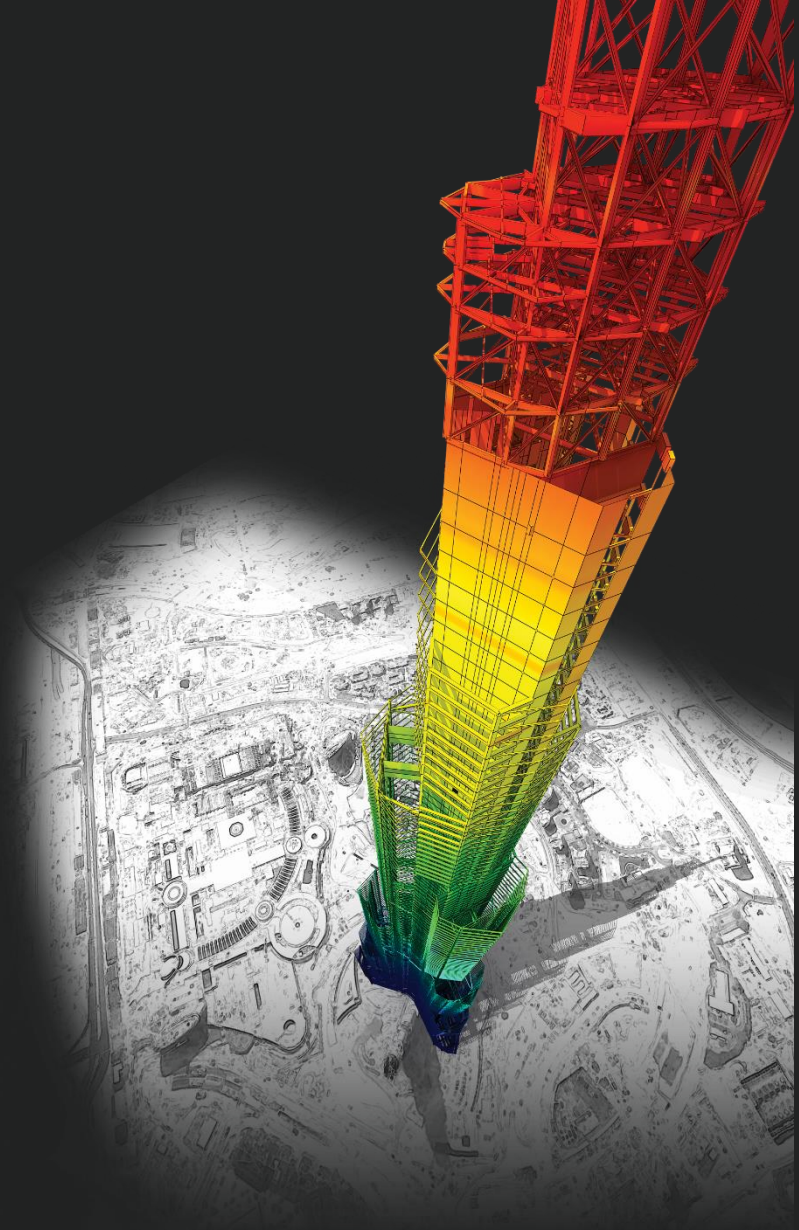


Release Note

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 改善基座板的螺栓設計
- 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

Design Code Dialog Box in TWN-111

Concrete Design

Design Code : TWN-USD111

☒ Apply Special Provisions for Seismic Design
☐ Consider strong column-weak beam on last floor

Shear for Design Update by Code

$R^*V_c(a1 \cdot \sum(Mpr)/L > \max(Vu1, Vu2)/2)$, $R = 0$

Method
☒ MAX(Vu1, Vu2) ☐ MIN(Vu1, Vu2) ☐ Vu1 ☐ Vu2

$Vu1, Vg + a1 \cdot \sum(Mpr)/L$, $a1 = 0$
 $Vu2, Vg + a2 \cdot Veq$, $a2 = 0$

SCWB Design/Checking Method
☐ Design Strength ☒ Nominal Strength
☐ Don't consider the k1 factor
 Reduction factor of column : 0.65

Member Types to be excluded in Seismic Design
☒ Sub-Beam ☒ Cantilever
☒ Underground Beam/Column

☐ Torsion Design
 Torsion Reduction Factor for Beam : 1

Moment Redistribution Factor for Beam : 1
 Moment Calculation Method for Beam
☐ Equivalent Rebar ☒ Each Rebar

☐ Use Subdivided Force for Beam Assigned as Member

P-M Curve Calculation Method
☐ Keep P Constant
☒ Keep M/P Constant

☐ Check the interaction for biaxial shear
 fs of Main bar in Beam Design
☒ 2/3*fy ☐ By Program

Design Code Dialog Box in TWN-112

Concrete Design

Design Code : TWN-USD112

☐ Check Beam Deflection
☒ Apply Special Provisions for Seismic Design
☐ Seismic Design Parameter
☐ Consider strong column-weak beam on last floor

Shear Wall Type
☐ Special RC Structural Wall
 Boundary Element Method
☒ Displacement Based Method
 Deflection Amplification Factor (Cd) 4.50
 Important Factor (Ie) 1.20
☐ Stress Based Method

Shear for Design Update by Code

$R^*V_c(a1 \cdot \sum(Mpr)/L > \max(Vu1, Vu2)/2)$, $R = 0$

Method
☐ MAX(Vu1, Vu2) ☒ MIN(Vu1, Vu2) ☐ Vu1 ☐ Vu2

$Vu1, Vg + a1 \cdot \sum(Mpr)/L$, $a1 = 1$
 $Vu2, Vg + a2 \cdot Veq$, $a2 = 2$
 $Vu2, Vg + a2 \cdot Veq$ (Column) , $a2 = 2$

SCWB Design/Checking Method
☐ Design Strength ☒ Nominal Strength
☐ Don't consider the k1 factor
 Reduction factor of column : 0.65

☐ Beam-Column Joint Design
 Select Check Position
☐ Top ☒ Bottom

Member Types to be excluded in Seismic Design
☒ Sub-Beam ☒ Cantilever
☒ Underground Beam/Column

- 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 – 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

Concrete Design Code

Design Code : TWN-USD112

☒ Check Beam Deflection

☒ Apply Special Provisions for Seismic Design

☐ Seismic Design Parameter

☐ Consider strong column-weak beam on last floor

Shear Wall Type

☒ Special RC Structural Wall

Boundary Element Method

☐ Displacement Based Method

Deflection Amplification Factor (Cd) 4.50

Important Factor (Ie) 1.20

☒ Stress Based Method

RC-Wall Design 結果

TWN-USD112 RC-Wall Design Result Dialog

Code : TWN-USD112 (Method 2) Unit : kgf , cm

Sorted by ☒ Wall ID + Story ☐ Wall ID (WID) Primary Sorting Option ☐ WID ☒ Story

Sort Result...

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

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：

$$V_e = V_{uns} + (\Omega_v \omega_v) V_{uEH} \quad (18.7.3.1)$$

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 亦得採撓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
$h_{wcl}/l_w \leq 1.0$	1.0	(a)
$1.0 < h_{wcl}/l_w < 2.0$	(a)與(c)之間線性內插	(b)
$h_{wcl}/l_w \geq 2.0$	1.5	(c)

(a) $\omega_v = 1.0$

(b) $\omega_v = 1.0$

(c) $\omega_v = 0.8 + 0.0288 h_{wcl}^{1/3}$
 $[0.8 + 0.0134 h_{wcl}^{1/3}]$

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
$V_u / \phi V_{n,i}$		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

$$\begin{aligned} V_u &= 210,570.374\text{kgf} \\ V_{uns} &= 0.000\text{kgf} \\ V_{uEH} &= 210,570.374\text{kgf} \\ h_{wcl} &= 3,930.000\text{cm} \\ l_w &= 800.000\text{cm} \\ (h_{wcl} / l_w &= 4.9125 \geq 2.0) \\ h_w &= 4,570.000\text{cm} \\ \Omega_v &= 1.5000 \\ \omega_v &= 0.8 + 0.0288 h_{wcl}^{1/3} = 1.2779 \\ V_e &= V_{uns} + \Omega_v \omega_v V_{uEH} = 403,641.388\text{kgf} \\ V_u &= V_e = 403,641.388\text{kgf} \end{aligned} \quad \begin{matrix} 18.7.3.2 \\ 18.7.3.1 \end{matrix}$$

2) Design Parameter

$$\begin{aligned} L_w &= 800.000\text{cm}, h = 20.0 \\ f_c &= \min(f_c, 700.0\text{kgf/cm}^2) \\ \lambda &= 1.0 \\ \phi &= 0.75 \end{aligned}$$

3) Calculate shear strength by

$$\begin{aligned} \alpha_c &= 0.530 \\ A_{cv} &= h L_w = 16,000.000\text{cm}^2 \\ V_c &= \alpha_c \lambda \sqrt{f_c} A_{cv} = 14 \end{aligned}$$

4) Check required shear reinf

$$\begin{aligned} V_u &= 403,641.388\text{kgf} \\ \phi &= 0.750 \\ \phi V_c &= \phi \cdot V_c = 106,423.11 \\ V_u &= 403,641.388\text{kgf} > \phi V_c \\ \rightarrow &\text{Transverse reinforcement} \end{aligned}$$

5) Check spacing of shear rein

$$s_{vmax} = \min(l_w / 5, 3h, 4s_v)$$

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.

$$\begin{aligned} c &= 230.557\text{cm} \\ BEL_{req} &= \max[c - 0.1L_w, c / 2] = 150.557\text{cm} \end{aligned} \quad 18.7.6.4$$

2) Determine if special boundary elements are required by stress based method.

$$\begin{aligned} \sigma &= 149.022\text{kgf/cm}^2 > 0.2 f_c = 56.000\text{kgf/cm}^2 \\ \rightarrow &\text{Special boundary elements are required} \end{aligned} \quad 18.7.6.3$$

3) Check special boundary elements are required in current wall.

$$\begin{aligned} \sigma &= 63.686\text{kgf/cm}^2 > 0.15 f_c = 42.000\text{kgf/cm}^2 \\ \rightarrow &\text{Special boundary element transverse reinforcement is required} \end{aligned} \quad 18.7.6.3$$

4) Check dimension of the special boundary element

$$\begin{aligned} b &= 20.000\text{cm} \\ h_b &= 320.000\text{cm} \\ b &> \frac{h_b}{16} \rightarrow 0.K \\ \text{If } h_w / L_w &> 2, c / L_w > 3/8 \\ b &< 30.000\text{cm} \rightarrow \text{Not Acceptable} \end{aligned}$$

5) Compute maximum spacing of horizontal rebar for boundary element.

$$\begin{aligned} A_{b1} &= 0.710\text{cm}^2 \\ h_b &= h_w - 2 \cdot D_o + Dia_{end} + Dia_{hor} = 17.543\text{cm} \\ s_{max1} &= \min[Dimension_{min} / 3, 8 d_o, 20.000\text{cm}] = 6.667\text{cm} \\ s_{max2} &= \min[\max(10.000\text{cm}, 10 + (35 - h_b) / 3, 15.000\text{cm})] = 15.819\text{cm} \\ s_{max} &= \min[s_{max1}, s_{max2}] = 6.667\text{cm} \\ s_{use} &= 20.000\text{cm} \\ s_{use} &= 20.000\text{cm} > s_{max} = 6.667\text{cm} \rightarrow \text{Not Acceptable} \end{aligned} \quad \begin{matrix} \text{Table 18.7.6.5(b)} \\ 18.4.5.3 (e) \end{matrix}$$

6) Compute horizontal rebar for special boundary element for thickness direction.

$$\begin{aligned} h_{c1} &= BEL_{req} - 2 \cdot D_o + Dia_{end} + Dia_{hor} = 146.194\text{cm} \\ A_{bh1} &= 0.3 S h_{c1} \left(\frac{A_s}{A_{bh}} - 1 \right) f_c / f_{yt} = 10.180\text{cm}^2 \\ A_{bh1} &= 0.09 S h_{c1} f_c / f_{yt} = 17.543\text{cm}^2 \end{aligned}$$

Special Boundary

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

Concrete Design Code

Design Code : TWN-USD112

☒ Check Beam Deflection

☒ Apply Special Provisions for Seismic Design

☐ Seismic Design Parameter

☐ Consider strong column-weak beam on last floor

Shear Wall Type

☒ Special RC Structural Wall

Boundary Element Method

☒ Displacement Based Method

Deflection Amplification Factor (Cd) 4.50

Important Factor (Ie) 1.20

☐ Stress Based Method

Shear for Design

Update by Code

$R^*V_c(a1 \cdot \sum(Mpr)/L > \max(Vu1, Vu2)/2)$, R = 0

Method

☒ MAX(Vu1, Vu2) ☐ MIN(Vu1, Vu2) ☐ Vu1 ☐ Vu2

Vu1, Vg + a1 * $\sum(Mpr)/L$, a1 = 1

Vu2, Vg + a2 * Veq , a2 = 1

Vu2, Vg + a2 * Veq (Column) , a2 = 2

SCWB Design/Checking Method

☐ Design Strength ☒ Nominal Strength

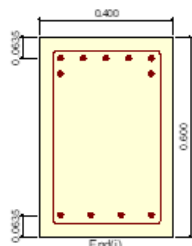
☐ Don't consider the k1 factor

Reduction factor of column : 0.65

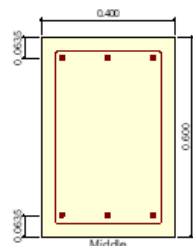
詳細計算書結果-Beam

1. Member Information

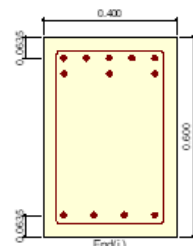
- Design Code
TWN-USD112
- Section Property
G1 (ID : 11)
- Material
Concrete
 $f_c = 2,800,000.000 \text{ kgf/m}^2$, $E_c = 2.007984 \text{ e}+9 \text{ kgf/m}^2$
Reinforcement
 $f_y = 42,000,000.000 \text{ kgf/m}^2$, $f_{ys} = 28,000,000.000 \text{ kgf/m}^2$, $E_s = 2.040000 \text{ e}+10 \text{ kgf/m}^2$
- Length
L = 9.500m
- Reinforcement Data



Top 5-D22
2-D22
Bottom 4-D22
Stirrups 2-D13@120



Top 3-D22
-
Bottom 3-D22
Stirrups 2-D13@220



Top 5-D22
3-D22
Bottom 4-D22
Stirrups 2-D13@110

6) Description of applied factors for design

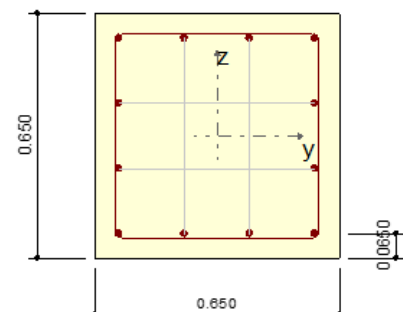
- Special Provisions For Seismic Design : Special Moment Frames
- Seismic Scale Up Factor for Shear (α_1) = 1.000
 - Seismic Scale Up Factor for Shear (α_2) = 1.000
 - MAX[Shear by α_1 , Shear by α_2]

a2 = 1 (for Beam)

詳細計算書結果-Column

1. Member Information

- Design Code
TWN-USD112
- Section Property
C1 (ID : 1)
- Material
Concrete
 $f_c = 2,800,000.000 \text{ kgf/m}^2$, $E_c = 2.007984 \text{ e}+9 \text{ kgf/m}^2$
Reinforcement
 $f_y = 42,000,000.000 \text{ kgf/m}^2$, $f_{ys} = 28,000,000.000 \text{ kgf/m}^2$, $E_s = 2.040000 \text{ e}+10 \text{ kgf/m}^2$
- Length
L = 4.200m
- Reinforcement Data



End Part Middle Part

Main 12-4-D22 12-4-D22

Stirrups 4-D13@90 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

SCWB Design/Checking Method

☐ Design Strength ☒ Nominal Strength

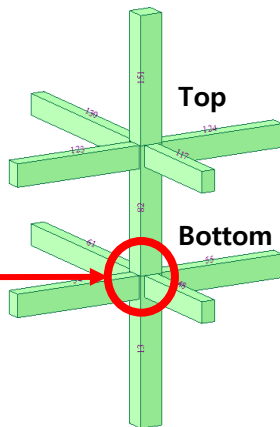
☐ Don't consider the k1 factor

Reduction factor of column :

☒ Beam-Column Joint Design

Select Check Position

☐ Top ☒ Bottom



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

Sorted by ☒ Member ☐ Property

MEMB	SECT	Section	fc	fy	LCB	Pu	Mc	As	V-Rebar	LCB	Vu.end	Rat-V.end	As-H.end	H-Rebar.end	Vjhd
SECT		Bc Hc	Height	fys		Rat-P	Rat-M				Vu.mid	Rat-V.mid	As-H.mid	H-Rebar.mid	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/Vnj)	103235 / 216335 = 0.477	191620 / 293994 = 0.652		
Joint Ratio	0.477 < 1.000 O.K	0.652 < 1.000 O.K		

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

Joint	LCB	cLCB9	
Vhj/Vnj	103,234.777kgf / 216,335.183kgf = 0.477		OK

* cLCB9 : 0.9D - 1.0EX

1) Compute joint geometry information

$$b_b = 0.400m$$

$$b_c = 0.650m$$

$$h_c = 0.600m$$

$$h_b = 0.600m$$

$$x_1 = x_2 = \min \{ (b_c - b_b) / 2, h_c / 4 \} = 0.125m$$

$$b_j = \min \{ b_c, b_b + x_1 + x_2 \} = 0.650m$$

2) Compute horizontal shear force

$$\sum M_{bpr,CW} = 61,485.226kgf \cdot m$$

$$\sum M_{bpr,CCW} = 61,485.226kgf \cdot m$$

$$\sum V_{be} = 37,762.145kgf$$

$$l_c = 3.900m$$

$$V_{col,CW} = (\sum M_{bpr,CW} + \sum V_{be} \cdot h_j / 2) / l_c = 18,670.223kgf$$

$$V_{col,CCW} = (\sum M_{bpr,CCW} + \sum V_{be} \cdot h_j / 2) / l_c = 18,670.223kgf$$

$$\text{Applied shear force: } V_{col} = \max \{ V_{col,CW}, V_{col,CCW} \} = 18,670.223kgf$$

$$\text{Beam demand top: } A_{s1} \cdot 1.25 f_{yt} = 60,952.500kgf$$

$$\text{Beam demand bottom: } A_{s2} \cdot 1.25 f_{yt} = 60,952.500kgf$$

Column Location Type : Interior Column

$$V_{hj} = (A_{s1} + A_{s2}) \cdot 1.25 f_{yt} - V_{col} = 103,234.777kgf$$

3) Compute nominal joint shear capacity

$$F_c = 2,800,000.000kgf/m^2$$

$$A_j = 0.390m^2$$

The joint is classified as,

Continuous column + Continuous beams + Not confined column.

$$V_n = 3.9\lambda \sqrt{F_c} A_j = 254,511.980kgf$$

4) Compute design joint shear capacity

$$\phi = 0.850$$

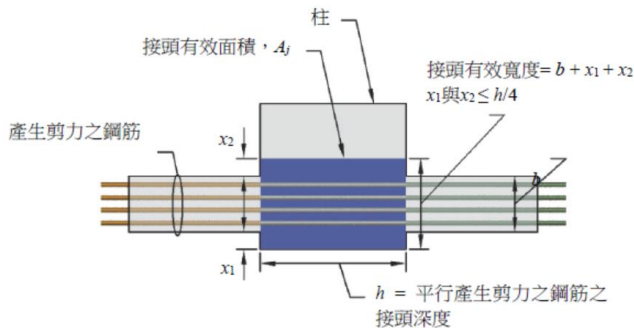
$$V_{hj} = \phi V_n = 216,335.183kgf$$

詳細計算書結果

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節規定之橫向梁圖象	V_n , kgf [N] [†]
連續或符合第15.2.6節規定	連續或符合第15.2.7節規定	圓束	$5.3\lambda \sqrt{f'_c} A_j [1.7\lambda \sqrt{f'_c} A_j]$
		非圓束	$3.9\lambda \sqrt{f'_c} A_j [1.2\lambda \sqrt{f'_c} A_j]$
其他	其他	圓束	$3.9\lambda \sqrt{f'_c} A_j [1.2\lambda \sqrt{f'_c} A_j]$
		非圓束	$3.2\lambda \sqrt{f'_c} A_j [1.0\lambda \sqrt{f'_c} A_j]$
其他	連續或符合第15.2.7節規定	圓束	$3.9\lambda \sqrt{f'_c} A_j [1.2\lambda \sqrt{f'_c} A_j]$
		非圓束	$3.2\lambda \sqrt{f'_c} A_j [1.0\lambda \sqrt{f'_c} A_j]$
其他	其他	圓束	$3.2\lambda \sqrt{f'_c} A_j [1.0\lambda \sqrt{f'_c} A_j]$
		非圓束	$2.1\lambda \sqrt{f'_c} A_j [0.66\lambda \sqrt{f'_c} A_j]$

[†]若混凝土使用輕質材料， λ 應為0.75；若混凝土使用常重材料， 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_0)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

Option
☒ Add ☐ Replace

Code Selection
☐ Steel ☒ Concrete ☐ SRC
☐ Cold Formed Steel ☐ Footing
☐ Aluminum

Design Code : TWN-USD112

Scale Up of Response Spectrum Load Cases
 Scale Up Factor : 1 RX
 Factor Load Case Add Modify Delete

Manipulation of Construction Stage Load Case
 ST : Static Load Case
 CS : Construction Stage Load Case
☒ ST Only ☐ CS Only ☐ ST+CS

☐ Consider Orthogonal Effect
 Set Load Cases for Orthogonal Effect...

☒ 100 : 30 Rule
☐ SRSS(Square-Root-of-Sum-of-Squares)

Generate Additional Load Combinations
☒ for Special Seismic Load
☐ for Vertical Seismic Forces
 Factors for Seismic Design...

☐ Will Execute Construction Stage Analysis
☐ Consider Losses for Prestress Load Cases
 Transfer Stage : 1 Define Factors
 Service Load Stage : 1

OK Cancel

Over-Strength Factor

Factors for Seismic Design

Special Seismic Loads
 Vertical Load Factor : 0.2
 Sds : 0

System Over-Strength Factor
 Load Case : RX(RS)
 Over-Strength Factor : 2.1

Load Case	Factor
RX(RS)	2.1
RY(RS)	2.3

Vertical Seismic Forces
 Vertical Force Factor : 0.2

OK Cancel

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)(2.3)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)(2.3)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)(2.3)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)(2.3)RY - (0.2)(0.0)D

Seismic Load Combination Type

General | Steel | Concrete | SRC | Cold Formed Steel

Seismic Load Combination Type

Option
☒ Add/Replace ☐ Delete

Assign Member
☒ for Special Seismic Loads
☐ for Vertical Seismic Forces

Apply Close

Special Load Combinations

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

Automatic Generation of Load Combinations

Option
☒ Add ☐ Replace

Code Selection
☐ Steel ☒ Concrete ☐ SRC
☐ Cold Formed Steel ☐ Footing
☐ Aluminum

Design Code : Eurocode2:04

National Annex : Italy

☐ Scale Up of Response Spectrum Load Cases

Scale Up Factor : 1 Rx

Factor	Load Case
1.000	Rx
1.000	Ry

Manipulation of Construction Stage Load Case
 ST : Static Load Case
 CS : Construction Stage Load Case
☒ ST Only ☐ CS Only ☐ ST+CS

☒ Consider Orthogonal Effect
 Set Load Cases for Orthogonal Effect...

☒ 100 : 30 : 30 Rule

Define Factors for Variable Actions
 Factors for Variable Actions...

Partial factors for actions
 Gamma_G : 1.3 Gamma_Q : 1.5

☐ Will Execute Construction Stage Analysis
☐ Consider Losses for Prestress Load Cases

Transfer Stage : 1 Define Factors
 Service Load Stage : 1

☐ Consider Imperfection Load
 Set Load Cases and Direction...

Generate Additional Load Combinations
☐ for Non-Dissipative

OK Cancel

Set Load Cases for Orthogonal Effect

100:30 Rule

Orthogonal Loads Group

Define Orthogonal Load Cases

Load Case 1 : Rx(RS)

Load Case 2 : Ry(RS)

Load Case 3 : None

Auto Grouping Generation...

Group No	LC1	LC2	LC3
1	Rx(RS)	Ry(RS)	None

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

Set Load Cases for 100:30:30 Rule

Orthogonal Loads Group

Define Orthogonal Load Cases

Load Case 1 : Rx(RS)

Load Case 2 : Ry(RS)

Load Case 3 : Rz(RS)

Auto Grouping Generation...

Group No	LC1	LC2	LC3
1	Rx(RS)	Ry(RS)	Rz(RS)
2	EX(ST)	EY(ST)	EZ(ST)

- 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	-0.3000
3	cLCB12	Stren	Add	1.0000	0.3000			1.0000	-0.3000	0.3000
4	cLCB13	Stren	Add	1.0000	0.3000			1.0000	-0.3000	-0.3000
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	-0.3000
8	cLCB17	Stren	Add	1.0000	0.3000			-0.3000	1.0000	-0.3000
9	cLCB18	Stren	Add	1.0000	0.3000			0.3000	0.3000	1.0000
10	cLCB19	Stren	Add	1.0000	0.3000			0.3000	-0.3000	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	-0.3000	1.0000
13	cLCB22	Stren	Add	1.0000	0.3000			-1.0000	-0.3000	-0.3000
14	cLCB23	Stren	Add	1.0000	0.3000			-1.0000	-0.3000	0.3000
15	cLCB24	Stren	Add	1.0000	0.3000			-1.0000	0.3000	-0.3000
16	cLCB25	Stren	Add	1.0000	0.3000			-1.0000	0.3000	0.3000
17	cLCB26	Stren	Add	1.0000	0.3000			-0.3000	-1.0000	-0.3000
18	cLCB27	Stren	Add	1.0000	0.3000			0.3000	-1.0000	-0.3000
19	cLCB28	Stren	Add	1.0000	0.3000			-0.3000	-1.0000	0.3000
20	cLCB29	Stren	Add	1.0000	0.3000			0.3000	-1.0000	0.3000
21	cLCB30	Stren	Add	1.0000	0.3000			-0.3000	-0.3000	-1.0000
22	cLCB31	Stren	Add	1.0000	0.3000			-0.3000	0.3000	-1.0000
23	cLCB32	Stren	Add	1.0000	0.3000			0.3000	-0.3000	-1.0000
24	cLCB33	Stren	Add	1.0000	0.3000			0.3000	0.3000	-1.0000

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

Set Cyclic Shear Resistance Parameters

Load Case/Combination
c.LCB7

Cyclic Shear Resistance Table Type
☐ Show Selected Elements
☒ Show All Elements

Confidence Factor
1.0

Displacement Behavior Factor(qd)
1

Importance Factor(Ie)
1

☒ Print Calculation Report

OK Cancel

Pushover Result

Set Cyclic Shear Resistance Parameters

Pushover Load Case
Y

Step for Demand
☐ Damage Limitation (DL)
☐ Significant Damage (SD)
☐ Near Collapse (NC)
☒ User Defined 20

Cyclic Shear Resistance Table Type
☒ Show Selected Elements
☐ Show All Elements

Confidence Factor
1.0

☒ Print Calculation Report

OK Cancel

Cyclic Shear Resistance Check Report for Frame

MIDAS/Text Editor [Joint Design_CyclicFram.txt]

```

=====
[[[+]]] Element : 1 (Primary), Load = c.LCB7, CF = 1.000
=====

*. Pos : 1, 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 = 0.026399

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     = N / V = 2236.782 mm
Ac     = 380250.000 mm²
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 = c.LCB7, CF = 1.000
=====

*. Pos : 1, 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

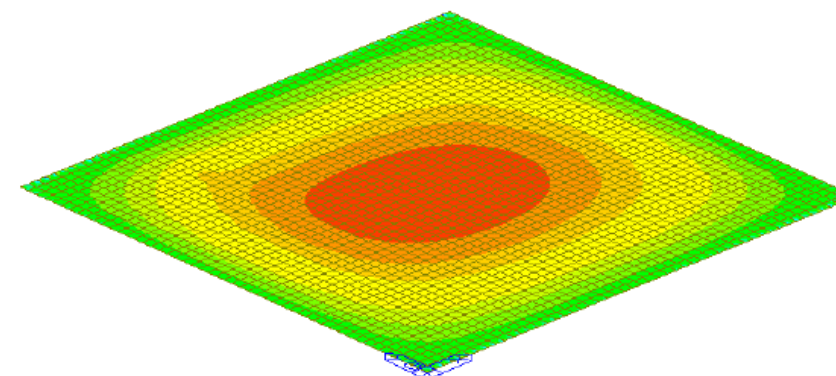
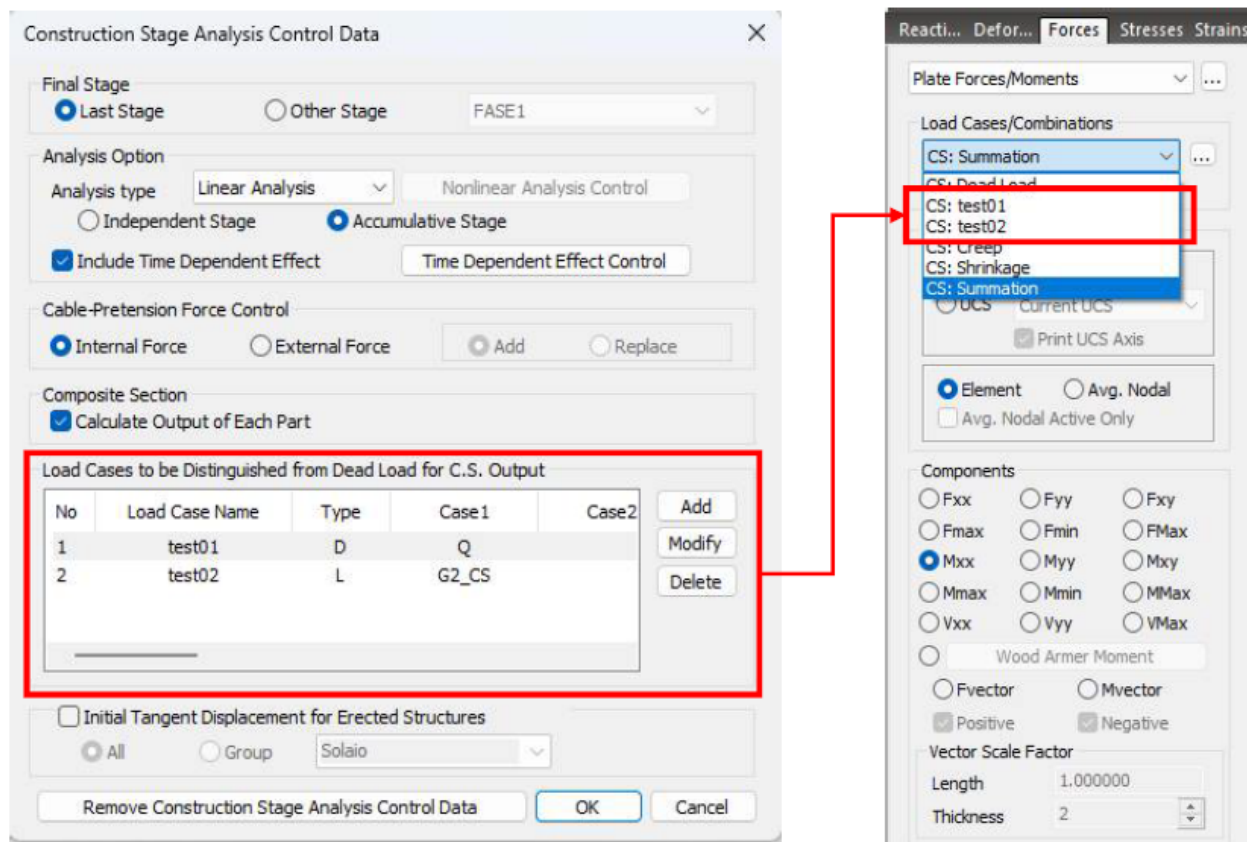
( ). Section Information.
h      = 4600.000 mm
Lv     = M / V = 5379.384 mm
Ac     = 1532220.000 mm²
ρtot   = 0.006569

( ). 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) = 1059.371 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

Material Data

General
Material ID: 1 Name: SSCS330

Elasticity Data
Type of Design: Steel

Steel
Standard: TIS 1228-2018(S)
DB: SSCS330
Product: SSCS330
Concrete: SSCS400
Concrete: SSCS490
Concrete: SSCS540

Type of Material
☒ Isotropic ☐ Orthotropic

Steel
Modulus of Elasticity: 2.0300e+05 N/mm²
Poisson's Ratio: 0.3
Thermal Coefficient: 1.1700e-05 1/[C]
Weight Density: 7.8500e-05 N/mm³
☐ Use Mass Density: 7.85e-05 N/mm³/g

Concrete
Modulus of Elasticity: 0.0000e+00 N/mm²
Poisson's Ratio: 0
Thermal Coefficient: 0.0000e+00 1/[C]
Weight Density: 0 N/mm³
☐ Use Mass Density: 0 N/mm³/g

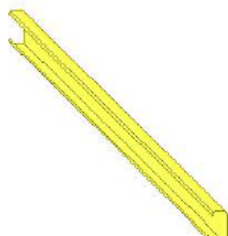
Plasticity Data
Plastic Material Name: NONE

Inelastic Material Properties for Fiber Model & Non-dissipative element
Concrete: None Steel: None
Confined Concrete for Columns: None

Thermal Transfer
Specific Heat: 0 Btu/lb·°F [C]
Heat Conduction: 0 Btu/in·hr·°F [C]
Damping Ratio: 0.02

OK Cancel Apply

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



AISI-CFSD08 Code Checking Result Dialog

Code: AISI-CFSD08 Unit: kN, m Primary Sorting Option: SECT, MEMB

Sorted by: Member Property Change... Update...

CH	MEMB	SECT	SEL	Section	LCB	Len	Ly	Cb	Ky	Cmy	1/Ap_y	Fu	Muy	Muz	Vuy	Vuz
K	COM	SHR		Material	Fy	Lb	Lz		Kz	Cmz	1/Ap_z	Pa	May	Maz	Vay	Vaz
OK	38	101		LC-150x85x20x4.0		5.00000	5.00000		1.000	1.000	1.000	0.00000	-1.1307	0.00000	0.00000	0.45227
	0.348	0.194		SSCS330	205000	1	5.00000	5.00000	1.000	1.000	1.000	240.875	3.24875	10.9675	49.5967	38.7450

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

DB	Es Modulus of Elasticity	v Poisson'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

Section Data

DB/User | Value | SRC | Combined | Tapered | Composite

Section ID: 1

Name: Cold Formed Channel

Sect. Name: TIS 1228(2018)

LC-250x75x25x4.5
LC-200x75x25x4.5
LC-200x75x25x4.0
LC-200x75x25x3.2
LC-200x75x20x4.5
LC-200x75x20x4.0
LC-200x75x20x3.2
LC-150x75x25x4.5
LC-150x75x25x4.0
LC-150x75x25x3.2
LC-150x75x20x4.5
LC-150x75x20x4.0
LC-150x75x20x3.2
LC-150x65x20x4.0
LC-150x65x20x3.2
LC-150x65x20x2.3
LC-125x50x20x4.5
LC-125x50x20x4.0
LC-125x50x20x3.2
LC-125x50x20x2.3
LC-120x60x25x4.5
LC-120x60x20x3.2
LC-120x60x20x2.3
LC-120x40x20x3.2
LC-100x50x20x4.5
LC-100x50x20x4.0
LC-100x50x20x3.2
LC-100x50x20x2.3
LC-100x50x20x1.6
LC-75x45x15x2.3

Offset: Center-Center

☒ Consider Shear Deformation.

☐ Consider Warping Effect(7th DOF)

Show Calculation Results... OK Cancel Apply

Section Properties

	Value	Unit
Area	1.503718e-02	ft ²
Asy	6.361935e-03	ft ²
Asz	8.194491e-03	ft ²
Ixx	1.065243e-06	ft ⁴
Iyy	5.665640e-04	ft ⁴
Izz	1.149349e-04	ft ⁴
Cyp	1.640420e-01	ft
Cym	8.202100e-02	ft
Czp	2.460630e-01	ft
Czm	2.460630e-01	ft
Qyb	8.814152e-02	ft ²
Qzb	1.861063e-02	ft ²
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

Close

Z-Section

Section Data

DB/User | Value | SRC | Combined | Tapered | Composite

Section ID: 101

Name: Z-Section

Sect. Name: Z 100x50x20/2.3
Z 100x50x20/2.3
Z 100x50x20/3.2

Get Data from Single Angle

DB Name: AISC10(US)

Sect. Name:

H: 0.328084 ft
B: 0.164042 ft
tw: 0.00754593 ft
r: 0 ft
d: 0.0556168 ft
th: 90 [deg]

Offset: Center-Center

☒ Consider Shear Deformation.

☐ Consider Warping Effect(7th DOF)

Show Calculation Results... OK Cancel Apply

Section Properties

	Value	Unit
Area	5.567094e-03	ft ²
Asy	2.144928e-03	ft ²
Asz	2.361817e-03	ft ²
Ixx	0.000000e+00	ft ⁴
Iyy	9.350045e-05	ft ⁴
Izz	4.031990e-05	ft ⁴
Cyp	1.602690e-01	ft
Cym	1.602690e-01	ft
Czp	1.640420e-01	ft
Czm	1.640420e-01	ft
Qyb	4.593811e-02	ft ²
Qzb	5.113656e-04	ft ²
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

Close

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

Add/Modify Seismic Load Specification

Load Case Name : **HEX**

Seismic Load Code : **Eurocode-8(2004)**

National Annex : **Malaysia**

Description :

Seismic Load Parameters

Ground Type : **B**

Region Type : **Peninsular**

Spectrum Parameters

☒ Type1 ☐ Type2 ☐ User Defined

Soil Factor (S) : **1.4**

T_B : **0.05** T_C : **0.3** T_D : **2.2**

Ref. Peak Ground Acc. (A_gR) : **0.08** g

Behavior Factor (q) : **1.5**

Lower Bound Factor (b) : **0.2**

Importance Factor (I) : **1.0**

Structural Parameters

X-Dir. : ☒ Y-Dir. : ☐

Fundamental Period : **1** **0**

Seismic Load Direction Factor (Scale Factor)

X-Direction : **1** Y-Direction : **0**

Seismic Load Profile

Component : ☒ X-Dir ☐ Y-Dir ☐ X & Y Dir ☐ SRSS

Select Profile : ☒ Story Force ☐ Story Shear ☐ Overturning Moment

Story Name	Weight	Elev.	Seismic Force	Added Force
26_CUB_M	58.3536	74500.0	6.4495108	0.0
25_Cub	272.89794	71800.0	26.088588	0.0
24_P18	357.7877	69000.0	36.57586	0.0
23_P17	357.7877	66200.0	36.091642	0.0
22_P16	357.7877	63400.0	33.897493	0.0
21_P15	357.7877	60600.0	32.123164	0.0
20_P14	357.7877	57800.0	30.638526	0.0
19_P13	357.7877	55000.0	28.154687	0.0

File Name : D:\F06_release\work\midas_gen\2023\25.7.1

Make Seismic Load Calc. Sheet Browse

Response Spectrum Function

Generate Design Spectrum

Design Spectrum : **Eurocode-8(2004)**

National Annex : **Malaysia**

Spectrum Type : **Horizontal Design Spectrum**

Ground Type : **B**

Region : **Peninsular**

Spectrum Parameters

☒ Type1 ☐ Type2 ☐ User Defined

Soil Factor (S) : **1.4**

T_B : **0.05** T_C : **0.3** T_D : **2.2**

Ref. Peak Ground Acc. (A_gR) : **0.08** g

Importance Factor (I) : **1.0**

Behavior Factor (q) : **1.5**

Lower Bound Factor (b) : **0.2**

Max. Period : **6** (Sec)

Add/Modify/Show Response Spectrum Functions

Function Name : **EUROCODE-8(2004)**

Spectral Data Type : ☒ Normalized Accel ☐ Acceleration ☐ Velocity ☐ Displacement

Scaling : ☒ Scale Factor **1** ☐ Maximum Value **1** g

Gravity : **9806** mm/sec²

Damping Ratio : **0.05**

Graph Options : ☐ X-axis log scale ☐ Y-axis log scale

Period (sec)	Spectral Data (g)
1	0.0000
2	0.0000
3	0.0000
4	0.1200
5	0.1800
6	0.2400
7	0.3000
8	0.3600
9	0.4200
10	0.4800
11	0.5400
12	0.6000
13	0.6600
14	0.7200

Description : EUROCODE-8(2004) S=1.4, T_B=0.05, T_C=0.30, T_D=2.20, A_gR=0.08g, I=1.0, q=1.5, b=0.20

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.

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	0.05	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

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	0.4	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

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	0.05	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

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 γ_I

Class I : γ_I = 0.8
 Class III : γ_I = 1.2
 Class IV : γ_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

Rebar Size

KS	JIS	CHS	ASTM	BS/EN	UNI	IS	GB	CSA	SS	GOST	AS/NZS	PNS49
☐ D6	☐ D6	☐ D10	☐ #3	☐ P5	☐ P4	☐ P6	☐ d4	☐ 10M	☐ H5	☐ d6	☐ D6	☐ D10
☒ D10	☐ D10	☐ D13	☐ #4	☐ P6	☐ P5	☐ P8	☐ d5	☐ 15M	☐ H6	☐ d8	☐ D8	☐ D12
☒ D13	☐ D13	☐ D16	☐ #5	☐ P7	☐ P6	☐ P10	☐ d6	☐ 20M	☐ H7	☐ d10	☐ D10	☐ D16
☒ D16	☐ D16	☐ D19	☐ #6	☐ P8	☐ P8	☐ P12	☐ d8	☐ 25M	☐ H8	☐ d12	☐ D12	☐ D20
☐ D19	☐ D19	☐ D22	☐ #7	☐ P9	☐ P10	☐ P16	☐ d10	☐ 30M	☐ H9	☐ d14	☐ D16	☐ D25
☐ D22	☐ D22	☐ D25	☐ #8	☐ P10	☐ P12	☐ P18	☐ d12	☐ 35M	☐ H10	☐ d16	☐ D20	☐ D28
☐ D25	☐ D25	☐ D29	☐ #9	☐ P11	☐ P14	☐ P20	☐ d14	☐ 40M	☐ H11	☐ d18	☐ D22	☐ D32
☐ D29	☐ D29	☐ D32	☐ #10	☐ P12	☐ P16	☐ P22	☐ d16	☐ 45M	☐ H12	☐ d20	☐ D24	☐ D36
☐ D32	☐ D32	☐ D36	☐ #11	☐ P13	☐ P18	☐ P25	☐ d18	☐ 50M	☐ H13	☐ d22	☐ D25	☐ D40
☐ D36	☐ D36	☐ D39	☐ #12	☐ P14	☐ P20	☐ P28	☐ d20		☐ H14	☐ d24	☐ D28	☐ D44
☐ D39	☐ D39	☐ D43	☐ #13	☐ P15	☐ P22	☐ P32	☐ d22		☐ H15	☐ d26	☐ D30	☐ D48
☐ D41	☐ D41	☐ D45	☐ #14	☐ P16	☐ P24	☐ P36	☐ d24		☐ H16	☐ d28	☐ D32	☐ D50
☐ D43	☐ D43	☐ D47	☐ #15	☐ P17	☐ P26	☐ P40	☐ d26		☐ H17	☐ d30	☐ D34	
☐ D45	☐ D45	☐ D49	☐ #16	☐ P18	☐ P28		☐ d28		☐ H18	☐ d32	☐ D36	
☐ D47	☐ D47	☐ D51	☐ #17	☐ P19	☐ P30		☐ d30		☐ H19	☐ d34	☐ D38	
☐ D49	☐ D49	☐ D53	☐ #18	☐ P20	☐ P32		☐ d32			☐ d36	☐ D40	
☐ D51	☐ D51	☐ D55		☐ P21	☐ P34		☐ d34					
☐ D53	☐ D53			☐ P22	☐ P36		☐ d36					
☐ D55	☐ D55			☐ P23	☐ P38		☐ d38					

OK Close

Rebar Information

CHK	Name	Dia (mm)	Area (mm²)	Dia(Out) (mm)	Weight (kg/m)
☐	P5	0.0050	0.0000	0.0050	0.0015
☐	P6	0.0060	0.0000	0.0060	0.0022
☐	P7	0.0070	0.0000	0.0070	0.0030
☐	P8	0.0080	0.0001	0.0080	0.0039
☐	P9	0.0090	0.0001	0.0090	0.0049
☒	P10	0.0100	0.0001	0.0100	0.0061
☐	P11	0.0110	0.0001	0.0110	0.0073
☒	P12	0.0120	0.0001	0.0120	0.0087
☐	P13	0.0130	0.0001	0.0130	0.0102
☐	P16	0.0160	0.0002	0.0160	0.0155
☐	P20	0.0200	0.0003	0.0200	0.0242
☐	P25	0.0250	0.0005	0.0250	0.0378
☐	P32	0.0320	0.0008	0.0320	0.0619
☐	P40	0.0400	0.0013	0.0400	0.0967

OK Close

Select a rebar DB code
in Preferences

Rebar
Material Code
EN04(RC)

Material DB
Class A

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.

Component Properties

Component	Hinge Location	Skeleton Curve
☐ Fx	1&J-end	Eurocode 8 : 2004
☐ Fy	1&J-end	Eurocode 8 : 2004
☐ Fz	1&J-end	Eurocode 8 : 2004
☐ Mx	1&J-end	Trilinear Type
☒ My	1&J-end	Eurocode 8 : 2004
☒ Mz	1&J-end	Eurocode 8 : 2004

Yield Surface Properties... Masonry Properties... Shear Span(Lv)...

OK Cancel Apply

Shear Span

Comp.	Shear Span (Lv)
I-end	J-end
My	0.1 0.1
Mz	0.1 0.1

☒ Relative Length

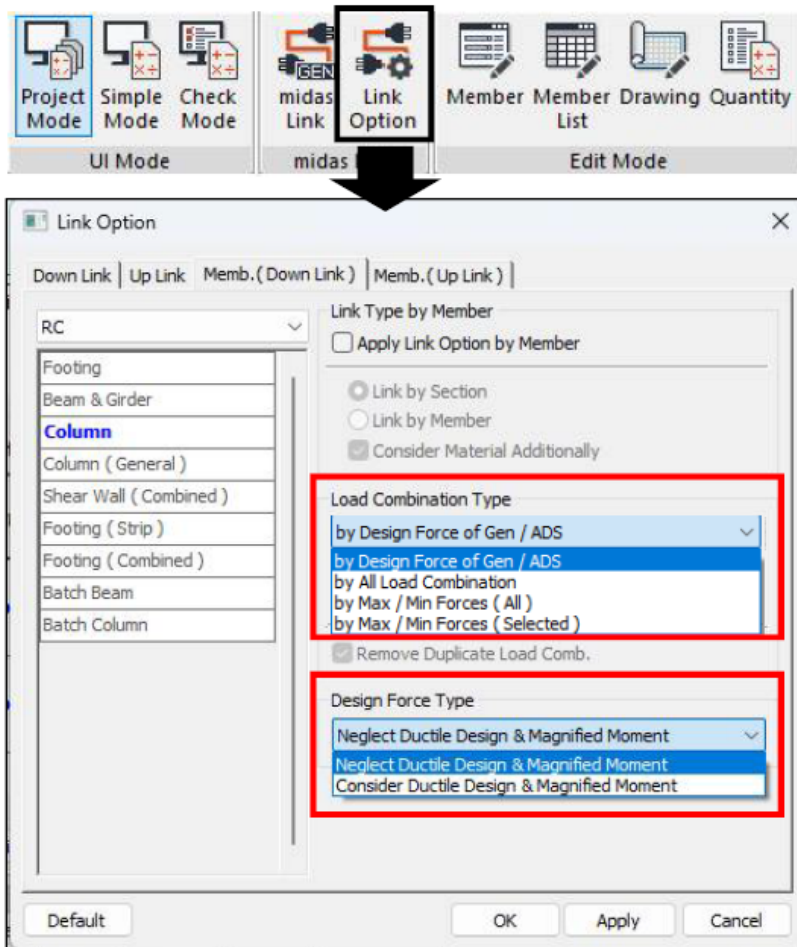
OK Cancel

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 dual system. * In the old version, the design member forces had been generated with the member force of the ground Level. Wall design force of a release version RF 5F 4F 3F 3F 2F 1F GL h_{cr} of a release version Wall design force of a current version h_{cr} of a current version Sample for wall design ● Analysis force ● Design force Design Moment Design Shear force

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]

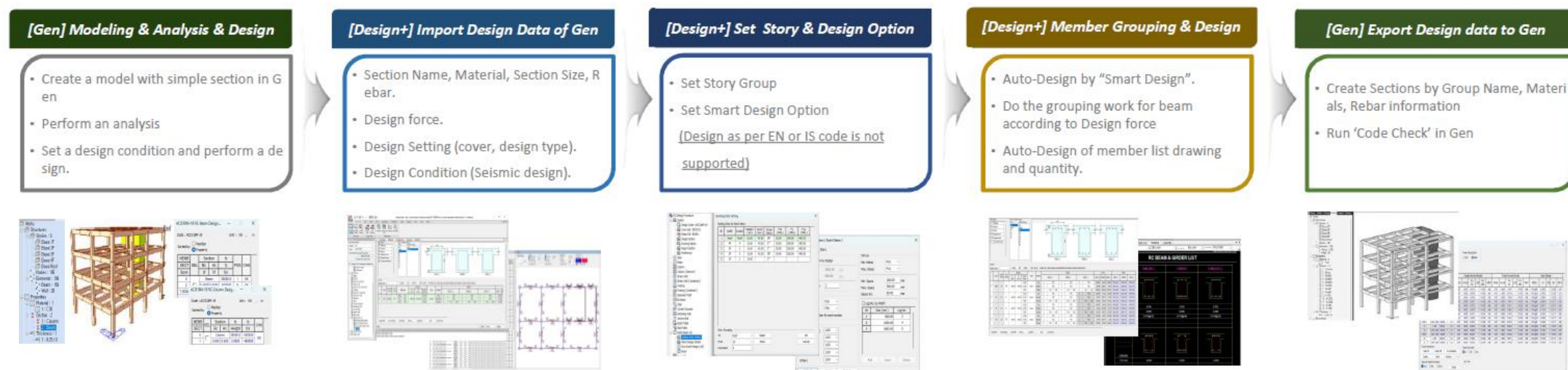
- Neglect Ductile Design & Magnified Moment
 - : Design forces by strong column-weak beam are not considered
 - : Design forces by 2nd Order Effect (by moment magnification method) are not considered.
 - Consider Ductile Design & Magnified Moment
 - : Design forces by strong column-weak beam are considered
 - : 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.



- 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 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 改善基座板的螺栓設計

- 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)

General
Member Name: BP01
Apply this Member to: Dwg & Report

Section | Plate | Rib | **Bolt**

Anchor Bolt
Install Type: Cast-In-Place Anchor B
Diameter: M12
Length: 22.40
Position (x): 50.00
Position (y): 50.00
Number (x): 2
Number (y): 2
Start Angle: 0

☒ Get number from Rib-Plate Layout
Post-Installed Anchor Bolt Design Data ...

Double click to Zoom

Section & Layout (Plan Only) ☒ Mesh Line ☒ Contour ☒ Value

Check Items	Value	Criteria	Remark
Bearing Stress (MPa)			
Comp. (MPa)	6.908	26.52	OK(0.260)
Tens. (kN)	-12.39	25.45	OK(0.487)
Base Plate			
Mxx (kN.m/m)	-6.585	13.54	OK(0.487)
Myy (kN.m/m)	-8.257	13.54	OK(0.610)
Rib Plate			
Mx (kN.m)	1.701	3.007	OK(0.566)
Vy (kN)	39.49	77.36	OK(0.510)
Wing Plate			
Mx (kN.m)	-	-	-
Vy (kN)	-	-	-
Anchor Bolt			
Vu (kN)	1.414	13.57	OK(0.104)
Tu (kN)	-12.39	25.45	OK(0.487)
Length (mm)	269	267	OK(0.994)
Edge Distance (mm)			
Post. Tension			

Design+ 2024 (V2.1)

General
Member Name: BP02
Apply this Member to: Dwg & Report

Section | Plate | Rib | **Anchor** | Layout

Anchor
Install Type: Cast-In-Place Anchor I
Anchor Type: Headed Stud
Diameter: M8
Length (lef): 150.00
Pullout Strength (No): 30.00
Dist. of J/L-Bolt (eh): 30.00

Strength Reduction Factor
Concrete, Tension: 0.650
Concrete, Shear: 0.750
Anchor, Tension: 0.750
Anchor, Shear: 0.650

Design
Breakout Strength Coefficient (k_c): 24.000

Bond Stress of Adhesive Anchor
T_{cr}: 1.40 MPa
T_{upper}: 2.10 MPa

RC Section
☒ Crack ☐ Uncrack

Double click to Zoom

Section & Layout (Plan Only) ☒ Mesh Line ☒ Contour ☒ Value

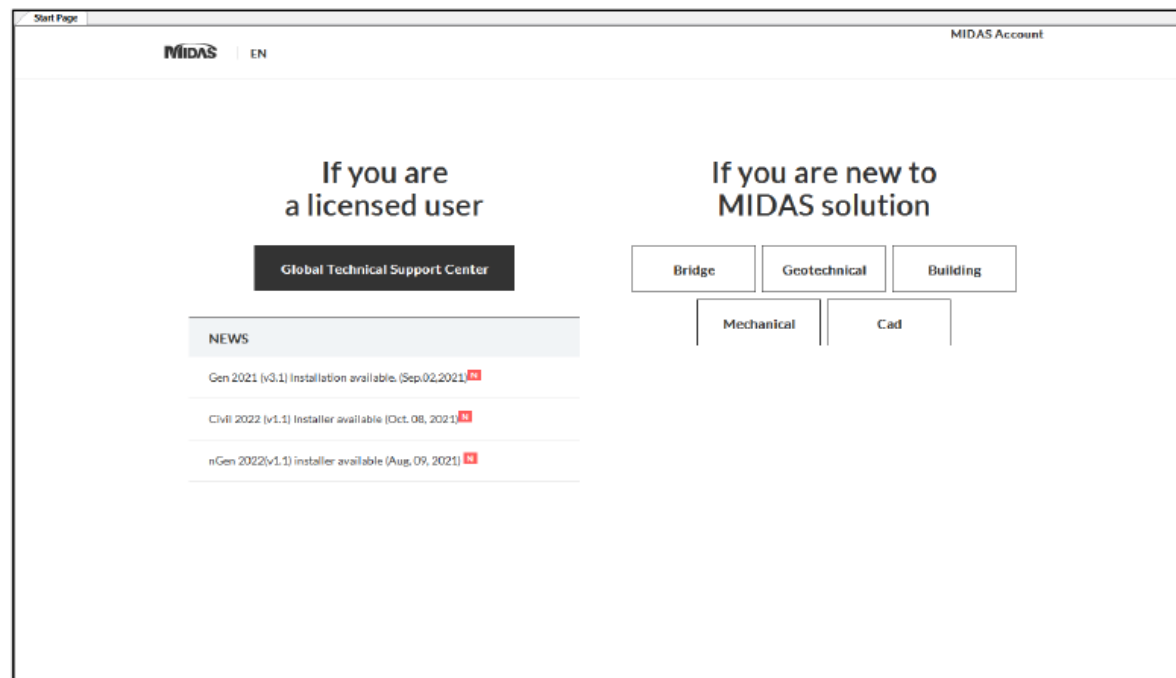
Calculation Result

Check Items	Value	Criteria	Remark
Splitting Failure			
Minimum Edge Distance (mm)	-	-	-
Limit of Embedment Depth (mm)	-	-	-
Anchor (Tens.)			
Steel Strength (kN)	11.65	15.08	OK(0.773)
Pullout Strength of Anchor (kN)	11.65	18.82	OK(0.619)
Concrete Breakout Strength (kN)	58.30	1241	OK(0.047)
Concrete Side-Face Blowout Strength (kN)	-	-	-
Bond Strength of Adhesive Anchor (kN)	-	-	-
Anchor (Shear)			
Steel Strength (kN)	1.179	10.46	OK(0.113)
Pullout Strength of Anchor (kN)	-	-	-
Concrete Breakout Strength-X (kN)	-	-	-
Concrete Breakout Strength-Y (kN)	-	-	-
Anchor (Ratio)			
Tension	-	-	OK(0.773)
Shear	-	-	OK(0.113)
Combined	0.773	1.000	OK(0.773)

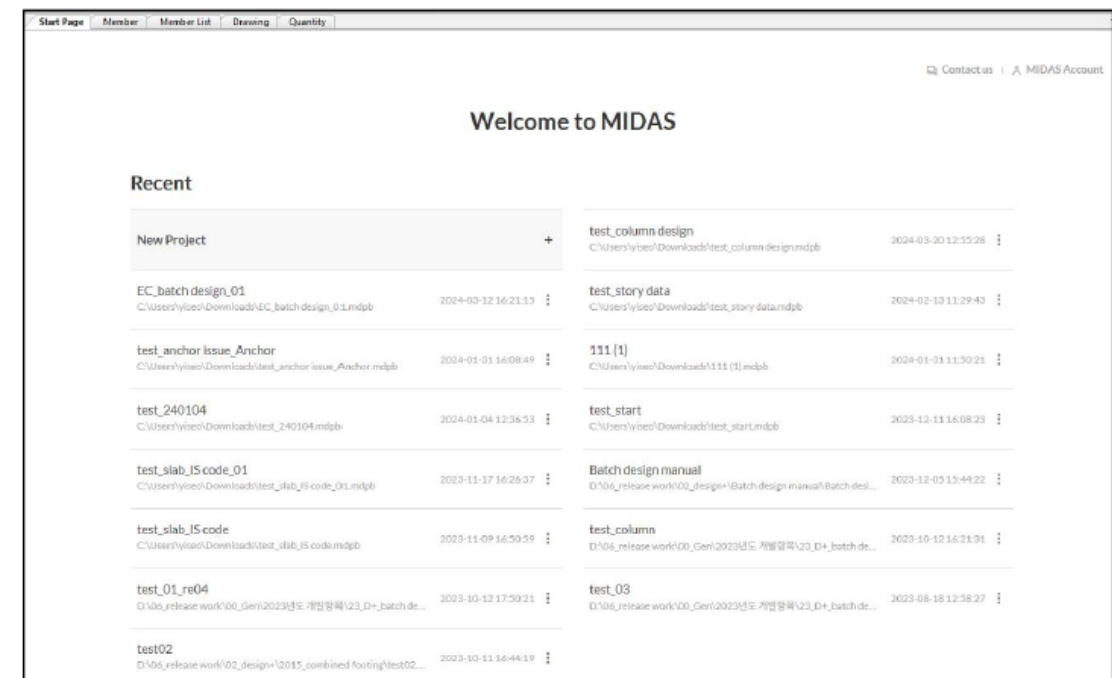
Improvement of Start Page 改善起始頁顯示

- 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

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
25	sLCB2	Streng	Add	0.9D - 1.5(1.0)RS X
26	sLCB2	Streng	Add	0.9D - 1.5(1.0)RS Y
27	sLCB2	Streng	Add	ASC:1.2D+3EL2
28	sLCB2	Streng	Add	ASC:0.9D+3EL2
29	sLCB2	Streng	Add	ASC:1.2D-3EL2
30	sLCB3	Streng	Add	ASC:0.9D-3EL2
31	sLCB3	Streng	Add	ASC:1.2D+2.5RS1
32	sLCB3	Streng	Add	ASC:1.2D+2.5RS1
33	sLCB3	Streng	Add	ASC:0.9D+2.5RS1
34	sLCB3	Streng	Add	ASC:0.9D+2.5RS1
35	sLCB3	Streng	Add	ASC:1.2D-2.5RS1
36	sLCB3	Streng	Add	ASC:1.2D-2.5RS1
37	sLCB3	Streng	Add	ASC:0.9D-2.5RS1
38	sLCB3	Streng	Add	ASC:0.9D-2.5RS1
39	sLCB3	Streng	Add	1.2D + 0.5(L) + 2.5EQ XP
40	sLCB4	Streng	Add	1.2D + 0.5(L) + 2.5EQ YP
41	sLCB4	Streng	Add	1.2D + 0.5(L) - 2.5EQ XP
42	sLCB4	Streng	Add	1.2D + 0.5(L) - 2.5EQ YP
43	sLCB4	Streng	Add	1.2D + 0.5(L) + 2.5RS X
44	sLCB4	Streng	Add	1.2D + 0.5(L) + 2.5RS Y
45	sLCB4	Streng	Add	1.2D + 0.5(L) - 2.5RS X
46	sLCB4	Streng	Add	1.2D + 0.5(L) - 2.5RS Y

Load Cases and Factors

Automatic Generation of Load Combinations

Option

☒ Add
 ☐ Replace

Code Selection

☒ Steel
 ☐ Concrete
 ☐ SRC
 ☐ Cold Formed Steel
 ☐ Footing
 ☐ Aluminum

Design Code :

IS:800-2007

Scale Up of Response Spectrum Load Cases

Scale Up Factor :

1

RS X

Factor

Load Case

Add

Modify

Delete

Manipulation of Construction Stage Load Case

ST : Static Load Case

CS : Construction Stage Load Case

☒ ST Only
 ☐ CS Only
 ☐ ST+CS

Consider Orthogonal Effect

☐ 100 : 30 Rule
 ☐ SRSS(Square-Root-of-Sum-of-Squares)

Set Load Cases for Orthogonal Effect...

Generate Additional Load Combinations

☒ for Special Seismic Load
 ☐ for Vertical Seismic Forces

Factors for Seismic Design...

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 Table 4 of IS : 800 : 2007, load combination mentioned below, must be also considered.

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

$$2) 0.9DL \pm 1.0 EL_m$$

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

$$0.9 DL \pm 1.0 EL_m \dots\dots(2)$$

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/m²
 - 0.50 for live load class more than 3.0 kN/m²;
- LL = Imposed load as per IS 875 (Part 2);
- EL_m = Estimated maximum equivalent earthquake force induced in the structure = ΩEL ;
- Ω = Overstrength factor = 2.5 for SCBFs and EBFs = 3.0 for SMRFs; and
- EL = Earthquake load as per IS 1893 (Part 1).

Factors for Seismic Design

Special Seismic Loads

Over-Strength & Safety Factor

Load Case :

EQ XP(ST)

Factor :

3

Load Case

Factor

EQ XP(ST)

3

EQ YP(ST)

3

RS X(RS)

2.5

Add

Modify

Delete

Vertical Seismic Forces

Vertical Force Factor :

0.2

OK

Cancel

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

- 01 -

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
12	Local y	LCB	192.1860	550.2155	0.35	N/A
12	Local z	LCB	37.5929	107.1165	0.35	N/A
12	Local y	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 the design code dialog box under Seismic provisions

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 of column and beam cross-sections respectively, 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

Steel Design Code

Design Code : IS:800-2007

☒ All Beams/Girders are Laterally Braced

☐ Check Beam/Column Deflection

☒ Apply Special Provisions for Seismic Design

Combined Ratio Method for Circular Section

☒ SRSS(Square root of sum of square)

☐ Linear Sum

Seismic Load Resisting System

System : Special Moment Resisting Frames

☒ Consider story on last floor

Special Moment Resisting Frames

Special Concentrically Braced Frames

OK Close

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

```
( ). Check flange width to thickness ratio for seismic 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 seismic 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 seismic provision [IS:18168-2023 6.4.1 & 8.4]
-. Plastic hinge strength, Mp = 1.1*Ry*fy*Zp = 246.27 kN-m.
-. Vses(D+L) = 13.50 kN.
-. Vses = Vses(D+L) + ((Mp+Mp)/(L-db)) = 210.51 kN.
Vses = 210.51
-. ----- = 0.118 < 1.000 --> O.K.
Vdz = 1787.48
```

```
( ). Check ratio of shear strength for seismic provision [IS:18168-2023 6.4.1 & 8.4]
-. Plastic hinge strength, Mp = 1.1*Ry*fy*Zp = 1734.27 kN-m.
-. Vses(D+L) = 23.38 kN.
-. Vses = Vses(D+L) + ((Mp+Mp)/(L-db)) = 1410.80 kN.
Vses = 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 special seismic provision.

- Limiting Flange width to thickness ratio , web depth to thickness ratio checks as per Table 2 of IS :18168-2023.
- Slenderness check as per Clause 6.2 of IS :18168-2023.
- 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 seismic 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 seismic 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 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

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 special 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

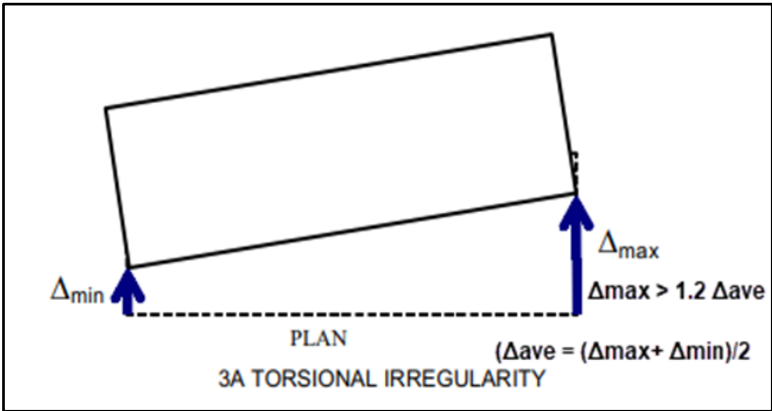
Load Case	Story	Level (m)	Story Height (m)	Average Value of Extreme Points		Maximum Value		Remark
				1.4*Story Drift (m)	1.2*Story Drift (m)	Node	Story Drift (m)	
EXP	12F	40.50	3.15	0.0016	0.0014	353	0.0012	Regular
EXP	11F	37.35	3.15	0.0026	0.0022	321	0.0018	Regular
EXP	10F	34.20	3.15	0.0035	0.0030	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

Weight Irregularity Ch

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

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**

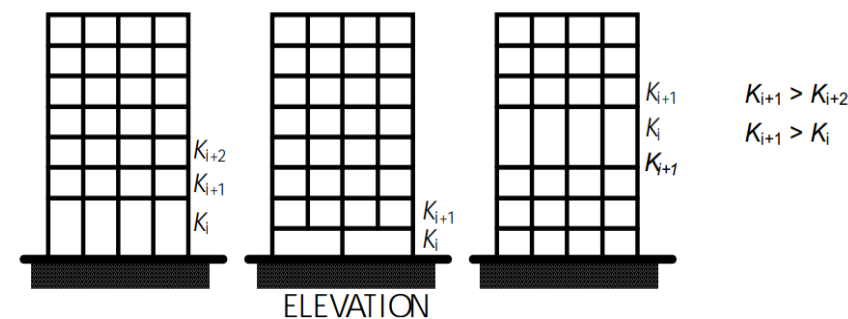
Stiffness Irregularity Chec

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

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 stiffness, 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**

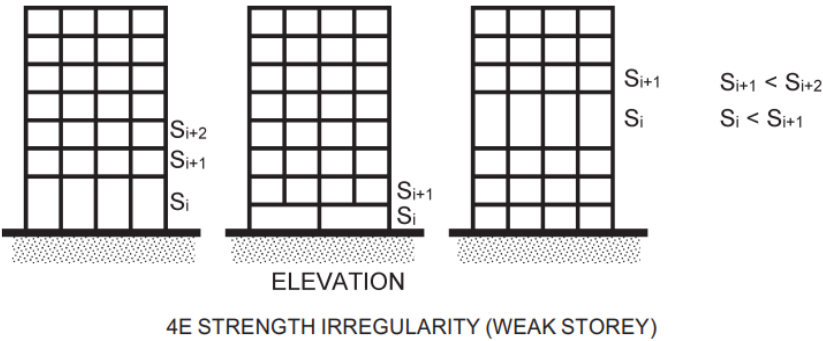
Capacity Irregularity Ch

Story	Level (m)	Story Height (m)	Angle1 ((deg))	Story Shear Strength1 (kN)	Upper Story Shear Strength1 (kN)	Story Shear Ratio1	Remark1	Angle2 ((deg))	Story Shear Strength2 (kN)	Upper Story Shear Strength2 (kN)	Story Shear 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	Regular	90.00	15303.2605		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

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.



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

- Reaction
- Displacements
- Truss
- Cable
- Beam
- Plate
- Plane Stress
- Plane Strain
- Axisymmetric
- Solid
- Wall
- Elastic Link
- General Link
- Vibration Mode Shape
- Mode Shapes Irregularity Check
- Buckling Mode Shape
- Nodal Results of RS
- Story
- Inelastic Hinge
- Time History Analysis
- Heat of Hydration Analysis
- Tendon
- Composite Section For C.S.
- Displacement Participation Factor
- Initial Element Force
- Imperfection

4	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 closer to each other by 10 percent of the larger value.

Hence for the 1st condition If summation of modal mass participation is less than 65 percent "Irregular" 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 "Regular" 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 natural period of the building in respective principal plan direction.

For final status , if both condition are "Irregular" , " Irregular" is printed, if both condition are "Regular" , " Regular" is printed, if one of the condition is "Regular" and other one is "Irregular", "Partial 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

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

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	1.0628	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

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/0.9Ttrans,min)	Remark			
9	1.2021	1.3148	1.0159	NG			

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 $0.9 \cdot T_{trans,min}$ 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 exceed 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

IS 1893:2016 Period Calculator

X- Direction Period

☒ 1. $T = 0.075 h^{(0.75)}$

☐ 2. $T = 0.080 h^{(0.75)}$

☐ 3. $T = 0.085 h^{(0.75)}$

☐ 4. $T = 0.075 h^{(0.75)} / \sqrt{A_w}$

☐ 5. $T = 0.09 h / \sqrt{d}$

☐ 6. $T = 0.0644 h^{(0.9)}$

☐ 7. $T = 0.0672 h^{(0.75)}$

h : (m)

Aw : (m²)

d : (m)

Y- Direction Period

☒ 1. $T = 0.075 h^{(0.75)}$

☐ 2. $T = 0.080 h^{(0.75)}$

☐ 3. $T = 0.085 h^{(0.75)}$

☐ 4. $T = 0.075 h^{(0.75)} / \sqrt{A_w}$

☐ 5. $T = 0.09 h / \sqrt{d}$

☐ 6. $T = 0.0644 h^{(0.9)}$

☐ 7. $T = 0.0672 h^{(0.75)}$

h : (m)

Aw : (m²)

d : (m)

Note: Formula 6 and 7 in both the direction are applicable only if $h > 50$

OK Cancel

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 by following expressions :-

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

$$T_a = 0.0672H^{0.75} \text{ for all the concrete structural systems}$$

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 Drift Parameters

Response Modification Coefficient: 3
 Deflection Amplification Factor(Cd): 1
 Importance Factor(Ie): 1.5
 Scale Factor: 1

Allowable story drift ratio: 0.002
 Allowable single story drift ratio: 0.0025

Results-Story Drift

Story Height (m)	Allowable Single Story Drift Ratio	Allowable Story Drift Ratio	Node	Maximum Drift of All Vertical Elements				Drift at the Center of Mass							
				Story Drift (m)	Story Drift Ratio	Story Drift Ratio/Allowable Single Drift	Remark	Story Drift (m)	Story Drift Ratio	Story Drift Ratio/Allowable Single Drift	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
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
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
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
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
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
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

Lateral Story drift check

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 the 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 Elements 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

Stability Coefficient Parameters

Response reduction factor
3

Allowable limit
0.2

Vertical Load Combination
DL Scale Factor 1

Load Ca... S.F. Add Modify Delete

Define Bet
Fixed
Story

Story Drift
Drift
Max.
Max.

Result-[Stability Coefficient]

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

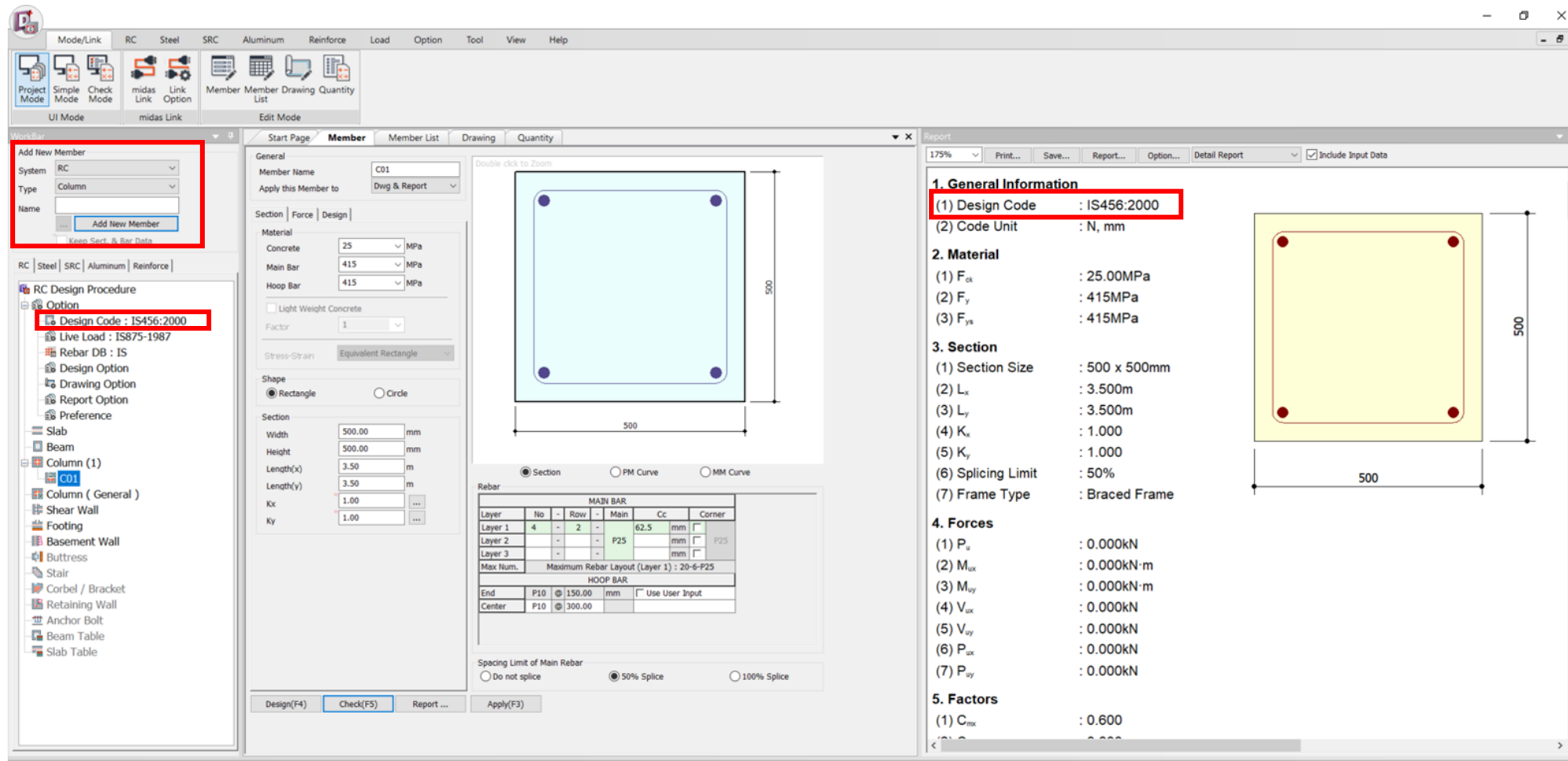
R = Response reduction factor

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

The screenshot displays the Design + 2024 v2.1 software interface for the Basement Wall design module. The interface is divided into several sections:

- Left Sidebar:** Contains a tree view with categories like RC, Steel, SRC, Aluminum, and Reinforce. Under RC, there is a sub-category 'Basement Wall (1)' with a member 'BW01' selected. A red box highlights the 'Design Code : IS456:2000' option.
- Member List:** Shows the member 'BW01' with a height of 3.00m and a thickness of 300.00mm.
- General Information:** Includes fields for Member Name (BW01), System (RC), Type (Basement Wall), and Name. A red box highlights the 'Design Code : IS456:2000' option.
- Design Parameters:** Includes fields for Concrete (25 MPa), Main Bar (415 MPa), Sub Bar (415 MPa), Factor (1), and Section Type (1 Way).
- Rebar Arrangement:** Shows a diagram of the rebar layout for the basement wall. The diagram includes labels for rebar types and quantities, such as P16@450(3) and P16@450(6).
- Report Window:** Displays the design results for the basement wall. The report includes:
 - 1. General Information:** (1) Design Code : IS456:2000, (2) Code Unit : N, mm.
 - 2. Material:** (1) F_{ck} : 25.00MPa, (2) F_y : 415MPa, (3) F_{ys} : 415MPa.
 - 3. Section:** (1) Basewall Type : 1 Way, (2) Cover : 40.00mm, (3) Story Information : Story(B1) : H=3.000m, THK.=300mm.
 - 4. Boundary Condition:** (1) Top : Pin (Factor = 0.000), (2) Bottom : Fix (Factor = 1.000).
 - 5. Soil Load:** (1) Surcharge Load : 0.000KPa, (2) 1st Floor Level : GL+0.000m, (3) Water Level : GL+0.000m, (4) Live Factor : 1.500, (5) Soil Factor : 1.500, (6) Water Factor : 1.500, (7) Soil Property : Use Active Soil Pressure : No.

Added Design Module for IS :456-2000

- Added Shear wall module

The screenshot displays the 'Member' design module for a Shear Wall (W01) in the Design + 2024 v2.1 software. The interface is divided into several sections:

- Left Sidebar:** Contains a tree view with categories like RC, Steel, SRC, Aluminum, and Reinforce. Under 'RC Design Procedure', 'Option' is selected, and 'Design Code : IS456:2000' is highlighted. Other options include Live Load, Rebar DB, Design Option, Drawing Option, Report Option, and Preference. A list of member types is shown below, including Slab, Beam, Column, and Shear Wall (1).
- Top Left Panel (Add New Member):** A red box highlights the 'Add New Member' dialog. It shows 'System' as RC, 'Type' as Shear Wall, and a field for 'Name' with an 'Add New Member' button.
- Central Parameter Input Area:**
 - General:** Member Name (W01), Apply this Member to (Dwg & Report).
 - Section | Force:**
 - Material (Basic):** Concrete (25 MPa), Ver. Bar (415 MPa), Hor. Bar (415 MPa).
 - Stress-Strain:** Equivalent Rectangle.
 - Material (Factor):** Light Weight Concrete, Factor (1).
 - Section:** Thickness (200.00 mm), Length (1.00 m), Cover (40.00 mm), Height(x) (3.50 m), Height(y) (3.50 m), Kx (1.00), Ky (1.00).
 - Rebar:** Ver. Bar (P10 @ 450), Hor. Bar (P10 @ 450), End Bar (2 - P12 @ 100), BE. Hor. (P10 @ 450).
 - Seismic Design:** Options for Apply Special Provisions (Special Structural Wall, Intermediate Structural Wall), Design Parameters, and Apply Pilots Guideline, MOLIT.
- Top Diagram:** A red box highlights the 'Add New Member' dialog. It shows a rectangular cross-section of the shear wall with dimensions 200 mm (thickness) and 1000 mm (length). The diagram is labeled 'Double click to Zoom'.
- Bottom PM Curve:** A graph showing the relationship between Moment (M) and Plastic Moment (P). The curve is labeled 'PM Curve' and 'Double click to Zoom'. The peak moment is 2447 kN.m. The graph also shows the yield moment (My) and the ultimate moment (Mu).
- Right Report Panel:**
 - 1. General Information:** (1) Design Code : IS456:2000, (2) Code Unit : N, mm.
 - 2. Material:** (1) F_{ck} : 25.00MPa, (2) F_y : 415MPa, (3) F_{ys} : 415MPa.
 - 3. Section:** (1) Thickness : 200mm, (2) Length : 1.000m, (3) Cover : 40.00mm, (4) Height(X) : 3.500m, (5) Height(Y) : 3.500m, (6) K_x : 1.000, (7) K_y : 1.000, (8) Frame Type : Braced Frame.
 - 4. Force:** (1) Axial & Moment.