

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΦΑΣΗ ΛΕΙΤΟΥΡΓΕΙΑΣ
ΠΕΡΙΒΑΛΛΟΥΣΕΣ ΕΝΤΑΤΙΚΩΝ ΜΕΓΕΘΩΝ

Generated Load Cases

THEMISTOKLIS VLACHOULIS
04/06/2026 17:10

Number	Combination	Designation
579	32	MAXR-PTZ SPRI
580	32	MINR-PTZ SPRI
601	33	MAXF-UX NODE
602	33	MINF-UX NODE
603	33	MAXF-UY NODE
604	33	MINF-UY NODE
605	33	MAXF-UZ NODE
606	33	MINF-UZ NODE
611	33	MAXF-N BEAM
612	33	MINF-N BEAM
613	33	MAXF-VY BEAM
614	33	MINF-VY BEAM
615	33	MAXF-VZ BEAM
616	33	MINF-VZ BEAM
617	33	MAXF-MT BEAM
618	33	MINF-MT BEAM
619	33	MAXF-MY BEAM
620	33	MINF-MY BEAM
621	33	MAXF-MZ BEAM
622	33	MINF-MZ BEAM
623	33	MAXF-MB BEAM
624	33	MINF-MB BEAM
625	33	MAXF-PTX SPRI
626	33	MINF-PTX SPRI
627	33	MAXF-PTY SPRI
628	33	MINF-PTY SPRI
629	33	MAXF-PTZ SPRI
630	33	MINF-PTZ SPRI
651	34	MAXP-UX NODE
652	34	MINP-UX NODE
653	34	MAXP-UY NODE
654	34	MINP-UY NODE
655	34	MAXP-UZ NODE
656	34	MINP-UZ NODE
661	34	MAXP-N BEAM
662	34	MINP-N BEAM
663	34	MAXP-VY BEAM
664	34	MINP-VY BEAM
665	34	MAXP-VZ BEAM
666	34	MINP-VZ BEAM
667	34	MAXP-MT BEAM
668	34	MINP-MT BEAM
669	34	MAXP-MY BEAM
670	34	MINP-MY BEAM
671	34	MAXP-MZ BEAM
672	34	MINP-MZ BEAM
673	34	MAXP-MB BEAM
674	34	MINP-MB BEAM
675	34	MAXP-PTX SPRI
676	34	MINP-PTX SPRI
677	34	MAXP-PTY SPRI
678	34	MINP-PTY SPRI
679	34	MAXP-PTZ SPRI
680	34	MINP-PTZ SPRI
701	35	MAXP-N BEAM
702	35	MINP-N BEAM
703	35	MAXP-VY BEAM
704	35	MINP-VY BEAM



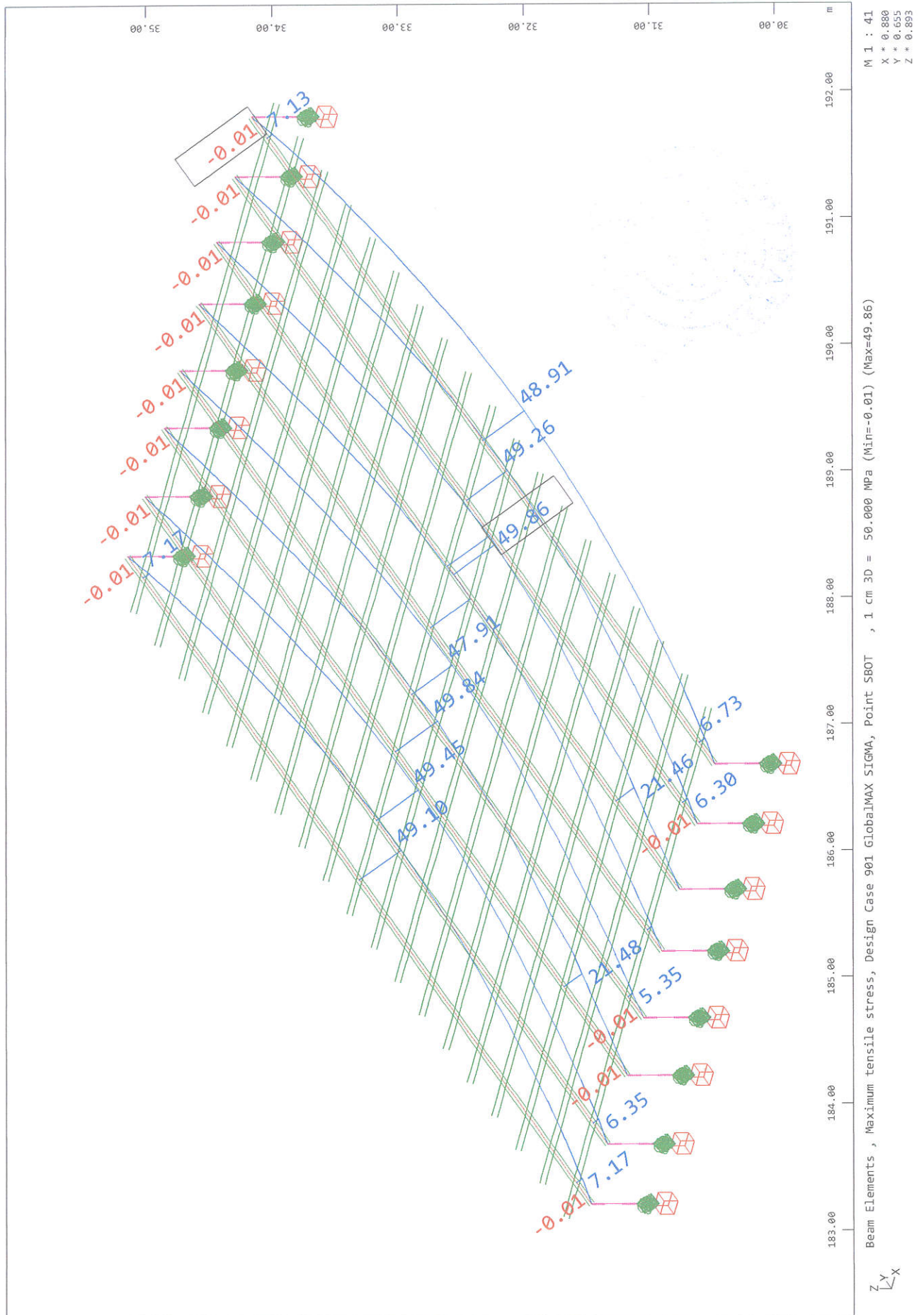
ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΦΑΣΗ ΛΕΙΤΟΥΡΓΕΙΑΣ
ΠΕΡΙΒΑΛΛΟΥΣΕΣ ΕΝΤΑΤΙΚΩΝ ΜΕΓΕΘΩΝ

Generated Load Cases

Number	Combination	Designation
705	35	MAXP-VZ BEAM
706	35	MINP-VZ BEAM
707	35	MAXP-MT BEAM
708	35	MINP-MT BEAM
709	35	MAXP-MY BEAM
710	35	MINP-MY BEAM
711	35	MAXP-MZ BEAM
712	35	MINP-MZ BEAM
713	35	MAXP-MB BEAM
714	35	MINP-MB BEAM

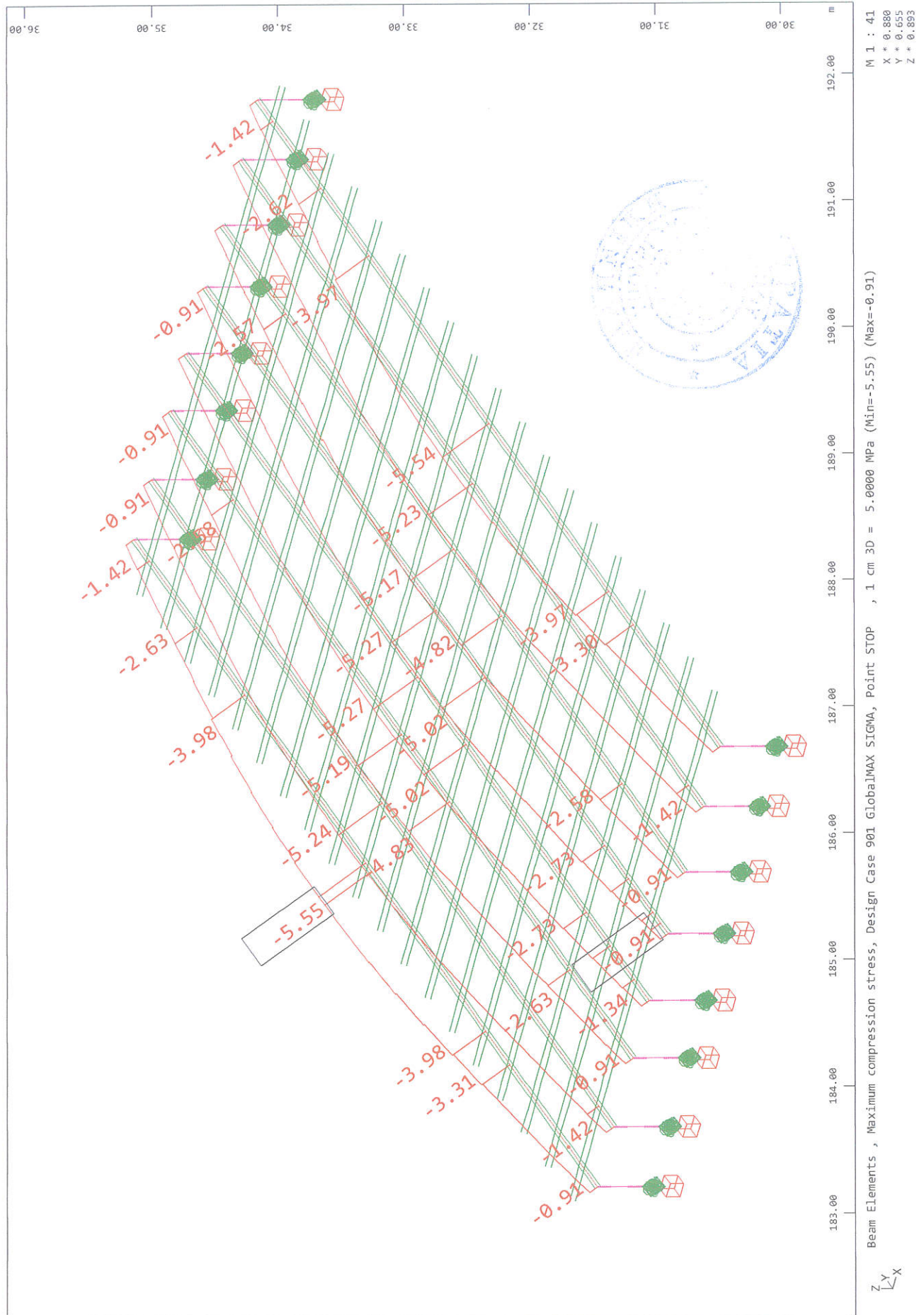


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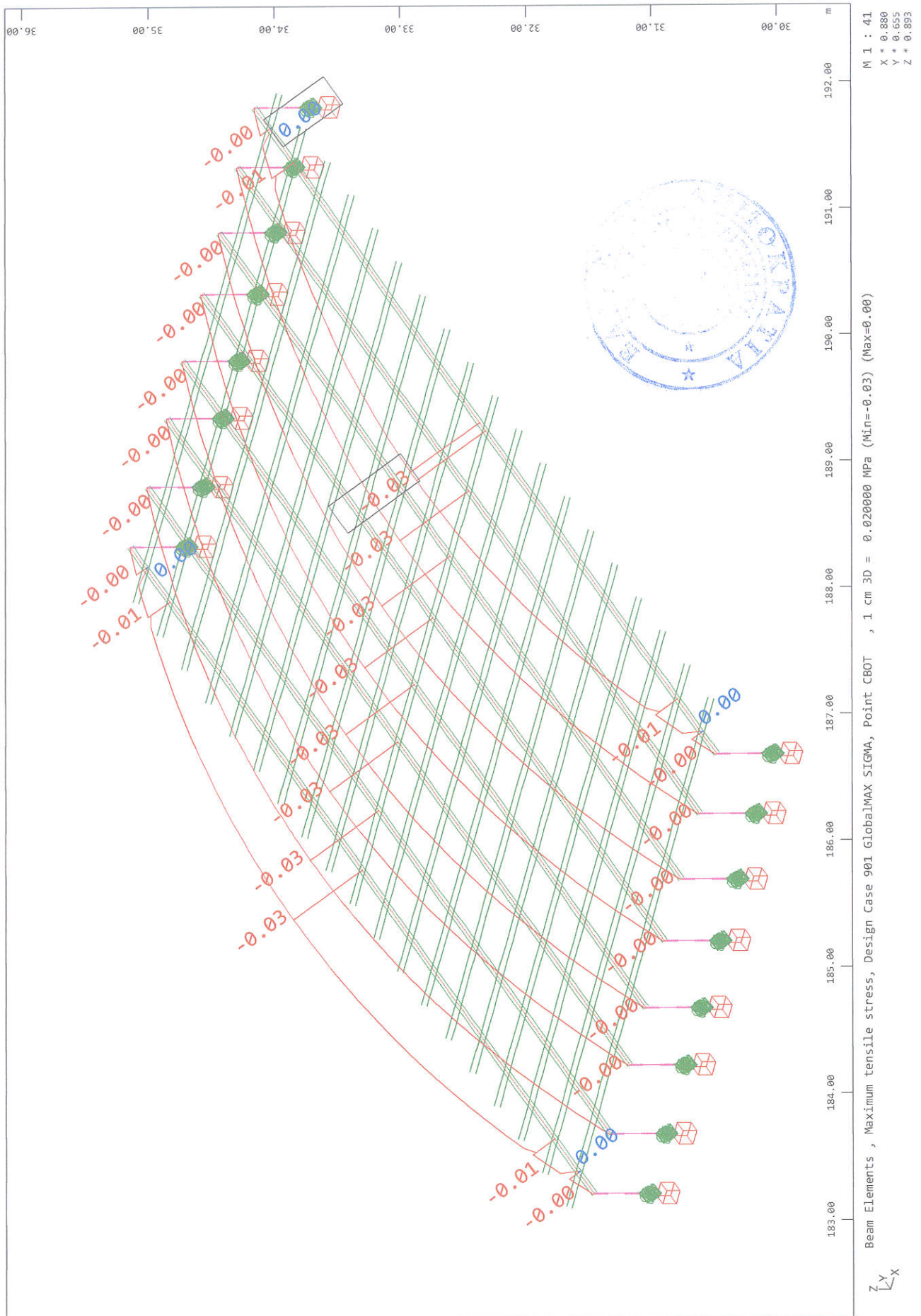
ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΦΑΣΗ ΛΕΙΤΟΥΡΓΕΙΑΣ
taseis

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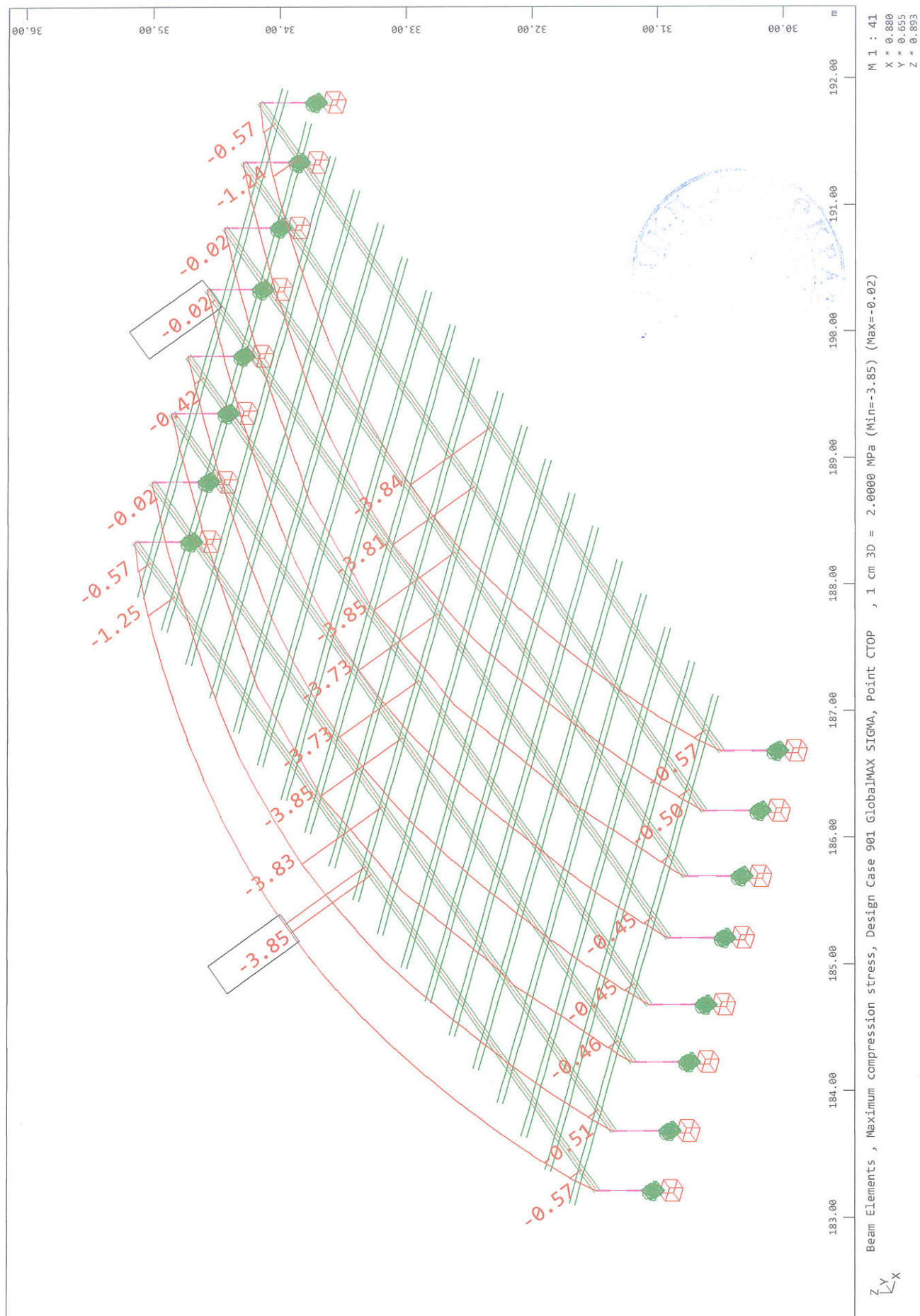
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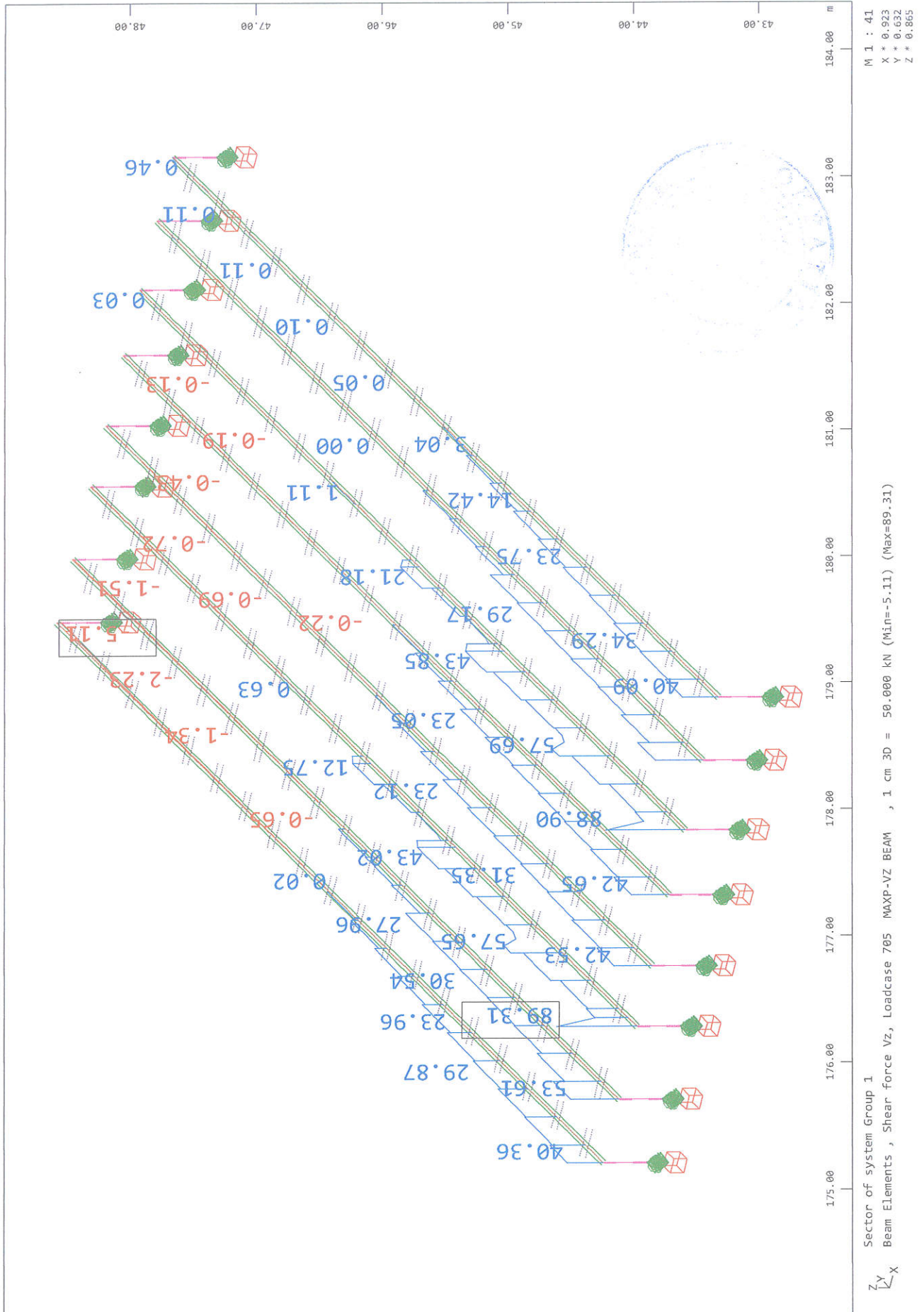
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taseis

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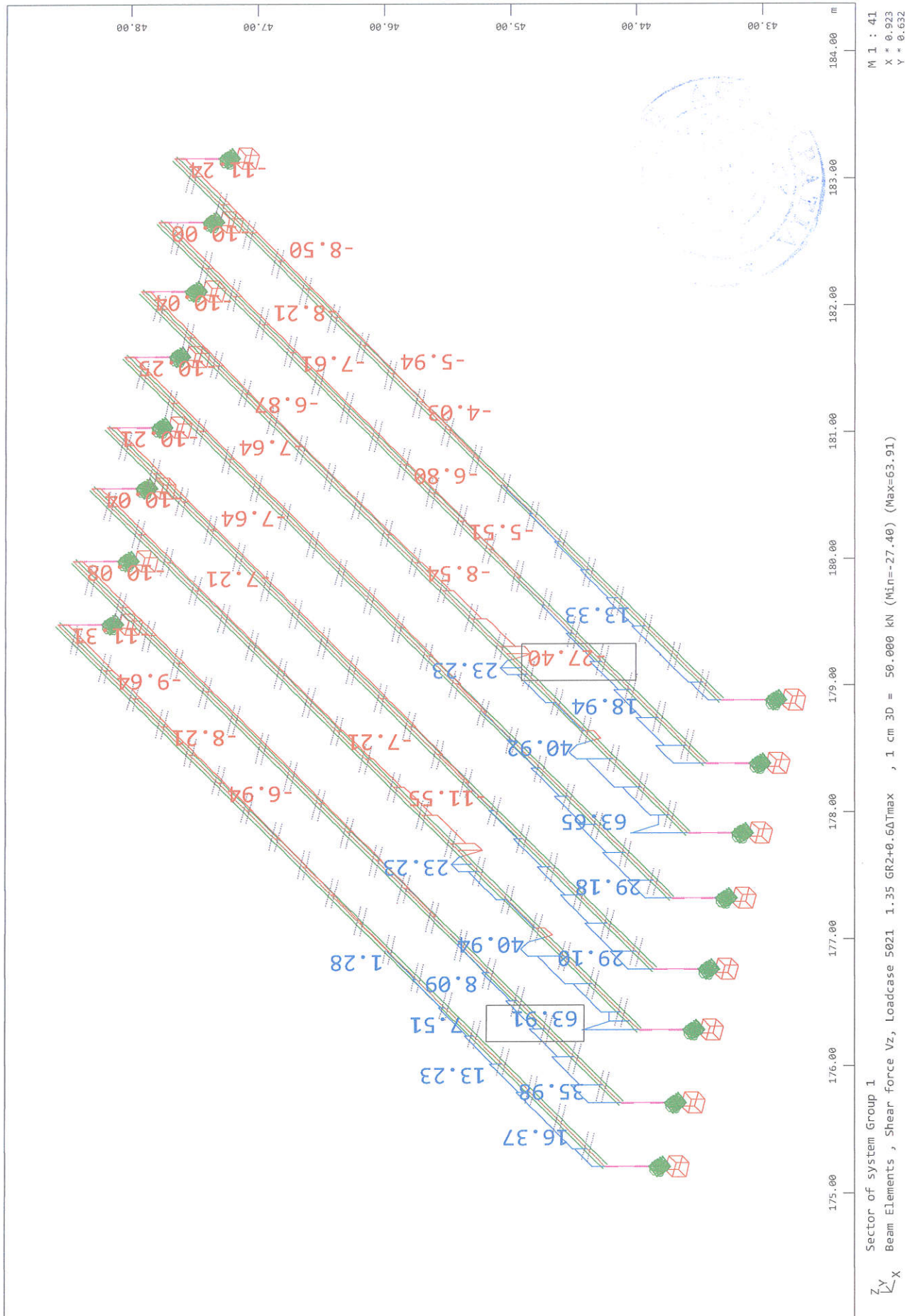


ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΦΑΣΗ ΛΕΙΤΟΥΡΓΕΙΑΣ
Interactive Graphics

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Sector of system Group 1
Beam Elements , Shear force Vz, Loadcase 5021 1.35 GR2+0.6ΔTmax , 1 cm 3D = 50.000 kN (Min=-27.40) (Max=63.91)



ΤΕΥΧΟΣ ΣΤΑΤΙΚΩΝ ΥΠΟΛΟΓΙΣΜΩΝ
ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ
ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ



ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Materials

Design Code

EuroNorm Bridges: EN 1992-2:2005 Design of concrete structures (Europe) V 2024
EuroNorm Bridges: EN 1993-2:2006 Design of steel structures
EuroNorm Bridges: EN 1994-2:2005 Design of composite steel and concrete structures
Structure: B (Road bridges)

Snow load zone : 1

National Defined Parameters

Reference of parameter in design code	Value
long term reduction concrete compressive strength α -cc EN 1992-2 3.1.6	0.850 ¹
long term reduction concrete tensile strength α -ct EN 1992-1-1 3.1.6 (2)	1.000 ¹
safety coefficient γ -c for concrete EN 1992-1-1 2.4.2.4	1.500 ¹
safety coefficient γ -CE for concrete elasticity EN 1992-1-1 5.8.6 (3)	1.200 ¹
safety coefficient γ -s for reinforcing steel EN 1992-1-1 2.4.2.4	1.150 ¹
safety coefficient γ -M0 for structural steel EN 1993-1-1 6.1	1.000 ¹
safety coefficient γ -M1 for structural steel EN 1993-2 6.1	1.100 ¹
safety coefficient γ -M2 for structural steel EN 1993-1-1 6.1	1.250 ¹

¹ national defined parameter taken from the INI-files

Materials

Mat	Classification
1	C 30/37 (EN 1992)
2	B 500 C (EN 1992)
3	S 235 (EN 1993)
4	C 30/37 (EN 1992) $g=0$

Mat 1 C 30/37 (EN 1992)

Young's modulus	E	32837	[N/mm ²]	Safetyfactor	1.50	[-]
Poisson's ratio	μ	0.20	[-]	Strength ¹	fc	25.50 [MPa]
Shear modulus	G	13682	[N/mm ²]	Nominal strength	fck	30.00 [MPa]
Compression modulus	K	18243	[N/mm ²]	Tensile strength	fctm	2.90 [MPa]
Nominal Weight	γ	25.0	[kN/m ³]	Tensile strength	fctk,05	2.03 [MPa]
Mean density	ρ	2400.0	[kg/m ³]	Tensile strength	fctk,95	3.77 [MPa]
Elongation coefficient	α	1.00E-05	[1/K]	Bond strength	fbd	3.04 [MPa]
				Service strength	fcm	38.00 [MPa]
				Fatigue strength	fcd,fat	14.96 [MPa]
				Tensile strength	fctd	1.35 [MPa]
				Tensile failure energy Gf		0.14 [N/mm]

¹ $f_c = f_{ck} * \alpha$ -cc

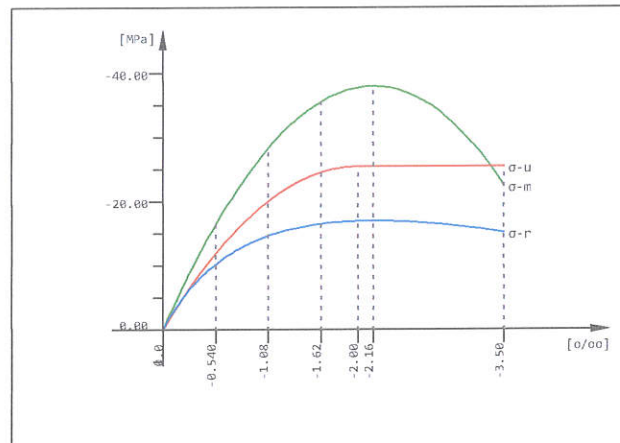
Stress-Strain for serviceability	ϵ [o/oo]	σ -m[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	34478
	-0.540	-16.42	26234
	-1.081	-28.31	17746
	-1.621	-35.55	9005
	-2.162	-38.00	0
	-3.500	-22.47	-23499
Safetyfactor			1.50

Stress-Strain for ultimate load	ϵ [o/oo]	σ -u[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	25500
	-2.000	-25.50	0
	-3.500	-25.50	0
Safetyfactor			1.50

Stress-Strain of calc. mean values	ϵ [o/oo]	σ -r[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	28732
	-0.540	-10.23	12007
	-1.081	-14.67	5278
	-1.621	-16.53	1917
	-2.162	-17.00	0

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Materials

Stress-Strain of calc. mean values	ϵ [o/oo]	σ -r[MPa]	E-t[N/mm2]
	-3.500	-15.23	-2279
	Safetyfactor (1.50)		



C 30/37 (EN 1992)

Mat 2 B 500 C (EN 1992)

Young's modulus	E	200000 [N/mm2]	Safetyfactor	1.15 [-]
Poisson's ratio	μ	0.30 [-]	Yield stress	f_y 500.00 [MPa]
Shear modulus	G	76923 [N/mm2]	Compressive yield	f_{yc} 500.00 [MPa]
Compression modulus	K	166667 [N/mm2]	Tensile strength	f_t 575.00 [MPa]
Nominal Weight	γ	78.5 [kN/m3]	Compressive strength	f_c 575.00 [MPa]
Mean density	ρ	7850.0 [kg/m3]	Ultimate strain	75.00 [o/oo]
Elongation coefficient	α	1.20E-05 [1/K]	relative bond coeff.	1.00 [-]
max. thickness	t-max	32.00 [mm]	EN 1992 bond coeff.	k_1 0.80 [-]
			Hardening modulus	E_h 0.00 [MPa]
			Proportional limit	f_p 500.00 [MPa]
			Dynamic allowance	σ -dyn 152.17 [MPa]

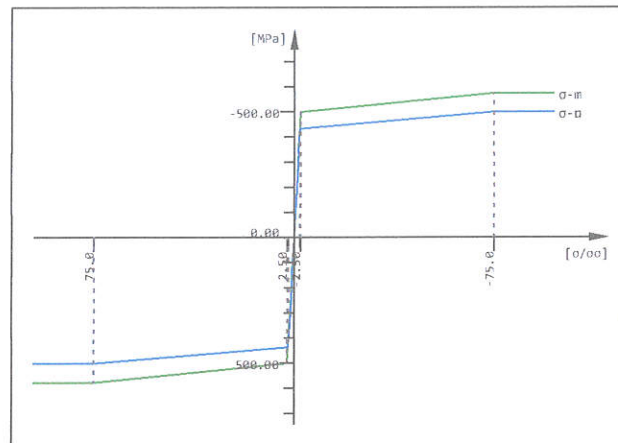
Stress-Strain for serviceability	ϵ [o/oo]	σ -m[MPa]	E-t[N/mm2]
Is also extended beyond the defined stress range	1000.000	575.00	0
	75.000	575.00	0
	2.500	500.00	1034
	0.000	0.00	200000
	-2.500	-500.00	1034
	-75.000	-575.00	0
	-1000.000	-575.00	0
	Safetyfactor 1.15		

Stress-Strain for ultimate load	ϵ [o/oo]	σ -u[MPa]	E-t[N/mm2]
Is also extended beyond the defined stress range	1000.000	500.00	0
	75.000	500.00	0
	2.174	434.78	896
	0.000	0.00	200000
	-2.174	-434.78	896
	-75.000	-500.00	0
	-1000.000	-500.00	0
	Safetyfactor (1.15)		

Stress-Strain of calc. mean values	ϵ [o/oo]	σ -r[MPa]	E-t[N/mm2]
Is also extended beyond the defined stress range	1000.000	500.00	0
	75.000	500.00	0
	2.174	434.78	896
	0.000	0.00	200000
	-2.174	-434.78	896
	-75.000	-500.00	0

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Materials

Stress-Strain of calc. mean values	ϵ [o/oo]	σ -r[MPa]	E-t[N/mm2]
	-1000.000	-500.00	0
Safetyfactor			(1.15)



B 500 C (EN 1992)

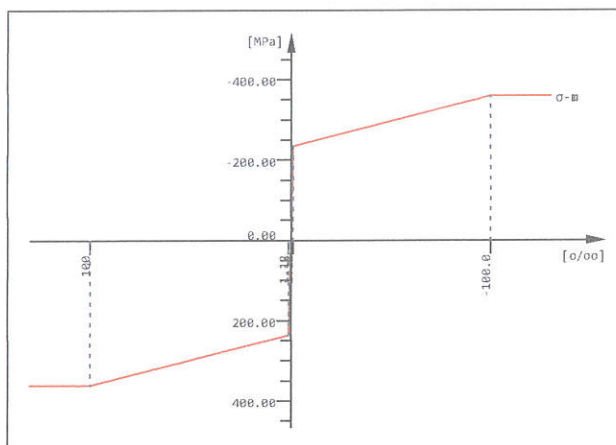
Mat 3 S 235 (EN 1993)

Young's modulus	E	210000 [N/mm2]	Safetyfactor	1.10 [-]
Poisson's ratio	μ	0.30 [-]	Yield stress	f_y 235.00 [MPa]
Shear modulus	G	80769 [N/mm2]	Compressive yield	f_{yc} 235.00 [MPa]
Compression modulus	K	175000 [N/mm2]	Tensile strength	f_t 360.00 [MPa]
Nominal Weight	γ	78.5 [kN/m3]	Compressive strength	f_c 360.00 [MPa]
Mean density	ρ	7850.0 [kg/m3]	Ultimate strain	100.00 [o/oo]
Elongation coefficient	α	1.20E-05 [1/K]	relative bond coeff.	0.00 [-]
max. thickness	t-max	40.00 [mm]	EN 1992 bond coeff.	k_1 0.00 [-]
Safety sectional design	γ -M0	1.00 [-]	Hardening modulus	E_h 0.00 [MPa]
Safety stability design	γ -M1	1.10 [-]	Proportional limit	f_p 235.00 [MPa]
Safety rupture	γ -M2	1.25 [-]	Dynamic allowance	σ -dyn 0.00 [MPa]

Stress-Strain for serviceability	ϵ [o/oo]	σ -m[MPa]	E-t[N/mm2]
Is also extended beyond the	1000.000	360.00	0
defined stress range	100.000	360.00	0
	1.119	235.00	1264
	0.000	0.00	210000
	-1.119	-235.00	1264
	-100.000	-360.00	0
	-1000.000	-360.00	0
Safetyfactor			1.00

Stress-Strain for ultimate load	ϵ [o/oo]	σ -u[MPa]	E-t[N/mm2]
Is also extended beyond the	1000.000	360.00	0
defined stress range	100.000	360.00	0
	1.119	235.00	1264
	0.000	0.00	210000
	-1.119	-235.00	1264
	-100.000	-360.00	0
	-1000.000	-360.00	0
Safetyfactor			1.10

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Materials



S 235 (EN 1993)

Mat 4 C 30/37 (EN 1992) g=0

Young's modulus	E	32837	[N/mm ²]	Safetyfactor	1.50	[-]
Poisson's ratio	μ	0.20	[-]	Strength ¹	fc	25.50 [MPa]
Shear modulus	G	13682	[N/mm ²]	Nominal strength	fck	30.00 [MPa]
Compression modulus	K	18243	[N/mm ²]	Tensile strength	fctm	2.90 [MPa]
Nominal Weight	γ	0.0	[kN/m ³]	Tensile strength	fctk,05	2.03 [MPa]
Mean density	ρ	0.0	[kg/m ³]	Tensile strength	fctk,95	3.77 [MPa]
Elongation coefficient	α	1.00E-05	[1/K]	Bond strength	fbd	3.04 [MPa]
				Service strength	fcm	38.00 [MPa]
				Fatigue strength	fcd,fat	14.96 [MPa]
				Tensile strength	fctd	1.35 [MPa]
				Tensile failure energy	Gf	0.14 [N/mm]

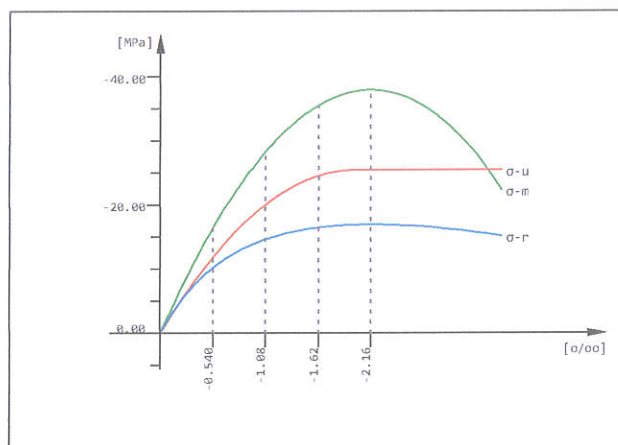
¹ fc = fck * α-cc

Stress-Strain for serviceability	ε[‰]	σ-m[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	34478
	-0.540	-16.42	26234
	-1.081	-28.31	17746
	-1.621	-35.55	9005
	-2.162	-38.00	0
	-3.500	-22.47	-23499
Safetyfactor			1.50

Stress-Strain for ultimate load	ε[‰]	σ-u[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	25500
	-2.000	-25.50	0
	-3.500	-25.50	0
Safetyfactor			1.50

Stress-Strain of calc. mean values	ε[‰]	σ-r[MPa]	E-t[N/mm ²]
Is only valid within the defined stress range	0.000	0.00	28732
	-0.540	-10.23	12007
	-1.081	-14.67	5278
	-1.621	-16.53	1917
	-2.162	-17.00	0
	-3.500	-15.23	-2279
Safetyfactor			(1.50)

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Materials



C 30/37 (EN 1992) g=0

Thermal material constants

Mat	T [°C]	S [kJ/K/m ³]	Kxx [W/K/m]	Kyy [W/K/m]	Kzz [W/K/m]	
1	AUTO	2.16E+03	1.951E+00			C 30/37 (EN 1992)
2	AUTO	3.45E+03	5.333E+01			B 500 C (EN 1992)
3	AUTO	3.45E+03	5.333E+01			S 235 (EN 1993)
4	AUTO	2.16E+03	1.951E+00			C 30/37 (EN 1992) g=0
Mat	material number	S [kJ/K/m ³]	Heat capacity			
T [°C]	Temperature	Kxx [W/K/m], Kyy [W/K/m], Kzz [W/K/m]	Heat conductivity			

Design Code

Snow load zone : 1

Mat	Classification
1	C 30/37 (EN 1992)
2	B 500 C (EN 1992)
3	S 235 (EN 1993)
4	C 30/37 (EN 1992) $g=0$



SNo	Mat MRf	A[m2] It[m4]	Ay[m2] Az[m2] Ayz[m2]	Iy[m4] Iz[m4] Iyz[m4]	yc[mm] zc[mm]	ysc[mm] zsc[mm]	E[N/mm2] G[N/mm2]	g[kg/m]	I-1[m4] I-2[m4] α [°]
1	3 2 ¹	1.9778E-02 3.145E-06	1.200E-02 4.970E-03	5.774E-04 1.080E-04	0.0 200.0	0.0 200.0	210000 80769	155.3 (BEAM)	
= STEEL BEAM									
2	3 2 ¹	8.9460E-03 1.488E-06	6.019E-03 1.408E-03	8.310E-06 5.400E-05 -1.504E-07	1.3 24.6	1.2 12.0	210000 80769	70.2 (BEAM)	5.400E-05 8.309E-06 89.81
= 1/3 STEEL BEAM									
3	3 2 ¹	6.9650E-03 3.821E-07	4.556E-03 4.339E-03	9.389E-06 7.473E-05	0.0 16.1	0.0 0.0	210000 80769	54.7 (BEAM)	7.473E-05 9.389E-06
= enisxisi									
¹ No valid reinforcements are defined									
SNo	section number				yc[mm],zc[mm]		ordinate of elastic centroid		
Mat	material number				ysc[mm],zsc[mm]		ordinate of shear centre		
A[m2]	sectional area				E[N/mm2]		Young's modulus		
Ay[m2],Az[m2],Ayz[m2]	transverse shear deformation area				g[kg/m]		mass per length		
Iy[m4],Iz[m4],Iyz[m4]	bending moment of inertia								
I-1[m4],I-2[m4], α [°]	principal moments of inertia and angle of the principal axes								
MRf	reinforcement material number								
It[m4]	torsional moment of inertia								
G[N/mm2]	Shear modulus								

Mat	A[m2]	Ay[m2]	Iy[m4]	yc[mm]	ysc[mm]	E[N/mm2]	g[kg/m]	I-1[m4]
MRf	It[m4]	Az[m2]	Iz[m4]	zc[mm]	zsc[mm]	G[N/mm2]		I-2[m4]
		Ayz[m2]	Iyz[m4]					$\alpha[^\circ]$
3	1.9778E-02	1.200E-02	5.774E-04	0.0	0.0	210000	155.3	
2 ¹	3.145E-06	4.970E-03	1.080E-04	200.0	200.0	80769	(BEAM)	

¹ No valid reinforcements are defined

Mat	material number	yc[mm],zc[mm]	ordinate of elastic centroid
A[m2]	sectional area	ysc[mm],zsc[mm]	ordinate of shear centre
Ay[m2],Az[m2],Ayz[m2]	transverse shear deformation area	E[N/mm2]	Young's modulus
Iy[m4],Iz[m4],Iyz[m4]	bending moment of inertia	g[kg/m]	mass per length
I-1[m4],I-2[m4], $\alpha[^\circ]$	principal moments of inertia and angle of the principal axes		
MRf	reinforcement material number		
It[m4]	torsional moment of inertia		
G[N/mm2]	Shear modulus		

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Sections

Additional static properties of cross section

$\alpha\text{-T}[1/K]$	$y_{\min}[mm]$ $y_{\max}[mm]$	$z_{\min}[mm]$ $z_{\max}[mm]$	$hy_{\min}[mm]$ $hz_{\min}[mm]$	$AK[m^2]$ $AB[m^2]$	MRs	$1/WT[1/m^3]$ $1/WT2[1/m^3]$	$1/WVy[1/m^2]$ $1/WVz[1/m^2]$
1.2E-05	-150.0 150.0	-200.0 200.0	200.0 356.9	9.992E-03	2	7.630E+03 5.541E+02	1.042E+02 2.075E+02
$\alpha\text{-T}[1/K]$ Elongation coefficient $y_{\min}[mm], z_{\min}[mm], y_{\max}[mm], z_{\max}[mm]$ extreme coordinates relative to centroid $hy_{\min}[mm], hz_{\min}[mm]$ minimum value for internal lever $AK[m^2]$ torsional equivalent area (Bredt) MRs transverse reinforcements material number $1/WT[1/m^3], 1/WT2[1/m^3]$ torsional resistance $1/WVy[1/m^2], 1/WVz[1/m^2]$ shear force resistance $AB[m^2]$ gross concrete area							

Section values for warping

$W_{\min}[m^2]$	$W_{\max}[m^2]$	$CM[m^6]$	$CMS[m^4]$	$AS_{wy}[m^6]$	$AS_{wz}[m^6]$	$ry[mm]$	$rz[mm]$
-0.0282	0.0282	3.817E-06	0.000	6.767E-23	2.707E-22	0.0	0.0
$W_{\min}[m^2], W_{\max}[m^2]$ unit warping $CM[m^6]$ warping resistance $CMS[m^4]$ warping shear resistance $AS_{wy}[m^6], AS_{wz}[m^6]$ warping sectional value $ry[mm], rz[mm]$ sectional distance							

Design forces and moments

	$N[kN]$	$Vy[kN]$	$Vz[kN]$	$Mt[kNm]$	$Mt2[kNm]$	$Mb[kNm^2]$	$My[kNm]$	$Mz[kNm]$	$y[mm]$	$z[mm]$	BUCK
$P^{1,2}$	4647.8	1953.75	729.64	28.73	367.31	47.71	760.27	258.37	0.0	200.0	- , a, b
$E^{3,2}$	4647.8	1302.50	653.76	17.78	244.87	31.81	678.40	169.20	0.0	200.0	
¹ P = plastic design values (ultimate bearing capacity) ² Material safety $\gamma\text{-M0}$ for structural steel = 1.00 ³ E = elastic design values (stress limit reached)											
$N[kN]$ normal force $Vy[kN], Vz[kN]$ shear force $Mt[kNm]$ primary torsional moment $Mt2[kNm]$ secondary torsional moment $Mb[kNm^2]$ warping moment $My[kNm], Mz[kNm]$ bending moment $y[mm], z[mm]$ ordinate of plastic centre BUCK buckling curve (LTB, y-y, z-z)											

Additional design data

Mat	periphery-0/-I	deff	t-min	t-max	thet-p	thet-y	thet-z	thet-yz	yg	zg
	$[m^2/m]$	$[m^2/m]$	$[mm]$	$[mm]$	$[kgm^2/m]$	$[kgm^2/m]$	$[kgm^2/m]$	$[kgm^2/m]$	$[mm]$	$[mm]$
	1.952		20.3	13.5	24.0	5.380	4.532	0.848	0.0	200.0
Mat material number periphery-0/-I peripheral area per length deff effective depth t-min, t-max thet-p, thet-y, thet-z, thet-yz yg, zg thickness rotational mass ordinate of the mass centre										

Reinforcement global values

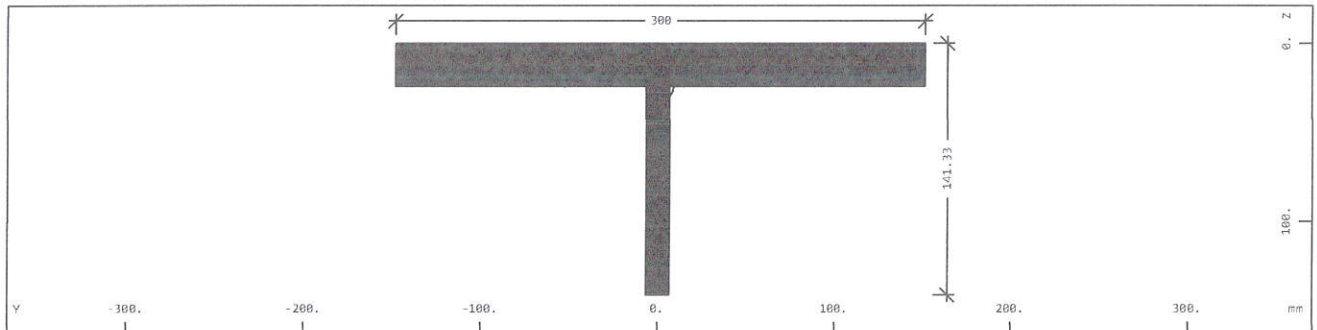
Layer	Mref	Mat	As	As-min	As-max	D	yr	zr	L-tors	N-p	My-p	Mz-p
			$[cm^2]$	$[cm^2]$	$[cm^2]$	$[mm]$	$[mm]$	$[mm]$	$[mm]$	$[kN]$	$[kNm]$	$[kNm]$
M1	0	2	0.00	0.00			0.0	0.0				
M2	0	2	0.00	0.00			0.0	0.0				
M3	0	2	0.00	0.00			0.0	0.0				
M4	0	2	0.00	0.00			0.0	0.0				
Layer layer of reinforcement Mref embedding reference material Mat material number As reinforcement area As-min minimum reinforcement area As-max maximum reinforcement area D bar diameter yr, zr ordinate of elastic centroid L-tors torsional effective length N-p prestress normal force My-p, Mz-p prestress bending moment												

Rolled steel

Rolled steel	D[mm]	B[mm]	s[mm]	t[mm]	r[mm]	yr[mm]	zr[mm]	[grd]
HEB 400			13.5	24.0	27.0	-1.7	0.0	
D[mm] height B[mm] width s[mm] web thickness t[mm] flange thickness r[mm] fillet radius yr[mm], zr[mm] sectional coordinate								

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Sections

Cross section No. 2 - 1/3 STEEL BEAM



Cross section No. 2 - 1/3 STEEL BEAM

Static properties of cross section

Mat	A[m ²]	Ay[m ²]	Iy[m ⁴]	yc[mm]	ysc[mm]	E[N/mm ²]	g[kg/m]	I-1[m ⁴]
MRf	It[m ⁴]	Az[m ²]	Iz[m ⁴]	zc[mm]	zsc[mm]	G[N/mm ²]		I-2[m ⁴]
		Ayz[m ²]	Iyz[m ⁴]					α[°]
3	8.9460E-03	6.019E-03	8.310E-06	1.3	1.2	210000	70.2	5.400E-05
2 ¹	1.488E-06	1.408E-03	5.400E-05	24.6	12.0	80769	(BEAM)	8.309E-06
			-1.504E-07					89.81

¹ No valid reinforcements are defined

Mat	material number	yc[mm],zc[mm]	ordinate of elastic centroid
A[m ²]	sectional area	ysc[mm],zsc[mm]	ordinate of shear centre
Ay[m ²],Az[m ²],Ayz[m ²]	transverse shear deformation area	E[N/mm ²]	Young's modulus
Iy[m ⁴],Iz[m ⁴],Iyz[m ⁴]	bending moment of inertia	g[kg/m]	mass per length
I-1[m ⁴],I-2[m ⁴],α[°]	principal moments of inertia and angle of the principal axes		
MRf	reinforcement material number		
It[m ⁴]	torsional moment of inertia		
G[N/mm ²]	Shear modulus		

Additional static properties of cross section

α-T[1/K]	ymin[mm]	zmin[mm]	hymin[mm]	AK[m ²]	MRs	1/WT[1/m ³]	1/WVy[1/m ²]
	ymax[mm]	zmax[mm]	hzmin[mm]	AB[m ²]		1/WT2[1/m ³]	1/WVz[1/m ²]
1.2E-05	-149.7	-24.6	199.1	4.582E-03	2	1.612E+04	2.081E+02
	150.3	116.7	90.4			9.225E+05	8.100E+02

α-T[1/K]	Elongation coefficient
ymin[mm],zmin[mm],ymax[mm],zmax[mm]	extreme coordinates relative to centroid
hymin[mm],hzmin[mm]	minimum value for internal lever
AK[m ²]	torsional equivalent area (Bredt)
MRs	transverse reinforcements material number
1/WT[1/m ³],1/WT2[1/m ³]	torsional resistance
1/WVy[1/m ²],1/WVz[1/m ²]	shear force resistance
AB[m ²]	gross concrete area

Section values for warping

wmin[m ²]	wmax[m ²]	CM[m ⁶]	CMS[m ⁴]	ASwyy[m ⁶]	ASwzz[m ⁶]	ry[mm]	rz[mm]
-0.0001	0.0001	4.717E-12	0.000	3.303E-10	1.228E-10	1.1	16.8
wmin[m ²],wmax[m ²]	unit warping		ASwyy[m ⁶],ASwzz[m ⁶]	warping sectional value			
CM[m ⁶]	warping resistance		ry[mm],rz[mm]	sectional distance			
CMS[m ⁴]	warping shear resistance						

Design forces and moments

	N[kN]	Vy[kN]	Vz[kN]	Mt[kNm]	Mt2[kNm]	Mb[kNm2]	My[kNm]	Mz[kNm]	y[mm]	z[mm]	BUCK
p ¹²	2102.3	976.88	236.89	13.32	12.09	0.00	36.11	128.30	0.3	14.8	-, b, b
p ¹²	-1361.8						43.21	0.00	0.0	24.6	COMB ³
p ¹²	77.4						0.00	128.34	1.3	0.0	COMB ³
E ⁴²	2102.3	652.09	167.50	8.41	0.15	0.01	5.20	84.55	1.3	24.6	

¹ P = plastic design values (ultimate bearing capacity)

² Material safety γ-M0 for structural steel = 1.00

³ Maximum moment (defining point D in interaction diagram)

⁴ E = elastic design values (stress limit reached)

N[kN]	normal force	Mb[kNm2]	warping moment
Vy[kN],Vz[kN]	shear force	My[kNm],Mz[kNm]	bending moment
Mt[kNm]	primary torsional moment	y[mm],z[mm]	ordinate of plastic centre
Mt2[kNm]	secondary torsional moment	BUCK	buckling curve (LTB, y-y, z-z)

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Sections

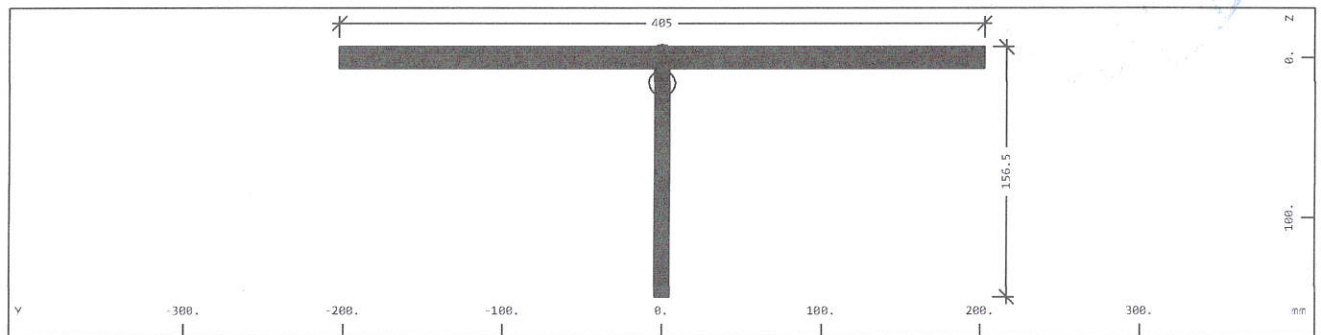
Additional design data

Mat	periphery-0/-I [m2/m]	deff [mm]	t-min [mm]	t-max [mm]	thet-p [kgm2/m]	thet-y [kgm2/m]	thet-z [kgm2/m]	thet-yz [kgm2/m]	yg [mm]	zg [mm]
	0.859	20.8	13.5	24.0	0.489	0.065	0.424	-0.001	1.3	24.6
Mat	material number		t-min,t-max		thickness					
periphery-0/-I	peripheral area per length		thet-p,thet-y,thet-z,thet-yz		rotational mass					
deff	effective depth		yg,zg		ordinate of the mass centre					

Reinforcement global values

Layer	Mref	Mat	As [cm2]	As-min [cm2]	As-max [cm2]	D [mm]	yr [mm]	zr [mm]	L-tors [mm]	N-p [kN]	My-p [kNm]	Mz-p [kNm]
M1	0	2	0.00	0.00			0.0	0.0				
M2	0	2	0.00	0.00			0.0	0.0				
M3	0	2	0.00	0.00			0.0	0.0				
M4	0	2	0.00	0.00			0.0	0.0				
Layer	layer of reinforcement			D		bar diameter						
Mref	embedding reference material			yr,zr		ordinate of elastic centroid						
Mat	material number			L-tors		torsional effective length						
As	reinforcement area			N-p		prestress normal force						
As-min	minimum reinforcement area			My-p,Mz-p		prestress bending moment						
As-max	maximum reinforcement area											

Cross section No. 3 - enisxisi



Cross section No. 3 - enisxisi

Static properties of cross section

Mat	A[m2]	Ay[m2]	Iy[m4]	yc[mm]	ysc[mm]	E[N/mm2]	g[kg/m]	I-1[m4]
MRf	It[m4]	Az[m2]	Iz[m4]	zc[mm]	zsc[mm]	G[N/mm2]		I-2[m4]
		Ayz[m2]	Iyz[m4]					α[°]
3	6.9650E-03	4.556E-03	9.389E-06	0.0	0.0	210000	54.7	7.473E-05
2 ¹	3.821E-07	4.339E-03	7.473E-05	16.1	0.0	80769	(BEAM)	9.389E-06

¹ No valid reinforcements are defined

Mat	material number	yc[mm],zc[mm]	ordinate of elastic centroid
A[m2]	sectional area	ysc[mm],zsc[mm]	ordinate of shear centre
Ay[m2],Az[m2],Ayz[m2]	transverse shear deformation area	E[N/mm2]	Young's modulus
Iy[m4],Iz[m4],Iyz[m4]	bending moment of inertia	g[kg/m]	mass per length
I-1[m4],I-2[m4],α[°]	principal moments of inertia and angle of the principal axes		
MRf	reinforcement material number		
It[m4]	torsional moment of inertia		
G[N/mm2]	Shear modulus		

Additional static properties of cross section

α-T[1/K]	ymin[mm]	zmin[mm]	hymin[mm]	AK[m2]	MRs	1/WT[1/m3]	1/WVy[1/m2]
	ymax[mm]	zmax[mm]	hzmin[mm]	AB[m2]		1/WT2[1/m3]	1/WVz[1/m2]
1.2E-05	-202.5	-22.8	270.0	3.522E-03	2	3.533E+04	2.743E+02
	202.5	133.7	105.1				9.375E+02

α-T[1/K]	Elongation coefficient
ymin[mm],zmin[mm],ymax[mm],zmax[mm]	extreme coordinates relative to centroid
hymin[mm],hzmin[mm]	minimum value for internal lever
AK[m2]	torsional equivalent area (Bredt)
MRs	transverse reinforcements material number
1/WT[1/m3],1/WT2[1/m3]	torsional resistance
1/WVy[1/m2],1/WVz[1/m2]	shear force resistance
AB[m2]	gross concrete area

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
Sections

Section values for warping

Wmin[m2]	Wmax[m2]	CM[m6]	CMS[m4]	ASwyy[m6]	ASwzz[m6]	ry[mm]	rz[mm]
0.0000	0.0000	2.135E-23	0.000	0.000E+00	0.000E+00	0.0	-13.4
Wmin[m2], Wmax[m2]	unit warping		ASwyy[m6], ASwzz[m6]		warping sectional value		
CM[m6]	warping resistance		ry[mm], rz[mm]		sectional distance		
CMS[m4]	warping shear resistance						

Design forces and moments

	N[kN]	Vy[kN]	Vz[kN]	Mt[kNm]	Mt2[kNm]	Mb[kNm2]	My[kNm]	Mz[kNm]	y[mm]	z[mm]	BUCK
P ¹²	1636.8	741.82	203.18	6.02			30.37	130.97	0.0	1.8	-, b, b
P ¹²	-1008.6						41.98	0.00	0.0	16.1	COMB ³
E ⁴²	1636.8	494.54	144.73	3.84			16.51	86.73	0.0	16.1	

¹ P = plastic design values (ultimate bearing capacity)

² Material safety γ-M0 for structural steel = 1.00

³ Maximum moment (defining point D in interaction diagram)

⁴ E = elastic design values (stress limit reached)

N[kN]	normal force	Mb[kNm2]	warping moment
Vy[kN],Vz[kN]	shear force	My[kNm],Mz[kNm]	bending moment
Mt[kNm]	primary torsional moment	y[mm],z[mm]	ordinate of plastic centre
Mt2[kNm]	secondary torsional moment	BUCK	buckling curve (LTB, y-y, z-z)

Additional design data

Mat	periphery-0/-I	deff	t-min	t-max	thet-p	thet-y	thet-z	thet-yz	yg	zg
	[m2/m]	[m2/m]	[mm]	[mm]	[kgm2/m]	[kgm2/m]	[kgm2/m]	[kgm2/m]	[mm]	[mm]
	1.110		12.6	10.0	13.5	0.660	0.074	0.587	0.0	16.1
Mat	material number		t-min,t-max		thickness					
periphery-0/-I	peripheral area per length		thet-p,thet-y,thet-z,thet-yz		rotational mass					
deff	effective depth		yg,zg		ordinate of the mass centre					

Reinforcement global values

Layer	Mref	Mat	As [cm2]	As-min [cm2]	As-max [cm2]	D [mm]	yr [mm]	zr [mm]	L-tors [mm]	N-p [kN]	My-p [kNm]	Mz-p [kNm]
M1	0	2	0.00	0.00			0.0	0.0				
M2	0	2	0.00	0.00			0.0	0.0				
M3	0	2	0.00	0.00			0.0	0.0				
M4	0	2	0.00	0.00			0.0	0.0				
Layer	layer of reinforcement			D		bar diameter						
Mref	embedding reference material			yr,zr		ordinate of elastic centroid						
Mat	material number			L-tors		torsional effective length						
As	reinforcement area			N-p		prestress normal force						
As-min	minimum reinforcement area			My-p,Mz-p		prestress bending moment						
As-max	maximum reinforcement area											

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΟΦΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
ΠΕΡΙΓΡΑΦΗ ΒΑΣΙΚΩΝ ΦΟΡΤΙΣΕΩΝ

Actions

type	part	sup	Designation	$\gamma-u$	$\gamma-f$	$\gamma-a$	ψ_0	ψ_1	ψ_2	ψ_{1inf}
G	G	perm	DEAD LOADS	1.35	1.00	1.00	1.00	1.00	1.00	1.00
G_1	G	perm	DEAD LOADS G_1	1.35	1.00	1.00	1.00	1.00	1.00	1.00
G_2	G	perm	dead load g2	1.35	1.00	1.00	1.00	1.00	1.00	1.00
C	P	perm	creep + shrinkage	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P	P	perm	prestressing	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_T	Q	cond	LT	1.35	0.00	1.00	0.75	0.75	0.00	0.80
L_U	Q	cond	LU	1.35	0.00	1.00	0.40	0.40	0.00	0.80
Q	Q	cond	Q Buildings	1.50	0.00	1.00	0.70	0.70	0.30	0.70
QX	Q	cond	EARTH PR. Q	1.50	0.00	1.00	0.70	0.70	0.30	0.70
S	Q	cond	SNOW	1.50	0.00	1.00	0.80	0.00	0.00	0.20
T	Q	cond	TEMPERATURE	1.50	0.00	1.00	0.60	0.20	0.00	0.60
W	Q	cond	WIND	1.35	0.00	1.00	0.60	0.20	0.00	1.00
X	Q	cond	EARTH PRESSURE	1.35	0.00	1.00	1.00	1.00	1.00	1.00
E	E	cond		1.00	0.00	1.00	1.00	1.00	1.00	1.00
			Reliability factor	Kfi	1.000					
			Reduction factor	xsi	0.850					
type	action			$\gamma-u, \gamma-f, \gamma-a$	partial safety factors for unfavourable/favourable/accidental					
part	partition of the action			$\psi_0, \psi_1, \psi_2, \psi_{1inf}$	combination coefficients					
sup	superposition type									

Load Case 1 (G) I.B. (G)

Factor forces and moments		1.000
Factor dead weight	DL-ZZ	-1.000
unfavourable partial safety factor		1.350
favourable partial safety factor		1.000
Combination coefficient	ψ_0	1.000 (rare)
Combination coefficient	ψ_{1inf}	1.000 (infrequent)
Combination coefficient	ψ_1	1.000 (frequent)
Combination coefficient	ψ_2	1.000 (permanent)

Load Case 2 (G_1) ΠΡΟΣΘΕΤΑ ΜΟΝΙΜΑ (G1)

Factor forces and moments		1.000
unfavourable partial safety factor		1.350
favourable partial safety factor		1.000
Combination coefficient	ψ_0	1.000 (rare)
Combination coefficient	ψ_{1inf}	1.000 (infrequent)
Combination coefficient	ψ_1	1.000 (frequent)
Combination coefficient	ψ_2	1.000 (permanent)

Loads acting on Beam elements

Number	Type	a[m]	l[m]	Load value	Load value	Unit	ya[mm]	za[mm]	ye[mm]	ze[mm]	Ref
10001	PG	0.000	1.204	4.59		[kN/m]					
10002	PG	0.000	1.204	4.59		[kN/m]					
10003	PG	0.000	1.204	4.59		[kN/m]					
10004	PG	1.199		6.8		[kN]					
10004	PG	0.000	1.204	4.59		[kN/m]					
10005	PG	0.000	1.204	4.59		[kN/m]					
10006	PG	0.000	1.204	4.59		[kN/m]					
10007	PG	0.000	1.204	4.59		[kN/m]					
10008	PG	0.000	1.204	4.59		[kN/m]					

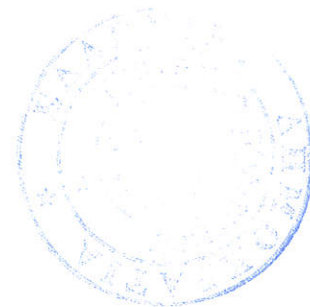
Load Case 3 (G_1) ΠΡΟΣΘΕΤΑ ΜΟΝΙΜΑ (G1)

Factor forces and moments		1.000
unfavourable partial safety factor		1.350
favourable partial safety factor		1.000
Combination coefficient	ψ_0	1.000 (rare)
Combination coefficient	ψ_{1inf}	1.000 (infrequent)
Combination coefficient	ψ_1	1.000 (frequent)
Combination coefficient	ψ_2	1.000 (permanent)

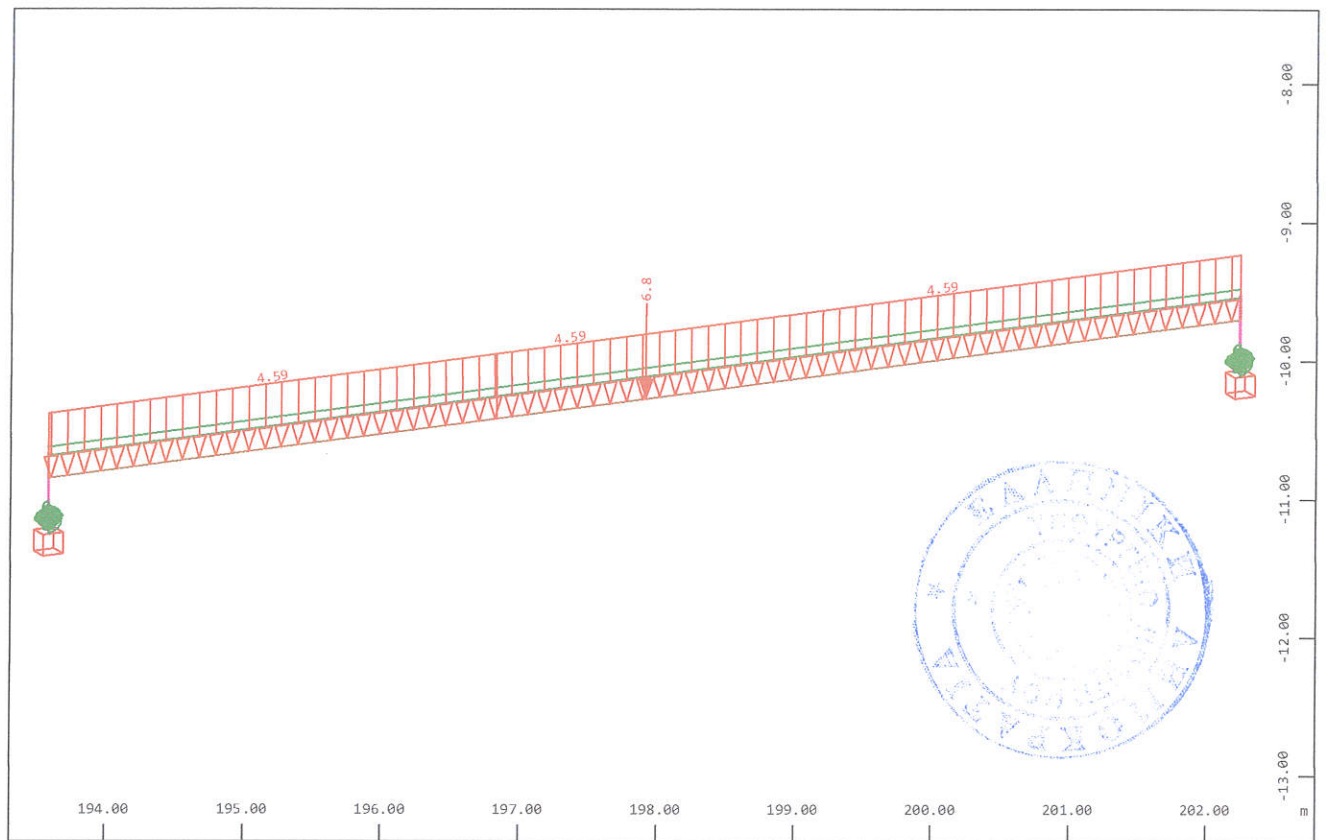
ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
ΠΕΡΙΓΡΑΦΗ ΒΑΣΙΚΩΝ ΦΟΡΤΙΣΕΩΝ

Loads acting on Beam elements

Number	Type	a[m]	l[m]	Load value	Load value	Unit	ya[mm]	za[mm]	ye[mm]	ze[mm]	Ref
10001	PG	0.000	1.204	0.48		[kN/m]					
10002	PG	0.000	1.204	0.48		[kN/m]					
10003	PG	0.000	1.204	0.48		[kN/m]					
10004	PG	0.000	1.204	0.48		[kN/m]					
10005	PG	0.000	1.204	0.48		[kN/m]					
10006	PG	0.000	1.204	0.48		[kN/m]					
10007	PG	0.000	1.204	0.48		[kN/m]					
10008	PG	0.000	1.204	0.48		[kN/m]					

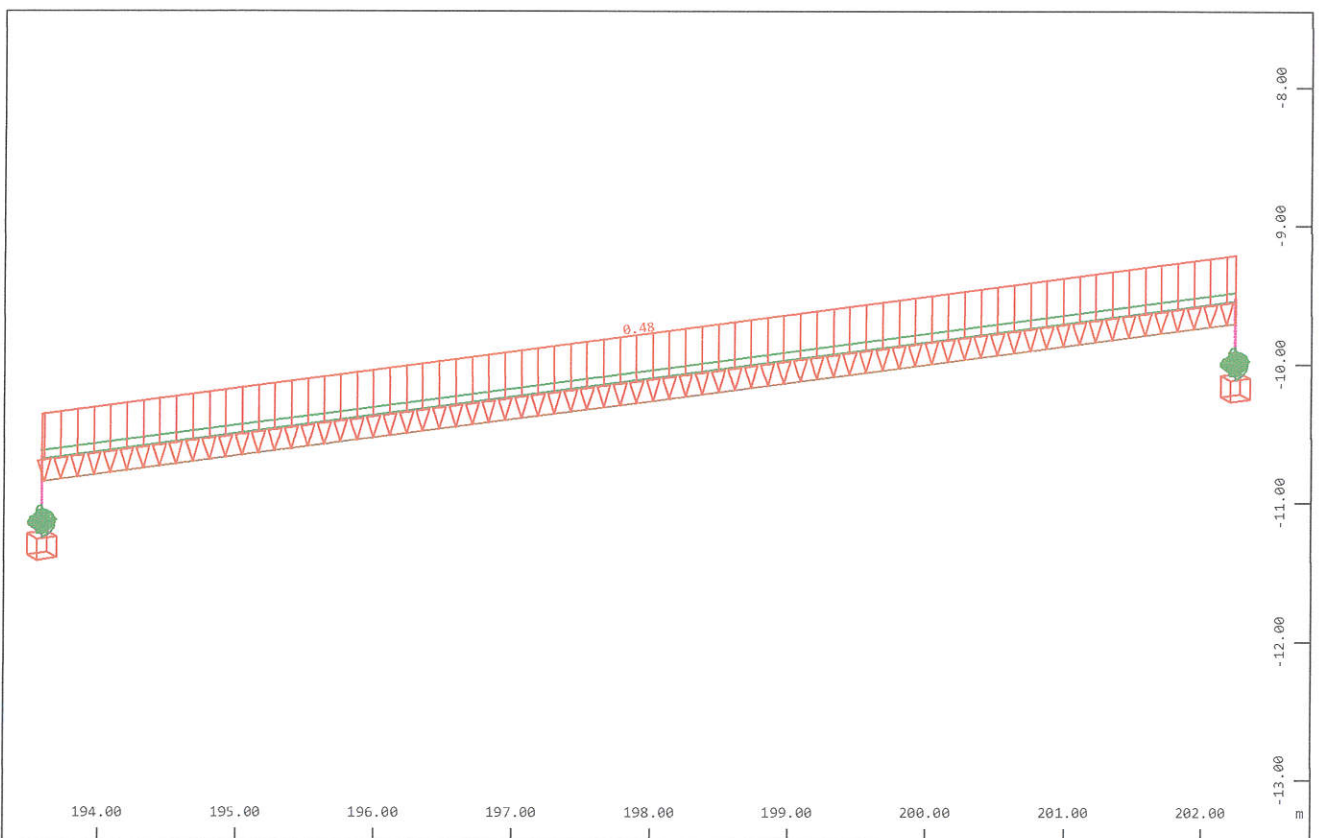


ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ



All loads (in components), Loadcase 2 ΠΡΟΣΘΕΤΑ ΜΟΝΙΜΑ (G), (1 cm 3D = unit) Beam single load (force) in global Z (Unit=5.0 kN, Min=-6.8 Max=-6.8 load (force) in global Z (Unit=5.00 kN/m, Min=-4.59 Max=-4.59), Beam line

M 1 : 53
X * 0.502
Y * 0.906
Z * 0.962



All loads (in components), Loadcase 3 ΠΡΟΣΘΕΤΑ ΜΟΝΙΜΑ (G1), (1 cm 3D = unit) Beam line load (force) in global Z (Unit=0.50 kN/m (Min=-0.48) (Max=-0.48)

M 1 : 53
X * 0.502
Y * 0.906
Z * 0.962

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
ΣΥΝΔΥΑΣΜΟΙ ΦΟΡΤΙΣΕΩΝ

Actions

type	part	sup	Designation	γ -u	γ -f	γ -a	ψ_0	ψ_1	ψ_2	ψ_{inf}
G	G	perm	DEAD LOADS	1.35	1.00	1.00	1.00	1.00	1.00	1.00
G_1	G	perm	DEAD LOADS G_1	1.35	1.00	1.00	1.00	1.00	1.00	1.00
G_2	G	perm	dead load g2	1.35	1.00	1.00	1.00	1.00	1.00	1.00
C	P	perm	creep + shrinkage	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P	P	perm	prestressing	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_T	Q	cond	LT	1.35	0.00	1.00	0.75	0.75	0.00	0.80
L_U	Q	cond	LU	1.35	0.00	1.00	0.40	0.40	0.00	0.80
Q	Q	cond	Q Buildings	1.50	0.00	1.00	0.70	0.70	0.30	0.70
QX	Q	cond	EARTH PR. Q	1.50	0.00	1.00	0.70	0.70	0.30	0.70
S	Q	cond	SNOW	1.50	0.00	1.00	0.80	0.00	0.00	0.20
T	Q	cond	TEMPERATURE	1.50	0.00	1.00	0.60	0.20	0.00	0.60
W	Q	cond	WIND	1.35	0.00	1.00	0.60	0.20	0.00	1.00
X	Q	cond	EARTH PRESSURE	1.35	0.00	1.00	1.00	1.00	1.00	1.00
E	E	cond		1.00	0.00	1.00	1.00	1.00	1.00	1.00
			Reliability factor	Kfi	1.000					
			Reduction factor	xsi	0.850					
type	action		γ -u, γ -f, γ -a	partial safety factors for unfavourable/favourable/accidental						
part	partition of the action		$\psi_0,\psi_1,\psi_2,\psi_{inf}$	combination coefficients						
sup	superposition type									

Load Case 1501 ((D)) 1.35G

Factor forces and moments		1.000	
Factor dead weight	DL-ZZ	-1.350	
Selected loads	copied from load case	2 with factor	1.350
Selected loads	copied from load case	3 with factor	1.500

Load Case 2501 ((R)) 1.0G

Factor forces and moments		1.000	
Factor dead weight	DL-ZZ	-1.000	
Selected loads	copied from load case	2 with factor	1.000
Selected loads	copied from load case	3 with factor	1.000

ΦΟΡΕΑΣ ΚΑΤΑΣΤΡΩΜΑΤΟΣ ΕΛΕΓΧΟΣ ΣΤΡΕΠΤΟΚΑΜΠΤΙΚΟΥ ΛΥΓΙΣΜΟΥ
ΠΕΡΙΒΑΛΛΟΥΣΕΣ ΕΝΤΑΤΙΚΩΝ ΜΕΓΕΘΩΝ

Design Code

EuroNorm Bridges: EN 1990:2002 Basis of structural design (Europe) V 2024

Combination rule Number 31

Συνολικές Περιβ. ΜΟΝ ΟΚΑ

Resulting Load Cases type ULS fundamental combination

Load Case selection

Number	Fact	Type	Designation
1501	1.00	AG1	1.35G
Fact factor for load case			
Type type of the load case			
AG exclusive load permanent			

Combination rule Number 32

Συνολικές Περιβ. ΜΟΝ ΟΚΑ-RARE

Resulting Load Cases type SLS characteristic combination

Load Case selection

Number	Fact	Type	Designation
2501	1.00	AG1	1.0G
Fact factor for load case			
Type type of the load case			
AG exclusive load permanent			

Generated Load Cases

Number	Combination	Designation
501	31	MAX-UX NODE
502	31	MIN-UX NODE
503	31	MAX-UY NODE
504	31	MIN-UY NODE
505	31	MAX-UZ NODE
506	31	MIN-UZ NODE
511	31	MAX-N BEAM
512	31	MIN-N BEAM
513	31	MAX-VY BEAM
514	31	MIN-VY BEAM
515	31	MAX-VZ BEAM
516	31	MIN-VZ BEAM
517	31	MAX-MT BEAM
518	31	MIN-MT BEAM
519	31	MAX-MY BEAM
520	31	MIN-MY BEAM
521	31	MAX-MZ BEAM
522	31	MIN-MZ BEAM
523	31	MAX-MB BEAM
524	31	MIN-MB BEAM
551	32	MAXR-UX NODE
552	32	MINR-UX NODE
553	32	MAXR-UY NODE
554	32	MINR-UY NODE
555	32	MAXR-UZ NODE
556	32	MINR-UZ NODE
561	32	MAXR-N BEAM
562	32	MINR-N BEAM
563	32	MAXR-VY BEAM
564	32	MINR-VY BEAM
565	32	MAXR-VZ BEAM
566	32	MINR-VZ BEAM
567	32	MAXR-MT BEAM
568	32	MINR-MT BEAM
569	32	MAXR-MY BEAM