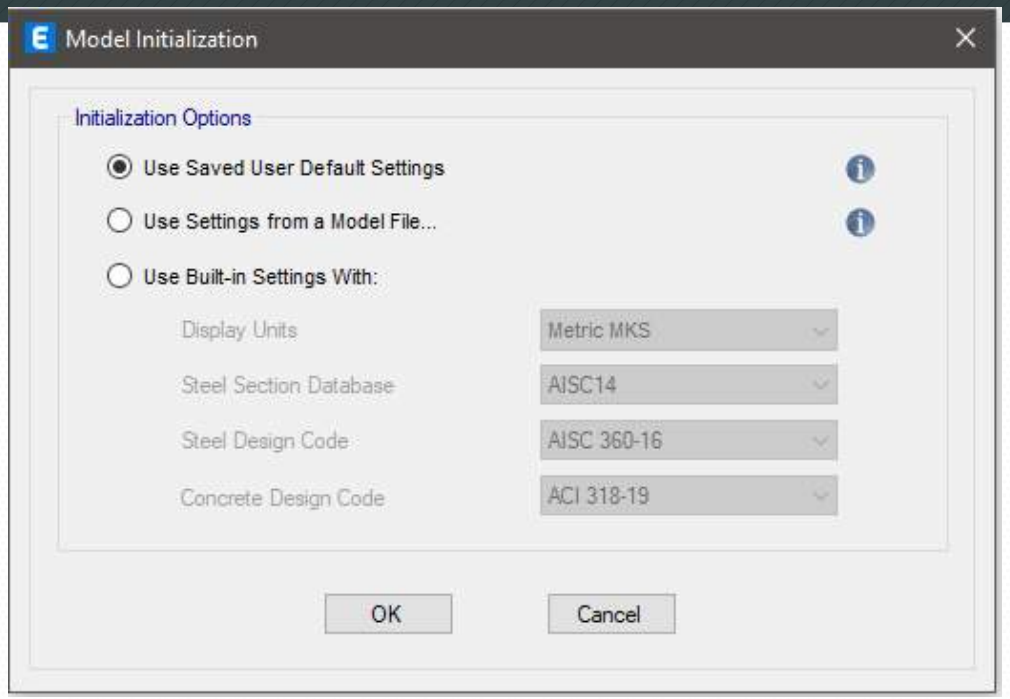
Introducción

1. Inicio del programa
2. Líneas guías (grids)
3. Materiales y normativas
4. Barras de refuerzo
5. Pre-dimensionamiento de elementos estructurales

DISEÑO ESTRUCTURAL ASISTIDO POR COMPUTADORA

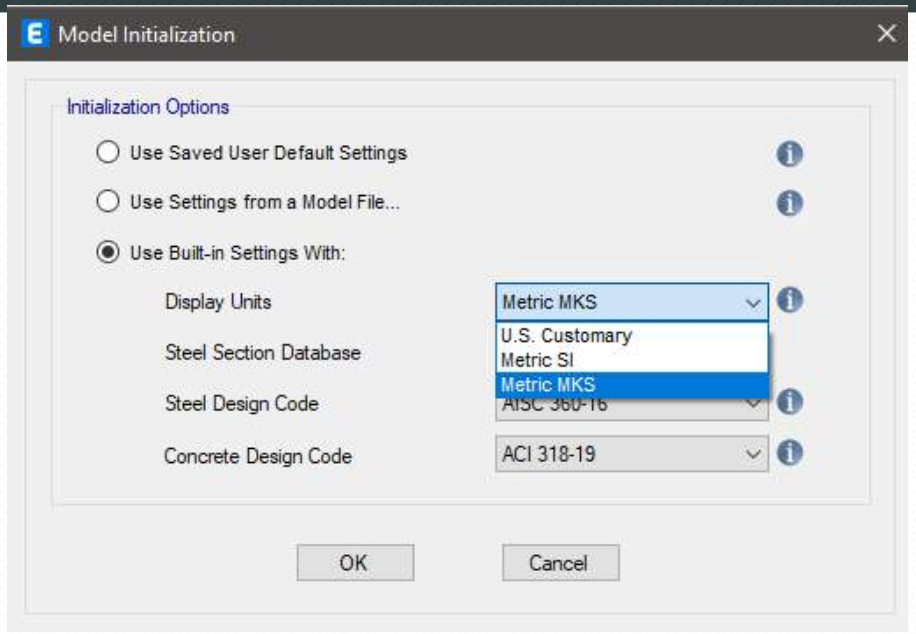
Inicio del programa



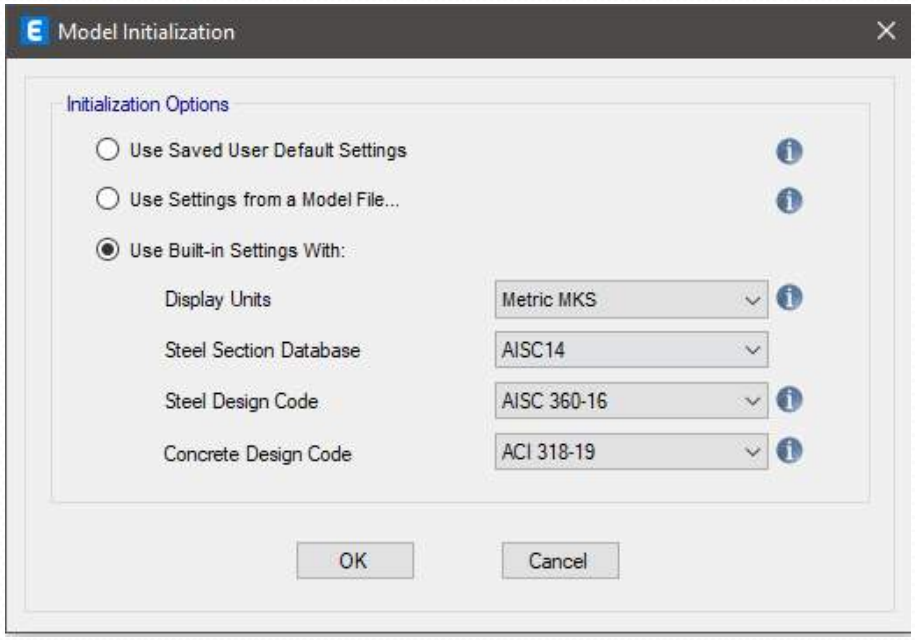
Inicia con la configuración definida por el programa

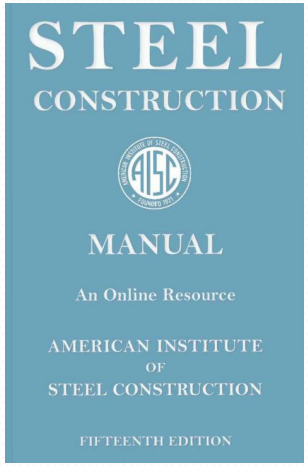
Inicia con la configuración de un modelo existente

Inicia con la configuración definida por el usuario

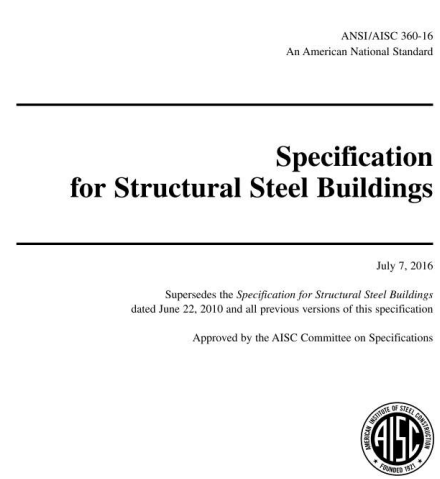


Sistema ingles (Libras, pies, segundos)
Sistema internacional (Newton, metro, segundo)
Sistema MKS (Kilogramo, metro, segundo

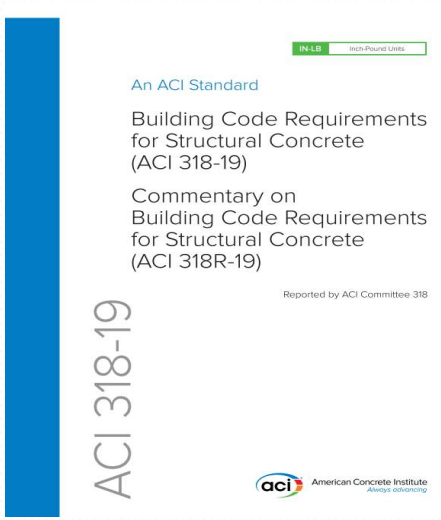




Steel Data Base

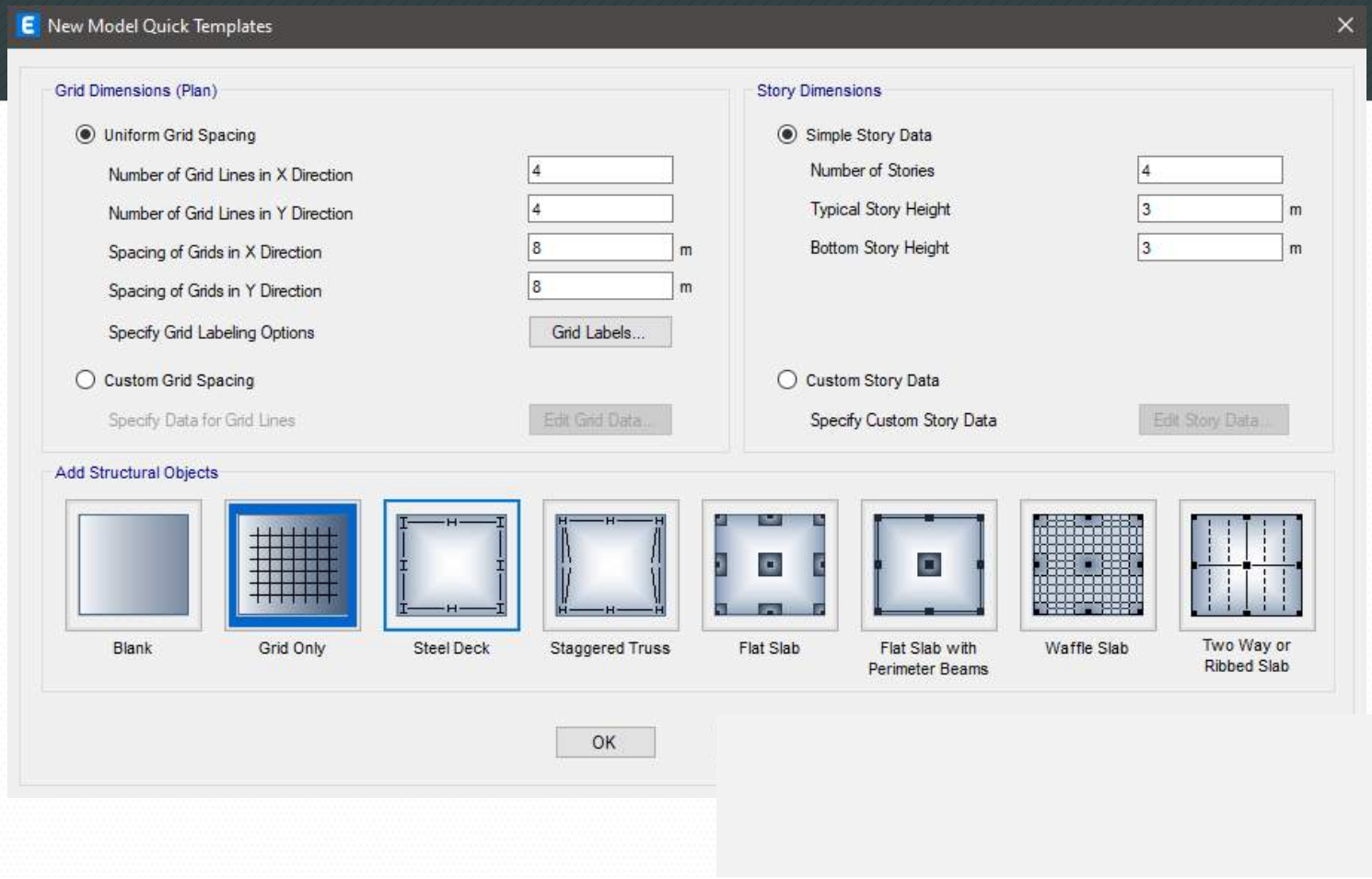


AISC 360-16



ACI 318-19

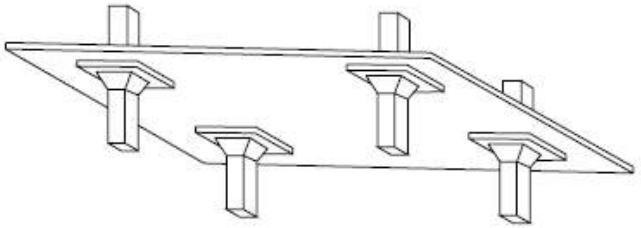
Lineas Grids



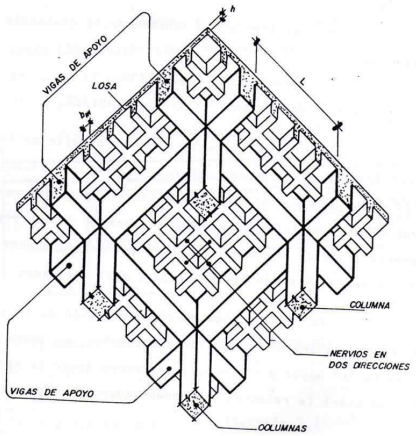
Steel Deck

Staggered Truss

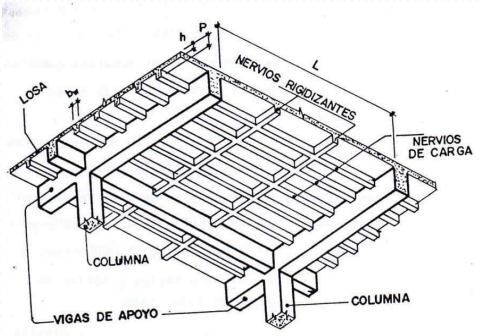
Modelos básicos



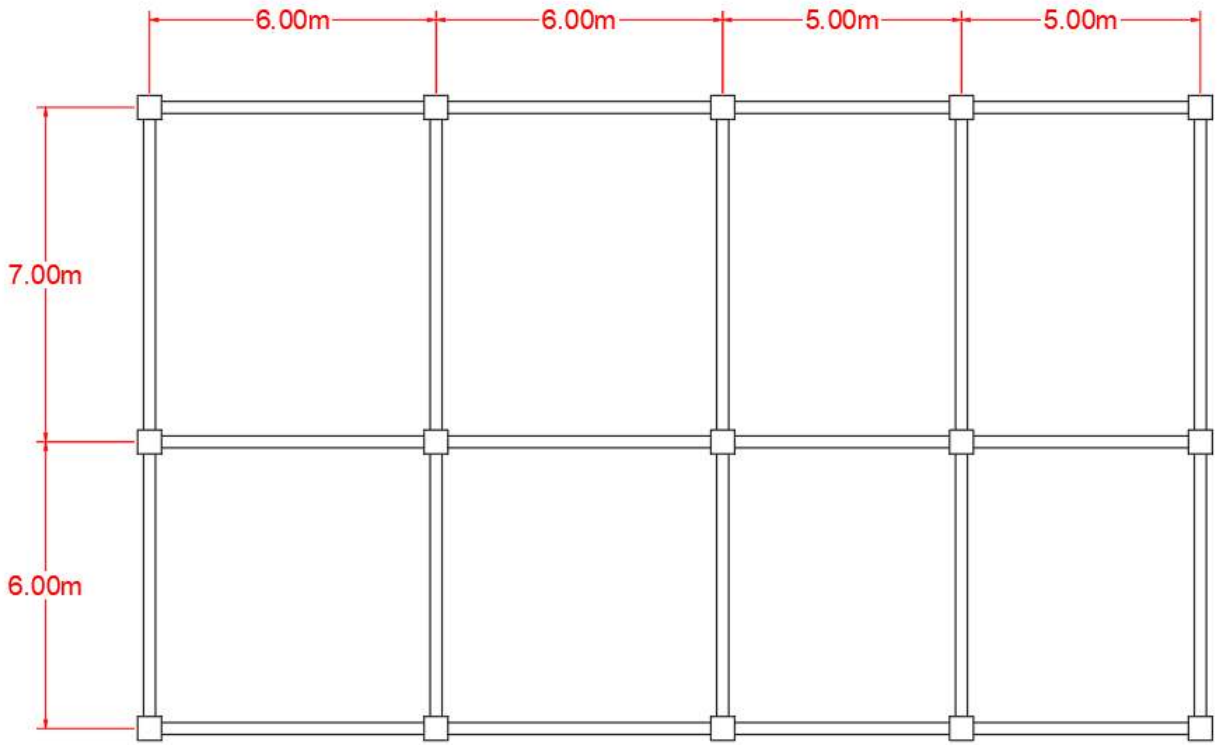
Flat Slab



Waffle Slab

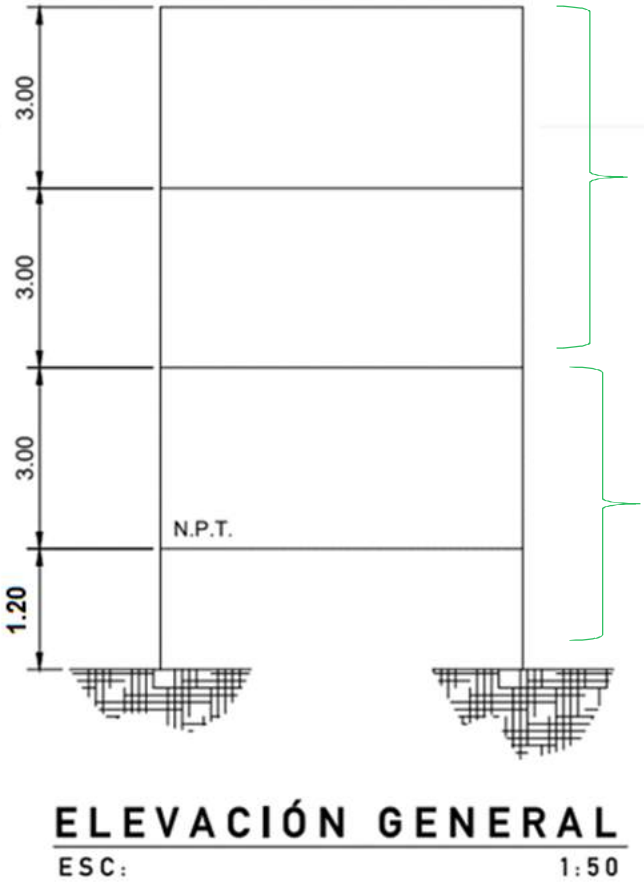


Ribbed Slab



Lineas guías dirección “X”= 5

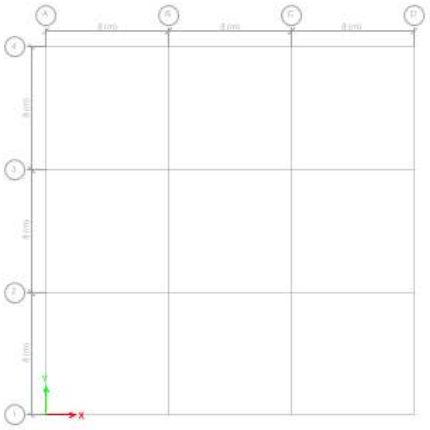
Lineas guías dirección “Y”= 3

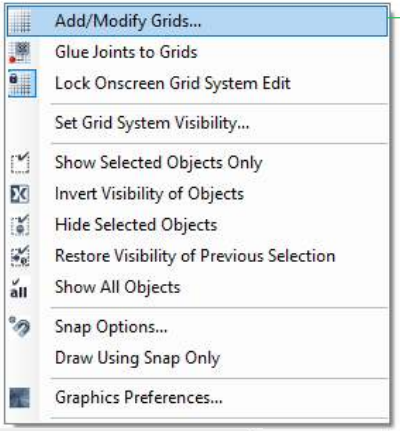


Typical Story Height

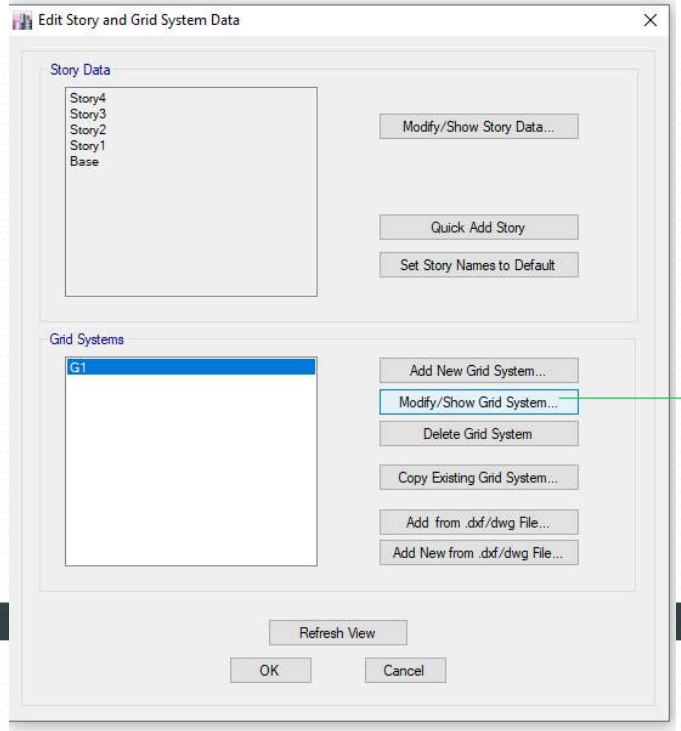
Bottom Story Height

Numero de niveles 3

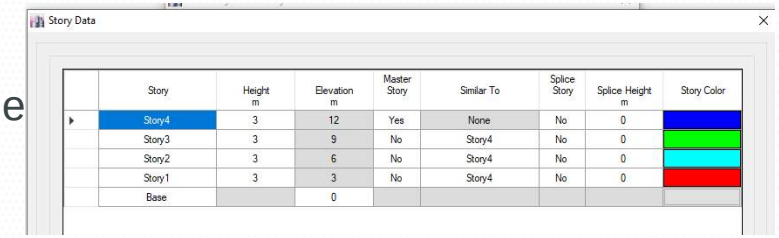




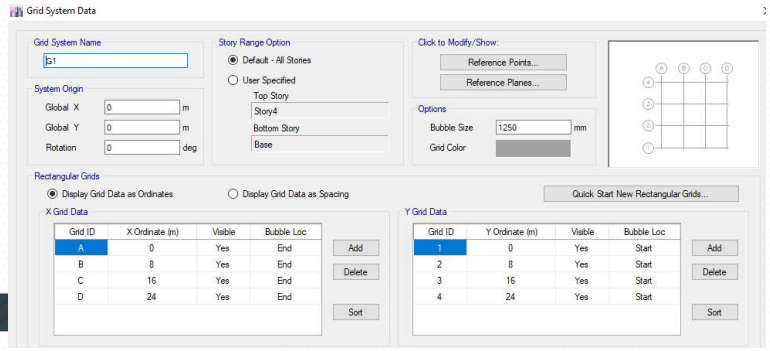
Modificar o editar la distancia entre líneas guías en planta y elevación



Edición de distancia e elevación

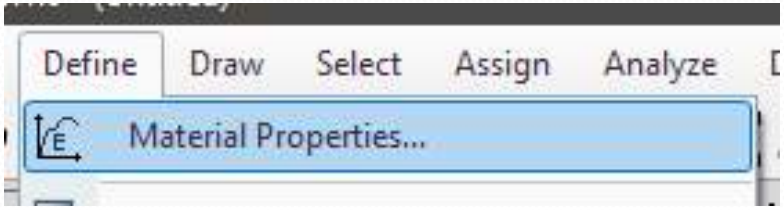


Edición de distancias en planta

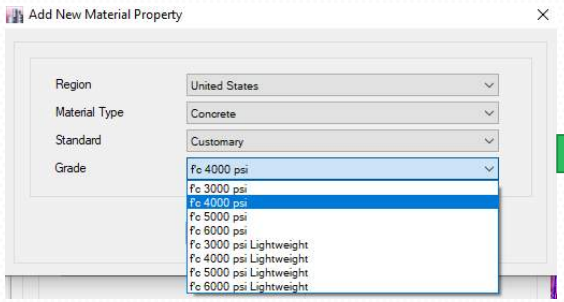


Materiales y normativas

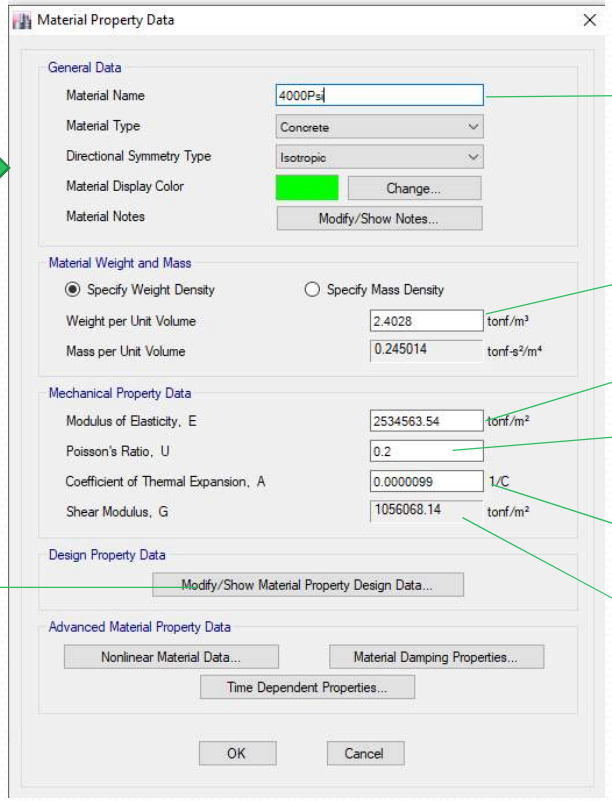
Define → Material → Add New Material

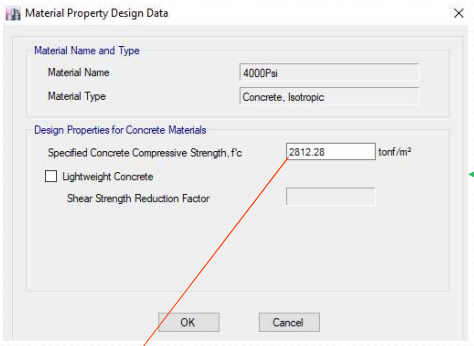


Concreto



Clic “ok”





Definir la resistencia del concreto a los 28 días

Coloque el nombre deseado

Definir el peso especifico Wc=2400 kg/m^3

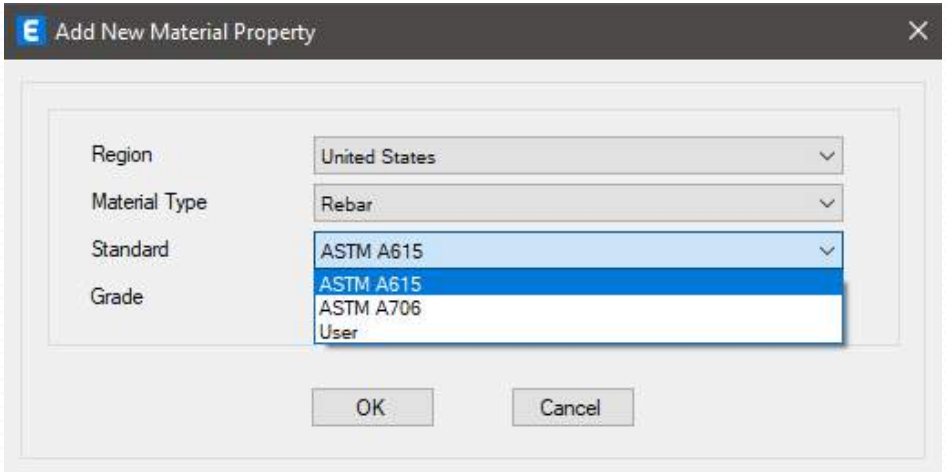
Modulo de elasticidad en kg/cm^2
$15100\sqrt{f'c}$ (19.2.2.1)

Relación de Poisson =0.25 (6.6.3)

Coeficiente de expansión térmica

Módulo de rigidez o cortante (6.6.3)

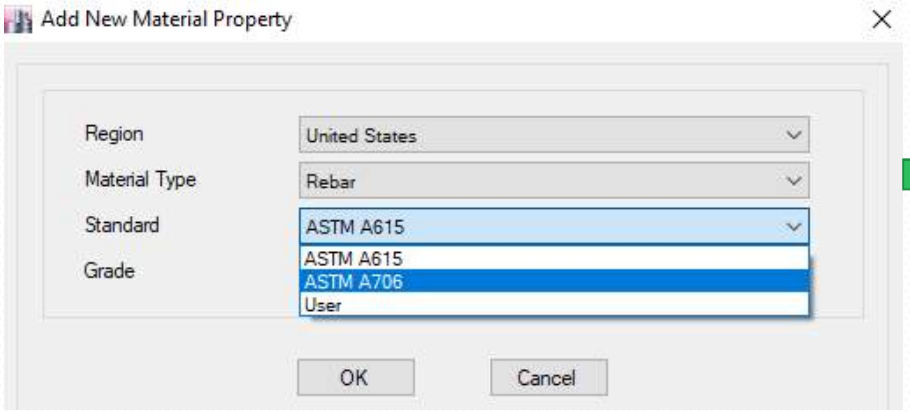
Acero



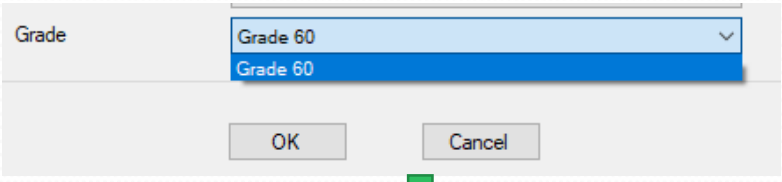
Barras normadas para el concreto reforzado

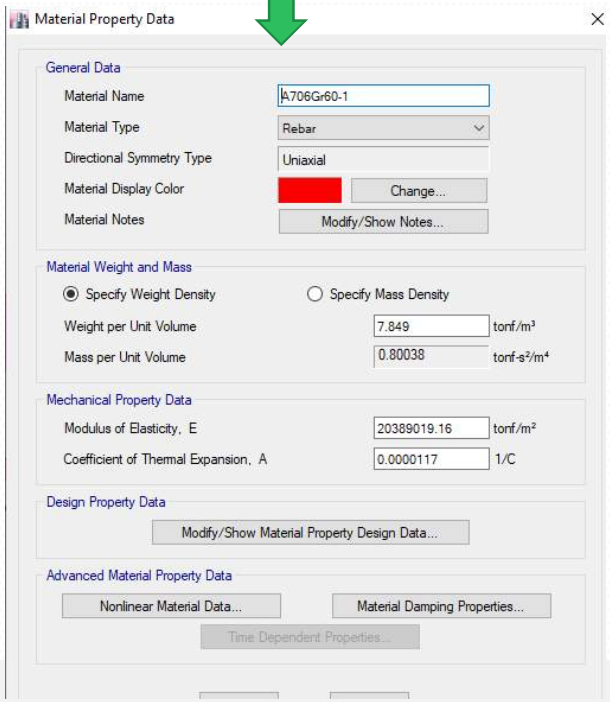
ASTM A706

ASTM A615



Definir el grado





Dejar datos por Default ya que cumple con la normativa asignada

Barras de refuerzo

CUADRO 1 – Designación de la barra corrugada, masa nominal dimensiones nominales y requisitos de las corrugaciones

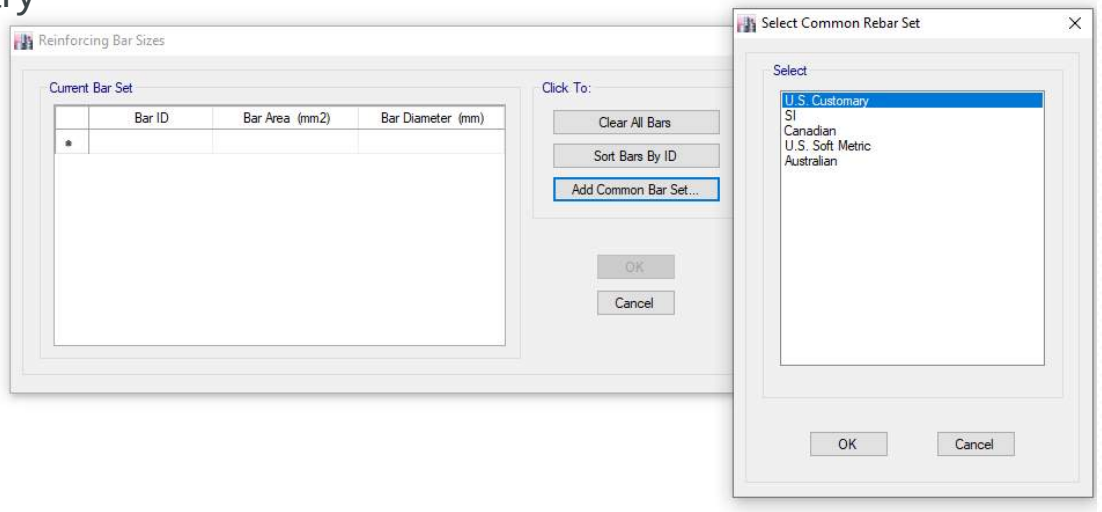
No. de designación de barra [A]	Masa nominal kg/m (lb/pie)	Dimensiones nominales [B]			Requerimientos de corrugaciones mm (pulg)		
		Diámetro mm (pulg)	Área de la sección transversal mm² (pulg²)	Perímetro mm (pulg)	Espaciamiento máximo promedio	Altura mínima promedio	Ancho máximo sin corruga-cines [C] (cordón de 12.5% del perímetro nominal)
7M[D]	0.302 (0.203)	7.0 (0.276)	38 (0.06)	22.0 (0.866)	4.9 (0.193)	0.38 (0.015)	2.7 (0.108)
8M[D]	0.395 (0.265)	8.0 (0.315)	50 (0.08)	25.1 (0.990)	5.6 (0.220)	0.38 (0.015)	3.1 (0.124)
10 (3)	0.560 (0.376)	9.5 (0.375)	71 (0.11)	29.9 (1.178)	6.7 (0.262)	0.38 (0.015)	3.6 (0.143)
11M[D]	0.746 (0.501)	11.0 (0.147)	95 (0.15)	34.6 (1.361)	7.7 (0.303)	0.51 (0.020)	4.3 (0.170)
13 (4)	0.994 (0.668)	12.7 (0.500)	129 (0.20)	39.9 (1.571)	8.9 (0.350)	0.51 (0.020)	4.9 (0.191)
16 (5)	1.552 (1.439)	15.9 (0.625)	199 (0.31)	49.9 (1.963)	11.1 (0.437)	0.71 (0.028)	6.1 (0.239)
19 (6)	2.235 (1.502)	19.1 (0.750)	284 (0.44)	59.8 (2.356)	13.3 (0.525)	0.97 (0.038)	7.3 (0.286)
22 (7)	3.042 (2.044)	22.2 (0.875)	387 (0.60)	69.8 (2.749)	15.5 (0.612)	1.12 (0.044)	8.5 (0.334)
25 (8)	3.973 (2.670)	25.4 (1.000)	510 (0.79)	79.8 (3.142)	17.8 (0.700)	1.27 (0.050)	9.7 (0.383)
29 (9)	5.060 (3.400)	28.7 (1.128)	645 (1.00)	90.0 (3.544)	20.1 (0.790)	1.42 (0.056)	10.9 (0.431)
32 (10)	6.404 (4.303)	32.3 (1.270)	819(1.27)	101.3 (3.990)	22.6 (0.889)	1.63 (0.064)	12.4 (0.487)
36 (11)	7.907 (5.313)	35.8 (1.410)	1006 (1.56)	112.5 (4.430)	25.1 (0.987)	1.80 (0.071)	13.7 (0.540)
38 (12)	8.950 (6.014)	38.1 (1.500)	1140 (1.77)	119.7 (4.712)	26.7 (1.050)	1.91 (0.075)	15.0 (0.589)
43 (14)	11.38 (7.65)	43.0 (1.643)	1452 (2.25)	135.1 (5.32)	30.1 (1.185)	2.16 (0.085)	16.5 (0.648)
57 (18)	20.24 (13.60)	57.3 (2.257)	2581 (4.00)	180.1 (7.09)	40.1 (1.58)	2.59 (0.102)	21.9 (0.864)

Número Designación	Diámetro Nominal (pulg)	Diámetro Nominal (pulg)		Diámetro Pin* Ensayo Doblado (pulg.)		Varillas por Quintal		
		Mínimo	Máximo	Grado 40	Grado 60	6 mts	9 mts	12 mts
3	3/8	9.24	9.50	1.31	1.31	13.29	8.86	6.65
4	1/2	12.31	12.70	1.75	1.75	7.48	4.99	3.74
5	5/8	15.39	15.90	2.19	2.19	4.79	3.20	2.40
6	3/4	18.47	19.10	3.75	3.75	3.32	2.22	1.66
7	7/8	21.55	22.20	4.38	4.38	2.45	1.63	1.22
8	1	24.63	25.40	5.00	5.00	1.87	1.25	0.94
9	1 1/8	27.78	28.70	------	7.90	1.47	0.98	0.74
10	1 1/4	31.28	32.30	------	8.89	1.16	0.77	0.58
11	1 3/8	34.72	35.80	------	12.69	0.94	0.63	0.47

- Definición de barras de acero

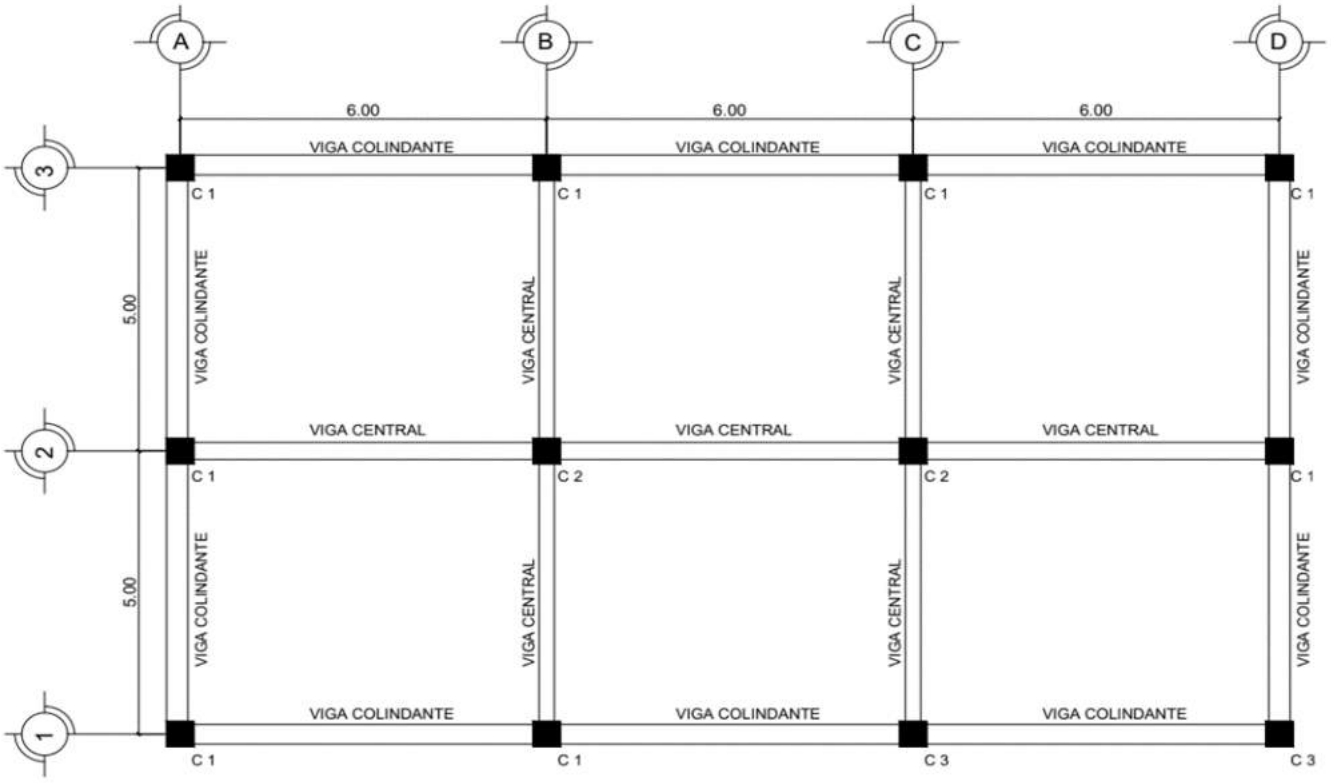
Define → Section properties → Reinforcing bar sizes

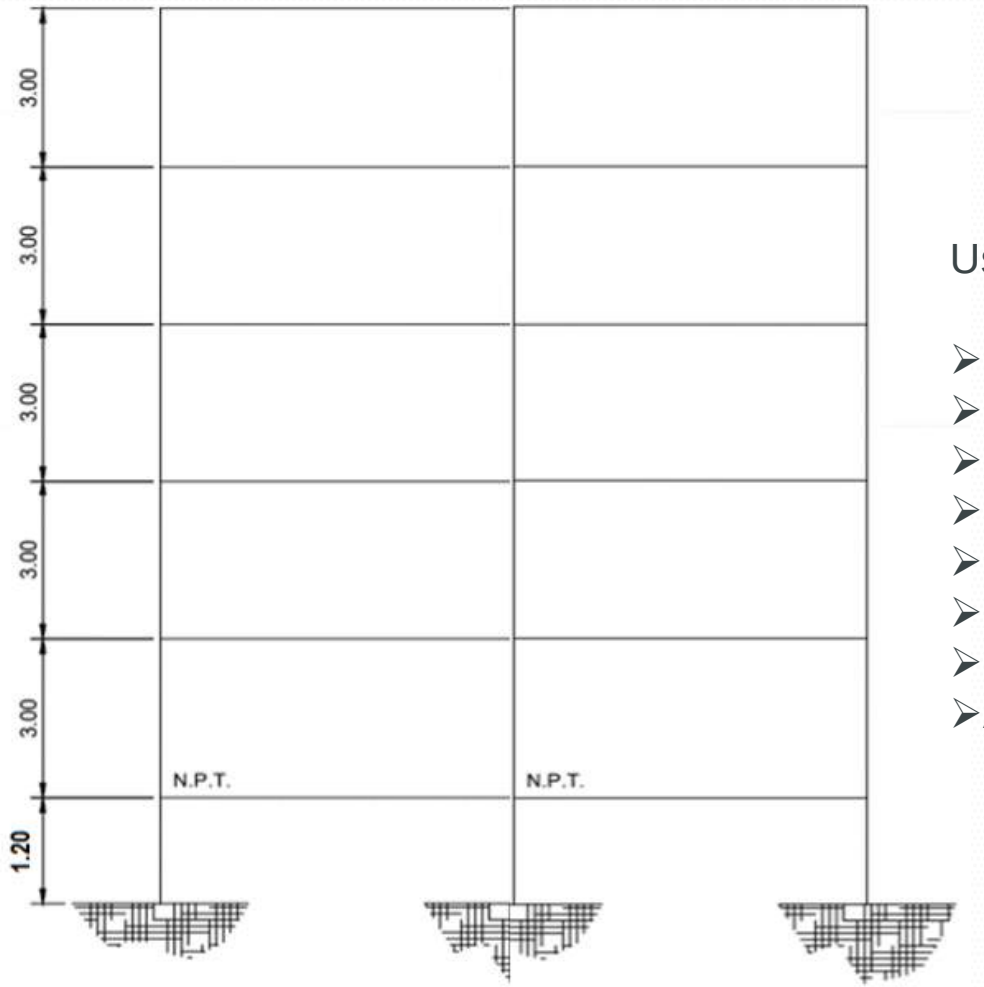
Dar clic en “Clear All Bars” y luego seleccionar “Add Common Bar set” dar clic en “U.S. Customary”



Pre-dimensionamiento de elementos estructurales

Planta a diseñar:





ELEVACIÓN GENERAL

ESC: 1:50

Uso: Hospital en Quetzaltenango, Quetzaltenango

- Carga viva nivel 1,2,3, y 4 = 350 kg/m^2
- Carga viva techo= 200 kg/m^2
- Sobrecarga nivel 1,2,3,4= 300 kg/m^2
- Sobrecarga de techo = 200 kg/m^2
- Sobrecarga lineal vigas nivel 1,2,3,4= 500 kg/m
- Sobercarga lineal vigas colindantes de techo=100 kg/m
- Concreto f’c= 280 kg/cm2
- Acero A706 Grado 60

Pre-dimensionamiento de losa

- Losas en dos sentidos

t= Perímetro / 180

Table 8.3.1.2—Minimum thickness of nonprestressed two-way slabs with beams spanning between supports on all sides

α_{fm}[1]	Minimum h, in.		
$\alpha_{fm} \le 0.2$	8.3.1.1 applies		(a)
$0.2 < \alpha_{fm} \le 2.0$	Greater of:	$\dfrac{\ell_n\left(0.8+\dfrac{f_y}{200,000}\right)}{36+5\beta(\alpha_{fm}-0.2)}$	(b)[1],[2]
		5.0	(c)
$\alpha_{fm} > 2.0$	Greater of:	$\dfrac{\ell_n\left(0.8+\dfrac{f_y}{200,000}\right)}{36+9\beta}$	(d)
		3.5	(e)

[1]α_{fm} is the average value of α_f for all beams on edges of a panel.
[2]ℓ_n is the clear span in the long direction, measured face-to-face of beams (in.).
[3]β is the ratio of clear spans in long to short directions of slab.

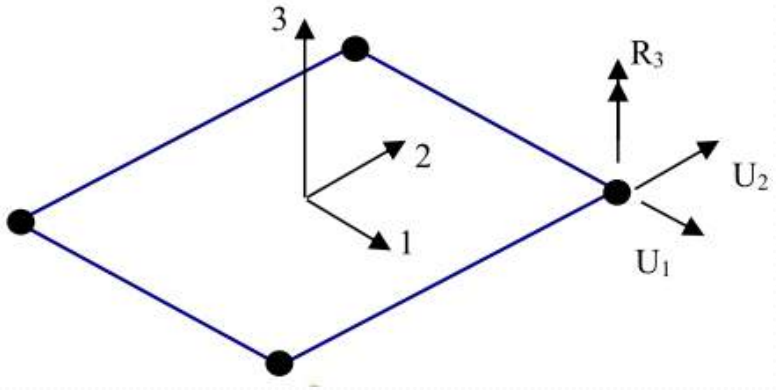
Losas en un sentido

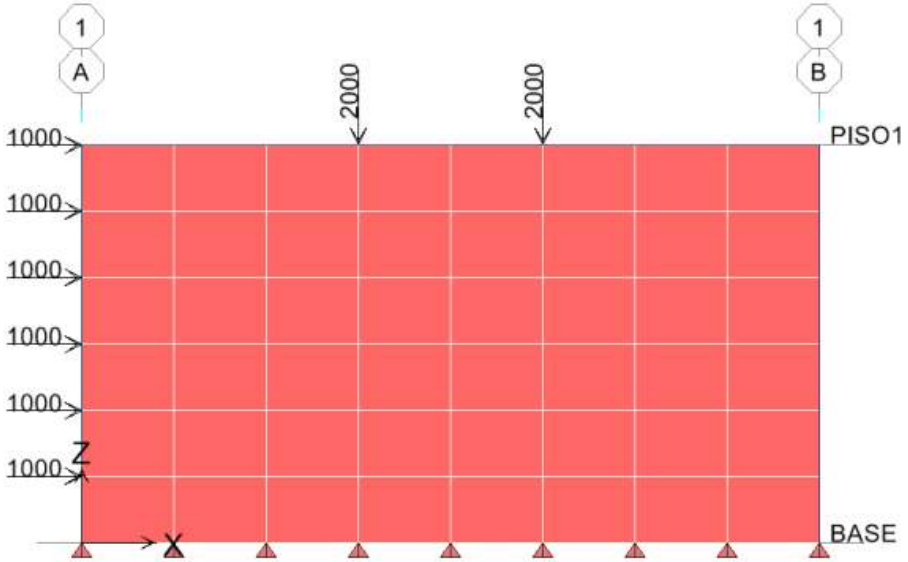
Table 7.3.1.1—Minimum thickness of solid nonprestressed one-way slabs

Support condition	Minimum h[1]
Simply supported	$\ell/20$
One end continuous	$\ell/24$
Both ends continuous	$\ell/28$
Cantilever	$\ell/10$

[1]Expression applicable for normalweight concrete and f_y = 60,000 psi. For other cases, minimum h shall be modified in accordance with 7.3.1.1.1 through 7.3.1.1.3, as appropriate.

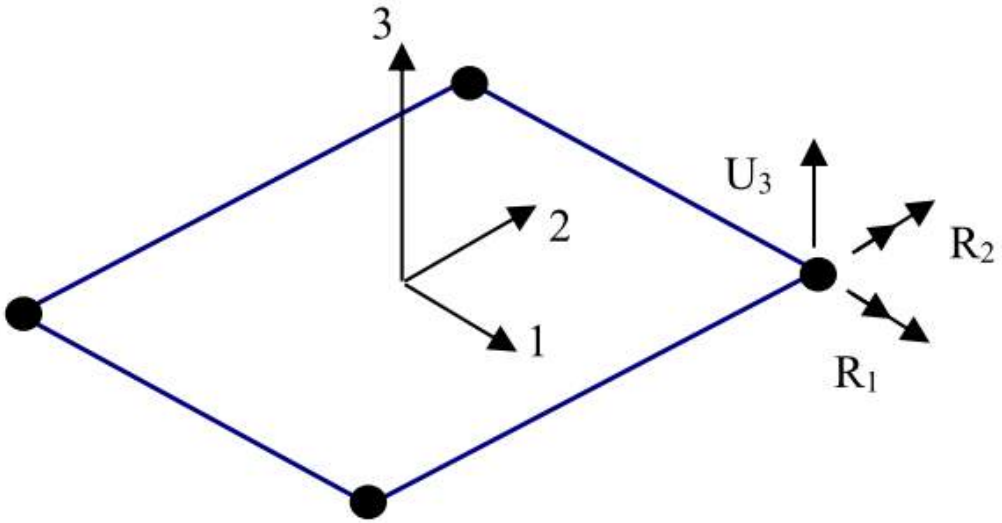
Elemento Tipo Membrane.

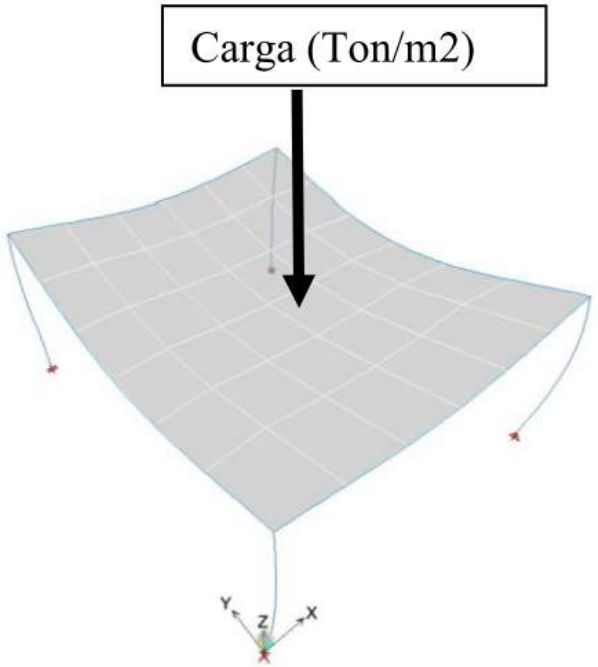




Fuente: Manual de Aplicación del Programa ETABS v9
Msc. Ing. Eliud Hernández

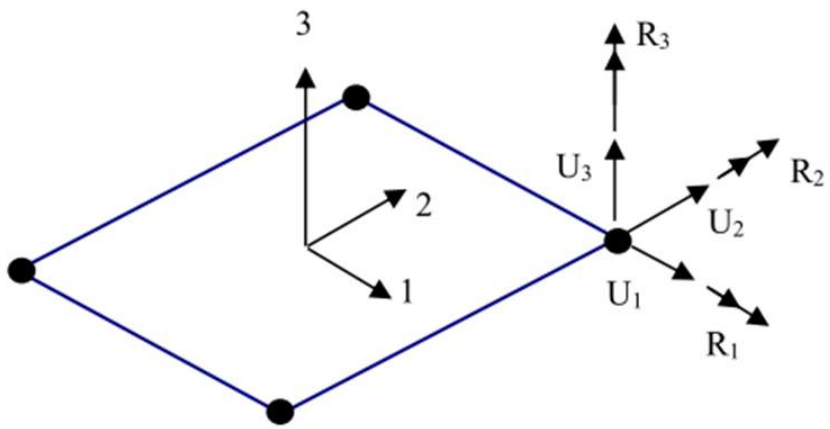
Elemento Tipo Plate.





Fuente: Manual de Aplicación del Programa ETABS v9
Msc. Ing. Eliud Hernández

Elemento Tipo Shell.

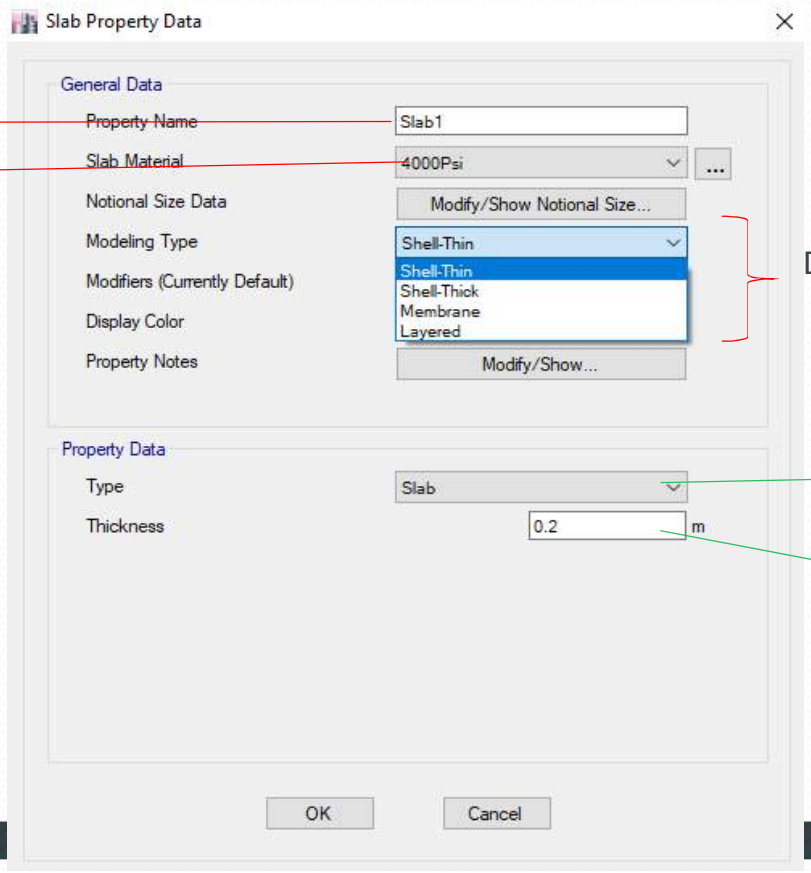


Fuente: Manual de Aplicación del Programa ETABS v9
Msc. Ing. Eliud Hernández

Elemento tipo membrana + tipo plate

Shell-thin: Cascara delgada (L/t>20)
Shell-thick: Cascara gruesa (L/t<20)

Define → Section properties → Slab Sections → Add New Property



Nombre de la sección

Material

Definición del modelado de elementos finitos

Seleccionar tipo “Slab”

Espesor de losa

Pre-dimensionamiento de vigas

$$\frac{Ln}{14} < h < \frac{Ln}{10}$$

$$\frac{h}{2} < b < \frac{2h}{3}$$

Table 9.3.1.1—Minimum depth of nonprestressed beams

Support condition	Minimum h[1]
Simply supported	ℓ/16
One end continuous	ℓ/18.5
Both ends continuous	ℓ/21
Cantilever	ℓ/8

[1]Expressions applicable for normalweight concrete and f_y = 60,000 psi. For other cases, minimum h shall be modified in accordance with 9.3.1.1.1 through 9.3.1.1.3, as appropriate.

18.6.2 *Dimensional limits*

18.6.2.1 Beams shall satisfy (a) through (c):

(a) Clear span ℓ_n shall be at least **4*d***
(b) Width b_w shall be at least the lesser of **0.3*h*** and 10 in.
(c) Projection of the beam width beyond the width of the supporting column on each side shall not exceed the lesser of c_2 and $0.75c_1$.

Define → Section properties → Frame Section → Add New Property

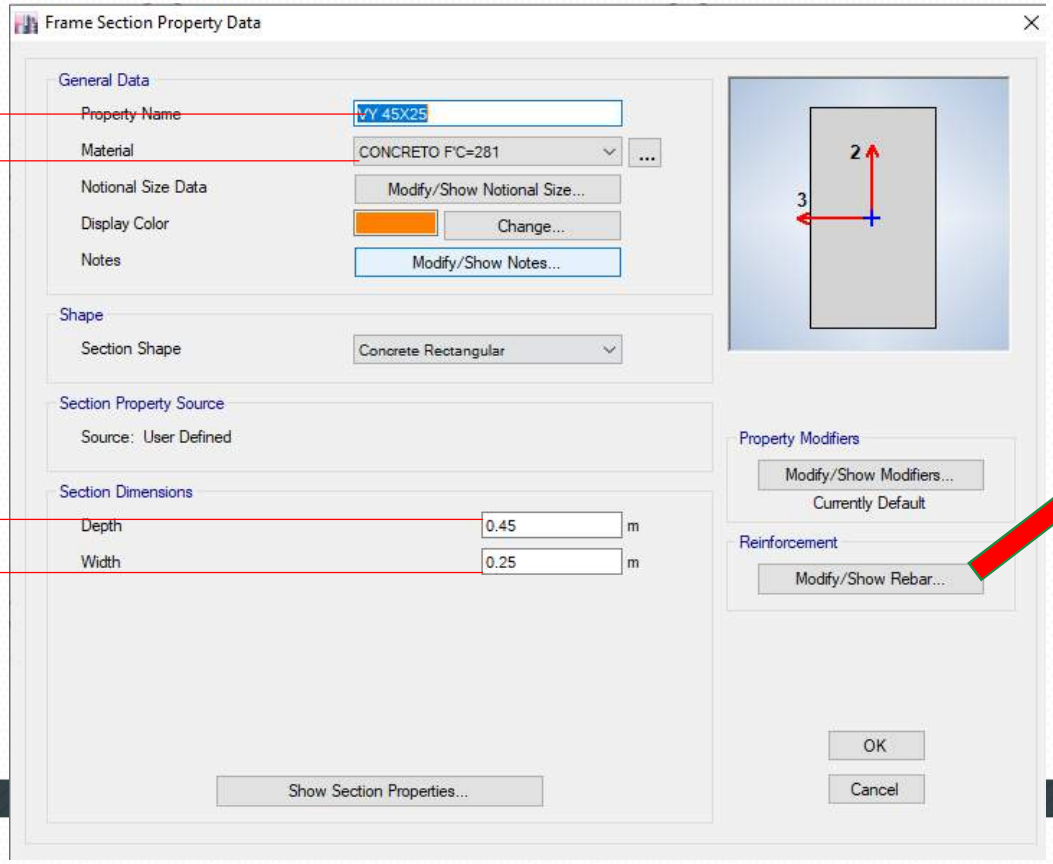
Selección tipo de sección “Beam”

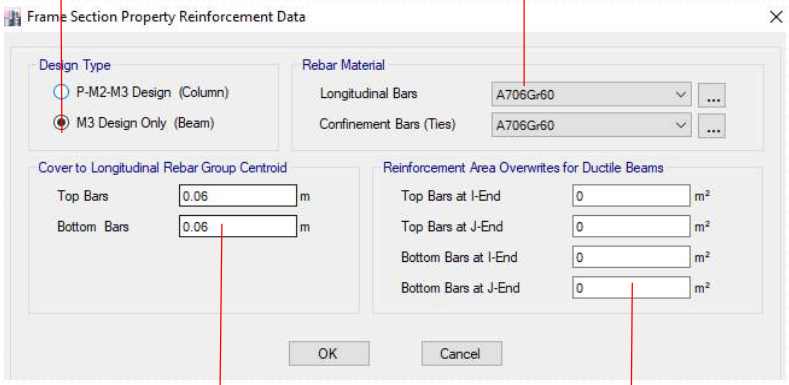
Acero de refuerzo para barras longitudinales y estribos

Material

Altura

Base





Rec+Φest +Φlong/2

Armado propuesto (Se realiza al final del diseño)

Pre-dimensionamiento de columnas

$$A_{COL} = \frac{\lambda P_G}{\eta f_C'} \qquad \text{(Ec. 3.4)}$$

Dónde:

A_{COL} : Área de Columna.
P_G : Carga por Gravedad.
λ, η : Factores que dependen de la ubicación de la columna.

Tabla 3.4 Factores para el predimensionamiento de columnas.

TIPO DE COLUMNA	λ	η
CENTRAL	1.1	0.3
PERIMETRAL	1.25	0.25
ESQUINA	1.5	0.2

18.7.2 *Dimensional limits*

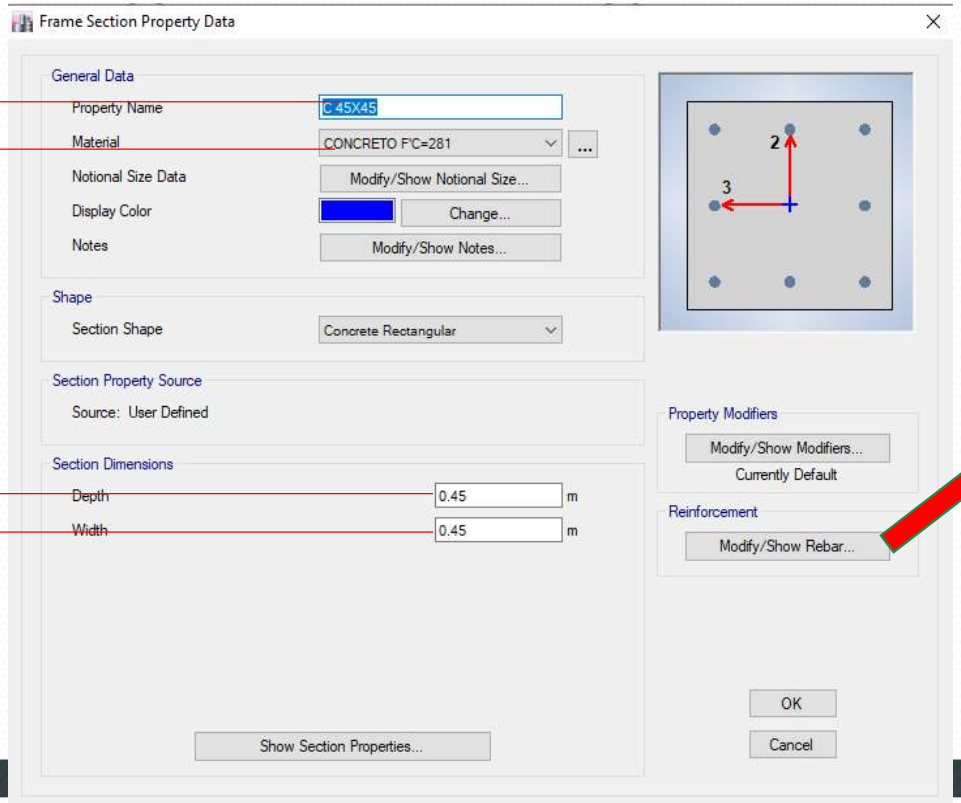
18.7.2.1 Columns shall satisfy (a) and (b):

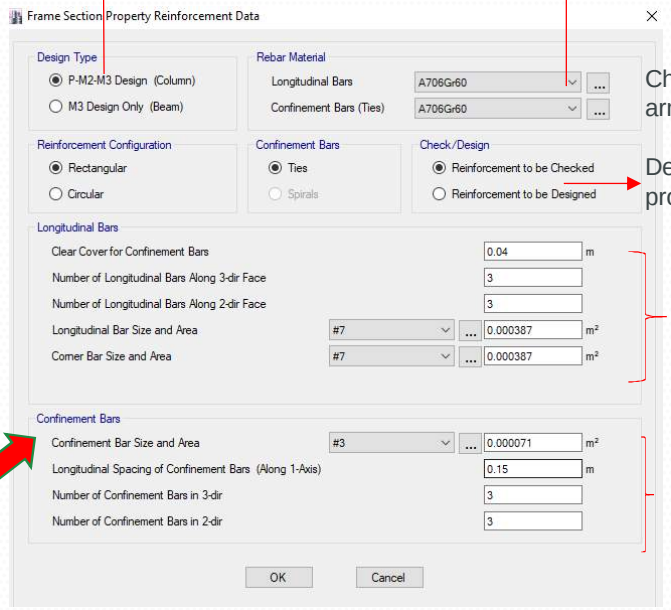
(a) The shortest cross-sectional dimension, measured on a straight line passing through the geometric centroid, shall be at least 12 in.
(b) The ratio of the shortest cross-sectional dimension to the perpendicular dimension shall be at least 0.4.

Define → Section properties → Frame Section → Add New Property

Selección tipo de sección "Column"

Acero de refuerzo para barras longitudinales y estribos





Nombre de la sección

Material

Altura o profundidad

Base

Checked: verficar el armado propuesto,

Designed: el programa diseña

Armado longitudinal

Armado transversal