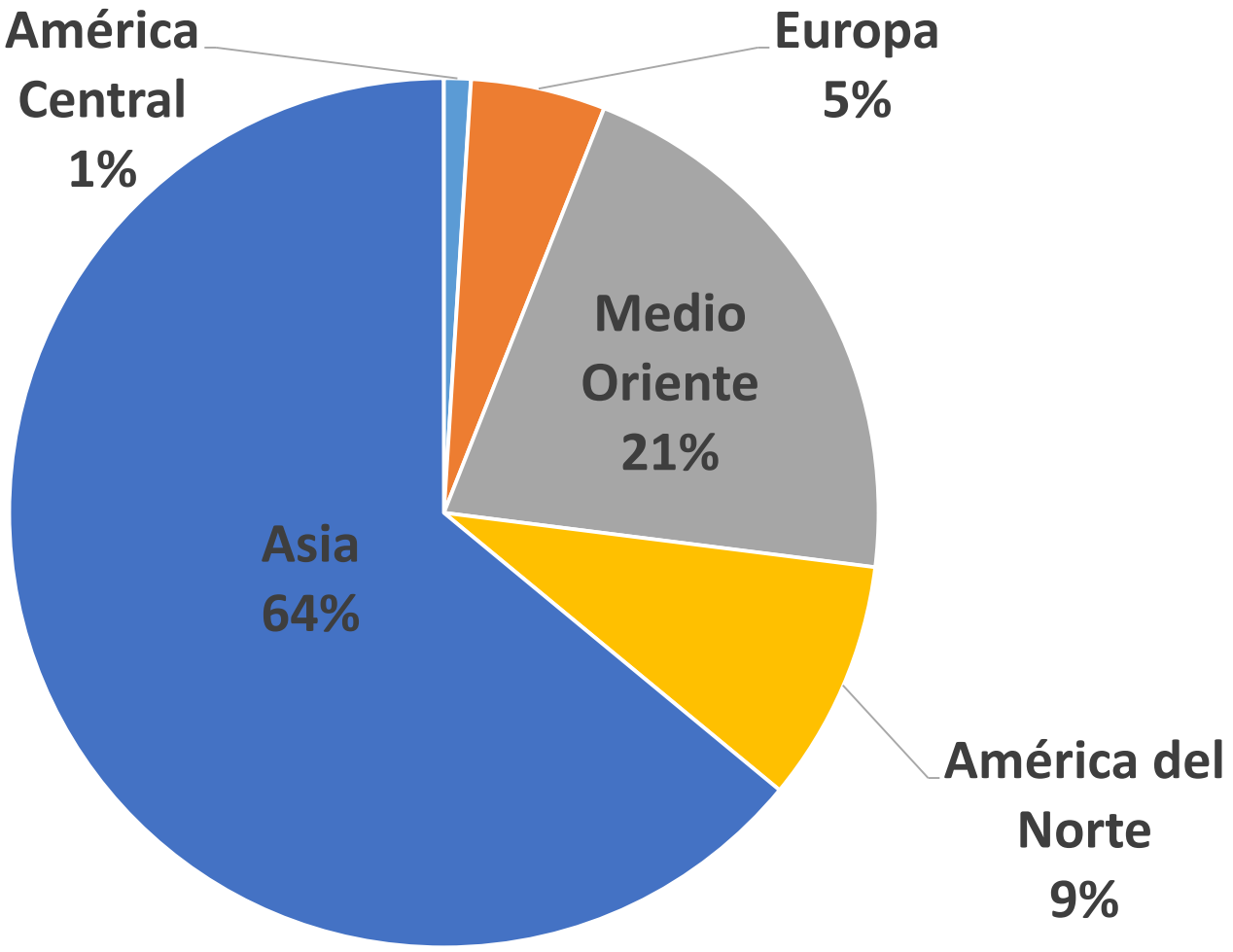
Important Facts of Tall Buildings

Dr. Roberto Stark

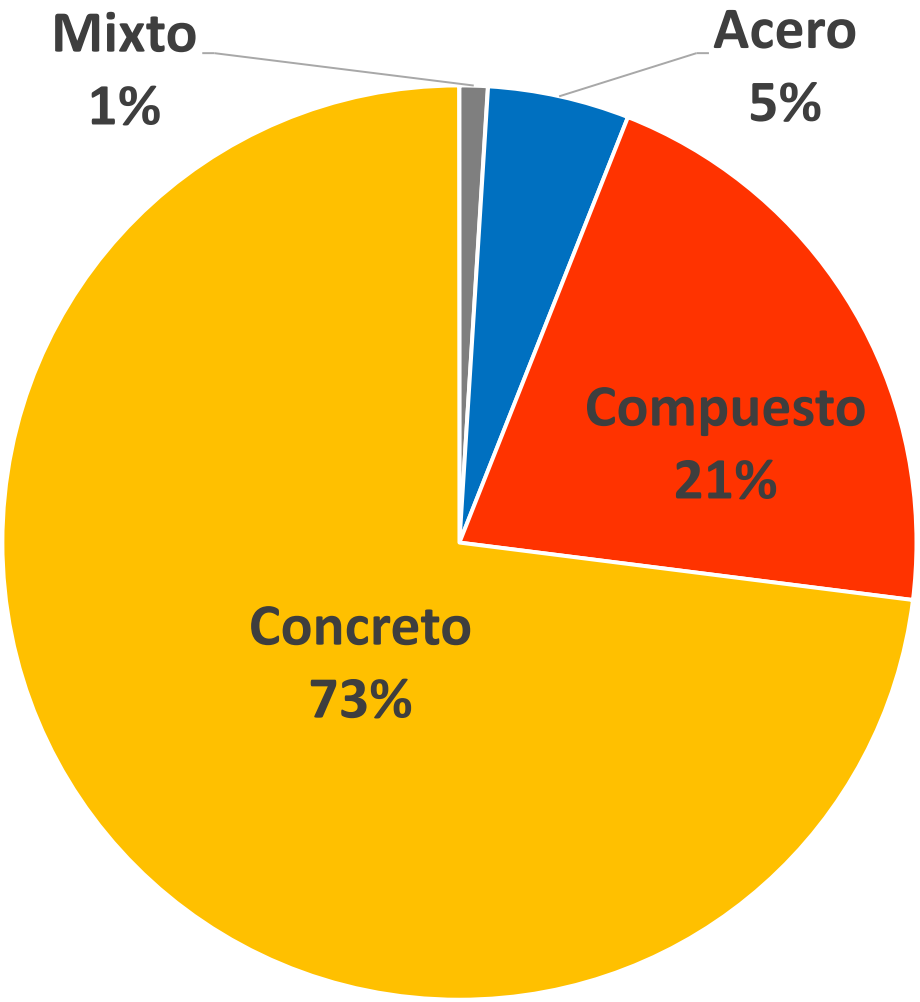
STARK + ORTIZ, S.C.

Distribution of tall buildings



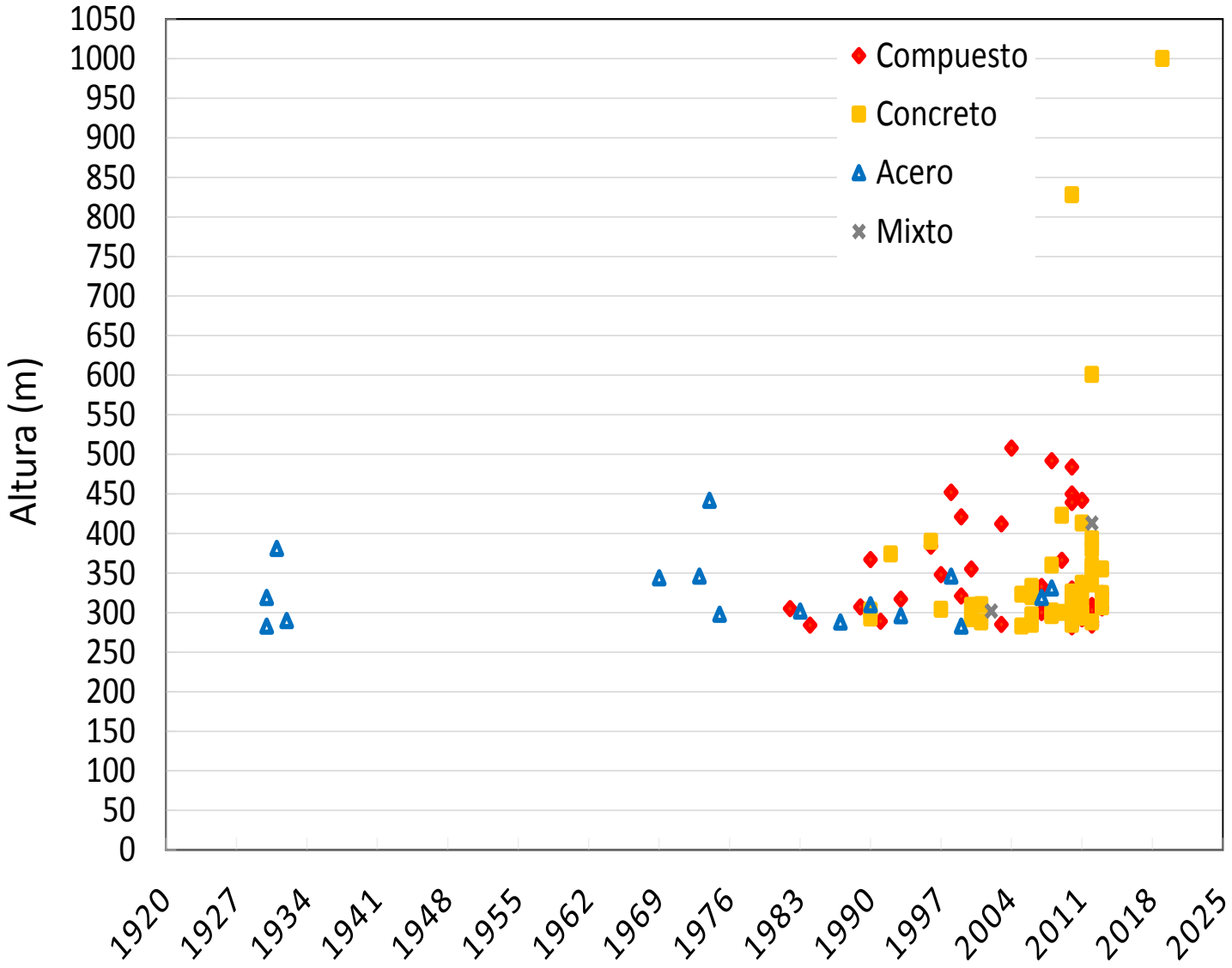
Datos Obtenidos de: CTBUH

Material of the structure



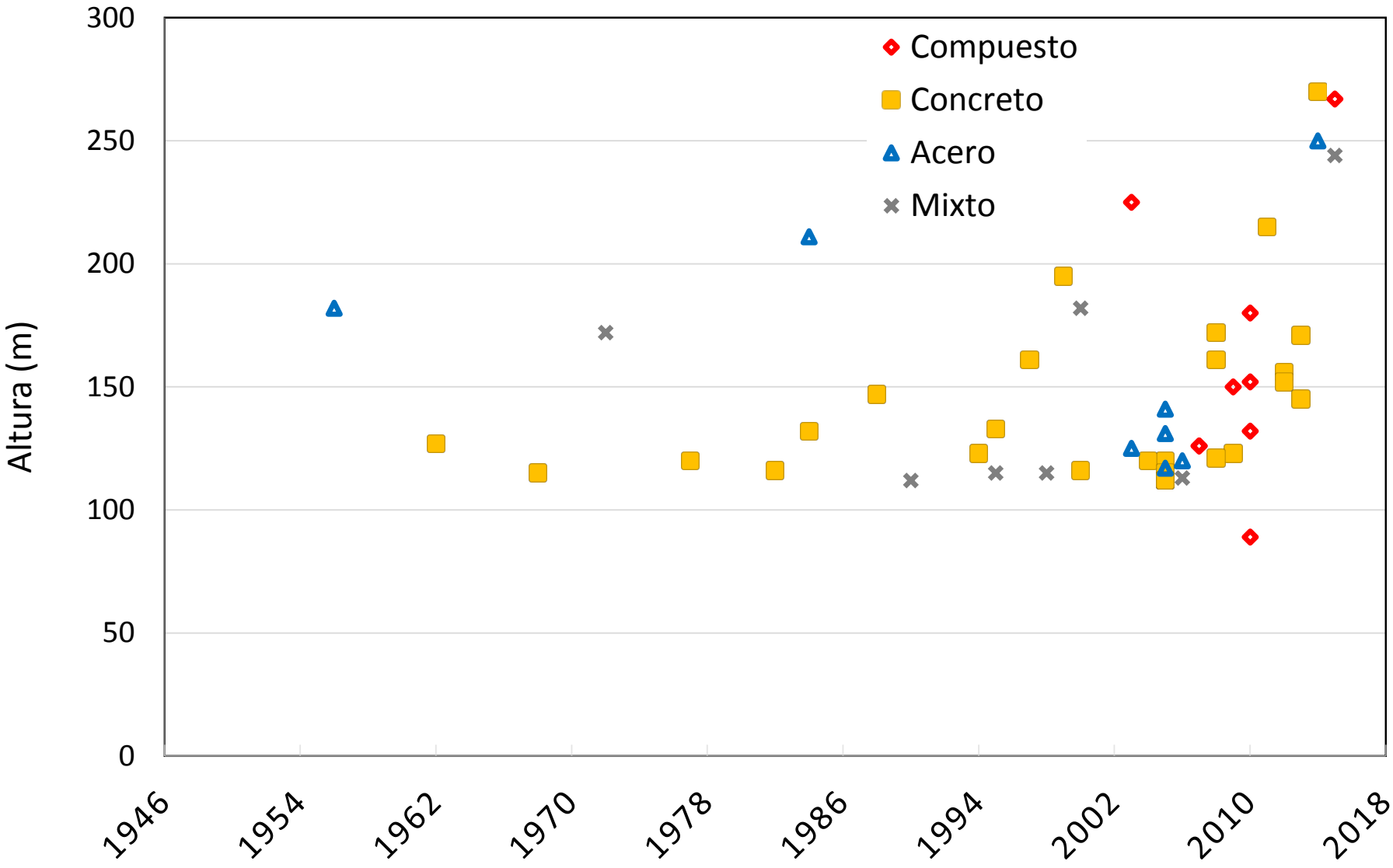
Datos Obtenidos de: CTBUH

Tallest Buildings – World Wide



Datos Obtenidos de: CTBUH

Tallest Building in Mexico



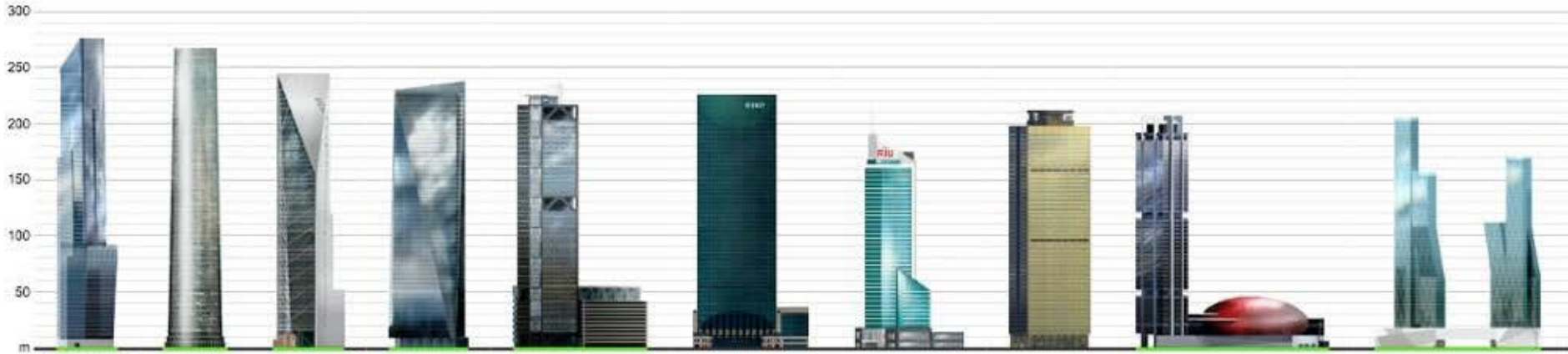
Datos Obtenidos de: CTBUH

TORRE LATINOAMERICANA

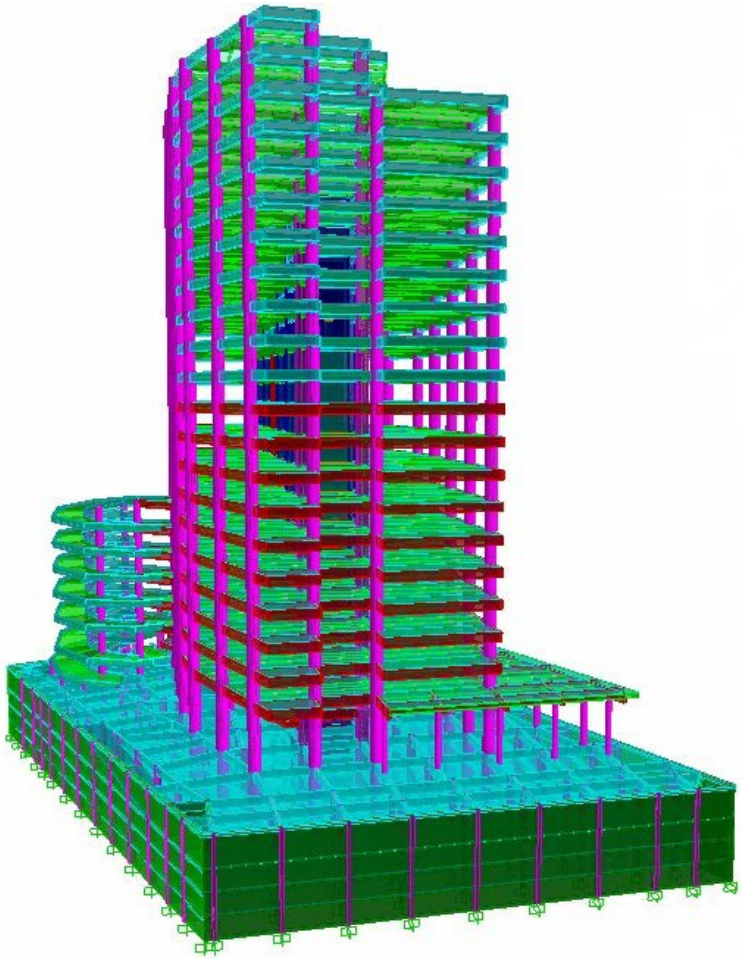
Height = 140 Meters

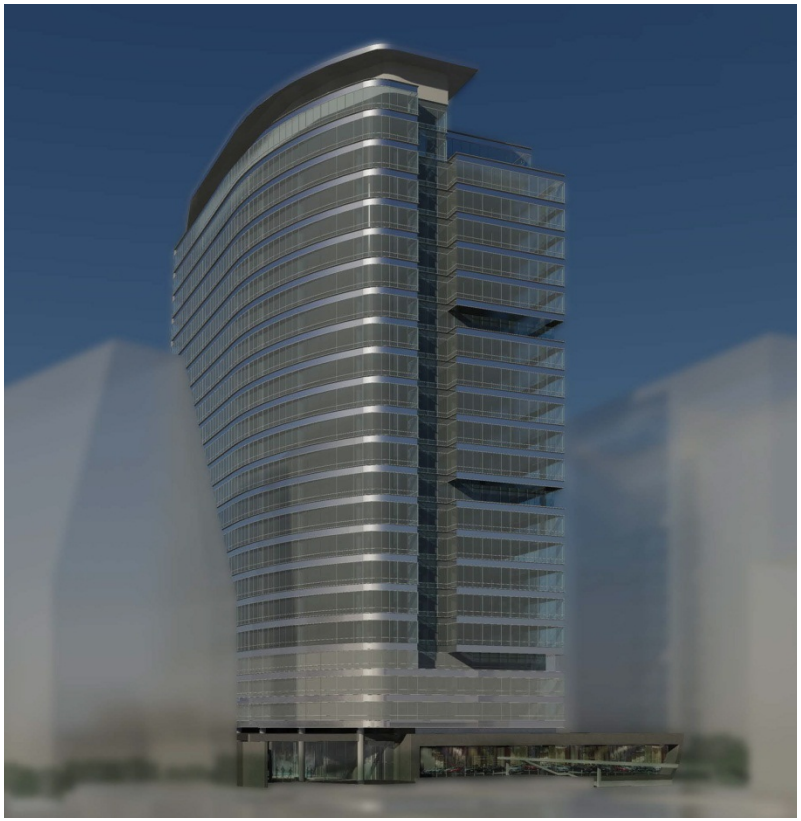
Height = 180 Meters included the anthena

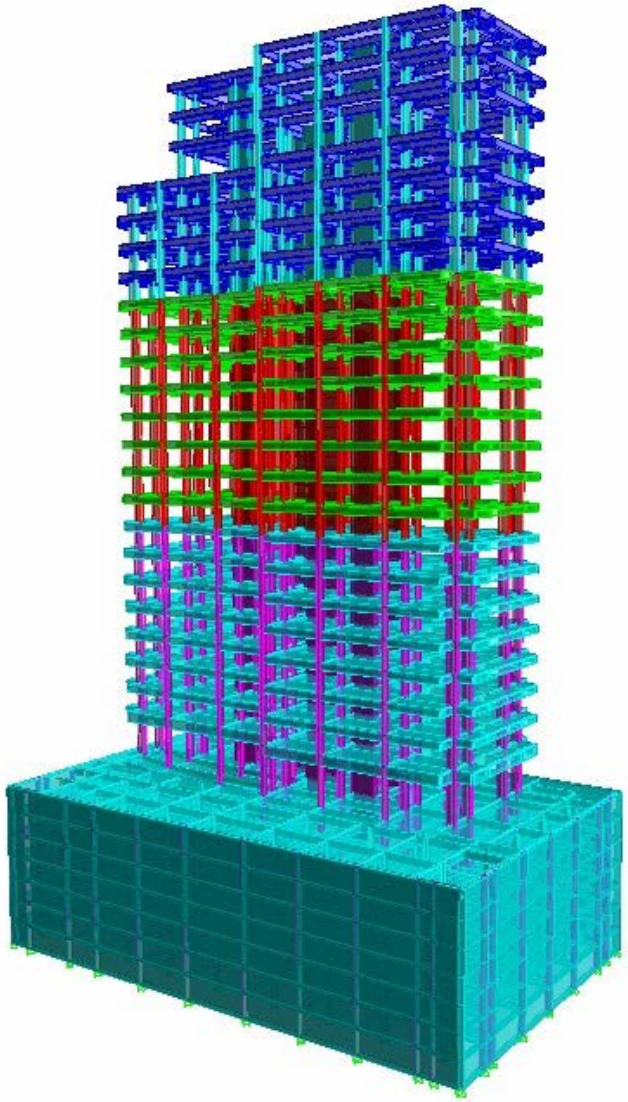
Finished in 1956

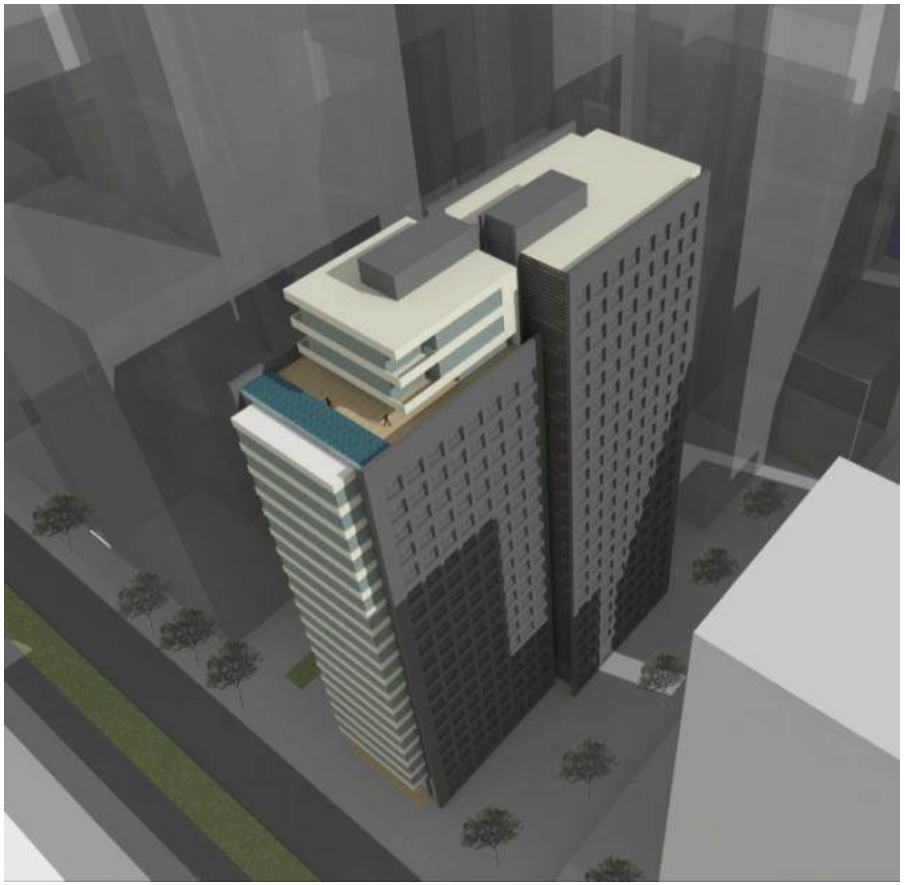


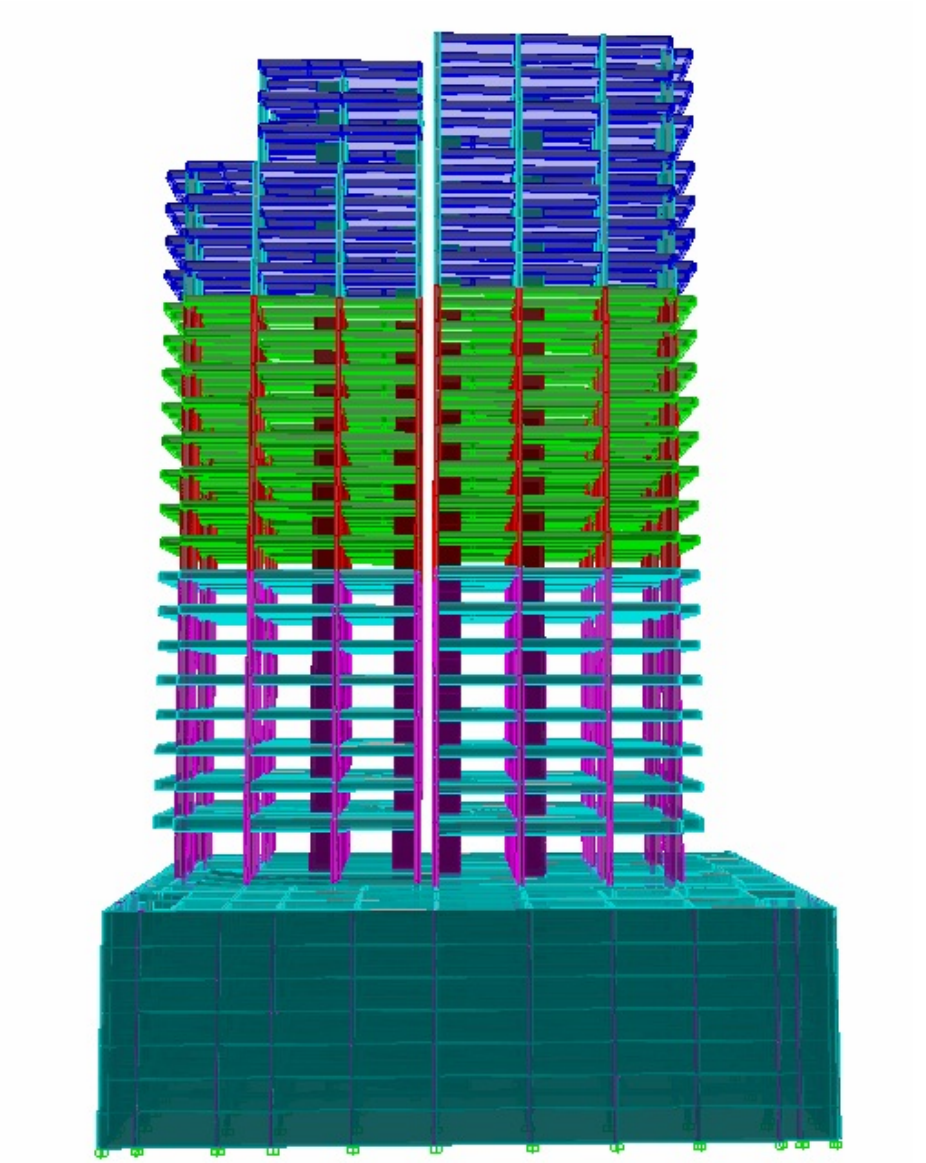
	Torre KOI & Sky Residences	Torre Mitikah	Torre Reforma	Punto Chapultepec	Corporativo BBVA Bancomer	Torre Mayor	Hotel Riu Plaza Guadalajara	Torre Ejecutiva Pemex	Pabellon M	Peninsula Four Seasons Santa Fe
Name										
City	San Pedro Garza Garcia (Nuevo Leon)	Mexico	Mexico	Mexico	Mexico	Mexico	Guadalajara (Jalisco)	Mexico	Monterrey (Nuevo Leon)	Mexico
Country	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico
Illustrator	Martin H Unzon	Martin H Unzon	Martin H Unzon	Martin H Unzon	Martin H Unzon	Val5413	Rodrigoscar	Martin H Unzon	Martin H Unzon	Martin H Unzon
Status	Under construction	Under construction	Under construction	Under construction	Under construction	Built	Built	Built	Under construction	Under construction
Built	2016	2016	2015	2015	2014	2003	2011	1982	2015	
Floors	67	62	57	59	50	55	44	52	47	62
Use	Mixed use	Mixed use	Office	Mixed use	Office	Office	Hotel	Office	Mixed use	Residential
Antenna										
Spire	276 m			237.6 m	234.9 m	225.4 m			206 m	
Roof	252.4 m	267 m	244 m	237.6 m	225 m		189.2 m	211.3 m		

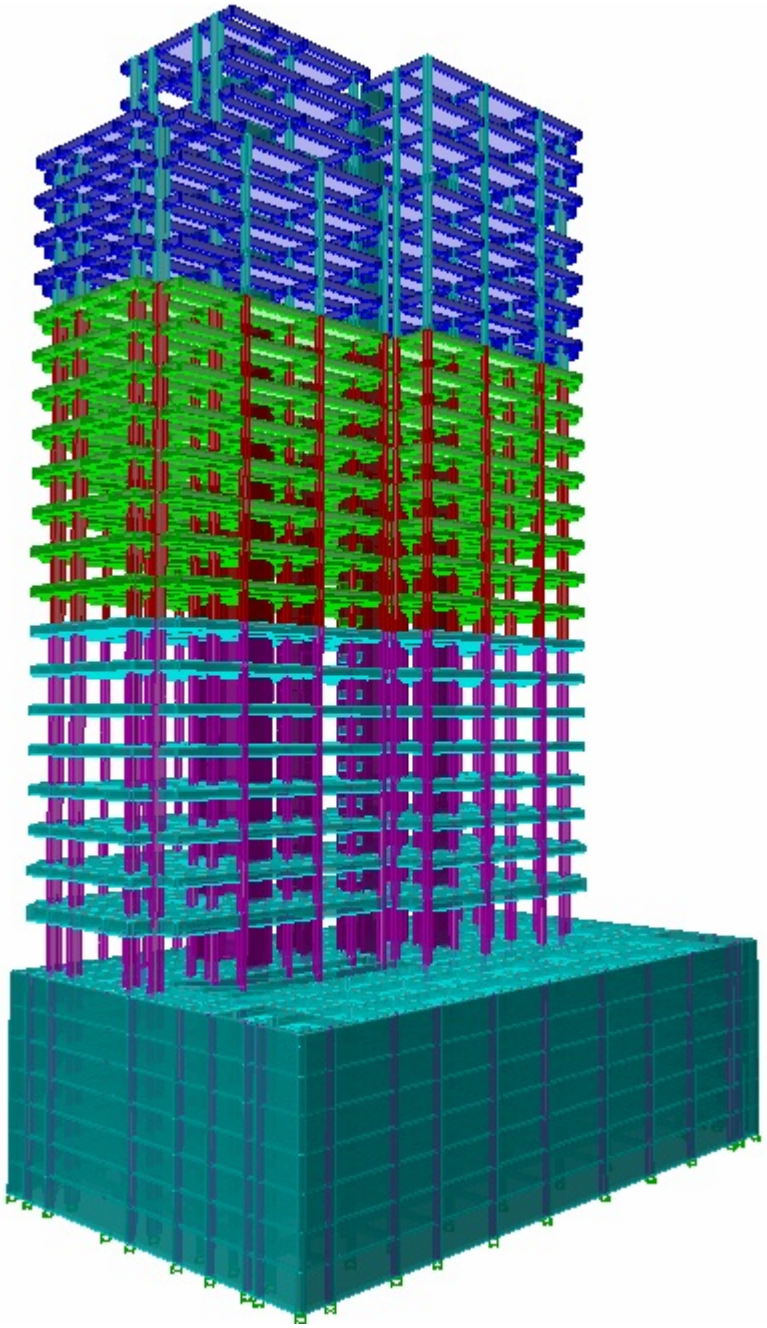


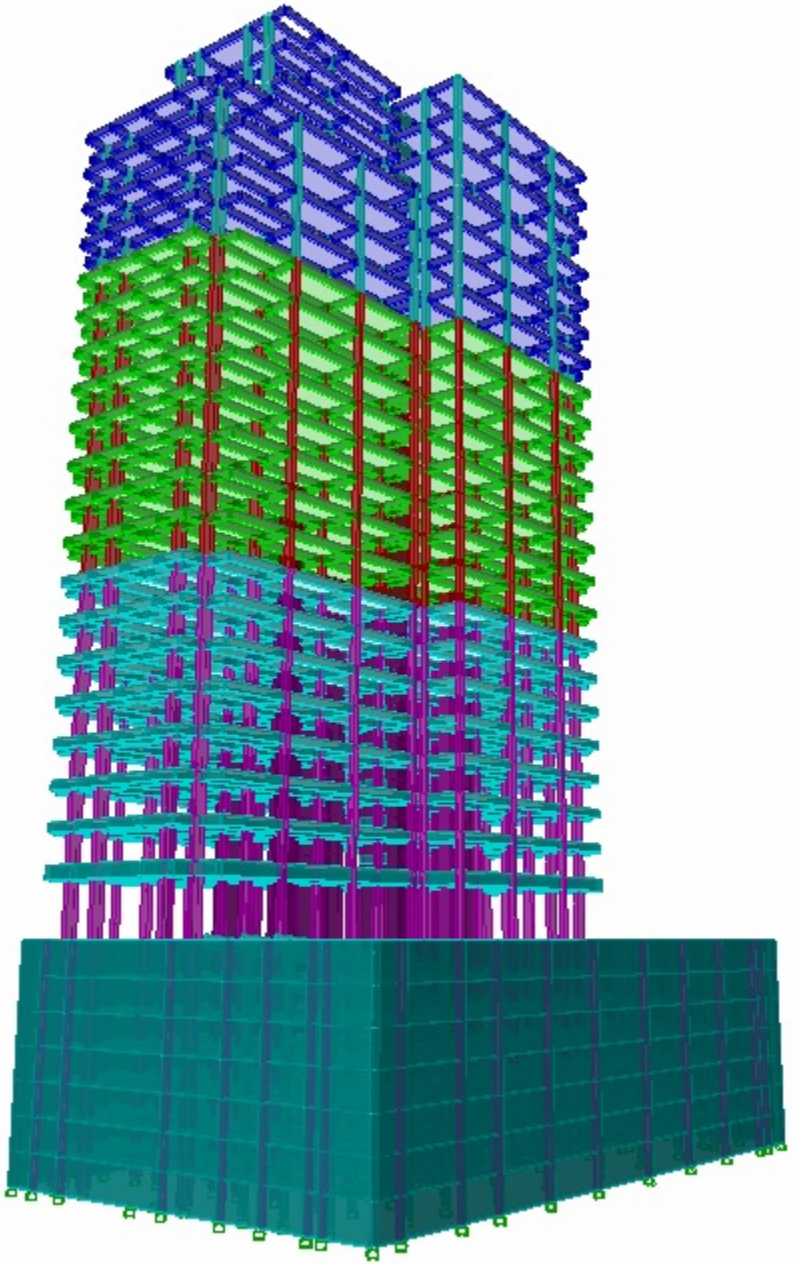










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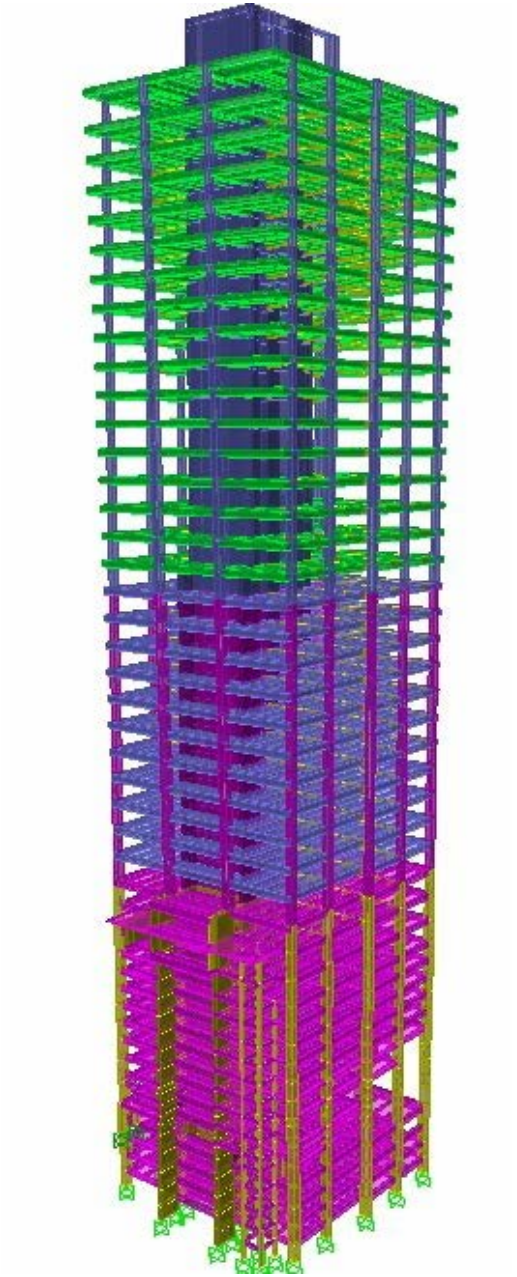

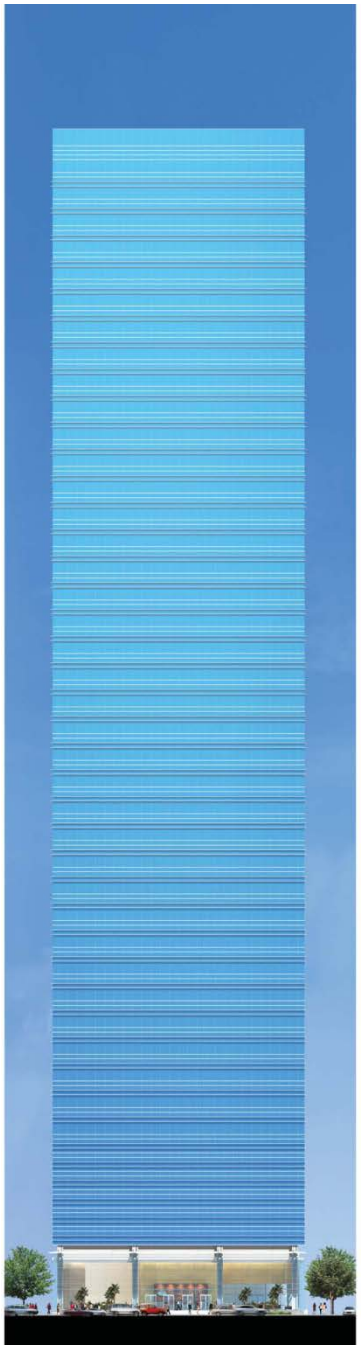

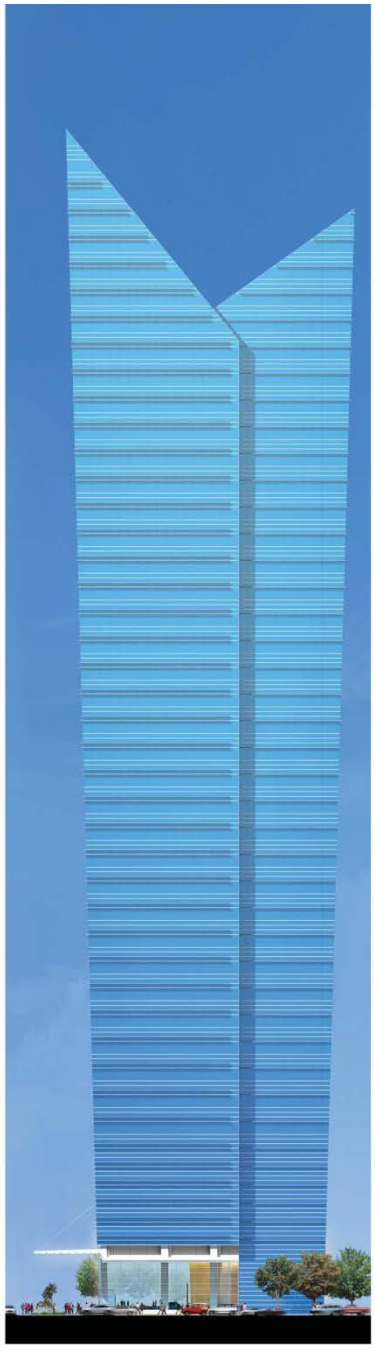

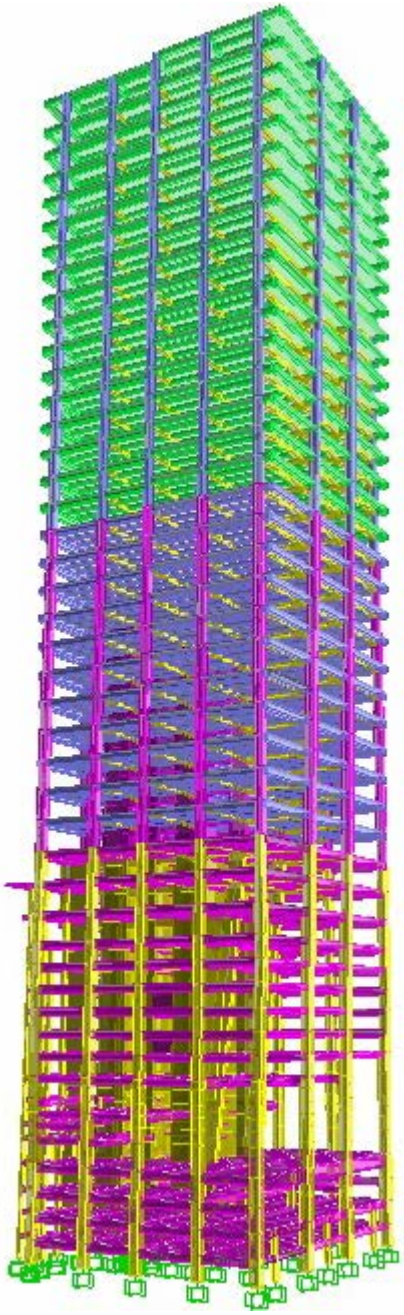

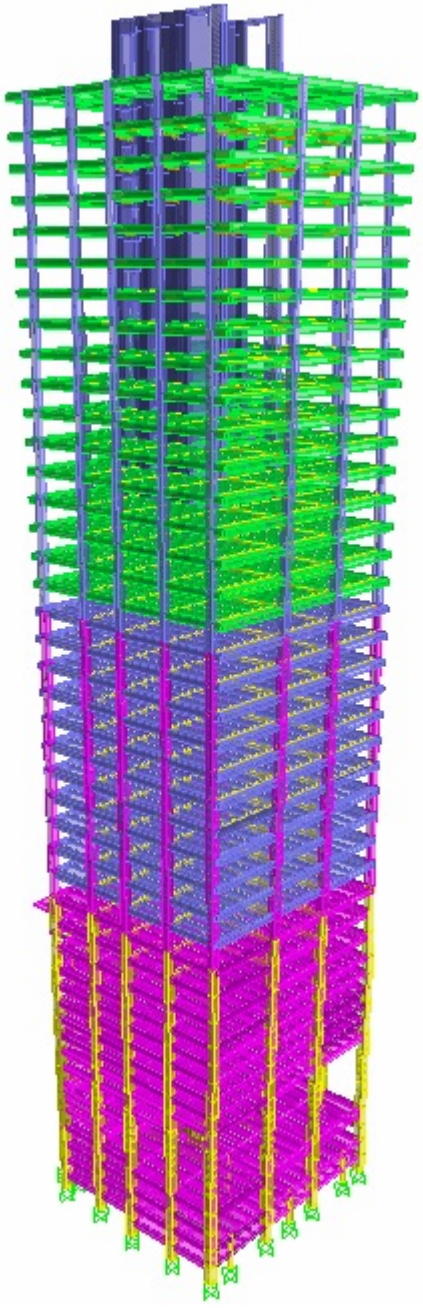

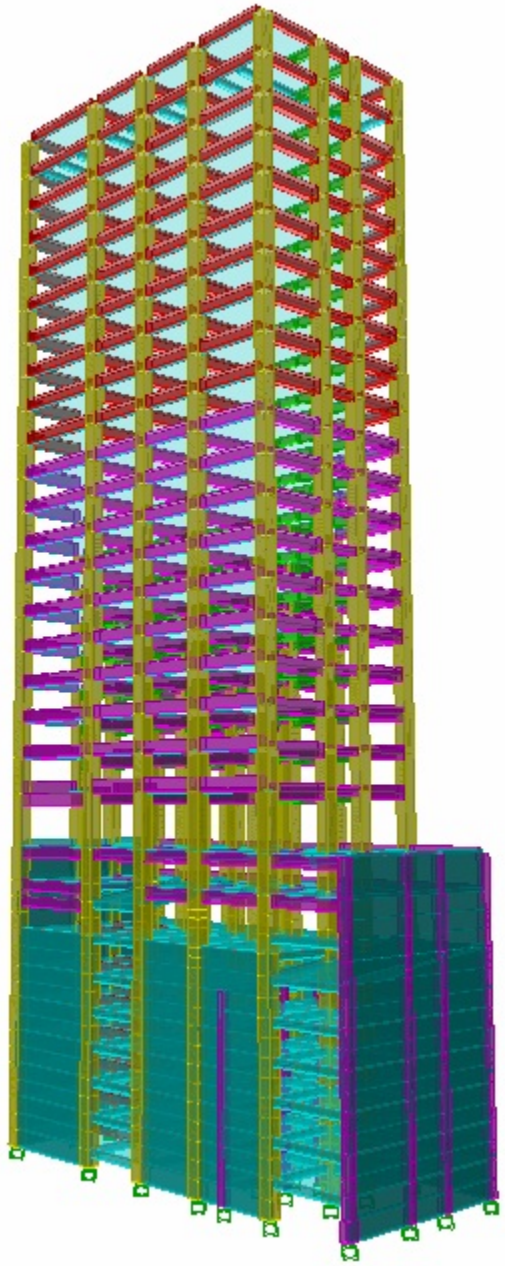

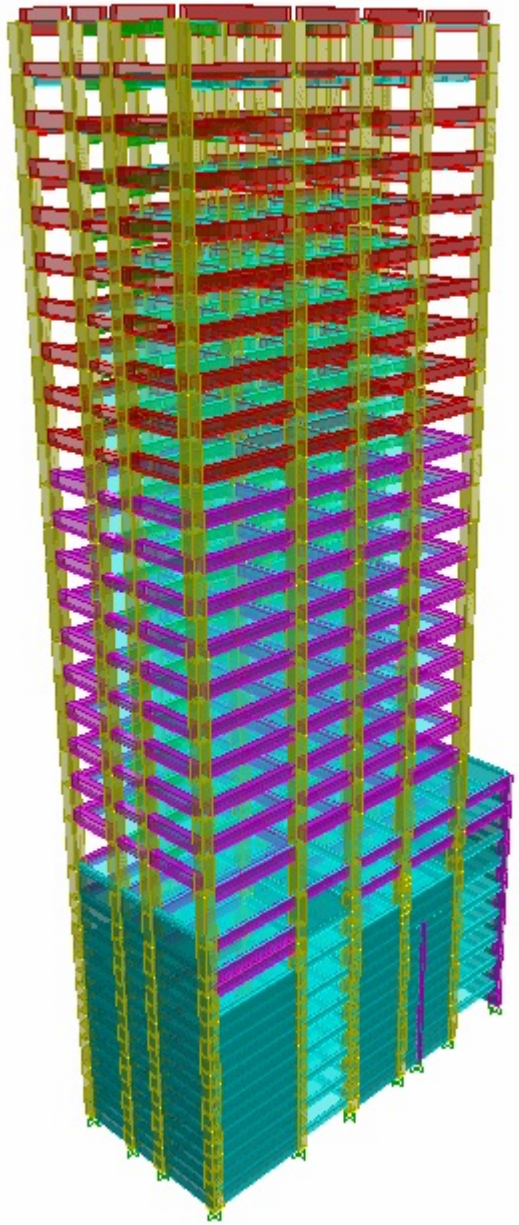

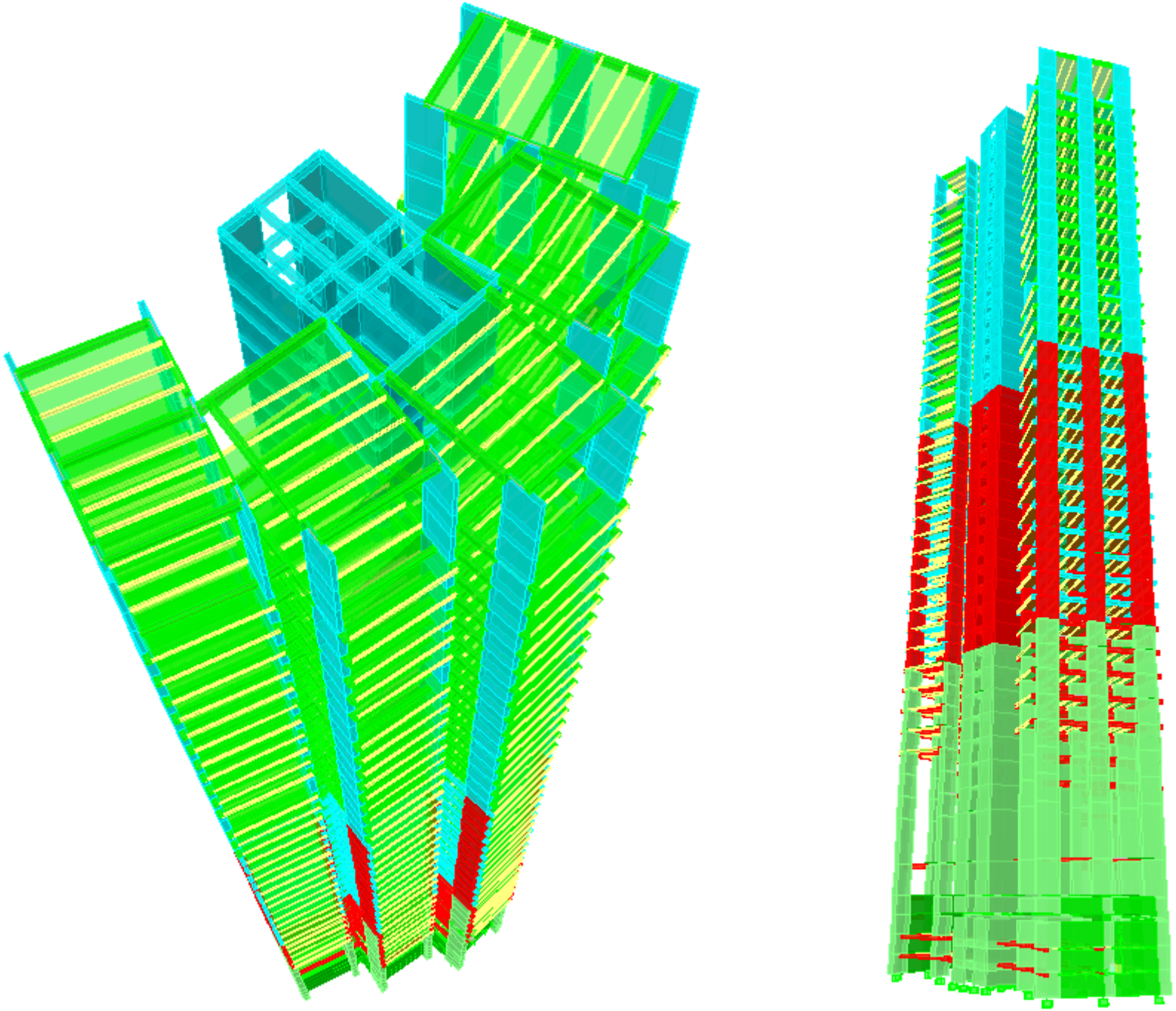

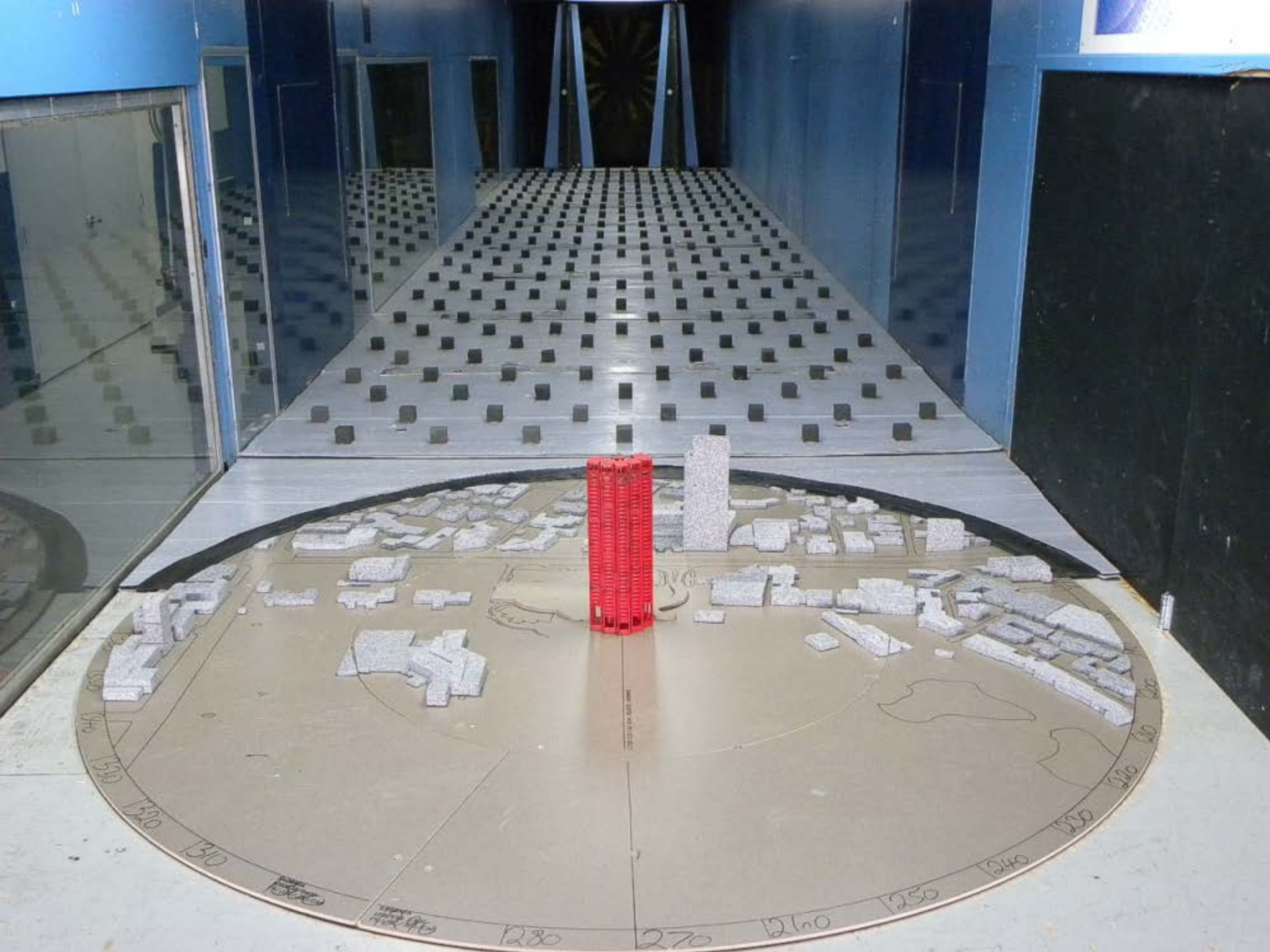
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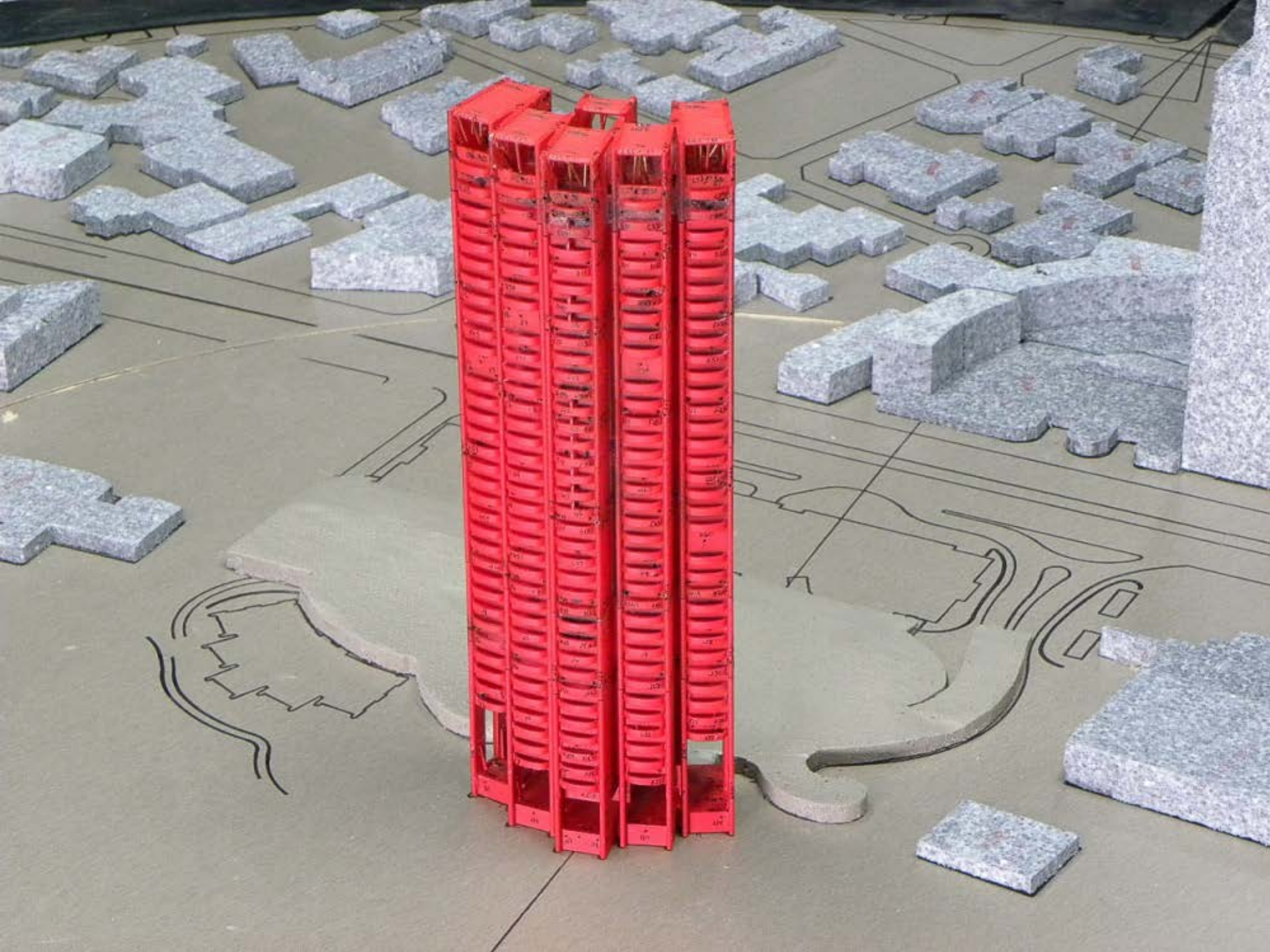
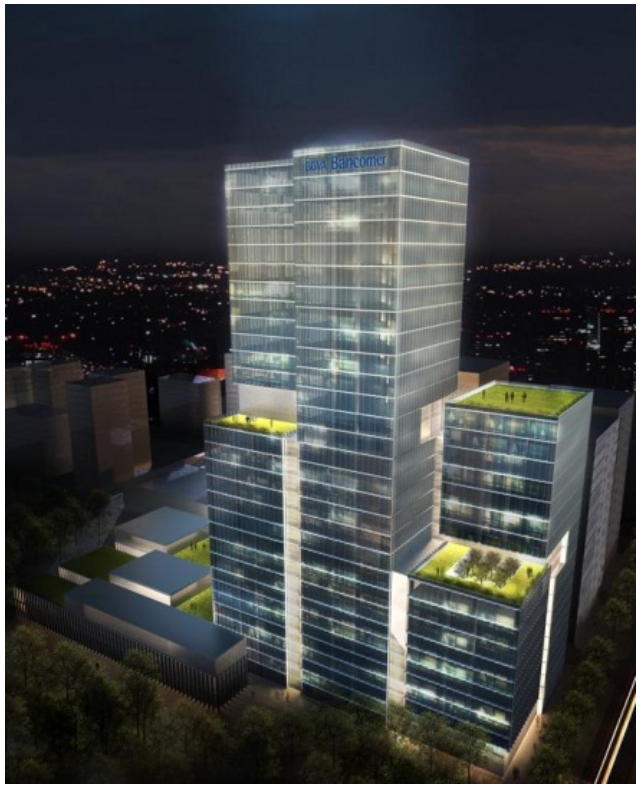
260
250



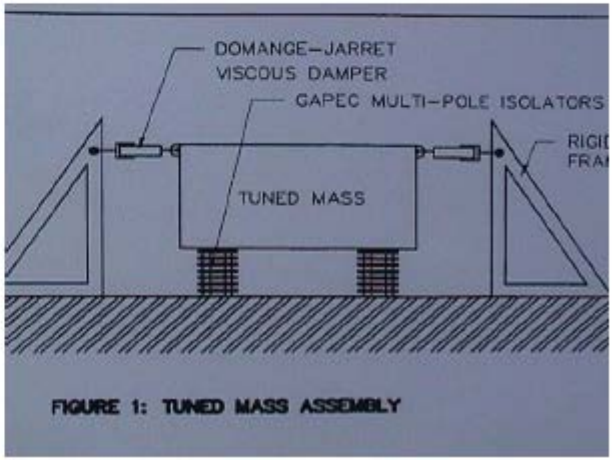

BBVA Bancomer


BBVA Bancomer

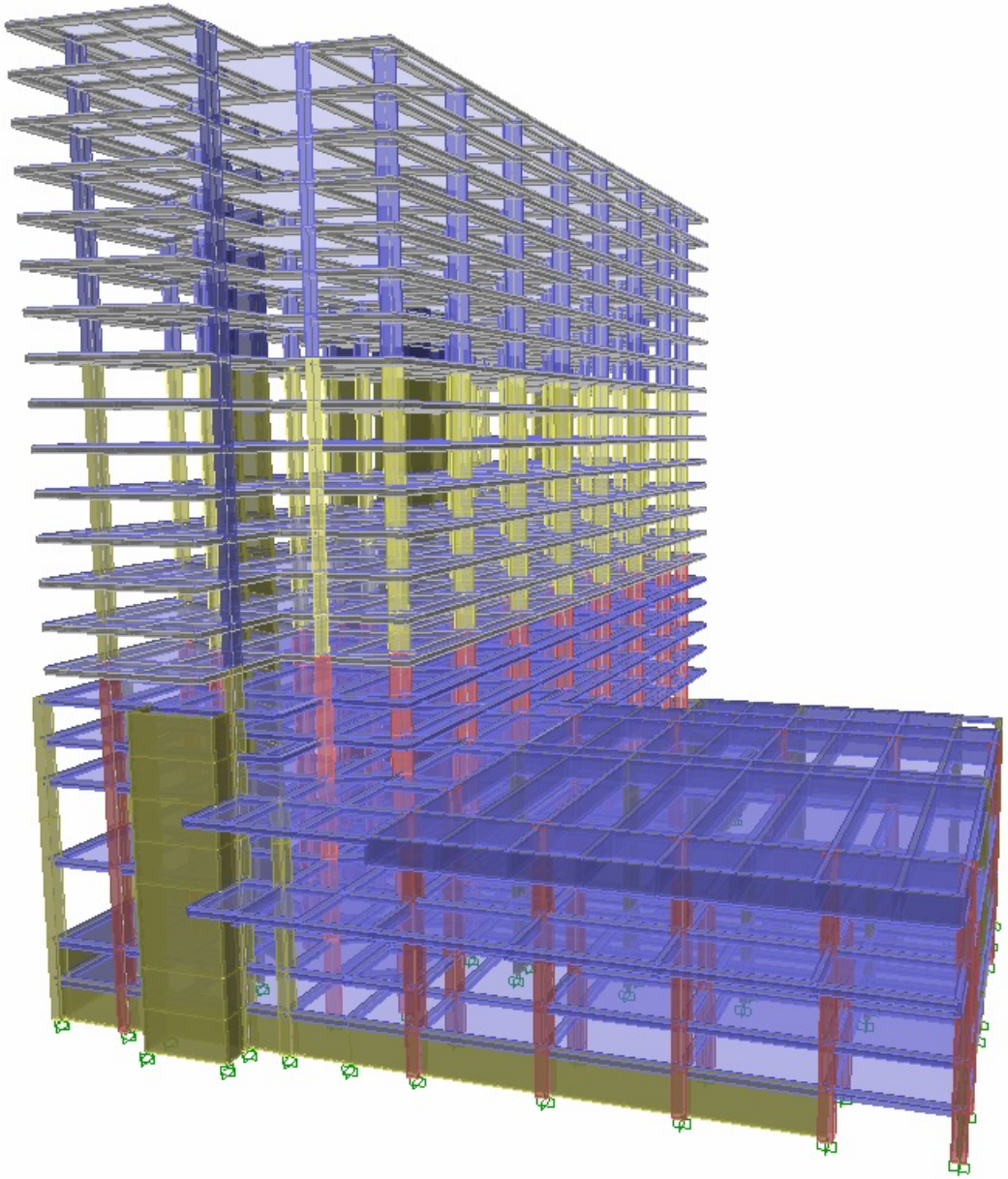
b) DISIPADORES PASIVOS DE ENERGÍA
USANDO FLUIDOS VISCOSOS

Torre Mayor Mexico

c) DISIPACIÓN DE ENERGÍA POR REACCIÓN DE MASAS SINTONIZADAS




MERIDIEN



TORRE KOI

San Pedro Garza García
Monterrey, Nuevo León

General:

- Total Height: 279.5 meters
- Mixed Used
- Concrete Structure, central core with two levels of excentric Outriggers. Level 21-22 and Level 62-63.

Foundation

- Mat Foundation 4 meters deep supported by 76 drilled piles 1.5 m diameter with an effective length of 7 meters.
- 7,070 m3.

Foundation

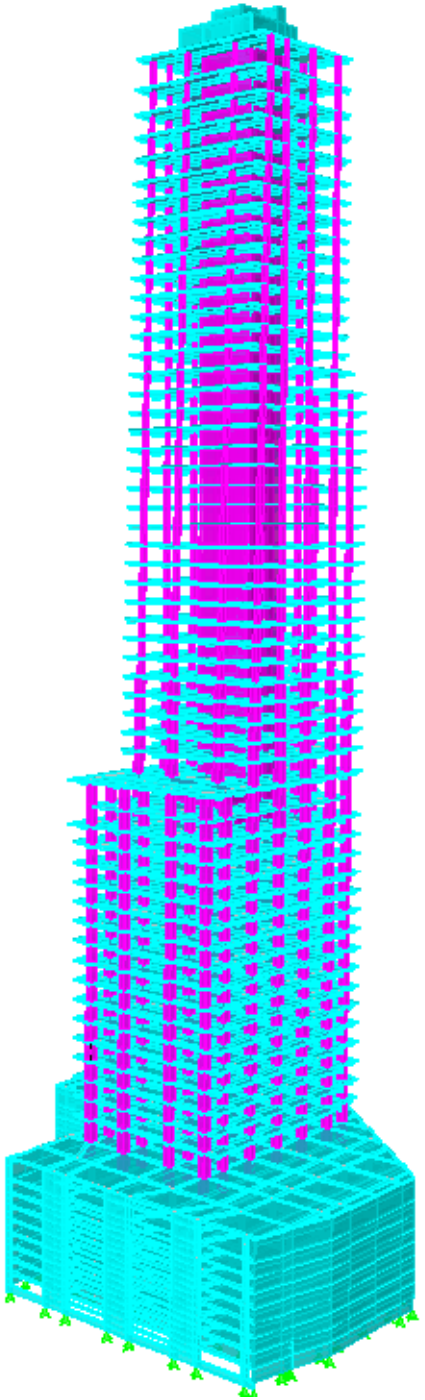
- Second largest concrete pour in Mexico.
- 7 concrete plants, 98 mix trucks, 1,010 drops and 7 pumps.
- 26 hours y 17 minutes continuous pour

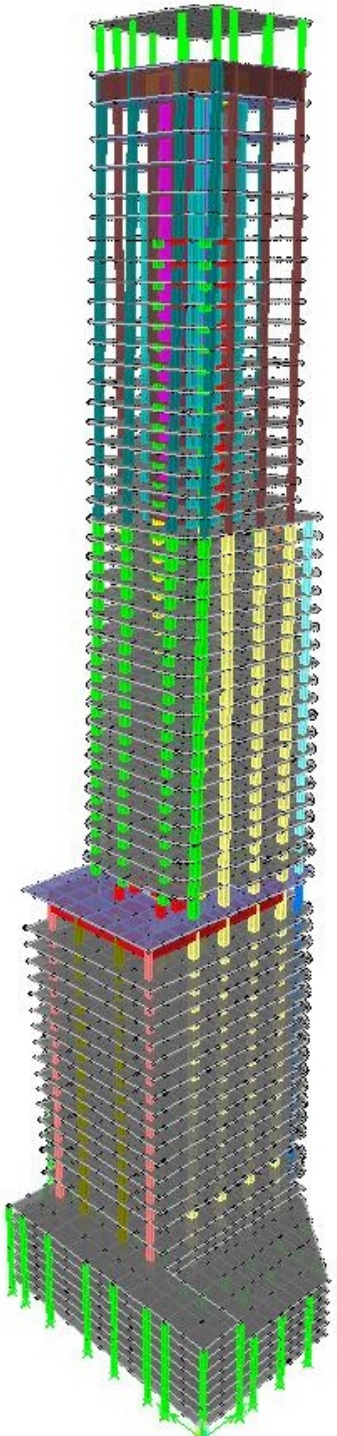
Floor system

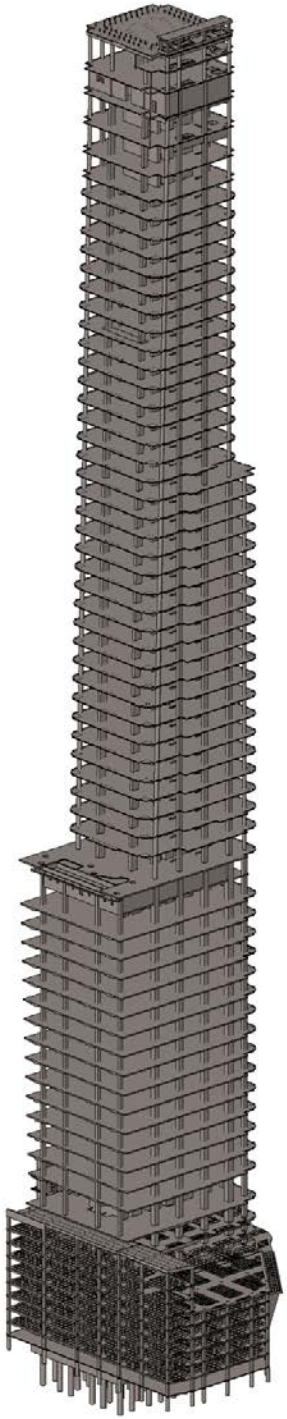
- Postensioned, unbonded strands with a thickness of 250 mm and central strips of 350 mm.

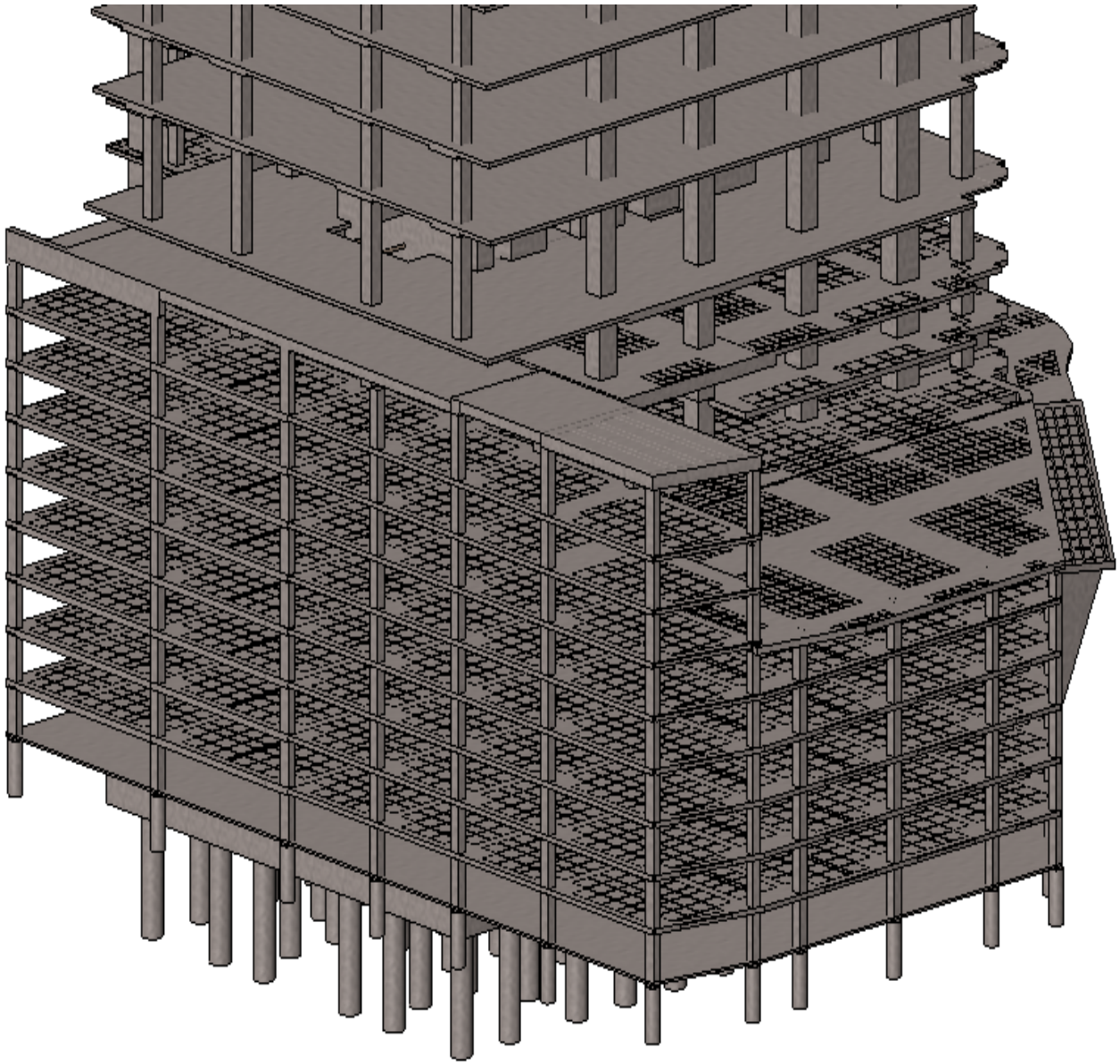
Concrete Strength

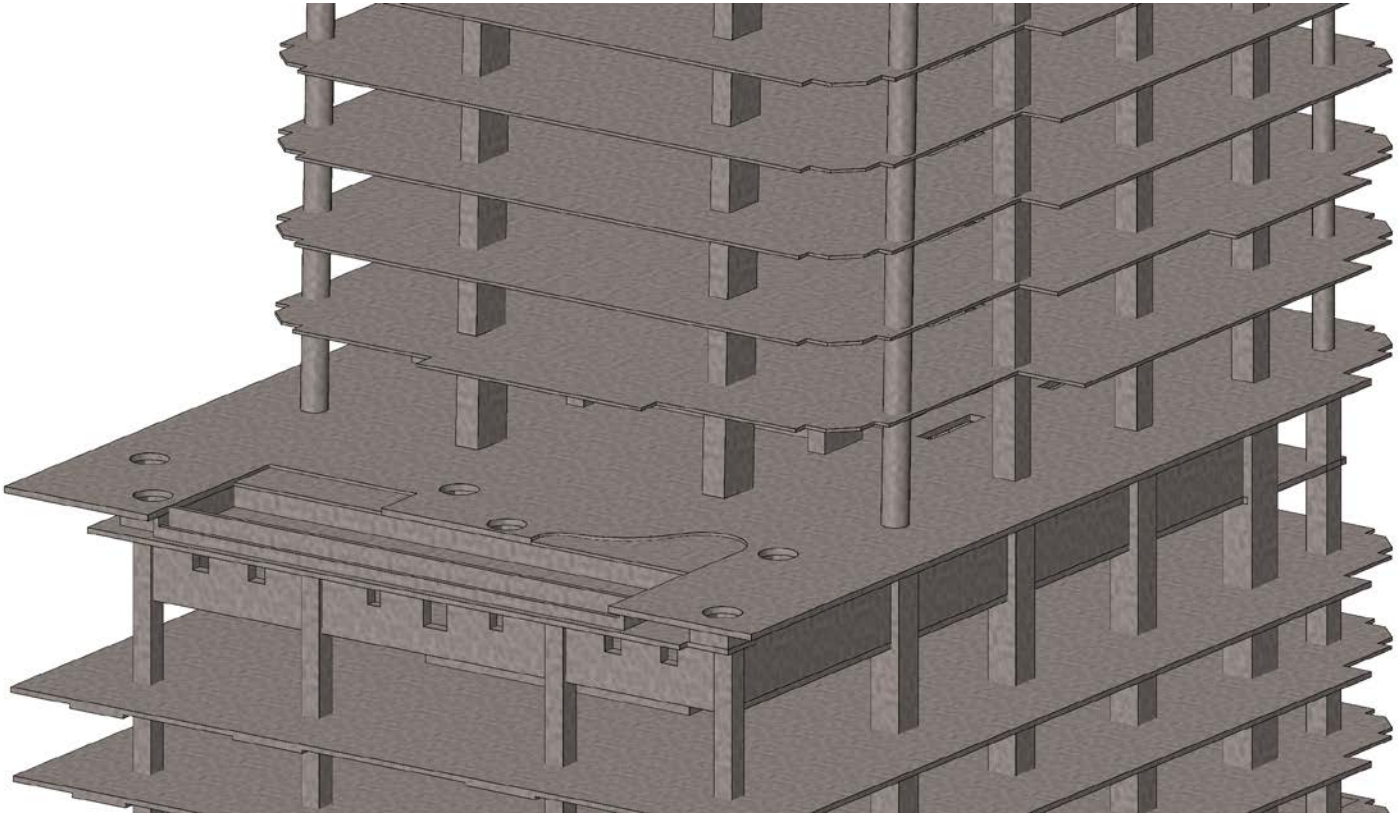
- Columns and Walls 700 to 500 kg/cm2. (70 to 50 Mpa)
- Floors 500 to 350 kg/cm2 (50 to 35 Mpa)





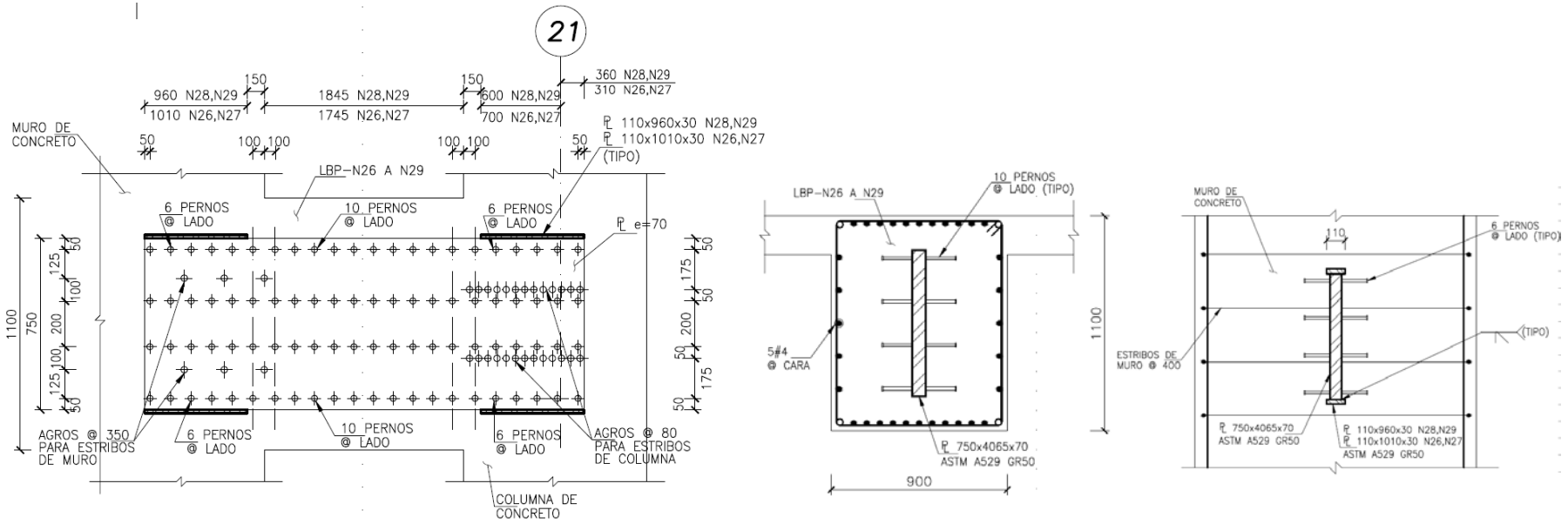






UN RETO CONSTANTE :

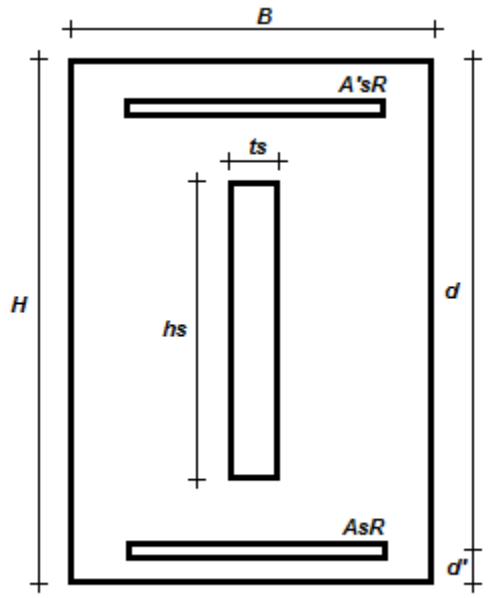
TORRE KOI:



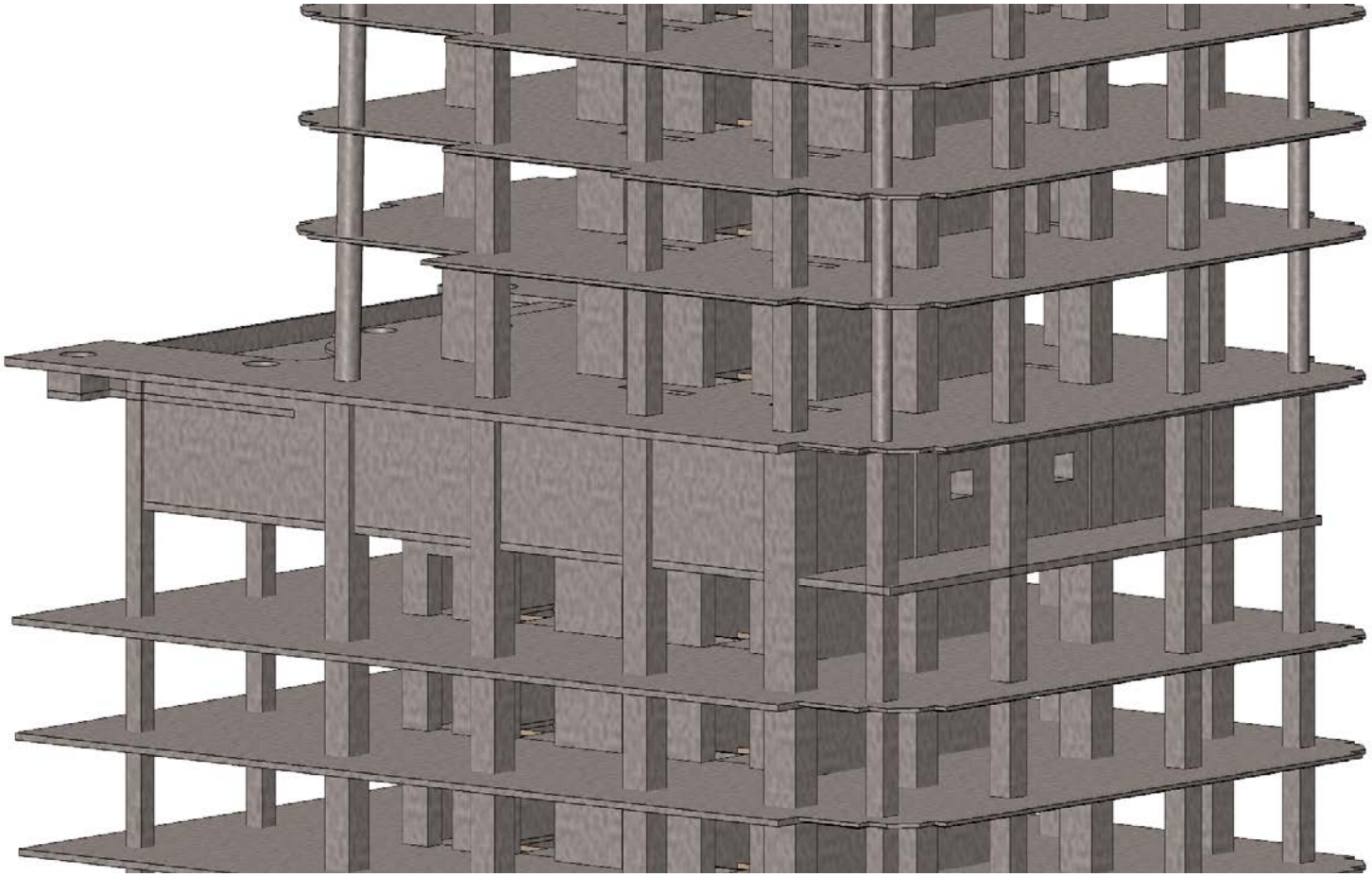
Link Beams

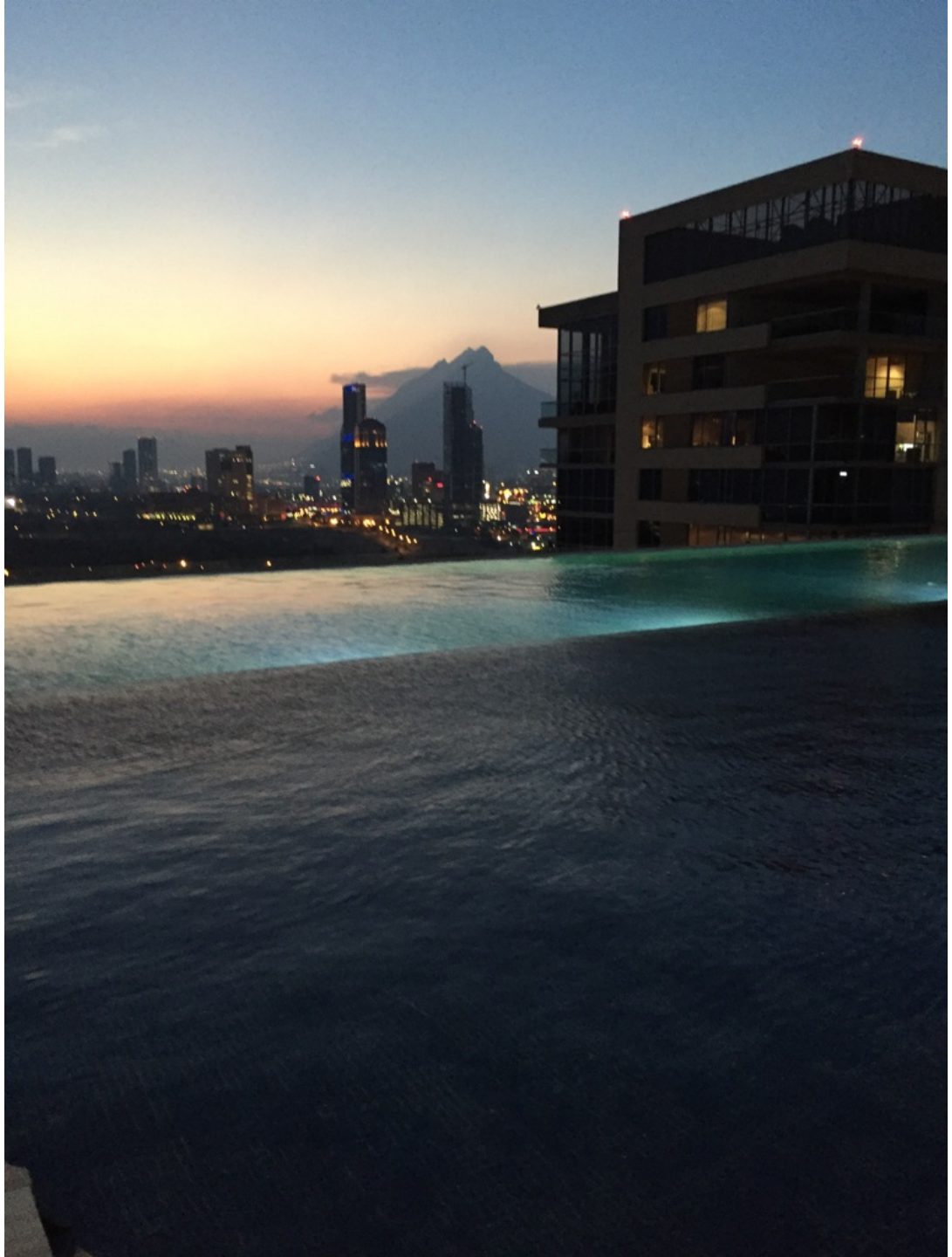
Flexure.

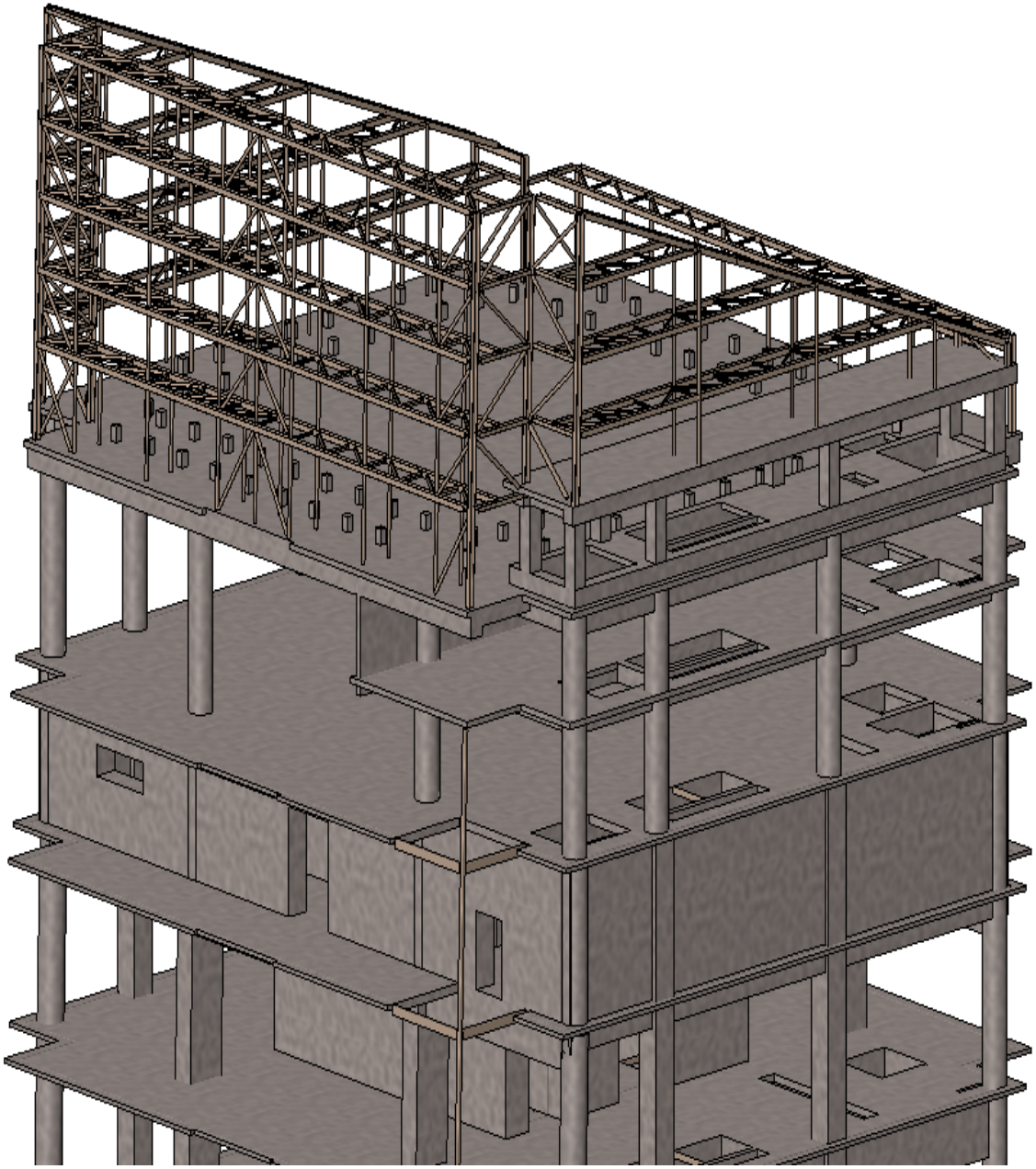
Shear Design.



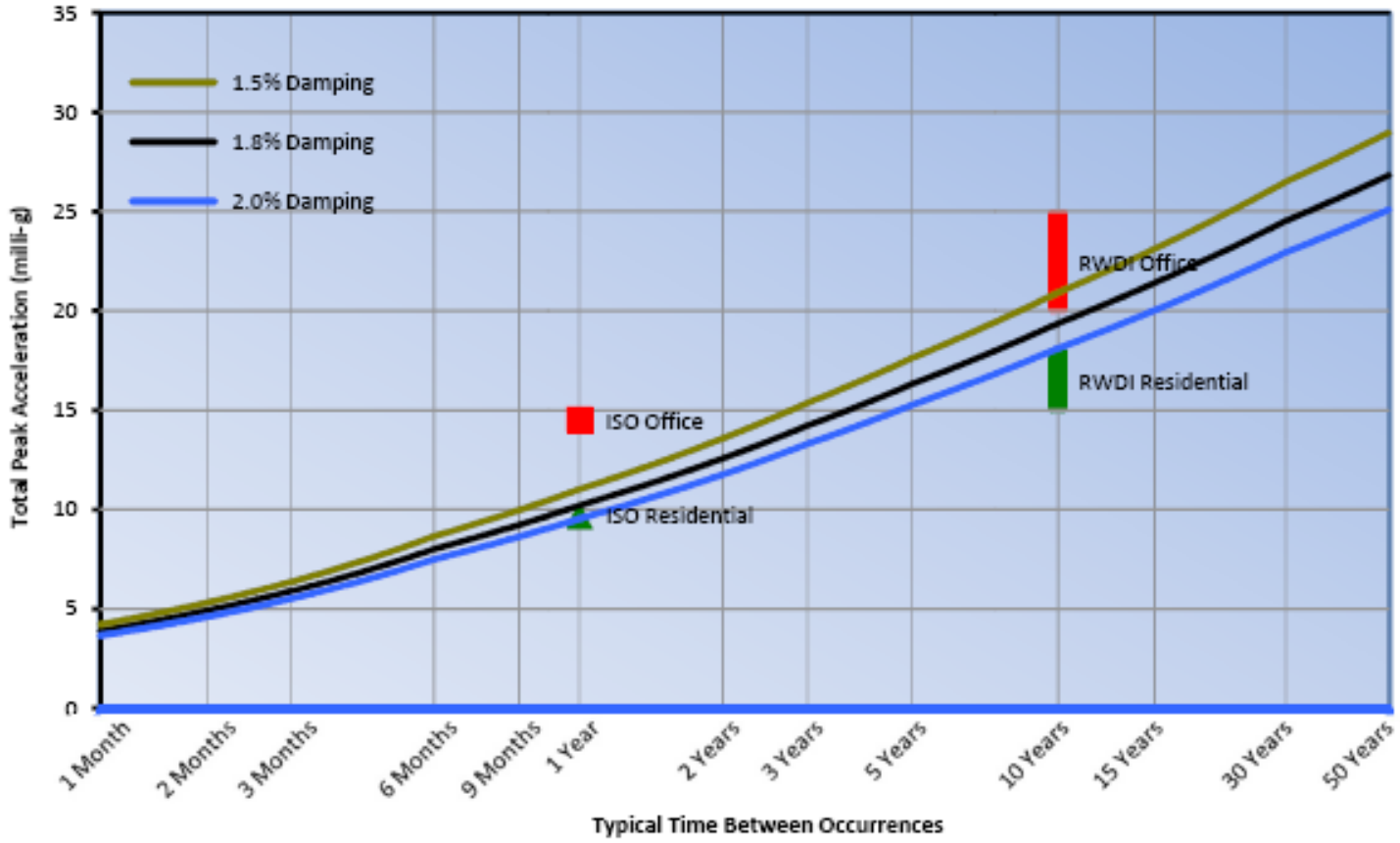
Esquema general sección doblemente armada y placa de acero



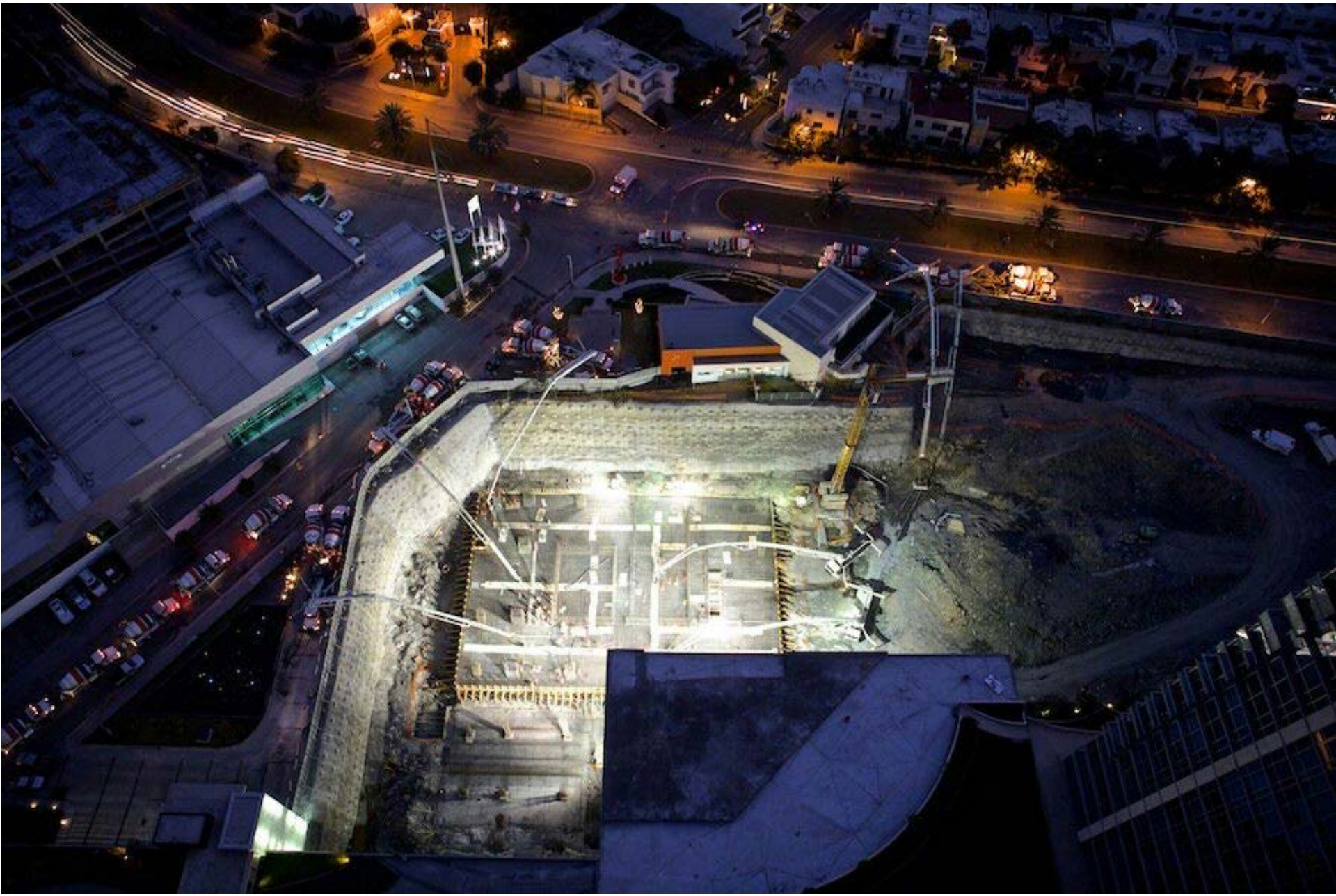




Peak acceleration from test




Vicraya2 2013
185H
SULLAIR




Seguros Monterrey


VICRAYA2 2014

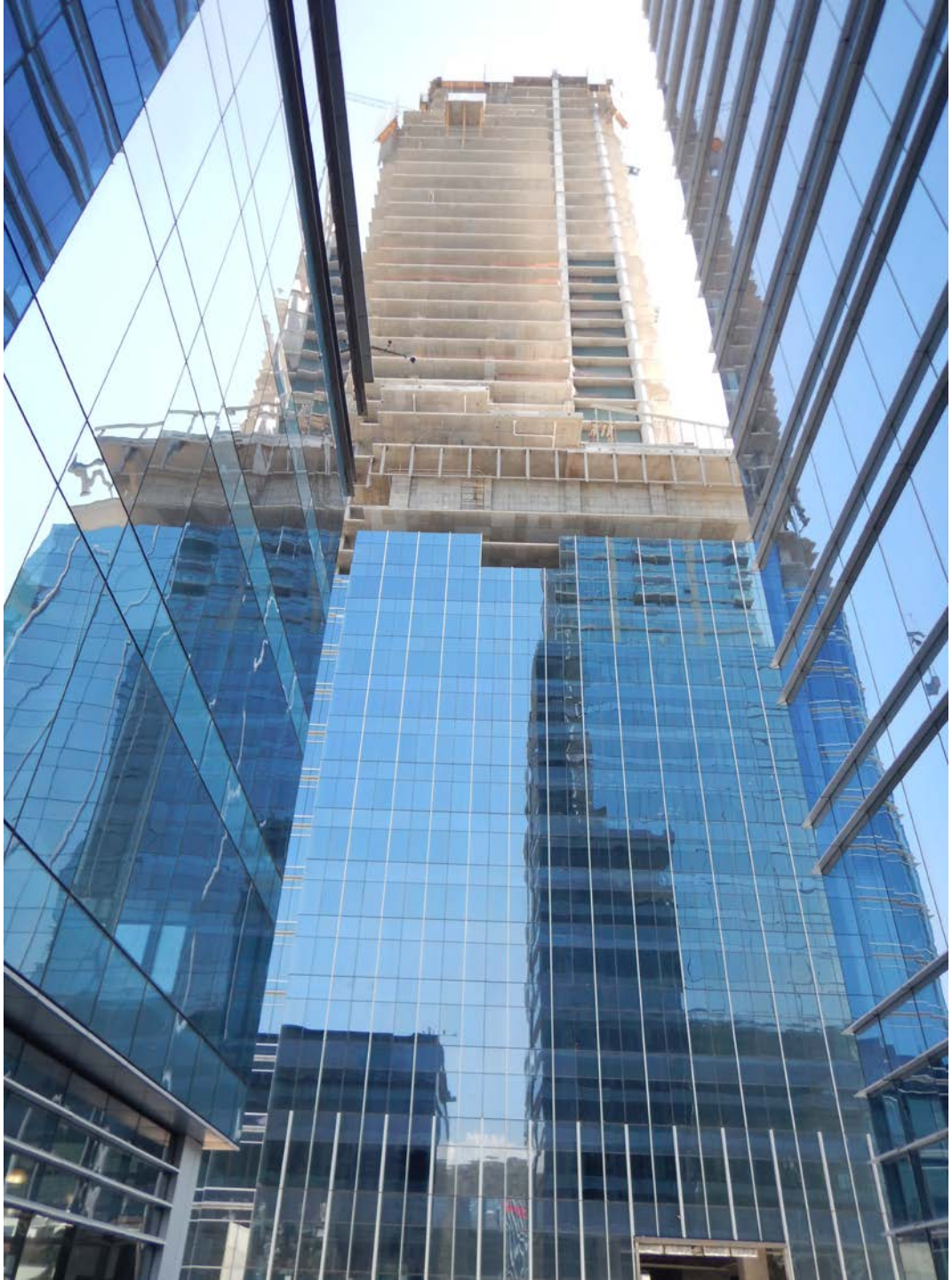

Vieraya2 2014


Viraya2 2014

UN RETO CONSTANTE :

TORRE KOI

AVANCE ACTUAL




8004.4343


800 4.4343


8004.4343

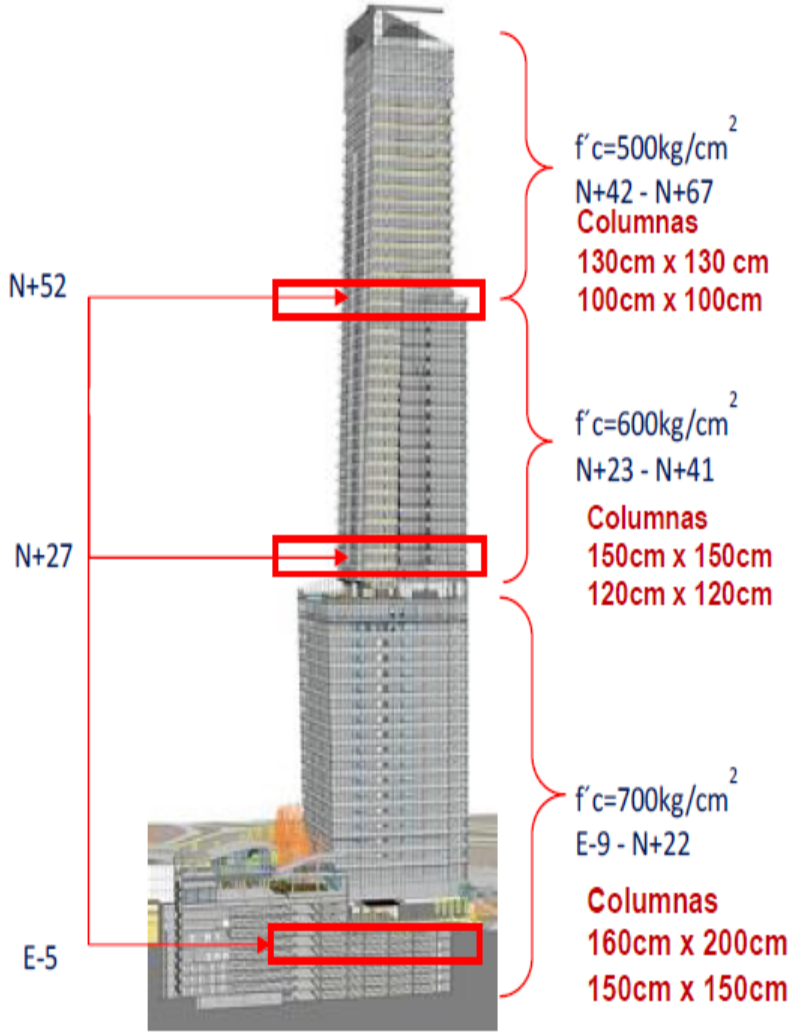


Figura 1 Variaciones de la resistencia a compresión del concreto y secciones de columnas

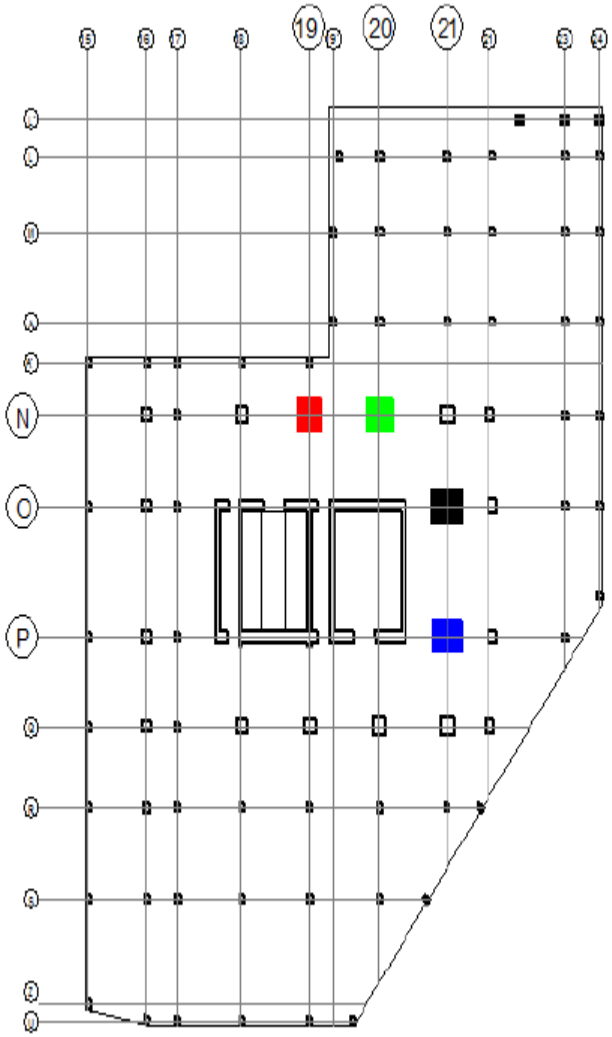


Figura 2. Columnas instrumentadas en el nivel N-5

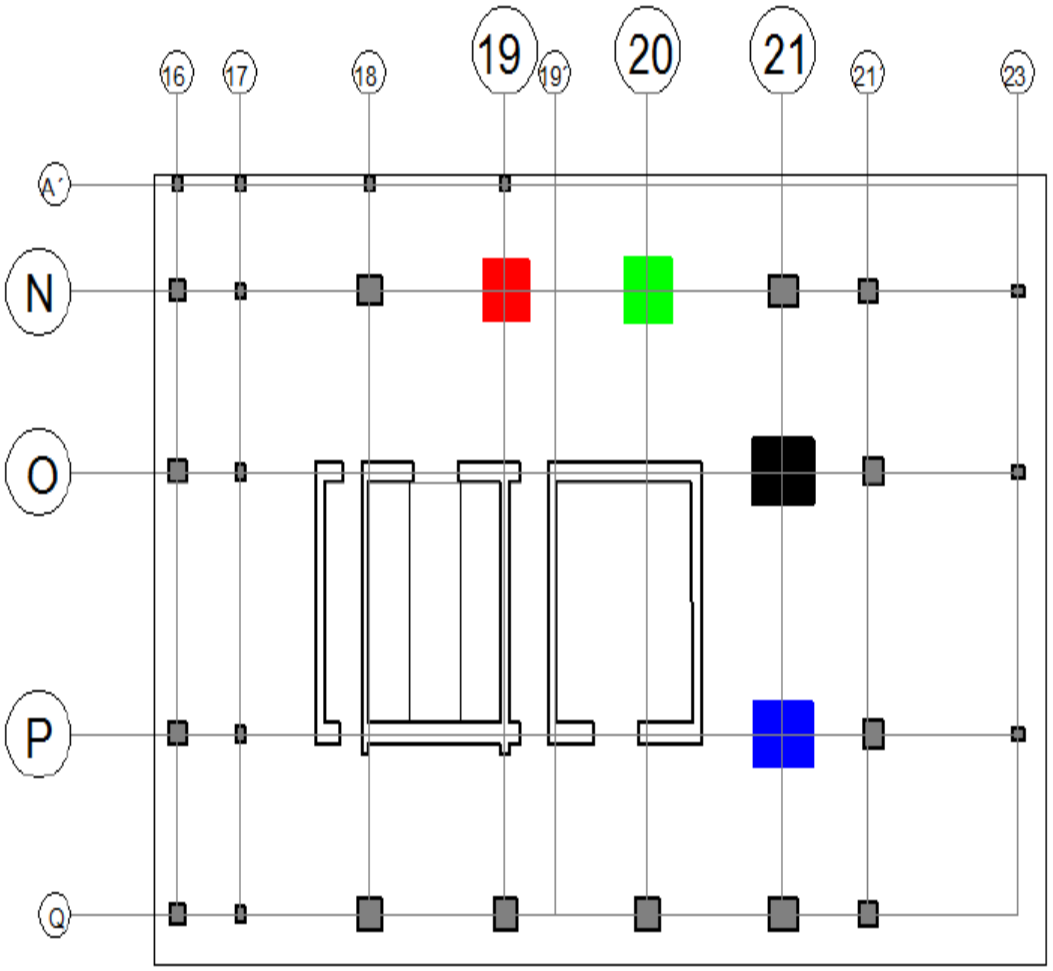


Figura 3. Columnas instrumentadas en el nivel N+27

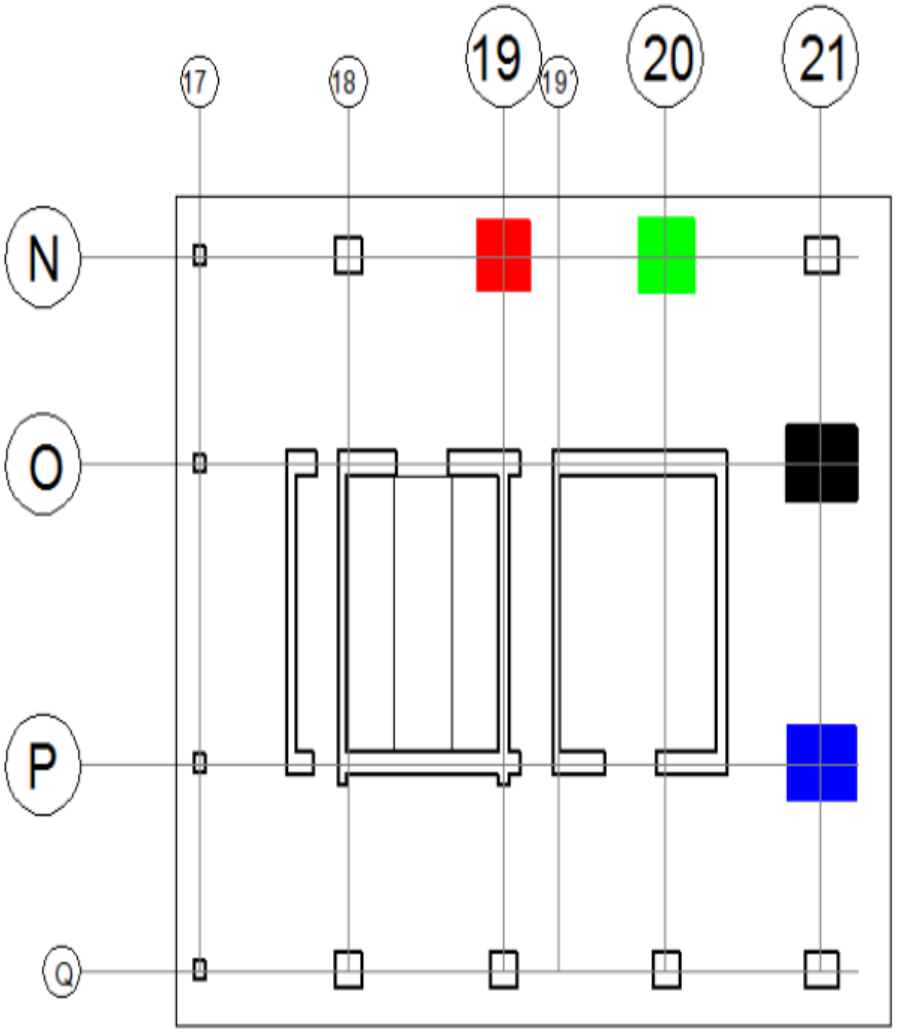
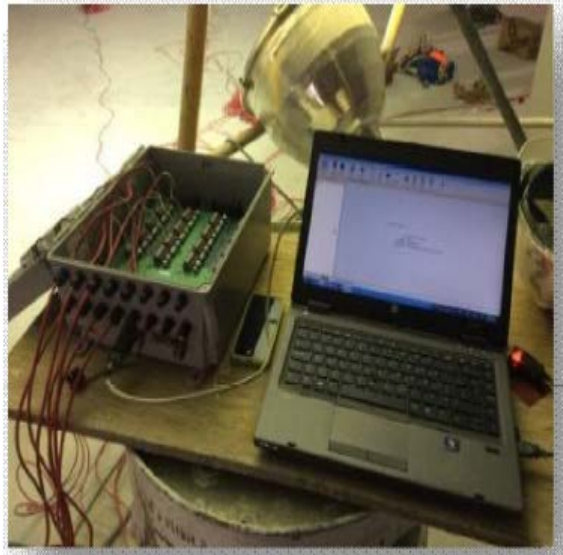


Figura 4. Columnas instrumentadas en el nivel N+52

Preparación de sensor

Colocación de sensor

Estación de medición



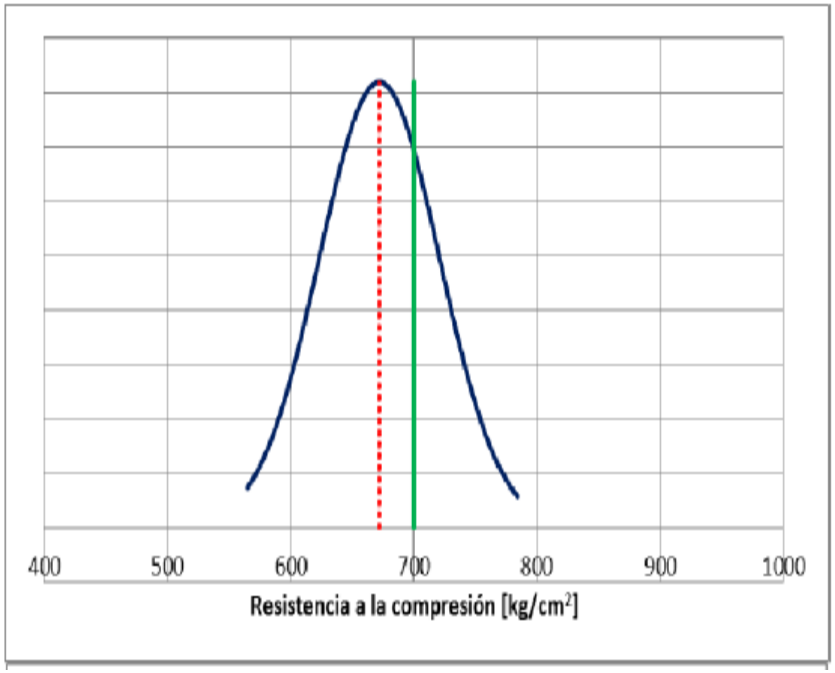
Configuración de equipo

6.1. RESISTENCIA A LA COMPRESIÓN

Distribución normal de las resistencias a compresión f´c=700 kg/cm^2

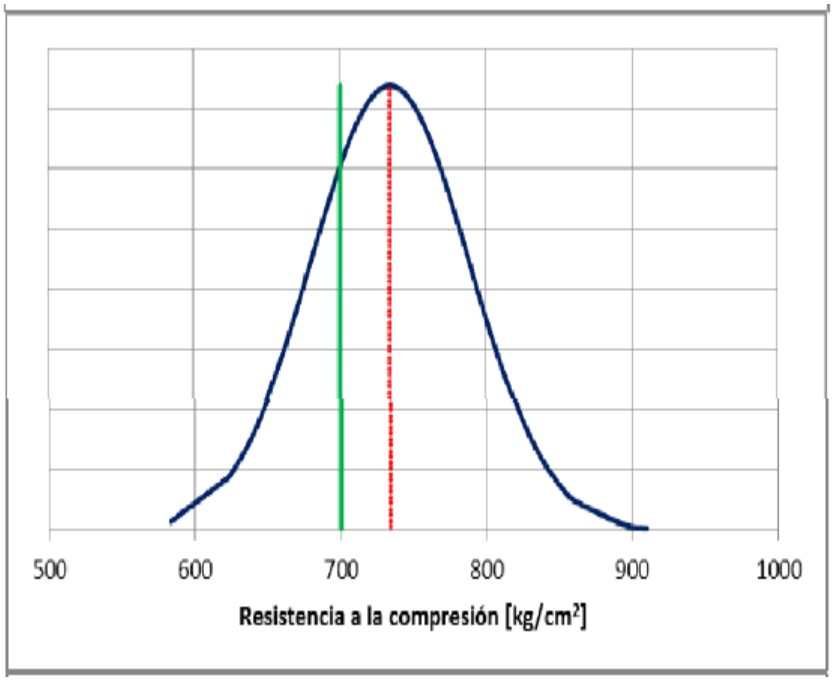
Edad: 28 días

- N=234
- Xm=672 [kg/cm^2]
- S=48 [kg/cm^2]
- V=7%



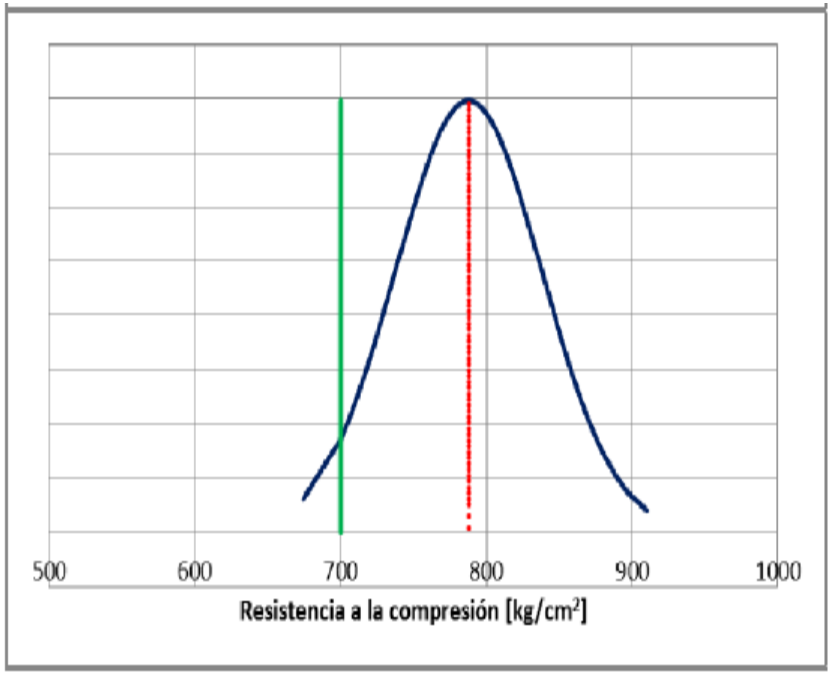
Edad: 56 días

- N=253
- Xm=734 [kg/cm^2]
- S=54[kg/cm^2]
- V=7%



Edad: 91 días

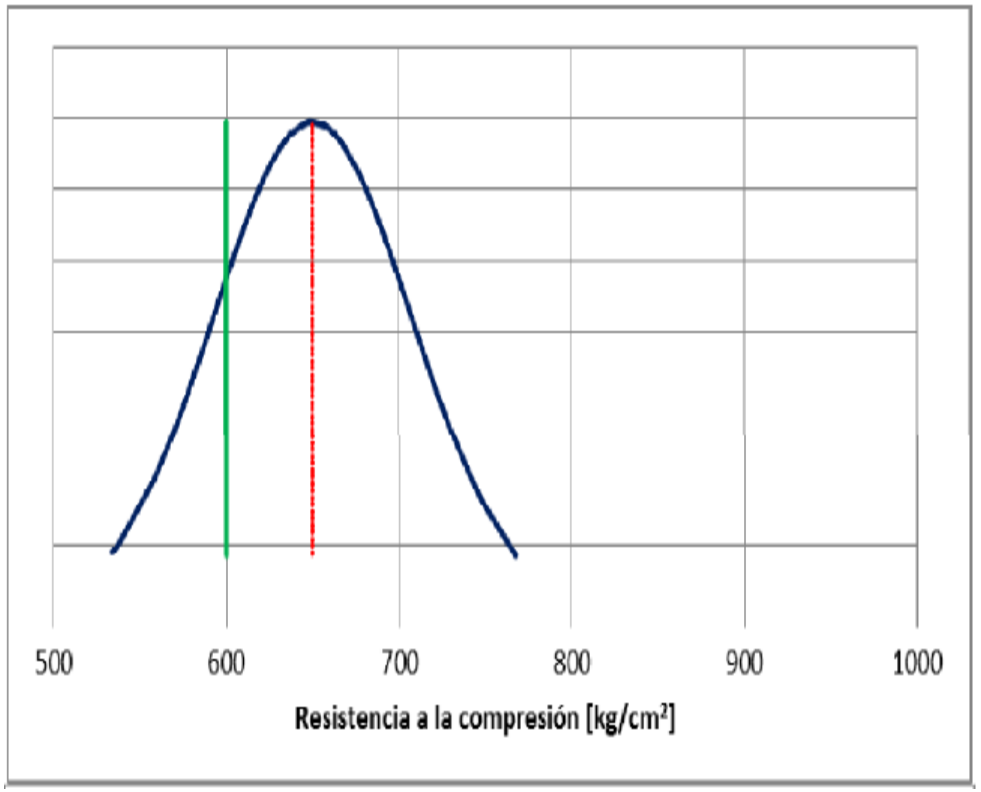
- N=249
- Xm=788 [kg/cm^2]
- S=50 [kg/cm^2]
- V=6%



Distribución normal de las resistencias a compresión f´c=600 kg/cm^2

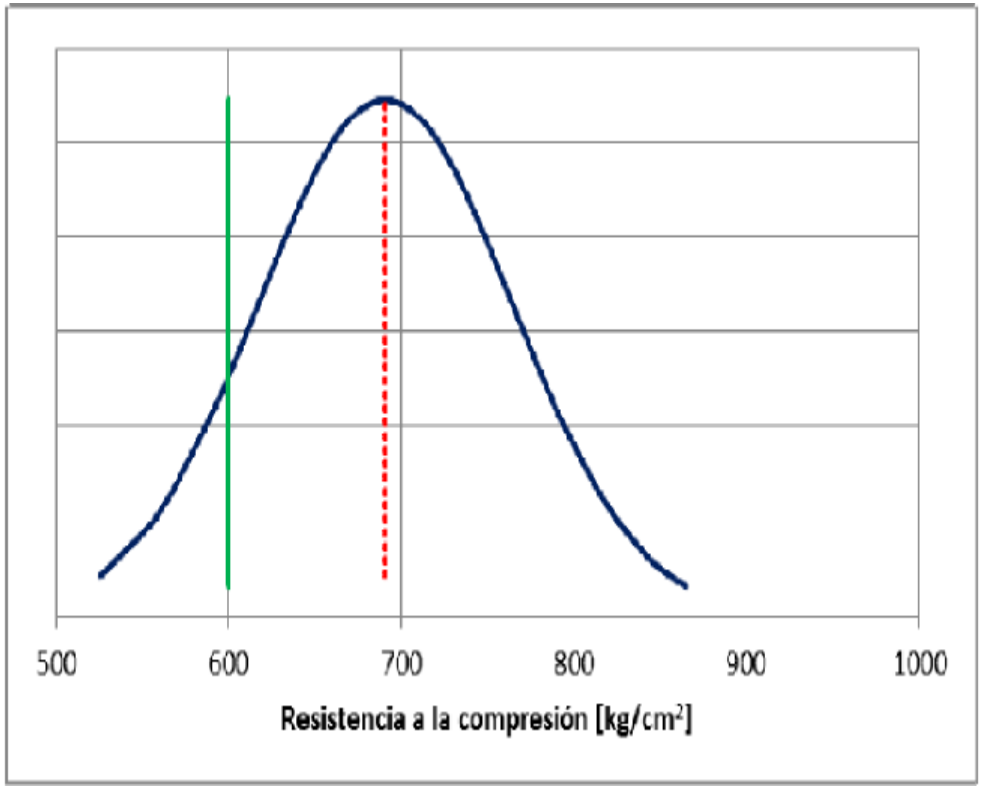
Edad: 28 días

- N=75
- Xm=650 [kg/cm^2]
- S=57 [kg/cm^2]
- V=9%



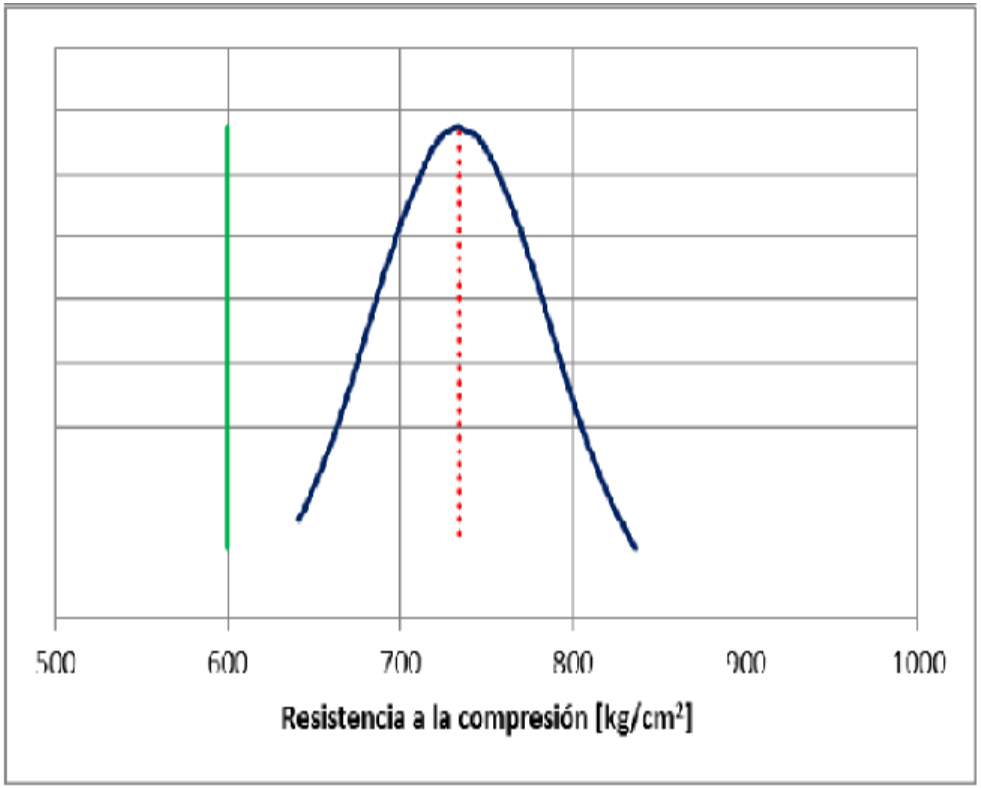
Edad: 56 días

- N=77
- Xm=691 [kg/cm^2]
- S=73 [kg/cm^2]
- V=11%



Edad: 91 días

- N=58
- Xm=734 [kg/cm^2]
- S=51 [kg/cm^2]
- V=7%



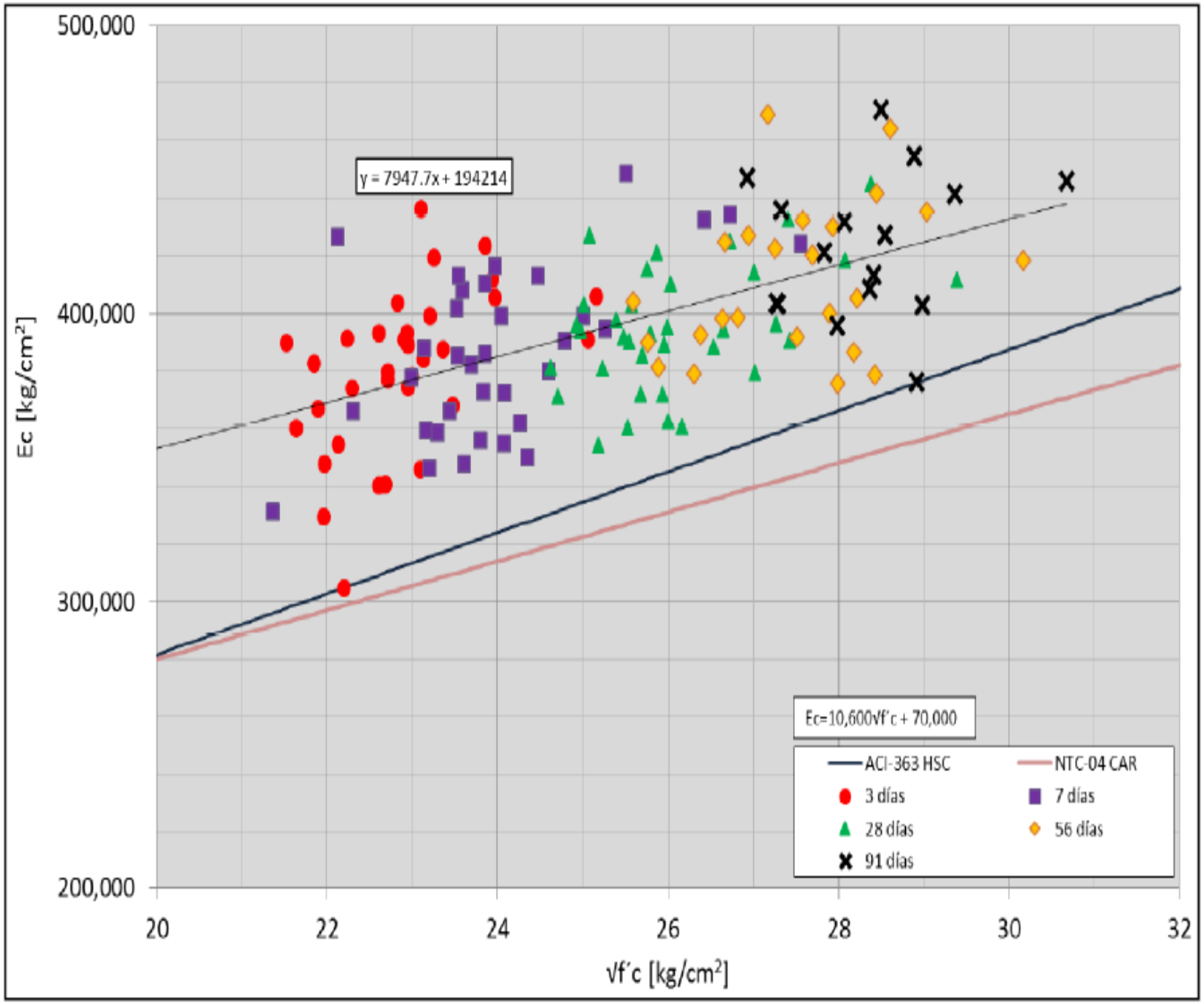


Figura 7. Módulos de elasticidad de los concretos suministrados

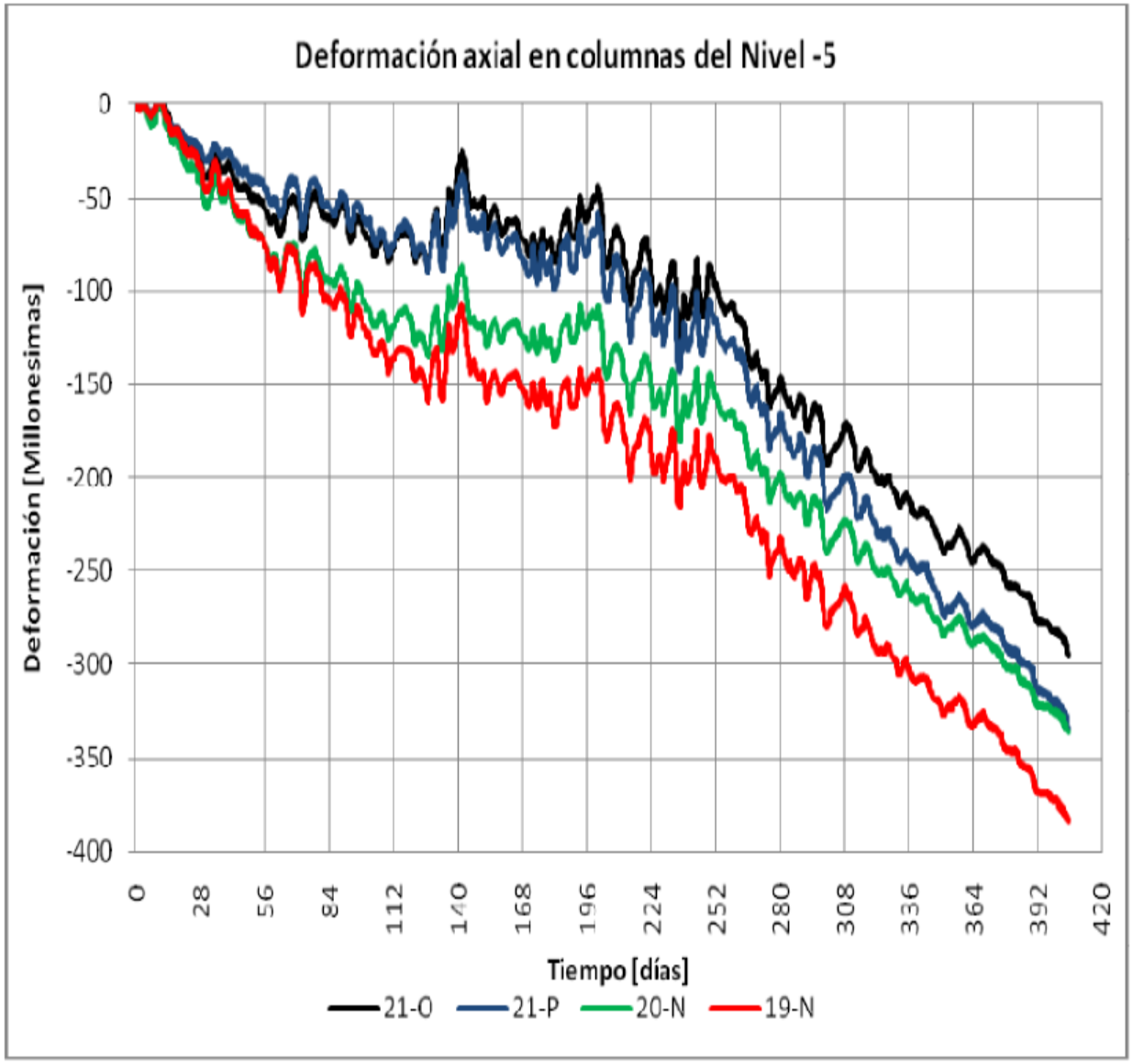


Figura 8. Deformación de columnas nivel N-5

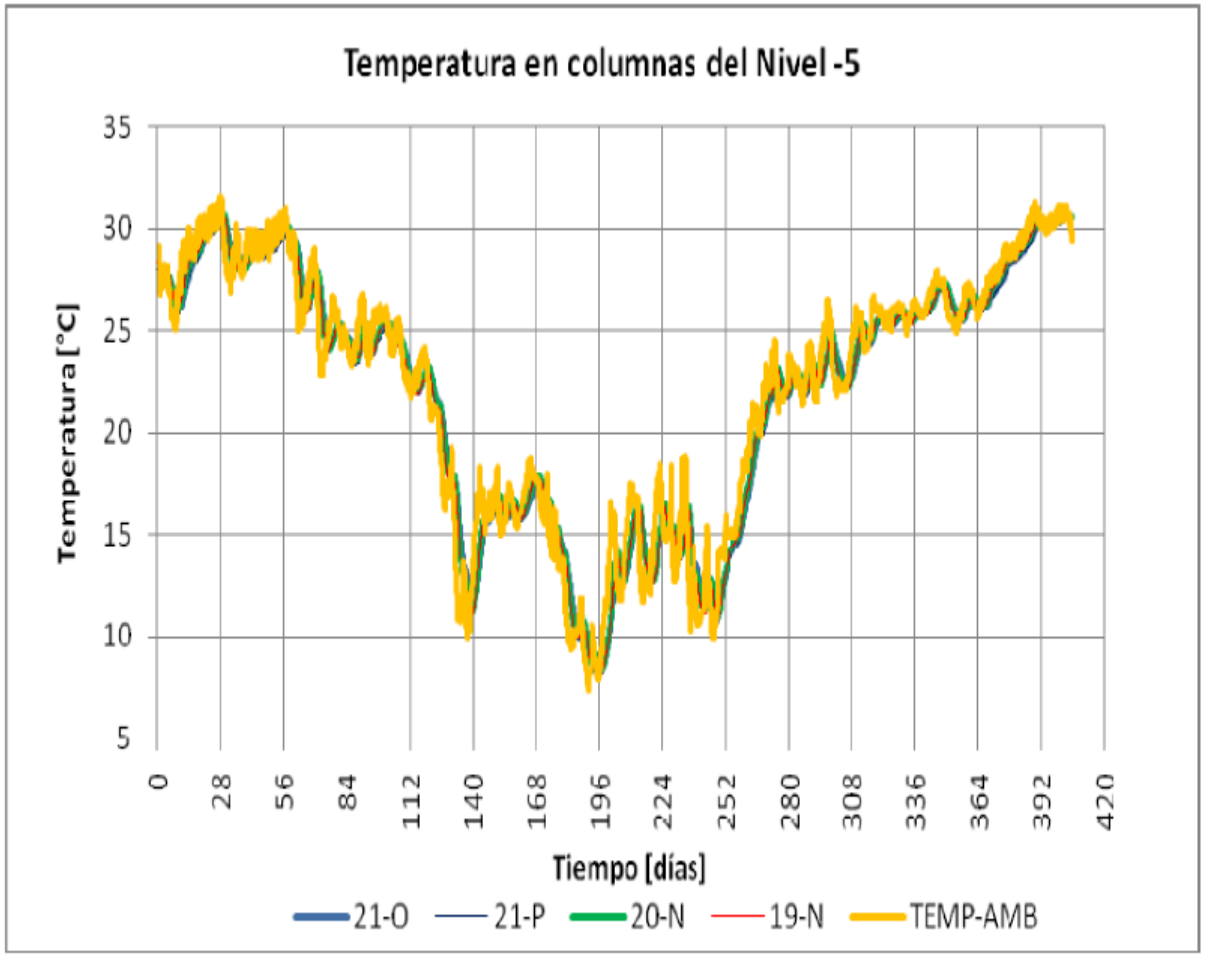


Figura 9. Temperatura de columnas nivel N-5

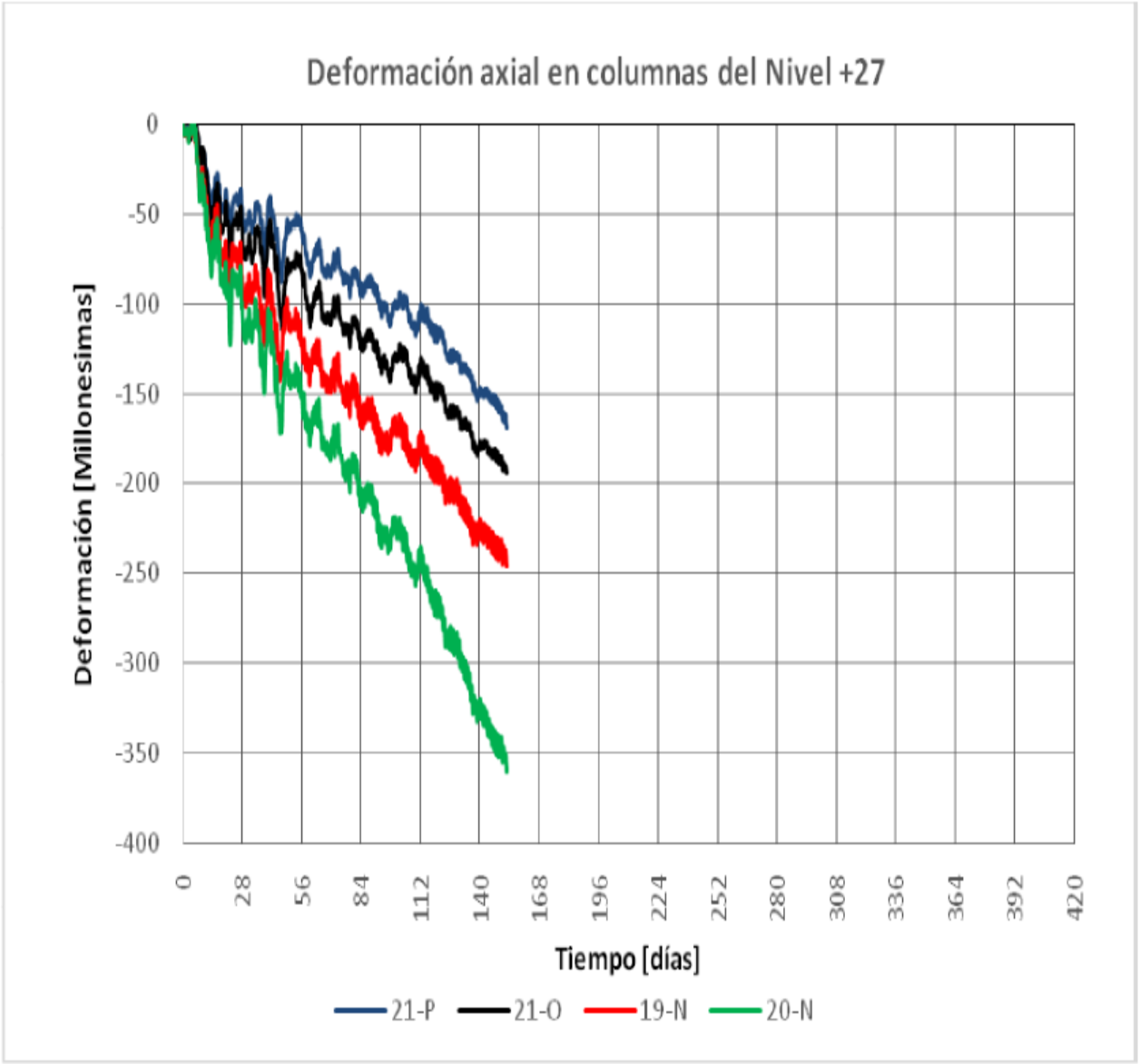


Figura 10. Deformación de columnas nivel N+27

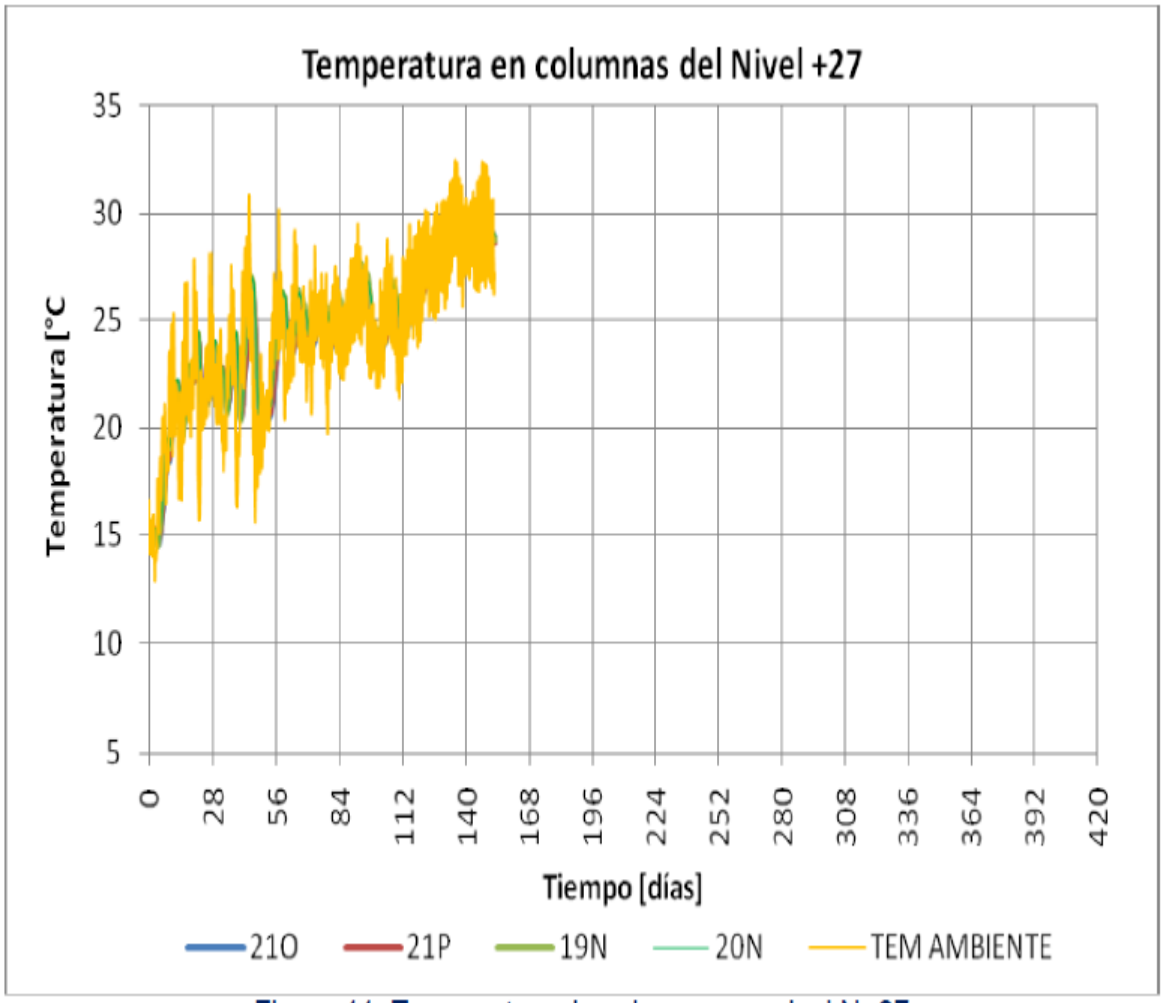
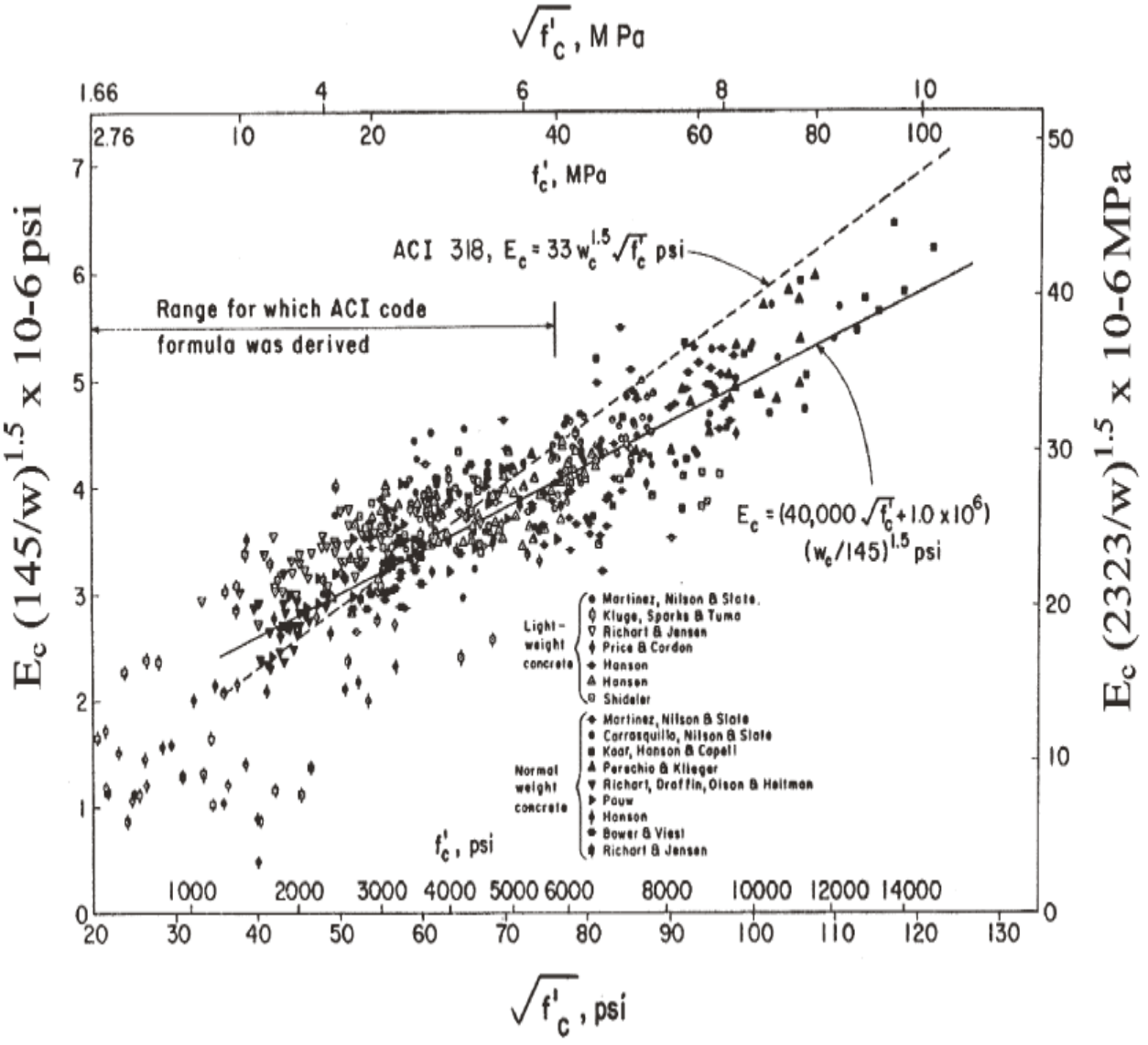
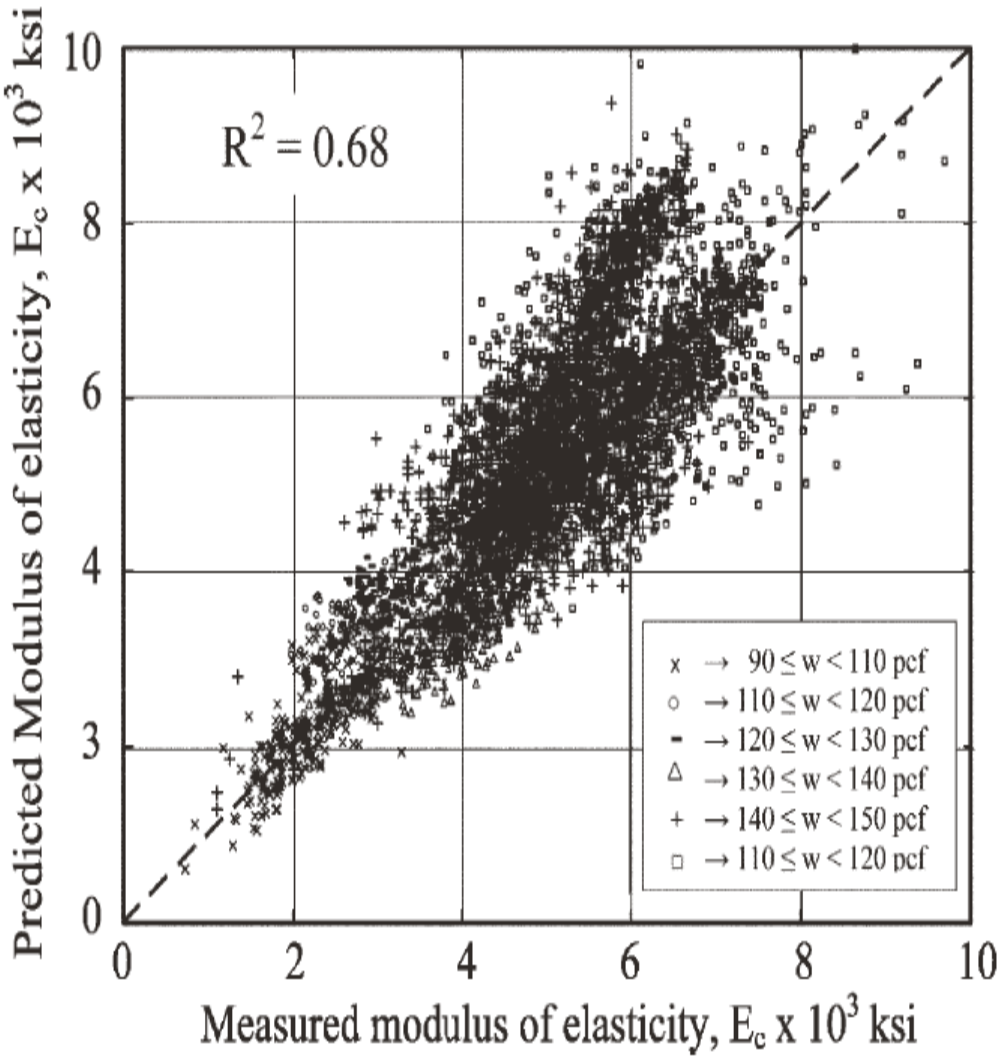
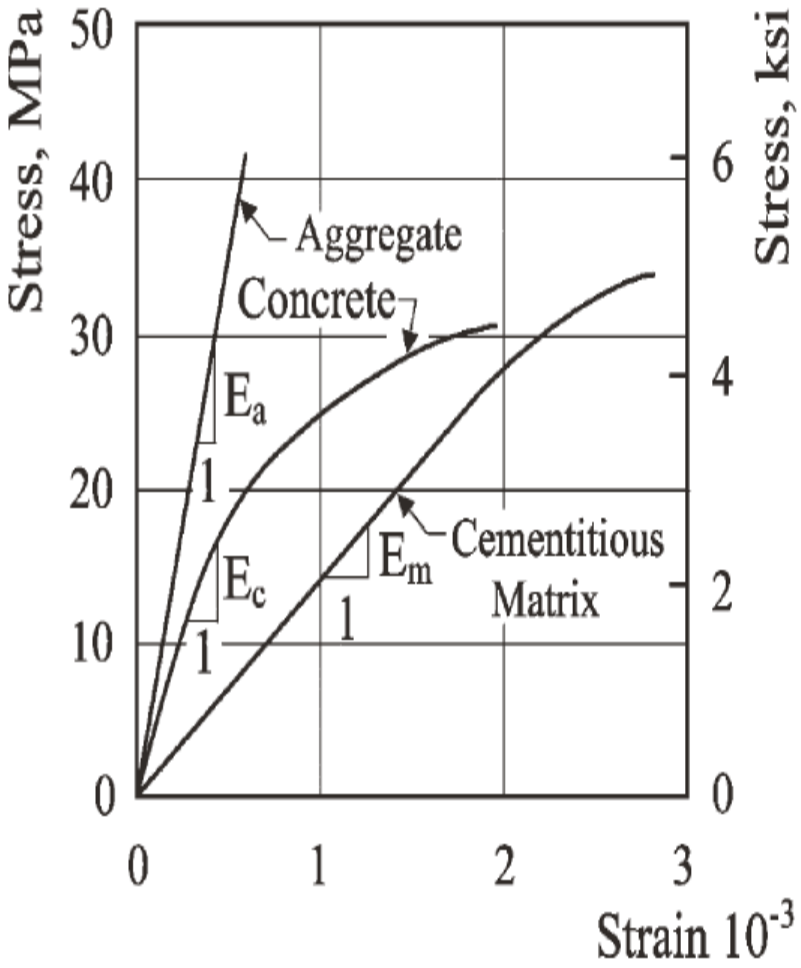


Figura 11. Temperatura de columnas en nivel N+27


√f'c, M Pa
1.66
4
6
8
10
2.76
10
20
40
60
80
100
f'c, MPa
Ec (145/w)^1.5 x 10-6 psi
Ec (2323/w)^1.5 x 10-6 MPa
ACI 318, Ec = 33 wc^1.5 √f'c psi
Range for which ACI code formula was derived
Ec = (40,000 √f'c + 1.0 x 10^6) (wc/145)^1.5 psi
Light-weight concrete
Martinez, Nilson & Slate
Kluge, Sparks & Tuma
Richart & Jansen
Price & Cordon
Hanson
Hansen
Shideler
Normal weight concrete
Martinez, Nilson & Slate
Carrasquillo, Nilson & Slate
Kaar, Hanson & Capell
Perechio & Klieger
Richart, Draffin, Olson & Holtman
Pauw
Hanson
Bower & Viest
Richart & Jansen
f'c, psi
1000
2000
3000
4000
5000
6000
8000
10000
12000
14000
20
30
40
50
60
70
80
90
100
110
120
130
√f'c, psi

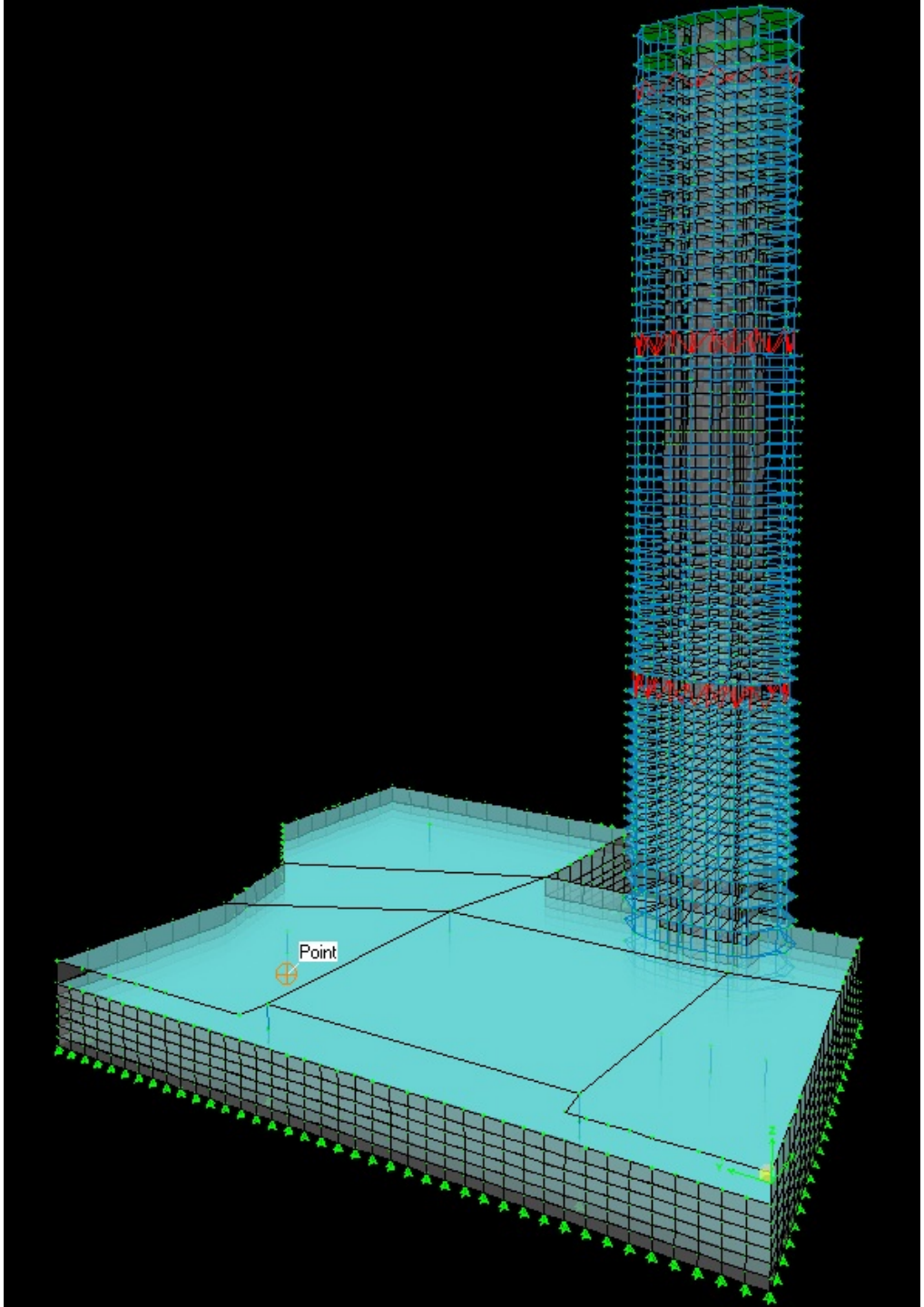

$R^2 = 0.68$
Predicted Modulus of elasticity, E_c x 10^3 ksi
Measured modulus of elasticity, E_c x 10^3 ksi
0
2
3
4
6
8
10
x → 90 ≤ w < 110 pcf
○ → 110 ≤ w < 120 pcf
▬ → 120 ≤ w < 130 pcf
△ → 130 ≤ w < 140 pcf
+ → 140 ≤ w < 150 pcf
□ → 110 ≤ w < 120 pcf

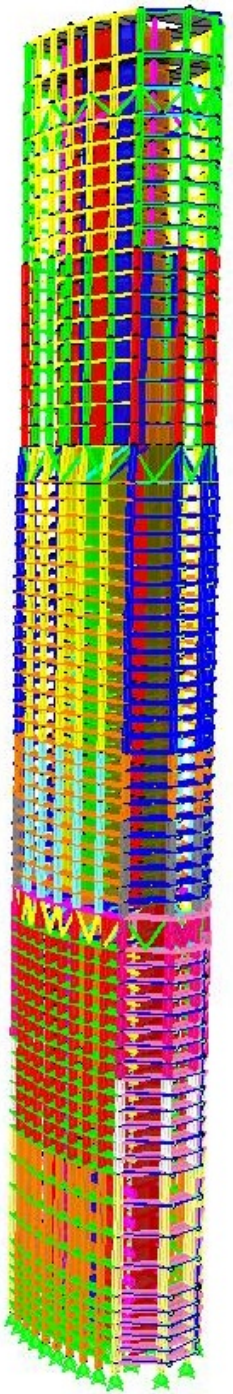


The term "cementitious matrix" include the Portland cement plus, fly ash, granulated blast-furnace slag, raw or calcined natural pozzolans, silica fume, chemical admixtures, air entrained, and the combined water.

Mitikah

MEXICO CITY


Point



02

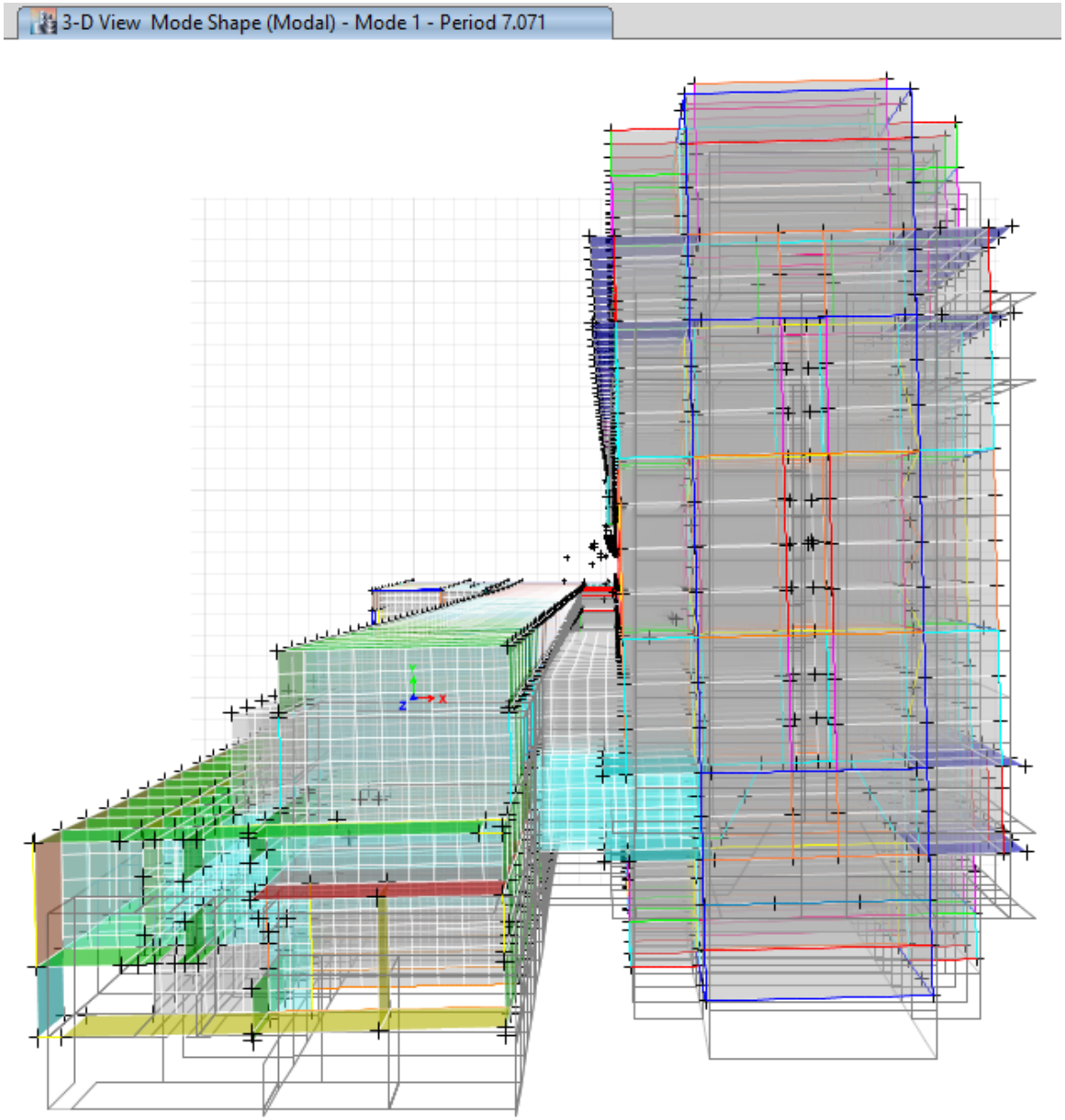
VISUALIZACIÓN ARQUITECTÓNICA

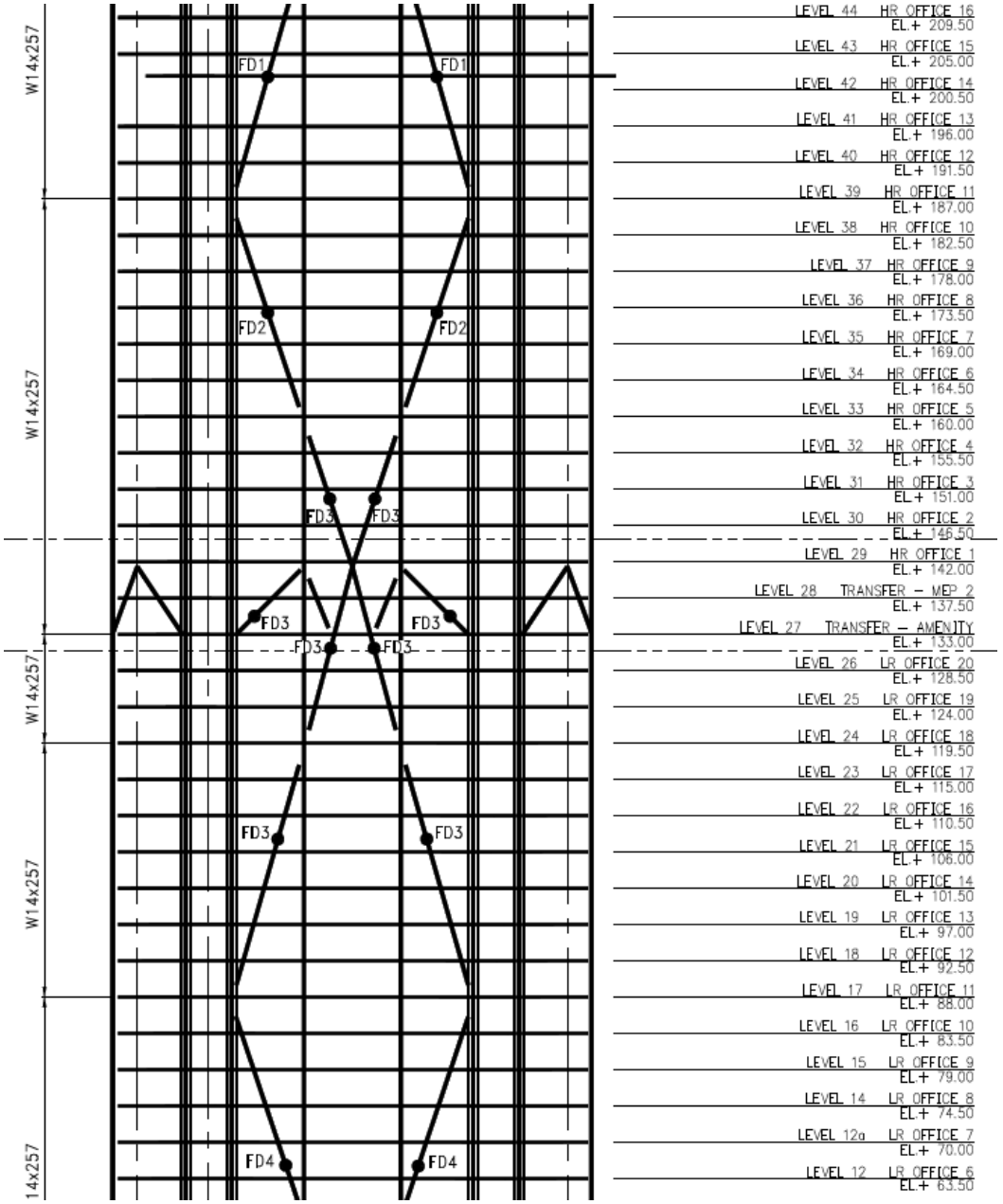
FOSTER&PARTNERS / TORRE REFORMA 432 - MÉXICO / RENDER 24STUDIO

Modal Analysis

TABLE: Modal Participating Mass Ratios				
Case	Mode	Period	UX	UY
		sec		
Modal	1	7.071	0.019	0.463
Modal	2	5.579	0.3783	0.0274
Modal	3	4.776	0.0626	0.0002
Modal	4	2.188	0.0014	0.1074
Modal	5	1.652	0.018	0.0095
Modal	6	1.288	0.1087	0.0024
Modal	7	1.207	0.0149	0.0587
Modal	8	0.842	0.0079	0.0109
Modal	9	0.755	2.179E-06	0.0164
Modal	10	0.598	0.0617	7.837E-06
Modal	11	0.575	0.0011	0.0105
Modal	12	0.554	0.0001	0.011
Modal	13	0.412	5.00E-04	0.0039
Modal	14	0.398	0.018	0.0071
Modal	15	0.371	0.022	0.0035
Modal	16	0.335	0.0007	0.0037
Modal	17	0.296	0.0061	0.0067
Modal	18	0.263	0.0231	0.0043
Modal	19	0.252	0.0008	0.0048
Modal	20	0.237	0.0049	0.0166
Modal	21	0.223	0.0057	0.0008
Modal	22	0.205	0.0002	0.0116
Modal	23	0.2	0.0026	0.0001
Modal	24	0.195	0.0059	0.0114
Modal	25	0.188	0.0154	0.0096
Modal	26	0.168	0.0008	0.0323
Modal	27	0.155	0.0347	0.0157
Modal	28	0.148	0.0116	0.0373
Modal	29	0.131	0.0146	0.034
Modal	30	0.125	0.0548	0.0135
Modal	31	0.104	0.0227	0.0071
Modal	32	0.099	0.0144	0.0077
Modal	33	0.069	0.0178	0.0005
Modal	34	0.057	0.0005	0.0198
Modal	35	0.035	0.0305	0.0042
Modal	36	0.033	0.0071	0.0189
		Suma	0.989	0.993

Vibration Modes

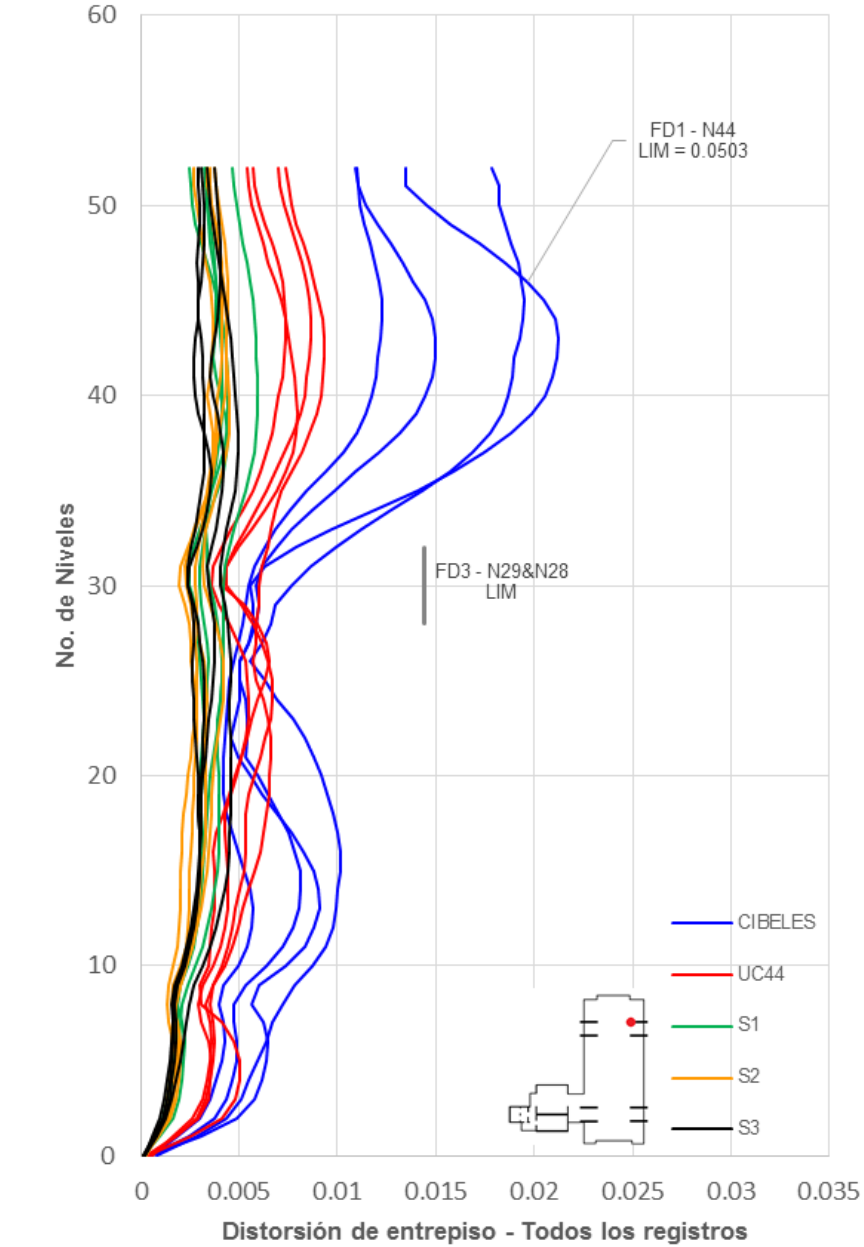


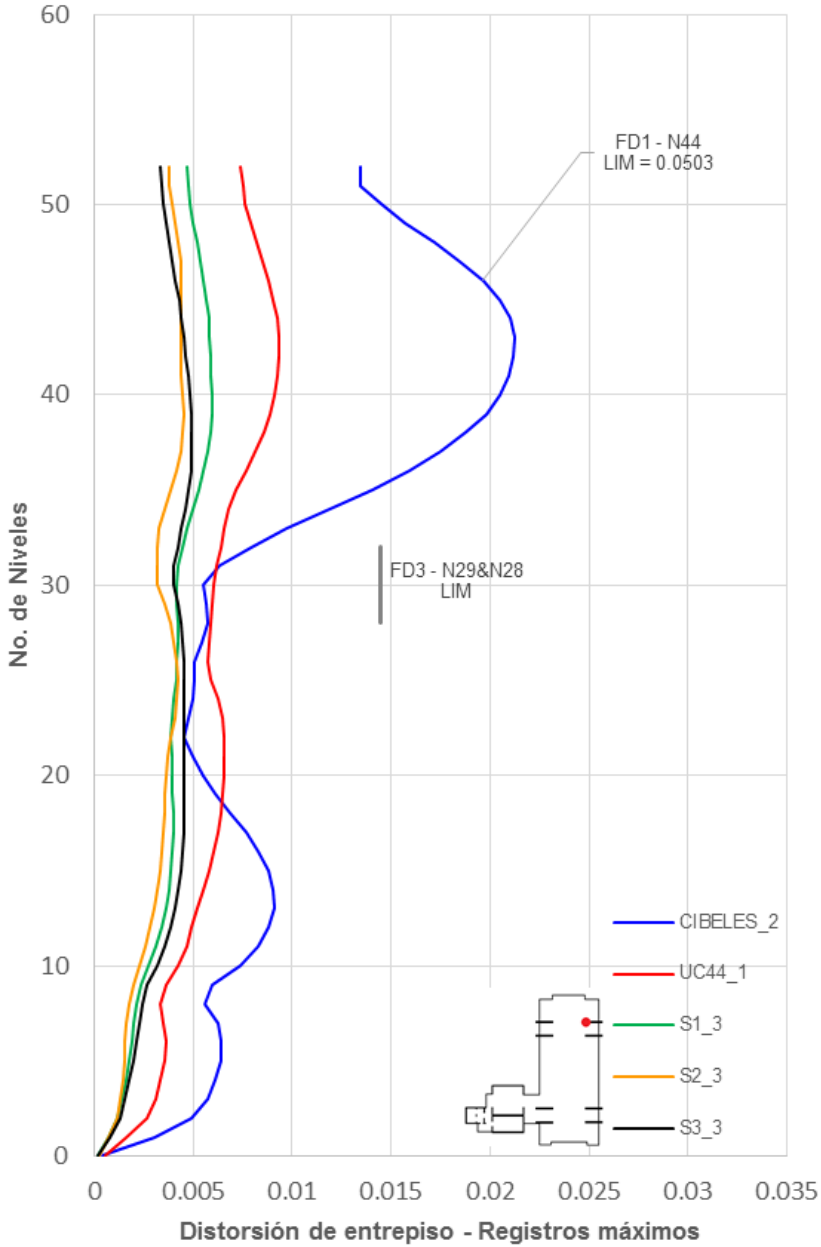


PROPERTIES OF FRICTION DAMPERS

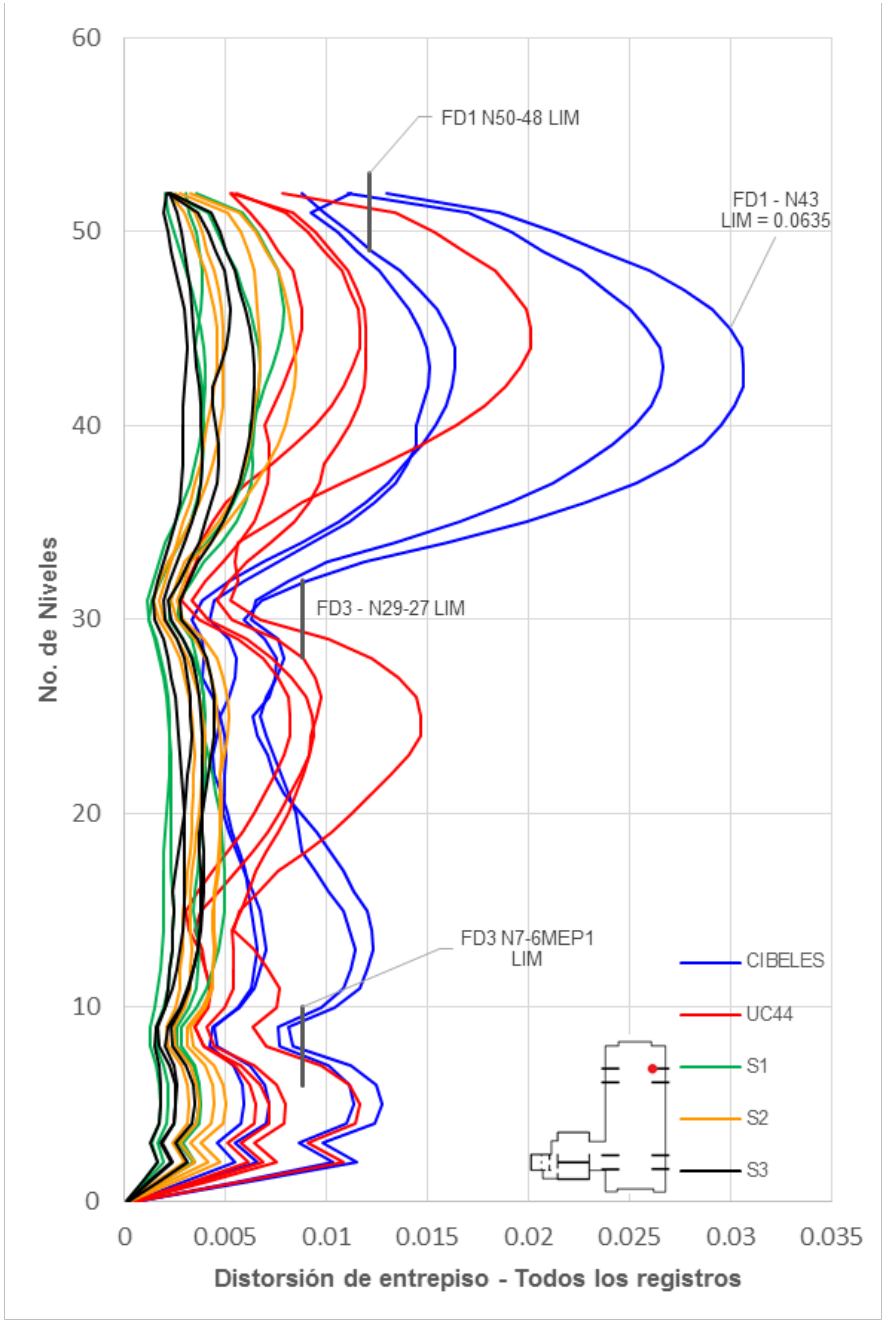
DAMPER	SLIP LOAD (kip)	STROKE (in)
FD1	1100	+/– 3
FD2	1300	+/– 3
FD3	1650	+/– 2
FD4	1950	+/– 2

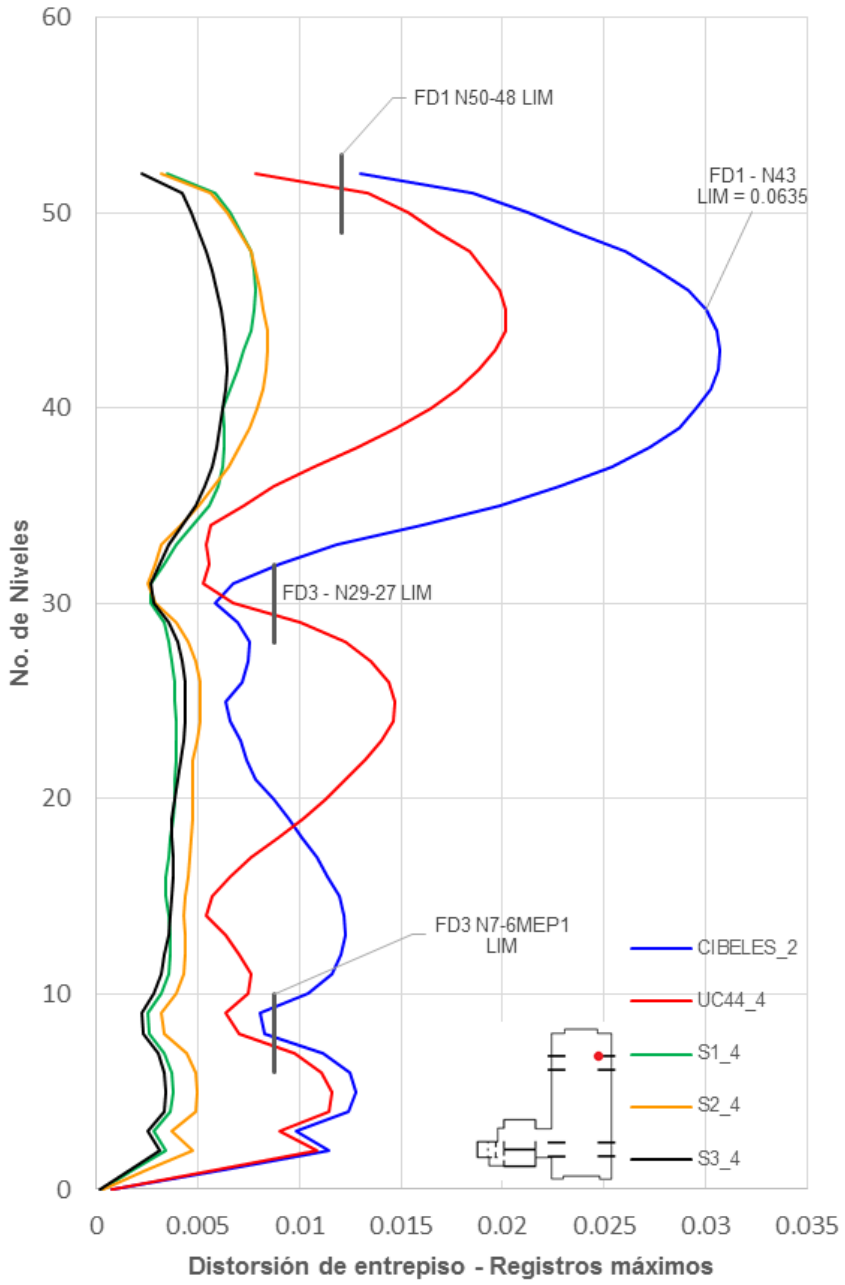
Distorsiones de Entrepiso - Dirección X



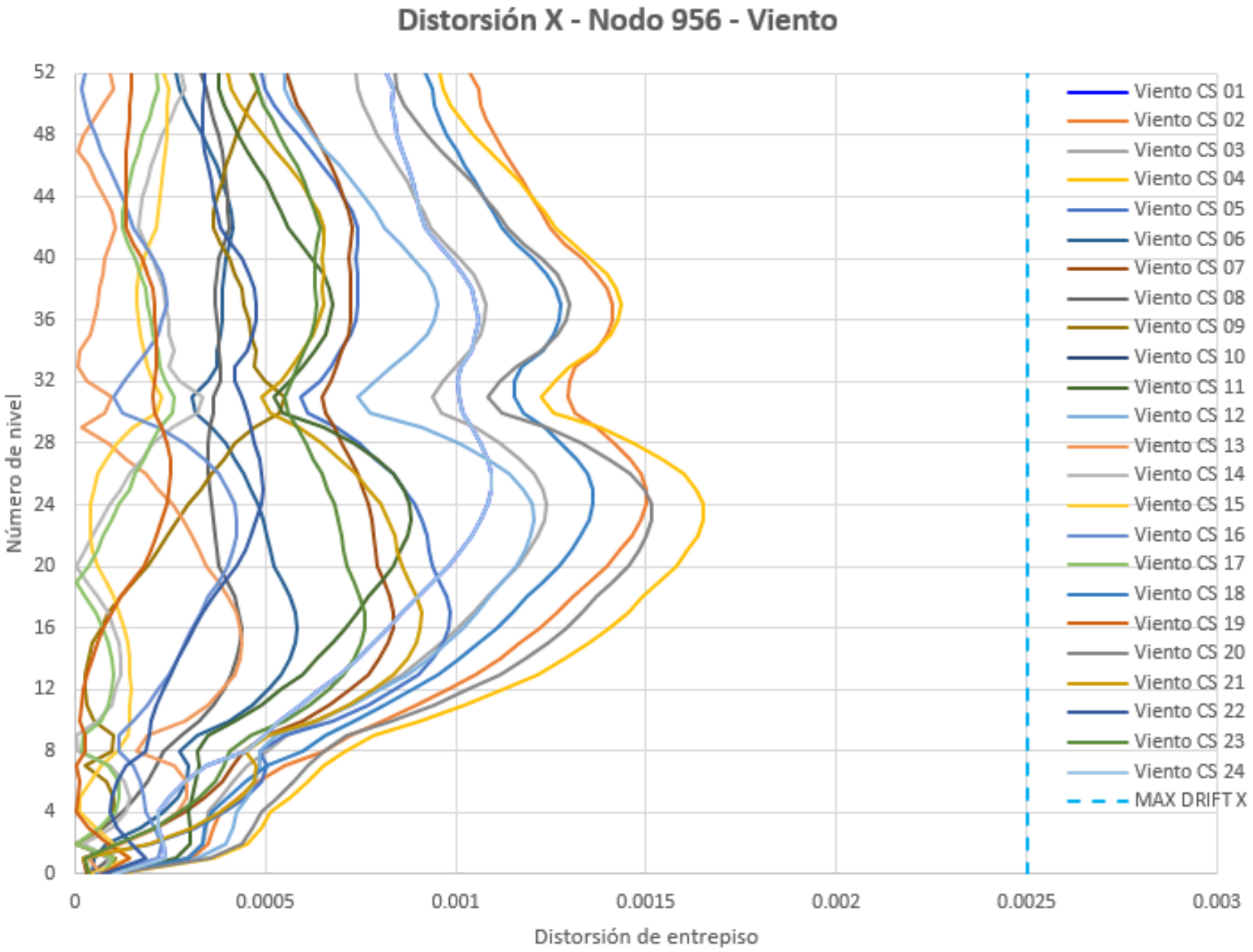


Distorsiones de Entrepiso - Dirección Y

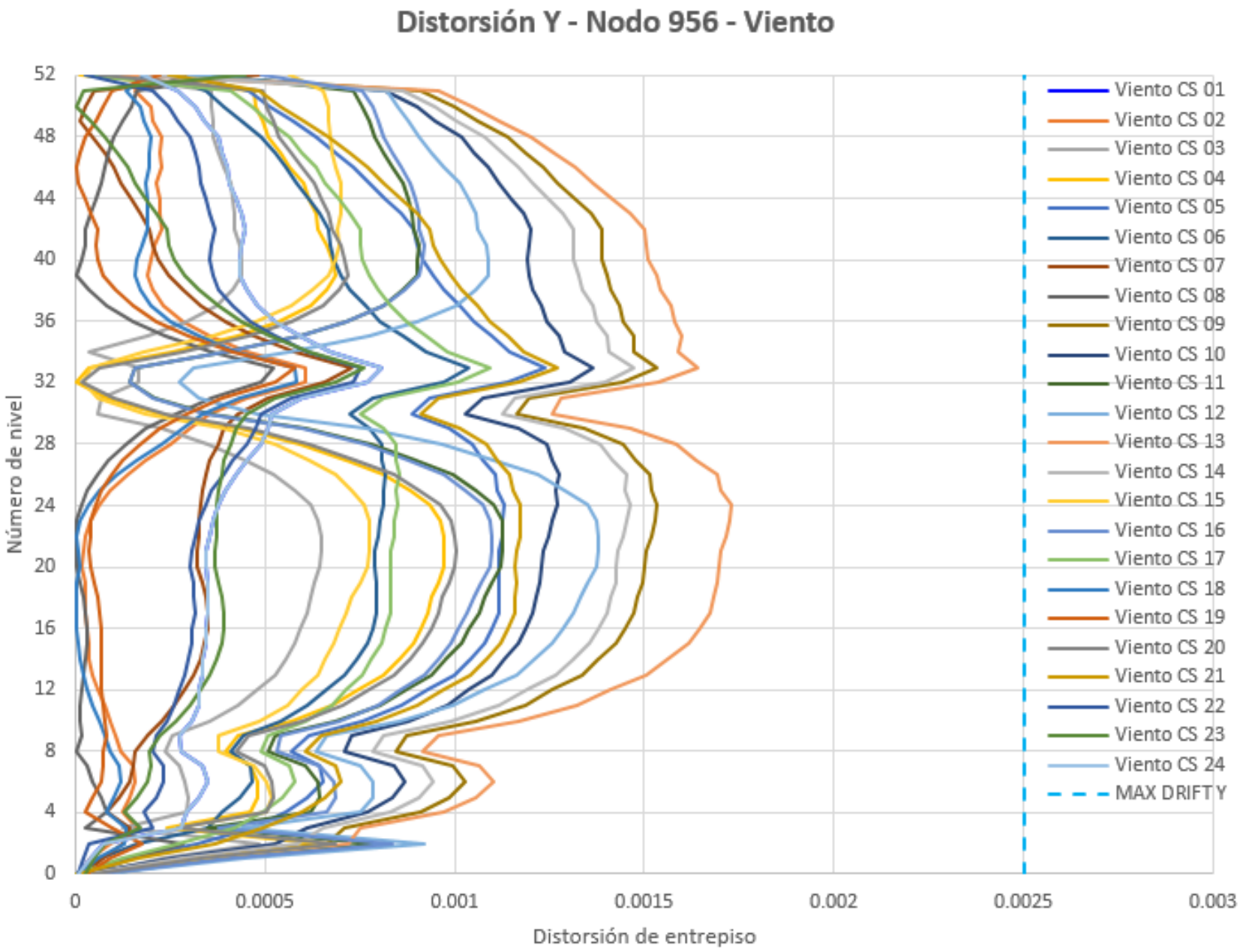


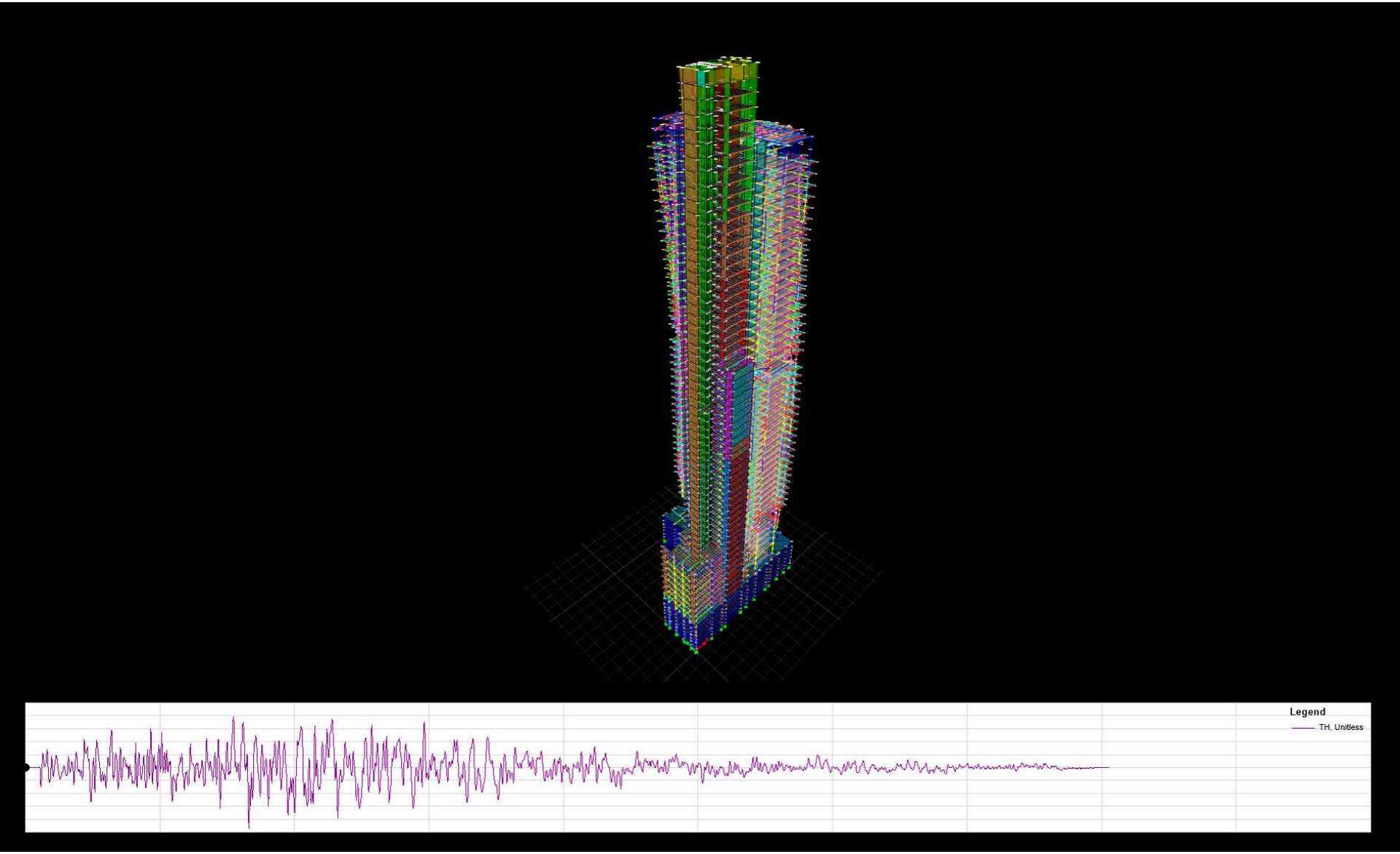


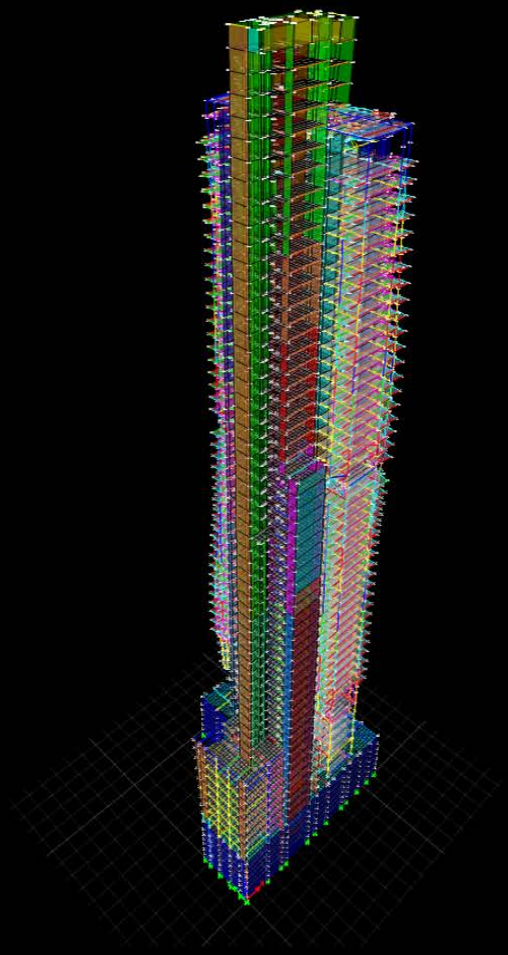
Distorsiones de Entrepiso por Viento

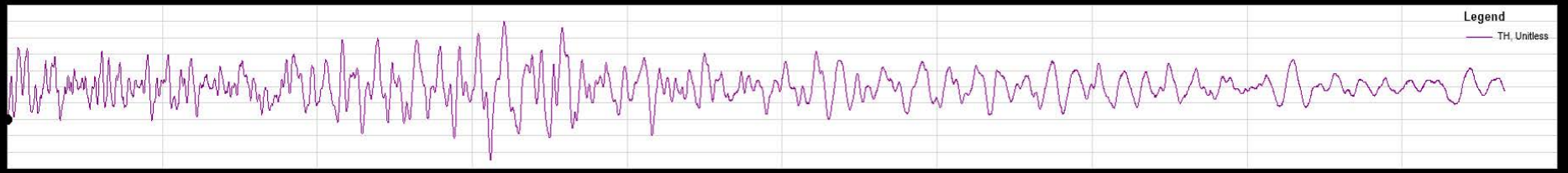


Distorsiones de Entrepiso por Viento




Legend
TH, Unitless

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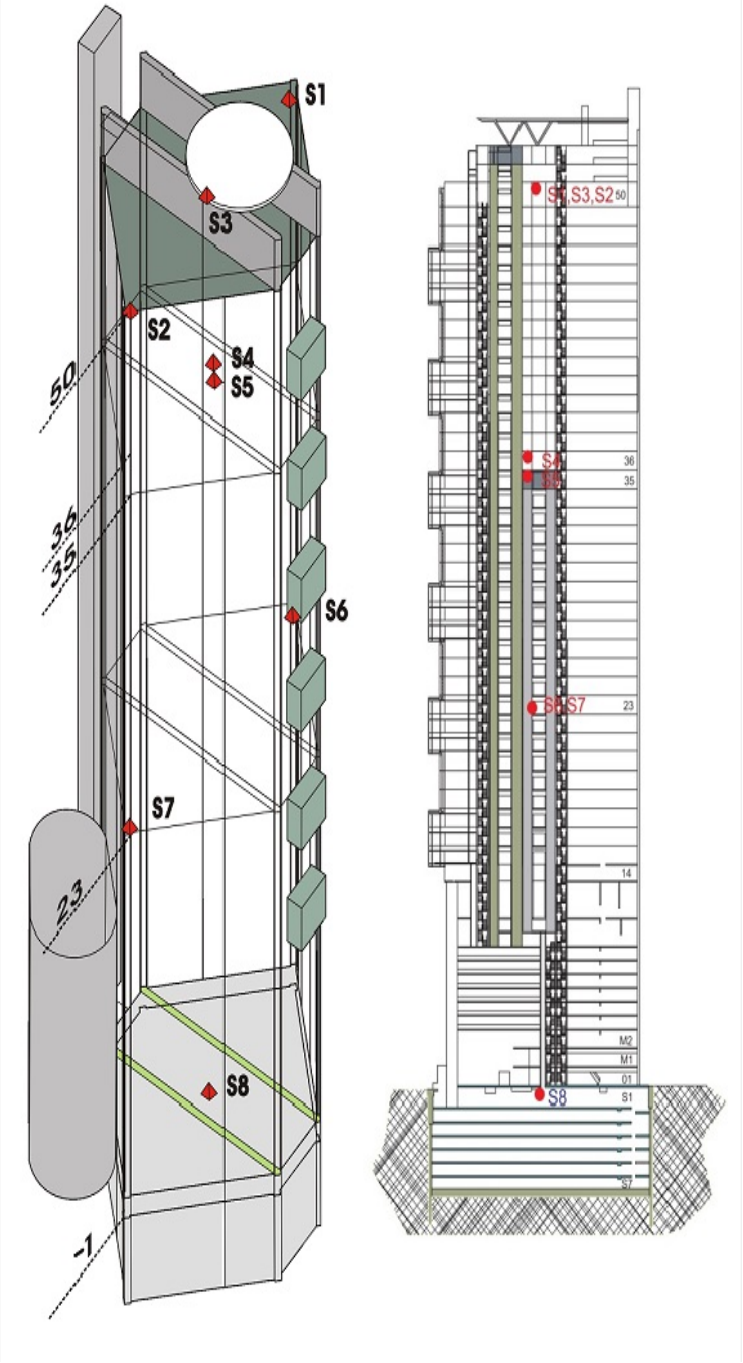
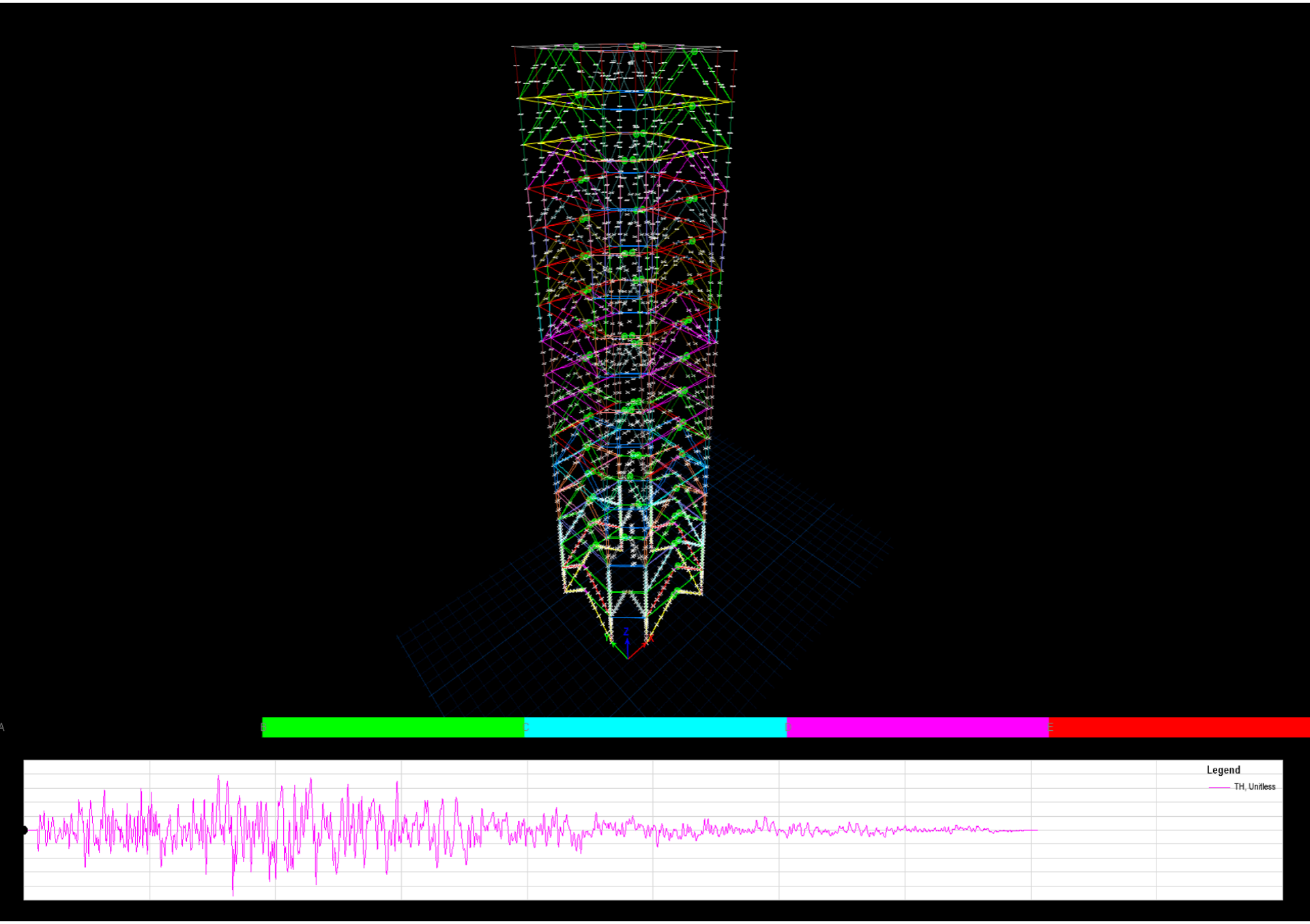
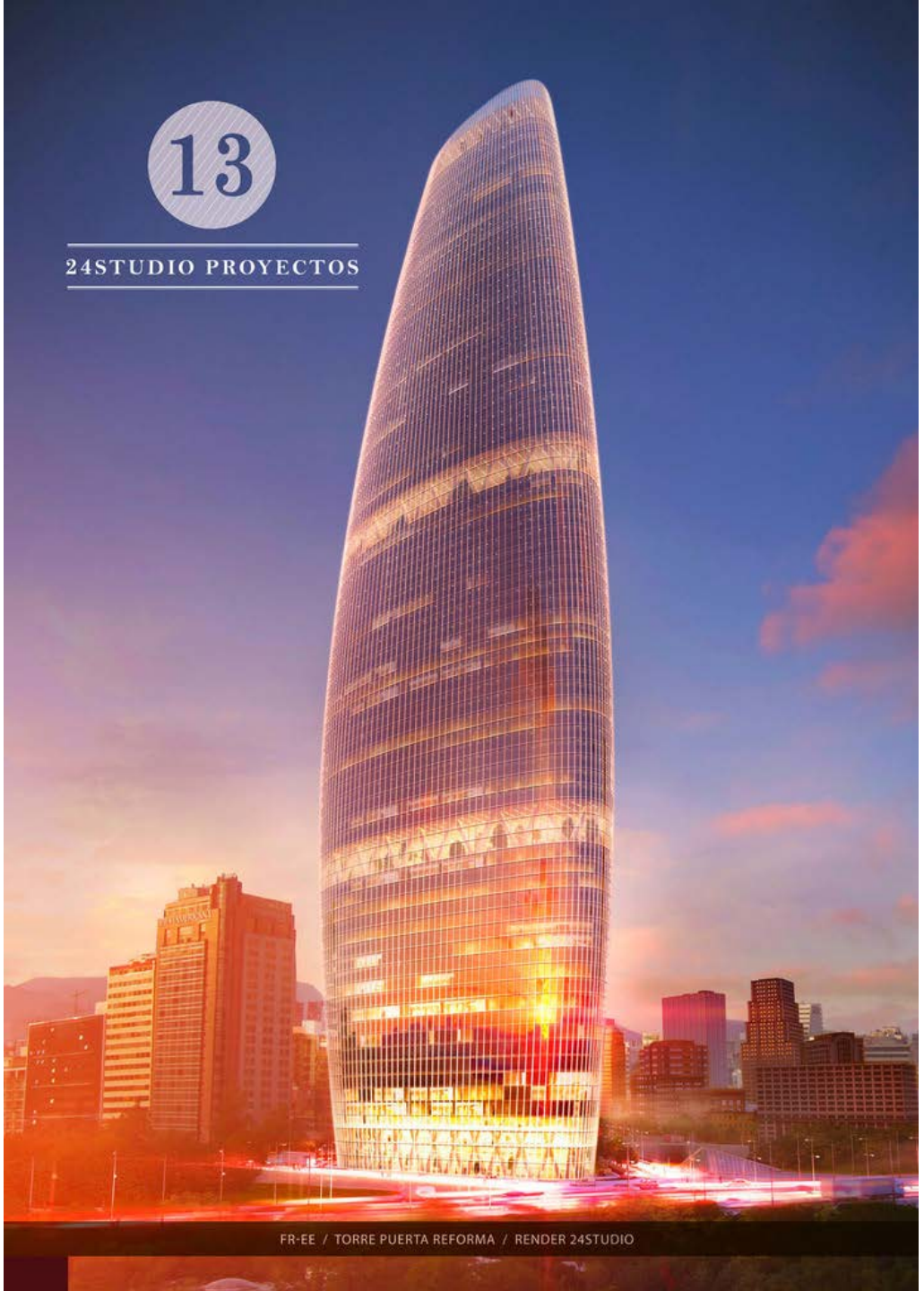
TH, Unitless


S1
S3
S2
S4
S5
50
36
35
S6
S7
23
S8
-1
S1,S3,S2
50
S4
36
S5
35
S6,S7
23
14
M2
M1
01
S1
S8
S7


Legend
TH, Unitless

13

24STUDIO PROYECTOS



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Obrigado !!

Ready for questions ???