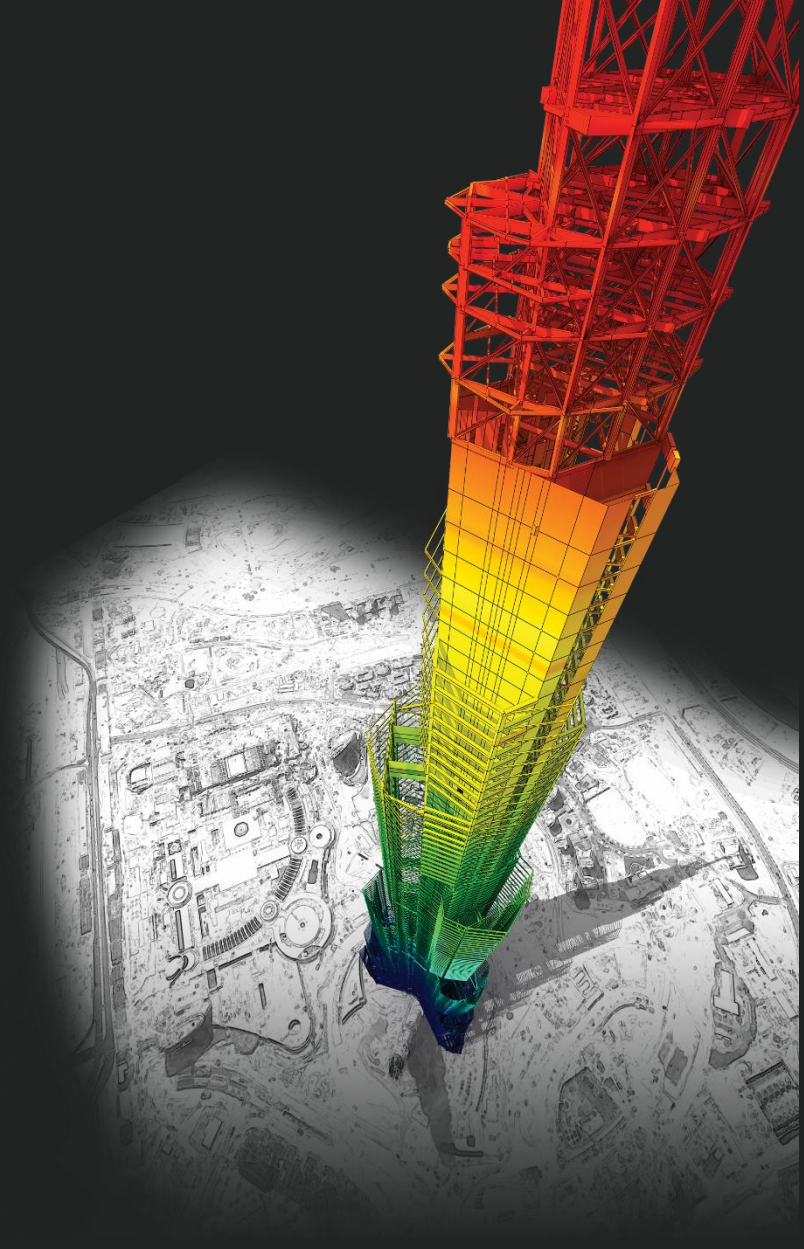
Release Note

Release Date : June. 2024.

Product Ver. : midas Gen 2024 (v2.1) + Design+ 2024(v2.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

INDEX

midas Gen

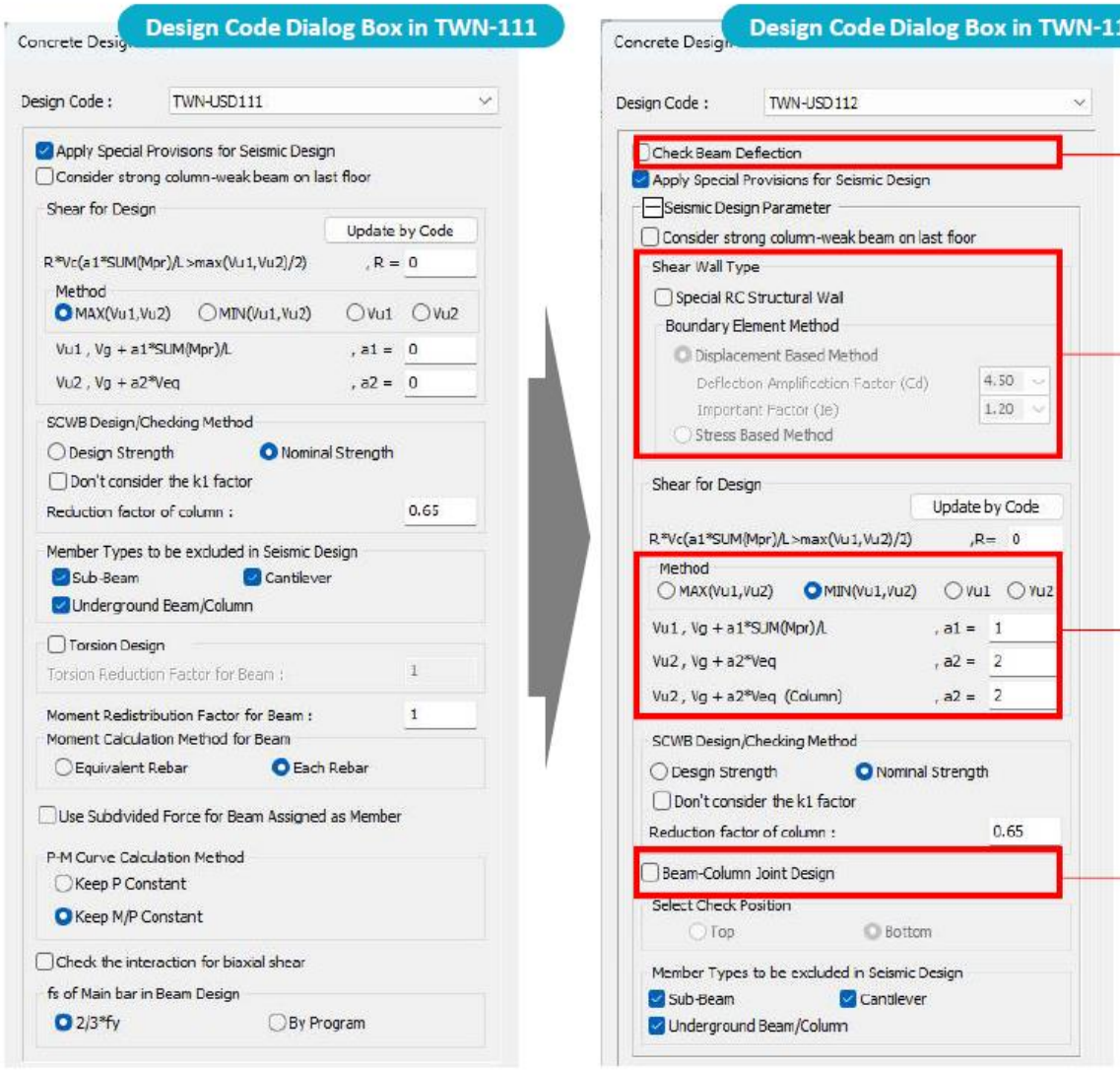
- Added TWN-USD 112 (Taiwan) 新增 112 年國家 RC 設計規範 TWN-USD 112
- Improved Steel Design, Irregularity Check and other features according to IS Code (India) 改善印度規範之鋼構設計、不規則檢討等多項功能
- Added 100:30:30 Rule according to Eurocode 8 新增歐洲規範 100:30:30 載重組合規則
- Added Detail Report for Cyclic Shear Resistance Check 新增循環剪切作用力檢核詳細報表
- Improved Construction Stage Analysis Control Data (Setting of Load Case) 改善施工階段分析的載重設定功能
- Added Cold Formed Material of TIS 1228-2018 (Thailand) 新增泰國冷軋鋼材資料庫
- Added Cold Formed Section of TIS 1228-2018 (Thailand) 新增泰國冷軋型鋼斷面資料庫
- Added Static Seismic Load and Response Spectrum Function according to EC-8(2004) Malaysia N.A. 新增歐規馬來西亞特區靜態設計地震力與反應譜函數
- ETC 其他新增改善項目
  1. Improved Rebar Size Dialog box in Meshed Design 改善鋼筋號數對話方塊
  2. Improved Shear Span in RC members under Eurocode 8 (Pushover Hinge) 改善歐規 RC 桿件剪力非線性鉸對應位置
  3. Improved Wall Design Force as per EC8 改善歐規牆設計力

Design+

- Added Member Design Module for IS :456-2000. (Column, Basement Wall, Shear Wall Module) 新增印度規範設計模組 (柱、地下外牆、剪力牆)
- Improved Link Option 改善 Link 項目
- Added Eurocode 2 in Batch Design 新增歐規批次設計
- Improved Batch Wall Design 改善批次牆設計
- Improved Anchor Bolt Design in Base Plate 改善基座鈑的螺栓設計
- Improved Start Page 改善起始頁顯示

midas Gen

Add TWN-USD 112 (Taiwan) 新增112年國家RC設計規範 TWN-USD 112

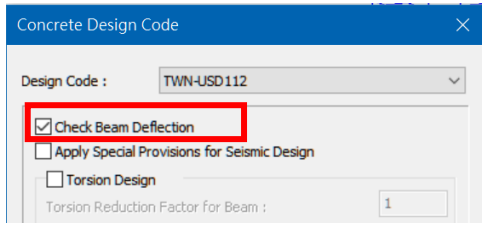


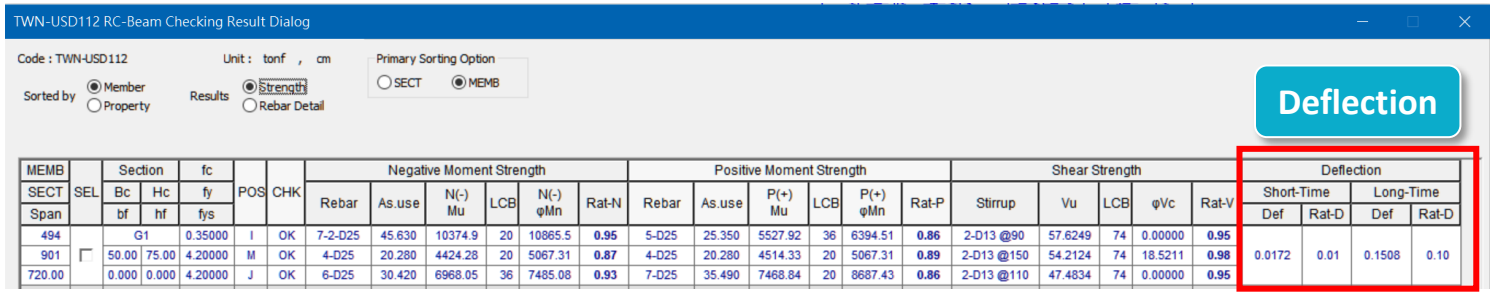
- **Add to check the beam deflection**
  新增梁的撓度檢討功能
- **Add Special Wall Design**
  新增特殊結構牆設計
- **Add settings for columns in the capacity design**
  新增柱的剪力強度設定係數
- **Add joint design**
  新增梁柱接頭剪力檢討功能

TWN-USD 112 RC Design – Check Beam Deflection 梁的撓度檢討功能

- 撓度的計算考慮了開裂斷面以及長期撓度行為
- 提供考慮長期撓度係數的分析結果與允許位移的比值

Check Beam Deflection





MEMB	SEL	Section		fc	POS	CHK	Negative Moment Strength						Positive Moment Strength						Shear Strength					Deflection			
SECT		Bc	Hc	fy			Rebar	As.use	N(-) Mu	LCB	N(-) φMn	Rat-N	Rebar	As.use	P(+) Mu	LCB	P(+) φMn	Rat-P	Stirrup	Vu	LCB	φVc	Rat-V	Short-Time		Long-Time	
Span		bf	hf	fys																				Def	Rat-D	Def	Rat-D
494		G1		0.35000	I	OK	7-2-D25	45.630	10374.9	20	10865.5	**0.95**	5-D25	25.350	5527.92	36	6394.51	**0.86**	2-D13 @90	57.6249	74	0.00000	**0.95**				
901		50.00	75.00	4.20000	M	OK	4-D25	20.280	4424.28	20	5067.31	**0.87**	4-D25	20.280	4514.33	20	5067.31	**0.89**	2-D13 @150	54.2124	74	18.5211	**0.98**	0.0172	0.01	0.1508	0.10
720.00		0.000	0.000	4.20000	J	OK	6-D25	30.420	6968.05	36	7485.08	**0.93**	7-D25	35.490	7468.84	20	8687.43	**0.86**	2-D13 @110	47.4834	74	0.00000	**0.95**				

24.2.3.5 對於非預力構材，若無較詳盡之分析，有效慣性矩I_e須使用下式及依表24.2.3.5計算。

$$M_{cr}=\frac{f_r I_g}{y_t} \qquad (24.2.3.5)$$

表 24.2.3.5 有效慣性矩 I_e

使用彎矩	有效慣性矩I_e	
$M_a \le (2/3)M_{cr}$	I_g	(a)
$M_a > (2/3)M_{cr}$	$\frac{I_{cr}}{1-\left(\frac{(2/3)M_{cr}}{M_a}\right)^2\left(1-\frac{I_{cr}}{I_g}\right)}$	(b)

24.2.4 依時撓度計算

24.2.4.1 非預力構材

24.2.4.1.1 除非根據更詳細的分析，由潛變及收縮所引起之額外依時撓度，應由持續載重計得的即時撓度乘以下列因數λ_Δ得之。

$$\lambda_\Delta=\frac{\xi}{1+50\rho'} \qquad (24.2.4.1.1)$$

24.2.4.1.2 式(24.2.4.1.1)中之 ρ'值，於簡支或連續時應取跨度中央之值，懸臂時應取支承處之值。

24.2.4.1.3 式(24.2.4.1.1)中持續載重之依時因數ξ，須依據表 24.2.4.1.3 所列之值。

表 24.2.4.1.3 持續載重之依時因數

載重持續時間，月	依時因數ξ
3	1.0
6	1.2
12	1.4
60 或以上	2.0

詳細計算書結果

9. Check Deflection (Sector I, 0.25L)

Deflection	$\delta_{Short\text{-}term}$ / δ_{allow}	0.0172cm / 2.000cm = 0.009	OK
	$\delta_{Long\text{-}term}$ / δ_{allow}	0.151cm / 1.500cm = 0.101	OK

1) Criteria for deflection
For short-term deflection : Span/360.000
For long-term deflection : Span/480.000

2) Time-dependent factor
Time-dependent factor for sustained load (ξ) = 2.000
ρ' = 0.00747
$\lambda = \frac{\xi}{1+50\rho'} = 1.456$

3) Calculate crack moment of section
$I_g = \frac{b\,h^3}{12} = 1{,}757{,}812.500cm^4$
$n = E_s / E_c = 9.087$
$f_r = 2\sqrt{f'_c} = 0.0374tonf/cm^2$
$M_{cr} = \frac{f_r I_g}{y_t} = 1{,}753.902tonf\cdot cm$

4) Calculate positive moment
M_D = 726.523tonf·cm
M_L = 146.539tonf·cm
M_{D+L} = 873.061tonf·cm
$M_{SUS.} = M_D + 0.50M_L = 799.792tonf\cdot cm$

5) Calculate inertia of moment for positive section
$I_{cr} = \frac{b(kd)^3}{3} + nA_s(d-kd)^2 + (n-1)A'_s(kd-d')^2 = 746{,}707.466cm^4$
$I_{e.D} = I_g = 1{,}757{,}812.500cm^4 \; (M_D \le (2/3)M_{cr})$
$I_{e.D+L} = I_g = 1{,}757{,}812.500cm^4 \; (M_{D+L} \le (2/3)M_{cr})$
$I_{e.SUS.} = I_g = 1{,}757{,}812.500cm^4 \; (M_{SUS.} \le (2/3)M_{cr})$

6) Calculate negative moment
M_D = -2,099.790tonf·cm
M_L = -437.408tonf·cm
M_{D+L} = -2,537.198tonf·cm
$M_{SUS.} = M_D + 0.50M_L = -2{,}318.494tonf\cdot cm$

7) Calculate inertia of moment for negative section
$I_{cr} = \frac{b(kd)^3}{3} + nA_s(d-kd)^2 + (n-1)A'_s(kd-d')^2 = 1{,}105{,}947.074cm^4$
$I_{e.D} = \frac{I_{cr}}{1-\left((2/3)M_{cr}/M_D\right)^2\left(1-(I_{cr}/I_g)\right)} = 1{,}249{,}644.191cm^4$
$I_{e.D+L} = \frac{I_{cr}}{1-\left((2/3)M_{cr}/M_{D+L}\right)^2\left(1-(I_{cr}/I_g)\right)} = 1{,}200{,}498.086cm^4$
$I_{e.SUS.} = \frac{I_{cr}}{1-\left((2/3)M_{cr}/M_{SUS.}\right)^2\left(1-(I_{cr}/I_g)\right)} = 1{,}221{,}122.755cm^4$

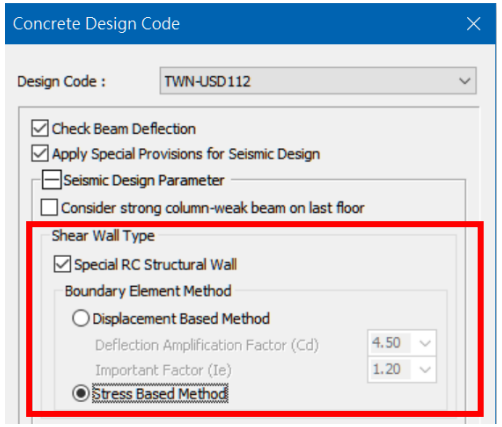
8) Calculate effective inertia of moment
$I_{e.avg.D} = 0.85I_{D(+)} + 0.15I_{D(-)} = 1{,}681{,}587.254cm^4$
$I_{e.avg.D+L} = 0.85I_{D+L(+)} + 0.15I_{D+L(-)} = 1{,}674{,}215.338cm^4$
$I_{e.avg.SUS} = 0.85I_{SUS.(+)} + 0.15I_{SUS.(-)} = 1{,}677{,}309.038cm^4$

9) Calculate deflection
K = 0.800 (Fix-Pin support)
$\delta_{LD} = \frac{5}{48}\frac{K\,M_D\,L^2}{E_c\,I_{e.avg.D}} = 0.0831cm$
$\delta_{LD+L} = \frac{5}{48}\frac{K\,M_{D+L}\,L^2}{E_c\,I_{e.avg.D+L}} = 0.100cm$
$\delta_{LSUS} = \frac{5}{48}\frac{K\,M_{SUS}\,L^2}{E_c\,I_{e.avg.SUS}} = 0.0918cm$
$\delta_{LL} = \delta_{LD+L} - \delta_{LD} = 0.0172cm$
$\delta_{Short\text{-}Term} = \delta_{LL} = 0.0172cm$
$\delta_{Long\text{-}Term} = \delta_{LL} + \lambda\,\delta_{LSUS} = 0.151cm$

TWN-USD 112 RC Design – Special RC Structural Wall 新增特殊結構牆設計

- 牆設計考慮橫向鋼筋面積需求與厚度限制等
- 包括考量邊界構材計算

Special Structural Wall



18.7.3 設計力

V_u應按因數化載重組合之側向力分析而得。

18.7.3.1 若V_{uEh}係由線性分析所取得，設計剪力V_e應按下式計算：

$$V_e = V_{uns} + (\Omega_v \omega_v) V_{uEh} \qquad (18.7.3.1)$$

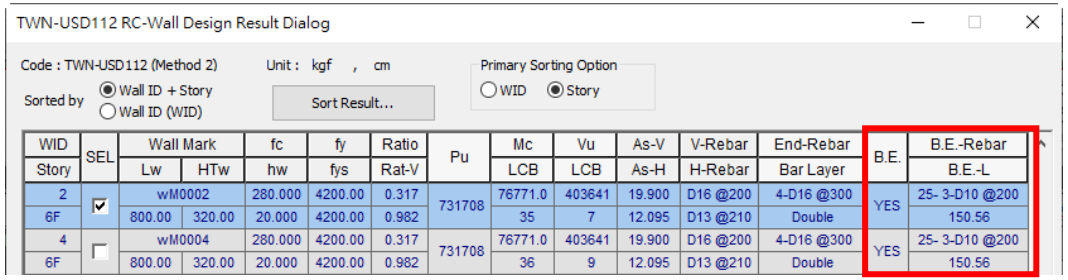
V_{uEh}和V_{uns}為導致最大V_e之適用載重組合所產生的剪力，而Ω_v與ω_v則定義於第18.7.3.2節至第18.7.3.5節。

18.7.3.2 Ω_v與ω_v應按表18.7.3.2計算之，Ω_v亦得採挽曲臨界斷面在包含地震效應(E)之載重組合下M_{pr}/M_u之計算值。

表 18.7.3.2 Ω_v與ω_v

情況	Ω_v		ω_v
$h_{wcs}/\ell_w \le 1.0$	1.0	(a)	1.0
$1.0 < h_{wcs}/\ell_w < 2.0$	(a)與(c)之間線性內插	(b)	
$h_{wcs}/\ell_w \ge 2.0$	1.5	(c)	$0.8 + 0.0288 h_n^{\frac{1}{3}}$ $[0.8 + 0.0134 h_n^{\frac{1}{3}}]$

RC-Wall Design 結果



WID	SEL	Wall Mark		fc	fy	Ratio	Pu	Mc	Vu	As-V	V-Rebar	End-Rebar	B.E.	B.E.-Rebar
Story		Lw	HTw	hw	fys	Rat-V		LCB	LCB	As-H	H-Rebar	Bar Layer		B.E.-L
2	☑	wM0002		280.000	4200.00	0.317	731708	76771.0	403641	19.900	D16 @200	4-D16 @300	YES	25- 3-D10 @200
6F		800.00	320.00	20.000	4200.00	0.982		35	7	12.095	D13 @210	Double		150.56
4	☐	wM0004		280.000	4200.00	0.317	731708	76771.0	403641	19.900	D16 @200	4-D16 @300	YES	25- 3-D10 @200
6F		800.00	320.00	20.000	4200.00	0.982		36	9	12.095	D13 @210	Double		150.56

Special Boundary

詳細計算書結果

3. Shear Capacity (z-Dir.) (Sector I, 0.00R)

Shear	LCB	cLCB7	
	$V_u / \phi V_{n,max}$	403,641.388kgf / 425,692.622kgf = 0.948	OK
	$V_u / \phi V_n$	403,641.388kgf / 411,223.155kgf = 0.982	OK

* cLCB7 : 1.2D + 1.0(1.0Ex1+0.3Ez) + 1.0L

1) Calculate design shear force according to special provisions for seismic design
V_u = 210,570.374kgf
V_{uns} = 0.000kgf
V_{uEh} = 210,570.374kgf
h_{wcs} = 3,930.000cm
l_w = 800.000cm
(h_{wcs} / l_w = 4.9125 ≥ 2.0) 18.7.3.2
h_w = 4,570.000cm
Ω_v = 1.5000
$\omega_v = 0.8 + 0.0288\ h_n^{1/3}$ = 1.2779
$V_e = V_{uns} + \Omega_v\ \omega_v\ V_{uEh}$ = 403,641.388kgf 18.7.3.1
$V_u = V_e$ = 403,641.388kgf

2) Design Parameter
L_w = 800.000cm, h = 20.0
f'c = min(f'c , 700.0kgf/cm
λ = 1.0
ø = 0.75

3) Calculate shear strength by
α_c = 0.530
$A_{cv} = h\ L_w$ = 16,000.000cm
$V_c = \alpha_c \lambda \sqrt{f'_c}\ A_{cv}$ = 14

4) Check required shear reinfc
V_u = 403,641.388kgf
ø = 0.750
ø V_c = ø * V_c = 106,423.15
V_u = 403,641.388kgf > ø \
→ Transverse reinforcem

5) Check spacing of shear rein
s_{max} = min (l_w /5, 3 h, 4

4. Detailing rules for the local ductility of concrete members (Sector I, 0.00R)

Boundary Element	LCB	cLCB8		
	BEL_{use} , BEL_{req}	BEL_{use} = 150.557cm ≤ BEL_{req} = 150.557cm		OK
	S_{use} , S_{req}	S_{use} = 20.000cm > S_{req} = 6.667cm		NG

* cLCB8 : 1.2D + 1.0(1.0Ex1-0.3Ez) + 1.0L

1) Compute boundary element transverse reinforcement length.
c = 230.557cm
BEL_{req} = max [c - 0.1L_w , c / 2] = 150.557cm 18.7.6.4

2) Determine if special boundary elements are required by stress based method.
σ = 149.022kgf/cm² > 0.2 f'c = 56.000kgf/cm² 18.7.6.3
- Special boundary elements are required

3) Check special boundary elements are required in current wall.
σ = 63.686kgf/cm² > 0.15 f'c = 42.000kgf/cm² 18.7.6.3
- Special boundary element transverse reinforcement is required

4) Check dimension of the special boundary element
b = 20.000cm
h_u = 320.000cm
$b > \frac{h_u}{16}$ → O.K
If H_w / L_w > 2, c / L_w > 3/8
b < 30.000cm → Not Acceptable

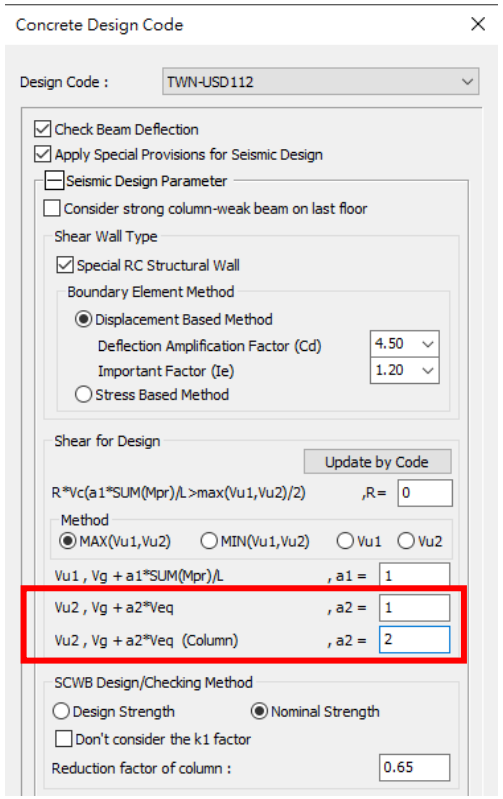
5) Compute maximum spacing of horizontal rebar for boundary element.
A_{h1} = 0.710cm²
$h_x = h_w - 2 * D_e + Dia_{end} + Dia_{hor}$ = 17.543cm
s_{max1} = min [$Dimension_{min}$ /3 , 8 d_b , 20.000cm] = 6.667cm Table 18.7.6.5(b)
s_{max2} = min[max[10.000cm, 10 + (35 - h_x)/3 , 15.000cm] = 15.819cm 18.4.5.3 (e)
s_{max} = min [s_{max1} ,$_{max2}$] = 6.667cm
s_{use} = 20.000cm
s_{use} = 20.000cm > s_{max} = 6.667cm → Not Acceptable

6) Compute horizontal rebar for special boundary element for thickness direction.
$h_{c1} = BEL_{req} - 2 * D_e + Dia_{end} + Dia_{hor}$ = 146.194cm
$A_{sh1i} = 0.3\ S\ h_{c1} \left(\frac{A_g}{A_{ch}} - 1 \right) f'_c / f_{yt}$ = 10.180cm²
$A_{sh1ii} = 0.09\ S\ h_{c1}\ f'_c / f_{yt}$ = 17.543cm²

TWN-USD 112 RC Design – Shear for Seismic Design Setting 新增柱的剪力強度設定係數

- 梁和柱桿件可以分別採用不同的放大係數(a2)來計算考量地震效應的設計剪力

Shear for Seismic Design



詳細計算書結果-Beam

1. Member Information

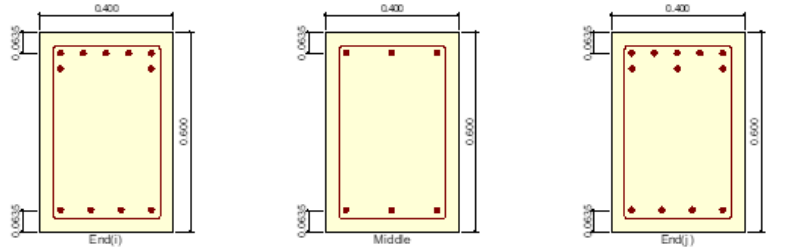
1) Design Code
TWN-USD112

2) Section Property
G1 (ID : 11)

3) Material
Concrete
f'_c = 2,800,000.000kgf/m², E_c = 2.007984e+9kgf/m²
Reinforcement
f_y = 42,000,000.000kgf/m², f_{ys} = 28,000,000.000kgf/m², E_s = 2.040000e+10kgf/m²

4) Length
L = 9.500m

5) Reinforcement Data



	End(i)	Middle	End(j)
Top	5-D22 2-D22	3-D22 -	5-D22 3-D22
Bottom	4-D22	3-D22	4-D22
Stirrups	2-D13@120	2-D13@220	2-D13@110

6) Description of applied factors for design
Special Provisions For Seismic Design : Special Moment Frames
- Seismic Scale Up Factor for Shear (α_1) = 1.000
- Seismic Scale Up Factor for Shear (α_2) = 1.000
- MAX[Shear by α_1 , Shear by α_2]

a2 = 1 (for Beam)

詳細計算書結果-Column

1. Member Information

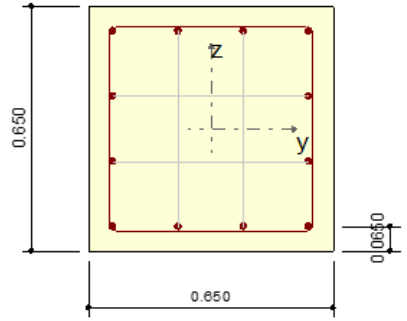
1) Design Code
TWN-USD112

2) Section Property
C1 (ID : 1)

3) Material
Concrete
f'_c = 2,800,000.000kgf/m², E_c = 2.007984e+9kgf/m²
Reinforcement
f_y = 42,000,000.000kgf/m², f_{ys} = 28,000,000.000kgf/m², E_s = 2.040000e+10kgf/m²

4) Length
L = 4.200m

5) Reinforcement Data



	Main	Stirrups
End Part	12-4-D22	4-D13@90
Middle Part	12-4-D22	4-D13@130

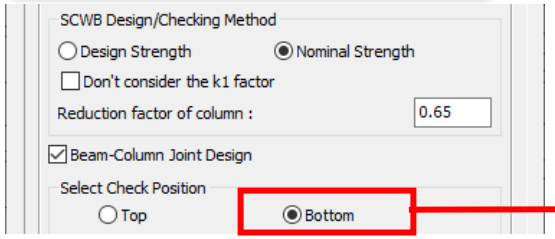
6) Description of applied factors for design
Special Provisions For Seismic Design : Special Moment Frames
- Seismic Scale Up Factor for Shear (α_1) = 1.000
- Seismic Scale Up Factor for Shear (α_2) = 2.000
- MAX[Shear by α_1 , Shear by α_2]

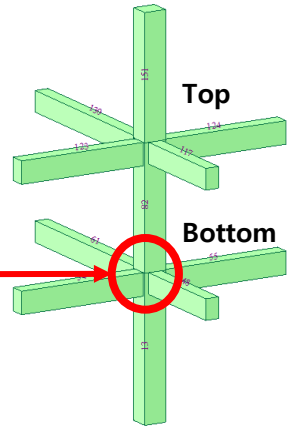
a2 = 2 (for Column)

TWN-USD 112 RC Design – Beam-Column Joint Design 梁柱接頭剪力檢核

- 柱桿件上、下兩端均可檢核接頭剪力
- 以1D梁/柱桿件中心-中心 (Center to Center) 計算有效面積 A_j

接頭剪力-Bottom柱底





接頭剪力檢核結果

TWN-USD112 RC-Column Design Result Dialog For Ductile Design

Code : TWN-USD112 Unit : kgf , m Primary Sorting Option: SECT / MEMB

Sorted by: Member / Property

MEMB / SECT	SEL	Section Bc	Hc	fc / Height	fy / fys	LCB	Pu / Rat-P	Mc / Rat-M	Ast	V-Rebar	LCB	Vu.end / Vu.mid	Rat-V.end / Rat-V.mid	As-H.end / As-H.mid	H-Rebar.end / H-Rebar.mid	Vjhd / Rat-J
81		C2		2800000	4.2E+07	9	97776.7	35036.7	0.0046	12-4-D22	9	36226.0	0.380	0.0008	4-D13 @90	153443
2		0.600	0.650	3.6000	2.8E+07		0.453	0.450			9	36226.0	0.489	0.0008	4-D13 @130	0.522
82		C2		2800000	4.2E+07	9	81737.6	37336.0	0.0046	12-4-D22	9	38073.7	0.407	0.0011	4-D13 @90	191620
2		0.600	0.650	3.6000	2.8E+07		0.465	0.464			9	38073.7	0.526	0.0011	4-D13 @130	0.652

3. Shear Capacity

[END]	y (LCB : 9, POS : J)	z (LCB : 9, POS : J)
Applied Shear Force (Vu)	2505.71 kgf	38073.7 kgf
Design Shear Strength (φVc+φVs)	23992.2 + 63415.3 = 87407.5 kgf	24168.9 + 69342.0 = 93510.9 kgf
Shear Ratio	0.029 < 1.000 ..... O.K	0.407 < 1.000 ..... O.K
As-H.req	4-D13 @90	0.00113 m²/m, 4-D13 @90

[MIDDLE]	y (LCB : 9, POS : 1/2)	z (LCB : 9, POS : 1/2)
Applied Shear Force (Vu)	2505.71 kgf	38073.7 kgf
Design Shear Strength (φVc+φVs)	24161.2 + 43902.9 = 68064.1 kgf	24339.4 + 48006.0 = 72345.4 kgf
Shear Ratio	0.037 < 1.000 ..... O.K	0.526 < 1.000 ..... O.K
As-H.req	4-D13 @130	0.00112 m²/m, 4-D13 @130

[JOINT : Bottom]	y (LCB : 9, POS : I)	z (LCB : 9, POS : I)
Joint Shear (Vhj/φVnj)	103235 / 216335 = 0.477	191620 / 293994 = 0.652
Joint Ratio	0.477 < 1.000 ..... O.K	0.652 < 1.000 ..... O.K

詳細計算書結果

2. Beam-Column Joint Capacity (y-Dir.) (Bottom, 0.00R)

Joint	LCB	cLCB9	
	V_{hjd} / V_{hjc}	103,234.777kgf / 216,335.183kgf = 0.477	OK

* cLCB9 : 0.9D - 1.0EX

1) Compute joint geometry information
- b_b = 0.400m
- b_c = 0.650m
- h_c = 0.600m
- h_j = 0.600m
- $x_1 = x_2$ = min ((b_c -b_b)/2 , h_c /4) = 0.125m
- b_j = min (b_c , $b_b + x_1 + x_2$) = 0.650m

2) Compute horizontal shear force
- $\sum M_{bpr.CW}$ = 61,485.226kgf·m
- $\sum M_{bpr.CCW}$ = 61,485.226kgf·m
- $\sum V_{be}$ = 37,762.145kgf
- l_c = 3.900m
- $V_{col.CW}$ = ($\sum M_{bpr.CW} + \sum V_{be} * h_j / 2$) / l_c = 18,670.223kgf
- $V_{col.CCW}$ = ($\sum M_{bpr.CCW} + \sum V_{be} * h_j / 2$) / l_c = 18,670.223kgf
- Applied shear force: V_{col} = max ($V_{col.CW}$ $V_{col.CCW}$) = 18,670.223kgf
- Beam demand top: $A_{s1} * 1.25\ f_{yt}$ = 60,952.500kgf — 18.5.2.1
- Beam demand bottom: $A_{s2} * 1.25\ f_{yt}$ = 60,952.500kgf
- Column Location Type : Interior Column
- V_{hjd} = ($A_{s1} + A_{s2}$) * 1.25 f_{yt} - V_{col} = 103,234.777kgf — 18.5.4.1

3) Compute nominal joint shear capacity
- f'_c = 2,800,000.000kgf/m²
- A_j = 0.390m²
- The joint is classified as, — 15.2.6~8
  Continuous column + Continuous beams + Not confined column.
- $V_n = 3.9\lambda \sqrt{f'_c}\ A_j$ = 254,511.980kgf — Table 18.5.4.3

4) Compute design joint shear capacity
- ø = 0.850
- V_{hjc} = ø V_n = 216,335.183kgf

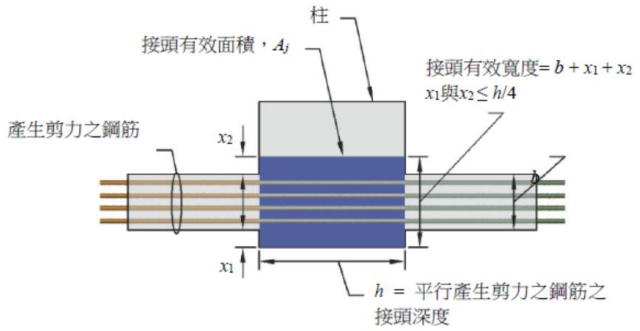


表15.4.2.3 接頭剪力標稱強度V_n

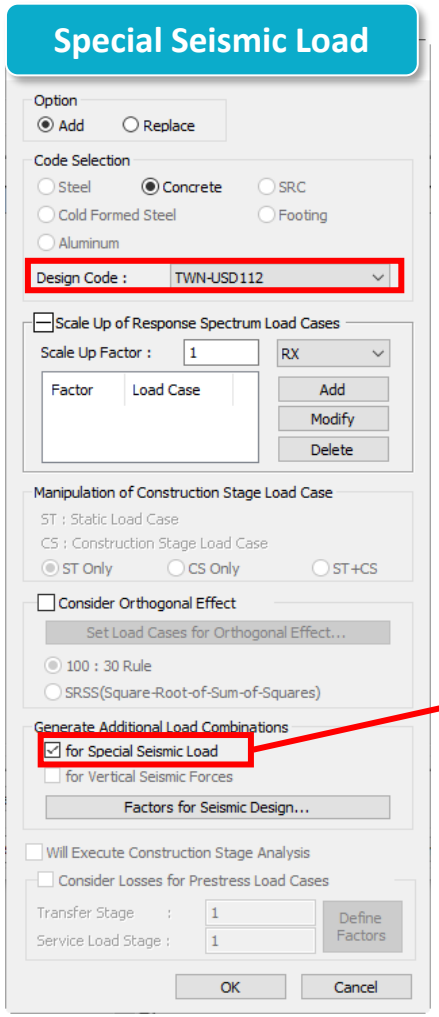
柱	V_n設計方向之梁	依第15.2.8節規定之橫向梁圍束	V_n, kgf [N][1]
連續或符合第15.2.6節規定	連續或符合第15.2.7節規定	圍束	$5.3\lambda\sqrt{f'_c}A_j$ [$1.7\lambda\sqrt{f'_c}A_j$]
		非圍束	$3.9\lambda\sqrt{f'_c}A_j$ [$1.2\lambda\sqrt{f'_c}A_j$]
	其他	圍束	$3.9\lambda\sqrt{f'_c}A_j$ [$1.2\lambda\sqrt{f'_c}A_j$]
		非圍束	$3.2\lambda\sqrt{f'_c}A_j$ [$1.0\lambda\sqrt{f'_c}A_j$]
其他	連續或符合第15.2.7節規定	圍束	$3.9\lambda\sqrt{f'_c}A_j$ [$1.2\lambda\sqrt{f'_c}A_j$]
		非圍束	$3.2\lambda\sqrt{f'_c}A_j$ [$1.0\lambda\sqrt{f'_c}A_j$]
	其他	圍束	$3.2\lambda\sqrt{f'_c}A_j$ [$1.0\lambda\sqrt{f'_c}A_j$]
		非圍束	$2.1\lambda\sqrt{f'_c}A_j$ [$0.66\lambda\sqrt{f'_c}A_j$]

[1]若混凝土使用輕質粒料，λ應為0.75；若混凝土使用常重粒料，λ應為1.0。

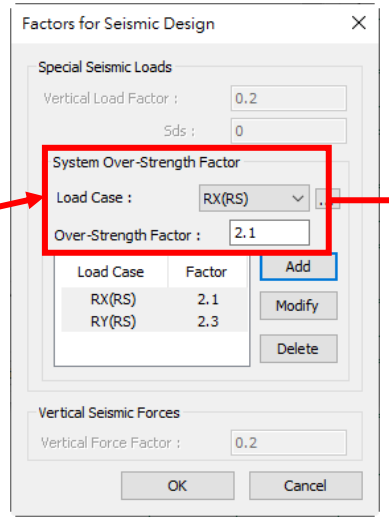
TWN-USD 112 – Special Load Combinations for Seismic Design 新增應用於耐震設計的特殊載重組合

- 額外產生特殊耐震設計時考慮的載重組合 (Special Seismic Load)
- 輸入地震力載重對應的 Over-Strength Factors (Ω_o)自動建立特殊耐震設計載重組
- 利用 Seismic Load Combinations Type 功能將特殊載重組應用到耐震桿件

Special Seismic Load



Over-Strength Factor



Load Combinations

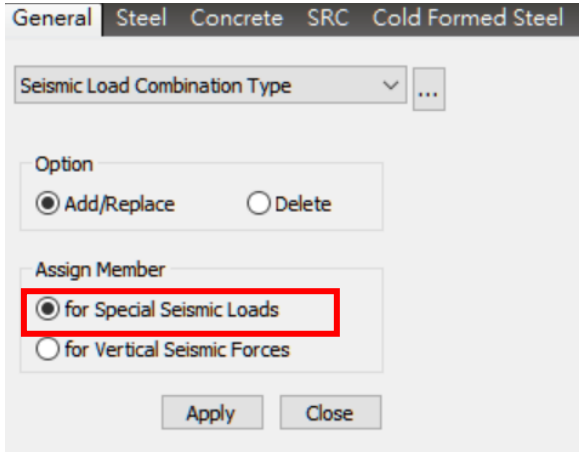
General | Steel Design | Concrete Design | SRC Design | Cold Formed Steel Design | Footing Design | Aluminum Design |

Load Combination List

No	Name	Active	Type	Description
1	cLCB1	Strengt	Add	1.4(D)
2	cLCB2	Strengt	Add	1.2(D) + 1.6(L)
3	cLCB3	Strengt	Add	1.2(D) + 1.0EX + 1.0(L)
4	cLCB4	Strengt	Add	1.2(D) + 1.0EY + 1.0(L)
5	cLCB5	Strengt	Add	1.2(D) - 1.0EX + 1.0(L)
6	cLCB6	Strengt	Add	1.2(D) - 1.0EY + 1.0(L)
7	cLCB7	Strengt	Add	1.2(D) + 1.0(1.0)RX + 1.0(L)
8	cLCB8	Strengt	Add	1.2(D) + 1.0(1.0)RY + 1.0(L)
9	cLCB9	Strengt	Add	1.2(D) - 1.0(1.0)RX + 1.0(L)
10	cLCB10	Strengt	Add	1.2(D) - 1.0(1.0)RY + 1.0(L)
11	cLCB11	Strengt	Add	0.9D
12	cLCB12	Strengt	Add	0.9(D) + 1.0EX
13	cLCB13	Strengt	Add	0.9(D) + 1.0EY
14	cLCB14	Strengt	Add	0.9(D) - 1.0EX
15	cLCB15	Strengt	Add	0.9(D) - 1.0EY
16	cLCB16	Strengt	Add	0.9(D) + 1.0(1.0)RX
17	cLCB17	Strengt	Add	0.9(D) + 1.0(1.0)RY
18	cLCB18	Strengt	Add	0.9(D) - 1.0(1.0)RX
19	cLCB19	Strengt	Add	0.9(D) - 1.0(1.0)RY
20	cLCB20	Service	Add	SERV :1.0D + 1.0L
21	cLCB21	Special	Add	1.4(D)
22	cLCB22	Special	Add	1.2(D) + 1.6(L)
23	cLCB23	Special	Add	1.2(D) + 1.0(1.0)EX + 1.0(L) + (0.2)(0.0)D
24	cLCB24	Special	Add	1.2(D) + 1.0(1.0)EY + 1.0(L) + (0.2)(0.0)D
25	cLCB25	Special	Add	1.2(D) - 1.0(1.0)EX + 1.0(L) + (0.2)(0.0)D
26	cLCB26	Special	Add	1.2(D) - 1.0(1.0)EY + 1.0(L) + (0.2)(0.0)D
27	cLCB27	Special	Add	1.2(D) + 1.0(1.0)(2.1)RX + 1.0(L) + (0.2)(0.0)D
28	cLCB28	Special	Add	1.2(D) + 1.0(1.0)(2.30)RY + 1.0(L) + (0.2)(0.0)D
29	cLCB29	Special	Add	1.2(D) - 1.0(1.0)(2.1)RX + 1.0(L) + (0.2)(0.0)D
30	cLCB30	Special	Add	1.2(D) - 1.0(1.0)(2.30)RY + 1.0(L) + (0.2)(0.0)D
31	cLCB31	Special	Add	0.9D
32	cLCB32	Special	Add	0.9(D) + 1.0(1.0)EX - (0.2)(0.0)D
33	cLCB33	Special	Add	0.9(D) + 1.0(1.0)EY - (0.2)(0.0)D
34	cLCB34	Special	Add	0.9(D) - 1.0(1.0)EX - (0.2)(0.0)D
35	cLCB35	Special	Add	0.9(D) - 1.0(1.0)EY - (0.2)(0.0)D
36	cLCB36	Special	Add	0.9(D) + 1.0(1.0)(2.1)RX - (0.2)(0.0)D
37	cLCB37	Special	Add	0.9(D) + 1.0(1.0)(2.30)RY - (0.2)(0.0)D
38	cLCB38	Special	Add	0.9(D) - 1.0(1.0)(2.1)RX - (0.2)(0.0)D
39	cLCB39	Special	Add	0.9(D) - 1.0(1.0)(2.30)RY - (0.2)(0.0)D

Special Load Combinations

Seismic Load Combination Type



Improved Steel Design, Irregularity Check & Other Features according to IS Code (India)

改善印度規範之鋼構設計、不規則檢討等多項功能

The items below have been updated. If you want to know more details, please click on [Here]

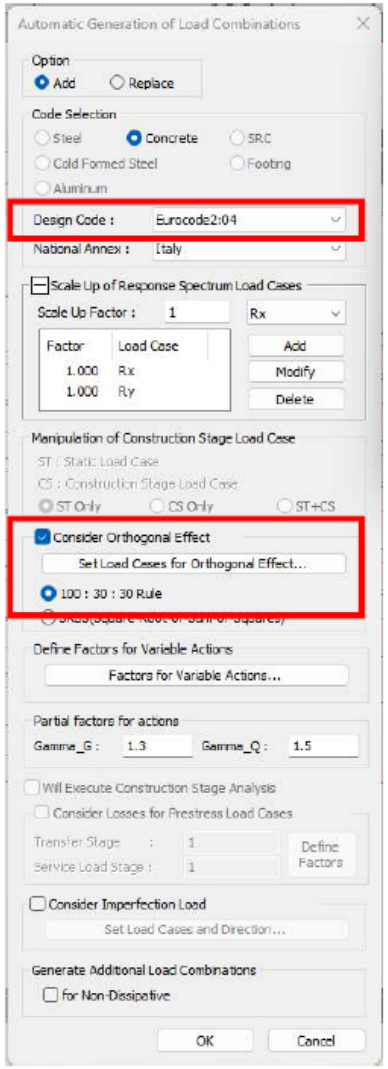
- ***Added Seismic Provisions for Steel Design as per IS : 18168 -2023***
  1. *Additional Seismic Load Combination as per IS : 18168 : 2023*
  2. *Column to beam strength ratio as per IS : 18168 -2023*
  3. *Seismic Beam Design for SMRF as per IS : 18168-2023*
  4. *Seismic Beam Design & Brace Design for SCBF as per IS : 18168-2023*

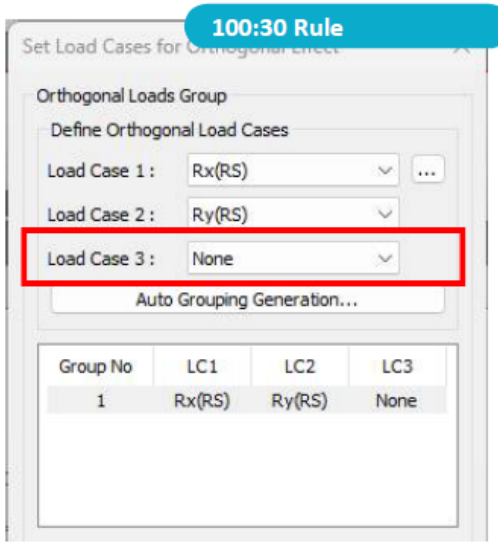
- ***Irregularity Check according to IS : 1893 -2016***
  1. *Torsional Irregularity & Weight Irregularity*
  2. *Stiffness Irregularity*
  3. *Capacity Irregularity*
  4. *Irregular modes of oscillation*

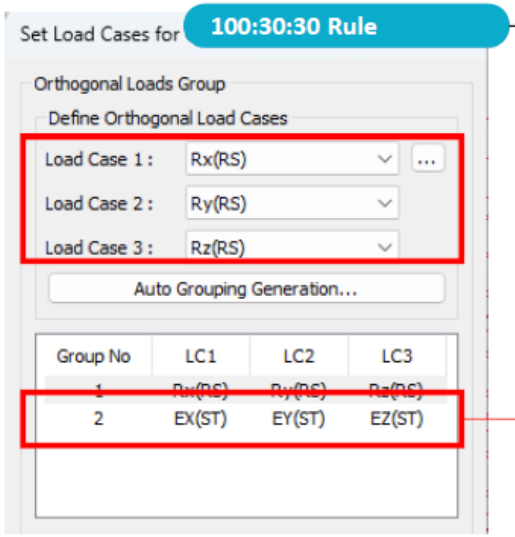
- ***Irregularity Check according to IS : 16700 -2023***
  1. *Stiffness Irregularity & Capacity Irregularity*
  2. *Natural modes of vibration*

- ***Approximate Time period of building according to IS : 16700-2023***
- ***Lateral Story Drift Check according to IS : 16700 – 2023***
- ***Stability Coefficient Check according to IS : 16700 - 2023***

100:30:30 Rule according to Eurocode 8 新增歐洲規範 100:30:30 載重組合規則







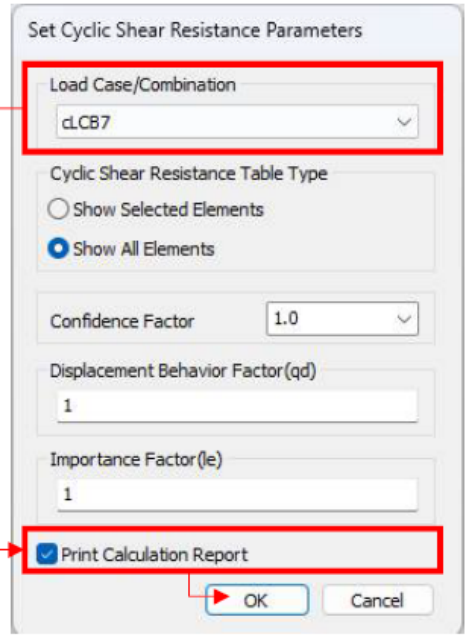
- 100:30 rule is applied when not selecting 'Load case 3'
- 100:30:30 rule is applied when selecting all load cases

	No	Name	Active	Type	DL(ST)	LL(ST)	WX(ST)	WY(ST)	EX(ST)	EY(ST)	EZ(ST)
▶	1	cLCB10	Stren	Add	1.0000	0.3000			1.0000	0.3000	0.3000
	2	cLCB11	Stren	Add	1.0000	0.3000			1.0000	0.3000	-0.300
	3	cLCB12	Stren	Add	1.0000	0.3000			1.0000	-0.300	0.3000
	4	cLCB13	Stren	Add	1.0000	0.3000			1.0000	-0.300	-0.300
	5	cLCB14	Stren	Add	1.0000	0.3000			0.3000	1.0000	0.3000
	6	cLCB15	Stren	Add	1.0000	0.3000			-0.3000	1.0000	0.3000
	7	cLCB16	Stren	Add	1.0000	0.3000			0.3000	1.0000	-0.300
	8	cLCB17	Stren	Add	1.0000	0.3000			-0.3000	1.0000	-0.300
	9	cLCB18	Stren	Add	1.0000	0.3000			0.3000	0.3000	1.0000
	10	cLCB19	Stren	Add	1.0000	0.3000			0.3000	-0.300	1.0000
	11	cLCB20	Stren	Add	1.0000	0.3000			-0.3000	0.3000	1.0000
	12	cLCB21	Stren	Add	1.0000	0.3000			-0.3000	-0.300	1.0000
	13	cLCB22	Stren	Add	1.0000	0.3000			-1.0000	-0.300	-0.300
	14	cLCB23	Stren	Add	1.0000	0.3000			-1.0000	-0.300	0.3000
	15	cLCB24	Stren	Add	1.0000	0.3000			-1.0000	0.3000	-0.300
	16	cLCB25	Stren	Add	1.0000	0.3000			-1.0000	0.3000	0.3000
	17	cLCB26	Stren	Add	1.0000	0.3000			-0.3000	-1.000	-0.300
	18	cLCB27	Stren	Add	1.0000	0.3000			0.3000	-1.000	-0.300
	19	cLCB28	Stren	Add	1.0000	0.3000			-0.3000	-1.000	0.3000
	20	cLCB29	Stren	Add	1.0000	0.3000			0.3000	-1.000	0.3000
	21	cLCB30	Stren	Add	1.0000	0.3000			-0.3000	-0.300	-1.000
	22	cLCB31	Stren	Add	1.0000	0.3000			-0.3000	0.3000	-1.000
	23	cLCB32	Stren	Add	1.0000	0.3000			0.3000	-0.300	-1.000
	24	cLCB33	Stren	Add	1.0000	0.3000			0.3000	0.3000	-1.000

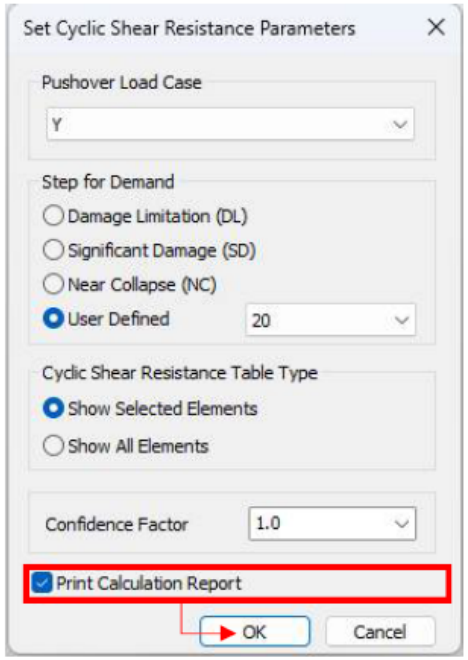
Detail Report for Cyclic Shear Resistance Check 新增循環剪切作用力檢核詳細報表

- Only activated for individual load cases
- Report provided separately for wall and Frame

Concrete Design



Pushover Result



Cyclic Shear Resistance Check Report for Frame

MIDAS/Text Editor - [Joint Design_CyclicFram.txt]

```
=============================================================================
  [[[+]]]   Element : 1 (Primary), Load = cLCB7, CF = 1.000
=============================================================================

-----------------------------------------------------------------------------
 *.  Pos : I, Dir : Fy - Mz
-----------------------------------------------------------------------------

( ). Analysis result.
  N       =     1215.220 kN
  V       =      124.024 kN
  M       =      277.415 kN-m
  γs      =        1.150
  K       =        2.100
  ε       =     0.001791
  L       =     4200.000 mm
  D       =      585.000 mm
  θy      = K * ε * L / D =     0.026999

  q       =     1.000000
  θ       =     0.000047
  μpl     = max[ ABS (q*θ / θy) - 1, 0.0 ] -     0.000000
  x       =      221.717 mm

( ). Material Information.
  γel     =        1.150
  γc      =        1.500
  γs      =        1.150
  fc      = fck  / (CF * γc) =      18.306 MPa
  fyw     = fywk / (CF * γs) =     238.771 MPa

( ). Section Information.
  h       =      650.000 mm
  Lv      = M / V     =     2236.782 mm
  Ac      =   380250.000 mm^2
  ρtot    =     0.029311

( ). Calculate Vw.
  ρw      = Asv / (b * s)    =     0.078154
  z       =      585.000 mm
  Vw      = ρw * b * z * fyw =     7095.785 kN

( ). Calculate VR.
  Param1  = (h-x) / 2Lv * min(N, 0.55*Ac*fc) =      116.341 kN
  Param2  = 1 - 0.05 * min(5, μpl)           =        1.000
  Param3  = 0.16 * max(0.5, 100*ρtot)        =        0.469
  Param4  = 1.0 - 0.16 * min(5, Lv / h)      =        0.449
  VR      = 1/γel * [ Param1 + Param2 * (Param3 * Param4 * sqrt(fc) * Ac + Vw ]
          =     6569.581 kN
```

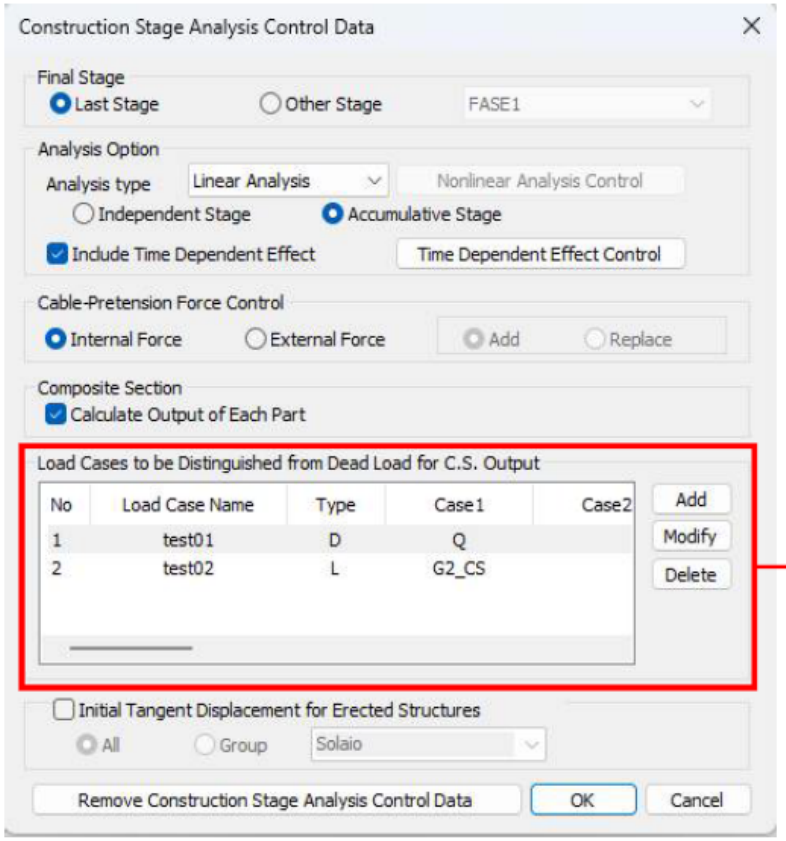
Cyclic Shear Resistance Check Report for Wall

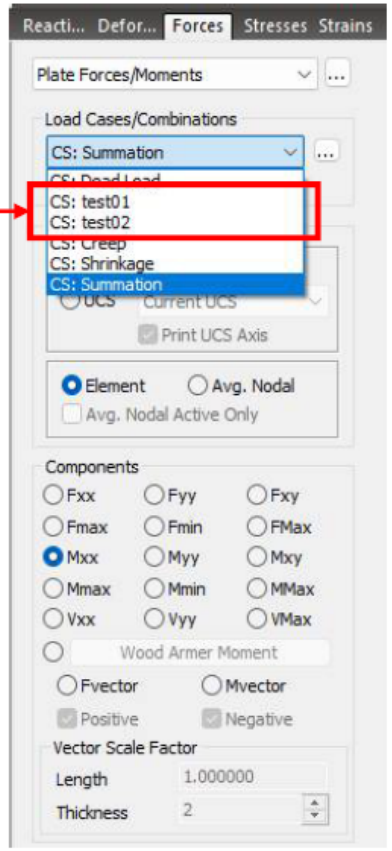
MIDAS/Text Editor - [Joint Design_CyclicWall.txt]

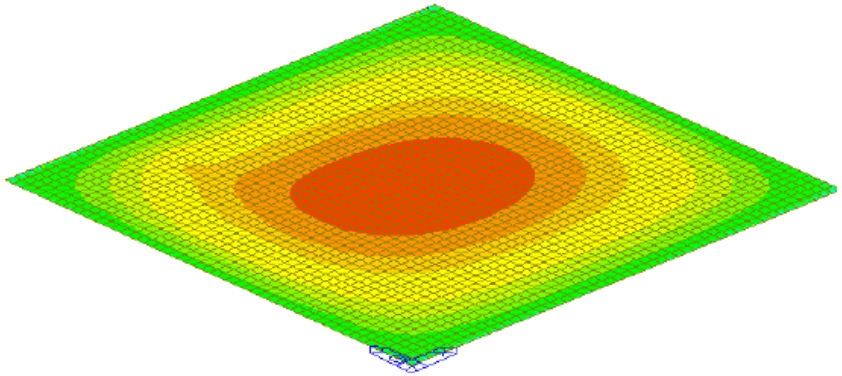
```
=============================================================================
  [[[+]]]   Wall ID : 1, Story : Base:1F (Primary), Load = cLCB7, CF = 1.000
=============================================================================

-----------------------------------------------------------------------------
 *.  Pos : I, Dir : Fz - My
-----------------------------------------------------------------------------

( ). Analysis result.
  N       =     3000.861 kN
  V       =      722.126 kN
  M       =     3884.590 kN-m
  q       =     1.000000
  θ       =     0.002124
  μpl     = max[ ABS (q*θ / θy) - 1, 0.0 ] -     0.000000
  x       =      801.902 mm

( ). Material Information.
  γel     =        1.150
  γc      =        1.500
  γs      =        1.150
  fc      = fck  / (CF * γc) =      18.306 MPa
  fyw     = fywk / (CF * γs) =     238.771 MPa

( ). Section Information.
  h       =     4600.000 mm
  Lv      = M / V     =     5379.384 mm
  Ac      =  1592220.000 mm^2
  ρtot    =     0.006569

( ). Calculate Vw.
  ρw      = Asv / (b * s)    =     405.714286
  z       =     4094.280 mm
  Vw      = ρw * b * z * fyw = 138818309.343 kN

( ). Calculate VR.
  Param1  = (h-x) / 2Lv * min(N, 0.55*Ac*fc) =     1059.374 kN
  Param2  = 1 - 0.05 * min(5, μpl)           =        1.000
  Param3  = 0.16 * max(0.5, 100*ρtot)        =        0.105
  Param4  = 1.0 - 0.16 * min(5, Lv / h)      =        0.813
  VR      = 1/γel * [ Param1 + Param2 * (Param3 * Param4 * sqrt(fc) * Ac + Vw ]
          = 120713000.650 kN
```

Improvement for Load Case Setting in Construction Stage Analysis Control Data 改善施工階段分析的載重設定功能

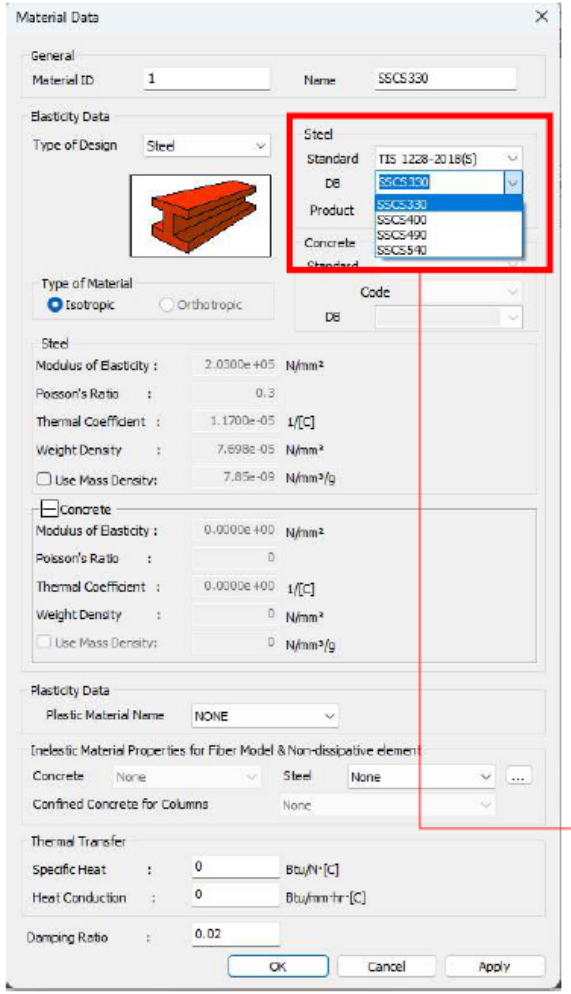
- **Separate analysis results can be obtained for the load case specified by the user. (Previously, only Live Load could be separated from Dead Load.)**



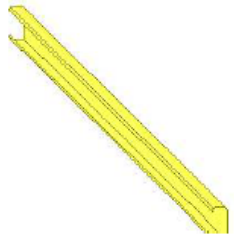


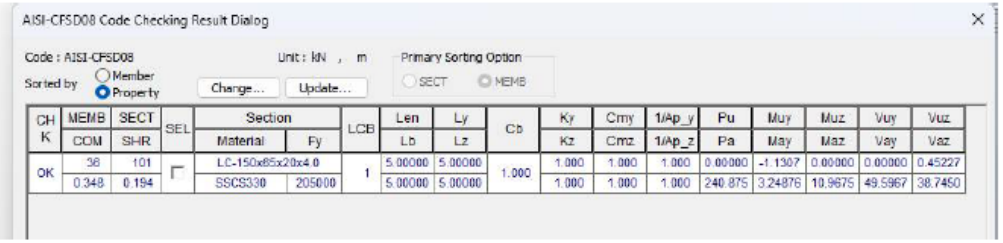


Add Cold Formed Material of TIS 1228-2018 (Thailand) 新增泰國冷軋鋼材資料庫



- Cold-formed section design is supported for only AISI-CF08.



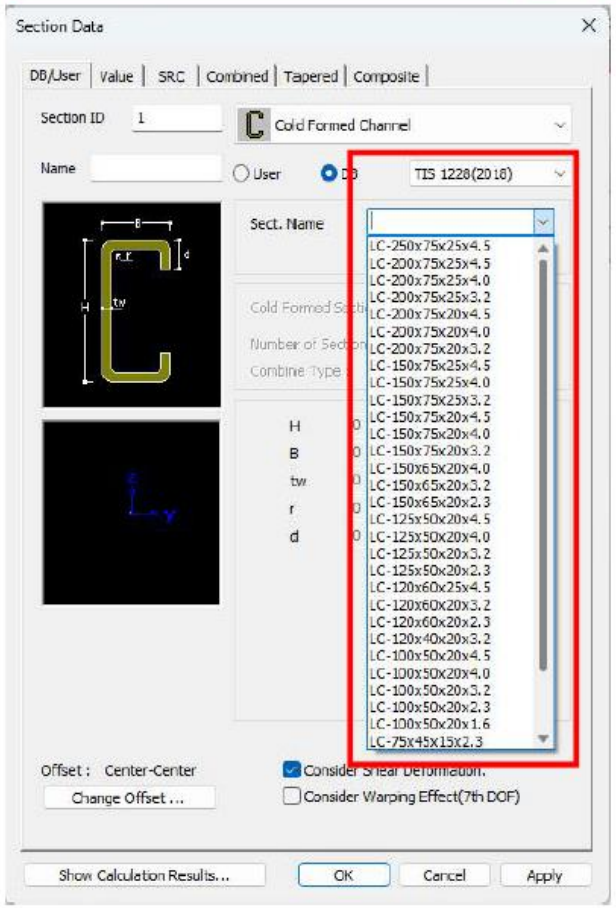


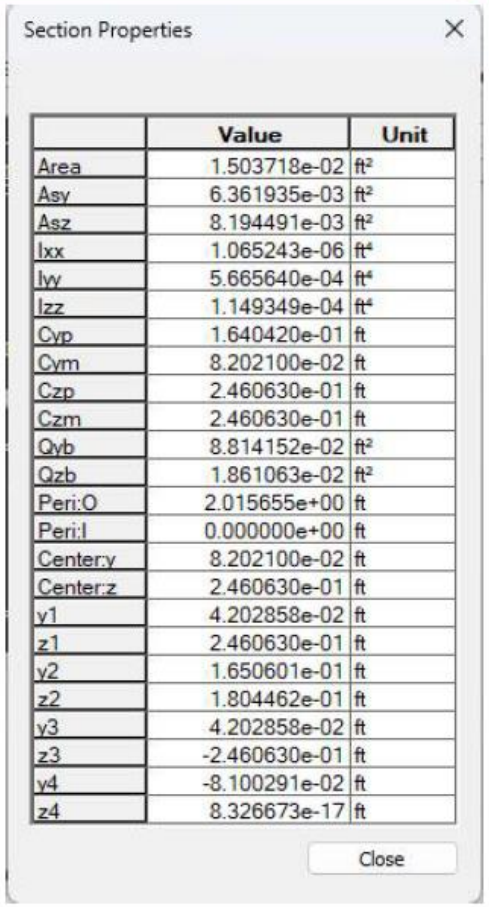
- When applied to a cross-section with a thickness exceeding 6mm, the strength value is applied as 0.

DB	Es Modulus of Elasticity	v Possion's Ratio	α Thermal Coefficient	W Weight Density	Fu Tensile Strength	Fy Yield Strength	Limit for Thickness
SSCS330	203,000 Mpa	0.3	11.7 μm/m	7,850 kg/m^3	330 Mpa	205 Mpa	≤ 6mm
SSCS400					400 Mpa	245 Mpa	
SSCS490					490 Mpa	285 Mpa	
SSCS540					540 Mpa	400 Mpa	

Add Cold Formed Section of TIS 1228-2018 (Thailand) 新增泰國冷軋型鋼斷面資料庫

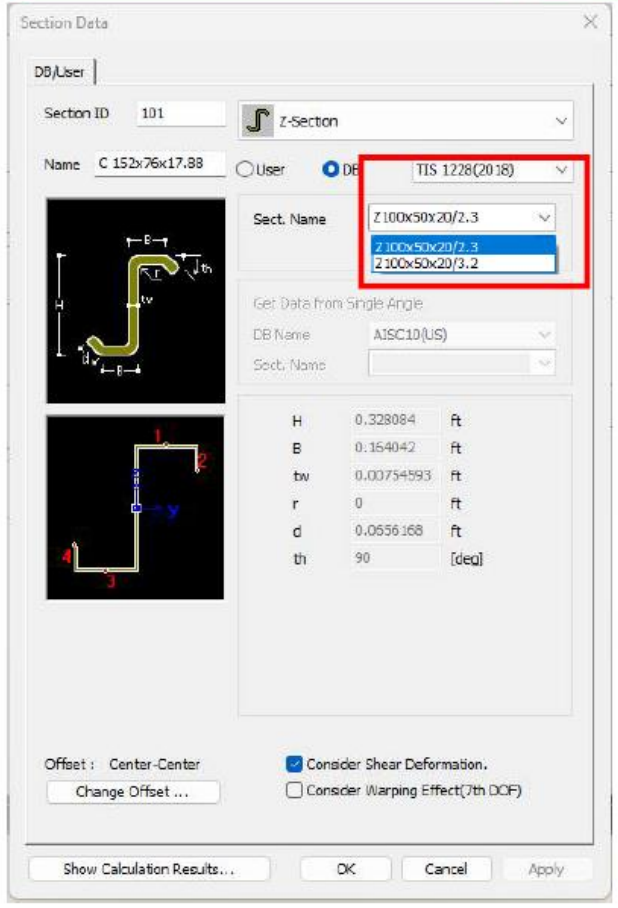
Channel

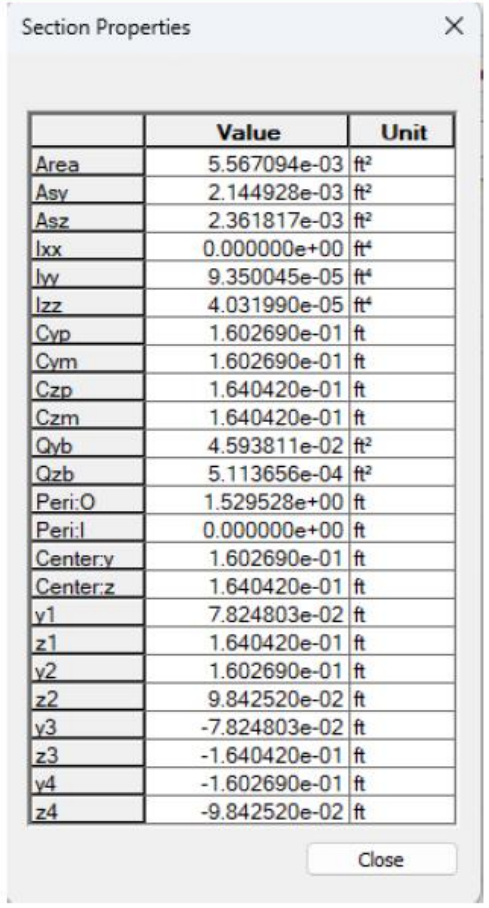




	Value	Unit
Area	1.503718e-02	ft²
Asy	6.361935e-03	ft²
Asz	8.194491e-03	ft²
Ixx	1.065243e-06	ft⁴
Iyy	5.665640e-04	ft⁴
Izz	1.149349e-04	ft⁴
Cyp	1.640420e-01	ft
Cym	8.202100e-02	ft
Czp	2.460630e-01	ft
Czm	2.460630e-01	ft
Qyb	8.814152e-02	ft²
Qzb	1.861063e-02	ft²
Peri:O	2.015655e+00	ft
Peri:I	0.000000e+00	ft
Center:y	8.202100e-02	ft
Center:z	2.460630e-01	ft
y1	4.202858e-02	ft
z1	2.460630e-01	ft
y2	1.650601e-01	ft
z2	1.804462e-01	ft
y3	4.202858e-02	ft
z3	-2.460630e-01	ft
y4	-8.100291e-02	ft
z4	8.326673e-17	ft

Z-Section



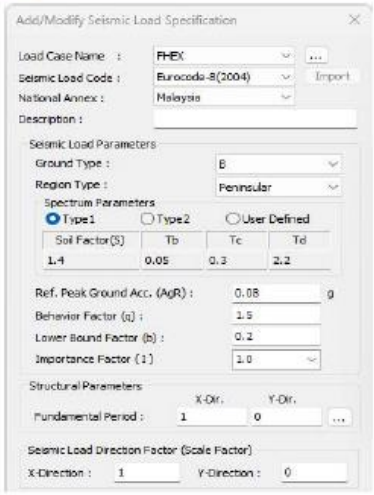


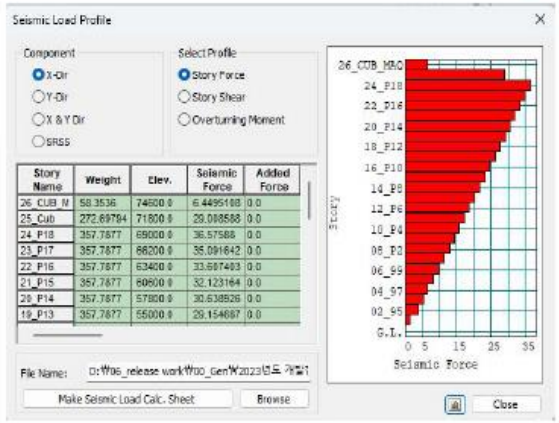
	Value	Unit
Area	5.567094e-03	ft²
Asy	2.144928e-03	ft²
Asz	2.361817e-03	ft²
Ixx	0.000000e+00	ft⁴
Iyy	9.350045e-05	ft⁴
Izz	4.031990e-05	ft⁴
Cyp	1.602690e-01	ft
Cym	1.602690e-01	ft
Czp	1.640420e-01	ft
Czm	1.640420e-01	ft
Qyb	4.593811e-02	ft²
Qzb	5.113656e-04	ft²
Peri:O	1.529528e+00	ft
Peri:I	0.000000e+00	ft
Center:y	1.602690e-01	ft
Center:z	1.640420e-01	ft
y1	7.824803e-02	ft
z1	1.640420e-01	ft
y2	1.602690e-01	ft
z2	9.842520e-02	ft
y3	-7.824803e-02	ft
z3	-1.640420e-01	ft
y4	-1.602690e-01	ft
z4	-9.842520e-02	ft

Add Static Seismic Load and Response Spectrum Function according to EC-8(2004) Malaysia N.A.

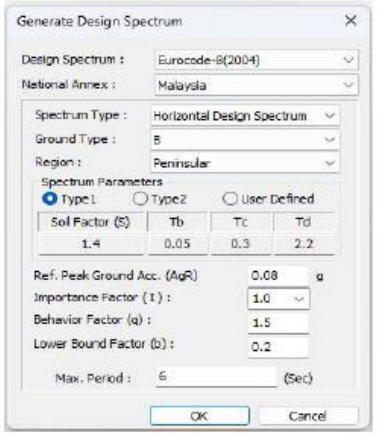
新增歐規馬來西亞特區的靜態設計地震力與反應譜函數

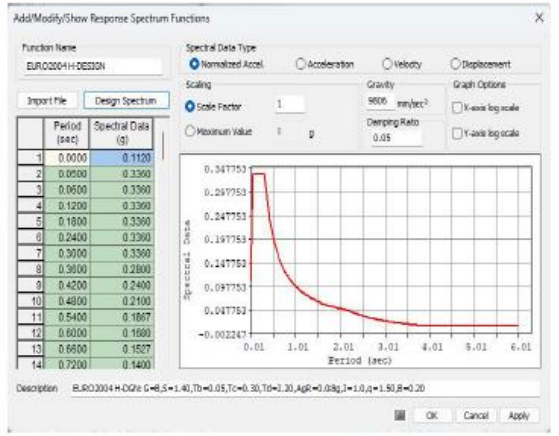
Static Seismic Load





Response Spectrum Function





Malaysia values for nationally determined parameters described in MS EN 1998-1:2015

• Parameter for Horizontal Response Spectrum

In the absence of deep soil effects, and for site specific information Malaysia spectra. Use the table below or refer to Annex C.

Peninsular:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.05	0.2	2.2
B	1.4	0.05	0.3	2.2
C	1.15	0.05	0.5	2.2
D	1.35	0.3	0.8	2.2
E	1.4	0.15	0.5	2.2

Sabah:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.1	0.4	2
B	1.4	0.15	0.4	2
C	1.35	0.15	0.6	2
D	1.35	0.2	0.8	2
E	1.4	0.15	0.5	2

Sarawak:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.05	0.5	1.2
B	1.2	0.15	0.5	1.2
C	1.3	0.2	0.5	1.2
D	1.35	0.2	0.5	1.2
E	1.4	0.15	0.5	1.2

Or alternatively, for Malaysia spectra, site natural period (T_S) calculation is required for soil deposit exceeding 30 m in depth (deep geology). Use the table below or refer to Annexes A and D.

Peninsular:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.1	0.3	2.0
B	1.5	0.1	0.3	1.5
C	1.8	0.1	0.6	1.0
D	1.35	0.1	0.8	1.5
E	1.8	0.1	0.6	2.0

Sabah:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.1	0.3	4.0
B	1.5	0.1	0.3	4.0
C	1.8	0.1	0.6	1.0
D	1.35	0.1	0.8	1.5
E	1.8	0.1	0.6	2.0

Sarawak:

Ground type	S	T_B (s)	T_C (s)	T_D (s)
A	1	0.1	0.3	1.25
B	1.5	0.1	0.3	1.25
C	1.8	0.1	0.6	1.0
D	1.35	0.1	0.8	1.5
E	1.8	0.1	0.6	2.0

• Vertical Parameter for Vertical Response Spectrum

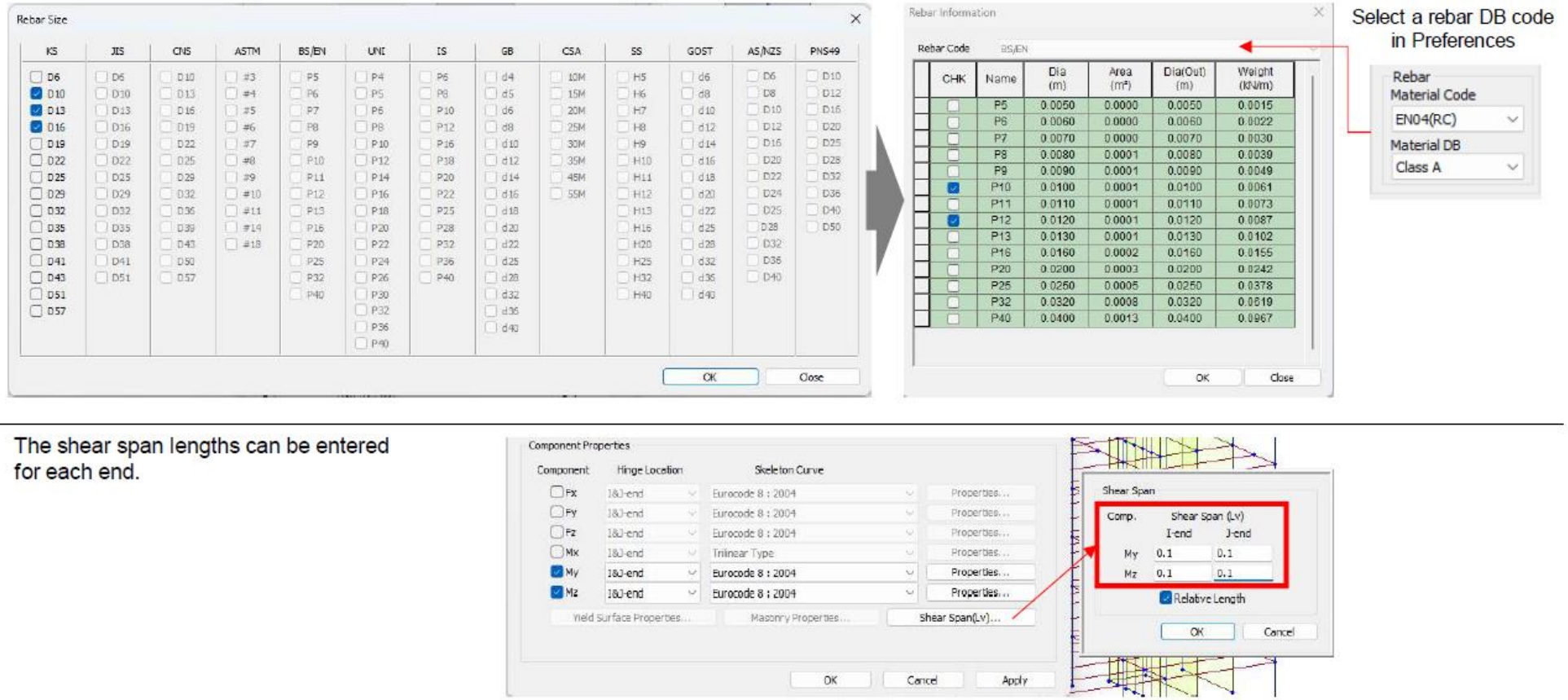
a_{vg}/a_g	T_B (s)	T_C (s)	T_D (s)
0.70	0.05	0.15	1.0

• Importance factor γI

Class I : $\gamma_I = 0.8$
Class III : $\gamma_I = 1.2$
Class IV : $\gamma_I = 1.5$

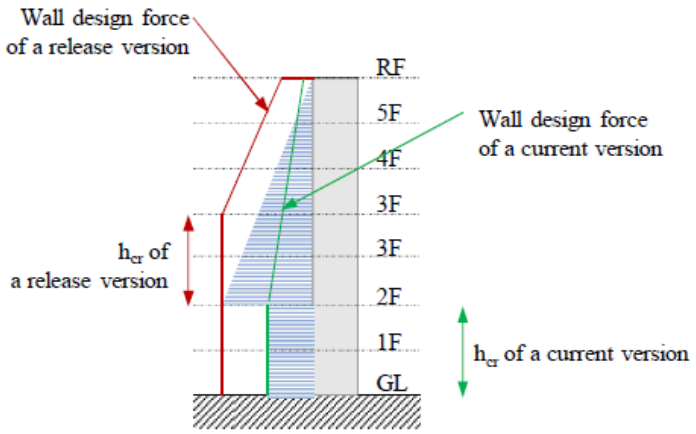
ETC 其他新增改善項目

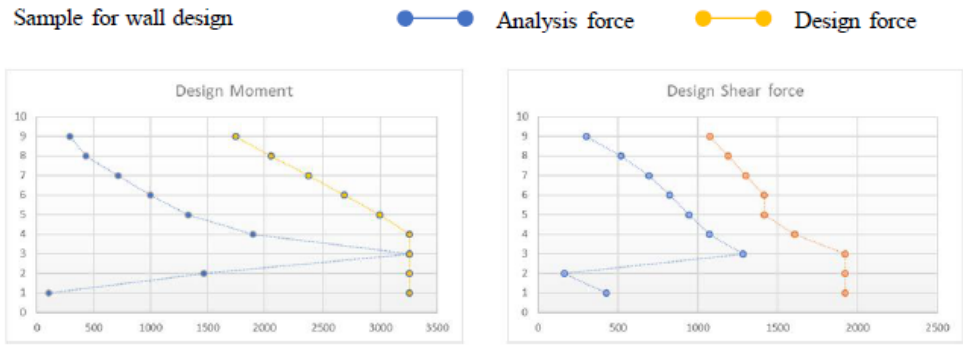
Items	Detail
Setting of Rebar Size in Meshed Design 鋼筋號數定義	• Improved to use the same dialog box as the 1D member's rebar criteria feature
Shear span in RC member under Eurocode 8 (Pushover Hinge) 塑鉸剪力位置	• The shear span lengths can be entered for each end.



ETC 其他新增改善項目

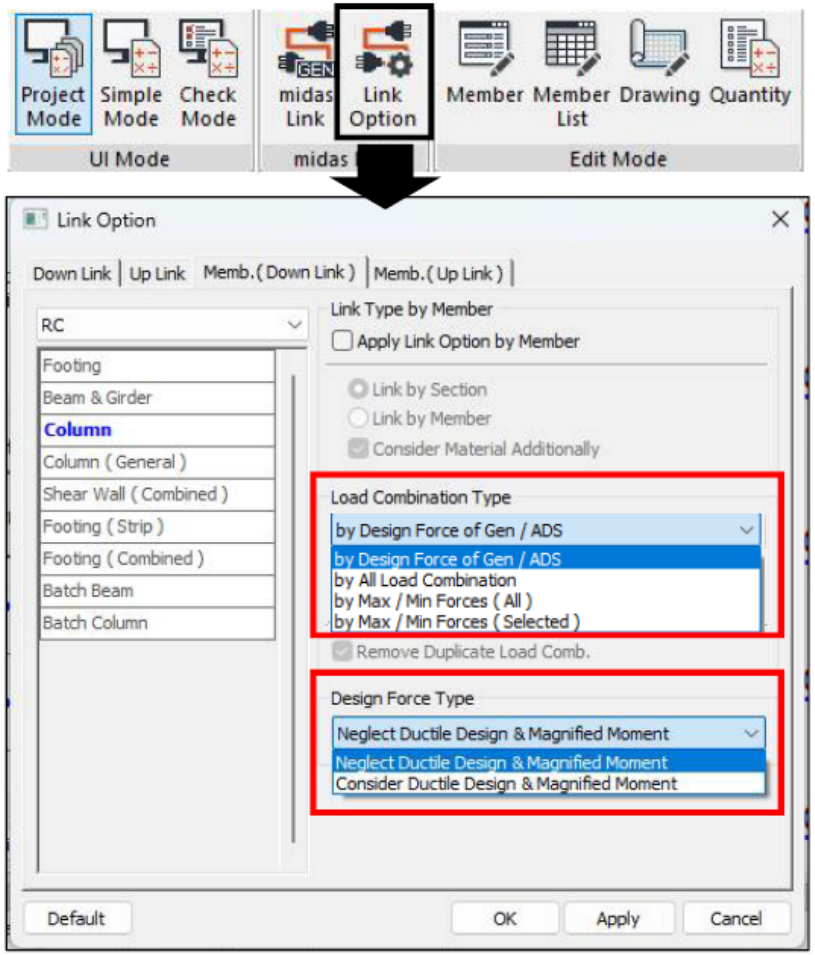
Items	Detail
Improvement of wall design force as per EC8 EC8 牆設計力	• Generate a wall design forces based on the story with the maximum member force under the duel system. * In the old version, the design member forces had been generated with the member force of the ground Level.





midas Design+

Improvement of Link Option 改善Link項目



"Memb.(Down Link) " > Load Combination Type

[Column & Column(General)& Shear Wall & Footing]

- By Design force of Gen / ADS : Import the design forces used in Gen's design.
- By All Load Combination : Results for all load combinations are imported individually.
- By Max/Min Forces (All) : Import only the Max. and Min. values among member forces from all load combinations.
- By Max/Min Forces (Selected) : Import only the design forces for the selected design components.

[All Batch Design]

- By Design force of Gen / ADS : Import the design forces used in Gen's design.

"Memb.(Down Link) " > Design Force Type

[Column & Column(General) & Shear Wall &Shear Wall (Combined) & Batch Column & Batch Wall]

- Neglect Ductile Design & Magnified Moment
  : Design forces by strong column-weak beam are not considered
  : Design forces by 2nd Order Effect (by moment magnification method) are not considered.
- Consider Ductile Design & Magnified Moment
  : Design forces by strong column-weak beam are considered
  : Design forces by 2nd Order Effect (by moment magnification method) are considered.
  * Moment magnification method is not reflected : "2nd Order Effect" option is checked off when importing from Gen.

[Footing & Footing(Combined)]

- Design force of Column : Use the Design forces of column.
- Reaction of Support : Use the forces of reaction result.

Add Eurocode 2 in Batch Design 新增歐規批次設計

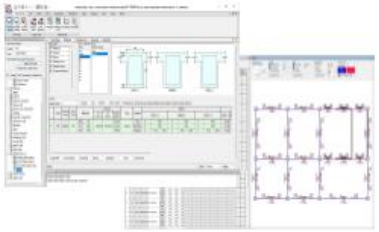
- There are many inconveniences when performing design in Gen. For example, when a section needs to be added when grouping members or when the cross section needs to be increased according to design results, analysis and design should be performed again. Since these cases must be performed repeatedly, a lot of time and effort are required depending on the magnitude of the building.
- Batch Design is a design feature to provide convenience for these repetitive parts in Gen, and the procedure is as follows.

[Gen] Modeling & Analysis & Design

- Create a model with simple section in Gen
- Perform an analysis
- Set a design condition and perform a design.

[Design+] Import Design Data of Gen

- Section Name, Material, Section Size, Rebar.
- Design force.
- Design Setting (cover, design type).
- Design Condition (Seismic design).



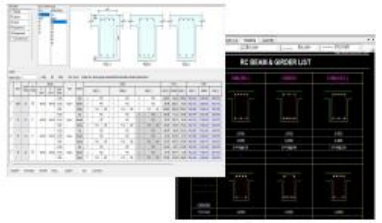
[Design+] Set Story & Design Option

- Set Story Group
- Set Smart Design Option

(Design as per EN or IS code is not supported)

[Design+] Member Grouping & Design

- Auto-Design by "Smart Design".
- Do the grouping work for beam according to Design force
- Auto-Design of member list drawing and quantity.



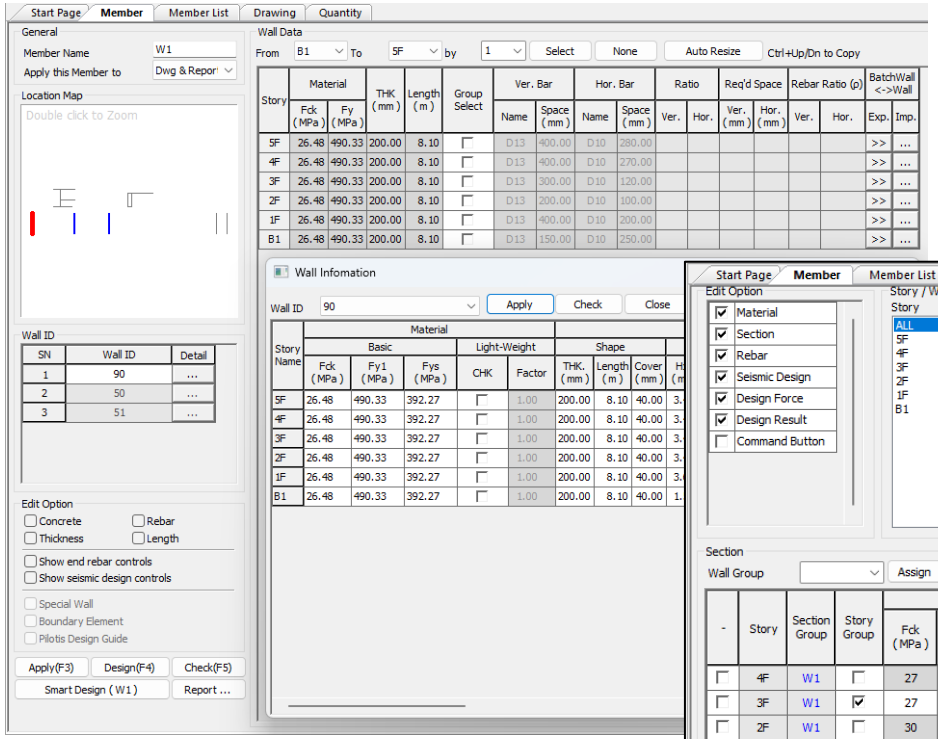
[Gen] Export Design data to Gen

- Create Sections by Group Name, Materials, Rebar information
- Run 'Code Check' in Gen

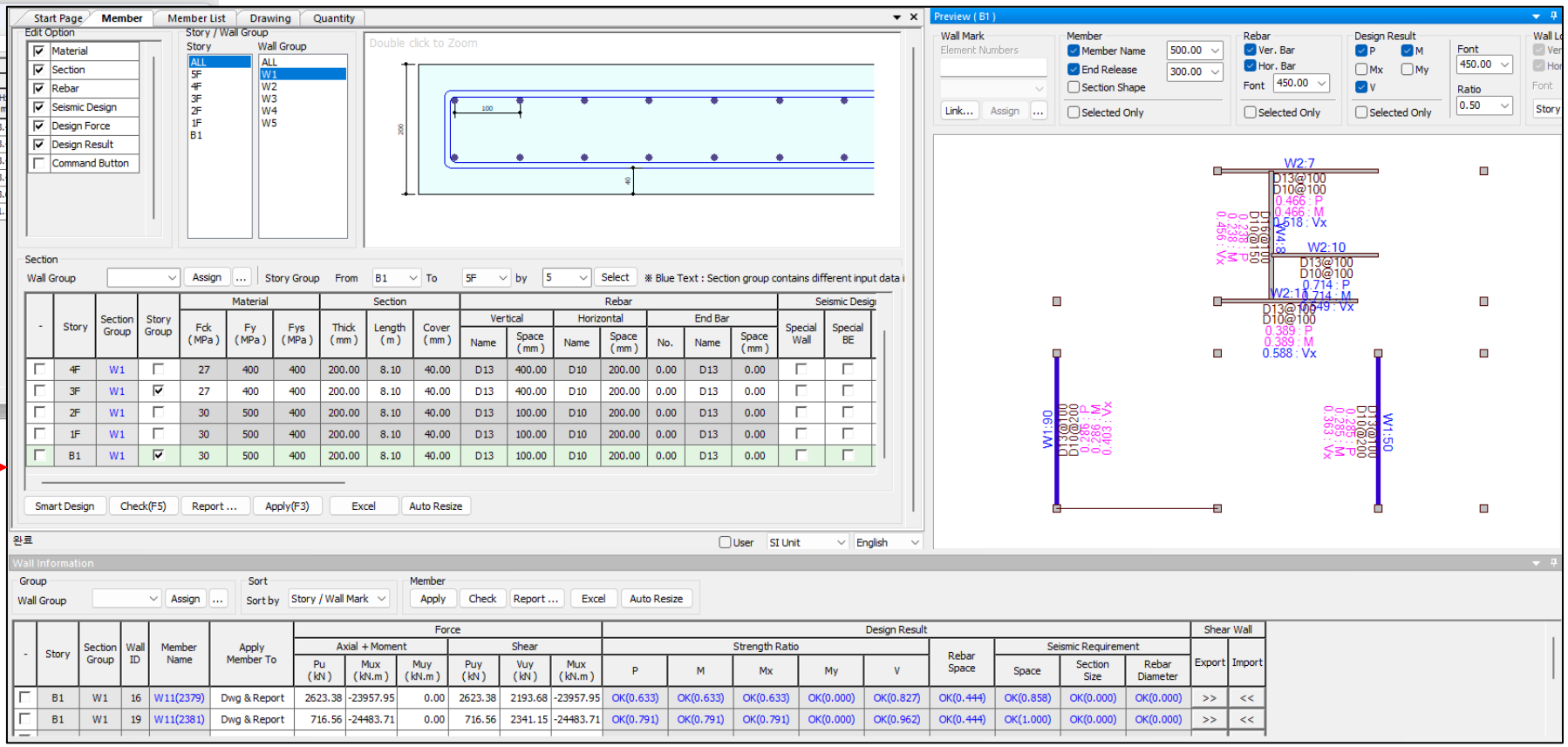
- The purpose of Batch Design is to quickly create and link the material, cross-section, and rebar information to Gen for analysis and design in Gen. Please use this product with the understanding that design results may differ slightly due to internal differences in design settings for Gen and Design+.
- Design as per EN or IS code is not supported.

❖ ***Batch Design Guide : [Download]***

Improved Batch Wall Design 改善批次牆設計功能



Design+ 2024 (v1.1)



Batch Design Guide : [Download]

Design+ 2024 (v2.1)

- Improved UI identical to Batch Beam/Column Design
- For detailed modifications, please refer to the Batch Design Guide.

Improved Design Module according to IS Code (India)

改善印度規範設計模組相關功能

The items below have been updated. If you want to know more details, please click on [Here]

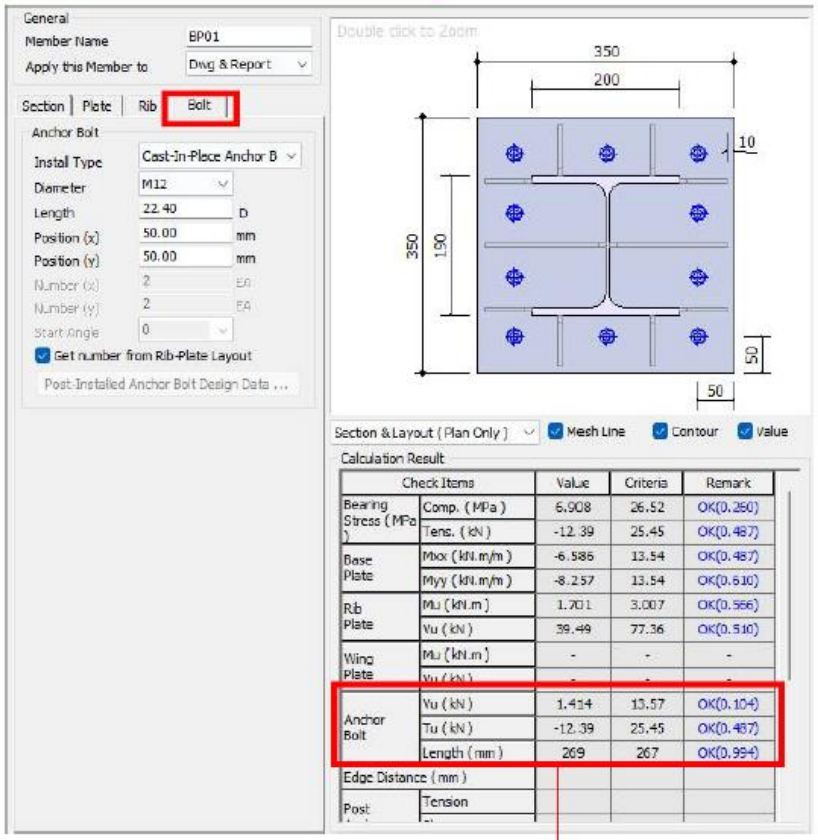
- ***Added Design Module for IS :456-2000.***

1. *Column Module*
2. *Basement Wall Module*
3. *Shear Wall Module*

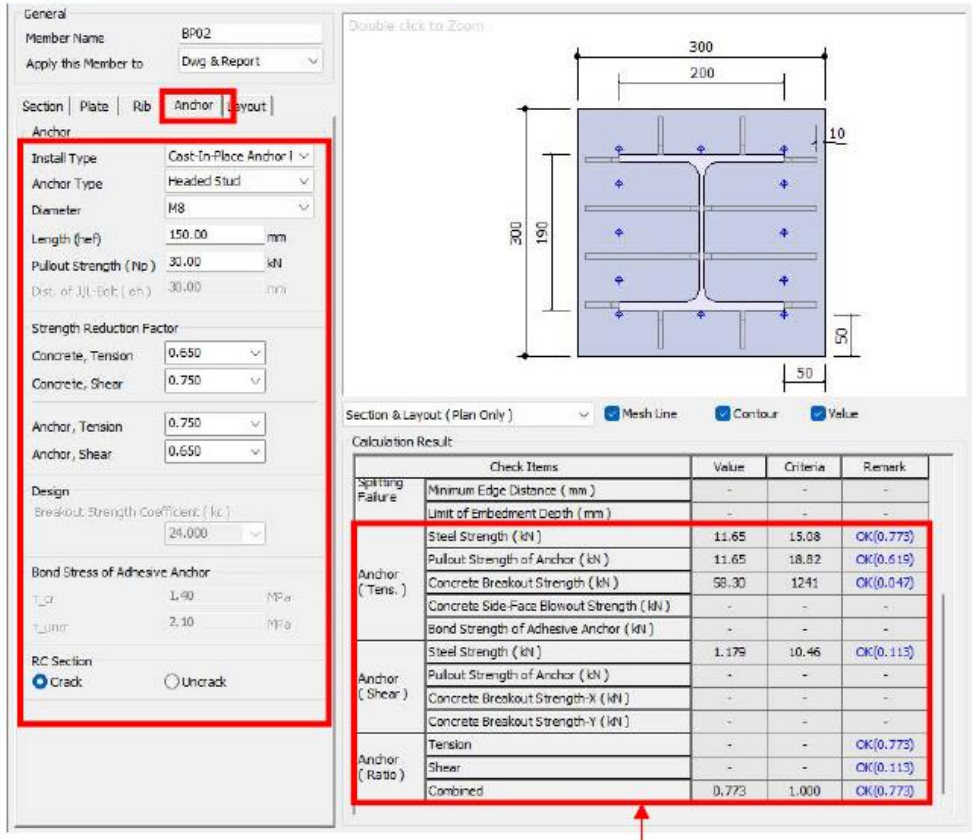
Improvement of Anchor Bolt Design in Base Plate 改善基座鈑的螺栓設計

- The anchor design of the base plate was modified to be designed according to the design process of "RC>Anchor Bolt Design".

Design+ 2024 (V1.1)



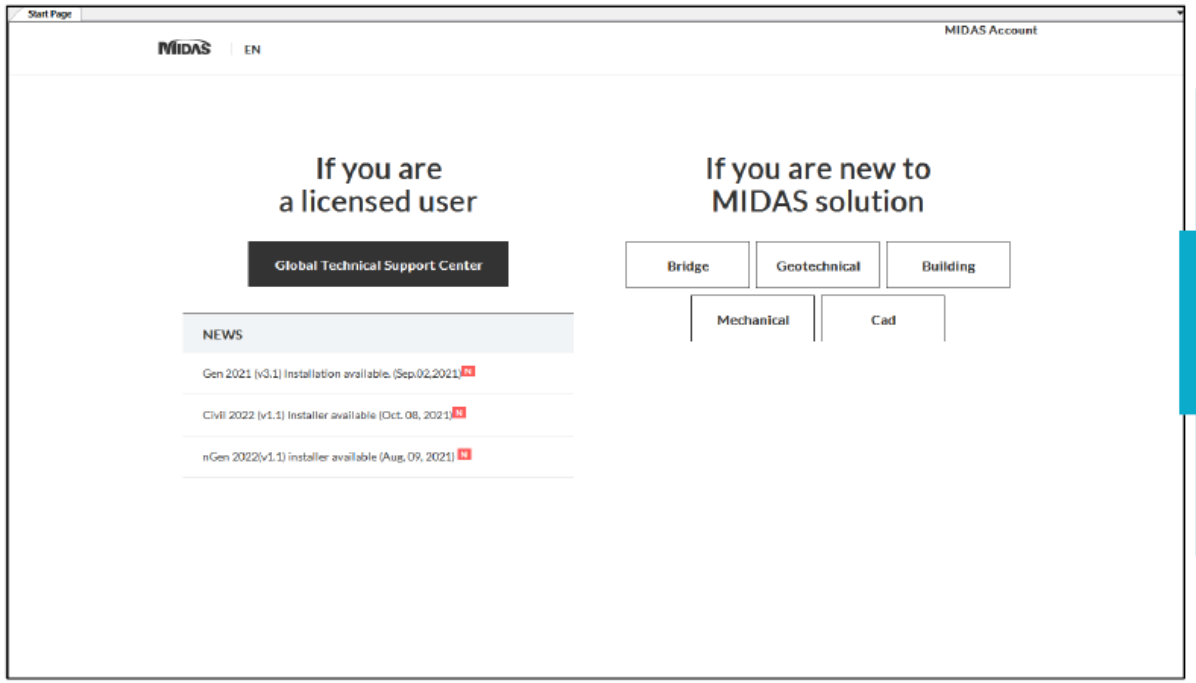
Design+ 2024 (V2.1)



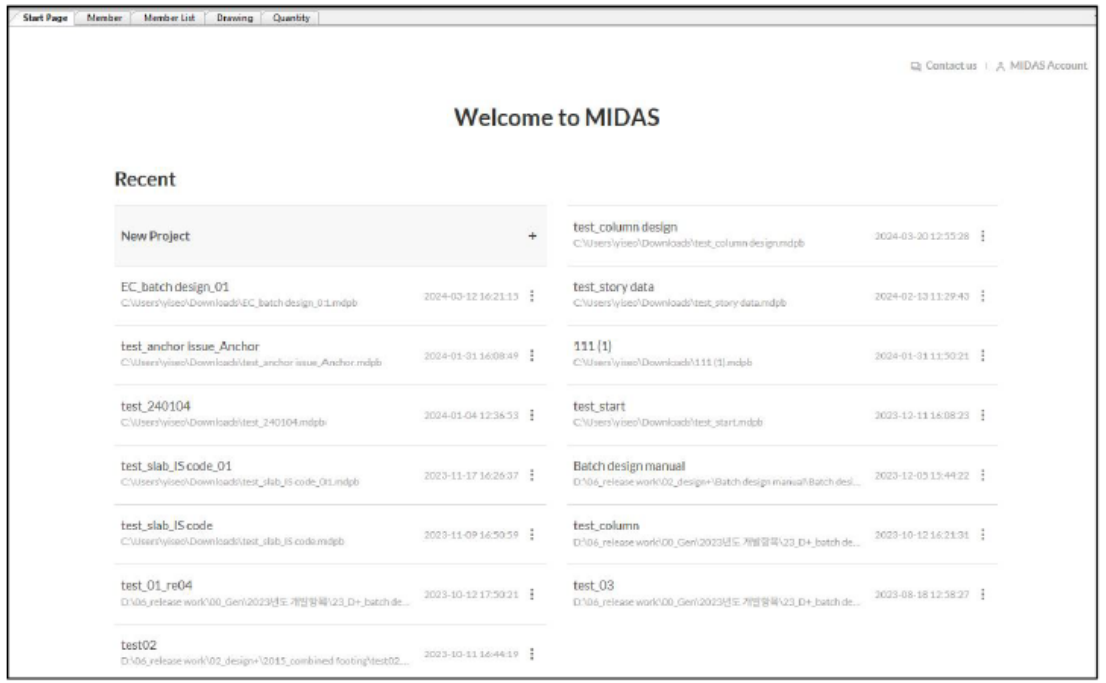
Improvement of Start Page 改善起始頁顯示

- Supports recent project list

Design+ 2024 (V1.1)



Design+ 2024 (V2.1)



Thank you

Improvement of IS code in midas Gen

- ***Added Seismic Provisions for Steel Design as per IS : 18168 -2023***
  1. *Additional Seismic Load Combination as per IS : 18168 : 2023*
  2. *Column to beam strength ratio as per IS : 18168 -2023*
  3. *Seismic Beam Design for SMRF as per IS : 18168-2023*
  4. *Seismic Beam Design & Brace Design for SCBF as per IS : 18168-2023*

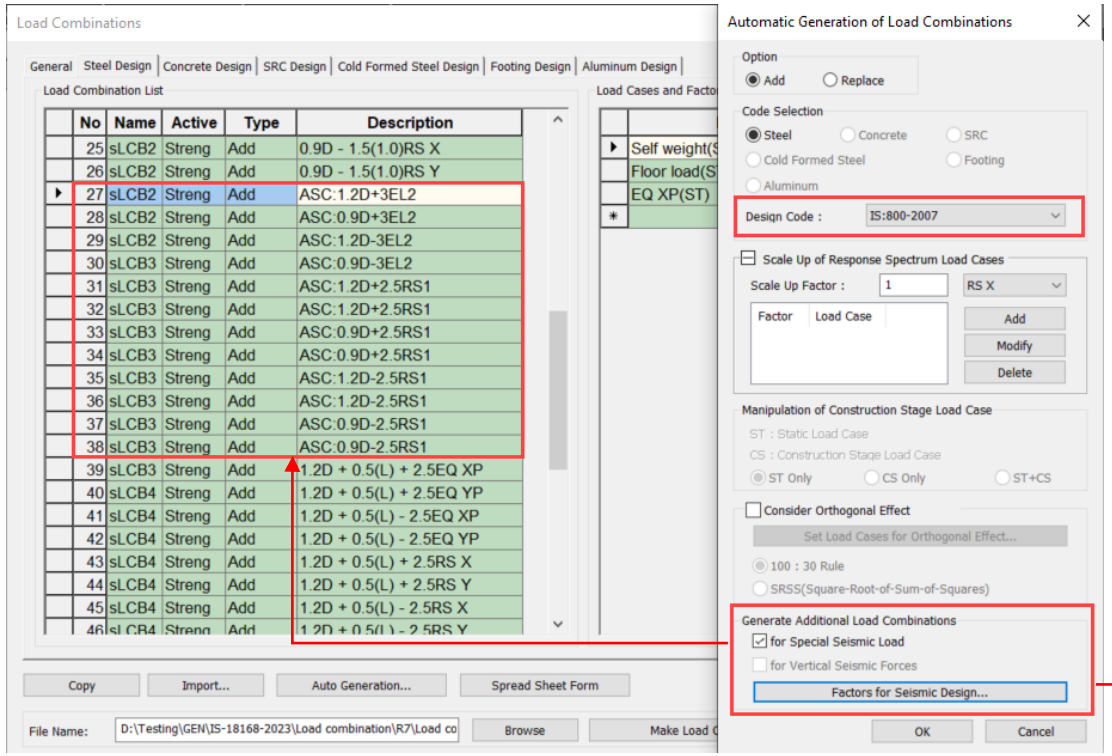
- ***Irregularity Check according to IS : 1893 -2016***
  1. *Torsional Irregularity & Weight Irregularity*
  2. *Stiffness Irregularity*
  3. *Capacity Irregularity*
  4. *Irregular modes of oscillation*

- ***Irregularity Check according to IS : 16700 -2023***
  1. *Stiffness Irregularity & Capacity Irregularity*
  2. *Natural modes of vibration*

- ***Added Column Module for IS :456-2000.***
- ***Added Basement Wall Module for IS :456-2000.***
- ***Added Shear Wall Module for IS :456-2000***

Added Seismic Provisions for Steel Design as per IS : 18168 -2023

1. Additional Seismic Load Combination as per IS : 18168 : 2023



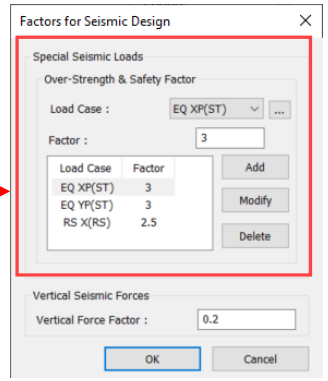
1.Additional Seismic load Combination

According to Clause 5.5 of IS : 18168 -2023

For Seismic analysis of steel buildings, in addition to the load combination as per IS : 1893 : 2016 & those in T able 4 of IS : 800 : 2007, load combination mentioned below, must be also considered.

1) $1.2\ DL + \gamma_{LL} LL \pm 1.0\ EL_m$

2) $0.9DL \pm 1.0\ EL_m$



$$1.2\ DL + \gamma_{LL} LL \pm 1.0\ EL_m \quad \text{.....(1)}$$

$$0.9\ DL \pm 1.0\ EL_m \quad \text{.....(2)}$$

where

DL = Dead load as per IS 875 (Part 1);

γ_{LL} = Partial safety factor for live load

= 0.25 for live load class less than or equal to 3.0 kN/m^2

0.50 for live load class more than 3.0 kN/m^2;

LL = Imposed load as per IS 875 (Part 2);

EL_m = Estimated maximum equivalent earthquake force induced in the structure = $\Omega\ EL$;

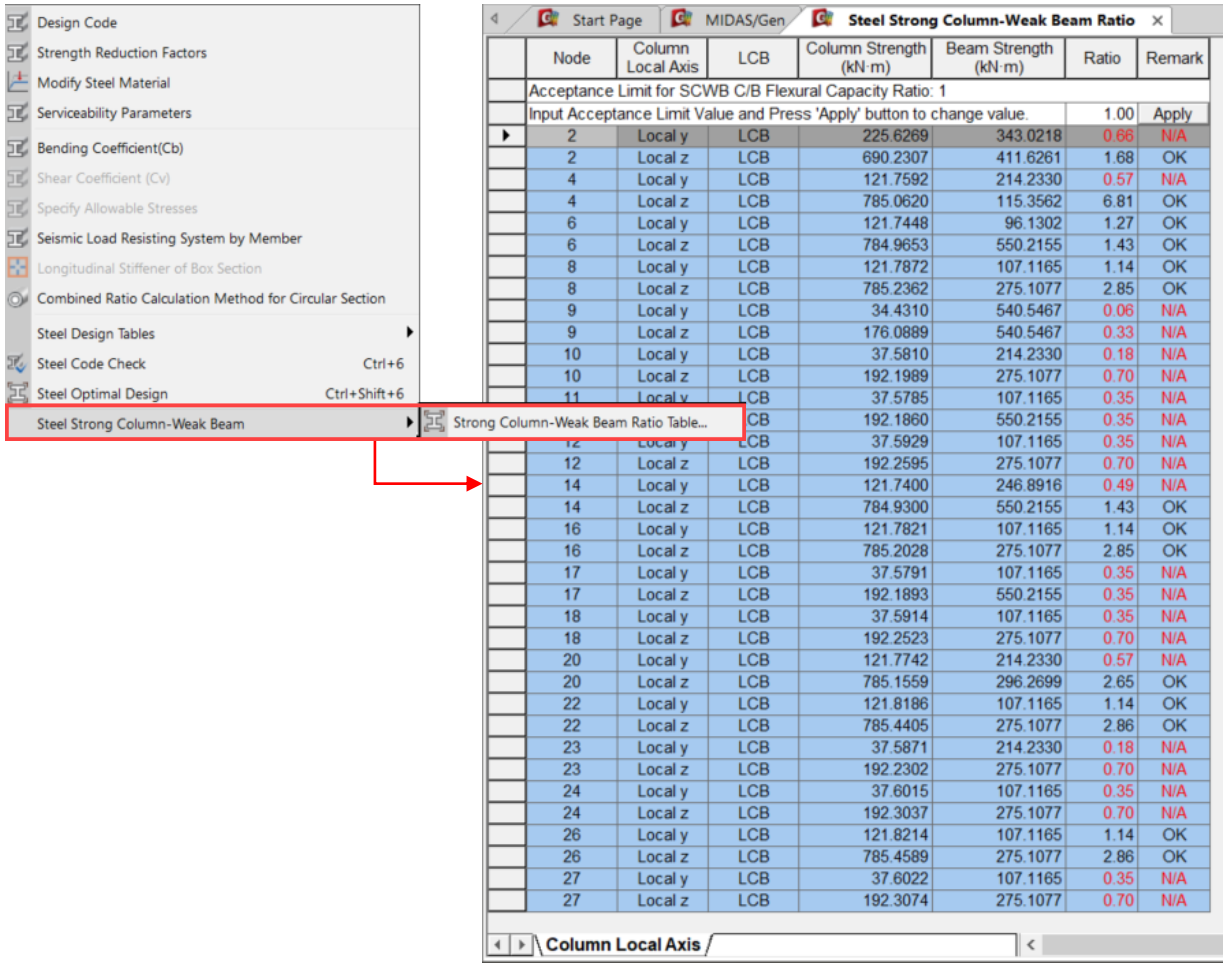
Ω = Overstrength factor = 2.5 for SCBFs and EBFs = 3.0 for SMRFs; and

EL = Earthquake load as per IS 1893 (Part 1).

Dialog box for assigning concerned Overstrength factor (2.5,3.0) and Partial safety factor (0.25, 0.3) has been added.

Added Seismic Provisions for Steel Design as per IS : 18168 -2023

2. Column to beam strength ratio as per IS : 18168 -2023



Node	Column Local Axis	LCB	Column Strength (kN·m)	Beam Strength (kN·m)	Ratio	Remark
Acceptance Limit for SCWB C/B Flexural Capacity Ratio: 1						
Input Acceptance Limit Value and Press 'Apply' button to change value.					1.00	Apply
2	Local y	LCB	225.6269	343.0218	0.66	N/A
2	Local z	LCB	690.2307	411.6261	1.68	OK
4	Local y	LCB	121.7592	214.2330	0.57	N/A
4	Local z	LCB	785.0620	115.3562	6.81	OK
6	Local y	LCB	121.7448	96.1302	1.27	OK
6	Local z	LCB	784.9653	550.2155	1.43	OK
8	Local y	LCB	121.7872	107.1165	1.14	OK
8	Local z	LCB	785.2362	275.1077	2.85	OK
9	Local y	LCB	34.4310	540.5467	0.06	N/A
9	Local z	LCB	176.0889	540.5467	0.33	N/A
10	Local y	LCB	37.5810	214.2330	0.18	N/A
10	Local z	LCB	192.1989	275.1077	0.70	N/A
11	Local y	LCB	37.5785	107.1165	0.35	N/A
11	Local z	LCB	192.1860	550.2155	0.35	N/A
12	Local y	LCB	37.5929	107.1165	0.35	N/A
12	Local z	LCB	192.2595	275.1077	0.70	N/A
14	Local y	LCB	121.7400	246.8916	0.49	N/A
14	Local z	LCB	784.9300	550.2155	1.43	OK
16	Local y	LCB	121.7821	107.1165	1.14	OK
16	Local z	LCB	785.2028	275.1077	2.85	OK
17	Local y	LCB	37.5791	107.1165	0.35	N/A
17	Local z	LCB	192.1893	550.2155	0.35	N/A
18	Local y	LCB	37.5914	107.1165	0.35	N/A
18	Local z	LCB	192.2523	275.1077	0.70	N/A
20	Local y	LCB	121.7742	214.2330	0.57	N/A
20	Local z	LCB	785.1559	296.2699	2.65	OK
22	Local y	LCB	121.8186	107.1165	1.14	OK
22	Local z	LCB	785.4405	275.1077	2.86	OK
23	Local y	LCB	37.5871	214.2330	0.18	N/A
23	Local z	LCB	192.2302	275.1077	0.70	N/A
24	Local y	LCB	37.6015	107.1165	0.35	N/A
24	Local z	LCB	192.3037	275.1077	0.70	N/A
26	Local y	LCB	121.8214	107.1165	1.14	OK
26	Local z	LCB	785.4589	275.1077	2.86	OK
27	Local y	LCB	37.6022	107.1165	0.35	N/A
27	Local z	LCB	192.3074	275.1077	0.70	N/A

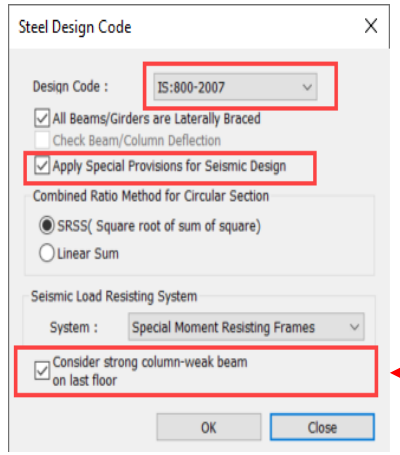
1.Column to beam strength ratio

According to Clause 8.2 of IS : 18168 -2023

For Seismic analysis of steel buildings At a Beam-Column joint, the following strength ratio shall be satisfied :

$$\frac{\sum M_{pc}}{\sum M_{bo}} = \frac{\sum Z_{pc} f_{yc}\left(1-\frac{P_u}{P_d}\right)}{\sum 1.1 R_y Z_{pb} f_{yb}} > 1.4$$

For clause 8.2.1 following option is added in th e design code dialog box under Seismic provisi ons



8.2 Column to Beam Strength Ratio

At a beam–column joint, the following strength ratio shall be satisfied:

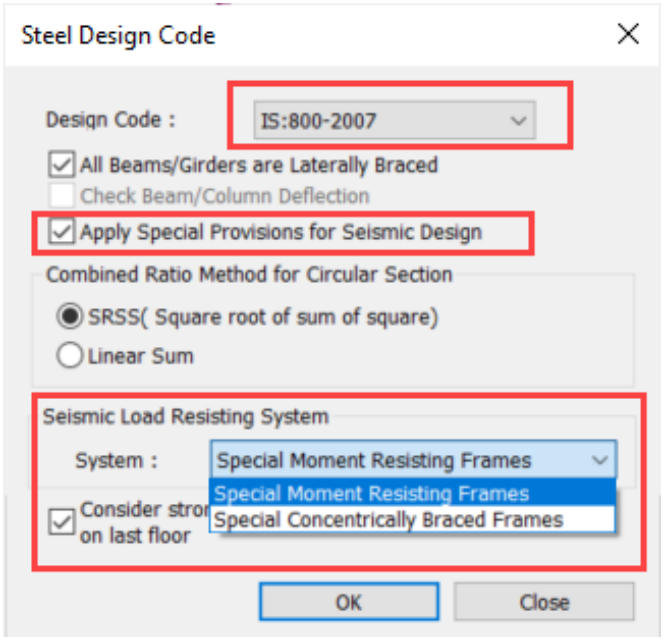
$$\frac{\sum M_{pc}}{\sum M_{bo}} = \frac{\sum Z_{pc} f_{yc}\left(1-\frac{P_u}{P_d}\right)}{\sum 1.1 R_y Z_{pb} f_{yb}} > 1.4$$

where Z_{pc} and Z_{pb} are the plastic section modulus and f_{yc} and f_{yb} are the characteristic yield strength of column and beam cross-sections respectively, P_u is the maximum factored axial compressive load and P_d is the design strength under axial compression, and R_y is the material uncertainty factor corresponding to the grade of steel in beams.

8.2.1 The above requirement need not be satisfied at the roof level.

Added Seismic Provisions for Steel Design as per IS : 18168 -2023

3. Seismic Beam Design for SMRF as per IS : 18168-2023



Limiting (b/t) and (d/t) ratio check

```
( ).Check flange width to thickness ratio for seimsic provision
     [ IS:18168-2023 6.1, Table 2 ]
     -. e       = SQRT( 250/fy )     =    0.67
     -. b/t     = BTR                =    5.23
     -. BTR < 9.0*e/SQRT(Ry) --> NOT ACCEPTABLE
```

```
( ).Check web depth to thickness ratio for seimsic provision
     [ IS:18168-2023 6.1, Table 2 ]
     -. e       = SQRT( 250/fy )     =    0.67
     -. d/t     = HTR                =   42.31
     -. HTR < 44.5*e/SQRT(Ry)--> NOT ACCEPTABLE
```

Slenderness ratio check

```
( ). Check slenderness ratio for Seismic Provision
     [ IS:18168:2003 6.2]
     for the portion near to beam-column joint
     -. l/r =  85.2< 25 -->NG
     For remaining portion
     -. l/r =  85.2< 0.10*E/Ry*fy -->NG
```

Shear Strength check

```
( ). Check ratio of shear strength for siesmic provision [IS:18168-2023 6.4.1 & 8.4]
     -.Plastic hinge strength, Mp = 1.1*Ry*Fy*Zp =         246.27 kN-m.
     -. Vzses(D+L)    =          13.50 kN.
     -. Vzses = Vzses(D+L)+((Mp+Mp)/(L-db)) =         210.51 kN.
          Vzses              210.51
     -. -----  =  ---------------  =  0.118  <  1.000  --->  O.K.
          Vdz              1787.48
```

```
( ). Check ratio of shear strength for siesmic provision [IS:18168-2023 6.4.1 & 8.4]
     -.Plastic hinge strength, Mp = 1.1*Ry*Fy*Zp =        1734.27 kN-m.
     -. Vzses(D+L)    =          23.38 kN.
     -. Vzses = Vzses(D+L)+((Mp+Mp)/(L-db)) =        1410.80 kN.
          Vzses              1410.80
     -. -----  =  ---------------  =  0.958  <  1.000  --->  O.K.
          Vdz              1472.24
```

1. Seismic provisions for steel design of Special moment resisting frame and Special Concentrically braced frame

For Seismic design of steel buildings, as per Section 12 of IS : 18168-2023 Two types of Seismic load Resisting system are added i.e. Special moment resisting frame (SMRF) & Special concentrically braced frame (SCBF).

2. Seismic provisions for Beam design under SMRF are added

As per Clause 12.1.4.1 and Section 6 of IS : 18168-2023 following checks are added under specials seismic provision.

a) Limiting Flange width to thickness ratio , web depth to thickness ratio checks as per Table 2 of IS :18168-2023.

b) Slenderness check as per Clause 6.2 of IS :18168-2023.

c) Shear Capacity check as per clause 6.4.1 and clause 8.4 of IS :18168-2023

Added Seismic Provisions for Steel Design as per IS : 18168 -2023

4. Seismic Beam Design & Brace Design for SCBF as per IS : 18168-2023

Limiting (b/t) and (d/t) ratio check

```
( ).Check flange width to thickness ratio for seimsic provision
    [ IS:18168-2023 6.1, Table 2 ]
    -. e       = SQRT( 250/fy )    =    0.91
    -. b/t     = BTR               =    5.65
    -. BTR < 11.3*e/SQRT(Ry) --> O.K.
```

```
( ).Check web depth to thickness ratio for seimsic provision
    [ IS:18168-2023 6.1, Table 2 ]
    -. e       = SQRT( 250/fy )    =    0.91
    -. d/t     = HTR               =   32.96
    -. HTR < 44.4*e/SQRT(Ry)--> O.K.
```

Slenderness ratio check

```
( ). Check slenderness ratio for Seismic Provision
     [ IS:18168:2003 6.2]
     -. l/r = 149.4< 160 -->O.K.
```

1. Seismic provisions for Beam design under SCBF are added

As per Clause 12.2.4.4 and Section 6 of IS : 18168-2023 following checks are added under special s seismic provision.

a) Limiting Flange width to thickness ratio , web depth to thickness r atio checks as per Table 2 of IS :18168-2023.

b) Slenderness check as per Clause 6.2 of IS :18168-2023.

c) Shear Capacity check as per clause 6.4.1 and clause 8.4 of IS :1816 8-2023

2. Seismic provisions for Brace design under SCBF are added

As per Clause 12.2.4.2 and Section 10 of IS : 18168-2023 following checks are added under speci als seismic provision.

a) Limiting Flange width to thickness ratio , web depth to thickness ratio checks as per Table 2 of IS :18168-2023.

b) Slenderness check as per Clause 10.2 of IS :18168-2023.

Irregularity Check according to IS : 1893 -2016

1. Torsional Irregularity & Weight Irregularity

- Results > Results Tables > Story> Irregularity check parameter > **IS : 1893-2016 > Torsional Irregularity / Weight Irregularity check**

Torsional Irregularity Chec

Result-[Torsional Irregularity Check]

	Load Case	Story	Level (m)	Story Height (m)	Average Value of Extreme Points		Maximum Value		Remark
					1.4*Story Drift (m)	1.2*Story Drift (m)	Node	Story Drift (m)	
▸	EXP	12F	40.50	3.15	0.0016	0.0014	353	0.0012	Regular
	EXP	11F	37.35	3.15	0.0026	0.0022	321	0.0018	Regular
	EXP	10F	34.20	3.15	0.0035	0.0030	289	0.0025	Regular
	EXP	9F	31.05	3.15	0.0043	0.0037	257	0.0031	Regular
	EXP	8F	27.90	3.15	0.0050	0.0043	225	0.0036	Regular
	EXP	7F	24.75	3.15	0.0055	0.0047	193	0.0040	Regular
	EXP	6F	21.60	3.15	0.0059	0.0051	161	0.0042	Regular
	EXP	5F	18.45	3.15	0.0062	0.0053	129	0.0044	Regular
	EXP	4F	15.30	3.15	0.0063	0.0054	97	0.0045	Regular
	EXP	3F	12.15	3.15	0.0063	0.0054	65	0.0045	Regular
	EXP	2F	9.00	3.15	0.0059	0.0050	1	0.0042	Regular
	EXP	1F	5.00	4.00	0.0047	0.0040	33	0.0033	Regular

Torsional Irregularity(X) / Torsional Irregularity(Y)

Weight Irregularity Ch

Result-[Weight Irregularity Check]

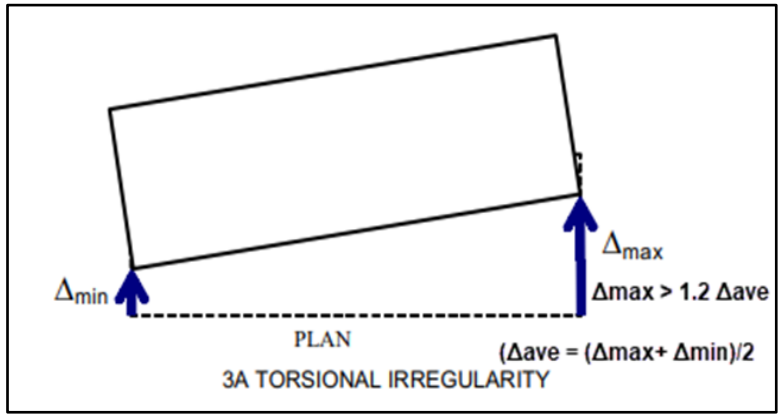
	Load Case	Story	Level (m)	Story Height (m)	Story Weight (kN)	1.5*Lower Story Weight (kN)	Story Weight Ratio	Remark
▸	DL	Roof	43.65	0.00	11818.865	20758.417	0.000	Regular
	DL	12F	40.50	3.15	13838.944	20758.417	0.667	Regular
	DL	11F	37.35	3.15	13838.944	20758.417	0.667	Regular
	DL	10F	34.20	3.15	13838.944	20758.417	0.667	Regular
	DL	9F	31.05	3.15	13838.944	20758.417	0.667	Regular
	DL	8F	27.90	3.15	13838.944	20758.417	0.667	Regular
	DL	7F	24.75	3.15	13838.944	20758.417	0.667	Regular
	DL	6F	21.60	3.15	13838.944	20758.417	0.667	Regular
	DL	5F	18.45	3.15	13838.944	20758.417	0.667	Regular
	DL	4F	15.30	3.15	13838.944	20758.417	0.667	Regular
	DL	3F	12.15	3.15	13838.944	21059.693	0.657	Regular
	DL	2F	9.00	3.15	14039.795	0.000	0.000	Regular
	DL	1F	5.00	4.00	945.180	0.000	0.000	Regular

Weight Irregularity(X) / Weight Irregularity(Y)

1.Torsional Irregularity Check

According to Table 5-i) of Clause 7.1 of IS : 1893 Part-1 -2016,

"Story Drift of Maximum Value" divided by "Story Drift of Average Value of Extreme Points." If it exceeds 1 .2 but less than 1.4 , "Irregular-Building Config" is printed , If it exceeds 1.4 "Irregular-Structure Config" is printed. If it is less than 1.2, 'Regular' is printed.



2.Weight Irregularity Check

According to Table 6-ii) of Clause 7.1 of IS : 1893 Part-1 -2016

" Story Weight Ratio", Story Weight divided by 1.5*Story Weight of adjacent lower story, If it exceeds 1.0, "Irregular" is printed. If it is less than 1.0, 'Regular' is printed.

Irregularity Check according to IS : 1893 -2016

2. Stiffness Irregularity

- *Results > Results Tables > Story> Irregularity check parameter >* ***IS : 1893-2016 > Stiffness Irregularity check***

Stiffness Irregularity Chec

Start Page | MIDAS/Gen | Result-[Stiffness Irregularity Check]

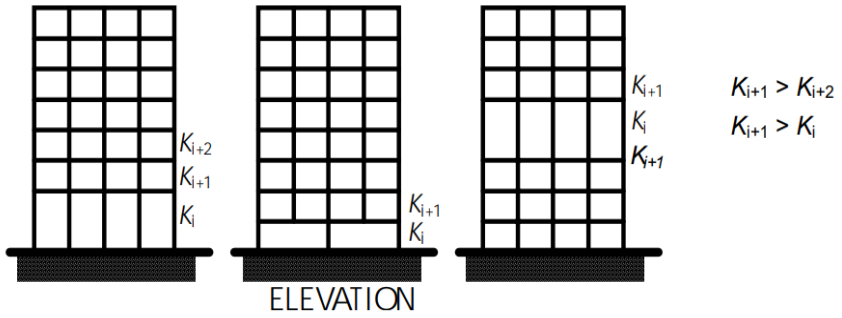
	Load Case	Story	Level (m)	Story Height (m)	Story Drift (m)	Story Shear Force (kN)	Story Stiffness (kN/m)	Upper Story Stiffness (kN/m)	Story Stiffness Ratio	Remark
	EXP	12F	40.50	3.15	0.0012	588.84	506898.41	0.00	0.000	Irregular
	EXP	11F	37.35	3.15	0.0018	1170.52	637927.53	506898.41	1.258	Regular
	EXP	10F	34.20	3.15	0.0025	1653.55	657991.75	637927.53	1.031	Regular
	EXP	9F	31.05	3.15	0.0031	2047.09	660336.13	657991.75	1.004	Regular
	EXP	8F	27.90	3.15	0.0036	2360.30	659726.78	660336.13	0.999	Irregular
	EXP	7F	24.75	3.15	0.0039	2602.35	658901.20	659726.78	0.999	Irregular
	EXP	6F	21.60	3.15	0.0042	2782.38	658529.77	658901.20	0.999	Irregular
	EXP	5F	18.45	3.15	0.0044	2909.57	659301.21	658529.77	1.001	Regular
	EXP	4F	15.30	3.15	0.0045	2993.07	663288.06	659301.21	1.006	Regular
	EXP	3F	12.15	3.15	0.0045	3042.03	677823.81	663288.06	1.022	Regular
	EXP	2F	9.00	3.15	0.0042	3065.63	731110.47	677823.81	1.079	Regular
▸	EXP	1F	5.00	4.00	0.0033	3073.12	922094.54	731110.47	1.261	Regular

Stiffness Irregularity(X) | Stiffness Irregularity(Y)

3. Stiffness Irregularity(Soft Story) Check

According to Table 6-i) of Clause 7.1 of IS : 1893 Part-1 -2016

When the story stiffness of a particular story is greater than the stiffness of the story below, then the story will be defined as irregular. i.e. if the ratio of Story stiffness divided by the upper story stif fness, IF exceeds 1 " Regular" is printed, If less than 1 "Irregular" is printed in remarks



4A STIFFNESS IRREGULARITY (SOFT STOREY)

Irregularity Check according to IS : 1893 -2016

3. Capacity Irregularity

- *Results > Results Tables > Story> Irregularity check parameter >* ***IS : 1893-2016 > Capacity Irregularity check***

Capacity Irregularity Ch

Start Page | MIDAS/Gen | Result-[Capacity Irregularity Check]

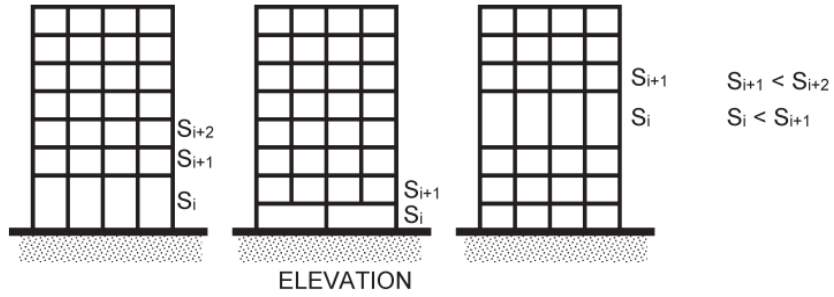
Story	Level (m)	Story Height (m)	Angle1 ([deg])	Story Shear Strength1 (kN)	Upper Story Shear Strength1 (kN)	Story Shear Strength Ratio1	Remark1	Angle2 ([deg])	Story Shear Strength2 (kN)	Upper Story Shear Strength2 (kN)	Story Shear Strength Ratio2	Remark2
Angle = 0 [Deg]												
Input angle and press the 'Apply' button to change the angle.			0.00	Apply								
12F	40.50	3.15	0.00	11349.3080	0.0000	0.0000	Regular	90.00	15303.2605	0.0000	0.0000	Regular
11F	37.35	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
10F	34.20	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
9F	31.05	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
8F	27.90	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
7F	24.75	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
6F	21.60	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
5F	18.45	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
4F	15.30	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
3F	12.15	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
2F	9.00	3.15	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular
1F	5.00	4.00	0.00	11349.3080	11349.3080	1.0000	Regular	90.00	15303.2605	15303.2605	1.0000	Regular

Capacity Irregularity

4. Capacity Irregularity (Weak Story) check

According to Table 6-v) of Clause 7.1 of IS : 1893 Part-1 -2016

If the ratio of the lateral strength of a story to lateral strength of the story above exceeds 1.0, "Regular" is printed. If it is less than 1.0, 'Irregular' is printed.



ELEVATION

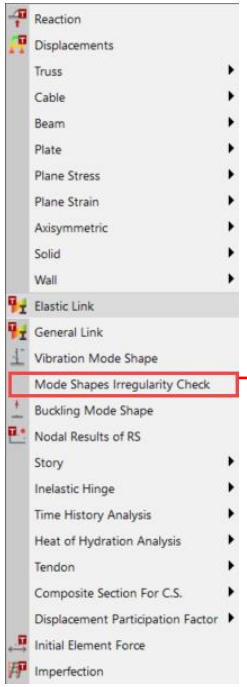
4E STRENGTH IRREGULARITY (WEAK STOREY)

Irregularity Check according to IS : 1893 -2016

4. Irregular modes of oscillation

- *Results > Results Tables > Story> Irregularity check parameter >* ***IS : 1893-2016 > Mode shapes irregularity check***

Irregular modes of oscillation c



Start Page | MIDAS/Gen | Result-[Irregular Mode Check]

Node	Mode	UX	UY	UZ	RX	RY	RZ
MODAL IRREGULARITY CHECK							
1.First three lateral translational mode Contribution							
	Along X			Along Y			
	Mode No	Period	Modal Mass	Mode No	Period	Modal Mass	
	1	2.21231	81.8474	2	1.20097	69.4455	
	4	0.712644	9.70896	6	0.275954	18.8484	
	5	0.401828	3.6644	-			
		Sum =	95.2208		Sum =	88.2939	
			>65			>65	
			Remark	OK			
2.Closeness of fundamental period Tx and Ty							
	Tmax	Tmin	Tratio(Tmi	Remark			
	2.2123	1.20097	0.603177	OK			
			Status	REGULAR			

Eigenvalue Mode

4. Irregular modes of oscillation check

According to Table 6-vii) of Clause 7.1 of IS : 1893 Part-1 -2016

A building is said to be irregular if it satisfies both condition mentioned below :-
1)the first three modes contribute less than 65 percent mass participation factor in each principal plan direction.
2) the fundamental lateral natural periods of the building in the two principal plan directions are c loser to each other by 10 percent of the larger value.

Hence for the 1st condition If summation of modal mass participation is less then 65 percent "Irreg ular" is printed, if greater than 65 percent "Regular" is printed.

For 2nd condition if the ratio T_{min} to 0.9 *T_{max} exceeds 1 "Irregular" is printed, If less than 1 "Regula r" is printed.
Here T_{min} = minimum (T_x and T_y) and T_{max} = maximum (T_x and T_y) , T_x and T_y are fundamental nat ural period of the building in respective principal plan direction.

For final status , if both condition are "Irregular" , " Irregular" is printed, if both condition are "Reg ular" , " Regular" is printed, if one of the condition is "Regular" and other one is "Irregular", "Part ial Regular" is printed.

Irregularity Check according to IS : 16700 -2023

1. Stiffness Irregularity & Capacity Irregularity

- *Results > Results Tables > Story> Irregularity check parameter >* ***IS : 16700-2023 > Stiffness Irregularity check / Capacity Irregularity check***

Stiffness Irregularity Chec

Start Page | MIDAS/Gen | Result-[Stiffness Irregularity Check]

Load Case	Story	Level (m)	Story Height (m)	Story Drift (m)	Story Shear Force (kN)	Story Stiffness (kN/m)	Upper Story Stiffness (kN/m)	Story Stiffness Ratio	Remark
EX	13F	34.10	2.37	-0.0001	237.93	3051251.0	0.00	0.000	Irregular
EX	12F	32.80	1.30	0.0003	299.56	1076140.7	-3051251.07	0.353	Irregular
EX	11F	30.00	2.80	0.0007	527.39	724971.58	1076140.74	0.674	Irregular
EX	10F	27.20	2.80	0.0007	858.20	1161068.0	724971.58	1.602	Regular
EX	9F	24.40	2.80	0.0007	1158.13	1553532.5	1161068.07	1.338	Regular
EX	8F	21.60	2.80	0.0007	1428.56	1915197.4	1553532.51	1.233	Regular
EX	7F	18.80	2.80	0.0007	1668.01	2255651.5	1915197.43	1.178	Regular
EX	6F	16.00	2.80	0.0007	1886.17	2597632.5	2255651.59	1.152	Regular
EX	5F	13.20	2.80	0.0007	2076.23	2944598.8	2597632.50	1.134	Regular
EX	4F	10.40	2.80	0.0007	2233.21	3307545.7	2944598.80	1.123	Regular
EX	3F	7.60	2.80	0.0006	2356.89	3708006.5	3307545.70	1.121	Regular
EX	2F	4.50	3.10	0.0047	2450.48	518907.56	3708006.57	0.140	Irregular
EX	1F	0.00	4.50	0.0133	2496.55	188326.13	518907.56	0.363	Irregular
EX	B1	-3.50	3.50	0.0078	2496.55	322089.17	188326.13	1.710	Regular
EX	B2	-4.50	1.00	0.0006	2496.55	3918566.2	322089.17	12.166	Regular

Stiffness Irregularity(X) | Stiffness Irregularity(Y)

Capacity Irregularity Check

Start Page | MIDAS/Gen | Result-[Capacity Irregularity Check]

Story	Level (m)	Story Height (m)	Angle1 ([deg])	Story Shear Strength1 (kN)	Upper Story Shear Strength1 (kN)	Story Shear Strength Ratio1	Remark1	Angle2 ([deg])	Story Shear Strength2 (kN)	Upper Story Shear Strength2 (kN)	Story Shear Strength Ratio2	Remark2
Angle = 0 [Deg]												
Input angle and press the 'Apply' button to change the angle			0.00	Apply								
13F	34.10	2.37	0.00	1225.7204	0.0000	0.0000	Regular	90.00	5494.3922	0.0000	0.0000	Regular
12F	32.80	1.30	0.00	3252.2616	1225.7204	2.6533	Regular	90.00	0.0000	5494.3922	0.0000	Irregular
11F	30.00	2.80	0.00	24385.1941	3252.2616	7.4979	Regular	90.00	0.0000	0.0000	0.0000	Irregular
10F	27.20	2.80	0.00	24385.1941	24385.1941	1.0000	Regular	90.00	0.0000	0.0000	0.0000	Irregular
9F	24.40	2.80	0.00	24385.1941	24385.1941	1.0000	Regular	90.00	0.0000	0.0000	0.0000	Irregular
8F	21.60	2.80	0.00	24401.1017	24385.1941	1.0007	Regular	90.00	0.0000	0.0000	0.0000	Irregular
7F	18.80	2.80	0.00	24401.1017	24401.1017	1.0000	Regular	90.00	0.0000	0.0000	0.0000	Irregular
6F	16.00	2.80	0.00	26422.2531	24401.1017	1.0828	Regular	90.00	2021.1514	0.0000	0.0000	Irregular
5F	13.20	2.80	0.00	26526.9082	26422.2531	1.0040	Regular	90.00	2125.8065	2021.1514	1.0518	Regular
4F	10.40	2.80	0.00	26526.9082	26526.9082	1.0000	Regular	90.00	2125.8065	2125.8065	1.0000	Regular
3F	7.60	2.80	0.00	26526.9082	26526.9082	1.0000	Regular	90.00	2125.8065	2125.8065	1.0000	Regular
2F	4.50	3.10	0.00	9275.0574	26526.9082	0.3496	Irregular	90.00	9275.0574	2125.8065	4.3631	Regular
1F	0.00	4.50	0.00	10629.0326	9275.0574	1.1460	Regular	90.00	10629.0326	9275.0574	1.1460	Regular
B1	-3.50	3.50	0.00	11265.6844	10629.0326	1.0599	Regular	90.00	11265.6844	10629.0326	1.0599	Regular
B2	-4.50	1.00	0.00	11265.6844	11265.6844	1.0000	Regular	90.00	11265.6844	11265.6844	1.0000	Regular

Capacity Irregularity

1.Stiffness Irregularity Check

According to Clause 5.3 a) of IS : 16700-2023,

Lateral stiffness of any story shall not be less than 70 percent of that of the story above. Hence the story stiffness ratio If it exceeds 0.7 "Irregular" is printed. If it is less than 0.7, 'Regular' is printed.

2.Capacity Irregularity Check

According to Clause 5.3 b) of IS : 1893 Part-1 -2016,

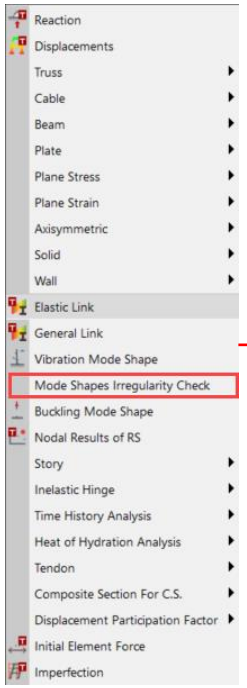
Lateral strength of any story shall not be less than 90 percent of that of the story above. Hence the story strength ratio If it exceeds 0.9 "Irregular" is printed. If it is less than 0.7, 'Regular' is printed.

Irregularity Check according to IS : 16700 -2023

2. Natural modes of vibration

- *Results > Results Tables > Story> Irregularity check parameter >* ***IS : 16700-2023 > mode shape irregularity check***

Mode shape Irregularity Ch



Start Page | MIDAS/Gen | Result-[Irregular Mode Check]

Node	Mode	UX	UY	UZ	RX	RY	RZ
MODAL IRREGULARITY CHECK							
1.Fundamental Translation Natural period check							
	Along X		Along Y				
	Mode No	Period	Mode No	Period			
	8	1.31481	7	1.71358			
		<=8		<=8			
		Remark	OK				
2.Torsional-Translational Fundamental natural period							
	Mode	Torsional Period(sec)	Minimum Translational peri		Ratio(Ttor/0.9Trans,min)	Remark	
	9	1.2021	1.3148		1.0159	NG	

Eigenvalue Mode

3. Mode shape irregularity Check

According to Clause 5.5.1 of IS : 16700-2023

The natural period of fundamental torsional mode of vibration (T_{tor}) shall not exceed 0.9 times the smaller of the natural periods of the fundamental translational modes of vibration ($T_{trans,min}$) in each of the orthogonal directions in plan. Hence if the ratio of T_{tor} to 0.9*$T_{trans,min}$ exceeds 1 "Irregular" is printed, If less than 1 "Regular" is printed.

According to Clause 5.5.2 of IS : 1893 Part-1 -2016

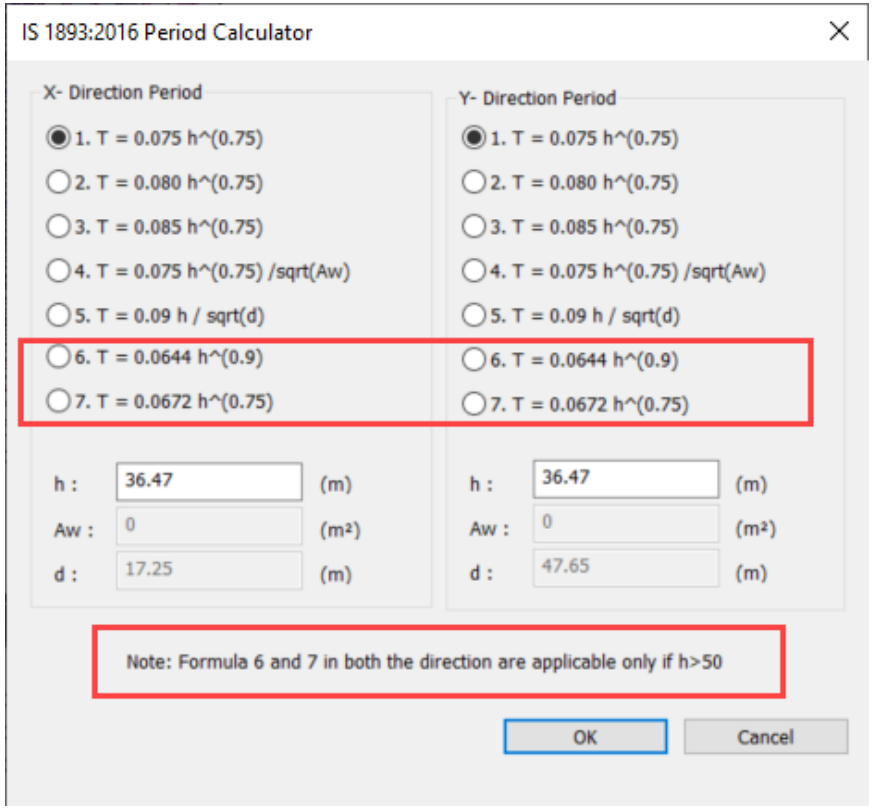
The fundamental translational natural Period (T_x and T_y) in any of the two horizontal plan directions, shall not exceed 8s. hence here IF T_x , T_y < 8 sec , "Regular" is printed , IF exceeds 8s "Irregular" is printed.

Approximate Time period of building according to IS : 16700-2023

1. Approximate Time period

- From the Main Menu select Load > Static Load > Lateral > Seismic Loads >Add > **Structural parameters > Period Calculator**

Approximate Time peri



1. Approximate Fundamental Natural period

According to Clause 6.3.4 of IS : 16700-2023

The approximate fundamental natural period for buildings of height greater than 50 m is given b y following expressions :-

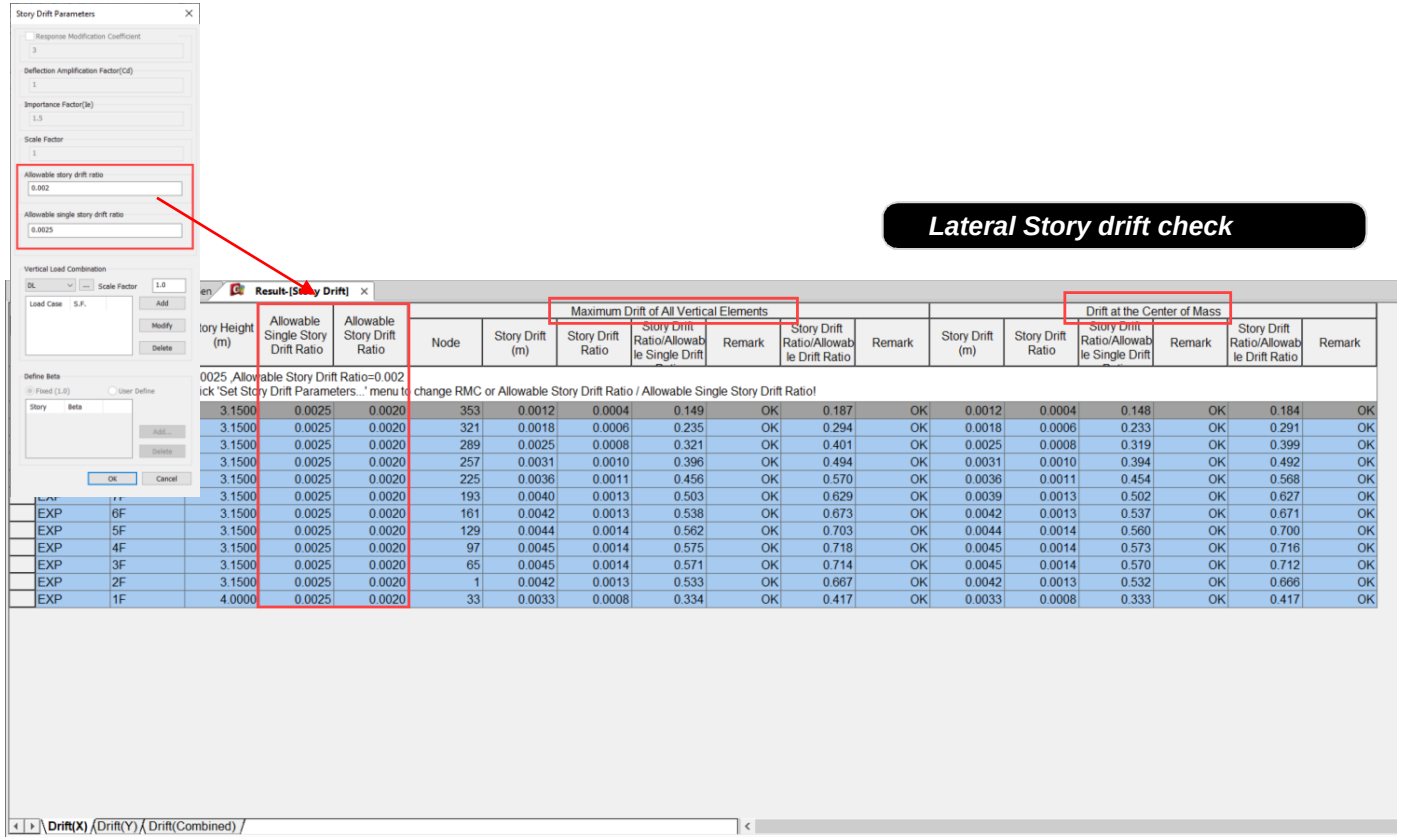
$$T_a = 0.0644H^{0.9}\ for\ Concrete\ MRF\ systems$$

$$T_a = 0.0672H^{0.75}\ for\ all\ ther\ conrete\ structural\ systems$$

Lateral Story Drift Check according to IS : 16700 - 2023

1. Lateral story drift check

- Results > Results Tables > Story> check parameter > **IS : 16700-2023 > Story drift**



		Story Height (m)	Allowable Single Story Drift Ratio	Allowable Story Drift Ratio	Node	Story Drift (m)	Story Drift Ratio	Story Drift Ratio/Allowable Single Drift	Remark	Story Drift Ratio/Allowable Drift Ratio	Remark	Story Drift (m)	Story Drift Ratio	Story Drift Ratio/Allowable Single Drift	Remark	Story Drift Ratio/Allowable Drift Ratio	Remark
		3.1500	0.0025	0.0020	353	0.0012	0.0004	0.149	OK	0.187	OK	0.0012	0.0004	0.148	OK	0.184	OK
		3.1500	0.0025	0.0020	321	0.0018	0.0006	0.235	OK	0.294	OK	0.0018	0.0006	0.233	OK	0.291	OK
		3.1500	0.0025	0.0020	289	0.0025	0.0008	0.321	OK	0.401	OK	0.0025	0.0008	0.319	OK	0.399	OK
		3.1500	0.0025	0.0020	257	0.0031	0.0010	0.396	OK	0.494	OK	0.0031	0.0010	0.394	OK	0.492	OK
		3.1500	0.0025	0.0020	225	0.0036	0.0011	0.456	OK	0.570	OK	0.0036	0.0011	0.454	OK	0.568	OK
		3.1500	0.0025	0.0020	193	0.0040	0.0013	0.503	OK	0.629	OK	0.0039	0.0013	0.502	OK	0.627	OK
EXP	6F	3.1500	0.0025	0.0020	161	0.0042	0.0013	0.538	OK	0.673	OK	0.0042	0.0013	0.537	OK	0.671	OK
EXP	5F	3.1500	0.0025	0.0020	129	0.0044	0.0014	0.562	OK	0.703	OK	0.0044	0.0014	0.560	OK	0.700	OK
EXP	4F	3.1500	0.0025	0.0020	97	0.0045	0.0014	0.575	OK	0.718	OK	0.0045	0.0014	0.573	OK	0.716	OK
EXP	3F	3.1500	0.0025	0.0020	65	0.0045	0.0014	0.571	OK	0.714	OK	0.0045	0.0014	0.570	OK	0.712	OK
EXP	2F	3.1500	0.0025	0.0020	1	0.0042	0.0013	0.533	OK	0.667	OK	0.0042	0.0013	0.532	OK	0.666	OK
EXP	1F	4.0000	0.0025	0.0020	33	0.0033	0.0008	0.334	OK	0.417	OK	0.0033	0.0008	0.333	OK	0.417	OK

1. Lateral Story drift check

According to Clause 5.4.1 of IS : 16700-2023

When design lateral forces are applied on the building, the maximum inter-story lateral drift ratio (Δ_{Max}/h_i) limited to 1/500. For a single story the drift limit may be relaxed to $h_i/400$.

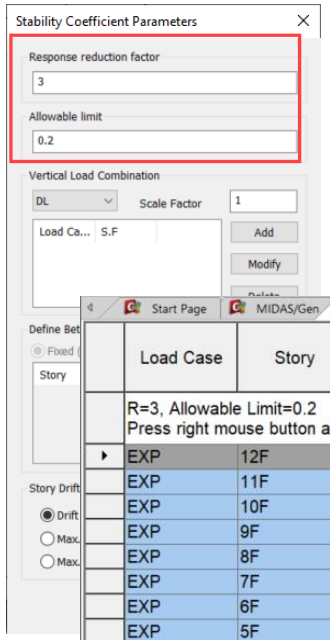
Hence input for allowable limit for single story is added , And if the story drift ratio exceeds t he allowable limit "N.G" is printed else "OK" is printed

Note : For story drift calculation only two methods i.e. Maximum Drift of All vertical Element s and Drift at center of mass are considered for now.

Stability Coefficient Check according to IS : 16700 - 2023

1. Stability Coefficient check

- *Results > Results Tables > Story> check parameter >* ***IS : 16700-2023 > Stability Coefficient***



Stability Coefficient check

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Load Case	Story	Story Height (m)	Vertical Load (kN)	Story Shear Force (kN)	Story Drift (m)	Response Reduction factor (m)	Stability Coefficient (θ)	Allowable Limit	Remark
R=3, Allowable Limit=0.2 Press right mouse button and click 'Set Stability Coefficient Parameters...' menu to change R/Allowable limit!									
EXP	12F	3.15	12137.9445	588.8395	0.0012	3.0000	0.0026	0.2000	OK
EXP	11F	3.15	25409.8890	1170.5164	0.0018	3.0000	0.0042	0.2000	OK
EXP	10F	3.15	38681.8335	1653.5459	0.0025	3.0000	0.0063	0.2000	OK
EXP	9F	3.15	51953.7780	2047.0877	0.0031	3.0000	0.0084	0.2000	OK
EXP	8F	3.15	65225.7225	2360.3013	0.0036	3.0000	0.0105	0.2000	OK
EXP	7F	3.15	78497.6670	2602.3463	0.0040	3.0000	0.0127	0.2000	OK
EXP	6F	3.15	91769.6115	2782.3822	0.0042	3.0000	0.0148	0.2000	OK
EXP	5F	3.15	105041.5560	2909.5688	0.0044	3.0000	0.0169	0.2000	OK
EXP	4F	3.15	118313.5005	2993.0656	0.0045	3.0000	0.0189	0.2000	OK
EXP	3F	3.15	131585.4450	3042.0322	0.0045	3.0000	0.0206	0.2000	OK
EXP	2F	3.15	144857.3895	3065.6281	0.0042	3.0000	0.0210	0.2000	OK
EXP	1F	4.00	158531.0355	3073.1202	0.0033	3.0000	0.0144	0.2000	OK

Stability Coefficient(X) | Stability Coefficient(Y)

1. Stability Coefficient check

According to Clause 7.3.10 of IS : 16700-2023

Stability coefficient is by : -

$$\theta = \frac{P_i \Delta_i}{V_i h_{i-r} R} \leq 0.2$$

Where ,

θ = *Inter-Storey Drift stability coefficient*

P_i = *Total design vertical load at level i*

Δ_i = *Design storey drift at level i*

V_i = *Design shear force at level i;*

h_{i-r} = *Story height below level i*

R = *Response reduction factor*

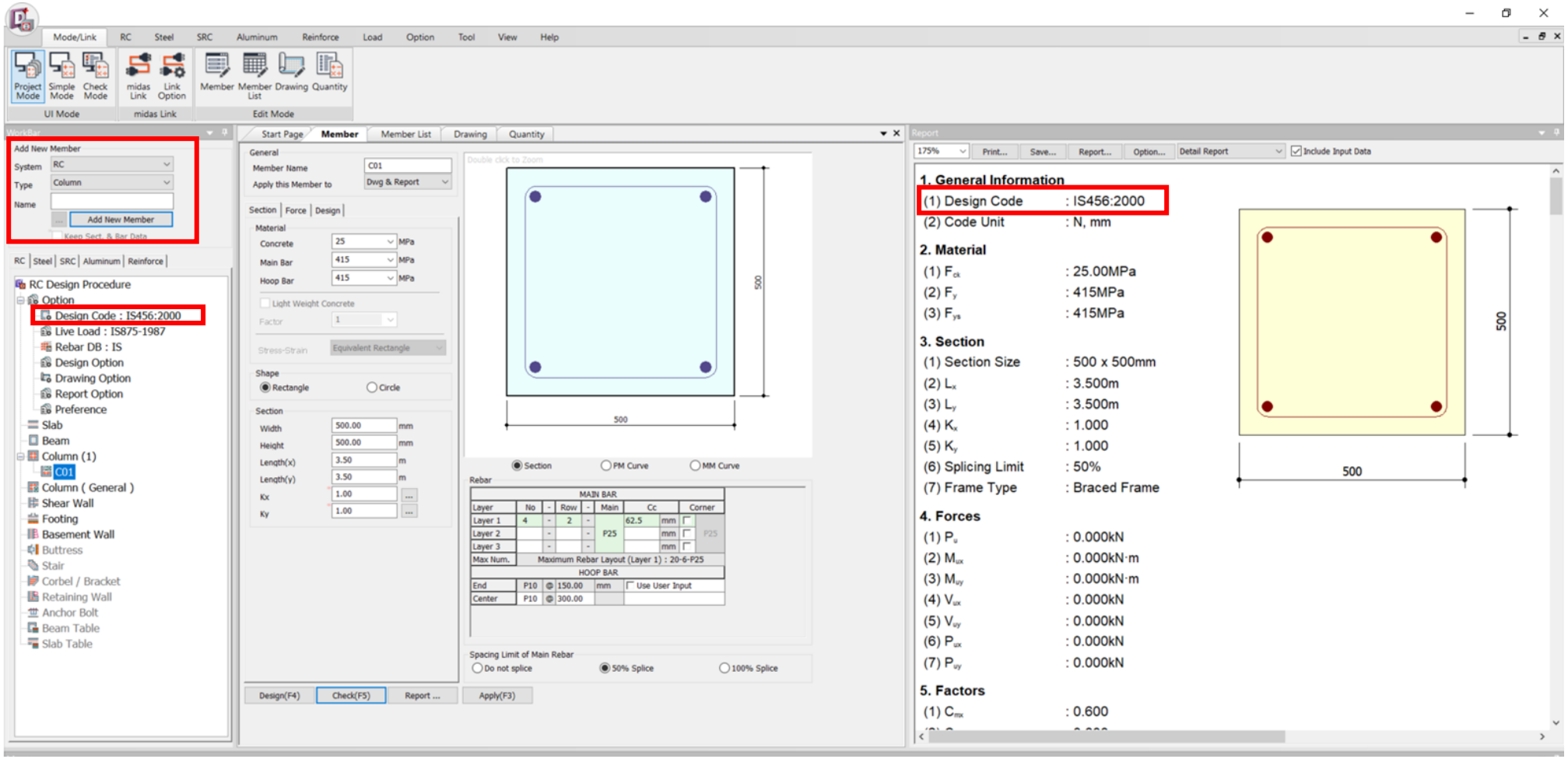
Improvement of IS code in Design+

- ***Added Design Module for IS :456-2000.***

  1. *Column Module*
  2. *Basement Wall Module*
  3. *Shear Wall Module*

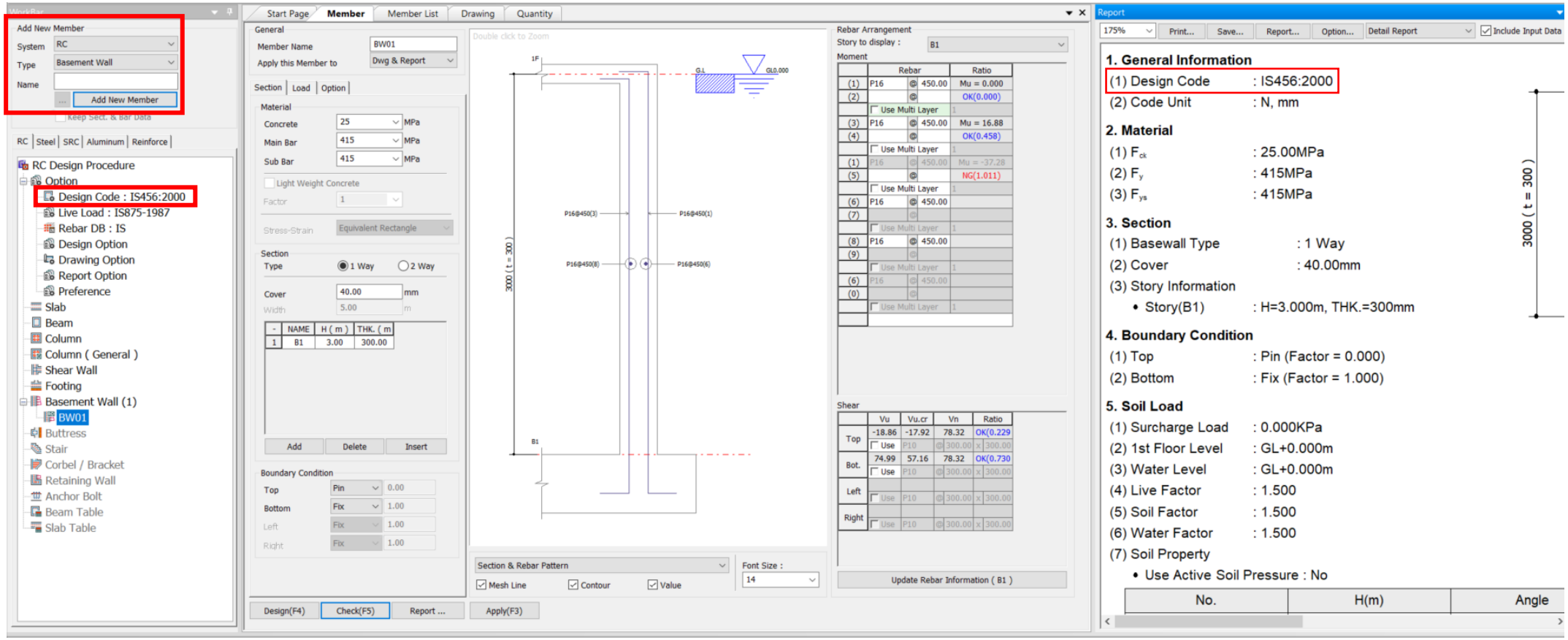
Added Design Module for IS :456-2000

- **Added Column module**



Added Design Module for IS :456-2000

- **Added Basement wall module**



Added Design Module for IS :456-2000

- **Added Shear wall module**