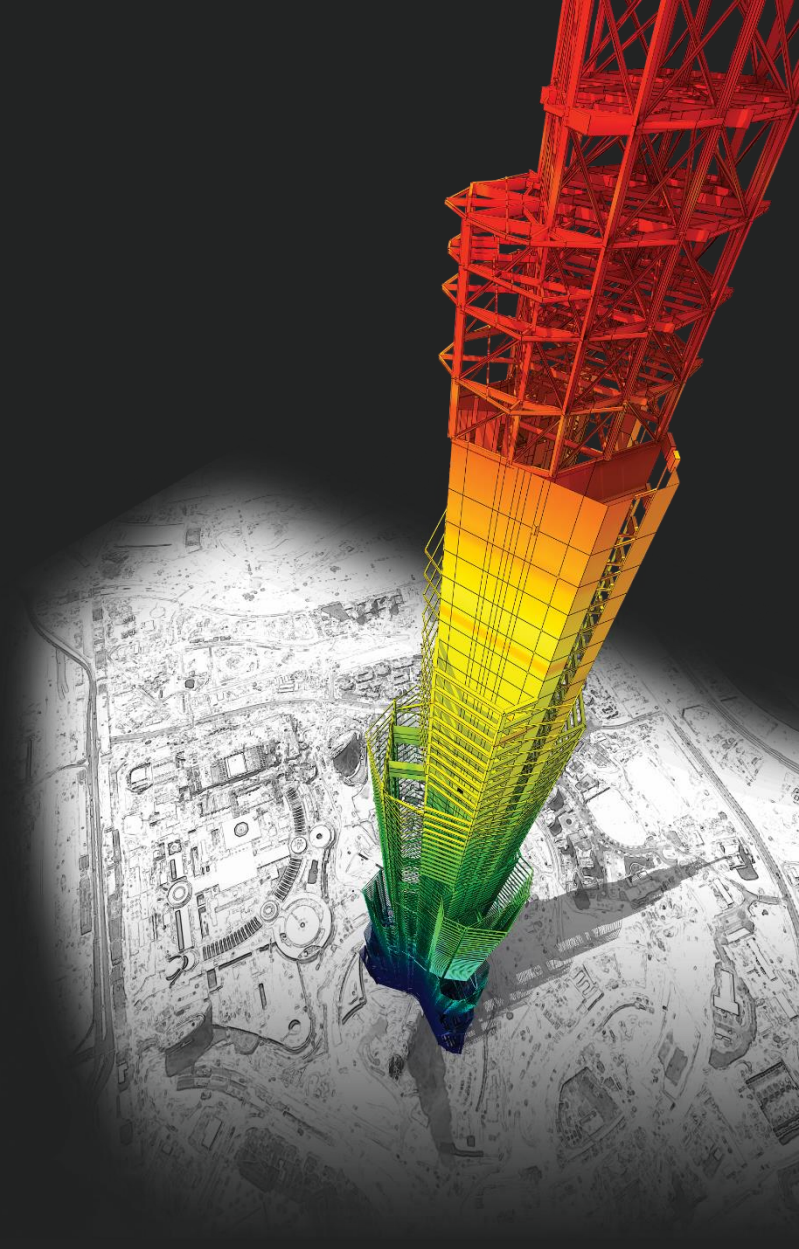
Release Note

Release Date : Mar. 2022

Product Ver. : midas Gen 2022 (v1.1) and Design+2022(v1.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

Enhancements

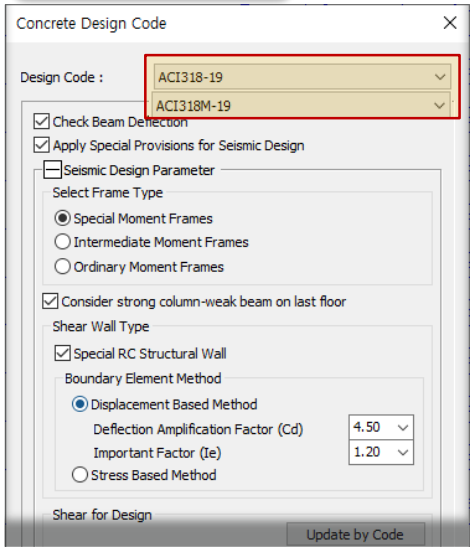
- *midas Gen*

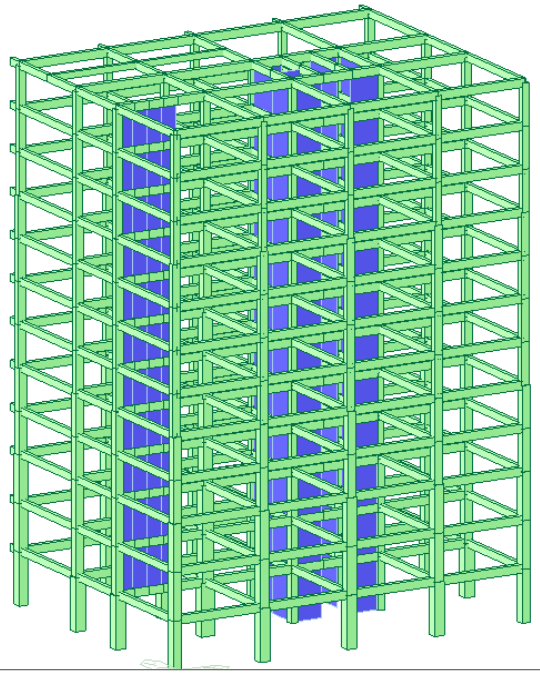
midas Gen

1. New American RC Code : ACI318-19 (US.SI)

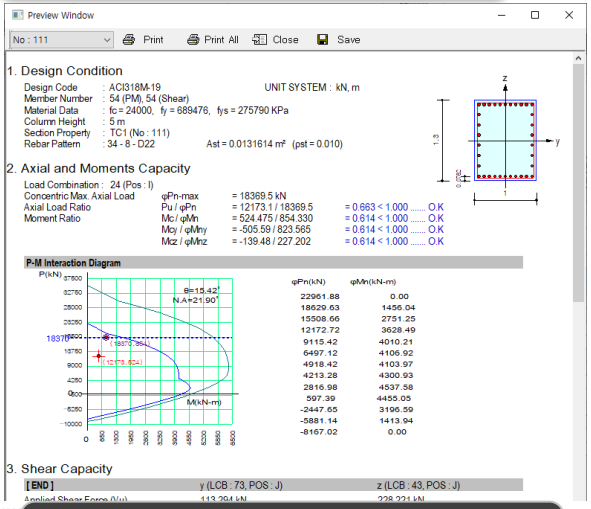
Added ACI318-19(US)/ACI318M-19(SI) Code for RC Design

Concrete Design Code

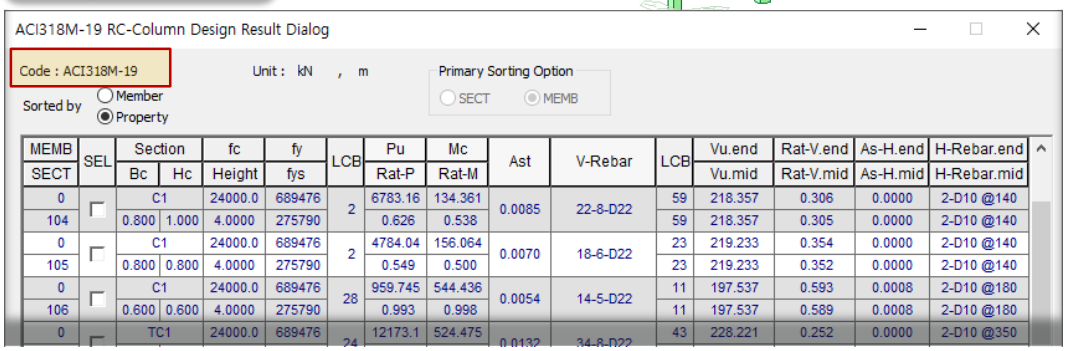




Graphic Report

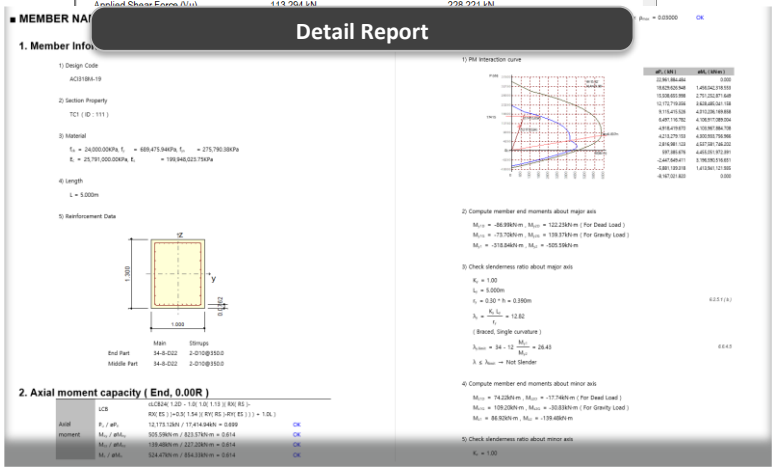


Design Result Table



MEMB / SECT	SEL	Section Bc	Section Hc	fc Height	fy fys	LCB	Pu Rat-P	Mc Rat-M	Ast	V-Rebar	LCB	Vu.end Vu.mid	Rat-V.end Rat-V.mid	As-H.end As-H.mid	H-Rebar.end H-Rebar.mid
0		C1		24000.0	689476	2	6783.16	134.361	0.0085	22-8-D22	59	218.357	0.306	0.0000	2-D10 @140
104		0.800	1.000	4.0000	275790		0.626	0.538			59	218.357	0.305	0.0000	2-D10 @140
0		C1		24000.0	689476	2	4784.04	156.064	0.0070	18-6-D22	23	219.233	0.354	0.0000	2-D10 @140
105		0.800	0.800	4.0000	275790		0.549	0.500			23	219.233	0.352	0.0000	2-D10 @140
0		C1		24000.0	689476	28	959.745	544.436	0.0054	14-5-D22	11	197.537	0.593	0.0008	2-D10 @180
106		0.600	0.600	4.0000	275790		0.993	0.998			11	197.537	0.589	0.0008	2-D10 @180
0		TC1		24000.0	689476	24	12173.1	524.475	0.0132	34-8-D22	43	228.221	0.252	0.0000	2-D10 @350

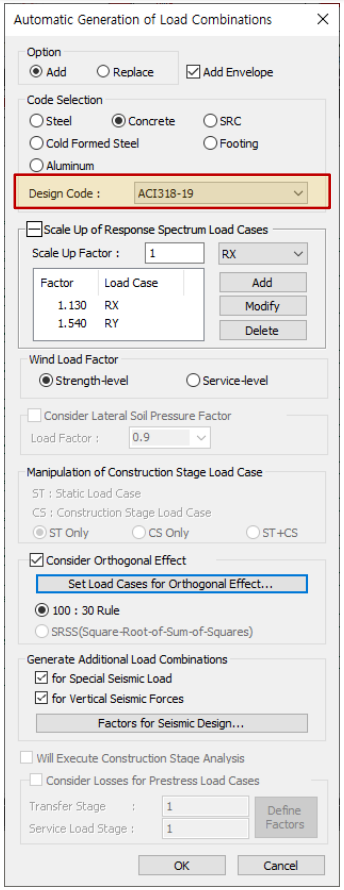
Detail Report



1. New American RC Code : ACI318-19 (US.SI)

Added ACI318-19 Load combinations

For Concrete Design

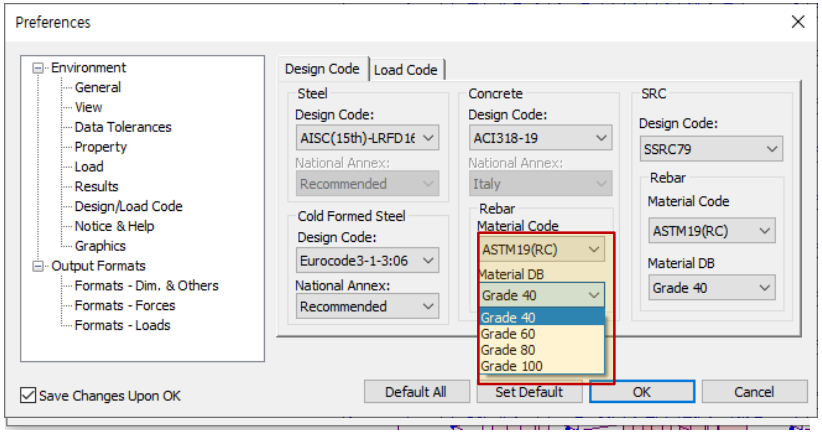


Provision	Load factors and combinations	Remark
Strength Load Combinations	1.4 (D+F)	• D : Dead Load • F : Fluid Load • T : Temperature Load • H : Lateral pressure load of soil and water in soil • L : Live load • Lr : Roof live load • R : Rain load • W : Wind load • E : Earthquake load (=Eh + Ev) • Em : maximum effect of horizontal and vertical earth-quake force (=Ω_0Eh) • Ω_0 : Seismic force amplification factor • Eh : Horizontal earthquake load • Ev : Vertical earthquake load (not provided in Gen2022 v1.1)
	1.2(D+F+T) +1.6(L+H) + 0.5(Lr or R)	
	1.2D +1.6(Lr or R) + (1.0L or 0.5W)	
	1.2D ± 1.0W + 1.0L +0.5(Lr or R)	
	1.2D ± 1.0E + 1.0L	
	0.9D ± 1.0W + 1.6H	
	0.9D ± 1.0E + 1.6H	
Allowable stress Load Combinations	D + F	
	D + H + F + L + T	
	D + H + F + (Lr or R)	
	D + H + F + 0.75[L+T(Lr or R)]	
	D + H + F ± (0.6W or E / 1.4)	
Special load combinations	1.2D + 1.0L +1.0Em	
	0.9D ± 1.0Em	

1. New American RC Code : ACI318-19 (US.SI)

Added New Rebar DB and Material as per ASTM19

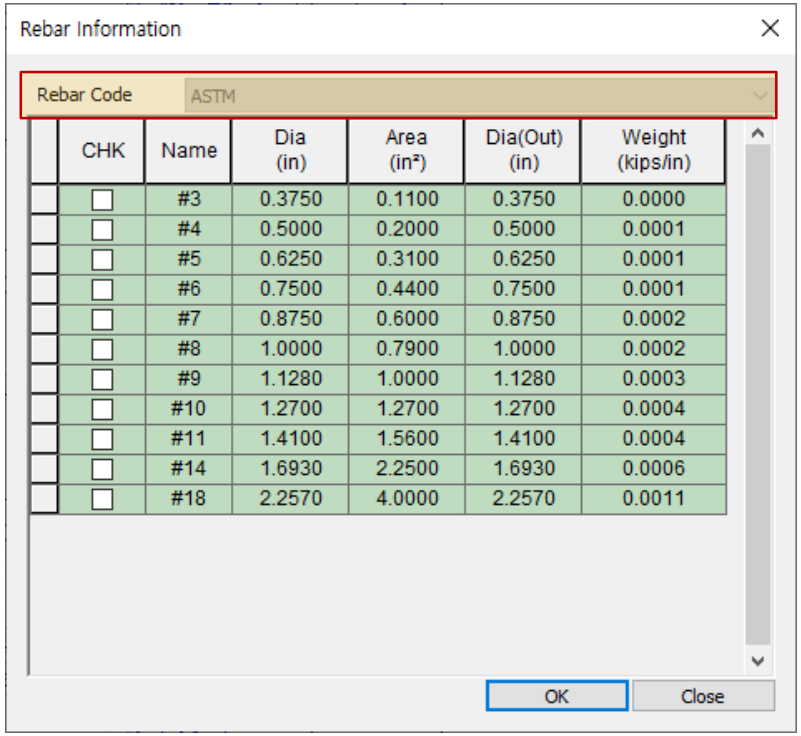
Set Rebar Material



Rebar strength as per ASTM 19

	Tensile Strength Fu (psi)	Yield Strength Fy (psi)
Grade 40	60,000	40,000
Grade 60	80,000	60,000
Grade 80	100,000	80,000
Grade 100	117,000	10,000

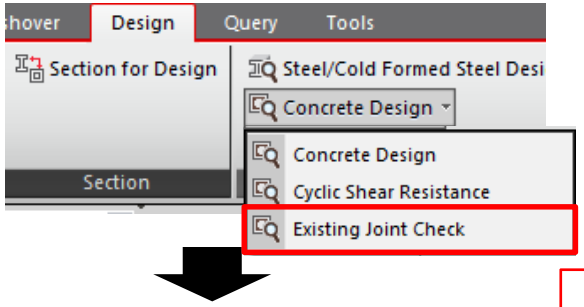
Rebar DB as per ASTM19 & Design rebar setting



2. Beam-Column Joints Check for Existing Building as per NTC2018

Beam-Column Joints Capacity Check for Existing Building

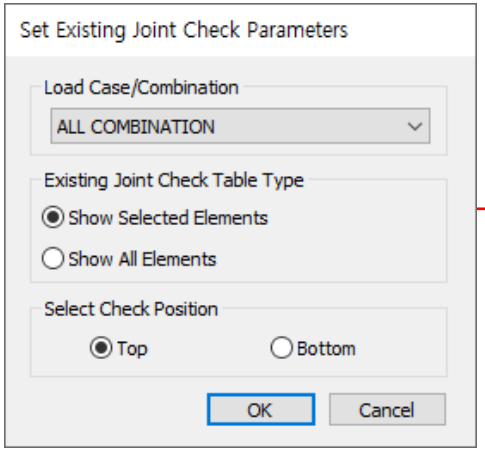
- *Design > result > Concrete Design > Existing Joint Check*



Result Table for Joint Capacity check for existing building

	Elem	Position	Stress		Beam-Column Joint Check for Existing Building							
					y-axis				z-axis			
					Load	Demand (N/mm²)	Capacity (N/mm²)	Remark	Load	Demand (N/mm²)	Capacity (N/mm²)	Remark
	Check Position = Bottom											
	Press right mouse button and click 'Set Existing Joint Check Parameters' menu to change Load Case/Combination/Select Check Position											
▶	81	Bottom	Tensile	sism22		8.2225	1.5000	NG	sism22	5.0651	1.5000	NG
	81	Bottom	Compressive	sism22		8.2471	12.5000	OK	sism22	5.0942	12.5000	OK

Set Existing Joint Check Parameters



Demand : Joints Stress, σ_{jt} and σ_{jc}

Capacity : by Equation below

– per la resistenza a trazione: ***Tensile stress***

$$\sigma_{jt} = \left| \frac{N}{2A_j} - \sqrt{\left(\frac{N}{2A_j}\right)^2 + \left(\frac{V_j}{A_j}\right)^2} \right| \le 0.3\sqrt{f_c}(f_c \text{ in } MPa) \qquad [C8.7.2.11]$$

– per la resistenza a compressione: ***Compressive stress***

$$\sigma_{jc} = \frac{N}{2A_j} + \sqrt{\left(\frac{N}{2A_j}\right)^2 + \left(\frac{V_j}{A_j}\right)^2} \le 0.5 f_c (f_c in MPa) \qquad [C8.7.2.12]$$

Demand ≤ Capacity → O.K

Demand > Capacity → N.G.

2. Beam-Column Joints Check for Existing Building as per NTC2018

Beam-Column Joints Check for Existing Building

- *Design > result > Concrete Design > Existing Joint Check*

Result Table for Beam-Column Joint check for Existing Building

	Elem	Position	Stress	Beam-Column Joint Check for Existing Building							
				y-axis				z-axis			
				Load	Demand (N/mm²)	Capacity (N/mm²)	Remark	Load	Demand (N/mm²)	Capacity (N/mm²)	Remark
	Check Position = Bottom										
	Press right mouse button and click 'Set Existing Joint Check Parameters' menu to change Load Case/Combination/Select Check Position										
▶	81	Bottom	Tensile	sism22	8.2225	1.5000	NG	sism22	5.0651	1.5000	NG
	81	Bottom	Compressive	sism22	8.2471	12.5000	OK	sism22	5.0942	12.5000	OK

✓ Use Tips

1) ***This check option is activated only with NTC2018.***
2) ***If 'Apply Special Provision for Seismic Design' of concrete design code is active, this check option can't be activated.***
3) ***This check must be performed only for 'Not Confined Joint' as defined in § 7.4.4.3 of the NTC***
4) ***This check is 'existing structure review', so it is calculated using the beam reinforcement information entered by the user.***

✓ Note

C8.7.2.3.5 Beam and Column for Existing Building as per CIRCOLARE NTC2018

- ***[Calculation & check of diagonal tensile stress for beam-column joint]***

$$\sigma_{jt} = \left| \frac{N}{2A_j} - \sqrt{\left(\frac{N}{2A_j}\right)^2 + \left(\frac{V_j}{A_j}\right)^2} \right| \le 0.3\sqrt{f_c}(f_c \text{ in } MPa) \qquad [C8.7.2.11]$$

- ***[Calculation & check of diagonal compressive stress for beam-column joint]***

$$\sigma_{jc} = \frac{N}{2A_j} + \sqrt{\left(\frac{N}{2A_j}\right)^2 + \left(\frac{V_j}{A_j}\right)^2} \le 0.5 f_c(f_c in MPa) \qquad [C8.7.2.12]$$

Where,

1) N *: Axial force acting on the upper column (+ : compressive,-:tensile)*

2) Vj *: Total shear acting on the joint, obtained as a sum algebraic of the shear transmitted by the upper pillar and of the horizontal stresses transmitted by the upper parts of the beams*

3)Aj : bj * hjc
where bj and hjc are defined in § 7.4.4.3.1 of the NTC

3. Crack Control Check for RC Column as per EC2:04 & NTC

RC Column Crack Width Check as per EC2:04 & NTC2018

Set Beam-Column Joint Design Parameter

Seismic Design Parameter
- Beam-Column Joint Design
  - Gamma_rd 1.1
  - Confined Joint
  - Not Confined Joint
  - Select Check Position
    - Top
    - Bottom

Check the serviceability check

RC Column Check

Code : EC2:04,NTC2018 Unit : N , mm

Sorted by: Member / Property — Results: Strength / Serviceability — Primary Sorting Option: SECT / MEMB

MEMB / SECT	SEL	Section Bc	Section Hc	fck / Height	fyk / fyw	CHK	Stress Control LCB	sig-ct	sig-cta	LCB	sig-cc	sig-cca	LCB	sig-s	sig-sa	Crack Control LCB	w_y	wa_y	LCB	w_z	wa_z
913		C1		24.0000	550.000	NG#	101	11.7624	2.49610	101	15.8097	14.4000	101	113.438	440.000	97	0.0687	0.3000	80	0.3729	0.3000
106		600.0	600.0	4000.0	420.000																

Graphic Result

4. Serviceability : Stress Limit Check

	Conc.(Tens.)	Conc.(Comp.)	Conc.(Comp.)(QP)	Rebar
Load Combination	101(F)	101(F)	97(Q)	101(F)
Stress(s)	-11.76	15.81	15.64	113.44
Allowable Stress(sa)	2.50	14.40	10.80	440.00
Stress Ratio(s/sa)	Cracked Section	Cracked Section	Cracked Section	Cracked Section
Check Linear Creep			Non-linear Creep	

5. Serviceability : Crack Limit Check

When cracked section,

	y (LCB : 97, POS : J)	z (LCB : 80, POS : J)
Crack Width(w)	0.06870 mm	0.37293 mm
Allowable Crack Width(wa)	0.30000 mm	0.30000 mm
Check Ratio(w/wa)	0.229 < 1.000 ..... O.K	1.243 > 1.000 ..... N.G

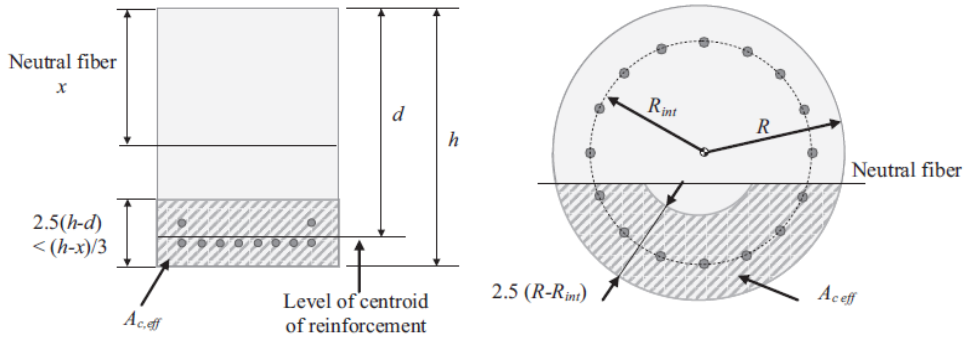
Detail Result

```
================================================================================
  [[[*]]]   CHECK SERVICEABILITY CRACK LIMIT ABOUT MAJOR AXIS.
================================================================================

    ( ). Calculate crack width.
         [ EN 1992-1-1:2004 Clause 7.3.4 , Appendix B. ]
         ( LCB =  97,  POS = J )
         -. Pu       =   816411.88 N.
         -. Muy      =-191305395.40 N-mm.
         -. fcm      = fck+8(MPa)     =     32.00000 MPa.
         -. fctm     = 0.30*fck^(2/3)=     2.49610 MPa.(fck<=C50/60)
         -. fct.eff  = fctm (by 28 days).
         -. n        =    12.82603
         -. Sigma_s  =       64.662 MPa.
         -. kt       = 0.6 (for short term loading.).
         -. X        =   329.19948 mm.
         -. hc,ef    = MIN[ 2.5*(h-d), (h-X)/3, h/2 ] =    90.26684 mm.
         -. Ac.eff   = Bc*hc,ef              = 54160.10376 mm^2.
         -. Rho_p.eff= As/Ac.eff             =    0.0214
         -. Ecm      = 22[fcm/10]^0.3 *1000 =   31186.574 MPa. (by Table 3.1)
         -. Alpha_e  = Es/Ecm                =    6.41302
         -. (Eps_sm-Eps_cm) = (Sigma_s-kt*fct.eff/Rho_p.eff*(1+Alpha_e*Rho_p.eff))/Es
                            =  -0.000074
                              < 0.6*Sigma_s/Es =  0.000194
         -. (Eps_sm-Eps_cm) = 0.6*Sigma_s/Es =  0.000194

         -. Bond coefficient(k1)             =    0.8000
         -. Strain distribution coefficient(k2) =  0.5000
         -. NAD Value (k3)                   =    3.4000
         -. NAD Value (k4)                   =    0.4250
         -. c        =    52.40000 mm.
         -. Phi      =    22.20000 mm.
         -. S_r.max  = k3*c + k1*k2*k4*Phi/Rho_p.eff =   354.16984 mm.

         -. wk       = S_r.max * ( Eps_sm-Eps_cm)    =     0.06870 mm.
            wk <  0.300 mm.   --->  O.K !
```

3. Crack Control Check for RC Column as per EC2:04 & NTC

RC Column Crack Width Check as per EC2:04 & NTC2018

Calculating effective area of concrete in tension, Ac,eff ,in program [Rectangular and Circular Column]



✓ Note

Calculate crack width using the following formula as per EC2:04 and NTC

$$Wk = S_{r.max}\,(\varepsilon_{sm} - \varepsilon_{cm}) \le Wk,max$$

1. Determine $\varepsilon_{sm} - \varepsilon_{cm}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \dfrac{f_{ct,eff}}{\rho_{p,eff}}\left(1 + \alpha_e \rho_{p,eff}\right)}{E_s} \ge 0.6\frac{\sigma_s}{E_s}$$

2. Determine $S_{r.max}$

$$s_{r.\max} = k_3 c + \frac{k_1 k_2 k_4 \phi}{\rho_{p,eff}}$$

✓ Information

1) ***The stress check with cracked section is obtained along each axis in the program. Similarly, crack check is performed along local axis (y & z axis)***
2) ***In GSD, you can also check actual stress in the cracked section on bi-axis along with stress in each reinforcement bar.***
3) ***For calculating effective area of concrete in tension for circular cross sections (Ac,eff), the program use the equation by Wiese et al (left side)***

- For determining $\varepsilon_{sm} - \varepsilon_{cm}$

1) ε_{sm} *: The mean strain in the reinforcement under the relevant combination of loads, including the effect of imposed deformations and taking into account the effects of tensile stiffening.*
2) ε_{cm} *: The mean strain in the concrete between cracks.*
3) σ_s *:The stress in the tension reinforcement*
4) α_e *: Es / Ecm.*
5) K_t *: factor dependent on duration of the load.*
0.6 for short-term load, 0.4 for long-term load
6) $\rho_{p,eff}$ *: As / Ac,eff*

- For determining $S_{r.max}$

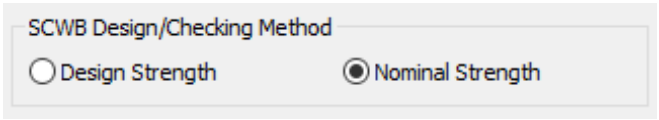
1) ϕ *:bar diameter. The program uses the ϕ of the outer layer.*
2) c *: cover to the longitudinal reinforcement.*
3)k1 *: A coefficient accounting the bond properties of rebar (0.8 for high bond bars)*
4)k2 *: Coefficient accounting for distribution of strain. (0.5 for bending)*
5)k3 *: 3.4 (recommended values)*
6) k4 *: 0.425(recommended values)*

4. SCWB Design/Checking Method Option as per ACI Series

Added nominal strength method for design force calculation, special provision for seismic design

- *Design > RC Design> Design Code > SCWB Design/Checking Method*

SCWB Design/Checking Option



✓ Use Tips

1) *The applied codes are ACI318-19,14(including M), NSR-10, NSCP2015*

2) *This option can be activated when*
① *ACI 318-19,14 , NSCP-2015: Special Moment Frames in Seismic Design Parameter*
② *NSR-10 : DES(Special Energy Dissipation) or DMO (Moderate Energy Dissipation) Class in Seismic Design Parameter*

✓ Note

1. Column design moment as per selection
Performing Ductile Design & Checking

[Design Strength Method] Using the Design strength of beams, $\emptyset_b M_n$

$$M_{c,B} = \left(\frac{6}{5}\right)\left(\emptyset_b M_{nb,L} + \emptyset_b M_{nb,R}\right)\left(\frac{M_{ce,B}}{M_{ce,T}+M_{ce,B}}\right)$$

$$M_{c,T} = \left(\frac{6}{5}\right)\left(\emptyset_b M_{nb,L} + \emptyset_b M_{nb,R}\right)\left(\frac{M_{ce,T}}{M_{ce,T}+M_{ce,B}}\right)$$

[Nominal Strength Method] Using the nominal strength of beams, M_n

$$M_{c,B} = \left(\frac{6}{5}\right)\left(M_{nb,L} + M_{nb,R}\right)\left(\frac{M_{ce,B}}{M_{ce,T}+M_{ce,B}}\right)$$

$$M_{c,T} = \left(\frac{6}{5}\right)\left(M_{nb,L} + M_{nb,R}\right)\left(\frac{M_{ce,T}}{M_{ce,T}+M_{ce,B}}\right)$$

2. SCWB Ratio Calculation as per selection
Performing SCWB Design & Checking

[Design Strength Method] Using the Design strength of beams and Column, $\emptyset_b M_{nb}$, $\emptyset_c M_{nc}$

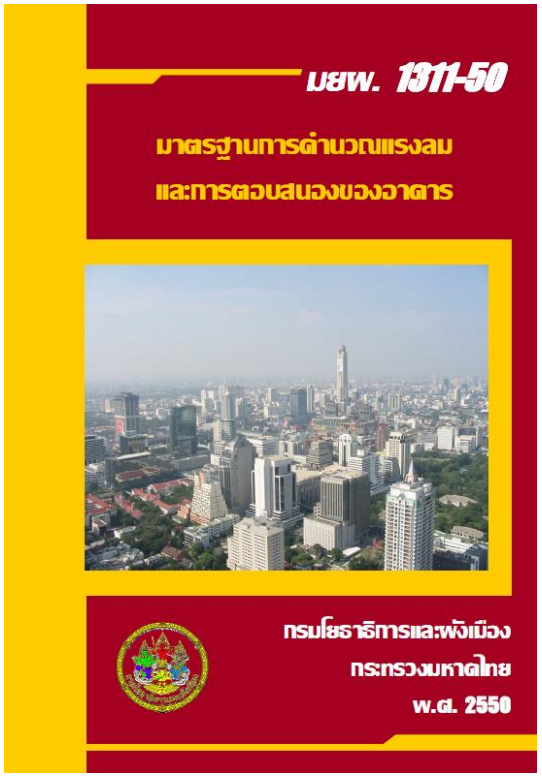
$$Ratio = \left(\frac{\emptyset_c M_{nc,T}+\emptyset_c M_{nc,B}}{\emptyset_b M_{nb,L}+\emptyset_b M_{nb,R}}\right)$$

[Nominal Strength Method] Using the nominal strength of beams & Column , M_{nb}, M_{nc}

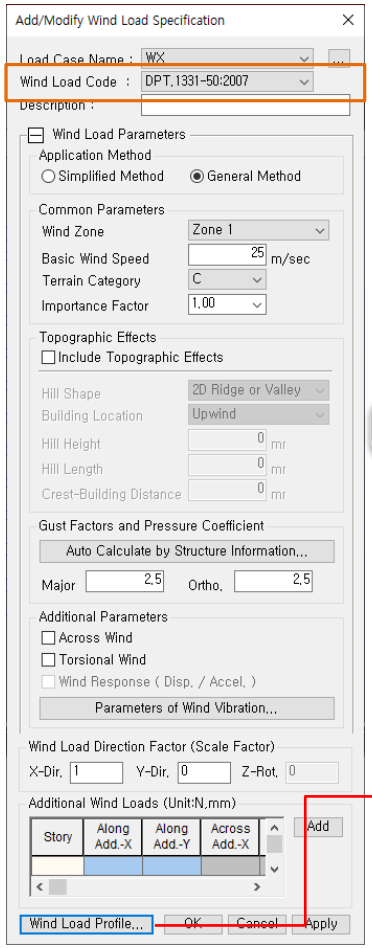
$$Ratio = \left(\frac{M_{nc,T}+M_{nc,B}}{M_{nb,L}+M_{nb,R}}\right)$$

5. Thailand Code : DPT (Wind and Seismic load)

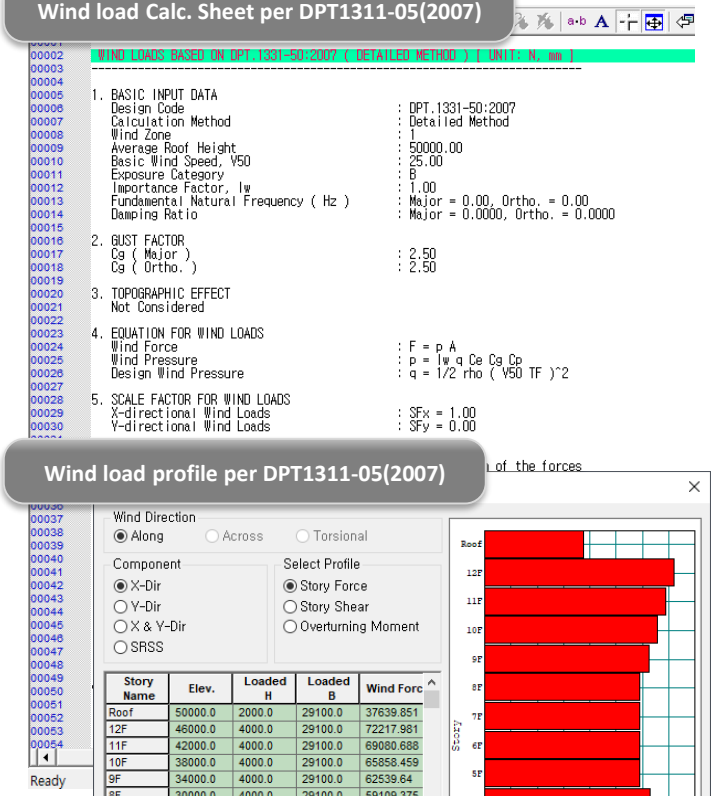
Added DPT.1311-50:2007(Wind Load)



Wind Load



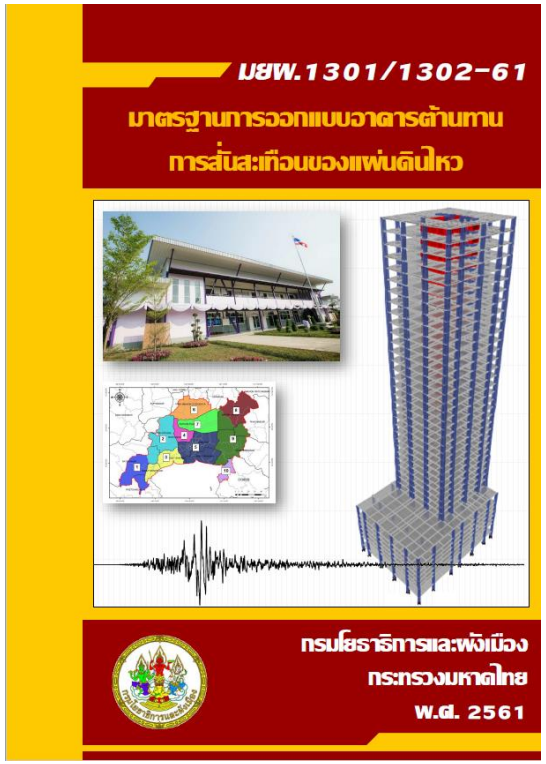
Wind load Calc. Sheet per DPT1311-05(2007)



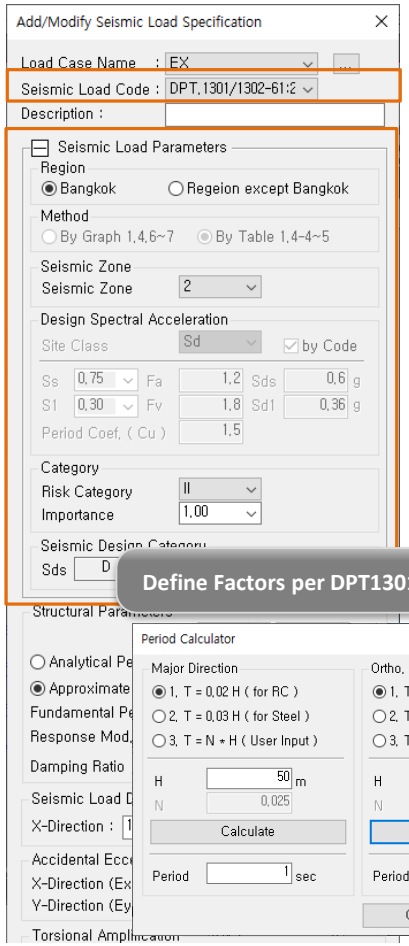
Wind load profile per DPT1311-05(2007)

5. Thailand Code : DPT (Wind and Seismic load)

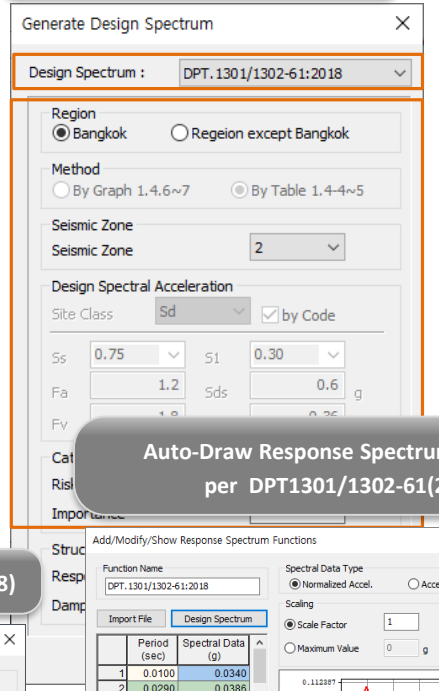
Added DPT.1301/1302-61:2018 (Seismic Load)



Static seismic Load

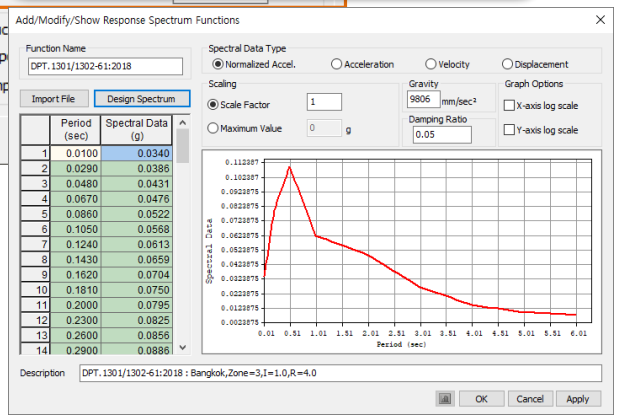


Response Spectrum



Auto-Draw Response Spectrum Functions per DPT1301/1302-61(2018))

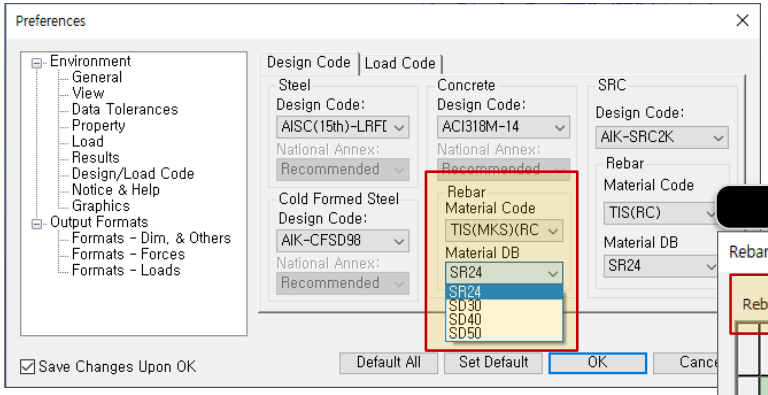
Define Factors per DPT1301/1302-61(2018)



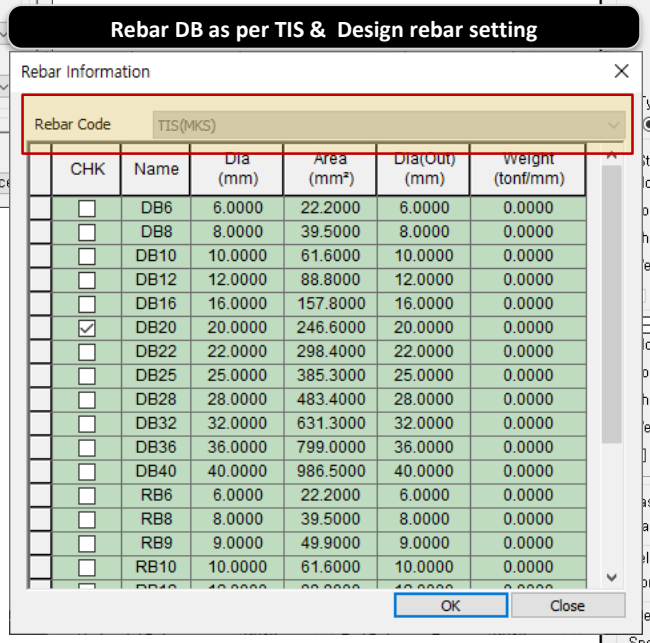
6. Addition of Thailand DB(TIS for SI,MKS)

Added Concrete/Rebar DB and material as per TIS (for SI,MKS Unit system)

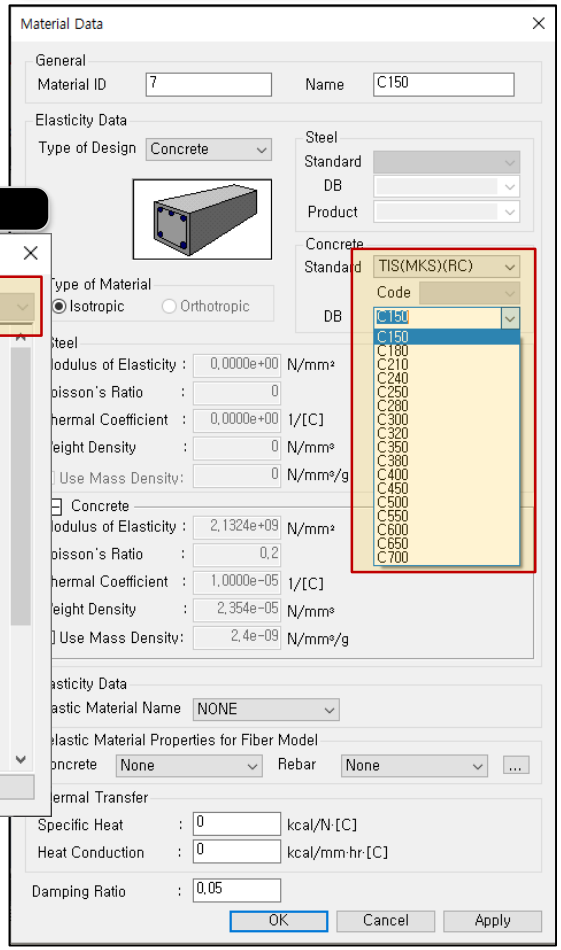
Set Rebar Material



Rebar DB as per TIS & Design rebar setting



Concrete strength as per TIS



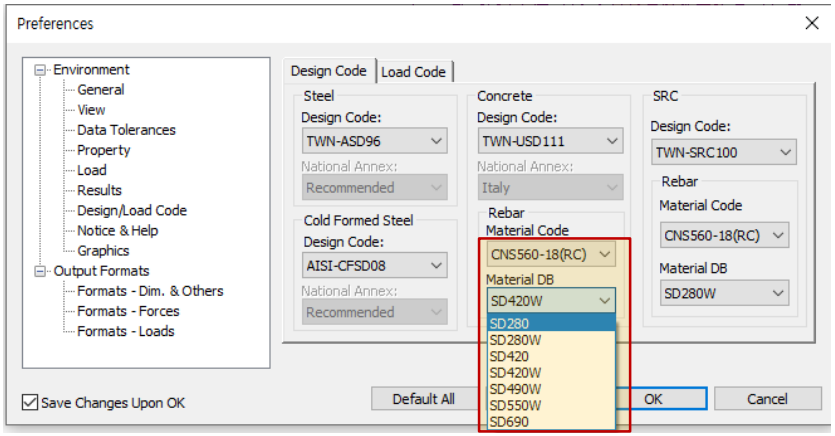
Rebar strength as per TIS

	Tensile Strength Fu (MPa)	Yield Strength Fy (MPa)	Yield Strength Fy (KSC)
SR 24	385	235	2400
SD 30	480	295	3000
SD 40	560	390	4000
SD 50	620	490	5000

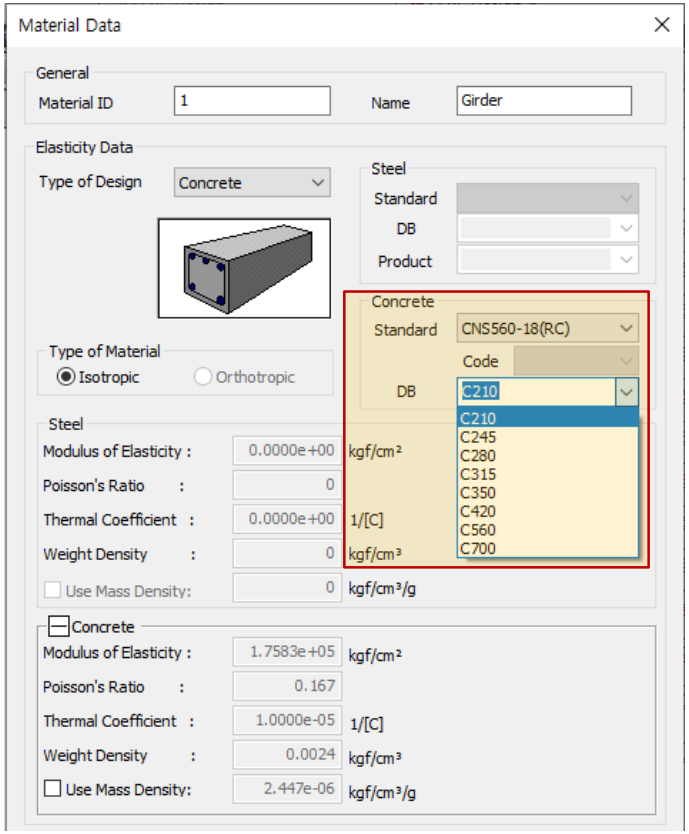
7. Addition of Taiwan DB(CNS560-18)

Added New Concrete/Rebar DB and Material as per CNS560-18

Set Rebar Material



Concrete Material DB



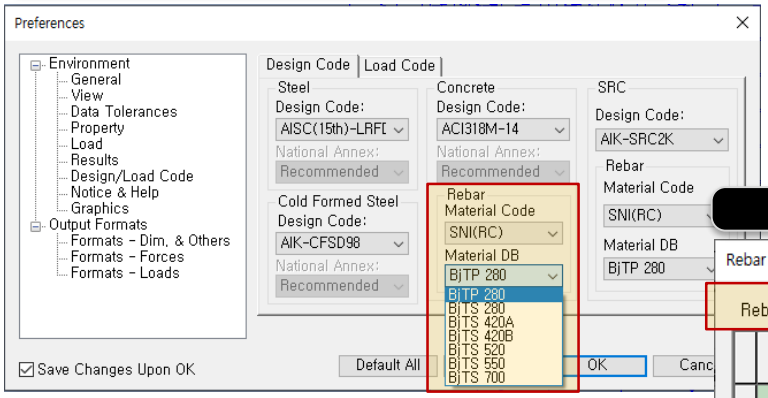
Rebar strength as per CNS560-18

	Yield Strength Fy (kgf/cm^2)
SD280	2,800
SD280W	2,800
SD420	4,200
SD420W	4,200
SD490W	5,000
SD550W	5,600
SD690	7,000

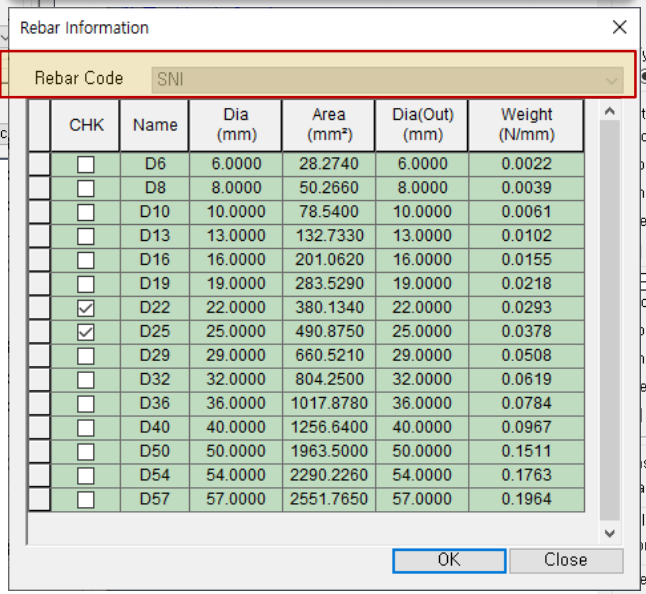
8. Addition of Indonesia DB(SNI)

Added Concrete/Rebar DB and material as per SNI

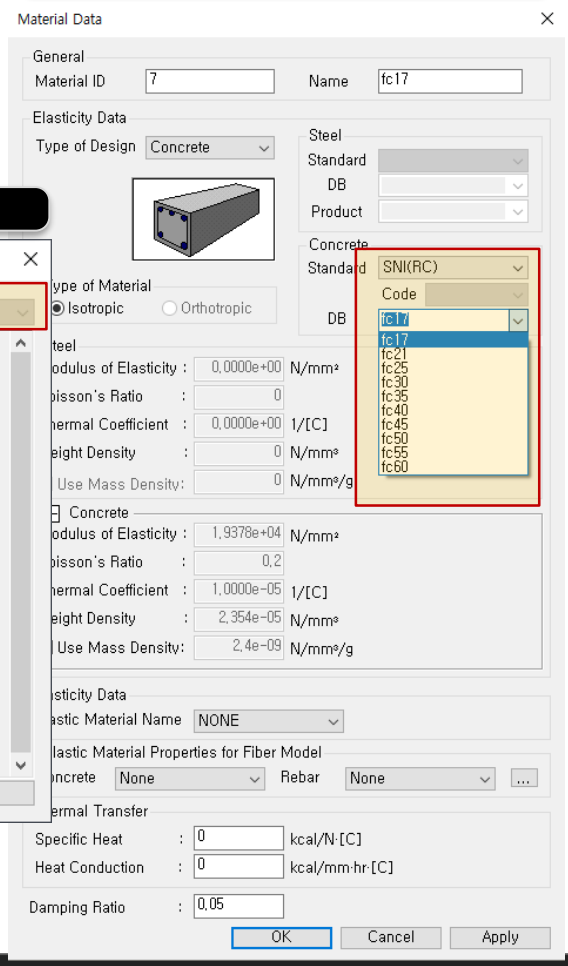
Set Rebar Material



Rebar DB as per SNI & Design rebar setting



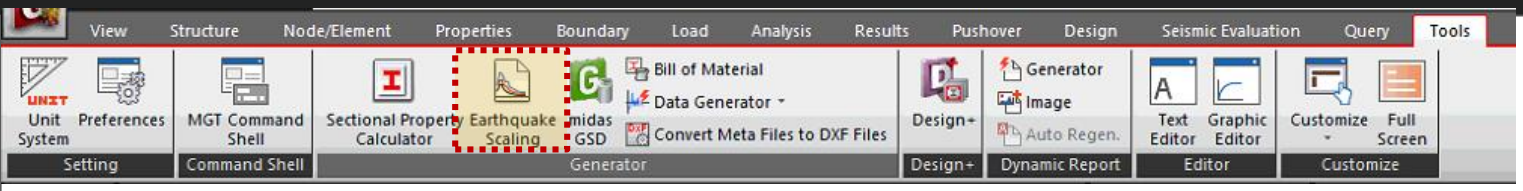
Concrete strength as per SNI

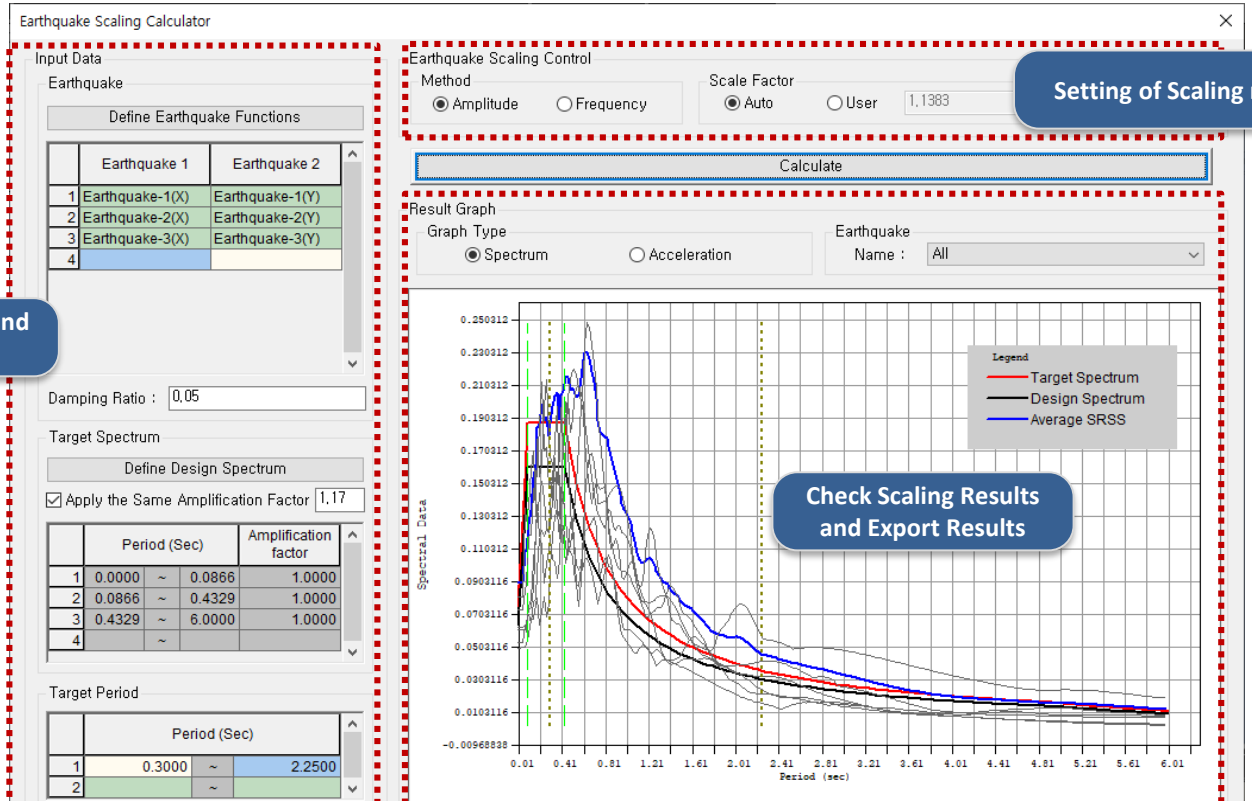


Rebar strength as per SNI

Grade	Tensile Strength Fu (MPa)	Yield Strength Fy (MPa)
BjTP 280	350	280
BjTS 280	350	280
BjTS 420A	525	420
BjTS 420B	525	420
BjTS 520	650	520
BjTS 550	687.5	550
BjTS 700	805	700

9. Earthquake Scaling Calculator





Setting of Scaling method and scale factor

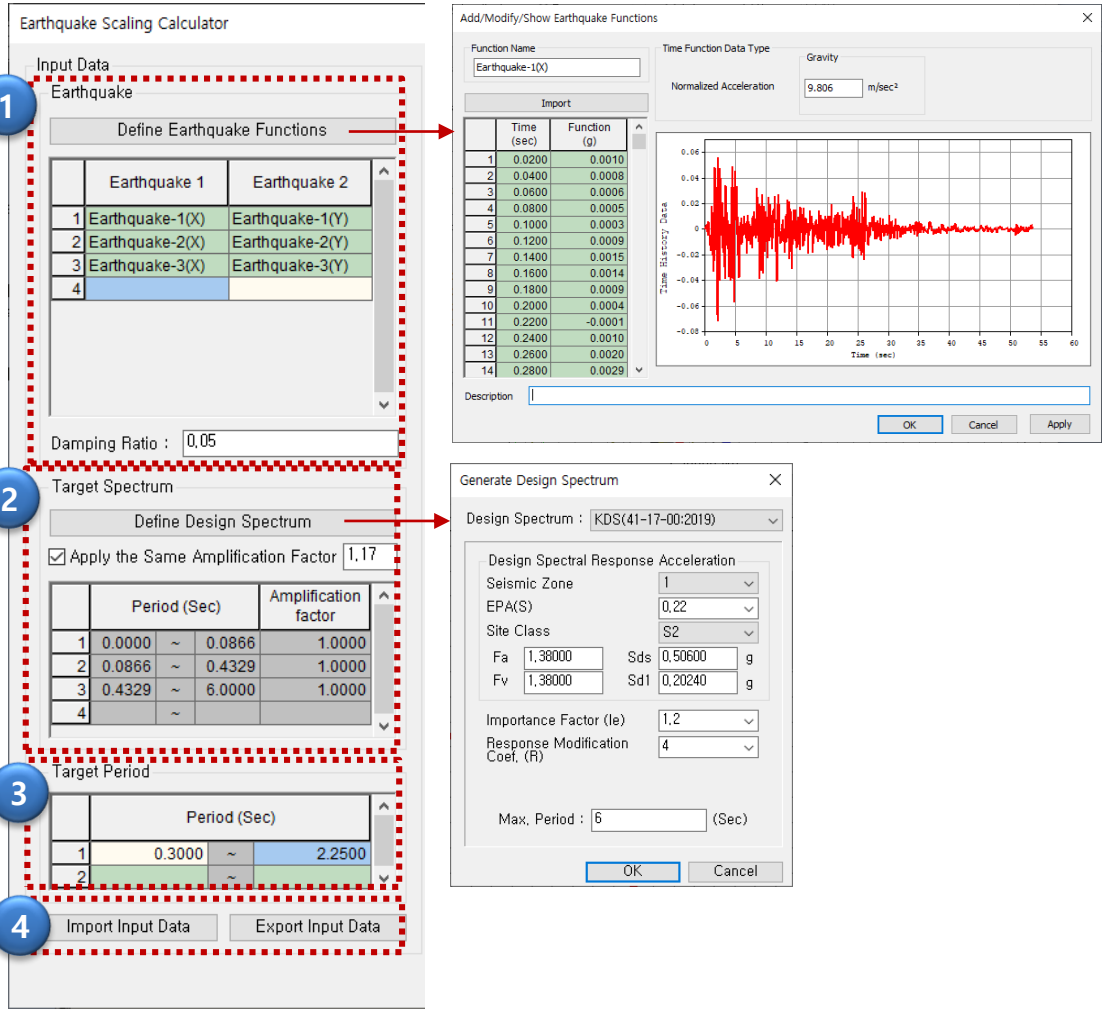
Input Seismic wave and target spectrum

Check Scaling Results and Export Results

-Function : Scaling so that the average of the SRSS spectrum of the input seismic wave is greater than or equal to the target spectrum for the target period

9. Earthquake Scaling Calculator

-Tools > Generator > Earthquake Scaling



1 ***Enter seismic wave information considering the conditions of the ground where the structure is located.***
Import seismic waves saved as SGS files or copy and paste input data into Excel format.

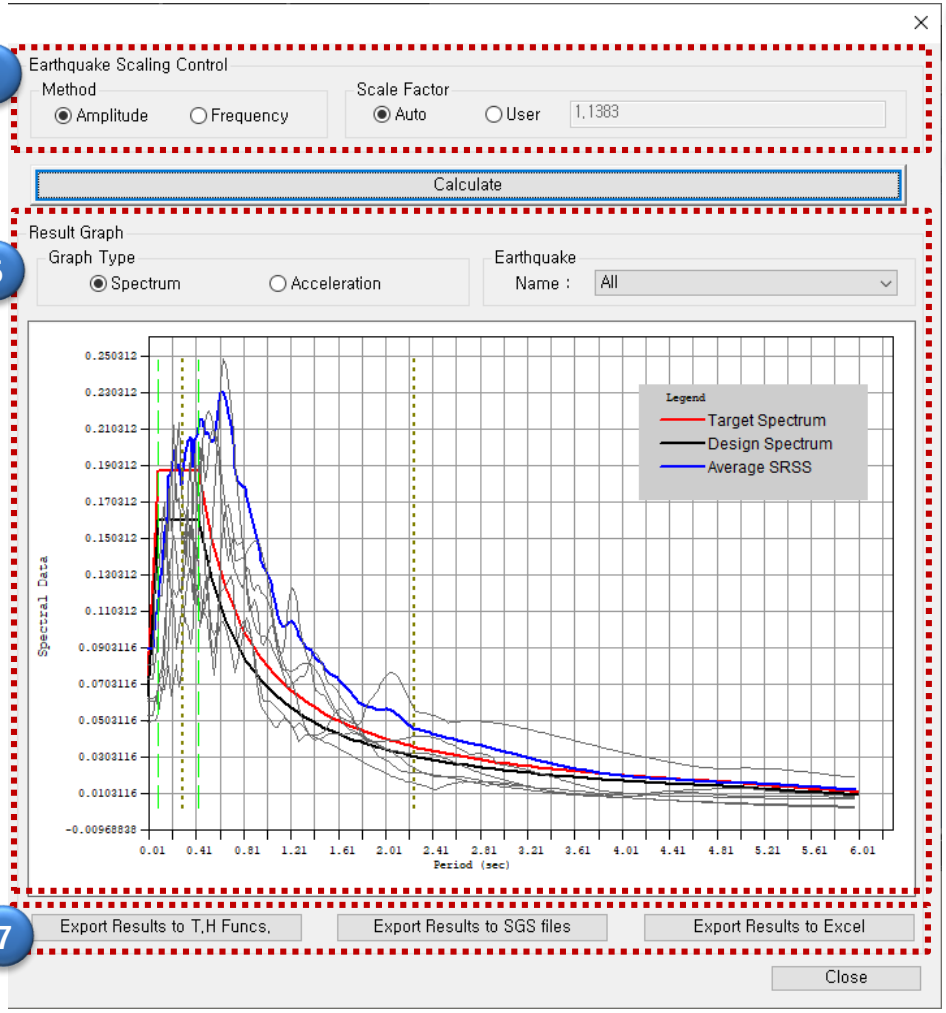
2 ***Set the design response spectrum according to the standard and input the magnification of the target spectrum.***

3 ***Set the scaling target period.***

4 ***Import and export input data as wzd files.***

9. Earthquake Scaling Calculator

-Tools > Generator > Earthquake Scaling

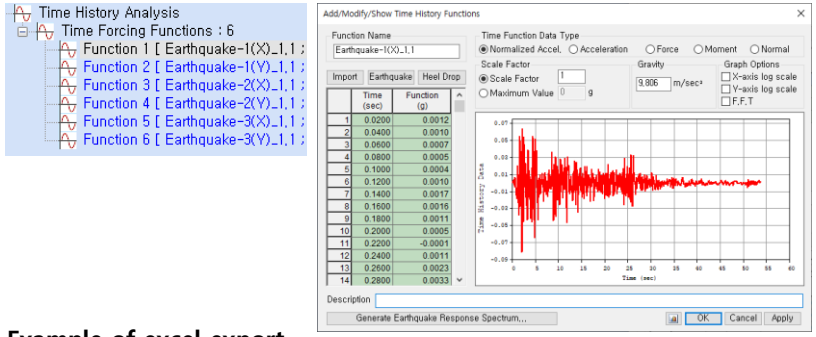


5 ***Set the method and scale factor of earthquake scaling control.***

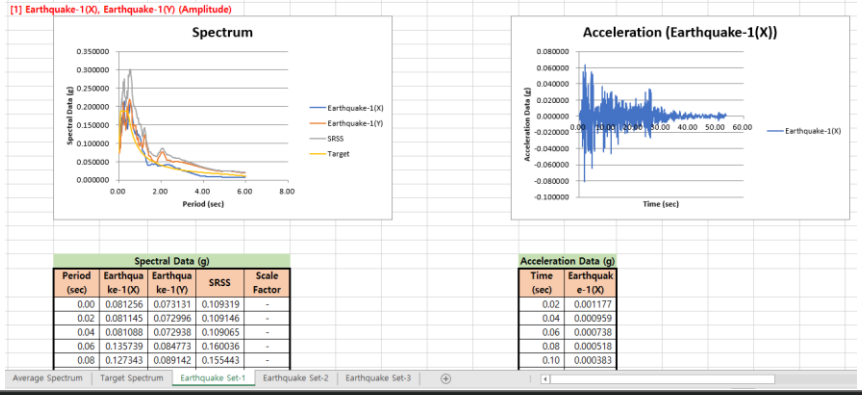
6 ***Check the scaling results in spectrum and acceleration graphs.***

7 ***The scaled seismic wave results can be exported as SGS files or time history functions or saved as Excel files.***

▪ Example of T.H function export

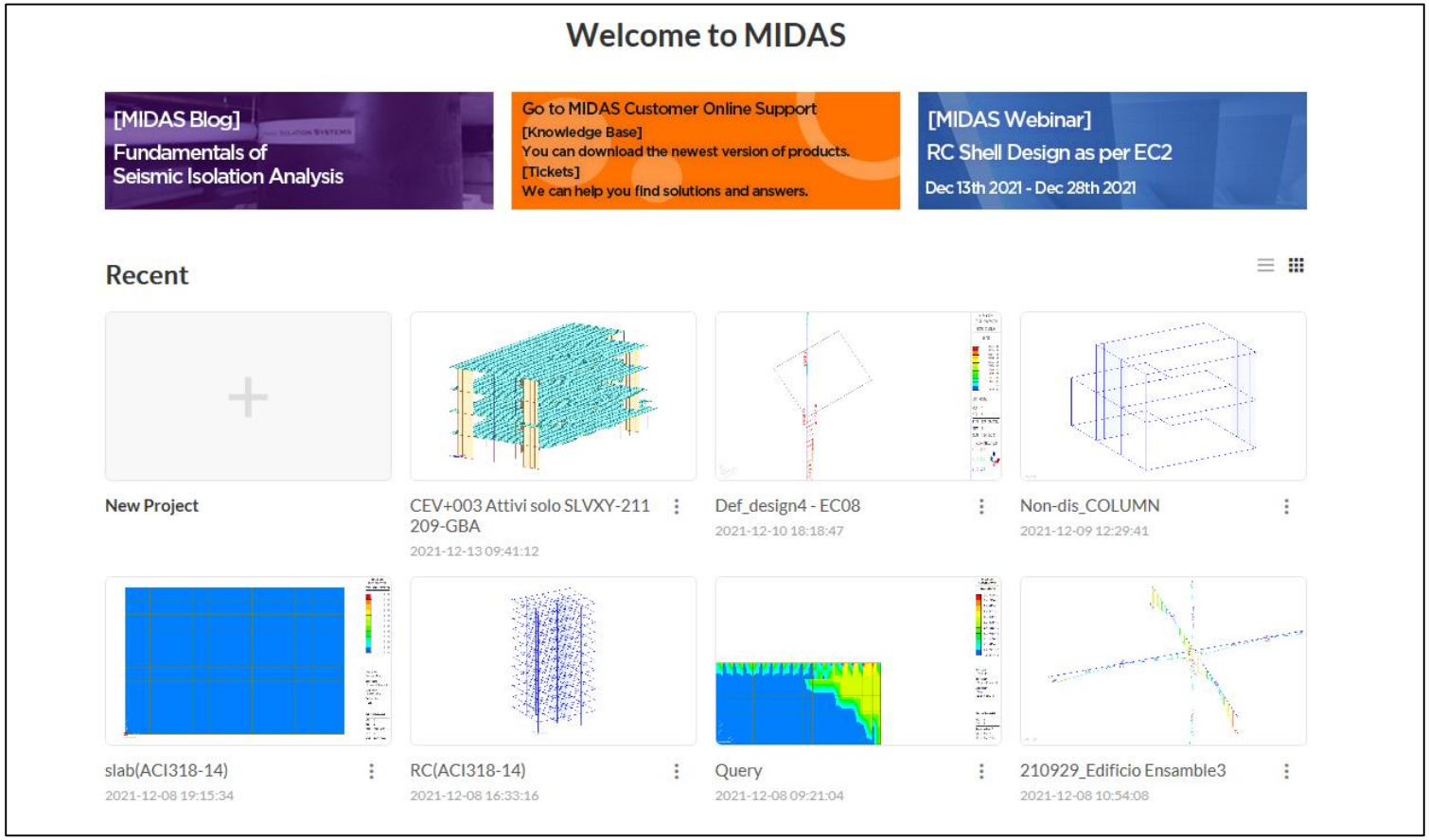


▪ Example of excel export



10. Preview function of Start Page

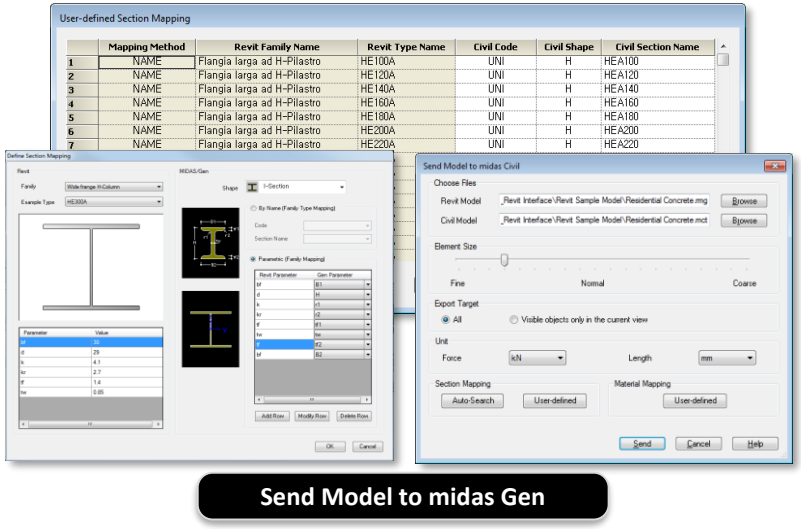
-Personalized welcome message
-A section to see most recently used models
-Link to our technical knowledge site



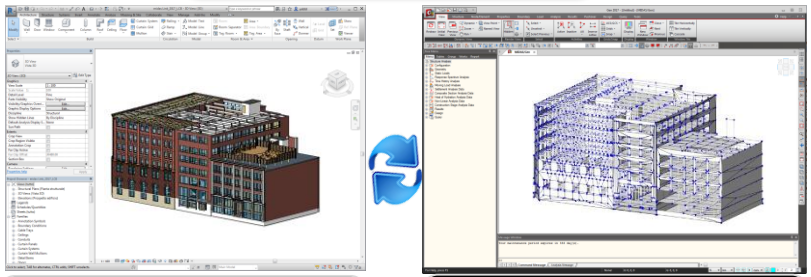
11. Revit 2022 Interface

Gen-Revit Link

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



Send Model to midas Gen



Revit 2022 | **Gen2022 v1.1 (New version)**

	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	>