm	No. bolts / end / flange		=	***4***	
$L_{v;cr}$		=	***3353***	mm	Type of bolts	M / "	=	***24***	
$L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	End distance bolt	e1	=	***50***	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	Centre-centre spacing bolt	s1	=	***90***	mm
$L_{perpendicular\ force}$		=	***6707***	mm	Edge distance bolt	e2	=	***40***	mm
Position perpendicular force		=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,03** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **290** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,01** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 2,03 = 203%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb3 Staven L150x150x14* *M61*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-365,39*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*304,77*	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	=	*8453963*	mm^4
b		=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f		=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s		=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}		=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2500*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*2500*	mm	Type of bolts	M / "	=	*30*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*60* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*110* mm
$L_{perpendicular\ force}$		=	*2500*	mm	Edge distance bolt	e2	=	*40* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*16*	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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,05** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **86** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,59** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,85** **< 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) : **$U.C_{max}$ = 0,85 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb3 Staven L90x90x9* *M62*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-50,39***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***49,75***	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 :			***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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0*** 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	=	***35*** mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	Centre-centre spacing bolt	s1	=	***70*** mm
$L_{perpendicular\ force}$		=	***3536***	mm	Edge distance bolt	e2	=	***35*** mm
Position perpendicular force		=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,31** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **203** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,98** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,07** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,07 = 107%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb3 Staven L75x75x8* *M63*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-1,29***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***1,29***	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 : ***H75/75/8*** (*1)

h	=	***75***	mm	I_y	=	***588737***	mm^4
b	=	***75***	mm	$W_{y;el;eff.1}$	=	***10964***	mm^3
t_f	=	***8***	mm	$W_{y;el;eff.2}$	=	***27635***	mm^3
y_s	=	***21,3***	mm	i_y	=	***22,7***	mm
A_{bruto}	=	***1147***	mm^2	i_v	=	***14,4***	mm

Material :

Mat. qual. Fe360 / Fe510	=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0***	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	***5000***	mm	No. bolts / end / flange		=	***1***	
$L_{v;cr}$	=	***5000***	mm	Type of bolts	M / "	=	***16***	
$L_{tot\ (with\ comb.\ buckling)}$	=	***0***	mm	End distance bolt	e1	=	***30***	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	=	***40***	mm
Position perpendicular force	=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***	
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,73** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **347** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,08** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,03** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,73 = 73%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 1-2 Bovern Randen* *M64*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***77,97***	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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0*** 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 / "	=	***24***
$L_{tot\ (with\ comb.\ buckling)}$		=	***0***	mm	End distance bolt	e1	=	***50*** 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	=	***45*** mm
Position perpendicular force		=	***1***	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	***4,6***
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,27** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **245** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 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) : **$U.C_{max}$ = 0,38 = 38%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 1-2 Horiz.-vert. en schuine Knikverkort. L50x50x5* *M65*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-12,41*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,44*	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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1888*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1888*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*30*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 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) : **$U.C_{max}$ = 0,75 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 1-2 Horizontale kruizen L65x65x7* *M66*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-44,95*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*37,25*	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 : *H65/65/7* (*1)

h		=	*65*	mm	I_y	=	*334319*	mm^4
b		=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f		=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s		=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}		=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2073*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*1600*	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	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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) : **$U.C_{max}$ = 0,52 = 52%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 1-2 Horizontale kruizen L55x55x6* *M67*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-18,04* kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	*21,28* 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 : *H55/55/6* (*1)

h		=	*55* mm	I_y	=	*172872*	mm^4	
b		=	*55* mm	$W_{y;el;eff.1}$	=	*4391*	mm^3	
t_f		=	*6* mm	$W_{y;el;eff.2}$	=	*11060*	mm^3	
y_s		=	*15,6* mm	i_y	=	*16,6*	mm	
A_{bruto}		=	*631* mm^2	i_v	=	*10,5*	mm	

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*	Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2713* mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$		=	*1600* mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	Centre-centre spacing bolt	s1	=	*60*	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	=	*4,6*	
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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **164** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 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) : **$U.C_{max}$ = 0,45 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 1-2 Horizontale kruizen L80x80x8* *M68*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-58,25*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*37,57*	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	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4190*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2445*	mm	Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 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) : **$U.C_{max}$ = 0,97 = 97%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 1-2 Schuine verbanden L60x60x6* *M69*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0* kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	*62,12* 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		=	*Fe360*	Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4190* mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$		=	*2445* mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	Centre-centre spacing bolt	s1	=	*60*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,74** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **231** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,03** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,92** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,03 = 103%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 3-4 Boven renden L80x80x8* *M70*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***0***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***56,45***	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		=	***Fe360***		Permissible stress	$f_{y;d}$	=	***235,0*** N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***2880***	mm	No. bolts / end / flange		=	***3***
$L_{v;cr}$		=	***2880***	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	=	***70*** 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	=	***4,6***
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,40** **< 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) : **$U.C_{max}$ = 0,40 = 40%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 3-4 Horizontale kruizen L60x60x6* *M71*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-39,07*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*33,79*	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 : *H65/65/7* (*1)

h		=	*65*	mm	I_y	=	*334319*	mm^4
b		=	*65*	mm	$W_{y;el;eff.1}$	=	*7185*	mm^3
t_f		=	*7*	mm	$W_{y;el;eff.2}$	=	*18103*	mm^3
y_s		=	*18,5*	mm	i_y	=	*19,6*	mm
A_{bruto}		=	*870*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2347*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2347*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*60* 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	=	*4,6*
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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **188** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,65** **< 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) : **$U.C_{max}$ = 0,72 = 72%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 5-6 Randen L80x80x8* *M72*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-110,05*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*74,89*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3350*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2008*	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	=	*73* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **138** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,08** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,17** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,94** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,17 = 117%**

(*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 :	27-mrt-2014						
Name :	S. Al Masgta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 5-6 Schuine randen L100x75x7* *M73*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-48,43*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*67,48*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*6950*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*1726*	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	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,47** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **220** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,94** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 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) : **$U.C_{max}$ = 0,94 = 94%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 5-6 Horizontale en schuine knikverkorters L50x50x5* *M74*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-3,23*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,17*	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		=	*Fe360*		Permissible stress	$f_{y;d}$ =	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1910*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$		=	*1910*	mm	Type of bolts	M / " =	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1 =	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1 =	*60*	mm
$L_{perpendicular\ force}$		=	*969*	mm	Edge distance bolt	e2 =	*25*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9 =	*4,6*	
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,51** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,20** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,11** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 5-6 Verticale verbanden1 L50x50x5* *M75*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-12,59*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*12,66*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*60* mm
$L_{perpendicular\ force}$		=	*969*	mm	Edge distance bolt	e2	=	*25* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,27** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,74** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,92** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,42** **< 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) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	S. Al Masha						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 5-6 Verticale verbanden2 L50x50x5* *M76*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-18,92* kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	*18,02* 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		=	*Fe360*	Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2
Geometry section and bolts:								
$L_{y;cr}$		=	*2184* mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$		=	*1155* mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	End distance bolt	e1	=	*30* mm	
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0* mm	Centre-centre spacing bolt	s1	=	*60* 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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,39** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **145** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,84** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,64** **< 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Horizontale en Verticale Knikverkorters L70x70x7* *V06*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-23,73*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,73*	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:

$L_{y;cr}$		=	*3322*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*3322*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*50* mm
$L_{perpendicular\ force}$		=	*3322*	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		=	*7*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,42** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **246** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,82** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,96** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,37** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Knikverkorters L70x70x7* *V09*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-28,83*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*28,83*	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:

$L_{y;cr}$		=	*2620*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2620*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **194** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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) : **$U.C_{max}$ = 0,80 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039	**Berekening :** B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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 Verticale Knikverkorters L55x55x6* *V21*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-26,78*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*26,78*	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 : *H55/55/6* (*1)

h	=	*55*	mm	I_y	=	*172872*	mm^4
b	=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s	=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}	=	*631*	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:

$L_{y;cr}$	=	*1720*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*1720*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	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	=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,85** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 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) : **$U.C_{max}$ = 0,85 = 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

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Date :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Verticale Knikverkorters L55x55x6* *V31*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-19,39*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*17,86*	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 : *H55/55/6* (*1)

h		=	*55*	mm	I_y	=	*172872*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*4391*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*11060*	mm^3
y_s		=	*15,6*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*631*	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:

$L_{y;cr}$		=	*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	=	*30* 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		=	*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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **194** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,32** **< 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) : **$U.C_{max}$ = 0,80 = 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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *Vak 7-8-9-10-13-14 Boven randen L160x160x15* *V36*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-253,93*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*381,05*	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	=	*10988350*	mm^4
b	=	*160*	mm		$W_{y;el;eff.1}$	=	*95470*	mm^3
t_f	=	*15*	mm		$W_{y;el;eff.2}$	=	*244713*	mm^3
y_s	=	*44,9*	mm		i_y	=	*48,8*	mm
A_{bruto}	=	*4606*	mm^2		i_v	=	*31,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3680*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*3680*	mm	Type of bolts	M / "	=	*30*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,64** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **119** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,07** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,07 = 107%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039	**Berekening** : B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb1 Staven L70x70x7* *V56*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-17,87*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*17,61*	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:

$L_{y;cr}$		=	*5374*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*5374*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*5374*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,11** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,67** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **398** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,12** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,93 = 93%**

(*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

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Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *HorVerb1 Staven L75x75x8* *V57*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***-1,71***	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	***1,71***	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 : ***H75/75/8*** (*1)

h		=	***75***	mm	I_y	=	***588737***	mm^4
b		=	***75***	mm	$W_{y;el;eff.1}$	=	***10964***	mm^3
t_f		=	***8***	mm	$W_{y;el;eff.2}$	=	***27635***	mm^3
y_s		=	***21,3***	mm	i_y	=	***22,7***	mm
A_{bruto}		=	***1147***	mm^2	i_v	=	***14,4***	mm

Material :

Mat. qual. Fe360 / Fe510		=	***Fe510***		Permissible stress	$f_{y;d}$	=	***355,0*** N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	***3800***	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	=	***30*** 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	=	***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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,73** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,05** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,07** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,03** **< 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) : **$U.C_{max}$ = 0,73 = 73%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb2 Staven L75x75x8* *V60*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-0,27*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,08*	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 : *H75/75/8* (*1)

h		=	*75*	mm	I_y	=	*588737*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s		=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}		=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe510*		Permissible stress	$f_{y;d}$	=	*355,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3353*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*3353*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*90* mm
$L_{perpendicular\ force}$		=	*6707*	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		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **232** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,00** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,65 = 65%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier :**	13.039 **Berekening :**	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *HorVerb3 Staven L90x90x9* *V62*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-50,39*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,75*	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 :			*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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*3536*	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		=	*10*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,40** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,31** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **203** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,76** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,98** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,72** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

Check section: *CrossArm 1-2 Schuine verbanden L60x60x6* *V69*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	***0*** kN	***Combined forces diagonal:***				
Tension:	N_{Sd}	=	***62,12*** 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	=	***Fe360***		Permissible stress $f_{y;d}$	=	***235,0***	N/mm^2	

Geometry section and bolts:

$L_{y;cr}$	=	***4190***	mm	No. bolts / end / flange	=	***2***		
$L_{v;cr}$	=	***2445***	mm	Type of bolts M / "	=	***16***		
$L_{tot\ (with\ comb.\ buckling)}$	=	***0***	mm	End distance bolt e1	=	***30***	mm	
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	***0***	mm	Centre-centre spacing bolt s1	=	***60***	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,74** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **231** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,52** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,92** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

Order	:	14509	**Dossier** :	13.039 **Berekening** :	B.14014
Project	:	Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer			
Part	:	Mast 73			

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: *CrossArm 5-6 Randen L80x80x8* *V72*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-110,05*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*74,89*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*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	=	*73* 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		=	*10*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,50** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **130** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,91** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,58** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,94** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,94 = 94%**

(*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 :	27-mrt-2014						
Name :	S. Al Mashta						
Checked :	J. Hollaar						

3. CONTROLE BEREKENING MAST 75

D&C ENGINEERING
design and construct

Postbus 1
2950 AA Alblasserdam
Nieuwland Parc 301-302
2952 DD Alblasserdam
T +31 (0) 78 691 9222
E info@dcengineering.nl
w www.dcengineering.nl

Omleiding mast 52 tot 54 en noodmast 74, 150 kv-Lijn Leiden-Zoetermeer

Onderwerp	:	Controleberekening mast 75, 150 kV-lijn Zoetermeer -Leiden
Opdrachtgever	:	Cofely Fabricom Koen Pieters
Referentienr	:	1303914509
Opgesteld	:	M. Glegola
Gecontroleerd	:	J.Hollaar
Goedgekeurd	:	J.Hollaar
Revisie	:	0
Datum	:	7-Apr-2014
D&C documentnr.	:	B.14013

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H:\Projecten\13.039 Fabricom vervangen mast 74 150 kV-lijn Leiden-Zoetermeer\1303914509, noodmast P74 etc\02 - Documenten\Mast 75\B14013_rev0

Rev.	Datum	Omschrijving	Opgesteld	Gecontr.	Goedgek.
0	7-Apr-14	Ontwerpberekening	M.Glegola	J.Hollaar	J.Hollaar
A					

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3.0	Berekening mast
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4.0	Fundatie
4.1	Algemeen
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4.3	Berekening Fundatie
5.0	Resultaten
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Bijlage A	Geleiderbelastingen
Bijlage B	Berekening Mast 75; Scia Engineer
Bijlage C	Controle staven mastlichaam

1 Algemeen

1.1 Inleiding

Door Cofely Fabricom is aan D&C engineering te Alblasserdam opdracht verstrekt voor o.a. het uitvoeren van een controleberekening voor mast nr.75 in de 150 kV-lijn Zoetermeer -Leiden. Mast 75 moet gecontroleerd worden, omdat rond de nieuwe 380kv-lijn een omleiding nodig is. Voor mast 73 komt een portaal waardoor de belasting op mast 75 wijzigd.
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 :

Mast nr.75 in de 150 kV-lijn Zoetermeer -Leiden.	
tek.nr.	omschrijving
5703-21-E	Ondergedeelte mastlichaam masttype D-D
5703-20-D	Tussengedeelte mastlichaam masttype D-D
5703-19-E	Bovengedeelte mastlichaam masttype D-D
5703-17-C	Ondertraverse masttype D-D
5703-16-D	Ondertraverse masttype D-D
5703-14-A	Boventraverse masttype D-D
5703-13-G	Boventraverse masttype D-D

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.

De gestelde slankheidsrestricties in NEN-EN 50341-1 en 3 worden geacht niet van toepassing te zijn, omdat in sommige gevallen in het verleden grotere slankheden zijn toegestaan.

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 2013

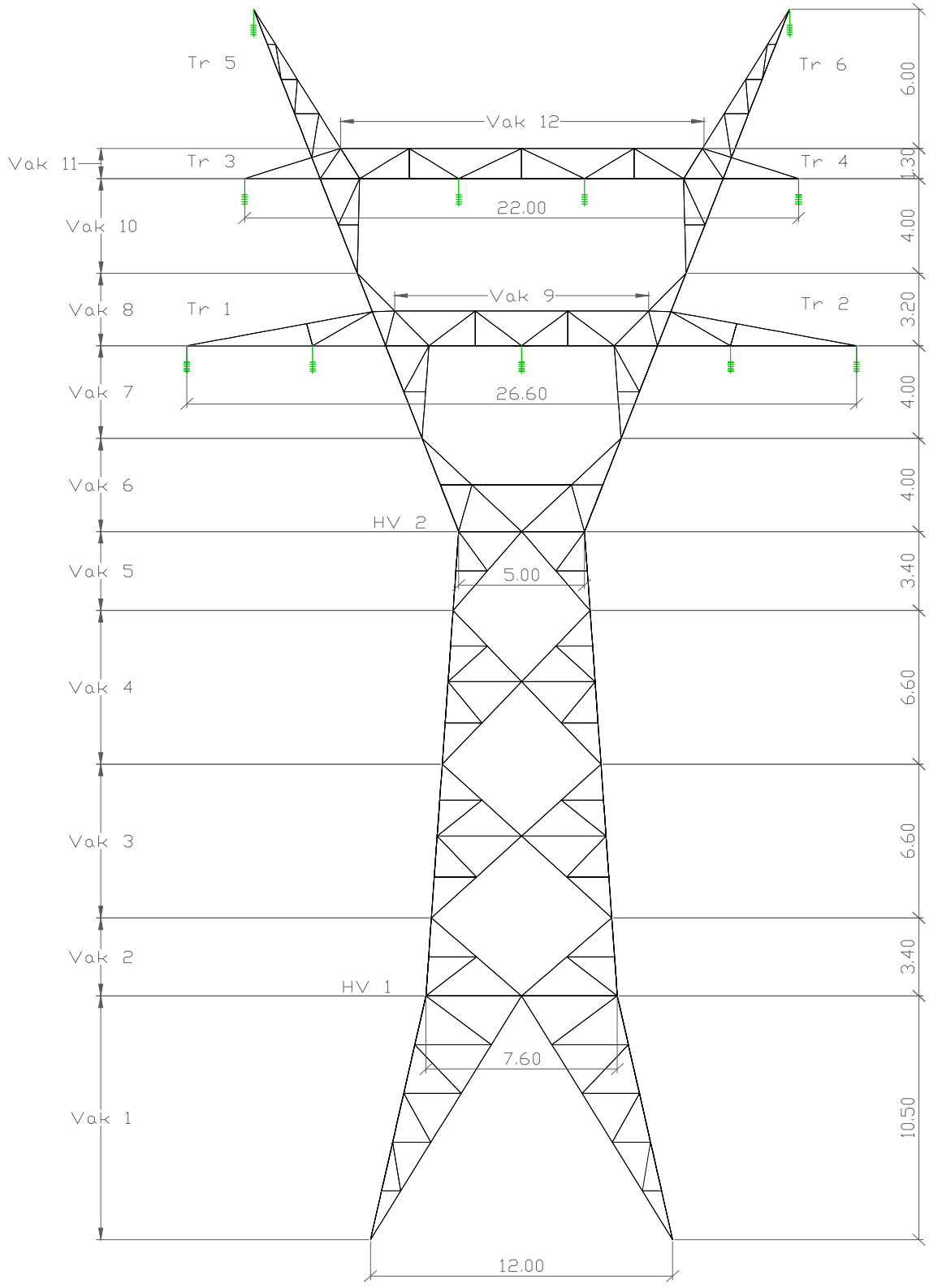
Voor de geleiderbelasting vanuit de bliksemdraden wordt gerekend met ijsgebied A. Zie richtlijn van Tennet: "Lijnen; standaard programma van eisen; PVE.05.000; 25 november 2010; versie 1.0; artikel 5.3".

1.4 Materialen

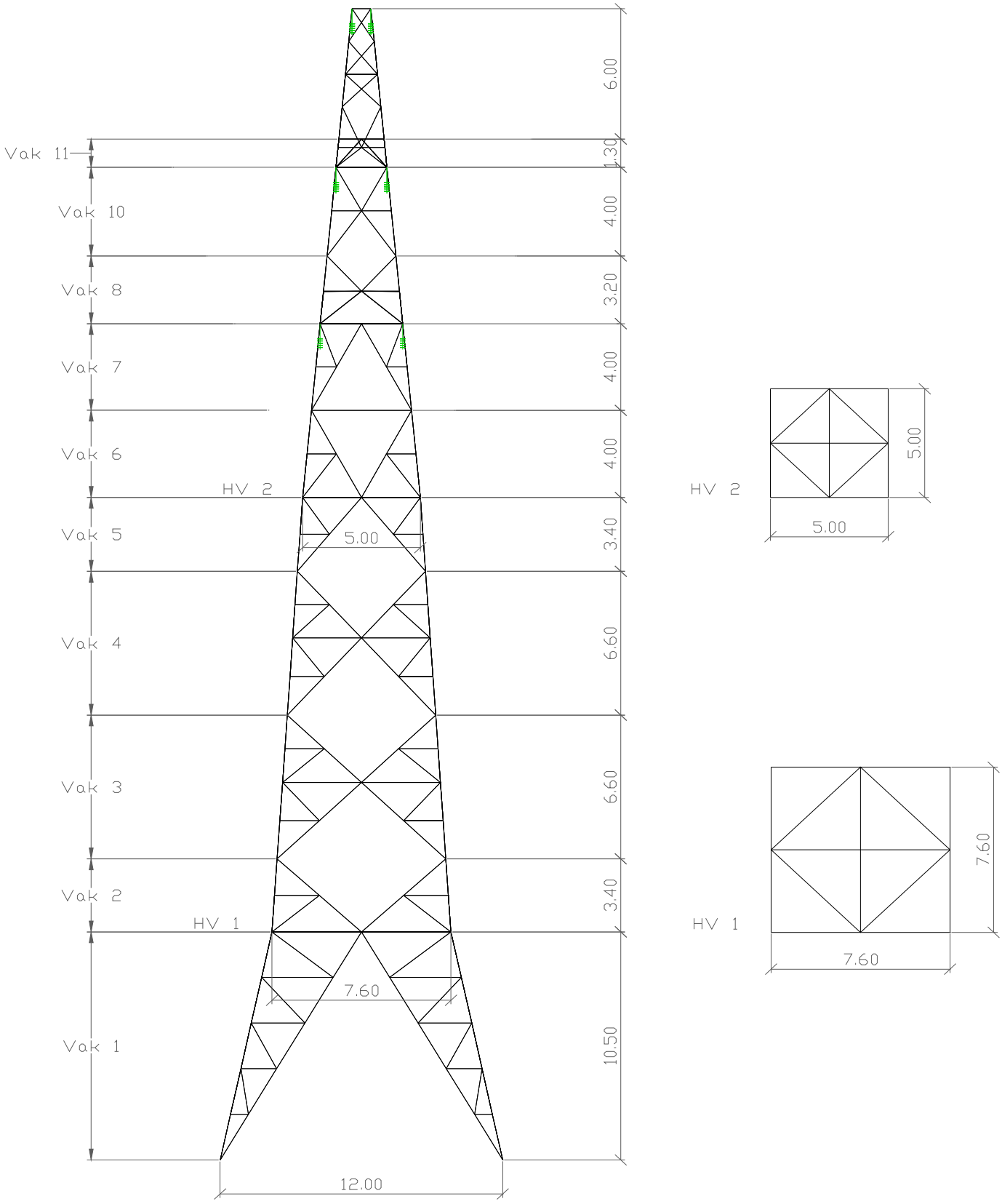
Materiaal randen	:	Fe360
Materiaal diagonalen	:	Fe360
Materiaal bouten	:	4.6 (8.8 nieuw)

1.5 Overzicht mast

1.5.1 Overzicht voorvlak mastlichaam



1.5.2 Overzicht zijvlak mastlichaam



2 Ontwerpgegevens mast

2.1 Ontwerpcode

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

2.2 Ontwerpgegevens

Lijnhoek	-	8°	
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	-	421/418 m	
Bliksemdraden	-	Br 50	(2x)
Factor β bliksemdraad	-	1,0	
Fasedraden	-	CU 185	(9 x 2-bundel)
Factor β fasedraad	-	0,8	
Boutklasse	-	8.8	
Materiaal mastranden	-	S235	
Materiaal overige mast	-	S235	
	-		

*) 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.

3 Berekening mast

3.1 Uitgangspunten berekening

Ontwerp-norm	NEN-EN 50341-3
Boutkwaliteit	4,6
Staalkwaliteit	S235
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.

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 : Globaal
Selectie : Alle
Klasse : All UGT

Steunpunt	BG	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Sn2/N3	1a/3	**-162,62**	155,08	763,04	0,00	0,00	0,00
Sn1/N1	1a/2	**194,94**	**212,20**	**1021,68**	0,00	0,00	0,00
Sn4/N6	1a/1	179,11	**-195,03**	927,69	0,00	0,00	0,00
Sn3/N7	1a-p/4	150,15	161,16	**-783,97**	0,00	0,00	0,00
Sn1/N1	1a/5	52,05	60,34	300,61	**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/6	467,30	28,34	545,09	-1192,90	15690,86	-56,23
1a/7	-325,97	28,34	545,09	-1192,90	-9675,22	-67,66
1a-p/8	75,50	328,37	408,82	-9776,25	3208,66	-67,05
1a/9	75,32	-292,54	545,09	8269,15	3198,81	-70,61
3/10	294,07	19,61	657,68	-834,45	11397,70	-80,03
3-p/11	-94,27	19,61	408,82	-843,14	-2819,43	-88,57
1a-p/12	467,30	28,34	408,82	-1195,23	15691,17	-56,23
5a13/13	108,91	-24,58	455,24	939,74	4608,10	283,72
5a21/14	108,91	-24,58	455,24	938,94	4605,45	-475,83

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]
1a-p/15	Sn1/N1	Rx	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rx	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Ry	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Ry	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Rz	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rz	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a/3	Sn2/N3	Rx	215,85	689,43	-93,89	-3,03	-162,62	-141,93	-654,77
1a-p/16	Sn2/N3	Rx	196,33	755,03	94,04	3,71	128,70	148,26	729,05
1a-p/17	Sn2/N3	Ry	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Ry	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a-p/17	Sn2/N3	Rz	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Rz	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a/18	Sn3/N7	Rx	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Rx	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a/18	Sn3/N7	Ry	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Ry	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a-p/15	Sn3/N7	Rz	191,46	807,01	-179,57	-4,09	-134,37	-136,39	-783,97
1a/2	Sn3/N7	Rz	210,53	702,46	2,15	3,18	143,18	154,34	670,17
1a-p/17	Sn4/N6	Rx	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rx	206,91	950,48	-104,96	4,48	179,11	103,60	927,69
1a/3	Sn4/N6	Ry	220,78	537,36	107,05	-2,22	-103,49	-195,03	-489,91
1a-p/16	Sn4/N6	Ry	204,50	916,64	-102,32	4,37	172,14	110,41	893,54
1a-p/17	Sn4/N6	Rz	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rz	206,91	950,48	-104,96	4,48	179,11	103,60	927,69

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 Resultaten

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

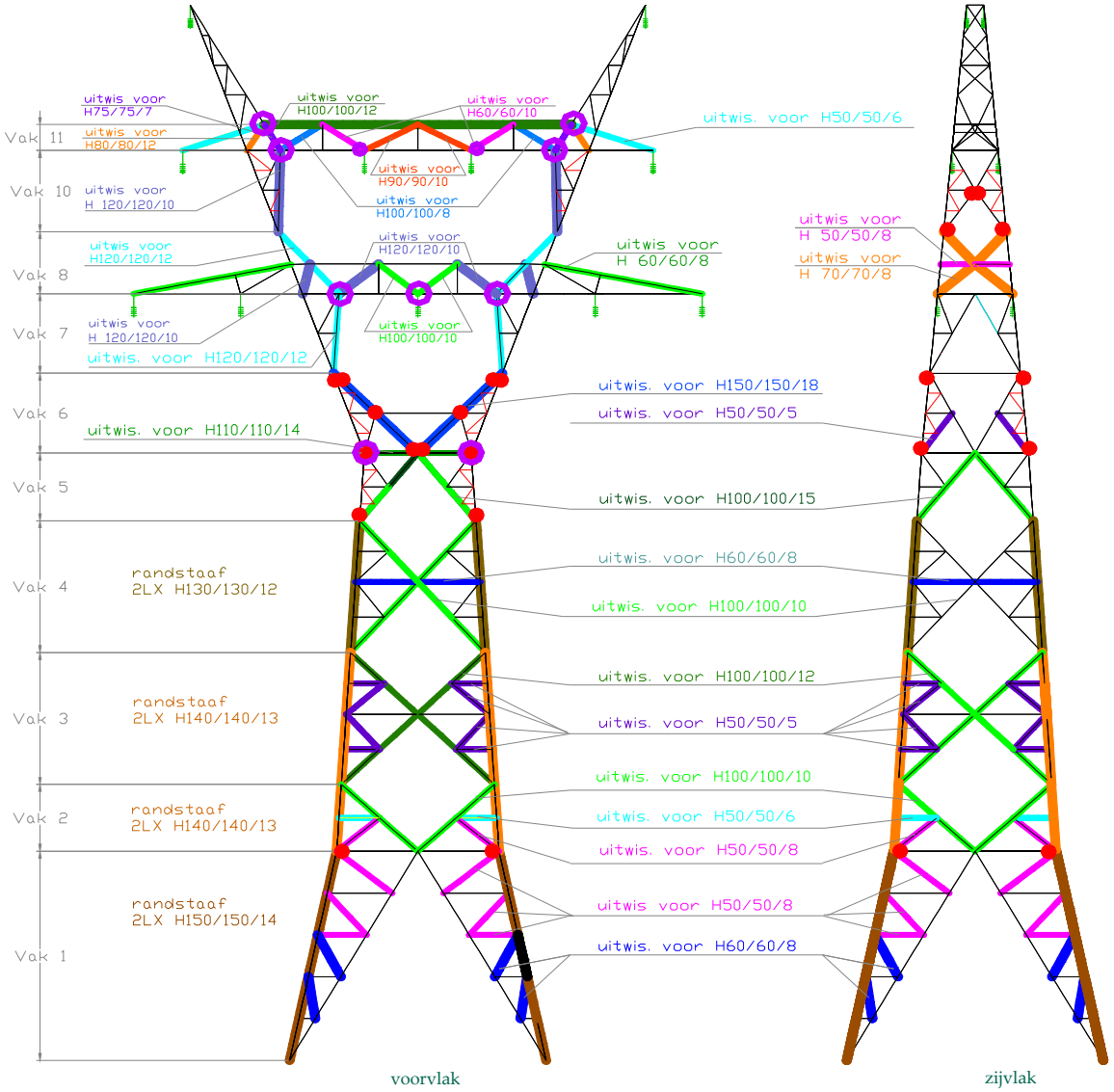
5.1 Overzicht spanningniveau's

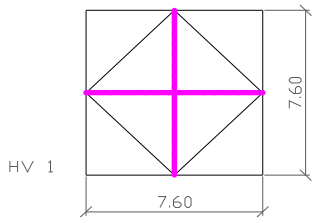
Plaats		$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 1 - randen	H150/150/14	161%	vlindersprofiel bouten visselen voor	2x H150/150/14 kl 8,8		87%
Vak 1 - diagonalen	H180/90/10	89%				
Vak 1 - 1e en 2e hor knikverkorters	H50/40/5	92%				
Vak 1 - 3e hor. knikverkorters	H50/50/5	119%	uitwisselen voor	H50/50/8	kl8,8	78%
Vak 1 - 4e hor. knikverkorters	H60/60/6	92%				
Vak 1 1e en 2e schuine knikverkorters	H50/40/5	235%	uitwisselen voor	H60/60/8	kl8,8	85%
Vak 1 - 3e schuine knikverkorters	H50/40/5	164%	knikverkorters			61%
Vak 1 4e schuine knikverkorters	H50/50/5	145%	knikverkorters			74%
Vak 2 - randen	H140/140/13	158%	vlindersprofiel	2x H140/140/13	kl8,8	98%
Vak 2 - diagonalen	H100/100/10	96%				
Vak 2 - hor. kikverkorters	H50/40/5	115%	uitwisselen voor	H50/50/6	kl8,8	84%
Vak 2 schuin kikverkorter	H50/40/5	180%	uitwisselen voor	H50/50/8	kl8,8	90%
Vak3 randen	H140/140/13	144%	vlindersprofiel	2 x H140/140/13	kl 8,8	96%
Vak 3 diagonalen	H100/75/7	154%	uitwisselen voor	H100/100/12	kl 8,8	95%
Vak 3 horizontaal	H70/70/6	74%				
Vak 3 hor. knikverkorters	H50/40/5	101%	uitwisselen voor	H50/50/5	kl 8,8	88%
Vak 3 - schuine knikverkorters	H50/40/5	117%	knikverkorters			47%
Vak 4 randen	H130/130/12	136%	vlindersprofiel	2x H130/130/12	kl 8,8	61%
Vak 4 diagonalen	H100/75/7	105%	uitwisselen voor	H100/100/10	kl8,8	69%
Vak 4 horizontaal	H60/60/5	105%	uitwisselen voor	H60/60/8	kl8,8	68%
Vak 4 hor. knikverkorters	H50/40/5	88%				
Vak 4 schuine knikverkorters	H50/40/5	70%				
Vak 5 randen	H130/130/12	147%	extra knikverkoters	H50/50/5	kl8,8	84%
Vak 5 diagonalen	H100/75/7	176%	uitwisselen voor	H100/100/15	kl8,8	90%
Vak 5 hor. knikverkorters	H50/40/5	76%				
Vak 5 schuine knikverkorters	H50/40/5	67%				
Vak 6 randen	H130/130/12	144%	extra knikverkoters	H50/50/5	kl 8,8	93%
Vak 6 diagonalen voor- en achtervlak	H150/150/14	154%	uitwisselen voor extra schetsplaat t=14mm	H150/150/18	kl 8,8	88%
Vak 6 diagonalen zijvlak	H100/75/7	97%				
Vak 6 horizontaal	H130/130/12	68%				
Vak 6 hor. knikverkorters	H50/40/5	76%				
Vak 6 schuine knikverkorters voorvlak	H100/100/6	19%				
Vak 6 schuine knikverkorters zijvlak	H50/40/5	112%	uitwisselen voor	H50/50/5	kl 8,8	83%
Vak 7 randen	H130/130/12	77%				
Vak 7 diagonalen voor- en achtervlak	H120/80/8	174%	uitwisselen voor	H120/120/12	kl 8,8	**102%**
Vak 7 diagonalen zijvlak	H120/80/8	71%				
Vak 7 horizontaal zijvlak	H75/75/8	62%				
Vak 7 hor. knikverkorters	H50/40/5	52%				
Vak 7 schuine knikverkorters	H50/40/5	73%				

Plaats			$UC_{tot,1}$	Verzwaring:			$UC_{tot,2}$
Vak 8	randen	H130/130/12	44%				
Vak 8	diagonalen voor en achter vlak	H120/80/8	139%	uitwisselen voor	H120/120/12	kl 8,8	90%
Vak 8	diagonalen zijvlak	H70/70/5	138%	uitwisselen voor	H70/70/8	kl 8,8	98%
Vak 8	hor. knikverkorters voorvlak	H130/130/10	79%				
Vak 8	hor. knikverkorters zijvlak	H50/40/5	147%	uitwisselen voor	H50/50/8	kl 8,8	82%
Vak 8	schuine knikverkorters voorvlak	H120/80/8	127%	uitwisselen voor	H120/120/10	kl 8,8	81%
Vak 9	bovenrand	H130/130/12	81%				
Vak 9	onderrand	UNP160	96%				
Vak 9	diagonalen voor-en achtervlak	H100/100/8	118%	uitwisselen voor	H100/100/10		**118%**
Vak 9	diagonalen voor-en achtervlak	H120/120/8	117%	uitwisselen voor	H120/120/10		**117%**
Vak 9	verticalen	H50/50/5	17%				
Vak 9	diagonalen ondervlak	H75/75/6	76%				
Vak 10	randen	H100/100/6	127%	extra knikverkoters	H50/50/5		61%
Vak 10	diagonalen voor- en achtervlak	H120/80/8	105%	uitwisselen voor extra schets plaat t=8	H120/120/10		84%
Vak 10	diagonalen zijvlak	H80/80/6	79%				
Vak 10	diagonalen zijvlak	H80/80/10	106%	bouten wisselen		kl 8,8	88%
Vak 10	hor. knikverkorters voorvlak	H45/30/5	68%				
Vak 10	hor. knikverkorters zijvlak	H45/45/5	83%				
Vak 10	schuine knikverkorters voorvlak	H50/40/5	29%				
Vak 11	randen	H80/80/6	36%				
Vak 11	diagonalen voor- en achtervlak	H75/75/6	143%	uitwisselen voor	H75/75/7	kl 8,8	90%
Vak 11	schuine diagonalen zijvlak	H45/30/5	85%				
Vak 11	horizontaal zijvlak	H65/65/6	87%				
Vak 11	hor. voor en achtervlak	H50/40/5	114%	uitwisselen voor	H50/50/6	kl 8,8	82%
Vak 11	schuine diagonaal v.v en a.v	H80/80/6	162%	uitwisselen voor	H80/80/12	kl 8,8	81%
Vak 11	hor. knikverkorters zijvlak	H45/45/5	65%				
Vak 12	bovenrand	H100/100/10	120%	uitwisselen voor nieuwe schets plaat t=12	H100/100/12		80%
Vak 12	onderrand	UNP120	91%				
Vak 12	diagonalen ondervlak	H55/55/5	58%				
Vak 12	diagonalen v.v en a.v	H100/100/6	103%	uitwisselen voor	H100/100/8		62%
Vak 12	diagonalenv.v en a.v	H90/90/6	167%	uitwisselen voor extra bout M16	H90/90/10	kl 8,8	81%
Vak 12	diagonalen v.v en a.v	H50/40/5	217%	uitwisselen voor	H60/60/10	kl 8,8	98%
HV 1	rand	H120/120/11	108%	bouten wisselen		kl 8,8	77%
HV 1	diagonalen	H80/80/6	92%				
HV 1	kruis	H70/70/5	216%	uitwisselen voor	H80/80/10	kl 8,8	79%
HV 2	randen voor- en achtervlak	H110/110/10	166%	uitwisselen voor	H110/110/14	kl 8,8	**110%**
HV 2	randen zijvlak	H80/80/6	52%				
HV 2	diagonalen	H100/100/8	35%				
HV 2	kruis	H60/60/5	179%	uitwisselen voor	H60/60/10		95%

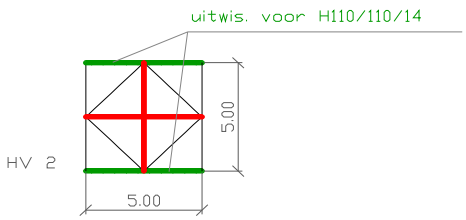
Plaats			**$UC_{tot,1}$**	**Verzwaring:**			**$UC_{tot,2}$**
Tr. 1 en 2	bovenrand	H65/50/5	137%	uitwisselen voor	H65/65/8	kl 8,8	84%
Tr. 1 en 2	onderrand	UNP160	97%				
Tr. 1 en 2	diagonalen v.v en a.v	H50/40/5	89%				
Tr. 1 en 2	diagonalen ondervlak	H75/75/6	84%				
Tr. 1 en 2	diagonalen ondervlak	H55/55/5	90%				
Tr. 3 en 4	bovenrand	H50/40/5	114%	uitwisselen voor	H50/50/6	kl 8,8	83%
Tr. 3 en 4	onderrand	UNP120	34%				
Tr. 3 en 4	diagonalen ondervlak	H50/50/5	69%				
Tr. 5 en 6	bovenrand	H75/75/12	78%	uitwisselen voor H75/75/12 nieuwe schets plaat t=12			78%
Tr. 5 en 6	onderrand	H80/80/6	79%				
Tr. 5 en 6	diagonalen ondervlak	H45/45/5	66%				
Tr. 5 en 6	diagonalen ondervlak	H45/30/5	30%				
Tr. 5 en 6	diagonalen v.v en a.v.	H45/30/5	40%				

5.2 Overzicht verzwaring





kruis uitwis. voor H80/80/10

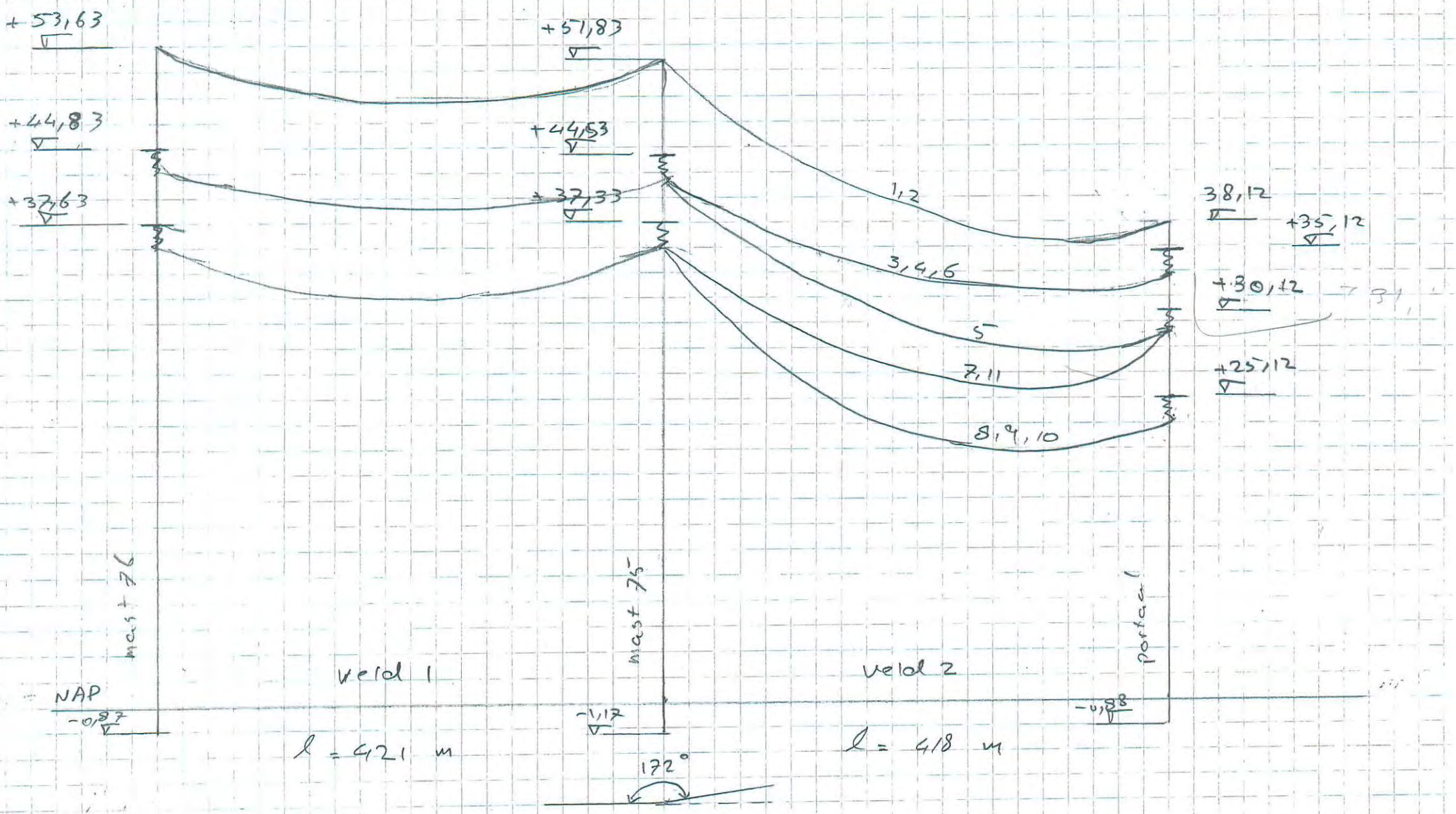


kruis uitwis. voor H60/60/10

Verzwaring :

Extra knikveroters	L50/50/5	bij randstaven	**Vaknr. 5; 6 en 10**	voor- en achtervlak
Bouten wisselen voor	kl 8.8	bij randstaven	**Vaknr. 1 t/m 6**	voor- en achtervlak
		bij randstaven	**HV 1**	voor- en achtervlak
		bij diagonalen	**Vaknr. 6 en 10**	voorvlak
Bouten	kl 8.8	bij alle nieuwe staven		

Bijlage A Geleiderbelastingen



Mast 75 : fase draad 2x bundle CUR 185 ; eds = 24 %

bliksem " Br 50 ; eds = 24 %

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	:	150 kv-Lijn Leiden-Zoetermeer
Masttype	:	steunmast
Mastnaam	:	Mast 75 type DD
Mastnummer	:	75
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	A
Referentie periode	:	50

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	164
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	421	418
Vaklengte	[m]	839	

* 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

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel: y ^ Veld 2
|
y = lijnrichting L---> x
Veld 1

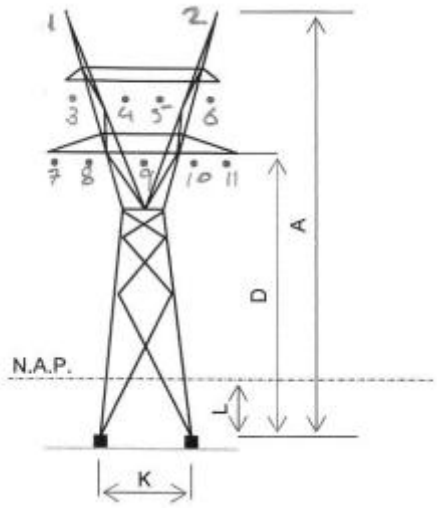
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	bliksemdraad	
Geleidersoort + plaats	:	bliksemdr. boventrav	
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] :	28390.2	
Maximum percentage breekbelasting	[%] :	100	
EDS percentage breekbelasting	[%] :	24	
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] :		0	0
Hoogte verschil draadbevestiging	[m] :		1.5	-14.5

(aangrenzende minus beschouwende mast)

(hoger = positief)



Mastnummer	:	75
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
Geleiders veld 1 en 2	:	Br 50
Veldlengte voor gewicht [m]	:	467.37

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 0.91	- 1.17	0.00	0.00
Qijs;rep		- 3.08	- 3.95	0.00	0.00
Qonderhoud;rep		0.00	0.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.65	1.52	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-0.21	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.03	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.00	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	0.83	0.56	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.08	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	0.83	0.99	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.14	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	1.65	1.57	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	0.83	0.78	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	0.83	0.78	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	9.62	8.72	0.00	0.00
Qw;rep loodrecht lijn,	y	-0.00	-1.23	0.00	0.00
Qw;rep in lijnrichting,	x	0.00	-0.17	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.00	0.00
Qw;rep 45 graden (+y, +x),	x	4.81	3.22	0.00	0.00
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.45	0.00	0.00
Qw;rep 45 graden (-y, +x),	x	4.81	5.67	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.80	0.00	0.00
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	9.62	8.98	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	4.81	4.49	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	4.81	4.49	0.00	0.00
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	0.00	0.00

Mastnummer	:	75
Draadnummer	:	1,2
Geleidersoort + plaats	:	bliksemdr. boventrav
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°	17.81	17.81	17.20	17.32
	0°	8.26	8.26	8.61	8.30
	45°	14.23	14.23	12.69	13.89
	-45°	14.23	14.23	14.96	13.89
jTrep bij combinatie (1b)	90°	9.61	9.61	9.58	9.60
	0°	8.88	8.88	8.94	8.92
	45°	9.25	9.25	9.17	9.27
	-45°	9.25	9.25	9.36	9.27
jTrep bij combinatie (3)	90°	39.15	39.15	38.56	38.66
	0°	33.08	33.08	33.32	33.20
	45°	36.33	36.33	35.35	36.11
	-45°	36.33	36.33	36.84	36.11
jTrep bij combinatie (4)	90°	9.05	9.05	9.02	9.03
	0°	8.35	8.35	8.38	8.37
	45°	8.71	8.71	8.62	8.71
	-45°	8.71	8.71	8.80	8.71
jTrep bij combinatie (5a)	90°	6.88		6.91	
jTrep bij combinatie (6)	90°	9.29		9.33	

Geleidersoort + plaats	:	bliksemdr	aantal draden in bundel: 1
Geleiders veld 1 en 2	:	Br 50	
Veldlengte voor gewicht [m]	:	467,37	

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-0,91	-1,17	0	0	**-0,91**	**-1,17**
Qijs;rep		-3,08	-3,95	0	0	**-3,08**	**-3,95**
Qonderhoud;rep		0	0			**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN -						**0,00**	**0,00**
Qw;rep loodrecht lijn,	x	1,65	1,52	0	0	**1,65**	**1,52**
Qw;rep loodrecht lijn,	y	0	-0,21	0	0	**0,00**	**-0,21**
Qw;rep in lijnrichting,	x	0	-0,03	0	0	**0,00**	**-0,03**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,83	0,56	0	0	**0,83**	**0,56**
Qw;rep 45 graden (+y, +x),	y	0	-0,08	0	0	**0,00**	**-0,08**
Qw;rep 45 graden (-y, +x),	x	0,83	0,99	0	0	**0,83**	**0,99**
Qw;rep 45 graden (-y, +x),	y	0	-0,14	0	0	**0,00**	**-0,14**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	1,65	1,57	0	0	**1,65**	**1,57**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	0,83	0,78	0	0	**0,83**	**0,78**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	0,83	0,78	0	0	**0,83**	**0,78**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	9,62	8,72	0	0	**9,62**	**8,72**
Qw;rep loodrecht lijn,	y	0	-1,23	0	0	**0,00**	**-1,23**
Qw;rep in lijnrichting,	x	0	-0,17	0	0	**0,00**	**-0,17**
Qw;rep in lijnrichting,	y	0	0,02	0	0	**0,00**	**0,02**
Qw;rep 45 graden (+y, +x),	x	4,81	3,22	0	0	**4,81**	**3,22**
Qw;rep 45 graden (+y, +x),	y	0	-0,45	0	0	**0,00**	**-0,45**
Qw;rep 45 graden (-y, +x),	x	4,81	5,67	0	0	**4,81**	**5,67**
Qw;rep 45 graden (-y, +x),	y	0	-0,8	0	0	**0,00**	**-0,80**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	9,62	8,98	0	0	**9,62**	**8,98**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (+y, +x),	x	4,81	4,49	0	0	**4,81**	**4,49**
Qw;rep 45 graden (+y, +x),	y	0	0	0	0	**0,00**	**0,00**
Qw;rep 45 graden (-y, +x),	x	4,81	4,49	0	0	**4,81**	**4,49**
Qw;rep 45 graden (-y, +x),	y	0	0	0	0	**0,00**	**0,00**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	17,81	17,81	17,2	17,32	**17,81**	**17,81**	**17,2**	**17,32**
	0°	8,26	8,26	8,61	8,3				
	45°	14,23	14,23	12,69	13,89				
	-45°	14,23	14,23	14,96	13,89				
jTrep bij combinatie (1b)	90°	9,61	9,61	9,58	9,6	**9,61**	**9,61**	**9,58**	**9,6**
	0°	8,88	8,88	8,94	8,92				
	45°	9,25	9,25	9,17	9,27				
	-45°	9,25	9,25	9,36	9,27				
jTrep bij combinatie (3)	90°	39,15	39,15	38,56	38,66	**39,15**	**39,15**	**38,56**	**38,66**
	0°	33,08	33,08	33,32	33,2				
	45°	36,33	36,33	35,35	36,11				
	-45°	36,33	36,33	36,84	36,11				
jTrep bij combinatie (4)	90°	9,05	9,05	9,02	9,03	**9,05**	**9,05**	**9,02**	**9,03**
	0°	8,35	8,35	8,38	8,37				
	45°	8,71	8,71	8,62	8,71				
	-45°	8,71	8,71	8,8	8,71				
jTrep bij combinatie (5a)	90°	6,88		6,91		**6,88**		**6,91**	
jTrep bij combinatie (6)	90°	9,29		9,33		**9,29**		**9,33**	

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (1b)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (3)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (4)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								

KARAKTERISTIEKE GEGEVENS

Naam hoogspanningslijn	:	150 kv-Lijn Leiden-Zoetermeer
Masttype	:	steunmast
Mastnaam	:	Mast 75 type DD
Mastnummer	:	75
Windgebied	:	II
Bebouwing	:	Onbebouwd
IJsgebied	:	B
Referentie periode	:	50

		VELD 1	VELD 2
Minimum lijnhoek	[graden]	180	164
Maximum lijnhoek	[graden]	180	180
Veldlengte	[m]	421	418
Vaklengte	[m]	839	

* 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

* Alle belastingscomponenten zijn exclusief belastingsfactoren, uitgezonderd draadtrekkrachten jTrep

* Assenstelsel: y ^ Veld 2
|
y = lijnrichting L---> x
Veld 1

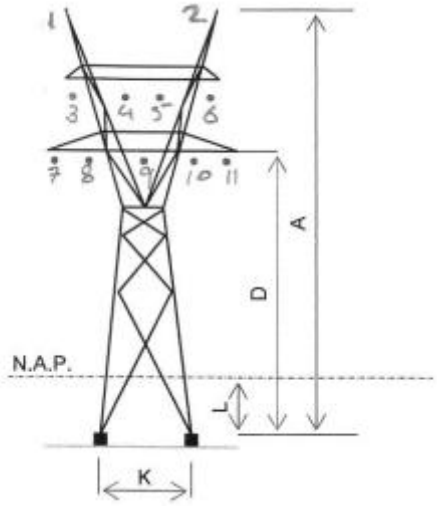
INVOERGEGEVENS VOOR DRAAD No.:1

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
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	[%] :	24
Hoogte draadbevestiging	[m] :	44.7

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		46.2	46.2
Hoogte verschil draadbevestiging	[m] :		0.3	-9.41

(aangrenzende minus beschouwende mast)

(hoger = positief)



INVOERGEGEVENS VOOR DRAAD No.:2

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. boventravers	
Geleiders veld 1 en 2	:	CU185	
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	[%] :	24	
Hoogte draadbevestiging	[m] :	44.7	

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		46.2	46.2
Hoogte verschil draadbevestiging	[m] :		0.3	-14.41
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

INVOERGEGEVENS VOOR DRAAD No.:3

Geleidersoort	:	fasedraad	
Geleidersoort + plaats	:	fasedr. ondertravers	
Geleiders veld 1 en 2	:	CU185	
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	[%] :	24	
Hoogte draadbevestiging	[m] :	37.5	

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.3	-7.21
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

INVOERGEGEVENS VOOR DRAAD No.:4

Geleidersoort	:	fasedraad
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
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	[%] :	24
Hoogte draadbevestiging	[m] :	37.5

Eigen gewicht isolator	[kN] :		2.5	2.5
Lengte isolator	[m] :		2	2
Diameter isolatorschaal	[mm] :		170	170
Hoogte isolator boven maaiveld	[m] :		39	39
Hoogte verschil draadbevestiging	[m] :		0.3	-12.21
(aangrenzende minus beschouwende mast)				
(hoger = positief)				

Mastnummer	:	75
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	442.40

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 3.90	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.77	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.41	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.34	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	0.89	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.13	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.57	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.22	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.48	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	1.24	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.24	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.16	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.87	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	2.28	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.32	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	4.01	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.56	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.35	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	3.17	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.17	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	75
Draadnummer	:	3,4,6
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

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°	29.02	29.02	28.33	28.45
	0°	21.38	21.38	21.63	21.47
	45°	25.52	25.52	24.26	25.23
	-45°	25.52	25.52	26.17	25.23
jTrep bij combinatie (1b)	90°	22.54	22.54	22.60	22.60
	0°	22.16	22.16	22.27	22.26
	45°	22.35	22.35	22.39	22.43
	-45°	22.35	22.35	22.48	22.43
jTrep bij combinatie (3)	90°	36.50	36.50	36.28	36.33
	0°	33.31	33.31	33.51	33.45
	45°	34.95	34.95	34.52	34.92
	-45°	34.95	34.95	35.32	34.92
jTrep bij combinatie (4)	90°	27.10	27.10	26.60	26.61
	0°	26.69	26.69	26.25	26.24
	45°	26.89	26.89	26.37	26.42
	-45°	26.89	26.89	26.48	26.42
jTrep bij combinatie (5a)	90°	17.82		17.89	
jTrep bij combinatie (6)	90°	24.05		24.15	

Mastnummer	:	75
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	454.97

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 4.11	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.86	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.33	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.33	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.05	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	0.86	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.12	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.51	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.21	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.64	2.40	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	1.32	1.20	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	1.32	1.20	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	5.96	0.57	0.57
Qw;rep loodrecht lijn,	y	-0.00	-0.84	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.12	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	2.20	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.31	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.87	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.54	-0.40	-0.40
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.75	6.13	0.57	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	0.57	0.57
Qw;rep 45 graden (+y, +x),	x	3.37	3.07	0.40	0.40
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.40	0.40
Qw;rep 45 graden (-y, +x),	x	3.37	3.07	0.40	0.40
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.40	-0.40

Mastnummer	:	75
Draadnummer	:	5
Geleidersoort + plaats	:	fasedr. boventravers
Geleiders veld 1 en 2	:	CU185

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°	29.02	29.02	28.02	28.13
	0°	21.38	21.38	21.68	21.53
	45°	25.52	25.52	24.15	25.07
	-45°	25.52	25.52	25.95	25.07
jTrep bij combinatie (1b)	90°	22.54	22.54	22.63	22.64
	0°	22.16	22.16	22.33	22.32
	45°	22.35	22.35	22.44	22.48
	-45°	22.35	22.35	22.52	22.48
jTrep bij combinatie (3)	90°	36.50	36.50	36.20	36.25
	0°	33.31	33.31	33.59	33.54
	45°	34.95	34.95	34.55	34.92
	-45°	34.95	34.95	35.29	34.92
jTrep bij combinatie (4)	90°	27.10	27.10	26.36	26.37
	0°	26.69	26.69	26.03	26.02
	45°	26.89	26.89	26.15	26.20
	-45°	26.89	26.89	26.24	26.20
jTrep bij combinatie (5a)	90°	17.82		17.94	
jTrep bij combinatie (6)	90°	24.05		24.22	

Mastnummer	:	75
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	436.87

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 3.80	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.72	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.20	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.31	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	0.81	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.43	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.20	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.27	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	1.13	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.13	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.63	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.79	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.02	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.29	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	3.66	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.51	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.80	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.90	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	2.90	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	75
Draadnummer	:	7,11
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

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°	27.93	27.93	27.30	27.40
	0°	21.38	21.38	21.58	21.44
	45°	24.90	24.90	23.80	24.63
	-45°	24.90	24.90	25.43	24.63
jTrep bij combinatie (1b)	90°	22.48	22.48	22.52	22.52
	0°	22.16	22.16	22.24	22.24
	45°	22.32	22.32	22.34	22.38
	-45°	22.32	22.32	22.42	22.38
jTrep bij combinatie (3)	90°	36.00	36.00	35.79	35.83
	0°	33.31	33.31	33.46	33.41
	45°	34.69	34.69	34.31	34.65
	-45°	34.69	34.69	34.98	34.65
jTrep bij combinatie (4)	90°	27.03	27.03	26.65	26.65
	0°	26.69	26.69	26.35	26.34
	45°	26.86	26.86	26.46	26.50
	-45°	26.86	26.86	26.54	26.50
jTrep bij combinatie (5a)	90°	17.82		17.87	
jTrep bij combinatie (6)	90°	24.05		24.13	

Mastnummer	:	75
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185
Veldlengte voor gewicht [m]	:	449.44

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**	
		VELD 1	VELD 2	VELD 1	VELD 2
Grep		- 3.51	- 4.02	- 2.50	- 2.50
Qijs;rep		- 1.59	- 1.82	0.00	0.00
Qonderhoud;rep		- 1.00	- 1.00		
BIJ MINIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.10	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.30	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.04	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	0.78	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.11	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.37	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.19	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN -					
Qw;rep loodrecht lijn,	x	2.41	2.16	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	1.21	1.08	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	1.21	1.08	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39
BIJ MINIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.37	0.55	0.55
Qw;rep loodrecht lijn,	y	-0.00	-0.76	-0.00	-0.00
Qw;rep in lijnrichting,	x	0.00	-0.11	0.00	0.00
Qw;rep in lijnrichting,	y	-0.00	0.01	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	1.98	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	-0.28	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	3.49	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	-0.49	-0.39	-0.39
BIJ MAXIMUM LIJNHOEKEN - BEIJSD					
Qw;rep loodrecht lijn,	x	6.18	5.53	0.55	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	0.55	0.55
Qw;rep 45 graden (+y, +x),	x	3.09	2.77	0.39	0.39
Qw;rep 45 graden (+y, +x),	y	-0.00	0.00	0.39	0.39
Qw;rep 45 graden (-y, +x),	x	3.09	2.77	0.39	0.39
Qw;rep 45 graden (-y, +x),	y	-0.00	0.00	-0.39	-0.39

Mastnummer	:	75
Draadnummer	:	8,9,10
Geleidersoort + plaats	:	fasedr. ondertravers
Geleiders veld 1 en 2	:	CU185

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°	27.93	27.93	26.91	27.00
	0°	21.38	21.38	21.62	21.50
	45°	24.90	24.90	23.66	24.43
	-45°	24.90	24.90	25.17	24.43
jTrep bij combinatie (1b)	90°	22.48	22.48	22.55	22.55
	0°	22.16	22.16	22.30	22.29
	45°	22.32	22.32	22.39	22.42
	-45°	22.32	22.32	22.46	22.42
jTrep bij combinatie (3)	90°	36.00	36.00	35.68	35.72
	0°	33.31	33.31	33.54	33.50
	45°	34.69	34.69	34.32	34.63
	-45°	34.69	34.69	34.93	34.63
jTrep bij combinatie (4)	90°	27.03	27.03	26.39	26.40
	0°	26.69	26.69	26.12	26.11
	45°	26.86	26.86	26.22	26.26
	-45°	26.86	26.86	26.29	26.26
jTrep bij combinatie (5a)	90°	17.82		17.92	
jTrep bij combinatie (6)	90°	24.05		24.19	

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	3,4,6
Veldlengte voor gewicht [m]	:	442,4		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-3,9	-2,5	-2,5	**-9,52**	**-10,30**
Qijs;rep		-1,59	-1,77	0	0	**-3,18**	**-3,54**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,41	0,57	0,57	**5,85**	**5,39**
Qw;rep loodrecht lijn,	y	0	-0,34	0	0	**0,00**	**-0,68**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,32	0,89	0,4	0,4	**3,04**	**2,18**
Qw;rep 45 graden (+y, +x),	y	0	-0,13	0,4	0,4	**0,40**	**0,14**
Qw;rep 45 graden (-y, +x),	x	1,32	1,57	0,4	0,4	**3,04**	**3,54**
Qw;rep 45 graden (-y, +x),	y	0	-0,22	-0,4	-0,4	**-0,40**	**-0,84**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,48	0,57	0,57	**5,85**	**5,53**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,32	1,24	0,4	0,4	**3,04**	**2,88**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,32	1,24	0,4	0,4	**3,04**	**2,88**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,16	0,57	0,57	**14,07**	**12,89**
Qw;rep loodrecht lijn,	y	0	-0,87	0	0	**0,00**	**-1,74**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	3,37	2,28	0,4	0,4	**7,14**	**4,96**
Qw;rep 45 graden (+y, +x),	y	0	-0,32	0,4	0,4	**0,40**	**-0,24**
Qw;rep 45 graden (-y, +x),	x	3,37	4,01	0,4	0,4	**7,14**	**8,42**
Qw;rep 45 graden (-y, +x),	y	0	-0,56	-0,4	-0,4	**-0,40**	**-1,52**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,35	0,57	0,57	**14,07**	**13,27**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,37	3,17	0,4	0,4	**7,14**	**6,74**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	3,37	3,17	0,4	0,4	**7,14**	**6,74**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,02	29,02	28,33	28,45	**58,04**	**58,04**	**56,66**	**56,9**
	0°	21,38	21,38	21,63	21,47				
	45°	25,52	25,52	24,26	25,23				
	-45°	25,52	25,52	26,17	25,23				
jTrep bij combinatie (1b)	90°	22,54	22,54	22,6	22,6	**45,08**	**45,08**	**45,2**	**45,2**
	0°	22,16	22,16	22,27	22,26				
	45°	22,35	22,35	22,39	22,43				
	-45°	22,35	22,35	22,48	22,43				
jTrep bij combinatie (3)	90°	36,5	36,5	36,28	36,33	**73**	**73**	**72,56**	**72,66**
	0°	33,31	33,31	33,51	33,45				
	45°	34,95	34,95	34,52	34,92				
	-45°	34,95	34,95	35,32	34,92				
jTrep bij combinatie (4)	90°	27,1	27,1	26,6	26,61	**54,2**	**54,2**	**53,2**	**53,22**
	0°	26,69	26,69	26,25	26,24				
	45°	26,89	26,89	26,37	26,42				
	-45°	26,89	26,89	26,48	26,42				
jTrep bij combinatie (5a)	90°	17,82		17,89		**35,64**		**35,78**	
jTrep bij combinatie (6)	90°	24,05		24,15		**48,1**		**48,3**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

	VELD 1		VELD 2		VELD 1		VELD 2	
Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)					**0**	**0**	**0**	**0**
jTrep bij combinatie (1b)					**0**	**0**	**0**	**0**
jTrep bij combinatie (3)					**0**	**0**	**0**	**0**
jTrep bij combinatie (4)					**0**	**0**	**0**	**0**

Geleidersoort + plaats	:	fasedr. boventravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	5	
Veldlengte voor gewicht [m]	:	454,97			

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-4,11	-2,5	-2,5	**-9,52**	**-10,72**
Qijs;rep		-1,59	-1,86	0	0	**-3,18**	**-3,72**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,33	0,57	0,57	**5,85**	**5,23**
Qw;rep loodrecht lijn,	y	0	-0,33	0	0	**0,00**	**-0,66**
Qw;rep in lijnrichting,	x	0	-0,05	0	0	**0,00**	**-0,10**
Qw;rep in lijnrichting,	y	0	0,01	0,57	0,57	**0,57**	**0,59**
Qw;rep 45 graden (+y, +x),	x	1,32	0,86	0,4	0,4	**3,04**	**2,12**
Qw;rep 45 graden (+y, +x),	y	0	-0,12	0,4	0,4	**0,40**	**0,16**
Qw;rep 45 graden (-y, +x),	x	1,32	1,51	0,4	0,4	**3,04**	**3,42**
Qw;rep 45 graden (-y, +x),	y	0	-0,21	-0,4	-0,4	**-0,40**	**-0,82**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,64	2,4	0,57	0,57	**5,85**	**5,37**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,32	1,2	0,4	0,4	**3,04**	**2,80**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	1,32	1,2	0,4	0,4	**3,04**	**2,80**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	5,96	0,57	0,57	**14,07**	**12,49**
Qw;rep loodrecht lijn,	y	0	-0,84	0	0	**0,00**	**-1,68**
Qw;rep in lijnrichting,	x	0	-0,12	0	0	**0,00**	**-0,24**
Qw;rep in lijnrichting,	y	0	0,02	0,57	0,57	**0,57**	**0,61**
Qw;rep 45 graden (+y, +x),	x	3,37	2,2	0,4	0,4	**7,14**	**4,80**
Qw;rep 45 graden (+y, +x),	y	0	-0,31	0,4	0,4	**0,40**	**-0,22**
Qw;rep 45 graden (-y, +x),	x	3,37	3,87	0,4	0,4	**7,14**	**8,14**
Qw;rep 45 graden (-y, +x),	y	0	-0,54	-0,4	-0,4	**-0,40**	**-1,48**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,75	6,13	0,57	0,57	**14,07**	**12,83**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,57	0,57	**0,57**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,37	3,07	0,4	0,4	**7,14**	**6,54**
Qw;rep 45 graden (+y, +x),	y	0	0	0,4	0,4	**0,40**	**0,40**
Qw;rep 45 graden (-y, +x),	x	3,37	3,07	0,4	0,4	**7,14**	**6,54**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,4	-0,4	**-0,40**	**-0,40**

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

	VEL	VELD 2				VELD 1		VELD 2	
	Hoe	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°	29,02	29,02	28,02	28,13	**58,04**	**58,04**	**56,04**	**56,26**
	0°	21,38	21,38	21,68	21,53				
	45°	25,52	25,52	24,15	25,07				
	-45°	25,52	25,52	25,95	25,07				
jTrep bij combinatie (1b)	90°	22,54	22,54	22,63	22,64	**45,08**	**45,08**	**45,26**	**45,28**
	0°	22,16	22,16	22,33	22,32				
	45°	22,35	22,35	22,44	22,48				
	-45°	22,35	22,35	22,52	22,48				
jTrep bij combinatie (3)	90°	36,5	36,5	36,2	36,25	**73**	**73**	**72,4**	**72,5**
	0°	33,31	33,31	33,59	33,54				
	45°	34,95	34,95	34,55	34,92				
	-45°	34,95	34,95	35,29	34,92				
jTrep bij combinatie (4)	90°	27,1	27,1	26,36	26,37	**54,2**	**54,2**	**52,72**	**52,74**
	0°	26,69	26,69	26,03	26,02				
	45°	26,89	26,89	26,15	26,2				
	-45°	26,89	26,89	26,24	26,2				
jTrep bij combinatie (5a)	90°	17,82		17,94		**35,64**		**35,88**	
jTrep bij combinatie (6)	90°	24,05		24,22		**48,1**		**48,44**	

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

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (1b)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (3)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								
jTrep bij combinatie (4)	90°					**0**	**0**	**0**	**0**
	0°								
	45°								
	-45°								

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2	
Geleiders veld 1 en 2	:	CU185	Draadnummer	7,11	
Veldlengte voor gewicht [m]	:	436,87			

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-3,8	-2,5	-2,5	**-9,52**	**-10,10**
Qijs;rep		-1,59	-1,72	0	0	**-3,18**	**-3,44**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,2	0,55	0,55	**5,37**	**4,95**
Qw;rep loodrecht lijn,	y	0	-0,31	0	0	**0,00**	**-0,62**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,21	0,81	0,39	0,39	**2,81**	**2,01**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,21	1,43	0,39	0,39	**2,81**	**3,25**
Qw;rep 45 graden (-y, +x),	y	0	-0,2	-0,39	-0,39	**-0,39**	**-0,79**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,27	0,55	0,55	**5,37**	**5,09**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,21	1,13	0,39	0,39	**2,81**	**2,65**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,21	1,13	0,39	0,39	**2,81**	**2,65**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,63	0,55	0,55	**12,91**	**11,81**
Qw;rep loodrecht lijn,	y	0	-0,79	0	0	**0,00**	**-1,58**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,02	0,55	0,55	**0,55**	**0,59**
Qw;rep 45 graden (+y, +x),	x	3,09	2,08	0,39	0,39	**6,57**	**4,55**
Qw;rep 45 graden (+y, +x),	y	0	-0,29	0,39	0,39	**0,39**	**-0,19**
Qw;rep 45 graden (-y, +x),	x	3,09	3,66	0,39	0,39	**6,57**	**7,71**
Qw;rep 45 graden (-y, +x),	y	0	-0,51	-0,39	-0,39	**-0,39**	**-1,41**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,8	0,55	0,55	**12,91**	**12,15**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	3,09	2,9	0,39	0,39	**6,57**	**6,19**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	3,09	2,9	0,39	0,39	**6,57**	**6,19**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	27,93	27,93	27,3	27,4	**55,86**	**55,86**	**54,6**	**54,8**
	0°	21,38	21,38	21,58	21,44				
	45°	24,9	24,9	23,8	24,63				
	-45°	24,9	24,9	25,43	24,63				
jTrep bij combinatie (1b)	90°	22,48	22,48	22,52	22,52	**44,96**	**44,96**	**45,04**	**45,04**
	0°	22,16	22,16	22,24	22,24				
	45°	22,32	22,32	22,34	22,38				
	-45°	22,32	22,32	22,42	22,38				
jTrep bij combinatie (3)	90°	36	36	35,79	35,83	**72**	**72**	**71,58**	**71,66**
	0°	33,31	33,31	33,46	33,41				
	45°	34,69	34,69	34,31	34,65				
	-45°	34,69	34,69	34,98	34,65				
jTrep bij combinatie (4)	90°	27,03	27,03	26,65	26,65	**54,06**	**54,06**	**53,3**	**53,3**
	0°	26,69	26,69	26,35	26,34				
	45°	26,86	26,86	26,46	26,5				
	-45°	26,86	26,86	26,54	26,5				
jTrep bij combinatie (5a)	90°	17,82		17,87		**35,64**		**35,74**	
jTrep bij combinatie (6)	90°	24,05		24,13		**48,1**		**48,26**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)						0	0	0	0
jTrep bij combinatie (1b)						0	0	0	0
jTrep bij combinatie (3)						0	0	0	0
jTrep bij combinatie (4)						0	0	0	0

Geleidersoort + plaats	:	fasedr. ondertravers	aantal draden in bundel:	2
Geleiders veld 1 en 2	:	CU185	Draadnummer	8,9,10
Veldlengte voor gewicht [m]	:	449,44		

BELASTING COMPONENTEN [kN]		**GELEIDER**		**ISOLATOR**			
		VELD 1	VELD 2	VELD 1	VELD 2	**VELD 1**	**VELD 2**
Grep		-3,51	-4,02	-2,5	-2,5	**-9,52**	**-10,54**
Qijs;rep		-1,59	-1,82	0	0	**-3,18**	**-3,64**
Qonderhoud;rep		-1	-1			**-1,00**	**-1,00**
BIJ MINIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,1	0,55	0,55	**5,37**	**4,75**
Qw;rep loodrecht lijn,	y	0	-0,3	0	0	**0,00**	**-0,60**
Qw;rep in lijnrichting,	x	0	-0,04	0	0	**0,00**	**-0,08**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	1,21	0,78	0,39	0,39	**2,81**	**1,95**
Qw;rep 45 graden (+y, +x),	y	0	-0,11	0,39	0,39	**0,39**	**0,17**
Qw;rep 45 graden (-y, +x),	x	1,21	1,37	0,39	0,39	**2,81**	**3,13**
Qw;rep 45 graden (-y, +x),	y	0	-0,19	-0,39	-0,39	**-0,39**	**-0,77**
BIJ MAXIMUM LIJNHOEKEN -							
Qw;rep loodrecht lijn,	x	2,41	2,16	0,55	0,55	**5,37**	**4,87**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	1,21	1,08	0,39	0,39	**2,81**	**2,55**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	1,21	1,08	0,39	0,39	**2,81**	**2,55**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**
BIJ MINIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,37	0,55	0,55	**12,91**	**11,29**
Qw;rep loodrecht lijn,	y	0	-0,76	0	0	**0,00**	**-1,52**
Qw;rep in lijnrichting,	x	0	-0,11	0	0	**0,00**	**-0,22**
Qw;rep in lijnrichting,	y	0	0,01	0,55	0,55	**0,55**	**0,57**
Qw;rep 45 graden (+y, +x),	x	3,09	1,98	0,39	0,39	**6,57**	**4,35**
Qw;rep 45 graden (+y, +x),	y	0	-0,28	0,39	0,39	**0,39**	**-0,17**
Qw;rep 45 graden (-y, +x),	x	3,09	3,49	0,39	0,39	**6,57**	**7,37**
Qw;rep 45 graden (-y, +x),	y	0	-0,49	-0,39	-0,39	**-0,39**	**-1,37**
BIJ MAXIMUM LIJNHOEKEN - BEIJSD							
Qw;rep loodrecht lijn,	x	6,18	5,53	0,55	0,55	**12,91**	**11,61**
Qw;rep loodrecht lijn,	y	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	x	0	0	0	0	**0,00**	**0,00**
Qw;rep in lijnrichting,	y	0	0	0,55	0,55	**0,55**	**0,55**
Qw;rep 45 graden (+y, +x),	x	3,09	2,77	0,39	0,39	**6,57**	**5,93**
Qw;rep 45 graden (+y, +x),	y	0	0	0,39	0,39	**0,39**	**0,39**
Qw;rep 45 graden (-y, +x),	x	3,09	2,77	0,39	0,39	**6,57**	**5,93**
Qw;rep 45 graden (-y, +x),	y	0	0	-0,39	-0,39	**-0,39**	**-0,39**

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

		VELD 1		**VELD 2**		**VELD 1**		**VELD 2**	
	Hoek t,o,v,lijnrichting	**Min,lijnh**	**Max,lijnh**	**Min,lijnh**	**Max,lijnhoek**				
jTrep bij combinatie (1a)	90°	27,93	27,93	26,91	27	**55,86**	**55,86**	**53,82**	**54**
	0°	21,38	21,38	21,62	21,5				
	45°	24,9	24,9	23,66	24,43				
	-45°	24,9	24,9	25,17	24,43				
jTrep bij combinatie (1b)	90°	22,48	22,48	22,55	22,55	**44,96**	**44,96**	**45,1**	**45,1**
	0°	22,16	22,16	22,3	22,29				
	45°	22,32	22,32	22,39	22,42				
	-45°	22,32	22,32	22,46	22,42				
jTrep bij combinatie (3)	90°	36	36	35,68	35,72	**72**	**72**	**71,36**	**71,44**
	0°	33,31	33,31	33,54	33,5				
	45°	34,69	34,69	34,32	34,63				
	-45°	34,69	34,69	34,93	34,63				
jTrep bij combinatie (4)	90°	27,03	27,03	26,39	26,4	**54,06**	**54,06**	**52,78**	**52,8**
	0°	26,69	26,69	26,12	26,11				
	45°	26,86	26,86	26,22	26,26				
	-45°	26,86	26,86	26,29	26,26				
jTrep bij combinatie (5a)	90°	17,82		17,92		**35,64**		**35,84**	
jTrep bij combinatie (6)	90°	24,05		24,19		**48,1**		**48,38**	

DRAADTREKKRACHTEN - "Special Limit State" (inclusief veiligheidsfactor, table 4,2,11/NL,3)

		VELD 1		VELD 2		VELD 1		VELD 2	
	Hoek t,o,v,lijnrichting	Min,lijnh	Max,lijnh	Min,lijnh	Max,lijnhoek				
jTrep bij combinatie (1a)						0	0	0	0
jTrep bij combinatie (1b)						0	0	0	0
jTrep bij combinatie (3)						0	0	0	0
jTrep bij combinatie (4)						0	0	0	0

Bijlage B Berekening Mast 75; Scia Engineer

Licentienaam	Onbekend
Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Auteur	MG
Datum	27-03-2014
Constructie	Algemeen XYZ
Aantal knopen :	402
Aantal staven :	694
Aantal gebruikte doorsneden :	101
Aantal belastingsgevallen :	60
Aantal gebruikte materialen :	2
Gravitatieversnelling [m/s^2]	9,810
Nationale norm	EC - EN

D&C ENGINEERING	**Project**	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

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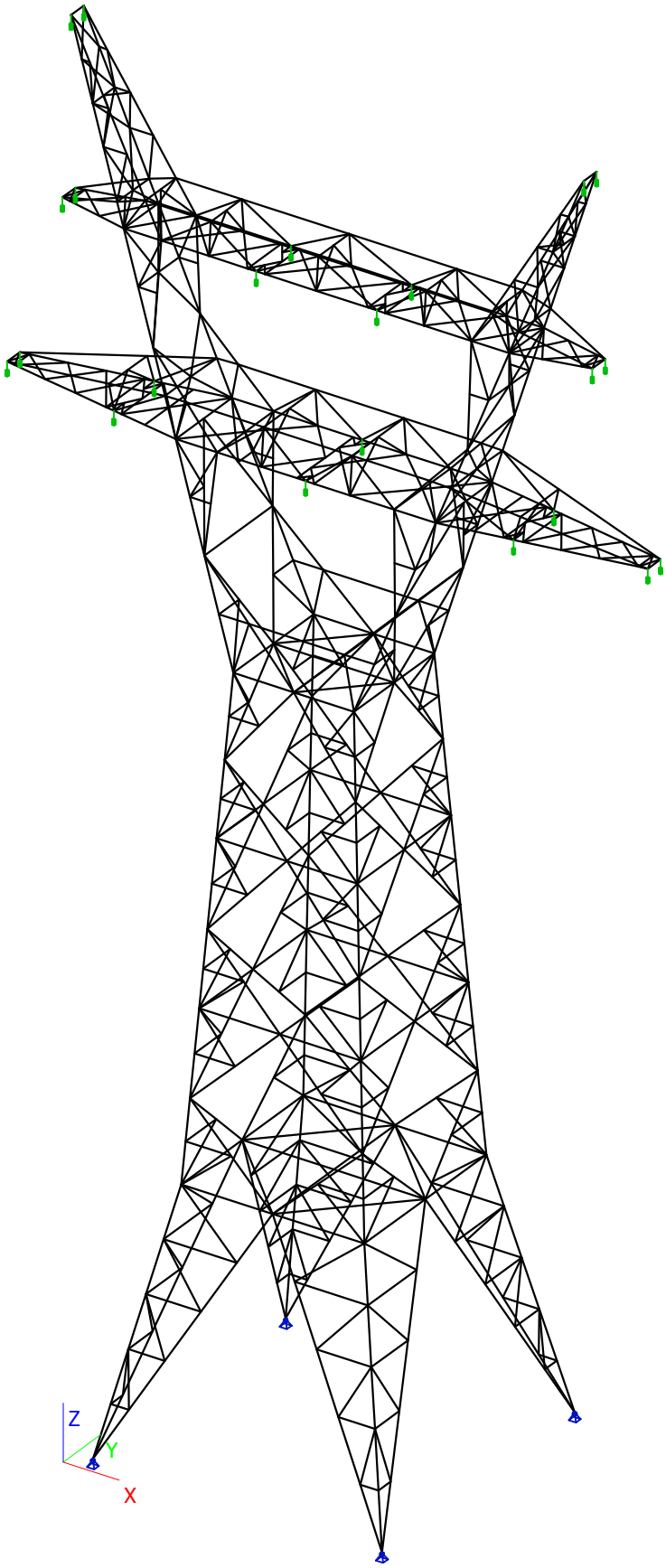

3. Knoop

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
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
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
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
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
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	-8,543	-0,008	39,449
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	-8,543	1,185	39,449
K424	13,297	0,400	38,500
K426	8,297	1,256	38,500
K428	8,543	1,185	39,449
K429	-13,297	-0,400	38,500
K433	-8,543	-1,185	39,449
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	8,543	-1,185	39,449
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	1,507	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	8,543	-0,008	39,449
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
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

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
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	-5,560	-5,560	2,100
N21	-5,120	-5,120	4,200
N22	-4,680	-4,680	6,300
N55	-5,120	-3,600	4,200
N57	-4,240	-1,200	8,400
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
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

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
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
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
N191	0,000	0,960	47,000
N192	0,000	-0,960	47,000
K631	-11,000	0,400	45,700
K661	-5,560	-4,800	2,100
K662	-4,800	-5,560	2,100
K663	-3,600	-5,120	4,200

Naam	Coördinaat X [m]	Coördinaat Y [m]	Coördinaat Z [m]
K665	-2,400	-4,680	6,300
K666	-4,680	-2,400	6,300
K667	-1,200	-4,240	8,400
K668	-4,240	-4,240	8,400
K669	4,240	-1,200	8,400
K670	4,240	-4,240	8,400
K671	4,680	-2,400	6,300
K672	4,680	-4,680	6,300
K673	5,120	-3,600	4,200
K674	5,560	-4,800	2,100
K675	5,120	-5,120	4,200
K676	5,560	-5,560	2,100
K677	4,800	-5,560	2,100
K678	3,600	-5,120	4,200
K679	2,400	-4,680	6,300
K680	1,200	-4,240	8,400
K681	1,200	4,240	8,400
K682	4,240	4,240	8,400
K683	2,400	4,680	6,300
K684	4,680	4,680	6,300
K685	3,600	5,120	4,200
K686	4,800	5,560	2,100
K687	5,120	5,120	4,200
K688	5,560	5,560	2,100
K689	5,560	4,800	2,100
K690	5,120	3,600	4,200
K691	4,680	2,400	6,300
K692	4,240	1,200	8,400
K693	-4,240	1,200	8,400
K694	-4,240	4,240	8,400
K695	-4,680	2,400	6,300
K696	-4,680	4,680	6,300
K697	-5,120	3,600	4,200
K698	-5,560	4,800	2,100
K699	-5,120	5,120	4,200
K700	-5,560	5,560	2,100
K701	-4,800	5,560	2,100
K702	-3,600	5,120	4,200
K703	-2,400	4,680	6,300
K704	-1,200	4,240	8,400
N247	0,000	-3,353	17,382
K706	3,353	0,000	17,382
K709	0,000	3,353	17,382
K712	-3,353	0,000	17,382
K714	-6,838	0,000	38,500
K715	6,837	0,000	38,500
K716	1,976	2,313	32,505
K717	-1,976	2,313	32,505
K718	-1,976	-2,313	32,505
K719	1,976	-2,313	32,505
K720	-4,678	1,939	36,515
K721	6,526	-1,462	41,620
K728	6,527	1,462	41,621
K729	8,684	0,000	45,700
K731	2,500	0,541	45,700
K732	2,145	1,081	45,700
K733	2,500	-0,541	45,700
K734	2,145	-1,081	45,700
K735	-2,503	-0,541	45,700
K736	-2,145	-1,081	45,700
K737	-2,503	0,541	45,700
K738	-2,145	1,081	45,700
K739	-0,003	1,320	38,500
K740	-0,003	-1,320	38,500
K741	8,297	0,598	38,500
K742	8,297	-0,598	38,500
K743	-8,297	0,598	38,500
K744	-8,297	-0,598	38,500

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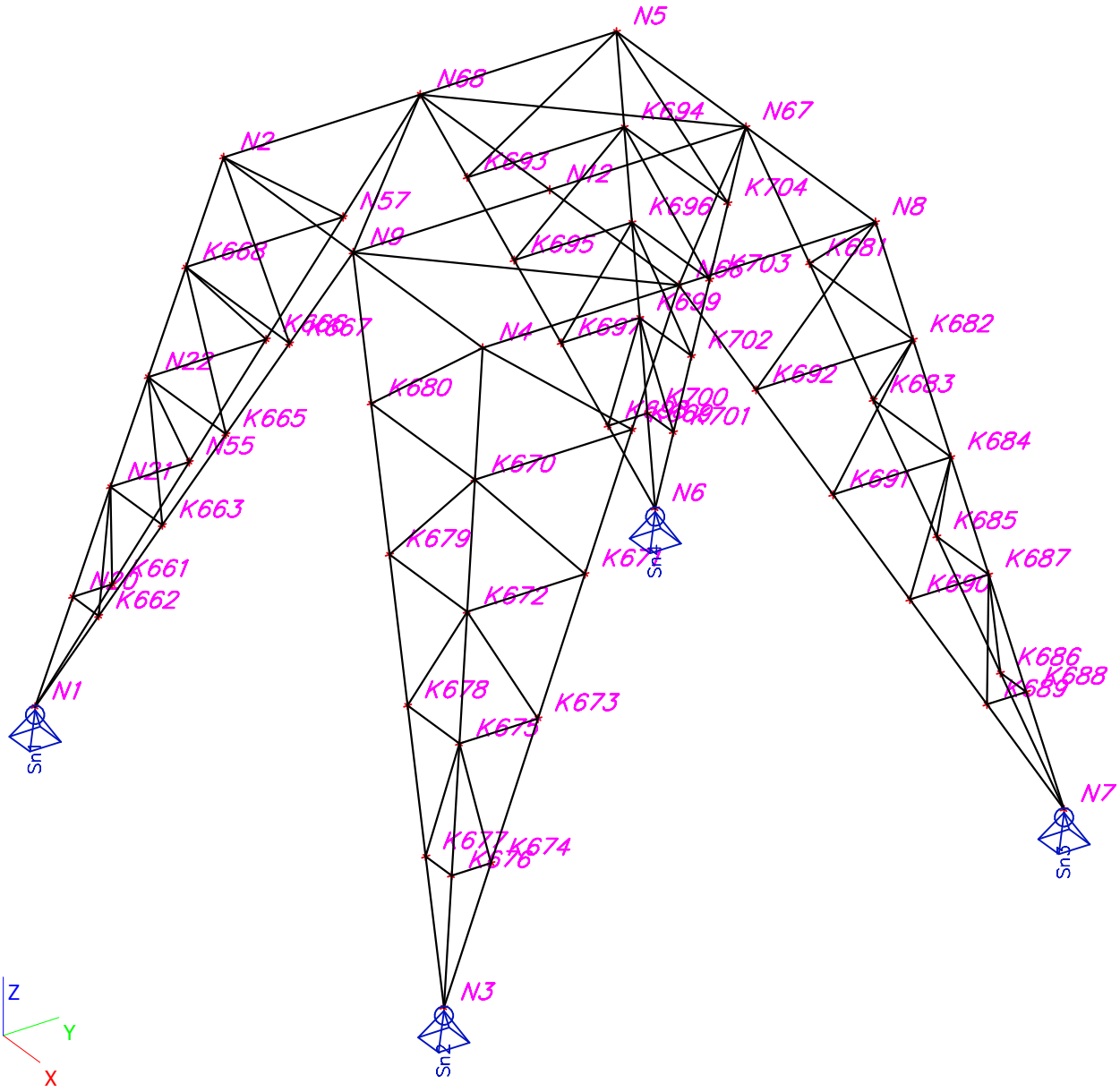
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

4. Knoopnummers steunpunten



5. 1D-staaf

Naam	Doorsnede	Lengte [m]	Type	Laag
S1	CS140 - L45X30X5	0,941	Balk (80)	CrossArm6
S2	CS138 - L45X5	1,862	Kolom (100)	CrossArm6
S3	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm6
S4	CS138 - L45X5	1,862	Kolom (100)	CrossArm6
S5	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm6
S6	CS136 - L45X5	1,364	Balk (80)	CrossArm6
S7	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm6
S8	CS134 - L45X5	2,162	Kolom (100)	CrossArm6
S9	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm6
S10	CS134 - L45X5	2,162	Kolom (100)	CrossArm6
S11	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm6
S12	CS140 - L45X30X5	0,336	Balk (80)	CrossArm6
S13	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm6
S14	CS138 - L45X5	0,649	Balk (80)	CrossArm6
S15	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm6
S16	CS140 - L45X30X5	0,969	Balk (80)	CrossArm6
S17	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm6
S18	CS140 - L45X30X5	0,336	Balk (80)	CrossArm6
S19	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm6
S20	CS138 - L45X5	0,649	Balk (80)	CrossArm6
S21	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm6
S22	CS140 - L45X30X5	0,969	Balk (80)	CrossArm6
S23	CS130 - L45X30X5	1,450	Kolom (100)	Vak11
S24	CS130 - L45X30X5	1,451	Kolom (100)	Vak11
S25	CS131 - L45X5	1,993	Balk (80)	Vak11
S26	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10
S27	CS121 - L80X6	2,652	vertikaal windverband (0)	Vak10
S28	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10
S29	CS121 - L80X6	2,651	vertikaal windverband (0)	Vak10
S30	CS123 - L45X5	2,536	horizontaal windverband (0)	Vak10
S31	CS93 - L70x70x5	2,265	Kolom (100)	Vak8
S33	CS4 - L50X40X5	1,616	Balk (80)	Vak8
S34	CS93 - L70x70x5	2,366	Kolom (100)	Vak8
S35	CS4 - L50X40X5	1,616	Balk (80)	Vak8
S36	CS93 - L70x70x5	2,265	Kolom (100)	Vak8
S38	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7
S41	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7
S42	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7
S43	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7l
S44	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7l
S46	CS86 - L130X12	3,952	Balk (80)	Vak6
S47	CS86 - L130X12	3,952	Balk (80)	Vak6
S49	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S51	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S52	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S54	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak7
S55	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S56	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S61	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S63	CS140 - L45X30X5	0,941	Balk (80)	CrossArm5
S64	CS140 - L45X30X5	0,941	Balk (80)	CrossArm5
S65	CS138 - L45X5	1,862	Kolom (100)	CrossArm5
S66	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm5
S67	CS138 - L45X5	1,862	Kolom (100)	CrossArm5
S68	CS137 - L45X30X5	2,018	Kolom (100)	CrossArm5
S69	CS136 - L45X5	1,364	Balk (80)	CrossArm5
S70	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm5
S71	CS134 - L45X5	2,162	Kolom (100)	CrossArm5
S72	CS135 - L45X30X5	2,184	Kolom (100)	CrossArm5
S73	CS134 - L45X5	2,162	Kolom (100)	CrossArm5
S74	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm5
S75	CS140 - L45X30X5	0,336	Balk (80)	CrossArm5
S76	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm5
S77	CS138 - L45X5	0,649	Balk (80)	CrossArm5
S78	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm5
S79	CS140 - L45X30X5	0,969	Balk (80)	CrossArm5
S80	CS140 - L45X30X5	1,511	Kolom (100)	CrossArm5

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S81	CS140 - L45X30X5	0,336	Balk (80)	CrossArm5
S82	CS140 - L45X30X5	1,501	Kolom (100)	CrossArm5
S83	CS138 - L45X5	0,649	Balk (80)	CrossArm5
S84	CS139 - L50X40X5	1,911	Kolom (100)	CrossArm5
S85	CS140 - L45X30X5	0,969	Balk (80)	CrossArm5
S86	CS130 - L45X30X5	1,450	Kolom (100)	Vak11l
S87	CS130 - L45X30X5	1,451	Kolom (100)	Vak11l
S88	CS131 - L45X5	1,993	Balk (80)	Vak11l
S89	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10l
S90	CS121 - L80X6	2,652	vertikaal windverband (0)	Vak10l
S91	CS121 - L80X6	2,386	vertikaal windverband (0)	Vak10l
S92	CS121 - L80X6	2,651	vertikaal windverband (0)	Vak10l
S93	CS123 - L45X5	2,536	horizontaal windverband (0)	Vak10l
S94	CS128 - L60X6	1,851	Kolom (100)	Vak11
S95	CS128 - L60X6	1,849	Kolom (100)	Vak11
S96	CS128 - L60X6	1,850	Kolom (100)	Vak11l
S97	CS128 - L60X6	1,849	Kolom (100)	Vak11l
S98	CS127 - L50X5	1,920	Balk (80)	Vak11
S99	CS127 - L50X5	1,920	Balk (80)	Vak11l
S100	CS24 - LS100X6	2,364	Kolom (100)	Vak12d
S101	CS146 - L50X40X5	2,361	Kolom (100)	Vak12c
S102	CS145 - L90x90x6	2,818	Balk (80)	Vak12c
S103	CS149 - L50X40X5	1,691	Kolom (100)	Vak12c
S104	CS148 - L50X5	1,306	Kolom (100)	Vak12c
S105	CS149 - L50X40X5	1,691	Kolom (100)	Vak12c
S106	CS148 - L50X5	1,920	Balk (80)	Vak12c
S107	CS24 - LS100X6	2,364	Kolom (100)	Vak12d
S108	CS148 - L50X5	1,306	Kolom (100)	Vak12c
S109	CS146 - L50X40X5	2,360	Kolom (100)	Vak12c
S110	CS145 - L90x90x6	2,819	Balk (80)	Vak12c
S111	CS24 - LS100X6	2,363	Kolom (100)	Vak12a
S112	CS146 - L50X40X5	2,361	Kolom (100)	Vak12b
S113	CS145 - L90x90x6	2,819	Balk (80)	Vak12b
S114	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S115	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S116	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S117	CS148 - L50X5	1,920	Balk (80)	Vak12b
S118	CS24 - LS100X6	2,363	Kolom (100)	Vak12a
S119	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S120	CS146 - L50X40X5	2,361	Kolom (100)	Vak12b
S121	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S122	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S123	CS149 - L50X40X5	1,691	Kolom (100)	Vak12b
S124	CS148 - L50X5	1,920	Balk (80)	Vak12b
S125	CS148 - L50X5	1,306	Kolom (100)	Vak12b
S126	CS145 - L90x90x6	2,819	Balk (80)	Vak12b
S127	CS97 - L100X8	2,721	Balk (80)	Vak12d
S129	CS132 - L50X40X5	1,213	Balk (80)	Vak11
S130	CS147 - L50X40X5	2,880	Balk (80)	CrossArm4
S131	CS126 - L80x80x6	1,541	Kolom (100)	Vak11
S132	CS126 - L80x80x6	1,541	Kolom (100)	Vak11
S133	CS7 - L45X30X5	0,799	horizontaal windverband (0)	Vak10
S134	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10
S135	CS96 - L120X80X8	4,098	Kolom (100)	Vak10
S136	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10
S137	CS132 - L50X40X5	1,213	Balk (80)	Vak11
S138	CS147 - L50X40X5	2,880	Balk (80)	CrossArm4
S139	CS125 - L75x75x6	1,506	Kolom (100)	Vak11
S140	CS96 - L120X80X8	4,099	Kolom (100)	Vak10
S141	CS125 - L75x75x6	1,506	Kolom (100)	Vak11
S142	CS132 - L50X40X5	1,213	Balk (80)	Vak11l
S143	CS147 - L50X40X5	2,880	Balk (80)	CrossArm3
S144	CS126 - L80x80x6	1,541	Kolom (100)	Vak11l
S145	CS126 - L80x80x6	1,541	Kolom (100)	Vak11l
S146	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10l
S147	CS7 - L45X30X5	0,800	horizontaal windverband (0)	Vak10l
S148	CS96 - L120X80X8	4,098	Kolom (100)	Vak10l
S149	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10l
S150	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10l

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S151	CS132 - L50X40X5	1,213	Balk (80)	Vak11l
S152	CS147 - L50X40X5	2,880	Balk (80)	CrossArm3
S153	CS125 - L75x75x6	1,506	Kolom (100)	Vak11l
S154	CS96 - L120X80X8	4,099	Kolom (100)	Vak10l
S155	CS125 - L75x75x6	1,506	Kolom (100)	Vak11l
S156	CS93 - L70x70x5	2,264	Kolom (100)	Vak8l
S159	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8
S160	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8l
S161	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9b
S162	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8l
S164	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8
S166	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8
S167	CS150 - L55x55x5	1,943	Balk (80)	CrossArm4
S168	CS148 - L50X5	2,235	Balk (80)	CrossArm4
S169	CS150 - L55x55x5	1,943	Balk (80)	CrossArm4
S170	CS148 - L50X5	2,235	Balk (80)	CrossArm4
S171	CS101 - UNP120	3,073	Balk (80)	CrossArm4
S172	CS101 - UNP120	3,073	Balk (80)	CrossArm4
S173	CS30 - UNP140	0,961	Balk (80)	CrossArm4
S175	CS148 - L50X5	0,800	Balk (80)	CrossArm6
S177	CS82 - L130X12	4,280	Kolom (100)	Vak6
S178	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12c
S179	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12c
S180	CS150 - L55x55x5	2,672	Balk (80)	Vak12d
S181	CS150 - L55x55x5	2,671	Balk (80)	Vak12d
S182	CS15 - HFLeq60x60x5	2,921	Balk (80)	Vak12d
S183	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12c
S184	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12d
S185	CS15 - HFLeq60x60x5	2,692	Balk (80)	Vak12c
S186	CS149 - L50X40X5	1,297	Balk (80)	Vak12c
S187	CS149 - L50X40X5	1,297	Balk (80)	Vak12c
S188	CS30 - UNP140	2,163	Balk (80)	Vak12c
S189	CS30 - UNP140	2,163	Balk (80)	Vak12c
S190	CS150 - L55x55x5	1,943	Balk (80)	CrossArm3
S191	CS148 - L50X5	2,235	Balk (80)	CrossArm3
S192	CS150 - L55x55x5	1,943	Balk (80)	CrossArm3
S193	CS148 - L50X5	2,235	Balk (80)	CrossArm3
S194	CS101 - UNP120	3,073	Balk (80)	CrossArm3
S195	CS101 - UNP120	3,073	Balk (80)	CrossArm3
S196	CS30 - UNP140	0,961	Balk (80)	CrossArm3
S198	CS150 - L55x55x5	2,672	Balk (80)	Vak12a
S199	CS150 - L55x55x5	2,672	Balk (80)	Vak12a
S200	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12a
S201	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12b
S202	CS15 - HFLeq60x60x5	2,925	Balk (80)	Vak12a
S203	CS15 - HFLeq60x60x5	2,696	Balk (80)	Vak12b
S204	CS149 - L50X40X5	1,294	Balk (80)	Vak12b
S205	CS149 - L50X40X5	1,294	Balk (80)	Vak12b
S206	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12b
S207	CS15 - HFLeq60x60x5	3,046	Balk (80)	Vak12b
S208	CS30 - UNP140	2,163	Balk (80)	Vak12b
S209	CS30 - UNP140	2,163	Balk (80)	Vak12b
S210	CS101 - UNP120	1,569	Balk (80)	Vak12a
S211	CS129 - L65x65x6	2,163	Balk (80)	Vak11l
S212	CS129 - L65x65x6	2,163	Balk (80)	Vak11
S213	CS101 - UNP120	1,569	Balk (80)	Vak12a
S214	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S215	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S216	CS156 - L50X5	2,369	Balk (80)	CrossArm2
S217	CS158 - L50X40X5	1,587	Kolom (100)	CrossArm2
S218	CS158 - L50X40X5	1,600	Kolom (100)	CrossArm2
S219	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S220	CS156 - L50X5	2,305	Kolom (100)	Vak9c
S221	CS156 - L50X5	3,227	Balk (80)	Vak9c
S222	CS156 - L50X5	3,227	Balk (80)	Vak9c
S223	CS156 - L50X5	2,369	Balk (80)	CrossArm1
S224	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S225	CS153 - L120x120x8	2,373	Kolom (100)	Vak9b
S226	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c

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	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S227	CS153 - L120x120x8	2,373	Kolom (100)	Vak9a
S228	CS40 - L65X50X5	7,610	Balk (80)	CrossArm2
S229	CS157 - L45X5	0,983	Kolom (100)	CrossArm2
S231	CS40 - L65X50X5	7,611	Balk (80)	CrossArm1
S232	CS158 - L50X40X5	2,810	Kolom (100)	CrossArm1
S233	CS157 - L45X5	0,983	Kolom (100)	CrossArm1
S235	CS40 - L65X50X5	7,611	Balk (80)	CrossArm2
S236	CS158 - L50X40X5	2,811	Kolom (100)	CrossArm2
S237	CS157 - L45X5	0,983	Kolom (100)	CrossArm2
S239	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S240	CS153 - L120x120x8	2,373	Kolom (100)	Vak9b
S241	CS154 - L100x100x8	2,376	Kolom (100)	Vak9c
S242	CS153 - L120x120x8	2,373	Kolom (100)	Vak9a
S243	CS93 - L70x70x5	2,366	Kolom (100)	Vak8l
S244	CS4 - L50X40X5	1,616	Balk (80)	Vak8l
S245	CS93 - L70x70x5	2,366	Kolom (100)	Vak8l
S247	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7l
S248	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7l
S249	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S250	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S252	CS161 - L120X80X8	4,747	Kolom (100)	Vak7l
S253	CS40 - L65X50X5	7,611	Balk (80)	CrossArm1
S254	CS158 - L50X40X5	2,810	Kolom (100)	CrossArm1
S255	CS157 - L45X5	0,983	Kolom (100)	CrossArm1
S257	CS4 - L50X40X5	1,616	Balk (80)	Vak8l
S258	CS120 - ISEA130/130/10	0,888	Balk (80)	Vak8l
S260	CS4 - L50X40X5	0,879	horizontaal windverband (0)	Vak7l
S263	CS95 - L75x75x6	2,542	Balk (80)	Vak9b
S264	CS95 - L75x75x6	2,294	Balk (80)	Vak9c
S265	CS95 - L75x75x6	2,456	Balk (80)	Vak9b
S266	CS95 - L75x75x6	2,542	Balk (80)	Vak9b
S267	CS95 - L75x75x6	2,294	Balk (80)	Vak9c
S268	CS43 - L75x75x6	3,507	Balk (80)	Vak9b
S270	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak8
S273	CS159 - L55x55x5	1,845	Balk (80)	CrossArm2
S274	CS159 - L55x55x5	2,188	Balk (80)	CrossArm2
S275	CS159 - L55x55x5	2,579	Balk (80)	CrossArm2
S278	CS159 - L55x55x5	1,845	Balk (80)	CrossArm2
S279	CS159 - L55x55x5	2,188	Balk (80)	CrossArm2
S280	CS159 - L55x55x5	2,579	Balk (80)	CrossArm2
S282	CS152 - UNP140	0,921	Balk (80)	CrossArm2
S283	CS152 - UNP140	2,391	Balk (80)	CrossArm2
S284	CS94 - L50X5	1,390	Balk (80)	CrossArm2
S285	CS94 - L50X5	1,391	Balk (80)	CrossArm2
S286	CS152 - UNP140	2,635	Balk (80)	CrossArm2
S287	CS43 - L75x75x6	3,013	Balk (80)	CrossArm2
S288	CS95 - L75x75x6	2,269	Balk (80)	CrossArm2
S289	CS144 - UNP160	8,015	Balk (80)	CrossArm2
S290	CS95 - L75x75x6	2,456	Balk (80)	Vak9a
S291	CS95 - L75x75x6	2,542	Balk (80)	Vak9a
S292	CS95 - L75x75x6	2,298	Balk (80)	Vak9c
S293	CS4 - L50X40X5	1,135	Balk (80)	Vak9c
S294	CS4 - L50X40X5	1,121	Balk (80)	Vak9c
S295	CS144 - UNP160	8,015	Balk (80)	CrossArm1
S296	CS158 - L50X40X5	1,587	Kolom (100)	CrossArm1
S297	CS158 - L50X40X5	1,600	Kolom (100)	CrossArm1
S298	CS36 - ISEA70/70/5	3,507	Balk (80)	Vak8l
S299	CS44 - UNP160	3,507	Balk (80)	Vak9c
S300	CS93 - L70x70x5	2,265	Kolom (100)	Vak8l
S301	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7l
S302	CS159 - L55x55x5	1,845	Balk (80)	CrossArm1
S303	CS159 - L55x55x5	2,188	Balk (80)	CrossArm1
S304	CS159 - L55x55x5	2,579	Balk (80)	CrossArm1
S307	CS159 - L55x55x5	1,845	Balk (80)	CrossArm1
S308	CS159 - L55x55x5	2,188	Balk (80)	CrossArm1
S309	CS159 - L55x55x5	2,579	Balk (80)	CrossArm1
S311	CS152 - UNP140	0,921	Balk (80)	CrossArm1
S312	CS152 - UNP140	2,391	Balk (80)	CrossArm1
S313	CS94 - L50X5	1,390	Balk (80)	CrossArm1

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S314	CS94 - L50X5	1,391	Balk (80)	CrossArm1
S315	CS152 - UNP140	2,634	Balk (80)	CrossArm1
S316	CS43 - L75x75x6	3,013	Balk (80)	CrossArm1
S317	CS95 - L75x75x6	2,269	Balk (80)	CrossArm1
S318	CS95 - L75x75x6	2,456	Balk (80)	Vak9a
S319	CS95 - L75x75x6	2,542	Balk (80)	Vak9a
S320	CS95 - L75x75x6	2,298	Balk (80)	Vak9c
S321	CS43 - L75x75x6	3,507	Balk (80)	Vak9a
S322	CS4 - L50X40X5	1,135	Balk (80)	Vak9c
S323	CS4 - L50X40X5	1,121	Balk (80)	Vak9c
S324	CS44 - UNP160	3,507	Balk (80)	Vak9c
S328	CS155 - HFLue120x80x8	1,544	Kolom (100)	Vak8l
S330	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7l
S331	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7l
S333	CS88 - L50X40X5	2,571	vertikaal windverband (0)	Vak6
S334	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S336	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S340	CS144 - UNP160	8,015	Balk (80)	CrossArm1
S343	CS12 - L50X5	0,800	Balk (80)	CrossArm5
C1	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C2	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C4	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
C3	CS172 - 2LX (L150X14; 15)	10,951	Kolom (100)	Vak1
B9	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B14	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B16	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B18	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
SB2	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB18	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB34	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB1	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB17	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB33	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB4	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB20	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB36	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB3	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB19	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB35	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
B89	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B90	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B91	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
B92	CS3 - HFLue180x90x10	12,292	vakwerkdiagonaal (90)	Vak1
C5	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C6	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C7	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
C8	CS173 - 2LX (L140X13; 13)	3,374	Kolom (100)	Vak2
B8	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B10	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B12	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B93	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
SB49	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB50	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB51	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB52	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB53	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB54	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB55	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB56	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB57	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB58	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB59	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB60	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB61	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB62	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
SB63	CS63 - L50X40X5	1,900	vertikaal windverband (0)	Vak2
SB64	CS65 - L50X40X5	2,621	vertikaal windverband (0)	Vak2
B31	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B32	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
B33	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
B34	CS100 - L100X75X7	4,916	vakwerkdiagonaal (90)	Vak2
C9	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C10	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C11	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
C12	CS174 - 2LX (L140X13; 13)	6,648	Kolom (100)	Vak3
B94	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B95	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B22	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B26	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
SB65	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB66	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB67	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB68	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB69	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB70	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB71	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB72	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB73	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB74	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB75	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB76	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB77	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB78	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB79	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB80	CS66 - L50X40X5	2,356	vertikaal windverband (0)	Vak3
SB81	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB82	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB83	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB84	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB85	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB86	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB87	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB88	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB89	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB90	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB91	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB92	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB93	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB94	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
SB95	CS66 - L50X40X5	2,360	vertikaal windverband (0)	Vak3
SB96	CS67 - L50X40X5	1,676	vertikaal windverband (0)	Vak3
B73	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B74	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B75	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
B76	CS68 - L100X75X7	9,452	vakwerkdiagonaal (90)	Vak3
C13	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C14	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C15	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
C16	CS175 - 2LX (L130X12; 12)	6,648	Kolom (100)	Vak4
B98	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B99	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B100	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B101	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B102	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B103	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B104	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B105	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
SB97	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB98	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB99	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB100	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB101	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB102	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB103	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB104	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB105	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB106	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB107	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
SB108	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB109	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB110	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB111	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB112	CS71 - L50X40X5	2,231	vertikaal windverband (0)	Vak4
SB113	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB114	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB115	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB116	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB117	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB118	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB119	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB120	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB121	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB122	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB123	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB124	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB125	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB126	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
SB127	CS71 - L50X40X5	2,190	vertikaal windverband (0)	Vak4
SB128	CS69 - L50X40X5	1,460	vertikaal windverband (0)	Vak4
B106	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B107	CS70 - L100X75X7	8,859	vakwerkdiagonaal (90)	Vak4
B108	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B109	CS70 - L100X75X7	8,860	vakwerkdiagonaal (90)	Vak4
B110	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B111	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B112	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
B113	CS81 - L60X5	2,920	vertikaal windverband (0)	Vak4
C17	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C18	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C19	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
C20	CS112 - HFLeq130x130x12	3,414	Kolom (100)	Vak5
B114	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B115	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B116	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B117	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
SB129	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB130	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB131	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB132	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB133	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB134	CS72 - L50X40X5	2,049	vertikaal windverband (0)	Vak5
SB135	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB136	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB137	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB138	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB139	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB140	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB141	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB142	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
SB143	CS20 - L50X40X5	1,250	vertikaal windverband (0)	Vak5
SB144	CS72 - L50X40X5	2,050	vertikaal windverband (0)	Vak5
B36	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B37	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B38	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
B39	CS73 - L100X75X7	4,360	vakwerkdiagonaal (90)	Vak5
S355	CS82 - L130X12	4,280	Kolom (100)	Vak6
S359	CS90 - L100x100x6	4,356	Kolom (100)	Vak10
S361	CS124 - L80X6	0,970	Kolom (100)	Vak11
S368	CS143 - L130X12	3,331	Kolom (100)	Vak8
S370	CS90 - L100x100x6	4,356	Kolom (100)	Vak10
S372	CS124 - L80X6	0,970	Kolom (100)	Vak11
S373	CS133 - L80X6	6,823	Kolom (100)	CrossArm6
S377	CS141 - L120X80X8	2,030	Balk (80)	Vak8
S378	CS141 - L120X80X8	2,206	Balk (80)	Vak8
S379	CS141 - L120X80X8	2,030	Balk (80)	Vak8
S380	CS141 - L120X80X8	2,205	Balk (80)	Vak8
S381	CS141 - L120X80X8	2,030	Balk (80)	Vak8l

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S382	CS141 - L120X80X8	2,206	Balk (80)	Vak8l
S383	CS141 - L120X80X8	2,030	Balk (80)	Vak8l
S384	CS141 - L120X80X8	2,205	Balk (80)	Vak8l
S388	CS144 - UNP160	3,674	Balk (80)	Vak9c
S390	CS144 - UNP160	1,840	Balk (80)	Vak9a
S397	CS92 - L50X40X5	2,227	vertikaal windverband (0)	Vak7
S399	CS36 - ISEA70/70/5	1,753	Balk (80)	Vak8
S400	CS95 - L75x75x6	2,456	Balk (80)	Vak9b
S401	CS93 - L70x70x5	2,366	Balk (80)	Vak8
S402	CS143 - L130X12	3,331	Balk (80)	Vak8
S411	CS90 - L100x100x6	4,356	Kolom (100)	Vak10l
S413	CS124 - L80X6	0,970	Kolom (100)	Vak11l
S417	CS133 - L80X6	6,823	Kolom (100)	CrossArm5
S418	CS82 - L130X12	4,280	Kolom (100)	Vak6
S421	CS143 - L130X12	3,332	Kolom (100)	Vak8l
S425	CS124 - L80X6	0,970	Kolom (100)	Vak11l
S426	CS133 - L80X6	6,823	Kolom (100)	CrossArm5
S430	CS37 - HFLeq75x75x8	4,252	Balk (80)	Vak7l
S441	CS101 - UNP120	1,970	Balk (80)	Vak12a
S446	CS101 - UNP120	1,970	Balk (80)	Vak12d
S447	CS101 - UNP120	1,568	Balk (80)	Vak12d
S448	CS158 - L50X40X5	2,810	Balk (80)	CrossArm2
S449	CS140 - L45X30X5	0,941	Balk (80)	CrossArm6
S450	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7
S453	CS4 - L50X40X5	0,864	horizontaal windverband (0)	Vak7
S456	CS122 - L50X40X5	2,179	vertikaal windverband (0)	Vak10
S457	CS155 - HFLue120x80x8	1,544	Balk (80)	Vak8
S458	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7
S459	CS92 - L50X40X5	2,231	vertikaal windverband (0)	Vak7
S460	CS84 - L100x100x6	2,080	vertikaal windverband (0)	Vak6
S461	CS156 - L50X5	1,503	Balk (80)	Vak9c
S462	CS156 - L50X5	1,503	Balk (80)	Vak9c
S463	CS156 - L50X5	1,503	Balk (80)	Vak9c
S464	CS156 - L50X5	1,503	Balk (80)	Vak9c
S465	CS95 - L75x75x6	1,719	Balk (80)	CrossArm2
S466	CS95 - L75x75x6	2,269	Balk (80)	CrossArm1
B7	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B118	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B119	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B120	CS75 - L120X11	7,600	Balk (80)	HorVerb1
B11	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B121	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B13	CS39 - ISEA80/80/6	5,374	vakwerkdiagonaal (90)	HorVerb1
B122	CS39 - ISEA80/80/6	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 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B130	CS79 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B131	CS79 - L100X8	3,535	vakwerkdiagonaal (90)	HorVerb2
B132	CS79 - L100X8	3,536	vakwerkdiagonaal (90)	HorVerb2
B133	CS77 - L60X5	5,000	vakwerkdiagonaal (90)	HorVerb2
B134	CS77 - L60X5	2,500	vakwerkdiagonaal (90)	HorVerb2
B135	CS77 - L60X5	2,500	vakwerkdiagonaal (90)	HorVerb2
S467	CS78 - L110X10	5,000	Balk (80)	HorVerb2
S470	CS113 - L80X6	5,000	Balk (80)	HorVerb2
S472	CS78 - L110X10	5,000	Balk (80)	HorVerb2
S474	CS113 - L80X6	5,000	Balk (80)	HorVerb2
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	CS133 - L80X6	6,823	Kolom (100)	CrossArm6
S491	CS151 - HFLeq130x130x12	3,201	Balk (80)	Vak9b
S492	CS144 - UNP160	1,720	Balk (80)	Vak9a
S493	CS144 - UNP160	3,674	Balk (80)	Vak9a
S495	CS101 - UNP120	1,970	Balk (80)	Vak12d
S497	CS101 - UNP120	1,568	Balk (80)	Vak12d
S503	CS97 - L100X8	2,721	Balk (80)	Vak12d

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
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
S513	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S514	CS36 - ISEA70/70/5	0,950	Balk (80)	CrossArm4
S547	CS144 - UNP160	1,840	Balk (80)	Vak9b
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
SB145	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB146	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB147	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB148	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB149	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB150	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB151	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB152	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB153	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB154	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB155	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB156	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB157	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB158	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB159	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB160	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB161	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB162	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB163	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB164	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB165	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB166	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB167	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB168	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB169	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB170	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB171	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB172	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB173	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB174	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB175	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB176	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB177	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB178	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB179	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB180	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB181	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
SB182	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB183	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB184	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB185	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB186	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB187	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB188	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB189	CS4 - L50X40X5	0,760	vertikaal windverband (0)	Vak1
SB190	CS4 - L50X40X5	1,520	vertikaal windverband (0)	Vak1
SB191	CS4 - L50X40X5	2,169	vertikaal windverband (0)	Vak1
SB192	CS102 - L50X5	2,280	vertikaal windverband (0)	Vak1
SB193	CS4 - L50X40X5	2,402	vertikaal windverband (0)	Vak1
SB194	CS61 - L60X6	3,040	vertikaal windverband (0)	Vak1
SB195	CS4 - L50X40X5	2,827	vertikaal windverband (0)	Vak1
SB196	CS60 - L50X5	3,371	vertikaal windverband (0)	Vak1
S588	CS104 - L70X6	3,353	Balk (80)	Vak3
S589	CS104 - L70X6	3,353	Balk (80)	Vak3
S590	CS104 - L70X6	3,353	Balk (80)	Vak3
S591	CS104 - L70X6	3,353	Balk (80)	Vak3

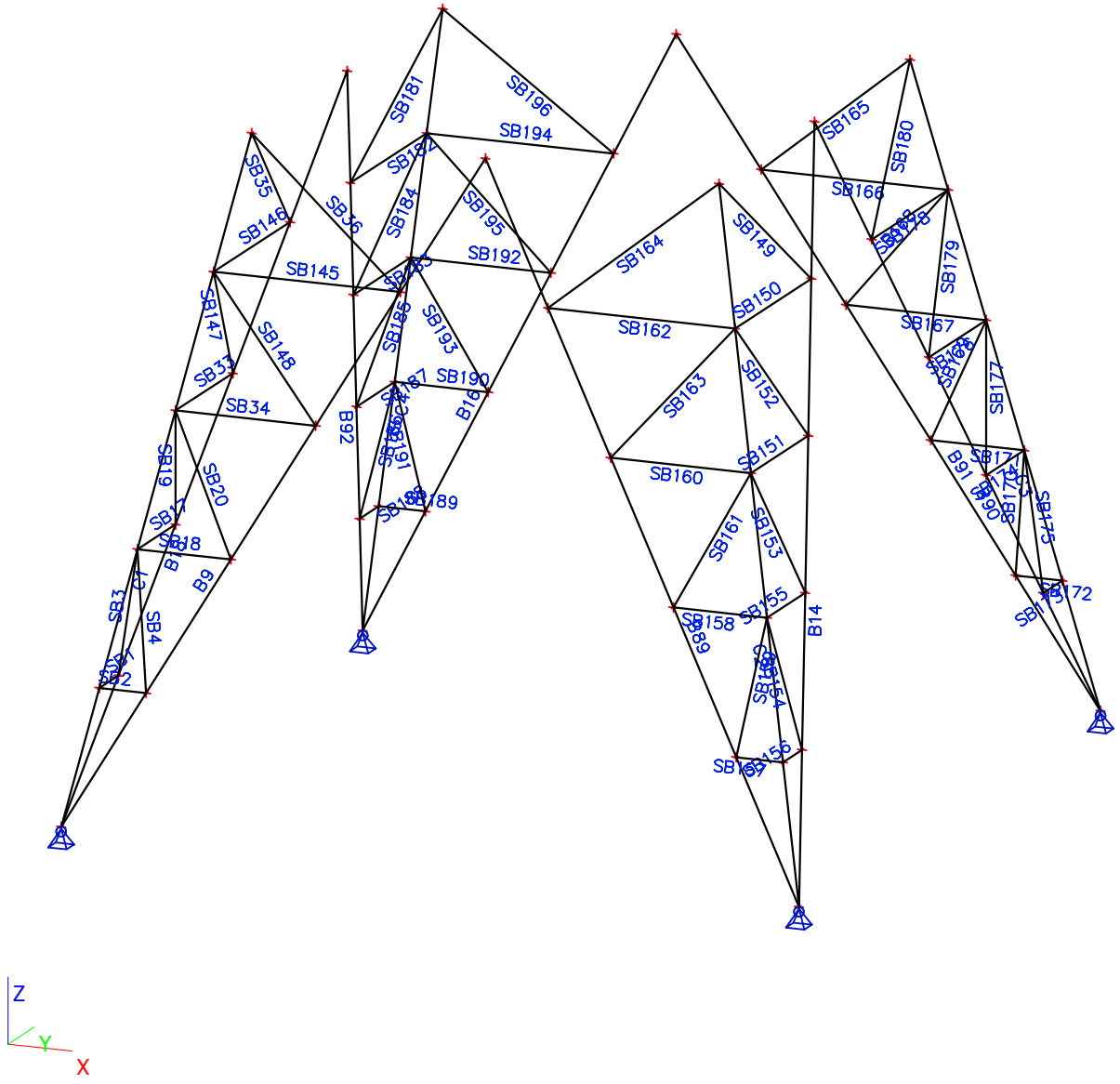
D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Doorsnede	Lengte [m]	Type	Laag
S592	CS104 - L70X6	3,353	Balk (80)	Vak3
S593	CS104 - L70X6	3,353	Balk (80)	Vak3
S594	CS104 - L70X6	3,353	Balk (80)	Vak3
S595	CS104 - L70X6	3,353	Balk (80)	Vak3
S596	CS95 - L75x75x6	1,719	Balk (80)	CrossArm2
S597	CS95 - L75x75x6	2,269	Balk (80)	CrossArm2
S598	CS95 - L75x75x6	1,719	Balk (80)	CrossArm1
S599	CS95 - L75x75x6	1,719	Balk (80)	CrossArm1
S600	CS144 - UNP160	8,015	Balk (80)	CrossArm2
S601	CS144 - UNP160	1,720	Balk (80)	Vak9b
S602	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S603	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S604	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S605	CS160 - L150X14	5,642	vakwerkdiagonaal (90)	Vak6
S606	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S607	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S608	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S609	CS88 - L50X40X5	1,250	horizontaal windverband (0)	Vak6
S610	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S611	CS82 - L130X12	4,280	vakwerkdiagonaal (90)	Vak6
S612	CS83 - L100X75X7	4,764	vakwerkdiagonaal (90)	Vak6
S613	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S614	CS83 - L100X75X7	4,765	vakwerkdiagonaal (90)	Vak6
S615	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7l
S616	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7l
S617	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7
S618	CS89 - L130X12	4,261	vakwerkdiagonaal (90)	Vak7
S619	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7
S620	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7l
S621	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7l
S622	CS142 - L120X80X8	4,017	vakwerkdiagonaal (90)	Vak7
S623	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7l
S624	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7
S625	CS161 - L120X80X8	4,747	vakwerkdiagonaal (90)	Vak7
S626	CS90 - L100x100x6	4,356	Kolom (100)	Vak10l
S627	CS97 - L100X8	2,720	Balk (80)	Vak12a
S628	CS97 - L100X8	4,465	Balk (80)	Vak12b
S629	CS97 - L100X8	4,464	Balk (80)	Vak12c
S630	CS101 - UNP120	1,970	Balk (80)	Vak12a
S631	CS101 - UNP120	4,465	Balk (80)	Vak12b
S632	CS101 - UNP120	4,465	Balk (80)	Vak12c
S633	CS101 - UNP120	4,465	Balk (80)	Vak12c
S634	CS101 - UNP120	4,465	Balk (80)	Vak12b
S635	CS97 - L100X8	2,720	Balk (80)	Vak12a
S636	CS97 - L100X8	4,465	Balk (80)	Vak12b
S637	CS97 - L100X8	4,464	Balk (80)	Vak12c
S638	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9a
S639	CS151 - HFLeq130x130x12	3,680	Balk (80)	Vak9c
S640	CS151 - HFLeq130x130x12	3,680	Balk (80)	Vak9c
S641	CS151 - HFLeq130x130x12	3,202	Balk (80)	Vak9a
S642	CS144 - UNP160	1,840	Balk (80)	Vak9b
S643	CS144 - UNP160	1,720	Balk (80)	Vak9b
S644	CS144 - UNP160	1,720	Balk (80)	Vak9a
S645	CS144 - UNP160	1,840	Balk (80)	Vak9a
S646	CS143 - L130X12	3,332	Kolom (100)	Vak8l
S648	CS170 - L50X5	0,541	Balk (80)	vers
S649	CS170 - L50X5	0,647	Balk (80)	vers
S650	CS170 - L50X5	0,541	Balk (80)	vers
S651	CS170 - L50X5	0,647	Balk (80)	vers
S652	CS170 - L50X5	0,541	Balk (80)	vers
S653	CS170 - L50X5	0,649	Balk (80)	vers
S654	CS170 - L50X5	0,541	Balk (80)	vers
S655	CS170 - L50X5	0,649	Balk (80)	vers
S656	CS170 - L50X5	0,560	Balk (80)	vers
S657	CS170 - L50X5	0,434	Balk (80)	vers
S658	CS170 - L50X5	0,434	Balk (80)	vers
S659	CS170 - L50X5	0,560	Balk (80)	vers
S660	CS171 - L60X8	0,659	Balk (80)	vers
S661	CS171 - L60X8	0,802	Balk (80)	vers

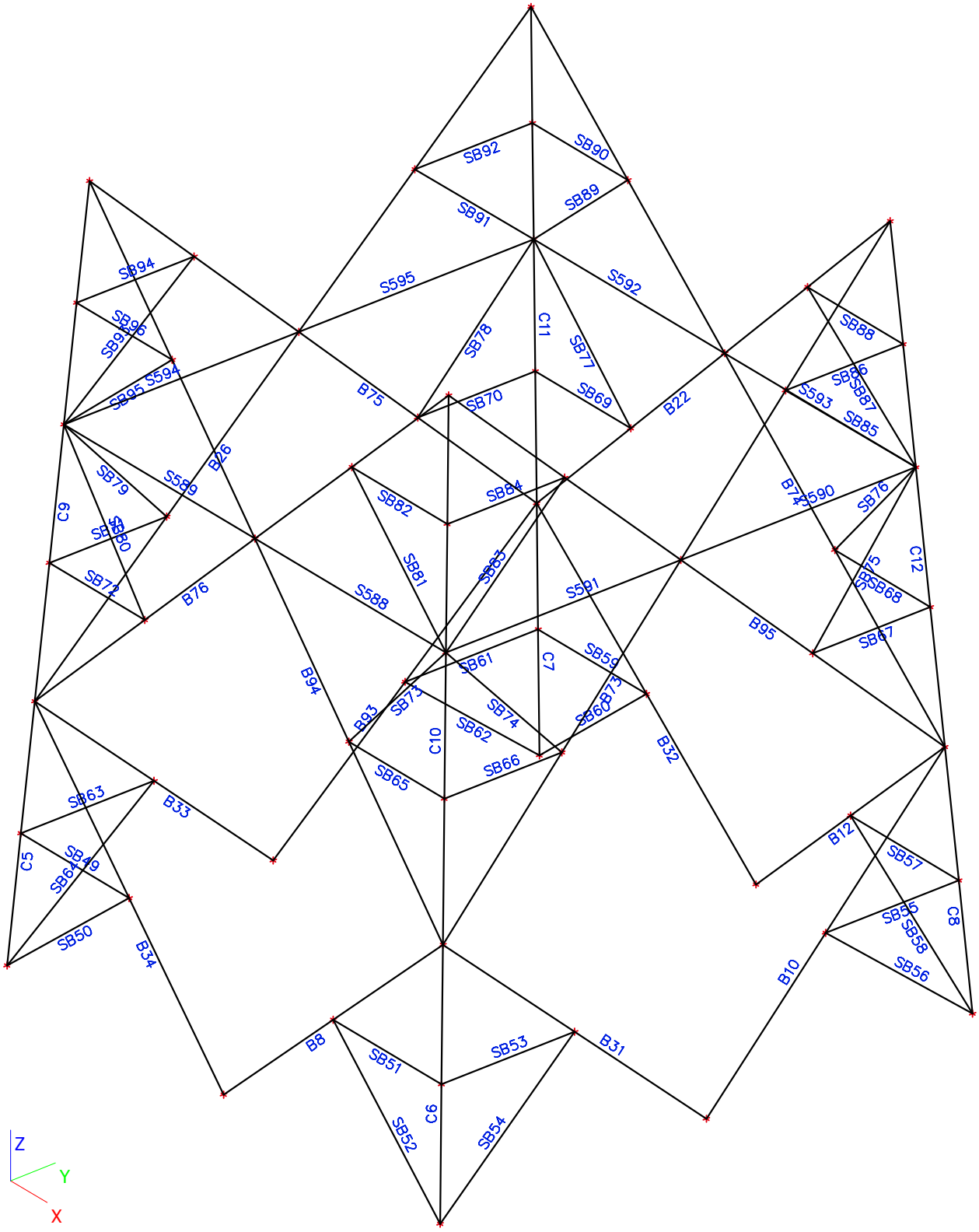
Naam	Doorsnede	Lengte [m]	Type	Laag
S662	CS171 - L60X8	0,659	Balk (80)	vers
S663	CS171 - L60X8	0,802	Balk (80)	vers
S664	CS171 - L60X8	0,659	Balk (80)	vers
S665	CS171 - L60X8	0,802	Balk (80)	vers
S666	CS171 - L60X8	0,659	Balk (80)	vers
S667	CS171 - L60X8	0,802	Balk (80)	vers

6. Staafnummers mastlichaam

6.1. Vak 1



6.2. Vak 2 en 3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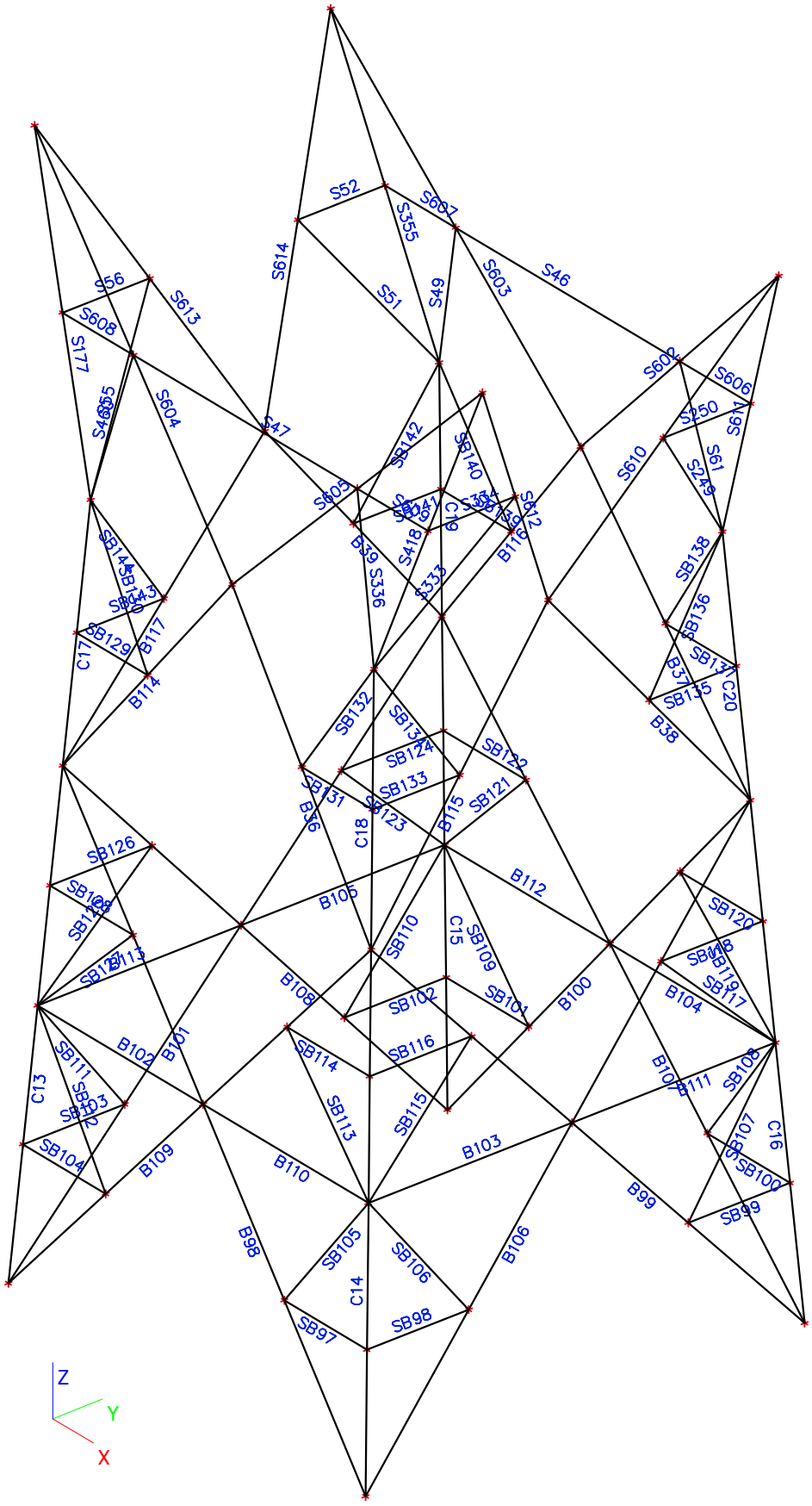
6.3. Vak 4 en 5



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C17
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SB132
SB124
SB122
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SB131
SB123
SB121
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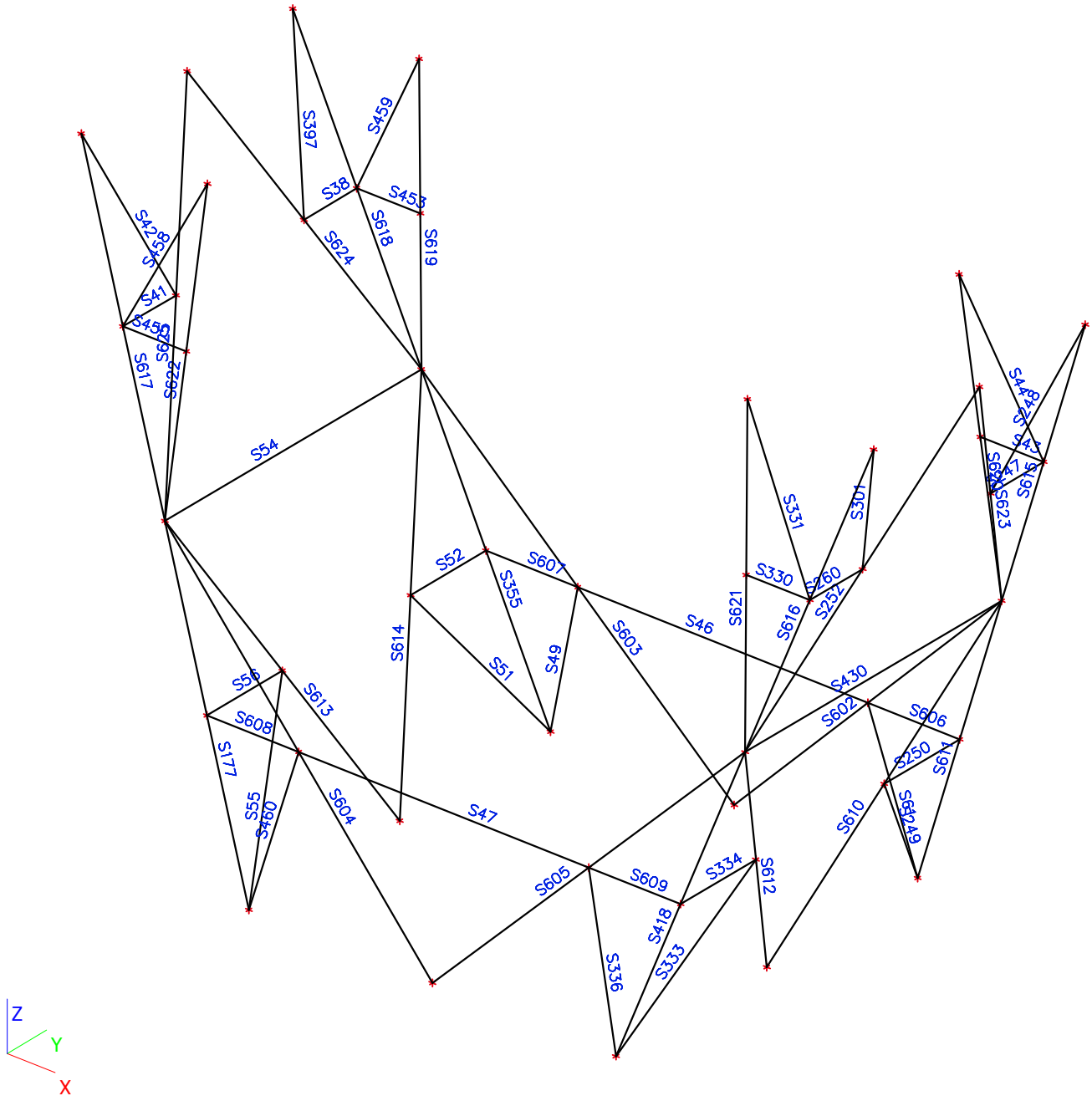
6.4. Vak 6 en 7



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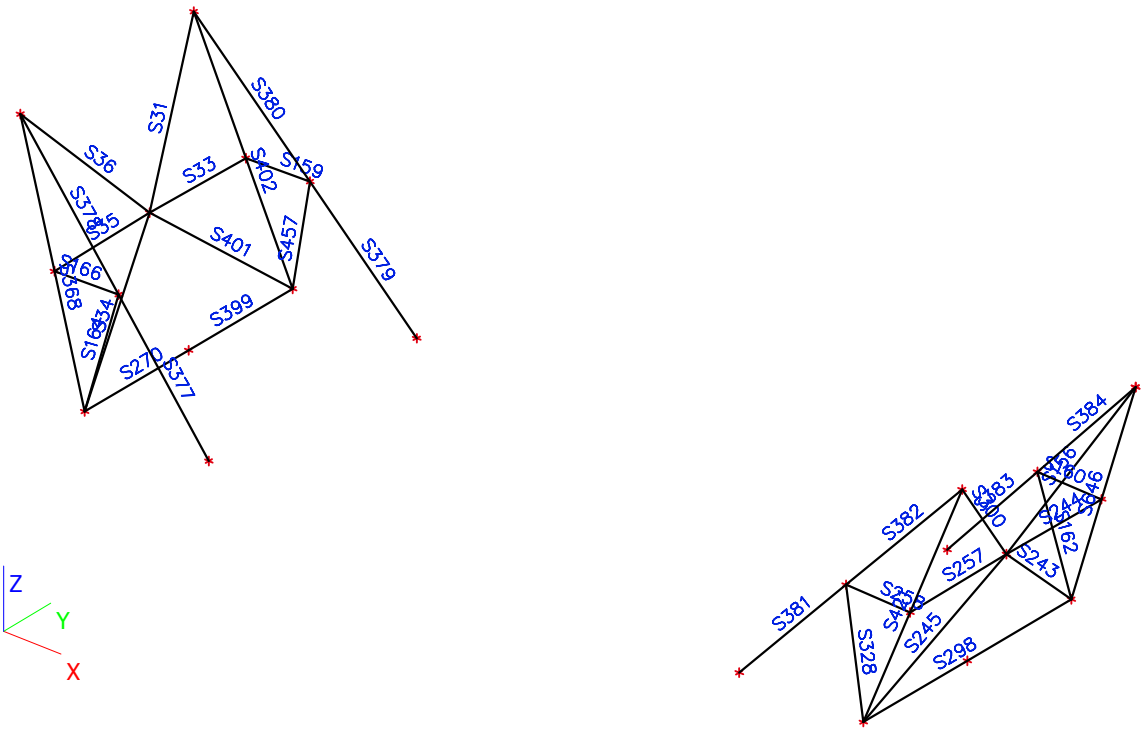
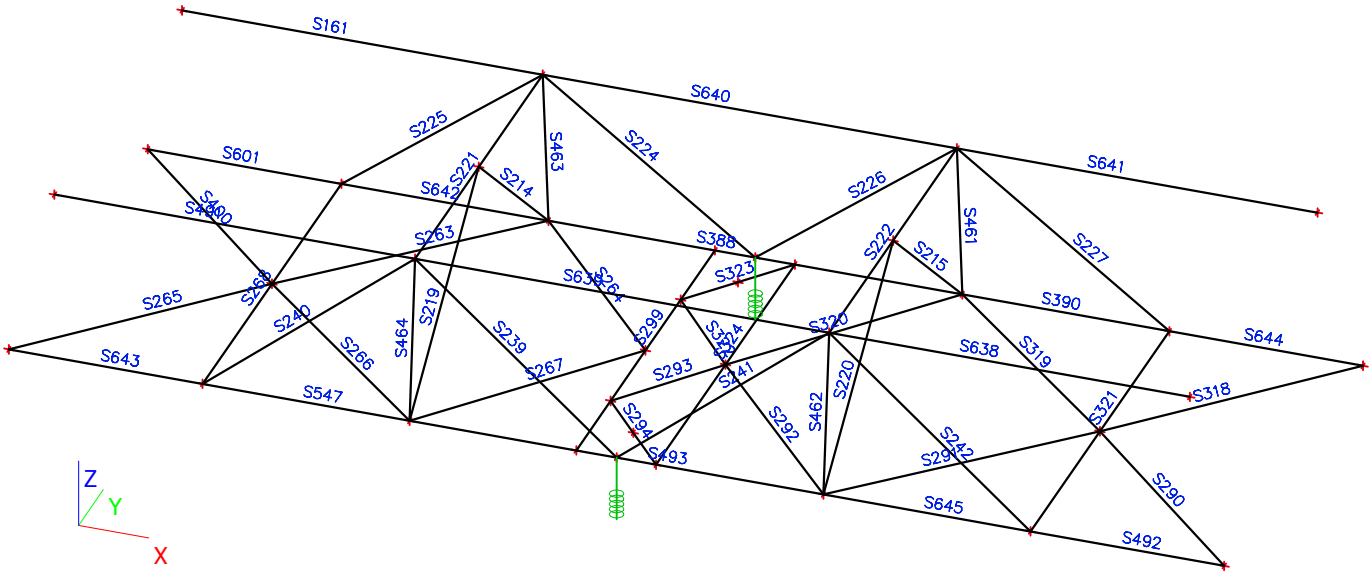
S602
S606
S250
S611
S610
S249
S448
S248
S43
S47
S615
S623
S56
S613
S608
S177
S55
S460
S604
S47
S605
S609
S334
S612
S418
S333
S336
Z
Y
X

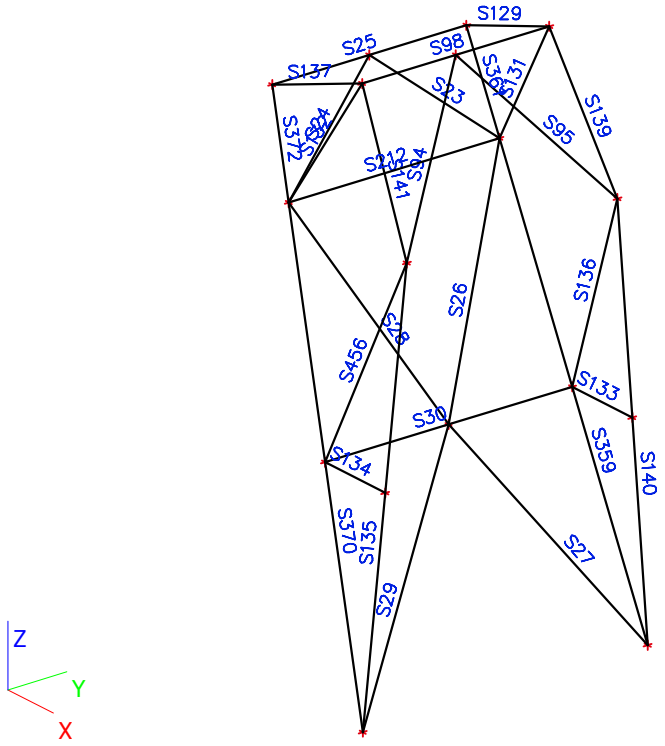
6.5. Vak 8 links en rechts



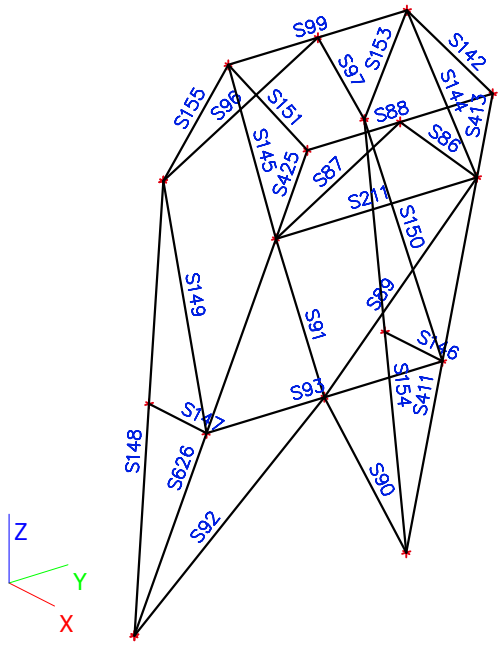
6.6. Vak 9



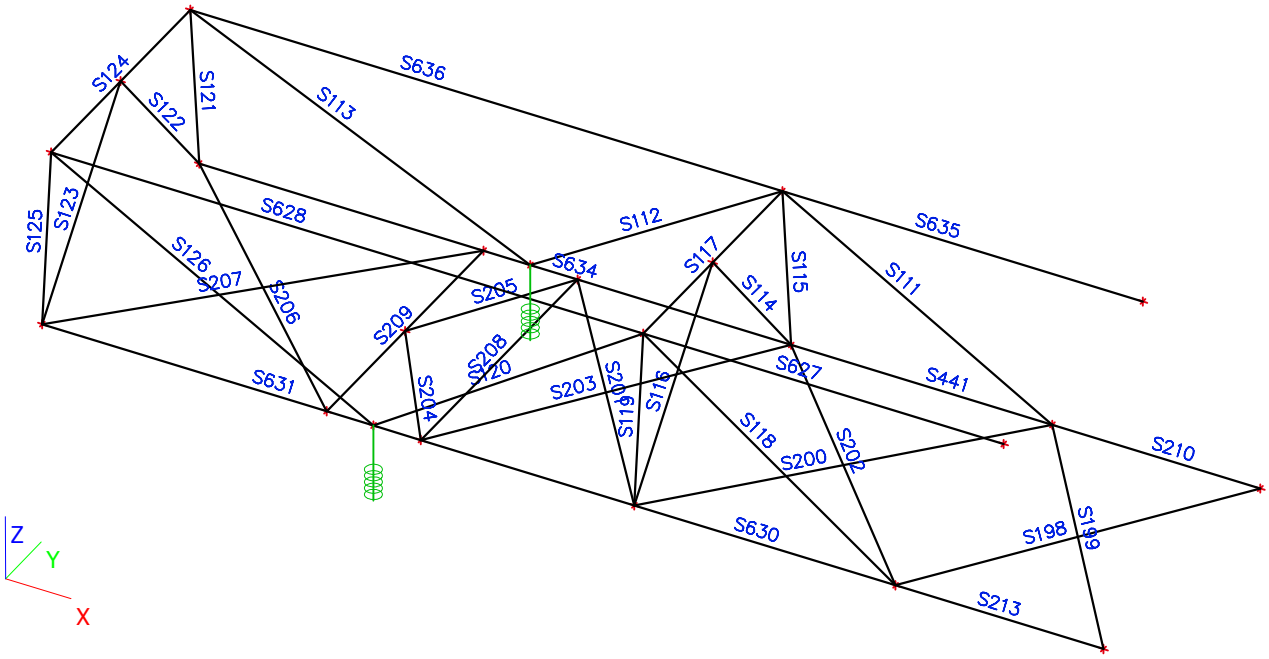
6.7. Vak 10 en 11 - rechts



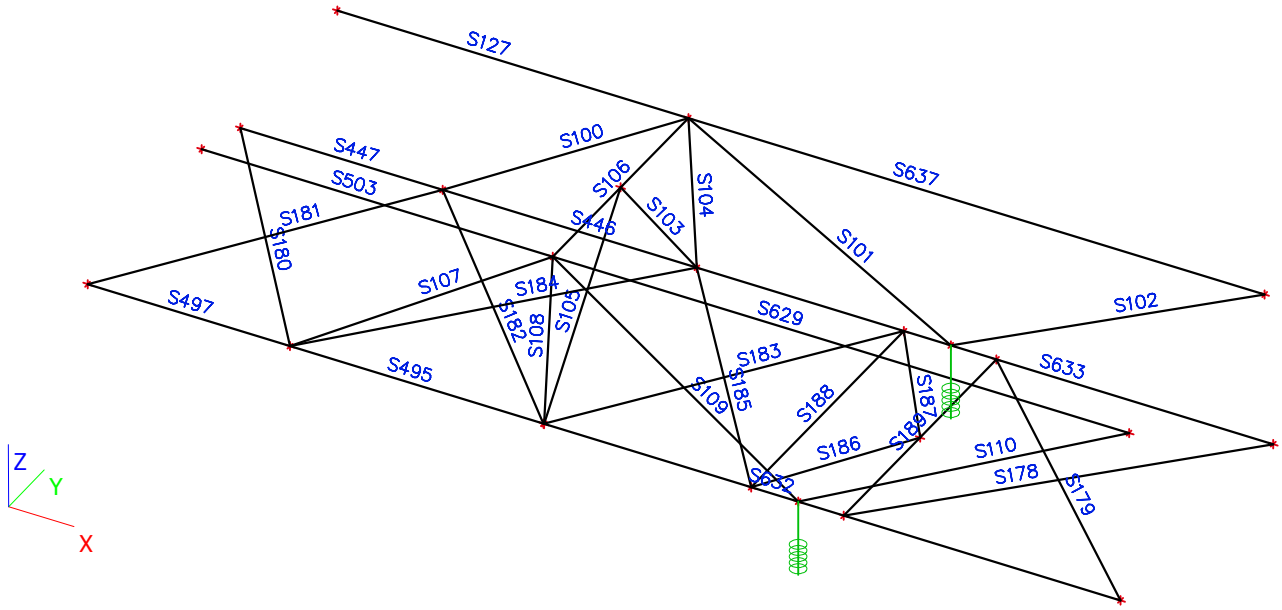
6.8. Vak 10l en 11l - links



6.9. Vak 12 a,12b,

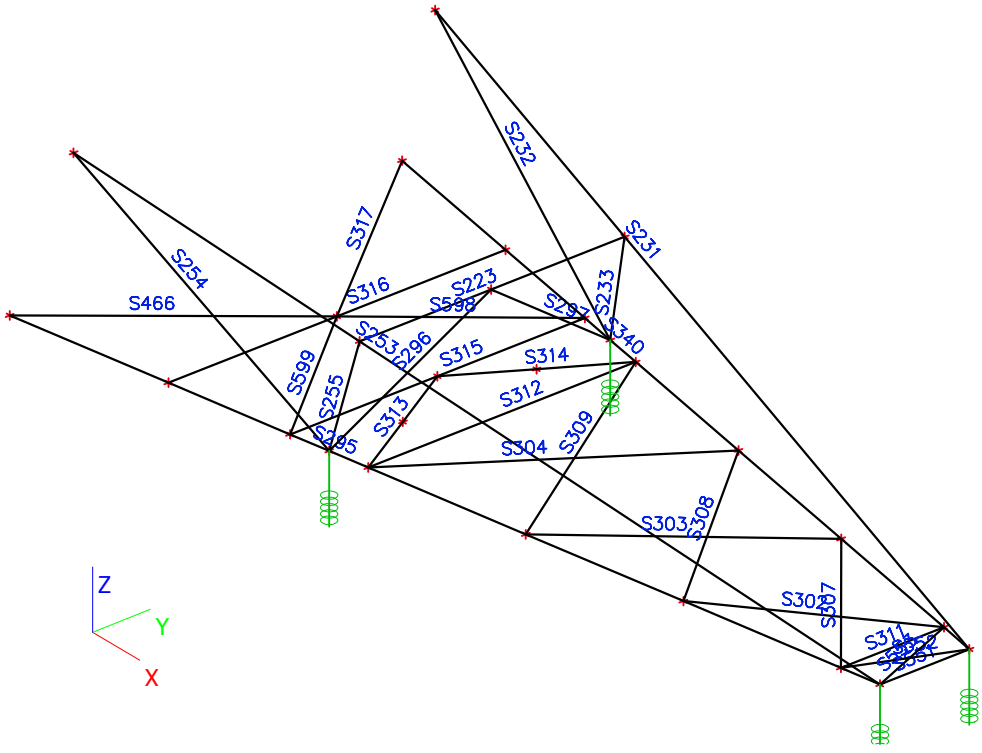


6.10. Vak 12a, 12b,

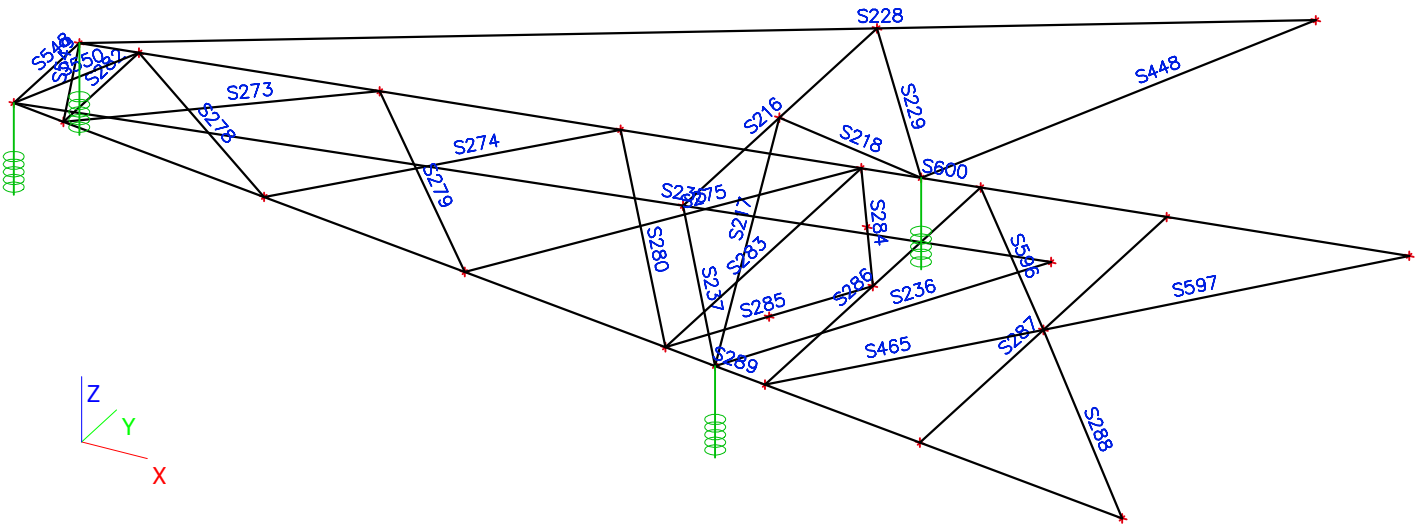


7. Staafnummers traverses

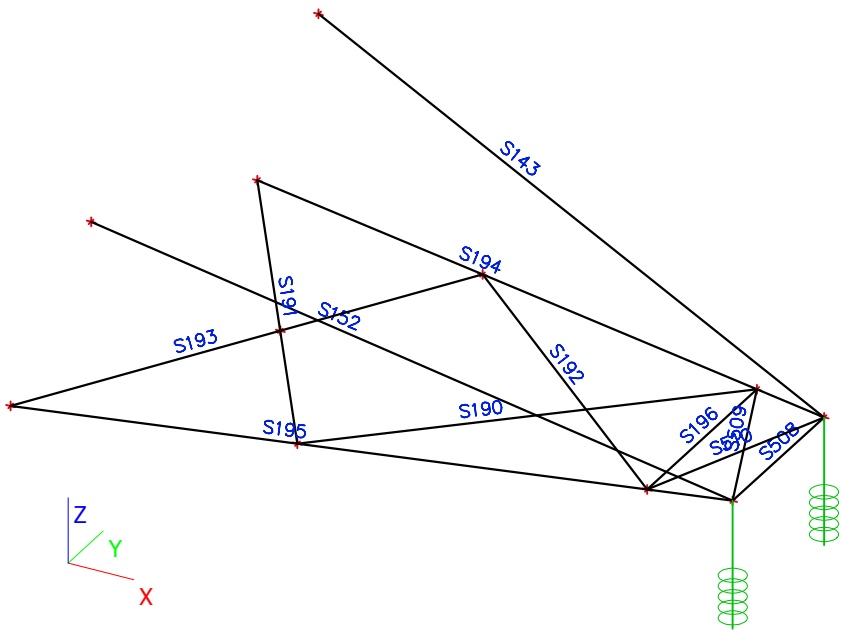
7.1. Traverse 1



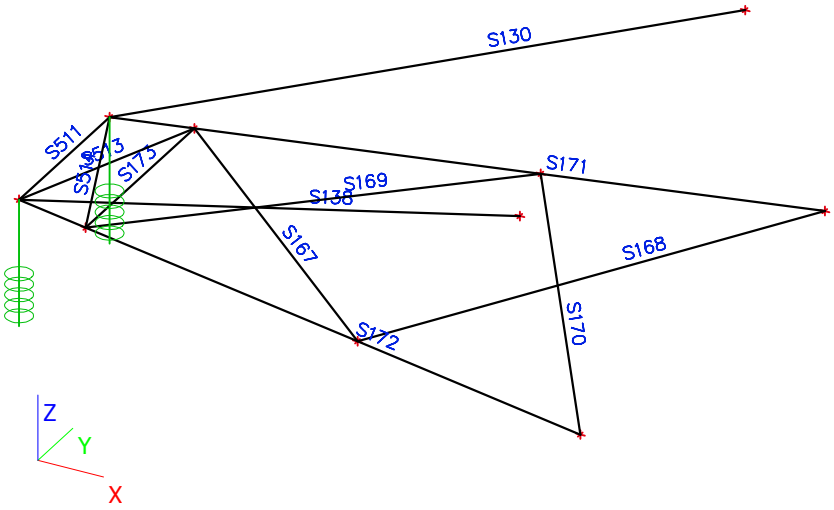
7.2. Traverse 2



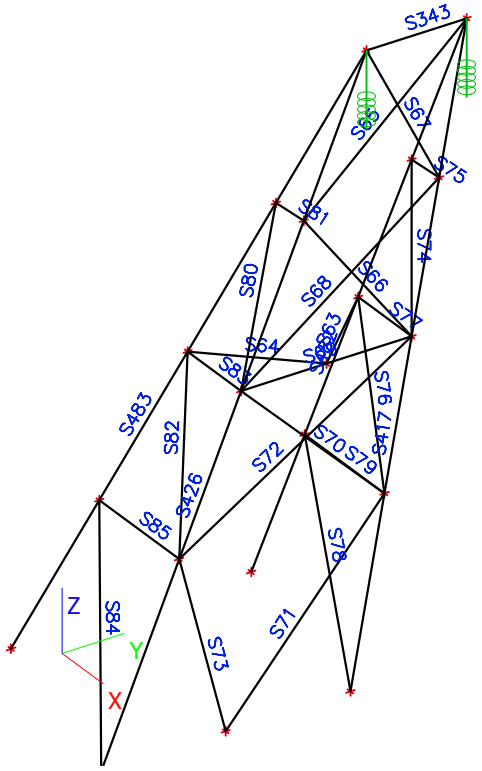
7.3. Traverse 3



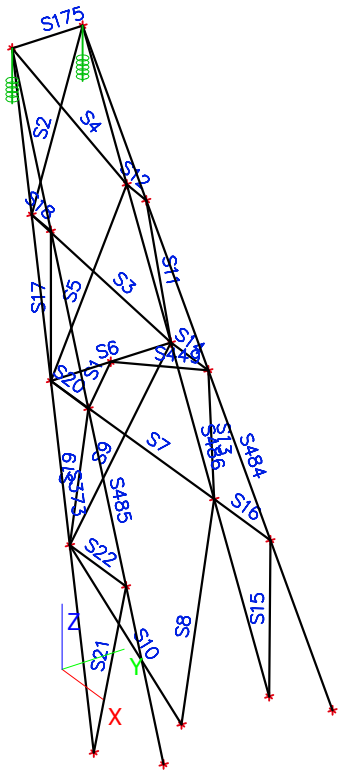
7.4. Traverse 4



7.5. Traverse 5

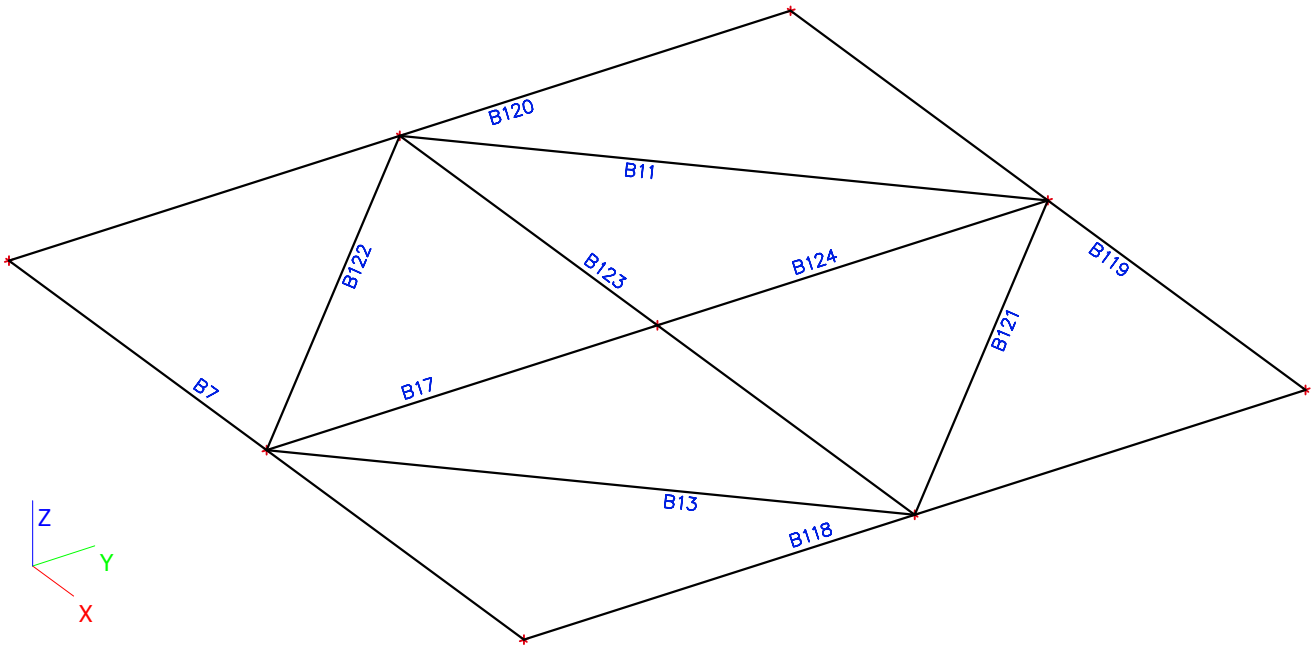


7.6. Traverse 6

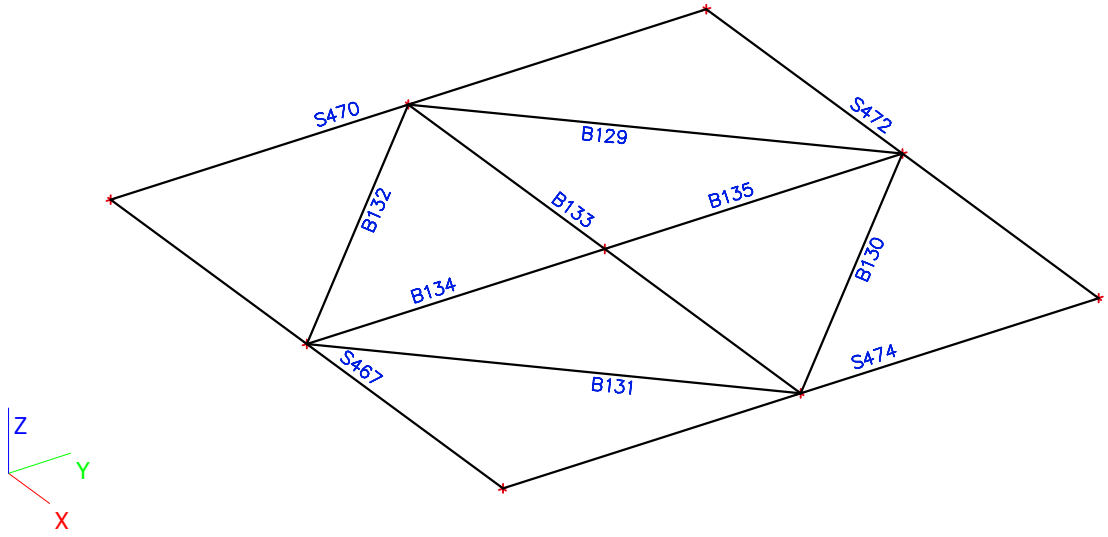


8. Staafnummers horizontale verbanden

8.1. Horizontaal verband 1



8.2. Horizontaal verband 2



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+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x+y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_x-y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y+	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
WI_y-	Wind on tower and iced conductor line	Variabel	WindIce	Statisch	Standaard		Kort	Geen
Ice	IJs	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	Perm	Standaard				
Tuls-1b	Conductor tension	Permanent	Perm	Standaard				
Tuls-3	Conductor tension	Permanent	Perm	Standaard				
Tuls-4	Conductor tension	Permanent	Perm	Standaard				
Tuls-6	Conductor tension	Permanent	Perm	Standaard				
Tuls-5a_CI1	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI2	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI3	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI4	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI5	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI6	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI7	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI8	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI9	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI10	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI11	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI12	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI13	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI14	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI15	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI16	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI17	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI18	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI19	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI20	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI21	Conductor tension	Variabel	5a_CI	Statisch	Standaard		Kort	Geen
Tuls-5a_CI22	Conductor tension	Variabel	5a_CI	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
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	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-1b - 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-1b - Conductor tension	1,00
3	wind+ice	Omhullende - uiterst	Ice - IJs	1,50
			WI_x+ - Wind on tower and iced conductor line	0,45
				0,45
			WI_x- - Wind on tower and iced conductor line	0,45
				0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
				0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
				0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
				1,44
			WI_x-y- - Wind on tower and iced conductor line	1,20
				1,00
			WI_y+ - Wind on tower and iced conductor line	
			WI_y- - Wind on tower and iced conductor line	
			6T - self weight of tower	
			6C - self weight of conductor	
			Tuls-3 - Conductor tension	
3-p	wind+ice	Omhullende - uiterst	Ice - IJs	1,50

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
3-p	wind+ice	Omhullende - uiterst	WI_x+ - Wind on tower and iced conductor line	0,45
				0,45
			WI_x- - Wind on tower and iced conductor line	0,45
				0,45
			WI_x+y+ - Wind on tower and iced conductor line	0,45
				0,45
			WI_x+y- - Wind on tower and iced conductor line	0,45
				0,45
			WI_x-y+ - Wind on tower and iced conductor line	0,45
				1,08
			WI_x-y- - Wind on tower and iced conductor line	0,90
				1,00
			WI_y+ - Wind on tower and iced conductor line	
			WI_y- - Wind on tower and iced conductor line	
			6T - self weight of tower	
			6C - self weight of conductor	
			Tuls-3 - Conductor tension	
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
			4C11 - Construction	1,50
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
6	permanent	Omhullende - uiterst	6T - self weight of tower	1,35
			6C - self weight of conductor	1,35

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Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
6	permanent	Omhullende - uiterst	Tuls-6 - Conductor tension	1,00
5a1	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	0,80
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a2	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl1 - Conductor tension	0,80
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00

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Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a2	safety	Omhullende - uiterst	Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a3	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	0,80
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a4	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	0,80
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a4	safety	Omhullende - uiterst	Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a5	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	0,80
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a6	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a6	safety	Omhullende - uiterst	Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	0,80
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a7	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a8	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a8	safety	Omhullende - uiterst	4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	0,80
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a9	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	0,80
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a10	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	0,80
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a11	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	0,80
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a11	safety	Omhullende - uiterst	Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a12	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	0,80
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a13	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a13	safety	Omhullende - uiterst	Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	0,80
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a14	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	0,80
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl19 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	1,00
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a15	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00

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Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a15	safety	Omhullende - uiterst	Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a16	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	0,80
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a17	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a17	safety	Omhullende - uiterst	4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a18	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	0,80
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a19	safety	Omhullende - uiterst	6T - self weight of tower	1,20

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	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a19	safety	Omhullende - uiterst	6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00
			Tuls-5a_Cl17 - Conductor tension	1,00
			Tuls-5a_Cl18 - Conductor tension	1,00
			Tuls-5a_Cl20 - Conductor tension	0,80
			Tuls-5a_Cl21 - Conductor tension	1,00
			Tuls-5a_Cl22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a20	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_Cl2 - Conductor tension	1,00
			Tuls-5a_Cl1 - Conductor tension	1,00
			Tuls-5a_Cl3 - Conductor tension	1,00
			Tuls-5a_Cl5 - Conductor tension	1,00
			Tuls-5a_Cl6 - Conductor tension	1,00
			Tuls-5a_Cl7 - Conductor tension	1,00
			Tuls-5a_Cl8 - Conductor tension	1,00
			Tuls-5a_Cl11 - Conductor tension	1,00
			Tuls-5a_Cl9 - Conductor tension	1,00
			Tuls-5a_Cl4 - Conductor tension	1,00
			Tuls-5a_Cl12 - Conductor tension	1,00
			Tuls-5a_Cl10 - Conductor tension	1,00
			Tuls-5a_Cl13 - Conductor tension	1,00
			Tuls-5a_Cl14 - Conductor tension	1,00
			Tuls-5a_Cl15 - Conductor tension	1,00
			Tuls-5a_Cl16 - Conductor tension	1,00

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a20	safety	Omhullende - uiterst	Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	0,80
			Tuls-5a_CI21 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	1,00
			4C11 - Construction	1,00
5a21	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI22 - Conductor tension	0,80
			4C11 - Construction	1,00
5a22	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00

D&C ENGINEERING	**Project**	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Naam	Omschrijving	Type	Belastingsgevallen	Coëff. [-]
5a22	safety	Omhullende - uiterst	Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	1,00
5a23	safety	Omhullende - uiterst	6T - self weight of tower	1,20
			6C - self weight of conductor	1,00
			Tuls-6 - Conductor tension	1,00
			4C0 - Construction	1,00
			4C1 - Construction	1,00
			4C2 - Construction	1,00
			4C3 - Construction	1,00
			4C4 - Construction	1,00
			4C5 - Construction	1,00
			4C6 - Construction	1,00
			4C7 - Construction	1,00
			4C8 - Construction	1,00
			4C9 - Construction	1,00
			4C10 - Construction	1,00
			Tuls-5a_CI2 - Conductor tension	1,00
			Tuls-5a_CI1 - Conductor tension	1,00
			Tuls-5a_CI3 - Conductor tension	1,00
			Tuls-5a_CI5 - Conductor tension	1,00
			Tuls-5a_CI6 - Conductor tension	1,00
			Tuls-5a_CI7 - Conductor tension	1,00
			Tuls-5a_CI8 - Conductor tension	1,00
			Tuls-5a_CI11 - Conductor tension	1,00
			Tuls-5a_CI9 - Conductor tension	1,00
			Tuls-5a_CI4 - Conductor tension	1,00
			Tuls-5a_CI12 - Conductor tension	1,00
			Tuls-5a_CI10 - Conductor tension	1,00
			Tuls-5a_CI13 - Conductor tension	1,00
			Tuls-5a_CI14 - Conductor tension	1,00
			Tuls-5a_CI15 - Conductor tension	1,00
			Tuls-5a_CI16 - Conductor tension	1,00
			Tuls-5a_CI17 - Conductor tension	1,00
			Tuls-5a_CI18 - Conductor tension	1,00
			Tuls-5a_CI19 - Conductor tension	1,00
			Tuls-5a_CI20 - Conductor tension	1,00
			Tuls-5a_CI21 - Conductor tension	0,80
			4C11 - Construction	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	CS140 - L45X30X5	1a/9	0,000	**-0,51**
S1	CS140 - L45X30X5	1a-p/8	0,941	**0,42**
S2	CS138 - L45X5	5a2/19	0,000	**-4,76**
S2	CS138 - L45X5	5a1/20	1,862	**4,75**
S3	CS137 - L45X30X5	5a1/20	0,000	**-3,11**
S3	CS137 - L45X30X5	5a2/19	2,018	**3,01**
S4	CS138 - L45X5	5a1/21	0,000	**-4,88**
S4	CS138 - L45X5	5a2/22	1,862	**5,00**
S5	CS137 - L45X30X5	5a2/19	0,000	**-3,32**
S5	CS137 - L45X30X5	5a1/21	2,018	**2,85**
S6	CS136 - L45X5	3/10	0,000	**-2,75**
S6	CS136 - L45X5	3-p/11	0,682	**1,29**
S7	CS135 - L45X30X5	1a/18	0,000	**-1,83**
S7	CS135 - L45X30X5	3-p/23	2,184	**4,29**
S8	CS134 - L45X5	3/10	0,000	**-6,68**
S8	CS134 - L45X5	1a-p/15	2,162	**2,84**
S9	CS135 - L45X30X5	1a/3	0,000	**-2,45**
S9	CS135 - L45X30X5	3-p/23	2,184	**3,18**
S10	CS134 - L45X5	1a/1	0,000	**-4,67**
S10	CS134 - L45X5	1a/3	2,162	**3,71**
S11	CS140 - L45X30X5	3/10	1,511	**-2,63**
S11	CS140 - L45X30X5	1a-p/17	0,000	**0,27**
S12	CS140 - L45X30X5	1a-p/17	0,000	**-0,04**
S12	CS140 - L45X30X5	3/10	0,336	**0,86**
S13	CS140 - L45X30X5	1a/1	1,501	**-1,27**
S13	CS140 - L45X30X5	1a-p/17	0,000	**0,40**
S14	CS138 - L45X5	1a-p/17	0,000	**-0,14**
S14	CS138 - L45X5	1a/1	0,649	**0,58**
S15	CS139 - L50X40X5	1a/1	1,911	**-1,81**
S15	CS139 - L50X40X5	1a-p/17	0,000	**0,60**
S16	CS140 - L45X30X5	1a-p/17	0,000	**-0,28**
S16	CS140 - L45X30X5	1a/1	0,969	**0,98**
S17	CS140 - L45X30X5	3/10	1,511	**-2,07**
S17	CS140 - L45X30X5	3-p/11	0,000	**0,56**
S18	CS140 - L45X30X5	3-p/11	0,000	**-0,22**
S18	CS140 - L45X30X5	3/10	0,336	**0,59**
S19	CS140 - L45X30X5	1a/2	1,501	**-1,66**
S19	CS140 - L45X30X5	1a-p/15	0,000	**0,69**
S20	CS138 - L45X5	1a-p/17	0,000	**-0,15**

Staaf	css	BG	dx [m]	N [kN]
S20	CS138 - L45X5	1a/1	0,649	**0,67**
S21	CS139 - L50X40X5	1a/2	1,911	**-1,71**
S21	CS139 - L50X40X5	1a-p/15	0,000	**0,54**
S22	CS140 - L45X30X5	1a-p/15	0,000	**-0,42**
S22	CS140 - L45X30X5	1a/2	0,000	**1,04**
S23	CS130 - L45X30X5	3-p/23	0,000	**-6,83**
S23	CS130 - L45X30X5	1a/3	1,450	**3,91**
S24	CS130 - L45X30X5	3/10	0,000	**-9,14**
S24	CS130 - L45X30X5	1a-p/15	1,451	**2,59**
S25	CS131 - L45X5	3/24	0,997	**-13,98**
S25	CS131 - L45X5	1a-p/8	0,000	**-5,81**
S26	CS121 - L80X6	1a/3	0,000	**-39,34**
S26	CS121 - L80X6	5a5/25	2,386	**34,05**
S27	CS121 - L80X6	1a/18	0,000	**-24,80**
S27	CS121 - L80X6	1a-p/4	2,652	**42,66**
S28	CS121 - L80X6	1a/18	0,000	**-25,87**
S28	CS121 - L80X6	1a-p/4	2,386	**46,24**
S29	CS121 - L80X6	1a/3	0,000	**-36,35**
S29	CS121 - L80X6	1a-p/16	2,651	**31,41**
S30	CS123 - L45X5	1a/1	1,268	**-0,26**
S30	CS123 - L45X5	1a-p/16	1,268	**0,17**
S31	CS93 - L(ARC)70x70x5	1a-p/4	0,000	**-31,44**
S31	CS93 - L(ARC)70x70x5	1a/18	2,265	**18,77**
S33	CS4 - L50X40X5	3/10	1,616	**-24,83**
S33	CS4 - L50X40X5	1a-p/15	0,000	**-11,40**
S34	CS93 - L(ARC)70x70x5	1a-p/4	0,000	**-35,15**
S34	CS93 - L(ARC)70x70x5	1a/18	2,366	**20,28**
S35	CS4 - L50X40X5	3/26	0,000	**-22,05**
S35	CS4 - L50X40X5	1a-p/4	1,616	**-9,37**
S36	CS93 - L(ARC)70x70x5	1a-p/16	0,000	**-25,20**
S36	CS93 - L(ARC)70x70x5	1a/3	2,265	**26,96**
S38	CS4 - L50X40X5	1a/1	0,000	**0,00**
S38	CS4 - L50X40X5	1a/27	0,878	**0,00**
S41	CS4 - L50X40X5	1a/9	0,879	**0,00**
S41	CS4 - L50X40X5	1a/18	0,000	**0,00**
S42	CS92 - L50X40X5	1a/18	0,000	**-0,99**
S42	CS92 - L50X40X5	1a/2	2,227	**0,90**
S43	CS4 - L50X40X5	1a/6	0,000	**0,00**
S43	CS4 - L50X40X5	1a/6	0,864	**0,00**
S44	CS92 - L50X40X5	1a/7	0,000	**-0,55**
S44	CS92 - L50X40X5	1a/6	2,231	**1,02**
S46	CS86 - L130X12	1a/9	0,000	**-28,65**
S46	CS86 - L130X12	1a-p/8	0,000	**6,37**
S47	CS86 - L130X12	1a/27	0,000	**-31,63**
S47	CS86 - L130X12	1a-p/28	0,000	**3,26**
S49	CS84 - L(ARC)100x100x6	1a/9	0,000	**-27,24**
S49	CS84 - L(ARC)100x100x6	1a-p/8	2,080	**3,61**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S51	CS88 - L50X40X5	1a/1	0,000	**-1,37**
S51	CS88 - L50X40X5	1a-p/17	2,571	**0,88**
S52	CS88 - L50X40X5	1a-p/17	0,000	**-0,88**
S52	CS88 - L50X40X5	1a/1	1,250	**1,01**
S54	CS37 - HFLeq75x75x8	1a-p/29	0,000	**-1,03**
S54	CS37 - HFLeq75x75x8	3/10	0,000	**7,24**
S55	CS88 - L50X40X5	1a/2	0,000	**-3,33**
S55	CS88 - L50X40X5	1a-p/15	2,571	**1,18**
S56	CS88 - L50X40X5	1a-p/15	1,250	**-1,03**
S56	CS88 - L50X40X5	1a/2	0,000	**2,57**
S61	CS84 - L(ARC)100x100x6	1a/9	0,000	**-27,21**
S61	CS84 - L(ARC)100x100x6	1a-p/8	2,080	**6,27**
S63	CS140 - L45X30X5	1a/27	0,000	**-0,55**
S63	CS140 - L45X30X5	1a-p/28	0,941	**0,45**
S64	CS140 - L45X30X5	1a/9	0,000	**-0,49**
S64	CS140 - L45X30X5	1a-p/8	0,941	**0,38**
S65	CS138 - L45X5	5a4/30	0,000	**-4,23**
S65	CS138 - L45X5	5a3/31	1,862	**5,43**
S66	CS137 - L45X30X5	5a3/31	0,000	**-3,44**
S66	CS137 - L45X30X5	5a4/30	2,018	**2,64**
S67	CS138 - L45X5	5a3/32	0,000	**-3,95**
S67	CS138 - L45X5	5a4/33	1,862	**5,40**
S68	CS137 - L45X30X5	3-p/34	0,000	**-3,55**
S68	CS137 - L45X30X5	5a3/32	2,018	**2,47**
S69	CS136 - L45X5	3/35	0,682	**-0,73**
S69	CS136 - L45X5	3-p/34	0,682	**3,30**
S70	CS135 - L45X30X5	1a/1	0,000	**-3,08**
S70	CS135 - L45X30X5	1a-p/17	2,184	**2,55**
S71	CS134 - L45X5	1a/3	0,000	**-4,08**
S71	CS134 - L45X5	1a/1	2,162	**4,66**
S72	CS135 - L45X30X5	1a/2	0,000	**-3,74**
S72	CS135 - L45X30X5	1a-p/15	2,184	**1,91**
S73	CS134 - L45X5	1a/18	0,000	**-3,27**
S73	CS134 - L45X5	1a/2	2,162	**5,64**
S74	CS140 - L45X30X5	1a/3	1,511	**-1,14**
S74	CS140 - L45X30X5	3-p/34	0,000	**1,66**
S75	CS140 - L45X30X5	3-p/34	0,000	**-0,58**
S75	CS140 - L45X30X5	1a/18	0,336	**0,28**
S76	CS140 - L45X30X5	1a/18	1,501	**-1,69**
S76	CS140 - L45X30X5	1a-p/4	0,000	**0,82**
S77	CS138 - L45X5	1a-p/16	0,000	**-0,23**
S77	CS138 - L45X5	1a/3	0,649	**0,64**
S78	CS139 - L50X40X5	1a/18	1,911	**-1,74**
S78	CS139 - L50X40X5	1a-p/4	0,000	**0,67**
S79	CS140 - L45X30X5	1a-p/4	0,969	**-0,50**
S79	CS140 - L45X30X5	1a/18	0,969	**1,07**
S80	CS140 - L45X30X5	3/35	1,511	**-1,71**
S80	CS140 - L45X30X5	1a-p/16	0,000	**0,69**
S81	CS140 - L45X30X5	3-p/34	0,000	**-0,24**
S81	CS140 - L45X30X5	3/35	0,336	**0,53**
S82	CS140 - L45X30X5	1a/3	1,501	**-1,37**
S82	CS140 - L45X30X5	1a-p/16	0,000	**0,42**
S83	CS138 - L45X5	1a-p/16	0,000	**-0,16**
S83	CS138 - L45X5	1a/3	0,649	**0,61**
S84	CS139 - L50X40X5	1a/3	1,911	**-1,85**
S84	CS139 - L50X40X5	1a-p/16	0,000	**0,71**
S85	CS140 - L45X30X5	1a-p/16	0,969	**-0,35**
S85	CS140 - L45X30X5	1a/3	0,000	**1,00**
S86	CS130 - L45X30X5	1a-p/15	0,000	**-3,39**
S86	CS130 - L45X30X5	1a/2	1,450	**6,49**
S87	CS130 - L45X30X5	1a/3	0,000	**-4,79**
S87	CS130 - L45X30X5	1a-p/16	1,451	**5,16**
S88	CS131 - L45X5	3/24	0,997	**-14,11**
S88	CS131 - L45X5	1a-p/8	0,000	**-5,93**
S89	CS121 - L80X6	1a/2	0,000	**-49,75**
S89	CS121 - L80X6	1a-p/15	2,386	**20,95**
S90	CS121 - L80X6	1a/1	0,001	**-42,87**
S90	CS121 - L80X6	1a-p/17	2,652	**23,76**
S91	CS121 - L80X6	5a11/36	0,000	**-46,69**
S91	CS121 - L80X6	1a-p/17	2,386	**27,20**
S92	CS121 - L80X6	1a/2	0,000	**-48,01**
S92	CS121 - L80X6	1a-p/15	2,651	**18,18**
S93	CS123 - L45X5	1a-p/16	1,268	**-0,17**
S93	CS123 - L45X5	1a/1	1,268	**0,35**
S94	CS128 - L60X6	1a/27	0,000	**-2,84**
S94	CS128 - L60X6	1a-p/28	1,851	**2,60**
S95	CS128 - L60X6	1a/9	0,000	**-2,79**
S95	CS128 - L60X6	1a-p/8	1,849	**2,65**
S96	CS128 - L60X6	1a/27	0,000	**-3,17**
S96	CS128 - L60X6	1a-p/28	1,850	**2,64**
S97	CS128 - L60X6	1a/9	0,000	**-2,85**
S97	CS128 - L60X6	1a-p/8	1,849	**2,96**
S98	CS127 - L50X5	1a/9	0,961	**-1,62**
S98	CS127 - L50X5	1a-p/8	0,000	**1,56**
S99	CS127 - L50X5	1a/27	1,920	**-1,84**
S99	CS127 - L50X5	1a-p/8	0,000	**1,68**
S100	CS24 - LS(CH)100X6	3/10	2,364	**-91,97**
S100	CS24 - LS(CH)100X6	1a-p/29	0,000	**-0,25**
S101	CS146 - L50X40X5	1a-p/29	0,000	**-2,58**
S101	CS146 - L50X40X5	3/10	2,361	**88,21**
S102	CS145 - L(ARC)90x90x6	3/10	2,818	**-66,50**
S102	CS145 - L(ARC)90x90x6	1a-p/29	0,000	**25,06**
S103	CS149 - L50X40X5	1a/9	0,000	**-2,28**
S103	CS149 - L50X40X5	1a-p/8	1,691	**2,10**
S104	CS148 - L50X5	1a-p/8	0,000	**-0,69**
S104	CS148 - L50X5	1a/9	1,306	**2,53**
S105	CS149 - L50X40X5	1a/27	0,000	**-2,27**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S105	CS149 - L50X40X5	1a-p/28	1,691	**2,11**
S106	CS148 - L50X5	1a/9	0,960	**-1,46**
S106	CS148 - L50X5	1a-p/28	0,960	**1,32**
S107	CS24 - LS(CH)100X6	3/10	2,364	**-83,27**
S107	CS24 - LS(CH)100X6	1a-p/29	0,000	**3,99**
S108	CS148 - L50X5	1a-p/28	0,000	**-0,78**
S108	CS148 - L50X5	1a/27	1,306	**2,43**
S109	CS146 - L50X40X5	1a-p/29	0,000	**-6,64**
S109	CS146 - L50X40X5	3/10	2,360	**79,74**
S110	CS145 - L(ARC)90x90x6	1a/6	2,819	**-59,78**
S110	CS145 - L(ARC)90x90x6	1a-p/29	0,000	**28,63**
S111	CS24 - LS(CH)100X6	1a/7	2,363	**-52,85**
S111	CS24 - LS(CH)100X6	3-p/34	0,000	**29,17**
S112	CS146 - L50X40X5	3-p/34	0,000	**-32,00**
S112	CS146 - L50X40X5	1a/7	2,361	**49,31**
S113	CS145 - L(ARC)90x90x6	1a/7	2,819	**-29,55**
S113	CS145 - L(ARC)90x90x6	3-p/34	0,000	**61,63**
S114	CS149 - L50X40X5	1a/9	0,000	**-2,61**
S114	CS149 - L50X40X5	1a-p/8	1,691	**2,44**
S115	CS148 - L50X5	1a-p/8	0,000	**-0,86**
S115	CS148 - L50X5	1a/9	1,306	**2,85**
S116	CS149 - L50X40X5	1a/27	0,000	**-2,63**
S116	CS149 - L50X40X5	1a-p/28	1,691	**2,42**
S117	CS148 - L50X5	1a/27	1,920	**-1,68**
S117	CS148 - L50X5	1a-p/8	0,000	**1,53**
S118	CS24 - LS(CH)100X6	1a/7	2,363	**-53,13**
S118	CS24 - LS(CH)100X6	1a-p/12	0,000	**25,91**
S119	CS148 - L50X5	1a-p/28	0,000	**-0,90**
S119	CS148 - L50X5	1a/27	1,306	**2,80**
S120	CS146 - L50X40X5	1a-p/12	0,000	**-28,74**
S120	CS146 - L50X40X5	1a/7	2,361	**49,73**
S121	CS148 - L50X5	1a-p/8	1,306	**-0,99**
S121	CS148 - L50X5	1a/9	0,000	**3,18**
S122	CS149 - L50X40X5	1a/9	0,000	**-2,83**
S122	CS149 - L50X40X5	1a-p/8	1,691	**2,64**
S123	CS149 - L50X40X5	1a/27	0,000	**-2,83**
S123	CS149 - L50X40X5	1a-p/28	1,691	**2,64**
S124	CS148 - L50X5	1a/27	1,920	**-1,83**
S124	CS148 - L50X5	1a-p/8	0,000	**1,64**
S125	CS148 - L50X5	1a-p/28	1,306	**-1,06**
S125	CS148 - L50X5	1a/27	0,000	**3,10**
S126	CS145 - L(ARC)90x90x6	1a/7	2,819	**-32,99**
S126	CS145 - L(ARC)90x90x6	1a-p/12	0,000	**55,41**
S127	CS97 - L100X8	1a-p/29	0,000	**-40,99**
S127	CS97 - L100X8	3/10	0,000	**185,10**
S129	CS132 - L50X40X5	1a-p/17	1,213	**29,58**
S129	CS132 - L50X40X5	3/37	0,000	**57,78**
S130	CS147 - L50X40X5	3-p/38	2,880	**30,74**
S130	CS147 - L50X40X5	3/10	0,000	**57,75**
S131	CS126 - L(ARC)80x80x6	1a/7	1,541	**-78,35**
S131	CS126 - L(ARC)80x80x6	3-p/34	0,000	**124,84**
S132	CS126 - L(ARC)80x80x6	1a/7	1,541	**-82,04**
S132	CS126 - L(ARC)80x80x6	1a-p/12	0,000	**113,76**
S133	CS7 - L45X30X5	1a/7	0,799	**-0,14**
S133	CS7 - L45X30X5	1a-p/12	0,000	**0,25**
S134	CS7 - L45X30X5	1a-p/29	0,800	**-0,08**
S134	CS7 - L45X30X5	1a/6	0,000	**0,20**
S135	CS96 - L120X80X8	1a/6	0,000	**-131,28**
S135	CS96 - L120X80X8	1a-p/29	4,098	**44,99**
S136	CS122 - L50X40X5	1a-p/12	2,179	**-0,52**
S136	CS122 - L50X40X5	1a/7	0,000	**0,81**
S137	CS132 - L50X40X5	1a-p/15	1,213	**27,35**
S137	CS132 - L50X40X5	3/39	0,000	**53,30**
S138	CS147 - L50X40X5	1a-p/29	2,880	**28,52**
S138	CS147 - L50X40X5	3/37	0,000	**53,13**
S139	CS125 - L(ARC)75x75x6	1a-p/12	0,000	**-92,99**
S139	CS125 - L(ARC)75x75x6	1a/7	1,506	**61,65**
S140	CS96 - L120X80X8	1a/6	0,000	**-125,95**
S140	CS96 - L120X80X8	1a-p/29	4,099	**51,09**
S141	CS125 - L(ARC)75x75x6	1a-p/12	0,000	**-102,04**
S141	CS125 - L(ARC)75x75x6	1a/7	1,506	**51,89**
S142	CS132 - L50X40X5	1a-p/4	1,213	**29,42**
S142	CS132 - L50X40X5	3/26	0,000	**57,82**
S143	CS147 - L50X40X5	1b-p/40	2,880	**30,71**
S143	CS147 - L50X40X5	3/35	0,000	**57,71**
S144	CS126 - L(ARC)80x80x6	3/10	1,541	**-162,25**
S144	CS126 - L(ARC)80x80x6	1a-p/29	0,000	**43,52**
S145	CS126 - L(ARC)80x80x6	3/10	1,541	**-144,34**
S145	CS126 - L(ARC)80x80x6	1a-p/29	0,000	**53,89**
S146	CS7 - L45X30X5	3/10	0,000	**-0,29**
S146	CS7 - L45X30X5	1a-p/29	0,800	**0,12**
S147	CS7 - L45X30X5	1a/6	0,800	**-0,29**
S147	CS7 - L45X30X5	1a-p/29	0,000	**0,10**
S148	CS96 - L120X80X8	1a/7	0,000	**-68,34**
S148	CS96 - L120X80X8	1a-p/12	4,098	**107,67**
S149	CS122 - L50X40X5	1a-p/29	2,179	**-0,15**
S149	CS122 - L50X40X5	3/10	0,000	**1,43**
S150	CS122 - L50X40X5	1a-p/29	2,179	**-0,34**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S150	CS122 - L50X40X5	3/10	0,000	**1,98**
S151	CS132 - L50X40X5	1a-p/16	1,213	**27,33**
S151	CS132 - L50X40X5	3/41	0,000	**53,27**
S152	CS147 - L50X40X5	3-p/34	2,880	**28,52**
S152	CS147 - L50X40X5	3/26	0,000	**53,14**
S153	CS125 - L(ARC)75x75x6	1a-p/29	0,000	**-47,07**
S153	CS125 - L(ARC)75x75x6	1a/6	1,506	**107,08**
S154	CS96 - L120X80X8	1a/7	0,001	**-70,82**
S154	CS96 - L120X80X8	1a-p/12	4,099	**105,20**
S155	CS125 - L(ARC)75x75x6	1a-p/29	0,000	**-43,62**
S155	CS125 - L(ARC)75x75x6	1a/6	1,506	**109,74**
S156	CS93 - L(ARC)70x70x5	1a-p/17	0,000	**-19,08**
S156	CS93 - L(ARC)70x70x5	1a/1	2,264	**31,00**
S159	CS120 - ISEA130/130/10	1a-p/17	0,000	**74,22**
S159	CS120 - ISEA130/130/10	3/10	0,888	**141,86**
S160	CS120 - ISEA130/130/10	1a-p/4	0,000	**72,20**
S160	CS120 - ISEA130/130/10	3/35	0,888	**141,27**
S161	CS151 - HFLeq130x130x12	1a-p/29	0,000	**-95,12**
S161	CS151 - HFLeq130x130x12	1a/6	0,000	**377,65**
S162	CS155 - HFLue120x80x8	1a/6	0,000	**-289,16**
S162	CS155 - HFLue120x80x8	1a-p/29	1,544	**117,40**
S164	CS155 - HFLue120x80x8	1a/7	0,000	**-167,21**
S164	CS155 - HFLue120x80x8	1a-p/12	1,544	**239,53**
S166	CS120 - ISEA130/130/10	1a-p/15	0,888	**69,75**
S166	CS120 - ISEA130/130/10	3/10	0,000	**135,01**
S167	CS150 - L(ARC)55x55x5	5a6/42	0,000	**-16,53**
S167	CS150 - L(ARC)55x55x5	5a5/43	0,000	**12,56**
S168	CS148 - L50X5	5a5/43	0,000	**-6,54**
S168	CS148 - L50X5	5a6/42	0,000	**8,44**
S169	CS150 - L(ARC)55x55x5	5a5/25	0,000	**-17,90**
S169	CS150 - L(ARC)55x55x5	5a6/44	0,000	**10,72**
S170	CS148 - L50X5	5a6/44	0,000	**-5,59**
S170	CS148 - L50X5	5a5/25	0,000	**9,14**
S171	CS101 - UNP120	5a5/45	0,000	**-64,11**
S171	CS101 - UNP120	5a6/44	0,000	**8,45**
S172	CS101 - UNP120	5a6/46	0,000	**-68,67**
S172	CS101 - UNP120	5a5/47	0,000	**8,10**
S173	CS30 - UNP140	3-p/34	0,000	**-4,85**
S173	CS30 - UNP140	1a/7	0,641	**0,59**
S175	CS148 - L50X5	4-p/48	0,000	**8,73**
S175	CS148 - L50X5	3/10	0,000	**38,89**
S177	CS82 - L130X12	1a/2	0,000	**-562,61**
S177	CS82 - L130X12	1a-p/15	4,280	**173,68**
S178	CS15 - HFLeq60x60x5	5a7/49	0,000	**-9,44**
S178	CS15 - HFLeq60x60x5	5a9/50	3,046	**5,11**
S179	CS15 - HFLeq60x60x5	5a8/51	0,000	**-5,89**
S179	CS15 - HFLeq60x60x5	5a10/52	0,000	**8,56**
S180	CS150 - L(ARC)55x55x5	5a7/53	0,000	**-9,67**
S180	CS150 - L(ARC)55x55x5	5a8/54	1,781	**13,31**
S181	CS150 - L(ARC)55x55x5	5a8/55	2,078	**-13,25**
S181	CS150 - L(ARC)55x55x5	5a7/56	0,000	**9,63**
S182	CS15 - HFLeq60x60x5	5a7/56	0,000	**-10,62**
S182	CS15 - HFLeq60x60x5	5a8/55	0,584	**14,41**
S183	CS15 - HFLeq60x60x5	5a8/55	0,000	**-13,78**
S183	CS15 - HFLeq60x60x5	5a7/56	0,000	**9,47**
S184	CS15 - HFLeq60x60x5	5a8/54	0,000	**-14,66**
S184	CS15 - HFLeq60x60x5	5a7/53	0,000	**10,51**
S185	CS15 - HFLeq60x60x5	5a7/53	0,000	**-10,14**
S185	CS15 - HFLeq60x60x5	5a8/54	0,598	**13,17**
S186	CS149 - L50X40X5	5a10/52	0,649	**-48,46**
S186	CS149 - L50X40X5	5a9/50	0,000	**4,69**
S187	CS149 - L50X40X5	5a9/50	0,000	**-45,06**
S187	CS149 - L50X40X5	5a10/52	0,649	**7,95**
S188	CS30 - UNP140	1b/57	0,000	**21,47**
S188	CS30 - UNP140	5a9/50	0,000	**40,94**
S189	CS30 - UNP140	1b/58	1,081	**20,99**
S189	CS30 - UNP140	5a10/52	0,360	**47,94**
S190	CS150 - L(ARC)55x55x5	5a12/59	0,000	**-19,18**
S190	CS150 - L(ARC)55x55x5	5a11/60	0,000	**8,37**
S191	CS148 - L50X5	5a11/61	0,958	**-4,39**
S191	CS148 - L50X5	5a12/62	0,000	**9,86**
S192	CS150 - L(ARC)55x55x5	5a11/36	0,000	**-17,12**
S192	CS150 - L(ARC)55x55x5	5a12/63	0,000	**10,95**
S193	CS148 - L50X5	5a12/64	0,000	**-5,69**
S193	CS148 - L50X5	5a11/65	1,277	**8,75**
S194	CS101 - UNP120	5a11/66	0,000	**-77,28**
S194	CS101 - UNP120	5a12/64	0,000	**-1,80**
S195	CS101 - UNP120	5a12/67	0,000	**-69,95**
S195	CS101 - UNP120	5a11/60	0,000	**1,36**
S196	CS30 - UNP140	3-p/11	0,000	**-3,08**
S196	CS30 - UNP140	3/10	0,641	**2,23**
S198	CS150 - L(ARC)55x55x5	5a9/68	0,000	**-11,56**
S198	CS150 - L(ARC)55x55x5	5a10/69	0,000	**11,74**
S199	CS150 - L(ARC)55x55x5	5a10/69	0,000	**-8,98**
S199	CS150 - L(ARC)55x55x5	5a9/68	0,000	**14,41**
S200	CS15 - HFLeq60x60x5	5a9/70	0,000	**-15,74**
S200	CS15 - HFLeq60x60x5	5a10/71	1,463	**9,82**
S201	CS15 - HFLeq60x60x5	5a10/71	0,000	**-9,53**

Staaf	css	BG	dx [m]	N [kN]
S201	CS15 - HFLeq60x60x5	5a9/70	0,000	**14,19**
S202	CS15 - HFLeq60x60x5	5a10/71	2,924	**-12,78**
S202	CS15 - HFLeq60x60x5	5a9/70	0,000	**12,69**
S203	CS15 - HFLeq60x60x5	5a9/70	0,000	**-12,18**
S203	CS15 - HFLeq60x60x5	5a10/71	0,000	**11,43**
S204	CS149 - L50X40X5	5a8/51	0,647	**-45,62**
S204	CS149 - L50X40X5	5a7/49	0,000	**7,85**
S205	CS149 - L50X40X5	5a7/49	0,000	**-48,09**
S205	CS149 - L50X40X5	5a8/51	0,647	**5,07**
S206	CS15 - HFLeq60x60x5	5a9/50	0,000	**-5,78**
S206	CS15 - HFLeq60x60x5	5a7/49	2,437	**8,77**
S207	CS15 - HFLeq60x60x5	5a10/52	0,000	**-9,22**
S207	CS15 - HFLeq60x60x5	5a8/51	0,000	**5,23**
S208	CS30 - UNP140	1b/72	0,000	**21,04**
S208	CS30 - UNP140	5a8/73	0,000	**40,25**
S209	CS30 - UNP140	1b/74	0,000	**21,11**
S209	CS30 - UNP140	5a7/49	1,081	**47,62**
S210	CS101 - UNP120	1a/7	0,000	**-61,99**
S210	CS101 - UNP120	3-p/34	0,000	**88,53**
S211	CS129 - L(ARC)65x65x6	1a-p/29	0,000	**0,80**
S211	CS129 - L(ARC)65x65x6	3/10	0,000	**23,84**
S212	CS129 - L(ARC)65x65x6	1a-p/12	0,000	**-5,48**
S212	CS129 - L(ARC)65x65x6	3/35	0,309	**16,11**
S213	CS101 - UNP120	1a/7	0,000	**-71,84**
S213	CS101 - UNP120	3-p/34	0,000	**73,11**
S214	CS156 - L50X5	1a/9	0,000	**-2,50**
S214	CS156 - L50X5	1a-p/8	2,305	**2,39**
S215	CS156 - L50X5	1a/9	0,000	**-2,72**
S215	CS156 - L50X5	1a-p/8	2,305	**2,46**
S216	CS156 - L50X5	1a/27	2,369	**-0,10**
S216	CS156 - L50X5	1a/27	0,000	**0,06**
S217	CS158 - L50X40X5	1a/27	1,587	**-0,28**
S217	CS158 - L50X40X5	1a-p/28	0,000	**0,08**
S218	CS158 - L50X40X5	1a/9	1,600	**-0,24**
S218	CS158 - L50X40X5	1a-p/8	0,000	**0,11**
S219	CS156 - L50X5	1a/27	0,000	**-2,71**
S219	CS156 - L50X5	1a-p/28	2,305	**2,20**
S220	CS156 - L50X5	1a/27	0,000	**-2,75**
S220	CS156 - L50X5	1a-p/28	2,305	**2,37**
S221	CS156 - L50X5	1a/27	1,614	**-2,14**
S221	CS156 - L50X5	1a-p/8	0,000	**1,70**
S222	CS156 - L50X5	1a/9	0,000	**-2,11**
S222	CS156 - L50X5	1a-p/8	0,000	**1,87**
S223	CS156 - L50X5	1a/9	0,000	**-0,09**
S223	CS156 - L50X5	1a/9	2,369	**0,07**
S224	CS154 - L(ARC)100x100x8	1a-p/29	2,376	**-92,25**
S224	CS154 - L(ARC)100x100x8	1a/6	0,000	**207,26**
S225	CS153 - L(ARC)120x120x8	1a/6	0,000	**-208,19**
S225	CS153 - L(ARC)120x120x8	1a-p/29	2,373	**87,50**

Staaf	css	BG	dx [m]	N [kN]
S226	CS154 - L(ARC)100x100x8	1a-p/12	2,376	**-186,79**
S226	CS154 - L(ARC)100x100x8	1a/7	0,000	**112,91**
S227	CS153 - L(ARC)120x120x8	1a/7	0,000	**-115,30**
S227	CS153 - L(ARC)120x120x8	1a-p/12	2,373	**180,24**
S228	CS40 - L65X50X5	1a-p/15	2,700	**48,89**
S228	CS40 - L65X50X5	3/10	0,000	**91,05**
S229	CS157 - L45X5	3/37	0,983	**-0,46**
S229	CS157 - L45X5	1a-p/17	0,000	**-0,29**
S231	CS40 - L65X50X5	1a-p/16	7,611	**48,70**
S231	CS40 - L65X50X5	3/35	0,000	**90,97**
S232	CS158 - L50X40X5	1a-p/17	2,810	**24,86**
S232	CS158 - L50X40X5	3/37	0,000	**45,27**
S233	CS157 - L45X5	1a/1	0,983	**-0,45**
S233	CS157 - L45X5	1a-p/17	0,000	**-0,25**
S235	CS40 - L65X50X5	1a-p/17	7,611	**46,26**
S235	CS40 - L65X50X5	3/37	0,000	**85,73**
S236	CS158 - L50X40X5	1a-p/16	2,811	**23,01**
S236	CS158 - L50X40X5	3/41	0,000	**41,41**
S237	CS157 - L45X5	3/39	0,983	**-0,46**
S237	CS157 - L45X5	1a-p/15	0,000	**-0,29**
S239	CS154 - L(ARC)100x100x8	1a-p/29	2,376	**-96,27**
S239	CS154 - L(ARC)100x100x8	1a/6	0,000	**204,77**
S240	CS153 - L(ARC)120x120x8	1a/6	0,000	**-204,59**
S240	CS153 - L(ARC)120x120x8	1a-p/29	2,373	**90,60**
S241	CS154 - L(ARC)100x100x8	1a-p/12	2,376	**-186,15**
S241	CS154 - L(ARC)100x100x8	1a/7	0,000	**115,01**
S242	CS153 - L(ARC)120x120x8	1a/7	0,000	**-116,86**
S242	CS153 - L(ARC)120x120x8	1a-p/12	2,373	**178,13**
S243	CS93 - L(ARC)70x70x5	1a-p/15	0,000	**-15,47**
S243	CS93 - L(ARC)70x70x5	1a/2	2,366	**38,05**
S244	CS4 - L50X40X5	3/39	1,616	**-24,67**
S244	CS4 - L50X40X5	1a-p/28	0,000	**-11,12**
S245	CS93 - L(ARC)70x70x5	1a-p/17	0,000	**-18,97**
S245	CS93 - L(ARC)70x70x5	1a/1	2,366	**30,49**
S247	CS4 - L50X40X5	1a/27	0,879	**0,00**
S247	CS4 - L50X40X5	1a/6	0,000	**0,00**
S248	CS92 - L50X40X5	1a/6	0,000	**-0,83**
S248	CS92 - L50X40X5	1a/18	2,227	**0,54**
S249	CS88 - L50X40X5	1a/18	0,000	**-1,85**
S249	CS88 - L50X40X5	1a-p/4	2,571	**2,59**
S250	CS88 - L50X40X5	1a-p/4	1,250	**-2,19**
S250	CS88 - L50X40X5	1a/18	0,000	**1,35**
S252	CS161 - L120X80X8	1a/27	0,000	**-64,88**
S252	CS161 - L120X80X8	1a-p/28	4,747	**55,35**
S253	CS40 - L65X50X5	1a-p/12	7,611	**46,24**
S253	CS40 - L65X50X5	3/26	0,000	**85,68**
S254	CS158 - L50X40X5	1a-p/15	2,810	**23,04**
S254	CS158 - L50X40X5	3/39	0,000	**41,42**
S255	CS157 - L45X5	1a/2	0,983	**-0,46**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S255	CS157 - L45X5	1a-p/15	0,000	**-0,26**
S257	CS4 - L50X40X5	3/35	0,000	**-21,65**
S257	CS4 - L50X40X5	1a-p/4	1,616	**-9,14**
S258	CS120 - ISEA130/130/10	1a-p/16	0,888	**68,60**
S258	CS120 - ISEA130/130/10	3/35	0,000	**130,38**
S260	CS4 - L50X40X5	1a/3	0,000	**0,00**
S260	CS4 - L50X40X5	1a/9	0,879	**0,00**
S263	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,63**
S263	CS95 - L(ARC)75x75x6	5a17/76	0,000	**5,37**
S264	CS95 - L(ARC)75x75x6	5a13/77	0,000	**-5,63**
S264	CS95 - L(ARC)75x75x6	5a21/75	0,000	**14,18**
S265	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,06**
S265	CS95 - L(ARC)75x75x6	5a17/76	0,000	**5,26**
S266	CS95 - L(ARC)75x75x6	5a22/78	0,000	**-11,16**
S266	CS95 - L(ARC)75x75x6	5a21/75	0,000	**10,71**
S267	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-10,87**
S267	CS95 - L(ARC)75x75x6	5a13/77	0,000	**8,94**
S268	CS43 - L(ARC)75x75x6	1a/2	3,214	**-3,10**
S268	CS43 - L(ARC)75x75x6	1a-p/15	1,753	**2,78**
S270	CS36 - ISEA70/70/5	1a-p/28	0,000	**-7,21**
S270	CS36 - ISEA70/70/5	1a/27	0,000	**50,58**
S273	CS159 - L(ARC)55x55x5	5a13/77	0,000	**-18,82**
S273	CS159 - L(ARC)55x55x5	5a14/79	0,000	**13,56**
S274	CS159 - L(ARC)55x55x5	5a13/80	0,000	**-8,81**
S274	CS159 - L(ARC)55x55x5	5a14/81	0,625	**10,16**
S275	CS159 - L(ARC)55x55x5	5a13/77	0,000	**-8,05**
S275	CS159 - L(ARC)55x55x5	5a14/82	0,000	**5,11**
S278	CS159 - L(ARC)55x55x5	5a14/81	0,000	**-17,74**
S278	CS159 - L(ARC)55x55x5	5a13/80	0,000	**14,88**
S279	CS159 - L(ARC)55x55x5	5a14/79	0,000	**-8,03**
S279	CS159 - L(ARC)55x55x5	5a13/77	0,000	**10,80**
S280	CS159 - L(ARC)55x55x5	5a14/81	0,000	**-7,61**
S280	CS159 - L(ARC)55x55x5	5a13/83	0,000	**5,64**
S282	CS152 - UNP140	5a6/84	0,000	**-14,22**
S282	CS152 - UNP140	1b/57	0,000	**-4,52**
S283	CS152 - UNP140	1b-p/85	0,000	**23,25**
S283	CS152 - UNP140	5a14/86	0,000	**43,22**
S284	CS94 - L50X5	5a14/81	0,695	**-40,28**
S284	CS94 - L50X5	5a15/87	0,000	**8,36**
S285	CS94 - L50X5	5a13/77	0,000	**-40,79**
S285	CS94 - L50X5	5a16/88	0,695	**7,22**
S286	CS152 - UNP140	1b-p/40	1,317	**22,79**
S286	CS152 - UNP140	5a13/77	0,000	**46,56**
S287	CS43 - L(ARC)75x75x6	5a14/89	3,013	**-0,78**
S287	CS43 - L(ARC)75x75x6	1b/57	0,000	**-0,26**

Staaf	css	BG	dx [m]	N [kN]
S288	CS95 - L(ARC)75x75x6	5a16/88	0,000	**-14,80**
S288	CS95 - L(ARC)75x75x6	5a15/90	0,000	**16,56**
S289	CS144 - UNP160	5a14/86	1,462	**-137,41**
S289	CS144 - UNP160	5a13/91	2,943	**30,02**
S290	CS95 - L(ARC)75x75x6	1a/3	0,000	**-6,81**
S290	CS95 - L(ARC)75x75x6	5a21/75	1,535	**16,25**
S291	CS95 - L(ARC)75x75x6	5a17/92	2,542	**-10,43**
S291	CS95 - L(ARC)75x75x6	5a13/77	0,000	**11,41**
S292	CS95 - L(ARC)75x75x6	5a22/78	0,000	**-11,19**
S292	CS95 - L(ARC)75x75x6	5a17/92	1,436	**9,01**
S293	CS4 - L50X40X5	5a21/75	0,000	**-9,95**
S293	CS4 - L50X40X5	1a/7	0,000	**0,68**
S294	CS4 - L50X40X5	5a22/78	0,000	**-38,73**
S294	CS4 - L50X40X5	5a21/75	0,560	**12,38**
S295	CS144 - UNP160	5a22/93	1,462	**-136,23**
S295	CS144 - UNP160	5a21/94	2,942	**21,97**
S296	CS158 - L50X40X5	1a/27	1,587	**-0,26**
S296	CS158 - L50X40X5	1a-p/28	0,000	**0,10**
S297	CS158 - L50X40X5	1a/9	1,600	**-0,31**
S297	CS158 - L50X40X5	1a-p/8	0,000	**0,07**
S298	CS36 - ISEA70/70/5	1a-p/4	1,753	**-20,29**
S298	CS36 - ISEA70/70/5	1a/3	0,000	**42,35**
S299	CS44 - UNP160	1b/57	0,000	**21,64**
S299	CS44 - UNP160	5a21/75	1,753	**58,93**
S300	CS93 - L(ARC)70x70x5	1a-p/15	0,000	**-14,97**
S300	CS93 - L(ARC)70x70x5	1a/2	2,264	**32,75**
S301	CS92 - L50X40X5	1a/6	0,000	**-0,83**
S301	CS92 - L50X40X5	1a/3	2,227	**0,54**
S302	CS159 - L(ARC)55x55x5	5a22/95	0,000	**-19,36**
S302	CS159 - L(ARC)55x55x5	5a21/96	0,000	**12,18**
S303	CS159 - L(ARC)55x55x5	5a22/97	0,000	**-8,55**
S303	CS159 - L(ARC)55x55x5	5a21/98	0,000	**9,87**
S304	CS159 - L(ARC)55x55x5	5a22/99	0,000	**-8,22**
S304	CS159 - L(ARC)55x55x5	5a21/100	0,000	**4,58**
S307	CS159 - L(ARC)55x55x5	5a21/98	0,000	**-17,32**
S307	CS159 - L(ARC)55x55x5	5a22/97	0,000	**14,46**
S308	CS159 - L(ARC)55x55x5	5a21/96	0,000	**-7,22**
S308	CS159 - L(ARC)55x55x5	5a22/95	0,313	**11,06**
S309	CS159 - L(ARC)55x55x5	5a21/14	0,000	**-7,40**
S309	CS159 - L(ARC)55x55x5	5a22/101	0,860	**5,49**
S311	CS152 - UNP140	5a14/102	0,000	**-12,95**
S311	CS152 - UNP140	1b/72	0,000	**-3,82**
S312	CS152 - UNP140	1b-p/103	0,000	**22,79**
S312	CS152 - UNP140	5a14/89	0,299	**42,28**
S313	CS94 - L50X5	5a21/104	0,695	**-39,17**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S313	CS94 - L50X5	5a20/105	0,000	**8,43**
S314	CS94 - L50X5	5a22/95	0,000	**-40,03**
S314	CS94 - L50X5	5a19/106	0,695	**6,60**
S315	CS152 - UNP140	1b-p/107	1,317	**24,52**
S315	CS152 - UNP140	5a22/108	0,000	**50,47**
S316	CS43 - L(ARC)75x75x6	5a21/14	1,506	**-0,83**
S316	CS43 - L(ARC)75x75x6	1b/72	1,506	**-0,27**
S317	CS95 - L(ARC)75x75x6	5a19/109	0,000	**-19,15**
S317	CS95 - L(ARC)75x75x6	5a20/110	0,000	**11,33**
S318	CS95 - L(ARC)75x75x6	5a21/75	1,842	**-9,82**
S318	CS95 - L(ARC)75x75x6	5a22/78	0,000	**11,49**
S319	CS95 - L(ARC)75x75x6	5a18/111	0,000	**-6,16**
S319	CS95 - L(ARC)75x75x6	5a21/75	0,953	**16,16**
S320	CS95 - L(ARC)75x75x6	5a21/75	0,000	**-16,00**
S320	CS95 - L(ARC)75x75x6	5a18/111	0,000	**4,74**
S321	CS43 - L(ARC)75x75x6	1a/3	0,000	**-2,13**
S321	CS43 - L(ARC)75x75x6	1a-p/16	1,169	**2,34**
S322	CS4 - L50X40X5	5a13/77	0,000	**-7,46**
S322	CS4 - L50X40X5	5a21/75	0,000	**2,41**
S323	CS4 - L50X40X5	5a21/75	0,000	**-40,78**
S323	CS4 - L50X40X5	5a13/77	0,841	**9,83**
S324	CS44 - UNP160	1b/72	1,753	**18,77**
S324	CS44 - UNP160	5a21/75	0,000	**41,99**
S328	CS155 - HFLue120x80x8	1a/6	0,000	**-288,48**
S328	CS155 - HFLue120x80x8	1a-p/29	1,544	**120,53**
S330	CS4 - L50X40X5	1a-p/12	0,864	**0,00**
S330	CS4 - L50X40X5	1a/7	0,000	**0,00**
S331	CS92 - L50X40X5	1a/7	0,000	**-0,55**
S331	CS92 - L50X40X5	1a/6	2,231	**1,02**
S333	CS88 - L50X40X5	1a/3	0,000	**-1,36**
S333	CS88 - L50X40X5	1a-p/16	2,571	**0,83**
S334	CS88 - L50X40X5	1a-p/16	1,250	**-0,82**
S334	CS88 - L50X40X5	1a/3	0,000	**1,02**
S336	CS84 - L(ARC)100x100x6	1a/27	0,000	**-28,66**
S336	CS84 - L(ARC)100x100x6	1a-p/28	2,080	**2,10**
S340	CS144 - UNP160	5a21/104	1,462	**-152,70**
S340	CS144 - UNP160	5a22/112	2,942	**20,53**
S343	CS12 - L50X5	4-p/113	0,000	**8,48**
S343	CS12 - L50X5	3/35	0,000	**37,80**
C1	CS172 - 2LX	1a/2	0,000	**-1139,02**
C1	CS172 - 2LX	1a-p/15	10,951	**477,55**
C2	CS172 - 2LX	1a/3	0,000	**-814,67**
C2	CS172 - 2LX	1a-p/16	10,951	**798,95**
C4	CS172 - 2LX	1a/1	0,000	**-1022,61**
C4	CS172 - 2LX	1a-p/17	10,951	**591,32**
C3	CS172 - 2LX	1a/18	0,000	**-701,23**
C3	CS172 - 2LX	1a-p/4	10,951	**915,65**
B9	CS3 - HFLue180x90x10	1a/7	0,000	**-30,26**
B9	CS3 - HFLue180x90x10	3-p/23	12,292	**93,56**
B14	CS3 - HFLue180x90x10	5a5/114	0,000	**-31,45**
B14	CS3 - HFLue180x90x10	5a6/115	12,292	**39,21**
B16	CS3 - HFLue180x90x10	1a/7	0,000	**-38,50**

Staaf	css	BG	dx [m]	N [kN]
B16	CS3 - HFLue180x90x10	3-p/23	12,292	**83,05**
B18	CS3 - HFLue180x90x10	5a11/116	0,000	**-40,37**
B18	CS3 - HFLue180x90x10	5a12/117	12,292	**30,22**
SB2	CS4 - L50X40X5	1a-p/4	0,000	**0,00**
SB2	CS4 - L50X40X5	3/118	0,760	**0,00**
SB18	CS4 - L50X40X5	1a-p/4	0,000	**0,00**
SB18	CS4 - L50X40X5	3/118	1,520	**0,00**
SB34	CS102 - L50X5	1a-p/4	0,000	**0,00**
SB34	CS102 - L50X5	3/118	2,280	**0,00**
SB1	CS4 - L50X40X5	1a/27	0,760	**0,00**
SB1	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB17	CS4 - L50X40X5	1a/27	1,520	**0,00**
SB17	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB33	CS102 - L50X5	1a/27	2,280	**0,00**
SB33	CS102 - L50X5	1a/18	0,000	**0,00**
SB4	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB4	CS4 - L50X40X5	3/118	2,169	**0,00**
SB20	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB20	CS4 - L50X40X5	3/118	2,402	**0,00**
SB36	CS60 - L50X5	1a/2	0,000	**-0,11**
SB36	CS60 - L50X5	3/118	3,371	**0,00**
SB3	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB3	CS4 - L50X40X5	1a-p/28	2,169	**0,00**
SB19	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB19	CS4 - L50X40X5	1a/27	2,402	**0,00**
SB35	CS60 - L50X5	1a/2	0,000	**-0,11**
SB35	CS60 - L50X5	1a/27	3,371	**0,00**
B89	CS3 - HFLue180x90x10	3/118	0,000	**-101,41**
B89	CS3 - HFLue180x90x10	1a-p/29	12,292	**21,91**
B90	CS3 - HFLue180x90x10	5a6/119	0,000	**-46,00**
B90	CS3 - HFLue180x90x10	5a5/43	12,292	**24,40**
B91	CS3 - HFLue180x90x10	3/118	0,000	**-89,55**
B91	CS3 - HFLue180x90x10	1a-p/29	12,292	**32,57**
B92	CS3 - HFLue180x90x10	5a12/120	0,000	**-30,43**
B92	CS3 - HFLue180x90x10	5a11/121	12,292	**40,41**
C5	CS173 - 2LX	1a/2	0,000	**-1085,93**
C5	CS173 - 2LX	1a-p/15	3,374	**463,06**
C6	CS173 - 2LX	1a/3	0,000	**-773,55**
C6	CS173 - 2LX	1a-p/16	3,374	**772,61**
C7	CS173 - 2LX	1a/1	0,000	**-973,82**
C7	CS173 - 2LX	1a-p/17	3,374	**572,64**
C8	CS173 - 2LX	1a/18	0,000	**-664,29**
C8	CS173 - 2LX	1a-p/4	3,374	**885,01**
B8	CS100 - L100X75X7	1a-p/12	0,000	**-74,43**
B8	CS100 - L100X75X7	1a/7	4,916	**58,47**
B10	CS100 - L100X75X7	1a-p/8	0,000	**-52,54**
B10	CS100 - L100X75X7	1a/9	4,916	**53,63**
B12	CS100 - L100X75X7	1a-p/12	0,000	**-79,14**
B12	CS100 - L100X75X7	1a/7	4,916	**52,85**
B93	CS100 - L100X75X7	1a-p/8	0,000	**-54,44**
B93	CS100 - L100X75X7	1a/9	4,916	**51,83**
SB49	CS63 - L50X40X5	1a/2	0,000	**0,00**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
SB49	CS63 - L50X40X5	1a-p/15	0,000	**0,00**
SB50	CS65 - L50X40X5	1a/2	0,000	**-0,08**
SB50	CS65 - L50X40X5	1a/2	2,621	**0,00**
SB51	CS63 - L50X40X5	1a/3	0,000	**0,00**
SB51	CS63 - L50X40X5	1a/3	1,900	**0,00**
SB52	CS65 - L50X40X5	1a/3	0,000	**-0,08**
SB52	CS65 - L50X40X5	1a/3	2,621	**0,00**
SB53	CS63 - L50X40X5	1a/3	1,900	**0,00**
SB53	CS63 - L50X40X5	1a-p/16	1,267	**0,00**
SB54	CS65 - L50X40X5	1a/3	0,000	**-0,08**
SB54	CS65 - L50X40X5	1a/3	2,621	**0,00**
SB55	CS63 - L50X40X5	1a/18	0,000	**0,00**
SB55	CS63 - L50X40X5	1a-p/15	1,583	**0,00**
SB56	CS65 - L50X40X5	1a/18	0,000	**-0,08**
SB56	CS65 - L50X40X5	1a/18	2,621	**0,00**
SB57	CS63 - L50X40X5	1a/18	1,583	**0,00**
SB57	CS63 - L50X40X5	1a-p/4	0,000	**0,00**
SB58	CS65 - L50X40X5	1a/18	0,000	**-0,08**
SB58	CS65 - L50X40X5	1a/18	2,621	**0,00**
SB59	CS63 - L50X40X5	1a/1	0,000	**0,00**
SB59	CS63 - L50X40X5	5a21/122	1,583	**0,00**
SB60	CS65 - L50X40X5	1a/1	0,000	**-0,08**
SB60	CS65 - L50X40X5	1a/1	2,621	**0,00**
SB61	CS63 - L50X40X5	1a/1	1,267	**0,00**
SB61	CS63 - L50X40X5	1a-p/17	0,000	**0,00**
SB62	CS65 - L50X40X5	1a/1	0,000	**-0,08**
SB62	CS65 - L50X40X5	1a/1	2,621	**0,00**
SB63	CS63 - L50X40X5	1a/2	0,000	**0,00**
SB63	CS63 - L50X40X5	1a/2	1,900	**0,00**
SB64	CS65 - L50X40X5	1a/2	0,000	**-0,08**
SB64	CS65 - L50X40X5	1a/2	2,621	**0,00**
B31	CS100 - L100X75X7	1a-p/28	0,000	**-52,28**
B31	CS100 - L100X75X7	1a/27	4,916	**54,17**
B32	CS100 - L100X75X7	1a-p/29	0,000	**-50,61**
B32	CS100 - L100X75X7	1a/6	4,916	**81,09**
B33	CS100 - L100X75X7	1a-p/28	0,000	**-43,48**
B33	CS100 - L100X75X7	1a/27	4,916	**62,69**
B34	CS100 - L100X75X7	1a-p/29	0,000	**-59,17**
B34	CS100 - L100X75X7	1a/6	4,916	**74,00**
C9	CS174 - 2LX	1a/2	0,000	**-923,04**
C9	CS174 - 2LX	1a-p/15	6,648	**366,82**
C10	CS174 - 2LX	1a/3	0,000	**-646,27**
C10	CS174 - 2LX	1a-p/16	6,648	**639,35**
C11	CS174 - 2LX	1a/1	0,000	**-819,87**
C11	CS174 - 2LX	1a-p/17	6,648	**467,86**
C12	CS174 - 2LX	1a/18	0,000	**-551,02**
C12	CS174 - 2LX	1a-p/4	6,648	**737,57**
B94	CS68 - L100X75X7	1a/7	0,000	**-58,90**
B94	CS68 - L100X75X7	1a/6	9,452	**77,61**
B95	CS68 - L100X75X7	1a/9	0,000	**-53,25**
B95	CS68 - L100X75X7	1a-p/8	9,452	**52,10**
B22	CS68 - L100X75X7	1a/6	0,000	**-85,07**
B22	CS68 - L100X75X7	1a/7	9,452	**49,97**
B26	CS68 - L100X75X7	1a/27	0,000	**-63,78**
B26	CS68 - L100X75X7	1a-p/28	9,452	**41,52**

Staaf	css	BG	dx [m]	N [kN]
SB65	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB65	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB66	CS67 - L50X40X5	1a-p/8	1,341	**0,00**
SB66	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB67	CS67 - L50X40X5	1a-p/4	1,341	**0,00**
SB67	CS67 - L50X40X5	1a/18	1,006	**0,00**
SB68	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
SB68	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB69	CS67 - L50X40X5	1a-p/29	1,341	**0,00**
SB69	CS67 - L50X40X5	1a/6	1,341	**0,00**
SB70	CS67 - L50X40X5	1a-p/16	1,676	**0,00**
SB70	CS67 - L50X40X5	1a/3	1,341	**0,00**
SB71	CS67 - L50X40X5	1a-p/15	1,341	**0,00**
SB71	CS67 - L50X40X5	1a/2	1,341	**0,00**
SB72	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB72	CS67 - L50X40X5	1a/7	1,341	**0,00**
SB73	CS66 - L50X40X5	1a/1	0,000	**-0,08**
SB73	CS66 - L50X40X5	1a/2	2,356	**0,00**
SB74	CS66 - L50X40X5	1a/1	0,000	**-0,08**
SB74	CS66 - L50X40X5	1a/18	2,356	**0,00**
SB75	CS66 - L50X40X5	1a/2	0,000	**-0,08**
SB75	CS66 - L50X40X5	1a/3	2,356	**0,00**
SB76	CS66 - L50X40X5	1a/2	0,000	**-0,08**
SB76	CS66 - L50X40X5	1a/1	2,356	**0,00**
SB77	CS66 - L50X40X5	1a/3	0,000	**-0,08**
SB77	CS66 - L50X40X5	1a/18	2,356	**0,00**
SB78	CS66 - L50X40X5	1a/3	0,000	**-0,08**
SB78	CS66 - L50X40X5	1a/2	2,356	**0,00**
SB79	CS66 - L50X40X5	1a/18	0,000	**-0,08**
SB79	CS66 - L50X40X5	1a/1	2,356	**0,00**
SB80	CS66 - L50X40X5	1a/18	0,000	**-0,08**
SB80	CS66 - L50X40X5	1a/3	2,356	**0,00**
SB81	CS66 - L50X40X5	1a/3	0,000	**-0,07**
SB81	CS66 - L50X40X5	1a/7	2,360	**0,00**
SB82	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB82	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
SB83	CS66 - L50X40X5	1a/3	0,000	**-0,07**
SB83	CS66 - L50X40X5	1a/3	2,360	**0,00**
SB84	CS67 - L50X40X5	1a/27	1,676	**0,00**
SB84	CS67 - L50X40X5	1a-p/28	1,676	**0,00**
SB85	CS66 - L50X40X5	1a/18	0,000	**-0,07**
SB85	CS66 - L50X40X5	1a/18	2,360	**0,00**
SB86	CS67 - L50X40X5	1a/27	1,676	**0,00**
SB86	CS67 - L50X40X5	1a-p/28	1,676	**0,00**
SB87	CS66 - L50X40X5	1a/18	0,000	**-0,07**
SB87	CS66 - L50X40X5	1a/7	2,360	**0,00**
SB88	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB88	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB89	CS66 - L50X40X5	1a/1	0,000	**-0,07**
SB89	CS66 - L50X40X5	1a/6	2,360	**0,00**
SB90	CS67 - L50X40X5	1a/7	1,676	**0,00**
SB90	CS67 - L50X40X5	1a-p/12	1,676	**0,00**
SB91	CS66 - L50X40X5	1a/1	0,000	**-0,07**
SB91	CS66 - L50X40X5	1a/1	2,360	**0,00**
SB92	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB92	CS67 - L50X40X5	1a-p/8	1,676	**0,00**
SB93	CS66 - L50X40X5	1a/2	0,000	**-0,07**
SB93	CS66 - L50X40X5	1a/2	2,360	**0,00**
SB94	CS67 - L50X40X5	1a/9	1,676	**0,00**
SB94	CS67 - L50X40X5	1a-p/8	1,676	**0,00**
SB95	CS66 - L50X40X5	1a/2	0,000	**-0,07**
SB95	CS66 - L50X40X5	1a/2	2,360	**0,00**
SB96	CS67 - L50X40X5	1a/6	1,676	**0,00**
SB96	CS67 - L50X40X5	1a-p/29	1,676	**0,00**
B73	CS68 - L100X75X7	1a/27	0,000	**-53,93**
B73	CS68 - L100X75X7	1a-p/28	9,452	**51,86**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
B74	CS68 - L100X75X7	1a/7	0,000	**-52,42**
B74	CS68 - L100X75X7	1a/6	9,452	**83,18**
B75	CS68 - L100X75X7	1a/9	0,000	**-51,25**
B75	CS68 - L100X75X7	1a-p/8	9,452	**54,29**
B76	CS68 - L100X75X7	1a/6	0,000	**-76,90**
B76	CS68 - L100X75X7	1a/7	9,452	**59,98**
C13	CS175 - 2LX	1a/2	0,000	**-755,08**
C13	CS175 - 2LX	1a-p/15	6,648	**256,96**
C14	CS175 - 2LX	1a/3	0,000	**-509,79**
C14	CS175 - 2LX	1a-p/16	6,648	**495,88**
C15	CS175 - 2LX	1a/1	0,000	**-665,69**
C15	CS175 - 2LX	1a-p/17	6,648	**343,94**
C16	CS175 - 2LX	1a/18	0,000	**-435,43**
C16	CS175 - 2LX	1a-p/4	6,648	**573,64**
B98	CS70 - L100X75X7	1a/7	0,000	**-60,02**
B98	CS70 - L100X75X7	1a-p/12	8,859	**78,10**
B99	CS70 - L100X75X7	1a-p/28	0,000	**-49,88**
B99	CS70 - L100X75X7	1a/27	8,860	**50,15**
B100	CS70 - L100X75X7	1a/6	0,000	**-88,64**
B100	CS70 - L100X75X7	1a/7	8,860	**48,23**
B101	CS70 - L100X75X7	1a-p/8	0,000	**-52,81**
B101	CS70 - L100X75X7	1a/9	8,859	**46,70**
B102	CS81 - L60X5	1a-p/15	2,920	**-0,44**
B102	CS81 - L60X5	1a/2	0,000	**1,10**
B103	CS81 - L60X5	1a-p/16	2,920	**-1,06**
B103	CS81 - L60X5	1a/3	0,000	**0,87**
B104	CS81 - L60X5	1a-p/4	2,920	**-0,97**
B104	CS81 - L60X5	1a/18	0,000	**0,56**
B105	CS81 - L60X5	1a-p/17	2,920	**-0,67**
B105	CS81 - L60X5	1a/1	0,000	**1,26**
SB97	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB97	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB98	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB98	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB99	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB99	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB100	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB100	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB101	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB101	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB102	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB102	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB103	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB103	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB104	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB104	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB105	CS71 - L50X40X5	1a/2	0,000	**-0,08**
SB105	CS71 - L50X40X5	1a/2	2,231	**0,00**
SB106	CS71 - L50X40X5	1a/18	0,000	**-0,08**
SB106	CS71 - L50X40X5	1a/18	2,231	**0,00**
SB107	CS71 - L50X40X5	1a/3	0,000	**-0,08**
SB107	CS71 - L50X40X5	1a/3	2,231	**0,00**
SB108	CS71 - L50X40X5	1a/1	0,000	**-0,08**
SB108	CS71 - L50X40X5	1a/1	2,231	**0,00**
SB109	CS71 - L50X40X5	1a/18	0,000	**-0,08**
SB109	CS71 - L50X40X5	1a/18	2,231	**0,00**

Staaf	css	BG	dx [m]	N [kN]
SB110	CS71 - L50X40X5	1a/2	0,000	**-0,08**
SB110	CS71 - L50X40X5	1a/2	2,231	**0,00**
SB111	CS71 - L50X40X5	1a/1	0,000	**-0,08**
SB111	CS71 - L50X40X5	1a/1	2,231	**0,00**
SB112	CS71 - L50X40X5	1a/3	0,000	**-0,08**
SB112	CS71 - L50X40X5	1a/3	2,231	**0,00**
SB113	CS71 - L50X40X5	1a/7	0,000	**-0,07**
SB113	CS71 - L50X40X5	1a/7	2,190	**0,00**
SB114	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB114	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB115	CS71 - L50X40X5	1a/27	0,000	**-0,07**
SB115	CS71 - L50X40X5	1a/3	2,190	**0,00**
SB116	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB116	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB117	CS71 - L50X40X5	1a/9	0,000	**-0,07**
SB117	CS71 - L50X40X5	1a/18	2,190	**0,00**
SB118	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB118	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB119	CS71 - L50X40X5	1a/7	0,000	**-0,07**
SB119	CS71 - L50X40X5	1a/7	2,190	**0,00**
SB120	CS69 - L50X40X5	1a/7	1,460	**0,00**
SB120	CS69 - L50X40X5	1a-p/12	1,460	**0,00**
SB121	CS71 - L50X40X5	1a/6	0,000	**-0,07**
SB121	CS71 - L50X40X5	1a/6	2,190	**0,00**
SB122	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
SB122	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB123	CS71 - L50X40X5	1a/9	0,000	**-0,07**
SB123	CS71 - L50X40X5	1a/1	2,190	**0,00**
SB124	CS69 - L50X40X5	1a/9	1,460	**0,00**
SB124	CS69 - L50X40X5	1a-p/8	1,460	**0,00**
SB125	CS71 - L50X40X5	1a/3	0,000	**-0,07**
SB125	CS71 - L50X40X5	1a/2	2,190	**0,00**
SB126	CS69 - L50X40X5	1a-p/28	1,460	**0,00**
SB126	CS69 - L50X40X5	1a/27	1,460	**0,00**
SB127	CS71 - L50X40X5	1a/6	0,000	**-0,07**
SB127	CS71 - L50X40X5	1a/6	2,190	**0,00**
SB128	CS69 - L50X40X5	1a/6	1,460	**0,00**
SB128	CS69 - L50X40X5	1a-p/29	1,460	**0,00**
B106	CS70 - L100X75X7	1a-p/8	0,000	**-50,53**
B106	CS70 - L100X75X7	1a/9	8,859	**49,64**
B107	CS70 - L100X75X7	1a/7	0,000	**-48,23**
B107	CS70 - L100X75X7	1a/6	8,859	**88,92**
B108	CS70 - L100X75X7	1a-p/28	0,000	**-37,70**
B108	CS70 - L100X75X7	1a/27	8,860	**62,82**
B109	CS70 - L100X75X7	1a/6	0,000	**-82,71**
B109	CS70 - L100X75X7	1a/7	8,860	**56,70**
B110	CS81 - L60X5	1a/6	0,000	**0,00**
B110	CS81 - L60X5	1a/7	2,920	**0,00**
B111	CS81 - L60X5	1a/2	0,000	**0,00**
B111	CS81 - L60X5	1a/9	2,920	**0,00**
B112	CS81 - L60X5	1a/7	0,000	**0,00**
B112	CS81 - L60X5	1a/6	2,920	**0,00**
B113	CS81 - L60X5	1a/18	0,000	**0,00**
B113	CS81 - L60X5	1a/27	2,920	**0,00**
C17	CS112 - HFLeq130x130x12	1a/2	0,000	**-563,06**
C17	CS112 - HFLeq130x130x12	1a-p/15	3,414	**162,32**
C18	CS112 - HFLeq130x130x12	1a/3	0,000	**-376,52**
C18	CS112 - HFLeq130x130x12	1a-p/16	3,414	**340,55**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
C19	CS112 - HFLeq130x130x12	1a/1	0,000	**-488,36**
C19	CS112 - HFLeq130x130x12	1a-p/17	3,414	**235,22**
C20	CS112 - HFLeq130x130x12	1a/18	0,000	**-324,92**
C20	CS112 - HFLeq130x130x12	1a-p/4	3,414	**394,78**
B114	CS73 - L100X75X7	1a/6	0,000	**-87,98**
B114	CS73 - L100X75X7	1a-p/29	4,360	**61,74**
B115	CS73 - L100X75X7	1a/27	0,000	**-52,42**
B115	CS73 - L100X75X7	1a-p/28	4,360	**49,69**
B116	CS73 - L100X75X7	1a/6	0,000	**-100,44**
B116	CS73 - L100X75X7	1a-p/29	4,360	**46,66**
B117	CS73 - L100X75X7	1a/27	0,000	**-67,88**
B117	CS73 - L100X75X7	1a-p/28	4,360	**33,70**
SB129	CS20 - L50X40X5	1a-p/12	1,250	**0,00**
SB129	CS20 - L50X40X5	1a/7	1,250	**0,00**
SB130	CS72 - L50X40X5	1a/2	0,000	**-0,08**
SB130	CS72 - L50X40X5	1a/7	2,050	**0,00**
SB131	CS20 - L50X40X5	1a-p/12	1,250	**0,00**
SB131	CS20 - L50X40X5	1a/7	1,250	**0,00**
SB132	CS72 - L50X40X5	1a/3	0,000	**-0,08**
SB132	CS72 - L50X40X5	1a/6	2,050	**0,00**
SB133	CS20 - L50X40X5	1a-p/8	1,250	**0,00**
SB133	CS20 - L50X40X5	1a/9	1,250	**0,00**
SB134	CS72 - L50X40X5	1a/3	0,000	**-0,08**
SB134	CS72 - L50X40X5	1a/18	2,049	**0,00**
SB135	CS20 - L50X40X5	1a-p/8	1,250	**0,00**
SB135	CS20 - L50X40X5	1a/9	1,250	**0,00**
SB136	CS72 - L50X40X5	1a/18	0,000	**-0,08**
SB136	CS72 - L50X40X5	1a/3	2,050	**0,00**
SB137	CS20 - L50X40X5	1a/7	0,000	**0,00**
SB137	CS20 - L50X40X5	1a/6	1,250	**0,00**
SB138	CS72 - L50X40X5	1a/18	0,000	**-0,08**
SB138	CS72 - L50X40X5	1a/6	2,050	**0,00**
SB139	CS20 - L50X40X5	1a/7	0,000	**0,00**
SB139	CS20 - L50X40X5	1a/6	1,250	**0,00**
SB140	CS72 - L50X40X5	1a/1	0,000	**-0,08**
SB140	CS72 - L50X40X5	1a/7	2,050	**0,00**
SB141	CS20 - L50X40X5	1a-p/28	1,250	**0,00**
SB141	CS20 - L50X40X5	1a/27	1,250	**0,00**
SB142	CS72 - L50X40X5	1a/1	0,000	**-0,08**
SB142	CS72 - L50X40X5	1a/2	2,050	**0,00**
SB143	CS20 - L50X40X5	1a-p/28	1,250	**0,00**
SB143	CS20 - L50X40X5	1a/27	1,250	**0,00**
SB144	CS72 - L50X40X5	1a/2	0,000	**-0,08**
SB144	CS72 - L50X40X5	1a/1	2,050	**0,00**
B36	CS73 - L100X75X7	1a/7	0,000	**-60,26**
B36	CS73 - L100X75X7	1a-p/12	4,360	**88,81**
B37	CS73 - L100X75X7	1a/7	0,000	**-50,20**
B37	CS73 - L100X75X7	1a-p/12	4,360	**97,27**
B38	CS73 - L100X75X7	1a/9	0,000	**-51,55**
B38	CS73 - L100X75X7	1a-p/8	4,360	**50,26**
B39	CS73 - L100X75X7	1a/9	0,000	**-48,78**
B39	CS73 - L100X75X7	1a-p/8	4,360	**53,22**

Staaf	css	BG	dx [m]	N [kN]
S355	CS82 - L130X12	1a/1	0,000	**-490,82**
S355	CS82 - L130X12	1a-p/17	4,280	**248,62**
S359	CS90 - L(ARC)100x100x6	1a/18	2,220	**-61,18**
S359	CS90 - L(ARC)100x100x6	1a-p/4	4,356	**73,20**
S361	CS124 - L80X6	3/10	0,000	**-62,44**
S361	CS124 - L80X6	1a-p/17	0,970	**7,13**
S368	CS143 - L130X12	1a/2	0,000	**-239,54**
S368	CS143 - L130X12	1a-p/15	3,331	**38,20**
S370	CS90 - L(ARC)100x100x6	1a/3	2,220	**-70,88**
S370	CS90 - L(ARC)100x100x6	1a-p/16	4,356	**61,57**
S372	CS124 - L80X6	3/10	0,000	**-43,17**
S372	CS124 - L80X6	1a-p/15	0,970	**14,01**
S373	CS133 - L80X6	3/10	2,008	**-47,43**
S373	CS133 - L80X6	3-p/11	5,210	**16,86**
S377	CS141 - L120X80X8	1a-p/12	0,000	**-201,82**
S377	CS141 - L120X80X8	1a/7	2,030	**169,56**
S378	CS141 - L120X80X8	1a-p/29	0,000	**-47,89**
S378	CS141 - L120X80X8	1a/6	2,206	**122,79**
S379	CS141 - L120X80X8	1a-p/12	0,000	**-212,15**
S379	CS141 - L120X80X8	1a/7	2,030	**155,93**
S380	CS141 - L120X80X8	1a-p/29	0,000	**-53,39**
S380	CS141 - L120X80X8	1a/6	2,205	**121,25**
S381	CS141 - L120X80X8	1a-p/29	0,000	**-97,16**
S381	CS141 - L120X80X8	1a/6	2,030	**272,93**
S382	CS141 - L120X80X8	1a-p/12	0,000	**-105,16**
S382	CS141 - L120X80X8	1a/7	2,205	**69,86**
S383	CS141 - L120X80X8	1a-p/29	0,000	**-93,29**
S383	CS141 - L120X80X8	1a/6	2,030	**276,94**
S384	CS141 - L120X80X8	1a-p/12	0,000	**-102,73**
S384	CS141 - L120X80X8	1a/7	2,205	**70,51**
S388	CS144 - UNP160	1a/6	0,000	**-193,21**
S388	CS144 - UNP160	1a-p/12	1,837	**149,11**
S390	CS144 - UNP160	1a/7	0,000	**-111,86**
S390	CS144 - UNP160	1a-p/12	0,000	**129,88**
S397	CS92 - L50X40X5	1a/3	0,000	**-0,99**
S397	CS92 - L50X40X5	1a/1	2,227	**0,90**
S399	CS36 - ISEA70/70/5	1a-p/8	0,000	**-19,17**
S399	CS36 - ISEA70/70/5	1a/9	0,000	**39,64**
S400	CS95 - L(ARC)75x75x6	5a13/77	0,000	**-10,88**
S400	CS95 - L(ARC)75x75x6	5a21/75	0,000	**10,41**
S401	CS93 - L(ARC)70x70x5	1a-p/16	0,000	**-24,07**
S401	CS93 - L(ARC)70x70x5	1a/3	2,366	**26,80**
S402	CS143 - L130X12	1a/1	0,000	**-211,36**
S402	CS143 - L130X12	1a-p/17	3,331	**73,26**
S411	CS90 - L(ARC)100x100x6	1a/1	2,221	**-95,20**
S411	CS90 - L(ARC)100x100x6	1a-p/17	4,356	**37,45**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S413	CS124 - L80X6	1a/18	0,000	**-15,45**
S413	CS124 - L80X6	3-p/34	0,970	**43,51**
S417	CS133 - L80X6	3/35	5,210	**-14,99**
S417	CS133 - L80X6	3-p/34	3,599	**49,14**
S418	CS82 - L130X12	1a/3	0,000	**-368,49**
S418	CS82 - L130X12	1a-p/16	4,280	**362,60**
S421	CS143 - L130X12	1a/3	0,000	**-181,75**
S421	CS143 - L130X12	1a-p/16	3,330	**97,86**
S425	CS124 - L80X6	3/35	0,000	**-45,92**
S425	CS124 - L80X6	1a-p/16	0,970	**13,17**
S426	CS133 - L80X6	3/35	2,008	**-45,94**
S426	CS133 - L80X6	3-p/34	5,210	**18,17**
S430	CS37 - HFLeq75x75x8	3-p/34	0,000	**-4,23**
S430	CS37 - HFLeq75x75x8	1a/7	0,000	**3,32**
S441	CS101 - UNP120	1a-p/29	0,000	**-43,76**
S441	CS101 - UNP120	3/118	0,000	**117,55**
S446	CS101 - UNP120	3-p/23	0,000	**-103,73**
S446	CS101 - UNP120	1a/7	0,000	**57,32**
S447	CS101 - UNP120	3/10	0,000	**-136,86**
S447	CS101 - UNP120	1a-p/29	0,000	**28,51**
S448	CS158 - L50X40X5	1a-p/4	2,810	**24,80**
S448	CS158 - L50X40X5	3/26	0,000	**45,17**
S449	CS140 - L45X30X5	1a/27	0,941	**-0,47**
S449	CS140 - L45X30X5	1a-p/28	0,000	**0,34**
S450	CS4 - L50X40X5	1a/7	0,000	**0,00**
S450	CS4 - L50X40X5	1a/7	0,864	**0,00**
S453	CS4 - L50X40X5	1a-p/29	0,864	**0,00**
S453	CS4 - L50X40X5	1a/1	0,000	**0,00**
S456	CS122 - L50X40X5	1a-p/12	0,000	**-0,80**
S456	CS122 - L50X40X5	1a/7	2,179	**0,96**
S457	CS155 - HFLue120x80x8	1a/7	1,544	**-160,84**
S457	CS155 - HFLue120x80x8	1a-p/12	0,000	**247,80**
S458	CS92 - L50X40X5	1a/2	0,000	**-0,84**
S458	CS92 - L50X40X5	1a/7	2,231	**1,08**
S459	CS92 - L50X40X5	1a/1	0,000	**-0,84**
S459	CS92 - L50X40X5	1a/7	2,231	**1,08**
S460	CS84 - L(ARC)100x100x6	1a/27	2,080	**-32,54**
S460	CS84 - L(ARC)100x100x6	1a-p/28	0,000	**0,81**
S461	CS156 - L50X5	1a-p/17	0,000	**-1,03**
S461	CS156 - L50X5	1a/1	1,503	**4,09**
S462	CS156 - L50X5	1a-p/15	0,000	**-1,32**
S462	CS156 - L50X5	1a/2	1,503	**4,91**
S463	CS156 - L50X5	1a-p/4	0,000	**-2,32**
S463	CS156 - L50X5	1a/18	1,503	**2,53**
S464	CS156 - L50X5	1a-p/16	0,000	**-2,78**
S464	CS156 - L50X5	1a/3	1,503	**3,14**
S465	CS95 - L(ARC)75x75x6	5a15/87	0,573	**-16,47**
S465	CS95 - L(ARC)75x75x6	5a16/123	0,000	**15,09**
S466	CS95 - L(ARC)75x75x6	5a20/124	0,000	**-21,77**
S466	CS95 - L(ARC)75x75x6	5a19/125	0,000	**8,40**
B7	CS75 - L120X11	1a/2	0,000	**-151,11**
B7	CS75 - L120X11	1a-p/16	3,800	**103,39**
B118	CS75 - L120X11	1a/3	0,000	**-106,13**
B118	CS75 - L120X11	1a-p/4	3,800	**119,52**
B119	CS75 - L120X11	1a/1	3,800	**-134,98**

Staaf	css	BG	dx [m]	N [kN]
B119	CS75 - L120X11	1a-p/4	0,000	**119,56**
B120	CS75 - L120X11	1a/2	3,800	**-151,07**
B120	CS75 - L120X11	1a-p/17	0,000	**74,60**
B11	CS39 - ISEA80/80/6	5a11/116	0,000	**-3,02**
B11	CS39 - ISEA80/80/6	5a12/126	0,000	**1,93**
B121	CS39 - ISEA80/80/6	5a5/45	0,000	**-2,62**
B121	CS39 - ISEA80/80/6	5a6/44	0,000	**2,36**
B13	CS39 - ISEA80/80/6	5a6/46	0,000	**-3,91**
B13	CS39 - ISEA80/80/6	5a5/47	0,000	**1,02**
B122	CS39 - ISEA80/80/6	5a12/120	0,000	**-2,19**
B122	CS39 - ISEA80/80/6	5a11/127	0,000	**2,82**
B123	CS46 - ISEA70/70/5	1a/7	3,800	**-0,19**
B123	CS46 - ISEA70/70/5	3-p/128	0,000	**-0,04**
B17	CS46 - ISEA70/70/5	3/39	0,000	**-0,45**
B17	CS46 - ISEA70/70/5	1a-p/29	0,000	**-0,30**
B124	CS46 - ISEA70/70/5	3/39	0,000	**-0,84**
B124	CS46 - ISEA70/70/5	1a-p/29	0,000	**-0,59**
B129	CS79 - L100X8	5a11/127	0,000	**-16,93**
B129	CS79 - L100X8	5a12/120	0,000	**6,12**
B130	CS79 - L100X8	5a12/120	0,000	**-7,21**
B130	CS79 - L100X8	5a11/127	0,000	**15,69**
B131	CS79 - L100X8	5a6/44	0,000	**-12,79**
B131	CS79 - L100X8	5a5/114	0,000	**10,15**
B132	CS79 - L100X8	5a5/114	0,000	**-11,51**
B132	CS79 - L100X8	5a11/116	0,000	**11,36**
B133	CS77 - L60X5	3/37	2,500	**-1,76**
B133	CS77 - L60X5	1a-p/12	0,000	**-0,86**
B134	CS77 - L60X5	1a-p/12	0,000	**0,51**
B134	CS77 - L60X5	3/37	0,000	**1,08**
B135	CS77 - L60X5	1a-p/12	0,000	**0,35**
B135	CS77 - L60X5	3/37	0,000	**0,87**
S467	CS78 - L110X10	1a/2	2,500	**-218,80**
S467	CS78 - L110X10	1a-p/16	0,000	**141,94**
S470	CS113 - L80X6	1a-p/17	2,500	**-10,00**
S470	CS113 - L80X6	1a/2	0,000	**19,26**
S472	CS78 - L110X10	1a/1	0,000	**-189,04**
S472	CS78 - L110X10	1a-p/4	2,500	**163,33**
S474	CS113 - L80X6	1a-p/4	0,000	**-14,68**
S474	CS113 - L80X6	1a/3	2,501	**13,83**
S482	CS21 - ISUA65/50/6	3-p/34	1,726	**-49,03**
S482	CS21 - ISUA65/50/6	3/35	1,726	**10,88**
S483	CS21 - ISUA65/50/6	3-p/34	3,452	**-22,37**
S483	CS21 - ISUA65/50/6	3/35	1,726	**37,48**
S484	CS21 - ISUA65/50/6	1a-p/29	0,000	**-0,33**
S484	CS21 - ISUA65/50/6	3/10	1,726	**68,41**
S485	CS21 - ISUA65/50/6	3-p/11	3,452	**-22,09**
S485	CS21 - ISUA65/50/6	3/10	1,726	**37,77**
S486	CS133 - L80X6	3/10	2,008	**-69,65**
S486	CS133 - L80X6	5a2/129	2,008	**7,83**
S491	CS151 - HFLeq130x130x12	1a-p/29	0,000	**-106,86**

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S491	CS151 - HFLeq130x130x12	1a/6	0,000	**367,01**
S492	CS144 - UNP160	1a/7	0,000	**-143,82**
S492	CS144 - UNP160	1a-p/12	0,000	**64,02**
S493	CS144 - UNP160	1a/6	2,195	**-193,48**
S493	CS144 - UNP160	1a-p/12	1,485	**140,46**
S495	CS101 - UNP120	1a-p/12	0,000	**-103,50**
S495	CS101 - UNP120	1a/7	1,964	**58,08**
S497	CS101 - UNP120	3/10	0,000	**-127,75**
S497	CS101 - UNP120	1a-p/29	0,000	**26,92**
S503	CS97 - L100X8	1a-p/29	0,000	**-47,66**
S503	CS97 - L100X8	3/10	0,000	**168,15**
S508	CS30 - UNP140	1b-p/103	0,000	**39,74**
S508	CS30 - UNP140	5a6/84	0,000	**73,87**
S509	CS36 - ISEA70/70/5	5a11/60	0,000	**-6,49**
S509	CS36 - ISEA70/70/5	5a12/59	0,000	**19,63**
S510	CS36 - ISEA70/70/5	5a12/63	0,000	**-8,52**
S510	CS36 - ISEA70/70/5	5a11/36	0,000	**17,34**
S511	CS30 - UNP140	1b-p/85	0,000	**40,78**
S511	CS30 - UNP140	5a2/130	0,000	**75,87**
S513	CS36 - ISEA70/70/5	5a5/25	0,000	**-8,19**
S513	CS36 - ISEA70/70/5	5a6/131	0,000	**18,58**
S514	CS36 - ISEA70/70/5	5a6/42	0,000	**-6,80**
S514	CS36 - ISEA70/70/5	5a5/132	0,000	**20,19**
S547	CS144 - UNP160	1a/6	0,000	**-193,84**
S547	CS144 - UNP160	1a-p/29	1,227	**52,74**
S548	CS38 - HFLeq80x80x8	1b-p/85	0,000	**34,76**
S548	CS38 - HFLeq80x80x8	5a22/133	0,000	**64,13**
S549	CS38 - HFLeq80x80x8	5a14/81	0,000	**0,17**
S549	CS38 - HFLeq80x80x8	5a13/134	0,000	**28,60**
S550	CS38 - HFLeq80x80x8	5a13/77	0,310	**-0,74**
S550	CS38 - HFLeq80x80x8	5a14/135	0,000	**27,41**
S551	CS38 - HFLeq80x80x8	1b-p/103	0,000	**34,24**
S551	CS38 - HFLeq80x80x8	5a14/136	0,000	**63,11**
S552	CS38 - HFLeq80x80x8	5a22/93	0,000	**-1,73**
S552	CS38 - HFLeq80x80x8	5a21/137	0,000	**26,22**
S553	CS38 - HFLeq80x80x8	5a21/104	0,000	**0,04**
S553	CS38 - HFLeq80x80x8	5a22/133	0,000	**28,37**
SB145	CS61 - L60X6	1a-p/4	0,000	**0,00**
SB145	CS61 - L60X6	3/118	3,040	**0,00**
SB146	CS61 - L60X6	1a/27	2,736	**0,00**
SB146	CS61 - L60X6	1a/18	0,000	**0,00**
SB147	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB147	CS4 - L50X40X5	1a/27	2,827	**0,00**
SB148	CS4 - L50X40X5	1a/2	0,000	**-0,10**
SB148	CS4 - L50X40X5	3/118	2,827	**0,00**
SB149	CS60 - L50X5	1a/3	0,000	**-0,11**
SB149	CS60 - L50X5	1a/27	3,371	**0,00**
SB150	CS61 - L60X6	1a-p/17	0,000	**0,00**
SB150	CS61 - L60X6	1a/27	3,040	**0,00**
SB151	CS102 - L50X5	1a-p/17	0,000	**0,00**
SB151	CS102 - L50X5	1a/27	1,710	**0,00**

Staaf	css	BG	dx [m]	N [kN]
SB152	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB152	CS4 - L50X40X5	1a/27	2,827	**0,00**
SB153	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB153	CS4 - L50X40X5	1a/27	2,402	**0,00**
SB154	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB154	CS4 - L50X40X5	1a/27	2,169	**0,00**
SB155	CS4 - L50X40X5	1a-p/17	0,000	**0,00**
SB155	CS4 - L50X40X5	1a/2	0,912	**0,00**
SB156	CS4 - L50X40X5	1a-p/17	0,000	**0,00**
SB156	CS4 - L50X40X5	1a/27	0,760	**0,00**
SB157	CS4 - L50X40X5	1a/7	0,760	**0,00**
SB157	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB158	CS4 - L50X40X5	1a/7	1,520	**0,00**
SB158	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB159	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB159	CS4 - L50X40X5	3-p/23	2,169	**0,00**
SB160	CS102 - L50X5	1a/7	2,280	**0,00**
SB160	CS102 - L50X5	1a/1	0,000	**0,00**
SB161	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB161	CS4 - L50X40X5	1a/7	2,402	**0,00**
SB162	CS61 - L60X6	1a/7	3,040	**0,00**
SB162	CS61 - L60X6	1a/1	0,000	**0,00**
SB163	CS4 - L50X40X5	1a/3	0,000	**-0,10**
SB163	CS4 - L50X40X5	1a/7	2,827	**0,00**
SB164	CS60 - L50X5	1a/3	0,000	**-0,11**
SB164	CS60 - L50X5	1a/7	3,371	**0,00**
SB165	CS60 - L50X5	1a/18	0,000	**-0,11**
SB165	CS60 - L50X5	1a/7	3,371	**0,00**
SB166	CS61 - L60X6	1a/18	0,000	**0,00**
SB166	CS61 - L60X6	1a/7	3,040	**0,00**
SB167	CS102 - L50X5	1a/18	0,000	**0,00**
SB167	CS102 - L50X5	1a/7	2,280	**0,00**
SB168	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB168	CS4 - L50X40X5	1a/7	2,827	**0,00**
SB169	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB169	CS4 - L50X40X5	1a/7	2,402	**0,00**
SB170	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB170	CS4 - L50X40X5	1a/7	2,169	**0,00**
SB171	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB171	CS4 - L50X40X5	1a/7	1,520	**0,00**
SB172	CS4 - L50X40X5	1a/18	0,000	**0,00**
SB172	CS4 - L50X40X5	1a/7	0,760	**0,00**
SB173	CS4 - L50X40X5	1a/9	0,760	**0,00**
SB173	CS4 - L50X40X5	1a/2	0,000	**0,00**
SB174	CS4 - L50X40X5	1a/9	1,520	**0,00**
SB174	CS4 - L50X40X5	1a/2	0,000	**0,00**
SB175	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB175	CS4 - L50X40X5	1a-p/17	2,169	**0,00**
SB176	CS102 - L50X5	1a/9	2,280	**0,00**
SB176	CS102 - L50X5	1a/2	0,000	**0,00**
SB177	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB177	CS4 - L50X40X5	1a/9	2,402	**0,00**
SB178	CS61 - L60X6	1a/9	3,040	**0,00**
SB178	CS61 - L60X6	1a/2	0,000	**0,00**
SB179	CS4 - L50X40X5	1a/18	0,000	**-0,10**
SB179	CS4 - L50X40X5	1a/9	2,827	**0,00**
SB180	CS60 - L50X5	1a/18	0,000	**-0,11**
SB180	CS60 - L50X5	1a/9	3,371	**0,00**
SB181	CS60 - L50X5	1a/1	0,000	**-0,11**
SB181	CS60 - L50X5	1a/9	3,371	**0,00**
SB182	CS61 - L60X6	1a/1	0,000	**0,00**
SB182	CS61 - L60X6	1a/9	3,040	**0,00**
SB183	CS102 - L50X5	1a/1	0,000	**0,00**
SB183	CS102 - L50X5	1a/9	2,280	**0,00**
SB184	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB184	CS4 - L50X40X5	1a/9	2,827	**0,00**
SB185	CS4 - L50X40X5	1a/1	0,000	**-0,10**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
SB185	CS4 - L50X40X5	1a/9	2,402	**0,00**
SB186	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB186	CS4 - L50X40X5	1a/9	2,169	**0,00**
SB187	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB187	CS4 - L50X40X5	1a/9	1,520	**0,00**
SB188	CS4 - L50X40X5	1a/1	0,000	**0,00**
SB188	CS4 - L50X40X5	1a/9	0,760	**0,00**
SB189	CS4 - L50X40X5	3/10	0,760	**0,00**
SB189	CS4 - L50X40X5	1a/3	0,000	**0,00**
SB190	CS4 - L50X40X5	3/10	1,520	**0,00**
SB190	CS4 - L50X40X5	1a/3	0,000	**0,00**
SB191	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB191	CS4 - L50X40X5	1a-p/29	2,169	**0,00**
SB192	CS102 - L50X5	3/10	2,280	**0,00**
SB192	CS102 - L50X5	1a/3	0,000	**0,00**
SB193	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB193	CS4 - L50X40X5	3/118	2,402	**0,00**
SB194	CS61 - L60X6	3/10	3,040	**0,00**
SB194	CS61 - L60X6	1a/3	0,000	**0,00**
SB195	CS4 - L50X40X5	1a/1	0,000	**-0,10**
SB195	CS4 - L50X40X5	3/118	2,827	**0,00**
SB196	CS60 - L50X5	1a/1	0,000	**-0,11**
SB196	CS60 - L50X5	3/118	3,371	**0,00**
S588	CS104 - L70X6	1a/1	0,000	**0,00**
S588	CS104 - L70X6	1a/7	3,353	**0,00**
S589	CS104 - L70X6	1a/6	3,353	**0,00**
S589	CS104 - L70X6	1a/2	0,000	**0,00**
S590	CS104 - L70X6	1a/2	0,000	**0,00**
S590	CS104 - L70X6	1a-p/28	3,353	**0,00**
S591	CS104 - L70X6	1a/27	3,353	**0,00**
S591	CS104 - L70X6	1a/3	0,000	**0,00**
S592	CS104 - L70X6	1a/3	0,000	**0,00**
S592	CS104 - L70X6	1a/6	3,353	**0,00**
S593	CS104 - L70X6	1a/7	3,353	**0,00**
S593	CS104 - L70X6	1a/18	0,000	**0,00**
S594	CS104 - L70X6	1a/18	0,000	**0,00**
S594	CS104 - L70X6	1a-p/8	3,353	**0,00**
S595	CS104 - L70X6	1a/9	3,353	**0,00**
S595	CS104 - L70X6	1a/1	0,000	**0,00**
S596	CS95 - L(ARC)75x75x6	5a16/88	0,000	**-14,80**
S596	CS95 - L(ARC)75x75x6	5a15/90	0,000	**17,04**
S597	CS95 - L(ARC)75x75x6	5a15/87	0,851	**-16,41**
S597	CS95 - L(ARC)75x75x6	5a16/123	0,000	**14,66**
S598	CS95 - L(ARC)75x75x6	5a20/124	0,000	**-21,77**
S598	CS95 - L(ARC)75x75x6	5a19/125	0,000	**8,90**
S599	CS95 - L(ARC)75x75x6	5a19/109	0,000	**-19,09**
S599	CS95 - L(ARC)75x75x6	5a20/110	0,286	**11,89**
S600	CS144 - UNP160	5a13/13	1,461	**-125,50**
S600	CS144 - UNP160	5a14/138	2,942	**29,59**
S601	CS144 - UNP160	3/10	0,000	**-204,63**
S601	CS144 - UNP160	1a-p/29	0,000	**19,25**
S602	CS160 - L150X14	1a/6	2,821	**-312,82**
S602	CS160 - L150X14	1a/7	2,821	**157,57**
S603	CS160 - L150X14	1a/7	2,821	**-170,33**
S603	CS160 - L150X14	1a/6	2,821	**303,84**
S604	CS160 - L150X14	1a/7	2,821	**-181,83**
S604	CS160 - L150X14	1a/6	2,821	**298,64**
S605	CS160 - L150X14	1a/6	2,821	**-311,84**
S605	CS160 - L150X14	1a/7	2,821	**168,62**
S606	CS88 - L50X40X5	1a-p/4	0,000	**-3,41**
S606	CS88 - L50X40X5	1a/18	0,000	**2,60**

Staaf	css	BG	dx [m]	N [kN]
S607	CS88 - L50X40X5	1a-p/29	1,250	**-0,21**
S607	CS88 - L50X40X5	1a/6	0,000	**1,26**
S608	CS88 - L50X40X5	1a-p/15	0,000	**-1,34**
S608	CS88 - L50X40X5	1a/2	1,250	**4,73**
S609	CS88 - L50X40X5	1a-p/12	0,000	**-0,66**
S609	CS88 - L50X40X5	1a/7	1,250	**0,82**
S610	CS83 - L100X75X7	1a/27	0,000	**-51,53**
S610	CS83 - L100X75X7	1a-p/28	2,382	**47,06**
S611	CS82 - L130X12	1a/18	0,000	**-315,19**
S611	CS82 - L130X12	1a-p/4	2,140	**413,39**
S612	CS83 - L100X75X7	1a/9	0,000	**-46,40**
S612	CS83 - L100X75X7	1a-p/8	2,382	**51,90**
S613	CS83 - L100X75X7	1a/9	0,000	**-47,02**
S613	CS83 - L100X75X7	1a-p/8	2,382	**53,47**
S614	CS83 - L100X75X7	1a/27	0,000	**-64,87**
S614	CS83 - L100X75X7	1a-p/28	2,382	**35,36**
S615	CS89 - L130X12	1a/1	0,000	**-298,50**
S615	CS89 - L130X12	1a-p/17	4,261	**54,17**
S616	CS89 - L130X12	1a/2	0,000	**-314,16**
S616	CS89 - L130X12	1a-p/15	4,261	**36,12**
S617	CS89 - L130X12	1a/3	0,000	**-251,47**
S617	CS89 - L130X12	1a-p/16	4,261	**103,92**
S618	CS89 - L130X12	1a/18	0,000	**-207,70**
S618	CS89 - L130X12	1a-p/4	4,261	**148,16**
S619	CS142 - L120X80X8	1a-p/12	0,000	**-295,06**
S619	CS142 - L120X80X8	1a/7	4,017	**169,58**
S620	CS142 - L120X80X8	1a-p/29	0,000	**-144,34**
S620	CS142 - L120X80X8	1a/6	4,017	**321,60**
S621	CS142 - L120X80X8	1a-p/29	0,000	**-148,36**
S621	CS142 - L120X80X8	1a/6	4,017	**317,46**
S622	CS142 - L120X80X8	1a-p/12	0,000	**-284,59**
S622	CS142 - L120X80X8	1a/7	4,017	**182,10**
S623	CS161 - L120X80X8	1a/9	0,000	**-56,51**
S623	CS161 - L120X80X8	1a-p/8	4,747	**63,50**
S624	CS161 - L120X80X8	1a/9	0,000	**-48,63**
S624	CS161 - L120X80X8	1a/27	4,747	**73,30**
S625	CS161 - L120X80X8	1a/27	0,000	**-74,27**
S625	CS161 - L120X80X8	1a-p/28	4,747	**47,78**
S626	CS90 - L(ARC)100x100x6	1a/2	2,221	**-111,98**
S626	CS90 - L(ARC)100x100x6	1a-p/15	4,356	**22,92**
S627	CS97 - L100X8	1a-p/12	0,000	**-107,94**
S627	CS97 - L100X8	1a/7	0,000	**95,09**
S628	CS97 - L100X8	3/10	0,000	**-67,77**
S628	CS97 - L100X8	1a-p/29	0,000	**14,36**
S629	CS97 - L100X8	1a/7	0,000	**-43,72**
S629	CS97 - L100X8	1a-p/12	0,000	**38,40**
S630	CS101 - UNP120	1a-p/29	0,000	**-49,90**
S630	CS101 - UNP120	1a/6	0,000	**108,78**
S631	CS101 - UNP120	1a-p/29	2,855	**-48,23**

Project	150 kV lijn Leiden - Zoetermeer
Onderdeel	Berekening Mast 75
Omschrijving	Controle berekening
Nationale norm	EC - EN
Auteur	MG

Staaf	css	BG	dx [m]	N [kN]
S631	CS101 - UNP120	3/118	2,498	**124,02**
S632	CS101 - UNP120	1a-p/12	0,000	**-97,53**
S632	CS101 - UNP120	5a8/139	1,967	**78,16**
S633	CS101 - UNP120	3-p/23	2,861	**-106,23**
S633	CS101 - UNP120	5a7/140	2,145	**84,17**
S634	CS101 - UNP120	1a-p/29	0,000	**-43,72**
S634	CS101 - UNP120	3/118	1,610	**136,24**
S635	CS97 - L100X8	3-p/34	0,000	**-122,97**
S635	CS97 - L100X8	1a/7	0,000	**87,63**
S636	CS97 - L100X8	3/10	0,000	**-77,79**
S636	CS97 - L100X8	1a-p/29	0,000	**7,94**
S637	CS97 - L100X8	1a/7	0,000	**-44,31**
S637	CS97 - L100X8	3-p/34	0,000	**40,28**
S638	CS151 - HFLeq130x130x12	1a-p/12	0,000	**-244,11**
S638	CS151 - HFLeq130x130x12	1a/7	0,000	**229,49**
S639	CS151 - HFLeq130x130x12	1a-p/17	0,000	**35,41**
S639	CS151 - HFLeq130x130x12	3/37	0,000	**71,38**
S640	CS151 - HFLeq130x130x12	5a13/134	0,000	**38,52**
S640	CS151 - HFLeq130x130x12	3/41	0,000	**76,60**
S641	CS151 - HFLeq130x130x12	1a-p/12	0,000	**-241,06**
S641	CS151 - HFLeq130x130x12	1a/7	0,000	**233,63**
S642	CS144 - UNP160	1a/6	0,000	**-186,45**
S642	CS144 - UNP160	1a-p/29	0,000	**57,41**
S643	CS144 - UNP160	3/10	0,000	**-211,74**
S643	CS144 - UNP160	1a-p/29	0,000	**6,49**
S644	CS144 - UNP160	1a/7	0,000	**-138,01**
S644	CS144 - UNP160	1a-p/12	0,000	**71,15**
S645	CS144 - UNP160	1a/7	0,000	**-119,67**
S645	CS144 - UNP160	1a-p/12	0,000	**121,73**
S646	CS143 - L130X12	1a/18	0,000	**-164,63**
S646	CS143 - L130X12	1a-p/4	3,330	**113,25**
S648	CS170 - L50X5	1b/141	0,000	**36,36**
S648	CS170 - L50X5	5a8/142	0,000	**69,93**

Staaf	css	BG	dx [m]	N [kN]
S649	CS170 - L50X5	5a8/142	0,000	**-41,86**
S649	CS170 - L50X5	1b/141	0,000	**-21,78**
S650	CS170 - L50X5	1b/143	0,000	**36,90**
S650	CS170 - L50X5	5a7/144	0,000	**70,41**
S651	CS170 - L50X5	5a7/144	0,000	**-42,15**
S651	CS170 - L50X5	1b/143	0,000	**-22,10**
S652	CS170 - L50X5	1b/145	0,000	**37,05**
S652	CS170 - L50X5	5a9/146	0,000	**70,69**
S653	CS170 - L50X5	5a9/146	0,000	**-42,74**
S653	CS170 - L50X5	1b/145	0,000	**-22,38**
S654	CS170 - L50X5	1b/147	0,000	**36,72**
S654	CS170 - L50X5	5a10/148	0,000	**70,41**
S655	CS170 - L50X5	5a10/148	0,000	**-42,56**
S655	CS170 - L50X5	1b/147	0,000	**-22,17**
S656	CS170 - L50X5	5a13/13	0,000	**-40,47**
S656	CS170 - L50X5	1b/147	0,000	**-20,97**
S657	CS170 - L50X5	1b/147	0,000	**32,81**
S657	CS170 - L50X5	5a13/13	0,000	**63,36**
S658	CS170 - L50X5	1b/145	0,000	**33,34**
S658	CS170 - L50X5	5a14/86	0,000	**63,95**
S659	CS170 - L50X5	5a14/86	0,000	**-40,80**
S659	CS170 - L50X5	1b/145	0,000	**-21,25**
S660	CS171 - L60X8	1b-p/149	0,000	**35,19**
S660	CS171 - L60X8	5a21/104	0,000	**67,12**
S661	CS171 - L60X8	5a21/104	0,000	**-40,86**
S661	CS171 - L60X8	1b-p/149	0,000	**-21,44**
S662	CS171 - L60X8	1b-p/40	0,000	**36,46**
S662	CS171 - L60X8	5a22/93	0,000	**69,08**
S663	CS171 - L60X8	5a22/93	0,000	**-42,05**
S663	CS171 - L60X8	1b-p/40	0,000	**-22,21**
S664	CS171 - L60X8	1b-p/107	0,000	**36,51**
S664	CS171 - L60X8	5a13/13	0,000	**69,68**
S665	CS171 - L60X8	5a13/13	0,000	**-42,16**
S665	CS171 - L60X8	1b-p/107	0,000	**-22,12**
S666	CS171 - L60X8	1b-p/150	0,000	**36,01**
S666	CS171 - L60X8	5a14/86	0,000	**68,36**
S667	CS171 - L60X8	5a14/86	0,000	**-41,38**
S667	CS171 - L60X8	1b-p/150	0,000	**-21,81**

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	1a-p/15	**-94,61**	**-93,85**	**-432,00**	0,00	0,00	0,00
Sn1/N1	1a/2	**194,94**	**212,20**	**1021,68**	0,00	0,00	0,00
Sn1/N1	1a/5	52,05	60,34	300,61	**0,00**	**0,00**	**0,00**
Sn2/N3	1a/3	**-162,62**	**155,08**	**763,04**	0,00	0,00	0,00
Sn2/N3	1a-p/16	**128,70**	**-148,75**	**-688,76**	0,00	0,00	0,00
Sn2/N3	1a/5	-17,73	3,71	38,37	**0,00**	**0,00**	**0,00**
Sn3/N7	1a/18	**-141,34**	**-143,20**	**670,17**	0,00	0,00	0,00
Sn3/N7	1a-p/4	**150,15**	**161,16**	**-783,97**	0,00	0,00	0,00
Sn3/N7	1a/5	-0,80	3,44	-28,58	**0,00**	**0,00**	**0,00**
Sn4/N6	1a-p/17	**-110,46**	**110,41**	**-524,06**	0,00	0,00	0,00
Sn4/N6	1a/1	**179,11**	**-195,03**	**927,69**	0,00	0,00	0,00
Sn4/N6	1a/5	40,68	-48,43	234,69	**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]
1a-p/15	Sn1/N1	Rx	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rx	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Ry	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Ry	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a-p/15	Sn1/N1	Rz	133,26	452,08	-0,23	-3,24	-94,61	-93,85	-432,00
1a/2	Sn1/N1	Rz	288,15	1061,53	-177,57	3,55	194,94	212,20	1021,68
1a/3	Sn2/N3	Rx	215,85	689,43	-93,89	-3,03	-162,62	-141,93	-654,77
1a-p/16	Sn2/N3	Rx	196,33	755,03	94,04	3,71	128,70	148,26	729,05
1a-p/17	Sn2/N3	Ry	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Ry	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a-p/17	Sn2/N3	Rz	215,33	721,63	-91,31	-3,20	-155,69	-148,75	-688,76
1a/1	Sn2/N3	Rz	197,17	788,10	96,86	3,87	121,77	155,08	763,04
1a/18	Sn3/N7	Rx	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Rx	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a/18	Sn3/N7	Ry	201,21	776,32	-179,62	-3,73	-141,34	-143,20	-749,80
1a-p/4	Sn3/N7	Ry	220,27	673,06	2,02	2,89	150,15	161,16	636,00
1a-p/15	Sn3/N7	Rz	191,46	807,01	-179,57	-4,09	-134,37	-136,39	-783,97
1a/2	Sn3/N7	Rz	210,53	702,46	2,15	3,18	143,18	154,34	670,17
1a-p/17	Sn4/N6	Rx	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rx	206,91	950,48	-104,96	4,48	179,11	103,60	927,69
1a/3	Sn4/N6	Ry	220,78	537,36	107,05	-2,22	-103,49	-195,03	-489,91
1a-p/16	Sn4/N6	Ry	204,50	916,64	-102,32	4,37	172,14	110,41	893,54
1a-p/17	Sn4/N6	Rz	218,23	567,68	104,59	-2,40	-110,46	-188,21	-524,06
1a/1	Sn4/N6	Rz	206,91	950,48	-104,96	4,48	179,11	103,60	927,69

11.4. Controle UNP profilen

11.4.1. Traverse 1 en 2 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS144 - UNP160	5a21/94	S340	S 235	2,942	0,68	0,51	0,68

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

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

Staaf S340	**8,015 m**	**UNP160**	**S 235**	**5a21/94**	**0,68 -**

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	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,82

=> Interne drukonderdelen klasse 1

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

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	18,29

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

Kritische controle op positie 2.942 m

Interne krachten	Berekende	Eenheid
N,Ed	-97,76	kN
Vy,Ed	6,69	kN
Vz,Ed	1,73	kN
T,Ed	0,01	kNm
My,Ed	-3,59	kNm
Mz,Ed	-1,89	kNm

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

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,17	-

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

Tau,t,Ed	2,0	MPa
Tau,Rd	135,7	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	1,3650e-03	m^2

Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,04	-

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

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	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	1,3760e-04	m^3
Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,11	-

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

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	kNm
Eenheidscontrole	0,23	-

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

Npl,Rd	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,17 + 0,11 + 0,23 = 0,51 -

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: 2,942 m
Classificatie van interne drukonderdelen
Volgens EN 1993-1-1 tabel 5.2 blad 1

Maximale breedte/dikte-verhouding	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,82

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

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	18,29

=> 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	5.073	0.360	m
lef/lsys k	0.99	0.86	
Kniklengte Lcr	5.039	0.310	m
Kritische Euler belastingen Ncr	755.12	18358.54	kN
Slankheid	81.16	16.46	
Relatieve slankheid Lambda	0.86	0.18	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.62	1.00	
Knikweerstand Nb,Rd	350.78	564.00	kN

Tabel van waarden		
A	2.4000e-03	m^2
Knikweerstand Nb,Rd	350.78	kN
Eenheidscontrole	0.28	-

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

Tabel van waarden		
Torsieknik lengte	0.360	m
Ncr,T	11372.49	kN
Ncr,TF	740.86	kN
Relatieve slankheid Lambda,T	0.87	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.62	
Knikweerstand Nb,Rd	347.88	kN
Eenheidscontrole	0.28	-

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	1.1600e-04	m^3
Elastisch critisch moment Mcr	1037.61	kNm
Relatieve slankheid Lambda,LT	0.16	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	0.360	m
k	1.00	
kw	1.00	
C1	1.09	
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	0.458	
kyz	0.602	
kzy	0.998	
kzz	0.602	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-3.59	kNm
Mz,Ed	-1.89	kNm
Interactie Methode 2		
Psi y	-0.009	
Psi z	-0.277	
Cmy	0.400	
Cmz	0.591	
CmLT	0.931	

Eenheidscontrole (6.61) = 0.28 + 0.06 + 0.26 = 0.60
Eenheidscontrole (6.62) = 0.28 + 0.13 + 0.26 = 0.68

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

Tabel van waarden	
hw/t	18.533

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. Traverse 2 en 3 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS101 - UNP120	5a11/65	S194	S 235	0,000	0,32	0,22	0,32

EC 3

D&C ENGINEERING	**Project**	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

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

Staaf S194	**3,073 m**	**UNP120**	**S 235**	**5a11/65**	**0,32 -**

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	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,63

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

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,79

=> 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	-77,28	kN
Vy,Ed	0,00	kN
Vz,Ed	0,44	kN
T,Ed	0,01	kNm
My,Ed	-0,38	kNm
Mz,Ed	0,01	kNm

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

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,19	-

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

Tau,t,Ed	1,2	MPa
Tau,Rd	135,7	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	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,00	-

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

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	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	7,2600e-05	m^3

Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

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

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	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	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,19 + 0,02 + 0,00 = 0,22 -

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	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	44,63

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

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,79

=> 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	1.00	0.89	
Kniklengte Lcr	3.070	1.090	m
Kritische Euler belastingen Ncr	800.27	753.14	kN
Slankheid	66.35	68.40	
Relatieve slankheid Lambda	0.71	0.73	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.72	0.71	
Knikweerstand Nb,Rd	287.89	282.48	kN

Tabel van waarden		
A	1.7000e-03	m^2
Knikweerstand Nb,Rd	282.48	kN
Eenheidscontrole	0.27	-

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	1349.67	kN
Ncr,TF	624.37	kN
Relatieve slankheid Lambda,T	0.80	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	1.7000e-03	m^2
Reductie factor Chi	0.66	
Knikweerstand Nb,Rd	264.56	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	6.0700e-05	m^3
Elastisch critisch moment Mcr	113.69	kNm
Relatieve slankheid Lambda,LT	0.35	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.220	m
k	1.00	
kw	1.00	
C1	2.12	
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	0.446	
kyz	0.981	
kzy	0.959	
kzz	0.981	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.38	kNm
Mz,Ed	0.01	kNm
Interactie Methode 2		
Psi y	-0.051	
Psi z	0.691	
Cmy	0.400	
Cmz	0.876	
CmLT	0.492	

Eenheidscontrole (6.61) = 0.27 + 0.01 + 0.00 = 0.28
Eenheidscontrole (6.62) = 0.29 + 0.03 + 0.00 = 0.32

Plooicontrole

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

Tabel van waarden	
hw/t	14.571

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

11.4.3. Vak 9 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS144 - UNP160	3/10	S643	S 235	0,000	0,81	0,57	0,81

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

EN 1993-1-1 Norm Controle

Nationale bijlage: Nederlandse NEN-EN NA

Staaf S643	**1,720 m**	**UNP160**	**S 235**	**3/10**	**0,81 -**

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

Materiaal		
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	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	53,81

=> Interne drukonderdelen klasse 1

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

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,93

=> 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	-211,74	kN
Vy,Ed	-0,12	kN
Vz,Ed	3,33	kN
T,Ed	0,00	kNm
My,Ed	-5,33	kNm
Mz,Ed	0,21	kNm

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

A	2,4000e-03	m^2
Nc,Rd	564,00	kN
Eenheidscontrole	0,38	-

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	1,3650e-03	m^2
Vpl,y,Rd	185,20	kN
Eenheidscontrole	0,00	-

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

Eta	1,20	
Av	1,2240e-03	m^2
Vpl,z,Rd	166,07	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	1,3760e-04	m^3
Mpl,y,Rd	32,34	kNm
Eenheidscontrole	0,16	-

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

Wpl,z	3,5200e-05	m^3
Mpl,z,Rd	8,27	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	564,00	kN
Mpl,y,Rd	32,34	kNm
Mpl,z,Rd	8,27	kNm

Eenheidscontrole (6.2) = 0,38 + 0,16 + 0,03 = 0,57 -

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	15,73
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	53,81

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

Maximale breedte/dikte-verhouding	4,48
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,93

=> 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	0.94	0.85	
Kniklengte Lcr	1.623	1.463	m
Kritische Euler belastingen Ncr	7281.42	826.53	kN
Slankheid	26.14	77.58	
Relatieve slankheid Lambda	0.28	0.83	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.96	0.65	
Knikweerstand Nb,Rd	541.55	364.23	kN

Tabel van waarden		
A	2.4000e-03	m^2
Knikweerstand Nb,Rd	364.23	kN
Eenheidscontrole	0.58	-

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	1486.54	kN
Ncr,TF	1395.17	kN
Relatieve slankheid Lambda,T	0.64	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	2.4000e-03	m^2
Reductie factor Chi	0.76	
Knikweerstand Nb,Rd	430.87	kN
Eenheidscontrole	0.49	-

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	1.1600e-04	m^3
Elastisch critisch moment Mcr	130.74	kNm
Relatieve slankheid Lambda,LT	0.46	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.720	m
k	1.00	
kw	1.00	
C1	1.82	
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	0.623	
kyz	0.979	
kzy	0.928	
kzz	0.979	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	2.4000e-03	m^2
Wy	1.1600e-04	m^3
Wz	1.8300e-05	m^3
NRk	564.00	kN
My,Rk	27.26	kNm
Mz,Rk	4.30	kNm
My,Ed	-5.33	kNm
Mz,Ed	0.21	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.585	
Cmz	0.760	
CmLT	0.585	

Eenheidscontrole (6.61) = 0.39 + 0.12 + 0.05 = 0.56
Eenheidscontrole (6.62) = 0.58 + 0.18 + 0.05 = 0.81

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

Tabel van waarden	
hw/t	18.533

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

11.4.4. Vak 12 - onderrand

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

css	BG	Staaf	mat	dx [m]	Algehele toetsing [-]	Doorsnedetoetsing [-]	Stabiliteittoetsing [-]
CS101 - UNP120	3-p/23	S632	S 235	1,604	**3,41**	0,34	**3,41**

EC 3

Lineaire berekening, Extreem : Doorsnede
, Extreem : DoorsnedeKlasse : All UGT

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

Staaf S632	**4,465 m**	**UNP120**	**S 235**	**3-p/23**	**3,41 -**

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	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00
Grenswaarde klasse 3	42,76

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

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	16,86

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

Kritische controle op positie 1.604 m

Interne krachten	Berekende	Eenheid
N,Ed	-96,75	kN
Vy,Ed	-0,32	kN
Vz,Ed	0,58	kN
T,Ed	0,00	kNm
My,Ed	0,27	kNm
Mz,Ed	-0,41	kNm

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

A	1,7000e-03	m^2
Nc,Rd	399,50	kN
Eenheidscontrole	0,24	-

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	9,9000e-04	m^2
Vpl,y,Rd	134,32	kN
Eenheidscontrole	0,00	-

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

Eta	1,20	
Av	8,5400e-04	m^2
Vpl,z,Rd	115,87	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	7,2600e-05	m^3
Mpl,y,Rd	17,06	kNm
Eenheidscontrole	0,02	-

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

Wpl,z	2,1200e-05	m^3
Mpl,z,Rd	4,98	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	399,50	kN
Mpl,y,Rd	17,06	kNm
Mpl,z,Rd	4,98	kNm

Eenheidscontrole (6.2) = 0,24 + 0,02 + 0,08 = 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	12,00
Grenswaarde klasse 1	33,00
Grenswaarde klasse 2	38,00

Grenswaarde klasse 3	47,68

=> Interne drukonderdelen klasse 1

Classificatie van uitkragende flenzen

Volgens EN 1993-1-1 tabel 5.2 blad 2

Maximale breedte/dikte-verhouding	4,33
Grenswaarde klasse 1	9,00
Grenswaarde klasse 2	10,00
Grenswaarde klasse 3	13,99

=> 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	ongeschoord	geschoord	
Systeemlengte L	1.967	1.604	m
lef/lsys k	7.47	0.71	
Kniklengte Lcr	14.694	1.146	m
Kritische Euler belastingen Ncr	34.94	681.92	kN
Slankheid	317.55	71.88	
Relatieve slankheid Lambda	3.38	0.77	
Limiet slankheid Lambda,0	0.20	0.20	
Knikkromme	c	c	
Imperfectie Alpha	0.49	0.49	
Reductie factor Chi	0.08	0.68	
Knikweerstand Nb,Rd	30.45	273.21	kN

Waarschuwing: slankheid 317.55 is groter dan 200.00 !

Tabel van waarden		
A	1.7000e-03	m^2
Knikweerstand Nb,Rd	30.45	kN
Eenheidscontrole	**3.18**	-

Torsieknikcontrole

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

Tabel van waarden		
Torsieknik lengte	1.604	m
Ncr,T	1177.88	kN
Ncr,TF	34.60	kN
Relatieve slankheid Lambda,T	3.40	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	1.7000e-03	m^2
Reductie factor Chi	0.08	
Knikweerstand Nb,Rd	30.17	kN
Eenheidscontrole	**3.21**	-

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	6.0700e-05	m^3
Elastisch critisch moment Mcr	87.95	kNm
Relatieve slankheid Lambda,LT	0.40	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.604	m
k	1.00	
kw	1.00	
C1	2.30	
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	2.616	
kyz	0.465	
kzy	0.923	
kzz	0.465	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	1.7000e-03	m^2
Wy	6.0700e-05	m^3
Wz	1.1100e-05	m^3

Tabel van waarden		
NRk	399.50	kN
My,Rk	14.26	kNm
Mz,Rk	2.61	kNm
My,Ed	-0.84	kNm
Mz,Ed	-0.41	kNm
Interactie Methode 2		
Psi y	-0.445	
Psi z	-0.224	
Cmy	0.900	
Cmz	0.400	
CmLT	0.427	

Eenheidscontrole (6.61) = 3.18 + 0.15 + 0.07 = 3.41
Eenheidscontrole (6.62) = 3.21 + 0.05 + 0.07 = 3.33

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

Tabel van waarden	
hw/t	14.571

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

11.5. Controle verzwaarde randstaaf van Vak 1 t/m 4

11.5.1. Randen : Vak 1 t/m 4

Lineaire berekening, Extreem : Doorsnede
Selectie : Benoemde selectie - Randen vak 1 t/m 4
Klasse : All UGT

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

Staaf C1	**10,951 m**	**2LX (L150X14; 15)**	**S 235**	**1a/2**	**0,87 -**

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	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 10.951 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-1129,09	kN
Vy,Ed	-0,03	kN
Vz,Ed	1,46	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,00	kNm

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

A	8,0640e-03	m^2
Nc,Rd	1895,03	kN
Eenheidscontrole	0,60	-

Afschuivingscontrole voor Vy
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vy,Ed	0,0	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	85,2	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,63	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	1	
Sigma,N,Ed	140,0	MPa
Sigma,My,Ed	0,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	140,0	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	85,2	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	85,2	MPa
Sigma,von Mises,Ed	203,4	MPa
Eenheidscontrole	0,87	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

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

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	2.190	m
ivv	57.69	mm
Knikkromme	c	
Kritische slankheid	37.96	
Effectieve slankheid	0.40	
Knikfactor (omega_buc)	0.90	
UC slankheid	0.32	
Limiet slankheid	120.00	

Tabel van waarden		
A	8.0640e-03	m^2
Knikweerstand Nb,Rd	1696.20	kN
Eenheidscontrole	0.67	-

Torsieknikcontrole

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

Tabel van waarden		
Torsieknik lengte	2.190	m
Ncr,T	17448.30	kN
Ncr,TF	12441.36	kN
Relatieve slankheid Lambda,T	0.39	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	8.0640e-03	m^2
Reductie factor Chi	0.90	
Knikweerstand Nb,Rd	1710.17	kN
Eenheidscontrole	0.66	-

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	0.751	
kyz	0.751	
kzy	0.966	
kzz	0.751	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	8.0640e-03	m^2
Wy	3.7793e-04	m^3
Wz	2.5307e-04	m^3
NRk	1895.03	kN
My,Rk	88.81	kNm
Mz,Rk	59.47	kNm
My,Ed	-2.58	kNm
Mz,Ed	-0.05	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	

Tabel van waarden		
Cmy	0.646	
Cmz	0.646	
CmLT	0.646	

Eenheidscontrole (6.61) = 0.67 + 0.02 + 0.00 = 0.69
Eenheidscontrole (6.62) = 0.67 + 0.03 + 0.00 = 0.69
De staaf voldoet aan de stabiliteitscontrole.

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

Staaf C5	**3,374 m**	**2LX (L140X13; 13)**	**S 235**	**1a/2**	**0,71 -**

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	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 0.000 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-1085,93	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,12	kN
T,Ed	0,00	kNm
My,Ed	0,00	kNm
Mz,Ed	0,00	kNm

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

A	6,9912e-03	m^2
Nc,Rd	1642,93	kN
Eenheidscontrole	0,66	-

Afschuivingscontrole voor Vz
Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	8,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,06	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.
Controle gecombineerde buiging, axiale kracht en afschuifkracht
Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	13	
Sigma,N,Ed	155,3	MPa
Sigma,My,Ed	0,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	155,3	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	8,4	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	8,4	MPa
Sigma,von Mises,Ed	156,0	MPa
Eenheidscontrole	0,66	-

De staaf voldoet aan de doorsnedecontrole.
...::STABILITEITSCONTROLE::...
Buigingsknik Controle
Volgens artikel EN 1993-1-1 : 6.3.1.1. en formule (6.46)

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.687	m
ivv	53.85	mm
Knikkromme	c	

D&C ENGINEERING	Project	150 kV lijn Leiden - Zoetermeer
	Onderdeel	Berekening Mast 75
	Omschrijving	Controle berekening
	Nationale norm	EC - EN
	Auteur	MG

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
Kritische slankheid	31.33	
Effectieve slankheid	0.33	
Knikfactor (omega_buc)	0.93	
UC slankheid	0.26	
Limiet slankheid	120.00	

Tabel van waarden		
A	6.9912e-03	m^2
Knikweerstand Nb,Rd	1531.10	kN
Eenheidscontrole	0.71	-

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

Tabel van waarden		
Torsieknik lengte	1.687	m
Ncr,T	15393.61	kN
Ncr,TF	14831.65	kN
Relatieve slankheid Lambda,T	0.33	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	6.9912e-03	m^2
Reductie factor Chi	0.93	
Knikweerstand Nb,Rd	1531.75	kN
Eenheidscontrole	0.71	-

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	0.982	
kyz	0.982	
kzy	0.981	
kzz	0.982	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.9912e-03	m^2
Wy	3.0188e-04	m^3
Wz	2.0480e-04	m^3
NRk	1642.93	kN
My,Rk	70.94	kNm
Mz,Rk	48.13	kNm
My,Ed	-0.11	kNm
Mz,Ed	0.00	kNm
Interactie Methode 2		
Psi y	0.000	
Psi z	0.000	
Cmy	0.860	
Cmz	0.860	
CmLT	0.860	

Eenheidscontrole (6.61) = 0.71 + 0.00 + 0.00 = 0.71
Eenheidscontrole (6.62) = 0.71 + 0.00 + 0.00 = 0.71
De staaf voldoet aan de stabiliteitscontrole.

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

Staaf C9	**6,648 m**	**2LX (L140X13; 13)**	**S 235**	**1a/2**	**0,61 -**

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	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.
...::DOORSNEDE CONTROLE::...
Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.
Kritische controle op positie 1.768 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-921,59	kN
Vy,Ed	0,00	kN
Vz,Ed	-0,10	kN
T,Ed	0,00	kNm
My,Ed	-0,29	kNm
Mz,Ed	0,00	kNm

Waarschuwing: Torsie wordt niet in rekening genomen voor deze doorsnede!

Drukcontrole

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

A	6,9912e-03	m^2
Nc,Rd	1642,93	kN
Eenheidscontrole	0,56	-

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	6,5	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,05	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,y,min	3,0188e-04	m^3
Mel,y,Rd	70,94	kNm
Eenheidscontrole	0,00	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,z,min	2,0480e-04	m^3
Mel,z,Rd	48,13	kNm
Eenheidscontrole	0,00	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	16	
Sigma,N,Ed	131,8	MPa
Sigma,My,Ed	1,0	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	132,8	MPa
Tau,Vy,Ed	0,0	MPa
Tau,Vz,Ed	0,0	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	0,0	MPa
Sigma,von Mises,Ed	132,8	MPa
Eenheidscontrole	0,57	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

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

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.768	m
ivv	53.85	mm
Knikkromme	c	
Kritische slankheid	32.84	
Effectieve slankheid	0.35	
Knikfactor (omega_buc)	0.92	
UC slankheid	0.27	
Limiet slankheid	120.00	

Tabel van waarden		
A	6.9912e-03	m^2
Knikweerstand Nb,Rd	1517.50	kN
Eenheidscontrole	0.61	-

Torsieknikcontrole

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

Tabel van waarden		
Torsieknik lengte	1.768	m
Ncr,T	15393.61	kN
Ncr,TF	13454.27	kN
Relatieve slankheid Lambda,T	0.35	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	

Tabel van waarden		
Imperfectie Alpha	0.49	
A	6.9912e-03	m^2
Reductie factor Chi	0.92	
Knikweerstand Nb,Rd	1517.66	kN
Eenheidscontrole	0.61	-

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	3.0188e-04	m^3
Elastisch critisch moment Mcr	1328.33	kNm
Relatieve slankheid Lambda,LT	0.23	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.768	m
k	1.00	
kw	1.00	
C1	1.04	
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)

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	1.123	
kyz	1.127	
kzy	0.986	
kzz	1.127	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	6.9912e-03	m^2
Wy	3.0188e-04	m^3
Wz	2.0480e-04	m^3
NRk	1642.93	kN
My,Rk	70.94	kNm
Mz,Rk	48.13	kNm
My,Ed	-0.36	kNm
Mz,Ed	0.00	kNm
Interactie Methode 2		
Psi y	0.833	
Psi z	0.848	
Cmy	0.996	
Cmz	1.000	
CmLT	0.996	

Eenheidscontrole (6.61) = 0.61 + 0.01 + 0.00 = 0.61
Eenheidscontrole (6.62) = 0.61 + 0.00 + 0.00 = 0.61
De staaf voldoet aan de stabiliteitscontrole.

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

Staaf C13	6,648 m	2LX (L130X12; 12)	S 235	1a/2	0,65 -

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	

Waarschuwing: Sterktereductie gerelateerd aan de dikte wordt niet ondersteund voor dit type doorsnede.

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

Classificatie voor doorsnede-ontwerp
Volgens EN 1993-1-1 artikel 5.5.2
Waarschuwing: Classificatie wordt niet ondersteund voor dit type doorsnede.
De doorsnede wordt gecontroleerd als elastisch, klasse 3.

Kritische controle op positie 1.784 m
As definitie :
- hoofd y- as in deze normcontrole verwijst naar de hoofd z as in Scia Engineer
- hoofd z- as in deze normcontrole verwijst naar de hoofd y as in Scia Engineer

Interne krachten	Berekende	Eenheid
N,Ed	-753,83	kN

Interne krachten	Berekende	Eenheid
Vy,Ed	0,36	kN
Vz,Ed	-0,44	kN
T,Ed	0,00	kNm
My,Ed	-0,89	kNm
Mz,Ed	-0,65	kNm

Waarschuwing: Torsie wordt niet in rekening genomen voor deze doorsnede!

Drukcontrole

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

A	5,9948e-03	m^2
Nc,Rd	1408,79	kN
Eenheidscontrole	0,54	-

Afschuivingscontrole voor Vy

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vy,Ed	0,1	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,00	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Afschuivingscontrole voor Vz

Volgens EN 1993-1-1 artikel 6.2.6 en formule (6.19)

Tau,Vz,Ed	34,4	MPa
Tau,Rd	135,7	MPa
Eenheidscontrole	0,25	-

Opmerking: Er is geen afschuifoppervlak opgegeven voor deze doorsnede/bouwwijze, waardoor de plastische afschuifweerstand niet kan worden bepaald. Het gevolg is dat de elastische afschuifweerstand volgens EN 1993-1-1 artikel 6.2.6(4) wordt getoetst.

Controle buigend moment voor My

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,y,min	2,3996e-04	m^3
Mel,y,Rd	56,39	kNm
Eenheidscontrole	0,02	-

Controle buigend moment voor Mz

Volgens EN 1993-1-1 artikel 6.2.5 en formule (6.12),(6.14)

Wel,z,min	1,6308e-04	m^3
Mel,z,Rd	38,32	kNm
Eenheidscontrole	0,02	-

Controle gecombineerde buiging, axiale kracht en afschuifkracht

Volgens EN 1993-1-1 artikel 6.2.1(5) en formule (6.1)

Elastische toetsing		
Vezel	13	
Sigma,N,Ed	125,7	MPa
Sigma,My,Ed	0,3	MPa
Sigma,Mz,Ed	0,0	MPa
Sigma,tot,Ed	126,0	MPa
Tau,Vy,Ed	0,1	MPa
Tau,Vz,Ed	34,4	MPa
Tau,t,Ed	0,0	MPa
Tau,tot,Ed	34,4	MPa
Sigma,von Mises,Ed	139,4	MPa
Eenheidscontrole	0,59	-

De staaf voldoet aan de doorsnedecontrole.

...::STABILITEITSCONTROLE::...

Buigingsknik Controle

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

Slankheidsgegevens (EN 50341-1) voor : Staaf met symmetrische schoren		
L	1.784	m
ivv	50.01	mm
Knikkromme	c	
Kritische slankheid	35.67	
Effectieve slankheid	0.38	
Knikfactor (omega_buc)	0.91	
UC slankheid	0.30	
Limiet slankheid	120.00	

Tabel van waarden		
A	5.9948e-03	m^2
Knikweerstand Nb,Rd	1279.09	kN
Eenheidscontrole	0.59	-

Torsieknikcontrole

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

Tabel van waarden		
Torsieknik lengte	1.784	m
Ncr,T	13103.56	kN
Ncr,TF	17869.85	kN
Relatieve slankheid Lambda,T	0.33	
Limiet slankheid Lambda,0	0.20	
Knikkromme	c	
Imperfectie Alpha	0.49	
A	5.9948e-03	m^2
Reductie factor Chi	0.93	
Knikweerstand Nb,Rd	1317.03	kN
Eenheidscontrole	0.57	-

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	2.3996e-04	m^3
Elastisch critisch moment Mcr	1155.67	kNm
Relatieve slankheid Lambda,LT	0.22	
Limiet slankheid Lambda,LT,0	0.40	

Mcr Parameters		
Kiplengte	1.784	m
k	1.00	
kw	1.00	
C1	1.24	
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	0.951	
kyz	0.908	
kzy	0.981	
kzz	0.908	
Delta My	0.00	kNm
Delta Mz	0.00	kNm
A	5.9948e-03	m^2
Wy	2.3996e-04	m^3
Wz	1.6308e-04	m^3
NRk	1408.79	kN
My,Rk	56.39	kNm
Mz,Rk	38.32	kNm
My,Ed	-1.56	kNm
Mz,Ed	-1.29	kNm
Interactie Methode 2		
Psi y	0.566	
Psi z	0.500	
Cmy	0.839	
Cmz	0.800	
CmLT	0.839	

Eenheidscontrole (6.61) = 0.59 + 0.03 + 0.03 = 0.65
Eenheidscontrole (6.62) = 0.59 + 0.03 + 0.03 = 0.65

De staaf voldoet aan de stabiliteitscontrole.

EC 3

Bijlage C Controle staven mastlichaam

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

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 - randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1087,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*888,3*	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 : *H150/150/14* (*1)

h	=	*150*	mm	I_y	=	*8453963*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm	i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2	i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2190*	mm	No. bolts / end / flange		=	*5*	(Per flange !)
$L_{v;cr}$	=	*2190*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*75*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,04** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **75** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,59** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,61** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,77** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = **1,61** = **161%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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}	=	*-107,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*93,6*	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 : *H180/90/10* (*1)

h	=	*180*	mm		I_y	=	*8803399*	mm^4
b	=	*90*	mm		$W_{y;el;eff.1}$	=	*54516*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*475424*	mm^3
y_s	=	*18,5*	mm		i_y	=	*58,0*	mm
A_{bruto}	=	*2621*	mm^2		i_v	=	*19,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*12292*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*40*	mm
Position perpendicular force	=	*2*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **212** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,89** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 en 2e schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-25,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*25,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2169*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2169*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*8*	mm	Dubble strap joint	no=1, yes=2	=	*2*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **258** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **2,14** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **2,35** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,42** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,37** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 2,35 = 235%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 en 2e schuine knikverkorters* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-25,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*25,1*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2169*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2169*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*0*	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		=	*8*	mm	Dubble strap joint	no=1, yes=2	=	*2*

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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **188** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,77** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,21** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,85** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-10,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,9*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2827*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2827*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt	e2	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*7*	mm	Dubble strap joint	no=1, yes=2	=	*2*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,29** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **336** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,53** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,64** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,59** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,64 = 164%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 schuine knikverkorters* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-10,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,9*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2827*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2827*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*0*	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		=	*7*	mm	Dubble strap joint	no=1, yes=2	=	*2*

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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,69** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,09** **< 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) : **$U.C_{max}$ = 0,81 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 4e schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,8*	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 : *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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3371*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*3371*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*0*	mm	Edge distance bolt	e2	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
Column profile?		=	*1*	no=1, yes=2	Rolled screw threads		=	*1*
Thickness tie plate		=	*6*	mm	Dubble strap joint	no=1, yes=2	=	*2*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,26** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **351** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,32** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,45** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,53** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,45 = 145%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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* *4e schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,8*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3371*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*3371*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*6*	mm	Dubble strap joint	no=1, yes=2	=	*2*	

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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **352** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,86** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,96** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,33** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$** = **0,96** = **96%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 1 - 1e en 2e hor knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1520*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1520*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1520*	mm		Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **181** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,49** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 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) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 1 - 3e hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8*	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 : *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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2280*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2280*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2280*	mm		Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,19** **> 1 !!**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **237** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,57** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 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) : **$U.C_{max}$ = 1,19 = 119%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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. knikverkorters* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2280*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2280*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2280*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,78** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,47** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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): **$U.C_{max}$ = 0,78 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 - 4e hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,8*	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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3040*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*3040*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3040*	mm		Edge distance bolt e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,20** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **263** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,48** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,58** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 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) : **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2 - randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1041,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*857,8*	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 : *H140/140/13* (*1)

h	=	*140*	mm		I_y	=	*6385392*	mm^4
b	=	*140*	mm		$W_{y;el;eff.1}$	=	*63366*	mm^3
t_f	=	*13*	mm		$W_{y;el;eff.2}$	=	*162768*	mm^3
y_s	=	*39,2*	mm		i_y	=	*42,7*	mm
A_{bruto}	=	*3495*	mm^2		i_v	=	*27,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1687*	mm		No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*1687*	mm		Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*75*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,17** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **62** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,58** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,92** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,00** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,92 = 192%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2 - diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-74,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*76,6*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2458*	mm		Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2		Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	mm		Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **156** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,33** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,13** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 1,33 = 133%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2 - diagonalen* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-74,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*76,6*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4916*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2458*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*13*	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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,96** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,56** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,77** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **U.C$_{max}$ = 0,96 = 96%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2 schuin kikverkorter*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-13,7* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*13,7* 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 : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2621*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2621*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **312** **< 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:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,66** **> 1 !!**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,80** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,45** **< 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) : **$U.C_{max}$ = 1,80 = 180%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2* *schuin kikverkorter* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-13,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*13,7*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2621*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2621*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*13*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **274** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,90** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 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) : **$U.C_{max}$ = 0,90 = 90%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 2 - hor. kikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,5*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1900*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1900*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1900*	mm		Edge distance bolt e2	=	*40*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2		Rolled screw threads	=	*1*	
Thickness tie plate	=	*13*	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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,15** **> 1 !!**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **226** **< 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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,59** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 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) : **$U.C_{max}$ = 1,15 = 115%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 2 - hor. kikverkorters* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,5*	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 : *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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1900*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*1900*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1900*	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	=	*13*	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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,84** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **198** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,29** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,39** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** **< 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$_{max}$** = **0,84** = **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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak3* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-930,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*745,6*	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 : *H140/140/13* (*1)

h	=	*140*	mm		I_y	=	*6385392*	mm^4
b	=	*140*	mm		$W_{y;el;eff.1}$	=	*63366*	mm^3
t_f	=	*13*	mm		$W_{y;el;eff.2}$	=	*162768*	mm^3
y_s	=	*39,2*	mm		i_y	=	*42,7*	mm
A_{bruto}	=	*3495*	mm^2		i_v	=	*27,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1768*	mm	No. bolts / end / flange		=	*4*	(Per flange !)
$L_{v;cr}$	=	*1768*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*75*	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	=	*4,6*	
Column profile?	=	*2*	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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,02** **> 1 !!**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **65** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,44** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,72** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,86** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): $U.C_{max}$ = **1,72** = **172%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-83,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*80,7*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2514*	mm		Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,91** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **159** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,07** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,54** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,22** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,40** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,54 =** **154%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3* *diagonalen* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-83,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*80,7*	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 : *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	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5028*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2514*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,53** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **167** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,60** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,95** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,61** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 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.

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Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3* *horizontaal*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,4*	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 : *H70/70/6* (*1)

h		=	*70*	mm	I_y	=	*368840*	mm^4
b		=	*70*	mm	$W_{y;el;eff.1}$	=	*7272*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*19129*	mm^3
y_s		=	*19,3*	mm	i_y	=	*21,3*	mm
A_{bruto}		=	*813*	mm^2	i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3353*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*3353*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*3353*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,08** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,74** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **248** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,38** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,47** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,23** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 0,74 = 74%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-0,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,2*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1676*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1676*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1676*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,01** **> 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,05** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,06** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,35** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** $U.C_{max}$ = **1,01** = **101%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3* *hor. knikverkorters* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-0,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*9,2*	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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1676*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1676*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1676*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,05** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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) : **$U.C_{max}$ = 0,88 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3 - schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-10,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,5*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2356*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2356*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **280** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,17** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$** = **1,17** = **117%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 3 - schuine knikverkorters* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-10,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*10,5*	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 : *H50/50/5* (*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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2356*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2356*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,14** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **245** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,72** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,88** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-723,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*554,1*	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 : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1784*	mm	No. bolts / end / flange	=	*4*	(Per flange !)
$L_{v;cr}$	=	*1784*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*75*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,90** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **71** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,36** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,33** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,70** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = **1,36** = **136%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-89,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,8*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4754*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,62** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **151** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,05** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 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) : **$U.C_{max}$ = 1,05 = 105%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *diagonalen* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-89,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,8*	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 : *H100/100/10* (*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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4754*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*2377*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,37** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,17** **< 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *horizontaal*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,5*	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 : *H60/60/5* (*1)

h		=	*60*	mm	I_y	=	*193708*	mm^4
b		=	*60*	mm	$W_{y;el;eff.1}$	=	*4447*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*11785*	mm^3
y_s		=	*16,4*	mm	i_y	=	*18,2*	mm
A_{bruto}		=	*582*	mm^2	i_v	=	*11,6*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,07** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,05** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,43** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 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)**:** **$U.C_{max}$ = 1,05 = 105%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *horizontaal* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-7,2	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	5,5	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 : 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	=	Fe360		Permissible stress	$f_{y;d}$	=	235,0	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	=	25	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	0	mm	Centre-centre spacing bolt	s1	=	70	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	=	7	mm	Dubble strap joint	no=1, yes=2	=	1	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,05** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,68** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **253** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,12** **< 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) : **$U.C_{max}$ = 0,68 = 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 4* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,5*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1460*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1460*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1460*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,88** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,23** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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)**:** **$U.C_{max}$ = 0,88 = 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 4* *schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-6,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,8*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,09** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **265** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,61** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,70** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,26** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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}	=	*-598,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*419,5*	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 : *H130/130/12* (*1)

h		=	*130*	mm	I_y	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1707*	mm	No. bolts / end / flange		=	*3* (Per flange !)
$L_{v;cr}$		=	*1707*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*40* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **68** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,10** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,47** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 1,47 = 147%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

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* *randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-598,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*419,5*	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 : *H130/130/12* (*1)

h		=	*130*	mm	I_y	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*854*	mm	No. bolts / end / flange		=	*3* (Per flange !)
$L_{v;cr}$		=	*854*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*40* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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?		=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,68** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **34** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,90** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C_{max}** = **0,90** = **90%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-106,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*101,6*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2180*	mm		Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2		Rolled screw threads	=	*1*	
Thickness tie plate	=	*7*	mm		Dubble strap joint no=1, yes=2	=	*1*	
					Staggered holes no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,15** **> 1 !!**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **138** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,09** **> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,65** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,58** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,76** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,76 = 176%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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* *diagonalen* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-106,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*101,6*	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 : *H100/100/15* (*1)

h	=	*100*	mm		I_y	=	*2485619*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*35605*	mm^3
t_f	=	*15*	mm		$W_{y;el;eff.2}$	=	*82335*	mm^3
y_s	=	*30,2*	mm		i_y	=	*29,8*	mm
A_{bruto}	=	*2790*	mm^2		i_v	=	*19,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4360*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2180*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*45*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*14*	mm	Dubble strap joint	no=1, yes=2	=	*1*	
				Staggered holes	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,53** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,88** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,6*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$		=	*1250*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,19** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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)**:** **$U.C_{max}$ = 0,76 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-7,54*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,54*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	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	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,00** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **244** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,67** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 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) : **$U.C_{max}$ = 0,67 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-586,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*431,8*	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	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2140*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*2140*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **85** **< 120**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,26** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,44** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,93** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): $U.C_{max}$ = **1,44** = **144%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

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* *randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-586,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*431,8*	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	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1070*	mm	No. bolts / end / flange		=	*3*	(Per flange !)
$L_{v;cr}$	=	*1070*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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?	=	*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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **42** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,92** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,93** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **U.C$_{max}$ = 0,93 = 93%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-312,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*306,6*	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 : *H150/150/14* (*1)

h	=	*150*	mm		I_y	=	*8453963*	mm^4
b	=	*150*	mm		$W_{y;el;eff.1}$	=	*78326*	mm^3
t_f	=	*14*	mm		$W_{y;el;eff.2}$	=	*200966*	mm^3
y_s	=	*42,1*	mm		i_y	=	*45,8*	mm
A_{bruto}	=	*4031*	mm^2		i_v	=	*29,1*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2821*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2821*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
Column profile?	=	*1*	no=1, yes=2	Rolled screw threads		=	*1*	
Thickness tie plate	=	*14*	mm	Dubble strap joint no=1, yes=2		=	*1*	
				Staggered holes no=1, yes=2		=	*2*	

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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,54** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,14** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): $U.C_{max}$ = **1,54** = **154%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

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* *diagonalen voor- en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-312,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*306,6*	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 : *H150/150/18* (*1)

h	=	*150*	mm	I_y	=	*10499654*	mm^4
b	=	*150*	mm	$W_{y;el;eff.1}$	=	*98735*	mm^3
t_f	=	*18*	mm	$W_{y;el;eff.2}$	=	*240494*	mm^3
y_s	=	*43,7*	mm	i_y	=	*45,4*	mm
A_{bruto}	=	*5103*	mm^2	i_v	=	*29,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2821*	mm	No. bolts / end / flange	=	*3*		
$L_{v;cr}$	=	*2821*	mm	Type of bolts M / "	=	*24*		
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	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	=	*14*	mm	Dubble strap joint no=1, yes=2	=	*2*	

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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **97** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,45** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-56,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*62,3*	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 : *H100/75/7* (*1)

h	=	*100*	mm		I_y	=	*1179878*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*14444*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*64418*	mm^3
y_s	=	*18,3*	mm		i_y	=	*31,5*	mm
A_{bruto}	=	*1187*	mm^2		i_v	=	*15,9*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2382*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2382*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,70** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,65** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,92** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,97** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2): **$U.C_{max}$ = 0,97 = 97%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 6* *horizontaal*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-51,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,5*	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	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3952*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*3952*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*3952*	mm	Edge distance bolt	e2	=	*20* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,06** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,13** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,22** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 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) : **$U.C_{max}$ = 0,68 = 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,80*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,80*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1250*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,76** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,15** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,20** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,16** **< 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)**:** **$U.C_{max}$ = 0,76 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-19,17*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*19,17*	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 : *H100/100/6* (*1)

h	=	*100*	mm		I_y	=	*680089*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm		$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm		i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2		i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2080*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2080*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,19** **< 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:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,19** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 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) : **$U.C_{max}$ = 0,19 = 19%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,64*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,64*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*50* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **306** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,01** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,12** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,29** **< 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) : **$U.C_{max}$ = 1,12 = 112%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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* *schuine knikverkorters zijvlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-8,64*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*8,64*	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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	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*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*50*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,12** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **268** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,83** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,14** **< 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) : **$U.C_{max}$ = 0,83 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-312,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*147,3*	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 : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2119*	mm	No. bolts / end / flange	=	*3*	(Per flange !)
$L_{v;cr}$	=	*2119*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **84** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,67** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 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) : **$U.C_{max}$ = 0,77 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-295,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*321,8*	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 : *H120/80/8* (*1)

h	=	*120*	mm		I_y	=	*2256520*	mm^4
b	=	*80*	mm		$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm		i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2		i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange		=	*6*	
$L_{v;cr}$	=	*2009*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,62** **> 1 !!**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,74** **> 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,04** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$** = **1,74** = **174%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7* *diagonalen voor- en achtervlak* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-295,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*312,8*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4017*	mm	No. bolts / end / flange		=	*6*	
$L_{v;cr}$	=	*2009*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,86** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,92** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,38** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,02** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,02 = 102%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 7 diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-74,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*73,2*	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 : *H120/80/8* (*1)

h		=	*120*	mm	I_y	=	*2256520*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s		=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}		=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4747*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2009*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **124** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,49** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,71** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 7 horizontaal zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*7,9*	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 : *H75/75/8* (*1)

h		=	*75*	mm	I_y	=	*588737*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*10964*	mm^3
t_f		=	*8*	mm	$W_{y;el;eff.2}$	=	*27635*	mm^3
y_s		=	*21,3*	mm	i_y	=	*22,7*	mm
A_{bruto}		=	*1147*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*4252*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,62** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **295** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,43** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,19** **< 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): **$U.C_{max}$ = 0,62 = 62%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7* *hor. knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,3*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*860*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*860*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*860*	mm		Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,03** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,52** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,04** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,06** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 0,52 = 52%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 7* *schuine knikverkorters*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	-7,2	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	7,2	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 : H50/40/5 (*1)

h		=	50	mm	I_y	=	103800	mm^4
b		=	40	mm	$W_{y;el;eff.1}$	=	2638	mm^3
t_f		=	5	mm	$W_{y;el;eff.2}$	=	9746	mm^3
y_s		=	10,7	mm	i_y	=	15,6	mm
A_{bruto}		=	427	mm^2	i_v	=	8,4	mm

Material :

Mat. qual. Fe360 / Fe510		=	Fe360		Permissible stress	$f_{y;d}$	=	235,0 N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	2227	mm	No. bolts / end / flange		=	1
$L_{v;cr}$		=	2227	mm	Type of bolts	M / "	=	16
$L_{tot\ (with\ comb.\ buckling)}$		=	0	mm	End distance bolt	e1	=	25 mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	0	mm	Centre-centre spacing bolt	s1	=	70 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	=	4,6
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,10** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **265** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,73** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 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) : **$U.C_{max}$ = 0,73 = 73%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 8* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-239,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*113,3*	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 : *H130/130/12* (*1)

h		=	*130*	mm	I_y	=	*4721746*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s		=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}		=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1570*	mm	No. bolts / end / flange		=	*4* (Per flange !)
$L_{v;cr}$		=	*1570*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*125* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **62** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,42** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,44** **< 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): **$U.C_{max}$ = 0,44 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 voor en achter vlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-212,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*277,2*	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 : *H120/80/8* (*1)

h	=	*120*	mm		I_y	=	*2256520*	mm^4
b	=	*80*	mm		$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm		i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2		i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2030*	mm	No. bolts / end / flange		=	*6*	
$L_{v;cr}$	=	*2030*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,39** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **118** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,26** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,39 =** **139%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 voor en achter vlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-212,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*277,2*	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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2030*	mm	No. bolts / end / flange		=	*6*	
$L_{v;cr}$	=	*2030*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,76** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **87** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-35,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*38,3*	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 : *H70/70/5* (*1)

h	=	*70*	mm	I_y	=	*268391*	mm^4
b	=	*70*	mm	$W_{y;el;eff.1}$	=	*5609*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*14898*	mm^3
y_s	=	*18,0*	mm	i_y	=	*20,3*	mm
A_{bruto}	=	*651*	mm^2	i_v	=	*13,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2366*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2366*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 1 !!**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,38** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,38 = 138%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 8* *diagonalen zijvlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-35,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*38,3*	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 : *H70/70/8* (*1)

h	=	*70*	mm		I_y	=	*474882*	mm^4
b	=	*70*	mm		$W_{y;el;eff.1}$	=	*9522*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*23596*	mm^3
y_s	=	*20,1*	mm		i_y	=	*21,1*	mm
A_{bruto}	=	*1065*	mm^2		i_v	=	*13,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2366*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*2366*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*6*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,35** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **176** **< 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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,82** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,98** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,98 = 98%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

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. knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*141,6*	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 : *H130/130/10* (*1)

h		=	*130*	mm	I_y	=	*3872340*	mm^4
b		=	*130*	mm	$W_{y;el;eff.1}$	=	*41938*	mm^3
t_f		=	*10*	mm	$W_{y;el;eff.2}$	=	*109995*	mm^3
y_s		=	*35,2*	mm	i_y	=	*39,4*	mm
A_{bruto}		=	*2493*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*888*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*888*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*888*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,03** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **35** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,52** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 8* *hor. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-24,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,0*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	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*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1616*	mm		Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,98** **< 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:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,23** **> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,47** **> 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,43** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,47 = 147%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

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 8* *hor. knikverkorters zijvlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-24,8* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,0* 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 : *H50/50/8* (*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	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	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)	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a*L_{tot}$ (with comb. buckling)	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1616*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,55** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **169** **< 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:

$UC_{5-1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** **< 1**

$UC_{5-2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,82** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 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) : **$U.C_{max}$ = 0,82 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

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 8 schuine knikverkorters voorvlak*

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*-289,52* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*247,65* 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 : *H120/80/8* (*1)

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1544*	mm	No. bolts / end / flange	=	*5*	
$L_{v;cr}$	=	*1544*	mm	Type of bolts M / "	=	*24*	
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	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,24** **> 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,27** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,27 = 127%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 knikverkorters voorvlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-289,52*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*247,65*	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	=	*3129382*	mm^4
b	=	*120*	mm		$W_{y;el;eff.1}$	=	*36027*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*94438*	mm^3
y_s	=	*33,1*	mm		i_y	=	*36,7*	mm
A_{bruto}	=	*2318*	mm^2		i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1544*	mm	No. bolts / end / flange		=	*5*	
$L_{v;cr}$	=	*1544*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*10*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **66** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,43** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,77** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 9* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-244,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*377,3*	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 : *H130/130/12* (*1)

h	=	*130*	mm	I_y	=	*4721746*	mm^4
b	=	*130*	mm	$W_{y;el;eff.1}$	=	*50442*	mm^3
t_f	=	*12*	mm	$W_{y;el;eff.2}$	=	*129742*	mm^3
y_s	=	*36,4*	mm	i_y	=	*39,7*	mm
A_{bruto}	=	*2997*	mm^2	i_v	=	*25,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3202*	mm	No. bolts / end / flange	=	*0*	
$L_{v;cr}$	=	*3202*	mm				
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm				mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm				mm
$L_{perpendicular\ force}$	=	*0*	mm				mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)				
Column profile?	=	*1*	no=1, yes=2				

Summary checks :

Only the stresses in the sections has to be checked.

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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **127** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **n.v.t.** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **n.v.t.** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *diagonalen voor-en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-186,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*207,7*	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 : *H100/100/8* (*1)

h	=	*100*	mm		I_y	=	*1448424*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm		i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2		i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,98** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,15** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,02** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,18** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,18 = 118%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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* *diagonalen voor-en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-186,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*207,7*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*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	=	*8*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,80** **< 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:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,18** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$** = **1,18** = **118%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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* *diagonalen voor-en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-208,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*180,6*	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 : *H120/120/8* (*1)

h	=	*120*	mm		I_y	=	*1911566*	mm^4
b	=	*120*	mm		$W_{y;el;eff.1}$	=	*24300*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*64520*	mm^3
y_s	=	*29,6*	mm		i_y	=	*33,5*	mm
A_{bruto}	=	*1705*	mm^2		i_v	=	*21,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm		No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2373*	mm		Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,81** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **111** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,06** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,02** **> 1 !!**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 1,17 = 117%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 9* *diagonalen voor-en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-208,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*180,6*	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	=	*3129382*	mm^4
b	=	*120*	mm		$W_{y;el;eff.1}$	=	*36027*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*94438*	mm^3
y_s	=	*33,1*	mm		i_y	=	*36,7*	mm
A_{bruto}	=	*2318*	mm^2		i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2373*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2373*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,59** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **102** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2): **$U.C_{max}$ = 1,17 = 117%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *verticalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-3,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*4,5*	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 : *H50/50/5* (*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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1503*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1503*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* 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	=	*4,6*
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 :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **156** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,10** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,14** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,15** **< 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)**:** **$U.C_{max}$ = 0,17 = 17%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 9* *diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-28,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*27,7*	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 : *H75/75/6* (*1)

h		=	*75*	mm	I_y	=	*455710*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s		=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}		=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2456*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2456*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,55** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,76** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,70** **< 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 10* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-112,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*73,3*	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 : *H100/100/6* (*1)

h	=	*100*	mm		I_y	=	*680089*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm		$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm		i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2		i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	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	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*135*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **133** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,27** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 1,27 = 127%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 10* *randen* *verzwaard*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-112,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*73,3*	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 : *H100/100/6* (*1)

h	=	*100*	mm		I_y	=	*680089*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm		$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm		i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2		i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1110*	mm	No. bolts / end / flange		=	*2*	(Per flange !)
$L_{v;cr}$	=	*1110*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*135*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **67** **< 120**

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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,41** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,39** **< 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-130,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*108,0*	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 : *H120/80/8* (*1)

h	=	*120*	mm	I_y	=	*2256520*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*22266*	mm^3
t_f	=	*8*	mm	$W_{y;el;eff.2}$	=	*120944*	mm^3
y_s	=	*18,7*	mm	i_y	=	*38,2*	mm
A_{bruto}	=	*1549*	mm^2	i_v	=	*17,2*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4098*	mm	No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2090*	mm	Type of bolts M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,66** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **122** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,80** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,05** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** $U.C_{max}$ = **1,05** = **105%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 10* *diagonalen voor- en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-130,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*108,0*	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 : *H120/120/10* (*1)

h	=	*120*	mm		I_y	=	*3129382*	mm^4
b	=	*120*	mm		$W_{y;el;eff.1}$	=	*36027*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*94438*	mm^3
y_s	=	*33,1*	mm		i_y	=	*36,7*	mm
A_{bruto}	=	*2318*	mm^2		i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4098*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2090*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*2*	

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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **112** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,50** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-50,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*46,0*	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 : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2651*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*60*	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	=	*4,6*	
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 :
$UC_3 = C_{max;buc} / C_{perm}$ = **174** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,53** **< 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)**:** **$U.C_{max}$ = 0,79 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 10* *diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-50,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*46,0*	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 : *H80/80/10* (*1)

h		=	*80*	mm	I_y	=	*875033*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f		=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s		=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}		=	*1511*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2651*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2651*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*60* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **172** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,06** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** $U.C_{max}$ = **1,06** = **106%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 zijvlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-50,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*46,0*	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 : *H80/80/10* (*1)

h	=	*80*	mm	I_y	=	*875033*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f	=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s	=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}	=	*1511*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2651*	mm	No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*2651*	mm	Type of bolts M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt s1	=	*60*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,33** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **172** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,58** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,88** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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. knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1,12*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,12*	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 : *H45/30/5* (*1)

h		=	*45*	mm	I_y	=	*69843*	mm^4
b		=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s		=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}		=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*799*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$		=	*799*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*799*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,68** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,04** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,04** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1,12*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,12*	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 : *H45/45/5* (*1)

h		=	*45*	mm	I_y	=	*78410*	mm^4
b		=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s		=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}		=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1268*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1268*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1268*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,83** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **147** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,03** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,05** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,04** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 10* *schuine knikverkorters voorvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-2,89*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,89*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,04** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **259** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,25** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,10** **< 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) : **$U.C_{max}$ = 0,29 = 29%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 11* *randen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-62,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*43,6*	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 : *H80/80/6* (*1)

h	=	*80*	mm	I_y	=	*521007*	mm^4
b	=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f	=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s	=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}	=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*970*	mm	No. bolts / end / flange		=	*2*	(Per flange !)
$L_{v;cr}$	=	*970*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*75*	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	=	*4,6*	
Column profile?	=	*2*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **64** **< 120**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,36** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 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)**:** **$U.C_{max}$ = 0,36 = 36%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *diagonalen voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-101,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*110,1*	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 : *H75/75/6* (*1)

h		=	*75*	mm	I_y	=	*455710*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s		=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}		=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,26** **> 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,93** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,81** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,43** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,43 = 143%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 11* *diagonalen voor- en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-67,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*80,8*	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 : *H75/75/7* (*1)

h	=	*75*	mm		I_y	=	*523536*	mm^4
b	=	*75*	mm		$W_{y;el;eff.1}$	=	*9673*	mm^3
t_f	=	*7*	mm		$W_{y;el;eff.2}$	=	*25075*	mm^3
y_s	=	*20,9*	mm		i_y	=	*22,7*	mm
A_{bruto}	=	*1012*	mm^2		i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	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 / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,80** **< 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:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,54** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,30** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 11* *schuine diagonalen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-9,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*6,4*	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 : *H45/30/5* (*1)

h		=	*45*	mm	I_y	=	*69843*	mm^4
b		=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s		=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}		=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1451*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*1451*	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	=	*70* 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	=	*4,6*
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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,75** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,31** **< 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): **$U.C_{max}$ = 0,85 = 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 :	27-3-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 11* *horizontaal zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-6,2*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*23,1*	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 : *H65/65/6* (*1)

h		=	*65*	mm	I_y	=	*291871*	mm^4
b		=	*65*	mm	$W_{y;el;eff.1}$	=	*6215*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*16182*	mm^3
y_s		=	*18,0*	mm	i_y	=	*19,7*	mm
A_{bruto}		=	*753*	mm^2	i_v	=	*12,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*2163*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,56** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **173** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,14** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,77** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,87** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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* *hor. voor en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*57,8*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1231*	mm		No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*1231*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	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	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,14** **> 1 !!**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **146** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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) : **$U.C_{max}$ = 1,14 = 114%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr :	13039140509	**Berekening :**	B.14013
Project	: 150 kV lijn Leiden - Zoetermeer		
Part	: mast 75		

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 11* *hor. voor en achtervlak* **verzwaard**

Memberforces : **(Attention! pressure = "-" and tension ="+")**

Compression:	N_{Sd}	=	*0,0* kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*59,4* 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 : ***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	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1231*	mm	No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*1231*	mm	Type of bolts M / "	=	*16*	
L_{tot} (with comb. buckling)	=	*0*	mm	End distance bolt e1	=	*25*	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	=	*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	=	*8*	mm	Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,86** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,00** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,25** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,67** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *schuine diagonaal v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-162,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*124,5*	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 : *H80/80/6* (*1)

h		=	*80*	mm	I_y	=	*521007*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s		=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}		=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*1541*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,35** **> 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,38** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,20** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,62** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,62 = 162%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *schuine diagonaal v.v en a.v* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-162,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*124,5*	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 : *H80/80/12* (*1)

h	=	*80*	mm		I_y	=	*1016934*	mm^4
b	=	*80*	mm		$W_{y;el;eff.1}$	=	*18203*	mm^3
t_f	=	*12*	mm		$W_{y;el;eff.2}$	=	*42138*	mm^3
y_s	=	*24,1*	mm		i_y	=	*23,9*	mm
A_{bruto}	=	*1787*	mm^2		i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	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 / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*1541*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,69** **< 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:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,70** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,60** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *hor. knikverkorters zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-14,11*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,00*	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 : *H45/45/5* (*1)

h		=	*45*	mm	I_y	=	*78410*	mm^4
b		=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s		=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}		=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*996*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$		=	*996*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*996*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,65** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,30** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,52** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,47** **< 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) : **$U.C_{max}$ = 0,65 = 65%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-123,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*184,7*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2750*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2750*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,73** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,91** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,20** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): $U.C_{max}$ = **1,20** = **120%**

(*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.

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Date :	27-mrt-2014						
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Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *bovenrand* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-123,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*184,7*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2750*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2750*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*2*	

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 :

$UC_3 = C_{max;buc} / C_{perm}$ = **143** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,23** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,80** **< 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.

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Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-16,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*13,7*	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 : *H55/55/5* (*1)

h		=	*55*	mm	I_y	=	*147150*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s		=	*15,2*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*532*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*1500*	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	=	*40* 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	=	*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		=	*8*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,37** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,58** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,47** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 0,58 = 58%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-91,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*29,4*	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 : *H100/100/6* (*1)

h	=	*100*	mm		I_y	=	*680089*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*11071*	mm^3
t_f	=	*6*	mm		$W_{y;el;eff.2}$	=	*29775*	mm^3
y_s	=	*22,8*	mm		i_y	=	*26,0*	mm
A_{bruto}	=	*1006*	mm^2		i_v	=	*16,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2363*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2363*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,28** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **142** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,03** **> 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,82** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 1,03 = 103%**

(*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.

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Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalen v.v en a.v* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-91,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*29,4*	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 : *H100/100/8* (*1)

h	=	*100*	mm		I_y	=	*1448424*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm		i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2		i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2363*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2363*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*10*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,18** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **122** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,56** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,34** **< 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) : **$U.C_{max}$ = 0,62 = 62%**

(*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.

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Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalenv.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-66,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*62,1*	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 : *H90/90/6* (*1)

h	=	*90*	mm		I_y	=	*605764*	mm^4
b	=	*90*	mm		$W_{y;el;eff.1}$	=	*10255*	mm^3
t_f	=	*6*	mm		$W_{y;el;eff.2}$	=	*27352*	mm^3
y_s	=	*22,1*	mm		i_y	=	*25,1*	mm
A_{bruto}	=	*965*	mm^2		i_v	=	*16,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	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 / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*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	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,67** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **176** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,24** **> 1 !!**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **1,67** **> 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,97** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,17** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,67 = 167%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalenv.v en a.v* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-66,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*62,1*	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 : *H90/90/10* (*1)

h	=	*90*	mm		I_y	=	*1269150*	mm^4
b	=	*90*	mm		$W_{y;el;eff.1}$	=	*19768*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*49197*	mm^3
y_s	=	*25,8*	mm		i_y	=	*27,2*	mm
A_{bruto}	=	*1713*	mm^2		i_v	=	*17,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2819*	mm		No. bolts / end / flange	=	*2*	
$L_{v;cr}$	=	*2819*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*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	=	*6*	mm		Dubble strap joint no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,32** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **162** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,51** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,81** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-31,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*88,5*	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 : *H50/40/5* (*1)

h	=	*50*	mm	I_y	=	*103800*	mm^4
b	=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2361*	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	=	*100*	mm
$L_{perpendicular\ force}$	=	*0*	mm	Edge distance bolt	e2	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,30** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **281** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **2,17** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,98** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,15** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **U.C$_{max}$ = 2,17 = 217%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Vak 12* *diagonalen v.v en a.v* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-31,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*88,5*	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 : *H60/60/10* (*1)

h	=	*60*	mm		I_y	=	*349321*	mm^4
b	=	*60*	mm		$W_{y;el;eff.1}$	=	*8408*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*18928*	mm^3
y_s	=	*18,5*	mm		i_y	=	*17,8*	mm
A_{bruto}	=	*1107*	mm^2		i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2361*	mm	No. bolts / end / flange		=	*3*	
$L_{v;cr}$	=	*2361*	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	=	*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	=	*6*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,63** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **205** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,52** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,49** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,96** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : **$U.C_{max}$ = 0,96 = 96%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* *rand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-145,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,8*	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 : *H120/120/11* (*1)

h		=	*120*	mm	I_y	=	*3406399*	mm^4
b		=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f		=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s		=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}		=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3800*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$		=	*3800*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$		=	*3800*	mm	Edge distance bolt	e2	=	*40*	mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,08** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2) : $U.C_{max}$ = **1,08** = **108%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HV 1* *rand* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-145,8*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*117,8*	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 : *H120/120/11* (*1)

h	=	*120*	mm	I_y	=	*3406399*	mm^4
b	=	*120*	mm	$W_{y;el;eff.1}$	=	*39406*	mm^3
t_f	=	*11*	mm	$W_{y;el;eff.2}$	=	*101512*	mm^3
y_s	=	*33,6*	mm	i_y	=	*36,6*	mm
A_{bruto}	=	*2537*	mm^2	i_v	=	*23,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3800*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*3800*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*40*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3800*	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	=	*14*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,43** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,15** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **163** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,54** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,73** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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}	=	*-3,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*2,7*	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 : *H80/80/6* (*1)

h		=	*80*	mm	I_y	=	*521007*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s		=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}		=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*5374*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*5374*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*5374*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,92** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **352** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,26** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,30** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,07** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 0,92 = 92%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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}	=	*-1,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,3*	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 : *H70/70/5* (*1)

h	=	*70*	mm		I_y	=	*268391*	mm^4
b	=	*70*	mm		$W_{y;el;eff.1}$	=	*5609*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*14898*	mm^3
y_s	=	*18,0*	mm		i_y	=	*20,3*	mm
A_{bruto}	=	*651*	mm^2		i_v	=	*13,0*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*7600*	mm		No. bolts / end / flange	=	*1*	
$L_{v;cr}$	=	*7600*	mm		Type of bolts M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		Centre-centre spacing bolt s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*7600*	mm		Edge distance bolt e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **2,16** **> 1 !!**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **585** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,29** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,31** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 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)**:** **$U.C_{max}$ = 2,16 = 216%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-1,1*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,3*	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 : *H80/80/10* (*1)

h		=	*80*	mm	I_y	=	*875033*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*15449*	mm^3
t_f		=	*10*	mm	$W_{y;el;eff.2}$	=	*37458*	mm^3
y_s		=	*23,4*	mm	i_y	=	*24,1*	mm
A_{bruto}		=	*1511*	mm^2	i_v	=	*15,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*7600*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*7600*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt		=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*7600*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,79** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **493** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,10** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,01** **< 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$_{max}$** = **0,79** = **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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 voor- en achtervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-225,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*169,4*	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 : *H110/110/10* (*1)

h		=	*110*	mm	I_y	=	*2386992*	mm^4
b		=	*110*	mm	$W_{y;el;eff.1}$	=	*30108*	mm^3
t_f		=	*10*	mm	$W_{y;el;eff.2}$	=	*77703*	mm^3
y_s		=	*30,7*	mm	i_y	=	*33,6*	mm
A_{bruto}		=	*2115*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2500*	mm	No. bolts / end / flange		=	*2*
$L_{v;cr}$		=	*2500*	mm	Type of bolts	M / "	=	*24*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*2500*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,13** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **117** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,97** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,66** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,32** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** $U.C_{max}$ = **1,66** = **166%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 2* *randen voor- en achtervlak* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-225,6*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*169,4*	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 : *H110/110/14* (*1)

h	=	*110*	mm	I_y	=	*3188262*	mm^4
b	=	*110*	mm	$W_{y;el;eff.1}$	=	*41039*	mm^3
t_f	=	*14*	mm	$W_{y;el;eff.2}$	=	*98672*	mm^3
y_s	=	*32,3*	mm	i_y	=	*33,2*	mm
A_{bruto}	=	*2899*	mm^2	i_v	=	*21,3*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*	Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2500*	mm	No. bolts / end / flange		=	*2*	
$L_{v;cr}$	=	*2500*	mm	Type of bolts	M / "	=	*24*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*2500*	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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,55** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,10** **< 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:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,71** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,10** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 1,10 = 110%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HV 2* *randen zijvlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-15,4*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*20,3*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=	*1,5*	kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H80/80/6* (*1)

h		=	*80*	mm	I_y	=	*521007*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s		=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}		=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2500*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*2500*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt		=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* mm
$L_{perpendicular\ force}$		=	*2500*	mm	Edge distance bolt	e2	=	*35* mm
Position perpendicular force		=	*1*	(⌜=1, ⌟=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,24** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,43** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **164** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,38** **< 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:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,52** **< 1**

Remarks:

The maximum increase of stress or totalstress is(*2): **$U.C_{max}$ = 0,52 = 52%**

(*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.

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Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING

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Check section: *HV 2* *diagonalen*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-16,5*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,4*	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 : *H100/100/8* (*1)

h	=	*100*	mm		I_y	=	*1448424*	mm^4
b	=	*100*	mm		$W_{y;el;eff.1}$	=	*19942*	mm^3
t_f	=	*8*	mm		$W_{y;el;eff.2}$	=	*52924*	mm^3
y_s	=	*27,4*	mm		i_y	=	*30,6*	mm
A_{bruto}	=	*1551*	mm^2		i_v	=	*19,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*3535*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*3535*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	mm
$L_{perpendicular\ force}$	=	*3535*	mm	Edge distance bolt	e2	=	*35*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,28** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,20** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,35** **< 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): **$U.C_{max}$ = 0,35 = 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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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Check section: *HV 2* *kruis*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-0,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,6*	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 : *H60/60/5* (*1)

h		=	*60*	mm	I_y	=	*193708*	mm^4
b		=	*60*	mm	$W_{y;el;eff.1}$	=	*4447*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*11785*	mm^3
y_s		=	*16,4*	mm	i_y	=	*18,2*	mm
A_{bruto}		=	*582*	mm^2	i_v	=	*11,6*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*5000*	mm	No. bolts / end / flange		=	*1*
$L_{v;cr}$		=	*5000*	mm	Type of bolts	M / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt		=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*70* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,01** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **1,79** **> 1 !!**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **432** **< 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**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,13** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,02** **< 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) : **$U.C_{max}$ = 1,79 = 179%**

(*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.

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Date :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *HV 2* *kruis* **verzwaard**

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-0,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*0,6*	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 : *H60/60/10* (*1)

h	=	*60*	mm		I_y	=	*349321*	mm^4
b	=	*60*	mm		$W_{y;el;eff.1}$	=	*8408*	mm^3
t_f	=	*10*	mm		$W_{y;el;eff.2}$	=	*18928*	mm^3
y_s	=	*18,5*	mm		i_y	=	*17,8*	mm
A_{bruto}	=	*1107*	mm^2		i_v	=	*11,5*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*5000*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*5000*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt		=	*30*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*70*	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	=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*	

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **0,95** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **434** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,06** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,07** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,01** **< 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) : **$U.C_{max}$ = 0,95 = 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.

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Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Traverse 1 en 2 bovenrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,0*	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 : *H65/50/5* (*1)

h		=	*65*	mm	I_y	=	*230454*	mm^4
b		=	*50*	mm	$W_{y;el;eff.1}$	=	*4389*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*18449*	mm^3
y_s		=	*12,5*	mm	i_y	=	*20,4*	mm
A_{bruto}		=	*554*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*4911*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$		=	*4911*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*60*	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	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,37** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **466** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,01** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** $U.C_{max}$ = **1,37** = **137%**

(*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.

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Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

Check equal leg angle-members according to Eurocode 3, prEN 1993-1-1 : 2003

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Check section: *Traverse 1 en 2 bovenrand* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*91,0*	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 : *H65/65/8* (*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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*4911*	mm	No. bolts / end / flange		=	*4*	
$L_{v;cr}$	=	*4911*	mm	Type of bolts	M / "	=	*20*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*35*	mm
$a^*L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	Centre-centre spacing bolt	s1	=	*60*	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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,75** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **394** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,24** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

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 1 en 2 diagonalen v.v en a.v*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	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 : *H50/40/5* (*1)

h	=	*50*	mm		I_y	=	*103800*	mm^4
b	=	*40*	mm		$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f	=	*5*	mm		$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s	=	*10,7*	mm		i_y	=	*15,6*	mm
A_{bruto}	=	*427*	mm^2		i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2810*	mm		No. bolts / end / flange	=	*3*	
$L_{v;cr}$	=	*2810*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	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	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,89** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **334** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,50** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,82** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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 ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-21,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*18,6*	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 : *H75/75/6* (*1)

h		=	*75*	mm	I_y	=	*455710*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*8351*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*22305*	mm^3
y_s		=	*20,4*	mm	i_y	=	*22,8*	mm
A_{bruto}		=	*875*	mm^2	i_v	=	*14,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2269*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$		=	*2269*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,41** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **157** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,72** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,84** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-17,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*16,5*	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 : *H55/55/5* (*1)

h		=	*55*	mm	I_y	=	*147150*	mm^4
b		=	*55*	mm	$W_{y;el;eff.1}$	=	*3697*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9685*	mm^3
y_s		=	*15,2*	mm	i_y	=	*16,6*	mm
A_{bruto}		=	*532*	mm^2	i_v	=	*10,5*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,44** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **123** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:
$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **n.v.t.** **< 1**

5 - Check stress in member due to compression with excentricity:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,34** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,59** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,90** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 0,90 = 90%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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}	=	*57,8*	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 : *H50/40/5* (*1)

h		=	*50*	mm	I_y	=	*103800*	mm^4
b		=	*40*	mm	$W_{y;el;eff.1}$	=	*2638*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*9746*	mm^3
y_s		=	*10,7*	mm	i_y	=	*15,6*	mm
A_{bruto}		=	*427*	mm^2	i_v	=	*8,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*2880*	mm	No. bolts / end / flange		=	*4*
$L_{v;cr}$		=	*2880*	mm	Type of bolts	M / "	=	*16*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,14** **> 1 !!**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **343** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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) : **$U.C_{max}$ = 1,14 = 114%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*0,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*57,8*	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 : *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	=	*Fe360*			Permissible stress $f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*2880*	mm		No. bolts / end / flange	=	*4*	
$L_{v;cr}$	=	*2880*	mm		Type of bolts M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm		End distance bolt e1	=	*25*	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	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)		Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,83** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **300** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,48** **< 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$_{max}$** = **0,83** = **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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14008
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 52

D&C ENGINEERING design and construct

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 diagonalen ondervlak*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-19,3*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*12,7*	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 : *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	=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0*	N/mm^2

Geometry section and bolts:

$L_{y;cr}$	=	*1118*	mm	No. bolts / end / flange		=	*1*	
$L_{v;cr}$	=	*1118*	mm	Type of bolts	M / "	=	*16*	
$L_{tot\ (with\ comb.\ buckling)}$	=	*0*	mm	End distance bolt	e1	=	*25*	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	=	*22*	mm
Position perpendicular force	=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,34** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,62** **< 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): **$U.C_{max}$ = 0,69 = 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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}	=	*-49,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*68,4*	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 : *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		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3452*	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	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **1,00** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **170** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **1,22** **> 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **1,13** **> 1 !!**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **1,55** **> 1 !!**

Remarks:

The maximum increase of stress or totalstress is(*2): $U.C_{max}$ = **1,55** = **155%**

(*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 :	23-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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* verzwaard

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-49,0*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*68,4*	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 : *H75/75/12* (*1)

h		=	*75*	mm	I_y	=	*825669*	mm^4
b		=	*75*	mm	$W_{y;el;eff.1}$	=	*15842*	mm^3
t_f		=	*12*	mm	$W_{y;el;eff.2}$	=	*36085*	mm^3
y_s		=	*22,9*	mm	i_y	=	*22,3*	mm
A_{bruto}		=	*1667*	mm^2	i_v	=	*14,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* N/mm^2

Geometry section and bolts:

$L_{y;cr}$		=	*3452*	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	=	*25* 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	=	*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		=	*12*	mm	Dubble strap joint	no=1, yes=2	=	*1*

Summary checks :

1 - Check tension on member :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,38** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **155** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,43** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,57** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,78** **< 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 :	23-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast75

D&C ENGINEERING design and construct

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 onderrand*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-69,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*49,1*	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 : *H80/80/6* (*1)

h		=	*80*	mm	I_y	=	*521007*	mm^4
b		=	*80*	mm	$W_{y;el;eff.1}$	=	*9280*	mm^3
t_f		=	*6*	mm	$W_{y;el;eff.2}$	=	*24509*	mm^3
y_s		=	*21,3*	mm	i_y	=	*23,9*	mm
A_{bruto}		=	*914*	mm^2	i_v	=	*15,3*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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 / "	=	*20*
$L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	End distance bolt	e1	=	*30* mm
$a^*L_{tot\ (with\ comb.\ buckling)}$		=	*0*	mm	Centre-centre spacing bolt	s1	=	*60* 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	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,51** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **132** **< 200 or 240**

4 - Check stress in member due to compression without excentricity:

$UC_4 = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,79** **< 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:

$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,74** **< 1**

8 - Check bearing stress boltconnection:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,74** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 ondervlak L45/45/5*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-6,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,6*	kN	$N_{comb1;c;s;d}$ (min. Compr. or tension)	=	*0*	kN
	$F_{perpend.;s;d}$	=		kN	$N_{comb2;c;s;d}$ (max. compression)	=	*0*	kN

Angle profile : *H45/45/5* (*1)

h	=	*45*	mm	I_y	=	*78410*	mm^4
b	=	*45*	mm	$W_{y;el;eff.1}$	=	*2435*	mm^3
t_f	=	*5*	mm	$W_{y;el;eff.2}$	=	*6129*	mm^3
y_s	=	*12,8*	mm	i_y	=	*13,5*	mm
A_{bruto}	=	*430*	mm^2	i_v	=	*8,6*	mm

Material :

Mat. qual. Fe360 / Fe510	=	*Fe360*		Permissible stress $f_{y;d}$	=	*235,0*	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	=	*25*	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	=	*22*	mm
Position perpendicular force	=	*1*	(⌜=1, ⌟=2)	Boltquality 4.6/5.6/8.8/10.9	=	*4,6*	
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **251** **< 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**
$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,66** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,22** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013
Project : 150 kV lijn Leiden - Zoetermeer
Part : mast 75

D&C ENGINEERING design and construct

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 ondervlak L45/30/5*

Memberforces : (Attention! pressure = "-" and tension ="+")

Compression:	N_{Sd}	=	*-4,9*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*5,4*	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 : *H45/30/5* (*1)

h		=	*45*	mm	I_y	=	*69843*	mm^4
b		=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s		=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}		=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :
$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,15** **< 1**

2 - Check perpendicular force on member :
$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :
$UC_3 = C_{max;buc} / C_{perm}$ = **171** **< 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:
$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,24** **< 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:
$UC_7 = F_{v;Ed} / F_{v;Rd}$ = **0,18** **< 1**

8 - Check bearing stress boltconnection:
$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,30** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2) : **$U.C_{max}$ = 0,30 = 30%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Referentienr : 13039140509 **Berekening :** B.14013

Project : 150 kV lijn Leiden - Zoetermeer

Part : mast 75

D&C ENGINEERING design and construct

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}	=	*-2,7*	kN	***Combined forces diagonal:***			
Tension:	N_{Sd}	=	*1,7*	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 : *H45/30/5* (*1)

h		=	*45*	mm	I_y	=	*69843*	mm^4
b		=	*30*	mm	$W_{y;el;eff.1}$	=	*1877*	mm^3
t_f		=	*5*	mm	$W_{y;el;eff.2}$	=	*8962*	mm^3
y_s		=	*7,8*	mm	i_y	=	*14,1*	mm
A_{bruto}		=	*352*	mm^2	i_v	=	*6,4*	mm

Material :

Mat. qual. Fe360 / Fe510		=	*Fe360*		Permissible stress	$f_{y;d}$	=	*235,0* 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	=	*25* 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	=	*22* mm
Position perpendicular force		=	*1*	(⌉=1, ⌋=2)	Boltquality	4.6/5.6/8.8/10.9	=	*4,6*
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 :

$UC_1 = N_{Ed} / N_{t.Rd}$ = **0,04** **< 1**

2 - Check perpendicular force on member :

$UC_2 = M_{Ed} / M_{c.Rd}$ = **n.v.t.** **< 1**

3 - Check of the member slenderness :

$UC_3 = C_{max;buc} / C_{perm}$ = **299** **< 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:

$UC_{5\text{-}1} = N_{E;d} / (C_{max;buc} \times N_{b;Rd})$ = **0,37** **< 1**

$UC_{5\text{-}2} = N_{E;d} / N_{b;Rd} + k_{yy} \times (M_{y;Ed} + DM_{y;Ed}) / (C_{LT} \times M_{y;Rk})$ = **0,40** **< 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:

$UC_8 = F_{b;Ed} / F_{b;Rd}$ = **0,09** **< 1**

Remarks:

The maximum increase of stress or totalstress is (*2)**:** **$U.C_{max}$ = 0,40 = 40%**

(*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 :	27-mrt-2014						
Name :	M. Glegola						
Checked :	J. Hollaar						

Randstad380 Schakel voor de toekomst

Planning Tijdelijke Hoogspanningsverbinding Vijfhuizen - Bleiswijk

Datum: 28 april 2014

TenneT Taking power further

	2015				2016				2017				2018			
	K1	K2	K3	K4	K1	K2	K3	K4	K1	K2	K3	K4	K1	K2	K3	K4
Tijdelijke Hoogspanningsverbinding OSP 213 150kV Drie Merenweg			1 juli - 1 okt 2015	In gebruik 1 oktober 2015 - 27 maart 2018												
Tijdelijke mast 74 Alkemade Bospad 150kV			20 juli - 17 nov 2015	In gebruik 18 nov 2015 - 23 maart 2017												
Tijdelijke verbinding mast 53 - 54 150kV				1 okt 2015 - 1 maart 2016	In gebruik 1 maart 2016 - 23 maart 2017											

Uitvoering aanleg bouwwegen, -terreinen en tijdelijke verbinding

Tijdelijke verbinding in gebruik

Amoveren tijdelijke verbinding