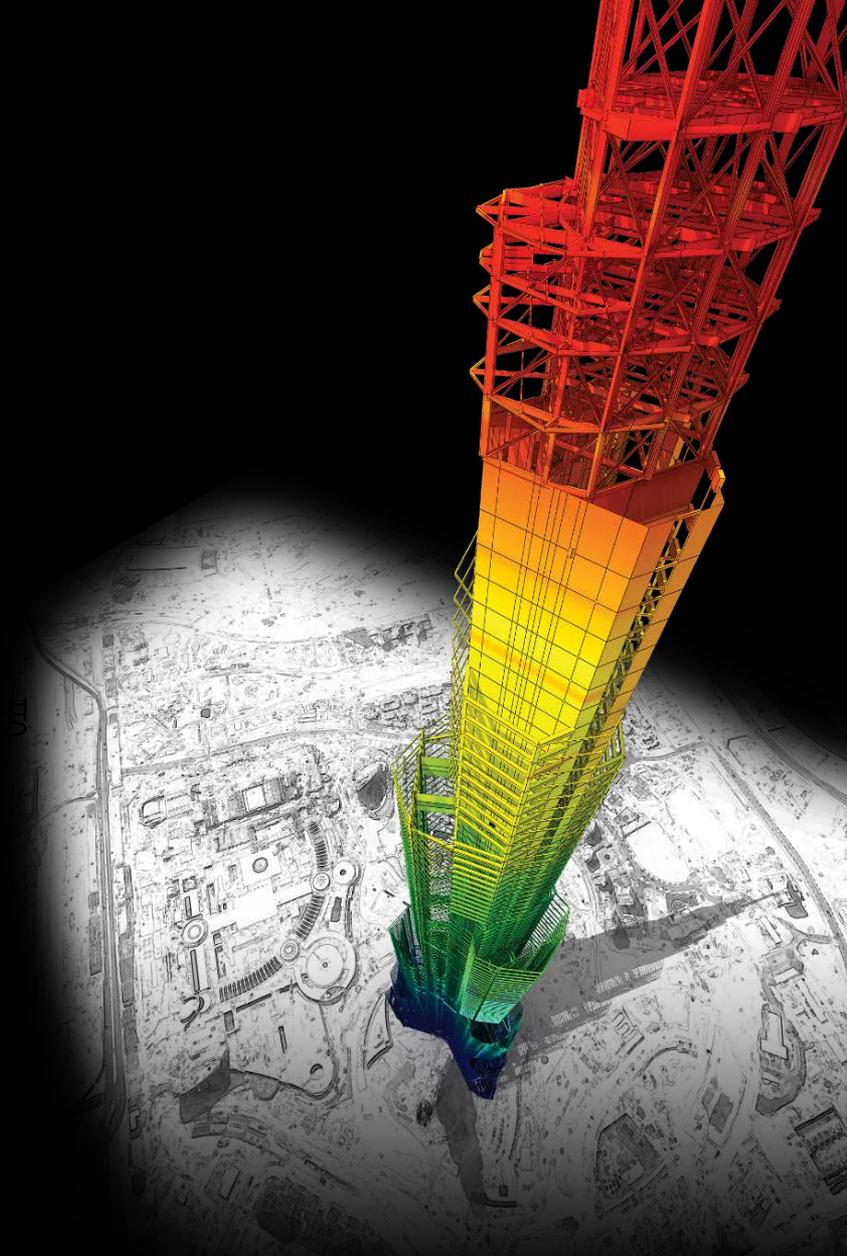


Release Note

Release Date: July, 2018

Product Ver. : Gen 2019 (v1.1) and Design + 2019 (v1.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

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• midas Gen

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midas **Gen**

1. 構件設計 (歐規NTC 2018)

Reference in NTC 2018	Details
-	Add Material of NTC2018 in DShop
-	Add Material of NTC2018 in GSD
7.4.6.2.2	<p>[Column] Modify the calculation of 'Volume of concrete core' in Check mechanical volumetric ratio of confining hoops within the critical regions.</p> <p>[Wall End] Modify the calculation of mechanical volumetric ratio within the critical regions.</p>
7.4.4.5.1	<p>1) Shear strength in wall elements under seismic combination is reduced by a 0.4 factor.</p> <p>2) Design shear force of wall elements use the shear force from analysis without any modification in CD "B".</p>
7.4.6.2.2	Minimum mechanical volumetric ratio is considered as 0.12 only for CD"A" in column and wall.
7.4.4.5.2.2	In wall element for seismic and non-seismic case, wall length for shear design is calculated by ' $d=0.9Lw'$ and ' $z= 0.8Lw'$

1. 構件設計 (歐規NTC 2018)

- Detail Report for Punching Shear Checking as per 6.4.4 and 6.4.5 of EN1992-1-1

```

Basic control perimeter
rho1y = 0.0000
rho1z = 0.0000
rho1 = min[ sqrt(rho1y*rho1z), 0.02 ] = 0.0000
K = min[ 1+(200/d)^0.5, 2.0 ] = 2.000 (d in mm)
gamma_c = 1.500
U_Rd,c = max[ 0.035*k^1.5*sqrt(fck), (0.18/gamma_c)*K*(100*rho1*fck)^1/3 ]*u1*d
        = 432.1333 kN.

RatU = Beta*U_Ed / U_Rd,c = 1.747 > 1.0 ---> Not Acceptable !!!
      (Need Vertical Reinforcements.)
fywd = 347826.0870 KPa.
fywd_ef = min[ 250+0.25*d, fywd ] = 293500.0000 KPa
Asw/Sr = Beta*U_Ed / (1.5*d*fywd_ef) = 0.0099 m^2/m. ( 0.0099 m^2/m.)
      (Calculating the outermost perimeter of shear reinforcement.)
uout_ef = Beta*U_Ed / (0_Rd,c*U1) = 0.0010 m.
    
```

Calculating "Area(Asw) / space(Sr)" of shear reinforcement. as per EN 1992-1-1:2005/A1:2014

"(1) Where shear reinforcement is required it should be calculated in accordance with Expression (6.52):

$$V_{Rd,cs} = 0,75 V_{Rd,c} + 1,5 (d / s_r) A_{sw} f_{ywd,ef} [1 / (u_1 d)] \sin \alpha \leq k_{max} \cdot V_{Rd,c} \quad (6.52)$$

where

- A_{sw} is the area of one perimeter of shear reinforcement around the column [mm²];
- s_r is the radial spacing of perimeters of shear reinforcement [mm];
- $f_{ywd,ef}$ is the effective design strength of the punching shear reinforcement according to $f_{ywd,ef} = 250 + 0,25 d \leq f_{ywd}$ [MPa];
- d is the mean of the effective depths in the orthogonal directions [mm];
- α is the angle between the shear reinforcement and the plane of the slab;
- $V_{Rd,c}$ according to 6.4.4;
- k_{max} is the factor, limiting the maximum capacity that can be achieved by application of shear reinforcement.

NOTE The value of k_{max} for use in a country may be found in its National Annex. The recommended value is 1.5.

- Update default value and default options



2. 優化材料非線性分析的後處理程序

- Strain results are provided for plastic materials, i.e. Tresca, Von Mises, Mohr-Coulomb, Drucker-Prager, and Concrete Damage.
- Damage ratios for compression and tension are provided for the 'Concrete Damage' model.

Results > Tables > Results Tables > Plate/ Solid > Strain(local)/ Strain(Global)

The screenshot displays the MIDAS Gen interface. On the left, the 'Results Tables' menu is open, showing a tree structure where 'Plate' and 'Solid' are selected, and 'Strain (Local)' is highlighted. On the right, a table titled 'Result: (Plate Strain(Local))' is shown, containing columns for Element, Load, Step, Node, Part, Strain components, and Damage ratios.

Elem	Load	Step	Node	Part	Strain-xx	Strain-yy	Strain-xy	Strain Max	Strain Min	Angle (deg)	Max-Shear	Comp. Damage	Tens. Damage	Damage
1	LDC1	nl_001	Cent	Top	-9.802e-005	5.819e-005	0.000e+000	5.819e-005	-9.802e-005	90.0000	7.811e-005	6.720e-002	0.000e+000	6.720e-002
1	LDC1	nl_002	Cent	Top	-2.612e-004	1.551e-004	0.000e+000	1.551e-004	-2.612e-004	90.0000	2.082e-004	1.791e-001	1.197e-007	1.791e-001
1	LDC1	nl_003	Cent	Top	-4.181e-004	2.482e-004	0.000e+000	2.482e-004	-4.181e-004	90.0000	3.332e-004	2.788e-001	1.197e-007	2.788e-001
1	LDC1	nl_004	Cent	Top	-7.988e-004	4.742e-004	0.000e+000	4.742e-004	-7.988e-004	90.0000	6.365e-004	3.963e-001	1.197e-007	3.963e-001
1	LDC1	nl_005	Cent	Top	-1.237e-003	7.343e-004	0.000e+000	7.343e-004	-1.237e-003	90.0000	9.856e-004	4.946e-001	1.197e-007	4.946e-001
1	LDC1	nl_006	Cent	Top	-1.708e-003	1.014e-003	0.000e+000	1.014e-003	-1.708e-003	90.0000	1.361e-003	5.690e-001	1.197e-007	5.690e-001
1	LDC1	nl_007	Cent	Top	-2.197e-003	1.305e-003	0.000e+000	1.305e-003	-2.197e-003	90.0000	1.751e-003	6.247e-001	1.197e-007	6.247e-001
1	LDC1	nl_008	Cent	Top	-2.693e-003	1.599e-003	0.000e+000	1.599e-003	-2.693e-003	90.0000	2.146e-003	6.692e-001	1.197e-007	6.692e-001
1	LDC1	nl_009	Cent	Top	-3.193e-003	1.896e-003	0.000e+000	1.896e-003	-3.193e-003	90.0000	2.545e-003	7.099e-001	1.197e-007	7.099e-001
1	LDC1	nl_010	Cent	Top	-3.695e-003	2.193e-003	0.000e+000	2.193e-003	-3.695e-003	90.0000	2.944e-003	7.352e-001	1.197e-007	7.352e-001
1	LDC1	nl_011	Cent	Top	-4.197e-003	2.492e-003	0.000e+000	2.492e-003	-4.197e-003	90.0000	3.344e-003	7.573e-001	1.197e-007	7.573e-001
1	LDC1	nl_012	Cent	Top	-4.700e-003	2.790e-003	0.000e+000	2.790e-003	-4.700e-003	90.0000	3.745e-003	7.793e-001	1.197e-007	7.793e-001
1	LDC1	nl_013	Cent	Top	-5.203e-003	3.089e-003	0.000e+000	3.089e-003	-5.203e-003	90.0000	4.146e-003	7.996e-001	1.197e-007	7.996e-001
1	LDC1	nl_014	Cent	Top	-5.706e-003	3.388e-003	0.000e+000	3.388e-003	-5.706e-003	90.0000	4.547e-003	8.101e-001	1.197e-007	8.101e-001
1	LDC1	nl_015	Cent	Top	-6.209e-003	3.686e-003	0.000e+000	3.686e-003	-6.209e-003	90.0000	4.948e-003	8.206e-001	1.197e-007	8.206e-001
1	LDC1	nl_016	Cent	Top	-6.713e-003	3.985e-003	0.000e+000	3.985e-003	-6.713e-003	90.0000	5.349e-003	8.311e-001	1.197e-007	8.311e-001
1	LDC1	nl_017	Cent	Top	-7.217e-003	4.285e-003	0.000e+000	4.285e-003	-7.217e-003	90.0000	5.751e-003	8.416e-001	1.197e-007	8.416e-001
1	LDC1	nl_018	Cent	Top	-7.722e-003	4.584e-003	0.000e+000	4.584e-003	-7.722e-003	90.0000	6.152e-003	8.521e-001	1.197e-007	8.521e-001

Plate Strain (local) menu

Solid Strain (local) menu

Plate Strain (local) Table

2. 優化混凝土破壞模式分析的後處理程序

Results > Results > Strains > Plate Strains/Solid Strains

The image shows the 'Plate Strain' post-processor interface in Midas Gen. It consists of a main 3D view and a detailed control panel on the right. The 3D view shows a frame structure with a color-coded strain distribution. The control panel on the right has the following settings:

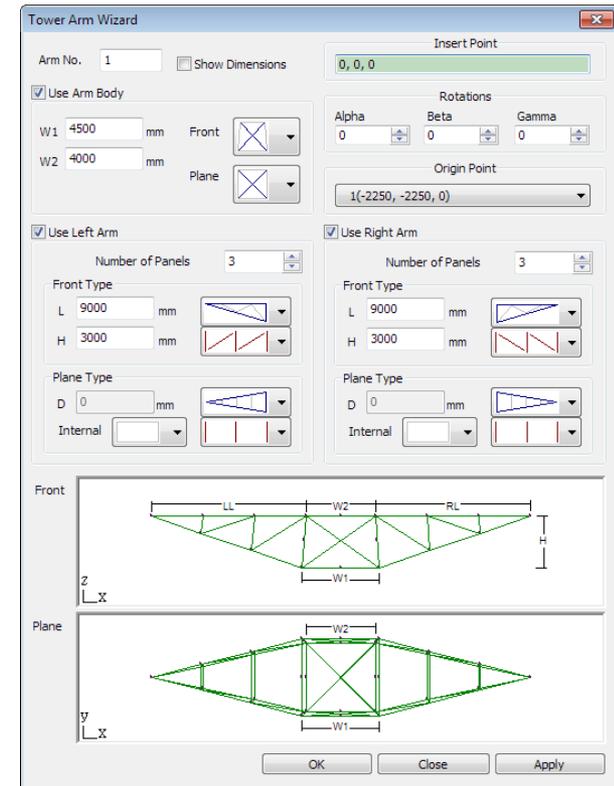
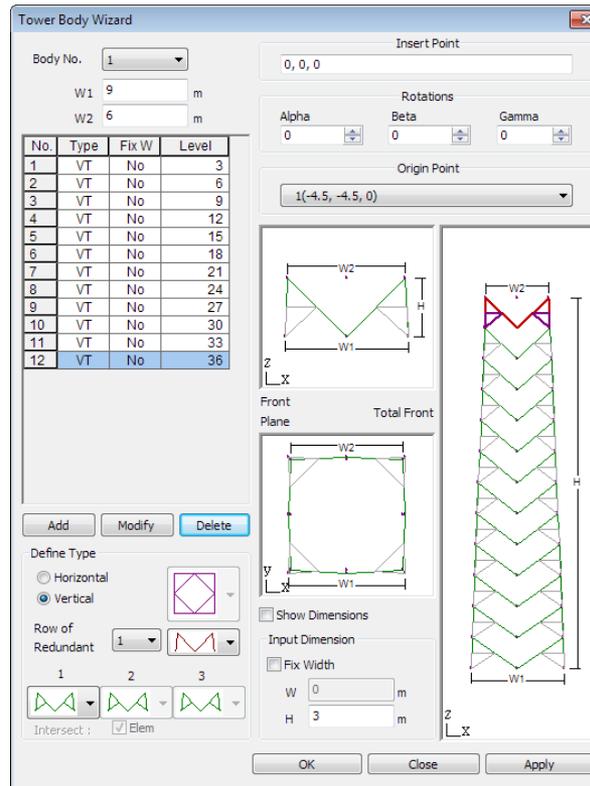
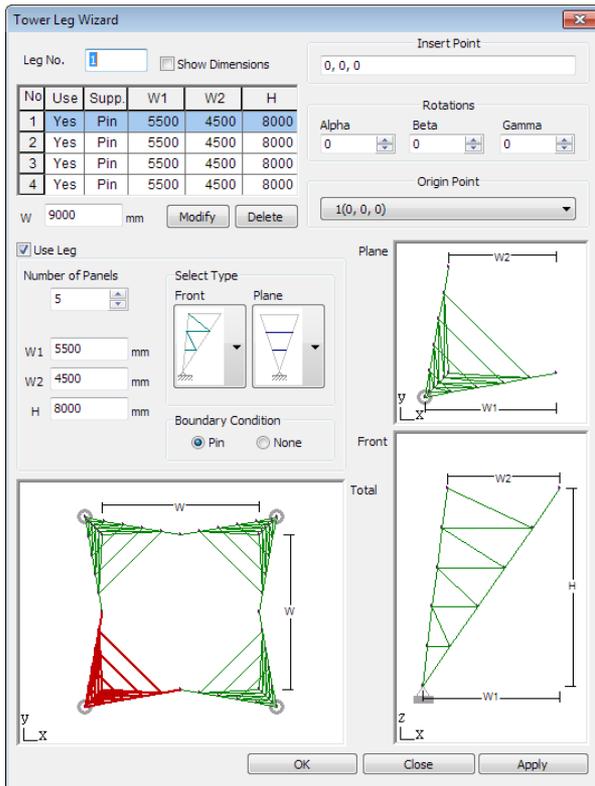
- Plate Strain** (selected)
- Load Cases/Combinations**: ST: LDC1
- Step**: NL Step:20
- Strain Type**: Total Strain, Plastic Strain, Damage Ratio
- Strain Options**:
 - Local, UCS (Current UCS)
 - Element, Avg. Nodal
 - Avg. Nodal Active Only
 - Top, Bottom, Both Sides, Abs Max
- Components**: Compressive, Tensile, Total
- Type of Display**:
 - Contour, Deform
 - Values, Legend
 - Animate, Undeformed
 - Mirrored
- Value Option**: Max, Element Center

Red arrows point from the 'Total Strain' and 'Damage Ratio' options in the control panel to the corresponding 3D models. The top model shows a color-coded strain distribution, and the bottom model shows a blue color scheme. The control panel also includes 'Apply' and 'Close' buttons at the bottom.

3. 建模精靈自動建立電塔模型

- Tower wizard makes it easy to model the leg / body / arm part of a complex 3D tower structure.

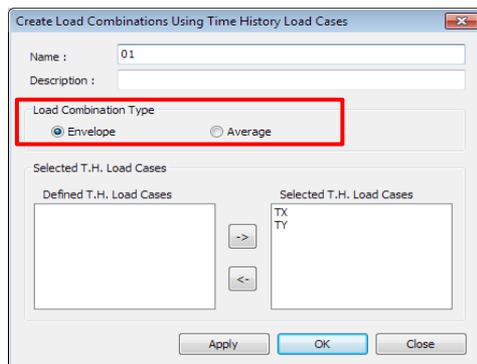
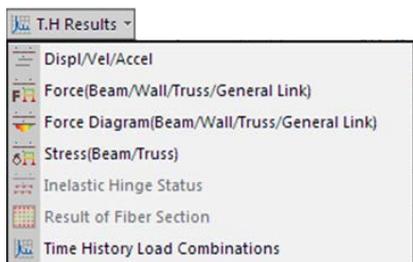
Structure > Wizard > Tower > Tower Leg/ Body/ Arm



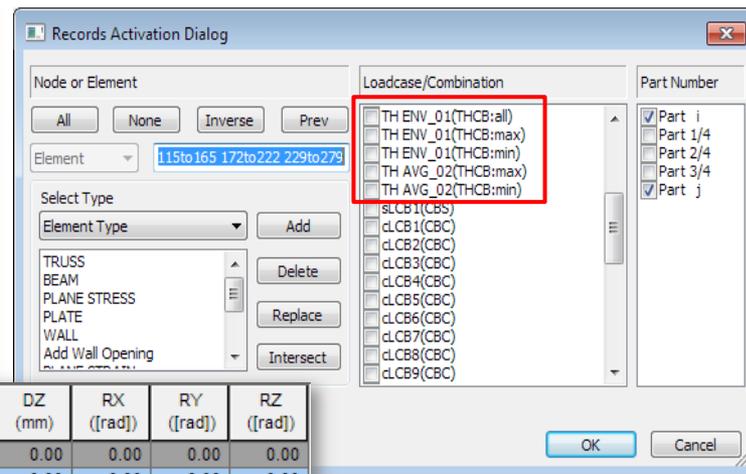
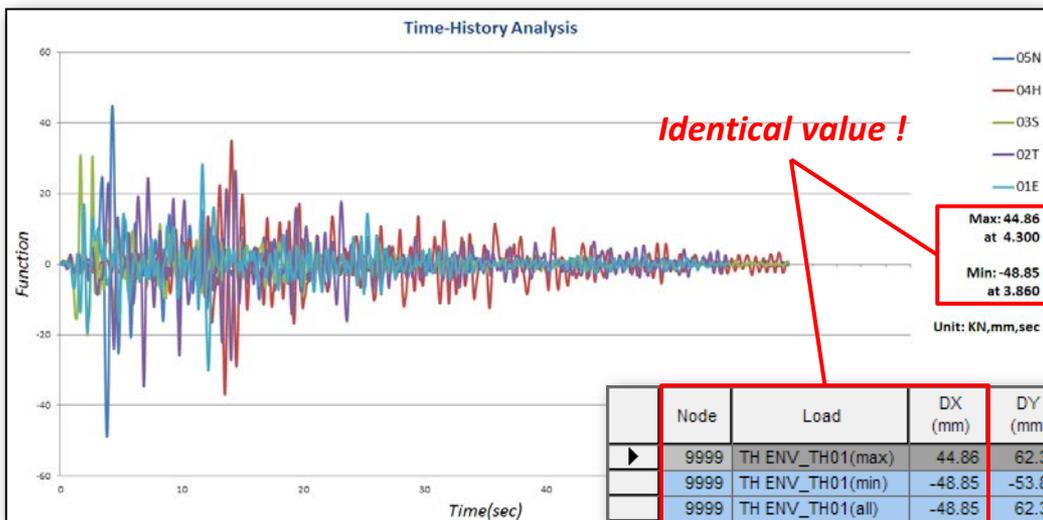
4. 優化歷時分析的後處理程序

- The average and envelope load cases for the time-history load cases are generated in the table.
- The displacement and the member force are only supported.

Results > Time History > T.H Results > Time History Load Combination



Time History Load Case	Result Type	Detail
Added nonlinear load combination	Cball : TH ENV_User input name	The maximum absolute value among the selected load cases
	Cbmax : TH ENV_User input name	The maximum value among the maximum value of selected load cases
	Cbmin : TH ENV_User input name	The minimum value among the minimum value of selected load cases
	Cbmax : TH AVR_User input name	The average value of the maximum value of selected load cases
	Cbmin : TH AVR_User input name	The average value of minimum value of selected load cases



5. 優化扭轉不規則性檢核表格

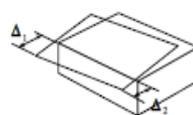
- The ϕ_p value is added in Torsional Irregularity Check Table as per the Colombia NSR-10 standard.
- The extreme irregular type is added in Remark field.

Tipo 1aP — Irregularidad torsional
 $\phi_p = 0.9$

$$1.4 \left(\frac{\Delta_1 + \Delta_2}{2} \right) \geq \Delta_1 > 1.2 \left(\frac{\Delta_1 + \Delta_2}{2} \right)$$

Tipo 1bP — Irregularidad torsional extrema
 $\phi_p = 0.8$

$$\Delta_1 > 1.4 \left(\frac{\Delta_1 + \Delta_2}{2} \right)$$



ϕ_p is the factor regarding the plan irregularity. If the structure has normal torsional irregularity (between 1.2 and 1.4) it must use ϕ_p as 0.9. If the structure has extreme torsional irregularity (more than 1.4), ϕ_p will be 0.8. If the structure is regular, ϕ_p will be 1.0.

← Figura A.3-1 — Irregularidades en planta

Select Calculation Method

Country Code : NSR-10

Story Drift Method

Drift at the Center of Mass

Max. Drift of Outer Extreme Points

Max. Drift of All Vertical Elements

Story Stiffness Method

1 / Story Drift Ratio

Story Shear / Story Drift

OK Cancel

	Load Case	Story	Level (mm)	Story Height (mm)	Average Value of Extreme Points		Maximum Value		Remark	Phi_p
					1.4*Story Drift (mm)	1.2*Story Drift (mm)	Node	Story Drift (mm)		
DL	5F	15500.00	3500.00	0.0002	0.0001	107	0.0001	Regular	1.0	
DL	4F	12000.00	3500.00	0.0001	0.0000	85	0.0000	Regular	1.0	
DL	3F	8500.00	3500.00	0.0000	0.0000	63	0.0000	Regular	1.0	
DL	2F	5000.00	3500.00	0.0000	0.0000	21	0.0000	Regular	1.0	
DL	1F	0.00	5000.00	0.0000	0.0000	41	0.0000	Regular	1.0	
LL	5F	15500.00	3500.00	0.0005	0.0004	107	0.0003	Regular	1.0	
LL	4F	12000.00	3500.00	0.0002	0.0002	85	0.0002	Regular	1.0	
LL	3F	8500.00	3500.00	0.0002	0.0002	63	0.0001	Regular	1.0	
LL	2F	5000.00	3500.00	0.0001	0.0001	21	0.0001	Regular	1.0	
LL	1F	0.00	5000.00	0.0002	0.0002	41	0.0001	Regular	1.0	
EX	5F	15500.00	3500.00	2.8645	2.4553	123	2.3180	Regular	1.0	
EX	4F	12000.00	3500.00	4.1682	3.5728	101	3.5092	Regular	1.0	
EX	3F	8500.00	3500.00	5.0753	4.3503	79	4.4255	Irregular	0.9	
EX	2F	5000.00	3500.00	5.7329	4.9139	40	5.3288	Irregular	0.9	
EX	1F	0.00	5000.00	13.9758	11.9793	60	14.1114	Extreme Irregu	0.8	
EY	5F	15500.00	3500.00	6.5717	5.6328	126	5.1114	Regular	1.0	
EY	4F	12000.00	3500.00	11.2747	9.6641	104	8.7462	Regular	1.0	
EY	3F	8500.00	3500.00	15.9000	13.6286	82	12.2937	Regular	1.0	
EY	2F	5000.00	3500.00	23.9264	20.5084	40	18.3609	Regular	1.0	
EY	1F	0.00	5000.00	93.3580	80.0211	60	70.8491	Regular	1.0	
WX	5F	15500.00	3500.00	0.0000	0.0000	0	0.0000	Regular	1.0	
WX	4F	12000.00	3500.00	0.0000	0.0000	0	0.0000	Regular	1.0	
WX	3F	8500.00	3500.00	0.0000	0.0000	0	0.0000	Regular	1.0	
WX	2F	5000.00	3500.00	0.0000	0.0000	0	0.0000	Regular	1.0	
WX	1F	0.00	5000.00	0.0000	0.0000	0	0.0000	Regular	1.0	

Regular : Story Drift of Maximum Value = < 1.2*Story Drift of Average Value of Extreme Points

Irregular : 1.2*Story Drift of Average Value of Extreme Points < Story Drift of Maximum Value =< 1.4*Story Drift of Average Value of Extreme Points

Extreme Irregular : 1.4*Story Drift of Average Value of Extreme Points < Story Drift of Maximum Value

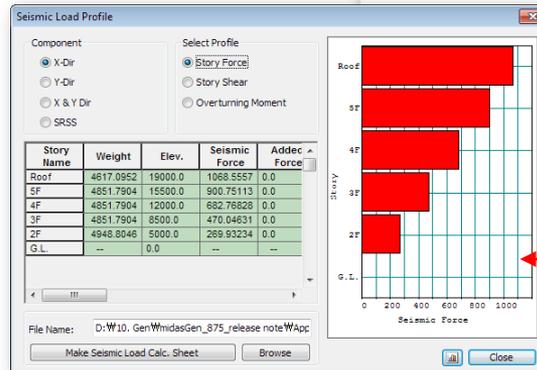
6. 自動計算不規則結構物的折減係數 (哥倫比亞規範NSR-10)

- Response modification factor R is calculated using three reduction factors to consider the irregularity of structure as per the Colombia NSR-10 standard. ($R = \phi_a * \phi_p * \phi_r * R_0$)
- Height Irregularity (ϕ_a), Plan irregularity (ϕ_p), Redundancy Check (ϕ_r)

Enter the ϕ_p obtained from the Torsional Irregularity table.

* EQUIVALENT SEISMIC LOAD IN ACCORDANCE WITH NSR-10 [UNIT: kN, mm]

Site Class	: 0
Effective Peak Acceleration(Aa)	: 0.15000
Effective Peak Velocity (Av)	: 0.15000
Site Coefficient at Short Periods (Fa)	: 1.50000
Site Coefficient at 1 s Period (Fv)	: 2.20000
Importance Factor (I)	: 1.00
Period Coefficient for Upper Limit (Cu)	: 1.3540
Fundamental Period Associated with X-dir. (Tx)	: 0.6652
Fundamental Period Associated with Y-dir. (Ty)	: 0.6652
Basic Ductility Factor for X-dir. (Rx0)	: 4.00000
Basic Ductility Factor for Y-dir. (Ry0)	: 4.00000
Reduction Factor of Irregularity for X-dir. (Phi _x)	: 1.00000
Reduction Factor of Irregularity for Y-dir. (Phi _y)	: 1.00000
Ductility Factor for X-dir. (Rx)	: 4.00000
Ductility Factor for Y-dir. (Ry)	: 4.00000
Total Effective Weight For X-dir. Seismic Loads (W _x)	: 24121.271122
Total Effective Weight For Y-dir. Seismic Loads (W _y)	: 24121.271122
Scale Factor For X-directional Seismic Loads	: 1.00
Scale Factor For Y-directional Seismic Loads	: 0.00
Accidental Eccentricity For X-direction (Ex)	: Positive
Accidental Eccentricity For Y-direction (Ey)	: Positive
Torsional Amplification for Accidental Eccentricity	: Do not Consider
Torsional Amplification for Inherent Eccentricity	: Do not Consider
Model For X-direction	: 3392.053752
Model For Y-direction	: 0.000000
Of Model For X-direction	: 628366525.678988
Of Model For Y-direction	: 0.000000



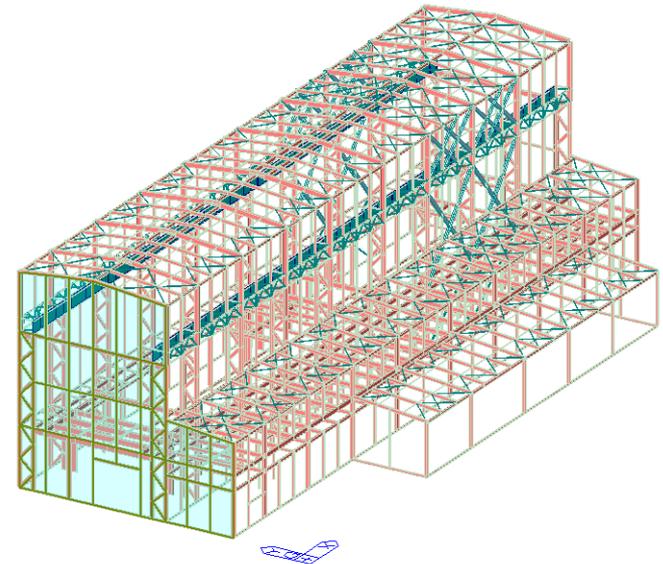
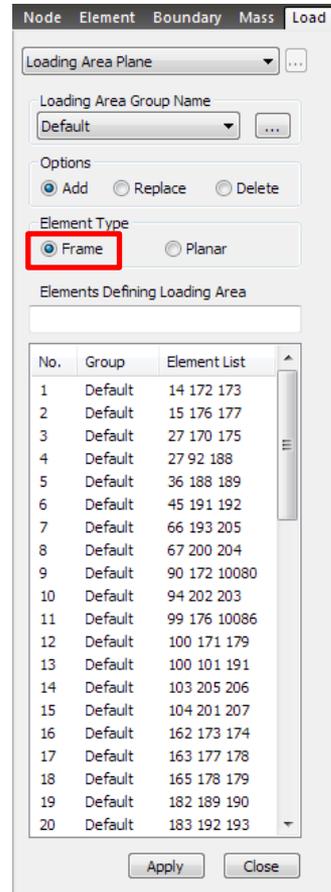
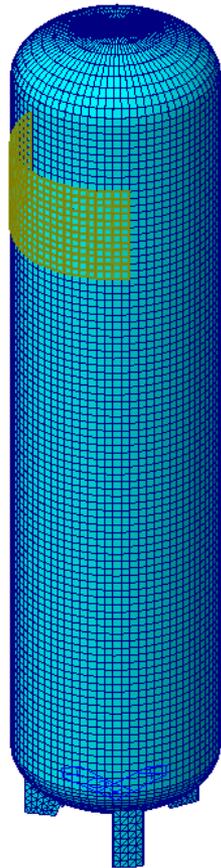
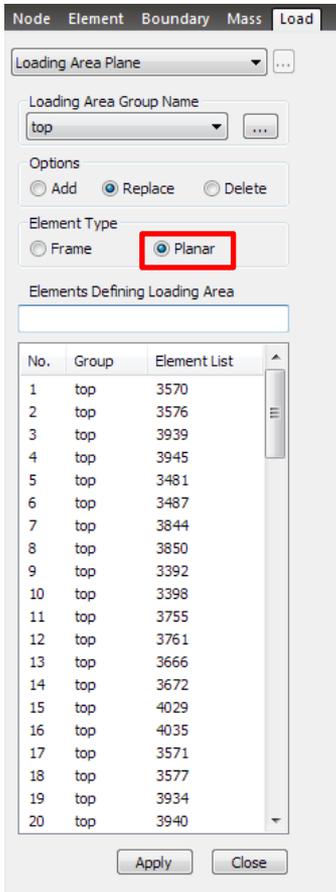
Calculation sheet of seismic load

Graph of the story force

7. 定義面載重群組

- Loading Area Group can be defined by selecting an area to apply wind pressure .

Structure > Group > B/L/T > Define Loading Area Group



8. 定義風壓計算方程式

- Wind load is applied on the space structure according to user-defined function.
- Wind load is applied as the nodal load on the nodes composing the defined loading area.

Load > Static Load > Lateral > Wind Pressure

Add/Modify/Show Wind Pressure Function

Function Name : Function_01

Coordinate System : Rectangular

Equation : $0.5*z*z$
(Example : $0.7*Z*Z, \cos(\text{TH})+R$)

Description : *Input Equation for Function*

Table Show Option

Fixed Axis : X, Y Unit : m, [deg]

X Start : 0 End : 5 Increment : 0.5

Fix Coordinates X : 0 Y : 0

Calculate

	X (m)	Y (m)	Z (m)	Wind Pressure (kN/m ²)
1	0	0	0	0
2	0	0	0.5	0.125
3	0	0	1	0.5
4	0	0	1.5	1.125
5	0	0	2	2
6	0	0	2.5	3.125
7	0	0	3	4.5
8	0	0	3.5	6.125
9	0	0	4	8
10	0	0	4.5	10.125
11	0	0	5	12.5

OK Cancel

Wind Pressure Function

Wind Pressure

Function Wind Pressure

Load Case Name : DL

Direction : X-Y

Angle : 0 [deg]

Inner Point : 0, 0, 0 m

Scale Factor : 1

Function Name : Function_01

Center Point : 0, 0, 0 m

Selection : Group Element

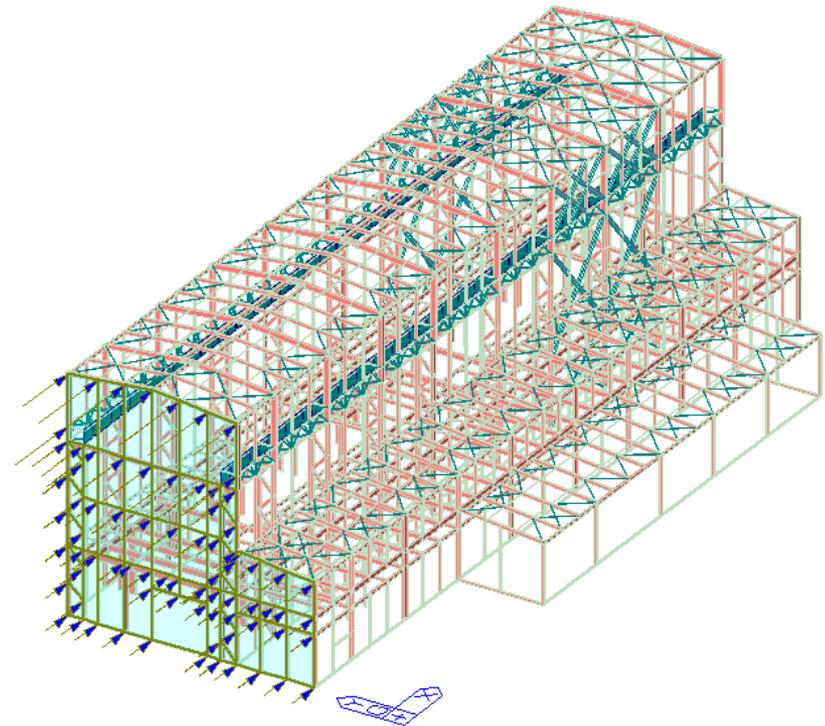
Loading Area Group Name : 01

Element Type
 Frame Planar

Elements Defining Loading Area :

Apply Close

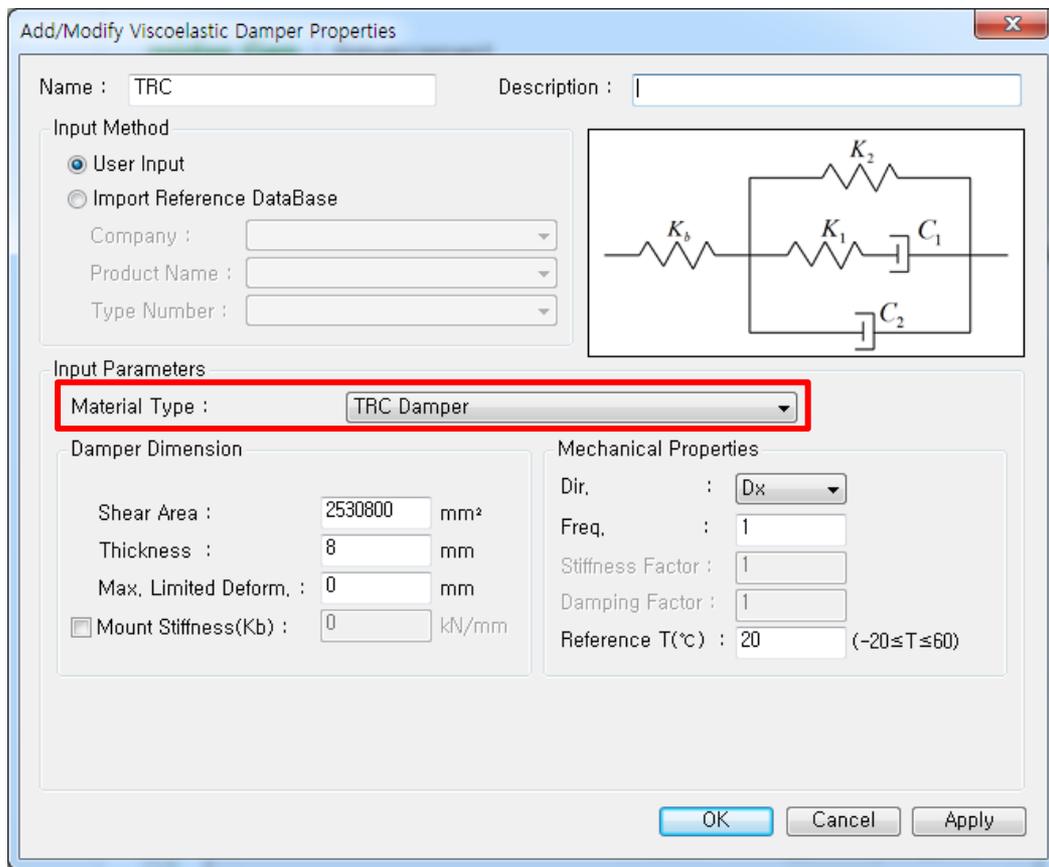
Function Wind Pressure



9. 優化黏彈性阻尼器設定

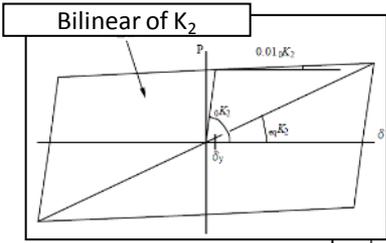
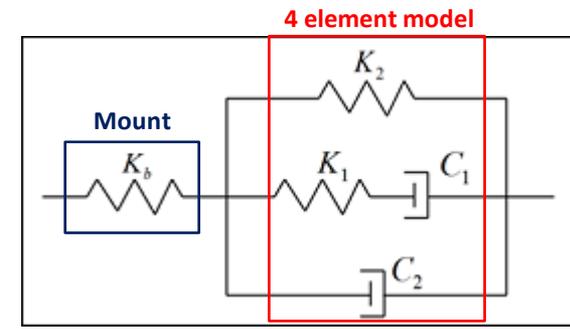
- TRC dampers manufactured by Sumitomo Riko Company Limited is added to the viscoelastic material properties.

Boundary > General Link > Seismic Device Properties... > Viscoelastic Damper

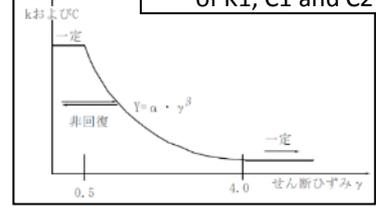


4 element model

Viscoelastic material properties TRC Damper



Shear strain dependence of K1, C1 and C2



9. 優化黏彈性阻尼器設定

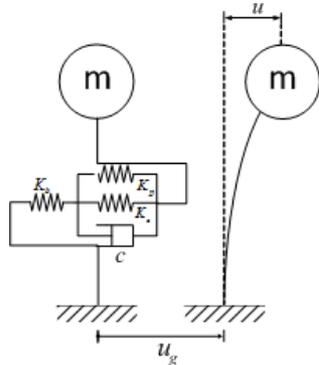
Boundary > General Link > Seismic Device Properties... > Viscoelastic Damper

TRC Damper (4 element model)

: Total Components (K1(Maxwell) + K2(Voigt) + C1(Maxwell) + C2(Voigt)) + Mount

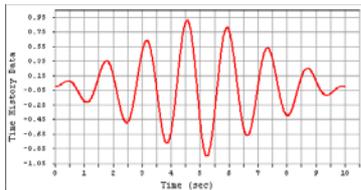
Compression with other products

- Verification model

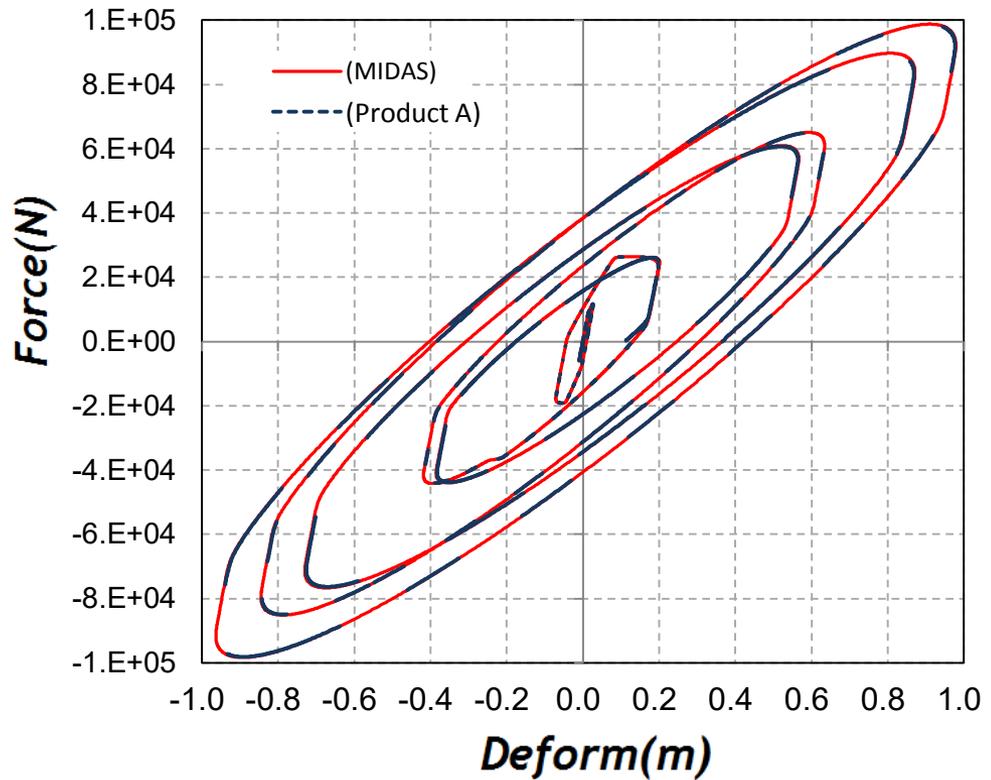


Mass = 5102.04 N/g
 Elastic Stiffness = 10000 N/m
 Undamped System
 Mounting Stiffness = 1000000 N/m

- Input seismic wave



- Compression of historical loop



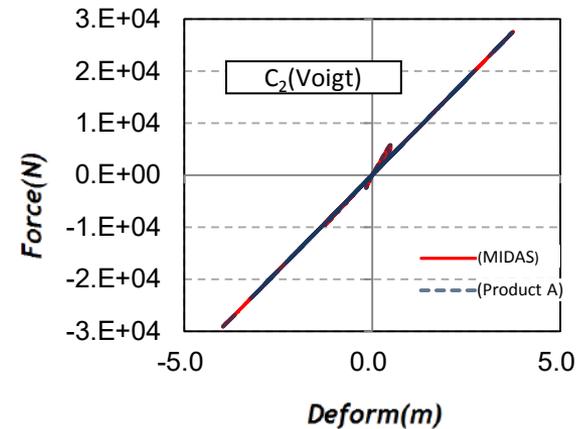
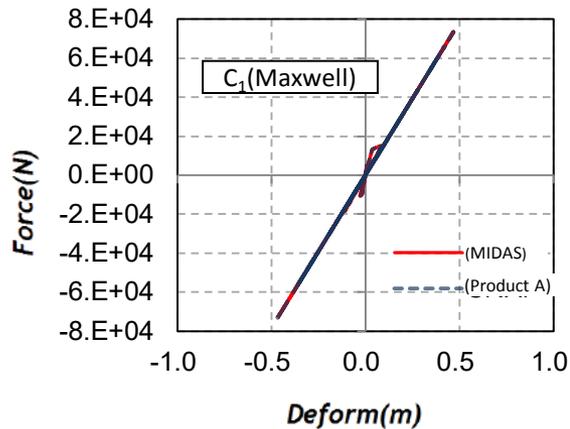
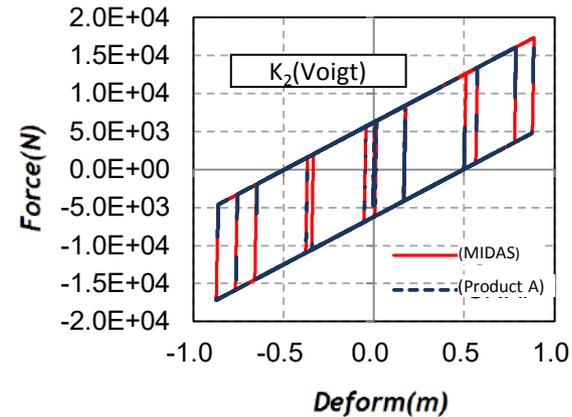
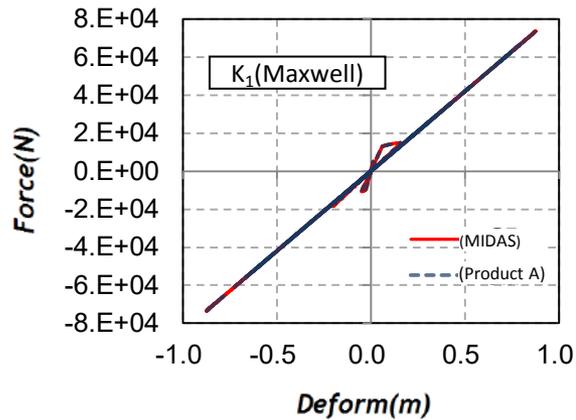
9. 優化黏彈性阻尼器設定

Boundary > General Link > Seismic Device Properties... > Viscoelastic Damper

TRC Damper (4 element model)

: Total Components (K1(Maxwell) + K2(Voigt) + C1(Maxwell) + C2(Voigt)) + Mount

Compression with other products(Historical loop)



10. 新增地震能量消散圖

- Print out energy results graph for isolator and vibration control device in the nonlinear time history analysis.

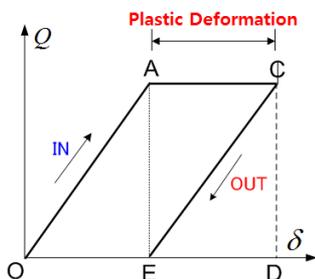
Result > T.H Graph/Text > Time History Energy Graph

Time History Energy Graph

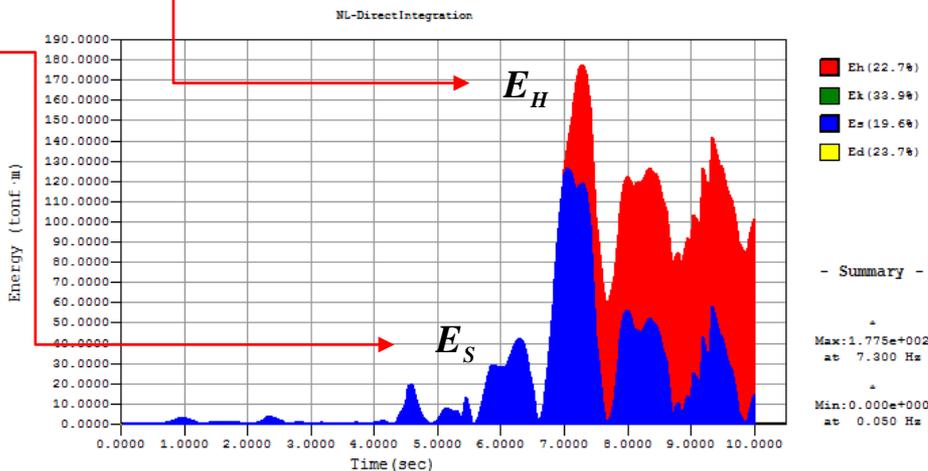
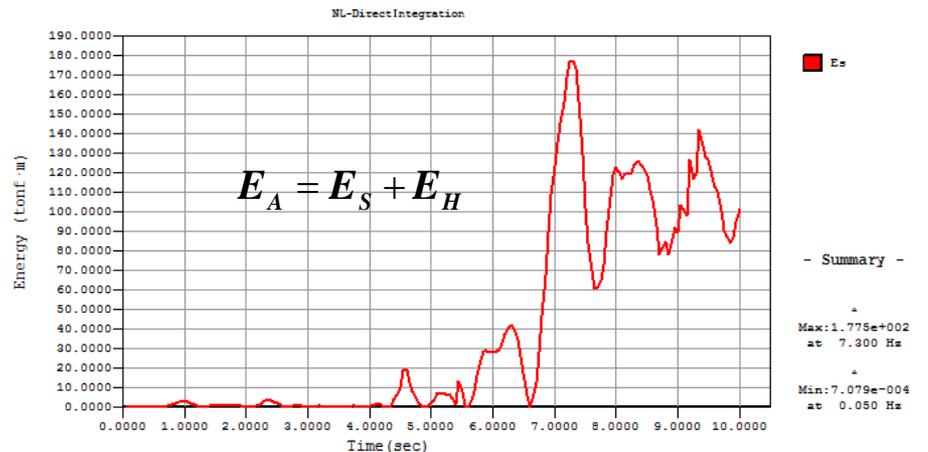
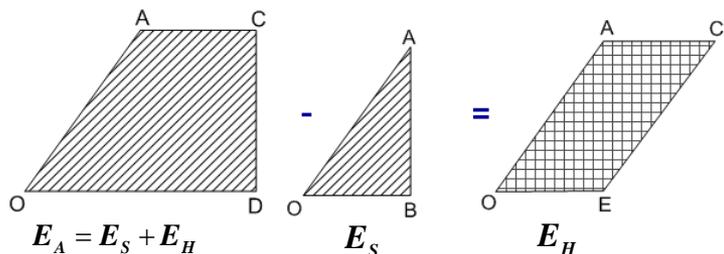
Structure Energy Graph

Time History Energy Graph Select

- Dissipated Inelastic Energy (Eh) [Inelastic Hinge]
- Kinetic Energy (Ek)
- Elastic Strain Energy (Es)
- Damping Energy (Ed)



■ Input Energy ■ Elastic Energy ■ Dissipated Energy



10. 新增地震能量消散圖

Result > T.H Graph/Text > Time History Energy Graph

Time History Energy Graph

Structure Energy Graph

Time History Energy Graph Select

- Dissipated Inelastic Energy (Eh)
[Inelastic Hinge]
- Kinetic Energy (Ek)
- Elastic Strain Energy (Es)
- Damping Energy (Ed)
- Maxwell Damper Energy (Em)
[Oil Damper]
- Velocity Dependent Device Energy (Ev)
[Viscous | Viscoelastic Damper]
- Strain Dependent Device Energy (Et)
[Elas. + Inel.][Steel | Hyst. Isolator]
- Isolator Device Energy (Eo)
- Plastic Strain Energy (Ep)
[Plastic Material (Plate)]
- Input Energy (Ei)

Type of Display

Cumulative Value Type

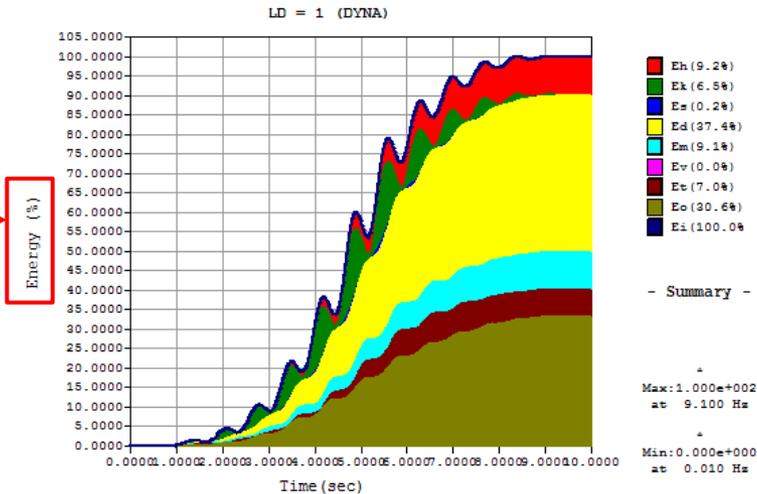
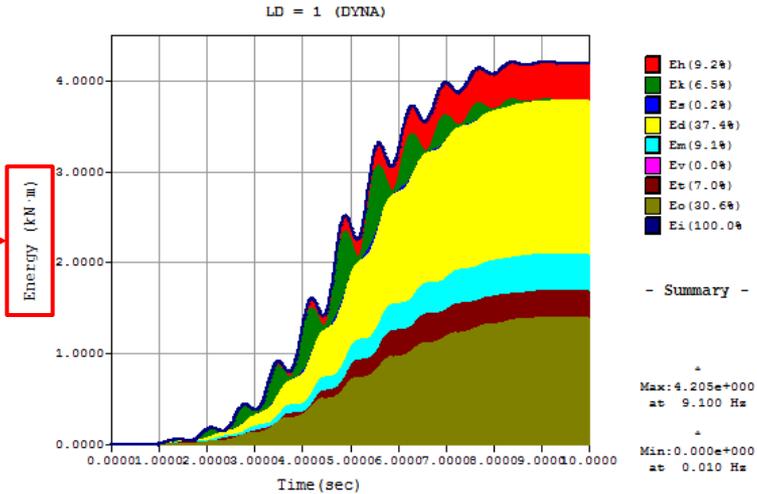
Value Percentage

Time History Load Case

Display Options

No Fill Solid Fill

Percentage Text Result



10. 新增地震能量消散圖

Result > T.H Graph/Text > Time History Energy Graph

Time History Energy Graph

Structure Energy Graph

Time History Energy Graph Select

- Dissipated Inelastic Energy (Eh)
[Inelastic Hinge]
- Kinetic Energy (Ek)
- Elastic Strain Energy (Es)
- Damping Energy (Ed)
- Maxwell Damper Energy (Em)
[Oil Damper]
- Velocity Dependent Device Energy (Ev)
[Viscous | Viscoelastic Damper]
- Strain Dependent Device Energy (Et)
[Elas. + Inel.][Steel | Hyst. Isolator]
- Isolator Device Energy (Eo)
- Plastic Strain Energy (Ep)
[Plastic Material (Plate)]
- Input Energy (Ei)

Type of Display

Cumulative Value Type

Value Percentage

Time History Load Case

Display Options

No Fill Solid Fill

Percentage Text Result

Text result of the each energy ratio

MIDAS/Text Editor - [App4_Time history analysis.spf]

File Edit View Window Help

```

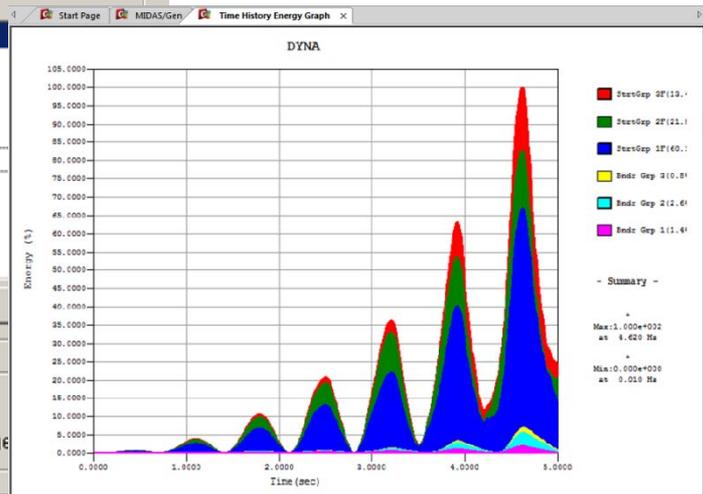
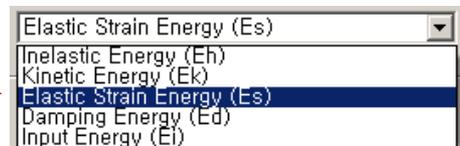
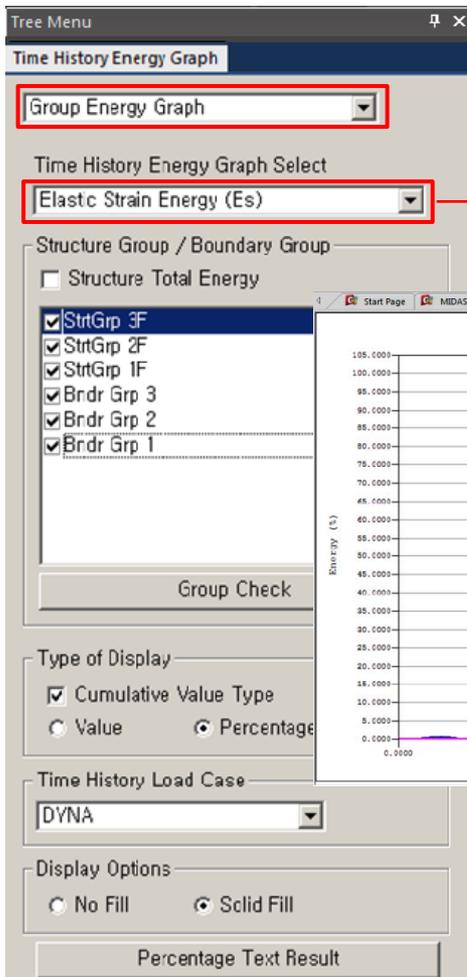
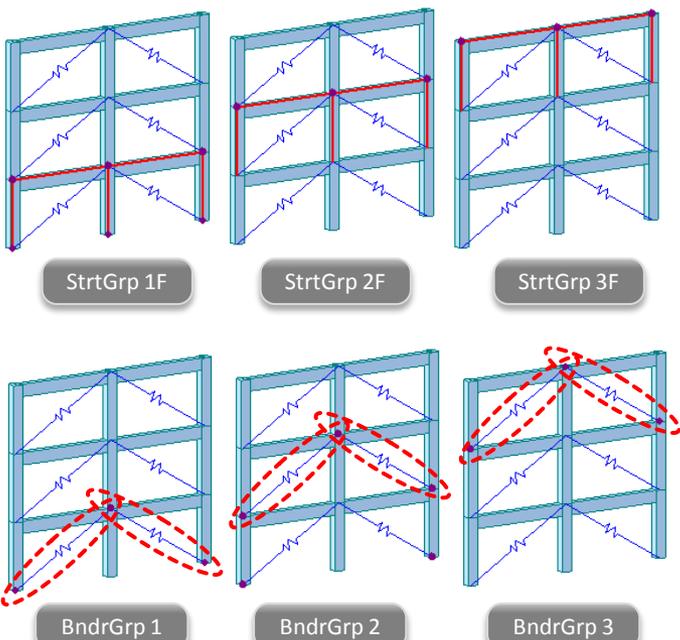
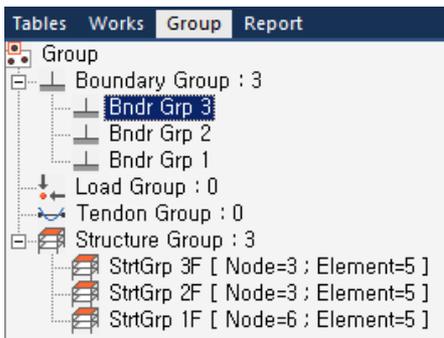
00001
00002 TIME HISTORY ANALYSIS | ENERGY RESULT PERCENTATE ; TIME HISTORY LOADCASE NO. = 1
00003
00004
00005
00006
00007
00008
00009
00010
00011
00012
00013
00014
00015
00016
00017
00018
00019
00020
00021
00022
00023
00024
00025
00026
00027
00028
00029
00030
00031
00032
00033

```

Energy Graph		Percentage (%)
(1) Dissipated Inelastic Energy [Inelastic Hinge]	Eh	9.196
(2) Kinetic Energy	Ek	6.503
(3) Elastic Strain Energy	Es	0.237
(4) Damping Energy	Ed	37.396
(5) Maxwell Damper Energy [Oil Damper]	Em	9.149
(6) Velocity Dependent Device Energy	Ev	0.000
(7) Strain Dependent Device [Steel Hyst. Isolator]	Et	6.959
(8) Isolator Device Energy	Eo	30.559
(9) Plastic Strain Energy [Plastic Material (Plate)]	Ep	0.000
(10) Input Energy	Ei	100.000
Error (Input Energy[Ei] - Energy Sum[(1)-(9)])		0.000

10. 新增地震能量消散圖

Result > T.H Graph/Text > Time History Energy Graph



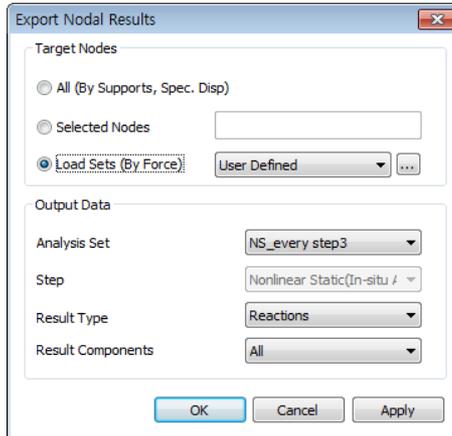
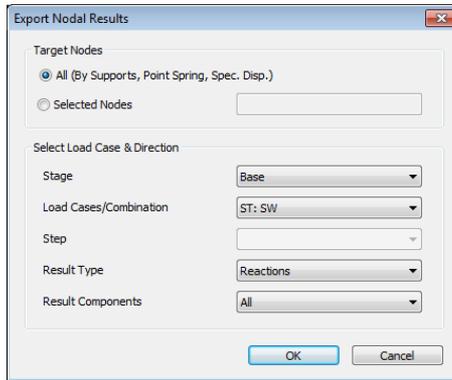
Result output of group distribution for each energy item

11.多線性彈簧性質與GTS NX的轉換介面

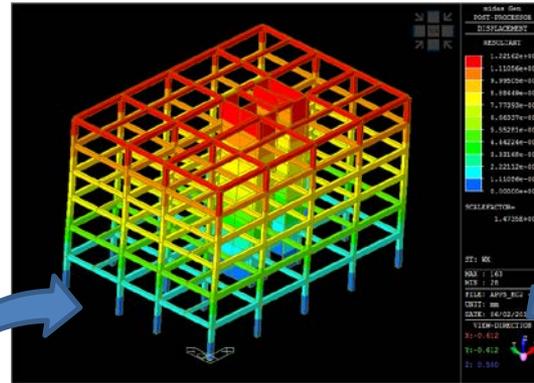
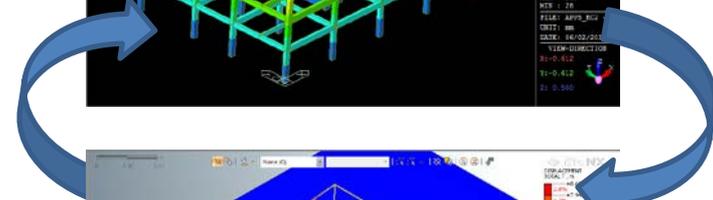
- Reactions from Point Spring Support can be exported to GTS NX.
- Force-displacement results of soil can be imported from GTS NX into midas Gen, and the input data of the multi-linear Point Spring Supports are updated.

File > Export > Nodal Results for GTS

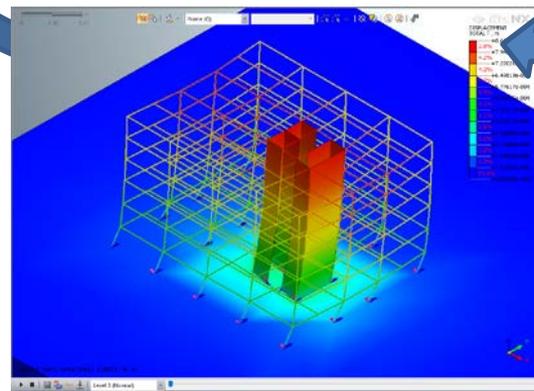
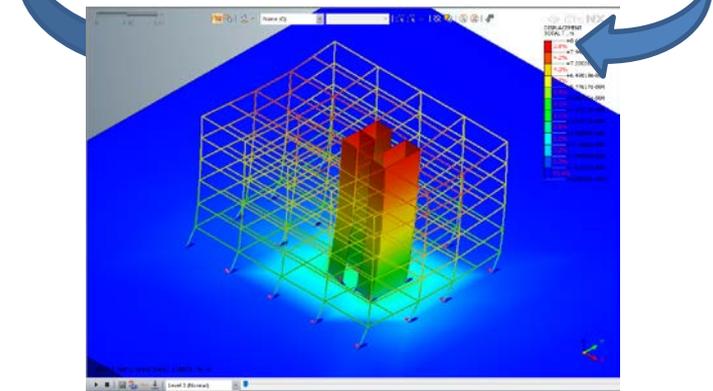
File > Import > Nodal Results for GTS



Spring Data



Reactions



12. 可定義彈簧或線性連接的力與位移多線性關係

- Multiple linear type elastic springs are defined as functions without limitation.

Previous version

	x : m	y : kN
a	0	0
b	0	0
c	0	0
d	0	0
e	0	0
f	0	0

Gen 2019 (v1.1)

	d(x) (mm)	F(y) (kN)
1	0.000000	0.000000
2	10.000000	10000.000
3	20.000000	12000.000
4	30.000000	13000.000
5	40.000000	13800.000
6	50.000000	14000.000
7	60.000000	14200.000
8	70.000000	14400.000
9	80.000000	14560.000
10	90.000000	14600.000
11	100.000000	14680.000
12		

	d(x) (mm)	F(y) (kN)
1	0.000000	0.000000
2	10.000000	10000.000
3	20.000000	12000.000
4	30.000000	13000.000
5	40.000000	13800.000
6	50.000000	14000.000
7	60.000000	14200.000
8	70.000000	14400.000
9	80.000000	14560.000
10	90.000000	14600.000
11	100.000000	14680.000
12		

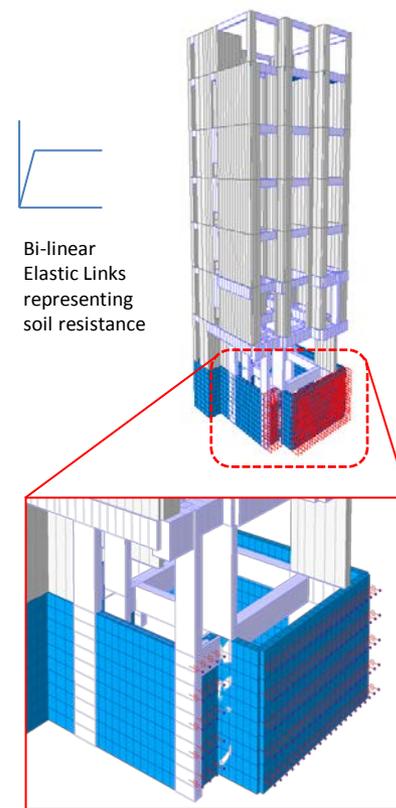
Multi-linear is defined as 6 points in the previous version.

13. 側推分析可考慮非線性彈性連接

- Nonlinear behavior of the elastic links, i.e. comp.-only, tens.-only, multi-linear can be taken into account in the pushover analysis.
- Link forces imported from static analysis or construction stage analysis cannot be specified as initial loads for pushover analysis.

Pushover > Elements > Pushover Global Control

Pushover Global Control



Bi-linear Elastic Links representing soil resistance

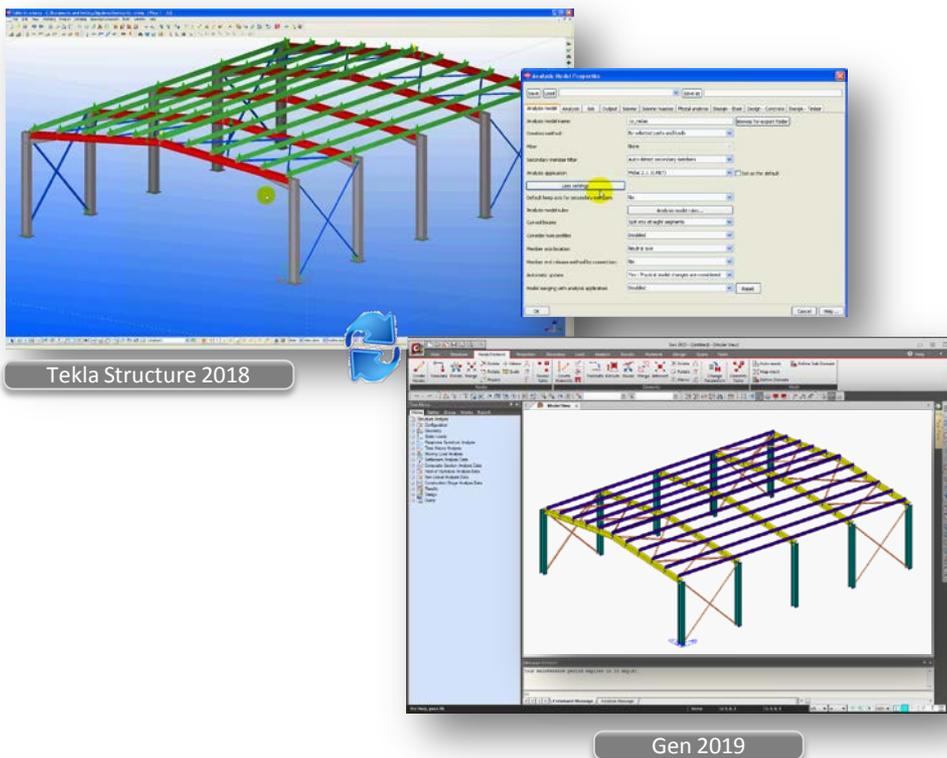
Pushover Analysis for the underground structure

14. Tekla Structure 2018 轉換介面

- Tekla Structures interface is a tool provided to speed up the entire modeling, analysis, and design procedure of a structure by data transfer with midas Gen. Data transfer is limited to structural elements. Tekla Structure interface enables us to transfer a Tekla model data to midas Gen, and delivery back to the Tekla model file. midas Gen text file (*.mgt) is used for the roundtrip.

File > Import > *midas Gen MGT File*

File > Export > *midas Gen MGT File*

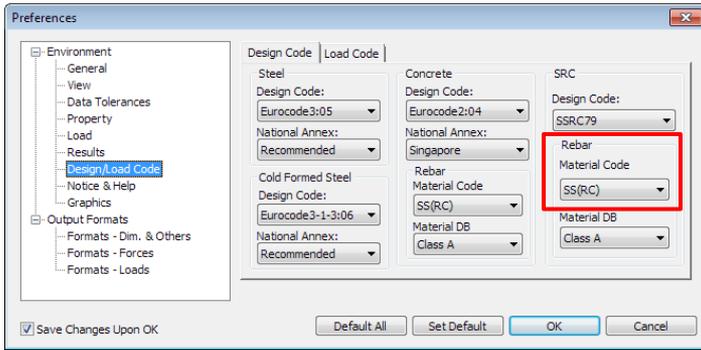


Category	Features	Tekla ↔ Gen
MATERIAL	concrete	↔
	steel	↔
	pre cast - wood and other types	↔
	Material user defined	↔
ELEMENT TYPE/ ROTATIONS	vertical column	↔
	inclined column	↔
	straight beam	↔
	curved beam	>
	Slab	↔
	vertical panel	>
2D ELEMENTS	Concrete panels and slab	↔
BOUNDARY CONDITIONS	support	>
	beam end release	↔
	section offset	>
STATIC LOAD	self weighth	>
	linear load (uniform or trapezoidal)	↔
MERGE OPTION	new element	↔
	new element that divide other elements	↔
	topology changes	↔

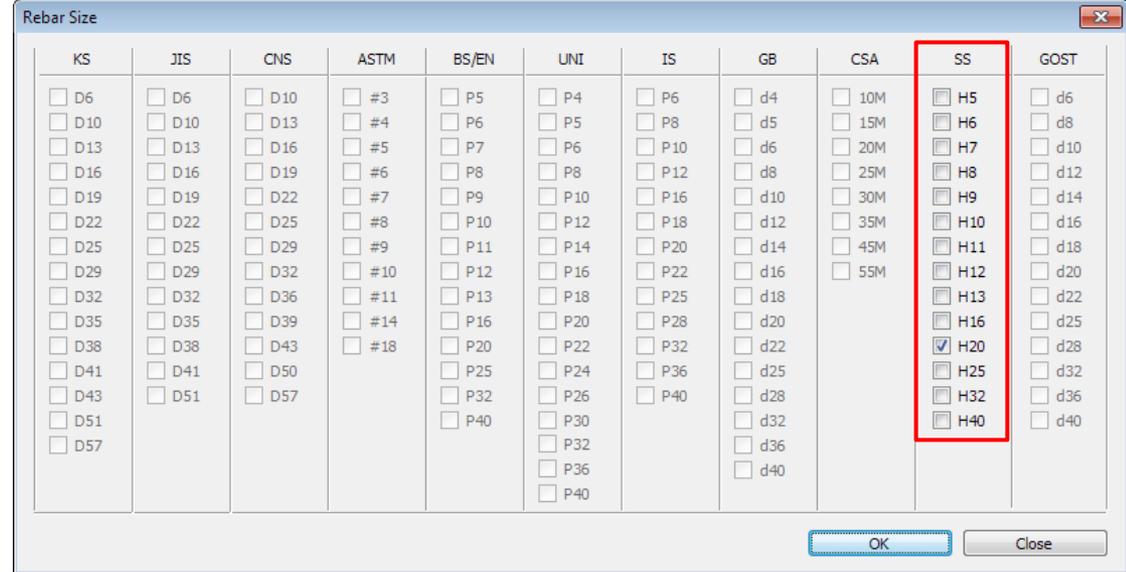
15. 新增鋼筋性質資料庫 (SS560 : 2010)

- Reinforcement as per Singapore SS560:2010 is added for the design.

Tools > Setting > Preferences



Design > Design > RC Design > Design Criteria for Rebar



midas **Design+**

1. SRC柱設計 (AISC-LRFD 10M)

- The automatic design / check of the SRC column is performed as per AISC-LRFD 10M.

WorkBar

Add new member

System: SRC
Type: Column
Name: []
Option... Add
Keep Sect. & Bar Data

RC: Steel SRC Aluminum Reinforce

SRC Design Procedure

- Design Option
 - SRC : AISC-LRFD 10M**
 - Rebar Code : ASTM
 - Material DB : ASTM09
 - Section Code : AISC10(US)
 - Steel Option
 - Preference
 - Composite Beam
 - Column (2)
 - SC01
 - SC02
 - CFT Column

Start Page Member Member List Drawing Quantity

General

Member Name: SC01
Apply this Member to: Dwg & Report

Material

Concrete: 3.481 ksi
Main Bar: 58.015 ksi
Hoop Bar: 58.015 ksi
H-Beam: A36
Stud: A36

Shape

Rectangular Circle

Section

Width: 19.69 in
Height: 19.69 in
Length(x): 11.48 ft
Length(y): 11.48 ft
Kx: 1.00
Ky: 1.00

H-Beam

Shape: H Section
 Use DB: W8X40

Force & Moment

Axial: 100.00 kip
Moment(x): 80.00 kip.in
Moment(y): 80.00 kip.in
Shear(x): 50.00 kip
Shear(y): 60.00 kip

Coefficient / Factor

Cmx: 0.600
Cmy: 0.600
Bd: 0.600

Load Combinations (1) ...

Design(F4) Check(F5) Report ...

Double click to Zoom

19.685
8.25
8.07
1.5748
19.685

PM Interaction Curve

Double click to Zoom

1750
1500
1250
1000
750
500
250
0
-250
-500
-750

4000
3600
3200
2800
2400
2000
1600
1200
800
400

$\theta = 45.95^\circ$
 $N/A = 50.63^\circ$
eb=14.5
M (kip.in)

Calculation Result

Check Item	Direction X	Direction Y	Remark
REQUIREMENT FOR MATERIAL			
Fck,min (ksi)	3.481	3.046	OK(0.875)
Fck,max (ksi)	3.481	10.15	OK(0.343)
Fy,max (ksi)	36.00	76.14	OK(0.473)
Fyr,max (ksi)	58.02	76.14	OK(0.762)
MOMENT CAPACITY			
psr			
ps			
σ			
σPn (kip)			
σMn (kip.in)			
Pu/σPn			
Mu/σMn			
smax (in)			
s/smox			
σVn,con (kip)			
σVn,stl+bar (kip)			
σVn,stl (kip)			

Rebar

MAIN BAR					
Layer	No	Row	Main	Dc	
Layer 1	4	2	#8	1.57	in
Max.Num Maximum Rebar Layout (Layer 1) : 16-4-#8					
HOOP BAR					
End	#3	@ 5.91	in	<input type="checkbox"/> Use User Input	
Center	#3	@ 11.81	in		

Main Bar Arrangement

Corner (Auto Calc) Identically Distribute
 Corner (by User : 3.07 in)

Check Load Transfer

External force to steel only External force to concrete only
 External force to Both materials concurrently

Headed Stud

Type: M19
Space: 11.81 in No. (Web) 1 EA
Length: 3.15 in No. (Flg) 1 EA

Spacing Limit of Main Rebar

Do not splice 50% 100%

Apply(F3)

↓ Drawing

MIDASIT SRC COLUMN LIST

NAME	SECTION	NAME	SECTION
SC01		SC02	
(19.69x19.69)		(19.69x19.69)	
STEEL SECT.	W8X40	STEEL SECT.	W8X40
MAIN BAR	4 #8	MAIN BAR	12 #8
HOOP (MID)	#3@11.81	HOOP (MID)	#3@11.81
HOOP (END)	#3@5.906	HOOP (END)	#3@5.906
STUD (WEB)		STUD (WEB)	
STUD (FLG.)		STUD (FLG.)	

2. CFT柱設計 (AISC-LRFD 10M)

- The automatic design / check of the CFT column is performed as per AISC-LRFD 10M.

Start Page Member Member List Drawing Quantity

General
 Member Name: SC01
 Apply this Member to: Dwg & Report

Material
 Steel: A36
 Concrete: 3.481 ksi

Section
 Shape: Pipe
 Use DB: HSS16X.375

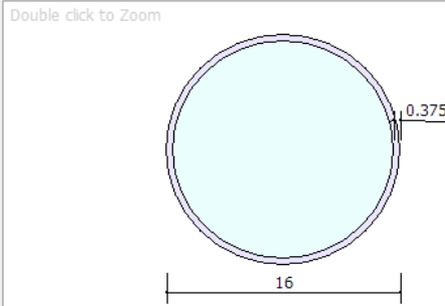
D	16.00	in
t	0.38	in

Force
 Axial: 100.00 kip
 Moment (x): 50.00 kip.in
 Moment (y): 80.00 kip.in
 Shear (x): 50.00 kip
 Shear (y): 50.00 kip

Length
 Lx: 11.48 ft
 Ly: 11.48 ft
 Kx: 1.00
 Ky: 1.00
 Lx: 0.00 ft
 Ly: 0.00 ft

Check Load Transfer
 External force to: Steel Only
 CFT member extends to: One Side

Design(F4) Check(F5) Report ... Apply(F3)



Calculation Result

Check Item	Direction X	Direction Y	Remark
REQUIREMENT FOR MATERIAL			
Fck,min (ksi)	3.481	3.046	OK(0.875)
Fck,max (ksi)	3.481	10.15	OK(0.343)
Fy,max (ksi)	36.00	76.14	OK(0.473)
As,min(%)	8.552	1.000	OK(0.117)
WIDTH-THICKNESS RATIO			
BTR	OK(0.184)		Compact
AXIAL CAPACITY			
σPn (kip)	881		σ=0.750
Pu/σPn	OK(0.114)		
MOMENT CAPACITY			
σMn (kip.in)	1759	1759	σ=0.900
Mu/σMn	OK(0.028)	OK(0.045)	
COMBINED RATIO			
ComRat	OK(0.131)		Pr/Pc < 0.2
SHEAR CAPACITY			
σVn,stl (kip)	167	167	σ=0.900

↓ Summary report

1. General Information

Design Code	Unit System
AISC-LRFD10M	N, mm

2. Material & Section

Concrete Material	Steel Material	Steel Shape
24.000MPa	A36 (Fy = 240MPa)	HSS16X.375

3. Length

Lx	Ly	Kx	Ky	Lx
3.500m	3.500m	1.000	1.000	0.000m

4. Force

Px	Mx	My	Vx	Vy
445kN	5.649kN.m	9.639kN.m	222kN	222kN

5. Check Limitation

Check Items	Value	Criteria	Ratio
Lower Limit of Conc. (f _{cr})	24.00	21.00	0.875
Upper Limit of Conc. (f _{cu})	24.00	70.00	0.343
Upper Limit of Steel (F _y)	240	---	---
Steel Section Area Ratio (A _s / A _g)	0.0052	---	---

Detail report →

9. Check Flexural Strength About Major Axis

(1) Check Flexural Strength About Minor Axis

- $K_c = f_c h^2 = 3,601 \text{ kN}$
- $K_s = F_y \frac{d-t}{2} t = 437 \text{ kN}$
- $\text{Param} = \sqrt{(0.0260K_c + 2K_s)^2 + 0.857K_c K_s}$
- $\theta = \frac{0.0260K_c - 2K_s}{0.0848K_c} + \frac{\text{Param}}{0.0848K_c} = 2.395 \text{ radian}$

(2) Calculate plastic section modulus

- $Z_{xx} = \frac{h^3 \sin^3(\theta/2)}{6} = 7,817,937 \text{ mm}^3$
- $Z_{yy} = \frac{d^3 \sin^3(\theta/2)}{6} - Z_{xx} = 1,211,124 \text{ mm}^3$

(3) Calculate plastic flexural strength

- $M_p = Z_{xx} F_y - \frac{Z_{yy} 0.85f_c}{2} = 221 \text{ kN.m}$

(4) Calculate flexural strength about major axis (ϕM_n)

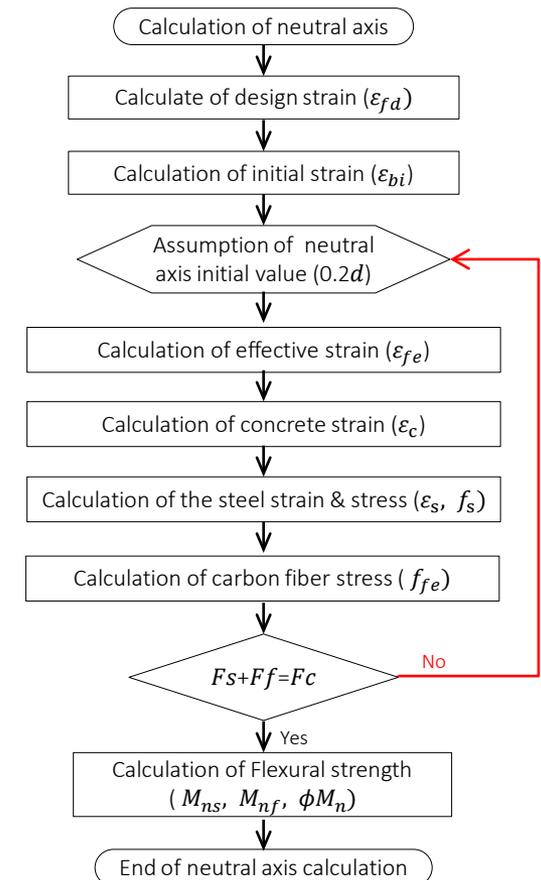
- $M_n = M_p = 221 \text{ kN.m}$
- Resistance factor for flexure : $\phi = 0.900$
- $\phi M_n = 199 \text{ kN.m}$
- $M_u / \phi M_n = 0.0284 < 1.000 \rightarrow \text{O.K.}$

3. 使用碳纖/玻纖進行構件補強

- Reinforced concrete beam strengthened with FRP / carbon fiber is automatically designed or checked.
- ACI318-08/11/14, ACI318M-08/11/14, NSR-10, and KCI-USD07/12 are supported.

Check Item	Value	Criteria	Ratio
Negative Moment (Before)			
Strength (kip.in)	-	-	-
Rebar Ratio (Min)	-	-	-
Rebar Ratio (Max)	-	-	-
Rebar Space (in)	-	-	-
Positive Moment (Before)			
Strength (kip.in)	30.00	1283	OK(0.023)
Rebar Ratio (Min)	0.00434	0.00013	OK(0.030)
Rebar Ratio (Max)	0.00434	0.03096	OK(0.140)
Rebar Space (in)	10.85	17.63	OK(0.615)
Shear Force (Before)			
Strength (kip)	30.00	50.74	OK(0.591)
Max. Strength (kip)	30.00	34.57	OK(0.868)
Rebar Space (in)	11.81	11.57	NG(1.021)
Skin Rebar			
Rebar Space (in)	-	-	-
Negative Moment (After)			
Limit (kip.in)	-	-	-
Strength (kip.in)	-	-	-
Stress (ksi)	-	-	-
Creep (ksi)	-	-	-
Positive Moment (After)			
Limit (kip.in)	116	1283	OK(0.091)
Strength (kip.in)	30.00	1952	OK(0.015)
Stress (ksi)	3.471	32.00	OK(0.108)
Creep (ksi)	3.289	223	OK(0.015)
Shear Force (After)			
Strength (kip)	30.00	34.57	OK(0.868)
Development Length			
Pos.(1) (in)		4.247	
Pos.(2) (in)		4.247	

Flow chart of neutral axis calculation



4. 鋁構材之梁/柱設計

- The aluminum beam / column design check is based on the Aluminum Design Manual (ADM1:2005) of AA (Aluminum Associate, USA).
- The automatic check of the aluminum beam / column is performed as per AISC-LRFD 10M.

< Design Code >

- AA-ASD05
- AA-ASD05M
- AA-LRFD05
- AA-LRFD05M

< Shape of Section >

- Beam/ Column
- H Section
- T Section
- Angle
- Channel
- Box
- Pipe
- Solid Round
- Solid Box

Beam/ Column(General)

- IJ-7781
- IJ-8382

WorkBar

Add new member

System: Aluminum

Type: Beam/Column (Gene)

Name: AG01

RC | Steel | SRC | Aluminum | Reinforce

Aluminum Design Procedure

- Design Option
 - Aluminum : AA-ASD05
 - Material DB : AA
 - Section Code : AISC 10(US)
 - Aluminum Option
 - Preference
- Beam/Column (1)
 - Beam/Column (General) (1)
 - AG01

Member

General

Member Name: AG01

Apply this Member to: Dwg & Report

Material

Material: 2014-T6511

Product: Extrusions

Section

Section: IJ-7781

Force & Factor

Check Minor Axis

Axial Force: 7.00 kN

Moment (x): 2.50 kN.m

Moment (y): 0.00 kN.m

Shear (x): 0.00 kN

Shear (y): 2.00 kN

Cmx: 0.85

Cmy: 0.85

Cb: 1.00

m: 0.67

Load Combinations (1) ...

Span

Lx: 1.00 m

Ly: 1.00 m

Kx: 1.00

Ky: 1.00

Lb: 1.00 m

Deflection

by Wind: 0.00 mm

by Self: 0.00 mm

Deflection Criteria ...

Design(F-4) Check(F5) Report ... Apply(F3)

Design Data

Sect.	CHK	Major			Minor		
		t	b, Rb	h, ae	t	b, Rb	h, ae
13	<input type="checkbox"/>	2.00	-	150.00	2.00	-	150.00
14	<input checked="" type="checkbox"/>	-	-	-	-	-	-
COMPRESSION IN BEAM ELEMENTS							
15	<input type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
16	<input type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
16.1	<input checked="" type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
16.2	<input type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
16.3	<input type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
COMPRESSION IN BEAM ELEMENTS							
17	<input type="checkbox"/>	2.00	100.00	-	2.00	100.00	-
18	<input checked="" type="checkbox"/>	2.00	-	150.00	2.00	-	150.00
19	<input type="checkbox"/>	2.00	-	150.00	2.00	-	150.00
SHEAR IN ELEMENTS							
20	<input checked="" type="checkbox"/>	2.00	-	150.00	2.00	-	150.00
21	<input type="checkbox"/>	2.00	-	150.00	2.00	-	150.00

Select All Unselect All

Moment of Inertia

Iox: 0.00 mm²

Ioy: 0.00 mm²

Edge Stiffener

ds: 50.00 mm

Ds: 50.00 mm

As: 0.00 mm²

Theta: 0.00

Section Property

Area	856.485	mm ²	Asx	383.142	mm ²
Xbar	73.919	mm	Asy	189.311	mm ²
Ybar	29.602	mm	Sx	14343.683	mm ³
Ix	424606.000	mm ²	Sy	26958.625	mm ³
Iy	1992760.000	mm ²	Zx	-	mm ³
J	847467.000	mm ²	Zy	-	mm ³
ix	-	mm	Cw	-	mm ²
iy	-	mm	Ixy	-	mm ²

Calculation Result

COMPRESSION STRESS				
Sect.	S	S1	S2	F
Sect. 3.4.7	1141	-73.25	1363	148
BENDING STRESS (MAJOR AXIS)				
Sect.	S	S1	S2	F
Sect. 3.4.14	1215	3109	28585	230
Sect. 3.4.16.1	1270	70.69	2519	205
Sect. 3.4.18	1905	1083	1538	186
SHEAR STRESS (MAJOR AXIS)				
Sect.	S	S1	S2	F
Sect. 3.4.20	1905	835	1360	51.15
STRESS RATIO				
-	f	F	f / F	
Axial	8.173	148	OK(0.055)	
Bending(Major)	174	186	OK(0.937)	
Bending(Minor)	-	-	-	
Shear(Major)	10.56	51.15	OK(0.207)	
Shear(Minor)	-	-	-	
COMBINED RATIO (AXIAL + BENDING)				
-	R1	R2	R	
Combined	0.888	0.972	OK(0.972)	
COMBINED RATIO (AXIAL + BENDING + SHEAR)				
-	Major		Minor	
Combined	NG(1.035)		-	
DEFLECTION				

5. 優化基座板設計之肋板配置

- When the rib plate is inserted in the baseplate and the length of the rib plate is larger than 1/2 of the thickness of the base plate, the rib plate is created on the flange of the column.
- AISC-LRFD 10, ASIC-LRFD 05, Eurocode3:05, KSSC-LSD 16, and KSSC-LSD 09 are supported.

The screenshot displays the midas Design+ software interface for designing a base plate with rib plates. The main drawing area shows a plan view of the base plate with dimensions: overall width 609.55 mm, overall height 604.978 mm, and a central rib plate width of 409.55 mm. A section view below shows the rib plate's profile with a height of 100 mm and a thickness of 6 mm. The properties panel on the right is configured for a rib plate with a thickness of 6 mm, height of 100.00 mm, and length of 10.00 mm. The report window on the right shows the results of a bearing stress check for the base plate, with a maximum stress of 45.49 MPa and a ratio of 2.301.

Base Plate Properties:

- Shape: Rectangle
- Width: 409.55 mm
- Height: 404.98 mm
- Thickness: 6 mm
- Placed on Pedestal:

Anchor Bolt Properties:

- Install Type: Cast-In-Place Anchor Bolt
- Diameter: 5/8
- Length: 25.00 mm
- Position (x): 50.00 mm
- Position (y): 50.00 mm
- Number (x | y): 2 | 2
- Start Angle: 0
- Get number from Rib-Plate Layout:

Calculation Result:

Check Items	Value	Criteria	Remark
Bearing Stress ()	Comp. (MPa)		
	Tens. (kN)		
Base Plate	Mxx (kN.m/m)		
	Myy (kN.m/m)		
Rib Plate	BTR		
	Mu (kN.m)		
Wing Plate	BTR		
	Mu (kN.m)		
Anchor Bolt	Vu (kN)		
	Tu (kN)		
	Length (mm)		

Report Summary:

σ_{max}	σ_{min}	ϕ	F_n	$\sigma_{max} / \phi F_n$
45.49 MPa	0.0594 MPa	0.650	30.42 MPa	2.301