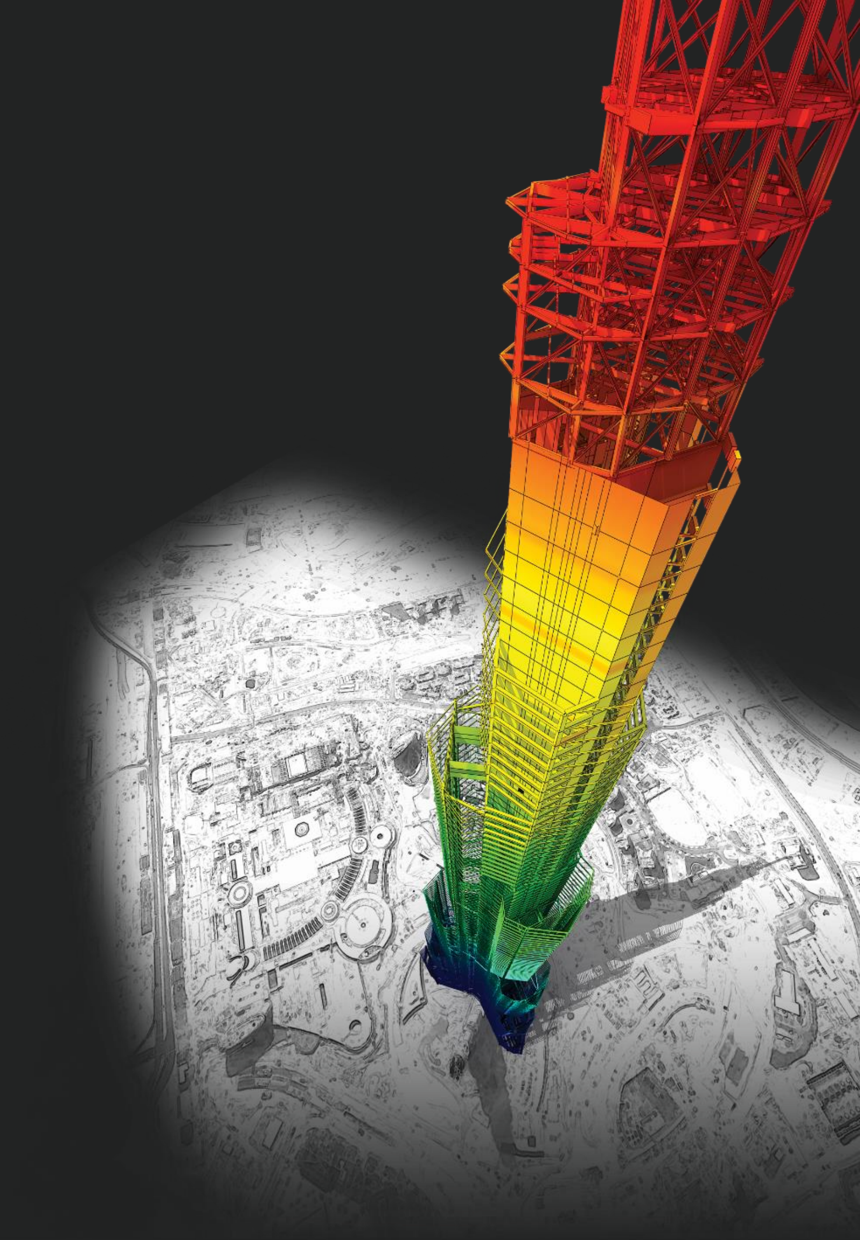
Release Note

Release Date : Mar. 2018

Product Ver. : Gen 2018 (v2.1) and Design+ 2018 (v2.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

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• midas Gen

• midas Design+

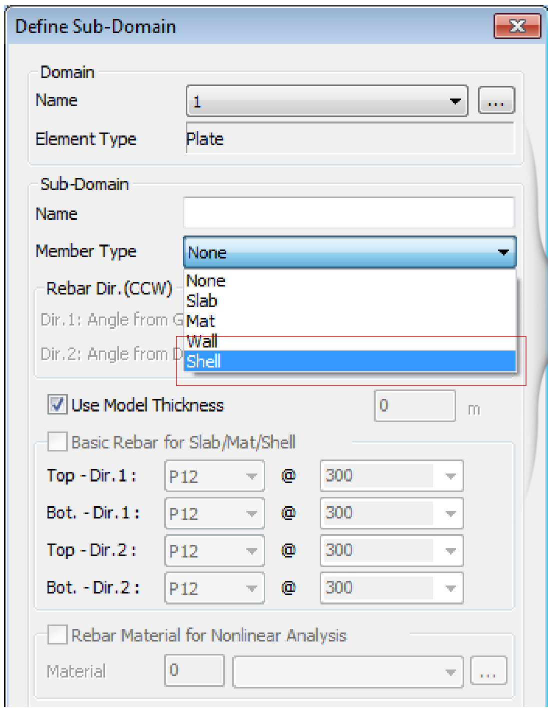
midas Gen

1. Shell Design as per Eurocode

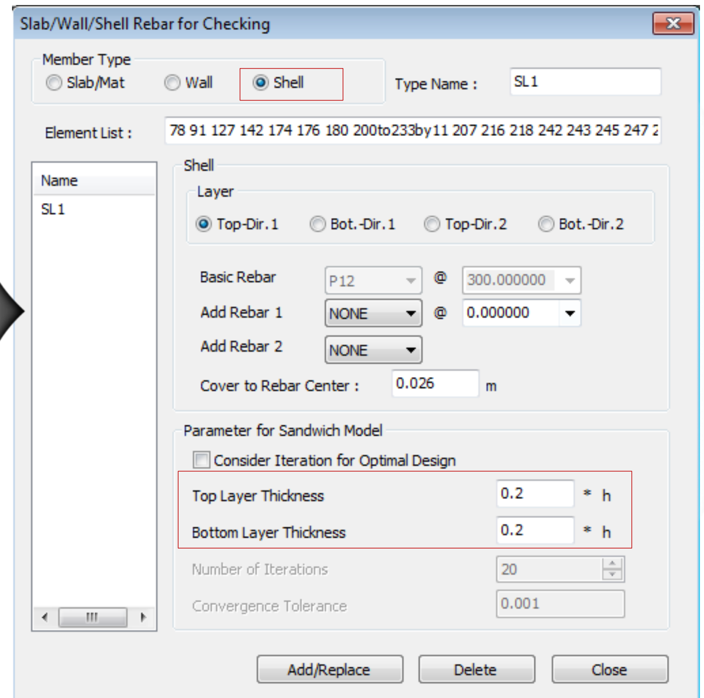
- Shell design as per EC2 (BS EN 1992-1-1:2004) is supported.
- Design and Checking for axial force, bending and shear can be done.

Shell Design

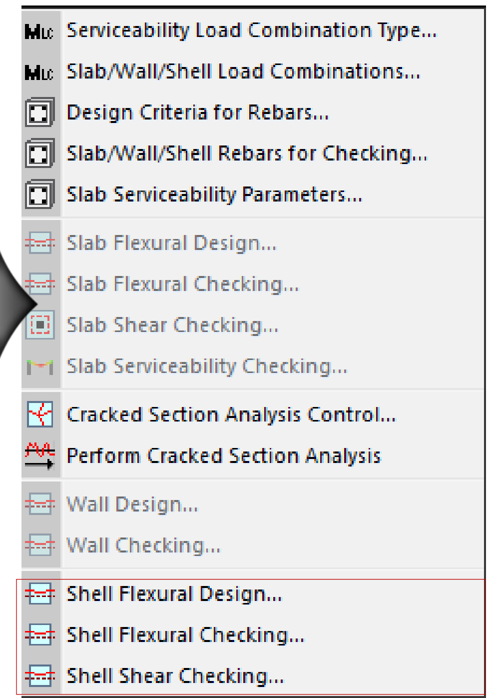
Step 1. Define as a shell element



Step 2. Define the layer of Rebar and Thickness



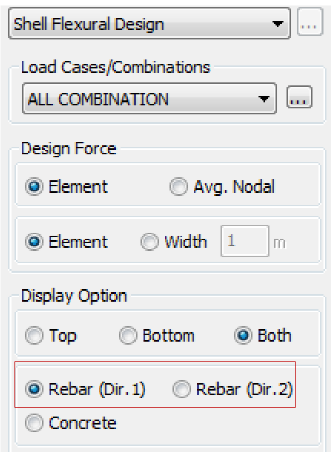
Step 3. Run Shell Design and Checking



1. Shell Design as per Eurocode

Shell Design for Flexure

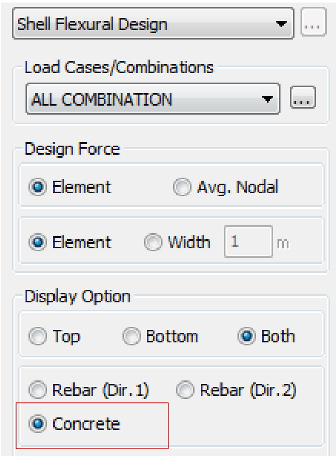
Result for Rebar



In Rebar option, the followings are supported.

1. Axial Force of Members
2. Shear Force of Members
3. Rebar Stress
4. As_req (mm^2/m)
   (Required reinforcement)
5. Rho_req
   (Area ratio of Required reinforcement)
6. Rebar Arrangement
7. Design Ratio

Result for Concrete



In Concrete option, the followings are supported.

1. Axial Force of Members
2. Shear Force of Members
3. Principal Compressive Stress of Concrete
4. Design Ratio

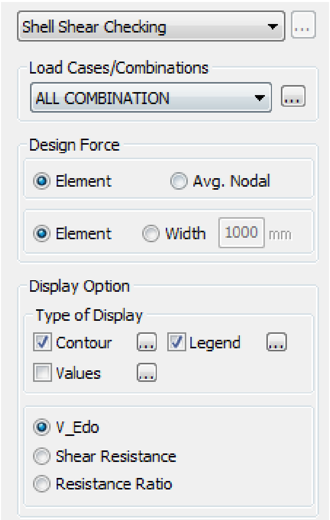
Results Table

Elem	Node	POS	CHK	Dir-1				Dir-2				Conc			
				Lcom	ftd (kN/m²)	ftd (kN/m²)	Ratio	Lcom	ftd (kN/m²)	ftd (kN/m²)	Ratio	Lcom	Sig_cd (kN/m²)	sigcdlim (kN/m²)	Ratio
2	2	TOP	NG	LC3-st	5720.27	808.63	7.07	LC3-st	1155.22	743.06	1.55	LC3-st	28.70	4000.00	0.01
2	2	BOT	NG	LC3-st	139.52	771.16	0.18	LC3-st	28.18	721.21	0.04	LC3-st	5855.31	4000.00	1.46
2	3	TOP	NG	LC3-st	5714.92	808.63	7.07	LC3-st	1148.37	743.06	1.55	LC3-st	13.97	4000.00	0.00
2	3	BOT	NG	LC3-st	139.39	771.16	0.18	LC3-st	28.01	721.21	0.04	LC3-st	5856.79	4000.00	1.46
2	7	TOP	NG	LC3-st	2992.12	808.63	3.70	LC3-st	524.62	743.06	0.71	LC3-st	69.89	4000.00	0.02
2	7	BOT	OK	LC3-st	72.98	771.16	0.09	LC3-st	12.80	721.21	0.02	LC3-st	3040.47	4000.00	0.76
2	8	TOP	NG	LC3-st	3092.07	808.63	3.82	LC3-st	630.71	743.06	0.85	LC3-st	27.22	4000.00	0.01
2	8	BOT	OK	LC3-st	75.42	771.16	0.10	LC3-st	15.38	721.21	0.02	LC3-st	3163.41	4000.00	0.79

1. Shell Design as per Eurocode

Shell Design for Shear

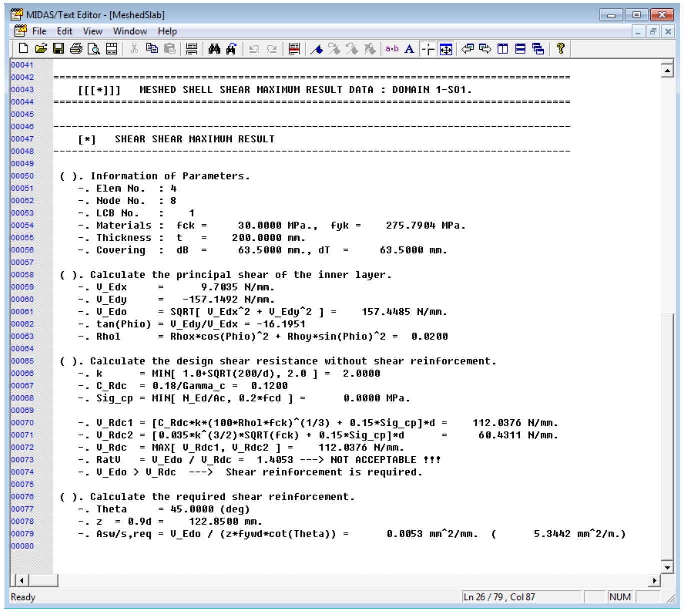
Result for One-Way Shear



In One-way shear, the followings are supported.

1. V_Ed for One-way shear
2. Shear Resistance for Concrete
3. Resistance Ratio

Text Output for design results



Results Table

	Elem	Sub-Domain	Lcom	Node	CHK	Shear Force				Resistance		
						V_Edx (kN/m)	V_Edy (kN/m)	V_Edo (kN/m)	phi_o	V_Rdc (kN/m)	V_Rds (kN/m)	Asw/s (m^2/m)
▶	2	L-B	LC2-ser	7	OK	-44.70	1.76	44.73	-0.04	117.78	0.00	0.00
	2	L-B	LC2-ser	8	OK	-43.10	1.76	43.14	-0.04	117.78	0.00	0.00
	2	L-B	LC2-ser	3	OK	-43.10	0.00	43.10	-0.00	126.37	0.00	0.00
	2	L-B	LC2-ser	2	OK	-44.70	0.00	44.70	-0.00	126.37	0.00	0.00

1. Shell Design as per Eurocode

Design Concept of Shell Design

- Shell or plate element subjected to membrane forces Nx,Ny,Nxy + flexural forces Mx,My,Mxy
- Resisted by resultant tensile forces of reinforcement + resultant compressive forces of concrete

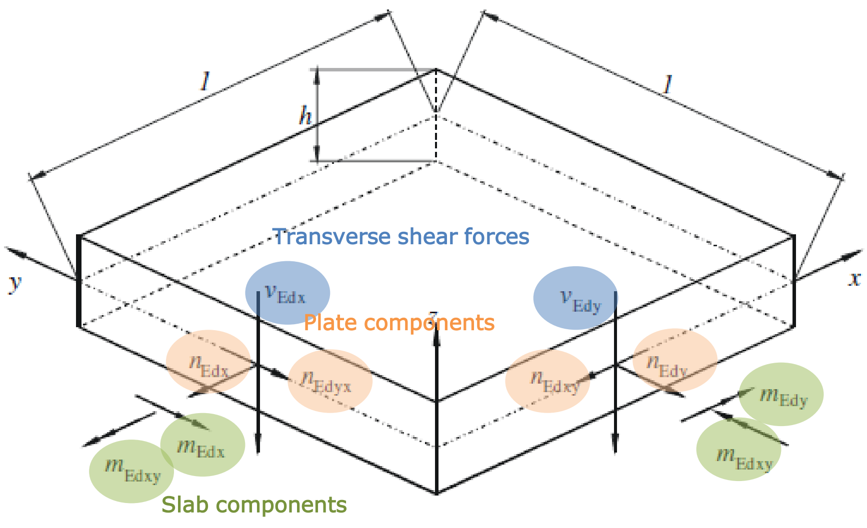


Figure LL.1 — Shell element

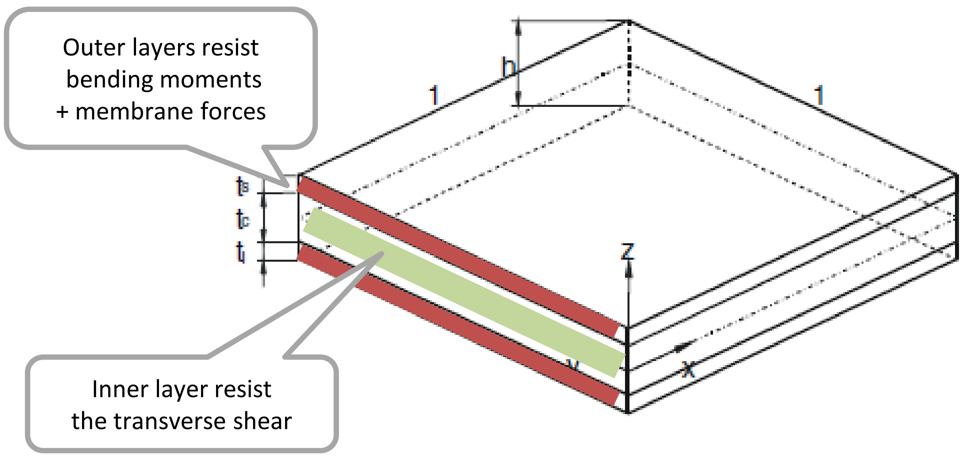
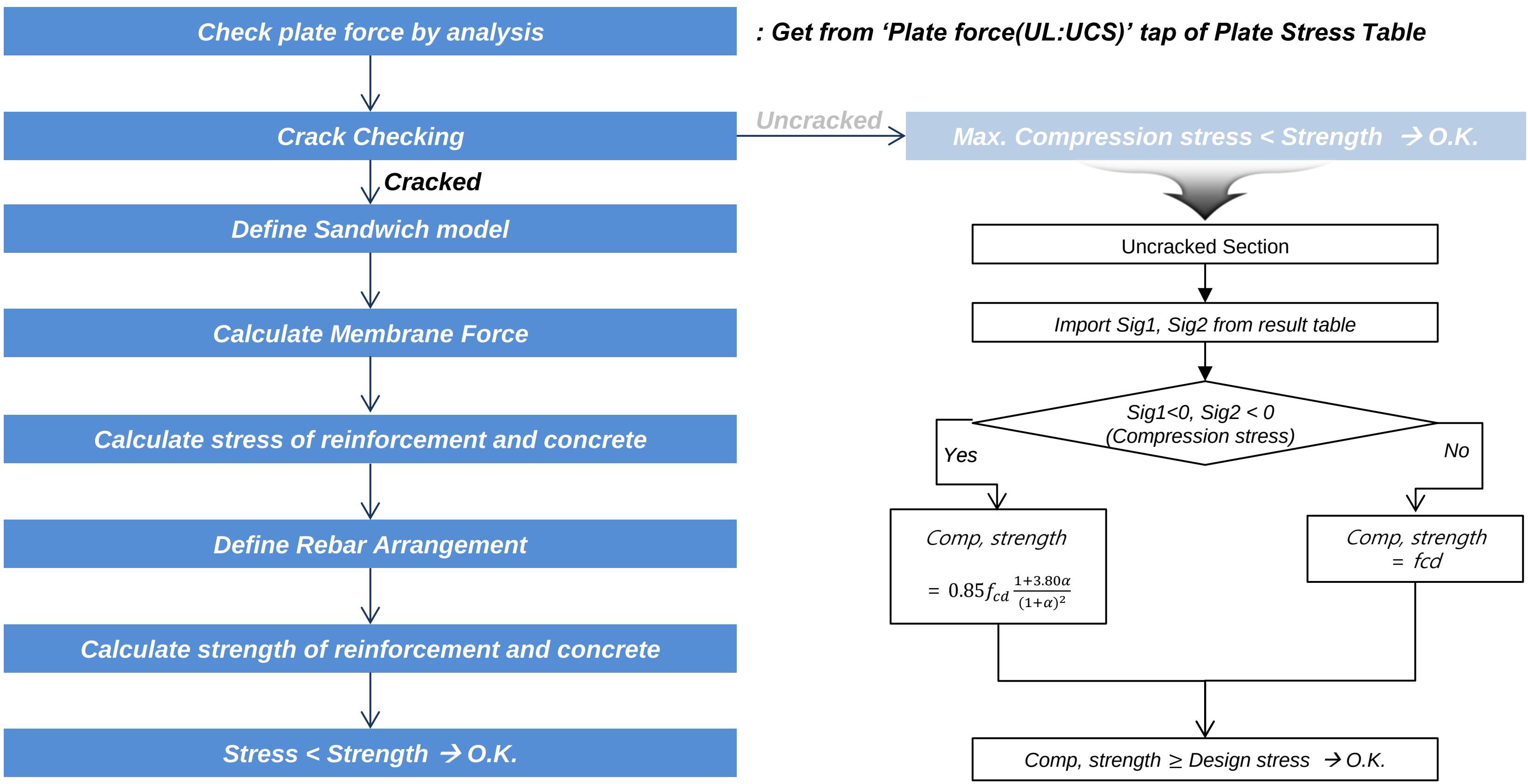


Figure LL.2 — The sandwich model

1. Shell Design as per Eurocode

Procedure of Shell Design



1. Shell Design as per Eurocode

Establishing whether shell elements are cracked [EN1992-2 : 2005]

Procedure of Shell Design

Crack Checking

$$\Phi = \alpha \frac{J_2}{f_{cm}{}^2} + \lambda \frac{\sqrt{J_2}}{f_{cm}} + \beta \frac{I_1}{f_{cm}} - 1 \le 0$$

→ *Uncracked,* *If Φ>0.0, Cracked*

where:

$$J_2 = \frac{1}{6}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2]$$

$$J_3 = (\sigma_1 - \sigma_m)(\sigma_2 - \sigma_m)(\sigma_3 - \sigma_m)$$

$$I_1 = \sigma_1 + \sigma_2 + \sigma_3$$

$$\sigma_m = (\sigma_1 + \sigma_2 + \sigma_3)/3$$

$$\alpha = \frac{1}{9k^{1,4}}$$

$$\lambda = c_1 \cos\left[\frac{1}{3}\text{ar}\cos(C_2 \cos 3\theta)\right] \quad \text{for} \quad \cos 3\theta \ge 0$$

$$\lambda = c_1 \cos\left[\frac{\pi}{3} - \frac{1}{3}\text{ar}\cos(-C_2 \cos 3\theta)\right] \quad \text{for} \quad \cos 3\theta < 0$$

$$\beta = \frac{1}{3{,}7k^{1,1}}$$

$$\cos 3\theta = \frac{3\sqrt{3}}{2} \frac{J_3}{J_2^{3/2}}$$

$$c_1 = \frac{1}{0{,}7k^{0,9}}$$

$$c_2 = 1 - 6{,}8\,(k - 0{,}07)^2$$

$$k = \frac{f_{ctm}}{f_{cm}}$$

σ1 = Max. [σx, σy] = Max. [Fxx, Fyy]

σ2 = Min. [σx, σy] = Min. [Fxx, Fyy]

σ3 = 0

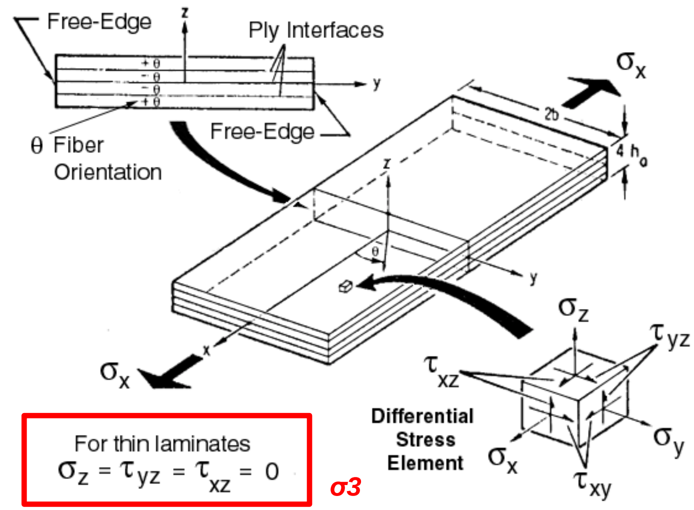


Plate Stress (UL : UCS) Table

	Elem	Load	Node	Fxx (kN/m)	Fyy (kN/m)	Fxy (kN/m)	Fmax (kN/m)	Fmin (kN/m)
▶	218	cLCB1	Cent	-17.633	-1.408	-0.083	-1.408	-17.634
	218	cLCB1	186	-18.198	-0.873	-0.319	-0.867	-18.203
	218	cLCB1	238	-17.152	-0.873	-0.275	-0.869	-17.157
	218	cLCB1	185	-17.152	-1.860	0.152	-1.859	-17.154
	218	cLCB1	150	-18.198	-1.860	0.108	-1.859	-18.198

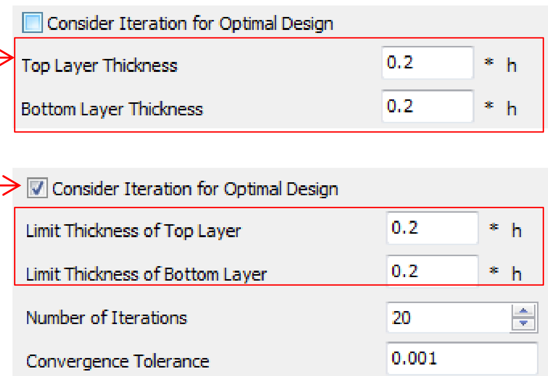
Plate Force(L) / Plate Force(G) / Plate Force(UL:Local) / **Plate Force(UL:UCS)**

1. Shell Design as per Eurocode

Procedure of Shell Design

Define Sandwich model

- Use ' 0.2*h' as default value.
- If check on " Consider Iteration for optimal design", layer thickness will be calculated automatically.
  if it does not converge, Limit Thickness will be used.



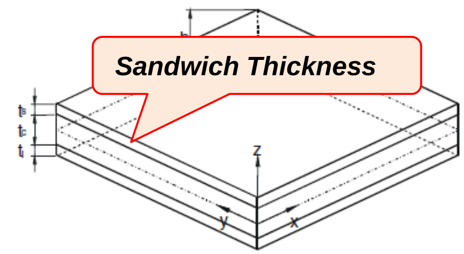


Figure LL.2 — The sandwich model

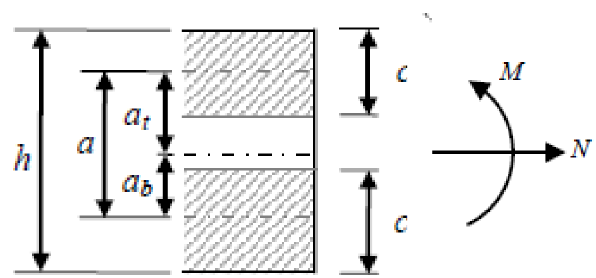
Calculate Membrane Force

- The geometry of sandwich element has to be known to compute the membrane forces (Nxk, Nyk, Nxyk).

$$N_{xt} = N_x \frac{a_b}{a} - \frac{M_x}{a} \qquad N_{xb} = N_x \frac{a_t}{a} + \frac{M_x}{a}$$

$$N_{yt} = N_y \frac{a_b}{a} - \frac{M_y}{a} \qquad N_{yb} = N_y \frac{a_t}{a} + \frac{M_y}{a}$$

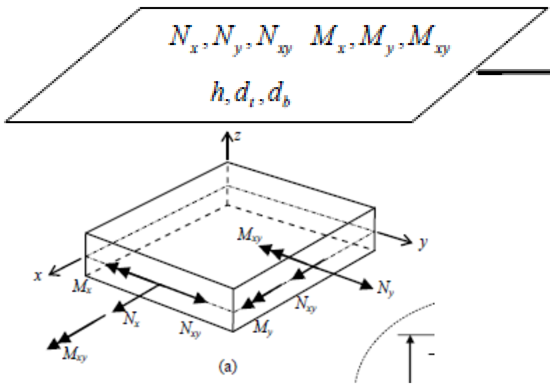
$$N_{xyt} = N_{xy} \frac{a_b}{a} - \frac{M_{xy}}{a} \qquad N_{xyb} = N_{xy} \frac{a_t}{a} + \frac{M_{xy}}{a}$$



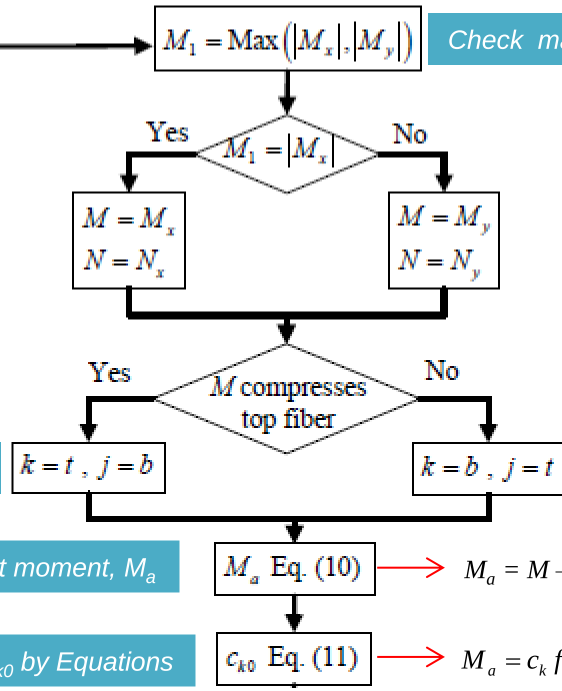
1. Shell Design as per Eurocode

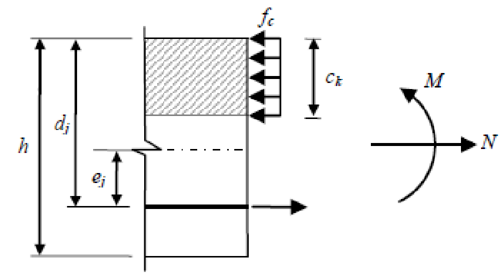
Procedure of Shell Design

Calculation of Sandwich Thickness for Optimal Design - 1



Check main moment





Define Comp. / Tens. by sign of moment

k=compression layer
j = tension layer

Cal. of Resultant moment, M_a

$M_a = M - Ne_j \qquad e_j = d_j - h/2$

Cal c_{k0} by Equations

$$M_a = c_k f_c\left(d_j - \frac{c_k}{2}\right),\ \ put\ \mu = \frac{M_a}{d_j^2 f_c}$$

$$c_k = d_j\left(1 - \sqrt{\max[1.0 - 2\mu,\ 0]}\right)$$

c_{k0} : 1st estimation of c_k
c_k : the depth of the compression block

1. Shell Design as per Eurocode

Procedure of Shell Design

Calculation of Sandwich Thickness for Optimal Design - 2

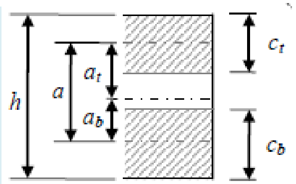
Membrane force in compression layer.

$$a = d_j - \frac{c_k}{2},\quad a_k = \frac{h - c_k}{2},\quad a_j = a - a_k$$

$$N_{xk} = N_x \frac{a_j}{a} - \frac{M_x}{a}$$

$$N_{yk} = N_y \frac{a_j}{a} - \frac{M_y}{a}$$

$$N_{xyk} = N_{xy} \frac{a_j}{a} - \frac{M_{xy}}{a}$$



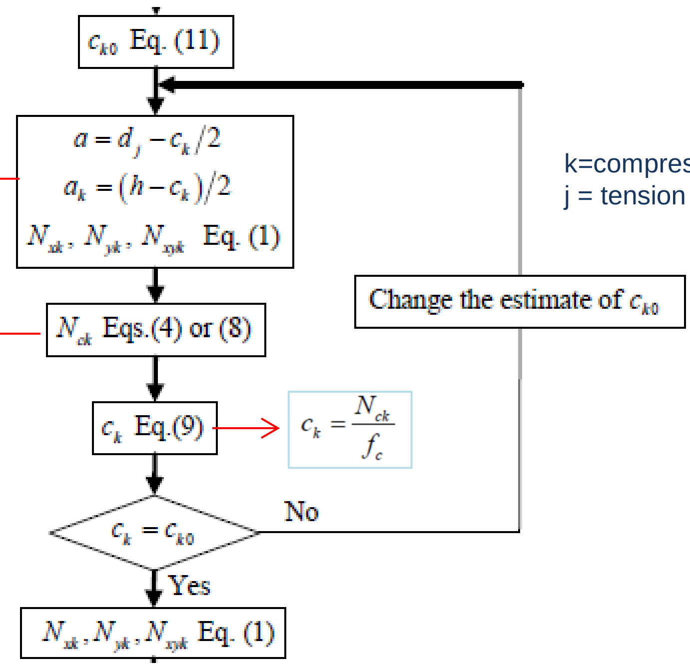
Compression Force of Concrete .

When $N_{xk} < -|N_{xyk}|,\ N_{yk} < -|N_{xyk}|$

$$N_{ck} = \frac{1}{2}(N_{xk} + N_{yk}) - \frac{1}{2}\sqrt{(N_{xk} - N_{yk})^2 + 4N_{xyk}}$$

When excluding $N_{xk} < -|N_{xyk}|,\ N_{yk} < -|N_{xyk}|$

$$N_{ck} = |N_{xyk}|(\tan\alpha_k + \cot\alpha_k)$$



k=compression layer
j = tension layer

1. Shell Design as per Eurocode

Procedure of Shell Design

Calculation of Membrane Force in tension layer and Required Rebar Area

N_{xk}, N_{yk}, N_{xyk} Eq. (1)

↓

N_{xak}, N_{yak} Eqs.(2) & (3)

$$N_{xak} = N_{xk} + |N_{xyk}| \cot \alpha_k$$
$$N_{yak} = N_{yk} + |N_{xyk}| \tan \alpha_k$$

Calculate Comp. forces in reinforcement in compressed layer.
In Gen, Ignore Comp. forces in reinforcement (Required rebar Area by comp. is 0)

↓

$$N_{xj} = N_x - N_{xk}$$
$$N_{yj} = N_y - N_{yk}$$
$$N_{xyj} = N_{xy} - N_{xyk}$$

Calculate membrane force in tensioned layer.

↓

N_{xaj}, N_{yaj} Eqs.(2) & (3)

N_{cj} Eqs.(4) or (8)

Calculate tension forces in reinforcement in tension layer.

↓

$$A_{req,x} = N_{xaj} / f_{yd}$$
$$A_{req,y} = N_{yaj} / f_{yd}$$

Calculate required Rebar Area in tension layer.

1. Shell Design as per Eurocode

Procedure of Shell Design

Calculate Force of reinforcement(Tension Layer) and concrete(Compression Layer)

$-|N_{xyk}|$

N_{yk}

$$N_{xk} < -|N_{xyk}|,\ N_{yk} \geq -|N_{xky}|$$

$$N_{xak} = 0$$

$$\alpha_k = \arctan\left(\frac{|N_{xyk}|}{-N_{xk}}\right)$$

$$N_{yak} = N_{yk} + |N_{xyk}| \tan\alpha_k$$

$$N_{ck} = |N_{xyk}|(\tan\alpha_k + \cot\alpha_k)$$

$$N_{yk} \geq -|N_{xyk}|,\ N_{xk} \geq -|N_{xky}|$$

$$\alpha_k = 45°$$

$$N_{xak} = N_{xk} + |N_{xyk}| \cot\alpha_k = N_{xk} + |N_{xyk}|$$

$$N_{yak} = N_{yk} + |N_{xyk}| \tan\alpha_k = N_{yk} + |N_{xyk}|$$

$$N_{ck} = |N_{xyk}|(\tan\alpha_k + \cot\alpha_k) = 2|N_{xyk}|$$

N_{xk}

$-|N_{xyk}|$

$$N_{xk} < -|N_{xyk}|,\ N_{yk} < -|N_{xyk}|$$

$$N_{xak} = N_{yak} = 0$$

$$N_{ck} = \frac{1}{2}(N_{xk} + N_{yk}) - \frac{1}{2}\sqrt{(N_{xk} - N_{yk})^2 + 4N_{xyk}^2}$$

$$N_{yk} < -|N_{xyk}|,\ N_{xk} \geq -|N_{xky}|$$

$$N_{yak} = 0$$

$$\alpha_k = \arctan\left(\frac{-N_{yk}}{|N_{xyk}|}\right)$$

$$N_{xak} = N_{xk} + |N_{xyk}| \cot\alpha_k$$

$$N_{ck} = |N_{xyk}|(\tan\alpha_k + \cot\alpha_k)$$

N_{xak}, N_{yak} : tension forces in reinforcement placed in x and y direction in layer k

N_{ck} : Concrete compression force in layer k

1. Shell Design as per Eurocode

Procedure of Shell Design

Modification of Tension force by considering the location of rebar

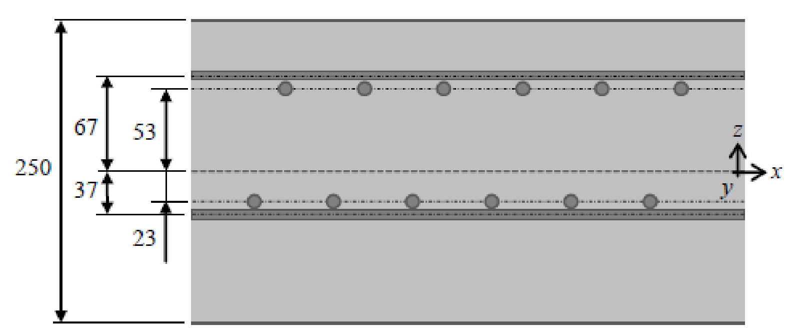
Distance from center section to center of outerRebar

Distance from center section to center of sandwich thickness

$$z_{ya} = \frac{N_{yat}\boxed{z_{yat}} + N_{yab}\boxed{z_{yab}}}{\sum N_{ya}} = \frac{168.71 \cdot 67 + 229.47(-80)}{398.18} = -17.72\ mm$$

The actual positions of y reinforcement in top and bottom layer are $z^*_{yat} = 53$ mm and $z^*_{yab} = -23$ mm, the corresponding tension forces at those levels, N^*_{yat} and N^*_{yab}, can be obtained from:

All the measurements in mm



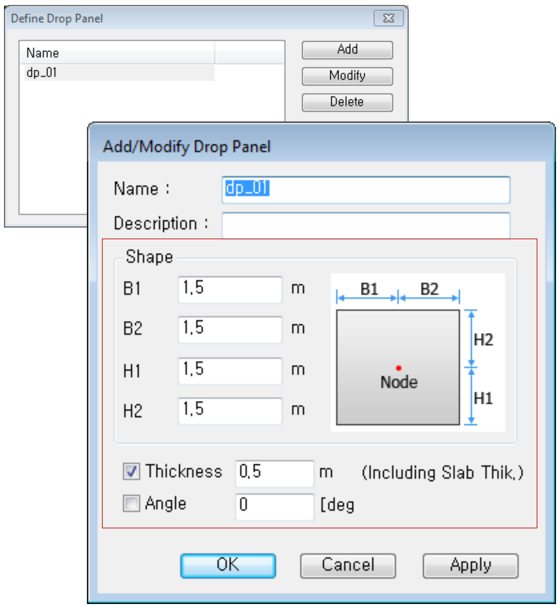
$$N^*_{yat} = \sum N_{ya} \frac{z_{ya} - z^*_{yab}}{z^*_{yat} - z^*_{yab}} = 398.18 \frac{-17.72 + 23}{53 + 23} = 27.68\ N/mm$$

$$N^*_{yab} = \sum N_{ya} \frac{z^*_{yat} - z_{ya}}{z^*_{yat} - z^*_{yab}} = 398.18 \frac{53 + 17.72}{53 + 23} = 370.50\ N/mm$$

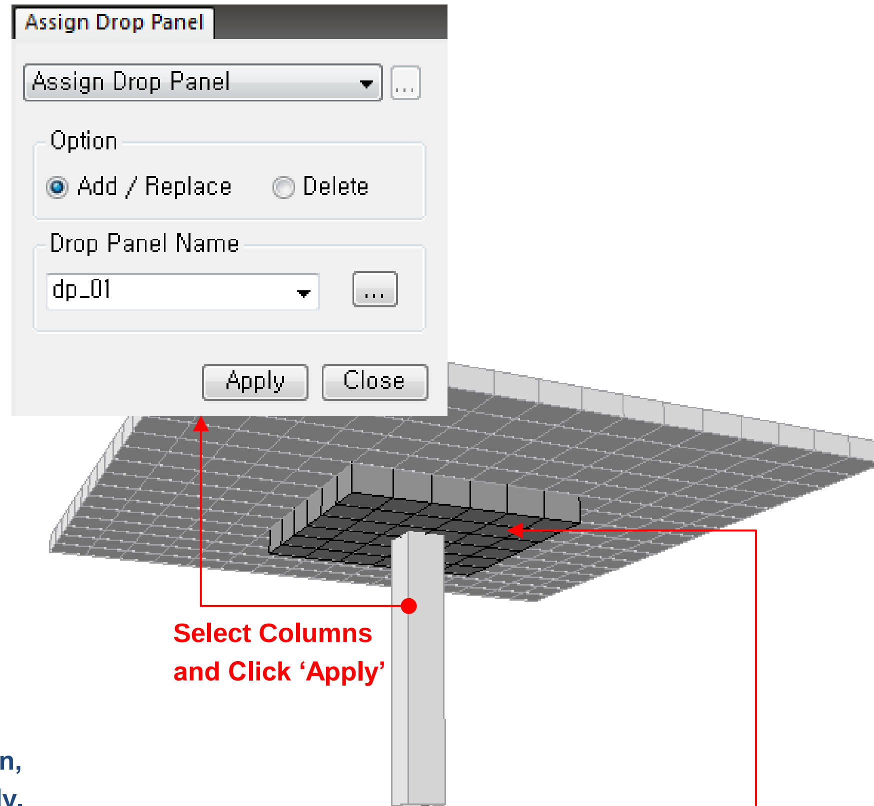
2. Modeling for Drop Panel and Column Capital

Drop Panel : Node/Element > Flat/Plate Structure > Drop Panel

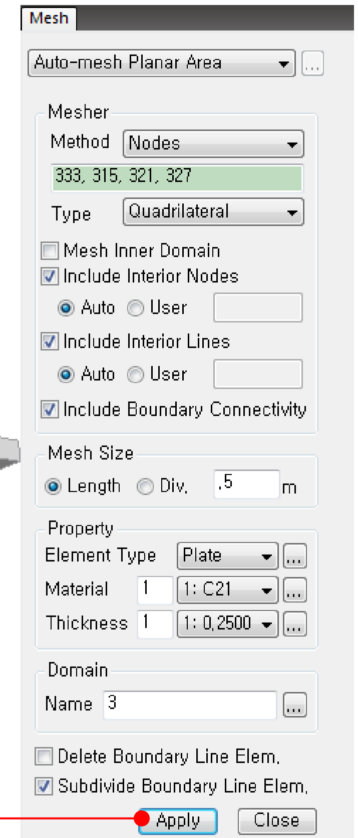
Step 1 : Define Drop Panel



Step 2 : Assign Drop Panel



Step 3 : Apply Auto-mesh

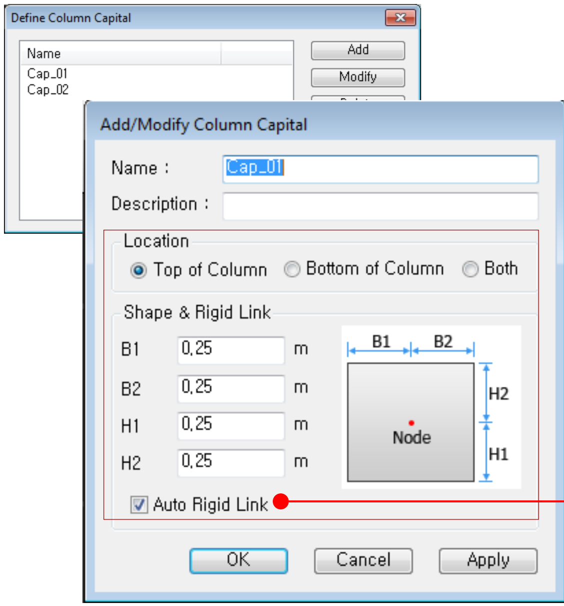


When modeling a slab by 'Auto-mesh' function, the defined drop panel generates automatically.

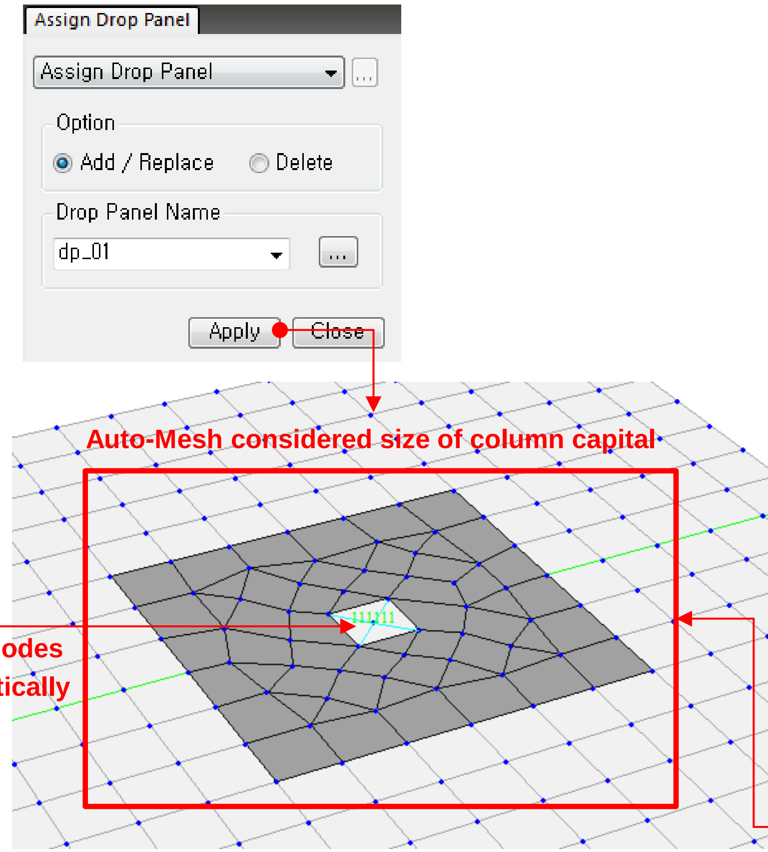
2. Modeling for Drop Panel and Column Capital

Column Capital : Node/Element > Flat/Plate Structure > Column Capital

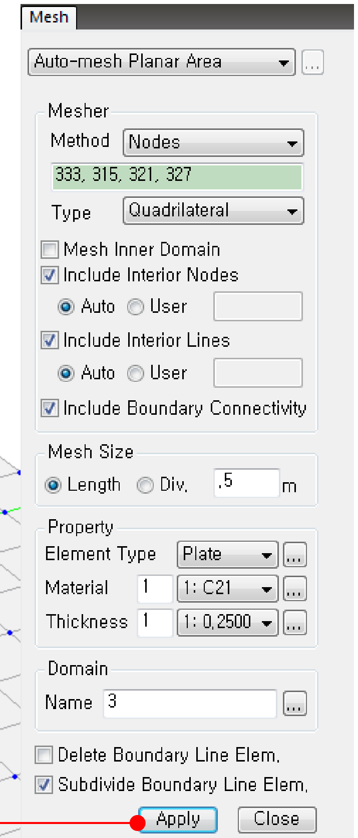
Step 1 : Define Drop Panel



Step 2 : Assign Drop Panel and run "Auto mesh"



Step 3 : Apply Auto-mesh



Rigid Link is defined for nodes of column capital automatically

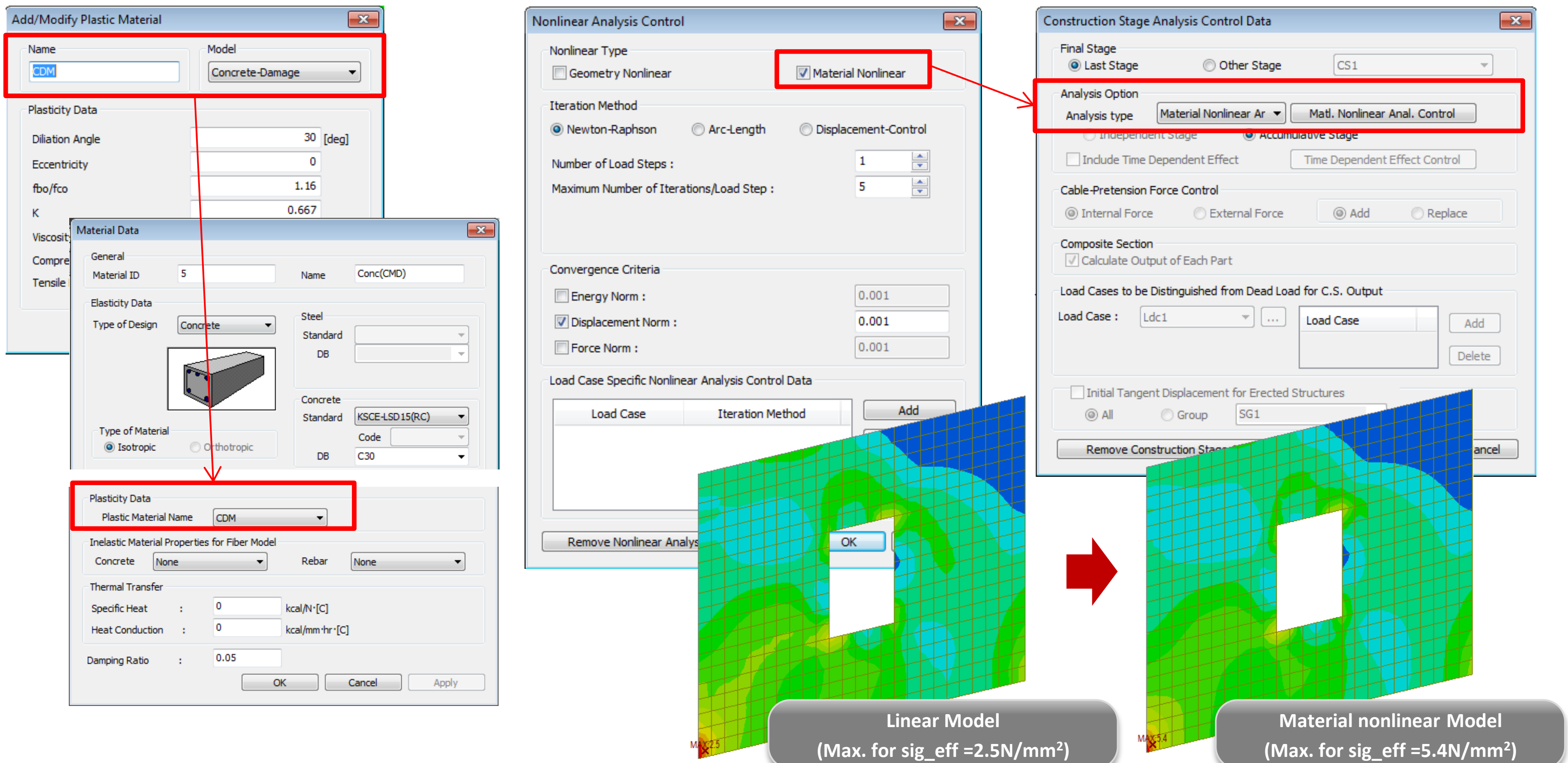
When modeling a slab by 'Auto-mesh' function, It is considering size of column capital and defining the rigid link for nodes in column capital

3. Construction Stage Analysis considering Material Nonlinearity

- Construction stage analysis with material nonlinear is supported
- Plastic model for material can be defined in dialog box of 'Plastic Material' and 'Material Data'

Setting for Construction Stage Analysis with Material nonlinear

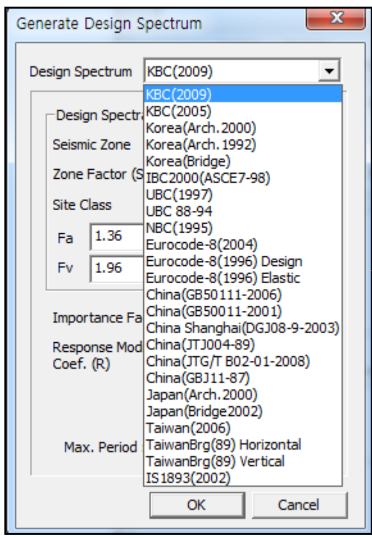
Step 1. Define Plastic Material Data ***Step 2. Define Material Nonlinear*** ***Step 3. Define Construction stage analysis Option***



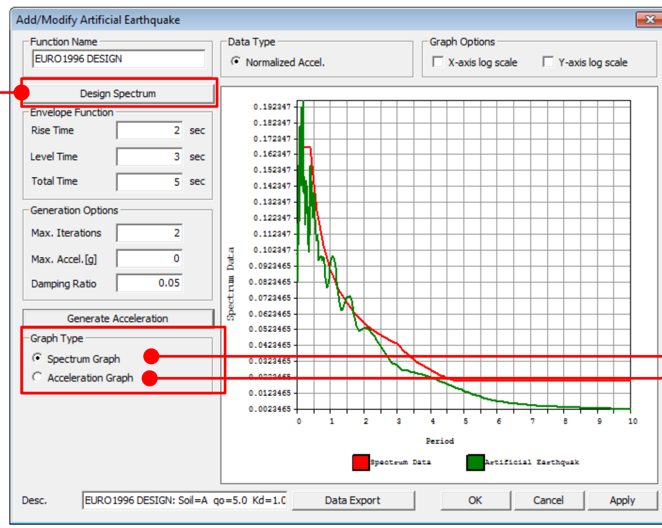
4. Addition of artificial earthquake generation function of dynamic analysis

- Spectral load and time history load used for dynamic analysis (Response Spectrum Analysis and Time History Analysis) can be generated as artificial seismic waves.
- It is possible to apply dynamic load with various variables through artificial earthquake generation referring to Design Spectrum according to country code.

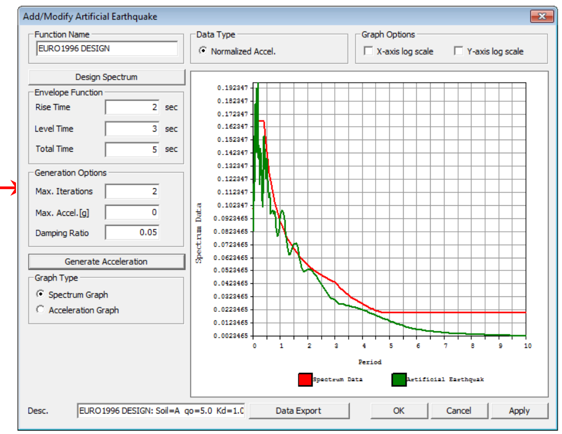
artificial earthquake : Tools > Data Generator > Artificial Earthquake

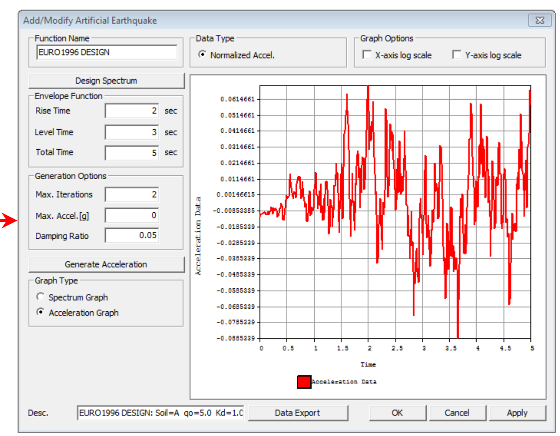


Design Spectrum



Generation of Artificial Earthquake



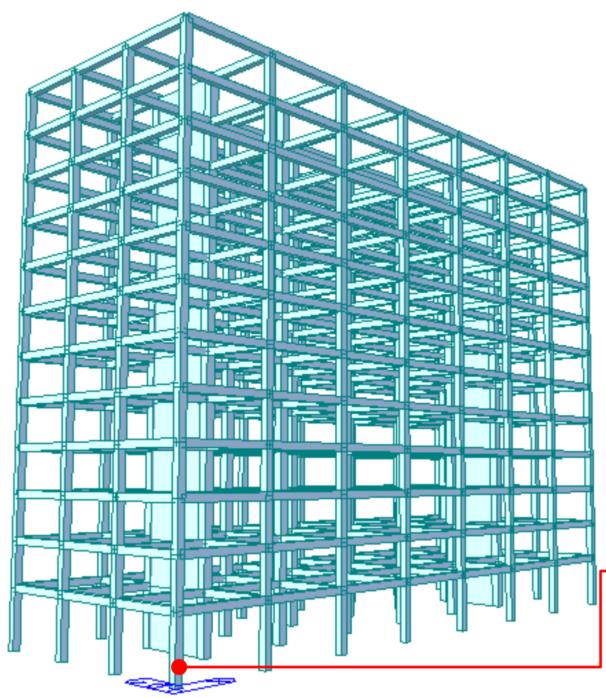


5. Reinforcement data interchange between Gen and GSD

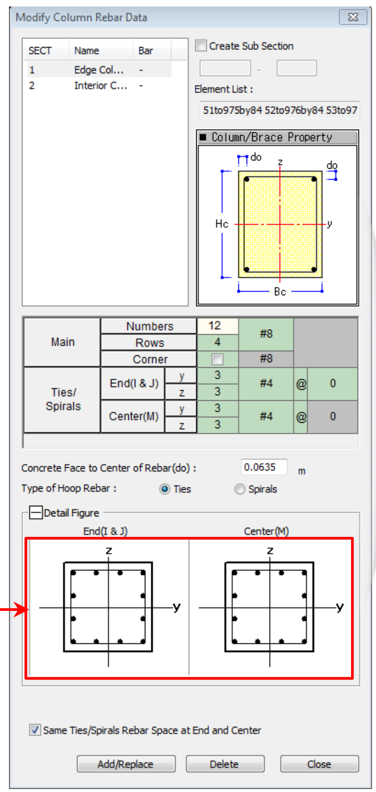
- Addition of the function to link rebar input data to Gen column with GSD.
- Improvement of GSD design process (Interaction Curve and Moment Curvature Curve) through convenient reinforcement input function of Gen.

Design > RC Design > Beam Section Data for Checking

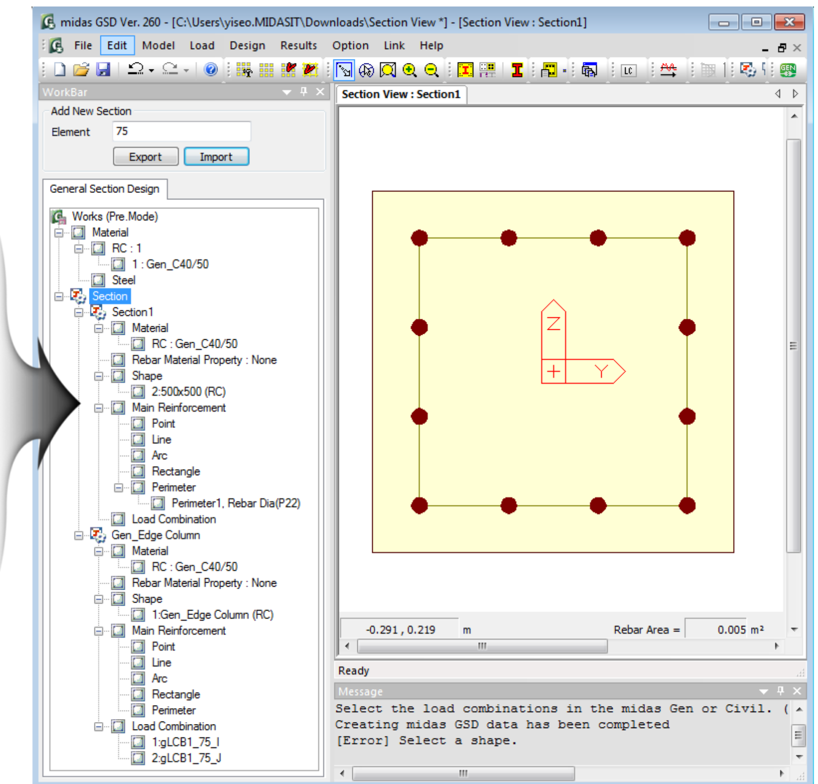
Design > RC Design > Column Section Data for Checking



Rebar input in Gen



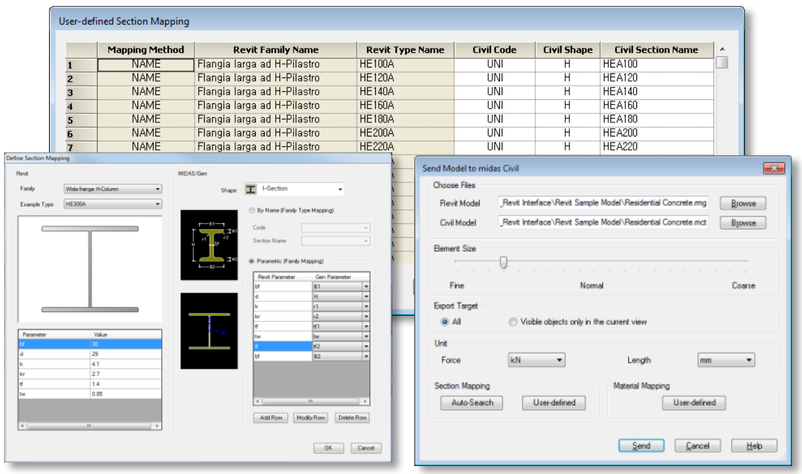
Reinforcement data interlock between Civil and GSD



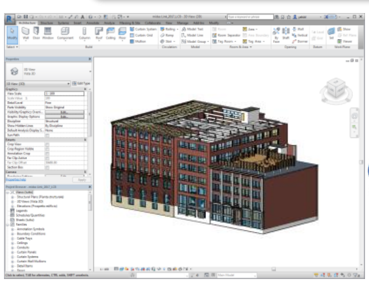
6. Revit 2018 Interface

- Using Midas Link for Revit Structure, direct data transfer between midas Gen and Revit 2018 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

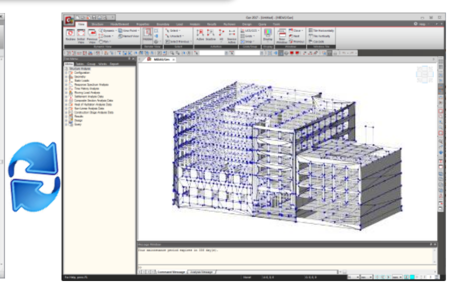
- ***File > Import > midas Gen MGT File***
- ***File > Export > midas Gen MGT File***



Send Model to midas Gen



Revit 2018

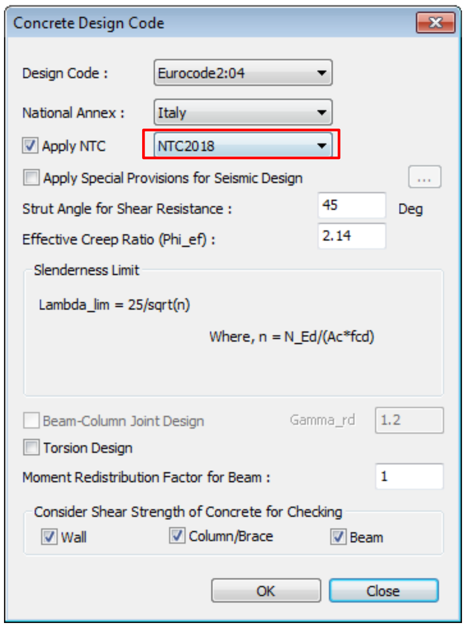


Gen2018

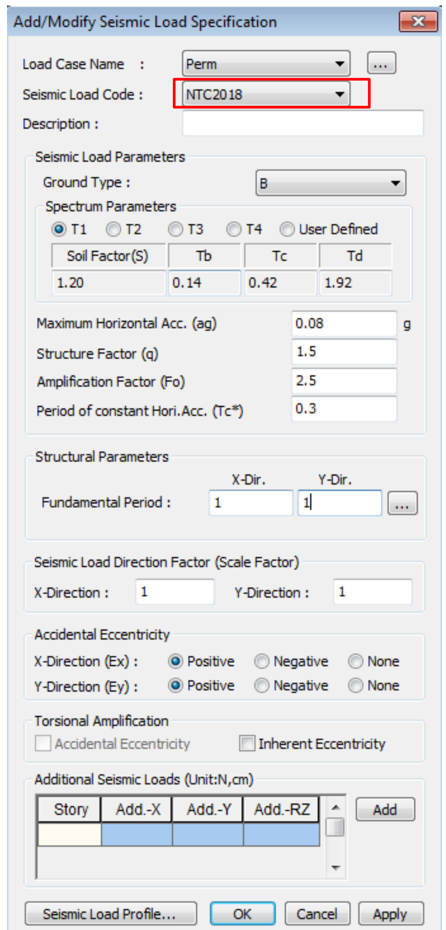
	Functions	Revit <> Gen
Linear Elements	Structural Column	< >
	Beam	< >
	Brace	< >
	Curved Beam	>
	Beam System	>
	Truss	>
Planar Elements	Foundation Slab	< >
	Structural Floor	< >
	Structural Wall	< >
	Wall Opening & Window	>
	Door	>
	Vertical or Shaft Opening	>
Boundary	Offset	>
	Rigid Link	>
	Cross-Section 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	>

7. Member Design as per NTC 2018

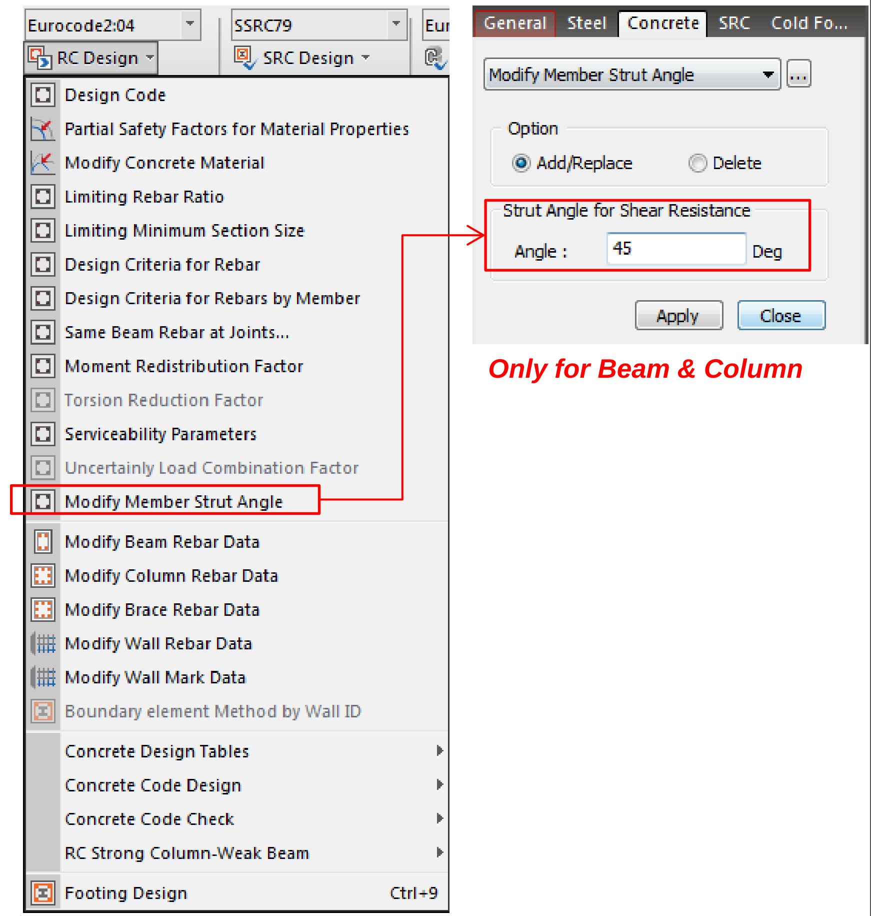
Concrete Design Code



Seismic Load Specification



User input for Strut angle for concrete shear resistance



Only for Beam & Column

7. Member Design as per NTC 2018

- *Add serviceability stress checks for 'Quasi Permanent' load combination*

Detail report

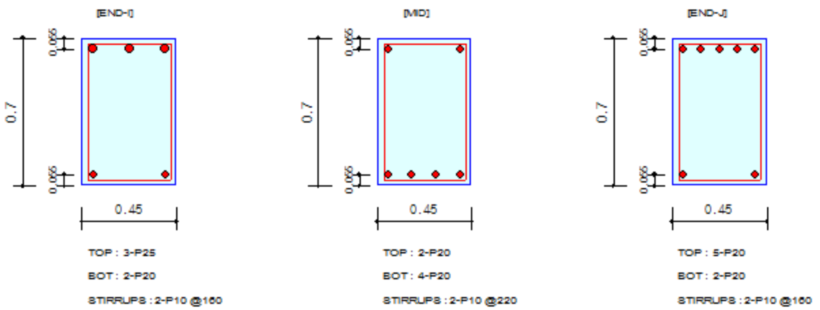
```
Calculate stress and check linear creep.
 -. LCB    =   30  (Quasi-permanent)
 -. k2     =     0.45000

 ( Assumed Uncracked Section )

 -. |Mu|   =      176.57 kN-m.
 -. n      =    12.18154( Long Term ).
 -. fctm   = 0.30 * fck^(2/3)        =  2896.46815 KPa.
 -. fr1    = (1.6 - H/1000) * fctm   =  2317.17452 KPa.
 -. fr     = MAX[ fctm, fr1 ]        =  2896.46815 KPa.
 -. z_bar  =      0.40207 m.
 -. Iyy    =      0.03279 m^4.

 -. Ss_con (Tens.) = Mu*(H-z_bar)/Iyy   =  2142.66645 KPa.
 -. Ss_con (Tens.) < fr    ---> UnCracked Section !

 -. Ss_con (Comp.) = Mu*(z_bar)/Iyy =  2164.99199 KPa.
    Ss_con (Comp.) < k2*fck = 13500.00000 KPa.   ---> O.K! and Linear Creep
```

Graphic report

Stress Check

	END-I		MID		END-J	
	Concrete	Rebar	Concrete	Rebar	Concrete	Rebar
(-) Load Combination No.	17(C)	17(C)	30(Q)	30(Q)	15(C)	15(C)
Stress(s)	2664.06	27678.56	0.00	0.00	1708.79	17953.55
Allowable Stress(sa)	18000.00	400000.00	0.00	0.00	18000.00	400000.00
Stress Ratio(s/sa)	0.1480	0.0692	*****	*****	0.0949	0.0449
(+) Load Combination No.	19(C)	19(C)	15(C)	15(C)	17(C)	17(C)
Stress(s)	354.06	3761.79	1418.04	14898.72	767.72	8066.08
Allowable Stress(sa)	18000.00	400000.00	18000.00	400000.00	18000.00	400000.00
Stress Ratio(s/sa)	0.0197	0.0094	0.0788	0.0372	0.0427	0.0202

- *Add plot of VRd,max, VRd,s when VRd,c <1*



Shear Capacity

	END-I	MID	END-J
Load Combination No.	6	6	2
Factored Shear Force (V_Ed)	174.35	109.51	150.13
Shear Strength by Conc.(V_Rdc)	187.00	187.00	187.00
Shear Strength by Rebar.(V_Rds)	183.17	183.17	183.17
Shear Strength by Rebar.(V_Rdmax)	2478.17	2478.17	2478.17
Required Shear Reinf. (Asw)	0.0008	0.0008	0.0008
Required Stirrups Spacing	2-P10 @200	2-P10 @200	2-P10 @200
Shear Ratio by Conc	0.9323	0.5856	0.8028
Shear Ratio by (V_Rds ; V_Rdmax)	0.9518	0.5979	0.8196
Check Ratio	0.9323	0.5856	0.8028

- ***Classification of load combinations***

  (C : Characteristic   Q : Quasi-permanent)

7. Member Design as per NTC 2018

- ***Detail Report for Punching Shear Checking as per 6.4.4 and 6.4.5 of UNI EN1992-1-1 (Scheduled for June)***

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

RatV    = Beta*V_Ed / V_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*V_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*V_Ed/(V_Rd,c/u1) =   8.0010 m.
```

Calculating "Area(Asw) / space(Sr)" of shear reinforcement.

as per SS-EN 1992-1-1:2005/A1:2014

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

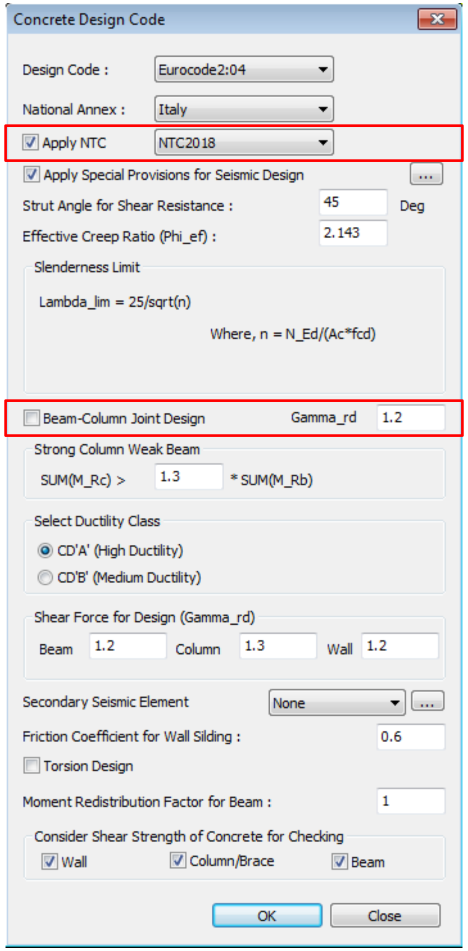
$$v_{Rd,cs} = 0{,}75\, v_{Rd,c} + 1{,}5\,(d/s_r)\, A_{sw} f_{ywd,ef}\,[1/(u_1 d)]\sin\alpha \boxed{\le k_{max} \cdot v_{Rd,c}} \qquad (6.52)$$

where

- A_{sw} is the area of one perimeter of shear reinforcement around the column [mm^2];
- 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 $f_{ywd,ef} = 250 + 0{,}25\, d \le f_{ywd}$ [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.

- ***Remove the default "flag" for Beam-Column Joint Design***



7. Member Design as per NTC 2018

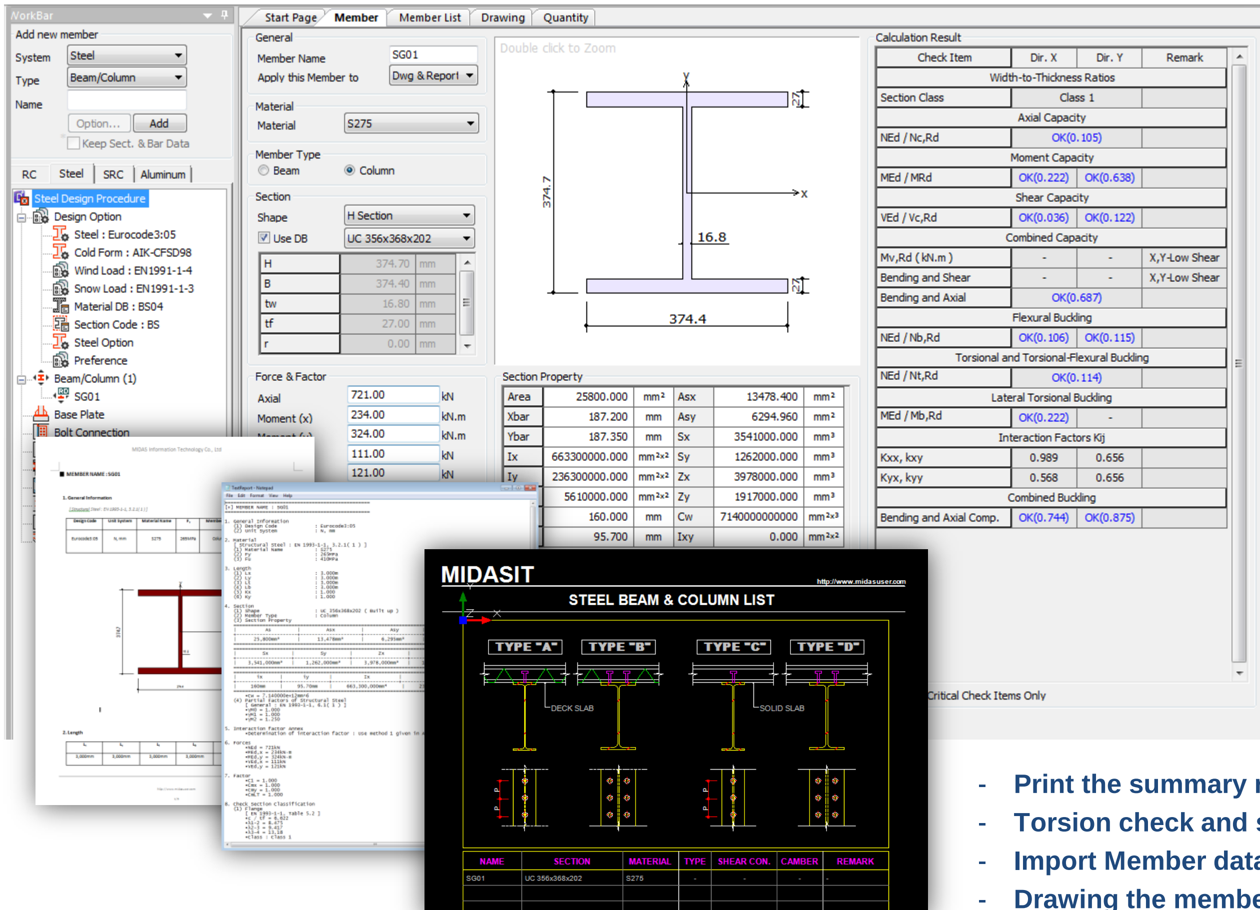
Location in NTC 2018	Details
7.2.5	**Minimum rebar ratio for mat foundation modifies the limit from 0.2% to 0.1%**
7.4.4.5.1	**When checking Wall element, it is not supported to apply ±50%N for design of wall.**
7.4.6.2.4	**Minimum Rebar Ratio for Wall Element and Plate Type Wall (ASWD) will be modified as As/Ac = 0.002 (Vertical and Horizontal)**
7.4.6.2.2	**Construction details for Ductility for column**
7.4.6.2.4	**Construction details for Ductility for wall**
7.4.4.1.2	**Update formula for Check of Ductility:** $\mu_\phi = \begin{cases} 1{,}2\cdot(2q_0-1) & \text{per } T_1 \geq T_C \\ 1{,}2\cdot\left(1+2(q_0-1)\frac{T_C}{T_1}\right) & \text{per } T_1 < T_C \end{cases}$ [7.4.3]

midas Design+

1. Steel Design as per Eurocode

- Supports steel beam and column design as per per EC3 (BS EN 1993-1-1:2005)
- Steel design supports only H-shape.

Steel Design as per Eurocode



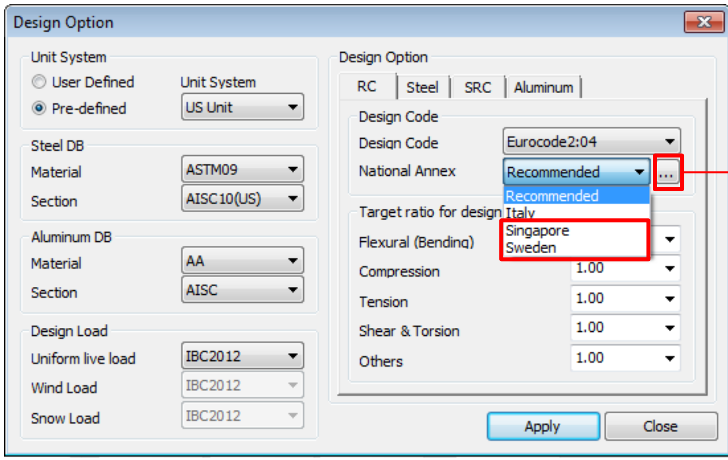
Checking item for Ultimate Limit State

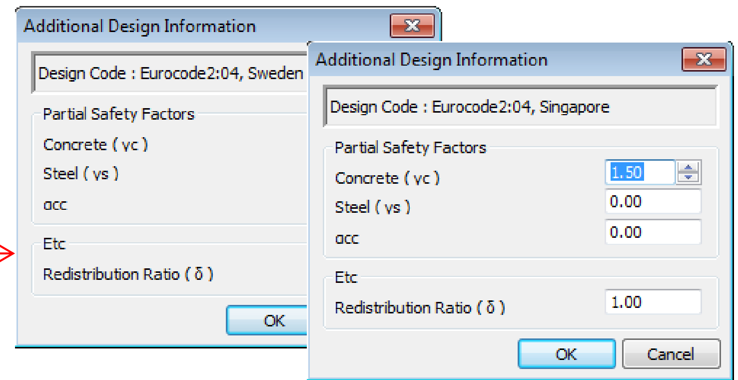
- **Resistance of cross-section**
  - Compression resistance
  - Bending Moment resistance
  - Shear (by Shear Buckling) resistance
  - Bending and Shear resistance
  - Bending and Axial force resistance
  - Bending, Shear and Axial force resistance
- **Buckling resistance of members**
  - Flexural buckling resistance
  - Torsional and Torsional-flexural buckling
  - Lateral torsional buckling resistance
  - Uniform member in bending and compression

- **Print the summary report and detail report as MS word or Text file**
- **Torsion check and serviceability limit state check are not supported**
- **Import Member data and force data from Gen by Midas Link**
- **Drawing the member list**

2. Addition of EC N.A. for RC Design

- National Annex of Singapore and Sweden is added





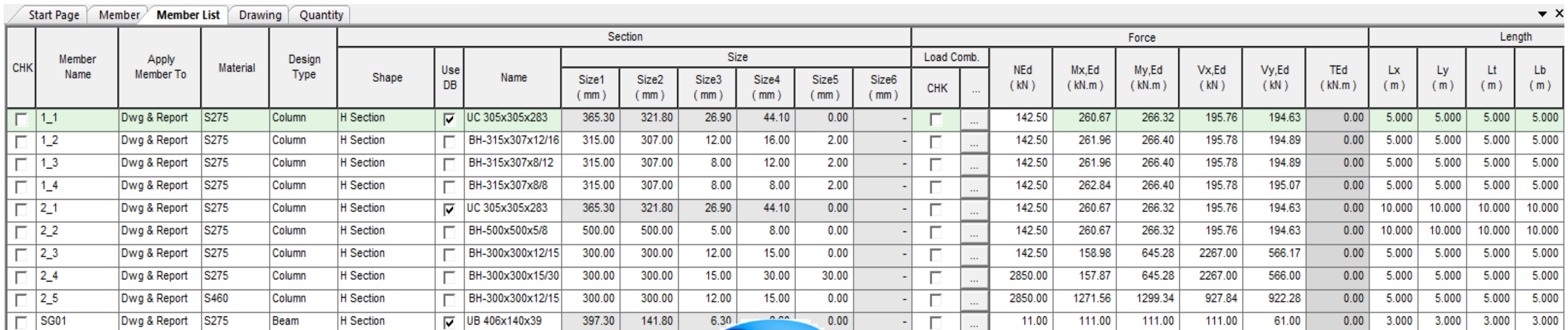
Additional Design Information for Sweden and Singapore

- **If click "Code Table", You can see a comparison table for each NA.**

3. Copy & Paste function in Member List table

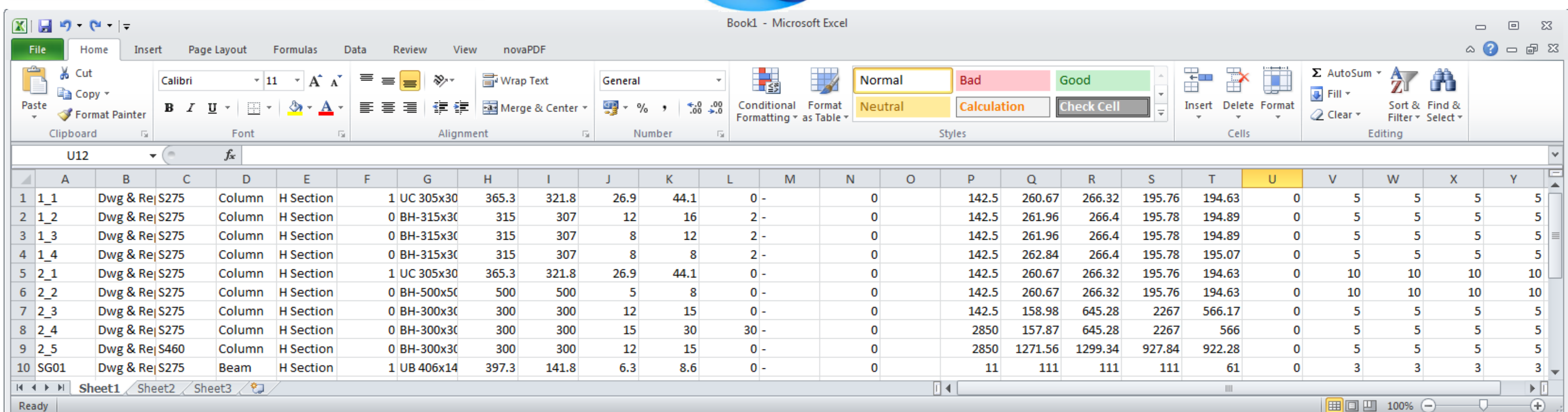
- *We can copy the value of the member list table to SW such as Excel, and simply edit the model data by pasting the modified value into the Member list table.*

Design+ : Member List



CHK	Member Name	Apply Member To	Material	Design Type	Section: Shape	Use DB	Name	Size1 (mm)	Size2 (mm)	Size3 (mm)	Size4 (mm)	Size5 (mm)	Size6 (mm)	Load Comb. CHK	...	NEd (kN)	Mx,Ed (kN.m)	My,Ed (kN.m)	Vx,Ed (kN)	Vy,Ed (kN)	TEd (kN.m)	Lx (m)	Ly (m)	Lt (m)	Lb (m)
☐	1_1	Dwg & Report	S275	Column	H Section	☑	UC 305x305x283	365.30	321.80	26.90	44.10	0.00	-	☐	...	142.50	260.67	266.32	195.76	194.63	0.00	5.000	5.000	5.000	5.000
☐	1_2	Dwg & Report	S275	Column	H Section	☐	BH-315x307x12/16	315.00	307.00	12.00	16.00	2.00	-	☐	...	142.50	261.96	266.40	195.78	194.89	0.00	5.000	5.000	5.000	5.000
☐	1_3	Dwg & Report	S275	Column	H Section	☐	BH-315x307x8/12	315.00	307.00	8.00	12.00	2.00	-	☐	...	142.50	261.96	266.40	195.78	194.89	0.00	5.000	5.000	5.000	5.000
☐	1_4	Dwg & Report	S275	Column	H Section	☐	BH-315x307x8/8	315.00	307.00	8.00	8.00	2.00	-	☐	...	142.50	262.84	266.40	195.78	195.07	0.00	5.000	5.000	5.000	5.000
☐	2_1	Dwg & Report	S275	Column	H Section	☑	UC 305x305x283	365.30	321.80	26.90	44.10	0.00	-	☐	...	142.50	260.67	266.32	195.76	194.63	0.00	10.000	10.000	10.000	10.000
☐	2_2	Dwg & Report	S275	Column	H Section	☐	BH-500x500x5/8	500.00	500.00	5.00	8.00	0.00	-	☐	...	142.50	260.67	266.32	195.76	194.63	0.00	10.000	10.000	10.000	10.000
☐	2_3	Dwg & Report	S275	Column	H Section	☐	BH-300x300x12/15	300.00	300.00	12.00	15.00	0.00	-	☐	...	142.50	158.98	645.28	2267.00	566.17	0.00	5.000	5.000	5.000	5.000
☐	2_4	Dwg & Report	S275	Column	H Section	☐	BH-300x300x15/30	300.00	300.00	15.00	30.00	30.00	-	☐	...	2850.00	157.87	645.28	2267.00	566.00	0.00	5.000	5.000	5.000	5.000
☐	2_5	Dwg & Report	S460	Column	H Section	☐	BH-300x300x12/15	300.00	300.00	12.00	15.00	0.00	-	☐	...	2850.00	1271.56	1299.34	927.84	922.28	0.00	5.000	5.000	5.000	5.000
☐	SG01	Dwg & Report	S275	Beam	H Section	☑	UB 406x140x39	397.30	141.80	6.30	[illegible]	0.00	-	☐	...	11.00	111.00	111.00	111.00	61.00	0.00	3.000	3.000	3.000	3.000

Excel or other SW for edit



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	1_1	Dwg & Re	S275	Column	H Section	1	UC 305x30	365.3	321.8	26.9	44.1	0	-	0		142.5	260.67	266.32	195.76	194.63	0	5	5	5	5
2	1_2	Dwg & Re	S275	Column	H Section	0	BH-315x3(	315	307	12	16	2	-	0		142.5	261.96	266.4	195.78	194.89	0	5	5	5	5
3	1_3	Dwg & Re	S275	Column	H Section	0	BH-315x3(	315	307	8	12	2	-	0		142.5	261.96	266.4	195.78	194.89	0	5	5	5	5
4	1_4	Dwg & Re	S275	Column	H Section	0	BH-315x3(	315	307	8	8	2	-	0		142.5	262.84	266.4	195.78	195.07	0	5	5	5	5
5	2_1	Dwg & Re	S275	Column	H Section	1	UC 305x30	365.3	321.8	26.9	44.1	0	-	0		142.5	260.67	266.32	195.76	194.63	0	10	10	10	10
6	2_2	Dwg & Re	S275	Column	H Section	0	BH-500x5(	500	500	5	8	0	-	0		142.5	260.67	266.32	195.76	194.63	0	10	10	10	10
7	2_3	Dwg & Re	S275	Column	H Section	0	BH-300x3(	300	300	12	15	0	-	0		142.5	158.98	645.28	2267	566.17	0	5	5	5	5
8	2_4	Dwg & Re	S275	Column	H Section	0	BH-300x3(	300	300	15	30	30	-	0		2850	157.87	645.28	2267	566	0	5	5	5	5
9	2_5	Dwg & Re	S460	Column	H Section	0	BH-300x3(	300	300	12	15	0	-	0		2850	1271.56	1299.34	927.84	922.28	0	5	5	5	5
10	SG01	Dwg & Re	S275	Beam	H Section	1	UB 406x14	397.3	141.8	6.3	8.6	0	-	0		11	111	111	111	61	0	3	3	3	3