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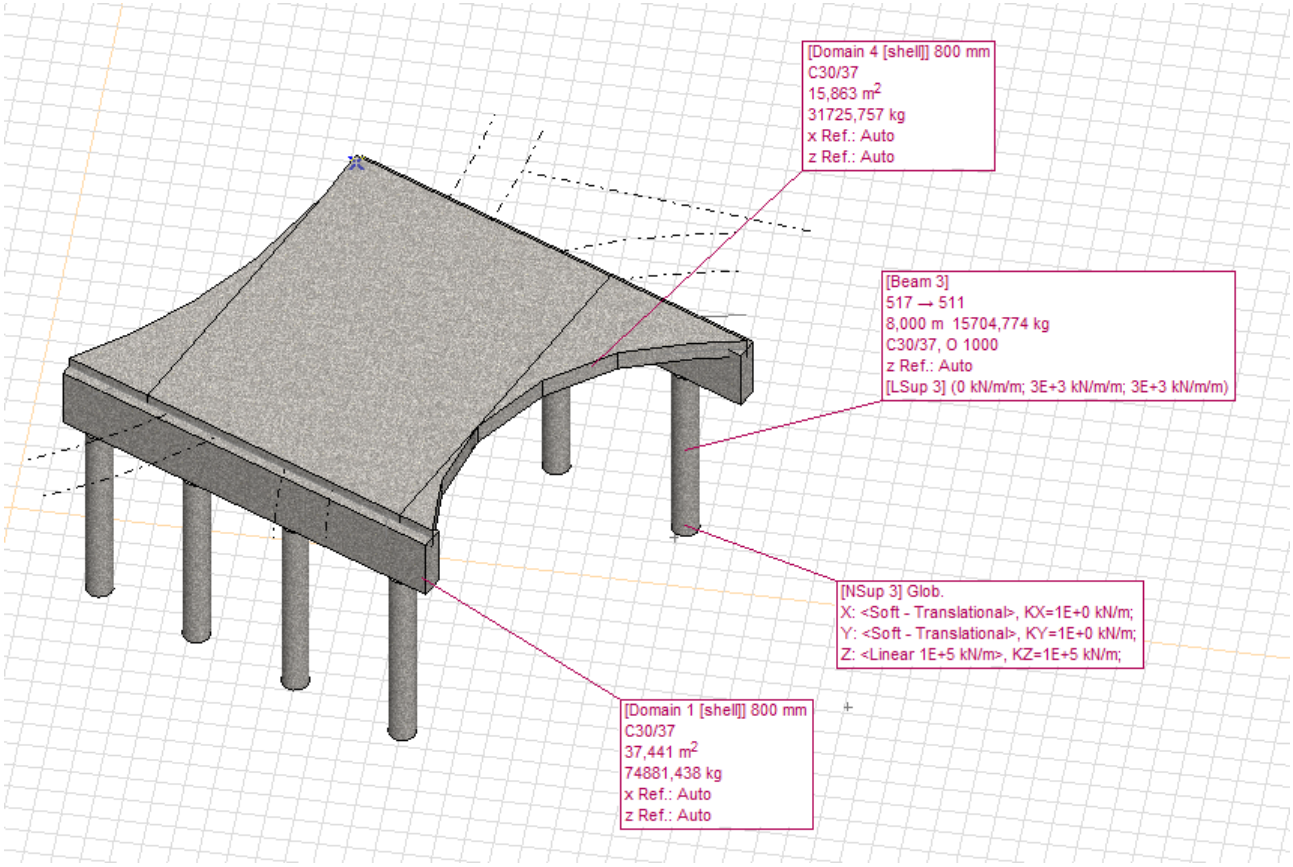
1 MODEL



Nosilnost na peti pilota Rb;d:	1687.6	kN
Nosilnost pilota skupaj Rc;d:	2182.0	kN

2 ANALIZA OBTEŽBE

2.1 LASTNA IN STALNA

sestav				0,15	25,00					3,75	kPa	
robni venec, ploskovno				0,30	25,00					7,50	kPa	
robni venec, linijsko				0,70	0,35	25,00				6,13	6,43	kN/m1
JVO				0,30						0,30		
mirni pritiski				3,00	20,00	0,50				30,00	kPa	
				4,00	20,00	0,50				40,00	kPa	
				1,50	20,00	0,50				15,00	kPa	

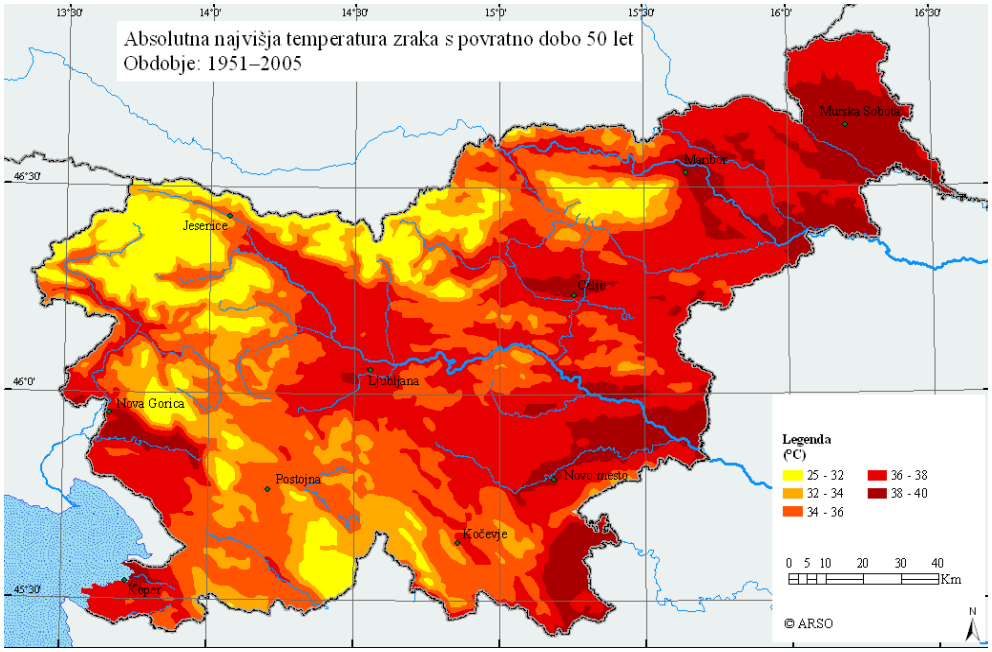
2.2 KRČENJE

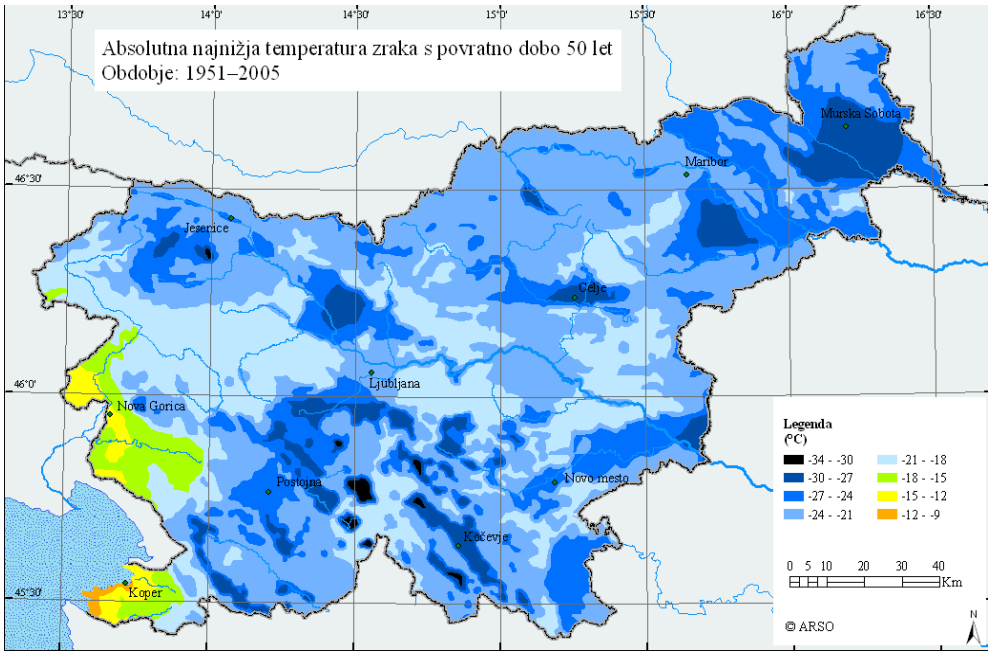
deformacija pri krčenju betona:

fck [MPa]:	**30,00**		
tip cementa [s, n, r]:	**n**		
RH [%]:	**80,00**		
Ac [mm2]:	**8,00E+05**		
u [mm]:	**2000,00**		
t [dnevi]:	**28,00**	...starost betona	
AVTOGENO KRČENJE			
βas (t):	0,65		
εca (t):	3,26E-05		
εca (t=lim.):	5,00E-05		
KRČENJE ZARADI SUŠENJA			
h0 [mm]:	800,00		
kh:	0,70		
ts [dnevi]:	**28,00**	...starost betona ob koncu nege	
βds (t, ts):	0,00		
βRH:	0,76		
αds,1:	4,00		
αds,2:	0,12		
εcd,0:	2,69E-04		
εcd (t, ts):	0,00E+00		
εcd (t=lim.):	1,88E-04		
SKUPNO KRČENJE			
εcs (t):	3,26E-05	*= 0,04 prom*	
εcs (t=lim.):	2,38E-04	*= 0,24 prom*	

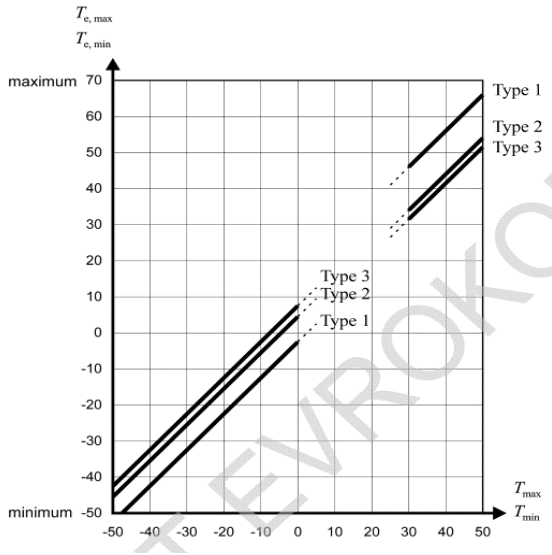
raz. koef		1,20E-05	1/K
nadomestna sprememba temperature			
dT		**-19,86**	**K**

2.3 TEMPERATURA





Tmin	-30,00	°C						
Tmax	40,00	°C						
To	10,00	°C	temperatura mostu ob izdelavi mostu					
Te,min	-20,00	°C						
Te,max	40,00	°C						



			za ležišča		za ležišča, če je znana temperatura ob vgradnji			
dTN,con	-30,00	K	-10,00	K	-20,00	K		
dTN,exp	30,00	K	50,00	K	40,00	K		
dTN	60,00	K						

Road, foot and railway bridges						
Surface Thickness	Type 1		Type 2		Type 3	
	Top warmer than bottom	Bottom warmer than top	Top warmer than bottom	Bottom warmer than top	Top warmer than bottom	Bottom warmer than top
[mm]	k_{sur}	k_{sur}	k_{sur}	k_{sur}	k_{sur}	k_{sur}
unsurfaced	0,7	0,9	0,9	1,0	0,8	1,1
water-proofed [1)]	1,6	0,6	1,1	0,9	1,5	1,0
50	1,0	1,0	1,0	1,0	1,0	1,0
100	0,7	1,2	1,0	1,0	0,7	1,0
150	0,7	1,2	1,0	1,0	0,5	1,0
ballast (750 mm)	0,6	1,4	0,8	1,2	0,6	1,0
[1)] These values represent upper bound values for dark colour						

Type of Deck	Top warmer than bottom	Bottom warmer than top
	$\Delta T_{M,heat}$ (°C)	$\Delta T_{M,cool}$ (°C)
Type 1: Steel deck	18	13
Type 2: Composite deck	15	18
Type 3: Concrete deck: - concrete box girder - concrete beam - concrete slab	 10 15 15	 5 8 8
NOTE 1: The values given in the table represent upper bound values of the linearly varying temperature difference component for representative sample of bridge geometries. NOTE 2: The values given in the table are based on a depth of surfacing of 50 mm for road and railway bridges. For other depths of surfacing these values should be multiplied by the factor k_{sur}. Recommended values for the factor k_{sur} is given in Table 6.2.		

ksur,heat	0,70	zgoraj topleje kot spodaj			
ksur,cool	1,00	spodaj topleje kot zgoraj			
dTM,cool,sur	8,00	K	...	4,00	K
dTM,heat,sur	15,00	K	...	5,25	K
ωN	0,35				
ωM	0,75				
C1	16	5		30	
C2	15	7		30	
C3	-5	-16		-30	
C4	-7	-15		-30	
C5	34	26		30	
C6	33	27		30	
C7	-26	-34		-30	
C8	-27	-33		-30	

2.4 HIDRODINAMIČNI PRITISK

$$q_b = \frac{1}{2} \cdot \rho \cdot v_b^2$$

	ro	1000	kg/m3	
	v	5	m/s	
	qb	12500,00	N/m2	
		12,50	kPa	
debelina		1	m	
linijska obtežba		12,50	kN/m1	

2.5 PROMET – LM1

Model LM1 - dve osi



w [m]:	6,00
n1:	2,00
w 1 [m]:	3,00
ostanek [m]:	0,00

		*na os	*na kolo	*površinsko
pas	αQi:	αQi × Qik [kN]	αQi × Qik/2 [kN]	αQi × qik [kN/m2]
(1)	1,00	300,00	150,00	9,00
(2)	1,00	200,00	100,00	2,50
(3)	1,00	100,00	50,00	2,50
(>3)	1,00	0,00	0,00	2,50
(ostanek)	1,00	0,00	0,00	2,50
(hodniki)	1,00	0,00	0,00	2,50

Površinska obtežba naj bo postavljena tam, kjer je njen vpliv neugoden, gledano vzdolžno in prečno.

Za globalne učinke se lahko pri mostovih, daljših od 10 m, tandem na posameznem pasu združi v eno os, s tem da je tedaj sila dvojna, tj. seštevek obeh osi.

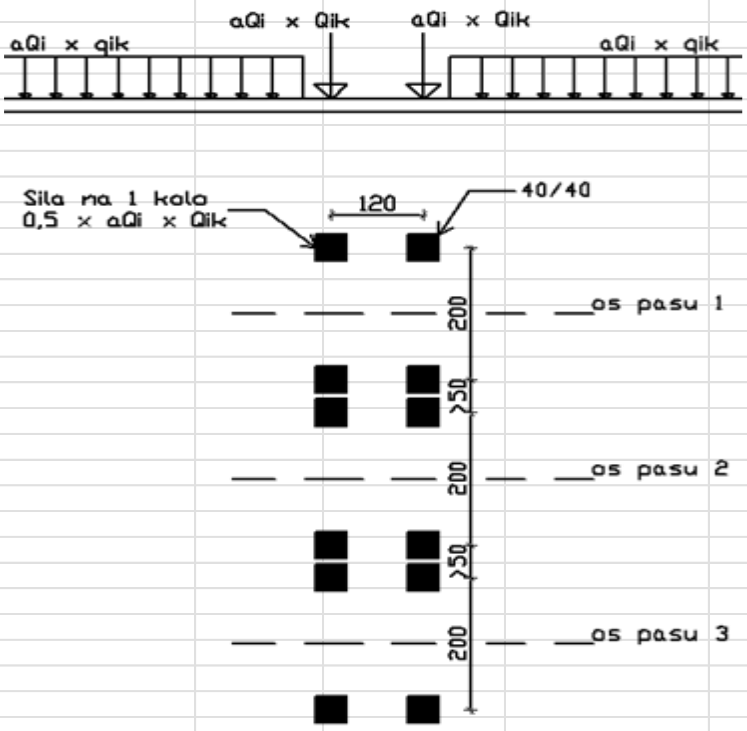
V primeru mostu iz dveh preklad; upošteva se ju kot eno, pri čemer je njena širina enaka vsoti obeh.

Prilagotitveni faktor za Qik in qik:

αQi: 1,00 > 0,80

(v splošnem za vsak pas različni)

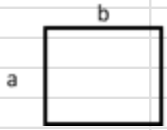
Shema obtežbe LM1:



Raznos kolesne sile:

a [cm]: 40,00

b [cm]: 40,00



Sestav:	h [cm]	Raznos [°]	da = db [cm]	
Sloji nad ploščo:	8,00	45,00	16,00	
AB plošča:	80,00	45,00	80,00	*pri h/2!

aeff [cm]: 136,00

beff [cm]: 136,00

2.6 KOMBINIRANJE

stalna projektna stanja (osnovne komb.): $\sum_{j\geq 1}\gamma_{G,j}\,G_{k,j}+\gamma_{Q,1}\,Q_{k,1}+\sum_{i>1}\gamma_{Q,i}\,\Psi_{0,i}\,Q_{k,i}$

potresna projektna stanja: $\sum_{j\geq 1}G_{k,j}+A_{\mathrm{Ed}}+\sum_{i\geq 1}\Psi_{2,i}\,Q_{k,i}$

vrsta spremenljivega vpliva	γ_Q
prometna obtežba	1.35 ali 0
temperaturni vplivi	1.5 ali 0
krčenje betona	1.5 ali 0
obtežba vetra	1.5 ali 0

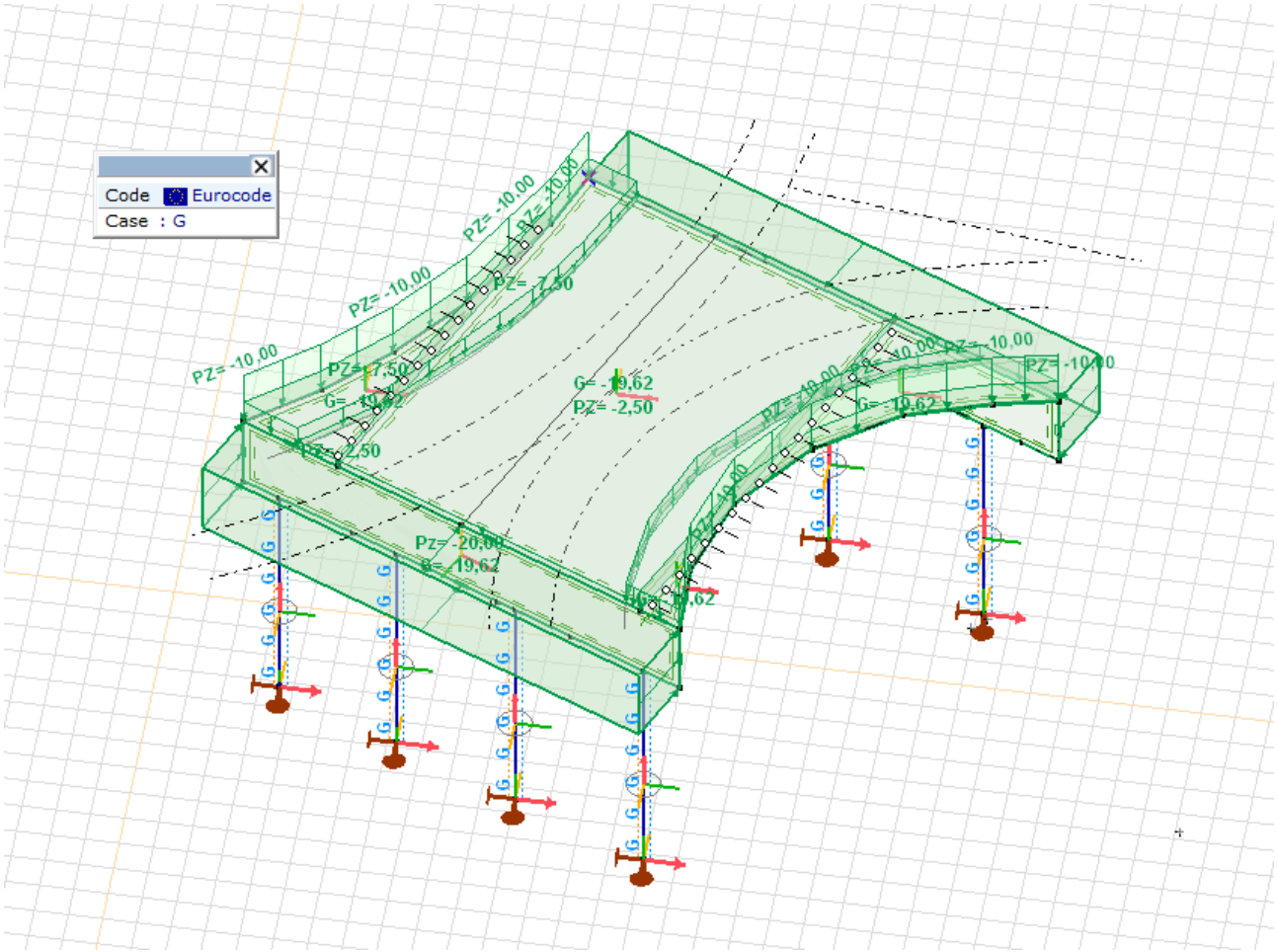
vrsta spremenljivega vpliva	ψ_0	ψ_1	ψ_2
Prometna obtežba – skupina gr1a:			
LM1-TS	0.75	0.75	0.2 / 0
LM1-UDL	0.4	0.4	0.2 / 0
hodniki	0.4	0.4	0.2 / 0
Prometna obtežba – skupina gr1b:			
LM2	0	0.75	0
Prometna obtežba – skupina gr2:			
LM1-TS (ψ_1)	0	0	0
LM1-UDL (ψ_1)	0	0	0
zavorne sile/sile speljevanja	0	0	0
temperaturni vplivi	0.6	0.6	0.5
krčenje betona	0.5	0.4	0.2
obtežba vetra	0.6	0.2	0

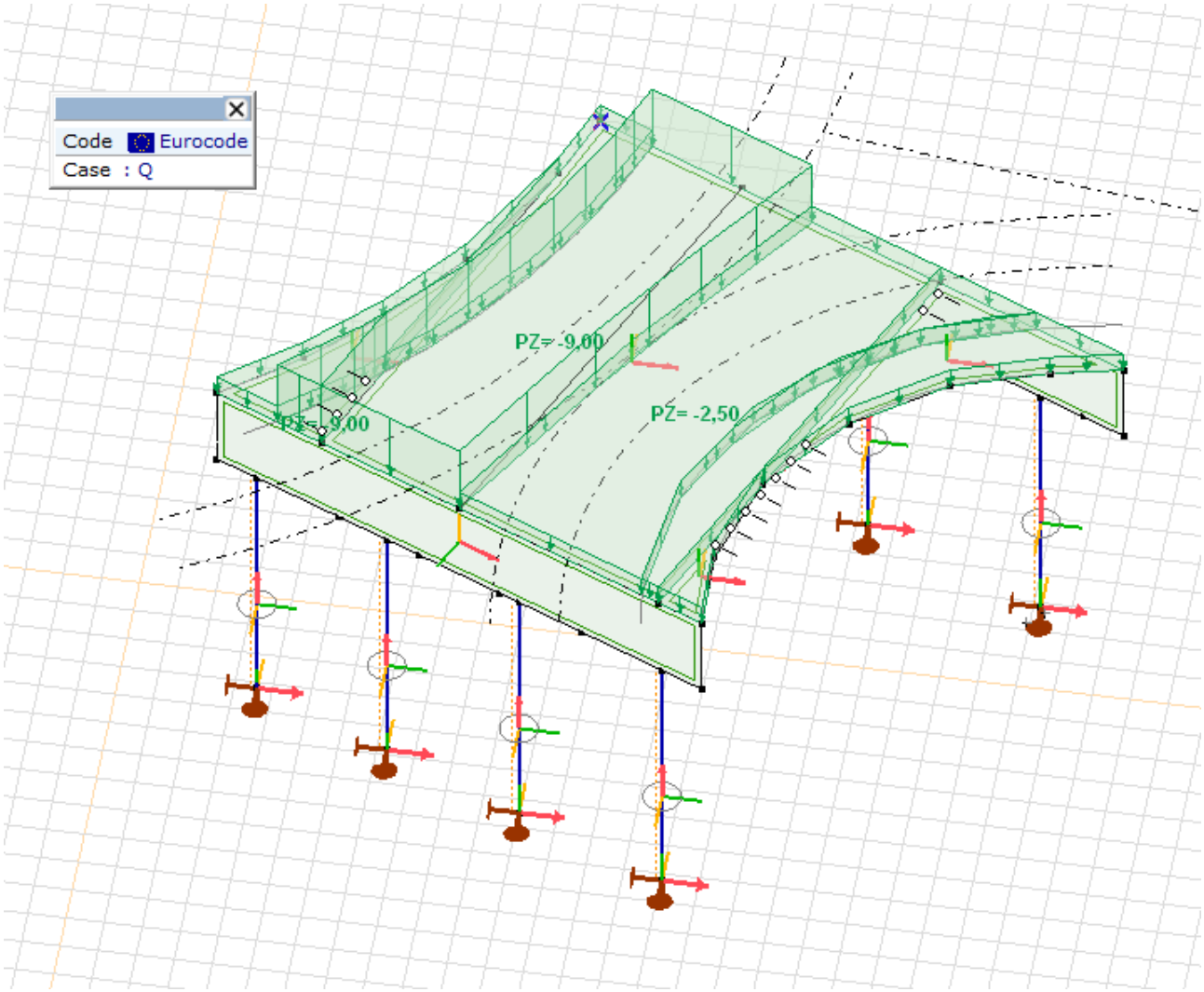
3 OBTEŽBA NA MODELU

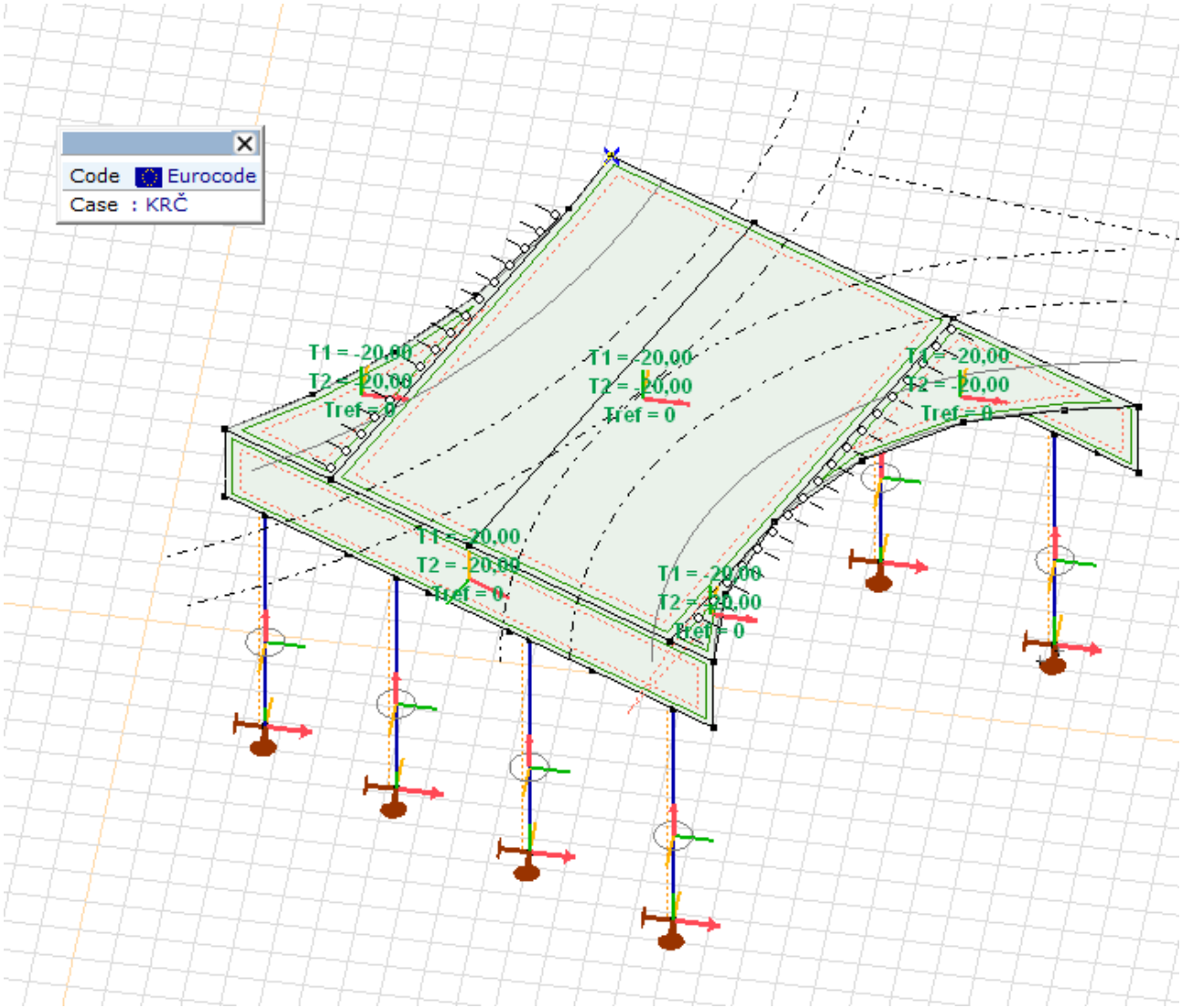
Load groups (Eurocode)

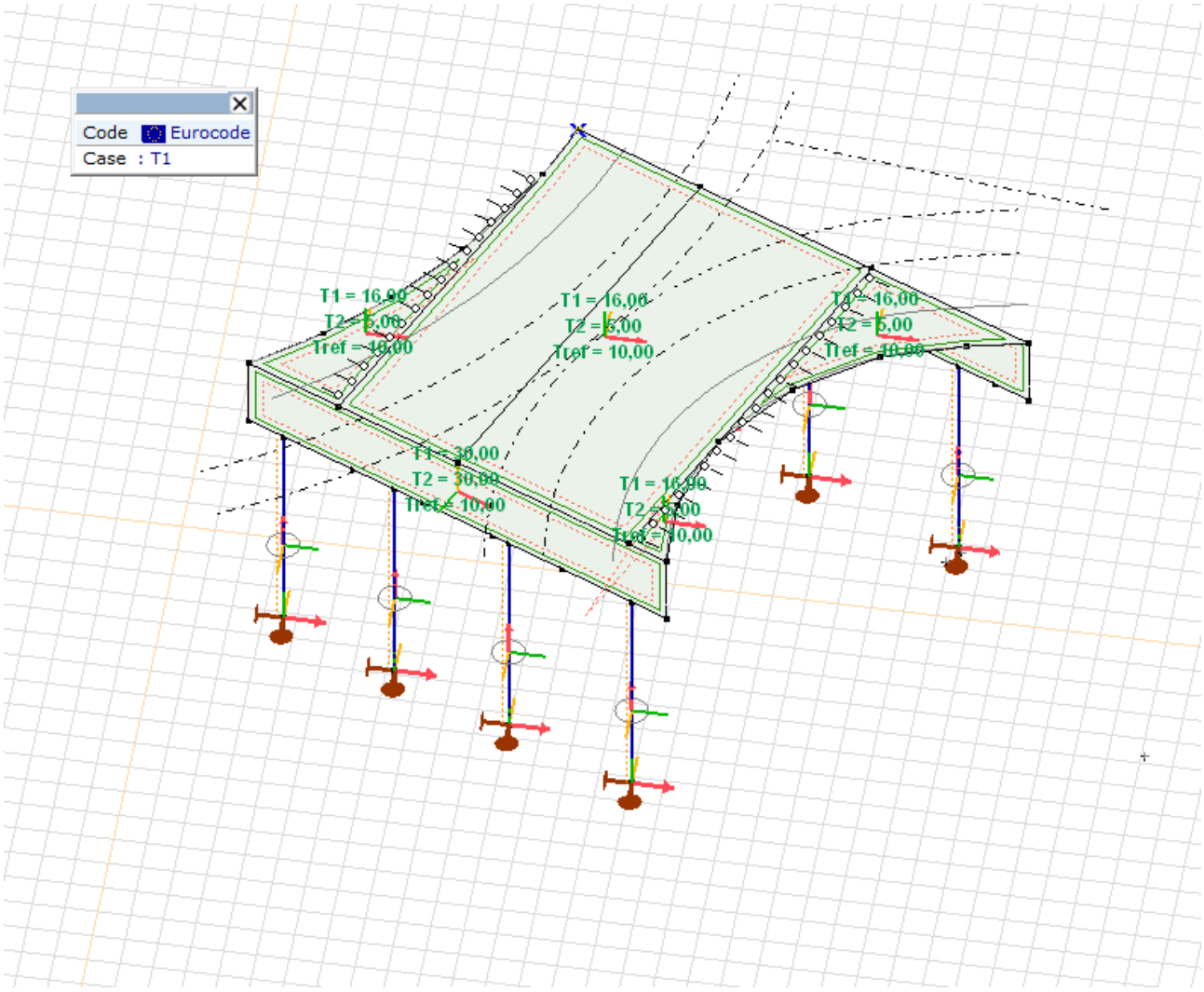
	Group	Type	$\gamma_{G,sup}$	$\gamma_{G,inf}$	ξ	γ	Ψ_0	Ψ_1	Ψ_2
1	G	Permanent	1,350	1,000	1,000				
2	S	Variable				1,500	0,500	0,200	0
3	krč	Variable				0,900	0,500	0,400	0,200
4	T	Variable				0,900	0,600	0,600	0,500
5	tok	Variable				1,500	1,000	1,000	1,000
6	LM1	Moving				1,350	0,750	0,750	0,200
7	LM1-surf	Variable				1,350	0,750	0,750	0,200
8	Q	Variable				1,350	0,750	0,750	0,200
9	LM2	Moving				1,350	0,750	0,750	0,200

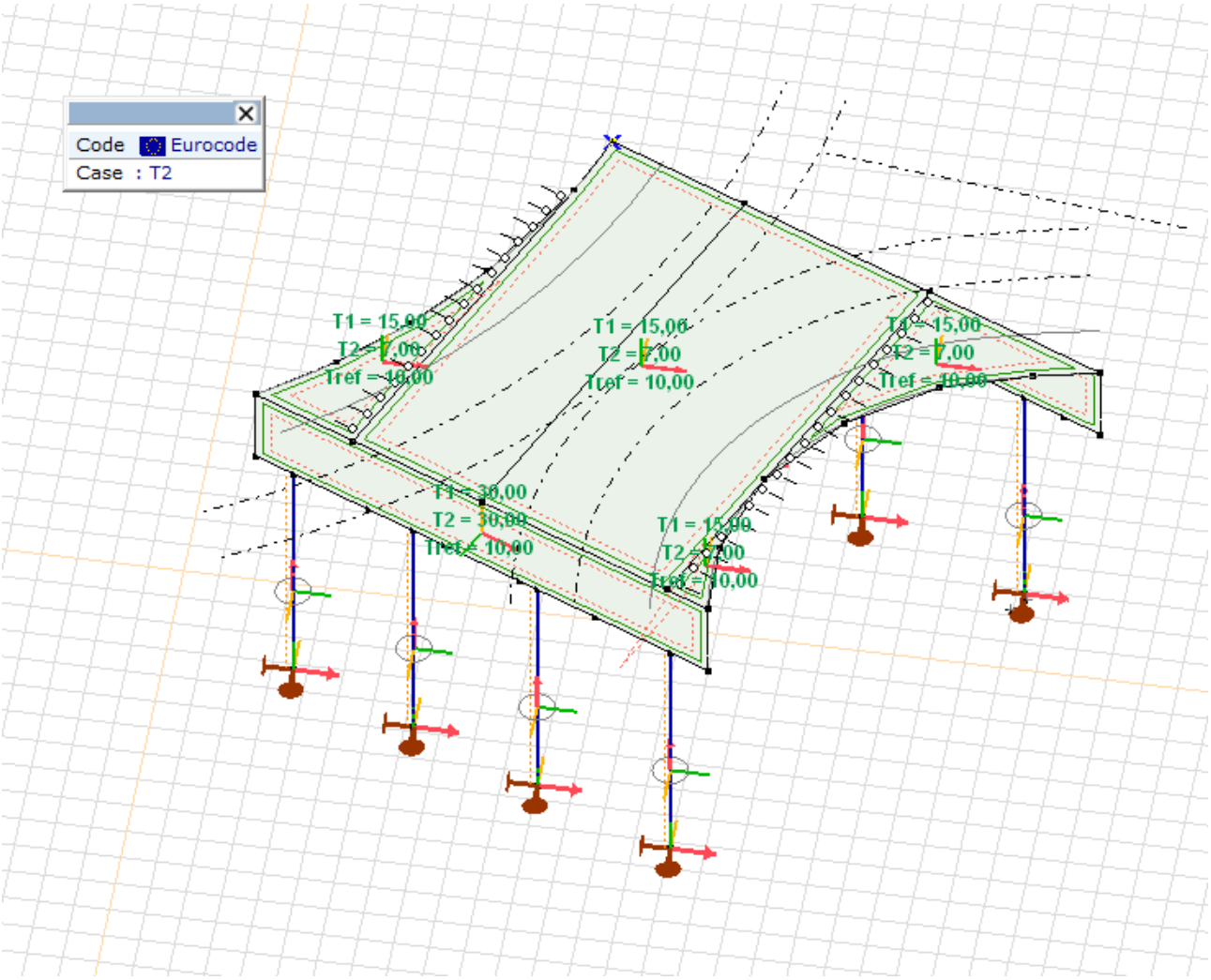
	Name	Group	Group type
1	G	G	Permanent
2	LM11-001	LM1	Moving
3	LM11-002	LM1	Moving
4	LM11-003	LM1	Moving
5	LM11-004	LM1	Moving
6	LM11-005	LM1	Moving
7	LM11-006	LM1	Moving
8	LM11-007	LM1	Moving
9	LM11-008	LM1	Moving
10	LM11-009	LM1	Moving
11	LM11-010	LM1	Moving
12	LM11-011	LM1	Moving
13	LM11-012	LM1	Moving
14	LM11-013	LM1	Moving
15	LM12-001	LM12	Moving
16	LM12-002	LM12	Moving
17	LM12-003	LM12	Moving
18	LM12-004	LM12	Moving
19	LM12-005	LM12	Moving
20	LM12-006	LM12	Moving
21	LM12-007	LM12	Moving
22	LM12-008	LM12	Moving
23	LM12-009	LM12	Moving
24	LM12-010	LM12	Moving
25	LM12-011	LM12	Moving
26	LM12-012	LM12	Moving
27	LM12-013	LM12	Moving
28	LM13-001	LM12	Moving
29	LM13-002	LM12	Moving
30	LM13-003	LM12	Moving
31	LM13-004	LM12	Moving
32	LM13-005	LM12	Moving
33	LM13-006	LM12	Moving
34	LM13-007	LM12	Moving
35	LM13-008	LM12	Moving
36	LM13-009	LM12	Moving
37	LM13-010	LM12	Moving
38	LM13-011	LM12	Moving
39	LM13-012	LM12	Moving
40	LM13-013	LM12	Moving
41	Q	Q	Variable
42	KRČ	KRČ	Variable
43	T1	T	Variable
44	T2	T	Variable
45	T3	T	Variable
46	T4	T	Variable
47	T5	T	Variable
48	T6	T	Variable
49	T7	T	Variable
50	T8	T	Variable

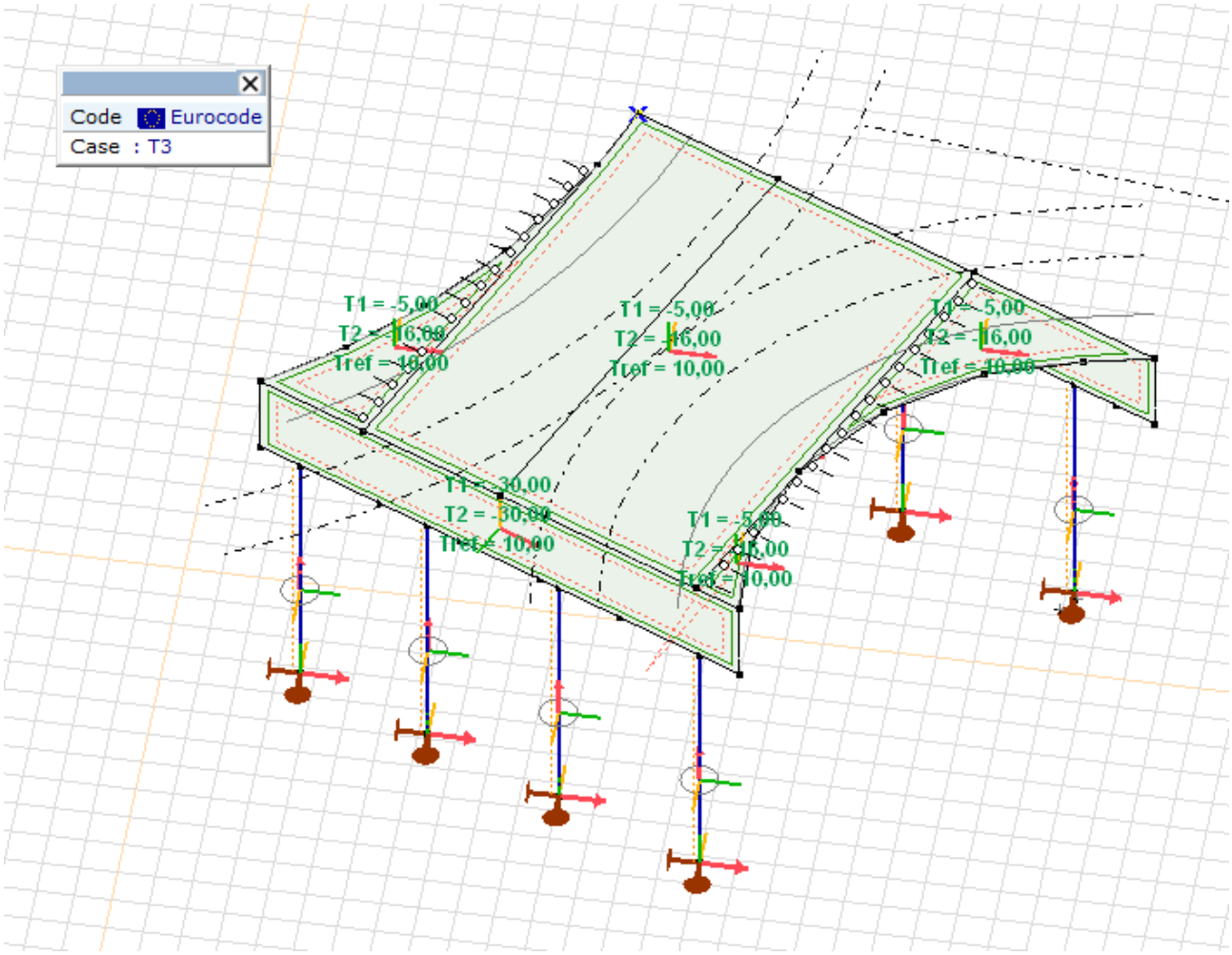

Code Eurocode
Case : G
PZ= -10,00
PZ= -7,50
G= -19,62
PZ= -2,50
Pz= -20,00

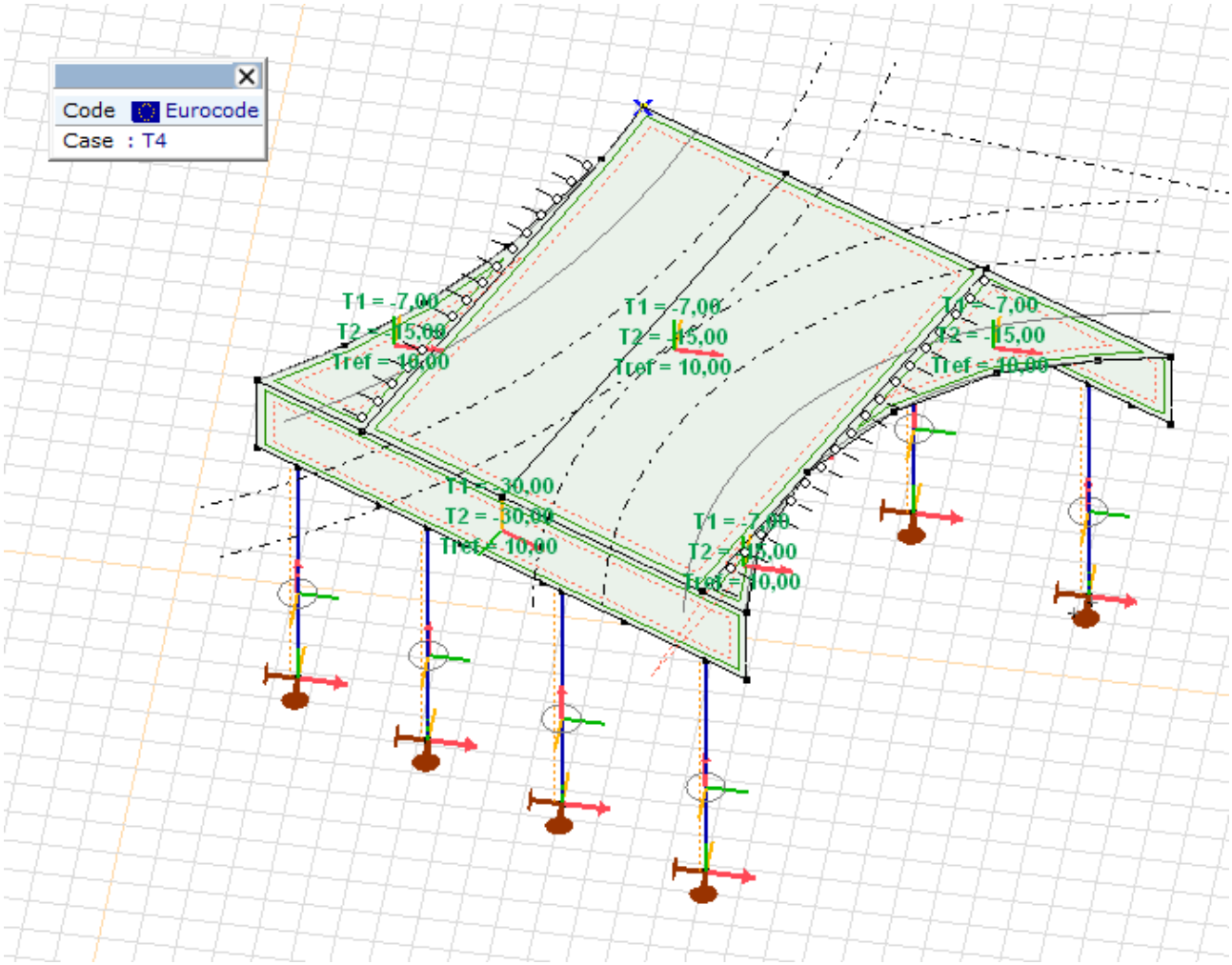

Code Eurocode
Case : Q
PZ= -9,00
PZ= -9,00
PZ= -2,50

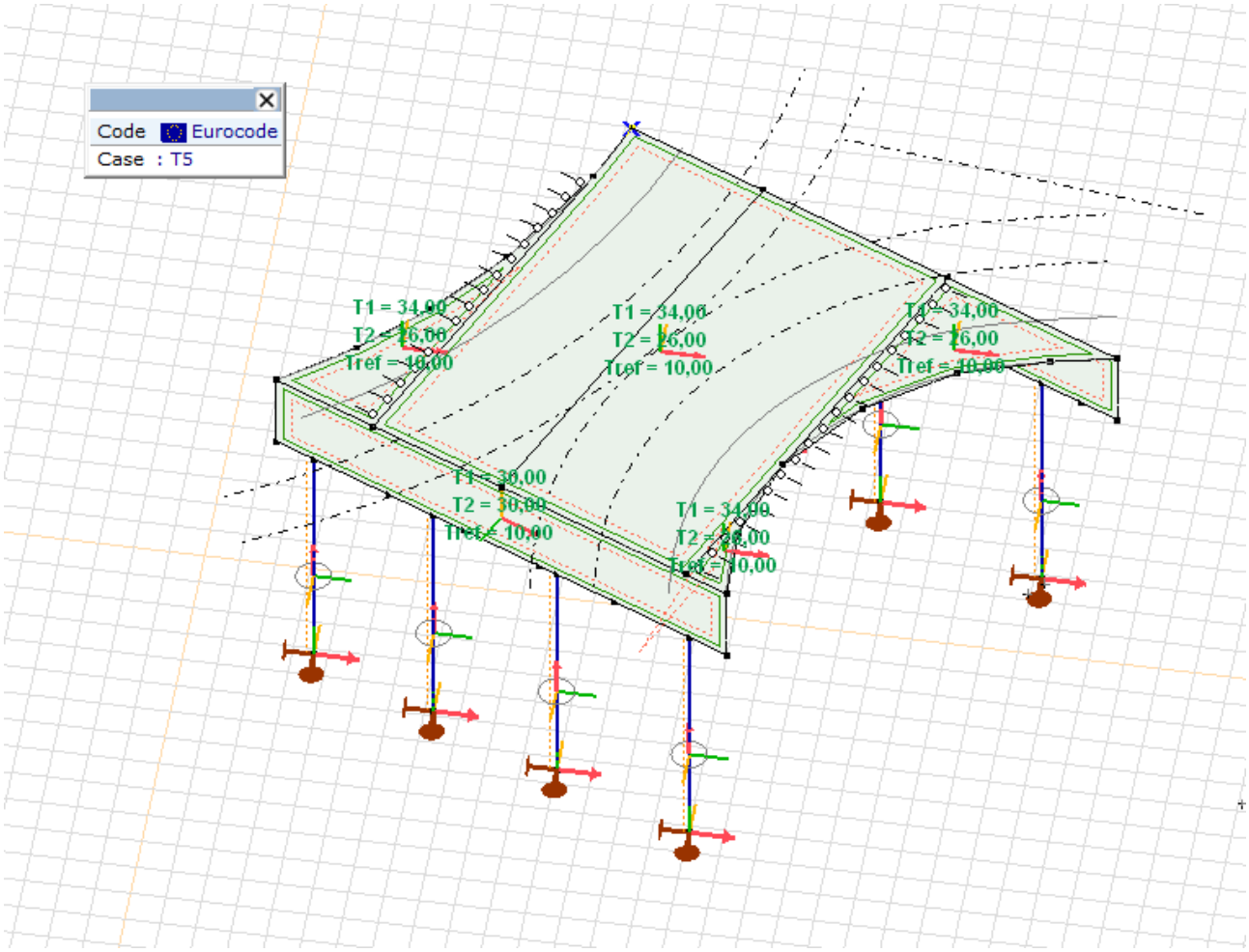

Code Eurocode
Case : KRČ
T1 = -20,00
T2 = -20,00
Tref = 0
T1 = -20,00
T2 = -20,00
Tref = 0
T1 = -20,00
T2 = -20,00
Tref = 0
T1 = -20,00
T2 = -20,00
Tref = 0
T1 = -20,00
T2 = -20,00
Tref = 0

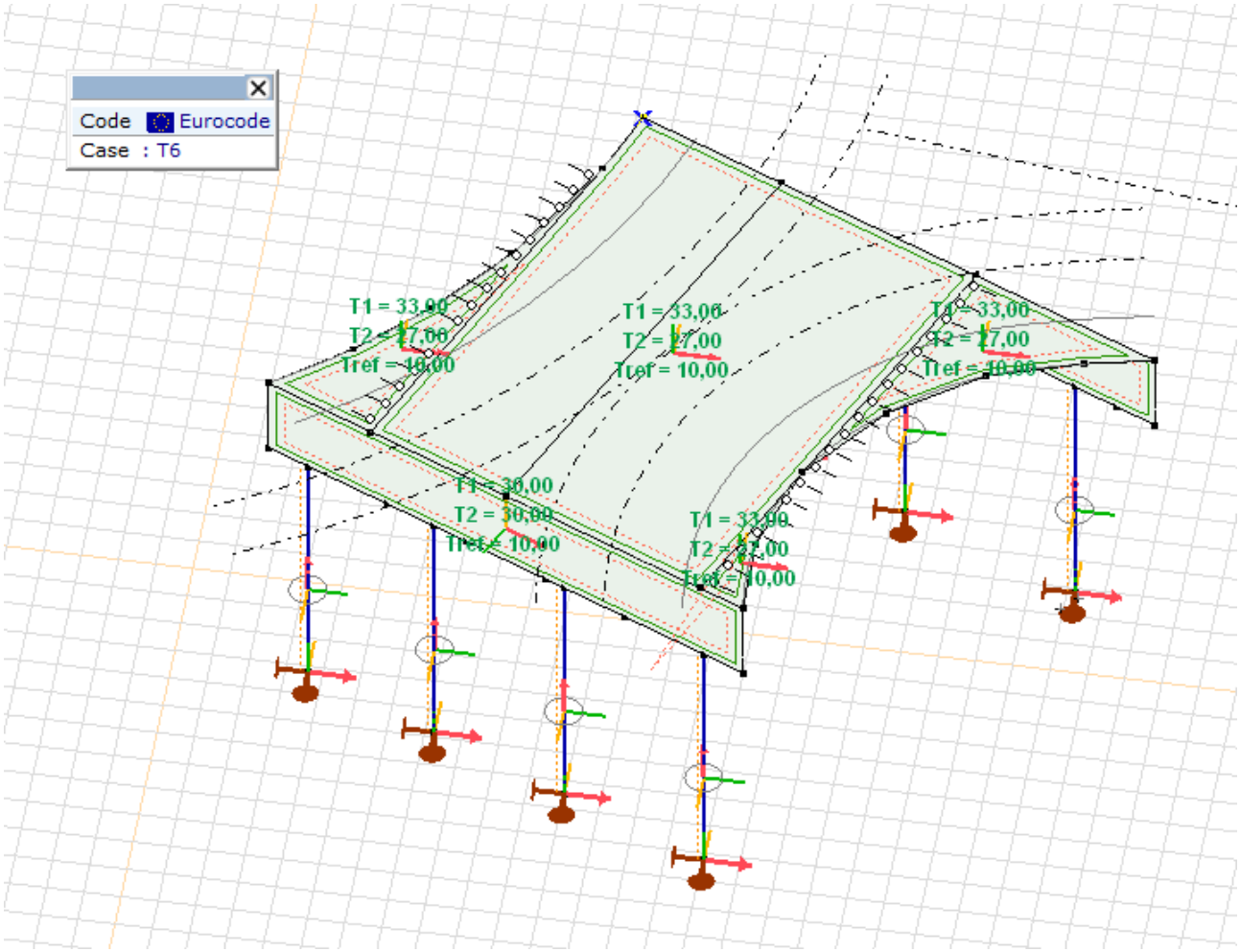

Code Eurocode
Case : T1
T1 = 16,00
T2 = 5,00
Tref = 10,00
T1 = 16,00
T2 = 5,00
Tref = 10,00
T1 = 16,00
T2 = 5,00
Tref = 10,00
T1 = 30,00
T2 = 30,00
Tref = 10,00
T1 = 16,00
T2 = 5,00
Tref = 10,00

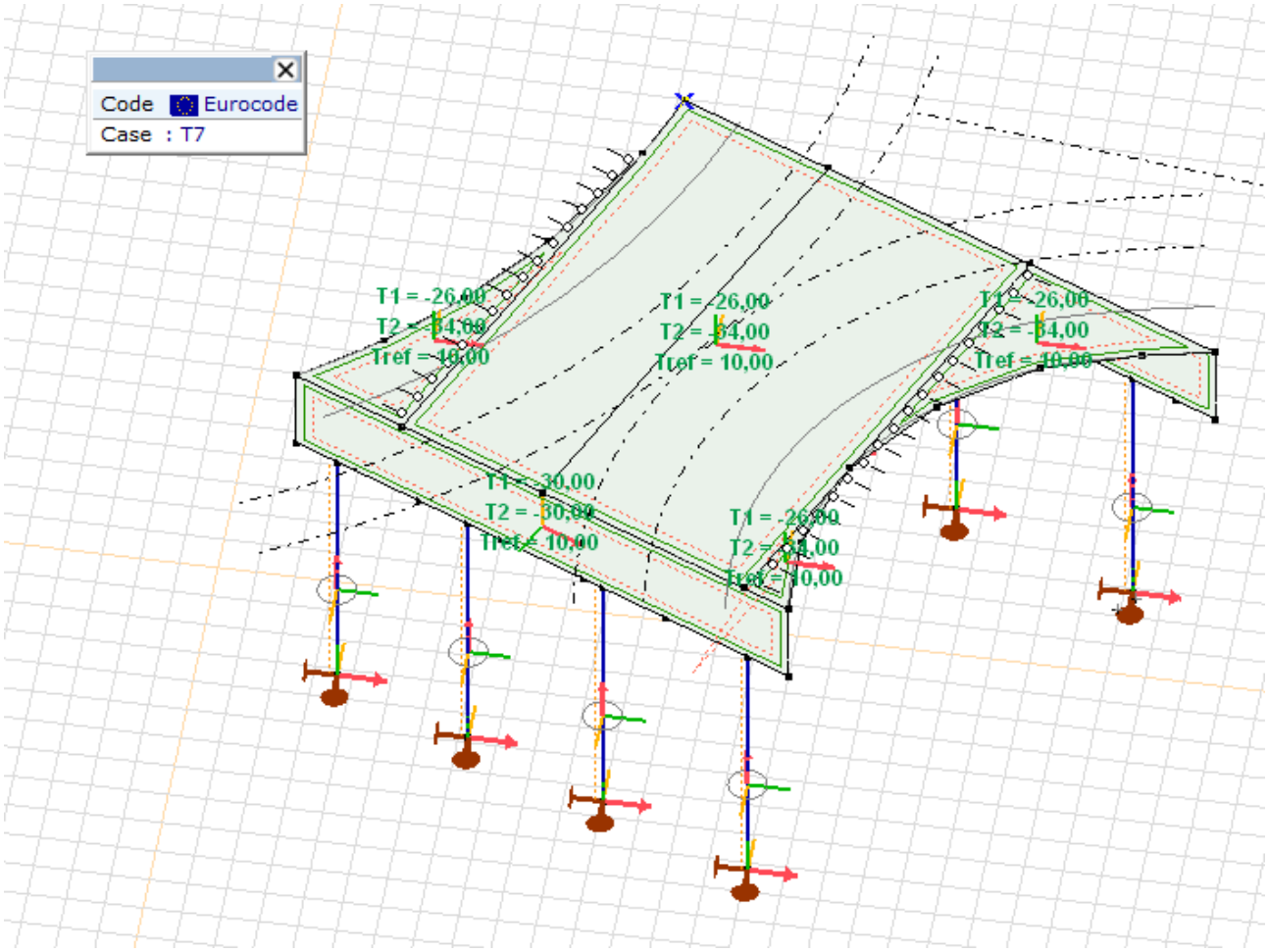

Code Eurocode
Case : T2
T1 = 15,00
T2 = 7,00
Tref = 10,00
T1 = 15,00
T2 = 7,00
Tref = 10,00
T1 = 15,00
T2 = 7,00
Tref = 10,00
T1 = 30,00
T2 = 30,00
Tref = 10,00
T1 = 15,00
T2 = 7,00
Tref = 10,00

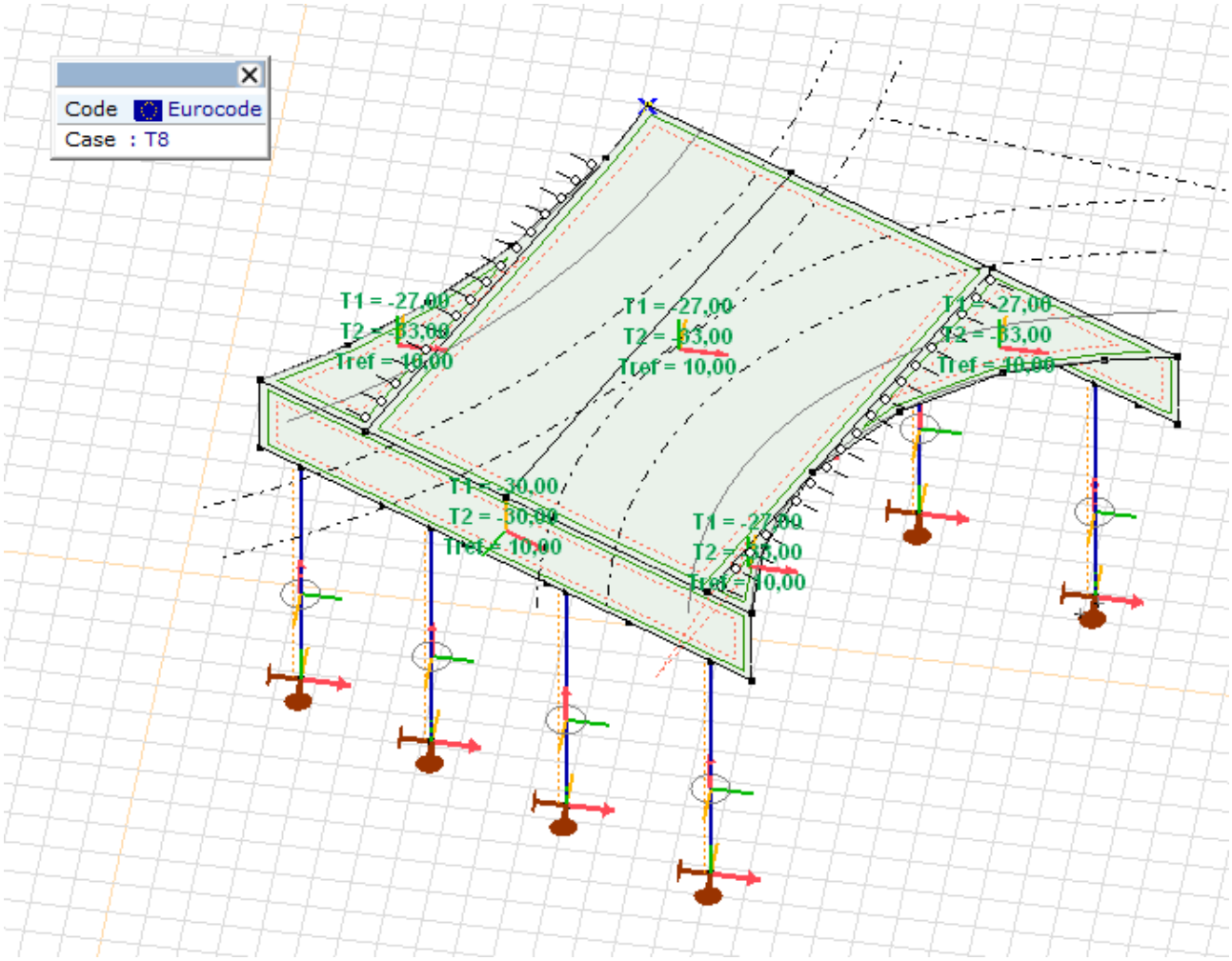

Code Eurocode
Case : T3
T1 = -5,00
T2 = 16,00
Tref = 10,00
T1 = -5,00
T2 = 16,00
Tref = 10,00
T1 = -5,00
T2 = 16,00
Tref = 10,00
T1 = -30,00
T2 = 30,00
Tref = 10,00
T1 = -5,00
T2 = 16,00
Tref = 10,00

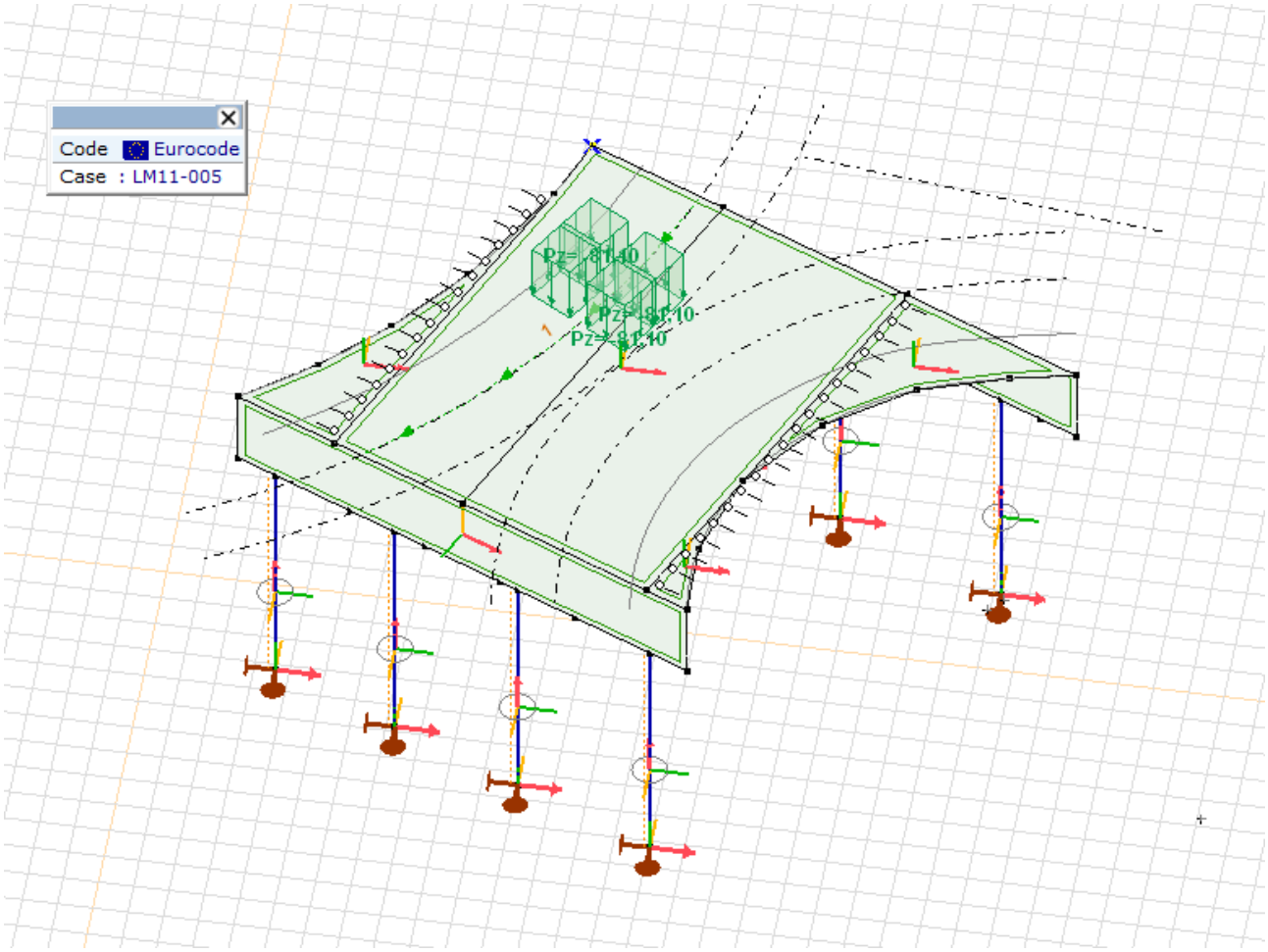

Code Eurocode
Case : T4
T1 = -7,00
T2 = 15,00
Tref = 10,00
T1 = -7,00
T2 = 15,00
Tref = 10,00
T1 = -7,00
T2 = 15,00
Tref = 10,00
T1 = -30,00
T2 = 30,00
Tref = 10,00
T1 = -7,00
T2 = 15,00
Tref = 10,00

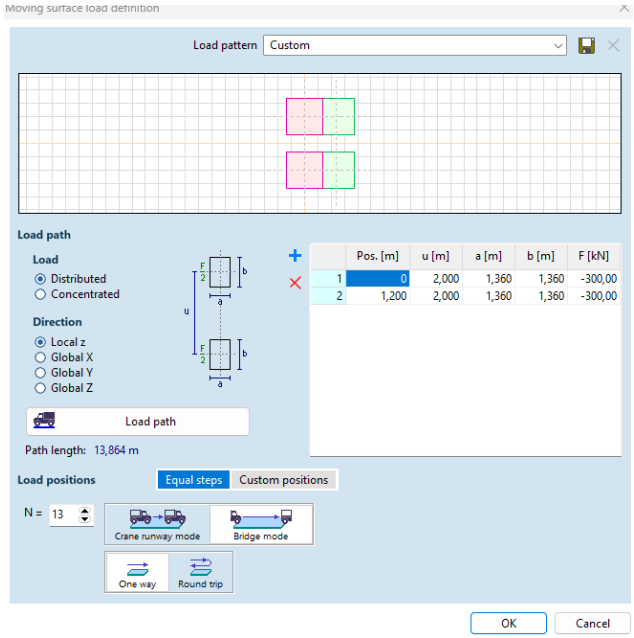

Code Eurocode
Case : T5
T1 = 34,00
T2 = 16,00
Tref = 10,00
T1 = 34,00
T2 = 16,00
Tref = 10,00
T1 = 34,00
T2 = 16,00
Tref = 10,00
T1 = 34,00
T2 = 16,00
Tref = 10,00
T1 = 34,00
T2 = 16,00
Tref = 10,00

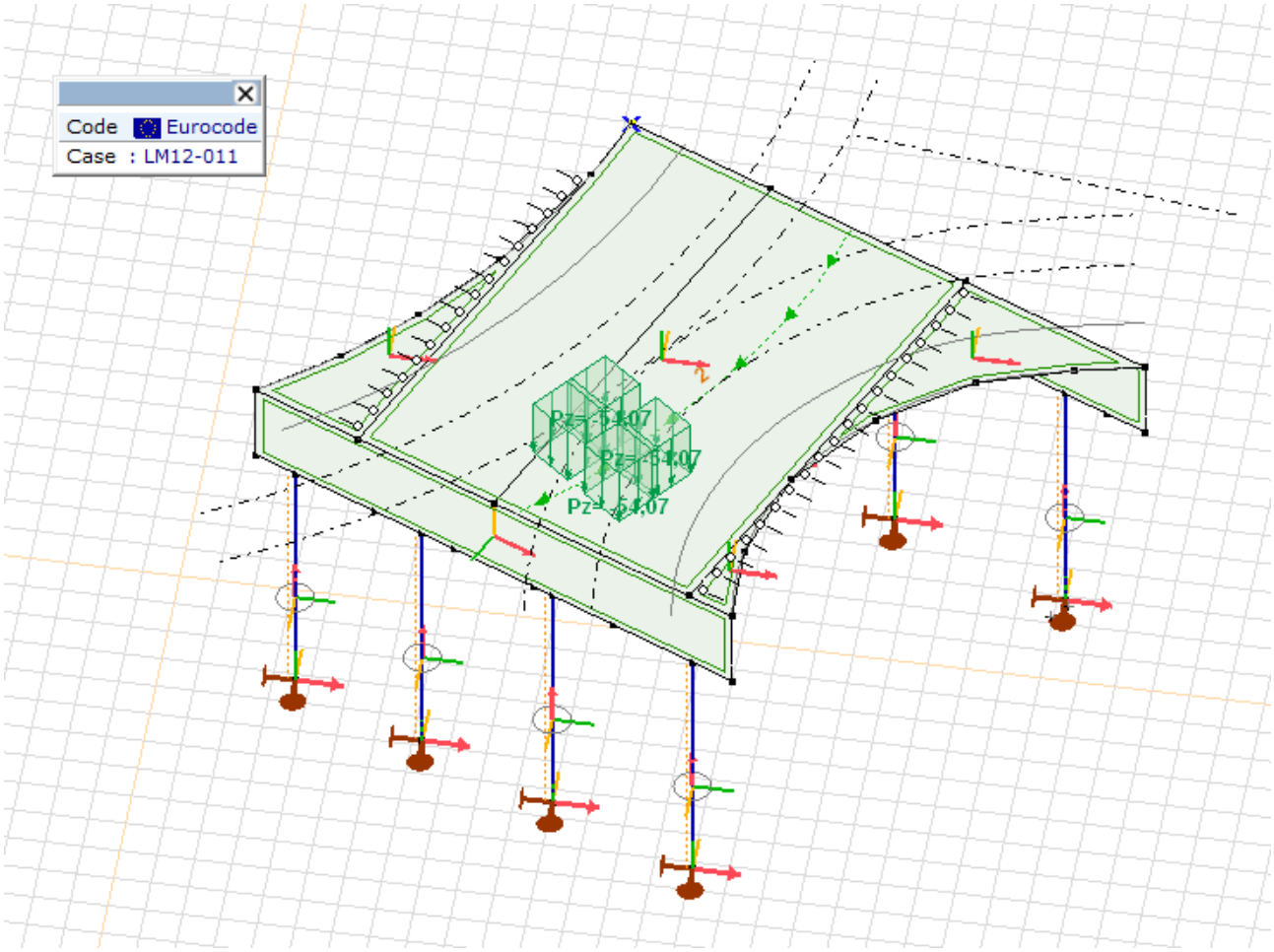

Code Eurocode
Case : T6
T1 = 33,00
T2 = 27,00
Tref = 10,00
T1 = 33,00
T2 = 27,00
Tref = 10,00
T1 = 33,00
T2 = 27,00
Tref = 10,00
T1 = 30,00
T2 = 30,00
Tref = 10,00
T1 = 33,00
T2 = 27,00
Tref = 10,00

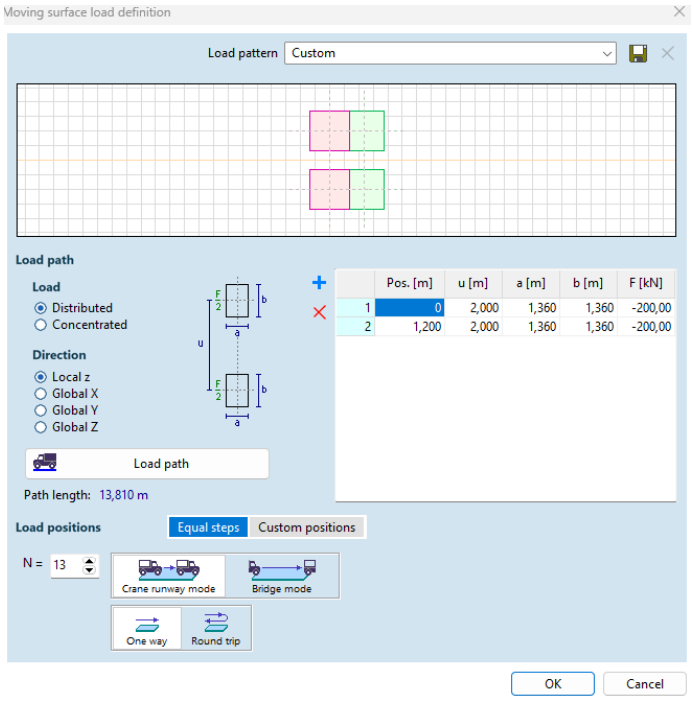

Code Eurocode
Case : T7
T1 = -26,00
T2 = -34,00
Tref = 10,00
T1 = -26,00
T2 = -34,00
Tref = 10,00
T1 = -26,00
T2 = -34,00
Tref = 10,00
T1 = -30,00
T2 = -30,00
Tref = 10,00
T1 = -26,00
T2 = -34,00
Tref = 10,00

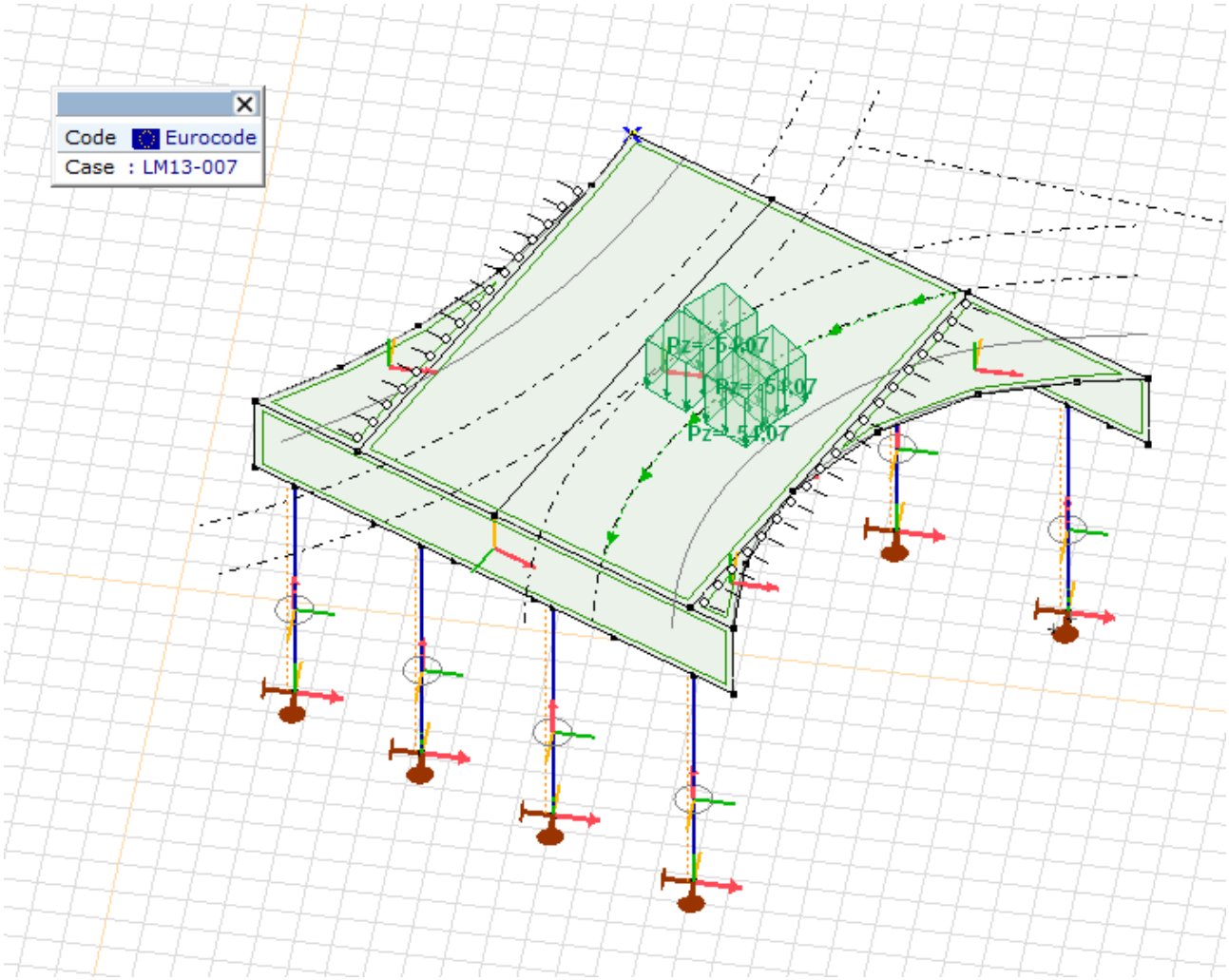

Code Eurocode
Case : T8
T1 = -27,00
T2 = -33,00
Tref = 10,00
T1 = -27,00
T2 = -33,00
Tref = 10,00
T1 = -27,00
T2 = -33,00
Tref = 10,00
T1 = -30,00
T2 = -30,00
Tref = 10,00
T1 = -27,00
T2 = -33,00
Tref = 10,00

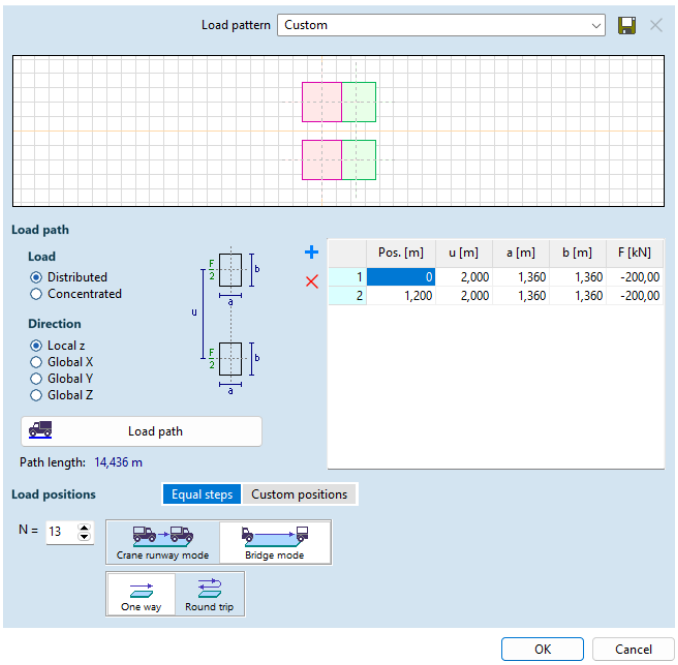

Code Eurocode
Case : LM11-005
Pz= -81,40
Pz= -81,40
Pz= -81,40


Moving surface load definition
Load pattern Custom
Load path
Load
Distributed
Concentrated
Direction
Local z
Global X
Global Y
Global Z
Load path
Path length: 13,864 m
Load positions
Equal steps
Custom positions
N = 13
Crane runway mode
Bridge mode
One way
Round trip
Pos. [m] u [m] a [m] b [m] F [kN]
1 0 2,000 1,360 1,360 -300,00
2 1,200 2,000 1,360 1,360 -300,00
OK
Cancel


Code Eurocode
Case : LM12-011
Pz= -1,07
Pz= -1,07
Pz= -1,07


Moving surface load definition
Load pattern
Custom
Load path
Load
Distributed
Concentrated
Direction
Local z
Global X
Global Y
Global Z
Load path
Path length: 13,810 m
Load positions
Equal steps
Custom positions
N = 13
Crane runway mode
Bridge mode
One way
Round trip
Pos. [m] u [m] a [m] b [m] F [kN]
1 0 2,000 1,360 1,360 -200,00
2 1,200 2,000 1,360 1,360 -200,00
OK
Cancel

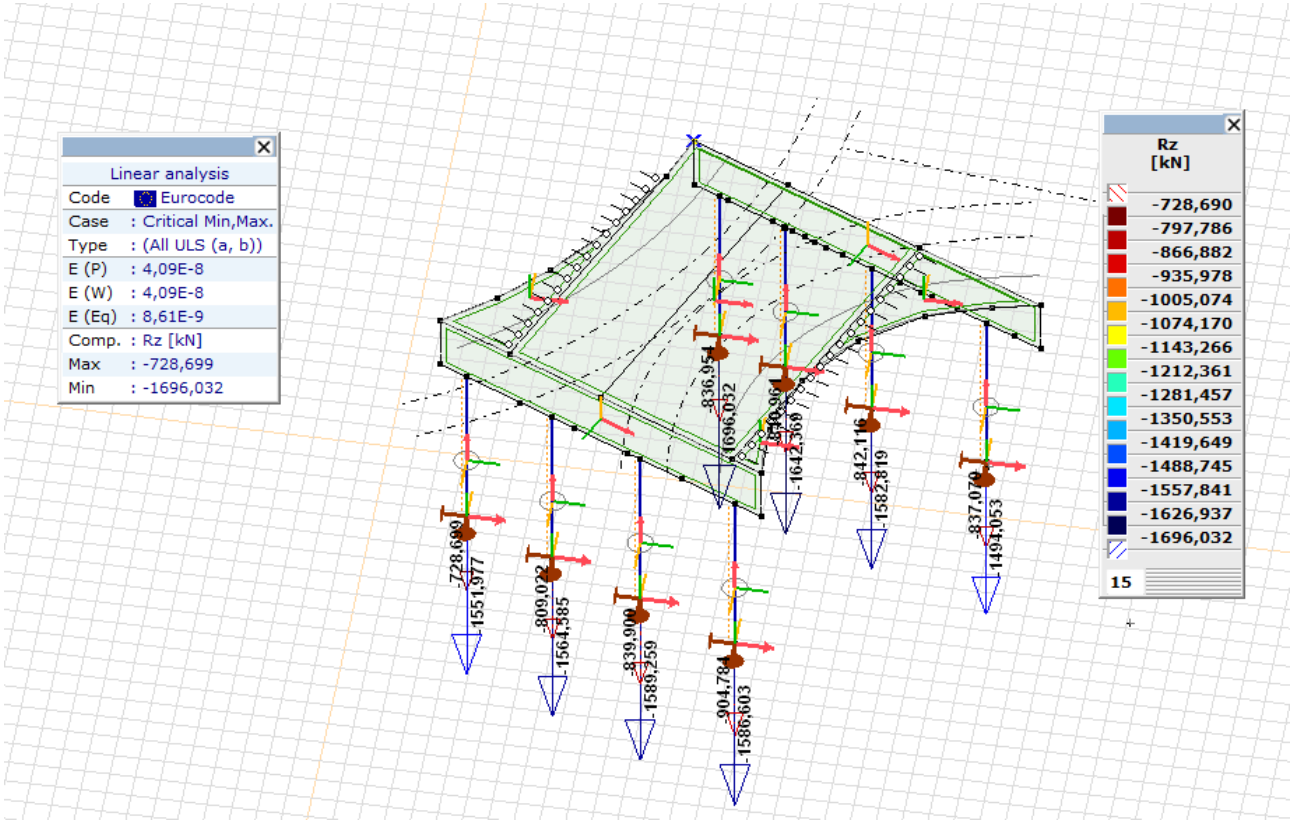

Code Eurocode
Case : LM13-007
Pz= -5,407
Pz= -5,407
Pz= -5,407


Load pattern
Custom
Load path
Load
Distributed
Concentrated
Direction
Local z
Global X
Global Y
Global Z
Load path
Path length: 14,436 m
Load positions
Equal steps
Custom positions
N = 13
Crane runway mode
Bridge mode
One way
Round trip
Pos. [m] u [m] a [m] b [m] F [kN]
1 0 2,000 1,360 1,360 -200,00
2 1,200 2,000 1,360 1,360 -200,00
OK
Cancel

4 ANALIZA

4.1 PILOTI

4.1.1 VERTIKALNE REAKCIJE



Nosilnost na peti pilota Rb;d:	1687.6	kN
Nosilnost pilota skupaj Rc;d:	2182.0	kN

4.1.2 BOČNE REAKCIJE

Niso relevantne v končnem stanju; gradnja mora biti takšna, da v času gradnje ni obremenitev prečno na pilote.

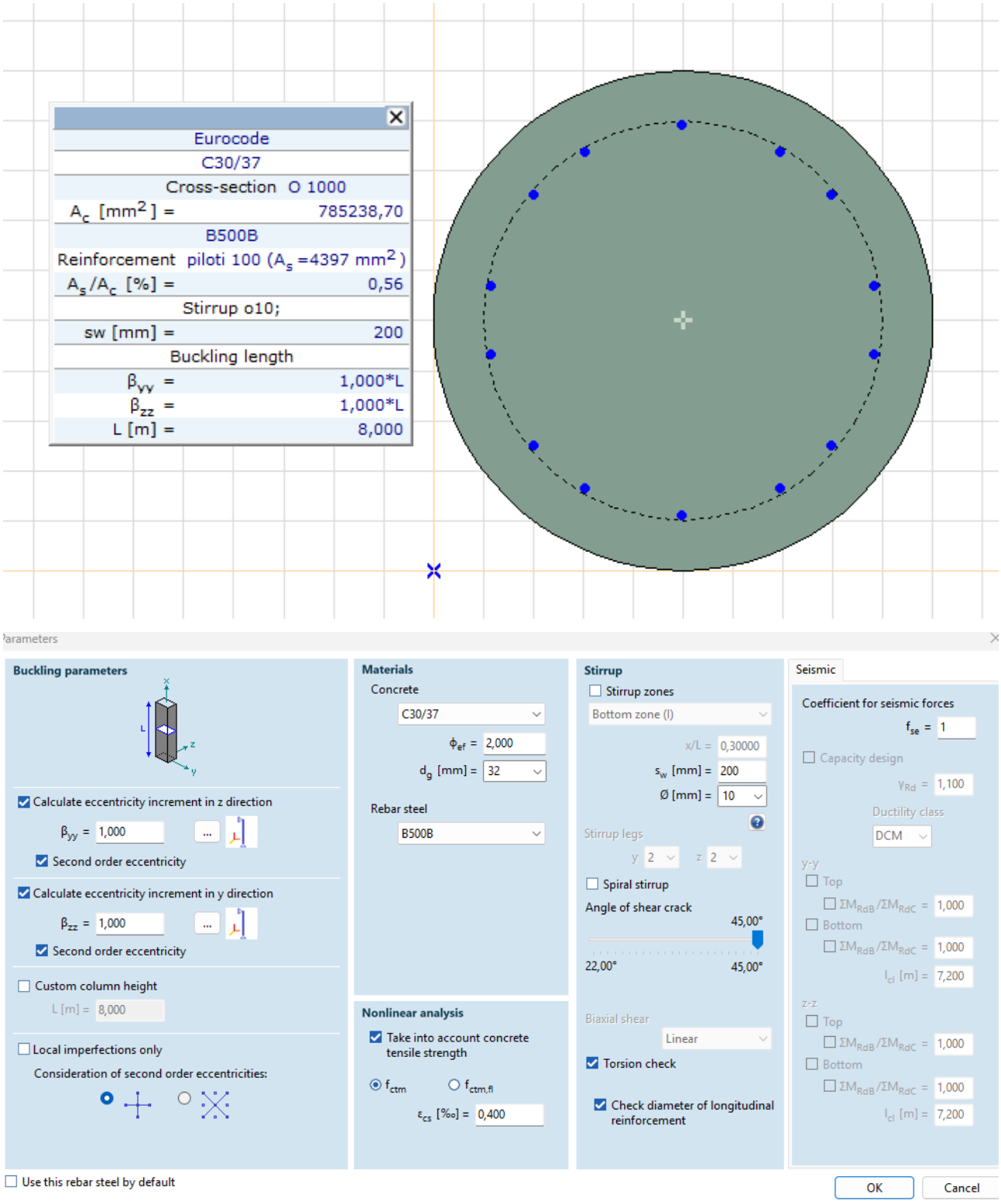
4.1.3 VERTIKALNA NOSILNOST PILOTOV

Nosilnost pod konico:				
Premer	B	1,00	m	
Nedr.str.trdnost	cu	322,00	kPa	
Površina konice	Ab	0,79	m2	
Vpetje v nos.sloj		1,50	m	
Faktor nosilnosti	Nc	9,00	pri vpetju vsaj 3,00 x premer	
Faktor nosilnosti	Nc	6,00	pri komanjšnjem naleganju	
Dejansko vpetje		1,50	x premer	
Dejanski faktor	Nc	7,50		
Nosilnost pod konico	qb	2415,00	kPa	
	Rb	1896,74	kN	
	Rbd	1354,81	kN	

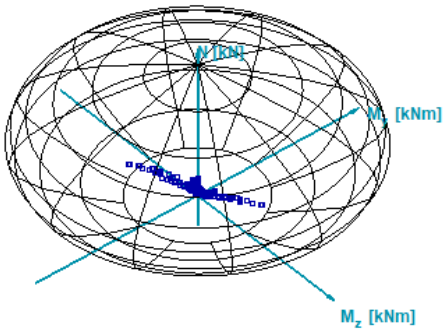
Nosilnost ob plašču:				
Premer	B	1,00	m	
	z glava	3,00	m	
	z noga	11,00	m	
	dz = L	8,00	m	
Površina plašča	As	25,13	m2	
Spec.teža zemljine	Yz	19,00	kN/m3	
Strižni kot	ϕ	30,00	°	
Razmerje	δ/ϕ	1,00		
Kot trenja z zemljino	δ	30,00	°	
Koeficient mirnih pritiskov	Ko	0,50		
Razmerje	K / Ko	1,50	... 1,50 - običajno	
			... 1,00 - zelo mehke zemljine	
Koeficient pritiskov	K	0,75		
Povprečne vert.napetosti	σv',povpr	133,00	kPa	
Nosilnost ob plašču (vtis.)	qs,vtis	57,59	kPa	
	Rs,vtis	1447,41	kN	
Nosilnost ob plašču (uvrt.)	qs,uvrt	40,31	kPa	
	Rs,uvrt	1013,19	kN	
		723,71	kN	

materiala v stiku	δ / φ'
pesek – hrapav beton	1,0
pesek – gladek beton	0,8 – 1,0
pesek – valovita pločevina	0,7 – 0,9
pesek – gladka pločevina	0,5 – 0,9
pesek – les	0,8 – 0,9

4.1.4 ARMATURA

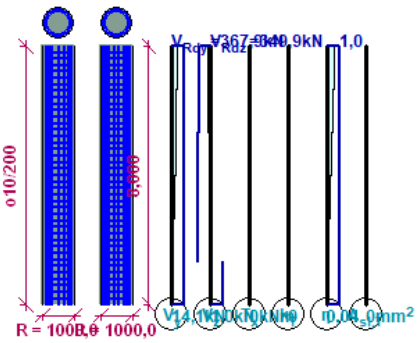


Eurocode	
C30/37	
Cross-section O 1000	
A_c [mm^2] =	785238,70
B500B	
Reinforcement piloti 100 (A_s =4397 mm^2)	
A_s/A_c [%] =	0,56
Stirrup o10;	
sw [mm] =	200
Buckling length	
β_{yy} =	1,000*L
β_{zz} =	1,000*L
L [m] =	8,000



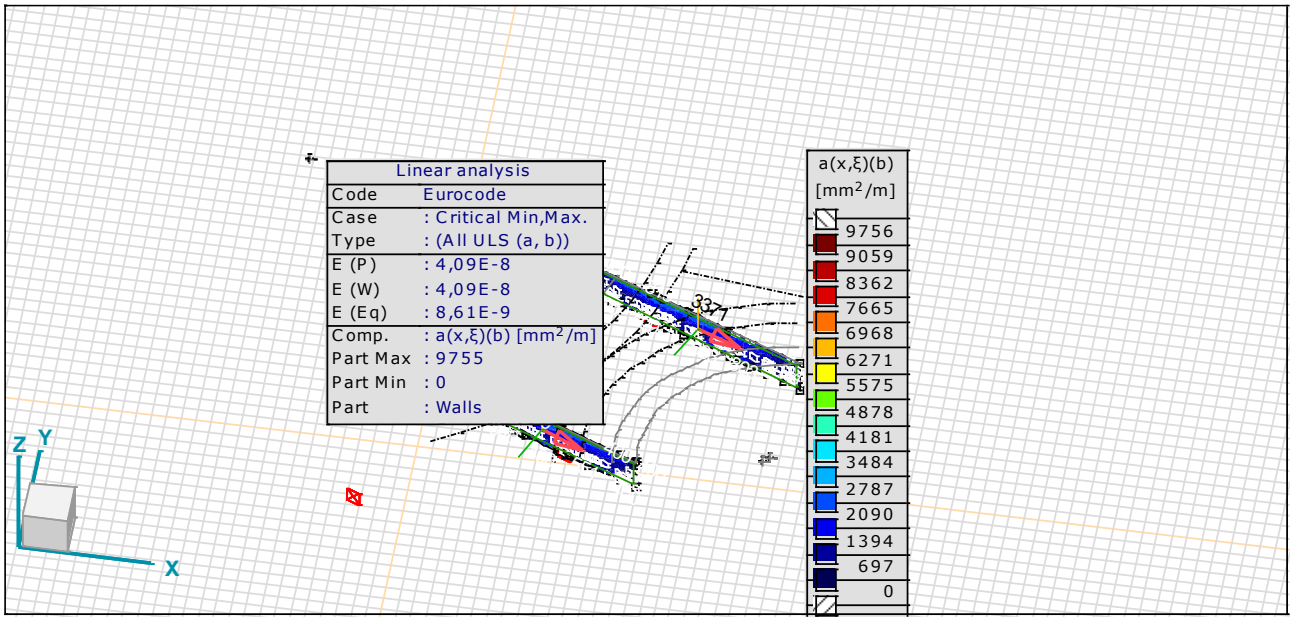
Eurocode		
Case : Linear,(All ULS (a, b)) Critical		
f_{se} = 1,000		
N [kN]	My [kNm]	Mz [kNm]
min/max		
-17451,09	-0,01	0
1912,27	0	0
	min/max	
-7200,00	-1961,32	0
-7200,00	1961,32	0
		min/max
-7200,00	0	-1985,89
-7200,00	0	1985,89
C30/37		
Cross-section O 1000		
A_c [mm^2] =	785238,70	
B500B		
Reinforcement piloti 100		
A_s/A_c [%] =	0,56	
Utilization(M-N)		
η(N = const.) =	0,668	

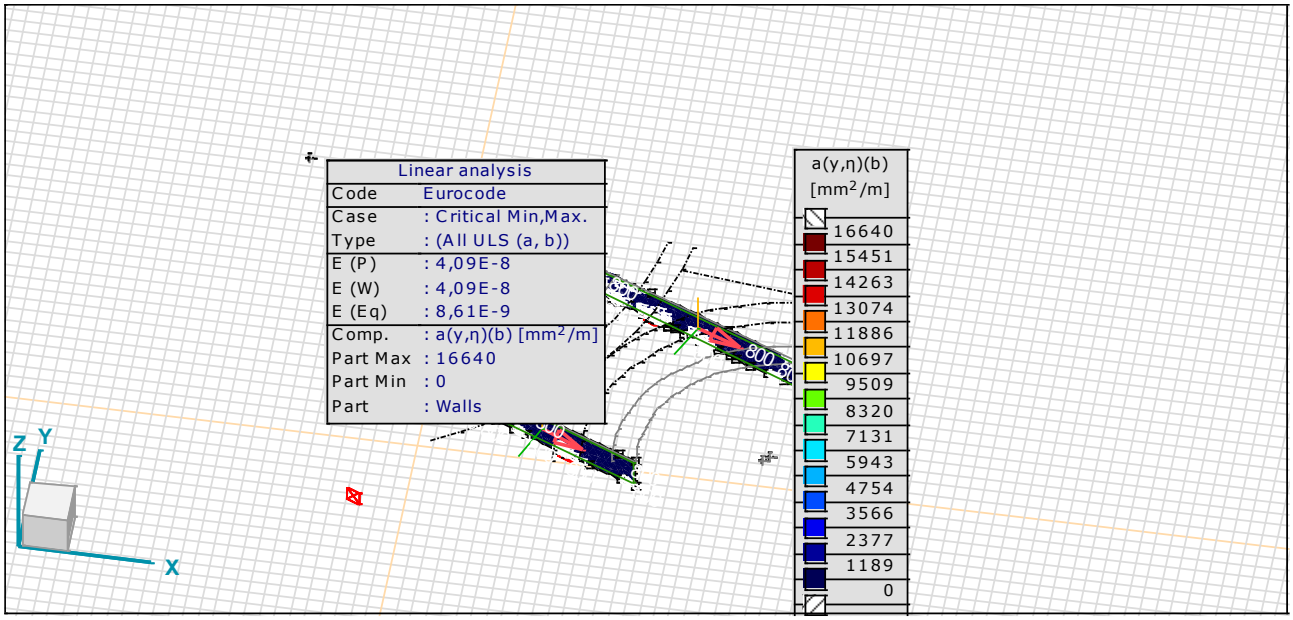
Eurocode	
C30/37	
Cross-section O 1000	
A_c [mm^2] =	785238,70
B500B	
Reinforcement piloti 100 (A_s =4397 mm^2)	
A_s/A_c [%] =	0,56
Stirrup o10;	
sw [mm] =	200
Buckling length	
β_{yy} =	1,000*L
β_{zz} =	1,000*L
L [m] =	8,000

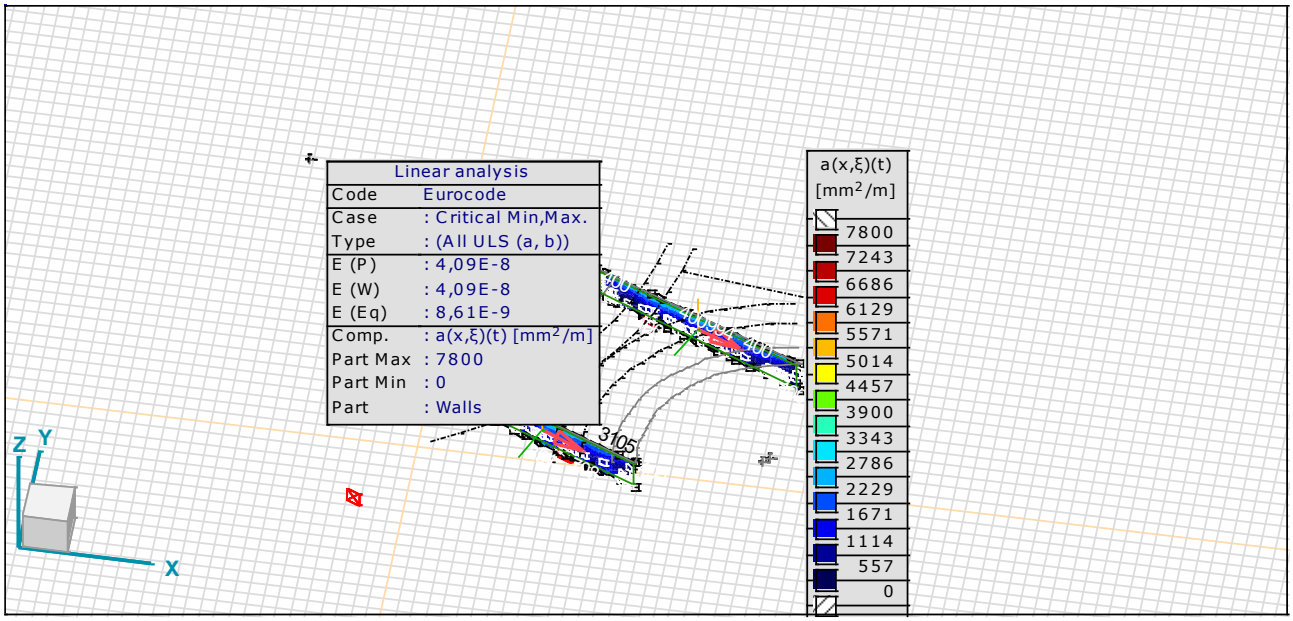


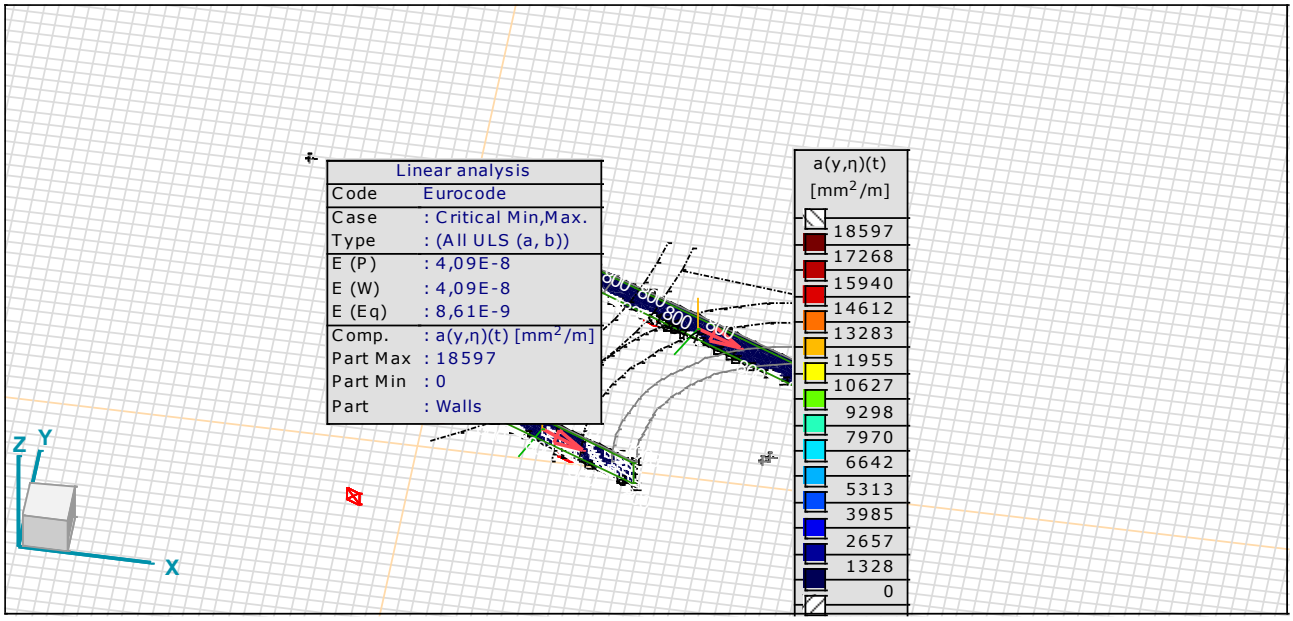
Eurocode	
Case	: Linear,(All ULS (a, b)) Critical
f_{se} =	1,000
C30/37	
Cross-section	O 1000
A_c [mm^2] =	785238,70
B500B	
Reinforcement	piloti 100
A_s/A_c [%] =	0,56
Utilization(V-T)	
η_{Vy} =	0,430
η_{Vz} =	0,302
η_{VyVz} =	0,525
η_{VyVzT} =	0,525
$\eta_{VyVzT,max}$ =	0,069
η_{max} =	0,525

4.2 OPORNIKI


Linear analysis
Code Eurocode
Case : Critical Min,Max.
Type : (All ULS (a, b))
E (P) : 4,09E-8
E (W) : 4,09E-8
E (Eq) : 8,61E-9
Comp. : a(x,ξ)(b) [mm²/m]
Part Max : 9755
Part Min : 0
Part : Walls
a(x,ξ)(b) [mm²/m]
9756
9059
8362
7665
6968
6271
5575
4878
4181
3484
2787
2090
1394
697
0
Z
Y
X

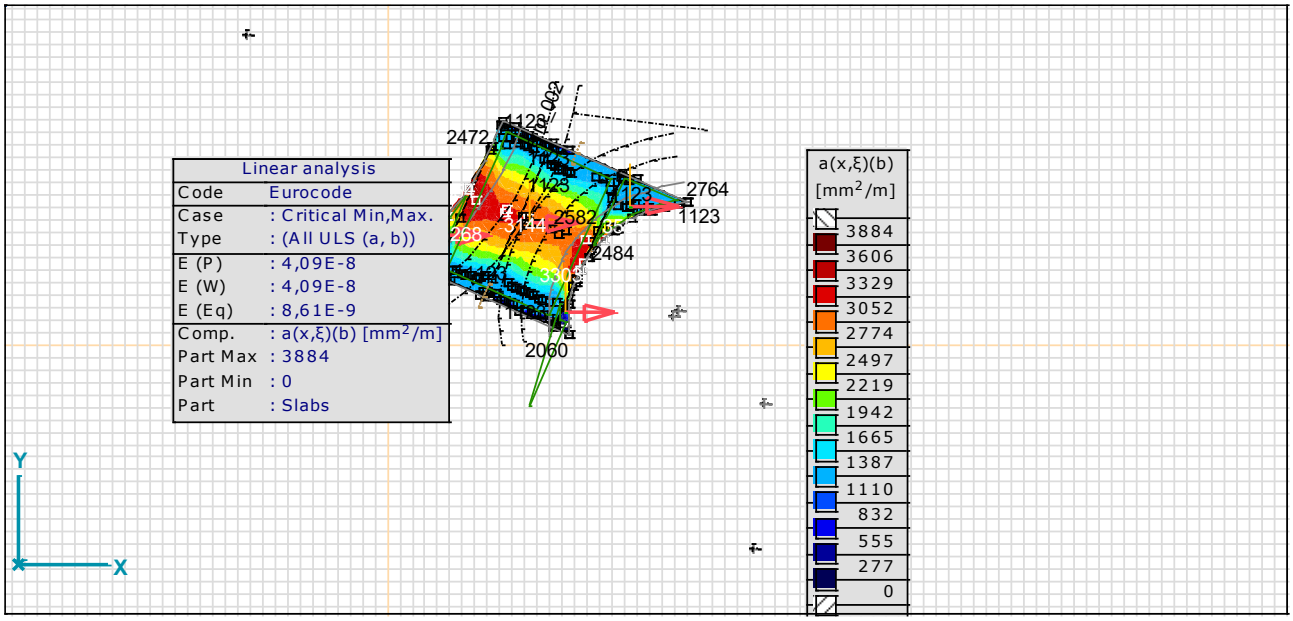

Linear analysis
Code Eurocode
Case : Critical Min,Max.
Type : (All ULS (a, b))
E (P) : 4,09E-8
E (W) : 4,09E-8
E (Eq) : 8,61E-9
Comp. : a(y,η)(b) [mm²/m]
Part Max : 16640
Part Min : 0
Part : Walls
a(y,η)(b) [mm²/m]
16640
15451
14263
13074
11886
10697
9509
8320
7131
5943
4754
3566
2377
1189
0
Z
Y
X

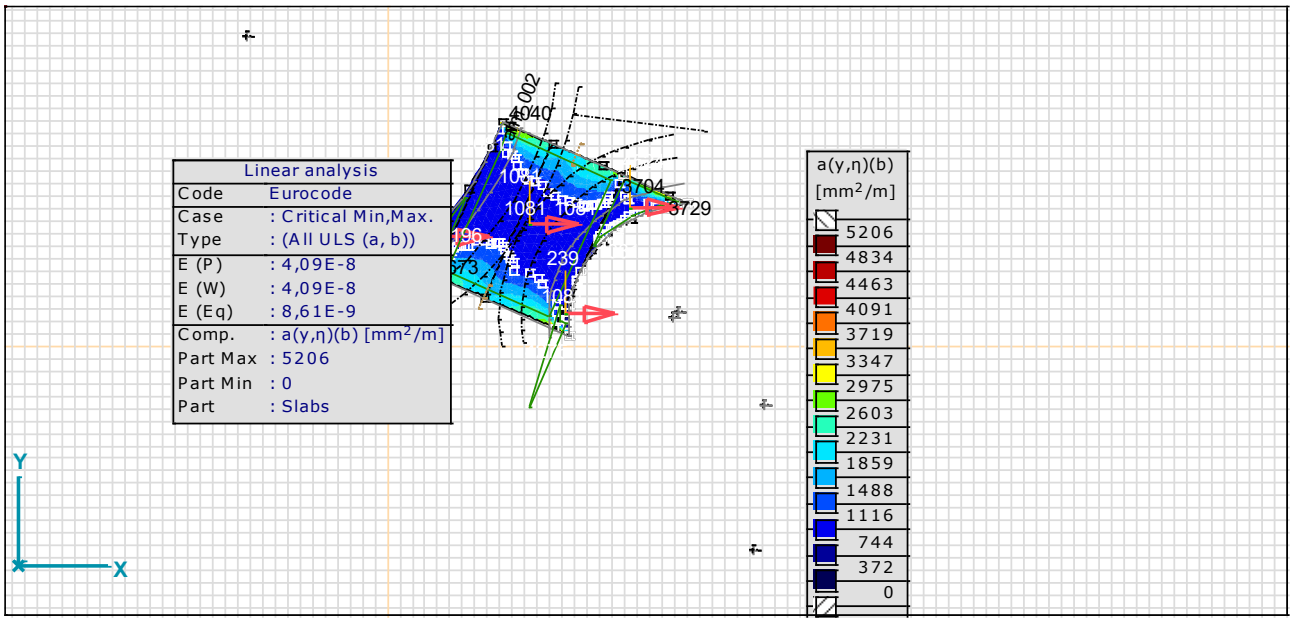

Linear analysis
Code Eurocode
Case : Critical Min,Max.
Type : (All ULS (a, b))
E (P) : 4,09E-8
E (W) : 4,09E-8
E (Eq) : 8,61E-9
Comp. : a(x,ξ)(t) [mm²/m]
Part Max : 7800
Part Min : 0
Part : Walls
a(x,ξ)(t) [mm²/m]
7800
7243
6686
6129
5571
5014
4457
3900
3343
2786
2229
1671
1114
557
0
3105
Z
Y
X

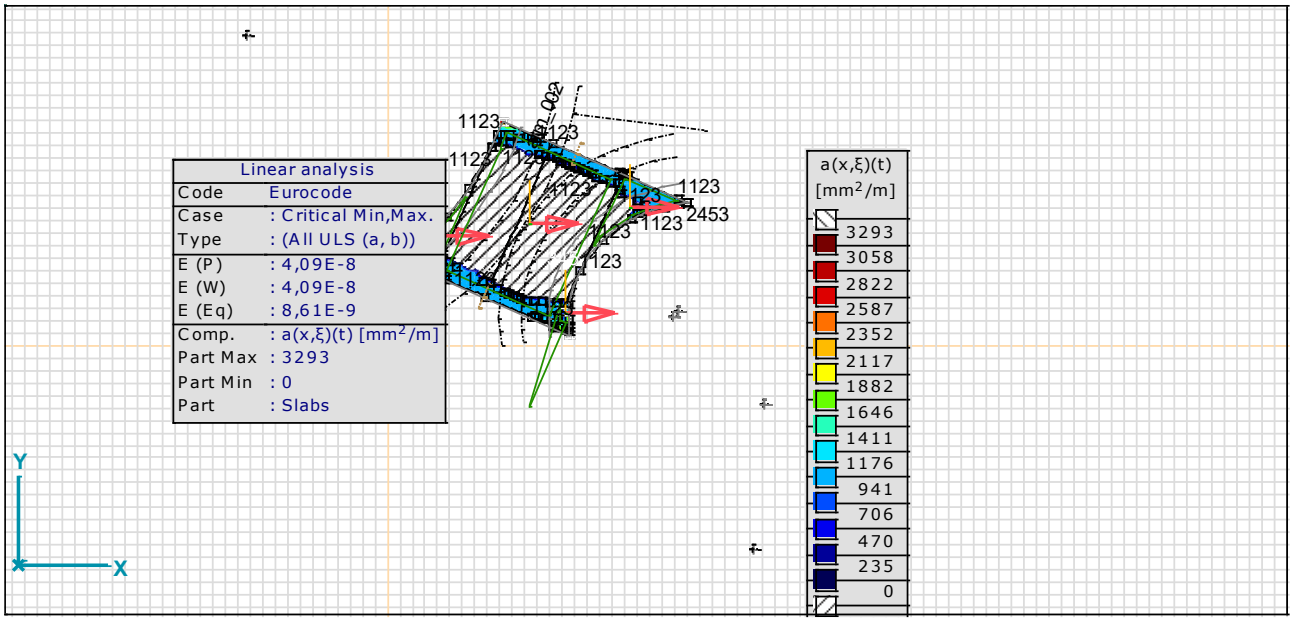

Linear analysis
Code Eurocode
Case : Critical Min,Max.
Type : (All ULS (a, b))
E (P) : 4,09E-8
E (W) : 4,09E-8
E (Eq) : 8,61E-9
Comp. : a(y,η)(t) [mm²/m]
Part Max : 18597
Part Min : 0
Part : Walls
a(y,η)(t) [mm²/m]
18597
17268
15940
14612
13283
11955
10627
9298
7970
6642
5313
3985
2657
1328
0
Z
Y
X

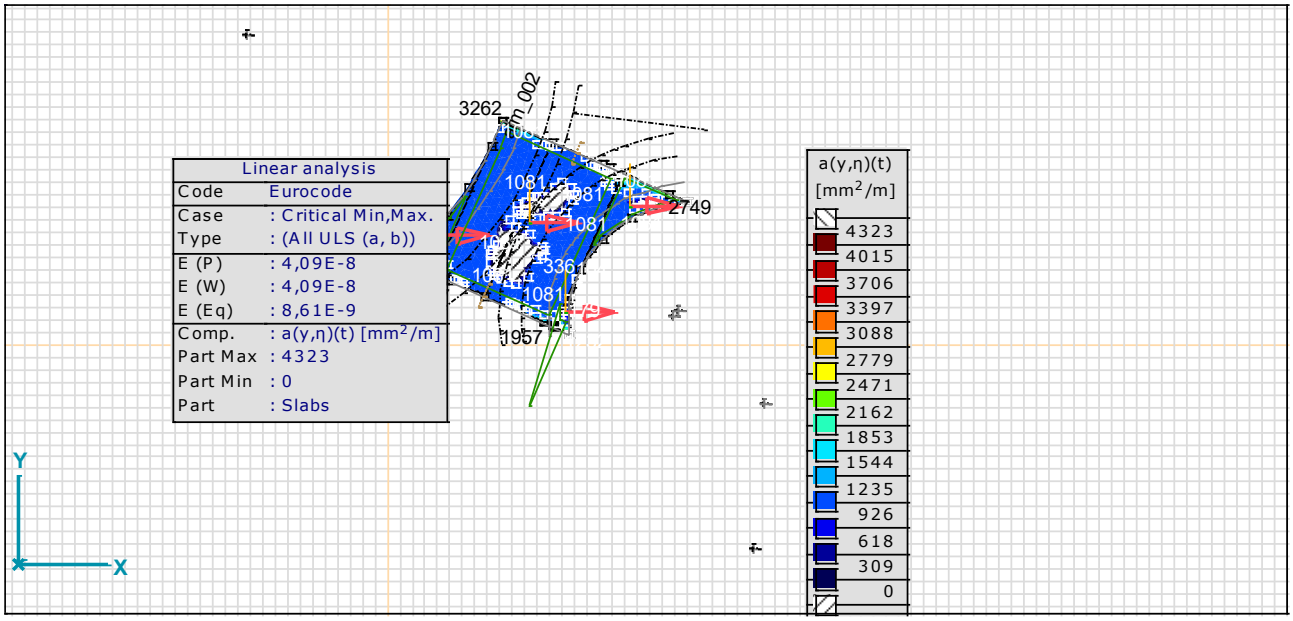
4.3 PLOŠČA

4.3.1 SPLOŠNA ARMATURA

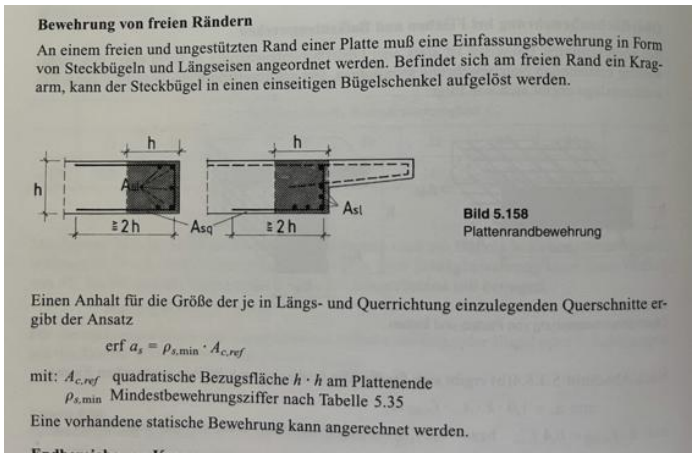








4.3.2 ROB PLOŠČE



Bewehrung von freien Rändern

An einem freien und ungestützten Rand einer Platte muß eine Einfassungsbewehrung in Form von Steckbügeln und Längseisen angeordnet werden. Befindet sich am freien Rand ein Kragarm, kann der Steckbügel in einen einseitigen Bügelschenkel aufgelöst werden.

Bild 5.158
Plattenrandbewehrung

Einen Anhalt für die Größe der je in Längs- und Querrichtung einzulegenden Querschnitte ergibt der Ansatz

$$\text{erf } a_s = \rho_{s,\min} \cdot A_{c,ref}$$

mit: $A_{c,ref}$ quadratische Bezugsfläche $h \cdot h$ am Plattenende
$\rho_{s,\min}$ Mindestbewehrungsziffer nach Tabelle 5.35

Eine vorhandene statische Bewehrung kann angerechnet werden.

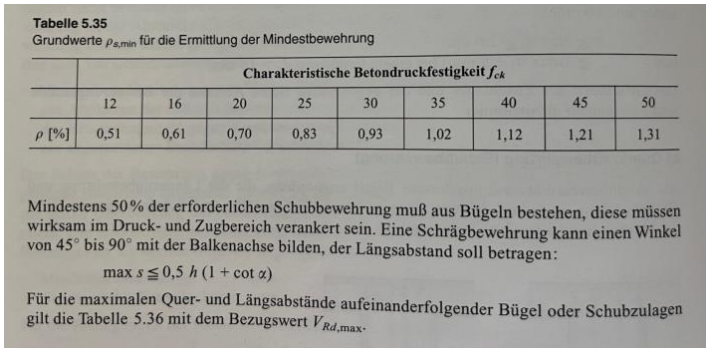


Tabelle 5.35
Grundwerte $\rho_{s,min}$ für die Ermittlung der Mindestbewehrung

	Charakteristische Betondruckfestigkeit f_{ck}								
	12	16	20	25	30	35	40	45	50
ρ [%]	0,51	0,61	0,70	0,83	0,93	1,02	1,12	1,21	1,31

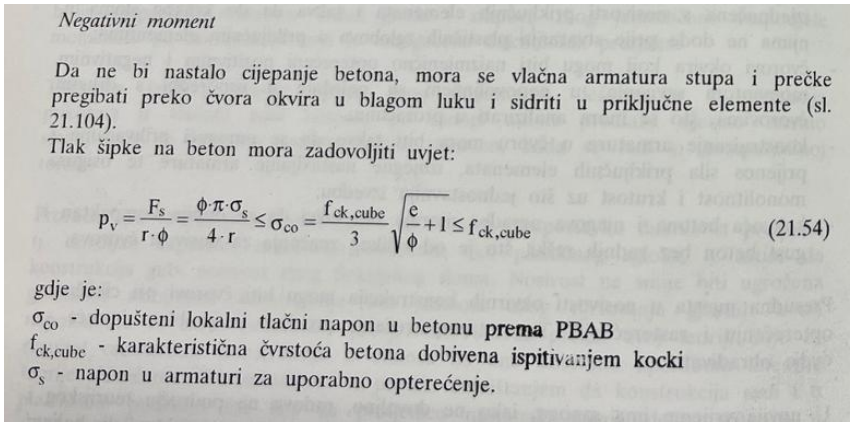
Mindestens 50 % der erforderlichen Schubbewehrung muß aus Bügeln bestehen, diese müssen wirksam im Druck- und Zugbereich verankert sein. Eine Schrägbewehrung kann einen Winkel von 45° bis 90° mit der Balkenachse bilden, der Längsabstand soll betragen:

$$\max s \leqq 0{,}5\ h\ (1 + \cot \alpha)$$

Für die maximalen Quer- und Längsabstände aufeinanderfolgender Bügel oder Schubzulagen gilt die Tabelle 5.36 mit dem Bezugswert $V_{Rd,max}$.

	plata, robna armatura		
	h	700	mm1
	Acref	490000	mm2
	ros,min	0,93	%
	as	4557	mm2
As,potr [mm2]:		**4557,00**	
	Φ [mm]:	28,00	
	kom.:	8,00	
As,dej [mm2]:		4926,02	

4.3.3 VOZLIŠČE STENA-PLOŠČA

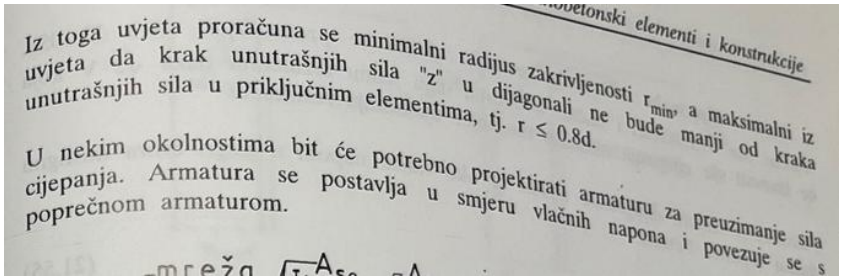


Negativni moment

Da ne bi nastalo cijepanje betona, mora se vlačna armatura stupa i prečke pregibati preko čvora okvira u blagom luku i sidriti u priključne elemente (sl. 21.104).
Tlak šipke na beton mora zadovoljiti uvjet:

$$p_v = \frac{F_s}{r \cdot \phi} = \frac{\phi \cdot \pi \cdot \sigma_s}{4 \cdot r} \leq \sigma_{co} = \frac{f_{ck,cube}}{3}\sqrt{\frac{e}{\phi} + 1} \leq f_{ck,cube} \qquad (21.54)$$

gdje je:
σ_{co} - dopušteni lokalni tlačni napon u betonu prema PBAB
$f_{ck,cube}$ - karakteristična čvrstoća betona dobivena ispitivanjem kocki
σ_s - napon u armaturi za uporabno opterećenje.



betonski elementi i konstrukcije

Iz toga uvjeta proračuna se minimalni radijus zakrivljenosti r_{min}, a maksimalni iz uvjeta da krak unutrašnjih sila "z" u dijagonali ne bude manji od kraka unutrašnjih sila u priključnim elementima, tj. $r \leq 0.8d$.

U nekim okolnostima bit će potrebno projektirati armaturu za preuzimanje sila cijepanja. Armatura se postavlja u smjeru vlačnih napona i povezuje se s poprečnom armaturom.

mrežo

fi		28	mm
r		300	mm
Ss		434,7826	Mpa
fck,cube		37	MPa
e		150	mm
Sco		31,0965	MPa
pv		31,87123	Mpa

radij krivljenja min. 30cm

4.3.4 RAZPOKE

4.3.4.1 POLJE – SPODAJ

Efektivne karakteristike betona			
fck [MPa]:	30,00	s:	0,25
fcm [MPa]:	38,00	βcc (t):	1,00
fctm [MPa]:	2,93	fcm (t) [MPa]:	38,00
Ecm [kN/cm2]:	3283,66	fck (t) [MPa]:	30,00
t [dni]:	28,00	fctm (t) [MPa]:	2,93
tip cementa [S, N, R]:	N	Ecm (t) [kN/cm2]:	3283,66

Račun širine razpok upogibno obremenjenih elementov:					
fck [MPa]:	30,00	Ic [mm4]:	4,27E+10		
fcm [MPa]:	38,00	αe:	6,09		
fctm [MPa]:	2,93	Iy,I [mm4]:	4,53E+10		
Ecm [MPa]:	32836,57	x [mm]:	167,04		
		Iy,II [mm4]:	9,34E+09		
fyk [MPa]:	500,00	Mcr [kNm]:	331,82		
Es [MPa]:	200000,00				
		σs [MPa]:	181,98		
b [mm]:	1000,00				
h [mm]:	800,00	fct,eff [MPa]:	2,93		
a [mm]:	75,00				
		hc,eff [mm]:	187,50		
Φ [mm]:	**28,00**	Ac,eff [mm2]:	1,88E+05		
s [mm]:	**150,00**	ρp,eff:	0,0219		
As [mm2]:	**4105,01**	εsm-εcm [prom.]:	0,61		
c [mm]:	40,00	Sr,max [mm]:	353,42		
		wk [mm]:	**0,21**		
Md,MSU [kNm]:	500,00	**wk,dop [mm]:**	**0,30**	**71,46 %**	
		0,8*fyk [MPa]:	400,00		
k1:	0,80	Act [mm2]:	4,00E+05		
k1=0,80 za RA, sicer 1,6		kc:	0,40		
k2:	0,50	k:	0,65		
k2=0,50 za upogib, sicer 1,0		**As,min [mm2]:**	**761,67**		
k3:	3,40	**As,dej [mm2]:**	**4105,01**	**OK.**	
k4:	0,43				
kt:	0,40				
kt=0,40 za trajno obtežbo, sicer 0,60					

4.3.5 POVES IN NAPETOSTI

koeficient lezenja betona:			
fck [MPa]:	**30,00**		
fcm [MPa]:	38,00		
tip cementa [s, n, r]:	**n**		
RH [%]:	**80,00**		
Ac [mm2]:	**8,00E+05**		
u [mm]:	**2000,00**		
t [dni]:	**100000000000,00**		
t0 [dni]:	**28,00**	...starost betona ob nanosu obtežbe	
α:	0,00		
h0 [mm]:	8000,00		
ϕRH:	1,08		
β (fcm):	2,48		
β (t0):	0,49		
βH:	1439,57		
βc (t, t0):	1,00		
φ (t, t0):	1,31		
φ (t=lim., t0):	1,31		
nelinearno lezenje			
kσ = σc / fck (to):	**0,40**		
φnelin / φlin:	1,00		

deformacija pri krčenju betona:				
fck [MPa]:		**30,00**		
tip cementa [s, n, r]:		**n**		
	RH [%]:	**80,00**		
	Ac [mm2]:	**8,00E+05**		
	u [mm]:	**2000,00**		
	t [dnevi]:	**28,00**	...starost betona	
	AVTOGENO KRČENJE			
	βas (t):	0,65		
	εca (t):	3,26E-05		
	εca (t=lim.):	5,00E-05		
	KRČENJE ZARADI SUŠENJA			
	h0 [mm]:	800,00		
	kh:	0,70		
ts [dnevi]:		**28,00**	...starost betona ob koncu nege	
	βds (t, ts):	0,00		
	βRH:	0,76		
	αds,1:	4,00		
	αds,2:	0,12		
	εcd,0:	2,69E-04		
	εcd (t, ts):	0,00E+00		
	εcd (t=lim.):	1,88E-04		
	SKUPNO KRČENJE			
	εcs (t):	3,26E-05	*= 0,04 prom*	
	εcs (t=lim.):	2,38E-04	*= 0,24 prom*	

Poves pri QSKO:

OPOMBA: Spodnji račun velja za pravokotno tlačeno cono!

MSU - POVES IN NAPETOSTI

fck [MPa]:	**30,00**	*ZAČETNI ČAS*				*KONČNI ČAS:*			
fctm [MPa]:	2,93	Ac [mm2]:	8,00E+05			Ac [mm2]:	8,00E+05		
fctk,0,05 [MPa]:	2,05	Ic [mm4]:	4,27E+10			Ic [mm4]:	4,27E+10		
Ecm [MPa]:	32836,57	Es/Ecm:	6,09			εcs (t) [prom.]:	**0,24**		
fyk [MPa]:	**500,00**	Iy,I [mm4]:	4,62E+10			φ (t, t0):	**1,31**		
Es [MPa]:	**200000,00**	x [mm]:	163,25			Ec,eff [MPa]:	14214,96		
b [mm]:	**1000,00**	Iy,II [mm4]:	9,40E+09			Es/Ec,eff:	14,07		
h [mm]:	**800,00**	Mcr [kNm]:	338,14			Iy,I,eff [mm4]:	5,08E+10		
a [mm]:	**75,00**	Mcr,0,05 [kNm]:	236,70			xeff [mm]:	227,43		
a' [mm]:	**75,00**					Iy,II,eff [mm4]:	1,87E+10		
As [mm2]:	**4105,01**	σs [MPa]:	254,69	(pri KKO)		Mcr,eff [kNm]:	371,75		
As' [mm2]:	**1340,41**	0,8fyk [MPa]:	400,00	OK.		Mcr,0,05,eff [kNm]:	260,22		
Md,QSKO [kNm]:	**500,00**	σc [MPa]:	12,15	(pri KKO)		Sa,I [mm3]:	8,98E+05		
Md,KKO [kNm]:	**700,00**	0,6fck [MPa]:	18,00	OK.		Sa,II [cm3]:	1,84E+06		
		σc [MPa]:	8,68	(pri QSKO)					
		0,45fck [MPa]:	13,50	OK.		σs [MPa]:	262,64	(pri KKO)	
						0,8fyk [MPa]:	400,00	OK.	
		β:	**0,50**	*0,5 (trajna obtežba), sicer 1,0		σc [MPa]:	8,53	(pri KKO)	
		ζ:	0,77			0,6fck [MPa]:	18,00	OK.	
		Iy,dej [mm4]:	1,15E+10			σc [MPa]:	6,09	(pri QSKO)	
		1/R [1/mm]:	1,32E-06			0,45fck [MPa]:	13,50	OK.	
						β:	**0,50**	(0,5 za trajno obtežbo, sicer 1,0)	
						ζ:	0,72		
	faktor povečanja elastičnih pomikov:					Iy,dej,eff [mm4]:	2,26E+10		
	4,36					1/Reff [1/mm]:	1,56E-06		
						1/Rcs,I [1/mm]:	5,98E-08		
						1/Rcs,II [1/mm]:	1,22E-07		
						1/Rcs [1/mm]:	1,05E-07		
						1/R [1/mm]:	**1,66E-06**		

dL [m]	K	*1/R*	*dw [mm]*
13,00	**0,104**	**1,66E-06**	29,19

Oblika momentov	K
	**0,125**
	**0,083**
	**0,104**
	**0,33**
	**0,25**

Poves pri stalnih vplivih / lastni teži:

OPOMBA: Spodnji račun velja za pravokotno tlačeno cono!

MSU - POVES IN NAPETOSTI

fck [MPa]:	**30,00**	*ZAČETNI ČAS*					
fctm [MPa]:	2,93	Ac [mm2]:	8,00E+05				
fctk,0,05 [MPa]:	2,05	Ic [mm4]:	4,27E+10				
Ecm [MPa]:	32836,57	Es/Ecm:	6,09				
fyk [MPa]:	**500,00**	Iy,I [mm4]:	4,62E+10				
Es [MPa]:	**200000,00**	x [mm]:	163,25				
b [mm]:	**1000,00**	Iy,II [mm4]:	9,40E+09				
h [mm]:	**800,00**	Mcr [kNm]:	338,14				
a [mm]:	**75,00**	Mcr,0,05 [kNm]:	236,70				
a' [mm]:	**75,00**						
As [mm2]:	**4105,01**	σs [MPa]:	254,69	(pri KKO)			
As' [mm2]:	**1340,41**	0,8fyk [MPa]:	400,00	OK.			
Md,QSKO [kNm]:	**375,00**	σc [MPa]:	12,15	(pri KKO)			
Md,KKO [kNm]:	**700,00**	0,6fck [MPa]:	18,00	OK.			
		σc [MPa]:	6,51	(pri QSKO)			
		0,45fck [MPa]:	13,50	OK.			
		β:	**0,50**	*0,5 (trajna obtežba), sicer 1,0			
		ζ:	0,59				
		Iy,dej [mm4]:	1,39E+10				
		1/R [1/mm]:	8,21E-07				

Oblika momentov	K
	0,125
	0,083
	0,104
	0,33
	0,25

Kc			
Ac			
Ic			
εcs			
φ (t, t0):	**1,31**		
Ec,eff [MPa]:	14214,96		
Es/Ec,eff:	14,07		
Iy,I,eff [mm4]:	5,08E+10		
xeff [mm]:	227,43		
Iy,II,eff [mm4]:	1,87E+10		
Mcr,eff [kNm]:	371,75		
Mcr,0,05,eff [kNm]:	260,22		
Sa,I [mm3]:	8,98E+05		
Sa,II [cm3]:	1,84E+06		
σs [MPa]:	262,64	(pri KKO)	
0,8fyk [MPa]:	400,00	OK.	
σc [MPa]:	8,53	(pri KKO)	
0,6fck [MPa]:	18,00	OK.	
σc [MPa]:	4,57	(pri QSKO)	
0,45fck [MPa]:	13,50	OK.	
β:	**0,50**	(0,5 za trajno obtežbo, sicer 1,0)	
ζ:	0,51		
Iy,dej,eff [mm4]:	2,71E+10		
1/Reff [1/mm]:	9,75E-07		
1/Rcs,I [1/mm]:	5,98E-08		
1/Rcs,II [1/mm]:	1,22E-07		
1/Rcs [1/mm]:	9,16E-08		
1/R [1/mm]:	**1,07E-06**		

faktor povečanja elastičnih pomikov:
3,64

dL [m]	K	*1/R*	*dw [mm]*
13,00	**0,104**	**1,07E-06**	18,74

Oblika momentov	K
	0,125
	0,083
	0,104
	0,33
	0,25

L/700 ~ 13000/700 ~ 2cm.

<u>Nadvišanje za stalne vplive za cca 2cm, razlika je nato znotraj dovoljenih mej.</u>

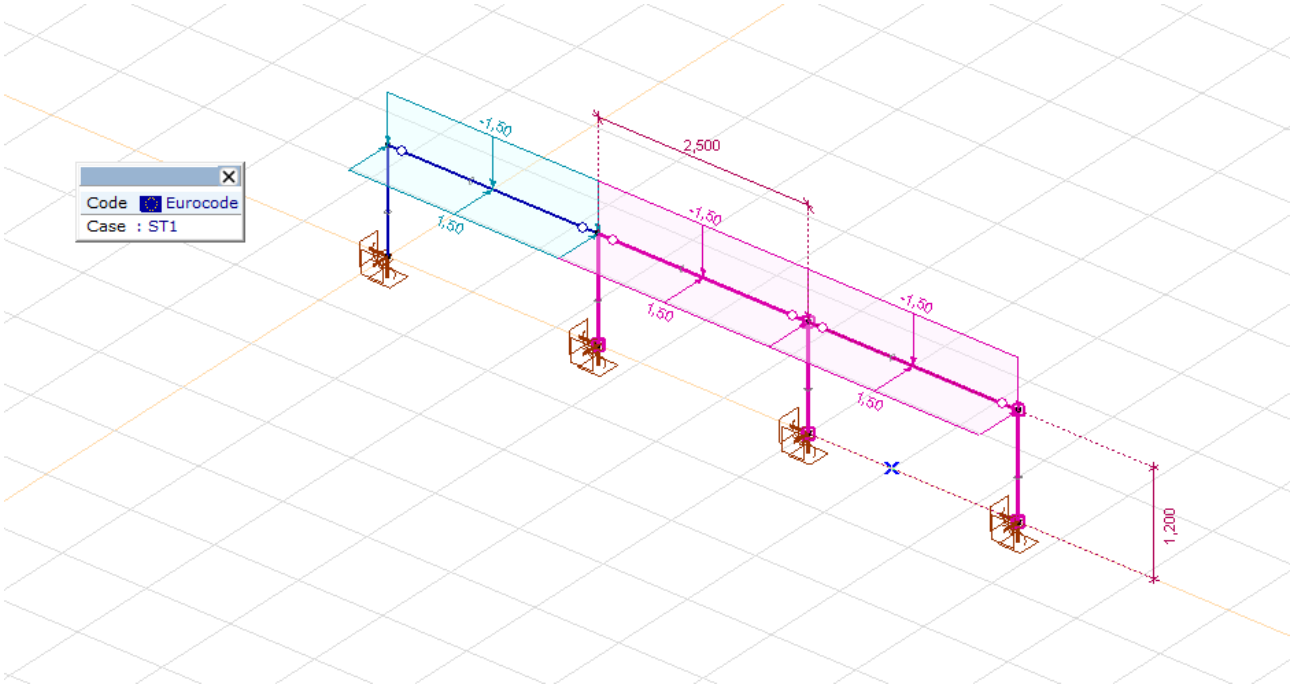
4.4 ROBNI VENEC

Skladno s TSC 07.102:

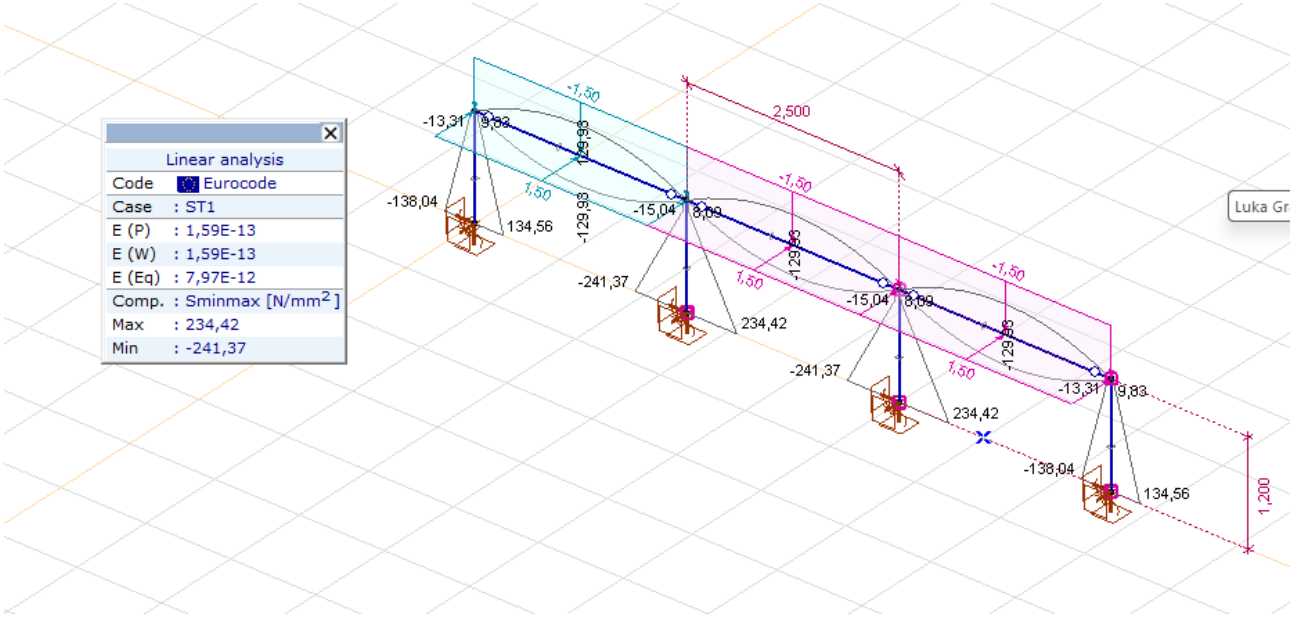
- Sidra za venec fi14/15
- Stremena fi10/15
- Vzdolžno zgoraj in na zunanjih izpostavljenih stranicah fi10/6.5, spodaj in notranje stranice fi10/11.5

4.5 OGRAJA ZA PEŠCE

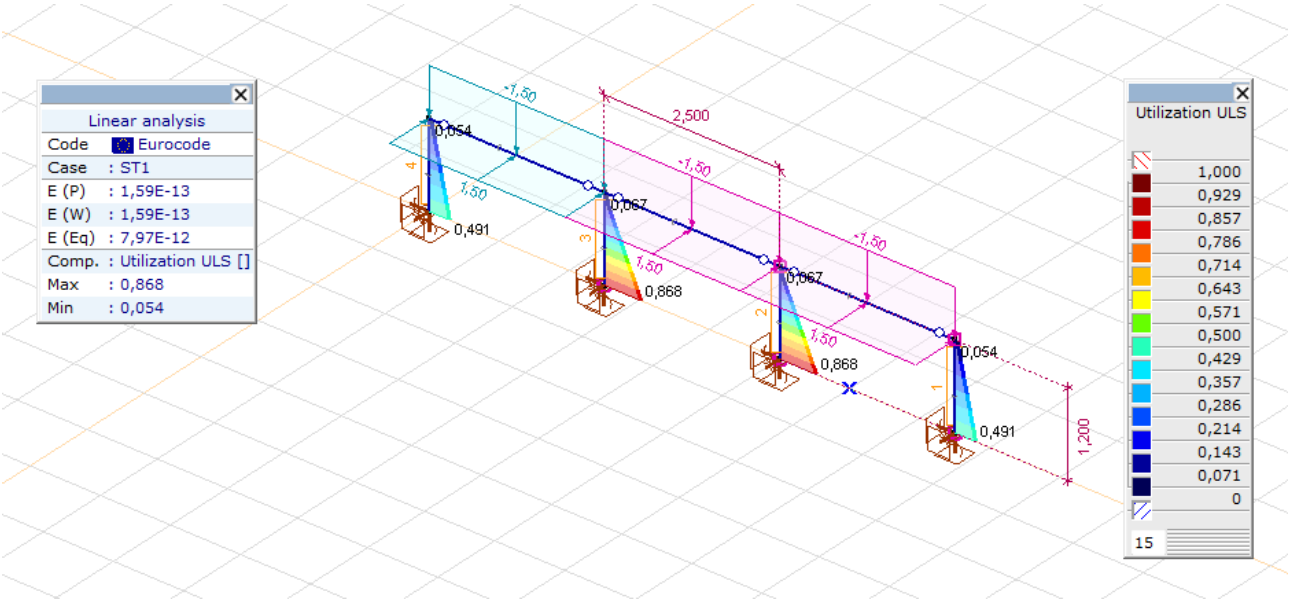
Ograja je zasnovana (izbira profilov, detajl vpetja) skladno s TSC. Sledi preverba.



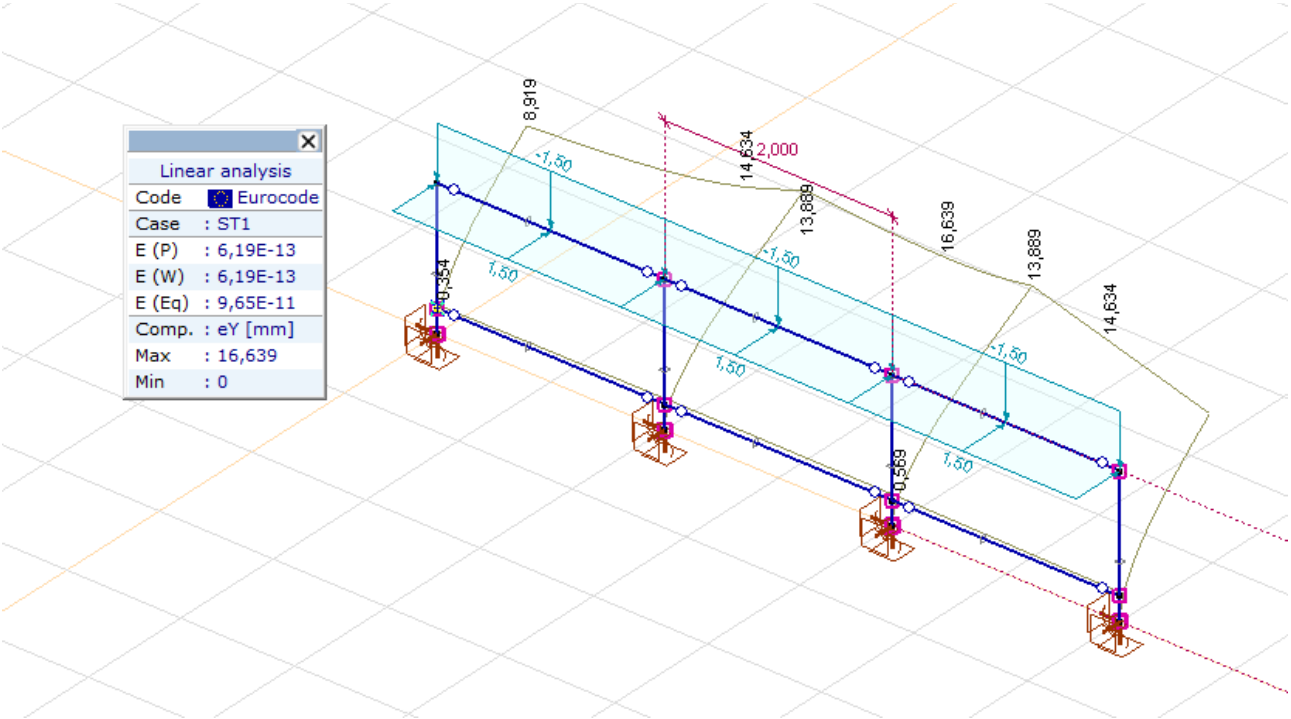
Globalne napetosti (profili 60x60x5 S235):



Izkoristek (profili 60x60x5 S235):



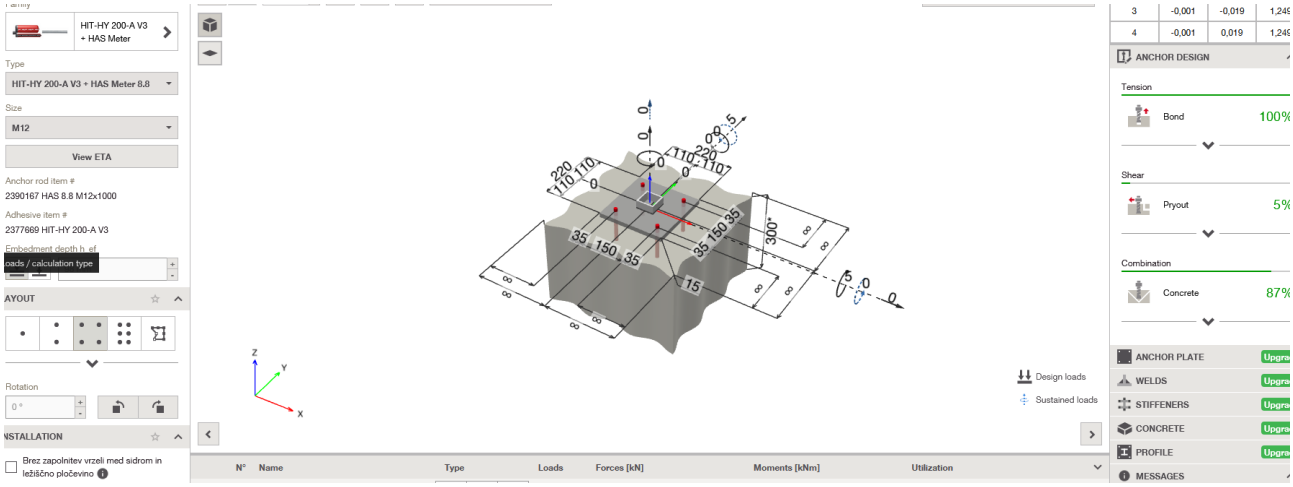
Pomik stebričkov (profili 60x60x5 S235):



14/1,5 ~ 1cm

Nosilnost ni problematična. Da omejimo pomike, je treba stebričke zgostiti na max 200cm.

Vpetje:



npr. 4x M12 8.8 HILTi HIT-HY 200 lepilo

4.6 ZIDOVI

Priloge.