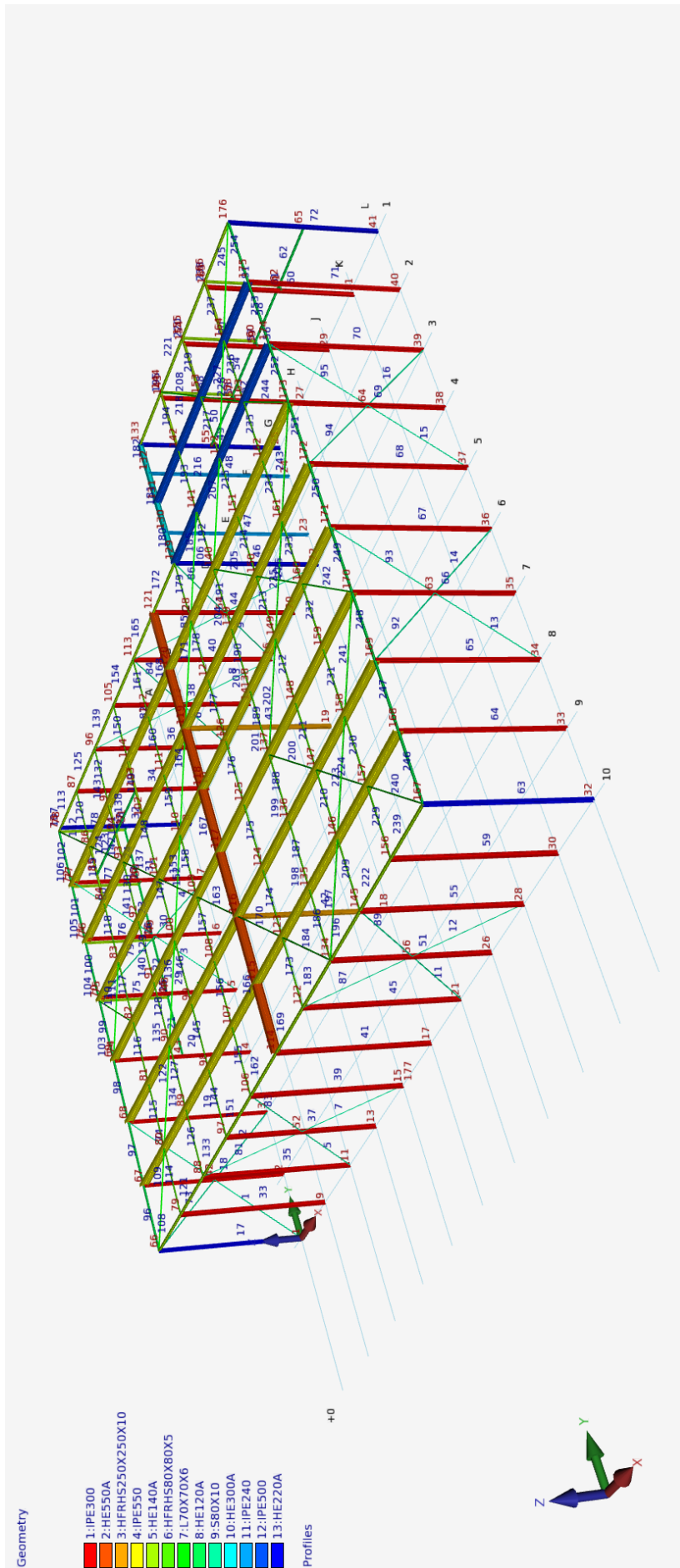


File :.....voorbeeld uitdraai\XFEM4USteelConcretePlate.xfem

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1. Input Data

Applied standards: : ANSI / AISC 360-16 Specification for Structural Steel Buildings

Gravity acceleration g : 9,81 m/s²**1.1 NODES**

Node Number	Coordinates			Restraints					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
1	0	0	0	A	A	A			
2	0	4700	0	A	A	A			
3	0	9400	0	A	A	A			
4	0	14100	0	A	A	A			
5	500	18800	0	A	A	A			
6	500	23500	0	A	A	A			
7	500	28200	0	A	A	A			
8	500	32900	0	A	A	A			
9	5000	0	0	A	A	A			
10	5000	32900	0	A	A	A			
11	10000	0	0	A	A	A			
12	10000	32900	0	A	A	A			
13	15000	0	0	A	A	A			
14	15000	32900	0	A	A	A			
15	20000	0	0	A	A	A			
16	20000	32900	0	A	A	A			
17	25000	0	0	A	A	A			
18	25000	9400	0	A	A	A			
19	25000	23500	0	A	A	A			
20	25000	32900	0	A	A	A			
21	30000	0	0	A	A	A			
22	30000	32900	0	A	A	A			
23	30000	35450	0	A	A	A			
24	30000	40550	0	A	A	A			
25	30000	43100	0	A	A	A			
26	35000	0	0	A	A	A			
27	35000	42600	0	A	A	A			
28	40000	0	0	A	A	A			
29	40000	42600	0	A	A	A			
30	45000	0	0	A	A	A			
31	45000	42600	0	A	A	A			
32	50000	0	0	A	A	A			
33	50000	4700	0	A	A	A			
34	50000	9400	0	A	A	A			
35	50000	14100	0	A	A	A			
36	50000	18800	0	A	A	A			
37	50000	23500	0	A	A	A			
38	50000	28200	0	A	A	A			
39	50000	32900	0	A	A	A			
40	50000	38000	0	A	A	A			
41	50000	43100	0	A	A	A			
42	0	4700	5000						
43	0	14100	5000						
44	0	18800	5000						
45	0	23500	5000						
46	0	28200	5000						
47	0	32900	5000						
48	500	18800	5000						
49	500	23500	5000						

Node Number	Coordinates			Restrains					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
50	500	28200	5000						
51	500	32900	5000						
52	15000	0	5000						
53	15000	32900	5000						
54	25000	32900	5000						
55	30000	43100	5000						
56	35000	0	5000						
57	35000	42600	5000						
58	35000	43100	5000						
59	40000	42600	5000						
60	40000	43100	5000						
61	45000	42600	5000						
62	45000	43100	5000						
63	50000	14100	5000						
64	50000	28200	5000						
65	50000	43100	5000						
66	0	0	10000						
67	0	4700	10000						
68	0	9400	10000						
69	0	14100	10000						
70	0	18800	10000						
71	0	23500	10000						
72	0	28200	10000						
73	0	32900	10000						
74	500	14100	10000						
75	500	18800	10000						
76	500	23500	10000						
77	500	28200	10000						
78	500	32900	10000						
79	5000	0	10000						
80	5000	4700	10000						
81	5000	9400	10000						
82	5000	14100	10000						
83	5000	18800	10000						
84	5000	23500	10000						
85	5000	25850	10000						
86	5000	28200	10000						
87	5000	32900	10000						
88	10000	0	10000						
89	10000	4700	10000						
90	10000	9400	10000						
91	10000	14100	10000						
92	10000	18800	10000						
93	10000	23500	10000						
94	10000	25850	10000						
95	10000	28200	10000						
96	10000	32900	10000						
97	15000	0	10000						
98	15000	4700	10000						
99	15000	9400	10000						
100	15000	14100	10000						
101	15000	18800	10000						
102	15000	23500	10000						
103	15000	25850	10000						
104	15000	28200	10000						
105	15000	32900	10000						
106	20000	0	10000						

Node Number	Coordinates			Restrains					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
107	20000	4700	10000						
108	20000	9400	10000						
109	20000	14100	10000						
110	20000	18800	10000						
111	20000	23500	10000						
112	20000	28200	10000						
113	20000	32900	10000						
114	25000	0	10000						
115	25000	4700	10000						
116	25000	9400	10000						
117	25000	14100	10000						
118	25000	18800	10000						
119	25000	23500	10000						
120	25000	28200	10000						
121	25000	32900	10000						
122	30000	0	10000						
123	30000	4700	10000						
124	30000	9400	10000						
125	30000	14100	10000						
126	30000	18800	10000						
127	30000	23500	10000						
128	30000	28200	10000						
129	30000	32900	10000						
130	30000	35450	10000						
131	30000	38000	10000						
132	30000	40550	10000						
133	30000	43100	10000						
134	35000	0	10000						
135	35000	4700	10000						
136	35000	9400	10000						
137	35000	14100	10000						
138	35000	18800	10000						
139	35000	23500	10000						
140	35000	28200	10000						
141	35000	32900	10000						
142	35000	38000	10000						
143	35000	42600	10000						
144	35000	43100	10000						
145	40000	0	10000						
146	40000	4700	10000						
147	40000	9400	10000						
148	40000	14100	10000						
149	40000	18800	10000						
150	40000	23500	10000						
151	40000	28200	10000						
152	40000	32900	10000						
153	40000	38000	10000						
154	40000	42600	10000						
155	40000	43100	10000						
156	45000	0	10000						
157	45000	4700	10000						
158	45000	9400	10000						
159	45000	14100	10000						
160	45000	18800	10000						
161	45000	23500	10000						
162	45000	28200	10000						
163	45000	32900	10000						

Node Number	Coordinates			Restrains					
	X [mm]	Y [mm]	Z [mm]	Tx	Ty	Tz	Rx	Ry	Rz
164	45000	38000	10000						
165	45000	42600	10000						
166	45000	43100	10000						
167	50000	0	10000						
168	50000	4700	10000						
169	50000	9400	10000						
170	50000	14100	10000						
171	50000	18800	10000						
172	50000	23500	10000						
173	50000	28200	10000						
174	50000	32900	10000						
175	50000	38000	10000						
176	50000	43100	10000						
177	40000	-10679	10000						

1.2 BEAMS

Beam Number	Node		Beam connections		Profile	Length [mm]
	from	to	begin	begin		
1	42	1	paa	aaa	S80X10	6862
2	3	42	paa	aaa	S80X10	6862
3	49	5	paa	aaa	S80X10	6862
4	7	49	paa	aaa	S80X10	6862
5	11	52	paa	aaa	S80X10	7071
6	53	12	paa	aaa	S80X10	7071
7	52	15	paa	aaa	S80X10	7071
8	16	53	paa	aaa	S80X10	7071
9	54	16	paa	aaa	S80X10	7071
10	22	54	paa	aaa	S80X10	7071
11	21	56	paa	aaa	S80X10	7071
12	56	28	paa	aaa	S80X10	7071
13	34	63	paa	aaa	S80X10	6862
14	63	36	paa	aaa	S80X10	6862
15	37	64	paa	aaa	S80X10	6862
16	64	39	paa	aaa	S80X10	6862
17	1	66	aaa	aaa	HE220A	10000
18	2	67	aaa	aaa	IPE300	10000
19	3	68	aaa	aaa	IPE300	10000
20	4	69	aaa	aaa	IPE300	10000
21	43	44	aaa	aaa	HE120A	4700
22	44	45	aaa	aaa	HE120A	4700
23	45	46	aaa	aaa	HE120A	4700
24	46	47	aaa	aaa	HE120A	4700
25	44	48	aaa	aaa	HE120A	500
26	45	49	aaa	aaa	HE120A	500
27	46	50	aaa	aaa	HE120A	500
28	47	51	aaa	aaa	HE120A	500
29	5	75	aaa	aaa	IPE300	10000
30	6	76	aaa	aaa	IPE300	10000
31	7	77	aaa	aaa	IPE300	10000
32	8	78	aaa	aaa	HE220A	10000
33	9	79	aaa	aaa	IPE300	10000
34	10	87	aaa	aaa	IPE300	10000
35	11	88	aaa	aaa	IPE300	10000
36	12	96	aaa	aaa	IPE300	10000
37	13	97	aaa	aaa	IPE300	10000
38	14	105	aaa	aaa	IPE300	10000

Beam Number	Node		Beam connections		Profile	Length [mm]
	from	to	begin	begin		
39	15	106	aaa	aaa	IPE300	10000
40	16	113	aaa	aaa	IPE300	10000
41	17	114	aaa	aaa	IPE300	10000
42	18	116	aaaaaa	aaaaaa	HFRHS250X250X10	10000
43	19	119	aaaaaa	aaaaaa	HFRHS250X250X10	10000
44	20	121	aaa	aaa	IPE300	10000
45	21	122	aaa	aaa	IPE300	10000
46	22	129	aaa	aaa	HE220A	10000
47	23	130	aaa	aaa	IPE240	10000
48	24	132	aaa	aaa	IPE240	10000
49	25	133	aaa	aaa	HE220A	10000
50	55	58	aaa	aaa	HE120A	5000
51	26	134	aaa	aaa	IPE300	10000
52	27	143	aaa	aaa	IPE300	10000
53	57	58	aaa	aaa	HE120A	500
54	58	60	aaa	aaa	HE120A	5000
55	28	145	aaa	aaa	IPE300	10000
56	29	154	aaa	aaa	IPE300	10000
57	59	60	aaa	aaa	HE120A	500
58	60	62	aaa	aaa	HE120A	5000
59	30	156	aaa	aaa	IPE300	10000
60	31	165	aaa	aaa	IPE300	10000
61	61	62	aaa	aaa	HE120A	500
62	62	65	aaa	aaa	HE120A	5000
63	32	167	aaa	aaa	HE220A	10000
64	33	168	aaa	aaa	IPE300	10000
65	34	169	aaa	aaa	IPE300	10000
66	35	170	aaa	aaa	IPE300	10000
67	36	171	aaa	aaa	IPE300	10000
68	37	172	aaa	aaa	IPE300	10000
69	38	173	aaa	aaa	IPE300	10000
70	39	174	aaa	aaa	IPE300	10000
71	40	175	aaa	aaa	IPE300	10000
72	41	176	aaa	aaa	HE220A	10000
73	42	66	paa	aaa	S80X10	6862
74	68	42	paa	aaa	S80X10	6862
75	44	70	aaa	aaa	HE140A	5000
76	45	71	aaa	aaa	HE140A	5000
77	46	72	aaa	aaa	HE140A	5000
78	47	73	aaa	aaa	HE140A	5000
79	49	75	paa	aaa	S80X10	6862
80	77	49	paa	aaa	S80X10	6862
81	88	52	paa	aaa	S80X10	7071
82	53	96	paa	aaa	S80X10	7071
83	106	52	paa	aaa	S80X10	7071
84	113	53	paa	aaa	S80X10	7071
85	54	113	paa	aaa	S80X10	7071
86	129	54	paa	aaa	S80X10	7071
87	122	56	paa	aaa	S80X10	7071
88	58	144	aaa	aaa	HE140A	5000
89	145	56	paa	aaa	S80X10	7071
90	60	155	aaa	aaa	HE140A	5000
91	62	166	aaa	aaa	HE140A	5000
92	169	63	paa	aaa	S80X10	6862
93	63	171	paa	aaa	S80X10	6862
94	172	64	paa	aaa	S80X10	6862
95	64	174	paa	aaa	S80X10	6862

Beam Number	Node		Beam connections		Profile	Length [mm]
	from	to	begin	begin		
96	66	67	aaa	aaa	HE120A	4700
97	67	68	aaa	aaa	HE120A	4700
98	68	69	aaa	aaa	HE120A	4700
99	69	70	aaa	aaa	HE120A	4700
100	70	71	aaa	aaa	HE120A	4700
101	71	72	aaa	aaa	HE120A	4700
102	72	73	aaa	aaa	HE120A	4700
103	69	74	aaaaaa	aaaaaa	IPE550	500
104	70	75	aaaaaa	aaaaaa	IPE550	500
105	71	76	aaaaaa	aaaaaa	IPE550	500
106	72	77	aaaaaa	aaaaaa	IPE550	500
107	73	78	aaaaaa	aaaaaa	HE140A	500
108	66	79	aaa	aaa	HE140A	5000
109	80	66	paa	aaa	L70X70X6	6862
110	70	82	paa	aaa	L70X70X6	6862
111	83	69	paa	aaa	L70X70X6	6862
112	86	73	paa	aaa	L70X70X6	6862
113	78	87	aaaaaa	aaa	HE140A	4500
114	79	80	aaa	aaa	HFRHS80X80X5	4700
115	80	81	aaa	aaa	HFRHS80X80X5	4700
116	81	82	aaa	aaa	HFRHS80X80X5	4700
117	82	83	aaa	aaa	HFRHS80X80X5	4700
118	83	84	aaa	aaa	HFRHS80X80X5	4700
119	84	86	aaa	aaa	HE140A	4700
120	86	87	aaa	aaa	HFRHS80X80X5	4700
121	79	88	aaa	aaa	HE140A	5000
122	90	80	paa	aaa	L70X70X6	6862
123	93	86	paa	aaa	L70X70X6	6862
124	85	94	aaa	aaa	HE120A	5000
125	87	96	aaa	aaa	HE140A	5000
126	88	89	aaa	aaa	HFRHS80X80X5	4700
127	89	90	aaa	aaa	HFRHS80X80X5	4700
128	90	91	aaa	aaa	HFRHS80X80X5	4700
129	91	92	aaa	aaa	HFRHS80X80X5	4700
130	92	93	aaa	aaa	HFRHS80X80X5	4700
131	93	95	aaa	aaa	HE140A	4700
132	95	96	aaa	aaa	HFRHS80X80X5	4700
133	88	97	aaa	aaa	HE140A	5000
134	67	115	aaa	aaaaaa	IPE550	25000
135	68	116	aaa	aaaaaa	IPE550	25000
136	100	90	paa	aaa	L70X70X6	6862
137	101	93	paa	aaa	L70X70X6	6862
138	94	103	aaa	aaa	HE120A	5000
139	96	105	aaa	aaa	HE140A	5000
140	74	117	aaaaaa	aaaaaa	IPE550	24500
141	75	118	aaaaaa	aaaaaa	IPE550	24500
142	76	119	aaaaaa	aaaaaa	IPE550	24500
143	77	120	aaaaaa	aaaaaa	IPE550	24500
144	97	98	aaa	aaa	HFRHS80X80X5	4700
145	98	99	aaa	aaa	HFRHS80X80X5	4700
146	99	100	aaa	aaa	HFRHS80X80X5	4700
147	101	100	aaa	aaa	HFRHS80X80X5	4700
148	102	101	aaa	aaa	HFRHS80X80X5	4700
149	102	104	aaa	aaa	HE140A	4700
150	104	105	aaa	aaa	HFRHS80X80X5	4700
151	97	106	aaa	aaa	HE140A	5000
152	109	101	paa	aaa	L70X70X6	6862

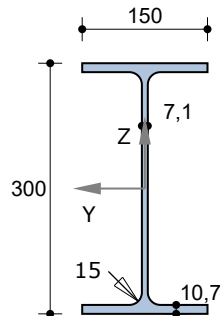
Beam Number	Node		Beam connections		Profile	Length [mm]
	from	to	begin	begin		
153	110	100	paa	aaa	L70X70X6	6862
154	105	113	aaa	aaa	HE140A	5000
155	106	107	aaa	aaa	HFRHS80X80X5	4700
156	107	108	aaa	aaa	HFRHS80X80X5	4700
157	108	109	aaa	aaa	HFRHS80X80X5	4700
158	109	110	aaa	aaa	HFRHS80X80X5	4700
159	110	111	aaa	aaa	HFRHS80X80X5	4700
160	111	112	aaa	aaa	HFRHS80X80X5	4700
161	112	113	aaa	aaa	HFRHS80X80X5	4700
162	106	114	aaa	aaa	HE140A	5000
163	116	109	paa	aaa	L70X70X6	6862
164	119	110	paa	aaa	L70X70X6	6862
165	113	121	aaa	aaa	HE140A	5000
166	114	116	aaa	aaaaaa	HE550A	9400
167	116	119	aaaaaa	aaaaaa	HE550A	14100
168	119	121	aaaaaa	aaa	HE550A	9400
169	114	122	aaa	aaa	HE140A	5000
170	123	116	paa	aaa	L70X70X6	6862
171	128	119	paa	aaa	L70X70X6	6862
172	121	129	aaa	aaa	HE140A	5000
173	122	123	aaa	aaa	HFRHS80X80X5	4700
174	123	124	aaa	aaa	HFRHS80X80X5	4700
175	124	125	aaa	aaa	HFRHS80X80X5	4700
176	125	126	aaa	aaa	HFRHS80X80X5	4700
177	126	127	aaa	aaa	HFRHS80X80X5	4700
178	127	128	aaa	aaa	HFRHS80X80X5	4700
179	128	129	aaa	aaa	HFRHS80X80X5	4700
180	129	130	aaaaaa	aaaaaa	HE300A	2550
181	130	132	aaaaaa	aaaaaa	HE300A	5100
182	132	133	aaaaaa	aaaaaa	HE300A	2550
183	122	134	aaa	aaa	HE140A	5000
184	134	123	paa	aaa	L70X70X6	6862
185	141	128	paa	aaa	L70X70X6	6862
186	134	135	aaa	aaa	HFRHS80X80X5	4700
187	135	136	aaa	aaa	HFRHS80X80X5	4700
188	136	137	aaa	aaa	HFRHS80X80X5	4700
189	137	138	aaa	aaa	HFRHS80X80X5	4700
190	138	139	aaa	aaa	HFRHS80X80X5	4700
191	139	140	aaa	aaa	HFRHS80X80X5	4700
192	140	141	aaa	aaa	HFRHS80X80X5	4700
193	141	142	aaa	aaa	HFRHS80X80X5	5100
194	142	143	aaa	aaaaaa	HE140A	4600
195	143	144	aaaaaa	aaa	HE140A	500
196	134	145	aaa	aaa	HE140A	5000
197	134	146	paa	aaa	L70X70X6	6862
198	115	168	aaaaaa	aaa	IPE550	25000
199	116	169	aaaaaa	aaa	IPE550	25000
200	147	137	paa	aaa	L70X70X6	6862
201	117	170	aaaaaa	aaa	IPE550	25000
202	137	149	paa	aaa	L70X70X6	6862
203	118	171	aaaaaa	aaa	IPE550	25000
204	119	172	aaaaaa	aaa	IPE550	25000
205	150	140	paa	aaa	L70X70X6	6862
206	120	173	aaaaaa	aaa	IPE550	25000
207	152	140	paa	aaa	L70X70X6	6862
208	153	144	paa	aaa	L70X70X6	7142
209	145	146	aaa	aaa	HFRHS80X80X5	4700

Beam Number	Node		Beam connections		Profile	Length [mm]
	from	to	begin	begin		
210	146	147	aaa	aaa	HFRHS80X80X5	4700
211	147	148	aaa	aaa	HFRHS80X80X5	4700
212	148	149	aaa	aaa	HFRHS80X80X5	4700
213	149	150	aaa	aaa	HFRHS80X80X5	4700
214	150	151	aaa	aaa	HFRHS80X80X5	4700
215	151	152	aaa	aaa	HFRHS80X80X5	4700
216	129	174	aaa	aaa	IPE500	20000
217	152	153	aaa	aaa	HFRHS80X80X5	5100
218	131	175	aaa	aaa	IPE500	20000
219	153	154	aaa	aaaaaa	HE140A	4600
220	154	155	aaaaaa	aaa	HE140A	500
221	133	176	aaa	aaa	HE140A	20000
222	145	156	aaa	aaa	HE140A	5000
223	146	158	paa	aaa	L70X70X6	6862
224	157	147	paa	aaa	L70X70X6	6862
225	149	161	paa	aaa	L70X70X6	6862
226	160	150	paa	aaa	L70X70X6	6862
227	164	152	paa	aaa	L70X70X6	7142
228	163	153	paa	aaa	L70X70X6	7142
229	156	157	aaa	aaa	HFRHS80X80X5	4700
230	157	158	aaa	aaa	HFRHS80X80X5	4700
231	158	159	aaa	aaa	HFRHS80X80X5	4700
232	159	160	aaa	aaa	HFRHS80X80X5	4700
233	160	161	aaa	aaa	HFRHS80X80X5	4700
234	161	162	aaa	aaa	HFRHS80X80X5	4700
235	162	163	aaa	aaa	HFRHS80X80X5	4700
236	163	164	aaa	aaa	HFRHS80X80X5	5100
237	164	165	aaa	aaaaaa	HE140A	4600
238	165	166	aaaaaa	aaa	HE140A	500
239	156	167	aaa	aaa	HE140A	5000
240	167	157	paa	aaa	L70X70X6	6862
241	158	170	paa	aaa	L70X70X6	6862
242	170	160	paa	aaa	L70X70X6	6862
243	161	173	paa	aaa	L70X70X6	6862
244	173	163	paa	aaa	L70X70X6	6862
245	176	164	paa	aaa	L70X70X6	7142
246	167	168	aaa	aaa	HE120A	4700
247	168	169	aaa	aaa	HE120A	4700
248	169	170	aaa	aaa	HE120A	4700
249	170	171	aaa	aaa	HE120A	4700
250	171	172	aaa	aaa	HE120A	4700
251	172	173	aaa	aaa	HE120A	4700
252	173	174	aaa	aaa	HE120A	4700
253	174	175	aaa	aaa	HE120A	5100
254	175	176	aaa	aaa	HE120A	5100

1.3 PROFILES

Profile Number	Name	Weight [kg/m]	E [N/mm²]	A [mm²]	Ix [mm⁴]	Iy [mm⁴]	Iz [mm⁴]
1	IPE300	42,3	210000	5,384E3	2,0208E5	8,3604E7	6,038E6
2	HE550A	166,2	210000	2,1178E	3,5264E6	1,1194E9	1,0819E8
3	HFRHS250X250X10	74,5	210000	9,492E3	1,3824E8	9,0538E7	9,0538E7
4	IPE550	105,5	210000	1,3444E	1,238E6	6,7131E8	2,6676E7
5	HE140A	24,7	210000	3,144E3	8,1643E4	1,0338E7	3,8934E6
6	HFRHS80X80X5	11,6	210000	1,479E3	2,1094E6	1,3743E6	1,3743E6
7	L70X70X6	6,4	210000	8,13E2	1,1168E4	3,6866E5	3,6866E5

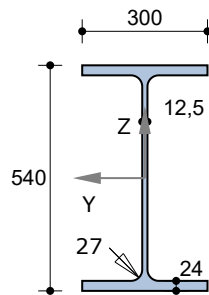
Profile Number	Name	Weight [kg/m]	E [N/mm ²]	A [mm ²]	I _x [mm ⁴]	I _y [mm ⁴]	I _z [mm ⁴]
8	HE120A	19,9	210000	2,536E3	6,0224E4	6,0661E6	2,3091E6
9	S80X10	6,3	210000	8E2	2,4567E4	6,667E3	4,2667E5
10	HE300A	88,4	210000	1,1255E	8,5566E5	1,8267E8	6,3096E7
11	IPE240	30,7	210000	3,914E3	1,2947E5	3,8943E7	2,8366E6
12	IPE500	90,7	210000	1,1554E	8,9665E5	4,821E8	2,1417E7
13	HE220A	50,5	210000	6,436E3	2,8578E5	5,4113E7	1,9546E7

IPE300**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F _y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

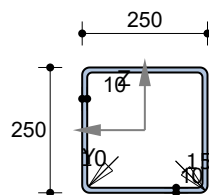
Maximum coordinate	y _{max}	= 75,0 mm	z _{max}	= 150,0 mm
Minimum coordinate	y _{min}	= -75,0 mm	z _{min}	= -150,0 mm
Centroid	z _s	= 0,0 mm	y _s	= 0,0 mm
Area / Weight	A	= 5383,6 mm ²	G	= 42,3 kg/m
First moment of area	S _y	= 314339 mm ³	S _z	= 62620 mm ³
Moment of inertia	I _x	= 202078 mm ⁴		
Moment of inertia	I _y	= 83604134 mm ⁴	I _z	= 6038030 mm ⁴
Radius of gyration	i _y	= 124,6 mm	i _z	= 33,5 mm
Elastic section modulus	W _{y,el}	= 557361 mm ³	W _{z,el}	= 80507 mm ³
Product moment of area	C _{yz}	= 0 mm ³	angle	= 0,00 degrees
Moment of inertia	I _{max}	= 83604134 mm ⁴	I _{min}	= 6038030 mm ⁴
Radius of gyration	i _{max}	= 124,6 mm	i _{min}	= 33,5 mm
Plastic neutral axis(PNA)	z _h	= 0,0 mm	y _h	= 0,0 mm
Plastic section modulus	W _{y,pl}	= 628677 mm ³	W _{z,pl}	= 125240 mm ³

HE550A**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	= 150,0 mm	z_{max}	= 270,0 mm
Minimum coordinate	y_{min}	= -150,0 mm	z_{min}	= -270,0 mm
Centroid	z_s	= 0,0 mm	y_s	= 0,0 mm
Area / Weight	A	= 21177,9 mm ²	G	= 166,2 kg/m
First moment of area	S_y	= 2311161 mm ³	S_z	= 553469 mm ³
Moment of inertia	I_x	= 3526429 mm ⁴		
Moment of inertia	I_y	= 1119441463 mm ⁴	I_z	= 108191196 mm ⁴
Radius of gyration	i_y	= 229,9 mm	i_z	= 71,5 mm
Elastic section modulus	$W_{y,el}$	= 4146079 mm ³	$W_{z,el}$	= 721275 mm ³
Product moment of area	C_{yz}	= 0 mm ³	angle	= 0,00 degrees
Moment of inertia	I_{max}	= 1119441463 mm ⁴	I_{min}	= 108191196 mm ⁴
Radius of gyration	i_{max}	= 229,9 mm	i_{min}	= 71,5 mm
Plastic neutral axis(PNA)	z_h	= 0,0 mm	y_h	= 0,0 mm
Plastic section modulus	$W_{y,pl}$	= 4622322 mm ³	$W_{z,pl}$	= 1106938 mm ³

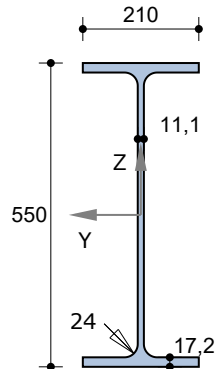
HFRHS250X250X10**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	= 125,0 mm	z_{max}	= 125,0 mm
Minimum coordinate	y_{min}	= -125,0 mm	z_{min}	= -125,0 mm
Centroid	z_s	= 0,0 mm	y_s	= 0,0 mm
Area / Weight	A	= 9491,9 mm ²	G	= 74,5 kg/m
First moment of area	S_y	= 425287 mm ³	S_z	= 425287 mm ³
Moment of inertia	I_x	= 138240000 mm ⁴		
Moment of inertia	I_y	= 90537538 mm ⁴	I_z	= 90537538 mm ⁴

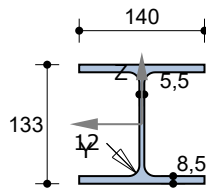
Radius of gyration	i_y	=	97,7 mm	i_z	=	97,7 mm
Elastic section modulus	$W_{y,el}$	=	724300 mm ³	$W_{z,el}$	=	724300 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	45,00 degrees
Moment of inertia	I_{max}	=	90537538 mm ⁴	I_{min}	=	90537538 mm ⁴
Radius of gyration	i_{max}	=	97,7 mm	i_{min}	=	97,7 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	850575 mm ³	$W_{z,pl}$	=	850575 mm ³

IPE550**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

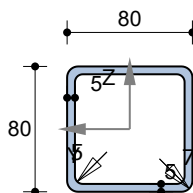
Maximum coordinate	y_{max}	=	105,0 mm	z_{max}	=	275,0 mm
Minimum coordinate	y_{min}	=	-105,0 mm	z_{min}	=	-275,0 mm
Centroid	z_s	=	0,0 mm	y_s	=	0,0 mm
Area / Weight	A	=	13443,9 mm ²	G	=	105,5 kg/m
First moment of area	S_y	=	1393789 mm ³	S_z	=	200285 mm ³
Moment of inertia	I_x	=	1238011 mm ⁴			
Moment of inertia	I_y	=	671307728 mm ⁴	I_z	=	26676430 mm ⁴
Radius of gyration	i_y	=	223,5 mm	i_z	=	44,5 mm
Elastic section modulus	$W_{y,el}$	=	2441119 mm ³	$W_{z,el}$	=	254061 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	0,00 degrees
Moment of inertia	I_{max}	=	671307728 mm ⁴	I_{min}	=	26676430 mm ⁴
Radius of gyration	i_{max}	=	223,5 mm	i_{min}	=	44,5 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	2787577 mm ³	$W_{z,pl}$	=	400569 mm ³

HE140A**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	= 70,0 mm	z_{max}	= 66,5 mm
Minimum coordinate	y_{min}	= -70,0 mm	z_{min}	= -66,5 mm
Centroid	z_s	= 0,0 mm	y_s	= 0,0 mm
Area / Weight	A	= 3143,9 mm ²	G	= 24,7 kg/m
First moment of area	S_y	= 86809 mm ³	S_z	= 42432 mm ³
Moment of inertia	I_x	= 81643 mm ⁴		
Moment of inertia	I_y	= 10337922 mm ⁴	I_z	= 3893360 mm ⁴
Radius of gyration	i_y	= 57,3 mm	i_z	= 35,2 mm
Elastic section modulus	$W_{y,el}$	= 155457 mm ³	$W_{z,el}$	= 55619 mm ³
Product moment of area	C_{yz}	= 0 mm ³	angle	= 0,00 degrees
Moment of inertia	I_{max}	= 10337922 mm ⁴	I_{min}	= 3893360 mm ⁴
Radius of gyration	i_{max}	= 57,3 mm	i_{min}	= 35,2 mm
Plastic neutral axis(PNA)	z_h	= 0,0 mm	y_h	= 0,0 mm
Plastic section modulus	$W_{y,pl}$	= 173618 mm ³	$W_{z,pl}$	= 84865 mm ³

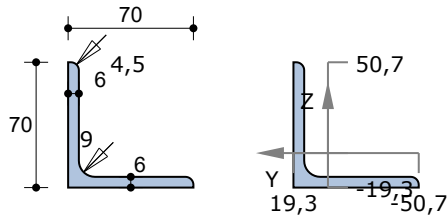
HFRHS80X80X5**Material data**

Steel grade	A572 Gr	(Hot rolled)
Yield stress	F_y	= 290 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	= 40,0 mm	z_{max}	= 40,0 mm
Minimum coordinate	y_{min}	= -40,0 mm	z_{min}	= -40,0 mm
Centroid	z_s	= 0,0 mm	y_s	= 0,0 mm
Area / Weight	A	= 1479,0 mm ²	G	= 11,6 kg/m
First moment of area	S_y	= 20672 mm ³	S_z	= 20672 mm ³
Moment of inertia	I_x	= 2109375 mm ⁴		
Moment of inertia	I_y	= 1374285 mm ⁴	I_z	= 1374285 mm ⁴
Radius of gyration	i_y	= 30,5 mm	i_z	= 30,5 mm
Elastic section modulus	$W_{y,el}$	= 34357 mm ³	$W_{z,el}$	= 34357 mm ³
Product moment of area	C_{yz}	= 0 mm ³	angle	= 45,00 degrees

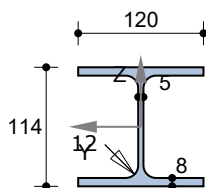
Moment of inertia	$I_{\max}$	=	1374285 mm ⁴	$I_{\min}$	=	1374285 mm ⁴
Radius of gyration	$i_{\max}$	=	30,5 mm	$i_{\min}$	=	30,5 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	41344 mm ³	$W_{z,pl}$	=	41344 mm ³

L70X70X6**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	$y_{\max}$	=	19,3 mm	$z_{\max}$	=	19,3 mm
Minimum coordinate	$y_{\min}$	=	-50,7 mm	$z_{\min}$	=	-50,7 mm
Centroid	z_s	=	0,0 mm	y_s	=	0,0 mm
Area / Weight	A	=	812,9 mm ²	G	=	6,4 kg/m
First moment of area	S_y	=	7499 mm ³	S_z	=	7499 mm ³
Moment of inertia	I_x	=	11168 mm ⁴	I_z	=	368662 mm ⁴
Moment of inertia	I_y	=	368662 mm ⁴	I_z	=	368662 mm ⁴
Radius of gyration	i_y	=	21,3 mm	i_z	=	21,3 mm
Elastic section modulus	$W_{y,el}$	=	7268 mm ³	$W_{z,el}$	=	7268 mm ³
Product moment of area	C_{yz}	=	-216012 mm ³	angle	=	45,00 degrees
Moment of inertia	$I_{\max}$	=	584675 mm ⁴	$I_{\min}$	=	152650 mm ⁴
Radius of gyration	$i_{\max}$	=	26,8 mm	$i_{\min}$	=	13,7 mm
Plastic neutral axis(PNA)	Z_h	=	13,4 mm	y_h	=	13,4 mm
Plastic section modulus	$W_{y,pl}$	=	13299 mm ³	$W_{z,pl}$	=	13299 mm ³

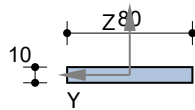
HE120A**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	$y_{\max}$	=	60,0 mm	$z_{\max}$	=	57,0 mm
Minimum coordinate	$y_{\min}$	=	-60,0 mm	$z_{\min}$	=	-57,0 mm
Centroid	z_s	=	0,0 mm	y_s	=	0,0 mm
Area / Weight	A	=	2535,9 mm ²	G	=	19,9 kg/m

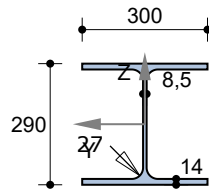
First moment of area	S_y	=	59796 mm ³	S_z	=	29434 mm ³
Moment of inertia	I_x	=	60224 mm ⁴			
Moment of inertia	I_y	=	6066116 mm ⁴	I_z	=	2309103 mm ⁴
Radius of gyration	i_y	=	48,9 mm	i_z	=	30,2 mm
Elastic section modulus	$W_{y,el}$	=	106423 mm ³	$W_{z,el}$	=	38485 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	0,00 degrees
Moment of inertia	I_{max}	=	6066116 mm ⁴	I_{min}	=	2309103 mm ⁴
Radius of gyration	i_{max}	=	48,9 mm	i_{min}	=	30,2 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	119593 mm ³	$W_{z,pl}$	=	58869 mm ³

S80X10**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

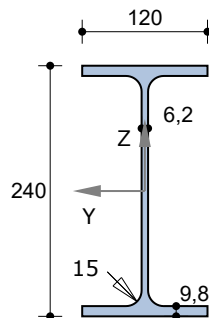
Maximum coordinate	y_{max}	=	40,0 mm	z_{max}	=	5,0 mm
Minimum coordinate	y_{min}	=	-40,0 mm	z_{min}	=	-5,0 mm
Centroid	z_s	=	0,0 mm	y_s	=	0,0 mm
Area / Weight	A	=	800,0 mm ²	G	=	6,3 kg/m
First moment of area	S_y	=	1000 mm ³	S_z	=	8000 mm ³
Moment of inertia	I_x	=	24567 mm ⁴			
Moment of inertia	I_y	=	6667 mm ⁴	I_z	=	426667 mm ⁴
Radius of gyration	i_y	=	2,9 mm	i_z	=	23,1 mm
Elastic section modulus	$W_{y,el}$	=	1333 mm ³	$W_{z,el}$	=	10667 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	90,00 degrees
Moment of inertia	I_{max}	=	426667 mm ⁴	I_{min}	=	6667 mm ⁴
Radius of gyration	i_{max}	=	23,1 mm	i_{min}	=	2,9 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	2000 mm ³	$W_{z,pl}$	=	16000 mm ³

HE300A**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F _y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y _{max}	= 150,0 mm	Z _{max}	= 145,0 mm
Minimum coordinate	y _{min}	= -150,0 mm	Z _{min}	= -145,0 mm
Centroid	Z _s	= 0,0 mm	y _s	= 0,0 mm
Area / Weight	A	= 11254,9 mm ²	G	= 88,4 kg/m
First moment of area	S _y	= 691765 mm ³	S _z	= 320598 mm ³
Moment of inertia	I _x	= 855659 mm ⁴	I _z	= 63096160 mm ⁴
Moment of inertia	I _y	= 182666481 mm ⁴	i _z	= 74,9 mm
Radius of gyration	i _y	= 127,4 mm	W _{z,el}	= 420641 mm ³
Elastic section modulus	W _{y,el}	= 1259769 mm ³	angle	= 0,00 degrees
Product moment of area	C _{yz}	= 0 mm ³	I _{min}	= 63096160 mm ⁴
Moment of inertia	I _{max}	= 182666481 mm ⁴	i _{min}	= 74,9 mm
Radius of gyration	i _{max}	= 127,4 mm	y _h	= 0,0 mm
Plastic neutral axis(PNA)	Z _h	= 0,0 mm	W _{z,pl}	= 641196 mm ³
Plastic section modulus	W _{y,pl}	= 1383530 mm ³		

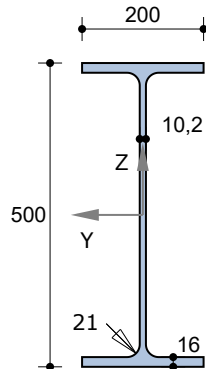
IPE240**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F _y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y _{max}	= 60,0 mm	Z _{max}	= 120,0 mm
Minimum coordinate	y _{min}	= -60,0 mm	Z _{min}	= -120,0 mm
Centroid	Z _s	= 0,0 mm	y _s	= 0,0 mm
Area / Weight	A	= 3914,0 mm ²	G	= 30,7 kg/m
First moment of area	S _y	= 183448 mm ³	S _z	= 36972 mm ³
Moment of inertia	I _x	= 129467 mm ⁴	I _z	= 2836568 mm ⁴
Moment of inertia	I _y	= 38942643 mm ⁴		

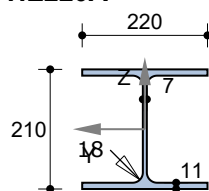
Radius of gyration	i_y	=	99,7 mm	i_z	=	26,9 mm
Elastic section modulus	$W_{y,el}$	=	324522 mm ³	$W_{z,el}$	=	47276 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	0,00 degrees
Moment of inertia	I_{max}	=	38942643 mm ⁴	I_{min}	=	2836568 mm ⁴
Radius of gyration	i_{max}	=	99,7 mm	i_{min}	=	26,9 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	366897 mm ³	$W_{z,pl}$	=	73944 mm ³

IPE500**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	=	100,0 mm	z_{max}	=	250,0 mm
Minimum coordinate	y_{min}	=	-100,0 mm	z_{min}	=	-250,0 mm
Centroid	z_s	=	0,0 mm	y_s	=	0,0 mm
Area / Weight	A	=	11554,4 mm ²	G	=	90,7 kg/m
First moment of area	S_y	=	1097311 mm ³	S_z	=	167954 mm ³
Moment of inertia	I_x	=	896648 mm ⁴			
Moment of inertia	I_y	=	482099426 mm ⁴	I_z	=	21417331 mm ⁴
Radius of gyration	i_y	=	204,3 mm	i_z	=	43,1 mm
Elastic section modulus	$W_{y,el}$	=	1928398 mm ³	$W_{z,el}$	=	214173 mm ³
Product moment of area	C_{yz}	=	0 mm ³	angle	=	0,00 degrees
Moment of inertia	I_{max}	=	482099426 mm ⁴	I_{min}	=	21417331 mm ⁴
Radius of gyration	i_{max}	=	204,3 mm	i_{min}	=	43,1 mm
Plastic neutral axis(PNA)	Z_h	=	0,0 mm	y_h	=	0,0 mm
Plastic section modulus	$W_{y,pl}$	=	2194622 mm ³	$W_{z,pl}$	=	335907 mm ³

HE220A**Material data**

Steel grade	A36	(Hot rolled)
Yield stress	F_y	= 250 MPa
Elasticity modulus	E	= 210000 MPa

Cross section data

Maximum coordinate	y_{max}	= 110,0 mm	z_{max}	= 105,0 mm
Minimum coordinate	y_{min}	= -110,0 mm	z_{min}	= -105,0 mm
Centroid	z_s	= 0,0 mm	y_s	= 0,0 mm
Area / Weight	A	= 6436,3 mm ²	G	= 50,5 kg/m
First moment of area	S_y	= 284322 mm ³	S_z	= 135308 mm ³
Moment of inertia	I_x	= 285781 mm ⁴		
Moment of inertia	I_y	= 54113401 mm ⁴	I_z	= 19545887 mm ⁴
Radius of gyration	i_y	= 91,7 mm	i_z	= 55,1 mm
Elastic section modulus	$W_{y,el}$	= 515366 mm ³	$W_{z,el}$	= 177690 mm ³
Product moment of area	C_{yz}	= 0 mm ³	angle	= 0,00 degrees
Moment of inertia	I_{max}	= 54113401 mm ⁴	I_{min}	= 19545887 mm ⁴
Radius of gyration	i_{max}	= 91,7 mm	i_{min}	= 55,1 mm
Plastic neutral axis(PNA)	z_h	= 0,0 mm	y_h	= 0,0 mm
Plastic section modulus	$W_{y,pl}$	= 568644 mm ³	$W_{z,pl}$	= 270616 mm ³

1.4 LOAD CASES

no.	Description	Type	ψ_0	ψ_1	ψ_2
1	Permanent	Dead load incl. self-weight	1,00	1,00	1,00
2	Veranderlijk	H:roofs	0,00	0,00	0,00
3	sneeuw	Snow	0,00	0,20	0,00
4	wind1	Wind	0,00	0,20	0,00
5	wind2	Wind	0,00	0,20	0,00

Total self-weight: : 71096 kg.

1.5.1 Beam loads

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
1	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	42	0	6862
2	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	3	0	6862
3	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	49	0	6862
4	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	7	0	6862
5	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	11	0	7071
6	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	53	0	7071
7	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	52	0	7071
8	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	16	0	7071
9	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	54	0	7071
10	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	22	0	7071
11	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	21	0	7071
12	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	56	0	7071
13	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	34	0	6862
14	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	63	0	6862
15	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	37	0	6862
16	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	64	0	6862
17	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	1	0	10000
18	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	2	0	10000
19	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	3	0	10000
20	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	4	0	10000
21	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	43	0	4700
22	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	44	0	4700
23	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	45	0	4700
24	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	46	0	4700
25	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	44	0	500
26	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	45	0	500
27	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	46	0	500
28	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	47	0	500
29	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	5	0	10000
30	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	6	0	10000
31	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	7	0	10000
32	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	8	0	10000
33	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	9	0	10000
34	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	10	0	10000
35	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	11	0	10000
36	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	12	0	10000
37	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	13	0	10000
38	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	14	0	10000
39	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	15	0	10000
40	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	16	0	10000
41	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	17	0	10000
42	G-Z	 q	-0,731 kN/m	-0,731 kN/m	0,0	0,0	18	0	10000
43	G-Z	 q	-0,731 kN/m	-0,731 kN/m	0,0	0,0	19	0	10000
44	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	20	0	10000
45	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	21	0	10000
46	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	22	0	10000
47	G-Z	 q	-0,301 kN/m	-0,301 kN/m	0,0	0,0	23	0	10000
48	G-Z	 q	-0,301 kN/m	-0,301 kN/m	0,0	0,0	24	0	10000
49	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	25	0	10000
50	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	55	0	5000
51	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	26	0	10000
52	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	27	0	10000
53	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	57	0	500
54	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	58	0	5000

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
55	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	28	0	10000
56	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	29	0	10000
57	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	59	0	500
58	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	60	0	5000
59	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	30	0	10000
60	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	31	0	10000
61	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	61	0	500
62	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	62	0	5000
63	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	32	0	10000
64	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	33	0	10000
65	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	34	0	10000
66	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	35	0	10000
67	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	36	0	10000
68	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	37	0	10000
69	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	38	0	10000
70	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	39	0	10000
71	G-Z	 q	-0,415 kN/m	-0,415 kN/m	0,0	0,0	40	0	10000
72	G-Z	 q	-0,496 kN/m	-0,496 kN/m	0,0	0,0	41	0	10000
73	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	42	0	6862
74	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	68	0	6862
75	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	44	0	5000
76	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	45	0	5000
77	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	46	0	5000
78	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	47	0	5000
79	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	49	0	6862
80	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	77	0	6862
81	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	88	0	7071
82	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	53	0	7071
83	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	106	0	7071
84	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	113	0	7071
85	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	54	0	7071
86	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	129	0	7071
87	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	122	0	7071
88	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	58	0	5000
89	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	145	0	7071
90	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	60	0	5000
91	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	62	0	5000
92	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	169	0	6862
93	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	63	0	6862
94	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	172	0	6862
95	G-Z	 q	-0,062 kN/m	-0,062 kN/m	0,0	0,0	64	0	6862
96	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	66	0	4700
96	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	66	0	4700
97	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	67	0	4700
97	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	67	0	4700
98	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	68	0	4700
98	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	68	0	4700
99	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	69	0	4700
99	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	69	0	4700
100	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	70	0	4700
100	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	70	0	4700
101	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	71	0	4700
101	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	71	0	4700
102	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	72	0	4700
102	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	72	0	4700
104	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	70	0	500

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
103	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	69	0	500
105	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	71	0	500
106	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	72	0	500
107	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	73	0	500
108	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	66	0	5000
108	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	66	0	5000
108	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	66	0	5000
109	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	80	0	6862
110	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	70	0	6862
111	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	83	0	6862
112	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	86	0	6862
113	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	78	0	4500
113	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	78	0	4500
113	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	78	0	4500
114	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	79	0	4700
115	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	80	0	4700
116	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	81	0	4700
117	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	82	0	4700
118	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	83	0	4700
119	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	84	0	4700
120	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	86	0	4700
121	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	79	0	5000
121	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	79	0	5000
121	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	79	0	5000
122	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	90	0	6862
123	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	93	0	6862
124	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	85	0	5000
124	L-Z	 qw01	-0,850 kN/m	-0,850 kN/m	0,0	0,0	85	0	5000
125	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	87	0	5000
125	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	87	0	5000
125	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	87	0	5000
126	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	88	0	4700
127	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	89	0	4700
128	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	90	0	4700
129	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	91	0	4700
130	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	92	0	4700
131	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	93	0	4700
132	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	95	0	4700
133	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	88	0	5000
133	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	88	0	5000
133	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	88	0	5000
134	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	67	0	25000
134	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	67	0	25000
135	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	68	0	25000
135	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	68	0	25000
136	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	100	0	6862
137	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	101	0	6862
138	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	94	0	5000
138	L-Z	 qw01	-0,850 kN/m	-0,850 kN/m	0,0	0,0	94	0	5000
139	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	96	0	5000
139	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	96	0	5000
139	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	96	0	5000
140	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	74	0	24500
140	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	74	0	24500
141	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	75	0	24500
141	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	75	0	24500

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
142	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	76	0	24500
142	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	76	0	24500
143	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	77	0	24500
143	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	77	0	24500
144	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	97	0	4700
145	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	98	0	4700
146	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	99	0	4700
147	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	101	0	4700
148	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	102	0	4700
149	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	102	0	4700
150	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	104	0	4700
151	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	97	0	5000
151	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	97	0	5000
151	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	97	0	5000
152	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	109	0	6862
153	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	110	0	6862
154	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	105	0	5000
154	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	105	0	5000
154	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	105	0	5000
155	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	106	0	4700
156	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	107	0	4700
157	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	108	0	4700
158	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	109	0	4700
159	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	110	0	4700
160	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	111	0	4700
161	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	112	0	4700
162	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	106	0	5000
162	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	106	0	5000
162	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	106	0	5000
163	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	116	0	6862
164	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	119	0	6862
165	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	113	0	5000
165	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	113	0	5000
165	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	113	0	5000
166	G-Z	 q	-1,631 kN/m	-1,631 kN/m	0,0	0,0	114	0	9400
167	G-Z	 q	-1,631 kN/m	-1,631 kN/m	0,0	0,0	116	0	14100
168	G-Z	 q	-1,631 kN/m	-1,631 kN/m	0,0	0,0	119	0	9400
169	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	114	0	5000
169	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	114	0	5000
169	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	114	0	5000
170	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	123	0	6862
171	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	128	0	6862
172	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	121	0	5000
172	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	121	0	5000
172	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	121	0	5000
173	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	122	0	4700
174	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	123	0	4700
175	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	124	0	4700
176	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	125	0	4700
177	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	126	0	4700
178	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	127	0	4700
179	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	128	0	4700
180	G-Z	 q	-0,867 kN/m	-0,867 kN/m	0,0	0,0	129	0	2550
180	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	129	0	2550
181	G-Z	 q	-0,867 kN/m	-0,867 kN/m	0,0	0,0	130	0	5100
182	G-Z	 q	-0,867 kN/m	-0,867 kN/m	0,0	0,0	132	0	2550

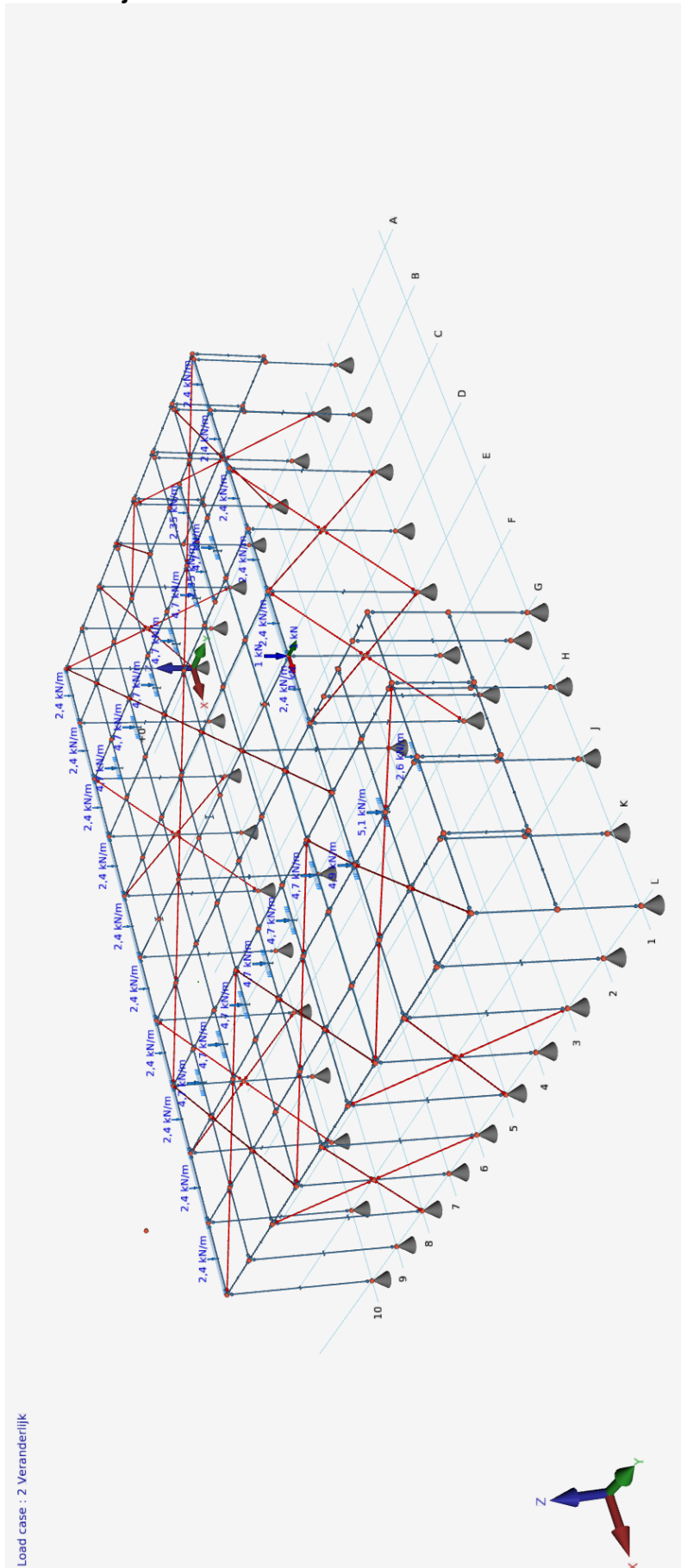
Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
182	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	132	0	2550
183	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	122	0	5000
183	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	122	0	5000
183	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	122	0	5000
184	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	134	0	6862
185	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	141	0	6862
186	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	134	0	4700
187	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	135	0	4700
188	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	136	0	4700
189	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	137	0	4700
190	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	138	0	4700
191	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	139	0	4700
192	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	140	0	4700
193	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	141	0	5100
194	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	142	0	4600
195	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	143	0	500
196	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	134	0	5000
196	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	134	0	5000
196	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	134	0	5000
197	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	134	0	6862
198	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	115	0	25000
198	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	115	0	25000
199	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	116	0	25000
199	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	116	0	25000
200	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	147	0	6862
201	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	117	0	25000
201	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	117	0	25000
202	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	137	0	6862
203	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	118	0	25000
203	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	118	0	25000
204	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	119	0	25000
204	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	119	0	25000
205	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	150	0	6862
206	G-Z	 q	-1,035 kN/m	-1,035 kN/m	0,0	0,0	120	0	25000
206	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	120	0	25000
207	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	152	0	6862
208	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	153	0	7142
209	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	145	0	4700
210	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	146	0	4700
211	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	147	0	4700
212	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	148	0	4700
213	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	149	0	4700
214	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	150	0	4700
215	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	151	0	4700
216	G-Z	 q	-0,890 kN/m	-0,890 kN/m	0,0	0,0	129	0	20000
216	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	129	0	20000
217	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	152	0	5100
218	G-Z	 q	-0,890 kN/m	-0,890 kN/m	0,0	0,0	131	0	20000
218	L-Z	 qw01	-1,700 kN/m	-1,700 kN/m	0,0	0,0	131	0	20000
219	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	153	0	4600
220	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	154	0	500
221	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	133	0	20000
221	L-Z	 qw01	-0,900 kN/m	-0,900 kN/m	0,0	0,0	133	0	20000
221	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	133	0	20000
222	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	145	0	5000
222	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	145	0	5000

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
222	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	145	0	5000
223	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	146	0	6862
224	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	157	0	6862
225	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	149	0	6862
226	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	160	0	6862
227	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	164	0	7142
228	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	163	0	7142
229	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	156	0	4700
230	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	157	0	4700
231	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	158	0	4700
232	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	159	0	4700
233	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	160	0	4700
234	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	161	0	4700
235	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	162	0	4700
236	G-Z	 q	-0,114 kN/m	-0,114 kN/m	0,0	0,0	163	0	5100
237	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	164	0	4600
238	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	165	0	500
239	G-Z	 q	-0,242 kN/m	-0,242 kN/m	0,0	0,0	156	0	5000
239	L-Z	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	156	0	5000
239	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	156	0	5000
240	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	167	0	6862
241	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	158	0	6862
242	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	170	0	6862
243	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	161	0	6862
244	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	173	0	6862
245	G-Z	 q	-0,063 kN/m	-0,063 kN/m	0,0	0,0	176	0	7142
246	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	167	0	4700
246	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	167	0	4700
247	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	168	0	4700
247	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	168	0	4700
248	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	169	0	4700
248	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	169	0	4700
249	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	170	0	4700
249	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	170	0	4700
250	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	171	0	4700
250	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	171	0	4700
251	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	172	0	4700
251	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	172	0	4700
252	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	173	0	4700
252	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	173	0	4700
253	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	174	0	5100
253	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	174	0	5100
254	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	175	0	5100
254	G-Z	 q	-0,195 kN/m	-0,195 kN/m	0,0	0,0	175	0	5100

1.5.2 Node loads

Node Number	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
121	1,000	1,000	-1,000			

1.6 LOAD CASE 2 Veranderlijk

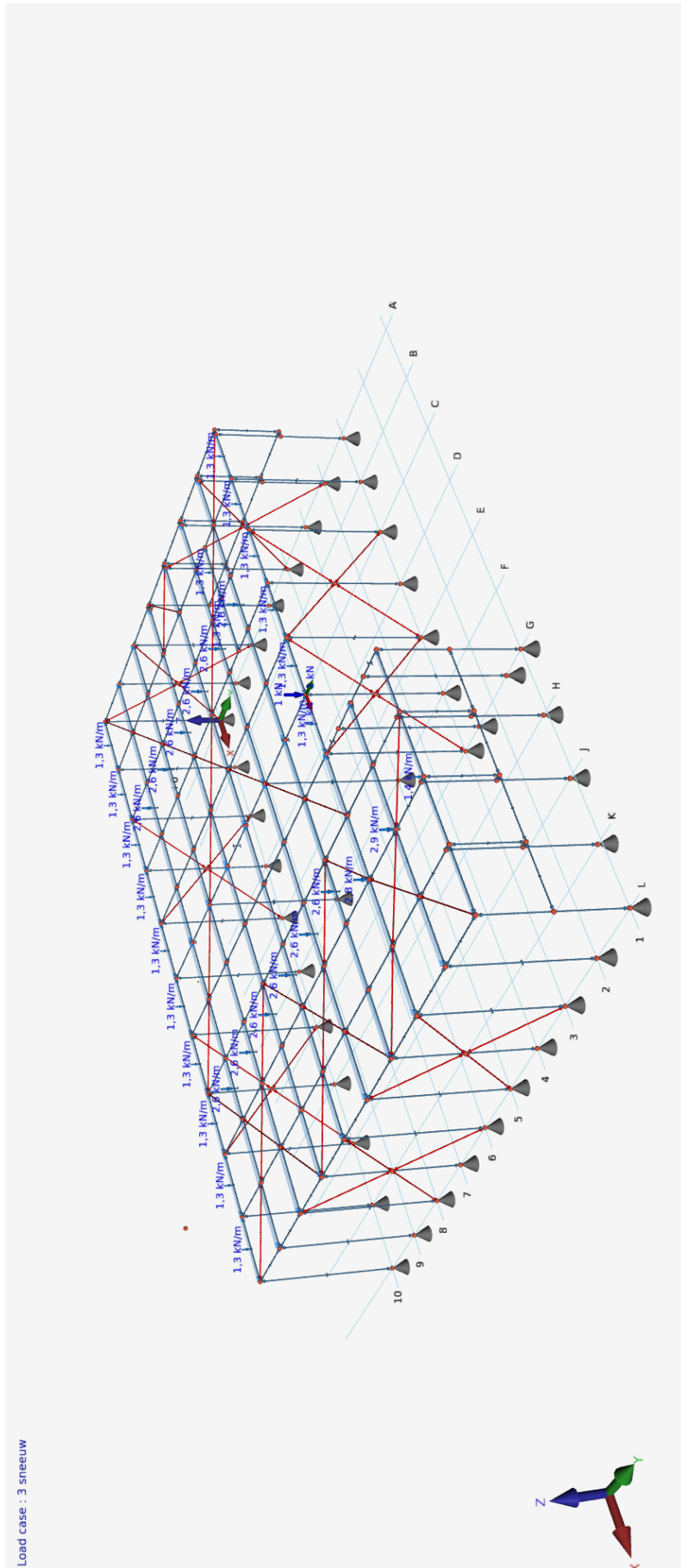


1.6.1 Beam loads

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
108	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	66	0	5000
113	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	78	0	4500
121	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	79	0	5000
124	L-Z	 qw01	-2,350 kN/m	-2,350 kN/m	0,0	0,0	85	0	5000
125	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	87	0	5000
133	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	88	0	5000
134	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	67	11500	2000
135	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	68	11500	2000
138	L-Z	 qw01	-2,350 kN/m	-2,350 kN/m	0,0	0,0	94	0	5000
139	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	96	0	5000
140	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	74	11000	2000
141	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	75	11000	2000
142	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	76	11000	2000
143	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	77	11000	2000
151	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	97	0	5000
154	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	105	0	5000
162	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	106	0	5000
165	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	113	0	5000
169	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	114	0	5000
172	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	121	0	5000
183	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	122	0	5000
196	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	134	0	5000
198	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	115	11500	2000
199	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	116	11500	2000
201	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	117	11500	2000
203	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	118	11500	2000
204	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	119	11500	2000
206	L-Z	 qw01	-4,700 kN/m	-4,700 kN/m	0,0	0,0	120	11500	2000
216	L-Z	 qw01	-4,900 kN/m	-4,900 kN/m	0,0	0,0	129	9000	2000
218	L-Z	 qw01	-5,100 kN/m	-5,100 kN/m	0,0	0,0	131	9000	2000
221	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	133	9000	2000
222	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	145	0	5000
239	L-Z	 qw01	-2,400 kN/m	-2,400 kN/m	0,0	0,0	156	0	5000

1.6.2 Node loads

Node Number	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
121	1,000	1,000	-1,000			

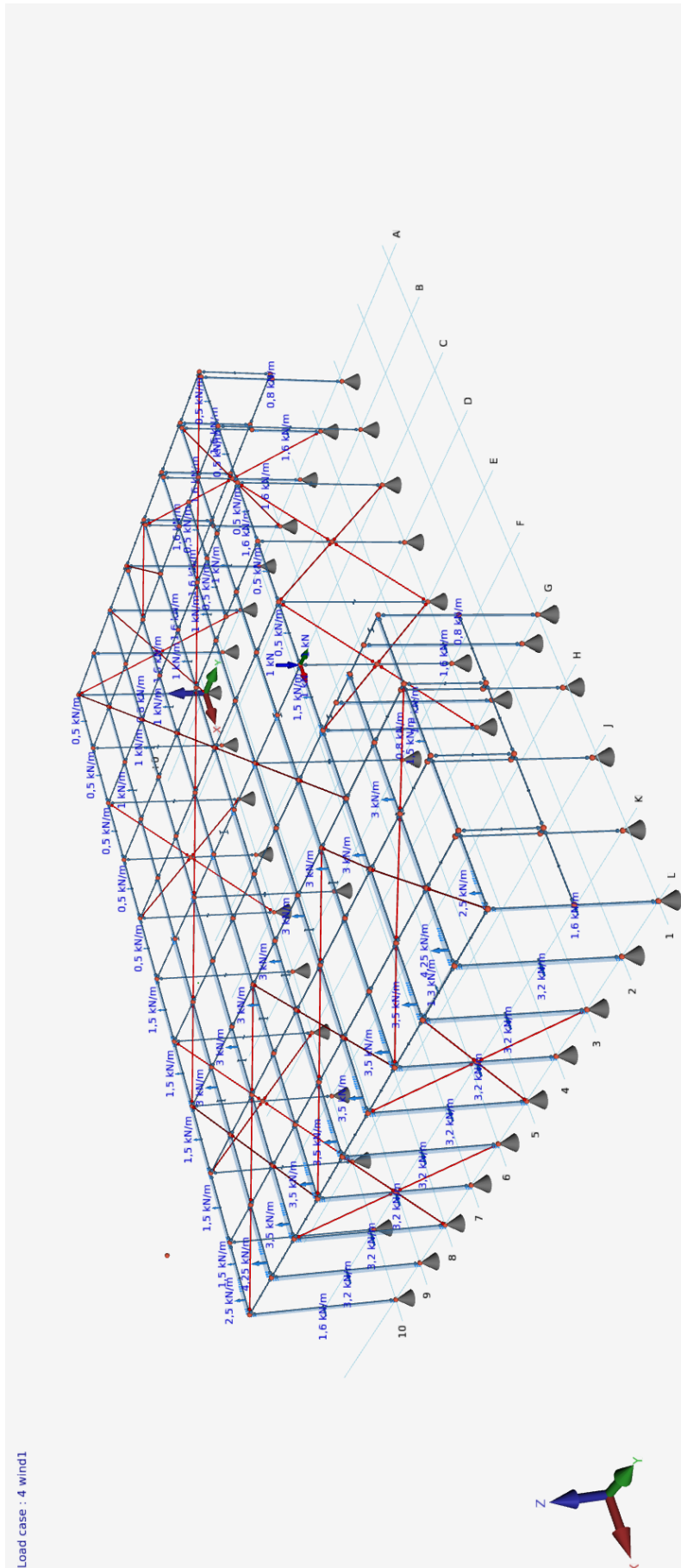
1.7 LOAD CASE 3 sneeuw

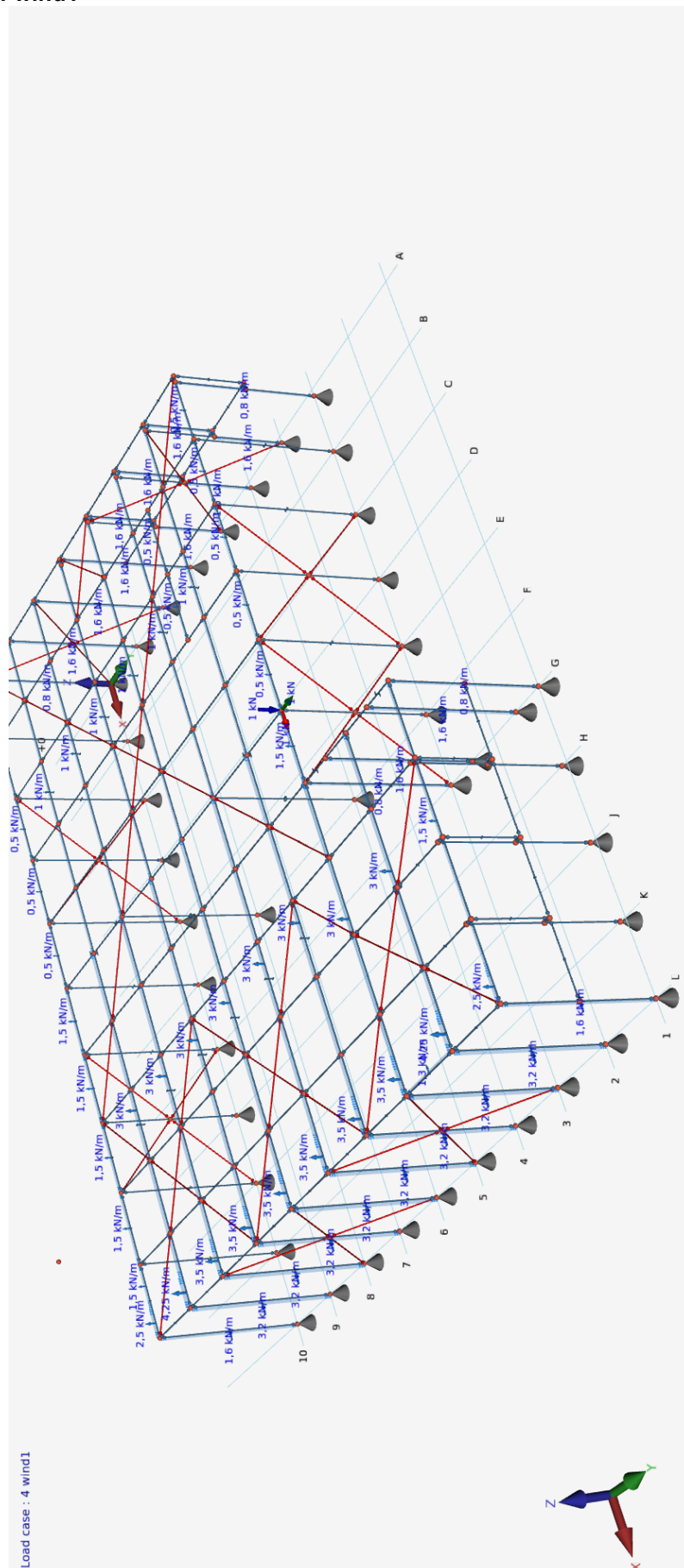
1.7.1 Beam loads

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
108	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	66	0	5000
113	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	78	0	4500
121	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	79	0	5000
124	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	85	0	5000
125	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	87	0	5000
133	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	88	0	5000
134	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	67	0	25000
135	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	68	0	25000
138	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	94	0	5000
139	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	96	0	5000
140	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	74	0	24500
141	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	75	0	24500
142	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	76	0	24500
143	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	77	0	24500
151	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	97	0	5000
154	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	105	0	5000
162	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	106	0	5000
165	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	113	0	5000
169	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	114	0	5000
172	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	121	0	5000
183	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	122	0	5000
196	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	134	0	5000
198	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	115	0	25000
199	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	116	0	25000
201	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	117	0	25000
203	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	118	0	25000
204	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	119	0	25000
206	L-Z	 qw01	-2,600 kN/m	-2,600 kN/m	0,0	0,0	120	0	25000
216	L-Z	 qw01	-2,800 kN/m	-2,800 kN/m	0,0	0,0	129	0	20000
218	L-Z	 qw01	-2,900 kN/m	-2,900 kN/m	0,0	0,0	131	0	20000
221	L-Z	 qw01	-1,400 kN/m	-1,400 kN/m	0,0	0,0	133	0	20000
222	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	145	0	5000
239	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	156	0	5000

1.7.2 Node loads

Node Number	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
121	1,000	1,000	-1,000			

1.8 LOAD CASE 4 wind1

1.8 LOAD CASE 4 wind1

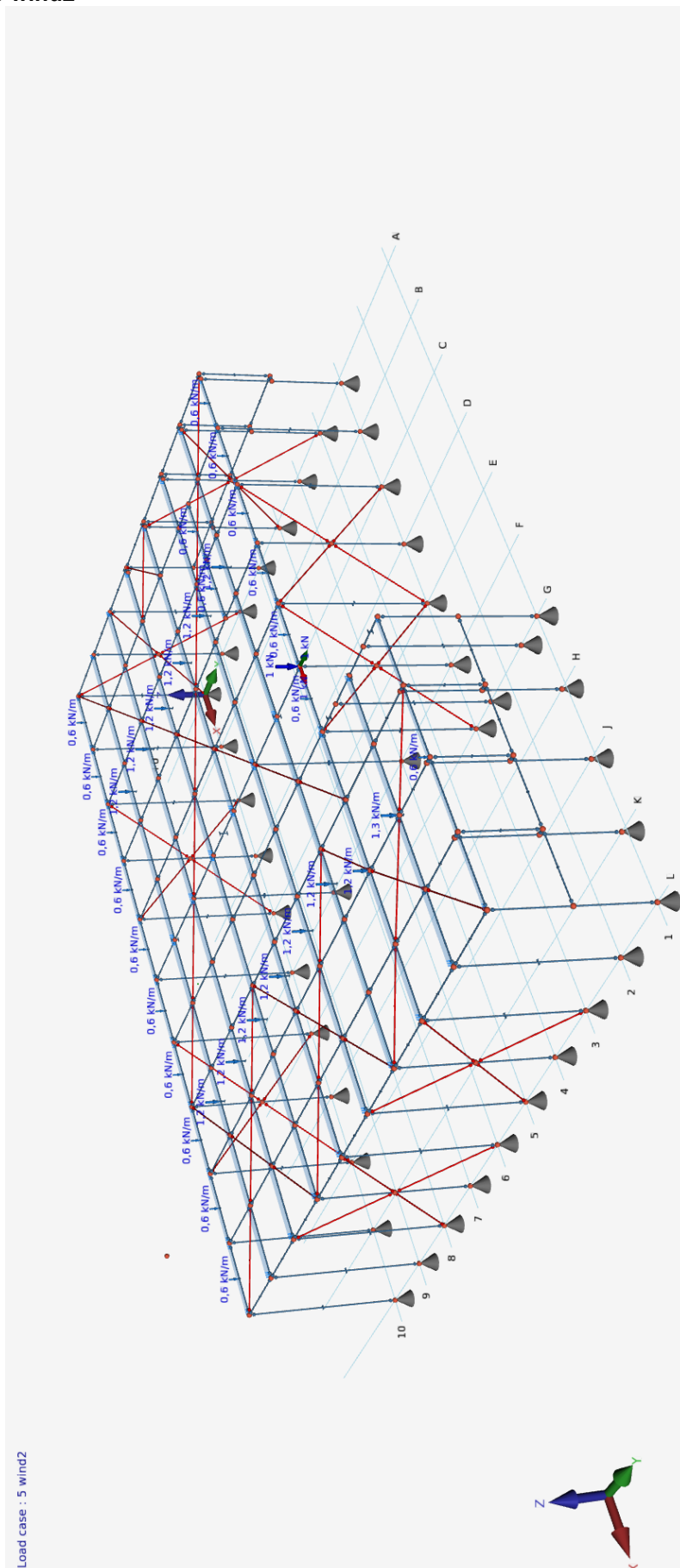
1.8.1 Beam loads

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
17	L-Y	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	1	0	10000
18	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	2	0	10000
19	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	3	0	10000
20	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	4	0	10000
29	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	5	0	5000
30	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	6	0	5000
31	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	7	0	5000
32	L-Y	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	8	0	10000
46	L-Y	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	22	0	10000
47	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	23	0	10000
48	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	24	0	10000
49	L-Y	 qw01	-0,800 kN/m	-0,800 kN/m	0,0	0,0	25	0	10000
63	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	32	0	10000
64	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	33	0	10000
65	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	34	0	10000
66	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	35	0	10000
67	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	36	0	10000
68	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	37	0	10000
69	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	38	0	10000
70	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	39	0	10000
71	L-Y	 qw01	-3,200 kN/m	-3,200 kN/m	0,0	0,0	40	0	10000
72	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	41	0	10000
75	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	44	0	5000
76	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	45	0	5000
77	L-Y	 qw01	-1,600 kN/m	-1,600 kN/m	0,0	0,0	46	0	5000
108	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	66	0	5000
113	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	78	0	4500
121	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	79	0	5000
124	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	85	0	5000
125	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	87	0	5000
133	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	88	0	5000
134	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	67	0	25000
135	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	68	0	25000
138	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	94	0	5000
139	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	96	0	5000
140	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	74	0	24500
141	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	75	0	24500
142	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	76	0	24500
143	L-Z	 qw01	1,000 kN/m	1,000 kN/m	0,0	0,0	77	0	24500
151	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	97	0	5000
154	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	105	0	5000
162	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	106	0	5000
165	L-Z	 qw01	0,500 kN/m	0,500 kN/m	0,0	0,0	113	0	5000
169	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	114	0	5000
172	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	121	0	5000
183	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	122	0	5000
196	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	134	0	5000
198	L-Z	 qw01	4,250 kN/m	4,250 kN/m	0,0	0,0	115	23000	2000
198	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	115	0	23000
199	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	116	23000	2000
199	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	116	0	23000
201	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	117	23000	2000
201	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	117	0	23000
203	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	118	23000	2000

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
203	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	118	0	23000
204	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	119	0	23000
204	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	119	23000	2000
206	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	120	0	23000
206	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	120	23000	2000
216	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	129	0	18000
216	L-Z	 qw01	3,500 kN/m	3,500 kN/m	0,0	0,0	129	18000	2000
218	L-Z	 qw01	4,250 kN/m	4,250 kN/m	0,0	0,0	131	18000	2000
218	L-Z	 qw01	3,000 kN/m	3,000 kN/m	0,0	0,0	131	0	18000
221	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	133	0	18000
221	L-Z	 qw01	2,500 kN/m	2,500 kN/m	0,0	0,0	133	18000	2000
222	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	145	0	5000
239	L-Z	 qw01	1,500 kN/m	1,500 kN/m	0,0	0,0	156	0	3000
239	L-Z	 qw01	2,500 kN/m	2,500 kN/m	0,0	0,0	156	3000	2000
253	L-Y	 qw01	1,300 kN/m	1,300 kN/m	0,0	0,0	174	0	5100

1.8.2 Node loads

Node Number	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
121	1,000	1,000	-1,000			

1.9 LOAD CASE 5 wind2

1.9.1 Beam loads

Beam Number	Directio	Type	Loads				Distance from		
			q1	q2	Angl	Exc.	Node	a [mm]	L [mm]
108	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	66	0	5000
113	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	78	0	4500
121	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	79	0	5000
124	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	85	0	5000
125	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	87	0	5000
133	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	88	0	5000
134	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	67	0	25000
135	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	68	0	25000
138	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	94	0	5000
139	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	96	0	5000
140	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	74	0	24500
141	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	75	0	24500
142	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	76	0	24500
143	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	77	0	24500
151	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	97	0	5000
154	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	105	0	5000
162	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	106	0	5000
165	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	113	0	5000
169	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	114	0	5000
172	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	121	0	5000
183	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	122	0	5000
196	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	134	0	5000
198	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	115	0	25000
199	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	116	0	25000
201	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	117	0	25000
203	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	118	0	25000
204	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	119	0	25000
206	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	120	0	25000
216	L-Z	 qw01	-1,200 kN/m	-1,200 kN/m	0,0	0,0	129	0	20000
218	L-Z	 qw01	-1,300 kN/m	-1,300 kN/m	0,0	0,0	131	0	20000
221	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	133	0	20000
222	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	145	0	5000
239	L-Z	 qw01	-0,600 kN/m	-0,600 kN/m	0,0	0,0	156	0	5000

1.9.2 Node loads

Node Number	Fx [kN]	Fy [kN]	Fz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
121	1,000	1,000	-1,000			

2. Calculation Results

2.1 ULTIMATE LIMIT STATES (ULS)

2.1.1 Load combinations

Geometric nonlinear analysis

Combination Number	Description	Type
1	Permanent	ULS

Combination Number	Load case ($\psi \times \gamma$)				
	1	2	3	4	5
1	1,00 x 1,22				

2.2 AISC 360-16 CHECKS

Steel design checks are based on 'Direct Analysis Method of Design' according to AISC 360-16 Section C1.1 using 'Design for Strength Using Load and Resistance Factor Design (LRFD)'. The direct analysis method of design used, is based on elastic P-delta-only second-order analysis. Imperfections (initial system imperfections) will be automatically included in calculating load combination(s).

Beam Number	Profile	Combination Number	Class	Article	U.C.
1	S80X10	1		D2	0,01
6	S80X10	1		D2	0,01
17	HE220A	1		E3	0,02
		1		E3	0,02
		2		Deflection	0,00
		2		Deflection	0,00
18	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
19	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
20	IPE300	1		E3	0,05
		1		E3	0,12
		2		Deflection	0,00
		2		Deflection	0,00
21	HE120A	1		F6	0,05
		1		G6	0,00
		2		Deflection	0,14
		2		Deflection	0,00
22	HE120A	1		F6	0,05
		1		G6	0,00
		2		Deflection	0,14
		2		Deflection	0,00
23	HE120A	1		F6	0,05
		1		G6	0,00
		2		Deflection	0,14
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
24	HE120A	1		F6	0,05
		1		G6	0,00
		2		Deflection	0,14
		2		Deflection	0,00
25	HE120A	2		Deflection	0,00
		2		Deflection	0,00
26	HE120A	2		Deflection	0,00
		2		Deflection	0,00
27	HE120A	2		Deflection	0,00
		2		Deflection	0,00
28	HE120A	2		Deflection	0,00
		2		Deflection	0,00
29	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
30	IPE300	1		E3	0,06
		1		E3	0,14
		2		Deflection	0,00
		2		Deflection	0,00
31	IPE300	1		E3	0,06
		1		E3	0,14
		2		Deflection	0,00
		2		Deflection	0,00
32	HE220A	1		E3	0,03
		1		E3	0,02
		2		Deflection	0,00
		2		Deflection	0,00
33	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
34	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
35	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
36	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
37	IPE300	1		E3	0,02
		1		E3	0,06
		2		Deflection	0,00
		2		Deflection	0,00
38	IPE300	1		E3	0,02
		1		E3	0,06
		2		Deflection	0,00
		2		Deflection	0,00
39	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
40	IPE300	1		E3	0,03
		1		E3	0,06
		2		Deflection	0,00
		2		Deflection	0,00
41	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
42	HFRHS250X250X10	1		E3	0,27
		1		E3	0,27
		1		F7	0,04
		1		G4	0,00
		1		H1	0,31
		2		Deflection	0,05
		2		Deflection	0,00
43	HFRHS250X250X10	1		E3	0,28
		1		E3	0,28
		1		F7	0,04
		1		F7	0,01
		1		G4	0,00
		1		G6	0,00
		1		H1	0,32
		2		Deflection	0,05
		2		Deflection	0,00
44	IPE300	1		E3	0,06
		1		E3	0,14
		1		F6	0,00
		1		H1	0,07
		2		Deflection	0,00
		2		Deflection	0,00
45	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
46	HE220A	1		E3	0,06
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
47	IPE240	1		E3	0,06
		1		E3	0,18
		2		Deflection	0,00
		2		Deflection	0,00
48	IPE240	1		E3	0,06
		1		E3	0,17
		2		Deflection	0,00
		2		Deflection	0,00
49	HE220A	1		E3	0,01
		1		E3	0,03
		2		Deflection	0,00
		2		Deflection	0,00
50	HE120A	1		F2	0,03
		1		G2	0,01
		2		Deflection	0,06
		2		Deflection	0,00
51	IPE300	1		E3	0,03
		1		E3	0,06

Beam Number	Profile	Combination Number	Class	Article	U.C.
51	IPE300	2		Deflection	0,00
		2		Deflection	0,00
52	IPE300	1		E3	0,03
		1		E3	0,08
		2		Deflection	0,00
		2		Deflection	0,00
53	HE120A	2		Deflection	0,00
		2		Deflection	0,00
54	HE120A	1		F2	0,03
		1		G2	0,01
		2		Deflection	0,06
		2		Deflection	0,00
55	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
56	IPE300	1		E3	0,03
		1		E3	0,07
		2		Deflection	0,00
		2		Deflection	0,00
57	HE120A	2		Deflection	0,00
		2		Deflection	0,00
58	HE120A	1		F2	0,03
		1		G2	0,01
		2		Deflection	0,06
		2		Deflection	0,00
59	IPE300	1		E3	0,02
		1		E3	0,05
		2		Deflection	0,00
		2		Deflection	0,00
60	IPE300	1		E3	0,03
		1		E3	0,08
		2		Deflection	0,00
		2		Deflection	0,00
61	HE120A	2		Deflection	0,00
		2		Deflection	0,00
62	HE120A	1		F2	0,03
		1		G2	0,01
		2		Deflection	0,06
		2		Deflection	0,00
63	HE220A	1		E3	0,02
		1		E3	0,02
		2		Deflection	0,00
		2		Deflection	0,00
64	IPE300	1		E3	0,05
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
65	IPE300	1		E3	0,05
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
66	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
67	IPE300	1		E3	0,06
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
68	IPE300	1		E3	0,05
		1		E3	0,13
		2		Deflection	0,00
		2		Deflection	0,00
69	IPE300	1		E3	0,06
		1		E3	0,07
		2		Deflection	0,00
		2		Deflection	0,00
70	IPE300	1		E3	0,06
		1		E3	0,07
		2		Deflection	0,00
		2		Deflection	0,00
71	IPE300	1		E3	0,05
		1		E3	0,06
		2		Deflection	0,00
		2		Deflection	0,00
72	HE220A	1		E3	0,02
		1		E3	0,02
		2		Deflection	0,00
		2		Deflection	0,00
74	S80X10	1		D2	0,01
75	HE140A	2		Deflection	0,00
		2		Deflection	0,00
76	HE140A	2		Deflection	0,00
		2		Deflection	0,00
77	HE140A	2		Deflection	0,00
		2		Deflection	0,00
78	HE140A	2		Deflection	0,00
		2		Deflection	0,00
84	S80X10	1		D2	0,01
88	HE140A	2		Deflection	0,00
		2		Deflection	0,00
90	HE140A	2		Deflection	0,00
		2		Deflection	0,00
91	HE140A	2		Deflection	0,00
		2		Deflection	0,00
96	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
97	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
98	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
99	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
100	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
101	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
102	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
103	IPE550	1		F2	0,03
		1		G2	0,03
		2		Deflection	0,00
		2		Deflection	0,00
104	IPE550	1		F2	0,01
		1		G2	0,01
		2		Deflection	0,00
		2		Deflection	0,00
105	IPE550	1		F2	0,01
		1		G2	0,01
		2		Deflection	0,00
		2		Deflection	0,00
106	IPE550	1		F2	0,01
		1		F6	0,00
		1		G2	0,01
		1		G6	0,00
		2		Deflection	0,00
		2		Deflection	0,00
107	HE140A	1		F2	0,09
		1		G2	0,06
		2		Deflection	0,01
		2		Deflection	0,00
108	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
113	HE140A	1		F2	0,15
		1		G2	0,07
		2		Deflection	0,24
		2		Deflection	0,00
114	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
115	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
116	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
117	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
117	HFRHS80X80X5	2		Deflection	0,13
		2		Deflection	0,00
118	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
119	HE140A	1		F2	0,12
		1		G2	0,02
		2		Deflection	0,22
		2		Deflection	0,00
120	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
121	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
124	HE120A	1		F2	0,17
		1		G2	0,04
		2		Deflection	0,33
		2		Deflection	0,00
125	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
126	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
127	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
128	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
129	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
130	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
131	HE140A	1		F2	0,21
		1		G2	0,04
		2		Deflection	0,39
		2		Deflection	0,00
132	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
133	HE140A	1		F2	0,27
		1		G2	0,07

Beam Number	Profile	Combination Number	Class	Article	U.C.
133	HE140A	2		Deflection	0,46
		2		Deflection	0,00
134	IPE550	1		F2	0,43
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,53
		2		Deflection	0,00
135	IPE550	1		F2	0,43
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,54
		2		Deflection	0,00
136	L70X70X6	1		D2	0,01
138	HE120A	1		F2	0,17
		1		G2	0,04
		2		Deflection	0,33
		2		Deflection	0,00
139	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
140	IPE550	1		F2	0,42
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,55
		2		Deflection	0,00
141	IPE550	1		F2	0,41
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,51
		2		Deflection	0,00
142	IPE550	1		F2	0,45
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,58
		2		Deflection	0,00
143	IPE550	1		F2	0,44
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,58
		2		Deflection	0,00
144	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
145	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
146	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
147	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13

Beam Number	Profile	Combination Number	Class	Article	U.C.
147	HFRHS80X80X5	2		Deflection	0,00
148	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
149	HE140A	1		F2	0,12
		1		G2	0,02
		2		Deflection	0,22
		2		Deflection	0,00
150	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
151	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
154	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
155	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
156	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
157	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
158	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
159	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
160	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
161	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
162	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
165	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46

Beam Number	Profile	Combination Number	Class	Article	U.C.
165	HE140A	2		Deflection	0,00
166	HE550A	1		F2	0,30
		1		G2	0,10
		2		Deflection	0,05
		2		Deflection	0,00
167	HE550A	1		F2	0,37
		1		G2	0,12
		2		Deflection	0,28
		2		Deflection	0,00
168	HE550A	1		F2	0,30
		1		G2	0,10
		2		Deflection	0,05
		2		Deflection	0,00
169	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
172	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
173	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
174	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
175	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
176	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
177	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
178	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
179	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
180	HE300A	1		F2	0,05
		1		G2	0,03
		2		Deflection	0,01
		2		Deflection	0,00
181	HE300A	1		F2	0,08
		1		G2	0,05
		2		Deflection	0,05

Beam Number	Profile	Combination Number	Class	Article	U.C.
181	HE300A	2		Deflection	0,00
182	HE300A	1		F2	0,05
		1		G2	0,03
		2		Deflection	0,01
		2		Deflection	0,00
183	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
186	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
187	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
188	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
189	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
190	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
191	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
192	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
193	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,17
		2		Deflection	0,00
194	HE140A	1		F2	0,26
		1		G2	0,03
		2		Deflection	0,25
		2		Deflection	0,00
195	HE140A	1		F2	0,26
		1		G2	0,19
		2		Deflection	0,03
		2		Deflection	0,00
196	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
198	IPE550	1		F2	0,43
		1		G2	0,06
		2		Deflection	0,55

Beam Number	Profile	Combination Number	Class	Article	U.C.
198	IPE550	2		Deflection	0,00
199	IPE550	1		F2	0,43
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,54
		2		Deflection	0,00
201	IPE550	1		F2	0,42
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,56
		2		Deflection	0,00
203	IPE550	1		F2	0,41
		1		F6	0,00
		1		G2	0,06
		2		Deflection	0,58
		2		Deflection	0,00
204	IPE550	1		F2	0,44
		1		G2	0,06
		2		Deflection	0,53
		2		Deflection	0,00
206	IPE550	1		F2	0,44
		1		G2	0,06
		2		Deflection	0,53
		2		Deflection	0,00
209	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
210	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
211	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
212	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
213	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
214	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
215	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
216	IPE500	1		F2	0,37
		1		G2	0,04
		2		Deflection	0,89
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
217	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,17
		2		Deflection	0,00
218	IPE500	1		F2	0,33
		1		G2	0,04
		2		Deflection	0,80
		2		Deflection	0,00
219	HE140A	1		F2	0,23
		1		G2	0,02
		2		Deflection	0,21
		2		Deflection	0,00
220	HE140A	1		F2	0,23
		1		G2	0,16
		2		Deflection	0,03
		2		Deflection	0,00
221	HE140A	1		F2	0,87
		1		G2	0,09
		2		Deflection	0,06
		2		Deflection	0,00
222	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
229	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
230	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
231	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
232	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
233	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
234	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
235	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,13
		2		Deflection	0,00
236	HFRHS80X80X5	1		F7	0,04
		1		G4	0,00
		2		Deflection	0,17
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
237	HE140A	1		F2	0,26
		1		G2	0,03
		2		Deflection	0,25
		2		Deflection	0,00
238	HE140A	1		F2	0,26
		1		G2	0,18
		2		Deflection	0,03
		2		Deflection	0,00
239	HE140A	1		F2	0,27
		1		G2	0,07
		2		Deflection	0,46
		2		Deflection	0,00
246	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
247	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
248	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
249	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
250	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
251	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
252	HE120A	1		F2	0,23
		1		G2	0,05
		2		Deflection	0,42
		2		Deflection	0,00
253	HE120A	1		F2	0,28
		1		G2	0,06
		2		Deflection	0,54
		2		Deflection	0,00
254	HE120A	1		F2	0,28
		1		G2	0,06
		2		Deflection	0,54
		2		Deflection	0,00

Beam Number	Profile	Combination Number	Class	Article	U.C.
Maximum values					
30	IPE300	1	0	E3	0,14
43	HFRHS250X250X10	1	0	H1	0,32
46	HE220A	1	0	E3	0,06
47	IPE240	1	0	E3	0,18
84	S80X10	1	0	D2	0,01
136	L70X70X6	1	0	D2	0,01
167	HE550A	1	0	F2	0,37
181	HE300A	1	0	F2	0,08
193	HFRHS80X80X5	2	0	Deflection	0,17
203	IPE550	2	0	Deflection	0,58
216	IPE500	2	0	Deflection	0,89
221	HE140A	1	0	F2	0,87
254	HE120A	2	0	Deflection	0,54

2.3 CALCULATION OF UNITY CHECKS

2.3.1 Beam 30 - IPE300

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=4999 mm $N_x=-54,504$ kN $V_y=0$ kN $V_z=0$ kN
 $M_x=0$ kNm $M_y=-0,001$ kNm $M_z=0$ kNm

$$F_{ex} = \frac{\pi^2 E}{\left(\frac{L_{cx}}{r_x}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{10000}{124,6}\right)^2} = 306,5 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cx}}{r_x} = \frac{10000}{124,6} = 80,25 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{crx} = \left(\left(0,658 \right)^{\frac{F_y}{250}} \right) F_y = \left(\left(0,658 \right)^{\frac{306,5}{250}} \right) \times 250 = 177,7 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{crx} A_g = 177,7 \times 5384 \times 10^{-3} = 956,68 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 956,68 = 861,01 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{54,50}{0,90 \times 956,68} = 0,06 < 1,00 \quad (\text{B3-1})$$

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=4999 mm $N_x=-54,504$ kN $V_y=0$ kN $V_z=0$ kN
 $M_x=0$ kNm $M_y=-0,001$ kNm $M_z=0$ kNm

$$F_{ey} = \frac{\pi^2 E}{\left(\frac{L_{cy}}{r_y}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{5000}{33,5}\right)^2} = 88,6 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cy}}{r_y} = \frac{5000}{33,5} = 149,3 > 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{cry} = 0,877 F_{ey} = 0,877 \times 88,6 = 77,7 \text{ MPa} \quad (\text{E3-3})$$

$$P_n = F_{cry} A_g = 77,7 \times 5384 \times 10^{-3} = 418,10 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 418,10 = 376,29 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{54,50}{0,90 \times 418,10} = 0,14 < 1,00 \quad (\text{B3-1})$$

Deflection

Combination: 2 x=5000 mm Nx=-44,673 kN Vy=0 kN Vz=0 kN
 Mx=0 kNm My=-0,001 kNm Mz=0 kNm

Local node displacements $d_{z1} = 0 \text{ mm}$ $d_{z2} = -0,5 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|0|}{10000 / 250} = \frac{|0|}{40} = 0,00 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{add,z}|}{W_{add,z,max}} = \frac{|0|}{10000 / 333} = \frac{|0|}{30} = 0,00 < 1,0$$

2.3.2 Beam 43 - HFRHS250X250X10

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=9999 mm Nx=-340,391 kN Vy=-0,168 kN Vz=-0,726 kN
 Mx=0 kNm My=-7,255 kNm Mz=-1,684 kNm

$$F_{ex} = \frac{\pi^2 E}{\left(\frac{L_{cx}}{r_x} \right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{10000}{97,7} \right)^2} = 188,3 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cx}}{r_x} = \frac{10000}{97,7} = 102,39 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{crx} = \left(\left(0,658 \right)^{\frac{F_y}{F_{ex}}} \right) F_y = \left(\left(0,658 \right)^{\frac{250}{188,3}} \right) \times 250 = 143,4 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{crx} A_g = 143,4 \times 9492 \times 10^{-3} = 1361,23 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 1361,23 = 1225,11 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{340,39}{0,90 \times 1361,23} = 0,28 < 1,00 \quad (\text{B3-1})$$

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=9999 mm Nx=-340,391 kN Vy=-0,168 kN Vz=-0,726 kN
 Mx=0 kNm My=-7,255 kNm Mz=-1,684 kNm

$$F_{ey} = \frac{\pi^2 E}{\left(\frac{L_{cy}}{r_y}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{10000}{97,7}\right)^2} = 188,3 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cy}}{r_y} = \frac{10000}{97,7} = 102,39 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{cry} = \left(\left(0,658 \right) \sqrt{\frac{F_y}{F_{ey}}} \right) F_y = \left(\left(0,658 \right) \sqrt{\frac{250}{188,3}} \right) \times 250 = 143,4 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{cry} A_g = 143,4 \times 9492 \times 10^{-3} = 1361,23 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 1361,23 = 1225,11 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{340,39}{0,90 \times 1361,23} = 0,28 < 1,00 \quad (\text{B3-1})$$

F7. SQUARE AND RECTANGULAR HSS AND BOX SECTIONS

Combination: 1 x=9999 mm Nx=-340,391 kN Vy=-0,168 kN Vz=-0,726 kN
 Mx=0 kNm My=-7,255 kNm Mz=-1,684 kNm

1. Yielding

$$M_n = M_p = F_y Z = 250 \times 850575 \times 10^{-6} = 212,64 \text{ kNm} \quad (\text{F7-1})$$

2. Flange Local Buckling

$$\lambda_f = \frac{b}{t_f} = \frac{250}{10} = 25$$

$$17: \lambda_{pf} = 1,12 \sqrt{\frac{E}{F_y}} = 1,12 \times \sqrt{\frac{200000}{250}} = 31,68 \quad \lambda_{rf} = 1,40 \sqrt{\frac{E}{F_y}} = 1,40 \times \sqrt{\frac{200000}{250}} = 39,6 \quad (\text{T-B4.1b})$$

(a) $\lambda_f < \lambda_{pf}$ The limit state of local buckling does not apply.

3. Web Local Buckling

$$\lambda_w = \frac{h}{t_w} = \frac{250}{10} = 25$$

$$19: \lambda_{pw} = 2,42 \sqrt{\frac{E}{F_y}} = 2,42 \times \sqrt{\frac{200000}{250}} = 68,45 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (\text{T-B4.1b})$$

(a) $\lambda_w < \lambda_{pw}$ The limit state of web local buckling does not apply.

4. Lateral-Torsional Buckling

$$R_c = 1.5 t = 1,5 \times 10 = 15 \text{ mm}$$

$$A_p = (d-t)(b-t) - R_c^2 (4 - \pi) = (250 - 10) \times (250 - 10) - 15^2 \times (4 - \pi) = 57407 \text{ mm}^2$$

$$p = 2 [(d-t) + (b-t)] - 2R_c (4 - \pi) = 2 \times [(250 - 10) + (250 - 10)] - 2 \times 15 \times (4 - \pi) = 934,2 \text{ mm}$$

$$J = \frac{4 A_p^2 t}{p} = \frac{4 \times 57407^2 \times 10}{934,2} = 141099501 \text{ mm}^4 \quad \text{St. Venants torsional constant}$$

$$C_w = 0 \text{ mm}^6 \quad \text{Warping torsional constant}$$

$$\sqrt{J A_g} \quad \sqrt{141099501 \times 9492}$$

$$L_p = 0,13 E r_y \frac{\sqrt{J A_g}}{M_p} = 0,13 \times 200000 \times 97,7 \times \frac{\sqrt{141099501 \times 9492}}{212643704} = 13820 \text{ mm} \quad (\text{F7-12})$$

(a) $L_b = 10000 \text{ mm} < L_p$ The limit state of lateral-torsional buckling does not apply.

$$M_1 = 0 \text{ kNm} \quad M_2 = -7,25 \text{ kNm}$$

$$C_m = 0,6 - 0,4(M_1/M_2) = 0,6 - 0,4 \times -(0/7,25) = 0,6 \quad (\text{A-8-4})$$

$$P_{e1} = \frac{\pi^2 EI}{(L_c)^2} = \frac{\pi^2 \times 200000 \times 90537538}{(10000)^2} = 1787,14 \text{ kN} \quad (\text{A-8-5})$$

$$B_1 = \max \left(\frac{C_m}{1 - \alpha P_r/P_{e1}}; 1 \right) = \max \left(\frac{0,6}{1 - 1,0 \times 340,39 / 1787,14}; 1 \right) = 1,00 \quad (\text{A-8-3})$$

$$M_r = B_1 M_{nt} = 1,00 \times 7,25 = 7,25 \text{ kNm} \quad (\text{A-8-1})$$

$$M_c = \phi_b M_n = 0,90 \times 212,64 = 191,38 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{7,25}{0,90 \times 212,64} = 0,04 < 1,00 \quad (\text{B3-1})$$

F7. SQUARE AND RECTANGULAR HSS AND BOX SECTIONS

Combination: 1 x=9999 mm $N_x=-340,391 \text{ kN}$ $V_y=-0,168 \text{ kN}$ $V_z=-0,726 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=-7,255 \text{ kNm}$ $M_z=-1,684 \text{ kNm}$

1. Yielding

$$M_n = M_p = F_y Z = 250 \times 850575 \times 10^{-6} = 212,64 \text{ kNm} \quad (\text{F7-1})$$

2. Flange Local Buckling

$$\lambda_f = \frac{b}{t_f} = \frac{250}{10} = 25$$

$$17: \lambda_{pf} = 1,12 \sqrt{\frac{E}{F_y}} = 1,12 \times \sqrt{\frac{200000}{250}} = 31,68 \quad \lambda_{rf} = 1,40 \sqrt{\frac{E}{F_y}} = 1,40 \times \sqrt{\frac{200000}{250}} = 39,6 \quad (\text{T-B4.1b})$$

(a) $\lambda_f < \lambda_{pf}$ The limit state of local buckling does not apply.

3. Web Local Buckling

$$\lambda_w = \frac{h}{t_w} = \frac{250}{10} = 25$$

$$19: \lambda_{pw} = 2,42 \sqrt{\frac{E}{F_y}} = 2,42 \times \sqrt{\frac{200000}{250}} = 68,45 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (\text{T-B4.1b})$$

(a) $\lambda_w < \lambda_{pw}$ The limit state of web local buckling does not apply.

4. Lateral-Torsional Buckling

$$R_c = 1,5 t = 1,5 \times 10 = 15 \text{ mm}$$

$$A_p = (d-t)(b-t) - R_c^2 (4 - \pi) = (250 - 10) \times (250 - 10) - 15^2 \times (4 - \pi) = 57407 \text{ mm}^2$$

$$p = 2 [(d-t) + (b-t)] - 2 R_c (4 - \pi) = 2 \times [(250 - 10) + (250 - 10)] - 2 \times 15 \times (4 - \pi) = 934,2 \text{ mm}$$

$$J = \frac{4 A_p^2 t}{p} = \frac{4 \times 57407^2 \times 10}{934,2} = 141099501 \text{ mm}^4 \quad \text{St. Venants torsional constant}$$

$$C_w = 0 \text{ mm}^6 \quad \text{Warping torsional constant}$$

$$L_p = 0,13 E r_y \frac{\sqrt{J A_g}}{M_p} = 0,13 \times 200000 \times 97,7 \times \frac{\sqrt{141099501 \times 9492}}{212643704} = 13820 \text{ mm} \quad (\text{F7-12})$$

(a) $L_b = 10000 \text{ mm} < L_p$ The limit state of lateral-torsional buckling does not apply.

$$M_1 = 0 \text{ kNm} \quad M_2 = -1,68 \text{ kNm}$$

$$C_m = 0,6 - 0,4 (M_1 / M_2) = 0,6 - 0,4 \times -(0/1,68) = 0,6 \quad (\text{A-8-4})$$

$$P_{e1} = \frac{\pi^2 EI}{(L_c)^2} = \frac{\pi^2 \times 200000 \times 90537538}{(10000)^2} = 1787,14 \text{ kN} \quad (\text{A-8-5})$$

$$B_1 = \max \left(\frac{C_m}{1 - \alpha P_r / P_{e1}}; 1 \right) = \max \left(\frac{0,6}{1 - 1,0 \times 340,39 / 1787,14}; 1 \right) = 1,00 \quad (\text{A-8-3})$$

$$M_r = B_1 M_{nt} = 1,00 \times 1,26 = 1,26 \text{ kNm} \quad (\text{A-8-1})$$

$$M_c = \phi_b M_n = 0,90 \times 212,64 = 191,38 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{1,26}{0,90 \times 212,64} = 0,01 < 1,00 \quad (\text{B3-1})$$

G4. RECTANGULAR HSS, BOX SECTIONS, AND OTHER SINGLY AND DOUBLY SYMMETRIC MEMBERS

Combination: 1 x=0 mm

Nx=-340,391 kN Vy=-0,168 kN Vz=-0,726 kN

Mx=0 kNm My=0 kNm Mz=0 kNm

$$A_w = 2ht = 2 \times 210 \times 10 = 4200 \text{ mm}^2$$

$$V_n = 0,6 F_y A_w C_{v2} = 0,6 \times 250 \times 4200 \times 1 \times 10^{-3} = 630,00 \text{ kN} \quad (\text{G4-1})$$

$$\frac{V_r}{\phi_v V_n} = \frac{0,73}{0,90 \times 630,00} = 0,00 < 1,00 \quad (\text{B3-1})$$

G6. WEAK-AXIS SHEAR IN DOUBLY SYMMETRIC AND SINGLY SYMMETRIC SHAPES

Combination: 1 x=0 mm $N_x=-340,391 \text{ kN}$ $V_y=-0,168 \text{ kN}$ $V_z=-0,726 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=0 \text{ kNm}$ $M_z=0 \text{ kNm}$

$$b_f/t_f = 250 / 10 = 25 < 1,10 \quad \sqrt{k_v E/F_y} = 1,10 \times \sqrt{1,20 \times 200000 / 250} = 34,08$$

$$C_{v2} = 1,0 \quad (\text{G2-9})$$

$$V_n = 0,6 F_y b_f t_f C_{v2} = 0,6 \times 250 \times 250 \times 10 \times 1 \times 10^{-3} = 375,00 \text{ kN} \quad (\text{G6-1})$$

$$\frac{V_r}{\phi_v V_n} = \frac{0,17}{0,90 \times 375,00} = 0,00 < 1,00 \quad (\text{B3-1})$$

H1. DOUBLY AND SINGLY SYMMETRIC MEMBERS SUBJECT TO FLEXURE AND AXIAL FORCE

Combination: 1 x=9999 mm $N_x=-340,391 \text{ kN}$ $V_y=-0,168 \text{ kN}$ $V_z=-0,726 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=-7,255 \text{ kNm}$ $M_z=-1,684 \text{ kNm}$

1. Doubly and Singly Symmetric Members Subject to Flexure and Compression

$$\frac{P_r}{P_c} = \frac{340,39}{1225,11} = 0,28 > 0,2$$

$$\frac{P_r}{P_c} + \frac{8}{9} \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}} \right) = \frac{340,39}{1225,11} + \frac{8}{9} \times \left(\frac{7,25}{191,38} + \frac{1,26}{191,38} \right) = 0,32 < 1,00 \quad (\text{H1-1a})$$

Deflection

Combination: 2 x=5773,3 mm $N_x=-278,996 \text{ kN}$ $V_y=-0,141 \text{ kN}$ $V_z=-0,615 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=-3,549 \text{ kNm}$ $M_z=-0,815 \text{ kNm}$

Local node displacements $d_{z1} = 0 \text{ mm}$ $d_{z2} = 0,8 \text{ mm}$

$$w_{fin,z} = w_z - w_{Pre-camber,z} = 2,1 - 0 = 2,1 \text{ mm}$$

$$\frac{|w_{fin,z}|}{w_{fin,z,max}} = \frac{|2,1|}{10000 / 250} = \frac{|2,1|}{40} = 0,05 < 1,0$$

$$w_{add,z} = w_z - w_{SLS Permanent,z} = 2,1 - 2,1 = 0 \text{ mm}$$

$$\frac{|w_{add,z}|}{w_{add,z,max}} = \frac{|0|}{10000 / 333} = \frac{|0|}{30} = 0,00 < 1,0$$

2.3.3 Beam 46 - HE220A

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=0 mm $N_x=-44,241$ kN $V_y=0$ kN $V_z=0$ kN
 $M_x=0$ kNm $M_y=0$ kNm $M_z=0$ kNm

$$F_{ex} = \frac{\pi^2 E}{\left(\frac{L_{cx}}{r_x}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{10000}{91,7}\right)^2} = 166 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cx}}{r_x} = \frac{10000}{91,7} = 109,06 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{crx} = \left(\left(0,658 \right)^{\frac{F_y}{F_{ex}}} \right) F_y = \left(\left(0,658 \right)^{\frac{250}{166}} \right) \times 250 = 133,1 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{crx} A_g = 133,1 \times 6436 \times 10^{-3} = 856,54 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 856,54 = 770,89 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{44,24}{0,90 \times 856,54} = 0,06 < 1,00 \quad (\text{B3-1})$$

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=0 mm $N_x=-44,241$ kN $V_y=0$ kN $V_z=0$ kN
 $M_x=0$ kNm $M_y=0$ kNm $M_z=0$ kNm

$$F_{ey} = \frac{\pi^2 E}{\left(\frac{L_{cy}}{r_y}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{5000}{55,1}\right)^2} = 239,8 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{cy}}{r_y} = \frac{5000}{55,1} = 90,73 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{cry} = \left(\left(0,658 \right)^{\frac{F_y}{F_{ey}}} \right) F_y = \left(\left(0,658 \right)^{\frac{250}{239,8}} \right) \times 250 = 161,6 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{cry} A_g = 161,6 \times 6436 \times 10^{-3} = 1040,04 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 1040,04 = 936,04 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{44,24}{0,90 \times 1040,04} = 0,05 < 1,00 \quad (\text{B3-1})$$

Deflection

Combination: 2 x=0 mm $N_x=-36,278$ kN $V_y=0$ kN $V_z=0$ kN
 $M_x=0$ kNm $M_y=0$ kNm $M_z=0$ kNm

Local node displacements $d_{z1} = 0 \text{ mm}$ $d_{z2} = 0,7 \text{ mm}$

$$W_{\text{fin.,z}} = W_z - W_{\text{Pre-camber,z}} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{\text{fin.,z}}|}{W_{\text{fin.,z,max}}} = \frac{|0|}{10000 / 250} = \frac{|0|}{40} = 0,00 < 1,0$$

$$W_{\text{add.,z}} = W_z - W_{\text{SLS Permanent,z}} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{\text{add.,z}}|}{W_{\text{add.,z,max}}} = \frac{|0|}{10000 / 333} = \frac{|0|}{30} = 0,00 < 1,0$$

2.3.4 Beam 47 - IPE240

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=0 mm $N_x = -32,113 \text{ kN}$ $V_y = 0 \text{ kN}$ $V_z = 0 \text{ kN}$
 $M_x = 0 \text{ kNm}$ $M_y = 0 \text{ kNm}$ $M_z = 0 \text{ kNm}$

$$F_{\text{ex}} = \frac{\pi^2 E}{\left(\frac{L_{\text{cx}}}{r_x}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{10000}{99,7}\right)^2} = 196,4 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{\text{cx}}}{r_x} = \frac{10000}{99,7} = 100,25 < 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{\text{crx}} = \left(\left(0,658 \right)^{\frac{F_y}{F_{\text{ex}}}} \right) F_y = \left(\left(0,658 \right)^{\frac{250}{196,4}} \right) \times 250 = 146,7 \text{ MPa} \quad (\text{E3-2})$$

$$P_n = F_{\text{crx}} A_g = 146,7 \times 3914 \times 10^{-3} = 574,35 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 574,35 = 516,91 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{32,11}{0,90 \times 574,35} = 0,06 < 1,00 \quad (\text{B3-1})$$

E3. FLEXURAL BUCKLING OF MEMBERS WITHOUT SLENDER ELEMENTS

Combination: 1 x=0 mm $N_x = -32,113 \text{ kN}$ $V_y = 0 \text{ kN}$ $V_z = 0 \text{ kN}$
 $M_x = 0 \text{ kNm}$ $M_y = 0 \text{ kNm}$ $M_z = 0 \text{ kNm}$

$$F_{\text{ey}} = \frac{\pi^2 E}{\left(\frac{L_{\text{cy}}}{r_y}\right)^2} = \frac{\pi^2 \times 200000}{\left(\frac{5000}{26,9}\right)^2} = 57,2 \text{ MPa} \quad (\text{E3-4})$$

$$\frac{L_{\text{cy}}}{r_y} = \frac{5000}{26,9} = 185,73 > 4,71 \sqrt{\frac{E}{F_y}} = 4,71 \times \sqrt{\frac{200000}{250}} = 133,22$$

$$F_{\text{cry}} = 0,877 F_{\text{ey}} = 0,877 \times 57,2 = 50,2 \text{ MPa} \quad (\text{E3-3})$$

$$P_n = F_{\text{cry}} A_g = 50,2 \times 3914 \times 10^{-3} = 196,42 \text{ kN} \quad (\text{E3-1})$$

$$P_c = \phi_c P_n = 0,90 \times 196,42 = 176,78 \text{ kN}$$

$$\frac{P_r}{\phi_c P_n} = \frac{32,11}{0,90 \times 196,42} = 0,18 < 1,00 \quad (\text{B3-1})$$

Deflection

Combination: 2 x=0 mm $N_x=-26,323 \text{ kN}$ $V_y=0 \text{ kN}$ $V_z=0 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=0 \text{ kNm}$ $M_z=0 \text{ kNm}$

Local node displacements $d_{z1} = 0 \text{ mm}$ $d_{z2} = 0,7 \text{ mm}$

$$W_{\text{fin},z} = W_z - W_{\text{Pre-camber},z} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{\text{fin},z}|}{W_{\text{fin},z,\text{max}}} = \frac{|0|}{10000 / 250} = \frac{|0|}{40} = 0,00 < 1,0$$

$$W_{\text{add},z} = W_z - W_{\text{SLS Permanent},z} = 0 - 0 = 0 \text{ mm}$$

$$\frac{|W_{\text{add},z}|}{W_{\text{add},z,\text{max}}} = \frac{|0|}{10000 / 333} = \frac{|0|}{30} = 0,00 < 1,0$$

2.3.5 Beam 84 - S80X10

D2. TENSILE STRENGTH

Combination: 1 x=0 mm $N_x=1,355 \text{ kN}$ $V_y=0 \text{ kN}$ $V_z=0,188 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=0 \text{ kNm}$ $M_z=0 \text{ kNm}$

$$P_n = F_y A_g = 250 \times 800 \times 10^{-3} = 200 \text{ kN} \quad (\text{D2-1})$$

$$P_c = \phi_t P_n = 0,90 \times 200,00 = 180,00 \text{ kN}$$

$$\frac{P_r}{\phi_t P_n} = \frac{1,35}{0,90 \times 200,00} = 0,01 < 1,00 \quad (\text{B3-1})$$

2.3.6 Beam 136 - L70X70X6

D2. TENSILE STRENGTH

Combination: 1 x=0 mm $N_x=1,034 \text{ kN}$ $V_y=0 \text{ kN}$ $V_z=0,262 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=0 \text{ kNm}$ $M_z=0 \text{ kNm}$

$$P_n = F_y A_g = 250 \times 813 \times 10^{-3} = 203,21 \text{ kN} \quad (\text{D2-1})$$

$$P_c = \phi_t P_n = 0,90 \times 203,21 = 182,89 \text{ kN}$$

$$\frac{P_r}{\phi_t P_n} = \frac{1,03}{0,90 \times 203,21} = 0,01 < 1,00 \quad (\text{B3-1})$$

2.3.7 Beam 167 - HE550A

F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS

Combination: 1 $x=14099$ mm $N_x=-0,22$ kN $V_y=0,005$ kN $V_z=-121,509$ kN
 $M_x=-0,042$ kNm $M_y=-322,58$ kNm $M_z=-0,03$ kNm

Number of lateral restraints: 0

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (\text{T-B4.1b})$$

$$\lambda_f = \frac{b}{t} = \frac{150}{24} = 6,25 < \lambda_{pf} \text{ Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (\text{T-B4.1b})$$

$$\lambda_w = \frac{h}{t_w} = \frac{438}{12,5} = 35,04 < \lambda_{pw} \text{ Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 4622322 \times 10^{-6} = 1155,58 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 71,5 \sqrt{\frac{200000}{250}} = 3558 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 300 \times 24^3 + 492 \times 12,5^3}{3} = 3085113 \text{ mm}^4 \text{ St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(492)^2 \times 300^3 \times 24}{24} = 6535728 \times 10^6 \text{ mm}^6 \text{ Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{108191196 \times 6535728 \times 10^6}}{4146079} = 6414 \text{ mm}^2 \quad r_{ts} = 80,1 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \frac{E}{0,70 F_y} \sqrt{\frac{J_c}{S_x h_0} + \left(\frac{J_c}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 80,1 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{3085113 \times 1,00}{4146079 \times 516} + \left(\frac{3085113 \times 1,00}{4146079 \times 516} \right)^2 + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2}$$

$$= 11478 \text{ mm}$$

(c) $L_b = 14100 \text{ mm} > L_r$

$$C_b = \frac{12,5M_{\max}}{2,5M_{\max} + 3M_A + 4M_B + 3M_C} = \frac{12,5 \times 322,6}{2,5 \times 322,6 + 3 \times 96,0 + 4 \times 233,4 + 3 \times 93,3} = 1,75 \quad (\text{F1-1})$$

$$F_{cr} = \frac{C_b \pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2} \sqrt{1 + 0,078 \frac{J_c}{S_x h_0} \left(\frac{L_b}{r_{ts}}\right)^2} = \quad (\text{F2-4})$$

$$= \frac{1,75 \times \pi^2 \times 200000}{\left(\frac{14100}{80,1}\right)^2} \times \sqrt{1 + 0,078 \times \frac{3085113 \times 1,00}{4146079 \times 516} \times \left(\frac{14100}{80,1}\right)^2} = 235,7 \text{ MPa}$$

$$M_n = F_{cr} S_x = 235,7 \times 4146079 \times 10^{-6} = 977,16 \text{ kNm} \quad (\text{F2-3})$$

$$M_c = \phi_b M_n = 0,90 \times 977,16 = 879,44 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{322,58}{0,90 \times 977,16} = 0,37 < 1,00 \quad (\text{B3-1})$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=0 mm $N_x=-0,248 \text{ kN}$ $V_y=-0,027 \text{ kN}$ $V_z=121,689 \text{ kN}$
 $M_x=-0,006 \text{ kNm}$ $M_y=-320,609 \text{ kNm}$ $M_z=0,109 \text{ kNm}$

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 492 / 12,5 = 39,4 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (\text{G2-2})$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 6750 \times 1,0 \times 10^{-3} = 1012,50 \text{ kN} \quad (\text{G2-1})$$

$$\frac{V_r}{\phi_v V_n} = \frac{121,69}{1,00 \times 1012,50} = 0,12 < 1,00 \quad (\text{B3-1})$$

Deflection

Combination: 2 x=7047,1 mm $N_x=-0,031 \text{ kN}$ $V_y=-0,017 \text{ kN}$ $V_z=-0,508 \text{ kN}$
 $M_x=0,022 \text{ kNm}$ $M_y=191,241 \text{ kNm}$ $M_z=-0,005 \text{ kNm}$

Local node displacements $d_{z1} = -1,7 \text{ mm}$ $d_{z2} = -1,7 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -15,7 - 0 = -15,7 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-15,7|}{14100 / 250} = \frac{|-15,7|}{56,4} = 0,28 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -15,7 + 15,7 = 0 \text{ mm}$$

$$\frac{|W_{\text{add},z}|}{W_{\text{add},z,\text{max}}} = \frac{|0|}{14100 / 333} = \frac{|0|}{42,3} = 0,00 < 1,0$$

2.3.8 Beam 181 - HE300A

F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS

Combination: 1 x=2550 mm Nx=0,003 kN Vy=-0,003 kN Vz=15,562 kN
 Mx=0 kNm My=26,161 kNm Mz=-0,013 kNm

Number of lateral restraints: 0

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (\text{T-B4.1b})$$

$$\lambda_f = \frac{b}{t} = \frac{150}{14} = 10,71 < \lambda_{pf} \quad \text{Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (\text{T-B4.1b})$$

$$\lambda_w = \frac{h}{t_w} = \frac{208}{8,5} = 24,47 < \lambda_{pw} \quad \text{Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 1383530 \times 10^{-6} = 345,88 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 74,9 \sqrt{\frac{200000}{250}} = 3727 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 300 \times 14^3 + 262 \times 8,5^3}{3} = 602434 \text{ mm}^4 \quad \text{St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(262)^2 \times 300^3 \times 14}{24} = 1081143 \times 10^6 \text{ mm}^6 \quad \text{Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{63096160 \times 1081143 \times 10^6}}{1259769} = 6556 \text{ mm}^2 \quad r_{ts} = 81 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \sqrt{\frac{E}{0,70 F_y}} \sqrt{\frac{J_c}{S_x h_0} + \left(\frac{J_c}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 81 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{602434 \times 1,00}{1259769 \times 276} + \left(\frac{602434 \times 1,00}{1259769 \times 276} \right)^2} + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2$$

$$= 12228 \text{ mm}$$

$$(b) L_p < L_b = 5100 \text{ mm} < L_r$$

$$C_b = \frac{12,5 M_{\max}}{2,5 M_{\max} + 3 M_A + 4 M_B + 3 M_C} = \frac{12,5 \times 26,2}{2,5 \times 26,2 + 3 \times 5,5 + 4 \times 26,2 + 3 \times 6,4} = 1,59 \quad (F1-1)$$

$$M_n = \min \left(C_b \left(M_p - (M_p - 0,70 F_y S_x) \frac{L_b - L_p}{L_r - L_p} \right); M_p \right) = \quad (F2-2)$$

$$= \min \left(1,59 \times \left(345,88 - (345,88 - \frac{0,70 \times 250 \times 1259769}{10^6}) \times \frac{5100 - 3727}{12228 - 3727} \right); 345,88 \right) = 345,88 \text{ kNm}$$

$$M_c = \phi_b M_n = 0,90 \times 345,88 = 311,29 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{26,16}{0,90 \times 345,88} = 0,08 < 1,00 \quad (B3-1)$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=0 mm

Nx=0,003 kN Vy=-0,003 kN Vz=18,259 kN

Mx=0 kNm My=-16,961 kNm Mz=-0,005 kNm

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 262 / 8,5 = 30,8 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (G2-2)$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 2465 \times 1,0 \times 10^{-3} = 369,75 \text{ kN} \quad (G2-1)$$

$$\frac{V_r}{\phi_v V_n} = \frac{18,26}{1,00 \times 369,75} = 0,05 < 1,00 \quad (B3-1)$$

Deflection

Combination: 2 x=2550 mm

Nx=0,002 kN Vy=-0,005 kN Vz=12,756 kN

Mx=0 kNm My=21,443 kNm Mz=-0,022 kNm

Local node displacements $d_{z1} = -0,4 \text{ mm}$ $d_{z2} = -0,4 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -1,1 - 0 = -1,1 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-1,1|}{5100 / 250} = \frac{|-1,1|}{20,4} = 0,05 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -1,1 + 1,1 = 0 \text{ mm}$$

$$\frac{|w_{\text{add.,z}}|}{w_{\text{add.,z,max}}} = \frac{|0|}{5100 / 333} = \frac{|0|}{15,3} = 0,00 < 1,0$$

2.3.9 Beam 193 - HFRHS80X80X5

F7. SQUARE AND RECTANGULAR HSS AND BOX SECTIONS

Combination: 1 x=2550 mm $N_x=-0,023 \text{ kN}$ $V_y=0 \text{ kN}$ $V_z=0 \text{ kN}$
 $M_x=0 \text{ kNm}$ $M_y=0,452 \text{ kNm}$ $M_z=0 \text{ kNm}$

1. Yielding

$$M_n = M_p = F_y Z = 290 \times 41344 \times 10^{-6} = 11,99 \text{ kNm} \quad (\text{F7-1})$$

2. Flange Local Buckling

$$\lambda_f = \frac{b}{t_f} = \frac{80}{5} = 16$$

$$17: \lambda_{pf} = 1,12 \sqrt{\frac{E}{F_y}} = 1,12 \times \sqrt{\frac{200000}{290}} = 29,41 \quad \lambda_{rf} = 1,40 \sqrt{\frac{E}{F_y}} = 1,40 \times \sqrt{\frac{200000}{290}} = 36,77 \quad (\text{T-B4.1b})$$

(a) $\lambda_f < \lambda_{pf}$ The limit state of local buckling does not apply.

3. Web Local Buckling

$$\lambda_w = \frac{h}{t_w} = \frac{80}{5} = 16$$

$$19: \lambda_{pw} = 2,42 \sqrt{\frac{E}{F_y}} = 2,42 \times \sqrt{\frac{200000}{290}} = 63,55 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{290}} = 149,69 \quad (\text{T-B4.1b})$$

(a) $\lambda_w < \lambda_{pw}$ The limit state of web local buckling does not apply.

4. Lateral-Torsional Buckling

$$R_c = 1,5 t = 1,5 \times 5 = 7,5 \text{ mm}$$

$$A_p = (d-t)(b-t) - R_c^2 (4-\pi) = (80-5) \times (80-5) - 7,5^2 \times (4-\pi) = 5577 \text{ mm}^2$$

$$p = 2 [(d-t) + (b-t)] - 2 R_c (4-\pi) = 2 \times [(80-5) + (80-5)] - 2 \times 7,5 \times (4-\pi) = 287,1 \text{ mm}$$

$$J = \frac{4 A_p^2 t}{p} = \frac{4 \times 5577^2 \times 5}{287,1} = 2166295 \text{ mm}^4 \quad \text{St. Venants torsional constant}$$

$$C_w = 0 \text{ mm}^6 \quad \text{Warping torsional constant}$$

$$L_p = 0,13 E r_y \sqrt{\frac{J A_g}{M_p}} = 0,13 \times 200000 \times 30,5 \times \sqrt{\frac{2166295 \times 1479}{11989880}} = 3742 \text{ mm} \quad (\text{F7-12})$$

$$L_r = 2E r_y \frac{\sqrt{J A_g}}{0,7 F_y S_x} = 2 \times 200000 \times 30,5 \times \frac{\sqrt{2166295 \times 1479}}{0,7 \times 290 \times 34357} = 98957 \text{ mm} \quad (\text{F7-13})$$

$$(b) L_p < L_b = 5100 \text{ mm} < L_r$$

$$C_b = \frac{12,5 M_{\max}}{2,5 M_{\max} + 3 M_A + 4 M_B + 3 M_C} = \frac{12,5 \times 0,5}{2,5 \times 0,5 + 3 \times 0,3 + 4 \times 0,5 + 3 \times 0,3} = 1,14 \quad (\text{F1-1})$$

$$M_n = C_b \left(M_p - (M_p - 0,70 F_y S_x) \frac{L_b - L_p}{L_r - L_p} \right) = \quad (\text{F7-10})$$

$$= 1,14 \times \left(11,99 - (11,99 - \frac{0,70 \times 290 \times 34357}{10^6}) \times \frac{5100 - 3742}{98957 - 3742} \right) = 11,99 \text{ kNm}$$

$$M_c = \phi_b M_n = 0,90 \times 11,99 = 10,79 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{0,45}{0,90 \times 11,99} = 0,04 < 1,00 \quad (\text{B3-1})$$

G4. RECTANGULAR HSS, BOX SECTIONS, AND OTHER SINGLY AND DOUBLY SYMMETRIC MEMBERS

Combination: 1 x=0 mm Nx=-0,023 kN Vy=0 kN Vz=0,354 kN
 Mx=0 kNm My=0 kNm Mz=0 kNm

$$A_w = 2ht = 2 \times 60 \times 5 = 600 \text{ mm}^2$$

$$V_n = 0,6 F_y A_w C_{v2} = 0,6 \times 290 \times 600 \times 1 \times 10^{-3} = 104,40 \text{ kN} \quad (\text{G4-1})$$

$$\frac{V_r}{\phi_v V_n} = \frac{0,35}{0,90 \times 104,40} = 0,00 < 1,00 \quad (\text{B3-1})$$

Deflection

Combination: 2 x=2550,6 mm Nx=-0,021 kN Vy=0 kN Vz=0 kN
 Mx=0 kNm My=0,37 kNm Mz=0 kNm

Local node displacements d_{z1} = -51 mm d_{z2} = -46,7 mm

$$W_{\text{fin},z} = W_z - W_{\text{Pre-camber},z} = -3,5 - 0 = -3,5 \text{ mm}$$

$$\frac{|W_{\text{fin},z}|}{W_{\text{fin},z,\max}} = \frac{|-3,5|}{5100 / 250} = \frac{|-3,5|}{20,4} = 0,17 < 1,0$$

$$W_{\text{add},z} = W_z - W_{\text{SLS Permanent},z} = -3,5 + 3,5 = 0 \text{ mm}$$

$$\frac{|W_{\text{add},z}|}{W_{\text{add},z,\max}} = \frac{|0|}{5100 / 333} = \frac{|0|}{15,3} = 0,00 < 1,0$$

2.3.10 Beam 203 - IPE550

F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS

Combination: 1 x=0 mm

Nx=0,155 kN Vy=0,013 kN Vz=53,651 kN

Mx=0 kNm My=-257,965 kNm Mz=-0,053 kNm

Number of lateral restraints: 1

Distance between lateral restraints: 10000 15000

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (\text{T-B4.1b})$$

$$\lambda_f = \frac{b}{t} = \frac{105}{17,2} = 6,1 < \lambda_{pf} \text{ Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (\text{T-B4.1b})$$

$$\lambda_w = \frac{h}{t_w} = \frac{467,6}{11,1} = 42,13 < \lambda_{pw} \text{ Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 2787577 \times 10^{-6} = 696,89 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 44,5 \sqrt{\frac{200000}{250}} = 2217 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 210 \times 17,2^3 + 515,6 \times 11,1^3}{3} = 947433 \text{ mm}^4 \text{ St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(515,6)^2 \times 210^3 \times 17,2}{24} = 1764416 \times 10^{-6} \text{ mm}^6 \text{ Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{26676430 \times 1764416 \times 10^{-6}}}{2441119} = 2810 \text{ mm}^2 \quad r_{ts} = 53 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \frac{E}{0,70 F_y} \sqrt{\frac{J_c}{S_x h_0} + \left(\frac{J_c}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 53 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{947433 \times 1,00}{2441119 \times 532,8} + \left(\frac{947433 \times 1,00}{2441119 \times 532,8} \right)^2 + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2}$$

$$= 6596 \text{ mm}$$

$$(b) L_p < L_b = 2778 \text{ mm} < L_r$$

$$C_b = \frac{12,5M_{\max}}{2,5M_{\max} + 3M_A + 4M_B + 3M_C} = \frac{12,5 \times 258,0}{2,5 \times 258,0 + 3 \times 221,5 + 4 \times 186,7 + 3 \times 153,4} = 1,28 \quad (F1-1)$$

$$M_n = \min \left(C_b \left[M_p - (M_p - 0,70F_y S_x) \frac{L_b - L_p}{L_r - L_p} \right]; M_p \right) = \quad (F2-2)$$

$$= \min \left(1,28 \times \left[696,89 - (696,89 - \frac{0,70 \times 250 \times 2441119}{10^6}) \times \frac{2778 - 2217}{6596 - 2217} \right]; 696,89 \right) = 696,89 \text{ kNm}$$

$$M_c = \phi_b M_n = 0,90 \times 696,89 = 627,20 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{257,96}{0,90 \times 696,89} = 0,41 < 1,00 \quad (B3-1)$$

F6. I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MINOR AXIS

Combination: 1 x=0 mm

Nx=0,155 kN Vy=0,013 kN Vz=53,651 kN

Mx=0 kNm My=-257,965 kNm Mz=-0,053 kNm

$$13: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (T-B4.1b)$$

$$\lambda_f = \frac{b}{t} = \frac{105}{17,2} = 6,1 < \lambda_{pf} \text{ Flange is compact.}$$

1. Yielding

$$M_n = M_p = \min \left(F_y Z_y; 1,6 F_y S_y \right) = \quad (F6-1)$$

$$= \min \left(250 \times 400569; 1,6 \times 250 \times 254061 \right) \times 10^{-6} = 100,14 \text{ kNm}$$

2. Flange Local Buckling

(a) $\lambda_f < \lambda_{pf}$ The limit state of local buckling does not apply.

$$M_c = \phi_b M_n = 0,90 \times 100,14 = 90,13 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{0,04}{0,90 \times 100,14} = 0,00 < 1,00 \quad (B3-1)$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=0 mm

Nx=0,155 kN Vy=0,013 kN Vz=53,651 kN

Mx=0 kNm My=-257,965 kNm Mz=-0,053 kNm

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 515,6 / 11,1 = 46,5 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (G2-2)$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 6105 \times 1,0 \times 10^{-3} = 915,75 \text{ kN} \quad (G2-1)$$

$$\frac{V_r}{\phi_v V_n} = \frac{53,65}{1,00 \times 915,75} = 0,06 < 1,00 \quad (B3-1)$$

Deflection

Combination: 2 x=15000 mm Nx=0,178 kN Vy=0 kN Vz=1,877 kN
 Mx=0 kNm My=132,447 kNm Mz=0,005 kNm

Local node displacements $d_{z1} = -15,2 \text{ mm}$ $d_{z2} = -0,4 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -58,2 - 0 = -58,2 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-58,2|}{25000 / 250} = \frac{|-58,2|}{100} = 0,58 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -58,2 + 58,2 = 0 \text{ mm}$$

$$\frac{|W_{add,z}|}{W_{add,z,max}} = \frac{|0|}{25000 / 333} = \frac{|0|}{75,1} = 0,00 < 1,0$$

2.3.11 Beam 216 - IPE500

F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS

Combination: 1 x=10000 mm Nx=-0,081 kN Vy=-0,002 kN Vz=-0,54 kN
 Mx=0 kNm My=169,453 kNm Mz=0,005 kNm

Number of lateral restraints: 6

Distance between lateral restraints: 2857 2857 2857 2857 2857 2857 2857

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (T-B4.1b)$$

$$\lambda_f = \frac{b}{t} = \frac{100}{16} = 6,25 < \lambda_{pf} \text{ Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (T-B4.1b)$$

$$\lambda_w = \frac{h}{t_w} = \frac{426}{10,2} = 41,76 < \lambda_{pw} \text{ Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 2194622 \times 10^{-6} = 548,66 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 43,1 \sqrt{\frac{200000}{250}} = 2143 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 200 \times 16^3 + 468 \times 10,2^3}{3} = 711682 \text{ mm}^4 \text{ St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(468)^2 \times 200^3 \times 16}{24} = 1168128 \times 10^6 \text{ mm}^6 \text{ Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{21417331 \times 1168128 \times 10^6}}{1928398} = 2594 \text{ mm}^2 \quad r_{ts} = 50,9 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \frac{E}{0,70 F_y} \sqrt{\frac{J_c}{S_x h_0} + \left(\frac{J_c}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 50,9 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{711682 \times 1,00}{1928398 \times 484} + \left(\frac{711682 \times 1,00}{1928398 \times 484} \right)^2 + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2}$$

$$= 6382 \text{ mm}$$

$$(b) L_p < L_b = 2857 \text{ mm} < L_r$$

$$C_b = \frac{12,5 M_{\max}}{2,5 M_{\max} + 3 M_A + 4 M_B + 3 M_C} = \frac{12,5 \times 169,5}{2,5 \times 169,5 + 3 \times 168,2 + 4 \times 169,5 + 3 \times 168,3} = 1,00 \quad (\text{F1-1})$$

$$M_n = \min \left(C_b \left(M_p - (M_p - 0,70 F_y S_x) \frac{L_b - L_p}{L_r - L_p} \right); M_p \right) = \quad (\text{F2-2})$$

$$= \min \left(1,00 \times \left(548,66 - (548,66 - \frac{0,70 \times 250 \times 1928398}{10^6}) \times \frac{2857 - 2143}{6382 - 2143} \right); 548,66 \right) = 514,90 \text{ kNm}$$

$$M_c = \phi_b M_n = 0,90 \times 514,90 = 463,41 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{169,45}{0,90 \times 514,90} = 0,37 < 1,00 \quad (\text{B3-1})$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=20000 mm Nx=0,002 kN Vy=0,001 kN Vz=-33,351 kN
 Mx=0 kNm My=0 kNm Mz=0 kNm

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 468 / 10,2 = 45,9 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (G2-2)$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 5100 \times 1,0 \times 10^{-3} = 765,00 \text{ kN} \quad (G2-1)$$

$$\frac{V_r}{\phi_v V_n} = \frac{33,35}{1,00 \times 765,00} = 0,04 < 1,00 \quad (B3-1)$$

Deflection

Combination: 2 x=10000 mm Nx=-0,043 kN Vy=0,002 kN Vz=0,554 kN
 Mx=0 kNm My=138,895 kNm Mz=0,011 kNm

Local node displacements $d_{z1} = -0,3 \text{ mm}$ $d_{z2} = -0,4 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -71,2 - 0 = -71,2 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-71,2|}{20000 / 250} = \frac{|-71,2|}{80} = 0,89 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -71,2 + 71,2 = 0 \text{ mm}$$

$$\frac{|W_{add,z}|}{W_{add,z,max}} = \frac{|0|}{20000 / 333} = \frac{|0|}{60,1} = 0,00 < 1,0$$

2.3.12 Beam 221 - HE140A

F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS

Combination: 1 x=15000 mm Nx=-0,025 kN Vy=0 kN Vz=-8,058 kN
 Mx=0 kNm My=-7,912 kNm Mz=-0,001 kNm

Number of lateral restraints: 0

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (T-B4.1b)$$

$$\lambda_f = \frac{b}{t} = \frac{70}{8,5} = 8,24 < \lambda_{pf} \text{ Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (T-B4.1b)$$

$$\lambda_w = \frac{h}{t_w} = \frac{92}{5,5} = 16,73 < \lambda_{pw} \text{ Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 173618 \times 10^{-6} = 43,40 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 35,2 \sqrt{\frac{200000}{250}} = 1752 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 140 \times 8,5^3 + 116 \times 5,5^3}{3} = 63752 \text{ mm}^4 \text{ St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(116)^2 \times 140^3 \times 8,5}{24} = 13077 \times 10^6 \text{ mm}^6 \text{ Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{3893360 \times 13077 \times 10^6}}{155457} = 1451 \text{ mm}^2 \quad r_{ts} = 38,1 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \frac{E}{0,70 F_y} \sqrt{\frac{Jc}{S_x h_0} + \left(\frac{Jc}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 38,1 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{63752 \times 1,00}{155457 \times 124,5} + \left(\frac{63752 \times 1,00}{155457 \times 124,5} \right)^2 + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2}$$

$$= 7253 \text{ mm}$$

$$(c) L_b = 20000 \text{ mm} > L_r$$

$$C_b = \frac{12,5 M_{\max}}{2,5 M_{\max} + 3 M_A + 4 M_B + 3 M_C} = \frac{12,5 \times 7,9}{2,5 \times 7,9 + 3 \times 7,9 + 4 \times 6,4 + 3 \times 7,9} = 1,07 \quad (\text{F1-1})$$

$$F_{cr} = \frac{C_b \pi^2 E}{\left(\frac{L_b}{r_{ts}} \right)^2} \sqrt{1 + 0,078 \frac{Jc}{S_x h_0} \left(\frac{L_b}{r_{ts}} \right)^2} = \quad (\text{F2-4})$$

$$= \frac{1,07 \times \pi^2 \times 200000}{\left(\frac{20000}{38,1} \right)^2} \times \sqrt{1 + 0,078 \times \frac{63752 \times 1,00}{155457 \times 124,5} \times \left(\frac{20000}{38,1} \right)^2} = 64,7 \text{ MPa}$$

$$M_n = F_{cr} S_x = 64,7 \times 155457 \times 10^{-6} = 10,06 \text{ kNm} \quad (\text{F2-3})$$

$$M_c = \phi_b M_n = 0,90 \times 10,06 = 9,05 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{7,91}{0,90 \times 10,06} = 0,87 < 1,00 \quad (\text{B3-1})$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=5000 mm

Nx=0,001 kN Vy=0 kN Vz=-9,334 kN

Mx=0 kNm My=-7,902 kNm Mz=0,001 kNm

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 116 / 5,5 = 21,1 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (G2-2)$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 731,5 \times 1,0 \times 10^{-3} = 109,73 \text{ kN} \quad (G2-1)$$

$$\frac{V_r}{\phi_v V_n} = \frac{9,33}{1,00 \times 109,73} = 0,09 < 1,00 \quad (B3-1)$$

Deflection

Combination: 2 x=2222,3 mm Nx=0,003 kN Vy=0 kN Vz=-0,589 kN
 Mx=0 kNm My=4,967 kNm Mz=0 kNm

Local node displacements d_{z1} = -0,1 mm d_{z2} = -0,1 mm

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -4,5 - 0 = -4,5 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-4,5|}{20000 / 250} = \frac{|-4,5|}{80} = 0,06 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -4,5 + 4,5 = 0 \text{ mm}$$

$$\frac{|W_{add,z}|}{W_{add,z,max}} = \frac{|0|}{20000 / 333} = \frac{|0|}{60,1} = 0,00 < 1,0$$

2.3.13 Beam 254 - HE120A**F2. DOUBLY SYMMETRIC COMPACT I-SHAPED MEMBERS AND CHANNELS BENT ABOUT THEIR MAJOR AXIS**

Combination: 1 x=2550 mm Nx=-0,027 kN Vy=0 kN Vz=0 kN
 Mx=0 kNm My=6,328 kNm Mz=0 kNm

Number of lateral restraints: 0

$$10: \lambda_{pf} = 0,38 \sqrt{\frac{E}{F_y}} = 0,38 \times \sqrt{\frac{200000}{250}} = 10,75 \quad \lambda_{rf} = 1,00 \sqrt{\frac{E}{F_y}} = 1,00 \times \sqrt{\frac{200000}{250}} = 28,28 \quad (T-B4.1b)$$

$$\lambda_f = \frac{b}{t} = \frac{60}{8} = 7,5 < \lambda_{pf} \text{ Flange is compact.}$$

$$15: \lambda_{pw} = 3,76 \sqrt{\frac{E}{F_y}} = 3,76 \times \sqrt{\frac{200000}{250}} = 106,35 \quad \lambda_{rw} = 5,70 \sqrt{\frac{E}{F_y}} = 5,70 \times \sqrt{\frac{200000}{250}} = 161,22 \quad (T-B4.1b)$$

$$\lambda_w = \frac{h}{t_w} = \frac{74}{5} = 14,8 < \lambda_{pw} \text{ Web is compact.}$$

1. Yielding

$$M_n = M_p = F_y Z_x = 250 \times 119593 \times 10^{-6} = 29,90 \text{ kNm} \quad (\text{F2-1})$$

2. Lateral-Torsional Buckling

$$L_p = 1,76 r_y \sqrt{\frac{E}{F_y}} = 1,76 \times 30,2 \sqrt{\frac{200000}{250}} = 1502 \text{ mm} \quad (\text{F2-5})$$

$$J = \frac{2 b t^3 + d' w^3}{3} = \frac{2 \times 120 \times 8^3 + 98 \times 5^3}{3} = 45043 \text{ mm}^4 \text{ St. Venants torsional constant}$$

$$C_w = \frac{(d')^2 b^3 t}{24} = \frac{(98)^2 \times 120^3 \times 8}{24} = 5532 \times 10^6 \text{ mm}^6 \text{ Warping torsional constant}$$

$$r_{ts}^2 = \frac{\sqrt{I_y C_w}}{S_x} = \frac{\sqrt{2309103 \times 5532 \times 10^6}}{106423} = 1062 \text{ mm}^2 \quad r_{ts} = 32,6 \text{ mm} \quad (\text{F2-7})$$

$$c = 1,00 \quad (\text{F2-8a})$$

$$L_r = 1,95 r_{ts} \frac{E}{0,70 F_y} \sqrt{\frac{Jc}{S_x h_0} + \left(\frac{Jc}{S_x h_0} \right)^2 + 6,76 \left(\frac{0,70 F_y}{E} \right)^2} = \quad (\text{F2-6})$$

$$= 1,95 \times 32,6 \times \frac{200000}{0,70 \times 250} \times \sqrt{\frac{45043 \times 1,00}{106423 \times 106} + \left(\frac{45043 \times 1,00}{106423 \times 106} \right)^2 + 6,76 \times \left(\frac{0,70 \times 250}{200000} \right)^2}$$

$$= 6730 \text{ mm}$$

$$(b) L_p < L_b = 5100 \text{ mm} < L_r$$

$$C_b = \frac{12,5 M_{\max}}{2,5 M_{\max} + 3 M_A + 4 M_B + 3 M_C} = \frac{12,5 \times 6,3}{2,5 \times 6,3 + 3 \times 4,7 + 4 \times 6,3 + 3 \times 4,7} = 1,14 \quad (\text{F1-1})$$

$$M_n = \min \left(C_b \left(M_p - (M_p - 0,70 F_y S_x) \frac{L_b - L_p}{L_r - L_p} \right); M_p \right) = \quad (\text{F2-2})$$

$$= \min \left(1,14 \times \left(29,9 - (29,9 - \frac{0,70 \times 250 \times 106423}{10^6}) \times \frac{5100 - 1502}{6730 - 1502} \right); 29,9 \right) = 25,16 \text{ kNm}$$

$$M_c = \phi_b M_n = 0,90 \times 25,16 = 22,64 \text{ kNm}$$

$$\frac{M_r}{\phi_b M_n} = \frac{6,33}{0,90 \times 25,16} = 0,28 < 1,00 \quad (\text{B3-1})$$

G2. I-SHAPED MEMBERS AND CHANNELS

Combination: 1 x=5100 mm Nx=-0,027 kN Vy=0 kN Vz=-4,963 kN
 Mx=0 kNm My=0 kNm Mz=0 kNm

1. Shear Strength of Webs without Tension Field Action

$$h/t_w = 98 / 5 = 19,6 < 2,24 \sqrt{E/F_y} = 2,24 \times \sqrt{200000 / 250} = 63,4$$

$$\phi_v = 1,00 \quad C_{v1} = 1,0 \quad (G2-2)$$

$$V_n = 0,6 F_y A_w C_{v1} = 0,6 \times 250 \times 570 \times 1,0 \times 10^{-3} = 85,50 \text{ kN} \quad (G2-1)$$

$$\frac{V_r}{\phi_v V_n} = \frac{4,96}{1,00 \times 85,50} = 0,06 < 1,00 \quad (B3-1)$$

Deflection

Combination: 2 x=2549,4 mm Nx=-0,018 kN Vy=0 kN Vz=0,001 kN
 Mx=0 kNm My=5,187 kNm Mz=0 kNm

Local node displacements $d_{z1} = -0,4 \text{ mm}$ $d_{z2} = -0,1 \text{ mm}$

$$W_{fin,z} = W_z - W_{Pre-camber,z} = -11 - 0 = -11 \text{ mm}$$

$$\frac{|W_{fin,z}|}{W_{fin,z,max}} = \frac{|-11|}{5100 / 250} = \frac{|-11|}{20,4} = 0,54 < 1,0$$

$$W_{add,z} = W_z - W_{SLS Permanent,z} = -11 + 11 = 0 \text{ mm}$$

$$\frac{|W_{add,z}|}{W_{add,z,max}} = \frac{|0|}{5100 / 333} = \frac{|0|}{15,3} = 0,00 < 1,0$$