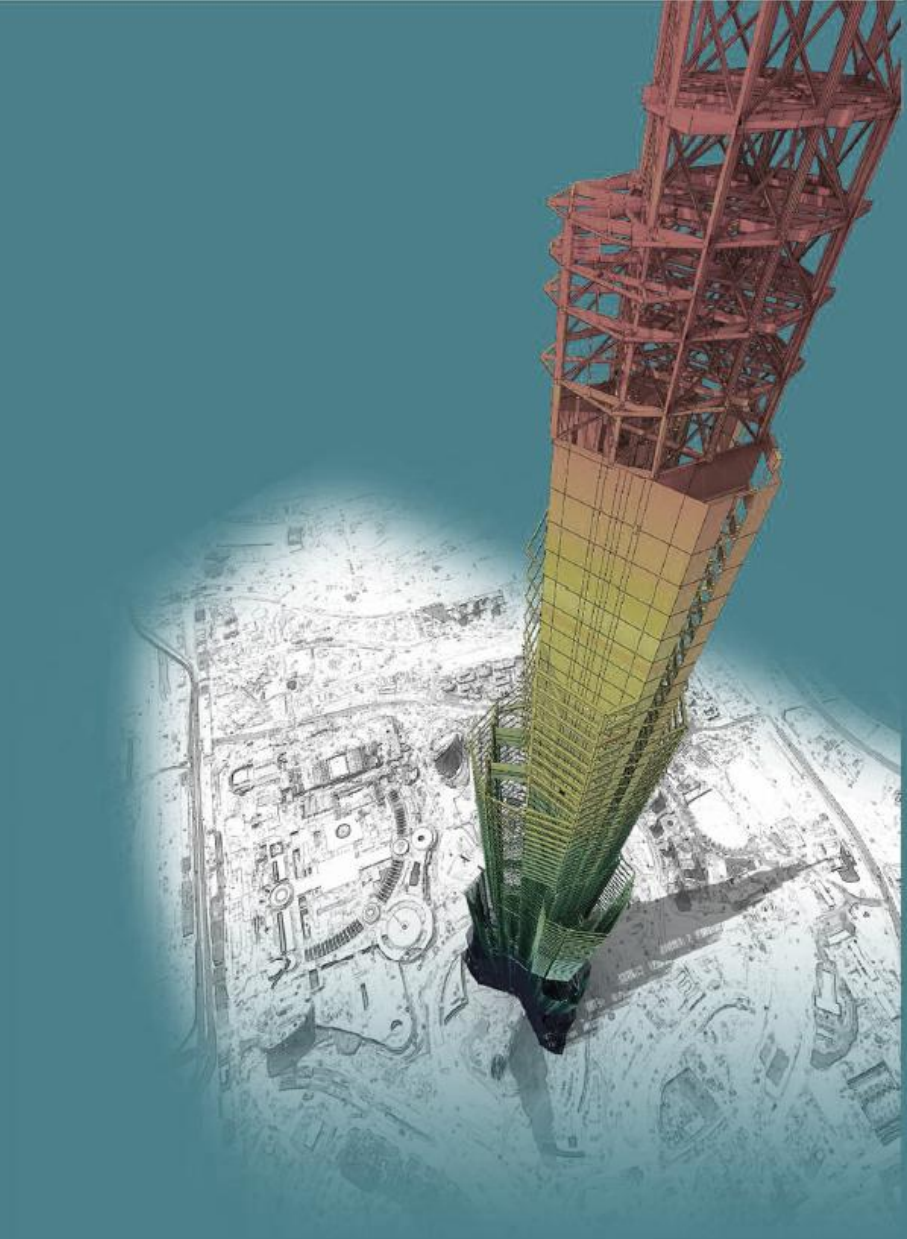


Release Note

Release Date: Jan. 2025

Product Version : GEN 2025 (v1.2)

DESIGN + 2025 (v1.1)



Design System of General Structures

Integrated Design System for Building and General Structures

Index

GEN

- [NMX 2023 & NTCS 2023 \(New Mexican design code\) : See Appendix 01](#)
- [Russian Standard \(New Design Code\) : See Appendix 02](#)
- [BS 5950-2000 \(New Steel Design Code\) : Added Steel Design as per BS 5950-2000](#)
- [NSCP 2015 \(Add New Features\)](#)
- [ETC](#)
 1. Add Combined Type for Cold-Formed Section
 2. Fix Bugs of Lateral Loads as per DTP (Thailand)
 3. Addition of “Master Design” as New Interface (Only for Italy)
 4. Improvement of Gen-IDEA statica Connection Interface (Load Combinations)
 5. Addition of New Rebar DB

DESIGN+

- [RC Column Design for Pipe Shape](#)
- [Improvement of Retained Wall Design](#)
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Appendix

- [01 : Revised provisions reflected in Gen of NTC & NMX 2023](#)
- [02 : Implemented Russian code in midas Gen](#)

GEN

1. Added the rebar size & material DB of NMX 2023 (Mexican design code)

Tabla 2.2.1 – Clases y propiedades de los concretos estructurales convencionales

Requerimiento (Inciso de referencia)	Método de ensayo	Concreto Clase 1		Concreto Clase 2
Resistencia a la compresión, f'_c (2.2.6)	NMX-C-083- ONNCCF-2020	$25 \leq f'_c \leq 40$ MPa (250 $\leq f'_c \leq 400$ kg/cm ²)	$40 \leq f'_c \leq 70$ MPa (400 $\leq f'_c \leq 700$ kg/cm ²)	$20 \leq f'_c \leq 35$ MPa (200 $\leq f'_c \leq 350$ kg/cm ²)
Resistencia media a la tensión, f_t (2.2.7)	NMX-C-163- ONNCCF-2019	$0.47\sqrt{f'_c}$, en MPa ($1.5\sqrt{f'_c}$, en kg/cm ²)	<ul style="list-style-type: none">• Concretos con agregado grueso calizo: $0.53\sqrt{f'_c}$, en MPa ($1.67\sqrt{f'_c}$, en kg/cm²)• Concretos con agregado grueso basáltico: $0.47\sqrt{f'_c}$, en MPa ($1.50\sqrt{f'_c}$, en kg/cm²)	$0.38\sqrt{f'_c}$, en MPa ($1.2\sqrt{f'_c}$, en kg/cm ²)
Resistencia media a la tensión por flexión o módulo de rotura, f_{fr} (2.2.7)	NMX-C-191- ONNCCF-2015	$0.63\sqrt{f'_c}$, en MPa ($2\sqrt{f'_c}$, en kg/cm ²)	<ul style="list-style-type: none">• Concretos con agregado grueso calizo: $0.85\sqrt{f'_c}$, en MPa ($2.70\sqrt{f'_c}$, en kg/cm²)• Concretos con agregado grueso basáltico: $0.80\sqrt{f'_c}$, en MPa ($2.54\sqrt{f'_c}$, en kg/cm²)	$0.44\sqrt{f'_c}$, en MPa ($1.4\sqrt{f'_c}$, en kg/cm ²)
Peso volumétrico en estado fresco (γ) (2.2)	NMX-C-162- ONNCCF-2014	≥ 22 kN/m ³ (≥ 2200 kg/m ³)		$19 \leq \text{peso vol.} \leq 22$ kN/m ³ ($1900 \leq \text{peso vol.} \leq 2200$ kg/m ³)
Módulo de elasticidad, E_c (2.2.8)	NMX-C-128- ONNCCF-2013	<ul style="list-style-type: none">• Concretos con agregado grueso calizo: $4400\sqrt{f'_c}$, en MPa ($14000\sqrt{f'_c}$, en kg/cm²)• Concretos con agregado grueso basáltico: $3500\sqrt{f'_c}$, en MPa ($11000\sqrt{f'_c}$, en kg/cm²)	<ul style="list-style-type: none">• Concretos con agregado grueso calizo: $2700\sqrt{f'_c} + 11000$, en MPa ($0500\sqrt{f'_c} + 11000$, en kg/cm²)• Concretos con agregado grueso basáltico: $2700\sqrt{f'_c} + 5000$, en MPa ($8500\sqrt{f'_c} + 5000$, en kg/cm²)	$2500\sqrt{f'_c}$, en MPa ($8000\sqrt{f'_c}$, en kg/cm ²)
Contracción por secado, ϵ_{cs} (2.2.9) Coeficiente de flujo plástico, C_f (2.2.10)	NMX C-173- ONNCCF-2010 ASTM C512/C512M-15	≤ 0.001	≤ 0.0006	≤ 0.002
Aplicaciones		Debe utilizarse en: <ul style="list-style-type: none">• Camellones y estructuras del grupo A, B1 y B2.• Estructuras con requerimientos de durabilidad. Es aceptable el uso en estructuras del grupo B2 que cumplan con todo lo siguiente: <ul style="list-style-type: none">• Claros no mayores que 4 m.• Alcan total de no más de 5 m en dos niveles, sobre nivel de banquetas y• Estructuras de no más de 120 m³ de construcción.		

Material Data

General

Material ID 1 Name

Elasticity Data

Type of Design Concrete

Steel

Standard

DB

Product

Concrete

Standard EN04(RC)

DB

Type of Material

Isotropic

Orthotropic

Steel

Modulus of Elasticity : 0.0000e+00 kN/m²

Poisson's Ratio : 0

Thermal Coefficient : 0.0000e+00 1/[F]

Weight Density : 0 kN/m³

Use Mass Density: 0 kN/m³/g

• Add Standards for SI & MKS unit

Concrete

Standard NMX2023(RC)

Code

DB

Type of Material

Isotropic

Orthotropic

Steel

Modulus of Elasticity : 0.0000e+00 kN/m²

Poisson's Ratio : 0

Thermal Coefficient : 0.0000e+00 1/[F]

Weight Density : 0 kN/m³

Use Mass Density: 0 kN/m³/g

Concrete

Modulus of Elasticity : 0.0000e+00 kN/m²

Poisson's Ratio : 0

Thermal Coefficient : 0.0000e+00 1/[F]

Weight Density : 0 kN/m³

Use Mass Density: 0 kN/m³/g

• Add DB for Class 1A, Class 1B, and Class 2

- "Class 2" Density : 22kN/m³

- Change in tensile strength and elastic modulus formulas according to class and aggregate type.

* DB Name

300 – C1A(C) → Aggregate type
(C) : Calizo (B) : Basáltico
Class Type
Compression Strength

2. Added the rebar size & material DB of NMX 2023 (Mexican design code)

DB	Ec modulus of elasticity	W weight density	Diameter	Area	Weight
UNIT	stress = F/L^2	density = F/L^3	cm	cm2	kgf/cm
#2	2.00E+06	0.00792	0.79	0.49	0.004
#3	2.00E+06	0.00788	0.953	0.71	0.006
#4	2.00E+06	0.00783	1.27	1.27	0.010
#5	2.00E+06	0.00784	1.588	1.98	0.016
#6	2.00E+06	0.00784	1.905	2.85	0.022
#7	2.00E+06	0.00784	2.223	3.88	0.030
#8	2.00E+06	0.00784	2.54	5.07	0.040
#9	2.00E+06	0.00784	2.865	6.42	0.050
#10	2.00E+06	0.00784	3.18	7.94	0.062
#11	2.00E+06	0.00784	3.49	9.57	0.075
#12	2.00E+06	0.00784	3.81	11.4	0.089
#14	2.00E+06	0.00783	4.45	15.52	0.121
#16	2.00E+06	0.00784	5.08	20.26	0.159
#18	2.00E+06	0.00783	5.72	25.65	0.201

Rebar Information

Rebar Code: NMX-2013(MKS)

CHK	Name	Dia (m)	Area (m²)	Dia(Out) (m)	Weight (kN/m)
<input type="checkbox"/>	#2	0.0079	0.0000	0.0079	0.0038
<input type="checkbox"/>	#3	0.0095	0.0001	0.0095	0.0055
<input type="checkbox"/>	#4	0.0127	0.0001	0.0127	0.0097
<input type="checkbox"/>	#5	0.0159	0.0002	0.0159	0.0152
<input type="checkbox"/>	#6	0.0191	0.0003	0.0191	0.0219
<input checked="" type="checkbox"/>	#7	0.0222	0.0004	0.0222	0.0298
<input type="checkbox"/>	#8	0.0254	0.0005	0.0254	0.0390
<input type="checkbox"/>	#9	0.0287	0.0006	0.0287	0.0494
<input type="checkbox"/>	#10	0.0318	0.0008	0.0318	0.0610
<input type="checkbox"/>	#11	0.0349	0.0010	0.0349	0.0736
<input type="checkbox"/>	#12	0.0381	0.0011	0.0381	0.0877
<input type="checkbox"/>	#14	0.0445	0.0016	0.0445	0.1191
<input type="checkbox"/>	#16	0.0508	0.0020	0.0508	0.1558
<input type="checkbox"/>	#18	0.0572	0.0026	0.0572	0.1969

OK Close

◀ Rebar Size DB as per NMX 2023

Tabla 2.4.2.1.2.b – Requisitos de tensión para refuerzo NMX-B-457-CANACERO-2019

Requisitos	Grado 42	Grado 56
Resistencia mínima a la tensión, MPa (kg/cm²)	550 (5 600)	690 (7 030)
Esfuerzo de fluencia, mínimo, MPa (kg/cm²)	412 (4 200)	550 (5 600)
Esfuerzo de fluencia, máximo, MPa (kg/cm²)	540 (5 500)	675 (6 880)
Relación mínima entre la resistencia a la tensión real y el esfuerzo de fluencia real	1.25	1.25
Alargamiento a la fractura en 200 mm, mínimo, %		
Designación 3, 4, 5, 6	14	12
Designación 7, 8, 9, 10, 11, 12	12	12
Designación 14, 16, 18	10	10

Preferences

Environment

- General
- View
- Data Tolerances
- Property
- Load
- Results
- Design/Load Code
- Notice & Help
- Graphics
- Output Formats
 - Formats - Dim. & Others
 - Formats - Forces
 - Formats - Loads

Common

Steel

Design Code: Eurocode3:05

National Annex: Recommended

Cold Formed Steel

Design Code: Eurocode3-1-3:06

National Annex: Recommended

Concrete

Design Code: Eurocode2:04

National Annex: Italy

Rebar

Material Code: NMX2023(MKS)(f)

Material DB: Grade 42

Material Code: ASTM(RC)

Material DB: Grade 60

SRC

Design Code: SSR79

Rebar

Material Code: ASTM(RC)

Material DB: Grade 60

Save Changes Upon OK

Default All Set Default OK Cancel

▲ Rebar Material DB as per NMX 2023

3. Added Design Code for NMX 2023 (Mexican design code)

• Design Code Setting for NTC-DCEC 2023

Concrete Design Code

Design Code : **NTC-DCEC(2023)**

☐ Check Beam Defl

☒ Apply Special Pro

☒ Seismic Design

☐ Torsion Design

☐ Torsion Reduction

Moment Redistrib

Moment Calculation

☐ Equivalent Re

☐ Use Subdivided

P-M Curve Calcula

☐ Keep P Const

☐ Check the intera

fs of Main bar in B

☒ 2/3*fy

NTC-DCEC(2023)

NTC-DCEC(2017)

SP 63.13330.2018

OK Close

• Irregularity Check for NTC-DCEC 2023

Irregularity Check Parameter...

Torsional Irregularity Check...

Criteria for Regularity in Plan...

Torsional Amplification Factor...

Stiffness Irregularity Check(Soft Story)...

Weight Irregularity Check...

Capacity Irregularity Check (Weak Story)...

Select Calculation Method

Country Code : **NTCS2023**

Story Drift Method

☒ Drift at the C

☐ Max. Drift of

☐ Max. Drift of

Story Stiffness Me

☒ 1 / Story Drif

☐ Story Shear / Story Drift

Seismic Behavior Factor, Q

☒ Q = 4

☐ Q ≤ 3

OK Cancel

◀ Irregularity Check Parameter (Added NTCS-2023)

Load Case	Story	Level (mm)	Story Height (mm)	Average Value of Extreme Points				Maximum Value		Remark
				Story Drift (mm)	1.15*Story Drift (mm)	1.3*Story Drift (mm)	1.4*Story Drift (mm)	Node	Story Drift (mm)	
Ex	5F	16000.00	4000.00	0.0696	0.0801	0.0905	0.0975	18	0.0711	Regular
Ex	4F	12000.00	4000.00	0.1739	0.1999	0.2260	0.2434	14	0.1818	Regular
Ex	3F	8000.00	4000.00	1.3834	1.5909	1.7984	1.9367	10	1.3897	Regular
Ex	2F	4000.00	4000.00	0.3723	0.4282	0.4840	0.5212	2	0.3852	Regular
Ex	1F	0.00	4000.00	6.0428	6.9492	7.8557	8.4599	1	6.0506	Regular

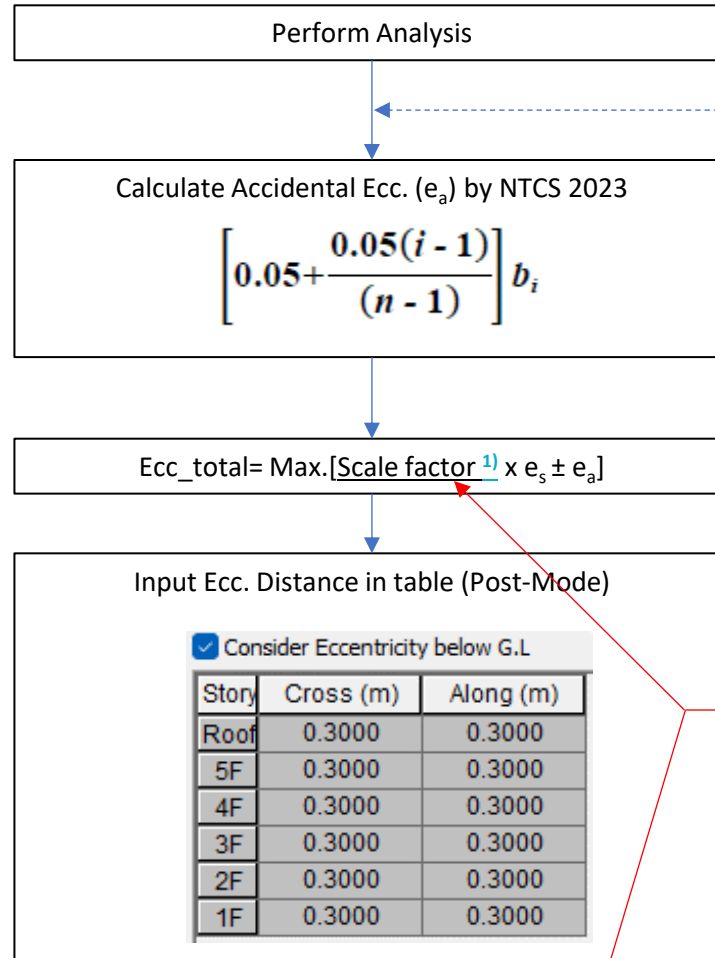
▲ Torsional Irregular Check Table as per NTCS-2023

Load Case	Story	Level (mm)	Story Height (mm)	Story Drift (mm)	Story Shear Force (kN)	Story Stiffness	Upper Story Stiffness				Remark	Average(Ki+1, Ki-1)		Remark
							1.3K (Upper)	0.85K (Upper)	0.5K (Upper)	0.4K (Upper)		0.5K (Average)	0.4K (Average)	
Ex	5F	16000.00	4000.00	0.0696	3.61	57436.14	-	-	-	-	-	-	-	-
Ex	4F	12000.00	4000.00	0.1739	7.40	23005.77	74666.98	48820.72	28718.07	22974.45	Irregular	15081.90	12065.52	Regular
Ex	3F	8000.00	4000.00	1.3834	10.13	2891.46	29907.50	19554.90	11502.89	9202.31	Irregular	8437.35	6749.88	Strongly Irreg
Ex	2F	4000.00	4000.00	0.3723	11.95	10743.61	3758.90	2457.74	1445.73	1156.58	Irregular	888.35	710.68	Regular
Ex	1F	0.00	4000.00	6.0428	12.86	661.94	13966.69	9132.07	5371.80	4297.44	Irregular	-	-	-

▲ Stiffness Irregular Check Table as per NTCS-2023

4. Added Eccentricity as per NTCS 2023

- The analysis eccentricity is additionally reflected in the accidental eccentricity.
- The accidental eccentricity ratio can be reflected to increase linearly.



- Get Analysis Ecc. (e_s) from Story Eccentricity Table

	Story	Level (m)	Weight Center		Stiffness Center		Ecc. Dist.	
			X (m)	Y (m)	X (m)	Y (m)	X (m)	Y (m)
	Roof	20.00	0.00	0.00	0.00	0.00	0.00	0.00
	5F	16.00	0.00	0.00	0.00	0.00	0.00	0.00
	4F	12.00	0.00	0.00	0.00	0.00	0.00	0.00
	3F	8.00	0.00	0.00	0.00	0.00	0.00	0.00
	2F	4.00	0.00	0.00	0.00	0.00	0.00	0.00
	1F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.3 Efectos de torsión

La excentricidad torsional, e_s , calculada en cada entrepiso, debe tomarse como la distancia entre el centro de torsión del nivel correspondiente y la línea de acción de la fuerza lateral que actúa en él. Para fines de diseño, el momento torsionante debe tomarse, por lo menos, igual a la fuerza lateral que actúa en el nivel multiplicada por la excentricidad que para cada elemento vertical sismo-resistente resulte más desfavorable de las siguientes:

[Example] Scale factor = $(1.5 - 1) = 0.5$ $1.5e_s + e_a$ (2.3.1.a)

[Example] Scale factor = $(1.0 - 1) = 0$ $e_s + e_a$ (2.3.1.b)

donde e_a es la excentricidad accidental en la dirección de análisis, medida perpendicularmente a la acción sísmica.

La excentricidad accidental, e_{ai} , en la dirección perpendicular a la de análisis en el i -ésimo entrepiso debe calcularse como sigue:

$$\left[0.05 + \frac{0.05(i-1)}{(n-1)} \right] b_i \quad (2.3.2)$$

donde b_i es la dimensión del i -ésimo piso en la dirección perpendicular a la dirección de análisis; y n , el número de pisos del sistema estructural. Cuando las fuerzas sísmicas se aplican de manera concurrente en 2 direcciones ortogonales, la excentricidad accidental no necesita ser considerada de manera simultánea en ambas direcciones, sino que debe ser aplicada en la dirección que produce el mayor efecto.

¹⁾ e_s (analysis Ecc.) is automatically reflected during an analysis, so it is used only when applying a factor exceeding 1.0.

4. Added Eccentricity as per NTCS 2023 : Eccentricity in Response Spectrum

Accidental Eccentricity for Response Spe...

Eccentricity Data

☐ Automatic ☒ User Defined

Eccentricity: 5 % of Plan Dim.

Eccentricity Calculation by User's Method

Perpendicular to Excitation Angle

☒ Consider Eccentricity below G.L.

Story	Cross (mm)	Along (mm)
Roof	494.9747	494.9747
5F	494.9747	494.9747
4F	494.9747	494.9747
3F	494.9747	494.9747
2F	494.9747	494.9747
1F	494.9747	494.9747

☐ Limit Minimum Accidental Torsional Moment

OK Cancel

Eccentricity Calculation by Design Code

Method(Code): NTC-2023 (Mexico)

Eccentricity of Linear Increasing Type

Ecc_input: 5.00 % of Plan Dim.

Ecc(%) of top story: 2.00 times(x) of Ecc_input

$$Ecc_l = Ecc_{input} \times \left[1 + (x - 1) \times \frac{(l-1)}{(n-1)} \right] \times b_l$$

where

l = Number of Story Level under Consideration

n = Total Number of Story

b = Dimension of Plan

☒ Consider Eccentricity by analysis (Ecc_a)

Ecc_total = .5 × Ecc_a + Ecc_i

OK Cancel

Ecc. of top = Ecc_input * x = 5% * 2 = 10%

Eccentricity Shape

Top Floor

GL

Ecc_input

5%

2 times

Example

Eccentricity by Ecc_i

Story	Cross (mm)	Along (mm)
Roof	600.0000	600.0000
5F	540.0000	540.0000
4F	480.0000	480.0000
3F	420.0000	420.0000
2F	360.0000	360.0000
1F	300.0000	300.0000

Eccentricity by Ecc_a (Analysis Ecc.)

Story	Level (mm)	Weight Center		Stiffness Center		Ecc. Dist.	
		X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)
Roof	20000.00	3000.00	3000.00	3013.00	2989.53	13.00	10.47
5F	16000.00	3000.00	3000.00	3021.94	3012.38	21.94	12.38
4F	12000.00	3000.00	3000.00	3001.98	2983.70	1.98	16.30
3F	8000.00	3000.00	3000.00	3005.60	2998.62	5.60	1.38
2F	4000.00	3000.00	2999.43	2999.04	2993.14	0.96	6.29
1F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Roof & Y-Dir.: $0.5 \times 10.47 + 600 = 605.235$

5F & Y-Dir.: $0.5 \times 12.38 + 540 = 546.190$

Resulting Eccentricity Table:

Story	Cross (mm)	Along (mm)
Roof	606.4976	605.2345
5F	550.9701	546.1913
4F	480.9876	488.1518
3F	422.7997	420.6920
2F	360.4816	363.1472
1F	300.0000	300.0000

$1.5e_s + e_a$: Input "0.5" in Ecc_total Equation

→ Because $1.0e_s$ (analysis Ecc.) is automatically reflected during an analysis, consider just "0.5" (=1.5 - 1.0)

$e_s - e_a$: Check off "Consider Eccentricity by..."

→ Because $1.0e_s$ (analysis Ecc.) is automatically reflected during an analysis, Ecc_a (Analysis Ecc.) should not be considered

4. Added Eccentricity as per NTCS 2023 : Eccentricity for Static Seismic

Story Data

Name	Accidental Eccentricity X-Dir(mm)	Accidental Eccentricity Y-Dir(mm)	Inherent Eccentricity X-Dir(mm)	Inherent Eccentricity Y-Dir(mm)	Torsional Amplification Factor X-Dir	Torsional Amplification Factor Y
Roof	300.00	300.00	0.00	0.00	1.00	1.00
5F	300.00	300.00	0.00	0.00	1.00	1.00
4F	300.00	300.00	0.00	0.00	1.00	1.00
3F	300.00	300.00	0.00	0.00	1.00	1.00
2F	300.00	300.00	0.00	0.00	1.00	1.00
1F	300.00	300.00	0.00	0.00	1.00	1.00

Seismic

Calculate Accidental Ecc.

Eccentricity Calculation by Design Code

Method(Code) : NTC-2023 (Mexico)

Eccentricity of Linear Increasing Type

Ecc_input : 5.00 % of Plan Dim.

Ecc(%) of top story : 2.00 times(x) of Ecc_input

$$Ecc_i = Ecc_{input} \times \left[1 + (x - 1) \times \frac{(i-1)}{(n-1)} \right] \times b_i$$

where
 i = Number of Story Level under Consideration
 n = Total Number of Story
 b = Dimension of Plan

☒ Consider Eccentricity by analysis (Ecc_a)

Ecc_total = .5 × Ecc_a + Ecc_i

OK Cancel

Ecc. of top = $Ecc_{input} \times x = 5\% \times 2 = 10\%$

Eccentricity Shape

Top Floor

GL

Ecc_input

2 times

Accidental Eccentricity X-Dir(mm)	Accidental Eccentricity Y-Dir(mm)
600.00	600.00
540.00	540.00
480.00	480.00
420.00	420.00
360.00	360.00
300.00	300.00

Accidental Eccentricity X-Dir(mm)	Accidental Eccentricity Y-Dir(mm)
606.50	605.23
550.97	546.19
480.99	488.15
422.80	420.69
360.48	363.15
300.00	300.00

Example

Story	Level (mm)	Weight Center		Stiffness Center		Ecc. Dist.	
		X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)
Roof	20000.00	3000.00	3000.00	3013.00	2989.53	13.00	10.47
5F	16000.00	3000.00	3000.00	3021.94	3012.38	21.94	12.38
4F	12000.00	3000.00	3000.00	3001.98	2983.70	1.98	16.30
3F	8000.00	3000.00	3000.00	3005.60	2998.62	5.60	1.38
2F	4000.00	3000.00	2999.43	2999.04	2993.14	0.96	6.29
1F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Roof & Y-Dir. : $0.5 \times 10.47 + 600 = 605.23$

5F & Y-Dir. : $0.5 \times 12.38 + 540 = 546.190$

$1.5e_s + e_a$: Input "0.5" in Ecc_total Equation.

→ Because $1.0e_s$ (analysis Ecc.) is automatically reflected during an analysis, consider just "0.5" (=1.5 - 1.0)

$e_s - e_a$: Check off "Consider Eccentricity by~~"

→ Because $1.0e_s$ (analysis Ecc.) is automatically reflected during an analysis, Ecc_a (Analysis Ecc.) should not be considered

Items	Detail	
Steel Material	<ul style="list-style-type: none"> SP 16_2017 (t.B3) : C235 / C245 / C255 / C345K / C355 / C355-1; / C355-K / C355Π / C390; / C390-1 / C440 / C550 / C590 / C69 SP 16_2017 (t.B4) : C255Б / C255Б-1 / C345Б / C345Б-1 / C355Б / C355Б-1 / C390Б / C440Б SP 16_2017 (t.B5) : C245 / C255 / C345 / C345K / C355 / C355-1 / C390 / C 	
RC material	<ul style="list-style-type: none"> SP 63-2018 → Heavyweight, Fine grained-gr A type, Fine grained-gr B type (표기 : B + Number + Type) → Lightweight D800, D1000, D1200, D1400, D1600, D1800, D2000 (표기 : LB + Number) → Cellular D500, D600, D700, D800, D900, D1000, D1100, D1200 (표기 : CB + Number) 	
Steel Section DB	<ul style="list-style-type: none"> I-Shape(GOST 8239 – 89, GOST 26020 – 83, STO ASCHM 20 – 93, GOST 19425-74, GOST P 57837-2017) Channel Bar (GOST 8240 - 97) Cold Formed Channel (GOST 8278 - 83) T-Shape (GOST 8239 – 72, TU 14 - 2 - 24 – 72) Angle (GOST 8509 – 93, GOST 8510 - 72) Box (GOST 30245 – 2003, GOST 8639 – 82, GOST P 54157 – 2010) Pipe (GOST 8732 – 78, GOST 10704-91, GOST 54929-2012) Solid Circle / Square (GOST 2590-2006, GOST 2591-2006) Z-Shape (TU 100-180) 	
Rebar Material / DB	<ul style="list-style-type: none"> Material : SP 63-2018 → A240 / A400 / A500 / A600 / A800 / A1000 / B500 / BP500 / BP1200 / BP1300 / Bp1400 / BP1500 / Bp1600 / K1400 / K1450 / K1500 / K1550 / K1650 / K1750 / K1850 / K1900 Size : GOST → #4 / #5 / #6 / #7 / #8 / #9 / #10 / #11 / #12 / #13 / #14 / #15 / #16 / #17 / #18 / #19 / #20 / #22 / #25 / #28 / #32 / #36 / #40 	

Items	Detail	
Steel Design	<ul style="list-style-type: none">Design Code : SP 16.13330.2017Added Design parameter features<ul style="list-style-type: none">Type of stress stateCross Rib LengthLocal stressPure bending zoneLateral bucklingSupported Table design result, Graphic result, Detail result	<div><div>Steel Design Code</div><div><div>Design Code :</div><div>SP 16.13330.2017</div></div><div><div><input checked="" type="checkbox"/> All Beams/Girders are Laterally Braced</div><div><input type="checkbox"/> Check Beam/Column Deflection</div><div><input type="checkbox"/> Apply Special Provisions for Seismic Design</div></div><div><div>OK</div><div>Close</div></div></div>
RC Design	<ul style="list-style-type: none">Design Code : SP 63.13330.2018Supported Member Design type : Beam, Column, Truss, Wall, Meshed Slab, Meshed WallSupported Table design result, Graphic result, Detail result	<div><div>Concrete Design Code</div><div><div>Design Code :</div><div>SP 63.13330.2018</div></div><div><div>General Parameter</div><div><div><input checked="" type="checkbox"/> Consider Φ_n for longitudinal forces</div><div><input checked="" type="checkbox"/> The system is statically determinable</div><div><input checked="" type="checkbox"/> Take creep into account</div><div><input checked="" type="checkbox"/> Calculation for the second group of limit states</div></div><div><div>Seismic Design Parameter</div><div><div><input checked="" type="checkbox"/> Cosider SP 14.13330.2018</div><div><input checked="" type="checkbox"/> Include seismics in the calculation of crack resistance</div><div><div>Select Earthquake-Resistant Grade</div><div><div><input checked="" type="radio"/> Intensity degree 7.0</div><div><input type="radio"/> Intensity degree 8.0</div><div><input type="radio"/> Intensity degree 9.0</div></div></div></div><div><div>P-M Curve Calculation Method</div><div><div><input type="radio"/> Keep P Constant</div><div><input checked="" type="radio"/> Keep M/P Constant</div></div></div></div></div></div>

Detail

- ### Wind Load

Add/Modify Wind Load Specification

Load Case Name : Wind ...

Wind Load Code : SP 20.113330.2016(User ... Import

Description :

	Story	Elev.	Wind Pressure		Loaded H
			X-Dir	Y-Dir	
	Roof	20000	0	0	2000
	5F	16000	0	0	4000
	4F	12000	0	0	4000
	3F	8000	0	0	4000
	2F	4000	0	0	4000
*					

Wind Eccentricity

X-Dir. (Wx) : ☐ Positive ☐ Negative ☒ None

Y-Dir. (Wy) : ☐ Positive ☐ Negative ☒ None

☒ Wind Pulsation
 X-Dir. (Wx) : ☒ Positive ☐ Negative
 Y-Dir. (Wy) : ☒ Positive ☐ Negative
Create Wind Pulsation

Wind Load Direction Factor (Scale Factor)

X-Dir. 1 Y-Dir. 1 Z-Rot. 0

Additional Wind Loads (Unit:kN/mm)

Story	Add-X	Add-Y	Add-RZ

Add

Wind Load Profile... OK Cancel Apply

Create Wind Pulsation

Type of construction Towers, masts

Type of Terrain A

Logarithmic Decrement of Oscillations 0.3

Normative value of wind pressure - wo (kPa) 0.23

Dimension

X-Dir 11 mm Y-Dir 11 mm

Along Wind Front 12 mm 10 mm

Modes & Direction Factor

X-Dir 1 Y-Dir 1

Direction Factor 1 1

☒ Select Mode Shapes

Mode	Use	MASS
1	<input checked="" type="checkbox"/>	99.22
2	<input checked="" type="checkbox"/>	2.627
3	<input checked="" type="checkbox"/>	3.604
4	<input checked="" type="checkbox"/>	1.137
5	<input checked="" type="checkbox"/>	0.760
6	<input checked="" type="checkbox"/>	4.816
7	<input checked="" type="checkbox"/>	0.000
8	<input checked="" type="checkbox"/>	5.519
9	<input checked="" type="checkbox"/>	9.758
10	<input checked="" type="checkbox"/>	9.082

Mode	Use	MASS
1	<input checked="" type="checkbox"/>	1.419
2	<input checked="" type="checkbox"/>	77.55
3	<input checked="" type="checkbox"/>	2.974
4	<input checked="" type="checkbox"/>	2.670
5	<input checked="" type="checkbox"/>	3.156
6	<input checked="" type="checkbox"/>	1.948
7	<input checked="" type="checkbox"/>	1.207
8	<input checked="" type="checkbox"/>	5.125
9	<input checked="" type="checkbox"/>	19.44
10	<input checked="" type="checkbox"/>	1.034

All None All None

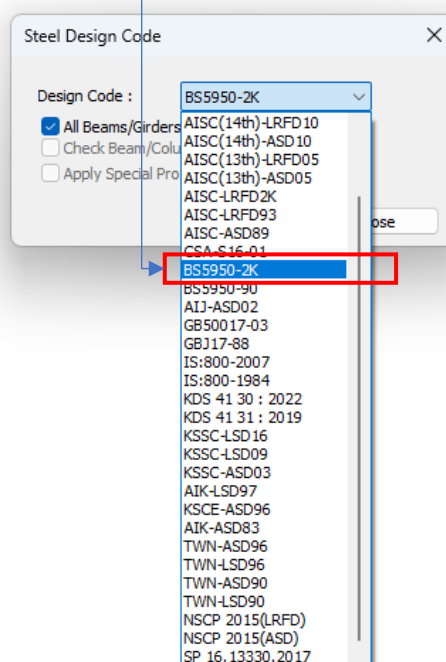
Sum of Modal Mass Percentage (%) 99.9824154414821 99.9693880531816

Create as Report Generate Cancel

Items	Detail																																																	
Seismic Load	<ul style="list-style-type: none">User Type → <u>Input by user (Not auto-generation)</u>	<div><div>Add/Modify Seismic Load Specification</div><div><div>Load Case Name : Ex</div><div>Seismic Load Code : User Type</div><div>Description :</div></div><table><tr><th></th><th>Story</th><th>Weight</th><th>Elev.</th><th colspan="2">Seismic Force</th></tr><tr><th></th><th></th><th></th><th></th><th>X-Dir</th><th>Y-Dir</th></tr><tr><td></td><td>Roof</td><td>31.0474</td><td>20000</td><td>0</td><td>0</td></tr><tr><td></td><td>5F</td><td>40.7729</td><td>16000</td><td>0</td><td>0</td></tr><tr><td></td><td>4F</td><td>39.1149</td><td>12000</td><td>0</td><td>0</td></tr><tr><td></td><td>3F</td><td>39.1149</td><td>8000</td><td>0</td><td>0</td></tr><tr><td></td><td>2F</td><td>39.1149</td><td>4000</td><td>0</td><td>0</td></tr><tr><td></td><td>*</td><td></td><td></td><td></td><td></td></tr></table></div>		Story	Weight	Elev.	Seismic Force						X-Dir	Y-Dir		Roof	31.0474	20000	0	0		5F	40.7729	16000	0	0		4F	39.1149	12000	0	0		3F	39.1149	8000	0	0		2F	39.1149	4000	0	0		*				
		Story	Weight	Elev.	Seismic Force																																													
				X-Dir	Y-Dir																																													
	Roof	31.0474	20000	0	0																																													
	5F	40.7729	16000	0	0																																													
	4F	39.1149	12000	0	0																																													
	3F	39.1149	8000	0	0																																													
	2F	39.1149	4000	0	0																																													
	*																																																	
RS Load	<ul style="list-style-type: none">Code : SP 14.13330.20018	<div><div>Add/Modify/Show Response Spectrum Functions</div><div><div>Function Name SP 14.13330.2018</div><div>Import FileDesign Spectrum</div><table><tr><th></th><th>Period (sec)</th><th>Spectral Data (g)</th></tr><tr><td>1</td><td>0.0000</td><td>0.0000</td></tr><tr><td>2</td><td>0.0600</td><td>0.0000</td></tr><tr><td>3</td><td>0.1000</td><td>0.0000</td></tr><tr><td>4</td><td>0.1200</td><td>0.0000</td></tr><tr><td>5</td><td>0.1800</td><td>0.0000</td></tr><tr><td>6</td><td>0.2400</td><td>0.0000</td></tr><tr><td>7</td><td>0.3000</td><td>0.0000</td></tr><tr><td>8</td><td>0.3600</td><td>0.0000</td></tr><tr><td>9</td><td>0.4000</td><td>0.0000</td></tr><tr><td>10</td><td>0.4200</td><td>0.0000</td></tr><tr><td>11</td><td>0.4800</td><td>0.0000</td></tr><tr><td>12</td><td>0.5400</td><td>0.0000</td></tr><tr><td>13</td><td>0.6000</td><td>0.0000</td></tr><tr><td>14</td><td>0.6600</td><td>0.0000</td></tr></table><div><div>Spectral Data Type Normalized Accel.</div><div>Scaling Scale Factor 1</div><div><div>3.87938e-5</div><div>3.37938e-5</div><div>2.87938e-5</div><div>2.37938e-5</div><div>1.87938e-5</div><div>1.37938e-5</div><div>8.79385e-6</div></div><div><div>0.01</div><div>1.01</div><div>2.01</div><div>3.01</div><div>4.01</div><div>5.01</div><div>6.01</div></div></div><div><div>Generate Design Spectrum</div><div>Design Spectrum : SP 14.13330.2018</div><div>Design Spectral Response Acceleration</div><div>Soil Category I</div><div>K0 Factor 1.00</div><div>K1 Factor 0.12</div><div>KPsi Factor 1.30</div><div>Accel. in the Base Level 1.00</div><div>mm/sec²</div><div>Consider NL deform. of soils</div><div>Max. Period : 6.00 (Sec)</div><div>OKCancel</div></div><div>Description Soil=I, K0=1.00, K1=0.12, KP=1.30, Acce=1.00</div><div>OKCancelApply</div></div></div>		Period (sec)	Spectral Data (g)	1	0.0000	0.0000	2	0.0600	0.0000	3	0.1000	0.0000	4	0.1200	0.0000	5	0.1800	0.0000	6	0.2400	0.0000	7	0.3000	0.0000	8	0.3600	0.0000	9	0.4000	0.0000	10	0.4200	0.0000	11	0.4800	0.0000	12	0.5400	0.0000	13	0.6000	0.0000	14	0.6600	0.0000			
	Period (sec)	Spectral Data (g)																																																
1	0.0000	0.0000																																																
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12	0.5400	0.0000																																																
13	0.6000	0.0000																																																
14	0.6600	0.0000																																																

1. Added Steel Design as per BS 5950-2000

• Design Code Setting for NTC-DCEC 2023



• Design Result

BS5950-2K Code Checking Result Dialog

Code : BS5950-2K Unit : kN , mm Primary Sorting Option

Sorted by ☒ Member ☐ Property Change... Update...

☐ SECT ☒ MEMB

CH	MEMB	SECT	SEL	Section	LCB	Len	1/mL	m _y	F _a	M _y	M _y	M _z	F _y	F _z
K	COM	SHR		Material	F _y	Le		m _z	Pa	Mb/mL	M _{cy}	M _{cz}	P _{cy}	P _{cz}
OK	28	1		HEM200		4000.00	1.000	0.850	314.12	-44776	-44776	-64721	-26.516	-13.239
	0.996	0.028		SS400	0.23500	4000.00		0.850	1981.13	254865	268960	128903	1307.07	465.300
OK	29	2		H 400x200x8/13		8000.00	1.000	0.00000	175252	175252	-0.0026	0.00000	-87.626	
	0.561	0.194		SS400	0.23500	8000.00		1.000	1976.82	111353	312550	62980.0	659.880	451.200
OK	30	2		H 400x200x8/13		6000.00	1.000	0.00000	98579.3	98579.3	0.00286	0.00000	-85.720	
	0.315	0.146		SS400	0.23500	6000.00		1.000	1976.82	150914	312550	62980.0	659.880	451.200

Preview Window

Mem No : 30

1. Design Information

Design Code : BS5950-2K
Unit System : kN, mm
Member No : 30
Material : SS400 (No.1)
Section Name : H 400x200x8/13 (No.2)
(Rolled : H 400x200x8/13)
Member Length : 1900.00

2. Member Forces

Axial Force : F_{ax} = 0.0000 (LCB : 1, POS:1/2)
Bending Moments : M_y = 98579.3, M_z = 0.0000
End Moments : M_{y1} = 0.0000, M_{y2} = 0.0000 (for Lcb)
M_{z1} = 0.0000, M_{z2} = 0.0000 (for Lcb)
Shear Forces : F_{yx} = 0.0000 (LCB : 1, POS:1)
F_{yz} = -85.720 (LCB : 1, POS:1)

3. Design Parameters

Effective Length for LTB : L_e = 6000.00
Effective Length Factors : K_y = 1.00, K_z = 1.00
Equivalent Uniform Moment Factors / Slenderness Correction Factor : $\eta = 1.00, \alpha = 1.00, 1/LT = 1.00$

4. Checking Result

Slenderness Ratio : $L/r = 152.2 < 300.0$ (LCB : 1) ...

Axial Resistance : $F_t/F_t = 0.00/1976.82 = 0.000 < 1.000$

Bending Resistance : $M_y/M_{cy} = 98579.3/312550 = 0.315 < 1.000$

Combined Capacity (Tension-Bending) : $F_{ax} = F_t/F_t + M_y/M_{cy} + M_z/M_{cz} = 0.315 < 1.000$

Shear Resistance : $F_{yz}/P_{cy} = 0.000 < 1.000$

$F_{yz}/A_{yz} = 3.140 < 1.000$

▲ Table Result

MIDAS/Text Editor - [test_Stiffness irregular.acs]

```

- In case of Fvz < 0.6*Pvz (Plastic or Compact).
- Mcy = Py*Syy = 312550.00 kN-mm.

( ). Check ratio of flexural capacity (My/Mcy).
My 98579.33
- Mcy 312550.00 = 0.315 < 1.000 ----> 0.K.

=====
[[[+]]] CHECK BENDING CAPACITY ABOUT MINOR AXIS.
=====
( ). Calculate bending strength in local-z direction (Mz).
[ BS5950-2K Part1. 4.2.5 ]
- In case of Fvz < 0.6*Pvz (Plastic or Compact).
- Mcz = Py*Szz = 62980.00 kN-mm.

( ). Check ratio of flexural capacity (Mz/Mcz).
Mz 2.86e-03
- Mcz 62980.00 = 0.000 < 1.000 ----> 0.K.

=====
[[[+]]] CHECK LATERAL-TORSIONAL BUCKLING.
=====
( ). Calculate Lateral-Torsional Buckling resistance of the member (Mb).
[ BS5950-2K Part1. 4.3.6, Appendix B ]
- BetaW = 1.0
- LambdaLO = 0.4 + SQRT(pi^2*Es/py) = 37.115
- hs = H - (tf1+tf2)/2 = 387.000 mm.
- Gamma = [ (4*Syy*2*Gamma) / (A*hs)^2 ]^0.25 = 0.927
- u = 0.566*hs*SQRT(A/I) = 33.624 0.867
- X = 1 / [ 1+0.05*(Lambda/x)^2 ]^0.25 = 132.159 0.867
- Lambda = Le/rz = 132.159
- LambdaLT = u*Ni/Lambda*SQRT(BetaW) = 101.580
- aLT = 7.0
- In case of Rolled.
- EtaLT = MAX[ aLT*(LambdaLT-LambdaLO)/1000, 0.0 ] = 0.451
- pE = pi^2*0.4Es / LambdaLT^2.0 = 0.196 kN/mm^2.
- phiLT = [ py + (EtaLT+1.0)*pE ] / 2.0 = 0.260 kN/mm^2.
- pb = pE*py / [ phiLT^2 + (phiLT^2-pE*py)^0.5 ] = 0.113 kN/mm^2.

- Mb = pb * Syy = 150913.79 kN-mm.
- My 98579.33
- Mb/MLT 150913.79 = 0.653 < 1.000 ----> 0.K.

=====
[[[+]]] CHECK INTERACTION OF COMBINED CAPACITY.
=====
( ). Calculate Tension member with moments.
[ BS5950-2K Part1. 4.8.2 ]
- In case of Doubly symmetric member, Fvz < 0.6*Pvz and 0.6*Vw.
- Rmax = Ft/My + Mz/Mcz
= 0.315 < 1.000 ----> 0.K.

```

Ln 205 / 249 , Col 1

▲ Detail Report

◀ Graphic Report

1. Added Auto-Generation of Special and Vertical Seismic Load per NSCP 2015

• Load Combination Setting for NTC-DCEC 2023

Automatic Generation of Load Combinations

Option

☒ Add

☐ Replace

Code Selection

☒ Steel

☐ Concrete

☐ SRC

☐ Cold Formed Steel

☐ Footing

☐ Aluminum

Design Code :

NSCP 2015(LRFD)

☐ Scale Up of Response Spectrum Load Cases

Scale Up Factor : 1

Rx

Factor

Load Case

Add

Modify

Delete

Manipulation of Construction Stage Load Case

ST : Static Load Case

CS : Construction Stage Load Case

☒ ST Only

☐ CS Only

☐ ST+CS

☐ Consider Orthogonal Effect

Set Load Cases for Orthogonal Effect...

☒ 100 : 30 Rule

☐ SRSS(Square-Root-of-Sum-of-Squares)

Generate Additional Load Combinations

☒ for Special Seismic Load

☒ for Vertical Seismic Forces

Factors for Seismic Design...

☐ Consider Redundancy Factor r:

Load Factor : 1

☐ Consider Live Load Reduction Factor f1:

Factor for Live load Reduction...

OK

Cancel

Factors for Seismic Design

Special Seismic Loads

Vertical Load Factor :

0.2

Ca*I :

0.8

System Over-Strength Factor

Load Case :

Ex(ST)

Over-Strength Factor :

2.5

Load Case

Factor

Add

Modify

Delete

Ex(ST)

2.5

Ey(ST)

2.5

Vertical Seismic Forces

Factor = R*Ca*I, R =

0.5

OK

Cancel

• Load Combination Table

No	Name	Active	Type	Description
1	sLCB42	Special	Add	1.4(D)
2	sLCB43	Special	Add	1.2(D) + 1.6L
3	sLCB44	Special	Add	1.2D + 1.0(2.5)Ex + 1.0(1.0L) + (0.2)(0.8)D
4	sLCB45	Special	Add	1.2D + 1.0(2.5)Ey + 1.0(1.0L) + (0.2)(0.8)D
5	sLCB46	Special	Add	1.2D - 1.0(2.5)Ex + 1.0(1.0L) + (0.2)(0.8)D
6	sLCB47	Special	Add	1.2D - 1.0(2.5)Ey + 1.0(1.0L) + (0.2)(0.8)D
7	sLCB56	Special	Add	0.9D + 1.0(2.5)Ex - (0.2)(0.8)D
8	sLCB57	Special	Add	0.9D + 1.0(2.5)Ey - (0.2)(0.8)D
9	sLCB58	Special	Add	0.9D - 1.0(2.5)Ex - (0.2)(0.8)D
10	sLCB59	Special	Add	0.9D - 1.0(2.5)Ey - (0.2)(0.8)D
11	sLCB68	Vertical	Add	1.4(D)
12	sLCB69	Vertical	Add	1.2(D) + 1.6L
13	sLCB70	Vertical	Add	1.2D + 1.0Ex + 1.0(1.0L)
14	sLCB71	Vertical	Add	1.2D + 1.0Ey + 1.0(1.0L)
15	sLCB72	Vertical	Add	1.2D - 1.0Ex + 1.0(1.0L)
16	sLCB73	Vertical	Add	1.2D - 1.0Ey + 1.0(1.0L)
17	sLCB82	Vertical	Add	0.9D + 1.0Ex
18	sLCB83	Vertical	Add	0.9D + 1.0Ey
19	sLCB84	Vertical	Add	0.9D - 1.0Ex
20	sLCB85	Vertical	Add	0.9D - 1.0Ey
21	sLCB94	Vertical	Add	-(0.4)D + 1.0Ex
22	sLCB95	Vertical	Add	-(0.4)D + 1.0Ey
23	sLCB96	Vertical	Add	-(0.4)D - 1.0Ex
24	sLCB97	Vertical	Add	-(0.4)D - 1.0Ey

Vertical Load Factor * (CaI) * Dead Load

Vertical Seismic Force → R * CaI * Dead Load

2. Added Irregularity Check per NSCP 2015

- Torsional Irregularity Check
- Calculation of Torsional Amplification Factory
- Stiffness Irregularity Check (Soft Story)
- Weight Irregularity Check
- Capacity Irregularity Check (Weak Story)

Story Drift...
 Story Drift (Time History Analysis)...
 Story Displacement...
 Story Shear (Response Spectrum Analysis)...
 Story Shear (Time History Analysis)...
 Story Mode Shape...
 Story Eccentricity...
 Story Shear Force Ratio...
 Overturning Moment...
 Story Axial Force Sum...
 Stability Coefficient...

Irregularity Check Parameter...
 Torsional Irregularity Check...
 Criteria for Regularity in Plan...
 Torsional Amplification Factor...
 Stiffness Irregularity Check(Soft Story)...
 Weight Irregularity Check...
 Capacity Irregularity Check (Weak Story)...

Select Calculation Method

Country Code : NSCP2015

Story Drift Method

☒ Drift at the C

☐ Max. Drift of

☐ Max. Drift of

Story Stiffness Method

☒ 1 / Story Drift

☐ Story Shear / Story Drift

OK Cancel

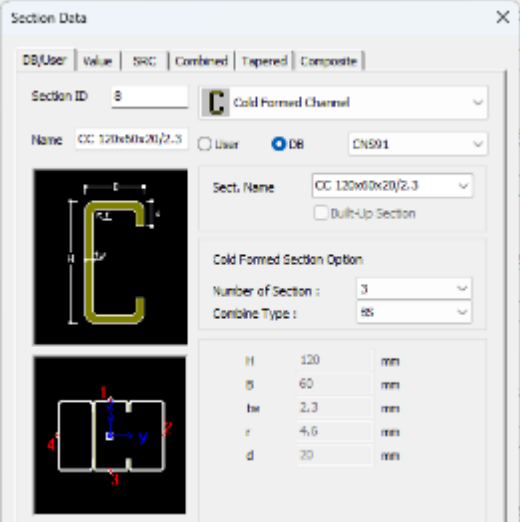
	Load Case	Story	Level (mm)	Story Height (mm)	Average Value of Extreme Points		Maximum Value		Remark
					Story Drift (mm)	1.2*Story Drift (mm)	Node	Story Drift (mm)	
▶	Ex	5F	16000.00	4000.00	0.0696	0.0836	18	0.0711	Regular
	Ex	4F	12000.00	4000.00	0.1739	0.2086	14	0.1818	Regular
	Ex	3F	8000.00	4000.00	1.3834	1.6601	10	1.3897	Regular
	Ex	2F	4000.00	4000.00	0.3723	0.4468	2	0.3852	Regular
	Ex	1F	0.00	4000.00	6.0428	7.2514	1	6.0506	Regular

	Load Case	Story	Level (mm)	Story Height (mm)	Average Displacement of Extreme Points (mm)	Maximum Displacement		Torsional Amplification Factor (Ax)	Note
						Node	Displacement (mm)		
	To obtain right results, the torsional amplification factors in 'Story/Seismic Tab' dialogue box must be all set to '1'.								
▶	Ex	Roof	20000.00	0.00	8.0420	22	8.0784	0.701	
	Ex	5F	16000.00	4000.00	7.9724	18	8.0073	0.701	
	Ex	4F	12000.00	4000.00	7.7985	14	7.8255	0.699	
	Ex	3F	8000.00	4000.00	6.4151	10	6.4358	0.699	
	Ex	2F	4000.00	4000.00	6.0428	2	6.0506	0.696	
	Ex	1F	0.00	4000.00	0.0000	0	0.0000	0.000	No Diaphragm

	Load Case	Story	Level (mm)	Story Height (mm)	Story Drift (mm)	Story Shear Force (kN)	Story Stiffness	Upper Story Stiffness		Story Stiffness Ratio	Story Drift Angle Ratio	Remark
								0.7Ku1	0.8Ku123			
▶	Ex	5F	16000.00	4000.00	0.0696	3.61	57436.14	0.00	0.00	0.000	0.000	Regular
	Ex	4F	12000.00	4000.00	0.1739	7.40	23005.77	40205.30	0.00	0.572	2.497	Irregular
	Ex	3F	8000.00	4000.00	1.3834	10.13	2891.46	16104.04	0.00	0.180	7.956	Irregular
	Ex	2F	4000.00	4000.00	0.3723	11.95	10743.61	2024.02	22222.23	0.483	0.269	Regular
	Ex	1F	0.00	4000.00	6.0428	12.86	661.94	7520.53	9770.89	0.068	16.230	Irregular

	Load Case	Story	Level (mm)	Story Height (mm)	Story Weight (kN)	Adjacent Story Weight		Story Weight Ratio	Story Drift Angle Ratio	Remark
						1.5M(Upper) (kN)	1.5M(Lower) (kN)			
▶	Ex	Roof	20000.00	0.00	31.047	0.000	61.159	0.508	0.000	Regular
	Ex	5F	16000.00	4000.00	40.773	46.571	58.672	0.875	0.000	Regular
	Ex	4F	12000.00	4000.00	39.115	61.159	58.672	0.667	2.497	Regular
	Ex	3F	8000.00	4000.00	39.115	58.672	58.672	0.667	7.956	Regular
	Ex	2F	4000.00	4000.00	39.115	58.672	0.000	0.667	0.269	Regular
	Ex	1F	0.00	4000.00	9.404	58.672	0.000	0.160	16.230	Regular

	Story	Level (mm)	Story Height (mm)	Angle1 ([deg])	Story Shear Strength1 (kN)	Upper Story Shear Strength1 (kN)	Story Shear Strength Ratio1	Remark1	Angle2 ([deg])	Story Shear Strength2 (kN)	Upper Story Shear Strength2 (kN)	Story Shear Strength Ratio2	Remark2
Angle = 0 [Deg]													
Input angle and press the 'Apply' button to change the angle.					0.00	Apply							
▶	5F	16000.00	4000.00	0.00	2440.7805	0.0000	0.0000	Regular	90.00	5416.9485	0.0000	0.0000	Regular
	4F	12000.00	4000.00	0.00	2440.7805	2440.7805	1.0000	Regular	90.00	4840.9998	5416.9485	0.8937	Regular
	3F	8000.00	4000.00	0.00	1861.2000	2440.7805	0.7625	Regular	90.00	5416.9485	4840.9998	1.1190	Regular
	2F	4000.00	4000.00	0.00	2440.7805	1861.2000	1.3114	Regular	90.00	4840.9998	5416.9485	0.8937	Regular
	1F	0.00	4000.00	0.00	1861.2000	2440.7805	0.7625	Regular	90.00	5416.9485	4840.9998	1.1190	Regular

Items	Detail	
Cold Formed Section	<ul style="list-style-type: none"> Supported the combined cold-formed section. Combined No. : 1~4 Combined Type (IS, IW, ES, EW) <ul style="list-style-type: none"> I : Web-to-web shape (I-shape) E : Flange-to-Flange shape (Box-shape) S : Bolt(Screw) connection W : Welded connection 	
Lateral Load as per DTP (Thailand)	<ul style="list-style-type: none"> Fixed the bug for static seismic load & response spectrum Fixed the bug for static wind load 	
Interface	<ul style="list-style-type: none"> Add "Master Design" 	Only for Italy
IDEA statica Connection	<ul style="list-style-type: none"> The member forces by each load combination can be exported to IDEA statica connection. 	
Addition of Rebar DB	<ul style="list-style-type: none"> Thailand : TIS(SI), TIS(MKS) Mexico : NMX-2013 (SI), NMX-2013 (MKS) Russia : GOST-SP, GOST-SNiP, SP 63-2018 Austria / New Zealand : AS / NZS South Africa : TMH7 	

DESIGN +

1. Added RC pipe column design as per ACI

- Supported Design Code : ACI 318(M) -11, ACI 318(M) -14, ACI 318(M) -19, KDS 41 20 : 2022, KDS 41 20 : 2018, NSR-10
- Supported Features : Column Design, Patch Column Design, Drawing, Quantity

RC Design Procedures

Option

Design Code : ACI 318(M)-19

Live Load : 30C2012

Rebar DB : IS

Design Option

Drawing Option

Report Option

Performance

Slab

Beam

Column (2)

1C01(1)

C01

Column (General)

Shear Wall

Shear Wall (Combined)

Footing

Footing (Combined)

Basement Wall

Buried

Stair

Canal / Bracket

Retaining Wall

Beam Table

Slab Table

Bench Beam (1)

Bench Column (2)

Bench Wall

Add New Member

System: RC

Type: Column

Name:

Add New Member

Keep Sect. & Bar Data

Start Page

Member

Member List

Drawing

Quantity

General

Member Name: 1C01(1)

Apply this Member to: Draw & Report

Section: Force

Design

Material

Concrete: 30 MPa

Main Bar: 300 MPa

Hoop Bar: 300 MPa

Light Weight Concrete

Factor: 1

Stress-Strain: Equivalent Rectangle

Shape: Pipe

Section

Diameter: 600.00 mm

Thickness: 150.00 mm

Length(x): 4.00 m

Length(y): 4.00 m

Kx: 1.00

Ky: 1.00

Double click to Zoom

Rebar

Section

PH Curve

MM Curve

MAIN BAR

Layer	No	Bar	Main	CL	Corner
Outer	8	-	D19	83.5	mm
Inner	-	-	D19	-	mm
Center	-	-	-	-	mm

Max Num. Maximum Rebar No = 2284

HOOP BAR

End	D4	200.00
Start	D4	200.00

Splicing Limit of Main Rebar

Do not splice

50% Splice

100% Splice

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

Report

100%

Print...

Save...

Report...

Options...

Detail Report

Include Input Data

1. Calculation Summary

(1) Check Magnified Moment

Category	Value	Criteria	Ratio	Note
Moment Magnification Factor (Dir. X)	1.033	1.400	0.734	M_{2x} / M_{2max}
Moment Magnification Factor (Dir. Y)	1.033	1.400	0.734	M_{2y} / M_{2max}

(2) Check Design Parameter

Category	Value	Criteria	Ratio	Note
Rebar Ratio (Min.)	0.0100	0.0100	0.925	ρ_{min} / ρ
Rebar Ratio (Max.)	0.0168	0.0800	0.129	ρ / ρ_{max}

(3) Check Moment Capacity (Neutral axis)

Category	Value	Criteria	Ratio	Note
Moment Capacity (Dir. X) (kN-m)	81.88	171	0.477	$M_u / \phi M_n$
Moment Capacity (Dir. Y) (kN-m)	45.14	84.53	0.477	$M_u / \phi M_n$
Axial Capacity (kN)	1,434	2,884	0.477	$P_u / \phi P_n$
Moment Capacity (kN-m)	93.45	196	0.477	$M_u / \phi M_n$

(4) Shear Strength (Dir. X)

Category	Value	Criteria	Ratio	Note
Maximum Shear Strength (kN)	14.55	749	0.0194	$V_u / \phi V_{c,max}$
Shear Strength (kN)	14.55	238	0.0618	$V_u / \phi V_{c,max}$
Spacing Limit for Reinforcement (mm)	200	203	0.985	$s_u / s_{u,max}$
Shear Capacity (SRSS)	6.177	1.886	0.177	

(5) Shear Strength (Dir. Y)

Category	Value	Criteria	Ratio	Note
Maximum Shear Strength (kN)	35.33	749	0.0465	$V_u / \phi V_{c,max}$
Shear Strength (kN)	35.33	236	0.166	$V_u / \phi V_{c,max}$
Spacing Limit for Reinforcement (mm)	200	203	0.985	$s_u / s_{u,max}$
Shear Capacity (SRSS)	6.177	1.886	0.177	

2. Check Magnified

Calculation Sum

Moment Magnified

Moment Magnified

Moment Magnified

Moment Magnified

NAME

SECTION

1C01(1)

(Ø600)

OUTER

INNER

CENTER

HOOP (MID)

HOOP (END)

TIE BAR

8-D19

-

-

D4@200

D4@200

-

Start Page

Member

Member List

Drawing

Quantity

Name	Size (mm)	Section					Quantity per Unit Length						
		Main			Hoop		Concrete (m³)	Form (m²)	Main (kN)	Hoop		Sum	
		Layer 1	Layer 2	Layer 3	END (mm)	MIDDLE (mm)				END (kN)	MIDDLE (kN)	END (kN)	MIDDLE (kN)
1C01(1)	D600(T=150)	8-D19	-	-	D4@200	D4@200	0.212	2.827	0.177	0.013	0.013	0.190	0.190
C01	D500	10-D19	-	-	D4@100	D4@100	0.196	1.571	0.221	0.014	0.014	0.234	0.234

▲ Drawing : Member List

▲ Quantity

Go to Index

- 18 -

1. Improved retained wall design as follows

- Application of load (Active Soil Pressure) by Front Fill
- Reinforcement of Detail Report. : Explain the design process and formulas in more detail

General

Member Name: RW01

Apply this Member to: Dwg & Report

Material | Section | Soil

Back Fill

☒ Inclined Back Fill

Slope = 1: 2.00

Height: 1.00 m

Friction Angle: 30.00 deg.

Density: 18.00 kN/m³

Surcharge (Flat): 4.00 kN/m²

Surcharge (Slope): 0.00 kN/m²

Foundation Ground

Friction Angle: 30.00 deg.

Cohesion: 0.00 kPa

Bearing Capa.: 100.00 kPa

☒ Auto Calculate Friction Factor

Friction Factor: 0.50

Front Fill

☒ Consider Front Fill

Height: 2.00 m

Friction Angle: 30.00 deg.

Density: 18.00 kN/m³

Surcharge Load: 4.00 kN/m²

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

Double click to Zoom

Select item to display: Self Weight

Stability Calculation Result

Check Items	Value	Criteria	Remark
Overtuning	2.262	2.000	OK(0.884)
Sliding	2.939	1.500	OK(0.510)
Bearing	289	100.00	NG(2.888)

Rebar Arrangement

Stem (at Bottom)

Bar	D	S	L
Back 1st	D25	@	200.00
Back 2nd	@		0.00
Front	D25	@	200.00
Horz.	D22	@	200.00

Moment (kN.m/m) 2165 NG(4.632)

Shear (kN/m) 933 NG(2.779)

Min. Bar Area (mm²) 2534 1200

Min. Bar Space (mm) 200 450

Stem (at 1/2)

Bar	D	S	L
Back 1st	D25	@	200.00
Back 2nd	@		0.00
Front	D25	@	200.00
Horz.	D22	@	200.00

Moment (kN.m/m) 146 OK(0.443)

Shear (kN/m) 123 OK(0.508)

Min. Bar Area (mm²) 2534 900

Min. Bar Space (mm) 200 450

Heel

Bar	D	S	L
Top / Bot 1st	D25	@	200.00
Top 2nd	@		0.00
Dist.	D22	@	200.00

Moment (kN.m/m) 551 OK(0.596)

Shear (kN/m) 260 OK(0.402)

Min. Bar Area (mm²) 2534 2200

Min. Bar Space (mm) 200 450

Toe

Bar	D	S	L
Top / Bot 1st	D25	@	200.00
Bot. 2nd	@		0.00
Dist.	D22	@	200.00

Moment (kN.m/m) 116 OK(0.126)

Shear (kN/m) 220 OK(0.339)

(3) Calculate soil pressure of surcharge

• $P_{01} = K_0 W_0 H_0 = 24.00 \text{ kN/m}$

(2) Check soil bearing

• $q_{heel} = \frac{\sum W_{soil}}{L} + \frac{\sum W_{wall}}{Z} = \frac{\sum W_{soil}}{L} + \frac{\sum W_{wall}}{L^2 / 6} = \frac{\sum W_{soil}}{L} (1 + \frac{6e}{L}) = 289 \text{ kN/m}^2$

• $q_{heel} = \frac{\sum W_{soil}}{L} - \frac{\sum W_{wall}}{Z} = \frac{\sum W_{soil}}{L} - \frac{\sum W_{wall}}{L^2 / 6} = \frac{\sum W_{soil}}{L} (1 - \frac{6e}{L}) = 0.000 \text{ kN/m}^2$

• $q_{min} = \min(q_{heel}, q_{toe}) = 0.000 \text{ kN/m}^2$

• $q_{max} = \max(q_{heel}, q_{toe}) = 289 > q_c = 100.00 \text{ kN/m}^2 \rightarrow \text{N.G.}$

Items	Detail	
<div>Addition of Rebar DB</div>	<div><ul style="list-style-type: none">Thailand : TIS(SI), TIS(MKS)Mexico : NMX-2013 (SI), NMX-2013 (MKS)Russia : GOST-SP, GOST-SNiP, SP 63-2018Australia : ASSouth Africa : TMH7</div>	<div><div>Rebar Option</div><div><div>Rebar Code</div><div>Rebar Code</div><div>KS</div><div>Rebar Option for</div><div>RC-1RC-2</div><div>JIS</div><div>CNS</div><div>CNS560-18</div><div>ASTM</div><div>BS</div><div>EN</div><div>IS</div><div>UNI</div><div>SS</div><div>GB</div><div>CSA</div><div>U.S.C(US)</div><div>U.S.C(SI)</div><div>SNI</div><div>ENIS46</div><div>GOST(SP)</div><div>GOST(SNiP)</div><div>SP63-2018</div><div>AS17</div><div>TIS(SI)</div><div>TIS(MKS)</div><div>NMX-2013(SI)</div><div>NMX-2013(MKS)</div><div>TMH7</div><div>Default</div></div><div><div>Spacing List</div><div>MomentShear</div><div><div><input type="checkbox"/></div><div>100.00</div></div><div><div><input type="checkbox"/></div><div>150.00</div></div><div><div><input type="checkbox"/></div><div>200.00</div></div><div><div><input type="checkbox"/></div><div>250.00</div></div><div><div><input type="checkbox"/></div><div>300.00</div></div><div><div><input type="checkbox"/></div><div>350.00</div></div><div><div><input type="checkbox"/></div><div>400.00</div></div><div><div><input type="checkbox"/></div><div>450.00</div></div><div><div>Add</div><div>Remove</div></div><div><div><input type="checkbox"/> Use user-defined space.</div></div><div><div>Apply</div><div>Close</div></div></div></div>

Thank you

Appendix 01

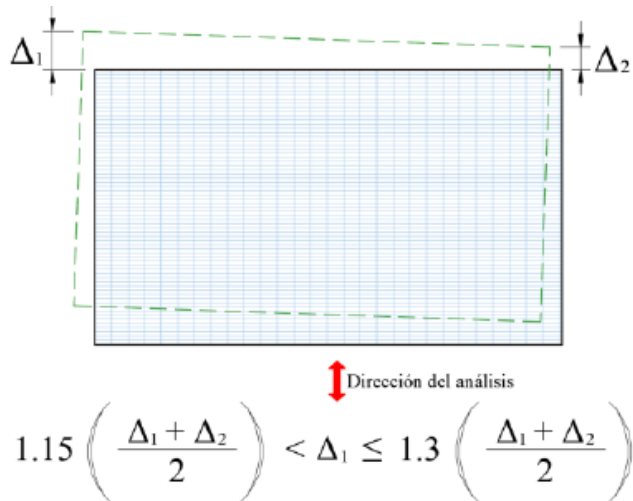
NTC & NMX 2023

Revised provisions (reflected to midas Gen)

Torsional Irregular Check (NTC 2023)

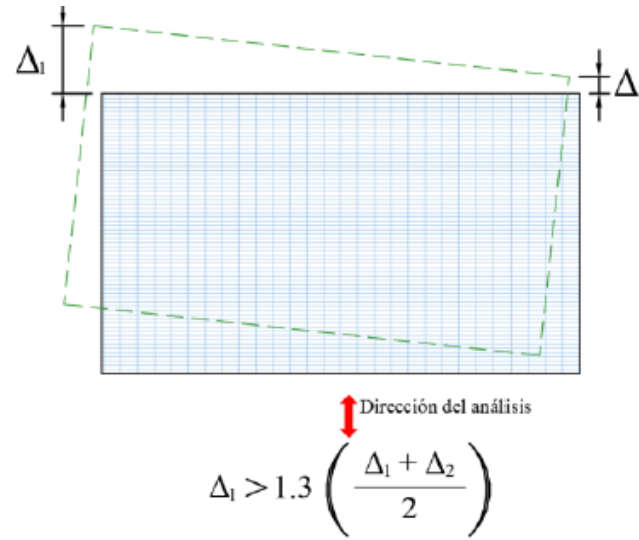
Irregular

5.2.1.1 It will be considered that a structure is irregular in torsion when in any story there is a point with a lateral displacement that exceeds in more than 15% the average lateral displacement of the extreme points of the story in the analysis direction.



Strongly Irregular

5.2.2.1 A structure is strongly irregular in torsion when in any story there is a point with a lateral displacement that exceeds in more than 30% the average lateral displacement of the extreme points of the story in the analysis direction.



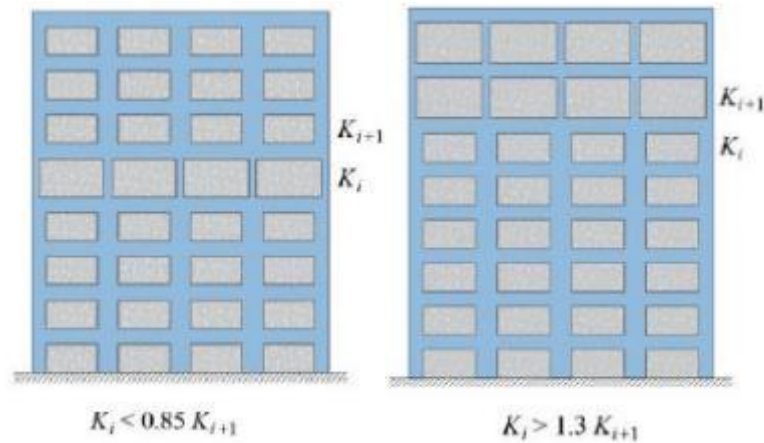
PBE

5.5.3 If in any story there is a point with a lateral displacement that exceeds in more than 40% the average lateral displacement of the extreme points of the story in the analysis direction, a non-linear time history analysis must be performed as a review of the structure regardless of his height in order to verify the allowable drift indicated in 4.3 and reduced by 50%.

Stiffness Irregular Check (NTC 2023)

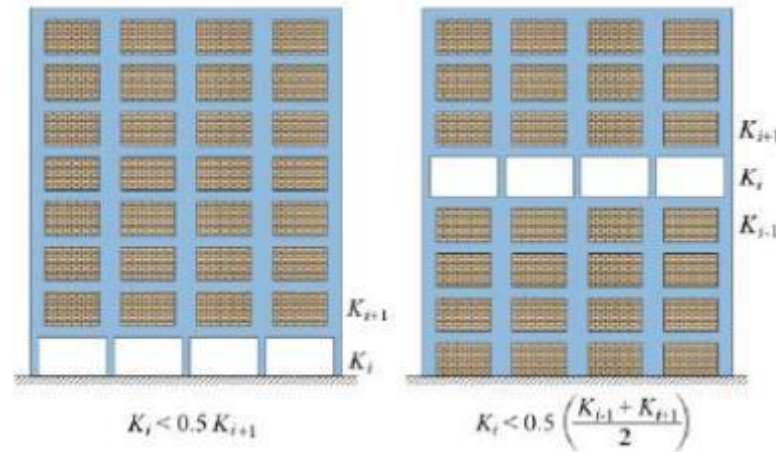
Irregular

5.3.2.1 A structure will be considered as Irregular in elevation due to sudden changes in lateral stiffness in height when the lateral stiffness of a story is 15% less than the lateral stiffness of the story immediately above or 30% greater than the stiffness of the story immediately above.



Strongly Irregular

5.3.3.1 A structure will be considered as strongly irregular due to sudden reductions in lateral stiffness, that is when the lateral stiffness of a story is less than 50% of the lateral stiffness of the story immediately above or less than 50% of the lateral stiffness average of the stories immediately below and above a story.



PBE

5.6.3 If the lateral stiffness of any story is less than 40% of the lateral stiffness of the story immediately above it or less than 40% of the average lateral stiffness of the stories immediately below and above the story, a non-linear time history analysis must be performed as a review of the structure regardless of its height in order to verify that at the story with abrupt reduction in lateral stiffness and all stories below the structure will have linear behavior under established ground accelerations according to 7.4.1.

Added the Mexican design code (NTC 2023)

- Changed the reference ' f'_c ' value to apply to ' β_1 ' formula. : 28MPa → 30MPa

2017	2023
<p>3.5</p> <p>$\beta_1 = 0.85;$</p> <p>$\beta_1 = 1.05 - \frac{f'_c}{140} \geq 0.65;$</p> <p>$\left(\beta_1 = 1.05 - \frac{f'_c}{1400} \geq 0.65; \right)$</p>	<p>3.6.1</p> <p>$\beta_1 = 0.85;$</p> <p>$\beta_1 = 1.05 - \frac{f'_c}{140} \geq 0.65;$</p> <p>$\left(\beta_1 = 1.05 - \frac{f'_c}{1400} \geq 0.65; \right)$</p>

$if\ f'_c \leq 28MPa(280kg/cm^2)$

$if\ f'_c > 28MPa$

$if\ f'_c > 280kg/cm^2$

$if\ f'_c \leq 30MPa(300kg/cm^2)$

$if\ f'_c > 30MPa$

$if\ f'_c > 300kg/cm^2$

- Changed a limitation formula for design shear force.

2017	2023
<p>5.3.4 Limitation for design shear force</p> <p>In no case shall the design shear force, V_u, be allowed to exceed the following values:</p> <p>a) In beams</p> <p>$V_u < F_R 0.8 \sqrt{f'_c} b d$</p> <p>(5.3.27)</p> <p>$\left(V_u < F_R 2.5 \sqrt{f'_c} b d \right)$</p>	<p>5.5.2 Sizing and limits on material strength</p> <p>5.5.2.2 The cross-section dimensions shall be selected to comply with Eq. 5.5.2.2:</p> <p>$V_u \leq F_R \left(V_c + 0.66 \sqrt{f'_c} b_w d \right)$</p> <p>(5.5.2.2)</p> <p>$\left(V_u \leq F_R \left(V_c + 2.2 \sqrt{f'_c} b_w d \right) \right)$</p>

Added the Mexican design code (NTC 2023)

- Changed a formula for a concrete shear resistance.

2017	2023
<p>5.3.3.1 Concrete resistance to shear force</p> <p>5.3.3.1a Non-prestressed elements</p> <p>In beams with a span to total depth ratio, L/h, not less than 5, the shear force taken by the concrete, V_{cR}, shall be calculated using the following criteria:</p> <p>if $p < 0.015$</p> $V_{cR} = F_R(0.2 + 20p)0.3\sqrt{f'_c}bd \quad \left(V_{cR} = F_R(0.2 + 20p)\sqrt{f'_c}bd \right)$ <p>if $p \geq 0.015$</p> $V_{cR} = F_R0.16\sqrt{f'_c}bd \quad \left(V_{cR} = F_R0.5\sqrt{f'_c}bd \right) \quad (5.3.2)$ <p>In any case, V_{cR} must comply with:</p> $V_{cR} \leq F_R0.47\sqrt{f'_c}bd \quad \left(V_{cR} \leq F_R1.5\sqrt{f'_c}bd \right) \quad (5.3.2)$	<p>5.5.3 Resistance to shear force in one-way</p> <p>5.5.3.1.1 In all concrete elements, except those included in table 6.3.5.4.1 and in 5.5.3.8, a minimum amount of transverse reinforcement shall be placed in the web, even if it is not required for strength, as prescribed in table 6.3.5.4.4. If this minimum amount is available, the shear force resisted by the concrete shall be calculated with either of the equations 5.5.3.1.1.a or 5.5.3.1.1.b taking into account the limitations established in 5.5.3.1.2. The force P_u shall be considered positive if it is compressive, negative if it is tensile, and zero in the case of beams. V_{cR} shall not be less than zero. The factor λ shall be taken from 2.3.3.2.</p> $V_{cR} = F_R \left(0.17\lambda\sqrt{f'_c} + \frac{P_u}{6A_g} \right) b_w d$ <p>(5.5.3.1.1.a)</p> $\left(V_{cR} = F_R \left(0.5\lambda\sqrt{f'_c} + \frac{P_u}{6A_g} \right) b_w d \right)$ $V_{cR} = F_R \left[0.66\lambda(p)^{1/3} \sqrt{f'_c} + \frac{P_u}{6A_g} \right] b_w d$ <p>(5.5.3.1.1.b)</p> $\left(V_{cR} = F_R \left[0.66\lambda(p)^{1/3} \sqrt{f'_c} + \frac{P_u}{6A_g} \right] b_w d \right)$ <p>5.5.3.1.2 In Eqs. 5.5.3.1.1.a and 5.5.3.1.1.b limitations a) and b) shall be taken into account:</p> $a) F_R0.08\sqrt{f'_c}bd \leq V_{cR} \leq F_R0.42\sqrt{f'_c}bd$ $\left(F_R0.25\sqrt{f'_c}bd \leq V_{cR} \leq F_R1.25\sqrt{f'_c}bd \right)$ <p>when greater than $0.05f'_c$.</p>

Added the Mexican design code (NTC 2023)

- Changed a formula to calculate 'F_R' : Calculating Fr by 'ε_t' instead of 'c/d_t'

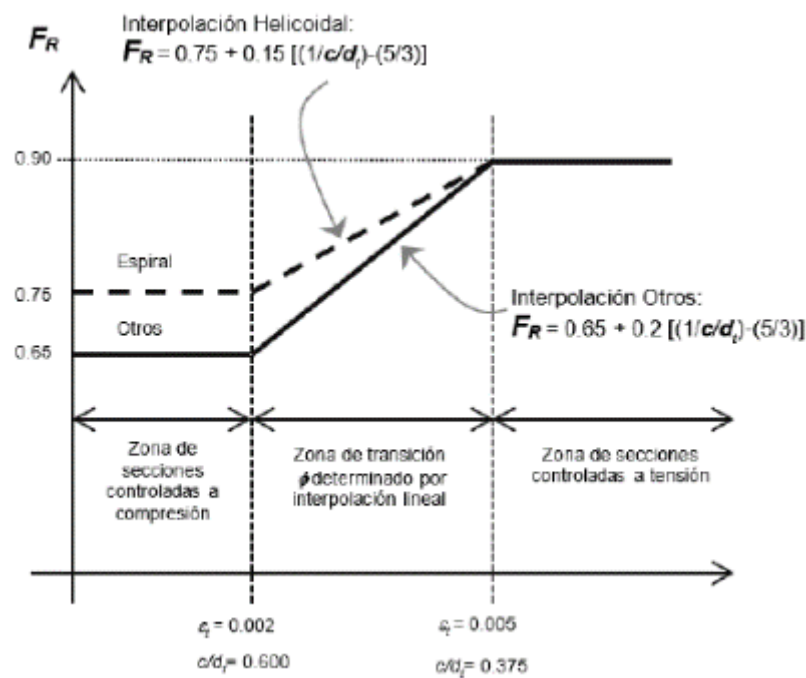


Tabla 3.8.2.2 – Valores del factor de resistencia F_R para momento, fuerza axial, o momento con fuerza axial

Deformación unitaria neta de tensión ϵ_t	Clasificación	F_R			
		Tipo de refuerzo transversal			
		Refuerzo helicoidal (zunchos) que cumple con 14.7.4		Otros	
$\epsilon_t \leq \epsilon_{ty}$	Controladas por compresión	0.75	a)	0.65	b)
$\epsilon_{ty} < \epsilon_t < \epsilon_{ty} + 0.003$	Transición	$0.75 + 0.15 \frac{(\epsilon_t - \epsilon_{ty})}{(0.003)}$	c)	$0.65 + 0.25 \frac{(\epsilon_t - \epsilon_{ty})}{(0.003)}$	d)
$\epsilon_t \geq \epsilon_{ty} + 0.003$	Controlada por tensión	0.90	e)	0.90	f)

Added the Mexican design code (NTC 2023)

- Beam design of low ductility structure

2017	2023																							
5.1.4 Flexural reinforcement	6.3.5 Reinforcement limits																							
5.1.4.1 Minimum reinforcement	6.3.5.1 Minimum flexural reinforcement in non-prestressed beams																							
$A_{s,min} = \frac{0.22\sqrt{f'_c}}{f_y} b d \left(A_{s,min} = \frac{0.7\sqrt{f'_c}}{f_y} b_w d \right)$	6.3.5.1.2 $A_{s,min}$ $a) \frac{0.25\sqrt{f'_c}}{f_y} b_w d \left(\frac{0.80\sqrt{f'_c}}{f_y} b_w d \right)$ $b) \frac{1.4}{f_y} b_w d \left(\frac{14}{f_y} b_w d \right)$																							
	6.3.7.6 Transverse reinforcement Tabla 6.3.7.6.2.2 – Separación máxima de ramas del refuerzo para cortante en vigas de ductilidad baja																							
	<table><tr><th rowspan="3">V_r requerido</th><th colspan="4">Separación máxima s</th></tr><tr><th colspan="2">Vigas no prestroadas</th><th colspan="2">Vigas prestroadas</th></tr><tr><th>A lo largo del claro</th><th>A través del ancho</th><th>A lo largo del claro</th><th>A través del ancho</th></tr><tr><td>$\leq 0.33\sqrt{f'_c} b_w d$ ($\leq 1.1\sqrt{f'_c} b_w d$)</td><td>$d/2$</td><td>$d$</td><td>$3d/4$</td><td>$3b/2$</td></tr><tr><td>$> 0.33\sqrt{f'_c} b_w d$ ($> 1.1\sqrt{f'_c} b_w d$)</td><td>$d/4$</td><td>$d/2$</td><td>$3d/8$</td><td>$3b/4$</td></tr></table>	V_r requerido	Separación máxima s				Vigas no prestroadas		Vigas prestroadas		A lo largo del claro	A través del ancho	A lo largo del claro	A través del ancho	$\leq 0.33\sqrt{f'_c} b_w d$ ($\leq 1.1\sqrt{f'_c} b_w d$)	$d/2$	d	$3d/4$	$3b/2$	$> 0.33\sqrt{f'_c} b_w d$ ($> 1.1\sqrt{f'_c} b_w d$)	$d/4$	$d/2$	$3d/8$	$3b/4$
V_r requerido	Separación máxima s																							
	Vigas no prestroadas		Vigas prestroadas																					
	A lo largo del claro	A través del ancho	A lo largo del claro	A través del ancho																				
$\leq 0.33\sqrt{f'_c} b_w d$ ($\leq 1.1\sqrt{f'_c} b_w d$)	$d/2$	d	$3d/4$	$3b/2$																				
$> 0.33\sqrt{f'_c} b_w d$ ($> 1.1\sqrt{f'_c} b_w d$)	$d/4$	$d/2$	$3d/8$	$3b/4$																				
	Tabla 6.3.5.4.4 – $A_{s,min}$ requerida																							
	<table><tr><th>Tipo de viga</th><th>$A_{s,min}$</th></tr><tr><td rowspan="2">No prestroada y prestroada con $A_{ps}/b_w \leq 0.4$ ($f_{ps}/f_{ys} \leq 1.4$, f_y)</td><td>$0.062\sqrt{f'_c} \frac{b_w s}{f_{ys}} \left(0.2\sqrt{f'_c} \frac{b_w s}{f_{ys}} \right)$</td></tr><tr><td>$0.35 \frac{b_w s}{f_{ys}} \left(3.5 \frac{b_w s}{f_{ys}} \right)$</td></tr></table>	Tipo de viga	$A_{s,min}$	No prestroada y prestroada con $A_{ps}/b_w \leq 0.4$ ($f_{ps}/f_{ys} \leq 1.4$, f_y)	$0.062\sqrt{f'_c} \frac{b_w s}{f_{ys}} \left(0.2\sqrt{f'_c} \frac{b_w s}{f_{ys}} \right)$	$0.35 \frac{b_w s}{f_{ys}} \left(3.5 \frac{b_w s}{f_{ys}} \right)$																		
Tipo de viga	$A_{s,min}$																							
No prestroada y prestroada con $A_{ps}/b_w \leq 0.4$ ($f_{ps}/f_{ys} \leq 1.4$, f_y)	$0.062\sqrt{f'_c} \frac{b_w s}{f_{ys}} \left(0.2\sqrt{f'_c} \frac{b_w s}{f_{ys}} \right)$																							
	$0.35 \frac{b_w s}{f_{ys}} \left(3.5 \frac{b_w s}{f_{ys}} \right)$																							

▲ [Go to Index](#)

Added the Mexican design code (NTC 2023)

- Column design of low ductility structure - 1

2017	2023														
7.3.1 Geometry The ratio of the largest transverse dimension of a column to the smallest shall not exceed 4. The smallest transverse dimension shall be at least equal to 200 mm.	6.4.2 General requirements 6.4.2.1.1 The ratio between the largest transverse dimension of a column and the smallest shall not exceed 4. The smallest transverse dimension shall be at least equal to 250 mm for structures of Subgroup B2 and equal to 300 mm for structures of Group A and Subgroup B1.														
	6.4.3 Limits of reinforcement 6.4.3.2 Minimum shear reinforcement 6.4.3.2.1 A minimum area of shear reinforcement, $A_{v,min}$ shall be provided in each column that is the greater of a) and b): <div><div>a) $0.062 \sqrt{f'_c} \frac{b_w s}{f_{yt}}$</div><div>b) $0.35 \frac{b_w s}{f_{yt}}$</div><div>$\left(0.2 \sqrt{f'_c} \frac{b_w s}{f_{yt}} \right)$ $\left(3.5 \frac{b_w s}{f_{yt}} \right)$</div></div>														
	6.4.4.4 Transverse reinforcement Tabla 6.4.4.4.5.1 – Separación máxima del refuerzo por cortante en columnas de estructuras de ductilidad baja <table><tr><th rowspan="2">V_r requerido</th><th rowspan="2"></th><th colspan="2">Separación máxima, s</th></tr><tr><th>Columnas no presforzadas</th><th>Columnas presforzadas</th></tr><tr><td>$\leq 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$</td><td>La menor de:</td><td>$d/2$ 600 mm</td><td>$3h/4$</td></tr><tr><td>$> 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$</td><td>La menor de:</td><td>$d/4$ 300 mm</td><td>$3h/8$</td></tr></table>	V_r requerido		Separación máxima, s		Columnas no presforzadas	Columnas presforzadas	$\leq 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$	La menor de:	$d/2$ 600 mm	$3h/4$	$> 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$	La menor de:	$d/4$ 300 mm	$3h/8$
V_r requerido				Separación máxima, s											
		Columnas no presforzadas	Columnas presforzadas												
$\leq 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$	La menor de:	$d/2$ 600 mm	$3h/4$												
$> 0.33 \sqrt{f'_c} b_w d$ $\left(1.1 \sqrt{f'_c} b_w d \right)$	La menor de:	$d/4$ 300 mm	$3h/8$												

Added the Mexican design code (NTC 2023)

- Column design of low ductility structure - 2

2017	2023
	<p>6.4.4.4 Transverse reinforcement</p> <p>6.4.4.4.2.4 At both ends of the column, closed stirrups complying with 14.7.3 shall be provided with spacing so over a distance L_o measured from the face of the node. The spacing so shall not exceed the lesser of a) to d):</p> <div><p>a) For Grade 42 bars, the lesser of $8d_b$ of the thinnest longitudinal bar and 200 mm</p><p>b) For Grade 56 bars, the lesser of $6d_b$ of the thinnest longitudinal bar and 150 mm</p><p>c) For Grade 70 bars, the lesser of $5d_b$ of the thinnest longitudinal bar and 150 mm</p><p>d) One-fourth of the smallest cross-sectional dimension of the column.</p></div> <p>The length L_o shall not be less than the maximum value of a) to d):</p> <div><p>a) One-sixth of the clear height of the column</p><p>b) The largest cross-sectional dimension of the column</p><p>c) 600 mm</p><p>d) $H/2$ for ground floor or first floor columns subject to earthquake, where H is the clear height of the column.</p></div>

Added the Mexican design code (NTC 2023)

- Wall design of low ductility structure - 1

2017	2023
<p>7.4.2.4 Shear force</p> <p>a) Shear force by the concrete</p> <p>The shear force, V_{cR} by the concrete in walls will be determined with the following criteria:</p> <p>1. If the ratio of total height to length, H_m/L of the wall or H_s/L of the segment (see item 8.4.2.4) does not exceed 1.5, equation 7.4.3 will be applied.</p> <div style="border: 2px solid red; padding: 10px; margin: 10px 0;"> $V_{cR} = 0.27 F_R \sqrt{f'_c} t L$ <p>(7.4.3)</p> $\left(V_{cR} = 0.85 F_R \sqrt{f'_c} t L \right)$ </div> <p>2. If H_m/L or H_s/L is equal to 2.0 or greater, equations 5.3.1 or 5.3.2 shall apply, where b shall be replaced by the thickness of the wall, t; and the effective height of the wall shall be taken as $0.8L$. When H_m/L or H_s/L is between 1.5 and 2.0, it may be linearly interpolated.</p>	<p>6.5.5.3 Shear force in the plane</p> <p>6.5.5.3.2 V_u at any horizontal section shall not exceed</p> <div style="border: 2px solid red; padding: 10px; margin: 10px 0;"> $0.63 \sqrt{f'_c} A_{cv} \quad \left(2 \sqrt{f'_c} A_{cv} \right)$ <p>(6.5.5.3.2)</p> <p>6.5.5.3.3 V_R shall be calculated as:</p> $V_R = F_R \left(\alpha_c \lambda \sqrt{f'_c} + p_t f_{yt} \right) A_{cv}$ <p>(6.5.5.3.3)</p> </div> <p>where:</p> <p>$\alpha_c = 0.25$, if SI is used (0.80, if MKS is used) for $H_m/L_m \leq 1.5$ $\alpha_c = 0.17$, if SI is used (0.53, if MKS is used) for $H_m/L_m \leq 2.0$ α_c varies linearly between the values above if $1.5 < H_m/L_m < 2.0$</p> <p>6.5.5.3.4 Where walls are subject to net tension forces, α_c in Eq. 6.5.5.3.3 shall be taken as:</p> $\alpha_c = 0.17 \left(1 + \frac{P_u}{3.5 A_g} \right) \geq 0.0$ <p>(6.5.5.3.4)</p> $\left(\alpha_c = 0.53 \left(1 + \frac{P_u}{35 A_g} \right) \geq 0.0 \right)$ <p>where P_u is negative under tension.</p>

Added the Mexican design code (NTC 2023)

- Wall design of low ductility structure - 2

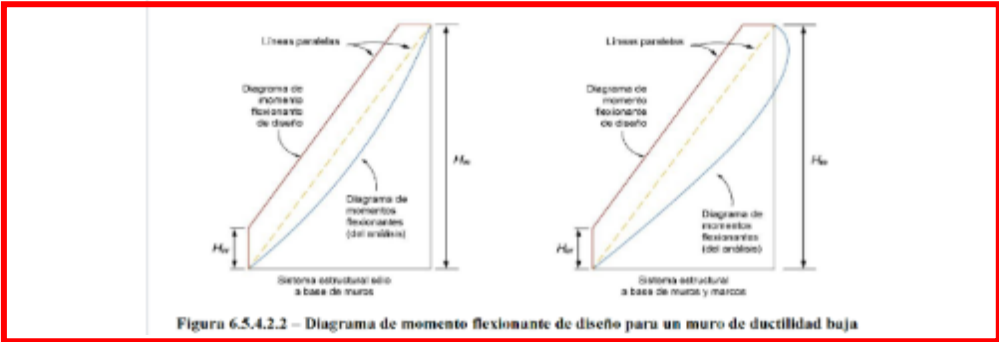
2017	2023
7.4.2.1 Scope and general requirements	6.5.3 Design limits
The thickness of these walls will not be less than 130 mm.	6.5.3.2 The minimum thickness of solid walls shall be as indicated in table 6.5.3.2. Smaller thicknesses shall be accepted if their strength and stability are demonstrated by structural analysis and/or laboratory tests.

Tabla 6.5.3.2 – Espesor mínimo de muros macizos

Tipo de muro	Espesor mínimo t		
De carga ¹⁾	El mayor de:	140 mm	a)
		0.06 veces la altura no restringida lateralmente	b)
De relleno (no de carga)	El mayor de:	100 mm	c)
		0.04 veces la altura no restringida lateralmente	d)
En muros en contacto con el terreno y cimentaciones		200 mm	e)

¹⁾ Para ser diseñados con el método simplificado de 6.5.5.2.

6.5.4.2.2 En muros en que $H_m/L \geq 2$ se considerará al momento flexionante de diseño a lo largo de H_{cr} con un valor constante e igual al momento M_u obtenido del análisis en la base del muro. La altura crítica H_{cr} será igual al valor mayor de L o $M_u/4V_u$. A partir de la altura del muro, H_{cr} , se usará un diagrama de momentos flexionantes lineal tal que sea paralelo a la línea que une los momentos calculados en la base y en la punta del muro (fig. 6.5.4.2.2). En edificios con muros perimetrales de cimentación, se considerará el momento flexionante de magnitud constante a lo largo del primer nivel del sótano y de la altura crítica, H_{cr} , medida desde el desplante del muro en la parte superior del cajón hacia arriba.



Added the Mexican design code (NTC 2023)

- Wall design of low ductility structure - 3

2017	2023																					
<p>7.4.3.2</p> <p>b) Shear force taken by the web steel</p> <p>The amount of reinforcement parallel to the direction of the design shear force, p_m, shall be calculated using the expression</p> $p_m = \frac{V_u - V_{cR}}{F_R f_y A_{cm}}$ <p>(7.4.4)</p> <p>and that of the reinforcement perpendicular to the design shear force, p_n, with</p> $p_n = 0.0025 + 0.5 \left(2.5 - \frac{H_m}{L} \right) (p_m - 0.0025)$ <p>(7.4.5)</p> <p>where:</p> $p_m = \frac{A_{vm}}{s_m t}; \quad p_n = \frac{A_{vn}}{s_n t};$ <p>c) Minimum reinforcement, spacing and anchoring of the reinforcement</p> <p>The reinforcement quantities p_m and p_n will not be less than 0.0025.</p>	<p>6.5.6 Reinforcement limits</p> <p>6.5.6.1 In case of</p> $V_u \leq 0.04 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv} \left(V_u \leq 0.13 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv} \right)$ <p>Tabla 6.5.6.1 – Refuerzo mínimo para muros con $V_u \leq 0.04 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv}$ ($V_u \leq 0.13 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv}$)</p> <table><tr><th>Tipo de muro</th><th>Tipo de refuerzo no presforzado</th><th>Tamaño de barra o alambre</th><th>f_y, MPa (kg/cm²)</th><th>p_l mínima (longitudinal)^[1]</th><th>p_t mínima (transversal)</th></tr><tr><td rowspan="3">Colado en sitio</td><td rowspan="2">Barras corrugadas</td><td>≤ No. 5</td><td>≥ 420 (4 200)</td><td>0.0012</td><td>0.0020</td></tr><tr><td>> No. 5</td><td>≥ 420 (4 200)</td><td>0.0015</td><td>0.0025</td></tr><tr><td>Alambres soldados, corrugados</td><td>≤ 16 mm</td><td>Cualquier</td><td>0.0012</td><td>0.0020</td></tr></table> <p>6.5.6.2 In case of</p> $V_u > 0.04 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv} \left(V_u > 0.13 F_R \alpha_c \lambda \sqrt{f'_c} A_{cv} \right)$ <p>a) p_l shall be the greater of the value calculated from Eq. 6.5.6.2 and 0.0025, but need not exceed p_t calculated to resist shear from 6.5.5.3.3</p> $p_l \geq 0.0025 + 0.5 \left(2.5 - \frac{H_m}{L_m} \right) (p_t - 0.0025)$ <p>(6.5.6.2)</p> <p>b) $p_t \geq 0.0025$.</p>	Tipo de muro	Tipo de refuerzo no presforzado	Tamaño de barra o alambre	f_y , MPa (kg/cm ²)	p_l mínima (longitudinal) ^[1]	p_t mínima (transversal)	Colado en sitio	Barras corrugadas	≤ No. 5	≥ 420 (4 200)	0.0012	0.0020	> No. 5	≥ 420 (4 200)	0.0015	0.0025	Alambres soldados, corrugados	≤ 16 mm	Cualquier	0.0012	0.0020
Tipo de muro	Tipo de refuerzo no presforzado	Tamaño de barra o alambre	f_y , MPa (kg/cm ²)	p_l mínima (longitudinal) ^[1]	p_t mínima (transversal)																	
Colado en sitio	Barras corrugadas	≤ No. 5	≥ 420 (4 200)	0.0012	0.0020																	
		> No. 5	≥ 420 (4 200)	0.0015	0.0025																	
	Alambres soldados, corrugados	≤ 16 mm	Cualquier	0.0012	0.0020																	

Added the Mexican design code (NTC 2023)

- *Wall design of low ductility structure - 4*

2017	2023
<p>7.4.3.2 c) Minimum reinforcement, spacing and anchoring of the reinforcement</p> <p>The reinforcement will be placed uniformly distributed with a separation of no more than 350 mm.</p>	<p>6.5.7 Detailing of reinforcement</p> <div><p>6.5.7.1.1 The spacing s of longitudinal (vertical) reinforcement in cast-in-place walls shall not exceed the lesser of $3t$ and 450 mm. If reinforcement is required to resist shear in the plane of the wall, the spacing of longitudinal reinforcement shall not exceed $L/3$.</p><p>6.5.7.2.1 The transverse (horizontal) reinforcement spacing s in cast-in-place walls shall not exceed the lesser of $3t$ and 450 mm. If reinforcement is required to resist shear in the plane, s shall not exceed $L/5$.</p></div>

- *Joint design of low ductility structure*

: Applied the joint design under low ductility system.

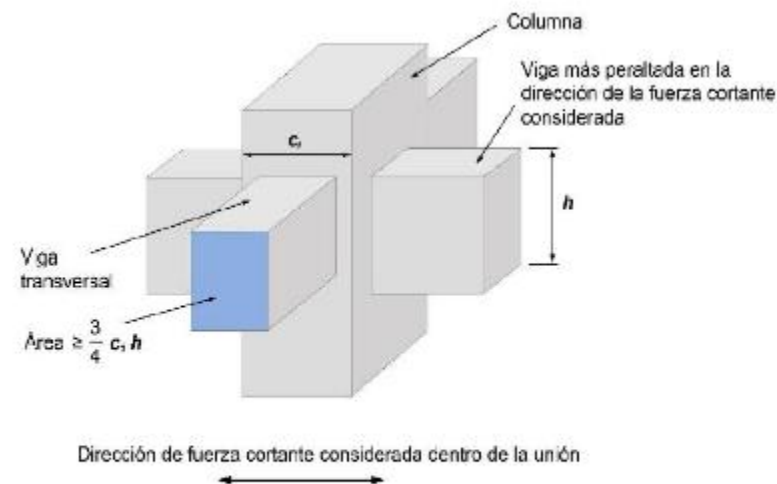


Figura C6.9.2 – Sección mínima de una viga transversal para propósitos de confinamiento de la unión viga-columna (adaptada de ACI CODE-318-19)

Added the Mexican design code (NTC 2023)

- Beam design of medium ductility structure

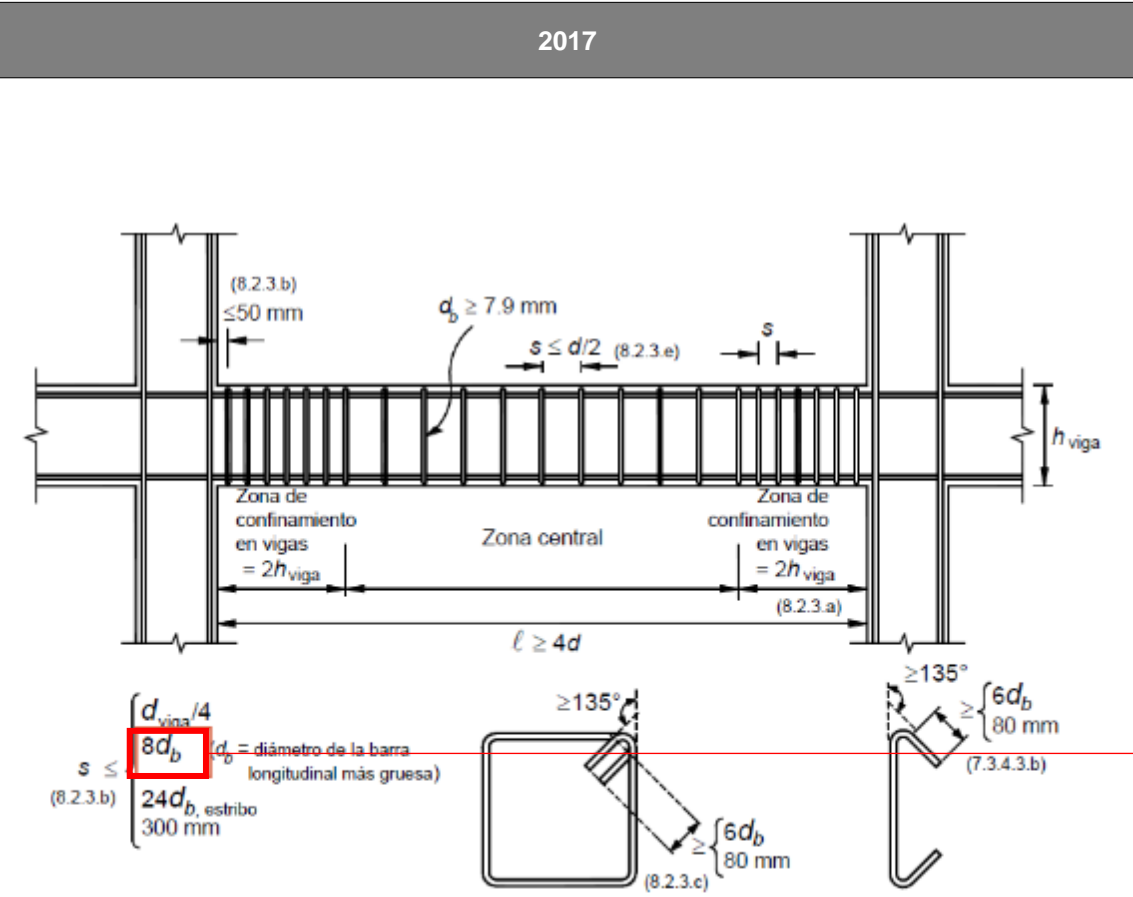


Figura 8.2.1 Detallado de elementos a flexión de ductilidad media

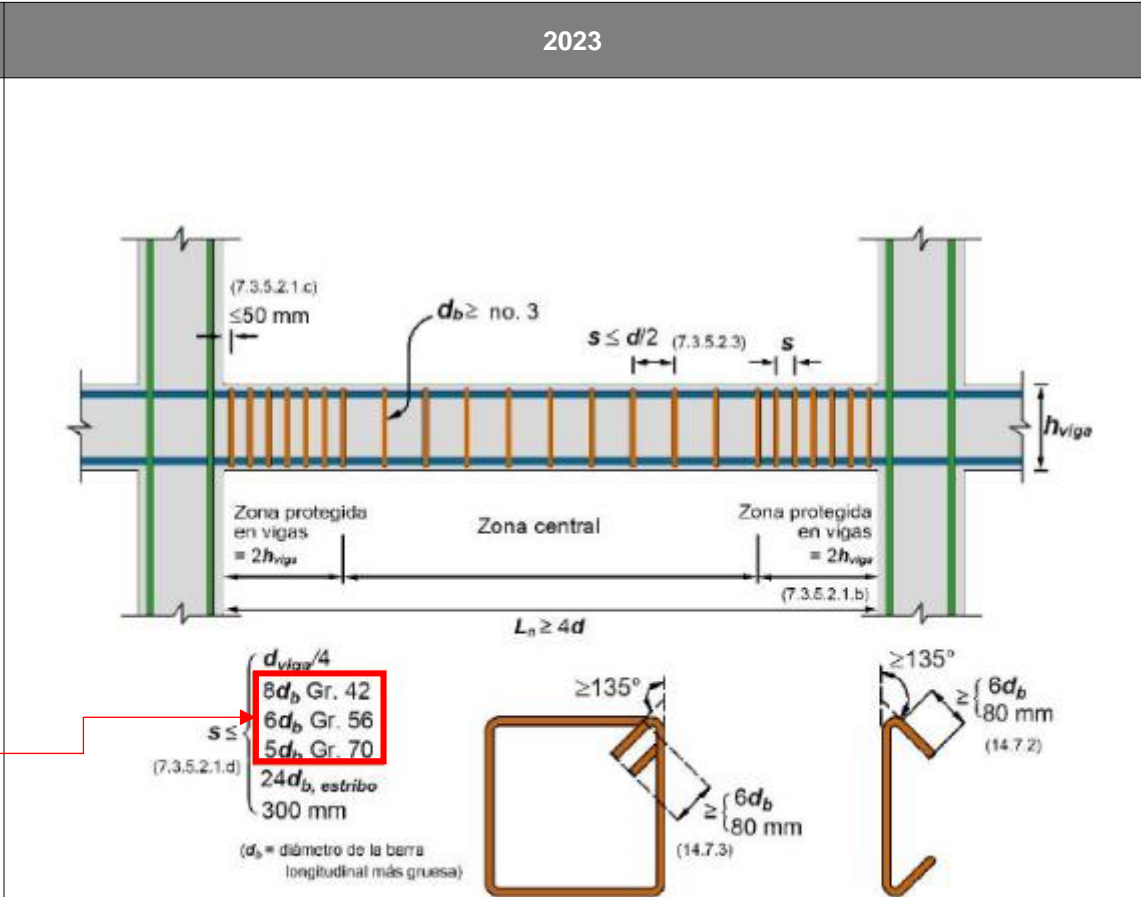
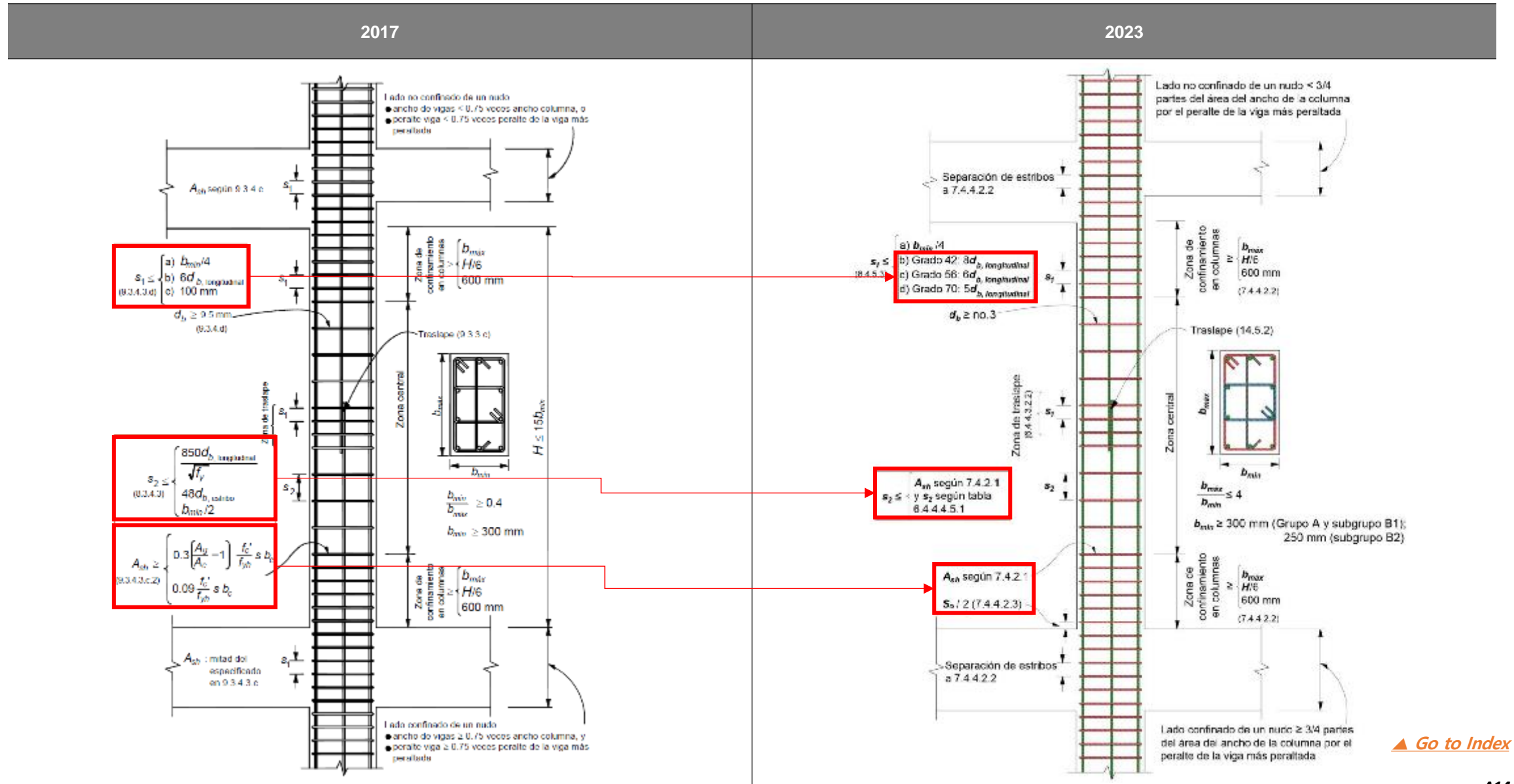


Figura 7.3.5.1.2 - Detallado de vigas de ductilidad media

Added the Mexican design code (NTC 2023)

- Column design of medium ductility structure - 1



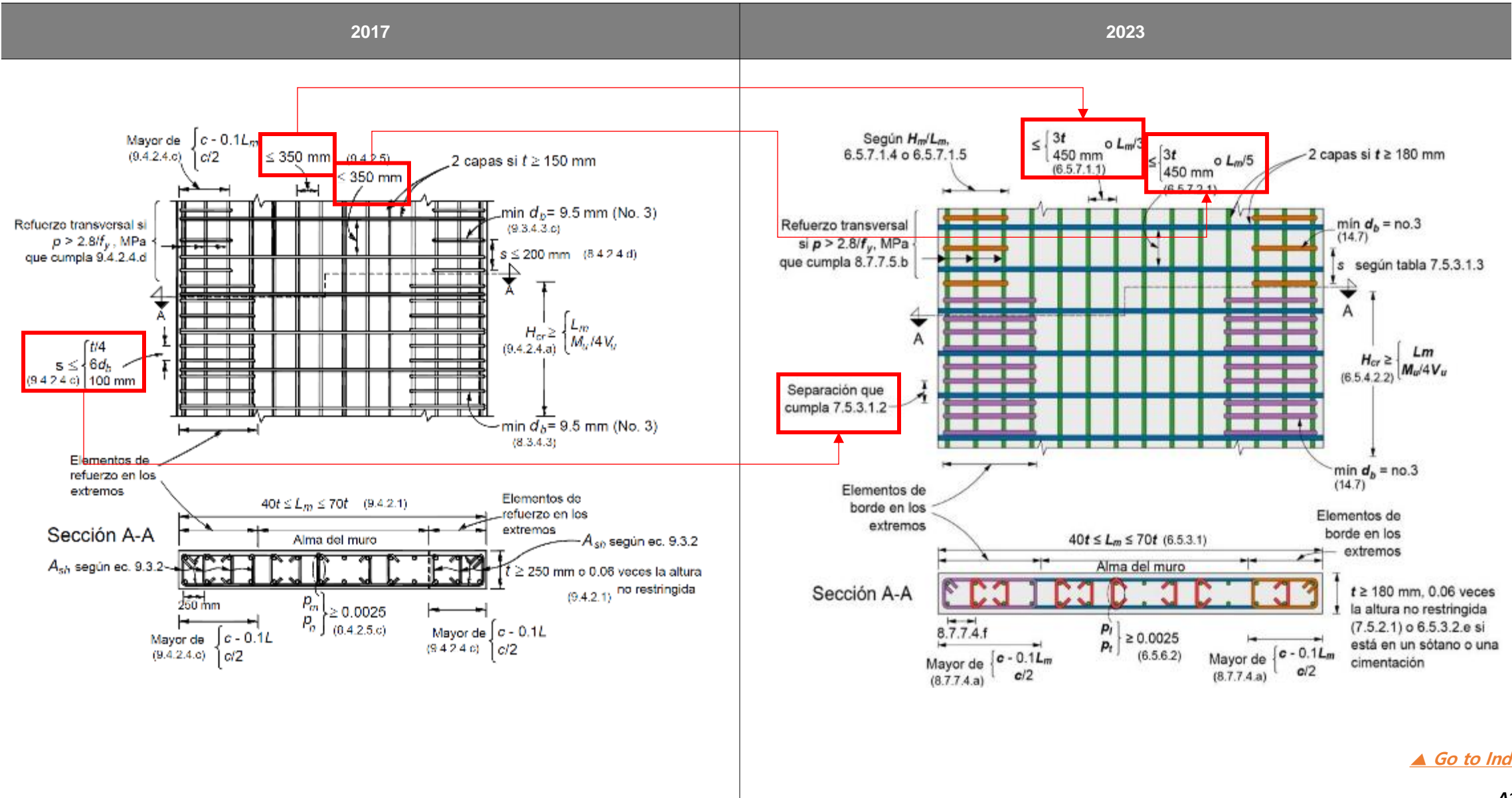
Added the Mexican design code (NTC 2023)

- Column design of medium ductility structure - 2

2017	2023
	<p>7.4.4.2.2 Closed stirrups complying with <u>14.7.3</u> shall be provided at both ends of the column with spacing so over a distance L_o measured from the face of the node. Spacing so shall not exceed the lesser of a) to d):</p> <p>a) For Grade 42 bars, the lesser of $8d_b$ of the thinnest longitudinal bar and 200 mm b) For Grade 56 bars, the lesser of $6d_b$ of the thinnest longitudinal bar and 150 mm c) For Grade 70 bars, the lesser of $5d_b$ of the thinnest longitudinal bar and 150 mm d) One-fourth of the smallest cross-sectional dimension of the column. The length L_o shall not be less than the maximum value of a) to d): a) One sixth of the free height of the column b) The largest dimension of the cross section of the column c) 600 mm d) $H/2$ for ground floor columns or the first level subject to earthquakes, where H is the free height of the column.</p>
<p>8.3.2 Minimum flexural strength of columns 8.3.2.1 General procedure The flexural strengths of columns at a node must satisfy equation 8.3.1</p> <p>$\Sigma M_e \geq 1.2 \Sigma M_g$ (8.3.1)</p> <p>where: ΣM_e adds to the node span of the moments of resistance in the analysis plane calculated with a resistance factor equal to one, of the columns that reach that node; the moment of resistance will be that which corresponds to the factored axial load that, in an interaction diagram of the column, produces the lowest moment of resistance. When calculating the moments of resistance in the analysis plane, the moments that act in the perpendicular plane will not be considered; and ΣM_g adds to the node span of the moments of resistance calculated with a resistance factor equal to one, of the beams that reach the node. The above sums must be made so that the moments of the columns oppose those of the beams. The condition must be met for both directions in which the earthquake can act.</p>	<p>7.4.2.2 Minimum flexural strength of columns 7.4.2.2.2 The flexural strengths of the columns shall satisfy Eq. 7.4.2.2.2:</p> <p>$\Sigma M_{nc} \geq 1.2 \Sigma M_{nb}$ (7.4.2.2.2)</p> <p>where: ΣM_{nc} sum of the nominal flexural strengths of the column sections above and below the node, in the analysis plane, calculated at the node span. The nominal resistant moment shall be that corresponding to the factored axial force that, in an interaction diagram of the column, produces the smallest resistant moment. ΣM_{nb} sums to the node span of the nominal flexural strengths of the beams reaching the node. In the case of monolithically cast beams with slabs, it will not be necessary to consider the contribution of the slab reinforcement steel to the flexural strength. The flexural strength of columns and beams shall be calculated with a steel stress of f_y and a resistance factor equal to 1.0. The above sums must be made so that the moments of the columns oppose those of the beams. This condition must be met for both directions in which the earthquake can act.</p>

Added the Mexican design code (NTC 2023)

- Wall design of medium ductility structure



Added the Mexican design code (NTC 2023)

- Joint design of medium ductility structure

2017	2023
	7.9.2 Beam-column connections 7.9.2.1 Beam-column connections shall satisfy the detailing requirements of 6.9.7.1.1.2 and 6.9.7.1.1.3. and 7.9.2.2 through
	7.9.2.7 Shear strength of beam-column connections 7.9.2.7.1 Vu of the node shall be determined in accordance with 8.5.5.1. (Same as Low Ductility System) 7.9.2.7.2 VR of a beam-column connection shall be calculated in accordance with 6.9.5.2.

Added the Mexican design code (NTC 2023)

- Beam design of High ductility structure

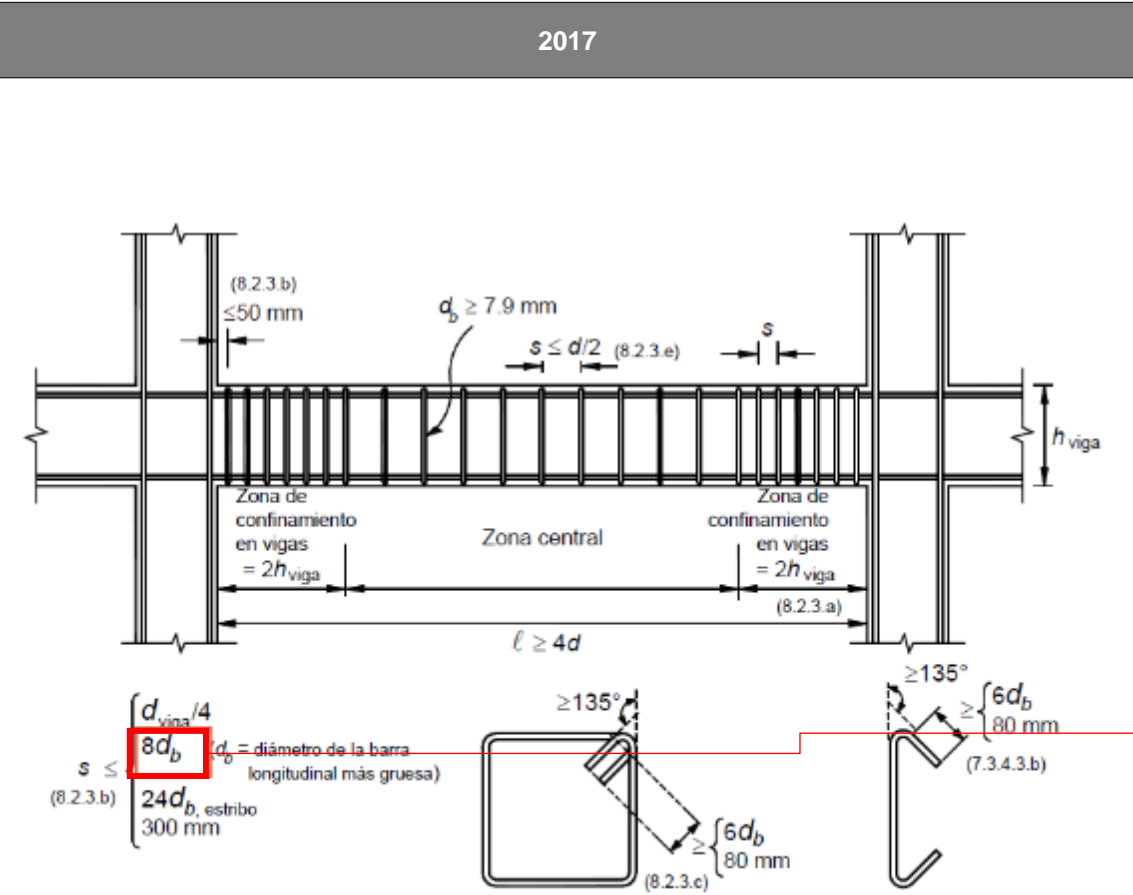


Figura 8.2.1 Detallado de elementos a flexión de ductilidad media

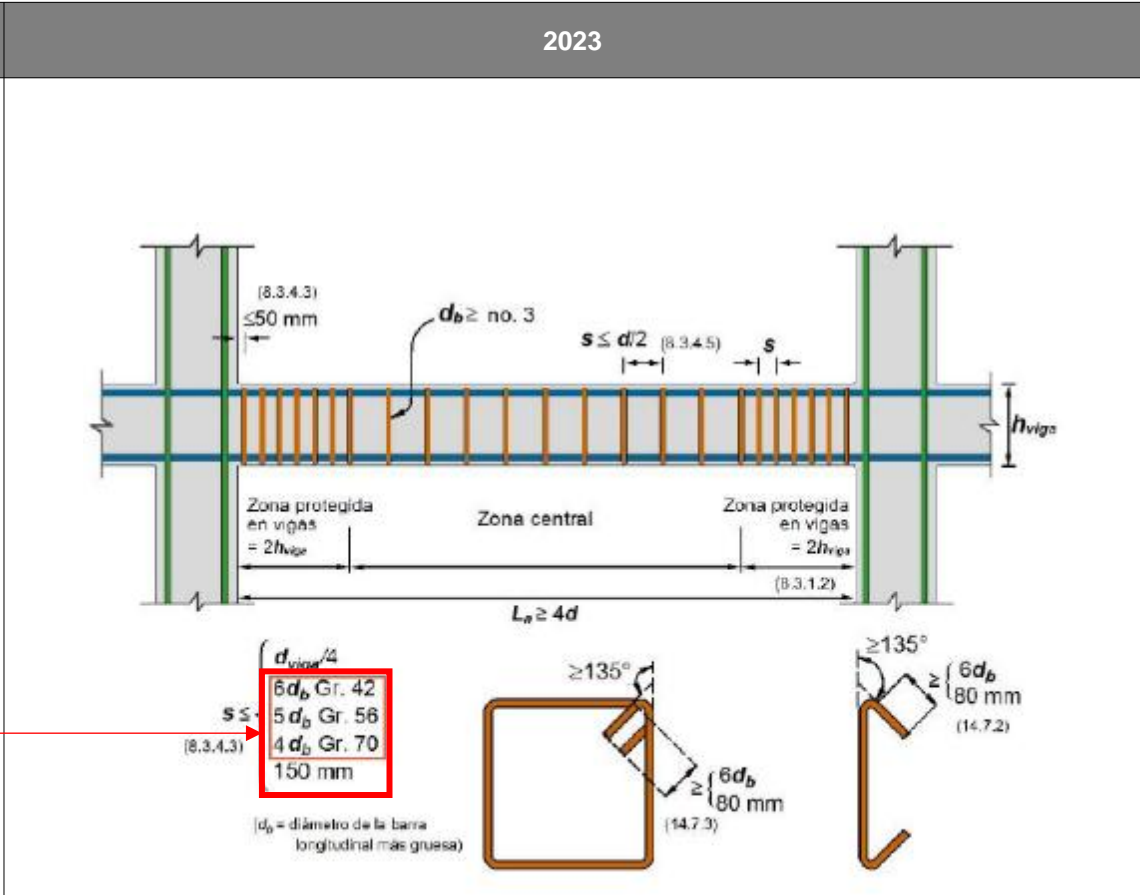
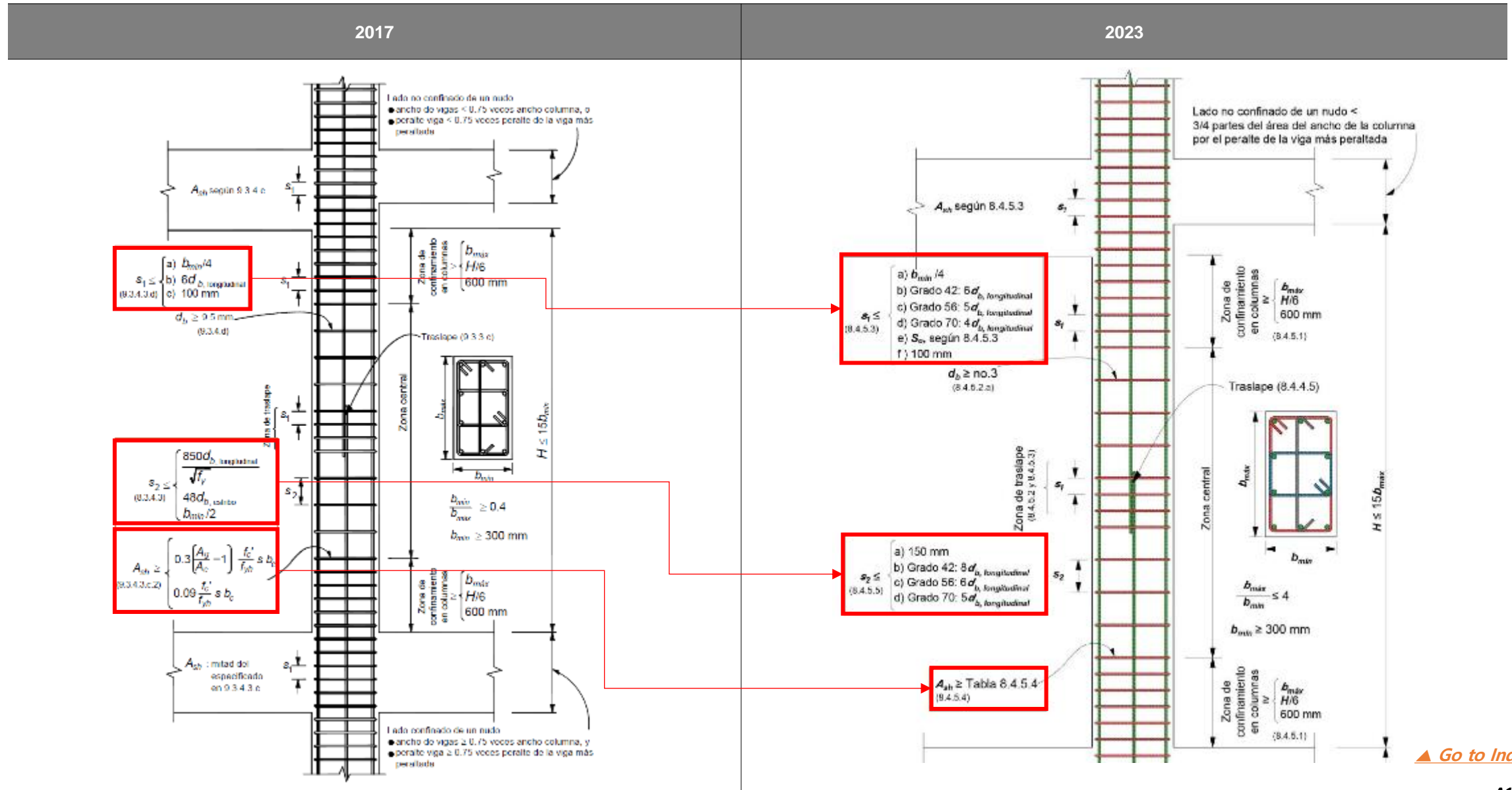


Figura 8.3.1.1 - Detallado de vigas de ductilidad alta

Added the Mexican design code (NTC 2023)

Column design of High ductility structure - 1



Added the Mexican design code (NTC 2023)

- Column design of High ductility structure - 2

2017	2023																		
	<p>8.4.5.3 The spacing of transverse reinforcement shall not exceed the lesser of a) to e):</p> <p>a) One-fourth of the smallest transverse dimension of the element</p> <p>b) 6db of the thinnest longitudinal bar of the primary flexural reinforcement Grade 42</p> <p>c) 5db of the thinnest longitudinal bar of the primary flexural reinforcement Grade 56</p> <p>d) 4db of the thinnest longitudinal bar of the primary flexural reinforcement Grade 70</p> <p>e) or according to Eq. 8.4.5.3:</p> $s_o = 100 + \frac{350 + h_x}{3}$ <p>The value of so in Eq. 8.4.5.3 shall not exceed 150 mm and shall not be less than 100 mm.</p>																		
	<p>8.4.5.4 The amount of transverse reinforcement shall be as obtained from table 8.4.5.4. The kf factor associated with the concrete strength and the kn factor on the confinement effectiveness shall be calculated according to eqs. 8.4.5.4.a and 8.4.5.4.b, respectively:</p> $k_f = \frac{f'_c}{175} + 0.6 \geq 1.0 \quad (8.4.5.4.a)$ $k_n = \frac{n_l}{n_l - 2} \quad (8.4.5.4.b)$ <p>where nl is the number of bars or bundles of longitudinal reinforcement around the perimeter of the core of a column with rectangular stirrups that are laterally supported by stirrup corners or by standard 135-degree hooks.</p> <div><p>Tabla 8.4.5.4 – Refuerzo transversal en columnas de marcos de ductilidad alta</p><table><tr><th>Refuerzo transversal</th><th>Condiciones</th><th colspan="2">Ecuación aplicable</th></tr><tr><td rowspan="2">A_{st}/s_b para estribos rectangulares</td><td>$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm²)</td><td>El mayor de a) y b):</td><td>a) $0.3 \left(\frac{A_{st}}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yt}}$ b) $0.09 \frac{f'_c}{f_{yt}}$</td></tr><tr><td>$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm²)</td><td>El mayor de a), b) y c):</td><td>c) $0.2k_f k_n \frac{v_{cs}}{f_{yt} d_{cs}}$</td></tr><tr><td rowspan="2">p_s para refuerzo helicoidal o estribos circulares</td><td>$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm²)</td><td>El mayor de d) y e):</td><td>d) $0.45 \left(\frac{A_g}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yc}}$</td></tr><tr><td>$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm²)</td><td>El mayor de d), e) y f):</td><td>e) $0.12 \frac{f'_c}{f_{yt}}$ f) $0.35k_f \frac{p_n}{f_{yt} A_{csk}}$</td></tr></table></div>	Refuerzo transversal	Condiciones	Ecuación aplicable		A _{st} /s _b para estribos rectangulares	$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm ²)	El mayor de a) y b):	a) $0.3 \left(\frac{A_{st}}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yt}}$ b) $0.09 \frac{f'_c}{f_{yt}}$	$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm ²)	El mayor de a), b) y c):	c) $0.2k_f k_n \frac{v_{cs}}{f_{yt} d_{cs}}$	p _s para refuerzo helicoidal o estribos circulares	$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm ²)	El mayor de d) y e):	d) $0.45 \left(\frac{A_g}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yc}}$	$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm ²)	El mayor de d), e) y f):	e) $0.12 \frac{f'_c}{f_{yt}}$ f) $0.35k_f \frac{p_n}{f_{yt} A_{csk}}$
Refuerzo transversal	Condiciones	Ecuación aplicable																	
A _{st} /s _b para estribos rectangulares	$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm ²)	El mayor de a) y b):	a) $0.3 \left(\frac{A_{st}}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yt}}$ b) $0.09 \frac{f'_c}{f_{yt}}$																
	$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm ²)	El mayor de a), b) y c):	c) $0.2k_f k_n \frac{v_{cs}}{f_{yt} d_{cs}}$																
p _s para refuerzo helicoidal o estribos circulares	$P_n \leq 0.3A_g f'_c$ y $f'_c \leq 70$ MPa (700 kg/cm ²)	El mayor de d) y e):	d) $0.45 \left(\frac{A_g}{A_{csk}} - 1 \right) \frac{f'_c}{f_{yc}}$																
	$P_n > 0.3A_g f'_c$ o $f'_c > 70$ MPa (700 kg/cm ²)	El mayor de d), e) y f):	e) $0.12 \frac{f'_c}{f_{yt}}$ f) $0.35k_f \frac{p_n}{f_{yt} A_{csk}}$																

▲ Go to Ind

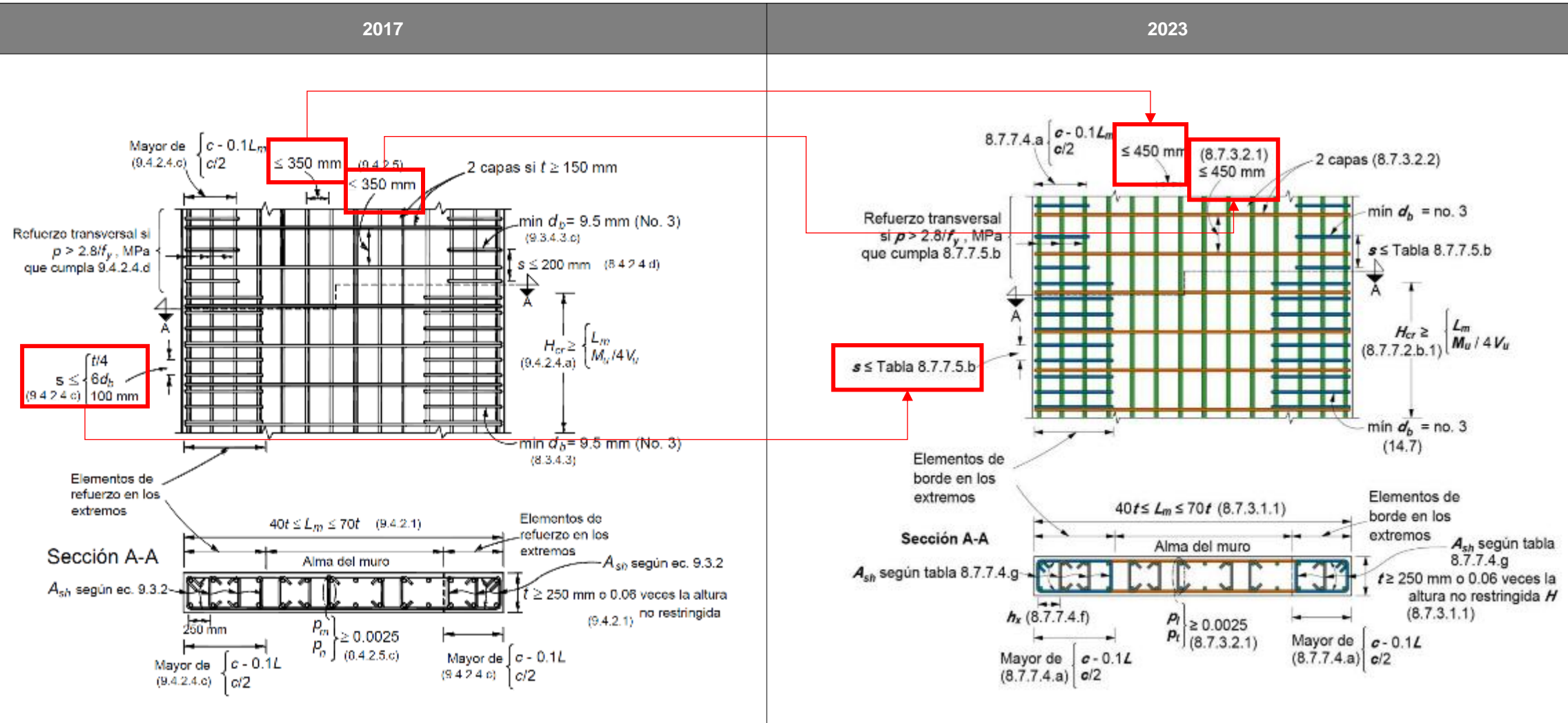
Added the Mexican design code (NTC 2023)

- Column design of High ductility structure - 3

2017	2023
	8.4.5.5 Beyond the length calculated in accordance with 8.4.5.1, helical reinforcement complying with 14.7.4 or stirrups and clips in accordance with 14.7.3 and 14.7.2, respectively, shall be provided. The spacing s shall not exceed the lesser of a) through d), unless a greater amount of transverse reinforcement is required in accordance with 8.4.4.5 and 8.4.6: a) 150 mm b) 8db of the thinnest longitudinal bar, for Grade 42 bars c) 6db of the thinnest longitudinal bar, for Grade 56 bars d) 5db of the thinnest longitudinal bar, for Grade 70 bars.
	8.4.5.1 The minimum confining transverse reinforcement specified in 8.4.5.2 to 8.4.5.4 shall be provided in a length l_o at both ends of the member and on both sides of any section where longitudinal reinforcement is likely to yield in flexure under lateral displacements in the inelastic range of behaviour. The length l_o shall be the greater of a) to c): a) The greatest depth of the column at the node face or at the section where longitudinal reinforcement is likely to yield in flexure (see Fig. 8.4.1) b) $H/6$, where H is the clear height of the column c) 600 mm.
9.3.2 Minimum flexural strength of columns	8.4.3 Minimum flexural strength of columns
The flexural strengths of columns at a node must satisfy equation 9.3.1	8.4.3.2 The flexural strengths of the columns shall satisfy Eq. 8.4.3.2:
$\Sigma M_e \geq 1.2 \Sigma M_g$ (9.3.1)	$\Sigma M_{nc} \geq 1.2 \Sigma M_{prb}$ (8.4.3.2)
where: ΣM_e adds to the node span the moments of resistance in the analysis plane calculated with a resistance factor equal to one, of the columns that reach that node; the moment of resistance will be that which corresponds to the factored axial load that, in an interaction diagram of the column, produces the lowest moment of resistance. When calculating the moments of resistance in the analysis plane, the moments that act in the perpendicular plane will not be considered; and ΣM_g adds to the node span the moments of resistance calculated with a resistance factor equal to one, of the beams that reach the node.	where: ΣM_{nc} sum of the nominal flexural strengths of the column sections above and below the node, in the analysis plane, calculated at the node span. The nominal resisting moment shall be that corresponding to the factored axial load that, in an interaction diagram of the column, produces the smallest resisting moment in the analysis direction, using a resistance factor equal to 1.0. ΣM_{prb} sums to the node span the probable flexural strengths of the beams reaching the node. In the case of beams cast monolithically with slabs, when the slab is in tension due to moments at the node face, the slab reinforcing steel within the effective width established in 8.5.2.2 shall be considered to contribute to M_{prb} if the slab reinforcing steel can develop its yield strength at the critical section by bending. <u>The flexural strength of the beams shall be calculated with a steel stress of 1.25 f_y and a resistance factor equal to 1.0.</u>
The above sums must be made so that the moments of the columns oppose those of the beams. The condition must be met for both directions in which the earthquake can act.	The above sums must be made so that the moments of the columns oppose those of the beams. The condition must be met for both directions in which the earthquake can act.
It will not be necessary to comply with equation 9.3.1 at the roof nodes.	

Added the Mexican design code (NTC 2023)

- Wall design of *High ductility structure - 1*



Added the Mexican design code (NTC 2023)

- Wall design of High ductility structure - 2

2017	2023											
	<p>8.7.4 Design Shear Force</p> <p>8.7.4.3.2 If the factored shear force V_{ush} is determined from an elastic structural analysis, the portion of the design shear force of the wall due to the horizontal component of the earthquake, calculated according to NTC-Earthquake, shall be amplified by the product $\Omega_v \omega_v$, where Ω_v and ω_v are defined in 8.7.4.3.3 to 8.7.4.3.5.</p> <p>8.7.4.4.3.3 Ω_v and ω_v shall be calculated in accordance with Table 8.7.4.3.3, except that Ω_v shall be permitted to be calculated as M_{pr}/M_u at the critical flexural section for the applicable load combination that includes earthquake.</p> <div><p>Tabla 8.7.4.3.3 – Factores Ω_v y ω_v</p><table><tr><th>Condición</th><th>Ω_v</th><th>ω_v [1]</th></tr><tr><td>$H_{base}/L_n \leq 1.0$</td><td>1.0</td><td rowspan="2">1.0</td></tr><tr><td>$1.0 < H_{base}/L_n < 2.0$</td><td>Se permite la interpolación lineal 1.0 y 1.5</td></tr><tr><td>$H_{base}/L_n \geq 2.0$</td><td>1.5</td><td>$0.8 + 0.13 H_n^{1/3}$</td></tr></table></div> <p>[1] H_n is the height of the structure from the base to the highest level of the seismic-resisting system, in meters. The base of the structure is the level where the seismic motion is considered to be applied.</p> <p>8.7.4.3.4 The product $\Omega_v \omega_v$ shall not exceed 2.0.</p>	Condición	Ω_v	ω_v [1]	$H_{base}/L_n \leq 1.0$	1.0	1.0	$1.0 < H_{base}/L_n < 2.0$	Se permite la interpolación lineal 1.0 y 1.5	$H_{base}/L_n \geq 2.0$	1.5	$0.8 + 0.13 H_n^{1/3}$
Condición	Ω_v	ω_v [1]										
$H_{base}/L_n \leq 1.0$	1.0	1.0										
$1.0 < H_{base}/L_n < 2.0$	Se permite la interpolación lineal 1.0 y 1.5											
$H_{base}/L_n \geq 2.0$	1.5	$0.8 + 0.13 H_n^{1/3}$										

Added the Mexican design code (NTC 2023)

- Joint design of High ductility structure

2017	2023																										
	8.5.2 General requirements 8.5.2.1 The forces in the non-prestressed deformed bars of the longitudinal reinforcement of the beams at the node face shall be calculated assuming that <u>the stress in the tensile flexural reinforcement is $1.25f_y$</u> .																										
	8.5.5 Shear strength resistance 8.5.5.1 The joint shear resistance in each principal direction of the section shall be checked independently. The joint shear force V_{uj} shall be calculated in the horizontal plane leading to the largest value of V_{uj}/A_j from the calculated forces at the joint face using the values of beam tension and compression forces determined in accordance with 8.5.2.1 and 8.5.2.3, as applicable, and <u>the column shear consistent with the probable beam flexural strengths M_{pr}</u> .																										
	<u>8.5.5.3 V_{Rj}</u> Tabla 8.5.5.3 - Resistencia de diseño a cortante de nudos de marcos de ductilidad alta <table><tr><th>Columna</th><th>Viga en la dirección de F_{vj}</th><th>Confinamiento por vigas transversales de acuerdo con 8.5.5.3</th><th>V_{Rj}</th></tr><tr><td rowspan="4">Continua o cumple con 6.9.5.2.3</td><td rowspan="2">Continua o cumple con 8.5.5.3.a y 8.5.5.3.b</td><td>Confinada</td><td>$1.7F_R\sqrt{f'_c}A_j$ $(5.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td>No confinada</td><td>$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td rowspan="2">Otra</td><td>Confinada</td><td>$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td>No confinada</td><td>$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td rowspan="4">Otra</td><td rowspan="2">Continua o cumple con 8.5.5.3.a y 8.5.5.3.b</td><td>Confinada</td><td>$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td>No confinada</td><td>$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td rowspan="2">Otra</td><td>Confinada</td><td>$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$</td></tr><tr><td>No confinada</td><td>$0.67F_R\sqrt{f'_c}A_j$ $(2.0F_R\sqrt{f'_c}A_j)$</td></tr></table>	Columna	Viga en la dirección de F_{vj}	Confinamiento por vigas transversales de acuerdo con 8.5.5.3	V_{Rj}	Continua o cumple con 6.9.5.2.3	Continua o cumple con 8.5.5.3.a y 8.5.5.3.b	Confinada	$1.7F_R\sqrt{f'_c}A_j$ $(5.5F_R\sqrt{f'_c}A_j)$	No confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$	Otra	Confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$	No confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$	Otra	Continua o cumple con 8.5.5.3.a y 8.5.5.3.b	Confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$	No confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$	Otra	Confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$	No confinada	$0.67F_R\sqrt{f'_c}A_j$ $(2.0F_R\sqrt{f'_c}A_j)$
Columna	Viga en la dirección de F_{vj}	Confinamiento por vigas transversales de acuerdo con 8.5.5.3	V_{Rj}																								
Continua o cumple con 6.9.5.2.3	Continua o cumple con 8.5.5.3.a y 8.5.5.3.b	Confinada	$1.7F_R\sqrt{f'_c}A_j$ $(5.5F_R\sqrt{f'_c}A_j)$																								
		No confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$																								
	Otra	Confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$																								
		No confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$																								
Otra	Continua o cumple con 8.5.5.3.a y 8.5.5.3.b	Confinada	$1.3F_R\sqrt{f'_c}A_j$ $(4.5F_R\sqrt{f'_c}A_j)$																								
		No confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$																								
	Otra	Confinada	$1.0F_R\sqrt{f'_c}A_j$ $(3.5F_R\sqrt{f'_c}A_j)$																								
		No confinada	$0.67F_R\sqrt{f'_c}A_j$ $(2.0F_R\sqrt{f'_c}A_j)$																								

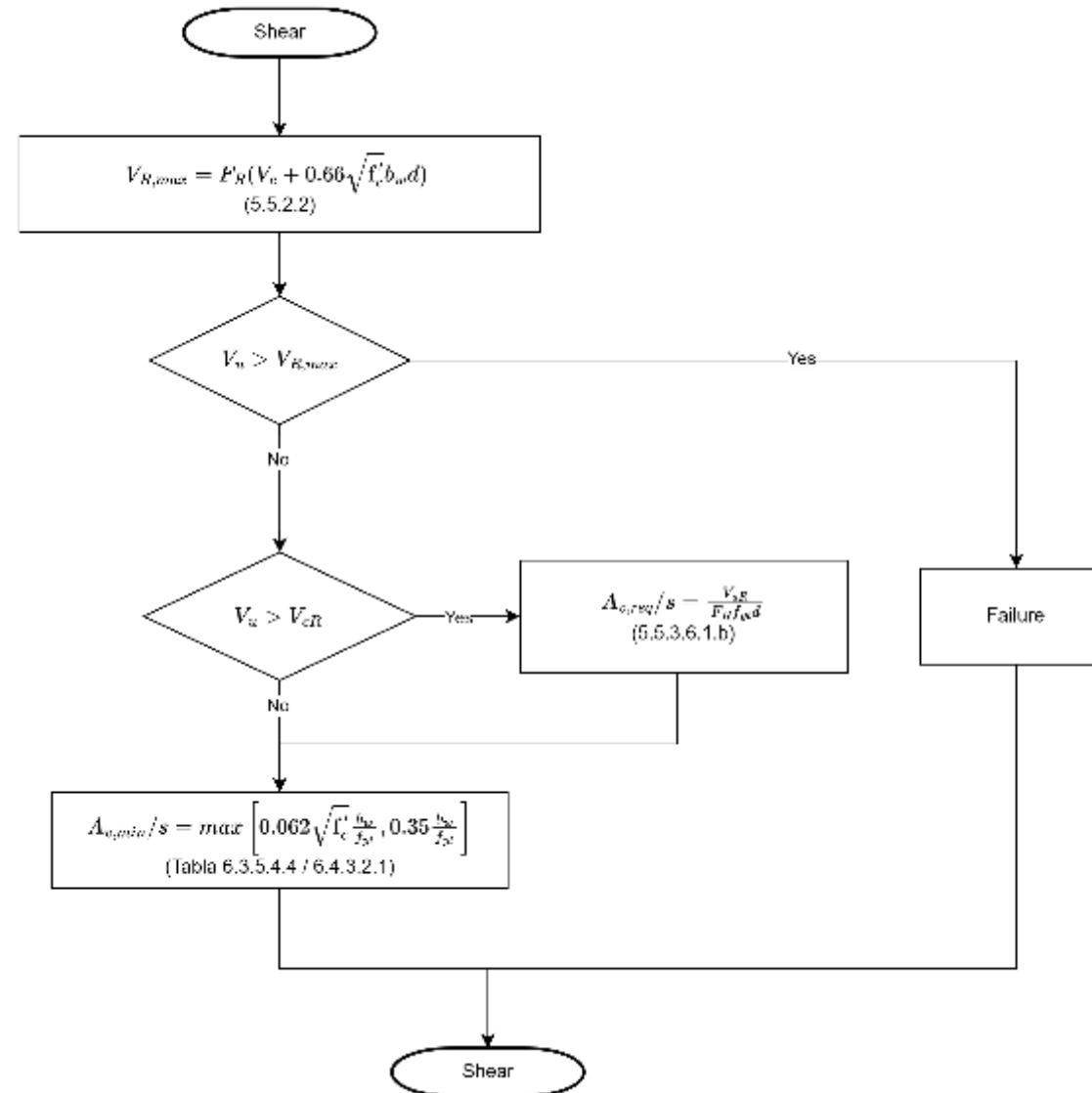
Added the Mexican design code (NTC 2023)

- *Transverse Rebar Detail*

2017	2023
5.3.5 Shear reinforcement 5.3.5.1 Reinforcement in beams and columns without prestressing b) If V_u is greater than V_{cR} but less than or equal to the value calculated using equation 5.3.4, the spacing of stirrups perpendicular to the axis of the element shall not be greater than $0.5d$. c) If V_u is greater than the value calculated using equation 5.3.4, the spacing of stirrups perpendicular to the axis of the element shall not be greater than $0.25d$.	14.7.3 Close stirrups 14.7.3.2 Closed stirrups shall be made of deformed bars with spacings indicated in a) and b): a) Clear spacing at least equal to $1.5t_{mag}$ b) Center spacing not exceeding the lesser of $16d_b$ of the longitudinal bar, $48d_t$ of the stirrup bar and the distance required according to the type of member (beam, column) and the expected level of ductility (low, medium or high). $s_{max} = \min(d_t + 1.5t_{mag}, 16d_b, 48d_t)$

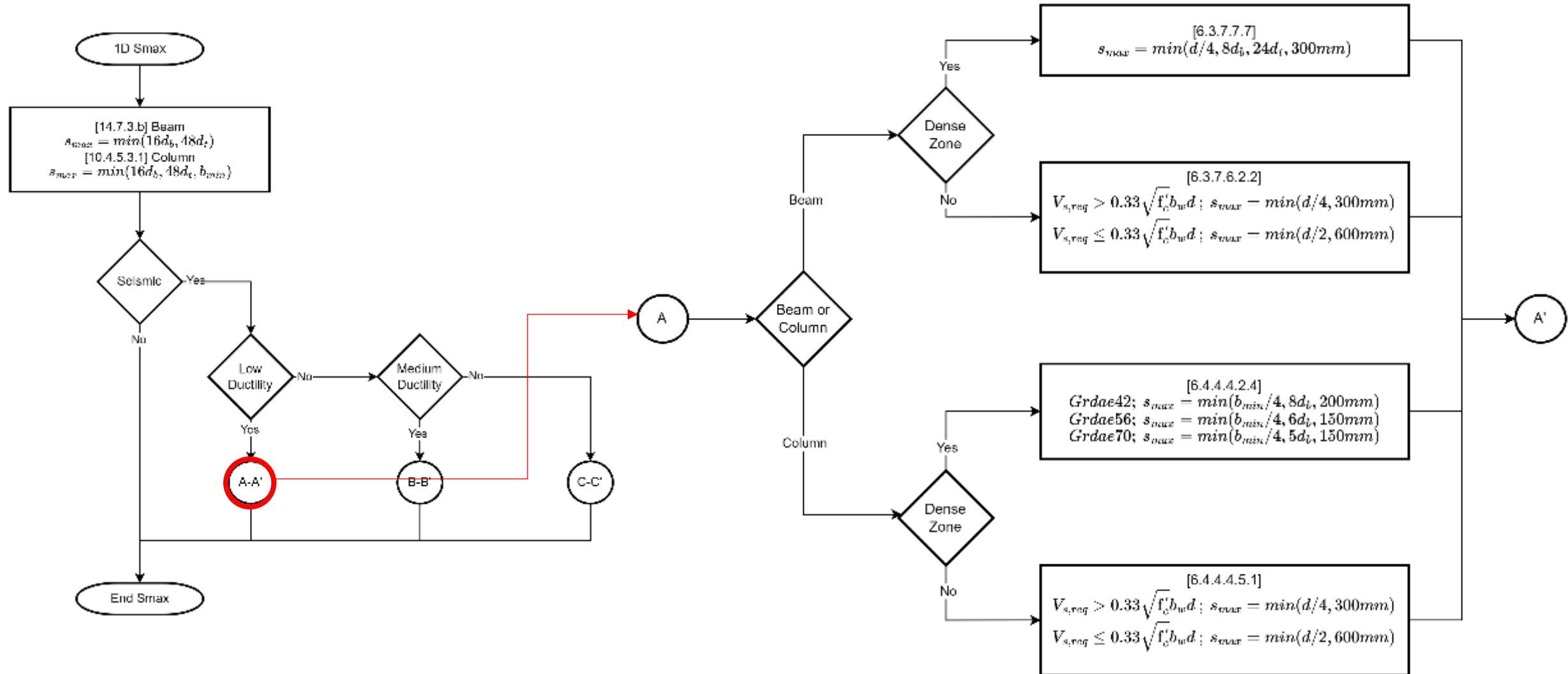
Added the Mexican design code (NTC 2023)

- *Design Flow Chart → Shear Reinforcement*



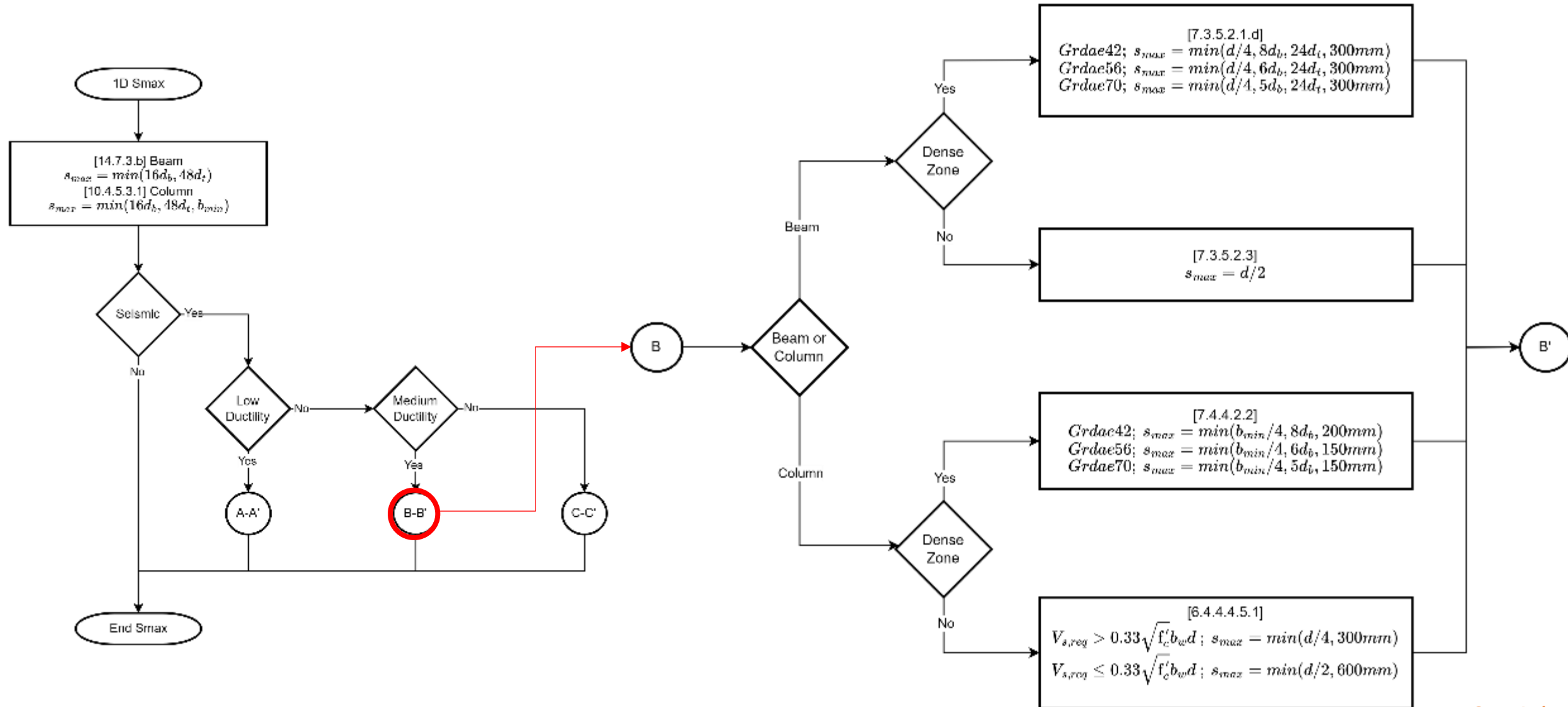
Added the Mexican design code (NTC 2023)

- Design Flow Chart → Max. Space of Shear Reinforcement in 1D member - 01



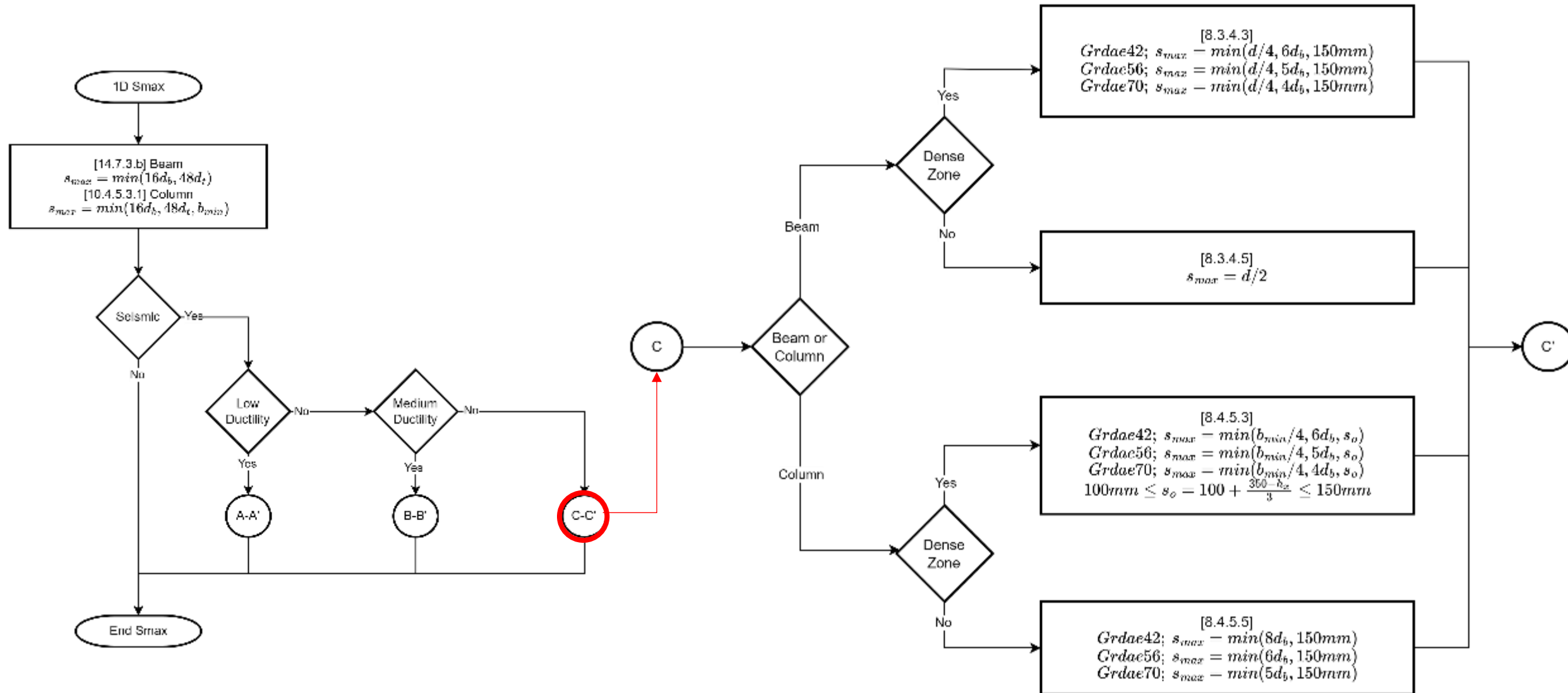
Added the Mexican design code (NTC 2023)

- Design Flow Chart → Max. Space of Shear Reinforcement in 1D member - 02



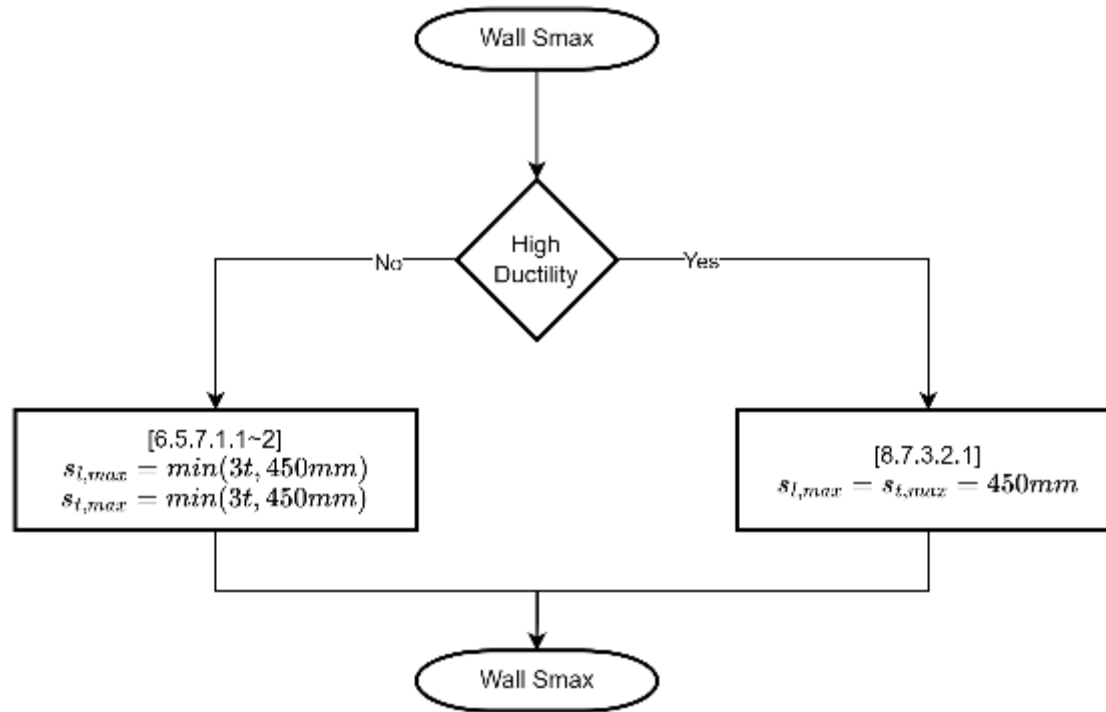
Added the Mexican design code (NTC 2023)

- Design Flow Chart → Max. Space of Shear Reinforcement in 1D member - 03



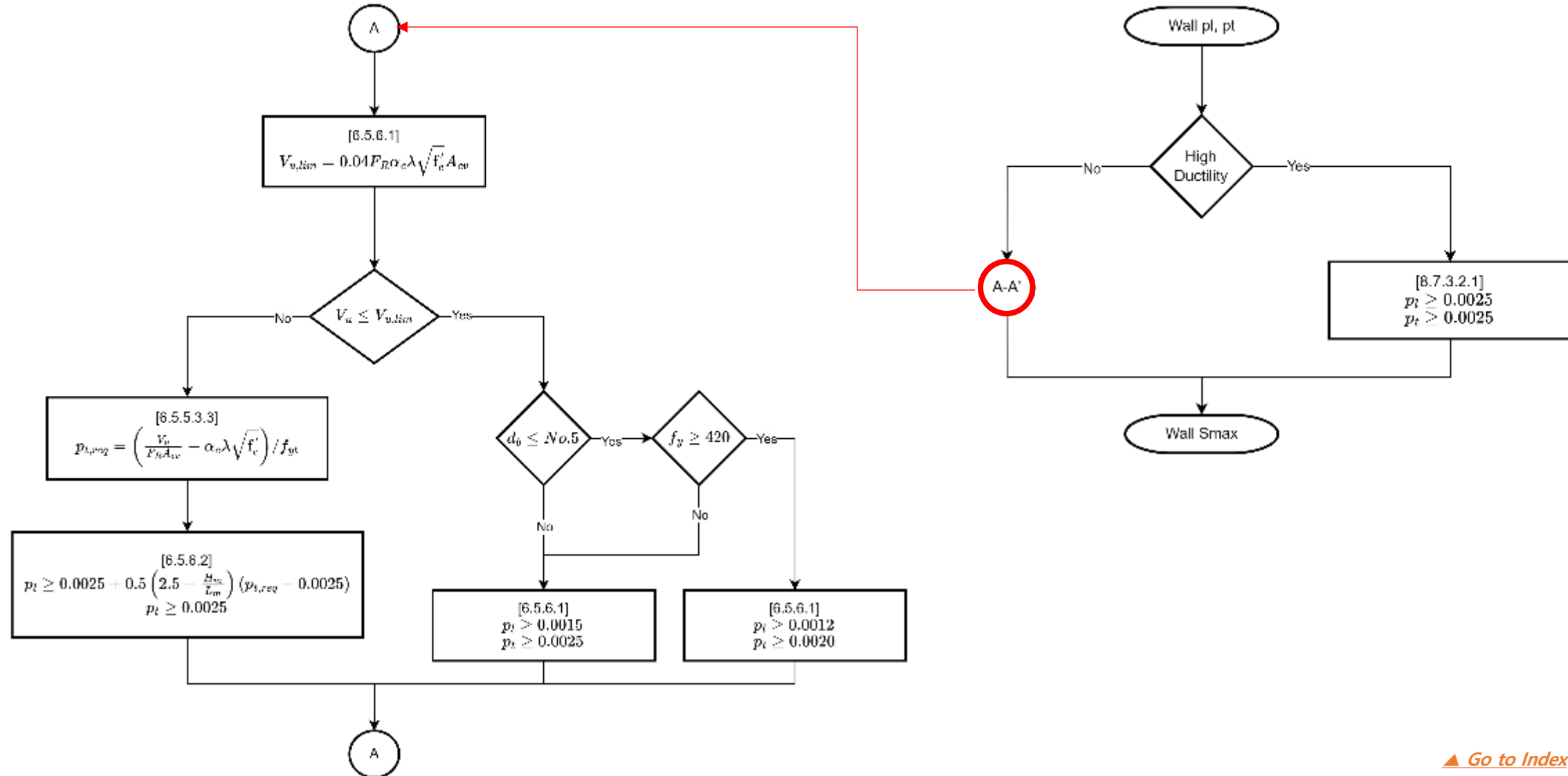
Added the Mexican design code (NTC 2023)

- *Design Flow Chart $\rightarrow S_{max}$ in Wall Shear Design*



Added the Mexican design code (NTC 2023)

- Design Flow Chart → Rebar Ratio Limit in Wall Design



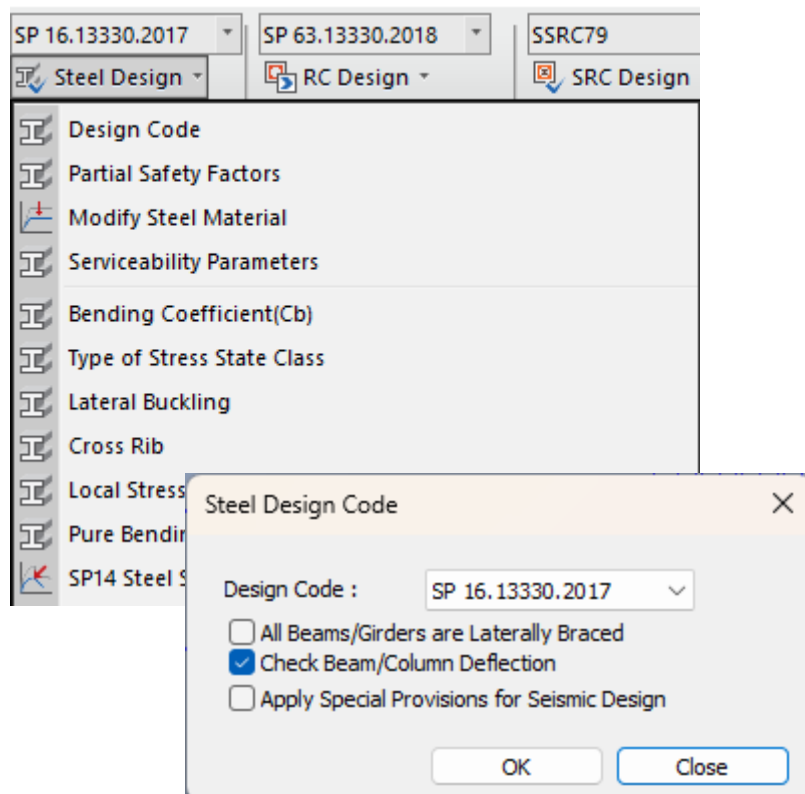
Appendix 02

Russian code in midas Gen

- **Added design of steel according to SP 16.13330.2017**
 1. Calculation of section strength
 2. Calculation of the stability of a plane bending form
 3. Calculation of stability of off-centre compressed elements
 4. Check of local stability of webs and flanges of the cross section
- **Added design of reinforced concrete structures according to SP 63.13330.2018**
 1. Strength check of the normal section of a beam/column element
 2. Checking the strength of the inclined section of a beam/column, element against the action of moment and shear force
 3. Calculation of crack resistance and crack opening width in the normal section of a beam element
- **Special structural requirements are taken into account in the design of structures**
 1. Added consideration of structural requirements in seismic design according to SP 14.13330.2018
 2. Added accounting of responsibility of the structure according to GOST 27751-2014
- **Added load combinations according to SP 20.13330.2016**
 1. Main, special, crane, seismic load combinations
 2. Added special load combinations according to SP 296.1325800.2017
- **Implemented calculation of the pulsation component of the wind load according to SP 20.13330.2016**
 1. Calculation of the pulsation force acting on a rigid floor diaphragm
- **Added response spectrum according to SP 14.13330.2018**
- **Added base of materials and profiles for calculation according to Russian code**

Added design of steel according to SP 16.13330.2017

1. Calculation of section strength
2. Calculation of the stability of a plane bending form
3. Calculation of stability of off-centre compressed elements



Dialog box for setting parameters for steel structures calculation according to SP 16.13330.2017

Realised calculation types

- **Par. 7.1.1-** Strength calculation of elements in central tension or compression
- **Par. 8.2.1, 8.2.3** - Strength calculation of bending elements
- **Par. 9.1.1, 9.1.3** - Strength calculation of eccentrically compressed and eccentrically tensile elements
- **Par. 8.4.1** - Calculation of stability of I-beams of class 1: under the action of a moment
- **Par. 7.1.3** - Calculation of stability of elements of continuous section under central compression
- **Par. 9.2.2, 9.2.8, 9.2.9, 9.2.10, 9.2.4** - Calculation of stability of elements of continuous section under off-centre compression

Material properties: Fy = 35000, Es = 2.06e+07, MATERIAL NAME = C355		
Design parameters		
Parameter	Description	Value
Gamma_cstr	Working conditions factor (strength)	1
Gamma_cstab	Operating conditions coefficient (stability)	1
SSS type	Type of design stress-strain state	1
Ly	Type of stress state	200
Lz	Unbraced length for the calculation of compressed elements	200
Lef	Design length for fi_b calculation	200
Ky	Effective Length Factor	1
Kz	Effective Length Factor	1
a	Cross rib spacing	Not set
Sigma_loc	Local stress	0
Point of Load	Place of load application	Top
Load belt for Phi_b	Type of compression girder bracing	Compressed
Type beam fixing for Phi_b	Fixing in the lateral buckling calculation	More than 2 fixes
Load type for Phi_b	Load type for lateral buckling	Distributed

Forces and Moments at (I) Point: LCB 1		
Axial Force	Fxx = 0	
Shear Forces	Fyy = 0	Fzz = 100000
Bending Moments	My = 1.5e+07	Mz = 0

Forces and Moments for shear check at (I) Point: LCB 1		
Axial Force	Fxx = 0	
Shear Forces	Fyy = 0	Fzz = 100000
Bending Moments	My = 0	Mz = 0

Sign conventions for stress and axial force.
 - Stress: Compression positive.
 - Axial force: Tension positive.

Calc Unit System: N, mm

• **Strength check**

1. Checking the section for shear forces

ratio1 = max(abs(Qx * Sy / (Iyn * tw * Rs * Gamma_c)), abs(Qy * Sx / (Ixn * tw * Rs * Gamma_c))) = max(abs(0 * 252200 / (1.73401e+07 * 6 * 203 * 1)), abs(100000 * 608007 / (2.2093e+08 * 6 * 203 * 1))) = 0.225947 <= 1

[0.225947 <= 1] OK

ratio2 = tau / (Rs * Gamma_c) = 45.8673 / (203 * 1) = 0.225947 <= 1

[0.225947 <= 1] OK

• **Strength check**

Text report in RTF format.

Added design of steel according to SP 16.13330.2017

4. Check of local stability of walls and flanges of the cross section

SP 16.13330.2017 Code Checking Result Dialog

Code : SP 16.13330.2017 Unit : N , cm Primary Sorting Option

Sorted by ☐ Member ☒ Property Change... Update...

☐ SECT ☒ MEMB

CH	MEMB	SECT	SEL	Section	LCB	λ	Len	L_y	K_y	σ_{Ed}	τ_{Ed}	My.stab	NMy.Ed	NMz.Ed	NMyz.E	NMyz.E	λ_w	λ_f	Def
K	COM	SHR		Material Fy		λ_u	Lb	Lz	Kz	σ_{Rd}	τ_{Rd}	My.stab	NMy.Rd	NMz.Rd	NMyz.R	NMyz.R	λ_{uw}	λ_{uf}	Defa
OK	38	18		ДБ 400x200x6x13	1	0.000	150.000	200.000	1.000	13687.0	4586.73	13.5790	-	-	-	-	2.569	0.308	-
	0.734	0.226		C355 35000.0		0.000	200.000	200.000	1.000	35000.0	20300.0	35.0000	-	-	-	-	3.500	0.803	-

☐ Connect Model View View Result Ratio... Result View Option ☒ All ☐ OK ☐ NG

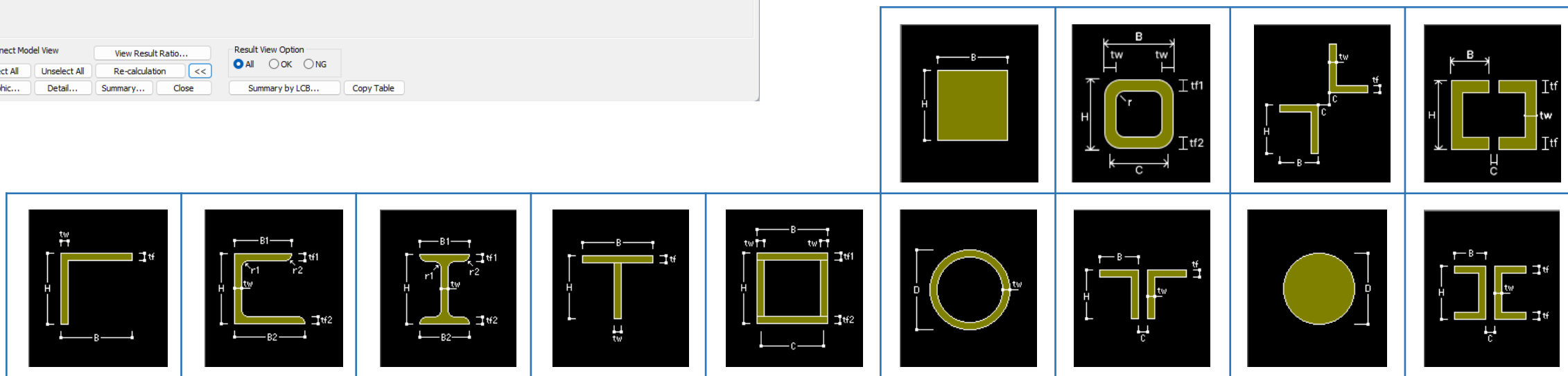
Select All Unselect All Re-calculation <<

Graphic... Detail... Summary... Close

Summary by LCB... Copy Table

Realised calculation types

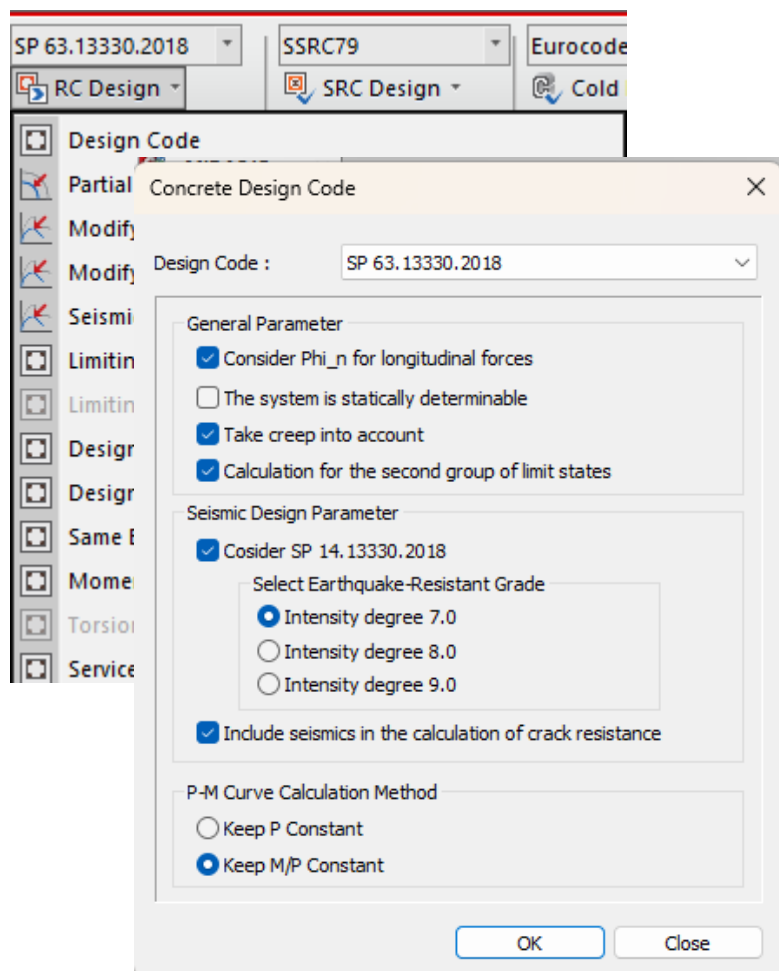
- Par. 7.3.2, 7.3.3 - Web stability of centrally compressed elements of continuous section
- Par. 8.5.1, 8.2.2, 8.5.3, 8.5.7, 8.5.8 - Stability of webs under the action of the moment
- Par. 9.4.2 - Stability of web of off-centre compressed elements
- Par. 11.2.2 - Web stability calculation of seamless or electrically welded pipes
- Par. 7.3.8 - Stability of belt plates (flanges) of centrally compressed elements of continuous section
- Par. 8.5.18, 8.5.19 - Stability of compressed beam flanges
- Par. 9.4.7 - Stability of girdles (flanges) of off-centre compressed bars



Supported section types for calculation according to SP 16.13330.2017

Added design of reinforced concrete structures according to SP 63.13330.2018

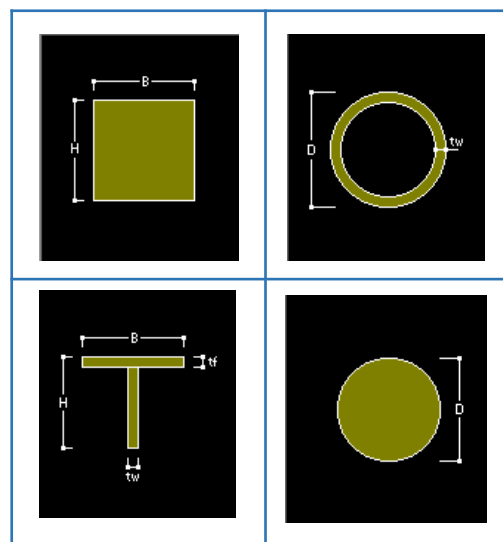
1. Strength check of the normal section of a beam/column element
2. Checking the strength of the inclined section of a beam/column, element against the action of moment and shear force



Dialog box for specifying parameters for calculation of reinforced concrete structures according to SP 63.13330.2018

Realised calculation types

- Par. 8.1.8, 8.1.14, 8.1.18, 8.1.19, 8.1.24 - Strength of normal section against longitudinal forces and bending moments
- Par. 8.1.33, 8.1.35, 8.1.37, 8.1.38, 8.1.40, 8.1.41, 8.1.42 – Strength of the inclined section under shear force and torque action



Supported section types for calculation according to SP 63.13330.2018

Reinforcement pattern				
Location	i-End	di(mm)	Rebar	Asi(mm^2)
Top	1	12	2-P12	226.195
	2	12	0-P12	0.000
Bottom	1	32	6-P32	4825.486
	2	32	0-P32	0.000
Stirrups	P10	10	P10@200.0	2356.194
Skin	-	-	0-P0	0.000

* Checking the strength of the normal section

1) Strength calculation of bending elements (par. 8.1.8)

LCB lcb_long

Axial Force Fxx = 0.0 N

Shear Forces Fyy = 0.0 N, Fzz = 0.0 N

Bending Moments Mx = 0.0 N-mm, My = 55000000.0 N-mm, Mz = 0.0 N-mm

$$x = (R_s \cdot A_s - R_{sc} \cdot A_{sc}) / (R_b \cdot b) = (340.000 \times 4825.486 - 340.000 \times 226.195) / (14.500 \times 300.000) = 359.485 \text{ mm}$$

$$h_0 = h - a_s = 700.000 - 70.000 = 630.000 \text{ mm}$$

$$\xi = x / h_0 = 359.485 / 630.000 = 0.571$$

$$\xi_{R} = 0.5384621 < \xi = 0.571$$

$$x = \xi_{R} \cdot h_0 = 0.538 \times 630.000 = 339.231 \text{ mm}$$

$$M_{ult} = R_b \cdot b \cdot x \cdot (h_0 - 0.5 \cdot x) + R_{sc} \cdot A_{sc} \cdot (h_0 - a_s) = 14.500 \times 300.000 \times 339.231 \times (630.000 - 0.5 \times 339.231) + 340.000 \times 226.195 \times (630.000 - 70.000) = 722435793.772 \text{ N-mm}$$

$$Rat_Normal = M / M_{ult} = 55000000.000 / 722435793.772 = 0.76131333$$

[0.761 ≤ 1]—OK

* Shear Check

1) Calculation by concrete strip between inclined sections (par. 8.1.32)

Y Dir

LCB lcb_long

Axial Force Fxx = 0.0 N

Shear Forces Fyy = 0.0 N, Fzz = 0.0 N

Bending Moments Mx = 0.0 N-mm, My = 55000000.0 N-mm, Mz = 0.0 N-mm

Phi_b1 = 0.300

$$Q_{ult} = \Phi_{b1} \cdot R_b \cdot b \cdot h_0 = 0.300 \times 14.500 \times 300.000 \times 630.000 = 822150.000 \text{ N}$$

$$Rat_Shear = Q / Q_{ult} = 0.000 / 822150.000 = 0.00000000$$

[0.000 ≤ 1]—OK

Text report in DOC format.

Added design of reinforced concrete structures according to SP 63.13330.2018

3. Calculation of crack resistance and crack opening width in the normal section of a beam element

SP 63.13330.2018 RC-Beam Checking Result Dialog

Code : SP 63.13330.2018 Unit : kN , m

Sorted by: ☐ Member ☒ Property Results: ☒ Strength ☐ Rebar Detail ☐ Serviceability

Primary Sorting Option: ☐ SECT ☒ MEMB

MEMB	SECT	SEL	Section	fck	POS	CHK	Raf-full	LCB	Raf-Normal	LCB	Rat-Torsion	LCB	Rat-Shear
Span			Bc Hc bf hf fyw										
0			8_1_8(0) 800	14500.0	I	OK	0.8932	1	0.8932	0	-	1	0.7931
1			0.300 0.800	340000	M	OK	0.8932	1	0.8932	0	-	1	0.7931
3.0000			0.000 0.000	170000	J	OK	0.8932	1	0.8932	0	-	1	0.7931
0			8_1_8(1) 700	14500.0	I	OK	0.7613	1	0.7613	0	-	1	0.5749
2			0.300 0.700	340000	M	OK	0.7613	1	0.7613	0	-	1	0.5749
3.0000			0.000 0.000	170000	J	OK	0.7613	1	0.7613	0	-	1	0.5749
0			8_1_8(2) T60	14500.0	I	OK	0.7965	1	0.7965	0	-	1	0.7198
3			0.200 0.600	340000	M	OK	0.7965	1	0.7965	0	-	1	0.7198
3.0000			0.400 0.100	170000	J	OK	0.7965	1	0.7965	0	-	1	0.7198
0			8_1_18(0) 20	14500.0	I	OK	0.0659	3	0.0659	0	-	3	0.0000
7			0.500 0.200	340000	M	OK	0.0659	3	0.0659	0	-	3	0.0000
3.0000			0.000 0.000	170000	J	OK	0.0659	3	0.0659	0	-	3	0.0000
0			8_1_18(1) 20	14500.0	I	OK	0.0515	3	0.0515	0	-	3	0.0000
8			0.500 0.200	435000	M	OK	0.0515	3	0.0515	0	-	3	0.0000
3.0000			0.000 0.000	170000	J	OK	0.0515	3	0.0515	0	-	3	0.0000

☐ Connect Model View

Select All Unselect All Re-calculation

Graphic... Detail... Summary... <<

Option for Detail Print Position: ☒ End I. ☐ Mid. ☐ End J.

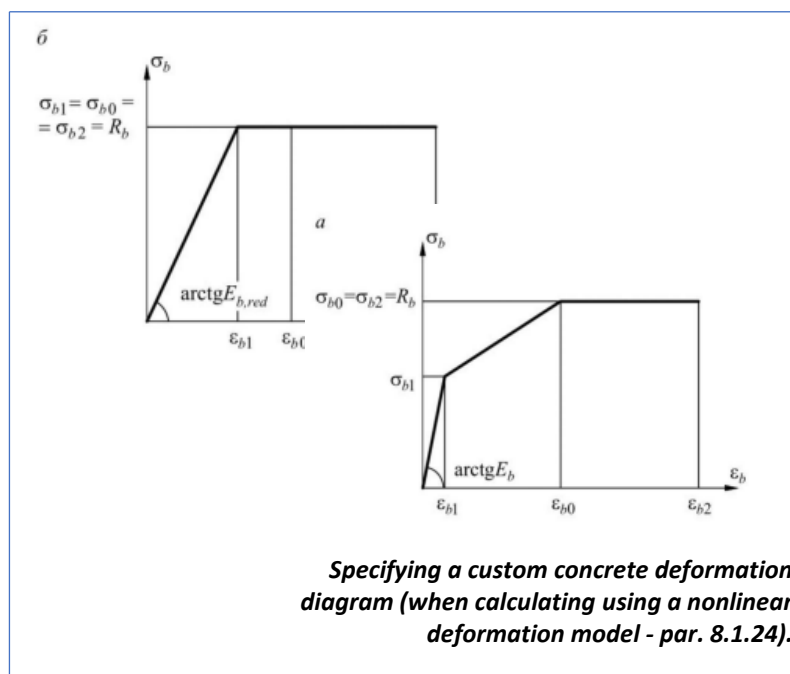
Result View Option: ☒ All ☐ OK ☐ NG

Copy Table

Close

Realised calculation types

- Par. 8.2.4 - 8.2.7 - Calculation of crack resistance and crack width in a normal section of a rod element



General Steel Concrete SRC Cold For...

Modify nonlinear deformation model of c ...

Option: ☒ Add/Replace ☐ Delete

Diagram type: Two-line stress-s1

Parameters of the deformation model

☐ by material ☒ user define

Compression

Sigma_b1: 0 kN/m^2

Sigma_b0: 0 kN/m^2

Sigma_b2: 0 kN/m^2

Epsilon_b1: 0

Epsilon_b0: 0

Epsilon_b2: 0

Tension

Sigma_bt1: 0 kN/m^2

Sigma_bt0: 0 kN/m^2

Sigma_bt2: 0 kN/m^2

Epsilon_bt1: 0

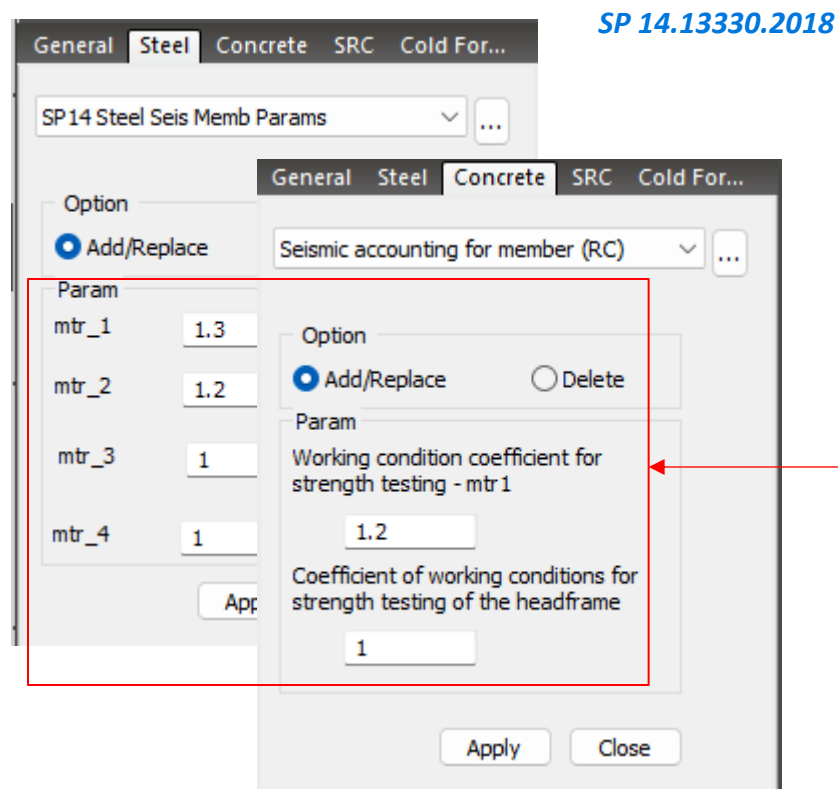
Epsilon_bt0: 0

Epsilon_bt2: 0

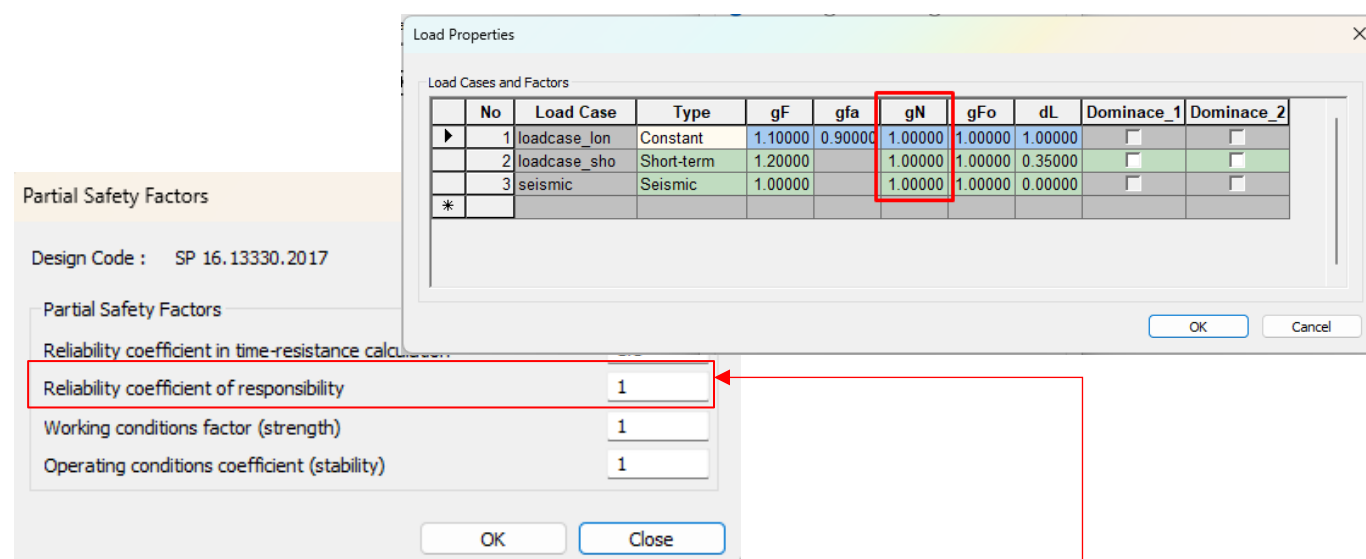
Apply Close

Special structural requirements are taken into account in the design of structures

1. Added consideration of structural requirements in seismic design according to SP 14.13330.2018
2. Added accounting of responsibility of the structure according to GOST 27751-2014



5.15 When calculating structures for strength and stability, in addition to the coefficients of working conditions accepted in accordance with other current regulatory documents, an additional coefficient of working conditions m_{tr} , determined according to Table 5.4, should be introduced. The m_{tr} coefficient is multiplied by the design resistance of the corresponding material of the structure.



GOST 27751-2014

10.1 Depending on the class and level of responsibility of structures (see 3.1), reliability coefficients for responsibility should be used in their design, the minimum values of which are given in Table 2.

Added load combinations according to SP 20.13330.2016

- 1. Main, special, crane, seismic load combinations
- 2. Added special load combinations according to SP 296.1325800.2017

Automatic Generation of Load Combinations

Option

☒ Add ☐ Replace ☒ Add Envelope

Code Selection

☒ Steel ☐ Concrete ☐ SRC
☐ Cold Formed Steel ☐ Footing
☐ Aluminum

Design Code :

SP 20.13330.2016

Define Factors for Variable Actions

Factors for Variable Actions...

Partial factors for actions

Partial factors for actions

☒ Define links between load cases

Set Load Cases for links

Generate Additional Load Combinations

☒ Main
☒ Special
☒ Seismic

OK

Cancel

Dialog box for controlling the generation of combinations according to SP 20.13330.2016

SP 20.13330.2016

6.2 Depending on the load composition to be taken into account, a distinction should be made:

a) the main load combinations consisting of constant, long-term and short-term loads

$$C_m = P_d + (\psi_{11}P_{11} + \psi_{12}P_{12} + \psi_{13}P_{13} + \dots) + (\psi_{21}P_{21} + \psi_{22}P_{22} + \psi_{23}P_{23} + \dots); \quad (6.1)$$

6) special load combinations consisting of constant, long-term, short-term and one of the special loads.

$$C_s = C_m + P_s; \quad (6.2)$$

where C_m - load for the main combination;
 C_s - load for a special combination;
 ψ_{ii} ($i = 1, 2, 3, \dots$) - combination coefficients for long-term loads;
 ψ_{ii} ($i = 1, 2, 3, \dots$) - combination factors for short-term loads.

Load Combinations

General Steel Design Concrete Design SRC Design Cold Formed Steel Design Footing Design

Load Combination List

No	Name	Active	Type	Load 1 (ST)	Load 2 (ST)	Load 3 (ST)
1	sLCB1	Stren	Add	1.1000		
2	sLCB2	Stren	Add	0.9000		
3	sLCB4	Stren	Add	1.1000	1.2000	
4	sLCB9	Stren	Add	1.1000		1.2000
*						

The example establishes that Load 2 and Load 3 are mutually exclusive loads, so they are included in different combinations when forming the combination.

Load Properties

Load Cases and Factors

No	Load Case	Type	gF	gfa	gN	gFo	dL	Dominace_1	Dominace_2
1	Load 1	Constant	1.10000	0.90000	1.00000	1.00000	1.00000		
2	Load 2	Short-term	1.20000		1.00000	1.00000	0.35000		
3	Load 3	Short-term	1.20000		1.00000	1.00000	0.35000		
*									

Dialog box for assigning reliability coefficients

Factors for Variable Actions

Load Cases and Factors

No	Load Case	Type	Psi1	Psi2	Psi3	PsiSe	PsiO1	PsiO2	PsiO3
1	Load 1	Constant	1.00000			0.90000	1.00000	1.00000	1.00000
2	Load 2	Short-term	1.00000	0.90000	0.70000	0.50000	0.50000	0.30000	0.30000
3	Load 3	Short-term	1.00000	0.90000	0.70000	1.00000	0.00000	0.00000	0.00000
*									

Dialog box for assigning load combination factors

Factors for Variable Actions

Load Cases and Factors

No	Load Case	+/-	Semblance	Combination	Mutual	Companionship
1	Load 1	<input type="checkbox"/>				
2	Load 2	<input checked="" type="checkbox"/>			3	
3	Load 3	<input type="checkbox"/>			2	
*						

Dialog box for assigning links and rules for forming load combinations

Implemented calculation of the pulsation component of the wind load according to SP 20.13330.2016

1. Calculation of the pulsation force acting on a rigid floor diaphragm

SP 20.13330.2016

Add/Modify Wind Load Specification

Load Case Name : static

Wind Load Code : SP 20.113330.2016(User Type)

Description :

Story	Elev.	Wind Pressure	Loaded
		X-Dir	Y-Dir
Roof	15000	3e-08	0
3F	10000	3e-08	0
2F	5000	3e-08	0

Wind Eccentricity

X-Dir. (Wx) : ☐ Positive ☐ Negative ☒ None

Y-Dir. (Wy) : ☐ Positive ☐ Negative ☒ None

Create Wind Pulsation

Wind Load Direction Factor (Scale Factor)

X-Dir. 1 Y-Dir. 0 Z-Rot. 0

Additional Wind Loads (Unit: tonf,mm)

Story	Add.-X	Add.-Y	Add.-RZ

Wind Load Profile...

OK Cancel Apply

Automatic generation of additional loads with wind pulsation according to the modes. And also formation of special loading with resulting results according to formula (11.9).

Active in result mode if eigenvalue analysis has been performed.

Masses

Static Loads

Static Load Case 1 [dead ;]

Nodal Loads : 3

Static Load Case 2 [static ;]

Wind Loads [SP 20.113330.2016(User Type)]

Static Load Case 3 [static (mode: 1) ;]

Nodal Loads : 3

Static Load Case 4 [static (mode: 2) ;]

Static Load Case 5 [static (mode: 3) ;]

Nodal Loads : 3

Static Load Case 6 [static (pulsation) ;]

Create Wind Pulsation

Type of construction : Other structures

Type of Terrain : A

Logarithmic Decrement of Oscillations : 0.3

Normative value of wind pressure - w0 (kPa) : 0.3

Dimension

According to Plan : X-Dir 2000 mm Y-Dir 2000 mm

Along Wind Front : X-Dir 2000 mm Y-Dir 2000 mm

Modes & Direction Factor

Direction Factor : X-Dir 1 Y-Dir 1

Dialog box for setting the pulsation component of the wind load - Wg

11.1.2* In all cases, the standard value of the basic wind load w should be defined as the sum of the average wm and pulsation wg components

$$w = w_m + w_g \quad (11.1)$$

11.1.8* The standard value of the pulsation component of the main wind load wg at the equivalent height ze should be determined as follows:

a) for structures (and their structural elements) with the first frequency of natural vibrations f1, Hz, greater than the limit value of natural frequency flim, (see 11.1.10) - by the formula

$$w_g = w_m \zeta(z_e) v, \quad (11.5)$$

b) for all structures (and their structural elements) with f1 < flim < f2 - according to the formula

$$w_g = w_m \xi \zeta(z_e) v, \quad (11.7)$$

c) for structures with the second natural frequency less than the limiting frequency, it is necessary to carry out the dynamic calculation taking into account s of the first natural vibration forms. The number s should be determined from the condition fs < flim < fs+1;

d) when designing buildings, it is allowed to take into account the dynamic response of the three lowest natural vibration modes (two bending and one torsional or mixed torsional-bending).

11.1.9 The forces and displacements when considering the dynamic reaction by s eigenforms are determined by the formula

$$X^2 = \sum X_s^2 \quad (11.9)$$

Factors for Variable Actions

Load Cases and Factors

No	Load Case	+/-	Semblance	Combination
1	dead	<input type="checkbox"/>		
2	static	<input type="checkbox"/>	3	3
3	static (pulsation)	<input checked="" type="checkbox"/>	2	2

Creation of total wind load

Dialog box for setting the static component of the wind load - Wm

Added response spectrum according to SP 14.13330.2018

Generate Design Spectrum

Design Spectrum : SP 14.13330.2018

Design Spectral Response Acceleration

Soil Category : I

K0 Factor : 1.00

K1 Factor : 0.12

KPsi Factor : 1.30

Accel. in the Base Level : 1.00 m/sec²

☐ Consider NL deform. of soils

Max. Period : 6.00 (Sec)

OK Cancel

Dialog box for generating a response spectrum in accordance with SP 14.13330.2018

Add/Modify/Show Response Spectrum Functions

Function Name : SP 14.13330.2018

Import File Design Spectrum

	Period (sec)	Spectral Data (g)
1	0.0000	0.0159
2	0.0600	0.0302
3	0.1000	0.0398
4	0.1200	0.0398
5	0.1800	0.0398
6	0.2400	0.0398
7	0.3000	0.0398
8	0.3600	0.0398
9	0.4000	0.0398
10	0.4200	0.0388
11	0.4800	0.0363
12	0.5400	0.0342
13	0.6000	0.0325
14	0.6600	0.0310

Spectral Data Type : ☒ Normalized Accel. ☐ Acceleration ☐ Velocity ☐ Displacement

Scaling : ☒ Scale Factor 1 ☐ Maximum Value 0 g

Gravity : 9.806 m/sec²

Damping Ratio : 0.05

Graph Options : ☐ X-axis log scale ☐ Y-axis log scale

Description : Soil=I, K0=1.00, K1=0.12, KP=1.30, Acce=1.00

OK Cancel Apply

Added base of materials and profiles for calculation according to Russian code

Section Data

DB/User | Value | SRC | Combined | Tapered | Composite

Section ID: 2

Name: I-Section

DB: UNI

Sect. Name: KS21

Get Data from Single Angle: AISC1

DB Name: AISC1

Sect. Name: AISC1

H: 0

B1: 0

tw: 0

tf1: 0

B2: 0

tf2: 0

r1: 0

r2: 0

Offset: Center-Center

Consider Shear Deformation: ☒

Consider Warping Effect(7th DOF): ☐

Show Calculation Results... OK Cancel Apply

Additional sections of rolled steel sections

Material Data

General

Material ID: 2

Name: C255

Elasticity Data

Type of Design: Steel

Steel

Standard: SP 16.2017t.B3(S)

DB: DIN(S)

Product: EN05(S)

Concrete

Standard: EN(S)

DB: EN10326(S)

Type of Material: ☒ Isotropic ☐ Orthotropic

Steel

Modulus of Elasticity: 2.1006e+10 kgf/m²

Poisson's Ratio: 0.3

Thermal Coefficient: 6.6667e-06 1/[F]

Weight Density: 7.85e+09 kgf/m³

☐ Use Mass Density: 8.005e+08 kgf/m³/g

☐ Concrete

Modulus of Elasticity: 0.0000e+00 kgf/m²

Poisson's Ratio: 0

Thermal Coefficient: 0.0000e+00 1/[F]

Weight Density: 0 kgf/m³

☐ Use Mass Density: 0 kgf/m³/g

Plasticity Data

Plastic Material Name: NONE

Materials of steel elements according to table 3,4,5 SP 16.13330.2017

Material Data

General

Material ID: 2

Name: B35

Elasticity Data

Type of Design: Concrete

Concrete

Standard: SP 63.2018(RC)

DB: B35

Type of Material: ☒ Isotropic ☐ Orthotropic

Steel

Modulus of Elasticity: 0.0000e+00 kgf/m²

Poisson's Ratio: 0

Thermal Coefficient: 0.0000e+00 1/[F]

Weight Density: 0 kgf/m³

Concrete Material Selection

Code: SP 63.2018(RC)

Grade: B20

Specified Compressive Strength (fc|fdk): 1172673.6449 kgf/m²

☐ Light Weight Concrete Factor (Lambda): 1

Rebar Selection

Code: SP 63.2018(RC)

Grade of Main Rebar: A240

Grade of Sub-Rebar: A240_sw

Fy: 0 kgf/m²

Fys: 0 kgf/m²

Modify Close

Materials of reinforced concrete structures according to SP 63.13330.2018

Thanks