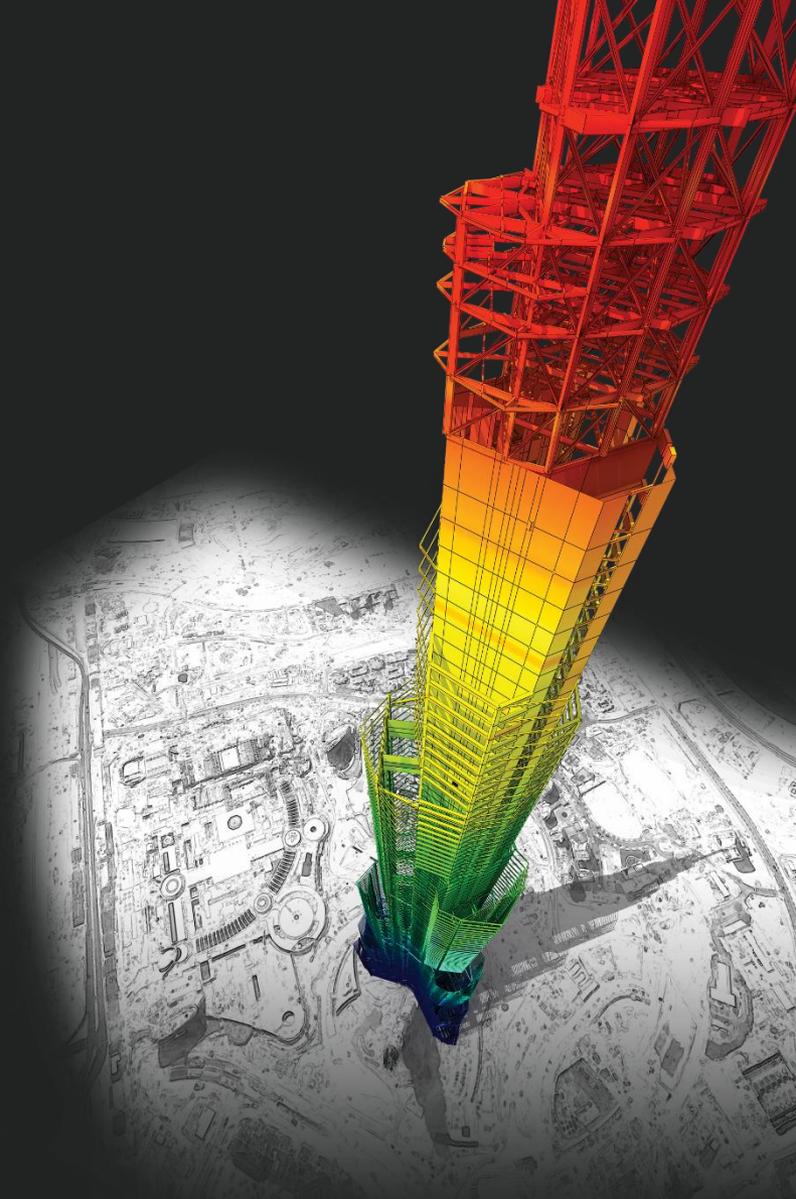


# Release Note

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Release Date : June. 2021

Product Ver. : midas Gen 2021 (v2.1) and Design+2021(v2.1)



*DESIGN OF General Structures*

*Integrated Design System for Building and General Structures*

# Enhancements

- *midas Gen*

1) Improvement of Section Stiffness Scale Factor	4
2) Improvement of Joint Design as per EC2:04 & NTC2018	11
3) User Definition of T1 for shear design as per EC8:04 & NTC2018	13
4) New method of Wall design moment calculation as per NTC2018	15
5) Addition of New Sweden National Annex in Eurocode	17

- *midas Design+*

1) User define of Deck Plate of composite beam module	20
---	----

*midas* **Gen**

# 1. Improvement of Section Stiffness Scale Factor

## Add element stiffness scale factor

- The stiffness can be adjusted by members.

Properties > Section > Scale Factor > **Element Stiffness Scale Factor**

Tree Menu

Node | **Element** | Boundary | Mass | Load

Element Stiffness Scale Fact ...

Start Number

Node Number : 5647 ...

Element Number : 6518 ...

Boundary Group Name

Default ...

Option

Add/Replace  Delete

Stiffness Scale Factor

Area : 1

Asy : 1

Asz : 1

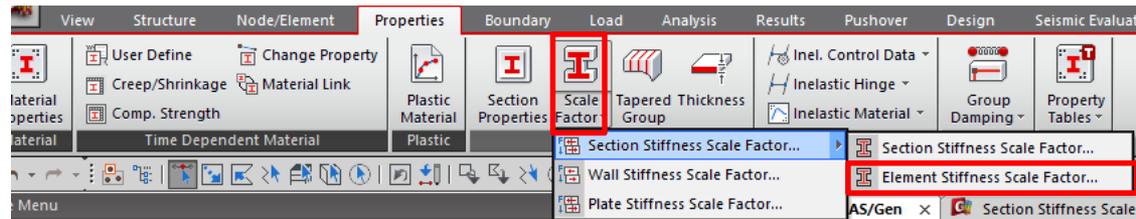
lxx : 0,55

lyy : 0,55

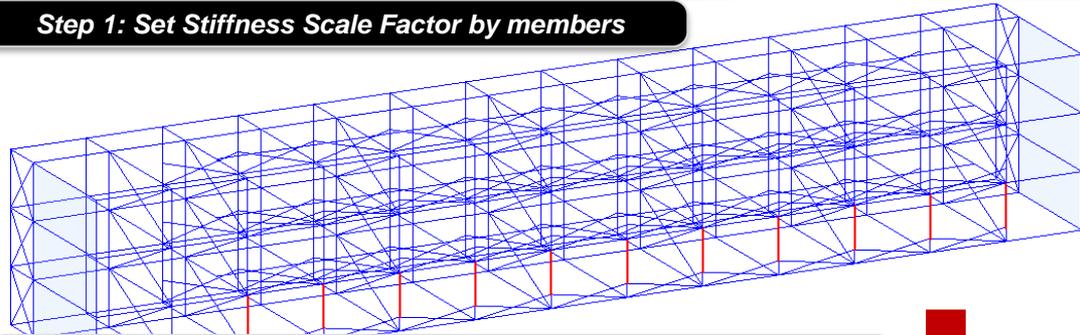
lzz : 1

Weight : 1

Apply Close



**Step 1: Set Stiffness Scale Factor by members**

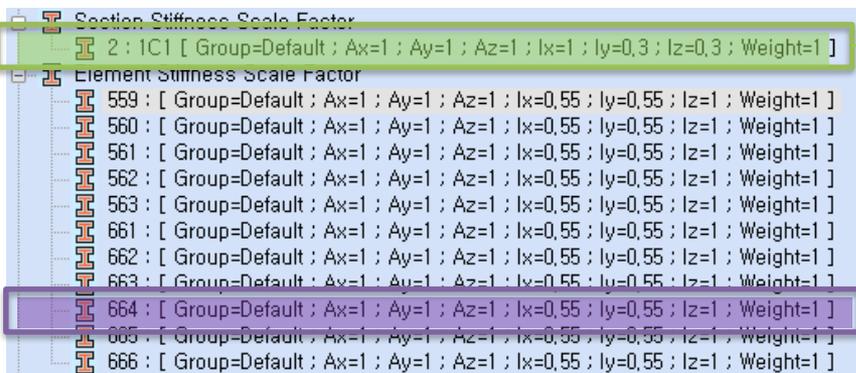


**Step 2: Check or Modify Element Stiffness Scale Factor Table**

Elem	Section ID	fArea	fAsy	fAsz	flxx	flyy	flzz	fWgt	Part	Group
559	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
560	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
561	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
562	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
563	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
661	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
662	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
663	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
664	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default
665	2	1.0000	1.0000	1.0000	0.5500	0.5500	1.0000	1.0000	Before	Default

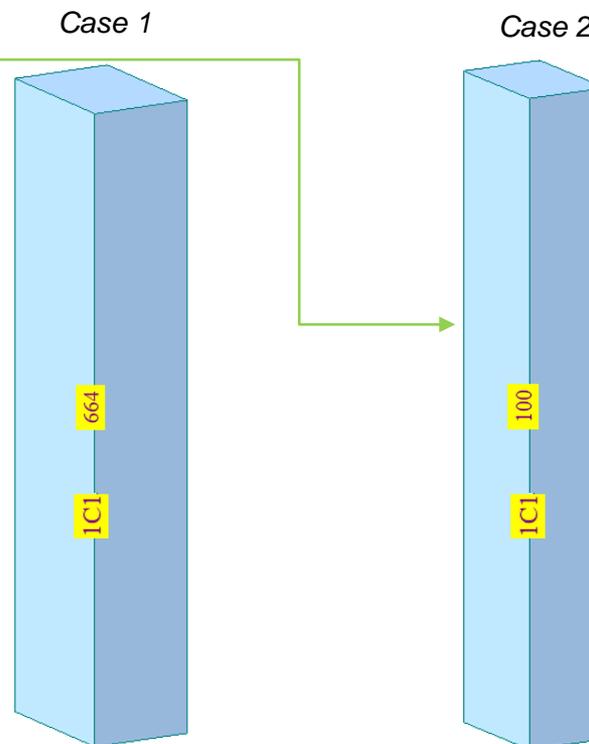
# 1. Improvement of Section Stiffness Scale Factor

Element Stiffness Scale Factor(E.S.S.F.) takes precedence over Section Stiffness Scale Factor(S.S.S.F.).



Case1 : Both S.S.S.F. and E.S.S.F are applied to "1C1".  
 → E.S.S.F is considered in an analysis.

Case 2: Only S.S.S.F is applied to "1C1".  
 (Element Stiffness Scale Factor is not applied)  
 → S.S.S.F is considered in an analysis.

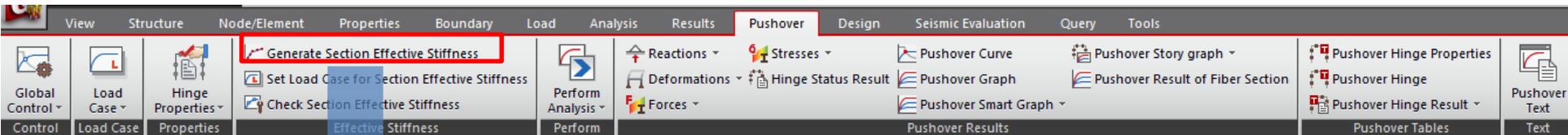


- Section Name : 1C1(ID:2)
- Element Number: 664

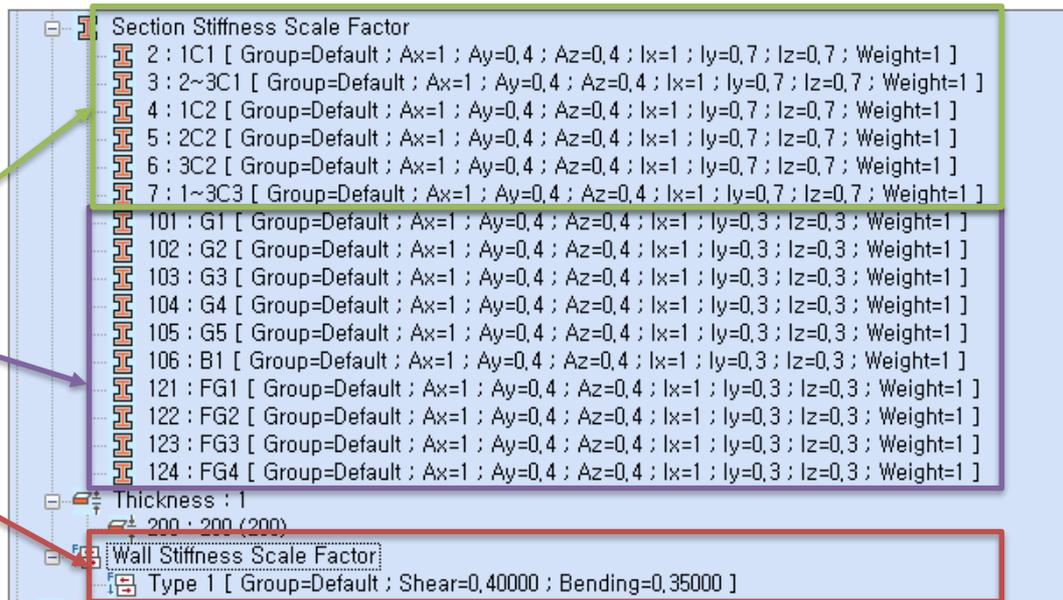
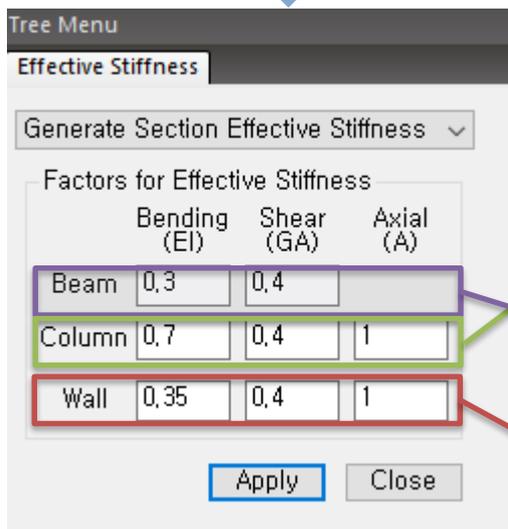
- Section Name : 1C1(ID:2)
- Element Number: 100

# 1. Improvement of Section Stiffness Scale Factor

*Supports the control of a section scale factor collectively for each member type*

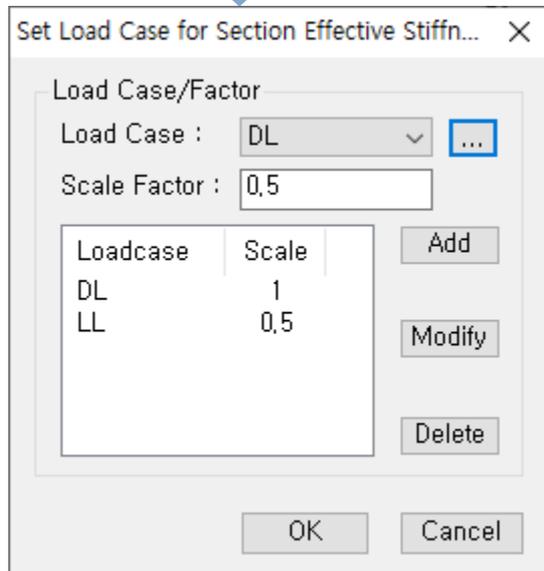
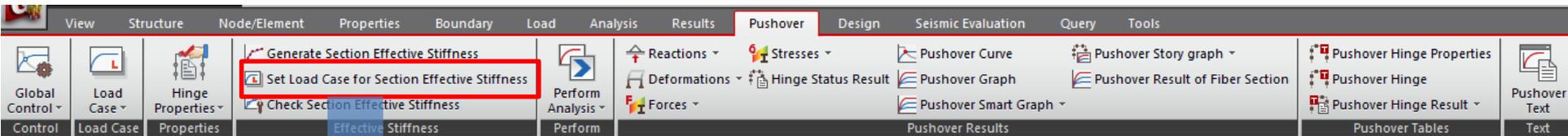


Pushover > Effective Stiffness > **Generate Section Effective Stiffness**



# 1. Improvement of Section Stiffness Scale Factor

Supports auto-calculation of the effective stiffness ratio of the column according to the column axial force by gravity load



**Step 1: Set the scale factor gravity load in order to calculate the column axial force**

✓ Note

## 6.4.1.2 Stiffness

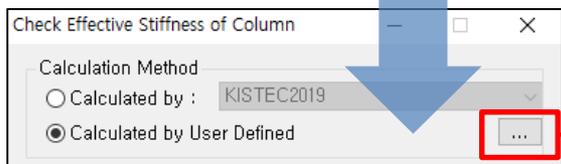
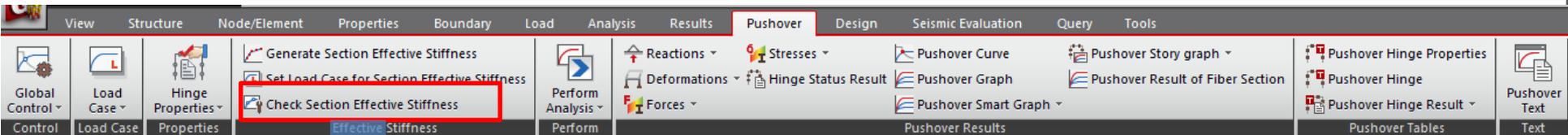
Component stiffnesses shall be calculated according to accepted principles of mechanics. Sources of flexibility shall include flexure, shear, axial load, and reinforcement slip from adjacent connections and components. Stiffnesses should be selected to represent the stress and deformation levels to which the components will be subjected, considering volume change effects (temperature and shrinkage) combined with design earthquake and gravity load effects.

Reference Code : 6.4.1.2 as per FEMA273

# 1. Improvement of Section Stiffness Scale Factor

**Step 2 : Select the calculation method.**

**Step 3 : In case of "by User Defined", input the axial force ration and bending stiffness scale factor for each point.**



	Axial Force Ratio	Bending Stiffness Scale Factor
1st Point	0.1	0.3
2nd Point	0.5	0.7

**Table 10-5. Effective Stiffne**

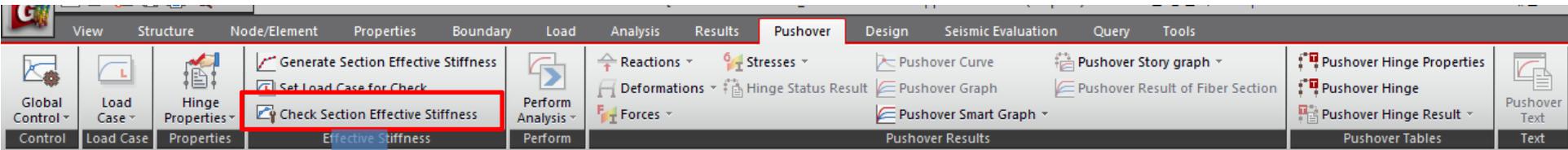
Component	Flexural Rigidity	Shear Ri
Beams—nonprestressed <sup>a</sup>	$0.3E_c I_g$	$0.4E_c$
Beams—prestressed <sup>a</sup>	$E_c I_g$	$0.4E_c$
Columns with compression caused by design gravity loads $\geq 0.5A_g f'_c$	$0.7E_c I_g$	$0.4E_c$
Columns with compression caused by design gravity loads $\leq 0.1A_g f'_c$ or with tension	$0.3E_c I_g$	$0.4E_c$
Beam—column joints	Refer to Section 10.4.2.2.1	
Flat slabs—nonprestressed	Refer to Section 10.4.4.2	$0.4E_c$
Flat slabs—prestressed	Refer to Section 10.4.4.2	$0.4E_c$
Walls-cracked <sup>b</sup>	$0.5E_c A_g$	$0.4E_c$

<sup>a</sup>For T-beams,  $I_g$  can be taken as twice the value of  $I_g$  of the web alone. Otherwise,  $I_g$  should be based on the effective moment of inertia.  
<sup>b</sup>For columns with axial compression falling between the limits provided, flexural rigidity should be determined based on the effective moment of inertia.  
<sup>c</sup>Not performed, the more conservative effective stiffnesses should be used.  
<sup>d</sup>See Section 10.7.2.2.

Reference Code : ASCE41-17 Table 10-5

# 1. Improvement of Section Stiffness Scale Factor

**Step 4 : Check and update the effective stiffness factor of columns.**



Check Effective Stiffness of Column

Calculation Method  
 Calculated by : KISTEC2019  
 Calculated by User Defined

Sorted by  Member  Property

MEMB	SECT	SEL	Section	Axial Load Ratio	Bending Stiffness Scale Factor
95	7	<input checked="" type="checkbox"/>	1-3C3	0.05	0.30
96	4	<input checked="" type="checkbox"/>	1C2	0.11	0.31
97	2	<input checked="" type="checkbox"/>	1C1	0.04	0.30
98	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30
99	4	<input checked="" type="checkbox"/>	1C2	0.21	0.41
100	2	<input checked="" type="checkbox"/>	1C1	0.13	0.33
101	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30
102	4	<input checked="" type="checkbox"/>	1C2	0.20	0.40
103	2	<input checked="" type="checkbox"/>	1C1	0.13	0.33
104	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30

Connect Model View

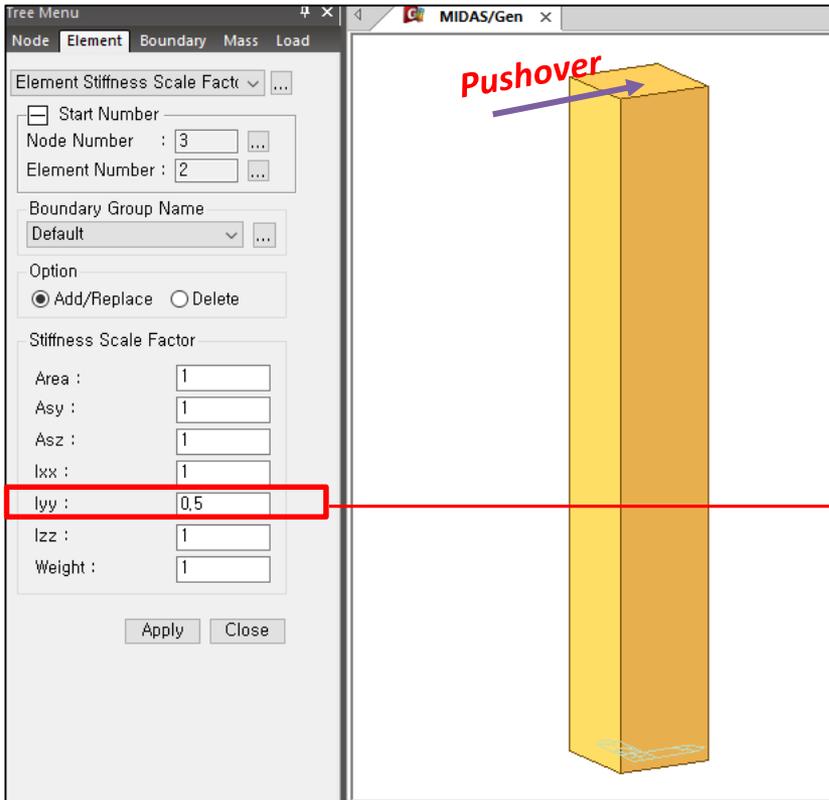
*If you click 'Update' button, the flexural stiffness factor of the selected member is updated in the model.  
 The updated stiffness factor is reflected in the 'Element stiffness Scale Factor'.*

**Updated Element stiffness Scale Factor**

MEMB	SECT	SEL	Section	Axial Load Ratio	Bending Stiffness Scale Factor
95	7	<input checked="" type="checkbox"/>	1-3C3	0.05	0.30
96	4	<input checked="" type="checkbox"/>	1C2	0.11	0.31
97	2	<input checked="" type="checkbox"/>	1C1	0.04	0.30
98	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30
99	4	<input checked="" type="checkbox"/>	1C2	0.21	0.41
100	2	<input checked="" type="checkbox"/>	1C1	0.13	0.33
101	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30
102	4	<input checked="" type="checkbox"/>	1C2	0.20	0.40
103	2	<input checked="" type="checkbox"/>	1C1	0.13	0.33
104	7	<input checked="" type="checkbox"/>	1-3C3	0.06	0.30

# 1. Improvement of Section Stiffness Scale Factor

- Hinge rotations are calculated by the element stiffness scale factor.



### Safety Verification result

Elem	Location	Seismic Element	Load	Verify Ductile Mechar		
				Demand	Capacity	Remark
Step for Demand = USER (Step 1), Confidence factor = 1.00						
Press right mouse button and click 'Set Safety Parameters' menu to change step or loadcase						
1	I-end	Primary	test	0.00014182	0.03613520	OK

### Beam Summary result

Type	Elem	Hinge Location	Pushover Hinge Prop.	Load	Step	Deform	Force
M-Theta	1	I-end	column	test	1	3.832e-004	9.645651

$$\theta = M / (\text{Scale Factor} \times K)$$

	Default (l <sub>yy</sub> =1.0)	l <sub>yy</sub> =0.50
Moment (M)	19.151625kNm	9.645651kNm
K (=3EI/L for Column)	136031.3	136031.3
Scale Factor	1.0	<b>0.5</b>
Hinge rotation(θ)	0.0001408	0.00014182

# 2. Improvement of Joint Design as per EC2:04 & NTC2018

## Add option to check joint position

- Available joint design on both ends of the columns

In previous version, joint check of roof story was not supported.

In Gen2021 v2.1, joint check is possible for all stories.

Concrete Design Code

Design Code : Eurocode2:04

National Annex : Italy

Apply NTC NTC2018

Apply EC8:04 Capacity Design

Strut Angle for Shear Resistance : 45 Deg

Effective Creep Ratio (Phi\_ef) : 1.143

Slenderness Limit

Lambda\_lim = 20 \* A + B + C / sqrt(h)

A : 0.7  Calculate by Program

B : 1.1  Calculate by Program

C : 1  Calculate by Program

Seismic Design Parameter

Beam-Column Joint Design

Gamma\_rd 1.1

Confined Joint  Not Confined Joint

Select Check Position

Top  Bottom

Strong Column Weak Beam

SUM(M\_Rc) > 1.3 \* SUM(M\_Rb)

Consider strong column-weak beam on last floor

Select Ductility Class

DCH (High Ductility)

DCM (Medium Ductility)

Secondary Seismic Member None

Shear Force for Design

Gamma\_rd

Beam 1.2 Column 1.3 Wall 1.2

Consider for Shear Wall alpha\_s max

Consider Vsd of elastic strength Load combination for primary members

Wall design bending moment for seismic load

Friction Coefficient for Wall Sliding : 0.6

Torsion Design

Moment Redistribution Factor for Beam : 1

Consider Shear Strength of Concrete for Checking

Wall  Column/Brace  Beam

P-M Curve Calculation Method

Keep P Constant

Keep M/P Constant

OK Close

Select Check Position

Top  Bottom

### Design report (Graphic)

1. Design Summary

Design Code : Eurocode2:04 UNIT SYSTEM : kN, m

Member Number : 346

Material Data : fck = 20000, fyk = 400000, fyw = 400000 KPa

Column Height : 4 m

Section Property : C3 (No : 303)

Rebar Pattern : 20 - 6 - D22 Ast = 0.007742 m² (pst = 0.012)

2. Axial and Moments Capacity

Load Combination : 14 (Pos : J)

Concentric Max. Axial Load N\_Rdmax = 11123.0 kN

Axial Load Ratio N\_Ed / N\_Rd = 88.1066 / 394.322 = 0.22

Moment Ratio M\_Ed / M\_Rd = 217.676 / 984.221 = 0.22

M\_Ed / M\_Rd = 210.596 / 953.652 = 0.22

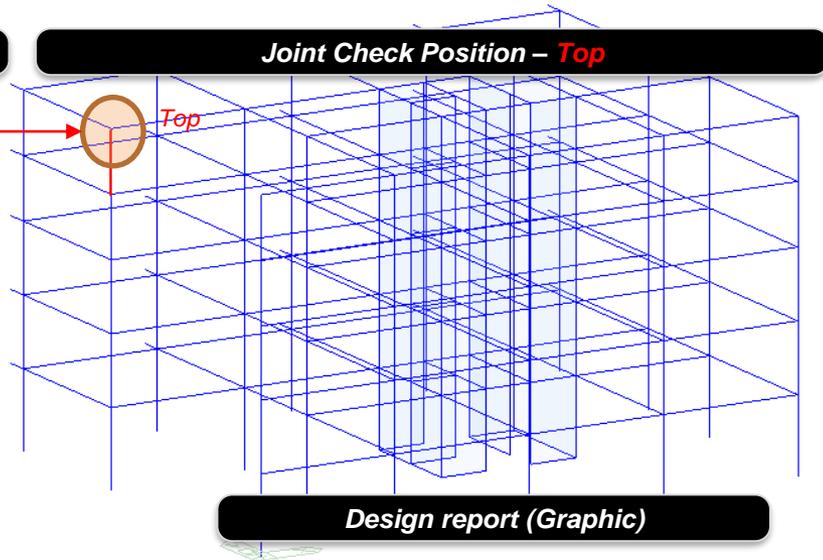
M\_Ed / M\_Rd = 55.0625 / 243.390 = 0.22

Normalized Axial Load Ratio Nu\_d / 0.55 = 0.222 / 0.550 = 0.04

M-N Interaction Diagram

3. Shear Capacity

	y (LCB : 19, POS : J)	z (LCB : 19, POS : J)
<b>[END]</b>		
Applied Shear Force (V_Ed)	332.720 kN	357.129 kN
V_Ed / V_Rdc	332.720 / 268.154 = 1.241	357.129 / 268.154 = 1.332
V_Ed / V_Rds	332.720 / 359.156 = 0.926	357.129 / 359.156 = 0.994
V_Ed / V_Rdmax	332.720 / 1917.78 = 0.173	357.129 / 1917.78 = 0.186
Shear Ratio	0.926 < 1.000 .....OK	0.984 < 1.000 .....OK
Asw-H_req	0.00147 m²/m, 2-D10 @90	0.00158 m²/m, 2-D10 @90
<b>[MIDDLE]</b>		
Applied Shear Force (V_Ed)	332.720 kN	357.129 kN
V_Ed / V_Rdc	332.720 / 272.497 = 1.221	357.129 / 272.497 = 1.311
V_Ed / V_Rds	332.720 / 359.156 = 0.926	357.129 / 359.156 = 0.994
V_Ed / V_Rdmax	332.720 / 1917.78 = 0.173	357.129 / 1917.78 = 0.186
Shear Ratio	0.926 < 1.000 .....OK	0.984 < 1.000 .....OK
Asw-H_req	0.00147 m²/m, 2-D10 @90	0.00158 m²/m, 2-D10 @90
<b>[JOINT : TOP]</b>		
Applied Shear Force (V_Ed)	332.720 kN	357.129 kN
Ash req / Ash use	0.00121 / 0.00128 = 0.940	0.00181 / 0.00185 = 0.973
Joint Ratio	0.940 < 1.000 .....OK	0.973 < 1.000 .....OK
Ash jnt	2-9 D10	2-13 D10



```

[[[+]]] CALCULATE BEAM-COLUMN JOINT CAPACITY ABOUT MAJOR AXIS. (TOP)
=====
( ). Compute joint geometry information.
[ NTC2018, 7.4.4.3 ]
-. bc = 800.0000 mm.
-. hc = 800.0000 mm.
-. bw = 600.0000 mm.
-. hjc = 647.6000 mm.
-. hjw = 647.6000 mm.
-. bj = MIN( bc, bw*0.5+hc ) = 800.0000 mm.
-. All sides don't have beams and bw >= 3/4*bc ----> Nonconfined joint.
( ). Compute maximum spacing of ties/spirals.
-. Smax = 50.0000 mm. (Hoop spacing for shear)
( ). Compute horizontal shear force in local-z direction.
[ LCB = 15, POS = J ]
[ NTC2018, 7.4.4.3.1 ]
-. Applied axial force : Pu = 83.63 kN.
-. Applied shear force : Vcz = 24.532 kN.
-. Beam Top Reinforcement : SUM As1.Fyd = SUM As1 * fyd(beam) ] = 204.974 kN.
    
```

## 2. Improvement of Joint Design as per EC2:04 & NTC2018

### Add option to check joint position

- Available joint design on both ends of the columns

In previous version, joint check of roof story was not supported.

In Gen2021 v2.1, joint check is possible for all stories.

Concrete Design Code

Design Code : Eurocode2:04

National Annex : Italy

Apply NTC : NTC2018

Apply EC8:04 Capacity Design

Strut Angle for Shear Resistance : 45 Deg

Effective Creep Ratio (Phi\_Let) : 2,143

Slenderness Limit

Lambda\_lim = 20\*A+B+C/sqrt(n)

A : 0,7 Calculate by Program

B : 1,1

C : 1 Calculate by Program

Seismic Design Parameter

Beam-Column Joint Design Gamma\_jrd 1,1

Confined Joint Not Confined Joint

Select Check Position

Top Bottom

Strong Column Weak Beam

SUM(M\_Rc) > 1,3 \* SUM(M\_Rb)

Consider strong column-weak beam on last floor

Select Ductility Class

DCH (High Ductility)

DCM (Medium Ductility)

Secondary Seismic Member None

Shear Force for Design

Gamma\_jrd

Beam 1,2 Column 1,3 Wall 1,2

Consider for Shear W\_alpha\_s max

Consider Vsd of elastic strength Load combination for primary members

Wall design bending moment for seismic load

Friction Coefficient for Wall Sliding : 0,6

Torsion Design

Moment Redistribution Factor for Beam : 1

Consider Shear Strength of Concrete for Checking

Wall Column/Brace Beam

P-M Curve Calculation Method

Keep P Constant

Keep M/P Constant

OK Close

Select Check Position

Top Bottom

### Design report (Graphic)

1. Design

Design Code : Eurocode2:04 UNIT SYSTEM : kN, m

Member Number : 345

Material Data : fck = 20000, fyk = 400000, fyw = 400000 KPa

Column Height : 4 m

Section Property : C3 (No : 303)

Rebar Pattern : 20 - 6 - D22 Ast = 0.007742 m² (pst = 0.012)

2. Axial and Moments Capacity

Load Combination : 14 (Pos: J)

Concentric Max. Axial Load N\_Rdmax = 11123.0 kN

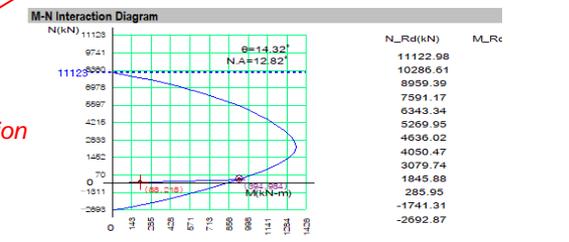
Axial Load Ratio N\_Ed / M\_Rd = 88.1066 / 394.322 = 0.223

Moment Ratio M\_Ed / M\_Rd = 217.676 / 984.221 = 0.221

M\_Ed / M\_Rd\_y = 210.596 / 953.652 = 0.221

M\_Ed / M\_Rd\_z = 55.0825 / 243.390 = 0.226

Normalized Axial Load Ratio Nu\_d / 0.55 = 0.022 / 0.550 = 0.040



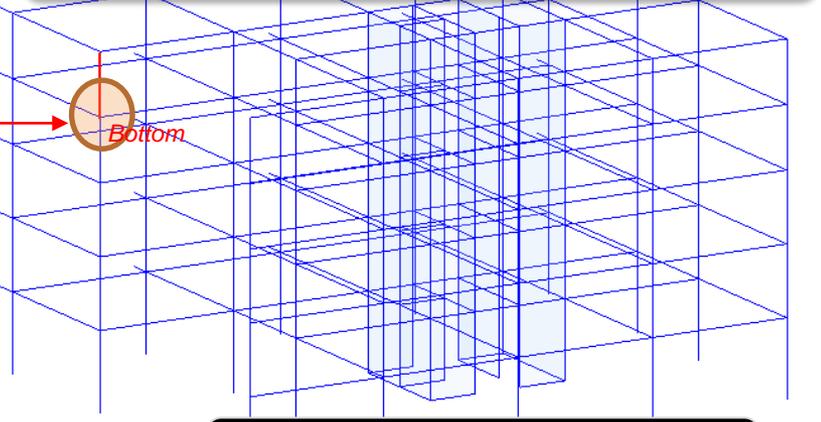
3. Shear Capacity

[END]	y (LCB : 19, POS: J)	z (LCB : 19, POS: J)
Applied Shear Force (V_Ed)	332.720 kN	357.129 kN
V_Ed / V_Rdc	332.720 / 268.154 = 1.241	357.129 / 268.154 = 1.332
V_Ed / V_Rds	332.720 / 359.156 = 0.926	357.129 / 359.156 = 0.994
V_Ed / V_Rdmax	332.720 / 1917.78 = 0.173	357.129 / 1917.78 = 0.186
Shear Ratio	0.926 < 1.000 O.K	0.994 < 1.000 O.K
Asw-H_req	0.00147 m²/m, 2-D10 @90	0.00158 m²/m, 2-D10 @90

[MIDDLE]	y (LCB : 19, POS: I/2)	z (LCB : 19, POS: I/2)
Applied Shear Force (V_Ed)	332.720 kN	357.129 kN
V_Ed / V_Rdc	332.720 / 272.497 = 1.221	357.129 / 272.497 = 1.311
V_Ed / V_Rds	332.720 / 359.156 = 0.926	357.129 / 359.156 = 0.994
V_Ed / V_Rdmax	332.720 / 1917.78 = 0.173	357.129 / 1917.78 = 0.186
Shear Ratio	0.926 < 1.000 O.K	0.994 < 1.000 O.K
Asw-H_req	0.00147 m²/m, 2-D10 @90	0.00158 m²/m, 2-D10 @90

[JOINT : BOTTOM]	y (LCB : 15, POS: I)	z (LCB : 17, POS: I)
Ash.req / Ash.use	0.00120 / 0.00128 = 0.934	0.00180 / 0.00185 = 0.969
Joint Ratio	0.934 < 1.000 O.K	0.969 < 1.000 O.K
Ash.jnt	2-9 D10	2-13 D10

### Joint Check Position - Bottom



### Design report (Graphic)

```

[[[+]]] CALCULATE BEAM-COLUMN JOINT CAPACITY ABOUT MAJOR AXIS. (BOTTOM)
-----
( ). Compute joint geometry information.
[ NTC2018, 7.4.4.3 ]
- bc = 800.0000 mm.
- hc = 800.0000 mm.
- bw = 600.0000 mm.
- hjc = 647.6000 mm.
- hjw = 647.6000 mm.
- bj = MIN( bc, bw+0.5*hc ) = 800.0000 mm.
- All sides don't have beams and bw >= 3/4*bc ----> Nonconfined joint.

( ). Compute maximum spacing of ties/spirals.
- Smax = 50.000 mm. (Hoop spacing for shear)

( ). Compute horizontal shear force in local-z direction.
[ LCB = 15, POS = I ]
[ NTC2018, 7.4.4.3.1 ]
- Applied axial force : Pu = 147.63 kN.
- Applied shear force : Vcz = 24.932 kN.
- Beam Top Reinforcement : SUM.Ast.Fyd = SUM( Ast * fyd(beam) ) = 704.974 kN.
    
```

### 3. User Definition of T1 for shear design as per EC8:04 & NTC2018

- Allow to define the fundamental period(T1) directly for slender wall shear design

Concrete Design Code

Design Code : Eurocode2:04

National Annex : Italy

Apply NTC : NTC2018

Apply Special Provisions for Seismic Design

Strut Angle for Shear Resistance : 45 Deg

Effective Creep Ratio (Phi\_Lef) : 2.14

Slenderness Limit

Lambda\_lim = 25/(eet/epsilon)

EC8:04 Capacity Design

Structure Information

Structure Type : Coupled Wall System

Behavior Factor (q)

Calculate by Program

Alpha\_u / Alpha\_1 : 1.2

User Input

q 2 q0 2

Fundamental Period(T1)

Calculate by Program *Add as option*

User Input

T1\_X 0,1 T1\_Y 0,1

Elastic Response Spectrum

Default By Function BS\_SLV\_q=2\_cat-B\_T1

Spectrum Parameters

Soil Factor (S)	Tb	Tc	Td
1.2	0.131	0.3931	2.6

Ref. Reak Ground Acc. (AgR) : 0.147 g

Importance Factor(I) : 1

Viscous Damping Ratio (xi) : 5 %

OK Cancel

Applied equation : 5.25 (EC8:04)

$$V_{Ed} = \varepsilon \cdot V'_{Ed} \quad (5.24)$$

where

$V_{Ed}$  is the shear force from the analysis;

$\varepsilon$  is the magnification factor, calculated from expression (5.25), but not less than 1,5:

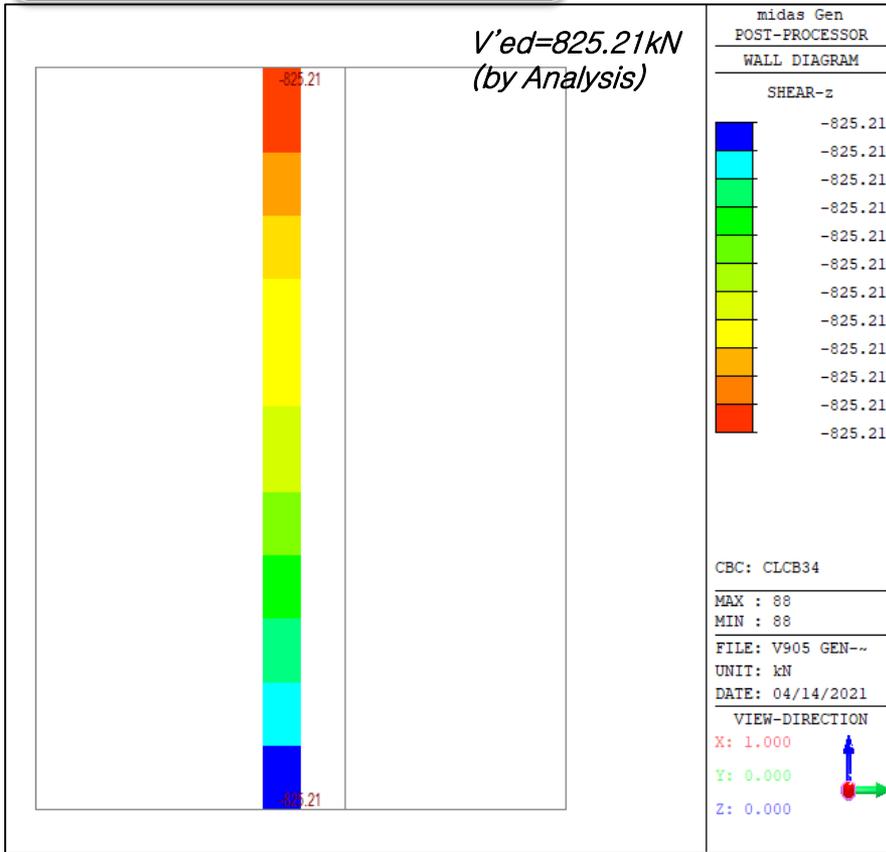
$$\varepsilon = q \cdot \sqrt{\left(\frac{\gamma_{Rd}}{q} \cdot \frac{M_{Rd}}{M_{Ed}}\right)^2 + 0,1 \left(\frac{S_e(T_C)}{S_e(T_1)}\right)^2} \leq q \quad (5.25)$$

$T_1$  is the fundamental period of vibration of the building in the direction of shear forces  $V_{Ed}$ ;

### 3. User Definition of T1 for shear design as per EC8:04 & NTC2018

- Allow to define the fundamental period(T1) directly for slender wall shear design

#### Analysis Shear Force (V'ed)



#### Applied Shear Force(Ved=ε \* V'ed)

Fundamental Period(T1)

Calculate by Program

User input

T1\_X [0,1] T1\_Y [0,1]

**T1 = 1.2486sec (Calculated by Gen)**  
 $\epsilon = 2.0$   
 $\rightarrow Ved = 2.0 * 825.21 = 1650.43kN$

#### Shear Capacity

Applied Shear Force	V_Ed	= 1650.43 kN (Load Combination : 1)
Shear Ratio by Conc	V_Ed/V_Rdc	= 1650.43 / 476.234 = 3.4656
Shear Ratio by V_Rds	V_Ed/V_Rds	= 1650.43 / 1395.39 = 1.1828
Shear Ratio by V_Rdmax	V_Ed/V_Rdmax	= 1650.43 / 986.047 = 1.6738

Fundamental Period(T1)

Calculate by Program

User Input

T1\_X [0,1] T1\_Y [0,1]

**T1 = 0.1sec (User input)**  
 $\epsilon = 1.56$   
 $\rightarrow Ved = 1.56 * 825.21 = 1287.67kN$

#### Shear Capacity

Applied Shear Force	V_Ed	= 1287.67 kN (Load Combination : 1)
Shear Ratio by Conc	V_Ed/V_Rdc	= 1287.67 / 585.751 = 2.2760
Shear Ratio by V_Rds	V_Ed/V_Rds	= 1287.67 / 1131.97 = 1.1376
Shear Ratio by V_Rdmax	V_Ed/V_Rdmax	= 1287.67 / 973.873 = 1.3222

# 4. New method of Wall design moment calculation as per NTC2018

- Method 2 is an alternative method in which the upper wall design moment is applied excessively to the code method(Method 1).

Concrete Design Code

Design Code : Eurocode2:04

National Annex : Italy

Apply NTC

Apply EC8:04 Capacity Design

Strut Angle for Shear Resistance : 45 Deg

Effective Creep Ratio (Phi\_Lef) : 2,143

Slenderness Limit

$\Lambda_{lim} = 20 \cdot A + B + C / \sqrt{n}$

A : 0,7  Calculate by Program

B : 1,1  Calculate by Program

C : 1  Calculate by Program

Seismic Design Parameter

Beam-Column Joint Design

Gamma\_rd 1,1

Confined Joint  Not Confined Joint

Select Check Position

Top  Bottom

Strong Column Weak Beam

$\sum(M_{Rc}) > 1,3 \sum(M_{Rb})$

Consider strong column-weak beam on last floor

Select Ductility Class

DCH (High Ductility)

DCM (Medium Ductility)

Secondary Seismic Member None

Shear Force for Design

Gamma\_rd

Beam 1,2 Column 1,3 Wall 1,2

Consider for Shear Wall  $\alpha_{s,max}$

Consider Ved of elastic strength Load combination for primary members

**Wall design bending moment for seismic load**

Friction Coefficient for Wall Sliding : 0,6

Torsion Design

Moment Redistribution Factor for Beam : 1

Consider Shear Strength of Concrete for Checking

Wall  Column/Brace  Beam

P-M Curve Calculation Method

Keep P Constant

Keep M/P Constant

OK Close

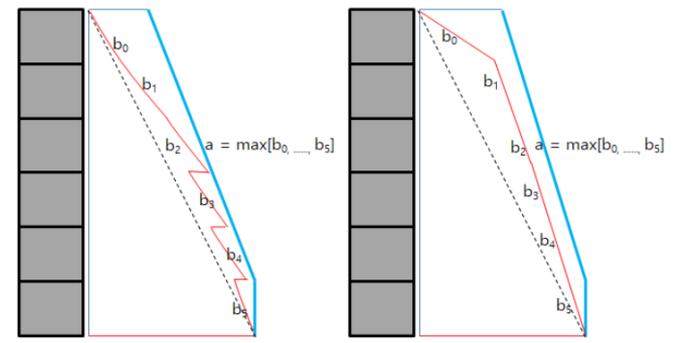
Method 1 : current procedure.

Wall design bending moment for seismic load

Wall Design Method

Method-1  Method-2

OK Close



- 1) Red : Analysis values
- 2) Blue : Use max value among red diagram's slope at last floor

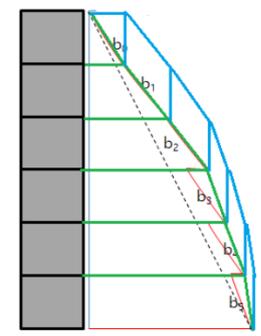
Method 2 : New method as request from code(EC & NTC)

Wall design bending moment for seismic load

Wall Design Method

Method-1  Method-2

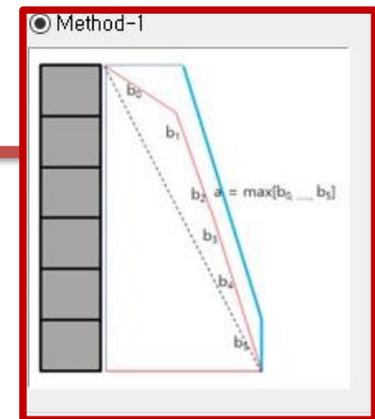
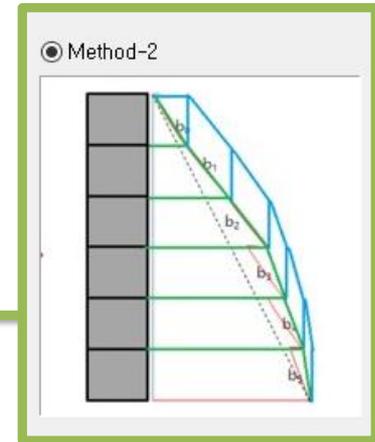
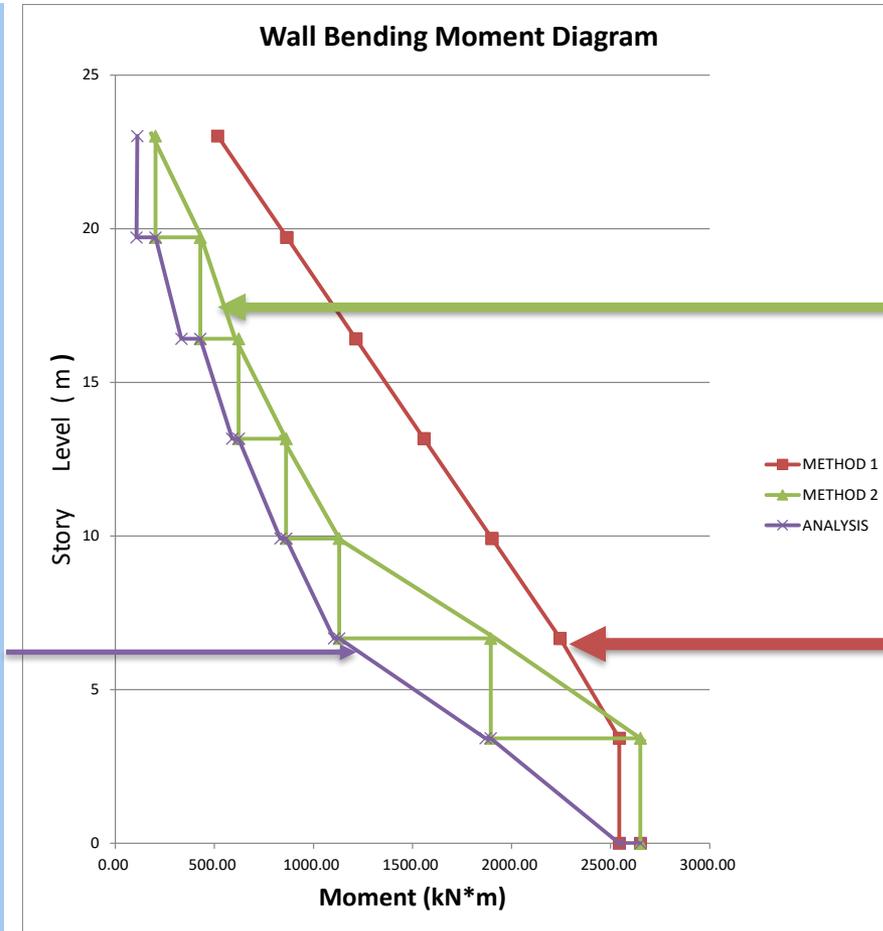
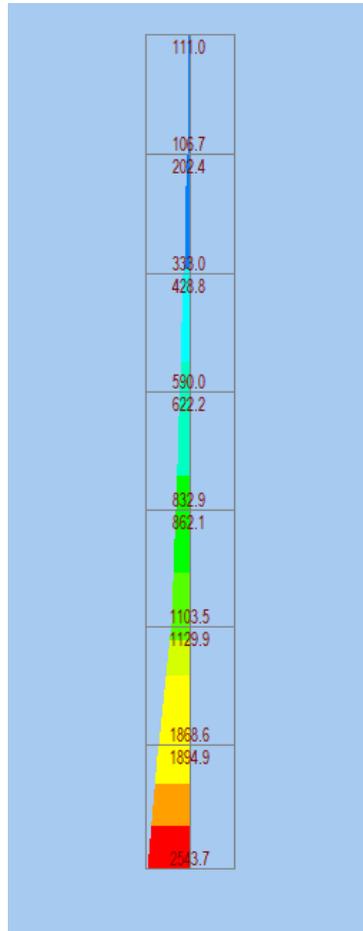
OK Close



- 1) Red : Analysis values
- 2) Green : max envelope bending moment results
- 3) Blue : translation of green diagram on Z direction

# 4. New method of Wall design moment calculation as per NTC2018

- Method 2 is an alternative method in which the upper wall design moment is applied excessively to the code method(Method 1).



# 5. Addition of New Sweden National Annex in Eurocode

## Add Sweden National Annex (BFS2019:1) of Steel Design

**Steel Design Code**

Design Code : Eurocode3:05

National Annex : Sweden(2019)

All Beams/Girders are Laterally Braced

Check Beam/Column Deflection

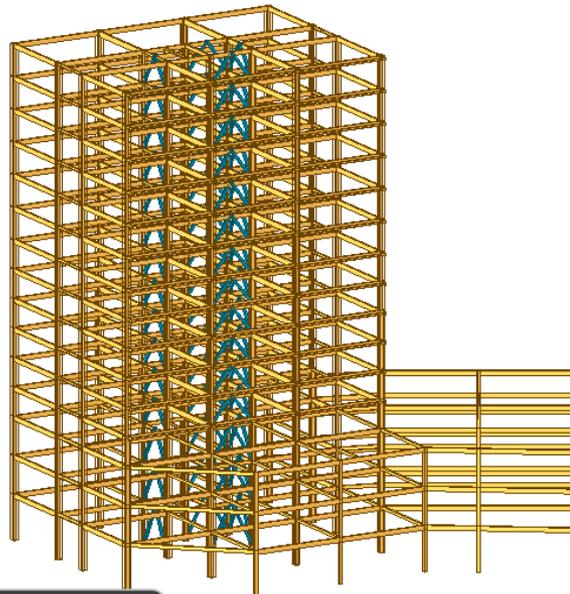
Apply Special Provisions for Seismic Design

Biaxial moments for buckling resistance

Biaxial moments at the same location

Maximum moments along the member

OK Close



Design Result Table

Eurocode3:05 Code Checking Result Dialog

Code : EC3:05, SWE2019 Unit : kN, m Primary Sorting Option

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

SECT  MEMB

CH	MEMB	SECT	SE	Section		LCB	Len		Ky	Bmy	N,Ed	My,Ed	Mx,Ed	Mz,Ed	Vy,Ed	Vz,Ed	T,Ed	Def
				Material	Fy		Lb	Lz										
OK	254	221	□	SG1, W24x76	248211	2	12.0000	12.0000	1.000	1.000	0.00000	-458.65	-458.65	0.00000	0.00000	181.729	-	-0.0142
	0.707	0.165		A36			4.00000	12.0000	1.000	1.000	3587.05	648.575	813.491	116.329	0.00000	1101.29	-	0.04800
OK	251	222	□	SG2, W18x55	248211	3	3.00000	3.00000	1.000	1.000	0.00000	-235.98	-235.98	0.00000	0.00000	141.276	-	-0.0016
	0.518	0.194		A36			2.00000	3.00000	1.000	1.000	2594.20	0.00000	455.555	75.2479	0.00000	729.078	-	0.02400
OK	125	223	□	SG3, W18x55	248211	6	6.00000	6.00000	1.000	1.000	0.00000	228.311	228.311	0.00000	0.00000	114.076	-	-0.0031
	0.501	0.156		A36			2.00000	6.00000	1.000	1.000	2594.20	0.00000	455.555	75.2479	0.00000	729.078	-	0.02400
	24	224	□	SG4, W30x116			10.8000	10.8000	1.000	1.000	0.00000	1274.54	1274.54	0.00000	0.00000	-562.25	-	-0.0465

Graphic Report (Summary Report)

Preview Window

Memb No.: 25

1. Design Information

Design Code Eurocode3:05 & SWE2019

Unit System kN, m

Member No 25

Material A36 (No.1)

(Fy = 248211, Es = 199948024)

Section Name SG4 (No.224)

(Rolled: W30x116)

Member Length : 10.8000

Detail Report

MIDAS/Text Editor - [App1\_Steel.acs]

2. Member Forces

Axial Force Fx = 0.0

Bending Moments My = 1240.64

End Moments My1 = 1240.64, My2 = 1184.15, Mz = 0.00000, Mz1 = 0.00000, Mz2 = 0.00000

Shear Forces Fy = 0.0, Fz = 562.25

3. Design Parameters

Unbraced Lengths

Effective Length Factors

Equivalent Uniform Moment Factors

4. Checking Result

Slenderness Ratio L/r = 194.2 <

Axial Resistance N,Ed/N,Rd = 0.00

Bending Resistance M,Ed/M,Rd = 1240.64

M,Edz/M,Rdz = 0.000

Combined Resistance R,MRd = MAX( N,Ed/N,Rd

midas Gen - Steel Code Checking[ Eurocode3:05, SWE2019 ] Gen 2021

PROJECT : MEMBER NO = 25, ELEMENT TYPE = Beam, SECTION NO = 224

LOADING NO = 2, MATERIAL NO = 1, SECTION NO = 224

UNIT SYSTEM : kN, m

SECTION PROPERTIES : Designation = 304, W30x116

Shape = I - Section, (Rolled)

Depth = 0.762, Top F Width = 0.267, Bot F Width = 0.267

Web Thick = 0.014, Top F Thick = 0.022, Bot F Thick = 0.022

Area = 2.20645e-002, Avy = 1.12450e-002, Avz = 1.23830e-002

Iybar = 1.33286e-001, Izbar = 3.81127e-001, Iywb = 2.13151e-001, Izwb = 8.86264e-003

Wely = 5.39134e-003, Welz = 5.12915e-004, Wply = 5.18431e-003, Wplz = 8.06244e-004

Iyy = 2.05202e-003, Izz = 6.82620e-005, Iyyc = 0.00000e+000

Jy = 3.04800e-001, Jz = 5.56200e-002

It = 2.67637e-006, Cwp = 9.34823e-006

DESIGN PARAMETERS FOR STRENGTH EVALUATION :

Ly = 1.03000e+001, Lz = 1.03000e+001, Lb = 2.70000e+000

Ky = 1.00000e+000, Kz = 1.00000e+000

MATERIAL PROPERTIES :

Fy = 2.48211e+005, Es = 1.99948e+008, MATERIAL NAME = A36

FORCES AND MOMENTS AT (1) POINT :

Axial Force Fx = 0.00000e+000

Shear Forces Fyy = 0.00000e+000, Fzz = 5.60270e+002

Bending Moments My = 1.24064e+003, Mz = 0.00000e+000

End Moments My1 = 1.24064e+003, My2 = 1.18415e+003 (for Lb)

My1 = 1.24064e+003, My2 = 1.18415e+003 (for Ly)

Mz1 = 0.00000e+000, Mz2 = 0.00000e+000 (for Lz)

Mz1 = 0.00000e+000, Mz2 = 0.00000e+000 (for Ly)

Sign convention for stress and axial force.

- Stress : Compression positive.

- Axial force: Tension positive.

CLASSIFY LEFT-TOP FLANGE OF SECTION (BTR).

Determine classification of compression outstand flanges.

[ Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5 ]

e = SQR( (25e/Fy) \* 1.07 )

b/tf = BTR = 5.B4

sigmal = 200287.268 kPa.

sigmam = 200287.268 kPa.

BTR < Sig ( Class 1 : Plastic ).

midas Gen - Steel Code Checking[ Eurocode3:05, SWE2019 ] Gen 2021

Ln 62 / 383 , Col 102

# 5. Addition of New Sweden National Annex in Eurocode

## Add Sweden National Annex (BFS2019:1) of RC Design

Concrete Design Code

Design Code : Eurocode2:04

National Annex : **Sweden(2019)**

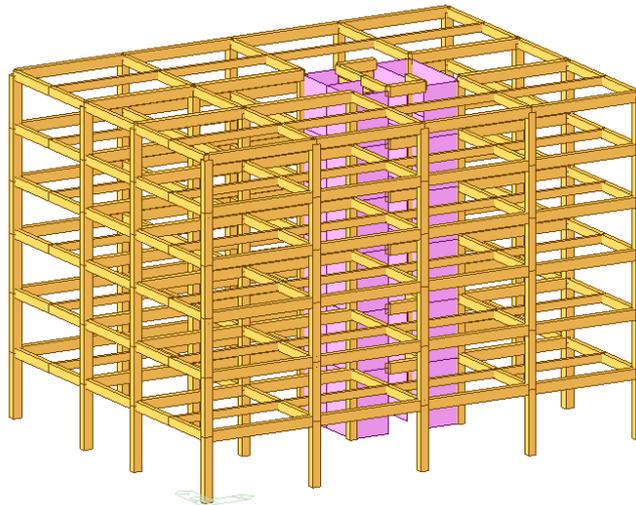
Apply NTC NTC2018

Apply EC8:04 Capacity Design

Strut Angle for Shear Resistance : 45 Deg

Effective Creep Ratio (Phi\_Lef) : 2.14

Slenderness Limit  
 Lambda\_lim = 20\*A+B+C/sqrt(n)  
 A : 0.7  Calculate by Program  
 B : 1.1



### Graphic Report (Summary Report)

Preview Window

No : 43

1. Design Condition

Design Code Eurocode204 & SWE2019 UNIT SYSTEM : N, mm

Member Number 43

Material Data  
 f<sub>yk</sub> = 30, f<sub>yk</sub> = 500, f<sub>yk</sub> = 400 MPa  
 Column Height 5000 mm  
 Section Property C3 (No. 306)  
 Rebar Pattern 10 - 5 - P25 Ast = 7853.92 mm<sup>2</sup> (rat = 0.019)

2. Axial and Moments Capacity

Load Combination: 12 (Ps - J)

Concrete Max. Axial Load N\_Rdmax = 11657689 N  
 Axial Load Ratio N\_Ed/N\_Rd = 21487581/5381027 = 0.399 < 1.000 - O.K.  
 Moment Ratio M\_Ed/M\_Rd = 413357927/1044520336 = 0.396 < 1.000 - O.K.  
 M\_Ed/M\_Rd\_y = 170002257/418035789 = 0.407 < 1.000 - O.K.  
 M\_Ed/M\_Rd\_z = 37676114/957219523 = 0.394 < 1.000 - O.K.  
 Normalized Axial Load Ratio Nu,d/0.55 = 0.256/0.550 = 0.465 < 1.000 - O.K.

M-N Interaction Diagram

3. Shear Capacity

[END]  
 Applied Shear Force (V\_Ed) 300163  
 V\_Ed/V\_Rd = 300164  
 V\_Ed/V\_Rdmax = 300165  
 Shear Ratio = 300166  
 Asw-H\_req = 300167  
 300168

[MIDDLE]  
 Applied Shear Force (V\_Ed) 300169  
 V\_Ed/V\_Rd = 300170  
 V\_Ed/V\_Rdmax = 300171  
 Shear Ratio = 300172  
 Asw-H\_req = 300173  
 300174  
 300175  
 300176  
 300177  
 300178  
 300179

### Detail Report

MIDAS/Text Editor - [App5\_EC2 Design-Finial model.rcs]

midas Gen - RC-Column Design [ Eurocode2:04 & Eurocode8:04 ] Gen 2021

```
( ). Calculate design moment for slender/non-slender element about minor axis.
- Minimum moment by eccentricity.
  Ein_z = 20.000 N-mm.
- M_Ed_min = N_Ed + Ein_z = 4096847.327 N-mm.
- Applied design moment.
  M_Ed_app = MAX( M_Ed_z, M_Ed_min ) = 54339527.396 N-mm.
----> M_Ed_app is applied for design.

( ). Design forces/moments of column(brace).
- Axial Force (Compression) N_Ed = 2048421.87 N.
- Combined Bending Moment M_Ed = 40939456.59 N-mm.
- Bending Moment about Local-y M_Ed_y = 189300632.19 N-mm.
- Bending Moment about Local-z M_Ed_z = 355817484.97 N-mm.
- Shear Force of Local-y V_Ed_y = 377350.15 N.
- Shear Force of Local-z V_Ed_z = 408951.15 N.

[[[+]]] ANALYZE CAPACITY OF BIAXIALLY LOADED RC COLUMN(RC-BRACE).

( ). Design Moment about y-direction For Ductile Design.
- M_Ed_y1 = 111445587.34 N-mm.(from Load Combination)
- M_Ed_y2 = 189300632.19 N-mm.(from Moment Resistance of Beams)
- M_Ed_y = MAX( M_Ed_y1, M_Ed_y2 ) = 189300632.19 N-mm.

( ). Design Moment about z-direction For Ductile Design.
- M_Ed_z1 = 54339527.40 N-mm.(from Load Combination)
- M_Ed_z2 = 355817484.97 N-mm.(from Moment Resistance of Beams)
- M_Ed_z = MAX( M_Ed_z1, M_Ed_z2 ) = 355817484.97 N-mm.

( ). Compute design parameters.
- As = 420000.0000 mm^2.
- lambda_s = 7853.9200 mm^2.
- Rhot = Ast/As = 0.018700.
- lambda_b = 0.0000 ( fcd <= 50 MPa. )
- eta = 1.0000 ( fcd <= 50 MPa. )
- gamma_cc = 1.50 (for Fundamental or Earthquakes).
- Alpha_cc = 1.00 (Default or User Defined).
- fcd = Alpha_cc + fck / gamma_cc = 20.000 MPa.
- gamma_s = 1.15 (for Fundamental or Earthquakes).
- fy_d = fy_k / gamma_s = 434.700 MPa.

( ). Check the ratio of reinforcement.
- Rhotin = 0.010000.
- Rhot = 0.018700.
Rhotin < Rhot ----> O.K!
```

### Design Result Table

Eurocode2:04 RC-Column Design Result Dialog

Code : EC2:04.SWE2019 Unit : N mm Primary Sorting Option

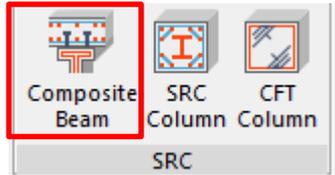
Sorted by  Member  Property

MEMB SECT	L	Section Bc Hc	fck Height	fyk f_w	LC B	Uc Rat-Uc	N_Ed Rat-N	M_Ed Rat-M	Ast	V-Rebar	LC B	V_Ed.end V_Ed.mid	Rat-V.end Rat-V.mid	Asw-H.e Asw-H.m	H-Rebar.end H-Rebar.mid	Ash.req Ash.us	Rat-As h	J-Rebar
0		C1	30.000	500.000	10	0.471	2894578	1.1E+09	11781	24-7-P25	12	395581	0.978	4524.0	2-P12 @50	4731.50	0.972	Failure
106		600.0 600.0	4500.0	400.000		0.856	0.583	0.974			13	555884	0.830	3258.2	2-P10 @40	4869.48		
0		C1A	30.000	500.000	13	0.249	1496645	4.2E+07	6872.2	14-5-P25	13	431672	0.959	3098.8	2-P12 @70	2229.69	0.986	2-10 P12
156		500.0 600.0	5000.0	400.000		0.454	0.188	0.190			13	431672	0.986	3098.8	2-P10 @50	2262.00		
0		C2	30.000	500.000	11	0.333	763175	9.9E+08	10799	22-6-P25	11	389761	0.964	3231.4	2-P12 @70	3300.71	0.955	2-22 P12
206		600.0 600.0	4000.0	400.000		0.605	0.912	0.927			11	419465	0.939	2458.6	2-P10 @60	3455.76		
0		C3	30.000	500.000	10	0.261	675835	7.5E+08	7853.9	16-5-P25	12	411273	0.898	2513.3	2-P12 @90	3216.31	0.975	2-21 P12
306		600.0 700.0	4000.0	400.000		0.474	0.780	0.770			12	393064	0.880	2303.9	2-P10 @60	3298.68		

*midas* **Design+**

# 1. User define of Deck Plate of composite beam module

- Deck plate section of composite beam can be customized.



**Use DB Section**

Section Deck Load Vibration

Deck Plate

Use Deck Plate  
 User Defined Prop. ...

Section DPL-75x200x58x80x1.6

Hr	75.00	mm
Sr	200.00	mm
Br0	58.00	mm
Br1	80.00	mm
t	1.60	mm

Direction Perpendicular to Beam

**User Defined Section**

Section Deck Load Vibration

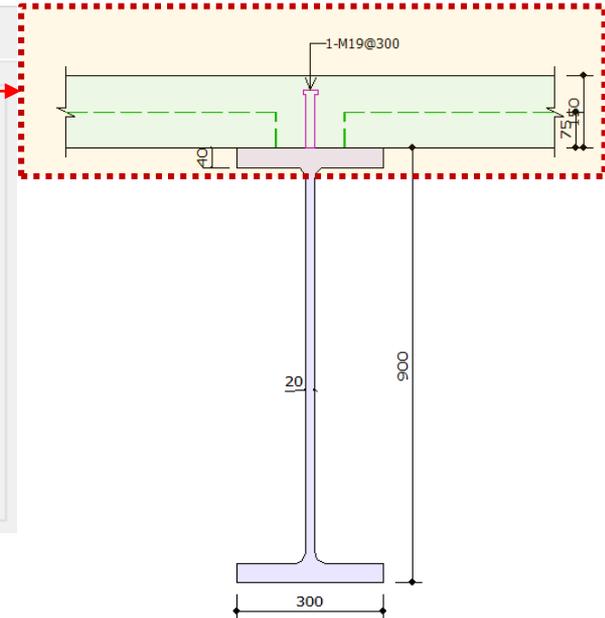
Deck Plate

Use Deck Plate  
 User Defined Prop. ...

Section DPL-75x100x58x80x1.6

Hr	75.00	mm
Sr	200.00	mm
Br0	58.00	mm
Br1	80.00	mm
t	1.60	mm

Direction Perpendicular to Beam



# 1. User define of Deck Plate of composite beam module

- Section properties can be directly input by the user for both DB section and user-defined section.

**User Defined Section**

Deck Plate

Use Deck Plate

User Defined

Prop. ...

Section:

Hr	80.00	mm
Sr	200.00	mm
Br0	58.00	mm
Br1	80.00	mm
t	2.00	mm

Direction:

**Auto-Calculated Deck Properties & Report**

Deck Properties

User Defined

A	3355.44	mm <sup>2</sup>
W	0.00	kN/m <sup>3</sup>
Centr	47.21	mm
Ixx	2550127.58	mm <sup>2</sup> x <sup>2</sup>
Z(+)	55190.14	mm <sup>3</sup>
Z(-)	80208.37	mm <sup>3</sup>
Ht	25.46	mm

(4) Deck Plate : DPL-80x200x58x80x2

• Direction : Perpendicular to Beam

H <sub>r</sub>	S <sub>r</sub>	B <sub>0</sub>	B <sub>r1</sub>	t	H <sub>t</sub>
80.00mm	200mm	58.00mm	80.00mm	2.000mm	25.46mm
A	W	C <sub>y</sub>	I <sub>xx</sub>	Z(+)	Z(-)
3,355mm <sup>2</sup>	0.000kN/m <sup>3</sup>	47.21mm	2,550,128mm <sup>4</sup>	55,190mm <sup>3</sup>	80,208mm <sup>3</sup>

1.DB section: The properties defined in the DB are applied.

2. User Defined section: Automatic calculation value applied. (Calculated as section property for Thin-Wall Section)