Release Note

發佈日期: May 31, 2023

產品版本: Civil 2023 (v1.1)

DESIGN OF CIVIL STRUCTURES

Integrated Solution System for Bridge and Civil Engineering

Civil 2023 (v1.1) 的優化項目

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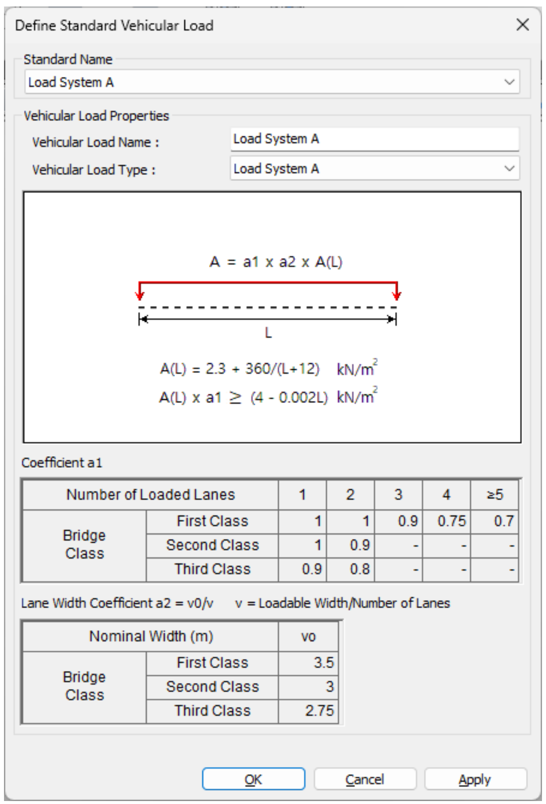
12. AASHTO LRFD預力梁的傳遞區設定
13. SNiP/SP PSC Design: 鋼腱材料裂縫開口係數
14. 伴隨力 (Concurrent Force)
15. 其他

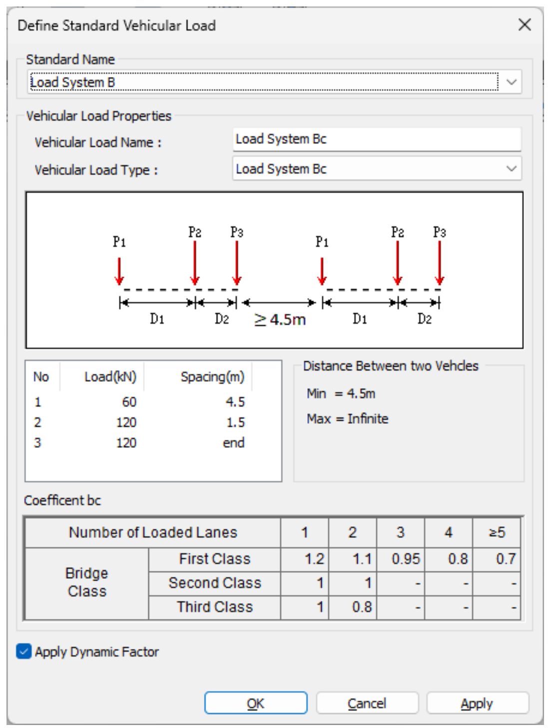
1.法國舊版規範FASCICULE N° 61 TITRE II移動載重分析

- 車輛資料庫新增法國舊版規範。
- 規範名稱：Fascicule N° 61, Conception, Calcul et Epreuves des Ouvrages d'art, Titre II - Programmes de Charges et Epreuves des Ponts-Routes

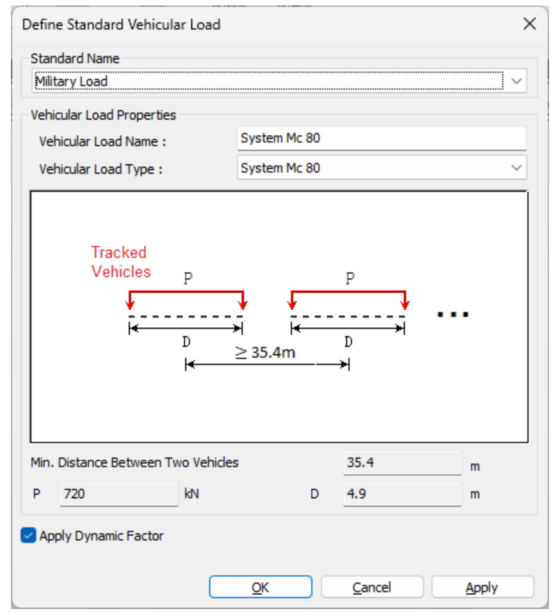
▪ ***Load> Moving Load > Moving Load Code > France***



Load System A



Load System Bc



Military Load Mc 80

1.法國舊版規範FASCICULE N° 61 TITRE II移動載重分析

- 在車道設定可定義道路寬，而非在單一車道內。

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

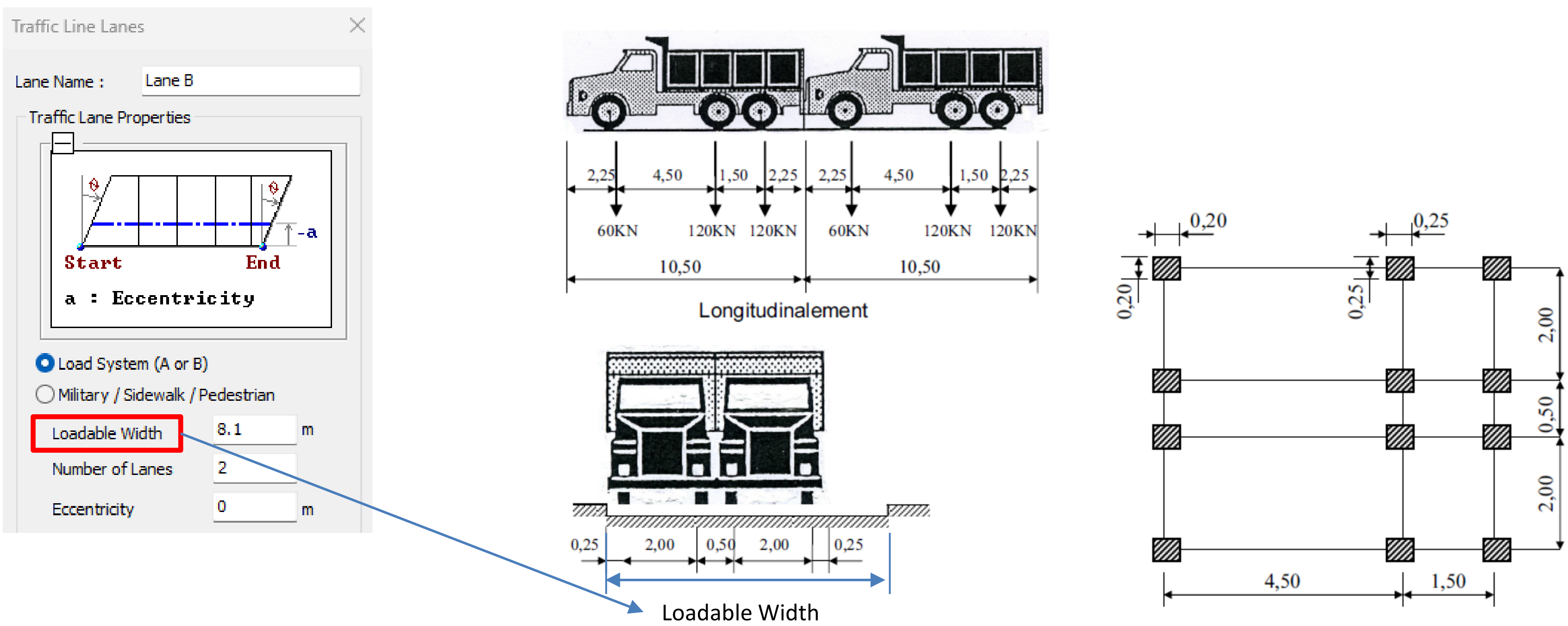
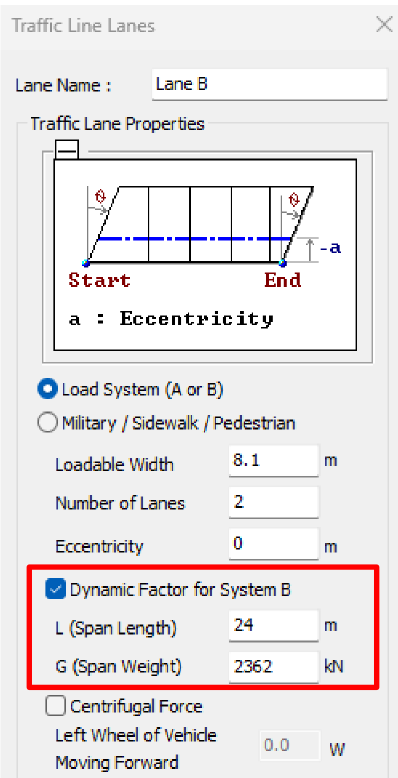


Figure 4.1 : Système B_c

1.法國舊版規範FASCICULE N° 61 TITRE II移動載重分析

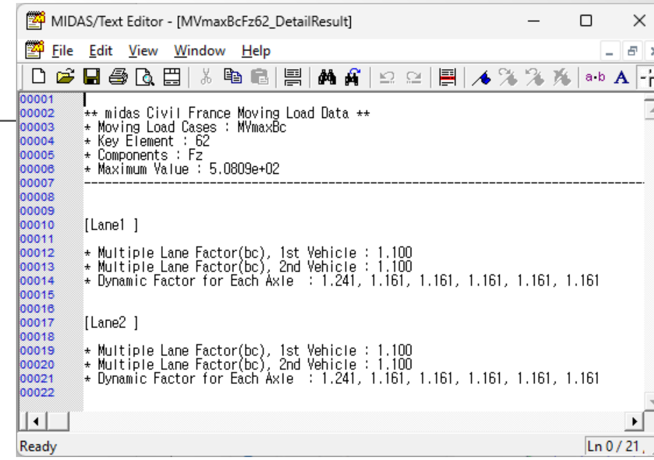
- 可對每跨輸入跨度長與跨度重，以計算動力因數 δ.
- 載重系統中每跨的最大重量 Bc 是由程式所決定。

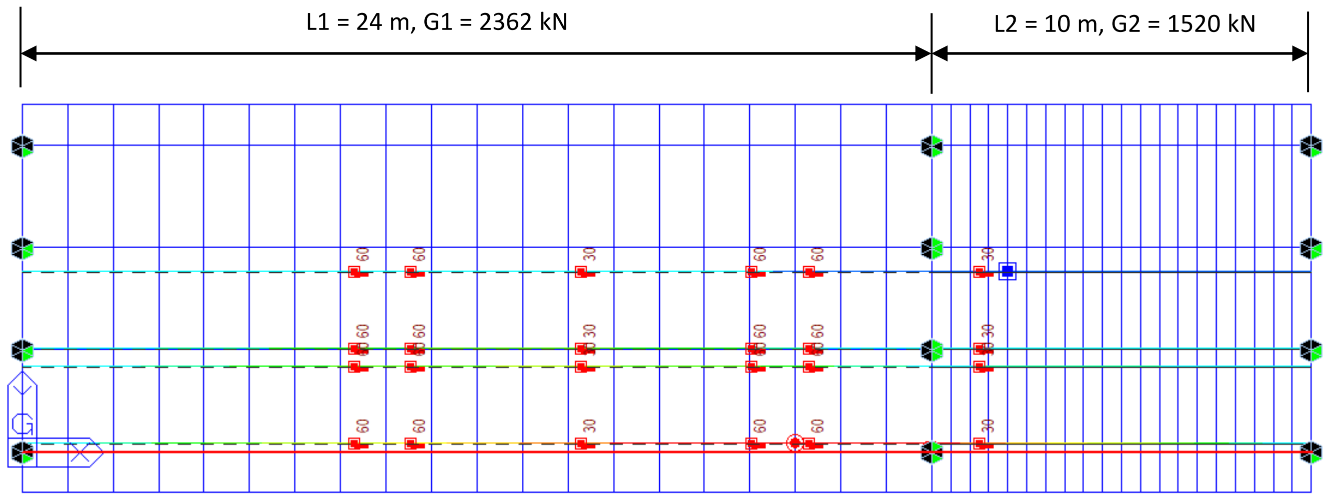
- ***Load> Moving Load > Moving Load Code > France***



- Dynamic Factor

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





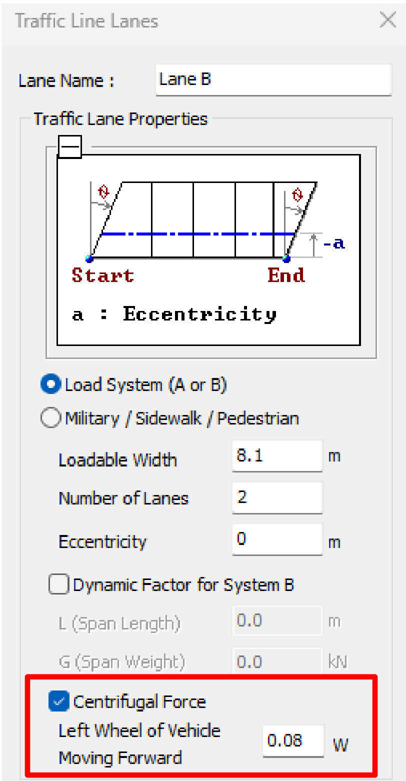
No	Elem	Eccen. (m)	L (m)	G (kN)	Span Start
1	82	-4.05	24	2362	☑
2	83	-4.05	24	2362	[illegible]

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

1.法國舊版規範FASCICULE N° 61 TITRE II移動載重分析

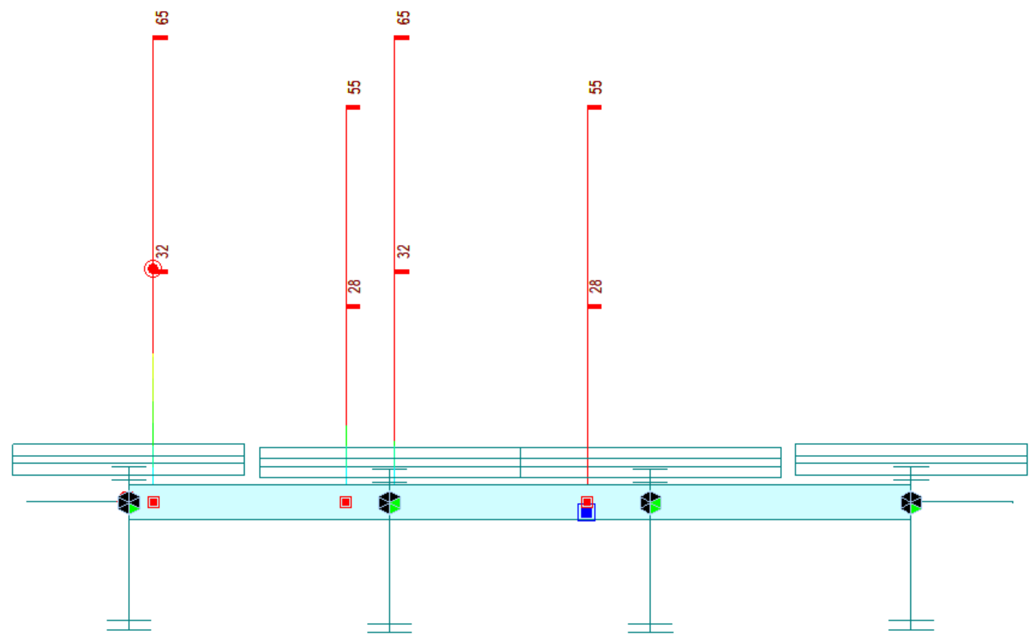
- 離心力的影響可以加至垂直力進行考慮。

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



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

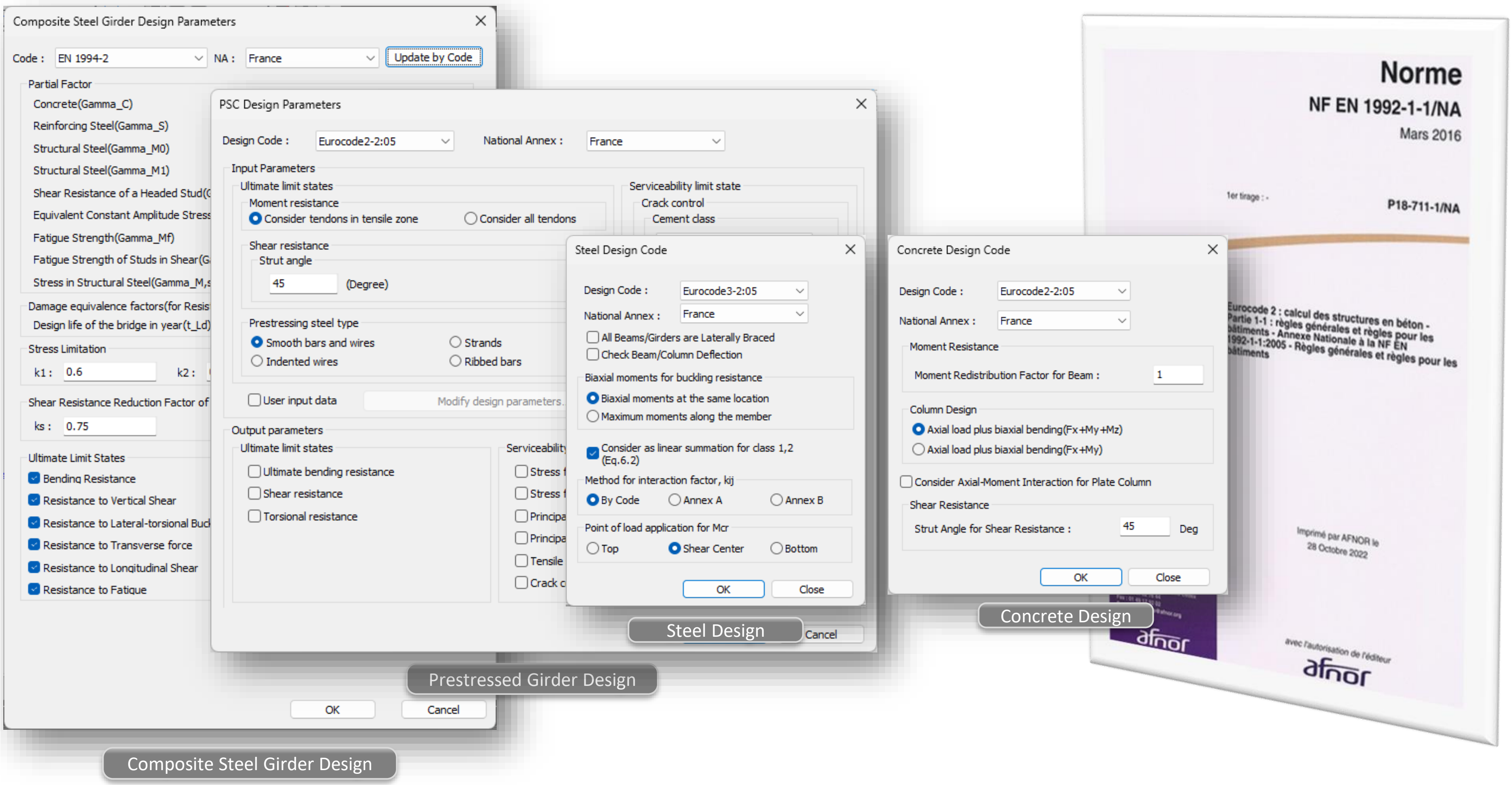
$\frac{R+150}{6R+350}$ if R < 400m $\quad$ $\frac{80}{R}$ if R ≥ 400m



Vertical Loads with Centrifugal Forces

2. French National Annex 新增至 Eurocode 2, 3, 4

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



3.歐洲規範設計報告法文版

- 歐洲規範設計報告可以使用法文輸出。

- ***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} = α_{cc} f_{ck} /γ_c = 20.000MPa
f_{yd} = f_{yk} /γ_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

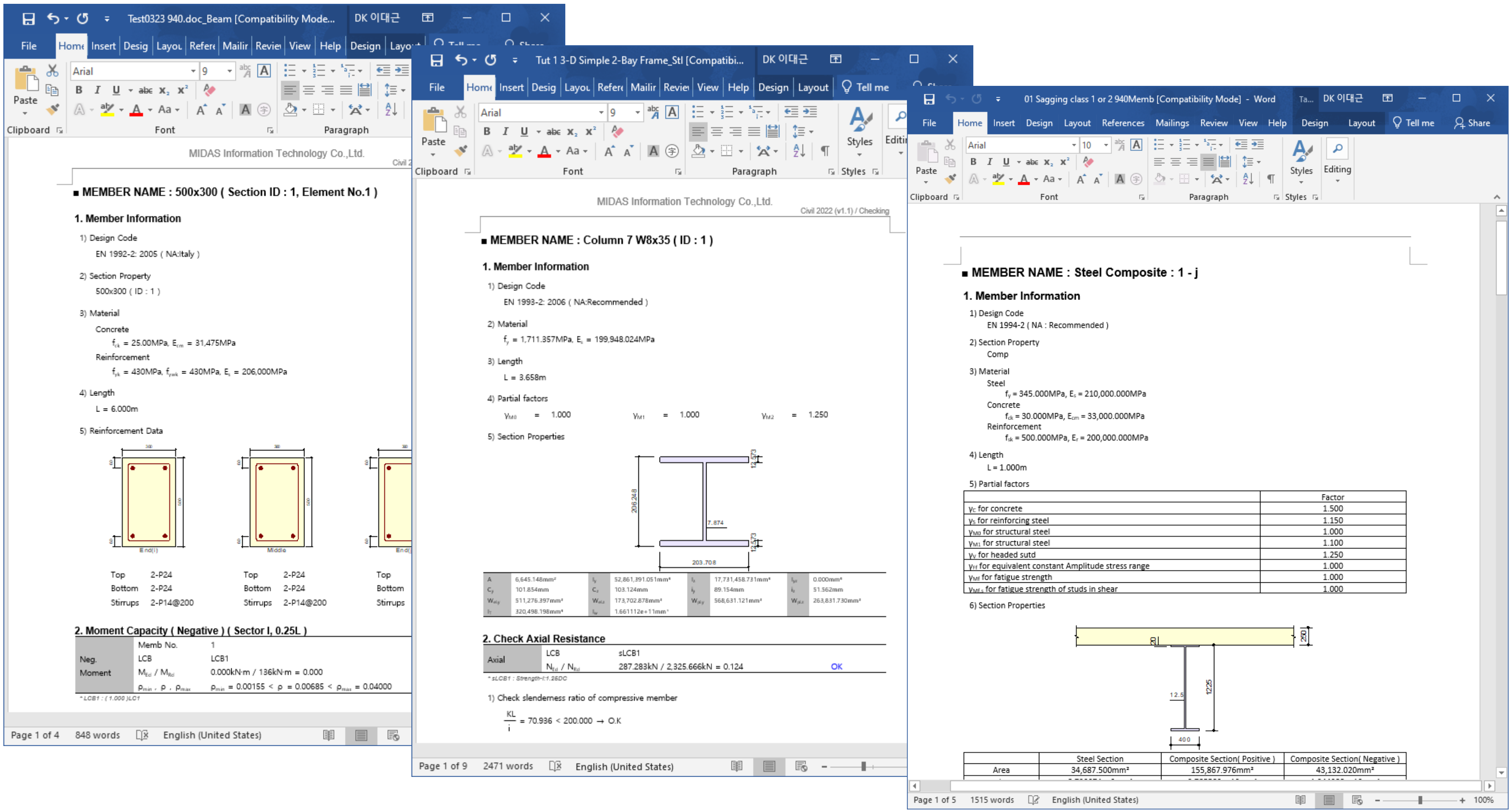
1.4 Předpjaté kabely

Typ	Název kabelu	Pozice (mm)	Plocha (mm²)	Pevnost (MPa)		E_p (MPa)
				f_{pk}	$f_{p0.1k}$	
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. Word版本歐洲規範設計報告

- 歐洲規範可以以Word形式產生，比Excel形式更為快速、且修正方便。
- PSC設計報告在本版本中仍是Excel形式。

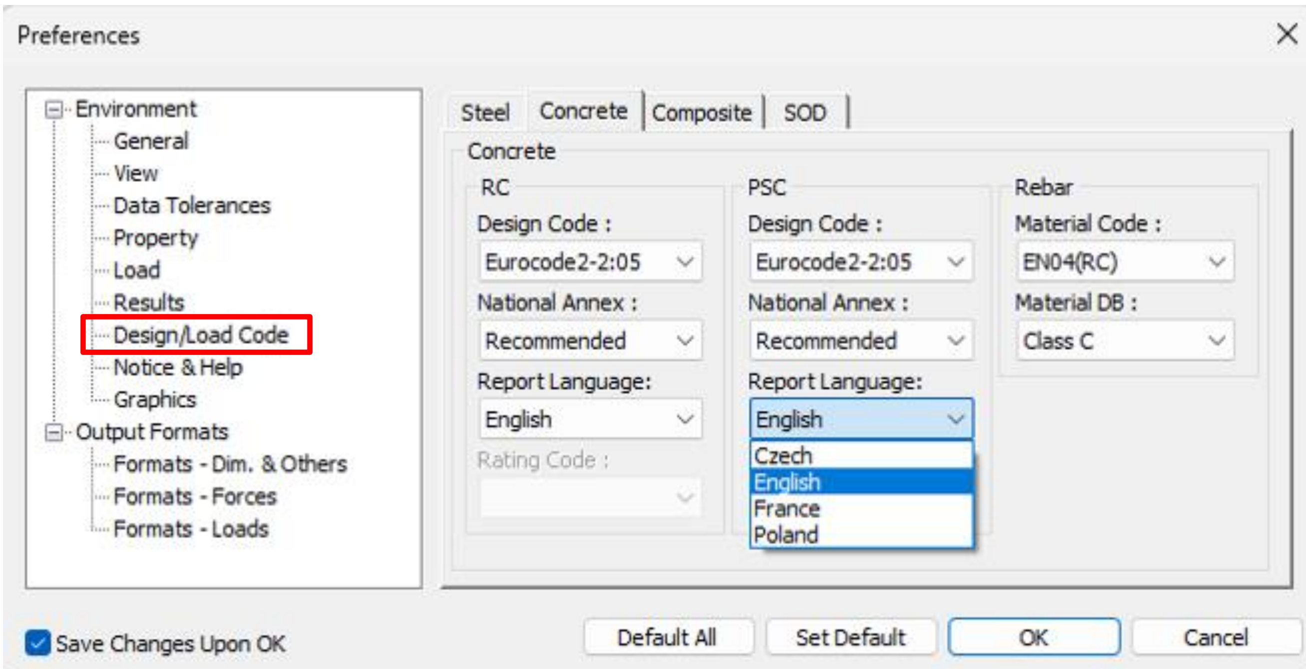
- ***Design>*** ***RC Design, Steel Design, Composite Design***



5. Preference 設定的設計報告語言

- 歐洲規範與 AASHTO LRFD 的設計報告書可由 Preference 選擇語言。
- AASHTO LRFD 設計報告書的單位系統可由 Preference 選擇。

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

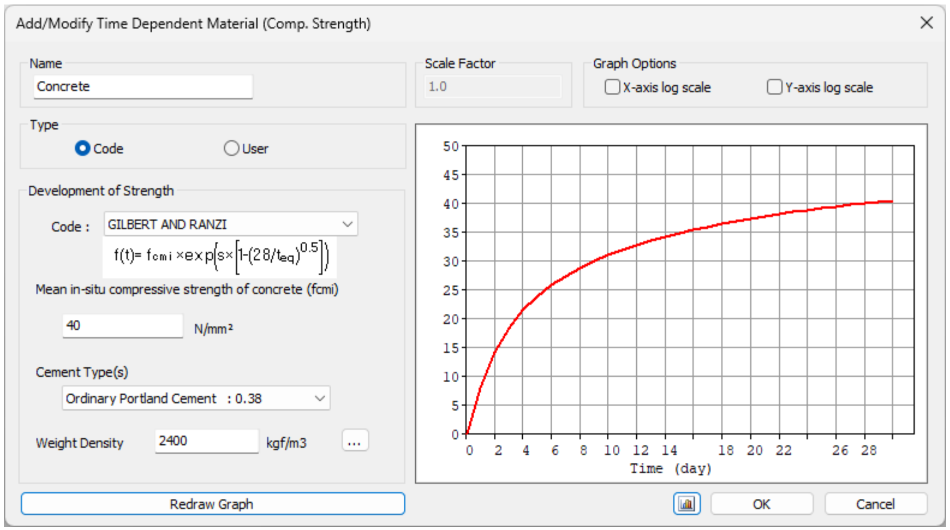


Report Language of Preference

6.時間依存性函數：彈性模數(Gilbert and Ranzi)

- 新增由 Gilbert and Ranzi 所建議之時間依存性彈性模數
- 依據： Raymond Ian Gilbert 與 Gianluca Ranzi 於 2010 年混凝土結構的時間依存行為

▪ ***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:

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

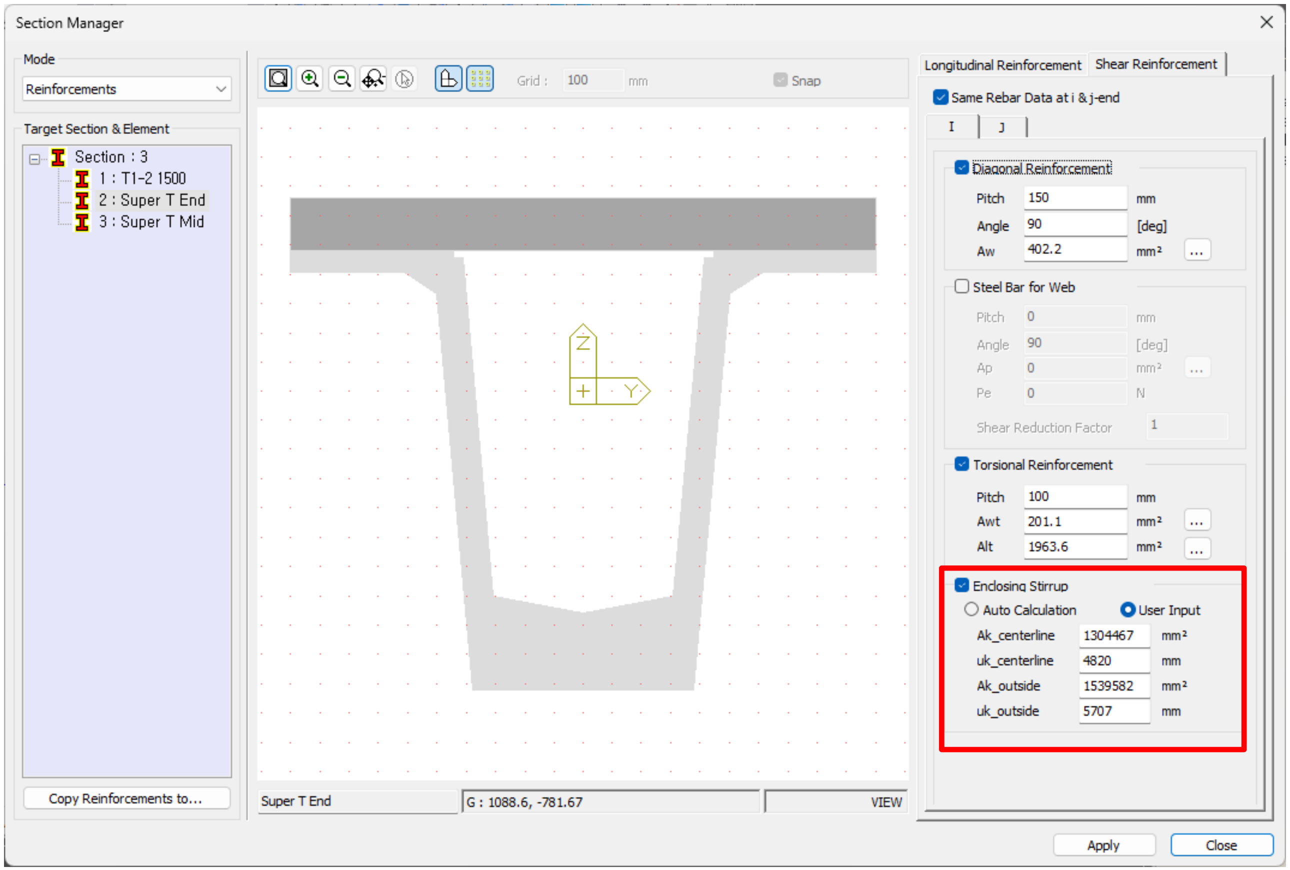
- Modulus of elasticity with time

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

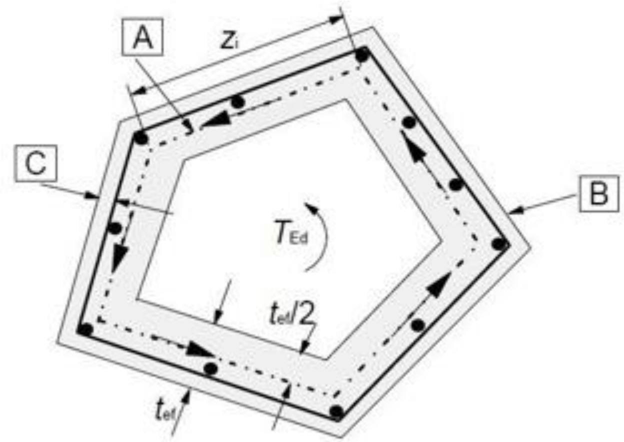
7. PSC Design: 扭矩參數 Ak 和 uk 可使用者輸入

- 扭矩設計中的面積與周長在PSC-Value, PSC-Composite, General-Composite三種斷面類型中可以由使用者輸入。

▪ ***Properties> Section > Section Manager > Reinforcements***



Shear Reinforcement of Section Manager



A - centre-line

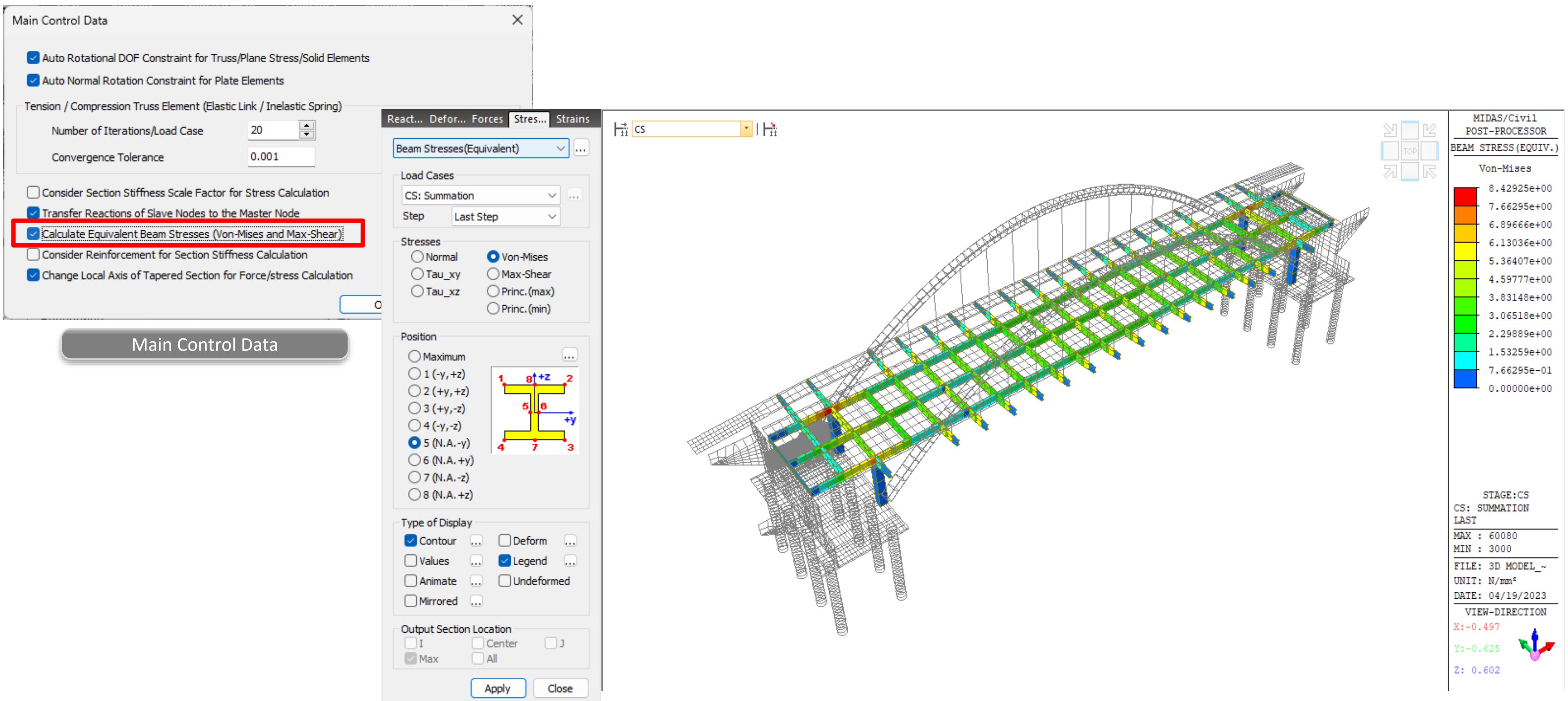
B - outer edge of effective cross-section, circumference *u*,

C - cover

8.施工階段分析的等效梁應力結果

- 在施工階段分析中，鋼梁斷面的等效梁應力包含 Von-Mises 應力可以使用。

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



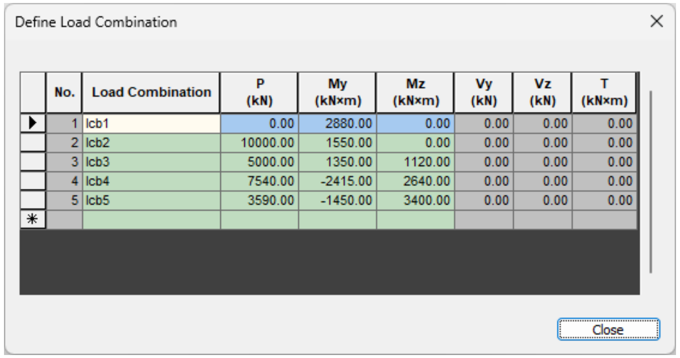
Main Control Data

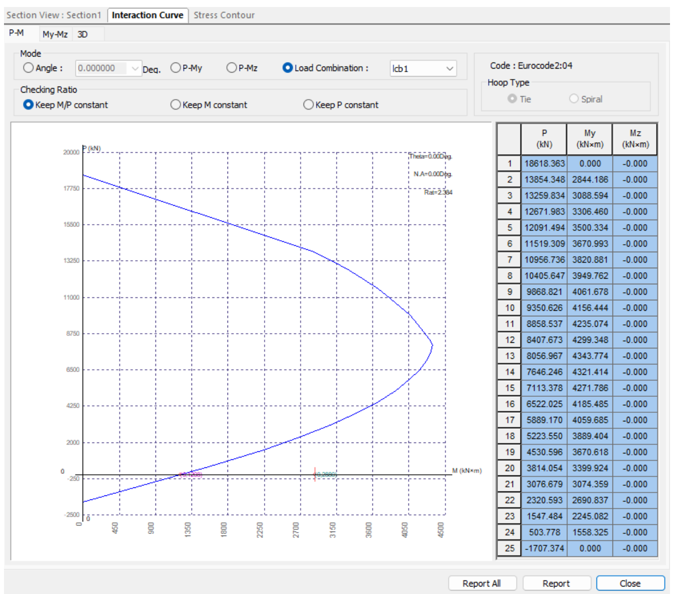
Von-Mises Stresses at Centroid of Steel Beam

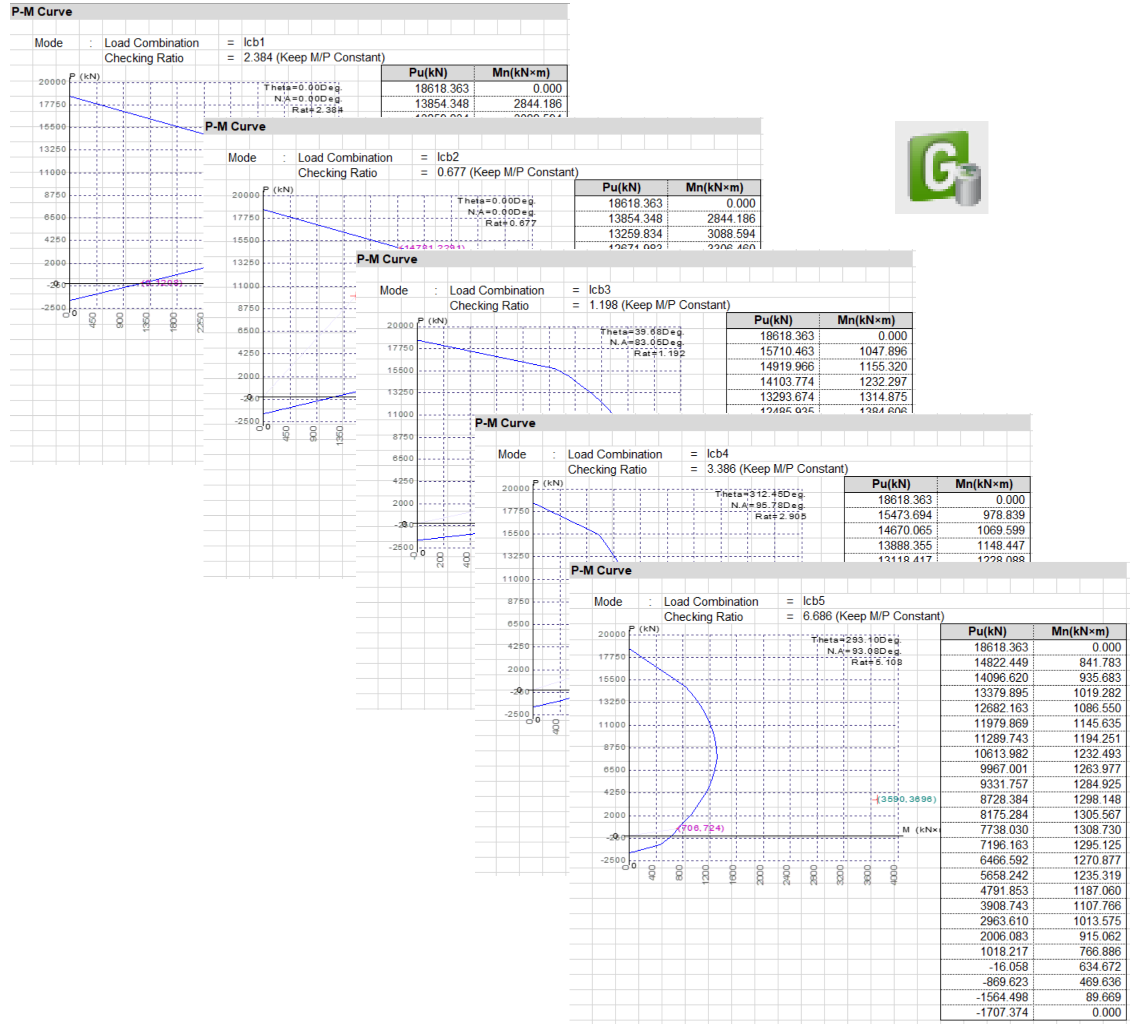
9. GSD Excel 報告: 輸出全載重組合之結果

- 全載重組合的設計結果現已整合在GSD report。

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



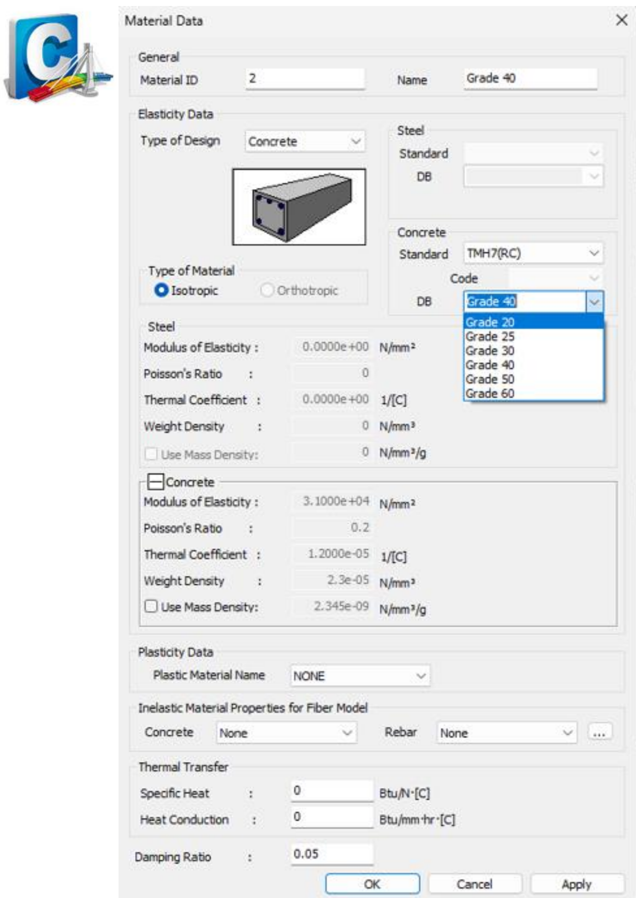




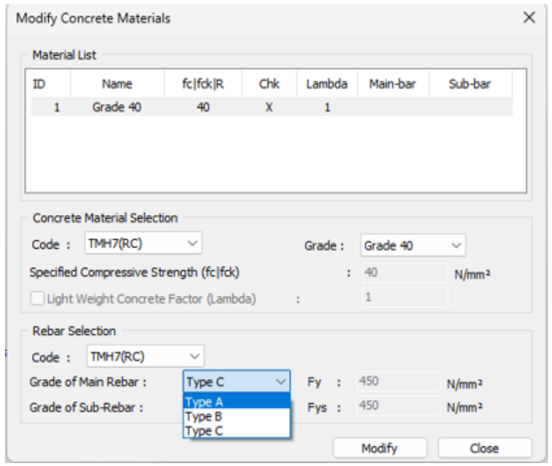
10.南非TMH7混凝土與鋼筋材料庫

- 混凝土與鋼筋材料資料庫已新增南非TMH7。

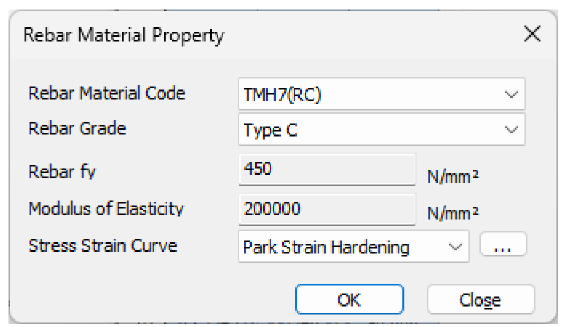
- ***Properties> Material > Concrete > TMH7***



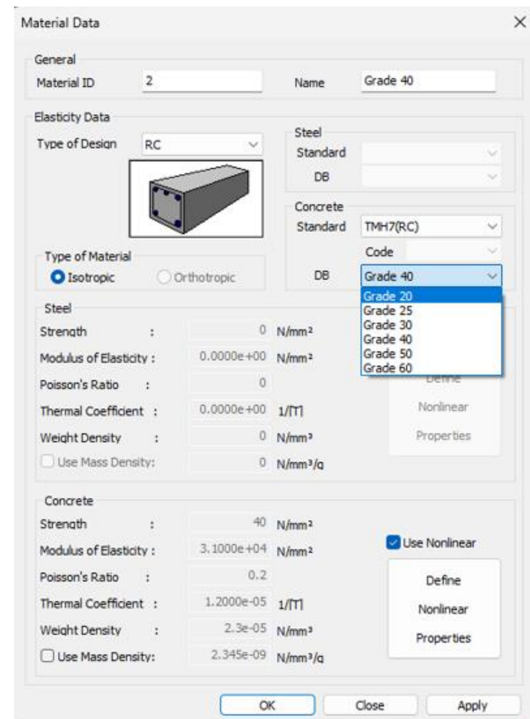
Concrete Material



Reinforcement Material



Reinforcement Material

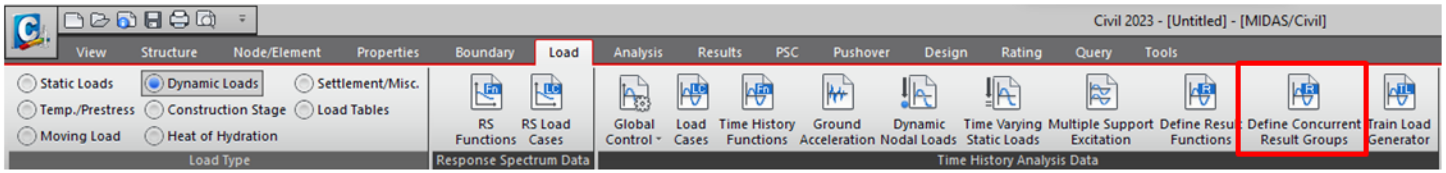


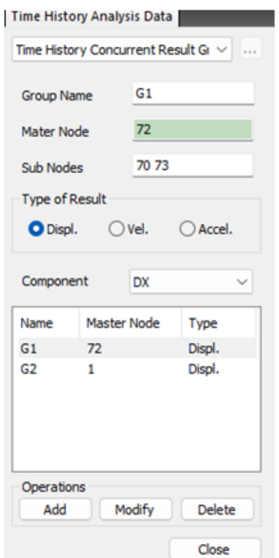
Concrete Material

11.歷時分析同時查看變位、速度、加速度

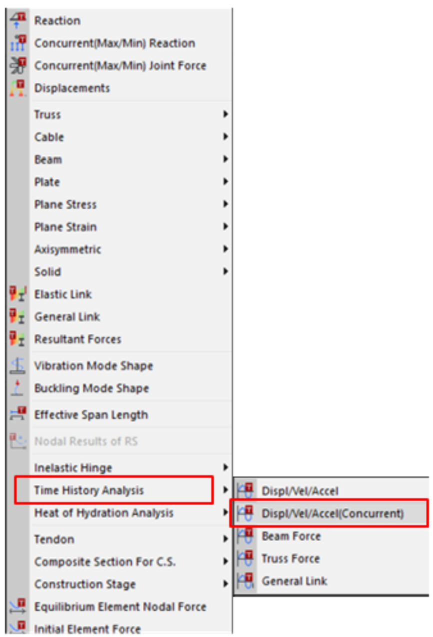
- 多個節點在同一時間增量中的同時變形在線性、非線性歷時分析中已可以查看。

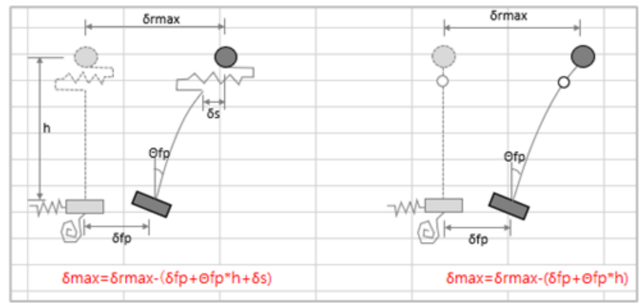
- ***Load> Load Type > Dynamic Loads > Time History Analysis Data > Define Concurrent Result Groups***
- ***Results> Result Tables > Time History Analysis > Displ./Vel./Accel. (Concurrent)***





Define Node Groups





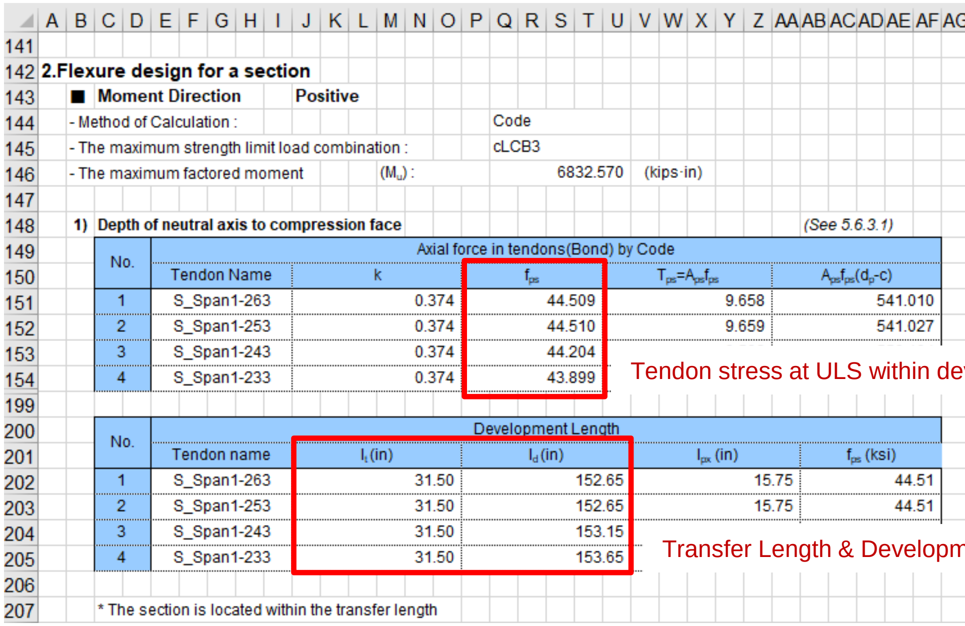
Group	Load	Node	DX (mm)	DY (mm)	DZ (mm)	RX ([rad])	RY ([rad])	RZ ([rad])
G1	EX(max)	Mater Node(72)	97.009600	0.000547	-0.205912	-0.000000	0.001684	-0.000033
		Sub Node(70)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
		Sub Node(73)	24.129700	-0.000193	-0.077511	0.000001	0.001782	-0.000050
G1	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. AASHTO LRFD預力梁的傳遞區設定

- 預力梁設計可以雙線性考慮鋼腱中應力發展，其關係由傳遞區長度與發展長度有關。
- 在極限狀態下抗彎強度現將發展長度納入考慮。

▪ ***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}	$T_{ps}=A_{ps}f_{ps}$	$A_{ps}f_{ps}(d_p\text{-}c)$
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		

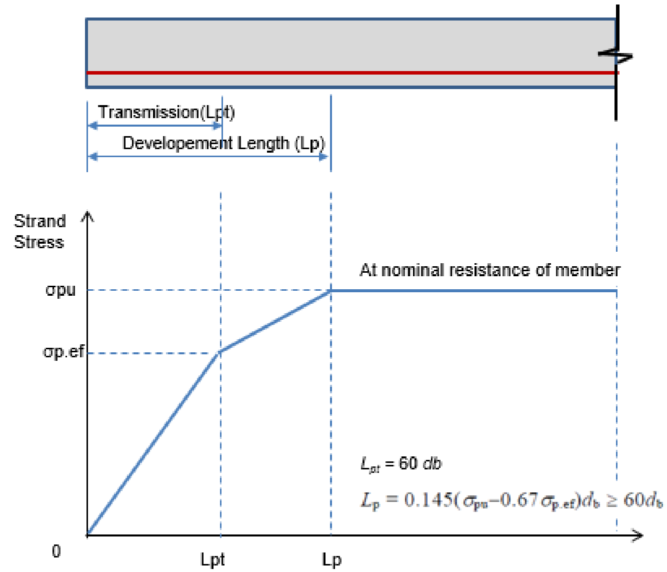
Tendon stress at ULS within development length

No.	Development Length				
	Tendon name	l_t (in)	l_d (in)	l_{px} (in)	f_{ps} (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		

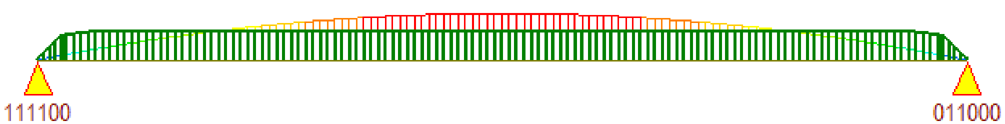
Transfer Length & Development Length

* The section is located within the transfer length

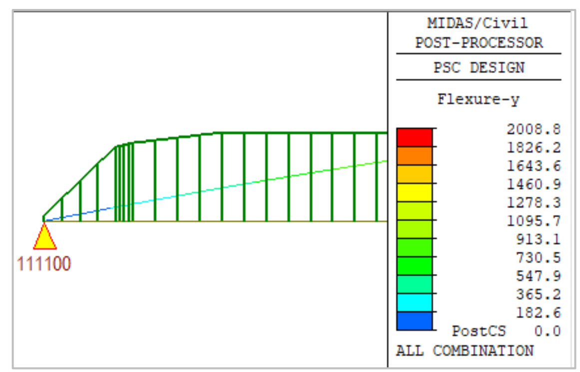
Development Length in Report



Stresses in the Tendon at ULS



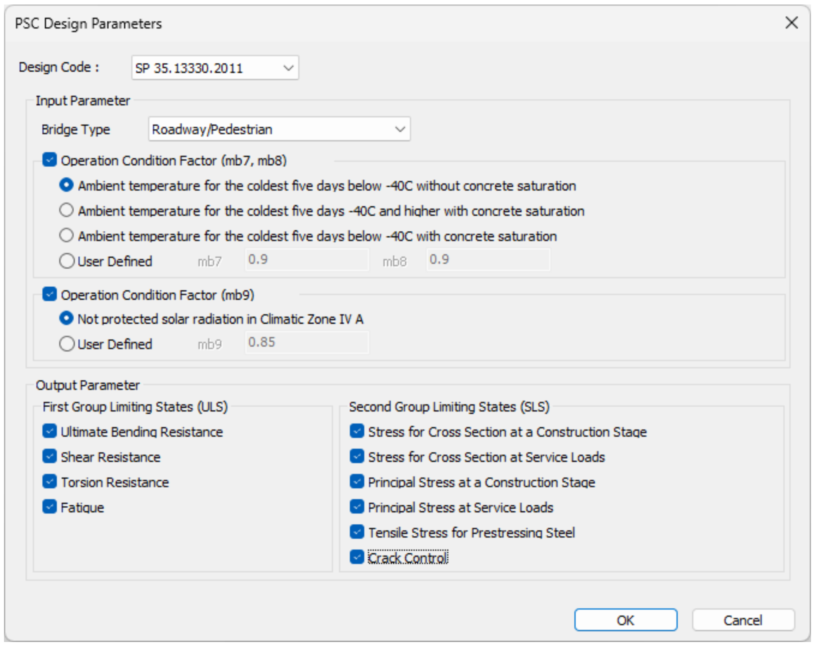
Flexural Resistance Diagram



13. SNiP/SP PSC Design: 鋼腱材料裂縫開口係數

- 在 SNiP/SP PSC Design，已新增不同鋼腱材料相對應的裂縫開裂係數。

- ***PSC> Design Parameter > CSP 35.13330.2011***



PSC Design Parameters

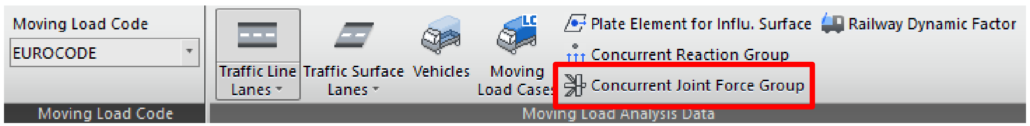
Material (GOST-SP)	Crack Opening Coefficient, Ψ
A600	1,5sqrt(Rr)
A800	1,5sqrt(Rr)
AT600	1,5sqrt(Rr)
AT800	1,5sqrt(Rr)
AT1000	1,5sqrt(Rr)
V1500	0,35(Rr)
V1400	0,35(Rr)
V1400 (Group S)	0,35(Rr)
V1400 (Group Zh)	0,35(Rr)
V1300	0,35(Rr)
V1200	0,35(Rr)
Vp1500	1,5sqrt(Rr)
Vp1400	1,5sqrt(Rr)
Vp1200	1,5sqrt(Rr)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

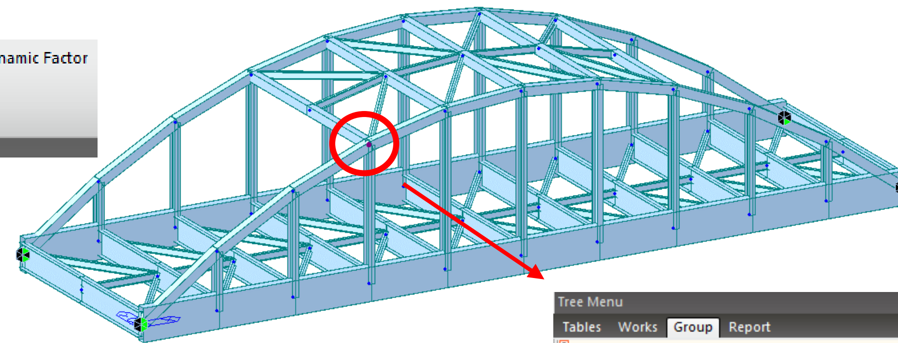
Crack Opening Coefficients

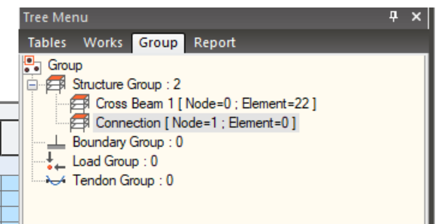
14.伴隨力 (Concurrent Force)

- 在移動載重分析、沉陷分析、載重組合中，考慮在同一節點的伴隨力。
- 在此版本，只有歐洲規範有支援。

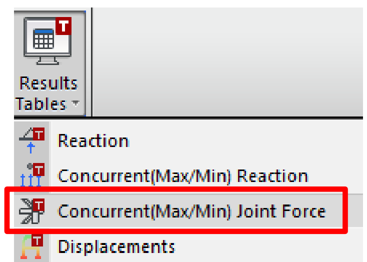
- ***Load> Moving Load Analysis Data > Concurrent Joint Force Group***
- ***Results> Result Tables > Concurrent (Max/Min) Joint Force***







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)	
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	
		Fy	-596.7	10.3	2.4	-9.3	-11.2	-87.2	-538.0	-14.8	-2.3	37.8	
		Fz	-1011.8	-4.7	28.5	5.1	80.0	39.7	-913.1	5.4	21.6	-9.3	
		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	
		Mz	-1282.0	-11.3	-13.6	12.4	211.7	94.2	-1130.5	12.8	25.1	-21.[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	0.0	
		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. 其他

- 更新與BIM軟體的銜接介面
  - Revit 2023
  - Tekla 2022

- 基於移動載重分析、沉陷分析、包絡型載重組合的共同作用力進行設計。
  - EC2 Concrete Design
  - EC3 Steel Design

- 在計算複合斷面的扭轉常數時，可以使用 Humbly equation 或網格法。
  - 勾選: 用 Humbly Equation 計算 beam-and-slab decks 扭矩常數。計算值與前版本相同。
  - 不勾選: 利用斷面的網格計算扭矩常數。

Properties>Section>Composite