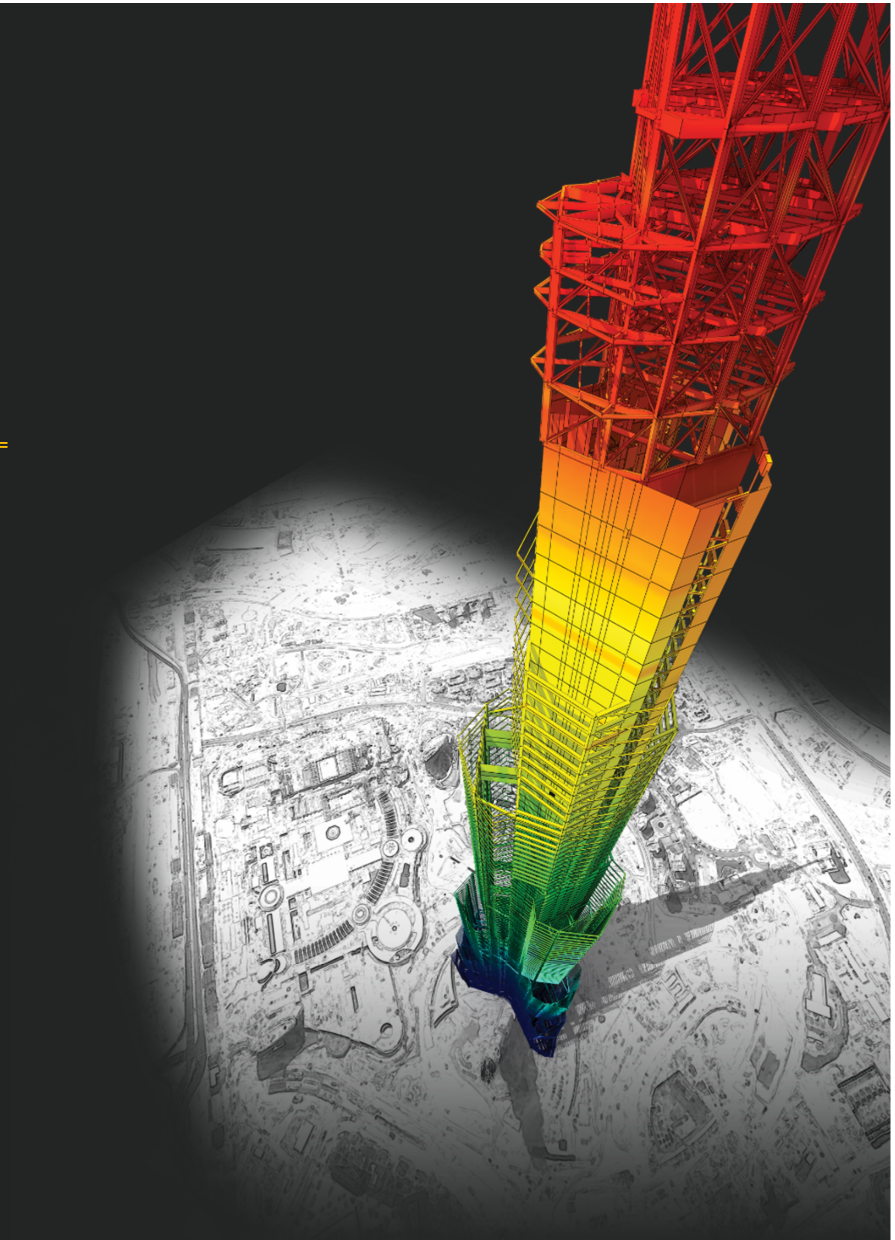
Release Note

Release Date : Nov. 2018

Product Ver. : Gen 2019 (v2.1) and Design+ 2019 (v2.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

Index

- **midas Gen**

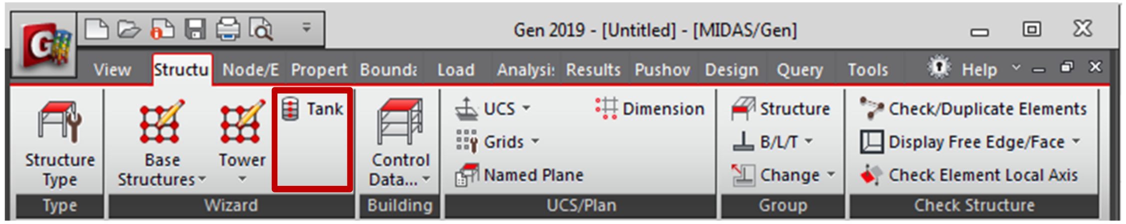
- **midas Design+**

midas Gen

1. Wizard sloshing for tank (Mass adding)

• The wizard makes it easy to create a tank model.

Structure > Wizard > Tank



❶ Input size(**R1,H1,H2**) of the tank and height(**Hw**) of filling.

❷ Select the **Material** and **Thickness**.

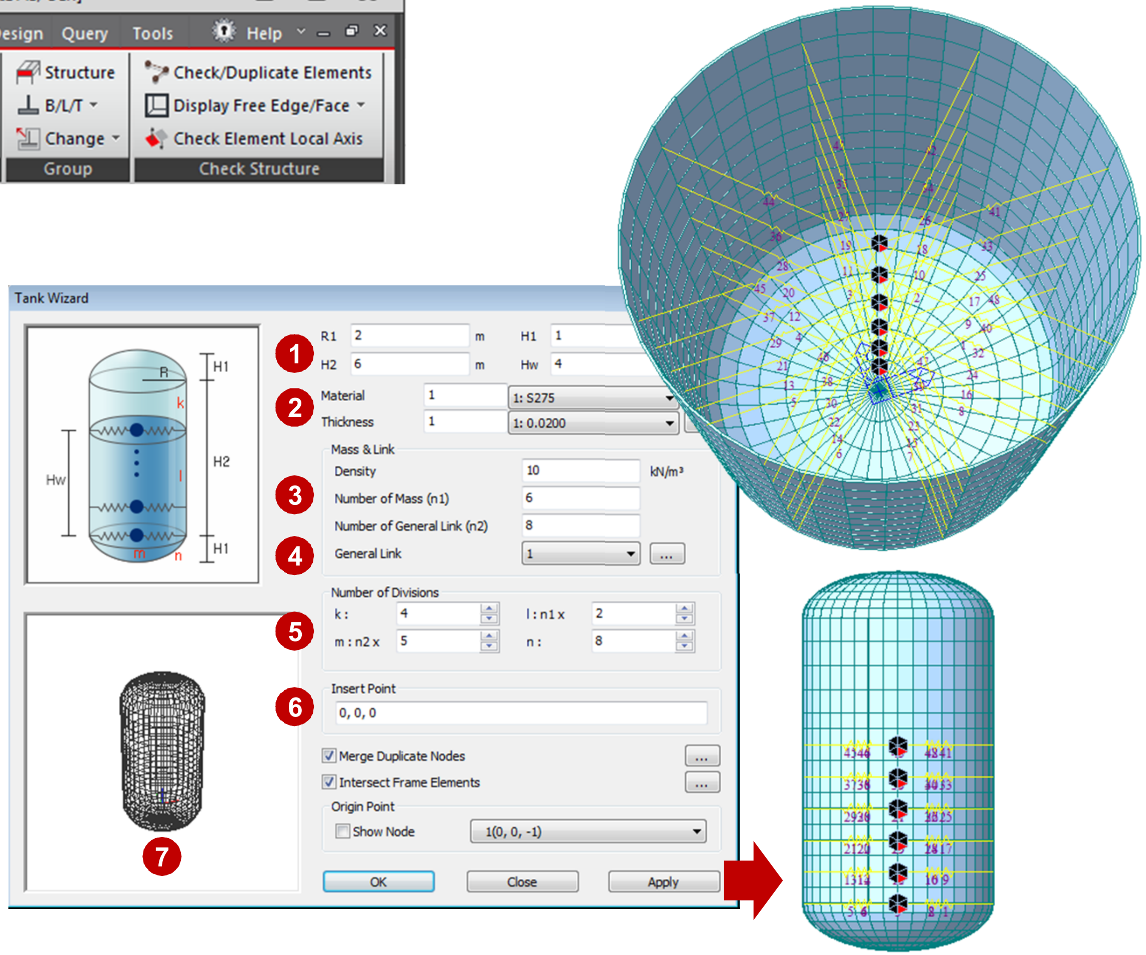
❸ Input **Density** of filling and **Number of Mass & General Link**.

❹ Select **General Link**.
(Click [...] to define general link properties.)

❺ Set **Number of Divisions** for meshing plate.

❻ Input coordination of **Insert Point**.

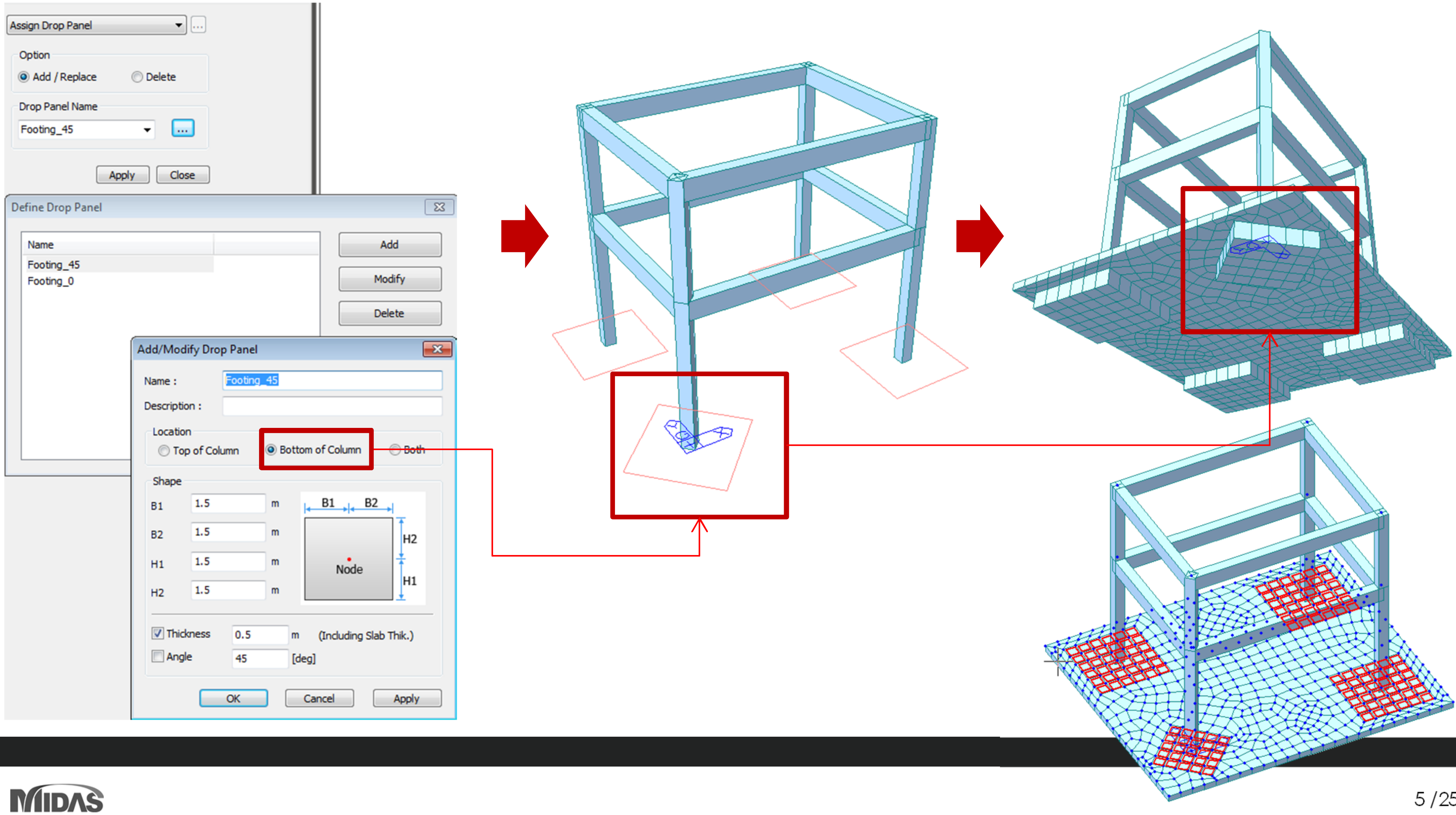
❼ Check the model shape with preview image



2. Foundation Drop Panel

- It is allowed to Install the drop panel at the bottom of the column.
- It is easy to create foundations with different thicknesses.

Define Size and Angle of Drop | **Define Size and Angle of Drop** | **Generation of foundation by Auto-mesh**



3. Check Criteria for Regularity in Plan as per NTC2018

Check Criteria for Regularity in Plan

EN 1998-1:2004 (E)

(7) For non-regular in elevation buildings the decreased values of the behaviour factor are given by the reference values multiplied by 0,8.

4.2.3.2 Criteria for regularity in plan

(1)P For a building to be categorised as being regular in plan, it shall satisfy all the conditions listed in the following paragraphs.

(2) With respect to the lateral stiffness and mass distribution, the building structure shall be approximately symmetrical in plan with respect to two orthogonal axes.

(3) The plan configuration shall be compact, i.e., each floor shall be delimited by a polygonal convex line. If in plan set-backs (re-entrant corners or edge recesses) exist, regularity in plan may still be considered as being satisfied, provided that these set-backs do not affect the floor in-plan stiffness and that, for each set-back, the area between the outline of the floor and a convex polygonal line enveloping the floor does not exceed 5 % of the floor area.

(4) The in-plan stiffness of the floors shall be sufficiently large in comparison with the lateral stiffness of the vertical structural elements, so that the deformation of the floor shall have a small effect on the distribution of the forces among the vertical structural elements. In this respect, the L, C, H, I, and X plan shapes should be carefully examined, notably as concerns the stiffness of the lateral branches, which should be comparable to that of the central part, in order to satisfy the rigid diaphragm condition. The application of this paragraph should be considered for the global behaviour of the building.

(5) The slenderness $\lambda = L_{max}/L_{min}$ of the building in plan shall be not higher than 4, where L_{max} and L_{min} are respectively the larger and smaller in plan dimension of the building, measured in orthogonal directions.

(6) At each level and for each direction of analysis x and y, the structural eccentricity e_o and the torsional radius r shall be in accordance with the two conditions below, which are expressed for the direction of analysis y:

$$e_{ox} \le 0{,}30 \cdot r_x \quad (4.1a)$$

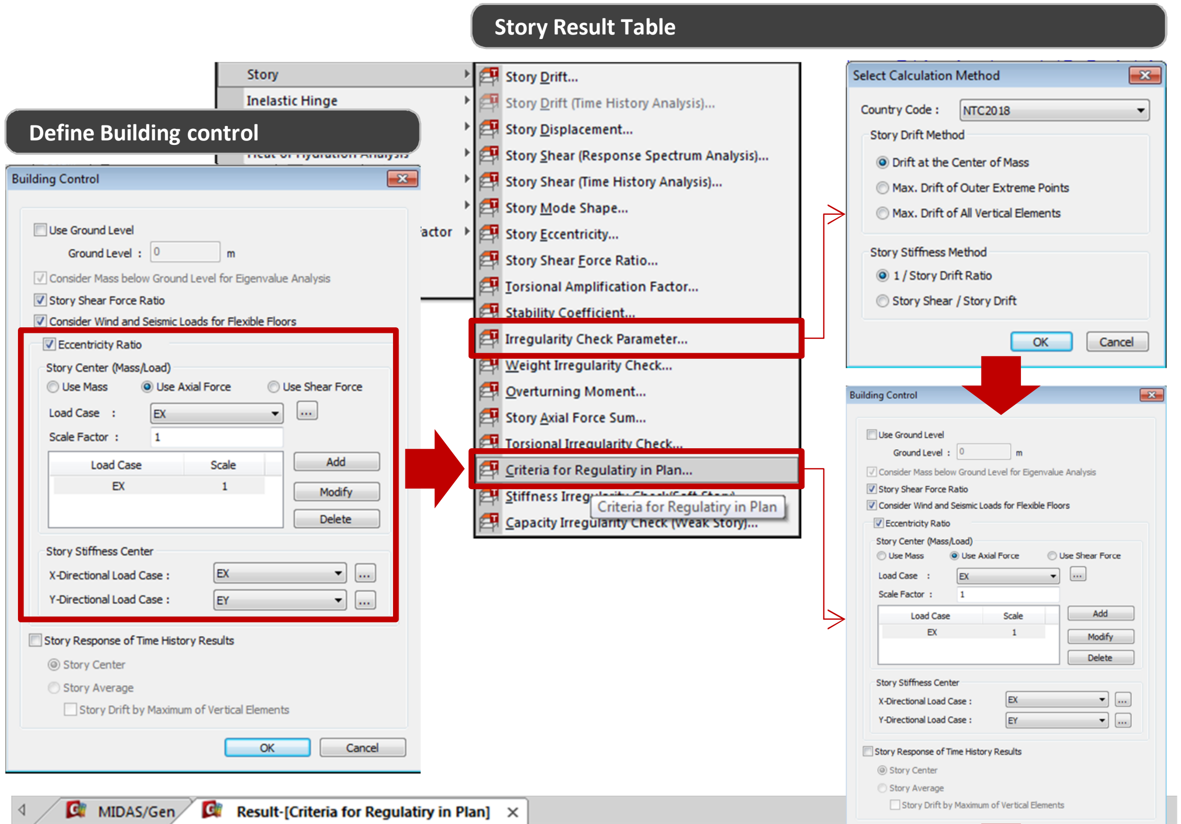
$$r_x \ge l_s \quad (4.1b)$$

where

e_{ox} is the distance between the centre of stiffness and the centre of mass, measured along the x direction, which is normal to the direction of analysis considered;

r_x is the square root of the ratio of the torsional stiffness to the lateral stiffness in the y direction ("torsional radius"); and

l_s is the radius of gyration of the floor mass in plan (square root of the ratio of (a) the polar moment of inertia of the floor mass in plan with respect to the centre of mass of the floor to (b) the floor mass).



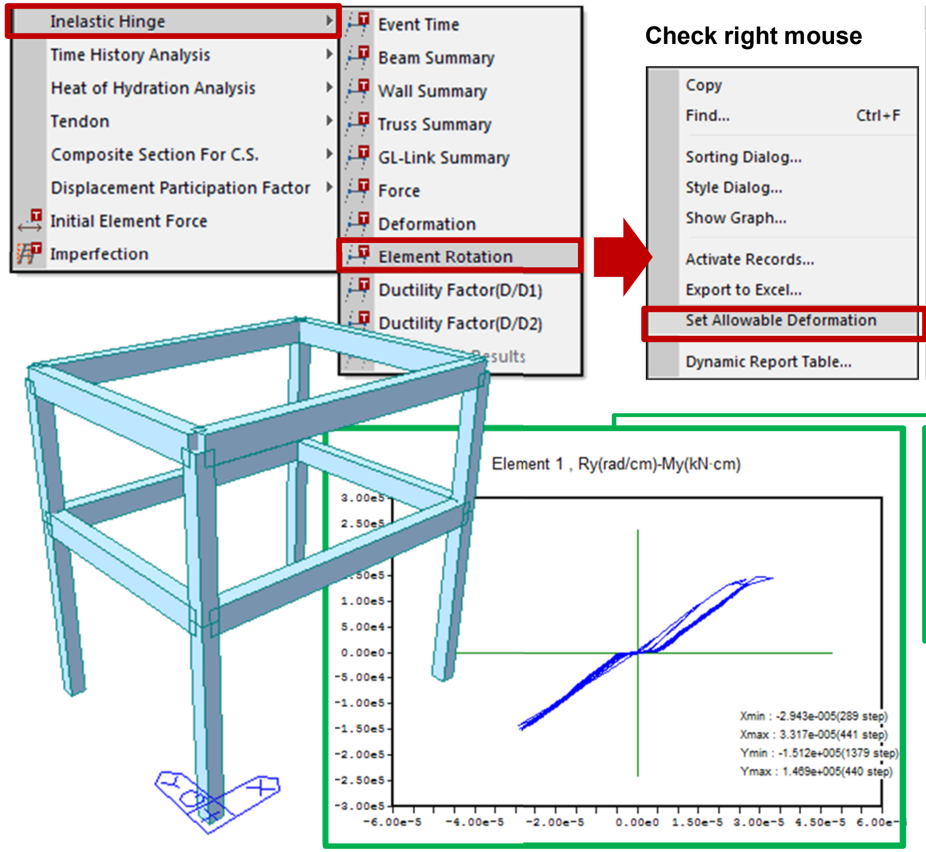
Story	Level (m)	Translational Mass X-DIR (N/g)	Translational Mass Y-DIR (N/g)	Rotational Mass (N/g·m²)	Rx (El.Radius) X (m)	Rx (El.Radius) Y (m)	X	Y	X	Y
Roof	26.00	831405.41702	831405.41702	169004281.6555	10.34	12.06	0.5263	0.7153	Regular	Regular
6F	22.00	773957.63175	773957.63175	155808106.2827	9.42	9.88	0.4405	0.4853	Regular	Regular
5F	18.00	773957.63175	773957.63175	155808106.2827	9.31	9.00	0.4301	0.4020	Regular	Regular
4F	14.00	782526.19968	782526.19968	157233873.5092	8.75	7.88	0.3810	0.3087	Regular	Regular
3F	9.50	791094.76762	791094.76762	158658979.8772	8.54	7.22	0.3634	0.2601	Regular	Regular
2F	5.00	799663.33556	799663.33556	160083446.6304	7.75	6.49	0.3004	0.2102	Regular	Regular
1F	0.00	0.00000000	0.00000000	0.0000	0.00	0.00	0.0000	0.0000	Regular	Regular

4. Inelastic Hinge Deformation Result as per Eurocode

- It is possible to check limitation of rotation for 1D element and wall.
- It is possible to confirm the damage state of the nonlinear behavior of the element by comparing it with the allowable deformation.

Check Procedure

Check right mouse



Result Table - Element Rotation

MIDAS/Gen | Result-[Inelastic Hinge(Element Rotation)]

Elem	Load	Part	Ry Rotation ([rad])	Ry Allowable ([rad])	Ry Check	Ry Time (sec)	Rz Rotation ([rad])	Rz Allowable ([rad])	Rz Check	Rz Time (sec)
1	TX(all)	I	0.000000	0.032493	OK	0.000	0.000000	0.037281	OK	0.000
1	TX(all)	J	0.000000	0.032493	OK	0.000	0.000000	0.037281	OK	0.000
4	TX(all)	I	0.000000	0.032493	OK	0.000	0.000000	0.037281	OK	0.000
4	TX(all)	J	0.000000	0.032493	OK	0.000	0.000000	0.037281	OK	0.000
16	TX(all)	I	0.000000	0.029381	OK	0.000	0.000000	0.033710	OK	0.000
16	TX(all)	J	0.000000	0.029381	OK	0.000	0.000000	0.033710	OK	0.000
20	TX(all)	I	0.000000	0.029381	OK	0.000	0.000000	0.033710	OK	0.000
20	TX(all)	J	0.000000	0.029381	OK	0.000	0.000000	0.033710	OK	0.000
32	TX(all)	I	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
32	TX(all)	J	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
33	TX(all)	I	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
33	TX(all)	J	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
36	TX(all)	I	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
36	TX(all)	J	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
37	TX(all)	I	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000
37	TX(all)	J	0.000000	0.032057	OK	0.000	0.000000	0.032057	OK	0.000

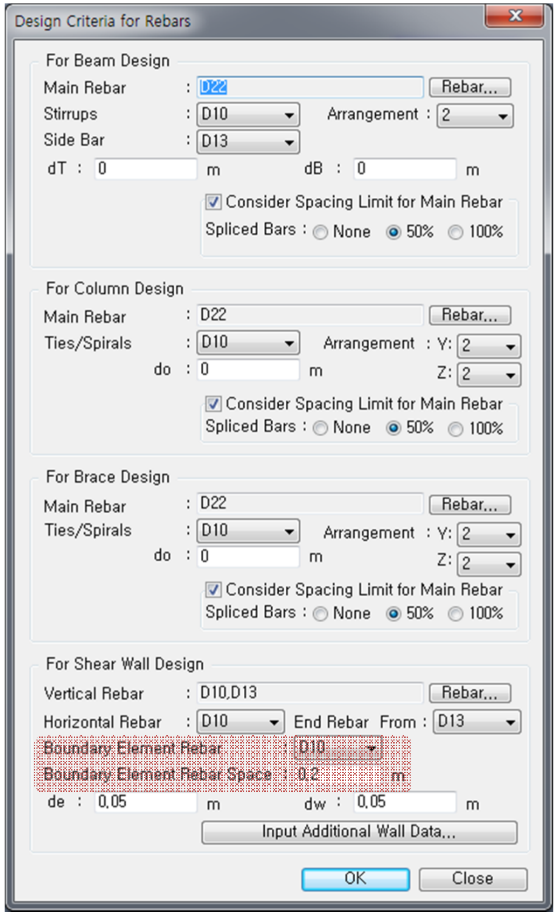
Allowable = θ_{um} *3/4

$$\theta_{um} = \frac{1}{\gamma_{el}} 0{,}016 \cdot (0{,}3^{\nu}) \left[\frac{\max(0{,}01; \omega')}{\max(0{,}01; \omega)} f_c \right]^{0{,}225} \left(\frac{L_V}{h} \right)^{0{,}35} 25^{\left(\alpha \rho_{sx} \frac{f_{yw}}{f_c} \right)} \left(1{,}25^{100 \rho_d} \right) \qquad (A.1)$$

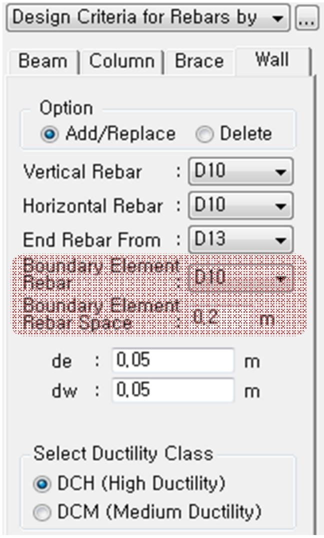
5. Improvement Ductile Wall Design as per NTC 2018

Allowable of setting Boundary Element Rebar Data

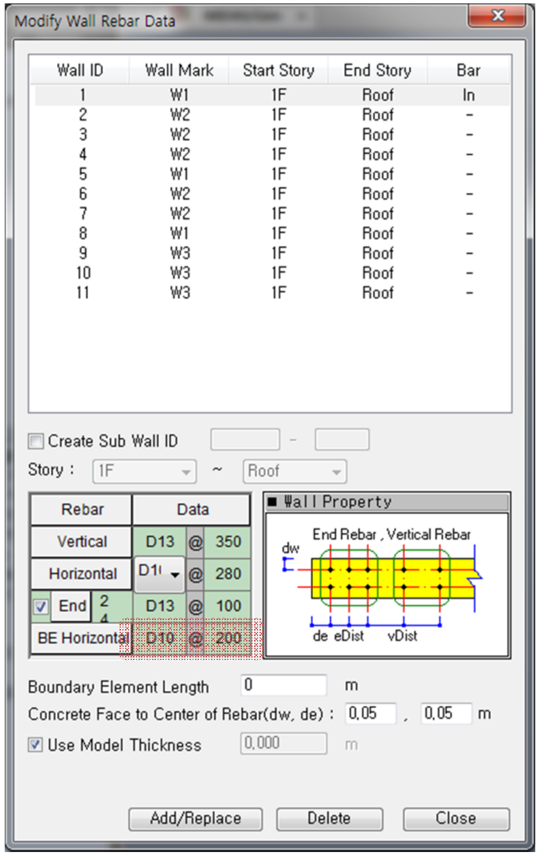
Design Criteria for Rebars



Design Criteria for Rebars by Member



Modify Wall Rebar Data



5. Improvement Ductile Wall Design as per NTC 2018

Improvement Shear Design of Ductile wall

Detail Report

```
==========================================================================
 [[[*]]]   ANALYZE SHEAR CAPACITY OF RC-WALL.
==========================================================================
 ( ). Compute maximum spacing of horizontal reinforcement.
      -. Smax    =     0.300 m.

 ( ). Calculate shear strength of concrete.
      -. k      = MAX[ 1.0+sqrt(200/d), 2.0 ]  =      1.2152  (by d unit is mm).
      -. Acv    =      1.08000 m^2.
      -. Asl    = Ast / 2 =      0.00228 m^2.
      -. Rhol   = Asl / Acv =      0.00211
      -. C_Rdc  = 0.18/Gamma_c =      0.1200
      -. Str_cp = MIN[ N_Ed/Ag, 0.2*fcd ] =    771.0568 KPa.
      -. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Str_cp]*Acv  =     379.472 kN.
      -. V_Rdc2 = [0.035*k^(3/2)*sqrt(fck) + 0.15*Str_cp]*Acv       =     351.355 kN.
      -. V_Rdc  = MAX[ V_Rdc1, V_Rdc2 ] =     379.472 kN.
      -. V_Rdc < V_Ed  ---> Shear reinforcement is required.
      -. Vwd    = V_Ed-V_Rdc =     142.525 kN.

 ( ). Calculate required shear reinforcement. ( Asw1 =  0.00007 m^2. )
      -. alpha_s= M_Ed / (V_Ed*Lw)               =     0.02946
      -. Asw/s1 = Vwd / (0.75*fywd*alpha_s*Lw) =     0.00386 m^2/m.
      -. Calculate spacing s1              =     0.03692 m.
      -. Rhow   =      0.00200  (by concrete and steel grade).
      -. Smax   = Asw / (hw*Rhow)          =     0.28532 m.
      -. Applied spacing s    = MIN[ s1, Smax1, Smax2 ] =     0.03692 m.
      -. Asw/s  = 2*Asw1 / s =      0.00386 m^2/m.

 ( ). Calculate shear strength of reinforcement.
      -. alpha_s = MEd / (VEd*Lw)               =  0.029
      -. V_Rd,s  = 0.75*Asw*fywd*alpha_s/s =        105.24 kN.

 ( ). Check Diagonal tension failure of the web to shear.
      -. alpha_s < 2.0
      -. Applied spacing s (User Input) =      0.05000 m.
      -. V_Rds = 0.75*fywd*alpha_s*Lw*2*Asw1/s =     105.243 kN.
      -. V_Rd  = V_Rdc + V_Rds =      484.716 kN.
      -. V_Rd < V_Ed  --->  Not Acceptable.

 ( ). Check ratio of shear capacity.
      -. V_Rd,c =       379.47 kN.
      -. V_Rd,s =       105.24 kN.
      -. V_Rd   = V_Rd,c + V_Rd,s          =       484.72 kN.
      -. Rat_V  = V_Ed / V_Rd              =  1.077  >  1.000  --->  Not Acceptable !

 ( ). Check vertical web bar capacity.
      -. Rhov =     0.003
      -. Rhoh = 2*Asw1/bwo/s               =    0.011
      -. Hor  = Rhoh*fyd*bwo*0.9*d         =     3858.52 kN.
      -. Ver  = Rhov*fyv*bwo*0.9*d + N_Ed =     2067.55 kN.
      -. Ver < Hor  --->  Not Acceptable.

==========================================================================
 [[[*]]]   CALCULATE HORIZONTAL REINFORCEMENT IN END ZONE.
==========================================================================
 ( ). Compute height of the critical region.
      -. hcr   = MIN[ MAX[ Lw, HTw/6 ], MIN[ 2Lw, 2hs ] ] =    8.3333 m.
      -. z,bot =     0.0000 m.
      -. z,top =     5.0000 m.
       ---> Need end horizontal reinforcement check.
 ( ). Compute maximum spacing of horizontal reinforcement in critical region.
      -. Bo   = hw - 2*(De-Ebar/2-Sbar/2)   =    0.169 m.
      -. dbL  =     0.010 m.
      -. Smax = MIN[ Bo/3, 6*Dbar, 125 mm ] =    0.056 m.
```

Rebar of Web is resisting for shear strength.
→ Modify rebar space limitation
→ Change shear strength by rebar

Add END ZONE Chapter

Determine whether horizontal rebar of End Zone is necessary.

Print out Space Limit of horizontal rebar of End Zone

SUMMARY RESULT OUTPUT

```
*.Wall Mark  = W1                                     Double Layer Rebar.  <<RC-Wall Design Result>>.
*.V-Rebar  : fyk =  400 N/mm^2,  H-Rebar  : fyw =  400 N/mm^2.
```

STO	HTw	hw	fck	fyk	fyw	N(kN)	M(kN-m,LCB,iWAL,Lw)	V(kN,LCB,iWAL,Lw)	AsV	V-Rebar	AswH	H-Rebar	End-Reba	BE-Rebar	BE-Length
12F	4000	250	24	400	400	140.	404.(1, 5, 4800)	526.(1, 8, 7200)	713.	D10@200	500.	D10@280	8-D13@10[illegible]	Not Use	-
11F	4000	250	24	400	400	1709.	1696.(1, 8, 7200)	843.(1, 8, 7200)	713.	D10@200	1065.	D10@130	8-D13@10[illegible]	Not Use	-
10F	4000	250	24	400	400	2545.	2435.(1, 8, 7200)	1132.(1, 8, 7200)	713.	D10@200	1643.	D10@80	8-D13@10[illegible]	Not Use	-
9F	4000	250	24	400	400	3356.	3053.(1, 8, 7200)	1271.(1, 8, 7200)	713.	D10@200	1889.	D10@70	8-D13@10[illegible]	Not Use	-
8F	4000	250	24	400	400	4139.	3741.(1, 8, 7200)	1450.(1, 8, 7200)	713.	D10@200	2133.	D10@60	8-D13@10[illegible]	Not Use	-
7F	4000	250	24	400	400	4893.	4457.(1, 8, 7200)	1625.(1, 8, 7200)	713.	D10@200	2398.	D10@50	8-D13@10[illegible]	Not Use	-
6F	4000	250	24	400	400	5631.	5304.(1, 8, 7200)	1833.(1, 8, 7200)	713.	D10@200	2785.	D10@50	8-D13@10[illegible]	Not Use	-
5F	4000	250	24	400	400	6091.	5805.(1, 8, 7200)	1882.(1, 8, 7200)	713.	D10@200	2781.	D10@50	8-D13@10[illegible]	Not Use	-
4F	4000	250	40	400	400	6767.	7098.(1, 8, 7200)	2189.(1, 8, 7200)*	713.	D10@200	3243.	D10@50	8-D13@10[illegible]	Not Use	-
3F	4500	250	40	400	400	6893.	8952.(1, 8, 7200)	2511.(1, 8, 7200)*	713.	D10@200	4767.	D10@50	8-D13@10[illegible]	Not Use	-
2F	4500	250	40	400	400	7966.	11295.(1, 8, 7200)	2912.(1, 8, 7200)*	713.	D10@200	6675.	D10@50	4-D13@15[illegible]	2- 2-D10 @56	1440.0
1F	5000	250	40	400	400	8981.	11825.(1, 8, 7200)	2116.(1, 8, 7200)	713.	D10@200	1169.	D10@120	4-D13@15[illegible]	2- 2-D10 @56	1440.0

Add rebar data of end zone

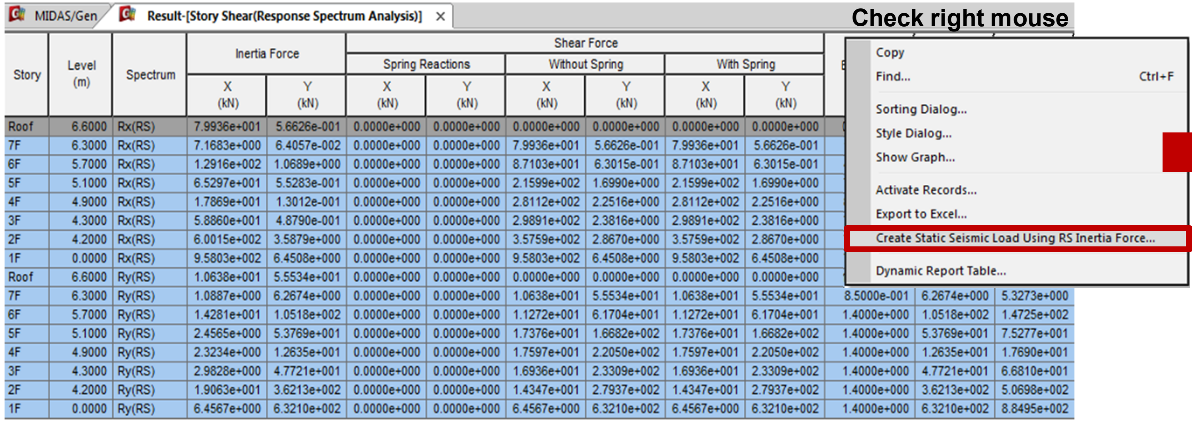
Items	EN1998-1-1:2004			NTC2018	
	DCH (5.5)	DCM (5.4)	DCL	CD"A"	CD"B"
DIMENSION					
Thickness limit of web, $b_{wo,min}$	[EN1998-1-1:2004, 5.5.1.2.3(2)] → [5.4.1.2.3(1)] $b_{wo} \geq max[0.15m, h_s/20]$	[EN1998-1-1:2004, 5.4.1.2.3(1)] $b_{wo} \geq max[0.15m, h_s/20]$		[NTC2018, 7.4.6.1.4, p.236] $b_w \geq max[0.15m, h_w/20]$	[NTC2018, 7.4.6.1.4, p.236] $b_w \geq max[0.15m, h_w/20]$
Height of critical region, h_{cr}	[EN1998-1-1:2004, 5.5.3.4.5(1)]→[5.4.3.4.2(1)] $h_{cr} = max[l_w, h_w/6]$ $\leq min[2l_w, h_s (n\leq6), 2h_s(n\geq7)]$	[EN1998-1-1:2004, 5.4.3.4.2(1)] $h_{cr} = max[l_w, h_w/6]$ $\leq min[2l_w, h_s (n\leq6), 2h_s(n\geq7)]$		[NTC2018, 7.4.4.5.1, p.230] $h_{cr} = max[l_w, h_w/6]$ $\leq min[2l_w, h_s (n\leq6), 2h_s(n\geq7)]$	[NTC2018, 7.4.4.5.1, p.230] $h_{cr} = max[l_w, h_w/6]$ $\leq min[2l_w, h_s (n\leq6), 2h_s(n\geq7)]$
BOUNDARY ELEMENT (in critical region)					
Dimension					
Length of confined boundary, l_c	[EN1998-1-1:2004, 5.5.3.4.5(6)]→[5.4.3.4.2(6)] $l_c \geq max[0.15l_w, 1.5b_w]$	[EN1998-1-1:20045.4.3.4.2(6)] $l_c \geq max[0.15l_w, 1.5b_w]$		[NTC2018, 7.4.4.5.2, p.232] $l_c \geq max[0.20l_w, 1.5b_w]$	[NTC2018, 7.4.4.5.2, p.232] $l_c \geq max[0.20l_w, 1.5b_w]$
Mechanical volumetric ratio, ω_{wd}	[EN1998-1-1:2004, 5.5.3.4.5(4)]→[5.4.3.4.2(4)] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$	[EN1998-1-1:2004, 5.4.3.4.2(4)] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$		[NTC2018, 7.4.6.2.4, p.238] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$	[NTC2018, 7.4.6.2.4, p.238] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$
Thickness limit b_w					
Longitudinal reinforcement ratio in the boundary elements	[EN1998-1-1:2004, 5.5.3.4.5(8)]→[5.4.3.4.2(8)] $\rho_{min} \geq 0.005$	[EN1998-1-1:2004, 5.4.3.4.2(8)] $\rho_{min} \geq 0.005$		[NTC2018, 7.4.6.2.4, p.238]→7.4.6.2.2, p.237] $1\% \leq \rho \leq 4\%$	[NTC2018, 7.4.6.2.4, p.238]→7.4.6.2.2, p.237] $1\% \leq \rho \leq 4\%$
Confined hoop					
$d_{bw} \geq$	[EN1998-1-1:2004, 5.5.3.4.5(8)]->[5.5.3.2.2(12)] $\geq 0.4d_{bL,max}$ SQRT[f_{ydL}/f_{ydw}]	[EN1998-1-1:2004, 5.4.3.2.2(10)] ≥ 6mm		[NTC2018, 7.4.6.2.2] ≥ max[6mm, $0.4d_{bl,max}$ SQRT[$f_{yd,l}/f_{y,st}$]]	[NTC2018, 7.4.6.2.2] ≥ 6mm
$s_w \geq$	[EN1998-1-1:2004, 5.5.3.4.5(8)]->[5.5.3.2.2(12)] min[$b_o/3$, 125mm, 6_{dbL}]	[EN1998-1-1:2004, 5.4.3.2.2(11)] min[$b_o/2$, 175mm, 8_{dbL}]		[NTC2018, 7.4.6.2.2] min[$b_o/3$, 12.5cm, 5~6_{dbL}]	[NTC2018, 7.4.6.2.2] min[$b_o/2$, 17.5cm, 8_{dbL}]
$\omega_{wd} \geq$	[EN1998-1-1:2004, 5.5.3.4.5(10)] $\omega_{wd,min} = 0.12$ (in critical region at the base) $\omega_{wd,min} = 0.08$ (in critical region above the base)	[EN1998-1-1:20045.4.3.4.2(9)] → [5.4.3.2.2(9)~(11)] $\omega_{wd,min} = 0.08$ $d_{bL,min}$ = 6mm s = min[$b_o/2$, 175mm, $8d_{bL}$]		[NTC2018, 7.4.6.2.2] $\omega_{wd,min} = 0.12$	[NTC2018, 7.4.6.2.2] $\omega_{wd,min} = 0.08$
$\alpha\omega_{wd} \geq$	[EN1998-1-1:2004, 5.5.3.4.5(4)]→[5.4.3.4.2(4)] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$	[EN1998-1-1:2004, 5.4.3.4.2(4)] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$		[NTC2018, 7.4.6.2.4, p.238] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$	[NTC2018, 7.4.6.2.4, p.238] $\alpha\omega_{wd} \geq 30\mu\varphi(v_d+\omega_v)\varepsilon_{sy,d} b_c/b_o - 0.035$
Transverse reinforcement detail of the boundary element by EC2		[EN1998-1-1:2004, 5.4.3.4.2(12)] $v_d \leq 0.15$			
Diagonal compression failure $V_{Rd,max}$	[EN1998-1-1:2004, 5.5.3.4.2(1)] a) outside the critical region : EN1992-1-1:2004 $z = 0.8l_w$, $tan\vartheta = 1.0$ b) in the critical region : $0.4V_{Rd,max}$			[NTC2018, 7.4.4.5.1, p.231] Verifica a taglio-compressione del calcestruzzo dell'anima a) outside the critical region : go to §4.1.2.3.5 $z = 0.8l_w$, $tan\vartheta = 1.0$ b) in the critical region : $0.4V_{Rd,max}$	[NTC2018, 7.4.4.5.1, p.231] Verifica a taglio-compressione del calcestruzzo dell'anima a) outside the critical region : go to §4.1.2.3.5 $z = 0.8l_w$, $tan\vartheta = 1.0$ b) in the critical region : $0.4V_{Rd,max}$
Diagonal tension failure	[EN1998-1-1:2004, 5.5.3.4.3] (2) $\alpha_s \geq 2.0$: go to EN1992-1-1:2004 $V_{Ed} \leq V_{Rd,c} : V_{Rd} = V_{Rd,c}$ $V_{Ed} > V_{Rd,s} : V_{Rd} = V_{Rd,s} = A_{sw}zf_{ywd}cot\vartheta/s$ (3) $\alpha_s < 2.0$: horizontal web bars $V_{Ed} \leq V_{Rd} = V_{Rd,c}+V_{Rd,s}$ $V_{Rd,s} = 0.75\rho_h f_{yd,h} b_{wo}\alpha_s l_w$ (in the critical region, $V_{Rd,c}$=0, N_{Ed} is tensile)			[NTC2018, 7.4.4.5.1, p.231] Verifica a taglio-trazione dell'armatura dell'anima (2) $\alpha_s \geq 2.0$: go to §4.1.2.3.5 $V_{Ed} \leq V_{Rd,c} : V_{Rd} = V_{Rd,c}$ $V_{Ed} > V_{Rd,s} : V_{Rd} = V_{Rd,s} = A_{sw}zf_{ywd}cot\vartheta/s$ ($z = 0.8l_w$, $tan\vartheta = 1.0$) (3) $\alpha_s < 2.0$: horizontal web bars $V_{Ed} \leq V_{Rd} = V_{Rd,c}+V_{Rd,s}$ $V_{Rd,s} = 0.75\rho_h f_{yd,h} b_{wo}\alpha_s l_w$ (in the critical region, $V_{Rd,c}$=0, N_{Ed} is tensile)	[NTC2018, 7.4.4.5.1, p.231] Verifica a taglio-trazione dell'armatura dell'anima (2) $\alpha_s \geq 2.0$: go to §4.1.2.3.5 $V_{Ed} \leq V_{Rd,c} : V_{Rd} = V_{Rd,c}$ $V_{Ed} > V_{Rd,s} : V_{Rd} = V_{Rd,s} = A_{sw}zf_{ywd}cot\vartheta/s$ ($z = 0.8l_w$, $tan\vartheta = 1.0$) (3) $\alpha_s < 2.0$: horizontal web bars $V_{Ed} \leq V_{Rd} = V_{Rd,c}+V_{Rd,s}$ $V_{Rd,s} = 0.75\rho_h f_{yd,h} b_{wo}\alpha_s l_w$ (in the critical region, $V_{Rd,c}$=0, N_{Ed} is tensile)
Sliding Failure	[EN1998-1-1:2004, 5.5.3.4.4] (1) $V_{Ed} \leq V_{Rd,S}$ (2) $V_{Rd,S} = V_{dd} + V_{id} + V_{fd}$			[NTC2018, 7.4.4.5.1, p.231] Verifica a scorrimento nelle zone dissipative (1) $V_{Ed} \leq V_{Rd,S}$ (2) $V_{Rd,S} = V_{dd} + V_{id} + V_{fd}$	[NTC2018, 7.4.4.5.1, p.231] Verifica a scorrimento nelle zone dissipative (1) $V_{Ed} \leq V_{Rd,S}$ (2) $V_{Rd,S} = V_{dd} + V_{id} + V_{fd}$
BOUNDARY ELEMENT (over the rest of the wall height)					
Above the critical region	[EN1998-1-1:2004, 5.5.3.4.5(12)]→[5.4.3.4.2(11)] Go to EN1992-1-1:2004 $\rho_{vert,min} = 0.005$	[EN1998-1-1:2004, 5.4.3.4.2(11)] Go to EN1992-1-1:2004 $\rho_{vert,min} = 0.005$			
WEB REINFORCEMENT					
Vertical reinforcement					
$\rho_{v,min}$	[EN1998-1-1:2004, 5.5.3.4.5(13)] 0.002		[EN1992-1-1:2004,9.6.2(1)] 0.002	[NTC2018, 7.4.6.2.4, p.238] 0.002	[NTC2018, 7.4.6.2.4, p.238] 0.002
$\rho_{v,max}$			[EN1992-1-1:2004,9.6.2(1)] 0.04		
$d_{bv,min}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] 8mm				
$d_{bv,max}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] $b_{wo}/8$			[NTC2018, 7.4.6.2.4] $b_{wo}/10$	[NTC2018, 7.4.6.2.4] $b_{wo}/10$
$s_{v,max}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] min[250mm, $25d_{bv}$]		[EN1992-1-1:2004,9.6.2(3)] min [3* b_{wo} , 400mm]	[NTC2018, 7.4.6.2.4] 30cm	[NTC2018, 7.4.6.2.4] 30cm
Horizontal reinforcement					
$\rho_{h,min}$	[EN1998-1-1:2004, 5.5.3.4.5(13)] 0.002		[EN1992-1-1:2004,9.6.3(1)] $A_{s,hmin} = max[0.25A_s, 0.001A_c]$	[NTC2018, 7.4.6.2.4, p.238] 0.002	[NTC2018, 7.4.6.2.4, p.238] 0.002
$d_{bh,min}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] 8mm				
$d_{bh,max}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] $b_{wo}/8$			[NTC2018, 7.4.6.2.4] $b_{wo}/10$	[NTC2018, 7.4.6.2.4] $b_{wo}/10$
$s_{h,max}$	[EN1998-1-1:2004, 5.5.3.4.5(15)] min[250mm, $25d_{bh}$]		[EN1992-1-1:2004,9.6.3(2)] 400mm	[NTC2018, 7.4.6.2.4] 30cm	[NTC2018, 7.4.6.2.4] 30cm
NORMALIZED AXIAL FORCE					
v_d	[EN1998-1-1:2004, 5.5.3.4.1(2)] $v_d \leq 0.35$	[EN1998-1-1:2004, 5.4.3.4.1(2)] $v_d \leq 0.4$		[7.4.4.5.1, p.230] $v_d \leq 0.4$	[7.4.4.5.1, p.230] $v_d \leq 0.35$

6. Pushover Load Pattern using story inertia force in RS analysis reference

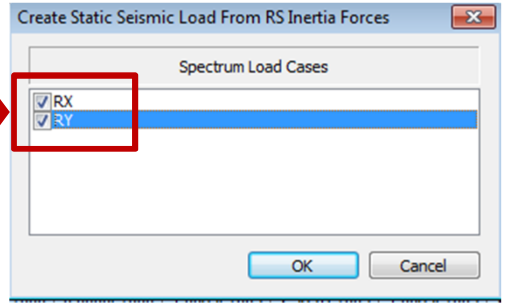
- The load patterns can be created by converting response spectrum load to static load.

Procedure for generating Load Pattern

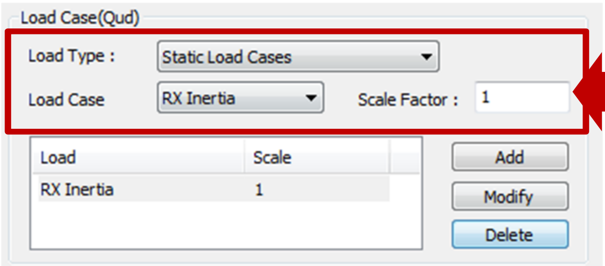
Step 1 : Create Static Seismic Load from RS force



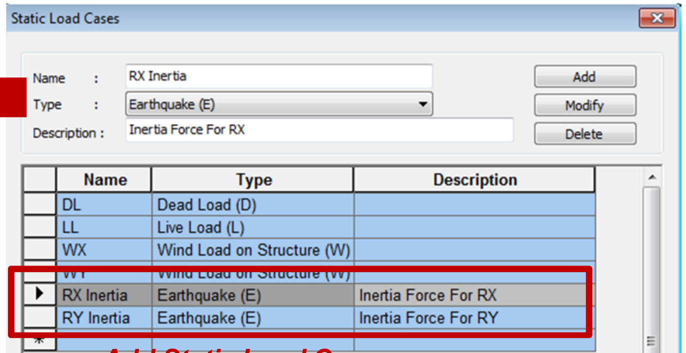
Story	Level (m)	Spectrum	Inertia Force X (kN)	Inertia Force Y (kN)	Shear Force: Spring Reactions X (kN)	Spring Reactions Y (kN)	Without Spring X (kN)	Without Spring Y (kN)	With Spring X (kN)	With Spring Y (kN)			
Roof	6.6000	Rx(RS)	7.9936e+001	5.6626e-001	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000			
7F	6.3000	Rx(RS)	7.1683e+000	6.4057e-002	0.0000e+000	0.0000e+000	7.9936e+001	5.6626e-001	7.9936e+001	5.6626e-001			
6F	5.7000	Rx(RS)	1.2916e+002	1.0689e+000	0.0000e+000	0.0000e+000	8.7103e+001	6.3015e-001	8.7103e+001	6.3015e-001			
5F	5.1000	Rx(RS)	6.5297e+001	5.5283e-001	0.0000e+000	0.0000e+000	2.1599e+002	1.6990e+000	2.1599e+002	1.6990e+000			
4F	4.9000	Rx(RS)	1.7869e+001	1.3012e-001	0.0000e+000	0.0000e+000	2.8112e+002	2.2516e+000	2.8112e+002	2.2516e+000			
3F	4.3000	Rx(RS)	5.8860e+001	4.8790e-001	0.0000e+000	0.0000e+000	2.9891e+002	2.3816e+000	2.9891e+002	2.3816e+000			
2F	4.2000	Rx(RS)	6.0015e+002	3.5879e+000	0.0000e+000	0.0000e+000	3.5759e+002	2.8670e+000	3.5759e+002	2.8670e+000			
1F	0.0000	Rx(RS)	9.5803e+002	6.4508e+000	0.0000e+000	0.0000e+000	9.5803e+002	6.4508e+000	9.5803e+002	6.4508e+000			
Roof	6.6000	Ry(RS)	1.0638e+001	5.5534e+001	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000			
7F	6.3000	Ry(RS)	1.0887e+000	6.2674e+000	0.0000e+000	0.0000e+000	1.0638e+001	5.5534e+001	1.0638e+001	5.5534e+001	8.5000e-001	6.2674e+000	5.3273e+000
6F	5.7000	Ry(RS)	1.4281e+001	1.0518e+002	0.0000e+000	0.0000e+000	1.1272e+001	6.1704e+001	1.1272e+001	6.1704e+001	1.4000e+000	1.0518e+002	1.4725e+002
5F	5.1000	Ry(RS)	2.4565e+000	5.3769e+001	0.0000e+000	0.0000e+000	1.7376e+001	1.6682e+002	1.7376e+001	1.6682e+002	1.4000e+000	5.3769e+001	7.5277e+001
4F	4.9000	Ry(RS)	2.3234e+000	1.2635e+001	0.0000e+000	0.0000e+000	1.7597e+001	2.2050e+002	1.7597e+001	2.2050e+002	1.4000e+000	1.2635e+001	1.7690e+001
3F	4.3000	Ry(RS)	2.9828e+000	4.7721e+001	0.0000e+000	0.0000e+000	1.6936e+001	2.3309e+002	1.6936e+001	2.3309e+002	1.4000e+000	4.7721e+001	6.6810e+001
2F	4.2000	Ry(RS)	1.9063e+001	3.6213e+002	0.0000e+000	0.0000e+000	1.4347e+001	2.7937e+002	1.4347e+001	2.7937e+002	1.4000e+000	3.6213e+002	5.0698e+002
1F	0.0000	Ry(RS)	6.4567e+000	6.3210e+002	0.0000e+000	0.0000e+000	6.4567e+000	6.3210e+002	6.4567e+000	6.3210e+002	1.4000e+000	6.3210e+002	8.8495e+002



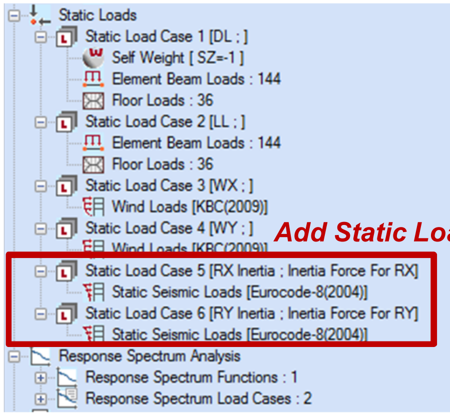
Step 3 : Select Static Load case > RS Inertia



Step 2 : Check Addition of Converted Load



Add Static Load Case

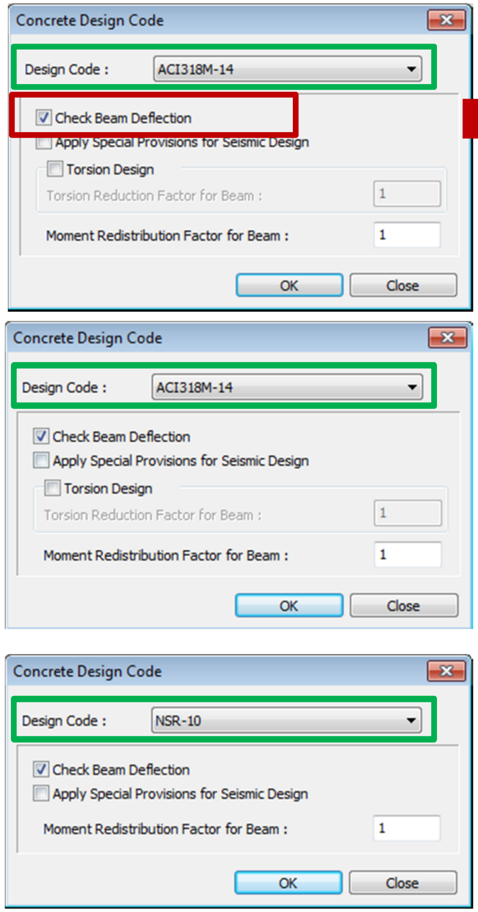


Add Static Load by RC

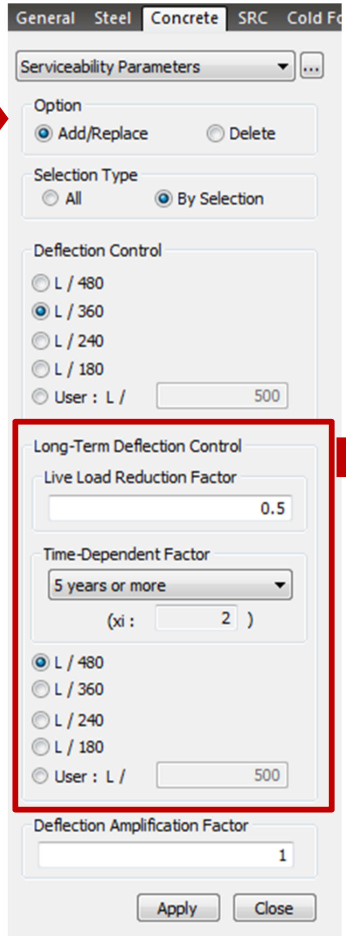
7. Check Beam Deflection as per ACI318-14, ACI318M-14 and NSR-10

- The calculation of deflection takes into account cracked section and long-term behavior.
- The ratio of the analysis results considering the long-term deflection coefficient to the allowable displacement is provided.

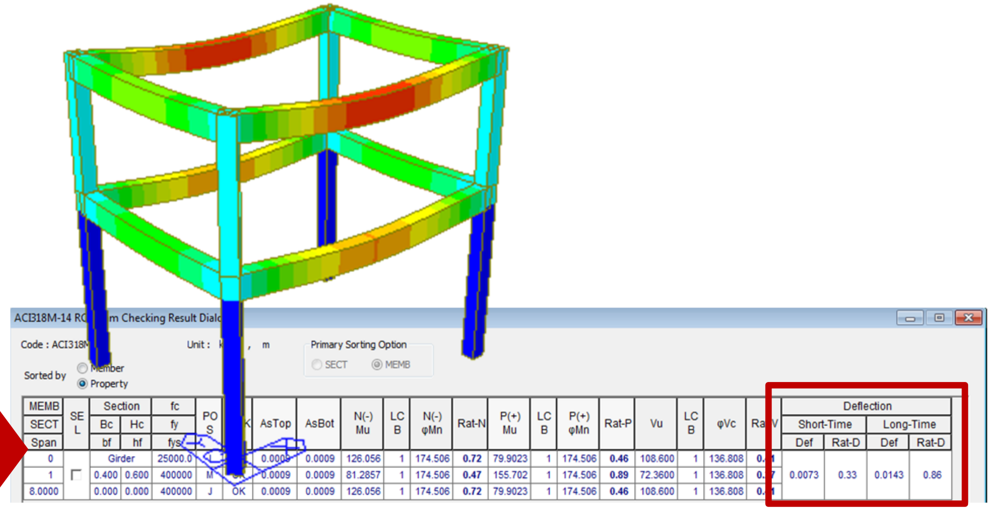
Check on Deflection Option in Design Setting



Setting Design Parameter



Deflection Check in Design result table



24.2.3 *Calculation of immediate deflections*

24.2.3.4 Modulus of elasticity, E_c, shall be permitted to be calculated in accordance with 19.2.2.

24.2.3.5 For nonprestressed members, effective moment of inertia, I_e, shall be calculated by Eq. (24.2.3.5a) unless obtained by a more comprehensive analysis, but I_e shall not be greater than I_g.

$$I_e = \left(\frac{M_{cr}}{M_a}\right)^3 I_g + \left[1-\left(\frac{M_{cr}}{M_a}\right)^3\right] I_{cr} \quad (24.2.3.5a)$$

where M_{cr} is calculated by

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

24.2.4.1.1 Unless obtained from a more comprehensive analysis, additional time-dependent deflection resulting from creep and shrinkage of flexural members shall be calculated as the product of the immediate deflection caused by sustained load and the factor λ_Δ

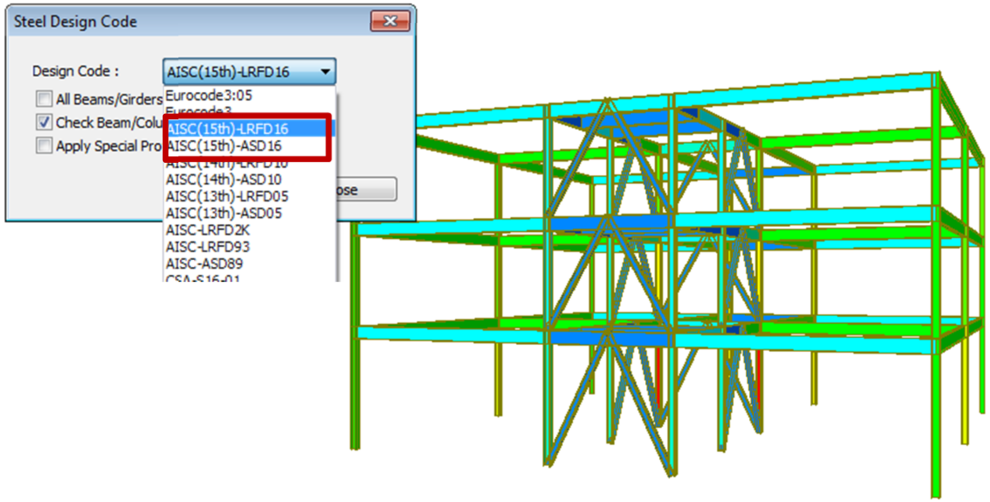
$$\lambda_\Delta = \frac{\xi}{1+50\rho'} \quad (24.2.4.1.1)$$

sustained loads

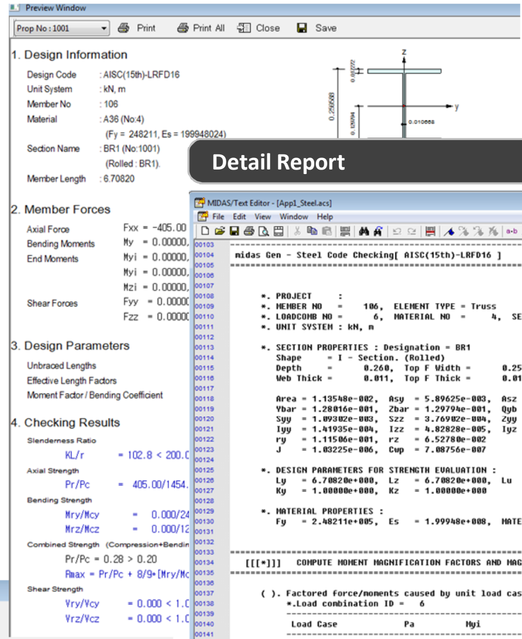
Sustained load duration, months	Time-dependent factor ξ
3	1.0
6	1.2
12	1.4
60 or more	2.0

8. Add Steel Design as per AISC360-16

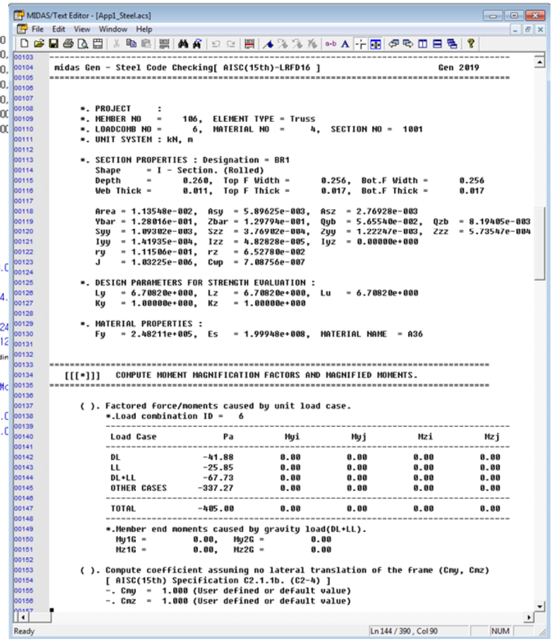
Steel Design as per AISC360-16



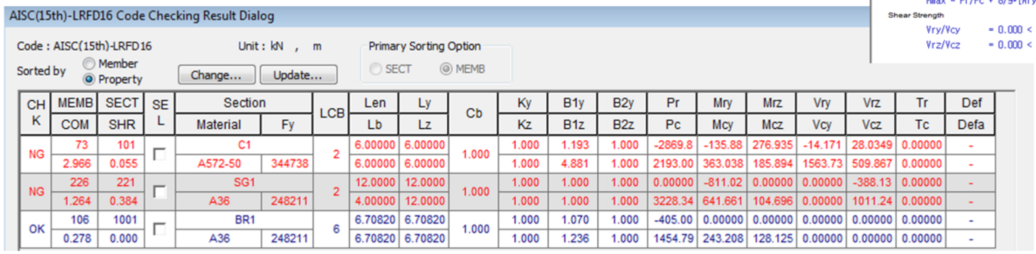
Graphic Report (Summary Report)



Detail Report



Design Result Table



AISC(15th)-LRFD16 Code Checking Result Dialog

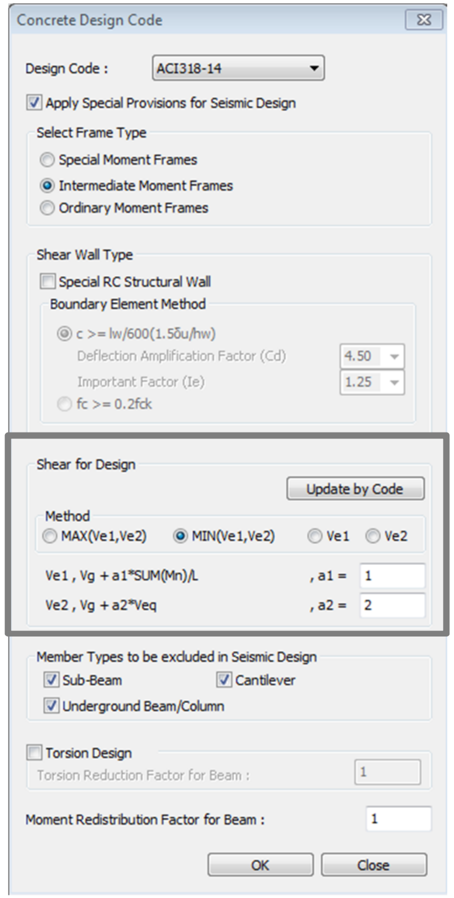
Code : AISC(15th)-LRFD16 Unit : kN , m

Sorted by: Member / Property (selected) — Change... Update...

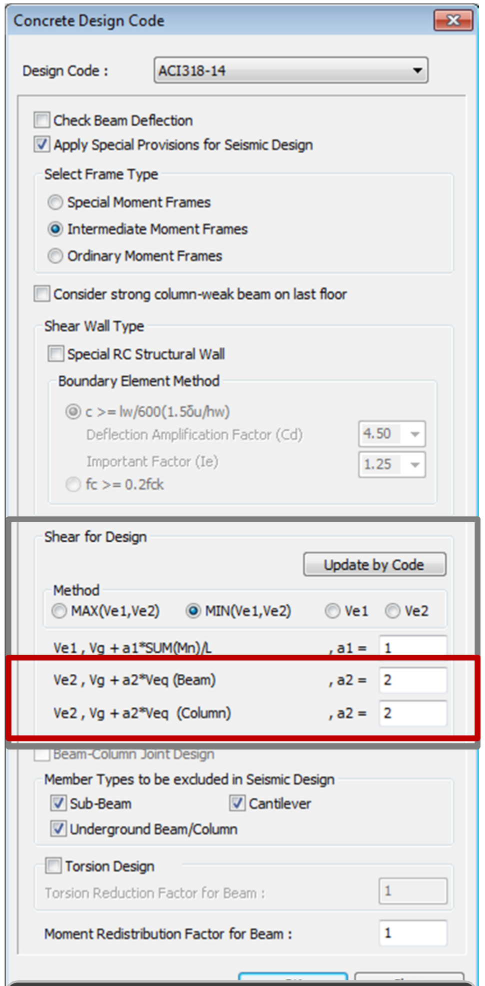
Primary Sorting Option: SECT / MEMB

CHK	MEMB / COM	SECT / SHR	SEL	Section / Material	Fy	LCB	Len / Lb	Ly / Lz	Cb	Ky / Kz	B1y / B1z	B2y / B2z	Pr / Pc	Mry / Mcy	Mrz / Mcz	Vry / Vcy	Vrz / Vcz	Tr / Tc	Def / Defa
NG	73	101	☐	C1		2	6.00000	6.00000	1.000	1.000	1.193	1.000	-2869.8	-135.88	276.935	-14.171	28.0349	0.00000	-
	2.966	0.055		A572-50	344738		6.00000	6.00000		1.000	4.881	1.000	2193.00	363.038	185.894	1563.73	509.867	0.00000	-
NG	226	221	☐	SG1		2	12.0000	12.0000	1.000	1.000	1.000	1.000	0.00000	-811.02	0.00000	0.00000	-388.13	0.00000	-
	1.264	0.384		A36	248211		4.00000	12.0000		1.000	1.000	1.000	3228.34	641.661	104.696	0.00000	1011.24	0.00000	-
OK	106	1001	☐	BR1		6	6.70820	6.70820	1.000	1.000	1.070	1.000	-405.00	0.00000	0.00000	0.00000	0.00000	0.00000	-
	0.278	0.000		A36	248211		6.70820	6.70820		1.000	1.236	1.000	1454.79	243.208	128.125	0.00000	0.00000	0.00000	-

9. Improvement of Seismic Design for ACI318-14, ACI318M-14 and NSR-10



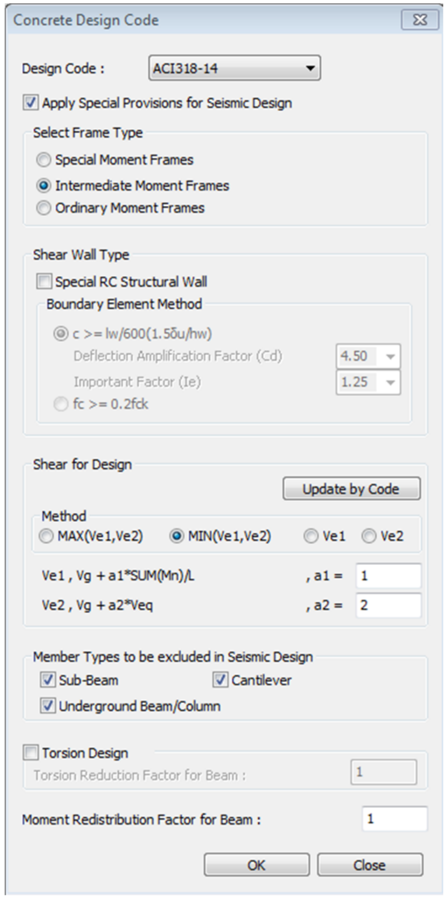
Design setting in Gen2019 v1.1



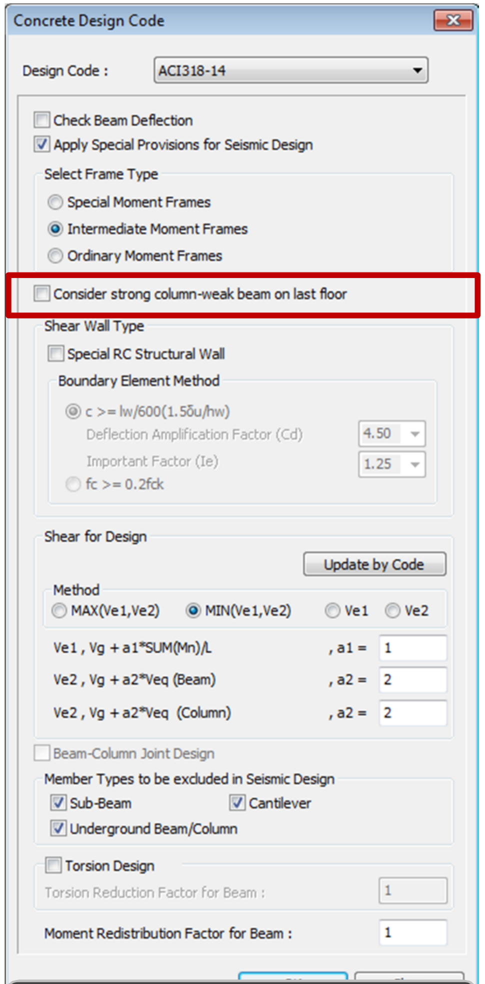
Design setting in Gen2019 v2.1

**In the seismic design,
the Amplification factor (a2) can be separately applied to calculate the shear force of the column and beam.**

10. Add Design Option for Strong Column-Weak Beam Check on Roof



Design setting in Gen2019 v1.1



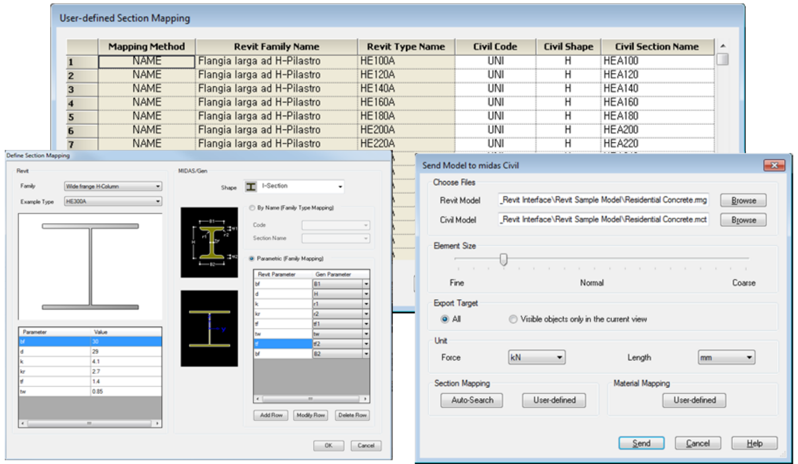
Design setting in Gen2019 v2.1

In previous versions, the checking of 'Strong Column-Weak Beam' on the roof have not been supported. From, midas Gen 2019 (v2.1), it is possible to consider the 'Strong Column-Weak Beam' on the roof.

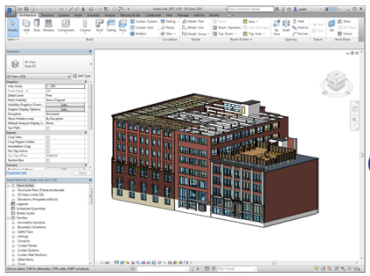
11. Revit 2019 Interface

- Using Midas Link for Revit Structure, direct data transfer between midas Gen and Revit 2019 is available for Building Information Modeling (BIM) workflow. Midas Link for Revit Structure enables us to directly transfer a Revit model data to midas Gen, and deliver it back to the Revit model file. This feature is provided as an Add-In module in Revit Structure and midas Gen text file (*.mgt) is used for the roundtrip

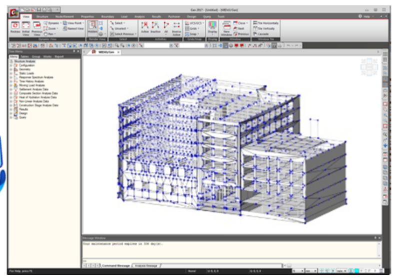
- ***File > Import > midas Gen MGT File***
- ***File > Export > midas Gen MGT File***



Send Model to midas Gen



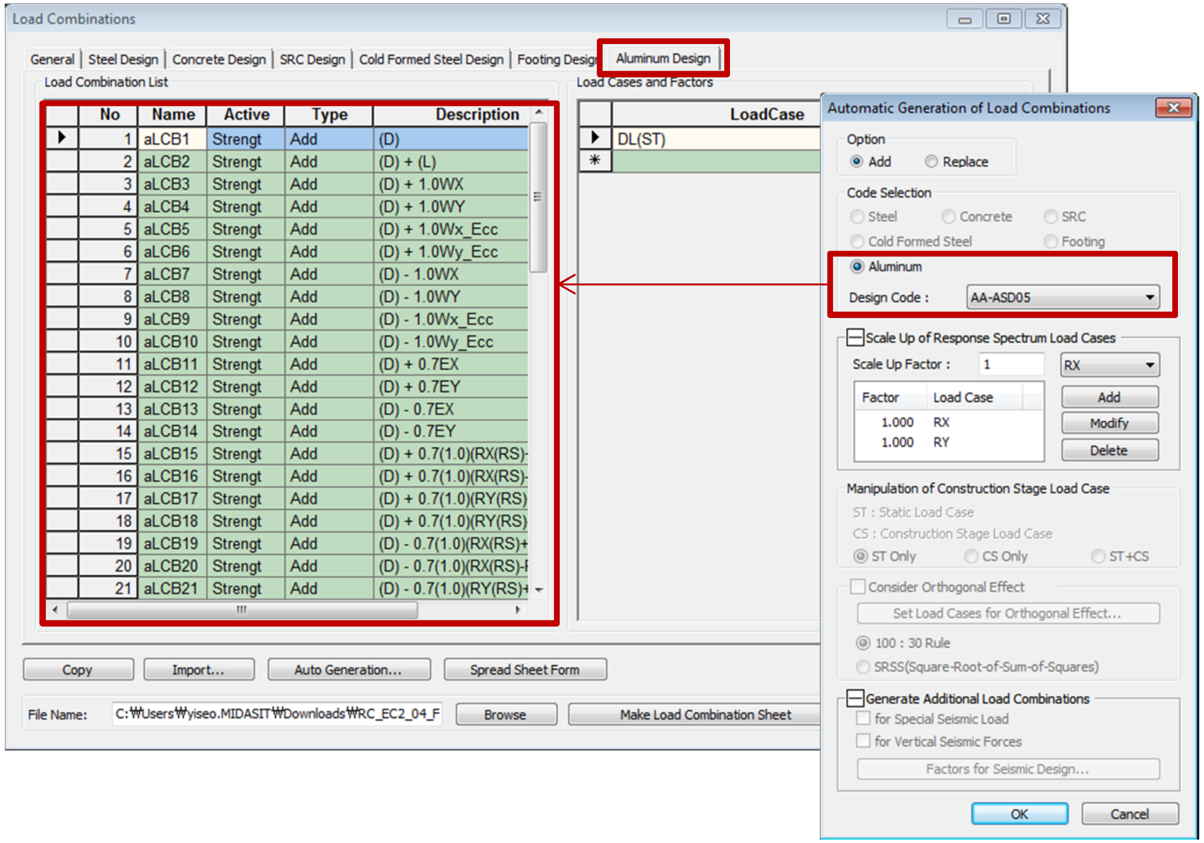
Revit 2019



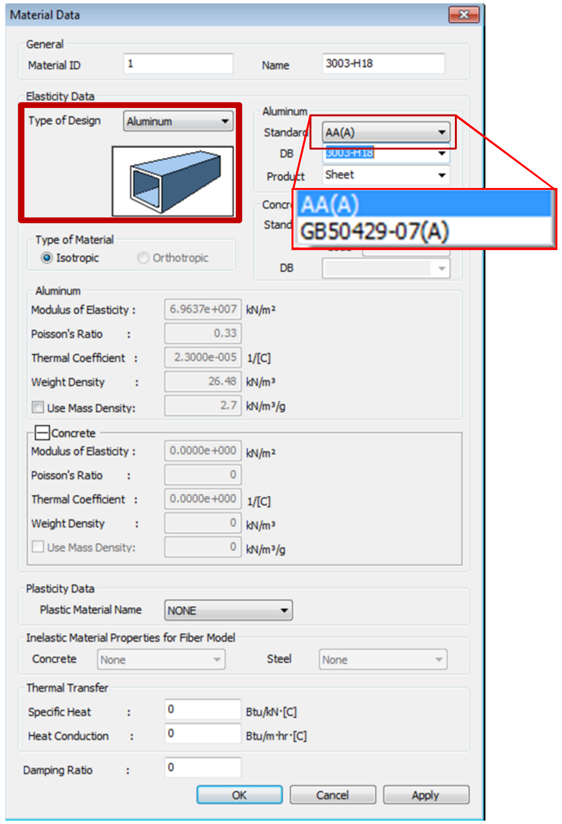
Gen2019

	Functions	Revit <> Gen
Linear Elements	Structural Column	<>
	Beam	<>
	Brace	<>
	Curved Beam	>
	Beam System	>
	Truss	>
Planar Elements	Foundation Slab	<>
	Structural Floor	<>
	Structural Wall	<>
	Wall Opening & Window	>
	Door	>
	Vertical or Shaft Opening	>
Boundary	Offset	>
	Rigid Link	>
	Cross-Section Rotation	>
	End Release	>
	Isolated Foundation Support	>
	Point Boundary Condition	>
	Line Boundary Condition	>
	Wall Foundation	>
	Area Boundary Condition	>
Load	Load Nature	>
	Load Case	>
	Load Combination	>
	Hosted Point Load	>
	Hosted Line Load	>
	Hosted Area Load	>
Other Parameters	Material	<>
	Level	>

12. Add Material DB and Load Combination for Aluminum

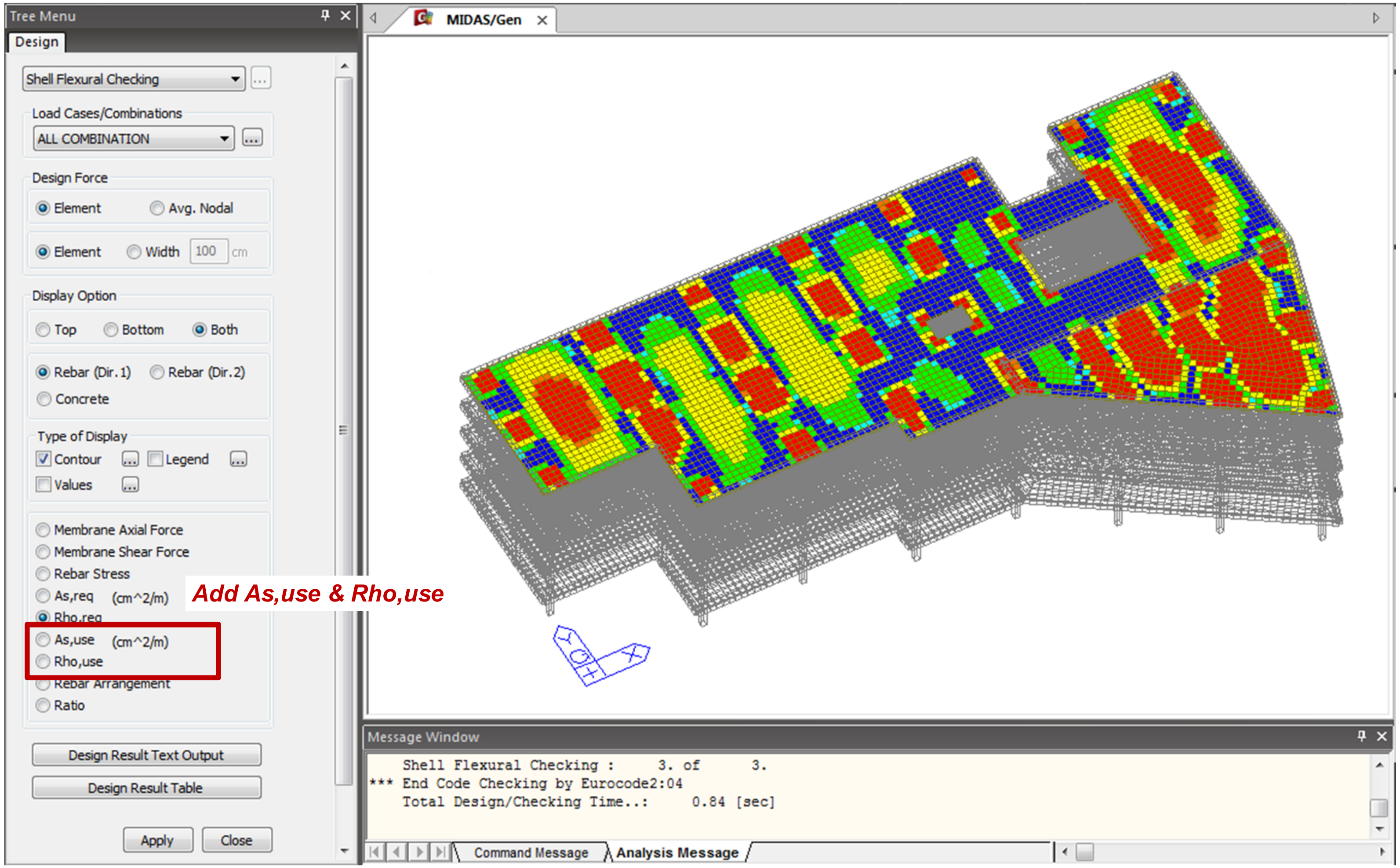


Load Combination for Aluminum Design



Material Data for Aluminum Design

13. Add options of As,use and Rho,use in shell flexural checking



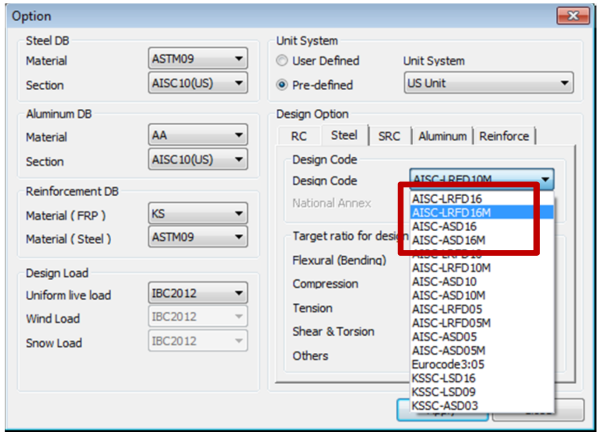
midas **Design+**

1. Add Steel Design as per AISC360-16 and AISC360-16M

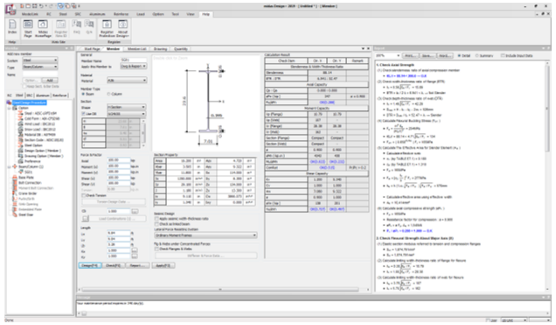
- ***Supported Design Items***

: Steel Beam/Column, CFT Column, SRC Column, Crane Girder, Bolt Connection, Steel Stair

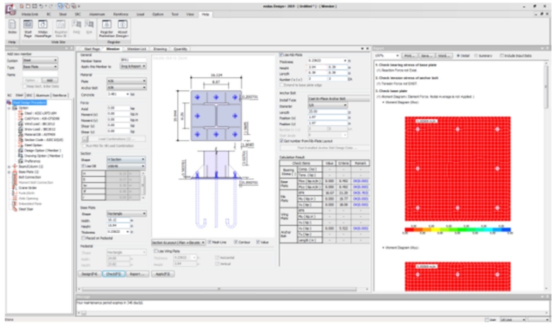
Steel Design as AISC360-16



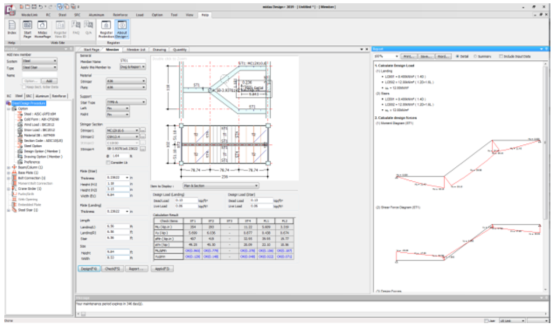
Beam / Column Design



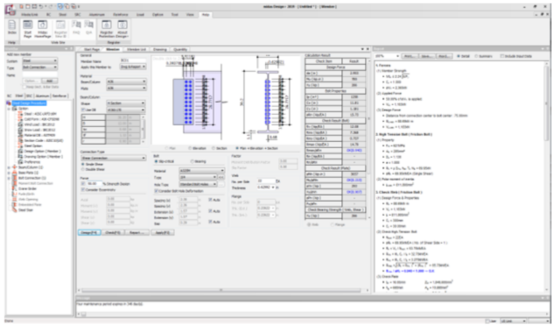
Base plate Design



Stair Design



Bolt Connection Design



Crane Girder Design