Opgesteld:	LER	Gecontroleerd:	KER	Goedgekeurd:	RIW
Datum	17-8-2021	Datum	17-8-2021	Datum	17-8-2021

"For approval"

Expansion storage capacity TP3

Pumpfloor

Civil design / weight calculation

Klant	Neste Terminals	Klant projectnr.	2307
Project	Expansion storage capacity TP3	KH projectnr.	68685
Locatie	Vlaardingen		
Installatie	Tank pit 3	Revisie	0
documentnr.	2307-E40-CN-1734-0001	Datum	17-08-2021

Revision	Description	Date
0	Released for approval	17-8-2021

1 Index

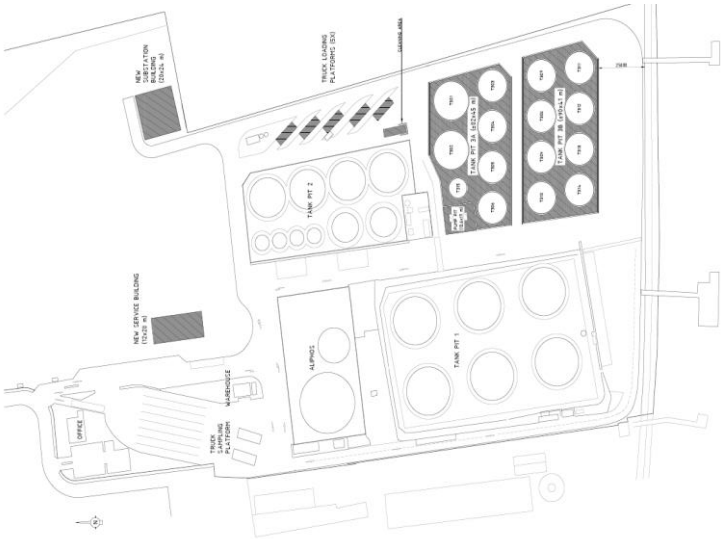
2 Introduction

Neste Terminal in Rotterdam has the intention to expand the storage capacity of their tank terminal in Rotterdam.

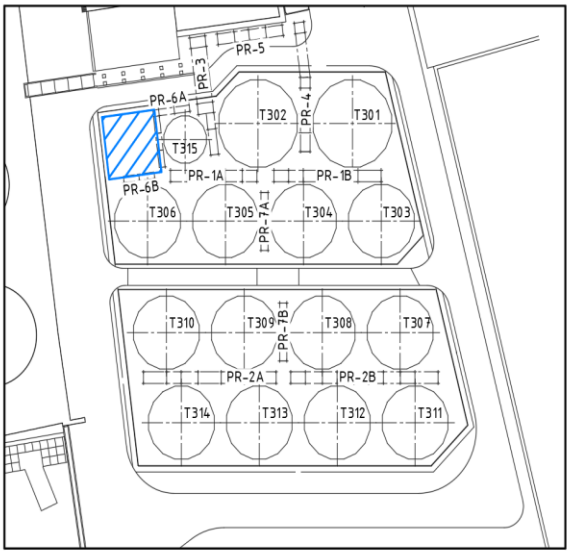
The expansion of the terminal consists of 15 tanks divided over two tank pits. There is a maintenance road between the two tank pits. Both tank pits are connected underground in order to guarantee the buffer capacity of the tank pits. The bund wall shall consist of either a retaining wall or sheet piling wall.

At the north-east side there is a new truck loading area with 5 bays.
The new tank pits are connected to the existing tank pit and new loading area by means of pipe racks.

On the north side of the new tank pits an recently built tank pit (built in 2017-2018) so called phase 1 is present. The tanks in this tank bund are founded on a crushed stone ring on a deep soil improvement.
At the westside also tank pit is present which is built in approximately 40 years ago (1960).



In this calculation the design of the pump slab is checked and the piling load is determined.



3 General

3.1 Standards

NEN-EN 1990/NB	Eurocode 0: Basis of structural design
NEN-EN 1991	Eurocode 1: Actions on structures
NEN-EN 1991-1-1/NB	General actions - Densities, self-weight, imposed loads for buildings
NEN-EN 1991-1-4/NB	General actions - Wind actions
NEN-EN 1991-1-5/NB	General actions - Thermal actions
NEN-EN 1992	Eurocode 2: Design of concrete structures
NEN-EN 1992-1-1/NB	General rules and rules for buildings
NEN-EN 1993	Eurocode 3: Design of steel structures
NEN-EN 1993-1-1/NB	General rules and rules for buildings
NEN-EN 1993-1-8/NB	Design of joints
2305-000-JSD-1700-04 Rev.4	General rules for steel structure and civil works

3.2 Reference documents

drawings:

- 2307-E40-DW-1743-0004 Form drawing Pump floor

other:

- 2307-E80-CN-1731-0002 calculation pipe rack 6

3.3 Used programs

SCIA Engineer, version: 20.0.2028
Microsoft Office

3.4 Basis

consequence class	*CC2*	
reliability class	*RC2*	
design working life	*50*	Years

materials

concrete class	*C30/37*
reinforcing steel grade	*B500B*

deformations limits

horizontal and vertical deflections	quasi permanent	$\omega_{lim} = l_{rep} / 250$

piling

The springs constants are derived from the geotechnical advise. Because crack control is assumed decisive the characteristic value is applied. For the horizontal spring constant see also chapter 6.3.

k_v = *60* MN/m
k_h = *6* MN/m

cracked concrete

In case of thermal forces the structure is checked with the modules of elasticity of the cracked cross section.

reduced stiffness cracked section, without tension stiffening, with creep. ULS only
poisson ratio cracked concrete = 0,00

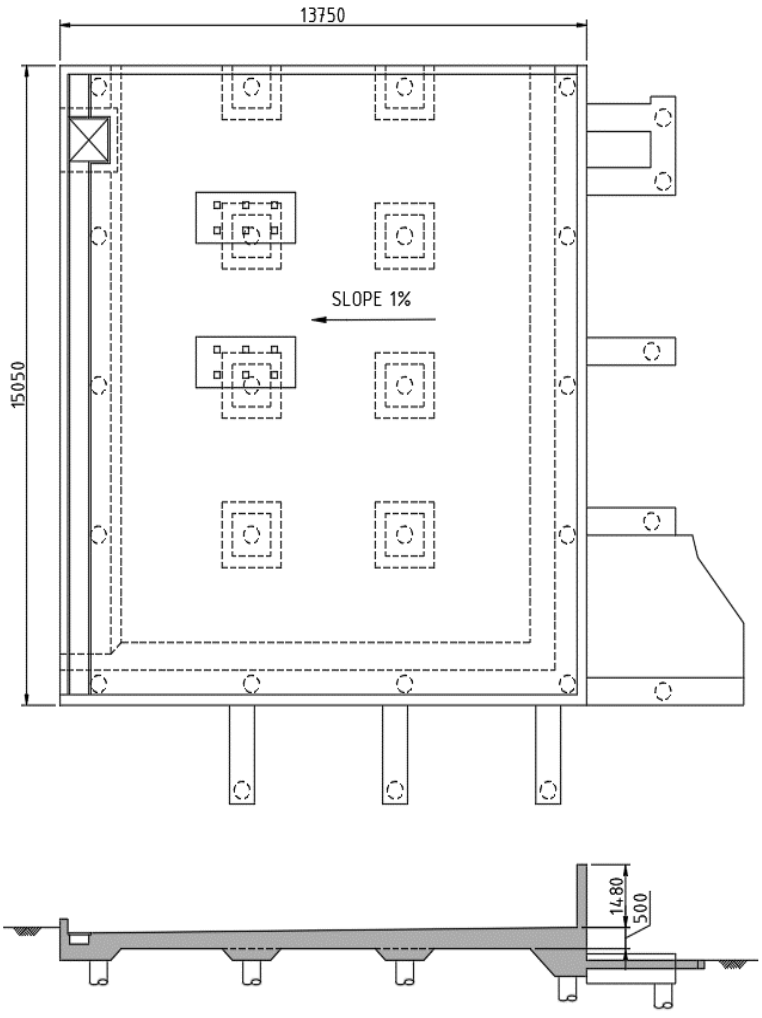
width		b =	*1000*	mm
height		h =	*400*	mm
concrete cover		c =	*50*	mm
cross sectional area of reinforcement, assumed	Ø *12* - *100*	A_s =	1131	mm²
effective height	h-c-0,5Ø=	d =	344	mm
reinforcement ratio	As/Ac=	ρ =	0,003	
design value of modules of elasticity reinforcing steel		E_s =	*2E+05*	N/mm²
secant modules of elasticity		E_{cm} =	*33000*	N/mm²
tangent modules of elasticity	1,05Ecm=	E_c =	34650	N/mm²
creep		φ =	*1,67*	
effective modules of elasticity of concrete	Ec/(1+φ)=	$E_{c,eff}$ =	12994	N/mm²
ratio	Es/Ec,eff=	α_e =	15,4	
height of compression area	$-\alpha_e\rho+((\alpha_e\rho)^2+2\alpha_e\rho)^{0,5}d$=	x =	93	mm
moment of inertia: - of uncracked cross section	$1/12bh^3$=	I_I =	5,3E+09	mm^4
- of cracked cross section	$1/12bx^3+bx(0,5x)^2+\alpha_e A_s(d-x)^2$=	I_{II} =	1,4E+09	mm^4
ratio	I_I / I_{II}=	α_I =	0,26	
reduced modules of elasticity	$E_{cm}\alpha_I$=	E_{cr} =	8445	N/mm²

4 Structure

The pump slab located at the west side of tank pit 3A. it functions as the foundation for two pumps, of which no data is yet available. In addition it supports a small manifold, hoisting beam and emergency shower. The slab also has a wall at the edge of the tank pit. This for retaining any products in the tank pit in case of an accident. Perpendicular to the wall there are foundation beams for piper rack 6, these beams are part of the structure of the pump slab.

The pump slab is approx. 15x14m and has a maximum thickness of 0,5m. The slope of 1% in the slab reduces this thickness toward the gutter at the west side of the slab. As part of the drainage there is a pit integrated in the gutter. The width of the gutter is 0,5m, the pit is 1x1m and has a depth of around 2m.

The slab will be liquid tight, the walls will be liquid retaining.



5 Loads and load combinations

For the loads from the pipe rack see calculation pipe rack 6

5.1 Dead load

Self-weight is calculated by calculation software.
For this calculation the slope, gutter, pit and plinths are not taken into account. It is assumed that this is mostly covered by the live load.

5.2 Equipment load

The equipment load is counted for by the imposed load.

5.3 Imposed load

equally distributed load	=	*15*	kN/m²

5.4 Wind load

The reference height for the wind load is increased due to the larger adjacent tanks.

top of high structure			h_{high} =	*24,5*	m
largest width of high structure			d_{large} =	*16,0*	m
radius	$h_{high} \leq 2d_{large}$ ->	h_{high}=	r =	24,5	m
reference height	$x \leq r$ ->	$0{,}5r$ =	z_n =	12,25	m

terrain category	*II*	area not build on			
basic wind velocity		conform client spec.	v_b =	*30*	m/s
roughness length			z_0 =	0,2	m
			$z_{0,II}$ =	*0,05*	m
minimum height			z_{min} =	4	m
terrain factor			k_r =	0,209	
roughness factor			$c_r(h)$ =	0,862	
orography factor			$c_0(z)$ =	*1,00*	
mean wind velocity			$v_{m(h)}$ =	25,85	m/s
turbulence factor			k_I =	*1*	
turbulence intensity			$I_v(h)$ =	0,243	
air density			ρ =	*1,25*	kg/m³
peak velocity pressure			$q_p(z)$ =	1,128	

structural factor	$c_s c_d$ =	*1,0*	

height of wall	h =	*1,5*	m

zone		A	B	C	D	
coefficient	c_f =	*2,1*	*1,8*	*1,4*	*1,2*	
pressure	q =	2,37	2,03	1,58	1,35	
factor		*0,3*	*2*	*4*		
zone length	l =	0,45	3	6		m

5.5 Crane load

5.5.1 sand layer

To allow the crane to be on the pump slab the surface needs to be levelled. For this a layer of sand is taken into account.

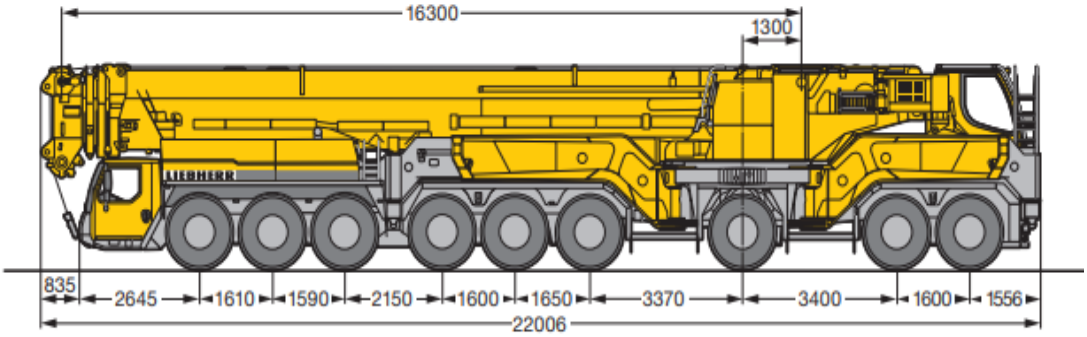
equally distributed load 0,3 x *20* = g_k = *6,0* kN/m²

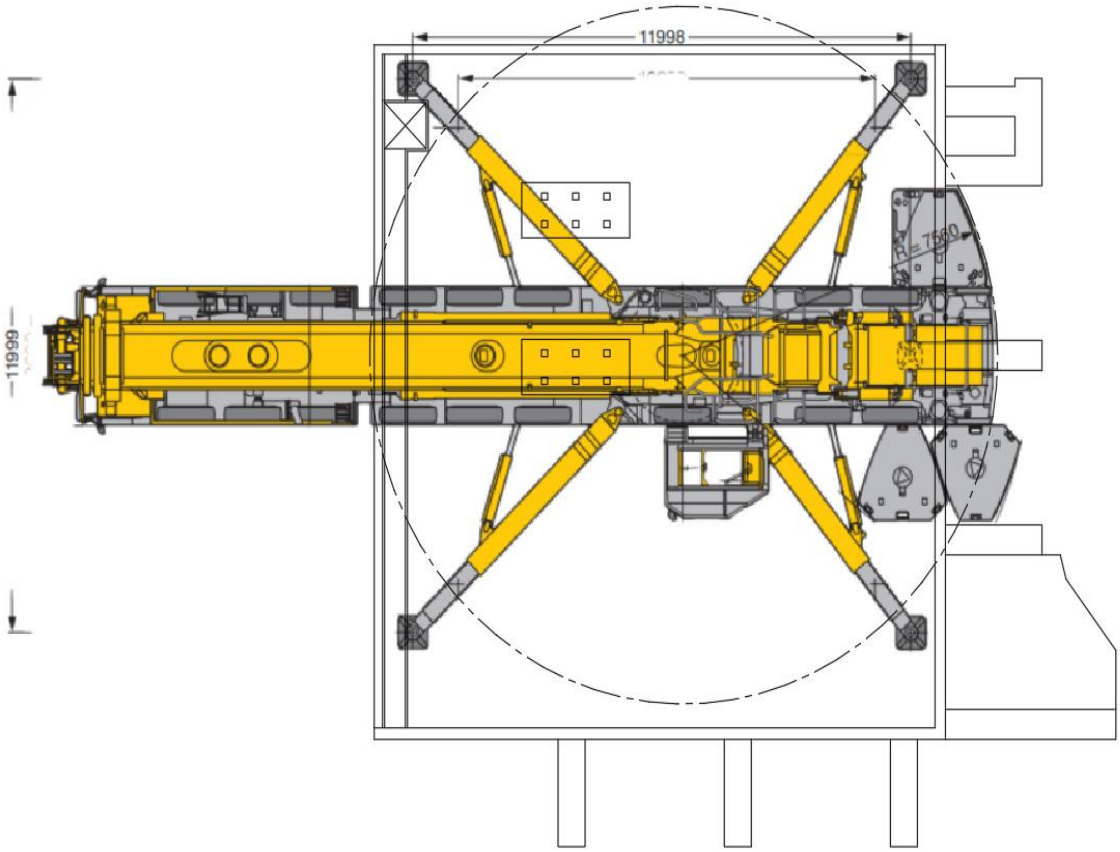
5.5.2 crane load

type of crane: mobile crane LTM1750

outrigger Q_k = *250* kN

axle load Q_k = *150* kN





note: the eastern wall can only be erected after lifting work is done.

5.6 Temperature load

temperature of top surface	T_{max} = 30	T_4 = 30	T_{top} =	*60*	°C
temperature of soil	NEN-EN 1991-5 N/A table 5.3 (t_8)		T_{bot} =	*10*	°C
properties of construction layers:					
concrete slab	h_4 = 0,4 m	λ_4 = *1,2* W/(mK)	$R_{m,4}$ =	0,345	m²K/W
thermal resistance of structure		ΣR_m=	R_c =	0,34	m²K/W
thermal resistance at the top surface			R_{top} =	*0,04*	m²K/W
thermal resistance at the bottom surface			R_{bot} =	*0,00*	m²K/W
total thermal resistance		$R_c+R_{in}+R_{out}$=	R_t =	0,38	m²K/W
temperature at top of concrete slab		$T_{out}-(R_{m,4}+R_{out})/R_{tot}\times(T_{out}-T_{in})$=	T_+ =	55	°C
temperature at bottom of concrete slab		$T_{out}-R_{out}/R_{tot}\times(T_{out}-T_{in})$=	T_- =	10	°C
reference temperature			t_0 =	*10*	°C
uniform temperature component			ΔT_u =	22,4	K
temperature gradient			ΔT_{Mz} =	44,8	K

5.7 Accidental load

specific weight of product		γ =	*10*	kN/m³
height of bund wall		h =	*2,1*	m
product load		q_k =	21,0	kN/m²

A portion of the horizontal load is applied to the beam underneath the wall. This load is:

height of wall from centre of the slab		h =	*1,73*	m
height of load on beam	2,1 - 1,73 =	h_1 =	*0,37*	m
mean value of surface load on beam	(17,3 + 21,0)/ 2 =	q_{av} =	*19,2*	kN/m²
line load on beam	0,37 x 19,2 =	q =	7,09	kN/m

5.8 Combinations

	ψ_0	ψ_1	ψ_2
industrial	*1,0*	*0,9*	*0,8*
wind	*0,6*	*0,2*	*0,0*
Temperature	*0,6*	*0,5*	*0,0*

$$ULS = \sum_{j\geq 1} \gamma_{G,j} G_{k,j} + \gamma_{Q,1}\psi_{0,1} Q_{k,1} + \sum_{i\geq 1} \gamma_{Q,i}\psi_{0,i} Q_{k,i}$$

$$ULS = \sum_{j\geq 1} \xi\gamma_{G,j} G_{k,j} + \gamma_{Q,1} Q_{k,1} + \sum_{i\geq 1} \gamma_{Q,i}\psi_{0,i} Q_{k,i}$$

ξ = *0,9* γ_G = *1,35* $\gamma_{G,inf}$ = *1,0* γ_Q = *1,5*

$$SLS_{char} = \sum_{j\geq 1} G_{k,j} + Q_{k,1} + \sum_{i>1} \psi_{0,i} Q_{k,i}$$

$$SLS_{freq} = \sum_{j\geq 1} G_{k,j} + \psi_{1,1} Q_{k,1} + \sum_{i>1} \psi_{2,i} Q_{k,i}$$

$$SLS_{quasi} = \sum_{j\geq 1} G_{k,j} + \psi_{2,1} Q_{k,1} + \sum_{i>1} \psi_{2,i} Q_{k,i}$$

6 Calc

6.1 Punching check

6.1.1 without reinforcement

f_{ck} = *30* N/mm²

$v_{min} = 0{,}035 \times k^{3/2} \times f_{ck}^{1/2}$

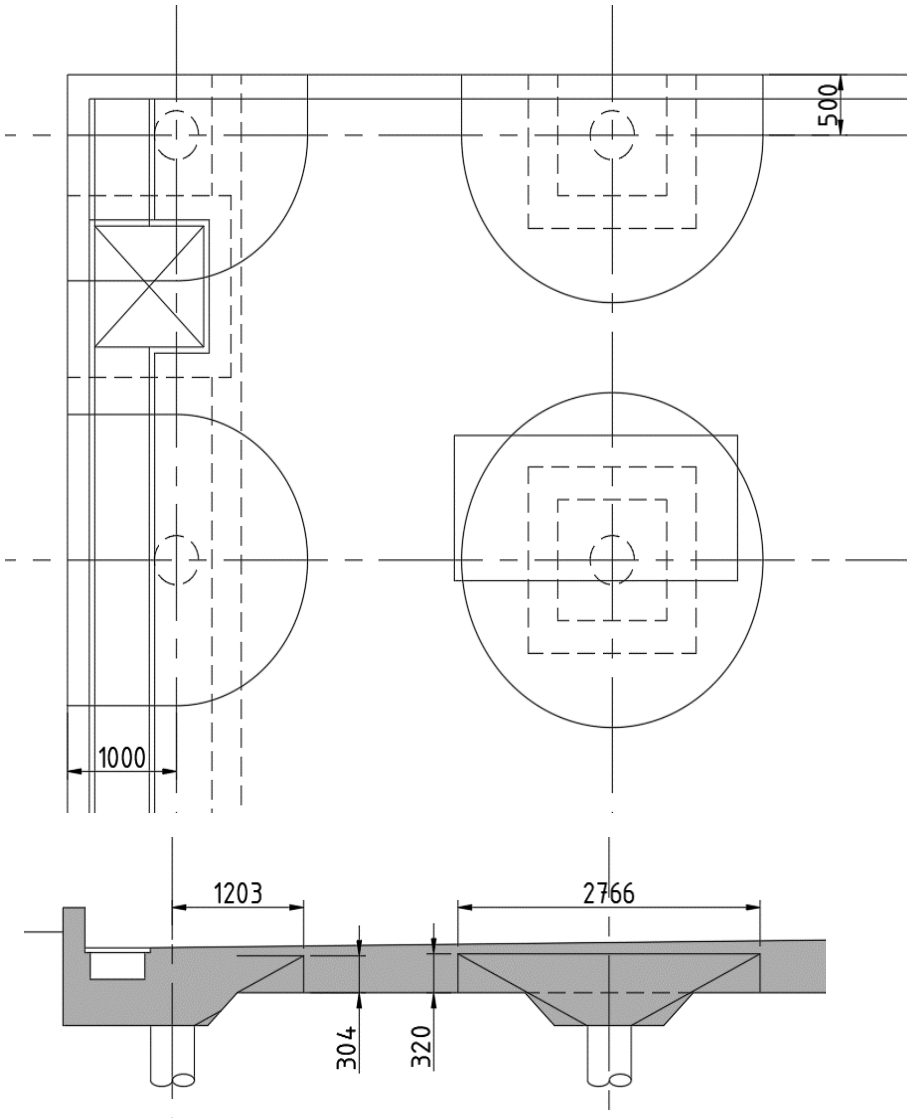
$v_{Ed} = \beta \times V_{Ed} / (u_1 \times d)$

$d_{eff} = 0{,}8h$

location	h_{min}	d_{eff}	u_1	β	V_{Ed}	v_{Ed}	k	v_{min}	UC	
centre	*400*	320	*8690*	*1,15*	*650*	0,27	1,79	0,46	0,59	Ok
edge 1	*400*	320	*5345*	*1,40*	*475*	0,39	1,79	0,46	0,85	Ok
edge 2	*380*	304	*5779*	*1,40*	*575*	0,46	1,81	0,47	0,98	Ok
corner	*380*	304	*3390*	*1,50*	*475*	0,69	1,81	0,47	1,48	*

* see 6.1.1

For the corner pile the pit is ignored. It is assumed that the periphery will run along the side of the pit, which results in a length that is almost equal to the length taken into account.
The length of the periphery is based on the dimensions as shown in the following image.



6.1.1 corner pile with reinforcement

Because the unity check for punching of the corner pile, without reinforcement taken into account, is to large this pile is checked including the positive effect of the reinforcement.
Since the largest reaction force (475kN) on this pile is as result from the crane load and most of this crane load is directly applied on top of the pile, this reaction force is ignored. Instead the second largest reaction force (400kN) as result of temperature load is taken into account.

characteristic compressive cylinder strength			f_{ck} =	*30*	N/mm²
thickness of slab			h =	*380*	mm
concrete cover			c =	*40*	mm
effective depth			d =	332	mm
tensile reinforcement	Ø *16* - *100*		A_{sl} =	2011	mm²/m
reinforcement ratio for longitudinal reinforcement		$A_{sl}/(b_w \times d)$=	ρ_l =	0,01	
design value of pile load			V_{Ed} =	*400*	kN
basic control perimeter			u_1 =	*3390*	mm
coefficient			β =	*1,5*	
design value of applied shear force		$\beta \times V_{Ed}/(u_1 \times d)$=	v_{Ed} =	0,53	N/mm²
coefficient		$0,18/\gamma_c$=	$C_{Rd,c}$ =	*0,12*	
coefficient		$1+\sqrt{(200/d)}$=	k =	1,78	
minimum shear strength of concrete		$0,035 \times k^{3/2} \times f_{ck}^{1/2}$=	v_{min} =	0,45	N/mm²
design value of shear resistance		$C_{Rd,c} \times k \times (100 \times \rho \times f_{ck})^{1/3}$=	$v_{Rd,c}$ =	0,56	N/mm²

Unity check = 0,95 OK

6.2 Deflection control

6.2.1 slab

Characteristic compressive cylinder strength			f_{ck} =	*30*	N/mm²
estimated tension reinforcement, see 3.4			ρ =	0,003	
reference reinforcement			ρ_0 =	0,005	
span/depth	l = *4000*	d = *304* mm	l/d =	13,16	
factor to take into account the structural system		table 7.4N	K =	*1,0*	
limit span/depth for $\rho \le \rho_0$		EN 1992-1-1 (7.16a)	l/d =	27,28	

13,2 ≤ 27,3 No deflection check is required

6.2.2 walls

Characteristic compressive cylinder strength			f_{ck} =	*30*	N/mm²
estimated tension reinforcement	Ø *12* - *100*		A_{sl} =	1131	mm²/m
			ρ =	*0,005*	
reference reinforcement			ρ_0 =	0,005	
span/depth	l = *1500*	d = *204* mm	l/d =	7,35	
factor to take into account the structural system		table 7.4N	K =	*0,4*	
limit span/depth for $\rho \le \rho_0$		EN 1992-1-1 (7.16a)	l/d =	8,412	

7,4 ≤ 8,4 No deflection check is required

7 Conclusion

The structure is checked with Scia engineer, see appendix A. The results of the calculation are as follows.

displacement

The dimensions of the structure are such that it is not required to check the deflection.

reaction forces

tension	$R_{z,min}$	=	*-10*	kN
compression	$R_{z,max}$	=	*675*	kN
shear	R_{xy}	=	*25*	kN

pile bearing capacity Ø406/496, pile tip -21,000 N.A.P, CPT 2018-3

compression	$R_{c,net,d}$	=	*897*	kN

reinforcement

A basic check for the slab reinforcement is done with Scia engineer. This with a cracking width limit of 0,15 (typical) and 0,3 (bottom of slab). This results in the following:

basic slab reinforcement	Ø	16	-	100
basic wall reinforcement	Ø	12	-	100

Appendix A

Scia report

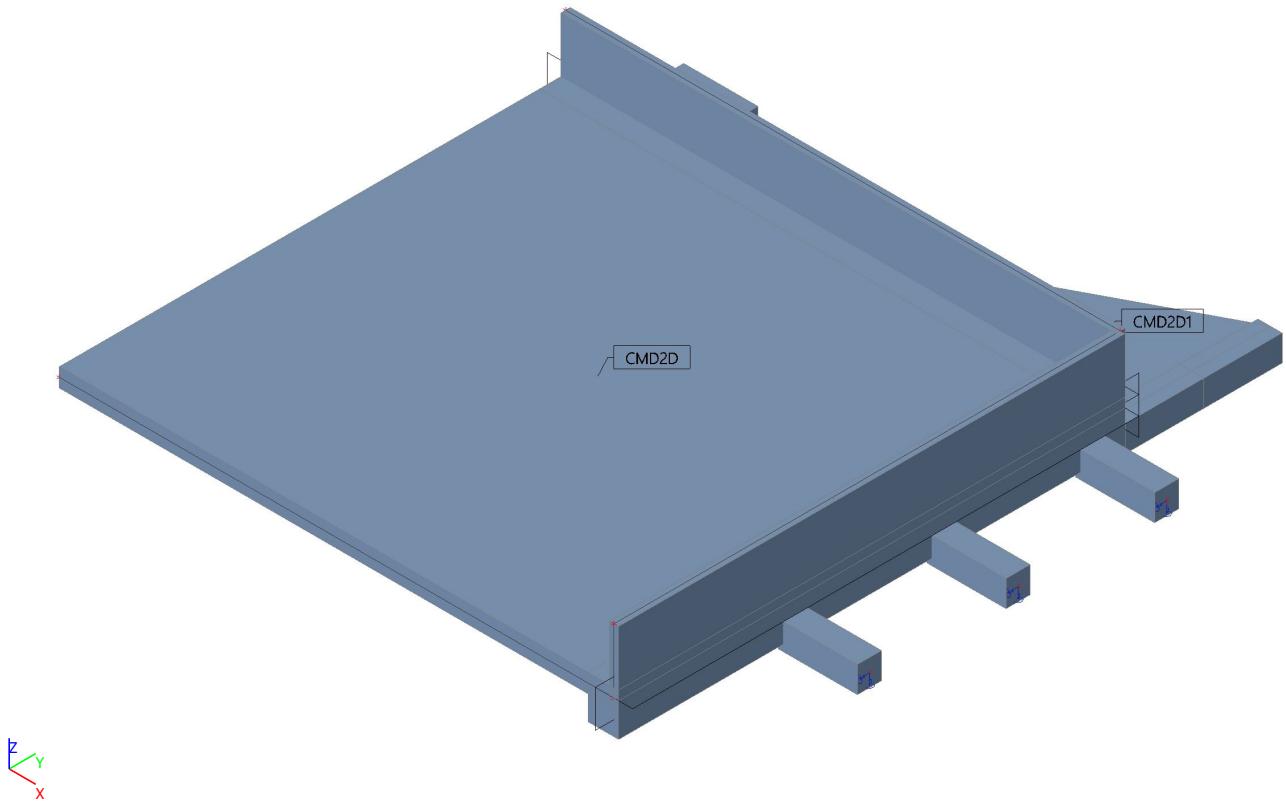
KH Engineering

1. Table of contents

2. General

2.1. Project

Licence name	KH Engineering
Project	Neste - Rotterdam terminal expansion
Part	Tank pit 3 - Pump slab
Description	Weight calculation
Author	LER
Date	08. 2021
Structure	General XYZ
No. of nodes :	62
No. of beams :	12
No. of slabs :	4
No. of solids :	0
No. of used profiles :	2
No. of load cases :	14
No. of used materials :	3
Acceleration of gravity [m/s^2]	9,810
National code	EC - EN



2.2. Setup manager

(STR/GEO) alternative

Combination	Eq.6.10a & Eq.6.10b

Psi factors

Load	Psi0	Psi1	Psi2
CategoryA	0.4	0.5	0.3
CategoryB	0.5	0.5	0.3
CategoryC	0.6	0.7	0.6
CategoryD	0.4	0.7	0.6
CategoryE	1	0.9	0.8
CategoryF	0.7	0.7	0.6
CategoryG	0.7	0.5	0.3
CategoryH	0	0	0
Snow	0	0.2	0

Load	Psi0	Psi1	Psi2
Wind	0	0.2	0
Temperature	0	0.5	0
Rain water	0	0	0
Construction loads	1	0	0.2

Load combination factors

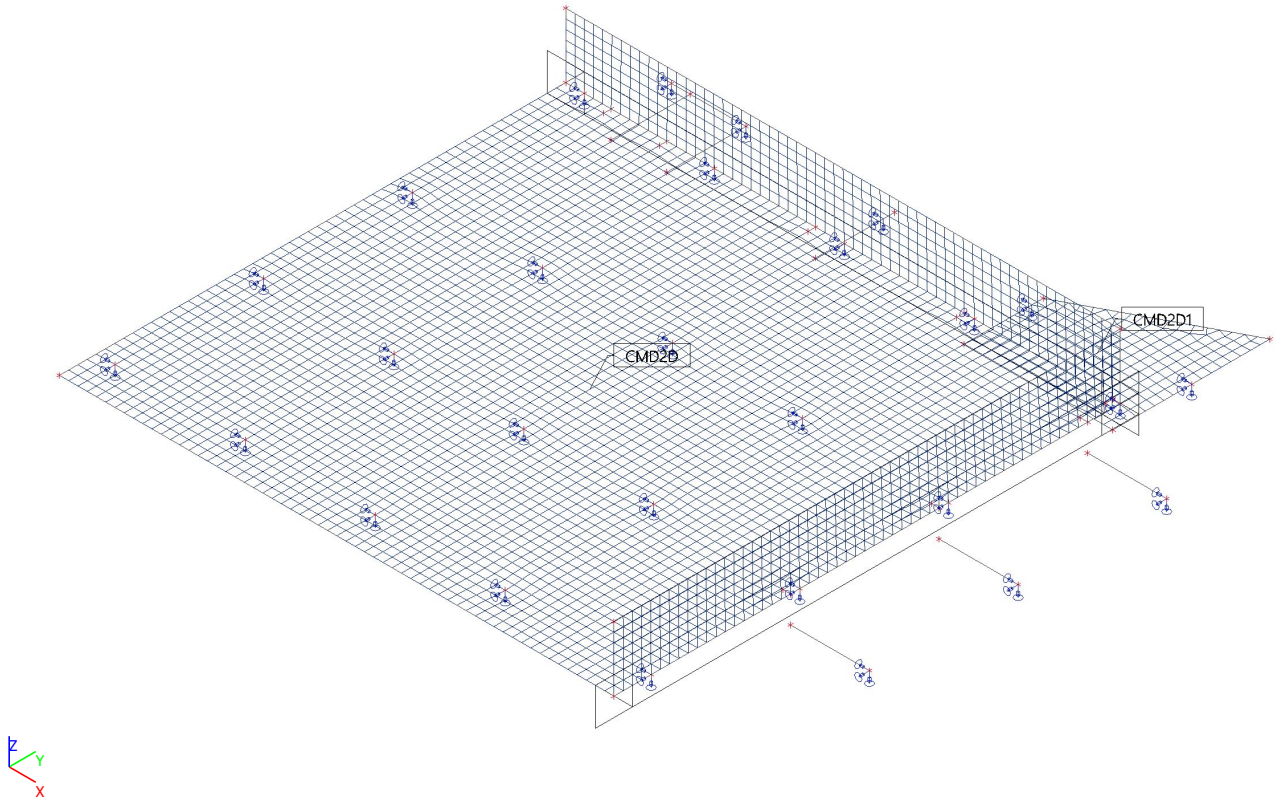
Permanent action - unfavorable	1,35
Permanent action - favorable [-]	0,90
Leading variable action	1,50
Accompanying variable action	1,50
Reduction factor ksi [-]	0,89
Permanent action - unfavorable	1,00
Permanent action - favorable	1,00
Leading variable action	1,30
Accompanying variable action	1,30

2.3. Solver setup

Name	SolverSetup1
Neglect shear force deformation (Ay, Az >> A)	×
Initial stress	×
Number of thicknesses of rib plate	20
Maximum soil interaction iterations	10
Number of sections on average member	10
Step for soil/water pressure [m]	0,500
C1x [MN/m ^{3}]	1,0000e-01
C1y [MN/m ^{3}]	1,0000e-01
C1z [MN/m ^{3}]	1,0000e+01
C2x [MN/m]	5,0000e+00
C2y [MN/m]	5,0000e+00
Coefficient for reinforcement	1
Warning when maximal translation is greater than [mm]	1000,0
Warning when maximal rotation is greater than [mrad]	100,0
Parallelism tolerance [deg]	10,00
Ratio to half - distance to adjacent beam beff,i/bi [-]	0,20
Ratio to effective span length beff,i/l0 [-]	0,10
Max ratio to effective span length beff,i/l0 [-]	0,20
Simply supported beam [-]	1,00
Inner span [-]	0,70
End span [-]	0,85
Cantilever, base ratio to current span [-]	1,00
Cantilever, base ratio to adjacent span [-]	0,15
Cantilever, max ratio to current span [-]	1,50
Max adjacent span length ratio [-]	1,50
Max cantilever length ratio to adjacent span [-]	0,50
Span length ratio Le/beff,i,max (1 side) [-]	8,00
Simply supported beam [-]	1,00
Inner span [-]	0,70
End span [-]	0,85
Cantilever [-]	2,00
Method used for non-concrete and non-steel / composite beams	EN 1994-1-1
Soil combination	None
Bending theory of plate/shell analysis	Mindlin
Type of solver	Direct

2.4. Mesh setup

Name	MeshSetup1
Generation of eccentric elements on members with variable height	×
Generation of nodes in connections of beam elements	×
Elastic mesh	✓
Use automatic mesh refinement	×
Connect members/nodes	✓
Division on haunches and arbitrary members	5
Division for 2D-1D upgrade	50
Average number of tiles of 1d element	1
Average size of 2d element/curved element [m]	0,250
Minimal length of beam element [m]	0,100
Maximal length of beam element [m]	1000,000
Average size of cables, tendons, elements on subsoil, nonlinear soil spring [m]	1,000
Maximal out of plane angle of a quadrilateral [mrad]	30,0
Predefined mesh ratio	1.5
Minimal distance between definition point and line [m]	0.001
Average size of panel element [m]	1,000
Mesh refinement following the beam type	None
Definition of mesh element size for panels	Manual



2.5. Materials

Name	Type	ρ [kg/m³]	Density in fresh state [kg/m³]	E_{mod} [MPa]	μ	α [m/mK]	$f_{c.k.28}$ [MPa]	Colour
C30/37	Concrete	2500,0	2600,0	3,2800e+04	0.2	0,00	30,00	
C30/37 Cracked	Concrete	2500,0	2600,0	8,5000e+03	0.0001	0,00	30,00	

Explanations of symbols	
Density in fresh state	The value in the density in fresh state property is used only in case a composite deck is input and its self-weight load is taken into account.

2.6. Cross-sections

Name	Type Detailed	Item material	Fabrication	A [m²]	A_y [m²] A_z [m²]	I_y [m⁴] I_z [m⁴]	$W_{el.y}$ [m³] $W_{el.z}$ [m³]	$W_{pl.y}$ [m³] $W_{pl.z}$ [m³]	Colour
CS1	Rectangle 1150; 825	C30/37	concrete	9,4875e-01	7,9063e-01 7,9063e-01	1,0456e-01 5,3812e-02	1,8184e-01 1,3045e-01	0,0000e+00 0,0000e+00	
CS2	Rectangle 700; 650	C30/37	concrete	4,5500e-01	3,7917e-01 3,7917e-01	1,8579e-02 1,6020e-02	5,3083e-02 4,9292e-02	0,0000e+00 0,0000e+00	

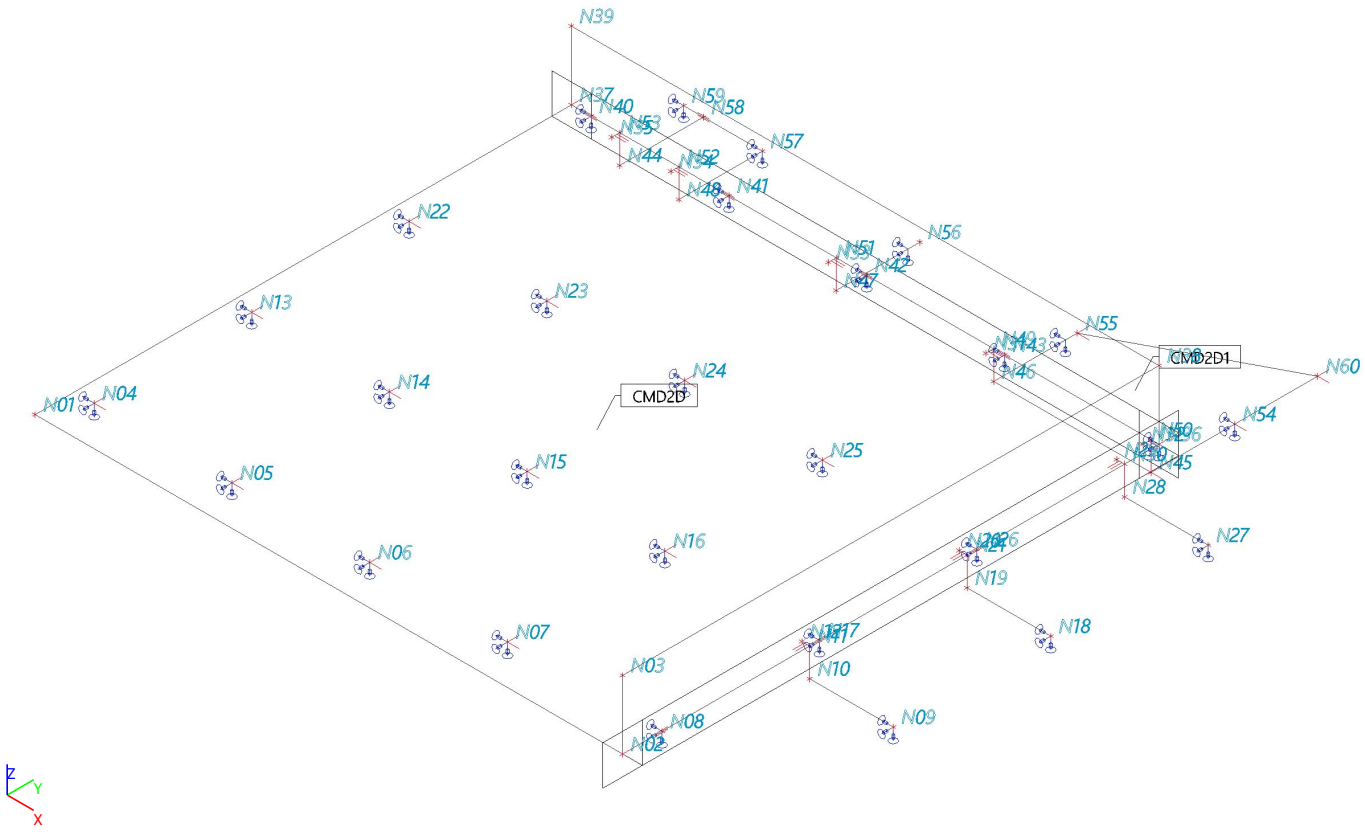
3. Structure

3.1. Nodes

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N01	2,000	0,000	0,000
N02	16,925	0,000	0,000
N36	16,925	13,625	0,000
N37	2,000	13,625	0,000
N38	16,925	13,625	1,730
N39	2,000	13,625	1,730
N03	16,925	0,000	1,730
N22	2,500	9,000	0,000
N23	6,000	9,000	0,000
N24	9,500	9,000	0,000
N25	13,000	9,000	0,000
N13	2,500	5,000	0,000
N14	6,000	5,000	0,000
N15	9,500	5,000	0,000
N16	13,000	5,000	0,000
N04	2,500	1,000	0,000
N05	6,000	1,000	0,000
N06	9,500	1,000	0,000
N07	13,000	1,000	0,000
N40	2,500	13,625	0,000
N41	6,000	13,625	0,000

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N42	9,500	13,625	0,000
N43	13,000	13,625	0,000
N08	16,925	1,000	0,000
N17	16,925	5,000	0,000
N26	16,925	9,000	0,000
N54	16,725	15,750	-0,720
N55	12,725	15,750	-0,720
N56	8,725	15,750	-0,720
N57	4,725	15,750	-0,720
N58	3,225	15,750	-0,720
N44	3,225	13,625	-0,720
N45	16,725	13,625	-0,720
N46	12,725	13,625	-0,720
N47	8,725	13,625	-0,720
N48	4,725	13,625	-0,720
N59	2,725	15,750	-0,720
N27	19,050	12,750	-0,720
N28	16,925	12,750	-0,720
N18	19,050	8,750	-0,720
N19	16,925	8,750	-0,720
N09	19,050	4,750	-0,720

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N10	16,925	4,750	-0,720
N11	16,925	4,750	0,000
N12	16,725	4,750	0,000
N20	16,725	8,750	0,000
N21	16,925	8,750	0,000
N29	16,725	12,750	0,000
N30	16,925	12,750	0,000
N49	12,725	13,625	0,000
N31	12,725	13,425	0,000
N50	16,725	13,625	0,000
N32	16,725	13,425	0,000
N51	8,725	13,625	0,000
N33	8,725	13,425	0,000
N52	4,725	13,625	0,000
N34	4,725	13,425	0,000
N53	3,225	13,625	0,000
N35	3,225	13,425	0,000
N68	16,725	17,855	0,865
N69	12,725	15,537	-0,295
N60	16,725	17,855	-0,720



3.2. Members

Name	Cross-section	Material	Length [m]	Beg. node	End node	Type
B01	CS1 - Rectangle (1150; 825)	C30/37	13,625	N02	N36	general (0)
B05	CS1 - Rectangle (1150; 825)	C30/37	14,925	N37	N36	general (0)
B07	CS2 - Rectangle (700; 650)	C30/37	2,125	N45	N54	general (0)
B08	CS2 - Rectangle (700; 650)	C30/37	2,125	N46	N55	general (0)
B09	CS2 - Rectangle (700; 650)	C30/37	2,125	N47	N56	general (0)
B10	CS2 - Rectangle (700; 650)	C30/37	2,125	N48	N57	general (0)

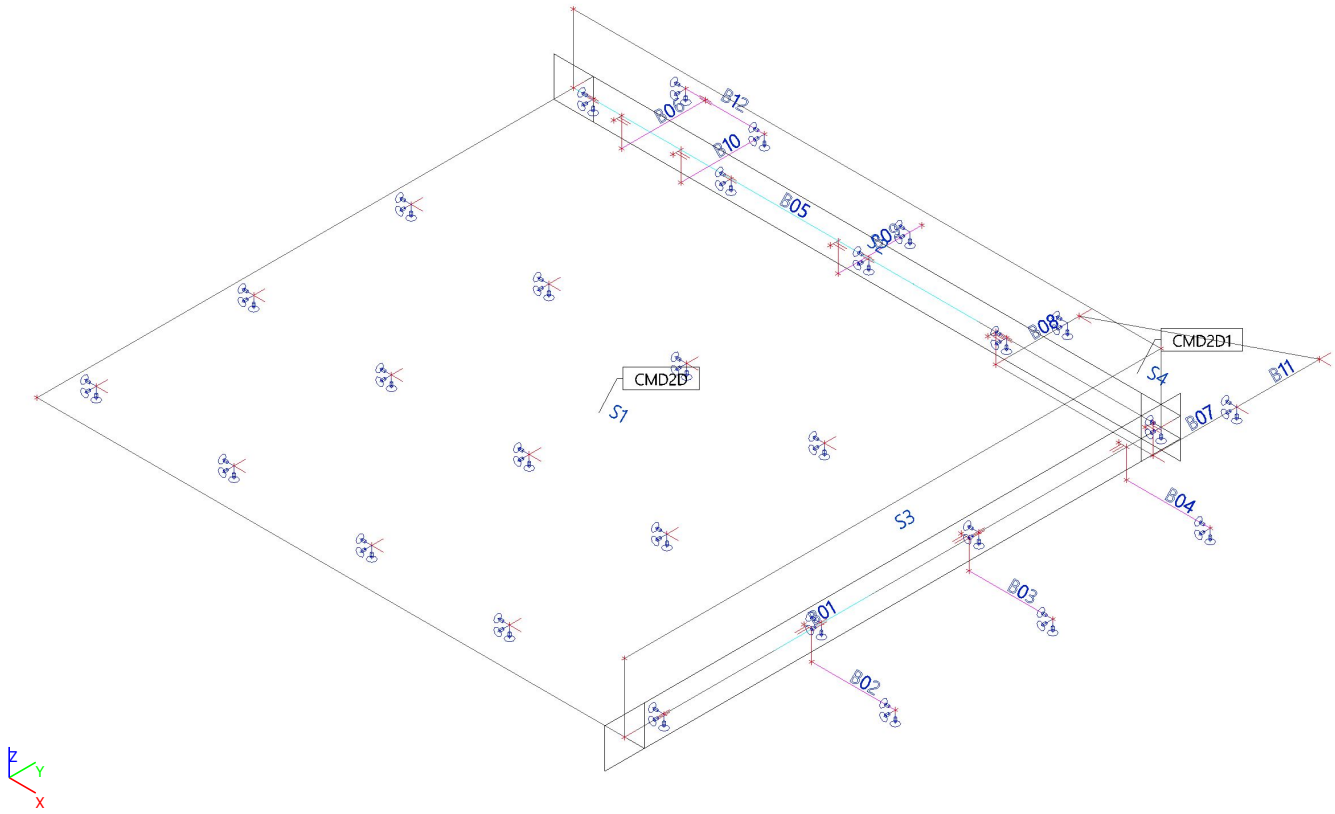
Name	Cross-section	Material	Length [m]	Beg. node	End node	Type
B06	CS2 - Rectangle (700; 650)	C30/37	2,125	N44	N58	general (0)
B12	CS2 - Rectangle (700; 650)	C30/37	2,000	N57	N59	general (0)
B04	CS2 - Rectangle (700; 650)	C30/37	2,125	N28	N27	general (0)
B03	CS2 - Rectangle (700; 650)	C30/37	2,125	N19	N18	general (0)
B02	CS2 - Rectangle (700; 650)	C30/37	2,125	N10	N09	general (0)
B11	CS2 - Rectangle (700; 650)	C30/37	2,105	N54	N60	general (0)

3.3. 2D members

Name	Layer	Type	Element type	Material	Thickness type	Th. [mm]
S1	Layer1	plate (90)	Standard	C30/37	constant	500
S2	Layer1	wall (80)	Standard	C30/37	constant	250
S3	Layer1	wall (80)	Standard	C30/37	constant	250
S4	Layer1	plate (90)	Standard	C30/37	constant	200

3.4. 2D member internal edges

Name	Member 1	Length [m]	Shape	Node	Edge
ES1	S1	0,200	Line	N11 N12	Line
ES2	S1	0,200	Line	N21 N20	Line
ES3	S1	0,200	Line	N30 N29	Line
ES4	S1	0,200	Line	N49 N31	Line
ES5	S1	0,200	Line	N50 N32	Line
ES6	S1	0,200	Line	N51 N33	Line
ES7	S1	0,200	Line	N52 N34	Line
ES8	S1	0,200	Line	N53 N35	Line



3.5. Rigid arms

Name	Master	Slave	Hinge on master	Hinge on slave
RA1	N10	N11	×	×
RA2	N19	N21	×	×
RA3	N28	N30	×	×
RA4	N45	N50	×	×
RA5	N46	N49	×	×
RA6	N47	N51	×	×
RA7	N48	N52	×	×
RA8	N44	N53	×	×

3.6. Nodal supports

Name	Node	System	Type	X	Y	Z	Rx	Ry	Rz	Stiffness X [MN/m]	Stiffness Y [MN/m]	Stiffness Z [MN/m]
Sn19	N36	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn13	N22	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn14	N23	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn15	N24	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn16	N25	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn07	N13	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn08	N14	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn09	N15	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn10	N16	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn01	N04	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn02	N05	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn03	N06	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn04	N07	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn20	N40	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn21	N41	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn22	N42	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn23	N43	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn05	N08	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn11	N17	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn17	N26	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn24	N54	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn25	N57	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn26	N59	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn18	N27	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn12	N18	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01
Sn06	N09	GCS	Standard	Flexible	Flexible	Flexible	Free	Free	Free	6,0000e+00	6,0000e+00	6,0000e+01

3.7. Point supports on member

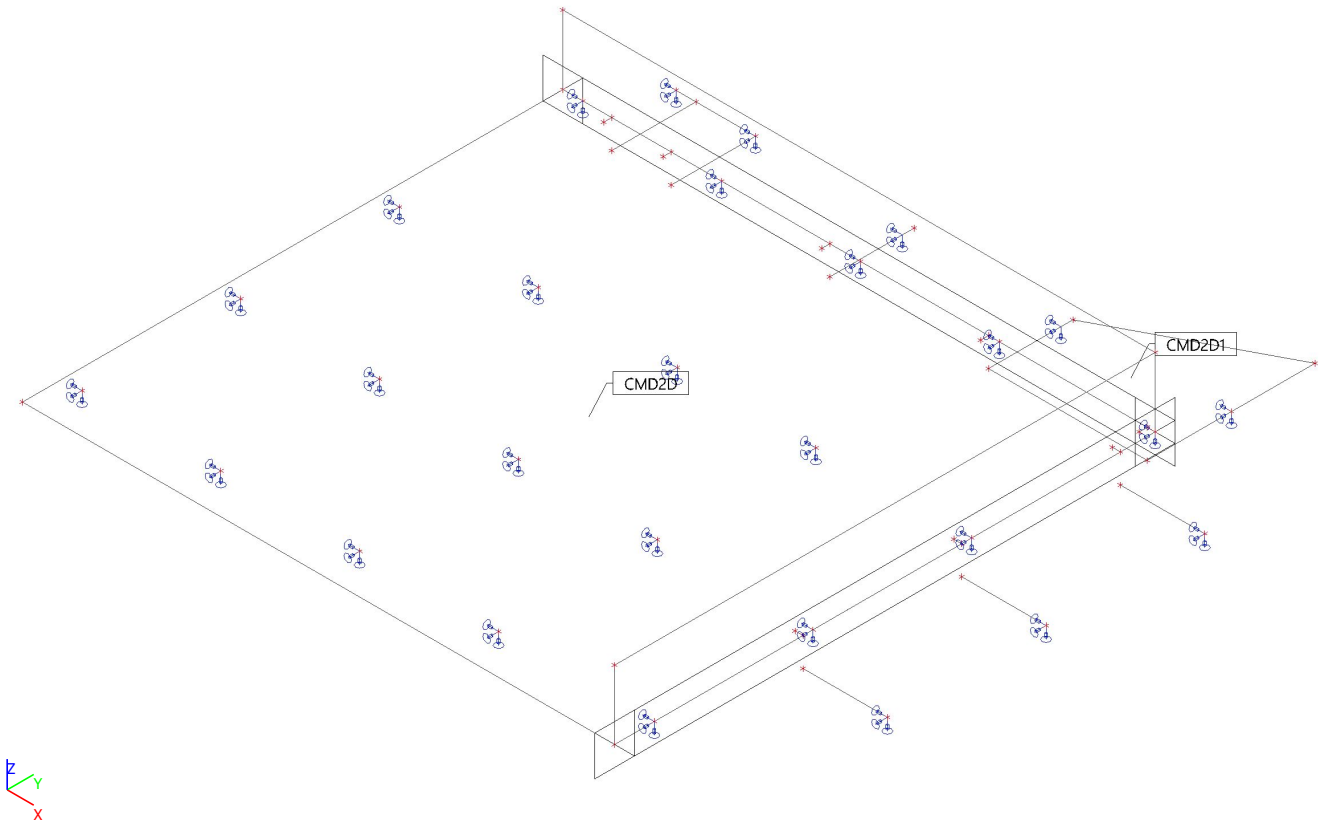
Name	Type	Coor System	Pos x [m] Orig	dx [m] Rep (n)	X Y Z	Rx Ry Rz	Stiffness X [MN/m] Stiffness Y [MN/m] Stiffness Z [MN/m]
Sb1	Standard	Abso GCS	0,300 From end	1	Flexible Flexible Flexible	Free Free Free	6,0000e+00 6,0000e+00 6,0000e+01
Sb2	Standard	Abso GCS	0,300 From end	1	Flexible Flexible Flexible	Free Free Free	6,0000e+00 6,0000e+00 6,0000e+01

4. Loads

4.1. Load cases

4.1.1. Load cases - DL

Name	Description	Action type	Load type	Load group	Direction
DL	Dead load - Self weight	Permanent	Self weight	LG1	-Z



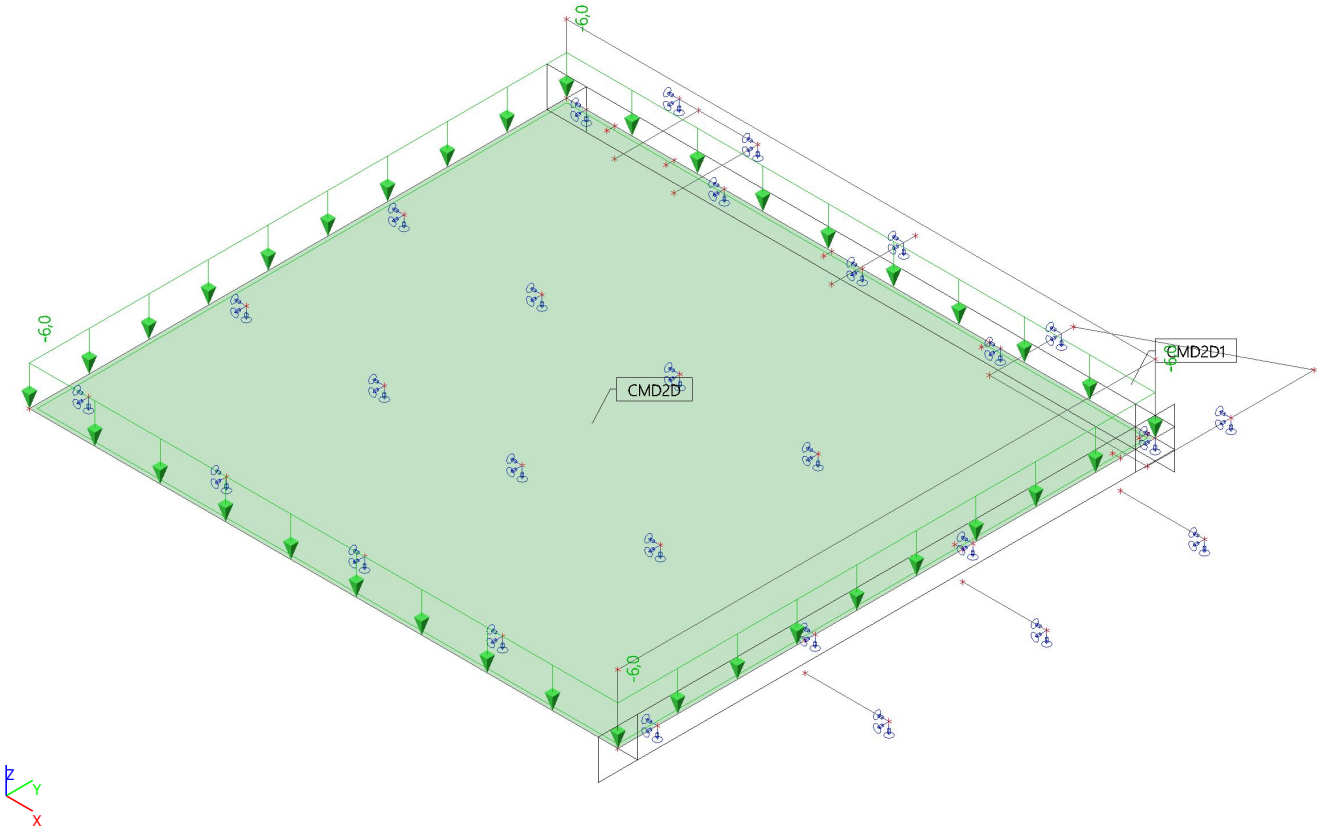
4.1.1.1. Resultant of reactions

Linear calculation
Load case: DL
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	DL	**0,0**	**0,0**	**3758,6**	**-2243,8**	**-352,5**	**0,0**

4.1.2. Load cases - DL1

Name	Description	Action type	Load type	Load group
DL1	Dead load - sand layer	Permanent	Standard	LG1



4.1.2.1. Surface load

Name	Dir	Type	Value [kN/m²]	2D member	Load case	System	Loc
SF1	Z	Force	-6,0	S1	DL1 - Dead load - sand layer	LCS	Length

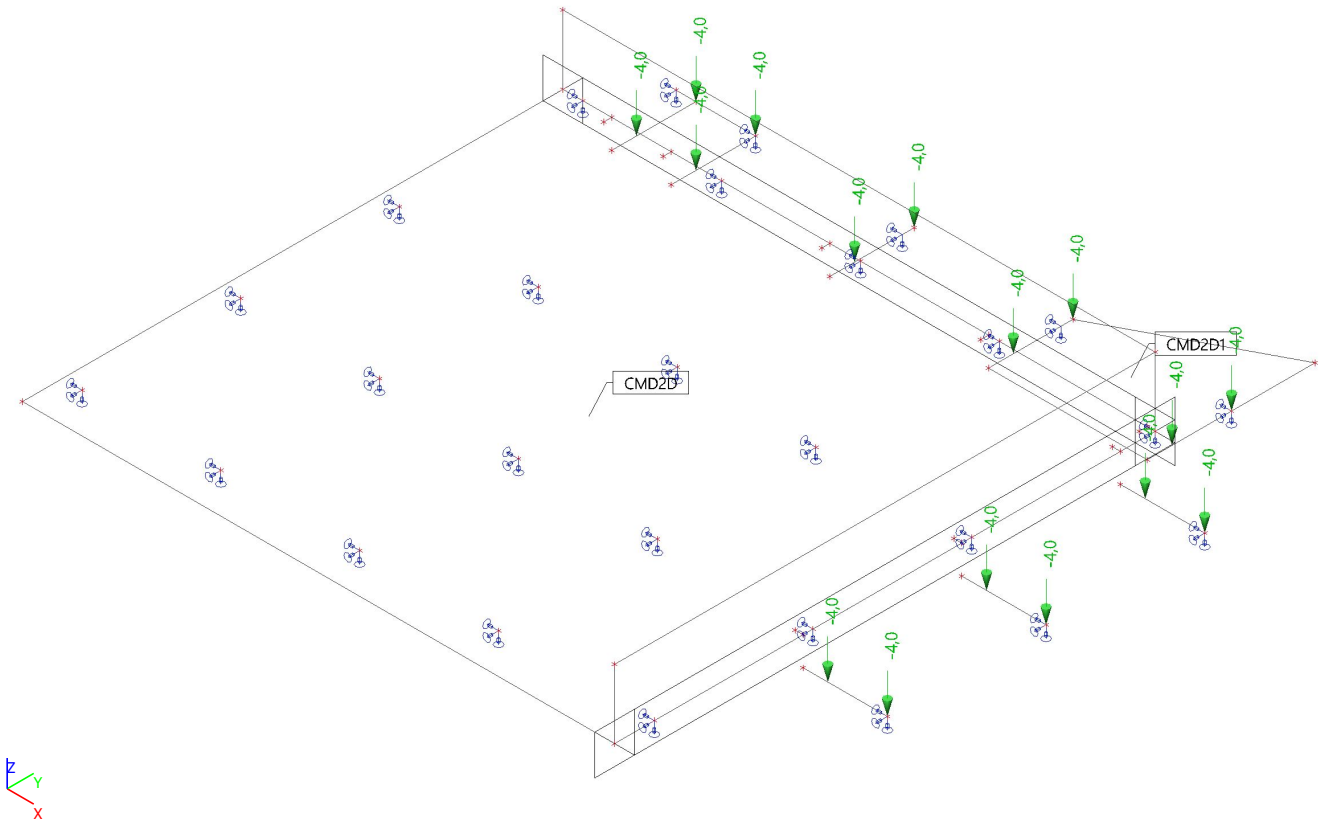
4.1.2.2. Resultant of reactions

Linear calculation
Load case: DL1
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	DL1	**0,0**	**0,0**	**1220,1**	**-2474,0**	**1286,6**	**0,0**

4.1.3. Load cases - DL2

Name	Description	Action type	Load type	Load group
DL2	Dead load - Steel structure	Permanent	Standard	LG1



4.1.3.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F1	N09	GCS	Z	Force	-4,0
F2	N18	GCS	Z	Force	-4,0
F3	N27	GCS	Z	Force	-4,0
F4	N54	GCS	Z	Force	-4,0

Name	Node	System	Dir	Type	Value - F [kN]
F5	N55	GCS	Z	Force	-4,0
F6	N56	GCS	Z	Force	-4,0
F7	N57	GCS	Z	Force	-4,0
F8	N58	GCS	Z	Force	-4,0

4.1.3.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb1	B03	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb2	B02	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb3	B04	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb4	B07	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb5	B08	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb6	B09	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb7	B10	GCS	Z	-4,0	Force	1,500	Abso	From end	1
Fb8	B06	GCS	Z	-4,0	Force	1,500	Abso	From end	1

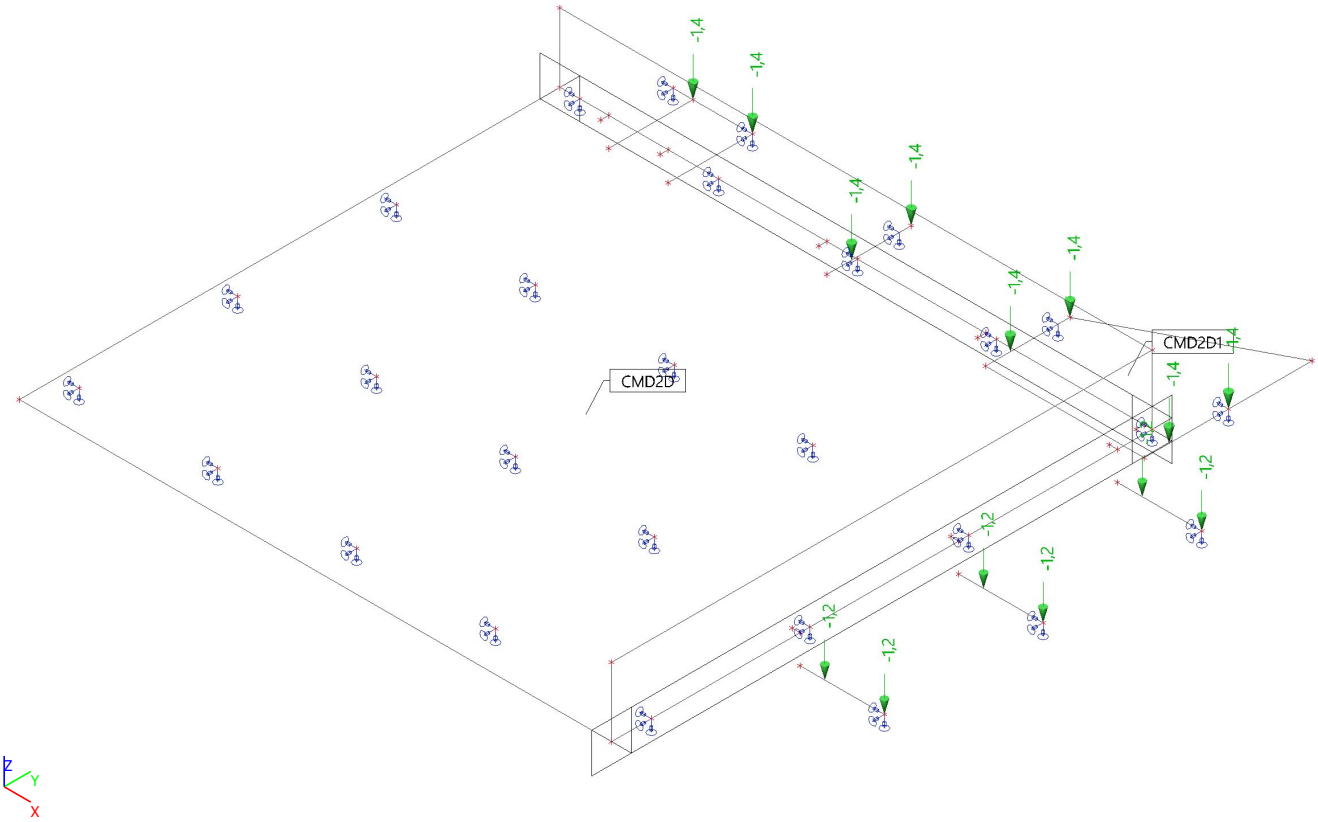
4.1.3.3. Resultant of reactions

Linear calculation
Load case: DL2
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	DL2	**0,0**	**0,0**	**64,0**	**244,2**	**-135,1**	**0,0**

4.1.4. Load cases - EE

Name	Description	Action type	Load type	Load group
EE	Equipment load - empty	Permanent	Standard	LG1



4.1.4.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F9	N09	GCS	Z	Force	-1,2
F10	N18	GCS	Z	Force	-1,2
F11	N27	GCS	Z	Force	-1,2
F12	N54	GCS	Z	Force	-1,4

Name	Node	System	Dir	Type	Value - F [kN]
F13	N55	GCS	Z	Force	-1,4
F14	N56	GCS	Z	Force	-1,4
F15	N57	GCS	Z	Force	-1,4
F16	N58	GCS	Z	Force	-1,4

4.1.4.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb9	B04	GCS	Z	-1,2	Force	1,500	Abso	From end	1
Fb10	B03	GCS	Z	-1,2	Force	1,500	Abso	From end	1
Fb11	B02	GCS	Z	-1,2	Force	1,500	Abso	From end	1
Fb12	B07	GCS	Z	-1,4	Force	1,500	Abso	From end	1
Fb13	B08	GCS	Z	-1,4	Force	1,500	Abso	From end	1
Fb14	B09	GCS	Z	-1,4	Force	1,500	Abso	From end	1

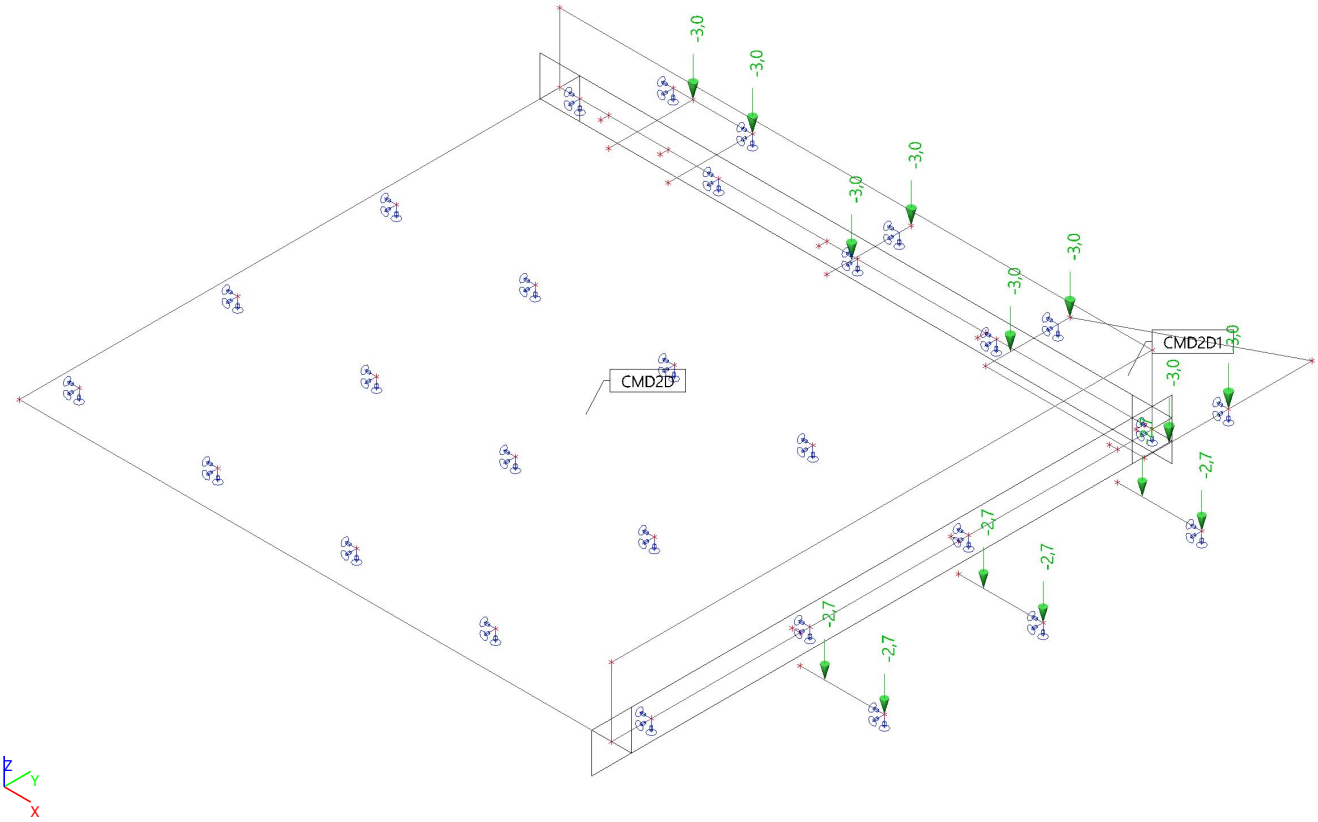
4.1.4.3. Resultant of reactions

Linear calculation
Load case: EE
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	EE	**0,0**	**0,0**	**18,0**	**67,9**	**-56,3**	**0,0**

4.1.5. Load cases - EO

Name	Description	Action type	Load type	Load group
EO	Equipment load - operating	Permanent	Standard	LG1



4.1.5.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F17	N27	GCS	Z	Force	-2,7
F18	N18	GCS	Z	Force	-2,7
F19	N09	GCS	Z	Force	-2,7
F20	N54	GCS	Z	Force	-3,0

Name	Node	System	Dir	Type	Value - F [kN]
F21	N55	GCS	Z	Force	-3,0
F22	N56	GCS	Z	Force	-3,0
F23	N57	GCS	Z	Force	-3,0
F24	N58	GCS	Z	Force	-3,0

4.1.5.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb15	B07	GCS	Z	-3,0	Force	1,500	Abso	From end	1
Fb16	B08	GCS	Z	-3,0	Force	1,500	Abso	From end	1
Fb17	B09	GCS	Z	-3,0	Force	1,500	Abso	From end	1
Fb18	B02	GCS	Z	-2,7	Force	1,500	Abso	From end	1
Fb19	B03	GCS	Z	-2,7	Force	1,500	Abso	From end	1
Fb20	B04	GCS	Z	-2,7	Force	1,500	Abso	From end	1

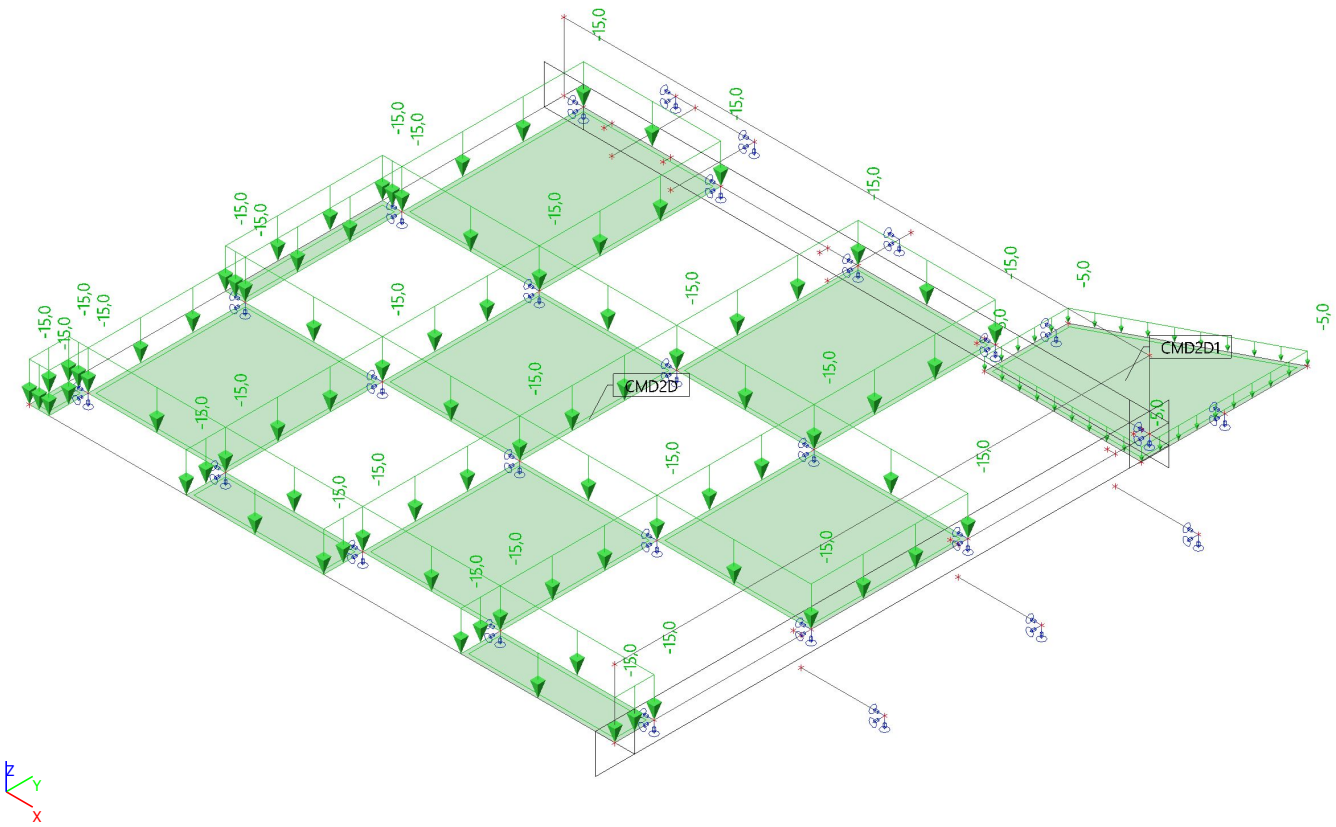
4.1.5.3. Resultant of reactions

Linear calculation
Load case: EO
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	EO	**0,0**	**0,0**	**40,2**	**150,9**	**-126,6**	**0,0**

4.1.6. Load cases - LL_1

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
LL_1	Imposed load	Standard	Variable	Static	LG2	Short	None



4.1.6.1. Free surface load

Name	Dir	Type	Distribution	q [kN/m²]	Validity	Select	System	Location
FF33	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF34	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF35	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF36	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF37	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF38	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF39	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF40	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF41	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF42	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length

4.1.6.2. Surface load

Name	Dir	Type	Value [kN/m²]	2D member	Load case	System	Loc
SF3	Z	Force	-5,0	S4	LL_1 - Imposed load	LCS	Length

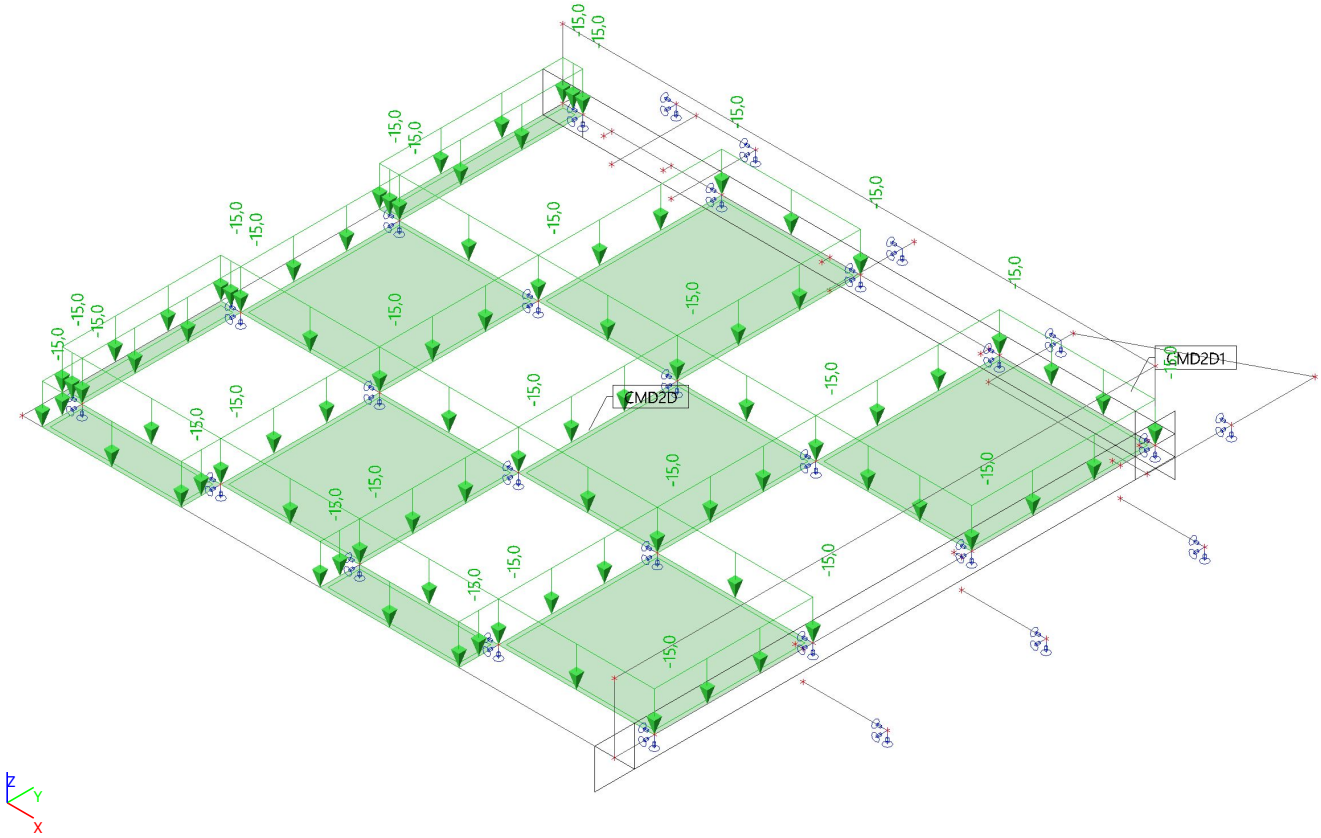
4.1.6.3. Resultant of reactions

Linear calculation
Load case: LL_1
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	LL_1	**0,0**	**0,0**	**1563,5**	**-2710,0**	**1952,1**	**0,0**

4.1.7. Load cases - LL_2

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
LL_2	Imposed load	Standard	Variable	Static	LG2	Short	None



4.1.7.1. Free surface load

Name	Dir	Type	Distribution	q [kN/m²]	Validity	Select	System	Location
FF43	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF44	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF45	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF46	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF47	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF48	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF49	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF50	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF51	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length
FF52	Z	Force	Uniform	-15,0	All	Auto	Member LCS	Length

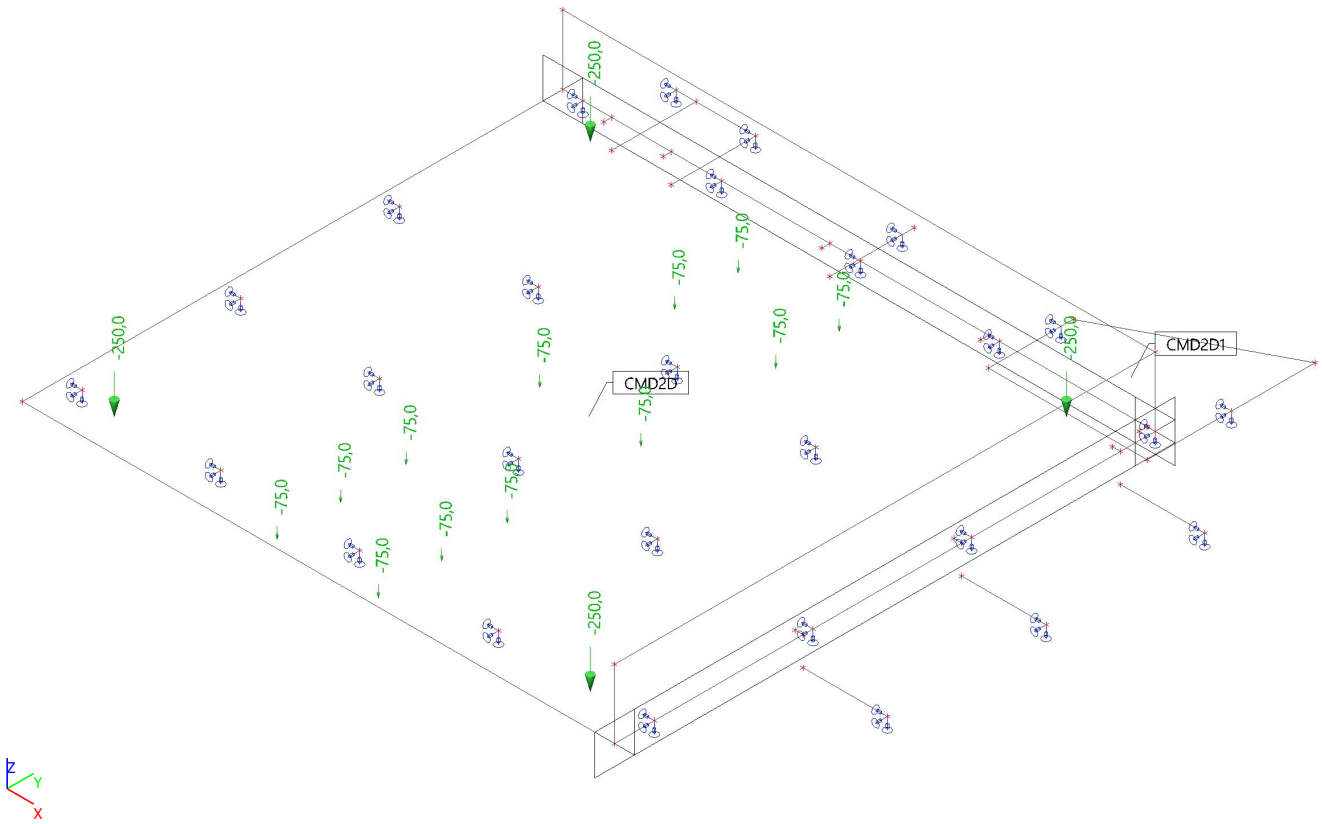
4.1.7.2. Resultant of reactions

Linear calculation
Load case: LL_2
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	LL_2	**0,0**	**0,0**	**1550,3**	**-3066,3**	**982,9**	**0,0**

4.1.8. Load cases - CR_1

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
CR_1	Crane load	Standard	Variable	Static	LG3	Short	None



4.1.8.1. Free point load

Name	System	Type	Coord X [m]	Coord Y [m]	Coord Z [m]	Value - F [kN]
FF1	GCS	Force	3,500	12,813	0,000	-250,0
FF2	GCS	Force	15,500	12,813	0,000	-250,0
FF3	GCS	Force	3,500	0,813	0,000	-250,0
FF4	GCS	Force	15,500	0,813	0,000	-250,0
FF5	GCS	Force	8,225	6,813	0,000	-75,0
FF6	GCS	Force	10,775	6,813	0,000	-75,0
FF7	GCS	Force	8,225	10,213	0,000	-75,0
FF8	GCS	Force	10,775	10,213	0,000	-75,0
FF9	GCS	Force	8,225	11,813	0,000	-75,0
FF10	GCS	Force	10,775	11,813	0,000	-75,0
FF11	GCS	Force	8,225	3,442	0,000	-75,0
FF12	GCS	Force	10,775	3,442	0,000	-75,0
FF13	GCS	Force	8,225	1,792	0,000	-75,0
FF14	GCS	Force	10,775	1,792	0,000	-75,0
FF15	GCS	Force	10,775	0,193	0,000	-75,0
FF16	GCS	Force	8,225	0,193	0,000	-75,0

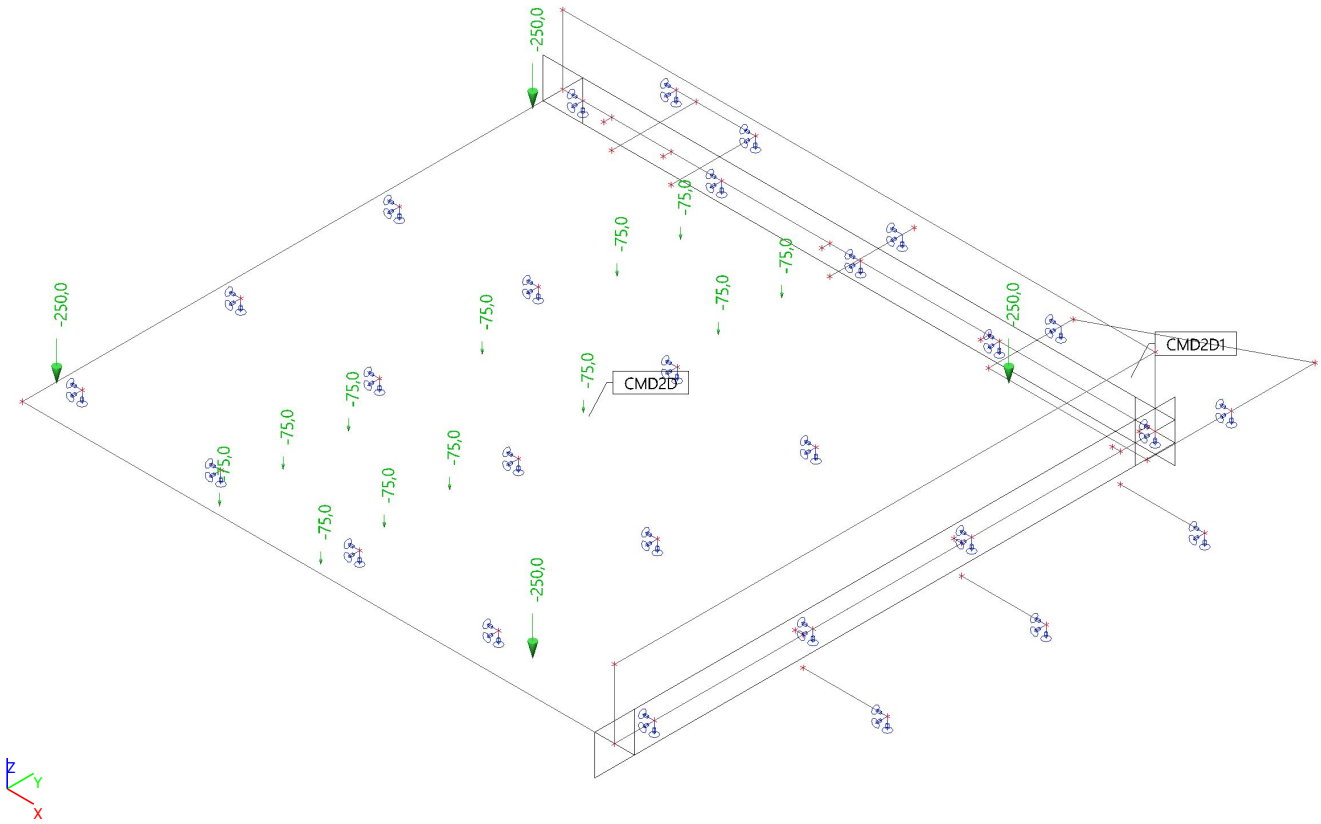
4.1.8.2. Resultant of reactions

Linear calculation
Load case: CR_1
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	CR_1	**0,0**	**0,0**	**1900,0**	**-4844,1**	**1932,2**	**0,0**

4.1.9. Load cases - CR_2

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
CR_2	Crane load	Standard	Variable	Static	LG3	Short	None



4.1.9.1. Free point load

Name	System	Type	Coord X [m]	Coord Y [m]	Coord Z [m]	Value - F [kN]
FF17	GCS	Force	2,050	12,813	0,000	-250,0
FF18	GCS	Force	14,050	12,813	0,000	-250,0
FF19	GCS	Force	2,050	0,813	0,000	-250,0
FF20	GCS	Force	14,050	0,813	0,000	-250,0
FF21	GCS	Force	6,775	6,813	0,000	-75,0
FF22	GCS	Force	9,325	6,813	0,000	-75,0
FF23	GCS	Force	6,775	10,213	0,000	-75,0
FF24	GCS	Force	9,325	10,213	0,000	-75,0
FF25	GCS	Force	6,775	11,813	0,000	-75,0
FF26	GCS	Force	9,325	11,813	0,000	-75,0
FF27	GCS	Force	6,775	3,442	0,000	-75,0
FF28	GCS	Force	9,325	3,442	0,000	-75,0
FF29	GCS	Force	6,775	1,792	0,000	-75,0
FF30	GCS	Force	9,325	1,792	0,000	-75,0
FF31	GCS	Force	9,325	0,193	0,000	-75,0
FF32	GCS	Force	6,775	0,193	0,000	-75,0

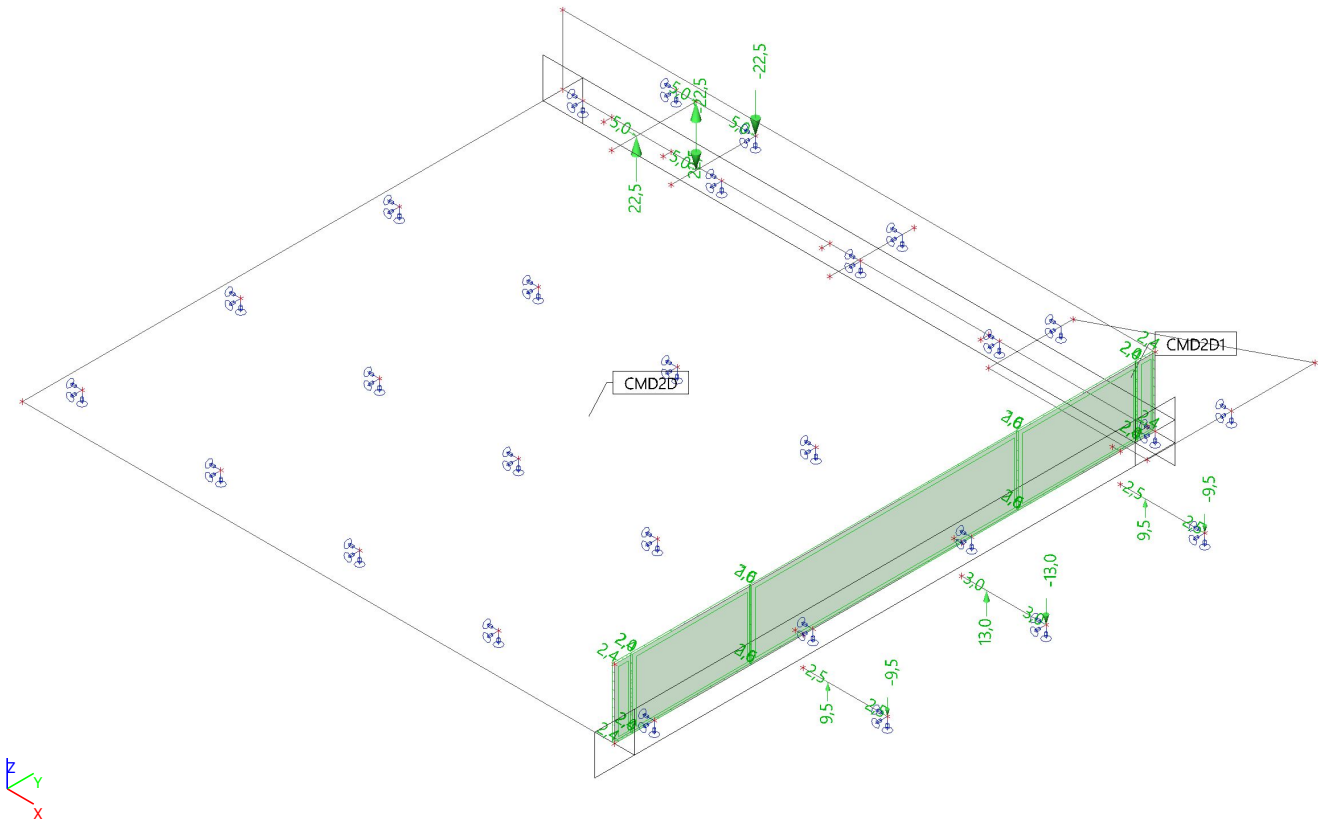
4.1.9.2. Resultant of reactions

Linear calculation
Load case: CR_2
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	CR_2	**0,0**	**0,0**	**1900,0**	**-4844,1**	**4687,2**	**0,0**

4.1.10. Load cases - WL_x

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
WL_x	Wind load	Standard	Variable	Static	LG4	Short	None



4.1.10.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F41	N09	GCS	X	Force	2,5
F42	N27	GCS	X	Force	2,5
F43	N18	GCS	X	Force	3,0
F44	N27	GCS	Z	Force	-9,5
F45	N18	GCS	Z	Force	-13,0

Name	Node	System	Dir	Type	Value - F [kN]
F46	N09	GCS	Z	Force	-9,5
F47	N57	GCS	Z	Force	-22,5
F48	N58	GCS	Z	Force	22,5
F49	N57	GCS	X	Force	5,0
F50	N58	GCS	X	Force	5,0

4.1.10.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb33	B04	GCS	X	2,5	Force	1,500	Abso	From end	1
Fb34	B03	GCS	X	3,0	Force	1,500	Abso	From end	1
Fb35	B02	GCS	X	2,5	Force	1,500	Abso	From end	1
Fb36	B04	GCS	Z	9,5	Force	1,500	Abso	From end	1
Fb37	B03	GCS	Z	13,0	Force	1,500	Abso	From end	1
Fb38	B02	GCS	Z	9,5	Force	1,500	Abso	From end	1
Fb39	B10	GCS	Z	-22,5	Force	1,500	Abso	From end	1
Fb40	B06	GCS	Z	22,5	Force	1,500	Abso	From end	1
Fb41	B10	GCS	X	5,0	Force	1,500	Abso	From end	1
Fb42	B06	GCS	X	5,0	Force	1,500	Abso	From end	1

4.1.10.3. Free surface load

Name	Dir	Type	Distribution	q [kN/m²]	Validity	Select	System	Location
FF21	Z	Force	Uniform	2,4	All	Auto	Member LCS	Length
FF22	Z	Force	Uniform	2,4	All	Auto	Member LCS	Length
FF23	Z	Force	Uniform	2,0	All	Auto	Member LCS	Length
FF24	Z	Force	Uniform	2,0	All	Auto	Member LCS	Length
FF25	Z	Force	Uniform	1,6	All	Auto	Member LCS	Length

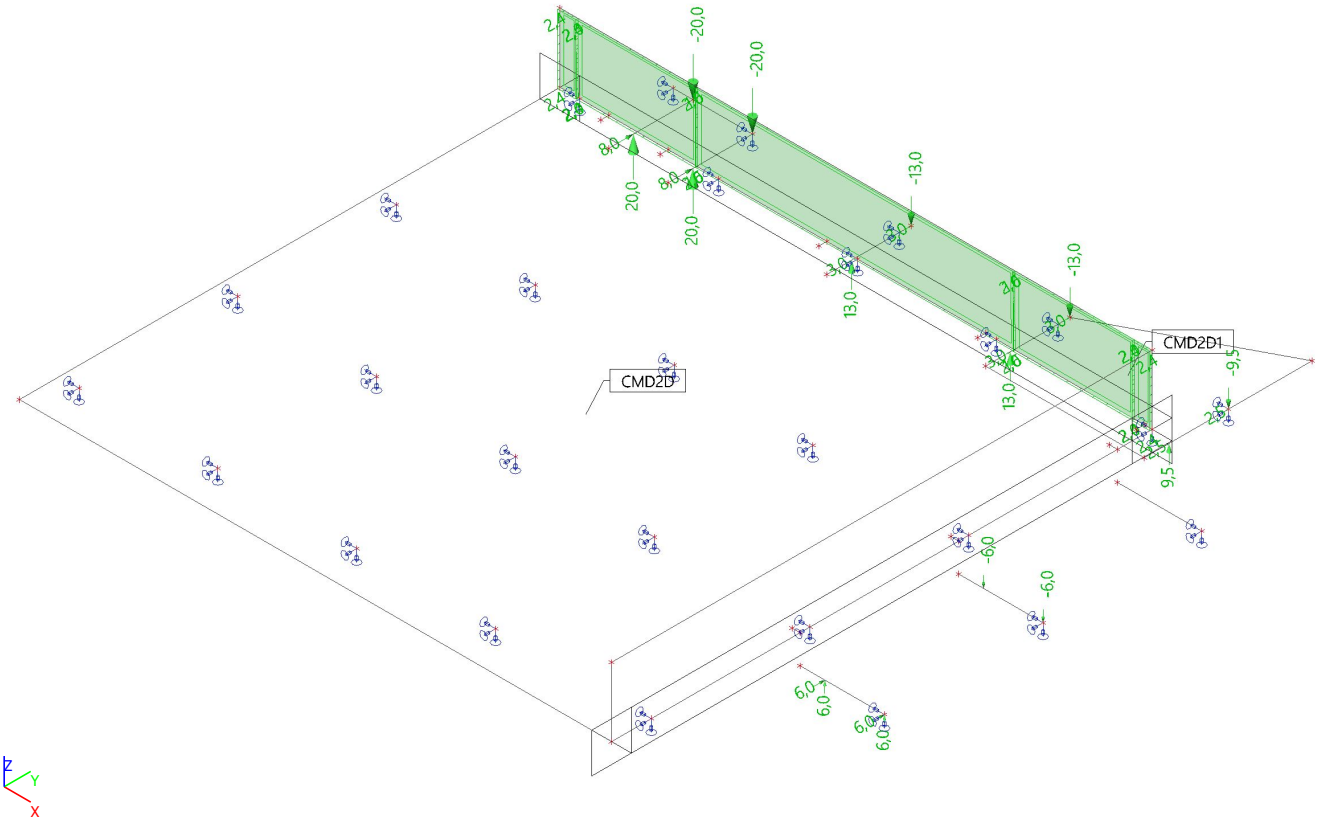
4.1.10.4. Resultant of reactions

Linear calculation
Load case: WL_x
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	WL_x	**7,1**	**0,0**	**0,0**	**0,0**	**-50,8**	**209,2**

4.1.11. Load cases - WL_y

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
WL_y	Wind load	Standard	Variable	Static	LG4	Short	None



4.1.11.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F51	N09	GCS	Y	Force	6,0
F52	N18	GCS	Z	Force	-6,0
F53	N09	GCS	Z	Force	6,0
F54	N54	GCS	Y	Force	2,5
F55	N55	GCS	Y	Force	3,0
F56	N56	GCS	Y	Force	3,0

Name	Node	System	Dir	Type	Value - F [kN]
F57	N54	GCS	Z	Force	-9,5
F58	N55	GCS	Z	Force	-13,0
F59	N56	GCS	Z	Force	-13,0
F60	N57	GCS	Z	Force	-20,0
F61	N58	GCS	Z	Force	-20,0

4.1.11.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb43	B02	GCS	Y	6,0	Force	1,500	Abso	From end	1
Fb44	B02	GCS	Z	6,0	Force	1,500	Abso	From end	1
Fb45	B03	GCS	Z	-6,0	Force	1,500	Abso	From end	1
Fb46	B07	GCS	Y	2,5	Force	1,500	Abso	From end	1
Fb47	B08	GCS	Y	3,0	Force	1,500	Abso	From end	1
Fb48	B09	GCS	Y	3,0	Force	1,500	Abso	From end	1
Fb49	B07	GCS	Z	9,5	Force	1,500	Abso	From end	1
Fb50	B08	GCS	Z	13,0	Force	1,500	Abso	From end	1
Fb51	B09	GCS	Z	13,0	Force	1,500	Abso	From end	1
Fb52	B10	GCS	Z	20,0	Force	1,500	Abso	From end	1
Fb53	B06	GCS	Z	20,0	Force	1,500	Abso	From end	1
Fb54	B06	GCS	Y	8,0	Force	1,500	Abso	From end	1
Fb55	B10	GCS	Y	8,0	Force	1,500	Abso	From end	1

4.1.11.3. Free surface load

Name	Dir	Type	Distribution	q [kN/m²]	Validity	Select	System	Location
FF26	Z	Force	Uniform	2,4	All	Auto	Member LCS	Length
FF27	Z	Force	Uniform	2,4	All	Auto	Member LCS	Length
FF28	Z	Force	Uniform	2,0	All	Auto	Member LCS	Length
FF29	Z	Force	Uniform	2,0	All	Auto	Member LCS	Length
FF30	Z	Force	Uniform	1,6	All	Auto	Member LCS	Length

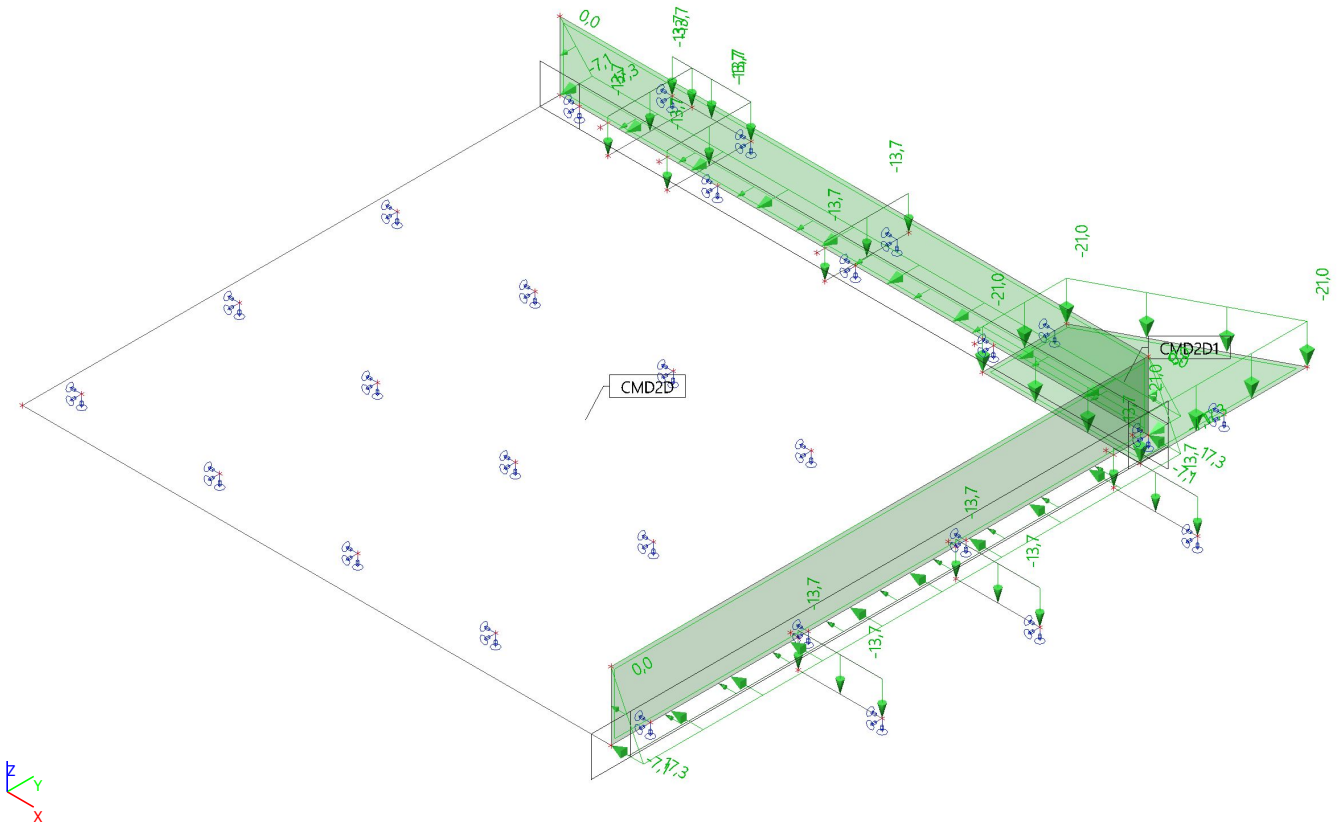
4.1.11.4. Resultant of reactions

Linear calculation
Load case: WL_y
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	WL_y	**0,0**	**1,7**	**0,0**	**88,1**	**0,0**	**-71,4**

4.1.12. Load cases - A

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
A	Accidental	Standard	Variable	Static	LG5	Short	None



4.1.12.1. Line force on 2D member edge

Name	2D member Load case	Type System	Dir Distribution	Value - P_1 [kN/m] Value - P_2 [kN/m]	Pos x_1 Pos x_2	Loc Coor	Edge Orig
LFS1	S1 A - Accidental	Force LCS	X Uniform	-7,1	0.000 1.000	Length Rela	2 From start
LFS2	S1 A - Accidental	Force LCS	Y Uniform	-7,1	0.000 1.000	Length Rela	3 From start

4.1.12.2. Free surface load

Name	Dir	Type	Distribution	q1 [kN/m²]	q2 [kN/m²]	Validity	Select	System	Location
FF31	Z	Force	Dir Y	0,0	17,3	All	Auto	Member LCS	Length
FF32	Z	Force	Dir Y	0,0	17,3	All	Auto	Member LCS	Length

4.1.12.3. Surface load

Name	Dir	Type	Value [kN/m²]	2D member	Load case	System	Loc
SF2	Z	Force	-21,0	S4	A - Accidental	LCS	Length

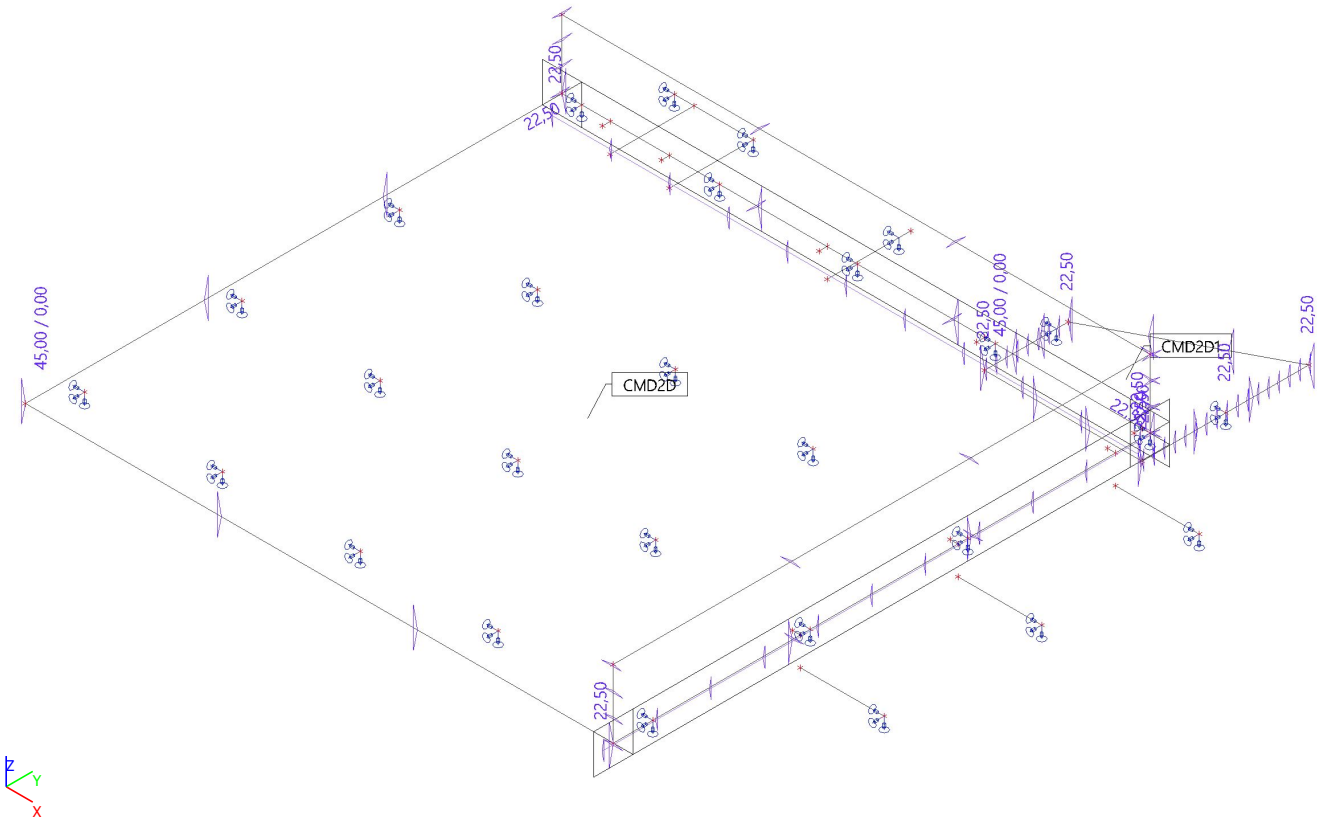
4.1.12.4. Resultant of reactions

Linear calculation
Load case: A
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	A	**300,6**	**329,3**	**468,2**	**2208,4**	**-1034,6**	**262,4**

4.1.13. Load cases - TLt

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
TLt	Temperature load	Standard	Variable	Static	LG6	Short	None



4.1.13.1. Thermal load

Name	Member	Pos x_1	Pos x_2	Coor	Orig	Distribution	Delta [K]
LT1	B01	0.000	1.000	Rela	From start	Constant	22,50
LT2	B05	0.000	1.000	Rela	From start	Constant	22,50
LT3	B08	0.000	1.000	Rela	From start	Constant	22,50
LT4	B11	0.000	1.000	Rela	From start	Constant	22,50
LT5	B07	0.000	1.000	Rela	From start	Constant	22,50

4.1.13.2. Thermal load on 2D member

Name	2D member	Distribution	Delta [K]	+z - Top delta [K]	-z - Bottom delta [K]
ST1	S1	Linear		45,00	0,00
ST2	S2	Constant	22,50		
ST3	S3	Constant	22,50		
ST4	S4	Linear		45,00	0,00

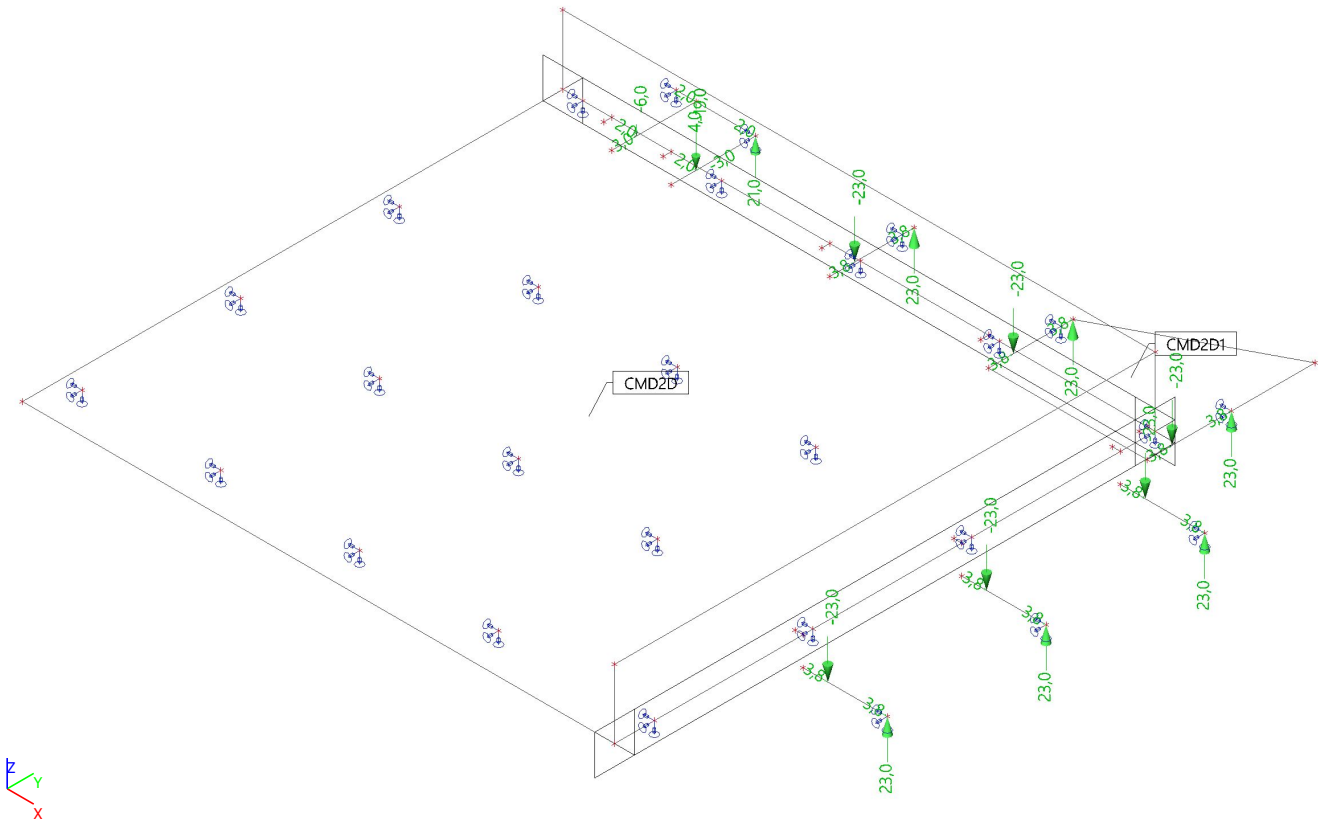
4.1.13.3. Resultant of reactions

Linear calculation
Load case: TLt
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	TLt	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**

4.1.14. Load cases - TLs

Name	Description	Spec	Action type	Load type	Load group	Duration	Master load case
TLs	Temperature load - stress	Standard	Variable	Static	LG6	Short	None



4.1.14.1. Point force in node

Name	Node	System	Dir	Type	Value - F [kN]
F25	N09	GCS	X	Force	3,8
F26	N18	GCS	X	Force	3,8
F27	N27	GCS	X	Force	3,8
F28	N57	GCS	X	Force	2,0
F29	N58	GCS	X	Force	2,0
F30	N54	GCS	Y	Force	3,8
F31	N55	GCS	Y	Force	3,8
F32	N56	GCS	Y	Force	3,8

Name	Node	System	Dir	Type	Value - F [kN]
F33	N09	GCS	Z	Force	23,0
F34	N18	GCS	Z	Force	23,0
F35	N27	GCS	Z	Force	23,0
F36	N57	GCS	Z	Force	21,0
F37	N54	GCS	Z	Force	23,0
F38	N55	GCS	Z	Force	23,0
F39	N56	GCS	Z	Force	23,0
F40	N58	GCS	Z	Force	4,0

4.1.14.2. Point force on beam

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb21	B04	GCS	X	3,8	Force	1,500	Abso	From end	1
Fb22	B03	GCS	X	3,8	Force	1,500	Abso	From end	1
Fb23	B02	GCS	X	3,8	Force	1,500	Abso	From end	1
Fb24	B07	GCS	Y	3,8	Force	1,500	Abso	From end	1
Fb25	B08	GCS	Y	3,8	Force	1,500	Abso	From end	1
Fb26	B09	GCS	Y	3,8	Force	1,500	Abso	From end	1
Fb27	B04	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb28	B03	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb29	B02	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb30	B07	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb31	B08	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb32	B09	GCS	Z	-23,0	Force	1,500	Abso	From end	1
Fb56	B10	GCS	Z	-19,0	Force	1,500	Abso	From end	1
Fb57	B06	GCS	Z	-6,0	Force	1,500	Abso	From end	1
Fb58	B10	GCS	Y	-3,0	Force	1,500	Abso	From end	1
Fb59	B06	GCS	Y	3,0	Force	1,500	Abso	From end	1

Name	Member	System	Dir	Value - F [kN]	Type	Pos x [m]	Coor	Orig	Rep (n)
Fb60	B10	GCS	X	2,0	Force	1,500	Abso	From end	1
Fb61	B06	GCS	X	2,0	Force	1,500	Abso	From end	1

4.1.14.3. Resultant of reactions

Linear calculation
Load case: TLs
Extreme: Global
Selection: All
System: Global

x [m]	y [m]	z [m]	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]
10,517	8,840	-0,206	TLs	**-30,5**	**-22,5**	**0,0**	**-152,6**	**122,2**	**2,1**

4.2. Load groups

Name	Load	Relation	Type
LG1	Permanent		
LG2	Variable	Standard	Cat E : Storage
LG3	Variable	Exclusive	Cat E : Storage
LG4	Variable	Exclusive	Wind
LG5	Accidental	Exclusive	
LG6	Variable	Exclusive	Temperature

4.3. Combinations

Name	Descr.	Type	Load cases	Coeff. [-]
ULS_1	InOperation	EN-ULS (STR/GEO) Set B	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			EO - Equipment load - operating	1,00
			TLs - Temperature load - stress	1,00
ULS_2	Crane	EN-ULS (STR/GEO) Set B	DL - Dead load - Self weight	1,00
			DL1 - Dead load - sand layer	1,00
			CR_1 - Crane load	1,00
			CR_2 - Crane load	1,00
ULS_3	Empty	EN-ULS (STR/GEO) Set B	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			EE - Equipment load - empty	1,00
ULS_T1	InOperation	EN-ULS (STR/GEO) Set B	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			TLt - Temperature load	1,00
			EO - Equipment load - operating	1,00
			TLs - Temperature load - stress	1,00
ULS_T2	Empty	EN-ULS (STR/GEO) Set B	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			TLt - Temperature load	1,00
			EE - Equipment load - empty	1,00
ULS_A		EN-Accidental 1	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			A - Accidental	1,00
			EO - Equipment load - operating	1,00
SLS_Char1	InOperation	EN-SLS Characteristic	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			EO - Equipment load - operating	1,00
			TLs - Temperature load - stress	1,00
SLS_Char2	Crane	EN-SLS Characteristic	DL - Dead load - Self weight	1,00
			DL1 - Dead load - sand layer	1,00
			CR_1 - Crane load	1,00
			CR_2 - Crane load	1,00
SLS_Char3	Empty	EN-SLS Characteristic	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			EE - Equipment load - empty	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
SLS_Freq_1	InOperation	EN-SLS Frequent	DL - Dead load - Self weight	1,00

Name	Descr.	Type	Load cases	Coeff. [-]
			DL2 - Dead load - Steel structure	1,00
			EO - Equipment load - operating	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			TLs - Temperature load - stress	1,00
SLS_Freq_2	Crane	EN-SLS Frequent	DL - Dead load - Self weight	1,00
			DL1 - Dead load - sand layer	1,00
			CR_1 - Crane load	1,00
			CR_2 - Crane load	1,00
SLS_Freq_3	Empty	EN-SLS Frequent	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			EE - Equipment load - empty	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
SLS_Freq_T1	InOperation	EN-SLS Frequent	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			EO - Equipment load - operating	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			TLt - Temperature load	1,00
			TLs - Temperature load - stress	1,00
SLS_Freq_T2	Empty	EN-SLS Frequent	DL - Dead load - Self weight	1,00
			DL2 - Dead load - Steel structure	1,00
			EE - Equipment load - empty	1,00
			LL_1 - Imposed load	1,00
			LL_2 - Imposed load	1,00
			WL_x - Wind load	1,00
			WL_y - Wind load	1,00
			TLt - Temperature load	1,00

4.4. Result classes

Name	List
ULS	ULS_1 - EN-ULS (STR/GEO) Set B
	ULS_2 - EN-ULS (STR/GEO) Set B
	ULS_3 - EN-ULS (STR/GEO) Set B
	ULS_A - EN-Accidental 1
ULS_Temperature	ULS_T1 - EN-ULS (STR/GEO) Set B
	ULS_T2 - EN-ULS (STR/GEO) Set B
SLS_Char	SLS_Char2 - EN-SLS Characteristic
	SLS_Char3 - EN-SLS Characteristic
	SLS_Char1 - EN-SLS Characteristic
SLS_Freq	SLS_Freq_1 - EN-SLS Frequent
	SLS_Freq_2 - EN-SLS Frequent
	SLS_Freq_3 - EN-SLS Frequent
	SLS_Freq_T1 - EN-SLS Frequent
	SLS_Freq_T2 - EN-SLS Frequent
ULS+SLS	ULS_1 - EN-ULS (STR/GEO) Set B
	ULS_2 - EN-ULS (STR/GEO) Set B
	ULS_3 - EN-ULS (STR/GEO) Set B
	SLS_Freq_1 - EN-SLS Frequent
	SLS_Freq_2 - EN-SLS Frequent
	SLS_Freq_3 - EN-SLS Frequent
	SLS_Freq_T1 - EN-SLS Frequent
	SLS_Freq_T2 - EN-SLS Frequent

5. Results

5.1. Reactions

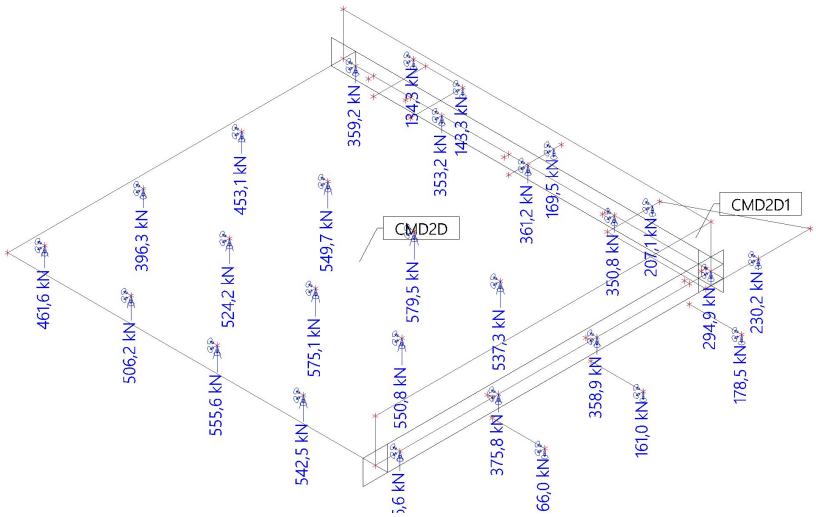
Linear calculation
Class: ULS
System: Global
Extreme: Global
Selection: All

Nodal reactions

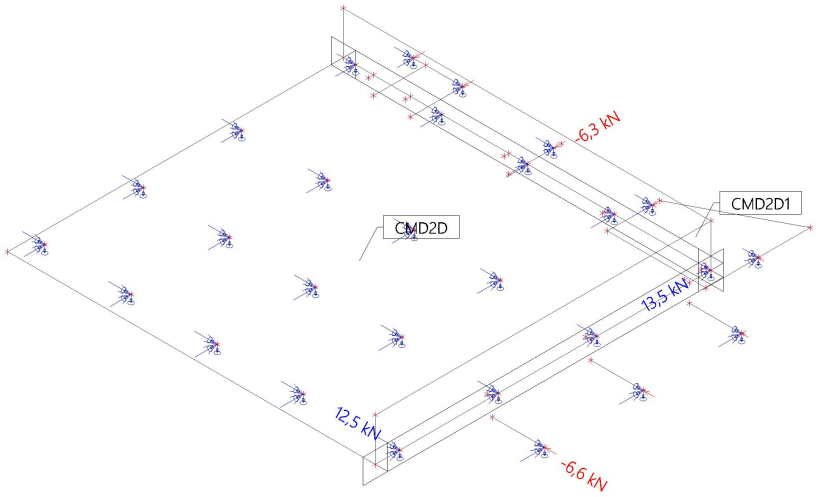
Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn06/N09	ULS_1/1	**-6,6**	-0,3	143,4	0,0	0,0	0,0	0,0	0,0
Sn05/N08	ULS_A/2	**12,5**	13,4	236,4	**0,0**	**0,0**	**0,0**	0,0	0,0
Sb2/B09	ULS_1/1	-0,8	**-6,3**	147,2	0,0	0,0	0,0	0,0	0,0
Sn19/N36	ULS_A/2	10,4	**13,5**	243,6	0,0	0,0	0,0	0,0	0,0
Sn26/N59	ULS_3/3	-0,6	-2,9	**44,9**	0,0	0,0	0,0	0,0	0,0
Sn15/N24	ULS_1/4	0,5	1,0	**579,5**	0,0	0,0	0,0	0,0	0,0

Name	Combination key
ULS_1/1	1.20*DL + 1.50*LL_1 + 1.50*LL_2 + 1.20*EO + 1.50*TLs + 1.20*DL2
ULS_A/2	DL + 0.80*LL_1 + 0.80*LL_2 + 0.20*WL_x + A + EO + DL2
ULS_3/3	0.90*DL + 1.50*WL_x + 0.90*EE + 0.90*DL2
ULS_1/4	1.35*DL + 1.50*LL_1 + 1.50*LL_2 + 1.35*EO + 1.35*DL2

Values: **R_z**
Linear calculation
Class: ULS
System: Global
Extreme: Mesh
Selection: All



Values: **R_x, R_y**
Linear calculation
Class: ULS
System: Global
Extreme: Global
Selection: All



6. Results cracked

6.1. Reactions

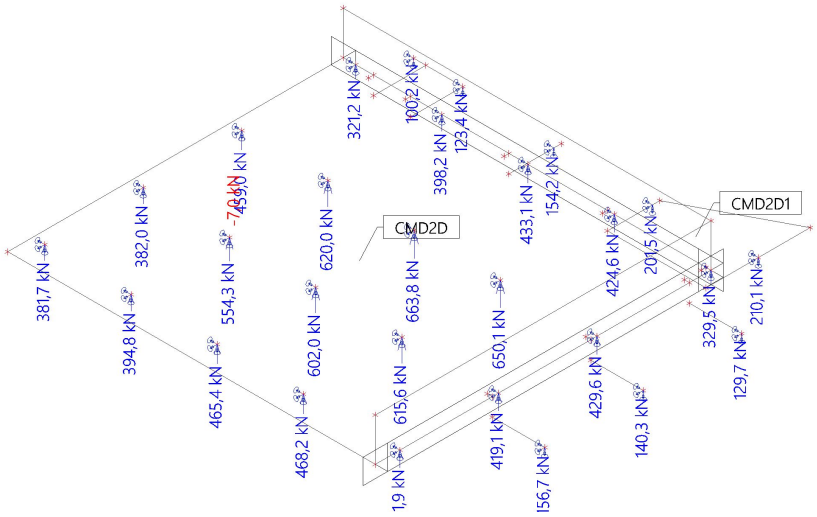
Linear calculation
Class: ULS_Temperature
System: Global
Extreme: Global
Selection: All

Nodal reactions

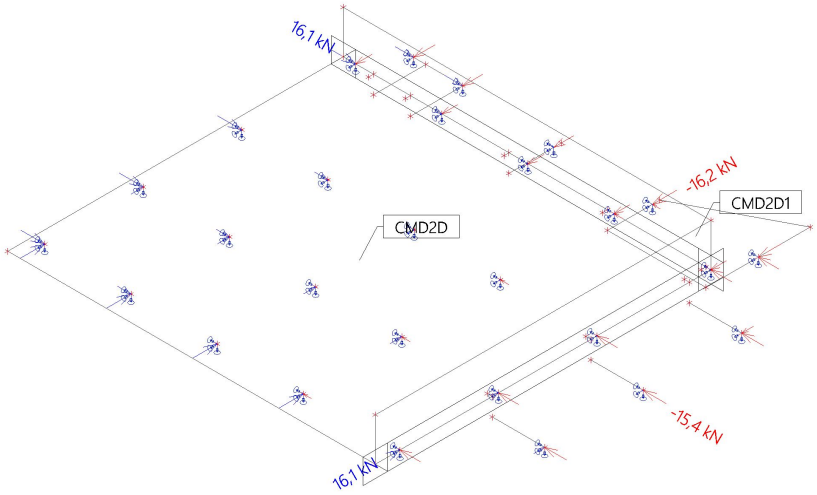
Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn12/N18	ULS_T2/1	**-15,4**	-0,2	138,1	0,0	0,0	0,0	0,0	0,0
Sn20/N40	ULS_T2/1	**16,1**	-9,4	316,2	**0,0**	**0,0**	**0,0**	0,0	0,0
Sb1/B08	ULS_T2/1	-5,3	**-16,2**	198,9	0,0	0,0	0,0	0,0	0,0
Sn05/N08	ULS_T2/1	-13,0	**16,1**	411,5	0,0	0,0	0,0	0,0	0,0
Sn08/N14	ULS_T1/2	8,5	6,7	**-7,0**	0,0	0,0	0,0	0,0	0,0
Sn15/N24	ULS_T1/3	0,9	1,8	**663,8**	0,0	0,0	0,0	0,0	0,0

Name	Combination key
ULS_T2/1	1.20*DL + 1.50*LL_1 + 1.50*LL_2 + 1.50*TLt + 1.20*EE + 1.20*DL2
ULS_T1/2	0.90*DL + 1.50*TLt + 0.90*EO + 0.90*DL2
ULS_T1/3	1.35*DL + 1.50*LL_1 + 1.50*LL_2 + 1.35*EO + 1.35*DL2

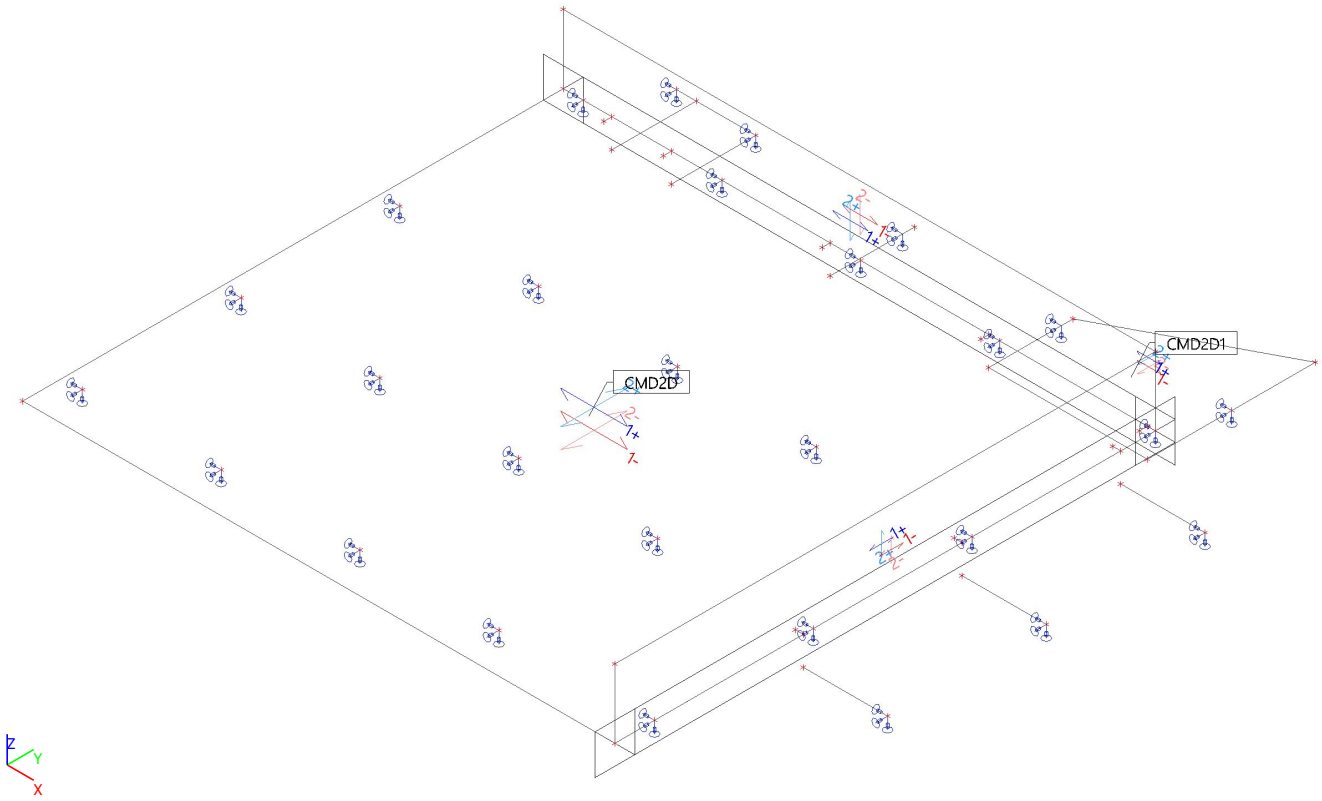
Values: **R_z**
Linear calculation
Class: ULS_Temperature
System: Global
Extreme: Mesh
Selection: All



Values: **R_x, R_y**
Linear calculation
Class: ULS_Temperature
System: Global
Extreme: Global
Selection: All



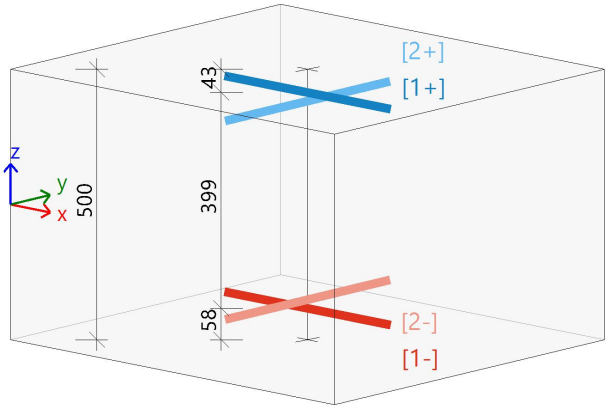
7. Basic slab reinforcement



7.1. Reinforcement design slabs (ULS+SLS)

Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S1
Location: In nodes avg. on macro. System: LCS mesh element

Plate S1	**h=500 mm**
NEN EN 1992-1-1+C2/NB+A1:2020	Node 188/13101 [X= 2,000, Y=10,652, Z=0,000 m]



Concrete: C30/37
Bi-linear stress-strain diagram
Exposure class: XC4, XF3, XS1
Cover: 35 mm (upper); 50 mm (lower)

Reinforcement: B 500B
Bi-linear with an inclined top branch
[1+] ϕ16,0/100
[2+] ϕ16,0/100
[1-] ϕ16,0/100
[2-] ϕ16,0/100 (insufficient)

Design width: b = 1.0 m

Longitudinal reinforcement

	Basic	Additional		$A_{s,ult}$	$A_{s,min}$	$\Delta A_{s,serv}$	$A_{s,req}$	$A_{s,prov}$	$A_{s,max}$	Status
		User	Provided	[mm²]	[mm²]	[mm²]	[mm²]	[mm²]	[mm²]	
[1+]	**ϕ16,0/100**	no reinf.	no reinf.	340	503	0	**503**	**2011**	3794	**OK**
[2+]	**ϕ16,0/100**	no reinf.	no reinf.	0	---	0	**0**	**2011**	---	**OK**
[1-]	**ϕ16,0/100**	no reinf.	no reinf.	317	503	0	**503**	**2011**	3794	**OK**
[2-]	**ϕ16,0/100**	no reinf.	no reinf.	1169	780	1190	**2359**	**2012**	3794	**Not OK**

Ultimate limit state

Designed in directions of the reinforcement layers:

	Case	α_s	m_{Ed}	n_{Ed}	d	x	z	F_{cd}	F_{sd}	$A_{s,ult}$
		[°]	[kNm]	[kN]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm²]
[1+]	ULS_2	0,0	**-4,11**	**285,59**	457,0	0,0	411,3	0,0	147,7	**340**
[1-]	ULS_2	0,0	**-4,11**	**285,59**	457,0	0,0	411,3	0,0	137,9	**317**
[2-]	ULS_2	90,0	**145,89**	**276,92**	426,0	15,4	420,0	-231,3	508,2	**1169**

ULS_2	1.35*DL+1.50*CR_2+1.35*DL1

Serviceability limit state

Designed in directions of principal stresses:

	Case	α_σ [°]		m_{Ed} [kNm]	n_{Ed} [kN]	$A_{s,ult,\sigma}$ [mm²]	$A_{s,serv,\sigma}$ [mm²]	σ_{ct} [MPa]	σ_s [MPa]	w_k [mm]	$\Delta A_{s,serv}$ [mm²]
σ_I[+]	SLS_Freq_2/24	-9,2	Ch	**-3,22**	**-0,20**	490	490	0,08	13,4	0,023	**Δ_{1+}=0**
			Fr	**-2,94**	**-0,20**			> 0,00	≤ 500,0	≤ 0,300	**Δ_{2+}=0**
σ_{II}[+]	SLS_Freq_1/23	84,5	Ch	**41,99**	**-4,88**	5	5	-1,00	4,4	0.000	**Δ_{1+}=0**
			Fr	**42,80**	**-4,20**			≤ 0,00	≤ 500,0	≤ 0,300	**Δ_{2+}=0**
σ_I[-]	SLS_Freq_T2/25	-87,5	Ch	**89,36**	**3,02**	1168	2355	2,00	241,4	0,298	**Δ_{1-}=0**
			Fr	**223,21**	**-10,18**			> 0,00	≤ 500,0	≤ 0,300	**Δ_{2-}=1188**
σ_{II}[-]	SLS_Freq_1/23	-5,6	Ch	**-0,45**	**-0,05**	509	520	-0,01	-0,1	0.000	**Δ_{1-}=0**
			Fr	**-0,46**	**-0,03**			≤ 0,00	≤ 500,0	≤ 0,300	**Δ_{2-}=11**

SLS_Freq_T2/25	Ch	DL+LL_1+LL_2+EE+DL2
	Fr	DL+0.80*LL_1+0.80*LL_2+EE+DL2
SLS_Freq_1/23	Ch	DL+WL_y+EO+DL2
	Fr	DL+EO+DL2
SLS_Freq_2/24	Ch	DL+CR_2+DL1
	Fr	DL+0.80*CR_2+DL1

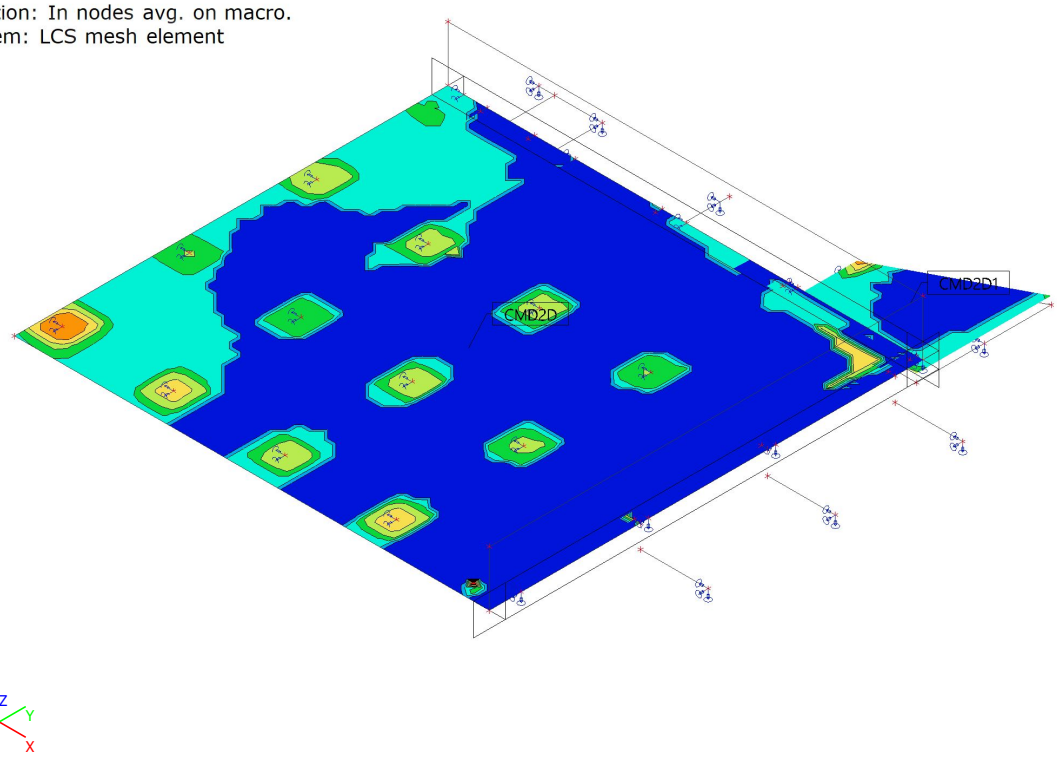
Shear reinforcement

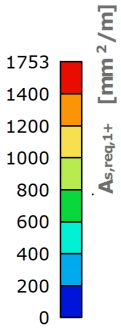
	Case	θ [°]	v_{Ed} [kN/m]	$A_{sl,x}$ [mm²]	$A_{sl,y}$ [mm²]	ρ_l [%]	$v_{Rd,c}$ [kN/m]	$v_{Rd,max}$ [kN/m]	$A_{sw,req}$ [mm²/m²]	Status
[-]	ULS_2	40,0	**481,5**	2011	2012	0,463	210,8	2200,5	**2196**	**OK**

Errors/Warnings/Notes

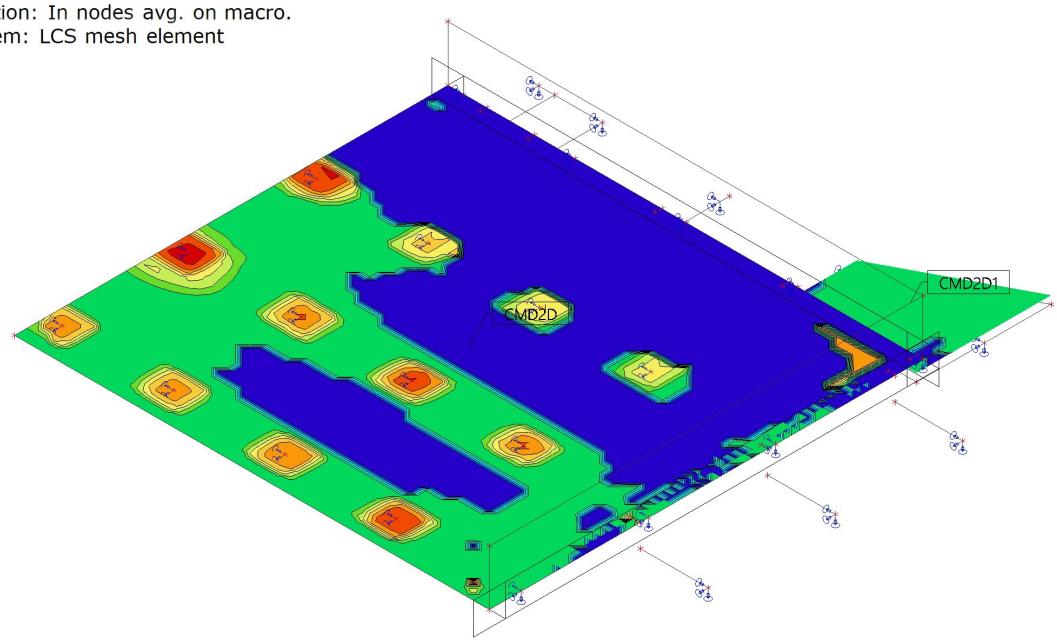
Code	Description	Solution
W/01	The applied provided reinforcement is not sufficient (As,prov < As,req).	Increase the amount of the basic or additional reinforcement.

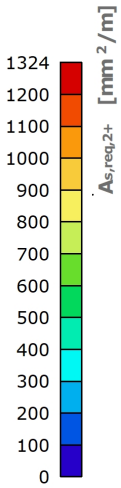
Values: $A_{s,req,1+}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S1, S4
Location: In nodes avg. on macro.
System: LCS mesh element



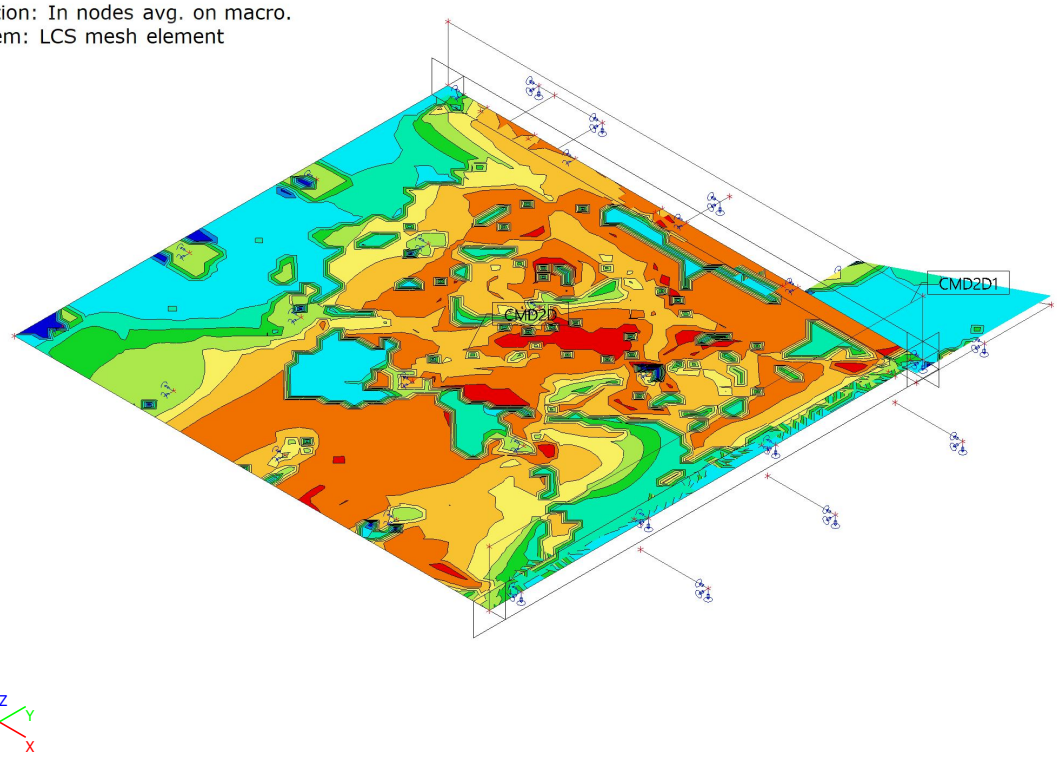


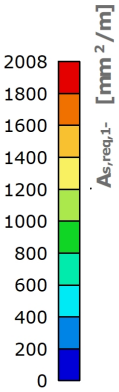
Values: $A_{s,req,2+}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S1, S4
Location: In nodes avg. on macro.
System: LCS mesh element



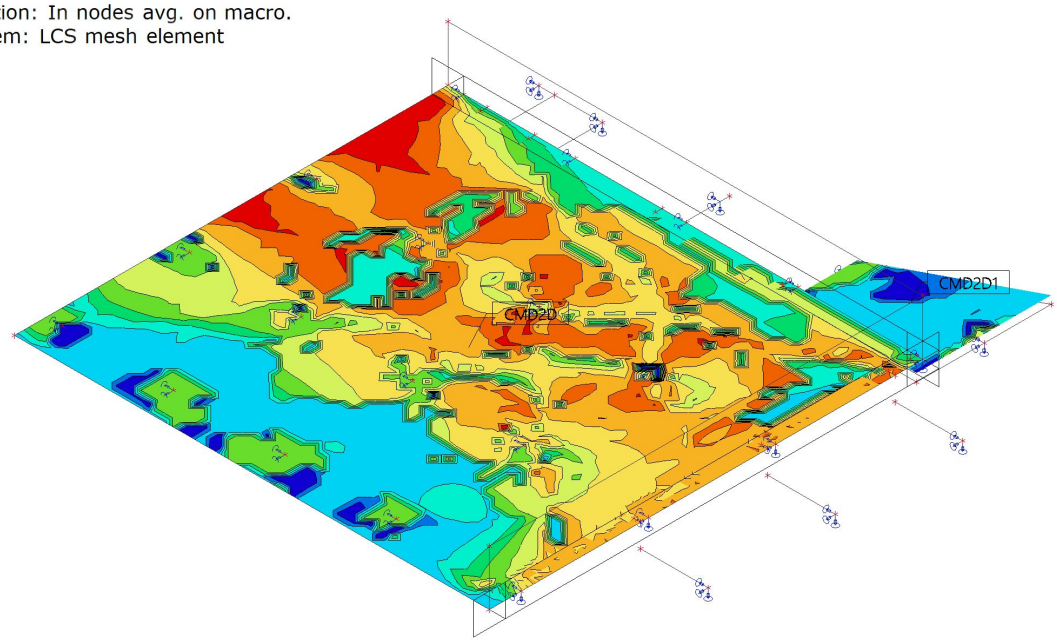


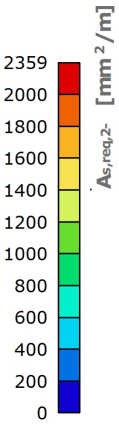
Values: $A_{s,req,1-}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S1, S4
Location: In nodes avg. on macro.
System: LCS mesh element





Values: $A_{s,req,2-}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S1, S4
Location: In nodes avg. on macro.
System: LCS mesh element

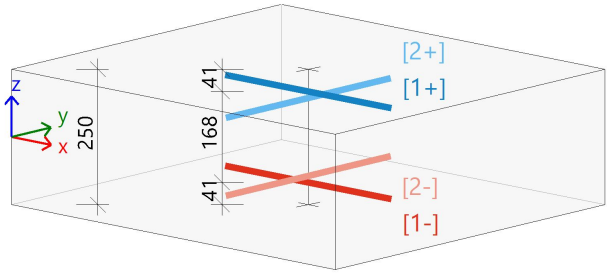




7.2. Reinforcement design beams (ULS+SLS)

Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S2, S3
Location: In nodes avg. on macro. System: LCS mesh element

Wall S3	**h=250 mm**
NEN EN 1992-1-1+C2/NB+A1:2020	Node 4209/1462 [X= 16,925, Y=4,707, Z=1,730 m]



Design width: b = 1.0 m

Concrete: C30/37
Bi-linear stress-strain diagram
Exposure class: XC4, XF3, XS1
Cover: 35 mm

Reinforcement: B 500B
Bi-linear with an inclined top branch
[1+] ϕ12,0/100 + ϕ12,0/200
[2+] ϕ12,0/100
[1-] ϕ12,0/100 + ϕ12,0/200
[2-] ϕ12,0/100

Longitudinal reinforcement

	Basic	Additional		$A_{s,ult}$	$A_{s,min}$	$\Delta A_{s,serv}$	$A_{s,req}$	$A_{s,prov}$	$A_{s,max}$	Status
		User	Provided	[mm²]	[mm²]	[mm²]	[mm²]	[mm²]	[mm²]	
[1+]	**ϕ12,0/100**	no reinf.	**ϕ12,0/200**	284	283	1163	**1446**	**1696**	2308	**OK**
[2+]	**ϕ12,0/100**	no reinf.	no reinf.	0	375	0	**375**	**1131**	2308	**OK**
[1-]	**ϕ12,0/100**	no reinf.	**ϕ12,0/200**	256	283	1096	**1378**	**1696**	2308	**OK**
[2-]	**ϕ12,0/100**	no reinf.	no reinf.	11	375	0	**375**	**1131**	2308	**OK**

Ultimate limit state

Designed in directions of the reinforcement layers:

	Case	α_s	m_{Ed}	n_{Ed}	d	x	z	F_{cd}	F_{sd}	$A_{s,ult}$
		[°]	[kNm]	[kN]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm²]
[1+]	ULS_2	0,0	**-1,01**	**234,46**	209,0	0,0	188,1	0,0	123,3	**284**
[1-]	ULS_2	0,0	**-1,01**	**234,46**	209,0	0,0	188,1	0,0	111,2	**256**
[2-]	ULS_3	90,0	**0,15**	**7,21**	197,0	0,0	177,3	0,0	4,7	**11**

ULS_2	0.90*DL+1.50*CR_1+0.90*DL1
ULS_3	1.35*DL+1.50*LL_1+1.50*LL_2+1.35*EE+1.35*DL2
ULS_2	0.90*DL+1.50*CR_2+0.90*DL1

Serviceability limit state

Designed in directions of principal stresses:

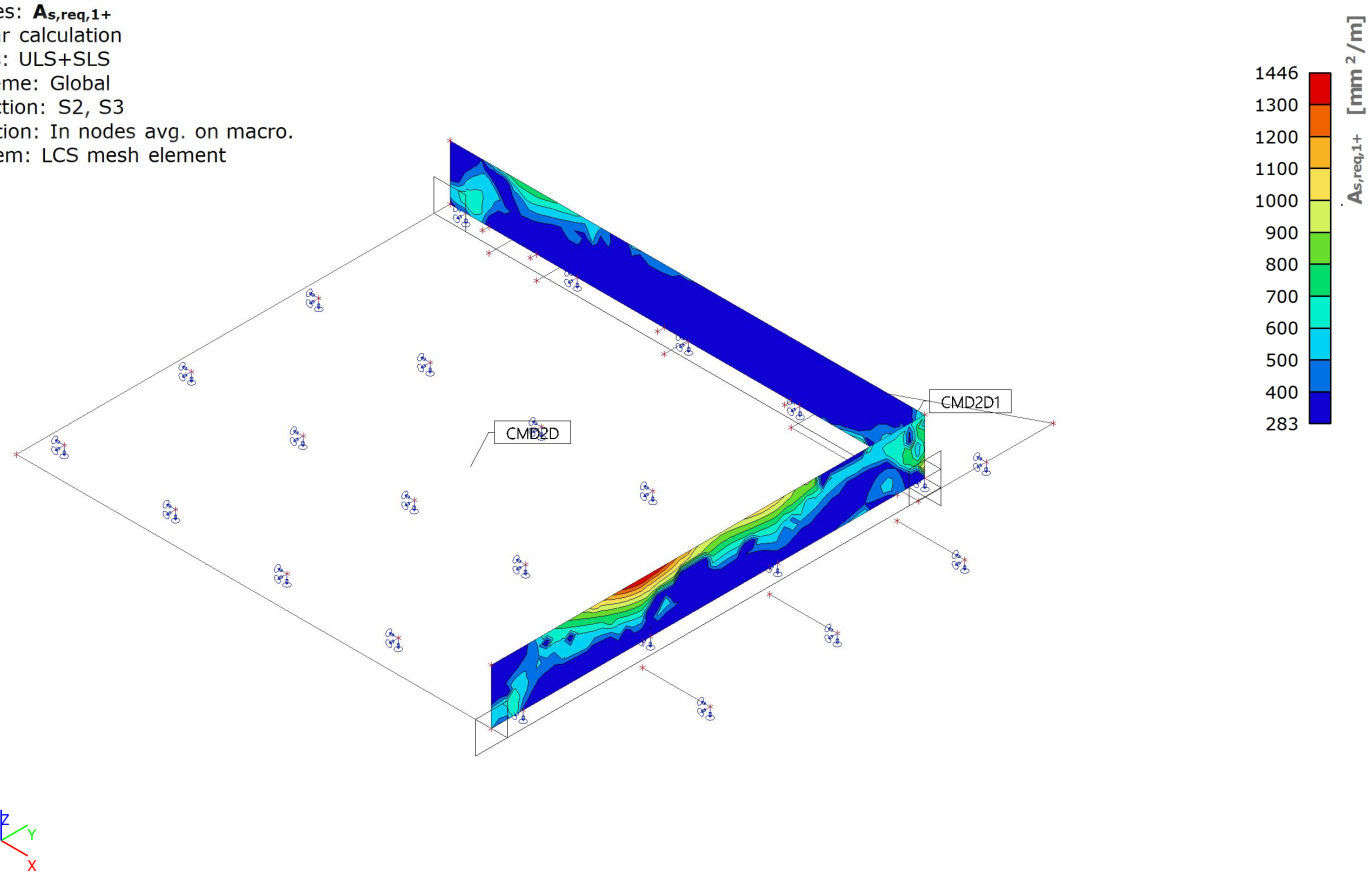
	Case	α_σ [°]		m_{Ed} [kNm]	n_{Ed} [kN]	$A_{s,ult,\sigma}$ [mm²]	$A_{s,serv,\sigma}$ [mm²]	σ_{ct} [MPa]	σ_s [MPa]	w_k [mm]	$\Delta A_{s,serv}$ [mm²]
σ_I[+]	SLS_Freq_T2/29	1,1	Ch	**-0,26**	**455,19**	284	1446	3,63	159,7	0,149	Δ_{1+}=**1162**
			Fr	**-0,55**	**967,15**			> 0,00	≤ 500,0	≤ 0,150	Δ_{2+}=**0**
σ_{II}[+]	SLS_Freq_T2/31	91,3	Ch	**-0,01**	**3,98**	375	376	0,01	5,0	0,005	Δ_{1+}=**1**
			Fr	**0,01**	**2,08**			> 0,00	≤ 500,0	≤ 0,150	Δ_{2+}=**0**
σ_I[-]	SLS_Freq_T2/29	-1,2	Ch	**-0,22**	**455,17**	283	1378	3,61	162,9	0,149	Δ_{1-}=**1095**
			Fr	**-0,52**	**967,09**			> 0,00	≤ 500,0	≤ 0,150	Δ_{2-}=**0**
σ_{II}[-]	SLS_Freq_T2/31	88,4	Ch	**-0,05**	**4,05**	375	376	0,00	4,9	0,005	Δ_{1-}=**1**
			Fr	**-0,03**	**2,02**			> 0,00	≤ 500,0	≤ 0,150	Δ_{2-}=**0**

SLS_Freq_T2/29	Ch	DL+TLt+EE+DL2
	Fr	DL+EE+DL2
SLS_Freq_T2/31	Ch	DL+LL_1+LL_2+EE+DL2
	Fr	DL+0.80*LL_1+0.80*LL_2+EE+DL2

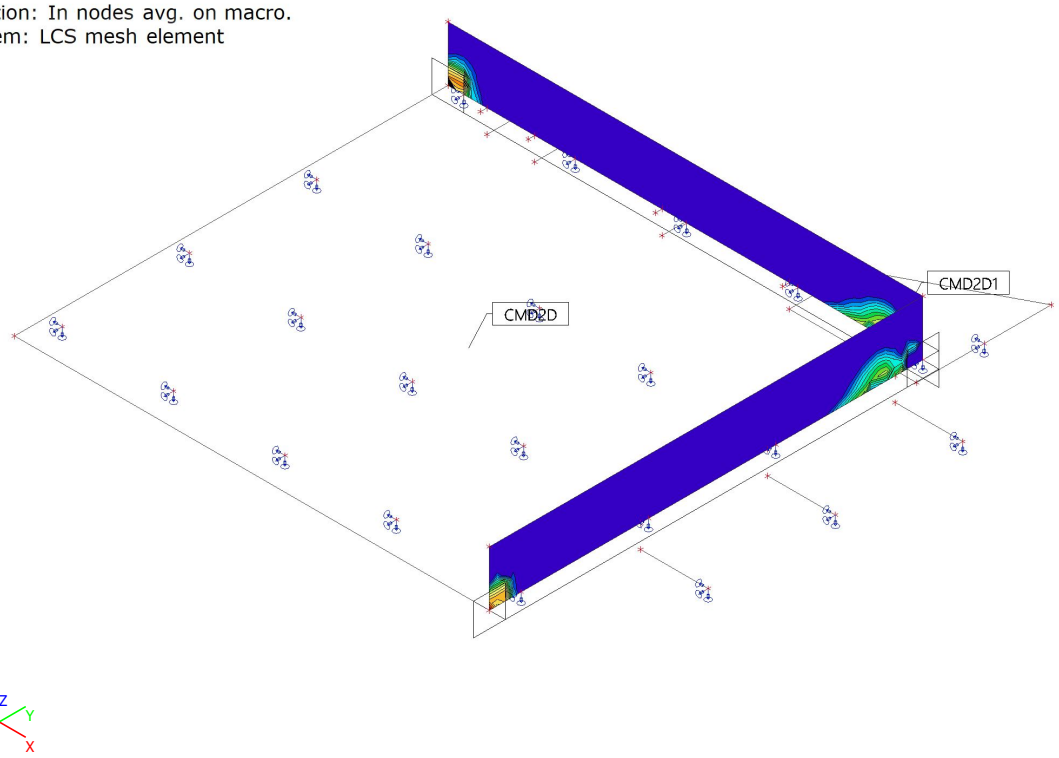
Shear reinforcement

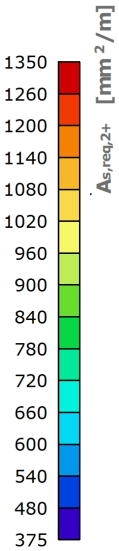
	Case	θ [°]	v_{Ed} [kN/m]	$A_{sl,x}$ [mm²]	$A_{sl,y}$ [mm²]	ρ_l [%]	$v_{Rd,c}$ [kN/m]	$v_{Rd,max}$ [kN/m]	$A_{sw,req}$ [mm²/m²]	Status
[+]	ULS_2	40,0	**7,9**	3392	1131	0,965	141,8	950,0	---	**OK**

Values: $A_{s,req,1+}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S2, S3
Location: In nodes avg. on macro.
System: LCS mesh element

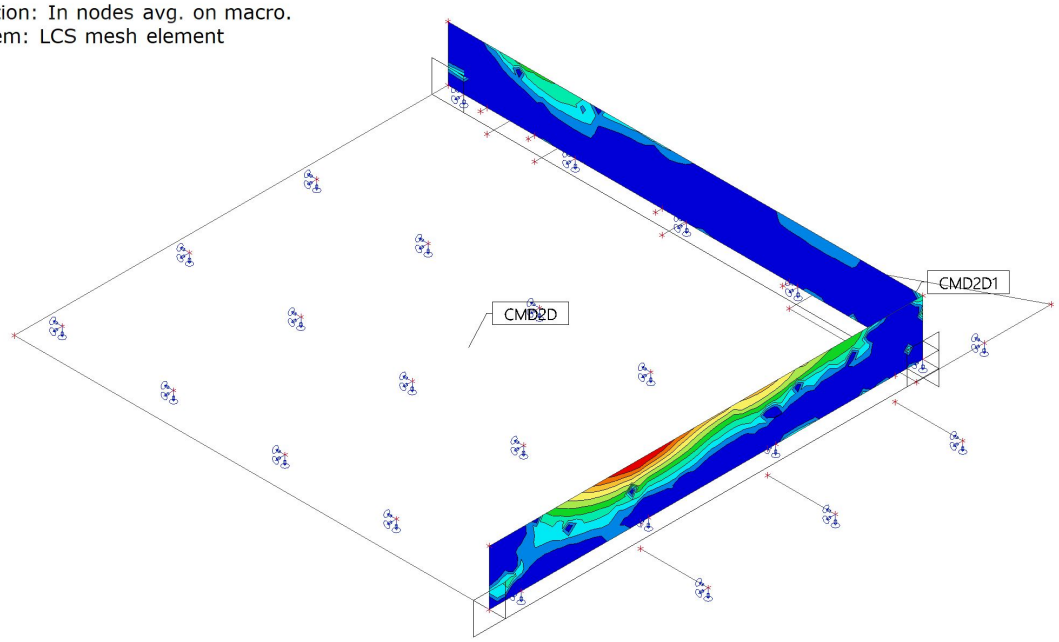


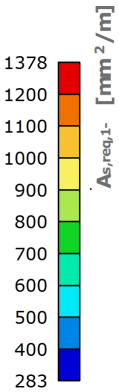
Values: $A_{s,req,2+}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S2, S3
Location: In nodes avg. on macro.
System: LCS mesh element



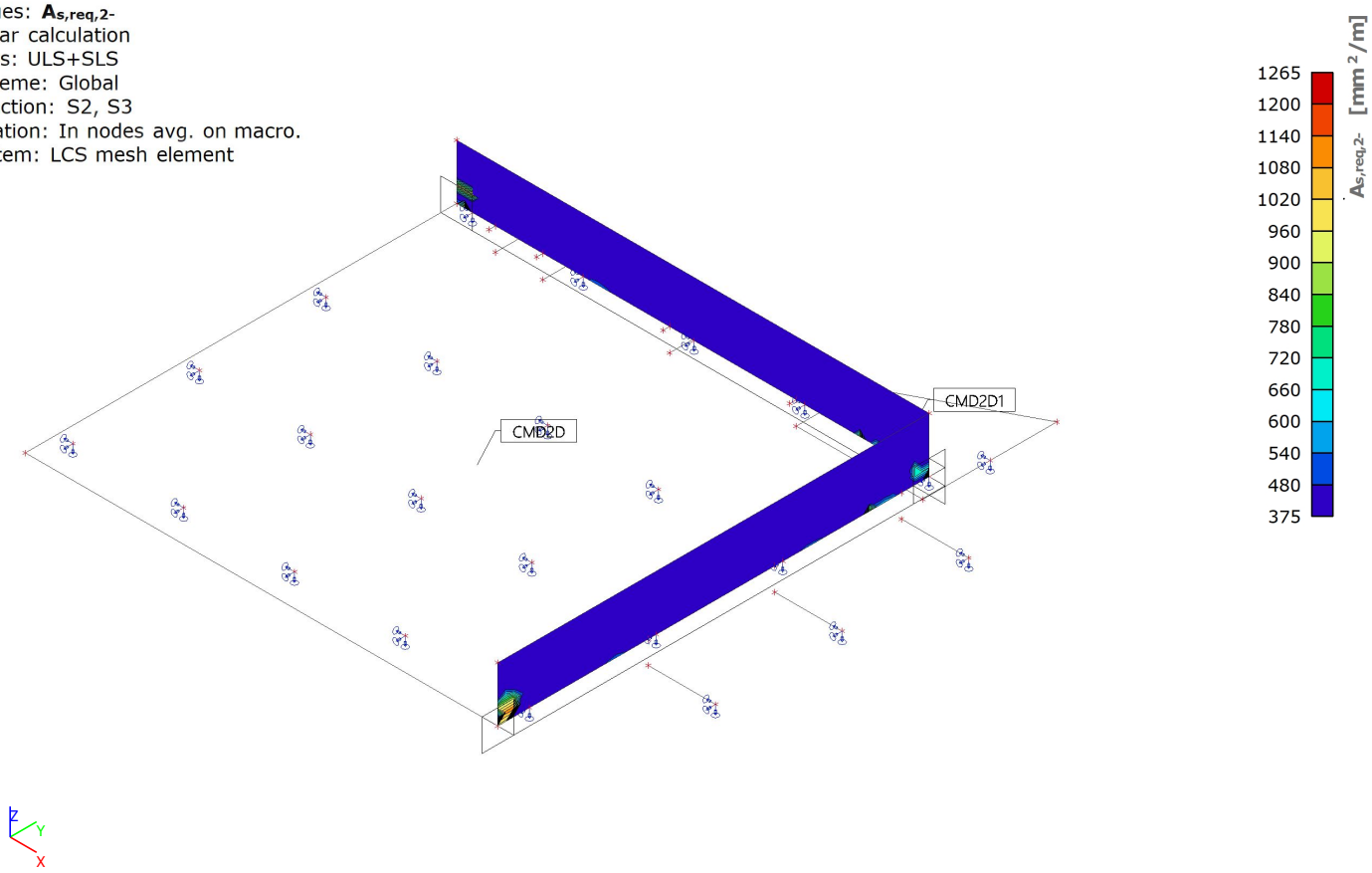


Values: $A_{s,req,1-}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S2, S3
Location: In nodes avg. on macro.
System: LCS mesh element





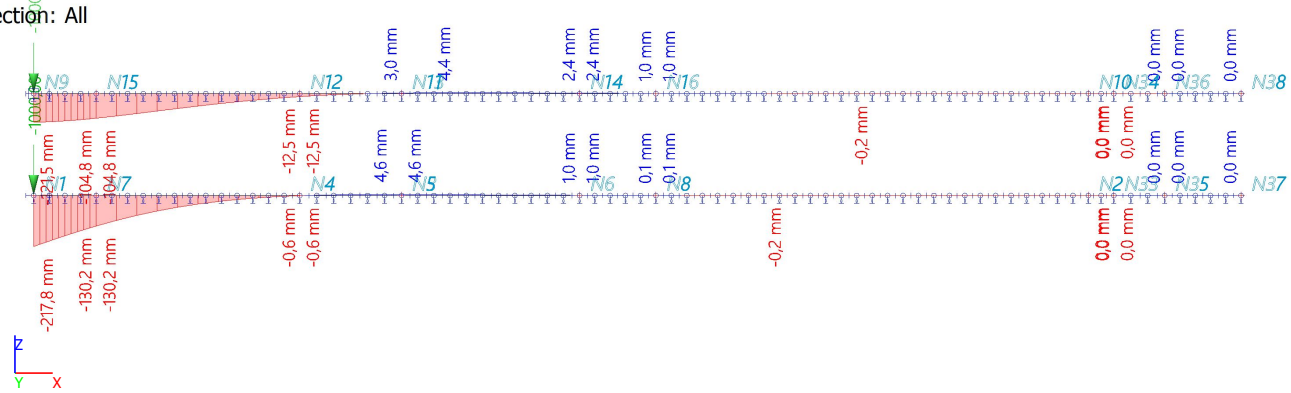
Values: $A_{s,req,2-}$
Linear calculation
Class: ULS+SLS
Extreme: Global
Selection: S2, S3
Location: In nodes avg. on macro.
System: LCS mesh element



Appendix B

Horizontal spring constant

Values: u_z
Linear calculation
Load case: LC2
Coordinate system: Global
Extreme 1D: Member
Selection: All



1. Nodes

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N1	-2,730	0,000	0,000
N2	18,000	0,000	0,000
N3	4,500	0,000	0,000
N4	2,500	0,000	0,000
N5	4,500	0,000	0,000
N6	8,000	0,000	0,000
N7	-1,500	0,000	0,000
N8	9,500	0,000	0,000

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N9	-2,730	0,000	2,000
N10	18,000	0,000	2,000
N11	4,500	0,000	2,000
N12	2,500	0,000	2,000
N13	4,500	0,000	2,000
N14	8,000	0,000	2,000
N15	-1,500	0,000	2,000
N16	9,500	0,000	2,000

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N33	18,500	0,000	0,000
N34	18,500	0,000	2,000
N35	19,500	0,000	0,000
N36	19,500	0,000	2,000
N37	21,000	0,000	0,000
N38	21,000	0,000	2,000

2. Members

Name	Cross-section	Length [m]	Node	_	Material
B1	CS2 - Circle (406)	2,000	N4	N5	C30/37
B2	CS2 - Circle (406)	3,500	N3	N6	C30/37
B4	CS2 - Circle (406)	1,230	N1	N7	C30/37
B5	CS2 - Circle (406)	4,000	N7	N4	C30/37
B6	CS2 - Circle (406)	1,500	N6	N8	C30/37
B7	CS2 - Circle (406)	8,500	N8	N2	C30/37
B8	CS2 - Circle (406)	2,000	N12	N13	C30/37
B9	CS2 - Circle (406)	3,500	N11	N14	C30/37
B11	CS2 - Circle (406)	1,230	N9	N15	C30/37

Name	Cross-section	Length [m]	Node	_	Material
B12	CS2 - Circle (406)	4,000	N15	N12	C30/37
B13	CS2 - Circle (406)	1,500	N14	N16	C30/37
B14	CS2 - Circle (406)	8,500	N16	N10	C30/37
B29	CS2 - Circle (406)	0,500	N2	N33	C30/37
B30	CS2 - Circle (406)	0,500	N10	N34	C30/37
B31	CS2 - Circle (406)	1,000	N33	N35	C30/37
B32	CS2 - Circle (406)	1,000	N34	N36	C30/37
B33	CS2 - Circle (406)	1,500	N35	N37	C30/37
B34	CS2 - Circle (406)	1,500	N36	N38	C30/37

3. Nodal supports

Name	Node	System	Type	X	Y	Z	Rx	Ry	Rz	Angle [deg]
Sn1	N9	GCS	Standard	Rigid	Free	Free	Free	Rigid	Free	Ry180.00
Sn2	N1	GCS	Standard	Rigid	Free	Free	Free	Free	Free	Ry180.00

4. Line supports on member

Name	Type	Member	System	Pos x_1	Pos x_2	Coor	Orig	X	Y	Z	Rx	Ry	Rz	Stiffness Z [MN/m²]
Slb1	Line	B1	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	1,9300e+01
Slb2	Line	B2	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	5,6000e+00
Slb4	Line	B4	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,9000e+00
Slb5	Line	B5	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	1,9000e+00
Slb6	Line	B6	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	4,0000e+00
Slb7	Line	B7	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,7000e+00
Slb8	Line	B8	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	1,9300e+01
Slb9	Line	B9	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	5,6000e+00
Slb11	Line	B11	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,9000e+00
Slb12	Line	B12	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	1,9000e+00
Slb13	Line	B13	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	4,0000e+00
Slb14	Line	B14	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,7000e+00
Slb29	Line	B29	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,4700e+01
Slb30	Line	B30	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,4700e+01
Slb31	Line	B31	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,7000e+00
Slb32	Line	B32	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	3,7000e+00
Slb33	Line	B33	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	2,3100e+01
Slb34	Line	B34	GCS	0.000	1.000	Rela	From start	Free	Rigid	Flexible	Rigid	Free	Free	2,3100e+01