STATYTOJO (UŽSAKOVO) PAVADINIMAS	AB Vilniaus šilumos tinklai
STATINIO PROJEKTO PAVADINIMAS	Pagalbinio ūkio paskirties pastato (Kamino; un. d. Nr. 1395-1000-1720), Elektrinės g. 2, Vilniuje kapitalinio remonto projektas.
STATINIO NUMERIS IR PAVADINIMAS	01 – Kaminas Nr. 3 (h = 100 m)
STATINIO PROJEKTO ETAPAS	Techninis projektas
STATINIO STATYBOS RŪŠIS	Kapitalinis remontas
STATINIO KATEGORIJA	Ypatingasis statinys
STATINIO PROJEKTO DALIS	Statinio konstrukcijos (Inžineriniai skaičiavimai)
BYLOS (SEGTUVO) LAIDOS ŽYMUO	0
TOMAS	III
BYLA	SS2143-01-TP-SK.IS

DIREKTORĖ	A.V.	parašas
STATINIO PROJEKTO VADOVAS		parašas
STATINIO PROJEKTO DALIES VADOVAS		parašas
KONSTRUKTORIUS		parašas

2022, VILNIUS

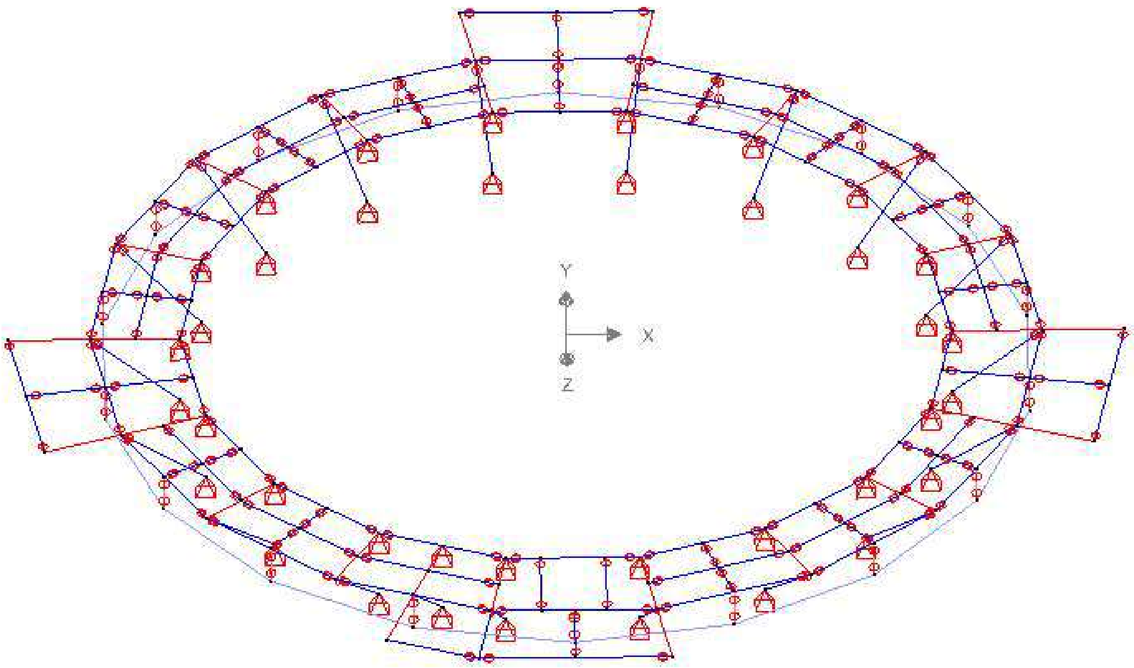
SS2143-01-TP-SK_IS

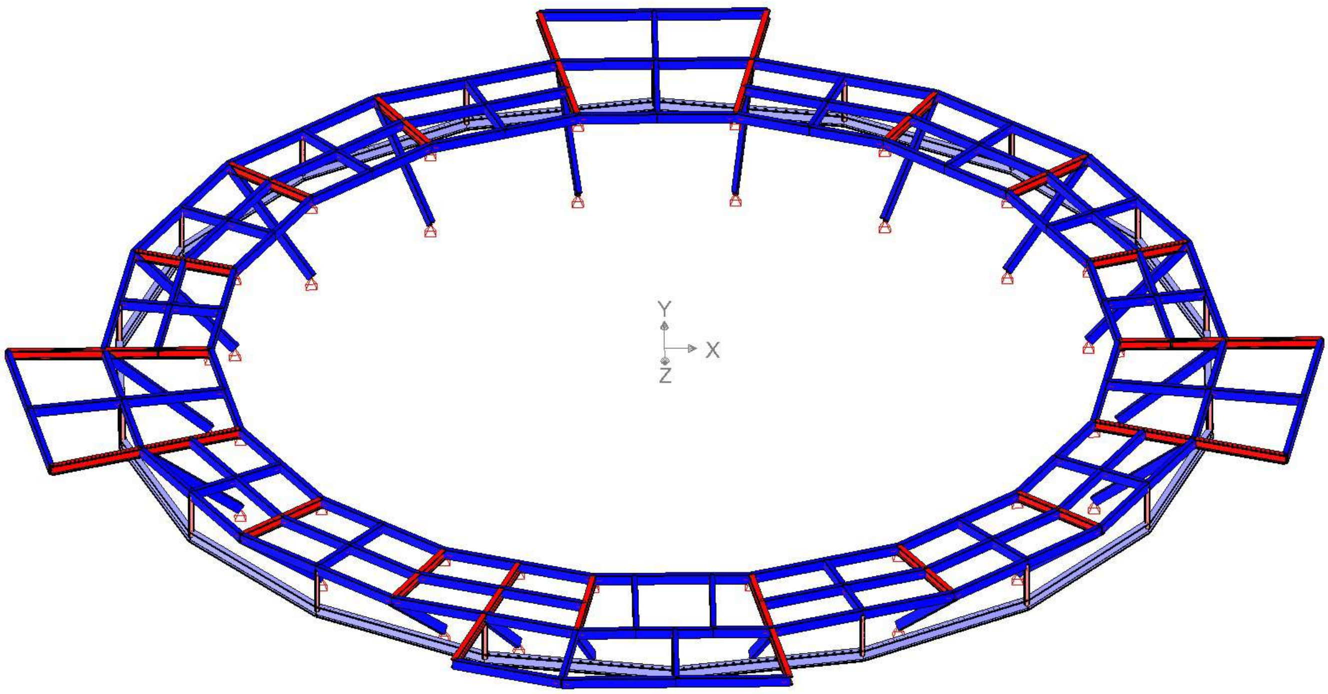
TURINYS

1 Software information

Structure designed with Diamonds Version 2021.0.0.0
Structure calculated with Buildsoft Server Version 2021.0.0.0
Report printed with Diamonds Version 2021.0.0.0

2 Geometry representation (m)

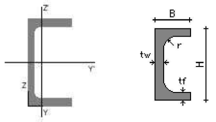




3 Cross-Section data

3.1 UPN (EU) - UPN 100

3.1.1 Dimensions



B = 50.0 mm
H = 100.0 mm
tw = 6.0 mm
tf = 8.5 mm
r = 8.5 mm

rolled

3.1.2 Properties

GENERAL

	default
Surface (mm^2)	1350.0
COG y (mm)	15.5
COG z (mm)	50.0
SC y (mm)	-13.8
SC z (mm)	50.0
λu (-)	0.000
λv (-)	0.000

ELASTIC

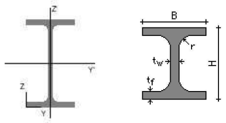
	default
Sy (mm^3)	68953
Sz (mm^3)	22989
Iy (mm^4)	2060000
Iz (mm^4)	293000
Iyz (mm^4)	0
iy (mm)	39.1
iz (mm)	14.7
It (mm^4)	28100
Iw (mm^6)	410000000
Twm (mm^3)	3111
Wel,y,t (mm^3)	41200
Wel,y,b (mm^3)	41200
Wel,z,l (mm^3)	17580
Wel,z,r (mm^3)	8490

PLASTIC

	default
Avy (mm^2)	850.0
Avz (mm^2)	646.0
Wpl,y (mm^3)	49000
Wpl,u (mm^3)	49000
Wpl,v (mm^3)	16200

3.2 IPE ext. (EU) - IPE 100

3.2.1 Dimensions



B = 55.0 mm
H = 100.0 mm
tw = 4.1 mm
tf = 5.7 mm
r = 7.0 mm

rolled

3.2.2 Properties

GENERAL

	default
Surface (mm^2)	1032.4
COG y (mm)	27.5
COG z (mm)	50.0

	default
SC y (mm)	27.5
SC z (mm)	50.0
λu (-)	2.901
λv (-)	2.214

ELASTIC

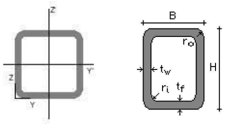
	default
Sy (mm³)	51620
Sz (mm³)	28391
Iy (mm⁴)	1710244
Iz (mm⁴)	159189
Iyz (mm⁴)	0
iy (mm)	40.7
iz (mm)	12.4
It (mm⁴)	12020
Iw (mm⁶)	351378406
Twm (mm³)	2013
Wel,y,t (mm³)	34205
Wel,y,b (mm³)	34205
Wel,z,l (mm³)	5789
Wel,z,r (mm³)	5789

PLASTIC

	default
Avy (mm²)	672.5
Avz (mm²)	508.6
Wpl,y (mm³)	39410
Wpl,u (mm³)	39410
Wpl,v (mm³)	9146

3.3 SHS (EU) - SHS 50x50x4

3.3.1 Dimensions



B = 50.0 mm
H = 50.0 mm
tf = 4.0 mm
tw = 4.0 mm
ri = 4.0 mm
ro = 8.0 mm

rolled

3.3.2 Properties

GENERAL

	default
Surface (mm²)	694.7
COG y (mm)	25.0
COG z (mm)	25.0
SC y (mm)	25.0
SC z (mm)	25.0
λu (-)	2.146
λv (-)	2.146

ELASTIC

	default
Sy (mm³)	17368
Sz (mm³)	17368
Iy (mm⁴)	237322
Iz (mm⁴)	237322
Iyz (mm⁴)	0
iy (mm)	18.5
iz (mm)	18.5
It (mm⁴)	400475
Iw (mm⁶)	0
Twm (mm³)	16681
Wel,y,t (mm³)	9493
Wel,y,b (mm³)	9493
Wel,z,l (mm³)	9493
Wel,z,r (mm³)	9493

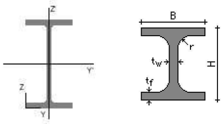
PLASTIC

	default
Avy (mm²)	347.4

	default
Avz (mm²)	347.4
Wpl,y (mm³)	11727
Wpl,u (mm³)	11727
Wpl,v (mm³)	11727

3.4 IPE (EU) - IPE 120

3.4.1 Dimensions



B = 64.0 mm
H = 120.0 mm
tw = 4.4 mm
tf = 6.3 mm
r = 7.0 mm

rolled

3.4.2 Properties

GENERAL

	default
Surface (mm²)	1321.1
COG y (mm)	32.0
COG z (mm)	60.0
SC y (mm)	32.0
SC z (mm)	60.0
λu (-)	2.869
λv (-)	2.260

ELASTIC

	default
Sy (mm³)	79266
Sz (mm³)	42275
Iy (mm⁴)	3177718
Iz (mm⁴)	276684
Iyz (mm⁴)	0
iy (mm)	49.0
iz (mm)	14.5
It (mm⁴)	17355
Iw (mm⁶)	889590546
Twm (mm³)	2831
Wel,y,t (mm³)	52962
Wel,y,b (mm³)	52962
Wel,z,l (mm³)	8646
Wel,z,r (mm³)	8646

PLASTIC

	default
Avy (mm²)	856.6
Avz (mm²)	630.6
Wpl,y (mm³)	60729
Wpl,u (mm³)	60729
Wpl,v (mm³)	13581

4 Material data

4.1 Steel Stainless Steel

4.1.1 Elastic material properties

Density = 8000.0 kg/m^3
Young Modulus E = 200000 N/mm^2
Poisson Ratio ν = 0.300
Transversal Young Modulus G = 76923 N/mm^2
Thermic dilatation coefficient = 0.000012 /°C

4.1.2 Strength properties according to Eurocode 3 : EN 1993-1-1/3 (--)

Strength :

thickness (mm)	**0.0 - 40.0**	**40.0 - 150.0**
yield strength fy (N/mm²)	200.0	200.0
ultimate stength fu (N/mm²)	500.0	500.0

Security coefficient :

γ_{M0} = 1.00
γ_{M1} = 1.00
γ_{M2} = 1.25
γ_{M3} = 1.25
γ_{M4} = 1.00
γ_{M5} = 1.00
γ_{M6} = 1.00
γ_{M7} = 1.10

4.1.3 Strength properties according to Eurocode 3 : EN 1993-1-1/3 (LT)

Strength :

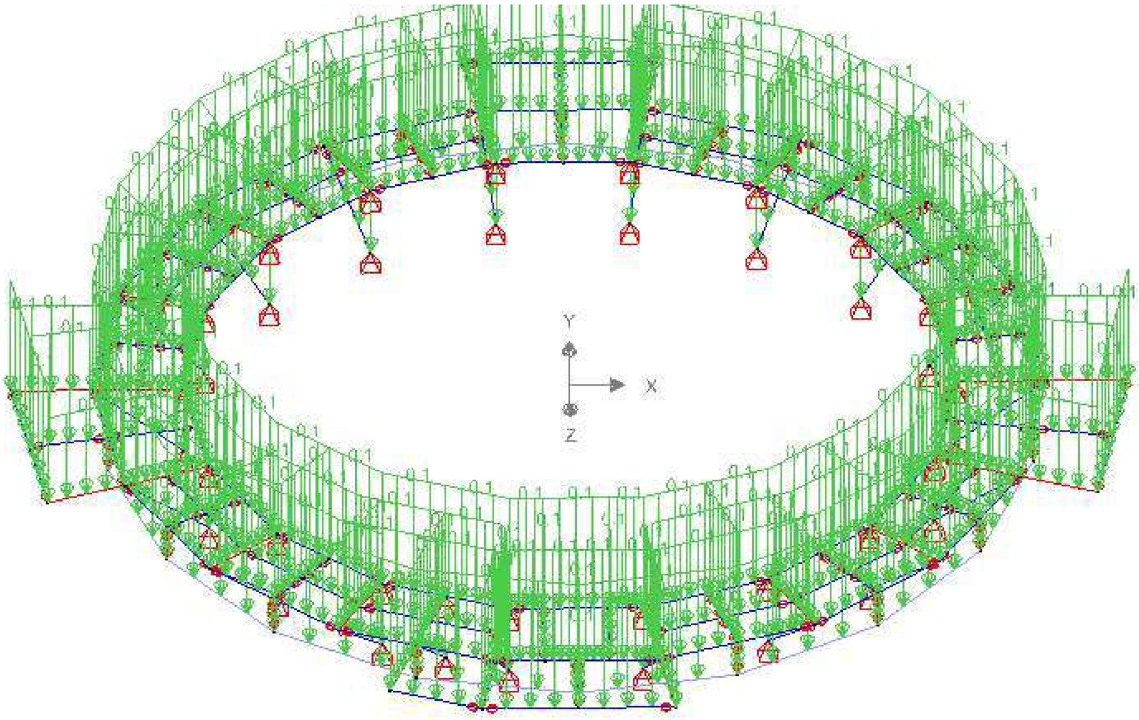
thickness (mm)	**0.0 - 40.0**	**40.0 - 150.0**
yield strength fy (N/mm²)	200.0	200.0
ultimate stength fu (N/mm²)	500.0	500.0

Security coefficient :

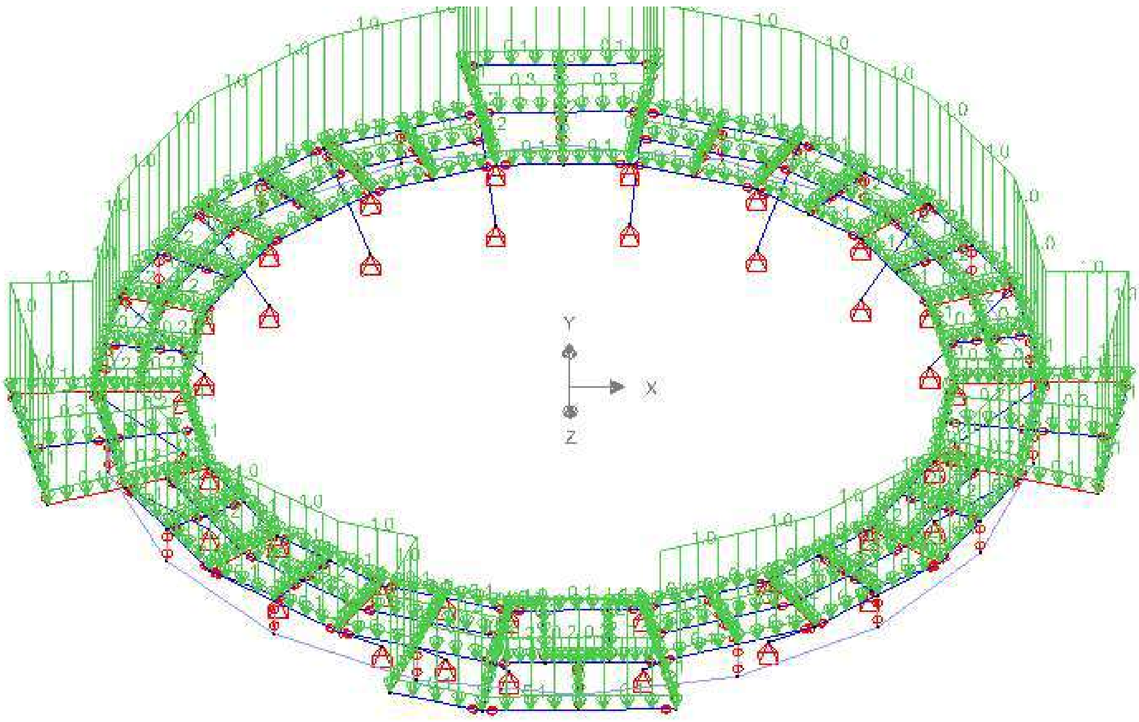
γ_{M0} = 1.00
γ_{M1} = 1.00
γ_{M2} = 1.25
γ_{M3} = 1.25
γ_{M4} = 1.00
γ_{M5} = 1.00
γ_{M6} = 1.00
γ_{M7} = 1.10

5 Loads representation (kN, kNm, mm, kN/m, kNm/m, kN/m^2)

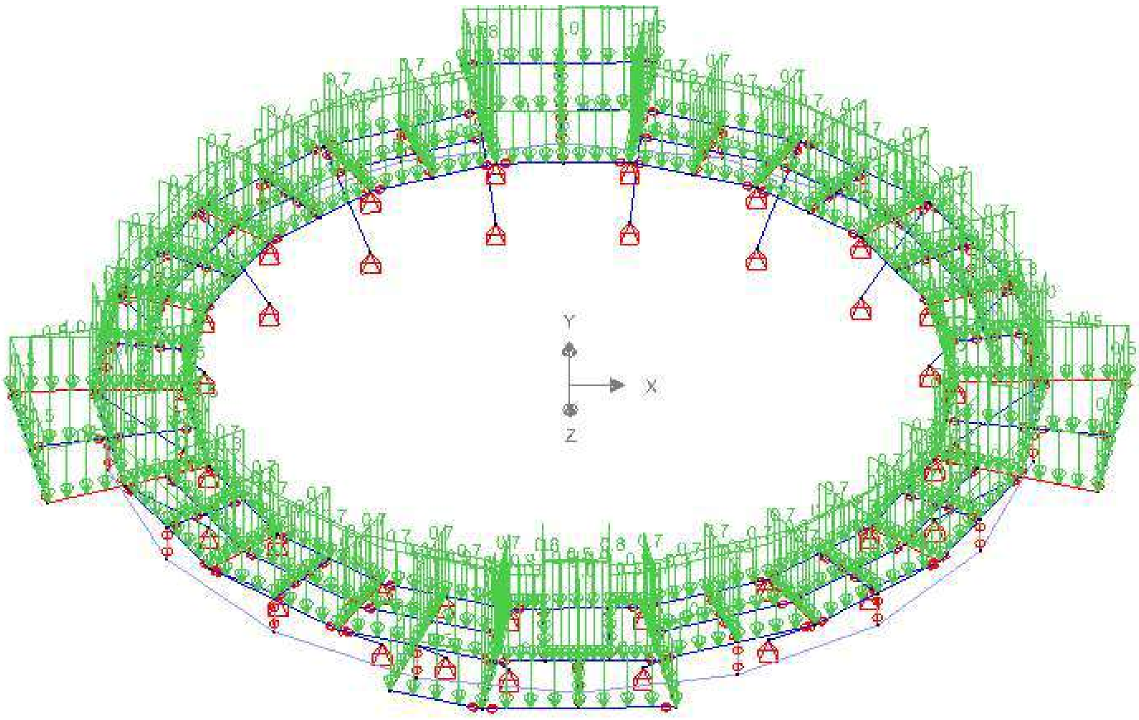
5.1 Selfweight



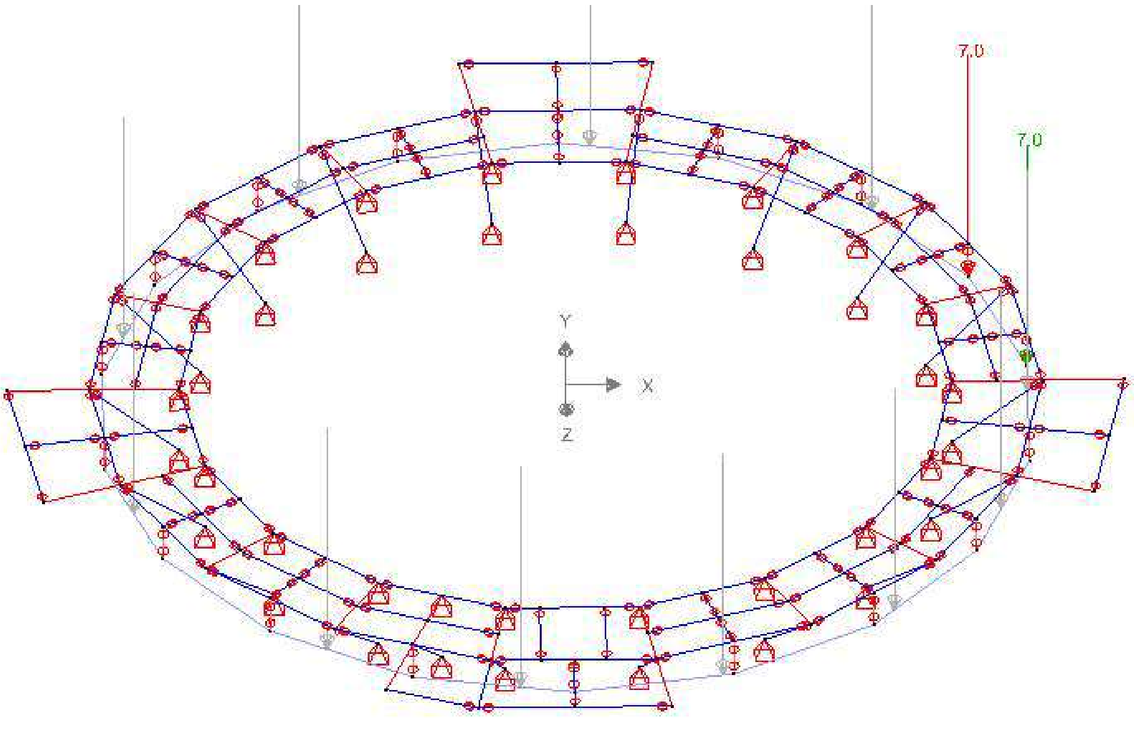
5.2 dead loads



5.3 live loads: Viewpoints



5.4 Crane loads



6 Load cases

Load factors for EN 1990(LT)
Service class: 1
Consequence class: 2
Design lifetime: 50 years

Name	γuls-	γuls+	γsls-	γsls+	ψ0	ψ1	ψ2	ξ	t0	kmod
Selfweight	1.35	1.10	1.00	1.00	1.00	1.00	1.00	0.85	0	permanent
dead loads	1.35	1.10	1.00	1.00	1.00	1.00	1.00	0.85	0	permanent
live loads: Viewpoints	1.30	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0	medium term
Crane loads	1.30	0.00	1.00	0.00	1.00	0.90	0.90	1.00	0	medium term

7 Combinations

7.1 ultimate limit state - fundamental combination

	Name	Selfweight	dead loads	live loads: Viewpoints	Crane loads
1	ULS FC 1	1.00 x 1.15	1.00 x 1.15	1.00 x 1.30	0.00
2	ULS FC 2	1.00 x 1.35	1.00 x 1.35	0.00	0.00
3	ULS FC 3	1.00 x 1.10	1.00 x 1.10	1.00 x 1.30	0.00
4	ULS FC 4	1.00 x 1.10	1.00 x 1.10	0.00	0.00
5	ULS FC 5	1.00 x 1.15	1.00 x 1.15	1.00 x 1.30	1.00 x 1.30
6	ULS FC 6	1.00 x 1.15	1.00 x 1.15	0.00	1.00 x 1.30
7	ULS FC 7	1.00 x 1.35	1.00 x 1.35	0.00	1.00 x 1.30
8	ULS FC 8	1.00 x 1.10	1.00 x 1.10	1.00 x 1.30	1.00 x 1.30
9	ULS FC 9	1.00 x 1.10	1.00 x 1.10	0.00	1.00 x 1.30

7.2 serviceability limit state - rare combination

	Name	Selfweight	dead loads	live loads: Viewpoints	Crane loads
1	SLS RC 1	1.00 x 1.00	1.00 x 1.00	1.00 x 1.00	0.00
2	SLS RC 2	1.00 x 1.00	1.00 x 1.00	0.00	0.00
3	SLS RC 3	1.00 x 1.00	1.00 x 1.00	1.00 x 1.00	1.00 x 1.00
4	SLS RC 4	1.00 x 1.00	1.00 x 1.00	0.00	1.00 x 1.00

7.3 serviceability limit state - frequent combination

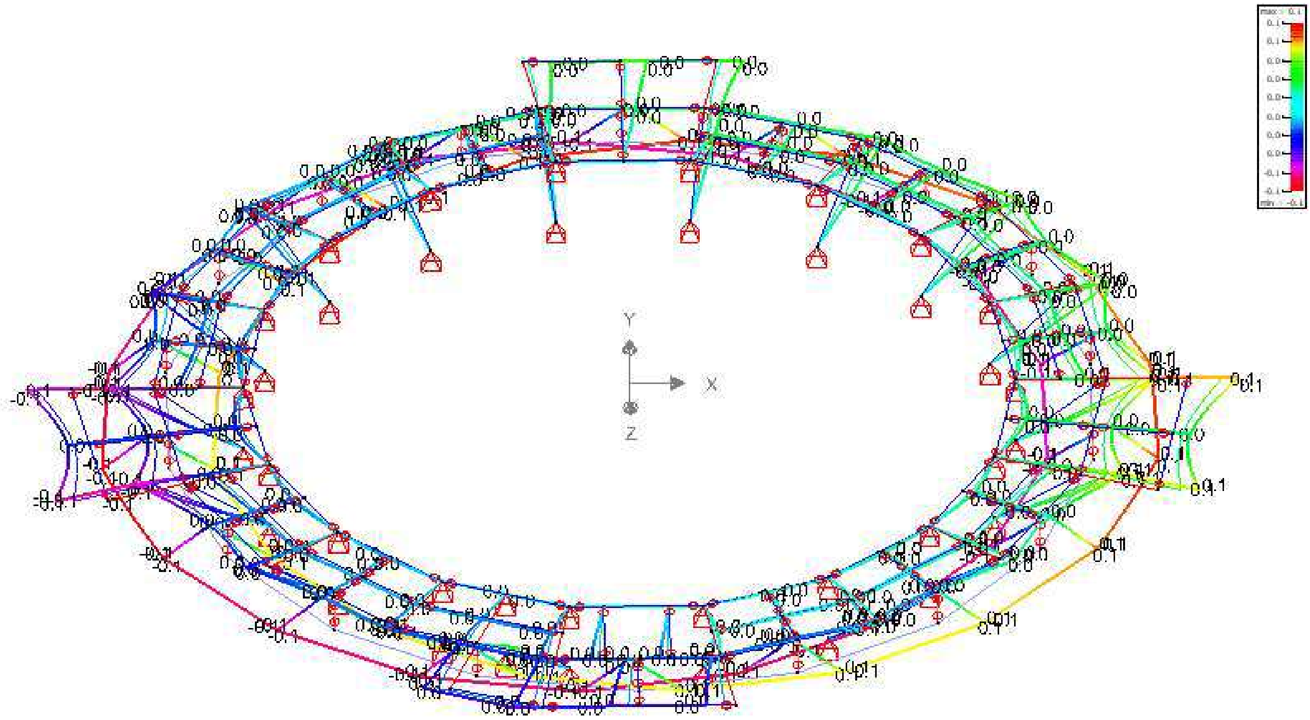
	Name	Selfweight	dead loads	live loads: Viewpoints	Crane loads
1	SLS FC 1	1.00 x 1.00	1.00 x 1.00	0.00	0.00
2	SLS FC 2	1.00 x 1.00	1.00 x 1.00	0.00	0.90 x 1.00

7.4 serviceability limit state - quasi-permanent combination

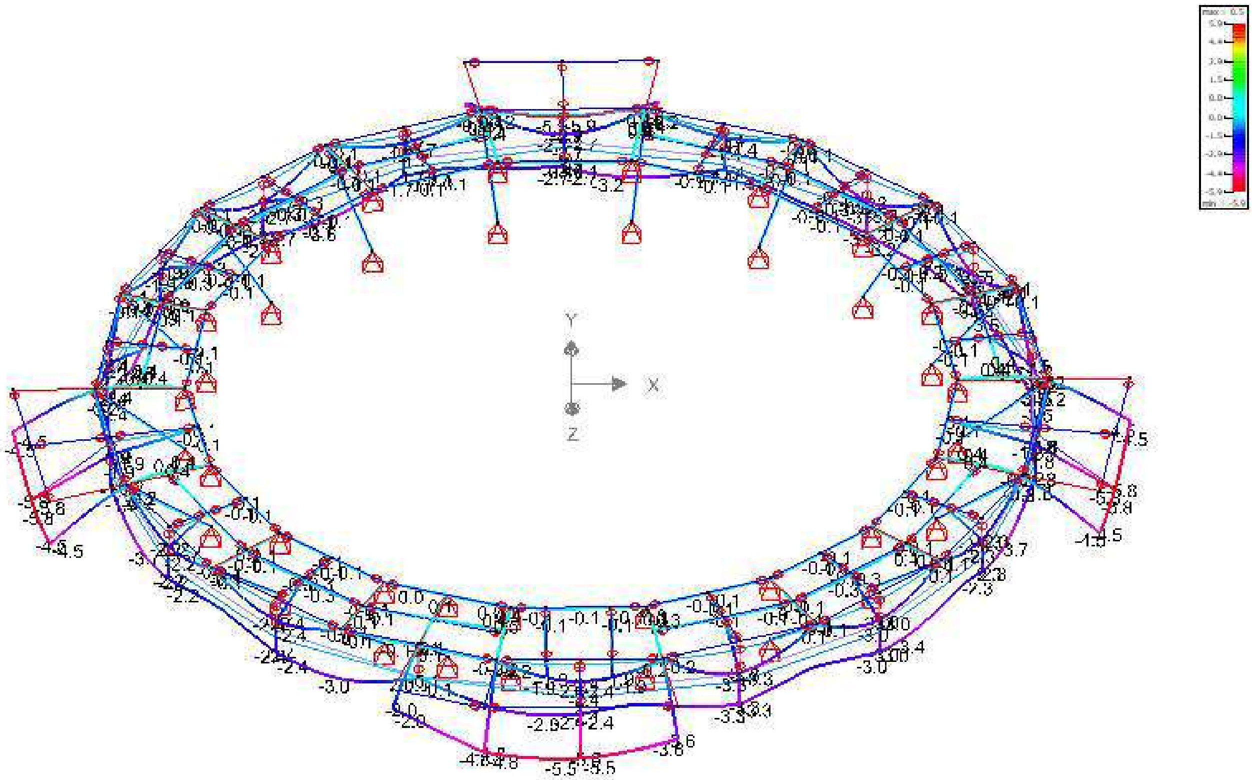
	Name	Selfweight	dead loads	live loads: Viewpoints	Crane loads
1	SLS QP 1	1.00 x 1.00	1.00 x 1.00	0.00	0.00
2	SLS QP 2	1.00 x 1.00	1.00 x 1.00	0.00	0.90 x 1.00

8 General results representation

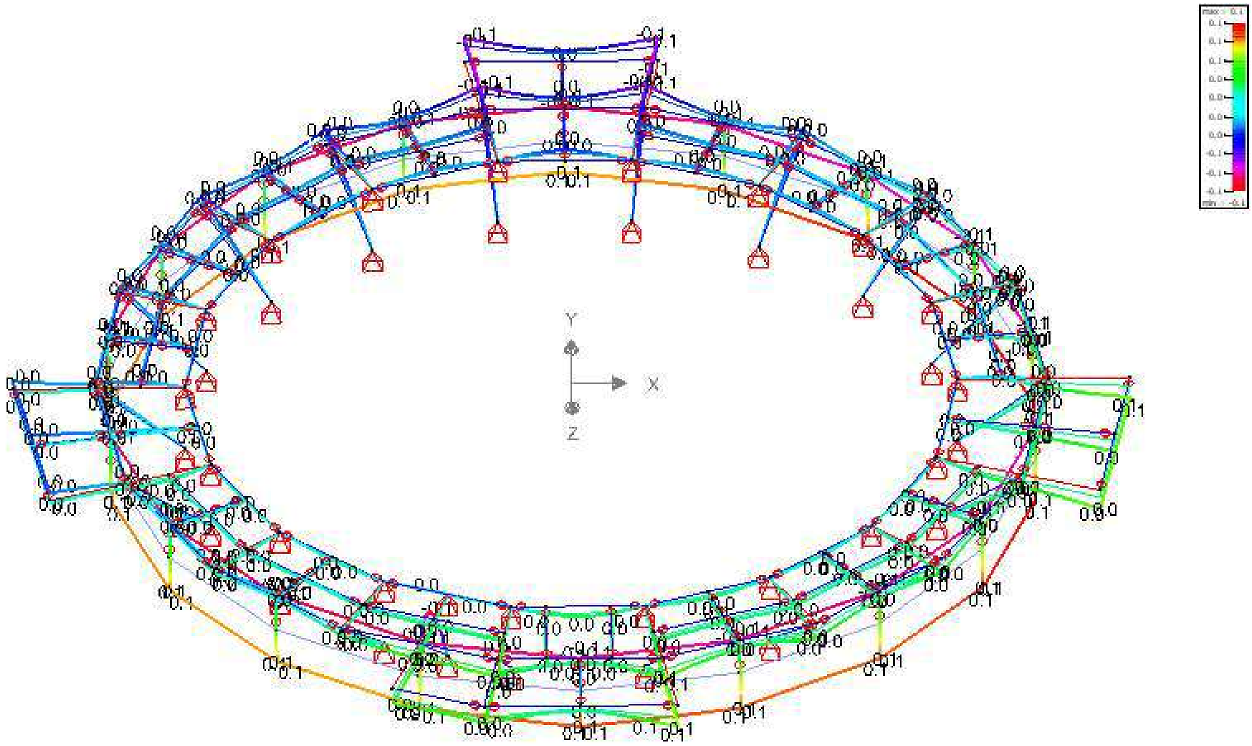
8.1 δx (mm) - SLS FC Envelope



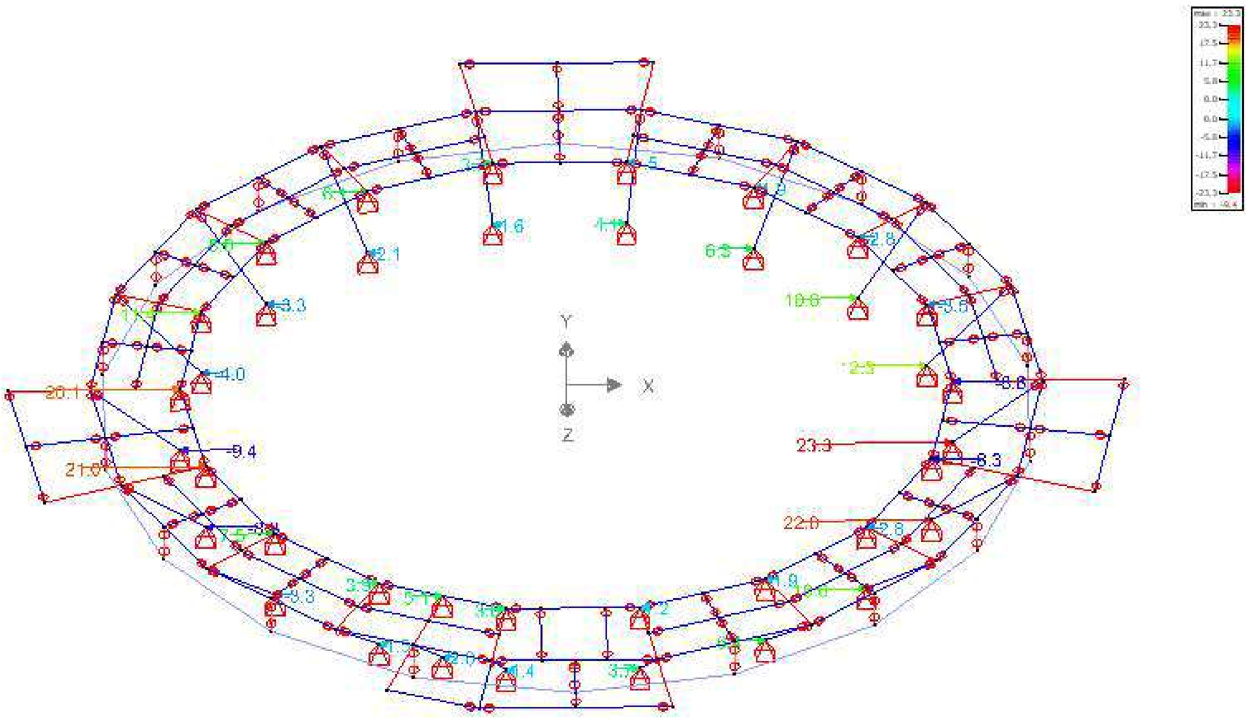
8.2 δy (mm) - SLS FC Envelope



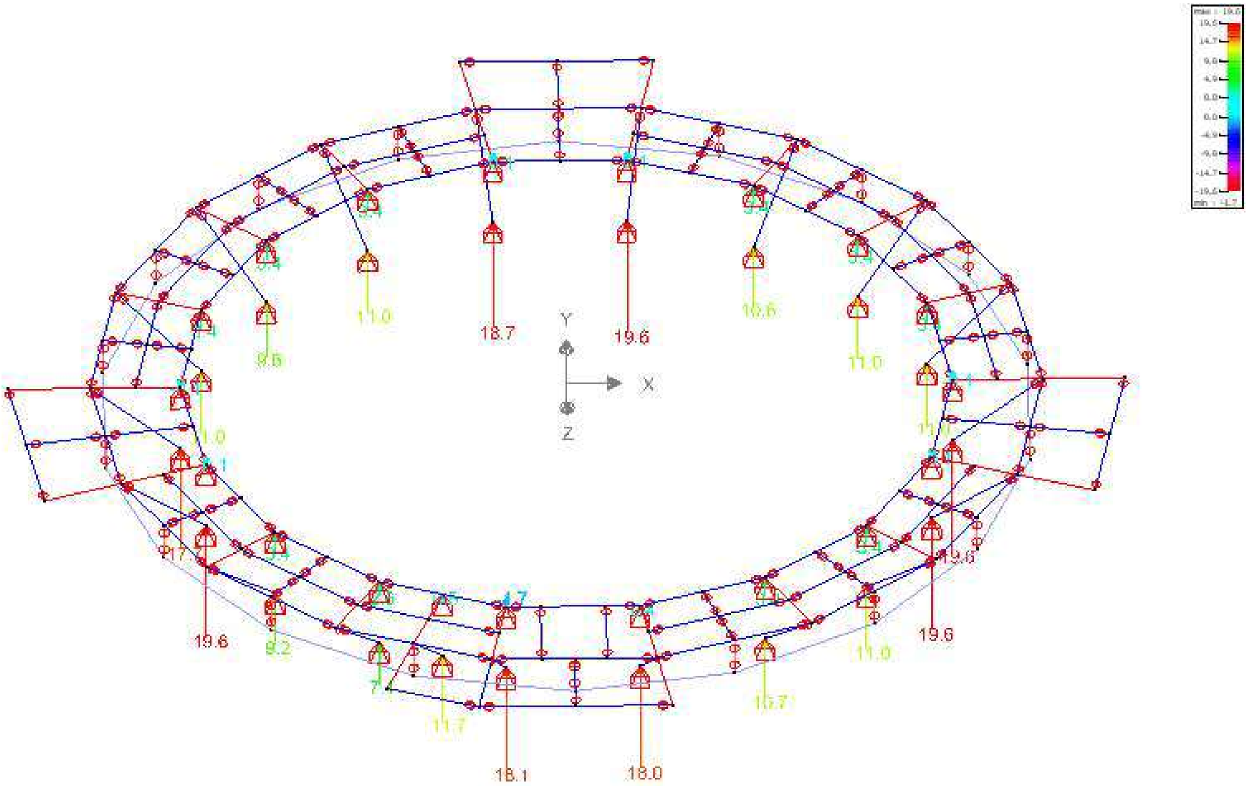
8.3 δz (mm) - SLS FC Envelope



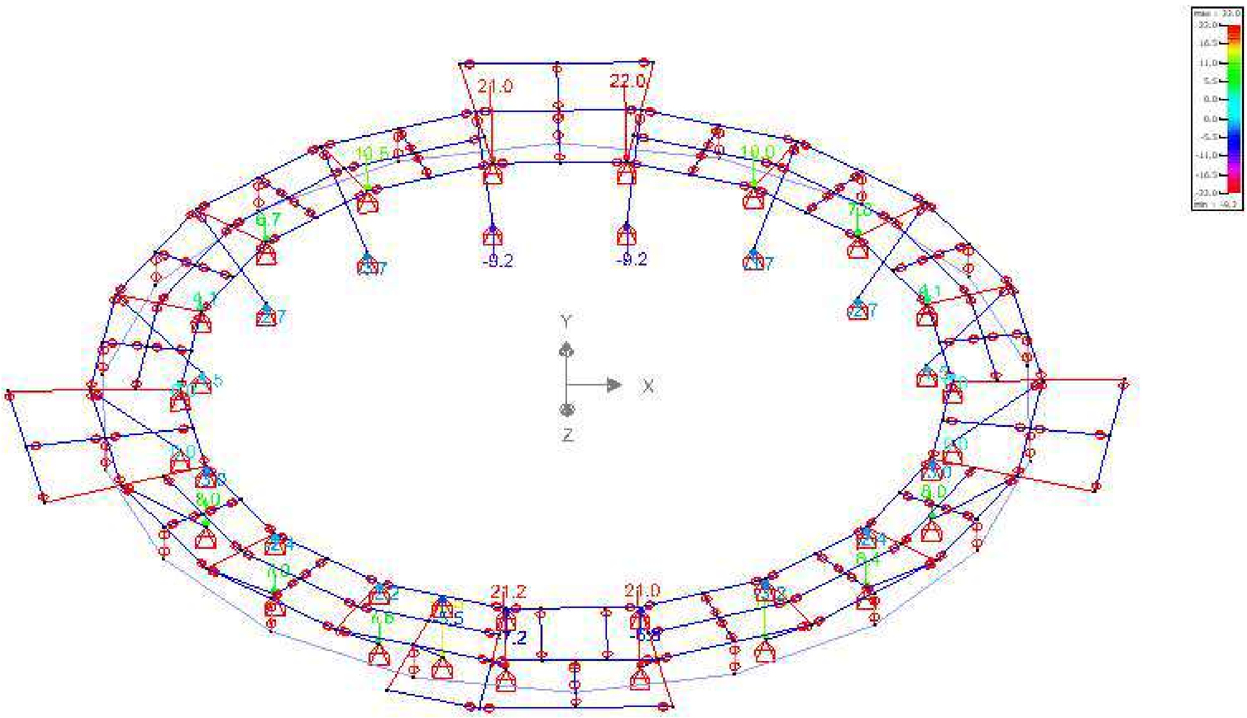
8.4 Reaction Rx on point (kN) - ULS FC Envelope max



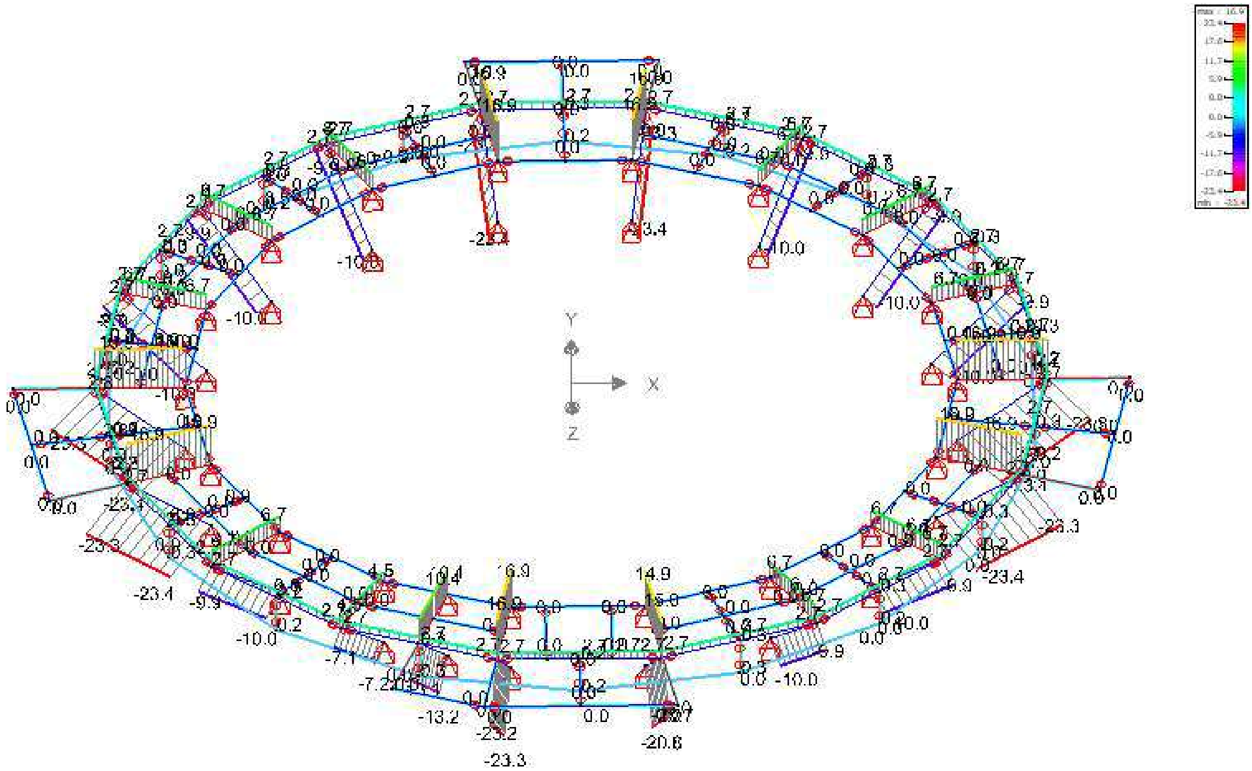
8.5 Reaction Ry on point (kN) - ULS FC Envelope max



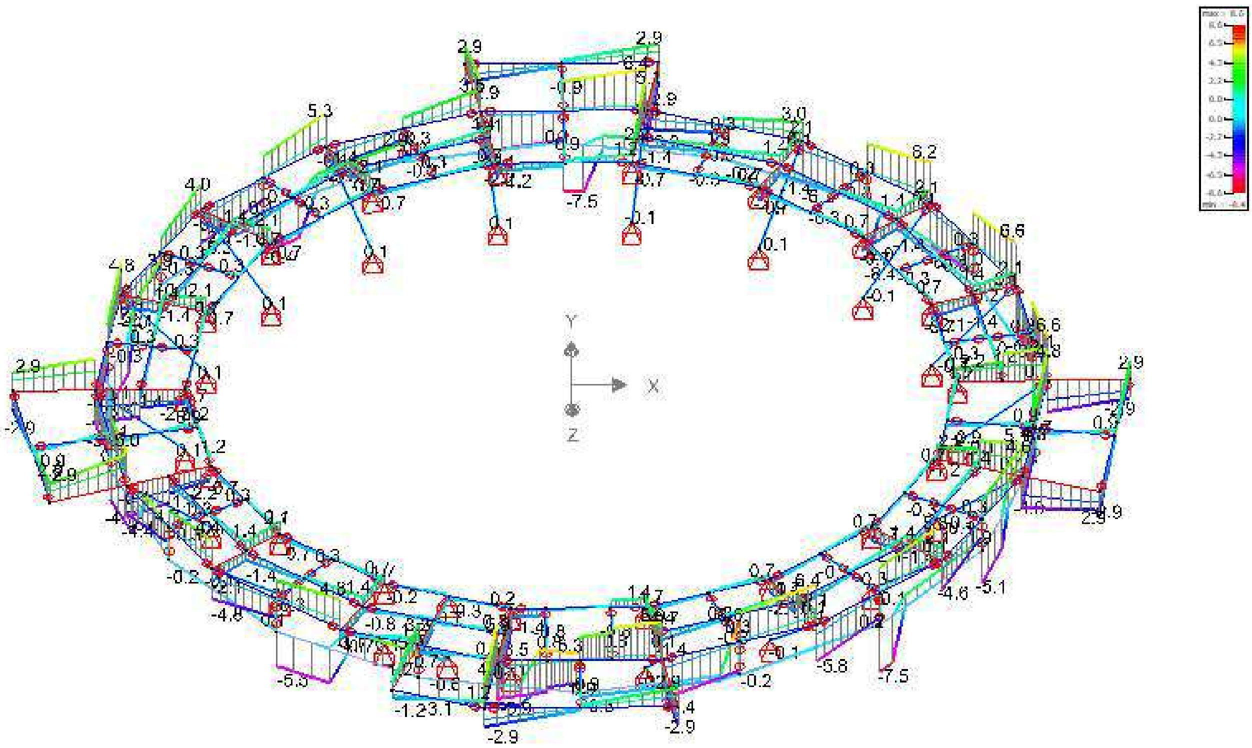
8.6 Reaction Rz on point (kN) - ULS FC Envelope max



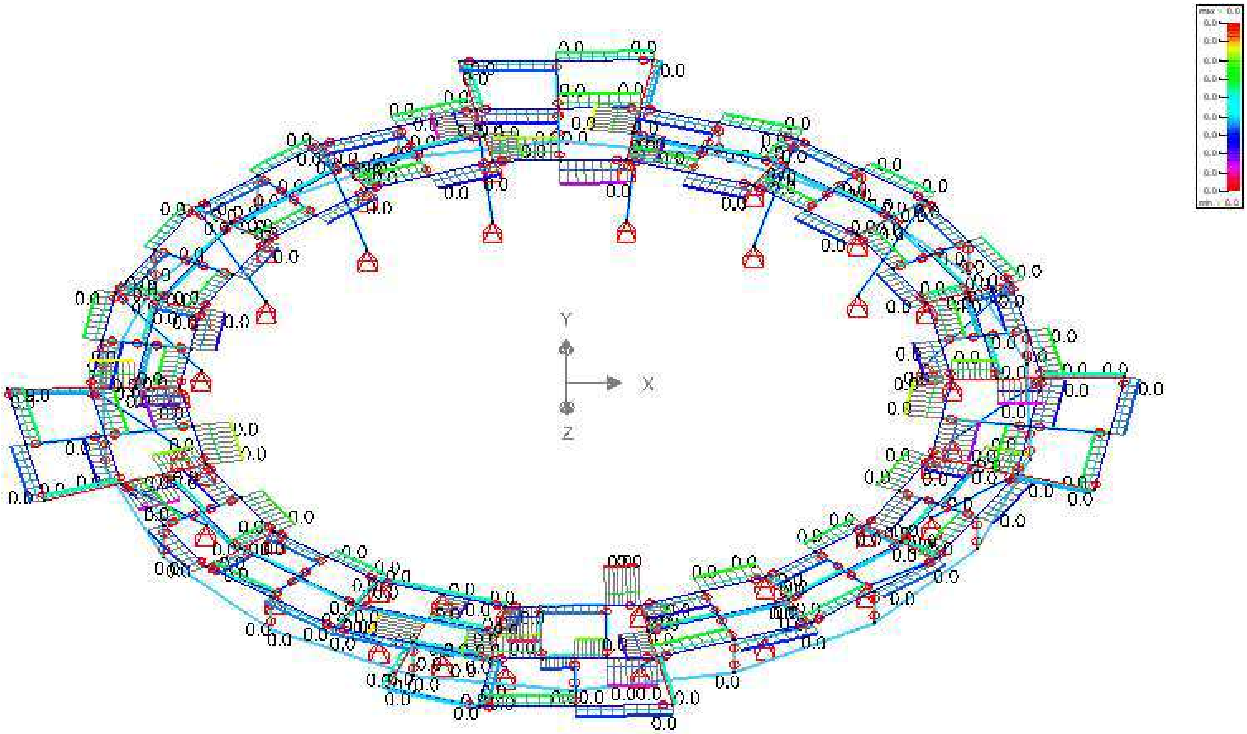
8.7 N in bar (kN) - ULS FC 1



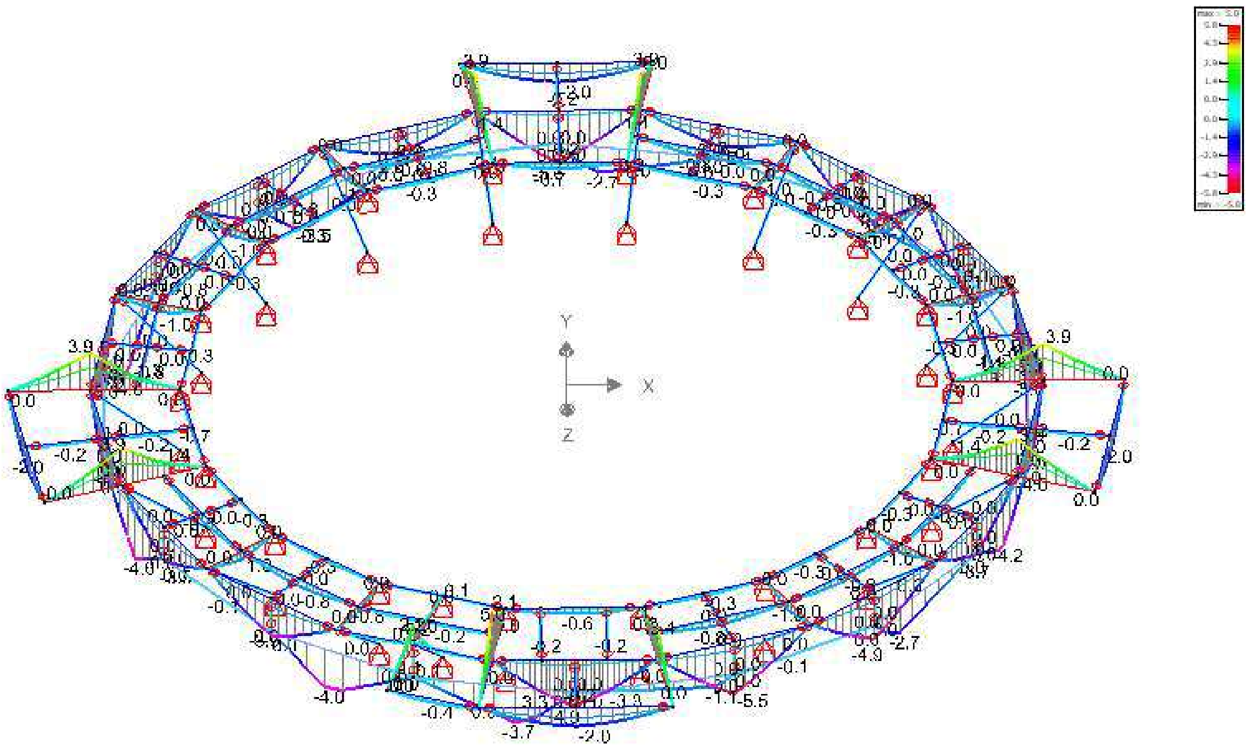
8.8 Vz in bar (kN) - ULS FC Envelope



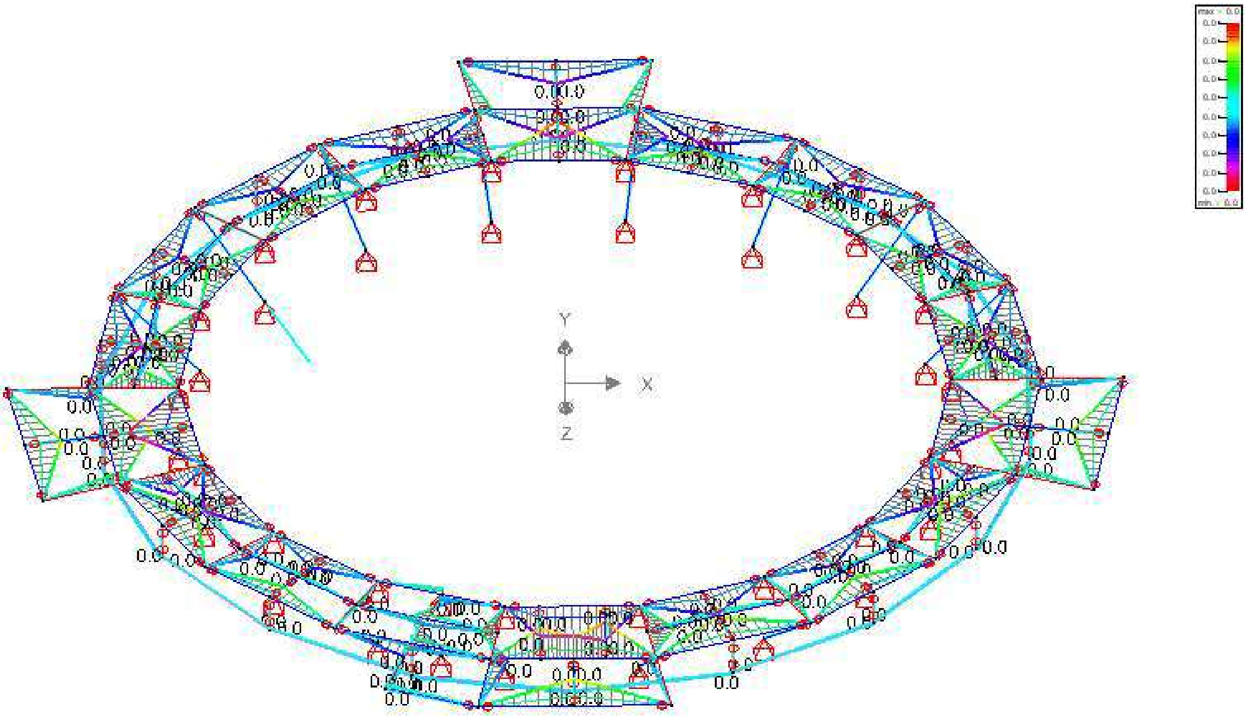
8.9 Vy in bar (kN) - ULS FC Envelope



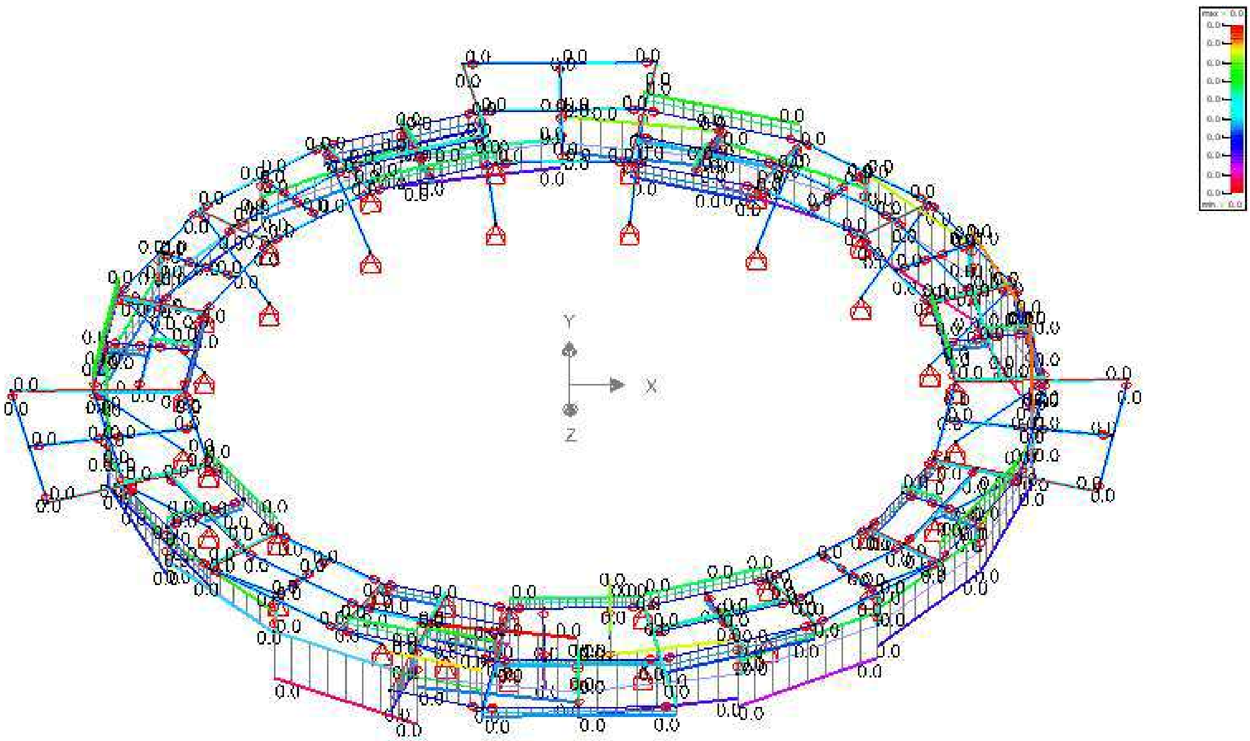
8.10 My in bar (kNm) - ULS FC Envelope



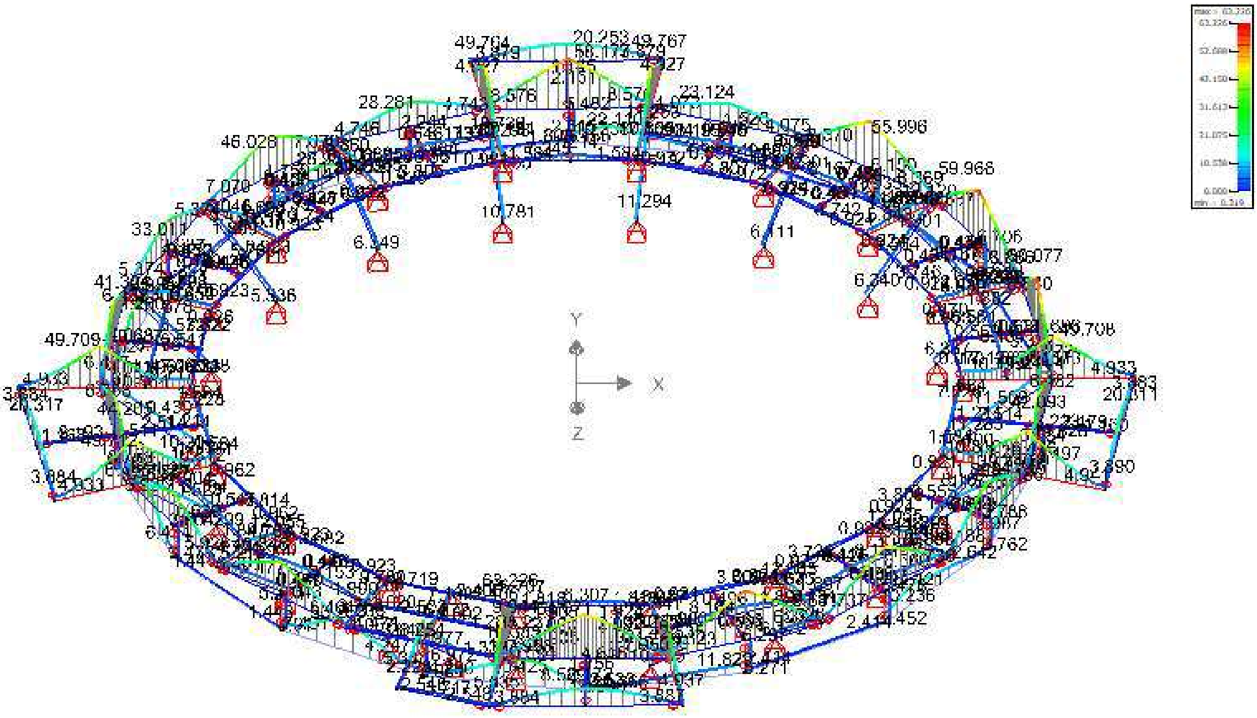
8.11 Mz in bar (kNm) - ULS FC Envelope



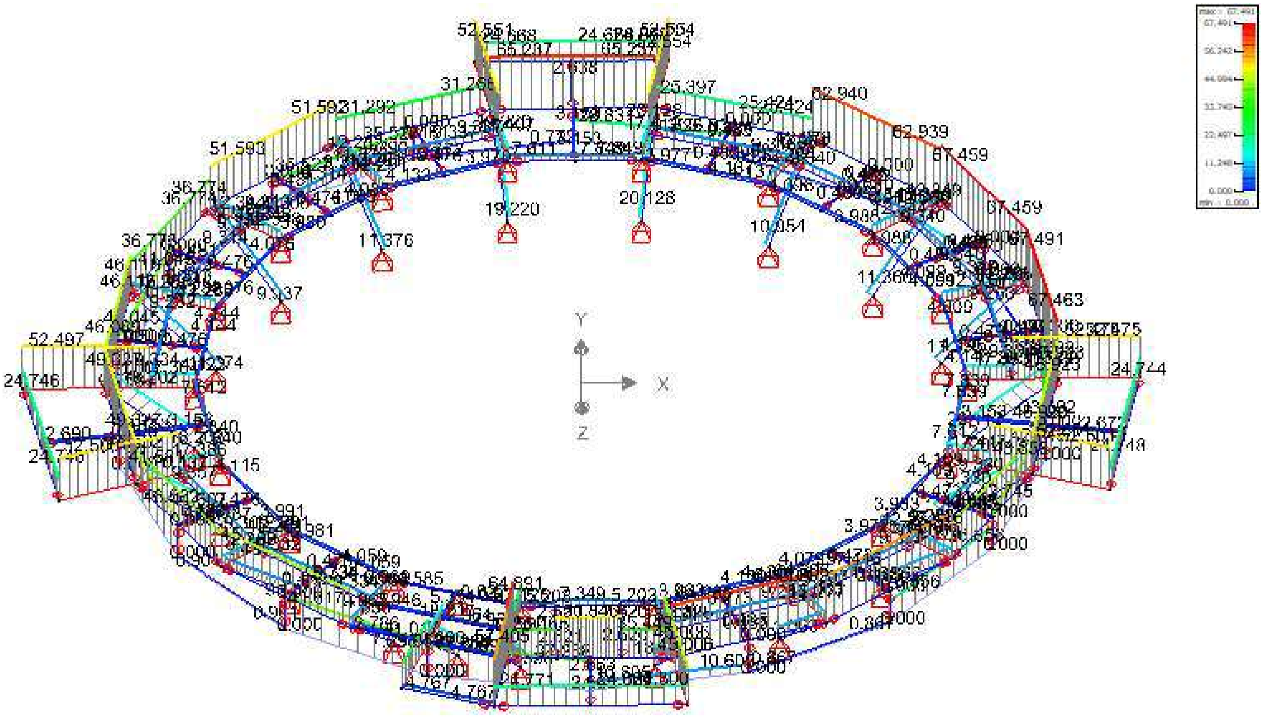
8.12 Tx in bar (kNm) - ULS FC Envelope



8.13 Resistance verification of bar (%) - Eurocode 3 : EN 1993-1-1/3 (LT)



8.14 Stability verification of bar (%) - Eurocode 3 : EN 1993-1-1/3 (LT)



9 General results

9.1 Bars verifications

bar number	Resistance (%)	Stability (%)
1	0.872 ~ 3.805	4.132
2	0.835 ~ 3.724	3.980
3	0.835 ~ 3.711	4.076
4	0.870 ~ 3.803	4.123
5	1.462 ~ 7.228	7.612
6	0.962 ~ 3.794	4.115
7	0.834 ~ 3.682	3.981
8	0.719 ~ 0.719	0.585
9	1.730 ~ 5.533	5.203
10	0.845 ~ 3.792	3.963
11	0.834 ~ 3.722	4.079
12	0.864 ~ 3.809	3.983
13	1.462 ~ 7.226	7.612
14	0.970 ~ 3.853	4.009
15	0.835 ~ 3.746	3.988
16	0.835 ~ 3.741	4.096
17	0.972 ~ 3.787	3.977
18	1.462 ~ 7.245	7.611
19	4.746 ~ 28.281	31.292
20	7.070 ~ 46.028	51.593
21	5.374 ~ 33.011	36.773
22	6.427 ~ 41.298	46.089
23	5.925 ~ 37.337	41.581
24	6.401 ~ 40.846	45.736
25	1.057 ~ 3.646	2.786
26	8.523 ~ 57.260	64.285
27	7.737 ~ 51.145	57.416
28	6.188 ~ 39.337	43.885
29	8.880 ~ 60.077	67.491
30	8.887 ~ 59.966	67.459
31	8.370 ~ 55.991	62.940
32	4.073 ~ 23.124	25.397
33	3.879 ~ 20.253	24.668
34	3.884 ~ 20.317	24.746
35	3.890 ~ 20.310	24.748
36	3.884 ~ 20.342	24.771
37	2.548 ~ 3.717	4.767
38	4.933 ~ 49.708	52.475
39	10.799 ~ 17.128	17.383
40	4.941 ~ 49.828	52.601
41	10.816 ~ 17.190	17.447
42	5.848 ~ 12.055	12.281
43	5.675 ~ 12.065	12.292
44	4.937 ~ 42.535	45.006
45	9.841 ~ 13.987	14.195
46	26.650 ~ 63.226	64.891
47	5.535 ~ 51.028	57.405
48	2.228 ~ 28.254	29.658
49	3.768 ~ 9.776	9.965
50	4.771 ~ 12.040	12.266
51	17.117 ~ 49.662	50.868
52	4.933 ~ 49.712	52.500
53	17.099 ~ 49.653	50.857
54	4.933 ~ 49.709	52.497
55	5.858 ~ 12.053	12.281
56	5.046 ~ 12.115	12.344
57	5.860 ~ 12.057	12.283
58	17.141 ~ 49.708	50.915
59	4.927 ~ 49.764	52.551
60	10.808 ~ 17.156	17.412
61	4.927 ~ 49.767	52.554
62	5.612 ~ 12.067	12.294
63	5.843 ~ 12.116	12.344
64	5.839 ~ 12.076	12.303
65	0.962 ~ 2.193	2.690
66	0.639 ~ 0.639	0.489
67	0.330 ~ 0.457	0.489
68	0.496 ~ 0.496	0.473
69	0.319 ~ 0.444	0.473
70	0.555 ~ 0.555	0.473
71	1.107 ~ 2.514	3.153
72	0.559 ~ 0.559	0.479
73	0.323 ~ 0.451	0.480
74	0.323 ~ 0.450	0.480
75	0.557 ~ 0.557	0.480

bar number	Resistance (%)	Stability (%)
76	0.944 ~ 2.151	2.638
77	0.646 ~ 0.646	0.481
78	0.324 ~ 0.450	0.481
79	0.324 ~ 0.450	0.481
80	0.637 ~ 0.637	0.506
81	1.715 ~ 8.139	9.313
82	1.714 ~ 8.175	9.334
83	1.717 ~ 8.150	9.332
84	1.714 ~ 8.131	9.307
85	1.718 ~ 8.167	9.340
86	1.718 ~ 8.167	9.340
87	1.715 ~ 8.141	9.313
88	7.795 ~ 35.237	35.465
89	1.712 ~ 8.131	9.290
90	1.721 ~ 8.195	9.363
91	1.711 ~ 8.124	9.283
92	1.701 ~ 8.112	9.258
93	8.576 ~ 58.176	65.237
94	6.476 ~ 42.093	46.920
95	6.758 ~ 44.200	49.327
96	0.954 ~ 2.172	2.663
97	1.924 ~ 2.092	2.620
98	1.905 ~ 2.090	2.621
99	1.337 ~ 3.600	2.692
100	1.717 ~ 8.164	9.328
101	0.836 ~ 2.503	2.946
102	1.720 ~ 8.194	9.357
103	7.139 ~ 16.265	16.581
104	2.406 ~ 2.406	0.627
105	1.462 ~ 7.228	7.840
106	3.884 ~ 20.317	24.746
107	5.928 ~ 37.334	41.607
108	0.962 ~ 3.814	3.991
109	6.401 ~ 40.841	45.735
110	0.835 ~ 3.680	4.059
111	0.846 ~ 3.809	4.130
112	8.526 ~ 57.263	64.308
113	0.834 ~ 3.722	3.972
114	7.738 ~ 51.145	57.416
115	0.864 ~ 3.789	4.109
116	6.186 ~ 39.340	43.858
117	1.462 ~ 7.226	7.839
118	3.883 ~ 20.311	24.744
119	0.970 ~ 3.833	4.146
120	8.873 ~ 60.074	67.463
121	0.835 ~ 3.746	4.099
122	8.886 ~ 59.960	67.459
123	0.835 ~ 3.742	3.988
124	8.369 ~ 55.996	62.939
125	0.972 ~ 3.807	4.137
126	4.075 ~ 23.118	25.424
127	1.462 ~ 7.245	7.849
128	3.879 ~ 20.253	24.668
129	0.872 ~ 3.785	3.970
130	4.743 ~ 28.271	31.266
131	0.834 ~ 3.724	4.083
132	7.070 ~ 46.026	51.592
133	0.834 ~ 3.711	4.076
134	5.374 ~ 33.010	36.774
135	0.870 ~ 3.822	4.144
136	6.432 ~ 41.304	46.116
137	5.037 ~ 12.119	12.348
138	5.850 ~ 12.062	12.288
139	9.717 ~ 17.109	17.364
140	4.763 ~ 12.055	12.281
141	3.760 ~ 9.780	9.969
142	5.681 ~ 12.051	12.277
143	5.855 ~ 12.047	12.274
144	5.848 ~ 12.060	12.288
145	5.852 ~ 12.120	12.349
146	5.621 ~ 12.051	12.278
147	5.851 ~ 12.065	12.291
148	10.293 ~ 17.151	17.407
149	17.142 ~ 49.718	50.926
150	17.181 ~ 49.771	50.980
151	17.114 ~ 49.659	50.864
152	35.214 ~ 51.040	50.821
153	3.887 ~ 20.366	24.800
154	7.792 ~ 35.285	35.449
155	1.730 ~ 5.586	5.202
156	35.167 ~ 51.071	50.846

bar number	Resistance (%)	Stability (%)
157	5.602 ~ 6.307	7.349
158	13.974 ~ 42.506	43.522
159	9.944 ~ 26.707	27.126
160	10.812 ~ 17.131	17.386
161	1.107 ~ 2.514	3.153
162	6.758 ~ 44.205	49.327
163	0.321 ~ 0.446	0.476
164	1.715 ~ 8.138	9.314
165	0.541 ~ 0.541	0.476
166	1.699 ~ 8.132	9.282
167	0.321 ~ 0.446	0.476
168	1.717 ~ 8.153	9.334
169	0.327 ~ 0.454	0.485
170	1.713 ~ 8.131	9.307
171	0.327 ~ 0.454	0.485
172	1.719 ~ 8.167	9.340
173	0.327 ~ 0.454	0.485
174	1.719 ~ 8.167	9.340
175	0.321 ~ 0.447	0.476
176	1.715 ~ 8.141	9.314
177	0.551 ~ 0.551	0.476
178	1.718 ~ 8.173	9.337
179	0.646 ~ 0.646	0.485
180	1.716 ~ 8.153	9.316
181	0.639 ~ 0.639	0.485
182	1.716 ~ 8.167	9.330
183	0.638 ~ 0.638	0.497
184	1.704 ~ 8.154	9.304
185	1.107 ~ 2.515	3.153
186	8.576 ~ 58.177	65.237
187	0.956 ~ 2.179	2.673
188	6.482 ~ 42.088	46.923
189	0.566 ~ 0.566	0.485
190	1.710 ~ 8.126	9.286
191	1.283 ~ 2.502	2.964
192	7.138 ~ 7.138	5.354
193	0.547 ~ 0.547	0.476
194	1.713 ~ 8.151	9.309
195	6.304 ~ 6.569	11.369
196	6.131 ~ 6.396	11.063
197	10.294 ~ 10.559	18.431
198	10.383 ~ 10.648	18.590
199	4.206 ~ 4.471	7.656
200	5.212 ~ 5.477	9.437
201	11.257 ~ 11.523	20.137
202	10.164 ~ 10.430	18.202
203	6.306 ~ 6.572	11.374
204	5.495 ~ 5.760	9.937
205	6.308 ~ 6.573	11.376
206	10.739 ~ 11.005	19.220
207	11.253 ~ 11.518	20.128
208	6.069 ~ 6.335	10.954
209	6.299 ~ 6.564	11.360
210	6.296 ~ 6.561	11.355
211	11.244 ~ 11.509	20.113
212	11.261 ~ 11.526	20.143
213	2.218 ~ 2.244	0.000
214	4.733 ~ 4.759	0.000
215	2.911 ~ 2.937	0.000
216	4.042 ~ 4.068	0.000
217	3.485 ~ 3.511	0.000
218	3.478 ~ 3.504	0.000
219	4.017 ~ 4.043	0.000
220	2.951 ~ 2.977	0.000
221	4.590 ~ 4.616	0.000
222	6.271 ~ 6.297	0.000
223	5.452 ~ 5.478	0.000
224	3.762 ~ 3.788	0.000
225	3.197 ~ 3.223	0.000
226	6.673 ~ 6.698	0.000
227	6.680 ~ 6.706	0.000
228	6.125 ~ 6.150	0.000
229	1.494 ~ 1.520	0.000
230	5.456 ~ 5.482	0.000
231	6.434 ~ 37.627	46.582
232	1.443 ~ 1.443	0.901
233	5.388 ~ 33.253	41.017
234	4.290 ~ 30.594	37.288
235	2.533 ~ 11.829	10.605
236	2.414 ~ 2.414	0.867
237	2.642 ~ 22.121	26.856

bar number	Resistance (%)	Stability (%)
238	5.891 ~ 34.315	42.745
239	3.684 ~ 27.311	33.692
240	3.332 ~ 3.332	0.971
241	3.190 ~ 11.935	14.110
242	2.123 ~ 2.123	0.857
243	2.640 ~ 22.110	26.831
244	1.808 ~ 1.808	0.772
245	4.029 ~ 28.936	35.527
246	1.189 ~ 1.189	0.759
247	5.351 ~ 33.260	41.045
248	1.319 ~ 1.319	0.758
249	6.972 ~ 16.972	18.217

10 Išvados:

Konstrukcijos atitinka saugos ir tinkamumo ribinių būvių keliamus esminius statinio reikalavimus.

Design office: *
Person in charge: *
Construction project:
Position:
Project number:

Date: 3/3/2022

Input data:

Concrete:
non-cracked concrete
strength class: C20/25
long term / short term temperature ≤ 50/80 °C

Reinforcement:
dense reinforcement
without edge reinforcement

Anchor bending:
without anchor bending

Installation conditions:
hammer-drilled hole
dry drill hole

Static / quasi-static action

Tensile load:
N_{Sd} = 25 kN

Shear load:
$V_{x,Sd}$ = 0.00 kN
$V_{y,Sd}$ = -4.00 kN

Moments:
$M_{x,Sd}$ = 0.00 kNm
$M_{y,Sd}$ = 0.00 kNm
$M_{z,Sd}$ = 0.00 kNm

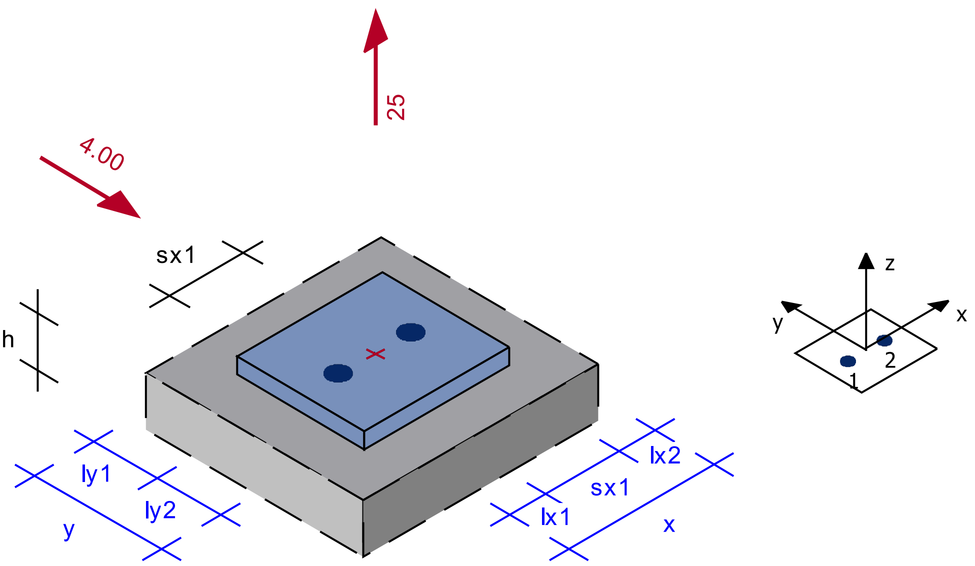
Eccentric load
e_x = 0.0 mm
e_y = 0.0 mm

Anchor plate:
x = 160 mm
y = 140 mm
l_{x1} = 40 mm
l_{x2} = 40 mm
l_{y1} = 70 mm
l_{y2} = 70 mm

Distance between anchors:
s_{x1} = 80 mm

Edge distances:
without influence

Thickness of anchor base:
h = 400 mm



[kN, kNm]

Chemical Anchor HB-V-P + HB-V-A A4 (70) M16
Design method A, ETAG 001, Annex C
Approval ETA-07/0257

The anchorage is verified.

	Tension loads β_N [%]	Shear loads β_V [%]	Interaction $\beta_{N,V}$ [%]	Boundary conditions:
Static / quasi-static action	68.2	5.7	57.7	OK

The calculation only applies if the notes on the last page are observed.

Anchor Design Program Version HB 3.30

Chemical Anchor HB-V-P + HB-V-A A4 (70) M16
Approval ETA-07/0257

Required proofs for tension loads

Anchor loads

Anchor	**1**	**2**
N_{Sd} [kN]	12.50	12.50

Proof steel failure

N^h_{Sd}	≤	$N_{Rk,s}$	/ γ_{Ms}	=	$N_{Rd,s}$	Utilisation:
12.50	≤	110.00	/ 1.87	=	58.82	21.3%

Proof pullout failure

N^h_{Sd}	≤	$N_{Rk,p}$	/ γ_{Mp}	=	$N_{Rd,p}$	Utilisation:
12.50	≤	50.00	/ 1.80	=	27.78	45.0%

$N_{Rk,p}$	$\Psi_{C,(C20/25)}$
50.00 kN	1.00

Proof concrete cone failure

N^g_{Sd}	≤	$N_{Rk,c}$	/ γ_{Mc}	=	$N_{Rd,c}$	Utilisation:
25.00	≤	66.00	/ 1.80	=	36.67	68.2%

$N^o_{Rk,c}$	$\Psi_{C\ (C20/25)}$	$\Psi_{A,c,N}$	$\Psi_{s,N}$	$\Psi_{re,N}$	$\Psi_{ec,N}$		
50.00 kN	1.00	1.32	1.00	1.00	1.00		
k_1	$A_{c,N}$	$A^o_{c,N}$	h_{ef}	$f_{ck,cube}$	$c_{cr,N}$	$e_{c1,N}$	$e_{c2,N}$
11.6	82500 mm^2	62500 mm^2	125 mm	25 N/mm^2	125.0 mm	0.0 mm	0.0 mm

Proof splitting failure

No proof of splitting failure is required because the following condition is fulfilled:

$c_{x1,x2,y1,y2} \geq 1{,}2\ c_{cr,sp}$ and: $h \geq 2\ h_{ef}$

$c_{cr,sp}$	h_{ef}
125.0 mm	125 mm

Chemical Anchor HB-V-P + HB-V-A A4 (70) M16
Approval ETA-07/0257

Required proofs for shear loads

Anchor loads

Anchor		**1**	**2**
V_{Sd}	[kN]	2.00	2.00
$V_{x,Sd}$	[kN]	0.00	0.00
$V_{y,Sd}$	[kN]	-2.00	-2.00

Proof steel failure without lever arm

V^h_{Sd}	≤	$V_{Rk,s}$	/	γ_{Ms}	=	$V_{Rd,s}$	Utilisation:
2.00	≤	55.00	/	1.56	=	35.26	5.7%

Proof concrete pryout failure

V^g_{Sd}	≤	$V_{Rk,cp}$	/	γ_{Mc}	=	$V_{Rd,cp}$	Utilisation:
4.00	≤	132.00	/	1.50	=	88.00	4.5%

$N^o_{Rk,c}$	$\Psi_{C\ (C20/25)}$	$\Psi_{A,c,N}$	$\Psi_{s,N}$	$\Psi_{re,N}$	$\Psi_{ec,N}$	k
50.00 kN	1.00	1.32	1.00	1.00	1.00	2.00
$A_{c,N}$	$A^o_{c,N}$	$c_{cr,N}$	$e_{c1,N}$	$e_{c2,N}$		
82500 mm²	62500 mm²	125.0 mm	0.0 mm	0.0 mm		

Proof concrete edge failure (closest edge)

No proof of concrete edge failure is required because one of the following conditions is fulfilled:

a) $c \geq 10h_{ef}$ and $c \geq 60d$

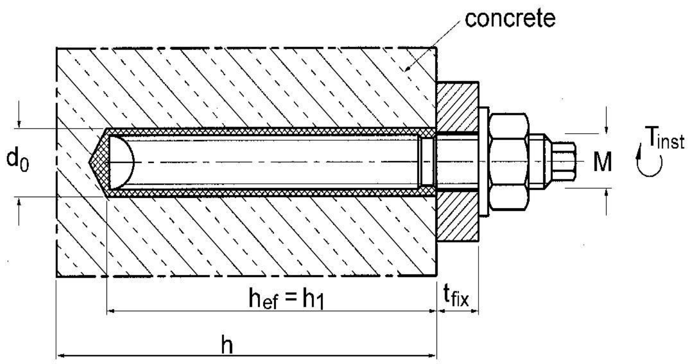
b) No shear load acts in direction or parallel to the concrete edge.

h_{ef}	d
125 mm	18 mm

Interaction, combined load in most unfavourable case

β_N^{α}	+	β_V^{α}			≤	1,0	Utilisation:
$0.68^{1.5}$	+	$0.06^{1.5}$	=	0.58	≤	1,0	57.7%

Chemical Anchor HB-V-P + HB-V-A A4 (70) M16
Approval ETA-07/0257



Installation parameters

Thread	M	= 16 mm
Diameter of drill hole	d_0	= 18 mm
Depth of drill hole	$h_{0(1)}$	= 125 mm
Effective anchorage depth	h_{ef}	= 125 mm
Diameter of clearance hole in the fixture	d_f	≤ 18 mm
Installation torque	T_{inst}	= 80 Nm
Width across nut	SW	= 24 mm

Remarks

The anchors are without influence of edge distance, if: $c \geq \max(10\ h_{ef}\ ;\ 60\ d)$
If the diameter df of the clearance hole does not correspond with the specifications in [1], Table 4.1, or with the design of slotted holes, follow the notes in [1], chapter 1.1.
The design is based on the assumption that the anchor plate remains flat under the acting forces.
The proof of the capacity of the anchor base component shall be shown according to chapter 7 in [1].

The temperature ranges are specified in [2].

[1] ETAG 001, Annex C
[2] Approval ETA-07/0257

Input data:

Concrete:
cracked concrete
strength class: C20/25
long term / short term temperature ≤ 24/40 °C

Reinforcement:
normal or no reinforcement
without edge reinforcement
with reinforcement to resist splitting according to [1] chapter 5.2.2.6

Anchor bending:
without anchor bending

Installation conditions:
hammer-drilled hole
dry drill hole

Static / quasi-static action

Tensile load:
N_{Sd} = -22 kN

Shear load:
$V_{x,Sd}$ = 0.00 kN
$V_{y,Sd}$ = -20 kN

Moments:
$M_{x,Sd}$ = 0.00 kNm
$M_{y,Sd}$ = 0.00 kNm
$M_{z,Sd}$ = 0.00 kNm

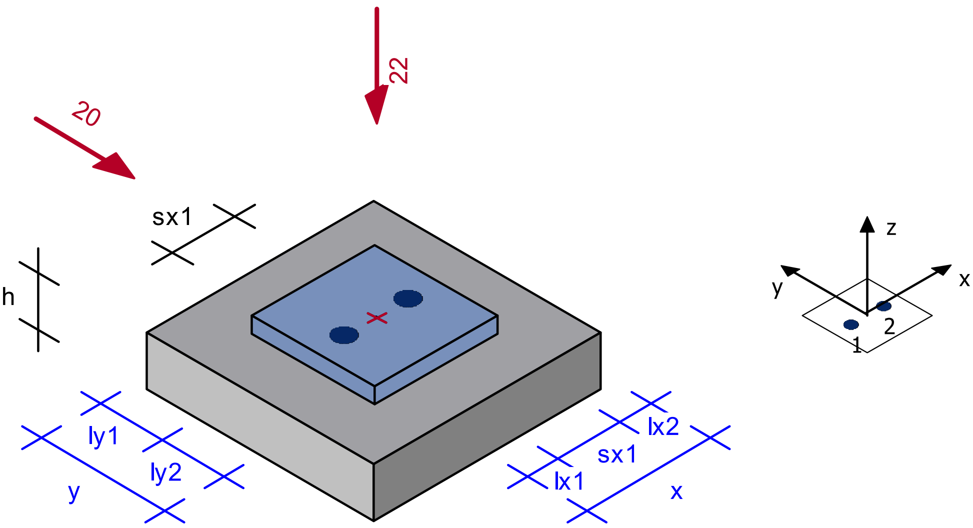
Eccentric load
e_x = 0.0 mm
e_y = 0.0 mm

Anchor plate:
x = 120 mm
y = 120 mm
l_{x1} = 30 mm
l_{x2} = 30 mm
l_{y1} = 60 mm
l_{y2} = 60 mm

Distance between anchors:
s_{x1} = 60 mm

Edge distances:
without influence

Thickness of anchor base:
h = 300 mm



Injection System HB-VMU plus + HB-VM-A A4 (70) M12 hef = 70mm
Design according to EOTA Technical Report TR 029
Assessment ETA-16/0691

The anchorage is verified.

	Tension loads β_N [%]	Shear loads β_V [%]	Interaction $\beta_{N,V}$ [%]	Boundary conditions:
Static / quasi-static action	- [1)]	74.2	- [1)]	OK

[1)] No proof required.

The calculation only applies if the notes on the last page are observed.

Injection System HB-VMU plus + HB-VM-A A4 (70) M12 hef = 70mm
Assessment ETA-16/0691

Required proofs for shear loads

Anchor loads

Anchor		**1**	**2**
V_{Sd}	[kN]	10.00	10.00
$V_{x,Sd}$	[kN]	0.00	0.00
$V_{y,Sd}$	[kN]	-10.00	-10.00

Proof steel failure without lever arm

V^h_{Sd}	≤	$V_{Rk,s}$	/	γ_{Ms}	=	$V_{Rd,s}$	Utilisation:
10.00	≤	30.00	/	1.56	=	19.23	52.0%

Proof concrete pryout failure

V^g_{Sd}	≤	$V_{Rk,cp}$	/	γ_{Mc}	=	$V_{Rd,cp}$	Utilisation:
20.00	≤	40.43	/	1.50	=	26.95	74.2%

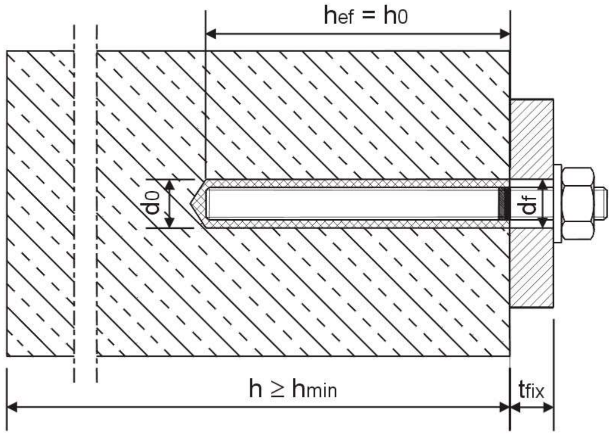
$N^o_{Rk,p}$	$\Psi_{C\ (C20/25)}$	$\Psi_{A,p,N}$	$\Psi_{s,Np}$	$\Psi_{g,Np}$	$\Psi_{re,Np}$	$\Psi_{ec,Np}$	k	
14.51 kN	1.00	1.29	1.00	1.08	1.00	1.00	2.00	
$A_{p,N}$	$A^o_{p,N}$	d	h_{ef}	$\tau_{Rk,cr(C20/25)}$	$\tau_{Rk,ucr(C20/25)}$	$c_{cr,Np}$	$e_{c1,V}$	$e_{c2,V}$
56700 mm^2	44100 mm^2	12.0 mm	70 mm	5.5 N/mm^2	12.0 N/mm^2	105.0 mm	0.0 mm	0.0 mm

Proof concrete edge failure (closest edge)

No proof of concrete edge failure is required because one of the following conditions is fulfilled:
a) $c \geq 10h_{ef}$ and $c \geq 60d$
b) No shear load acts in direction or parallel to the concrete edge.

h_{ef}	d
70 mm	12 mm

Injection System HB-VMU plus + HB-VM-A A4 (70) M12 hef = 70mm
Assessment ETA-16/0691



Installation parameters

Thread	M	= 12 mm
Diameter of drill hole	d_0	= 14 mm
Depth of drill hole	$h_{0(1)}$	= 70 mm
Effective anchorage depth	h_{ef}	= 70 mm
Diameter of clearance hole in the fixture	d_f	≤ 14 mm
Installation torque	T_{inst}	= 40 Nm
Width across nut	SW	= 19 mm

Remarks

The anchors are without influence of edge distance, if: $c \geq \max(10\, h_{ef}; 60\, d)$
If the diameter df of the clearance hole does not correspond with the specifications in [1], Table 4.1, or with the design of slotted holes, follow the notes in [1], chapter 1.1.
The design is based on the assumption that the anchor plate remains flat under the acting forces.
The proof of the capacity of the anchor base component shall be shown according to chapter 7 in [1].

The temperature ranges are specified in [2].
Cleaning with compressed air or manuell cleaning according to installation instructions

[1] EOTA Technical Report TR 029
[2] Assessment ETA-16/0691