Release Note

Release Date : Apr. 20, 2023

Product Ver. : Civil 2023 (v1.1)

DESIGN OF CIVIL STRUCTURES

Integrated Solution System for Bridge and Civil Engineering

Enhancements

Enhancements in Civil 2023 (v1.1)

1. Moving Load Analysis to French Former Standard: FASCICULE N° 61 TITRE II
2. French National Annex to Eurocode 2, 3, 4
3. Eurocode Design Report in French
4. Eurocode Design Report in Word Format
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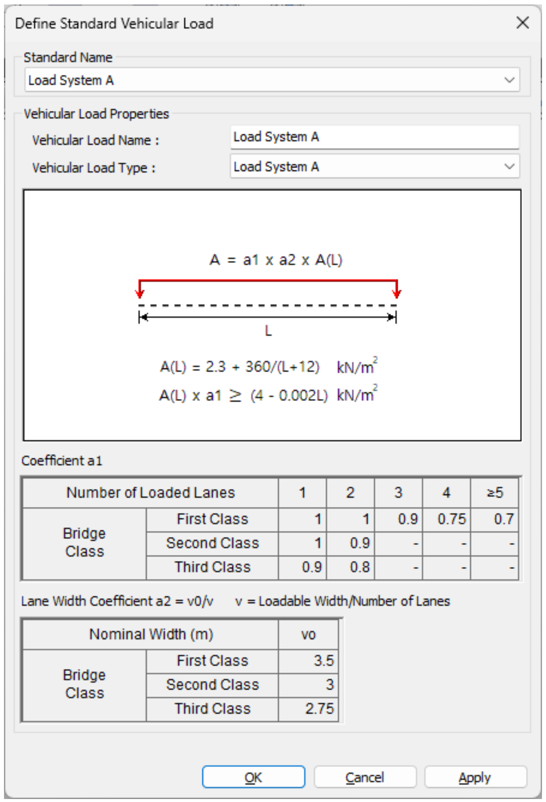
7. PSC Design: User Input of Torsion Parameters, Ak and uk
8. Equivalent Beam Stress Results for Construction Stage Analysis
9. GSD Excel Report: Print Results of All Load Combinations
10. Concrete & Rebar Material Database to South Africa: TMH7
11. Concurrent Disp./Vel./Accel. for Time History Analysis
12. Transmission Zone Design of Pretensioned Beam to AASHTO LRFD
13. SNiP/SP PSC Design: Crack Opening Coefficient by Tendon Material
14. Concurrent Joint Forces
15. Improvement in Auto Load combinations as per IRC 6
16. Improvement in PSC design parameters as per IRC 112:2020
17. Improvement in PSC & RC design as per IRC 112:2020
18. Other Enhancements

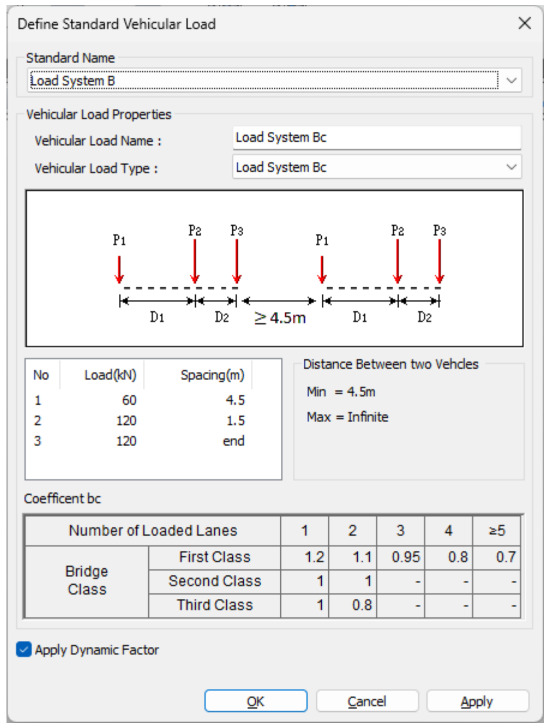
1. Moving Load Analysis to French Former Standard: FASCICULE N° 61 TITRE II

- Vehicle library has been added for former French national standard.
- Fascicule N° 61, Conception, Calcul et Epreuves des Ouvrages d'art, Titre II - Programmes de Charges et Epreuves des Ponts-Routes (in French)

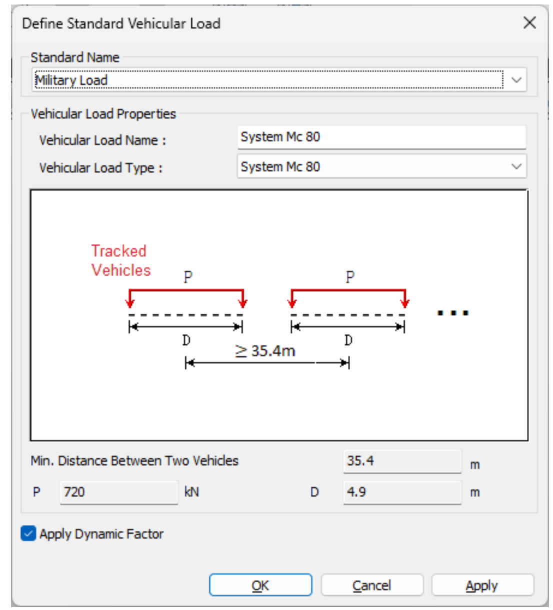
- ***Load> Moving Load > Moving Load Code > France***



Load System A



Load System Bc

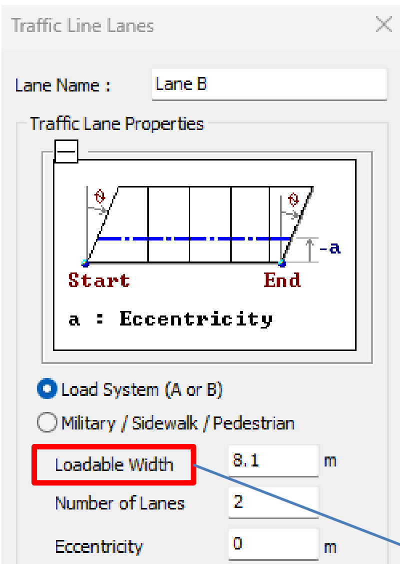


Military Load Mc 80

1. Moving Load Analysis to French Former Standard: FASCICULE N° 61 TITRE II

- Define the roadway width in the lane definition rather than the individual lane.

▪ ***Load> Moving Load > Moving Load Code > France***



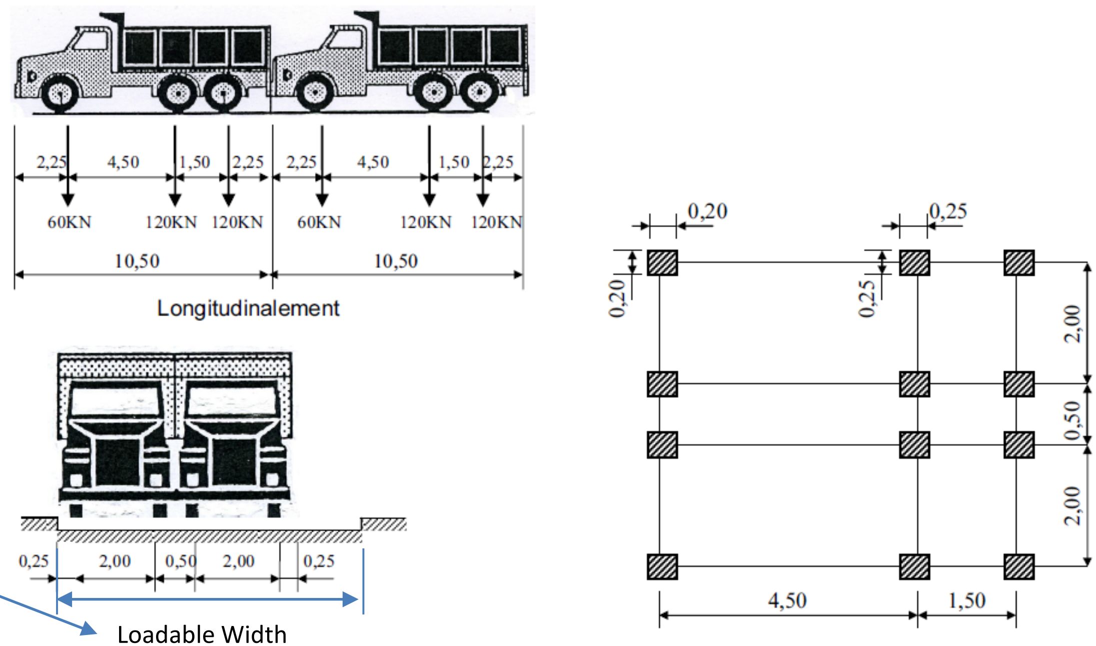
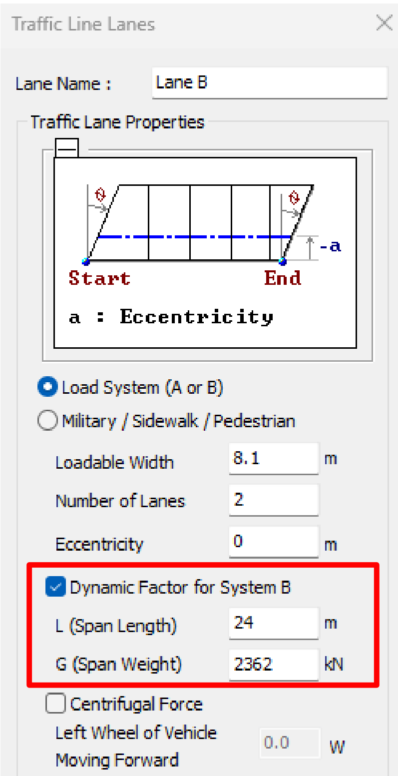


Figure 4.1 : Système B_c

1. Moving Load Analysis to French Former Standard: FASCICULE N° 61 TITRE II

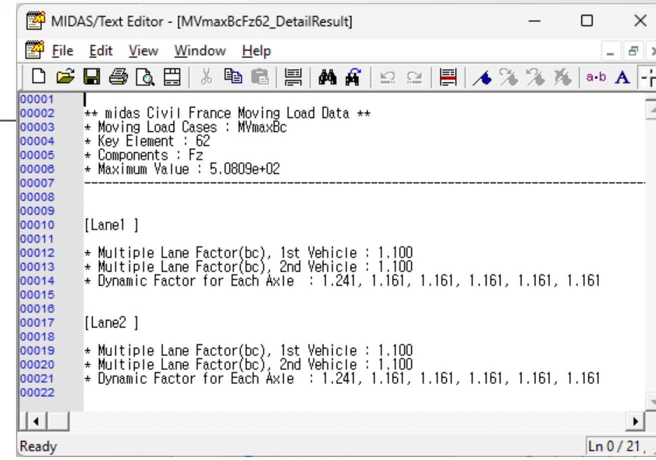
- Enter the span length and span weight for each span to calculate the dynamic factor, δ.
- The maximum weights of load system Bc for each span are determined by program.

▪ ***Load> Moving Load > Moving Load Code > France***



- Dynamic Factor

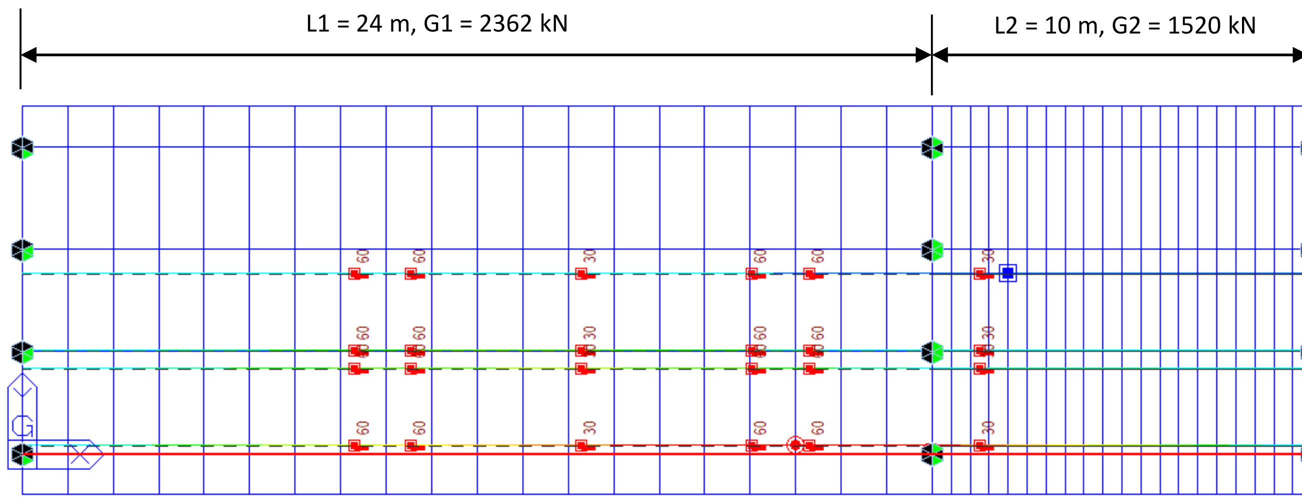
$$\delta = 1 + \frac{0,4}{1 + 0,2.L} + \frac{0,6}{1 + 4\frac{G}{S}}$$


MIDAS/Text Editor - [MVmaxBcFz62_DetailResult]

File Edit View Window Help

```
00001
00002 ** midas Civil France Moving Load Data **
00003 * Moving Load Cases : MVmaxBc
00004 * Key Element : 62
00005 * Components : Fz
00006 * Maximum Value : 5.0809e+02
00007 ------------------------------------------------------------
00008
00009
00010 [Lane1 ]
00011
00012 * Multiple Lane Factor(bc), 1st Vehicle : 1.100
00013 * Multiple Lane Factor(bc), 2nd Vehicle : 1.100
00014 * Dynamic Factor for Each Axle  : 1.241, 1.161, 1.161, 1.161, 1.161, 1.161
00015
00016
00017 [Lane2 ]
00018
00019 * Multiple Lane Factor(bc), 1st Vehicle : 1.100
00020 * Multiple Lane Factor(bc), 2nd Vehicle : 1.100
00021 * Dynamic Factor for Each Axle  : 1.241, 1.161, 1.161, 1.161, 1.161, 1.161
00022
```

Ready Ln 0 / 21,



No	Elem	Eccen. (m)	L (m)	G (kN)	Span Start
1	82	-4.05	24	2362	☑
2	83	-4.05	24	2362	☐

No	Elem	Eccen. (m)	L (m)	G (kN)	Span Start
40	121	-4.05	10	980.	☐

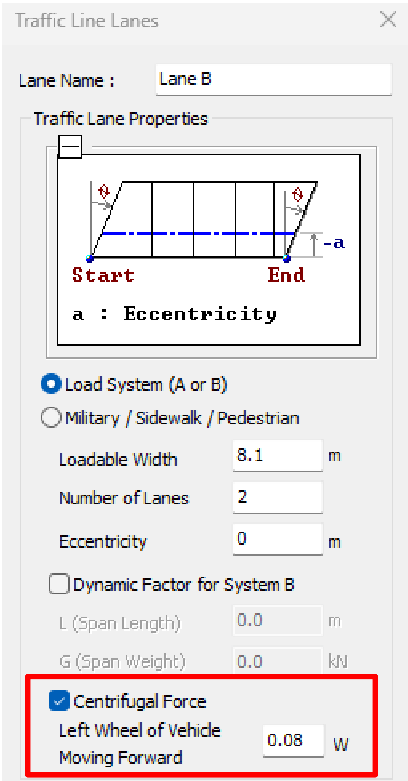
1. Moving Load Analysis to French Former Standard: FASCICULE N° 61 TITRE II

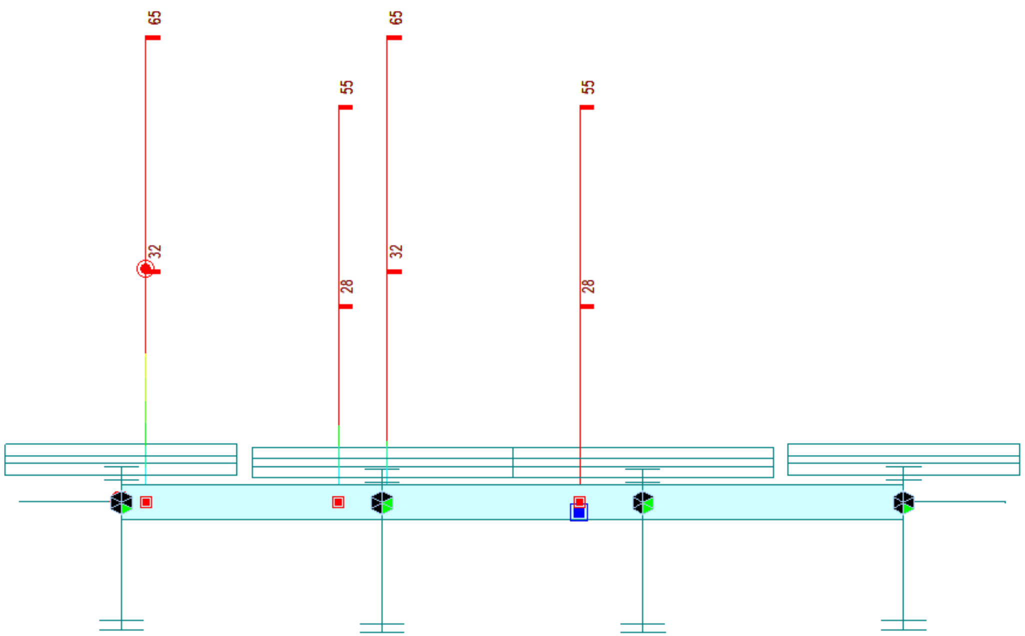
- The effects of the centrifugal forces can be added to the effects of vertical loads.

▪ ***Load> Moving Load > Moving Load Code > France***

- The ratio for the increase of left wheel load to consider the centrifugal forces

$$\frac{R+150}{6R+350} \quad \text{if } R < 400\text{m} \qquad \frac{80}{R} \quad \text{if } R \geq 400\text{m}$$



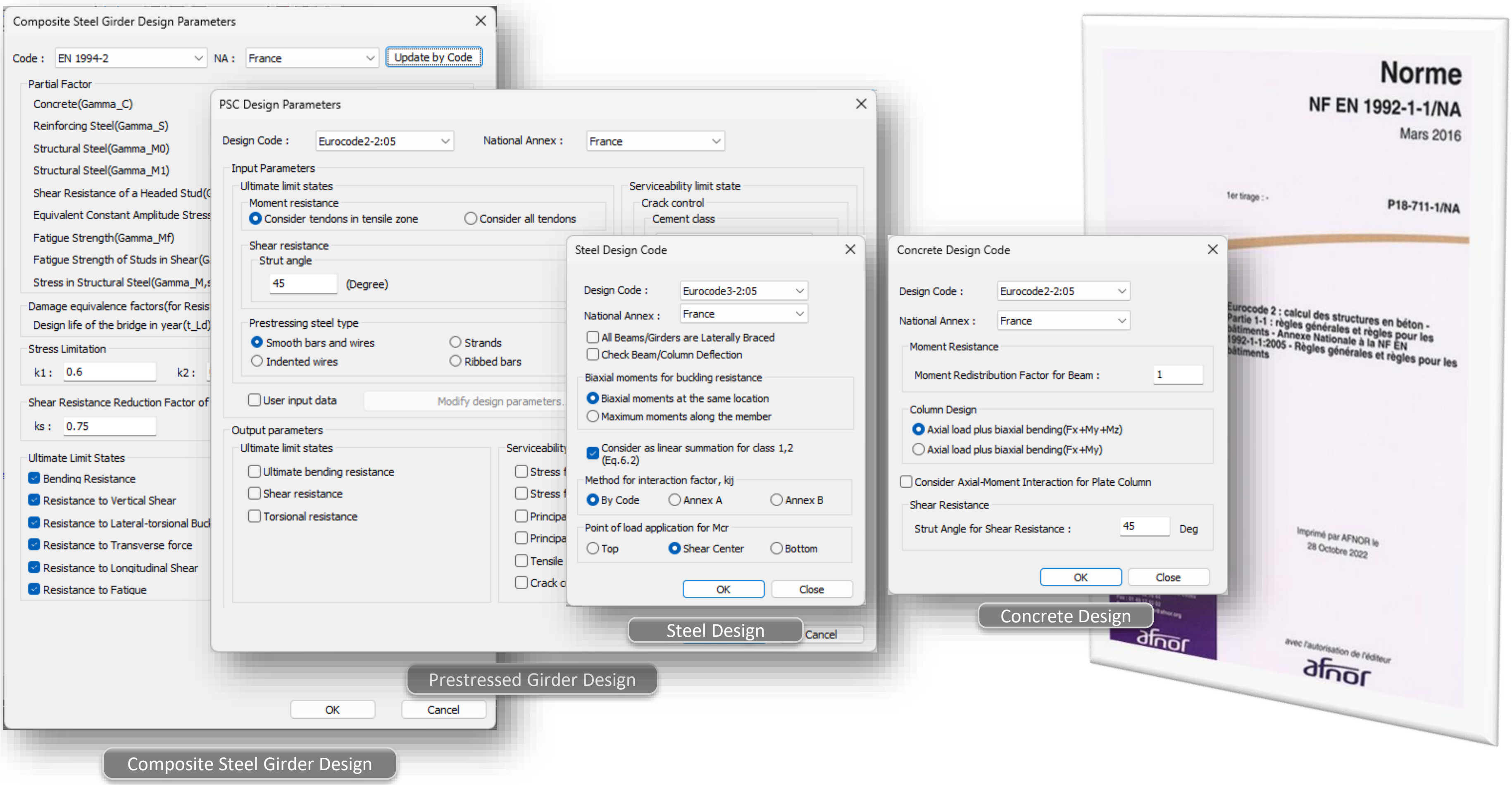


Vertical Loads with Centrifugal Forces

2. French National Annex to Eurocode 2, 3, 4

- French national annexes have been added for Eurocode 2, 3, and 4.

▪ ***Design> RC Design, Steel Design, Composite Design*** ***PSC> PSC Design***



3. Eurocode Design Report in French

- Design reports of Eurocode can now be generated in French.

- ***Design>*** ***RC Design, Steel Design, Composite Design***
- ***PSC>*** ***PSC Design***

MIDAS Information Technology Co.,Ltd.

Civil 2022 (v1.1) / Vérification

■ NOM DU MEMBRE : Slab-BC

1. Informations de l'élément

1) Code de conception
   EN 1992-2: 2005 (NA:France)

2) Propriété de section
   10 (ID : 10)

3) Propriété matérielle
   f_{ck} = 30.000MPa, f_y = 500.000MPa

4) Longueur
   L = 0.914m

5) Données de ferraillage
   Bot-Dir.1 : P16@300
   Top-Dir.1 : P16@300
   Bot-Dir.2 : P13@300
   Top-Dir.2 : P13@300

2. Capacité de Moment (Dir-x, Négatif)

Moment Nég.	Memb No.	740	
	Nœud No.	777	
	LCB	cLCB2	
	M_{Ed} / M_{Rd}	-56.696kN·m/m / -59.070kN·m/m = 0.960	OK
	ρ_{min} , ρ , ρ_{max}	ρ_{min} = 0.00151 < ρ = 0.00319 < ρ_{max} = 0.04000	OK

*cLCB2 : (1.350)SW+(1.350)EHmax+(1.350)LS+(1.350)MVL1+(1.350)EV

1) Paramètre de conception
   f_{ck} = 30.000MPa, f_{yk} = 500.000MPa
   b_w = 1,000.000mm, h = 260.000mm
   d = 210.000mm
   A_{st} = 670.200mm²
   α_{cc} = 1.000
   γ_c = 1.500, γ_s = 1.150
   $f_{cd} = \alpha_{cc} f_{ck} / \gamma_c$ = 20.000MPa
   $f_{yd} = f_{yk} / \gamma_s$ = 434.783MPa

Číslo prvku	16
Position Information	J

1.Nastavení posudku

1.1 Návrhové parametry

- Dílčí součinitele pro mezní stav únosnosti (EN 1992-1-1:2004, 2.4.2.4)

Návrhové situace	γ_c beton	γ_s betonářská výztuž	γ_s předpjatá výztuž
Trvalé & Dočasné	1.500	1.150	1.150
Mimořádné	1.200	1.000	1.000

- součinitel α_{cc} , α_{ct} : Součinitel pro dlouhodobé účinky únosnosti v tlaku a tahu.

α_{cc} = 0.850 (pro únosnost betonu v tlaku)

α_{ct} = 1.000 (pro únosnost betonu v tahu)

1.2 Průřezy

b_w	8500.0	mm	I_y	7.8668E+12	mm⁴	A_{sl}	0.000	mm²
h	3000.0	mm	I_z	2.9574E+13	mm⁴	A_{sc}	0.000	mm²
d_c	0.0	mm	C_y	4250.0	mm	A_{sw}	0.000	mm²
d_t	0.0	mm	C_z	1790.6	mm	A_{wt}	0.000	mm²
A	6208720.000	mm²				A_{lt}	0.000	mm²

1.3 Materiály

- Beton

f_{ck} = 40.000 MPa , E_c = 35220.000 MPa

- Výztuž

f_{yk} = 400.000 MPa , E_s = 200000.000 MPa

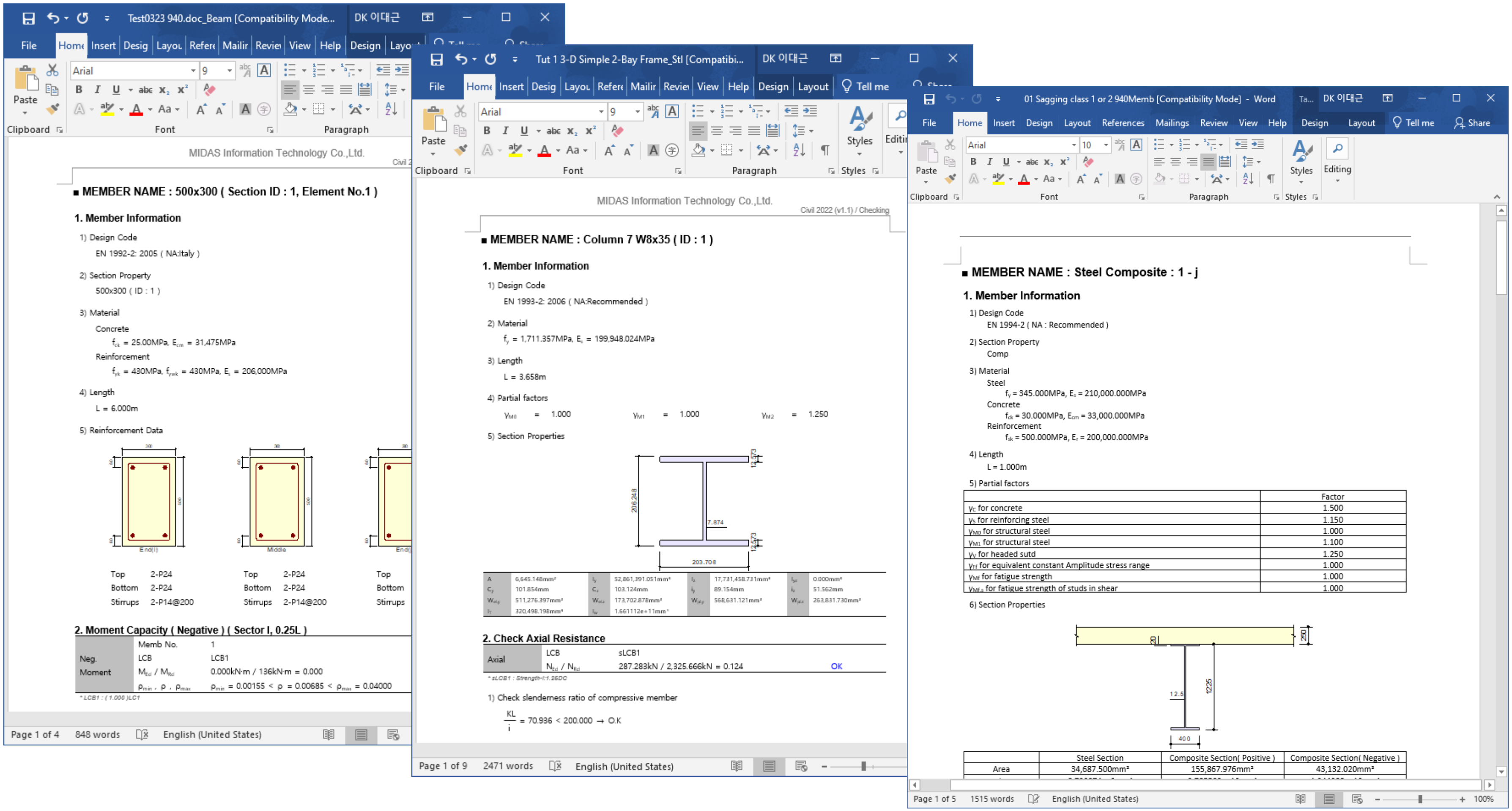
1.4 Předpjaté kabely

Typ	Název kabelu	Pozice (mm)	Plocha (mm²)	Pevnost (MPa) f_{pk}	Pevnost (MPa) $f_{p0.1k}$	E_p (MPa)
1	S_A2L	500.0	2635.300	1900.000	1600.000	200000.000
2	S_A3L	700.0	2635.300	1900.000	1600.000	200000.000
3	S_A4R	900.0	2635.300	1900.000	1600.000	200000.000
4	S_A4L	900.0	2635.300	1900.000	1600.000	200000.000

4. Eurocode Design Report in Word Format

- Design reports of Eurocode are now generated in Word format, which is faster than Excel format and enables the user to change the report style with ease.
- PSC design report is still in Excel format in this version.

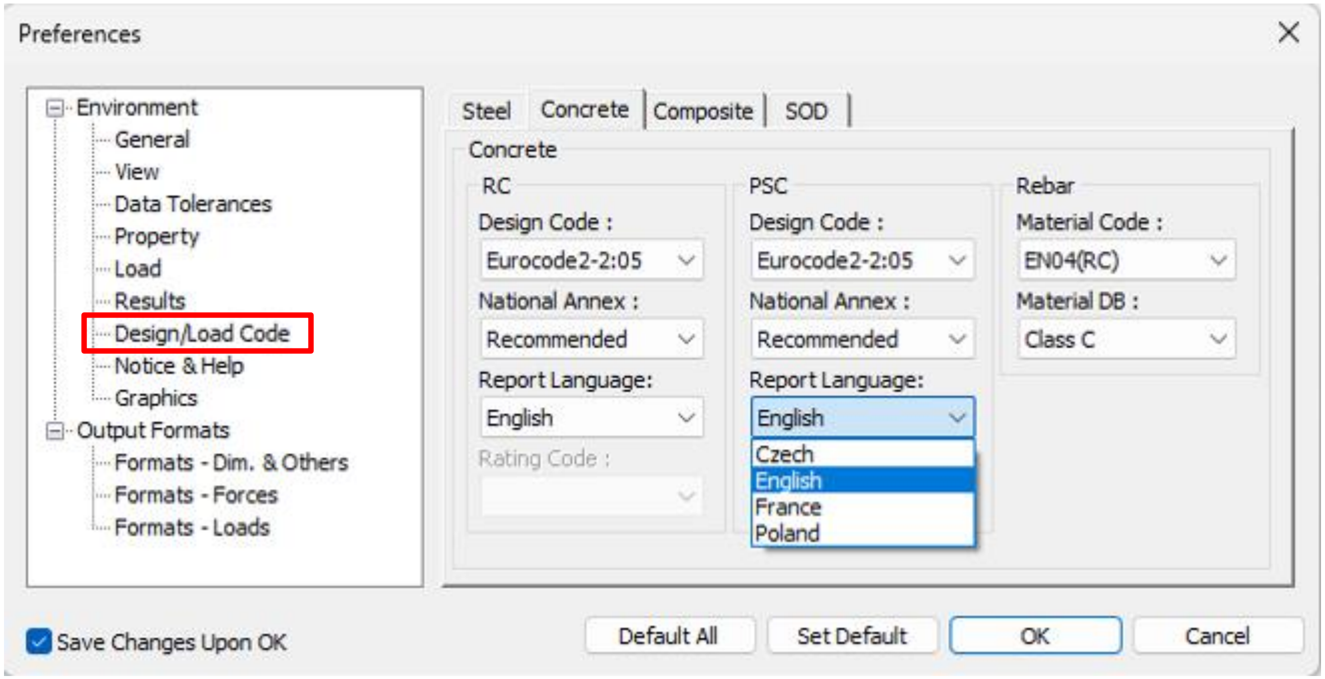
▪ ***Design>** RC Design, Steel Design, Composite Design*



5. Preference Setting for Design Report Language

- The preferred language of the design reports can now be selected from the Preference for Eurocode and AASHTO LRFD.
- The preferred unit system of the design reports can now be selected from the Preference for AASHTO LRFD.

▪ ***Tools> Setting > Preferences > Design/Load Code***

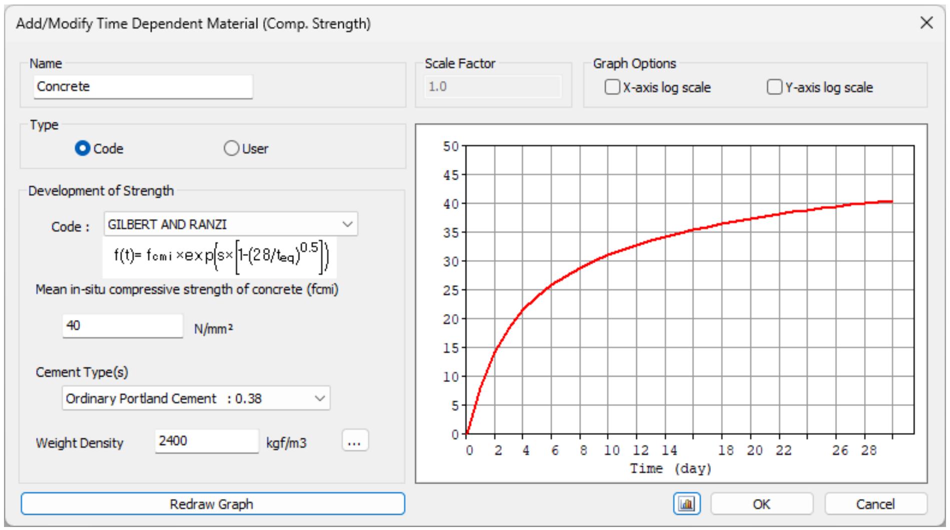


Report Language of Preference

6. Time Dependent Material: Modulus of Elasticity Suggested by Gilbert and Ranzi

- Time-dependent modulus of elasticity suggested by Gilbert and Ranzi has been added.
- Time-dependent behavior of concrete structures by Raymond Ian Gilbert and Gianluca Ranzi, 2010

- ***Properties> Time Dependent Material > Comp. Strength > GILBERT AND RANZI***



Development of Compressive Strength

- Modulus of elasticity

For $f_{cmi} \leq 40$ MPa:

$$E_c = \rho^{1.5} 0.043 \sqrt{f_{cmi}} \text{ (in MPa)}$$

For $40 < f_{cmi} \leq 100$ MPa:

$$E_c = \rho^{1.5} [0.024 \sqrt{f_{cmi}} + 0.12] \text{ (in MPa)}$$

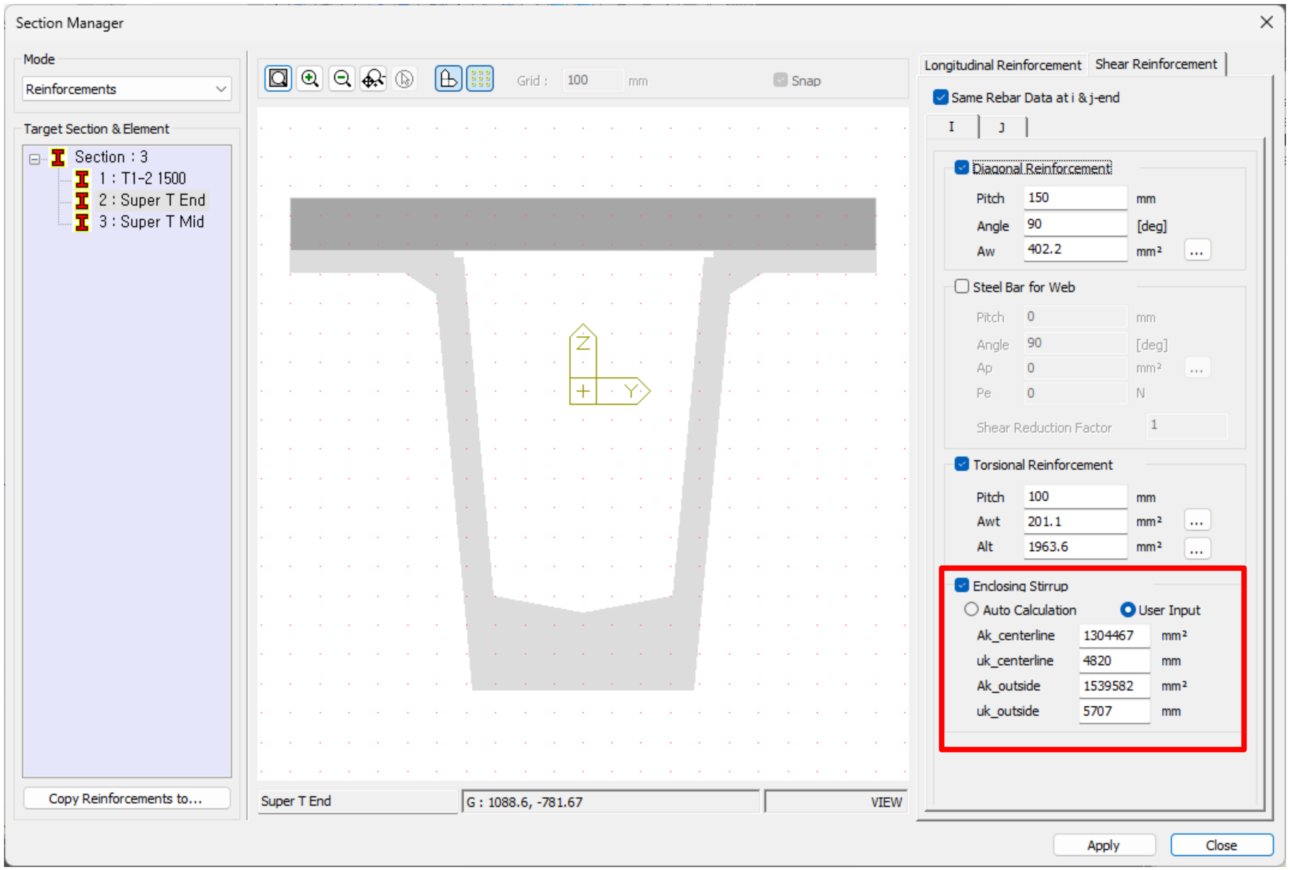
- Modulus of elasticity with time

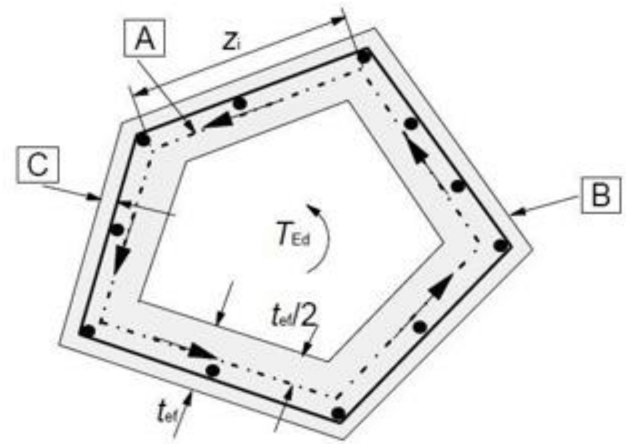
$$E_c(t) = \left(e^{s(1-\sqrt{28/t})}\right)^{0.5} E_c(28)$$

7. PSC Design: User Input of Torsion Parameters, Ak and uk

- Area and perimeter for the torsion design can now be user-defined for the PSC-Value type, PSC-Composite type, and General-Composite type sections.

- ***Properties> Section > Section Manager > Reinforcements***



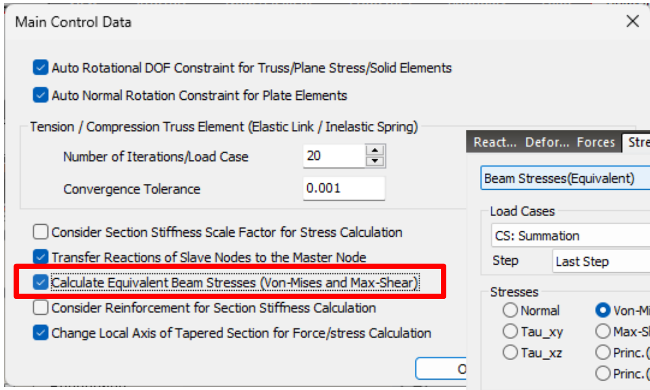


Shear Reinforcement of Section Manager

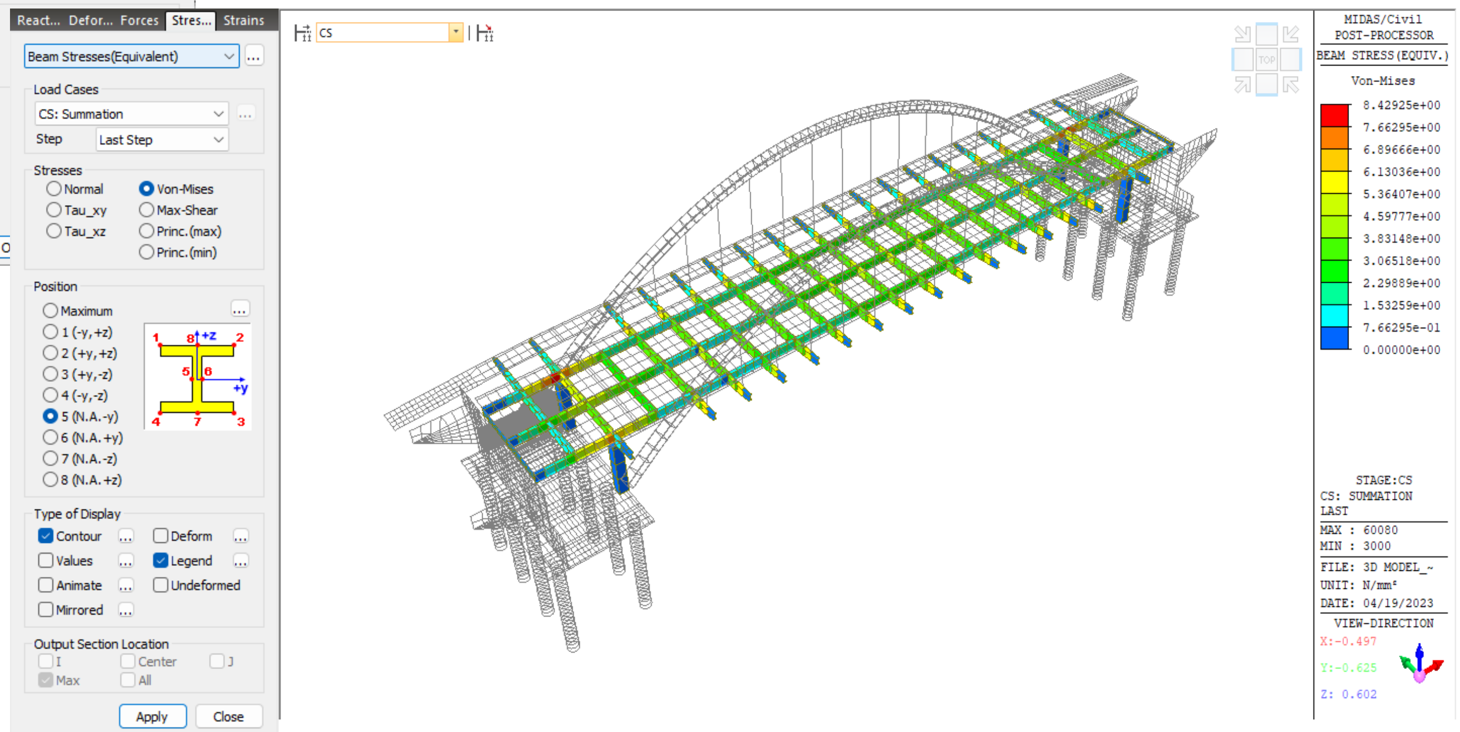
8. Equivalent Beam Stress Results for Construction Stage Analysis

- Equivalent beam stresses including von-Mise stresses of the steel beam sections are now provided for the construction stage analysis.

▪ ***Results> Stresses > Beam Stresses (Equivalent) or Beam Stresses Diagram (Equivalent)***



Main Control Data

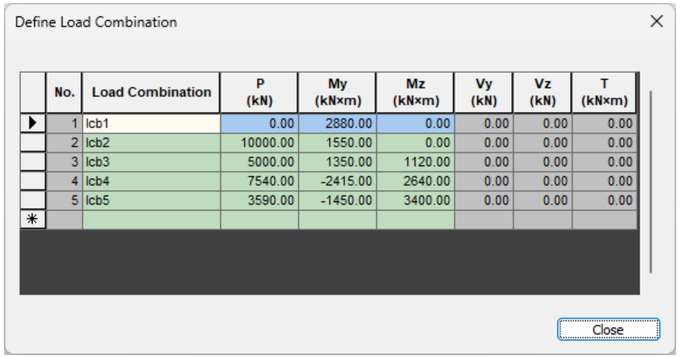


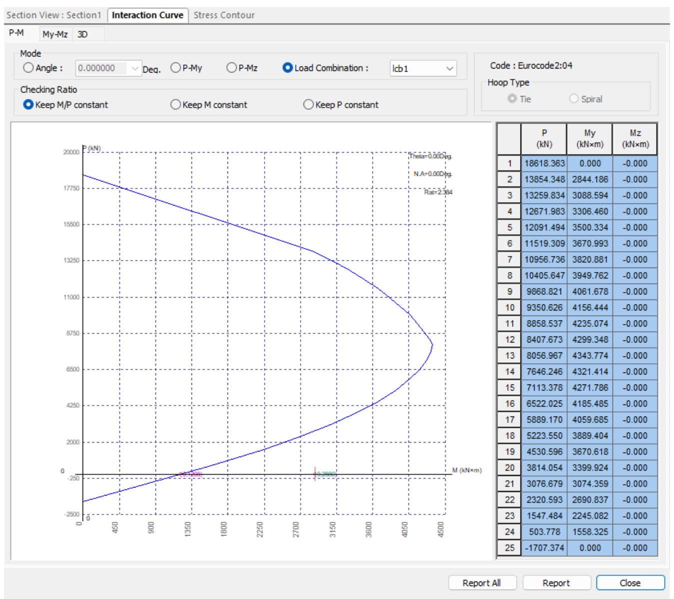
Von-Mises Stresses at Centroid of Steel Beam

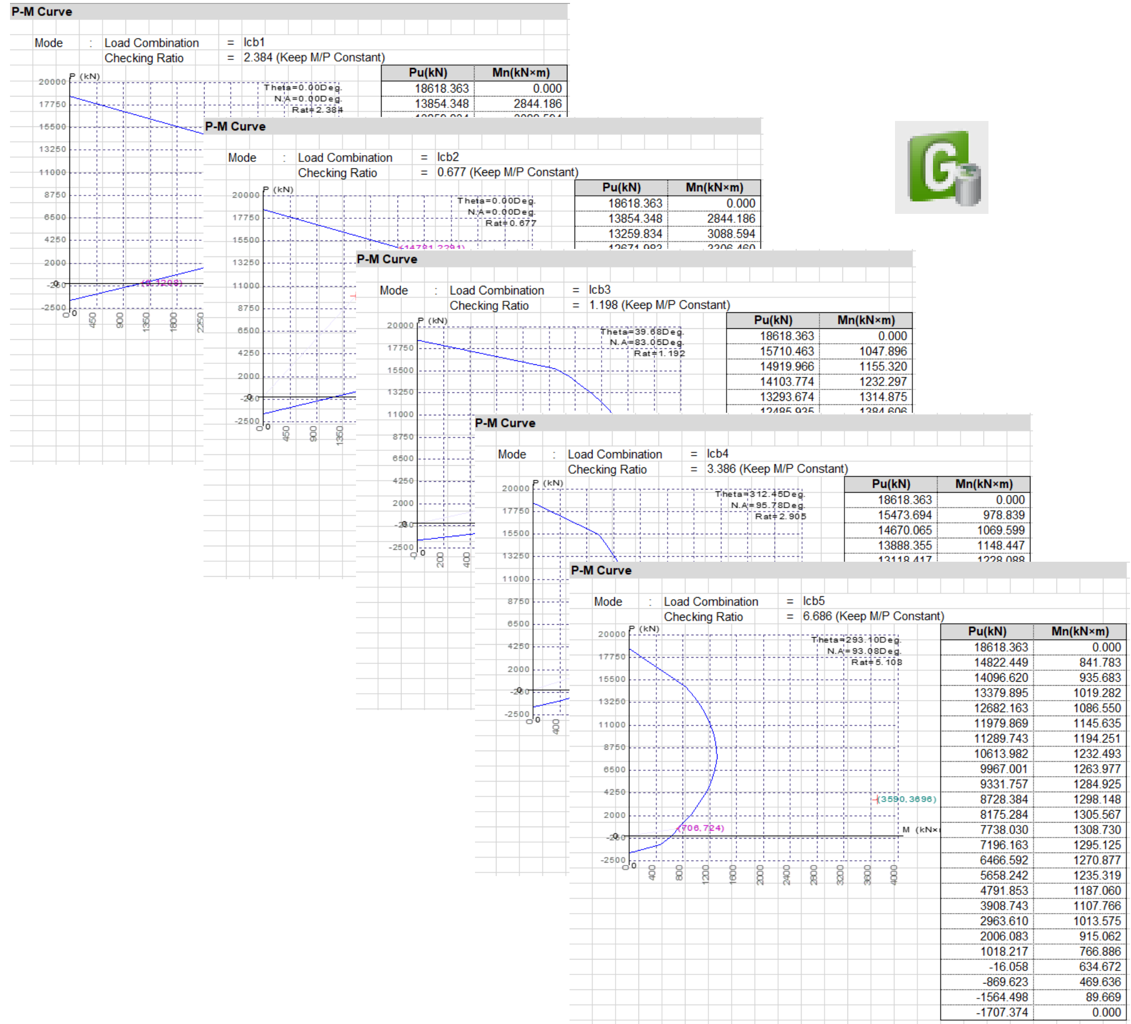
9. GSD Excel Report: Print Results of All Load Combinations

- The design results for all the load combinations are now generated together in the GSD report.

- ***Tools> Generator > General Section Designer***



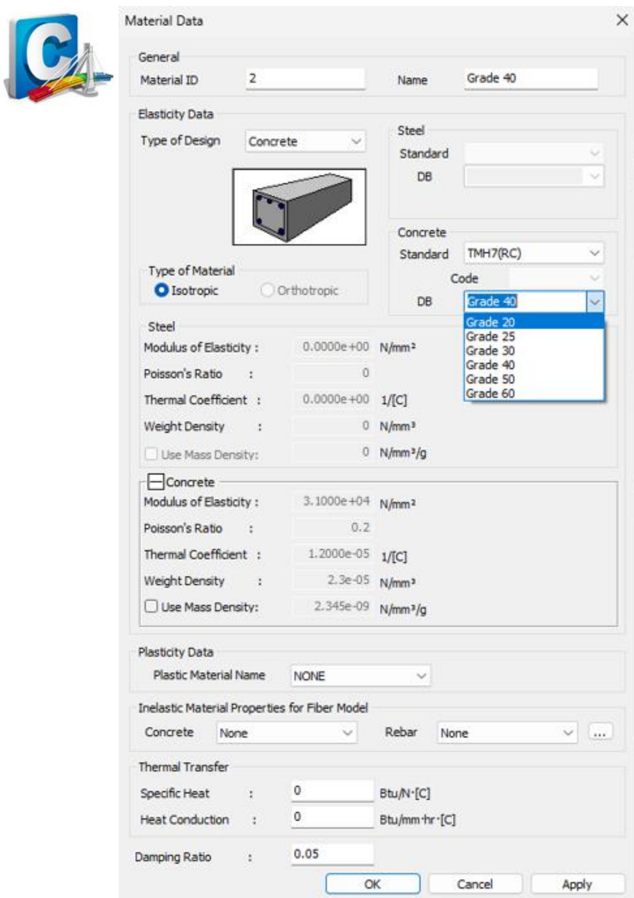




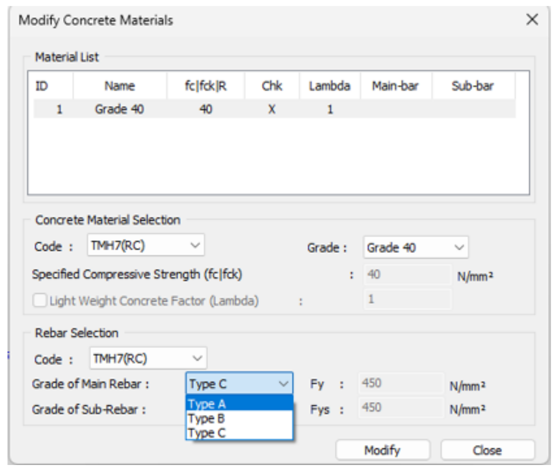
10. Concrete & Rebar Material Database to South Africa: TMH7

- Concrete and rebar material database have been added for South Africa TMH7.

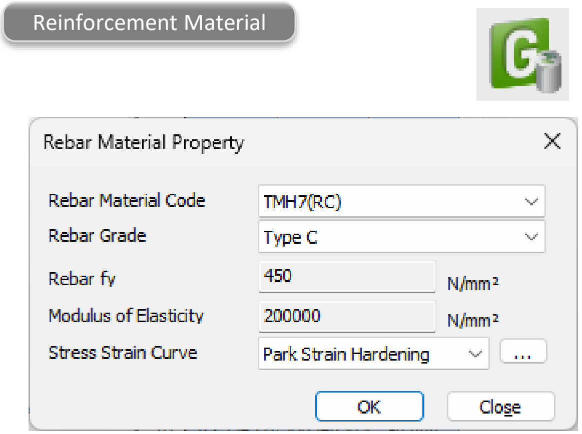
- ***Properties> Material > Concrete > TMH7***



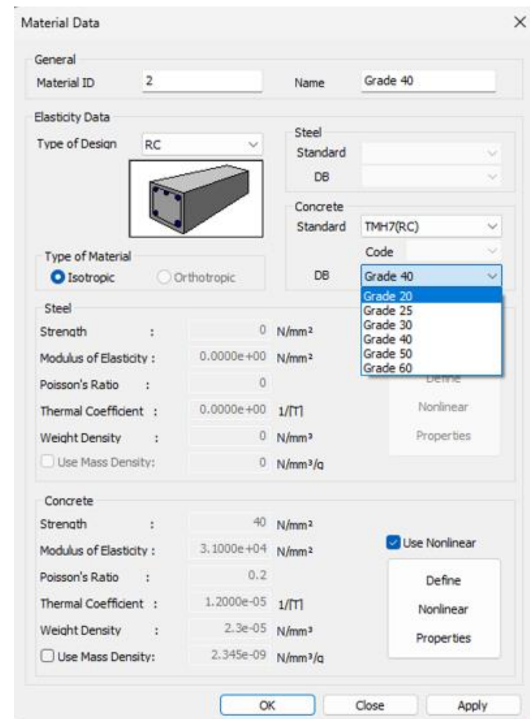
Concrete Material



Reinforcement Material



Reinforcement Material

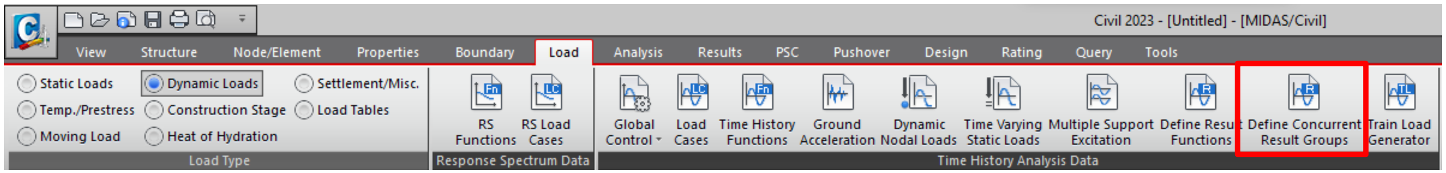


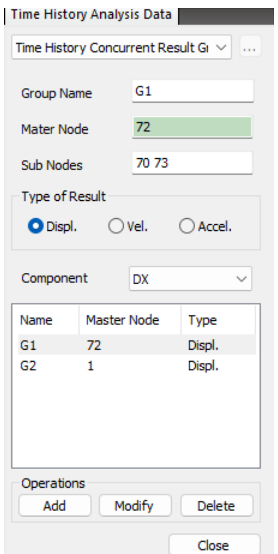
Concrete Material

11. Concurrent Disp./Vel./Accel. for Time History Analysis

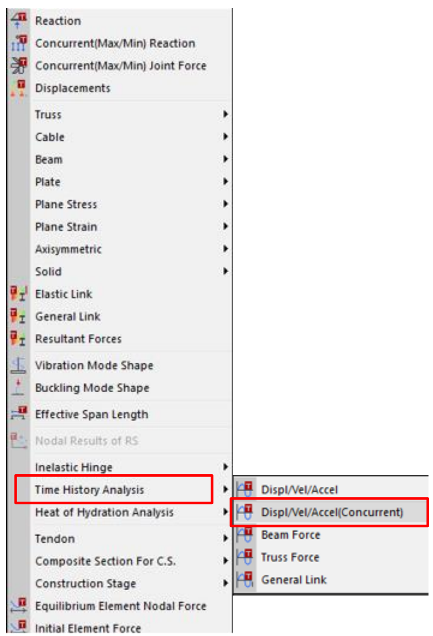
- Concurrent displacements of multiple nodes at the same time step are now available for the linear/nonlinear time history analysis.

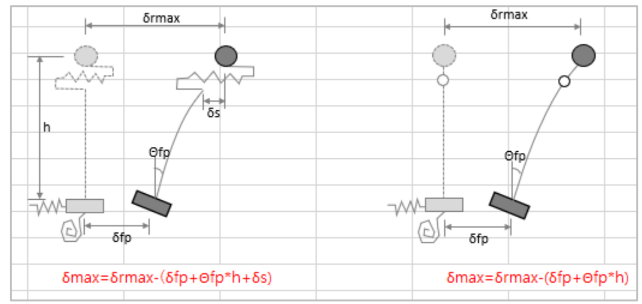
- ***Load> Load Type > Dynamic Loads > Time History Analysis Data > Define Concurrent Result Groups***
- ***Results> Result Tables > Time History Analysis > Displ./Vel./Accel. (Concurrent)***





Define Node Groups





Group	Load	Node	DX (mm)	DY (mm)	DZ (mm)	RX ([rad])	RY ([rad])	RZ ([rad])
G1	EX(max)	Mater Node(72)	97.009600	0.000547	-0.205912	-0.000000	0.001684	-0.000033
		Sub Node(70)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
		Sub Node(73)	24.129700	-0.000193	-0.077511	0.000001	0.001782	-0.000050
G1	EX(min)	Mater Node(72)	-77.893400	-0.003365	0.440000	0.000013	-0.001365	0.000019
		Sub Node(70)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
		Sub Node(73)	-23.230400	0.000922	0.170059	-0.000003	-0.001508	0.000049
G2	EX(max)	Mater Node(1)	131.728000	-0.012116	-0.319860	0.000002	0.000950	-0.000054
		Sub Node(70)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
		Sub Node(72)	96.609000	0.000783	-0.228289	-0.000001	0.001692	-0.000032
		Sub Node(73)	24.106900	-0.000252	-0.086362	0.000001	0.001773	-0.000049
G2	EX(min)	Mater Node(1)	-112.312000	-1.110280	0.590966	0.000043	-0.001041	0.000030
		Sub Node(70)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
		Sub Node(72)	-77.818700	-0.003272	0.432113	0.000013	-0.001381	0.000019
		Sub Node(73)	-22.805700	0.000893	0.167061	-0.000003	-0.001495	0.000046

Concurrent Displacements of Multiple Nodes

12. Transmission Zone Design of Pretensioned Beam to AASHTO LRFD

- Pretensioned beam design is performed considering stress development in tendons as a bi-linear relationship defined by the transmission length and development length .
- Flexural resistance at ULS within development length is now calculated considering the development length.

- ***PSC > Design Parameter> AASHTO LRFD***

2.Flexure design for a section

■ **Moment Direction** **Positive**

- Method of Calculation : Code
- The maximum strength limit load combination : cLCB3
- The maximum factored moment (M_u) : 6832.570 (kips·in)

1) Depth of neutral axis to compression face *(See 5.6.3.1)*

No.	Axial force in tendons(Bond) by Code				
	Tendon Name	k	f_{ps}	$T_{ps}=A_{ps}f_{ps}$	$A_{ps}f_{ps}(d_p-c)$
1	S_Span1-263	0.374	44.509	9.658	541.010
2	S_Span1-253	0.374	44.510	9.659	541.027
3	S_Span1-243	0.374	44.204		
4	S_Span1-233	0.374	43.899		

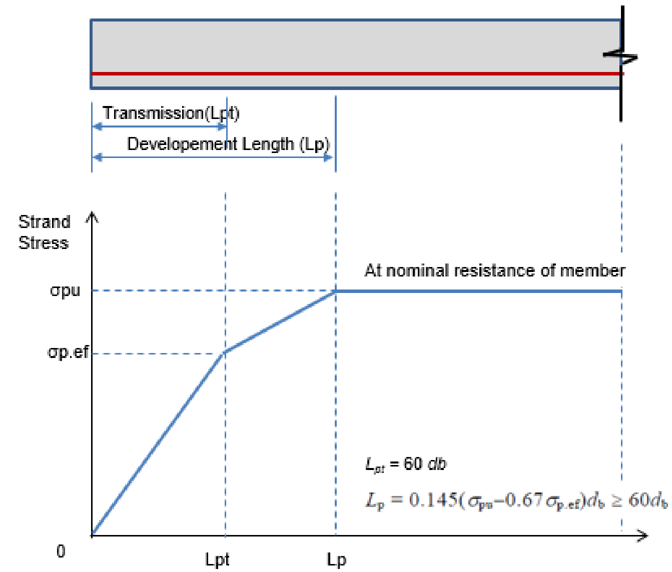
Tendon stress at ULS within development length

No.	Development Length				
	Tendon name	l_t (in)	l_d (in)	l_{px} (in)	f_{px} (ksi)
1	S_Span1-263	31.50	152.65	15.75	44.51
2	S_Span1-253	31.50	152.65	15.75	44.51
3	S_Span1-243	31.50	153.15		
4	S_Span1-233	31.50	153.65		

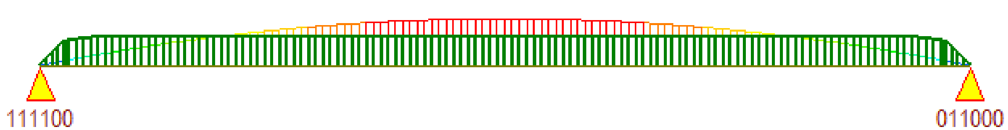
* The section is located within the transfer length

Transfer Length & Development Length

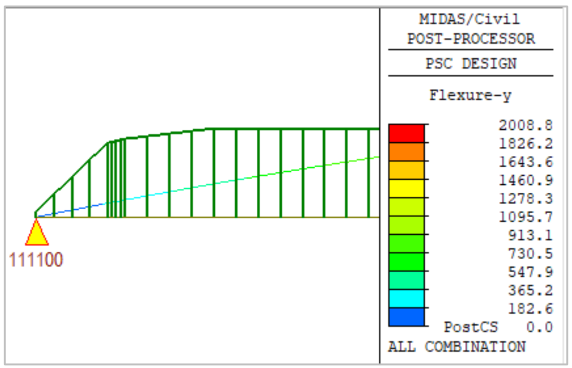
Development Length in Report



Stresses in the Tendon at ULS



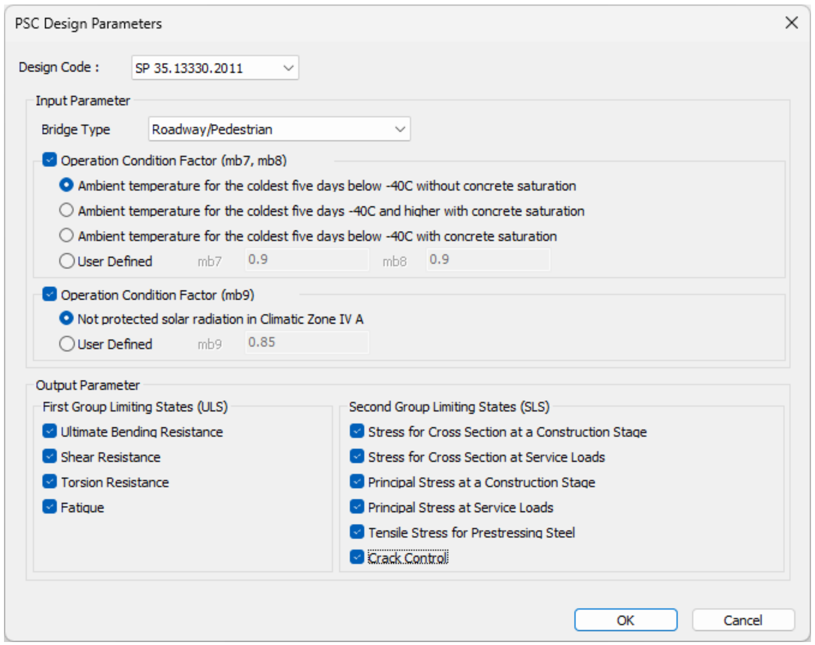
Flexural Resistance Diagram



13. SNiP/SP PSC Design: Crack Opening Coefficient by Tendon Material

- Crack opening coefficients for different tendon materials have been added for SNiP/SP PSC Design.

▪ ***PSC> Design Parameter > SP 35.13330.2011***



PSC Design Parameters

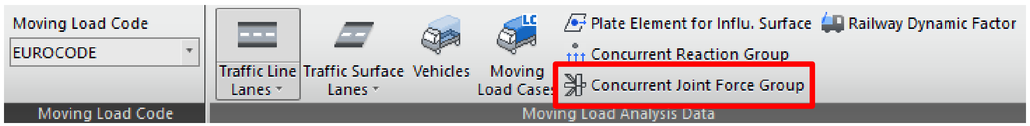
Material (GOST-SP)	Crack Opening Coefficient, Ψ
A600	1,5sqrt(Rr)
A800	1,5sqrt(Rr)
AT600	1,5sqrt(Rr)
AT800	1,5sqrt(Rr)
AT1000	1,5sqrt(Rr)
V1500	0,35(Rr)
V1400	0,35(Rr)
V1400 (Group S)	0,35(Rr)
V1400 (Group Zh)	0,35(Rr)
V1300	0,35(Rr)
V1200	0,35(Rr)
Vp1500	1,5sqrt(Rr)
Vp1400	1,5sqrt(Rr)
Vp1200	1,5sqrt(Rr)
K7-1500	1,5sqrt(Rr)
K7-1400	1,5sqrt(Rr)

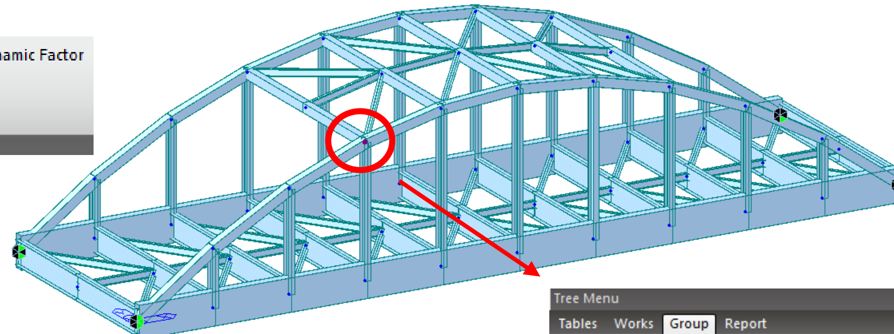
Crack Opening Coefficients

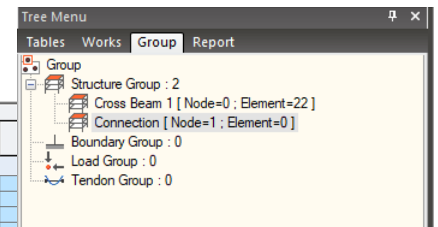
14. Concurrent Joint Forces

- Concurrent forces of the elements intersecting at a Joint are provided for the moving load analysis, settlement analysis, and load combinations.
- In this release, only Eurocode is supported.

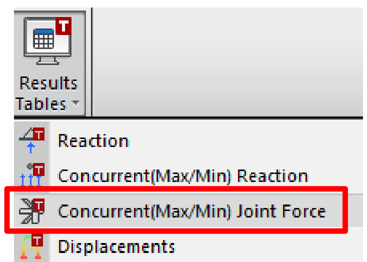
- ***Load> Moving Load Analysis Data > Concurrent Joint Force Group***
- ***Results> Result Tables > Concurrent (Max/Min) Joint Force***

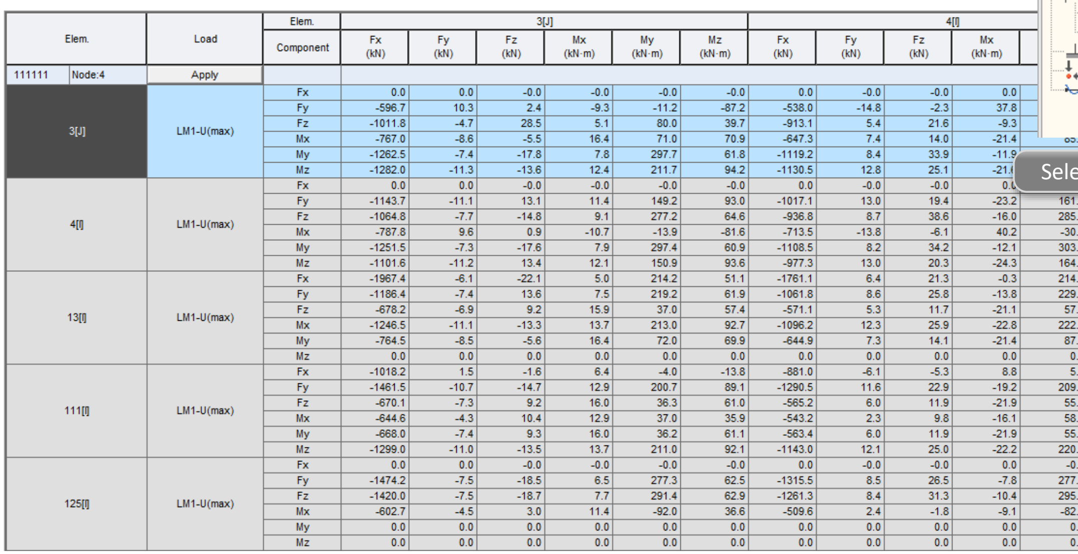






Select Nodes and Assign Structure Group





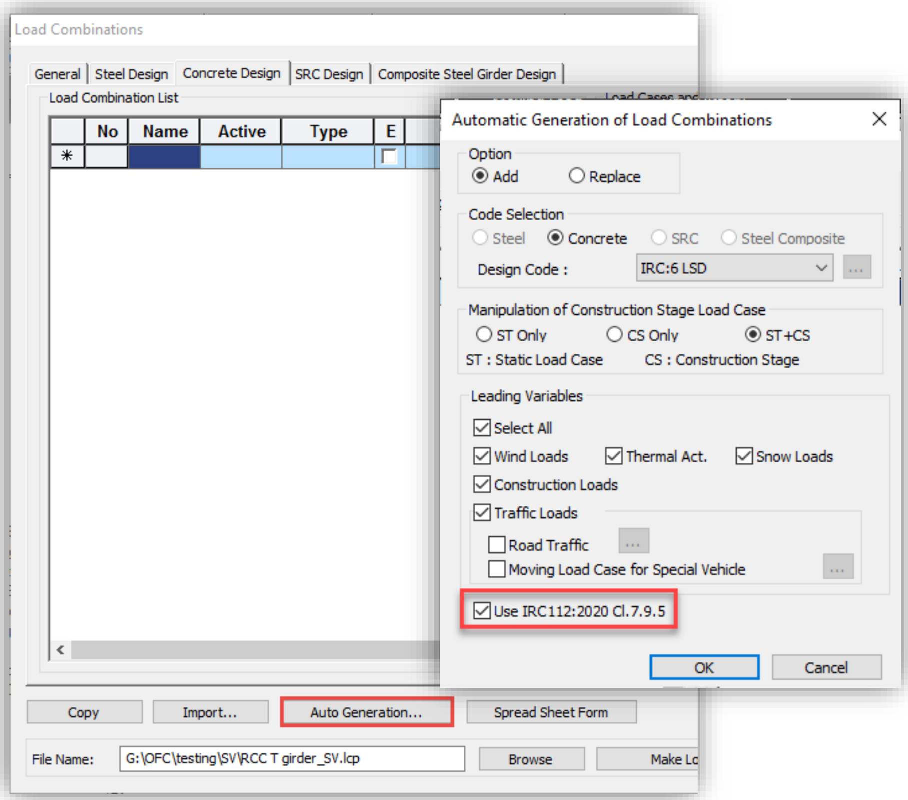
Elem.	Load	Elem. / Component	3[J] Fx (kN)	3[J] Fy (kN)	3[J] Fz (kN)	3[J] Mx (kN·m)	3[J] My (kN·m)	3[J] Mz (kN·m)	4[I] Fx (kN)	4[I] Fy (kN)	4[I] Fz (kN)	4[I] Mx (kN·m)	[illegible]
111111 Node:4	Apply												
3[J]	LM1-U(max)	Fx	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	0.0	[illegible]
		Fy	-596.7	10.3	2.4	-9.3	-11.2	-87.2	-538.0	-14.8	-2.3	37.8	[illegible]
		Fz	-1011.8	-4.7	28.5	5.1	80.0	39.7	-913.1	5.4	21.6	-9.3	[illegible]
		Mx	-767.0	-8.6	-5.5	16.4	71.0	70.9	-647.3	7.4	14.0	-21.4	[illegible]
		My	-1262.5	-7.4	-17.8	7.8	297.7	61.8	-1119.2	8.4	33.9	-11.9	[illegible]
		Mz	-1282.0	-11.3	-13.6	12.4	211.7	94.2	-1130.5	12.8	25.1	[illegible]	[illegible]
4[I]	LM1-U(max)	Fx	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	[illegible]	[illegible]
		Fy	-1143.7	-11.1	13.1	11.4	149.2	93.0	-1017.1	13.0	19.4	-23.2	161.3
		Fz	-1064.8	-7.7	-14.8	9.1	277.2	64.6	-936.8	8.7	38.6	-16.0	285.6
		Mx	-787.8	9.6	0.9	-10.7	-13.9	-81.6	-713.5	-13.8	-6.1	40.2	-30.2
		My	-1251.5	-7.3	-17.6	7.9	297.4	60.9	-1108.5	8.2	34.2	-12.1	303.1
		Mz	-1101.6	-11.2	13.4	12.1	150.9	93.6	-977.3	13.0	20.3	-24.3	164.0
13[I]	LM1-U(max)	Fx	-1967.4	-6.1	-22.1	5.0	214.2	51.1	-1761.1	6.4	21.3	-0.3	214.1
		Fy	-1186.4	-7.4	13.6	7.5	219.2	61.9	-1061.8	8.6	25.8	-13.8	229.5
		Fz	-678.2	-6.9	9.2	15.9	37.0	57.4	-571.1	5.3	11.7	-21.1	57.0
		Mx	-1246.5	-11.1	-13.3	13.7	213.0	92.7	-1096.2	12.3	25.9	-22.8	222.9
		My	-764.5	-8.5	-5.6	16.4	72.0	69.9	-644.9	7.3	14.1	-21.4	87.1
		Mz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111[I]	LM1-U(max)	Fx	-1018.2	1.5	-1.6	6.4	-4.0	-13.8	-881.0	-6.1	-5.3	8.8	5.1
		Fy	-1461.5	-10.7	-14.7	12.9	200.7	89.1	-1290.5	11.6	22.9	-19.2	209.5
		Fz	-670.1	-7.3	9.2	16.0	36.3	61.0	-565.2	6.0	11.9	-21.9	55.7
		Mx	-644.6	-4.3	10.4	12.9	37.0	35.9	-543.2	2.3	9.8	-16.1	58.3
		My	-668.0	-7.4	9.3	16.0	36.2	61.1	-563.4	6.0	11.9	-21.9	55.5
		Mz	-1299.0	-11.0	-13.5	13.7	211.0	92.1	-1143.0	12.1	25.0	-22.2	220.9
125[I]	LM1-U(max)	Fx	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	0.0	-0.0
		Fy	-1474.2	-7.5	-18.5	6.5	277.3	62.5	-1315.5	8.5	26.5	-7.8	277.9
		Fz	-1420.0	-7.5	-18.7	7.7	291.4	62.9	-1261.3	8.4	31.3	-10.4	295.9
		Mx	-602.7	-4.5	3.0	11.4	-92.0	36.6	-509.6	2.4	-1.8	-9.1	-82.1
		My	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Concurrent Forces of Members Connected at Joints

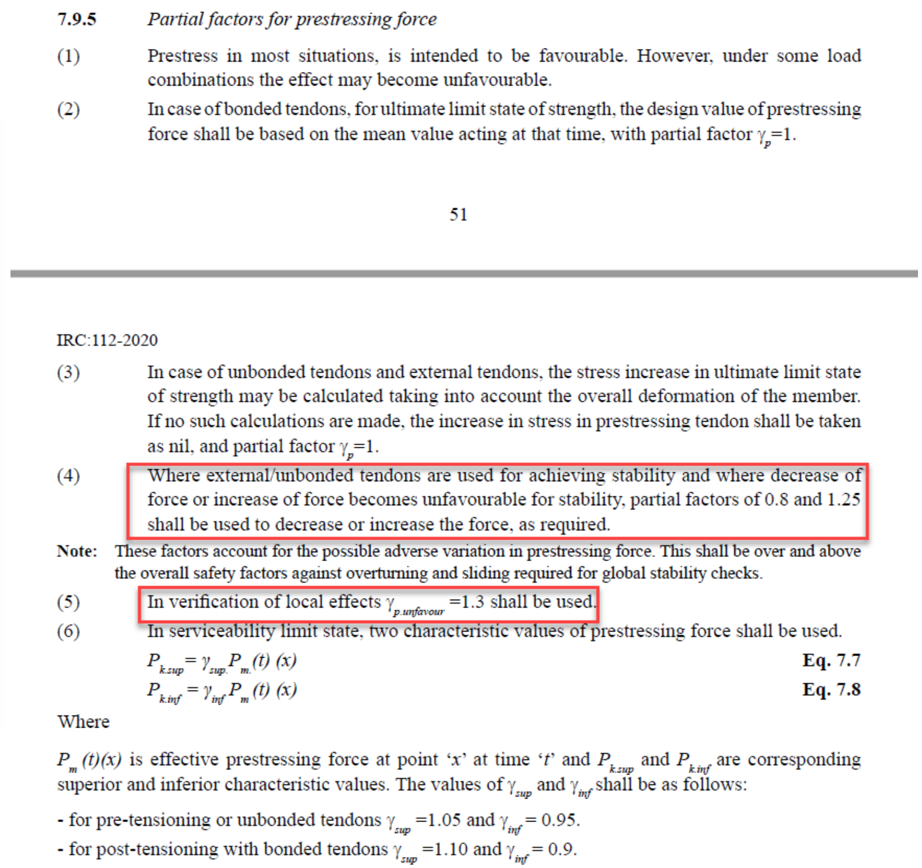
15. Improvement in Auto Load combinations as per IRC 6

- Improvement in Auto Load combinations of Temperature load factors (Temperature uniform and Temperature gradient loads).
- Updates in load factors for combinations considered for Special Vehicle as per IRC 6:2017 Amendments.

- ***Results > Load Combinations > Auto Generation***



Auto Generation of Load Combination



7.9.5 *Partial factors for prestressing force*

(1) Prestress in most situations, is intended to be favourable. However, under some load combinations the effect may become unfavourable.

(2) In case of bonded tendons, for ultimate limit state of strength, the design value of prestressing force shall be based on the mean value acting at that time, with partial factor γ_p=1.

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IRC:112-2020

(3) In case of unbonded tendons and external tendons, the stress increase in ultimate limit state of strength may be calculated taking into account the overall deformation of the member. If no such calculations are made, the increase in stress in prestressing tendon shall be taken as nil, and partial factor γ_p=1.

(4) Where external/unbonded tendons are used for achieving stability and where decrease of force or increase of force becomes unfavourable for stability, partial factors of 0.8 and 1.25 shall be used to decrease or increase the force, as required.

Note: These factors account for the possible adverse variation in prestressing force. This shall be over and above the overall safety factors against overturning and sliding required for global stability checks.

(5) In verification of local effects $\gamma_{p,unfavour}$ =1.3 shall be used.

(6) In serviceability limit state, two characteristic values of prestressing force shall be used.

$$P_{k,sup} = \gamma_{sup} P_{m} (t)\ (x) \qquad \textbf{Eq. 7.7}$$

$$P_{k,inf} = \gamma_{inf} P_{m} (t)\ (x) \qquad \textbf{Eq. 7.8}$$

Where

P_m (t)(x) is effective prestressing force at point 'x' at time 't' and $P_{k,sup}$ and $P_{k,inf}$ are corresponding superior and inferior characteristic values. The values of γ_{sup} and γ_{inf} shall be as follows:

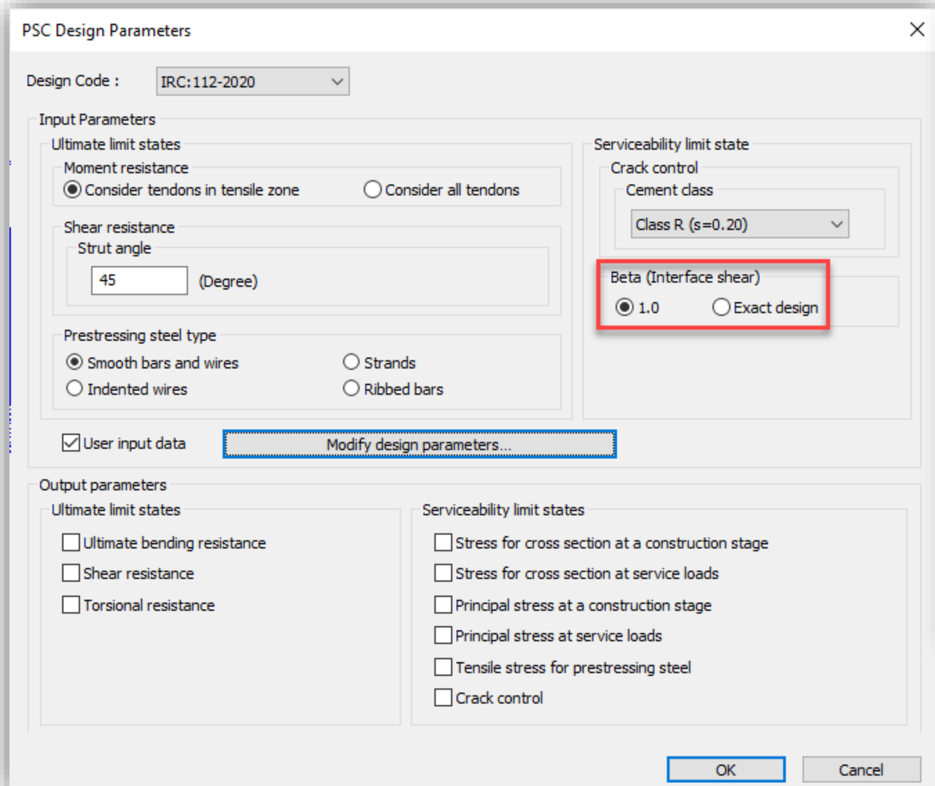
- for pre-tensioning or unbonded tendons γ_{sup} =1.05 and γ_{inf} = 0.95.
- for post-tensioning with bonded tendons γ_{sup} =1.10 and γ_{inf} = 0.9.

Code provision

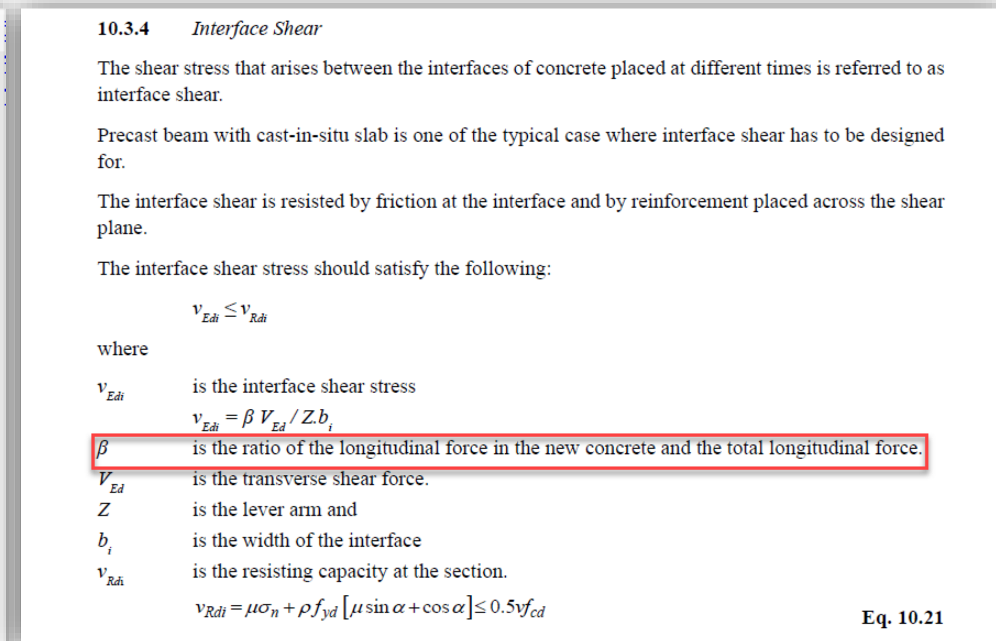
16. Improvement in PSC design parameters as per IRC 112:2020

- Addition of beta value for interface shear design for PSC Composite Girder design

■ ***PSC > Parameters***



Auto Generation of Load Combination



10.3.4 *Interface Shear*

The shear stress that arises between the interfaces of concrete placed at different times is referred to as interface shear.

Precast beam with cast-in-situ slab is one of the typical case where interface shear has to be designed for.

The interface shear is resisted by friction at the interface and by reinforcement placed across the shear plane.

The interface shear stress should satisfy the following:

$$v_{Edi} \le v_{Rdi}$$

where

v_{Edi} is the interface shear stress

$v_{Edi} = \beta\, V_{Ed} / Z.b_i$

β is the ratio of the longitudinal force in the new concrete and the total longitudinal force.

V_{Ed} is the transverse shear force.

Z is the lever arm and

b_i is the width of the interface

v_{Rdi} is the resisting capacity at the section.

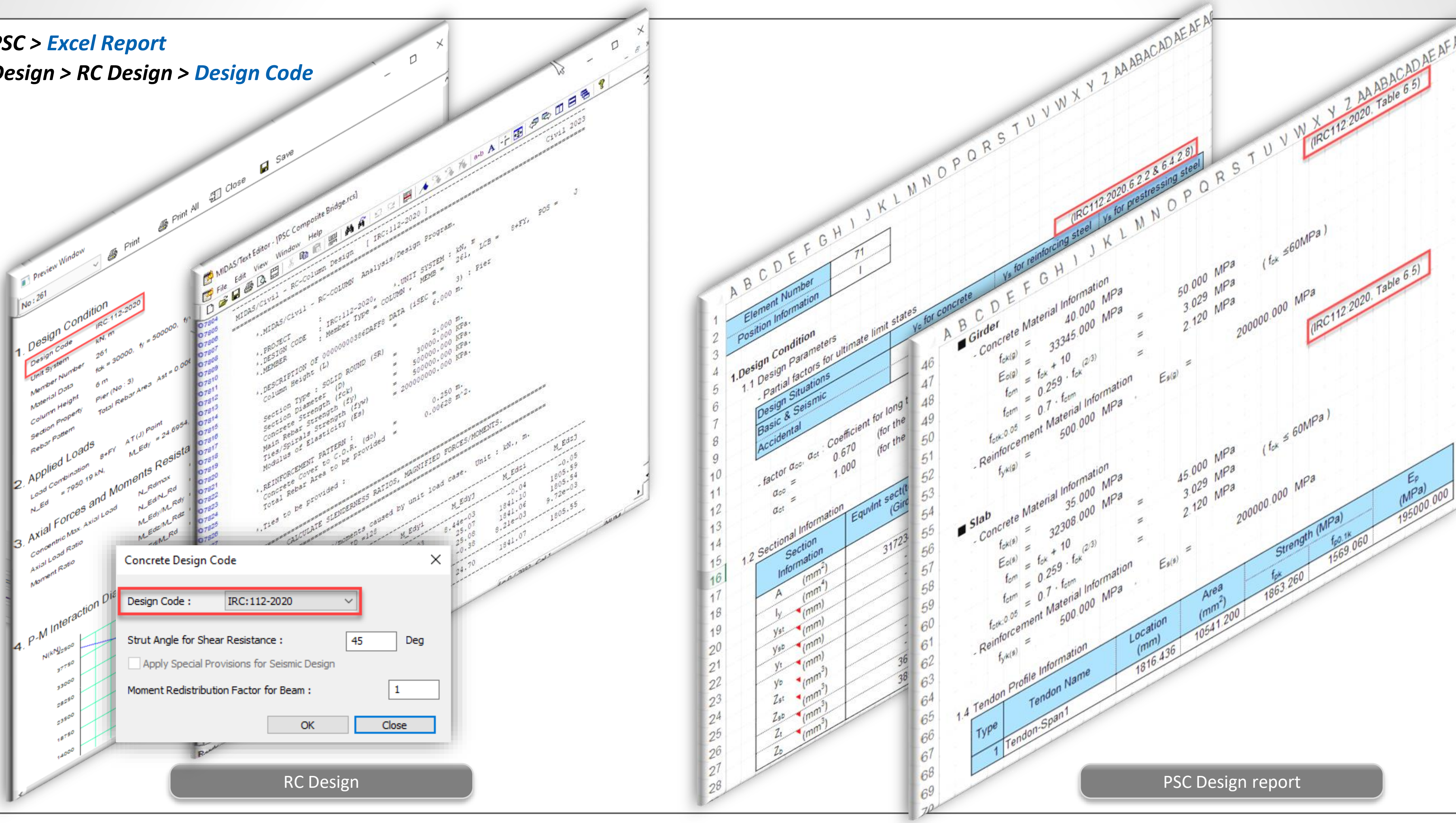
$$v_{Rdi} = \mu\sigma_n + \rho f_{yd}\left[\mu \sin\alpha + \cos\alpha\right] \le 0.5 v f_{cd} \quad \textbf{Eq. 10.21}$$

Code provision

17. Improvement in PSC & RC design as per IRC 112:2020

- RC design reports are now generated with reference to IRC 112:2020.
- Similarly, PSC reports are now generated with reference to the latest standard IRC 112:2020

- ***PSC >*** ***Excel Report***
- ***Design > RC Design >*** ***Design Code***



18. Other Enhancements

- Update Interface with BIM software
  - Revit 2023 Interface
  - and Tekla 2022 Interface

- Design based on concurrent member forces due to moving load analysis, settlement analysis and envelope-type load combination.
  - EC2 Concrete Design
  - EC3 Steel Design

- Option for Hambly equation or mesh to calculate the torsional constant of the composite section
  - Check on: Calculate the torsional constant using Hambly equation for beam-and-slab decks. Same value as previous version.
  - Check off: Calculate the torsional constant from the mesh of the cross-section.

Properties>Section>Composite