



Structural analysis created with BauText and SCIA ESA PT

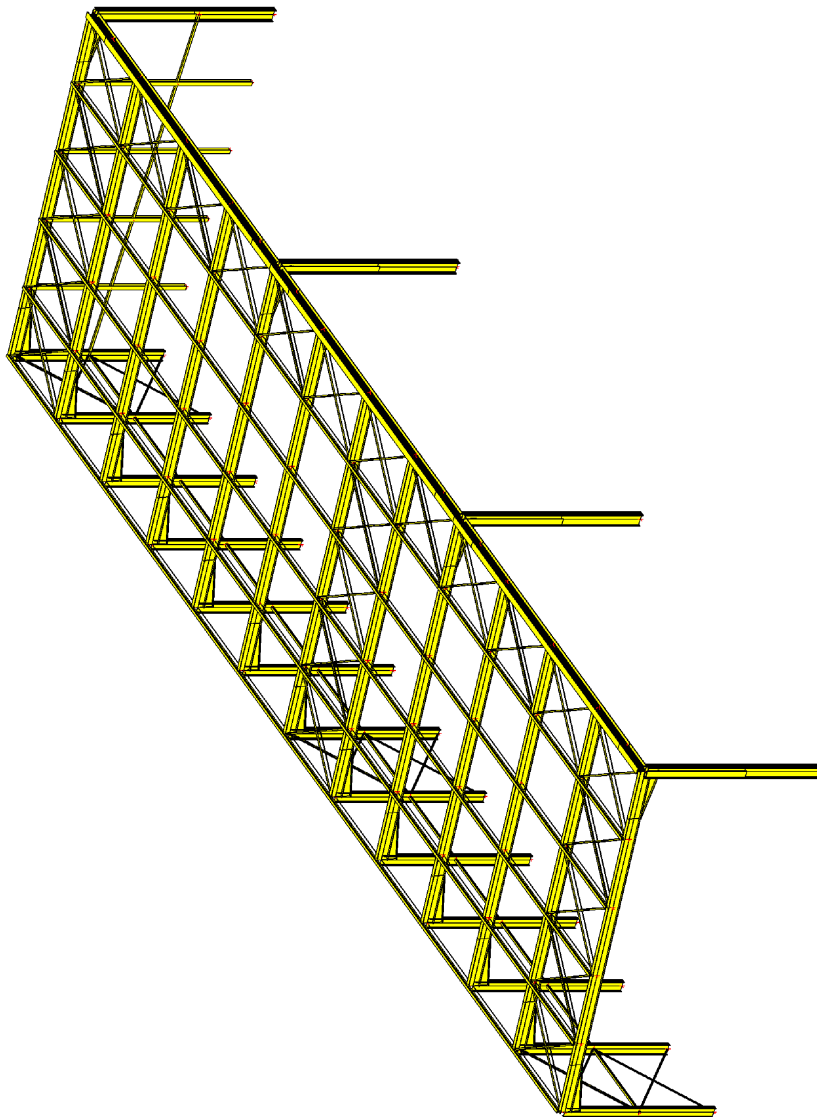
Example / abstract

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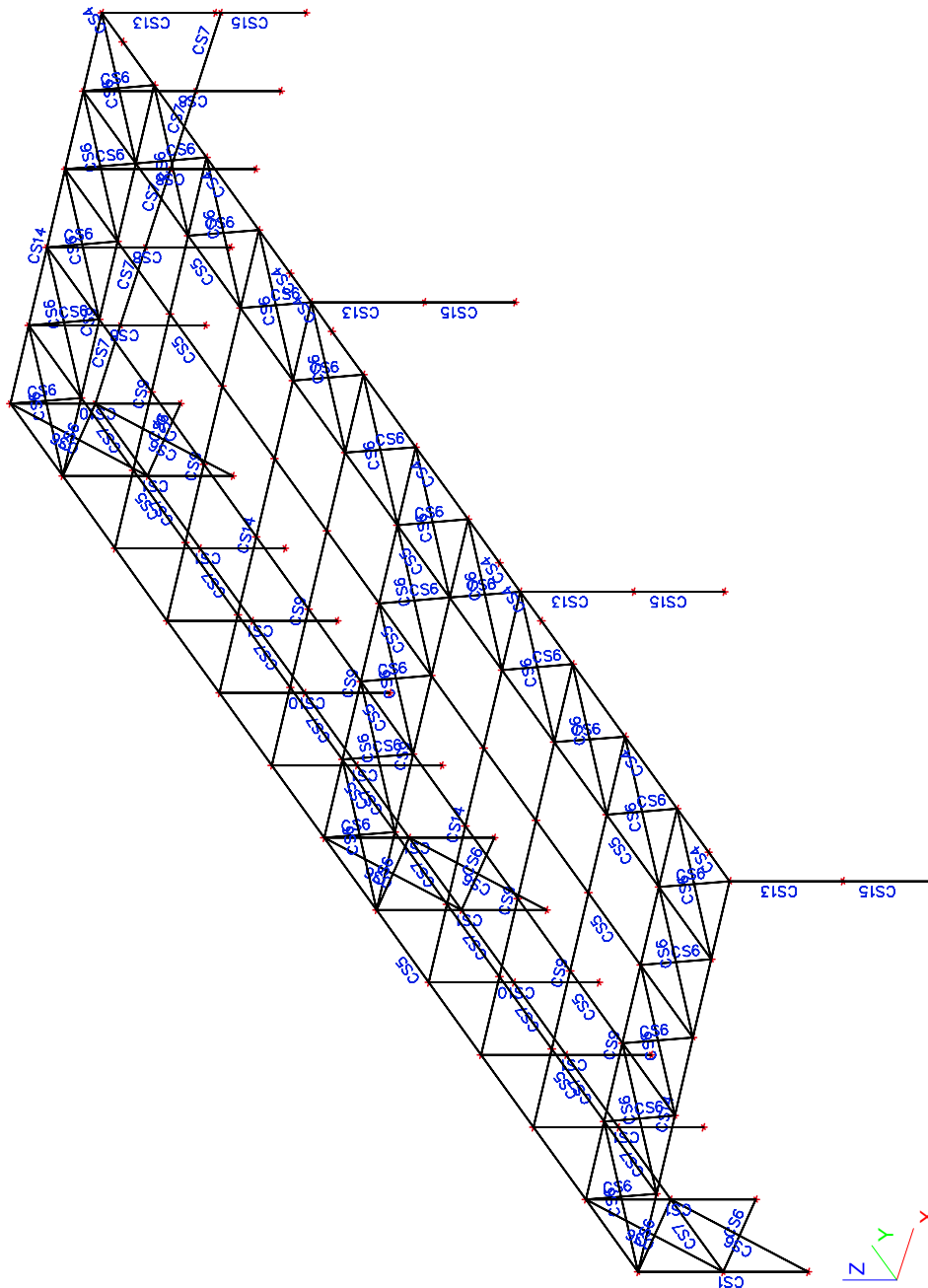
1. Representation of the System





2. System data

2.1 Used cross sections





2.2 Member

Name	CrossSection	Length [m]	Beg. node	End node	Type	FEM type	Layer
B1	CS1 - IPE500	7,500	N1	N2	column (100)	standard	Standard
B3	CS14 - I + I var (IPE550,450)	18,062	N2	N5	beam (80)	standard	Standard
B4	CS9 - I + I var (IPE550,450)	18,062	N4	N6	beam (80)	standard	Standard
B5	CS15 - HEA600	4,000	N7	N156	column (100)	standard	Standard
B6	CS1 - IPE500	7,500	N8	N9	column (100)	standard	Standard
B7	CS9 - I + I var (IPE550,450)	18,062	N9	N10	beam (80)	standard	Standard
B8	CS10 - IPE500	7,500	N11	N12	column (100)	standard	Standard
B9	CS14 - I + I var (IPE550,450)	18,062	N12	N13	beam (80)	standard	Standard
B10	CS15 - HEA600	4,000	N14	N157	column (100)	standard	Standard
B11	CS9 - I + I var (IPE550,450)	18,062	N15	N16	beam (80)	standard	Standard
B12	CS1 - IPE500	7,500	N17	N15	column (100)	standard	Standard
B13	CS4 - HEA550	2,000	N5	N160	beam (80)	standard	Standard
B26	CS6 - L70X9	6,168	N20	N31	beam (80)	axial force only	Standard
B27	CS6 - L70X9	6,168	N31	N24	beam (80)	axial force only	Standard
B28	CS6 - L70X9	6,168	N24	N6	beam (80)	axial force only	Standard
B29	CS6 - L70X9	6,168	N5	N32	beam (80)	axial force only	Standard
B30	CS6 - L70X9	6,168	N32	N22	beam (80)	axial force only	Standard
B34	CS7 - QRO100X4	5,000	N34	N42	beam (80)	standard	Standard
B35	CS7 - QRO100X4	5,000	N35	N123	beam (80)	standard	Standard
B38	CS6 - L70X9	6,168	N22	N40	beam (80)	axial force only	Standard
B39	CS6 - L70X9	6,168	N40	N37	beam (80)	axial force only	Standard
B40	CS6 - L70X9	6,168	N37	N4	beam (80)	axial force only	Standard
B41	CS6 - L70X9	6,168	N2	N41	beam (80)	axial force only	Standard
B42	CS6 - L70X9	6,168	N41	N20	beam (80)	axial force only	Standard
B43	CS6 - L70X9	6,250	N4	N34	beam (80)	axial force only	Standard
B44	CS6 - L70X9	6,250	N34	N3	beam (80)	axial force only	Standard
B45	CS6 - L70X9	6,250	N1	N42	beam (80)	axial force only	Standard
B46	CS6 - L70X9	6,250	N42	N2	beam (80)	axial force only	Standard
B47	CS9 - I + I var (IPE550,450)	18,062	N44	N45	beam (80)	standard	Standard



Name	CrossSection	Length [m]	Beg. node	End node	Type	FEM type	Layer
B48	CS1 - IPE500	7,500	N46	N47	column (100)	standard	Standard
B49	CS9 - I + I var (IPE550,450)	18,062	N47	N48	beam (80)	standard	Standard
B50	CS10 - IPE500	7,500	N49	N50	column (100)	standard	Standard
B51	CS14 - I + I var (IPE550,450)	18,062	N50	N51	beam (80)	standard	Standard
B52	CS15 - HEA600	4,000	N52	N158	column (100)	standard	Standard
B53	CS9 - I + I var (IPE550,450)	18,062	N53	N54	beam (80)	standard	Standard
B54	CS1 - IPE500	7,500	N55	N53	column (100)	standard	Standard
B55	CS4 - HEA550	2,000	N13	N162	beam (80)	standard	Standard
B64	CS1 - IPE500	7,500	N43	N44	column (100)	standard	Standard
B65	CS7 - QRO100X4	5,000	N36	N104	beam (80)	standard	Standard
B66	CS7 - QRO100X4	5,000	N64	N124	beam (80)	standard	Standard
B69	CS9 - I + I var (IPE550,450)	18,062	N72	N73	beam (80)	standard	Standard
B70	CS1 - IPE500	7,500	N74	N75	column (100)	standard	Standard
B71	CS9 - I + I var (IPE550,450)	18,062	N75	N76	beam (80)	standard	Standard
B72	CS10 - IPE500	7,500	N77	N78	column (100)	standard	Standard
B73	CS14 - I + I var (IPE550,450)	18,062	N78	N79	beam (80)	standard	Standard
B74	CS15 - HEA600	4,000	N80	N159	column (100)	standard	Standard
B75	CS9 - I + I var (IPE550,450)	18,062	N81	N82	beam (80)	standard	Standard
B76	CS1 - IPE500	7,500	N83	N81	column (100)	standard	Standard
B77	CS4 - HEA550	2,000	N51	N164	beam (80)	standard	Standard
B86	CS1 - IPE500	7,500	N71	N72	beam (80)	standard	Standard
B87	CS7 - QRO100X4	5,000	N65	N126	beam (80)	standard	Standard
B88	CS7 - QRO100X4	5,000	N92	N103	beam (80)	standard	Standard
B91	CS6 - L70X9	6,168	N99	N79	beam (80)	axial force only	Standard
B92	CS6 - L70X9	6,168	N100	N88	beam (80)	axial force only	Standard
B93	CS6 - L70X9	6,168	N88	N99	beam (80)	axial force only	Standard
B94	CS6 - L70X9	6,168	N82	N89	beam (80)	axial force only	Standard
B95	CS6 - L70X9	6,168	N89	N101	beam (80)	axial force only	Standard
B96	CS6 - L70X9	6,168	N101	N87	beam (80)	axial force only	Standard
B97	CS6 - L70X9	6,168	N87	N102	beam (80)	axial force only	Standard
B98	CS6 - L70X9	6,168	N102	N78	beam (80)	axial force only	Standard
B99	CS6 - L70X9	6,168	N81	N95	beam (80)	axial force only	Standard
B100	CS6 - L70X9	6,168	N95	N100	beam (80)	axial force only	Standard
B101	CS6 - L70X9	6,250	N78	N103	beam (80)	axial force only	Standard
B102	CS6 - L70X9	6,250	N103	N77	beam (80)	axial force only	Standard
B103	CS6 - L70X9	6,250	N83	N93	beam (80)	axial force only	Standard
B104	CS6 - L70X9	6,250	N93	N81	beam (80)	axial force only	Standard
B105	CS6 - L70X9	6,250	N43	N64	beam (80)	axial force only	Standard
B106	CS6 - L70X9	6,250	N104	N46	beam (80)	axial force only	Standard



2.3 Hinges on beam

Name	Member	ux	uy	uz	fix	fiy	fiz
H31	B34	Rigid	Rigid	Rigid	Rigid	Free	Free
H32	B35	Rigid	Rigid	Rigid	Rigid	Free	Free
H33	B65	Rigid	Rigid	Rigid	Rigid	Free	Free
H34	B66	Rigid	Rigid	Rigid	Rigid	Free	Free
H35	B87	Rigid	Rigid	Rigid	Rigid	Free	Free
H36	B88	Rigid	Rigid	Rigid	Rigid	Free	Free
H38	B142	Rigid	Rigid	Rigid	Rigid	Free	Free
H39	B144	Rigid	Rigid	Rigid	Rigid	Free	Free
H40	B145	Rigid	Rigid	Rigid	Rigid	Free	Free
H42	B151	Rigid	Rigid	Rigid	Rigid	Free	Free
H43	B152	Rigid	Rigid	Rigid	Rigid	Free	Free
H44	B153	Rigid	Rigid	Rigid	Rigid	Free	Free
H45	B154	Rigid	Rigid	Rigid	Rigid	Free	Free
H46	B155	Rigid	Rigid	Rigid	Rigid	Free	Free
H47	B156	Rigid	Rigid	Rigid	Rigid	Free	Free
H108	B122	Free	Rigid	Rigid	Free	Free	Free
H109	B148	Free	Rigid	Rigid	Free	Free	Free
H110	B147	Free	Rigid	Rigid	Free	Free	Free
H111	B143	Free	Rigid	Rigid	Free	Free	Free
H112	B146	Rigid	Rigid	Rigid	Rigid	Free	Free
H113	B146	Free	Rigid	Rigid	Free	Free	Free
H114	B123	Free	Rigid	Rigid	Free	Free	Free
H115	B123	Rigid	Rigid	Rigid	Rigid	Free	Free
H116	B159	Rigid	Rigid	Rigid	Rigid	Free	Free
H117	B160	Rigid	Rigid	Rigid	Rigid	Free	Free
H118	B161	Rigid	Rigid	Rigid	Rigid	Free	Free
H119	B162	Rigid	Rigid	Rigid	Rigid	Free	Free
H120	B163	Rigid	Rigid	Rigid	Rigid	Free	Free
H121	B164	Rigid	Rigid	Rigid	Rigid	Free	Free
H122	B165	Rigid	Rigid	Rigid	Rigid	Free	Free
H123	B166	Rigid	Rigid	Rigid	Rigid	Free	Free
H124	B163	Rigid	Rigid	Rigid	Rigid	Free	Free
H125	B164	Rigid	Rigid	Rigid	Rigid	Free	Free
H126	B165	Rigid	Rigid	Rigid	Rigid	Free	Free
H127	B166	Rigid	Rigid	Rigid	Rigid	Free	Free
H128	B167	Rigid	Rigid	Rigid	Rigid	Free	Free
H129	B168	Rigid	Rigid	Rigid	Rigid	Free	Free
H130	B169	Rigid	Rigid	Rigid	Rigid	Free	Free
H131	B170	Rigid	Rigid	Rigid	Rigid	Free	Free
H132	B167	Rigid	Rigid	Rigid	Rigid	Free	Free
H133	B168	Rigid	Rigid	Rigid	Rigid	Free	Free
H134	B169	Rigid	Rigid	Rigid	Rigid	Free	Free
H135	B170	Rigid	Rigid	Rigid	Rigid	Free	Free
H136	B159	Rigid	Rigid	Rigid	Rigid	Free	Free
H137	B160	Rigid	Rigid	Rigid	Rigid	Free	Free
H138	B161	Rigid	Rigid	Rigid	Rigid	Free	Free
H139	B162	Rigid	Rigid	Rigid	Rigid	Free	Free



2.4 Cross-link

Name	1st member	2st member	Type
CL1	B4	B159	hinged
CL2	B4	B160	hinged
CL3	B4	B161	hinged
CL4	B4	B162	hinged
CL5	B7	B159	hinged
CL6	B7	B160	hinged
CL7	B7	B161	hinged
CL8	B7	B162	hinged
CL41	B11	B159	hinged
CL42	B11	B160	hinged
CL43	B11	B161	hinged
CL44	B11	B162	hinged
CL45	B47	B163	hinged
CL46	B47	B164	hinged
CL47	B47	B165	hinged
CL48	B47	B166	hinged
CL49	B49	B163	hinged
CL50	B49	B164	hinged
CL51	B49	B165	hinged
CL52	B49	B166	hinged
CL53	B53	B163	hinged
CL54	B53	B164	hinged
CL55	B53	B165	hinged
CL56	B53	B166	hinged
CL57	B69	B167	hinged
CL58	B69	B168	hinged
CL59	B69	B169	hinged
CL60	B69	B170	hinged
CL61	B71	B167	hinged
CL62	B71	B168	hinged
CL63	B71	B169	hinged
CL64	B71	B170	hinged
CL65	B75	B167	hinged
CL66	B75	B168	hinged
CL67	B75	B169	hinged
CL68	B75	B170	hinged



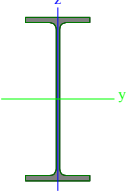
2.5 Supports in node

Name	Node	System	Type	X	Y	Z	Rx	Ry	Rz
S1	N1	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S2	N3	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S3	N8	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S4	N11	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S5	N17	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S6	N43	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S7	N46	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S8	N49	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S9	N55	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S10	N71	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S11	N74	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S12	N77	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S13	N83	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S14	N109	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Rigid
S15	N110	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Rigid
S16	N111	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Rigid
S17	N112	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Rigid
S18	N7	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S19	N14	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S20	N52	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free
S21	N80	GCS	Standard	Rigid	Rigid	Rigid	Free	Free	Free

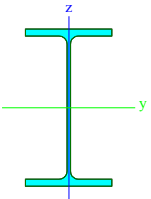


2.6 Cross-sections

2.6.1 Cross section CS1

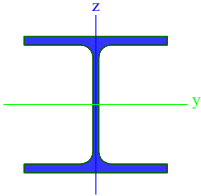
>	Name	CS1	
	Type	IPE500	
	Source description	Profil Arbed / Structural shapes / Edition Octobre 1995	
	Type description	European I beam	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m²]	1,1550e-002	
>	A y, z [m²]	5,5859e-003	4,8604e-003
	I y, z [m⁴]	4,8200e-004	2,1420e-005
	I t [m⁴], w [m⁶]	8,9290e-007	1,2667e-006
	alpha [deg]	0,00	
	Wel y, z [m³]	1,9280e-003	2,1420e-004
	Wpl y, z [m³]	2,2000e-003	3,3600e-004
	c YLKS, ZLKS [mm]	100	250
	d y, z [mm]	0	0
	AL [m²/m]	1,7434e+000	

2.6.2 Cross section CS4

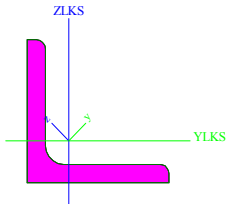
>	Name	CS4	
	Type	HEA550	
	Source description	Profil Arbed / Structural shapes / Edition Octobre 1995	
	Type description	European wide flange beam	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m²]	2,1200e-002	
	A y, z [m²]	1,2393e-002	6,3018e-003
	I y, z [m⁴]	1,1200e-003	1,0800e-004
	I t [m⁴], w [m⁶]	3,5200e-006	7,2451e-006
	alpha [deg]	0,00	
	Wel y, z [m³]	4,1500e-003	7,2100e-004
	Wpl y, z [m³]	4,6200e-003	1,1080e-003
	c YLKS, ZLKS [mm]	150	270
	d y, z [mm]	0	0
	AL [m²/m]	2,2084e+000	



2.6.3 Cross section CS5

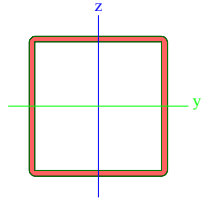
>	Name	CS5	
	Type	HEA140	
	Source description	Profil Arbed / Structural shapes / Edition Octobre 1995	
	Type description	European wide flange beam	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m ²]	3,1400e-003	
	A y, z [m ²]	2,0441e-003	6,3677e-004
	I y, z [m ⁴]	1,0300e-005	3,8900e-006
	I t [m ⁴], w [m ⁶]	8,1300e-008	1,5108e-008
	alpha [deg]	0,00	
	Wel y, z [m ³]	1,5500e-004	5,5600e-005
	Wpl y, z [m ³]	1,7400e-004	8,4800e-005
	c YLKS, ZLKS [mm]	70	66
	d y, z [mm]	0	0
	AL [m ² /m]	7,9430e-001	

2.6.4 Cross section CS6

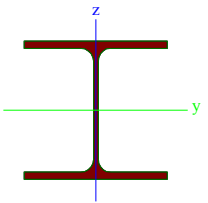
>	Name	CS6	
	Type	L70X9	
	Source description	Stahl im Hochbau / 14.Auflage Band I / Teil 1	
	Type description	Leg angle	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m ²]	1,1900e-003	
	A y, z [m ²]	4,9901e-004	4,9663e-004
	I y, z [m ⁴]	8,3100e-007	2,2000e-007
	I t [m ⁴], w [m ⁶]	3,7400e-008	0,0000e+000
	I YLCS, ZLCS [m ⁴]	5,2600e-007	5,2600e-007
	alpha [deg]	45,00	
	IYZLKS [m ⁴]	-3,0612e-007	
	Wel y, z [m ³]	1,6789e-005	7,5809e-006
	Wpl y, z [m ³]	2,7043e-005	1,3911e-005
	c YLKS, ZLKS [mm]	21	21
	d y, z [mm]	-23	0
	AL [m ² /m]	2,7224e-001	



2.6.5 Cross section CS7

>	Name	CS7	
	Type	QRO100X4	
>	Source description	Stahl im Hochbau / 14.Auflage Band I / Teil 1	
	Type description	Rectangular hollow section	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m ²]	1,5200e-003	
	A y, z [m ²]	7,6000e-004	7,6000e-004
	I y, z [m ⁴]	2,3300e-006	2,3300e-006
	I t [m ⁴], w [m ⁶]	3,5700e-006	3,3333e-009
	alpha [deg]	0,00	
	Wel y, z [m ³]	4,6600e-005	4,6600e-005
	Wpl y, z [m ³]	5,4654e-005	5,4654e-005
	c YLKS, ZLKS [mm]	50	50
	d y, z [mm]	0	0
	AL [m ² /m]	3,9710e-001	

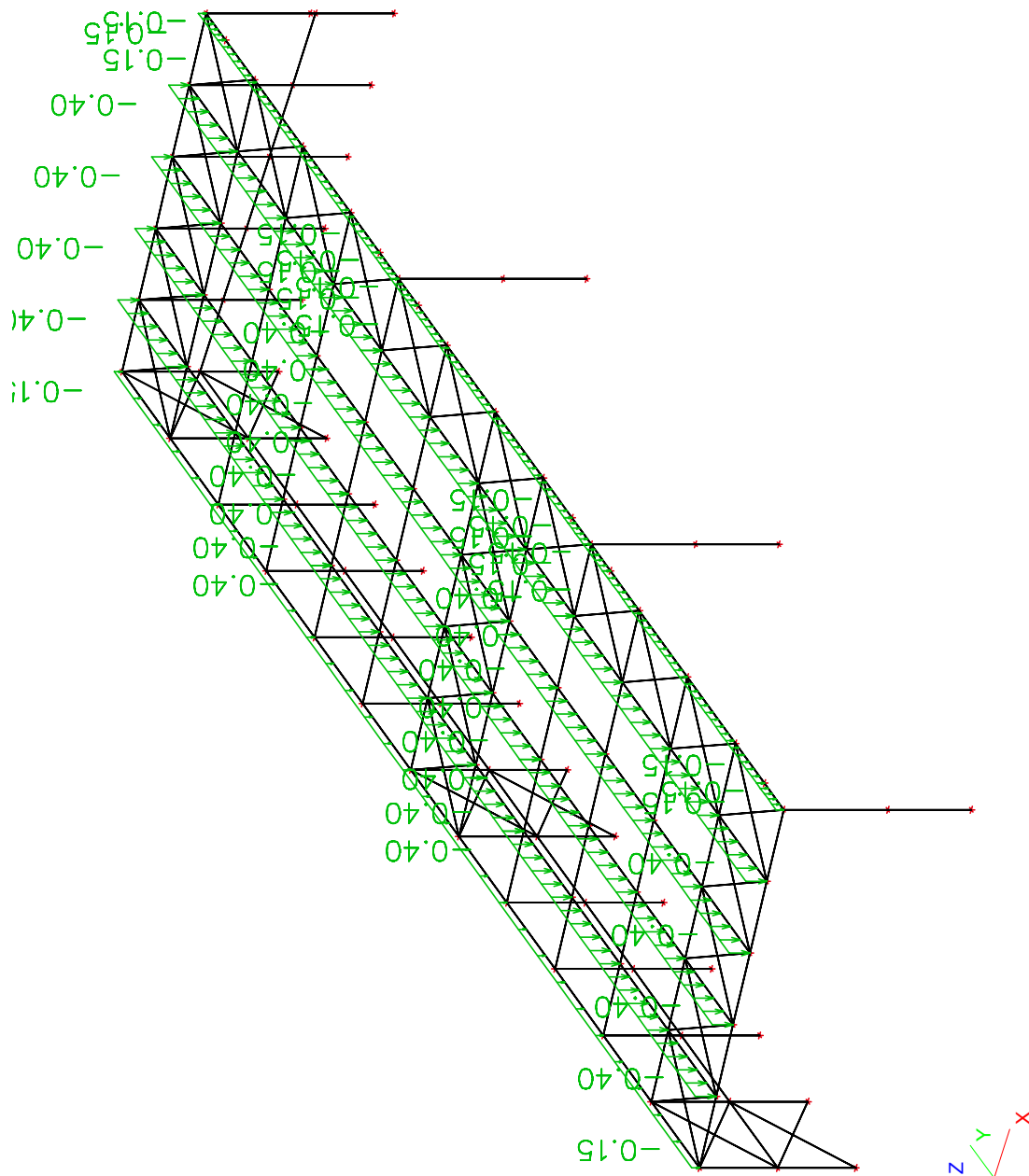
2.6.6 Cross section CS8

>	Name	CS8	
	Type	HEA200	
	Source description	Profil Arbed / Structural shapes / Edition Octobre 1995	
	Type description	European wide flange beam	
	Material	S 235	
	Fabrication	rolled	
	Buckling y-y, z-z	a	b
>	Zeichnung		
>	Material	S 235	
	A [m ²]	5,3800e-003	
	A y, z [m ²]	3,4893e-003	1,1060e-003
	I y, z [m ⁴]	3,6900e-005	1,3400e-005
	I t [m ⁴], w [m ⁶]	2,1000e-007	1,0832e-007
	alpha [deg]	0,00	
	Wel y, z [m ³]	3,8900e-004	1,3400e-004
	Wpl y, z [m ³]	4,3000e-004	2,0400e-004
	c YLKS, ZLKS [mm]	100	95
	d y, z [mm]	0	0
>	AL [m ² /m]	1,1360e+000	



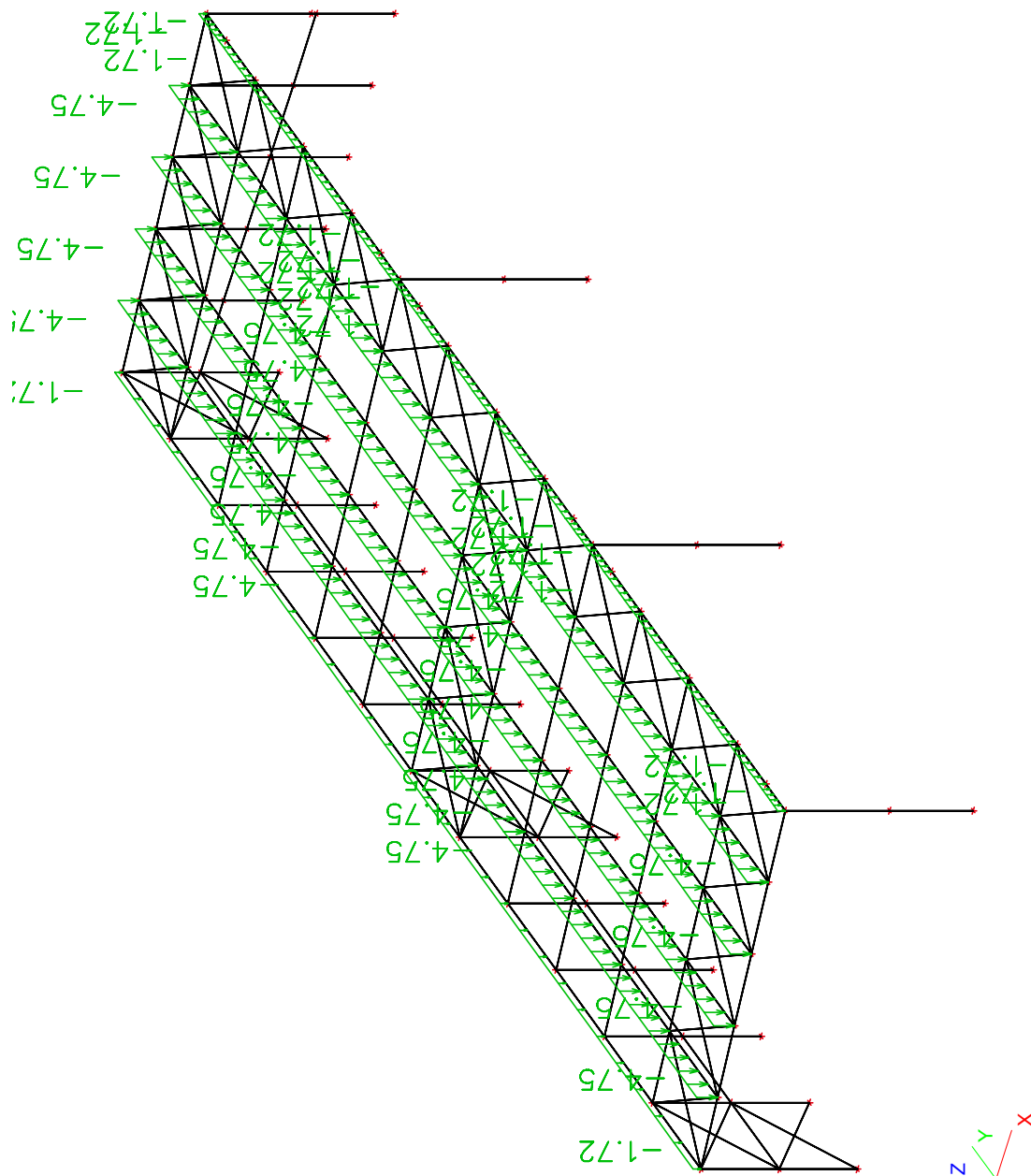
3. Load cases

3.1 Dead load



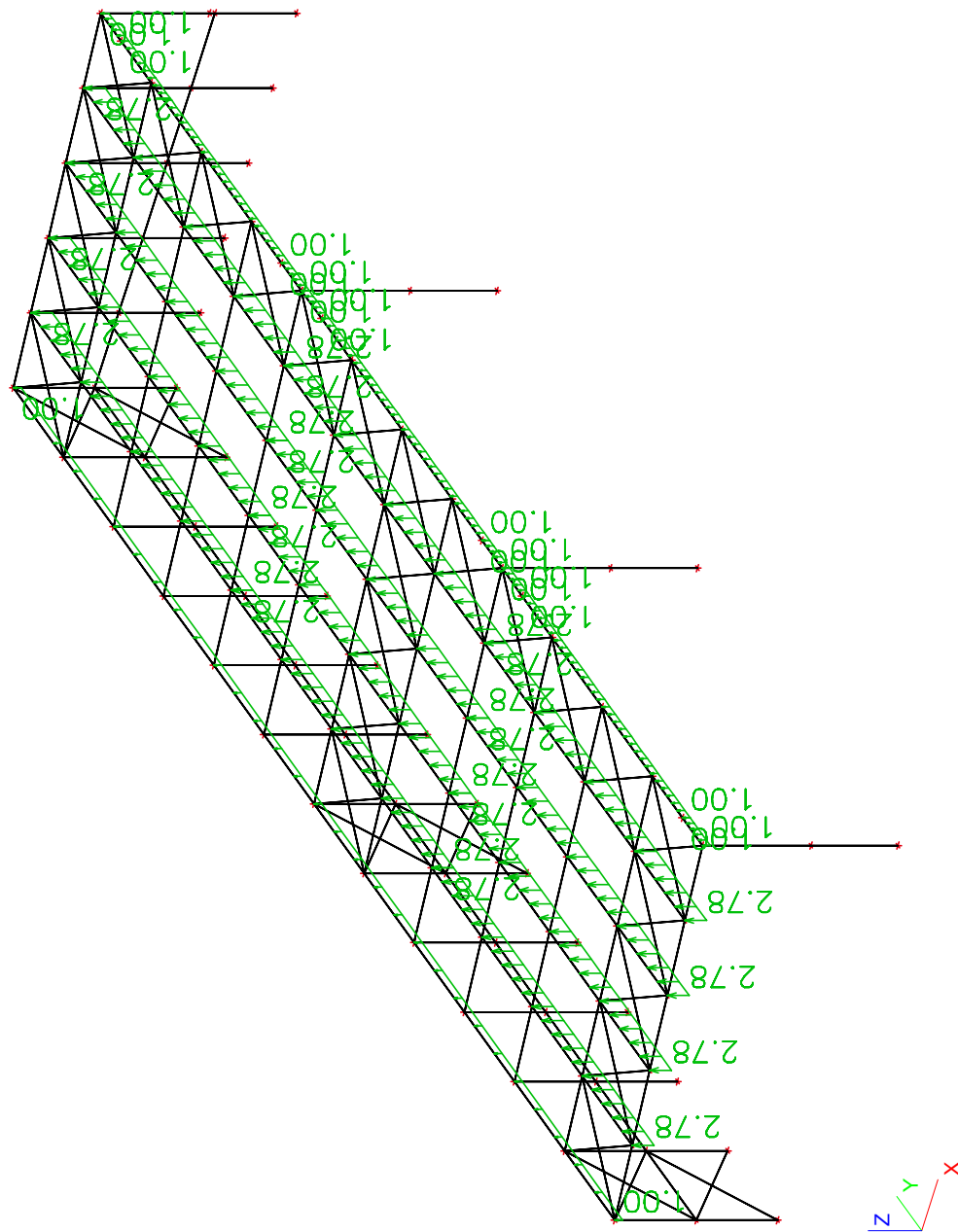


3.2 Snow load





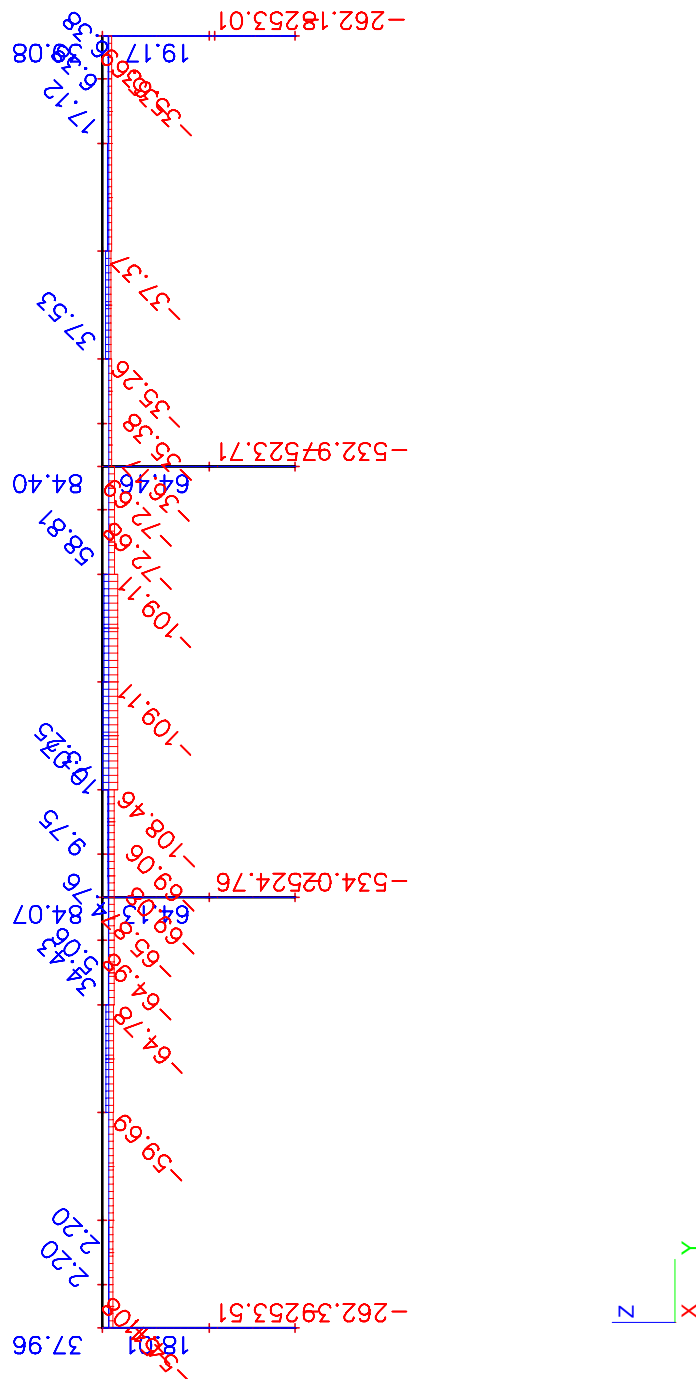
3.3 Wind load





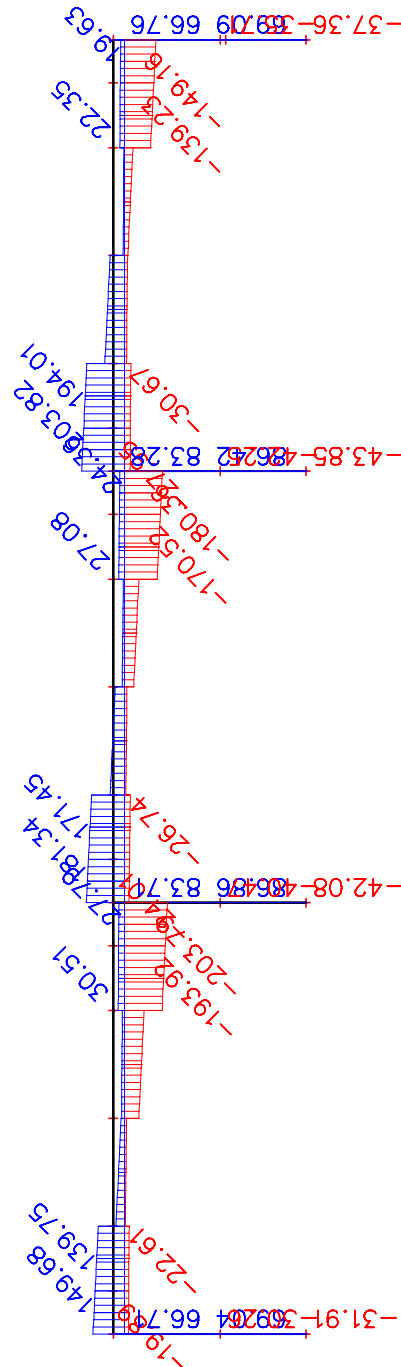
4. Results

4.1 Direct forces N



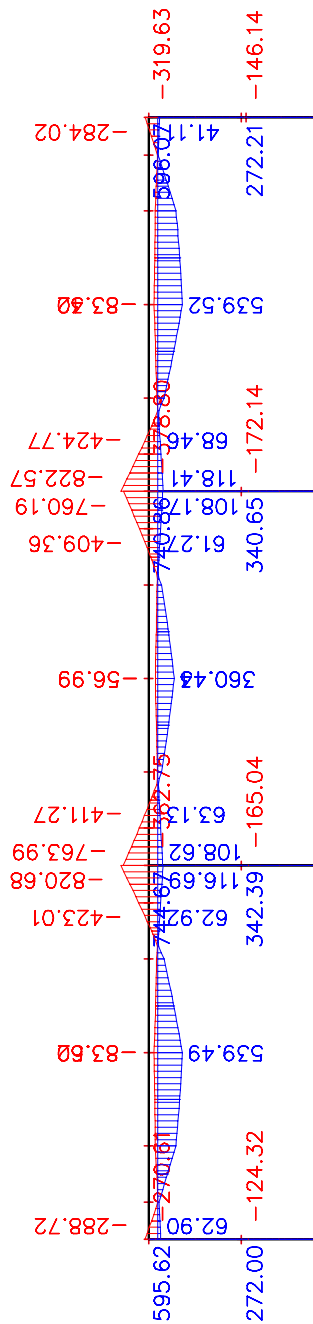


4.2 Lateral forces Vz





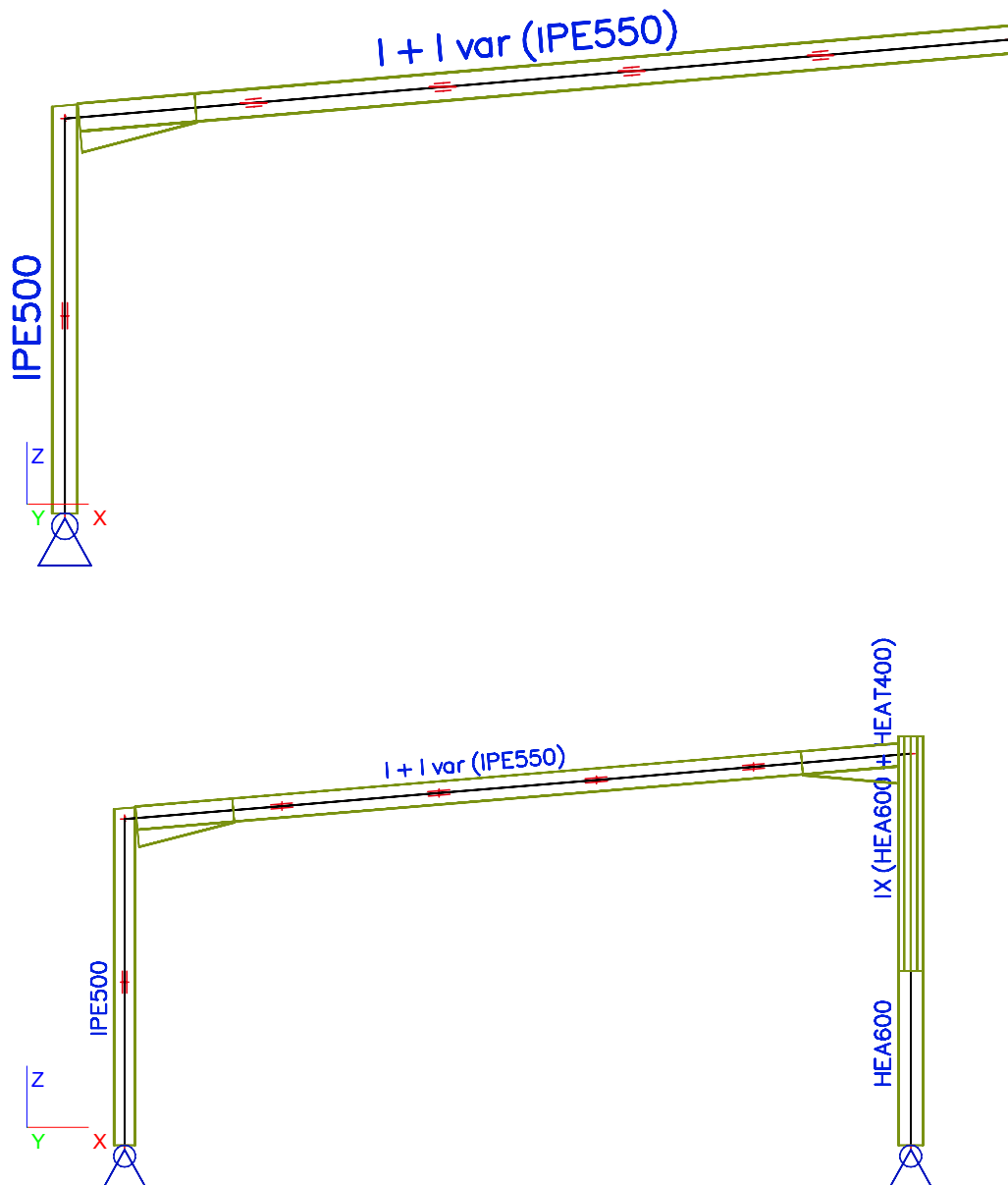
4.3 Moments





5. Detail drawings

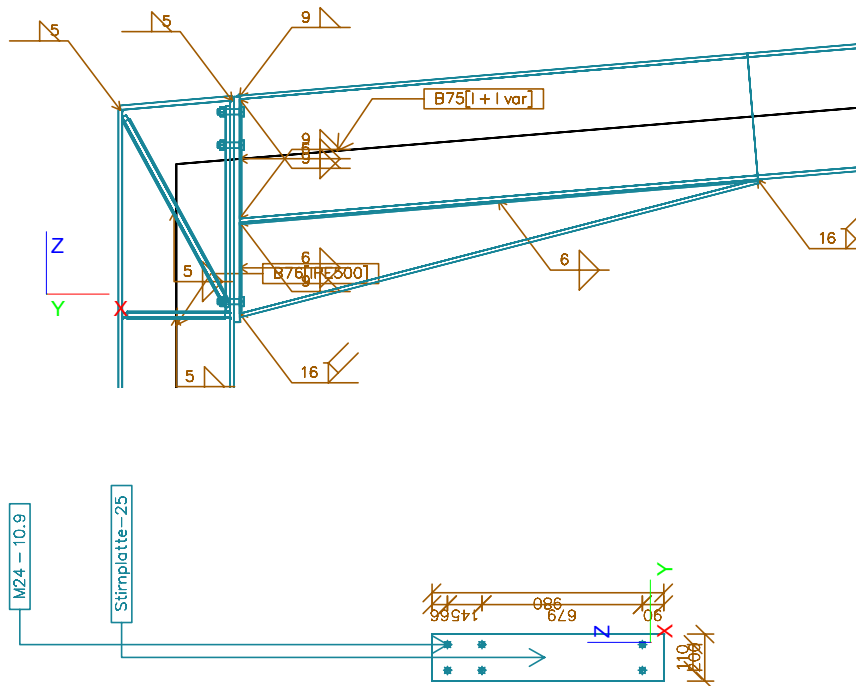
5.1 Framework





5.2 Frame corner

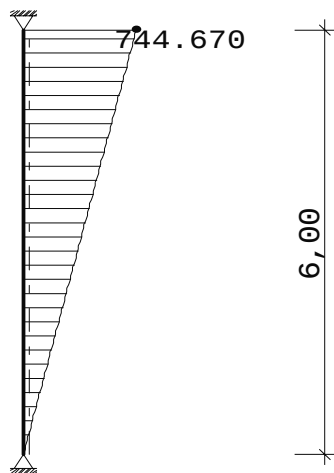
Rahmenecke Achse A





6. Structural analysis created with Friedrich+Lochner

Scale 1 : 100



My [kNm]

FRAME COLUMN HE 600 A

h = 6.00 m

St 37-2

Partial safety factor $\gamma_{M} = 1.10$

Support : -1 = rigid , 0 = free , > 0 = elastic (kN/m , kNm)
Node in z in y ab. y ab. z
head -1 -1 0 0
base -1 -1 0 0

ACTION : (compression positive) (kN , kNm)

Nd	Vzd	Vyd	Myd	Mzd
537.02	42.08	0.00	744.67	0.00

Moment diagram : Myd,base Myd,head Mzd,base Myd,head
zp = 0 mm 0.00 744.67 0.00 0.00

ANALYSIS FLEXURAL BUCKLING DIN 18800 T2 (Substitute member system)

sKy	, sKz	6.00	6.00 m
BSL in z	, BSL in y	a	b
Kappay	, Kappaz	0.99	0.65
Npld		4930.91	kN
Mplyd	, Mplzd	1169.45	204.82 kNm
Vplz	, Vply	1017.75	2078.46 kN
Mplyd,red	, Mplzd,red	1169.45	204.82 kNm
Betamy	, Betamz	0.99	1.10
NKiy	, NKiz	81292.63	6488.44 kN
Delta_n in z	, Delta_n in y	0.01	0.05

element 314

Eta = 0.75



ANALYSIS LATERAL TORSIONAL BUCKLING DIN 18800 T2 (Subst. memb. syst.)

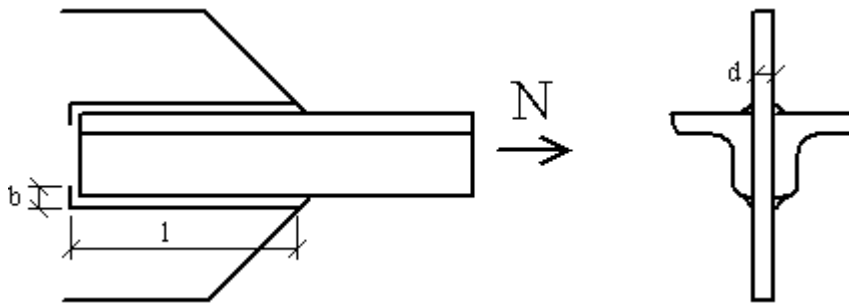
sKy	, sKz	6.00	6.00 m
BSL in z	, BSL in y	a	b
Kappay	, Kappaz	0.99	0.65
Npld		4930.91	kN
Mplyd	, Mplzd	1169.45	252.22 kNm
Zetay		1.77	
BetaMy	, BetaMz	1.80	1.10
NKiy	, NKiz	81292.63	6488.44 kN
MKiy		4130.76	kNm
KappaM		0.98	

element 320 Eta = 0.81

STRESS VERIFIC.:	SigmaX	Tau	SigmaV	Eta (N/mm2)
permiss.	218.18	125.97	218.18	
existent	179.34	6.13	179.35	0.82



7. Integrity proof created with BauText-template according EC3



Sizes:

by requirement of EC3 6.6.2.2 $b =$	12,00 mm
Weld length $l =$	100,00 mm
Gusset plate thickness $d =$	10,00 mm
Throat depth $a_w =$	4,00 mm

Angle bar P	=	L 60x6
Angle bar area A	=	6,91 cm ²
Angle bar width h	=	60,00 mm

Materials:

Steel	=	Fe 360
f_y	=	235,00 N/mm ²
f_u	=	360,00 N/mm ²
β_w	=	0,80
$\gamma_{M0} =$		1,10
$\gamma_{Mw} =$		1,25

Plastical marginal tension:

$N_{Rdp} =$	$2 * A * f_y / 10 / \gamma_{M0}$	=	295,25 kN
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Permissible stress of the lines of welding:

after 6.6.5.2(2)			
$3 / a_w$	=		0,75 < 1
$\text{MIN}(40; 6 * a_w) / l$	=		0,24 < 1
$l / (150 * a_w)$	=		0,17 < 1
$12 / b$	=		1,00 < 1
Reduction factor			
$\beta_{w1} =$	$1,2 - 0,2 * l / (150 * a_w)$	=	1,17
$\beta_w =$	$\text{MIN}(1; \beta_{w1})$	=	1,00
$l =$	$\beta_w * l$	=	100,00 mm
$N_{w,Rd} =$	$4 * l * a_w * f_u / (\sqrt{3} * \beta_w * \gamma_{Mw}) / 10^3$	=	266,04 kN

Permissible stress of the gusset plate:

Acceptance: Stress spreading with 30° in the gusset plate:

$A =$	$(2 * l * \text{TAN}(30) + h) * d / 100$	=	17,55 cm ²
$N_{Rd} =$	$A * f_y / 10 / \gamma_{M0}$	=	374,93 kN

Maximal permissible design direct force:

$\text{MIN}(N_{Rd}; N_{w,Rd}; N_{Rdp})$	=	<u>266,04 kN</u>
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