RESULTS COMPARISON

CDS-SectionDesigner / Cubs-Fagus

ANALYSIS 1 – Reinforced Concrete

CUBUS-FAGUS

Efficiency

Action forces / Efficiency: eff(M,N)=0.02 OK

No.	AP	P	Bending and axial force N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Shear forces and torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Complete CS eff(M,N,V,T) [-]
1	!ULS		0	1000.0	0	0.02					

Analysis parameters "!ULS" Standard: Eurocode EN

Extreme stresses and strain

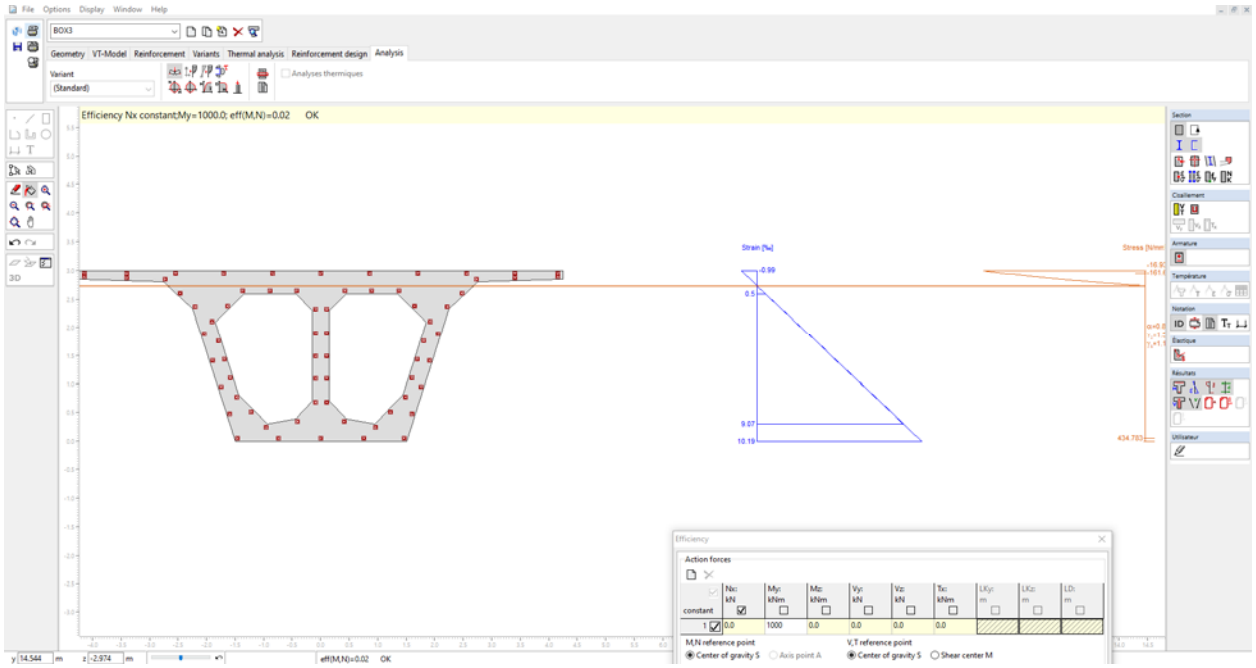
Name	Class	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	4.25	3.	-0.99	-16.937	1.76
C1	C40/50	-1.5	0.	10.19	0.	1.76
P26	B500B	4.15	2.95	-0.81	-161.626	1.15
P32	B500B	1.46	0.05	10.	434.783	1.15

Ultimate state "!ULS"

Internal forces N [kN]	M_y [kNm]	M_z [kNm]	Strain and Curvature ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Stiffness Values N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-1.5	40251.5	0.	3.32	3.7	-0.0	446.3	10800135.0	98964752.3

Internal section forces represented by two vectors

	Internal Forces CS [kN]	Rfmt [kN]	Sum [kN]	Moments M	Unit [kNm]	Geometric Values z	Unit [m]	x, d	Unit [m]
Compr. F_c=	-20009.	-3022.	-23031.	M_c=	-24704.1	z_c=	1.073	x_c =	0.267
Tens. F_s=	0.	23029.5	23029.5	M_s =	-15547.4	z_s =	0.675	d =	1.833
N =			-1.5	M =	-40251.5	z =	1.748	x/d =	0.15



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte					Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	40.27	0.0	40272.9	0.0	9.87e-4	-1.02e-2	16.9	0.0	8.01e-4	-1.00e-2	160.2	-434.8						-3.33e-3	3.72e-3	7.19e-20	8	1.79e-7

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	100650.4	99398.7	1.3
Resistant Moment Mz (kN.m)	0.0	0.0	0.0
Deformation at COG (e^{-3})	-1	-1	0.0
Curvature about Y (e^{-3})	2.2	2.2	0.0
Curvature about Z (e^{-3})	0	0	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 2 – Reinforced Concrete

CUBUS-FAGUS

Efficiency

Action forces / Efficiency: eff(M,N)=0.02 OK

No.	AP	P	Bending and axial force N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Shear forces and torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Complete CS eff(M,N,V,T) [-]
1	!ULS		1000.0	-1000.0	1000.0	0.02					

Analysis parameters "!ULS" Standard: Eurocode EN

Extreme stresses and strain

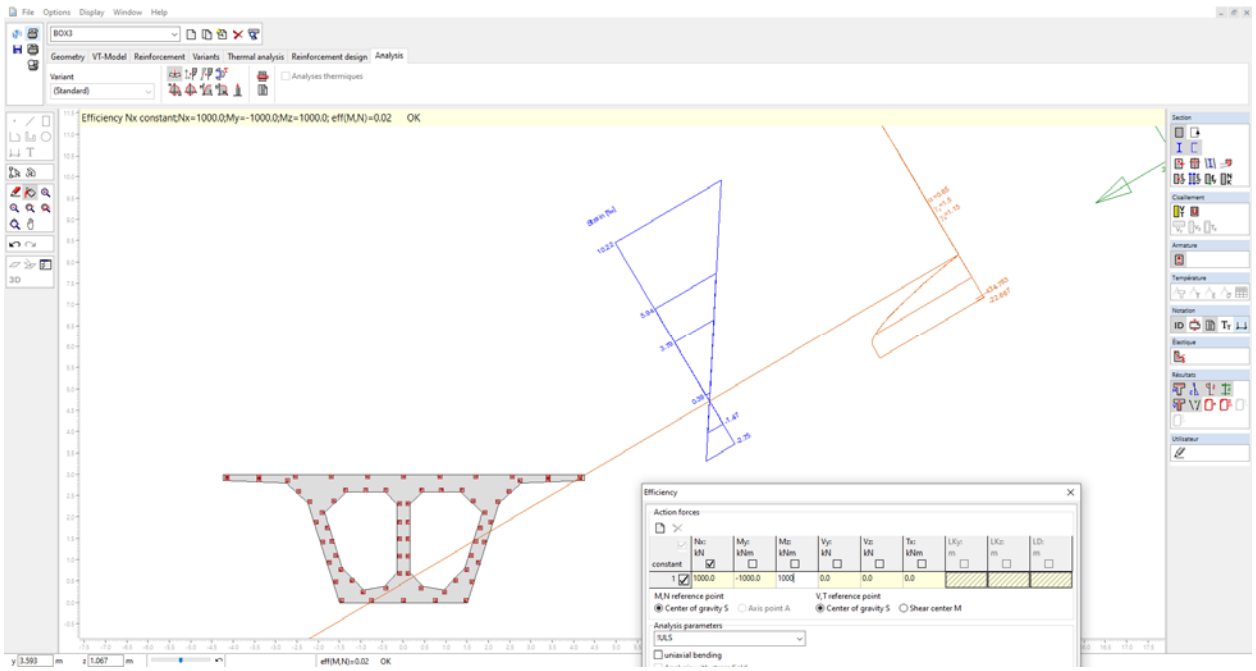
Name	Class	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	1.5	0.	-2.75	-22.667	1.76
C1	C40/50	-4.25	3.	10.22	0.	1.76
P32	B500B	1.46	0.05	-2.6	-434.783	1.15
P54	B500B	-4.15	2.95	10.	434.783	1.15

Ultimate state "!ULS"

Internal forces N [kN]	M_y [kNm]	M_z [kNm]	Strain and Curvature ε_x [‰]	χ_y [km-1]	χ_z [km-1]	Stiffness Values N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
999.	-40947.8	40946.9	2.78	-2.0	1.2	359034.44	20214757.7	34171554.6

Internal section forces represented by two vectors

	Internal Forces CS [kN]	Rfmt [kN]	Sum [kN]	Moments M	Unit [kNm]	Geometric Values z	Unit [m]	x, d	Unit [m]
Compr. F_c=	-19247.4	-3443.9	-22691.3	M_c=	-40465.3	z_c=	1.783	x_c =	1.167
Tens. F_s=	0.	23690.2	23690.2	M_s =	-15625.4	z_s =	0.66	d =	3.009
N =			999.	M =	-56090.7	z =	2.443	x/d =	0.39



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte					Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	41.03	-1000.0	-41027.6	41027.6	2.73e-3	-1.02e-2	22.7	0.0	2.58e-3	-1.00e-2	434.8	-434.8						-2.79e-3	-2.02e-3	1.20e-3	7	4.07e-5

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	-41027.6	-40947.8	0.2
Resistant Moment Mz (kN.m)	41027.6	40946.9	0.2
Deformation at COG (e^{-3})	2.79	2.78	0.4
Curvature about Y (e^{-3})	-2	-2	0.0
Curvature about Z (e^{-3})	1.2	1.2	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 3 – Reinforced Concrete

CUBUS-FAGUS

Efficiency

Action forces / Efficiency: eff(M,N)=0.01 OK

No.	AP	P	Bending and axial force N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Shear forces and torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Complete CS eff(M,N,V,T) [-]
1	!ULS		1000.0	0	-1000.0	0.01					

Analysis parameters "!ULS" Standard: Eurocode EN

Extreme stresses and strain

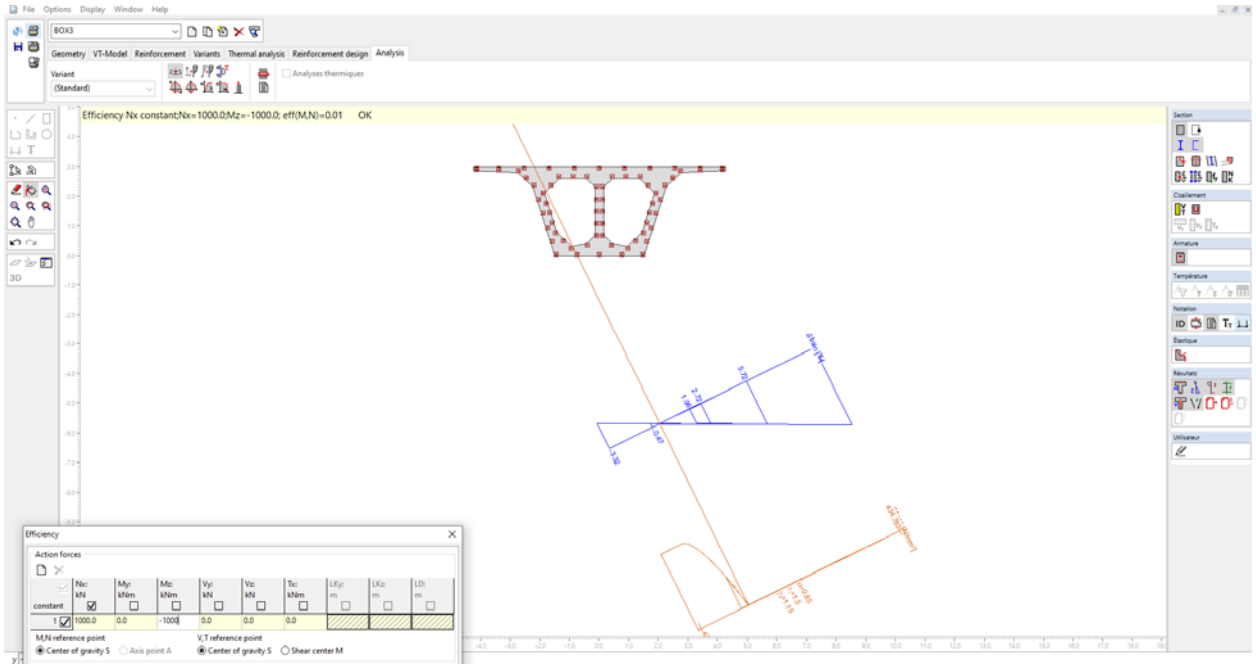
Name	Class	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	-4.25	2.85	-3.32	-22.667	1.76
C1	C40/50	4.25	3.	10.2	0.	1.76
P55	B500B	-4.15	2.9	-3.12	-434.783	1.15
P26	B500B	4.15	2.95	10.	434.783	1.15

Ultimate state "!ULS"

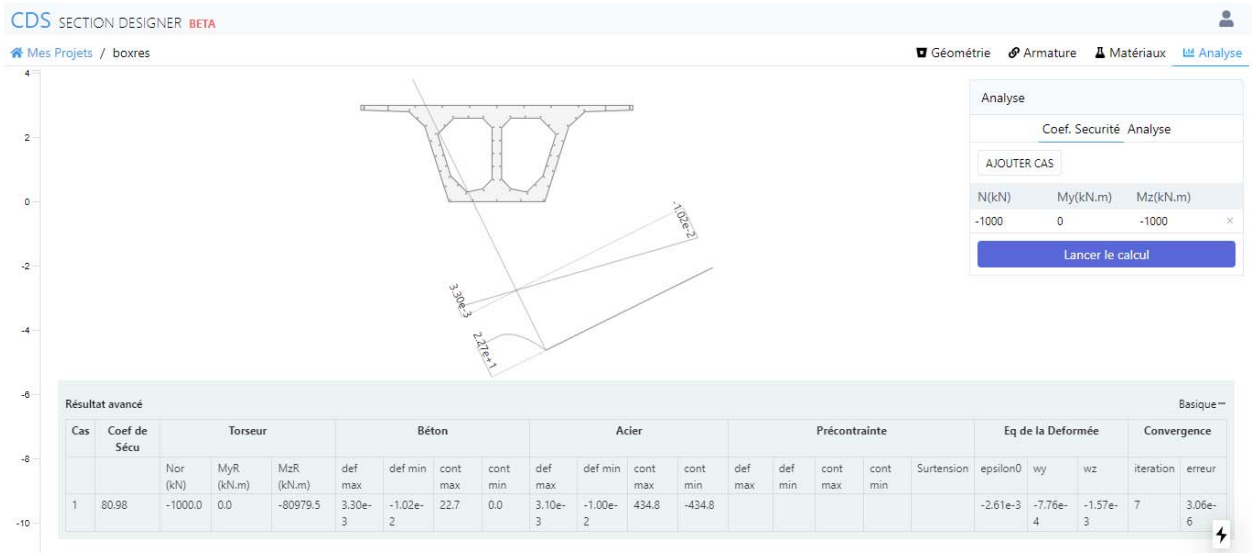
Internal forces N [kN]	M_y [kNm]	M_z [kNm]	Strain and Curvature ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Stiffness Values N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
999.	0.3	-80797.5	2.60	-0.8	-1.6	383932.53	386.6	51257528.6

Internal section forces represented by two vectors

	Internal Forces CS [kN]	Rfmt [kN]	Sum [kN]	Moments M	Unit [kNm]	Geometric Values z	Unit [m]	x, d	Unit [m]
Compr. F_c=	-18213.1	-4391.	-22604.	M_c=	-48520.4	z_c=	2.147	x_c =	1.89
Tens. F_s=	0.	23603.1	23603.1	M_s =	-24030.7	z_s =	1.018	d =	4.391
N =			999.	M =	-72551.1	z =	3.165	x/d =	0.43



CDS-SectionDesigner



Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	0	0	0.0
Resistant Moment Mz (kN.m)	-80979.5	-80797.5	0.2
Deformation at COG (e^{-3})	2.6	2.6	0.0
Curvature about Y (e^{-3})	-0.8	-0.8	0.0
Curvature about Z (e^{-3})	-1.6	-1.6	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 4 – Reinforced Concrete

CUBUS-FAGUS

Exploitation

Sollicitations / Taux d'exploitation: eff(M,N)=0. admissible

No	AP	P	Flexion et effort normal N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Effort tranchant et torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Section complète eff(M,N,V,T) [-]
1	!ELU		-1.0E+4	-20.0	-20.0	0.00					

Paramètres d'analyse "!ELU" Norme: Eurocode EN

Contraintes et dilatations extrêmes

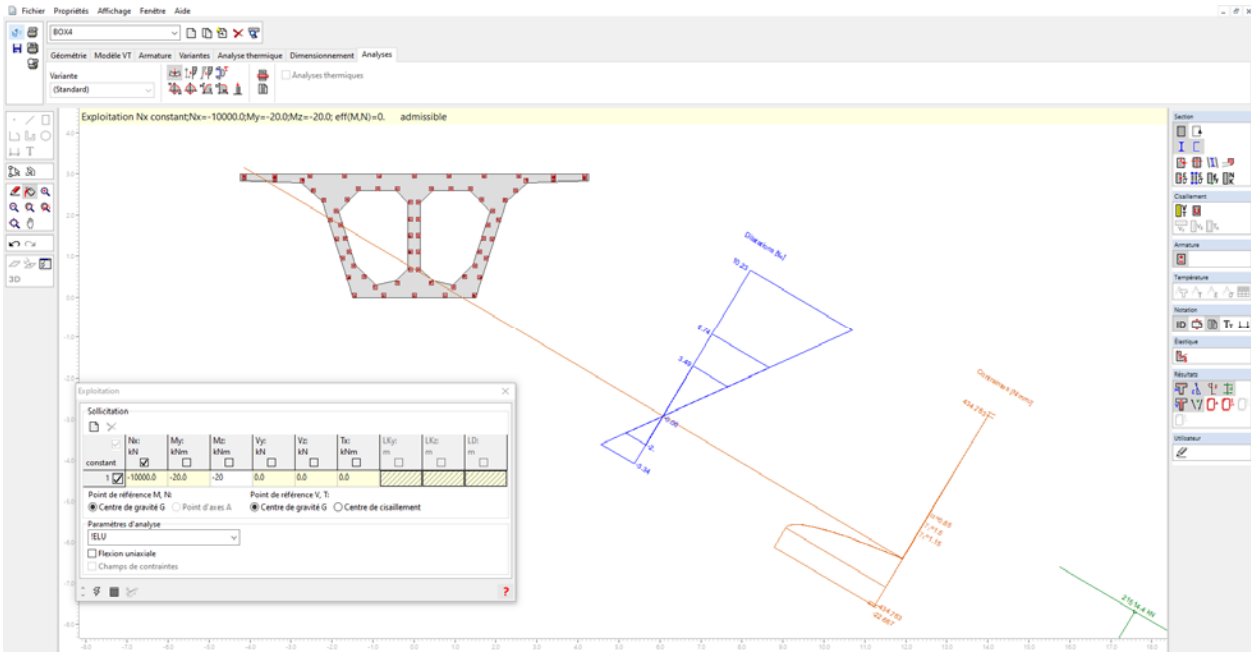
Nom	Classe	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	-1.5	0.	-3.34	-22.667	1.76
C1	C40/50	4.25	3.	10.23	0.	1.76
P60	B500B	-1.46	0.05	-3.19	-434.783	1.15
P26	B500B	4.15	2.95	10.	434.783	1.15

État limite "!ELU"

Efforts intérieurs N [kN]	M_y [kNm]	M_z [kNm]	Élongation et courbures ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Rigidités N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-10001.	-50847.4	-50846.1	2.44	-2.1	-1.3	4101388.61	24040183.5	40441550.8

Efforts internes comme un couple de forces :

Efforts intérieurs de traction et compression	Sct princip. [kN]	Armature [kN]	Somme [kN]	Moments M	Unité [kNm]	Valeurs géométriques z	Unité [m]	x, d	Unité [m]
Compr. F_c=	-26301.	-5214.4	-31515.4	M_c=	-52552.4	z_c=	1.668	x_c =	1.359
Tract. F_s=	0.	21514.4	21514.4	M_s =	-17136.8	z_s =	0.797	d =	3.146
N =			-10001.	M =	-69689.1	z =	2.464	x/d =	0.43



CDS-SectionDesigner

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	-50973.4	-50847.4	0.2
Resistant Moment Mz (kN.m)	-50973.4	-50846.1	0.3
Deformation at COG (e^{-3})	2.45	2.44	0.4
Curvature about Y (e^{-3})	-2.1	-2.1	0.0
Curvature about Z (e^{-3})	-1.3	-1.3	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 5 – Reinforced Concrete

CUBUS-FAGUS

Exploitation

Sollicitations / Taux d'exploitation: eff(M,N)=0. admissible

No	AP	P	Flexion et effort normal N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Effort tranchant et torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Section complète eff(M,N,V,T) [-]
1	!ELU		1000.0	0	20.0	0.00					

Paramètres d'analyse "!ELU" Norme: Eurocode EN

Contraintes et dilatations extrêmes

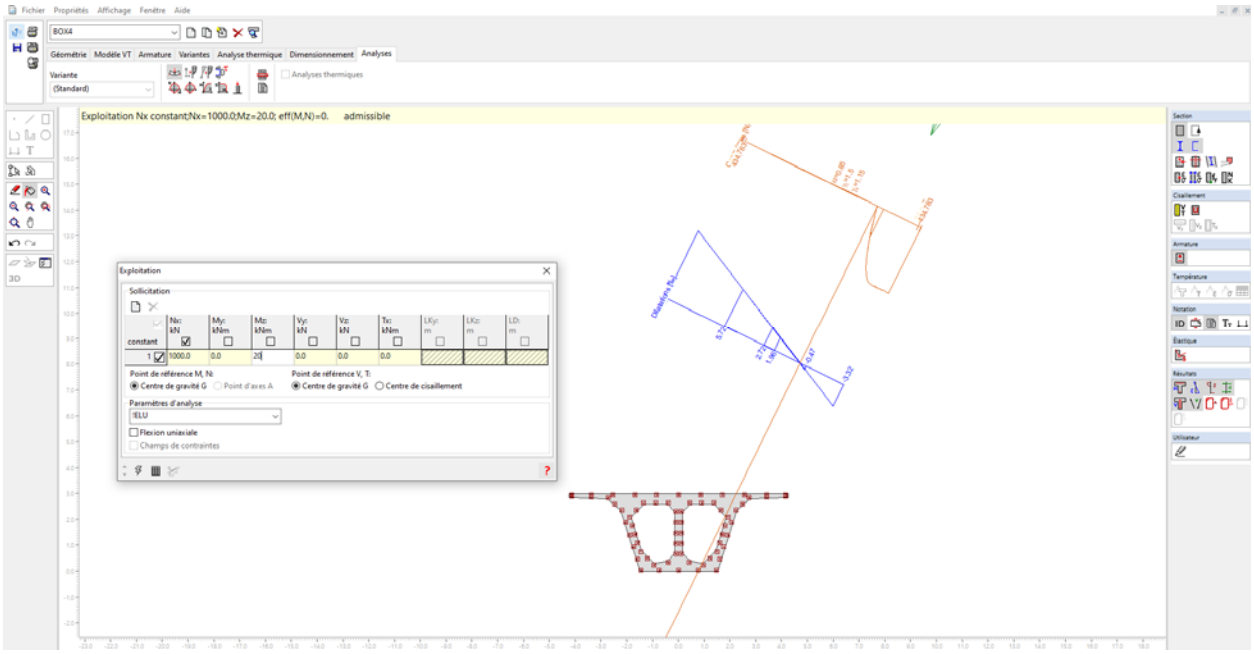
Nom	Classe	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	4.25	2.85	-3.32	-22.667	1.76
C1	C40/50	-4.25	3.	10.2	0.	1.76
P20	B500B	4.15	2.9	-3.12	-434.783	1.15
P54	B500B	-4.15	2.95	10.	434.783	1.15

État limite "!ELU"

Efforts intérieurs N [kN]	M_y [kNm]	M_z [kNm]	Élongation et courbures ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Rigidités N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
998.6	0.5	80798.4	2.60	-0.8	1.6	383768.94	596.59	51258071.7

Efforts internes comme un couple de forces :

Efforts intérieurs de traction et compression	Sct princip. [kN]	Armature [kN]	Somme [kN]	Moments M	Unité [kNm]	Valeurs géométriques z	Unité [m]	x, d	Unité [m]
Compr. F_c=	-18213.4	-4391.	-22604.4	M_c=	-48521.2	z_c=	2.147	x_c =	1.89
Tract. F_s=	0.	23603.	23603.	M_s =	-24030.8	z_s =	1.018	d =	4.391
N =			998.6	M =	-72552.	z =	3.165	x/d =	0.43



CDS-SectionDesigner

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	80979.4	80798.4	0.2
Resistant Moment Mz (kN.m)	0.0	0.0	0.0
Deformation at COG (e^{-3})	2.6	2.6	0.0
Curvature about Y (e^{-3})	-0.8	-0.8	0.0
Curvature about Z (e^{-3})	1.6	1.6	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 6 – Reinforced Concrete

CUBUS-FAGUS

Exploitation

Sollicitations / Taux d'exploitation: eff(M,N)=0. admissible

No	AP	P	Flexion et effort normal N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Effort tranchant et torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Section complète eff(M,N,V,T) [-]
1	!ELU		1000.0	-20.0	20.0	0.00					

Paramètres d'analyse "!ELU" Norme: Eurocode EN

Contraintes et dilatations extrêmes

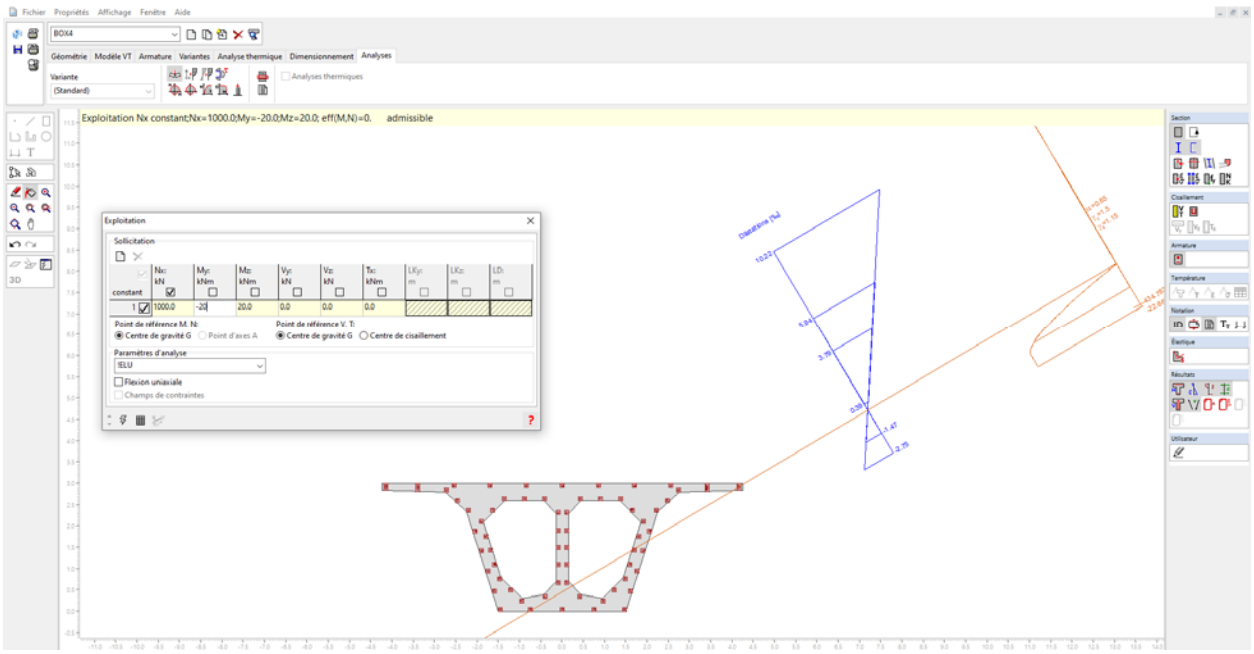
Nom	Classe	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	1.5	0.	-2.75	-22.667	1.76
C1	C40/50	-4.25	3.	10.22	0.	1.76
P32	B500B	1.46	0.05	-2.6	-434.783	1.15
P54	B500B	-4.15	2.95	10.	434.783	1.15

État limite "!ELU"

Efforts intérieurs N [kN]	M_y [kNm]	M_z [kNm]	Élongation et courbures ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Rigidités N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
998.3	-40948.7	40947.1	2.78	-2.0	1.2	358797.37	20215204.6	34171879.6

Efforts internes comme un couple de forces :

Efforts intérieurs de traction et compression	Sct princip. [kN]	Armature [kN]	Somme [kN]	Moments M	Unité [kNm]	Valeurs géométriques z	Unité [m]	x, d	Unité [m]
Compr. F_c=	-19247.9	-3444.	-22691.8	M_c=	-40466.1	z_c=	1.783	x_c =	1.167
Tract. F_s=	0.	23690.1	23690.1	M_s =	-15625.5	z_s =	0.66	d =	3.009
N =			998.3	M =	-56091.6	z =	2.443	x/d =	0.39



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte					Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	2051.39	-1000.0	-41027.8	41027.8	2.73e-3	-1.02e-2	22.7	0.0	2.58e-3	-1.00e-2	434.8	-434.8						-2.79e-3	-2.02e-3	1.20e-3	7	4.08e-5

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	-41027.8	-40948.7	0.2
Resistant Moment Mz (kN.m)	41027.8	40947.1	0.2
Deformation at COG (e^{-3})	2.8	2.8	0.0
Curvature about Y (e^{-3})	-2	-2	0.0
Curvature about Z (e^{-3})	1.2	1.2	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress Rebar – Steel Min (MPa)	-434.8	-434.8	0.0
Stress Rebar – Steel Max (MPa)	434.8	434.8	0.0

ANALYSIS 7 – Prestressed Concrete

CUBUS-FAGUS

Efficiency

Action forces / Efficiency: eff(M,N)=0.01 OK

No.	AP	P	Bending and axial force N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Shear forces and torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Complete CS eff(M,N,V,T) [-]
1	!ULS		0	1000.0	0	0.01					

Analysis parameters "!ULS" Standard: Eurocode EN

Extreme stresses and strain

Name	Class	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	-4.25	3.	-2.32	-22.667	1.76
C1	C40/50	-1.5	0.	10.21	0.	1.76
P42	B500B	-1.7	2.95	-2.11	-421.395	1.15
P32	B500B	1.46	0.05	10.	434.783	1.15
PP3	S1500/1670	1.3	2.8	3.52	686.256	1.15
PP6	S1500/1670	1.3	0.15	14.58	1304.348	1.15

Ultimate state "!ULS"

Internal forces N [kN]	M_y [kNm]	M_z [kNm]	Strain and Curvature ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Stiffness Values N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-12.	120142.1	0.	2.52	4.2	-0.0	4777.07	28777116.5	232930657.

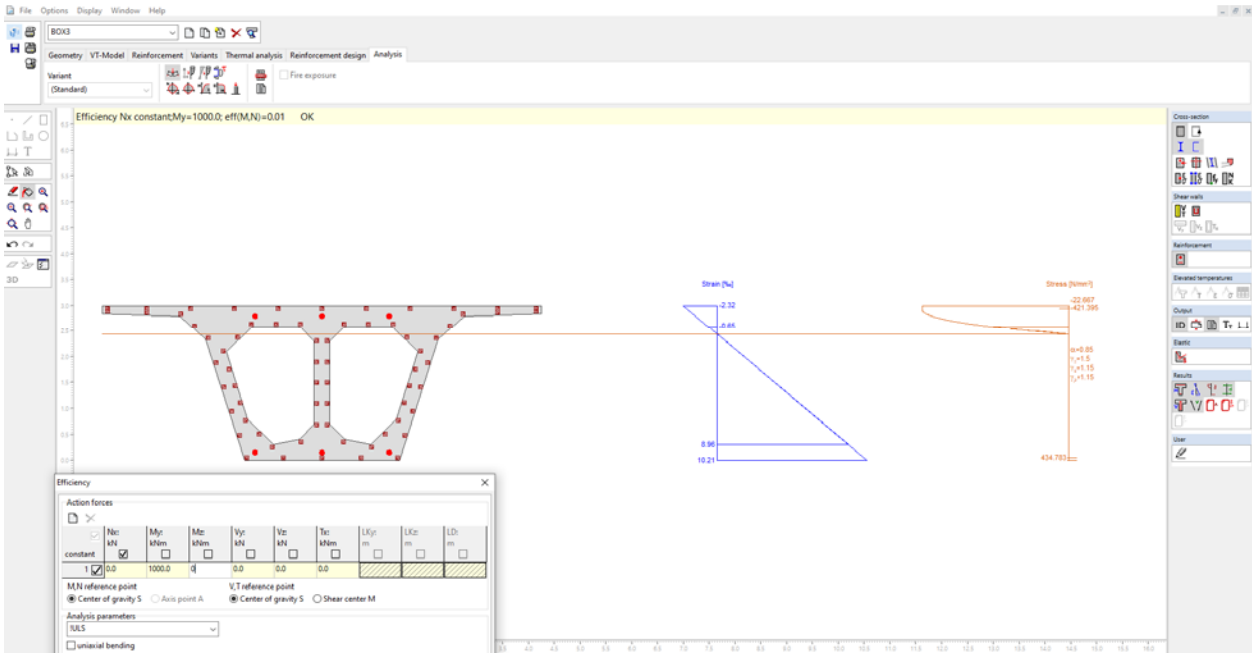
Prestressing forces P(t=o) at start of loading

N_p [kN]	M_{yp} [kNm]	M_{zp} [kNm]
-45922.5	-16846.7	0

Internal section forces represented by two vectors

	Internal Forces CS [kN]	Rfmt [kN]	Sum [kN]	Moments M	Unit [kNm]	Geometric Values z	Unit [m]	x, d	Unit [m]
Compr. F_c=	-57118.8	-10155.1	-67273.8	M_c=	-66647.6	z_c=	0.991	x_c =	0.555
Tens. F_s=	0.	67261.8	67261.8	M_s =	-53494.5	z_s =	0.795	d =	1.953
N =			-12.	M =	-120142.1	z =	1.786	x/d =	0.28

Result points and combinations



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte				Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	120.27	0.0	120274.4	0.0	2.30e-3	-1.02e-2	22.7	0.0	2.09e-3	-1.00e-2	417.5	-434.8	-3.54e-3	-1.46e-2	-689.8	-1304.3		-2.53e-3	4.17e-3	8.59e-19	18	9.57e-4

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	120274.4	120142.1	0.1
Resistant Moment Mz (kN.m)	0.0	0.0	0.0
Deformation at COG (e^{-3})	2.53	2.52	0.4
Curvature about Y (e^{-3})	4.2	4.2	0.0
Curvature about Z (e^{-3})	0.0	0.0	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress – Steel Min (MPa)	-417.5	-421.4	-0.9
Stress – Steel Max (MPa)	434.8	434.8	0.0
Stress – PT Min (MPa)	689.8	686.2	0.5
Stress – PT Max (MPa)	1304.3	1304.3	0.0

ANALYSIS 8 – Prestressed Concrete

CUBUS-FAGUS

Efficiency

Action forces / Efficiency: eff(M,N)=0.01 OK

No.	AP	P	Bending and axial force N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Shear forces and torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Complete CS eff(M,N,V,T) [-]
1	!ULS		0	0	1000.0	0.01					

Analysis parameters "!ULS" Standard: Eurocode EN

Extreme stresses and strain

Name	Class	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	4.25	2.85	-3.5	-22.667	1.76
C1	C40/50	-4.25	3.	5.09	0.	1.76
P20	B500B	4.15	2.9	-3.38	-434.783	1.15
P54	B500B	-4.15	2.95	4.96	434.783	1.15
PP6	S1500/1670	1.3	0.15	3.3	642.971	1.15
PP1	S1500/1670	-1.3	2.8	7.04	1304.348	1.15

Ultimate state "!ULS"

Internal forces N [kN]	M_y [kNm]	M_z [kNm]	Strain and Curvature ε_κ [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Stiffness Values N/ε_κ [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-1.4	11.8	145029.	0.33	-0.4	1.0	4181.89	27440.39	144667326.

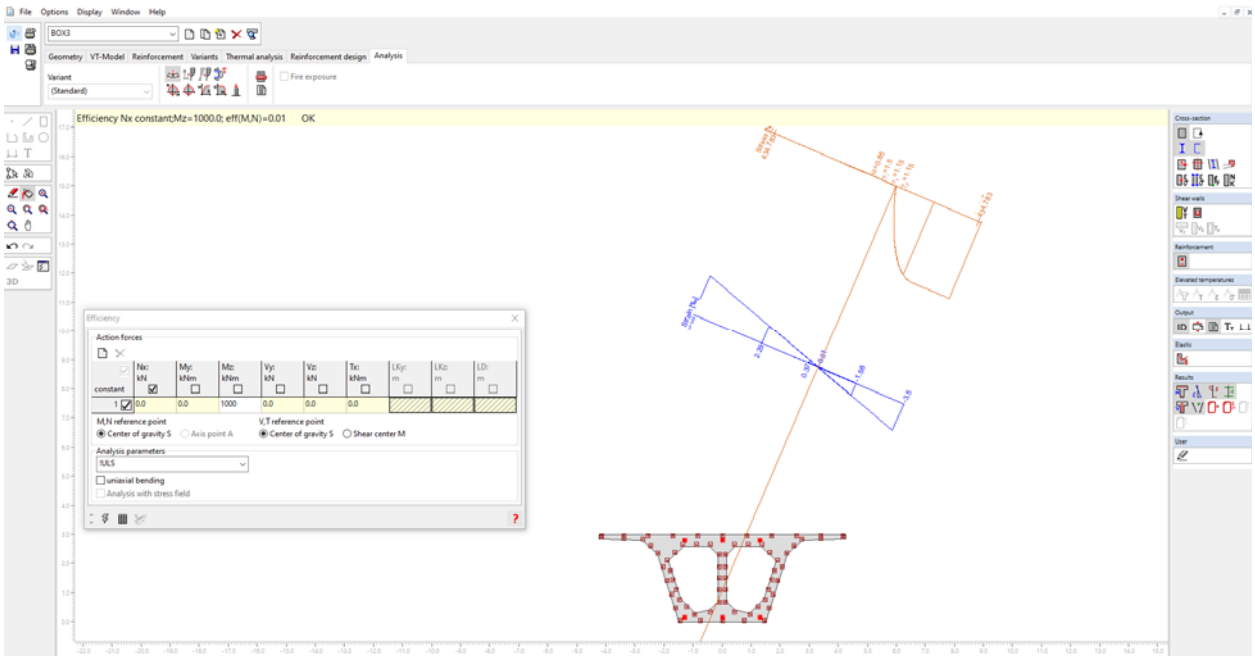
Prestressing forces P(t=o) at start of loading

N_p [kN]	M_{yp} [kNm]	M_{zp} [kNm]
-45922.5	-16846.7	0

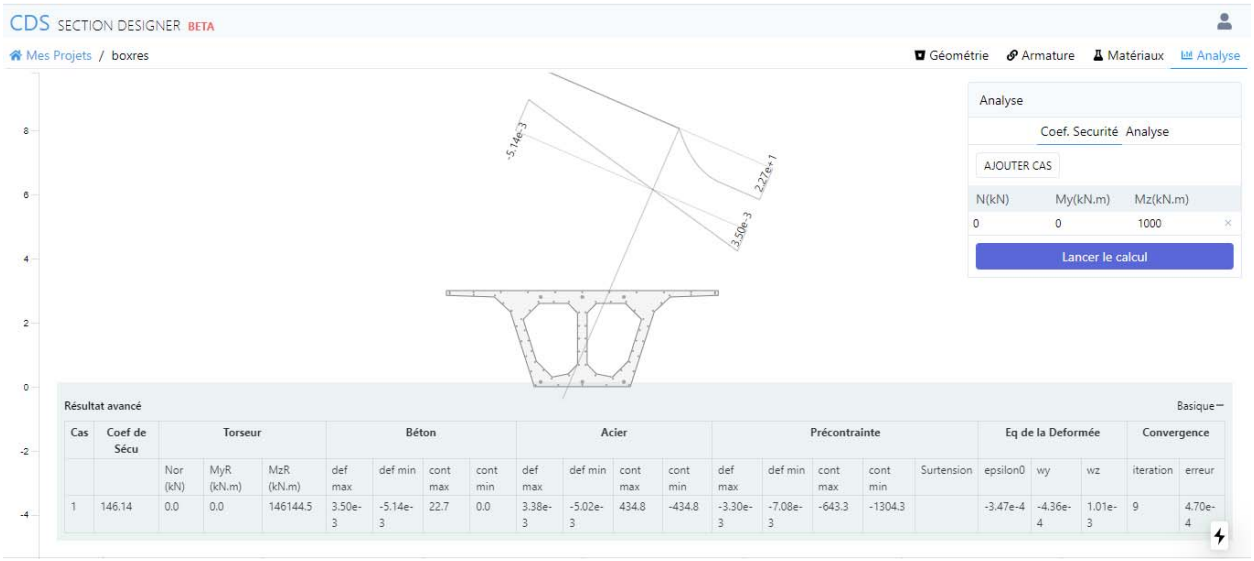
Internal section forces represented by two vectors

	Internal Forces CS [kN]	Rfmt [kN]	Sum [kN]	Moments M	Unit [kNm]	Geometric Values z	Unit [m]	x, d	Unit [m]
Compr. F_c=	-49345.6	-10355.2	-59700.8	M_c=	-104016.1	z_c=	1.742	x_c =	3.209
Tens. F_s=	0.	59699.4	59699.4	M_s =	-29286.	z_s =	0.491	d =	4.
N =			-1.4	M =	-133302.1	z =	2.233	x/d =	0.8

Result points and combinations



CDS-SectionDesigner



Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	146144.5	145029	0.8
Resistant Moment Mz (kN.m)	0.0	0.0	0.0
Deformation at COG (e^{-3})	0.35	0.33	6.1
Curvature about Y (e^{-3})	-0.4	-0.4	0.0
Curvature about Z (e^{-3})	1.0	1.0	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress – Steel Min (MPa)	-417.5	-434.8	-4.0
Stress – Steel Max (MPa)	434.8	434.8	0.0
Stress – PT Min (MPa)	643.3	643.0	0.0
Stress – PT Max (MPa)	1304.3	1304.3	0.0

ANALYSIS 9 – Prestressed Concrete

CUBUS-FAGUS

Exploitation

☑ **Sollicitations / Taux d'exploitation: eff(M,N)=0.08 admissible**

No	AP	P	Flexion et effort normal N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Effort tranchant et torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Section complète eff(M,N,V,T) [-]
1	!ELU		-1.0E+4	10000.0	1000.0	0.08					

☐ Paramètres d'analyse "!ELU" Norme: Eurocode EN

☑ **Contraintes et dilatations extrêmes**

Nom	Classe	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	4.25	3.	-3.4	-22.667	1.76
C1	C40/50	-1.5	0.	10.22	0.	1.76
P26	B500B	4.15	2.95	-3.18	-434.783	1.15
P60	B500B	-1.46	0.05	10.	434.783	1.15
PP3	S1500/1670	1.3	2.8	2.93	571.343	1.15
PP4	S1500/1670	-1.3	0.15	14.55	1304.348	1.15

☑ **État limite "!ELU"**

Efforts intérieurs N [kN]	M_y [kNm]	M_z [kNm]	Élongation et courbures ε_κ [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Rigidités N/ε_κ [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-10010.	127636.5	12766.4	2.19	4.2	0.2	4567425.73	30226250.9	76959618.3

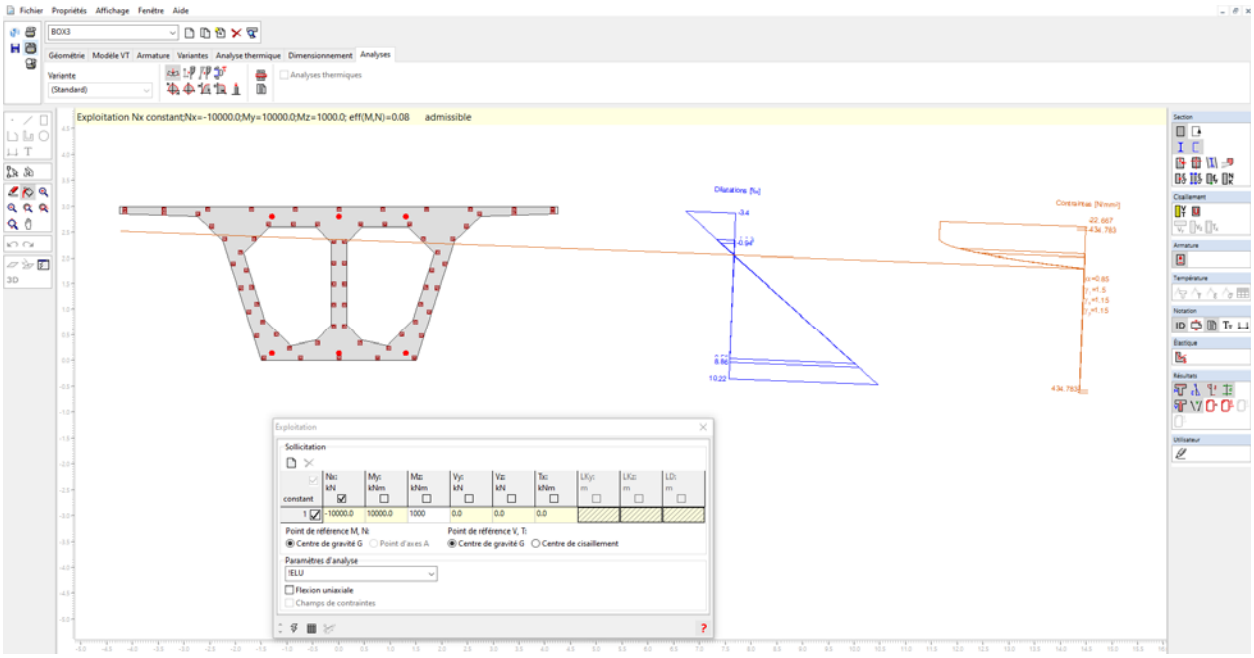
☑ **Forces de précontrainte P(t=o) au début du chargement**

N_p [kN]	M_{yp} [kNm]	M_{zp} [kNm]
-45922.5	-16846.7	0

☑ **Efforts internes comme un couple de forces :**

Efforts intérieurs de traction et compression	Sct princip. [kN]	Armature [kN]	Somme [kN]	Moments M	Unité [kNm]	Valeurs géométriques z	Unité [m]	x, d	Unité [m]
Compr. F_c=	-63567.7	-11229.1	-74796.8	M_c=	-72645.8	z_c=	0.971	x_c =	0.805
Tract. F_s=	0.	64786.8	64786.8	M_s =	-55393.6	z_s =	0.855	d =	2.179
N =			-10010.	M =	-128039.4	z =	1.826	x/d =	0.37

☐ Points de résultat



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte					Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	12.78	10000.0	127830.8	12783.1	3.36e-3	-1.02e-2	22.7	0.0	3.13e-3	-1.00e-2	434.8	-434.8	-2.96e-3	-1.46e-2	-577.6	-1304.3		-2.21e-3	4.21e-3	1.62e-4	19	3.75e-4

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	127830.8	127636.5	0.2
Resistant Moment Mz (kN.m)	12783.1	12766.4	0.1
Deformation at COG (e^{-3})	2.2	2.2	0.0
Curvature about Y (e^{-3})	4.2	4.2	0.0
Curvature about Z (e^{-3})	0.2	0.2	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress – Steel Min (MPa)	-434.8	-434.8	0.0
Stress – Steel Max (MPa)	434.8	434.8	0.0
Stress – PT Min (MPa)	577.6	571.3	1.1
Stress – PT Max (MPa)	1304.3	1304.3	0.0

ANALYSIS 10 – Prestressed Concrete

CUBUS-FAGUS

Exploitation

Sollicitations / Taux d'exploitation: eff(M,N)=0.02 admissible

No	AP	P	Flexion et effort normal N [kN]	M_y [kNm]	M_z [kNm]	eff(M,N) [-]	Effort tranchant et torsion V_y [kN]	V_z [kN]	T [kNm]	eff(V,T) [-]	Section complète eff(M,N,V,T) [-]
1	!ELU		0	2000.0	-1000.0	0.02					

Paramètres d'analyse "!ELU" Norme: Eurocode EN

Contraintes et dilatations extrêmes

Nom	Classe	y_q [m]	z_q [m]	ε [‰]	σ_d [N/mm²]	γ [-]
C1	C40/50	-4.25	3.	-3.5	-22.667	1.76
C1	C40/50	1.5	0.	6.25	0.	1.76
P54	B500B	-4.15	2.95	-3.34	-434.783	1.15
P32	B500B	1.46	0.05	6.1	434.783	1.15
PP1	S1500/1670	-1.3	2.8	3.11	606.681	1.15
PP6	S1500/1670	1.3	0.15	10.79	1304.348	1.15

État limite "!ELU"

Efforts intérieurs N [kN]	M_y [kNm]	M_z [kNm]	Élongation et courbures ε_x [‰]	χ_y [km⁻¹]	χ_z [km⁻¹]	Rigidités N/ε_x [kN]	M_y/χ_y [kNm²]	M_z/χ_z [kNm²]
-8.6	113673.3	-56833.1	1.02	2.5	-0.4	8358.77	44914967.4	151707768.

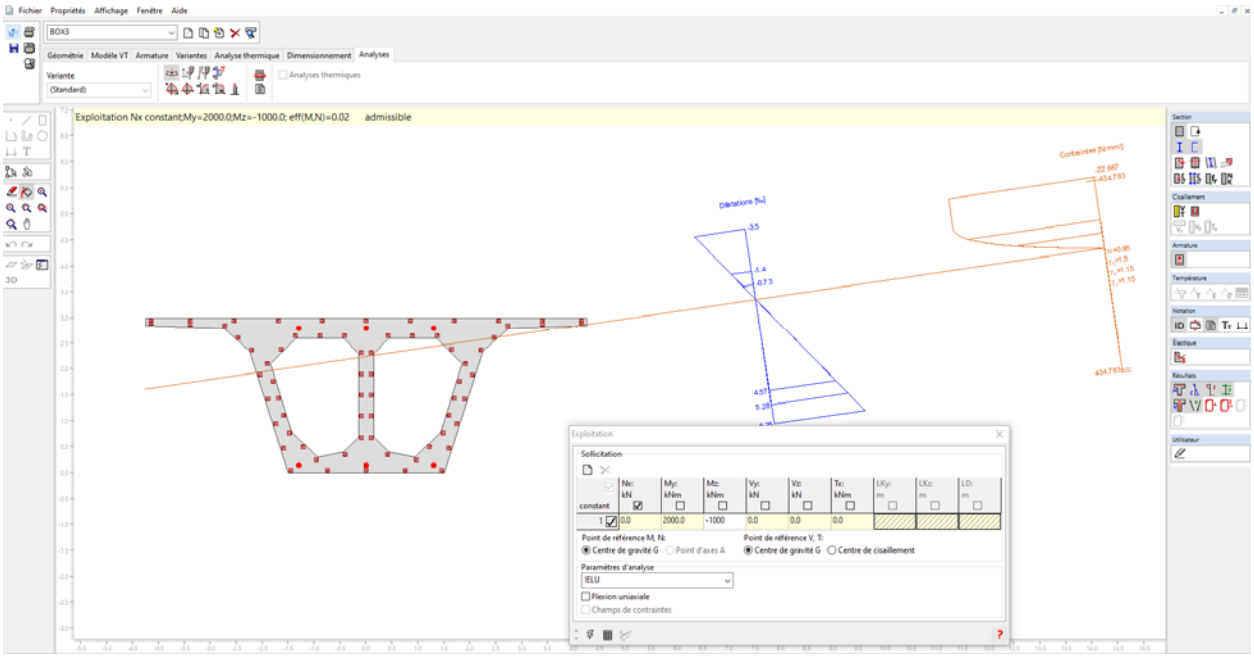
Forces de précontrainte P(t=o) au début du chargement

N_p [kN]	M_{yp} [kNm]	M_{zp} [kNm]
-45922.5	-16846.7	0

Efforts internes comme un couple de forces :

Efforts intérieurs de traction et compression	Sct princip. [kN]	Armature [kN]	Somme [kN]	Moments M	Unité [kNm]	Valeurs géométriques z	Unité [m]	x, d	Unité [m]
Compr. F_c=	-55738.1	-8796.2	-64534.3	M_c=	-67359.5	z_c=	1.044	x_c =	1.368
Tract. F_s=	0.	64525.8	64525.8	M_s =	-53411.1	z_s =	0.828	d =	2.596
N =			-8.6	M =	-120770.6	z =	1.872	x/d =	0.53

Points de résultat



CDS-SectionDesigner

Cas	Coef de Sécu	Torseur			Béton				Acier				Précontrainte					Eq de la Deformée			Convergence	
		Nor (kN)	MyR (kN.m)	MzR (kN.m)	def max	def min	cont max	cont min	def max	def min	cont max	cont min	def max	def min	cont max	cont min	Surtension	epsilon0	wy	wz	iteration	erreur
1	57.03	0.0	114050.8	-57025.4	3.50e-3	-6.39e-3	22.7	0.0	3.33e-3	-6.25e-3	434.8	-434.8	-3.12e-3	-1.09e-2	-608.0	-1304.3		-1.08e-3	2.58e-3	-3.73e-4	69	1.18e-3

Results comparison

	CDS-SectionDesigner	Fagus	Error (%)
Resistant Moment My (kN.m)	114050.8	113673.3	0.3
Resistant Moment Mz (kN.m)	-57025.4	-56833.1	0.3
Deformation at COG (e^{-3})	1.0	1.0	0.0
Curvature about Y (e^{-3})	2.5	2.5	0.0
Curvature about Z (e^{-3})	-0.4	-0.4	0.0
Stress - Concrete (MPa)	-22.7	-22.7	0.0
Stress – Steel Min (MPa)	-434.8	-434.8	0.0
Stress – Steel Max (MPa)	434.8	434.8	0.0
Stress – PT Min (MPa)	608.0	606.7	0.2
Stress – PT Max (MPa)	1304.3	1304.3	0.0