

# Release Note

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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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- 11.歷時分析同時查看變位、速度、加速度
- 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**

Define Standard Vehicular Load

Standard Name: Load System A

Vehicular Load Properties  
 Vehicular Load Name: Load System A  
 Vehicular Load Type: Load System A

$A = a1 \times a2 \times A(L)$

$A(L) = 2.3 + 360/(L+12) \text{ kN/m}^2$

$A(L) \times a1 \geq (4 - 0.002L) \text{ kN/m}^2$

Coefficient a1

Number of Loaded Lanes		1	2	3	4	≥5
Bridge Class	First Class	1	1	0.9	0.75	0.7
	Second Class	1	0.9	-	-	-
	Third Class	0.9	0.8	-	-	-

Lane Width Coefficient a2 = v0/v    v = Loadable Width/Number of Lanes

Nominal Width (m)		v0
Bridge Class	First Class	3.5
	Second Class	3
	Third Class	2.75

OK    Cancel    Apply

Load System A

Define Standard Vehicular Load

Standard Name: Load System B

Vehicular Load Properties  
 Vehicular Load Name: Load System Bc  
 Vehicular Load Type: Load System Bc

No	Load(kN)	Spacing(m)	Distance between two Vehicles
1	60	4.5	Min = 4.5m
2	120	1.5	Max = Infinite
3	120	end	

Coefficient bc

Number of Loaded Lanes		1	2	3	4	≥5
Bridge Class	First Class	1.2	1.1	0.95	0.8	0.7
	Second Class	1	1	-	-	-
	Third Class	1	0.8	-	-	-

Apply Dynamic Factor

OK    Cancel    Apply

Load System Bc

Define Standard Vehicular Load

Standard Name: Military Load

Vehicular Load Properties  
 Vehicular Load Name: System Mc 80  
 Vehicular Load Type: System Mc 80

Min. Distance Between Two Vehicles: 35.4 m

P: 720 kN    D: 4.9 m

Apply Dynamic Factor

OK    Cancel    Apply

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

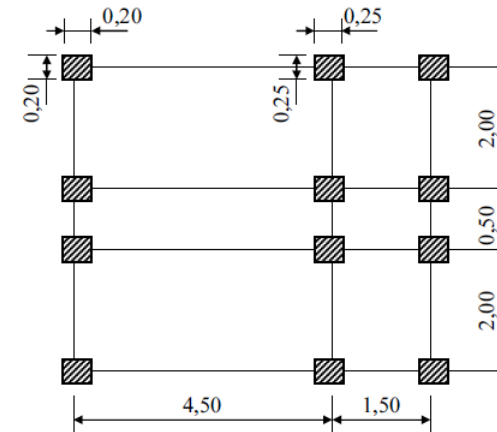
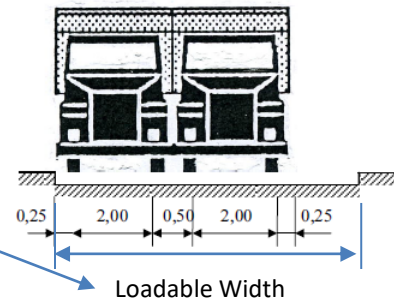
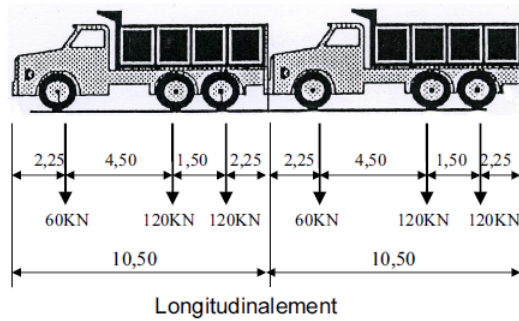
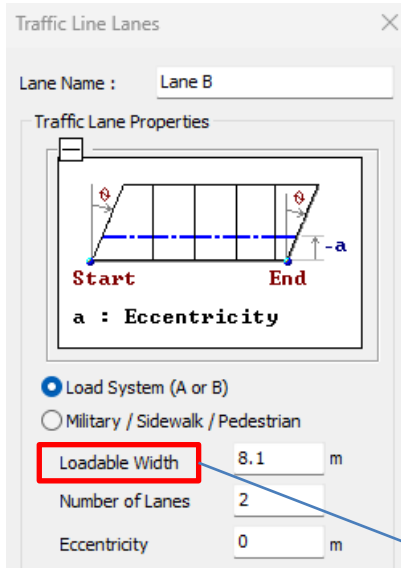


Figure 4.1 : Système B.

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

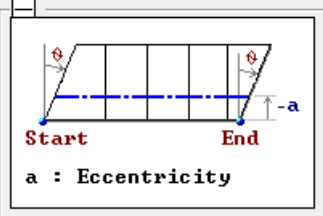
- 可對每跨輸入跨度長與跨度重，以計算動力因數  $\delta$ 。
- 載重系統中每跨的最大重量  $Bc$  是由程式所決定。

### ▪ Load > Moving Load > Moving Load Code > France

Traffic Line Lanes

Lane Name : Lane B

Traffic Lane Properties



**a : Eccentricity**

Load System (A or B)

Military / Sidewalk / Pedestrian

Loadable Width : 8.1 m

Number of Lanes : 2

Eccentricity : 0 m

Dynamic Factor for System B

L (Span Length) : 24 m

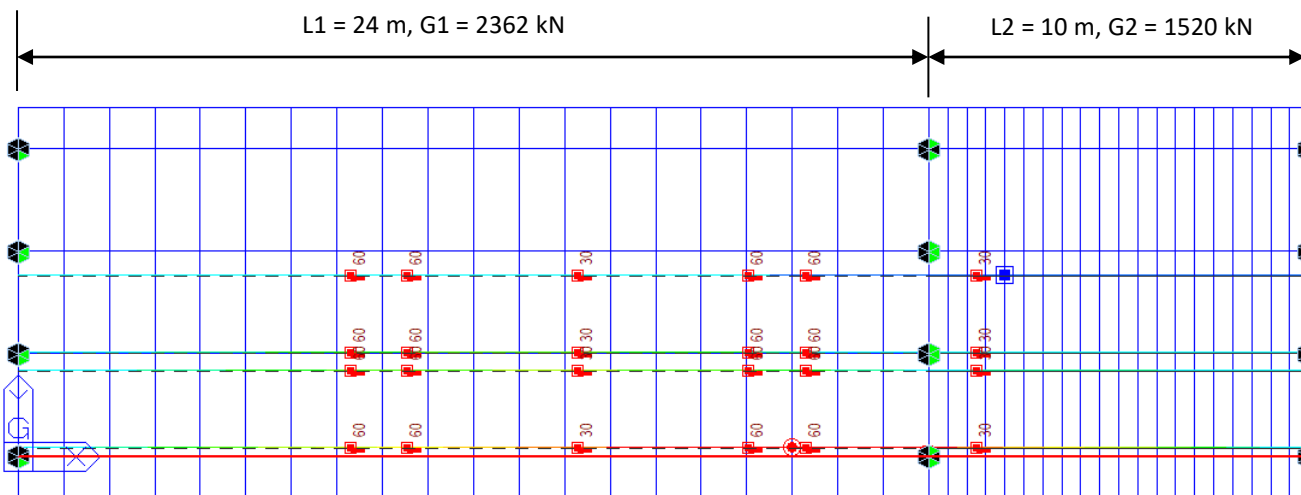
G (Span Weight) : 2362 kN

Centrifugal Force

Left Wheel of Vehicle Moving Forward : 0.0 W

- Dynamic Factor

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



No	Elem	Eccen. (m)	L (m)	G (kN)	Span Start
1	82	-4.05	24	2362	<input checked="" type="checkbox"/>
2	83	-4.05	24	2362	<input type="checkbox"/>

No	Elem	Eccen. (m)	L (m)	G (kN)	Span Start
40	121	-4.05	10	980.	<input type="checkbox"/>

```

MIDAS/Text Editor - [MVmax8cFz62_DetailResult]
File Edit View Window Help
00001
00002 ** midas Civil France Moving Load Data **
00003 * Moving Load Cases : MVmax8c
00004 * Key Element : 82
00005 * Components : Fz
00006 * Maximum Value : 5.0809e+02
-----
00007
00008
00009
00010
00011 [Lane1 ]
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 [Lane2 ]
00017
00018 * Multiple Lane Factor(bc), 1st Vehicle : 1.100
00019 * Multiple Lane Factor(bc), 2nd Vehicle : 1.100
00020 * Dynamic Factor for Each Axle : 1.241, 1.161, 1.161, 1.161, 1.161, 1.161
00021
00022
Ready Ln 0 / 21.
    
```

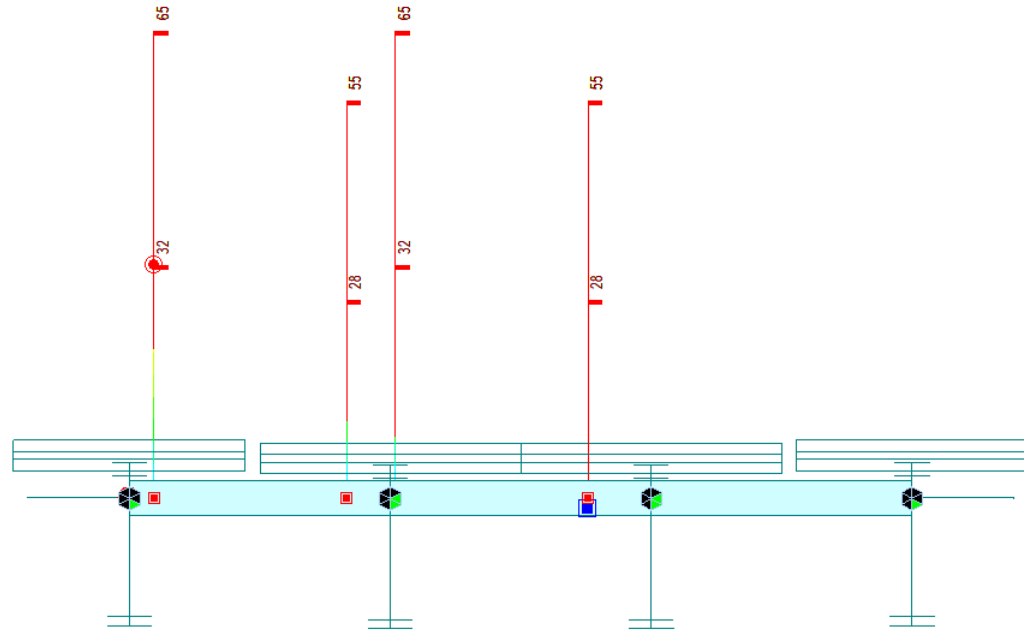
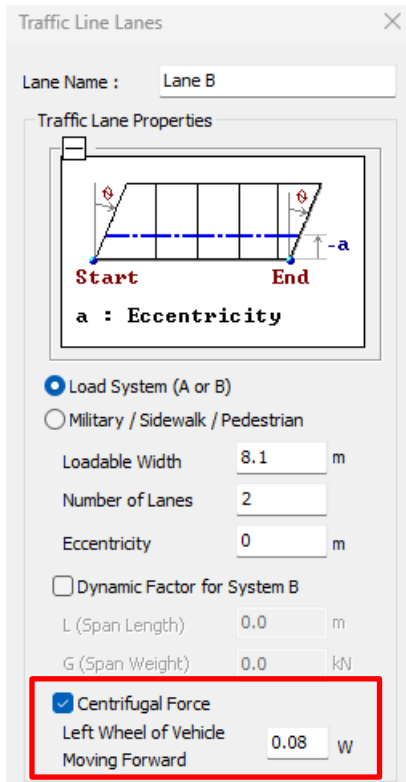
## 1.法國舊版規範FASCICULE N° 61 TITRE II移動載重分析

- 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

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



Vertical Loads with Centrifugal Forces

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

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

The image displays four overlapping dialog boxes from a structural design software, set against a background of a French standard document titled "Norme NF EN 1992-1-1/NA Mars 2016".

- Composite Steel Girder Design Parameters:** Shows design code "EN 1994-2" and national annex "France". It lists various partial factors like Concrete, Reinforcing Steel, and Structural Steel.
- PSC Design Parameters:** Shows design code "Eurocode2-2:05" and national annex "France". It includes input parameters for ultimate and serviceability limit states, shear resistance, and prestressing steel type.
- Steel Design Code:** Shows design code "Eurocode3-2:05" and national annex "France". It includes options for lateral bracing, buckling resistance, and load application points.
- Concrete Design Code:** Shows design code "Eurocode2-2:05" and national annex "France". It includes parameters for moment resistance, column design, and shear resistance.

At the bottom of the dialog boxes, there are buttons for "Composite Steel Girder Design", "Prestressed Girder Design", "Steel Design", and "Concrete 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**

- Code de conception  
EN 1992-2: 2005 ( NA:France )
- Propriété de section  
10 ( ID : 10 )
- Propriété matérielle  
 $f_{ck} = 30.000\text{MPa}$ ,  $f_y = 500.000\text{MPa}$
- Longueur  
 $L = 0.914\text{m}$
- Données de ferrailage  
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 )**

Memb No.	740
Nœud No.	777
Moment Nég.	LCB cLCB2
$M_{Ed} / M_{Rd}$	-56.696kN-m/m / -59.070kN-m/m = 0.960 <span style="float: right;">OK</span>
$\rho_{min} , \rho , \rho_{max}$	$\rho_{min} = 0.00151 < \rho = 0.00319 < \rho_{max} = 0.04000$ <span style="float: right;">OK</span>

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

- Paramètre de conception  
 $f_{ck} = 30.000\text{MPa}$ ,  $f_{yk} = 500.000\text{MPa}$   
 $b_w = 1,000.000\text{mm}$ ,  $h = 260.000\text{mm}$   
 $d = 210.000\text{mm}$   
 $A_{st} = 670.200\text{mm}^2$   
 $\alpha_{cc} = 1.000$   
 $\gamma_c = 1.500$ ,  $\gamma_s = 1.150$   
 $f_{cd} = \alpha_{cc} f_{ck} / \gamma_c = 20.000\text{MPa}$   
 $\bar{f}_{yd} = f_{yk} / \gamma_s = 434.783\text{MPa}$

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1																																	
2	Číslo prvku		16																														
3	Position Information		J																														
4																																	
5	<b>1.Nastavení posudku</b>																																
6	1.1 Návrhové parametry																																
7	- Dílčí součinitele pro mezní stav únosnosti (EN 1992-1-1:2004, 2.4.2.4)																																
8	Návrhové situace		$\gamma_c$ beton				$\gamma_s$ betonářská výztuž				$\gamma_s$ předpjatá výztuž																						
9	Trvalé & Dočasné		1.500				1.150				1.150																						
10	Mimořádné		1.200				1.000				1.000																						
11																																	
12	- součinitel $\alpha_{cc}$ , $\alpha_{ct}$ : Součinitel pro dlouhodobé účinky únosnosti v tlaku a tahu.																																
13	$\alpha_{cc} =$		0.850				(pro únosnost betonu v tlaku)																										
14	$\alpha_{ct} =$		1.000				(pro únosnost betonu v tahu)																										
15																																	
16	1.2 Průřezy																																
17	$b_w$	8500.0	mm	$I_y$	7.8668E+12	mm <sup>4</sup>	$A_{sl}$	0.000	mm <sup>2</sup>																								
18	$h$	3000.0	mm	$I_z$	2.9574E+13	mm <sup>4</sup>	$A_{sc}$	0.000	mm <sup>2</sup>																								
19	$d_c$	0.0	mm	$C_y$	4250.0	mm	$A_{sw}$	0.000	mm <sup>2</sup>																								
20	$d_t$	0.0	mm	$C_z$	1790.6	mm	$A_{wt}$	0.000	mm <sup>2</sup>																								
21	$A$	6208720.000	mm <sup>2</sup>				$A_{it}$	0.000	mm <sup>2</sup>																								
22																																	
23	1.3 Materiály																																
24	- Beton																																
25	$f_{ck} =$	40.000	MPa	$E_c =$	35220.000	MPa																											
26																																	
27	- Výztuž																																
28	$f_{yk} =$	400.000	MPa	$E_s =$	200000.000	MPa																											
29																																	
30	1.4 Předpjaté kabely																																
31	Typ	Název kabelu	Pozice (mm)	Plocha (mm <sup>2</sup> )	Pevnost (MPa)		$E_p$ (MPa)																										
32					$f_{ck}$	$f_{p0.1k}$																											
33	1	S_A2L	500.0	2635.300	1900.000	1600.000	200000.000																										
34	2	S_A3L	700.0	2635.300	1900.000	1600.000	200000.000																										
35	3	S_A4R	900.0	2635.300	1900.000	1600.000	200000.000																										
36	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

The image displays three overlapping Microsoft Word documents generated from the Civil 2023 software, showing design reports for different structural members. Each document is in English (United States) and includes detailed technical specifications, material properties, and section diagrams.

**Document 1: MEMBER NAME : 500x300 ( Section ID : 1, Element No.1 )**

**1. Member Information**

- Design Code: EN 1992-2: 2005 ( NA/Italy )
- Section Property: 500x300 ( ID : 1 )
- Material: Concrete  
 $f_c = 25.00\text{MPa}$ ,  $E_c = 31.475\text{MPa}$   
 Reinforcement  
 $f_{yk} = 430\text{MPa}$ ,  $f_{tk} = 430\text{MPa}$ ,  $E_s = 206,000\text{MPa}$
- Length:  $L = 6.000\text{m}$
- Reinforcement Data

Diagrams show cross-sections E-01, M-01, and E-02. Reinforcement details: Top 2-P24, Bottom 2-P24, Stirrups 2-P14@200.

**2. Moment Capacity ( Negative ) ( Sector I, 0.25L )**

Memb No.	1
Neg. LCB	LCB1
M <sub>ed</sub> / M <sub>td</sub>	0.000kNm / 136kNm = 0.000
$\rho_{min} < \rho < \rho_{max}$	$\rho_{min} = 0.00155 < \rho = 0.00685 < \rho_{max} = 0.04000$

**Document 2: MEMBER NAME : Column 7 W8x35 ( ID : 1 )**

**1. Member Information**

- Design Code: EN 1993-2: 2006 ( NA-Recommended )
- Material: Steel  
 $f_y = 1,711.357\text{MPa}$ ,  $E_s = 199,948.024\text{MPa}$
- Length:  $L = 3.658\text{m}$
- Partial factors:  $\gamma_{M1} = 1.000$ ,  $\gamma_{M2} = 1.250$
- Section Properties

Diagram shows an I-section with dimensions: 203.248mm height, 203.708mm flange width, 7.674mm flange thickness, and 203.708mm web thickness.

A	6,645.146mm <sup>2</sup>	I <sub>y</sub>	32,861.891051mm <sup>4</sup>	I <sub>x</sub>	17,731,458.731mm <sup>4</sup>	I <sub>pl,y</sub>	0.000mm <sup>4</sup>
C <sub>y</sub>	101.854mm	C <sub>x</sub>	103.124mm	I <sub>y</sub>	89.154mm	I <sub>pl,x</sub>	51.562mm
W <sub>pl,y</sub>	511,276.397mm <sup>3</sup>	W <sub>pl,x</sub>	173,702.878mm <sup>3</sup>	W <sub>pl,y</sub>	568,631.121mm <sup>3</sup>	W <sub>pl,x</sub>	263,831.730mm <sup>3</sup>
I <sub>t</sub>	320,498.198mm <sup>4</sup>	I <sub>tw</sub>	1.861112e+11mm <sup>4</sup>				

**2. Check Axial Resistance**

Axial	LCB	sLCB1
	$N_{Ed} / N_{Rk}$	$287.283\text{kN} / 2,325.666\text{kN} = 0.124$

OK

**Document 3: MEMBER NAME : Steel Composite : 1 - j**

**1. Member Information**

- Design Code: EN 1994-2 ( NA : Recommended )
- Section Property: Comp
- Material: Steel  
 $f_y = 345.000\text{MPa}$ ,  $E_s = 210,000.000\text{MPa}$   
 Concrete  
 $f_{ck} = 30.000\text{MPa}$ ,  $E_{cm} = 33,000.000\text{MPa}$   
 Reinforcement  
 $f_{yk} = 500.000\text{MPa}$ ,  $E_s = 200,000.000\text{MPa}$
- Length:  $L = 1.000\text{m}$
- Partial factors

	Factor
$\gamma_c$ for concrete	1.500
$\gamma_s$ for reinforcing steel	1.150
$\gamma_{M2}$ for structural steel	1.000
$\gamma_{M2}$ for structural steel	1.100
$\gamma_{M2}$ for headed stud	1.250
$\gamma_{M2}$ for equivalent constant Amplitude stress range	1.000
$\gamma_{M2}$ for fatigue strength	1.000
$\gamma_{M2}$ for fatigue strength of studs in shear	1.000

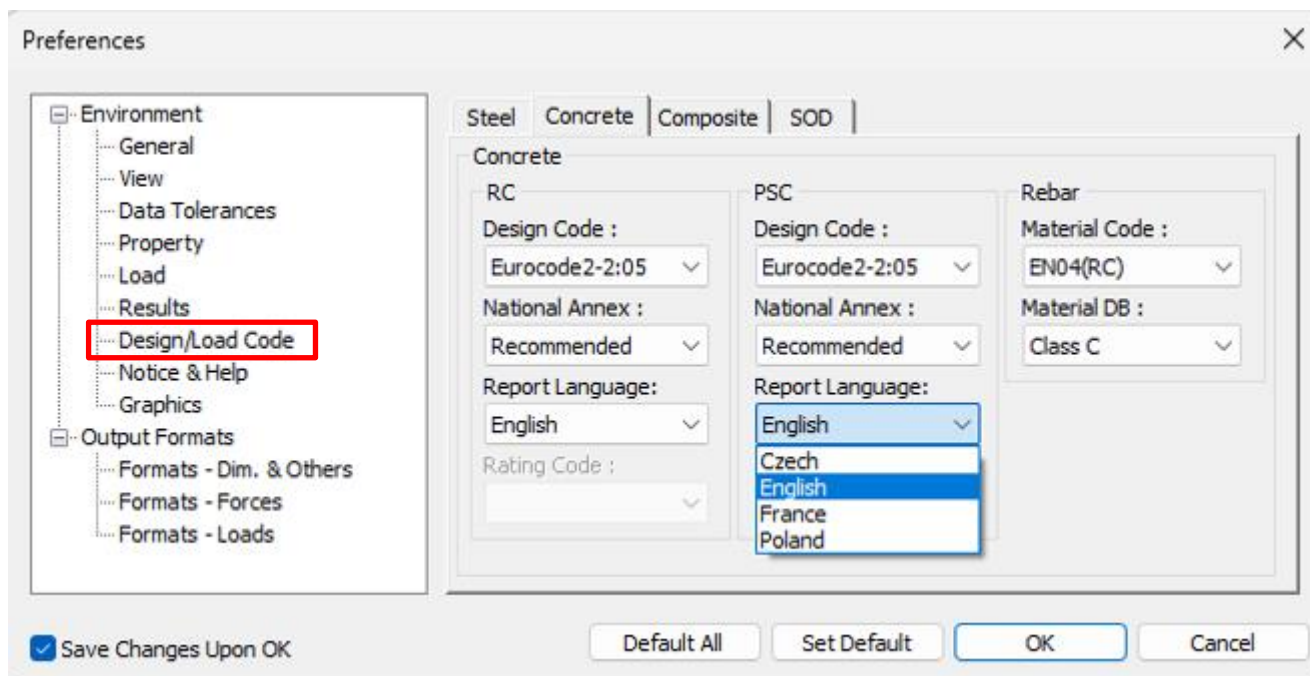
Diagram shows a composite section with a steel I-beam on top of a concrete slab. Dimensions: 400mm flange width, 12.5mm flange thickness, 200mm web thickness, and 200mm slab thickness.

	Steel Section	Composite Section( Positive )	Composite Section( Negative )
Area	34,687.500mm <sup>2</sup>	155,867.976mm <sup>2</sup>	43,132.020mm <sup>2</sup>

## 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**

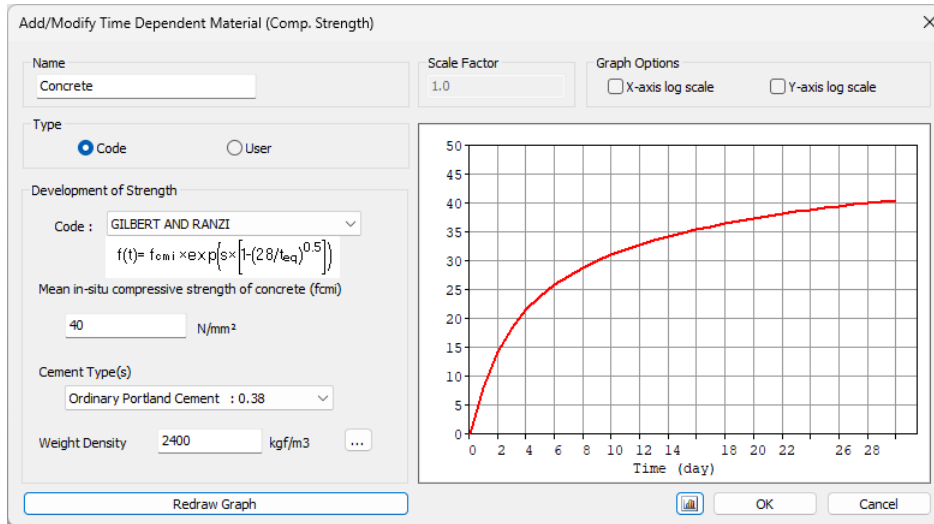


Report Language of Preference

## 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:

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

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

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

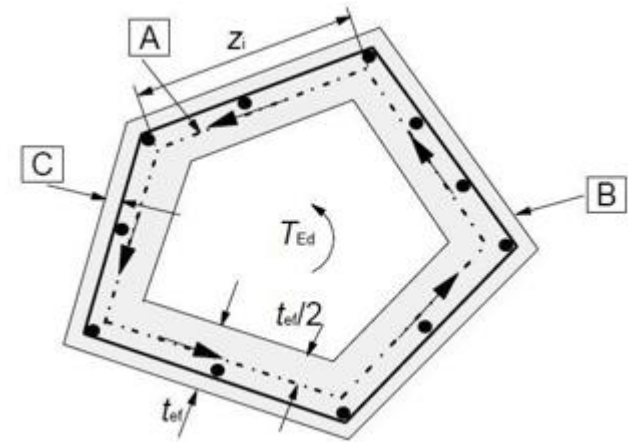
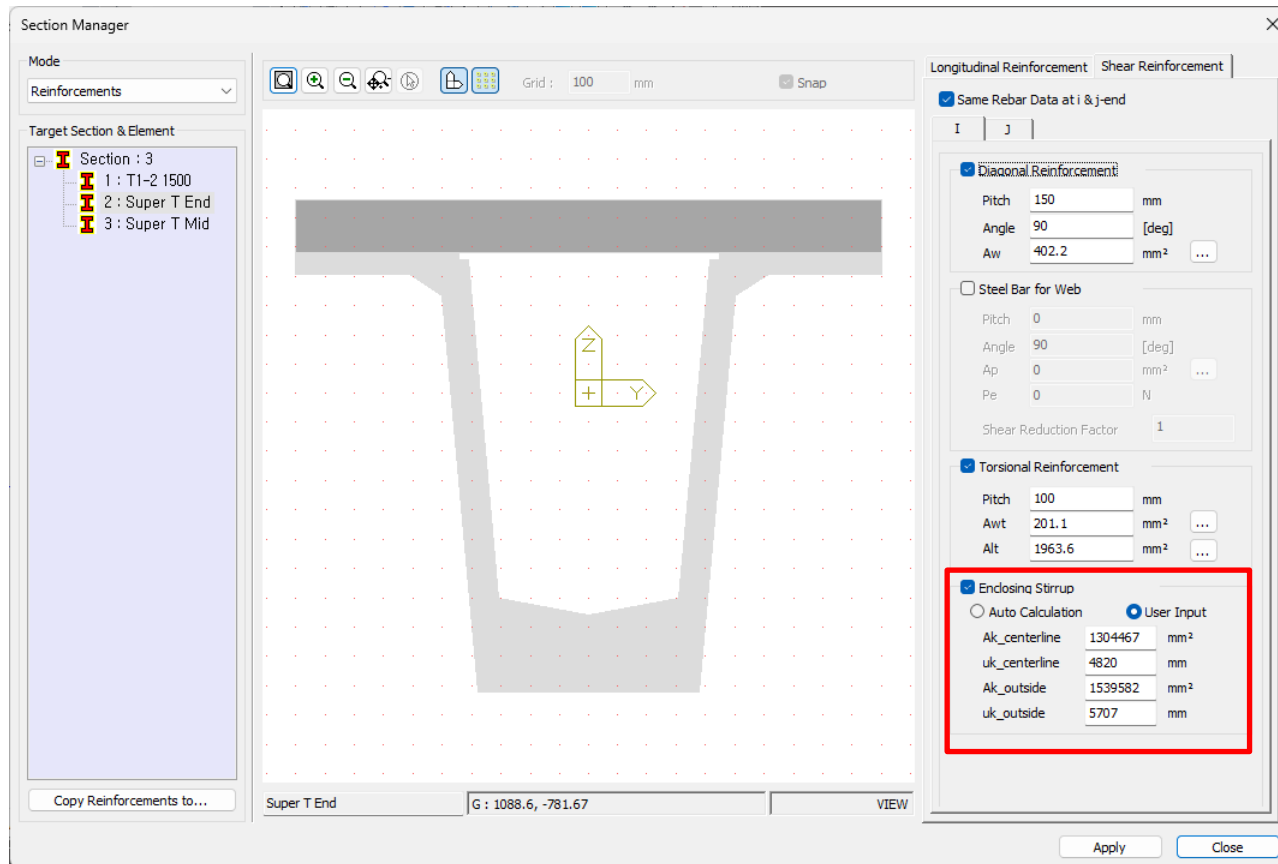
- Modulus of elasticity with time

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

## 7. PSC Design: 扭矩參數 $A_k$ 和 $u_k$ 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



- A** - centre-line
- B** - outer edge of effective cross-section, circumference  $u$ ,
- C** - cover

Shear Reinforcement of Section Manager

## 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**

Auto Rotational DOF Constraint for Truss/Plane Stress/Solid Elements

Auto Normal Rotation Constraint for Plate Elements

Tension / Compression Truss Element (Elastic Link / Inelastic Spring)

Number of Iterations/Load Case: 20

Convergence Tolerance: 0.001

Consider Section Stiffness Scale Factor for Stress Calculation

Transfer Reactions of Slave Nodes to the Master Node

Calculate Equivalent Beam Stresses (Von-Mises and Max-Shear)

Consider Reinforcement for Section Stiffness Calculation

Change Local Axis of Tapered Section for Force/stress Calculation

Main Control Data

React... Deform... Forces Stres... Strains

Beam Stresses(Equivalent)

Load Cases: CS: Summation

Step: Last Step

Stresses:

Normal  Von-Mises

Tau\_xy  Max-Shear

Tau\_xz  Princ. (max)

Princ. (min)

Position:

Maximum

1 (-y, +z)

2 (+y, +z)

3 (+y, -z)

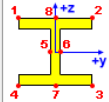
4 (-y, -z)

5 (N.A. -y)

6 (N.A. +y)

7 (N.A. -z)

8 (N.A. +z)



Type of Display:

Contour  Deform

Values  Legend

Animate  Undeformed

Mirrored

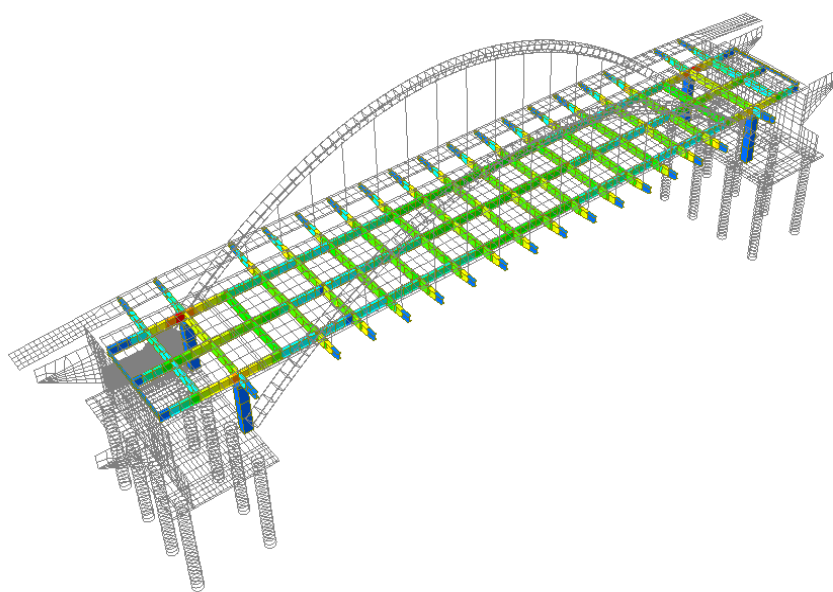
Output Section Location:

I  Center  J

Max  All

Apply Close

CS



MIDAS/Civil1  
POST-PROCESSOR

BEAM STRESS (EQUIV.)

Von-Mises

8.42925e+00
7.66295e+00
6.89666e+00
6.13036e+00
5.36407e+00
4.59777e+00
3.83148e+00
3.06518e+00
2.29889e+00
1.53259e+00
7.66295e-01
0.00000e+00

STAGE: CS  
CS: SUMMATION  
LAST

MAX : 60080  
MIN : 3000

FILE: 3D MODEL\_~  
UNIT: N/mm<sup>2</sup>  
DATE: 04/19/2023

VIEW-DIRECTION

X: -0.497

Y: -0.625

Z: 0.602

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

Define Load Combination

No.	Load Combination	P (kN)	My (kNxm)	Mz (kNxm)	Vy (kN)	Vz (kN)	T (kNxm)
1	lcb1	0.00	2880.00	0.00	0.00	0.00	0.00
2	lcb2	10000.00	1550.00	0.00	0.00	0.00	0.00
3	lcb3	5000.00	1350.00	1120.00	0.00	0.00	0.00
4	lcb4	7540.00	-2415.00	2640.00	0.00	0.00	0.00
5	lcb5	3590.00	-1450.00	3400.00	0.00	0.00	0.00

Close

Section View: Section1 Interaction Curve Stress Contour

Mode: My-Mz 3D

Mode: Angle: 0.000000 Dea: P-My P-Mz Load Combination: lcb1

Code: Eurocode2:04

Hoop Type: Tie Spiral

Checking Ratio: Keep M/P constant Keep M constant Keep P constant

	P (kN)	My (kNxm)	Mz (kNxm)
1	18618.363	0.000	-0.000
2	13854.348	2844.186	-0.000
3	13259.834	3088.594	-0.000
4	12671.983	3308.460	-0.000
5	12091.494	3500.334	-0.000
6	11519.309	3670.993	-0.000
7	10956.736	3820.881	-0.000
8	10405.647	3949.762	-0.000
9	9868.821	4061.678	-0.000
10	9350.626	4158.444	-0.000
11	8858.537	4235.074	-0.000
12	8407.673	4299.348	-0.000
13	8056.967	4343.774	-0.000
14	7846.246	4321.414	-0.000
15	7113.378	4271.786	-0.000
16	6522.025	4185.485	-0.000
17	5889.170	4059.685	-0.000
18	5223.550	3889.404	-0.000
19	4530.596	3670.616	-0.000
20	3814.054	3399.924	-0.000
21	3076.679	3074.359	-0.000
22	2320.593	2690.837	-0.000
23	1547.484	2245.082	-0.000
24	503.778	1558.325	-0.000
25	-1707.374	0.000	-0.000

Report All Report Close

P-M Curve

Mode: Load Combination = lcb1  
Checking Ratio = 2.384 (Keep M/P Constant)

Pu(kN)	Mn(kNxm)
18618.363	0.000
13854.348	2844.186
13259.834	3088.594
12671.983	3308.460
12091.494	3500.334
11519.309	3670.993
10956.736	3820.881
10405.647	3949.762
9868.821	4061.678
9350.626	4158.444
8858.537	4235.074
8407.673	4299.348
8056.967	4343.774
7846.246	4321.414
7113.378	4271.786
6522.025	4185.485
5889.170	4059.685
5223.550	3889.404
4530.596	3670.616
3814.054	3399.924
3076.679	3074.359
2320.593	2690.837
1547.484	2245.082
503.778	1558.325
-1707.374	0.000

Theta=0.000Deg  
NA=0.000Deg  
Rat=2.384

P-M Curve

Mode: Load Combination = lcb2  
Checking Ratio = 0.677 (Keep M/P Constant)

Pu(kN)	Mn(kNxm)
18618.363	0.000
13854.348	2844.186
13259.834	3088.594
12671.983	3308.460
12091.494	3500.334
11519.309	3670.993
10956.736	3820.881
10405.647	3949.762
9868.821	4061.678
9350.626	4158.444
8858.537	4235.074
8407.673	4299.348
8056.967	4343.774
7846.246	4321.414
7113.378	4271.786
6522.025	4185.485
5889.170	4059.685
5223.550	3889.404
4530.596	3670.616
3814.054	3399.924
3076.679	3074.359
2320.593	2690.837
1547.484	2245.082
503.778	1558.325
-1707.374	0.000

Theta=0.000Deg  
NA=0.000Deg  
Rat=0.677

P-M Curve

Mode: Load Combination = lcb3  
Checking Ratio = 1.198 (Keep M/P Constant)

Pu(kN)	Mn(kNxm)
18618.363	0.000
15710.463	1047.896
14919.966	1155.320
14103.774	1232.297
13293.674	1314.675
12495.936	1394.608

Theta=39.66Deg  
NA=83.00Deg  
Rat=1.198

P-M Curve

Mode: Load Combination = lcb4  
Checking Ratio = 3.388 (Keep M/P Constant)

Pu(kN)	Mn(kNxm)
18618.363	0.000
15473.694	978.839
14670.085	1069.599
13888.355	1148.447
13118.417	1228.088

Theta=12.48Deg  
NA=95.78Deg  
Rat=3.388

P-M Curve

Mode: Load Combination = lcb5  
Checking Ratio = 6.686 (Keep M/P Constant)

Pu(kN)	Mn(kNxm)
18618.363	0.000
14822.449	841.783
14096.620	935.683
13379.695	1019.282
12662.163	1096.550
11979.869	1145.635
11289.743	1194.251
10613.982	1232.493
9967.001	1263.977
9331.757	1284.925
8728.384	1298.148
8175.284	1305.567
7738.030	1308.730
7196.163	1295.125
6466.592	1270.877
5658.242	1235.319
4791.853	1187.060
3908.743	1107.766
2963.610	1013.575
2006.083	915.062
1018.217	766.886
-16.058	634.672
-869.623	468.636
-1564.498	89.869
-1707.374	0.000

Theta=263.10Deg  
NA=93.98Deg  
Rat=6.686



## 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



**Material Data**

General  
Material ID: 2 Name: Grade 40

Elasticity Data  
Type of Design: Concrete

Steel  
Standard: DB

Concrete  
Standard: TMH7(RC)  
Code: Grade 40

Type of Material  
 Isotropic  Orthotropic

Steel  
Modulus of Elasticity: 0.0000e+00 N/mm<sup>2</sup>  
Poisson's Ratio: 0  
Thermal Coefficient: 0.0000e+00 1/[C]  
Weight Density: 0 N/mm<sup>3</sup>  
 Use Mass Density: 0 N/mm<sup>3</sup>/g

Concrete  
Modulus of Elasticity: 3.1000e+04 N/mm<sup>2</sup>  
Poisson's Ratio: 0.2  
Thermal Coefficient: 1.2000e-05 1/[C]  
Weight Density: 2.3e-05 N/mm<sup>3</sup>  
 Use Mass Density: 2.345e-09 N/mm<sup>3</sup>/g

Plasticity Data  
Plastic Material Name: NONE

Inelastic Material Properties for Fiber Model  
Concrete: None Rebar: None

Thermal Transfer  
Specific Heat: 0 Btu/N-[C]  
Heat Conduction: 0 Btu/mm-hr-[C]  
Damping Ratio: 0.05

OK Cancel Apply

Concrete Material

**Modify Concrete Materials**

Material List

ID	Name	fc fck R	Chk	Lambda	Main-bar	Sub-bar
1	Grade 40	40	X	1		

Concrete Material Selection  
Code: TMH7(RC) Grade: Grade 40  
Specified Compressive Strength (fc|fck): 40 N/mm<sup>2</sup>  
 Light Weight Concrete Factor (Lambda): 1

Rebar Selection  
Code: TMH7(RC)  
Grade of Main Rebar: Type C Fy: 450 N/mm<sup>2</sup>  
Grade of Sub-Rebar: Type A Fys: 450 N/mm<sup>2</sup>

Modify Close

Reinforcement Material

**Rebar Material Property**

Rebar Material Code: TMH7(RC)  
Rebar Grade: Type C  
Rebar fy: 450 N/mm<sup>2</sup>  
Modulus of Elasticity: 200000 N/mm<sup>2</sup>  
Stress Strain Curve: Park Strain Hardening

OK Close

Reinforcement Material

**Material Data**

General  
Material ID: 2 Name: Grade 40

Elasticity Data  
Type of Design: RC

Steel  
Standard: DB

Concrete  
Standard: TMH7(RC)  
Code: Grade 40

Type of Material  
 Isotropic  Orthotropic

Steel  
Strength: 0 N/mm<sup>2</sup>  
Modulus of Elasticity: 0.0000e+00 N/mm<sup>2</sup>  
Poisson's Ratio: 0  
Thermal Coefficient: 0.0000e+00 1/[T]  
Weight Density: 0 N/mm<sup>3</sup>  
 Use Mass Density: 0 N/mm<sup>3</sup>/g

Concrete  
Strength: 40 N/mm<sup>2</sup>  
Modulus of Elasticity: 3.1000e+04 N/mm<sup>2</sup>  
Poisson's Ratio: 0.2  
Thermal Coefficient: 1.2000e-05 1/[T]  
Weight Density: 2.3e-05 N/mm<sup>3</sup>  
 Use Mass Density: 2.345e-09 N/mm<sup>3</sup>/g

Define Nonlinear Properties

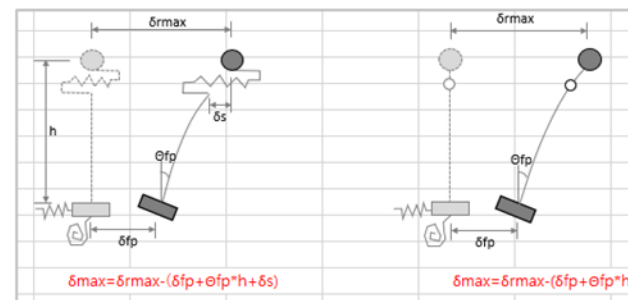
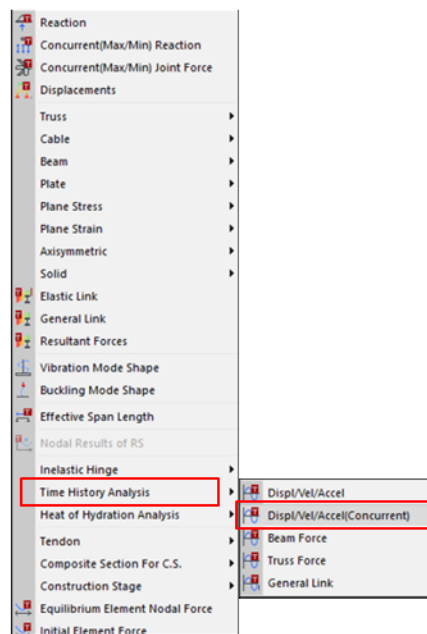
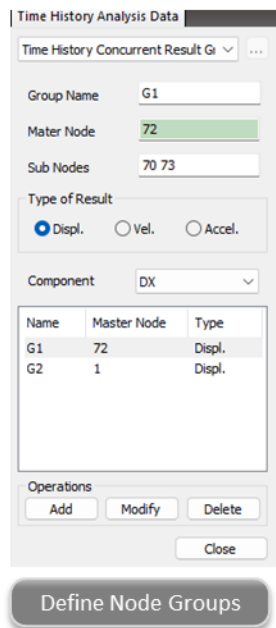
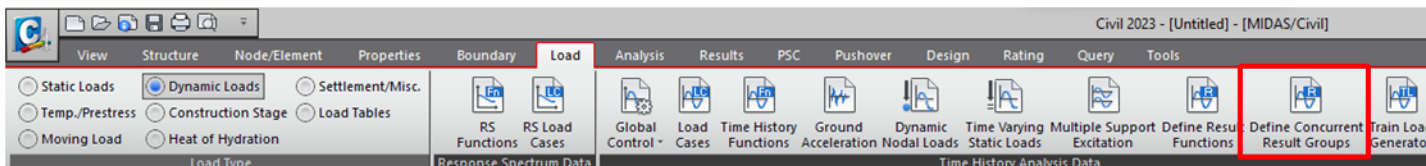
OK Close Apply

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)



Group	Load	Node	DX (mm)	DY (mm)	DZ (mm)	RX ([rad])	RY ([rad])	RZ ([rad])
G1	EX(max)	Master 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)	Master 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)	Master 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
G2	EX(min)	Master 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
G2	EX(max)	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

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
141																																	
142	<b>2.Flexure design for a section</b>																																
143	■ <b>Moment Direction</b> Positive																																
144	- Method of Calculation : Code																																
145	- The maximum strength limit load combination : CLCB3																																
146	- The maximum factored moment (M <sub>u</sub> ) : 6832.570 (kips-in)																																
147																																	
148	1) <b>Depth of neutral axis to compression face</b> (See 5.6.3.1)																																
149	Axial force in tendons(Bond) by Code																																
150	No.	Tendon Name	k	<b>f<sub>ps</sub></b>	T <sub>ps</sub> =A <sub>ps</sub> f <sub>ps</sub>	A <sub>ps</sub> f <sub>ps</sub> (d <sub>p</sub> -c)																											
151	1	S_Span1-263	0.374	44.509	9.658	541.010																											
152	2	S_Span1-253	0.374	44.510	9.659	541.027																											
153	3	S_Span1-243	0.374	44.204																													
154	4	S_Span1-233	0.374	43.899																													
199																																	
200	Development Length																																
201	No.	Tendon name	<b>l<sub>1</sub>(in)</b>	<b>l<sub>2</sub>(in)</b>	l <sub>ps</sub> (in)	f <sub>ps</sub> (ksi)																											
202	1	S_Span1-263	31.50	152.65	15.75	44.51																											
203	2	S_Span1-253	31.50	152.65	15.75	44.51																											
204	3	S_Span1-243	31.50	153.15																													
205	4	S_Span1-233	31.50	153.65																													
206																																	
207	* The section is located within the transfer length																																

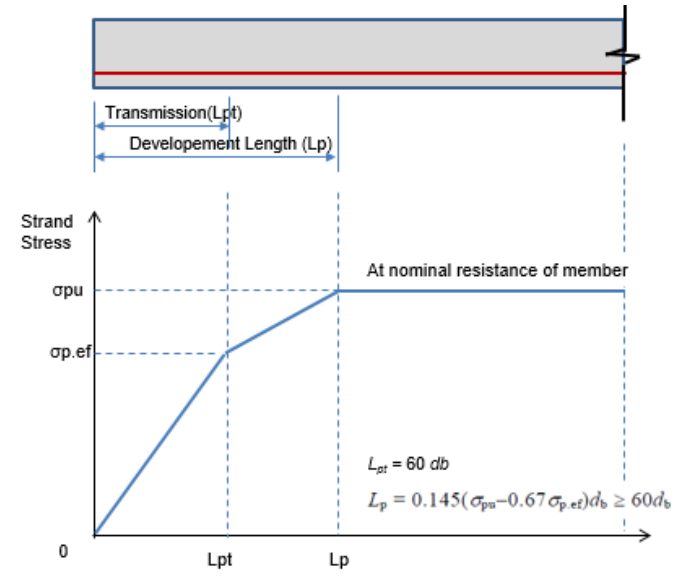
Tendon stress at ULS within development length

Transfer Length & Development Length

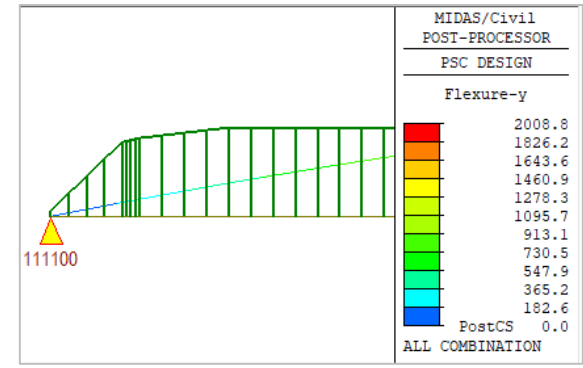
Development Length in Report



Flexural Resistance Diagram



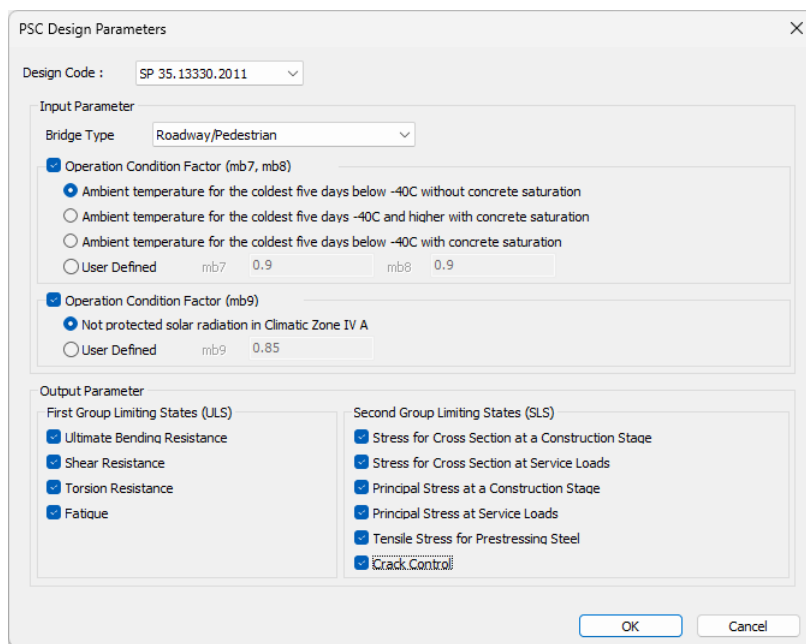
Stresses in the Tendon at ULS



### 13. SNIp/SP PSC Design: 鋼韌材料裂縫開口係數

- 在 SNIp/SP PSC Design，已新增不同鋼韌材料相對應的裂縫開口係數。

▪ PSC > Design Parameter > CSP 35.13330.2011



PSC Design Parameters

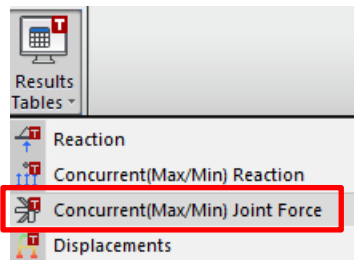
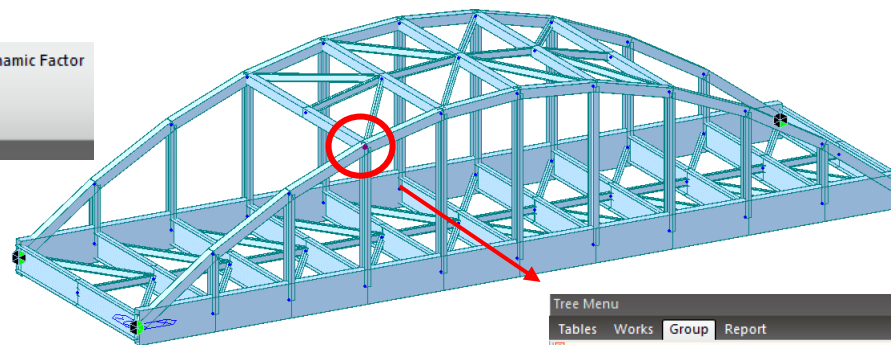
Material (GOST-SP)	Crack Opening Coefficient, $\Psi$
A600	1,5sqrt(Rr)
A800	1,5sqrt(Rr)
AT600	1,5sqrt(Rr)
AT800	1,5sqrt(Rr)
AT1000	1,5sqrt(Rr)
V1500	0,35(Rr)
V1400	0,35(Rr)
V1400 (Group S)	0,35(Rr)
V1400 (Group Zh)	0,35(Rr)
V1300	0,35(Rr)
V1200	0,35(Rr)
Vp1500	1,5sqrt(Rr)
Vp1400	1,5sqrt(Rr)
Vp1200	1,5sqrt(Rr)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

Crack Opening Coefficients

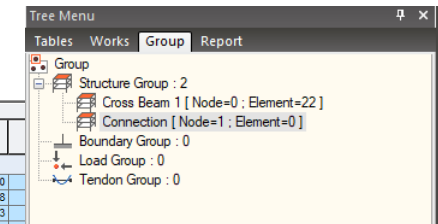
## 14. 伴隨力 (Concurrent Force)

- 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



Elem.	Load	Elem. Component	3[U]						4[]				
			Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN-m)	My (kN-m)	Mz (kN-m)	Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN-m)	
111111	Node:4	Apply	Fx	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	0.0
3[]	LM1-U(max)	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	
		My	-1282.5	-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	-21.1	
4[]	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
13[]	LM1-U(max)	Mz	-1101.6	-11.2	13.4	12.1	150.9	93.6	-977.3	13.0	20.3	-24.3	164.0
		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
111[]	LM1-U(max)	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
		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
125[]	LM1-U(max)	Mx	-644.6	-4.3	10.4	12.9	37.0	35.9	-543.2	2.3	9.8	-16.1	58.3
		My	-688.0	-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
		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	-62.1
		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



Select Nodes and Assign Structure Group

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

Use Humbly Eq. for Ixx