

*Tijdelijke 150kV opstijgpunten*

B.14 Rapport mastverzwaringen tijdelijke OSP

ZUID-WEST-OOST

# Rapport mastverzwaringen Tijdelijke OSPs

TenneT TSO B.V.

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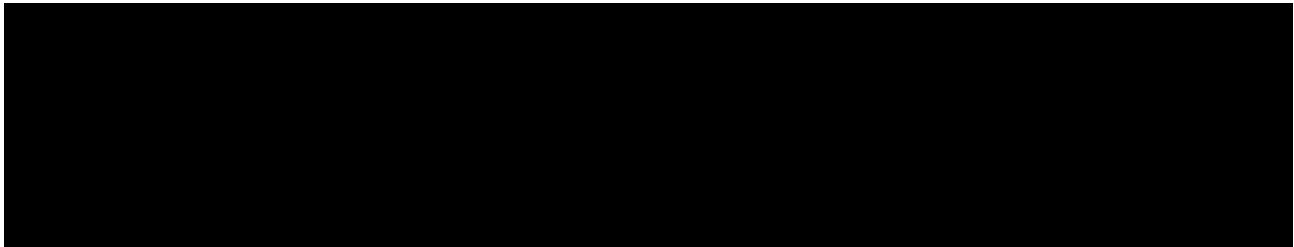
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1	2021-08-06	TenneT comments addressed			
2	2021-09-02	TenneT second round comments			
3	2022-04-07	Check of beams and foundation added			
4	2022-05-25	RFA comments treated, changed insulators			



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## 1 INTRODUCTION

### 1.1 Introduction

To increase the future capacity of electricity transmission, it is necessary to upgrade the transmission grid by building new and modifying existing high voltage connections.

It is for this reason the client (OG) intends to build a new 380 kV line between Rilland and Tilburg and to modify the existing 380 kV and 150 kV lines in the vicinity of the new line. This upgrading is part of the program “Zuid-West-Oost” and consists of the following sub-projects:

- Creating temporary riser points to allow for temporary underground high-voltage cables to be installed on the following lines:
  - o Geertruidenberg – Oosteind 150 kV (GT-OTD150)
  - o Geertruidenberg – Zevenbergschenhoek 150 kV (GT-ZBH150)
  - o Roosendaal – Moerdijk 150 kV (RSD-MDK150)
- Installing a temporary line deviation for one circuit (Wit) using Emergency Restoration Solution (ERS) structures to allow for the construction of the new Rilland – Tilburg 150/380kV combination transmission line
- Reconstructing a new line route for the existing Geertruidenberg – Eindhoven 380kV to loop into the new Tilburg transmission substation
- Creating new 150kV connections on adjusted lines to the new Rilland – Tilburg 150/380kV combination line

This report concerns the existing towers which will interface to the temporary riser points. The riser points will be temporary guyed steel structures which have been located at positions which TenneT have deemed the most viable in terms of functionality as well as land accessibility. These riser points can be positioned at variable line angles and distances away from the existing structures. Once the connection to the riser point has been made, the conductor will run through a series of end connections and voltage surge arrestors before being sent underground to another riser point location where the then underground cable will be taken up back onto the transmission line. These riser points are temporary as TenneT has it in their network plan to remove these sections of transmission line in the future but will only be done once a new line solution has been constructed.

### 1.2 Goal and scope of this report

The goal of this study is to determine whether the tower types described in this report are suitable to interface with the temporary riser points.

After modifications have been applied, the ability of the system to fulfil the applicable requirements will be verified.

### 1.3 Related documents

#### 1.3.1 Verification & validation plan

The requirements provided by TenneT have been evaluated for relevance. For requirements marked as applicable, a reference is given to the document in which the requirement is fulfilled. The results of this exercise are included in the report “Verificatie en validatie tijdelijke OSP's” [1].

#### 1.3.2 BO-Phase 1

In the report “Rapport TenneT Doorrekenen masten t.b.v. tijdelijke opstijgpunten” [2] an investigation into the various temporary OSP locations and relevant ERS structures and the associated internal and external clearance checks was completed. Further to this, a check on the electric and magnetic fields (EMF) was completed. The results of these



investigations influenced the design of the OSPs. Another document was formulated in October 2020, “Alternatief tijdelijke verbindingen t.b.v. reductie VNB tijden” [3], which detailed the latest temporary OSP positions as well as alternatives to the line deviation on Geetruidenberg – Borsele 380kV. No changes to the conductors and insulators have been described in the E-study for any tower types that require structural modifications.

### 1.3.3 Starting points document

The assumptions made for the investigation of the strengthening of the structures as part of the temporary OSP situation can be found in documents [2] & [3] which explains the design approach and analysis.

## 2 CALCULATIONS

### 2.1 Methodology

#### 2.1.1 Introduction

The previously submitted report regarding the Tijdelijke OSPs [2] performed tower analyses on all structures which focussed primarily on feasibility. This document looks at the strengthening of the structures that had insufficient strength according to the BO-report.

Prior to performing the new analyses, an investigation was performed to the cause of over-utilisations in the strain towers within the scope. It was concluded that the assumed presence of a conductor car [lijnwagens] in all of the wires of one circuit simultaneously in the SPLS 6a load cases caused the over-utilisations. After consultation with TenneT, DNV has received approval to analyse the structures in the SPLS 6a condition assuming that only one phase in a circuit will be loaded with a conductor car at a time and no conductor car will be in present in the span towards the OSP.

Additionally, it was concluded that the strength of the insulator beams in the D+0 and D+3.6 has to be verified into more details, since these beams will experience increased loads due to the vicinity of the riser points and because the insulators hardware exerts eccentric loads to the beams.

Table 1 compares the tower analyses based on the previous assumptions and those now accepted by TenneT. The last column includes the added verification of the beams. The structures which have the “NG” conclusion will be part of the scope of this report. This will cover tower type D+0, D+3.6 and tension tower A.

**Table 1 Comparison of tower analyses from previous assumptions**

Line	ID	Mast	Mast type	TOSP Distance (m)	Check with SPLS 6a (All Phases)	Check with SPLS 6a (Single Phase)	Check for strength of beams
Roosendaal-Moerdijk 150kV	B4.1:8	94	H-150	118	NG	OK	OK
	B4.1:10	91	D	80	NG	NG	NG
		92	D	65 & 94	NG	NG	NG
	B4.1:11	82	H-130	175	NG	OK	OK
		84	D	145	NG	NG	NG
Geertruidenberg-Zevenbergsehoek 150kV	B4.1:18	24	A	173	NG	NG	OK
		32	D+0	145	OK	OK	NG
	B4.1:22	20	D+0	55	OK	OK	NG
		22	D+3.6	100	NG	NG	NG
Geertruidenberg-Oosteind 150 kV	B4.1:27	199	S+0	160	OK	OK	OK
		202	S+0	160	OK	OK	OK
	B4.1:26	208	S+0	160	OK	OK	OK

**Revision 3:** At a number of locations, the riser points will be located next to the center line of the overhead line. This causes transversal loads to the tower structures. The beams are checked for these loads and reinforcement proposals have been included in chapter 4. A check is performed whether the increased support reactions can be handled by the existing foundation.

**Revision 4:** The modification to the beams is changed for tower 22 since insulators of the lower cross arm were changed to “hangende afspanningen” to solve internal clearance issues.

## 2.1.2 Starting points

The calculations are executed based on the starting points as included in the starting points document [2].

**Table 2 Calculation starting points**

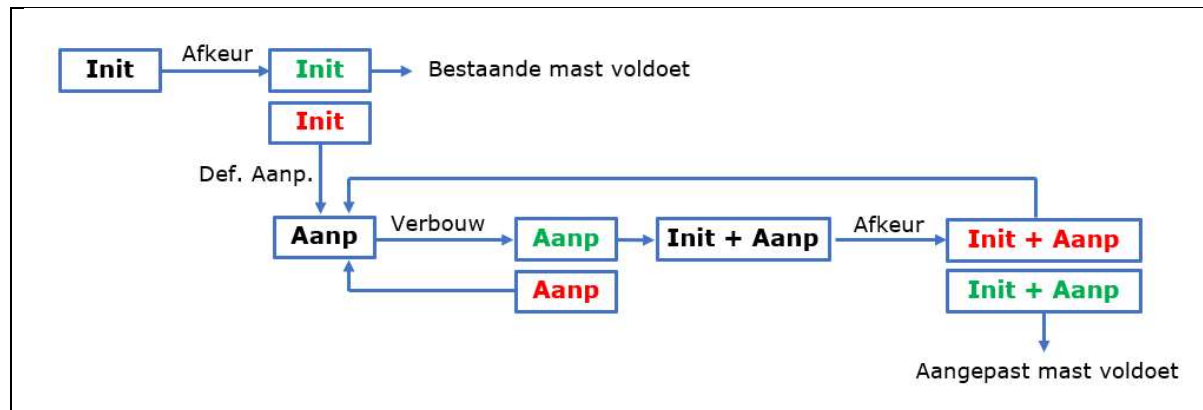
General	Code	NEN-EN50341-2-15:2019
	Wind zone	III
	Terrain category	II (onbebouwde omgeving)
Initial situation	Reduction factor cd <sub>ir</sub>	1,00
	Consequence class	CC2-0
	Reliability level	Afkeur CC2-0
Situation after modifications	Reference period	30 years
	Consequence class	CC2
	Reliability level	Verbouw
	Reference period	30 years

## 2.1.3 Process steps

The process required to determine whether tower reinforcements are required or not consists of the following steps:

- Step 1: Test the existing tower (Init) on “Afkeur”
- Step 2: Define the required reinforcements when the initial tower does not fulfill the “Afkeur” criterion (Def. Aanp.)
- Step 3: Testing (only) the prescribed modifications (AanP) on “Verbouw”
- Step 4: Test the complete tower including reinforcements (Initi + Aanp) on “Afkeur”

The process described above is represented in Figure 2-1.



**Figure 2-1 Process diagram**

## 2.1.4 Conductor loads

The calculations have been performed with the conductor loads obtained from PLS CADD in addition to the program developed by DNV. The results of the calculations have been included in Appendix A.

## 2.1.5 Reaction forces on foundation

The reaction forces on the foundation have been calculated to the newly applied temporary OSP situation which has been completed in the “Rapport TenneT Doorrekenen masten t.b.v. tijdelijke opstijgpunten” [2] document. New reaction forces as per PLS-TOWER analysis was completed and have been provided in Appendix A.



### 2.1.6 Modelling

Based on the received as-built information, the tower was modelled in PLS-Tower. Only the main elements were modelled. Profiles such as redundant members which are not critical for load support were excluded and checked separately. The angle profiles including the bolted connections were modelled and checked in PLS-Tower. Checking of detailed connections such as gusset plates is not included in the scope of work.

The conductor loads from the aforementioned conductor loads program were used as input for the calculations.

Diagonals in the front-, rear and side planes of the tower have been grouped and the check of these members is performed per group. In case one of the elements in the group is overloaded, the resulting upgrades apply for all members in the group.

### 2.1.7 Beams

The beams of the suspension structures D+0 and D+3.6 were modelled as an isolated structure with the software package AxisVM. The model is discussed into more detail in Appendix D.

### 2.1.8 Foundation

The foundation reactions of the D+0 and D+3.6 structures will be checked against the capacity of the foundations. The tensile and compressive capacity is calculated with the TS/Paalfunderingen software package. The soil profile is based on the available "sonderingen" of the asset data. This is included in Appendix C.



### 3 RESULTS PLS-TOWER

In this chapter the results of the analysis with PLS-TOWER are described. PLS-TOWER checks the members of the tower to compression and tension. The beams for the insulators are not included. All of the reinforcement proposals described in this chapter do not include the measures to the beams. The measures for the beams are included in chapter 4.

#### 3.1 GT-ZBH150 A

##### 3.1.1 Tower outline

The tower outline from the received asset data is included in Figure 3-1.

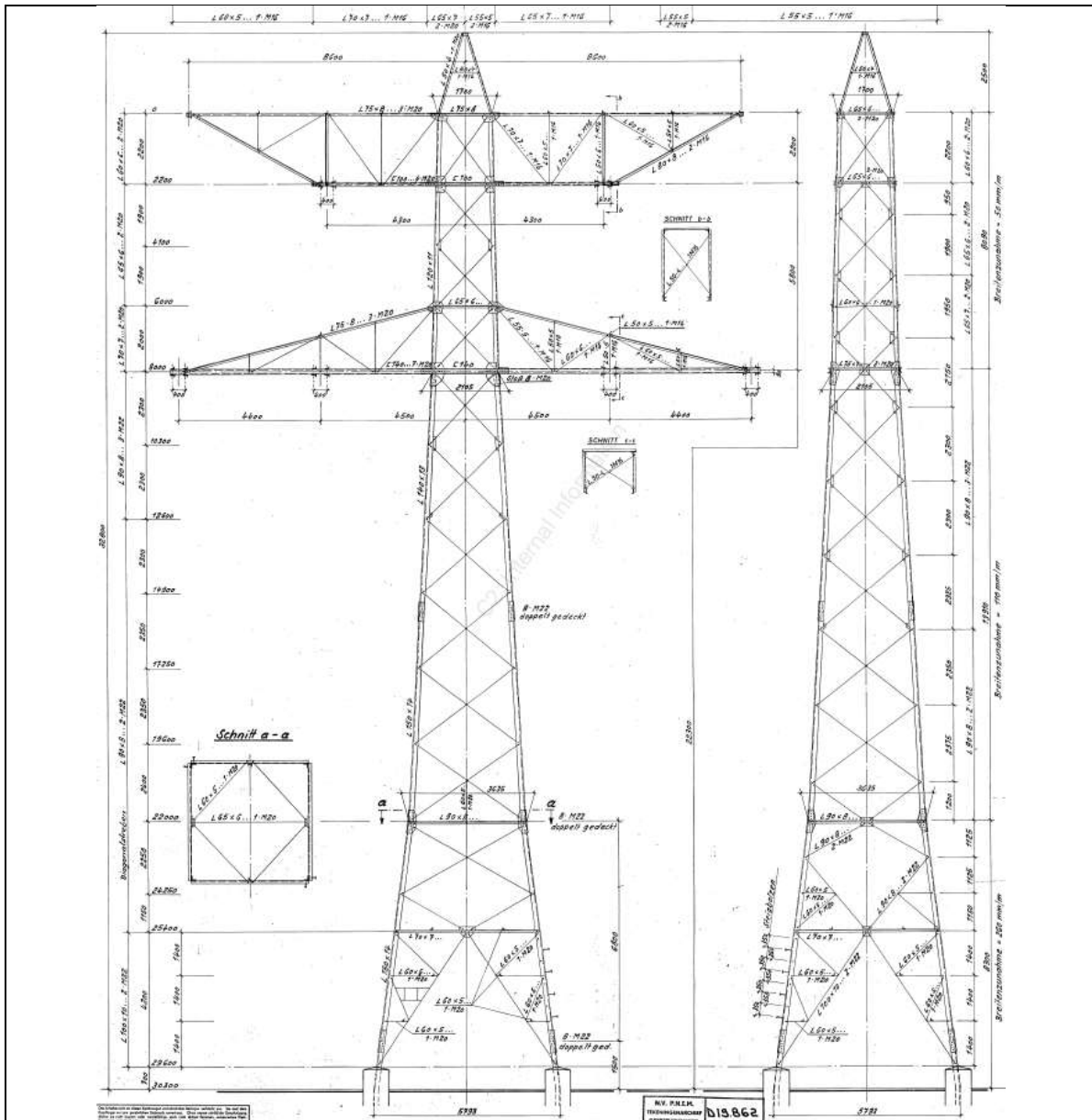


Figure 3-1 GT-ZBH150 Tower outline A

### 3.1.2 Tower list

This report describes tower type A. There is only one A type tower located along the investigated line at position 24. The tower is located in wind zone III and the wind loading is adjusted based on the increased height of neighboring towers (positive values indicate a height decrease). Table 3 summarises the wind and weight span parameters and indicates the governing tower which was analysed. Figure 3-3 & Figure 3-3 shows the overview of the span between mast 24 (A) and the temporary OSP.

**Table 3 Tower A details**

Line	Tower number	Tower type	Governing tower number	Line Angle (°)	Back span (m)	Ahead span (m)
GT-ZBH150	24	A	24	180	170	323



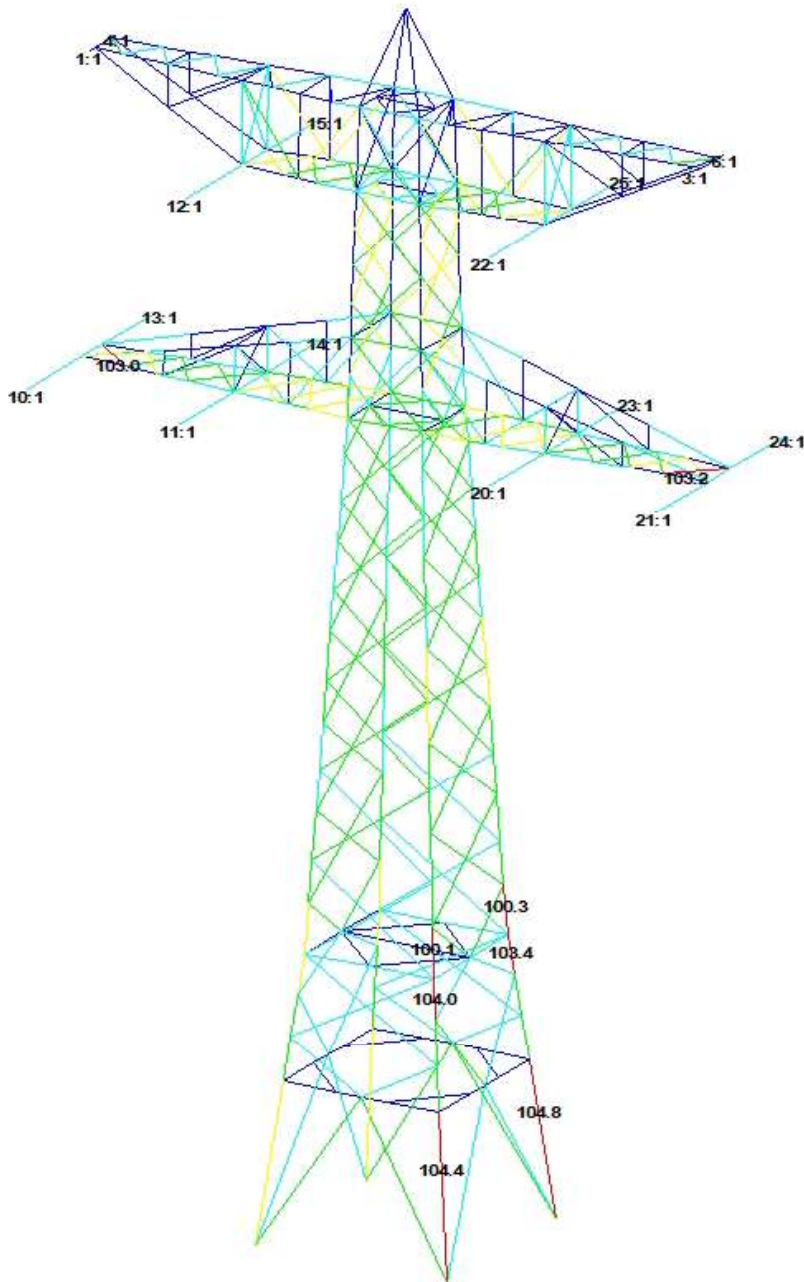
**Figure 3-2 GT-ZBH150 Mast 24 (A) to temporary OSP in QGIS view**



**Figure 3-3 GT-ZBH150 Mast 24 (A) to temporary OSP in PLS-CADD view**

### 3.1.3 Check of the tower

The results of the analysis for the A with the loads calculated according to “afkeurniveau” is depicted in Figure 3-4 below.



**Figure 3-4 PLS-TOWER result for the GT-ZBH150 tower A (24)**

The results of the analysis of the angle profiles, redundant members and main leg column anchors have been included in Table 4.

**Table 4 Summary of performed checks**

Check of	Evaluation	Reference
Profiles	NOK	Figure 3-4

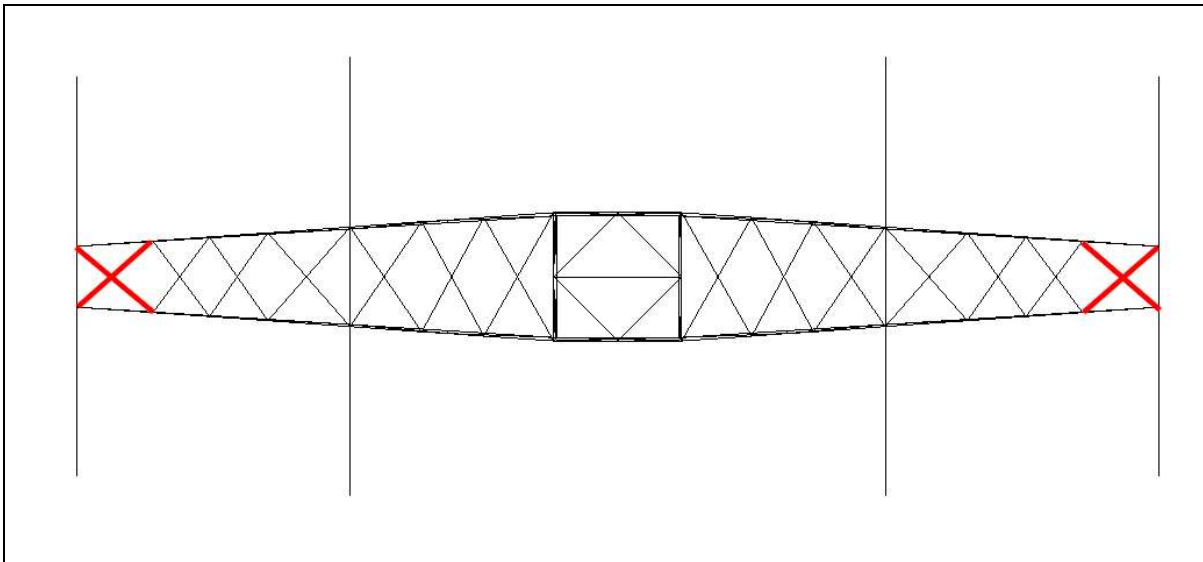
### 3.1.4 Modifications

This section proposes tower reinforcements to ensure the towers fulfill the “afkeurniveau” loads, new elements to verbouwniveau. The proposal contains the following measures:

- Replacement of bolts on lower section of tower on the main leg members
- Replacement of crossing diagonals in lower crossarms

### 3.1.5 Strengthening

As per the group summary outputs in Appendix B, the bracing members indicated in Figure 3-5 are to be replaced.



**Figure 3-5 Members that need to be replaced in lower cross-arm for GT-ZBH150 tower A (24)**

Table 5 provides an overview of the weight of profiles required for the strengthening of tower 24. Weight of plates is not included in the table.

**Table 5 Weight of profiles required for modifications on GT-ZBH150 tower 24**

Group Label	Profile ini.	Material ini.	Bolts ini.	Profile new	Material new	Bolts new	Mitigation	Number	Length (m)	Weight (kg)
t2od7	60x60x5	S235	1M16-5.6t	70x70x7	S355	1M16-8.8t	Profile exchanged	4	1.66	30.2
mr4	150x150x14	S235	8M22-5.6t			8M22-8.8t*	Bolts exchanged			
mr5	150x150x14	S235	8M22-5.6t			8M22-8.8t*	Bolts exchanged			
									<b>Total</b>	<b>30.2</b>

*\*Note: the exchange of bolts in mr4 and mr5 is about the lap joints of the main legs (refer to Appendix B). Special bolt sizes (M22) will be required which deviates from the TenneT specification but has been chosen to match the existing situation and to be able to re-use the existing bolt hole.*

No members are loaded in bending, no further measure to tower 24 are required.

### 3.2 GT-ZBH150 D+3.6

#### 3.2.1 Tower outline

The tower outline from the received asset data is included in Figure 3-6.

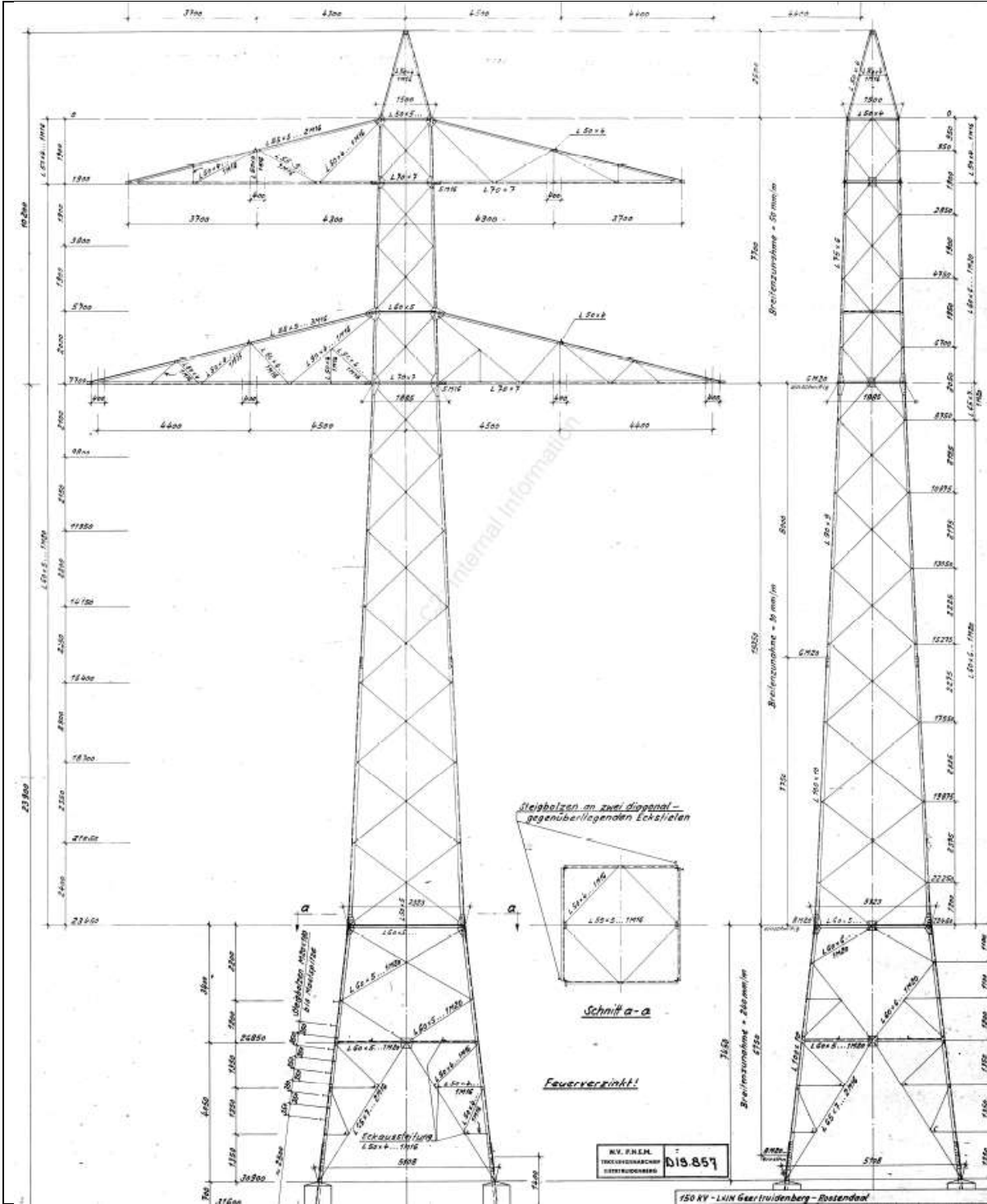


Figure 3-6 GT-ZBH150 Tower outline D+3.6

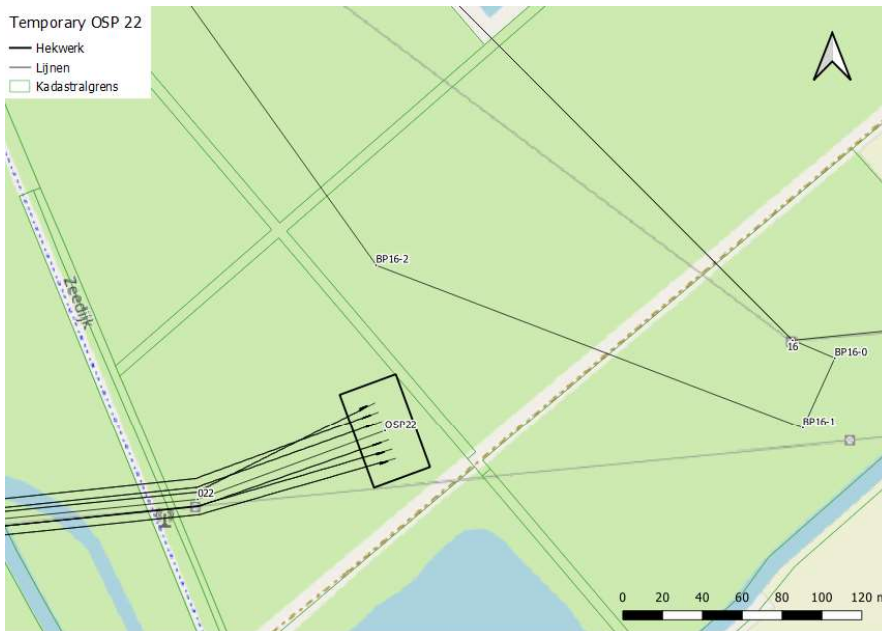


### 3.2.2 Tower list

This report describes tower type D+3.6. The tower is located in wind zone III and the wind loading is adjusted based on the increased height of neighboring towers (positive values indicate a height decrease). Table 6 summarises the wind and weight span parameters and indicates the governing tower which was analysed. Figure 3-7 & Figure 3-8 shows the overview of the span between mast 22 (D+3.6) and the temporary OSP.

**Table 6 Tower numbers**

Line	Tower number	Tower type	Governing tower number	Line Angle (°)	Back span (m)	Ahead span (m)
GT-ZBH150	22	D+3.6	22	14.5	310	100



**Figure 3-7 GT-ZBH150 Mast 22 (A) to temporary OSP in QGIS view**



**Figure 3-8 GT-ZBH150 Mast 22 (A) to temporary OSP in PLS-CADD view**

### 3.2.3 Check of the tower

The results of the analysis for the D+3.6 with the loads calculated according to "afkeurniveau" is depicted in Figure 3-9 below.

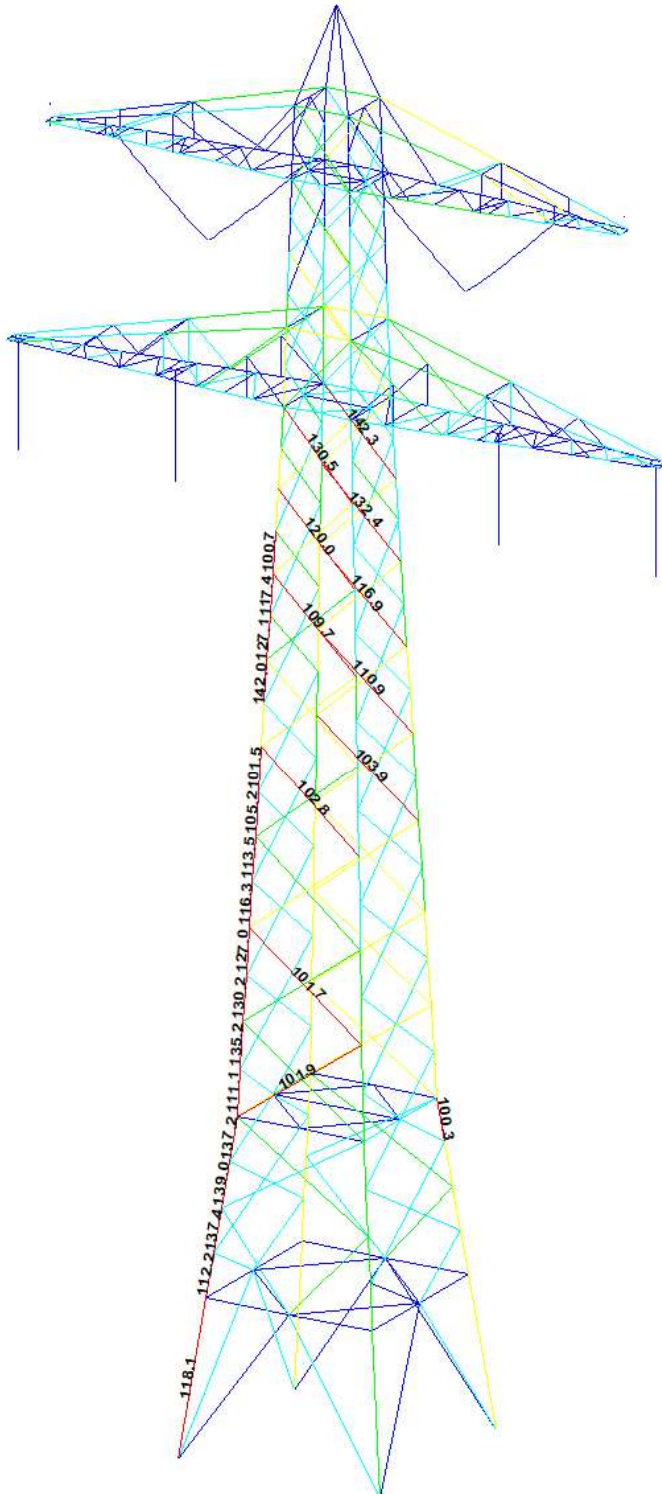


Figure 3-9 PLS-TOWER result for the GT-ZBH150 tower D+3.6 (22)



The results of the analysis of the angle profiles, redundant members and main leg column anchors have been included in Table 7.

**Table 7 Summary of performed checks**

Check of	Evaluation		Referentie
Profiles		<b>NOK</b>	Figure 3-9

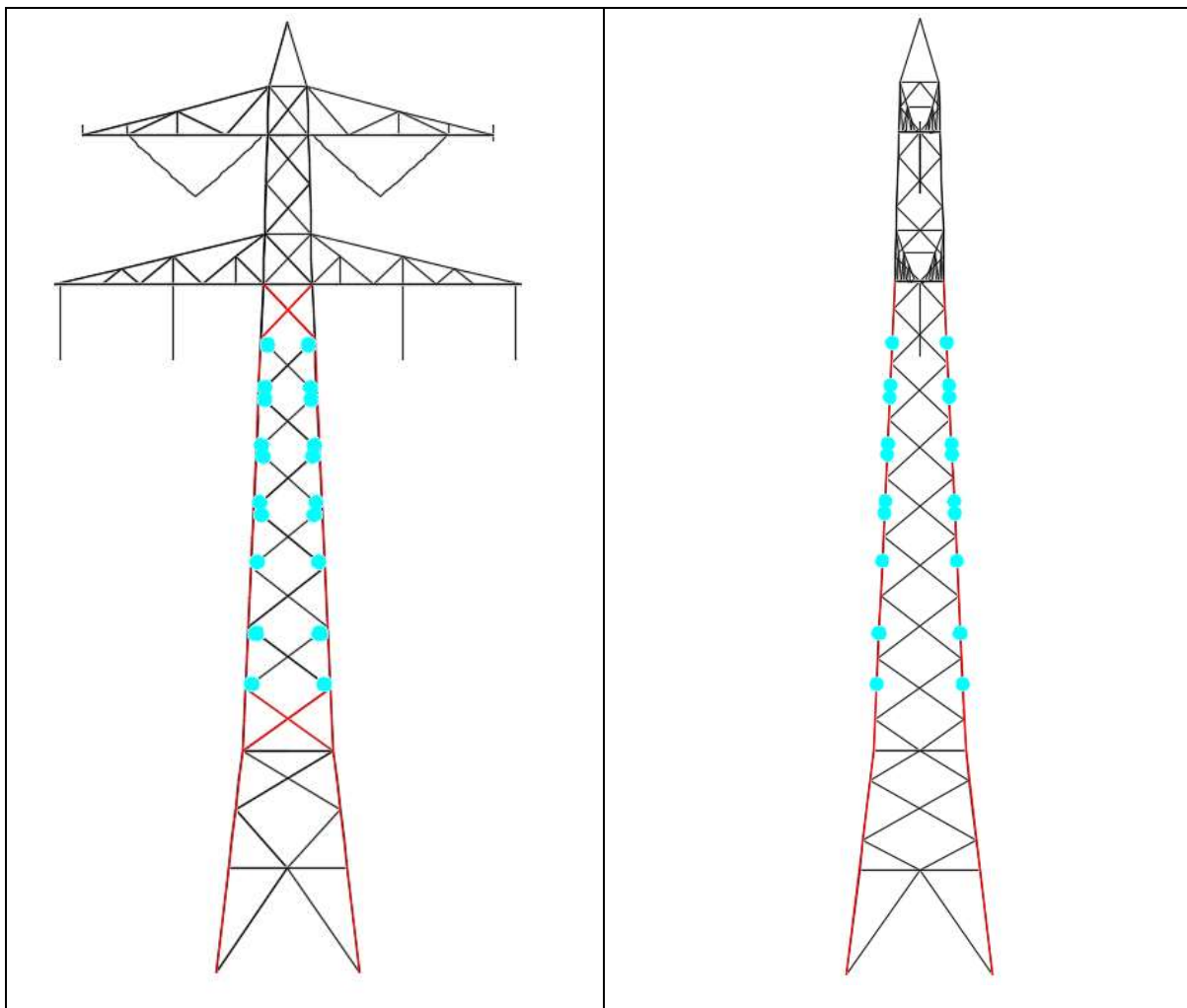
### 3.2.4 Modifications

This section proposes tower reinforcements to ensure the towers fulfill the “afkeurniveau” loads, new elements to verbouwniveau. The proposal contains the following measures:

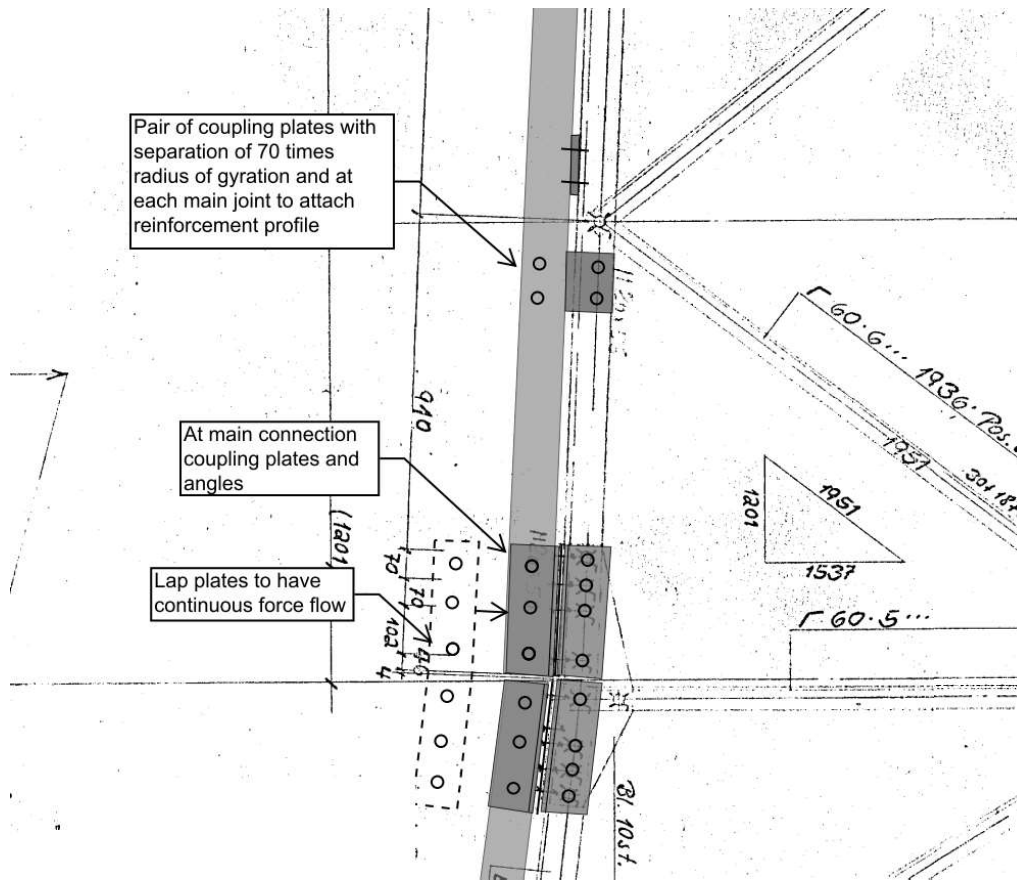
- Replacement of crossing diagonal bracing in the tower body
- Changing the number of bolts and their strength class in the cross diagonals from the lower tower body
- Retrofitting the main leg by strengthening it with the same cross section (XEA instead of EA)

### 3.2.5 Strengthening

As per the group summary outputs in Appendix B, the main legs indicated in Figure 3-10 are to be retrofitted and the crossing diagonals are to be replaced. The detail of the proposed retrofitting can be seen in Figure 3-11.



**Figure 3-10 Members to be changed/retrofitted and bolts that need to be replaced in Longitudinal (left) and Transverse (right) faces**



**Figure 3-11 Detail of retrofitting solution**

provides an overview of the weight of profiles required for the strengthening of tower 22. Weight of plates and the weight of the other modifications described in chapter 4 is not included in the table, see chapter 4 for these weights and total weight. Refer to Appendix B for description of the group labels given in this table.

**Table 8 Weight of profiles required for modifications on GT-ZBH150 tower 22**

Group Label	Profile ini.	Material ini.	Bolts ini.	Profile new	Material new	Bolts new	Mitigation	Number	Length (m)	Weight(kg)*
mr3B	90x90x9	S235		L90x9+L90x9	S355		Profile retrofitted	8	1,08	110,5
mr3C	90x90x9	S235		L90x9+L90x9	S355		Profile retrofitted	8	1,10	112,6
mr3D	90x90x9	S235	6M20-5.6t	L90x9+L90x9	S355	12M20-8.8t	Profile retrofitted	4	1,13	57,8
mr4A	110x110x10	S235	6M20-5.6t	L110x10+L110x10	S355	12M20-8.8t	Profile retrofitted	4	1,13	77,6
mr4B	110x110x10	S235		L110x10+L110x10	S355		Profile retrofitted	8	1,15	157,8
mr4C	110x110x10	S235		L110x10+L110x10	S355		Profile retrofitted	8	1,18	162,0
mr4D	110x110x10	S235		L110x10+L110x10	S355		Profile retrofitted	8	1,20	164,7
mr4E	110x110x10	S235		L110x10+L110x10	S355	16M20-8.8t	Profile retrofitted	8	1,20	164,7
mr5A	110x110x10	S235		L110x10+L110x10	S355		Profile retrofitted	8	1,17	160,6
mr5B	110x110x10	S235		L110x10+L110x10	S355		Profile retrofitted	8	1,17	160,6
mr5C	110x110x10	S235	8M20-5.6t	L110x10+L110x10	S355	16M20-8.8t	Profile retrofitted	4	4,11	282,1
mvd11	60x60x5	S235	1M20-5.6t	60x60x5	S235	2M20-8.8t	Bolts exchanged			
mvd12	60x60x5	S235	1M20-5.6t	60x60x6	S355	1M20-8.8t	Profile exchanged	4	4,19	91,3
mvd5	60x60x5	S235	1M20-5.6t	60x60x6	S355	2M20-8.8t	Profile exchanged	4	2,89	63,0
mvd6	60x60x5	S235	1M20-5.6t	60x60x5	S235	2M20-8.8t	Bolts exchanged			
mvd7	60x60x5	S235	1M20-5.6t	60x60x5	S235	2M20-8.8t	Bolts exchanged			
mvd8	60x60x5	S235	1M20-5.6t	60x60x5	S235	2M20-8.8t	Bolts exchanged			
mvd9	60x60x5	S235	1M20-5.6t	60x60x5	S235	2M20-8.8t	Bolts exchanged			
									Total	1765,3

### 3.3 RSD-MDK150 D+0

#### 3.3.1 Tower outline

The tower outline from the received asset data is included in Figure 3-12.

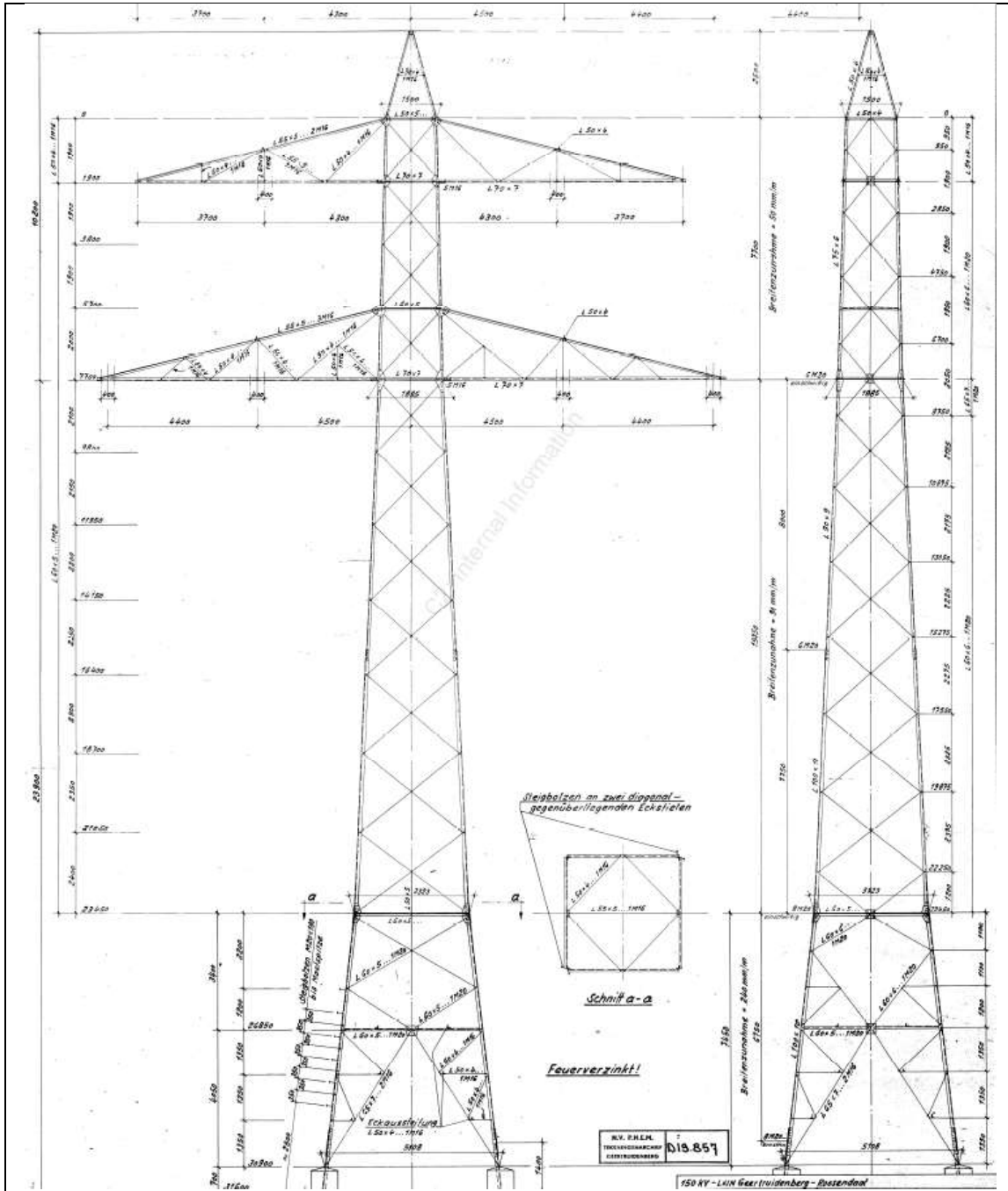


Figure 3-12 RSD-MDK150 Tower outline D+0

### 3.3.2 Tower list

This report describes tower type D+0. There are three D+0 type towers located along the investigated line at positions 84, 91 and 92. Based on loads, this report distinguishes between positions 84 and 91/92. Tower 91 and 92 have similar loads, with 92 governing. Tower 84 has more favourable loads and will be treated separately. All three towers are located in wind zone III and the wind loading is adjusted based on the increased height of neighboring towers (positive values indicate a height decrease). Table 9 summarises the wind and weight span parameters and indicates the governing tower which was analysed. Figure 3-13 to Figure 3-18 shows the overview of the spans with temporary OSP's.

**Table 9 Tower numbers for D+0**

Tower number	Tower type	Governing tower number	Circuit	Line Angle (°)	Back span (m)	Ahead span (m)
84	D+0	84	Wit & Zwart	180	325	145
91	D+0	92	Wit & Zwart	180	323	90
92	D+0	92	Wit	176	326	67
			Zwart	169	326	95



**Figure 3-13 RSD-MDK150 Mast 84 (D+0) span to temporary OSP in QGIS view**

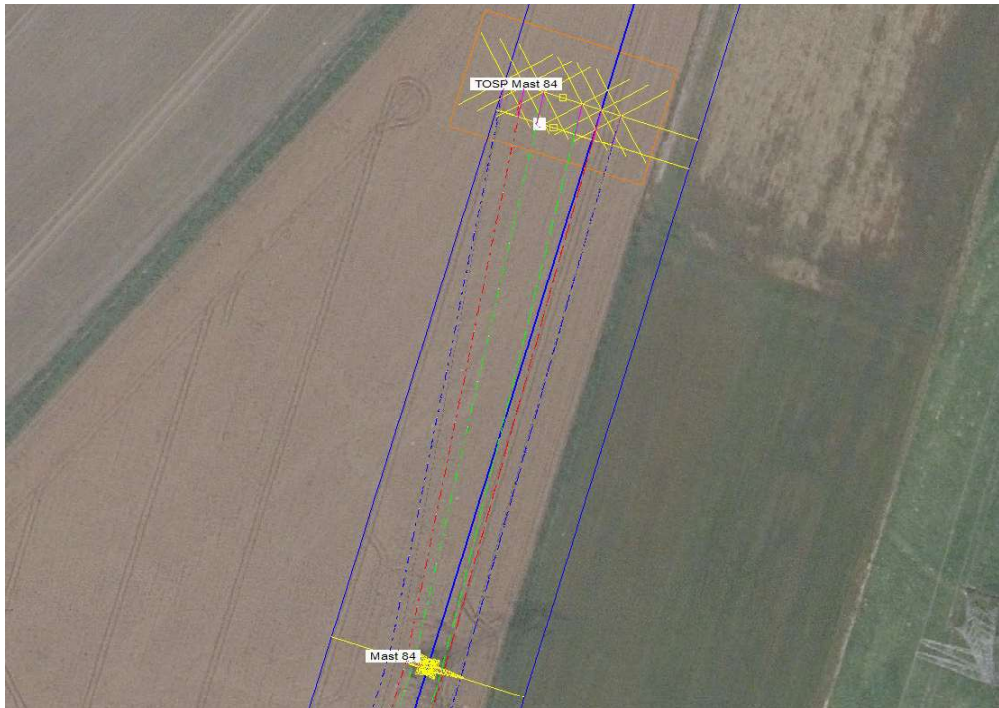


Figure 3-14 RSD-MDK150 Mast 84 (D+0) span to temporary OSP in PLS-CADD view



Figure 3-15 RSD-MDK150 Mast 91 (D+0) span to temporary OSP in QGIS view





Figure 3-16 RSD-MDK150 Mast 91 (D+0) span to temporary OSP in PLS-CADD view



Figure 3-17 RSD-MDK150 Mast 92 (D+0) span to temporary OSP in QGIS view



Figure 3-18 RSD-MDK150 Mast 92 (D+0) span to temporary OSP in PLS-CADD view

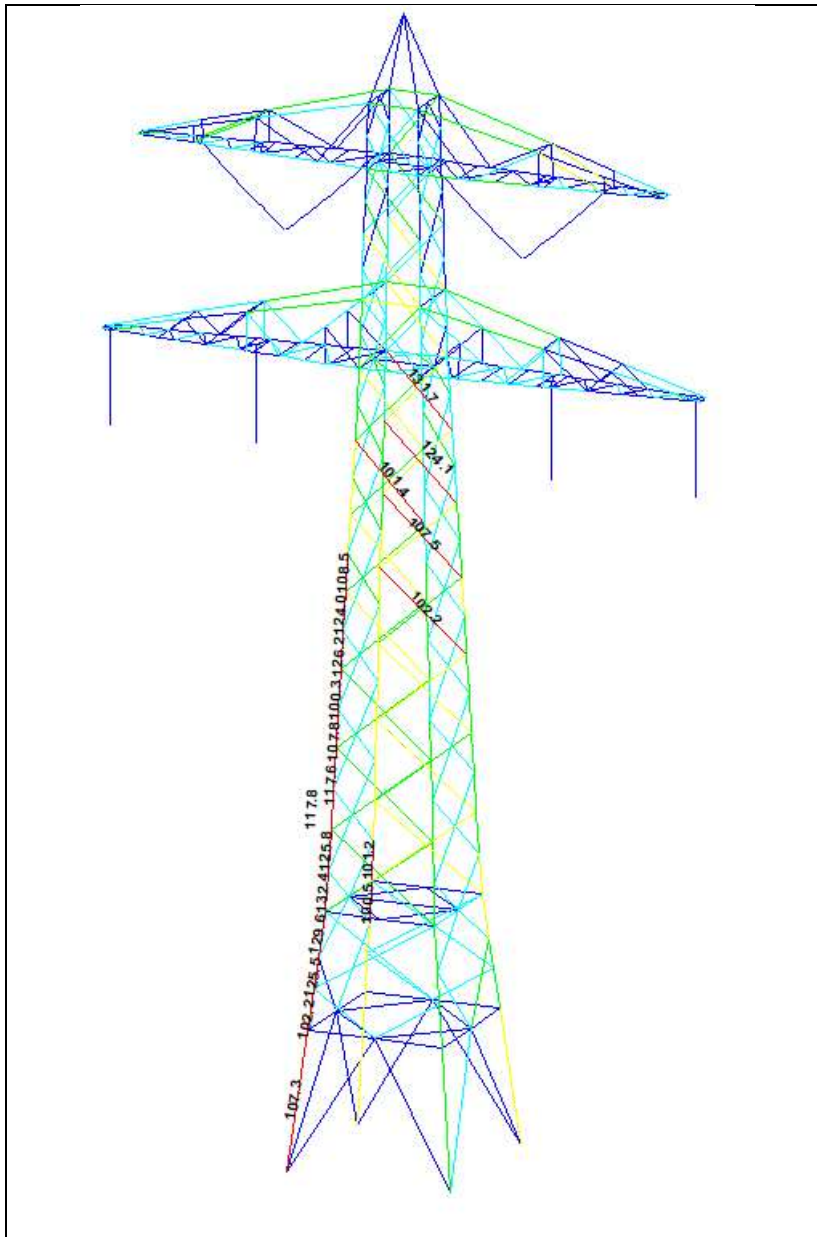


### 3.3.3 Check of the tower

The results of the analysis for the D+0, with the loads calculated according to “afkeurniveau” are depicted in Figure 3-19 and Figure 3-20.

#### 3.3.3.1 Tower 92 and 91

The compressive strength of the main legs is not sufficient for the considered loading and three of the crossing diagonals do not check for rupture.



**Figure 3-19 PLS-TOWER result for the RSD-MDK150 tower D+0 (92 and 91)**

The results of the analysis of the angle profiles, have been included in Table 10.

### 3.3.3.2 Tower 84

The compressive strength of the main legs is not sufficient for the considered loading and 2 of the crossing diagonals do not check for rupture.

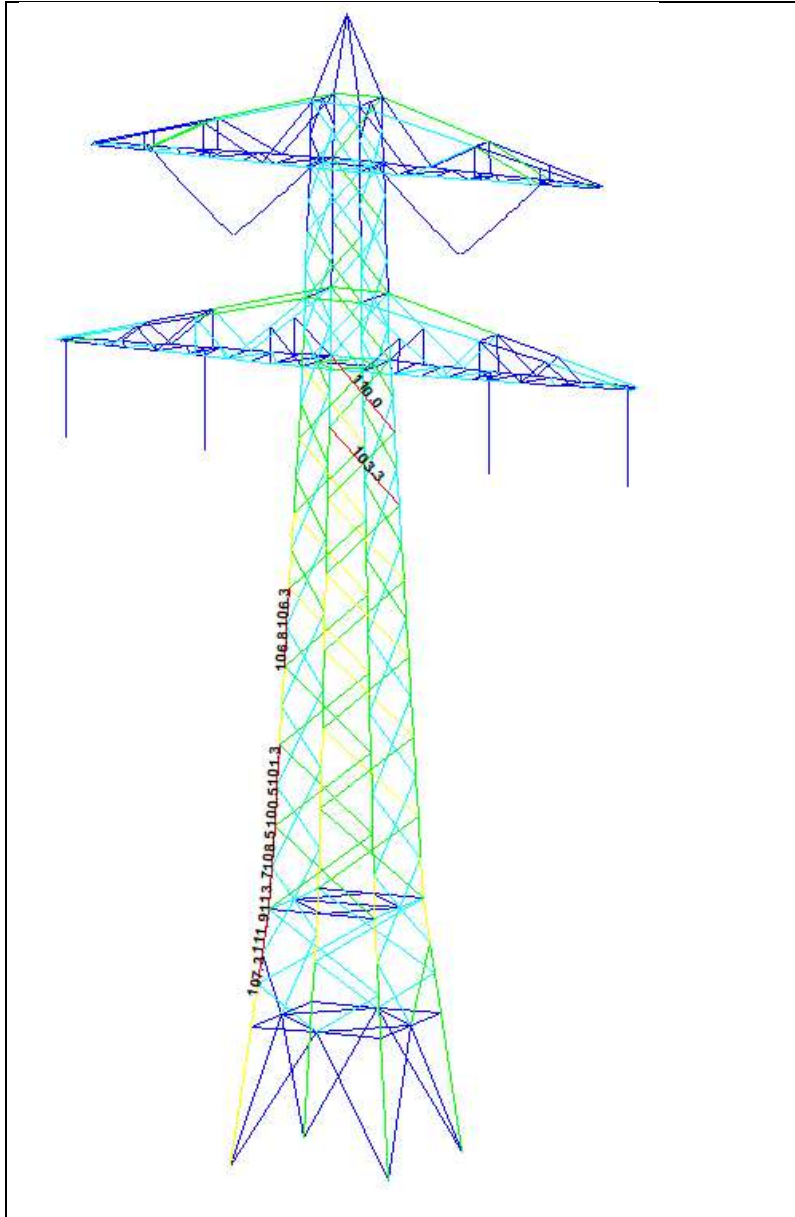


Figure 3-20 PLS-TOWER result for the RSD-MDK150 tower D+0 (84)

Table 10 Summary of performed checks

Check of	Evaluation	Referentie
Profiles Tower 91 and 92	NOK	Figure 3-19
Profiles Tower 84	NOK	Figure 3-20

### 3.3.4 Modifications

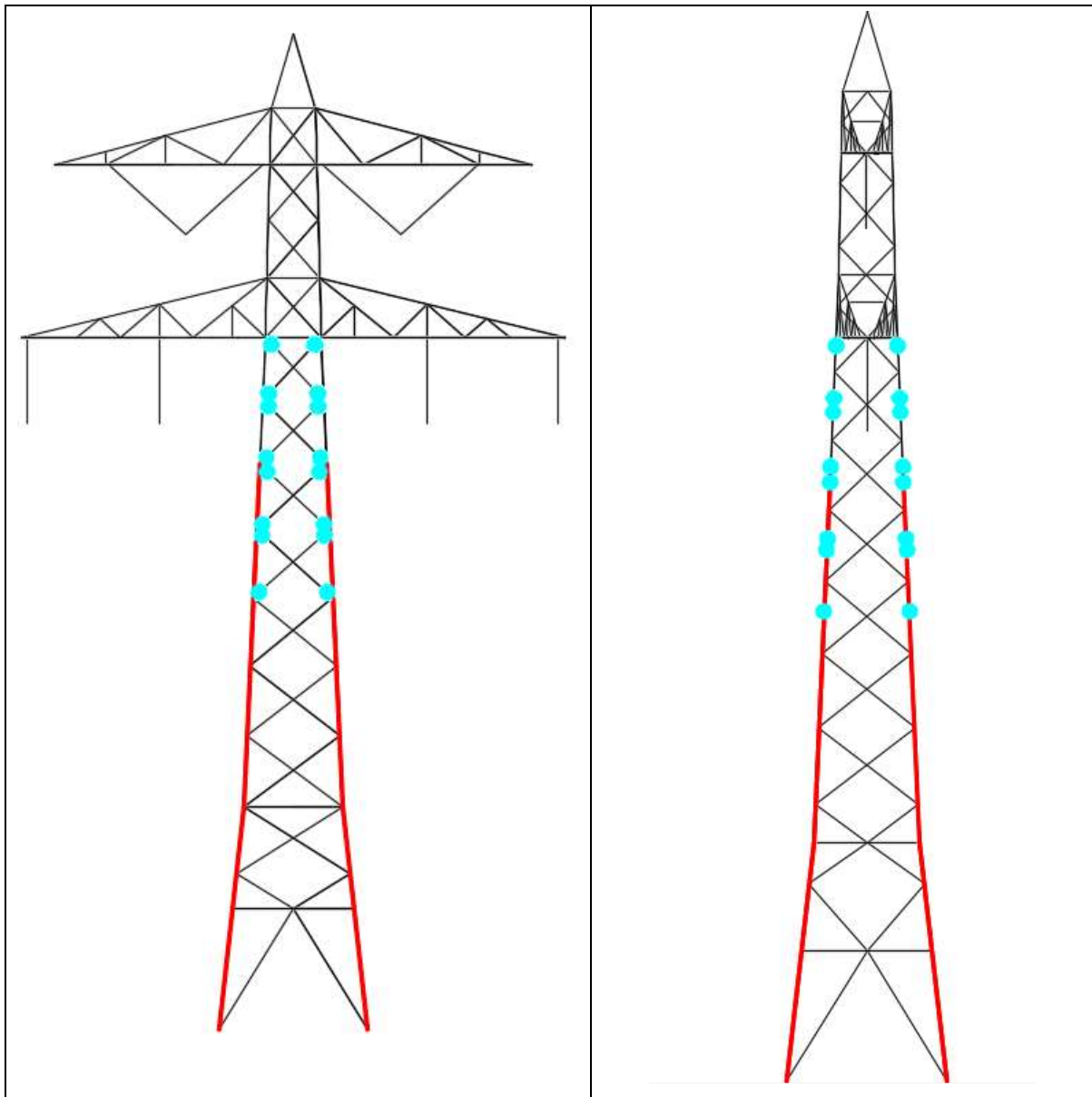
This section proposes tower reinforcements to ensure the towers fulfill the “afkeurniveau” loads, new elements to verbouwniveau. The proposal contains the following measures:

- Retrofitting of main leg along the tower body for tower number 91/92
- Strengthening the failing members by adding redundants for tower number 84

### 3.3.5 Strengthening

#### 3.3.5.1 Strengthening of tower 92 and 91

As per the group summary outputs in Appendix B, the highlighted members indicated in Figure 3-21 are to be retrofitted. A detail of the proposed solution can be seen in Figure 3-11.



**Figure 3-21 Members that need to be retrofitted and bolts to be replaced in Longitudinal (left) and Transverse (right) faces for D+0, RSD-MSK150 towers 91 and 92.**

Refer to Appendix B for description of the group labels given in this table.

Table 11 provides an overview of the weight of profiles required for the strengthening of tower 92 and 91. Weight of plates and the weight of the other modifications described in chapter 4 is not included in the table, see chapter 4 for these weights and total weight. Refer to Appendix B for description of the group labels given in this table.

**Table 11 Weight of profiles required for modifications on RSD-MDK150 tower 92 and 91**

Group Label	Profile ini.	Material ini.	Bolts ini.	Profile new	Material new	Bolts new	Mitigation	Number	Length (m)	Weight (kg)*
mvd5	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged			
mvd6	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged			
mvd7	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged	4		
mvd8	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged			
mr5	90x90x9	S235		<b>L90x9+L90x9</b>	S235		Profile retrofitted	8	1,10	112,6
mr6	90x90x9	S235	6M20-5.6t	<b>L90x9+L90x9</b>	S235	<b>12M20-8.8t</b>	Profile retrofitted	8	1,13	115,6
mr7	100x100x10	S235		<b>L100x10+L100x10</b>	S235		Profile retrofitted	8	1,15	144,4
mr8	100x100x10	S235		<b>L100x10+L100x10</b>	S235		Profile retrofitted	8	1,18	148,1
mr9	100x100x10	S235	8M20-5.6t	<b>L100x10+L100x10</b>	S235	<b>16M20-8.8t</b>	Profile retrofitted	8	1,20	150,6
mr10	100x100x10	S235	8M20-5.6t	<b>L100x10+L100x10</b>	S235	<b>16M20-8.8t</b>	Profile retrofitted	4	2,23	140,0
mr11	100x100x10	S235		<b>L100x10+L100x10</b>	S235		Profile retrofitted	4	1,21	76,0
mr12	100x100x10	S235	8M20-5.6t	<b>L100x10+L100x10</b>	S235	<b>16M20-8.8t</b>	Profile retrofitted	4	4,10	257,4
										1144,6

### 3.3.5.2 Strengthening of tower 84

As per the group summary outputs in Appendix B, the members highlighted in red are failing and in order to overcome that, the redundant members, here represented with green, are being added, as indicated in Figure 3-21. The redundant members are angle profile, of L50x50x5 and 1 bolt of M16-5.6t.

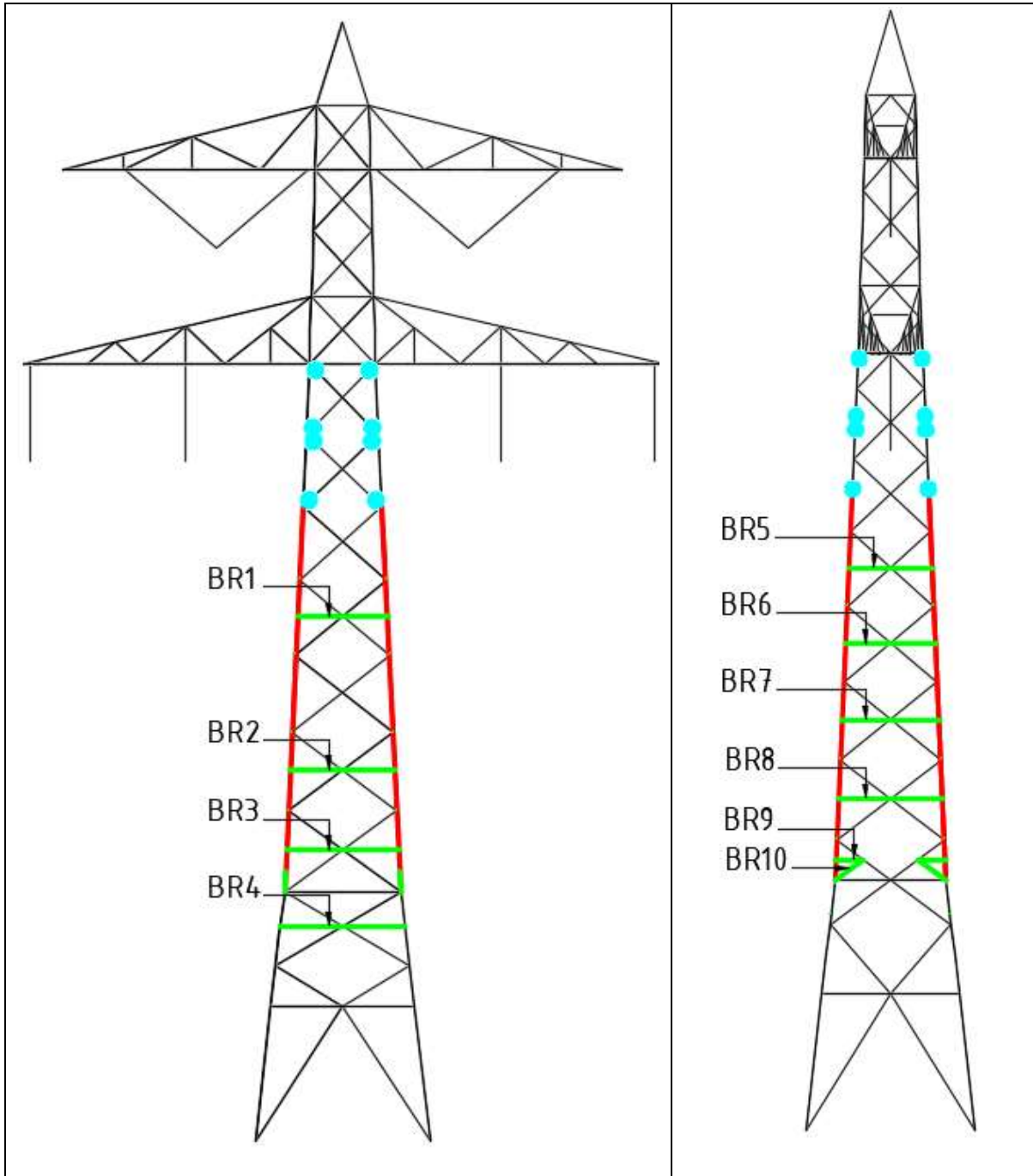


Figure 3-22 Main leg members to be changed, redundant members to be added, and bolts to be changed in Longitudinal (left) and Transverse (right) faces for D+0, RSD-MDK150 tower 84.

Table 12 provides an overview of the weight of profiles required for the strengthening of tower 84. Weight of plates and the weight of the other modifications described in chapter 4 is not included in the table, see chapter 4 for these weights and total weight. Refer to Appendix B for description of the group labels given in this table.

**Table 12 Weight of profiles required for modifications on RSD-MDK150 tower 84**

Group Label	Profile ini.	Material ini.	Bolts ini.	Profile new	Material new	Bolts new	Mitigation	Number	Length (m)	Weight (kg)
BR1	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.29	19.47
BR2	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.50	22.64
BR3	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.60	24.15
BR4	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.78	26.86
BR5	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.24	18.71
BR6	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.34	20.22
BR7	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.44	21.73
BR8	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.55	23.39
BR9	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	0.83	12.53
BR10	-	-	-	L50x50x5	S355	1M16-8.8t	Profile Added	4	1.05	15.85
mvd5	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged			
mvd6	60x60x5	S235	1M20-5.6t	60x60x5	S235	<b>2M20-8.8t</b>	Bolts exchanged			
mr6	90x90x9	S235	6M20-5.6t	90x90x9	S235	6M20-5.6t	Redundants added			
mr8	100x100x10	S235		100x100x10	S235		Redundants added			
mr9	100x100x10	S235	8M20-5.6t	100x100x10	S235	8M20-5.6t	Bolts exchanged			
mr10	100x100x10	S235	8M20-5.6t	100x100x10	S235	8M20-5.6t	Redundants added			
									<b>Total</b>	<b>205.55</b>

## 4 BEAMS

### 4.1 Introduction

The PLS-TOWER package does not check the structural beams for the insulator attachments in the structure subjected to bending. An additional check with the AxisVM software was performed to the beams. The check has been carried out for the D+0 & D+3.6 structures, since these towers have beams loaded in bending, beams in angle towers with tension insulators are not subjected to bending. Figure 4-1 Shows the location of the beams. The top cross arm stands out, because the insulators were attached below the plane of the cross arm, which results in additional bending load to the lower chord member of the cross arm.

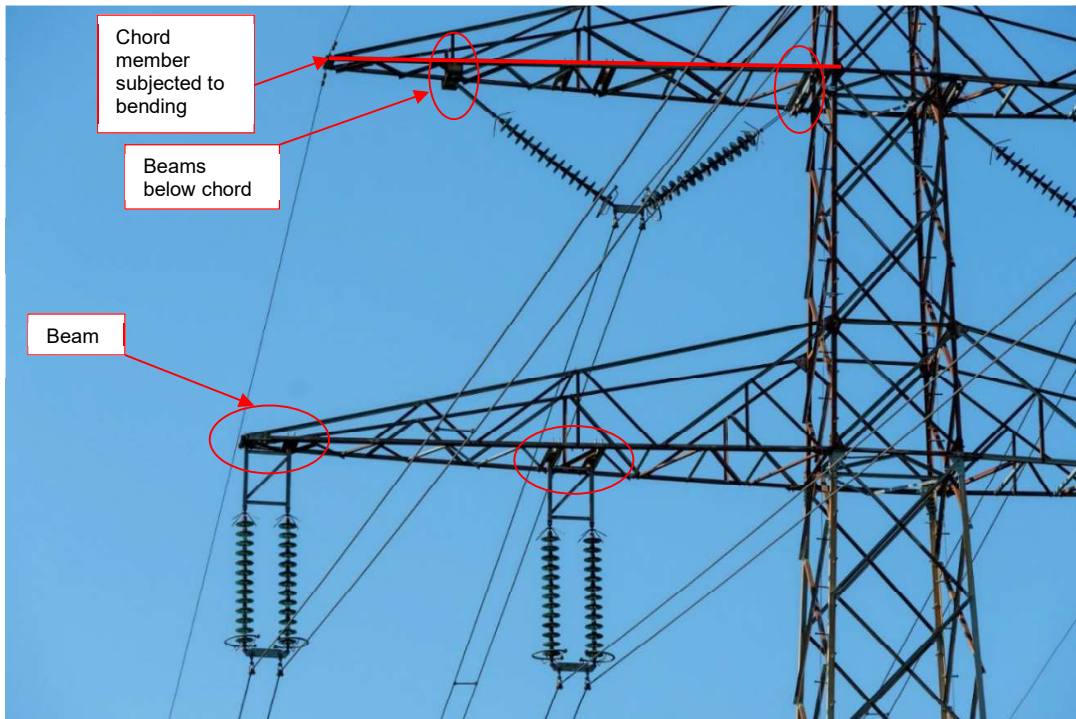


Figure 4-1 Beams in D+0 and D+3.6 structure

### 4.2 Insulators

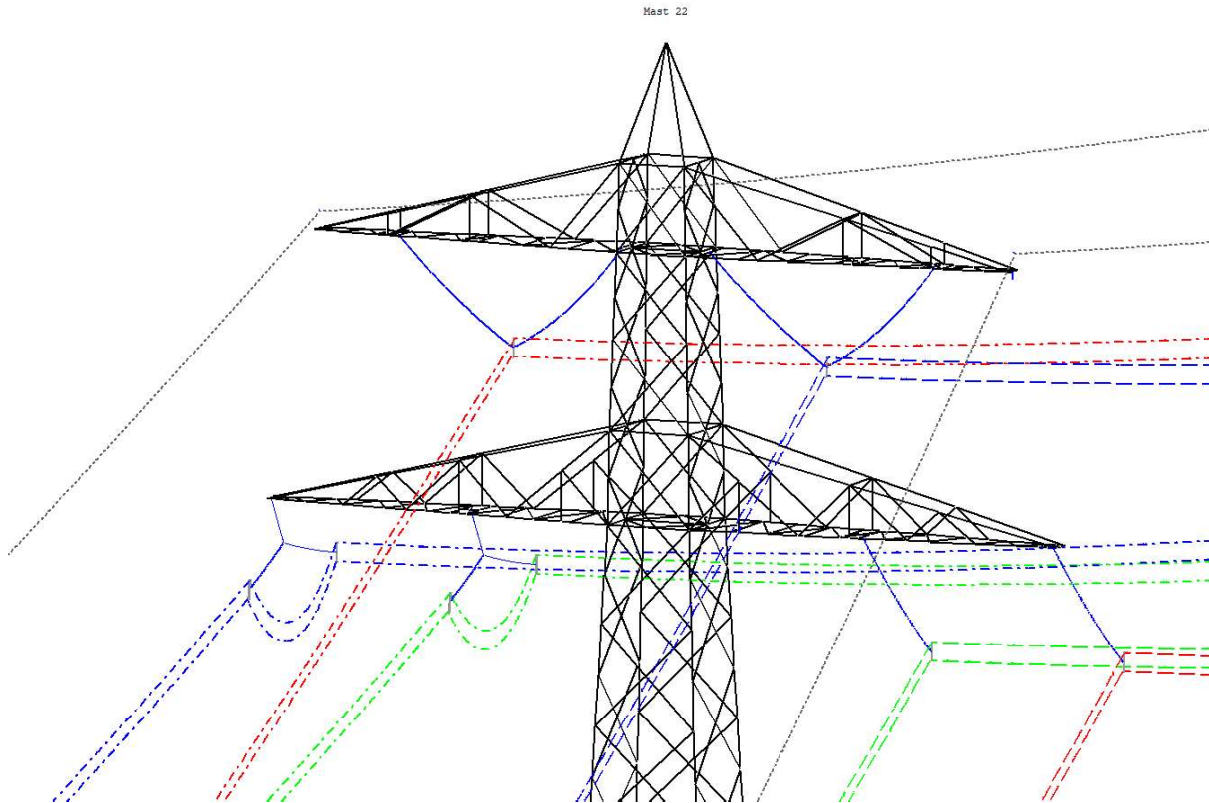
There are four locations with OSPs, with six neighbouring suspension towers and two angle towers. Since the proximity of the OSP causes an increase of the line angle and an additional vertical load it is necessary to perform checks to the insulator chains of suspension towers. No detailed drawings exist for the chains and furthermore, the condition of the chains is unknown. It is advised to modify the existing chains with new chains. Secondly, based upon the electrical design, some of the insulators need to be changed for sufficient clearance. The changes to the insulators are included in report 002.678.00 0928654 21-0968 "Definitief ontwerp OSP's tijdelijke opstijpunten".

For all of the suspension towers, the rigid N-shaped insulator brackets of the lower cross arm are to be replaced by bars that allow for rotation because the strength of these brackets is unknown and because they cause large bending moments in the lower chord member of the cross arm.

As an exception, the insulators in the outer corner of suspension towers 22 with large off-center position are to be replaced by suspension-tension sets (hangende afspanning).



The impact of the change to “hangende afspanning” was investigated with PLS-CADD. With 1 m pivoting length, the conductor tension was determined to be 79% of the EDS-tension. This is within the 80% value that was used in the calculations, so no revision of the conductor loads was required.



**Figure 4-2 Adjustment of suspension insulators to “Hangende afspanning” insulators on outer corner of tower 22 (D+3.6)**

Lastly, the V-assemblies of the top cross arm should be modified at the towers with larger line angle. The bridge is to be replaced by a triangle that allows for the required rotation of the conductor attachment.

Table 13 summarises the modifications.

**Table 13 modifications to insulators**

Suspension	Towers	Existing	New
Top cross arm	22, 91 and 92	V-assembly	V-assembly suitable for large line angle
	other	V-assembly	No changes
Lower cross arm	all	Double parallel chain + bracket	Double parallel chain <u>without</u> bracket
	22	Parallel chain + bracket	Suspension -Tension (“hangende afspanning”) in outer corner, inner corner with double parallel chain without bracket

### 4.3 Approach to verify beam strength

The beams of the suspension tower types D+0 and D+3.6 (both have similar tower top and cross arms) will be examined for the bending load. Decisive for the load is the proximity to the riser point and the change of direction towards the riser point. The line angle of the conductor towards riser point has the decisive impact to the magnitude of the bending load on the beam. The line angle varies between the tower locations, it was chosen to distinguish between large and smaller line angles. Table 14 shows the division between the two situations, situation one with a small angle, situation two with a large angle, requiring possibly more adaptations.

**Table 14 Considered loading situations**

Line	Tower No	Tower Type	Span (m)	Direction change (m)	Max. angle conductor (°)	Loading situation
GT-ZBH150	20	D+0	160	6	2	2
GT-ZBH150	22	D+3.6	100	36	20	1
GT-ZBH150	32	D+0	160	6	2	2
RSD-MDK150	84	D+0	145	16	6	2
RSD-MDK150	91	D+0	90	20	13	1
RSD-MDK150	92	D+0	67/95	18	11	1

### 4.4 Results

The assessment of the existing beams is included in Appendix D. The calculations show that the profiles of the bottom crossarm are satisfactory in all situations, see table 14. In case of the top crossarm, the inner beam does not meet the requirements in situation 1 and 2 (all towers). The outer beam does not pass in case 2 (20, 32 and 84).

**Table 15 Result of beams calculations**

Beam	U.C. (sit.1)	U.C. (sit.2)	Remark
Beam of the top crossarms inside	1.45	1.07	Situation 1 and 2 don't pass
Beam of the top crossarms outside	1.05	0.80	Situation 1 does not pass
Beam of the bottom crossarm inside	0.99	0.71	Pass
Beam of the bottom crossarm outside	0.28	0.21	Pass

The bottom chord of the top cross arm was checked as well as part of the beams calculations, since it is subject to bending whereas the lower cross arm does not experience significant bending. The results are shown in the table 15. The calculation shows that the bottom chord is not sufficient, this is for all of the towers.

**Table 16 Results of calculation of bottom chord top cross arm**

Results for bottom chord	U.C. (sit.1)	U.C. (sit.2)	Remark
Bottom chord top crossarm inside	1.32	1.11	Not OK
Bottom chord top crossarm outer	1.53	1.31	Not OK

## 4.5 Modification top cross arm

The calculations show that the inner beams of the top cross arm do not comply in situation 1 and 2 (all of the towers), and the outer beams do not comply in situation 1 (tower 22, 91, 92). The bottom chord of the top crossarm does not comply with bending in all cases, both at the inner beams and outer beams. A reinforcement is developed to support the inner beams and bottom chord in one solution. This is shown in Figure 4-3. The existing inner beams will be kept.

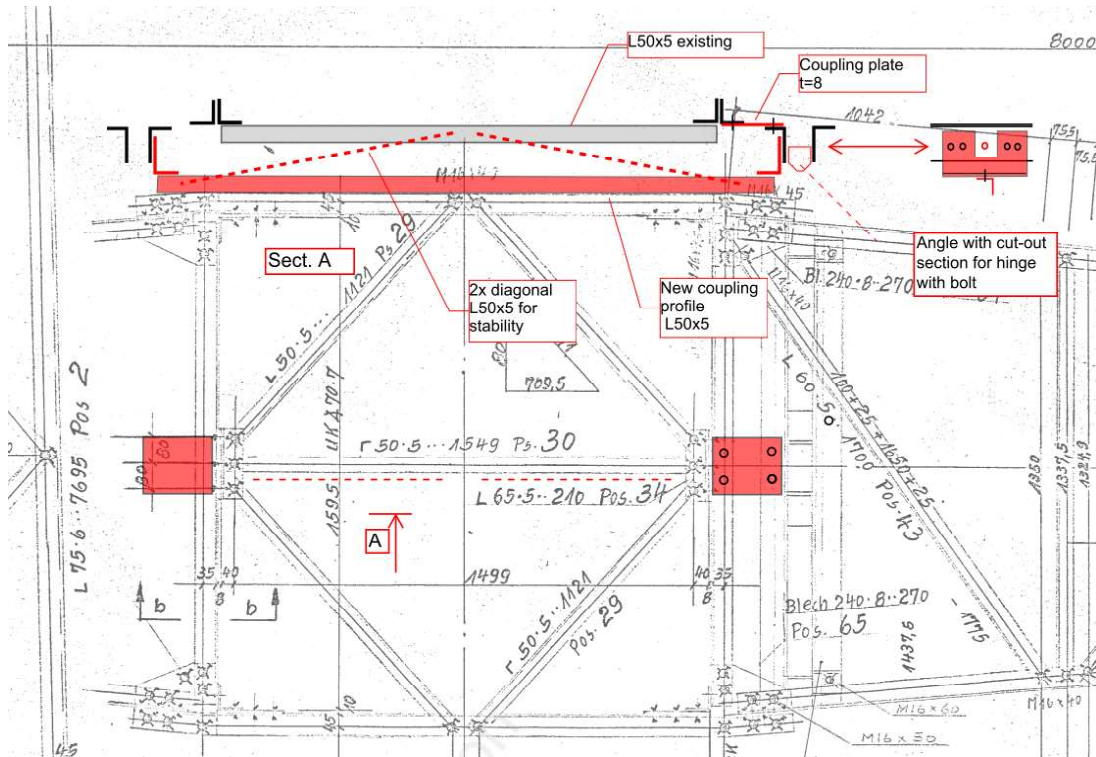


Figure 4-3 Modification of inner beams

The outer beams will need to be replaced by new beams (2 coupled beams L100x10) in loading situation 1. To support the lower chord against bending and to solve large eccentricities in the diagonal connections, in all of the towers the cross arm is to be modified as shown in Figure 4-4.

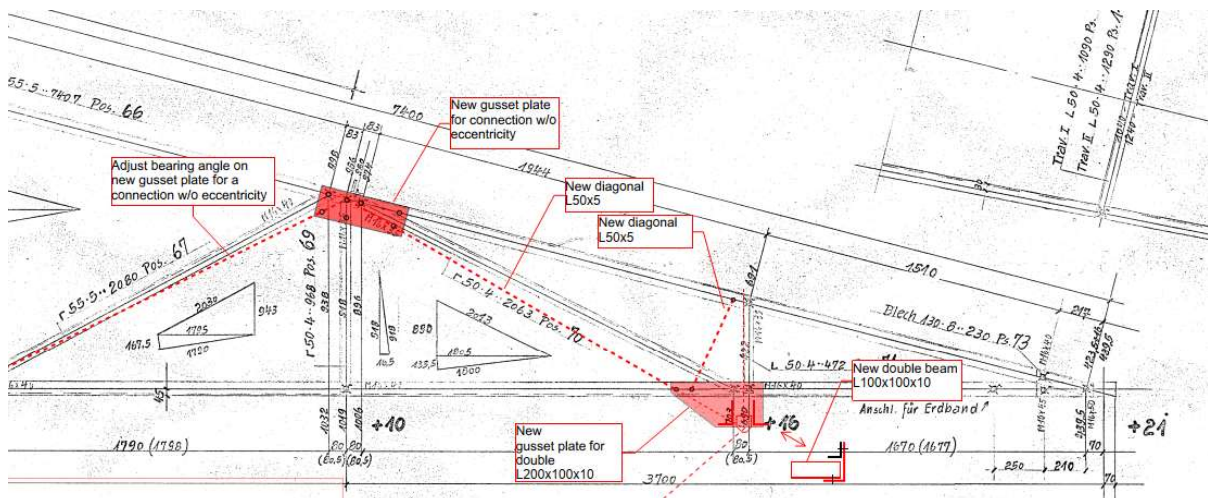


Figure 4-4 Modification of the top cross arm and outer beam (new beam only sit.1, tower 22, 91 and 92)

In Appendix D the modifications are explained in more detail.

The modified structure was checked for verbouwniveau loads. The results are included in table 16.

**Table 17 Results of verification of modified structure**

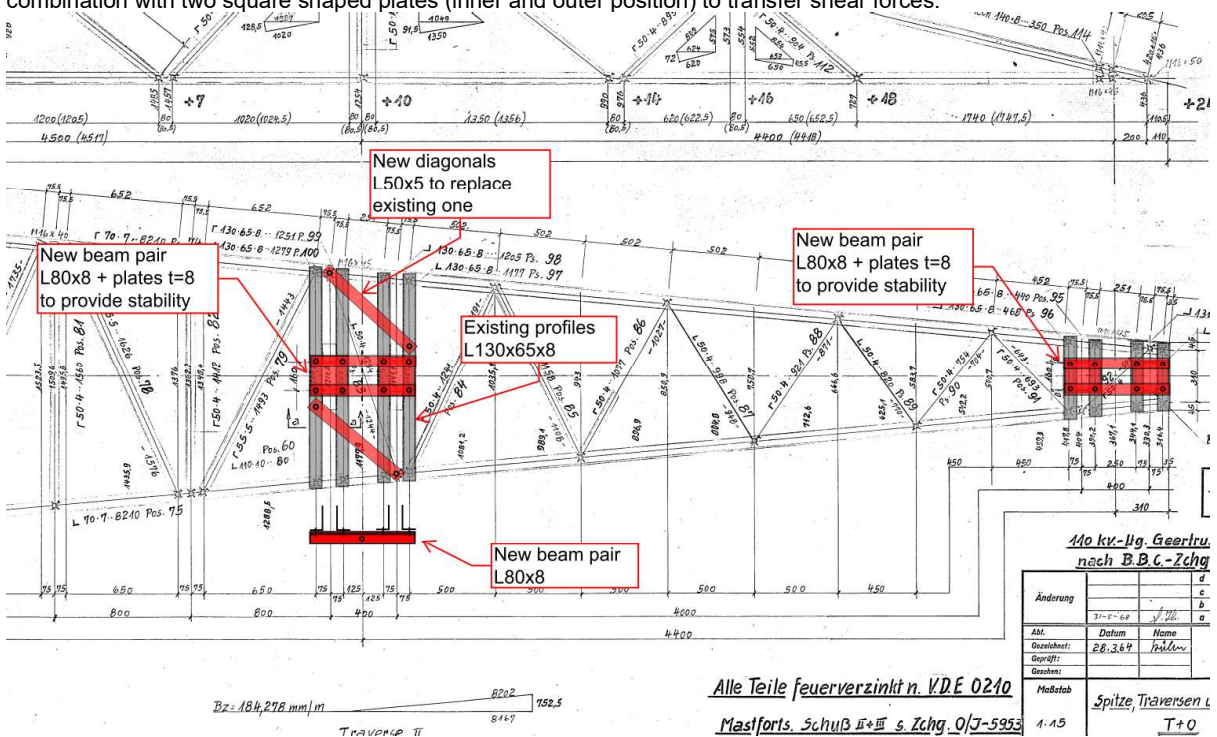
Results on bottom chord	U.C. (sit.1)	Remark
Beam top crossarm inside (existing)	0,77	Passes
Beam top crossarm outside (new. L100x10)	0,53	Passes
Diagonal (new. L50x5)	0,26	Passes
Coupling profile (new. L50x5)	0,35	Passes

The new members have utilizations below 1,00, the new structural elements pass the check.

In the implementation phase, the bolted connections, gusset plates and other elements should be checked into further detail.

#### 4.6 Modification lower cross arm (tower 22 only)

In order to attach the suspension-tension sets to the lower cross arm at the outer corner, new beams are required. The beams consist of two L80x8 profiles, these will be attached to the existing four profiles. The new beams clash with the existing diagonal, this profile should be removed. Its function should be taken over by new diagonals (inner position) in combination with two square shaped plates (inner and outer position) to transfer shear forces.



**Figure 4-5 New beams for lower cross arm tower 22 (outer corner only)**

The verification of the beams is included in Appendix D. Result:

U.C. = 0,23 ≤ 1,00 OK.

The new beams can be fitted directly underneath the existing beams and act favourably to the existing beams, so no further calculations were performed to the existing beams



## 4.7 Summary

In summary, the following changes have been performed in the towers discussed in this report, see Table 18. The changes apply to the top crossarms only.

**Table 18 Summary of changes performed in towers**

Line	Mast	Mast type	BO-check	Measure	Beams
Roosendaal-Moerdijk 150kV	94	H-150	OK		
	91	D	NG	Retrofitting of leg members, bolts exchanged in diagonal members.	1
	92	D	NG	Retrofitting of leg members, bolts exchanged in diagonal members.	1
	82	H-130	OK		
	84	D	NG	Redundant members added, bolts exchanged in diagonal members	2
Geertruidenberg-Zevenbergsehoek 150kV	24	A	NG	Diagonal members exchanged of the cross arm	
	32	D+0	NG		2
	20	D+0	NG		2
	22	D+3.6	NG	Retrofitting of leg members, diagonals and bolts exchanged	3
Geertruidenberg-Oosteind 150 kV	199	S+0	OK		
	202	S+0	OK		
	208	S+0	OK		

Modification 1:

For this loading situation, both attachment beams of insulators of the top cross arm are to be exchanged, For the inner beams, add new coupling profile (L50x5), new diagonal members for stability (L50x5), new coupling plate (t=8mm); for the outer beams, adjust the geometry of the diagonals on the vertical side of the crossarm.

Modification 2:

The structural modification is the same as 1, except the outer beams do not have to be replaced by new beams.

Modification 3:

All of the measures 1, additionally two new beams to be attached to the lower cross arm at the outer corner.

## 4.8 Profile weights including beam adjustments

The weights for the adjustments to beams have been determined. Profile names are based upon pos-numbers of original drawing if existing profiles. The weight of additional plates, gusset plates and other (welded) parts is not included in the table.

The weights of the new profiles for tower 84, 20 and 32 (measure "1") is shown in table 19.

**Table 19 Weights of the new profiles for beam adjustments for tower 84, 20 and 32**

Group Number	Profile ini	Material	Bolt Ini	Profile New	Material New	Bolt New	Mitigation	Number	Length (m)	Weight (kg)
67	L55x5	S235		L55x5	S235	<b>1M16-8.8t</b>	Bolts exchanged	4		
70	L50x4	S235		<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile exchanged	4	2,06	31,36
71A	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	4	0,50	7,60
30A <sup>1</sup>	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	1	2,40	9,12
30B <sup>2</sup>	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	2	1,20	9,12
									total	57,20

The weights of the new profiles for tower 91 and 92 (measure "2") is shown in table 20.

**Table 20 Weights of the new profiles for beam adjustments for tower 91 and 92**

Group Number	Profile ini	Material	Bolt Ini	Profile New	Material New	Bolt New	Mitigation	Number	Length (m)	Weight (kg)
67	L55x5	S235		L55x5	S235	<b>1M16-8.8t</b>	Bolts exchanged	4		
70	L50x4	S235		<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile exchanged	4	2,06	31,36
71A	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	4	0,50	7,60
30A	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	1	2,40	9,12
30B	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	2	1,20	9,12
Beam top CA	2x L100x65x9	S235		<b>2x L100x10</b>	<b>S355</b>	<b>2M16-8.8t</b>	Profile exchanged	2	0,70	42,28
									total	99,48

The weights of the new profiles for tower 22 (measure "1" and "3") is shown in table 21.

**Table 21 Weights of the new profiles for beam adjustments for tower 22**

Group Number	Profile ini	Material	Bolt Ini	Profile New	Material New	Bolt New	Mitigation	Number	Length (m)	Weight (kg)
67	L55x5	S235		L55x5	S235	<b>1M16-8.8t</b>	Bolts exchanged	4		
70	L50x4	S235		<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile exchanged	4	2,06	31,36
71A	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	4	0,50	7,60
30A	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	1	2,40	9,12
30B	-	-	-	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	2	1,20	9,12
Beam top CA	2x L100x65x9	S235		<b>2x L100x10</b>	<b>S355</b>	<b>2M16-8.8t</b>	Profile exchanged	2	0,70	42,28
83	-	S235	4M12-5.6t	<b>L50x5</b>	<b>S355</b>	<b>1M16-8.8t</b>	Profile added	2	0,65	4,94
Beam Lower CA <sup>3</sup>	-	S235	4M16-5.6t	<b>2x L80x8</b>	<b>S355</b>	<b>2M16-8.8t</b>	Profile added	2	0,58	22,20
									total	126,61

For tower 20,32, 22, 84, 91 and 92, the total weight of modifications to the tower and the beams is as following:

**Table 22 Total weight of profiles for adjustments**

Tower	Structure (kg)	Beams (kg)	Total (kg)
20,32	-	57	57
84	206	57	263
91 and 92	1145	99	1244 <sup>4</sup>
22	1765	127	1892

<sup>1</sup> "new coupling profile shown in figure 4-2

<sup>2</sup> "2x diagonal L50x5 for stability" shown in figure 4-2

<sup>3</sup> the profile pair is for the "hangende afspanning"

<sup>4</sup> the weight is for each tower



## 5 FOUNDATION

### 5.1 Introduction

In report 002.678.00 0790751 20-0476 DNV GL rapport TenneT Doorrekenen masten t.b.v. tijdelijke opstijgpunten” the foundations of TOSP towers were analysed. The results were used to determine the preferred location of the TOSP. For a number of locations, the reaction forces on the foundation increased regardless of the TOSP location.

Since the tower legs of the D+0 and D+3.6 structures have to be reinforced as per results of the tower analysis, the introduction of forces into the foundation is to be treated in this report. For these towers, the capacity of the foundation will be calculated and if necessary a reinforcement of the foundation is proposed.

### 5.2 Analysis

All of the four towers that have TOSP locations placed out of the centerline have increased foundation loads. The reaction forces are included in Appendix A. In table 18 the increase of forces is shown.

**Table 23 Increased reaction forces**

Lijn	Mast	Type	Current loading (kN)	New loading (kN)	Increase
GT-ZBH150	22	D+3.6	305	410	134%
RSD-MDK150	84	D+0	235	284	121%
RSD-MDK150	91	D+0	235	309	131%
RSD-MDK150	92	D+0	235	332	141%

The actual foundation capacity is determined with the software package TS/Paalfunderingen. The reaction forces of the tower is checked against the capacity of the foundation. The results are included in Appendix C and shown in table 19. Three of the four foundations have over-utilization and should be reinforced to resist the increased tower loads. For compression, all of the piles have sufficient capacity, only the tension capacity needs to be increased.

**Table 24 Utilization of existing foundation piles**

Lijn	Mast	Type	Tensile load afkeur 30 yr. (kN)	Capacity (kN)	Utilization (-)	Compressive load (kN)	Capacity (kN)	Utilization (-)
GT-ZBH150	22	D+3.6	410	274	150%	496	949	52%
RSD-MDK150	84	D+0	284	279	102%	339	893	38%
RSD-MDK150	91	D+0	309	289	107%	385	1431	27%
RSD-MDK150	92	D+0	332	361	92%	407	1243	33%

The reinforcement is to be designed with the loads for “Verbouwlevel”. In table 20 the required additional capacity of the foundation piles (for the sum of both piles) is shown.

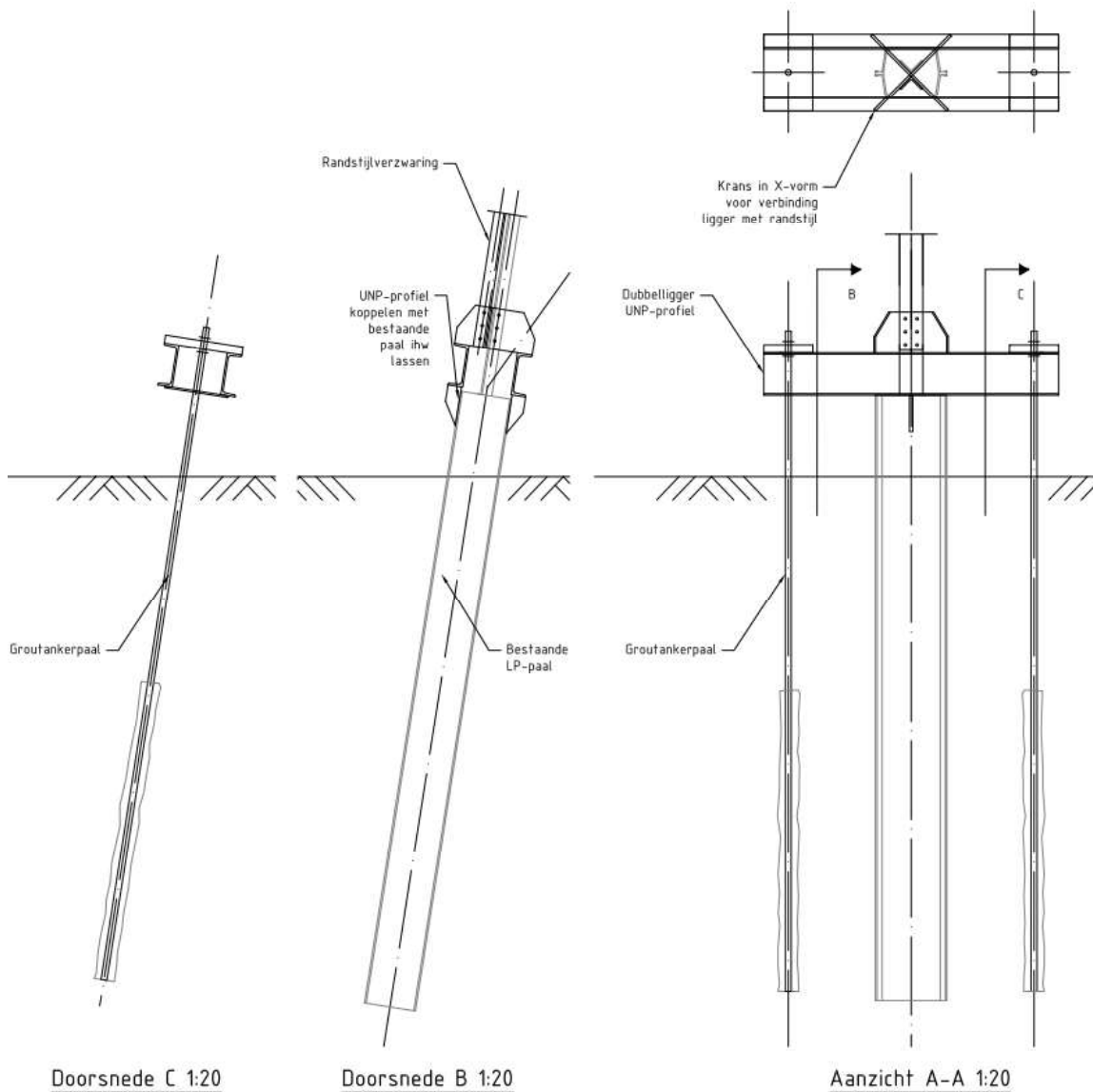
**Table 25 Required additional capacity of tension elements**

Lijn	Mast	Type	Tensile load afkeur 30 yr. (kN)	Existing capacity (kN)	Shortage (kN)
GT-ZBH150	22	D+3.6	474	274	200
RSD-MDK150	84	D+0	336	279	57
RSD-MDK150	91	D+0	356	289	67

### 5.3 Reinforcement of foundation

The shortage to the capacity of the existing foundation pile can be mitigated by adding two additional tension piles. Since it is a temporary pile, the application of grout anchor piles is accepted by AM of TenneT. Pre-condition is that the piles will be pre-tensioned to ensure that the piles are effective in carrying the loads from the tower. The proposal is worked out on drawing 10124719-032-210-A2 and included in Figure 5-1 below.

A pair of UNP-beams will be in situ welded to the pile. The tower leg and the additional profile of the tower leg are to be attached to the beam with bolted connections. In the implementation phase, the pile type and pile tip level, the bolted connections, gusset plates and other elements should be checked into further detail.



**Figure 5-1 Modification proposal for tower foundations with insufficient tension capacity**



## 5.4 Conclusion

The foundation strength of the towers that have increased loads on the foundation are analysed. Out of the four considered locations, three have insufficient strength against tension. These are tower 22 GT-ZBH150 and tower 84, 91 of RSD-MDK150. All foundations have sufficient compression capacity.

For the locations with insufficient strength a modification proposal was developed that comprises the installation of two grout anchorpiles next to the existing pile, which will be coupled with a beam structure that can also provide support to the reinforced tower leg. During the implementation phase, the structure is to be worked out into more detail.



## 6 VERIFICATION OF REQUIREMENTS

Verification of the applicable requirements is included in "Verificatie en validatie tijdelijke OSP's" [1].



## 7 REFERENCES

- [1] 002.678.00 0935198 - 21-0962 Verificatie en validatie tijdelijke OSP's.
- [2] 002.678.00 0790751 - 20-0476 DNV GL rapport TenneT Doorrekenen masten t.b.v. tijdelijke opstijgpunten.
- [3] 002.678.00 0864852 - 20-1395 Rev.4 - Alternatief tijdelijke verbindingen t.b.v. reductie VNB tijden.
- [4] 002.678.00 0928569 - 21-0960 Uitgangspunten definitief ontwerp tijdelijke OSP's.



## **APPENDIX A**

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### **CONDUCTOR LOADS**

The appendix A includes the conductor loads for tower GT-ZBH (24) type A. These loads are calculated with Geleiderbelastingen spreadsheet.

The conductor loads for tower 22, 84 91 and 92 were calculated with PLS-CADD because of differences in span length and direction between conductors and circuits. The loads for tower 22 and the governing tower 92 are included.

At the end of the Appendix, the reaction forces for Afkeurlevel and Verbouwlevel are shown.





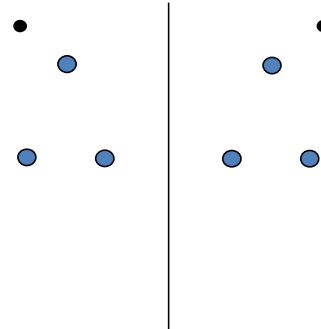
Project: GT-ZBH150  
 Tower: A  
 Number: 24

Auteur: TBR  
 Versie: v11.9

### Geleiderbelastingen

#### Algemeen

Benaming A  
 Masttype Hoekmast  
 Aantal circuits 2  
 Configuratie 2-circuit-donau  
 Aantal bliksemgeleiders 2



Configuratie geleiders

#### Uitgangspunten

Norm NEN-EN50341-2-15:2019  
 Gevolgklasse initieel CC2-0  
 Betrouwbaarheidsniveau initieel Afkeur CC2-0  
 Referentieperiode initieel 30 jaar  
 Gevolgklasse na aanpassing CC2  
 Betrouwbaarheidsniveau na aanpassing Verbouw  
 Referentieperiode na aanpassing 30 jaar  
 Windgebied III  
 Windsnelheid (m/s) 24,5 m/s  
 Terreincategorie II  
 Reductiefactor  $c_{dir}$  1,00  
 IJsg gebied fasegeleider B  
 IJsg gebied bliksemgeleider B

#### Geleiders Back

Omschrijving	Spanning	Geleider Back	Bundel Ba	IJsg gebied	Toeslag gewicht	Toeslag diameter	Intrekwaarden $P_{back}$
Circuit 1	150 kV	ACSR 20/224	2	B	2 %	2 %	1200
Circuit 2	150 kV	ACSR 20/224	2	B	2 %	2 %	1200
Bliksemdraad 1		ACSR 30/52 PETREL	1	B	2 %	2 %	1500
Bliksemdraad 2		ACSR 30/52 PETREL	1	B	2 %	2 %	1500

#### Geleiders Ahead

Omschrijving	Spanning	Geleider Ahead	Bundel Ah	IJsg gebied	Toeslag gewicht	Toeslag diameter	Intrekwaarden $P_{ahead}$
Circuit 1	150 kV	ACSR 20/224	2	B	2 %	2 %	1200
Circuit 2	150 kV	ACSR 20/224	2	B	2 %	2 %	1200
Bliksemdraad 1		ACSR 30/52 PETREL	1	B	2 %	2 %	1500
Bliksemdraad 2		ACSR 30/52 PETREL	1	B	2 %	2 %	1500

#### Isolatoren (1)

Omschrijving	Ophanging	Gewicht [kN]	Lengte [m]	Windopp. [m <sup>2</sup> ]
Circuit 1	Afspanketting	1,50	4,50	1,00
Circuit 2	Afspanketting	1,50	4,50	1,00
Bliksemdraad 1	Afspanketting	0,10	0,20	0,10
Bliksemdraad 2	Afspanketting	0,10	0,20	0,10

1. Eigenschappen gelden voor geheel van de isolatorset

#### Ophanghoogte en positie in mast

Circuits	Aanduiding	Nummer	Ophanghoogte	Aangrijppunt	Positie in mast Horizontale afstand
Circuit 1	10	150ct1f1	21,4 m	21,4 m	-8,9 m
Circuit 1	11	150ct1f2	21,4 m	21,4 m	-4,4 m
Circuit 1	12	150ct1f3	27,3 m	27,3 m	-4,3 m
Circuit 2	20	150ct2f1	21,4 m	21,4 m	4,4 m
Circuit 2	21	150ct2f2	21,4 m	21,4 m	8,9 m
Circuit 2	22	150ct2f3	27,3 m	27,3 m	4,3 m
Bliksemdraad 1	1	bl1	29,5 m	29,5 m	-8,6 m
Bliksemdraad 2	3	bl2	29,5 m	29,5 m	8,6 m

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**Hoogteaanpassing naastgelegen masten** (aanpassing wind- en weight span)

	Back	Ahead	
Verhoging voor windbelasting	0,0 m	0,0 m	(positief: omhoog)
Verlaging voor verticale belasting	-3,0 m	-3,0 m	(negatief: omlaag, grotere weight span)
Verlaging:	Niet in 0,9EG-combinaties		

**Hoogteafwijking mastbeeld naastgelegen masten en richtingsverandering t.o.v. Lijnrichting**

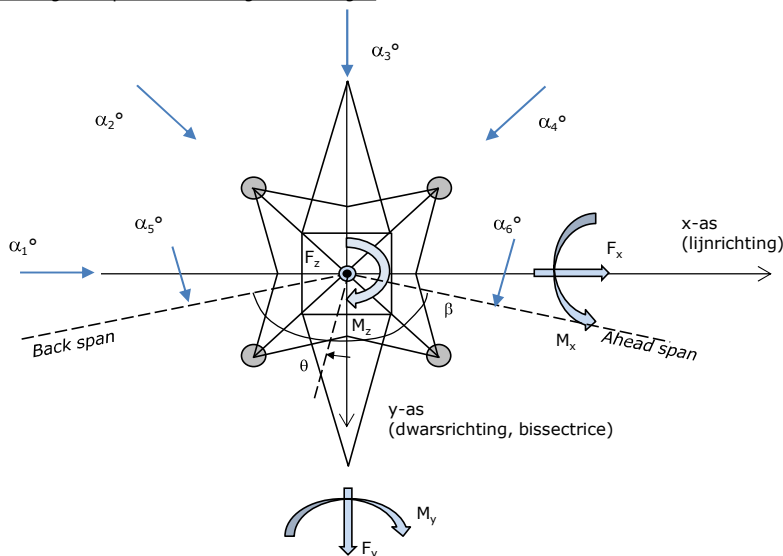
Circuits	Aanduiding	Nummer	Hoogteverschil		Richtingsverandering	
			$\Delta h_{back}$	$\Delta h_{ahead}$	$\Delta y_{back}$	$\Delta y_{ahead}$
Circuit 1	10	150ct1f1	-9,1	0,0 m	-6,6	0,0 m
Circuit 1	11	150ct1f2	-9,1	0,0 m	-5,8	0,0 m
Circuit 1	12	150ct1f3	-15,0	0,0 m	-0,9	0,0 m
Circuit 2	20	150ct2f1	-9,1	0,0 m	5,8	0,0 m
Circuit 2	21	150ct2f2	-9,1	0,0 m	6,6	0,0 m
Circuit 2	22	150ct2f3	-15,0	0,0 m	0,9	0,0 m
Bliksemdraad 1	1	bl1	-10,2	0,0 m	-6,6	0,0 m
Bliksemdraad 2	3	bl2	-10,2	0,0 m	6,6	0,0 m

**Lijn- en mastgegevens**

	Back	Ahead
Ruling span $\sqrt{(\Sigma L^3)/\Sigma L}$	170,0	323,0 m
Lijnhoek	170,0	295,0 m
Rotatie mast t.o.v. bissectrice	$\beta$	180 °
Vaklengte	$\theta$	0 °
Hoogte onderkant mast t.o.v. maaiveld	170	741 m
Beschouwde windrichtingen	$\alpha_1$	0 °
Windrichtingen volgens:	$\alpha_2$	45 °
<i>Geleiderbelastingen</i>	$\alpha_3$	75 °
	$\alpha_4$	90 °
	$\alpha_5$	105 °
	$\alpha_6$	135 °

Windrichtingen gelden t.o.v. hoofdrichting mastconstructie, niet t.o.v. bissectrice.

Windrichtingen en positieve richtingen belastingen



Beschouwd aantal windrichtingen

1a	6
3	6
4	1
6	1
Overig	1

Project: GT-ZBH150  
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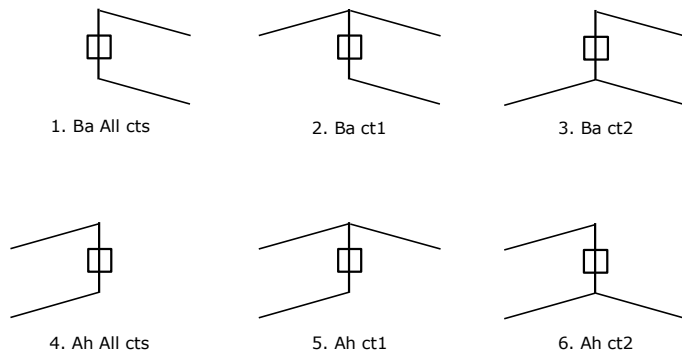
### Geleiderafval

		SPLS - torsie		SPLS - Enkelzijdige trek		5a - geleiderbreuk	
		Aanw.	Afw.	Aanw.	Afw.	Aanw.	Afw.
Circuit 1	150ct1f1	1	0	1	0	1	0
Circuit 1	150ct1f2	1	0	1	0	1	0
Circuit 1	150ct1f3	1	0	1	0	1	0
Circuit 2	150ct2f1	0	1	1	0	1	0
Circuit 2	150ct2f2	0	1	1	0	1	0
Circuit 2	150ct2f3	0	1	1	0	1	0
Bliksemdraad 1	b1	1	0	1	0	1	0
Bliksemdraad 2	b2	0	1	1	0	1	0

### Belastingsituaties SPLS

Beschouwde situaties SPLS: 1 t/m 6, alle mogelijke situaties.

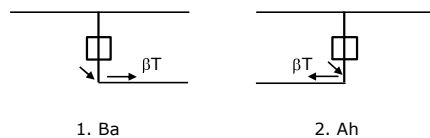
Principe belastingssituaties:



### Belastingsituaties 5a. Geleiderbreuk

Beschouwde situaties geleiderbreuk 5a: 1 en 2, alle mogelijke situaties.

Principe belastingssituaties:



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### Belastingsituaties 6. Bouw- en onderhoud

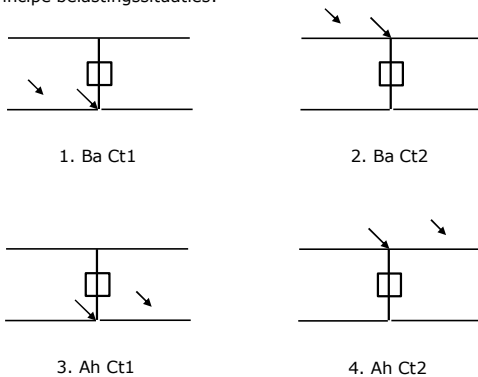
Onder 6a wordt de belasting door aanwezigheid lijnwagen of lijnfiets in combinatie met puntlast op traverse in rekening gebracht. Combinatie 6b bevat geen belastingen in geleider of op traverse. Deze combinatie is toegevoegd om te kunnen combineren met separate controle bordessen etc. De situaties worden in ULS en in iedere SPLS-situatie (in geval van hoekmast) toegepast.

	Fase	Bliksem
Lijnwagen	3,0 kN	1,0 kN
Puntlast op traverse	1,0 kN	1,0 kN

Beschouwde situaties bouw- en onderhoud 6a: 1 t/m 4, alle mogelijke situaties.

Aanwezigheid lijnwagen: Geleider, belasting aanwezig in één van de geleiders, anderen onbelast.

Principe belastingssituaties:



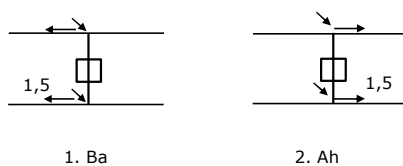
### Belastingsituaties 8. Lijndansen als statische belasting

Geleider		
Steunmast fase	0,866 W	1,5 W
Steunmast bliksem	1,5 EDS	1,5 W
Hoekmast fase en bliksem	1,5 EDS	1,5 W

Beschouwde situaties lijndansen 8: Geen (bestaande constructie)

Belasting tegelijk aanwezig in alle geleiders van het circuit.

Principe belastingssituaties:



### Belastingcombinatie 8. Lijndansen als dynamische belasting

Alleen van toepassing op hoek- en eindmasten

Belasting bestaat uit EDS-trekbelasting in één van de geleiders aan één zijde van de mast

Door gebruiker via het belastingsspectrum van tabel 4.11/NL.1 om te zetten naar spanningspectrum

Project: GT-ZBH150  
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## Mastconstructie

### Eigenschappen

Masttype	Hoekmast	
Mastbenaming	A	
Voetplaat t.o.v. maaiveld	0,5 m	
Masthoogte t.o.v. voetplaat	32,0 m	
Gewicht mast	102,3 kN	
<i>Breedte en helling mast bij fundatie</i>	x-ri.	y-ri.
Pootsprei	5,40	5,40 m
Helling van de randstijl	0,118	0,118 -
Factor spatkracht	1,3	1,3 -

### Berekening windbelasting

Dynamische invloed $G_T$	1,00 ( <i>Masthoogte &lt; 60 m</i> )
Windbelasting overhoeks op mastlichaam evenredig met:	$(A1C1\sin^2(\phi)+A2C2\cos^2(\phi))$
Windbelasting overhoeks op traverse evenredig met:	$(A1C1\sin^2(\phi)+A2C2\cos^2(\phi))$
Vergroting wind overhoeks mastlichaam	$(1+0,2\sin^2(2\phi))$
Vergroting wind overhoeks traverse	$(1+0,2\sin^2(2\phi))$
Factor wind evenwijdig t.o.v. haaks op traverse	0,4

### Eigenschappen mastsecties langsrichting (vooraanzicht, yz-vlak)

Omschrijving	h [m]	b <sub>1</sub> [m]	b <sub>2</sub> [m]	Δh [m]	Δ <sub>x</sub> [m]	A <sub>0</sub> [m <sup>2</sup> ]	A <sub>1</sub> [m <sup>2</sup> ]	χ = A <sub>1</sub> /A <sub>0</sub> [-]	C <sub>t</sub>
Broekstuk	7,50	5,40	3,63	7,50	0,118	33,86	12,86	0,38	2,28
Eerste tussenstuk	14,60	3,63	2,86	7,10	0,054	23,04	12,05	0,52	1,94
Tweede tussenstuk	21,41	2,86	2,10	6,81	0,056	16,89	10,31	0,61	1,81
Bovenstuk 1	27,30	2,10	1,81	5,89	0,025	11,51	8,02	0,70	1,74
Bovenstuk 2	29,50	1,81	1,70	2,20	0,025	3,86	3,47	0,90	1,82
Topstuk	32,00	1,70		2,50		2,13	0,53	0,25	2,72
Ondertraverse	21,41	17,78		2,09		18,58	11,50	0,62	1,80
Boventraverse	27,30	17,18		2,20		18,90	11,03	0,58	1,84

### Eigenschappen mastsecties dwarsrichting (zijaanzicht, xz-vlak)

Omschrijving	h [m]	b <sub>1</sub> [m]	b <sub>2</sub> [m]	Δh [m]	Δ <sub>x</sub> [m]	A <sub>0</sub> [m <sup>2</sup> ]	A <sub>1</sub> [m <sup>2</sup> ]	χ = A <sub>1</sub> /A <sub>0</sub> [-]	C <sub>t</sub>
Broekstuk	7,50	5,40	3,63	7,50	0,118	33,86	12,86	0,38	2,28
Eerste tussenstuk	14,60	3,63	2,86	7,10	0,054	23,04	12,05	0,52	1,94
Tweede tussenstuk	21,41	2,86	2,10	6,81	0,056	16,89	10,31	0,61	1,81
Bovenstuk 1	27,30	2,10	1,81	5,89	0,025	11,51	8,02	0,70	1,74
Bovenstuk 2	29,50	1,81	1,70	2,20	0,025	3,86	3,47	0,90	1,82
Topstuk	32,00	1,70		2,50		2,13	0,53	0,25	2,72
Ondertraverse	21,41	17,78		2,09		18,58	11,50	0,62	1,80
Boventraverse	27,30	17,18		2,20		18,90	11,03	0,58	1,84

NB: oppervlakte traverse dwarsrichting wordt in berekening gereduceerd.



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#### Windoppervlak feeders telecominstallaties

Onderdeel	A (m <sup>2</sup> /m)	Factor	Δh	A <sub>1</sub>
Broekstuk				
Eerste tussenstuk				
Tweede tussenstuk				
Bovenstuk 1				
Bovenstuk 2				

#### Invoer antennes

Omschrijving	A (m <sup>2</sup> )	h (m)	C <sub>r</sub> (m)
Antenne top			
Antenne o.t.			

#### Belastingen mastsectie langsrichting (x-richting) per windrichting

Omschrijving	P <sub>w</sub> [kN/m <sup>2</sup> ]	F <sub>x1</sub> [kN]	F <sub>x2</sub> [kN]	F <sub>x3</sub> [kN]	F <sub>x4</sub> [kN]	h <sub>ef</sub> [m]	M <sub>y1</sub> [kNm]	M <sub>y2</sub> [kNm]	M <sub>y3</sub> [kNm]	M <sub>y4</sub> [kNm]
Broekstuk	0,70	20,5	17,4	5,6	0,0	3,8	76,9	65,3	20,9	0,0
Eerste tussenstuk	0,73	16,9	14,4	4,6	0,0	11,1	187,1	158,8	50,8	0,0
Tweede tussenstuk	0,85	15,9	13,5	4,3	0,0	18,0	285,5	242,3	77,6	0,0
Bovenstuk 1	0,94	13,1	11,1	3,6	0,0	24,4	319,0	270,7	86,7	0,0
Bovenstuk 2	0,97	6,2	5,2	1,7	0,0	28,4	174,8	148,3	47,5	0,0
Topstuk	1,00	1,4	1,2	0,4	0,0	30,8	44,2	37,5	12,0	0,0
Ondertraverse	0,90	37,5	22,3	4,5	0,0	22,1	828,2	491,9	99,1	0,0
Boventraverse	0,97	39,4	23,4	4,7	0,0	28,0	1104,5	656,1	132,1	0,0
<b>Totaal</b>		<b>150,9</b>	<b>108,4</b>	<b>29,3</b>	<b>0,0</b>		<b>3020,3</b>	<b>2070,8</b>	<b>526,8</b>	<b>0,0</b>

#### Belastingen mastsectie dwarsrichting (y-richting) per windrichting

Omschrijving	P <sub>w</sub> [kN/m <sup>2</sup> ]	F <sub>y1</sub> [kN]	F <sub>y2</sub> [kN]	F <sub>y3</sub> [kN]	F <sub>y4</sub> [kN]	h <sub>ef</sub> [m]	M <sub>x1</sub> [kNm]	M <sub>x2</sub> [kNm]	M <sub>x3</sub> [kNm]	M <sub>x4</sub> [kNm]
Broekstuk	0,70	0,0	17,4	20,8	20,5	3,8	0,0	65,3	78,0	76,9
Eerste tussenstuk	0,73	0,0	14,4	17,2	16,9	11,1	0,0	158,8	189,8	187,1
Tweede tussenstuk	0,85	0,0	13,5	16,1	15,9	18,0	0,0	242,3	289,6	285,5
Bovenstuk 1	0,94	0,0	11,1	13,3	13,1	24,4	0,0	270,7	323,5	319,0
Bovenstuk 2	0,97	0,0	5,2	6,2	6,2	28,4	0,0	148,3	177,3	174,8
Topstuk	1,00	0,0	1,2	1,5	1,4	30,8	0,0	37,5	44,8	44,2
Ondertraverse	0,90	0,0	22,3	16,7	15,0	22,1	0,0	491,9	369,8	331,3
Boventraverse	0,97	0,0	23,4	17,6	15,8	28,0	0,0	656,1	493,1	441,8
<b>Totaal</b>		<b>0,0</b>	<b>108,4</b>	<b>109,4</b>	<b>104,7</b>		<b>0,0</b>	<b>2070,8</b>	<b>1965,9</b>	<b>1860,7</b>

#### Resulterende belastingen vanuit mastconstructie incl. antenne zonder geleiders niveau fundatie (kar. waarde)

Belasting / windrichting	F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>
	[kN]	[kN]	[kN]	[kNm]	[kNm]	[kNm]
Permanente belasting	0	0	102	0	0	0
Windrichting 0°	151	0	0	0	3020	0
Windrichting 45°	108	108	0	2071	2071	0
Windrichting 75°	29	109	0	1966	527	0
Windrichting 90°	0	105	0	1861	0	0

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### Tussenresultaten geleiderbelastingen

#### Geleiders back

Circuit	Geleider	Diameter [mm]	A [mm <sup>2</sup> ]	G [N/m]	E [N/mm <sup>2</sup> ]	$\alpha T$ [-]
Circuit 1	ACSR 20/224	20,3	244,5	7,60	66000	2,04E-05
Circuit 2	ACSR 20/224	20,3	244,5	7,60	66000	2,04E-05
Bliksemdraad 1	ACSR 30/52 PETREL	11,8	82,4	3,71	105500	1,53E-05
Bliksemdraad 2	ACSR 30/52 PETREL	11,8	82,4	3,71	105500	1,53E-05

#### Geleiders ahead

Circuit	Geleider	Diameter [mm]	A [mm <sup>2</sup> ]	G [N/m]	E [N/mm <sup>2</sup> ]	$\alpha T$ [-]
Circuit 1	ACSR 20/224	20,3	244,5	7,60	66000	2,04E-05
Circuit 2	ACSR 20/224	20,3	244,5	7,60	66000	2,04E-05
Bliksemdraad 1	ACSR 30/52 PETREL	11,8	82,4	3,71	105500	1,53E-05
Bliksemdraad 2	ACSR 30/52 PETREL	11,8	82,4	3,71	105500	1,53E-05

#### Verticale belasting back

Circuit	Bundel [-]	Toeslag [%]	$w_{z,G}$ [N/m]	IJsg gebied	Formule	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	2	2	15,5	B	4+0,2d	8,1	16,1
Circuit 2	2	2	15,5	B	4+0,2d	8,1	16,1
Bliksemdraad 1	1	2	3,8	B	4+0,2d	6,4	6,4
Bliksemdraad 2	1	2	3,8	B	4+0,2d	6,4	6,4

#### Verticale belasting ahead

Circuit	Bundel [-]	Toeslag [%]	$w_{z,G}$ [N/m]	IJsg gebied	Formule	$w_{z,ijs}$ [N/m]	$w_{z,ijs,bundel}$ [N/m]
Circuit 1	2	2	15,5	B	4+0,2d	8,1	16,1
Circuit 2	2	2	15,5	B	4+0,2d	8,1	16,1
Bliksemdraad 1	1	2	3,8	B	4+0,2d	6,4	6,4
Bliksemdraad 2	1	2	3,8	B	4+0,2d	6,4	6,4

#### Isolatoren

Geleider	$G_{isolator}$ [kN]	Aantal	$F_{v,iso}$ [kN]	Lengte [m]	Windopp. [m <sup>2</sup> ]	Windhoogte [m]	Stuwdruk [kN/m <sup>2</sup> ]	Vormfactor [-]	$F_{h,iso}$ [kN]
150ct1f1	1,50	1	1,5	4,5	1,0	21,90	0,90	1,2	1,08
150ct1f2	1,50	1	1,5	4,5	1,0	21,90	0,90	1,2	1,08
150ct1f3	1,50	1	1,5	4,5	1,0	27,80	0,97	1,2	1,16
150ct2f1	1,50	1	1,5	4,5	1,0	21,90	0,90	1,2	1,08
150ct2f2	1,50	1	1,5	4,5	1,0	21,90	0,90	1,2	1,08
150ct2f3	1,50	1	1,5	4,5	1,0	27,80	0,97	1,2	1,16
bl1	0,10	1	0,1	0,2	0,1	30,00	0,99	1,2	0,12
bl2	0,10	1	0,1	0,2	0,1	30,00	0,99	1,2	0,12

Project: GT-ZBH150  
 Tower: A  
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#### Windbelasting back

Geleider	hoogte		G <sub>c_dwars</sub> [-]	G <sub>c_trek</sub> [-]	C <sub>c</sub> [-]	d <sub>toeslag</sub> [mm]	W <sub>y</sub> [N/m]	W <sub>y,vak</sub> [N/m]	D <sub>ijs,toeslag</sub> [mm]	W <sub>y,ijs</sub> [N/m]	W <sub>y,ijs,vak</sub> [N/m]
	wind [m]	Stuwdruk [kN/m <sup>2</sup> ]									
150ct1f1	15,4	0,81	0,56	0,66	1,20	20,75	22,5	26,7	40,2	43,7	51,7
150ct1f2	15,4	0,81	0,56	0,66	1,20	20,75	22,5	26,7	40,2	43,7	51,7
150ct1f3	18,3	0,85	0,57	0,68	1,20	20,75	24,4	28,9	40,2	47,4	56,0
150ct2f1	15,4	0,81	0,56	0,66	1,20	20,75	22,5	26,7	40,2	43,7	51,7
150ct2f2	15,4	0,81	0,56	0,66	1,20	20,75	22,5	26,7	40,2	43,7	51,7
150ct2f3	18,3	0,85	0,57	0,68	1,20	20,75	24,4	28,9	40,2	47,4	56,0
bl1	23,3	0,92	0,60	0,70	1,20	11,99	7,9	9,3	32,8	21,6	25,4
bl2	23,3	0,92	0,60	0,70	1,20	11,99	7,9	9,3	32,8	21,6	25,4

#### Windbelasting ahead

Geleider	hoogte		G <sub>c_dwars</sub> [-]	G <sub>c_trek</sub> [-]	C <sub>c</sub> [-]	d <sub>toeslag</sub> [mm]	W <sub>y</sub> [N/m]	W <sub>y,vak</sub> [N/m]	D <sub>ijs,toeslag</sub> [mm]	W <sub>y,ijs</sub> [N/m]	W <sub>y,ijs,vak</sub> [N/m]
	wind [m]	Stuwdruk [kN/m <sup>2</sup> ]									
150ct1f1	14,7	0,80	0,56	0,53	1,20	20,75	22,0	20,8	40,2	42,7	40,4
150ct1f2	14,7	0,80	0,56	0,53	1,20	20,75	22,0	20,8	40,2	42,7	40,4
150ct1f3	20,6	0,89	0,58	0,55	1,20	20,75	25,8	24,4	40,2	49,9	47,2
150ct2f1	14,7	0,80	0,56	0,53	1,20	20,75	22,0	20,8	40,2	42,7	40,4
150ct2f2	14,7	0,80	0,56	0,53	1,20	20,75	22,0	20,8	40,2	42,7	40,4
150ct2f3	20,6	0,89	0,58	0,55	1,20	20,75	25,8	24,4	40,2	49,9	47,2
bl1	24,2	0,93	0,60	0,57	1,20	11,99	8,0	7,6	32,8	21,9	20,7
bl2	24,2	0,93	0,60	0,57	1,20	11,99	8,0	7,6	32,8	21,9	20,7

Project: GT-ZBH150  
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Auteur: TBR  
 Versie: v11.9

### Geleiderbelastingen

#### Uitgangspunten

Betrouwbaarheidsniveau Afkeur CC2-0  
 Referentieperiode 30 jaar

ULS (bezwijksterkte)		NEN-EN50341-2-15:2019							
Belastingsgeval	omschrijving	Temp °C	$\gamma_G$		$\gamma_Q$			$\gamma_a$ $A_k$	
			$G_{k,mast}$	$G_{k,geleider}$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$		
ULS 1a	Wind	10°	1,05	1,05	0,00	1,12	0,00	0,0	
ULS 1a_0,9	Wind 0,9Gk alleen mast	10°	0,90	1,05	0,00	1,12	0,00	0,0	
ULS 1a_0,9_0,9	Wind 0,9Gk ook geleider	10°	0,90	0,90	0,00	1,12	0,00	0,0	
ULS 3	Wind+ijs	-5°	1,05	1,05	0,00	0,34	0,97	0,0	
ULS 3_0,9	Wind+ijs 0,9	-5°	0,90	1,05	0,00	0,34	0,97	0,0	
ULS 4	Koude+wind	-20°	1,05	1,05	0,00	0,22	0,00	0,0	
ULS 4_0,9	Koude+wind 0,9	-20°	0,90	1,05	0,00	0,22	0,00	0,0	
ULS 5a	Torsiebelastingen	10°	1,00	1,00	1,00	0,00	0,00	1,0	
ULS 5b	Longitudinale belastingen	10°	1,00	1,00	0,00	0,00	0,00	1,0	
ULS 6	Bouw en onderhoud	5°	1,05	1,05	1,20	0,22	0,00	0,0	
ULS 6_0,9	Bouw en onderhoud	5°	1,05	1,05	0,00	0,22	0,00	0,0	
ULS 7	Permanent	10°	1,15	1,15	0,00	0,00	0,00	0,0	
ULS 8	Special	10°	1,00	1,00	0,00	0,00	0,00	1,0	
<b>SPLS</b> (Bezwijksterkte, enkel voor hoekmasten: afwezigheid geleiders)				$\gamma_G$	$\gamma_Q$				
			$G_k$	$G_k$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$	$A_k$	
SPLS 1a	Wind	10°	1,05	1,05	0,0	0,78	0,00	0,0	
SPLS 1a_0,9	Wind 0,9	10°	0,90	1,05	0,0	0,78	0,00	0,0	
SPLS 1a_0,9_0,9	Wind 0,9	10°	0,90	0,90	0,0	0,78	0,00	0,0	
SPLS 3	Wind+ijs	-5°	1,05	1,05	0,0	0,36	0,34	0,0	
SPLS 3_0,9	Wind+ijs 0,9	-5°	0,90	1,05	0,0	0,36	0,34	0,0	
SPLS 4	Koude+wind	-20°	1,05	1,05	0,0	0,24	0,00	0,0	
SPLS 4_0,9	Koude+wind 0,9	-20°	0,90	1,05	0,0	0,24	0,00	0,0	
SPLS 6	Bouw en onderhoud	5°	1,05	1,05	1,2	0,24	0,0	0,0	
SPLS 6_0,9	Bouw en onderhoud	5°	1,05	1,05	0,0	0,24	0,0	0,0	
<b>SLS</b> (controle van de vervormingen, vermoeiing, EDS)				$G_k$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$	$A_k$	
SLS 1a	Wind	10°	1,00	1,00	0,0	0,94	0,0	0,0	
SLS 3	Wind+ijs	-5°	1,00	1,00	0,0	0,28	0,88	0,0	
SLS 4	Wind	-20°	1,00	1,00	0,0	0,19	0,0	0,0	
SLS 6	Bouw en onderhoud	5°	1,00	1,00	0,0	0,19	0,0	0,0	
SLS 7	PB (EDS, geen wind)	10°	1,00	1,00	0,0	0,00	0,0	0,0	

Aantal windrichtingen 6  
 Aantal belastingcombinaties ULS 66  
 Aantal belastingcombinaties SPLS 294  
 Aantal belastingcombinaties SLS 15  
 Aantal knooplasten 6000

Project: GT-ZBH150  
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### Samenvattingstabellen geleiderbelastingen

In de onderstaande vier tabellen is weergegeven:

- De maximale geleiderbelasting in het globale assenstelsel, gesplitst in aandeel van back en ahead span
- De gecombineerde geleiderbelasting (Ba+Ah) in het globale assenstelsel met in het lokale assenstelsel de maximaal optredende trekkracht. Componenten Fx en Fy als absolute waarde
- De alledaagse (EDS) waarden van de gecombineerde geleiderbelastingen (Ba+Ah) met bijbehorende trekkrachten
- Controle op uplift, waar een negatieve waarde duidt op uplift

#### Maximale waarden voor back en ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-15,7	14,9	0,4	1,6	4,1	3,4
150ct2f1	-49,6	43,6	4,5	5,2	11,3	9,8
150ct2f2	-49,6	43,6	4,6	5,2	11,3	9,8
150ct2f3	-49,7	43,7	3,7	5,9	13,0	9,8
150ct1f1	-49,7	43,6	2,1	5,2	11,3	9,8
150ct1f2	-49,7	43,6	2,3	5,2	11,3	9,8
150ct1f3	-49,7	43,7	3,4	5,9	13,0	9,8
bl2	-15,7	14,9	1,3	1,6	4,1	3,4

#### Min. Weight span (m)

Weight spar Combinatie1

Geleider	SLS 1a	SLS 4	SLS 7
bl1	376,6	424,6	376,6
150ct2f1	342,9	379,4	342,9
150ct2f2	342,9	379,4	342,9
150ct2f3	384,5	438,8	384,5
150ct1f1	342,9	379,6	342,9
150ct1f2	342,9	379,6	342,9
150ct1f3	384,5	438,9	384,5
bl2	376,6	424,1	376,6

#### Max. Weight span (m)

Weight spar Combinatie1

Geleider	ULS 1a	ULS 3
bl1	492,7	362,2
150ct2f1	408,2	341,8
150ct2f2	408,2	341,8
150ct2f3	489,9	384,5
150ct1f1	408,2	341,8
150ct1f2	408,2	341,8
150ct1f3	489,9	384,5
bl2	492,7	362,2

Omhullende weight span over alle combinaties (incl. 0,9 combinaties)

Voor alle geleiders

	Wind / Weight span verhouding
Max. weight span	492,7 m 1,999 -
Min. weight span	304,4 m 1,235 -

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**Maximale waarden back+ahead span      Maximale waarden trekkracht geleider**

Geleider	Fx	Fy	Fz	Ft_ba	Ft_ah
	[kN]	[kN]	[kN]	[kN]	[kN]
bl1	15,7	2,0	4,1	-15,7	14,9
150ct2f1	49,6	9,6	11,3	-49,6	43,6
150ct2f2	49,6	9,8	11,3	-49,6	43,6
150ct2f3	49,7	9,6	13,0	-49,7	43,7
150ct1f1	49,7	7,3	11,3	-49,7	43,6
150ct1f2	49,7	7,4	11,3	-49,7	43,6
150ct1f3	49,7	9,2	13,0	-49,7	43,7
bl2	15,7	2,9	4,1	-15,7	14,9

**EDS-belastingen geleiders**

Geleider	Fx	Fy	Fz	Ft_ba	Ft_ah
	[kN]	[kN]	[kN]	[kN]	[kN]
bl1	5,7	0,0	0,9	-5,7	5,7
150ct2f1	18,6	0,6	4,2	-18,6	18,6
150ct2f2	18,6	0,7	4,2	-18,6	18,6
150ct2f3	18,6	0,1	4,8	-18,6	18,6
150ct1f1	18,6	0,0	4,2	-18,6	18,6
150ct1f2	18,6	0,0	4,2	-18,6	18,6
150ct1f3	18,6	0,0	4,8	-18,6	18,6
bl2	5,7	0,2	0,9	-5,7	5,7

**Controle uplift SLS-wind**

Combinatie: Geleider	Fz_ba	Fz_ah
	[kN]	[kN]
SLS 4      bl1	0,0	0,0
150ct2f1	0,0	0,0
150ct2f2	0,0	0,0
150ct2f3	0,0	0,0
150ct1f1	0,0	0,0
150ct1f2	0,0	0,0
150ct1f3	0,0	0,0
bl2	0,0	0,0



Project: GT-ZBH150  
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**ULS-fundatiebelasting combinatie 1 en 3 wind haaks op de lijn of bissectrice en EDS, vanuit geleiders**

Combinatie	Combination	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_75		-4	54	65	1292	-73	15
ULS 1a_0,9_0		1	0	54	0	25	0
ULS 1a_0,9_0,9_75		-7	54	52	1292	-144	16
ULS 3_0		15	0	93	0	368	0
SLS 7		0	0	54	0	1	0

**ULS-fundatiebelasting combinatie 1 en 3 wind haaks op de lijn of bissectrice en EDS, totaal geleiders en mast**

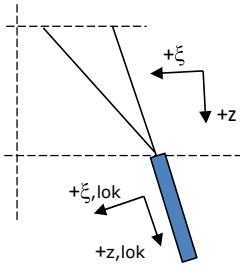
Combinatie	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_75	29	176	172	3487	515	15
ULS 1a_0,9_0,9_75	26	176	145	3487	444	16
SLS 7	0	0	157	0	1	0

**Fundatiebelastingen, selectie belastingcombinaties op basis grootste waarde**

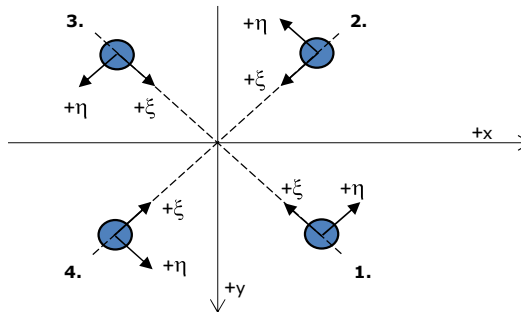
Combinatie	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_105	-37	176	172	<b>3492</b>	-661	-8
SPLS 1a_0 Ba All Cts	246	0	145	0	<b>5429</b>	0
SPLS 6a_75 Ba Ct2 Ba 10	45	33	180	536	1104	<b>683</b>
SPLS 1a_45 Ba All Cts	229	100	145	<b>1976</b>	<b>5079</b>	0

*Noot: grootste waarden kunnen in meerdere combinaties voorkomen, een combinatie is weergegeven.*

**Oplegreacties op fundering per randstijl**



Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_{\eta}$ [kN]	$R_{\xi}$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 1a_45 Ba All Cts	91	103	<b>689</b>	-8	-137	-22	699
2	SPLS 1a_0 Ba All Cts	67	-83	<b>539</b>	11	-106	-16	546
3	SPLS 3_135 Ah All Cts	-51	-71	<b>450</b>	-14	-86	-11	456
4	SPLS 1a_135 Ah All Cts	-90	102	<b>684</b>	8	-136	-22	693

**Maximale trekbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_{\eta}$ [kN]	$R_{\xi}$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-40	-59	<b>-377</b>	13	70	7	-383
2	SPLS 3_0,9_135 Ah All Cts	-79	92	<b>-614</b>	-9	121	18	-623
3	SPLS 1a_0,9_45 Ba All Cts	80	92	<b>-621</b>	8	122	18	-630
4	SPLS 1a_0,9_0 Ba All Cts	57	-72	<b>-471</b>	-11	91	13	-477

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_{\eta}$ [kN]	$R_{\xi}$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_90 Ah Ct1	24	-49	-105	<b>52</b>	17	0	-107
2	SPLS 3_0,9_90 Ba Ct2	-12	-60	185	<b>51</b>	-33	-3	188
3	SPLS 3_90 Ba Ct2	1	73	-275	<b>51</b>	53	7	-279
4	SPLS 6a_75 Ah Ct1 Ba 10	-9	78	311	<b>49</b>	-61	-9	315

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_{\eta}$ [kN]	$R_{\xi}$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_90 Ba Ct1	18	87	382	<b>-49</b>	-74	-10	387
2	SPLS 3_90 Ah Ct2	-4	75	-292	<b>-50</b>	56	7	-296
3	SPLS 3_0,9_90 Ah Ct2	10	-61	199	<b>-50</b>	-36	-3	201
4	SPLS 3_90 Ba Ct1	-29	-46	-79	<b>-53</b>	12	-1	-80

Project: GT-ZBH150  
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#### Combinatie Ftrek+Fhor

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SPLS 3_0,9_105 Ah All Cts	-38	-58	<b>-374</b>	<b>14</b>	68	6	-380
2	SPLS 1a_0,9_135 Ah All Cts	-79	92	<b>-614</b>	<b>-9</b>	121	18	-623
3	SPLS 1a_0,9_45 Ba All Cts	80	92	<b>-621</b>	<b>8</b>	122	18	-630
4	SPLS 1a_0,9_0 Ba All Cts	57	-72	<b>-471</b>	<b>-11</b>	91	13	-477

#### Permanente belasting

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SLS 7	6	6	39	0	-9	-2	40
2	SLS 7	6	-6	39	0	-9	-2	40
3	SLS 7	-6	-6	39	0	-8	-2	40
4	SLS 7	-6	6	39	0	-8	-2	40

#### Omhullenden ongeacht stijl

Belasting	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
Max. druk	SPLS 1a_45 Ba All Cts	91	103	<b>689</b>	-8	-137	-22	699
Max. trek	SPLS 1a_0,9_45 Ba All Cts	80	92	<b>-621</b>	8	122	18	-630
Max. pos. torsie	SPLS 3_90 Ah Ct1	24	-49	-105	<b>52</b>	17	0	-107
Max. neg. torsie	SPLS 3_90 Ba Ct1	-29	-46	-79	<b>-53</b>	12	-1	-80
Comb. trek+torsie	SPLS 1a_45 Ba All Cts	80	92	<b>-621</b>	<b>8</b>	122	18	-630

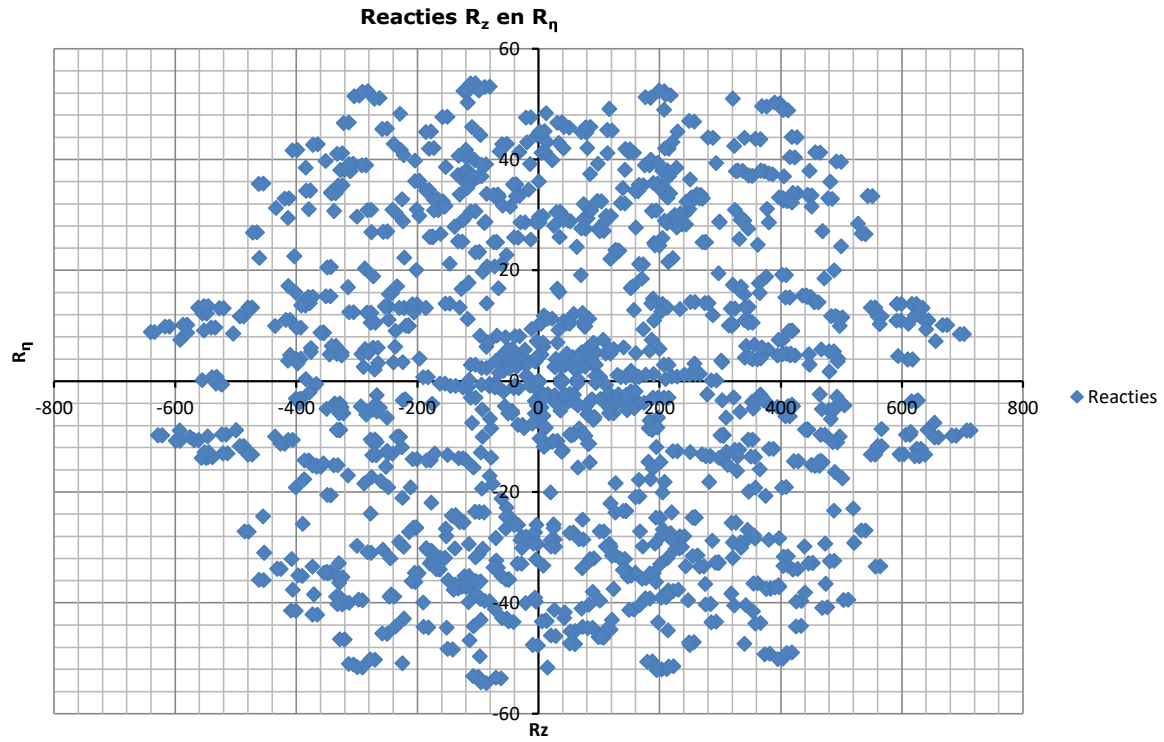
#### Maximale trekbelasting SLS

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SPLS 6a_75 Ah All Cts Ba 12	-20	-48	<b>-274</b>	20	48	2	-277
2	SLS 1a_135	-56	55	<b>-385</b>	0	79	14	-390
3	SLS 1a_45	54	53	<b>-367</b>	-1	75	14	-373
4	SLS 1a_0	30	-34	<b>-225</b>	-3	45	8	-228

#### Maximale drukbelasting SLS

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SLS 1a_45	68	63	<b>447</b>	3	-93	-18	453
2	SLS 1a_0	42	-46	<b>303</b>	3	-62	-12	307
3	SPLS 6a_75 Ah All Cts Ba 12	-44	-50	<b>360</b>	-4	-67	-7	365
4	SPLS 6a_75 Ah All Cts Ba 12	-49	77	<b>468</b>	20	-90	-12	474

Project: GT-ZBH150  
Masttype: A  
Mast: 24





Project: GT-ZBH150  
 Masttype: A  
 Mast: 24

### Samenvattingstabellen geleiderbelastingen

In de onderstaande vier tabellen is weergegeven:

- De maximale geleiderbelasting in het globale assenstelsel, gesplitst in aandeel van back en ahead span
- De gecombineerde geleiderbelasting (Ba+Ah) in het globale assenstelsel met in het lokale assenstelsel de maximaal optredende trekkracht. Componenten Fx en Fy als absolute waarde
- De alledaagse (EDS) waarden van de gecombineerde geleiderbelastingen (Ba+Ah) met bijbehorende trekkrachten
- Controle op uplift, waar een negatieve waarde duidt op uplift

#### Maximale waarden voor back en ahead span

Geleider	Fx_ba [kN]	Fx_ah [kN]	Fy_ba [kN]	Fy_ah [kN]	Fz_ba [kN]	Fz_ah [kN]
bl1	-16,6	16,6	0,6	1,8	4,4	3,7
150ct2f1	-52,5	46,8	5,1	6,0	12,2	10,6
150ct2f2	-52,5	46,8	5,3	6,0	12,2	10,6
150ct2f3	-52,6	46,9	4,3	6,8	14,0	10,6
150ct1f1	-52,6	46,8	2,5	6,0	12,2	10,6
150ct1f2	-52,6	46,8	2,7	6,0	12,2	10,6
150ct1f3	-52,6	46,9	3,9	6,8	14,0	10,6
bl2	-16,6	16,6	1,5	1,8	4,4	3,7

#### Min. Weight span (m)

Weight spar Combinatie1

Geleider	SLS 1a	SLS 4	SLS 7
bl1	376,6	424,6	376,6
150ct2f1	342,9	379,4	342,9
150ct2f2	342,9	379,4	342,9
150ct2f3	384,5	438,8	384,5
150ct1f1	342,9	379,6	342,9
150ct1f2	342,9	379,6	342,9
150ct1f3	384,5	438,9	384,5
bl2	376,6	424,1	376,6

#### Max. Weight span (m)

Weight spar Combinatie1

Geleider	ULS 1a	ULS 3
bl1	494,0	356,9
150ct2f1	409,9	338,2
150ct2f2	409,9	338,2
150ct2f3	492,7	379,4
150ct1f1	409,9	338,2
150ct1f2	409,9	338,2
150ct1f3	492,7	379,4
bl2	494,0	356,9

Omhullende weight span over alle combinaties (incl. 0,9 combinaties)

Voor alle geleiders

Max. weight span	494,0 m
Min. weight span	301,9 m

Wind / Weight span verhouding

2,004 -
1,225 -

Project: GT-ZBH150  
 Masttype: A  
 Mast: 24

**Maximale waarden back+ahead span      Maximale waarden trekkracht geleider**

Geleider	Fx	Fy	Fz	Ft_ba	Ft_ah
	[kN]	[kN]	[kN]	[kN]	[kN]
bl1	15,9	2,4	4,4	-16,6	16,6
150ct2f1	50,5	11,2	12,2	-52,6	46,8
150ct2f2	50,5	11,4	12,2	-52,6	46,8
150ct2f3	50,6	11,2	14,0	-52,6	46,9
150ct1f1	50,5	8,6	12,2	-52,6	46,8
150ct1f2	50,5	8,8	12,2	-52,6	46,8
150ct1f3	50,6	10,8	14,0	-52,6	46,9
bl2	15,9	3,3	4,4	-16,6	16,6

**EDS-belastingen geleiders**

Geleider	Fx	Fy	Fz	Ft_ba	Ft_ah
	[kN]	[kN]	[kN]	[kN]	[kN]
bl1	5,7	0,0	0,9	-5,7	5,7
150ct2f1	18,6	0,6	4,2	-18,6	18,6
150ct2f2	18,6	0,7	4,2	-18,6	18,6
150ct2f3	18,6	0,1	4,8	-18,6	18,6
150ct1f1	18,6	0,0	4,2	-18,6	18,6
150ct1f2	18,6	0,0	4,2	-18,6	18,6
150ct1f3	18,6	0,0	4,8	-18,6	18,6
bl2	5,7	0,2	0,9	-5,7	5,7

**Controle uplift SLS-wind**

Combinatie: Geleider	Fz_ba	Fz_ah
	[kN]	[kN]
SLS 4      bl1	0,0	0,0
150ct2f1	0,0	0,0
150ct2f2	0,0	0,0
150ct2f3	0,0	0,0
150ct1f1	0,0	0,0
150ct1f2	0,0	0,0
150ct1f3	0,0	0,0
bl2	0,0	0,0

Project: GT-ZBH150  
 Masttype: A  
 Mast: 24

**ULS-fundatiebelasting combinatie 1 en 3 wind haaks op de lijn of bissectrice en EDS, vanuit geleiders**

Combinatie	Combination	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_75		-1	63	71	1507	2	17
ULS 1a_0,9_0		3	0	58	0	74	0
ULS 1a_0,9_0,9_75		-5	63	54	1507	-107	18
ULS 3_0		22	0	104	0	540	0
SLS 7		0	0	54	0	1	0

**ULS-fundatiebelasting combinatie 1 en 3 wind haaks op de lijn of bissectrice en EDS, totaal geleiders en mast**

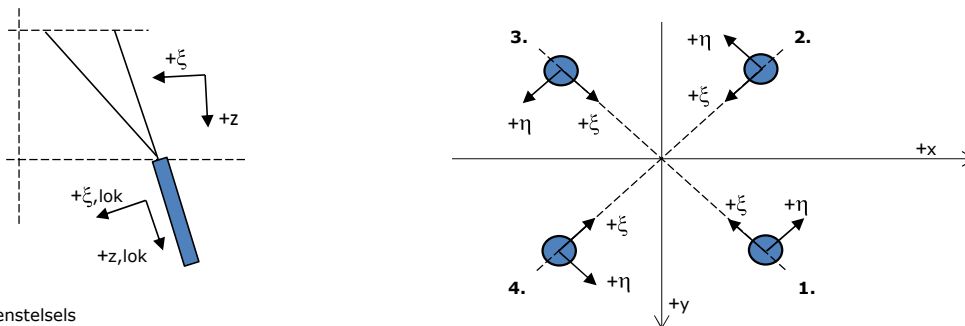
Combinatie	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_75	37	205	189	4068	689	17
ULS 1a_0,9_0,9_75	33	205	146	4069	579	18
SLS 7	0	0	157	0	1	0

**Fundatiebelastingen, selectie belastingcombinaties op basis grootste waarde**

Combinatie	$F_x$ [kN]	$F_y$ [kN]	$F_z$ [kN]	$M_x$ [kNm]	$M_y$ [kNm]	$M_z$ [kNm]
ULS 1a_105	-39	205	189	<b>4073</b>	-683	-9
SPLS 1a_0 Ba All Cts	257	0	159	0	<b>5687</b>	0
SPLS 6a_75 Ba Ct2 Ba 10	51	33	195	530	1263	<b>704</b>
SPLS 1a_45 Ba All Cts	238	100	159	<b>1976</b>	<b>5300</b>	0

*Noot: grootste waarden kunnen in meerdere combinaties voorkomen, een combinatie is weergegeven.*

**Oplegreacties op fundering per randstijl**



Assenstelsels

**Maximale drukbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 1a_45 Ba All Cts	94	106	<b>713</b>	-9	-141	-22	723
2	SPLS 1a_0 Ba All Cts	70	-87	<b>566</b>	12	-111	-17	574
3	SPLS 3_135 Ah All Cts	-53	-74	<b>469</b>	-15	-89	-11	475
4	SPLS 1a_135 Ah All Cts	-93	105	<b>703</b>	8	-139	-22	712

**Maximale trekbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_135 Ah All Cts	-42	-61	<b>-392</b>	14	73	7	-398
2	SPLS 1a_0,9_135 Ah All Cts	-80	94	<b>-629</b>	-10	123	18	-638
3	SPLS 1a_0,9_45 Ba All Cts	83	95	<b>-641</b>	9	126	19	-650
4	SPLS 1a_0,9_0 Ba All Cts	59	-76	<b>-494</b>	-12	95	13	-500

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_90 Ah Ct1	26	-50	-105	<b>54</b>	17	0	-106
2	SPLS 3_0,9_90 Ba Ct2	-12	-63	199	<b>52</b>	-36	-3	201
3	SPLS 3_90 Ba Ct2	1	75	-282	<b>52</b>	54	7	-286
4	SPLS 6a_75 Ah Ct1 Ba 10	-9	81	321	<b>51</b>	-63	-10	325

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SPLS 3_0,9_90 Ba Ct1	19	89	395	<b>-50</b>	-76	-10	401
2	SPLS 3_90 Ah Ct2	-3	76	-291	<b>-52</b>	56	7	-295
3	SPLS 6a_75 Ah Ct2 Ba 21	11	-63	194	<b>-52</b>	-37	-5	197
4	SPLS 3_90 Ba Ct1	-29	-48	-86	<b>-54</b>	14	-1	-88



Project: GT-ZBH150  
 Masttype: A  
 Mast: 24

#### Combinatie Ftrek+Fhor

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SPLS 3_0,9_135 Ah All Cts	-42	-61	<b>-392</b>	<b>14</b>	73	7	-398
2	SPLS 1a_0,9_135 Ah All Cts	-80	94	<b>-629</b>	<b>-10</b>	123	18	-638
3	SPLS 1a_0,9_45 Ba All Cts	83	95	<b>-641</b>	<b>9</b>	126	19	-650
4	SPLS 1a_0,9_0 Ba All Cts	59	-76	<b>-494</b>	<b>-12</b>	95	13	-500

#### Permanente belasting

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SLS 7	6	6	39	0	-9	-2	40
2	SLS 7	6	-6	39	0	-9	-2	40
3	SLS 7	-6	-6	39	0	-8	-2	40
4	SLS 7	-6	6	39	0	-8	-2	40

#### Omhullenden ongeacht stijl

Belasting	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
Max. druk	SPLS 1a_45 Ba All Cts	94	106	<b>713</b>	-9	-141	-22	723
Max. trek	SPLS 1a_0,9_45 Ba All Cts	83	95	<b>-641</b>	9	126	19	-650
Max. pos. torsie	SPLS 3_90 Ah Ct1	26	-50	-105	<b>54</b>	17	0	-106
Max. neg. torsie	SPLS 3_90 Ba Ct1	-29	-48	-86	<b>-54</b>	14	-1	-88
Comb. trek+torsie	SPLS 1a_0,9_45 Ba All Cts	83	95	<b>-641</b>	<b>9</b>	126	19	-650

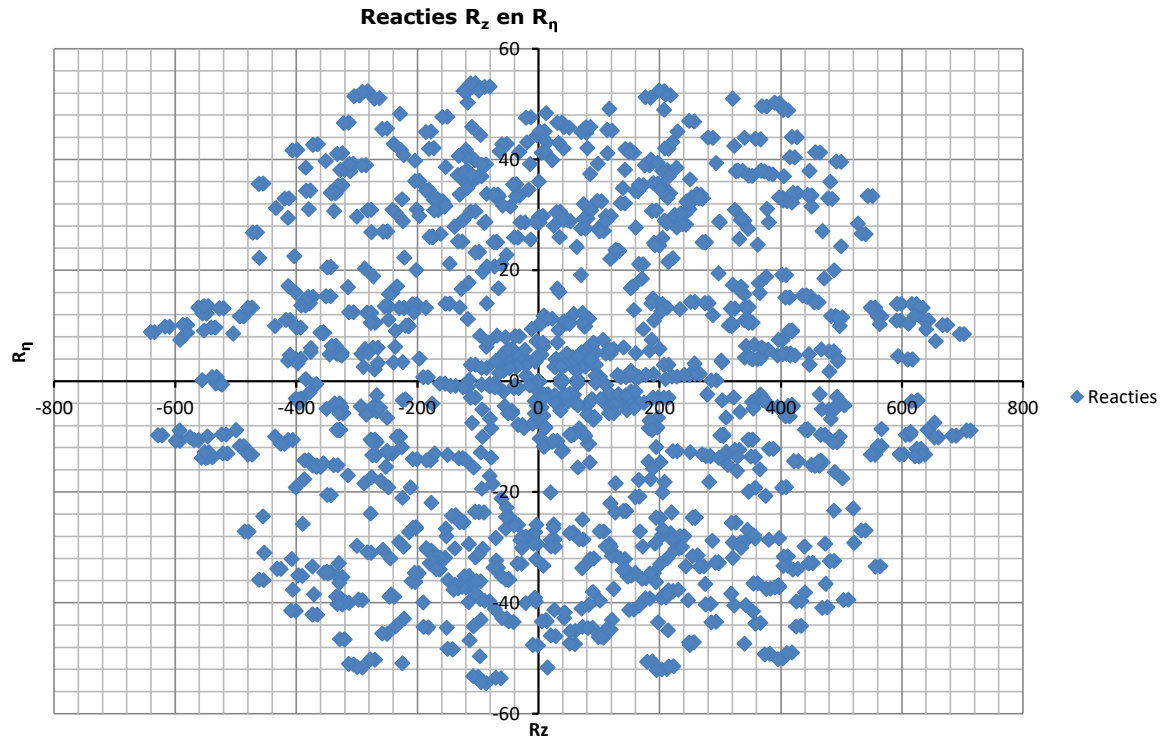
#### Maximale trekbelasting SLS

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SPLS 6a_75 Ah All Cts Ba 12	-21	-50	<b>-287</b>	20	50	2	-291
2	SPLS 6a_75 Ah All Cts Ba 12	-49	55	<b>-395</b>	-4	73	7	-400
3	SLS 1a_45	54	53	<b>-367</b>	-1	75	14	-373
4	SPLS 6a_75 Ba All Cts Ba 10	22	-36	<b>-230</b>	-10	41	3	-233

#### Maximale drukbelasting SLS

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	SLS 1a_45	68	63	<b>447</b>	3	-93	-18	453
2	SPLS 6a_75 Ba All Cts Ba 10	36	-50	<b>319</b>	10	-60	-7	323
3	SPLS 6a_75 Ah All Cts Ba 12	-47	-53	<b>380</b>	-4	-71	-7	386
4	SPLS 6a_75 Ah All Cts Ba 12	-52	80	<b>488</b>	20	-94	-12	495

Project: GT-ZBH150  
Masttype: A  
Mast: 24



## 01. Leeswijzer en set labels

### LEESWIJZER BELASTINGSCOMBINATIES

De belastingen gevallen in de tabellen zijn een afgeleide van de tabellen gegeven in de NORM EN50341-3-15:2017. Tabel 4.13.a, 4.13.b en 4.13.c. Daar waar relevant zijn deze belastinggevallen opgenomen in de berekening.

- De windrichtingen zijn gerelateerd zijn aan Alignment of bisector en zijn afgestemd op de ahead en back span.
- De belastingen in de tabellen zijn gegeven in het zogenaamde "structure coordinate system".
- De posities van de geleiders zijn gelabeld met zogenaamde setnummers. De figuren geven de setnummers weer met de toevoeging "...1". Voor de belastingen is dit weggelaten, gezien deze geen extra informatie geven.

Bijvoorbeeld:

ULS 50yr 1a W ZII Non-Urban WRB, staat voor:

ULS = Ultimate Limit State,

50yr = Referentie periode 50 jaar

1a W ZII Non-Urban = Belastinggevallen 1 met extreem wind Zone II in niet bebouwd gebied.

WRB = Wind van Rechts, loodrecht op de alignment van de Back span (zie legenda voor overige aanblaashoeken)

- De toevoeging Br:

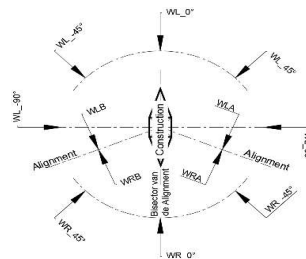
Br = Breuk, is bedoeld voor de simulatie van geleiderbreuk met verder een verwijzing naar de afspansets. Bijvoorbeeld SpLS Br. 1a W ZII Non-Urban WRB 1 2 3 7, afwezigheid van geleiders van de afspanningen ter plaatse van afspansets 1, 2, 3 en 7

- De toevoeging Ydl 0.9:

Ydl 0.9 = Gamma Deadload, is bedoeld voor de gunstige werking van eigengewicht van de constructie op de fundatie en als dusdanig ook (enkel) van belang voor de fundatie.

#### Legenda wind invalshoek:

WL [x]	= Wind van Links onder een hoek [x] ten opzichte van de Bisector
WR [x]	= Wind van Rechts onder een hoek [x] ten opzichte van de Bisector
WLB	= Wind van Links loodrecht op de alignment van de Back span
WLA	= Wind van Links loodrecht op de alignment van de Ahead span
WRB	= Wind van Rechts loodrecht op de alignment van de Back span
WRA	= Wind van Rechts loodrecht op de alignment van de Ahead span
GW	= Geen Wind



#### Gehanteerde algemene parameters

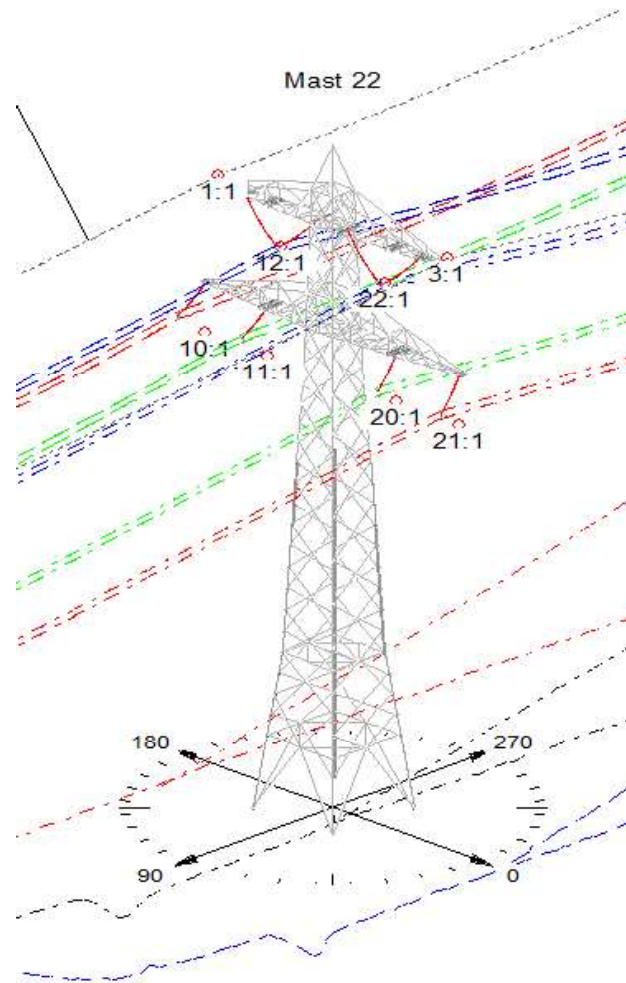
Status :	Afkeur CC2-0	$Y_{GW}$ :	1.13
Windgebied :	Zone 3	$Y_{G}$ :	0.97
Basiswindsnelheid :	24.5 m/s	Richtingsfactor (Cdir) :	1
Terreincategorie :	Non-Urban	IJsggebied fasegeleider :	B
Betrouwbaarheidsklasse :	CC2-0	IJsggebied bliksemtraad :	A
Referentieperiode :	30 jaar		

Factoren onder ULS 30yr		Partiele factor			
Omschrijving	Temperatuur	$G_k$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$
1a W ZIII	10	1.05		1.13	
3 W + I ZIII	-5	1.05		0.34	0.97
4 Cold ZIII	-20	1.05		0.23	
5a Trsnl ZIII	10	1.00	1.00		
6a C & M ZIII	5	1.05	1.20	0.23	
6b Wght Lnsmn	5	1.05	1.20	0.23	
7 Permanent	10	1.15			
8 Special	10	1.00		0.00	

Factoren onder SpLS		Partiele factor			
Omschrijving	Temperatuur	$G_k$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$
SpLS 1a W ZIII	10	1.05		0.78	
SpLS 3 W + I ZIII	-5	1.05		0.36	0.34
SpLS 4 Cold ZIII	-20	1.05		0.24	
SpLS 6a C & M ZIII	5	1.05	1.20	0.24	
SpLS 6b Wght Lnsmn	5	1.05	1.20	0.24	

Factoren onder SeLS		Partiele factor			
Omschrijving	Temperatuur	$G_k$	$Q_{pk}$	$Q_{wk}$	$Q_{ik}$
SeLS 1a W ZIII	10	1.00		0.94	
SeLS 3 W + I ZIII	-5	1.00		0.28	0.88
SeLS 4 Cold ZIII	-20	1.00		0.19	
SeLS 6a C & M ZIII	5	1.00	1.00	0.19	
SeLS 7 Permanent	10	1.00			

Overzicht set nummers tijdelijke masten



### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long	
Mast 22	10°C	1	618	0	5583	1007	-1754	-5302	
		10	3615	102	18245	4075	-5274	-17444	
		11	3614	101	18245	4075	-5182	-17472	
			12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 1a W ZIII WLB	1	636	1690	13236	1693	-2771	-9979	
		10	3641	5585	34887	6015	-8552	-34298	
		11	3639	5580	34916	6017	-8385	-34367	
			12	4991	6917	35774	9565	-6120	-34731
	ULS 30yr 1a W ZIII WRB	1	637	-1691	13284	1546	-3490	-8948	
		10	3776	-5183	33007	5962	-11008	-30433	
		11	3775	-5184	33019	5970	-10852	-30518	
			12	5045	-6884	35631	9643	-12579	-34217
ULS 30yr 1a W ZIII WLA	1	637	1587	12684	1683	-2744	-10035		
	10	3647	5274	33630	5817	-8053	-32918		
	11	3644	5270	33656	5818	-7895	-32980		
		12	4998	6543	34185	9152	-5541	-32735	
ULS 30yr 1a W ZIII WRA	1	638	-1587	12734	1589	-3595	-9128		
	10	3781	-4892	31865	5894	-10854	-29611		
	11	3780	-4893	31876	5901	-10698	-29691		
		12	5052	-6514	34393	9579	-12440	-33555	
ULS 30yr 1a W ZIII WL_0	1	636	1664	13098	1699	-2775	-10083		
	10	3641	5508	34595	5953	-8380	-33941		
	11	3638	5504	34623	5955	-8216	-34007		
		12	4992	6822	35336	9419	-5887	-34077	
ULS 30yr 1a W ZIII WL_-45	1	644	650	7691	1262	-2023	-7314		
	10	3745	2352	22614	4488	-5252	-12575		
	11	3744	2349	22616	4488	-5148	-12601		
		12	5057	3060	22038	6794	-3262	-19885	
ULS 30yr 1a W ZIII WL_-90	1	649	-34	5806	1011	-1758	-5360		
	10	3795	-64	18744	4110	-5243	-17161		
	11	3794	-65	18744	4111	-5155	-17189		
		12	5070	-332	18276	6165	-4500	-15721	
ULS 30yr 1a W ZIII WL_45	1	643	1067	9809	1398	-2352	-7764		
	10	3724	3629	26858	5234	-7100	-26692		
	11	3722	3626	26873	5234	-6961	-26741		
		12	5048	4643	27715	8480	-5522	-28036	
ULS 30yr 1a W ZIII WL_90	1	649	34	5828	1075	-1860	-5578		
	10	3796	278	19415	4429	-5782	-19310		
	11	3795	277	19416	4429	-5678	-19342		
		12	5069	331	19948	7246	-5584	-21220	
ULS 30yr 1a W ZIII WR_0	1	637	-1665	13148	1576	-3571	-9099		
	10	3778	-5113	32754	5967	-11041	-30309		
	11	3777	-5113	32766	5974	-10883	-30392		
		12	5047	-6790	35369	9675	-12637	-34227	
ULS 30yr 1a W ZIII WR_-45	1	647	-650	7707	1349	-2801	-7269		
	10	3804	-2106	21931	4813	-7677	-21127		
	11	3803	-2106	21934	4815	-7557	-21173		
		12	5075	-3055	23158	7867	-8676	-23945	
ULS 30yr 1a W ZIII WR_45	1	641	-1068	9818	1228	-2505	-6918		
	10	3794	-3319	25307	4912	-7921	-23035		
	11	3793	-3320	25313	4916	-7807	-23092		
		12	5066	-4629	26689	7731	-8760	-24471	
ULS 30yr 1a W ZIII 0.9 WLB	1	543	1690	13058	1646	-2745	-9901		
	10	3091	5582	33795	5593	-8237	-33265		
	11	3088	5577	33827	5595	-8076	-33335		
		12	4253	6923	34770	8910	-5864	-33794	
ULS 30yr 1a W ZIII 0.9 WRB	1	543	-1691	13108	1497	-3461	-8860		
	10	3229	-5190	31918	5549	-10703	-29427		
	11	3228	-5191	31931	5557	-10552	-29511		
		12	4311	-6888	34635	9000	-12315	-33278	
ULS 30yr 1a W ZIII 0.9 WLA	1	543	1587	12493	1636	-2718	-9956		
	10	3097	5270	32486	5389	-7724	-31833		
	11	3094	5266	32514	5390	-7573	-31897		
		12	4261	6550	33121	8487	-5269	-31739	
ULS 30yr 1a W ZIII 0.9 WRA	1	545	-1587	12545	1540	-3565	-9036		
	10	3233	-4900	30716	5474	-10532	-28548		
	11	3232	-4900	30728	5481	-10381	-28627		
		12	4318	-6518	33334	8924	-12160	-32554	
ULS 30yr 1a W ZIII 0.9 WL_0	1	542	1664	12917	1652	-2750	-10008		
	10	3090	5505	33492	5530	-8062	-32896		
	11	3088	5501	33523	5532	-7905	-32964		
		12	4254	6829	34318	8762	-5628	-33127	
ULS 30yr 1a W ZIII 0.9 WL_-45	1	551	650	7258	1189	-1939	-7060		
	10	3200	2340	20657	3968	-4697	-19724		
	11	3199	2338	20660	3968	-4603	-19747		

### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
		12	4331	3062	20105	5978	-2758	-18038
	ULS 30yr 1a W ZIII 0.9 WL_90	1	556	-34	5108	904	-1597	-4871
		10	3252	-79	16269	3530	-4536	-14811
		11	3251	-80	16269	3530	-4460	-14834
		12	4345	-332	15795	5252	-3845	-13322
	ULS 30yr 1a W ZIII 0.9 WL_45	1	550	1068	9516	1336	-2293	-7586
		10	3178	3621	25282	4756	-6649	-25198
		11	3176	3618	25298	4757	-6518	-25246
		12	4316	4648	26224	7740	-5135	-26617
	ULS 30yr 1a W ZIII 0.9 WL_90	1	556	34	5131	969	-1700	-5095
		10	3253	264	16945	3849	-5077	-16968
		11	3253	263	16946	3849	-4985	-16996
		12	4344	331	17475	6335	-4933	-18836
	ULS 30yr 1a W ZIII 0.9 WR_0	1	544	-1665	12970	1527	-3542	-9012
		10	3230	-5120	31651	5552	-10732	-29290
		11	3229	-5120	31664	5560	-10579	-29373
		12	4313	-6794	34358	9029	-12370	-33273
	ULS 30yr 1a W ZIII 0.9 WR_45	1	554	-650	7269	1279	-2723	-7036
		10	3259	-2118	19929	4290	-7111	-19246
		11	3259	-2118	19932	4291	-7000	-19288
		12	4349	-3055	21204	7051	-8160	-22070
	ULS 30yr 1a W ZIII 0.9 WR_45	1	548	-1068	9526	1166	-2446	-6739
		10	3248	-3328	23716	4436	-7469	-21538
		11	3247	-3329	23722	4440	-7363	-21592
		12	4337	-4631	25201	6996	-8364	-23039
	ULS 30yr 5a Trsnl ZIII Br. 1 Ba	1	0	0	0	833	-1239	-3741
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 3 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 10 Ba	1	618	0	5583	1007	-1754	-5302
		10	0	0	0	3571	-734	-2281
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 11 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	0	0	0	3569	-719	-2276
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 12 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	0	0	0	6278	-731	-2637
	ULS 30yr 5a Trsnl ZIII Br. 20 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 21 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 22 Ba	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 1 Ah	1	669	-1	5423	0	0	0
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 3 Ah	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 10 Ah	1	618	0	5583	1007	-1754	-5302
		10	4904	-1	11051	0	0	0
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 11 Ah	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	4904	-1	11037	0	0	0
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 12 Ah	1	618	0	5583	1007	-1754	-5302

### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	7387	-1	11663	0	0	0
	ULS 30yr 5a Trsnl ZIII Br. 20 Ah	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 21 Ah	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	ULS 30yr 5a Trsnl ZIII Br. 22 Ah	1	618	0	5583	1007	-1754	-5302
		10	3615	102	18245	4075	-5274	-17444
		11	3614	101	18245	4075	-5182	-17472
		12	4828	-1	18226	6391	-4808	-17614
	SeLS 1a W ZIII WLB	1	608	1406	11636	1562	-2587	-9153
		10	3494	4656	30769	5458	-7625	-30222
		11	3492	4652	30791	5459	-7476	-30280
		12	4774	5747	31459	8665	-5542	-30544
	SeLS 1a W ZIII WRB	1	608	-1407	11675	1435	-3175	-8265
		10	3604	-4303	29119	5399	-9644	-26924
		11	3603	-4303	29129	5405	-9505	-26997
		12	4815	-5723	31325	8717	-10927	-30126
	SeLS 1a W ZIII WLA	1	608	1320	11168	1546	-2546	-9146
		10	3499	4397	29733	5294	-7211	-29081
		11	3497	4394	29753	5295	-7070	-29134
		12	4780	5436	30146	8322	-5062	-28888
	SeLS 1a W ZIII WRA	1	609	-1320	11207	1468	-3254	-8390
		10	3607	-4061	28187	5344	-9520	-26254
		11	3606	-4061	28197	5350	-9381	-26323
		12	4820	-5415	30310	8666	-10815	-29588



04. Summary

		Maximaal optredende belasting (N)			
Mast nummer	Mast type	Verticaal	Dwarsbelasting	In lijnrichting	Maatgevende load case
Mast 22	D+3,6_ZBH-MDK150 - Verbouw	7530	-3002	360 ULS 30yr 3 W + I ZIII WLB	

## 01. Leeswijzer en set labels

### LEESWIJZER BELASTINGSCOMBINATIES

De belastingen gevallen in de tabellen zijn een afgeleide van de tabellen gegeven in de NORM EN50341-3-15:2017. Tabel 4.13.a, 4.13.b en 4.13.c. Daar waar relevant zijn deze belastinggevallen opgenomen in de berekening.

- De windrichtingen zijn gerelateerd zijn aan Alignment of bisector en zijn afgestemd op de ahead en back span.
- De belastingen in de tabellen zijn gegeven in het zogenaamde "structure coordinate system".
- De posities van de geleiders zijn gelabeld met zogenaamde setnummers. De figuren geven de setnummers weer met de toevoeging "...1". Voor de belastingen is dit weggelaten, gezien deze geen extra informatie geven.

Bijvoorbeeld:

ULS 50yr 1a W ZII Non-Urban WRB, staat voor:  
 ULS = Ultimate Limit State,  
 50yr = Referentie periode 50 jaar  
 1a W ZII Non-Urban = Belastinggevallen 1 met extreem wind Zone II in niet bebouwd gebied.  
 WRB = Wind van Rechts, loodrecht op de alignment van de Back span (zie legenda voor overige aanblaashoeken)

- De toevoeging Br:

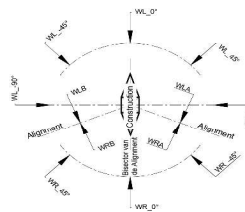
Br = Breuk, is bedoeld voor de simulatie van geleiderbreuk met verder een verwijzing naar de afspansets. Bijvoorbeeld SpLS Br. 1a W ZII Non-Urban WRB 1 2 3 7, afwezigheid van geleiders van de afspanningen ter plaatse van afspansets 1, 2, 3 en 7

- De toevoeging Ydl 0.9:

Ydl 0.9 = Gamma Deadload, is bedoeld voor de gunstige werking van eigengewicht van de constructie op de fundatie en als dusdanig ook (enkel) van belang voor de fundatie.

### Legenda wind invalshoek:

WL_x	Wind van Links onder een hoek [x] ten opzichte van de Bisector
WR_x	Wind van Rechts onder een hoek [x] ten opzichte van de Bisector
WLB	Wind van Links loodrecht op de alignment van de Back span
WLA	Wind van Links loodrecht op de alignment van de Ahead span
WRB	Wind van Rechts loodrecht op de alignment van de Back span
WRA	Wind van Rechts loodrecht op de alignment van de Ahead span
GW	Geen Wind



### Gehanteerde algemene parameters

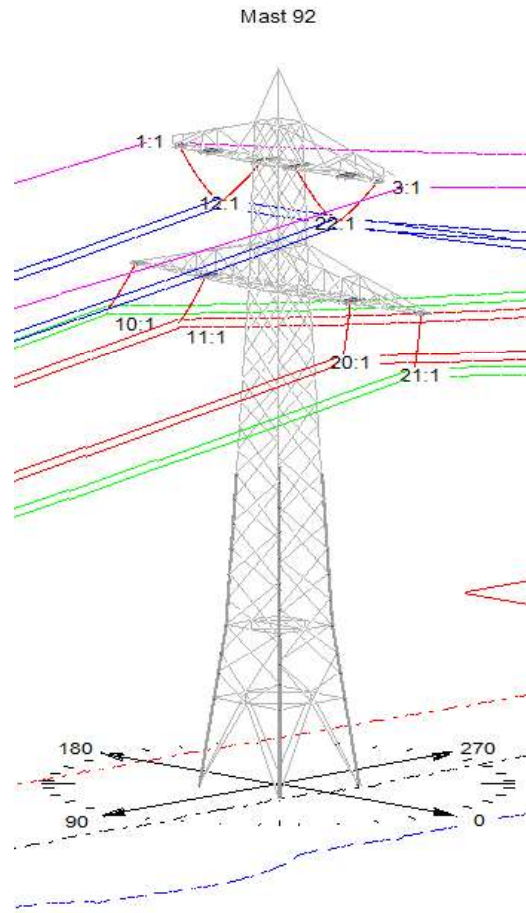
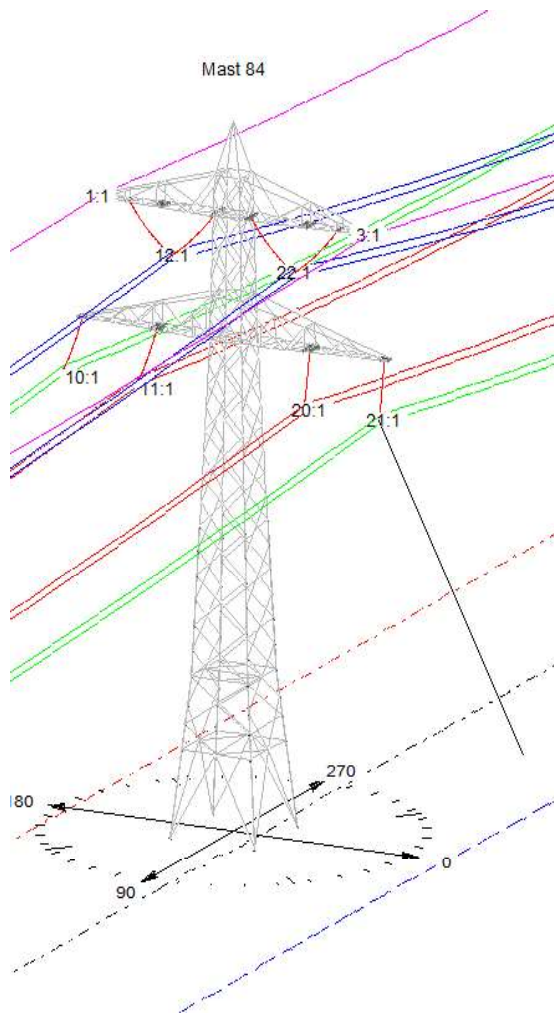
Status :	Afkeur CC2-0	$Y_{GW}$ :	1.13
Windgebied :	Zone 3	$Y_{SD}$ :	0.97
Basiswindsnelheid :	24.5 m/s	Richtingsfactor (Cdir) :	1
Terreincategorie :	Non-Urban	IJsg gebied fasegeleider :	B
Betrouwbaarheidsklasse :	CC2-0	IJsg gebied bliksemdraad :	A
Referentieperiode :	30 jaar		

Factoren onder ULS 30yr	Omschrijving	Temperatuur	Partiele factor			
			$G_s$	$Q_{pk}$	$Q_{wk}$	$Q_{sk}$
1a W ZIII		10	1.05		1.13	
3 W + I ZIII		-5	1.05		0.34	0.97
4 Cold ZIII		-20	1.05		0.23	
5a Trsnl ZIII		10	1.00	1.00		
6a C & M ZIII		5	1.05	1.20	0.23	
6b Wght Lnsmn		5	1.05	1.20	0.23	
7 Permanent		10	1.15			
8 Special		10	1.00		0.00	

Factoren onder SpLS	Omschrijving	Temperatuur	Partiele factor			
			$G_s$	$Q_{pk}$	$Q_{wk}$	$Q_{sk}$
SpLS 1a W ZIII		10	1.05		0.78	
SpLS 3 W + I ZIII		-5	1.05		0.36	0.34
SpLS 4 Cold ZIII		-20	1.05		0.24	
SpLS 6a C & M ZIII		5	1.05	1.20	0.24	
SpLS 6b Wght Lnsmn		5	1.05	1.20	0.24	

Factoren onder SeLS	Omschrijving	Temperatuur	Partiele factor			
			$G_s$	$Q_{pk}$	$Q_{wk}$	$Q_{sk}$
SeLS 1a W ZIII		10	1.00		0.94	
SeLS 3 W + I ZIII		-5	1.00		0.28	0.88
SeLS 4 Cold ZIII		-20	1.00		0.19	
SeLS 6a C & M ZIII		5	1.00	1.00	0.19	
SeLS 7 Permanent		10	1.00			

Overzicht set nummers tijdelijke masten



### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
Mast 92	10°C	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 1a W ZIII WLB	1	2149	-2012	-11499	681	1864	14486
		10	6563	-7940	-36386	3774	5968	36701
		11	6491	-7571	-36494	3771	5958	36742
		12	11501	-4455	-37383	5139	7414	38060
	ULS 30yr 1a W ZIII WRB	1	1965	-2560	-10410	682	-1862	14516
		10	6757	-9464	-33081	3902	-5608	34951
		11	6694	-9130	-33219	3901	-5609	34970
		12	11620	-10235	-37421	5159	-7397	38102
ULS 30yr 1a W ZIII WLA	1	2149	-2012	-11499	681	1864	14486	
	10	6563	-7940	-36386	3774	5968	36701	
	11	6491	-7571	-36494	3771	5958	36742	
	12	11501	-4455	-37383	5139	7414	38060	
ULS 30yr 1a W ZIII WRA	1	1965	-2560	-10410	682	-1862	14516	
	10	6757	-9464	-33081	3902	-5608	34951	
	11	6694	-9130	-33219	3901	-5609	34970	
	12	11620	-10235	-37421	5159	-7397	38102	
ULS 30yr 1a W ZIII WL_0	1	2149	-2012	-11499	681	1864	14486	
	10	6563	-7940	-36386	3774	5968	36701	
	11	6491	-7571	-36494	3771	5958	36742	
	12	11501	-4455	-37383	5139	7414	38060	
ULS 30yr 1a W ZIII WL_45	1	1617	-1510	-8594	683	946	9507	
	10	4950	-5172	-24427	3866	3192	25210	
	11	4904	-4923	-24485	3864	3187	25227	
	12	8248	-2525	-23363	5205	4096	25138	
ULS 30yr 1a W ZIII WL_90	1	1181	-1220	-5933	687	1	6187	
	10	4159	-4322	-17453	3933	86	18764	
	11	4128	-4141	-17498	3932	84	18766	
	12	6681	-3109	-16037	5220	1	18297	
ULS 30yr 1a W ZIII WL_45	1	1650	-1614	-8456	685	946	9508	
	10	5234	-5805	-25513	3881	3155	25366	
	11	5183	-5533	-25574	3878	3150	25374	
	12	9321	-3651	-27177	5209	4096	26283	
ULS 30yr 1a W ZIII WL_90	1	1238	-1289	-6092	687	1	6205	
	10	4527	-4941	-19519	3937	94	19402	
	11	4487	-4730	-19570	3935	92	19401	
	12	8035	-4309	-21511	5219	1	19939	
ULS 30yr 1a W ZIII WR_0	1	1965	-2560	-10410	682	-1862	14516	
	10	6757	-9464	-33081	3902	-5608	34951	
	11	6694	-9130	-33219	3901	-5609	34970	
	12	11620	-10235	-37421	5159	-7397	38102	
ULS 30yr 1a W ZIII WR_45	1	1638	-2018	-8314	685	-945	9529	
	10	5354	-6949	-23843	3933	-2957	24519	
	11	5308	-6698	-23938	3932	-2958	24534	
	12	9390	-7444	-27190	5213	-4092	26273	
ULS 30yr 1a W ZIII WR_90	1	1513	-1801	-7913	684	-944	9496	
	10	4976	-6157	-22235	3932	-2909	23912	
	11	4934	-5933	-22314	3931	-2911	23918	
	12	8298	-6308	-23317	5210	-4092	25131	
ULS 30yr 1a W ZIII 0.9 WLB	1	2116	-2003	-11458	582	1864	14315	
	10	6172	-7692	-35397	3204	5965	35672	
	11	6101	-7336	-35509	3200	5955	35719	
	12	10850	-4277	-36480	4381	7420	37115	
ULS 30yr 1a W ZIII 0.9 WRB	1	1929	-2547	-10348	583	-1862	14346	
	10	6379	-9218	-32112	3335	-5613	33917	
	11	6318	-8894	-32249	3333	-5614	33938	
	12	10993	-10047	-36541	4404	-7400	37174	
ULS 30yr 1a W ZIII 0.9 WLA	1	2116	-2003	-11458	582	1864	14315	
	10	6172	-7692	-35397	3204	5965	35672	
	11	6101	-7336	-35509	3200	5955	35719	
	12	10850	-4277	-36480	4381	7420	37115	
ULS 30yr 1a W ZIII 0.9 WRA	1	1929	-2547	-10348	583	-1862	14346	
	10	6379	-9218	-32112	3335	-5613	33917	
	11	6318	-8894	-32249	3333	-5614	33938	
	12	10993	-10047	-36541	4404	-7400	37174	
ULS 30yr 1a W ZIII 0.9 WL_0	1	2116	-2003	-11458	582	1864	14315	
	10	6172	-7692	-35397	3204	5965	35672	
	11	6101	-7336	-35509	3200	5955	35719	
	12	10850	-4277	-36480	4381	7420	37115	
ULS 30yr 1a W ZIII 0.9 WL_45	1	1555	-1466	-8384	585	946	9159	
	10	4470	-4767	-22788	3300	3184	23511	
	11	4427	-4538	-22850	3297	3178	23531	

### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
		12	7443	-2211	-21771	4455	4099	23498
	ULS 30yr 1a W ZIII 0.9 WL_90	1	1059	-1103	-5373	588	0	5453
		10	3571	-3724	-15047	3371	74	16271
		11	3544	-3568	-15087	3369	72	16272
		12	5685	-2626	-13590	4474	1	15799
	ULS 30yr 1a W ZIII 0.9 WL_45	1	1587	-1569	-8241	586	946	9157
		10	4749	-5390	-23845	3316	3147	23633
		11	4700	-5137	-23904	3314	3142	23643
		12	8515	-3336	-25577	4459	4100	24636
	ULS 30yr 1a W ZIII 0.9 WL_90	1	1117	-1174	-5540	588	0	5472
		10	3938	-4345	-17120	3375	81	16913
		11	3903	-4160	-17165	3373	80	16913
		12	7044	-3828	-19079	4473	1	17451
	ULS 30yr 1a W ZIII 0.9 WR_0	1	1929	-2547	-10348	583	-1862	14346
		10	6379	-9218	-32112	3335	-5613	33917
		11	6318	-8894	-32249	3333	-5614	33938
		12	10993	-10047	-36541	4404	-7400	37174
	ULS 30yr 1a W ZIII 0.9 WR_45	1	1578	-1976	-8113	587	-945	9179
		10	4873	-6537	-22189	3368	-2966	22786
		11	4830	-6303	-22276	3367	-2966	22803
		12	8591	-7124	-25594	4464	-4094	24627
	ULS 30yr 1a W ZIII 0.9 WR_45	1	1453	-1759	-7713	586	-944	9146
		10	4492	-5740	-20561	3367	-2917	22165
		11	4453	-5534	-20637	3366	-2919	22172
		12	7499	-5989	-21726	4460	-4094	23495
	ULS 30yr 5a Trsnl ZIII Br. 1 Ba	1	0	0	0	705	0	5781
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 3 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 10 Ba	1	1169	-1216	-5828	654	1	5954
		10	0	0	0	5039	0	11364
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 11 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	0	0	0	5039	0	11335
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 12 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	0	0	0	7524	0	11925
	ULS 30yr 5a Trsnl ZIII Br. 20 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 21 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 22 Ba	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 1 Ah	1	700	-582	-2783	0	0	0
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 3 Ah	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 10 Ah	1	1169	-1216	-5828	654	1	5954
		10	3192	-361	-1303	0	0	0
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 11 Ah	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	3198	-350	-1323	0	0	0
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 12 Ah	1	1169	-1216	-5828	654	1	5954

### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	5919	-338	-1684	0	0	0
	ULS 30yr 5a Trsnl ZIII Br. 20 Ah	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 21 Ah	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	ULS 30yr 5a Trsnl ZIII Br. 22 Ah	1	1169	-1216	-5828	654	1	5954
		10	4145	-4431	-17678	3748	86	18246
		11	4111	-4244	-17724	3746	84	18246
		12	7016	-3539	-17914	4971	1	18238
	SeLS 1a W ZIII WLB	1	1982	-1885	-10580	649	1551	12751
		10	5905	-7016	-31923	3622	4974	32223
		11	5841	-6689	-32015	3619	4966	32255
		12	10319	-4033	-32750	4917	6161	33325
	SeLS 1a W ZIII WRB	1	1832	-2344	-9688	650	-1549	12773
		10	6044	-8270	-29096	3725	-4659	30696
		11	5990	-7976	-29217	3724	-4660	30714
		12	10397	-8851	-32765	4930	-6149	33346
	SeLS 1a W ZIII WLA	1	1982	-1885	-10580	649	1551	12751
		10	5905	-7016	-31923	3622	4974	32223
		11	5841	-6689	-32015	3619	4966	32255
		12	10319	-4033	-32750	4917	6161	33325
	SeLS 1a W ZIII WRA	1	1832	-2344	-9688	650	-1549	12773
		10	6044	-8270	-29096	3725	-4659	30696
		11	5990	-7976	-29217	3724	-4660	30714
		12	10397	-8851	-32765	4930	-6149	33346
Mast 84	10°C	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 1a W ZIII WLB	1	1266	-795	-12853	-169	1834	15945
		10	4754	-2513	-41575	1607	5818	41327
		11	4760	-2353	-41535	1613	5811	41282
		12	7759	594	-40963	2974	7344	41235
	ULS 30yr 1a W ZIII WRB	1	1215	-2148	-12130	-173	-1833	16020
		10	4865	-6031	-37589	1915	-5670	38384
		11	4865	-5882	-37648	1912	-5670	38405
		12	7884	-6965	-40809	3042	-7300	41122
	ULS 30yr 1a W ZIII WLA	1	1266	-795	-12853	-169	1834	15945
		10	4754	-2513	-41575	1607	5818	41327
		11	4760	-2353	-41535	1613	5811	41282
		12	7759	594	-40963	2974	7344	41235
	ULS 30yr 1a W ZIII WRA	1	1215	-2148	-12130	-173	-1833	16020
		10	4865	-6031	-37589	1915	-5670	38384
		11	4865	-5882	-37648	1912	-5670	38405
		12	7884	-6965	-40809	3042	-7300	41122
	ULS 30yr 1a W ZIII WL_0	1	1266	-795	-12853	-169	1834	15945
		10	4754	-2513	-41575	1607	5818	41327
		11	4760	-2353	-41535	1613	5811	41282
		12	7759	594	-40963	2974	7344	41235
	ULS 30yr 1a W ZIII WL_-45	1	1047	-748	-10214	58	932	10827
		10	3866	-1549	-27195	2254	3118	27566
		11	3867	-1450	-27169	2257	3113	27537
		12	6079	536	-24701	3669	4072	26096
	ULS 30yr 1a W ZIII WL_-90	1	872	-872	-7498	272	1	7641
		10	3500	-1977	-19166	2829	64	19995
		11	3498	-1904	-19172	2829	62	19993
		12	5390	-1308	-16782	4200	1	18632
	ULS 30yr 1a W ZIII WL_45	1	1078	-873	-9979	138	932	11115
		10	4106	-2171	-30183	2414	3116	29613
		11	4107	-2053	-30180	2415	3111	29603
		12	6976	-346	-32118	3697	4074	30980
	ULS 30yr 1a W ZIII WL_90	1	898	-913	-7674	277	1	7736
		10	3770	-2449	-23540	2707	83	22955
		11	3767	-2357	-23553	2705	81	22957
		12	6385	-2125	-26626	3900	1	24853
	ULS 30yr 1a W ZIII WR_0	1	1215	-2148	-12130	-173	-1833	16020
		10	4865	-6031	-37589	1915	-5670	38384
		11	4865	-5882	-37648	1912	-5670	38405
		12	7884	-6965	-40809	3042	-7300	41122

### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
	ULS 30yr 1a W ZIII WR_-45	1	1091	-1640	-10065	133	-931	11218
		10	4234	-4323	-28302	2574	-2979	28208
		11	4232	-4204	-28334	2572	-2980	28218
		12	7032	-5010	-32182	3709	-4061	31010
	ULS 30yr 1a W ZIII WR_45	1	979	-1381	-9172	60	-931	10794
		10	3914	-3634	-24821	2438	-2952	25757
		11	3912	-3543	-24856	2436	-2953	25770
		12	6097	-4108	-24472	3692	-4061	25935
	ULS 30yr 1a W ZIII 0.9 WLB	1	1211	-784	-12755	-258	1834	15769
		10	4373	-2442	-40644	1100	5809	40374
		11	4380	-2284	-40601	1107	5802	40326
		12	7141	657	-40072	2272	7348	40305
	ULS 30yr 1a W ZIII 0.9 WRB	1	1158	-2134	-12016	-262	-1833	15846
		10	4471	-5926	-36580	1410	-5676	37341
		11	4472	-5781	-36639	1408	-5676	37362
		12	7274	-6883	-39894	2346	-7303	40173
	ULS 30yr 1a W ZIII 0.9 WLA	1	1211	-784	-12755	-258	1834	15769
		10	4373	-2442	-40644	1100	5809	40374
		11	4380	-2284	-40601	1107	5802	40326
		12	7141	657	-40072	2272	7348	40305
	ULS 30yr 1a W ZIII 0.9 WRA	1	1158	-2134	-12016	-262	-1833	15846
		10	4471	-5926	-36580	1410	-5676	37341
		11	4472	-5781	-36639	1408	-5676	37362
		12	7274	-6883	-39894	2346	-7303	40173
	ULS 30yr 1a W ZIII 0.9 WL_0	1	1211	-784	-12755	-258	1834	15769
		10	4373	-2442	-40644	1100	5809	40374
		11	4380	-2284	-40601	1107	5802	40326
		12	7141	657	-40072	2272	7348	40305
	ULS 30yr 1a W ZIII 0.9 WL_-45	1	983	-722	-9991	-23	932	10492
		10	3430	-1379	-25462	1789	3109	25809
		11	3431	-1287	-25434	1792	3104	25778
		12	5376	669	-22991	3015	4074	24360
	ULS 30yr 1a W ZIII 0.9 WL_-90	1	781	-801	-6898	214	1	6891
		10	3001	-1700	-16477	2415	54	17279
		11	3000	-1637	-16481	2414	53	17277
		12	4595	-1100	-14143	3598	1	15965
	ULS 30yr 1a W ZIII 0.9 WL_45	1	1013	-845	-9741	60	932	10738
		10	3663	-1999	-28428	1949	3108	27836
		11	3665	-1887	-28425	1950	3103	27825
		12	6275	-215	-30446	3042	4075	29278
	ULS 30yr 1a W ZIII 0.9 WL_90	1	807	-844	-7085	219	1	6991
		10	3274	-2178	-20906	2290	73	20287
		11	3271	-2096	-20917	2289	71	20292
		12	5596	-1920	-24046	3295	1	22239
	ULS 30yr 1a W ZIII 0.9 WR_0	1	1158	-2134	-12016	-262	-1833	15846
		10	4471	-5926	-36580	1410	-5676	37341
		11	4472	-5781	-36639	1408	-5676	37362
		12	7274	-6883	-39894	2346	-7303	40173
	ULS 30yr 1a W ZIII 0.9 WR_-45	1	1026	-1611	-9823	54	-931	10847
		10	3790	-4139	-26516	2111	-2987	26388
		11	3788	-4027	-26547	2109	-2988	26398
		12	6340	-4871	-30510	3057	-4060	29306
	ULS 30yr 1a W ZIII 0.9 WR_45	1	913	-1352	-8922	-19	-931	10450
		10	3467	-3449	-23018	1976	-2959	23926
		11	3466	-3365	-23052	1974	-2960	23940
		12	5397	-3965	-22738	3043	-4061	24180
	ULS 30yr 5a Trsnl ZIII Br. 1 Ba	1	0	0	0	322	0	7138
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 3 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 10 Ba	1	855	-870	-7392	255	1	7443
		10	0	0	0	4392	0	11947
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 11 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	0	0	0	4392	0	11938
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 12 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515



### 03. Belastingen

Mastnummer	Belastingsgeval	set nummer	loads_from_back_span_vert	loads_from_back_span_trans	loads_from_back_span_long	loads_from_ahead_span_vert	loads_from_ahead_span_trans	loads_from_ahead_span_long
		11	3463	-2038	-20410	2632	68	20515
		12	0	0	0	6848	0	12477
	ULS 30yr 5a Trsnl ZIII Br. 20 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 21 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 22 Ba	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 1 Ah	1	796	-690	-5857	0	0	0
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 3 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 10 Ah	1	855	-870	-7392	255	1	7443
		10	3842	-404	-3614	0	0	0
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 11 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3841	-388	-3611	0	0	0
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 12 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	6562	-343	-4281	0	0	0
	ULS 30yr 5a Trsnl ZIII Br. 20 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 21 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	ULS 30yr 5a Trsnl ZIII Br. 22 Ah	1	855	-870	-7392	255	1	7443
		10	3465	-2116	-20402	2633	70	20515
		11	3463	-2038	-20410	2632	68	20515
		12	5588	-1619	-20471	3869	1	20512
	SeLS 1a W ZIII WLB	1	1188	-815	-11993	-108	1526	14191
		10	4338	-2280	-36621	1696	4856	36421
		11	4343	-2140	-36592	1701	4849	36387
		12	7104	336	-36121	3000	6104	36340
	SeLS 1a W ZIII WRB	1	1136	-1924	-11261	-111	-1525	14267
		10	4446	-5219	-33262	1962	-4708	33909
		11	4445	-5087	-33312	1960	-4709	33927
		12	7195	-5969	-36009	3051	-6071	36248
	SeLS 1a W ZIII WLA	1	1188	-815	-11993	-108	1526	14191
		10	4338	-2280	-36621	1696	4856	36421
		11	4343	-2140	-36592	1701	4849	36387
		12	7104	336	-36121	3000	6104	36340
	SeLS 1a W ZIII WRA	1	1136	-1924	-11261	-111	-1525	14267
		10	4446	-5219	-33262	1962	-4708	33909
		11	4445	-5087	-33312	1960	-4709	33927
		12	7195	-5969	-36009	3051	-6071	36248

04. Summary

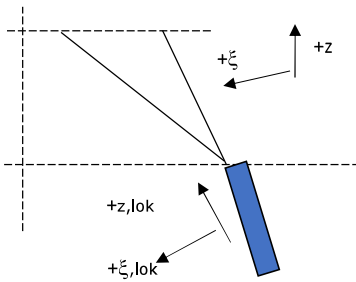
		Maximaal optredende belasting (N)				
Mast nummer	Mast type	Verticaal	Dwarsbelasting	In lijnrichting	Maatgevende load case	
Mast 92	D+0_150	7759	1481		385 ULS 30yr 3 W + I ZIII WLB	
Mast 84	D+0_150	5268	3635		32 ULS 30yr 3 W + I ZIII WLB	



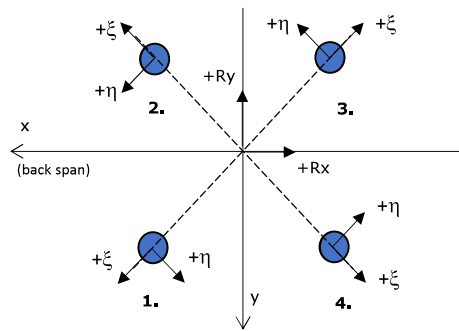
Project: ZW-Oost TOSP  
 Masttype: D+3.6  
 Mast: 22

**Oplegreacties per randstijl** Auteur: TBR  
Versie: 1.4

Betrouwbaarheidsniveau Afkeur CC2-0  
 Referentieperiode 30 jaar



Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII WL_45,T BI+	-30	-31	<b>-236</b>	1	43	-3	-240
4	ULS 30yr 1a W ZIII WRA,T NR-	-61	55	<b>-496</b>	4	82	2	-503
1	ULS 30yr 1a W ZIII WR_45,T BI-	50	43	<b>-377</b>	-5	66	-2	-383
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	29	-27	<b>-210</b>	2	39	-4	-214

**Maximale trekbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII 0.9 WR_45,T BI-	40	37	<b>299</b>	2	-55	4	304
4	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	20	-23	<b>141</b>	2	-30	6	144
1	ULS 30yr 1a W ZIII 0.9 WL_45,T BI+	-21	-25	<b>161</b>	-3	-33	6	164
2	ULS 30yr 1a W ZIII WRA,T NR-	-49	50	<b>410</b>	1	-70	1	416

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	4	-5	<b>-10</b>	6	1	1	-10
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-20	9	<b>-133</b>	8	21	2	-135
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	4	9	<b>-61</b>	3	9	1	-62
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-2	12	<b>58</b>	7	-10	0	58

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-4	3	<b>-4</b>	-5	0	0	-4
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-13	17	<b>-140</b>	-3	21	3	-142
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	14	1	<b>-72</b>	-9	11	2	-73
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-11	5	<b>69</b>	-5	-11	0	70

**Combinatie Ftrek+Fh**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII 0.9 WR_45,T BI-	40	37	<b>299</b>	2	-55	4	304
4	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	20	-23	<b>141</b>	2	-30	6	144
1	ULS 30yr 1a W ZIII 0.9 WL_45,T BI+	-21	-25	<b>161</b>	-3	-33	6	164
2	ULS 30yr 1a W ZIII WRA,T NR-	-49	50	<b>410</b>	1	-70	1	416

**Permanente belasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	10°C,T Global	13	9	<b>-102</b>	-3	15	2	-103
2	10°C,T Global	-5	6	<b>47</b>	1	-8	0	47
3	10°C,T Global	4	3	<b>26</b>	0	-5	0	27
4	10°C,T Global	-15	11	<b>-122</b>	3	19	2	-123

### Omhullenden ongeacht stijl

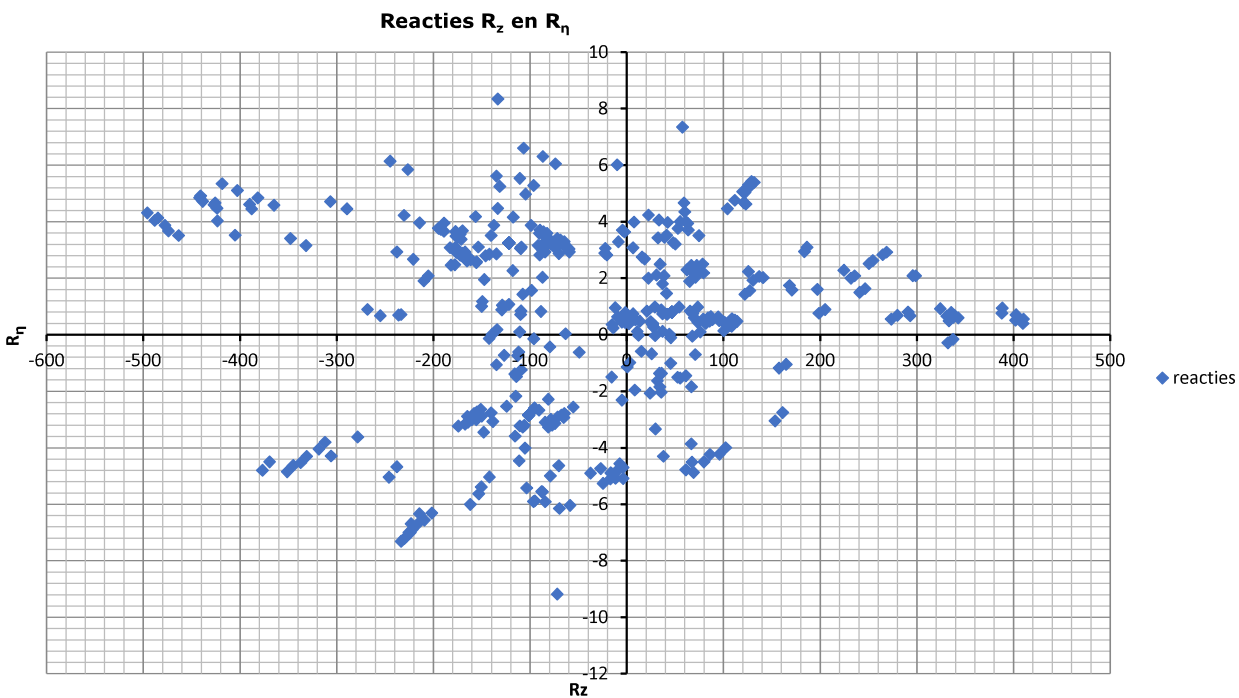
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WRA,T NR-	-61	55	<b>-496</b>	4	82	2	-503
Max. trek	ULS 30yr 1a W ZIII WRA,T NR-	-49	50	<b>410</b>	1	-70	1	416
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-20	9	-133	<b>8</b>	21	2	-135
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	14	1	-72	<b>-9</b>	11	2	-73
Comb. trek+torsie	ULS 30yr 1a W ZIII WRA,T NR-	-49	50	<b>410</b>	<b>1</b>	-70	1	416

### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
3	SeLS 1a W ZIII WLB,T NL+	-17	-20	<b>-147</b>	2	26	-1	-150
4	SeLS 1a W ZIII WRA,T NR-	-52	47	<b>-423</b>	4	70	2	-429
1	SeLS 1a W ZIII WRB,T NL-	39	33	<b>-306</b>	-4	51	1	-310
2	SeLS 1a W ZIII WLA,T NR+	17	-16	<b>-122</b>	1	24	-3	-124

### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
3	SeLS 1a W ZIII WRB,T NL-	30	26	<b>225</b>	2	-40	2	228
4	SeLS 1a W ZIII WLA,T NR+	6	-11	<b>41</b>	4	-12	5	43
1	SeLS 1a W ZIII WLB,T NL+	-7	-13	<b>67</b>	-4	-14	3	68
2	SeLS 1a W ZIII WRA,T NR-	-41	42	<b>343</b>	1	-59	1	348

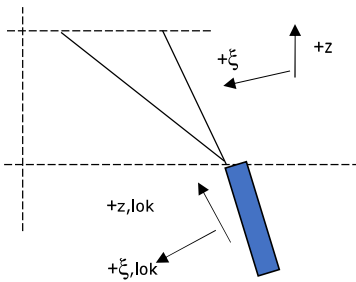




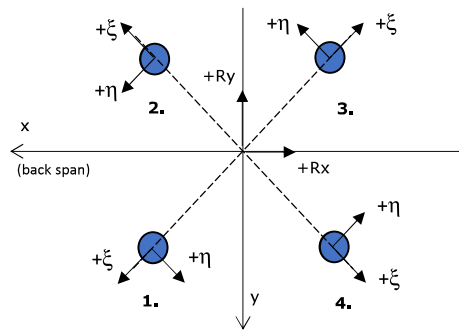
Project: ZW-Oost TOSP  
 Masttype: D+3.6  
 Mast: 22

**Oplegreacties per randstijl** Auteur: TBR  
Versie: 1.4

Betrouwbaarheidsniveau Verbouw CC2  
 Referentieperiode 30 jaar



Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII WL_45,T BI+	-32	-33	<b>-256</b>	1	46	-3	-260
4	ULS 30yr 1a W ZIII WRA,T NR-	-69	61	<b>-560</b>	5	92	3	-567
1	ULS 30yr 1a W ZIII WR_45,T BI-	54	46	<b>-406</b>	-6	70	-1	-412
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	30	-28	<b>-224</b>	2	41	-3	-228

**Maximale trekbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII 0.9 WR_45,T BI-	44	40	<b>329</b>	3	-59	4	334
4	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	22	-26	<b>161</b>	3	-33	6	165
1	ULS 30yr 1a W ZIII 0.9 WL_45,T BI+	-23	-29	<b>184</b>	-4	-37	6	188
2	ULS 30yr 1a W ZIII WRA,T NR-	-57	57	<b>474</b>	-1	-81	0	481

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 3 W + I ZIII WRB,T NL-	23	13	<b>146</b>	8	-26	1	149
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-20	9	<b>-129</b>	8	20	2	-131
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	4	8	<b>-58</b>	3	9	1	-59
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-2	12	<b>62</b>	7	-10	0	63

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-3	3	<b>0</b>	-5	0	0	0
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-13	17	<b>-137</b>	-3	21	2	-139
1	ULS 30yr 3 W + I ZIII WRB,T NL-	36	22	<b>-255</b>	-10	41	2	-258
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T Global	-12	5	<b>72</b>	-5	-12	0	73

**Combinatie Ftrek+Fh**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
3	ULS 30yr 1a W ZIII 0.9 WR_45,T BI-	44	40	<b>329</b>	3	-59	4	334
4	ULS 30yr 1a W ZIII 0.9 WL_-45,T BI+	22	-26	<b>161</b>	3	-33	6	165
1	ULS 30yr 1a W ZIII 0.9 WL_45,T BI+	-23	-29	<b>184</b>	-4	-37	6	188
2	ULS 30yr 1a W ZIII 0.9 WRA,T NR-	-58	56	<b>474</b>	-1	-81	1	480

**Permanente belasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	10°C,T Global	13	9	<b>-98</b>	-3	15	1	-99
2	10°C,T Global	-5	6	<b>50</b>	1	-8	0	51
3	10°C,T Global	4	3	<b>30</b>	1	-5	0	30
4	10°C,T Global	-15	11	<b>-119</b>	3	18	2	-120

### Omhullenden ongeacht stijl

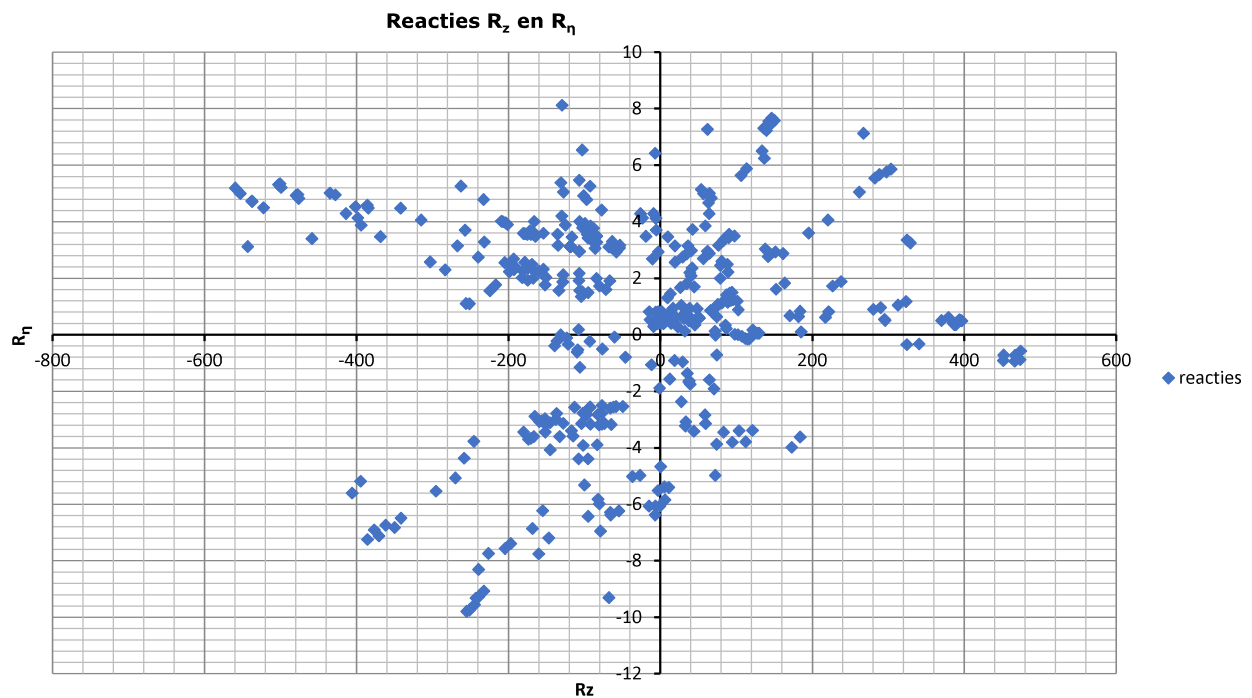
Belasting	Combinatie	$R_x$	$R_y$	$R_z$	$R_\eta$	$R_\xi$	$R_{\xi,lok}$	$R_{z,lok}$
		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Max. druk	ULS 30yr 1a W ZIII WRA,T NR-	-69	61	<b>-560</b>	5	92	3	-567
Max. trek	ULS 30yr 1a W ZIII WRA,T NR-	-57	57	<b>474</b>	-1	-81	0	481
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T Global	-20	9	-129	<b>8</b>	20	2	-131
Max. neg. torsie	ULS 30yr 3 W + I ZIII WRB,T NL-	36	22	-255	<b>-10</b>	41	2	-258
Comb. trek+torsie	ULS 30yr 1a W ZIII 0,9 WRA,T NR-	-58	56	<b>474</b>	<b>-1</b>	-81	1	480

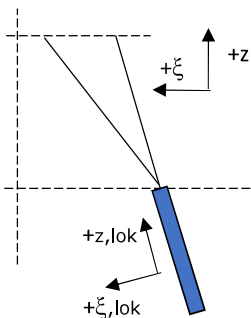
### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$	$R_y$	$R_z$	$R_\eta$	$R_\xi$	$R_{\xi,lok}$	$R_{z,lok}$
		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3	SeLS 1a W ZIII WLB,T NL+	-15	-18	<b>-134</b>	2	23	-1	-136
4	SeLS 1a W ZIII WRA,T NR-	-51	45	<b>-414</b>	4	68	2	-419
1	SeLS 1a W ZIII WRB,T NL-	38	31	<b>-295</b>	-6	49	1	-299
2	SeLS 1a W ZIII WLA,T NR+	15	-13	<b>-103</b>	2	20	-2	-105

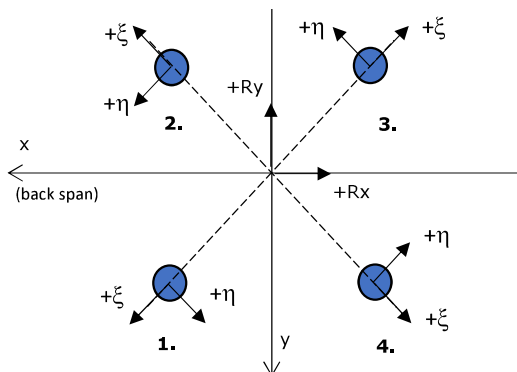
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$	$R_y$	$R_z$	$R_\eta$	$R_\xi$	$R_{\xi,lok}$	$R_{z,lok}$
		[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3	SeLS 1a W ZIII WRB,T NL-	30	24	<b>221</b>	4	-38	1	224
4	SeLS 1a W ZIII WLA,T NR+	4	-8	<b>29</b>	3	-9	4	30
1	SeLS 1a W ZIII WLB,T NL+	-7	-11	<b>59</b>	-3	-12	2	61
2	SeLS 1a W ZIII WRA,T NR-	-41	41	<b>340</b>	0	-58	0	345





Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII WL_45,T BI+	-31	-30	<b>-242</b>	1	-43	5	-246
2	ULS 30yr 1a W ZIII WRA,T NR-	-42	38	<b>-339</b>	-3	-57	3	-344
3	ULS 30yr 1a W ZIII WR_45,T BI-	36	33	<b>-278</b>	2	-49	5	-283
4	ULS 30yr 1a W ZIII WL_-45,T BI+	30	-28	<b>-228</b>	-1	-41	5	-231

**Maximale trekbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_45,T	31	26	<b>227</b>	-3	40	-5	230
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	24	-22	<b>179</b>	1	32	-4	182
3	ULS 30yr 1a W ZIII 0.9 WL_45,T t	-25	-23	<b>189</b>	-1	34	-4	192
4	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-36	32	<b>284</b>	3	48	-4	288

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-9	1	<b>-31</b>	7	-6	1	-32
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-4	14	<b>-78</b>	7	-13	1	-79
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	9	-3	<b>-21</b>	8	-4	0	-22
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-8	-3	<b>25</b>	8	3	0	25

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	1	-10	<b>-39</b>	-8	-7	0	-39
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-14	3	<b>-70</b>	-8	-12	1	-71
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-3	7	<b>-14</b>	-7	-3	1	-14
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	4	7	<b>18</b>	-8	3	0	18

**Combinatie Ftrek+Fh**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_45,T	31	26	<b>227</b>	-3	40	-5	230
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	24	-22	<b>179</b>	1	32	-4	182
3	ULS 30yr 1a W ZIII 0.9 WL_45,T t	-25	-23	<b>189</b>	-1	34	-4	192
4	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-36	32	<b>284</b>	3	48	-4	288



### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	-1	-1	<b>-5</b>	0	-1	0	-5
2	10°C,T Global	-7	6	<b>-50</b>	-1	-9	1	-51
3	10°C,T Global	6	6	<b>-49</b>	1	-8	1	-49
4	10°C,T Global	1	-1	<b>-4</b>	0	-1	0	-4

### Omhullenden ongeacht stijl

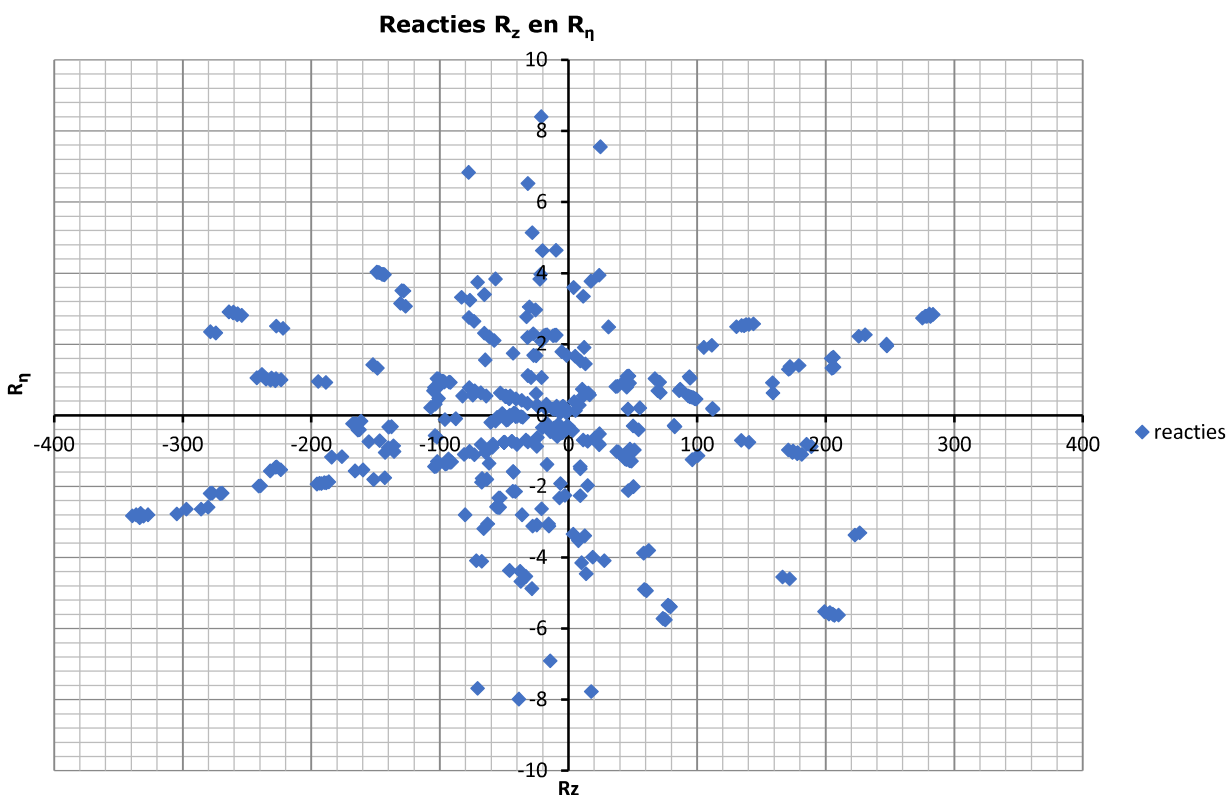
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WRA,T NR-	-42	38	<b>-339</b>	-3	-57	3	-344
Max. trek	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-36	32	<b>284</b>	3	48	-4	288
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,1	9	-3	-21	<b>8</b>	-4	0	-22
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,1	1	-10	-39	<b>-8</b>	-7	0	-39
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-36	32	<b>284</b>	<b>3</b>	48	-4	288

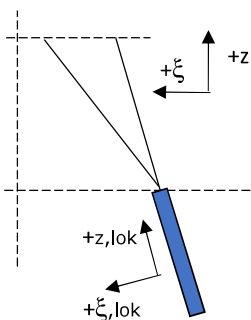
### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLB,T NL+	-24	-23	<b>-195</b>	1	-34	3	-197
2	SeLS 1a W ZIII WRA,T NR-	-36	32	<b>-286</b>	-3	-48	3	-290
3	SeLS 1a W ZIII WRB,T NL-	29	26	<b>-227</b>	3	-39	3	-231
4	SeLS 1a W ZIII WLA,T NR+	22	-20	<b>-166</b>	-2	-30	3	-168

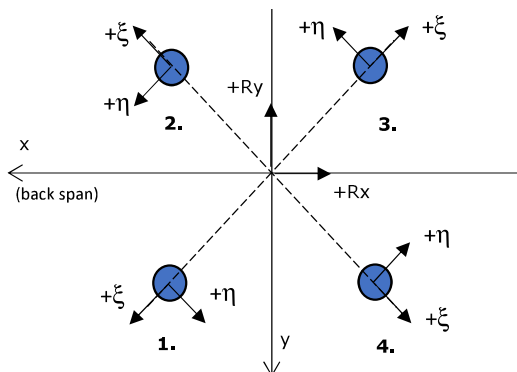
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRB,T NL-	25	18	<b>172</b>	-5	30	-3	175
2	SeLS 1a W ZIII WLA,T NR+	16	-13	<b>111</b>	2	20	-2	113
3	SeLS 1a W ZIII WLB,T NL+	-18	-17	<b>140</b>	-1	24	-2	142
4	SeLS 1a W ZIII WRA,T NR-	-29	26	<b>231</b>	2	39	-3	234





Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII WL_45,T BI+	-37	-35	<b>-285</b>	1	-51	5	-290
2	ULS 30yr 1a W ZIII WRA,T NR-	-49	45	<b>-395</b>	-3	-66	3	-400
3	ULS 30yr 1a W ZIII WR_45,T BI-	42	38	<b>-319</b>	3	-56	6	-324
4	ULS 30yr 1a W ZIII WL_-45,T BI+	35	-32	<b>-264</b>	-2	-47	6	-268

**Maximale trekbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_45,T	36	31	<b>264</b>	-4	47	-5	269
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	29	-26	<b>215</b>	2	39	-5	219
3	ULS 30yr 1a W ZIII 0.9 WL_45,T t	-30	-28	<b>229</b>	-1	41	-5	232
4	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-43	38	<b>336</b>	3	57	-4	340

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-9	1	<b>-31</b>	7	-6	1	-32
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-4	14	<b>-78</b>	7	-13	1	-79
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	9	-3	<b>-21</b>	8	-4	0	-22
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-8	-3	<b>25</b>	8	3	0	25

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	1	-10	<b>-39</b>	-8	-7	0	-39
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-14	3	<b>-70</b>	-8	-12	1	-71
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-3	7	<b>-14</b>	-7	-3	1	-14
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	4	7	<b>18</b>	-8	3	0	18

**Combinatie Ftrek+Fh**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_45,T	36	31	<b>264</b>	-4	47	-5	269
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	29	-26	<b>215</b>	2	39	-5	219
3	ULS 30yr 1a W ZIII 0.9 WL_45,T t	-30	-28	<b>229</b>	-1	41	-5	232
4	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-43	38	<b>336</b>	3	57	-4	340

### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	-1	-1	<b>-5</b>	0	-1	0	-5
2	10°C,T Global	-7	6	<b>-50</b>	-1	-9	1	-51
3	10°C,T Global	6	6	<b>-49</b>	1	-8	1	-49
4	10°C,T Global	1	-1	<b>-4</b>	0	-1	0	-4

### Omhullenden ongeacht stijl

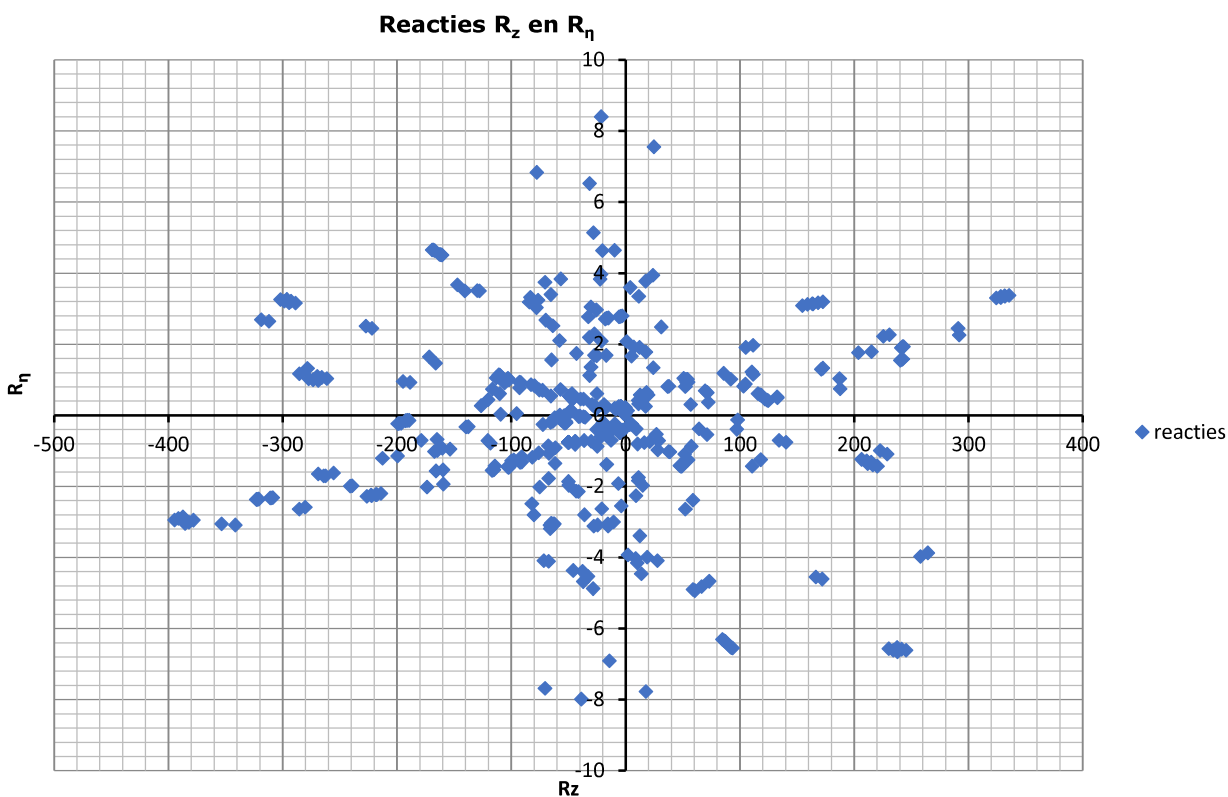
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WRA,T NR-	-49	45	<b>-395</b>	-3	-66	3	-400
Max. trek	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-43	38	<b>336</b>	3	57	-4	340
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,1	9	-3	-21	<b>8</b>	-4	0	-22
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,1	1	-10	-39	<b>-8</b>	-7	0	-39
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WRA,T NR	-43	38	<b>336</b>	<b>3</b>	57	-4	340

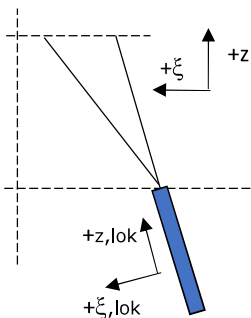
### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLB,T NL+	-24	-23	<b>-195</b>	1	-34	3	-197
2	SeLS 1a W ZIII WRA,T NR-	-36	32	<b>-286</b>	-3	-48	3	-290
3	SeLS 1a W ZIII WRB,T NL-	29	26	<b>-227</b>	3	-39	3	-231
4	SeLS 1a W ZIII WLA,T NR+	22	-20	<b>-166</b>	-2	-30	3	-168

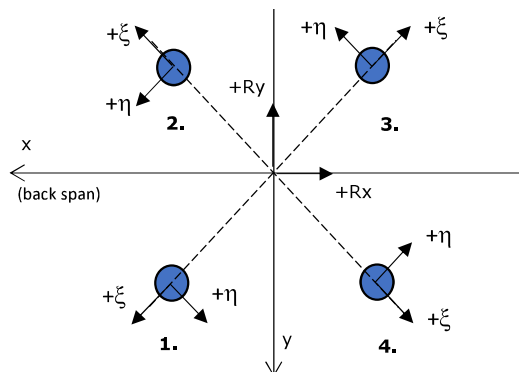
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRB,T NL-	25	18	<b>172</b>	-5	30	-3	175
2	SeLS 1a W ZIII WLA,T NR+	16	-13	<b>111</b>	2	20	-2	113
3	SeLS 1a W ZIII WLB,T NL+	-18	-17	<b>140</b>	-1	24	-2	142
4	SeLS 1a W ZIII WRA,T NR-	-29	26	<b>231</b>	2	39	-3	234





Assenstelsels



#### Maximale drukbelasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-28	-26	<b>-209</b>	1	-38	5	-212
2	ULS 30yr 1a W ZIII WR_-45,T BI-	-41	38	<b>-319</b>	-2	-56	6	-324
3	ULS 30yr 1a W ZIII WRB,T NL-	48	43	<b>-385</b>	3	-64	4	-390
4	ULS 30yr 1a W ZIII WL_-45,T BI+	28	-28	<b>-217</b>	0	-40	5	-221

#### Maximale trekbelasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WRB,T NL	37	37	<b>309</b>	0	52	-3	313
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	20	-20	<b>151</b>	0	28	-5	154
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-20	-20	<b>148</b>	0	28	-5	151
4	ULS 30yr 1a W ZIII 0.9 WR_-45,T	-34	29	<b>251</b>	4	45	-5	255

#### Maximale torsiebelasting (positief)

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	-2	9	<b>33</b>	8	5	0	34
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	1	10	<b>-36</b>	7	-6	1	-37
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	18	5	<b>-98</b>	9	-16	1	-100
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	-3	-10	<b>-28</b>	9	-5	0	-28

#### Maximale torsiebelasting (negatief)

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	10	-1	<b>45</b>	-8	7	1	45
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	-12	-1	<b>-47</b>	-9	-8	0	-48
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	8	17	<b>-109</b>	-6	-17	0	-110
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	7	2	<b>-18</b>	-6	-3	1	-18

#### Combinatie Ftrek+Fh

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WRB,T NL	37	37	<b>309</b>	0	52	-3	313
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	20	-20	<b>151</b>	0	28	-5	154
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-20	-20	<b>148</b>	0	28	-5	151
4	ULS 30yr 1a W ZIII 0.9 WR_-45,T	-34	29	<b>251</b>	4	45	-5	255

### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	2	1	<b>15</b>	0	2	0	15
2	10°C,T Global	-9	9	<b>-78</b>	-1	-13	0	-79
3	10°C,T Global	10	8	<b>-81</b>	1	-13	0	-82
4	10°C,T Global	-2	0	<b>12</b>	1	1	0	12

### Omhullenden ongeacht stijl

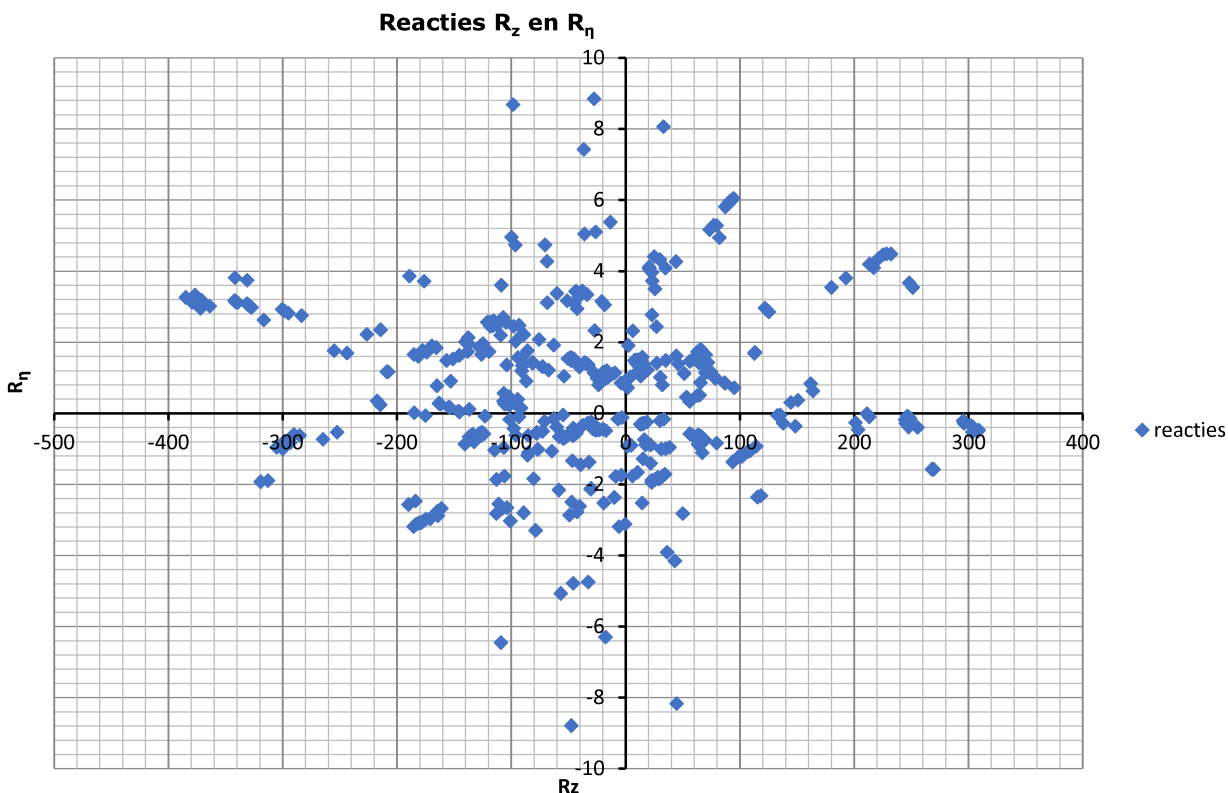
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WRB,T NL-	48	43	<b>-385</b>	3	-64	4	-390
Max. trek	ULS 30yr 1a W ZIII 0.9 WRB,T NL	37	37	<b>309</b>	0	52	-3	313
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,1	-3	-10	-28	<b>9</b>	-5	0	-28
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,1	-12	-1	-47	<b>-9</b>	-8	0	-48
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WRB,T NL	37	37	<b>309</b>	<b>0</b>	52	-3	313

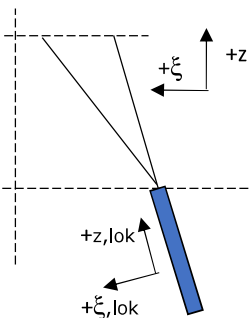
### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLB,T NL+	-18	-18	<b>-137</b>	0	-25	4	-139
2	SeLS 1a W ZIII WRA,T NR-	-32	31	<b>-265</b>	-1	-45	3	-269
3	SeLS 1a W ZIII WRB,T NL-	41	37	<b>-327</b>	3	-55	3	-332
4	SeLS 1a W ZIII WLA,T NR+	18	-20	<b>-151</b>	2	-27	3	-153

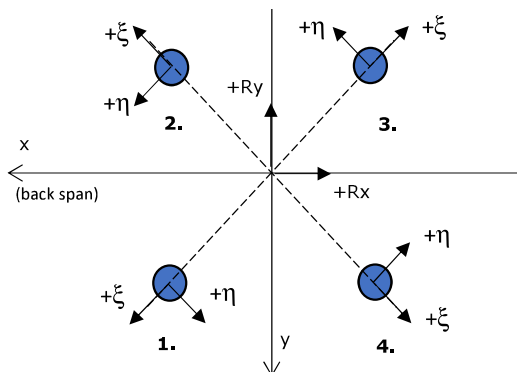
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRB,T NL-	31	30	<b>255</b>	0	43	-3	259
2	SeLS 1a W ZIII WLA,T NR+	10	-11	<b>80</b>	-1	15	-2	81
3	SeLS 1a W ZIII WLB,T NL+	-9	-10	<b>66</b>	1	13	-3	67
4	SeLS 1a W ZIII WRA,T NR-	-26	21	<b>193</b>	4	33	-3	196





Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-30	-28	<b>-226</b>	1	-41	5	-230
2	ULS 30yr 1a W ZIII WR_-45,T BI-	-45	41	<b>-345</b>	-3	-60	6	-351
3	ULS 30yr 1a W ZIII WRB,T NL-	54	48	<b>-431</b>	4	-72	4	-437
4	ULS 30yr 1a W ZIII WL_-45,T BI+	30	-31	<b>-239</b>	0	-43	5	-242

**Maximale trekbelasting**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WRB,T NL	45	41	<b>356</b>	-3	61	-5	361
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	23	-22	<b>175</b>	1	32	-4	178
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-23	-22	<b>171</b>	0	31	-4	174
4	ULS 30yr 1a W ZIII 0.9 WR_-45,T	-39	32	<b>280</b>	5	50	-6	284

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	-2	10	<b>37</b>	8	6	0	37
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	1	9	<b>-33</b>	7	-6	1	-34
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	18	5	<b>-95</b>	9	-16	1	-96
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,T	-3	-9	<b>-25</b>	9	-4	0	-25

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	11	-1	<b>48</b>	-8	7	0	48
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	-12	-1	<b>-44</b>	-9	-8	1	-45
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	8	17	<b>-106</b>	-6	-17	1	-107
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,T	6	2	<b>-14</b>	-6	-3	1	-14

**Combinatie Ftrek+Fh**

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	ULS 30yr 1a W ZIII 0.9 WRB,T NL	45	41	<b>356</b>	-3	61	-5	361
2	ULS 30yr 1a W ZIII 0.9 WL_-45,T	23	-22	<b>175</b>	1	32	-4	178
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T f	-23	-22	<b>171</b>	0	31	-4	174
4	ULS 30yr 1a W ZIII 0.9 WR_-45,T	-39	32	<b>280</b>	5	50	-6	284

### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	2	2	<b>19</b>	0	3	0	19
2	10°C,T Global	-9	8	<b>-75</b>	-1	-13	1	-76
3	10°C,T Global	10	8	<b>-78</b>	2	-13	1	-79
4	10°C,T Global	-2	0	<b>15</b>	1	2	0	15

### Omhullenden ongeacht stijl

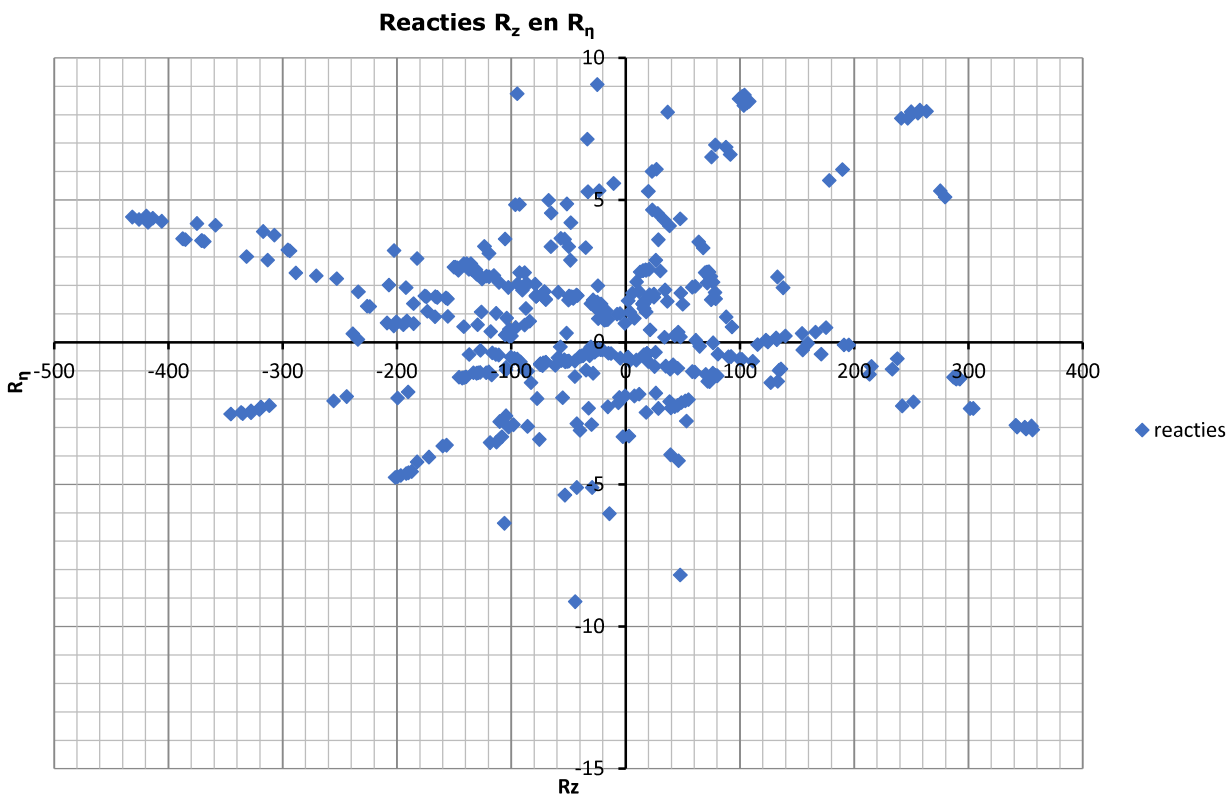
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WRB,T NL-	54	48	<b>-431</b>	4	-72	4	-437
Max. trek	ULS 30yr 1a W ZIII 0.9 WRB,T NL	45	41	<b>356</b>	-3	61	-5	361
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ba,1	-3	-9	-25	<b>9</b>	-4	0	-25
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ba,1	-12	-1	-44	<b>-9</b>	-8	1	-45
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WRB,T NL	45	41	<b>356</b>	<b>-3</b>	61	-5	361

### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLB,T NL+	-17	-16	<b>-126</b>	1	-23	3	-128
2	SeLS 1a W ZIII WRA,T NR-	-32	29	<b>-255</b>	-2	-44	3	-259
3	SeLS 1a W ZIII WRB,T NL-	40	35	<b>-317</b>	4	-53	3	-321
4	SeLS 1a W ZIII WLA,T NR+	17	-18	<b>-142</b>	1	-25	3	-144

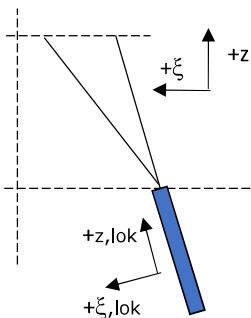
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRB,T NL-	32	29	<b>252</b>	-2	43	-3	255
2	SeLS 1a W ZIII WLA,T NR+	10	-10	<b>77</b>	0	14	-2	78
3	SeLS 1a W ZIII WLB,T NL+	-8	-8	<b>61</b>	0	12	-2	63
4	SeLS 1a W ZIII WRA,T NR-	-28	19	<b>190</b>	6	33	-3	193

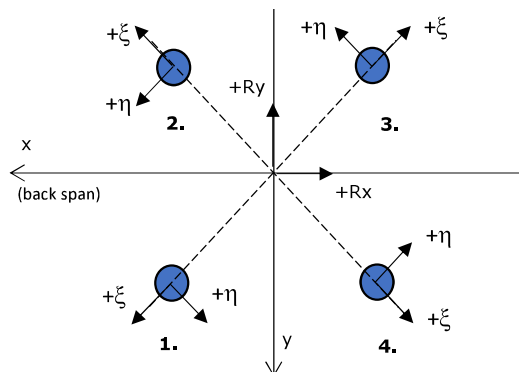


### Oplegreacties per randstijl

Betrouwbaarheidsniveau Afkeur CC2-0  
 Referentieperiode 30 jaar



Assenstelsels



#### Maximale drukbelasting

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII WL_-45,T BI+	-29	-30	<b>-229</b>	-1	-42	5	-233
2	ULS 30yr 1a W ZIII WLB,T NL+	-51	46	<b>-407</b>	-4	-68	4	-413
3	ULS 30yr 1a W ZIII WR_-45,T BI-	42	39	<b>-328</b>	2	-57	5	-333
4	ULS 30yr 1a W ZIII 0.9 WR_45,T	27	-25	<b>-198</b>	-1	-37	5	-201

#### Maximale trekbelasting

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_-45,T	35	30	<b>259</b>	-4	46	-5	263
2	ULS 30yr 1a W ZIII 0.9 WR_45,T	19	-18	<b>138</b>	0	26	-5	141
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T	-21	-21	<b>162</b>	0	30	-4	165
4	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-40	39	<b>332</b>	1	56	-4	337

#### Maximale torsiebelasting (positief)

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-6	1	<b>-16</b>	5	-3	1	-16
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-8	16	<b>-108</b>	5	-17	0	-109
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	11	0	<b>-49</b>	8	-8	0	-49
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-9	-1	<b>44</b>	7	6	1	44

#### Maximale torsiebelasting (negatief)

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	3	-9	<b>-28</b>	-8	-5	0	-28
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-16	5	<b>-94</b>	-8	-15	0	-96
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	0	9	<b>-36</b>	-7	-6	0	-36
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	2	8	<b>30</b>	-7	4	0	30

#### Combinatie Ftrek+Fh

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_-45,T	35	30	<b>259</b>	-4	46	-5	263
2	ULS 30yr 1a W ZIII 0.9 WR_45,T	19	-18	<b>138</b>	0	26	-5	141
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T	-21	-21	<b>162</b>	0	30	-4	165
4	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-40	39	<b>332</b>	1	56	-4	337



### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	2	0	<b>9</b>	-1	1	0	9
2	10°C,T Global	-11	8	<b>-83</b>	-2	-13	0	-84
3	10°C,T Global	9	8	<b>-75</b>	1	-12	0	-76
4	10°C,T Global	-2	1	<b>17</b>	0	2	0	17

### Omhullenden ongeacht stijl

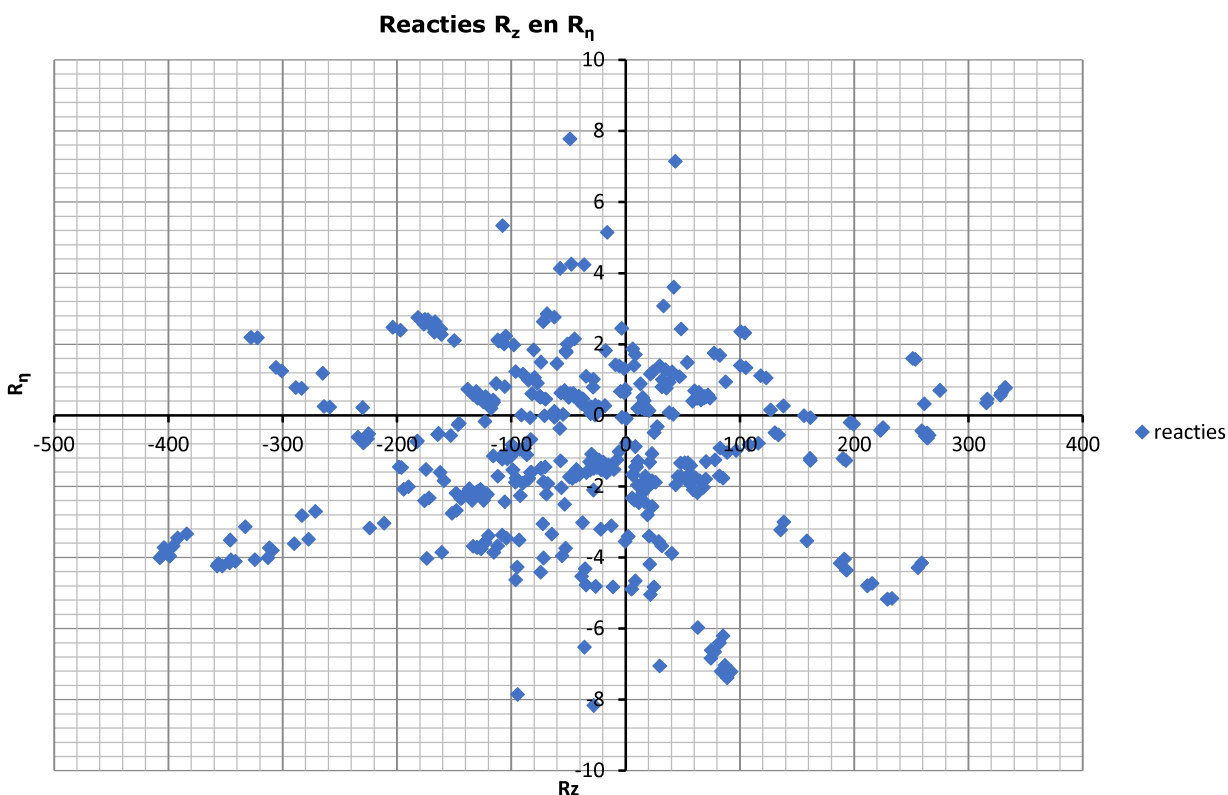
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WLB,T NL+	-51	46	<b>-407</b>	-4	-68	4	-413
Max. trek	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-40	39	<b>332</b>	1	56	-4	337
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,1	11	0	-49	<b>8</b>	-8	0	-49
Max. neg. torsie	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,1	3	-9	-28	<b>-8</b>	-5	0	-28
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-40	39	<b>332</b>	<b>1</b>	56	-4	337

### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLA,T NR+	-19	-21	<b>-159</b>	-2	-28	3	-161
2	SeLS 1a W ZIII WLB,T NL+	-44	39	<b>-346</b>	-4	-58	3	-351
3	SeLS 1a W ZIII WRA,T NR-	33	31	<b>-265</b>	1	-45	3	-269
4	SeLS 1a W ZIII WRB,T NL-	21	-20	<b>-153</b>	-1	-29	4	-155

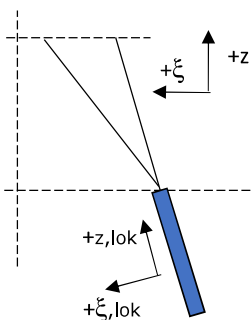
### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRA,T NR-	27	20	<b>193</b>	-4	33	-3	196
2	SeLS 1a W ZIII WRB,T NL-	11	-12	<b>83</b>	-1	17	-3	84
3	SeLS 1a W ZIII WLA,T NR+	-11	-12	<b>88</b>	1	16	-2	89
4	SeLS 1a W ZIII WLB,T NL+	-33	32	<b>275</b>	1	47	-3	279

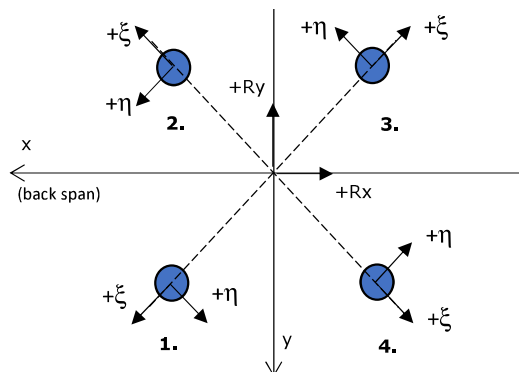


**Oplegreacties per randstijl**

Betrouwbaarheidsniveau **Verbouw CC2**  
 Referentieperiode **30** jaar



Assenstelsels



**Maximale drukbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII WL_-45,T BI+	-32	-33	<b>-253</b>	-1	-45	5	-257
2	ULS 30yr 1a W ZIII WLB,T NL+	-57	50	<b>-456</b>	-5	-76	4	-462
3	ULS 30yr 1a W ZIII WR_-45,T BI-	46	42	<b>-356</b>	3	-62	5	-361
4	ULS 30yr 1a W ZIII 0.9 WR_45,T	29	-27	<b>-214</b>	-1	-39	5	-218

**Maximale trekbelasting**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_-45,T	41	32	<b>289</b>	-6	51	-6	294
2	ULS 30yr 1a W ZIII 0.9 WR_45,T	21	-21	<b>160</b>	0	30	-4	163
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T	-24	-24	<b>188</b>	0	34	-4	191
4	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-48	44	<b>382</b>	3	65	-5	387

**Maximale torsiebelasting (positief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-5	2	<b>-13</b>	5	-3	1	-13
2	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-8	16	<b>-105</b>	5	-17	1	-106
3	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	11	0	<b>-45</b>	8	-8	1	-46
4	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,T	-10	0	<b>47</b>	7	7	1	47

**Maximale torsiebelasting (negatief)**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 3 W + I ZIII WRA,T NR-	20	5	<b>101</b>	-11	18	-2	102
2	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	-16	5	<b>-91</b>	-8	-15	1	-92
3	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	0	9	<b>-33</b>	-6	-6	1	-33
4	ULS 30yr 5a Trsnl ZIII Br. 10 Ah,T	2	9	<b>34</b>	-7	5	0	34

**Combinatie Ftrek+Fh**

Stijl	Combinatie	R <sub>x</sub> [kN]	R <sub>y</sub> [kN]	R <sub>z</sub> [kN]	R <sub>η</sub> [kN]	R <sub>ξ</sub> [kN]	R <sub>ξ,lok</sub> [kN]	R <sub>z,lok</sub> [kN]
1	ULS 30yr 1a W ZIII 0.9 WR_-45,T	41	32	<b>289</b>	-6	51	-6	294
2	ULS 30yr 1a W ZIII 0.9 WR_45,T	21	-21	<b>160</b>	0	30	-4	163
3	ULS 30yr 1a W ZIII 0.9 WL_-45,T	-24	-24	<b>188</b>	0	34	-4	191
4	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-48	44	<b>382</b>	3	65	-5	387

### Permanente belasting

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	10°C,T Global	2	0	<b>13</b>	-2	1	0	13
2	10°C,T Global	-11	8	<b>-79</b>	-2	-13	1	-81
3	10°C,T Global	9	8	<b>-72</b>	1	-12	1	-73
4	10°C,T Global	-2	2	<b>20</b>	0	3	1	21

### Omhullenden ongeacht stijl

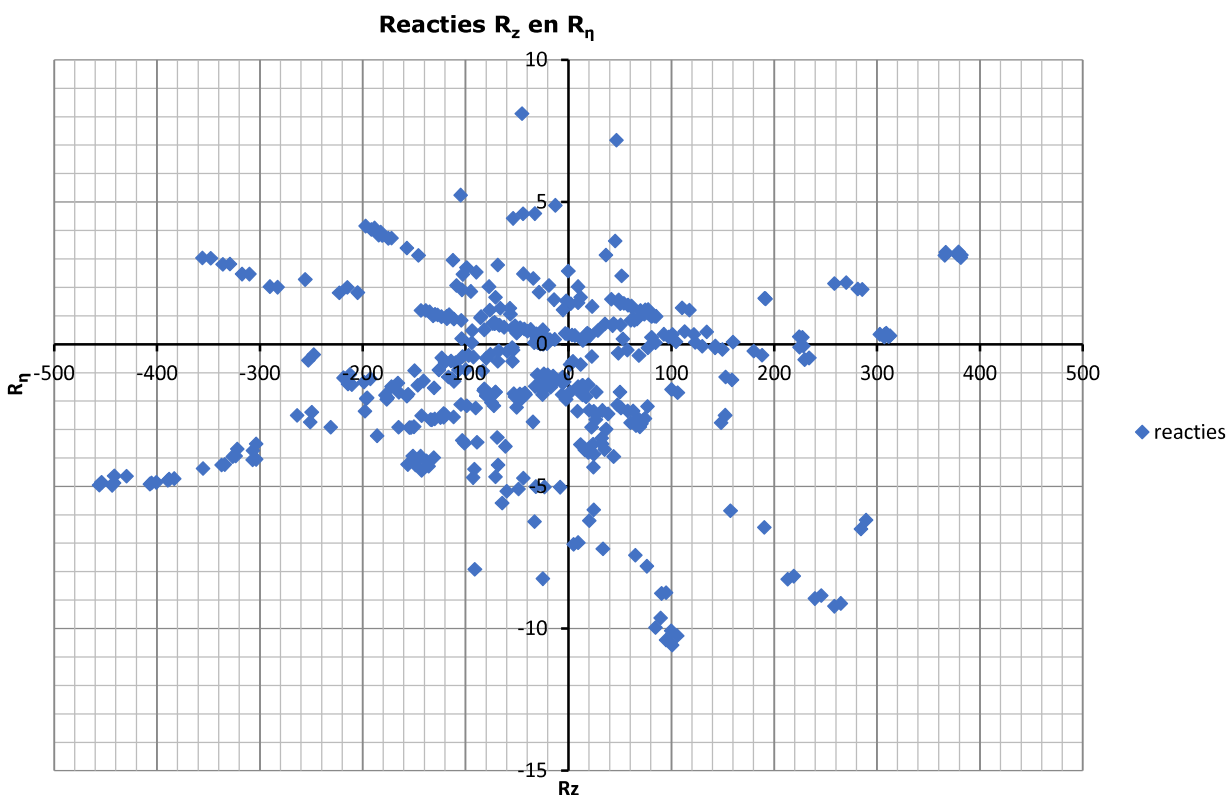
Belasting	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
Max. druk	ULS 30yr 1a W ZIII WLB,T NL+	-57	50	<b>-456</b>	-5	-76	4	-462
Max. trek	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-48	44	<b>382</b>	3	65	-5	387
Max. pos. torsie	ULS 30yr 5a Trsnl ZIII Br. 21 Ah,1	11	0	-45	<b>8</b>	-8	1	-46
Max. neg. torsie	ULS 30yr 3 W + I ZIII WRA,T NR-	20	5	101	<b>-11</b>	18	-2	102
Comb. trek+torsie	ULS 30yr 1a W ZIII 0.9 WLB,T NL	-48	44	<b>382</b>	<b>3</b>	65	-5	387

### Maximale drukbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WLA,T NR+	-18	-19	<b>-149</b>	-1	-27	3	-152
2	SeLS 1a W ZIII WLB,T NL+	-43	37	<b>-334</b>	-4	-56	3	-339
3	SeLS 1a W ZIII WRA,T NR-	32	29	<b>-256</b>	2	-43	3	-260
4	SeLS 1a W ZIII WRB,T NL-	19	-18	<b>-141</b>	-1	-26	4	-143

### Maximale trekbelasting SLS

Stijl	Combinatie	$R_x$ [kN]	$R_y$ [kN]	$R_z$ [kN]	$R_\eta$ [kN]	$R_\xi$ [kN]	$R_{\xi,lok}$ [kN]	$R_{z,lok}$ [kN]
1	SeLS 1a W ZIII WRA,T NR-	28	19	<b>190</b>	-6	33	-3	193
2	SeLS 1a W ZIII WRB,T NL-	10	-11	<b>77</b>	0	15	-3	79
3	SeLS 1a W ZIII WLA,T NR+	-11	-11	<b>85</b>	0	15	-2	86
4	SeLS 1a W ZIII WLB,T NL+	-34	31	<b>270</b>	2	46	-3	274



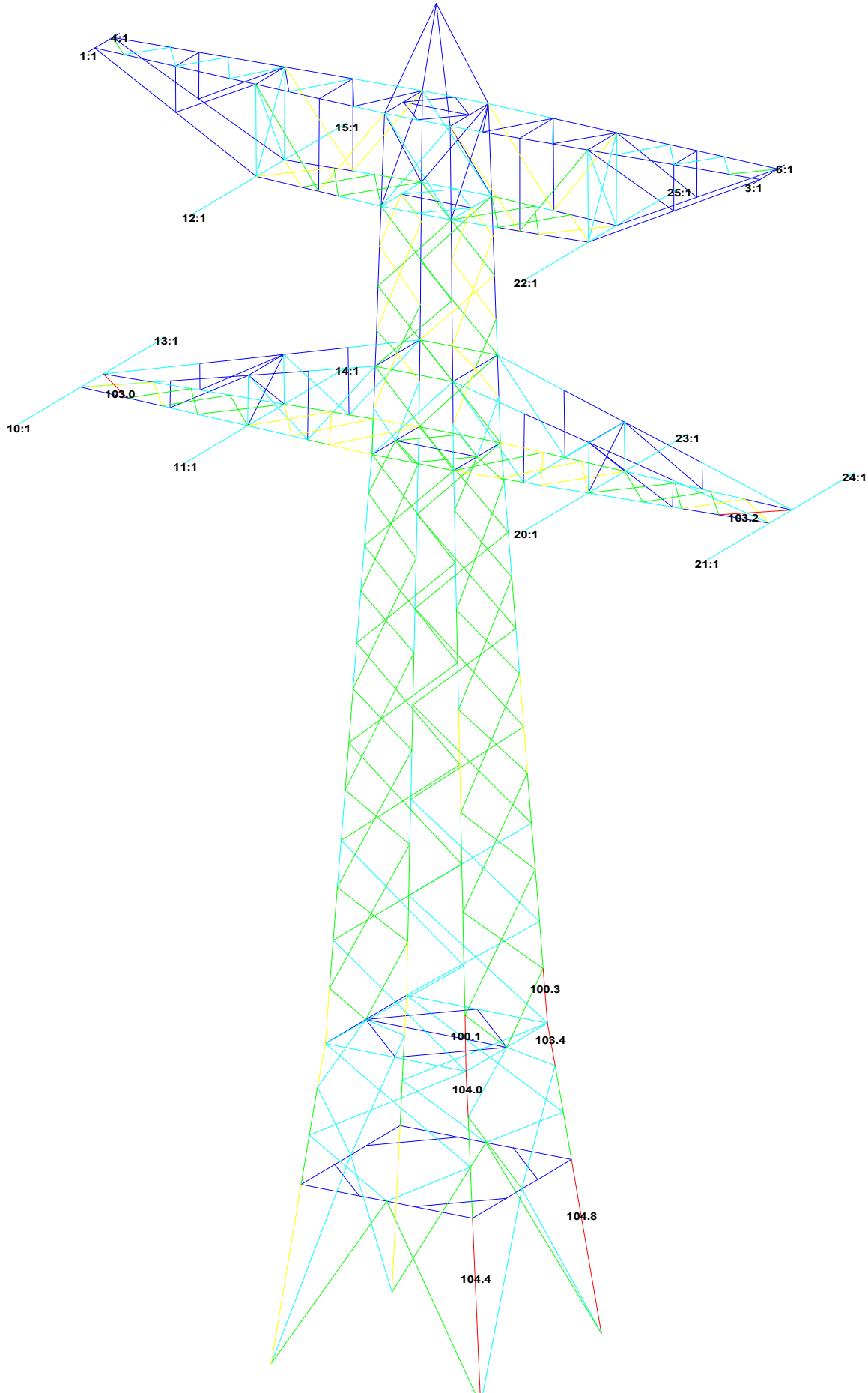


## **APPENDIX B**

### **PLS-TOWER OUTPUT**

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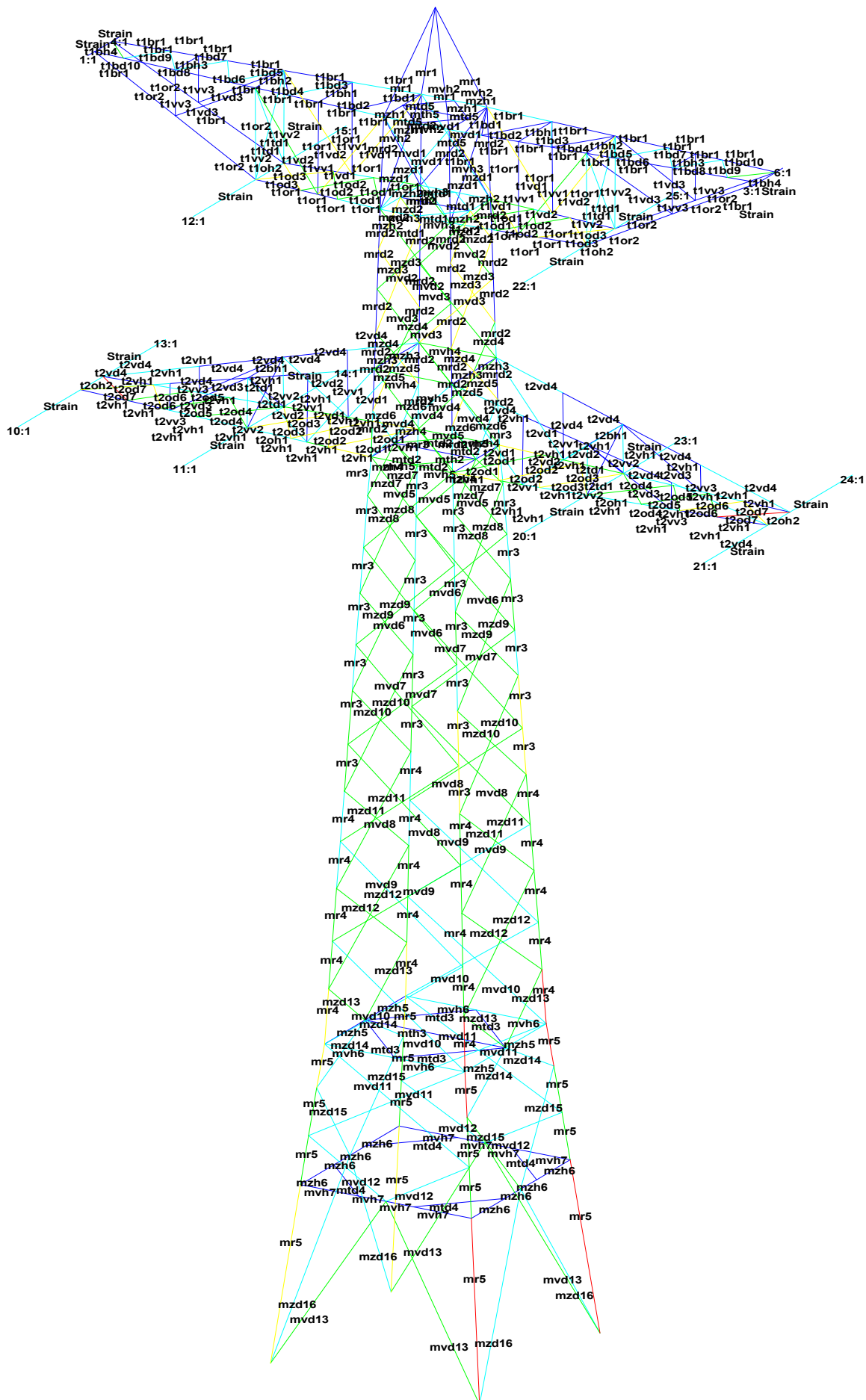
The results for tower type A, D+3.6 and D+0 are included. Results for tower 91 and 92 are combined, based on governing tower location 92.



% Usage Legend

Blue	0 ≤ % < 25
Cyan	25 ≤ % < 50
Green	50 ≤ % < 75
Yellow	75 ≤ % < 100
Red	100 ≤ %

1 (m)







**Toetsing initiële constructie afkeurniveau**

Datum: 30-7-2021  
 Auteur: SSHD  
 Versie: 1.0

GT-ZBH150  
 Mast 24

Staadgroep	Omschrijving	Profiel	Staalsoort	Bruten	RLX	RLY	RLZ	Slabheid	Druk Combinatie gruit	Knik	Afsluiting	Stuik (gruit)	U.C. (gruit)	Overschrijding gruit	Trek	Combinatie trek	Nettoed.	Afschrijf	Stuik (trek)	U.C. (trek)	Overschrijding trek	UC
mid3	mid3	60x60x5	S235	1920x56t	1,00	1,00	1,00	270	-11,4 ULS 18_0_9_75	231	58,3	54,0	54,0	4,2	U.S. 18_0_9_105	54,7	54,7	56,8	27,7	0,05	0,05	0,05
mid11	mid11	90x90x8	S235	2122x56t	0,53	0,53	0,53	134	-63,0 SPS 3_0_0_Ba C2	131,7	145,4	190,1	190,1	50,0	SP.S 3_0_0_Ba C1	155,3	155,3	145,4	140,8	0,36	0,36	0,48
mid12	mid12	90x90x8	S235	2122x56t	1,00	1,00	1,00	130	-57,4 SPS 3_0_0_Ba C1	130,0	145,4	186,1	186,1	62,7	SP.S 3_0_0_Ba C2	154,3	154,3	145,4	140,8	0,54	0,54	0,51
mid6	mid6	70x70x7	S235	1922x56t	2,30	1,76	1,20	163	-3,9 SPS 18_0_9_75 Ba All Cts	60,2	72,7	83,2	83,2	3,4	U.S. 18_0_9_135	92,7	92,7	72,7	73,4	0,05	0,05	0,06
mid7	mid7	70x70x7	S235	1922x56t	2,30	1,76	1,20	163	0,0 U.S. 18_0	60,2	72,7	83,2	83,2	11,4	SP.S 3_0_0_Ah Cts	92,7	92,7	72,7	73,4	0,15	0,15	0,15
mid16	mid16	100x100x10	S235	2124x56t	0,33	0,33	0,33	86	-84,6 SPS 3_0_0_Ba C1	272,4	169,4	259,2	259,2	72,3	SP.S 3_0_0_90_Ba C2	202,3	202,3	169,4	172,2	0,43	0,43	0,50
mid13	mid13	100x100x10	S235	2122x56t	0,33	0,33	0,33	86	-79,6 SPS 08_75_Ah_C1_Ba 10	272,4	145,4	237,6	237,6	73,6	SP.S 3_0_0_90_Ba C2	217,7	217,7	145,4	176,0	0,31	0,31	0,25







**Toetsing versterkte constructie afkeurniveau**

Datum: 30-7-2021  
 Auteur: SSHD  
 Versie: 1.0

**GT-ZBH150**  
**A**  
**Mast 24**

Stafgroep	Onschrijving	Profiel	Staalboort	Buiten	RLX	RLY	RLZ	Slankheid	Drnk	Combinatie	drnk	U.C. (drnk)	Opm.	Trnk	Combinatie	trek	Nettoedn.	Alechuif	Stuik (trek)	U.C. (trek)
L2od1	70x70x7	S235	1M16-5,6t	1M16-5,6t	0,50	0,50	0,50	86	-28,6	SPLS 6a_75 Ah All Cts	106,7	37,7	60,5	37,7	104,8	37,7	44,8	37,7	44,8	0,74
L2od6	60x60x5	S235	1M16-5,6t	1M16-5,6t	0,50	0,50	0,50	66	-24,0	SPLS 6a_75 Ah All Cts	72,3	37,7	43,2	37,7	60,5	37,7	32,0	37,7	32,0	0,80
L2od2	120x80x10	S235	2M16-8,8t	2M16-8,8t	1,00	1,00	1,00	59	0,0		328,9	120,6	172,8	0,00	383,9	120,6	0,0	120,6	0,32	
L2od7	70x70x7	S235	1M16-8,8t	1M16-8,8t	0,50	0,50	0,50	72	-36,7	SPLS 6a_75 Ah All Cts	170,0	60,3	82,3	0,61	115,2	60,3	61,0	60,3	61,0	0,55
L2od5	60x60x5	S235	1M16-5,6t	1M16-5,6t	0,50	0,50	0,50	52	-22,1	SPLS 6a_75 Ah All Cts	70,5	37,7	43,2	0,59	60,5	37,7	32,0	37,7	32,0	0,70
mz3	mz3	S235	3M22-5,6t	3M22-5,6t	2,00	1,00	1,00	52	-49,0	SPLS 1a_0_9_75 Ba All Cts	735,1	546,7	735,1	0,79	750,9	546,7	1029,6	546,7	1029,6	0,68
mz7	140x140x13#	S235	3M22-5,6t	3M22-5,6t	2,00	1,00	1,00	52	-49,0	SPLS 1a_0_9_75 Ba All Cts	735,1	546,7	735,1	0,79	750,9	546,7	1029,6	546,7	1029,6	0,68
mz8	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	88	-12,8	SPLS 3_0_9_90 Ah C11	178,4	218,2	285,1	0,72	207,0	218,2	211,2	218,2	211,2	0,62
mz9	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	102	-10,3	SPLS 3_0_9_90 Ah C11	172,8	218,2	285,1	0,59	184,0	218,2	211,2	218,2	211,2	0,57
mzd9	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	104	-10,4	SPLS 3_0_9_90 Ba C11	170,4	218,2	285,1	0,62	207,0	218,2	211,2	218,2	211,2	0,54
mzd7	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	109	-9,4	SPLS 3_0_9_90 Ba C11	163,3	145,4	190,1	0,62	189,8	145,4	140,8	145,4	140,8	0,62
mzd10	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	111	-9,6	SPLS 3_0_9_90 Ah C11	160,3	145,4	190,1	0,62	184,0	145,4	140,8	145,4	140,8	0,53
mzd8	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,52	0,52	0,52	112	-7,6	SPLS 3_0_9_90 Ba C11	159,3	145,4	190,1	0,53	189,8	145,4	140,8	145,4	140,8	0,56
mz4	150x150x14	S235	6M22-8,8t	6M22-8,8t	2,00	1,00	1,00	57	-58,6	SPLS 3_105 Ah All Cts	915,8	940,8	1390,6	0,72	966,2	930,8	1390,6	930,8	1390,6	0,60
mz11	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	119	-6,6	SPLS 3_0_9_90 Ba C11	145,4	145,4	190,1	0,57	145,4	145,4	140,8	145,4	140,8	0,52
mz12	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	123	-8,2	SPLS 3_0_9_90 Ah C11	150,2	145,4	190,1	0,57	155,3	145,4	140,8	145,4	140,8	0,52
mz12	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	139	-8,2	SPLS 3_0_9_90 Ah C11	144,5	145,4	190,1	0,57	155,3	145,4	140,8	145,4	140,8	0,56
mzd10	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,52	0,52	0,52	126	-7,8	SPLS 3_0_9_90 Ba C11	140,9	145,4	190,1	0,48	155,3	145,4	140,8	145,4	140,8	0,56
mzd13	90x90x8	S235	3M22-5,6t	3M22-5,6t	1,00	1,00	1,00	124	-7,4	SPLS 3_0_9_90 Ba C11	143,4	145,4	190,1	0,52	155,3	145,4	140,8	145,4	140,8	0,55
mth3	mth3	S235	3M22-5,6t	3M22-5,6t	1,00	1,00	1,00	296	-0,1	SPLS 1a_0_9_75 Ba All Cts	19,0	58,8	64,8	0,01	65,7	58,8	33,3	58,8	33,3	0,00
mzd14	90x90x8	S235	3M22-5,6t	3M22-5,6t	1,00	1,00	1,00	125	-5,3	SPLS 3_0_9_90 Ba C11	142,0	145,4	190,1	0,39	224,3	145,4	140,8	145,4	140,8	0,44
mz5	150x150x14	S235	6M22-8,8t	6M22-8,8t	2,00	1,00	1,00	45	-60,5	SPLS 1a_0_9_75 Ba All Cts	959,9	940,8	1390,6	0,70	966,2	930,8	1390,6	930,8	1390,6	0,62
mz15	90x90x8	S235	3M22-5,6t	3M22-5,6t	2,00	1,00	1,00	133	-5,4	SPLS 3_0_9_90 Ah All Cts	126,2	145,4	190,1	0,28	241,5	145,4	140,8	145,4	140,8	0,21
mz15	90x90x8	S235	3M22-5,6t	3M22-5,6t	2,00	1,00	1,00	133	-5,4	SPLS 3_0_9_90 Ah All Cts	126,2	145,4	190,1	0,28	241,5	145,4	140,8	145,4	140,8	0,21
mz13	60x60x5	S235	1M20-5,6t	1M20-5,6t	1,00	1,00	1,00	220	-1,4	ULS 1a_0_9_105	23,1	58,8	54,0	0,06	54,7	58,8	27,7	58,8	27,7	0,05
mzd11	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,53	0,53	0,53	134	-6,3	SPLS 3_0_9_90 Ba C11	131,7	145,4	190,1	0,48	155,3	145,4	140,8	145,4	140,8	0,36
mzd15	90x90x8	S235	3M22-5,6t	3M22-5,6t	0,50	0,50	0,50	110	-7,4	SPLS 3_0_9_90 Ba C11	153,0	145,4	190,1	0,51	155,3	145,4	140,8	145,4	140,8	0,45
mzd12	90x90x8	S235	3M22-5,6t	3M22-5,6t	1,00	1,00	1,00	135	-5,6	SPLS 3_0_9_90 Ba C11	130,7	145,4	190,1	0,43	155,3	145,4	140,8	145,4	140,8	0,34
mz16	mz16	S235	3M22-5,6t	3M22-5,6t	2,30	1,76	1,20	163	-3,8	SPLS 1a_0_9_135	60,2	72,7	83,2	0,06	92,7	72,7	73,4	72,7	73,4	0,05
mz17	70x70x7	S235	3M22-5,6t	3M22-5,6t	2,30	1,76	1,20	163	0,0		60,2	72,7	83,2	0,00	92,7	72,7	73,4	72,7	73,4	0,05
mz4	60x60x5	S235	3M22-5,6t	3M22-5,6t	1,00	1,00	1,00	182	-1,4	ULS 1a_0	30,1	58,8	54,0	0,04	54,7	58,8	27,7	58,8	27,7	0,03
mz6	100x100x10	S235	3M22-5,6t	3M22-5,6t	0,33	0,33	0,33	86	-9,4	SPLS 3_0_9_90 Ba C11	232,4	145,4	237,6	0,55	217,7	145,4	174,0	145,4	174,0	0,51
mzd13	100x100x10	S235	3M22-5,6t	3M22-5,6t	0,33	0,33	0,33	86	-7,9	SPLS 6a_75 Ah C11 Ba	272,4	145,4	237,6	0,55	217,7	145,4	174,0	145,4	174,0	0,51



Toetsing versterkte constructieonderdelen verbouwniveau

Datum: 30-7-2021
Auteur: SSHD
Versie: 1.0

GT-ZBH150
A
Mast 24

Table with columns: Staafgroep, Omschrijving, Profiel, Bouten, Staafboort, RLX, RLY, RLZ, Slankheid, Druk, Afschrijving, Stuk (druk), U.C. (druk), Opm., Trek, Combinatie, Nettoopp., Afrechuif, Stuk (trek), U.C. (trek). Contains detailed technical data for various steel components.

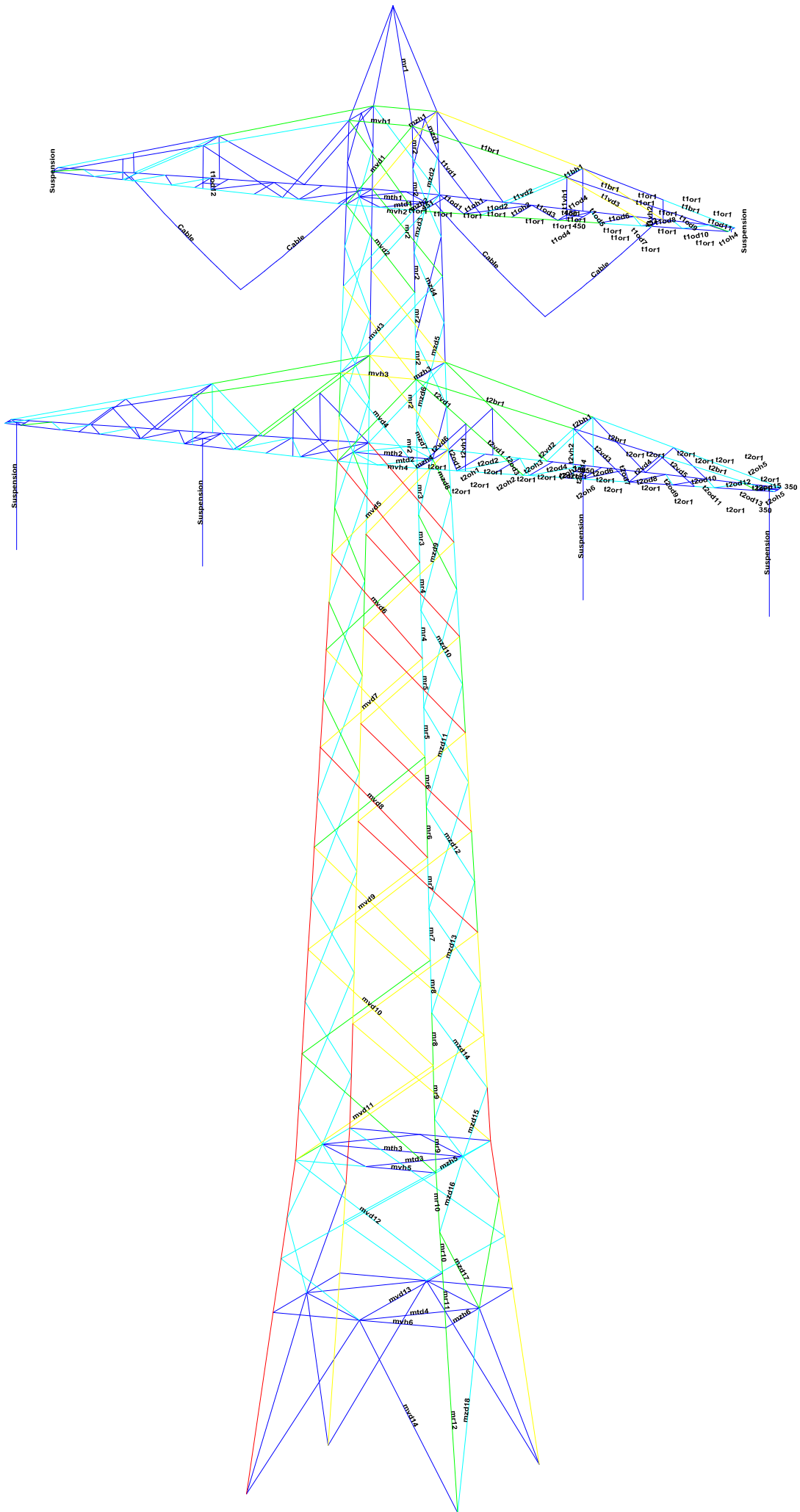


**Toetsing versterkte constructieonderdelen verbouwniveau**

Datum: 30-7-2021  
 Auteur: SSHD  
 Versie: 1.0

**GT-ZBH150**  
**A**  
**Mast 24**

Stafgroep	Omschrijving	Profiel	Bouten	Staalsoort	RLX	RLY	RLZ	Slankheid	Druk	Combinatie	Knik	Afschuiving	Stuik	(druk)	U.C.	(druk)	Opm.	Trek	Combinatie	Netto	Netto	Afschuif	Stuik	(trek)	U.C.	(trek)
t2od2	70x70x7	S235	1M16-5.6t	S235	0.50	0.50	0.50	79	-32.4	SPLS 6a_75 Ah Ct2 Ba	110.5	37.7	60.5	0.86	37.7	44.8		32.2	SPLS 6a_75 Ah Ct1 Ba	104.8	37.7	44.8	0.86			
t2od1	70x70x7	S235	1M16-5.6t	S235	0.50	0.50	0.50	86	-29.4	SPLS 6a_75 Ah All Cts	106.7	37.7	60.5	0.78	37.7	44.8		26.6	SPLS 6a_75 Ah All Cts	104.8	37.7	44.8	0.78			
t2od6	60x60x5	S235	1M16-5.6t	S235	0.50	0.50	0.50	66	-24.4	SPLS 6a_75 Ah All Cts	72.3	43.2	43.2	0.65	32.0	32.0		26.0	SPLS 6a_75 Ah All Cts	60.5	37.7	32.0	0.81			
t2od2	120x80x10	S235	2M16-8.8t	S235	1.00	1.00	1.00	59	0.0		328.9	120.6	172.8	0.00	6.0	6.0		41.6	ULS 3_90	383.9	120.6	6.0	0.35			
t2od7	70x70x7	S235	1M16-8.8t	S235	0.50	0.50	0.50	61	-37.5	SPLS 6a_75 Ah All Cts	170.0	60.3	82.3	0.62	61.0	61.0		33.6	SPLS 6a_75 Ah Ct2 Ba	152.2	60.3	61.0	0.56			
t2od5	120x80x10	S235	2M16-8.8t	S235	1.00	1.00	1.00	57	0.0		328.9	120.6	172.8	0.00	6.0	6.0		41.6	ULS 3_90	383.9	120.6	6.0	0.35			
t2od5	140x140x13#	S235	3M22-5.6t	S235	2.00	2.00	2.00	52	-44.5	SPLS 3_90 Ba All Cts	733.3	566.7	1285.5	0.83	70.9	70.9		364.9	SPLS 3_90 Ba All Cts	709.9	566.7	70.9	0.71			
mzd7	90x90x8	S235	3M22-5.6t	S235	1.00	1.00	1.00	82	-131.8	SPLS 3_90 Ah Ct1	203.2	218.2	285.1	0.65	211.2	211.2		131.5	SPLS 3_90 Ah Ct2	207.0	218.2	211.2	0.64			
mzd8	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	98	-132.8	SPLS 3_90 Ah Ct2	178.4	218.2	285.1	0.74	211.2	211.2		132.2	SPLS 3_90 Ah Ct1	207.0	218.2	211.2	0.64			
mzd6	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	102	-104.0	SPLS 6a_75 Ah Ct2 Ba	172.8	218.2	285.1	0.60	211.2	211.2		107.9	SPLS 6a_75 Ah Ct1 Ba	184.0	218.2	211.2	0.59			
mzd9	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	104	-113.7	SPLS 3_90 Ah Ct1	170.4	218.2	285.1	0.67	211.2	211.2		114.4	SPLS 3_90 Ah Ct2	207.0	218.2	211.2	0.55			
mzd7	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	109	-92.8	SPLS 6a_75 Ah Ct1 Ba	163.3	145.4	190.1	0.64	140.8	140.8		89.7	SPLS 6a_75 Ah Ct2 Ba	189.8	145.4	140.8	0.64			
mzd10	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	111	-102.8	SPLS 3_90 Ah Ct2	160.3	218.2	285.1	0.64	211.2	211.2		100.8	SPLS 3_90 Ah Ct1	184.0	218.2	244.2	0.55			
mzd8	90x90x8	S235	3M22-5.6t	S235	0.52	0.52	0.52	117	-64.2	SPLS 3_90 Ah Ct1	135.4	145.4	190.1	0.54	130.8	130.8		58.6	SPLS 6a_75 Ah Ct2 Ba	166.5	145.4	130.8	0.58			
mzd11	150x150x14	S235	6M22-5.6t	S235	2.00	2.00	2.00	157	-80.9	SPLS 3_90 Ba All Cts	813.8	936.7	1300.1	0.61	907.8	907.8		531.6	SPLS 3_90 Ah Ct1	866.5	936.7	907.8	0.54			
mzd11	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	116	-88.9	SPLS 3_90 Ba Ct1	154.1	145.4	190.1	0.61	140.8	140.8		90.7	SPLS 3_90 Ah Ct2	155.3	145.4	140.8	0.64			
mzd9	90x90x8	S235	3M22-5.6t	S235	0.52	0.52	0.52	119	-74.1	SPLS 3_90 Ba Ct2	150.2	145.4	190.1	0.51	145.4	145.4		71.8	SPLS 3_90 Ah Ct1	189.8	145.4	140.8	0.52			
mzd12	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	123	-84.8	SPLS 3_90 Ah Ct2	144.5	145.4	190.1	0.59	145.4	145.4		81.5	SPLS 3_90 Ah Ct1	155.3	145.4	140.8	0.58			
mzd10	90x90x8	S235	3M22-5.6t	S235	0.52	0.52	0.52	126	-69.4	SPLS 3_90 Ba Ct1	140.9	145.4	190.1	0.49	140.8	140.8		68.6	SPLS 3_90 Ah Ct2	189.8	145.4	140.8	0.49			
mzd13	90x90x8	S235	3M22-5.6t	S235	1.00	1.00	1.00	124	-76.5	SPLS 3_90 Ba Ct1	143.4	145.4	190.1	0.53	145.4	145.4		80.1	SPLS 3_90 Ah Ct2	155.3	145.4	140.8	0.57			
mzd14	65x65x6	S235	1M20-5.6t	S235	1.00	1.00	1.00	296	-60.1	SPLS 1a_09 Ba Ct2	19.0	58.8	64.8	0.01	58.8	58.8		0.0	ULS 3_09 Ba Ct1	65.7	58.8	33.3	0.00			
mzd14	150x150x14	S235	6M22-5.6t	S235	2.00	2.00	2.00	128	-56.3	SPLS 3_90 Ba Ct2	852.0	954.4	1301.1	0.40	870.8	870.8		62.9	SPLS 3_90 Ba Ct1	864.3	954.4	870.8	0.45			
mzd5	90x90x8	S235	3M22-5.6t	S235	1.00	1.00	1.00	133	-36.2	SPLS 3_90 Ba All Cts	126.2	145.4	190.1	0.29	140.8	140.8		50.4	SPLS 3_90 Ba All Cts	130.8	145.4	130.8	0.29			
mzd5	90x90x8	S235	3M22-5.6t	S235	2.00	2.00	2.00	133	-36.2	SPLS 3_90 Ba All Cts	126.2	145.4	190.1	0.29	140.8	140.8		50.4	SPLS 3_90 Ba All Cts	130.8	145.4	130.8	0.29			
mzd6	90x90x8	S235	3M22-5.6t	S235	2.00	2.00	2.00	133	-36.2	SPLS 3_90 Ba All Cts	126.2	145.4	190.1	0.29	140.8	140.8		50.4	SPLS 3_90 Ba All Cts	130.8	145.4	130.8	0.29			
mzd3	60x60x5	S235	1M20-5.6t	S235	1.00	1.00	1.00	220	-14.6	SPLS 1a_09_0_75	23.1	58.8	64.8	0.07	27.7	27.7		1.7	ULS 1a_09_0_105	241.5	58.8	27.7	0.06			
mzd11	90x90x8	S235	3M22-5.6t	S235	0.53	0.53	0.53	134	-64.8	SPLS 3_90 Ba Ct2	131.7	145.4	190.1	0.49	140.8	140.8		51.5	SPLS 6a_75 Ah Ct1 Ba	155.3	145.4	140.8	0.37			
mzd15	90x90x8	S235	3M22-5.6t	S235	1.00	1.00	1.00	110	-76.0	SPLS 3_90 Ba Ct1	130.7	145.4	190.1	0.52	140.8	140.8		65.1	SPLS 3_90 Ah Ct2	224.3	145.4	140.8	0.46			
mzd12	90x90x8	S235	3M22-5.6t	S235	1.00	1.00	1.00	135	-58.4	SPLS 6a_75 Ah Ct1 Ba	130.7	145.4	190.1	0.45	140.8	140.8		48.9	SPLS 3_90 Ah Ct1	155.3	145.4	140.8	0.35			
mzd5	70x70x7	S235	1M22-5.6t	S235	2.30	1.76	1.20	163	-40.0	SPLS 1a_09_0_135	60.2	72.7	83.2	0.07	72.7	72.7		31.9	SPLS 1a_09_0_135	82.7	72.7	72.7	0.05			
mzd5	70x70x7	S235	1M22-5.6t	S235	2.30	1.76	1.20	163	-40.0	SPLS 1a_09_0_135	60.2	72.7	83.2	0.07	72.7	72.7		31.9	SPLS 1a_09_0_135	82.7	72.7	72.7	0.05			
mzd4	60x60x5	S235	1M20-5.6t	S235	1.00	1.00	1.00	183	-11.2	ULS 1a_0	30.1	58.8	64.8	0.04	58.8	58.8		1.1	ULS 1a_0	202.3	58.8	22.7	0.04			
mzd16	100x100x10	S235	3M24-5.6t	S235	0.33	0.33	0.33	86	-86.9	SPLS 3_90 Ba Ct1	272.4	169.4	237.6	0.51	177.2	177.2		73.9	SPLS 3_90 Ah Ct2	202.3	169.4	177.2	0.51			
mzd13	100x100x10	S235	3M22-5.6t	S235	0.33	0.33	0.33	86	-82.9	SPLS 6a_75 Ah Ct1 Ba	272.4	145.4	237.6	0.57	176.0	176.0		75.6	SPLS 3_90 Ah Ct2	217.7	145.4	176.0	0.52			



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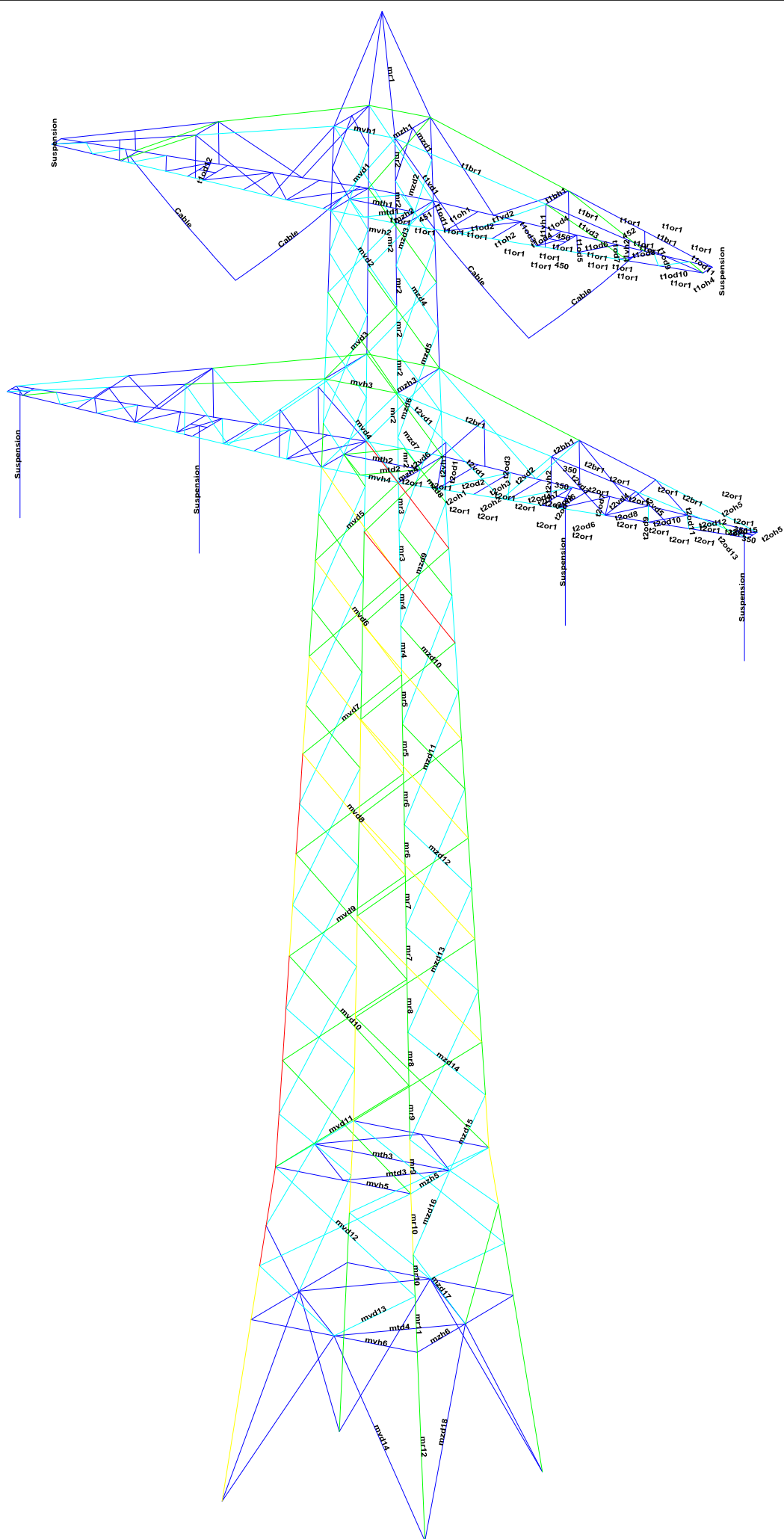




Assessment of groups for modified elements (verbouw level)

GT-ZBH150  
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Group Label	Description	Mod.1	Steel	plane	e1	e2	p1	U.C.	SLZ	SLZ	SLZ	Slenderness	Compression	Compression	Compression	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Comment	Tension	Tension	U.C. (Tens)	U.C. (Tens)	Comment
m2c		U10x04L10x10	S235		35	40	70	240	243	1,00	98	98	-293,9 ULS 300r 15 W ZHl WBA, T BR-	414,2	0,0	0,0	0,0	0,0	0,80	203,8 ULS 300r 15 W ZHl WBA, T BR-	728,5	0,0	0,0	0,36	
m2d		U10x04L10x10	S235		35	40	70	240	243	1,00	98	98	-293,9 ULS 300r 15 W ZHl WBA, T BR-	414,2	0,0	0,0	0,0	0,0	0,80	203,8 ULS 300r 15 W ZHl WBA, T BR-	728,5	0,0	0,0	0,36	
m3c		U10x04L10x10	S235		35	40	70	240	243	1,00	89	89	-309,5 ULS 300r 15 W ZHl WBA, T BR-	471,5	0,0	0,0	0,0	0,0	0,58	323,1 ULS 300r 15 W ZHl WBA, T BR-	932,4	0,0	0,0	0,35	
m3d		U10x04L10x10	S235		35	40	70	240	243	1,00	89	89	-309,5 ULS 300r 15 W ZHl WBA, T BR-	471,5	0,0	0,0	0,0	0,0	0,58	323,1 ULS 300r 15 W ZHl WBA, T BR-	932,4	0,0	0,0	0,35	
m4c		U10x04L10x10	S235		35	40	70	240	243	1,00	83	83	-447,4 ULS 300r 15 W ZHl WBA, T BR-	665,3	0,0	0,0	0,0	0,0	0,47	474,6 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,37	
m4d		U10x04L10x10	S235		35	40	70	240	243	1,00	83	83	-447,4 ULS 300r 15 W ZHl WBA, T BR-	665,3	0,0	0,0	0,0	0,0	0,47	474,6 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,37	
m4e		U10x04L10x10	S235		35	40	70	240	240	1,00	86	86	-546,4 ULS 300r 15 W ZHl WBA, T BR-	647,9	0,0	0,0	0,0	0,0	0,44	464,2 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,47	
m4f		U10x04L10x10	S235		35	40	70	240	240	1,00	86	86	-546,4 ULS 300r 15 W ZHl WBA, T BR-	647,9	0,0	0,0	0,0	0,0	0,44	464,2 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,47	
m5c		U10x04L10x10	S235		45	50	60	240	240	1,00	86	86	-597,9 ULS 300r 15 W ZHl WBA, T BR-	651,5	0,0	0,0	0,0	0,0	0,40	502,1 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,51	
m5d		U10x04L10x10	S235		45	50	60	240	240	1,00	86	86	-597,9 ULS 300r 15 W ZHl WBA, T BR-	651,5	0,0	0,0	0,0	0,0	0,40	502,1 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,51	
m5e		U10x04L10x10	S235		45	50	60	240	240	1,00	83	83	-590,9 ULS 300r 15 W ZHl WBA, T BR-	791,9	0,0	0,0	0,0	0,0	0,38	501,5 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,51	
m5f		U10x04L10x10	S235		45	50	60	240	240	1,00	83	83	-590,9 ULS 300r 15 W ZHl WBA, T BR-	791,9	0,0	0,0	0,0	0,0	0,38	501,5 ULS 300r 15 W ZHl WBA, T BR-	994,1	0,0	0,0	0,51	
m6c		U10x04L10x10	S355		30	30	30	0,52	0,52	0,52	185	185	-371,4 ULS 300r 15 W ZHl WBA, T BR-	391,5	148,3	148,3	148,3	148,3	0,94	491,6 ULS 300r 15 W ZHl WBA, T BR-	982,4	1420,6	1396,4	0,51	
m6d		U10x04L10x10	S355		30	30	30	0,52	0,52	0,52	185	185	-371,4 ULS 300r 15 W ZHl WBA, T BR-	391,5	148,3	148,3	148,3	148,3	0,94	491,6 ULS 300r 15 W ZHl WBA, T BR-	982,4	1420,6	1396,4	0,51	
m6e		U10x04L10x10	S355		30	30	30	0,52	0,52	0,52	139	139	-411,7 ULS 300r 15 W ZHl WBA, T BR-	424,1	188,2	188,2	188,2	188,2	0,71	427,9 ULS 300r 15 W ZHl WBA, T BR-	852,2	1882,2	1882,2	0,49	
m6f		U10x04L10x10	S355		30	30	30	0,52	0,52	0,52	144	144	-384,9 ULS 300r 15 W ZHl WBA, T BR-	424,1	188,2	188,2	188,2	188,2	0,71	427,9 ULS 300r 15 W ZHl WBA, T BR-	852,2	1882,2	1882,2	0,49	
m6g		U10x04L10x10	S355		30	30	30	0,52	0,52	0,52	150	150	-384,9 ULS 300r 15 W ZHl WBA, T BR-	352,6	188,2	188,2	188,2	188,2	0,66	348,8 ULS 300r 15 W ZHl WBA, T BR-	852,2	1882,2	1882,2	0,43	







Date 28-3-2022  
 Author TBR  
 Version v4.4

Assessment of groups for initial structure (afkeur level)

RSD-MDK150  
 D+0  
 84

Group Label	Description	Profile	Steel Quality	Belts	SKN/SP/nes	c1	e2	p1	RLX	RLY	RLZ	Slenderness	Compression (kN)	Load Case (Compression)	Buckling (Comp)	Bearing (Comp)	U.C. (Comp)	Comment (Comp)	Tension (kN)	Load Case (Tension)	Net Section Shear (Tens)	Shear (Tens)	U.C. (Tens)	Comment (Tens)	Total U.C. (with)
meas	meas	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,0	U.S.3007.18.W.2111.03.0864.F.N.B.	37,8	117,6	0,00	0,00	1,2	U.S.3007.18.W.2111.03.0864.F.N.B.	57,8	117,6	0,22	0,22	0,00
me18	me18	60x6x5	S235	2015-06-01	1	30	30	60	0,33	0,33	0,33	1,26	-4,6	U.S.3007.18.W.2111.03.0864.F.N.B.	82,9	75,4	12,10	0,00	1,6	U.S.3007.18.W.2111.03.0864.F.N.B.	102,1	75,4	0,22	0,22	0,00
me24	me24	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,4	U.S.3007.18.W.2111.03.0864.F.N.B.	183,9	184	0,11	0,00	2,4	U.S.3007.18.W.2111.03.0864.F.N.B.	121,9	177	0,22	0,22	0,11
me27	me27	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.S.3007.18.W.2111.03.0864.F.N.B.	183,9	184	0,11	0,00	2,4	U.S.3007.18.W.2111.03.0864.F.N.B.	121,9	177	0,22	0,22	0,11
me30	me30	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.S.3007.18.W.2111.03.0864.F.N.B.	42,5	0,0	0,0	0,00	0,0	U.S.3007.18.W.2111.03.0864.F.N.B.	56,9	0,0	0,00	0,00	0,00
me33	me33	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.S.3007.18.W.2111.03.0864.F.N.B.	103,9	37,7	0,00	0,00	2,4	U.S.3007.18.W.2111.03.0864.F.N.B.	84,1	37,7	0,22	0,22	0,00

Assessment of groups for modified structure (atkrue level)

BSI-MDK150

Group Label	Description	Profile	Steel	Rein.	h <sub>eff</sub>	h <sub>1</sub>	h <sub>2</sub>	h <sub>3</sub>	h <sub>4</sub>	h <sub>5</sub>	h <sub>6</sub>	h <sub>7</sub>	h <sub>8</sub>	h <sub>9</sub>	h <sub>10</sub>	h <sub>11</sub>	h <sub>12</sub>	h <sub>13</sub>	h <sub>14</sub>	h <sub>15</sub>	h <sub>16</sub>	h <sub>17</sub>	h <sub>18</sub>	h <sub>19</sub>	h <sub>20</sub>	h <sub>21</sub>	h <sub>22</sub>	h <sub>23</sub>	h <sub>24</sub>	h <sub>25</sub>	h <sub>26</sub>	h <sub>27</sub>	h <sub>28</sub>	h <sub>29</sub>	h <sub>30</sub>	h <sub>31</sub>	h <sub>32</sub>	h <sub>33</sub>	h <sub>34</sub>	h <sub>35</sub>	h <sub>36</sub>	h <sub>37</sub>	h <sub>38</sub>	h <sub>39</sub>	h <sub>40</sub>	h <sub>41</sub>	h <sub>42</sub>	h <sub>43</sub>	h <sub>44</sub>	h <sub>45</sub>	h <sub>46</sub>	h <sub>47</sub>	h <sub>48</sub>	h <sub>49</sub>	h <sub>50</sub>	h <sub>51</sub>	h <sub>52</sub>	h <sub>53</sub>	h <sub>54</sub>	h <sub>55</sub>	h <sub>56</sub>	h <sub>57</sub>	h <sub>58</sub>	h <sub>59</sub>	h <sub>60</sub>	h <sub>61</sub>	h <sub>62</sub>	h <sub>63</sub>	h <sub>64</sub>	h <sub>65</sub>	h <sub>66</sub>	h <sub>67</sub>	h <sub>68</sub>	h <sub>69</sub>	h <sub>70</sub>	h <sub>71</sub>	h <sub>72</sub>	h <sub>73</sub>	h <sub>74</sub>	h <sub>75</sub>	h <sub>76</sub>	h <sub>77</sub>	h <sub>78</sub>	h <sub>79</sub>	h <sub>80</sub>	h <sub>81</sub>	h <sub>82</sub>	h <sub>83</sub>	h <sub>84</sub>	h <sub>85</sub>	h <sub>86</sub>	h <sub>87</sub>	h <sub>88</sub>	h <sub>89</sub>	h <sub>90</sub>	h <sub>91</sub>	h <sub>92</sub>	h <sub>93</sub>	h <sub>94</sub>	h <sub>95</sub>	h <sub>96</sub>	h <sub>97</sub>	h <sub>98</sub>	h <sub>99</sub>	h <sub>100</sub>	h <sub>101</sub>	h <sub>102</sub>	h <sub>103</sub>	h <sub>104</sub>	h <sub>105</sub>	h <sub>106</sub>	h <sub>107</sub>	h <sub>108</sub>	h <sub>109</sub>	h <sub>110</sub>	h <sub>111</sub>	h <sub>112</sub>	h <sub>113</sub>	h <sub>114</sub>	h <sub>115</sub>	h <sub>116</sub>	h <sub>117</sub>	h <sub>118</sub>	h <sub>119</sub>	h <sub>120</sub>	h <sub>121</sub>	h <sub>122</sub>	h <sub>123</sub>	h <sub>124</sub>	h <sub>125</sub>	h <sub>126</sub>	h <sub>127</sub>	h <sub>128</sub>	h <sub>129</sub>	h <sub>130</sub>	h <sub>131</sub>	h <sub>132</sub>	h <sub>133</sub>	h <sub>134</sub>	h <sub>135</sub>	h <sub>136</sub>	h <sub>137</sub>	h <sub>138</sub>	h <sub>139</sub>	h <sub>140</sub>	h <sub>141</sub>	h <sub>142</sub>	h <sub>143</sub>	h <sub>144</sub>	h <sub>145</sub>	h <sub>146</sub>	h <sub>147</sub>	h <sub>148</sub>	h <sub>149</sub>	h <sub>150</sub>	h <sub>151</sub>	h <sub>152</sub>	h <sub>153</sub>	h <sub>154</sub>	h <sub>155</sub>	h <sub>156</sub>	h <sub>157</sub>	h <sub>158</sub>	h <sub>159</sub>	h <sub>160</sub>	h <sub>161</sub>	h <sub>162</sub>	h <sub>163</sub>	h <sub>164</sub>	h <sub>165</sub>	h <sub>166</sub>	h <sub>167</sub>	h <sub>168</sub>	h <sub>169</sub>	h <sub>170</sub>	h <sub>171</sub>	h <sub>172</sub>	h <sub>173</sub>	h <sub>174</sub>	h <sub>175</sub>	h <sub>176</sub>	h <sub>177</sub>	h <sub>178</sub>	h <sub>179</sub>	h <sub>180</sub>	h <sub>181</sub>	h <sub>182</sub>	h <sub>183</sub>	h <sub>184</sub>	h <sub>185</sub>	h <sub>186</sub>	h <sub>187</sub>	h <sub>188</sub>	h <sub>189</sub>	h <sub>190</sub>	h <sub>191</sub>	h <sub>192</sub>	h <sub>193</sub>	h <sub>194</sub>	h <sub>195</sub>	h <sub>196</sub>	h <sub>197</sub>	h <sub>198</sub>	h <sub>199</sub>	h <sub>200</sub>	h <sub>201</sub>	h <sub>202</sub>	h <sub>203</sub>	h <sub>204</sub>	h <sub>205</sub>	h <sub>206</sub>	h <sub>207</sub>	h <sub>208</sub>	h <sub>209</sub>	h <sub>210</sub>	h <sub>211</sub>	h <sub>212</sub>	h <sub>213</sub>	h <sub>214</sub>	h <sub>215</sub>	h <sub>216</sub>	h <sub>217</sub>	h <sub>218</sub>	h <sub>219</sub>	h <sub>220</sub>	h <sub>221</sub>	h <sub>222</sub>	h <sub>223</sub>	h <sub>224</sub>	h <sub>225</sub>	h <sub>226</sub>	h <sub>227</sub>	h <sub>228</sub>	h <sub>229</sub>	h <sub>230</sub>	h <sub>231</sub>	h <sub>232</sub>	h <sub>233</sub>	h <sub>234</sub>	h <sub>235</sub>	h <sub>236</sub>	h <sub>237</sub>	h <sub>238</sub>	h <sub>239</sub>	h <sub>240</sub>	h <sub>241</sub>	h <sub>242</sub>	h <sub>243</sub>	h <sub>244</sub>	h <sub>245</sub>	h <sub>246</sub>	h <sub>247</sub>	h <sub>248</sub>	h <sub>249</sub>	h <sub>250</sub>	h <sub>251</sub>	h <sub>252</sub>	h <sub>253</sub>	h <sub>254</sub>	h <sub>255</sub>	h <sub>256</sub>	h <sub>257</sub>	h <sub>258</sub>	h <sub>259</sub>	h <sub>260</sub>	h <sub>261</sub>	h <sub>262</sub>	h <sub>263</sub>	h <sub>264</sub>	h <sub>265</sub>	h <sub>266</sub>	h <sub>267</sub>	h <sub>268</sub>	h <sub>269</sub>	h <sub>270</sub>	h <sub>271</sub>	h <sub>272</sub>	h <sub>273</sub>	h <sub>274</sub>	h <sub>275</sub>	h <sub>276</sub>	h <sub>277</sub>	h <sub>278</sub>	h <sub>279</sub>	h <sub>280</sub>	h <sub>281</sub>	h <sub>282</sub>	h <sub>283</sub>	h <sub>284</sub>	h <sub>285</sub>	h <sub>286</sub>	h <sub>287</sub>	h <sub>288</sub>	h <sub>289</sub>	h <sub>290</sub>	h <sub>291</sub>	h <sub>292</sub>	h <sub>293</sub>	h <sub>294</sub>	h <sub>295</sub>	h <sub>296</sub>	h <sub>297</sub>	h <sub>298</sub>	h <sub>299</sub>	h <sub>300</sub>	h <sub>301</sub>	h <sub>302</sub>	h <sub>303</sub>	h <sub>304</sub>	h <sub>305</sub>	h <sub>306</sub>	h <sub>307</sub>	h <sub>308</sub>	h <sub>309</sub>	h <sub>310</sub>	h <sub>311</sub>	h <sub>312</sub>	h <sub>313</sub>	h <sub>314</sub>	h <sub>315</sub>	h <sub>316</sub>	h <sub>317</sub>	h <sub>318</sub>	h <sub>319</sub>	h <sub>320</sub>	h <sub>321</sub>	h <sub>322</sub>	h <sub>323</sub>	h <sub>324</sub>	h <sub>325</sub>	h <sub>326</sub>	h <sub>327</sub>	h <sub>328</sub>	h <sub>329</sub>	h <sub>330</sub>	h <sub>331</sub>	h <sub>332</sub>	h <sub>333</sub>	h <sub>334</sub>	h <sub>335</sub>	h <sub>336</sub>	h <sub>337</sub>	h <sub>338</sub>	h <sub>339</sub>	h <sub>340</sub>	h <sub>341</sub>	h <sub>342</sub>	h <sub>343</sub>	h <sub>344</sub>	h <sub>345</sub>	h <sub>346</sub>	h <sub>347</sub>	h <sub>348</sub>	h <sub>349</sub>	h <sub>350</sub>	h <sub>351</sub>	h <sub>352</sub>	h <sub>353</sub>	h <sub>354</sub>	h <sub>355</sub>	h <sub>356</sub>	h <sub>357</sub>	h <sub>358</sub>	h <sub>359</sub>	h <sub>360</sub>	h <sub>361</sub>	h <sub>362</sub>	h <sub>363</sub>	h <sub>364</sub>	h <sub>365</sub>	h <sub>366</sub>	h <sub>367</sub>	h <sub>368</sub>	h <sub>369</sub>	h <sub>370</sub>	h <sub>371</sub>	h <sub>372</sub>	h <sub>373</sub>	h <sub>374</sub>	h <sub>375</sub>	h <sub>376</sub>	h <sub>377</sub>	h <sub>378</sub>	h <sub>379</sub>	h <sub>380</sub>	h <sub>381</sub>	h <sub>382</sub>	h <sub>383</sub>	h <sub>384</sub>	h <sub>385</sub>	h <sub>386</sub>	h <sub>387</sub>	h <sub>388</sub>	h <sub>389</sub>	h <sub>390</sub>	h <sub>391</sub>	h <sub>392</sub>	h <sub>393</sub>	h <sub>394</sub>	h <sub>395</sub>	h <sub>396</sub>	h <sub>397</sub>	h <sub>398</sub>	h <sub>399</sub>	h <sub>400</sub>	h <sub>401</sub>	h <sub>402</sub>	h <sub>403</sub>	h <sub>404</sub>	h <sub>405</sub>	h <sub>406</sub>	h <sub>407</sub>	h <sub>408</sub>	h <sub>409</sub>	h <sub>410</sub>	h <sub>411</sub>	h <sub>412</sub>	h <sub>413</sub>	h <sub>414</sub>	h <sub>415</sub>	h <sub>416</sub>	h <sub>417</sub>	h <sub>418</sub>	h <sub>419</sub>	h <sub>420</sub>	h <sub>421</sub>	h <sub>422</sub>	h <sub>423</sub>	h <sub>424</sub>	h <sub>425</sub>	h <sub>426</sub>	h <sub>427</sub>	h <sub>428</sub>	h <sub>429</sub>	h <sub>430</sub>	h <sub>431</sub>	h <sub>432</sub>	h <sub>433</sub>	h <sub>434</sub>	h <sub>435</sub>	h <sub>436</sub>	h <sub>437</sub>	h <sub>438</sub>	h <sub>439</sub>	h <sub>440</sub>	h <sub>441</sub>	h <sub>442</sub>	h <sub>443</sub>	h <sub>444</sub>	h <sub>445</sub>	h <sub>446</sub>	h <sub>447</sub>	h <sub>448</sub>	h <sub>449</sub>	h <sub>450</sub>	h <sub>451</sub>	h <sub>452</sub>	h <sub>453</sub>	h <sub>454</sub>	h <sub>455</sub>	h <sub>456</sub>	h <sub>457</sub>	h <sub>458</sub>	h <sub>459</sub>	h <sub>460</sub>	h <sub>461</sub>	h <sub>462</sub>	h <sub>463</sub>	h <sub>464</sub>	h <sub>465</sub>	h <sub>466</sub>	h <sub>467</sub>	h <sub>468</sub>	h <sub>469</sub>	h <sub>470</sub>	h <sub>471</sub>	h <sub>472</sub>	h <sub>473</sub>	h <sub>474</sub>	h <sub>475</sub>	h <sub>476</sub>	h <sub>477</sub>	h <sub>478</sub>	h <sub>479</sub>	h <sub>480</sub>	h <sub>481</sub>	h <sub>482</sub>	h <sub>483</sub>	h <sub>484</sub>	h <sub>485</sub>	h <sub>486</sub>	h <sub>487</sub>	h <sub>488</sub>	h <sub>489</sub>	h <sub>490</sub>	h <sub>491</sub>	h <sub>492</sub>	h <sub>493</sub>	h <sub>494</sub>	h <sub>495</sub>	h <sub>496</sub>	h <sub>497</sub>	h <sub>498</sub>	h <sub>499</sub>	h <sub>500</sub>	h <sub>501</sub>	h <sub>502</sub>	h <sub>503</sub>	h <sub>504</sub>	h <sub>505</sub>	h <sub>506</sub>	h <sub>507</sub>	h <sub>508</sub>	h <sub>509</sub>	h <sub>510</sub>	h <sub>511</sub>	h <sub>512</sub>	h <sub>513</sub>	h <sub>514</sub>	h <sub>515</sub>	h <sub>516</sub>	h <sub>517</sub>	h <sub>518</sub>	h <sub>519</sub>	h <sub>520</sub>	h <sub>521</sub>	h <sub>522</sub>	h <sub>523</sub>	h <sub>524</sub>	h <sub>525</sub>	h <sub>526</sub>	h <sub>527</sub>	h <sub>528</sub>	h <sub>529</sub>	h <sub>530</sub>	h <sub>531</sub>	h <sub>532</sub>	h <sub>533</sub>	h <sub>534</sub>	h <sub>535</sub>	h <sub>536</sub>	h <sub>537</sub>	h <sub>538</sub>	h <sub>539</sub>	h <sub>540</sub>	h <sub>541</sub>	h <sub>542</sub>	h <sub>543</sub>	h <sub>544</sub>	h <sub>545</sub>	h <sub>546</sub>	h <sub>547</sub>	h <sub>548</sub>	h <sub>549</sub>	h <sub>550</sub>	h <sub>551</sub>	h <sub>552</sub>	h <sub>553</sub>	h <sub>554</sub>	h <sub>555</sub>	h <sub>556</sub>	h <sub>557</sub>	h <sub>558</sub>	h <sub>559</sub>	h <sub>560</sub>	h <sub>561</sub>	h <sub>562</sub>	h <sub>563</sub>	h <sub>564</sub>	h <sub>565</sub>	h <sub>566</sub>	h <sub>567</sub>	h <sub>568</sub>	h <sub>569</sub>	h <sub>570</sub>	h <sub>571</sub>	h <sub>572</sub>	h <sub>573</sub>	h <sub>574</sub>	h <sub>575</sub>	h <sub>576</sub>	h <sub>577</sub>	h <sub>578</sub>	h <sub>579</sub>	h <sub>580</sub>	h <sub>581</sub>	h <sub>582</sub>	h <sub>583</sub>	h <sub>584</sub>	h <sub>585</sub>	h <sub>586</sub>	h <sub>587</sub>	h <sub>588</sub>	h <sub>589</sub>	h <sub>590</sub>	h <sub>591</sub>	h <sub>592</sub>	h <sub>593</sub>	h <sub>594</sub>	h <sub>595</sub>	h <sub>596</sub>	h <sub>597</sub>	h <sub>598</sub>	h <sub>599</sub>	h <sub>600</sub>	h <sub>601</sub>	h <sub>602</sub>	h <sub>603</sub>	h <sub>604</sub>	h <sub>605</sub>	h <sub>606</sub>	h <sub>607</sub>	h <sub>608</sub>	h <sub>609</sub>	h <sub>610</sub>	h <sub>611</sub>	h <sub>612</sub>	h <sub>613</sub>	h <sub>614</sub>	h <sub>615</sub>	h <sub>616</sub>	h <sub>617</sub>	h <sub>618</sub>	h <sub>619</sub>	h <sub>620</sub>	h <sub>621</sub>	h <sub>622</sub>	h <sub>623</sub>	h <sub>624</sub>	h <sub>625</sub>	h <sub>626</sub>	h <sub>627</sub>	h <sub>628</sub>	h <sub>629</sub>	h <sub>630</sub>	h <sub>631</sub>	h <sub>632</sub>	h <sub>633</sub>	h <sub>634</sub>	h <sub>635</sub>	h <sub>636</sub>	h <sub>637</sub>	h <sub>638</sub>	h <sub>639</sub>	h <sub>640</sub>	h <sub>641</sub>	h <sub>642</sub>	h <sub>643</sub>	h <sub>644</sub>	h <sub>645</sub>	h <sub>646</sub>	h <sub>647</sub>	h <sub>648</sub>	h <sub>649</sub>	h <sub>650</sub>	h <sub>651</sub>	h <sub>652</sub>	h <sub>653</sub>	h <sub>654</sub>	h <sub>655</sub>	h <sub>656</sub>	h <sub>657</sub>	h <sub>658</sub>	h <sub>659</sub>	h <sub>660</sub>	h <sub>661</sub>	h <sub>662</sub>	h <sub>663</sub>	h <sub>664</sub>	h <sub>665</sub>	h <sub>666</sub>	h <sub>667</sub>	h <sub>668</sub>	h <sub>669</sub>	h <sub>670</sub>	h <sub>671</sub>	h <sub>672</sub>	h <sub>673</sub>	h <sub>674</sub>	h <sub>675</sub>	h <sub>676</sub>	h <sub>677</sub>	h <sub>678</sub>	h <sub>679</sub>	h <sub>680</sub>	h <sub>681</sub>	h <sub>682</sub>	h <sub>683</sub>	h <sub>684</sub>	h <sub>685</sub>	h <sub>686</sub>	h <sub>687</sub>	h <sub>688</sub>	h <sub>689</sub>	h <sub>690</sub>	h <sub>691</sub>	h <sub>692</sub>	h <sub>693</sub>	h <sub>694</sub>	h <sub>695</sub>	h <sub>696</sub>	h <sub>697</sub>	h <sub>698</sub>	h <sub>699</sub>	h <sub>700</sub>	h <sub>701</sub>	h <sub>702</sub>	h <sub>703</sub>	h <sub>704</sub>	h <sub>705</sub>	h <sub>706</sub>	h <sub>707</sub>	h <sub>708</sub>	h <sub>709</sub>	h <sub>710</sub>	h <sub>711</sub>	h <sub>712</sub>	h <sub>713</sub>	h <sub>714</sub>	h <sub>715</sub>	h <sub>716</sub>	h <sub>717</sub>	h <sub>718</sub>	h <sub>719</sub>	h <sub>720</sub>	h <sub>721</sub>	h <sub>722</sub>	h <sub>723</sub>	h <sub>724</sub>	h <sub>725</sub>	h <sub>726</sub>	h <sub>727</sub>	h <sub>728</sub>	h <sub>729</sub>	h <sub>730</sub>	h <sub>731</sub>	h <sub>732</sub>	h <sub>733</sub>	h <sub>734</sub>	h <sub>735</sub>	h <sub>736</sub>	h <sub>737</sub>	h <sub>738</sub>	h <sub>739</sub>	h <sub>740</sub>	h <sub>741</sub>	h <sub>742</sub>	h <sub>743</sub>	h <sub>744</sub>	h <sub>745</sub>	h <sub>746</sub>	h <sub>747</sub>	h <sub>748</sub>	h <sub>749</sub>	h <sub>750</sub>	h <sub>751</sub>	h <sub>752</sub>	h <sub>753</sub>	h <sub>754</sub>	h <sub>755</sub>	h <sub>756</sub>	h <sub>757</sub>	h <sub>758</sub>	h <sub>759</sub>	h <sub>760</sub>	h <sub>761</sub>	h <sub>762</sub>	h <sub>763</sub>	h <sub>764</sub>	h <sub>765</sub>	h <sub>766</sub>	h <sub>767</sub>	h <sub>768</sub>	h <sub>769</sub>	h <sub>770</sub>	h <sub>771</sub>	h <sub>772</sub>	h <sub>773</sub>	h <sub>774</sub>	h <sub>775</sub>	h <sub>776</sub>	h <sub>777</sub>	h <sub>778</sub>	h <sub>779</sub>	h <sub>780</sub>	h <sub>781</sub>	h <sub>782</sub>	h <sub>783</sub>	h <sub>784</sub>	h <sub>785</sub>	h <sub>786</sub>	h <sub>787</sub>	h <sub>788</sub>	h <sub>789</sub>	h <sub>790</sub>	h <sub>791</sub>	h <sub>792</sub>	h <sub>793</sub>	h <sub>794</sub>	h <sub>795</sub>	h <sub>796</sub>	h <sub>797</sub>	h <sub>798</sub>	h <sub>799</sub>	h <sub>800</sub>	h <sub>801</sub>	h <sub>802</sub>	h <sub>803</sub>	h <sub>804</sub>	h <sub>805</sub>	h <sub>806</sub>	h <sub>807</sub>	h <sub>808</sub>	h <sub>809</sub>	h <sub>810</sub>	h <sub>811</sub>
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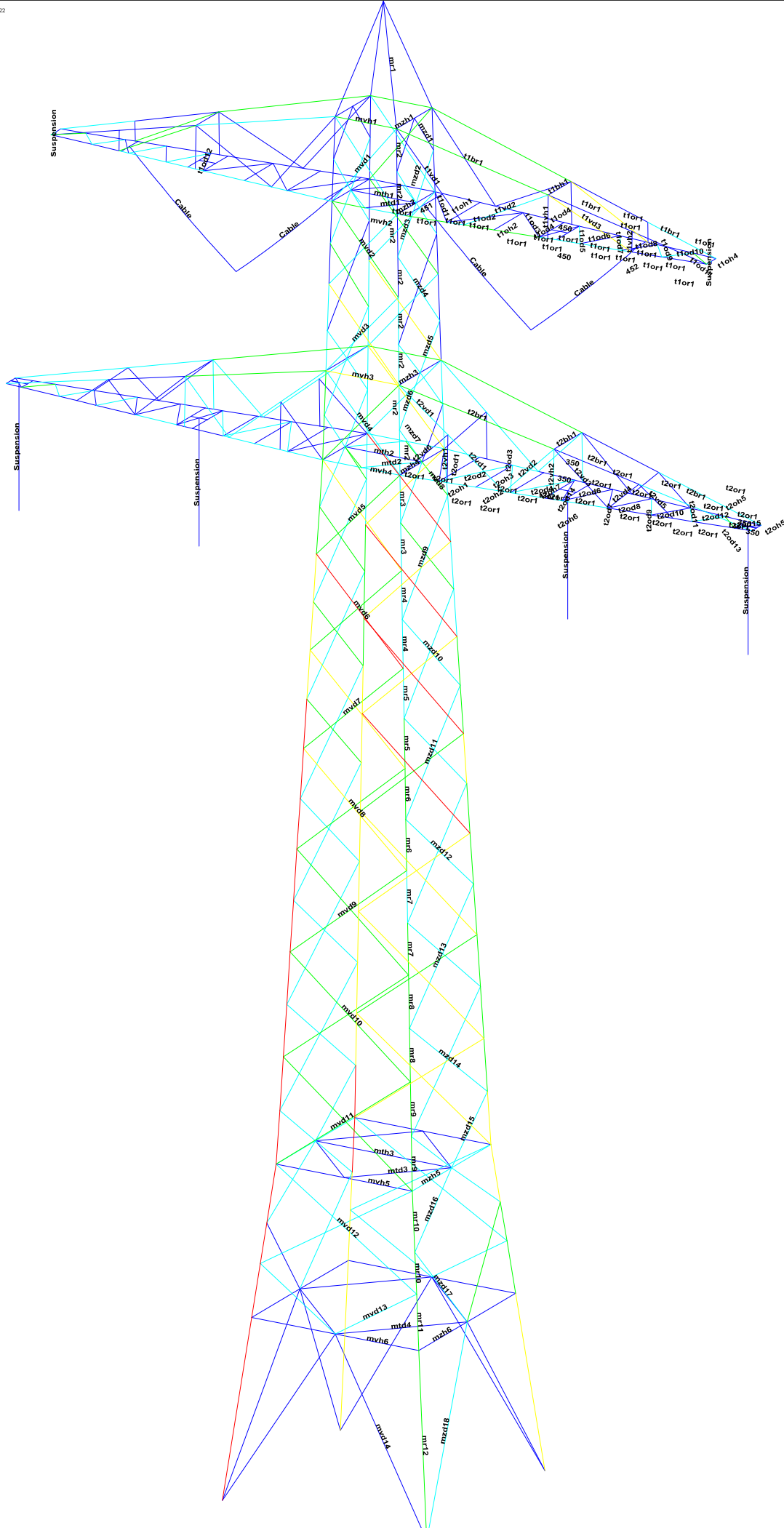
Date: 28-9-2022  
 Author: TBR  
 Version: v4.4

Assessment of groups for modified elements (verbouw level)

RSD-MDK150  
 D+0  
 84

Group Label	Description	Profile	Steel Quality	Bits	plmm	e1	e2	p1	RLX	RLY	RLZ	Slenderness	Compression (kN)	Load Case (Compression)	Buckling	Shear (Comp)	Bearing (Comp)	U.C. (Comp)	Comment (Comp)	Tension (kN)	Load Case (Tension)	Net Section	Shear (Tens)	Bearing (Tens)	U.C. (Tens)	Comment (Tens)
m05	m05	60x60x6	S235	240x24x4	1	30	30		1,00	1,00	1,00	64	-281,4	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	45,4	352,4	188,2	0,25		35,9	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	62,4	188,2	35,5	0,54	
m06	m06	60x60x6	S235	240x24x4	1	30	30		1,00	1,00	1,00	64	-281,4	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	45,4	352,4	188,2	0,25		35,9	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	62,4	188,2	35,5	0,54	
m07	m07	60x60x6	S235	240x24x4	1	35	40	70	1,00	1,00	1,00	64	-281,4	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	200,2	352,4	583,2	0,49		232,2	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	294,3	412,4	412,4	0,79	
m08	m08	60x60x6	S235	240x24x4	1	35	40	70	1,00	1,00	1,00	64	-281,4	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	200,2	352,4	583,2	0,49		232,2	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	294,3	412,4	412,4	0,79	
m09	m09	100x100x10	S235	80x24x5,6	1	35	50	70	1,00	1,00	1,00	60	-274,4	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	374,7	0,0	0,0	0,88		340,0	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	383,6	688,2	688,2	0,88	
m10	m10	100x100x10	S235	80x24x5,6	1	35	50	70	1,00	1,00	0,77	43	-199,8	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	414,8	470,4	854,0	0,89		355,6	U.S. 30pr. 18 W.Z.III.WBA.T.NR-	383,6	470,4	610,0	0,88	





1 [m]





Date 28-3-2022  
 Author TBR  
 Version v4.4

Assessment of groups for initial structure (afkeur level)

RSD-MDK150  
 D+0  
 92

Group Label	Description	Profile	Steel Quality	Belts	SKN/SP nes	c1	e2	p1	RLX	RLY	RLZ	Slenderness	Compressions (kN)	Load Cases (Compression)	Buckling (Comp)	U.C. (Comp)	Bearing (Comp)	U.C. (Comp)	Compress (Comp)	Tension (kN)	Load Cases (Tension)	Net Section Shear (Tens)	Shear (Tens)	U.C. (Tens)	Comment (Tens)	Total U.C. (with)
me1a	me1a	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,2	U.C. 3007-18 W 2111 WBA.T Nbc	37,8	117,6	108,0	0,00	0,00	4,2	U.C. 3007-18 W 2111 U3 Nbc -45.7 BP	37,8	117,6	52,5	0,22	0,00
me1B	me1B	60x6x5	S235	2015-06-01	1	30	30	60	0,33	0,33	0,33	1,26	-4,9	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	82,0	78,4	78,4	0,00	0,00	10,6	U.C. 3007-18 W 2111 U3 WBA.T Nbc	102,1	75,4	74,2	0,08	0,00
me1C	me1C	60x6x5	S235	2015-06-01	1	30	30	60	0,33	0,33	0,33	1,26	-4,9	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	82,0	78,4	78,4	0,00	0,00	10,6	U.C. 3007-18 W 2111 U3 WBA.T Nbc	102,1	75,4	74,2	0,08	0,00
me1D	me1D	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-18 W 2111 WBA.T Nbc	121,0	121,0	64,0	0,10	0,10
me1E	me1E	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-18 W 2111 WBA.T Nbc	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-18 W 2111 WBA.T Nbc	121,0	121,0	64,0	0,10	0,10
me1F	me1F	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1G	me1G	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1H	me1H	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1I	me1I	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1J	me1J	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1K	me1K	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1L	me1L	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1M	me1M	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1N	me1N	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1O	me1O	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1P	me1P	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1Q	me1Q	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1R	me1R	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1S	me1S	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1T	me1T	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1U	me1U	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1V	me1V	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1W	me1W	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1X	me1X	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1Y	me1Y	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10
me1Z	me1Z	60x6x5	S235	2015-06-01	1	30	30	60	2,00	2,00	2,00	1,25	-4,8	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	183,0	174,0	184,0	0,00	0,00	3,2	U.C. 3007-58 Tr 162 Z111 B.T 11,8A.T Global	121,0	121,0	64,0	0,10	0,10

Assessment of groups for modified structure (atkrue level)

RSB-MDK150  
D+0  
92

Group Label	Description	Profile	Steel	Rein	h <sub>th</sub>	h <sub>1</sub>	h <sub>2</sub>	h <sub>3</sub>	h <sub>4</sub>	h <sub>5</sub>	h <sub>6</sub>	h <sub>7</sub>	h <sub>8</sub>	h <sub>9</sub>	h <sub>10</sub>	h <sub>11</sub>	h <sub>12</sub>	h <sub>13</sub>	h <sub>14</sub>	h <sub>15</sub>	h <sub>16</sub>	h <sub>17</sub>	h <sub>18</sub>	h <sub>19</sub>	h <sub>20</sub>	h <sub>21</sub>	h <sub>22</sub>	h <sub>23</sub>	h <sub>24</sub>	h <sub>25</sub>	h <sub>26</sub>	h <sub>27</sub>	h <sub>28</sub>	h <sub>29</sub>	h <sub>30</sub>	h <sub>31</sub>	h <sub>32</sub>	h <sub>33</sub>	h <sub>34</sub>	h <sub>35</sub>	h <sub>36</sub>	h <sub>37</sub>	h <sub>38</sub>	h <sub>39</sub>	h <sub>40</sub>	h <sub>41</sub>	h <sub>42</sub>	h <sub>43</sub>	h <sub>44</sub>	h <sub>45</sub>	h <sub>46</sub>	h <sub>47</sub>	h <sub>48</sub>	h <sub>49</sub>	h <sub>50</sub>	h <sub>51</sub>	h <sub>52</sub>	h <sub>53</sub>	h <sub>54</sub>	h <sub>55</sub>	h <sub>56</sub>	h <sub>57</sub>	h <sub>58</sub>	h <sub>59</sub>	h <sub>60</sub>	h <sub>61</sub>	h <sub>62</sub>	h <sub>63</sub>	h <sub>64</sub>	h <sub>65</sub>	h <sub>66</sub>	h <sub>67</sub>	h <sub>68</sub>	h <sub>69</sub>	h <sub>70</sub>	h <sub>71</sub>	h <sub>72</sub>	h <sub>73</sub>	h <sub>74</sub>	h <sub>75</sub>	h <sub>76</sub>	h <sub>77</sub>	h <sub>78</sub>	h <sub>79</sub>	h <sub>80</sub>	h <sub>81</sub>	h <sub>82</sub>	h <sub>83</sub>	h <sub>84</sub>	h <sub>85</sub>	h <sub>86</sub>	h <sub>87</sub>	h <sub>88</sub>	h <sub>89</sub>	h <sub>90</sub>	h <sub>91</sub>	h <sub>92</sub>	h <sub>93</sub>	h <sub>94</sub>	h <sub>95</sub>	h <sub>96</sub>	h <sub>97</sub>	h <sub>98</sub>	h <sub>99</sub>	h <sub>100</sub>	h <sub>101</sub>	h <sub>102</sub>	h <sub>103</sub>	h <sub>104</sub>	h <sub>105</sub>	h <sub>106</sub>	h <sub>107</sub>	h <sub>108</sub>	h <sub>109</sub>	h <sub>110</sub>	h <sub>111</sub>	h <sub>112</sub>	h <sub>113</sub>	h <sub>114</sub>	h <sub>115</sub>	h <sub>116</sub>	h <sub>117</sub>	h <sub>118</sub>	h <sub>119</sub>	h <sub>120</sub>	h <sub>121</sub>	h <sub>122</sub>	h <sub>123</sub>	h <sub>124</sub>	h <sub>125</sub>	h <sub>126</sub>	h <sub>127</sub>	h <sub>128</sub>	h <sub>129</sub>	h <sub>130</sub>	h <sub>131</sub>	h <sub>132</sub>	h <sub>133</sub>	h <sub>134</sub>	h <sub>135</sub>	h <sub>136</sub>	h <sub>137</sub>	h <sub>138</sub>	h <sub>139</sub>	h <sub>140</sub>	h <sub>141</sub>	h <sub>142</sub>	h <sub>143</sub>	h <sub>144</sub>	h <sub>145</sub>	h <sub>146</sub>	h <sub>147</sub>	h <sub>148</sub>	h <sub>149</sub>	h <sub>150</sub>	h <sub>151</sub>	h <sub>152</sub>	h <sub>153</sub>	h <sub>154</sub>	h <sub>155</sub>	h <sub>156</sub>	h <sub>157</sub>	h <sub>158</sub>	h <sub>159</sub>	h <sub>160</sub>	h <sub>161</sub>	h <sub>162</sub>	h <sub>163</sub>	h <sub>164</sub>	h <sub>165</sub>	h <sub>166</sub>	h <sub>167</sub>	h <sub>168</sub>	h <sub>169</sub>	h <sub>170</sub>	h <sub>171</sub>	h <sub>172</sub>	h <sub>173</sub>	h <sub>174</sub>	h <sub>175</sub>	h <sub>176</sub>	h <sub>177</sub>	h <sub>178</sub>	h <sub>179</sub>	h <sub>180</sub>	h <sub>181</sub>	h <sub>182</sub>	h <sub>183</sub>	h <sub>184</sub>	h <sub>185</sub>	h <sub>186</sub>	h <sub>187</sub>	h <sub>188</sub>	h <sub>189</sub>	h <sub>190</sub>	h <sub>191</sub>	h <sub>192</sub>	h <sub>193</sub>	h <sub>194</sub>	h <sub>195</sub>	h <sub>196</sub>	h <sub>197</sub>	h <sub>198</sub>	h <sub>199</sub>	h <sub>200</sub>	h <sub>201</sub>	h <sub>202</sub>	h <sub>203</sub>	h <sub>204</sub>	h <sub>205</sub>	h <sub>206</sub>	h <sub>207</sub>	h <sub>208</sub>	h <sub>209</sub>	h <sub>210</sub>	h <sub>211</sub>	h <sub>212</sub>	h <sub>213</sub>	h <sub>214</sub>	h <sub>215</sub>	h <sub>216</sub>	h <sub>217</sub>	h <sub>218</sub>	h <sub>219</sub>	h <sub>220</sub>	h <sub>221</sub>	h <sub>222</sub>	h <sub>223</sub>	h <sub>224</sub>	h <sub>225</sub>	h <sub>226</sub>	h <sub>227</sub>	h <sub>228</sub>	h <sub>229</sub>	h <sub>230</sub>	h <sub>231</sub>	h <sub>232</sub>	h <sub>233</sub>	h <sub>234</sub>	h <sub>235</sub>	h <sub>236</sub>	h <sub>237</sub>	h <sub>238</sub>	h <sub>239</sub>	h <sub>240</sub>	h <sub>241</sub>	h <sub>242</sub>	h <sub>243</sub>	h <sub>244</sub>	h <sub>245</sub>	h <sub>246</sub>	h <sub>247</sub>	h <sub>248</sub>	h <sub>249</sub>	h <sub>250</sub>	h <sub>251</sub>	h <sub>252</sub>	h <sub>253</sub>	h <sub>254</sub>	h <sub>255</sub>	h <sub>256</sub>	h <sub>257</sub>	h <sub>258</sub>	h <sub>259</sub>	h <sub>260</sub>	h <sub>261</sub>	h <sub>262</sub>	h <sub>263</sub>	h <sub>264</sub>	h <sub>265</sub>	h <sub>266</sub>	h <sub>267</sub>	h <sub>268</sub>	h <sub>269</sub>	h <sub>270</sub>	h <sub>271</sub>	h <sub>272</sub>	h <sub>273</sub>	h <sub>274</sub>	h <sub>275</sub>	h <sub>276</sub>	h <sub>277</sub>	h <sub>278</sub>	h <sub>279</sub>	h <sub>280</sub>	h <sub>281</sub>	h <sub>282</sub>	h <sub>283</sub>	h <sub>284</sub>	h <sub>285</sub>	h <sub>286</sub>	h <sub>287</sub>	h <sub>288</sub>	h <sub>289</sub>	h <sub>290</sub>	h <sub>291</sub>	h <sub>292</sub>	h <sub>293</sub>	h <sub>294</sub>	h <sub>295</sub>	h <sub>296</sub>	h <sub>297</sub>	h <sub>298</sub>	h <sub>299</sub>	h <sub>300</sub>	h <sub>301</sub>	h <sub>302</sub>	h <sub>303</sub>	h <sub>304</sub>	h <sub>305</sub>	h <sub>306</sub>	h <sub>307</sub>	h <sub>308</sub>	h <sub>309</sub>	h <sub>310</sub>	h <sub>311</sub>	h <sub>312</sub>	h <sub>313</sub>	h <sub>314</sub>	h <sub>315</sub>	h <sub>316</sub>	h <sub>317</sub>	h <sub>318</sub>	h <sub>319</sub>	h <sub>320</sub>	h <sub>321</sub>	h <sub>322</sub>	h <sub>323</sub>	h <sub>324</sub>	h <sub>325</sub>	h <sub>326</sub>	h <sub>327</sub>	h <sub>328</sub>	h <sub>329</sub>	h <sub>330</sub>	h <sub>331</sub>	h <sub>332</sub>	h <sub>333</sub>	h <sub>334</sub>	h <sub>335</sub>	h <sub>336</sub>	h <sub>337</sub>	h <sub>338</sub>	h <sub>339</sub>	h <sub>340</sub>	h <sub>341</sub>	h <sub>342</sub>	h <sub>343</sub>	h <sub>344</sub>	h <sub>345</sub>	h <sub>346</sub>	h <sub>347</sub>	h <sub>348</sub>	h <sub>349</sub>	h <sub>350</sub>	h <sub>351</sub>	h <sub>352</sub>	h <sub>353</sub>	h <sub>354</sub>	h <sub>355</sub>	h <sub>356</sub>	h <sub>357</sub>	h <sub>358</sub>	h <sub>359</sub>	h <sub>360</sub>	h <sub>361</sub>	h <sub>362</sub>	h <sub>363</sub>	h <sub>364</sub>	h <sub>365</sub>	h <sub>366</sub>	h <sub>367</sub>	h <sub>368</sub>	h <sub>369</sub>	h <sub>370</sub>	h <sub>371</sub>	h <sub>372</sub>	h <sub>373</sub>	h <sub>374</sub>	h <sub>375</sub>	h <sub>376</sub>	h <sub>377</sub>	h <sub>378</sub>	h <sub>379</sub>	h <sub>380</sub>	h <sub>381</sub>	h <sub>382</sub>	h <sub>383</sub>	h <sub>384</sub>	h <sub>385</sub>	h <sub>386</sub>	h <sub>387</sub>	h <sub>388</sub>	h <sub>389</sub>	h <sub>390</sub>	h <sub>391</sub>	h <sub>392</sub>	h <sub>393</sub>	h <sub>394</sub>	h <sub>395</sub>	h <sub>396</sub>	h <sub>397</sub>	h <sub>398</sub>	h <sub>399</sub>	h <sub>400</sub>	h <sub>401</sub>	h <sub>402</sub>	h <sub>403</sub>	h <sub>404</sub>	h <sub>405</sub>	h <sub>406</sub>	h <sub>407</sub>	h <sub>408</sub>	h <sub>409</sub>	h <sub>410</sub>	h <sub>411</sub>	h <sub>412</sub>	h <sub>413</sub>	h <sub>414</sub>	h <sub>415</sub>	h <sub>416</sub>	h <sub>417</sub>	h <sub>418</sub>	h <sub>419</sub>	h <sub>420</sub>	h <sub>421</sub>	h <sub>422</sub>	h <sub>423</sub>	h <sub>424</sub>	h <sub>425</sub>	h <sub>426</sub>	h <sub>427</sub>	h <sub>428</sub>	h <sub>429</sub>	h <sub>430</sub>	h <sub>431</sub>	h <sub>432</sub>	h <sub>433</sub>	h <sub>434</sub>	h <sub>435</sub>	h <sub>436</sub>	h <sub>437</sub>	h <sub>438</sub>	h <sub>439</sub>	h <sub>440</sub>	h <sub>441</sub>	h <sub>442</sub>	h <sub>443</sub>	h <sub>444</sub>	h <sub>445</sub>	h <sub>446</sub>	h <sub>447</sub>	h <sub>448</sub>	h <sub>449</sub>	h <sub>450</sub>	h <sub>451</sub>	h <sub>452</sub>	h <sub>453</sub>	h <sub>454</sub>	h <sub>455</sub>	h <sub>456</sub>	h <sub>457</sub>	h <sub>458</sub>	h <sub>459</sub>	h <sub>460</sub>	h <sub>461</sub>	h <sub>462</sub>	h <sub>463</sub>	h <sub>464</sub>	h <sub>465</sub>	h <sub>466</sub>	h <sub>467</sub>	h <sub>468</sub>	h <sub>469</sub>	h <sub>470</sub>	h <sub>471</sub>	h <sub>472</sub>	h <sub>473</sub>	h <sub>474</sub>	h <sub>475</sub>	h <sub>476</sub>	h <sub>477</sub>	h <sub>478</sub>	h <sub>479</sub>	h <sub>480</sub>	h <sub>481</sub>	h <sub>482</sub>	h <sub>483</sub>	h <sub>484</sub>	h <sub>485</sub>	h <sub>486</sub>	h <sub>487</sub>	h <sub>488</sub>	h <sub>489</sub>	h <sub>490</sub>	h <sub>491</sub>	h <sub>492</sub>	h <sub>493</sub>	h <sub>494</sub>	h <sub>495</sub>	h <sub>496</sub>	h <sub>497</sub>	h <sub>498</sub>	h <sub>499</sub>	h <sub>500</sub>	h <sub>501</sub>	h <sub>502</sub>	h <sub>503</sub>	h <sub>504</sub>	h <sub>505</sub>	h <sub>506</sub>	h <sub>507</sub>	h <sub>508</sub>	h <sub>509</sub>	h <sub>510</sub>	h <sub>511</sub>	h <sub>512</sub>	h <sub>513</sub>	h <sub>514</sub>	h <sub>515</sub>	h <sub>516</sub>	h <sub>517</sub>	h <sub>518</sub>	h <sub>519</sub>	h <sub>520</sub>	h <sub>521</sub>	h <sub>522</sub>	h <sub>523</sub>	h <sub>524</sub>	h <sub>525</sub>	h <sub>526</sub>	h <sub>527</sub>	h <sub>528</sub>	h <sub>529</sub>	h <sub>530</sub>	h <sub>531</sub>	h <sub>532</sub>	h <sub>533</sub>	h <sub>534</sub>	h <sub>535</sub>	h <sub>536</sub>	h <sub>537</sub>	h <sub>538</sub>	h <sub>539</sub>	h <sub>540</sub>	h <sub>541</sub>	h <sub>542</sub>	h <sub>543</sub>	h <sub>544</sub>	h <sub>545</sub>	h <sub>546</sub>	h <sub>547</sub>	h <sub>548</sub>	h <sub>549</sub>	h <sub>550</sub>	h <sub>551</sub>	h <sub>552</sub>	h <sub>553</sub>	h <sub>554</sub>	h <sub>555</sub>	h <sub>556</sub>	h <sub>557</sub>	h <sub>558</sub>	h <sub>559</sub>	h <sub>560</sub>	h <sub>561</sub>	h <sub>562</sub>	h <sub>563</sub>	h <sub>564</sub>	h <sub>565</sub>	h <sub>566</sub>	h <sub>567</sub>	h <sub>568</sub>	h <sub>569</sub>	h <sub>570</sub>	h <sub>571</sub>	h <sub>572</sub>	h <sub>573</sub>	h <sub>574</sub>	h <sub>575</sub>	h <sub>576</sub>	h <sub>577</sub>	h <sub>578</sub>	h <sub>579</sub>	h <sub>580</sub>	h <sub>581</sub>	h <sub>582</sub>	h <sub>583</sub>	h <sub>584</sub>	h <sub>585</sub>	h <sub>586</sub>	h <sub>587</sub>	h <sub>588</sub>	h <sub>589</sub>	h <sub>590</sub>	h <sub>591</sub>	h <sub>592</sub>	h <sub>593</sub>	h <sub>594</sub>	h <sub>595</sub>	h <sub>596</sub>	h <sub>597</sub>	h <sub>598</sub>	h <sub>599</sub>	h <sub>600</sub>	h <sub>601</sub>	h <sub>602</sub>	h <sub>603</sub>	h <sub>604</sub>	h <sub>605</sub>	h <sub>606</sub>	h <sub>607</sub>	h <sub>608</sub>	h <sub>609</sub>	h <sub>610</sub>	h <sub>611</sub>	h <sub>612</sub>	h <sub>613</sub>	h <sub>614</sub>	h <sub>615</sub>	h <sub>616</sub>	h <sub>617</sub>	h <sub>618</sub>	h <sub>619</sub>	h <sub>620</sub>	h <sub>621</sub>	h <sub>622</sub>	h <sub>623</sub>	h <sub>624</sub>	h <sub>625</sub>	h <sub>626</sub>	h <sub>627</sub>	h <sub>628</sub>	h <sub>629</sub>	h <sub>630</sub>	h <sub>631</sub>	h <sub>632</sub>	h <sub>633</sub>	h <sub>634</sub>	h <sub>635</sub>	h <sub>636</sub>	h <sub>637</sub>	h <sub>638</sub>	h <sub>639</sub>	h <sub>640</sub>	h <sub>641</sub>	h <sub>642</sub>	h <sub>643</sub>	h <sub>644</sub>	h <sub>645</sub>	h <sub>646</sub>	h <sub>647</sub>	h <sub>648</sub>	h <sub>649</sub>	h <sub>650</sub>	h <sub>651</sub>	h <sub>652</sub>	h <sub>653</sub>	h <sub>654</sub>	h <sub>655</sub>	h <sub>656</sub>	h <sub>657</sub>	h <sub>658</sub>	h <sub>659</sub>	h <sub>660</sub>	h <sub>661</sub>	h <sub>662</sub>	h <sub>663</sub>	h <sub>664</sub>	h <sub>665</sub>	h <sub>666</sub>	h <sub>667</sub>	h <sub>668</sub>	h <sub>669</sub>	h <sub>670</sub>	h <sub>671</sub>	h <sub>672</sub>	h <sub>673</sub>	h <sub>674</sub>	h <sub>675</sub>	h <sub>676</sub>	h <sub>677</sub>	h <sub>678</sub>	h <sub>679</sub>	h <sub>680</sub>	h <sub>681</sub>	h <sub>682</sub>	h <sub>683</sub>	h <sub>684</sub>	h <sub>685</sub>	h <sub>686</sub>	h <sub>687</sub>	h <sub>688</sub>	h <sub>689</sub>	h <sub>690</sub>	h <sub>691</sub>	h <sub>692</sub>	h <sub>693</sub>	h <sub>694</sub>	h <sub>695</sub>	h <sub>696</sub>	h <sub>697</sub>	h <sub>698</sub>	h <sub>699</sub>	h <sub>700</sub>	h <sub>701</sub>	h <sub>702</sub>	h <sub>703</sub>	h <sub>704</sub>	h <sub>705</sub>	h <sub>706</sub>	h <sub>707</sub>	h <sub>708</sub>	h <sub>709</sub>	h <sub>710</sub>	h <sub>711</sub>	h <sub>712</sub>	h <sub>713</sub>	h <sub>714</sub>	h <sub>715</sub>	h <sub>716</sub>	h <sub>717</sub>	h <sub>718</sub>	h <sub>719</sub>	h <sub>720</sub>	h <sub>721</sub>	h <sub>722</sub>	h <sub>723</sub>	h <sub>724</sub>	h <sub>725</sub>	h <sub>726</sub>	h <sub>727</sub>	h <sub>728</sub>	h <sub>729</sub>	h <sub>730</sub>	h <sub>731</sub>	h <sub>732</sub>	h <sub>733</sub>	h <sub>734</sub>	h <sub>735</sub>	h <sub>736</sub>	h <sub>737</sub>	h <sub>738</sub>	h <sub>739</sub>	h <sub>740</sub>	h <sub>741</sub>	h <sub>742</sub>	h <sub>743</sub>	h <sub>744</sub>	h <sub>745</sub>	h <sub>746</sub>	h <sub>747</sub>	h <sub>748</sub>	h <sub>749</sub>	h <sub>750</sub>	h <sub>751</sub>	h <sub>752</sub>	h <sub>753</sub>	h <sub>754</sub>	h <sub>755</sub>	h <sub>756</sub>	h <sub>757</sub>	h <sub>758</sub>	h <sub>759</sub>	h <sub>760</sub>	h <sub>761</sub>	h <sub>762</sub>	h <sub>763</sub>	h <sub>764</sub>	h <sub>765</sub>	h <sub>766</sub>	h <sub>767</sub>	h <sub>768</sub>	h <sub>769</sub>	h <sub>770</sub>	h <sub>771</sub>	h <sub>772</sub>	h <sub>773</sub>	h <sub>774</sub>	h <sub>775</sub>	h <sub>776</sub>	h <sub>777</sub>	h <sub>778</sub>	h <sub>779</sub>	h <sub>780</sub>	h <sub>781</sub>	h <sub>782</sub>	h <sub>783</sub>	h <sub>784</sub>	h <sub>785</sub>	h <sub>786</sub>	h <sub>787</sub>	h <sub>788</sub>	h <sub>789</sub>	h <sub>790</sub>	h <sub>791</sub>	h <sub>792</sub>	h <sub>793</sub>	h <sub>794</sub>	h <sub>795</sub>	h <sub>796</sub>	h <sub>797</sub>	h <sub>798</sub>	h <sub>799</sub>	h <sub>800</sub>	h <sub>801</sub>	h <sub>802</sub>	h <sub>803</sub>	h <sub>804</sub>	h <sub>805</sub>	h <sub>806</sub>	h <sub>807</sub>	h <sub>808</sub>	h <sub>809</sub>	h <sub>810</sub>	h <sub>811</sub>	h <sub>812</sub>	h <sub>813</sub>
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## **APPENDIX C**

### **FOUNDATION SHEAR BLOCK CHECKS**

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The appendix contains the calculation of the capacity of the foundation piles with the TS/Paalfunderingen software and the verification of the shear block connection of the inserted leg into the pile. The output of TS/Paalfunderingen is included for tension and compression.

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**ALGEMENE GEGEVENS**

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek  
 Datum : 05-06-2020  
 Bestand : P:\EANL\_Projects\10124719 - TenneT Engineering  
 ZW380 kV Oost\2 Content\001 Tekeningen\050 PLS  
 cadd\Fundatie berekeningen RFC013\RFC013  
 trek.pvw  
 Berekeningstype : Verticaal belaste paal  
 Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

**Toegepaste normen volgens Eurocode met Nederlandse NB**

Geotechniek EN 1997-1:2004 AC:2009  
 NEN-EN 1997-1:2005 C1+A1:2013 NB:2016  
 NEN 9997-1:2016 C2:2017

**BODEMPROFIELGEGEVENS: B 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.01 Grondwaterstand [m] : -0.99

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$	$d_{50}$ [mm]
1	0.01	-1.97	Leem - Zwak zandig - Vast	1.0	50.0		
2	-1.97	-3.59	Zand - Schoon - Matig	1.0	100.0		
3	-3.59	-5.24	Leem - Zwak zandig - Vast	1.0	50.0		
4	-5.24	-14.90	Zand - Schoon - Matig	1.0	100.0		

**BODEMPROFIELGEGEVENS: B 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.04 Grondwaterstand [m] : -0.96

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$	$d_{50}$ [mm]
1	0.04	-4.57	Zand - Zwak siltig - Kleilig	1.0	100.0		
2	-4.57	-5.49	Klei - Zwak zandig - Vast	1.0	50.0		
3	-5.49	-11.99	Zand - Schoon - Matig	1.0	100.0		
4	-11.99	-13.18	Klei - Zwak zandig - Slap	1.0	50.0		
5	-13.18	-14.82	Klei - Schoon - Matig	1.0	50.0		

**BODEMPROFIELGEGEVENS: B 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.00 Grondwaterstand [m] : -1.00

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$	$d_{50}$ [mm]
1	0.00	-2.00	Veen - Matig voorbelast - Matig	1.0	50.0		
2	-2.00	-11.01	Zand - Zwak siltig - Kleilig	1.0	100.0		
3	-11.01	-11.89	Grind - Sterk siltig - Los	1.0	50.0		
4	-11.89	-12.55	Zand - Schoon - Matig	1.0	100.0		
5	-12.55	-13.29	Leem - Zwak zandig - Vast	1.0	50.0		
6	-13.29	-18.66	Zand - Sterk siltig - Kleilig	1.0	100.0		

**BODEMPROFIELGEGEVENS: B 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.00 Grondwaterstand [m] : -1.00

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$	$d_{50}$ [mm]
1	0.00	-1.11	Klei - Zwak zandig - Matig	1.0	50.0		
2	-1.11	-1.37	Zand - Schoon - Los	1.0	100.0		
3	-1.37	-3.70	Klei - Zwak zandig - Slap	1.0	50.0		
4	-3.70	-5.81	Veen - Matig voorbelast - Matig	1.0	50.0		
5	-5.81	-8.97	Zand - Schoon - Matig	1.0	100.0		
6	-8.97	-9.38	Leem - Zwak zandig - Vast	1.0	50.0		
7	-9.38	-13.74	Zand - Sterk siltig - Kleilig	1.0	100.0		
8	-13.74	-13.77	Leem - Zwak zandig - Vast	1.0	50.0		
9	-13.77	-14.22	Zand - Sterk siltig - Kleilig	1.0	100.0		
10	-14.22	-14.40	Leem - Zwak zandig - Vast	1.0	50.0		
11	-14.40	-15.62	Zand - Zwak siltig - Kleilig	1.0	100.0		
12	-15.62	-16.81	Leem - Zwak zandig - Vast	1.0	50.0		
13	-16.81	-16.99	Zand - Schoon - Los	1.0	100.0		

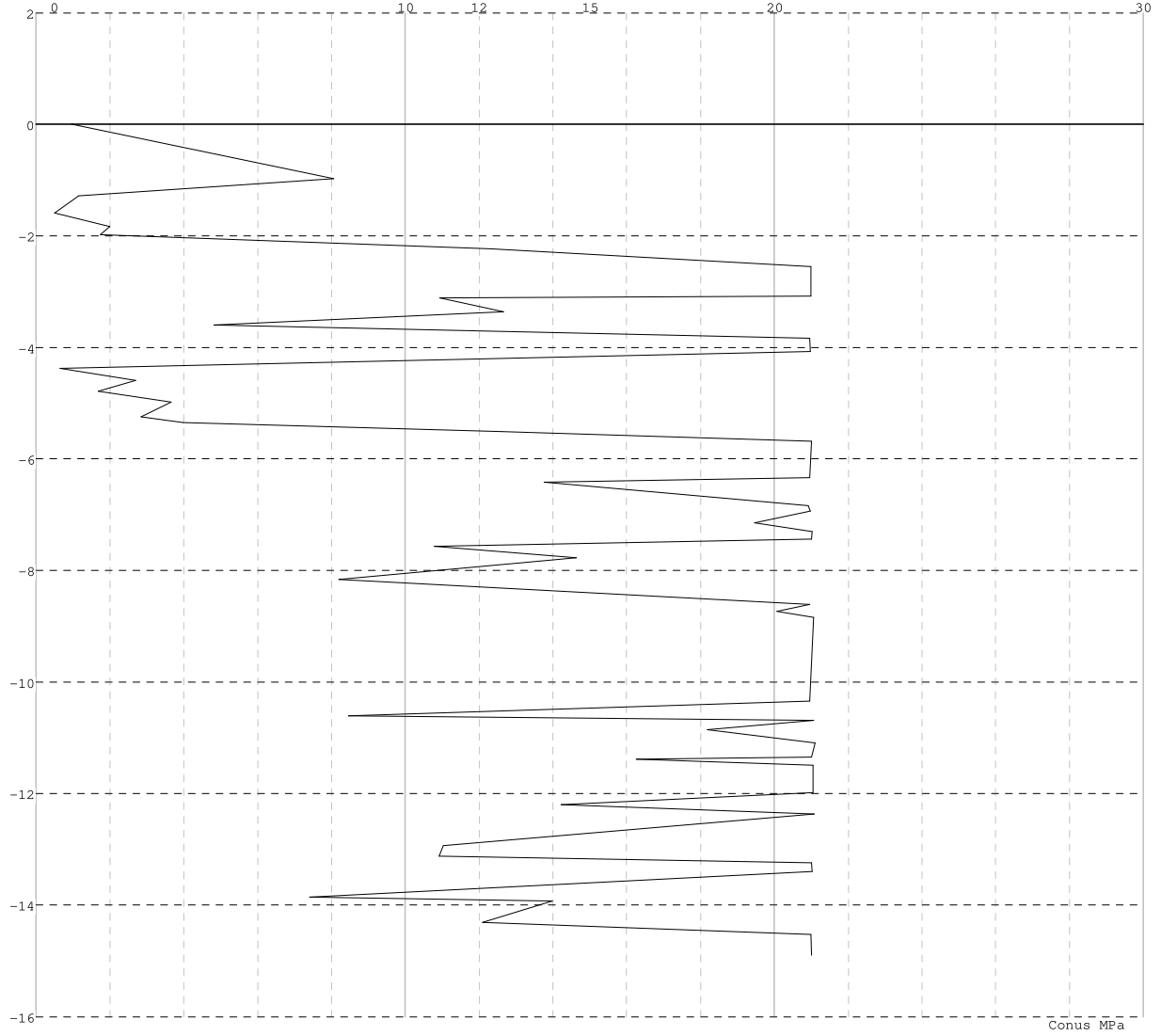
**SONDERINGSGEGEVENS ALGEMEEN: S 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 Hoogte maaienveld [m] : 0.01 Bodemprofiel: B 92 RSD - MDK  
 Traject negatieve kleeft : 0.00 tot -1.60 [m]  
 Traject positieve kleeft : -1.80 tot -14.90 [m]



Project : ZW-Oost  
Onderdeel : TOSP fundatie trek

SONDERINGSGEGEVENS GRAFIEK: S 92 RSD - MDK

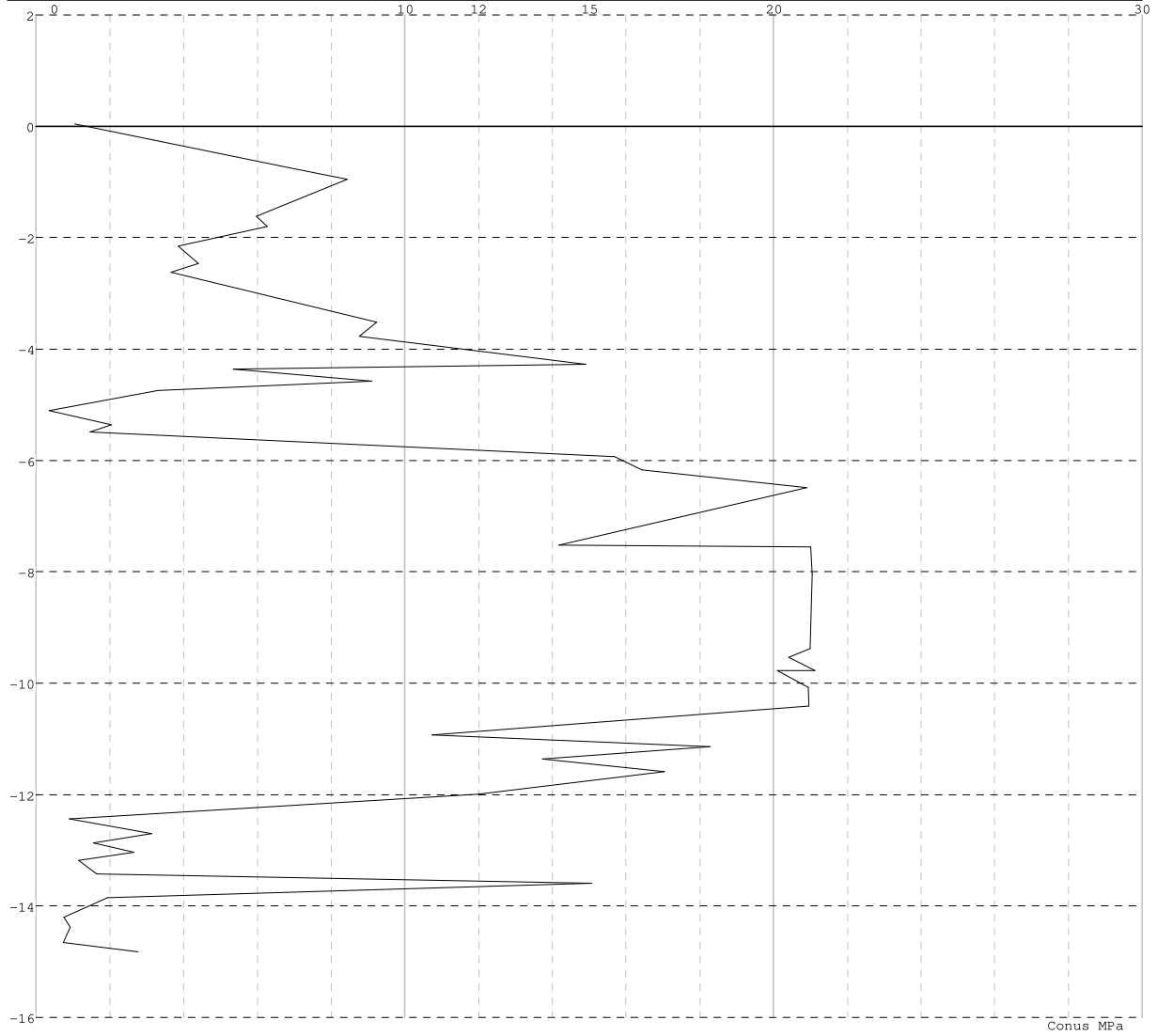


Project : ZW-Oost  
Onderdeel : TOSP fundatie trek

**SONDERINGSGEGEVENS ALGEMEEN: S 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
Hoogte maaiveld [m] : 0.04 Bodemprofiel: B 91 RSD - MDK  
Traject negatieve kleef : 0.04 tot -2.60 [m]  
Traject positieve kleef : -2.70 tot -14.82 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 91 RSD - MDK**

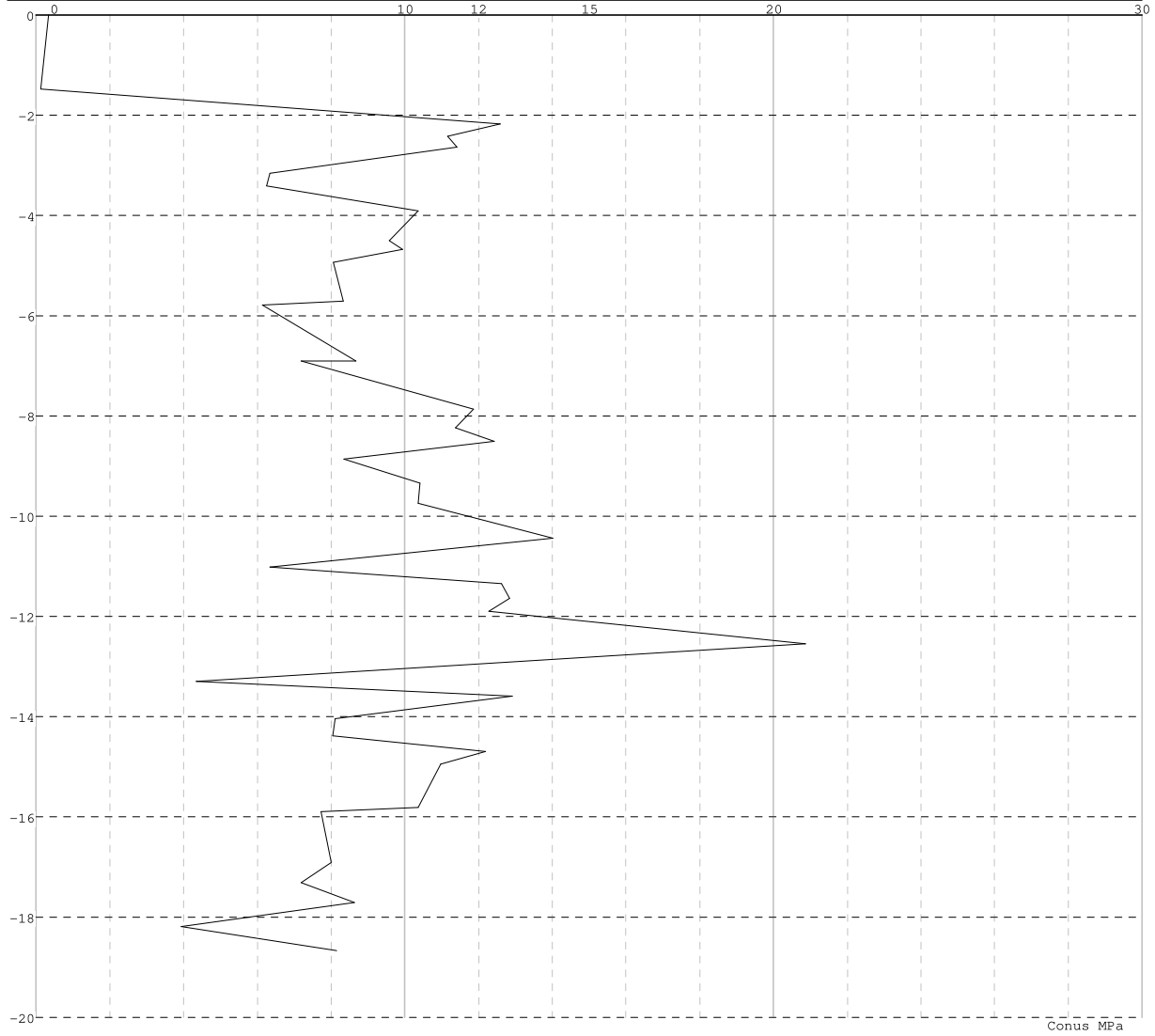


Project : ZW-Oost  
Onderdeel : TOSP fundatie trek

**SONDERINGSGEGEVENS ALGEMEEN: S 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
Hoogte maaiveld [m] : 0.00 Bodemprofiel: B 22 GT - ZBH  
Traject negatieve kleeft : -0.10 tot -1.40 [m]  
Traject positieve kleeft : -1.70 tot -18.66 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 22 GT - ZBH**

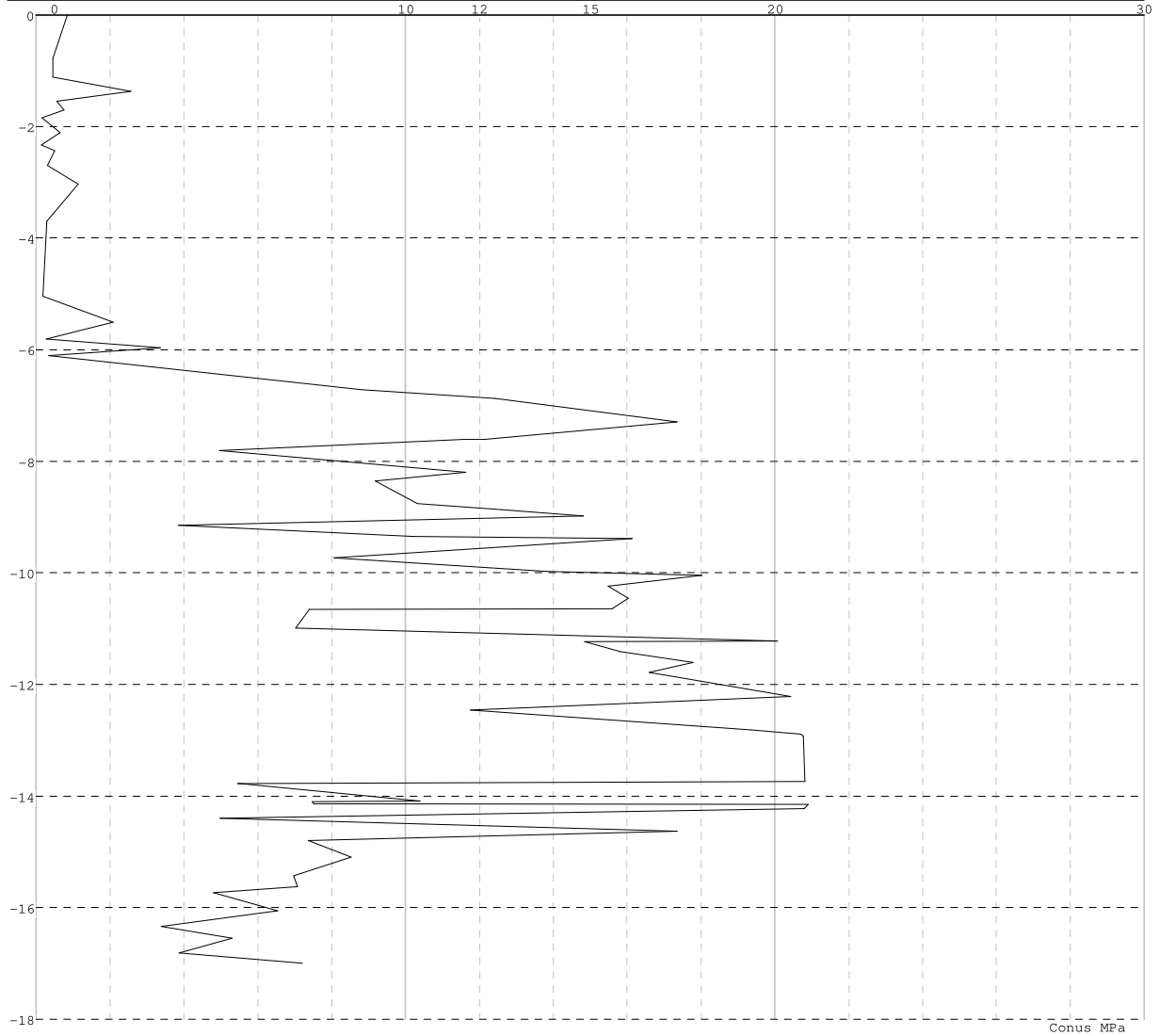


Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**SONDERINGSGEGEVENS ALGEMEEN: S 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 Hoogte maaiveld [m] : 0.00 Bodemprofiel: B 84 RSD - MDK  
 Traject negatieve kleef : -0.10 tot -6.40 [m]  
 Traject positieve kleef : -6.50 tot -16.99 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 84 RSD - MDK**



**REKENGEGEVENS 22 GT - ZBH**

Berekening : Controlerend  
 Rekenmethode : Trekpalen volgens NEN-EN 1997-1, art. 7.6.3  
 Sondering(en) : S 22 GT - ZBH  
 Let op: trekcapaciteit t.p.v. negatief kleeftraject is meegerekend.

Stijf bouwwerk : NEE  
 Paalgroep : NEE  
 Aantal sonderingen : 1  
 Factor  $\xi_3$  (n=1) : 1.39  
 Factor  $\xi_3$  (gem) : 1.39  
 Factor  $\xi_4$  (min) : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.35  
 $\gamma_{m;var;qc}$  : 1.50  
 UGT draagvermogen zonder negatieve kleef : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -9.90  
 $E_{d;1}$  [kN] : 0.00  $E_{d;2}$  [kN] : 0.00  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 22 GT - ZBH (n=1)**

**Sondering : S 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinveld [m]	Effectief inheinveld [m]	E.G. paal [kN]	$R_{t;calc;k}$ [kN]	$R_{t;d}$ [kN]	$F_{t;tot;1}$ [kN]	U.C.
-9.90	-9.90	16.3	274.3	274.3	0.0	0.00

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**SAMENVATTINGSTABEL 22 GT - ZBH (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_c$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen	Rekenwaarden		
	niveau	niveaue		$R_{t,cal}$ [kN]	$R_{t,d}$ [kN]	$R_{t,netto,d}$ [kN]
S 22 GT - ZBH	0.00	-9.90	274.3	274.3	274.3	

**REKENGEDEGENS 91 RSD - MDK**

Berekening : Controlerend  
 Rekenmethode : Trekpalen volgens NEN-EN 1997-1, art. 7.6.3  
 Sondering(en) : S 91 RSD - MDK  
 Let op: trekcapaciteit t.p.v. negatief kleeftraject is meegerekend.

Stijf bouwwerk : NEE  
 Paalgroep : NEE  
 Aantal sonderingen : 1  
 Factor  $\xi_{3(n=1)}$  : 1.39  
 Factor  $\xi_{3(geom)}$  : 1.39  
 Factor  $\xi_{3(min)}$  : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.35  
 $\gamma_{m;var,gc}$  : 1.50  
 UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -8.80  
 $E_{d,1}$  [kN] : 0.00  $E_{d,2}$  [kN] : 0.00  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 91 RSD - MDK (n=1)**

**Sondering : S 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinveld	Effectief inheinveld	E.G. paal	$R_{t,cal,k}$	$R_{t,d}$	$F_{t,tot,1}$	U.C.
[m]	[m]	[kN]	[kN]	[kN]	[kN]	
-8.80	-8.80	14.6	289.7	289.7	0.0	0.00

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**SAMENVATTINGSTABEL 91 RSD - MDK (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_c$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen	Rekenwaarden		
	niveau	niveau		$R_{t,calc}$ [kN]	$R_{t,d}$ [kN]	$R_{t,netto,d}$ [kN]
S 91 RSD - MDK	0.04	-8.80		289.7	289.7	289.7

**REKENGEGEVENS 92 RSD - MDK**

Berekening : Controlerend  
 Rekenmethode : Trekpalen volgens NEN-EN 1997-1, art. 7.6.3  
 Sondering(en) : S 92 RSD - MDK  
 Let op: trekcapaciteit t.p.v. negatief kleeftraject is meegerekend.

Stijf bouwwerk : NEE  
 Paalgroep : NEE  
 Aantal sonderingen : 1  
 Factor  $\xi_{3(n=1)}$  : 1.39  
 Factor  $\xi_{3(geom)}$  : 1.39  
 Factor  $\xi_{3(min)}$  : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.35  
 $\gamma_{m;var,gc}$  : 1.50  
 UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -9.30  
 $E_{d,1}$  [kN] : 0.00  $E_{d,2}$  [kN] : 0.00  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 92 RSD - MDK (n=1)**

**Sondering : S 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheineveau [m]	Effectief inheineveau [m]	E.G. paal [kN]	$R_{t,calc,k}$ [kN]	$R_{t,d}$ [kN]	$F_{t,tot,1}$ [kN]	U.C.
-9.30	-9.30	15.4	361.7	361.7	0.0	0.00

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**SAMENVATTINGSTABEL 92 RSD - MDK (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_c$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen	Rekenwaarden		
	niveau	niveau		$R_{t,calc}$ [kN]	$R_{t,d}$ [kN]	$R_{t,netto,d}$ [kN]
S 92 RSD - MDK	0.01	-9.30	361.7	361.7	361.7	

**REKENGEGEVENS 84 RSD - MDK**

Berekening : Controlerend  
 Rekenmethode : Trekpalen volgens NEN-EN 1997-1, art. 7.6.3  
 Sondering(en) : S 84 RSD - MDK  
 Let op: trekcapaciteit t.p.v. negatief kleeftraject is meegerekend.

Stijf bouwwerk : NEE  
 Paalgroep : NEE  
 Aantal sonderingen : 1  
 Factor  $\xi_{3(n=1)}$  : 1.39  
 Factor  $\xi_{3(geom)}$  : 1.39  
 Factor  $\xi_{3(min)}$  : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.35  
 $\gamma_{m,vari,qc}$  : 1.50  
 UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -12.30  
 $E_{d,1}$  [kN] : 0.00  $E_{d,2}$  [kN] : 0.00  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 84 RSD - MDK (n=1)**

**Sondering : S 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheineveau [m]	Effectief inheineveau [m]	E.G. paal [kN]	$R_{t,calc}$ [kN]	$R_{t,d}$ [kN]	$F_{t,tot,1}$ [kN]	U.C.
-12.30	-12.30	20.0	279.8	279.8	0.0	0.00

Project : ZW-Oost  
 Onderdeel : TOSP fundatie trek

**SAMENVATTINGSTABEL 84 RSD - MDK (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_c$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezuigdraagvermogen	Rekenwaarden		
	niveau	niveau		$R_{t,cal}$ [kN]	$R_{t,d}$ [kN]	$R_{t,netto,d}$ [kN]
S 84 RSD - MDK	0.00	-12.30	279.8	279.8	279.8	

**PAALGEGEVENS Larssen LP2**

Type : Eigen paal  
 Basispaaltype : Stalen buispaal (gesloten)  
 Wijze van installeren : Heien  
 Wijze van terugwinnen : n.v.t.  
 Afmeting a [m] : 0.314  
 Afmeting b [m] : 0.410  
 Elasticiteitsmodulus [N/mm<sup>2</sup>] : 40000  
 Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
 Factor  $\alpha_c$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Paalvoetvormfactor  $\beta$  : 1.00  
 Type lastzakingsdiagram : Grondverdringende paal  
 Verm.factor \*  $\phi'_{j,k}$  : 0.75  
 Groutomhulling : NEE



Project : ZW-Oost  
Onderdeel : TOSP fundatie trek

**OVERZICHT NETTO DRAAGVERMOGEN TREKPALEN (n=1)**

Netto paal draagvermogen(s) zijn naar beneden toe afgerond op: 1.0 kN nauwkeurig  
Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		R <sub>e, netto, d</sub> [kN]			
	niveau	niveau	22 GT - Z	91 RSD -	92 RSD -	84 RSD -
S 92 RSD - MDK	0.01	-9.30			361	
S 91 RSD - MDK	0.04	-8.80		289		
S 22 GT - ZBH	0.00	-9.90	274			
S 84 RSD - MDK	0.00	-12.30				279

Project : ZW-Oost  
 Onderdeel : D3 TOSP druk

**ALGEMENE GEGEVENS**

Project : ZW-Oost  
 Onderdeel : D3 TOSP druk  
 Datum : 05-06-2020  
 Bestand : P:\EANL\_Projects\10124719 - TenneT Engineering  
 ZW380 kV Oost\2 Content\001 Tekeningen\050 PLS  
 cadd\Fundatie berekeningen RFC013\RFC013  
 druk.pvw  
 Berekeningstype : Verticaal belaste paal  
 Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

**Toegepaste normen volgens Eurocode met Nederlandse NB**

Geotechniek EN 1997-1:2004 AC:2009  
 NEN-EN 1997-1:2005 C1+A1:2013 NB:2016  
 NEN 9997-1:2016 C2:2017

**BODEMPROFIELGEGEVENS: B 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.01 Grondwaterstand [m] : -0.99

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$ d <sub>50</sub> [mm]
1	0.01	-1.97	Leem - Zwak zandig - Vast	1.0	50.0	
2	-1.97	-3.59	Zand - Schoon - Matig	1.0	100.0	
3	-3.59	-5.24	Leem - Zwak zandig - Vast	1.0	50.0	
4	-5.24	-14.90	Zand - Schoon - Matig	1.0	100.0	

**BODEMPROFIELGEGEVENS: B 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.04 Grondwaterstand [m] : -0.96

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$ d <sub>50</sub> [mm]
1	0.04	-4.57	Zand - Zwak siltig - Kleilig	1.0	100.0	
2	-4.57	-5.49	Klei - Zwak zandig - Vast	1.0	50.0	
3	-5.49	-11.99	Zand - Schoon - Matig	1.0	100.0	
4	-11.99	-13.18	Klei - Zwak zandig - Slap	1.0	50.0	
5	-13.18	-14.82	Klei - Schoon - Matig	1.0	50.0	

**BODEMPROFIELGEGEVENS: B 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.00 Grondwaterstand [m] : -1.00

Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$ d <sub>50</sub> [mm]
1	0.00	-2.00	Veen - Matig voorbelast - Matig	1.0	50.0	
2	-2.00	-11.01	Zand - Zwak siltig - Kleilig	1.0	100.0	
3	-11.01	-11.89	Grind - Sterk siltig - Los	1.0	50.0	
4	-11.89	-12.55	Zand - Schoon - Matig	1.0	100.0	
5	-12.55	-13.29	Leem - Zwak zandig - Vast	1.0	50.0	
6	-13.29	-18.66	Zand - Sterk siltig - Kleilig	1.0	100.0	

**BODEMPROFIELGEGEVENS: B 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 d50-reductie is meegenomen overeenkomstig NEN-EN 9997 art. 7.6.2.3 (i)  
 Hoogte maaienveld [m] : 0.00 Grondwaterstand [m] : -1.00

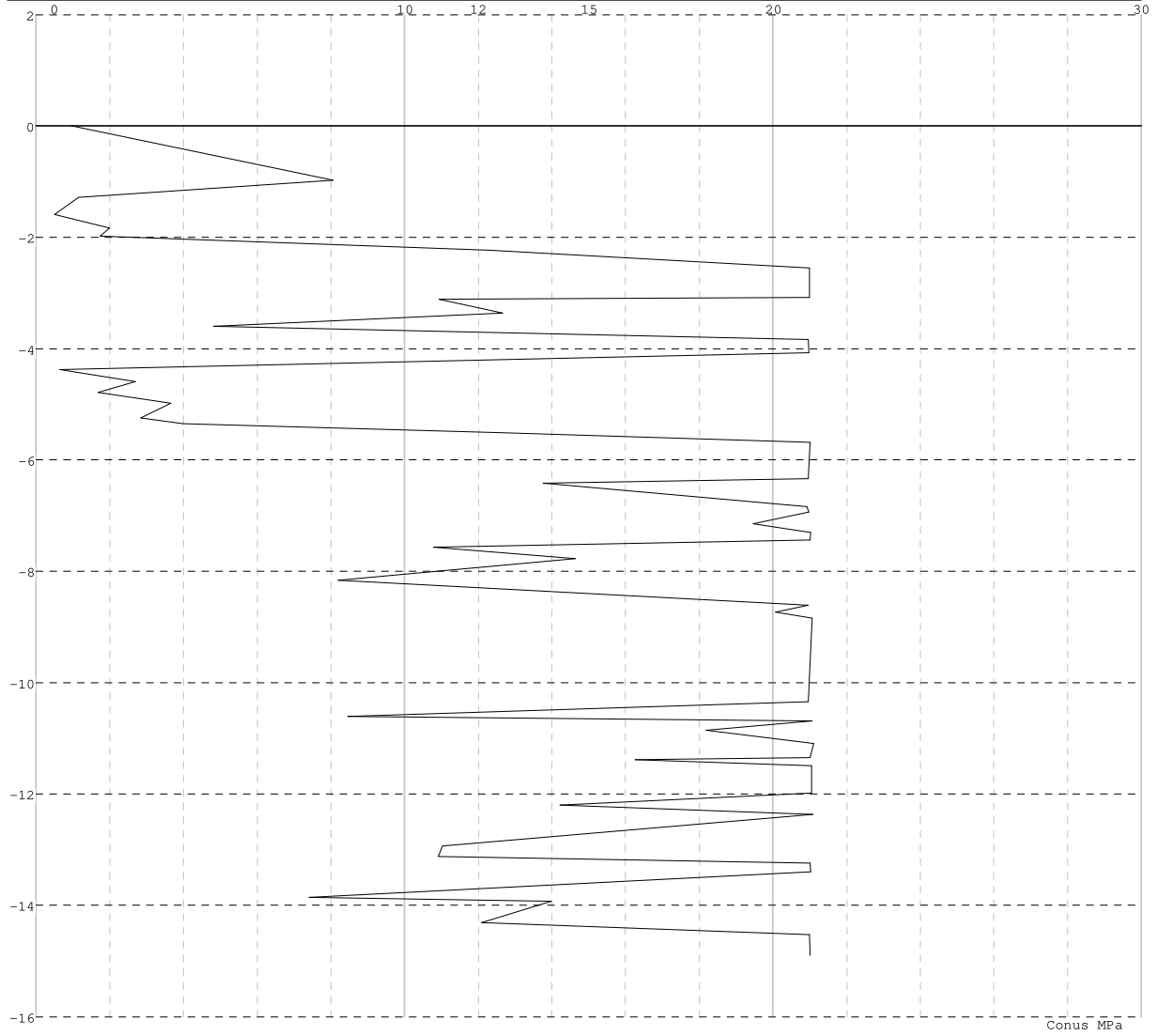
Laag	Van [m]	Tot [m]	Omschrijving	OCR	Aandeel pos. kleeft [%]	$\alpha_s$ d <sub>50</sub> [mm]
1	0.00	-1.11	Klei - Zwak zandig - Matig	1.0	50.0	
2	-1.11	-1.37	Zand - Schoon - Los	1.0	100.0	
3	-1.37	-3.70	Klei - Zwak zandig - Slap	1.0	50.0	
4	-3.70	-5.81	Veen - Matig voorbelast - Matig	1.0	50.0	
5	-5.81	-8.97	Zand - Schoon - Matig	1.0	100.0	
6	-8.97	-9.38	Leem - Zwak zandig - Vast	1.0	50.0	
7	-9.38	-13.74	Zand - Sterk siltig - Kleilig	1.0	100.0	
8	-13.74	-13.77	Leem - Zwak zandig - Vast	1.0	50.0	
9	-13.77	-14.22	Zand - Sterk siltig - Kleilig	1.0	100.0	
10	-14.22	-14.40	Leem - Zwak zandig - Vast	1.0	50.0	
11	-14.40	-15.62	Zand - Zwak siltig - Kleilig	1.0	100.0	
12	-15.62	-16.81	Leem - Zwak zandig - Vast	1.0	50.0	
13	-16.81	-16.99	Zand - Schoon - Los	1.0	100.0	

**SONDERINGSGEGEVENS ALGEMEEN: S 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 Hoogte maaienveld [m] : 0.01 Bodemprofiel: B 92 RSD - MDK  
 Traject negatieve kleeft : 0.00 tot -1.60 [m]  
 Traject positieve kleeft : -1.80 tot -14.90 [m]

Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**SONDERINGSGEGEVENS GRAFIEK: S 92 RSD - MDK**

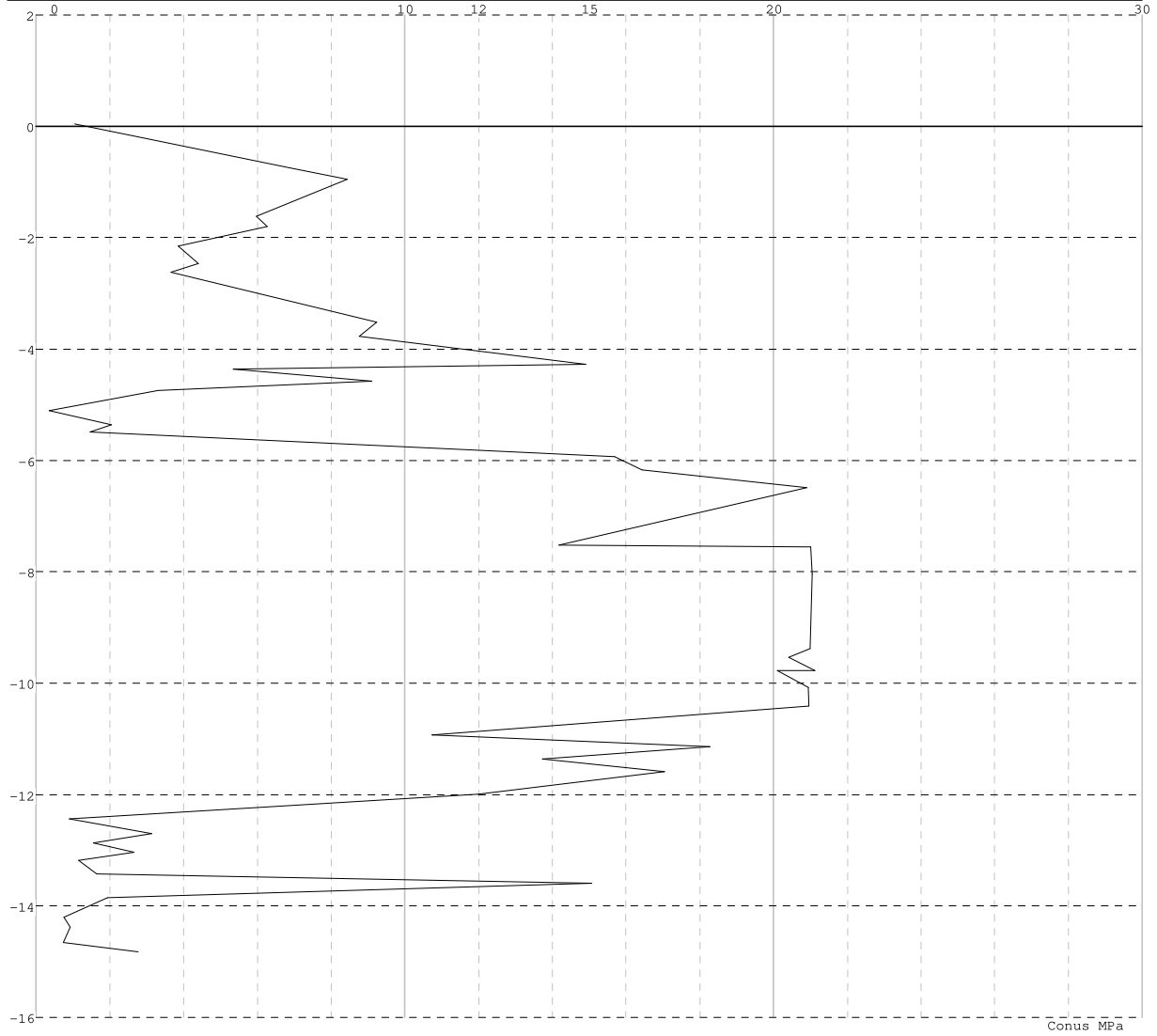


Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**SONDERINGSGEGEVENS ALGEMEEN: S 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
Hoogte maaiveld [m] : 0.04 Bodemprofiel: B 91 RSD - MDK  
Traject negatieve kleef : 0.04 tot -2.60 [m]  
Traject positieve kleef : -2.70 tot -14.82 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 91 RSD - MDK**

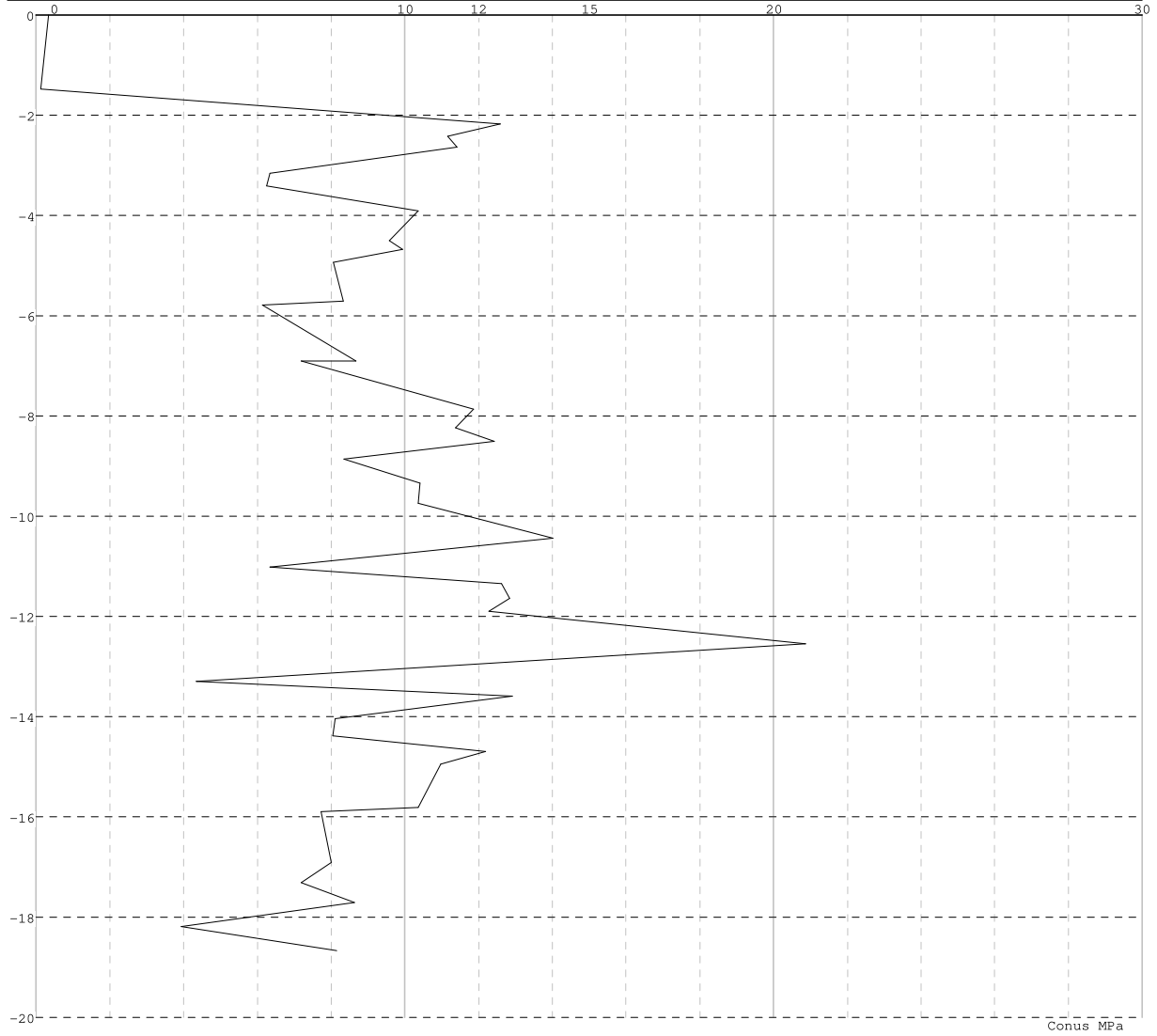


Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**SONDERINGSGEGEVENS ALGEMEEN: S 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
Hoogte maaiveld [m] : 0.00 Bodemprofiel: B 22 GT - ZBH  
Traject negatieve kleeft : -0.10 tot -1.40 [m]  
Traject positieve kleeft : -1.70 tot -18.66 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 22 GT - ZBH**

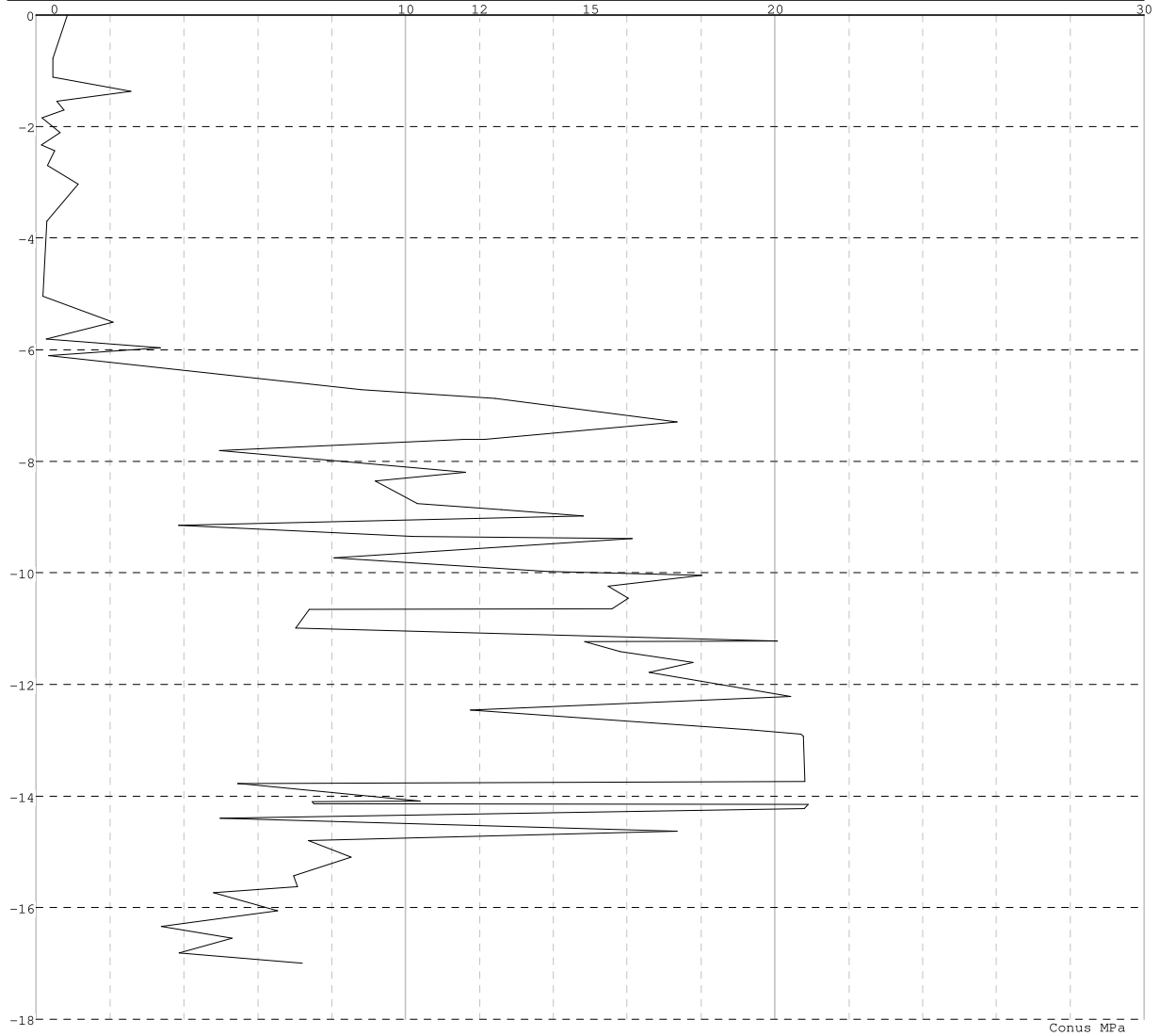


Project : ZW-Oost  
 Onderdeel : D3 TOSP druk

**SONDERINGSGEGEVENS ALGEMEEN: S 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.  
 Hoogte maaiveld [m] : 0.00 Bodemprofiel: B 84 RSD - MDK  
 Traject negatieve kleef : -0.10 tot -6.40 [m]  
 Traject positieve kleef : -6.50 tot -16.99 [m]

**SONDERINGSGEGEVENS GRAFIEK: S 84 RSD - MDK**



**REKENGEGEVENS 22 GT - ZBH**

Berekening : Controlerend  
 Rekenmethode : Drukpalen volgens NEN-EN 1997-1, art. 7.6.2  
 Sondering(en) : S 22 GT - ZBH

Stijf bouwwerk : NEE  
 Paalgroep : NEE  
 Aantal sonderingen : 1  
 Factor  $\xi_3 (n-1)$  : 1.39  
 Factor  $\xi_3 (gem)$  : 1.39  
 Factor  $\xi_4 (min)$  : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.20  
 $\gamma_{E;nk}$  : 1.0  
 $R_{b;cal;max;i}$  begrenzen op  $0.75 * R_{b;cal;max;i}$  : NEE  
 UGT draagvermogen zonder negatieve kleef : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -9.90  
 $E_{d;1}$  [kN] : 0.00  $E_{d;2}$  [kN] : 0.00  
 $S_{req;1}$  [m] : 0.15  $S_{req;2}$  [m] : 0.05  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 22 GT - ZBH (n=1)**

**Sondering : S 22 GT - ZBH**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Niveau	$R_b$	$R_s$	$R_{c;cal}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;nd}$	$F_{c;tot;1}$	U.C.	$s_{1;1}$	$s_{1;2}$
[m]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]		[mm]	[mm]
-9.90	633.5	957.9	1591	1145	954.1	-4.3	949.8	-4.3	0.00	-0.0	-0.0

Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**SAMENVATTINGSTABEL 22 GT - ZBH (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
- paaltype : Eigen paal  
- schachtafmeting : 314 x 410  
Paalklassefactor  $\alpha_p$  : 0.70  
Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen						Rekenwaarden	
	niveau	niveau	$R_{b,cal}$ [kN]	$R_{b,cal}$ [kN]	$R_{c,cal}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]		
S 22 GT - ZBH	0.00	-9.90	633.5	957.9	1591.4	954.1	-4.3	949.8		

**Totaal resultaten 22 GT - ZBH (van 1 sonderingen)**

**Uitgangspunten**

Correlatiefactor  $\xi_{3gem}$  (n= 1) : 1.39  
Correlatiefactor  $\xi_{4min}$  (n= 1) : 1.39

gebaseerd op sonderingen:

S 22 GT - ZBH

$$R_{c;k} = \min. \{ R_{c,cal;gem} / \xi_{3}; R_{c,cal;min} / \xi_{4} \} \quad (7.8)$$

Inheinniveau

[m]
-9.90 $R_{c;k} = \min. \{ (1591.4 / 1.39); (1591.4 / 1.39) \} = 1144.9$

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinniveau [m]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{c,tot;i}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-9.90	1144.9	954.1	-4.3	-4.3	949.8	0.00	-0.0	-0.0

**REKENGEGEVENS 91 RSD - MDK**

Berekening : Controlerend  
Rekenmethode : Drukpalen volgens NEN-EN 1997-1, art. 7.6.2  
Sondering(en) : S 91 RSD - MDK

Stijf bouwwerk : NEE  
Paalgroep : NEE

Aantal sonderingen : 1

Factor  $\xi_{3(n=1)}$  : 1.39

Factor  $\xi_{3(gem)}$  : 1.39

Factor  $\xi_{4(min)}$  : 1.39

Weerstandsfactor  $\gamma_R$  : 1.20

$\gamma_{f;nk}$  : 1.0

$R_{c,cal,max;i}$  begrenzen op  $0.75 * R_{b,cal,max;i}$  : NEE

UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2

Niveau paalkop [m] : N.A.P. 0.00

Paalpuntniveau : N.A.P. -8.80

$E_{d;1}$  [kN] : 0.00  $E_{d;2}$  [kN] : 0.00

$S_{req;1}$  [m] : 0.15  $S_{req;2}$  [m] : 0.05

Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 91 RSD - MDK (n=1)**

**Sondering : S 91 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Niveau [m]	$R_b$ [kN]	$R_b$ [kN]	$R_{c,cal}$ [kN]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	$F_{c,tot;i}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-8.80	1510	910.7	2421	1741	1451	-20.1	1431	-20.1	0.01	-0.1	-0.0

Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**SAMENVATTINGSTABEL 91 RSD - MDK (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
- paaltype : Eigen paal  
- schachtafmeting : 314 x 410  
Paalklassefactor  $\alpha_p$  : 0.70  
Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen					Rekenwaarden	
	niveau	niveau	$R_{b,cal}$ [kN]	$R_{b,cal}$ [kN]	$R_{c,cal}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	
S 91 RSD - MDK	0.04	-8.80	1510.0	910.7	2420.7	1451.2	-20.1	1431.2	

**Totaal resultaten 91 RSD - MDK (van 1 sonderingen)**

**Uitgangspunten**

Correlatiefactor  $\xi_{3gem}$  (n= 1) : 1.39  
Correlatiefactor  $\xi_{4min}$  (n= 1) : 1.39

gebaseerd op sonderingen:

S 91 RSD - MDK

$$R_{c;k} = \min. \{ R_{c,cal;gem} / \xi_3; R_{c,cal;min} / \xi_4 \} \quad (7.8)$$

Inheinniveau

$$-8.80 \quad R_{c;k} = \min. \{ (2420.7 / 1.39); (2420.7 / 1.39) \} = 1741.5$$

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinniveau [m]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{c,tot;i}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-8.80	1741.5	1451.2	-20.1	-20.1	1431.2	0.01	-0.1	-0.0

**REKENGEGEVENS 92 RSD - MDK**

Berekening : Controlerend  
Rekenmethode : Drukpalen volgens NEN-EN 1997-1, art. 7.6.2  
Sondering(en) : S 92 RSD - MDK

Stijf bouwwerk : NEE  
Paalgroep : NEE

Aantal sonderingen : 1  
Factor  $\xi_{3(n=1)}$  : 1.39  
Factor  $\xi_{3(gem)}$  : 1.39  
Factor  $\xi_{4(min)}$  : 1.39  
Weerstandsfactor  $\gamma_R$  : 1.20

$\gamma_{f;nk}$  : 1.0  
 $R_{c,cal,max;i}$  begrenzen op  $0.75 * R_{b,cal,max;i}$  : NEE  
UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2  
Niveau paalkop [m] : N.A.P. 0.00  
Paalpuntniveau : N.A.P. -9.30  
 $E_{d;1}$  [kN] : 0.00  $E_{d;2}$  [kN] : 0.00  
 $S_{req;1}$  [m] : 0.15  $S_{req;2}$  [m] : 0.05  
Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 92 RSD - MDK (n=1)**

**Sondering : S 92 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Niveau [m]	$R_b$ [kN]	$R_b$ [kN]	$R_{c,cal}$ [kN]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,nd}$ [kN]	$F_{c,tot;i}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-9.30	925.9	1165	2091	1504	1254	-10.2	1243	-10.2	0.01	-0.0	-0.0



Project : ZW-Oost  
 Onderdeel : D3 TOSP druk

**SAMENVATTINGSTABEL 92 RSD - MDK (n=1)**

**Uitgangspunten**  
 - paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezwijkdraagvermogen					Rekenwaarden	
	niveau	niveau	$R_{b,cal}$ [kN]	$R_{b,cal}$ [kN]	$R_{c,cal}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	
S 92 RSD - MDK	0.01	-9.30	925.9	1165.2	2091.1	1253.7	-10.2	1243.4	

**Totaal resultaten 92 RSD - MDK (van 1 sonderingen)**

Uitgangspunten  
 Correlatiefactor  $\xi_{3gem}$  (n= 1) : 1.39  
 Correlatiefactor  $\xi_{4min}$  (n= 1) : 1.39

gebaseerd op sonderingen:  
 S 92 RSD - MDK

$$R_{c;k} = \min. \{ R_{c,cal;gem} / \xi_3; R_{c,cal;min} / \xi_4 \} \quad (7.8)$$

Inheinniveau  
 [m]

-9.30	$R_{c;k} = \min. \{ (2091.1 / 1.39); (2091.1 / 1.39) \} = 1504.4$
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Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinniveau [m]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{c,tot;i}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,netto;d}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-9.30	1504.4	1253.7	-10.2	-10.2	1243.4	0.01	-0.0	-0.0

**REKENGEGEVENS 84 RSD - MDK**

Berekening : Controlerend  
 Rekenmethode : Drukpalen volgens NEN-EN 1997-1, art. 7.6.2  
 Sondering(en) : S 84 RSD - MDK

Stijf bouwwerk : NEE  
 Paalgroep : NEE

Aantal sonderingen : 1  
 Factor  $\xi_3$  (n=1) : 1.39  
 Factor  $\xi_3$  (gem) : 1.39  
 Factor  $\xi_4$  (min) : 1.39  
 Weerstandsfactor  $\gamma_R$  : 1.20

$\gamma_{f;nk}$  : 1.0  
 $R_{c,cal,max;i}$  begrenzen op  $0.75 * R_{b,cal,max;i}$  : NEE  
 UGT draagvermogen zonder negatieve kleeft : NEE

Paal : Larssen LP2  
 Niveau paalkop [m] : N.A.P. 0.00  
 Paalpuntniveau : N.A.P. -12.30  
 $E_{d;1}$  [kN] : 0.00  $E_{d;2}$  [kN] : 0.00  
 $S_{req;1}$  [m] : 0.15  $S_{req;2}$  [m] : 0.05  
 Bovenbel. [kN/m<sup>2</sup>] : 0.00

**RESULTATEN 84 RSD - MDK (n=1)**

**Sondering : S 84 RSD - MDK**

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Niveau [m]	$R_b$ [kN]	$R_b$ [kN]	$R_{c,cal}$ [kN]	$R_{c;k}$ [kN]	$R_{c,d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c,nd}$ [kN]	$F_{c,tot;i}$ [kN]	U.C.	$S_{i;1}$ [mm]	$S_{i;2}$ [mm]
-12.30	731.7	892.0	1624	1168	973.4	-80.2	893.2	-80.2	0.08	-0.3	-0.3

Project : ZW-Oost  
 Onderdeel : D3 TOSP druk

**SAMENVATTINGSTABEL 84 RSD - MDK (n=1)**

**Uitgangspunten**

- paal : Larssen LP2  
 - paaltype : Eigen paal  
 - schachtafmeting : 314 x 410  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
 Correlatiefactor  $\xi_{3(n=1)}$  : 1.39

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		Bezuwjkdraagvermogen					Rekenwaarden	
	niveau	niveau	$R_{b;cal}$ [kN]	$R_{a;cal}$ [kN]	$R_{c;cal}$ [kN]	$R_{c;d}$ [kN]	$F_{nk;d}$ [kN]	$R_{c;netto;d}$ [kN]	
S 84 RSD - MDK	0.00	-12.30	731.7	892.0	1623.7	973.4	-80.2	893.2	

**Totaal resultaten 84 RSD - MDK (van 1 sonderingen)**

**Uitgangspunten**

Correlatiefactor  $\xi_{3gem}$  (n= 1) : 1.39  
 Correlatiefactor  $\xi_{4min}$  (n= 1) : 1.39

gebaseerd op sonderingen:  
 S 84 RSD - MDK

$$R_{c;k} = \min. \{ R_{c;cal;gem} / \xi_{3}; R_{c;cal;min} / \xi_{4} \} \quad (7.8)$$

Inheinniveau  
 [m]

$$-12.30 \quad R_{c;k} = \min. \{ ( 1623.7 / 1.39 ); ( 1623.7 / 1.39 ) \} = 1168.1$$

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

Inheinniveau [m]	$R_{c;k}$ [kN]	$R_{c;d}$ [kN]	$F_{c;tot;1}$ [kN]	$F_{nk;d}$ [kN]	$R_{c;netto;d}$ [kN]	U.C.	$S_{1;1}$ [mm]	$S_{1;2}$ [mm]
-12.30	1168.1	973.4	-80.2	-80.2	893.2	0.08	-0.3	-0.3

**PAALGEGEVENS Larssen LP2**

Type : Eigen paal  
 Basispaaltype : Stalen buispaal (gesloten)  
 Wijze van installeren : Heien  
 Wijze van terugwinnen : n.v.t.  
 Afmeting a [m] : 0.314  
 Afmeting b [m] : 0.410  
 Elasticiteitsmodulus [N/mm<sup>2</sup>] : 40000  
 Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.010 (zandlagen; voor kleilagen zie tabel 7.d)  
 Factor  $\alpha_s$  (tabel 7.c EC 7.1) : 0.0070 (zandlagen; voor kleilagen zie tabel 7.d)  
 Paalklassefactor  $\alpha_p$  : 0.70  
 Paalvoetvormfactor  $\beta$  : 1.00  
 Type lastzakkingsdiagram : Grondverdringende paal  
 Verm.factor \*  $\phi'_{j;k}$  : 0.75  
 Groutomhulling : NEE

Project : ZW-Oost  
Onderdeel : D3 TOSP druk

**OVERZICHT NETTO DRAAGVERMOGEN DRUKPALEN**

Netto paal draagvermogen(s) zijn naar beneden toe afgerond op: 1.0 kN nauwkeurig

Alle niveaus/hoogtes/peilmaten zijn t.o.v.: N.A.P.

sondering	maaiveld paalpunt		R <sub>o, netto, d</sub> [kN]		
	niveau	niveau	22 GT - Z	91 RSD -	92 RSD - 84 RSD -
S 92 RSD - MDK	0.01	-9.30			1243
S 91 RSD - MDK	0.04	-8.80		1431	
S 22 GT - ZBH	0.00	-9.90	949		
S 84 RSD - MDK	0.00	-12.30			893



Project: GT-ZBH150  
Mast: 22 - D+3.6

**Shear blocks**

NEN-EN 1993-1-1 en NEN-EN 1994-1-1

Datum: 2022-04-06

Auteur: TBR

Versie: 1.4

Load			Results		
Compression	$F_{Ed,c}$	496 kN	Compression	U.C.	0.90 < 1,00 OK
Tension	$F_{Ed,t}$	410 kN	Tension	U.C.	0.81 < 1,00 OK

**Main leg**

Profile		<b>L120.11</b>
Steel material		S235
Cross section		2540 mm <sup>2</sup>
Axial capacity	$N_{pl}$	597 kN
Width	b	120 mm
Thickness	t	11 mm
Length in concrete		1125 mm

**Capacity shear blocks main leg**

$A_{f1}$		3300 mm <sup>2</sup>
$A_{f2}$		7500 mm <sup>2</sup>
Slope		1 : 5
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1.51
$f_{jd} = C_A \times f_{cd}$		20.1 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		398 kN
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		398 kN

**Shear blocks main leg**

Width	b	50 mm
Thickness	h	30 mm
Length	L	110 mm
Welds	a	4 mm
c.t.c. separation	s	150 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity foot plate**

$K_d$		1.73 -
$f_{jd} = C_A \times f_{cd}$		23.1 N/mm <sup>2</sup>
$c = t\sqrt{(f_{yd} / 3f_{jd})}$		49 mm
$m^* = \min(c,m)$		10 mm
Type foot plate		Diagonally cut
Effective for		Compr. and tension
$A_{p,c}$		7162 mm <sup>2</sup>
$F_{Rd,c} = A_{p,druk} \times f_{jd}$		165 kN
$A_{p,t}$		4622 mm <sup>2</sup>
$F_{Rd,t} = A_{p,t} \times f_{jd}$		107 kN

**Foot plate**

Thickness	t	25 mm
Ext. length	m	10 mm
Welds	a	5 mm

**Pile**

Name		Buispaal
Diameter		470 mm
Thickness		10 mm
Cross section		14451 mm <sup>2</sup>
Steel material		S235
Capacity		3396 kN
Concrete strength		C25/30

**Capacities**

$F_{Rd,c,plate}$		165 kN
$F_{Rd,blocks,c}$		398 kN
$F_{Rd,c} = F_{Rd,blk} + F_{Rd,footplate}$		<b>563 kN</b>
U.C. compression		0.88 < 1,00 OK
Welds foot plate (see next page)		476 kN
$F_{Rd,t} = \min. (welds / foot plate) =$		107 kN
$F_{Rd,blocks,t}$		398 kN
$F_{Rd,t} = F_{Rd,blk} + F_{Rd,footplate}$		<b>505 kN</b>
U.C. tension		0.81 < 1,00 OK
U.C. welds		0.55 < 1,00 OK

**Shear blocks pile**

Width	b	100 mm
Thickness	h	30 mm
Length	L	150 mm
Welds	a	4 mm
c.t.c. separation	s	200 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity shear blocks pile**

$A_{f1}$		4500 mm <sup>2</sup>
$A_{f2}$		10500 mm <sup>2</sup>
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1.53 -
$f_{jd} = k_d \times f_{cd}$		20.4 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		<b>550 kN</b>
U.C. compression		0.90 < 1,00 OK
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		<b>550 kN</b>
U.C. tension		0.75 < 1,00 OK
U.C. welds		0.41 < 1,00 OK

**Design value concrete strength**

Material factor	$\gamma_c$	1.5
Add. mat. factor	$\gamma_m$	1.25 -
$f_{cd} =$		13.3 N/mm <sup>2</sup>

**Steel tower stub**

Yield strength	$f_{yd} =$	235 N/mm <sup>2</sup>
Tensile strength	$f_{ud} =$	360 N/mm <sup>2</sup>

**"Splitting" of pile**

Spread of forces		45 °
Length force flow		900 mm
Splitting force		228 kN/m
Yield strength wall	$f_{yd} =$	235 N/mm <sup>2</sup>
Capacity tubular pile		4700 kN/m
U.C.		0.05 < 1,00 OK

### Welds of shear blocks of main leg

Out-of-plane loading

#### Plate

t =	50 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

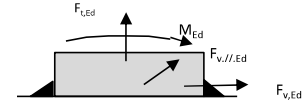
Factor	1.2
$F_{t,Ed}$ =	0 kN
$F_{v,Ed} = F_{Rd,c} / n =$	80 kN
$F_{v//,Ed} =$	0 kN
$M_{Ed} = 1/2 b / h \times F_{v,Ed} =$	1.19 kNm

#### Check

$\sigma_{vw,Ed} =$	199 N/mm <sup>2</sup>	≤	
$\sigma_1 =$	100 N/mm <sup>2</sup>	≤	

#### Welds

a =	4 mm
l =	110 mm
$\beta_w =$	0.8 -
$\gamma_{M2} =$	1.25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 4al =$	0 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 4al =$	64 N/mm <sup>2</sup>
	<hr/>
	64 N/mm <sup>2</sup>
$b^* = b + 2/3av2$	53.8 mm
$\sigma_1 = \tau_1 = 0,706M_{Ed} / al b^* =$	36 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al =$	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)} =$	199 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>	U.C. =	0.55 OK
$0,9f_u / \gamma_{M2} =$	259 N/mm <sup>2</sup>	U.C. =	0.38 OK

### Welds of shear blocks of pile

Out-of-plane loading

#### Plate

t =	100 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

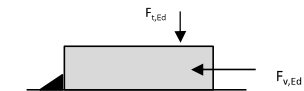
Factor	1.2
$F_{t,Ed} = 1/2 b / h \times F_{v,Ed} =$	16 kN
$F_{v,Ed} =$	110 kN
$F_{v//,Ed} =$	0 kN
$M_{Ed} =$	0.00 kNm

#### Check

$\sigma_{vw,Ed} =$	149 N/mm <sup>2</sup>	≤	
$\sigma_1 =$	75 N/mm <sup>2</sup>	≤	

#### Welds

a =	4 mm
l =	150 mm
$\beta_w =$	0.8 -
$\gamma_{M2} =$	1.25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 2al =$	10 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 2al =$	65 N/mm <sup>2</sup>
	<hr/>
	75 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al =$	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)} =$	149 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>	U.C. =	0.41 OK
$0,9f_u / \gamma_{M2} =$	259 N/mm <sup>2</sup>	U.C. =	0.29 OK

### Welds of foot plate

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>
Weld size a =	5 mm
Length l = 2b + 2b - t =	458 mm
Capacity $F_{Rd} = a \times l \times f_{w,d} / \sqrt{3} =$	476 kN



Project: GT-ZBH150  
Mast: 24 - A

**Shear blocks**

NEN-EN 1993-1-1 en NEN-EN 1994-1-1

Datum: 2022-04-07  
Auteur: TBR  
Versie: 1.4

Load			Results		
Compression	$F_{Ed,c}$	603 kN	Compression	U.C.	0,76 < 1,00 OK
Tension	$F_{Ed,t}$	523 kN	Tension	U.C.	0,78 < 1,00 OK

**Main leg**

Profile		<b>L160.17</b>
Steel material		S235
Cross section		5182 mm <sup>2</sup>
Axial capacity	$N_{pl}$	1218 kN
Width	b	160 mm
Thickness	t	17 mm
Length in concrete		1125 mm

**Capacity shear blocks main leg**

$A_{f1}$		4500 mm <sup>2</sup>
$A_{f2}$		9500 mm <sup>2</sup>
Slope		1: 5
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1,45
$f_{jd} = C_A \times f_{cd}$		19,4 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		523 kN
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		523 kN

**Shear blocks main leg**

Width	b	50 mm
Thickness	h	30 mm
Length	L	150 mm
Welds	a	4 mm
c.t.c. separation	s	150 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity foot plate**

$K_d$		1,73 -
$f_{jd} = C_A \times f_{cd}$		23,1 N/mm <sup>2</sup>
$c = t\sqrt{(f_{yd} / 3f_{jd})}$		50 mm
$m^* = \min(c,m)$		10 mm
Type foot plate		Diagonally cut
Effective for		Compr. and tension
$A_{p,c}$		11620 mm <sup>2</sup>
$F_{Rd,c} = A_{p,druk} \times f_{jd}$		268 kN
$A_{p,t}$		6438 mm <sup>2</sup>
$F_{Rd,t} = A_{p,t} \times f_{jd}$		149 kN

**Foot plate**

Thickness	t	25 mm
Ext. length	m	10 mm
Welds	a	5 mm

**Pile**

Name		Buispaal
Diameter		470 mm
Thickness		10 mm
Cross section		14451 mm <sup>2</sup>
Steel material		S235
Capacity		3396 kN
Concrete strength		C25/30

**Capacities**

$F_{Rd,c,plate}$		268 kN
$F_{Rd,blocks,c}$		523 kN
$F_{Rd,c} = F_{Rd,blk} + F_{Rd,footplate}$		<b>791 kN</b>
U.C. compression		0,76 < 1,00 OK
Welds foot plate (see next page)		630 kN
$F_{Rd,t} = \min. (welds / foot plate) =$		149 kN
$F_{Rd,blocks,t}$		523 kN
$F_{Rd,t} = F_{Rd,blk} + F_{Rd,footplate}$		<b>672 kN</b>
U.C. tension		0,78 < 1,00 OK
U.C. welds		0,53 < 1,00 OK

**Shear blocks pile**

Width	b	100 mm
Thickness	h	50 mm
Length	L	250 mm
Welds	a	6 mm
c.t.c. separation	s	290 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity shear blocks pile**

$A_{f1}$		12500 mm <sup>2</sup>
$A_{f2}$		27000 mm <sup>2</sup>
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1,47 -
$f_{jd} = k_d \times f_{cd}$		19,6 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		<b>1470 kN</b>
U.C. compression		0,41 < 1,00 OK
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		<b>1470 kN</b>
U.C. tension		0,36 < 1,00 OK
U.C. welds		0,48 < 1,00 OK

**Design value concrete strength**

Material factor	$\gamma_c$	1,5
Add. mat. factor	$\gamma_m$	1,25 -
$f_{cd} =$		13,3 N/mm <sup>2</sup>

**Steel tower stub**

Yield strength	$f_{yd} =$	235 N/mm <sup>2</sup>
Tensile strength	$f_{ud} =$	360 N/mm <sup>2</sup>

**"Splitting" of pile**

Spread of forces		45 °
Length force flow		900 mm
Splitting force		291 kN/m
Yield strength wall	$f_{yd} =$	235 N/mm <sup>2</sup>
Capacity tubular pile		4700 kN/m
U.C.		0,06 < 1,00 OK

### Welds of shear blocks of main leg

Out-of-plane loading

#### Plate

t =	50 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

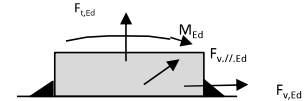
Factor	1,2
$F_{t,Ed}$ =	0 kN
$F_{v,Ed} = F_{rd,c} / n$ =	105 kN
$F_{v//,Ed}$ =	0 kN
$M_{Ed} = 1/2 b / h \times F_{v,Ed}$ =	1,57 kNm

#### Check

$\sigma_{vw,Ed}$ =	192 N/mm <sup>2</sup>	≤	
$\sigma_1$ =	96 N/mm <sup>2</sup>	≤	

#### Welds

a =	4 mm
l =	150 mm
$\beta_w$ =	0,8 -
$\gamma_{M2}$ =	1,25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 4al$ =	0 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 4al$ =	62 N/mm <sup>2</sup>
	<hr/>
	62 N/mm <sup>2</sup>
$b^* = b + 2/3av\sqrt{2}$	53,8 mm
$\sigma_1 = \tau_1 = 0,706M_{Ed} / al b^*$ =	34 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al$ =	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)}$ =	192 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2}$ =	360 N/mm <sup>2</sup>	U.C. =	0,53 OK
$0,9f_u / \gamma_{M2}$ =	259 N/mm <sup>2</sup>	U.C. =	0,37 OK

### Welds of shear blocks of pile

Out-of-plane loading

#### Plate

t =	100 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

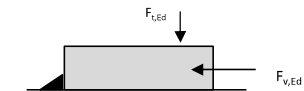
Factor	1,2
$F_{t,Ed} = 1/2 b / h \times F_{v,Ed}$ =	73 kN
$F_{v,Ed}$ =	294 kN
$F_{v//,Ed}$ =	0 kN
$M_{Ed}$ =	0,00 kNm

#### Check

$\sigma_{vw,Ed}$ =	173 N/mm <sup>2</sup>	≤	
$\sigma_1$ =	87 N/mm <sup>2</sup>	≤	

#### Welds

a =	6 mm
l =	250 mm
$\beta_w$ =	0,8 -
$\gamma_{M2}$ =	1,25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 2al$ =	17 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 2al$ =	69 N/mm <sup>2</sup>
	<hr/>
	87 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al$ =	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)}$ =	173 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2}$ =	360 N/mm <sup>2</sup>	U.C. =	0,48 OK
$0,9f_u / \gamma_{M2}$ =	259 N/mm <sup>2</sup>	U.C. =	0,33 OK

### Welds of foot plate

$f_u / \beta_w \gamma_{M2}$ =	360 N/mm <sup>2</sup>
Weld size a =	5 mm
Length l = 2b + 2b - t =	606 mm
Capacity $F_{Rd} = a \times l \times f_{w,d} / \sqrt{3}$ =	630 kN



Project: RSD-MDK150  
Mast: 92 - D+0

**Shear blocks**

NEN-EN 1993-1-1 en NEN-EN 1994-1-1

Datum: 2022-04-06

Auteur: TBR

Versie: 1.4

Load			Results		
Compression	$F_{Ed,c}$	407 kN	Compression	U.C.	0.74 < 1,00 OK
Tension	$F_{Ed,t}$	332 kN	Tension	U.C.	0.66 < 1,00 OK

**Main leg**

Profile		<b>L120.11</b>
Steel material		S235
Cross section		2540 mm <sup>2</sup>
Axial capacity	$N_{pl}$	597 kN
Width	b	120 mm
Thickness	t	11 mm
Length in concrete		1125 mm

**Capacity shear blocks main leg**

$A_{f1}$		3300 mm <sup>2</sup>
$A_{f2}$		7500 mm <sup>2</sup>
Slope		1 : 5
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1.51
$f_{jd} = C_A \times f_{cd}$		20.1 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		398 kN
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		398 kN

**Shear blocks main leg**

Width	b	50 mm
Thickness	h	30 mm
Length	L	110 mm
Welds	a	4 mm
c.t.c. separation	s	150 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity foot plate**

$K_d$		1.73 -
$f_{jd} = C_A \times f_{cd}$		23.1 N/mm <sup>2</sup>
$c = t\sqrt{(f_{yd} / 3f_{jd})}$		49 mm
$m^* = \min(c,m)$		10 mm
Type foot plate		Diagonally cut
Effective for		Compr. and tension
$A_{p,c}$		7162 mm <sup>2</sup>
$F_{Rd,c} = A_{p,druk} \times f_{jd}$		165 kN
$A_{p,t}$		4622 mm <sup>2</sup>
$F_{Rd,t} = A_{p,t} \times f_{jd}$		107 kN

**Foot plate**

Thickness	t	25 mm
Ext. length	m	10 mm
Welds	a	5 mm

**Pile**

Name		Buispaal
Diameter		470 mm
Thickness		10 mm
Cross section		14451 mm <sup>2</sup>
Steel material		S235
Capacity		3396 kN
Concrete strength		C25/30

**Capacities**

$F_{Rd,c,plate}$		165 kN
$F_{Rd,blocks,c}$		398 kN
$F_{Rd,c} = F_{Rd,blk} + F_{Rd,footplate}$		<b>563 kN</b>
U.C. compression		0.72 < 1,00 OK
Welds foot plate (see next page)		476 kN
$F_{Rd,t} = \min. (welds / foot plate) =$		107 kN
$F_{Rd,blocks,t}$		398 kN
$F_{Rd,t} = F_{Rd,blk} + F_{Rd,footplate}$		<b>505 kN</b>
U.C. tension		0.66 < 1,00 OK
U.C. welds		0.55 < 1,00 OK

**Shear blocks pile**

Width	b	100 mm
Thickness	h	30 mm
Length	L	150 mm
Welds	a	4 mm
c.t.c. separation	s	200 mm
Number for compr.	$n_c$	6 -
Number for tension	$n_t$	6 -

**Capacity shear blocks pile**

$A_{f1}$		4500 mm <sup>2</sup>
$A_{f2}$		10500 mm <sup>2</sup>
$C_A = \sqrt{(A_{f2}/A_{f1})}$		1.53 -
$f_{jd} = k_d \times f_{cd}$		20.4 N/mm <sup>2</sup>
$F_{Rd,c} = n_c \times A_{f1} \times f_{jd}$		<b>550 kN</b>
U.C. compression		0.74 < 1,00 OK
$F_{Rd,t} = n_t \times A_{f1} \times f_{jd}$		<b>550 kN</b>
U.C. tension		0.60 < 1,00 OK
U.C. welds		0.41 < 1,00 OK

**Design value concrete strength**

Material factor	$\gamma_c$	1.5
Add. mat. factor	$\gamma_m$	1.25 -
$f_{cd} =$		13.3 N/mm <sup>2</sup>

**Steel tower stub**

Yield strength	$f_{yd} =$	235 N/mm <sup>2</sup>
Tensile strength	$f_{ud} =$	360 N/mm <sup>2</sup>

**"Splitting" of pile**

Spread of forces		45 °
Length force flow		900 mm
Splitting force		184 kN/m
Yield strength wall	$f_{yd} =$	235 N/mm <sup>2</sup>
Capacity tubular pile		4700 kN/m
U.C.		0.04 < 1,00 OK



### Welds of shear blocks of main leg

Out-of-plane loading

#### Plate

t =	50 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

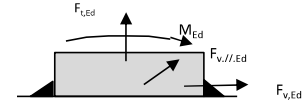
Factor	1.2
$F_{t,Ed}$ =	0 kN
$F_{v,Ed} = F_{rd,c} / n =$	80 kN
$F_{v//,Ed} =$	0 kN
$M_{Ed} = 1/2 b / h \times F_{v,Ed} =$	1.19 kNm

#### Check

$\sigma_{vw,Ed} =$	199 N/mm <sup>2</sup>	≤
$\sigma_1 =$	100 N/mm <sup>2</sup>	≤

#### Welds

a =	4 mm
l =	110 mm
$\beta_w =$	0.8 -
$\gamma_{M2} =$	1.25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 4al =$	0 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 4al =$	64 N/mm <sup>2</sup>
	<hr/>
	64 N/mm <sup>2</sup>
$b^* = b + 2/3av2$	53.8 mm
$\sigma_1 = \tau_1 = 0,706M_{Ed} / al b^* =$	36 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al =$	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)} =$	199 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>	U.C. =	<b>0.55 OK</b>
$0,9f_u / \gamma_{M2} =$	259 N/mm <sup>2</sup>	U.C. =	<b>0.38 OK</b>

### Welds of shear blocks of pile

Out-of-plane loading

#### Plate

t =	100 mm
Grade	S235
$f_{yd}$ =	235 N/mm <sup>2</sup>
$f_u$ =	360 N/mm <sup>2</sup>

#### Member forces

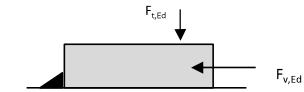
Factor	1.2
$F_{t,Ed} = 1/2 b / h \times F_{v,Ed} =$	16 kN
$F_{v,Ed} =$	110 kN
$F_{v//,Ed} =$	0 kN
$M_{Ed} =$	0.00 kNm

#### Check

$\sigma_{vw,Ed} =$	149 N/mm <sup>2</sup>	≤
$\sigma_1 =$	75 N/mm <sup>2</sup>	≤

#### Welds

a =	4 mm
l =	150 mm
$\beta_w =$	0.8 -
$\gamma_{M2} =$	1.25 -



#### Stress components

$\sigma_1 = \tau_1 = F_{t,Ed} \sqrt{2} / 2al =$	10 N/mm <sup>2</sup>
$\sigma_1 = \tau_1 = F_{v,Ed} \sqrt{2} / 2al =$	65 N/mm <sup>2</sup>
	<hr/>
	75 N/mm <sup>2</sup>
$\tau_{//} = F_{v//,Ed} / 2al =$	0 N/mm <sup>2</sup>
$\sigma_{vw,Ed} = \sqrt{(\sigma_1^2 + 3\tau_1^2 + 3\tau_{//}^2)} =$	149 N/mm <sup>2</sup>

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>	U.C. =	<b>0.41 OK</b>
$0,9f_u / \gamma_{M2} =$	259 N/mm <sup>2</sup>	U.C. =	<b>0.29 OK</b>

### Welds of foot plate

$f_u / \beta_w \gamma_{M2} =$	360 N/mm <sup>2</sup>
Weld size a =	5 mm
Length l = 2b + 2b - t =	458 mm
Capacity $F_{Rd} = a \times l \times f_{w,d} / \sqrt{3} =$	476 kN



**APPENDIX D**  
**BEAMS**

---

## INTRODUCTION

In the BO phase, calculations were performed on the towers. The members were checked in PLS-TOWER. The elaboration of the report has shown that the beams need additional calculations and checks, since these cannot be tested in PLS-TOWER. This memo describes the result of the checking. A reinforcement proposal has been worked out for the components that do not comply.

## STRUCTURE LOADS

There are four locations with OSPs, with an existing tower on either side. The beams of the suspension tower types D+0 and D+3.6 are examined for the bending load. Decisive for the load is the proximity to the riser point and the change of direction towards the riser point. Table 1 shows that the loads can be divided into two situations, one with a large angle, one with a small angle.

**Table 1 Overview locations with structural loads**

Line	Tower No	Tower Type	Span (m)	Direction change (m)	Max. angle conductor (°)	Loading situation
GT-ZBH150	20	D+0	160	6	2	1
GT-ZBH150	22	D+3.6	100	36	20	2
GT-ZBH150	24	A	170			
GT-ZBH150	32	D+0	160	6	2	1
RSD-MDK150	82	H130	175			
RSD-MDK150	84	D+0	145	16	6	1
RSD-MDK150	91	D+0	90	20	13	2
RSD-MDK150	92	D+0	67/95	18	11	2

The following tables show the loads from PLS-TOWER for towers of situation 1 and situation 2.

### Tower loading situation 2

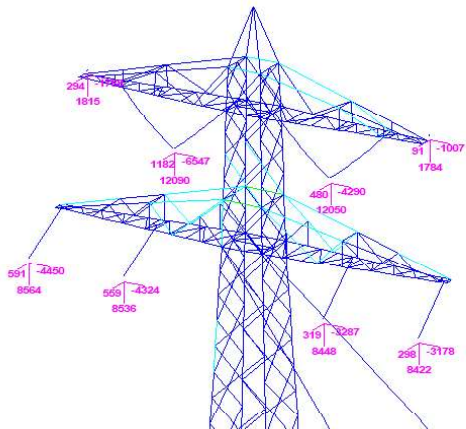
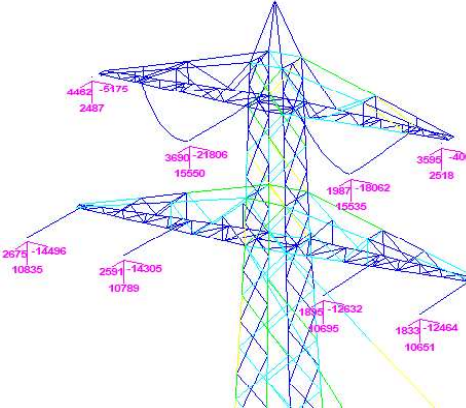
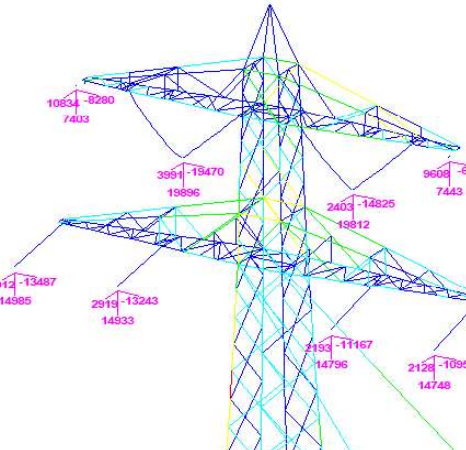
Towers 22 (table 2) and 92 (table 3) were examined. Tower 91 has not been found to be decisive because the vertical load is smaller than tower 92. Loads are shown for “afkeur” and “verbouw” level due to possible need for reinforcements.

A comparison between the two locations shows that the loads are highest at tower 22. These are used in the calculations.

**Revision 4:** at tower 22 the insulator string at the outer corner of the lower cross arm will be changed to a “hangende afspanning”. The changes to structural loads were found to be negligible, the loads that were determined with the vertical insulator chain were kept in the calculation.

The impact of the change to “hangende afspanning” was investigated with PLS-CADD. With 1 m pivoting length, the conductor tension was determined to be 79% of the EDS-tension. This is within the 80% value that was used in the calculations, so no revision of the conductor loads was required.

**Table 2 Structural loads for D+3.6 (GT-ZBH tower 22)<sup>1</sup>**

<p>SLS 7</p>	
<p>ULS 1a_90</p>	
<p>ULS 3_90</p>	

<sup>1</sup> The pictures shows a supporting guy-wire which was eventually not applied. The presence of the guy wire has no influence to the loads.

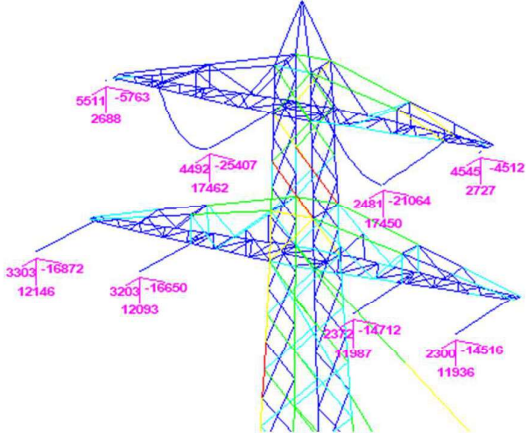
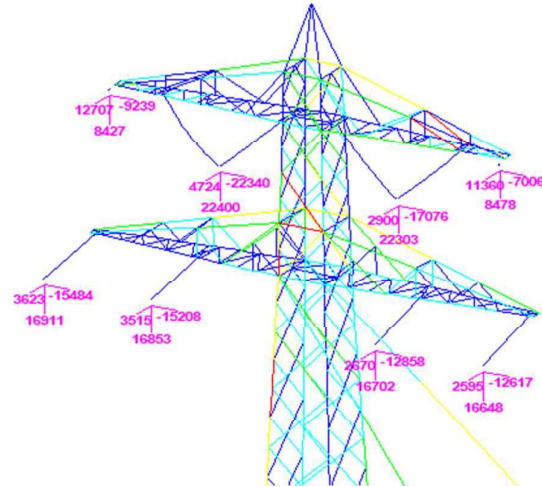
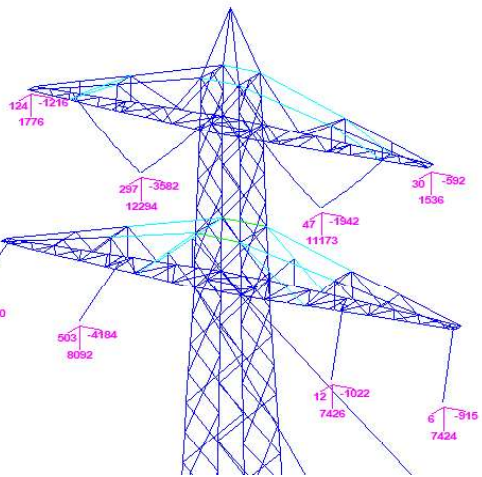
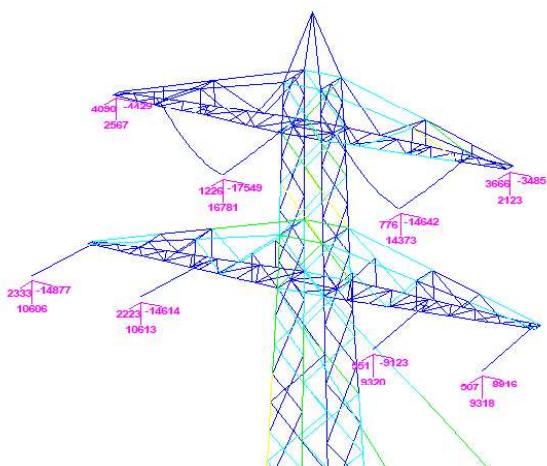
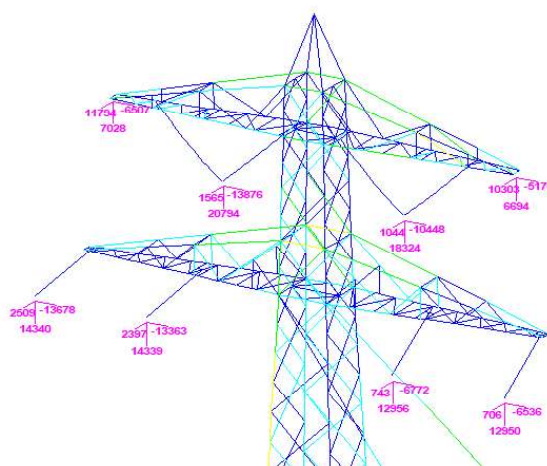
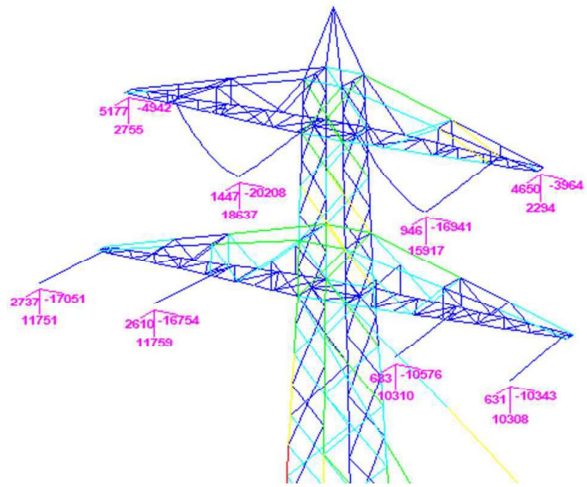
<p>ULS 1a_90 (verbouw)</p>	
<p>ULS 3_90 (verbouw)</p>	

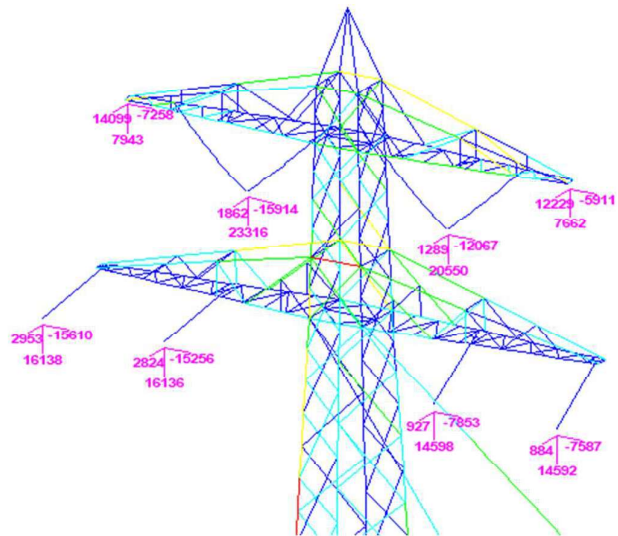
Table 3 Structural loads for D+0 (RSD-MDK tower 92)

<p>SLS 7</p>	 <p>Structural load diagram for SLS 7. The tower is shown with various load values in magenta. The values are: 134, -1215, 1776; 297, -3982, 12294; 30, -592, 1536; 47, -1342, 11173; 540, -4330, 8095; 503, -4184, 8092; 12, -1022, 7426; 6, -915, 7424.</p>
<p>ULS 1a_90</p>	 <p>Structural load diagram for ULS 1a_90. The tower is shown with various load values in magenta. The values are: 4090, -4125, 2567; 1226, -17549, 16781; 3659, -3485, 2123; 776, -14842, 14373; 2333, -14877, 10606; 2224, -14614, 10613; 551, -5123, 9330; 507, 8916, 9318.</p>
<p>ULS 3_90</p>	 <p>Structural load diagram for ULS 3_90. The tower is shown with various load values in magenta. The values are: 11704, -6507, 7028; 1565, -13876, 20734; 10301, -5176, 6694; 1044, -10448, 16324; 2509, -13678, 14340; 2357, -13363, 14339; 743, -6772, 12956; 706, -6536, 12950.</p>

ULS 1a\_90 (verbouw)



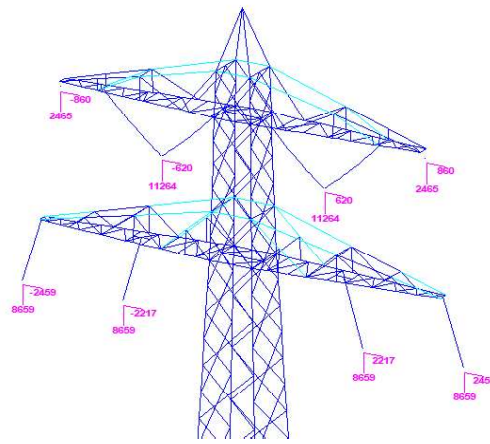
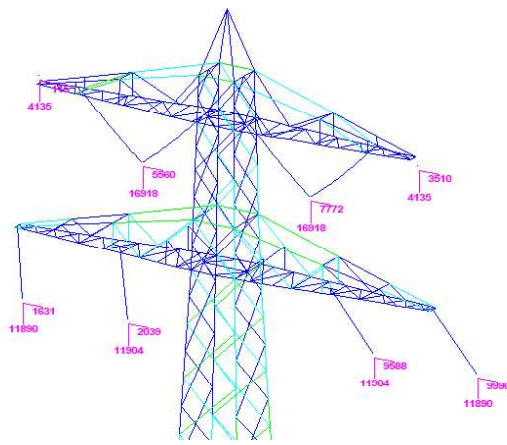
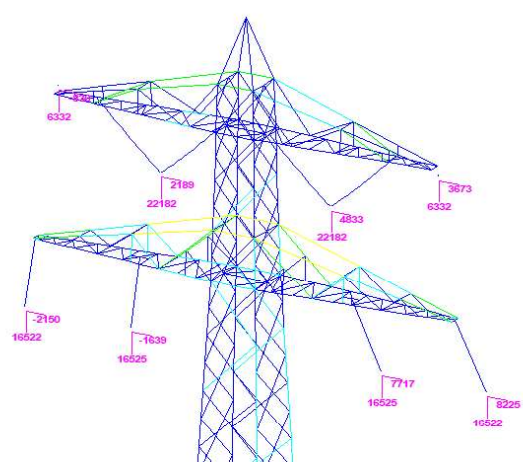
ULS 3\_90 (verbouw)



### Structural Loading Situation 1

In Table 4 and Table 5 the loads for towers 20 and 32 are given. The loads are based on a 55 m distance to the OSP.

**Table 4 Structural loads for D+0 (GT-ZBH tower 20 and 32 – TOSP 55 m)**



**Table 5 Structural loads for D+0 (GT-ZBH tower 20 – TOSP 160 m)**

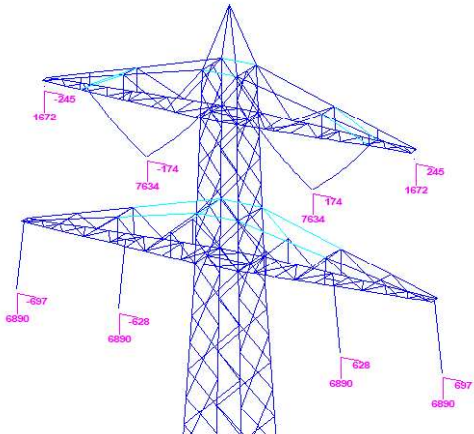
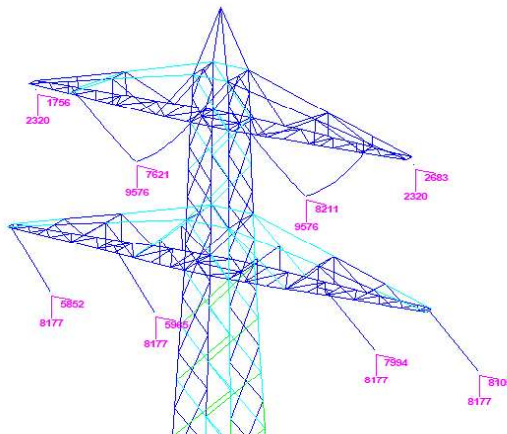
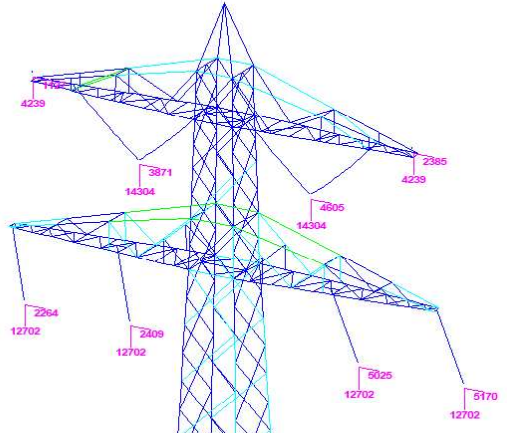
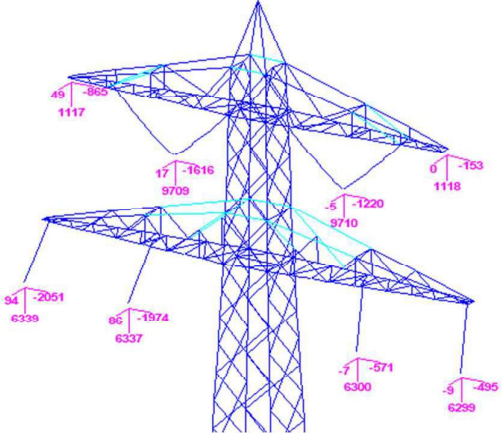
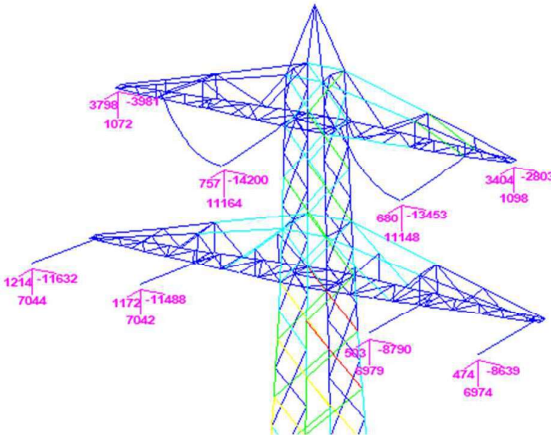
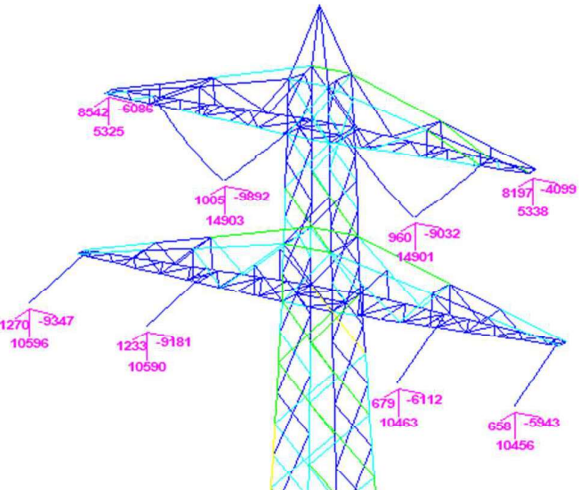
<p>Tower 32 – 160 m</p>	
<p>SLS 7</p>	
<p>ULS 1a_90</p>	
<p>ULS 3_90</p>	

Table 6 shows the loads for tower 84. Regarding the loads, this is in between the two groups and will be examined additionally.

**Table 6 Tower type D+0 (RSD-MDK tower 84)**

<p>SLS 7</p>	
<p>ULS 1a_90</p>	
<p>ULS 3_90</p>	

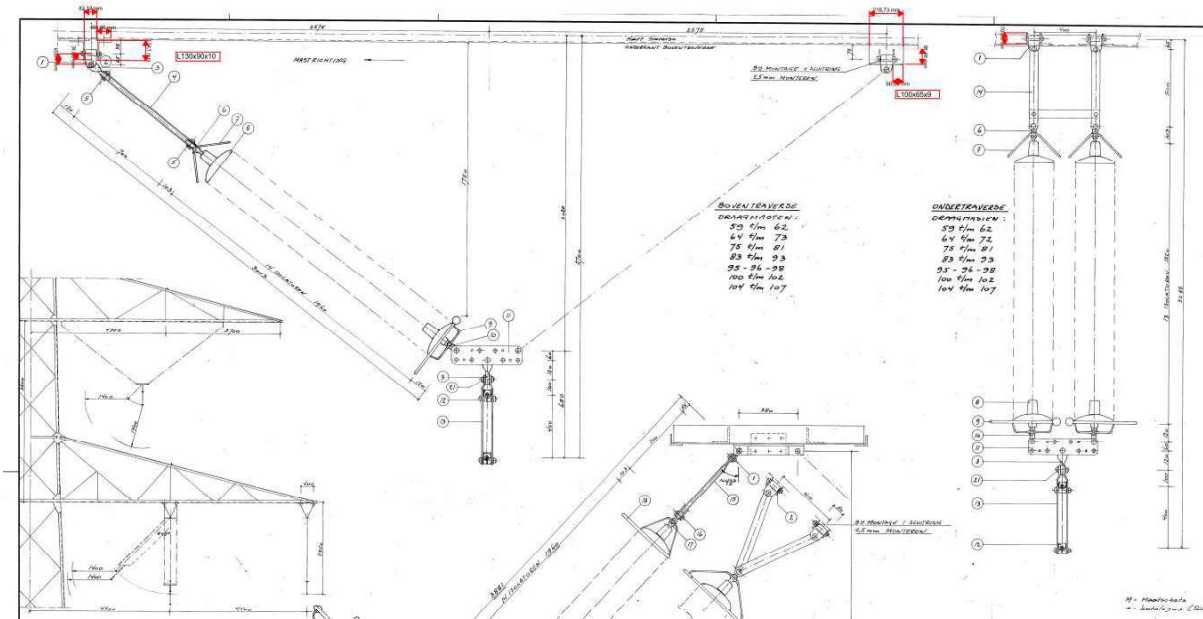
## CONSTRUCTION DETAILS

The suspension of the conductors of the 150 kV lines between Woensdrecht and Geertruidenberg was modified in the 1970s due to problems with galloping. In this case, the top conductor is suspended via a V-chain, with beams of double angle profile fitted under the crossarm. The two lower conductors have an extended chain via a steel bracket



**Figure 1 Current suspension phase conductors 150 kV lines between Woensdrecht and Geertruidenberg**

Detailed workshop drawings of the beams and of the brackets in the insulator chains are not available. The schematic drawing of the insulator chains is used.



**Figure 2 Schematic drawing of the insulator chain according to P-106330**

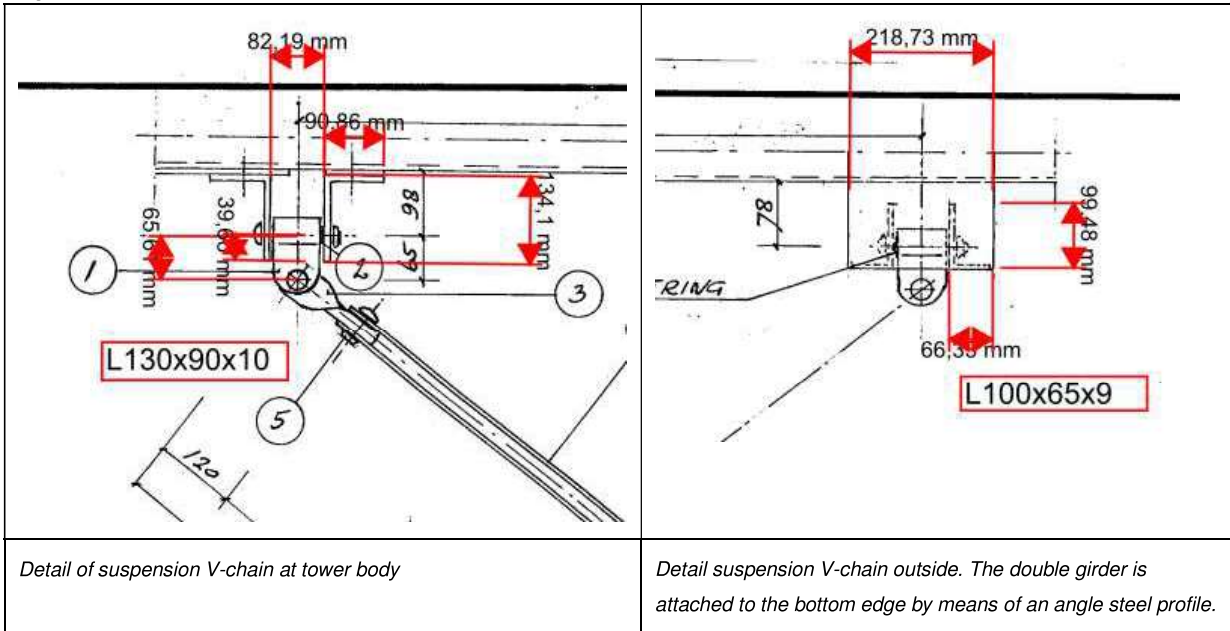


Figure 3 Details of insulator chain with measured beam size

The position of the beams is indicated on the workshop drawing of the crossarms.

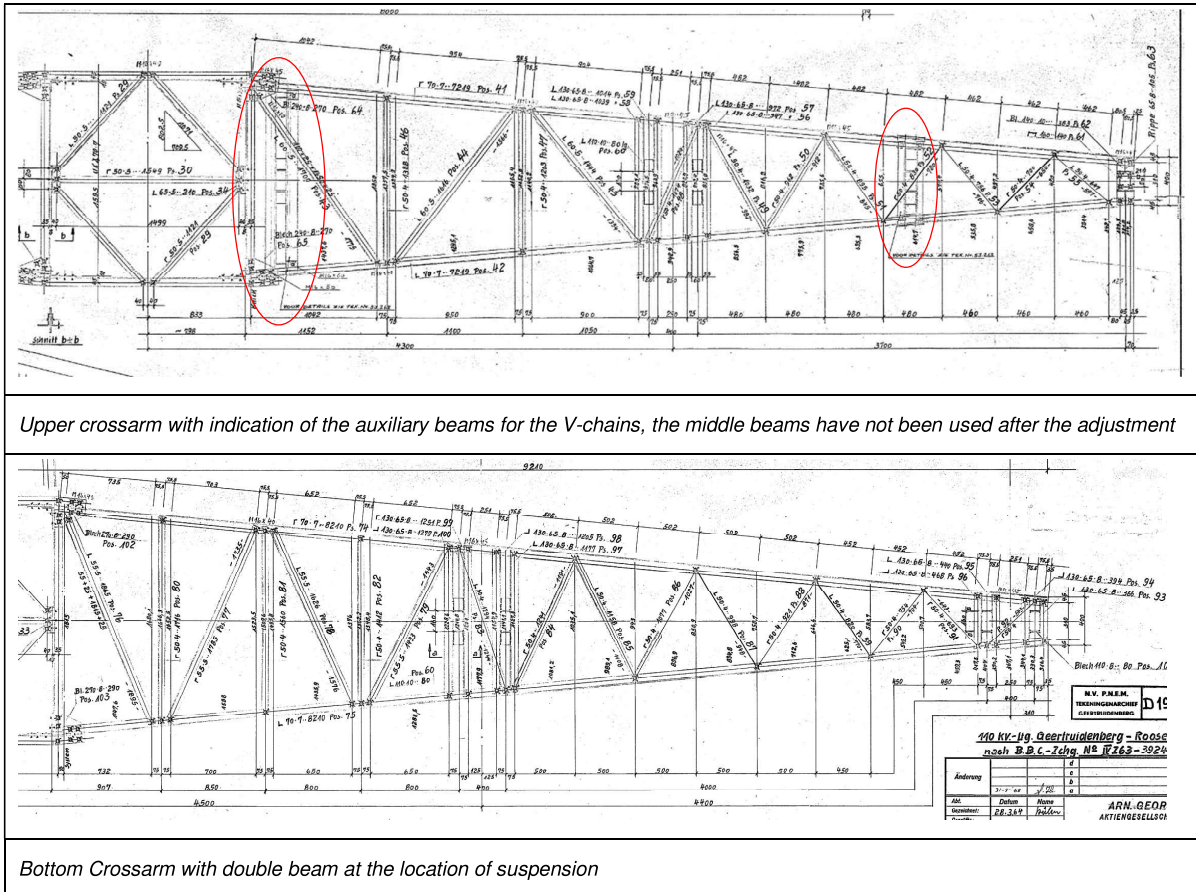


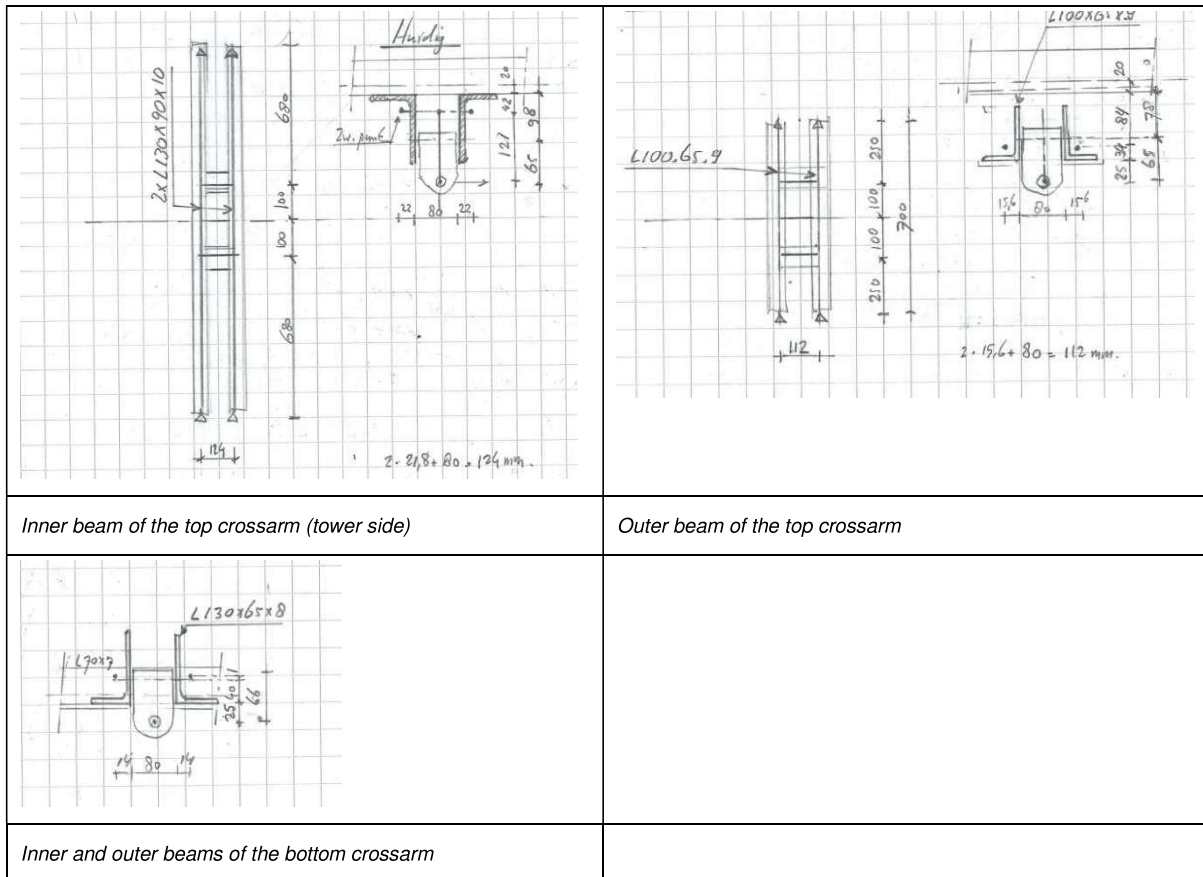
Figure 4 Details of crossarm drawing D-19829



## CHECK OF THE EXISTING BEAMS

### Beams of the insulators

The existing beams are calculated for the two situations. It is assumed that the N-shaped insulator frames in the lower cross arm are removed because the strength of these assemblies is unknown and because large bending moments arise at the lower edge of the beam that cannot be carried. In the drawing below, the schematic of the beams of the upper crossarms is given



**Figure 5 Beams schematics**

The loads are applied according to:

- situation 1: tower 22
- situation 2: tower 20

Due to the double chain, the load of the lower beam is divided by 2. With the V chain, the load on the suspension points is calculated from the conductor load with component T (transverse) and V (vertical) based on the geometry of the V-chain. If the resultant of the load falls within the dimension of the V-chain (both legs under tension), the following formulas are used.

$$F_z = V/2 + T \times h / 2b$$

$$F_y = F_z \times b/h$$

**Pagina 12 van 22**

With b: half the width of the V-chain (2.575 m) and h: the height of the V-chain (2.02 m). Table 7 shows the loads on the beams of the top crossarm.

**Table 7 Loading of the top crossarm**

Loading	Top Crossarm		T (kN)	V (kN)	Fy (kN)	Fz (kN)
Tower 22 (sit.1)	Inner	SLS 7	6,5	12,1	<b>11,0</b>	<b>8,6</b>
		ULS 1a_90	21,8	15,6	<b>21,8</b>	<b>15,6</b>
		ULS 3_90	19,5	19,9	<b>22,4</b>	<b>17,6</b>
	Outer	SLS 7	4,3	12,1	<b>9,9</b>	<b>7,7</b>
		ULS 1a_90	18	15,5	<b>18,9</b>	<b>14,8</b>
		ULS 3_90	14,8	19,8	<b>20,0</b>	<b>15,7</b>
Tower 20 (sit.2)	Inner	SLS 7	0,6	11,3	<b>7,5</b>	<b>5,9</b>
		ULS 1a_90	7,8	16,9	<b>14,7</b>	<b>11,5</b>
		ULS 3_90	4,8	22,2	<b>16,5</b>	<b>13,0</b>
	Outer	SLS 7	-0,6	11,3	<b>6,9</b>	<b>5,4</b>
		ULS 1a_90	5,6	16,9	<b>13,6</b>	<b>10,6</b>
		ULS 3_90	2,2	22,2	<b>15,2</b>	<b>12,0</b>

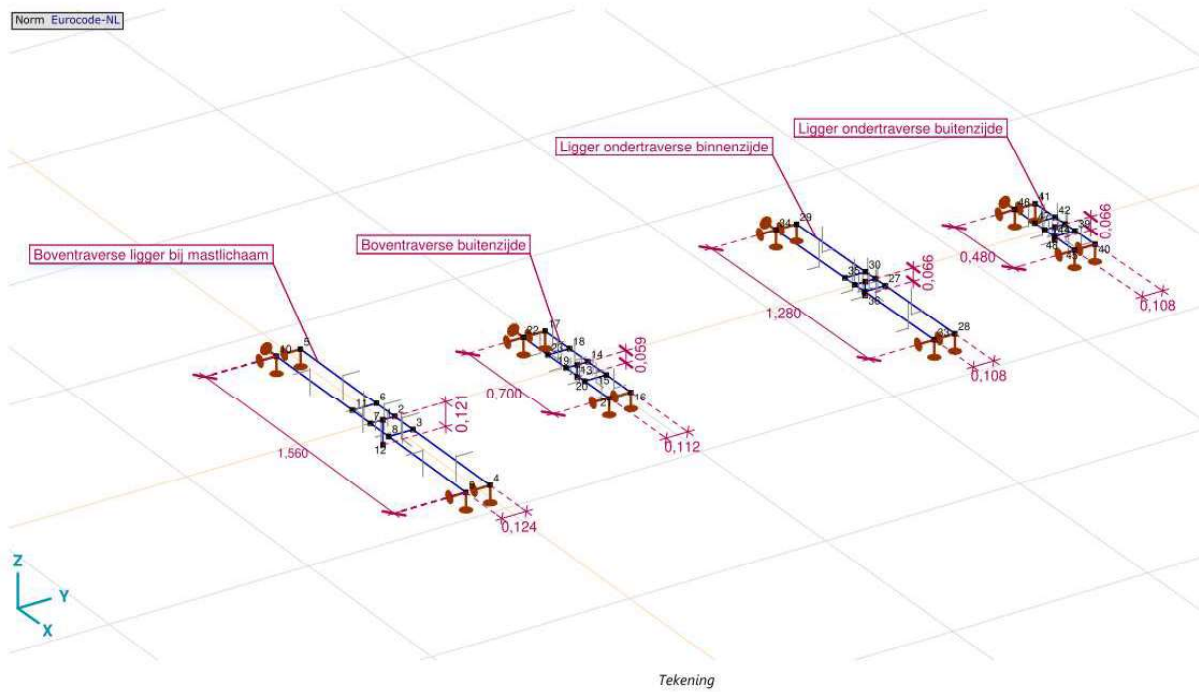
In Table 8 the loadings for the bottom crossarms are given

**Table 8 Loading of the bottom crossarm**

Loading	Bottom Crossarm		T (kN)	V (kN)	Fy (kN)	Fz (kN)
Tower 22 (sit.1)	Inner	SLS 7	4,3	8,5	<b>2,2</b>	<b>4,3</b>
		ULS 1a_90	14,3	10,8	<b>7,2</b>	<b>5,4</b>
		ULS 3_90	13,2	14,9	<b>6,6</b>	<b>7,5</b>
	Outer	SLS 7	4,5	8,6	<b>2,3</b>	<b>4,3</b>
		ULS 1a_90	14,5	10,8	<b>7,3</b>	<b>5,4</b>
		ULS 3_90	13,5	15	<b>6,8</b>	<b>7,5</b>
Tower 20 (sit.2)	Inner	SLS 7	2,5	8,7	<b>1,3</b>	<b>4,4</b>
		ULS 1a_90	9,6	11,9	<b>4,8</b>	<b>6,0</b>
		ULS 3_90	7,7	16,5	<b>3,9</b>	<b>8,3</b>
	Outer	SLS 7	2,2	8,7	<b>1,1</b>	<b>4,4</b>
		ULS 1a_90	10	11,9	<b>5,0</b>	<b>6,0</b>
		ULS 3_90	8,2	16,5	<b>4,1</b>	<b>8,3</b>

The beams have been verified in AxisVM with an elastic model

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**Figure 6 AxisVM Model of the beams**

The calculations show that the profiles of the bottom crossarm are satisfactory in all situations. In case of the top crossarm, the inner beam does not meet the requirements in situation 1 and 2. The outer beam does not meet the requirements in case 1 only.

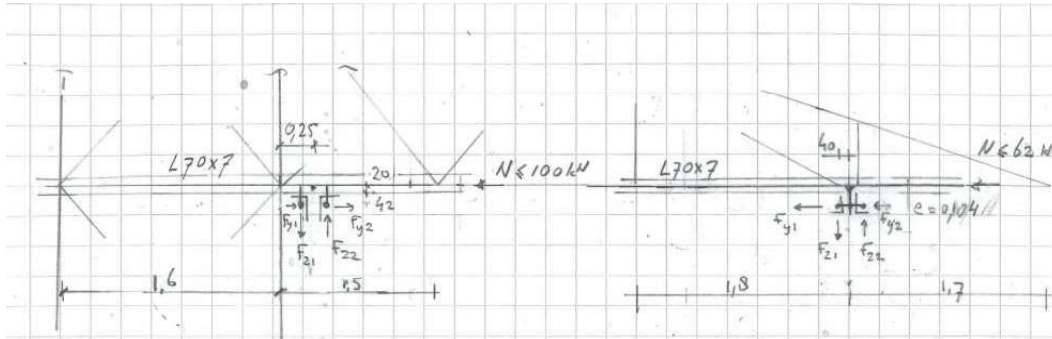
**Table 9 Results for beams**

Beam	U.C. (sit.1)	U.C. (sit.2)	Remark
Beam of the top crossarms inside	1.45	1.07	Not passing for situation 1 and 2
Beam of the top crossarms outside	1.05	0.80	Not passing for situation 1
Beam of the bottom crossarm inside	0.99	0.71	Pass
Beam of the bottom crossarm outside	0.28	0.21	Pass

## Bottom chord members top cross arm

The eccentrically applied load of the insulator chain leads to bending moments on the bottom chord of the crossarm. For the lower beam, bending moments are small because the force is distributed over two chains and the beams are connected directly to the bottom chord. The check for bending is therefore limited to the bottom chord of the top crossarm.

Two parts are modeled: one part at the inner beams, the second part at the outer beams. The load is applied per beam via short fictitious auxiliary bars. The scheme is shown in the figure below



**Figure 7 Schematics of bottom chord**

The loads are shown in the table. The envelope value of the compressive force in the bottom chord from the calculation of PLS-TOWER has been used, because the associated compressive force in the bottom chord is not known for each load combination. Moreover, the difference in load between extreme wind and wind and ice is small.

**Table 10 Loadings on bottom chord**

Loading	Top crossarm		Fy1 (kN)	Fy2 (kN)	Fz1 (kN)	Fz2 (kN)	N (kN)
Tower 22	Inside	Envelope	7.5	3.9	-15.5	6.6	100
	Outside	Envelope	-5.9	-4.3	1.3	-9.3	62
Tower 20	Inside	Envelope	5.5	2.8	-11.5	4.6	100
	Outside	Envelope	-4.4	-3.2	0.9	-6.3	62

## Results

The calculation was performed with AxisVM and is included at the end of this Appendix. The check is carried out on the basis of stresses and buckling stability.



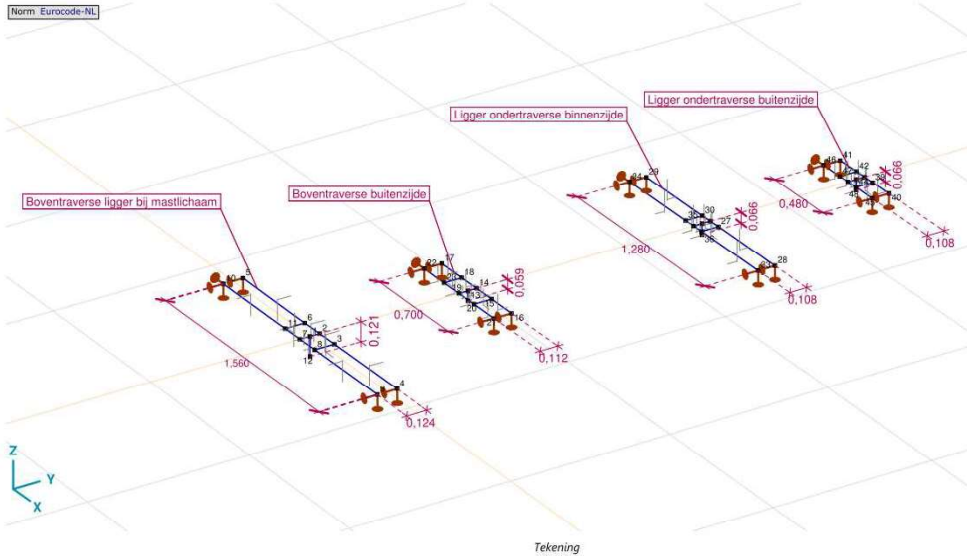


Figure 8 AxisVM beam model

The results are included in Table 11.

Table 11 Results of the bottom chord calculations

Results for bottom chord	U.C. (sit.1)	U.C. (sit.2)	
Bottom chord top crossarm inside	1.32	1.11	Not OK
Onderrand boventraverse buiten	1.53	1.31	Not OK

The calculation shows that the bottom chord is not sufficient in all of the cases



The outer beam reinforcement proposal focuses on reinforcing the beam while reducing the bending on the bottom chord. The beam is located under the bottom chord of the traverse and is not easy to support, so this profile has to be exchanged for a heavier one.

To reduce the bending moment on the bottom chord, adjust the geometry of the diagonals on the vertical side of the crossarms. This also aims to reduce the eccentricity of the connection on the top chord (Figure 10). A new gusset plate provides a connection without eccentricity.

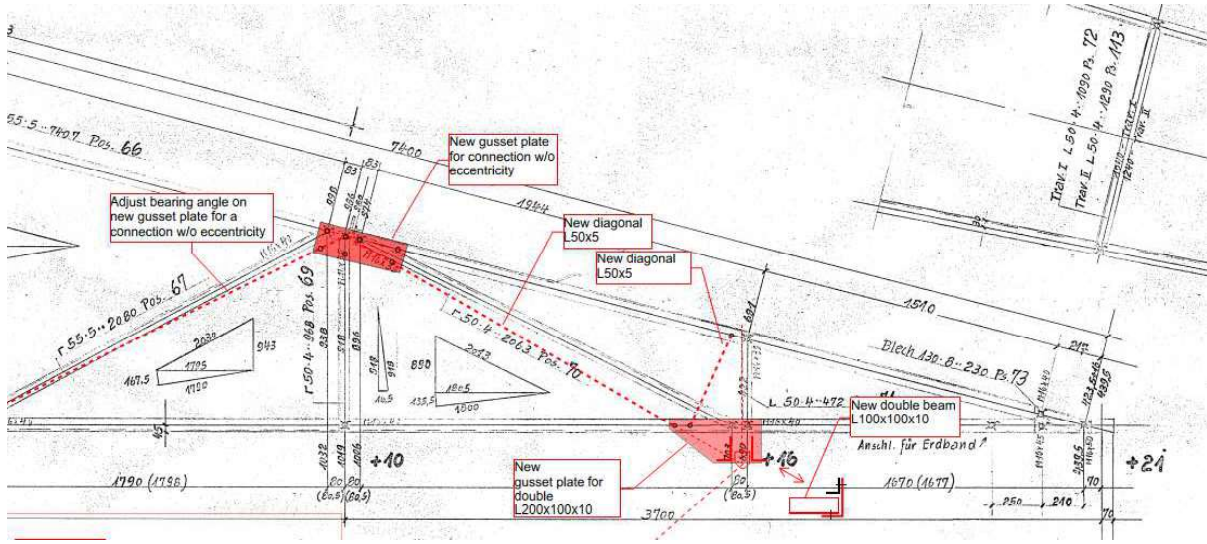
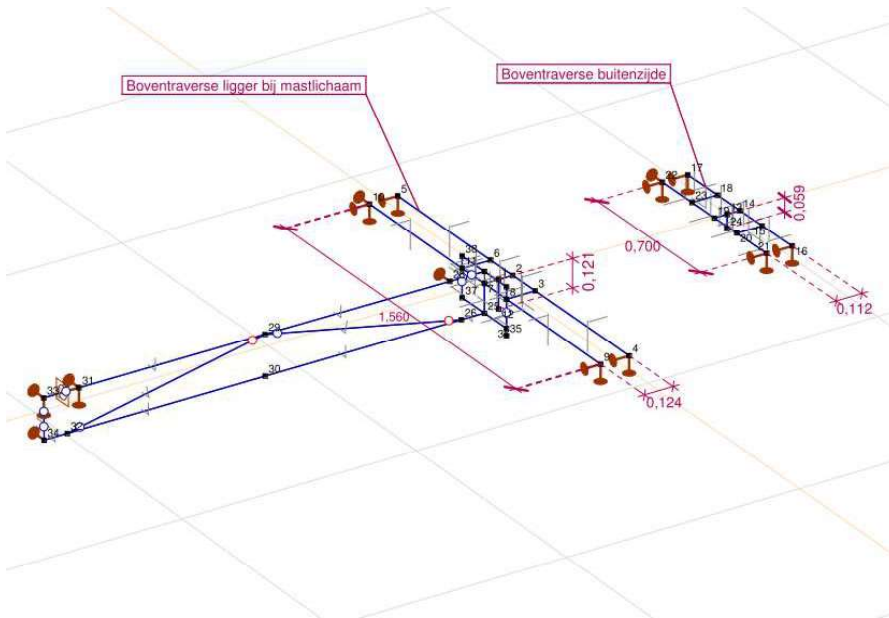


Figure 10 Adjustment of the top crossarm's outer beam

The following calculations are performed to the adjusted structure:

- reinforcement of the bottom chord of the top crossarm and the innermost beam of the top crossarm;
- new outer beam for the top crossarm;

The parts are tested in one model.



**Figure 11 Model of the reinforced structure**

## Structural loading

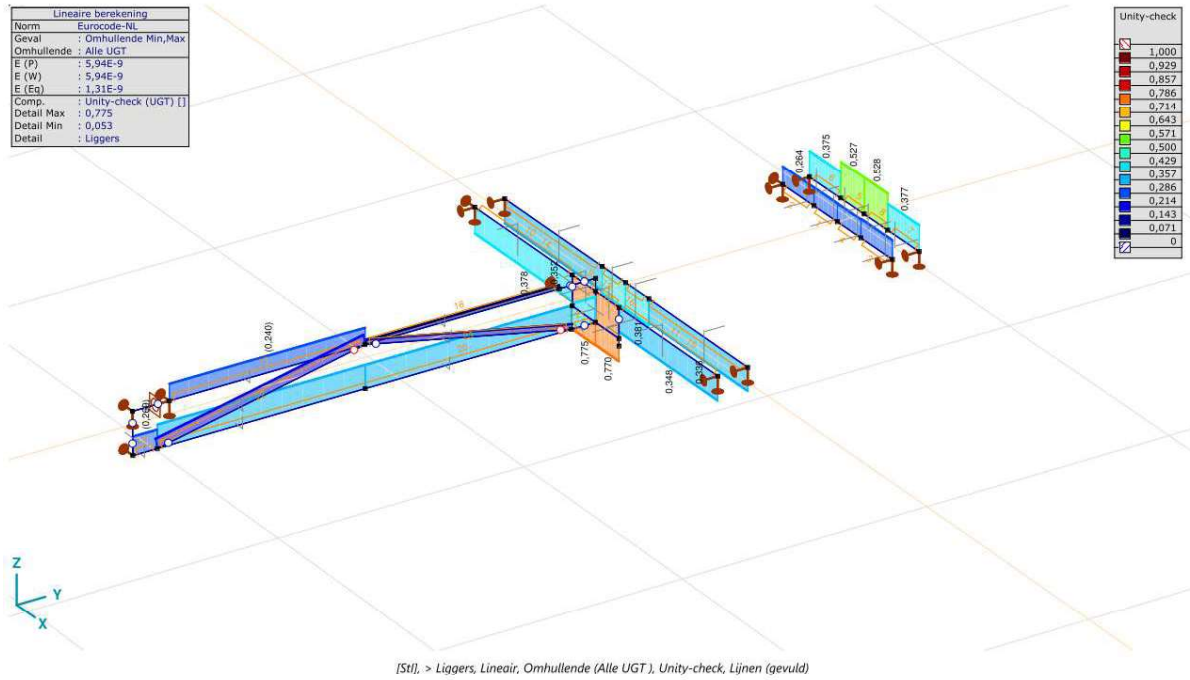
The starting point is the loading for the reinforced structure

**Table 12 Loadings on the reinforced structure**

Loading	Top Crossarm		T (kN)	V (kN)	Fy (kN)	Fz (kN)
Tower 22	Inside	SLS 7	6,5	12,1	<b>11,0</b>	<b>8,6</b>
		ULS 1a_90	25,4	17,5	<b>25,4</b>	<b>17,5</b>
		ULS 3_90	22,3	22,4	<b>25,4</b>	<b>19,9</b>
	Outside	SLS 7	4,3	12,1	<b>9,9</b>	<b>7,7</b>
		ULS 1a_90	21	17,5	<b>21,7</b>	<b>17,0</b>
		ULS 3_90	17,1	22,3	<b>22,8</b>	<b>17,9</b>

## Results

The calculation with AxisVM shows that the existing beams on both the inside and outside meet the requirements, the same holds for the new parts.



The unity checks are summarized in Table 13.

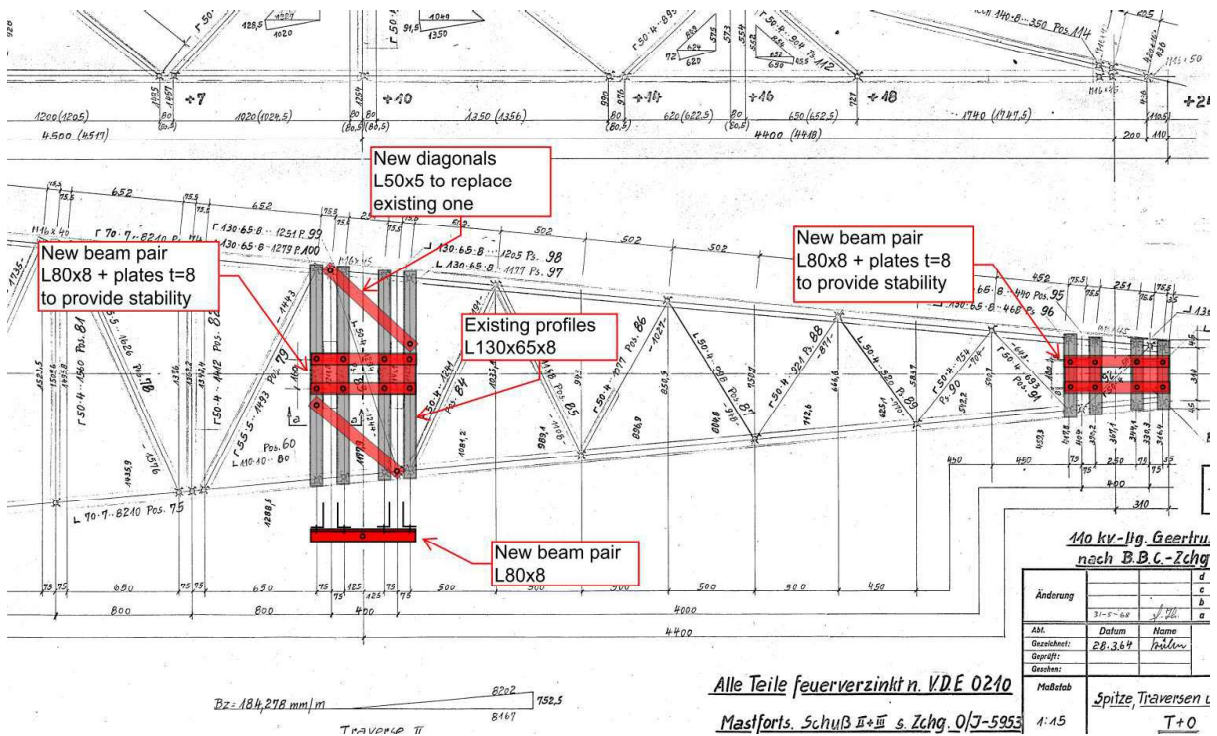
**Table 13 Results for the reinforced construction**

Results on bottom chord	U.C. (sit.1)	
Beam top crossarm inside (existing)	0,77	Passes
Beam top crossarm outside (new. L100x10)	0,53	Passes
Diagonal (new. L50x5)	0,26	Passes
Coupling profile (new. L50x5)	0,35	Passes



## New beams lower cross arm tower 22

In order to attach the suspension-tension sets to the lower cross arm at the outer corner, new beams are required. The beams consist of two L80x8 profiles, these will be attached to the existing four profiles. The new beams clash with the existing diagonal, this profile should be removed. Its function should be taken over by new diagonals (inner position) in combination with two square shaped plates (inner and outer position) to transfer shear forces.



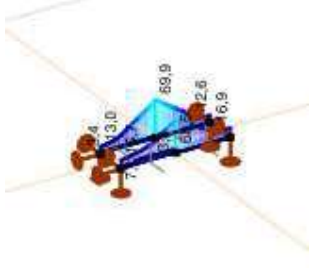
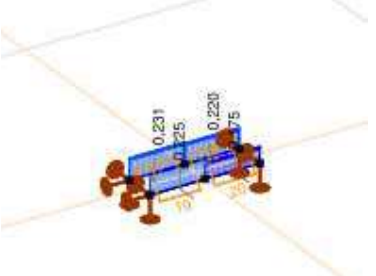
The new beams 2x L80x8 are checked in AxisVM software for the loads. The beams span the length of 0,4 m between the existing beams L130x90.

## Loads

The loads for “verbuwniveau” were used, based upon the output of PLS-TOWER shown in table 2 in this Appendix. The force is directly applied to the beams, since the insulator is connected with one bolt.

Loading	Bottom Crossarm	Fx (kN)	Fy (kN)	Fz (kN)
Tower 22	SLS 7	0,3	3,2	8,6
	ULS 1a_90	2,4	14,7	12,0
	ULS 3_90	2,7	12,9	16,7

Results

	
<p>Stress level 2x L80x8 profiles</p>	<p>Usage</p>

The calculation with AxisVM shows that the new beams L80x8 meet the requirements.

The new beams can be fitted directly underneath the existing beams and act favourably to the existing beams, so no further calculations were performed to the existing beams.

## Points of attention UO-fase

The reinforcements regarding the profiles are detailed in this report.

In the implementation phase, the checks of bolted connections, gusset plates and sheet parts subject to bending must be performed.

Output AxisVM:

- check of beams situation 1
- check of beams situation 2
- check of reinforced beams
- check of lower chord
- check of new beam "hangende afspanning"



## **Project:**

**Constructeur: DNV GL - Energy**

AxisVM X6 R1q - Geregistreerd aan DNV GL - Energy  
Liggers D+0 huidig sit 1.a.xls

**Rapport**

## Rapport, Inhoudsopgave

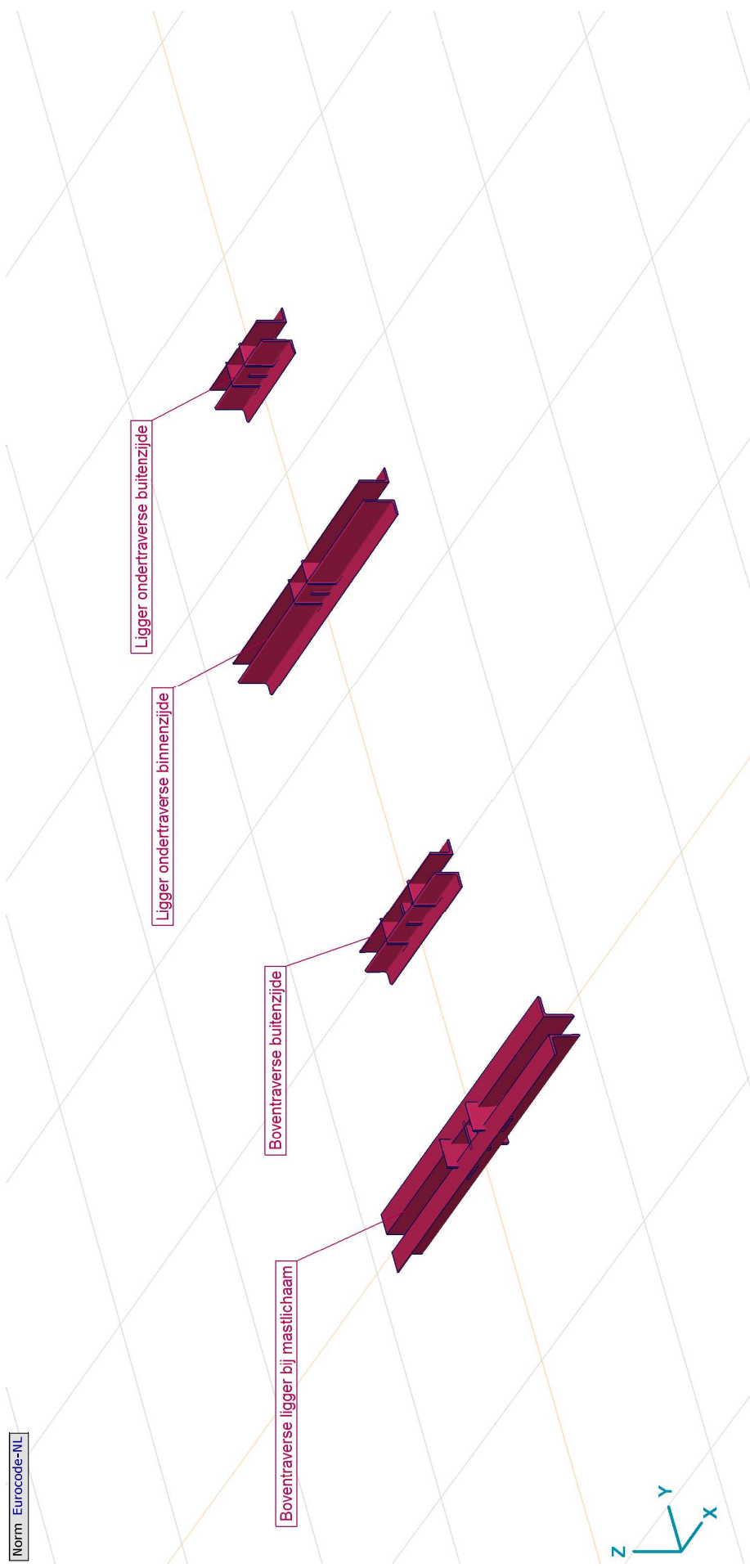
Onderdeel	Pagina	Onderdeel	Pagina
rendered view	3	3_90	16
Materialen	4	Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen	17
Tekening	5	[I], > Liggers, Linear, Omhullende (Alle UGT ), My, Lijnen (gevuld)	17
Knopen	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Mz, Lijnen (gevuld)	18
Staven	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Nx, Lijnen (gevuld)	19
Tekening profielen	8	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)	20
Profielen	9	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)	21
Tekening staven	10	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rx (knoopopl.), Lijnen	22
Staafaansluitingen	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Ry (knoopopl.), Lijnen	23
EG: Staaf eigen gewicht	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rz (knoopopl.), Lijnen	24
SLS 7	12	Interne krachten knooppogging [Linear, Omhullende (Alle UGT ), Liggers]	25
SLS 7: Knooppbelastingen	13	[I], Linear, Omhullende (Alle UGT ), eY, Lijnen	29
1a_90: Knooppbelastingen	13	[I], Linear, Omhullende (Alle UGT ), eZ, Lijnen	30
1a_90	14	[I], > Liggers, Linear, Omhullende (Alle UGT ), Sominmax, Lijnen (gevuld)	31
3_90: Knooppbelastingen	15	[STJ], > Liggers, Linear, Omhullende (Alle UGT ), Unity-check, Lijnen (gevuld)	32

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rendered view

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**Materialen**

	Naam	Type	Nationale norm	Materiaalnorm	Model	$E_x$ [N/mm <sup>2</sup> ]	$E_y$ [N/mm <sup>2</sup> ]	$\nu$	$\alpha_T$ [1/°C]	$\rho$ [kg/m <sup>3</sup> ]	Materiaal kleur	Contour kleur	Structuur	$P_1$
1	S 235	Staal	Eurocode-NL	10025-2	Lineair	210000	210000	0,30	1,2E-5	7850				$f_y$ [N/mm <sup>2</sup> ] = 235,00

Naam	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	$P_9$	$P_{10}$	$P_{11}$	$P_{12}$	$P_{13}$	$P_{14}$
1	$f_{t1}$ [N/mm <sup>2</sup> ] = 360,00	$f_y$ [N/mm <sup>2</sup> ] = 215,00	$f_{t0}$ [N/mm <sup>2</sup> ] = 360,00										

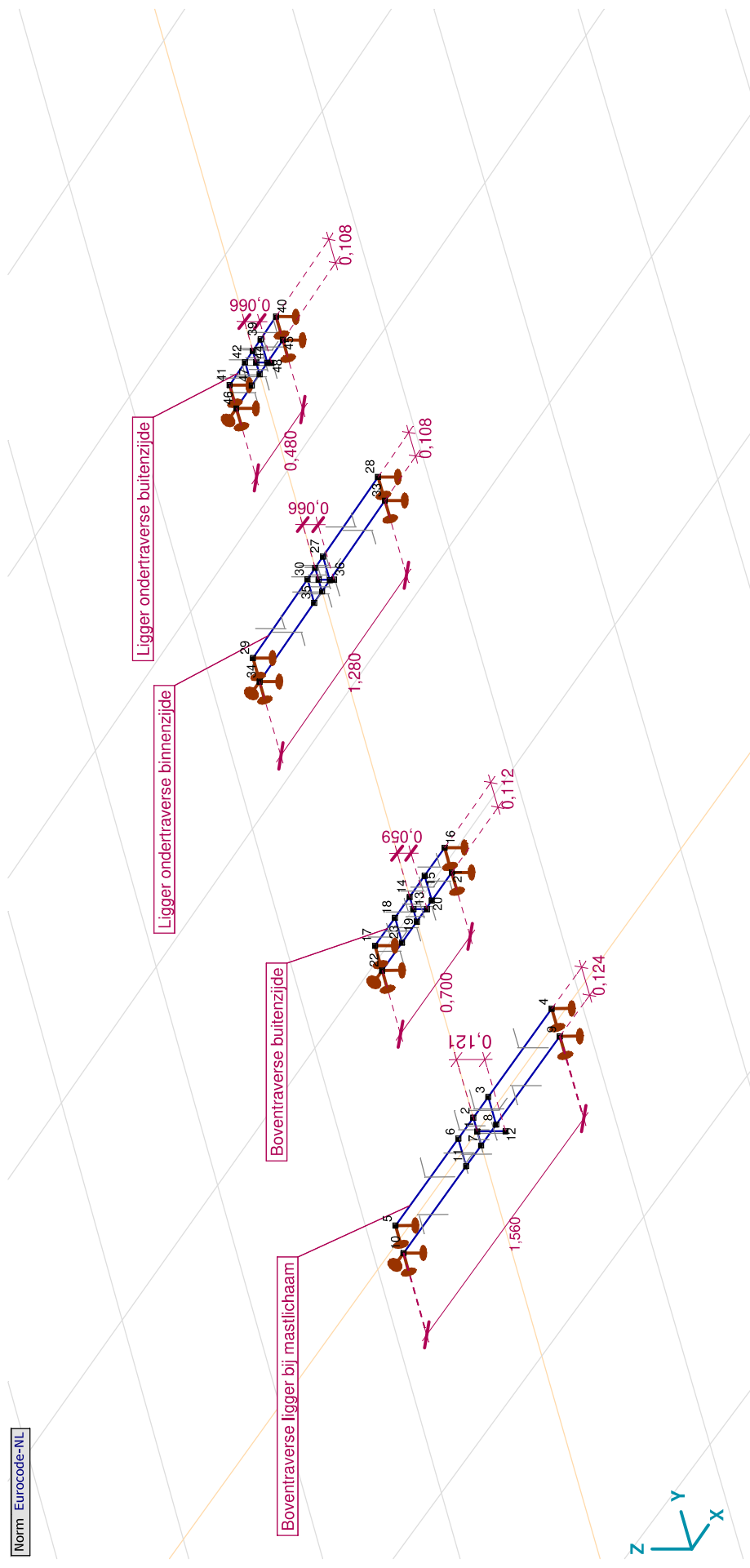
**Naam:** Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model;  **$E_x$ :** Elasticiteitsmodulus in lokale x richting;  **$E_y$ :** Elasticiteitsmodulus in lokale y richting;  **$\nu$ :** Poisson's verhouding;  **$\alpha_T$ :** Warmteuitzettingscoëfficiënt;  **$\rho$ :** Dichtheid; **Materiaal kleur:** Materiaalkleur; **Contour kleur:** Contourkleur;  **$P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}$ :** Ontwerpparameter.

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Tekening



**Project:**

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## Staven

	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Ref <sub>Z</sub>	<- Aansluitingen	Aansluitingen ->
22	19	23	0,150	i-j	S 235	3	Auto	.	.
23	19	13	0,056	j-i	S 235	2	R1	Schar-YZ	.
24	23	18	0,112	j-i	S 235	3	Auto	.	.
25	15	20	0,112	i-j	S 235	3	Auto	.	.
26	24	13	0,059	j-i	S 235	2	Auto	.	.
27	25	26	0,054	i-j	S 235	2	R1	.	100111
28	26	27	0,080	i-j	S 235	4	Auto	.	.
29	27	28	0,560	i-j	S 235	4	Auto	.	.
30	29	30	0,560	i-j	S 235	4	Auto	.	.
31	30	26	0,080	j-i	S 235	4	Auto	.	.
32	32	31	0,080	j-i	S 235	4	Auto	.	.
33	33	32	0,560	j-i	S 235	4	Auto	.	.
34	35	34	0,560	j-i	S 235	4	Auto	.	.
35	31	35	0,080	i-j	S 235	4	Auto	.	.
36	31	25	0,054	j-i	S 235	2	R1	Schar-YZ	.
37	35	30	0,108	j-i	S 235	4	Auto	.	.
38	27	32	0,108	i-j	S 235	4	Auto	.	.
39	36	25	0,066	j-i	S 235	2	Auto	.	.
40	37	38	0,054	i-j	S 235	2	R1	.	100111
41	38	39	0,080	i-j	S 235	4	Auto	.	.
42	39	40	0,160	i-j	S 235	4	Auto	.	.
43	41	42	0,160	i-j	S 235	4	Auto	.	.
44	42	38	0,080	j-i	S 235	4	Auto	.	.
45	44	43	0,080	j-i	S 235	4	Auto	.	.
46	45	44	0,160	j-i	S 235	4	Auto	.	.
47	47	46	0,160	j-i	S 235	4	Auto	.	.
48	43	47	0,080	i-j	S 235	4	Auto	.	.
49	43	37	0,054	j-i	S 235	2	R1	Schar-YZ	.
50	47	42	0,108	j-i	S 235	4	Auto	.	.
51	39	44	0,108	i-j	S 235	4	Auto	.	.
52	48	37	0,066	j-i	S 235	2	Auto	.	.

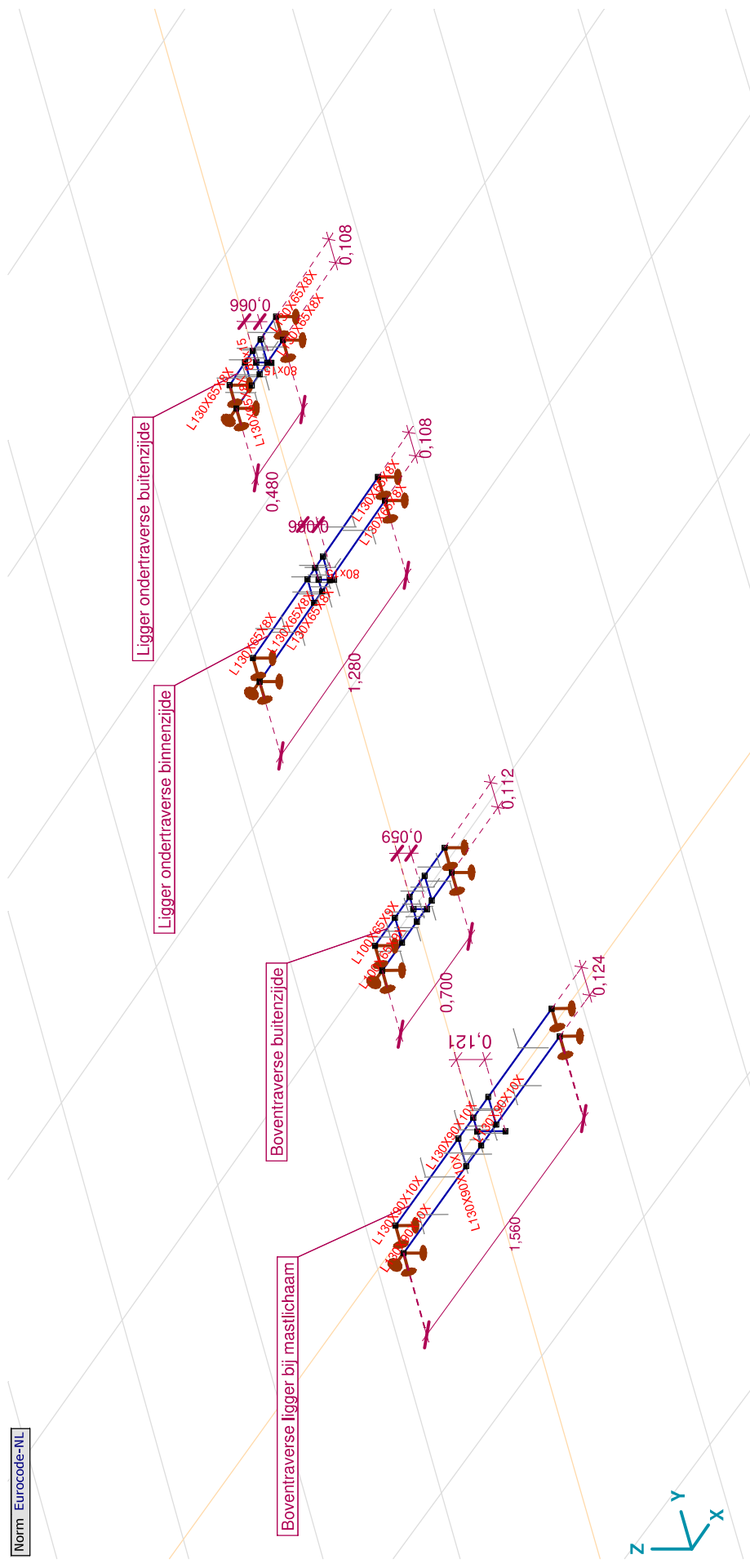
Lengte: Elementlengte; **Lokaal X**: Lokale X-richting; **Ref<sub>Z</sub>**: Referentie voor lokale Z-richting; <- **Aansluitingen**: Staafeindsluitingen op startpunt; **Aansluitingen** ->: Staafeindsluitingen op eindpunt;

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Tekening profielen



**Project:**





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**Profielen**

Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	Ax [mm <sup>2</sup> ]	Ay [mm <sup>2</sup> ]	Az [mm <sup>2</sup> ]	Ix [mm <sup>4</sup> ]	Iy [mm <sup>4</sup> ]	Iz [mm <sup>4</sup> ]
1	L 130X 90X10X 	Gewalst	L	130,0	90,0	10,0	10,0	12,0	6,0	0	2115,52	730,05	1115,03	75067,63	3579805,00	1407288,00
2	80x15 	Gewalst	Recht.	15,0	80,0	0	0	0	0	0	1200,00	1000,00	1000,00	79361,69	22500,00	640000,00
3	L 100X 65X 9X 	Gewalst	L	100,0	65,0	9,0	9,0	10,0	5,0	0	1414,78	477,96	772,93	40681,80	1406314,00	466914,90
4	L 130X 65X 8X 	Gewalst	L	130,0	65,0	8,0	8,0	11,0	5,5	0	1509,04	400,01	894,73	34749,90	2625007,00	447616,10

Naam	Iyz [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	Iω [mm <sup>6</sup> ]	W <sub>1,elt</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elt</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	i <sub>y</sub> [mm]	i <sub>z</sub> [mm]	Hy [mm]	Hx [mm]
1	L 130X 90X10X	-1302677,00	4189697,00	797396,10	25,09	67E+07	46873,24	62990,74	17179,39	81837,91	34394,52	41,1	25,8	90,0	130,0
2	80x15	0	640000,00	22500,00	90,00	1E+07	16000,00	16000,00	3000,00	24000,00	4500,00	4,3	23,1	80,0	15,0
3	L 100X 65X 9X	-466019,90	1598273,00	274955,80	22,39	2E+07	23552,43	32380,51	7940,67	41416,09	16324,54	31,5	18,2	65,0	100,0
4	L 130X 65X 8X	-608865,80	2783699,00	288924,20	14,61	2,9E+07	32704,41	48773,37	7411,05	56896,01	16576,57	41,7	17,2	65,0	130,0

Naam	Y <sub>G</sub> [mm]	Z <sub>G</sub> [mm]	Y <sub>S</sub> [mm]	Z <sub>S</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> [mm]	S <sub>p</sub>	
1	L 130X 90X10X	21,8	41,5	-16,4	-35,0	112,7	95,4	-292,0	4
2	80x15	40,0	7,5	0	0	0	0	0	5
3	L 100X 65X 9X	15,9	33,2	-11,1	-26,9	84,2	70,1	-343,9	4
4	L 130X 65X 8X	13,7	45,6	-9,5	-39,4	111,6	90,0	-547,9	4

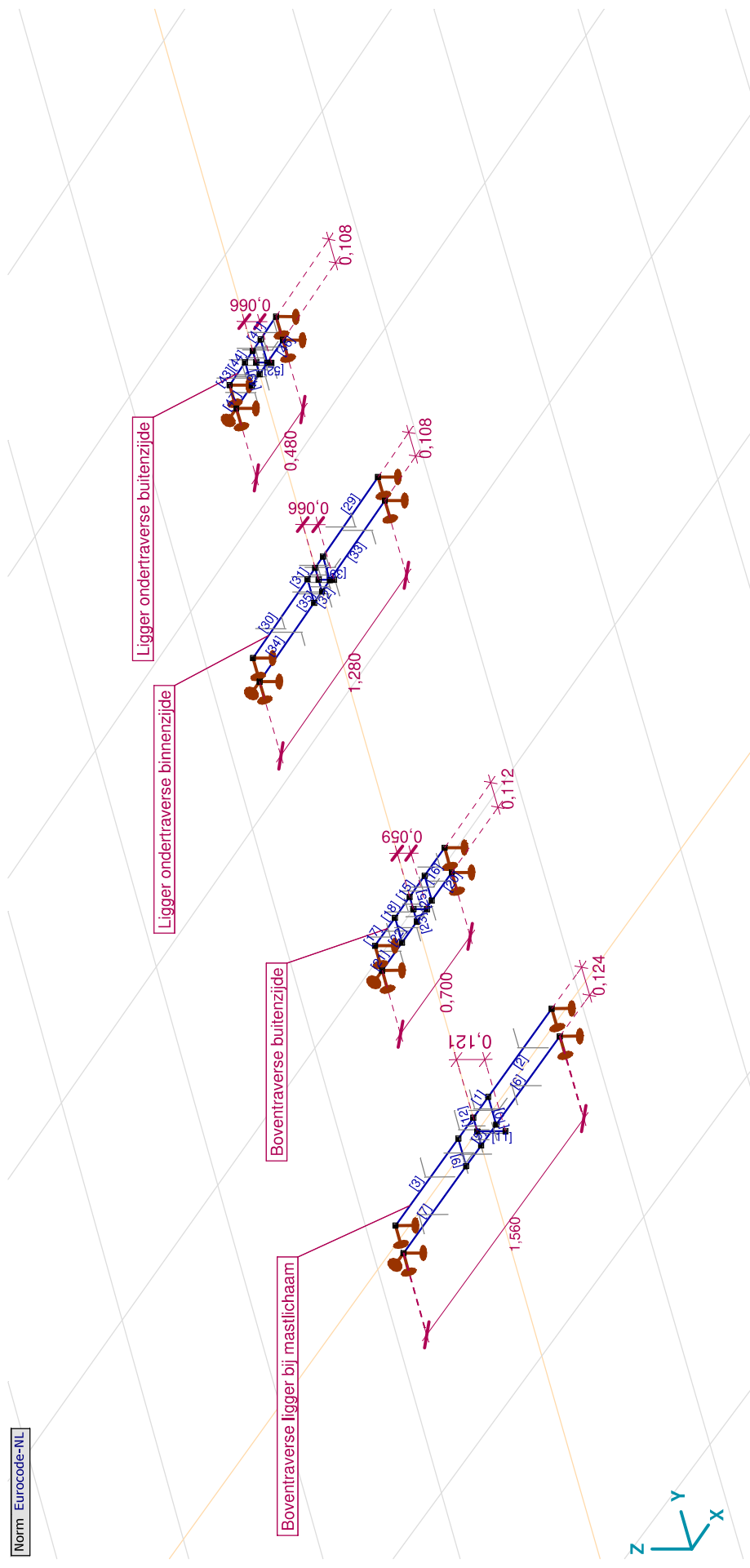
**Naam:** Doorsnede naam; **Productie:** Productieproces; **Vorm:** Profiel; **h:** Doorsnede hoogte; **b:** Doorsnede breedte; **tw:** Lijfdikte; **tf:** Flensdikte; **r<sub>1</sub>, r<sub>2</sub>, r<sub>3</sub>:** Afrondingswaarde; **Ax:** Doorsnede-oppervlak; **Ay, Az:** Afschuivingsoppervlak; **I<sub>x</sub>:** Torisieraagheidsmoment; **I<sub>y</sub>, I<sub>z</sub>:** Buigtraagheidsmoment; **I<sub>yz</sub>:** Centrifugaal traagheidsmoment; **I<sub>1</sub>, I<sub>2</sub>:** Hoofdbuigtraagheidsmoment; **α:** Hoofdrichtingen; **Iω:** Krommingsconstante; **W<sub>1,elt</sub>, W<sub>1,elb</sub>, W<sub>2,elt</sub>, W<sub>2,elb</sub>:** Elastisch weerstandsmoment; **W<sub>1,pl</sub>, W<sub>2,pl</sub>:** Plastisch weerstandsmoment; **W<sub>1,pr</sub>, W<sub>2,pr</sub>:** Traagheidsstraal; **Hy:** Afmeting in lokale Y-richting; **Hx:** Afmeting in lokale Z-richting; **Y<sub>G</sub>:** Y-coördinaat van het zwaartepunt; **Z<sub>G</sub>:** Z-coördinaat van het zwaartepunt; **Y<sub>S</sub>:** Y-coördinaat van het afschuivingsmiddelpunt (torsie); **Z<sub>S</sub>:** Z-coördinaat van het afschuivingsmiddelpunt (torsie); **β<sub>y</sub>, β<sub>z</sub>, β<sub>w</sub>:** Wagner's coëfficiënt; **S<sub>p</sub>:** Spanningspunten;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Norm Eurocode-NL



Tekening staven

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

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## Staafaansluitingen

	<-Aansluitingen	Aansluitingen ->	<-e <sub>x</sub>	<-θ <sub>x</sub>	<-θ <sub>y</sub>	<-θ <sub>z</sub>
12	.	Schar-YZ	.	.	.	.
13	100111	.	Vrij	Vrij	Vrij	Vrij
14	.	100111	.	.	.	.
23	Schar-YZ	.	.	.	Vrij	Vrij
27	.	100111	.	.	.	.
36	Schar-YZ	.	.	.	Vrij	Vrij
40	.	100111	.	.	.	.
49	Schar-YZ	.	.	.	Vrij	Vrij

<-Aansluitingen: Staafendaansluitingen op startpunt; **Aansluitingen ->**: Staafendaansluitingen op eindpunt; <-e<sub>x</sub>, <-θ<sub>x</sub>, <-θ<sub>y</sub>, <-θ<sub>z</sub>: Type;

## EG: Staaf eigen gewicht

	Σ [kg]
1-52	127,980
<b>Totaal</b>	<b>127,980</b>

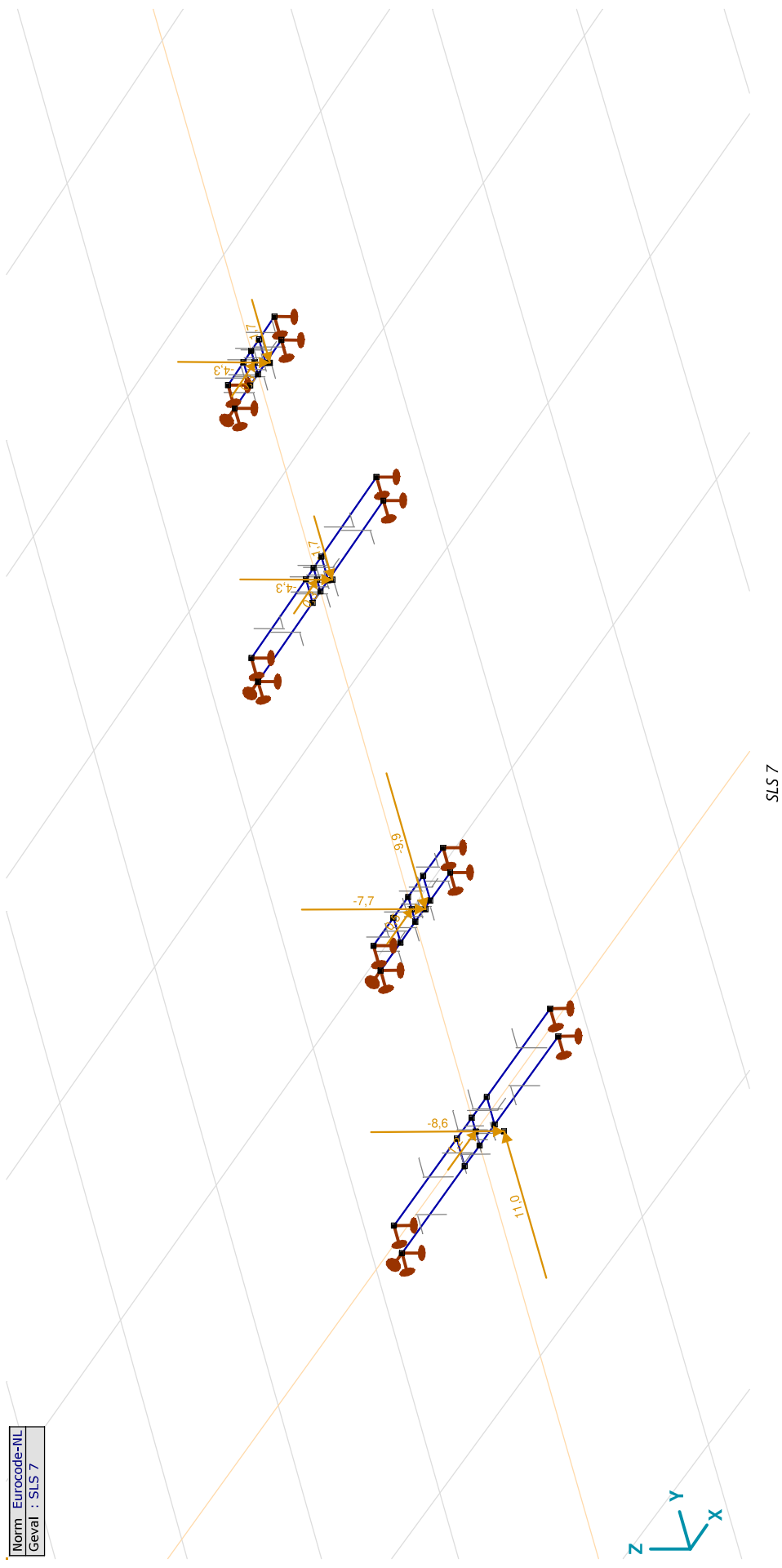
Σ: Totale massa:

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Norm Eurocode-NL  
Geval : SLS 7



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

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## SLS 7: Knoopbelastingen

	Richting	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	Globaal	1,2	0	0	0	0	0
12	Globaal	0	11,0	-8,6	0	0	0
13	Globaal	0,5	0	0	0	0	0
24	Globaal	0	-9,9	-7,7	0	0	0
25	Globaal	0,3	0	0	0	0	0
36	Globaal	0	-1,7	-4,3	0	0	0
37	Globaal	0,3	0	0	0	0	0
48	Globaal	0	-1,7	-4,3	0	0	0

Fx, Fy, Fz: Belastingkracht component; Mx, My, Mz: Belastingmoment component;

## 1a\_90: Knoopbelastingen

	Richting	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	Globaal	3,7	0	0	0	0	0
12	Globaal	0	21,8	-15,6	0	0	0
13	Globaal	2,0	0	0	0	0	0
24	Globaal	0	-18,9	-14,8	0	0	0
25	Globaal	1,3	0	0	0	0	0
36	Globaal	0	-7,2	-5,4	0	0	0
37	Globaal	1,3	0	0	0	0	0
48	Globaal	0	-7,2	-5,4	0	0	0

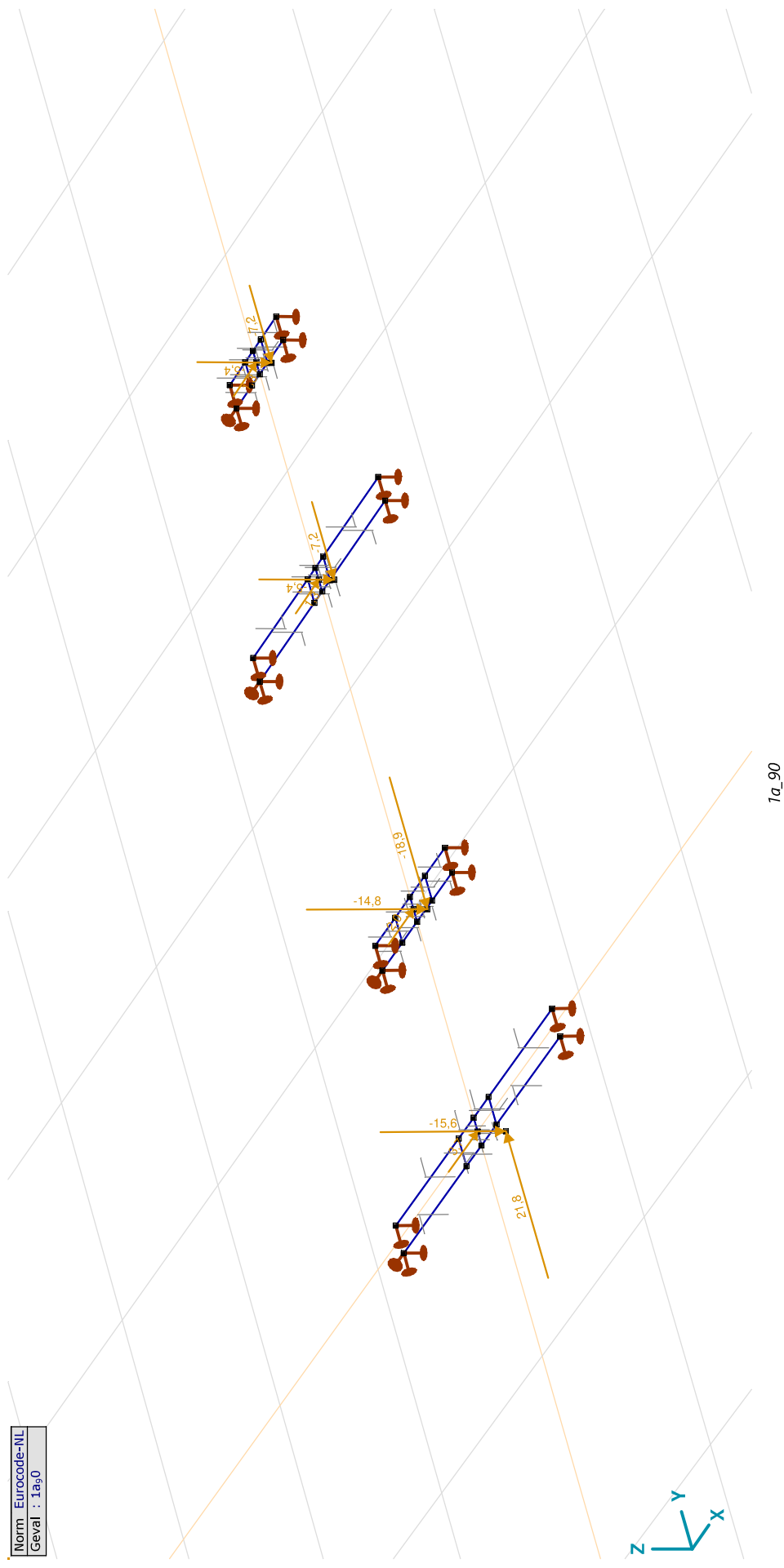
Fx, Fy, Fz: Belastingkracht component; Mx, My, Mz: Belastingmoment component;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Norm Eurocode-NL
Geval : 1a <sub>0</sub>



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

## 3\_90: Knoopbelastingen

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
1	Globaal	4,0	0	0	0	0	0
12	Globaal	0	22,4	-17,6	0	0	0
13	Globaal	2,4	0	0	0	0	0
24	Globaal	0	-20,0	-15,7	0	0	0
25	Globaal	1,5	0	0	0	0	0
36	Globaal	0	-6,7	-7,5	0	0	0
37	Globaal	1,5	0	0	0	0	0
48	Globaal	0	-6,7	-7,5	0	0	0

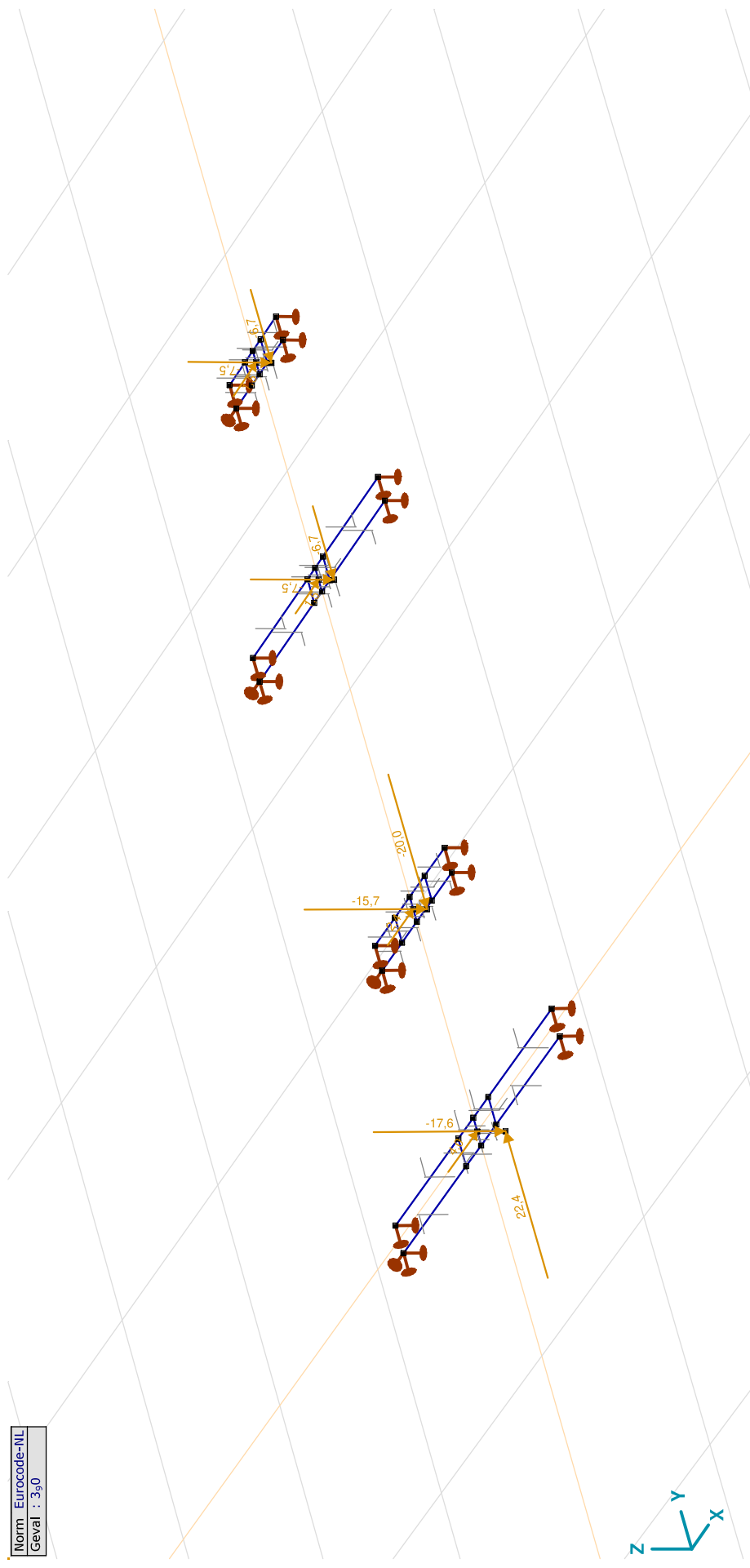
F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>: Belastingkracht component; M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>: Belastingmoment component;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Norm Eurocode-NL
Geval : 3,90





**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

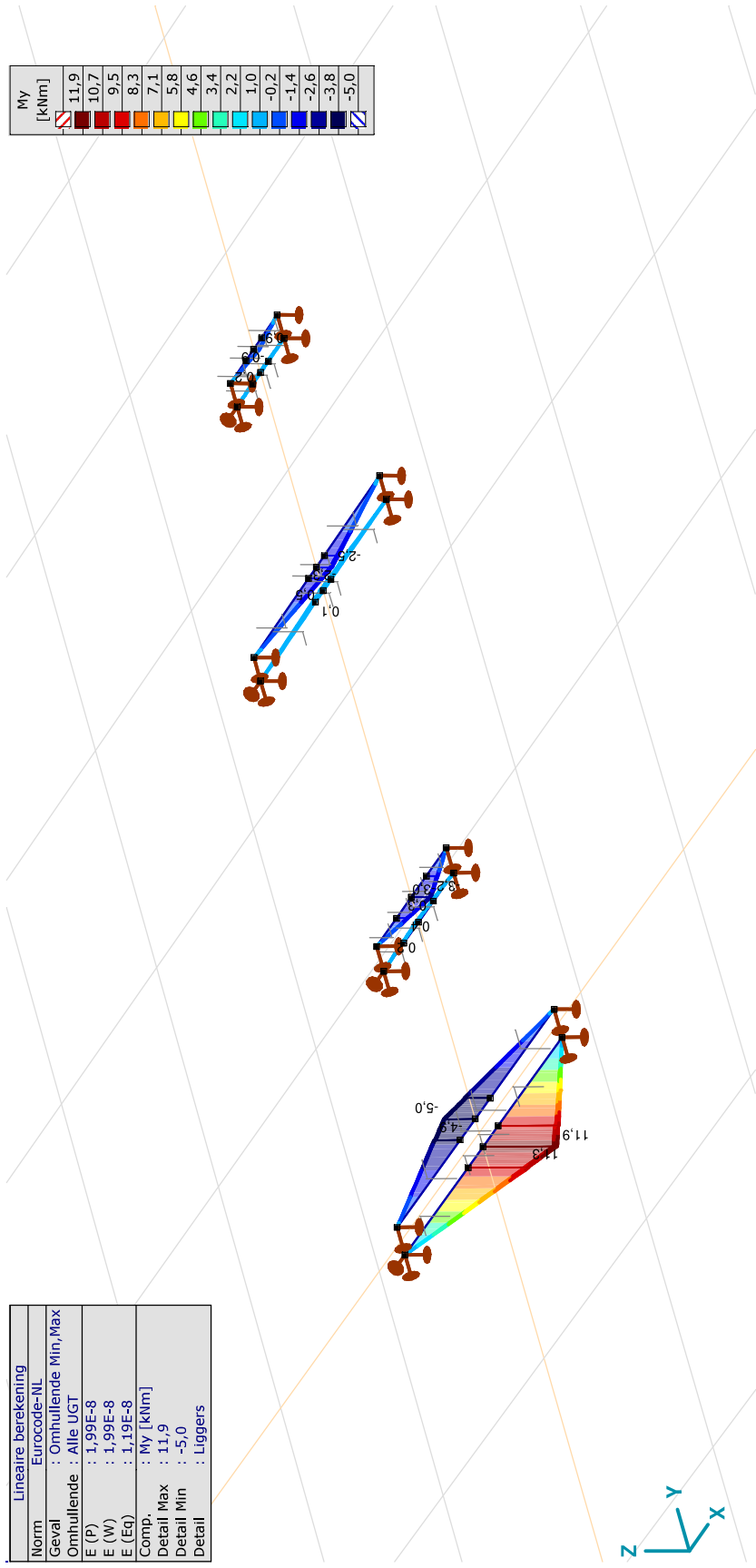
Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen

Naam	Type	ST1	EG (PERM1)	SLS 7 (VERT)	1a_90 (VERT)	3_90 (VERT)	Commentaar
1	UGT	0	1,20	0	1,00	0	
2	UGT	0	1,20	0	0	1,00	
3	BGT Quasi-blijvend	0	1,00	1,00	0	0	

**Naam:** Naam belastingcombinatie; **Type:** Type belastingcombinatie; **ST1, EG (PERM1), SLS 7 (VERT), 1a\_90 (VERT), 3\_90 (VERT):** Factor;

Lineaire berekening	
Norm	: Eurocode-NL
Geval	: Omhullende Min,Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,719E-8
Comp.	: My [kNm]
Detail Max	: 11,9
Detail Min	: -5,0
Detail	: Liggers

My [kNm]
11,9
10,7
9,5
8,3
7,1
5,8
4,6
3,4
2,2
1,0
-0,2
-1,4
-2,6
-3,8
-5,0



[I], > Liggers, Lineair, Omhullende (Alle UGT ), My, Lijnen (gevuld)

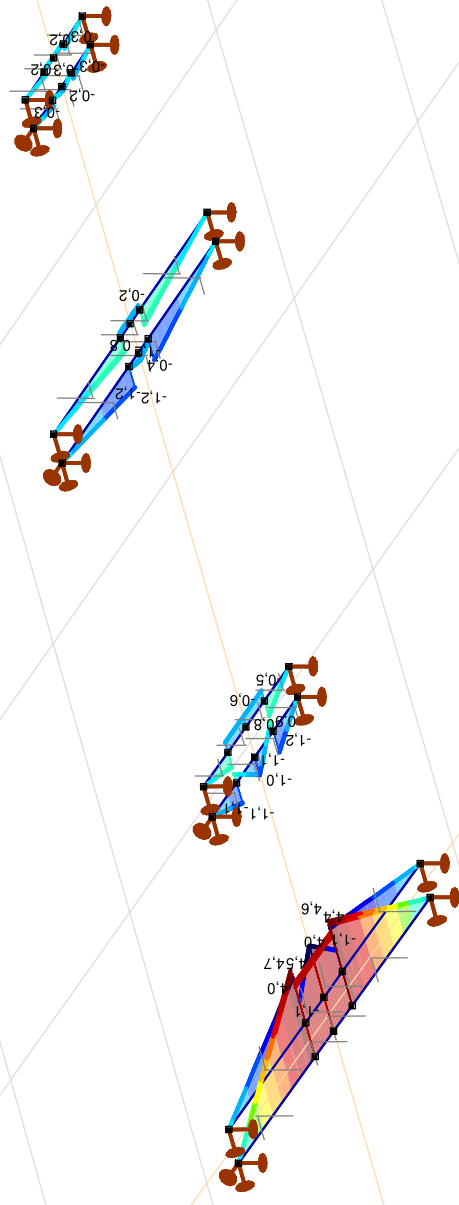
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Mz [kNm]
Detail Max	: 4,7
Detail Min	: -2,8
Detail	: Liggers

Mz [kNm]	
4,7	[Red]
4,2	[Dark Red]
3,6	[Red-Orange]
3,1	[Orange]
2,6	[Yellow-Orange]
2,0	[Yellow]
1,5	[Light Green]
0,9	[Green]
0,4	[Cyan]
-0,1	[Blue-Cyan]
-0,7	[Blue]
-1,2	[Dark Blue]
-1,7	[Very Dark Blue]
-2,3	[Navy]
-2,8	[Dark Blue]



[J] > Liggers, Linear, Omhullende (Alle UGT), Mz, Lijnen (gevuld)

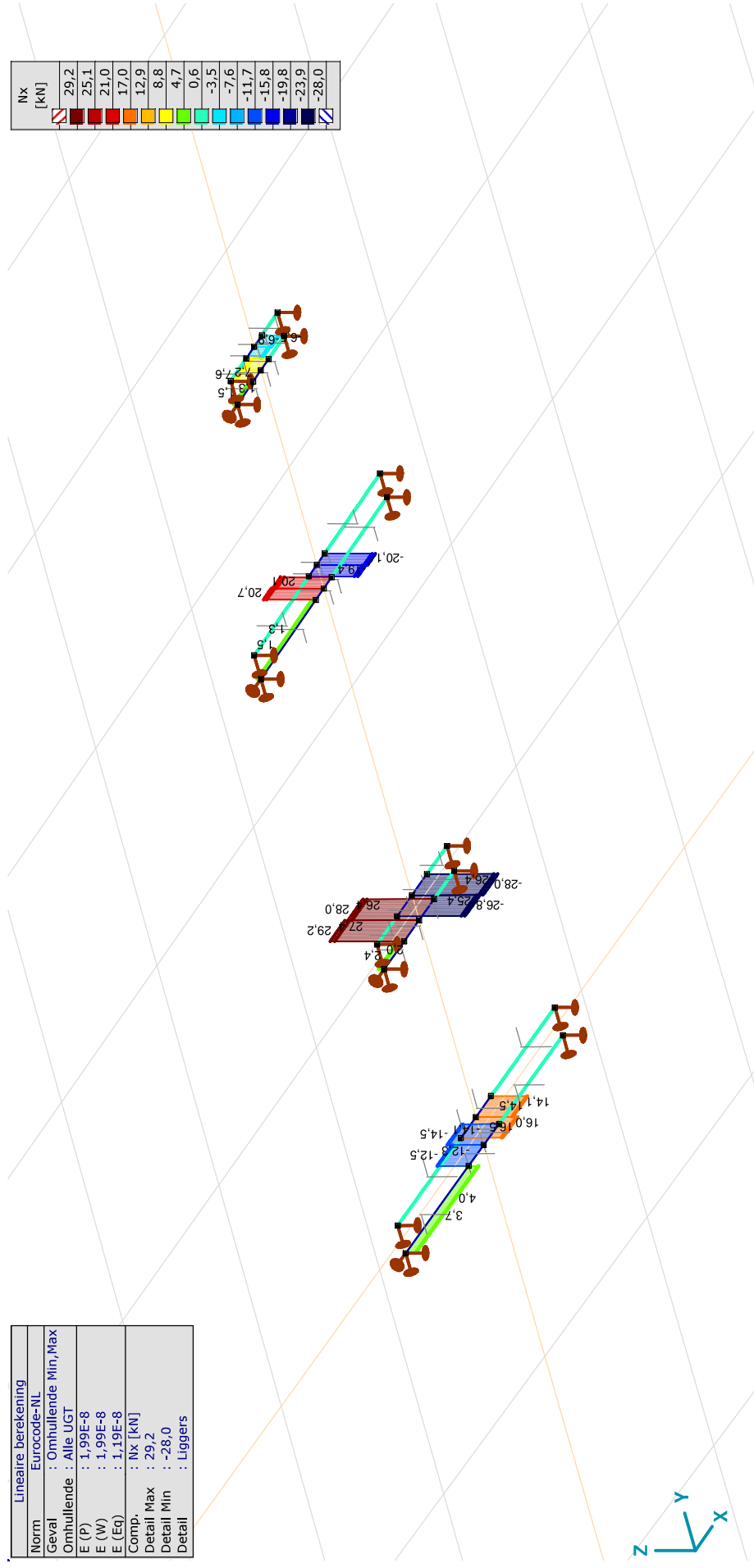
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Nx [kN]
Detail Max	: 29,2
Detail Min	: -28,0
Detail	: Liggers

Nx [kN]
29,2
25,1
21,0
17,0
12,9
8,8
4,7
0,6
-3,5
-7,6
-11,7
-15,8
-19,8
-23,9
-28,0



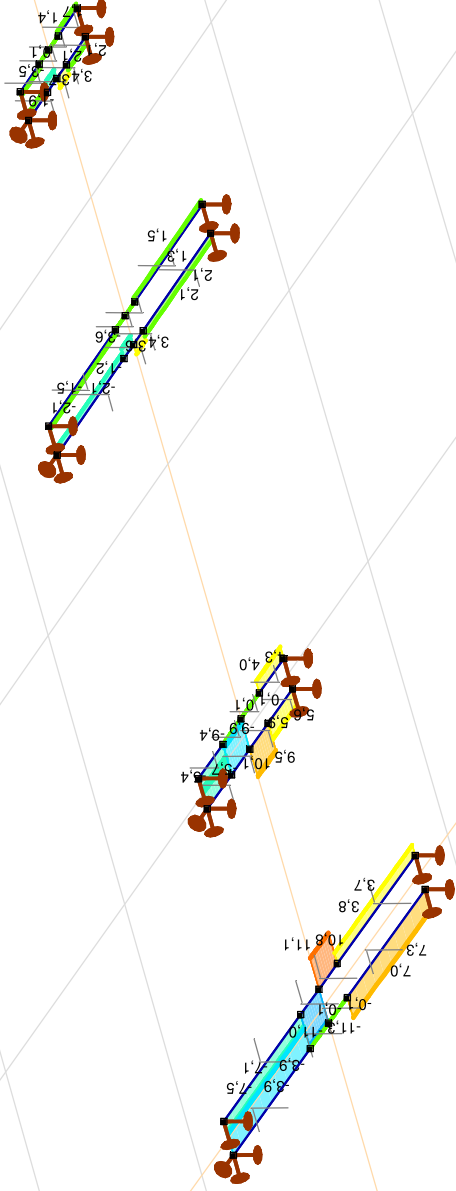
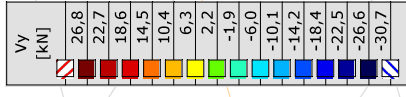
||| > Liggers, Lineair, Omhullende (Alle UGT), Nx, Lijnen (gevuld)

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Vy [kN]
Detail Max	: 11,1
Detail Min	: -11,3
Detail	: Liggers



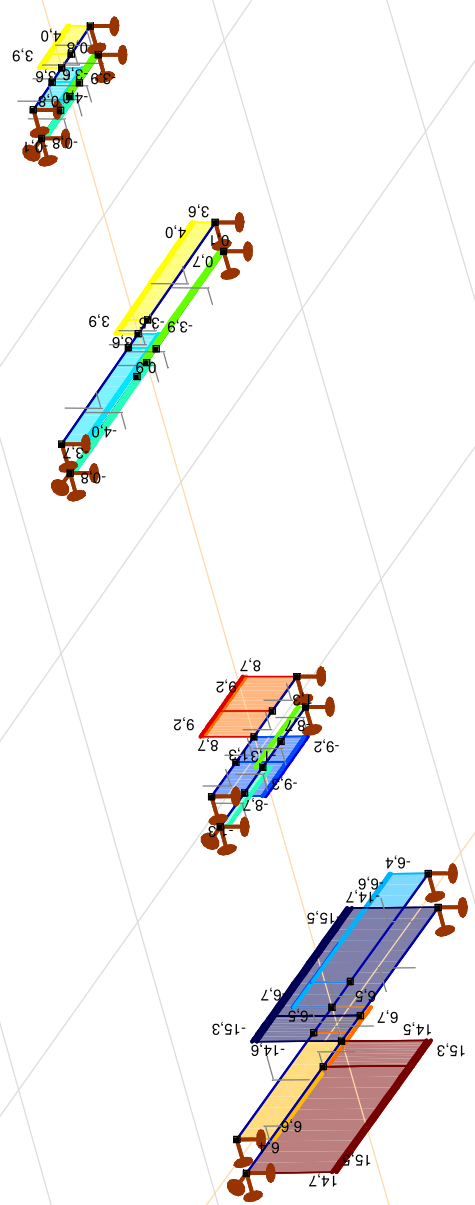
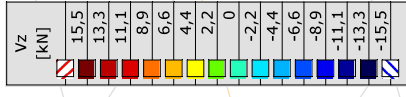
III. > Liggers, Lineair, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Vz [kN]
Detail Max	: 15,5
Detail Min	: -15,5
Detail	: Liggers



III. > Liggers, Lineair, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)

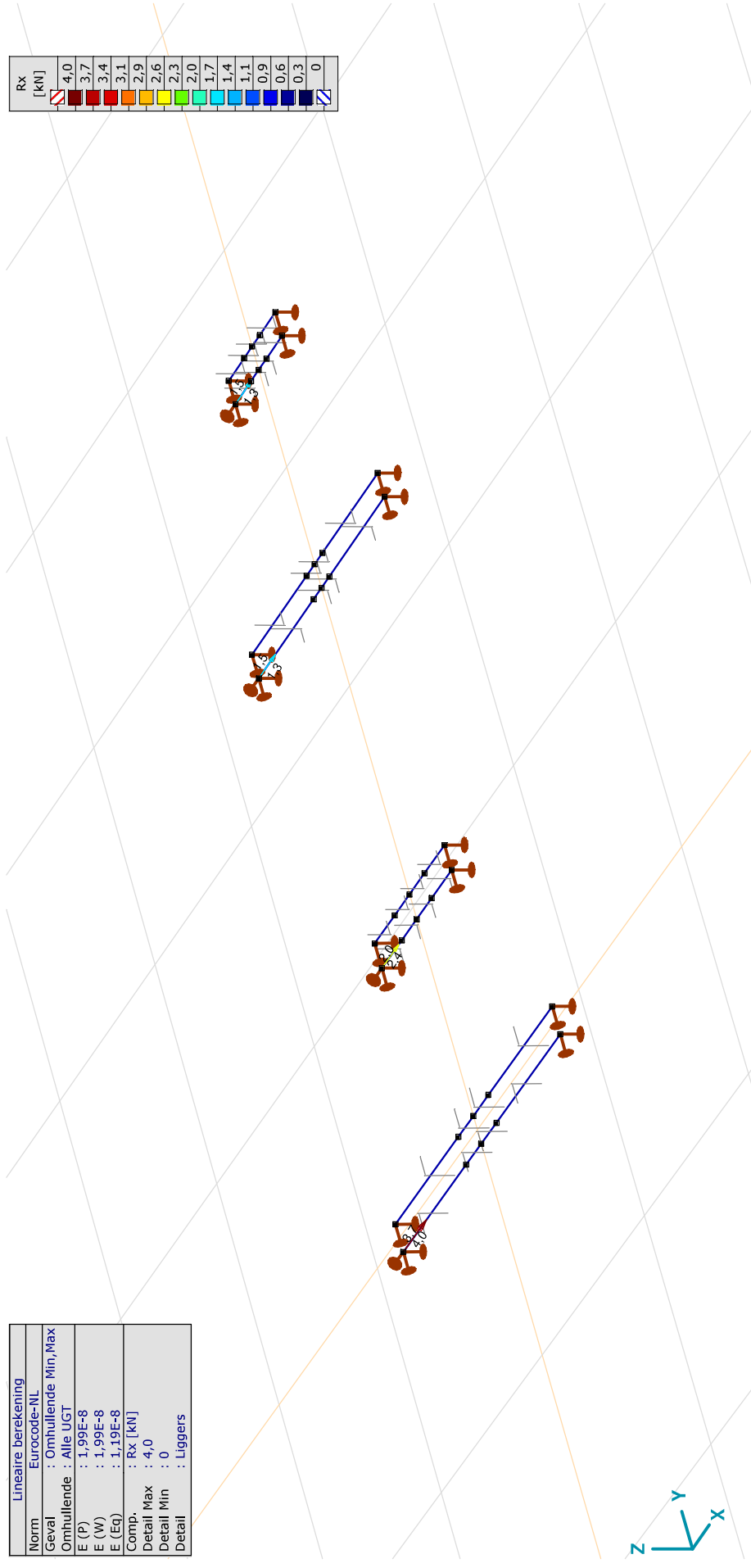
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Rx [kN]
Detail Max	: 4,0
Detail Min	: 0
Detail	: Liggers

Rx [kN]
4,0
3,7
3,4
3,1
2,9
2,6
2,3
2,0
1,7
1,4
1,1
0,9
0,6
0,3
0



[(I)] > Liggers, Lineair, Omhullende (Alle UGT), Rx (knoopopl.), Lijnen

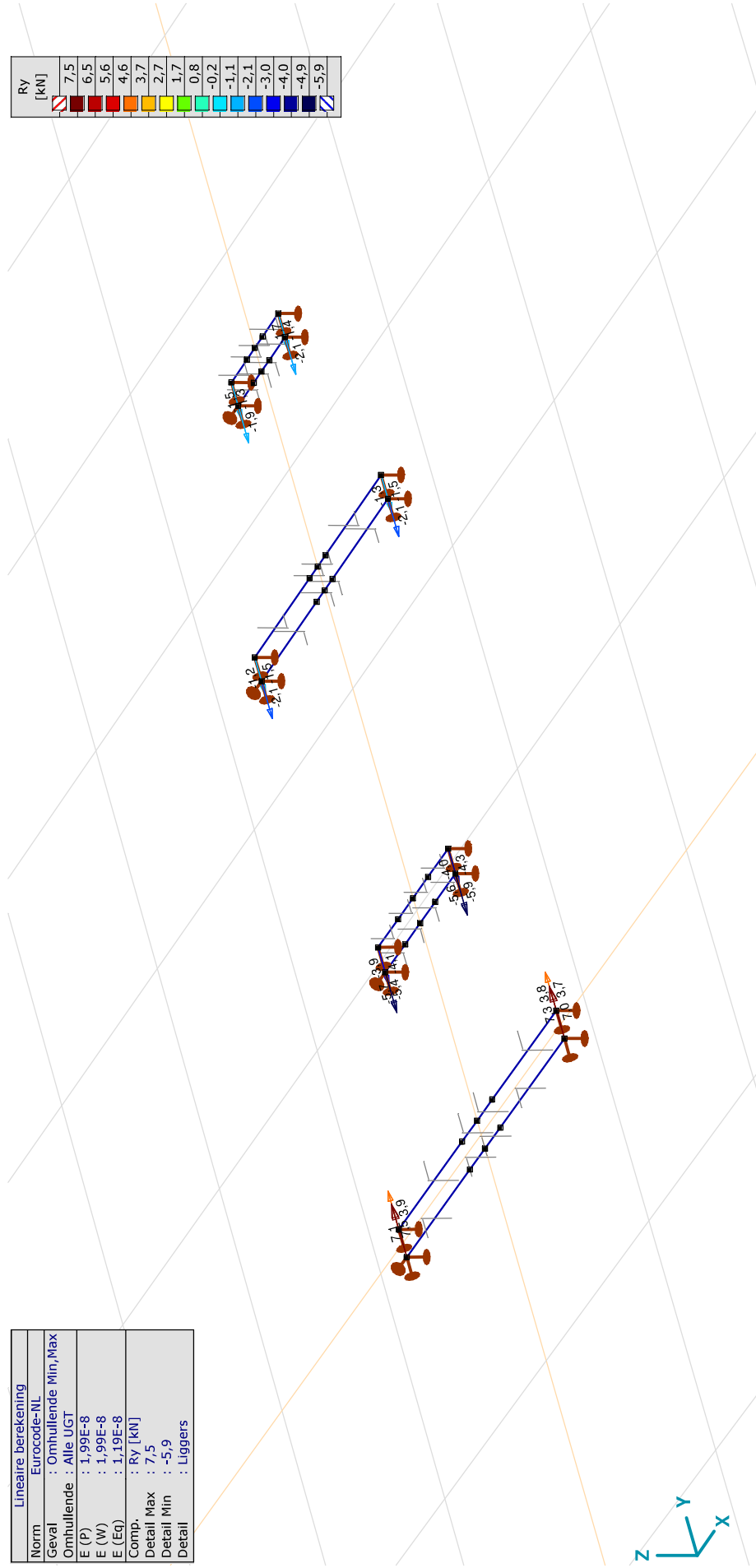
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Ry [kN]
Detail Max	: 7,5
Detail Min	: -5,9
Detail	: Liggers

Ry [kN]
7,5
6,5
5,6
4,6
3,7
2,7
1,7
0,8
-0,2
-1,1
-2,1
-3,0
-4,0
-4,9
-5,9



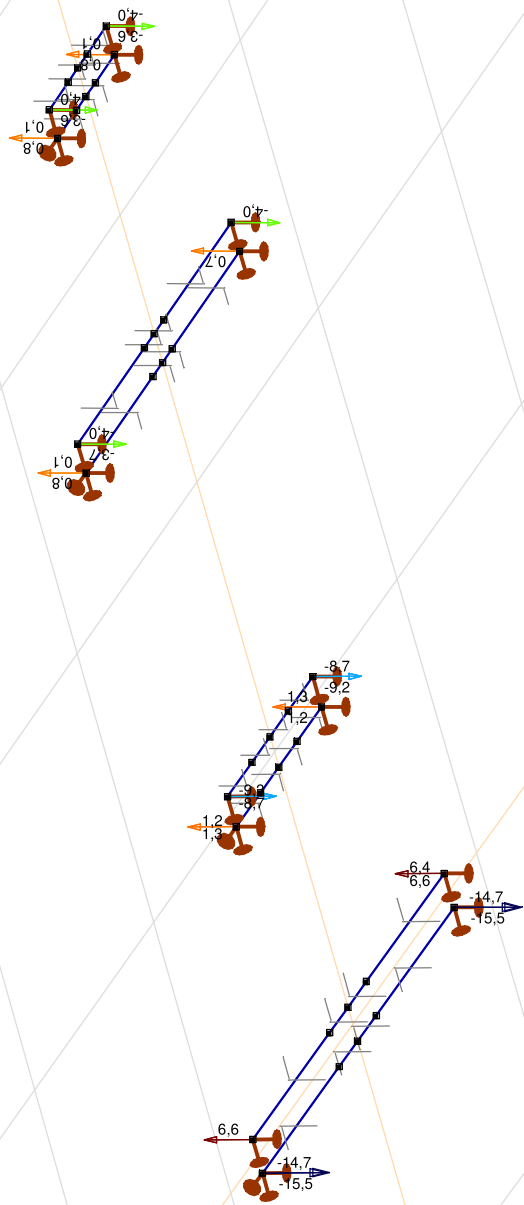
[1] > Liggers, Lineair, Omhullende (Alle UGT), Ry (knoopopl.), Lijnen

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Rz [kN]
Detail Max	: 6,6
Detail Min	: -15,5
Detail	: Liggers



III) > Liggers, Lineair, Omhullende (Alle UGT), Rz (knoopopl.), Lijnen



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
1	4	0,780	0,062	0	Glob.	Ry	Co #2		<b>3,7</b>	6,4	7,4	0,587
							Co #1		<b>3,8</b>	6,6	7,6	0,575
						Rz	Co #2		3,7	<b>6,4</b>	7,4	0,587
							Co #1		3,8	<b>6,6</b>	7,6	0,575
						$\alpha R$	Co #1		3,8	6,6	7,6	0,575
						Co #2		3,7	6,4	7,4	0,587	
2	-0,780	0,062	0	Glob.	Ry	Co #2			<b>3,9</b>	6,4	7,5	0,611
						Co #1		<b>3,9</b>	6,6	7,7	0,597	
					Rz	Co #2		3,9	<b>6,4</b>	7,5	0,611	
						Co #1		3,9	<b>6,6</b>	7,7	0,597	
					$\alpha R$	Co #1		3,9	6,6	7,7	0,597	
						Co #2		3,9	6,4	7,5	0,611	
3	0,780	-0,062	0	Glob.	Ry	Co #1			<b>7,0</b>	-14,7	16,3	-0,475
						Co #2		<b>7,3</b>	-15,5	17,1	-0,472	
					Rz	Co #2		7,3	<b>-15,5</b>	17,1	-0,472	
						Co #1		7,0	<b>-14,7</b>	16,3	-0,475	
					$\alpha R$	Co #1		7,0	-14,7	16,3	-0,475	
						Co #2		7,3	-15,5	17,1	-0,472	
4	-0,780	-0,062	0	Glob.	Rx	Co #1		<b>3,7</b>	7,1	-14,7	16,8	-0,546
						Co #2		<b>4,0</b>	7,5	-15,5	17,7	-0,547
					Ry	Co #1		3,7	<b>7,1</b>	16,8	-0,546	
						Co #2		4,0	<b>7,5</b>	17,7	-0,547	
					Rz	Co #2		4,0	7,5	<b>-15,5</b>	17,7	-0,547
						Co #1		3,7	7,1	16,8	-0,546	
						Co #2		4,0	7,5	17,7	-0,547	
						Co #1		3,7	7,1	16,8	-0,546	
						Co #2		4,0	7,5	17,7	-0,547	
						Co #1		3,7	7,1	16,8	-0,546	
5	0,350	1,056	0	Glob.	Ry	Co #2			<b>-4,3</b>	-9,2	10,2	-0,464
						Co #1		<b>-4,0</b>	-8,7	9,6	-0,464	
					Rz	Co #2		-4,3	<b>-9,2</b>	10,2	-0,464	
						Co #1		-4,0	<b>-8,7</b>	9,6	-0,464	
					$\alpha R$	Co #1		-4,3	-9,2	10,2	-0,464	
						Co #2		-4,0	-8,7	9,6	-0,464	
						Co #1		-4,0	-8,7	9,6	-0,464	

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$					
6	-0,350	1,056	0	Glob.	Ry	min	Co #2		-4,1	-9,3	10,1	-0,443					
						max	Co #1		-3,9	-8,7	9,6	-0,445					
						min	Co #2		-4,1	-9,3	10,1	-0,443					
						max	Co #1		-3,9	-8,7	9,6	-0,445					
						min	Co #1		-3,9	-8,7	9,6	-0,445					
						max	Co #2		-4,1	-9,3	10,1	-0,443					
7	0,350	0,944	0	Glob.	Ry	min	Co #2		-5,9	1,3	6,0	4,598					
						max	Co #1		-5,6	1,2	5,7	4,563					
						min	Co #1		-5,6	1,2	5,7	4,563					
						max	Co #2		-5,9	1,3	6,0	4,598					
						min	Co #1		-5,6	1,2	5,7	4,563					
						max	Co #2		-5,9	1,3	6,0	4,598					
8	-0,350	0,944	0	Glob.	Rx	min	Co #1	2,0	-5,4	1,2	5,9	4,713					
						max	Co #2	2,4	-5,7	1,3	6,3	4,810					
					Ry	min	Co #2	2,4	-5,7	1,3	6,3	4,810					
						max	Co #1	2,0	-5,4	1,2	5,9	4,713					
					Rz	min	Co #1	2,0	-5,4	1,2	5,9	4,713					
						max	Co #2	2,4	-5,7	1,3	6,3	4,810					
					$\alpha R$	min	Co #1	2,0	-5,4	1,2	5,9	4,713					
						max	Co #2	2,4	-5,7	1,3	6,3	4,810					
					9	0,640	2,554	0	Glob.	Ry	min	Co #1		-1,5	-3,6	4,0	-0,415
											max	Co #2		-1,3	-4,0	4,2	-0,315
										Rz	min	Co #2		-1,3	-4,0	4,2	-0,315
											max	Co #1		-1,5	-3,6	4,0	-0,415
$\alpha R$	min	Co #1		-1,5						-3,6	4,0	-0,415					
	max	Co #2		-1,3						-4,0	4,2	-0,315					
10	-0,640	2,554	0	Glob.	Ry	min	Co #1		-1,5	-3,7	3,9	-0,399					
						max	Co #2		-1,2	-4,0	4,2	-0,299					
					Rz	min	Co #2		-1,2	-4,0	4,2	-0,299					
						max	Co #1		-1,5	-3,7	3,9	-0,399					
					$\alpha R$	min	Co #1		-1,5	-3,7	3,9	-0,399					
						max	Co #2		-1,2	-4,0	4,2	-0,299					

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

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## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
11	33	0,640	2,446	0	Glob.	Ry	Co #2		-2,1	0,1	2,1	31,297
							Co #1		-2,1	0,7	2,3	2,868
						Rz	Co #2		-2,1	<b>0,1</b>	2,1	31,297
							Co #1		-2,1	<b>0,7</b>	2,3	2,868
						$\alpha R$	Co #1		-2,1	0,7	2,3	2,868
							Co #2		-2,1	0,1	2,1	31,297
12	34	-0,640	2,446	0	Glob.	Rx	Co #1	<b>1,3</b>	-2,1	0,8	2,6	3,277
							Co #2	<b>1,5</b>	-2,1	0,1	2,6	35,297
						Ry	Co #1	1,3	-2,1	0,8	2,6	3,277
							Co #2	1,5	-2,1	0,1	2,6	35,297
						Rz	Co #2	1,5	-2,1	<b>0,1</b>	2,6	35,297
							Co #1	1,3	-2,1	<b>0,8</b>	2,6	3,277
	$\alpha R$	Co #1	1,3	-2,1	0,8	2,6	3,277					
		Co #2	1,5	-2,1	0,1	2,6	35,297					
13	40	0,240	3,554	0	Glob.	Ry	Co #1		-1,7	-3,6	4,0	-0,468
							Co #2		-1,4	-4,0	4,2	-0,359
						Rz	Co #2		-1,4	<b>-4,0</b>	4,2	-0,359
							Co #1		-1,7	<b>-3,6</b>	4,0	-0,468
						$\alpha R$	Co #1		-1,7	-3,6	4,0	-0,468
							Co #2		-1,4	-4,0	4,2	-0,359
14	41	-0,240	3,554	0	Glob.	Ry	Co #1		-1,5	-3,6	3,9	-0,427
							Co #2		-1,3	-4,0	4,2	-0,317
						Rz	Co #2		-1,3	<b>-4,0</b>	4,2	-0,317
							Co #1		-1,5	<b>-3,6</b>	3,9	-0,427
						$\alpha R$	Co #1		-1,5	-3,6	3,9	-0,427
							Co #2		-1,3	-4,0	4,2	-0,317
15	45	0,240	3,446	0	Glob.	Ry	Co #2		-2,1	0,1	2,1	16,704
							Co #1		-2,1	0,8	2,2	2,568
						Rz	Co #2		-2,1	<b>0,1</b>	2,1	16,704
							Co #1		-2,1	<b>0,8</b>	2,2	2,568
						$\alpha R$	Co #1		-2,1	0,8	2,2	2,568
							Co #2		-2,1	0,1	2,1	16,704

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

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## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
16	46	-0,240	3,446	0	Glob.	Rx	Co #1	<b>1,3</b>	-1,9	0,8	2,5	2,876
						max	Co #2	<b>1,5</b>	-1,9	0,1	2,4	19,133
									<b>-1,9</b>	0,1	2,4	19,133
						max	Co #1	1,3	<b>-1,9</b>	0,8	2,5	2,876
						min	Co #2	1,5	-1,9	<b>0,1</b>	2,4	19,133
						max	Co #1	1,3	-1,9	<b>0,8</b>	2,5	2,876
						min	Co #2	1,5	-1,9	0,1	2,4	19,133
						$\alpha R$	Co #1	1,3	-1,9	0,8	2,5	2,876
						max	Co #2	1,5	-1,9	0,1	2,4	19,133
Ext.												
12	34	-0,640	2,446	0	Glob.	Rx	Co #1	<b>1,3</b>	-2,1	0,8	2,6	3,277
16	46	-0,240	3,446	0	Glob.		Co #1	<b>1,3</b>	-1,9	0,8	2,5	2,876
4	10	-0,780	-0,062	0	Glob.		Co #2	<b>4,0</b>	7,5	-15,5	17,7	-0,547
7	21	0,350	0,944	0	Glob.	Ry	Co #2	4,0	<b>-5,9</b>	1,3	6,0	4,598
4	10	-0,780	-0,062	0	Glob.		Co #2	4,0	<b>7,5</b>	-15,5	17,7	-0,547
3	9	0,780	-0,062	0	Glob.	Rz	Co #2	4,0	7,3	<b>-15,5</b>	17,1	-0,472
4	10	-0,780	-0,062	0	Glob.		Co #2	4,0	7,5	<b>-15,5</b>	17,7	-0,547
2	5	-0,780	0,062	0	Glob.		Co #1	4,0	3,9	<b>6,6</b>	7,7	0,597
4	10	-0,780	-0,062	0	Glob.	$\alpha R$	Co #2	4,0	7,5	-15,5	17,7	-0,547
12	34	-0,640	2,446	0	Glob.	max	Co #2	1,5	-2,1	0,1	2,6	35,297

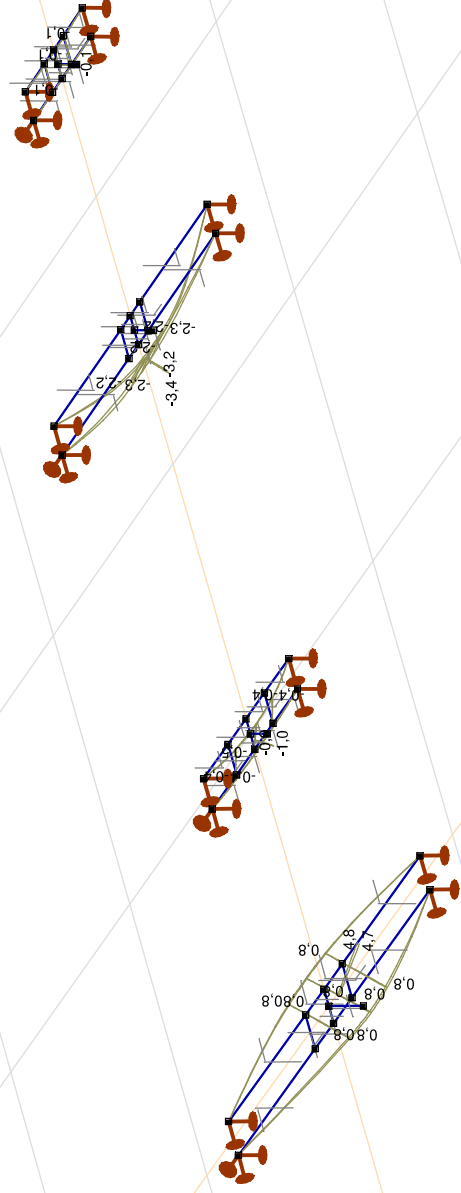
**Knoop:** Ondersteunde knoop; **Type:** Opleggingsstype; **C:** Extreme component; **min. max.:** Extreme type; **Geval:** Belastinggeval van de extreme; **Rx:** X-component opleggingsreactiekracht; **Ry:** Y-component opleggingsreactiekracht; **Rz:** Z-component opleggingsreactiekracht; **Rr:** Resulterende opleggingsreactiekracht;  **$\alpha R$ :** Verhouding verticale oplegkracht / horizontale oplegkracht;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: eY [mm]
Max	: 4,8
Min	: -3,4



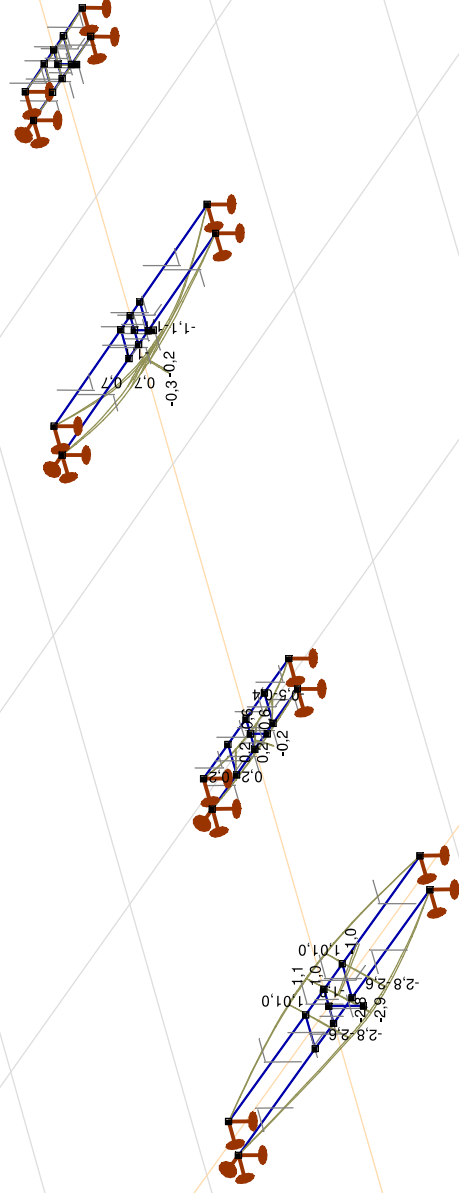
III, Lineair, Omhullende (Alle UGT), eY, Lijnen

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: ez [mm]
Max	: 1,1
Min	: -2,9



III, Lineair, Omhullende (Alle UGT), ez, Lijnen

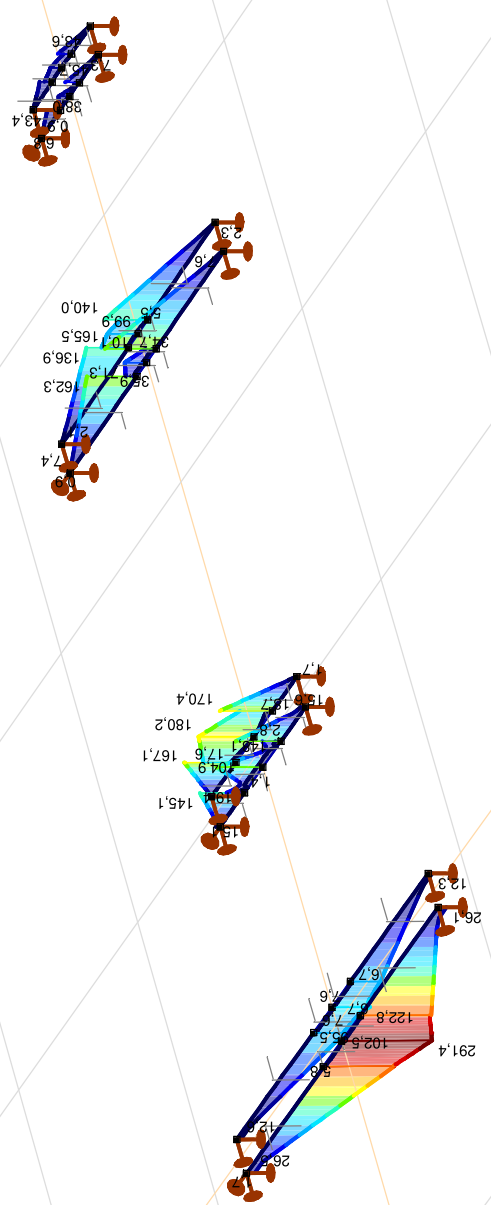
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Sominmax [N/mm <sup>2</sup> ]
Detail Max	: 291,4
Detail Min	: 0
Detail	: Liggers

Sominmax [N/mm <sup>2</sup> ]
291,4
270,6
249,8
229,0
208,2
187,3
166,5
145,7
124,9
104,1
83,3
62,4
41,6
20,8
0



[[I]] > Liggers, Linear, Omhullende (Alle UGT), Sominmax, Lijnen (gevuld)

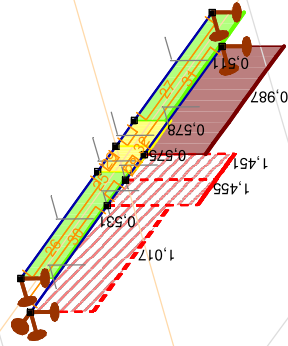
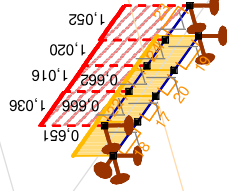
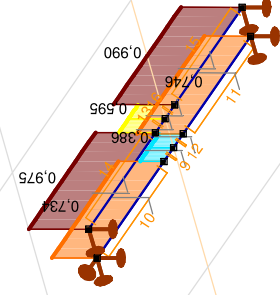
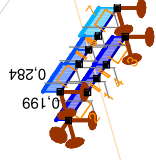
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 1.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,99E-8
E (W)	: 1,99E-8
E (Eq)	: 1,19E-8
Comp.	: Unity-check (UGT) <input type="checkbox"/>
Detail Max	: 1,455
Detail Min	: 0,191
Detail	: Liggers

Unity-check	
	1,000
	0,929
	0,857
	0,786
	0,714
	0,643
	0,571
	0,500
	0,429
	0,357
	0,286
	0,214
	0,143
	0,071
	0



[Stij] > Liggers, Lineair, Omhullende (Alle UGT), Unity-check, Lijnen (gevuld)



## **Project:**

**Constructeur: DNV GL - Energy**

AxisVM X6 R1q • Geregistreerd aan DNV GL - Energy  
Liggers D+0 huidig sit 2.axs

**Rapport**

## Rapport, Inhoudsopgave

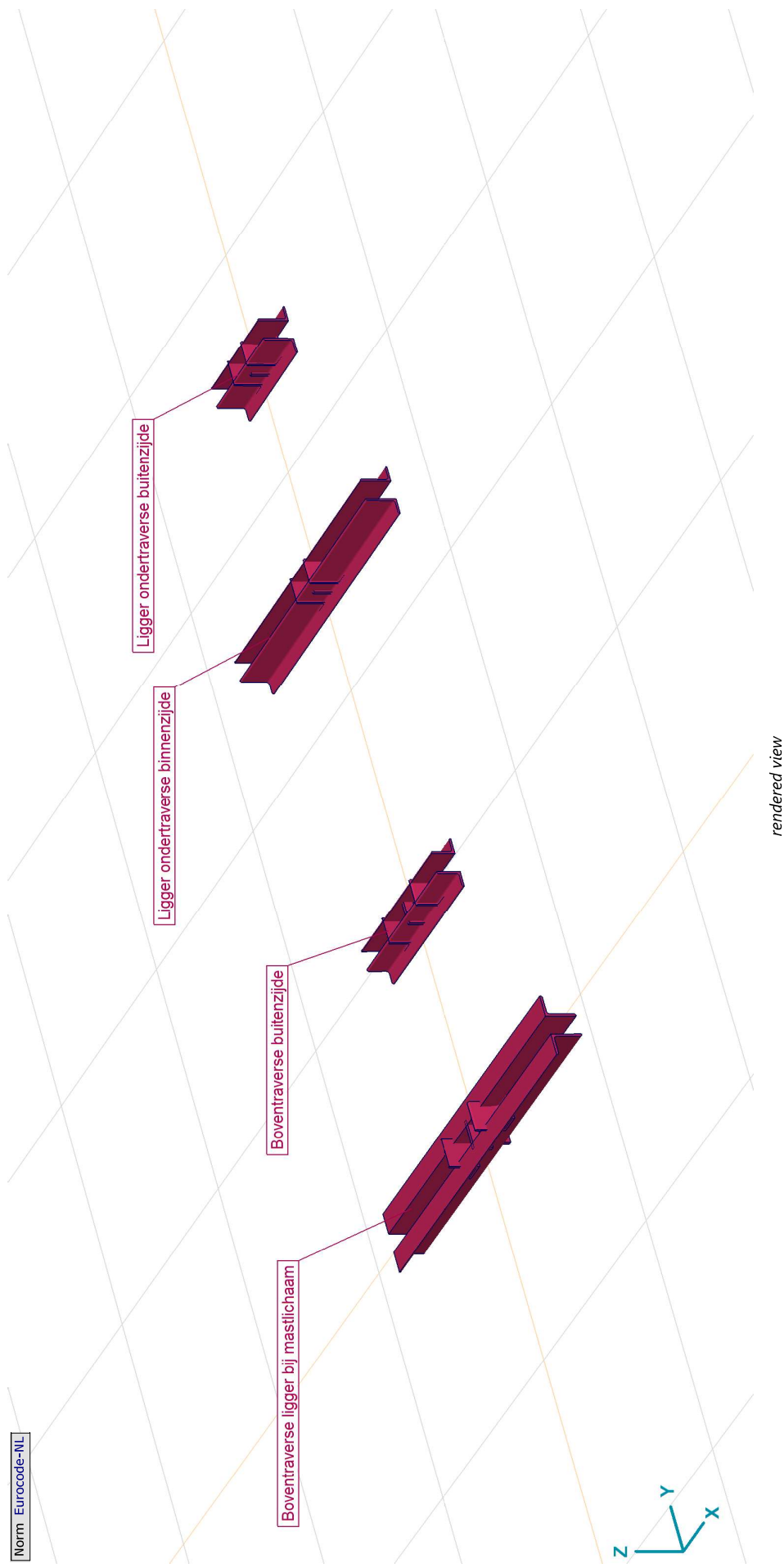
Onderdeel	Pagina	Onderdeel	Pagina
rendered view	3	3_90	15
Materialen	4	Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen	16
Tekening	5	[I], > Liggers, Linear, Omhullende (Alle UGT ), My, Lijnen (gevuld)	16
Knopen	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Mz, Lijnen (gevuld)	17
Staven	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Nx, Lijnen (gevuld)	18
Tekening profielen	8	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)	19
Profielen	9	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)	20
Tekening staven	10	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rx (knoopopl.), Lijnen	21
Staafaansluitingen	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Ry (knoopopl.), Lijnen	22
EG: Staaf eigen gewicht	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rz (knoopopl.), Lijnen	23
SLS 7	12	Interne krachten knooppogging [Linear, Omhullende (Alle UGT ), Liggers]	24
SLS 7: Knooppbelastingen	13	[I], Linear, Omhullende (Alle UGT ), eY, Lijnen	28
1a_90: Knooppbelastingen	13	[I], Linear, Omhullende (Alle UGT ), eZ, Lijnen	29
1a_90	14	[I], > Liggers, Linear, Omhullende (Alle UGT ), Somminmax, Lijnen (gevuld)	30
3_90: Knooppbelastingen	15	[STJ], > Liggers, Linear, Omhullende (Alle UGT ), Unity-check, Lijnen (gevuld)	31

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL



rendered view

**Project:**




Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

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**Materialen**

1	S 235	Staal	Nationale norm	Materialnorm	Model	$E_x$ [N/mm <sup>2</sup> ]	$E_y$ [N/mm <sup>2</sup> ]	$\nu$	$\alpha_T$ [1/°C]	$\rho$ [kg/m <sup>3</sup> ]	Material kleur	Contour kleur	Structuur	$P_1$
			Eurocode-NL	10025-2	Lineair	210000	210000	0,30	1,2E-5	7850				$f_{yk}$ [N/mm <sup>2</sup> ] = 235,00

Naam	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	$P_9$	$P_{10}$	$P_{11}$	$P_{12}$	$P_{13}$	$P_{14}$
1	S 235	$f_{yk}$ [N/mm <sup>2</sup> ] = 360,00	$f_{yk}$ [N/mm <sup>2</sup> ] = 215,00	$f_{tk}$ [N/mm <sup>2</sup> ] = 360,00									

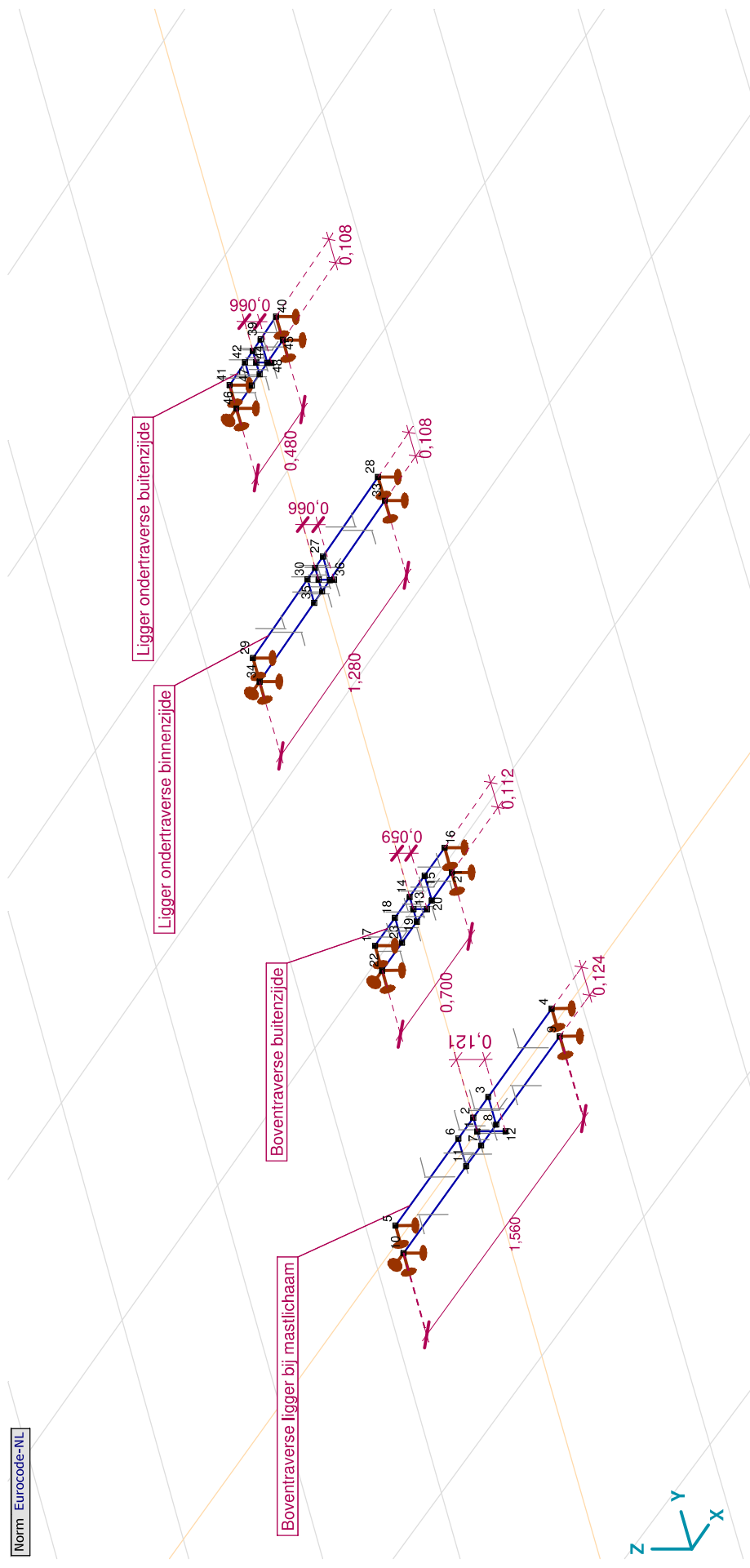
**Naam:** Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model;  **$E_x$ :** Elasticiteitsmodulus in lokale x richting;  **$E_y$ :** Elasticiteitsmodulus in lokale y richting;  **$\nu$ :** Poisson's verhouding;  **$\alpha_T$ :** Warmteuitzettingscoëfficiënt;  **$\rho$ :** Dichtheid; **Material kleur:** Materiaalkleur; **Contour kleur:** Contourkleur;  **$P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}$ :** Ontwerpparameter.

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL



Tekening



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

## Staven

	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Ref <sub>Z</sub>	<- Aansluitingen	Aansluitingen ->
22	19	23	0,150	i - j	S 235	3	Auto	.	.
23	19	13	0,056	j - i	S 235	2	R1	Schar-YZ	.
24	23	18	0,112	j - i	S 235	3	Auto	.	.
25	15	20	0,112	i - j	S 235	3	Auto	.	.
26	24	13	0,059	j - i	S 235	2	Auto	.	.
27	25	26	0,054	i - j	S 235	2	R1	.	100111
28	26	27	0,080	i - j	S 235	4	Auto	.	.
29	27	28	0,560	i - j	S 235	4	Auto	.	.
30	29	30	0,560	i - j	S 235	4	Auto	.	.
31	30	26	0,080	j - i	S 235	4	Auto	.	.
32	32	31	0,080	j - i	S 235	4	Auto	.	.
33	33	32	0,560	j - i	S 235	4	Auto	.	.
34	35	34	0,560	j - i	S 235	4	Auto	.	.
35	31	35	0,080	i - j	S 235	4	Auto	.	.
36	31	25	0,054	j - i	S 235	2	R1	Schar-YZ	.
37	35	30	0,108	j - i	S 235	4	Auto	.	.
38	27	32	0,108	i - j	S 235	4	Auto	.	.
39	36	25	0,066	j - i	S 235	2	Auto	.	.
40	37	38	0,054	i - j	S 235	2	R1	.	100111
41	38	39	0,080	i - j	S 235	4	Auto	.	.
42	39	40	0,160	i - j	S 235	4	Auto	.	.
43	41	42	0,160	i - j	S 235	4	Auto	.	.
44	42	38	0,080	j - i	S 235	4	Auto	.	.
45	44	43	0,080	j - i	S 235	4	Auto	.	.
46	45	44	0,160	j - i	S 235	4	Auto	.	.
47	47	46	0,160	j - i	S 235	4	Auto	.	.
48	43	47	0,080	i - j	S 235	4	Auto	.	.
49	43	37	0,054	j - i	S 235	2	R1	Schar-YZ	.
50	47	42	0,108	j - i	S 235	4	Auto	.	.
51	39	44	0,108	i - j	S 235	4	Auto	.	.
52	48	37	0,066	j - i	S 235	2	Auto	.	.

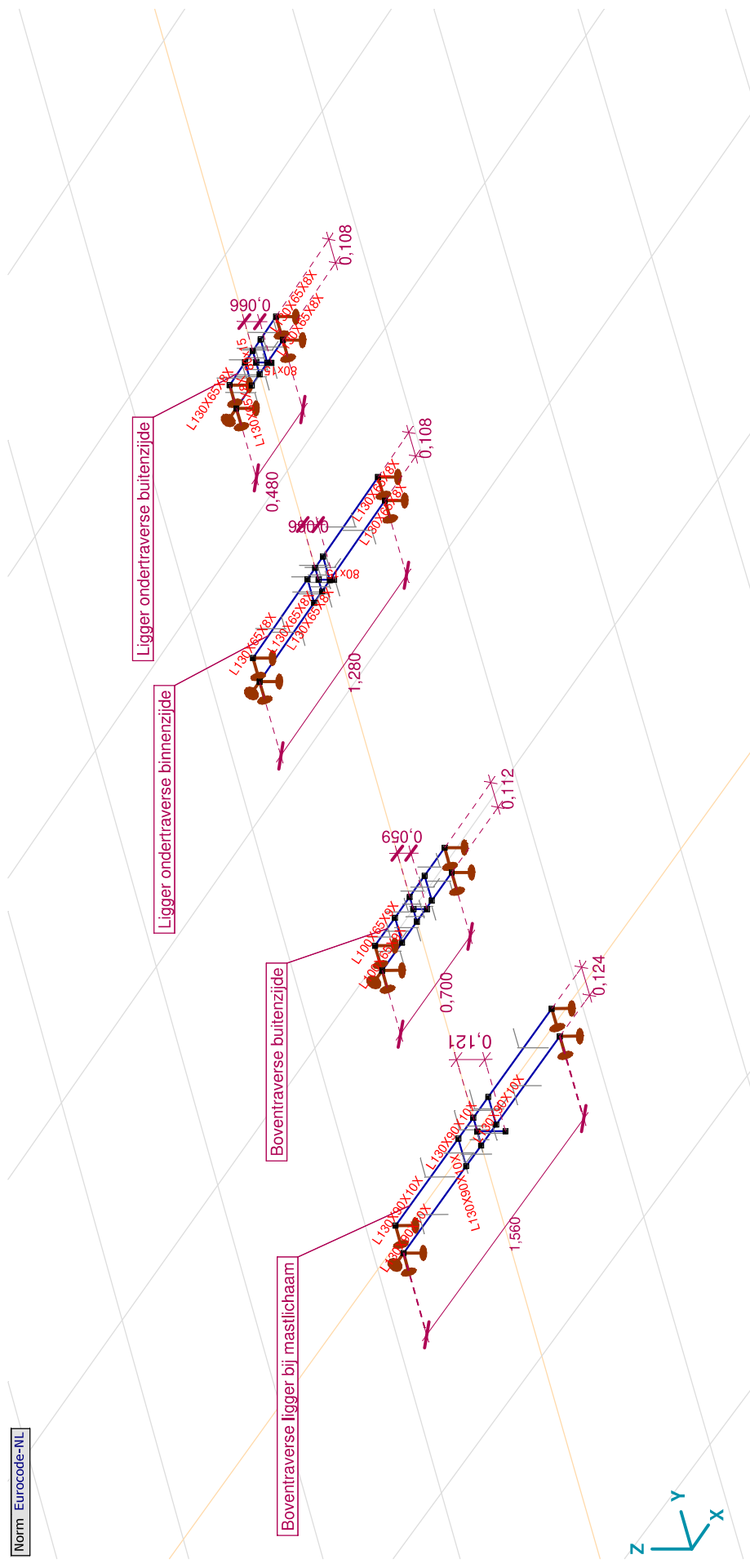
Lengte: Elementlengte; **Lokaal X**: Lokale X-richting; **Ref<sub>Z</sub>**: Referentie voor lokale Z-richting; <- **Aansluitingen**: Staafeindsluitingen op startpunt; **Aansluitingen** ->: Staafeindsluitingen op eindpunt;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL



Tekening profielen



**Project:**





Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

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**Profielen**

Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	Ax [mm <sup>2</sup> ]	Ay [mm <sup>2</sup> ]	Az [mm <sup>2</sup> ]	Ix [mm <sup>4</sup> ]	Iy [mm <sup>4</sup> ]	Iz [mm <sup>4</sup> ]
1	L 130X 90X10X 	Gewalst	L	130,0	90,0	10,0	10,0	12,0	6,0	0	2115,52	730,05	1115,03	75067,63	3579805,00	1407288,00
2	80x15 	Gewalst	Recht.	15,0	80,0	0	0	0	0	0	1200,00	1000,00	1000,00	79361,69	22500,00	640000,00
3	L 100X 65X 9X 	Gewalst	L	100,0	65,0	9,0	9,0	10,0	5,0	0	1414,78	477,96	772,93	40681,80	1406314,00	466914,90
4	L 130X 65X 8X 	Gewalst	L	130,0	65,0	8,0	8,0	11,0	5,5	0	1509,04	400,01	894,73	34749,90	2625007,00	447616,10

Naam	Iyz [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	Iω [mm <sup>6</sup> ]	W <sub>1,elt</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elt</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	i <sub>y</sub> [mm]	i <sub>z</sub> [mm]	Hy [mm]	Hx [mm]
1	L 130X 90X10X	-1302677,00	4189697,00	797396,10	25,09	67E+07	46873,24	62990,74	17179,39	34394,52	81837,91	21346,26	81837,91	41,1	25,8	90,0	130,0
2	80x15	0	640000,00	22500,00	90,00	1E+07	16000,00	16000,00	3000,00	4500,00	24000,00	3000,00	24000,00	4,3	23,1	80,0	15,0
3	L 100X 65X 9X	-466019,90	1598273,00	274955,80	22,39	2E+07	23552,43	32380,51	7940,67	16324,54	41416,09	10044,04	41416,09	31,5	18,2	65,0	100,0
4	L 130X 65X 8X	-608865,80	2783699,00	288924,20	14,61	2,9E+07	32704,41	48773,37	7411,05	16576,57	56896,01	11687,17	56896,01	41,7	17,2	65,0	130,0

Naam	Y <sub>G</sub> [mm]	Z <sub>G</sub> [mm]	Y <sub>S</sub> [mm]	Z <sub>S</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> [mm]	S <sub>p</sub>	
1	L 130X 90X10X	21,8	41,5	-16,4	-35,0	112,7	95,4	-292,0	4
2	80x15	40,0	7,5	0	0	0	0	0	5
3	L 100X 65X 9X	15,9	33,2	-11,1	-26,9	84,2	70,1	-343,9	4
4	L 130X 65X 8X	13,7	45,6	-9,5	-39,4	111,6	90,0	-547,9	4

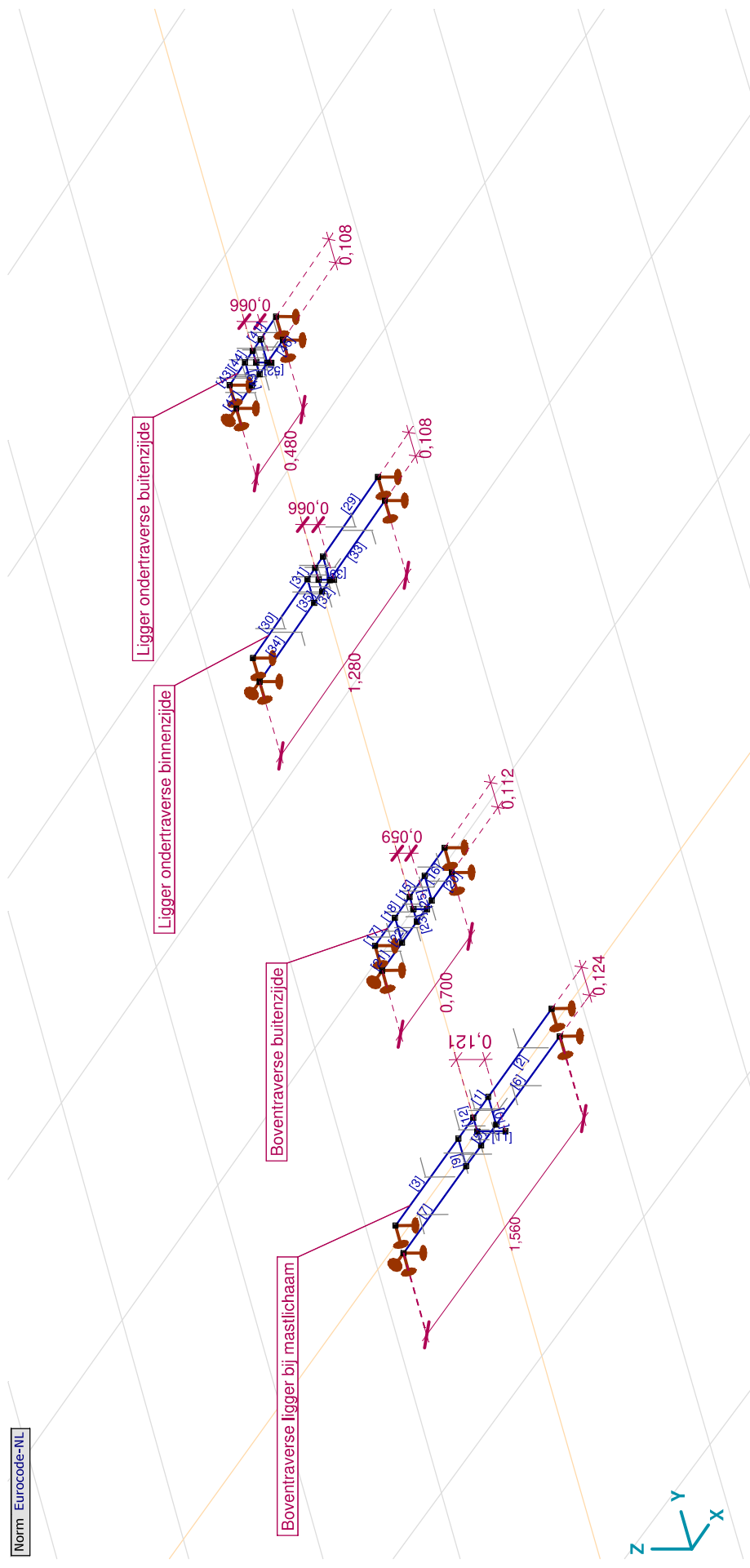
**Naam:** Doorsnede naam; **Productie:** Productieproces; **Vorm:** Profiel; **h:** Doorsnede hoogte; **b:** Doorsnede breedte; **tw:** Lijfdikte; **tf:** Flensdikte; **r<sub>1</sub>, r<sub>2</sub>, r<sub>3</sub>:** Afrondingswaarde; **Ax:** Doorsnede-oppervlak; **Ay, Az:** Afschuivingsoppervlak; **Ix:** Torietraagheidsmoment; **Iy, Iz:** Buigtrraagheidsmoment; **Iyz:** Centrifugaal traagheidsmoment; **I<sub>1</sub>, I<sub>2</sub>:** Hoofdbuigtrraagheidsmoment; **α:** Hoofdrichtingen; **Iω:** Krommingsconstante; **W<sub>1,elt</sub>, W<sub>1,elb</sub>, W<sub>2,elt</sub>, W<sub>2,elb</sub>:** Elastisch weerstandsmoment; **W<sub>1,pl</sub>, W<sub>2,pl</sub>:** Plastisch weerstandsmoment; **W<sub>1,pr</sub>, W<sub>2,pr</sub>:** Traagheidsstraal; **Hy:** Afmeting in lokale Y-richting; **Hx:** Afmeting in lokale Z-richting; **Y<sub>G</sub>:** Y-coördinaat van het zwaartepunt; **Z<sub>G</sub>:** Z-coördinaat van het zwaartepunt; **Y<sub>S</sub>:** Y-coördinaat van het afschuivingsmiddelpunt (torsie); **Z<sub>S</sub>:** Z-coördinaat van het afschuivingsmiddelpunt (torsie); **β<sub>y</sub>, β<sub>z</sub>, β<sub>w</sub>:** Wagner's coëfficiënt; **S<sub>p</sub>:** Spanningspunten;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL



Tekening staven

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

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## Staafaansluitingen

	<-Aansluitingen	Aansluitingen ->	<-e <sub>x</sub>	<-θ <sub>x</sub>	<-θ <sub>y</sub>	<-θ <sub>z</sub>
12	.	Schar-YZ	.	.	.	.
13	100111	.	Vrij	Vrij	Vrij	Vrij
14	.	100111	.	.	.	.
23	Schar-YZ	.	.	.	Vrij	Vrij
27	.	100111	.	.	.	.
36	Schar-YZ	.	.	.	Vrij	Vrij
40	.	100111	.	.	.	.
49	Schar-YZ	.	.	.	Vrij	Vrij

<-Aansluitingen: Staafendaansluitingen op startpunt; **Aansluitingen ->**: Staafendaansluitingen op eindpunt; <-e<sub>x</sub>, <-θ<sub>x</sub>, <-θ<sub>y</sub>, <-θ<sub>z</sub>: Type;

## EG: Staaf eigen gewicht

	Σ [kg]
1-52	127,980
<b>Totaal</b>	<b>127,980</b>

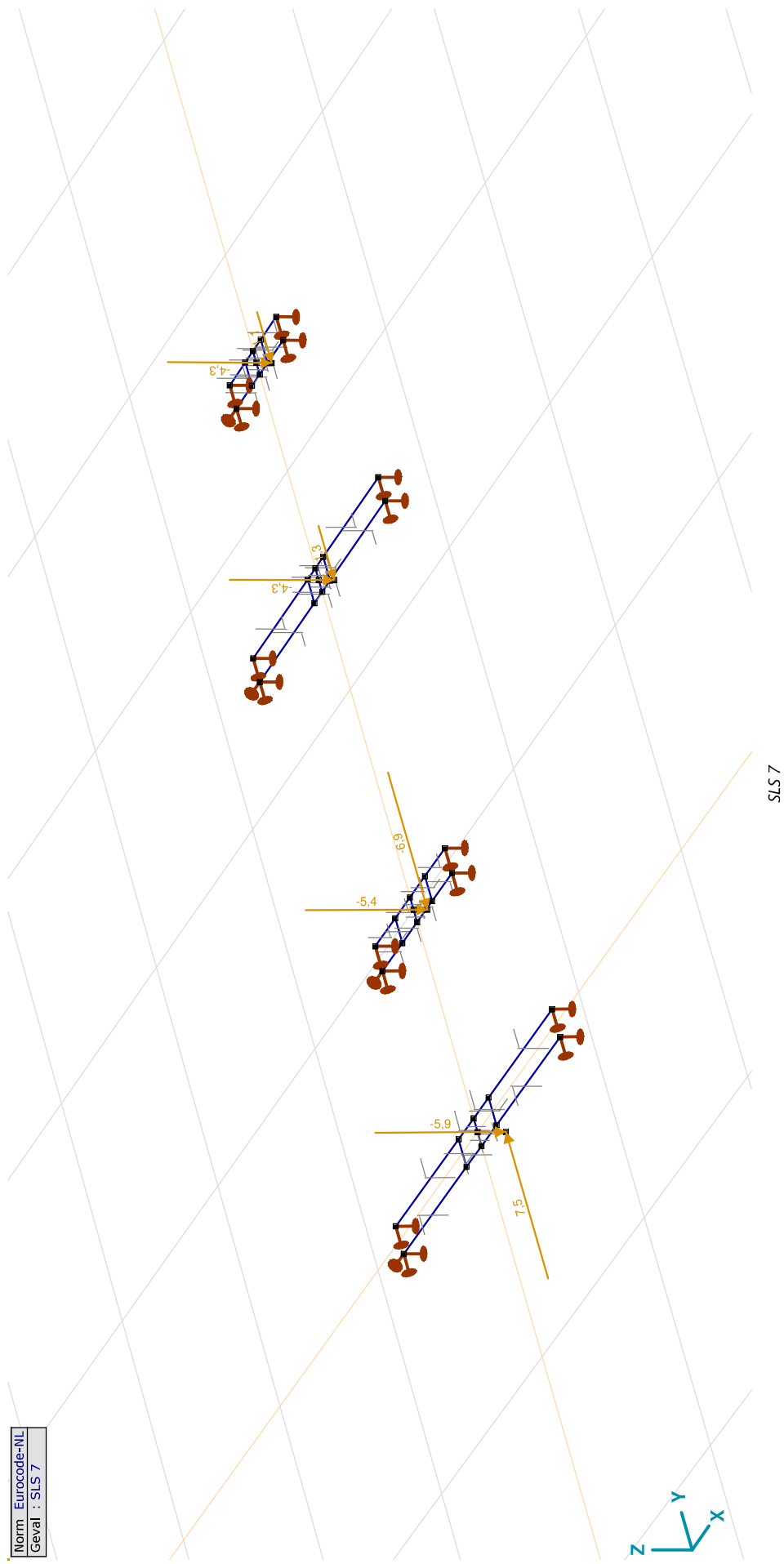
Σ: Totale massa:

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL  
Geval : SLS 7



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

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## SLS 7: Knoopbelastingen

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
12	Global	0	7,5	-5,9	0	0	0
24	Global	0	-6,9	-5,4	0	0	0
36	Global	0	-1,3	-4,3	0	0	0
48	Global	0	-1,1	-4,3	0	0	0

F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>: Belastingkracht component; M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>: Belastingmoment component;

## 1a\_90: Knoopbelastingen

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
12	Global	0	14,7	-11,5	0	0	0
24	Global	0	-13,6	-10,6	0	0	0
36	Global	0	-4,8	-6,0	0	0	0
48	Global	0	-5,0	-6,0	0	0	0

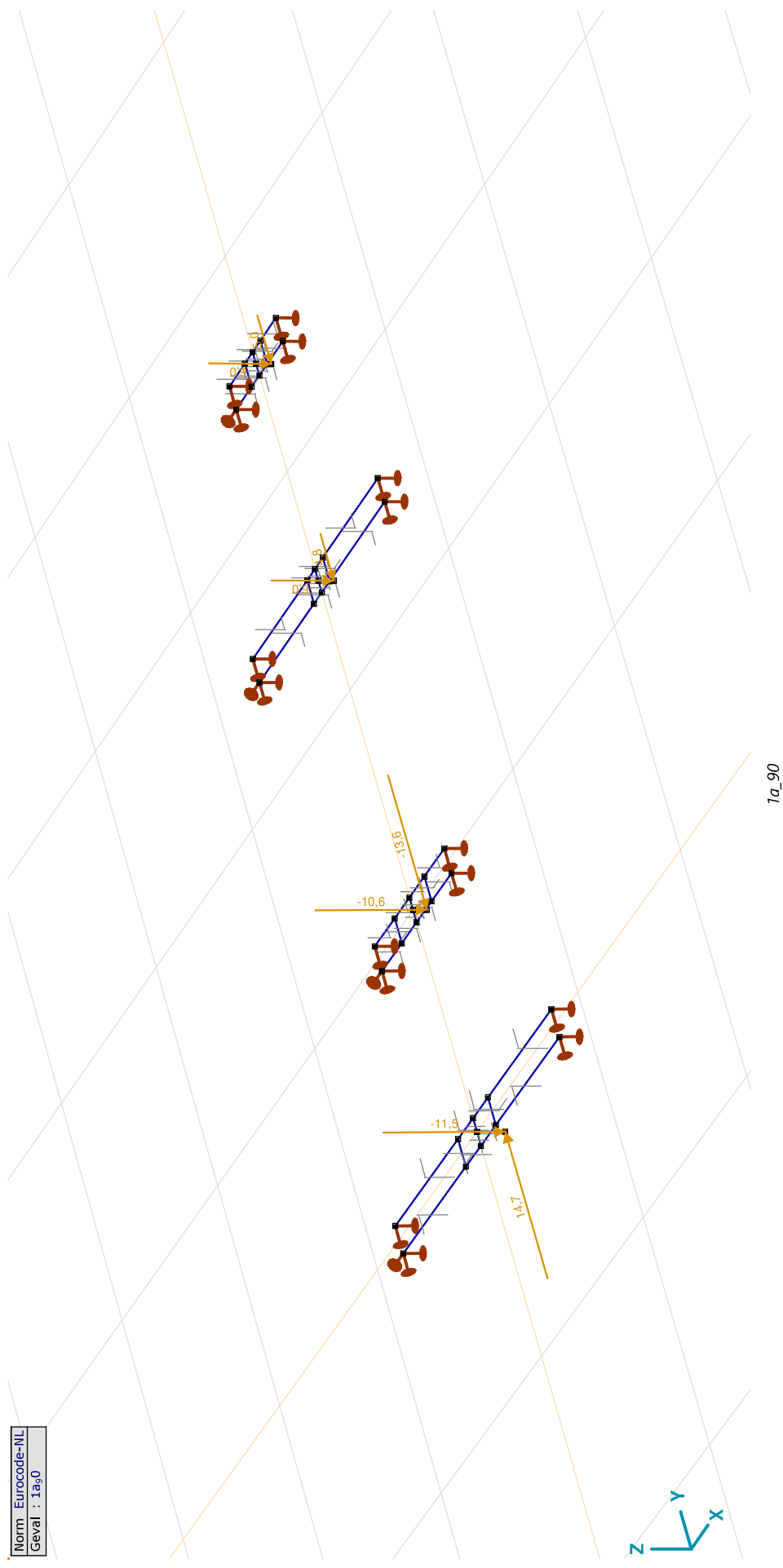
F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>: Belastingkracht component; M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>: Belastingmoment component;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm Eurocode-NL
Geval : 1a <sub>0</sub>



**Project:**

Constructeur: DNV GL - Energy

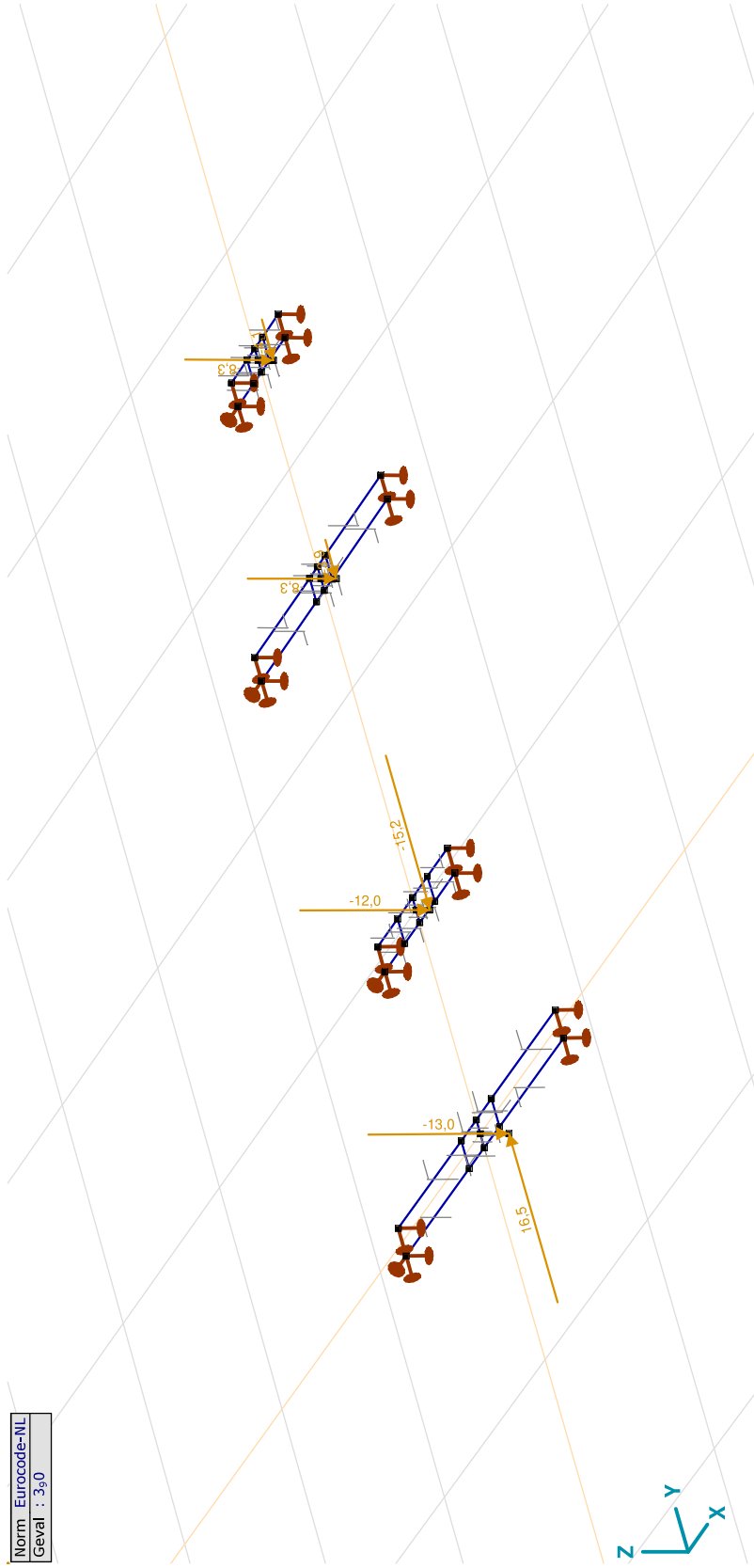
Model: **Liggers D+0 huidig sit 2.axs**

3\_90: Knoopbelastingen

Richting	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
12	0	16,5	-13,0	0	0	0
24	0	-15,2	-12,0	0	0	0
36	0	-3,9	-8,3	0	0	0
48	0	-4,1	-8,3	0	0	0

Fx, Fy, Fz: Belastingkracht component; Mx, My, Mz: Belastingmoment component;

Norm Eurocode-NL  
Geval : 3,90



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

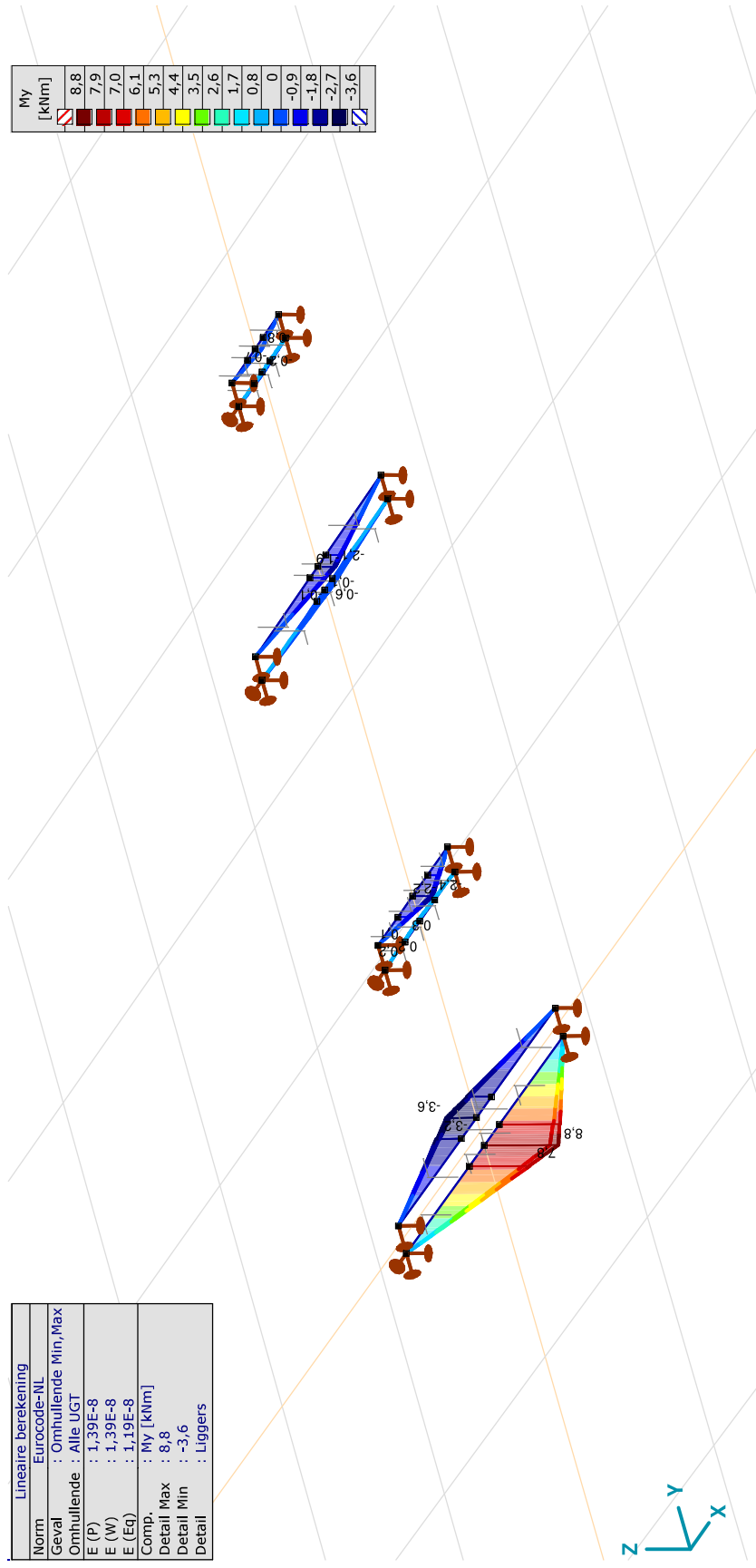
Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen

Naam	Type	ST1	EG (PERM1)	SLS 7 (VERT)	1a_90 (VERT)	3_90 (VERT)	Commentaar
1	UGT	0	1,20	0	1,00	0	
2	UGT	0	1,20	0	0	1,00	
3	BGT Quasi-blijvend	0	1,00	1,00	0	0	

Naam belastingcombinatie: **Type:** Type belastingcombinatie; **ST1, EG (PERM1), SLS 7 (VERT), 1a\_90 (VERT), 3\_90 (VERT):** Factor;

Lineaire berekening	
Norm	: Eurocode-NL
Geval	: Omhullende Min,Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,719E-8
Comp.	: My [kNm]
Detail Max	: 8,8
Detail Min	: -3,6
Detail	: Liggers

My [kNm]
8,8
7,9
7,0
6,1
5,3
4,4
3,5
2,6
1,7
0,8
0
-0,9
-1,8
-2,7
-3,6



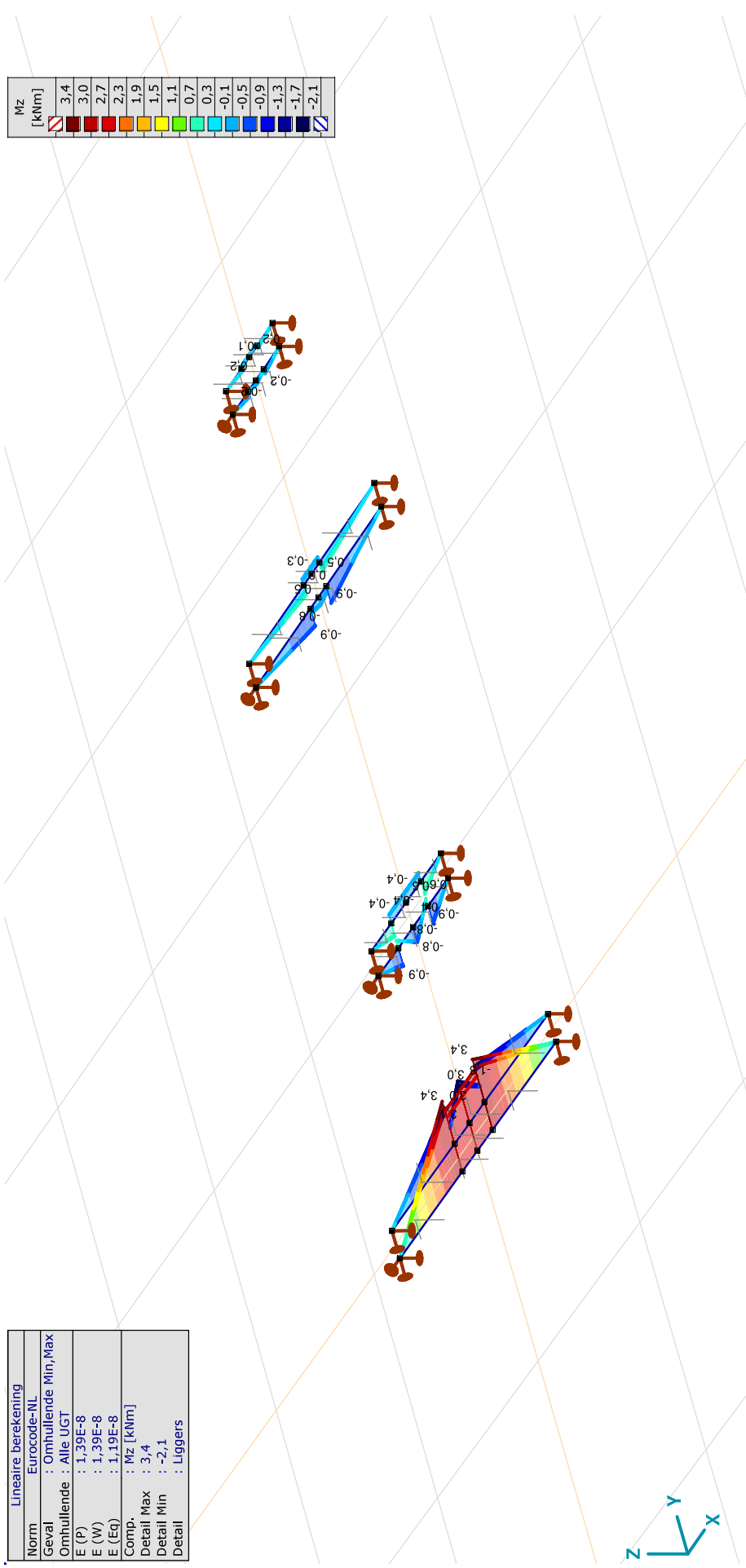
[I], > Liggers, Lineair, Omhullende (Alle UGT ), My, Lijnen (gevuld)



**Project:**  
 Constructeur: DNV GL - Energy  
 Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Mz [kNm]
Detail Max	: 3,4
Detail Min	: -2,1
Detail	: Liggers

Mz [kNm]
3,4
3,0
2,7
2,3
1,9
1,5
1,1
0,7
0,3
-0,1
-0,5
-0,9
-1,3
-1,7
-2,1



[J] > Liggers, Linear, Omhullende (Alle UGT), Mz, Lijnen (gevuld)

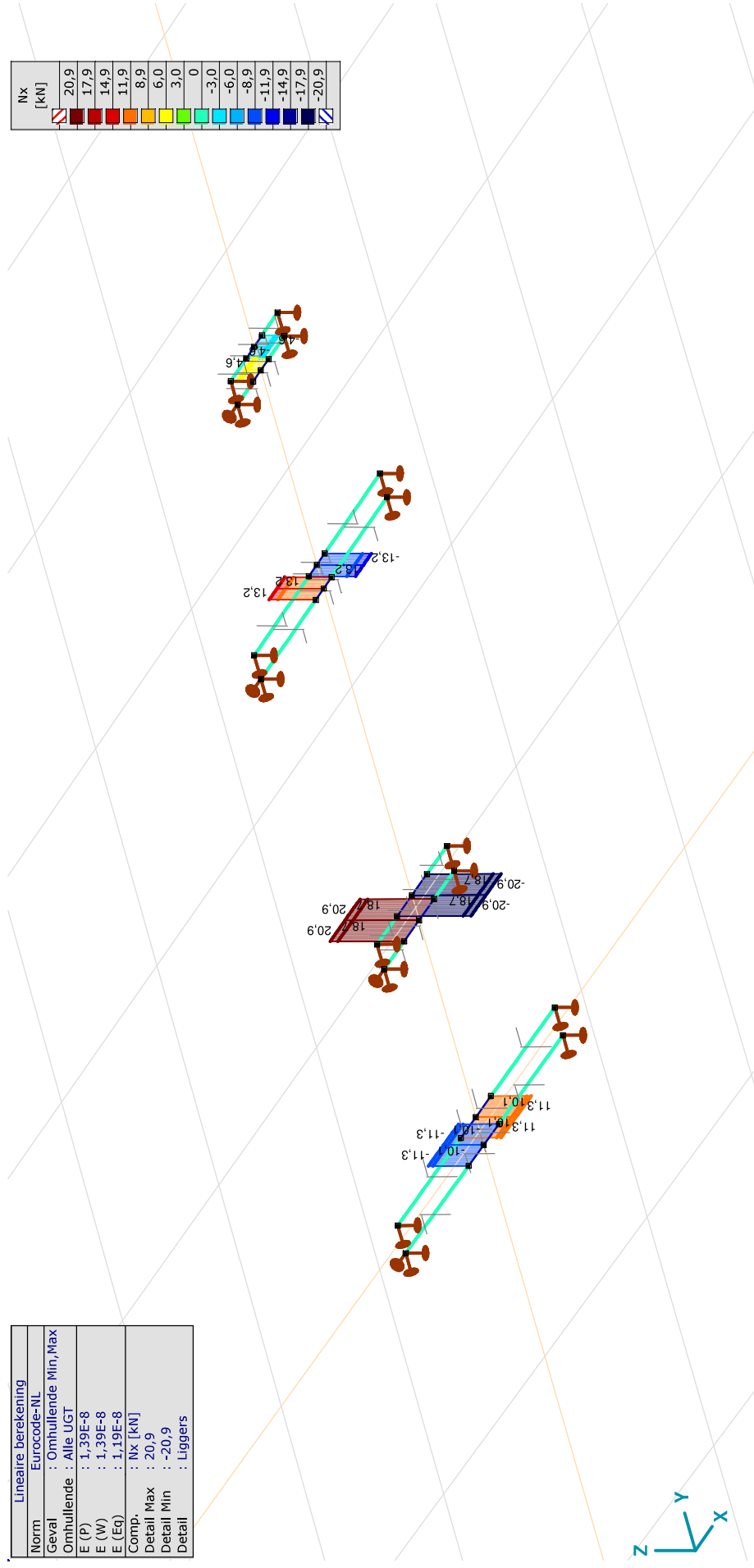
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Nx [kN]
Detail Max	: 20,9
Detail Min	: -20,9
Detail	: Liggers

Nx [kN]	
20,9	
17,9	
14,9	
11,9	
8,9	
6,0	
3,0	
0	
-3,0	
-6,0	
-8,9	
-11,9	
-14,9	
-17,9	
-20,9	

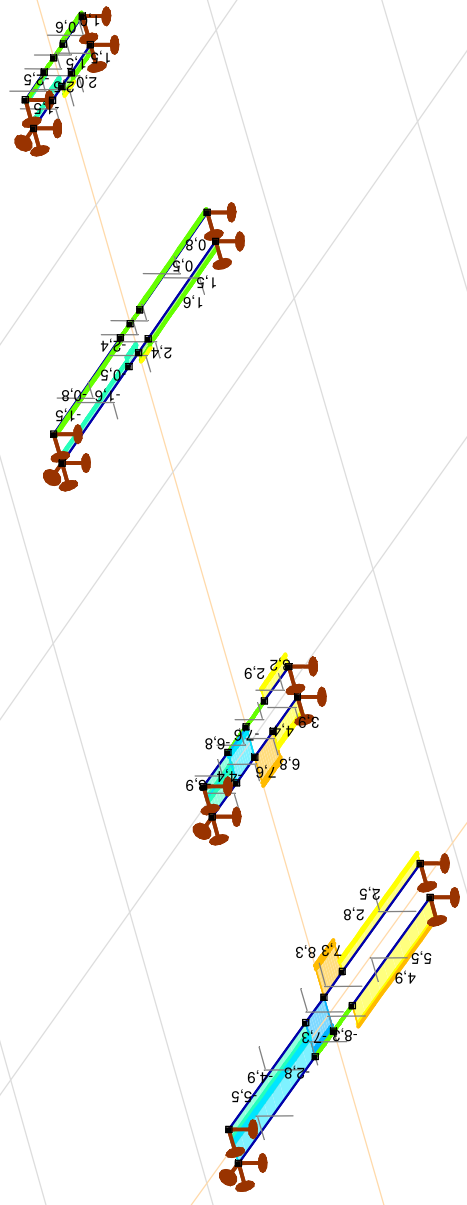


||| > Liggers, Lineair, Omhullende (Alle UGT), Nx, Lijnen (gevuld)

**Project:**  
 Constructeur: DNV GL - Energy  
 Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Vy [kN]
Detail Max	: 8,3
Detail Min	: -8,3
Detail	: Liggers

Vy [kN]	
20,9	
17,8	
14,7	
11,5	
8,4	
5,3	
2,2	
-0,9	
-4,0	
-7,1	
-10,2	
-13,3	
-16,4	
-19,5	
-22,6	



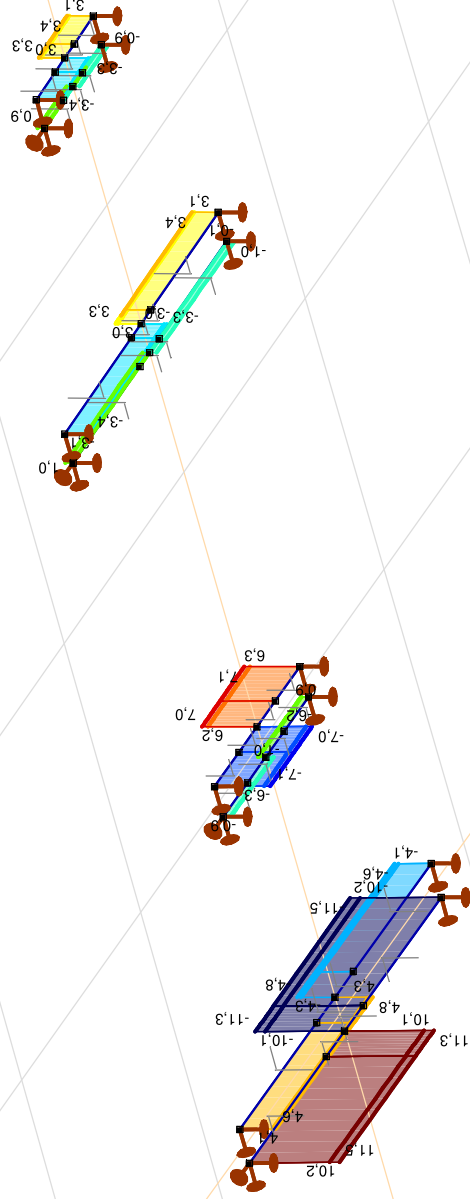
III. > Liggers, Lineair, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Vz [kN]
Detail Max	: 11,5
Detail Min	: -11,5
Detail	: Liggers



III. > Liggers, Lineair, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)



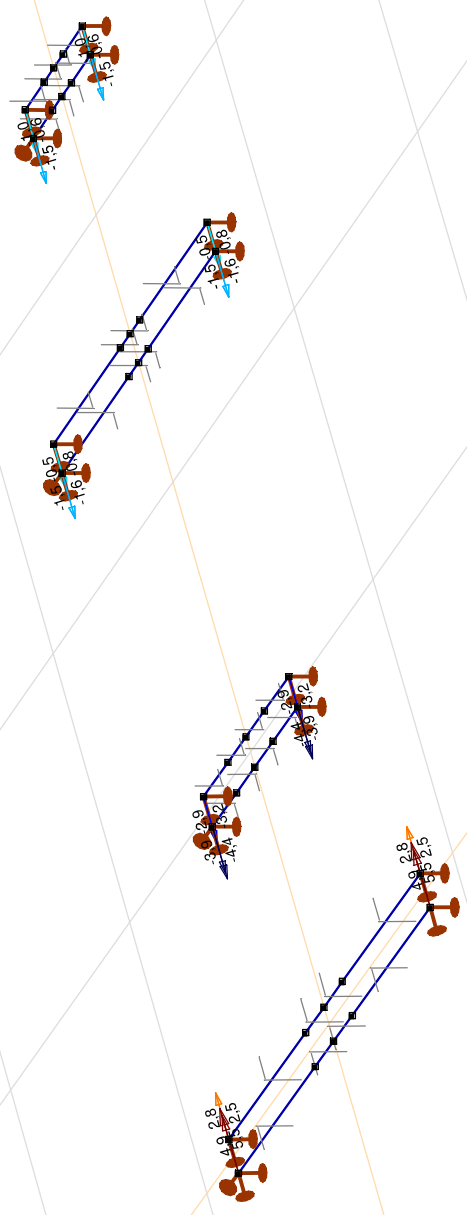
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Ry [kN]
Detail Max	: 5,5
Detail Min	: -4,4
Detail	: Liggers

Ry [kN]	
5,5	
4,8	
4,0	
3,3	
2,6	
1,9	
1,2	
0,5	
-0,2	
-0,9	
-1,6	
-2,3	
-3,0	
-3,7	
-4,4	



||| > Liggers, Lineair, Omhullende (Alle UGT), Ry (knoopopl.), Lijnen



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
1	4	0,780	0,062	0	Glob.	Ry	Co #1		2,5	4,1	4,8	0,603
							Co #2		2,8	4,6	5,4	0,603
						Rz	Co #1		2,5	4,1	4,8	0,603
							Co #2		2,8	4,6	5,4	0,603
						$\alpha R$	Co #2		2,8	4,6	5,4	0,603
							Co #1		2,5	4,1	4,8	0,603
2	-0,780	0,062	0	Glob.	Ry	Co #1			2,5	4,1	4,8	0,603
						Co #2		2,8	4,6	5,4	0,603	
					Rz	Co #1		2,5	4,1	4,8	0,603	
						Co #2		2,8	4,6	5,4	0,603	
					$\alpha R$	Co #2		2,8	4,6	5,4	0,603	
						Co #1		2,5	4,1	4,8	0,603	
3	0,780	-0,062	0	Glob.	Ry	Co #1			4,9	-10,2	11,3	-0,476
						Co #2		5,5	-11,5	12,7	-0,476	
					Rz	Co #2		5,5	-11,5	12,7	-0,476	
						Co #1		4,9	-10,2	11,3	-0,476	
					$\alpha R$	Co #2		5,5	-11,5	12,7	-0,476	
						Co #1		4,9	-10,2	11,3	-0,476	
4	-0,780	-0,062	0	Glob.	Rx	Co #1		0	4,9	-10,2	11,3	-0,476
						Co #1		0	4,9	-10,2	11,3	-0,476
					Ry	Co #1		0	4,9	-10,2	11,3	-0,476
						Co #2		0	5,5	-11,5	12,7	-0,476
					Rz	Co #2		0	5,5	-11,5	12,7	-0,476
						Co #1		0	4,9	-10,2	11,3	-0,476
	Co #2		0	5,5	-11,5	12,7	-0,476					
	Co #1		0	4,9	-10,2	11,3	-0,476					
5	0,350	1,056	0	Glob.	Ry	Co #2			-3,2	-7,1	7,7	-0,450
						Co #1		-2,9	-6,3	6,9	-0,454	
					Rz	Co #2		-3,2	-7,1	7,7	-0,450	
						Co #1		-2,9	-6,3	6,9	-0,454	
					$\alpha R$	Co #1		-2,9	-6,3	6,9	-0,454	
						Co #2		-3,2	-7,1	7,7	-0,450	



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
6	-0,350	1,056	0	Glob.	Ry	min	Co #2		<b>-3,2</b>	-7,1	7,7	-0,450
						max	Co #1		<b>-2,9</b>	-6,3	6,9	-0,454
						min	Co #2		-3,2	<b>-7,1</b>	7,7	-0,450
						max	Co #1		-2,9	<b>-6,3</b>	6,9	-0,454
						min	Co #1		-2,9	-6,3	6,9	-0,454
						max	Co #2		-3,2	-7,1	7,7	-0,450
7	0,350	0,944	0	Glob.	Ry	min	Co #2		<b>-4,4</b>	0,9	4,5	4,674
						max	Co #1		<b>-3,9</b>	0,9	4,0	4,511
						min	Co #1		-3,9	<b>0,9</b>	4,0	4,511
						max	Co #2		-4,4	<b>0,9</b>	4,5	4,674
						min	Co #1		-3,9	0,9	4,0	4,511
						max	Co #2		-4,4	0,9	4,5	4,674
8	-0,350	0,944	0	Glob.	Rx	min	Co #1	<b>0</b>	-3,9	0,9	4,0	4,511
						max	Co #1	<b>0</b>	-3,9	0,9	4,0	4,511
						min	Co #2	<b>0</b>	<b>-4,4</b>	0,9	4,5	4,674
						max	Co #1	<b>0</b>	<b>-3,9</b>	0,9	4,0	4,511
						min	Co #1	<b>0</b>	-3,9	<b>0,9</b>	4,0	4,511
						max	Co #2	<b>0</b>	-4,4	<b>0,9</b>	4,5	4,674
9	0,640	2,554	0	Glob.	Ry	min	Co #1		<b>-0,8</b>	-3,1	3,2	-0,275
						max	Co #2		<b>-0,5</b>	-3,4	3,4	-0,143
						min	Co #2		-0,5	<b>-3,4</b>	3,4	-0,143
						max	Co #1		-0,8	<b>-3,1</b>	3,2	-0,275
						min	Co #1		-0,8	-3,1	3,2	-0,275
						max	Co #2		-0,5	-3,4	3,4	-0,143
10	-0,640	2,554	0	Glob.	Ry	min	Co #1		<b>-0,8</b>	-3,1	3,2	-0,275
						max	Co #2		<b>-0,5</b>	-3,4	3,4	-0,143
						min	Co #2		-0,5	<b>-3,4</b>	3,4	-0,143
						max	Co #1		-0,8	<b>-3,1</b>	3,2	-0,275
						min	Co #1		-0,8	-3,1	3,2	-0,275
						max	Co #2		-0,5	-3,4	3,4	-0,143

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

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## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$	
11	0,640	2,446	0	Glob.	Ry	min	Co #1		<b>-1,6</b>	-0,1	1,6	-11,528	
						max	Co #2		<b>-1,5</b>	-1,0	1,8	-1,490	
						Rz	min	Co #2		-1,5	<b>-1,0</b>	1,8	-1,490
							max	Co #1		-1,6	<b>-0,1</b>	1,6	-11,528
							min	Co #1		-1,6	-0,1	1,6	-11,528
							max	Co #2		-1,5	-1,0	1,8	-1,490
12	-0,640	2,446	0	Glob.	Rx	min	Co #1	<b>0</b>	-1,6	-0,1	1,6	-11,528	
						max	Co #1		-1,6	-0,1	1,6	-11,528	
						Ry	min	Co #1	<b>0</b>	<b>-1,6</b>	-0,1	1,6	-11,528
							max	Co #2	<b>0</b>	-1,5	-1,0	1,8	-1,490
							min	Co #2	<b>0</b>	-1,5	<b>-1,0</b>	1,8	-1,490
							max	Co #1	<b>0</b>	-1,6	<b>-0,1</b>	1,6	-11,528
13	0,240	3,554	0	Glob.	Ry	min	Co #1		<b>-1,0</b>	-3,1	3,2	-0,317	
						max	Co #2		<b>-0,6</b>	-3,4	3,4	-0,173	
						Rz	min	Co #2		-0,6	<b>-3,4</b>	3,4	-0,173
							max	Co #1		-1,0	<b>-3,1</b>	3,2	-0,317
							min	Co #1		-1,0	-3,1	3,2	-0,317
							max	Co #2		-0,6	-3,4	3,4	-0,173
14	-0,240	3,554	0	Glob.	Ry	min	Co #1		<b>-1,0</b>	-3,1	3,2	-0,317	
						max	Co #2		<b>-0,6</b>	-3,4	3,4	-0,173	
						Rz	min	Co #2		-0,6	<b>-3,4</b>	3,4	-0,173
							max	Co #1		-1,0	<b>-3,1</b>	3,2	-0,317
							min	Co #1		-1,0	-3,1	3,2	-0,317
							max	Co #2		-0,6	-3,4	3,4	-0,173
15	0,240	3,446	0	Glob.	Ry	min	Co #1		<b>-1,5</b>	0	1,5	-84,594	
						max	Co #2		<b>-1,5</b>	-0,9	1,7	-1,690	
						Rz	min	Co #2		-1,5	<b>-0,9</b>	1,7	-1,690
							max	Co #1		-1,5	<b>0</b>	1,5	-84,594
							min	Co #1		-1,5	0	1,5	-84,594
							max	Co #2		-1,5	-0,9	1,7	-1,690

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

	Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
16	46	-0,240	3,446	0	Glob.	Rx	min	Co #1	0	-1,5	0	1,5	-84,594
							max	Co #1	0	-1,5	0	1,5	-84,594
						Ry	min	Co #1	0	<b>-1,5</b>	0	1,5	-84,594
							max	Co #2	0	<b>-1,5</b>	-0,9	1,7	-1,690
						Rz	min	Co #2	0	-1,5	<b>-0,9</b>	1,7	-1,690
							max	Co #1	0	-1,5	0	1,5	-84,594
						$\alpha R$	min	Co #1	0	-1,5	0	1,5	-84,594
							max	Co #2	0	-1,5	-0,9	1,7	-1,690
Ext.													
4	10	-0,780	-0,062	0	Glob.	Rx	min	Co #1	0	4,9	-10,2	11,3	-0,476
4	10	-0,780	-0,062	0	Glob.		max	Co #1	0	4,9	-10,2	11,3	-0,476
7	21	0,350	0,944	0	Glob.	Ry	min	Co #2		<b>-4,4</b>	0,9	4,5	4,674
8	22	-0,350	0,944	0	Glob.		min	Co #2	0	<b>-4,4</b>	0,9	4,5	4,674
3	9	0,780	-0,062	0	Glob.		max	Co #2		<b>5,5</b>	-11,5	12,7	-0,476
4	10	-0,780	-0,062	0	Glob.		max	Co #2	0	<b>5,5</b>	-11,5	12,7	-0,476
3	9	0,780	-0,062	0	Glob.	Rz	min	Co #2		5,5	<b>-11,5</b>	12,7	-0,476
4	10	-0,780	-0,062	0	Glob.		min	Co #2	0	5,5	<b>-11,5</b>	12,7	-0,476
1	4	0,780	0,062	0	Glob.		max	Co #2		2,8	<b>4,6</b>	5,4	0,603
2	5	-0,780	0,062	0	Glob.		max	Co #2		2,8	<b>4,6</b>	5,4	0,603
15	45	0,240	3,446	0	Glob.	$\alpha R$	min	Co #1		-1,5	0	1,5	-84,594
16	46	-0,240	3,446	0	Glob.		min	Co #1	0	-1,5	0	1,5	-84,594
7	21	0,350	0,944	0	Glob.		max	Co #2		-4,4	0,9	4,5	4,674
8	22	-0,350	0,944	0	Glob.		max	Co #2	0	-4,4	0,9	4,5	4,674

**Knoop:** Ondersteunde knoop; **Type:** Opleggingsstype; **C:** Extreme component; **min, max:** Extreme type; **Geval:** Belastinggeval van de extreme; **Rx:** X-component opleggingsreactiekracht; **Ry:** Y-component opleggingsreactiekracht; **Rz:** Z-component opleggingsreactiekracht; **Rr:** Resulterende opleggingsreactiekracht;  **$\alpha R$ :** Verhouding verticale oplegkracht / horizontale oplegkracht;

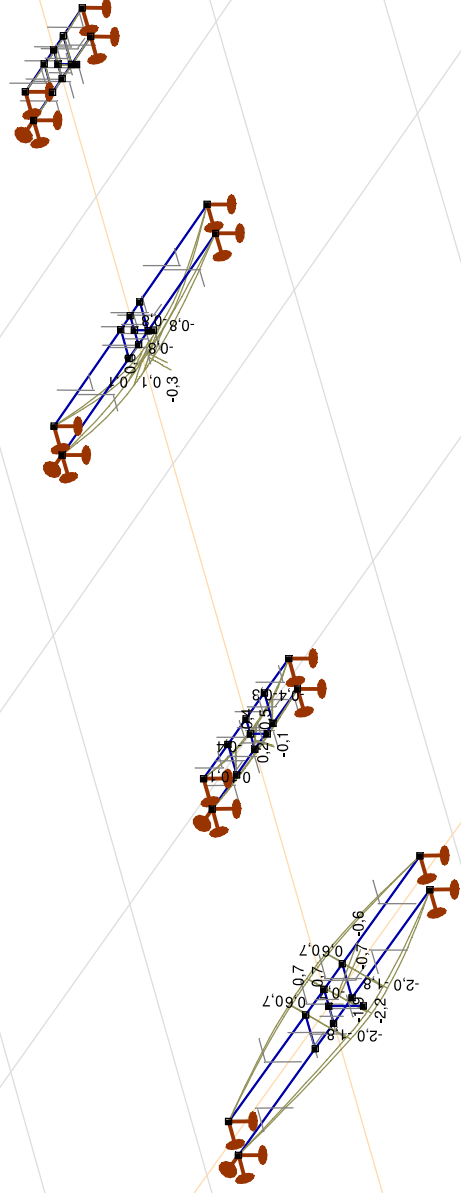


**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: ez [mm]
Max	: 0,7
Min	: -2,2



III, Lineair, Omhullende (Alle UGT), ez, Lijnen

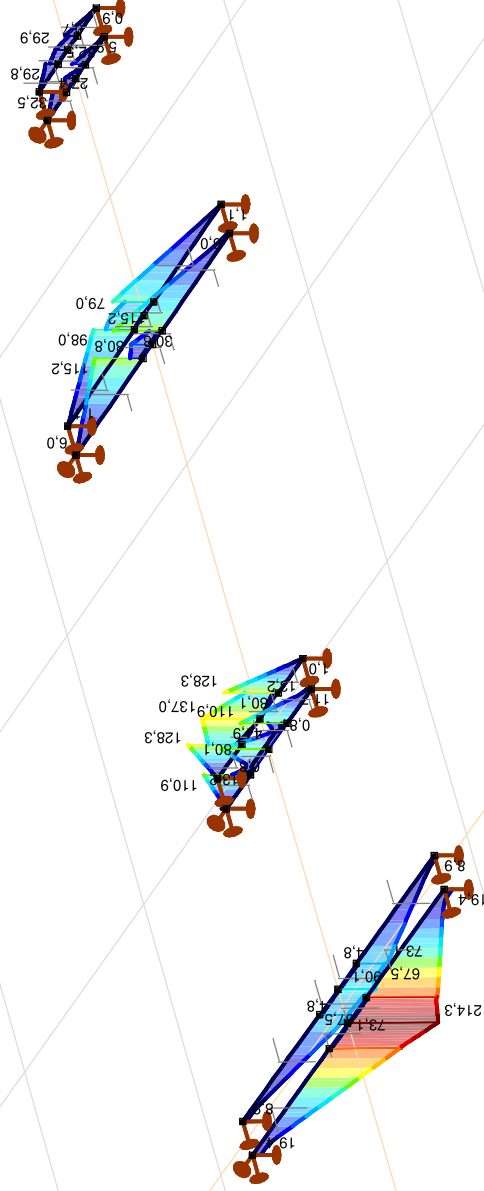
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Sominmax [N/mm <sup>2</sup> ]
Detail Max	: 214,3
Detail Min	: 0
Detail	: Liggers

Sominmax [N/mm <sup>2</sup> ]
214,3
199,0
183,7
168,3
153,0
137,7
122,4
107,1
91,8
76,5
61,2
45,9
30,6
15,3
0



[[]] > Liggers, Lineair, Omhullende (Alle UGT), Sominmax, Lijnen (gevuld)

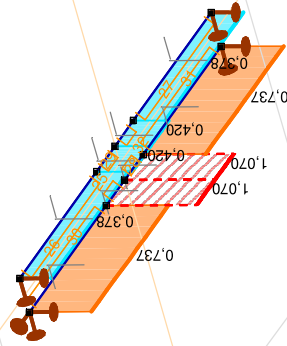
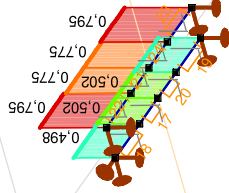
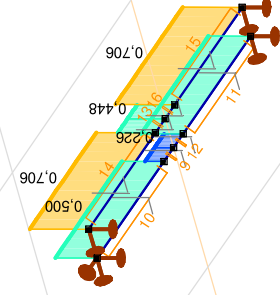
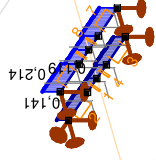
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 huidig sit 2.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 1,39E-8
E (W)	: 1,39E-8
E (Eq)	: 1,19E-8
Comp.	: Unity-check (UGT) []
Detail Max	: 1,070
Detail Min	: 0,119
Detail	: Liggers

Unity-check	
1,000	
0,929	
0,857	
0,786	
0,714	
0,643	
0,571	
0,500	
0,429	
0,357	
0,286	
0,214	
0,143	
0,071	
0	



[Stij] > Liggers, Lineair, Omhullende (Alle UGT), Unity-check, Lijnen (gevuld)

## **Project:**

**Constructeur: DNV GL - Energy**

AxisVM X6 R1q • Geregistreerd aan DNV GL - Energy  
Liggers D+0 versterkt.axs

**Rapport**



## Rapport, Inhoudsopgave

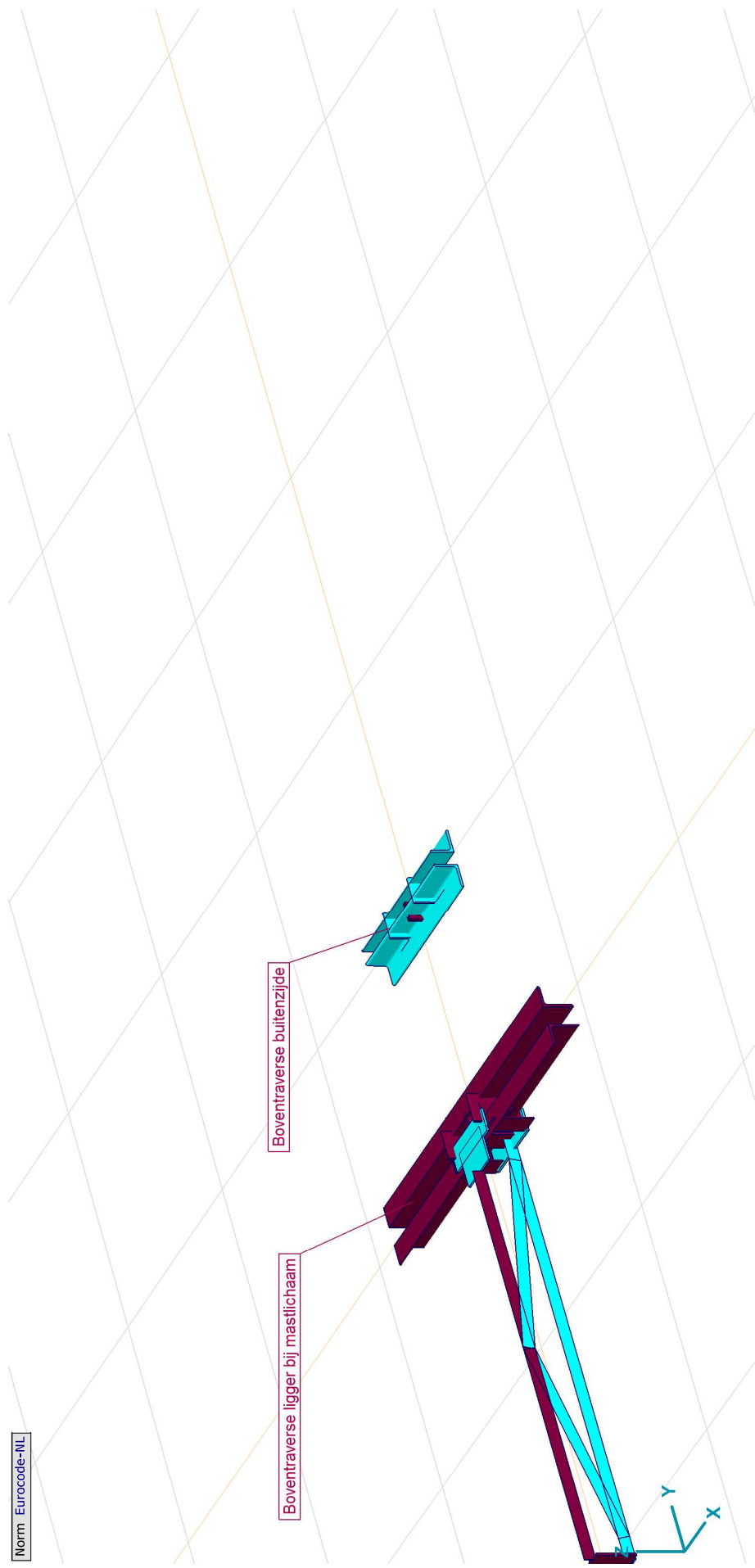
Onderdeel	Pagina	Onderdeel	Pagina
rendered view	3	3_90	17
Materialen	4	Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen	18
Tekening	5	[I], > Liggers, Linear, Omhullende (Alle UGT ), My, Lijnen (gevuld)	18
Knopen	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Mz, Lijnen (gevuld)	19
Staven	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Nx, Lijnen (gevuld)	20
Tekening profielen	8	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)	21
Profielen	9	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)	22
Tekening staven	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rx (knoopopl.), Lijnen	23
Staafaansluitingen	12	[I], > Liggers, Linear, Omhullende (Alle UGT ), Ry (knoopopl.), Lijnen	24
EG: Staaf eigen gewicht	12	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rz (knoopopl.), Lijnen	25
SLS 7	13	<b>Interne krachten knoopoplegging [Linear, Omhullende (Alle UGT ), Liggers]</b>	26
SLS 7: Knooppbelastingen	14	[I], Linear, Omhullende (Alle UGT ), eY, Lijnen	29
1a_90: Knooppbelastingen	14	[I], Linear, Omhullende (Alle UGT ), eZ, Lijnen	30
1a_90	15	[I], > Liggers, Linear, Omhullende (Alle UGT ), Sominmax, Lijnen (gevuld)	31
3_90: Knooppbelastingen	16	[STJ], > Liggers, Linear, Omhullende (Alle UGT ), Unity-check, Lijnen (gevuld)	32

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm Eurocode-NL



rendered view

**Project:**





Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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**Materialen**

Naam	Type	Nationale norm	Materiaalnorm	Model	$E_x$ [N/mm <sup>2</sup> ]	$E_y$ [N/mm <sup>2</sup> ]	$\nu$	$\alpha_T$ [1/°C]	$\rho$ [kg/m <sup>3</sup> ]	Materiaal kleur	Contour kleur	Structuur	$P_1$
1	S 235	Staal	Eurocode-NL 10025-2	Lineair	210000	210000	0,30	1,2E-5	7850			Steel	$f_y$ [N/mm <sup>2</sup> ] = 235,00
2	S 355	Staal	Eurocode-NL 10025-2	Lineair	210000	210000	0,30	1,2E-5	7850			Steel	$f_y$ [N/mm <sup>2</sup> ] = 355,00

Naam	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	$P_9$	$P_{10}$	$P_{11}$	$P_{12}$	$P_{13}$	$P_{14}$
1	$f_u$ [N/mm <sup>2</sup> ] = 360,00	$f_t$ [N/mm <sup>2</sup> ] = 215,00	$f_{t0}$ [N/mm <sup>2</sup> ] = 360,00										
2	$f_u$ [N/mm <sup>2</sup> ] = 510,00	$f_t$ [N/mm <sup>2</sup> ] = 335,00	$f_{t0}$ [N/mm <sup>2</sup> ] = 470,00										

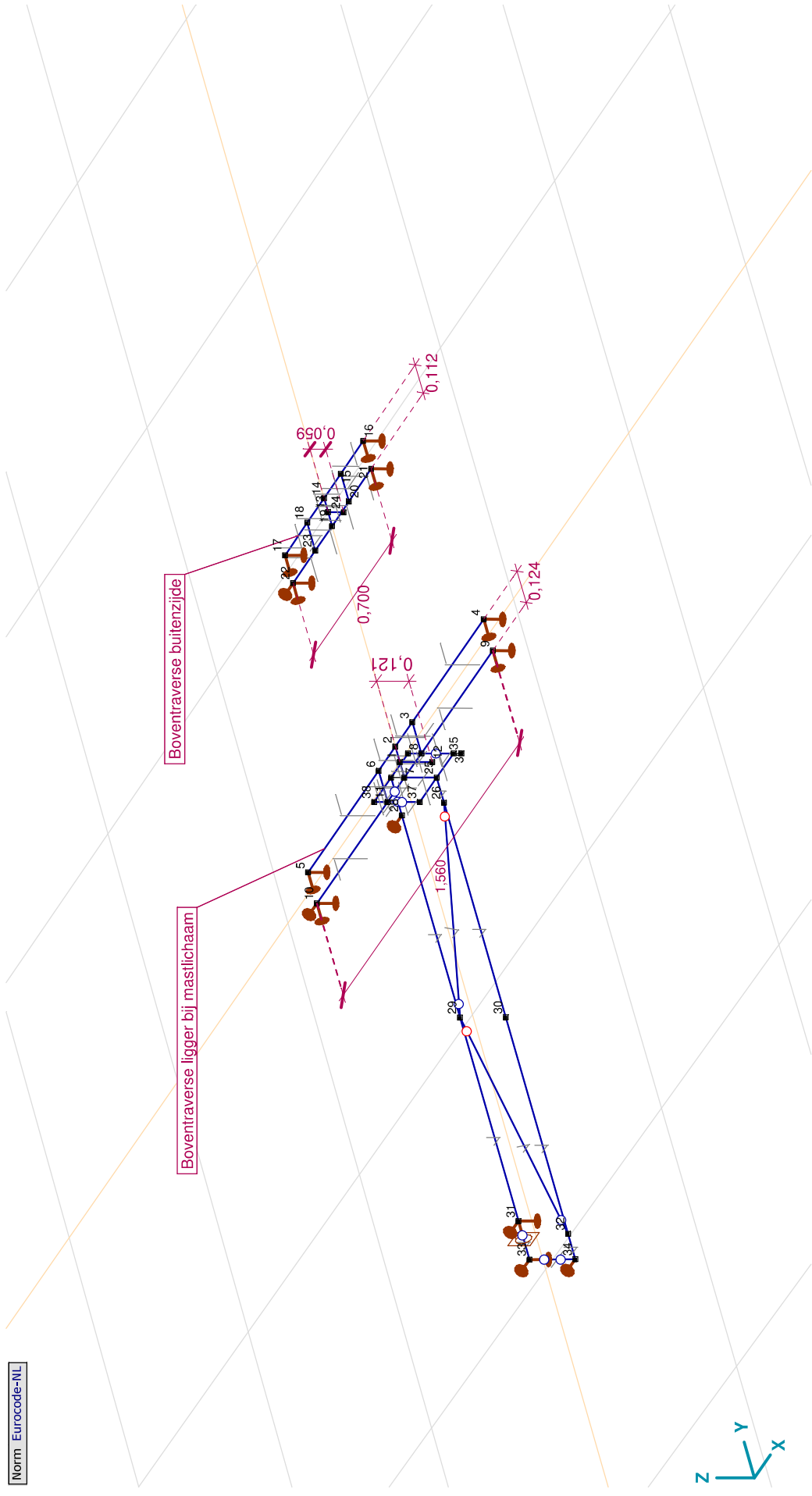
**Naam:** Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model;  **$E_x$ :** Elasticiteitsmodulus in lokale x richting;  **$E_y$ :** Elasticiteitsmodulus in lokale y richting;  **$\nu$ :** Poisson's verhouding;  **$\alpha_T$ :** Warmteuitzettingscoëfficiënt;  **$\rho$ :** Dichtheid; **Materiaal kleur:** Materiaalkleur; **Contour kleur:** Contourkleur;  **$P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}$ :** Ontwerpparameter;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm Eurocode-NL



Boventraverse buitenzijde

Boventraverse ligger bij mastlichaam

Tekening

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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## Knopen

	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]				
1	0	0	0	9	0,780	-0,062	0	17	-0,350	1,056	0	25	0	-0,062	-0,121	0,050
2	0	0,062	0	10	-0,780	-0,062	0	18	-0,150	1,056	0	26	0	-0,162	-0,121	-0,121
3	0,150	0,062	0	11	-0,150	-0,062	0	19	0	0,944	0	27	0	-0,062	0,050	-0,150
4	0,780	0,062	0	12	0	0	-0,121	20	0,150	0,944	0	28	0	-0,212	0,050	-0,121
5	-0,780	0,062	0	13	0	1,000	0	21	0,350	0,944	0	29	0	-1,012	0,050	-0,121
6	-0,150	0,062	0	14	0	1,056	0	22	-0,350	0,944	0	30	0	-1,012	-0,121	-0,062
7	0	-0,062	0	15	0,150	1,056	0	23	-0,150	0,944	0	31	0	-1,812	0,050	-0,062
8	0,150	-0,062	0	16	0,350	1,056	0	24	0	1,000	-0,059	32	0	-1,862	-0,121	0,050

## Staven

	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Ref <sub>Z</sub>	<- Aansluitingen	Aansluitingen ->
1	3	2	0,150	j-i	S 235	1	R2	.	.
2	4	3	0,630	j-i	S 235	1	R2	.	.
3	6	5	0,630	j-i	S 235	1	R2	.	.
4	2	6	0,150	i-j	S 235	1	R2	.	.
5	7	8	0,150	i-j	S 235	1	R2	.	.
6	8	9	0,630	i-j	S 235	1	R2	.	.
7	10	11	0,630	i-j	S 235	1	R2	.	.
8	11	7	0,150	j-i	S 235	1	R2	.	.
9	11	6	0,124	j-i	S 235	1	Auto	.	.
10	3	8	0,124	i-j	S 235	1	Auto	.	.
11	12	1	0,121	j-i	S 235	2	Auto	.	.
12	1	2	0,062	i-j	S 235	2	R1	.	Schar-YZ
13	7	1	0,062	j-i	S 235	2	R1	100111	.
14	13	14	0,056	i-j	S 235	2	R1	.	100111
15	14	15	0,150	i-j	S 355	6	Auto	.	.
16	15	16	0,200	i-j	S 355	6	Auto	.	.
17	17	18	0,200	i-j	S 355	6	Auto	.	.
18	18	14	0,150	j-i	S 355	6	Auto	.	.
19	20	19	0,150	j-i	S 355	6	Auto	.	.
20	21	20	0,200	j-i	S 355	6	Auto	.	.
21	23	22	0,200	j-i	S 355	6	Auto	.	.
22	19	23	0,150	i-j	S 355	6	Auto	.	.
23	19	13	0,056	j-i	S 235	2	R1	Schar-YZ	.

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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## Staven

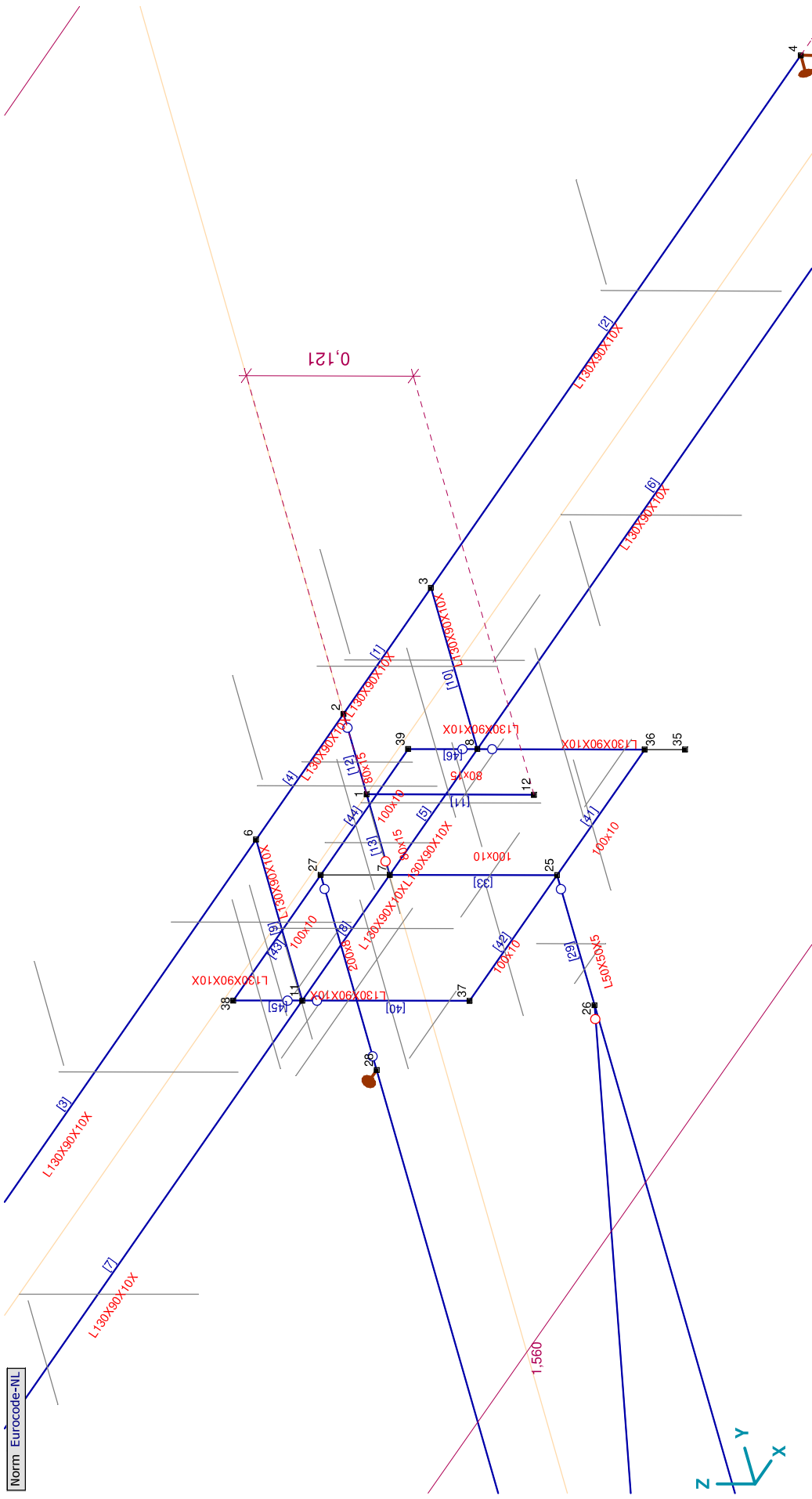
	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Ref <sub>Z</sub>	<- Aansluitingen	Aansluitingen ->
24	23	18	0,112	j-i	S 355	6	Auto	.	.
25	15	20	0,112	i-j	S 355	6	Auto	.	.
26	24	13	0,059	j-i	S 235	2	Auto	.	.
27	29	26	0,867	j-i	S 355	5	Auto	Schar-YZ	Bol
28	32	29	0,867	j-i	S 355	5	Auto	Schar-YZ	Bol
29	26	25	0,100	j-i	S 355	5	Auto	.	Schar-YZ
30	30	26	0,850	j-i	S 355	5	Auto	.	.
31	32	30	0,850	j-i	S 355	5	Auto	.	.
32	34	32	0,100	j-i	S 355	5	Auto	.	.
33	25	7	0,121	j-i	S 235	9	Auto	.	.
34	28	27	0,150	j-i	S 355	7	Auto	Schar-YZ	Schar-YZ
35	29	28	0,800	j-i	S 235	5	Auto	.	.
36	31	29	0,800	j-i	S 235	5	Auto	.	.
37	33	31	0,150	j-i	S 235	5	Auto	.	Schar-YZ
38	34	33	0,171	j-i	S 235	9	Auto	Schar-YZ	Schar-YZ
39	36	8	0,121	j-i	S 235	1	R1	.	Schar-Z
40	37	11	0,121	j-i	S 235	1	R1	.	Schar-Z
41	25	36	0,150	i-j	S 355	9	R1	.	.
42	37	25	0,150	j-i	S 355	9	R1	.	.
43	38	27	0,150	j-i	S 355	9	R1	.	.
44	27	39	0,150	i-j	S 355	9	R1	.	.
45	11	38	0,050	i-j	S 235	1	R1	Schar-Z	.
46	8	39	0,050	i-j	S 235	1	R1	Schar-Z	.

Lengte: Elementlengte; **Lokaal X**: Lokale X-richting; **Ref<sub>Z</sub>**: Referentie voor lokale Z-richting; <- **Aansluitingen**: Staafendaansluitingen op startpunt; **Aansluitingen** ->: Staafendaansluitingen op eindpunt;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**



Tekening profielen

**Project:**






Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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**Profielen**

	Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	Ax [mm <sup>2</sup> ]	Ay [mm <sup>2</sup> ]	Az [mm <sup>2</sup> ]	Ix [mm <sup>4</sup> ]	Iy [mm <sup>4</sup> ]	Iz [mm <sup>4</sup> ]
1	L 130X 90X10X		Gewalst	L	130,0	90,0	10,0	10,0	12,0	6,0	0	2115,52	730,05	1115,03	75067,63	3579805,00	1407288,00
2	80x15		Gewalst	Recht.	15,0	80,0	0	0	0	0	0	1200,00	1000,00	1000,00	79361,69	22500,00	640000,00
3	L 100X 65X 9X		Gewalst	L	100,0	65,0	9,0	9,0	10,0	5,0	0	1414,78	477,96	772,93	40681,80	1406314,00	466914,90
4	L 130X 65X 8X		Gewalst	L	130,0	65,0	8,0	8,0	11,0	5,5	0	1509,04	400,01	894,73	34749,90	2625007,00	447616,10
5	L 50X 50X 5		Gewalst	L	50,0	50,0	5,0	5,0	7,0	3,5	0	480,28	210,38	213,29	4408,87	109629,10	109629,10

	Naam	Iyz [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	Iω [mm <sup>6</sup> ]	W <sub>1,elit</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elit</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	i <sub>y</sub> [mm]	i <sub>z</sub> [mm]	H <sub>y</sub> [mm]	H <sub>z</sub> [mm]
1	L 130X 90X10X	-1302677,00	4189697,00	797396,10	25,09	6,7E+07	46873,24	62990,74	17179,39	21346,26	81837,91	34394,52	41,1	25,8	90,0	130,0
2	80x15	0	640000,00	22500,00	90,00	1E+07	16000,00	16000,00	3000,00	3000,00	24000,00	4500,00	4,3	23,1	80,0	15,0
3	L 100X 65X 9X	-466019,90	1598273,00	274955,80	22,39	2E+07	23552,43	32380,51	7940,67	10044,04	41416,09	16324,54	31,5	18,2	65,0	100,0
4	L 130X 65X 8X	-608865,80	2783699,00	28924,20	14,61	2,9E+07	32704,41	48773,37	7411,05	11687,17	56896,01	16576,57	41,7	17,2	65,0	130,0
5	L 50X 50X 5	-64162,80	173791,90	45466,32	45,00	678722	4915,58	4915,58	2584,40	2290,67	7830,31	4045,39	15,1	15,1	50,0	50,0

	Naam	Y <sub>G</sub> [mm]	Z <sub>G</sub> [mm]	Y <sub>s</sub> [mm]	Z <sub>s</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> [°]	S <sub>p</sub>
1	L 130X 90X10X	21,8	41,5	-16,4	-35,0	112,7	95,4	-292,0	4
2	80x15	40,0	7,5	0	0	0	0	0	5
3	L 100X 65X 9X	15,9	33,2	-11,1	-26,9	84,2	70,1	-343,9	4
4	L 130X 65X 8X	13,7	45,6	-9,5	-39,4	111,6	90,0	-547,9	4
5	L 50X 50X 5	14,0	14,0	-11,0	-11,0	45,0	45,0	0	4



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

**Profielen**

Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	Ax [mm <sup>2</sup> ]	Ay [mm <sup>2</sup> ]	Az [mm <sup>2</sup> ]	Ix [mm <sup>4</sup> ]	Iy [mm <sup>4</sup> ]	Iz [mm <sup>4</sup> ]
6 L 100X100X10		Gewalst	L	100,0	100,0	10,0	10,0	12,0	6,0	0	1915,52	840,25	849,06	68399,99	1766604,00	1766604,00
7 200x8		Gewalst	Recht.	8,0	200,0	0	0	0	0	0	1600,00	1333,33	1333,33	33261,65	8533,33	53333333,00
8 100x10		Gewalst	Recht.	10,0	100,0	0	0	0	0	0	1000,00	833,33	833,33	31229,21	8333,33	8333333,30
9 100x10		Gewalst	Recht.	10,0	100,0	0	0	0	0	0	1000,00	833,33	833,33	31229,21	8333333,30	8333,33

Naam	Iyz [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	Iω [mm <sup>6</sup> ]	W <sub>1,elt</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elt</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	I <sub>y</sub> [mm]	I <sub>z</sub> [mm]	H <sub>y</sub> [mm]	H <sub>z</sub> [mm]
6 L 100X100X10	-1036581,00	2803186,00	730023,00	45,00	4,4E+07	39643,03	39643,03	20631,62	18290,47	62957,84	32342,18	30,4	30,4	100,0	100,0
7 200x8	0	5333333,00	8533,33	90,00	2,8E+07	53333,33	53333,33	2133,33	2133,33	80000,00	3200,00	2,3	57,7	200,0	8,0
8 100x10	0	833333,30	8333,33	90,00	6626062	16666,67	16666,67	1666,67	1666,67	25000,00	2500,00	2,9	28,9	100,0	10,0
9 100x10	0	833333,30	8333,33	0	6626062	16666,67	16666,67	1666,67	1666,67	25000,00	2500,00	28,9	2,9	10,0	100,0

Naam	Y <sub>G</sub> [mm]	Z <sub>G</sub> [mm]	Y <sub>S</sub> [mm]	Z <sub>S</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> [°]	S <sub>p</sub>
6 L 100X100X10	28,2	28,2	-22,3	-22,3	90,4	90,4	0	4
7 200x8	100,0	4,0	0	0	0	0	0	5
8 100x10	50,0	5,0	0	0	0	0	0	5
9 100x10	5,0	50,0	0	0	0	0	0	5

**Naam:** Doorsnede naam; **Productie:** Productieproces; **Vorm:** Profiel; **h:** Doorsnede hoogte; **b:** Doorsnede breedte; **tw:** Lijfdikte; **tf:** Flensdikte; **r<sub>1</sub>, r<sub>2</sub>, r<sub>3</sub>:** Afrondingswaarde; **Ax:** Doorsnede-oppervlak; **Ay, Az:** Afschuivingsoppervlak; **Ix:** Torisieraagheidsmoment; **Iy, Iz:** Buigtraagheidsmoment; **Iyz:** Centrifugaal traagheidsmoment; **I<sub>1</sub>, I<sub>2</sub>:** Hoofdbuigtraagheidsmoment; **α:** Hoofdrichtingen; **Iω:** Krommingsconstante; **W<sub>1,elt</sub>, W<sub>1,elb</sub>, W<sub>2,elt</sub>, W<sub>2,elb</sub>:** Elastisch weerstandsmoment; **W<sub>1,pl</sub>, W<sub>2,pl</sub>:** Plastisch weerstandsmoment; **I<sub>y</sub>, I<sub>z</sub>:** Traagheidsstraal; **H<sub>y</sub>:** Afmeting in lokale Y-richting; **H<sub>z</sub>:** Afmeting in lokale Z-richting; **Y<sub>G</sub>:** Y-coördinaat van het zwaartepunt; **Z<sub>G</sub>:** Z-coördinaat van het zwaartepunt; **Z<sub>S</sub>:** Y-coördinaat van het afschuivingsmiddelpunt (torsie); **Z<sub>S</sub>:** Z-coördinaat van het afschuivingsmiddelpunt (torsie); **β<sub>y</sub>, β<sub>z</sub>, β<sub>w</sub>:** Wagner's coëfficiënt; **S<sub>p</sub>:** Spanningspunten;

**Project:**

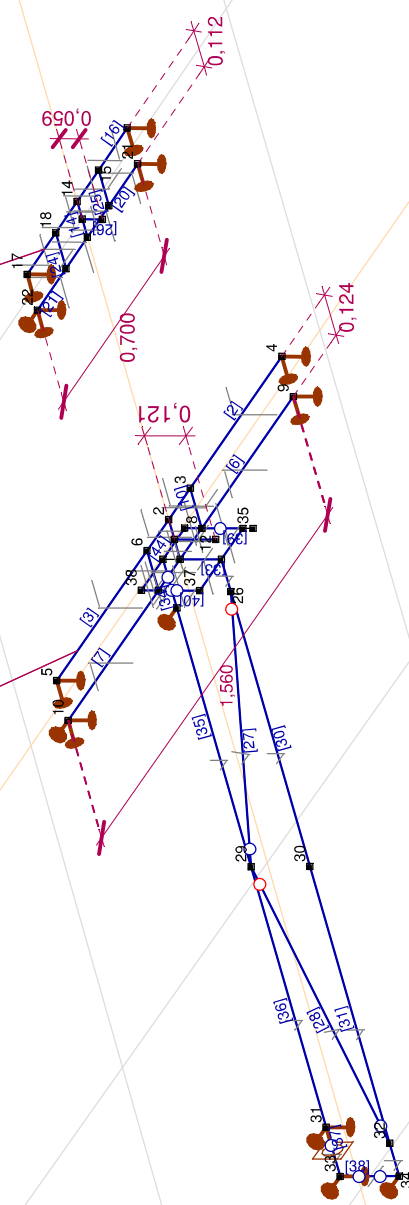
Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm Eurocode-NL

Boventraverse buitenzijde

Boventraverse ligger bij mastlichaam



Tekening staven

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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**Staafaansluitingen**

	<-Aansluitingen	Aansluitingen ->	<-e <sub>x</sub>	<-θ <sub>x</sub>	<-θ <sub>y</sub>	<-θ <sub>z</sub>		<-Aansluitingen	Aansluitingen ->	<-e <sub>x</sub>	<-θ <sub>x</sub>	<-θ <sub>y</sub>	<-θ <sub>z</sub>
12	.	Schar-YZ	.	.	.	.	34	Schar-YZ	Schar-YZ	.	.	Vrij	<-θ <sub>z</sub>
13	100111	.	Vrij	Vrij	Vrij	Vrij	37	.	Schar-YZ	.	.	.	.
14	.	100111	.	.	.	.	38	Schar-YZ	Schar-YZ	.	.	Vrij	Vrij
23	Schar-YZ	.	.	.	Vrij	Vrij	39	.	Schar-Z	.	.	.	.
27	Schar-YZ	Bol	.	.	Vrij	Vrij	40	.	Schar-Z	.	.	.	.
28	Schar-YZ	Bol	.	.	Vrij	Vrij	45	Schar-Z	.	.	.	.	Vrij
29	.	Schar-YZ	.	.	.	.	46	Schar-Z	.	.	.	.	Vrij

<-Aansluitingen: Staafeindaansluitingen op startpunt; **Aansluitingen ->**: Staafeindaansluitingen op eindpunt; <-e<sub>x</sub>, <-θ<sub>x</sub>, <-θ<sub>y</sub>, <-θ<sub>z</sub>: Type;

**EG: Staafeigen gewicht**

	Σ [kg]
1-46	119,135
<b>Totaal</b>	<b>119,135</b>

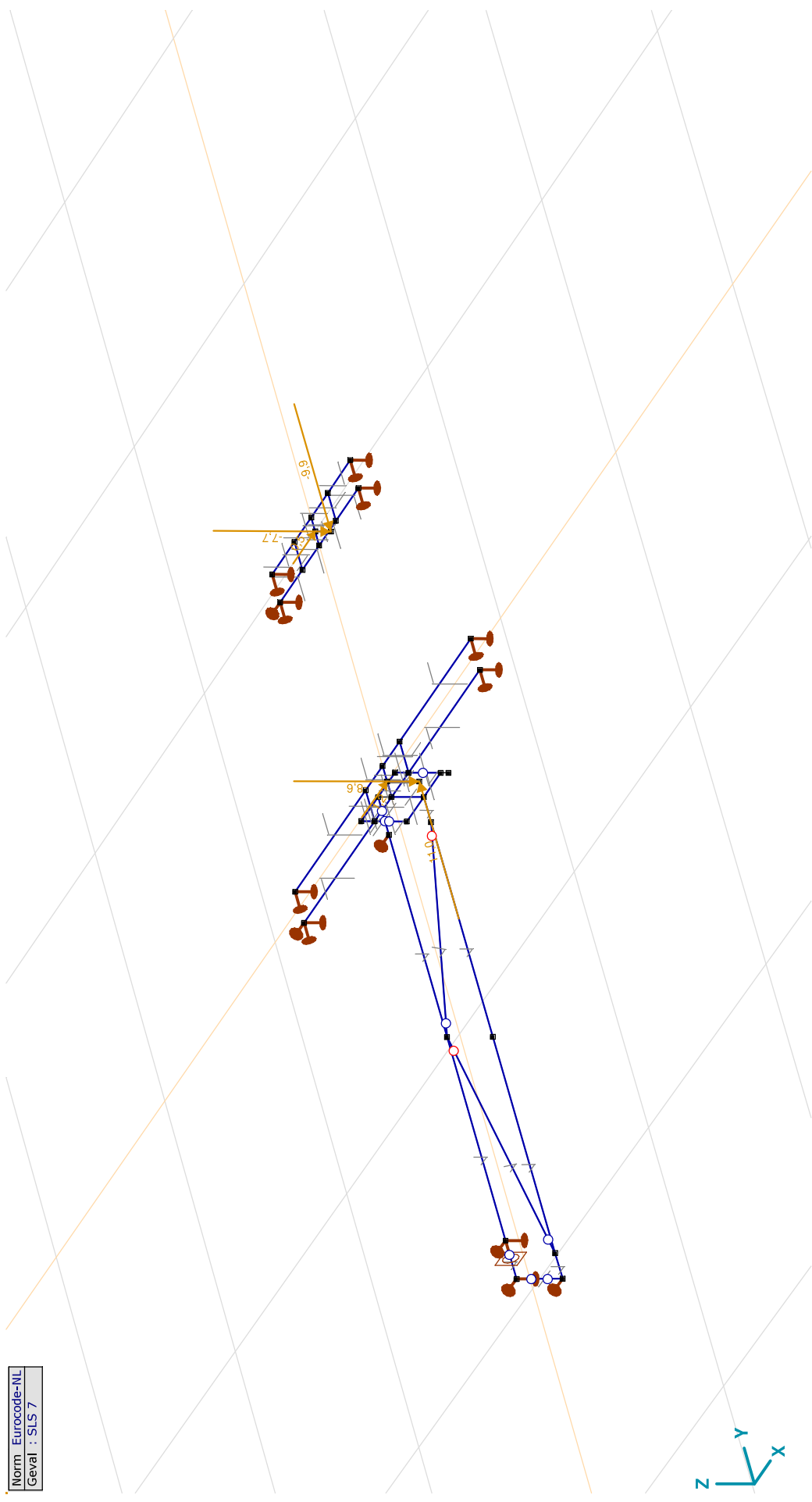
Σ: Totale massa;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm	Eurocode-NL
Geval	: SLS 7



SLS 7

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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**SLS 7: Knoopbelastingen**

	Richting	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	Globaal	1,2	0	0	0	0	0
12	Globaal	0	11,0	-8,6	0	0	0
13	Globaal	0,5	0	0	0	0	0
24	Globaal	0	-9,9	-7,7	0	0	0

**Fx, Fy, Fz:** Belastingkracht component; **Mx, My, Mz:** Belastingmoment component;**1a\_90: Knoopbelastingen**

	Richting	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	Globaal	3,7	0	0	0	0	0
12	Globaal	0	25,4	-17,5	0	0	0
13	Globaal	2,0	0	0	0	0	0
24	Globaal	0	-21,0	-17,0	0	0	0

**Fx, Fy, Fz:** Belastingkracht component; **Mx, My, Mz:** Belastingmoment component;

**Project:**

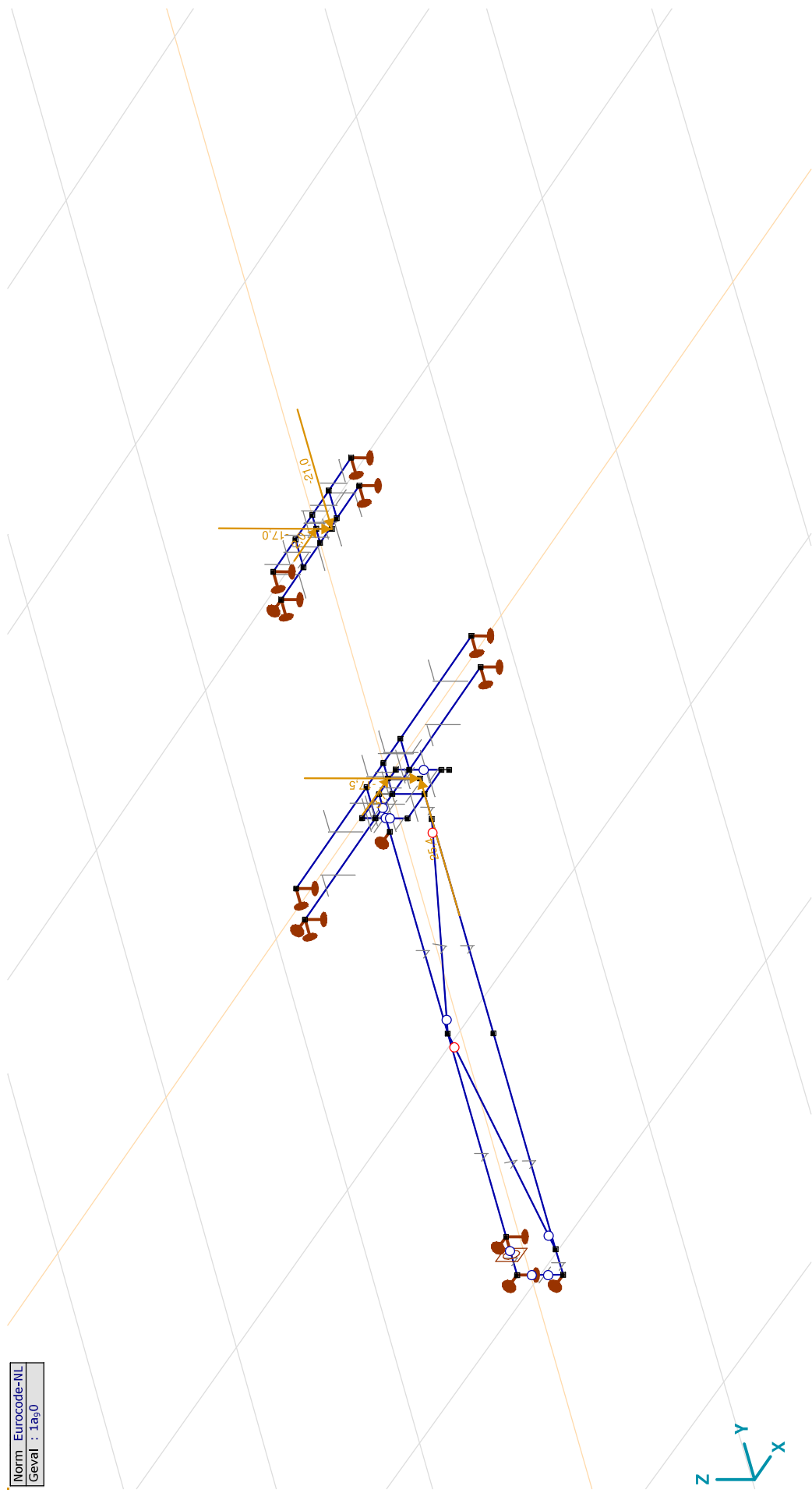
Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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Norm	Eurocode-NL
Geval	: 1a <sub>90</sub>



1a<sub>90</sub>

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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## 3\_90: Knoopbelastingen

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
1	Globaal	4,0	0	0	0	0	0
12	Globaal	0	25,4	-19,9	0	0	0
13	Globaal	2,4	0	0	0	0	0
24	Globaal	0	-22,8	-17,9	0	0	0

**F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>:** Belastingkracht component; **M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>:** Belastingmoment component;

**Project:**

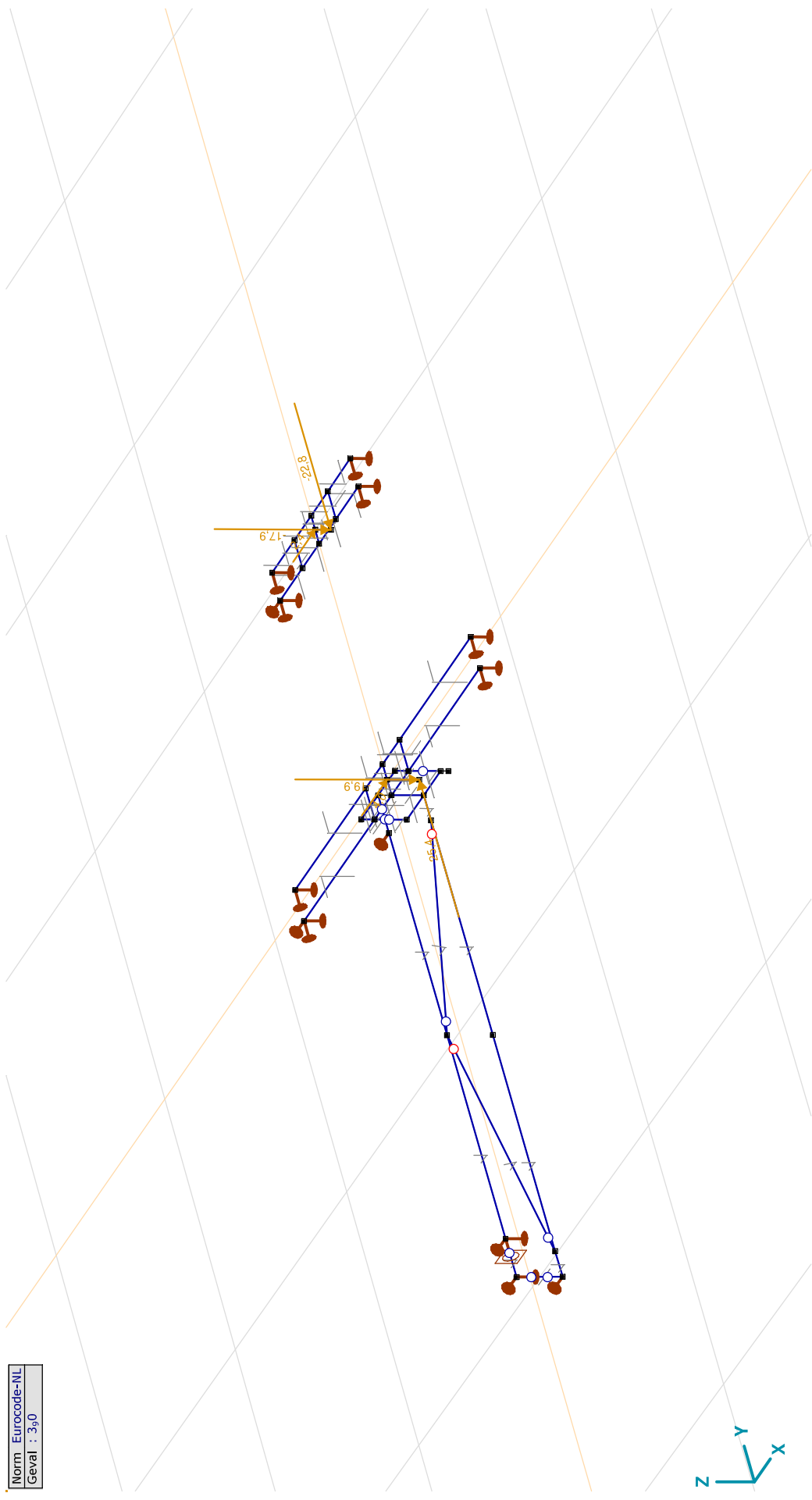
Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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Norm	Eurocode-NL
Geval	: 3,90



3\_90



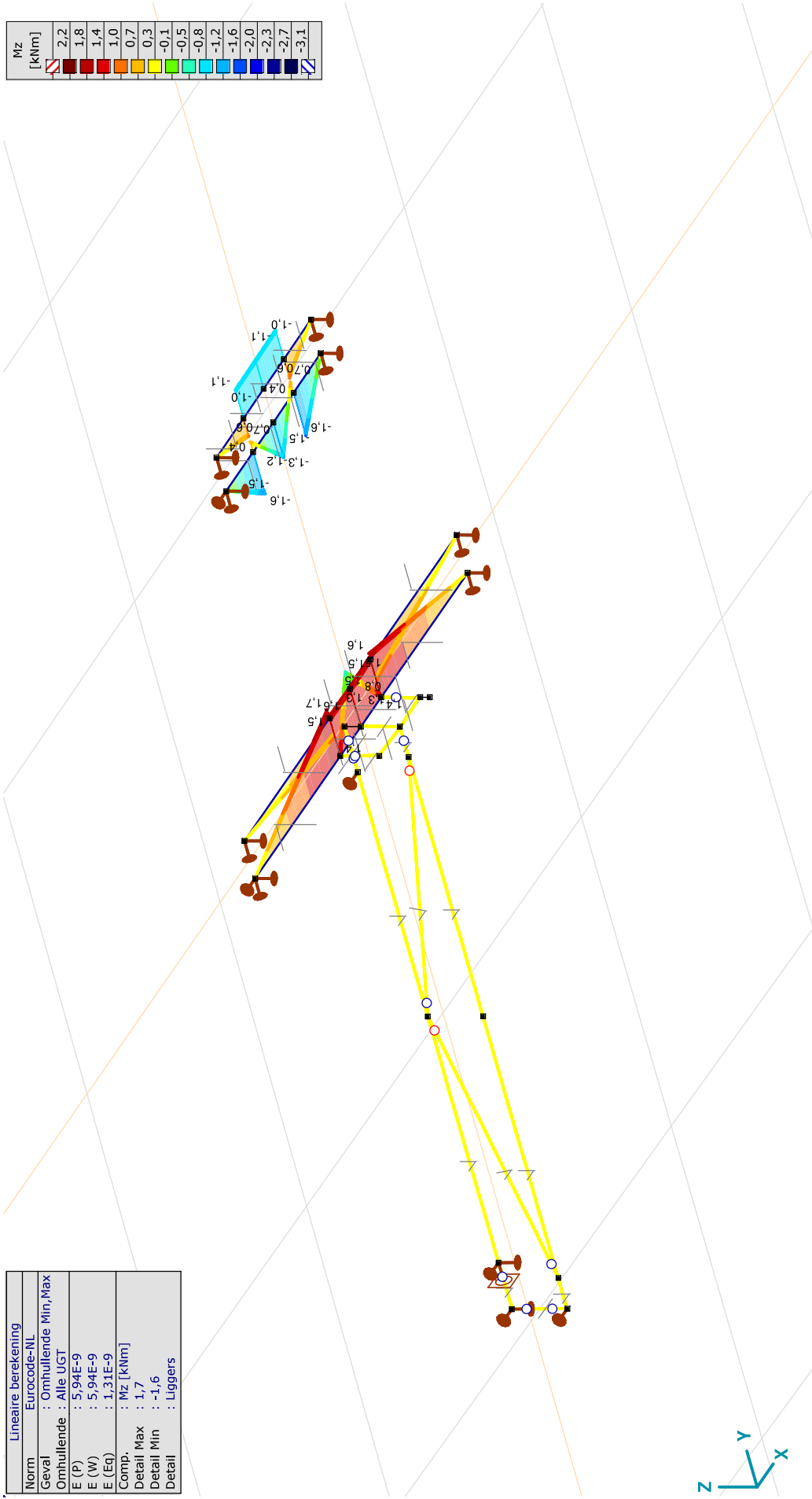


**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Mz [kNm]
Detail Max	: 1,7
Detail Min	: -1,6
Detail	: Liggers



|||, > Liggers, Lineair, Omhullende (Alle UGT), Mz, Lijnen (gevuld)



**Project:**

Constructeur: DNV GL - Energy

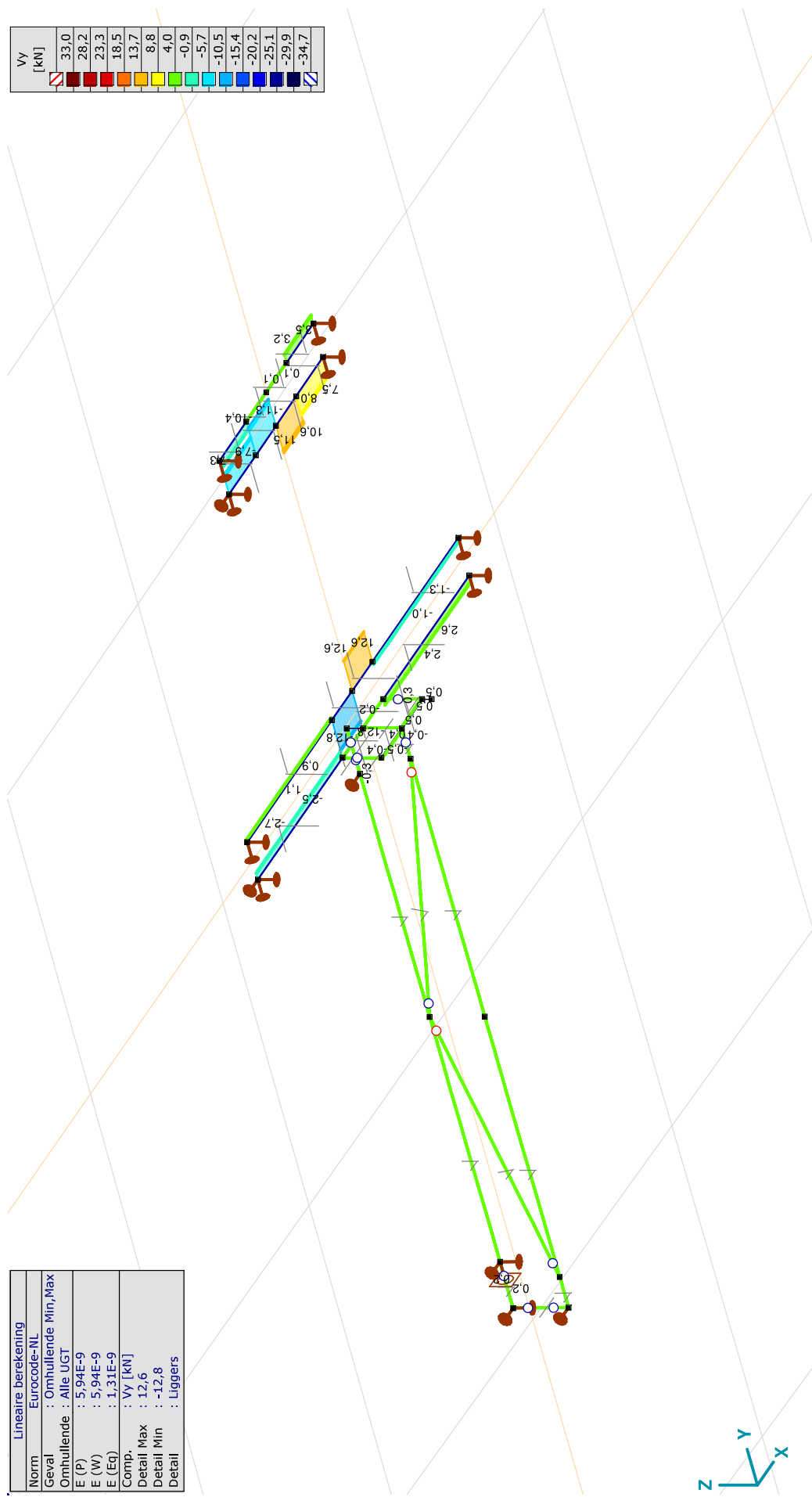
Model: **Liggers D+0 versterkt.axs**

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Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Vy [kN]
Detail Max	: 12,6
Detail Min	: -12,8
Detail	: Liggers

Vy [kN]	
33,0	
28,2	
23,3	
18,5	
13,7	
8,8	
4,0	
-0,9	
-5,7	
-10,5	
-15,4	
-20,2	
-25,1	
-29,9	
-34,7	



|||, > Liggers, Lineair, Omhullende (Alle UGT), Vy, Lijnen (gevuld)





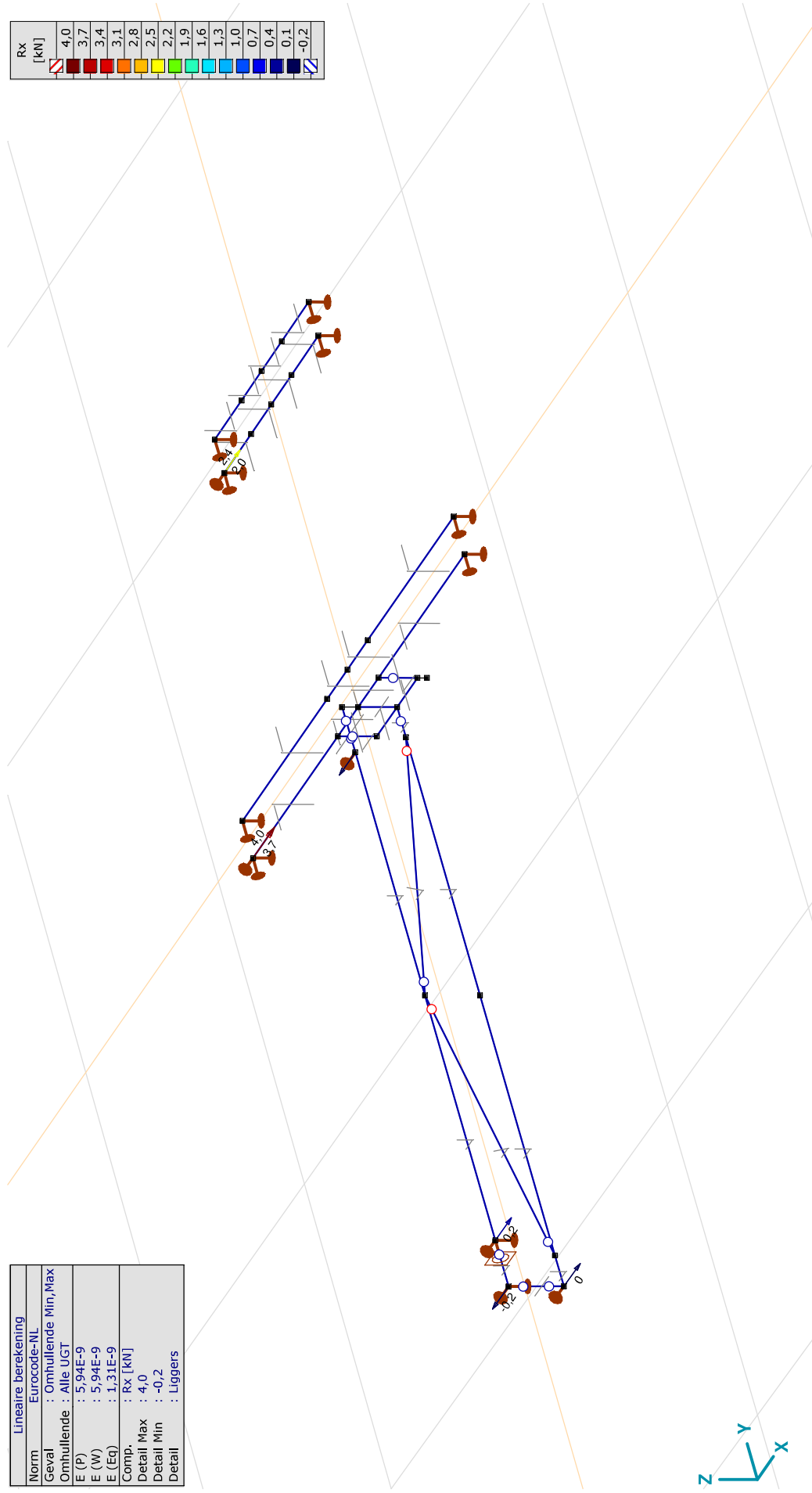
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Rx [kN]
Detail Max	: 4,0
Detail Min	: -0,2
Detail	: Liggers

Rx [kN]	
4,0	3,7
3,4	3,1
2,8	2,5
2,2	1,9
1,6	1,3
1,0	0,7
0,4	0,1
-0,2	



[I], > Liggers, Lineair, Omhullende (Alle UGT), Rx (knoopopl.), Lijnen

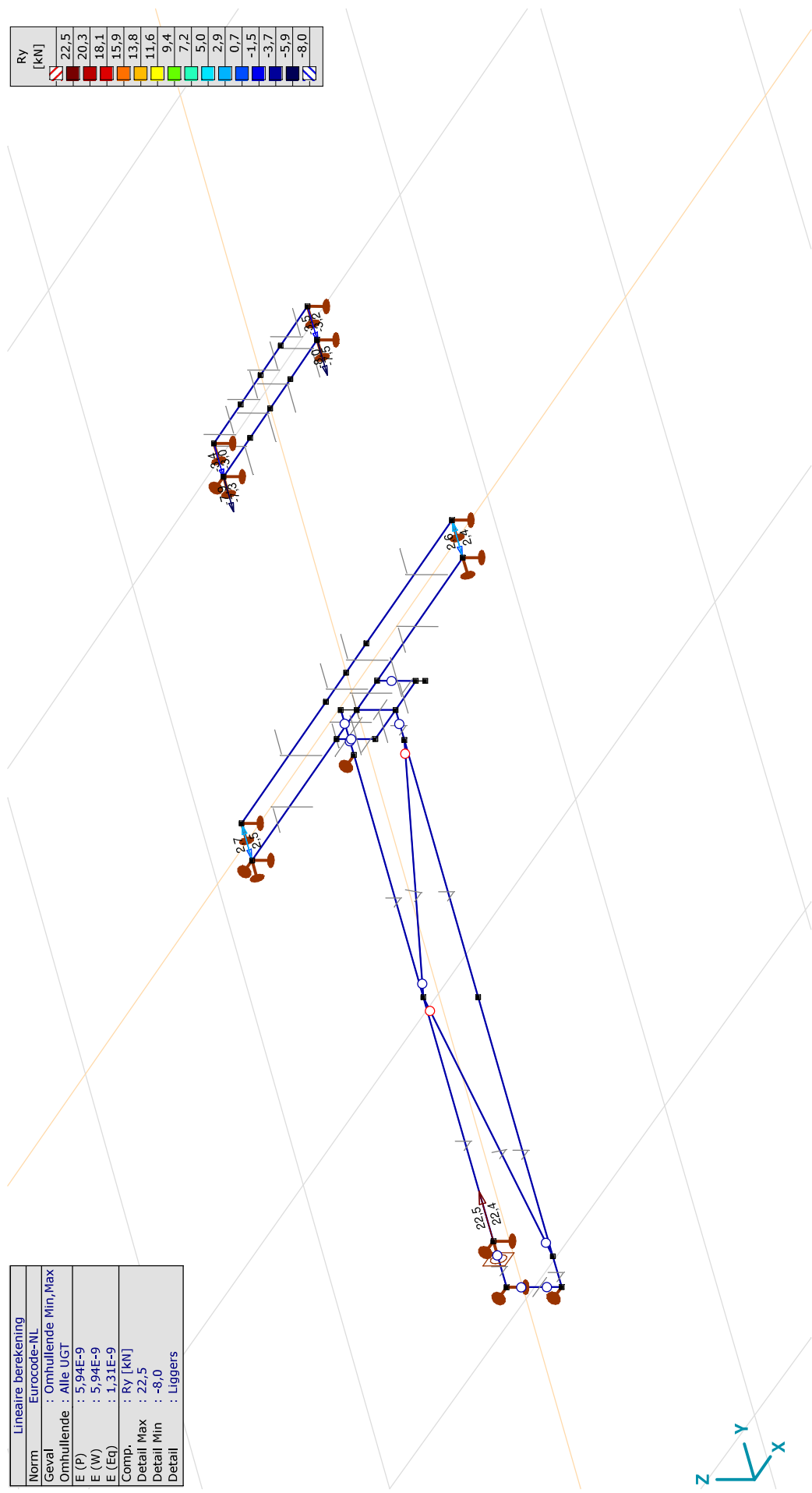
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Ry [kN]
Detail Max	: 22,5
Detail Min	: -8,0
Detail	: Liggers

Ry [kN]	
22,5	
20,3	
18,1	
15,9	
13,8	
11,6	
9,4	
7,2	
5,0	
2,9	
0,7	
-1,5	
-3,7	
-5,9	
-8,0	



[I], > Liggers, Lineair, Omhullende (Alle UGT), Ry (knoopopl.), Lijnen

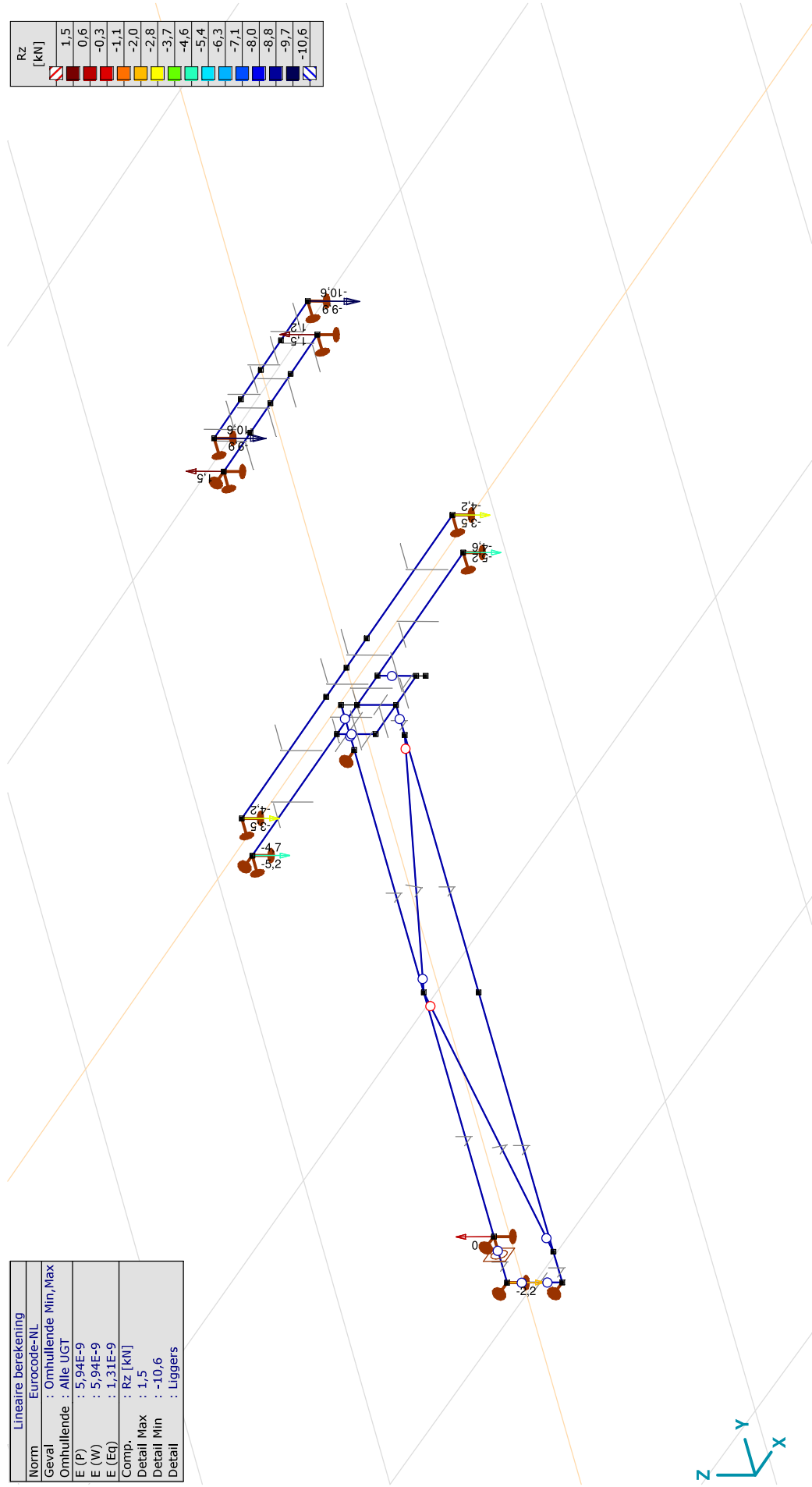
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Rz [kN]
Detail Max	: 1,5
Detail Min	: -10,6
Detail	: Liggers

Rz [kN]	1,5
	0,6
	-0,3
	-1,1
	-2,0
	-2,8
	-3,7
	-4,6
	-5,4
	-6,3
	-7,1
	-8,0
	-8,8
	-9,7
	-10,6



|||, > Liggers, Lineair, Omhullende (Alle UGT), Rz (knooppopl.), Lijnen



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
1	4	0,780	0,062	0	Glob.	Ry	Co #2		-1,3	-4,2	4,4	-0,305
							Co #1		-1,0	-3,5	3,7	-0,291
						Rz	Co #2		-4,2	4,4	-0,305	
							Co #1		-1,0	3,7	-0,291	
2	-0,780	0,062	0	Glob.	Ry	Co #2		-1,1	-4,2	4,3	-0,268	
						Co #1		-0,9	-3,5	3,6	-0,250	
					Rz	Co #2		-1,1	-4,2	4,3	-0,268	
						Co #1		-0,9	-3,5	3,6	-0,250	
3	0,780	-0,062	0	Glob.	Ry	Co #1		2,4	-4,6	5,2	-0,511	
						Co #2		2,6	-5,2	5,8	-0,493	
					Rz	Co #1		2,4	-4,6	5,2	-0,511	
						Co #2		2,4	-4,6	5,2	-0,511	
4	-0,780	-0,062	0	Glob.	Rx	Co #1		3,7	2,5	-4,7	6,5	-0,958
						Co #2		4,0	2,7	-5,2	7,1	-0,923
					Ry	Co #1		3,7	2,5	-4,7	6,5	-0,958
						Co #2		4,0	2,7	-5,2	7,1	-0,923
5	0,350	1,056	0	Glob.	Ry	Co #2		-3,5	-10,6	11,1	-0,336	
						Co #1		-3,2	-9,9	10,4	-0,321	
					Rz	Co #2		-3,5	-10,6	11,1	-0,336	
						Co #1		-3,2	-9,9	10,4	-0,321	
6	0,350	1,056	0	Glob.	Ry	Co #2		-3,5	-10,6	11,1	-0,336	
						Co #1		-3,2	-9,9	10,4	-0,321	
					Rz	Co #2		-3,5	-10,6	11,1	-0,336	
						Co #1		-3,2	-9,9	10,4	-0,321	

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha$ R
6	-0,350	1,056	0	Glob.	Ry	min	Co #2		<b>-3,4</b>	-10,6	11,1	-0,317
						max	Co #1		<b>-3,0</b>	-9,9	10,3	-0,305
					Rz	min	Co #2		-3,4	<b>-10,6</b>	11,1	-0,317
						max	Co #1		-3,0	<b>-9,9</b>	10,3	-0,305
					$\alpha$ R	min	Co #2		-3,4	-10,6	11,1	-0,317
						max	Co #1		-3,0	-9,9	10,3	-0,305
7	0,350	0,944	0	Glob.	Ry	min	Co #2		<b>-8,0</b>	1,5	8,2	5,543
						max	Co #1		<b>-7,5</b>	1,2	7,6	6,228
					Rz	min	Co #1		-7,5	<b>1,2</b>	7,6	6,228
						max	Co #2		-8,0	<b>1,5</b>	8,2	5,543
					$\alpha$ R	min	Co #2		-8,0	1,5	8,2	5,543
						max	Co #1		-7,5	1,2	7,6	6,228
8	-0,350	0,944	0	Glob.	Rx	min	Co #1	<b>2,0</b>	-7,3	1,2	7,7	6,303
						max	Co #2	<b>2,4</b>	-7,9	1,5	8,3	5,645
					Ry	min	Co #2	2,4	<b>-7,9</b>	1,5	8,3	5,645
						max	Co #1	2,0	<b>-7,3</b>	1,2	7,7	6,303
					Rz	min	Co #1	2,0	-7,3	<b>1,2</b>	7,7	6,303
						max	Co #2	2,4	-7,9	<b>1,5</b>	8,3	5,645
				$\alpha$ R	min	Co #2	2,4	-7,9	1,5	8,3	5,645	
					max	Co #1	2,0	-7,3	1,2	7,7	6,303	
9	0	-0,212	0,050	Glob.	Rx	min	Co #1	<b>0</b>			0	
						max	Co #2	<b>0</b>			0	
10	0	-1,812	0,050	Glob.	Rx	min	Co #1	<b>0,2</b>	22,4	0	22,4	2889,848
						max	Co #2	<b>0,2</b>	22,5	0	22,5	2896,644
					Ry	min	Co #1	0,2	<b>22,4</b>	0	22,4	2889,848
						max	Co #2	0,2	<b>22,5</b>	0	22,5	2896,644
					Rz	min	Co #1	0,2	22,4	<b>0</b>	22,4	2889,848
						max	Co #1	0,2	22,4	<b>0</b>	22,4	2889,848
				$\alpha$ R	min	Co #1	0,2	22,4	0	22,4	2889,848	
					max	Co #2	0,2	22,5	0	22,5	2896,644	
11	0	-1,962	0,050	Glob.	Rx	min	Co #2	<b>-0,2</b>		-2,2	2,2	-0,085
						max	Co #1	<b>-0,2</b>		-2,2	2,2	-0,085

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

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## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
12	0	-1,962	-0,121	Glob.	Rx	min max	Co #1 Co #2	0 0			0 0	
Ext.												
11	0	-1,962	0,050	Glob.	Rx	min max	Co #2 Co #2	-0,2 4,0		-2,2 -2,2	2,2 2,2	-0,085 -0,085
4	-0,780	-0,062	0	Glob.	Ry	min max	Co #2 Co #2	0 -8,0	2,7	-5,2	7,1	-0,923
7	0,350	0,944	0	Glob.	Ry	min max	Co #2 Co #2	0 22,5	-8,0	1,5	8,2	5,543
10	0	-1,812	0,050	Glob.	Rz	min max	Co #2 Co #2	0,2 -3,5	22,5	0	22,5	2896,644
5	0,350	1,056	0	Glob.	Rz	min max	Co #2 Co #2	0 -3,4	-3,5	-10,6	11,1	-0,336
6	-0,350	1,056	0	Glob.	Rz	min max	Co #2 Co #2	0 2,4	-3,4	-10,6	11,1	-0,317
8	-0,350	0,944	0	Glob.	Rz	min max	Co #2 Co #2	2,4 3,7	-7,9	1,5	8,3	5,645
4	-0,780	-0,062	0	Glob.	$\alpha R$	min max	Co #1 Co #2	3,7 0,2	2,5	-4,7	6,5	-0,958
10	0	-1,812	0,050	Glob.	$\alpha R$	min max	Co #1 Co #2	0,2 0,2	22,5	0	22,5	2896,644

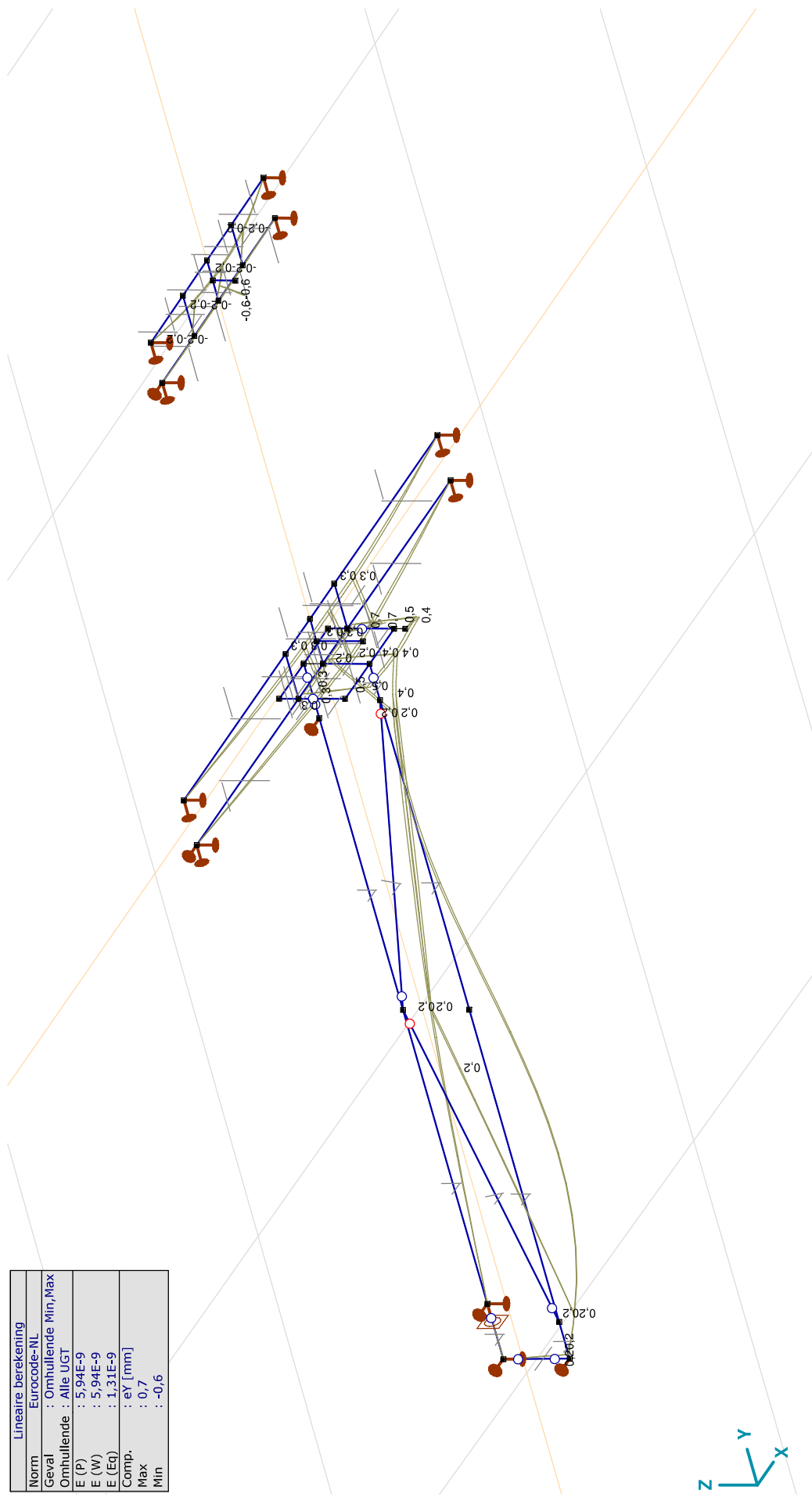
**Knoop:** Ondersteunde knoop; **Type:** Opleggingsstype; **C:** Extreme component; **min, max:** Extreme type; **Geval:** Belastinggeval van de extreme; **Rx:** X-component opleggingsreactiekracht; **Ry:** Y-component opleggingsreactiekracht; **Rz:** Z-component opleggingsreactiekracht; **Rr:** Resulterende opleggingsreactiekracht;  **$\alpha R$ :** Verhouding verticale oplegkracht / horizontale oplegkracht;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: eY [mm]
Max	: 0,7
Min	: -0,6



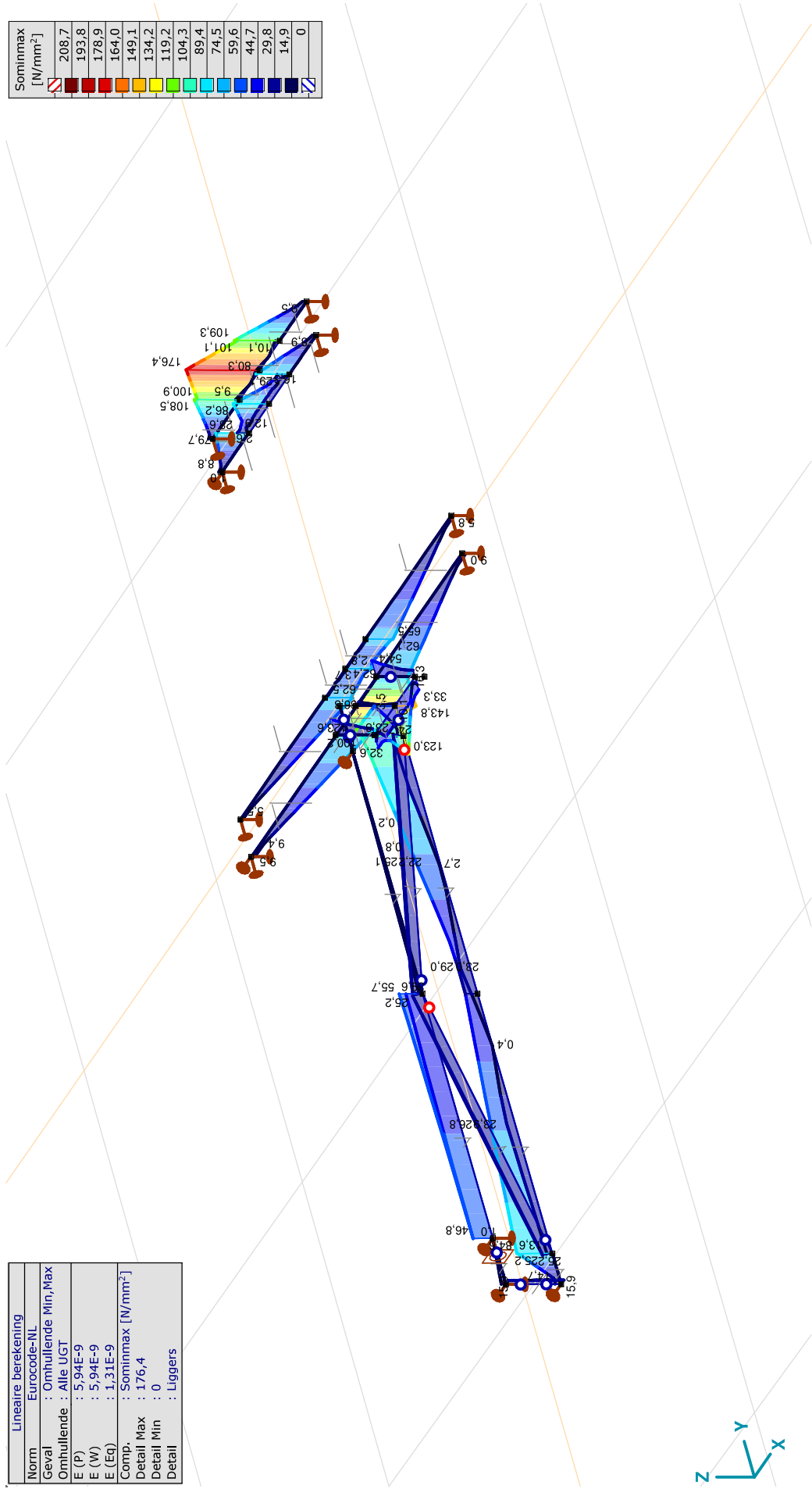
III, Lineair, Omhullende (Alle UGT), eY, Lijnen



**Project:**  
 Constructeur: DNV GL - Energy  
 Model: **Liggers D+0 versterkt.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Somimax [N/mm <sup>2</sup> ]
Detail Max	: 176,4
Detail Min	: 0
Detail	: Liggers

Somimax [N/mm <sup>2</sup> ]	
176,4	176,4
108,5	108,5
100,9	100,9
99,7	99,7
97,6	97,6
95,2	95,2
86,2	86,2
80,3	80,3
101,1	101,1
109,3	109,3
101,1	101,1
89,4	89,4
104,3	104,3
119,2	119,2
134,2	134,2
149,1	149,1
164,0	164,0
178,9	178,9
193,8	193,8
208,7	208,7
0	0



[[I], > Liggers, Linear, Omhullende (Alle UGT), Somimax, Lijnen (gevuld)

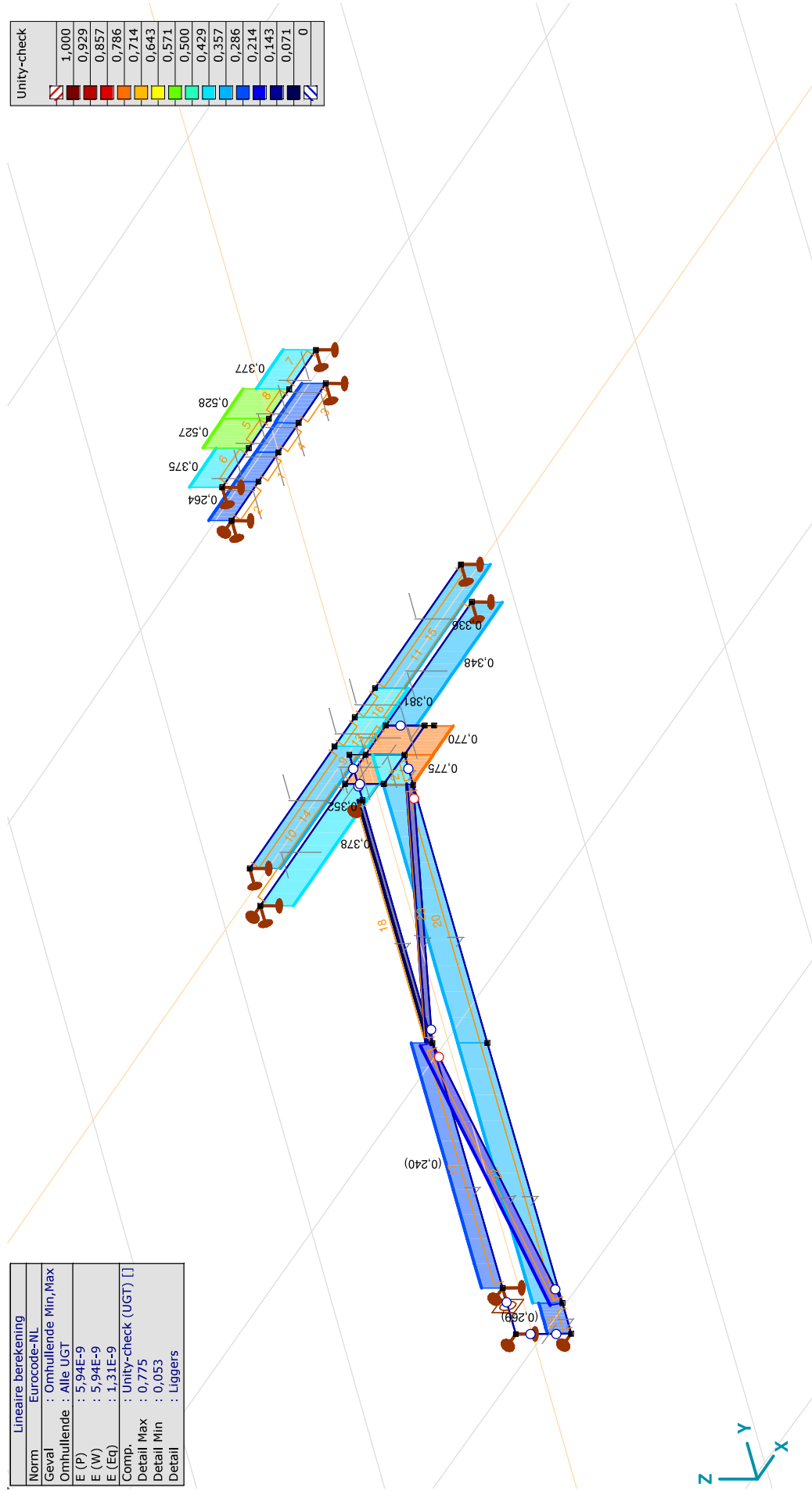
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+0 versterkt.axs**

Norm	Lineaire berekening
Geval	Eurocode-NL
Omhullende	: Omhullende Min, Max
E (P)	: 5,94E-9
E (W)	: 5,94E-9
E (Eq)	: 1,31E-9
Comp.	: Unity-check (UGT) []
Detail Max	: 0,775
Detail Min	: 0,053
Detail	: Liggers

Unity-check	
	1,000
	0,929
	0,857
	0,786
	0,714
	0,643
	0,571
	0,500
	0,429
	0,357
	0,286
	0,214
	0,143
	0,071
	0



[Stl] > Liggers, Lineair, Omhullende (Alle UGT), Unity-check, Lijnen (gevuld)

## **Project:**

**Constructeur: DNV GL - Energy**

AxisVM X6 R1q • Geregistreerd aan DNV GL - Energy  
Onderrand boventraverse.axs

**Rapport**



## Rapport, Inhoudsopgave

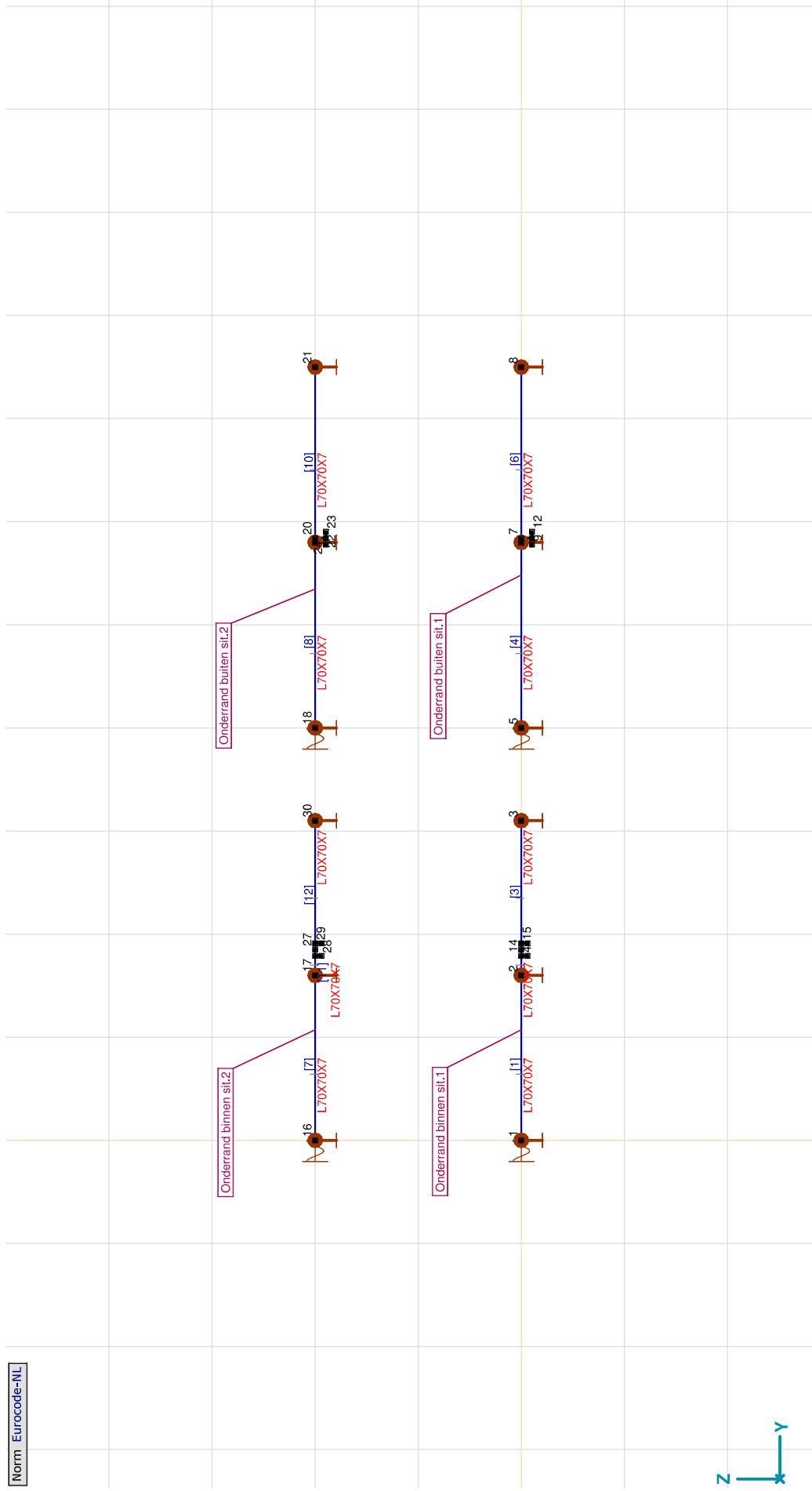
Onderdeel	Pagina	Onderdeel	Pagina
Zijaanzicht	3	EG: Staaf eigen gewicht	9
Materialen	4	EG, Zijaanzicht	9
Profielen	4	Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen	10
Knopen	5	[I], Lineair, Co #1 (UGT), My, Lijnen (gevuld), Zijaanzicht	10
Staven	5	[I], Lineair, Co #1 (UGT), Nx, Lijnen (gevuld), Zijaanzicht	11
Buiging: Knoopbelastingen	5	[I], Lineair, Co #1 (UGT), S;:minmax, Lijnen (gevuld), Zijaanzicht	12
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Druk: Knoopbelastingen	7	[StI], Lineair, Co #1 (UGT), Unity-check, Kleuren 2D, Zijaanzicht	14
Druk, Zijaanzicht	8		

**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

Norm Eurocode-NL



Zijaanzicht



## Project:

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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
## Materialen

Naam	Type	Nationale norm	Materiaalnorm	Model	$E_x$ [N/mm <sup>2</sup> ]	$E_y$ [N/mm <sup>2</sup> ]	$\nu$	$\alpha_T$ [1/°C]	$\rho$ [kg/m <sup>3</sup> ]	Materiaal kleur	Contour kleur	Structuur	$P_1$
1	S 235	Eurocode-NL	10025-2	Lineair	210000	210000	0,30	1,2E-5	7850				$f_{yk}$ [N/mm <sup>2</sup> ] = 235,00

Naam	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	$P_9$	$P_{10}$	$P_{11}$	$P_{12}$	$P_{13}$	$P_{14}$
1	S 235	$f_{yk}$ [N/mm <sup>2</sup> ] = 360,00	$f_{yk}$ [N/mm <sup>2</sup> ] = 215,00	$f_{tk}$ [N/mm <sup>2</sup> ] = 360,00									

**Naam:** Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model;  **$E_x$ :** Elasticiteitsmodulus in lokale x richting;  **$E_y$ :** Elasticiteitsmodulus in lokale y richting;  **$\nu$ :** Poisson's verhouding;  **$\alpha_T$ :** Warmteuitzettingscoëfficiënt;  **$\rho$ :** Dichtheid; **Materiaal kleur:** Materiaalkleur; **Contour kleur:** Contourkleur;  **$P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}$ :** Ontwerpparameter.

## Profielen

Naam	Tekening	Productie	Vorm	$h$ [mm]	$b$ [mm]	$tw$ [mm]	$tf$ [mm]	$r_1$ [mm]	$r_2$ [mm]	$r_3$ [mm]	$A_x$ [mm <sup>2</sup> ]	$A_y$ [mm <sup>2</sup> ]	$A_z$ [mm <sup>2</sup> ]	$I_x$ [mm <sup>4</sup> ]	$I_y$ [mm <sup>4</sup> ]	$I_z$ [mm <sup>4</sup> ]	$I_{yz}$ [mm <sup>4</sup> ]
1	L 70X 70X 7		Gewalst	L	70,0	70,0	7,0	7,0	4,5	0	939,73	412,00	416,89	16632,03	422933,40	422933,40	-247895,00

Naam	$I_1$ [mm <sup>4</sup> ]	$I_2$ [mm <sup>4</sup> ]	$\alpha$ [°]	$I_{\omega}$ [mm <sup>6</sup> ]	$W_{1,elt}$ [mm <sup>3</sup> ]	$W_{1,elb}$ [mm <sup>3</sup> ]	$W_{1,pl}$ [mm <sup>3</sup> ]	$W_{2,elb}$ [mm <sup>3</sup> ]	$W_{2,elt}$ [mm <sup>3</sup> ]	$W_{2,pl}$ [mm <sup>3</sup> ]	$i_y$ [mm]	$i_z$ [mm]	$H_y$ [mm]	$H_z$ [mm]	$Y_G$ [mm]	$Z_G$ [mm]
1	L 70X 70X 7	670828,40	175038,40	45,00	5155803	13552,78	13552,78	6279,10	7084,59	11096,74	21,2	21,2	70,0	70,0	19,7	19,7

Naam	$y_s$ [mm]	$z_s$ [mm]	$\beta_y$ [mm]	$\beta_z$ [mm]	$\beta_w$ [°]	S.p.
1	L 70X 70X 7	-15,5	-15,5	63,2	63,2	0

**Naam:** Doorsneede naam; **Productie:** Productieproces; **Vorm:** Profiel;  **$h$ :** Doorsneede hoogte;  **$b$ :** Doorsneede breedte;  **$tw$ :** Lijfdikte;  **$tf$ :** Flensdikte;  **$r_1, r_2, r_3$ :** Afrondingswaarde;  **$A_x, A_z$ :** Afschuivingsoppervlak;  **$I_x, I_z$ :** Buigtraagheidsmoment;  **$I_{yz}$ :** Centrifugaal traagheidsmoment;  **$I_1, I_2$ :** Hoofdtraagheidsmoment;  **$\alpha$ :** Hoofdrichtingen;  **$I_{\omega}$ :** Krommingsconstante;  **$W_{1,elt}, W_{1,elb}, W_{2,elt}, W_{2,elb}$ :** Elastisch weerstandsmoment;  **$W_{1,pl}, W_{2,pl}$ :** Plastisch weerstandsmoment;  **$i_y, i_z$ :** Traagheidsstraal;  **$H_y, H_z$ :** Afmeting in lokale Y-richting;  **$Y_G, Z_G$ :** Afmeting in lokale Z-richting;  **$y_s, z_s$ :** Y-coördinaat van het zwaartepunt;  **$\beta_y, \beta_z$ :** Y-coördinaat van het afschuivingsmiddenpunt (torsie);  **$\beta_w$ :** Wagner's coëfficiënt; **S.p.:** Spanningspunten.

**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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**Knopen**

	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]	X [m]	Y [m]	Z [m]
1	0	0	0	7	5,840	0	13	5,779	-0,104	19	0	5,800	25	0	1,789
2	0	1,600	0	8	7,500	0	14	1,789	0	20	0	5,840	26	0	1,789
3	0	3,100	0	9	5,840	-0,104	15	1,911	0	21	0	7,500	27	0	1,850
4	0	1,850	0	10	1,789	-0,062	16	0	2,000	22	0	5,840	28	0	1,911
5	0	4,000	0	11	1,911	-0,062	17	1,600	2,000	23	0	5,901	29	0	1,911
6	0	5,800	0	12	5,901	-0,104	18	4,000	2,000	24	0	5,779	30	0	3,100

**Staven**

	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede
1	1	2	1,600	i-j	S 235	1	16	17	1,600	i-j	S 235	1
2	2	4	0,250	i-j	S 235	1	8	19	1,800	i-j	S 235	1
3	4	3	1,250	j-i	S 235	1	9	20	0,040	i-j	S 235	1
4	5	6	1,800	i-j	S 235	1	10	21	1,660	i-j	S 235	1
5	6	7	0,040	i-j	S 235	1	11	27	0,250	i-j	S 235	1
6	7	8	1,660	i-j	S 235	1	12	30	1,250	i-j	S 235	1

Lengte: Elementlengte; **Lokaal X:** Lokale X-richting;**Buiging: Knoopbelastingen**

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
9	Global	0	-10,2	0	0	0	0	22	Global	0	-7,6	0	0	0
10	Global	0	7,5	-15,5	0	0	0	23	Global	0	0	-6,3	0	0
11	Global	0	3,9	6,6	0	0	0	24	Global	0	0	0,9	0	0
12	Global	0	0	-9,3	0	0	0	25	Global	0	5,5	-11,5	0	0
13	Global	0	0	1,3	0	0	0	28	Global	0	2,8	4,6	0	0

**F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>:** Belastingkracht component; **M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>:** Belastingmoment component;

**Project:**

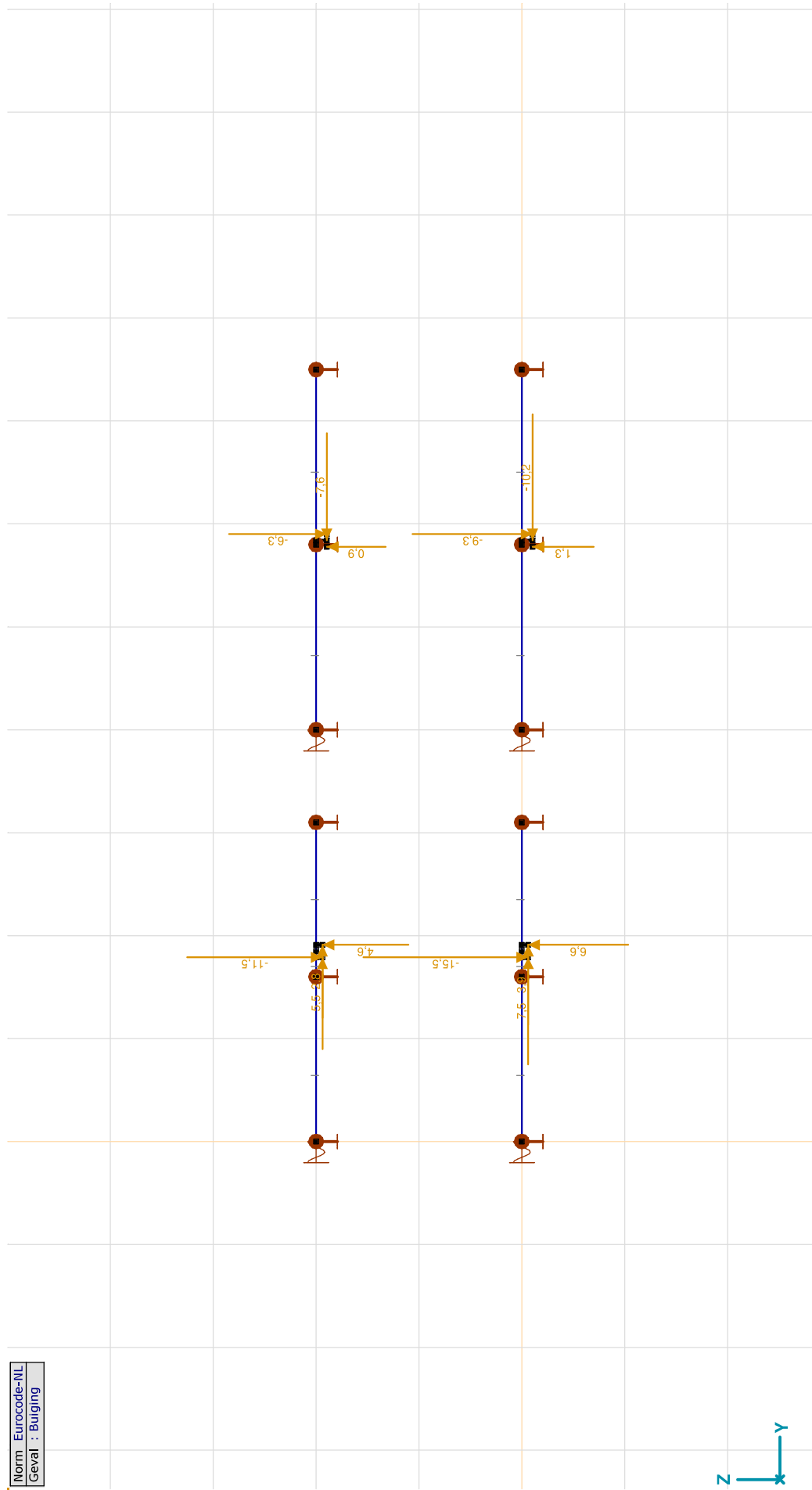
Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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Norm	Eurocode-NL
Geval	: Bûiging



Buiging, Zijaanzicht

**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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**Druk: Knoopbelastingen**

	<i>Richting</i>	<i>F<sub>x</sub></i> [kN]	<i>F<sub>y</sub></i> [kN]	<i>F<sub>z</sub></i> [kN]	<i>M<sub>x</sub></i> [kNm]	<i>M<sub>y</sub></i> [kNm]	<i>M<sub>z</sub></i> [kNm]
3	Globaal	0	-100,0	0	0	0	0
8	Globaal	0	-62,0	0	0	0	0
21	Globaal	0	-62,0	0	0	0	0
30	Globaal	0	-100,0	0	0	0	0

**F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>:** Belastingkracht component; **M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>:** Belastingmoment component;

**Project:**

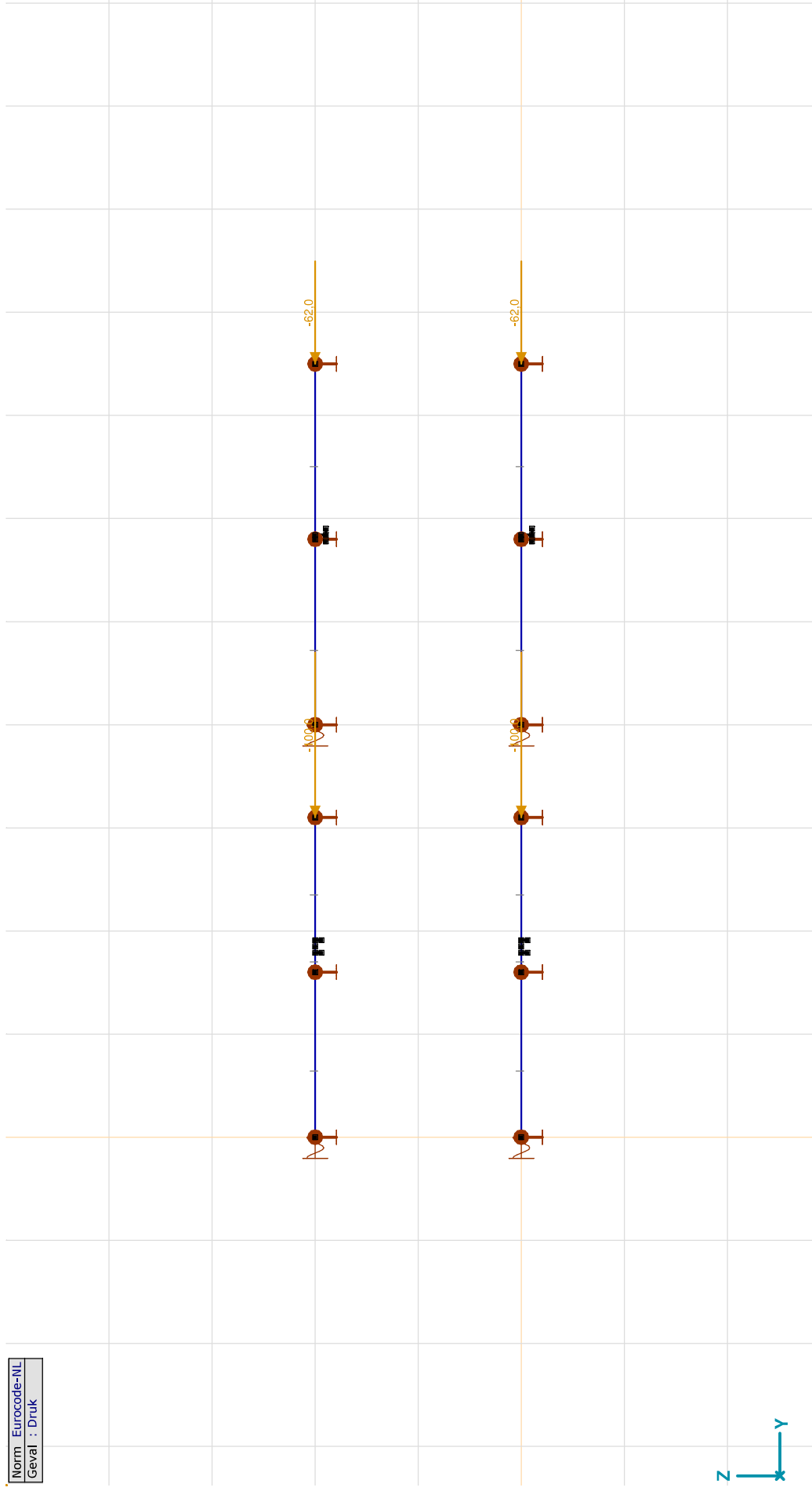
Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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Norm	Eurocode-NL
Geval	: Druk



Druk, Zijanzicht

**Project:**

Constructeur: DNV GL - Energy

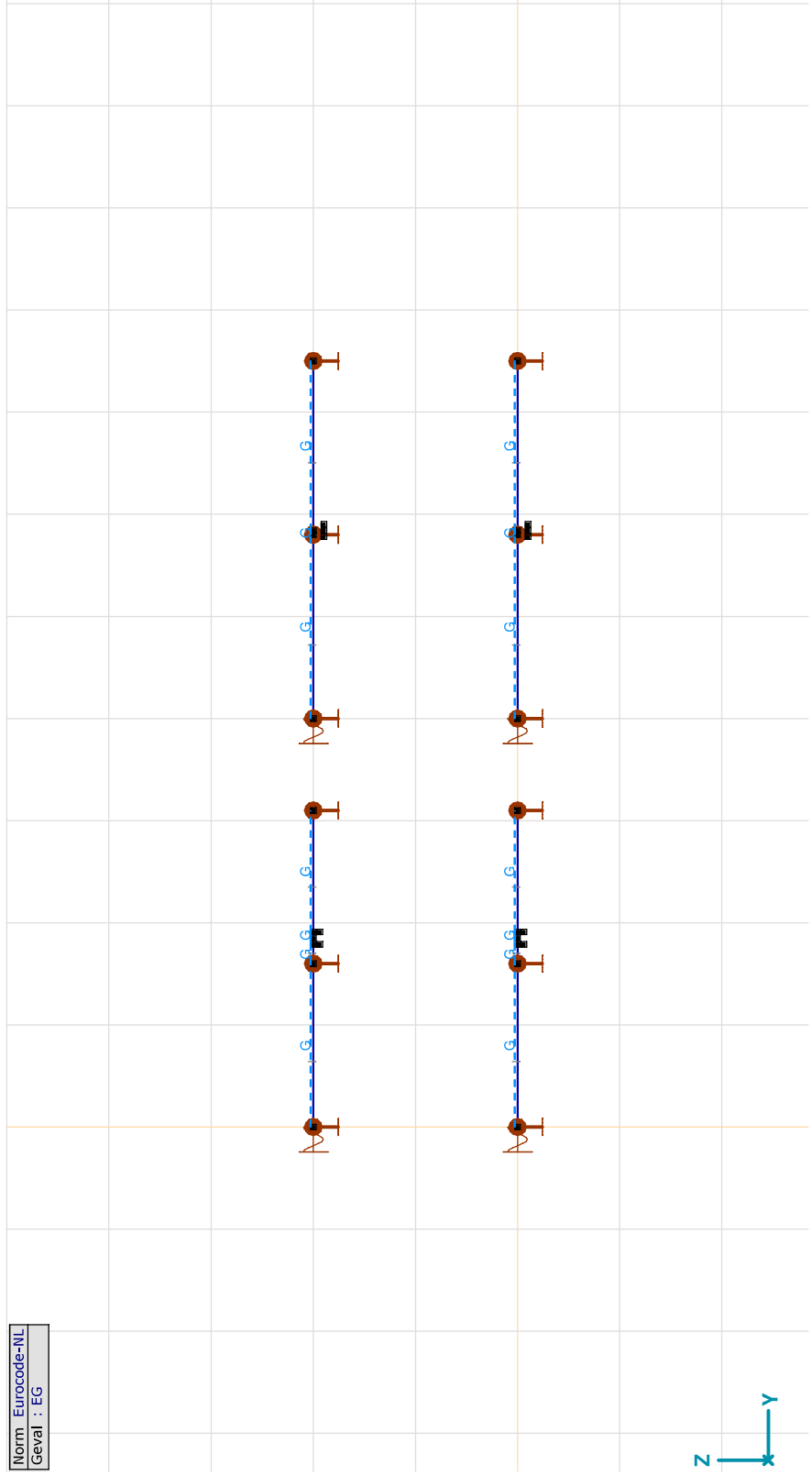
Model: **Onderrand boventraverse.axs**

EG: Staaf eigen gewicht

	$\Sigma$ [kg]
1-16	97,375
<b>Totaal</b>	<b>97,375</b>

$\Sigma$ : Totale massa:

Mom. Eurocode-NL  
Geval : EG



EG, Zijaanzicht



**Project:**

Constructeur: DNV GL - Energy

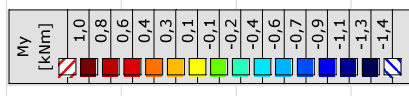
Model: **Onderrand boventransverse.axs**

Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen

Naam	Type	Buiging	Druk	EG	Commentaar
1	UGT	1,00	1,00	1,05	

Naam: Naam belastingcombinatie; Type: Type belastingcombinatie; Buiging, Druk, EG: Factor;

Lineaire berekening	
Norm	Eurocode-NL
Geval	Co #1
E (P)	: 2,86E-11
E (W)	: 2,86E-11
E (Eq)	: 1,35E-9
Comp.	: My [kNm]
Max	: 1,0
Min	: -1,4



III, Linear, Co #1 (UGT), My, Lijnen (gevuld), Zijaanzicht

**Project:**

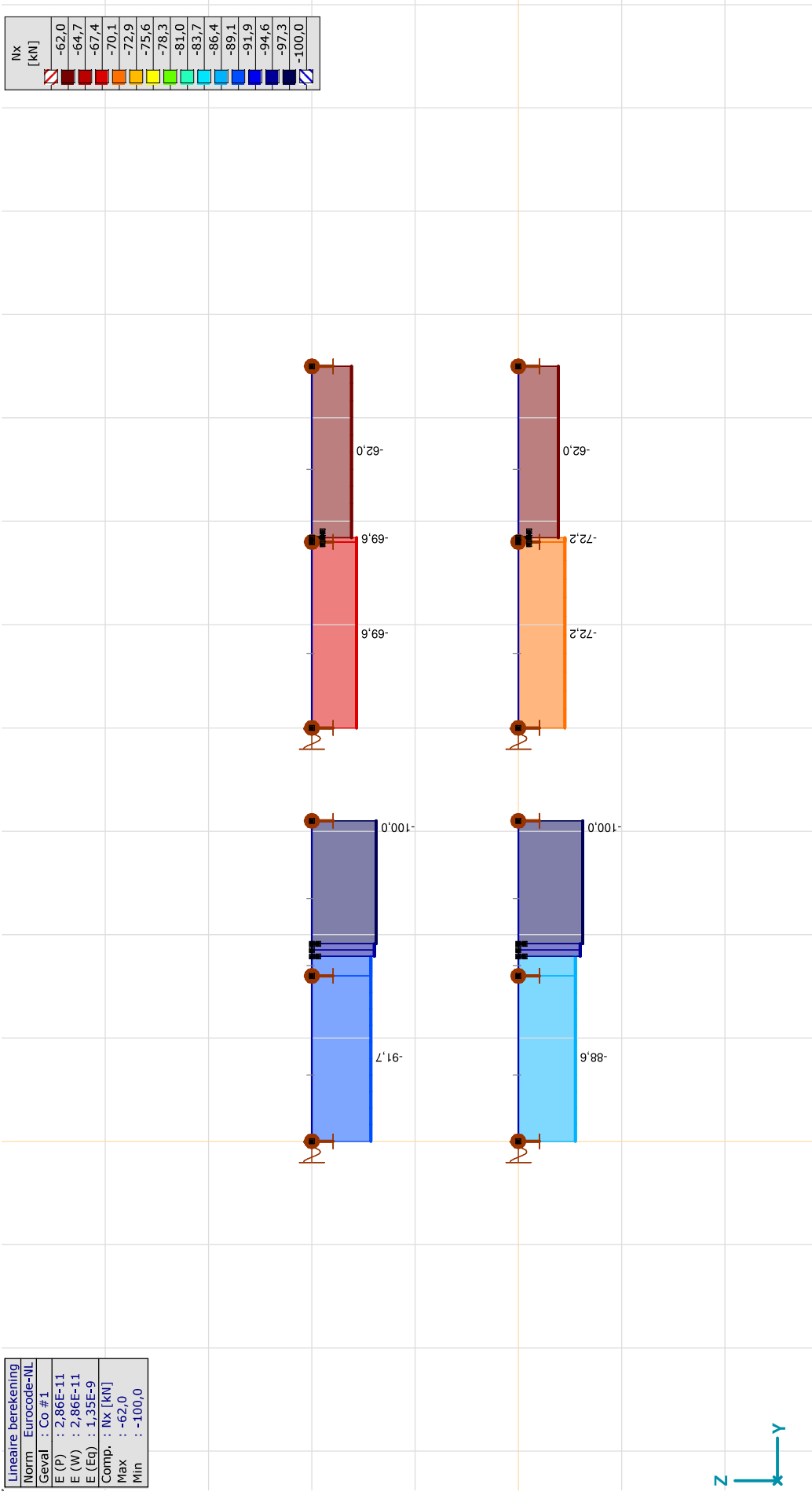
Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

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Lineaire berekening	
Norm	Eurocode-NL
Geval	: Co #1
E (P)	: 2,86E-11
E (W)	: 2,86E-11
E (Eq)	: 1,35E-9
Comp.	: Nx [kN]
Max	: -62,0
Min	: -100,0



[[], Linear, Co #1 (UGT), Nx, Lijnen (gevuld), Zijaanzicht

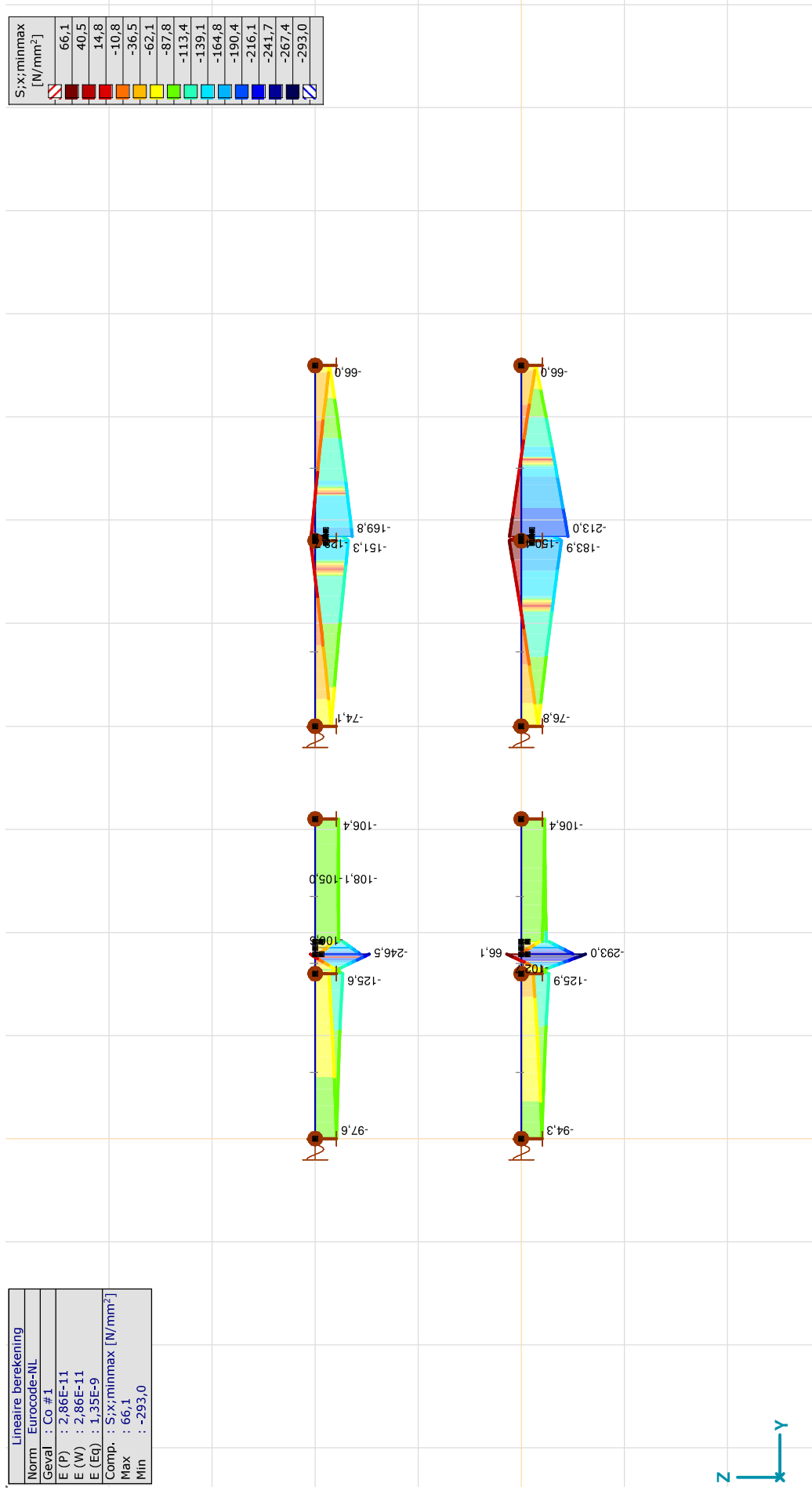
**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Co #1
E (P)	: 2,86E-11
E (W)	: 2,86E-11
E (Eq)	: 1,35E-9
Comp.	: S <sub>x</sub> :minmax [N/mm <sup>2</sup> ]
Max	: 66,1
Min	: -293,0

S <sub>x</sub> :minmax [N/mm <sup>2</sup> ]
66,1
40,5
14,8
-10,8
-36,5
-62,1
-87,8
-113,4
-139,1
-164,8
-190,4
-216,1
-241,7
-267,4
-293,0



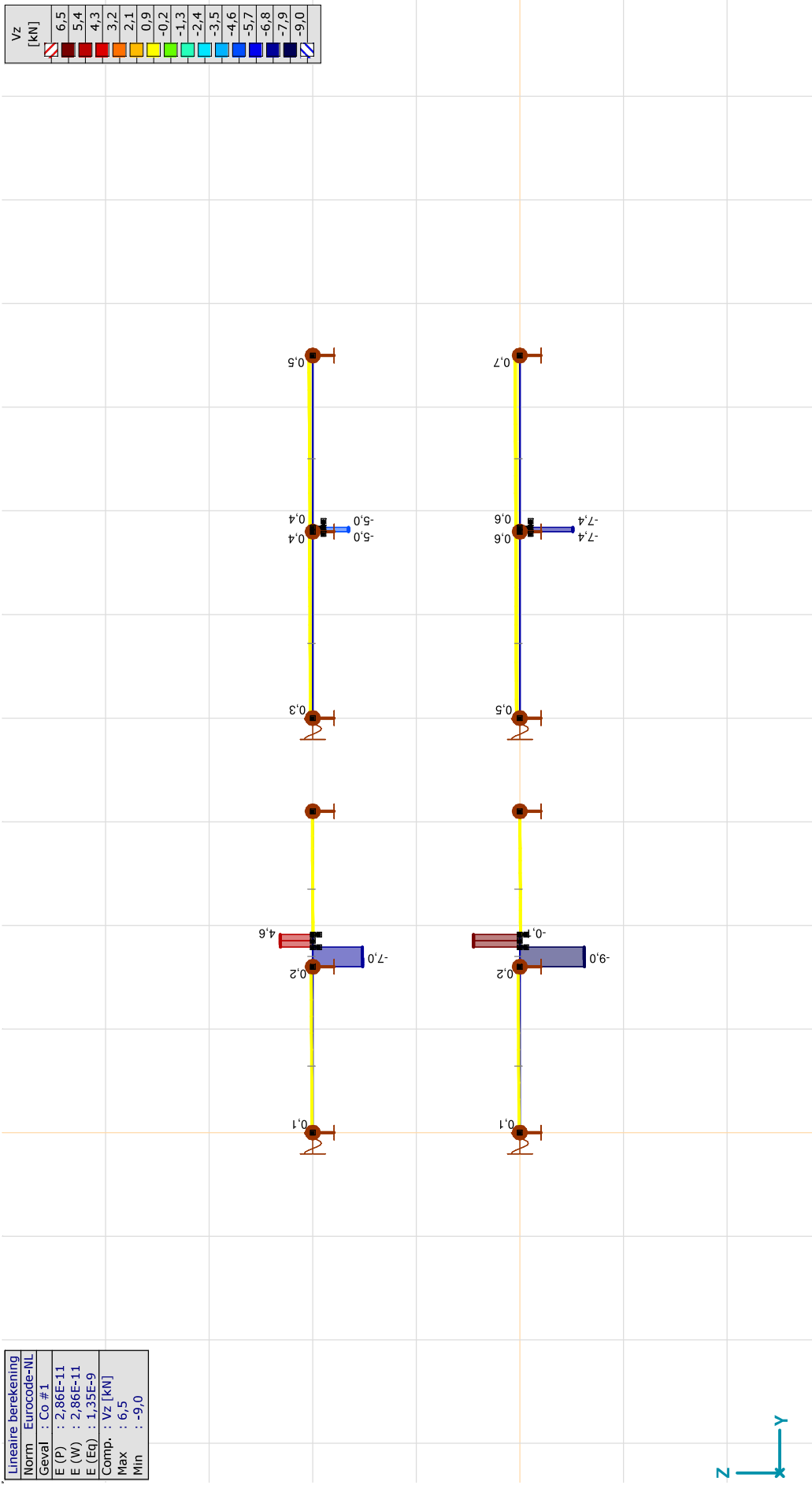
III, Lineair, Co #1 (UGT), S<sub>x</sub>:minmax, Lijnen (gevuld), Zijaanzicht

**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Co #1
E (P)	: 2,86E-11
E (W)	: 2,86E-11
E (Eq)	: 1,35E-9
Comp.	: Vz [kN]
Max	: 6,5
Min	: -9,0



[[], Linear, Co #1 (UGT), Vz, Lijnen (gevuld), Zijaanzicht



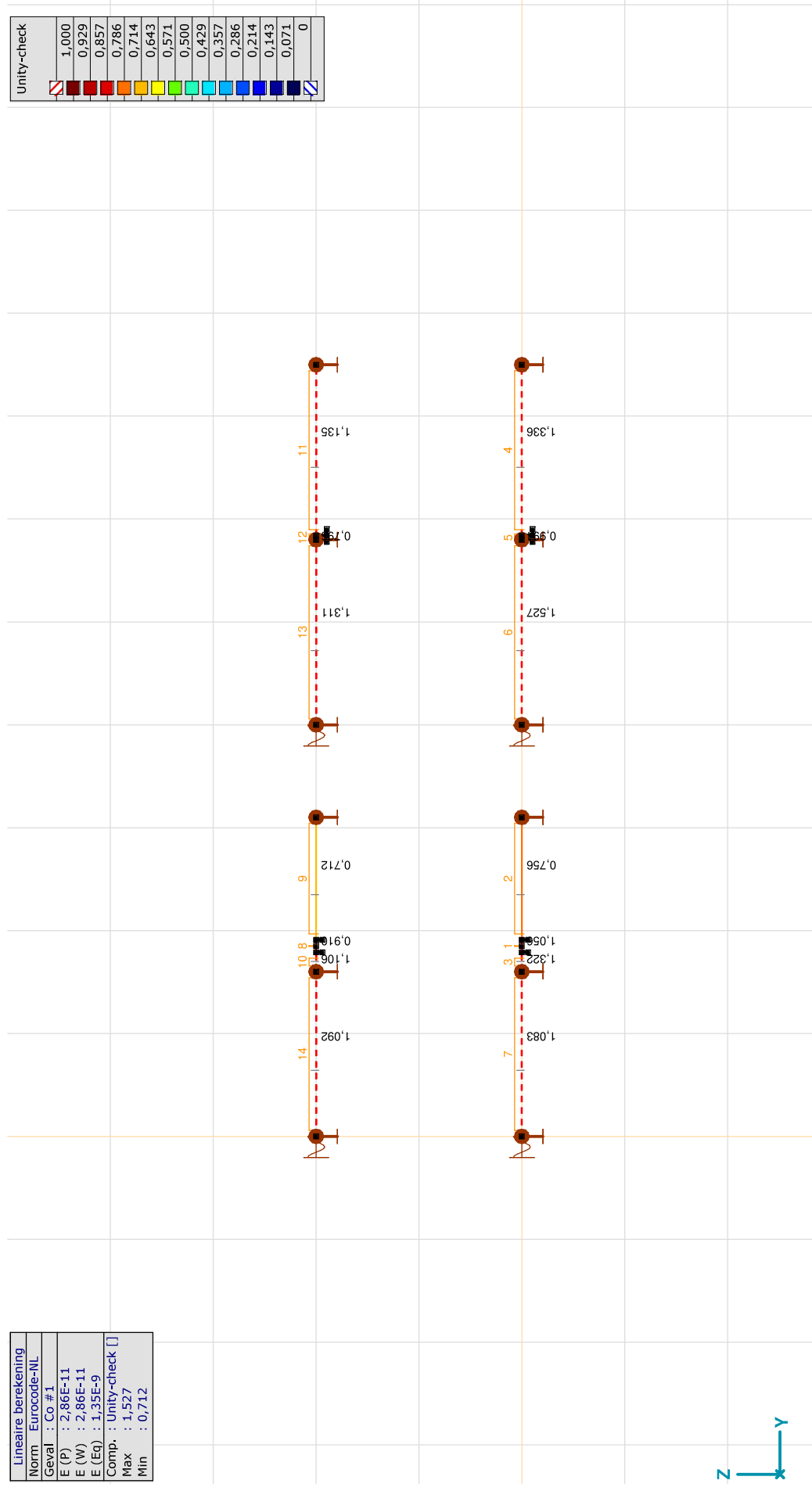
**Project:**

Constructeur: DNV GL - Energy

Model: **Onderrand boventraverse.axs**

Lineaire berekening
Norm Eurocode-NL
Geval : Co #1
E (P) : 2,86E-11
E (W) : 2,86E-11
E (Eq) : 1,35E-9
Comp. : Unity-check [ ]
Max : 1,527
Min : 0,712

Unity-check	
	1,000
	0,929
	0,857
	0,786
	0,714
	0,643
	0,571
	0,500
	0,429
	0,357
	0,286
	0,214
	0,143
	0,071
	0



[Stl], Linear, Co #1 (UGT), Unity-check, Kleuren 2D, Zijaanzicht

## **Project:**

**Constructeur: DNV GL - Energy**

AxisVM X6 R1q - Geregistreerd aan DNV GL - Energy  
Liggers D+3,6 HAF.axs

**Rapport**

## Rapport, Inhoudsopgave

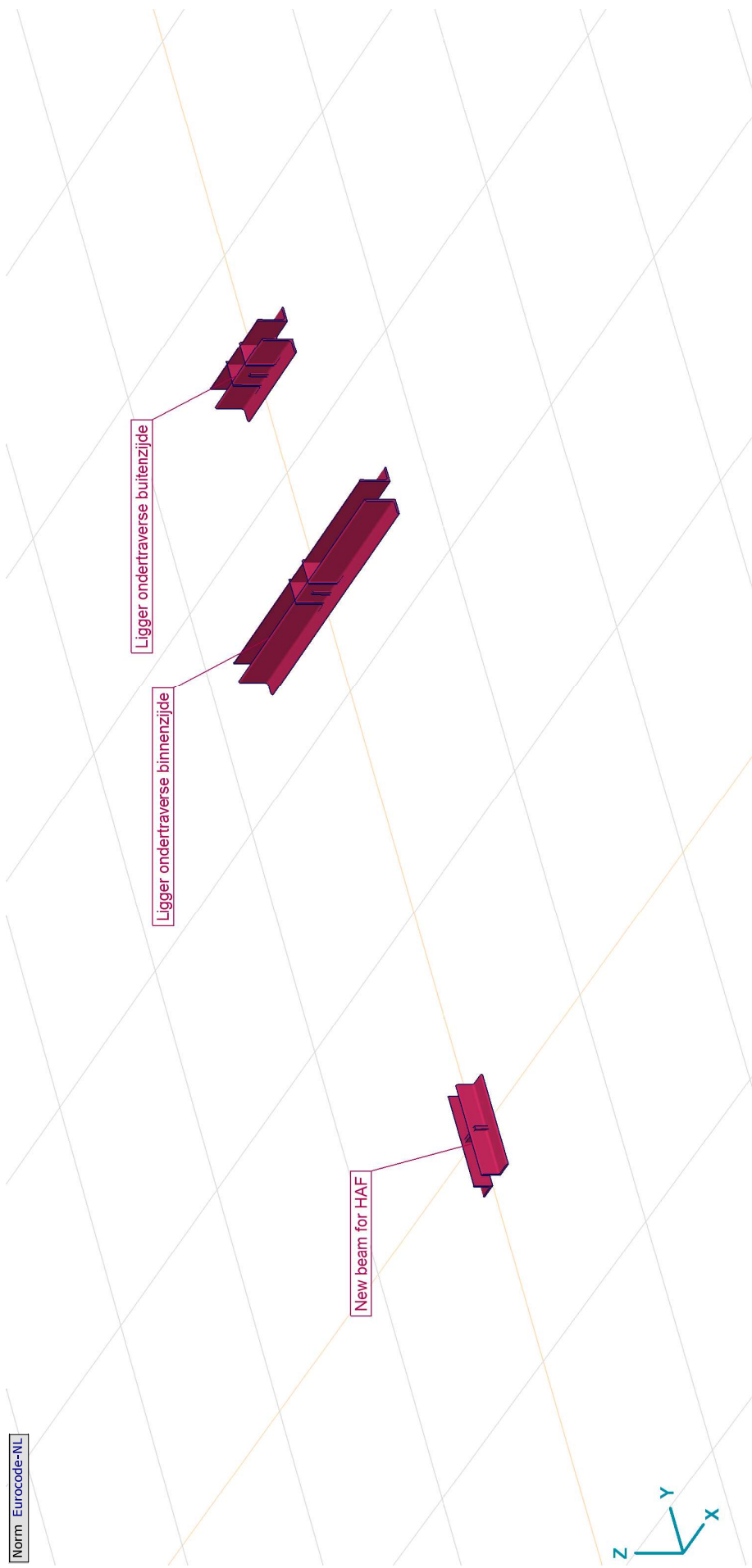
Onderdeel	Pagina	Onderdeel	Pagina
rendered view	3	3_90	16
Materialen	4	Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen	17
Tekening	5	[I], > Liggers, Linear, Omhullende (Alle UGT ), My, Lijnen (gevuld)	17
Knopen	6	[I], > Liggers, Linear, Omhullende (Alle UGT ), Mz, Lijnen (gevuld)	18
Staven	7	[I], > Liggers, Linear, Omhullende (Alle UGT ), Nx, Lijnen (gevuld)	19
Tekening profielen	8	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)	20
Profielen	9	[I], > Liggers, Linear, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)	21
Tekening staven	11	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rx (knoopopl.), Lijnen	22
Staafaansluitingen	12	[I], > Liggers, Linear, Omhullende (Alle UGT ), Ry (knoopopl.), Lijnen	23
EG: Staaf eigen gewicht	12	[I], > Liggers, Linear, Omhullende (Alle UGT ), Rz (knoopopl.), Lijnen	24
SLS 7	13	<b>Interne krachten knoopoplegging [Linear, Omhullende (Alle UGT ), Liggers]</b>	25
SLS 7: Knooppbelastingen	14	[I], Linear, Omhullende (Alle UGT ), eY, Lijnen	28
1a_90: Knooppbelastingen	14	[I], Linear, Omhullende (Alle UGT ), eZ, Lijnen	29
1a_90	15	[I], > Liggers, Linear, Omhullende (Alle UGT ), Somminmax, Lijnen (gevuld)	30
3_90: Knooppbelastingen	16	[STJ], > Liggers, Linear, Omhullende (Alle UGT ), Unity-check, Lijnen (gevuld)	31

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Norm Eurocode-NL



rendered view



**Project:**







Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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**Materialen**

Naam	Type	Nationale norm	Materiaalnorm	Model	$E_x$ [N/mm <sup>2</sup> ]	$E_y$ [N/mm <sup>2</sup> ]	$\nu$	$\alpha_T$ [1/°C]	$\rho$ [kg/m <sup>3</sup> ]	Materiaal kleur	Contour kleur	Structuur	$P_1$
1	S 235	Staal	Eurocode-NL 10025-2	Lineair	210000	210000	0,30	1,2E-5	7850				$f_y$ [N/mm <sup>2</sup> ] = 235,00
2	S 355	Staal	Eurocode-NL 10025-2	Lineair	210000	210000	0,30	1,2E-5	7850				$f_y$ [N/mm <sup>2</sup> ] = 355,00

Naam	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	$P_9$	$P_{10}$	$P_{11}$	$P_{12}$	$P_{13}$	$P_{14}$
1	$f_{t1}$ [N/mm <sup>2</sup> ] = 360,00	$f_{t2}$ [N/mm <sup>2</sup> ] = 215,00	$f_{t3}$ [N/mm <sup>2</sup> ] = 360,00										
2	$f_{t1}$ [N/mm <sup>2</sup> ] = 510,00	$f_{t2}$ [N/mm <sup>2</sup> ] = 335,00	$f_{t3}$ [N/mm <sup>2</sup> ] = 470,00										

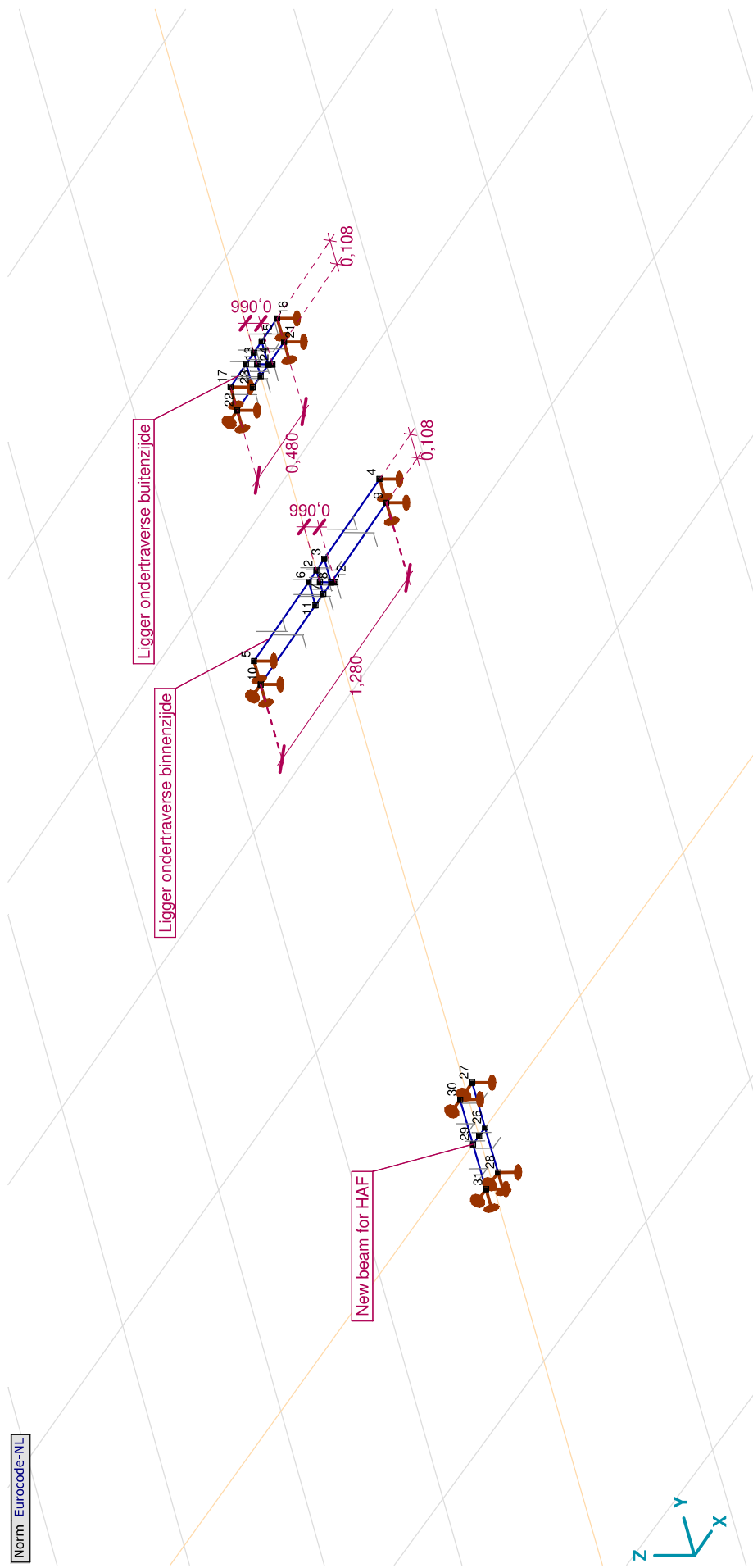
**Naam:** Materiaalnaam; **Type:** Type materiaal; **Model:** Materiaal model;  **$E_x$ :** Elasticiteitsmodulus in lokale x richting;  **$E_y$ :** Elasticiteitsmodulus in lokale y richting;  **$\nu$ :** Poisson's verhouding;  **$\alpha_T$ :** Warmteuitzettingscoëfficiënt;  **$\rho$ :** Dichtheid; **Materiaal kleur:** Materiaalkleur; **Contour kleur:** Contourkleur;  **$P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{11}, P_{12}, P_{13}, P_{14}$ :** Ontwerpparameter;

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Tekening

**Project:**

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**Knopen**

1	0	2,500	0	8	0,080	2,446	0	15	0,080	3,554	0	22	-0,240	3,446	0	29	-0,060	0	0
2	0	2,554	0	9	0,640	2,446	0	16	0,240	3,554	0	23	-0,080	3,446	0	30	-0,060	0,200	0
3	0,080	2,554	0	10	-0,640	2,446	0	17	-0,240	3,554	0	24	0	3,500	-0,066	31	-0,060	-0,200	0
4	0,640	2,554	0	11	-0,080	2,446	0	18	-0,080	3,554	0	25	0	0	0				
5	-0,640	2,554	0	12	0	2,500	-0,066	19	0	3,446	0	26	0,060	0	0				
6	-0,080	2,554	0	13	0	3,500	0	20	0,080	3,446	0	27	0,060	0,200	0				
7	0	2,446	0	14	0	3,554	0	21	0,240	3,446	0	28	0,060	-0,200	0				

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

## Staven

Start-punt	Eind-punt	Lengte	Lokaal X	Materiaal	Doorsnede	Ref <sub>Z</sub>	<- Aansluitingen	Aansluitingen ->
1	2	0,054	i-j	S 235	2	R1	.	100111
2	3	0,080	i-j	S 235	4	Auto	.	.
3	4	0,560	i-j	S 235	4	Auto	.	.
4	5	0,560	i-j	S 235	4	Auto	.	.
5	6	0,080	j-i	S 235	4	Auto	.	.
6	7	0,080	j-i	S 235	4	Auto	.	.
7	8	0,560	j-i	S 235	4	Auto	.	.
8	11	0,560	j-i	S 235	4	Auto	.	.
9	7	0,080	j-i	S 235	4	Auto	.	.
10	7	0,054	j-i	S 235	2	R1	Schar-YZ	.
11	6	0,108	j-i	S 235	4	Auto	.	.
12	3	0,108	j-i	S 235	4	Auto	.	.
13	12	0,066	j-i	S 235	2	Auto	.	.
14	13	0,054	j-i	S 235	2	R1	.	100111
15	14	0,080	j-i	S 235	4	Auto	.	.
16	15	0,160	j-i	S 235	4	Auto	.	.
17	17	0,160	j-i	S 235	4	Auto	.	.
18	18	0,080	j-i	S 235	4	Auto	.	.
19	20	0,080	j-i	S 235	4	Auto	.	.
20	21	0,160	j-i	S 235	4	Auto	.	.
21	23	0,160	j-i	S 235	4	Auto	.	.
22	19	0,080	j-i	S 235	4	Auto	.	.
23	19	0,054	j-i	S 235	2	R1	Schar-YZ	.
24	23	0,108	j-i	S 235	4	Auto	.	.
25	15	0,108	j-i	S 235	4	Auto	.	.
26	24	0,066	j-i	S 235	2	Auto	.	.
27	27	0,200	j-i	S 355	5	Auto	.	.
28	26	0,200	j-i	S 355	5	Auto	.	.
29	29	0,200	j-i	S 355	5	Auto	.	.
30	31	0,200	j-i	S 355	5	Auto	.	.
31	25	0,060	j-i	S 235	2	R1	.	.
32	29	0,060	j-i	S 235	2	R1	Schar-Y	.

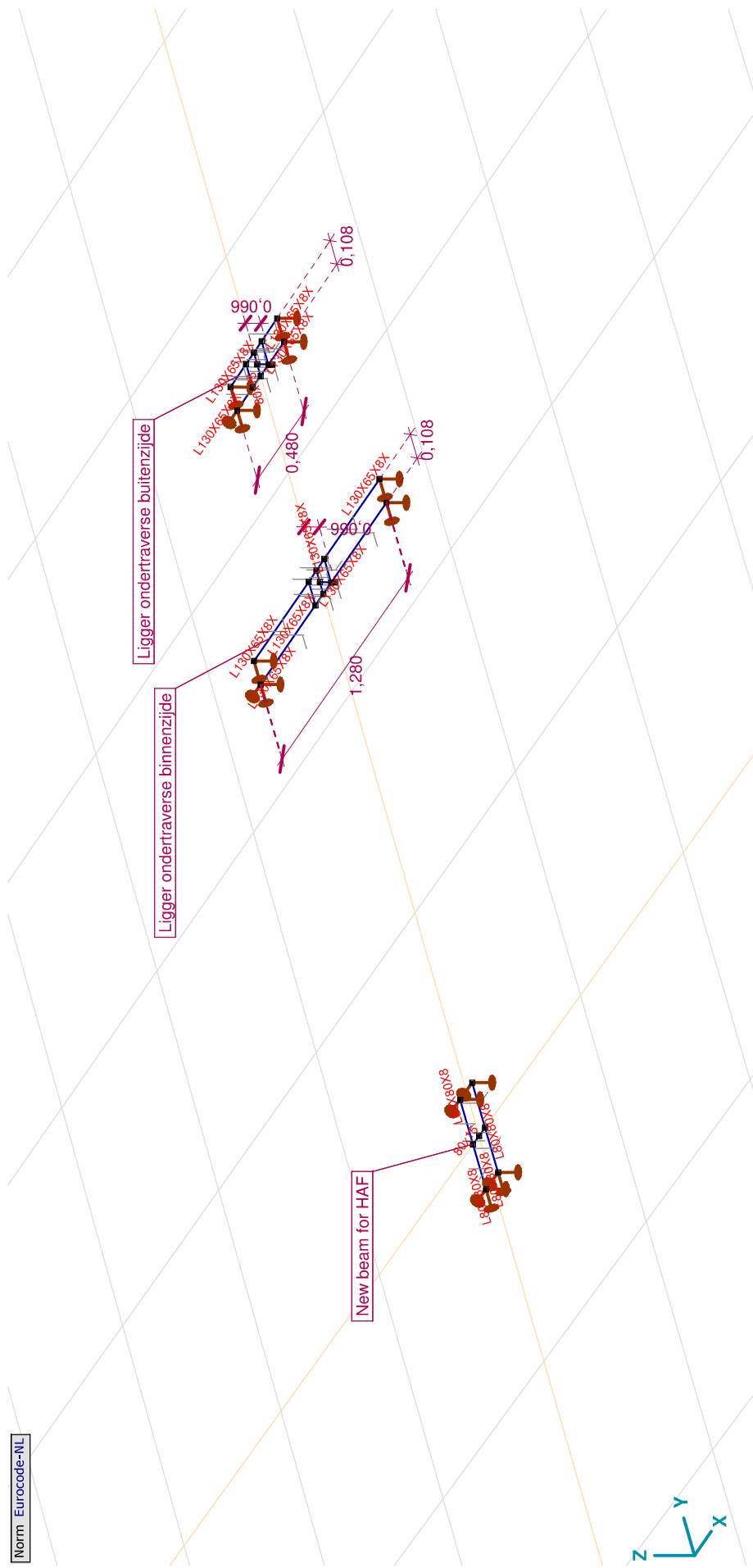
Lengte: Elementlengte; **Lokaal X**: Lokale X-richting; **Ref<sub>Z</sub>**: Referentie voor lokale Z-richting; <- **Aansluitingen**: Staafendaansluitingen op startpunt; **Aansluitingen** ->: Staafendaansluitingen op eindpunt;

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Model: **Liggers D+3.6 HAF.ans**

Norm Eurocode-NL



Tekening profielen

**Project:**





Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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## Profielen

Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	Ax [mm <sup>2</sup> ]	Ay [mm <sup>2</sup> ]	Az [mm <sup>2</sup> ]	I <sub>x</sub> [mm <sup>4</sup> ]	I <sub>y</sub> [mm <sup>4</sup> ]	I <sub>z</sub> [mm <sup>4</sup> ]
1	L 130X 90X10X 	Gewalst	L	130,0	90,0	10,0	10,0	12,0	6,0	0	2115,52	730,05	1115,03	75067,63	3579805,00	1407288,00
2	80x15 	Gewalst	Recht.	15,0	80,0	0	0	0	0	0	1200,00	1000,00	1000,00	79361,69	22500,00	640000,00
3	L 100X 65X 9X 	Gewalst	L	100,0	65,0	9,0	9,0	10,0	5,0	0	1414,78	477,96	772,93	40681,80	1406314,00	466914,90
4	L 130X 65X 8X 	Gewalst	L	130,0	65,0	8,0	8,0	11,0	5,5	0	1509,04	400,01	894,73	34749,90	2625007,00	447616,10

Naam	I <sub>yz</sub> [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	I <sub>ω</sub> [mm <sup>6</sup> ]	W <sub>1,elt</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elt</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	i <sub>y</sub> [mm]	i <sub>z</sub> [mm]	H <sub>y</sub> [mm]	H <sub>z</sub> [mm]
1	L 130X 90X10X	-1302677,00	4189697,00	797396,10	25,09	67E+07	46873,24	17179,39	21346,26	81837,91	34394,52	41,1	25,8	90,0	130,0
2	80x15	0	640000,00	22500,00	90,00	1E+07	16000,00	3000,00	3000,00	24000,00	4500,00	4,3	23,1	80,0	15,0
3	L 100X 65X 9X	-466019,90	1598273,00	274955,80	22,39	2E+07	23552,43	7940,67	10044,04	41416,09	16324,54	31,5	18,2	65,0	100,0
4	L 130X 65X 8X	-608865,80	2783699,00	288924,20	14,61	2,9E+07	32704,41	7411,05	11687,17	56896,01	16576,57	41,7	17,2	65,0	130,0

Naam	Y <sub>G</sub> [mm]	Z <sub>G</sub> [mm]	Y <sub>S</sub> [mm]	Z <sub>S</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> []	S <sub>p</sub>
1	L 130X 90X10X	21,8	41,5	-16,4	112,7	95,4	-292,0	4
2	80x15	40,0	7,5	0	0	0	0	5
3	L 100X 65X 9X	15,9	33,2	-11,1	84,2	70,1	-343,9	4
4	L 130X 65X 8X	13,7	45,6	-9,5	111,6	90,0	-547,9	4

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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**Profielen**

Naam	Tekening	Productie	Vorm	h [mm]	b [mm]	tw [mm]	tf [mm]	r <sub>1</sub> [mm]	r <sub>2</sub> [mm]	r <sub>3</sub> [mm]	A <sub>x</sub> [mm <sup>2</sup> ]	A <sub>y</sub> [mm <sup>2</sup> ]	A <sub>z</sub> [mm <sup>2</sup> ]	I <sub>x</sub> [mm <sup>4</sup> ]	I <sub>y</sub> [mm <sup>4</sup> ]	I <sub>z</sub> [mm <sup>4</sup> ]
5 L 80X 80X 8		Gewalst	L	80,0	80,0	8,0	8,0	10,0	5,0	0	1226,78	537,99	544,05	28221,86	722397,80	722397,80
Naam	I <sub>yz</sub> [mm <sup>4</sup> ]	I <sub>1</sub> [mm <sup>4</sup> ]	I <sub>2</sub> [mm <sup>4</sup> ]	α [°]	I <sub>w</sub> [mm <sup>6</sup> ]	W <sub>1,elt</sub> [mm <sup>3</sup> ]	W <sub>1,elb</sub> [mm <sup>3</sup> ]	W <sub>2,elt</sub> [mm <sup>3</sup> ]	W <sub>2,elb</sub> [mm <sup>3</sup> ]	W <sub>1,pl</sub> [mm <sup>3</sup> ]	W <sub>2,pl</sub> [mm <sup>3</sup> ]	i <sub>y</sub> [mm]	i <sub>z</sub> [mm]	H <sub>y</sub> [mm]	H <sub>z</sub> [mm]	
5 L 80X 80X 8	-423612,40	1146010,00	298785,40	45,00	1,2E+07	20258,79	20258,79	10570,72	9369,56	32196,08	16562,34	24,3	24,3	80,0	80,0	
Naam	y <sub>G</sub> [mm]	z <sub>G</sub> [mm]	y <sub>s</sub> [mm]	z <sub>s</sub> [mm]	β <sub>y</sub> [mm]	β <sub>z</sub> [mm]	β <sub>w</sub> [mm]	S.p.								
5 L 80X 80X 8	22,5	22,5	-17,8	-17,8	72,3	72,3	0	4								

**Naam:** Doorsnede naam; **Productie:** Productieproces; **Vorm:** Profiel; **h:** Doorsnede hoogte; **b:** Doorsnede breedte; **tw:** Lijfdikte; **tf:** Flensdikte; **r<sub>1</sub>, r<sub>2</sub>, r<sub>3</sub>:** Afrondingswaarde; **A<sub>x</sub>, A<sub>y</sub>, A<sub>z</sub>:** Afschuivingsoppervlak; **I<sub>x</sub>:** Torsetraagheidsmoment;

**I<sub>y</sub>, I<sub>z</sub>:** Buigtraagheidsmoment; **I<sub>yz</sub>:** Centrifugaal traagheidsmoment; **I<sub>1</sub>, I<sub>2</sub>:** Hoofdtraagheidsmoment; **I<sub>w</sub>:** Hoofdlijfdikte; **α:** Hoofdrichtingen; **I<sub>w</sub>:** Krommingsconstante; **W<sub>1,elt</sub>, W<sub>2,elt</sub>, W<sub>1,elb</sub>, W<sub>2,elb</sub>:** Elastisch weerstandsmoment; **W<sub>1,pl</sub>, W<sub>2,pl</sub>:** Plastisch weerstandsmoment; **i<sub>y</sub>, i<sub>z</sub>:** Traagheidsstraal;

**H<sub>y</sub>, H<sub>z</sub>:** Afmeting in lokale Y-richting; **H<sub>x</sub>:** Afmeting in lokale Z-richting; **y<sub>G</sub>:** Y-coördinaat van het zwaartepunt; **z<sub>G</sub>:** Z-coördinaat van het zwaartepunt; **y<sub>s</sub>:** Y-coördinaat van het afschuivingsmiddelpunt (torsie); **z<sub>s</sub>:** Z-coördinaat van het afschuivingsmiddelpunt (torsie);

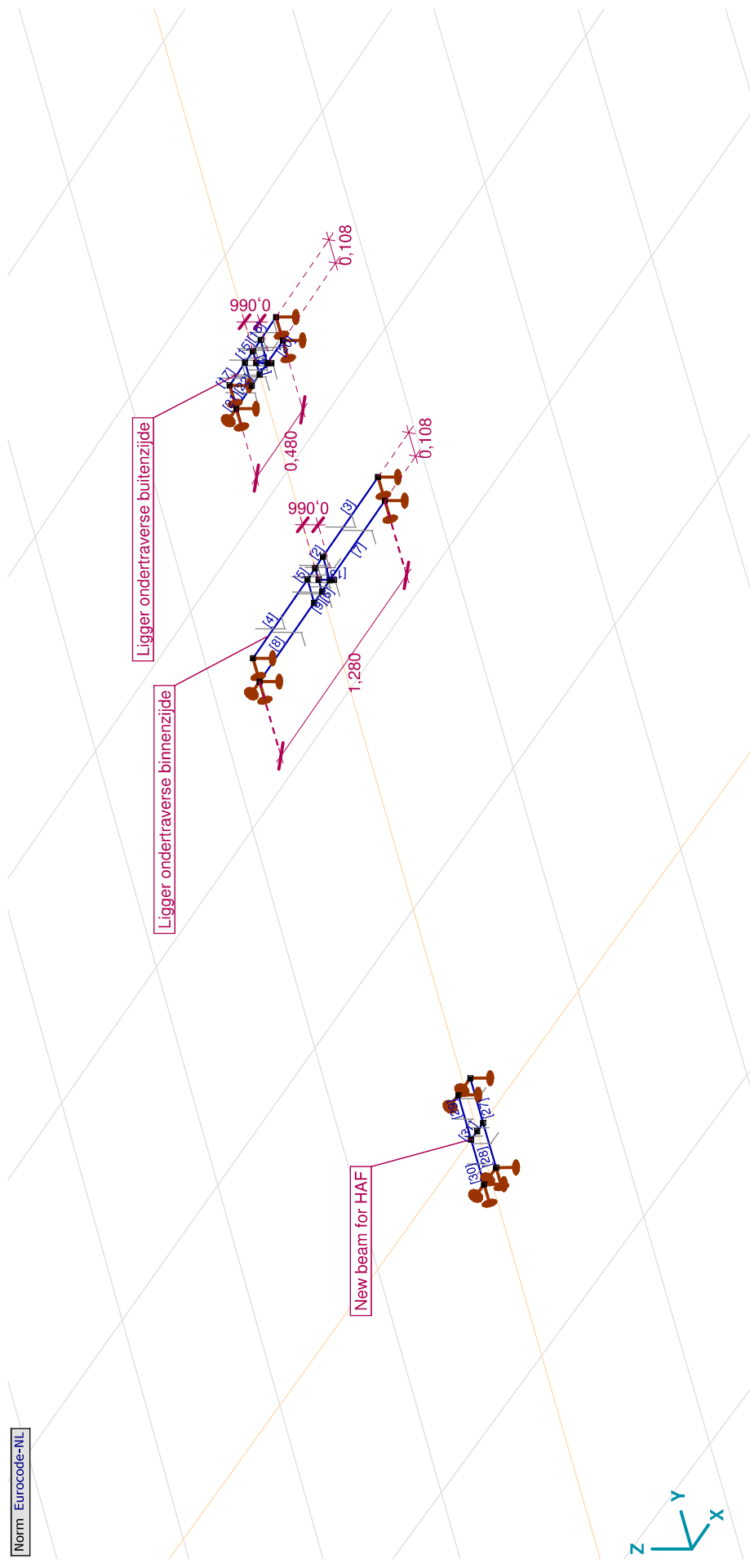
**β<sub>y</sub>, β<sub>z</sub>, β<sub>w</sub>:** Wagner's coefficient; **S.p.:** Spanningspunten;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.ans**

Norm Eurocode-NL



Tekening staven



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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## Staafaansluitingen

	<-Aansluitingen	Aansluitingen ->	<-e <sub>x</sub>	<-θ <sub>x</sub>	<-θ <sub>y</sub>	<-θ <sub>z</sub>
1	.	100111	.	.	.	.
10	Schar-YZ	.	.	.	Vrij	Vrij
14	.	100111	.	.	.	.
23	Schar-YZ	.	.	.	Vrij	Vrij
32	Schar-Y	.	.	.	Vrij	.

<-Aansluitingen: Staafendaansluitingen op startpunt; **Aansluitingen ->**: Staafendaansluitingen op eindpunt; <-e<sub>x</sub>, <-θ<sub>x</sub>, <-θ<sub>y</sub>, <-θ<sub>z</sub>: Type;

## EG: Staaf eigen gewicht

	Σ [kg]
1-32	58,928
<b>Totaal</b>	<b>58,928</b>

Σ: Totale massa:

**Project:**

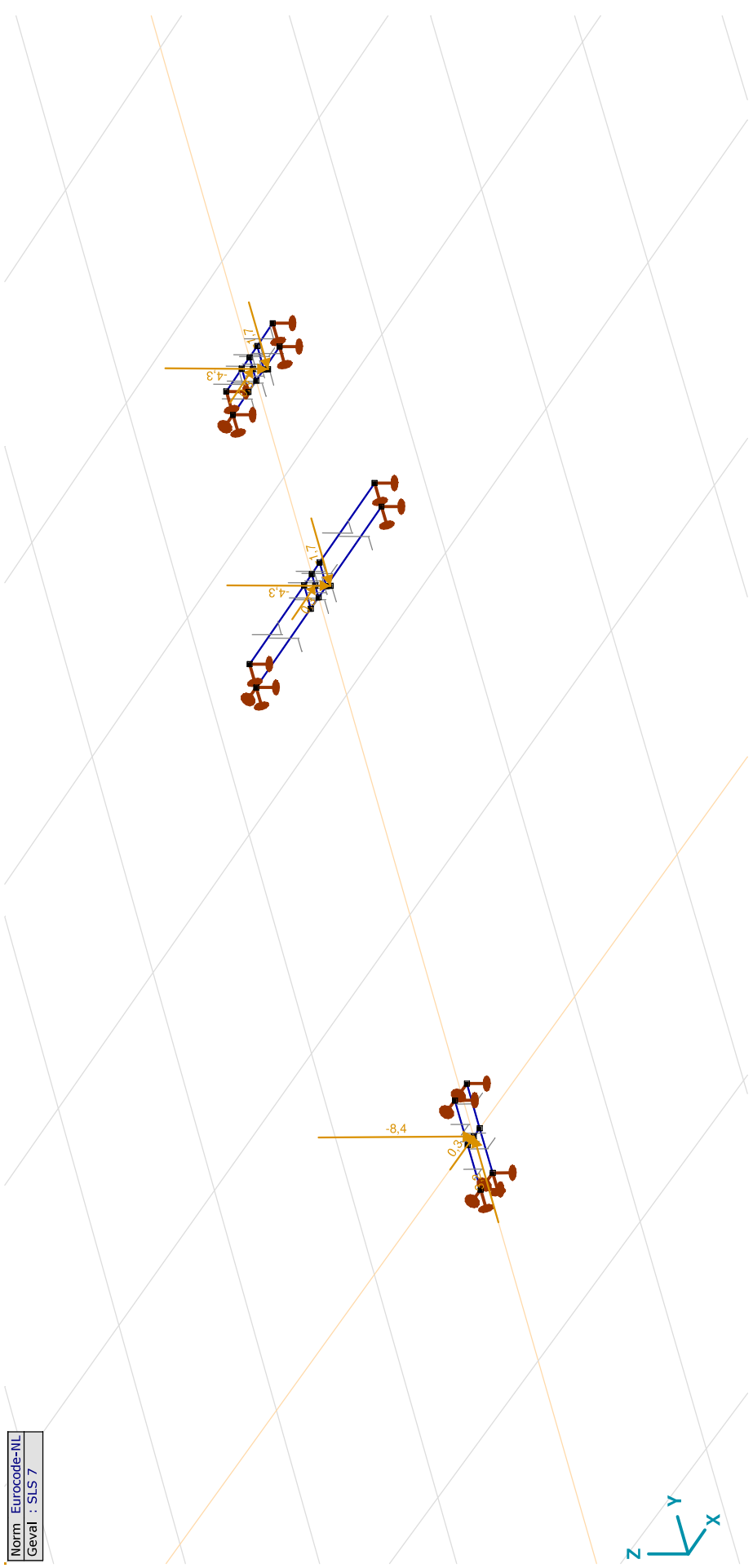
Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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Norm: Eurocode-NL  
Geval: SLS 7



SLS 7

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

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**SLS 7: Knoopbelastingen**

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
1	Globaal	0,3	0	0	0	0	0
12	Globaal	0	-1,7	-4,3	0	0	0
13	Globaal	0,3	0	0	0	0	0
24	Globaal	0	-1,7	-4,3	0	0	0
25	Globaal	0,3	3,2	-8,4	0	0	0

**F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>:** Belastingkracht component; **M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>:** Belastingmoment component;**1a\_90: Knoopbelastingen**

	Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
1	Globaal	1,3	0	0	0	0	0
12	Globaal	0	-7,2	-5,4	0	0	0
13	Globaal	1,3	0	0	0	0	0
24	Globaal	0	-7,2	-5,4	0	0	0
25	Globaal	2,4	14,7	-12,0	0	0	0

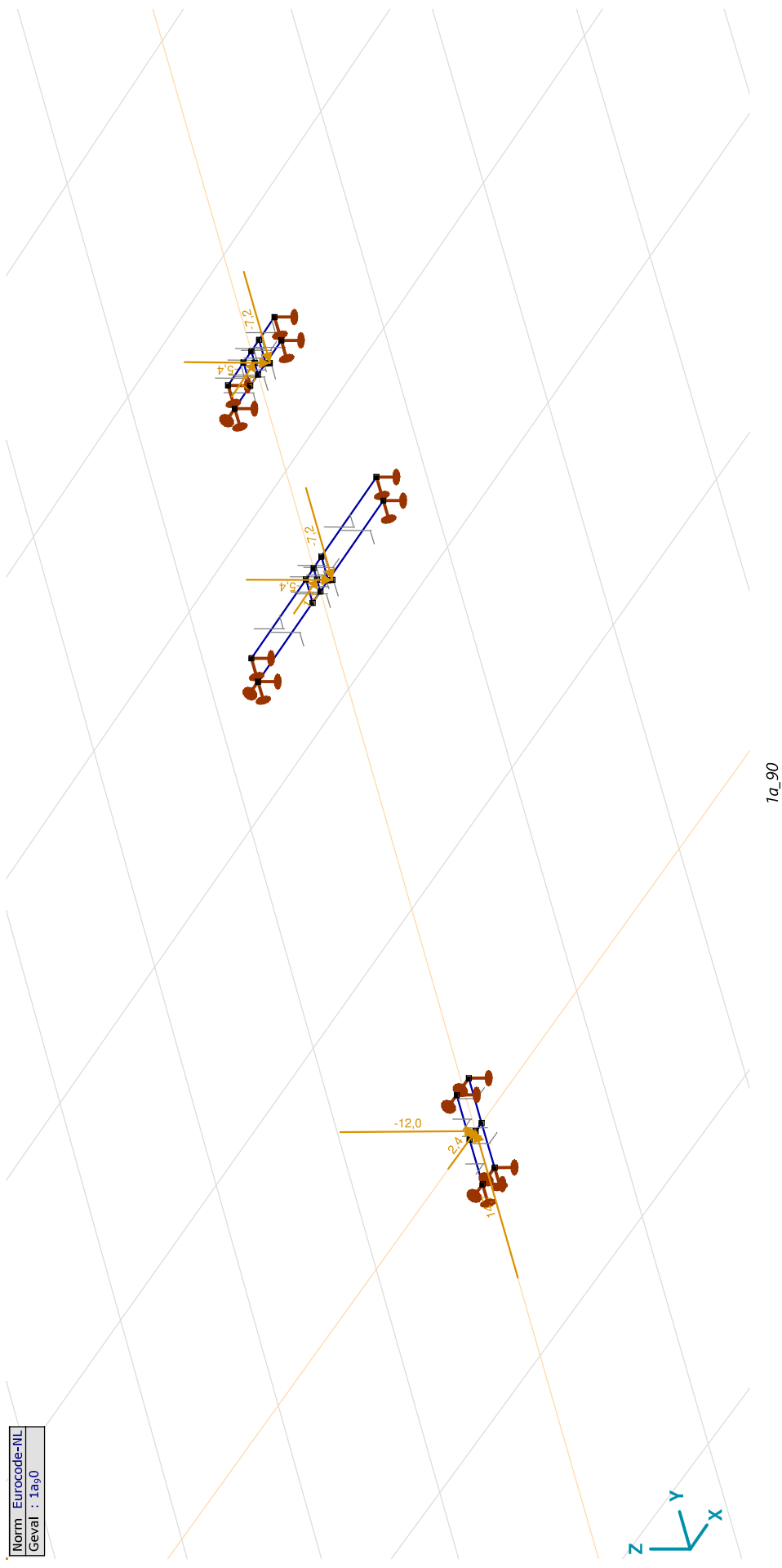
**F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>:** Belastingkracht component; **M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>:** Belastingmoment component;

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Norm Eurocode-NL  
Geval : 1a<sub>90</sub>



**Project:**

Constructeur: DNV GL - Energy

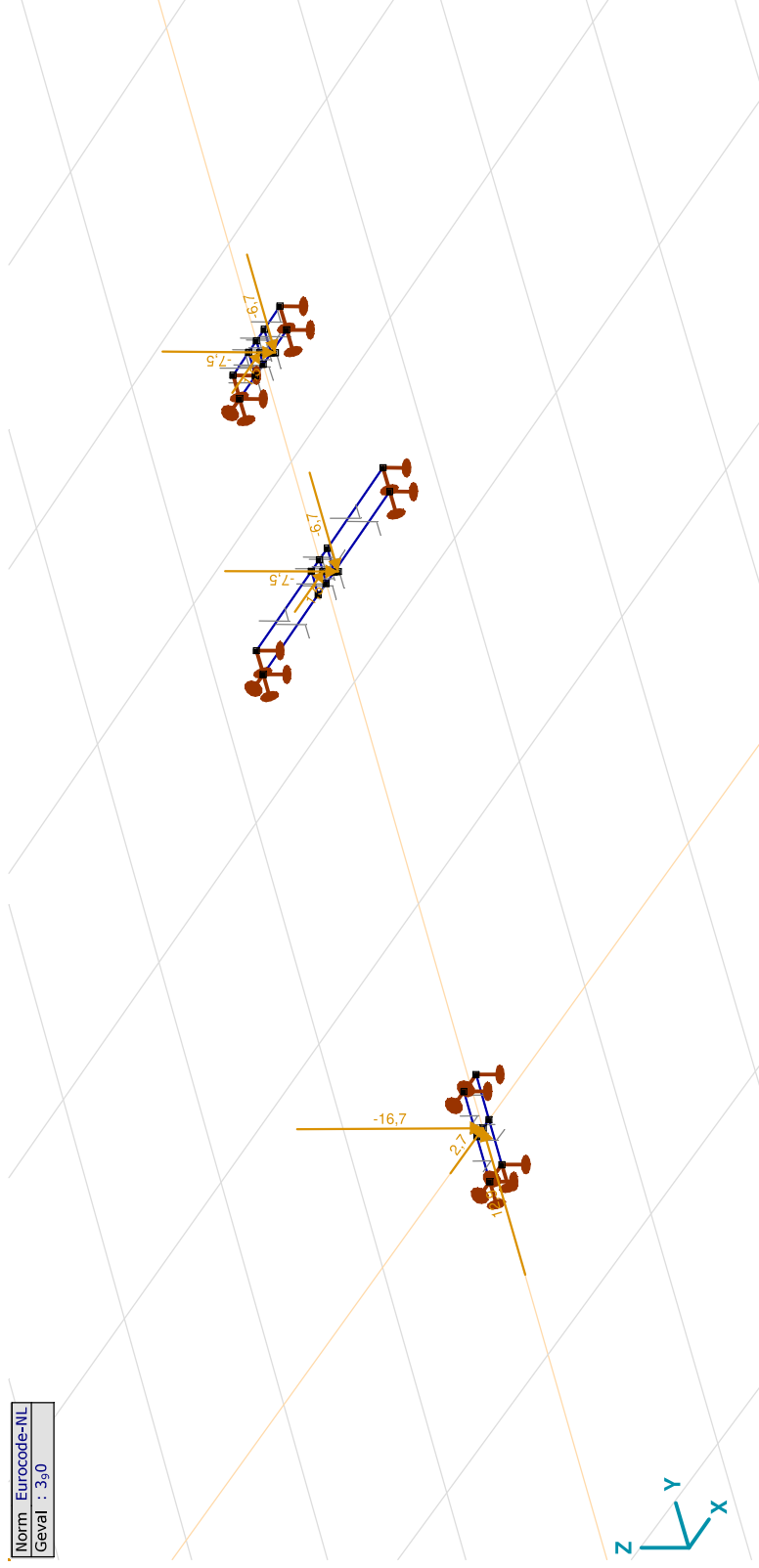
Model: **Liggers D+3.6 HAF.axs**

3\_90: Knoopbelastingen

Richting	F <sub>x</sub> [kN]	F <sub>y</sub> [kN]	F <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
1	1,5	0	0	0	0	0
12	0	-6,7	-7,5	0	0	0
13	1,5	0	0	0	0	0
24	0	-6,7	-7,5	0	0	0
25	2,7	12,9	-16,7	0	0	0

F<sub>x</sub>, F<sub>y</sub>, F<sub>z</sub>: Belastingkracht component; M<sub>x</sub>, M<sub>y</sub>, M<sub>z</sub>: Belastingmoment component;

Norm Eurocode-NL  
Geval : 3\_90



**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

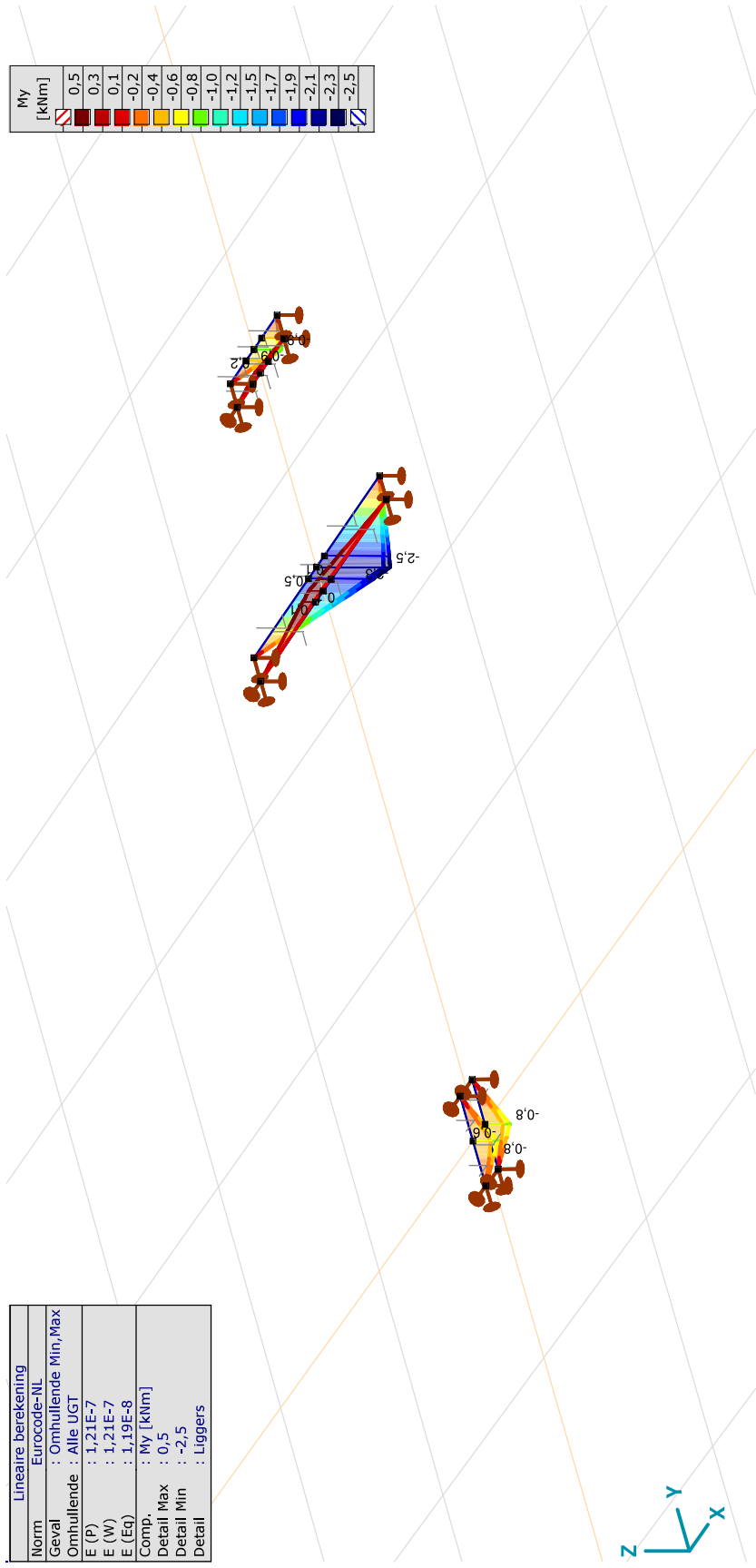
Gebruiker gedefinieerde belastingcombinaties uit belastinggevallen

Naam	Type	ST1	EG (PERM1)	SLS 7 (VERT)	1a_90 (VERT)	3_90 (VERT)	Commentaar
1	UGT	0	1,20	0	1,00	0	
2	UGT	0	1,20	0	0	1,00	
3	BGT Quasi-blijvend	0	1,00	1,00	0	0	

Naam: Naam belastingcombinatie; Type: Type belastingcombinatie; ST1, EG (PERM1), SLS 7 (VERT), 1a\_90 (VERT), 3\_90 (VERT); Factor:

Lineaire berekening	
Norm	: Eurocode-NL
Geval	: Omhullende Min,Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,719E-8
Comp.	: My [kNm]
Detail Max	: 0,5
Detail Min	: -2,5
Detail	: Liggers

My [kNm]
0,5
0,3
0,1
-0,1
-0,4
-0,6
-0,8
-1,0
-1,2
-1,5
-1,7
-1,9
-2,1
-2,3
-2,5



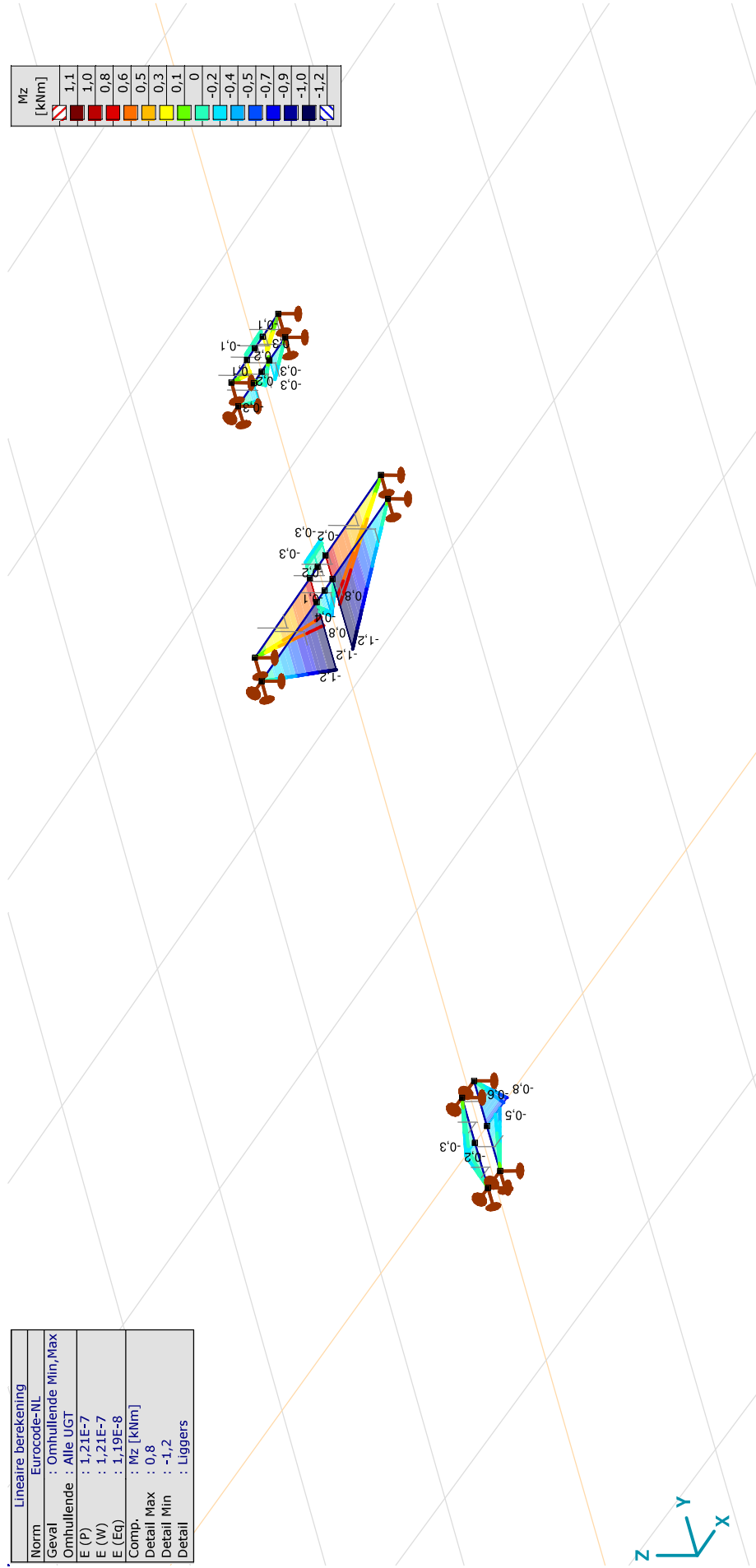
[1], > Liggers, Lineair, Omhullende (Alle UGT ), My, Lijnen (gevuld)

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Mz [kNm]
Detail Max	: 0,8
Detail Min	: -1,2
Detail	: Liggers



[J] > Liggers, Lineair, Omhullende (Alle UGT), Mz, Lijnen (gevuld)

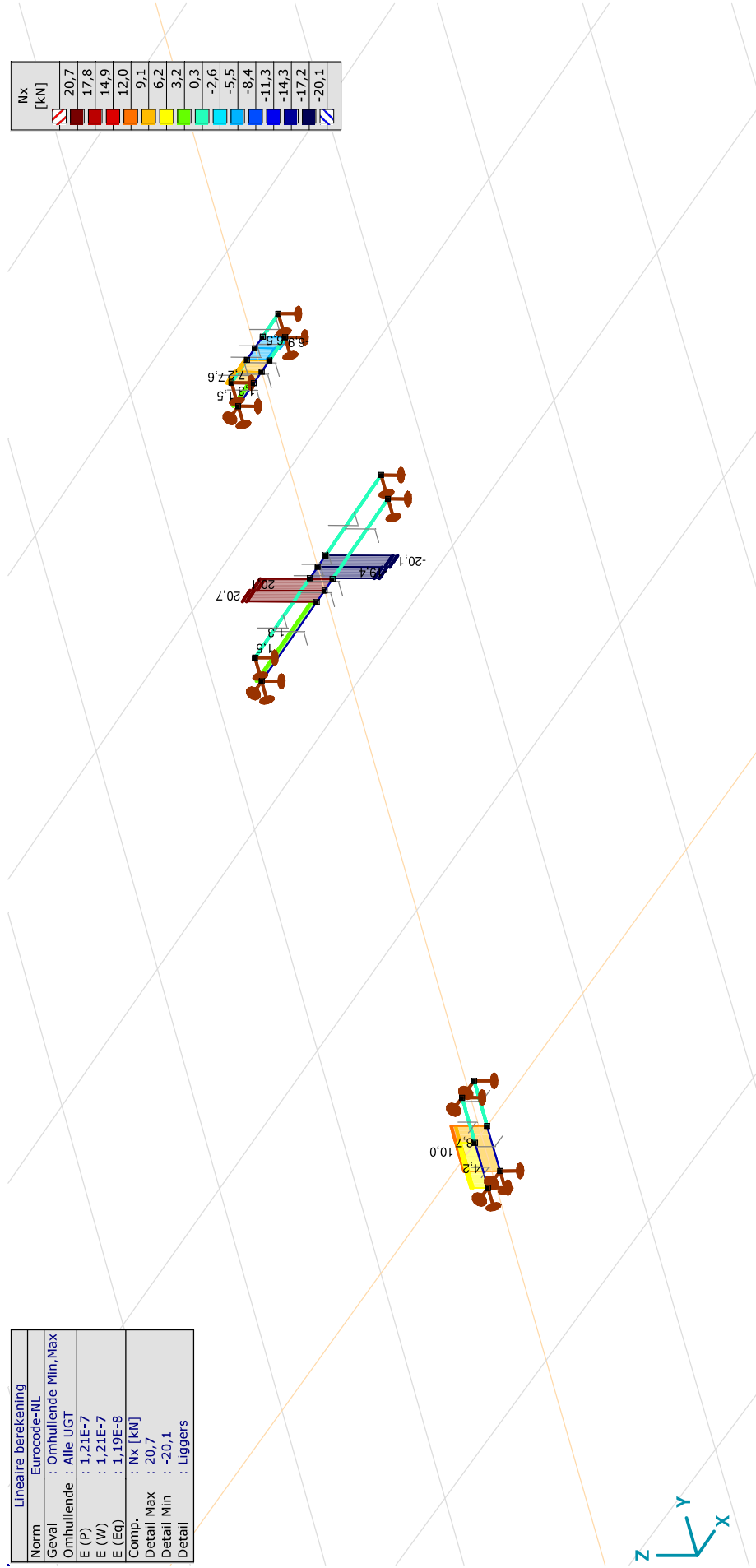
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Nx [kN]
Detail Max	: 20,7
Detail Min	: -20,1
Detail	: Liggers

Nx [kN]
20,7
17,8
14,9
12,0
9,1
6,2
3,2
0,3
-2,6
-5,5
-8,4
-11,3
-14,3
-17,2
-20,1



[I] > Liggers, Lineair, Omhullende (Alle UGT), Nx, Lijnen (gevuld)

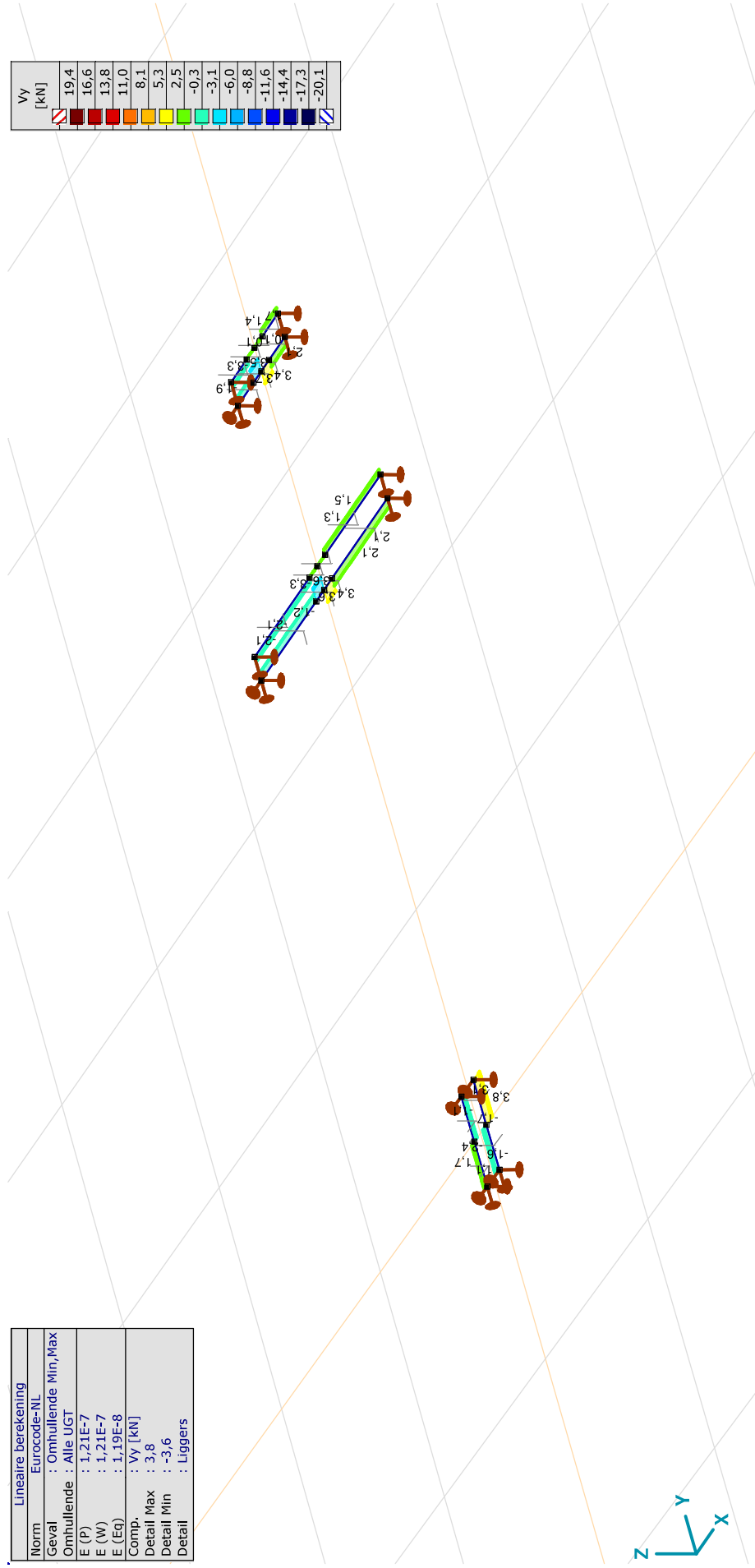
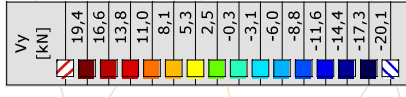


**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Vy [kN]
Detail Max	: 3,8
Detail Min	: -3,6
Detail	: Liggers



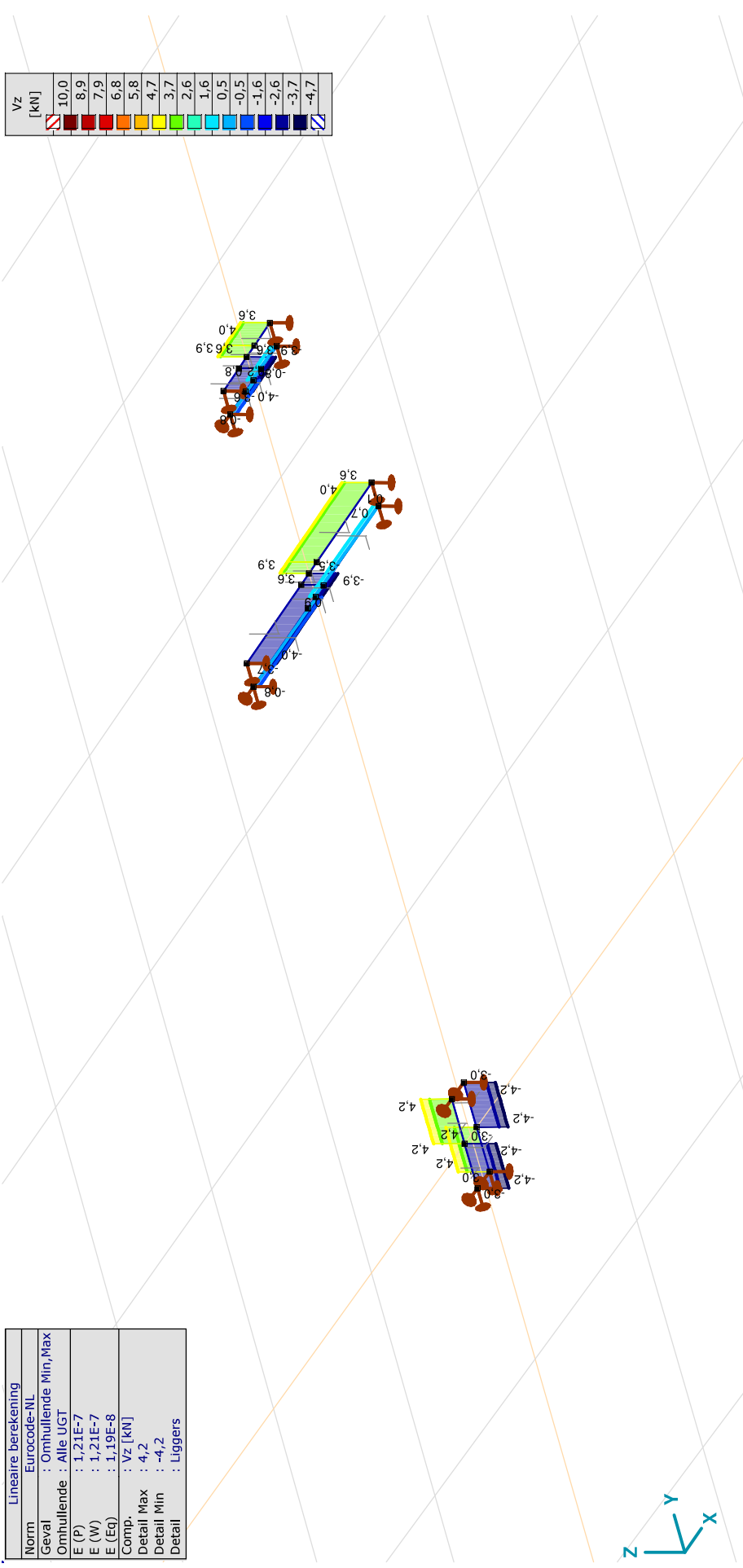
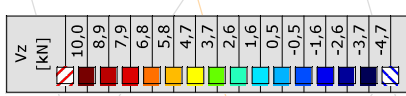
||| > Liggers, Lineair, Omhullende (Alle UGT ), Vy, Lijnen (gevuld)

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Vz [kN]
Detail Max	: 4,2
Detail Min	: -4,2
Detail	: Liggers



III. > Liggers, Lineair, Omhullende (Alle UGT ), Vz, Lijnen (gevuld)

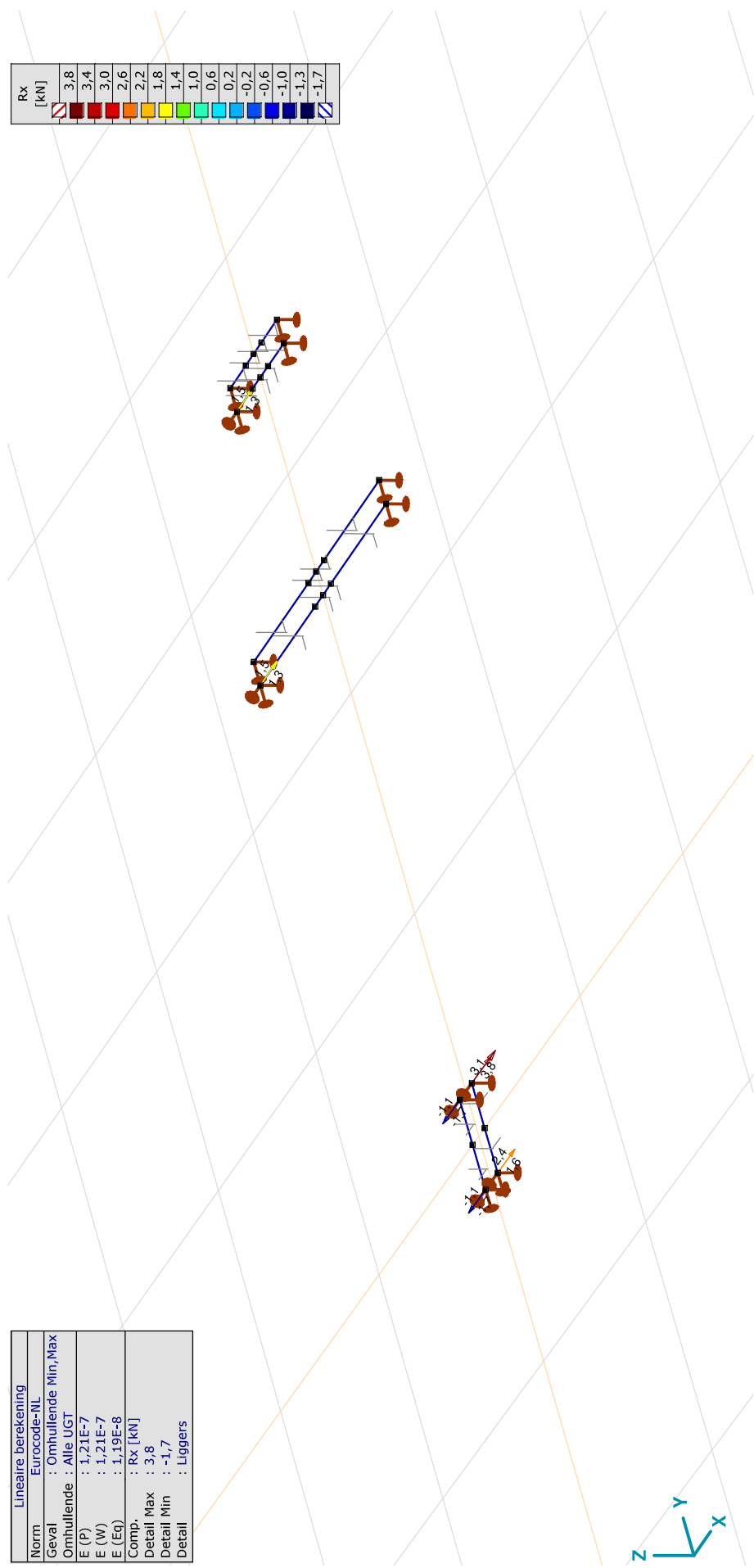
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Rx [kN]
Detail Max	: 3,8
Detail Min	: -1,7
Detail	: Liggers

Rx [kN]
3,8
3,4
3,0
2,6
2,2
1,8
1,4
1,0
0,6
0,2
-0,2
-0,6
-1,0
-1,3
-1,7



III) > Liggers, Lineair, Omhullende (Alle UGT), Rx (knoopopl.), Lijnen

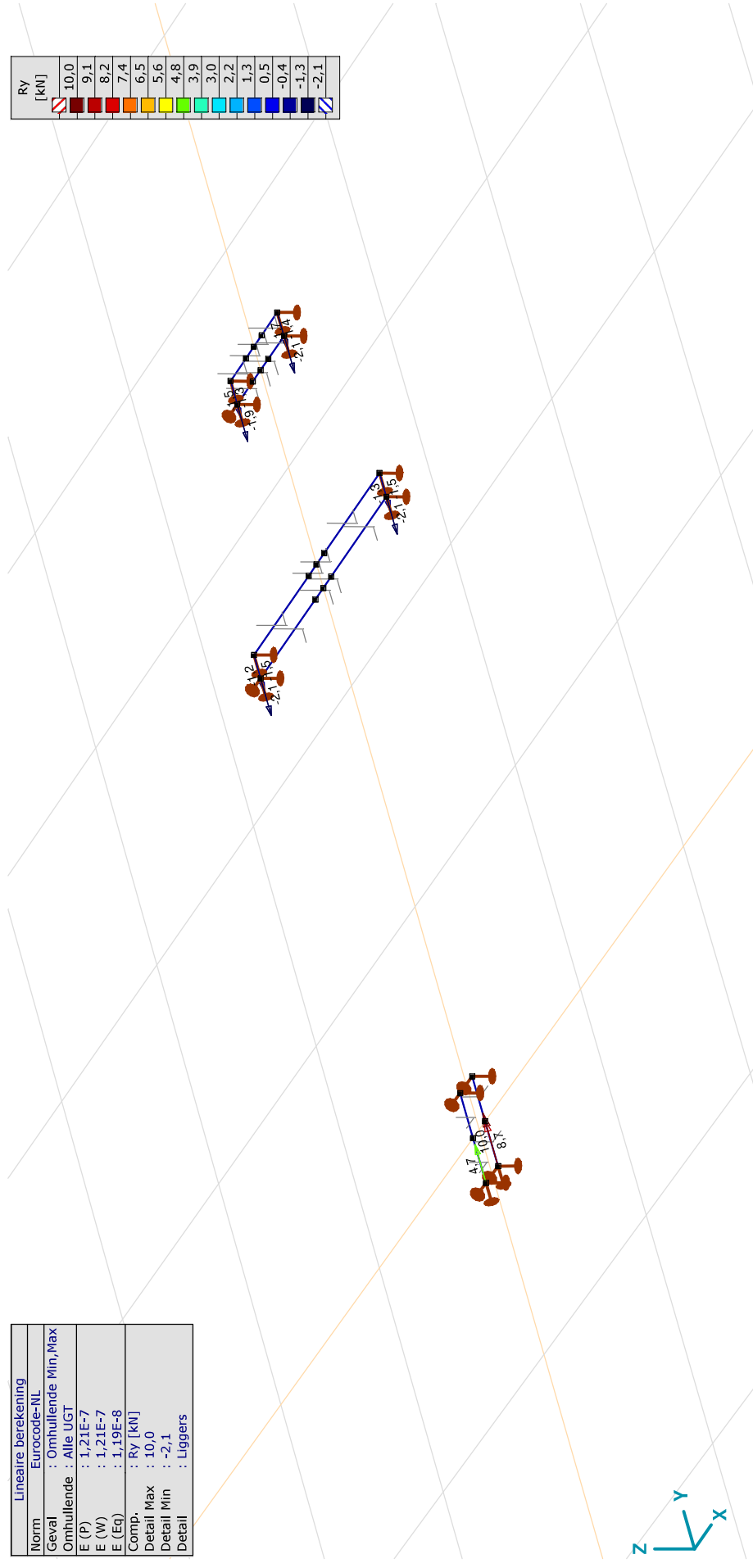
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Ry [kN]
Detail Max	: 10,0
Detail Min	: -2,1
Detail	: Liggers

Ry [kN]
10,0
9,1
8,2
7,4
6,5
5,6
4,8
3,9
3,0
2,2
1,3
0,5
-0,4
-1,3
-2,1



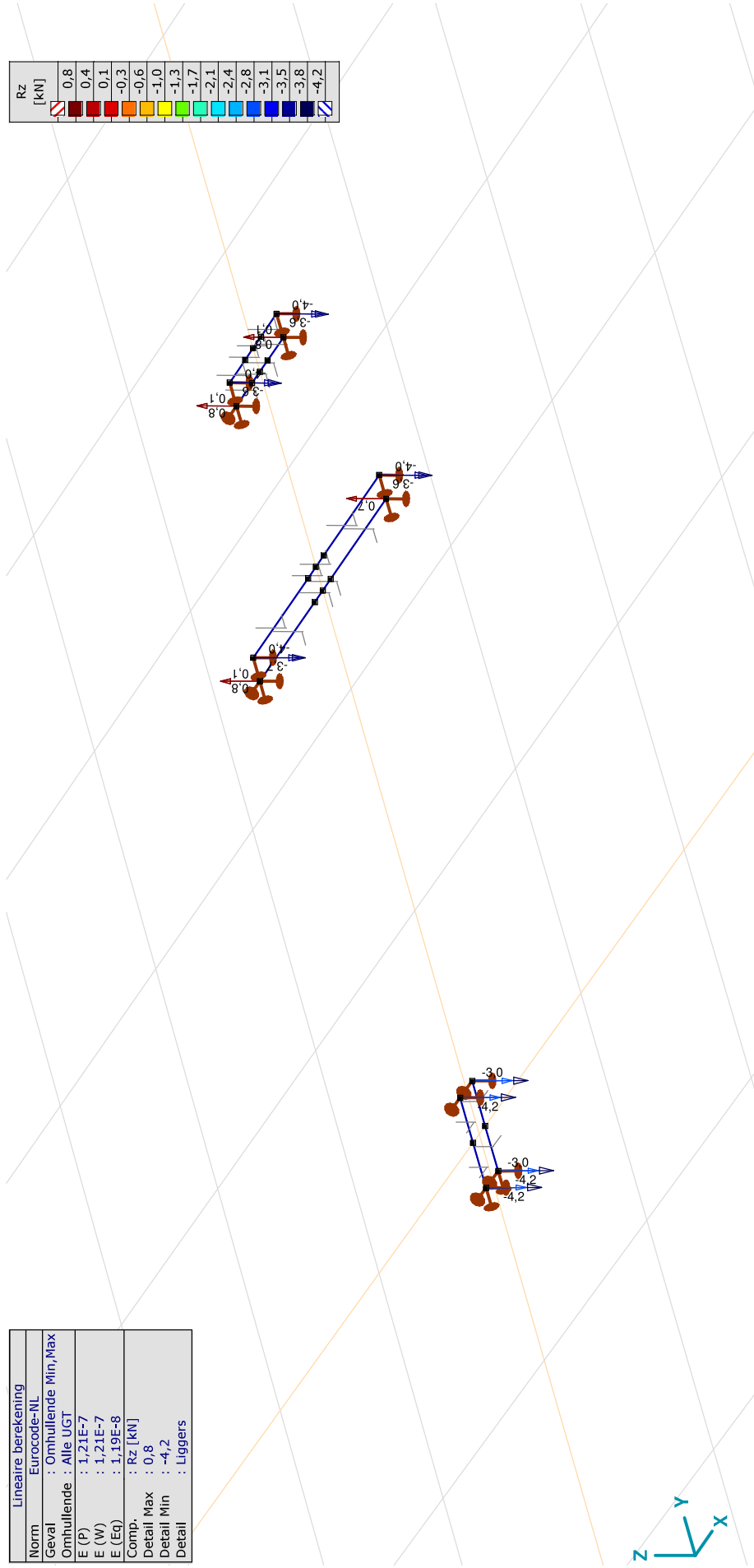
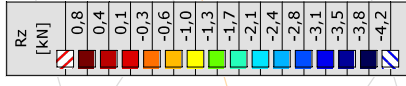
III) > Liggers, Lineair, Omhullende (Alle UGT), Ry (knoopopl.), Lijnen

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Rz [kN]
Detail Max	: 0,8
Detail Min	: -4,2
Detail	: Liggers



III) > Liggers, Lineair, Omhullende (Alle UGT), Rz (knoopopl.), Lijnen

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha$ R
1	4	0,640	2,554	0	Glob.	Ry	Co #1		-1,5	-3,6	4,0	-0,415
							Co #2		-1,3	-4,0	4,2	-0,315
						Rz	Co #2		-1,3	-4,0	4,2	-0,315
							Co #1		-1,5	-3,6	4,0	-0,415
							Co #1		-1,5	-3,6	4,0	-0,415
							Co #2		-1,3	-4,0	4,2	-0,315
2	5	-0,640	2,554	0	Glob.	Ry	Co #1		-1,5	-3,7	3,9	-0,399
							Co #2		-1,2	-4,0	4,2	-0,299
						Rz	Co #2		-1,2	-4,0	4,2	-0,299
							Co #1		-1,5	-3,7	3,9	-0,399
							Co #1		-1,5	-3,7	3,9	-0,399
							Co #2		-1,2	-4,0	4,2	-0,299
3	9	0,640	2,446	0	Glob.	Ry	Co #2		-2,1	0,1	2,1	31,297
							Co #1		-2,1	0,7	2,3	2,868
						Rz	Co #2		-2,1	0,1	2,1	31,297
							Co #1		-2,1	0,7	2,3	2,868
							Co #1		-2,1	0,7	2,3	2,868
							Co #2		-2,1	0,1	2,1	31,297
4	10	-0,640	2,446	0	Glob.	Rx	Co #1	1,3	-2,1	0,8	2,6	3,277
							Co #2	1,5	-2,1	0,1	2,6	35,297
						Ry	Co #1	1,3	-2,1	0,8	2,6	3,277
							Co #2	1,5	-2,1	0,1	2,6	35,297
						Rz	Co #2	1,5	-2,1	0,1	2,6	35,297
							Co #1	1,3	-2,1	0,8	2,6	3,277
	Co #1	1,3	-2,1	0,8	2,6	3,277						
	Co #2	1,5	-2,1	0,1	2,6	35,297						
5	16	0,240	3,554	0	Glob.	Ry	Co #1		-1,7	-3,6	4,0	-0,468
							Co #2		-1,4	-4,0	4,2	-0,359
						Rz	Co #2		-1,4	-4,0	4,2	-0,359
							Co #1		-1,7	-3,6	4,0	-0,468
							Co #1		-1,7	-3,6	4,0	-0,468
							Co #2		-1,4	-4,0	4,2	-0,359

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

## Interne krachten knooppogging [Lineair, Omhullende (Alle UGT ), Liggers]

Knoop	X [m]	Y [m]	Z [m]	Type	C	min. max.	Geval	Rx [kN]	Ry [kN]	Rz [kN]	Rr [kN]	$\alpha R$
6	-0,240	3,554	0	Glob.	Ry	min	Co #1		-1,5	-3,6	3,9	-0,427
						max	Co #2		-1,3	-4,0	4,2	-0,317
						min	Co #2		-1,3	-4,0	4,2	-0,317
						max	Co #1		-1,5	-3,6	3,9	-0,427
						min	Co #1		-1,5	-3,6	3,9	-0,427
						max	Co #2		-1,3	-4,0	4,2	-0,317
7	0,240	3,446	0	Glob.	Ry	min	Co #2		-2,1	0,1	2,1	16,704
						max	Co #1		-2,1	0,8	2,2	2,568
						min	Co #2		-2,1	0,1	2,1	16,704
						max	Co #1		-2,1	0,8	2,2	2,568
						min	Co #1		-2,1	0,8	2,2	2,568
						max	Co #2		-2,1	0,1	2,1	16,704
8	-0,240	3,446	0	Glob.	Rx	min	Co #1	1,3	-1,9	0,8	2,5	2,876
						max	Co #2	1,5	-1,9	0,1	2,4	19,133
						min	Co #2	1,5	-1,9	0,1	2,4	19,133
						max	Co #1	1,3	-1,9	0,8	2,5	2,876
						min	Co #2	1,5	-1,9	0,1	2,4	19,133
						max	Co #1	1,3	-1,9	0,8	2,5	2,876
9	0,060	0,200	0	Glob.	Rx	min	Co #1	3,1		-3,0	4,4	-1,030
						max	Co #2	3,8		-4,2	5,7	-0,898
						min	Co #2	3,8		-4,2	5,7	-0,898
						max	Co #1	3,1		-3,0	4,4	-1,030
						min	Co #1	3,1		-3,0	4,4	-1,030
						max	Co #2	3,8		-4,2	5,7	-0,898
10	0,060	-0,200	0	Glob.	Rx	min	Co #1	1,6	10,0	-3,0	10,5	-3,343
						max	Co #2	2,4	8,7	-4,2	10,0	-2,163
						min	Co #2	2,4	8,7	-4,2	10,0	-2,163
						max	Co #1	1,6	10,0	-3,0	10,5	-3,343
						min	Co #2	2,4	8,7	-4,2	10,0	-2,163
						max	Co #1	1,6	10,0	-3,0	10,5	-3,343



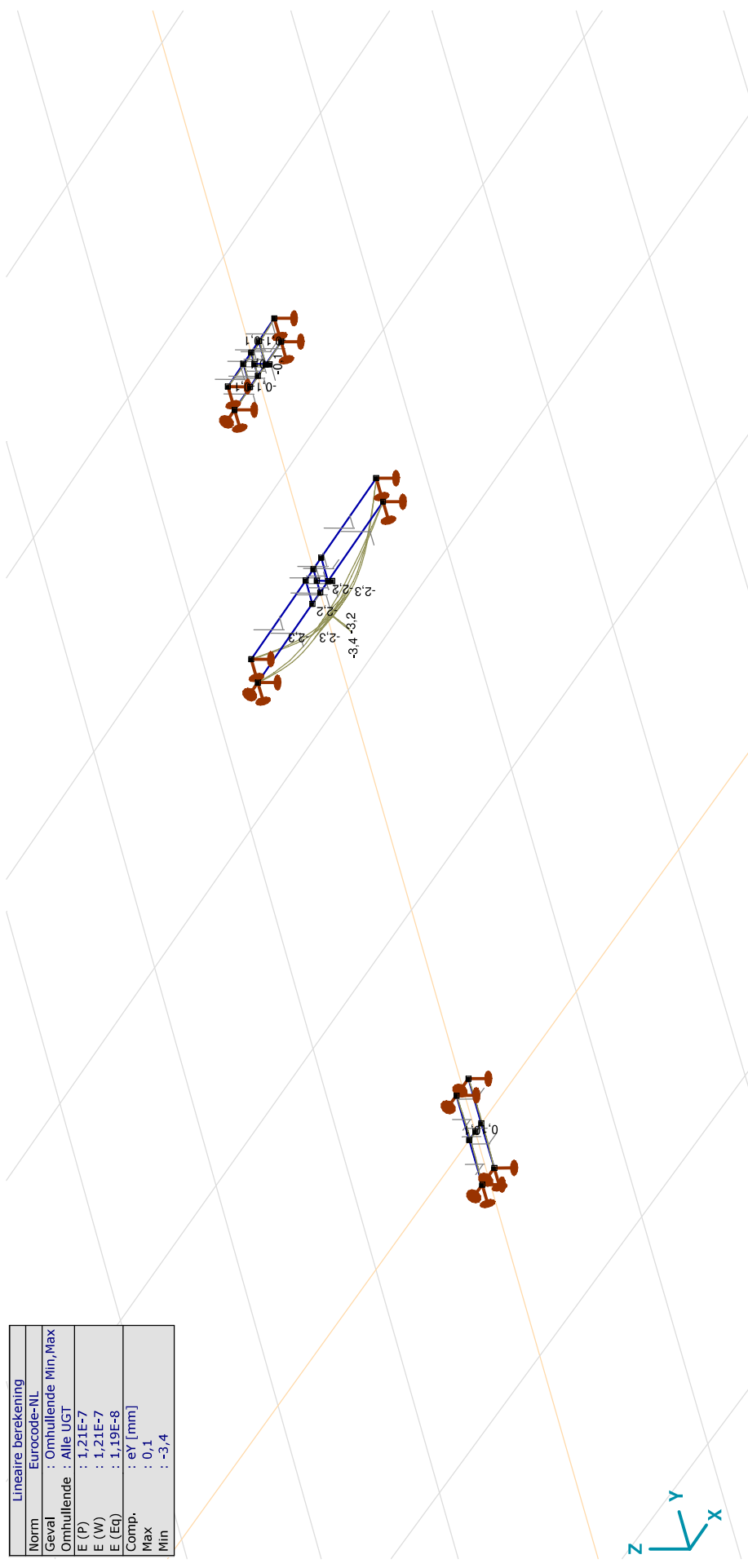


**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: eY [mm]
Max	: 0,1
Min	: -3,4



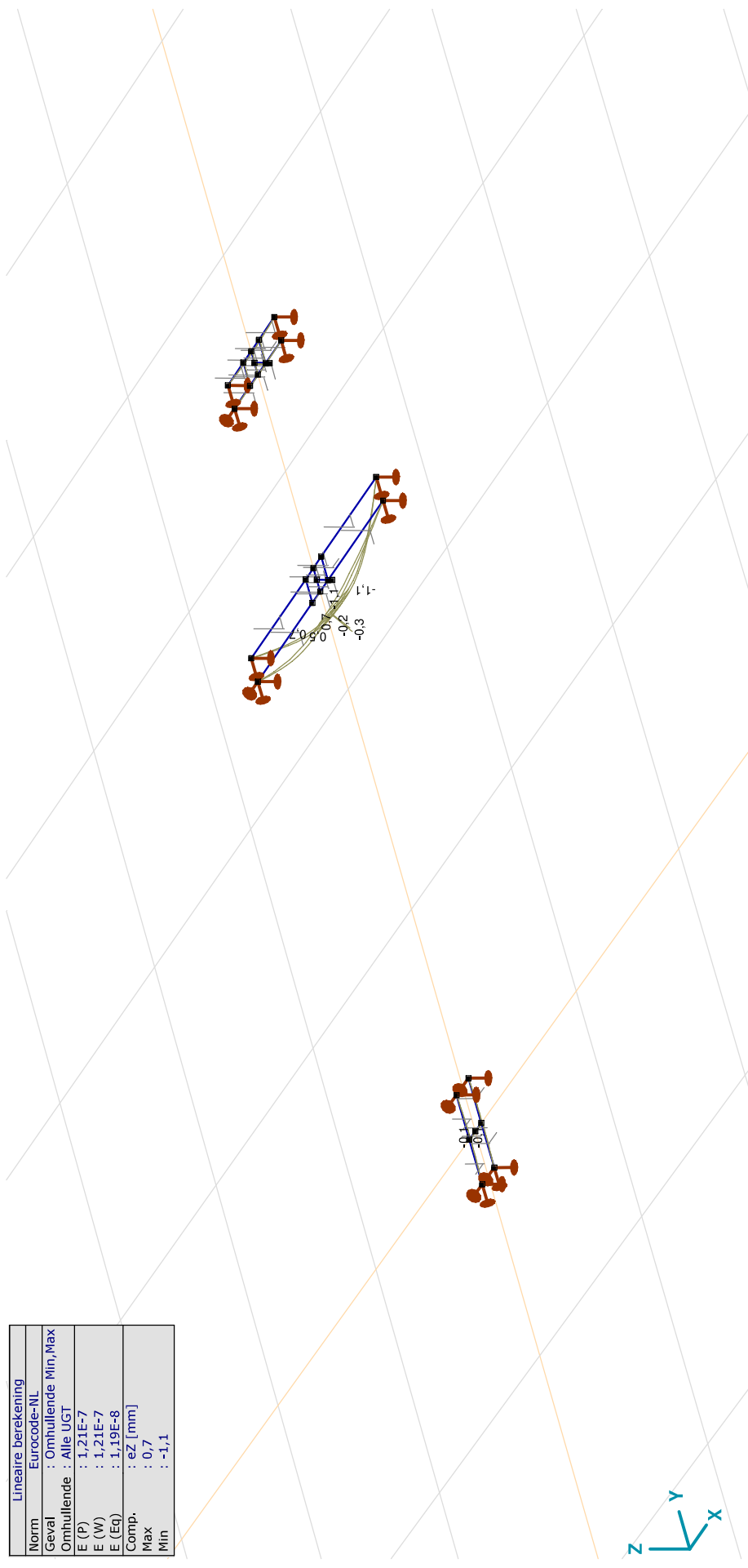
III) Lineair, Omhullende (Alle UGT), eY, Lijnen

**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: ez [mm]
Max	: 0,7
Min	: -1,1



III) Lineair, Omhullende (Alle UGT), ez, Lijnen

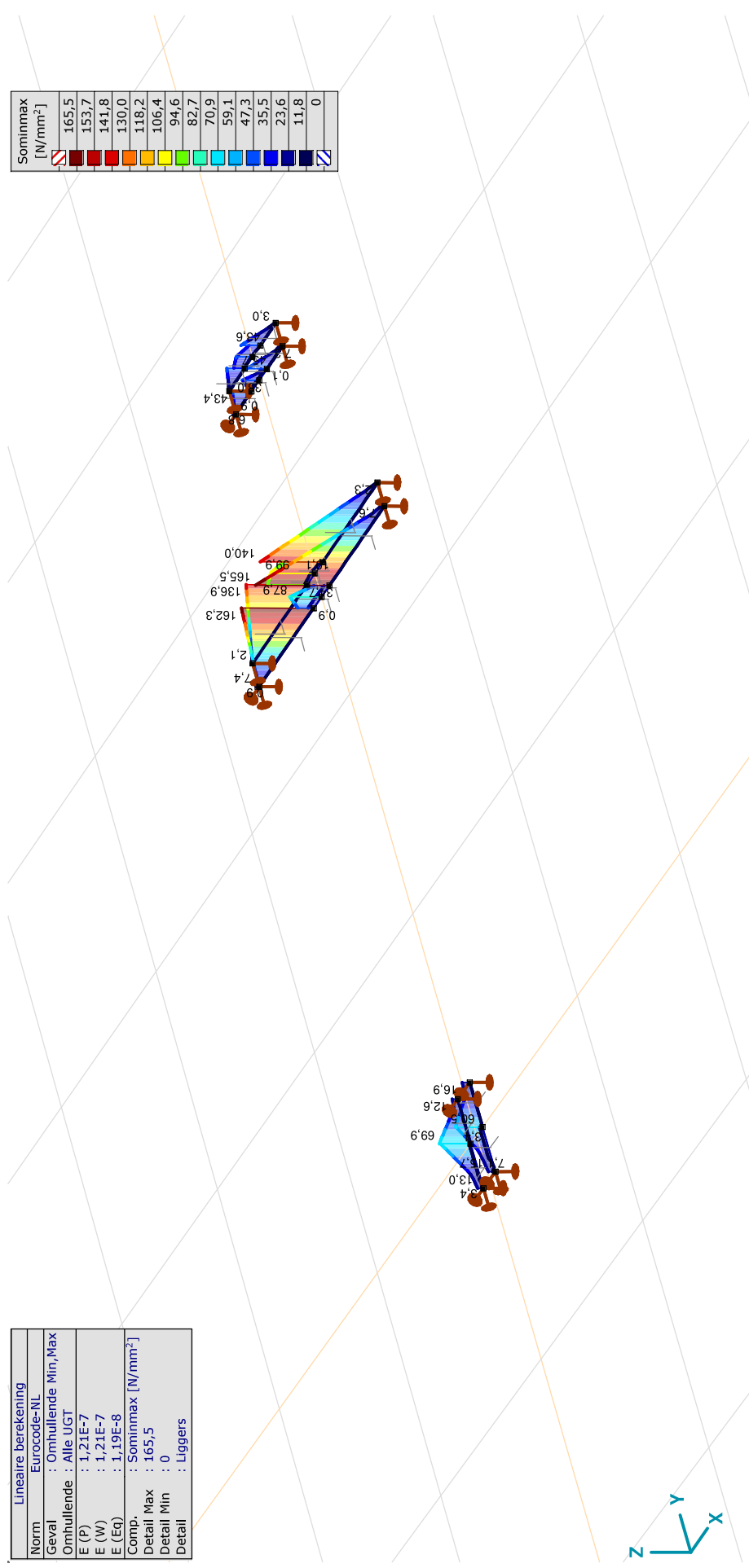
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Sominmax [N/mm <sup>2</sup> ]
Detail Max	: 165,5
Detail Min	: 0
Detail	: Liggers

Sominmax [N/mm <sup>2</sup> ]
165,5
153,7
141,8
130,0
118,2
106,4
94,6
82,7
70,9
59,1
47,3
35,5
23,6
11,8
0



[I] > Liggers, Lineair, Omhullende (Alle UGT), Sominmax, Lijnen (gevuld)

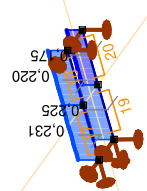
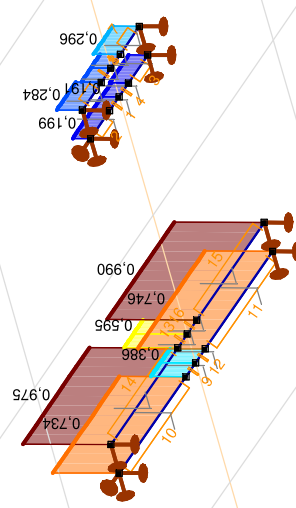
**Project:**

Constructeur: DNV GL - Energy

Model: **Liggers D+3.6 HAF.axs**

Lineaire berekening	
Norm	Eurocode-NL
Geval	: Omhullende Min, Max
Omhullende	: Alle UGT
E (P)	: 1,21E-7
E (W)	: 1,21E-7
E (Eq)	: 1,19E-8
Comp.	: Unity-check (UGT) []
Detail Max	: 0,990
Detail Min	: 0,175
Detail	: Liggers

Unity-check
1.000
0.929
0.857
0.786
0.714
0.643
0.571
0.500
0.429
0.357
0.286
0.214
0.143
0.071
0



[Stij] > Liggers, Lineair, Omhullende (Alle UGT), Unity-check, Lijnen (gevuld)



## **About DNV**

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.