



NEMETSCHKEK
Scia

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Nové technológie v posudkoch betónu

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Nové technológie v posudkoch betónu

Obsah


- Concrete toolbox
- Model data
- Priority nových posudkov
- Externé posudky
- Interné posudky




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Nové technológie v posudkoch betónu

Concrete toolbox



- Sada normovo nezávislých funkcií pre výpočet základných parametrov betónových priereзов
- Výhody
 - Použitie v interných posudkoch aj v externých posudkoch(Excel , DF...)
 - Rýchlejšie a jednoduchšie vytvorenie normovo závislých posudkov
 - Obecnosť (obecné zaťaženie, materiály a prierezy)

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„TERAZ UŽ VIEŠ KDE SI NECHAL NÁRADIE NA BETÓN“

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Nové technológie v posudkoch betónu

Concrete toolbox



- Concrete toolbox - MS Excel

Check of stress in component									
Extreme	Fibre [-]	Ext.stress fibre [MPa]	Lim.stress fibre [MPa]	Check fibre [%]	Reinf. [-]	Ext.strain reinf. [‰]	Lim.stress reinf. [MPa]	Check reinf [%]	Check value [%]
min	3	-16.6667	-16.6667	100	3	-371.359	-470.601	78.91158	100
max	1	-2.66443	-16.6667	15.98657	1	-108.439	-470.601	23.04275	

Plain of deformation									
ϵ_x	ϵ_y	ϵ_z	x	x_{max}	x_{min}	d	z	z+	z-
[-]	[-]	[-]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
-0.0012	-0.00392	-0.00132	269.0926	32.47423	450	0.405	0.18225	0.18225	-7

Forces in component						
Type of component	N_{max} [N]	$M_{max,x}$ [Nm]	$M_{max,y}$ [Nm]	Y_{com} [mm]	Z_{com} [mm]	A_c [mm ²]
Compressive concrete	0	0	0	1.396	16	0
Tensile concrete	0	-0	-0	0	0	154
Compressive reinf.	-301466	13313.75	9862.824	0	0	1254
Tensile reinf.	0	-0	-0	0	0	0
Summary	-301466	13313.75	9862.824	-	-	-

Forces						
	N_{max} [N]	$M_{max,x}$ [Nm]	$M_{max,y}$ [Nm]	ϵ_x [m]	ϵ_y [m]	ϵ_z [m]
Compressive	-301466	13313.75	9862.824	0.032716	0.044163	0
Tensile	0	-0	0	0	0	0

Vloženie funkcie

Výber kategórie: SBI Functions

Výber funkcie: HeightOfCompressionZone

OK Zrušiť

Argumenty funkcie

HeightOfCompressionZone

CsID: [Check N+My+Mz] =

ForcesID: ArrayForcesLS = [-2000000;50000;50000;50000;5...


Výsledok =

OK Zrušiť

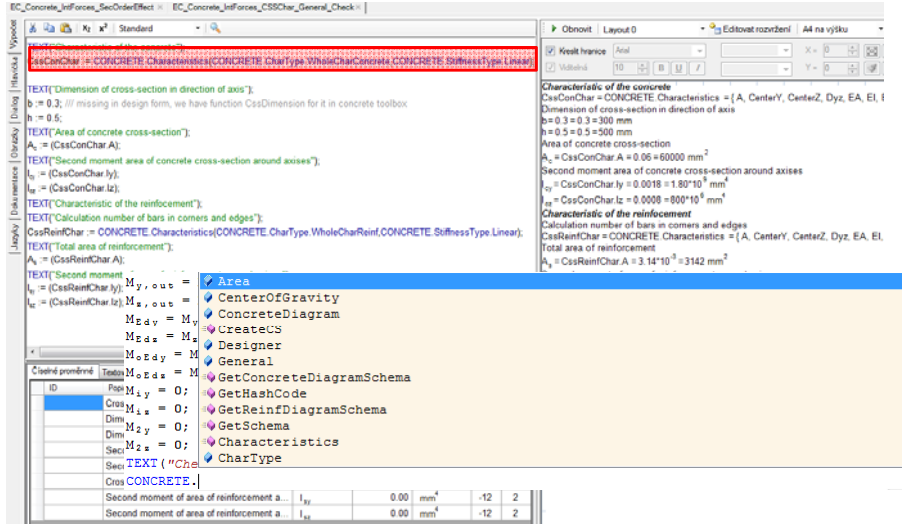
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Nové technológie v posudkoch betónu

Concrete toolbox



■ Concrete toolbox - SCIA Design forms



Concrete toolbox - SCIA Design forms

EC_Concrete_InfForces_SecOrderEffect | EC_Concrete_InfForces_CSSChar_General_Check |

Obnovit | Layout 0 | Editovať rozvrhnutie | A4 na výšku

Kresť hrance | Area | X: 0 | Y: 0

Characteristic of the concrete
 CcsConChar = CONCRETE.Characteristics(CONCRETE.CharType,WholeCharReinf.CONCRETE.StiffnessType.Linear)
 Dimension of cross-section in direction of axis
 b = 0.3, // missing in design form, we have function CcsDimension for it in concrete toolbox
 h = 0.5;
 TEXT("Dimension of cross-section in direction of axis");
 A_c = (CcsConChar.A);
 TEXT("Area of concrete cross-section");
 TEXT("Second moment area of concrete cross-section around axes");
 I_y = (CcsConChar.Iy);
 I_z = (CcsConChar.Iz);
 TEXT("Characteristic of the reinforcement");
 TEXT("Calculation number of bars in corners and edges");
 CcsReinChar := CONCRETE.Characteristics(CONCRETE.CharType,WholeCharReinf.CONCRETE.StiffnessType.Linear);
 TEXT("Total area of reinforcement");
 A_s = (CcsReinChar.A);

Characteristic of the reinforcement
 Calculation number of bars in corners and edges
 CcsReinChar = CONCRETE.Characteristics = {A, CenterY, CenterZ, Dyz, EA, EI,
 Total area of reinforcement
 A_s = CcsReinChar.A = 3.14 * 10^-3 = 3142 mm^2


ID	CharType	WholeCharRein	StiffnessType
1	Area		
2	CenterOfGravity		
3	ConcreteDiagram		
4	CreateCS		
5	Designer		
6	General		
7	GetConcreteDiagramSchema		
8	GetHashCode		
9	GetReinDiagramSchema		
10	GetSchema		
11	Characteristics		
12	CharType		

Second moment of area of reinforcement a: I_y = 0.00 mm^4 -12 2
 Second moment of area of reinforcement a: I_z = 0.00 mm^4 -12 2

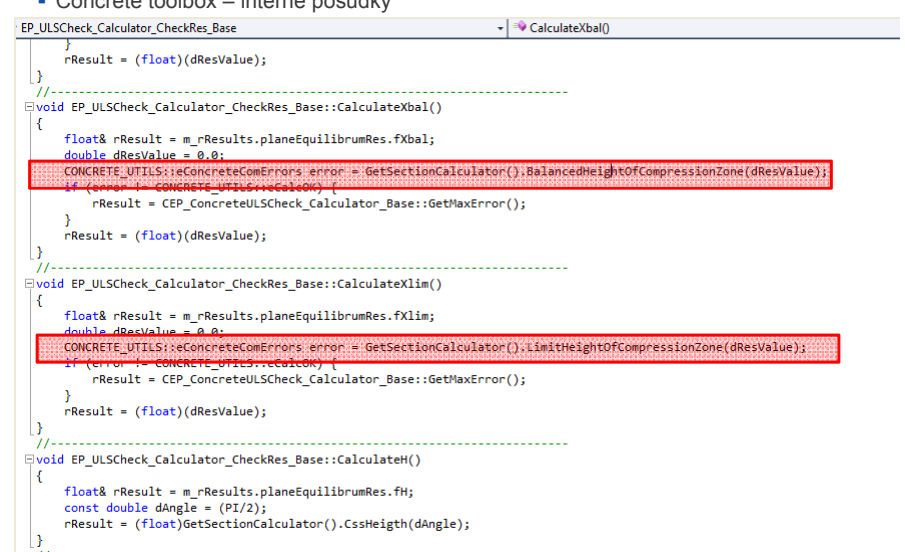
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Nové technológie v posudkoch betónu

Concrete toolbox



■ Concrete toolbox – interné posudky




EP_ULSCheck_Calculator_CheckRes_Base | CalculateXbal()

```

}
rResult = (float)(dResValue);
}
}
-----
void EP_ULSCheck_Calculator_CheckRes_Base::CalculateXbal()
{
    float& rResult = m_Results.planeEquilibriumRes.fxXbal;
    double dResValue = 0.0;
    CONCRETE_UTILS::eConcreteComErrors error = GetSectionCalculator().BalancedHeightOfCompressionZone(dResValue);
    if (error == CONCRETE_UTILS::eConcreteComErrors) {
        rResult = CEP_ConcreteULSCheck_Calculator_Base::GetMaxError();
    }
    rResult = (float)(dResValue);
}
}
-----
void EP_ULSCheck_Calculator_CheckRes_Base::CalculateXlim()
{
    float& rResult = m_Results.planeEquilibriumRes.fxLim;
    double dResValue = 0.0;
    CONCRETE_UTILS::eConcreteComErrors error = GetSectionCalculator().LimitHeightOfCompressionZone(dResValue);
    if (error == CONCRETE_UTILS::eConcreteComErrors) {
        rResult = CEP_ConcreteULSCheck_Calculator_Base::GetMaxError();
    }
    rResult = (float)(dResValue);
}
}
-----
void EP_ULSCheck_Calculator_CheckRes_Base::CalculateH()
{
    float& rResult = m_Results.planeEquilibriumRes.fH;
    const double dAngle = (PI/2);
    rResult = (float)GetSectionCalculator().CcsHeight(dAngle);
}
}
}
    
```

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Nové technológie v posudkoch betónu



Model data

- Nová štruktúra súborov s dátami zo SEN
- Možnosť použitia dát v externých aplikáciách(SDF....)

c:\Users\Palec\ESA13.022.02\Temp\ Esa_Model_Data*

Meno

- [.]
- [Beam.1]
- [Beam.2]
- [Beam.3]
- [Beam.4]
- [Beam.5]
- [Beam.6]
- [Beam.7]
- [Beam.8]
- InProperties
- Setup

c:\Users\Palec\ESA13.022.02\Temp\ Esa_Model_Data\Beam.1*

Meno

- [.]
- Beam
- BucklingData
- CrossSection
- InternalForces
- Load
- Materials
- Sections
- NBR_Concrete_IntForces_SecOrderEffect
- DesignForm Trace

Materials.emd - Poznámkový blok


```

[Material : type concrete : ID 4 ]
(:General :E 2.8e+010 :G 9.32e+009 :fck 2.5e+007 :fctm 2.56496e+006 :fctk_05 1.79547e+006 :eq
(:Diagram :type ULS )
(:Point :sig 0 :eps 0 )
(:Point :sig -1.39286e+008 :eps -0.0002 )
(:Point :sig -6.42857e+006 :eps -0.0004 )
(:Point :sig -9.10714e+008 :eps -0.0006 )
(:Point :sig -1.14286e+007 :eps -0.0008 )
(:Point :sig -1.39286e+007 :eps -0.001 )
(:Point :sig -1.5e+007 :eps -0.0012 )
(:Point :sig -1.625e+007 :eps -0.0014 )
(:Point :sig -1.74286e+007 :eps -0.0016 )
(:Point :sig -1.76786e+007 :eps -0.0018 )
(:Point :sig -1.78571e+007 :eps -0.002 )
(:Point :sig -1.78571e+007 :eps -0.0035 )
(:Material :type epsSteel :ID 10 )
(:General :E 2.1e+011 :G 8.75e+010 :fyk 2.5e+008 :eps_uk 0.01 )
(:Diagram :type ULS )
(:Point :sig -2.1739e+008 :eps -0.01 )
(:Point :sig -2.1739e+008 :eps -0.0010352 )
(:Point :sig 0 :eps 0 )
(:Point :sig 2.1739e+008 :eps 0.0010352 )
(:Point :sig 2.1739e+008 :eps 0.01 )
(:Material :type epsSteel :ID 11 )
(:General :E 2.1e+011 :G 8.75e+010 :fyk 6e+008 :eps_uk 0.01 )
(:Diagram :type ULS )
(:Point :sig -3.21739e+008 :eps -0.01 )
(:Point :sig -3.21739e+008 :eps -0.00248447 )
(:Point :sig 0 :eps 0 )
(:Point :sig 3.21739e+008 :eps 0.00248447 )
(:Point :sig 3.21739e+008 :eps 0.01 )

```

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Nové technológie v posudkoch betónu



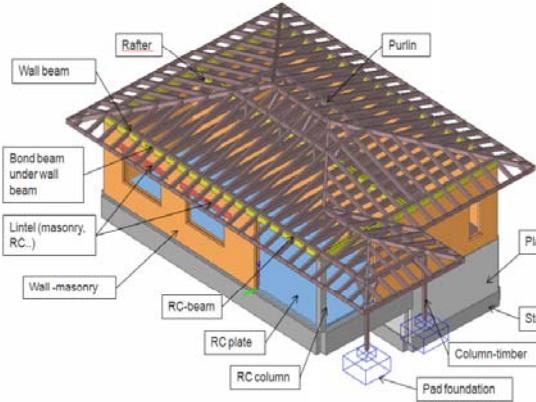
Nové betónové posudky

Typy posudkov

- Interné posudky
- Externé (otvorené) posudky

Priorita nových posudkov

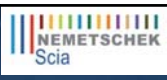
- otvorenosť
- transparentnosť
- rýchlosť
- obecnosť



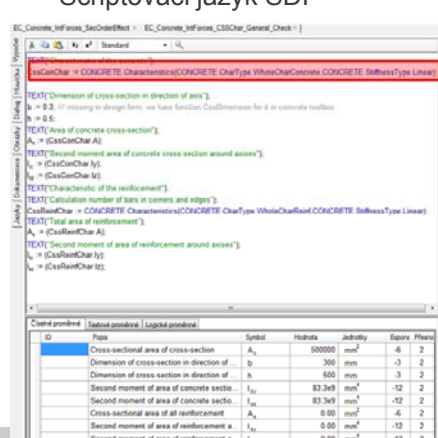
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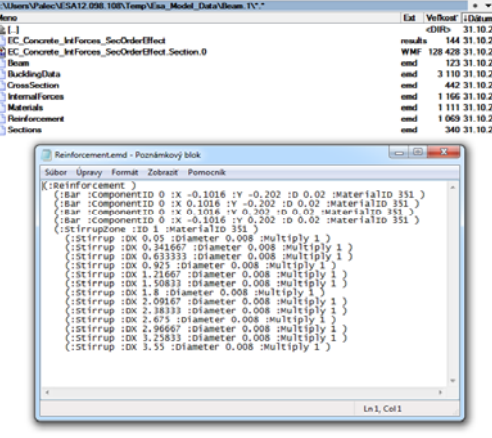
Nové technológie v posudkoch betónu

Nové betónové posudky (otvorenosť)




- Použitie „Concrete toolbox „ v externých aplikáciách
- Model data (poskytnutie dát zo SEN externým aplikáciám)
- Scriptovací jazyk SDF





Nové technológie v posudkoch betónu

Nové betónové posudky (transparentnosť)



- Detailnejšie a prehľadnejšie výstupy

Calculation first order eccentricity with imperfection (both directions)

$$e_{s1} = \text{sign} \cdot \max \left(\frac{e_0}{30} - 0.02, -1.00 \cdot \max \left(\frac{e_0}{30}, 0.02 \right) - 0.02 \right) \text{ m}$$

$$e_{s2} = \text{sign} \cdot \max \left(\frac{e_0}{30} - 0.02, 1.00 \cdot \max \left(\frac{e_0}{30}, 0.02 \right) - 0.02 \right) \text{ m}$$

Calculation first order eccentricity with imperfection and with minimum value

$$e_{s1} = \text{sign} \cdot \max \left(\text{abs}(e_{s1} + e_{min}) \cdot \text{abs}(e_{s1}) \right) = 1.00 \cdot \max \left(\text{abs}(0.0615 + 0.0075) \cdot \text{abs}(0.02) \right) = 0.069 \text{ m}$$

$$e_{s2} = \text{sign} \cdot \max \left(\text{abs}(e_{s2} + e_{min}) \cdot \text{abs}(e_{s2}) \right) = 1.00 \cdot \max \left(\text{abs}(0.228 + 0.0075) \cdot \text{abs}(0.02) \right) = 0.236 \text{ m}$$

Calculation second order eccentricity(both directions)

input parameters for calculation

Calculation radius of gyration of reinforcement in direction of y and z axis

$$i_y = \sqrt{\frac{I_{yy}}{A_s}} = \sqrt{\frac{50 \cdot 10^{-10}}{1.25 \cdot 10^{-2}}} = 200 \text{ mm}$$

$$i_z = \sqrt{\frac{I_{zz}}{A_s}} = \sqrt{\frac{12 \cdot 10^{-10}}{1.25 \cdot 10^{-2}}} = 100 \text{ mm}$$

Calculation effective depth of cross-section

$$d_y = 0.5 \cdot b + i_y = 0.5 \cdot 0.30 + 0.10 = 0.25 \text{ m}$$

$$d_z = 0.5 \cdot h + i_z = 0.5 \cdot 0.50 + 0.20 = 0.45 \text{ m}$$

$$\eta_y = 0.4 + 0.1 = 0.40$$

$$\eta_z = 1 + \eta_y = 1 + 0.219 = 1.22$$

$$\rho_y = 0.35 + \frac{f_{yk}}{200 \cdot 1000000} \cdot 150 = 0.35 + \frac{25 \cdot 10^6}{200 \cdot 1000000} = 0.336$$

$$\rho_z = 0.35 + \frac{f_{yk}}{200 \cdot 1000000} \cdot 150 = 0.35 + \frac{25 \cdot 10^6}{200 \cdot 1000000} = 0.344$$

Calculation of curvature: $\chi = \eta \cdot \rho_y \cdot \chi' = \eta \cdot \rho_z \cdot \chi'$

$$e_{s1} = 0.45 \cdot d_z = 0.45 \cdot 0.45 = 0.0107$$

$$e_{s2} = 0.45 \cdot d_y = 0.45 \cdot 0.25 = 0.0193$$

$$K_y = \min \left(\frac{n_1 \cdot n}{n_1 + n} - 1, \frac{1.22 - 0.80}{1.22 - 0.40} \right) = 0.511$$

$$K_z = \max \left(1 + \beta_1 \cdot \beta_{p1} - 1, \max(1 + 0.336 - 2 \cdot 48 \cdot 1) = 1.83 \right)$$

$$K_{y1} = \max(1 + \beta_1 \cdot \beta_{p1} - 1) = \max(1 + 0.244 - 2 \cdot 48 \cdot 1) = 1.61$$

$$K_{y2} = K_y \cdot K_{y1} = 0.511 + 0.183 = 0.0107 + 0.0101$$

$$K_{z1} = K_z \cdot K_{z1} = 0.511 + 1.61 - 0.0193 = 0.0159$$

Calculation of second order eccentricity

$$e_2 = 10 \cdot d$$

$$e_2 = 10 \cdot 0$$

$$e_2 = 34.6 > e_{s2} = 12.5 \Rightarrow \text{second order effect will be taken into account around z-axis(in direction of y-axis)}$$

Concrete N+My+Mz check

Summary of check

Reqd	Min	Max	Factor	Result	Unit	OK	Warning	Info				
0.00	-41.04	0.00	Concrete	1	2.1	2.35	15	28	15	OK	Warning	Info

Extreme values of stress/strain in component

Type of component	Fiber	e	Strain	Stress	Strain	Stress	e / Strain	e / Stress	Result
Compressive concrete (str. ecc.)	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OK
Tensile concrete (str. ecc.)	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Fail
Compressive nonprestressed reinf. (str. ecc.)	1	0.5	250.0	-25.30	240.22	0	-1	19	OK
Tensile nonprestressed reinf. (str. ecc.)	3	0.3	250.0	186.75	365.22	0	48	OK	

Parameters of the plane of equilibrium

Parameter	Value
xi (str. ecc.)	30.3
xi (str. ecc.)	0.0
xi (str. ecc.)	171
xi (str. ecc.)	25
xi (str. ecc.)	447
xi (str. ecc.)	390
xi (str. ecc.)	197
xi (str. ecc.)	150
xi (str. ecc.)	0.00

Cross section characteristic of cross-section component

Type of component	fy	fyd	A_s	A_s	I_y	I_z
Compressive concrete	0	0	0	112420000	108210700	18100000
Tensile concrete	0.00	0.00	0.00	0	0	0
Compressive nonprestressed reinf.	-197	429	2438413	523109	0	0
Tensile nonprestressed reinf.	180	429	2438413	523109	0	0
Whole concrete cross-section	0	0	10000	312620047	113499912	0
All nonprestressed reinforcement	0	0	5267	4876962	0	0

Forces in all cross-section component (concrete, reinforcement)

Type of component	Type	Material	Area	Strain	Stress	Strain	Stress	e / Strain	e / Stress	Result
Compressive concrete	1	Concrete	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Tensile concrete	2	Concrete	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Compressive reinf.	3	Reinf.	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Tensile reinf.	4	Reinf.	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Compressive force all	1	Concrete	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Tensile force all	2	Concrete	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Compressive force all	3	Reinf.	100	0.0	0.0	0.0	0.0	0.0	0.0	OK
Tensile force all	4	Reinf.	100	0.0	0.0	0.0	0.0	0.0	0.0	OK

Obtained results of stress and strain in concrete fibres

Fiber	Material	fy	fyd	e	Strain	Stress	Strain	Stress	e / Strain	e / Stress	Result
1	Material Type	100	250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OK
2	Material Type	100	250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Fail
3	Material Type	100	250	0.5	250.0	-25.30	240.22	0	-1	19	OK
4	Material Type	100	250	0.3	250.0	186.75	365.22	0	48	OK	

Nové technológie v posudkoch betónu

Nové betónové posudky (rýchlosť)



- Paralelný výpočet (použitie viacero vlákien)
- Výrazné urýchlenie posudkov (50-1000 krát)

Čas výpočtu [sec]	200 prvkov bez nábehov				200 prvkov s nábehmi			
	Kombinácia C01		Trieda MSÚ (20 kombinácií)		Kombinácia C01		Trieda MSÚ (20 kombinácií)	
	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút
Jestvujúci posudok	435.8	176.1	524.7	184.2	2580	1042.50	5400	1895.70
Nový interný posudok(sekvenčný)	4.663	0.029	26.664	0.126	26.002	0.162	75.861	0.358
Nový externý posudok(sekvenčný)	98.889	0.461	146.349	0.704	253.376	1.181	422.718	2.033
Nový interný posudok(paralelný)	2.95		19.3		23.2		61.6	
Nový externý posudok(paralelný)	42.4		59.6		123.1		154.4	

Porovnanie výpočtov - urýchlenie	200 prvkov bez nábehov				200 prvkov s nábehmi			
	Kombinácia C01		Trieda MSÚ (20 kombinácií)		Kombinácia C01		Trieda MSÚ (20 kombinácií)	
	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút	Všetky prúty	Jeden prút
Jestvujúci posudok/Nový interný posudok(sekvenčný)	93.46	6072.41	19.68	1461.90	99.22	6435.19	71.18	5295.25
Jestvujúci posudok/Nový interný posudok(paralelný)	147.73		27.19		111.21		87.66	
Jestvujúci posudok/Nový externý posudok(sekvenčný)	4.41	382.00	3.59	261.65	10.18	882.73	12.77	932.46
Jestvujúci posudok/Nový externý posudok(paralelný)	10.28		8.80		20.96		34.97	

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Nové technológie v posudkoch betónu

Nové betónové posudky (obecnosť)



- Obecnosť (obecné zaťaženie, materiály a prierezy)


Typ posudku	Typ prvku	Jestvujúci stav		Nový vývoj	
		Prierez	Zaťaženie	Prierez	Zaťaženie
Návrh pozdĺž. výstuže	Nosník	obecný	N+My	obecný	N+My+Mz
	Stĺp	obdĺžnik, kruh	N+My+Mz	obecný	N+My+Mz
Návrh šmyk. výstuže	Nosník	obecný	Vz+T	obecný	Vy+Vz+T*
	Stĺp	nepodporovaný		obecný	Vy+Vz+T*
Posudok N+M	Nosník	obecný	N+My+Mz	obecný	N+My+Mz
	Stĺp	obecný	N+My+Mz	obecný	N+My+Mz
Posudok Vz+T (šmyk + krútenie)	Nosník	obecný	Vz+T	obecný	Vy+Vz+T*
	Stĺp	nepodporovaný		obecný	Vy+Vz+T*
Posúdenie trhlín	Nosník	obecný	N+My+Mz	obecný	N+My+Mz
	Stĺp	nepodporovaný		obecný	N+My+Mz
Posúdenie priehybu	Nosník	obecný	N+My+Mz	obecný	N+My+Mz
	Stĺp	obecný	N+My+Mz	obecný	N+My+Mz

*Uhol medzi výslednicou šmykovej výstuže a rovinou momentového zaťaženia musí spĺňať stanovenú toleranciu

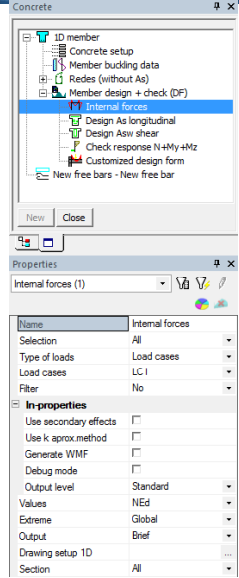
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Nové technológie v posudkoch betónu

Otvorené externé posudky




- Externé posudky založené na SDF
- Priority (**otvorenosť**, transparentnosť, rýchlosť, obecnosť)
- Posudky sú písane v SDF (použitie Concrete toolbox)
- Prepojenie medzi SEN a SDF (Model data)
- 4 typy posudkov pre NBR
 - Prepočet vnútorných síl (imperfekcie + sekundárne účinky)
 - Návrh pozdĺžnej výstuže
 - Návrh šmykovej výstuže
 - Posudok únosnosti (odzova prierezu)
 - **Užívateľom definované posudky (NBR+ EN)**
- Výstup
 - Stručný
 - Detailný (3 úrovne)



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Nové technológie v posudkoch betónu

Otvorené externé posudky



- Prepojenie SEN +SDF

```

InternalForces.emd - Poznámkový blok
Súbor Úpravy Formát Zobrazit Pomocnik
(:Section :ID 0 )
(:InternalForces :ID 0 :N -46067.2 :vy 0 :vz 150000 :Mx 0 :My -113411 :Mz 0 )
(:Section :ID 1 )
(:InternalForces :ID 0 :N -46067.2 :vy 0 :vz 125000 :Mx 0 :My -11661.4 :Mz 0 )
(:Section :ID 2 )
(:InternalForces :ID 0 :N -46067.2 :vy 0 :vz 100000 :Mx 0 :My 11588.6 :Mz 0 )
(:Section :ID 3 )
(:InternalForces :ID 0 :N -46067.2 :vy 0 :vz 75000 :Mx 0 :My 55338.6 :Mz 0 )
(:Section :ID 4 )
(:InternalForces :ID 0 :N -46067.2 :vy 0 :vz 50000 :Mx 0 :My 86588.6 :Mz 0 )
(:Section :ID 5 )
            
```

ID	Description	Symbol	Value	Unit
Result.2	Anal. val...	M _{xy}	0	
Section.BucklingData.b	Coefficie...	K _{yy}	1	
Section.BucklingData.b	Coefficie...	K _{zz}	1	
Result.6	Bending m...	M _{iy}	0	
Result.9	Bending m...	M _{ix}	0	
Result.10	First ord...	M _{0dx}	0	
Result.7	First ord...	M _{0dy}	0	
Result.11	Second or...	M _{2x}	0	
Result.8	Second or...	M _{2y}	0	
InternalForces.Mz	First ord...	M _z	0	
InternalForces.My	First ord...	M _y		kNm
CS.Geometry.FormCode	Type of c...	TypeCes	2003	

Customized design form


Linear calculation, Extreme : Global
 Selection : All
 Load cases : LC1
 Customized design form

Member	Position (m)	Case	Result1 Result11	Result2 Result12	Result3 Result13	Result4 Result14
B1	0.000	LC1	0.00	0.00	0.50	0.00

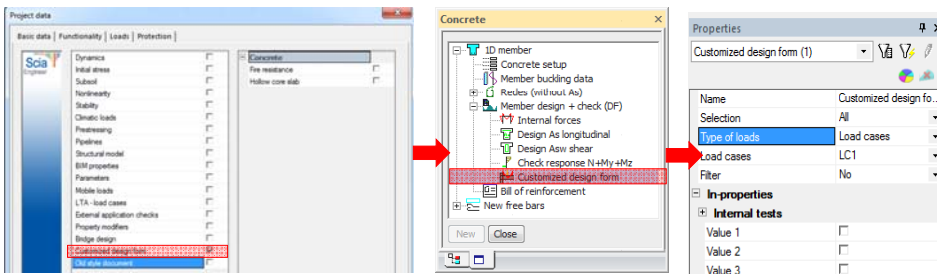
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Nové technológie v posudkoch betónu

Otvorené externé posudky



■ **Užívateľské posudky v SEN**



Customized design form


Linear calculation, Extreme : Global
 Selection : All
 Load cases : LC1
 Customized design form

Member	Position [m]	Case	Result1 [E] Result11 [E]	Result2 [E] Result12 [E]	Result3 [E] Result13 [E]	Result4 [E] Result14 [E]	Result5 [E] Result15 [E]	Result6 [E] Result16 [E]	Result7 [E] Result17 [E]	Result8 [E] Result18 [E]	Result9 [E] Result19 [E]	Result10 [E] Result20 [E]
B1	0,000	LC1	0,00 0,00	0,30 0,00	0,50 0,00	0,00 0,00	0,15 0,00	0,00 0,00	0,00 0,00	0,15 0,00	0,25 0,00	0,00 0,00

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Nové technológie v posudkoch betónu

Interne posudky



■ **Priority**

- Transparentnosť
- Rýchlosť
- Obecnosť

■ **Použitie Concrete toolbox**

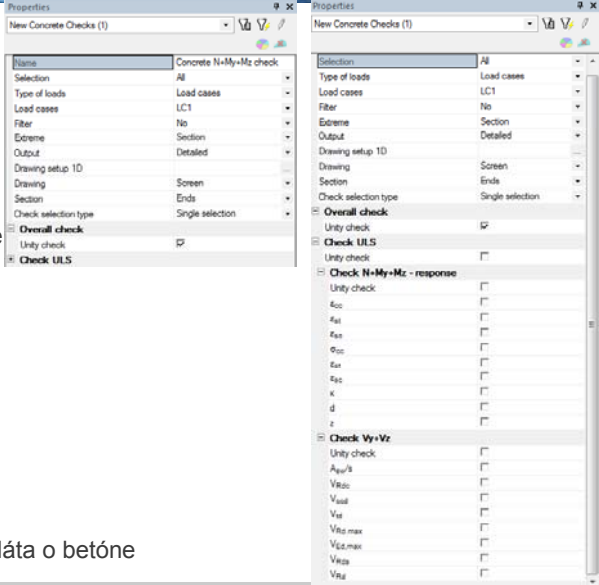
■ **Posúdenie v jednom servise**

- Multi výber
- Jednoduchý výber
- Predefinované posudky

■ **Tri typy výstupov**

- stručný
- štandardný
- detailný


■ **Nové nastavenie betónu + dáta o betóne**



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Nové technológie v posudkoch betónu

Interne posudky



- Numerické výstupy (stručný, štandardný, detailný)

Extreme values of stress/strain in component

Type of component	Fibre/Reinf. β	ϵ [1e-4]	σ_{lim} [1e-4]	σ [MPa]	σ_{lim} [MPa]
Compressive concrete (acc. osc.)	1	-0.6	-35.9	-0.29	0.00
Tensile concrete (acc. osc.)	3	1.2	0.0	0.00	0.00
Compressive nonprestressed reinf. (acc. osc.)	1	-0.4	-250.0	-8.78	-466.52
Tensile nonprestressed reinf. (acc. osc.)	3	1.0	250.0	20.62	365.22

Parameters of the plane of equilibrium

ix	[1e-4]	0.3
iy	[1e-4]	3.7
iz	[1e-4]	0.0
x	[mm]	371
xbal	[mm]	294
xbal	[mm]	55
ona	[deg]	0.00
nl	[mm]	500
d	[mm]	471
z	[mm]	390
z1	[mm]	0.03
z2	[mm]	197
z3	[mm]	193
d1rc	[mm]	150
zrc	[mm]	0
zrcd1rc	[mm]	0
zrc2	[mm]	0
zrc3	[mm]	0

Cross-section characteristics of cross-section component

Type of component	ty	tz	A	Iy	Iz
	[mm]	[mm]	[mm ²]	[mm ⁴]	[mm ⁴]
Compressive concrete	0	169	51201	1512574812	360020256
Tensile concrete	0	85	88799	1612425386	740993744
Compressive nonprestressed reinf.	0	-197	628	24364413	5203106
Tensile nonprestressed reinf.	0	197	628	24364413	5203106
Whole concrete cross-section	0	0	150000	312500000	112500000
All non-prestressed reinforcement	0	0	1257	48769626	10465211

Forces in all cross-section component (concrete, reinforcement)

Type of component	Nres	Mres.y	Mres.z	ey	ez	Nres / NED	Mresy / MEDy
	[kN]	[kNm]	[kNm]	[mm]	[mm]	[%]	[%]
Compressive concrete	0.00	-1.44	0.00	0	0	0	20
Tensile concrete	0.00	0.00	0.00	0	0	0	0
Compressive reinf.	0.00	-1.09	0.00	0	0	0	21
Tensile reinf.	12.96	-2.55	0.00	0	-197	0	50
Compressive force all	0.00	-2.53	0.00	0	0	0	50
Tensile force all	12.96	-2.55	0.00	0	-197	0	50
Summary all	0.00	-5.08	0.00	0	0	0	100

Design shear resistance of the member without shear reinforcement
Section is uncracked in flexure at ULS ($\sigma_{ct,max} = 0.41 \text{ MPa} < f_{ctd} = 0.73 \text{ MPa}$) or $Asl = 0$: => chapter 12.6.3 is used

Symbol and formulas	Reference	[Unit]	General
Acc	§ 12.6.3(2)	[mm ²]	51201
accp = NED/Acc	§ 12.6.3(2)	[MPa]	0.00
rcd = acc * rck / γ_c	Table 3.1	[MPa]	8.00
fctd = acc * fctk / γ_c	Table 3.1	[MPa]	0.73
$\sigma_{ct,lim} = f_{ctd} - 2 \cdot f_{ctd} \cdot (f_{ctd} + f_{ctd}) / 0.5$	§ 12.6.3(2)	[MPa]	2.54
fctvd = $(f_{ctd} + 2 \cdot accp \cdot f_{ctd}) / 0.5$ (accp <= acc,lim)	§ 12.6.3(2)	[MPa]	0.73
k12_6_3	§ 12.6.3(2)	[-]	1.50
VRd,c = fctvd Acc k12.6.3	§ 12.6.3(2)	[kN]	25.03

Design value of maximum shear force (calculation without reduction β), clause 6.2.2(6)

Symbol and formulas	Reference	[Unit]	General
bw1	§ 6.2.3(1)	[mm]	300
d	C	[mm]	447
$v = 0.6 \cdot (1 - f_{ck} / 250)$	§ 6.2.2(6)	NA	0.57
VEd,max = $0.6 \cdot bw1 \cdot d \cdot v \cdot f_{ctd}$	§ 6.2.2(6)	[kN]	305.39

Design value of maximum shear force: limited by crushing of the compression struts, clause 6.2.3(3,4)

Symbol and formulas	Reference	[Unit]	General
bw1	§ 6.2.3(1)	[mm]	300
z	C	[mm]	380
fcd = acc * fck / γ_c	Table 3.1	[MPa]	8.00
cot θ	§ 6.2.3(1)	[-]	1.19
cot θ	§ 6.2.3(1)	[-]	0.00
acw	§ 6.2.3(3)	NA	1.00
$v1 = 0.6 \cdot (\sigma_{swd} < 0.8 \cdot f_{yk} \text{ and } f_{ck} < 60 \text{ MPa})$	§ 6.2.3(3)	NA	0.60
VRd,max = $acw \cdot bw1 \cdot z \cdot v1 \cdot fcd \cdot (\cot\theta + \cot\theta) / (1 + \cot^2\theta)$	§ 6.2.3(3,4)	[kN]	276.61


Design value of shear force, clause 6.2.3(4)

Symbol and formulas	Reference	[Unit]	General
Asw/s	§ 6.2.3(3)	[m ² /m]	3.4078e-04
z	C	[mm]	380
cot θ	§ 6.2.3(1)	[-]	1.19
cot θ	§ 6.2.3(1)	[-]	0.00
$\sigma_{swd} = VEd \cdot (1 + \cot^2\theta) / (Asw/s \cdot z \cdot (\cot\theta + \cot\theta))$	§ 6.2.3(3)	[MPa]	134.87
$f_{ykwd} = 0.8 \cdot f_{yk} \cdot (\sigma_{swd} < 0.8 \cdot f_{yk})$	§ 6.2.3(3)	[MPa]	300.00
VRd,s = $(Asw/s) \cdot z \cdot f_{ykwd} \cdot (\cot\theta + \cot\theta) / (1 + \cot^2\theta)$	§ 6.2.3(3,4)	[kN]	20.95

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Nové technológie v posudkoch betónu

Interne posudky



- Nastavenie betón
 - Prehľadnejšie nastavenie
 - Filtrovanie, vyhľadavanie
 - Rôzne možnosti zobrazenie

Concrete solver settings

Code

View

Concrete commands

Code chapters

List

Description	Symbol	Value	Default	Unit	Chapter	Code	Struct.
Concrete solver							
Chapter 2. Basis design							
2.4 Verification by the partial factor method							
2.4.2 Design values							
Partial factor for shrinkage action	γ_{sh}	1.0	1.0	-	2.4.2.4	EN1992	
Chapter 3. Materials							
Chapter 4. Durability and cover to reinforcement							
Chapter 5. Structural analysis							
5.8.8 Analysis of second order effects with axial							
5.8.8 Method based on nominal curvature							
Use II. order effects	-	YES	NO	-	5.8.8.2	EN1992-1-1	Column
Use imperfection for SLS	-	NO	YES	-	5.8.8.2	EN1992-1-1	Column

OK

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Nové technológie v posudkoch betónu

Zhrnutie



- Concrete toolbox
- Model data
- Priority nových posudkov
- Externé posudky
- Interné posudky