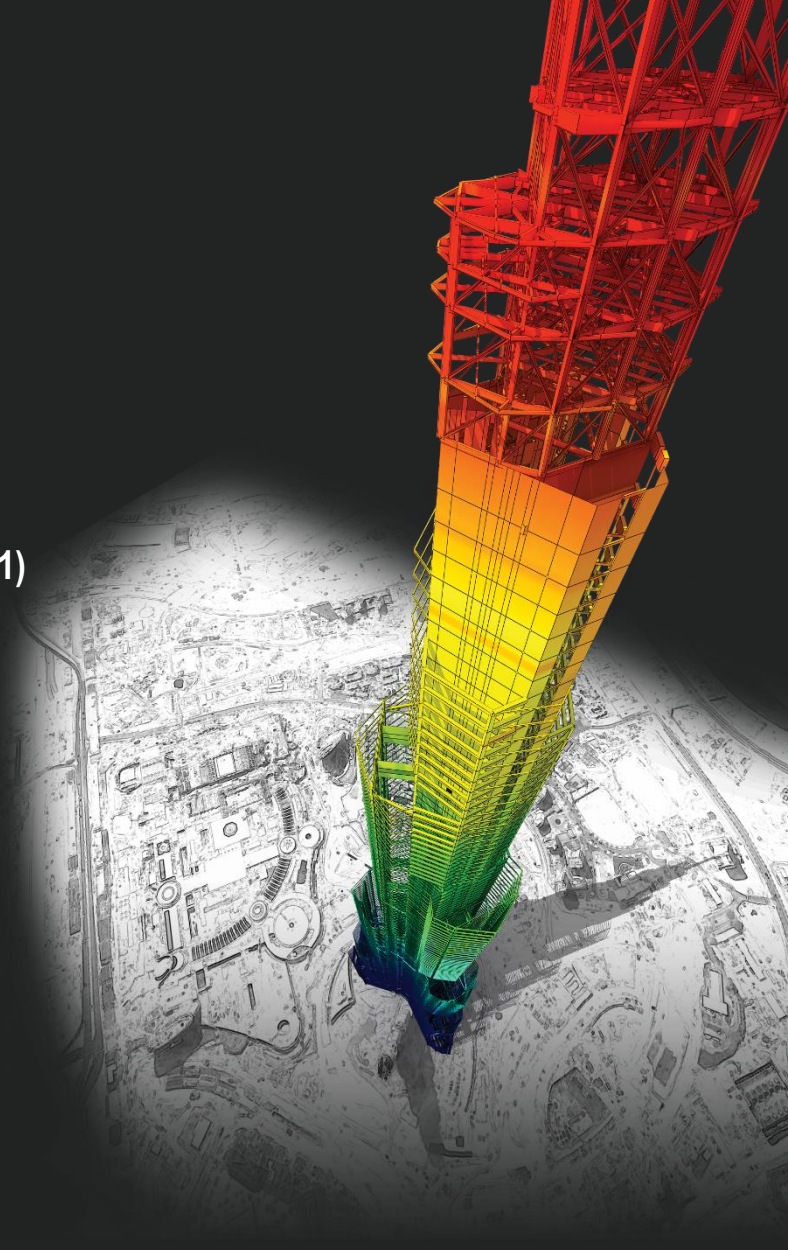
Release Note

Fecha de Lanzamiento: Enero, 2021

Versión de Producto: midas Gen 2021 (v1.1) y Design+2021(v1.1)



DESIGN OF General Structures

Integrated Design System for Building and General Structures

midas Gen

Mejoras

- ***midas Gen***

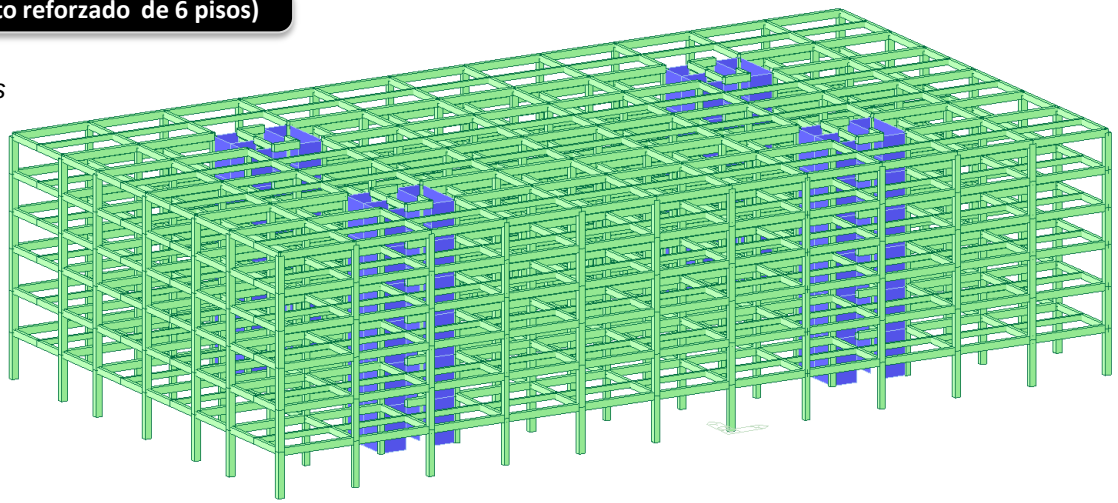
- ***midas Design+***

1. Mejora en velocidad de Diseño no-disipativo

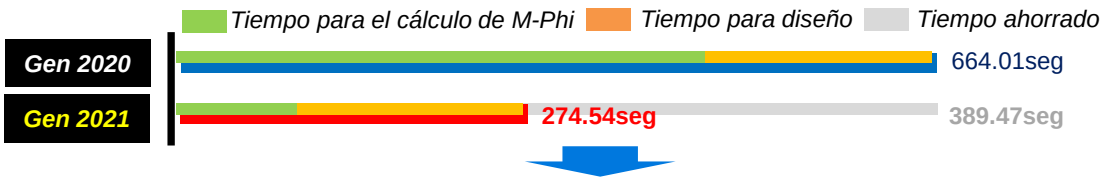
- *Reducción del tiempo de diseño optimizando el cálculo de m-phi y mejorando el algoritmo de salida*

Modelo de ejemplo (estructura concreto reforzado de 6 pisos)

- ✓ *Vigas / columnas: 1,974 elementos*
- ✓ *Muros: 216 elementos*
- ✓ *Combinaciones de carga: 100*



[Tiempo total de diseño de ND: Gen 2020 vs Gen 2021 (nueva versión)]



Reducción del 60% en el tiempo de diseño

2. Mejora en elemento no-disipativo por NTC2018

Tabla de Diseño – Diseño a flexion y cortante no-disipativo

- Salida de resultados separados para ULS excepto acción sísmica y ELS con sísmica modificada por q para elementos no disipativos

Ultimate Strength Check (LC_A) en diseño gráfico

** LC_A : Load combination to check ULS(Ultimate Limit State) except seismic loads*

Code : Eurocode2:04,NTC2018 Unit : kN , m

Sorted by: (•) Member ( ) Property — Results: (•) Strength ( ) Serviceability ( ) Elastic — Primary Sorting Option: ( ) SECT (•) MEMB

MEMB / SECT	SEL	Section Bc	Section Hc	fck / Height	fyk / fyw	CHK	LCB	V-Rebar	N_Rdmax	Uc / Rat-Uc	N_Ed / Rat-N	M_Edy / Rat-My	M_Edz / Rat-Mz	V_Rdc.end / Rat-Vc.end	V_Rds.end / Rat-Vs.end	V_Rdc.mid / Rat-Vc.mid	V_Rds.mid / Rat-Vs.mid	LCB	V_Ed.end / V_Ed.mid	Rat-V.end / Rat-V.mid	Ash.req / Rat-J
373	☑	P30x60		25000.0	450000	MV	19	14-5-P16	3611.27	0.000	114.887	267.411	67.9358	115.741	131.478	116.749	131.478	35	135.439	1.030	0.00000
1		0.300	0.600	3.2000	450000					0.000	0.998	1.083	1.090	1.170	1.030	1.160	1.030	35	135.439	1.030	0.000

Elastic Strength Check (LC_E) en diseño gráfico

** LC_E : Load combination to check ELS(Elastic Limit State)*

Code : Eurocode2:04,NTC2018 Unit : kN , m

Sorted by: (•) Member ( ) Property — Results: ( ) Strength ( ) Serviceability (•) Elastic — Primary Sorting Option: ( ) SECT (•) MEMB

MEMB / SECT	SEL	Section Bc	Section Hc	fck / Height	fyk / fyw	CHK	Seis. Class	LCB	M.Edy / M'.ydy	M.Edz / M'.ydz	Rat-My / Rat-Mz	Rat-Com (E)	V_Rdc.end / Rat-Vc.end	V_Rds.end / Rat-Vs.end	V_Rdc.mid / Rat-Vc.mid	V_Rds.mid / Rat-Vs.mid	LCB	V_Ed.end / V_Ed.mid	Rat-V.end / Rat-V.mid	Ash.req / Rat-J
373	☑	P30x60		25000.0	450000	OK	N.D.	51	214.132	54.2597	0.849	0.987	106.276	131.478	105.268	131.478	43	105.100	0.989	0.00000
1		0.300	0.600	3.2000	450000				252.227	107.695	0.504		0.989	0.799	0.998	0.799	43	105.100	0.998	0.000

Serviceability Check (LC_S) en diseño gráfico

** LC_S : Load combination to check SLS(Serviceability Limit State)*

Sorted by: (•) Member ( ) Property — Results: ( ) Strength (•) Serviceability ( ) Elastic — ( ) SECT (•) MEMB

MEMB / SECT	SEL	Section Bc	Section Hc	fck / Height	fyk / fyw	CHK	Stress Control LC	sig-ct	sig-cta	LC	sig-cc	sig-cca	LC	sig-s	sig-sa
373	☑	P30x60		25000.0	450000	OK		0.00000	2564.96	70	1134.84	15000.0	-	0.00000	0.00000
1		0.300	0.600	3.2000	450000										

2. Mejora en elemento no-disipativo por NTC2018

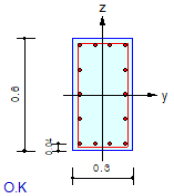
Reporte gráfico – Diseño a flexion y cortante no-disipativo

- Genere resultados de diseño para ULS, ELS y SLS por separado en informes de diseño.

Resultado de diseño para ULS(Ultimate Limit State)

1. Design Condition

Design Code	: Eurocode2:04 & NTC2018	UNIT SYSTEM : kN, m	
Member Number	: 373		
Material Data	: fck = 25000, fyk = 450000, fyw = 450000 KPa		
Column Height	: 3.2 m		
Section Property	: P30x60 (No : 1)		
Rebar Pattern	: 14 - 5 - P16	Ast = 0.002814 m² (pst = 0.016)	

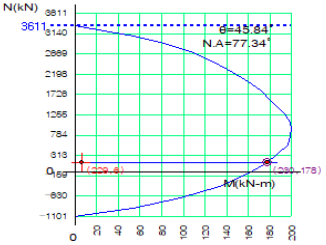


2. Axial and Moments Capacity

Load Combination : 1 (I)

Concentric Max. Axial Load	N_Rdmax	= 3611.27 kN	
Axial Load Ratio	N_Ed / N_Rd	= 229.268 / 229.761	= 0.998 < 1.000 ..... O.K
Moment Ratio	M_Ed / M_Rd	= 6.48468 / 178.003	= 0.036 < 1.000 ..... O.K
	M_Edy / M_Rdy	= 4.58536 / 124.006	= 0.037 < 1.000 ..... O.K
	M_Edz / M_Rdz	= 4.58536 / 127.702	= 0.036 < 1.000 ..... O.K

M-N Interaction Diagram



N_Rd(kN)	M_Rd(kN-m)
3611.27	0.00
3332.70	55.00
2959.27	107.00
2462.15	145.43
1977.21	172.00
1553.66	189.17
1296.51	197.30
1077.98	199.77
674.34	196.74
189.02	176.10
-351.87	133.72
-893.85	53.35
-1101.13	0.00

3. Shear Capacity

[END]	y : 1 (J)	z : 1 (J)
Applied Shear Force (V_Ed)	1.81597 kN	0.31087 kN
V_Ed / V_Rdc	1.81597 / 126.642 = 0.014	0.31087 / 118.248 = 0.003
V_Ed / V_Rds	1.81597 / 61.0435 = 0.030	0.31087 / 131.478 = 0.002
V_Ed / V_Rdmax	1.81597 / 497.250 = 0.004	0.31087 / 535.500 = 0.001
Shear Ratio	0.014 < 1.000 ..... O.K	0.003 < 1.000 ..... O.K
Asw-H_use	0.00067 m²/m, 2-P8 @150	0.00067 m²/m, 2-P8 @150

[MIDDLE]	y : 1 (1/2)	z : 1 (1/2)
Applied Shear Force (V_Ed)	1.81597 kN	0.31087 kN
V_Ed / V_Rdc	1.81597 / 127.858 = 0.014	0.31087 / 119.558 = 0.003
V_Ed / V_Rds	1.81597 / 61.0435 = 0.030	0.31087 / 131.478 = 0.002
V_Ed / V_Rdmax	1.81597 / 497.250 = 0.004	0.31087 / 535.500 = 0.001
Shear Ratio	0.014 < 1.000 ..... O.K	0.003 < 1.000 ..... O.K
Asw-H_use	0.00067 m²/m, 2-P8 @150	0.00067 m²/m, 2-P8 @150

Resultado de diseño para ELS(Elastic Limit State)

4. Elastic Bending Moment Capacity

	y : 2 (I)	z : 2 (I)
Moment (M.Ed)	81.7143 kN-m	21.7915 kN-m
Elastic Strength (M'yd')	254.437 kN-m	118.530 kN-m
Check Ratio	0.321 < 1.000 ..... O.K	0.184 < 1.000 ..... O.K
Check Combined Ratio (sqrt((M_Edy/M'_ydy)^2 + (M_Edz/M'_ydz)^2))		0.370 < 1.000 ..... O.K

5. Elastic Shear Capacity

[END]	y : 2 (J)	z : 2 (J)
Applied Shear Force (V_Ed)	12.1481 kN	40.1526 kN
V_Ed / V_Rdc	12.1481 / 120.093 = 0.101	40.1526 / 111.195 = 0.361
V_Ed / V_Rds	12.1481 / 61.0435 = 0.199	40.1526 / 131.478 = 0.305
V_Ed / V_Rdmax	12.1481 / 497.250 = 0.024	40.1526 / 535.500 = 0.075
Shear Ratio	0.101 < 1.000 ..... O.K	0.361 < 1.000 ..... O.K
Asw-H_use	0.00067 m²/m, 2-P8 @150	0.00067 m²/m, 2-P8 @150

[MIDDLE]	y : 2 (1/2)	z : 2 (1/2)
Applied Shear Force (V_Ed)	12.1481 kN	40.1526 kN
V_Ed / V_Rdc	12.1481 / 121.029 = 0.100	40.1526 / 112.203 = 0.358
V_Ed / V_Rds	12.1481 / 61.0435 = 0.199	40.1526 / 131.478 = 0.305
V_Ed / V_Rdmax	12.1481 / 497.250 = 0.024	40.1526 / 535.500 = 0.075
Shear Ratio	0.100 < 1.000 ..... O.K	0.358 < 1.000 ..... O.K
Asw-H_use	0.00067 m²/m, 2-P8 @150	0.00067 m²/m, 2-P8 @150

Resultado de diseño para SLS(Serviceability Limit State)

6. Serviceability : Stress Limit Check

	Load Combination	Stress(s)	Allowable Stress(sa)	Stress Ratio(s/sa)
Concrete (Tensile)	-	0.00	2564.96	0.0000
Concrete (Compression)	3(C)	1095.15	15000.00	0.0730
	-	0.00	0.00	*****
Rebar	-	0.00	0.00	*****
Check Linear Creep	*****	*****	*****	*****

3. Mejora en diseño a cortante por NTC2018

Diseño Fuerza cortante de elementos primarios según NTC 2018

- Al calcular una fuerza cortante de diseño para elementos primarios, la fuerza del miembro puede limitarse por una demanda de resistencia para combinaciones de carga ELS.

7.2.2. CRITERI GENERALI DI PROGETTAZIONE DEI SISTEMI STRUTTURALI

PROGETTAZIONE IN CAPACITÀ E FATTORI DI SOVRARESISTENZA

La domanda di resistenza valutata con i criteri della progettazione in capacità può essere assunta non superiore alla domanda di resistenza valutata per il caso di comportamento strutturale non dissipativo.

Le strutture di fondazione e i relativi elementi strutturali devono essere progettati sulla base della domanda ad essi trasmessa dalla struttura sovrastante (si veda § 7.2.5) attribuendo loro comportamento strutturale non dissipativo, indipendentemente dal comportamento attribuito alla struttura su di essi gravante.

La demanda de resistencia evaluada con los criterios de diseño de capacidad se puede asumir no mayor que la demanda de resistencia evaluada para el caso de comportamiento estructural no disipativo.

Design report (Detail)

```
================================================================================
   [[[*]]]   CALCULATE DATA OF SPECIAL PROVISIONS FOR SEISMIC DESIGN.
================================================================================

    ( ). Design parameters.
         -. fyk  = 450000.00000 KPa.
         -. phi    = 1.0

    ( ). Bending strength for design shear force.
         -. Mel+ =       66.455 kN-m.((I, Clockwise))
         -. MeJ- =       96.206 kN-m.((J, Clockwise))
         -. Mel- =       96.206 kN-m.((I, Counter-Clockwise))
         -. MeJ+ =       66.455 kN-m.((J, Counter-Clockwise))

    ( ). Calculate design shear force according to special provisions for seismic design.
         -. Alpha1  = 1.0000
         -. Span    =      4.3000 m.
         -. VzG     =    -10.004 kN.  (by Gravity-Direction Load).
         -. Clockwise
            Ve1_CW = VzG + Alpha1*(Mel+ + MeJ-)/Span =      27.824 kN.
            Ve2_CW = VzG - Alpha1*(Mel+ + MeJ-)/Span =     -47.832 kN.
            Ve1_CW  = MAX[ |Ve1_CW|, |Ve2_CW| ] =      47.832 kN.
         -. Counter-Clockwise
            Ve1_CCW= VzG + Alpha1*(Mel- + MeJ+)/Span =      27.824 kN.
            Ve2_CCW= VzG - Alpha1*(Mel- + MeJ+)/Span =     -47.832 kN.
            Ve1_CCW = MAX[ |Ve1_CCW|, |Ve2_CCW| ] =      47.832 kN.

         -. Ve1(M)  = MAX[ |Ve1_CW|, |Ve1_CCW| ]  =      47.832 kN.  (by Moment Strength).
         -. Ve1(E)  =      17.186 kN.  (by Elastic Load Combination).
         -. Ve1     = MIN[ Ve1(M), Ve1(E) ]       =      17.186 kN.
         -. VzOrg   =    -18.902 kN.  (by Strength Load Combination).
         -. V_Ed    = MAX[ |VzOrg|, Ve1 ] =      18.902 kN.
```

VzOrig = Design shear force by ULS load combination

Ve1(M) = Design shear force by flexural strength of member.

Ve1(E) = Design shear force by ELS load combination.

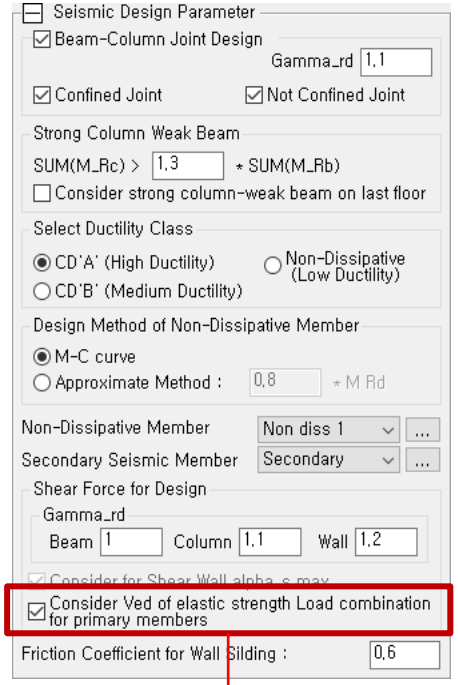
V_Ed = Max [VzOrig, Min[Ve1(M), Ve1(M)]]

3. Mejora en diseño a cortante por NTC2018

Diseño Fuerza cortante de elementos primarios según NTC 2018

- Al calcular una fuerza cortante de diseño para elementos primarios, la fuerza del miembro puede limitarse por una demanda de resistencia para combinaciones de carga ELS.

Design Setting → **Check off option** → **Check on option**



Opción agregada.

```
================================================================================
  [[[*]]]   CALCULATE DATA OF SPECIAL PROVISIONS FOR SEISMIC DESIGN.
================================================================================

    ( ). Design parameters.
        -. fyk  = 450000.00000 KPa.
        -. phi    = 1.0

    ( ). Bending strength for design shear force.
        -. Mel+ =       66.455 kN-m.((I, Clockwise))
        -. MeJ- =       96.206 kN-m.((J, Clockwise))
        -. Mel- =       96.206 kN-m.((I, Counter-Clockwise))
        -. MeJ+ =       66.455 kN-m.((J, Counter-Clockwise))

    ( ). Calculate design shear force according to special provisions for seismic design.
        -. Alpha1  = 1.0000
        -. Span    =      4.3000 m.
        -. VzG     =     -10.004 kN.  (by Gravity-Direction Load).
        -. Clockwise
           Ve11_CW = VzG + Alpha1*(Mel+ + MeJ-)/Span =      27.824 kN.
           Ve12_CW = VzG - Alpha1*(Mel+ + MeJ-)/Span =     -47.832 kN.
           Ve1_CW  = MAX[ |Ve11_CW|, |Ve12_CW| ] =      47.832 kN.
        -. Counter-Clockwise
           Ve11_CCW= VzG + Alpha1*(Mel- + MeJ+)/Span =      27.824 kN.
           Ve12_CCW= VzG - Alpha1*(Mel- + MeJ+)/Span =     -47.832 kN.
           Ve1_CCW = MAX[ |Ve11_CCW|, |Ve12_CCW| ] =      47.832 kN.

        -. Ve1     = MAX[ |Ve1_CW|, |Ve1_CCW| ]  =      47.832 kN.
        -. VzOrg   =     -18.902 kN.  (by Strength Load Combination).
        -. V_Ed    = MAX[ |VzOrg|, Ve1 ] =      47.832 kN.
```

--> V_Ed = Max [VzOrig, Ve1(M)]

```
================================================================================
  [[[*]]]   CALCULATE DATA OF SPECIAL PROVISIONS FOR SEISMIC DESIGN.
================================================================================

    ( ). Design parameters.
        -. fyk  = 450000.00000 KPa.
        -. phi    = 1.0

    ( ). Bending strength for design shear force.
        -. Mel+ =       66.455 kN-m.((I, Clockwise))
        -. MeJ- =       96.206 kN-m.((J, Clockwise))
        -. Mel- =       96.206 kN-m.((I, Counter-Clockwise))
        -. MeJ+ =       66.455 kN-m.((J, Counter-Clockwise))

    ( ). Calculate design shear force according to special provisions for seismic design.
        -. Alpha1  = 1.0000
        -. Span    =      4.3000 m.
        -. VzG     =     -10.004 kN.  (by Gravity-Direction Load).
        -. Clockwise
           Ve11_CW = VzG + Alpha1*(Mel+ + MeJ-)/Span =      27.824 kN.
           Ve12_CW = VzG - Alpha1*(Mel+ + MeJ-)/Span =     -47.832 kN.
           Ve1_CW  = MAX[ |Ve11_CW|, |Ve12_CW| ] =      47.832 kN.
        -. Counter-Clockwise
           Ve11_CCW= VzG + Alpha1*(Mel- + MeJ+)/Span =      27.824 kN.
           Ve12_CCW= VzG - Alpha1*(Mel- + MeJ+)/Span =     -47.832 kN.
           Ve1_CCW = MAX[ |Ve11_CCW|, |Ve12_CCW| ] =      47.832 kN.

        -. Ve1(M)  = MAX[ |Ve1_CW|, |Ve1_CCW| ]  =      47.832 kN.  (by Moment Strength).
        -. Ve1(E)  =      17.186 kN.  (by Elastic Load Combination).
        -. Ve1     = MIN[ Ve1(M), Ve1(E) ]  =      17.186 kN.
        -. VzOrg   =     -18.902 kN.  (by Strength Load Combination).
        -. V_Ed    = MAX[ |VzOrg|, Ve1 ] =      18.902 kN.
```

--> V_Ed = Max [VzOrig, Min[Ve1(M), Ve1(E)]]

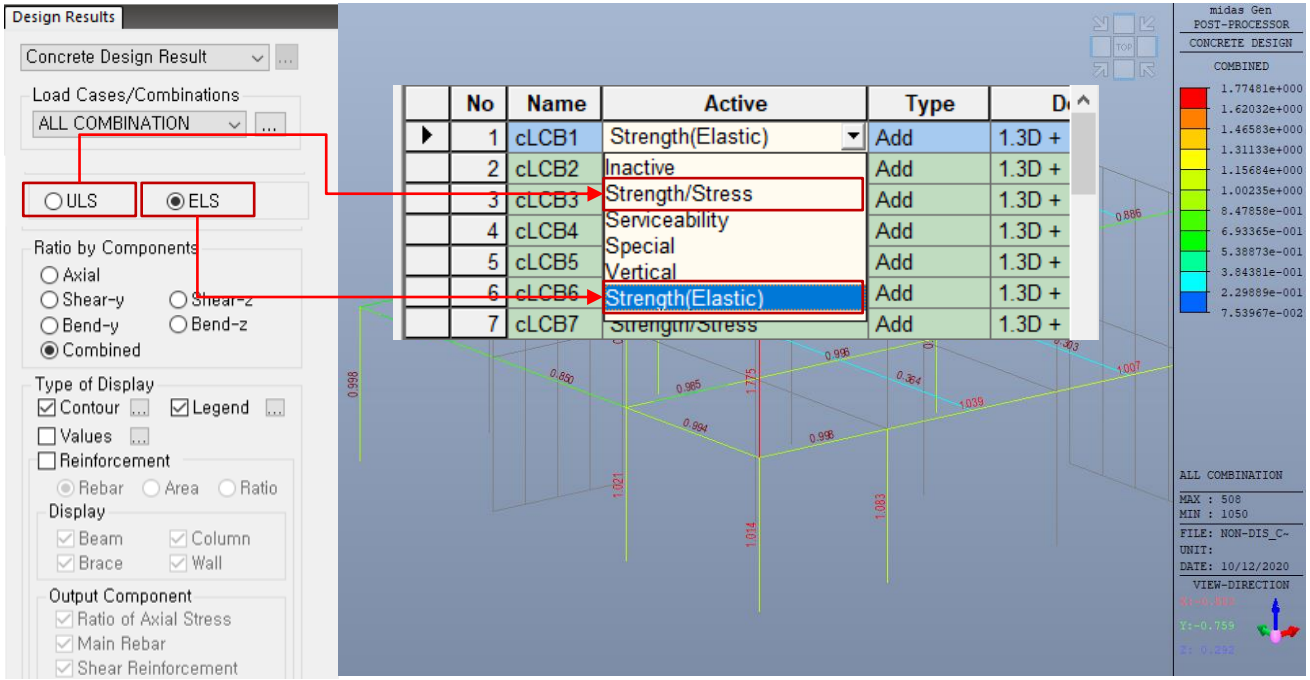
VzG = Design shear force by load combination with only gravity loads.

Ve1(M) = Design shear force by flexural strength of member.

Ve1(E) = Design shear force by ELS load combination.

4. Combinación de carga para resultado de diseño de concreto por resistencia elástica

Se agregaron resultados gráficos para la combinación de carga ELS.

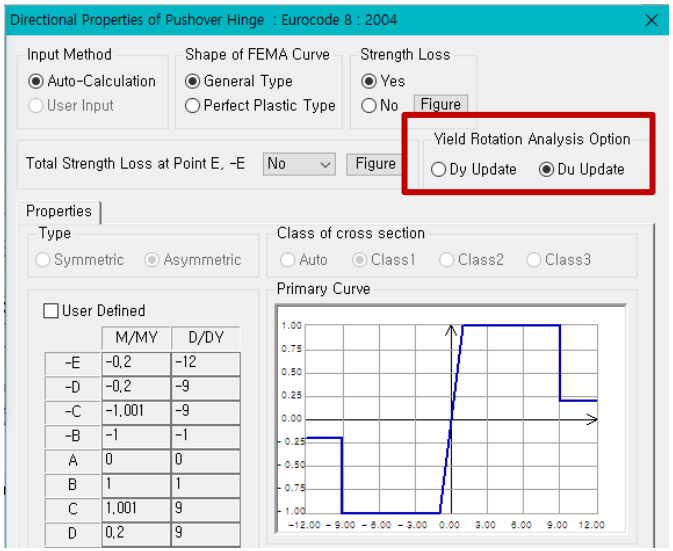


- ✓ *ULS : Load combinations assigned to "Strength/Stress" type in Load combination dialog box*
- ✓ *ELS : Load combinations assigned to "Strength(Elastic)" type in Load combination dialog box*

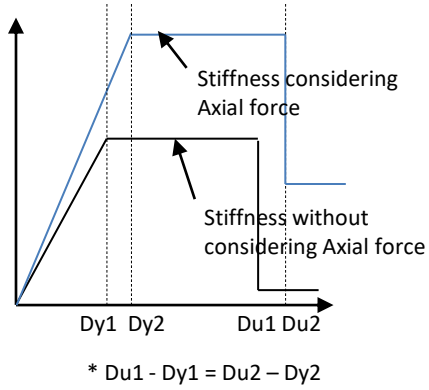
5. Adición de modelo de rótula por EC 8 :2004

Nuevo modelo de rotula por Eurocode 8 :2004

- Adición de curva de rotula con tipo "Du update"



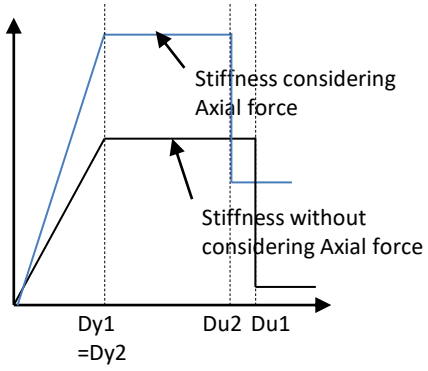
Actualización de Dy (compatible con la versión antigua)



* Du1 - Dy1 = Du2 – Dy2

Stiffness and Dy are changed by axial force Under PMM or PM type.

Du Update (Agregada a Gen2021 nueva)



Stiffness and Du are changed by axial force Under PMM or PM type

✓ Note

[Calculation of Du (= θu, Ultimate Rotation)]

$$\theta_{um} = \frac{1}{\gamma_{el}} 0{,}016 \cdot (0{,}3^{\nu}) \left[\frac{\max(0{,}01;\omega')}{\max(0{,}01;\omega)} f_c\right]^{0{,}225} \left(\min\left(9;\frac{L_V}{h}\right)\right)^{0{,}35} 25^{\left(\alpha\rho_{sx}\frac{f_{yw}}{f_c}\right)} (1{,}25^{100\rho_d})$$

[Calculation of Dy (= θy, Yielding Rotation)]

$$\theta_y = k \times \varepsilon_y \div Depth\ of\ element$$

** εy : Yielding strain at tensile face*

	k				
	rectangular section			circular section	
hinge type	column	beam	wall	column	beam
none	2.1	1.7	2	2.25	-
PM e PMM	2.1	1.7	2	2.25	-
Displacemet based Seismic Design of Structures- pg 165					
Priestley; Calvi; Kowalsky					

6. Adición de coeficientes de reducción de la capacidad de disipación de energía por irregularidades según NSR-10

- *Results > Results Tables > Story> Stiffness Irregularity Check, Capacity Irregularity Check, and Mass Irregularity Check*

Factores de reducción (Phi_p)

Chequeo Irregularidad de rigidez

						Story Stiffness	Upper Story Stiffness 0.6K (Upper)	Upper Story Stiffness 0.7K (Upper)	Upper 3 Story Stiffness(Avg.) 0.7K (3 Stories)	Upper 3 Story Stiffness(Avg.) 0.8K (3 Stories)	Remark	Phi_p
					(kN)							
Ey	12F	46.00	4.00	-0.0000	0.00	-	0.00	0.00	0.00	0.00	Regular	1.0
Ey	11F	42.00	4.00	-0.0000	0.00	-	-199998.58	-	-116665.84	-133332.39	Extreme Irregular	0.8
Ey	10F	38.00	4.00	-0.0000	0.00	-	-264205.86	-	-270785.92	-309469.62	Extreme Irregular	0.8
Ey	9F	34.00	4.00	-0.0000	0.00	-	-339744.66	-	-312646.87	-357310.71	Extreme Irregular	0.8
Ey	8F	30.00	4.00	-0.0000	0.00	-	-406558.07	-	-392975.56	-449114.93	Extreme Irregular	0.8
Ey	7F	26.00	4.00	-0.0000	0.00	-	-776743.33	-	-592295.69	-676909.36	Extreme Irregular	0.8
Ey	6F	22.00	4.00	0.0000	0.00	1830963.85	-4291921.05	-	-2129253.18	-2433432.20	Regular	1.0
Ey	5F	18.00	4.00	0.0000	0.00	1511336.03	1098578.31	-	-1543922.36	-1764482.70	Regular	1.0
Ey	4F	14.00	4.00	0.0000	0.00	1154767.03	906801.62	-	-889210.44	-1016240.50	Regular	1.0
Ey	3F	9.50	4.50	0.0000	0.00	3028926.91	692860.22	808336.92	1049315.61	1199217.84	Regular	1.0
Ey	2F	5.00	4.50	-0.0000	0.00	-	1817356.15	2120248.84	1328840.33	1518674.66	Extreme Irregular	0.8
Ey	1F	0.00	5.00	-0.0000	0.00	-	-688215.48	-	708555.90	809778.17	Extreme Irregular	0.8

Stiffness Irregularity(X) / Stiffness Irregularity(Y)

Chequeo Irregularidad de capacidad

						Shear h1	Story Shear Strength Ratio1	Remark1	Phi_p1	Angle2 ([deg])	Story Shear Strength2 (kN)	Upper Story Shear Strength2 (kN)	Story Shear Strength Ratio2	Remark2	Phi_p2
				(kN)	(kN)										
12F	46.00	4.00	0.00	8786.5611	0.0000	0.0000	Regular	1.0	90.00	8552.2528	0.0000	0.0000	Regular	1.0
11F	42.00	4.00	0.00	8786.5611	8786.5611	1.0000	Regular	1.0	90.00	8552.2528	8552.2528	1.0000	Regular	1.0
10F	38.00	4.00	0.00	8786.5611	8786.5611	1.0000	Regular	1.0	90.00	8552.2528	8552.2528	1.0000	Regular	1.0
9F	34.00	4.00	0.00	10218.4451	8786.5611	1.1630	Regular	1.0	90.00	9984.1368	8552.2528	1.1674	Regular	1.0
8F	30.00	4.00	0.00	10218.4451	10218.4451	1.0000	Regular	1.0	90.00	9984.1368	9984.1368	1.0000	Regular	1.0
7F	26.00	4.00	0.00	10478.7876	10218.4451	1.0255	Regular	1.0	90.00	10244.4793	9984.1368	1.0261	Regular	1.0
6F	22.00	4.00	0.00	10478.7876	10478.7876	1.0000	Regular	1.0	90.00	10244.4793	10244.4793	1.0000	Regular	1.0
5F	18.00	4.00	0.00	12821.8706	10478.7876	1.2236	Regular	1.0	90.00	12587.5623	10244.4793	1.2287	Regular	1.0
4F	14.00	4.00	0.00	12821.8706	12821.8706	1.0000	Regular	1.0	90.00	12587.5623	12587.5623	1.0000	Regular	1.0
3F	9.50	4.50	0.00	15392.7533	12821.8706	1.2005	Regular	1.0	90.00	15158.4450	12587.5623	1.2042	Regular	1.0
2F	5.00	4.50	0.00	15392.7533	15392.7533	1.0000	Regular	1.0	90.00	15158.4450	15158.4450	1.0000	Regular	1.0
1F	0.00	5.00	0.00	17484.7772	15392.7533	1.1359	Regular	1.0	90.00	17841.7063	15158.4450	1.1770	Regular	1.0

Capacity Irregularity

Chequeo Irregularidad Masa

					Adjacent Story Mass 1.5M(Upper) (kN/g)	Adjacent Story Mass 1.5M(Lower) (kN/g)	Story Mass Ratio	Remark	Phi_p
Ex	Roof	50.00	0.00	333.843	0.000	612.228	0.545	Regular	1.0
Ex	12F	46.00	4.00	408.152	500.764	612.228	0.815	Regular	1.0
Ex	11F	42.00	4.00	408.152	612.228	624.901	0.667	Regular	1.0
Ex	10F	38.00	4.00	416.600	612.228	637.573	0.680	Regular	1.0
Ex	9F	34.00	4.00	425.049	624.901	639.878	0.680	Regular	1.0
Ex	8F	30.00	4.00	426.585	637.573	642.182	0.669	Regular	1.0
Ex	7F	26.00	4.00	428.121	639.878	662.919	0.669	Regular	1.0
Ex	6F	22.00	4.00	441.946	642.182	683.657	0.688	Regular	1.0
Ex	5F	18.00	4.00	455.771	662.919	727.651	0.688	Regular	1.0
Ex	4F	14.00	4.00	485.101	683.657	771.646	0.710	Regular	1.0
Ex	3F	9.50	4.50	514.431	727.651	802.248	0.707	Regular	1.0
Ex	2F	5.00	4.50	534.832	771.646	0.000	0.693	Regular	1.0
Ex	1F	0.00	5.00	147.850	802.248	0.000	0.184	Regular	1.0

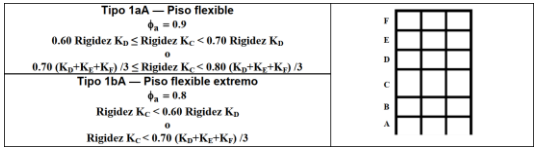
Mass Irregularity(X) / Mass Irregularity(Y)

✓ Nota

De acuerdo con la Tabla A.3-7 en NSR-10, Gen informa el factor de reducción, ø en las fuerzas de diseño sísmico para tener en cuenta la verificación de irregularidades

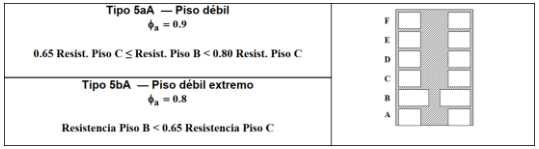
1. Chequeo Irregularidad de rigidez (piso flexible)

- *Estructuras Regulares $ø_a = 1.0$*
- *Irregulares Estructuras $ø_a = 0.9$*
- *Estructuras Irregulares Extremas $ø_a = 0.8$*



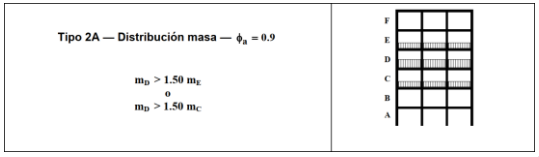
2.Chequeo Irregularidad de capacidad (Piso débil)

- *Estructuras Regulares $ø_a = 1.0$*
- *Irregulares Estructuras $ø_a = 0.9$*
- *Estructuras Irregulares Extremas $ø_a = 0.8$*



3. Chequeo Irregularidad Masa

- *Estructuras Regulares $ø_a = 1.0$*
- *Estructuras Irregulares $ø_a = 0.9$*

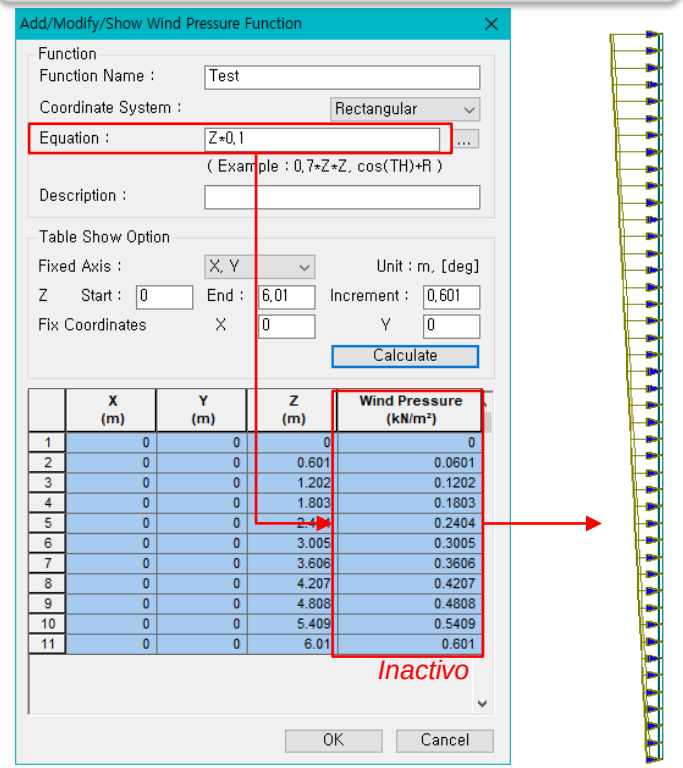


7. Mejora en función de presión de viento

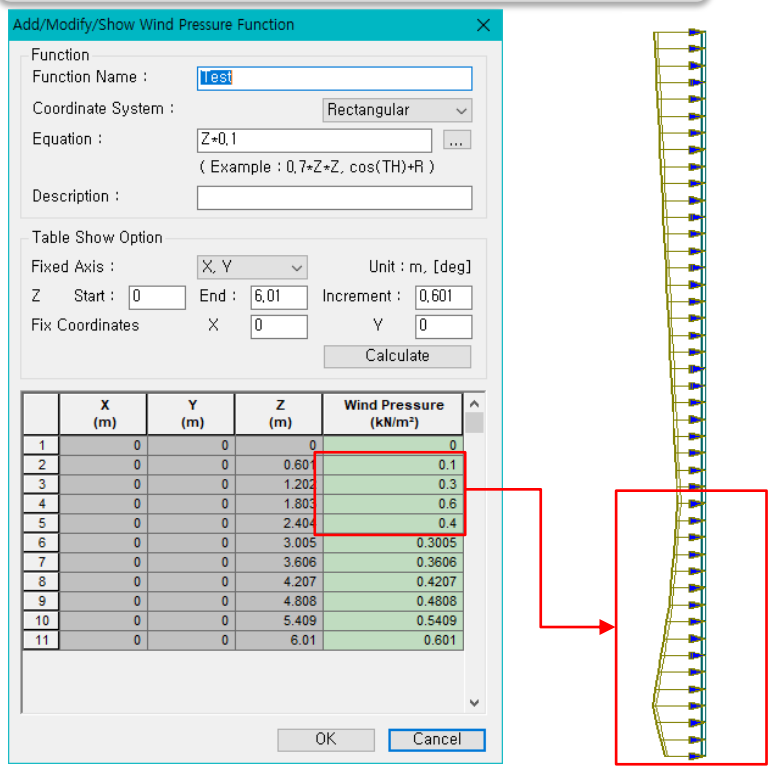
Inserción de presión de suelo con edición de tabla

- La presión de viento generada por ecuación en tabla puede ser editada y actualizada en el modelo

Gen 2020



Gen 2021 v1.1 (Nueva versión)

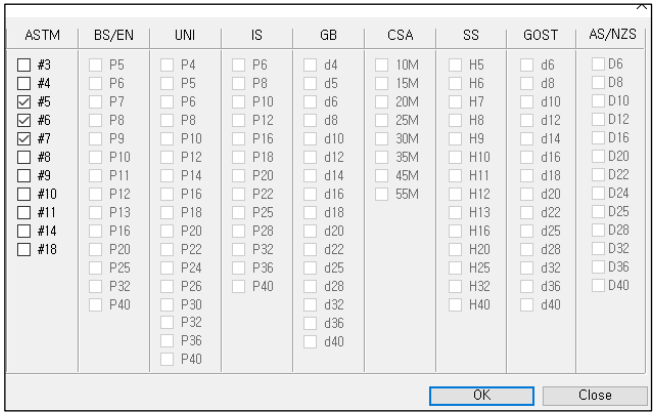


Al editar los valores de la tabla, la presión del viento se modifica automáticamente.

8. Adición de base de datos de materiale (Barra imperial U.S.)

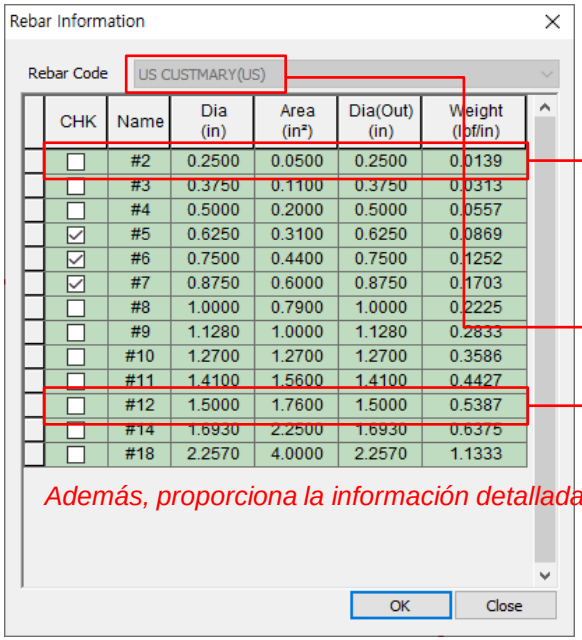
- *Proporcionar información de barras para el diámetro, el área y el peso en el cuadro de diálogo*
- *Adición de barras de refuerzo #2 y #12 en la base de datos estándar de EE. UU. (Imperial de EE. UU.)*

Gen 2020



Proporciona solo la función para seleccionar el tamaño de las barras.

Gen 2021 v1.1 (Nueva versión)



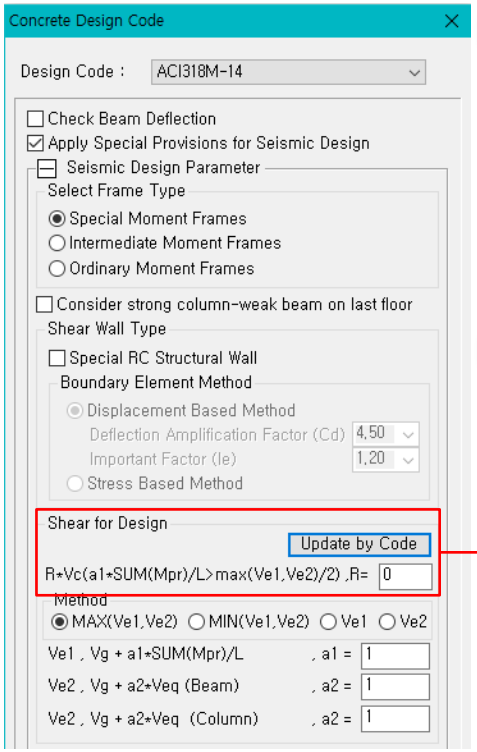
Agregue barras de refuerzo #2 y #12 en el código de Estados Unidos.

Además, proporciona la información detallada para Rebar DB

9. Mejoras en el diseño a cortante de pórticos especiales de concreto según ACI

El factor de reducción (R) para Vc no se usa en la mitad del tramo del miembro.

- 'Vc=0' se considera solo en ambos extremos del miembro.



Gen 2020

3. Design for Shear

[END]	y : 8 (J)	z : 8 (J)
Applied Shear Force (Vu)	40.5926 tonf	20.4299 tonf
Design Shear Strength (φVc+φVs)	0.00000 + 62.4078 = 62.4078 tonf	0.00000 + 62.4078 = 62.4078 tonf
Shear Ratio	0.650 < 1.000 ..... O.K	0.327 < 1.000 ..... O.K
As-H_req	0.00330 m²/m, 4-D13 @100	0.00166 m²/m, 4-D13 @100
[MIDDLE]	**y : 8 (1/2)**	**z : 8 (1/2)**
Applied Shear Force (Vu)	40.5926 tonf	20.4299 tonf
Design Shear Strength (φVc+φVs)	0.00000 + 41.6052 = 41.6052 tonf	0.00000 + 41.6052 = 41.6052 tonf
Shear Ratio	0.976 < 1.000 ..... O.K	0.491 < 1.000 ..... O.K
As-H_req	0.00330 m²/m, 4-D13 @150	0.00166 m²/m, 4-D13 @150

Gen 2021 v1.1 (Nueva versión)

3. Design for Shear

[END]	y : 8 (J)	z : 8 (J)
Applied Shear Force (Vu)	40.5926 tonf	20.4299 tonf
Design Shear Strength (φVc+φVs)	0.00000 + 62.4078 = 62.4078 tonf	0.00000 + 62.4078 = 62.4078 tonf
Shear Ratio	0.650 < 1.000 ..... O.K	0.327 < 1.000 ..... O.K
As-H_req	0.00330 m²/m, 4-D13 @100	0.00166 m²/m, 4-D13 @100
[MIDDLE]	**y : 10 (1/2)**	**z : 3 (1/2)**
Applied Shear Force (Vu)	50.2696 tonf	36.5179 tonf
Design Shear Strength (φVc+φVs)	33.0322 + 41.6052 = 74.6374 tonf	32.0340 + 41.6052 = 73.6392 tonf
Shear Ratio	0.674 < 1.000 ..... O.K	0.496 < 1.000 ..... O.K
As-H_req	0.00140 m²/m, 4-D13 @150	0.00083 m²/m, 4-D13 @150

*Vc en Diseño = R*Vc*

✓ Nota

Provisiones sísmicas en ACI 318M-19

18.6.4 *Transverse reinforcement*

18.6.4.1 Hoops shall be provided in the following regions of a beam:

(a) Over a length equal to twice the beam depth measured from the face of the supporting column toward midspan, at both ends of the beam
(b) Over lengths equal to twice the beam depth on both sides of a section where flexural yielding is likely to occur as a result of lateral displacements beyond the elastic range of behavior.

18.6.5 *Shear strength*

18.6.5.1 *Design forces*—The design shear force V_e shall be calculated from consideration of the forces on the portion of the beam between faces of the joints. It shall be assumed that moments of opposite sign corresponding to probable flexural strength, M_{pr}, act at the joint faces and that the beam is loaded with the factored tributary gravity load along its span.

18.6.5.2 *Transverse reinforcement*—Transverse reinforcement over the lengths identified in 18.6.4.1 shall be designed to resist shear assuming $V_c = 0$ when both (a) and (b) occur:

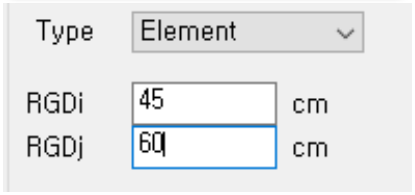
(a) The earthquake-induced shear force calculated in accordance with 18.6.5.1 represents at least one-half of the maximum required shear strength within those lengths.
(b) The factored axial compressive force P_u including earthquake effects is less than $A_g f_c'/20$.

10. Configuración asimétrica de Beam End Offset

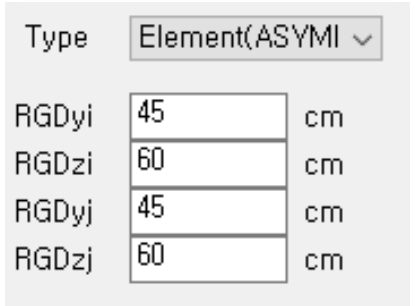
Adición tipo de elemento (Asymmetric)

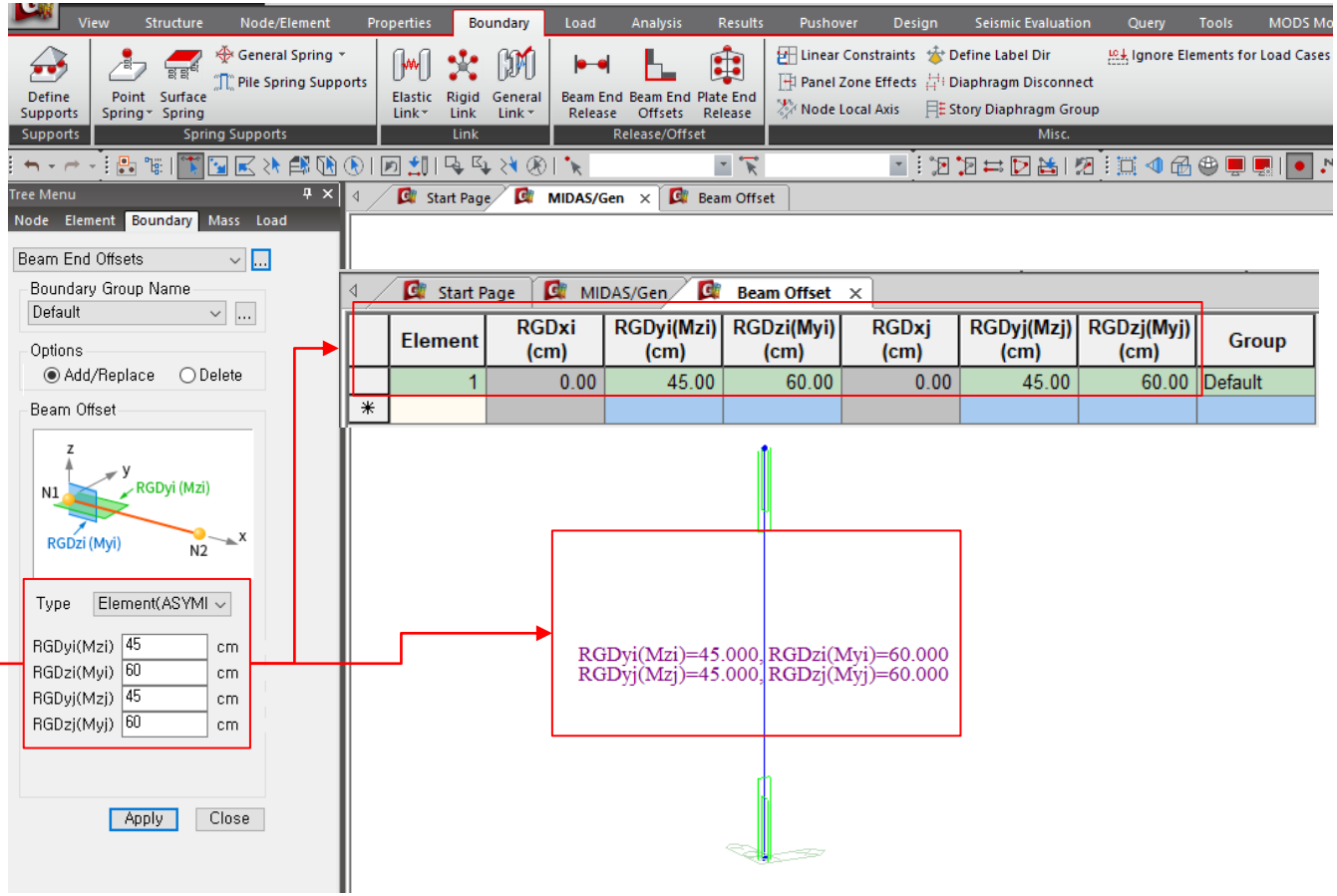
- Establezca un beam end offset para cada dirección

Gen 2020



Gen 2021 v1.1 (Nueva versión)



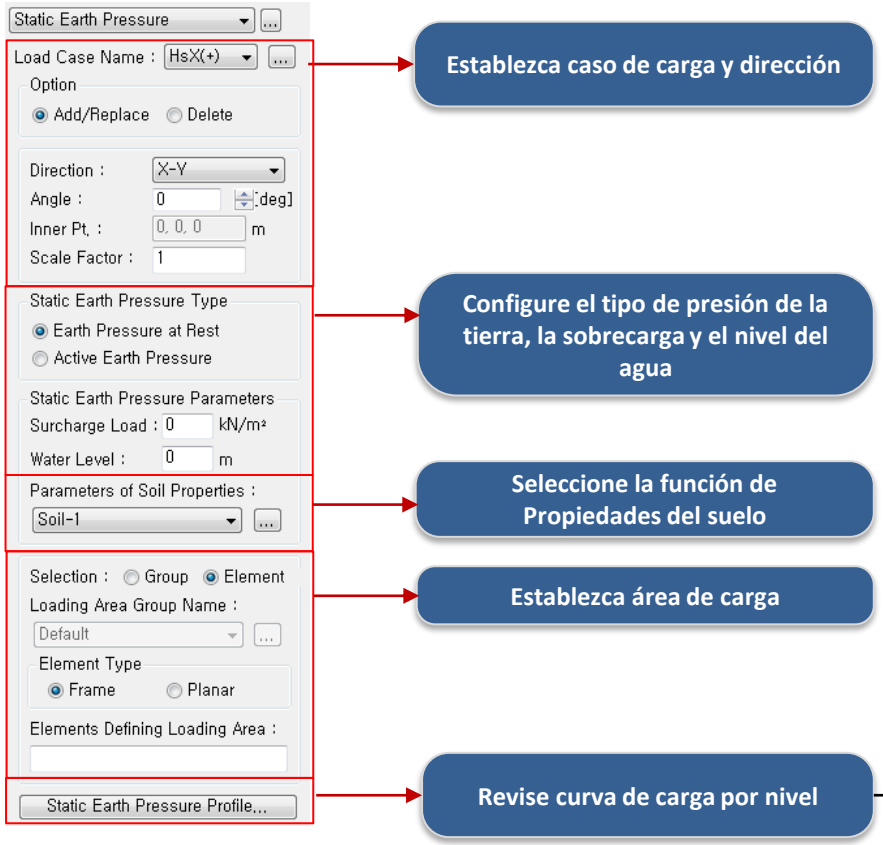


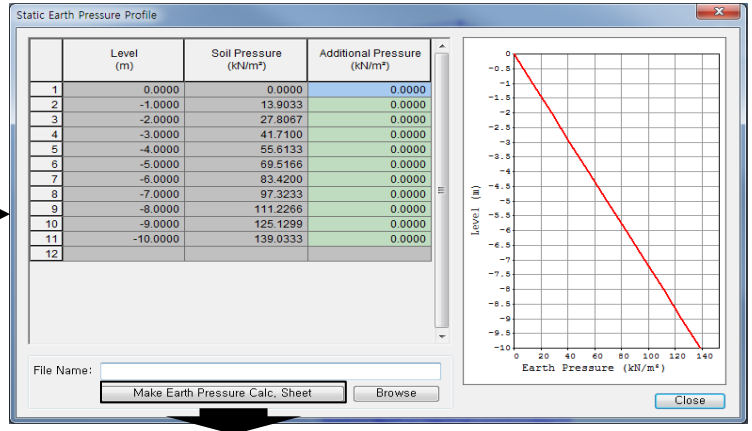
11. Función de presión de suelo estática

Adición de presión de suelo estática tipo función.

- - Al editar los valores de la tabla, la forma de la presión del suelo en el modelo se modifica automáticamente.

*Load > Static Loads > Lateral > **Earth Pressure > Static Earth Pressure***





Hoja de Cálculo

```
Surcharge Load                          : s  =      0.000 kN/m²
Ground Level                            : GL =      0.000 m
Water Level                             : WL =      0.000 m

Coefficient of Earth Pressure at Rest : KO = 1-sin(PHI)
 [Jaky's formula]
Soil Stress Friction Angle              : PHI = (12+N)^0.5+15 ([deg])
 [Dunham]

Soil Density              : GAMMA   = Density of Soil Property
Water Density             : GAMMA.w =      9.807 kN/m³
Scale Factor              : SF      =      1.000

Earth Pressure at Level z : pz = KO*s + KO*(GAMMA*z-GAMMA.w*(WL-z)) + GAMMA.w*(WL-z)
```

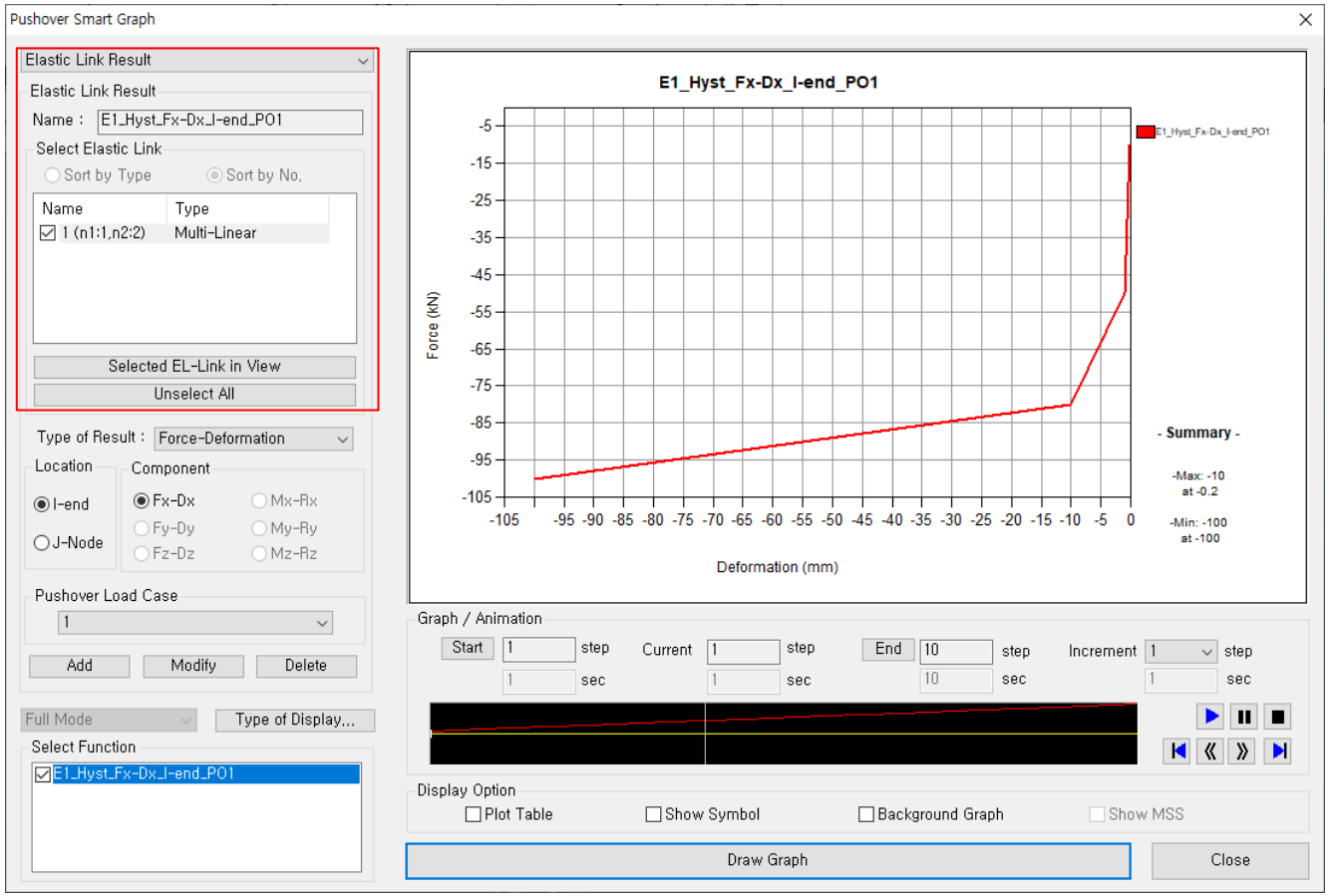
(). STATIC EARTH PRESSURE PROFILE

LEVEL (m)	PHI ([deg])	KO	GAMMA (kN/m³)	GAMMA.w (kN/m³)	p(z) (kN/m²)	ADD. p(z) (kN/m²)
0.000	30.000	0.500	18.000	9.807	0.000	0.000
-1.000	30.000	0.500	18.000	9.807	13.903	0.000
-2.000	30.000	0.500	18.000	9.807	27.807	0.000
-3.000	30.000	0.500	18.000	9.807	41.710	0.000
-4.000	30.000	0.500	18.000	9.807	55.613	0.000
-5.000	30.000	0.500	18.000	9.807	69.517	0.000
-6.000	30.000	0.500	18.000	9.807	83.420	0.000
-7.000	30.000	0.500	18.000	9.807	97.323	0.000
-8.000	30.000	0.500	18.000	9.807	111.227	0.000
-9.000	30.000	0.500	18.000	9.807	125.130	0.000
-10.000	30.000	0.500	18.000	9.807	139.033	0.000

12. Resultados gráficos de links elásticos en análisis pushover

Adición de salida gráfica del enlace elástico (tipo multilineal) en el análisis pushover

Pushover > > Pushover Results > Pushover Smart Graph > ***Elastic Link Graph***



Seleccione Elastic Link

Todos los enlaces elásticos asignados al modelo se muestran en la lista.
Para el mismo tipo, son posibles varias selecciones.

Tipo de Resultado

1.[Force-Deformation] *: Force/Deform.*
2.[Force] *: Force / Time*
3.[Deformation] *: Deformation/Time*

Ubicación/Componente

1.Ubicación *: Posición de salida de elementos*
2.Componente*: Stress-Deform/ ángulo Momento-Rotación en eje de elemento*

Gráfica /Animación

La función de animación comprueba los resultados en una sección específica.
Puede comprobarse junto con los resultados de la tabla

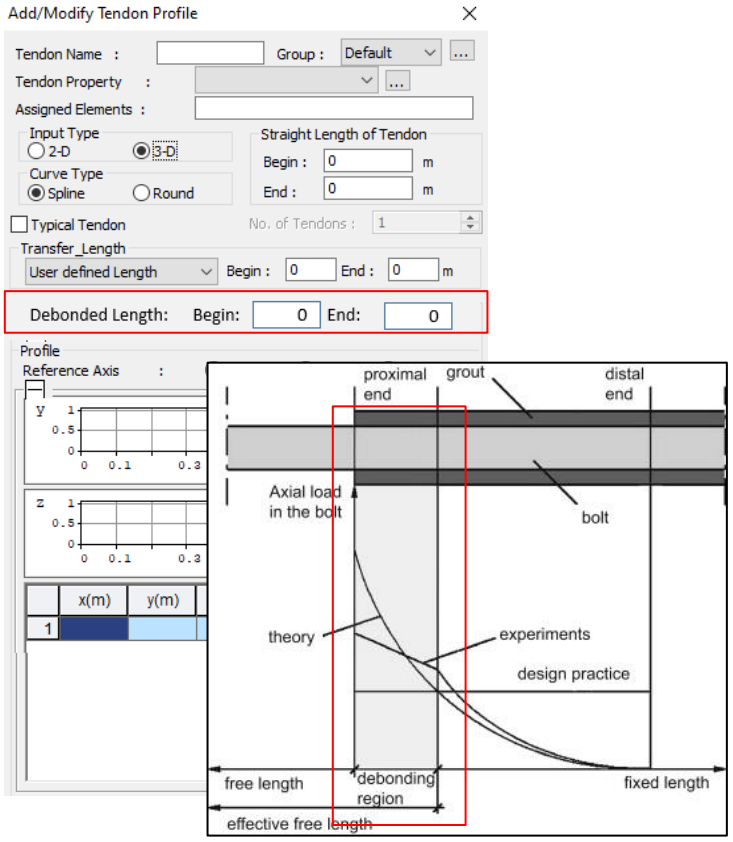
Opciones de Display

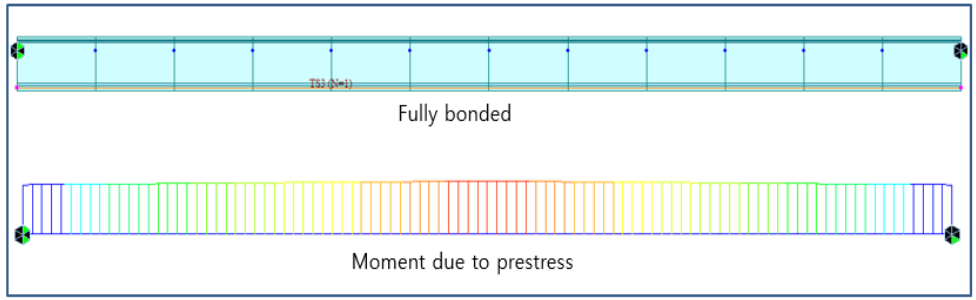
Después de comprobar cada elemento, haga clic en el botón [Gráfico] para aplicarlo al gráfico.

13. Longitud no adherida en vigas pretensadas

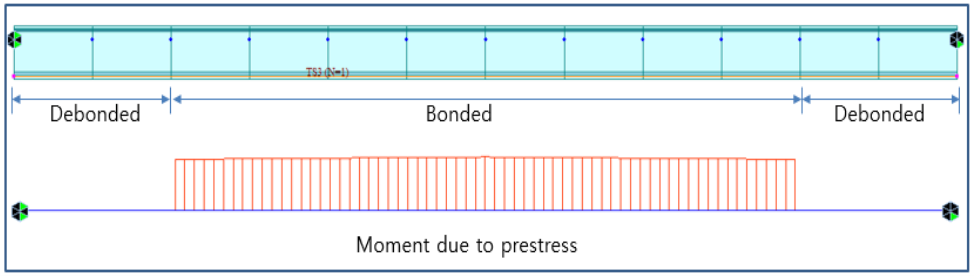
- *La longitud no adherida de la viga pretensada se puede definir directamente al crear torones desde el cuadro de diálogo "Perfil de tendón".*
- *Defina la longitud total real del torón, incluidas las partes no adheridas en ambos extremos y luego ingrese las longitudes de las partes no adheridas.*

Load > Temp./Prestress > Prestress Loads > ***Tendon Profile***





Cuando la longitud no adherida tiene 0, diagrama del momento primario del tendón

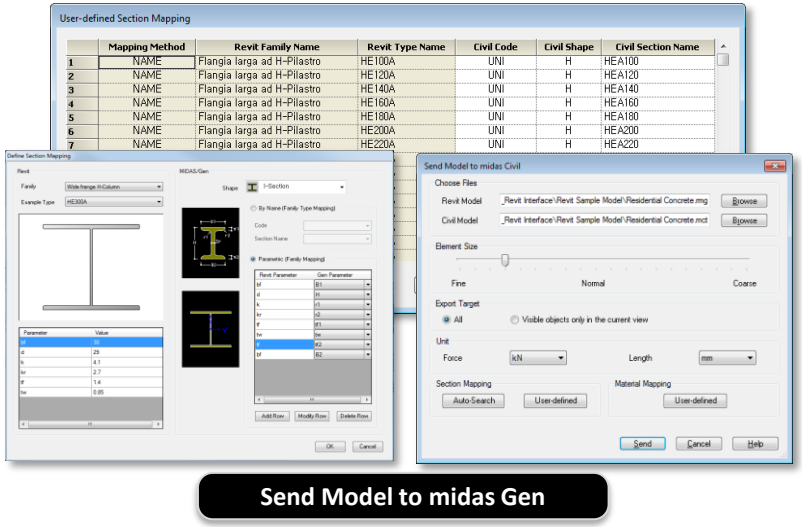


Cuando la longitud no adherida no es cero, diagrama de momento primario del tendón

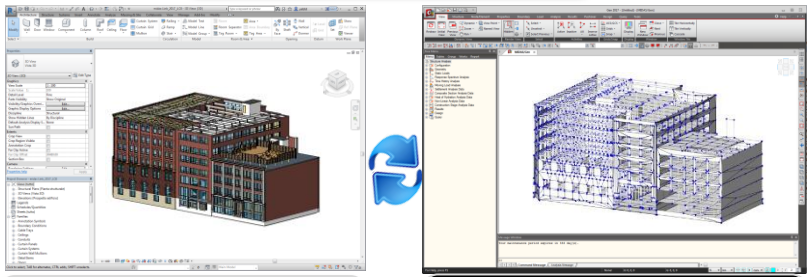
14. Interfaz con Revit 2021

Gen-Revit Link

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



Send Model to midas Gen



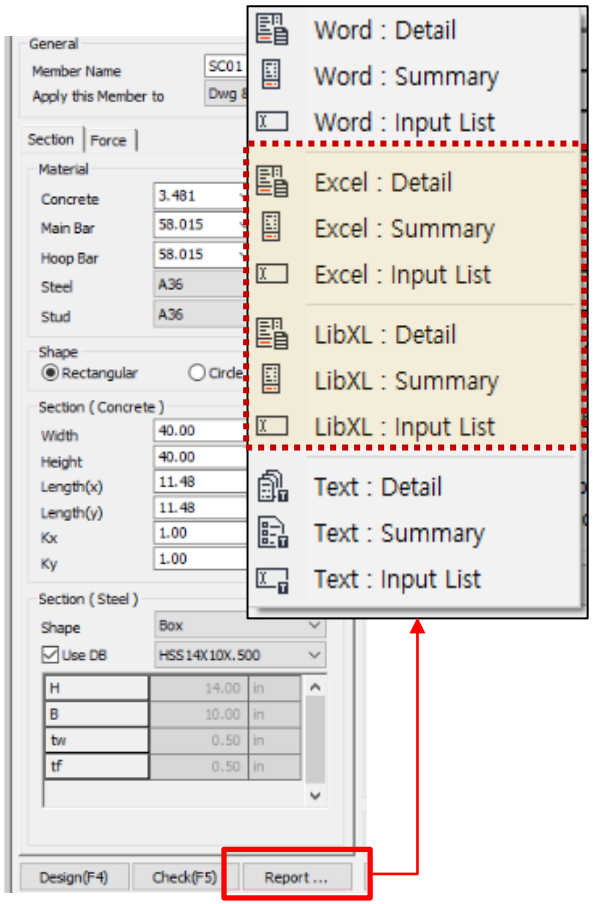
Revit 2021 | **Gen 2021 v1.1 (Nueva versión)**

	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	>

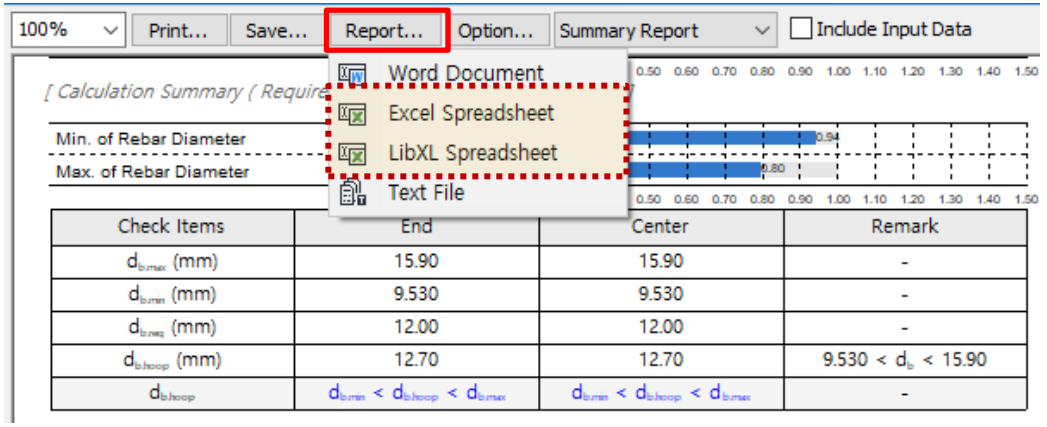
midas Design+

1. Reporte en formato Excel

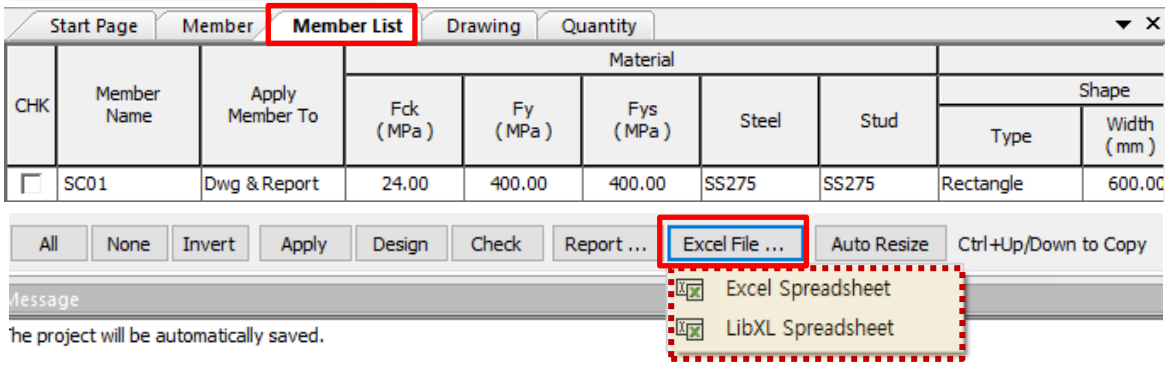
Generate a report of excel format.



Reporte Miembros



Reporte Lista de Miembros



1. Reporte en formato Excel

Reporte Excel

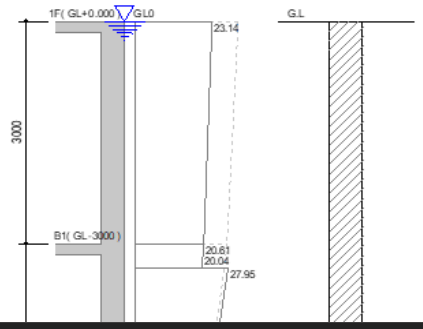
- Proporciona resultados de alta calidad
- Se pueden utilizar todas las funciones de Excel.

(5) *Calculate the Horizontal Ground Reaction Force Coefficient* $\left(\frac{K_H}{Layer}2\right)$

- $K_{H1} = \frac{4{,}082kN}{m^2}$ / m
- $K_{H2} = \frac{5{,}695kN}{m^2}$ / m
- $K_{H3} = \frac{8{,}770kN}{m^2}$ / m

(6) Calculate Displacement of Ground (Load Combination Factor is applied.)

H (m)	u(z) (mm)	u(z)-u(z)B (mm)	KH (kN/m²/m)	p(z) (kN/m²)	p(z) I/R (kN/m²)
0.000	14.17	14.17	4,082	57.84	23.14
3.000	12.62	12.62	4,082	51.54	20.61
3.333	12.27	12.27	4,082	50.09	20.04
3.333	12.27	12.27	5,695	69.88	27.95
6.000	8.329	8.329	5,695	47.43	18.97
6.667	7.085	7.085	5,695	40.35	16.14
6.667	7.085	7.085	8,770	62.13	24.85
9.000	2.217	2.217	8,770	19.44	7.776
10.00	0.000	0.000	8,770	0.000	0.000



Reporte LibXL

- Velocidad de generación de salida muy rápida
- Expresión en el mismo formato que Informe de texto

(2) Calculate the Acceleration Response Spectrum (Sa)
- Fa = 1.120
- Fv = 0.840
- SDS = 2.5 S Fa x 2 / 3 = 0.373
- SD1 = S Fv x 2 / 3 = 0.112
- T0 = 0.2 SD1 / SDS = 0.0600 sec.
- TS = SD1 / SDS = 0.300 sec.
- TL = 5.000 sec.
- Sa = 2.746m/s²

(3) Calculate the Acceleration Response Spectrum of Base Rock (Sv)
- Sv = Sa / ω0 = 0.175m/s

(4) Calculate the Horizontal Ground Reaction Force Coefficient (KH / Layer 1)
- KH1 = 4,082kN/m²/m
- KH2 = 5,695kN/m²/m
- KH3 = 8,770kN/m²/m

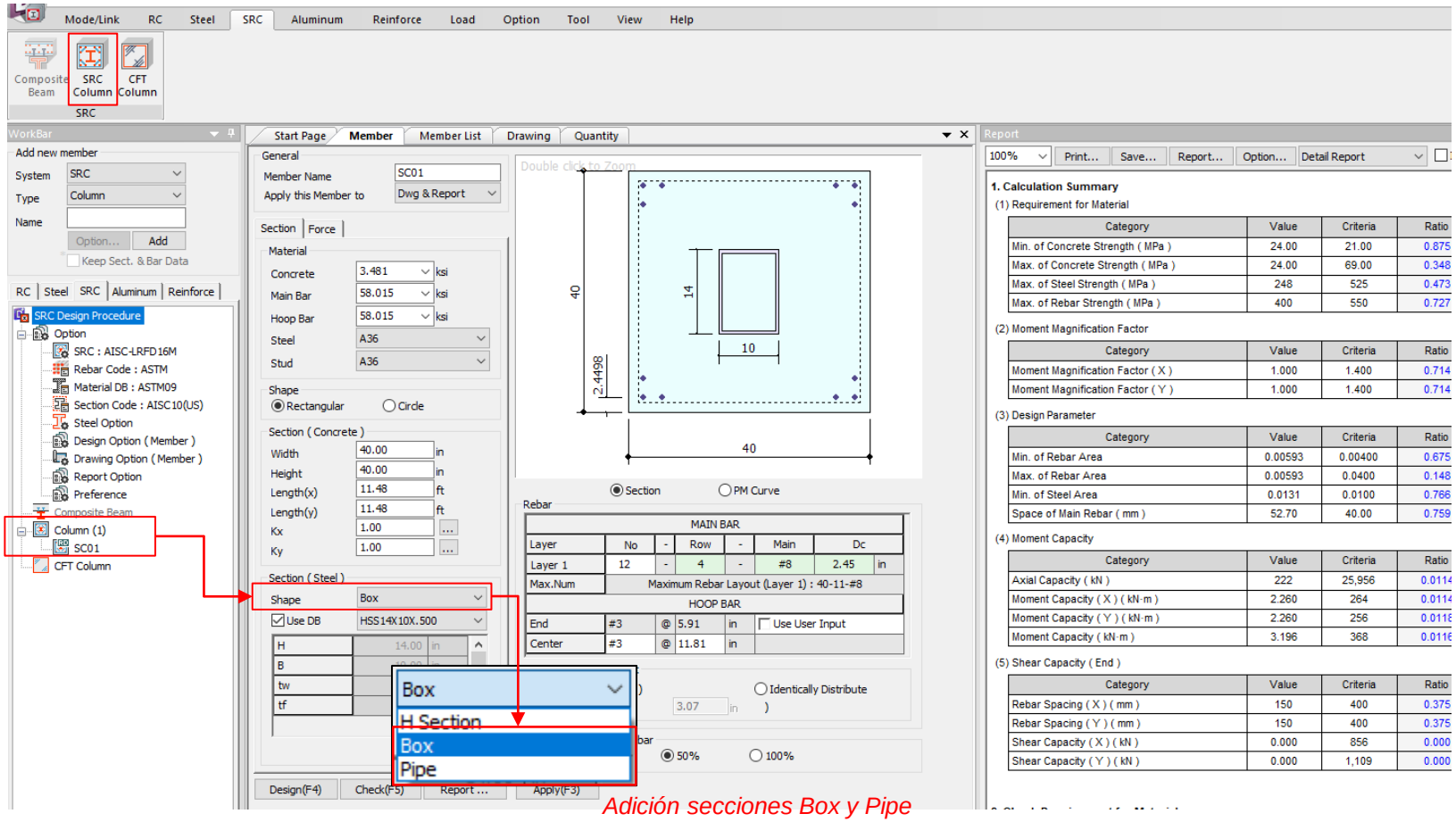
(5) Calculate the Horizontal Ground Reaction Force Coefficient (KH / Layer 2)
- KH1 = 4,082kN/m²/m
- KH2 = 5,695kN/m²/m
- KH3 = 8,770kN/m²/m

(6) Calculate Displacement of Ground (Load Combination Factor is applied.)

H (m)	u(z) (mm)	u(z)-u(z)B (mm)	KH (kN/m²/m)	p(z) (kN/m²)	p(z) I / R (kN/m²)
0.000	14.17	14.17	4,082	57.84	23.14
3.000	12.62	12.62	4,082	51.54	20.61
3.333	12.27	12.27	4,082	50.09	20.04
3.333	12.27	12.27	5,695	69.88	27.95
6.000	8.329	8.329	5,695	47.43	18.97
6.667	7.085	7.085	5,695	40.35	16.14
6.667	7.085	7.085	8,770	62.13	24.85
9.000	2.217	2.217	8,770	19.44	7.776
10.00	0.000	0.000	8,770	0.000	0.000

2. Módulo de columna SRC con secciones cajón y tubulares

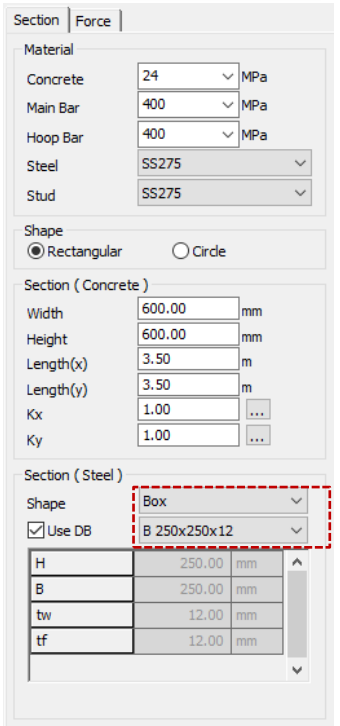
- *Código de diseño aplicado: AISC-LRFD16 (M), 10 (M)*
- *Forma de acero aplicada: sección H, cajón, tubería*

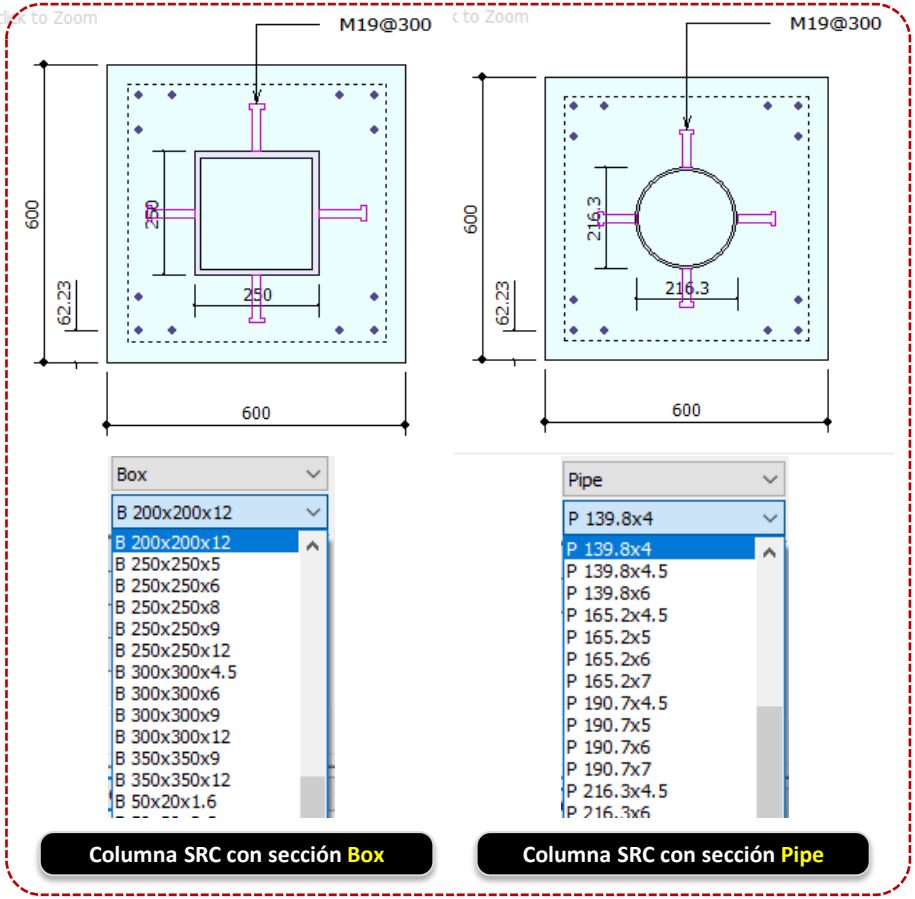


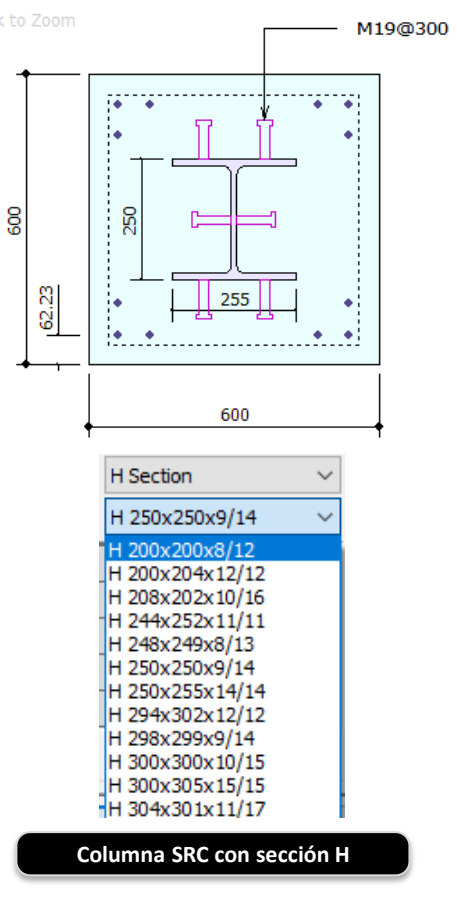
Adición secciones Box y Pipe

2. Módulo de columna SRC con secciones cajón y tubulares

Ejemplo



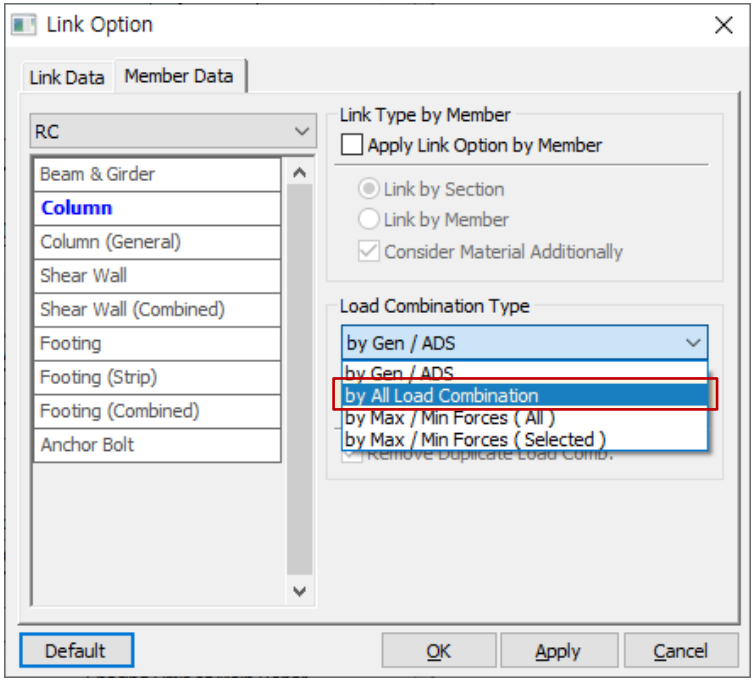




3. Opción de Midas link

- *Adición de tipo "by all combination" en el tipo de combinación de carga.*

Link Option > ***Member Data***



- *Función de enlace de apoyo para todas las combinaciones creadas en Gen*

Lista modulos con [by All Load Combination]

✓ **RC**
- Column / General Section Column
- Shear Wall / Combined Wall
- Footing (Isolated/Combined/Strip)
- Anchor Bolt

✓ **Steel**
- Beam / Column
- Bolt Connection (EC3)
- Moment Connection(KSSC, AISC, EC3)
- Baseplate / Embedded Plate
- Web Opening
- Welding

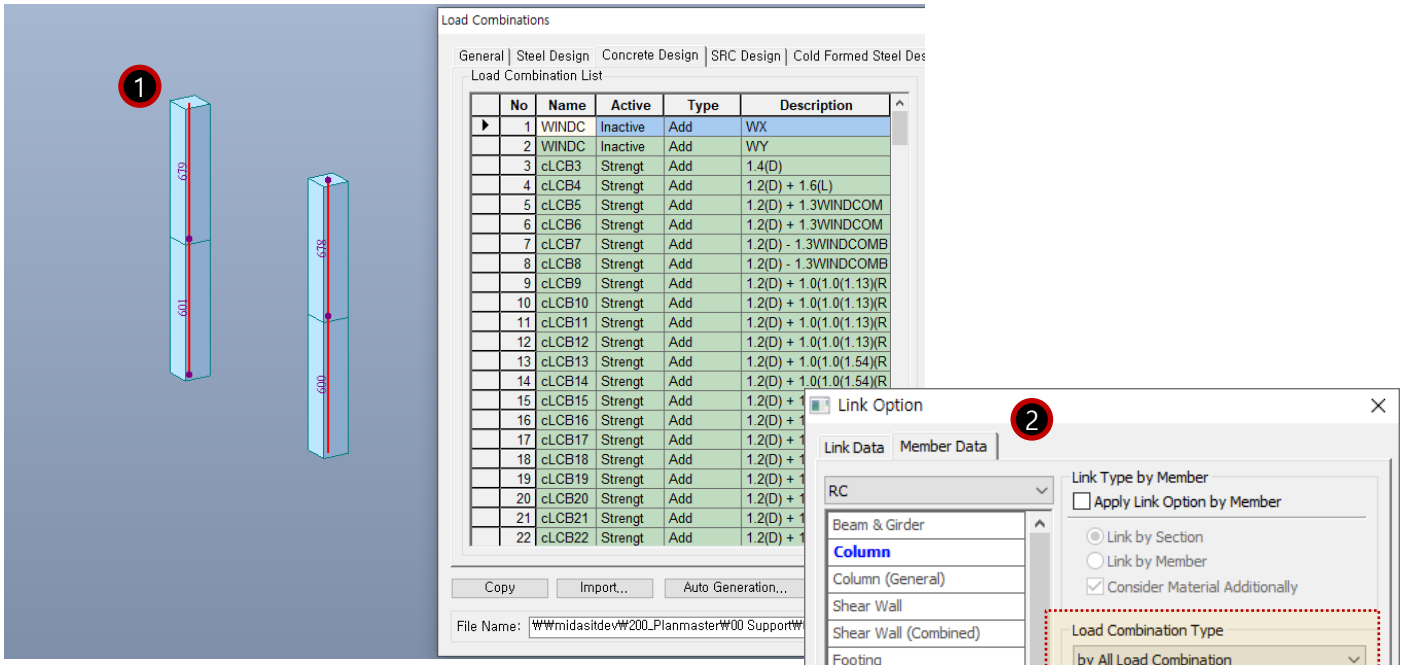
✓ **SRC**
- Column
- CFT Column

✓ **Aluminum**
- Beam / Column
- General Section Beam / Column

✓ **Reinforce**
- Reinforced Beam
- Reinforced Column

3. Opción de Midas link

Ejemplo para tipo “by All Combination”



1. Genere una combinación de carga y seleccione una columna.

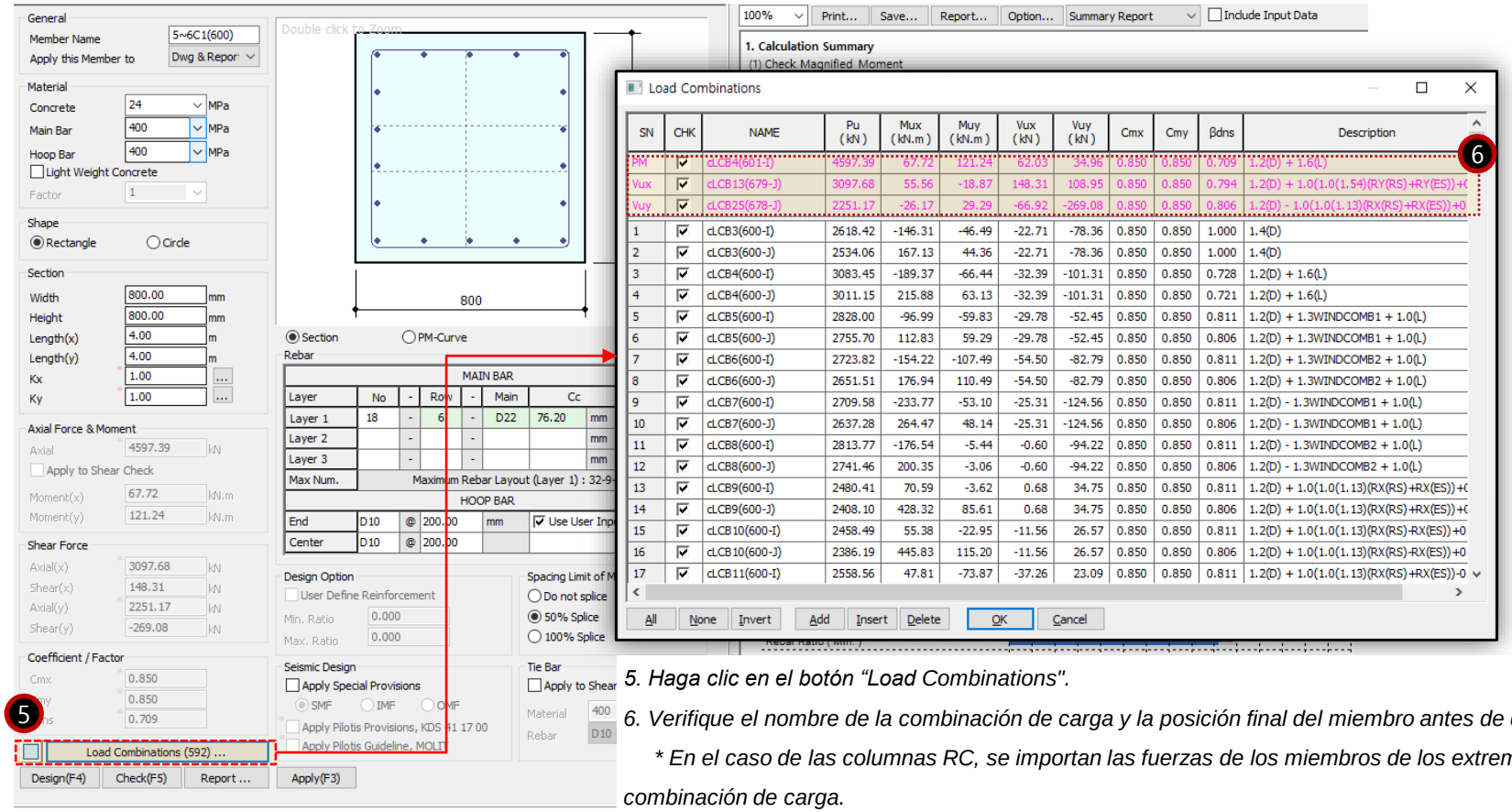
2. Establezca el tipo de combinación by All Load Combination en Link Option> Member Data> Column tab.

3. Verifique el número de miembro e importe la información de diseño de los miembros.

4. Verifique la Lista de miembros en el menú del árbol de RC.

3. Opción de Midas link

Ejemplo para tipo “by All Combination”



5. Haga clic en el botón “Load Combinations".

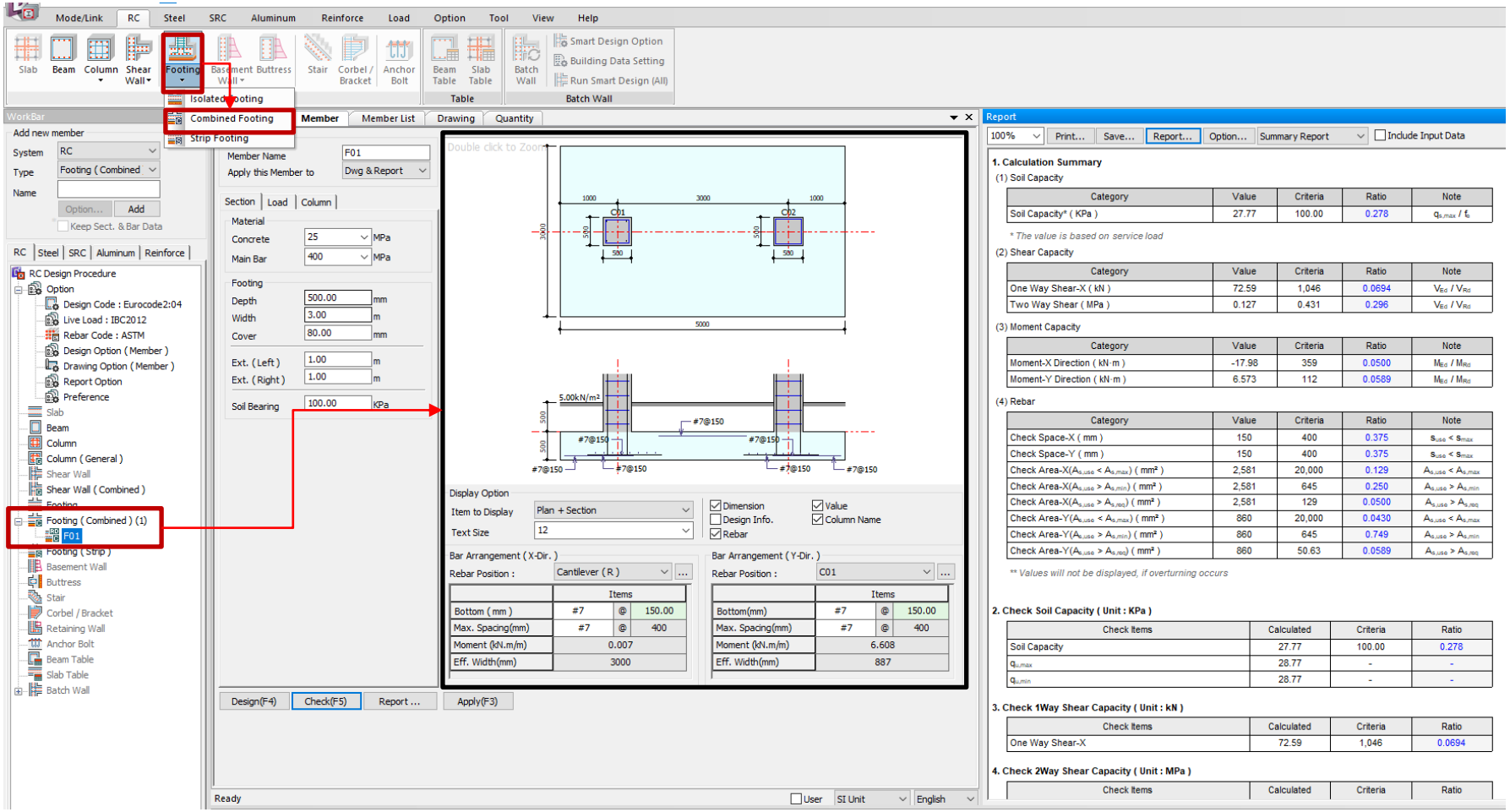
6. Verifique el nombre de la combinación de carga y la posición final del miembro antes de diseñar / verificar.

** En el caso de las columnas RC, se importan las fuerzas de los miembros de los extremos I y J por combinación de carga.*

Recomendado para comprobar la posición del diseño.

4. Diseño de zapatas combinadas por Eurocode

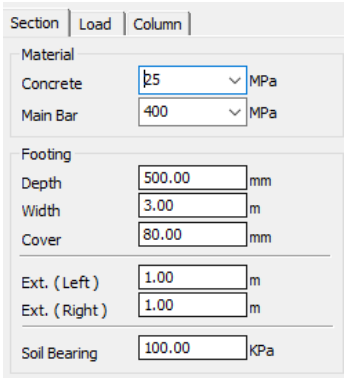
Adición de diseño de zapata combinada según Eurocódigo 2: 04



4. Diseño de zapatas combinadas por Eurocode

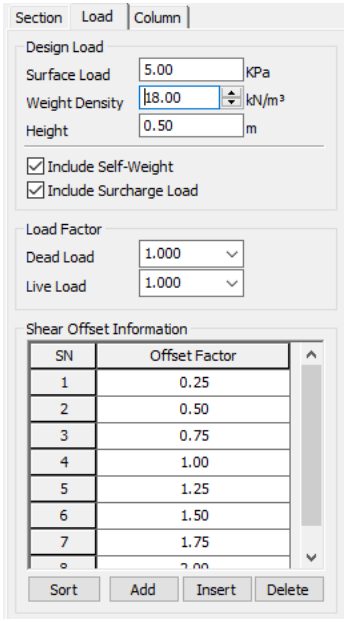
Procedimiento de diseño de zapatas combinadas

Defina Sección



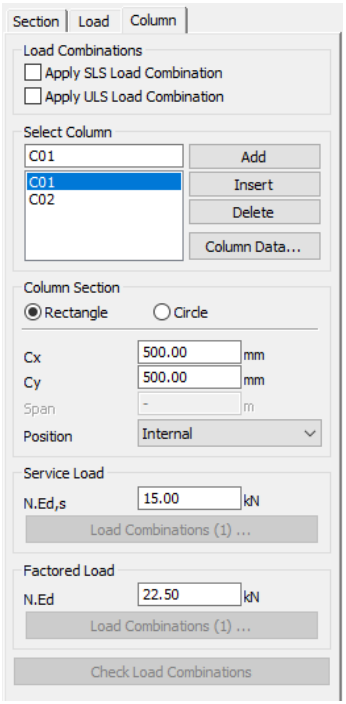
Paso 1.
Definir hormigón, material de armadura, capacidad del suelo e información del elemento de la zapata.

Defina Carga



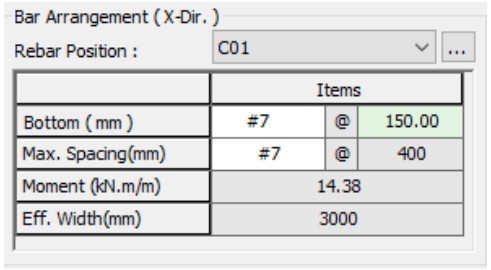
Paso 2.
Definir datos de carga. (Carga de diseño, factor, información de corte (Shear offset))

Defina información de columna



Paso 3.
Defina el elemento de columna e información de carga aplicada.

Defina arreglo de barras



Paso 4.
Defina arreglo de barras y espaciamiento

4. Diseño de zapatas combinadas por Eurocode

Reporte de Diseño resumido

3. Check 1Way Shear Capacity (Unit : kN)

Check Items	Calculated	Criteria	Ratio
One Way Shear-X	72.59	1,046	0.0694

4. Check 2Way Shear Capacity (Unit : MPa)

Check Items	Calculated	Criteria	Ratio
Two Way Shear-Column Face	0.184	3.825	0.0480
Two Way Shear-UserD	0.107	0.431	0.248
Two Way Shear-2D	0.0193	0.431	0.0447
Two Way Shear	0.107	0.431	0.248

5. Check Moment Capacity (Unit : kN·m/m)

Check Items	Calculated	Criteria	Ratio
Moment-X Direction(Cantilever)	0.0140	359	0.0000391
Moment-X Direction(Column)	14.38	359	0.0400
Moment-X Direction(Span)	-17.98	359	0.0500
Moment-X Direction	-17.98	359	0.0500
Moment-Y Direction	6.573	112	0.0589

Reporte de Diseño detallado

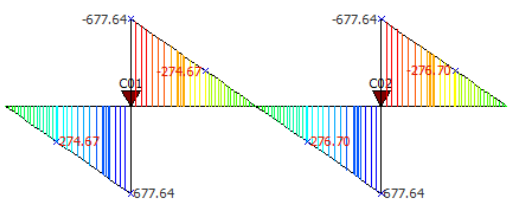
3. Check One-Way Shear (Direction X)

(1) Calculate ratio of shear capacity

Column	D_{eff} (mm)	k	ρ	V_{Rdx1} (kN)	V_{Rdx2} (kN)	V_{Ed} (kN)	$V_{Rd,max}$ (kN)	Ratio	Remark
C01	409	1.699	0.00631	1,046	793	72.59	1,046	0.0694	OK
C02	409	1.699	0.00631	1,046	793	72.59	1,046	0.0694	OK

- $k = \min[\,1 + \sqrt{200/d}\,,\ 2.0\,] = 1.699$
- $\rho_l = \min[\,A_{sl}\,/b_w\,d,\ 0.02\,] = 0.00631$
- $C_{Rd,c} = 0.18\,/\,\gamma_c = 0.120$
- $V_{Rdx1} = [C_{Rd,c}\ k\ (100\ \rho_l\ f_{ck})^{1/3} + k_1\ \sigma_{cp}\,]\ b_w\ d = 1,046kN$
- $V_{Rdx2} = [0.035\ k^{3/2}\ f_{ck}^{1/2} + k_1\ \sigma_{cp}\,]\ b_w\ d = 793kN$
- $V_{Rdx} = V_{Rd,c} = 1,046kN$
- $V_{Edx} = 72.59kN$
- $V_{Edx}\ /\ V_{Rdx} = 0.0694 \rightarrow O.K$

Diagram

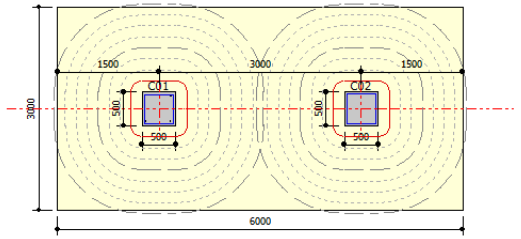


4. Check Two-Way Shear

(1) Calculate Shear at Face of Column

Column	Position	Offset (mm)	U (mm)	β	k	V_{Ed} (MPa)	$V_{Rd,max}$ (MPa)	Ratio	Remark
C01	Interior	0.000	2,000	6.497	0.000	0.184	3.825	0.0480	OK
C02	Interior	0.000	2,000	6.497	0.000	0.183	3.825	0.0478	OK

- U = 2,000mm
- $a = (\frac{e_x}{b_y})^2$, $b = (\frac{e_y}{b_x})^2$
- $\beta = 1+1.8\sqrt{a+b} = 6.497$
- $v_{Ed} = \frac{\beta\ N_{Ed}}{U\ d} = 0.184MPa$
- $f_{cd} = \alpha_{cc}\ f_{ck}\ /\ \gamma_c = 0.000MPa$



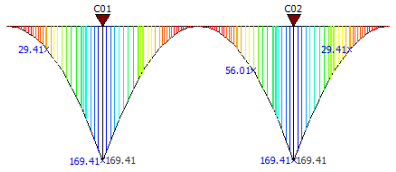
5. Calculate moment capacity

(1) Calculate moment capacity (Direction X)

Position	Top/Bottom	f_{yd} (MPa)	z (mm)	A_s (mm²)	M_{Ed} (kN·m/m)	M_{Rd} (kN·m/m)	Ratio	Remark
Cantilever(L)	Bottom	348	400	2,581	0.0140	359	0.0000391	OK
Colm (C01)	Bottom	348	400	2,581	14.38	359	0.0400	OK
Span (C01-C02)	Top	348	400	2,581	-17.98	359	0.0500	OK
Colm (C02)	Bottom	348	400	2,581	14.38	359	0.0400	OK
Cantilever(R)	Bottom	348	400	2,581	0.00746	359	0.0000208	OK

- $M_{Rd} = f_{yd}\ A_s\ z$

(2) Bending Moment Diagram (Direction X)

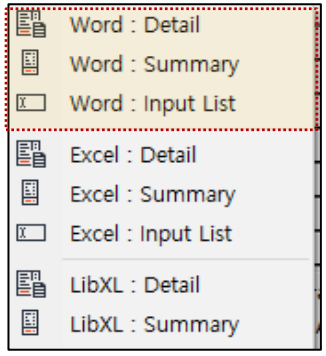


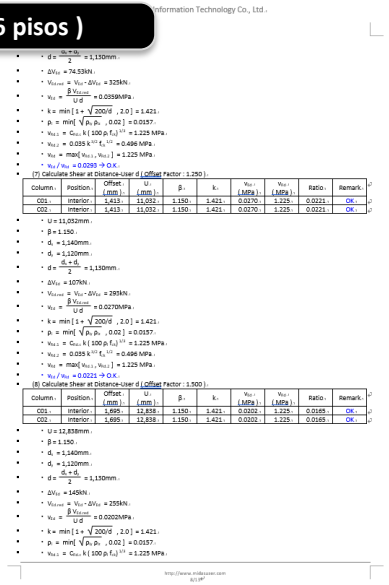
5. Velocidad de informes para formato MS Word

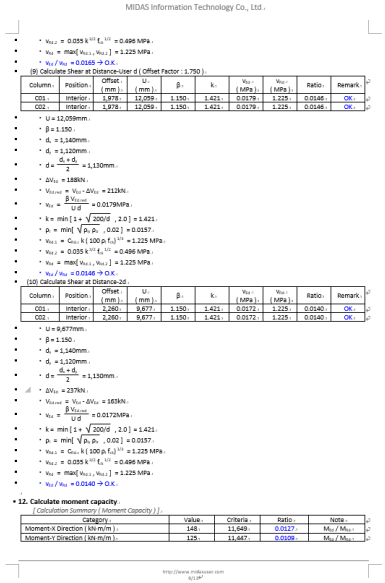
- *El tiempo de presentación de informes para el formato MS Word se ha reducido mejorando el algoritmo.*

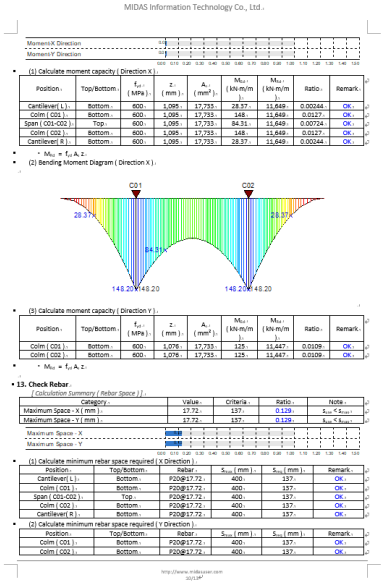
Ejemplo Modelo (Estructura RC de 6 pisos)

- ✓ *Código Nacional : Eurocode2:04*
- ✓ *Módulo: Combined Footing Design*
- ✓ *Páginas de Reporte: 13 cada una*









[Tiempo de Reporte : Design+ 2020 vs Design+ 2021 (Nueva Versión)]

99% reducción en tiempo de reporte