DESAFIOS EM EDIFICIOS ESPECIAIS

VENTO – TUNEL DE VENTO

CARGAS MINIMAS SISMO

RESISTÊNCIA AO FOGO

DESEMPENHO ELUs ELSs

ANÁLISE DINÂMICA

2ª ORDEM: **g**z / P-Delta

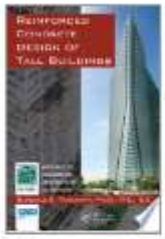
ANÁLISE INCREMENTAL

TORÇÃO

Sistema Estrutural para Edficios de Concreto

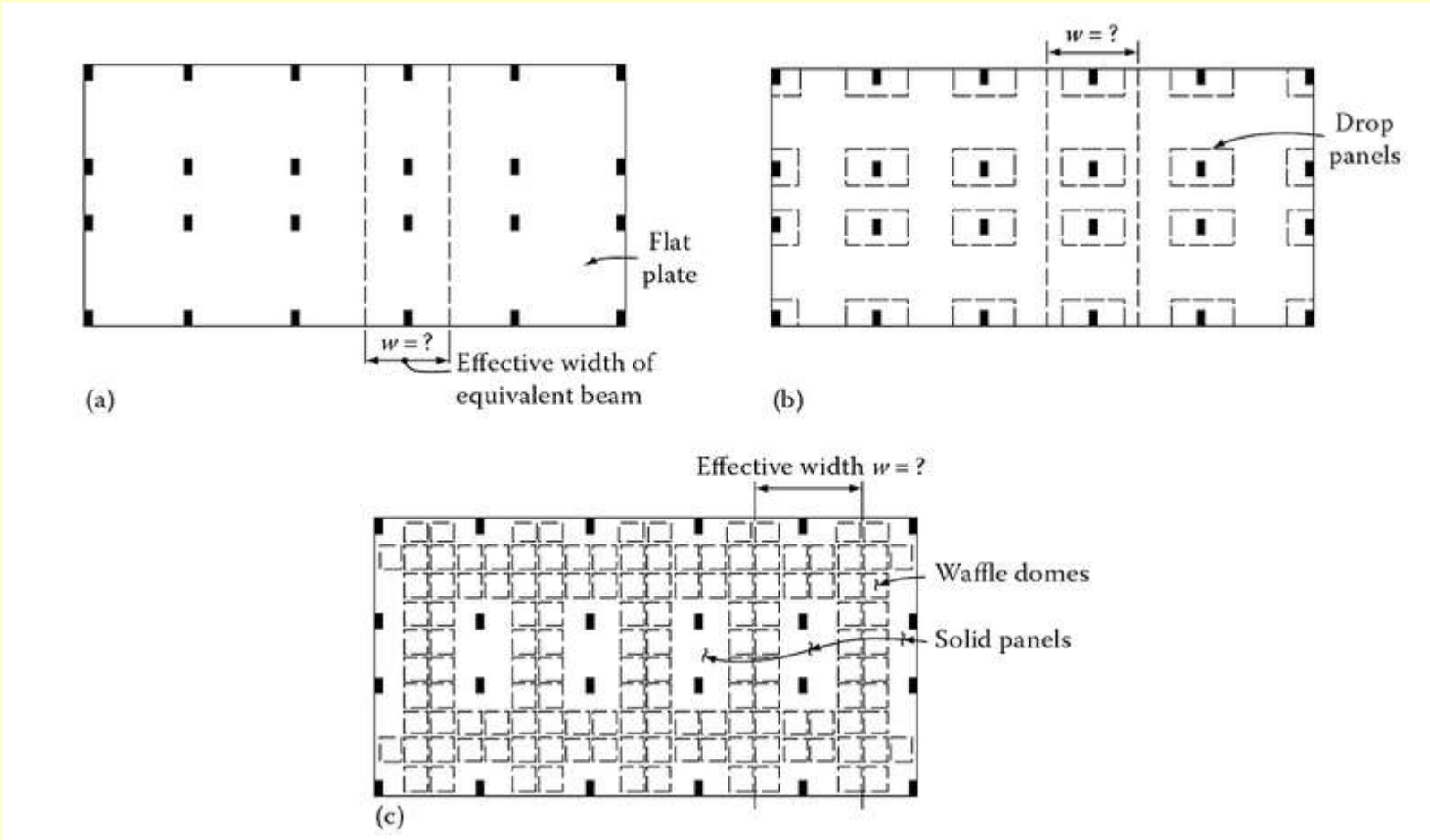
Numero de Andares

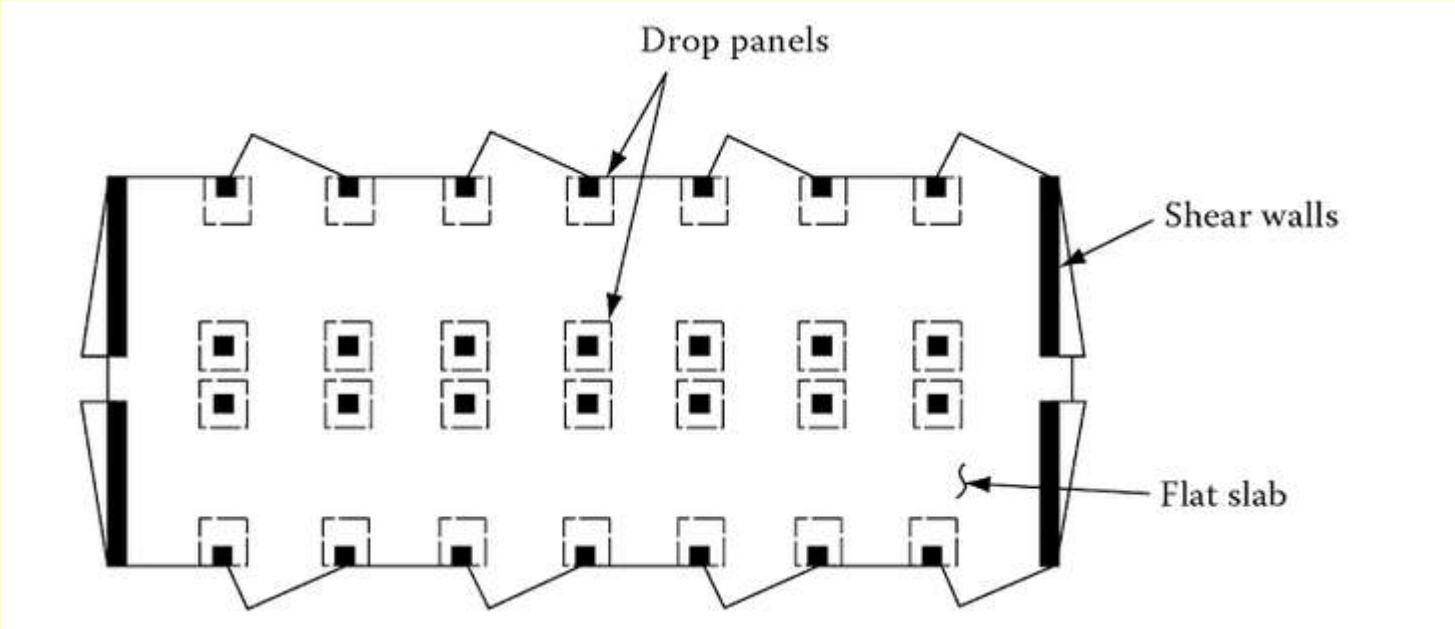
Sistema	10	20	30	40	50	60	70	80	90	100	110	120-200
Laje plana com colunas												
Laje plana com pilar parede												
Laje plana com pilar parede e colunas												
Vigas e pilares parede acoplados												
Portico rigido												
Tubo no perimetro com elementos espaçados												
Portico rigido com vigas misuladas												
Estruturas suportadas pelo Core												
Pilares parede e porticos												
Pilares parede e porticos com vigas misuladas												
Tubo no perimetro com elementos proximos												
Tube no perimetro com pilares parede no Core												
Tube no perimetro com diagonais												
Tubos Modulares com sistema de "Coluna Vertebral"												

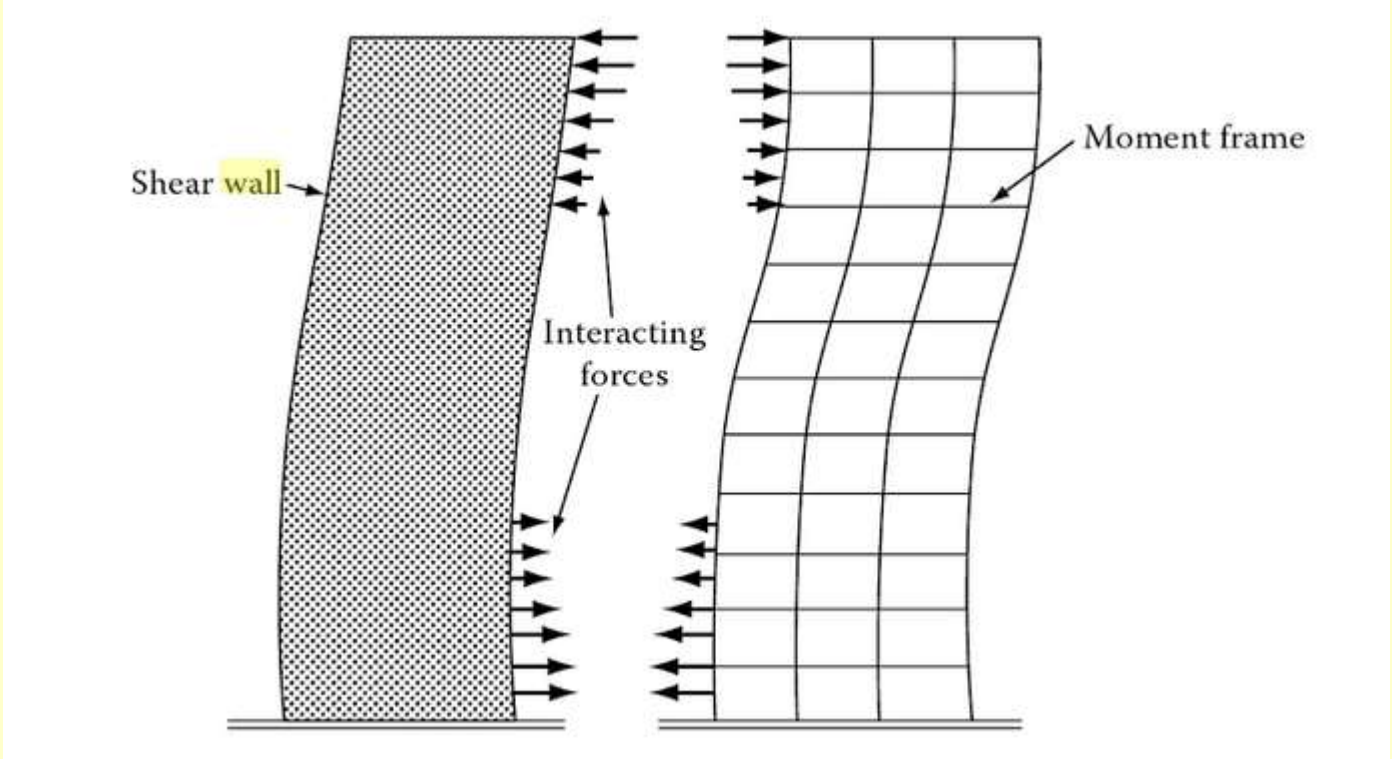


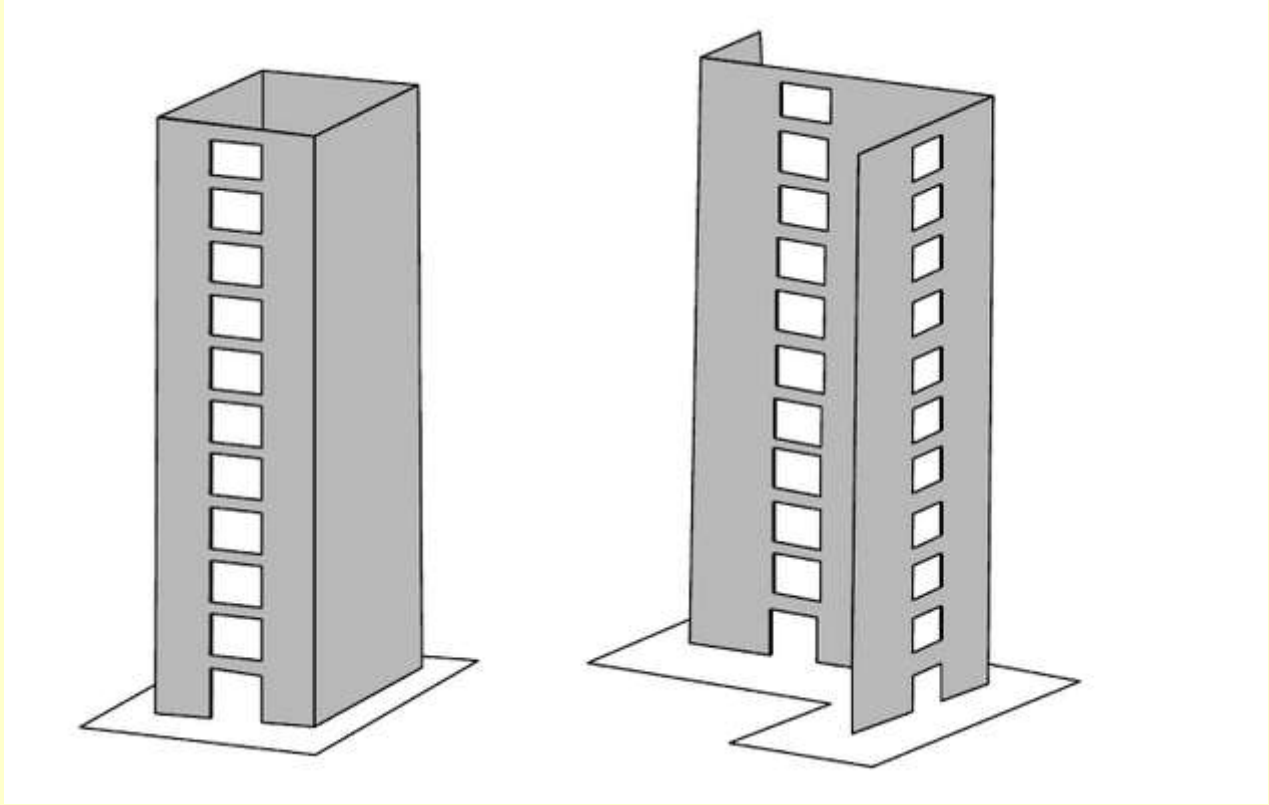
Reinforced Concrete Design of Tall Buildings

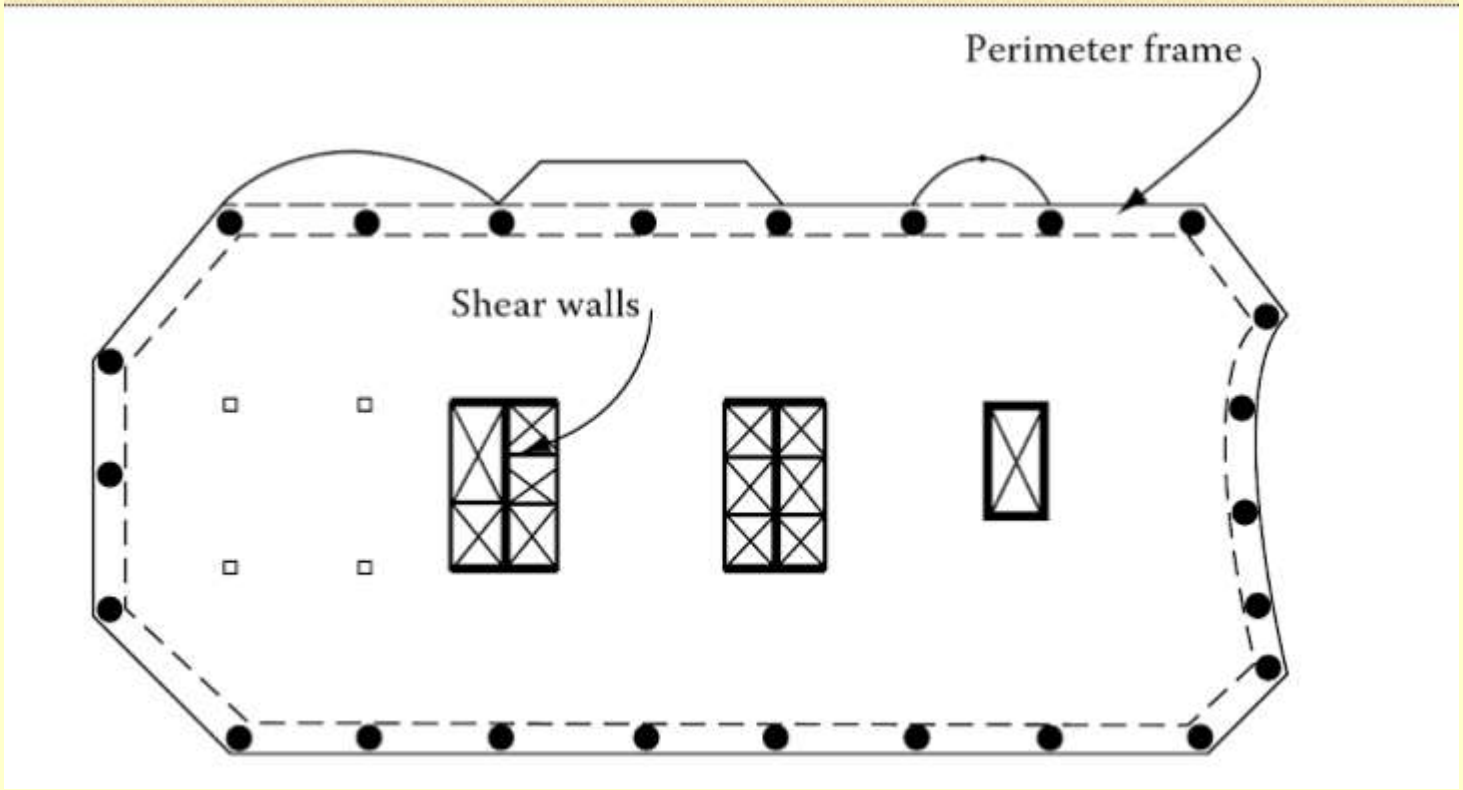
Por Bungale S. Taranath

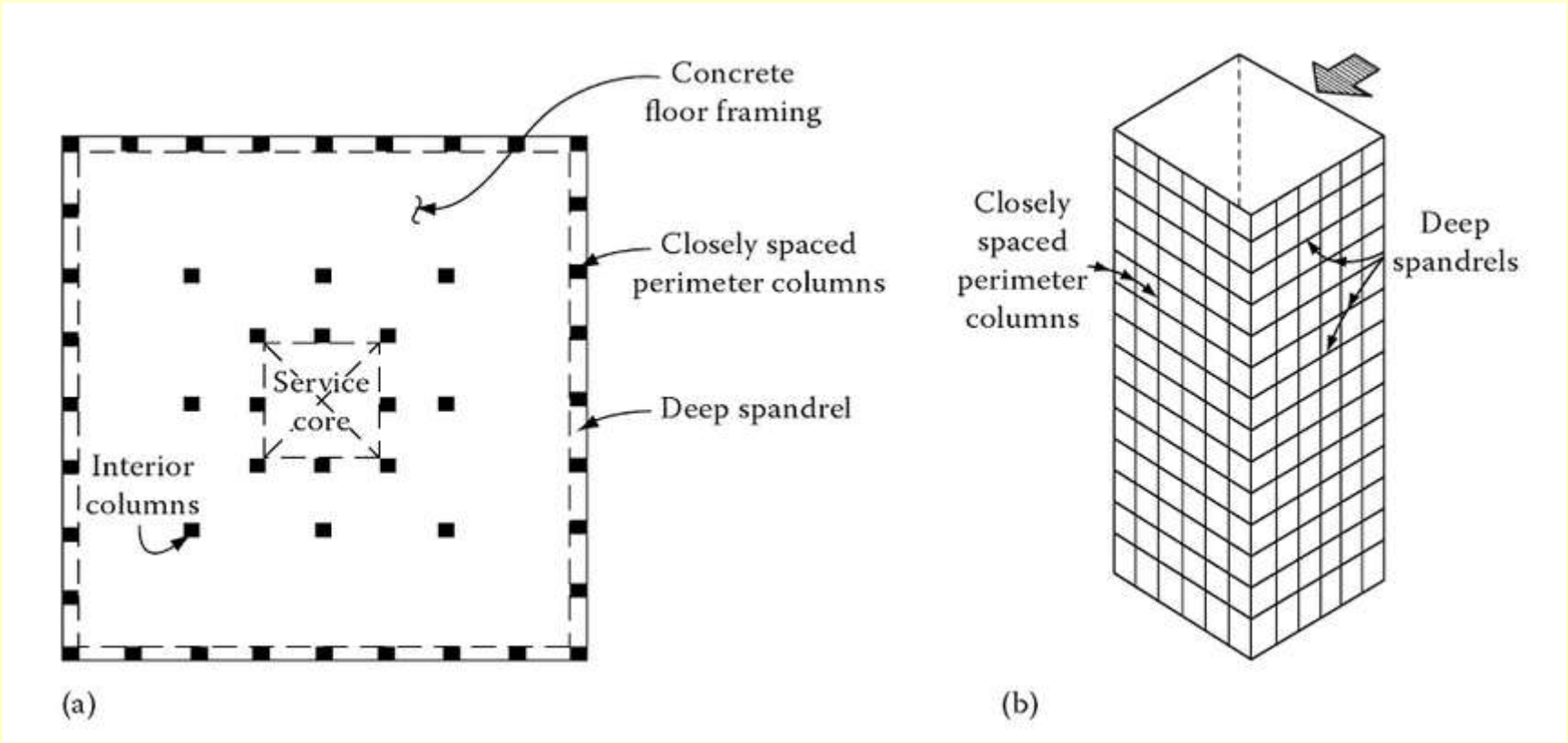

Flat
plate
w = ?
Effective width of
equivalent beam
(a)
w = ?
Drop
panels
(b)
Effective width w = ?
Waffle domes
Solid panels
(c)

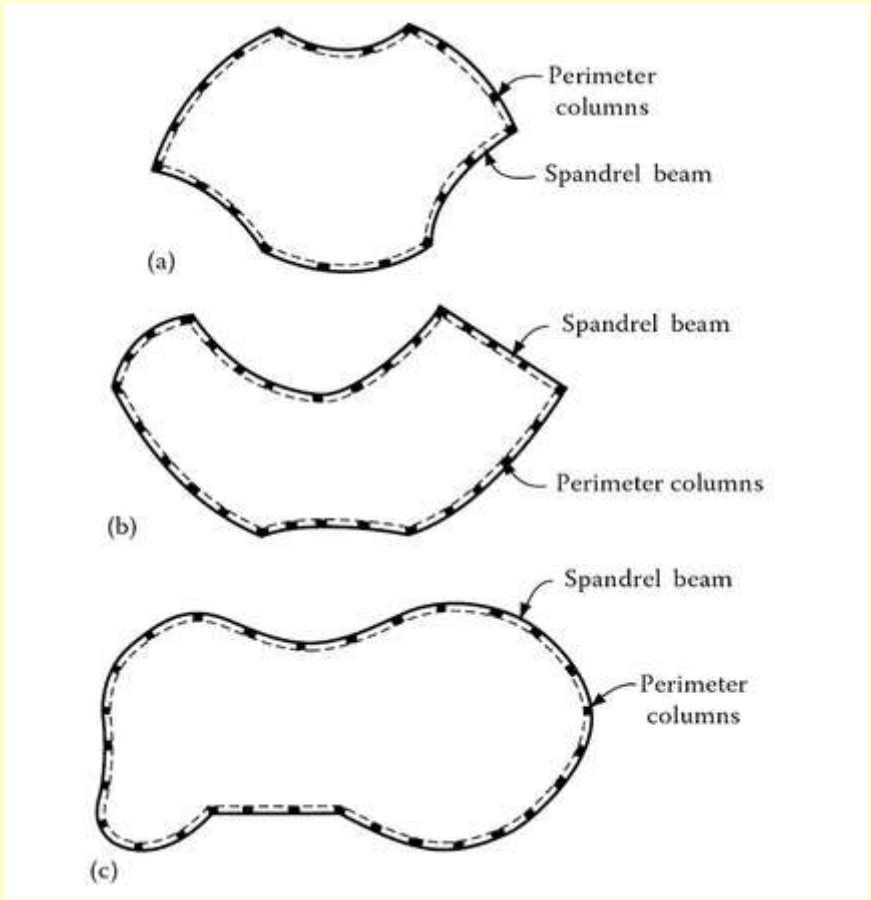

Drop panels
Shear walls
Flat slab

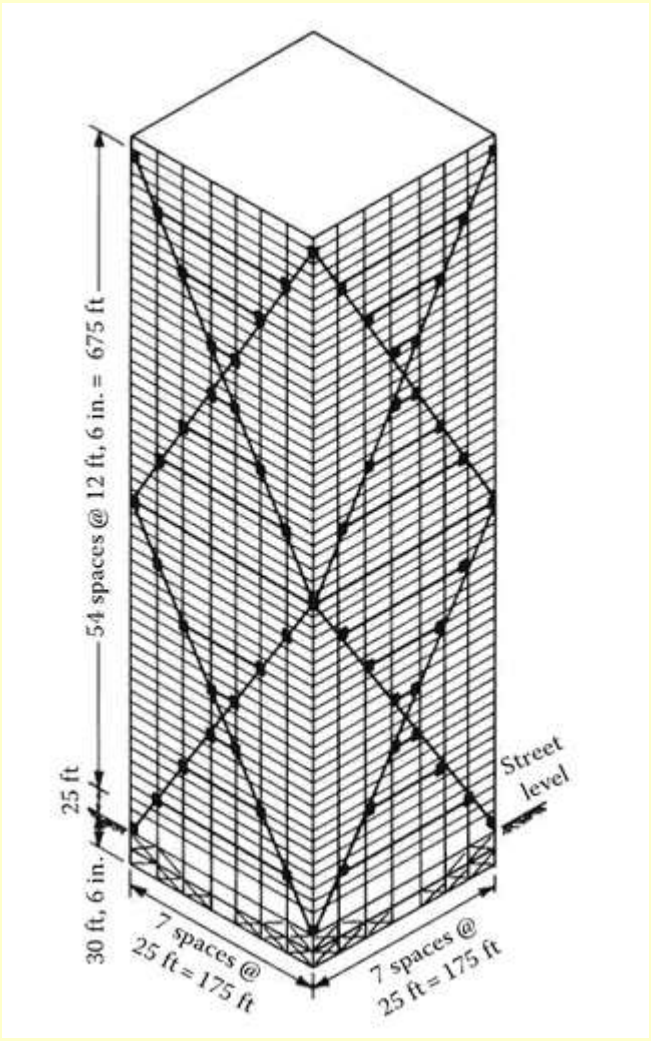

Shear wall
Interacting forces
Moment frame

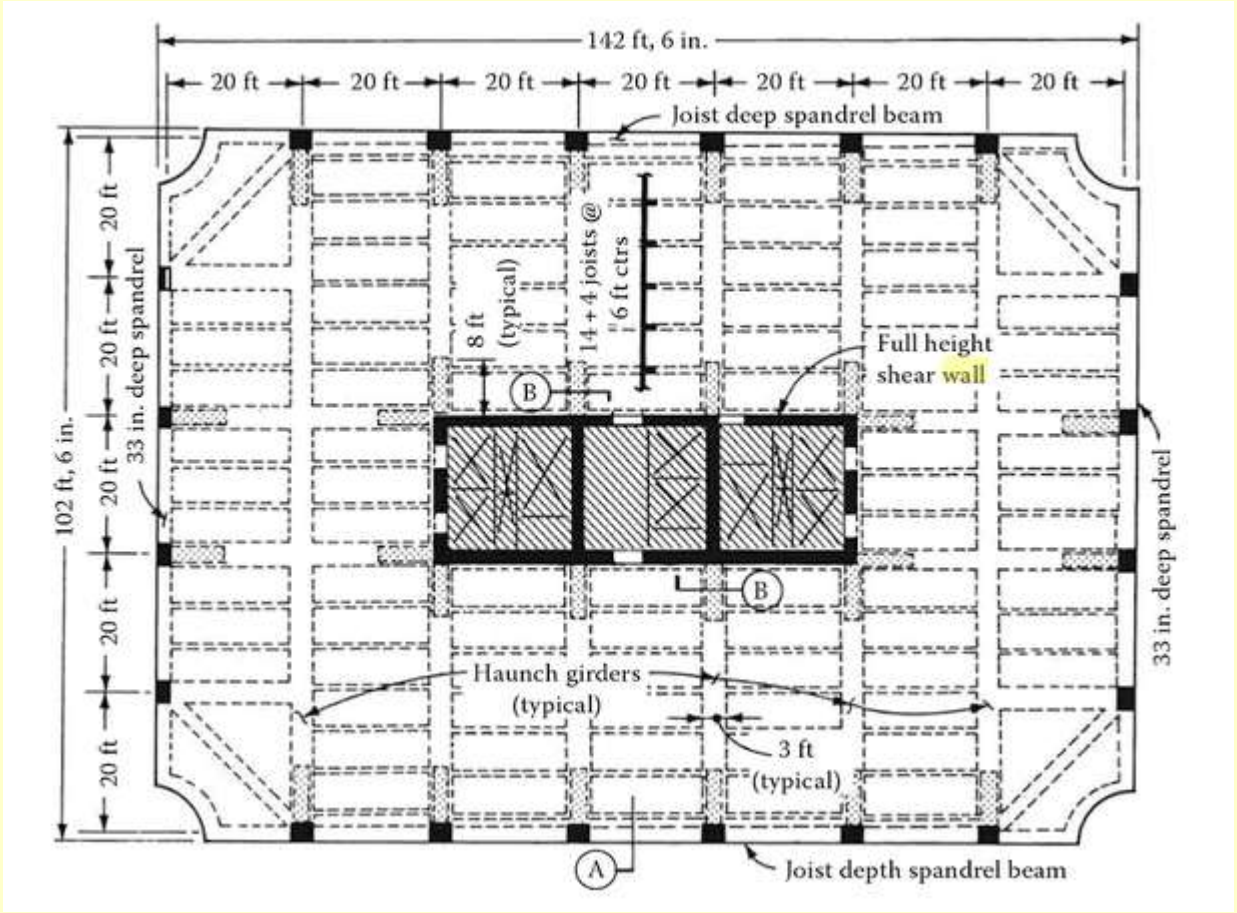


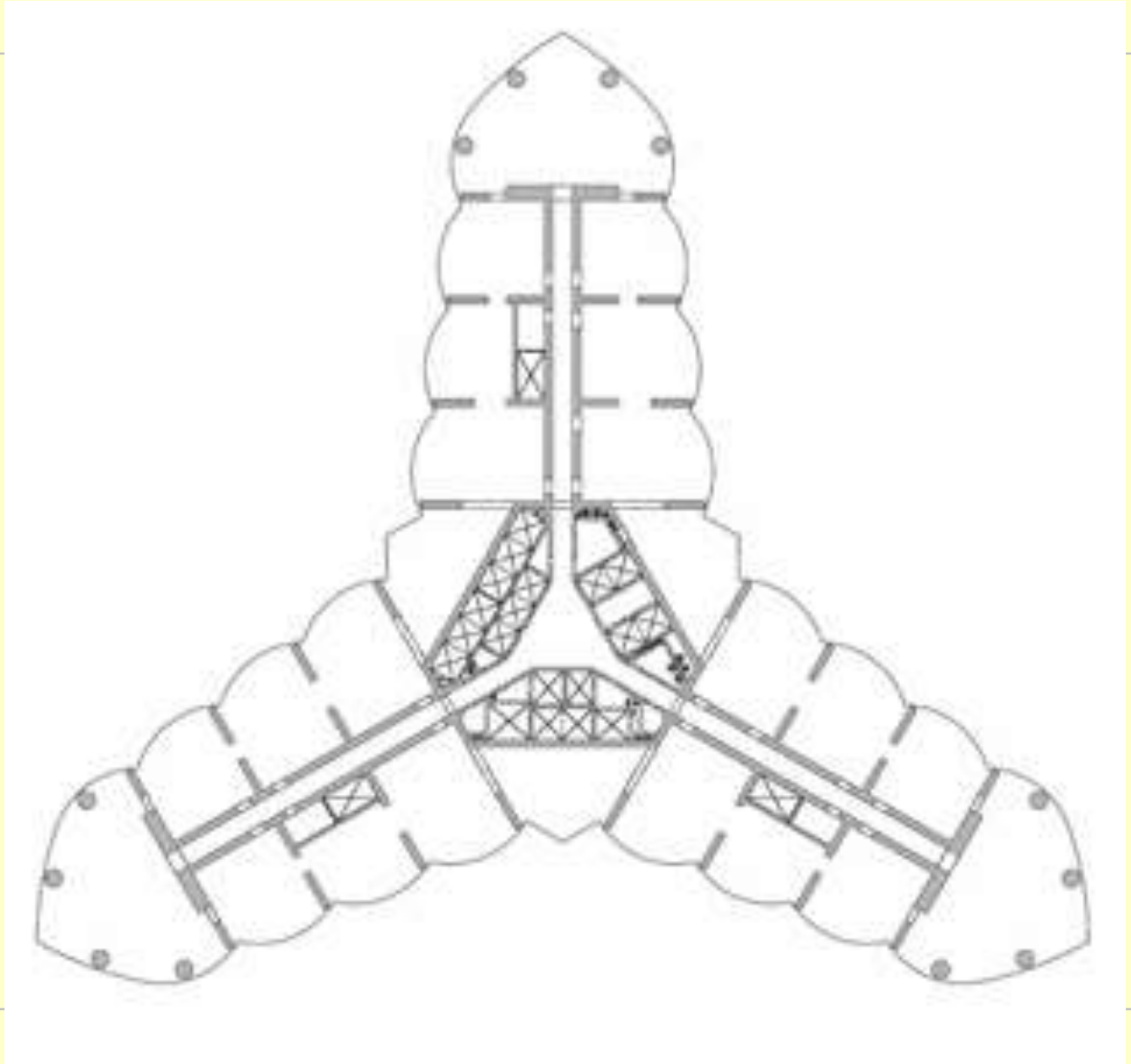

Perimeter frame
Shear walls

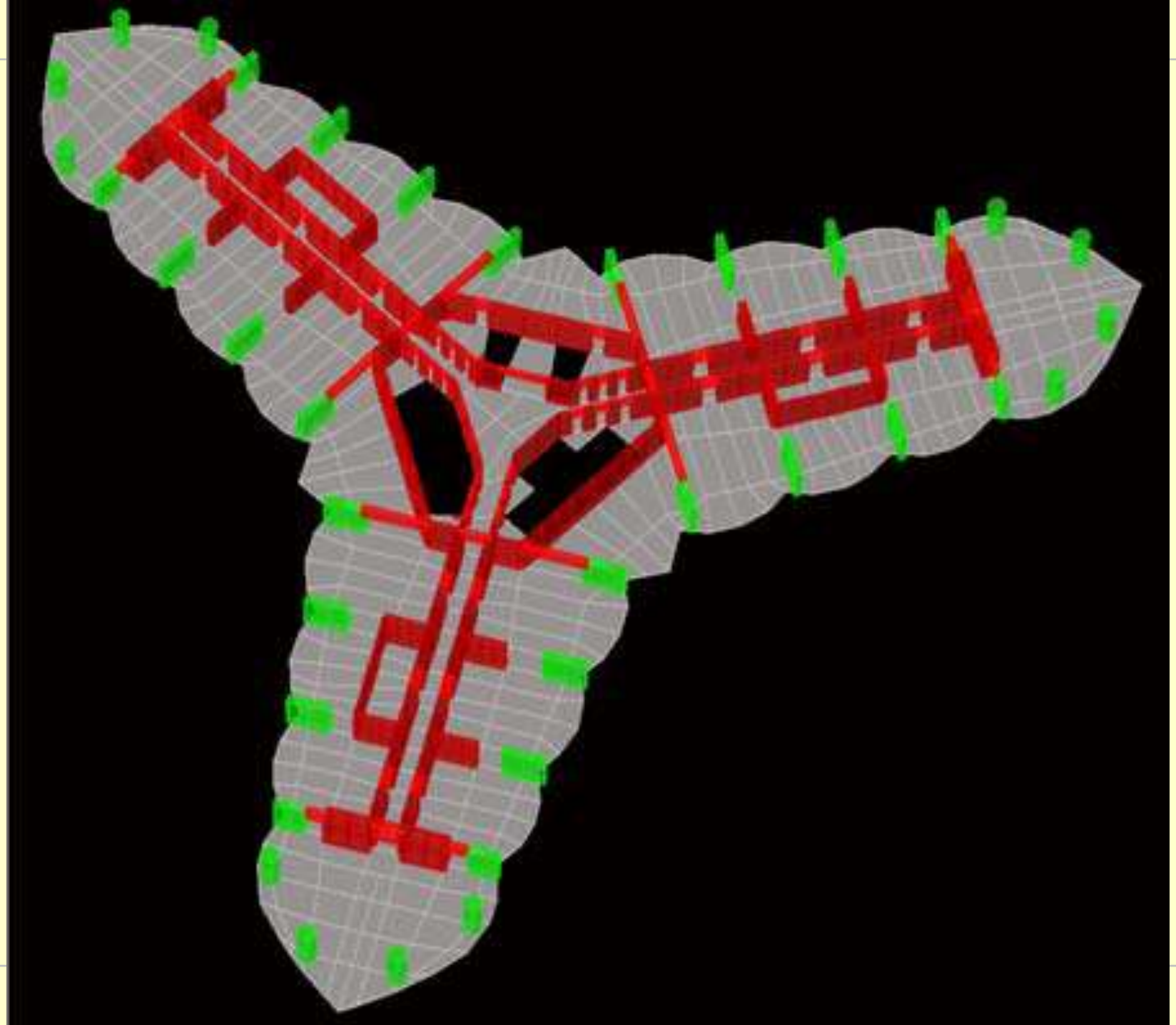

Concrete
floor framing
Closely spaced
perimeter columns
Service
core
Deep spandrel
Interior
columns
(a)
Closely
spaced
perimeter
columns
Deep
spandrels
(b)


Perimeter columns
Spandrel beam
(a)
Spandrel beam
Perimeter columns
(b)
Spandrel beam
Perimeter columns
(c)


54 spaces @ 12 ft, 6 in. = 675 ft
25 ft
30 ft, 6 in.
Street level
7 spaces @ 25 ft = 175 ft
7 spaces @ 25 ft = 175 ft


142 ft, 6 in.
20 ft
20 ft
20 ft
20 ft
20 ft
20 ft
20 ft
Joist deep spandrel beam
102 ft, 6 in.
20 ft
20 ft
20 ft
20 ft
20 ft
33 in. deep spandrel
8 ft (typical)
14 + 4 joists @ 6 ft ctrs
Full height shear wall
B
B
Haunch girders (typical)
3 ft (typical)
A
Joist depth spandrel beam
33 in. deep spandrel

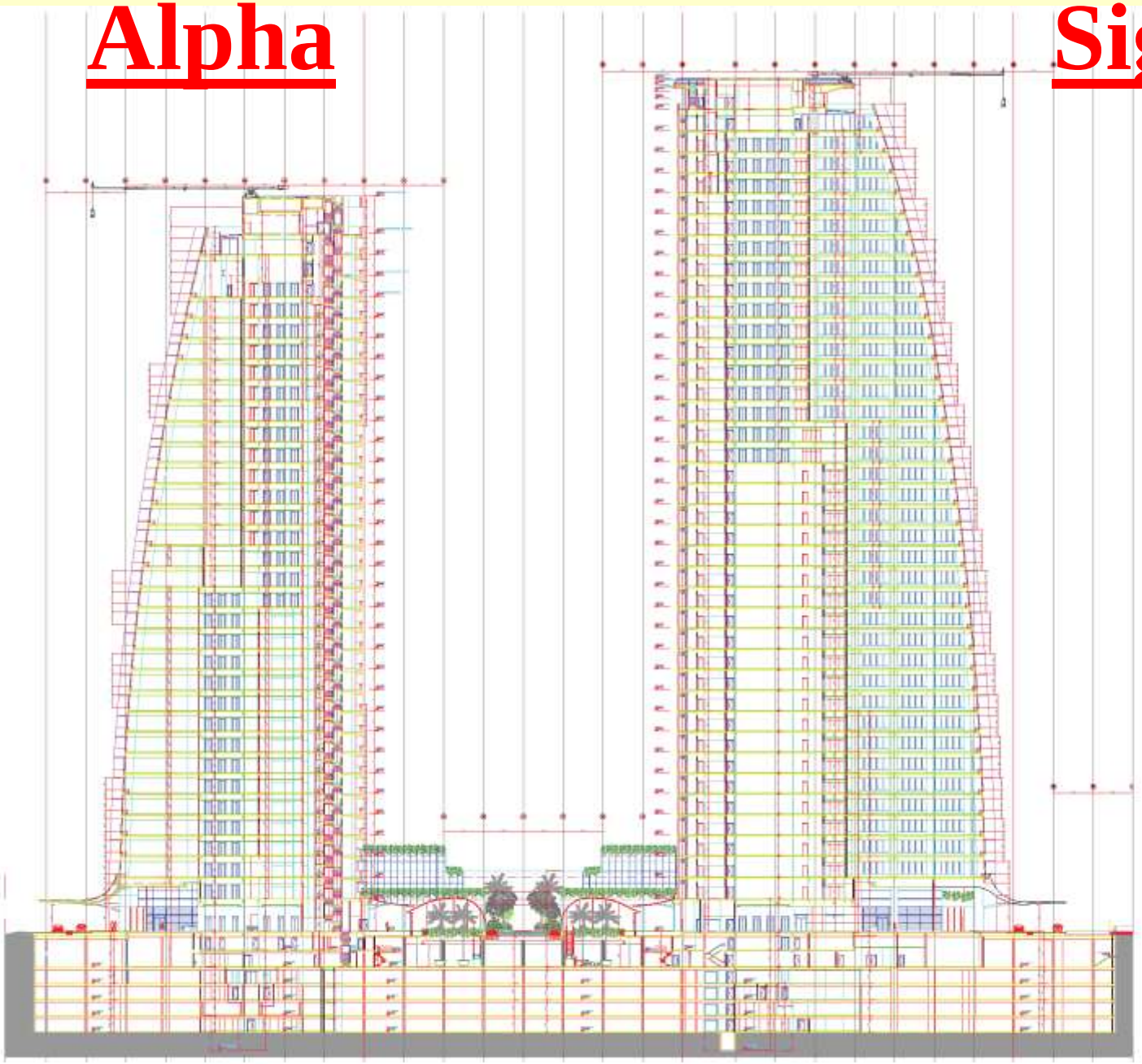


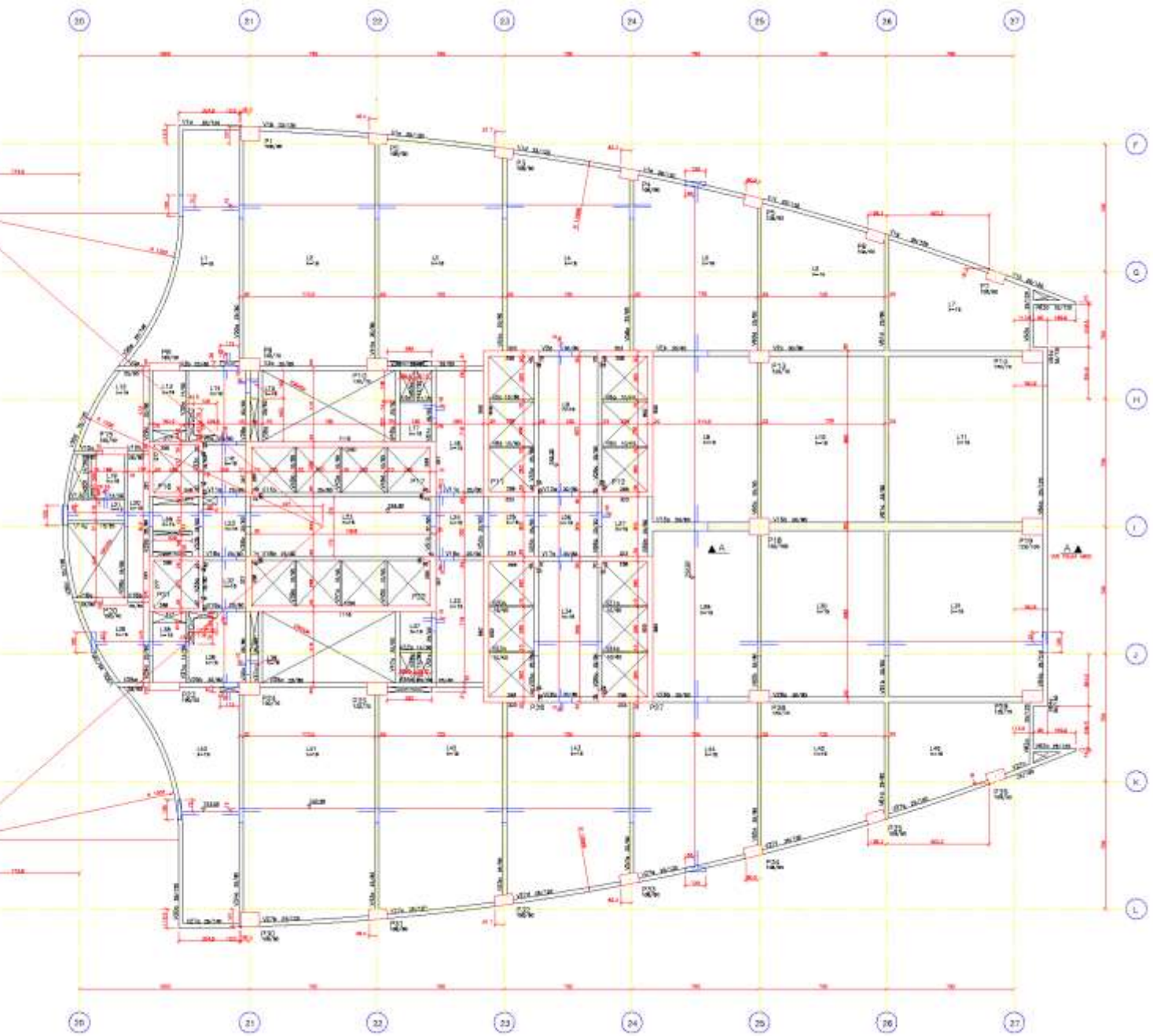


BROOKFIELD TOWERS

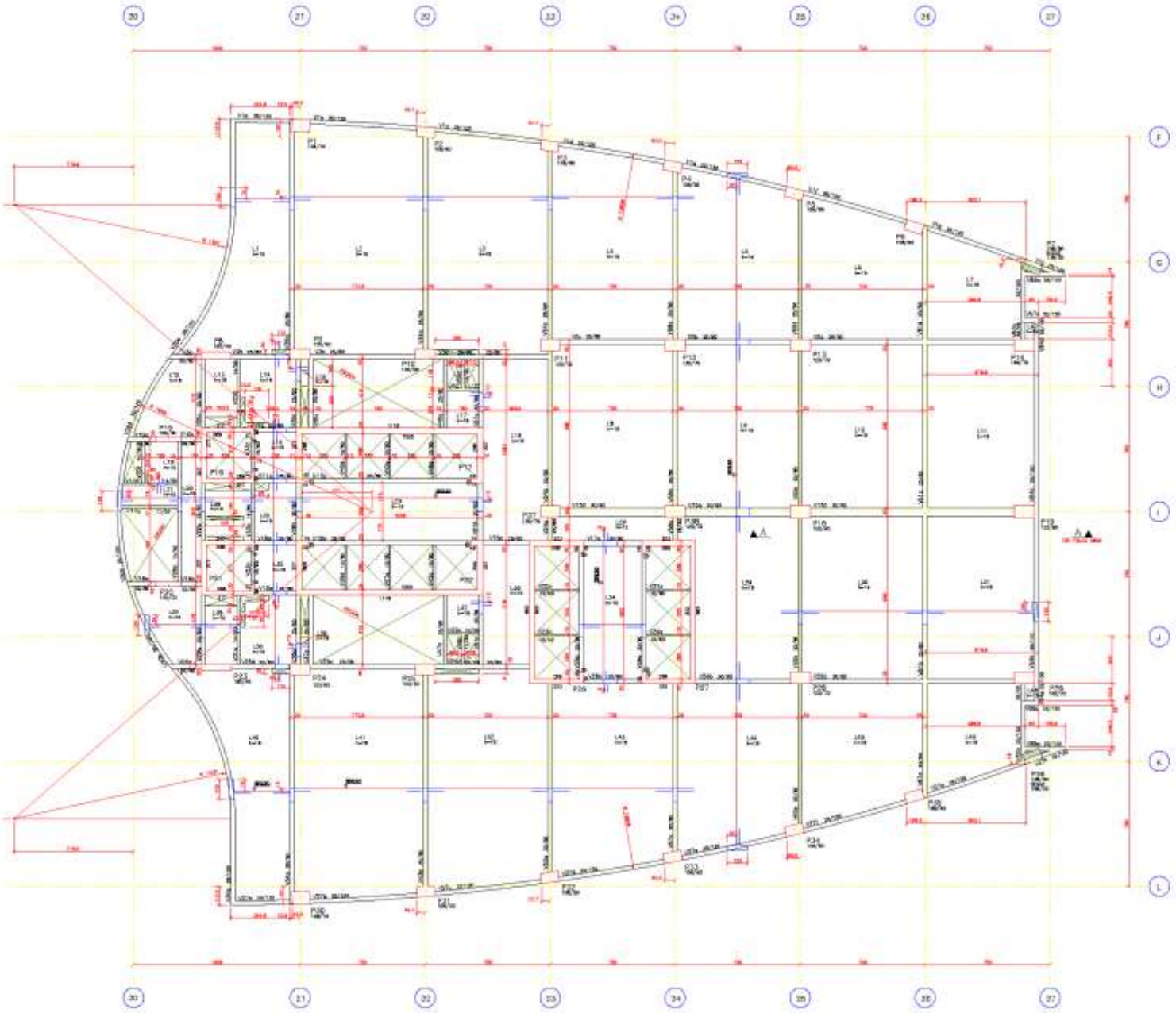
Alpha

Sigma

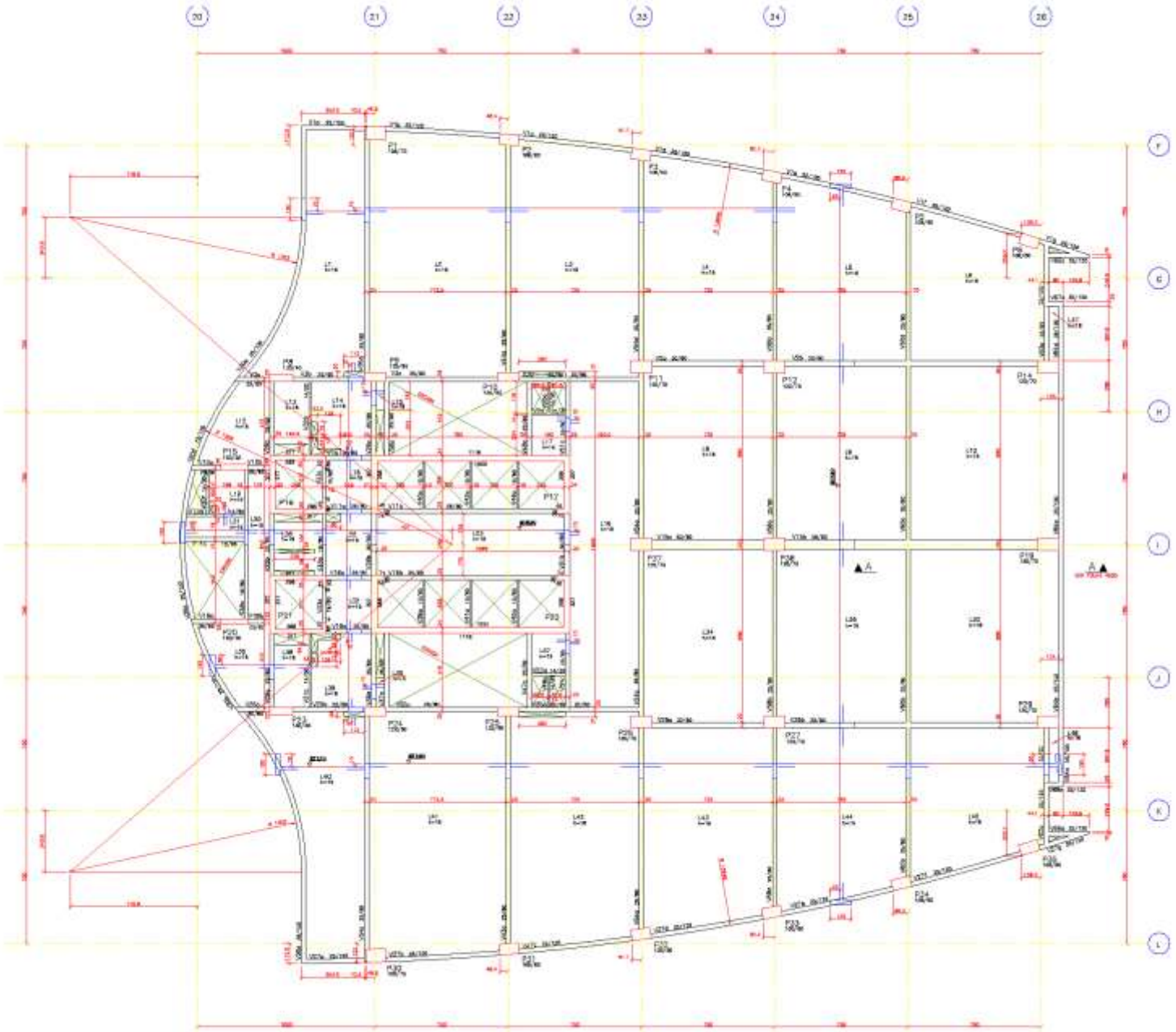




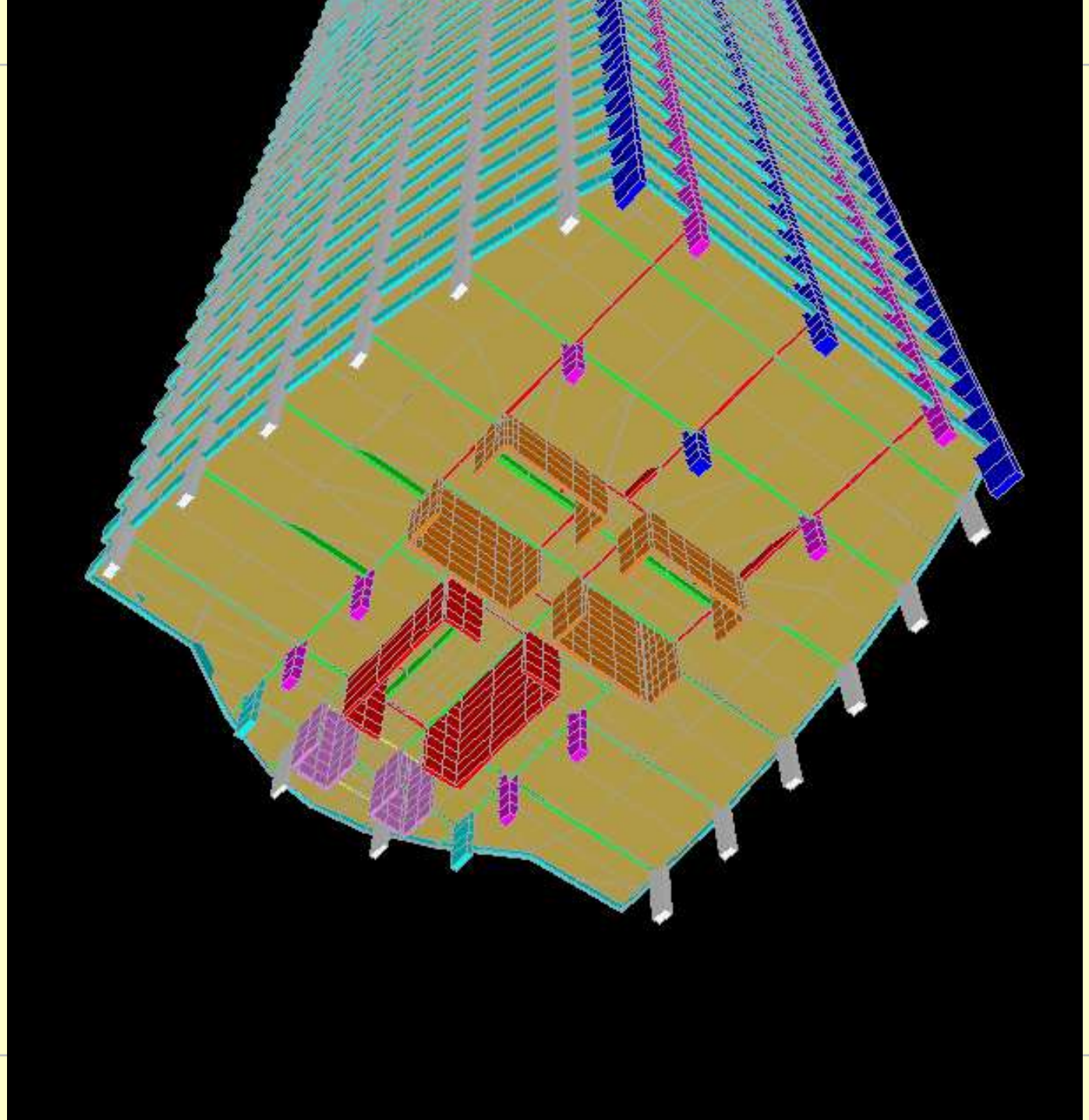
4o Pav.



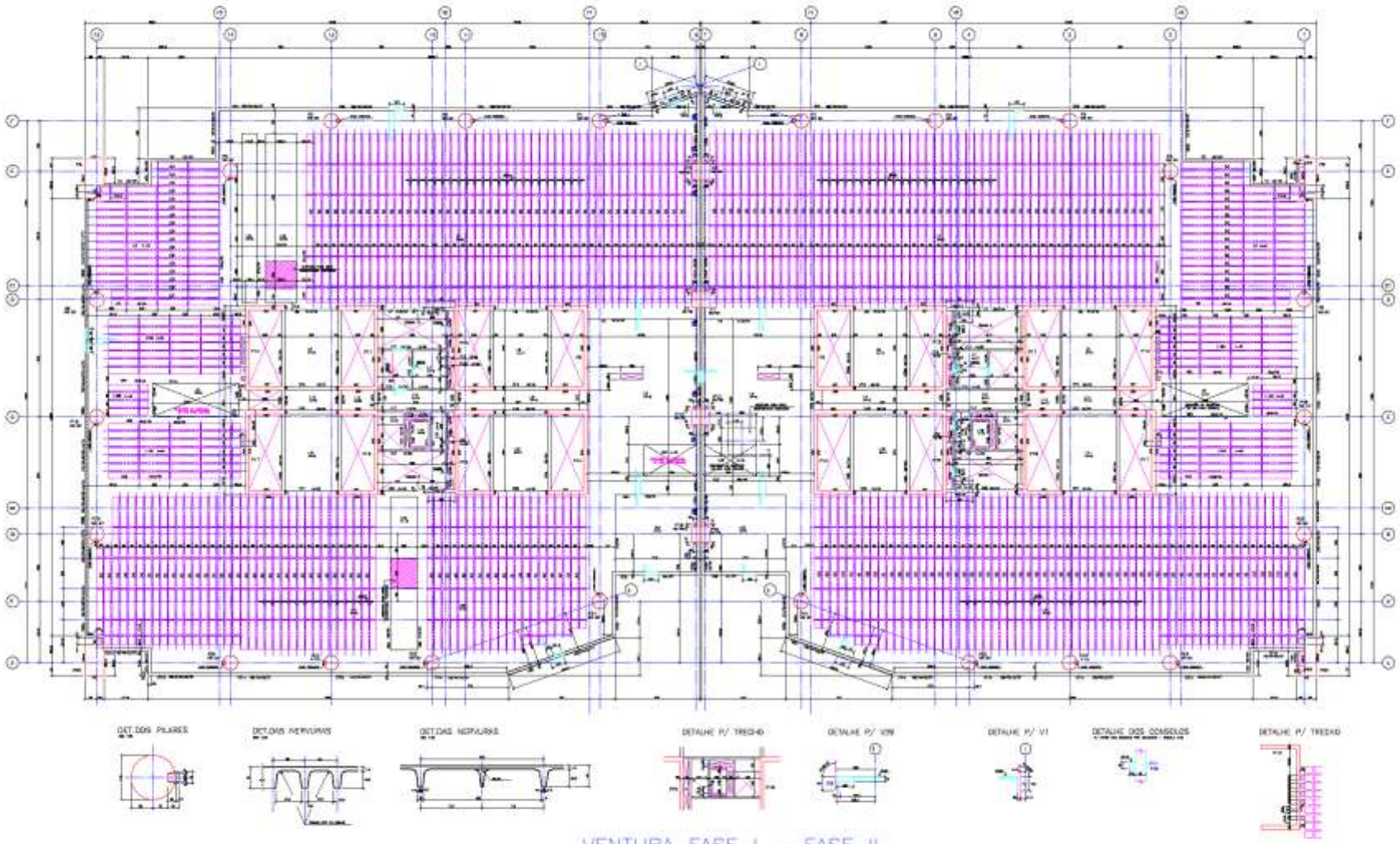
15o Pav.



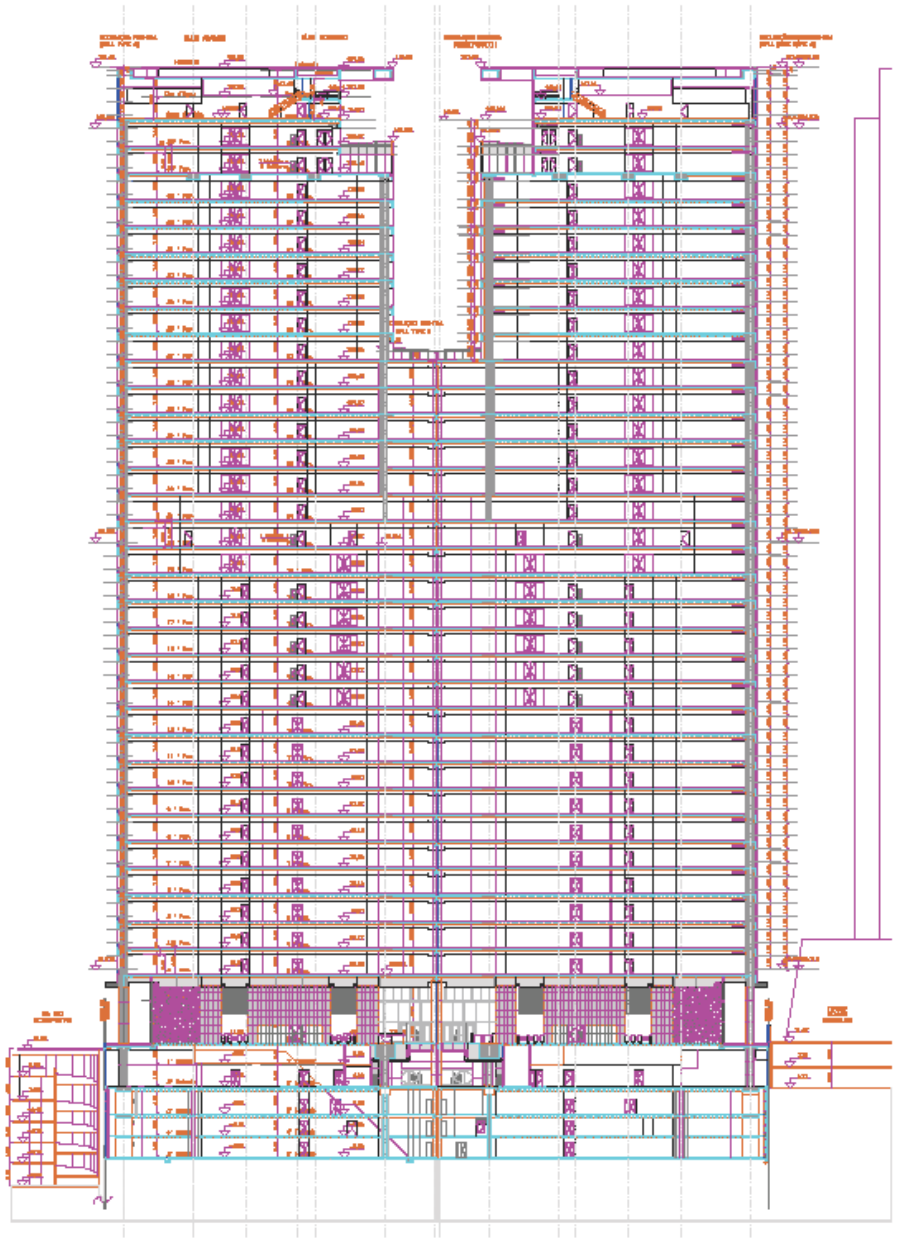
26o Pav.



Ventura Towers



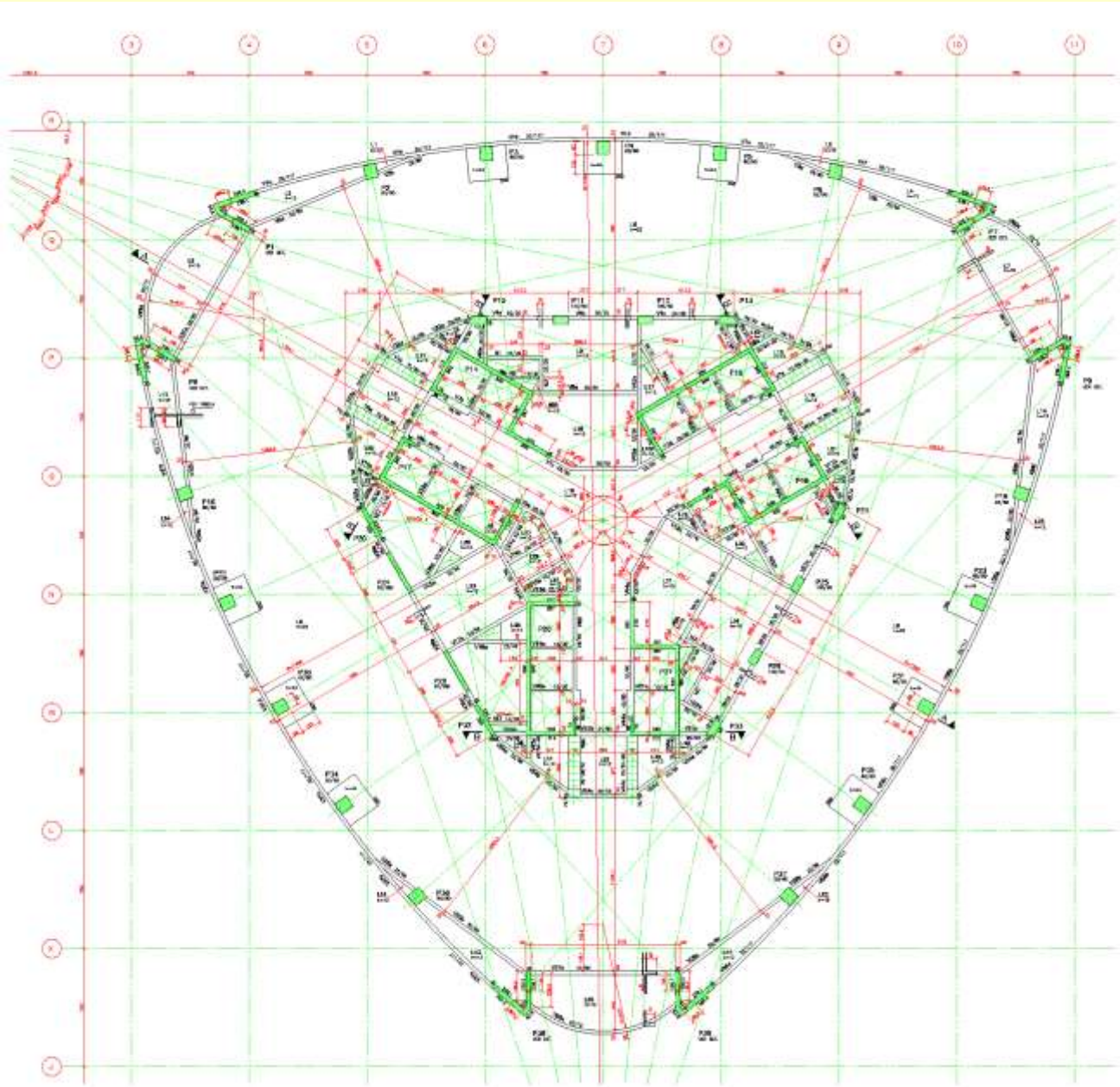
Andar tipo. h=40 cm, L=14 m



CORTE LONGITUDINAL
VENTURA – FASE 1 – 2

TORRE IV

TOWER BRIDGE



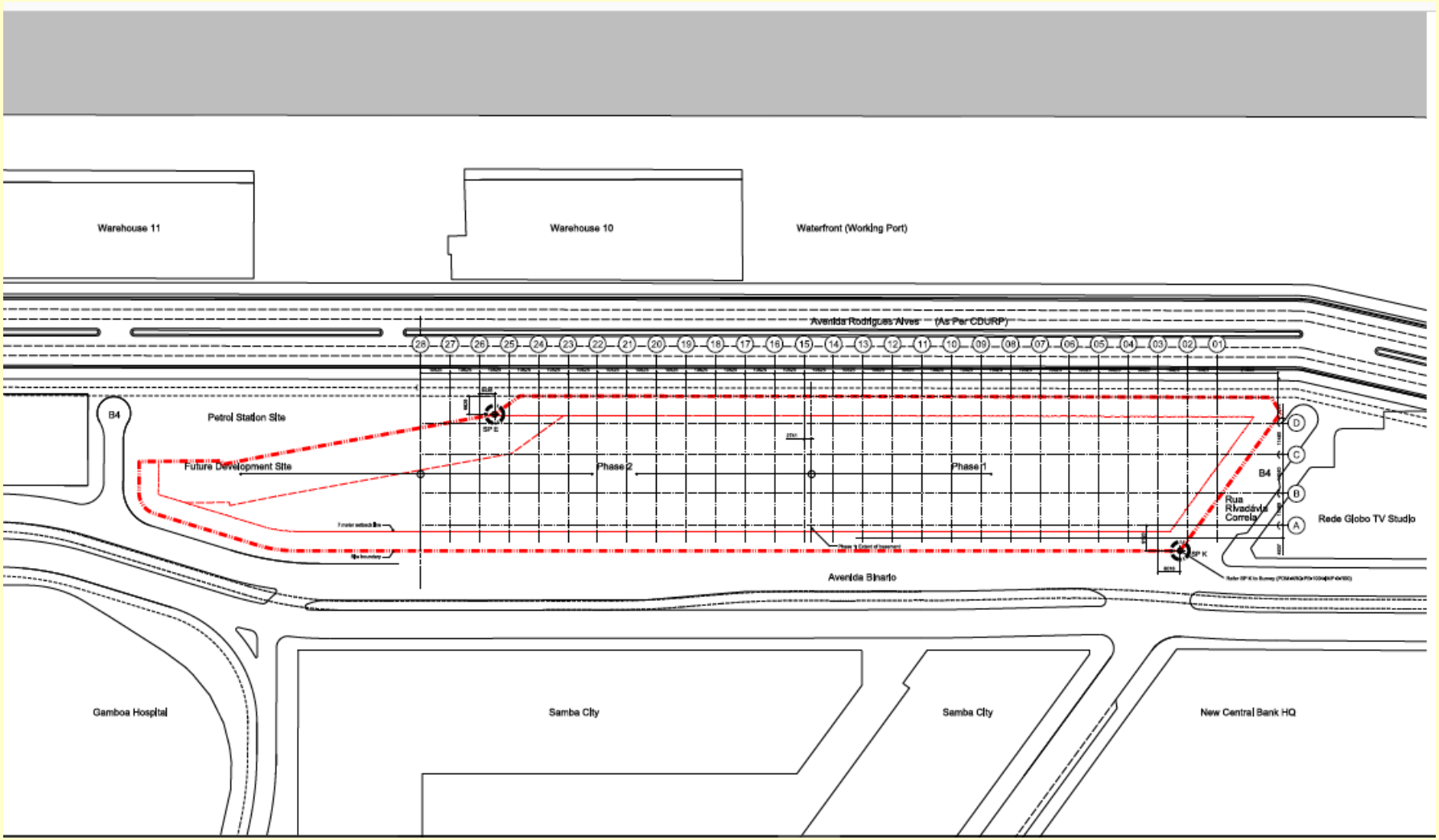
Fotografias do modelo do *Empreendimento CENU Torre IV*
no interior do túnel de vento.

PATIO DA MARITIMA

AQWA - RJ

Landmark in Rio de Janeiro

- Site with 23,810 sqm
- Porto Maravilha Redevelopment Zone
- Three phase development with 180,000 :
  - 140,000 sqm of offices in two phases with 1,900 parking spaces
  - 40,000 sqm of a multi-use project (including hotel, residential and retail)
- Designed by Foster + Partners
- LEED Gold Certification
- Class AAA amenities


Warehouse 11
Warehouse 10
Waterfront (Working Port)
Avenida Rodrigues Alves (As Per CDURP)
26 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01
B4
Petrol Station Site
Future Development Site
SP E
Phase 2
Phase 1
B4
D
C
B
A
Rua Rivadávia Correia
Rede Globo TV Studio
SP K
Avenida Binario
Gamboa Hospital
Samba City
Samba City
New Central Bank HQ

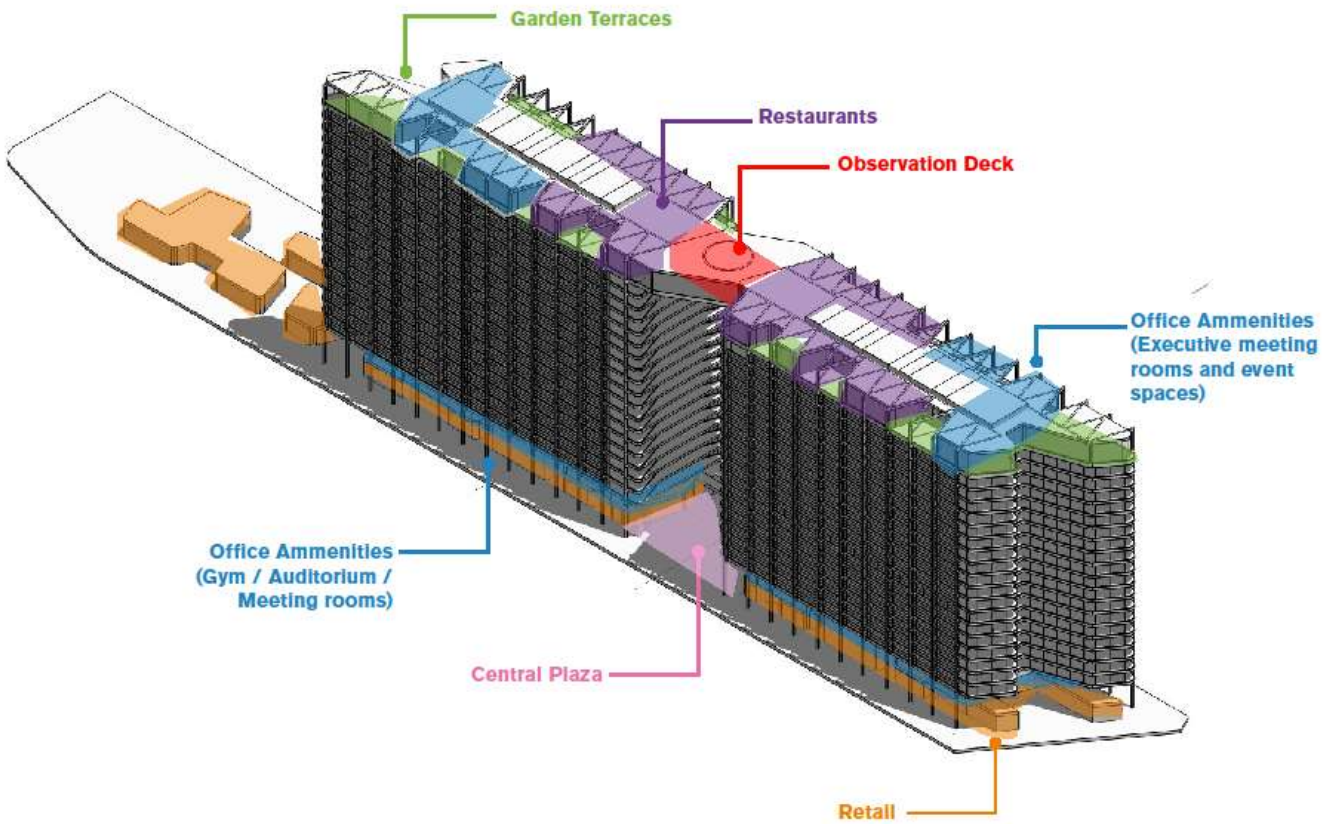
Criação da Geometria

ESTUDOS PRELIMINARES

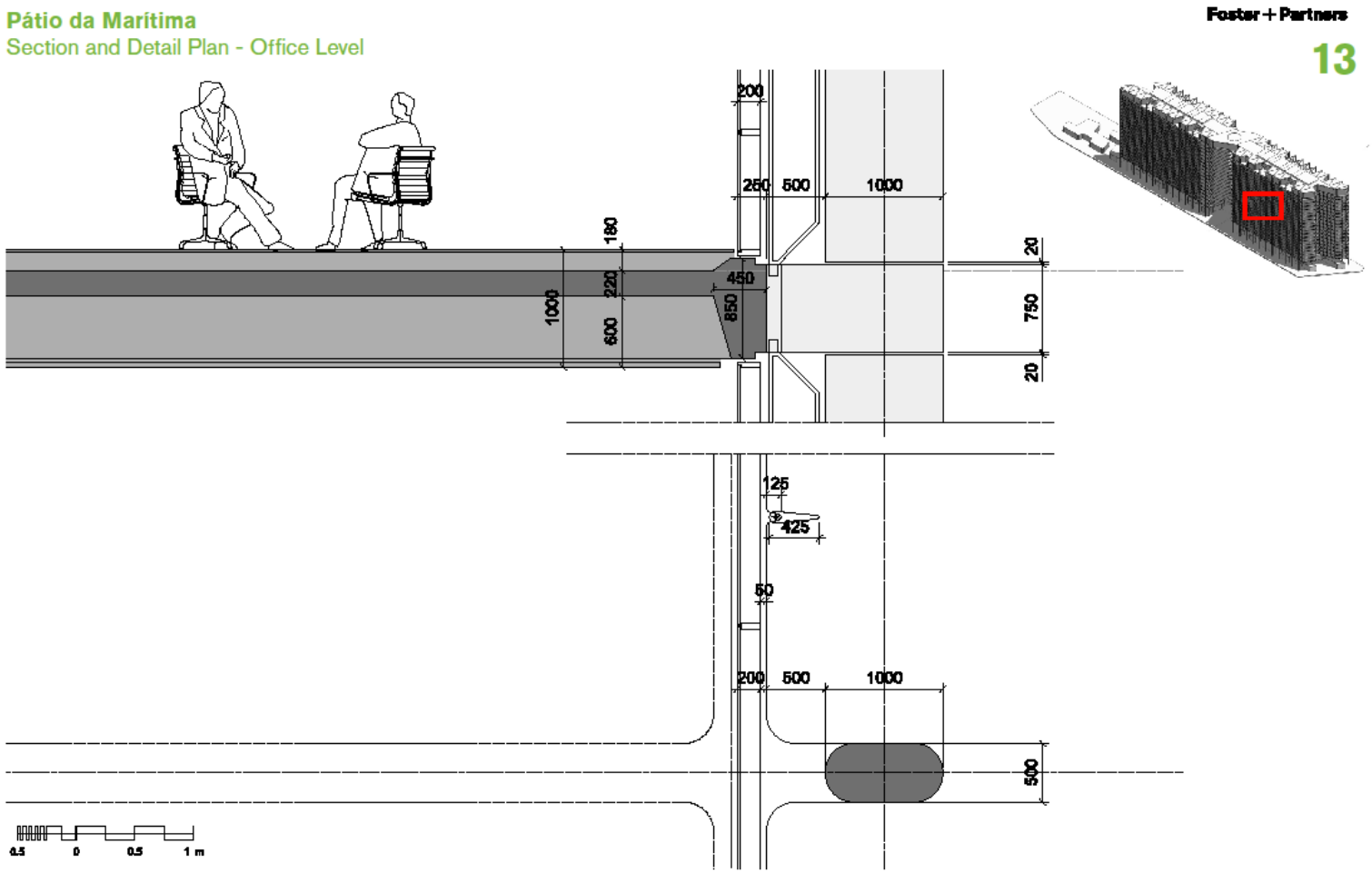
Pátio da Marítima
Axonometric

Foster + Partners

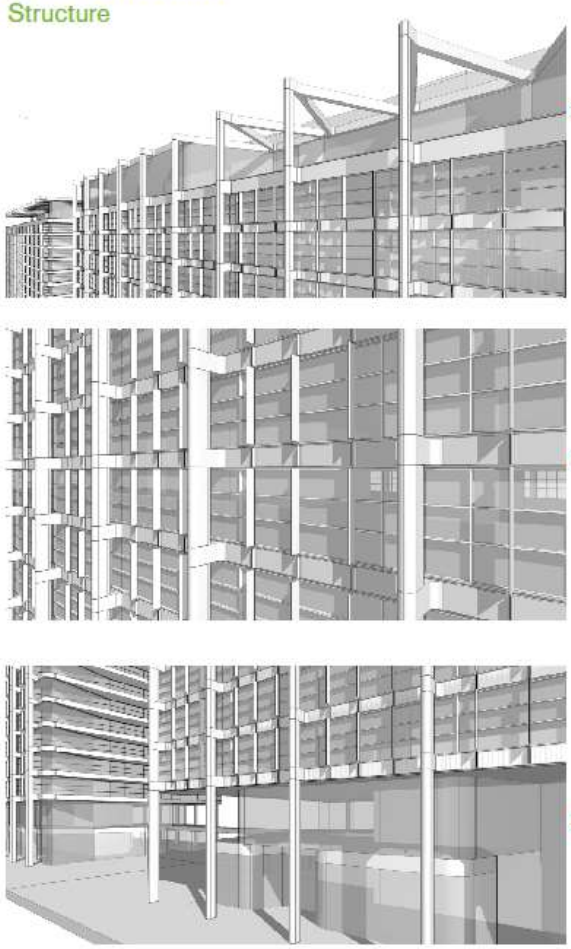
2



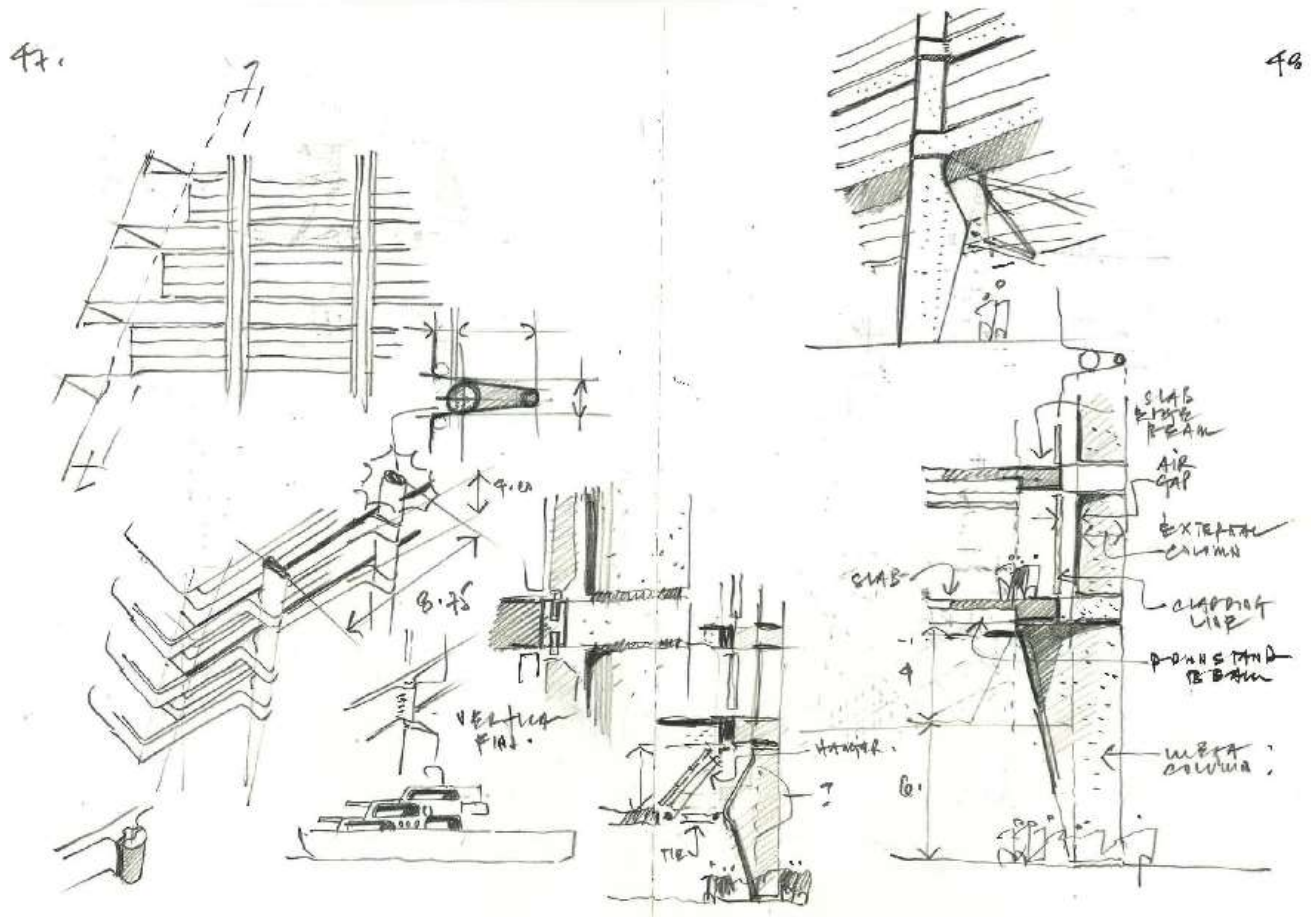
PILARES EXTERNOS A FACHADA



Pátio da Marítima
Structure



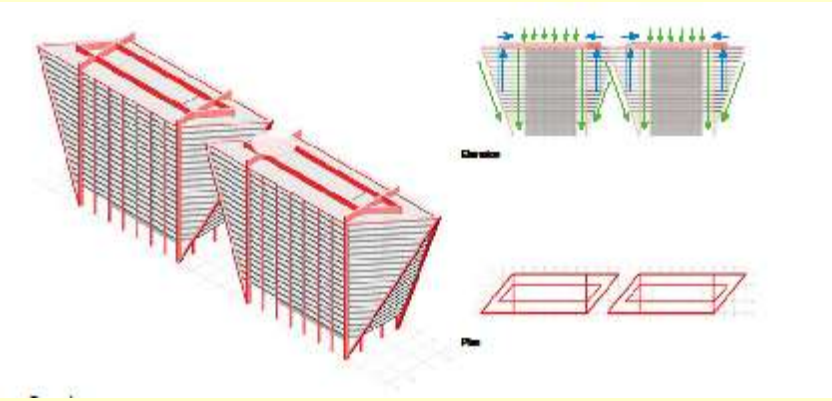
APROXIMANDO PILAR DA FACHADA



Pátio da Marítima

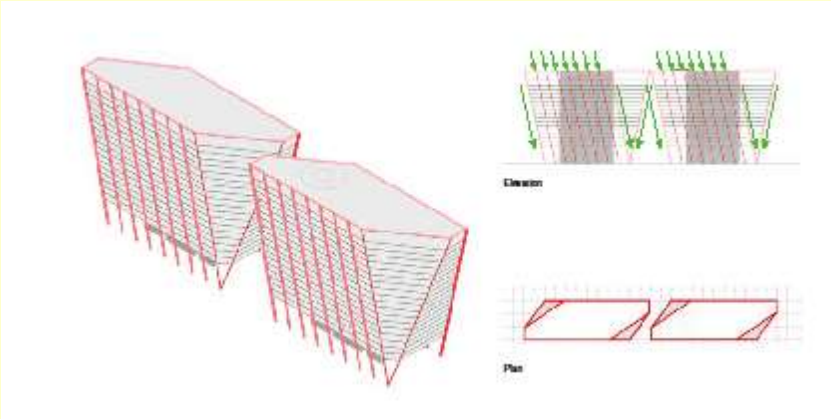
Waterfront View

Option 3



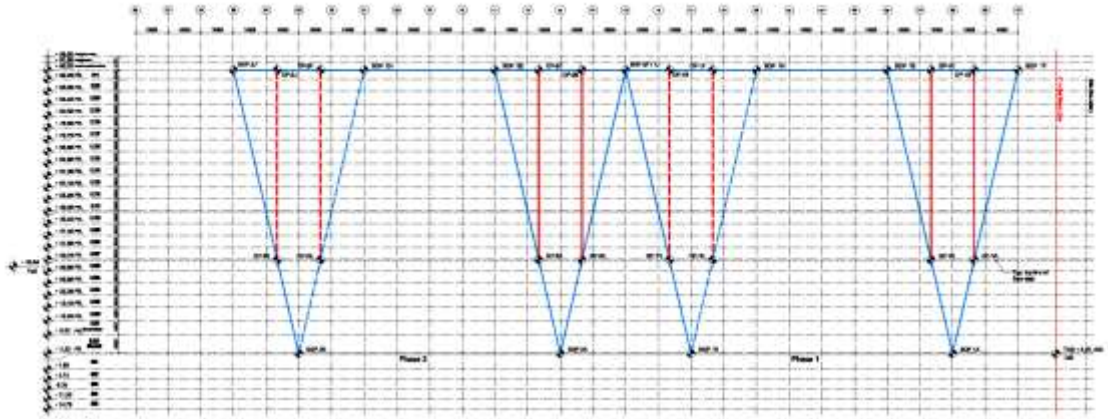
Opção 1:
Pilares Verticais com Bordas Inclinadas

Opção 2
Pilares Inclinados com Bordas Inclinadas

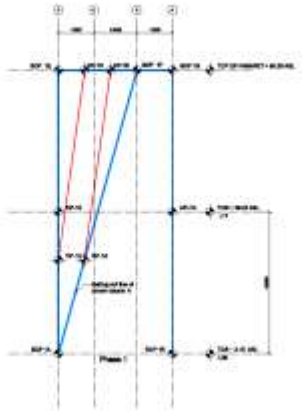


Pilares Verticais + Bordas Inclinadas da opção 2

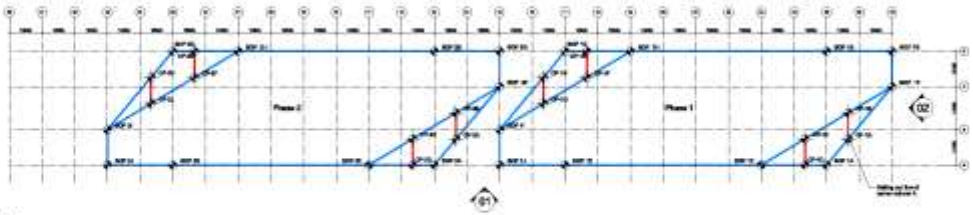
Inclinação das Megacolunas



01 South Elevation Setting Out

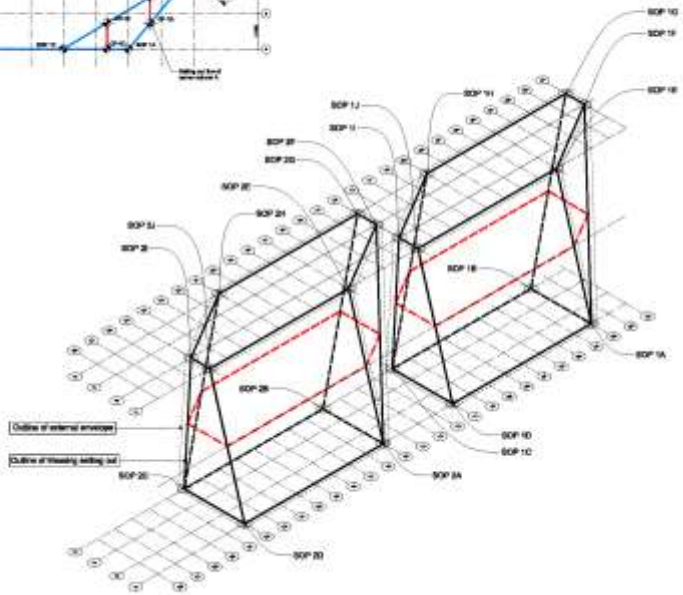


02 East Elevation Setting Out

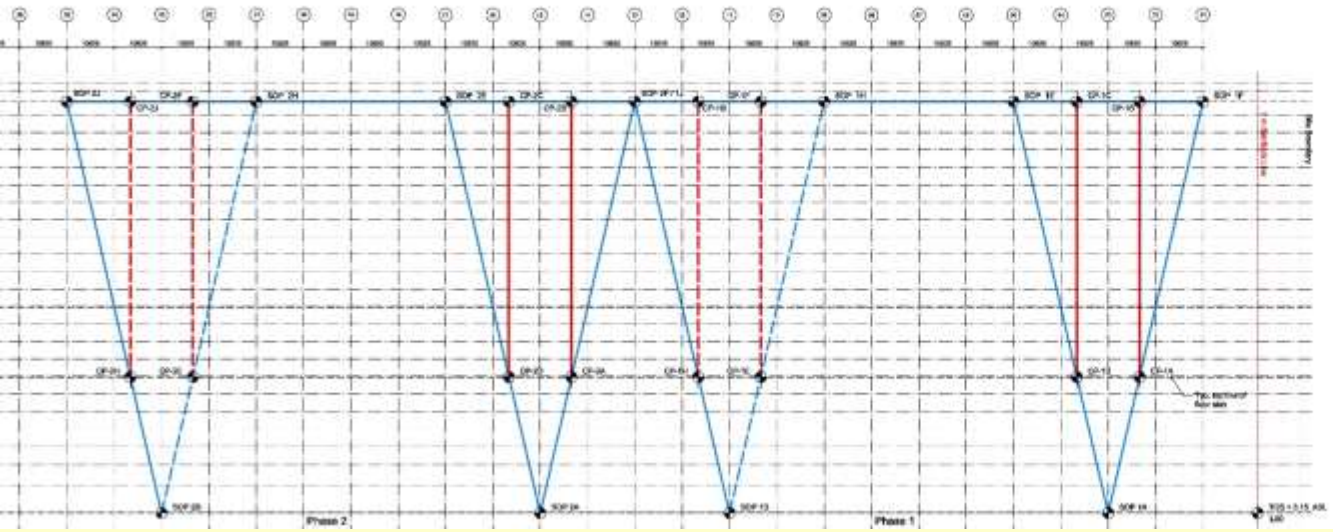


03 Plan Setting Out

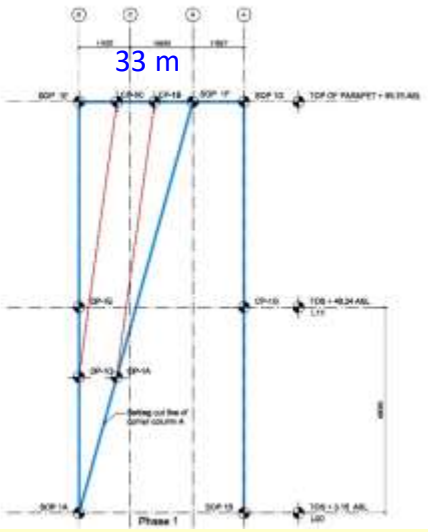
Axonometria

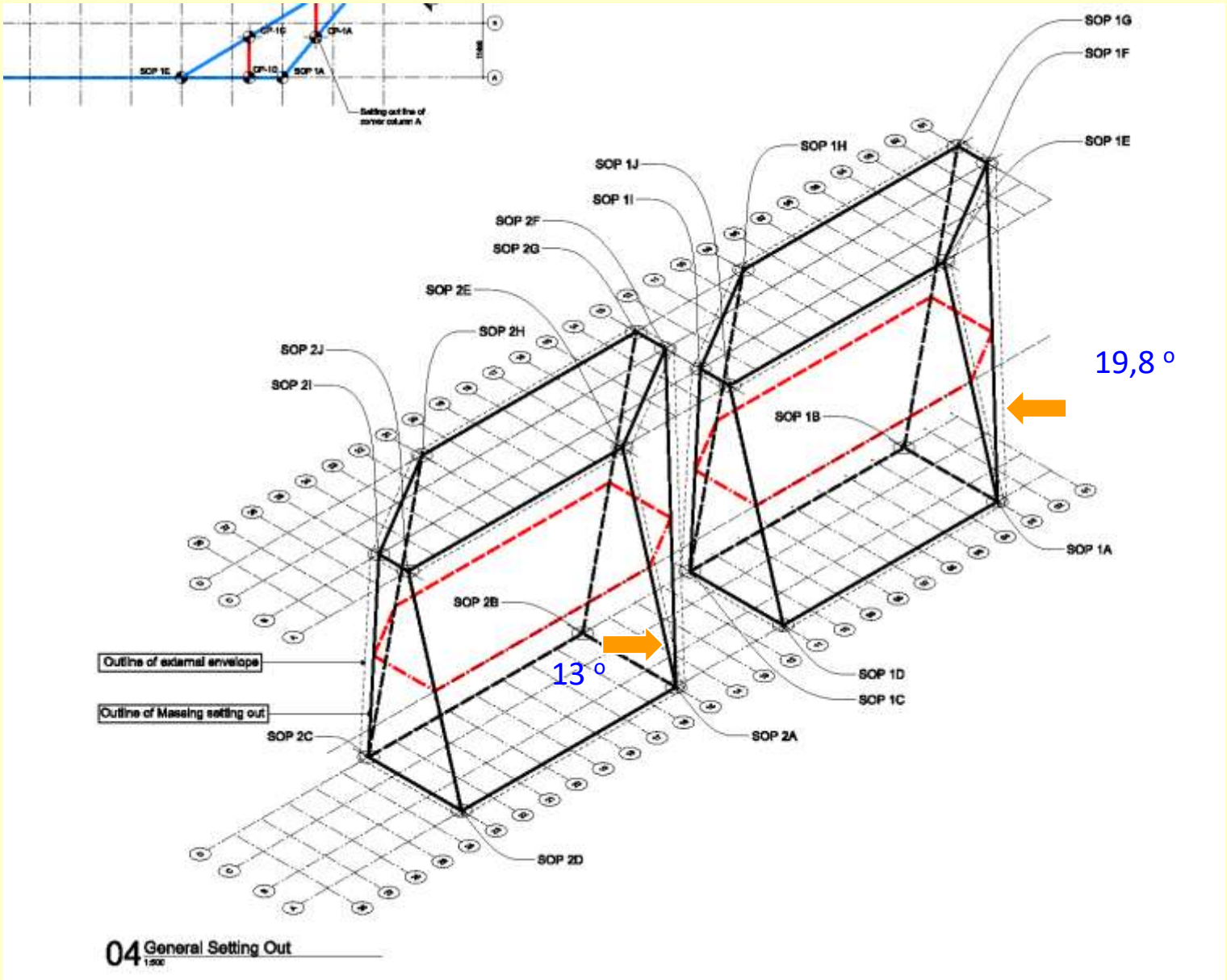


04 General Setting Out



95 m



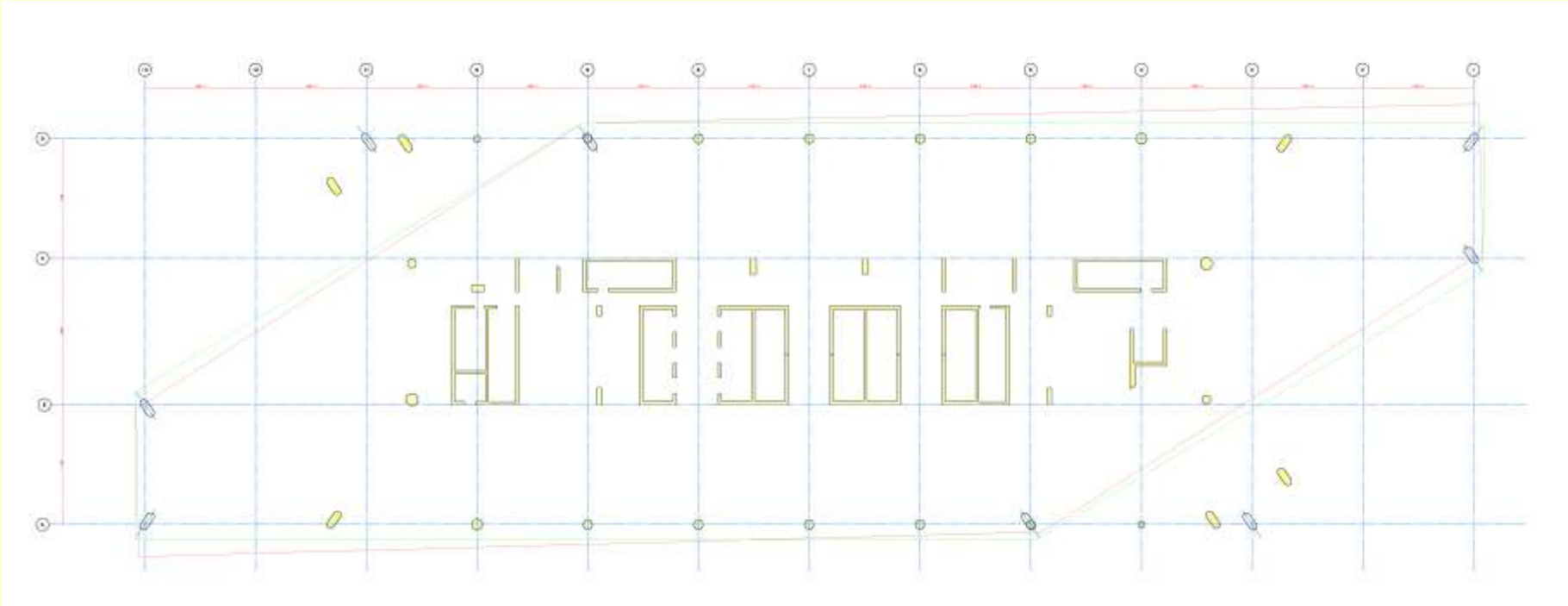

SOP 1G
SOP 1F
SOP 1E
SOP 1H
SOP 1J
SOP 1I
SOP 2F
SOP 2G
SOP 2E
SOP 2H
SOP 2J
SOP 2I
19,8 º
SOP 1B
SOP 1A
SOP 2B
13 º
Outline of external envelope
Outline of Massing setting out
SOP 1D
SOP 1C
SOP 2C
SOP 2A
SOP 2D
04 General Setting Out

EFEITO DE TORÇÃO DO EDIFICIO

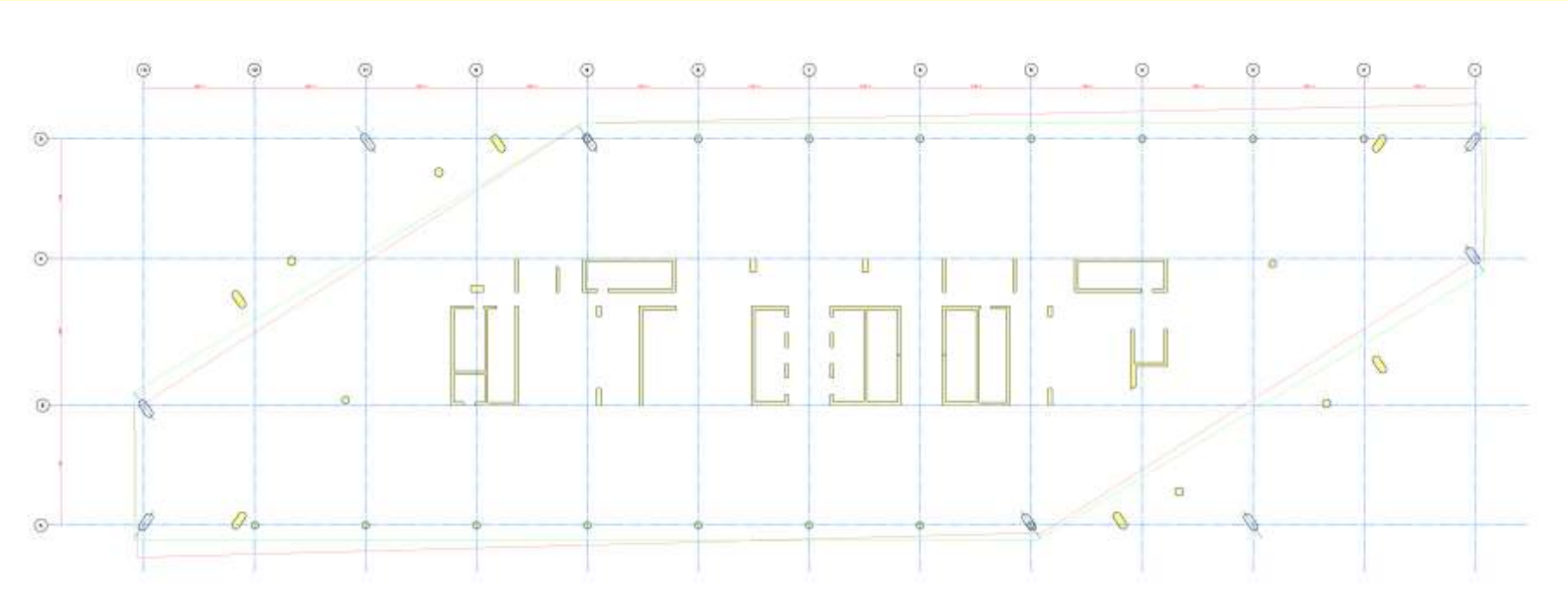
EFEITO DE 2ª ORDEM NÃO PODE SER AVALIADO PELO g_z

PROJECT DESIGN

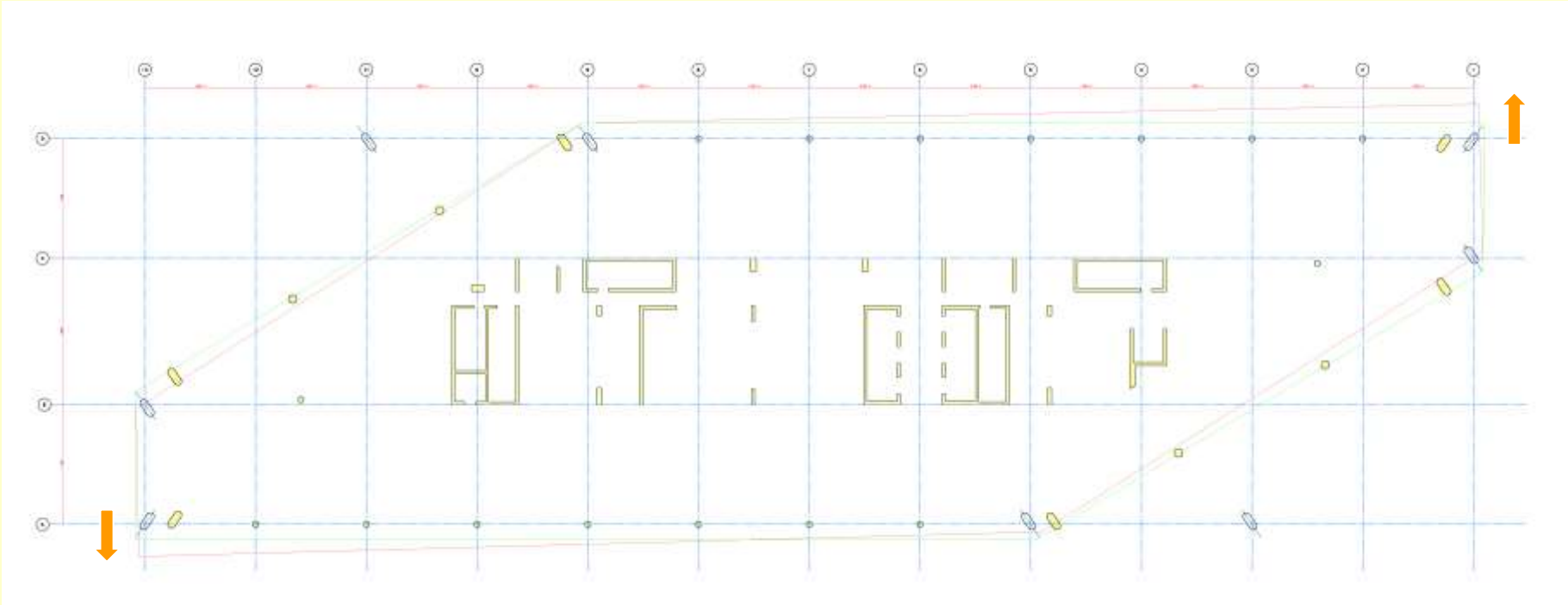
ZONA BAIXA – L01 AO L11



ZONA MÉDIA – 13 AO L19

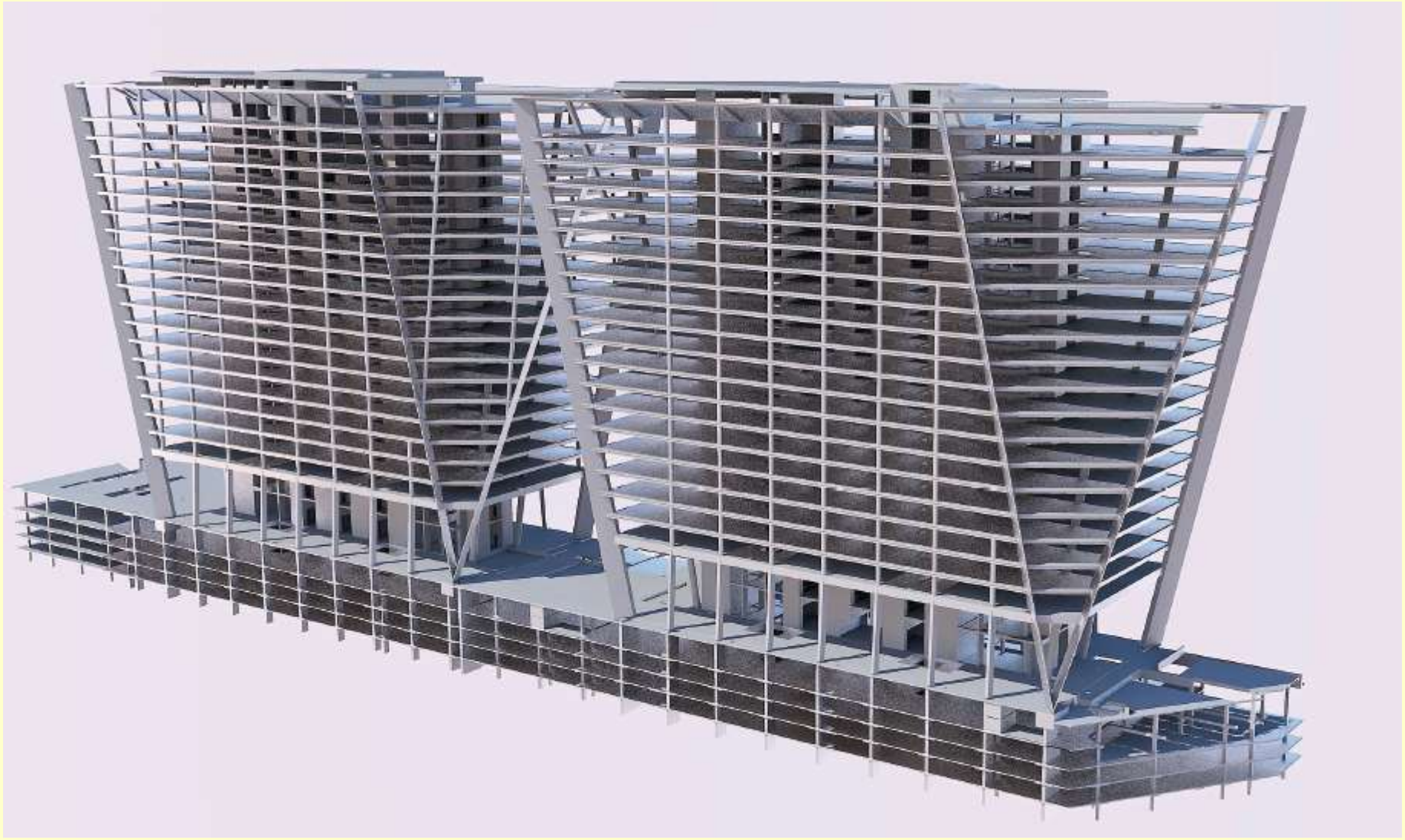


ZONA ALTA – 20 AO PAV. MEC.



Deformação máxima
pp + permanentes + sobrecarga = 10,5 cm
Vento = 2 cm

Modelo 3D - TQS

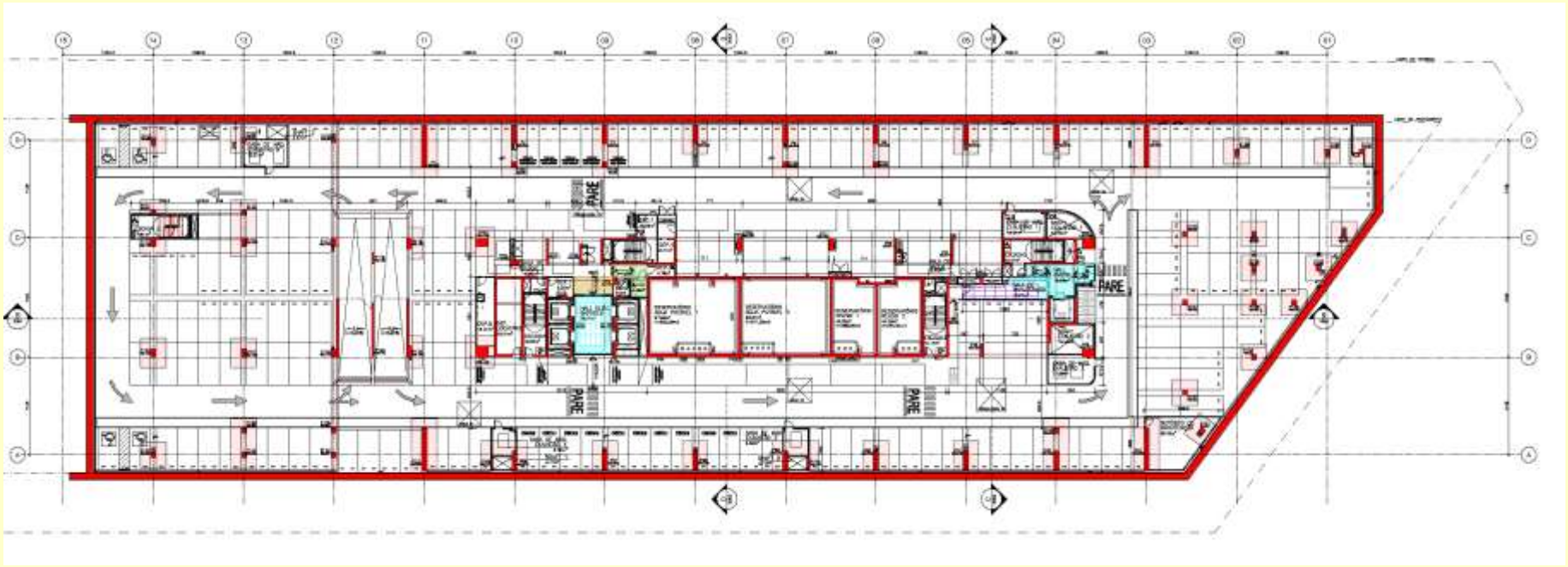


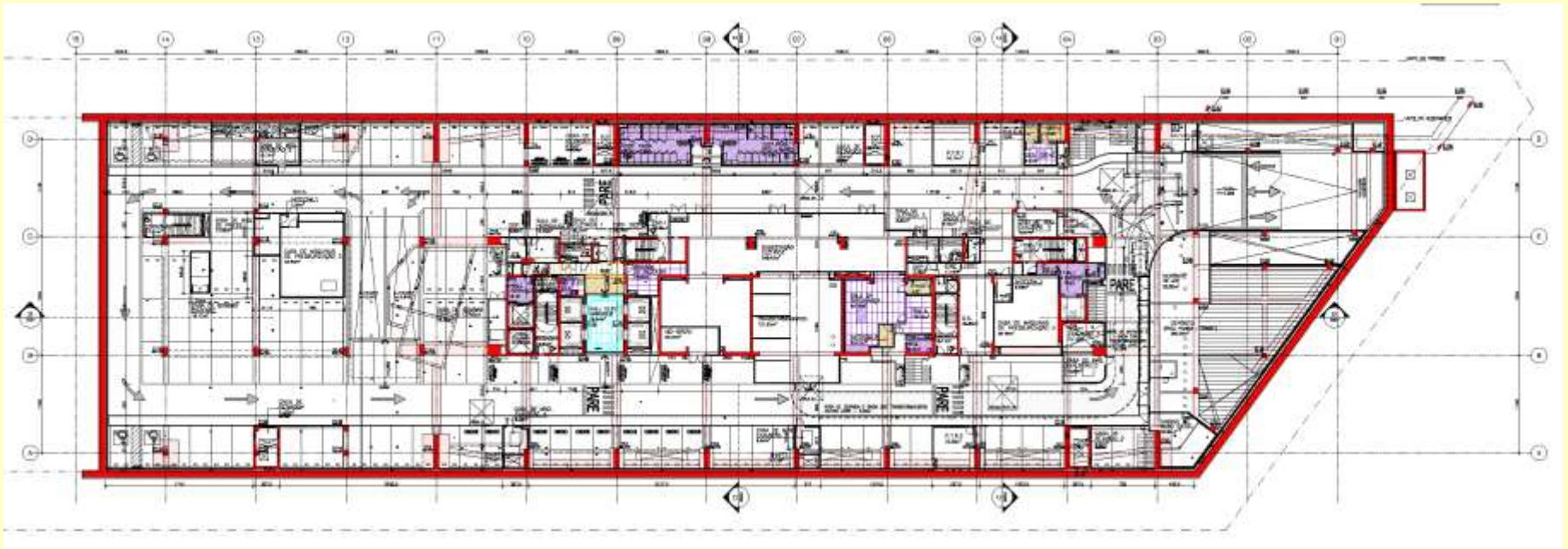
PROJETO EXECUTIVO

Precisão e Prazo

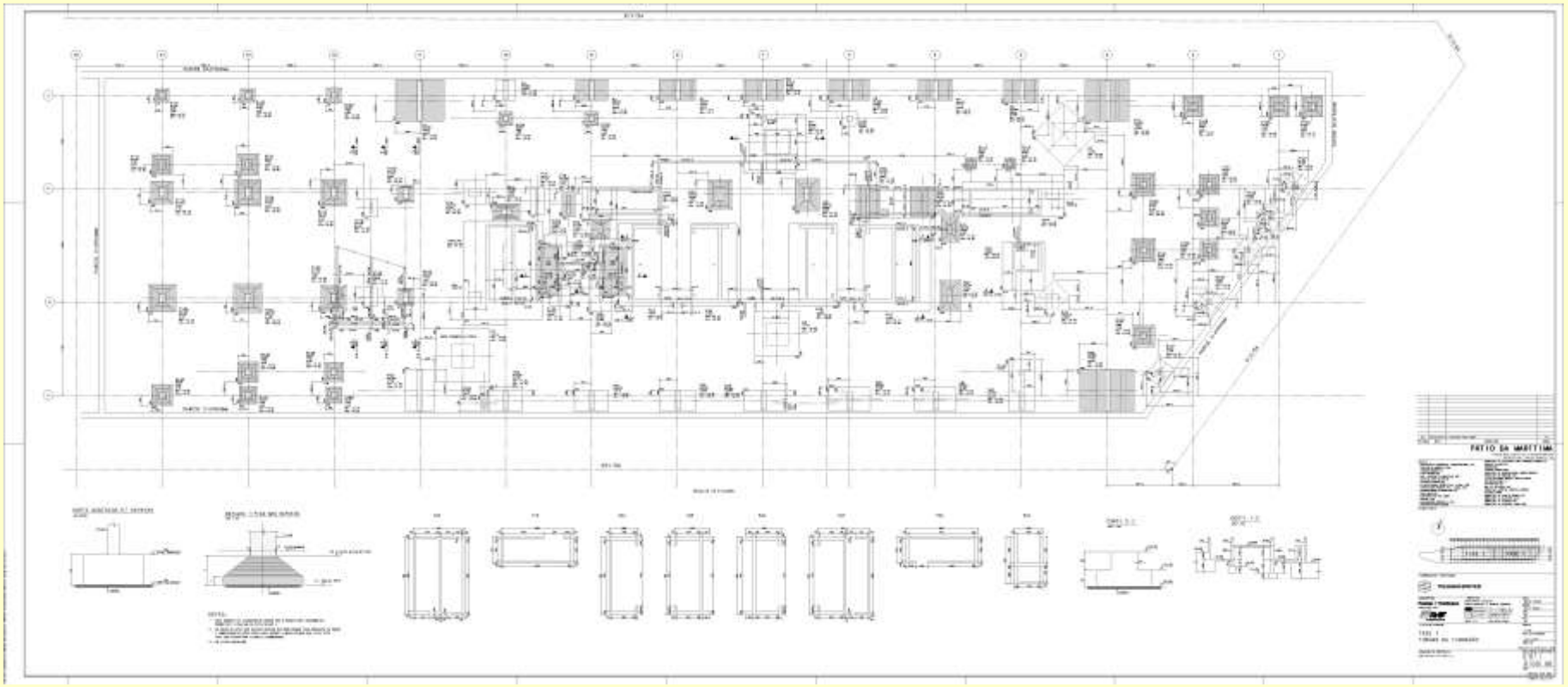
Subsolos e Térreo – concreto
Núcleo – concreto
Perímetro da Torre - Mista

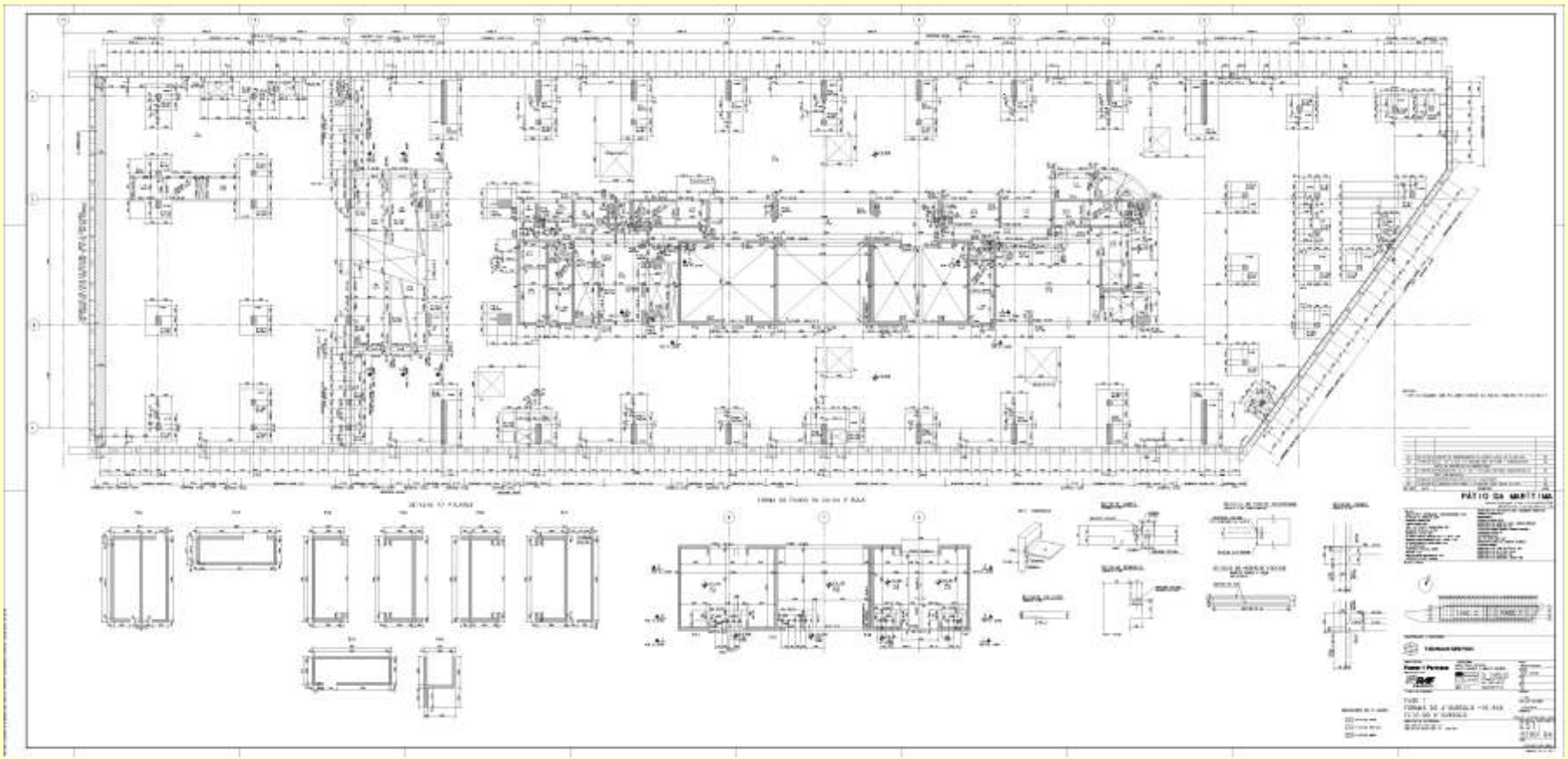
SUBSOLOS



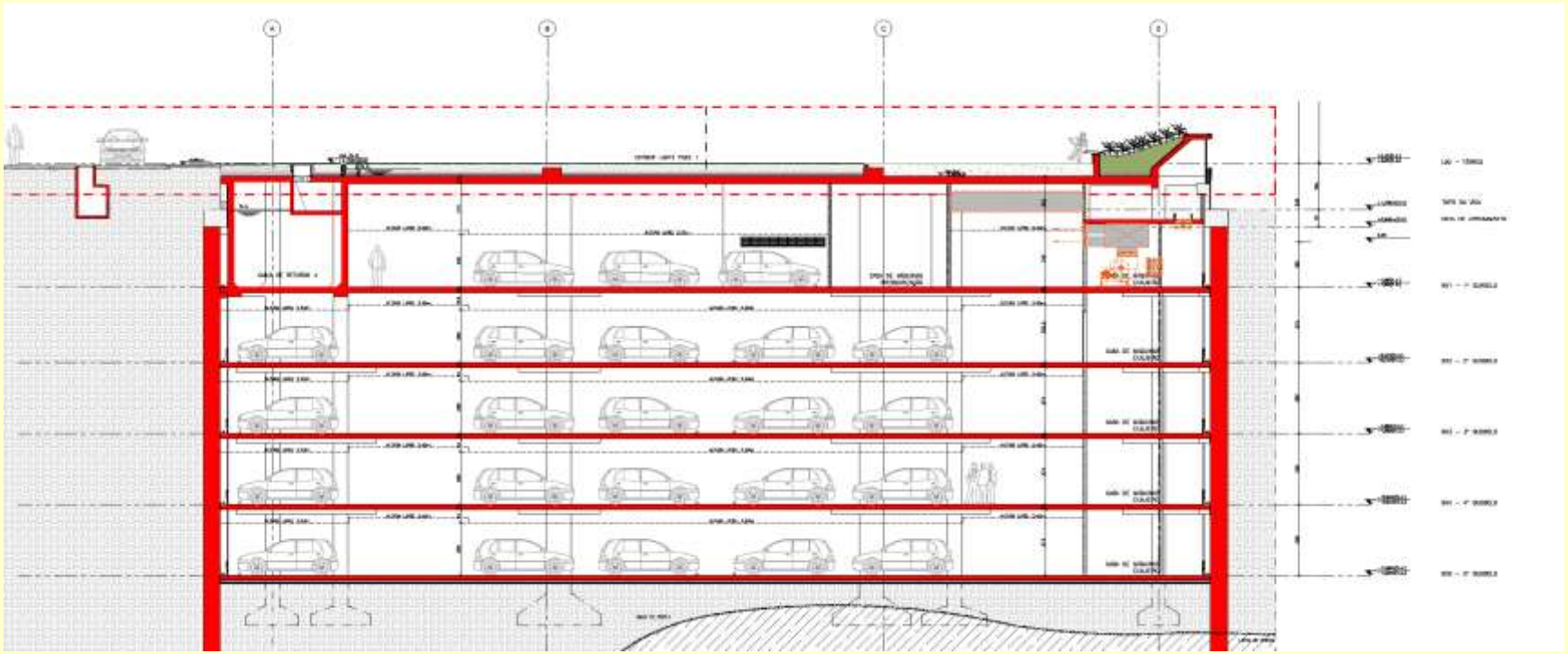

PARE
PARE
PARE

FUNDAÇÃO

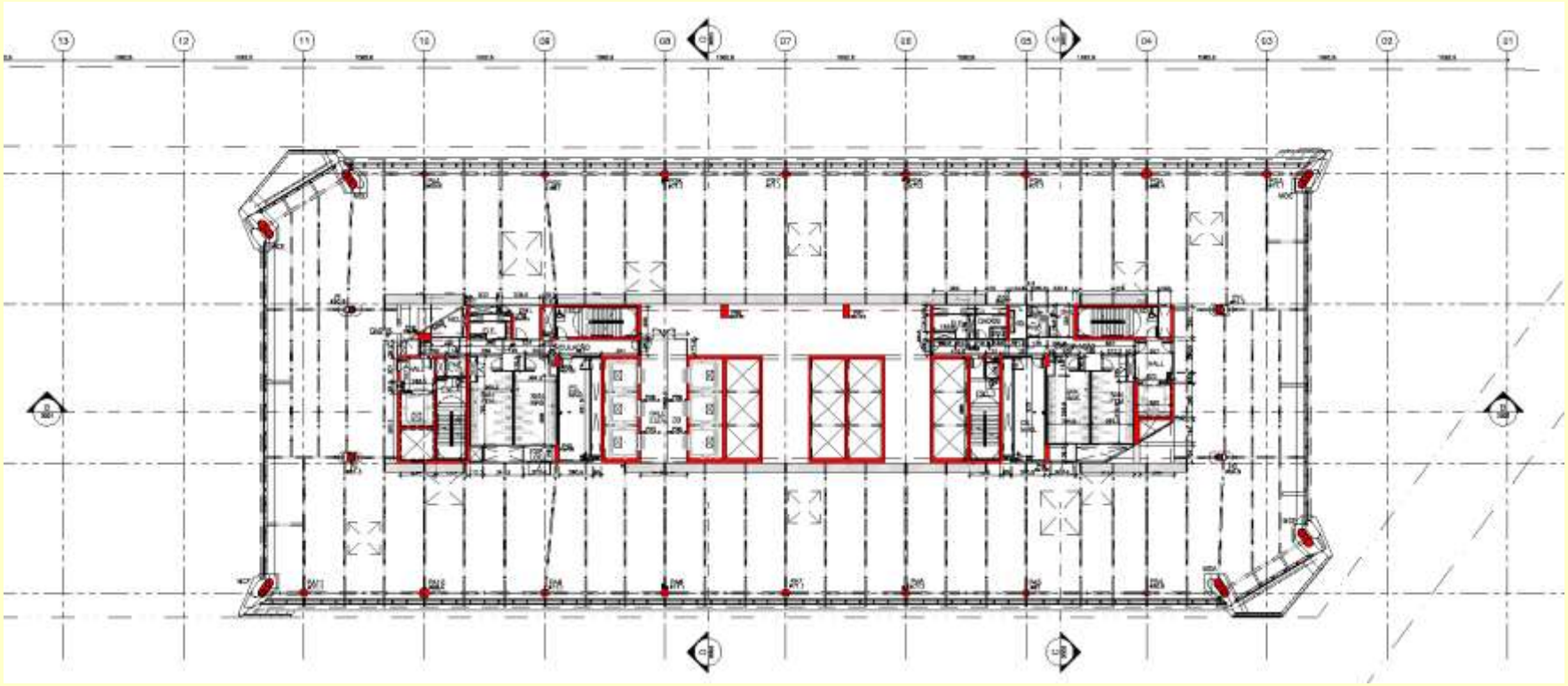


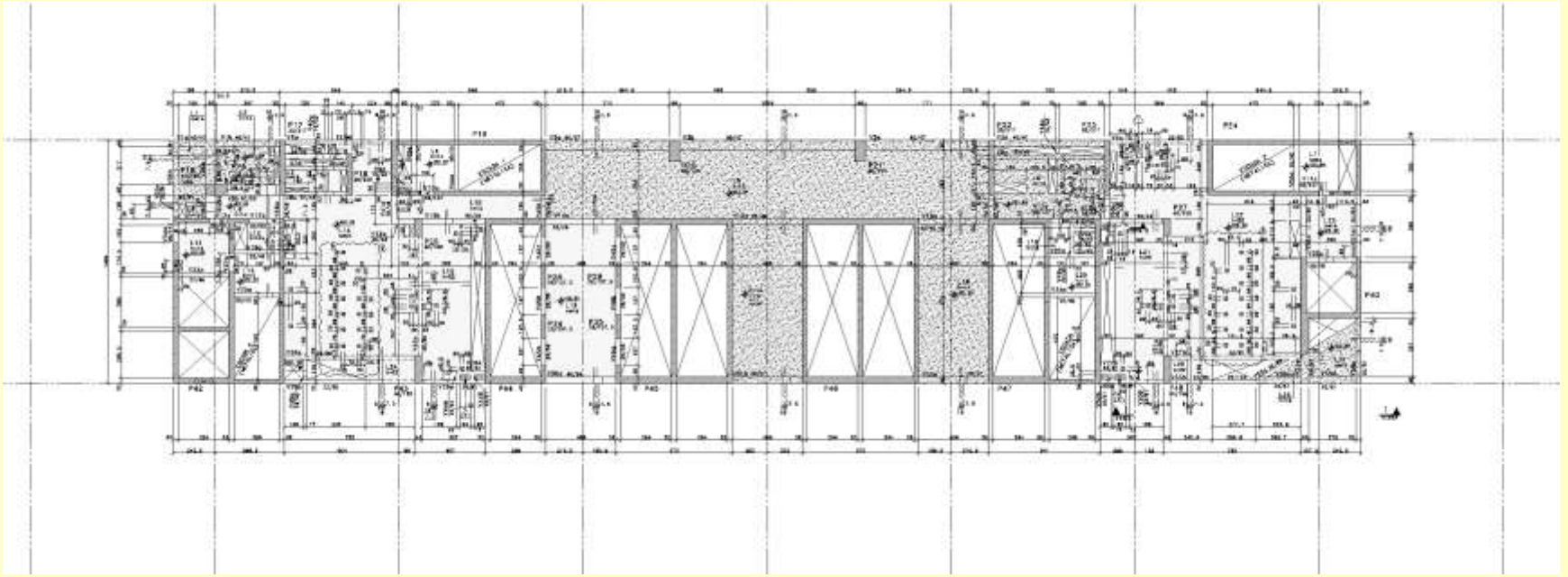


Lajes protendidas de 22 cm com capitéis de 40 cm
Vãos de 12 m e 14 m

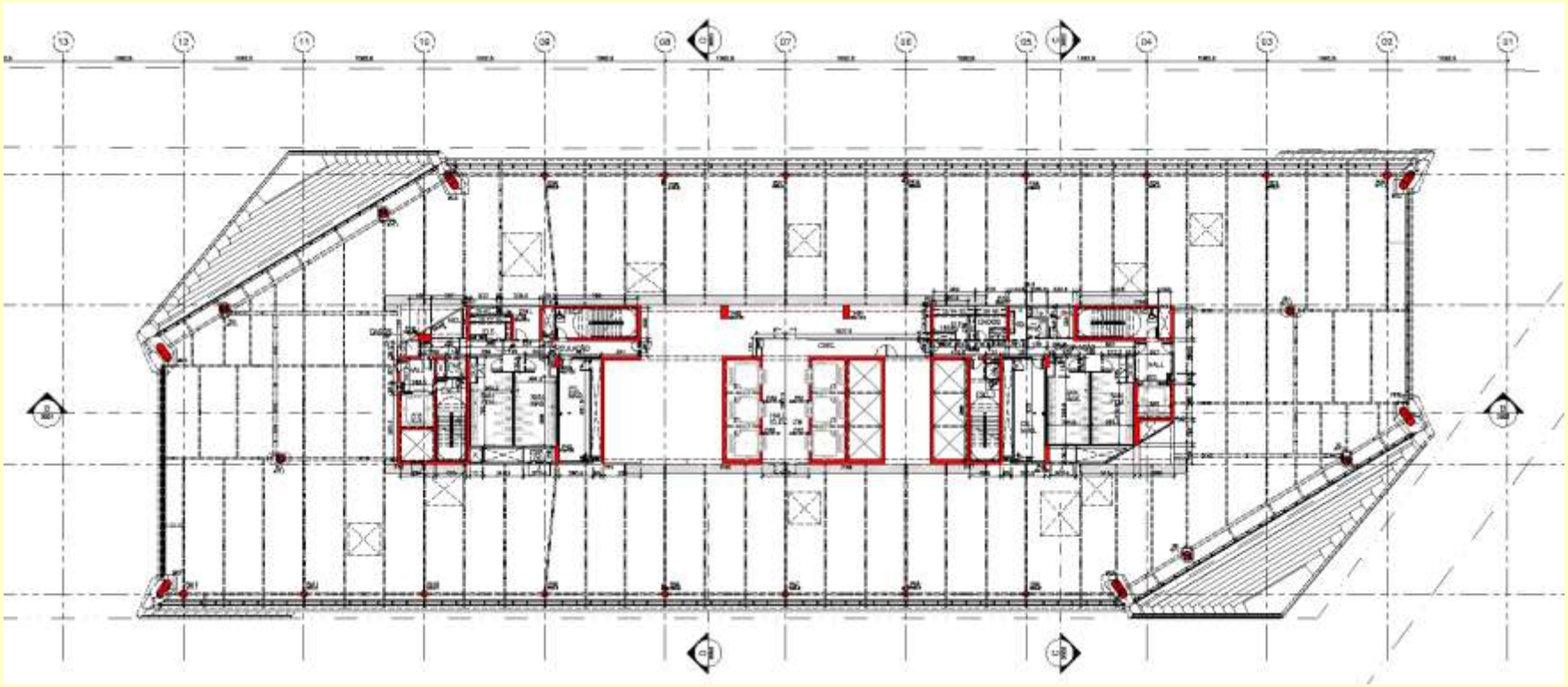


ZONA BAIXA – L01 AO L11

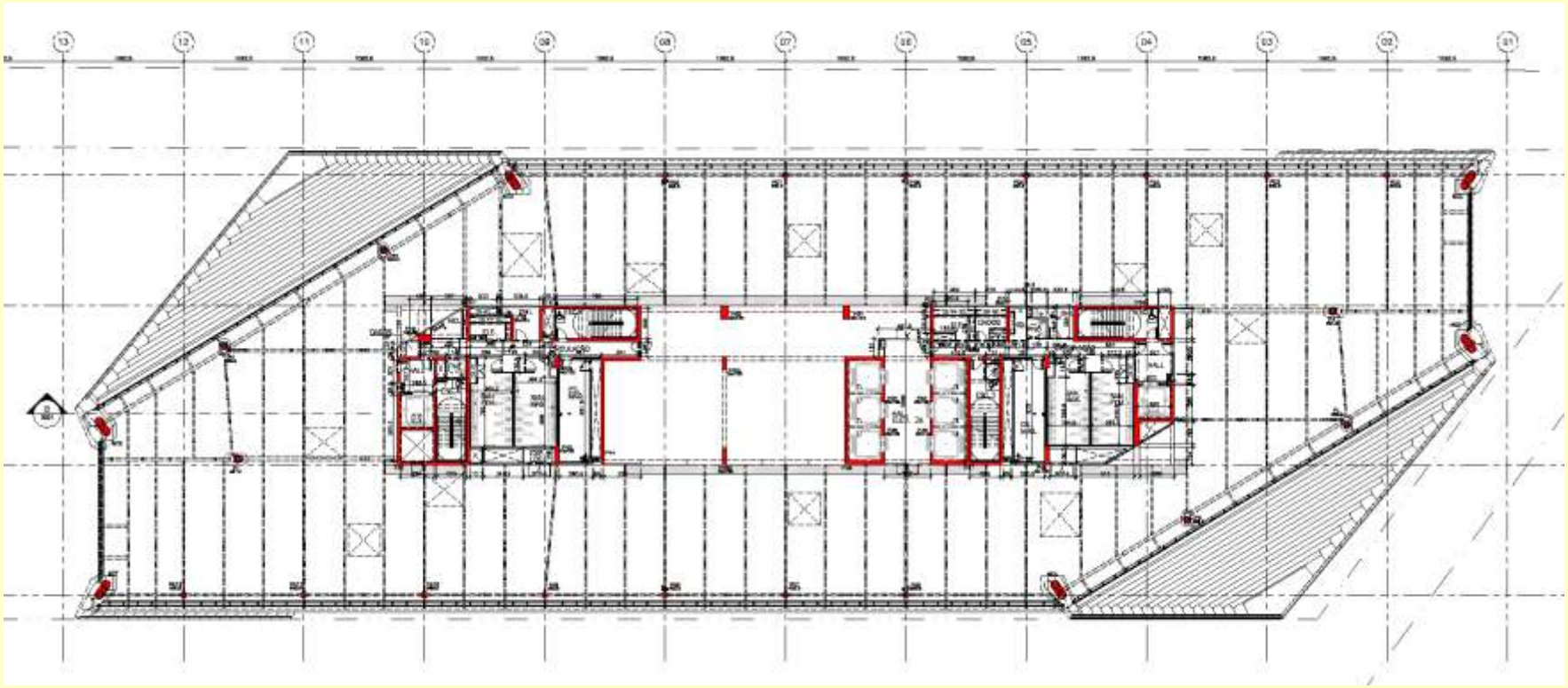


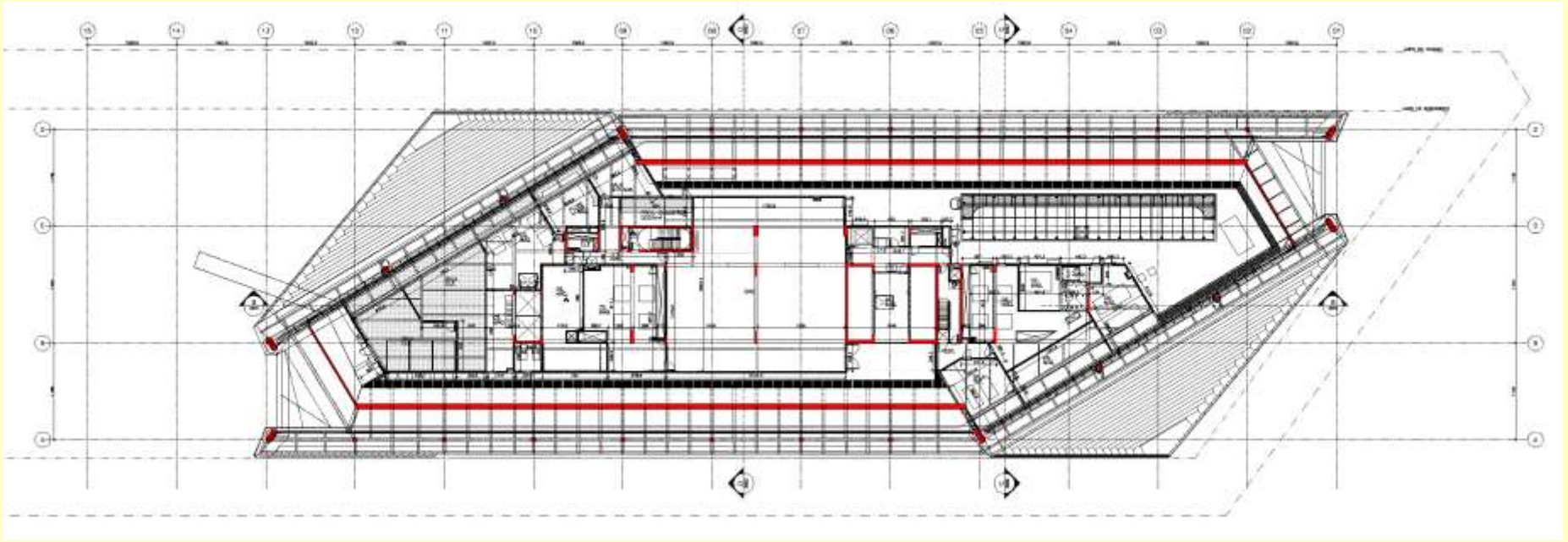


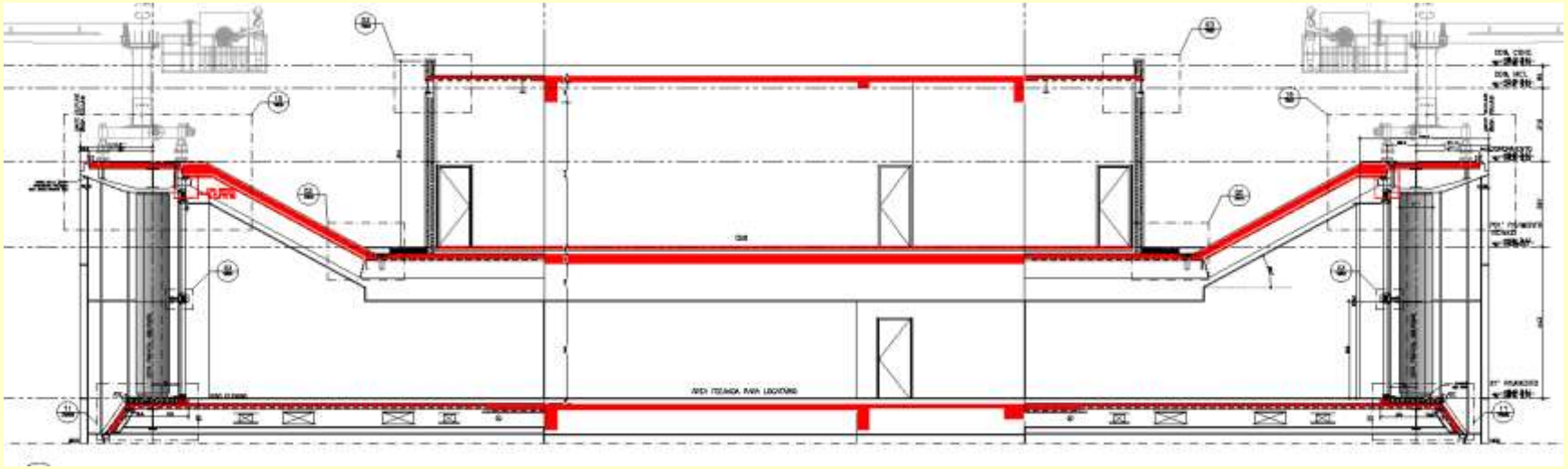
ZONA MÉDIA – L13 AO L19



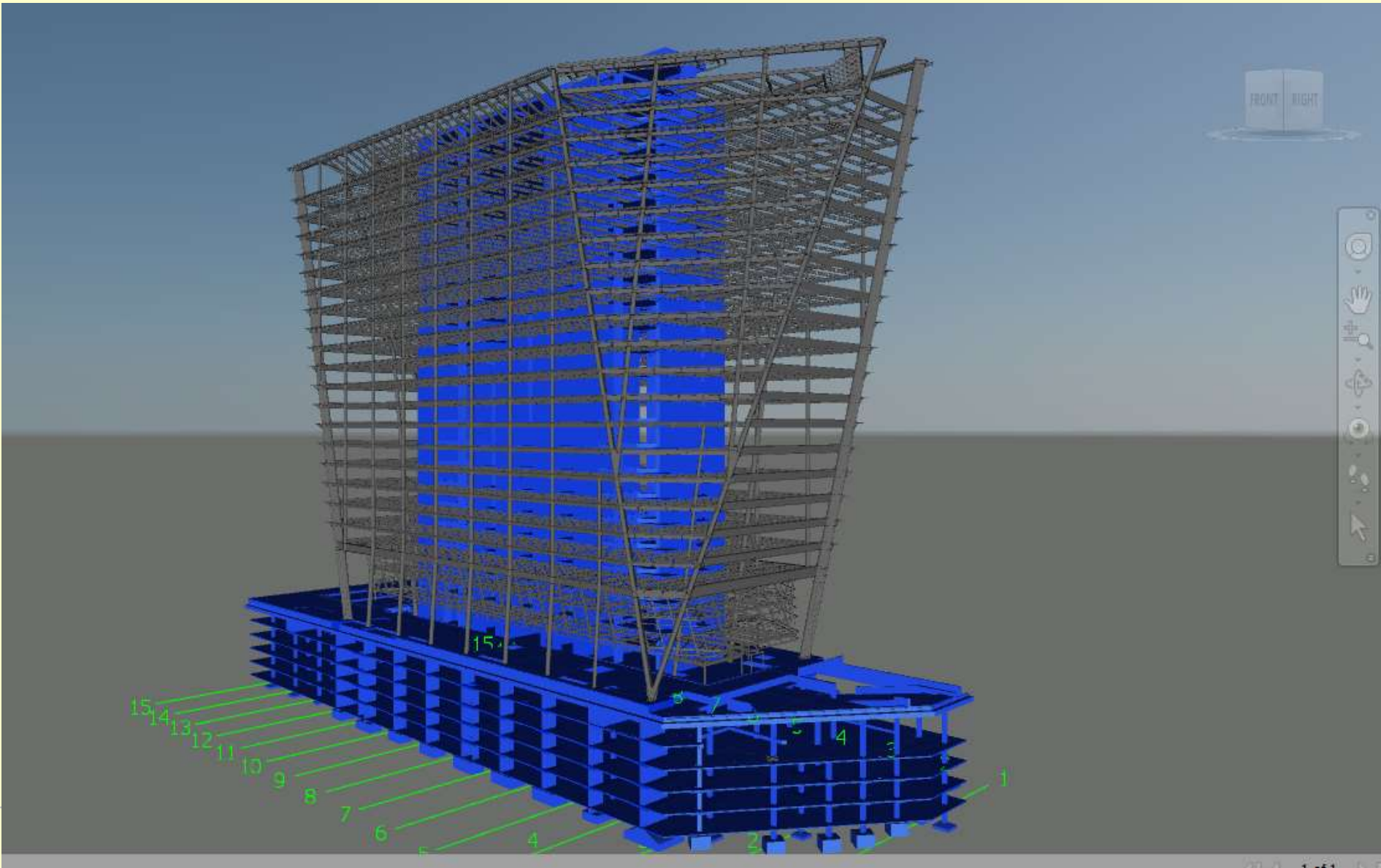
ZONA ALTA – L20 AO PAV. TEC.



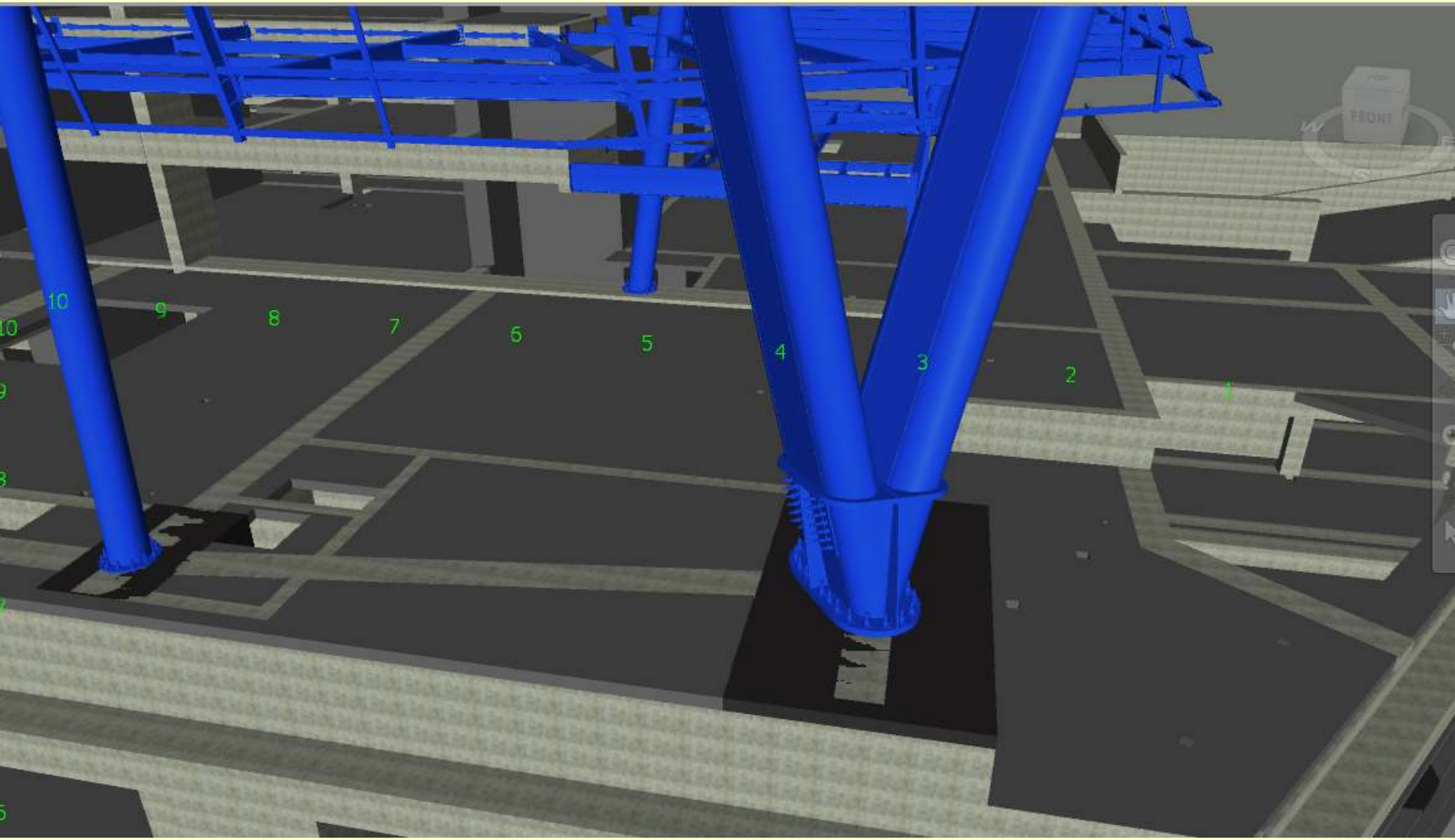




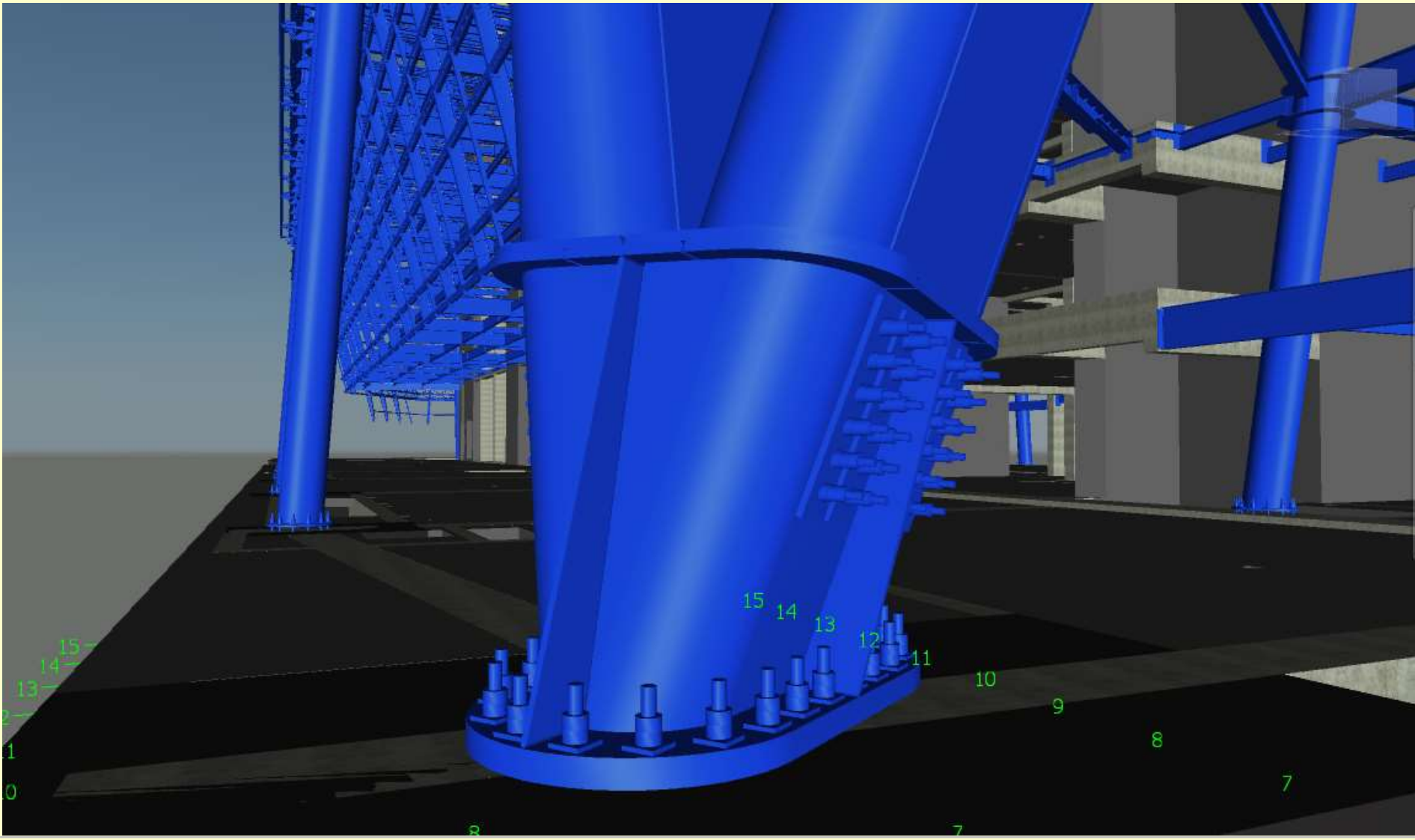
Estrutura Mista de concreto armado e aço
Base e núcleo em concreto



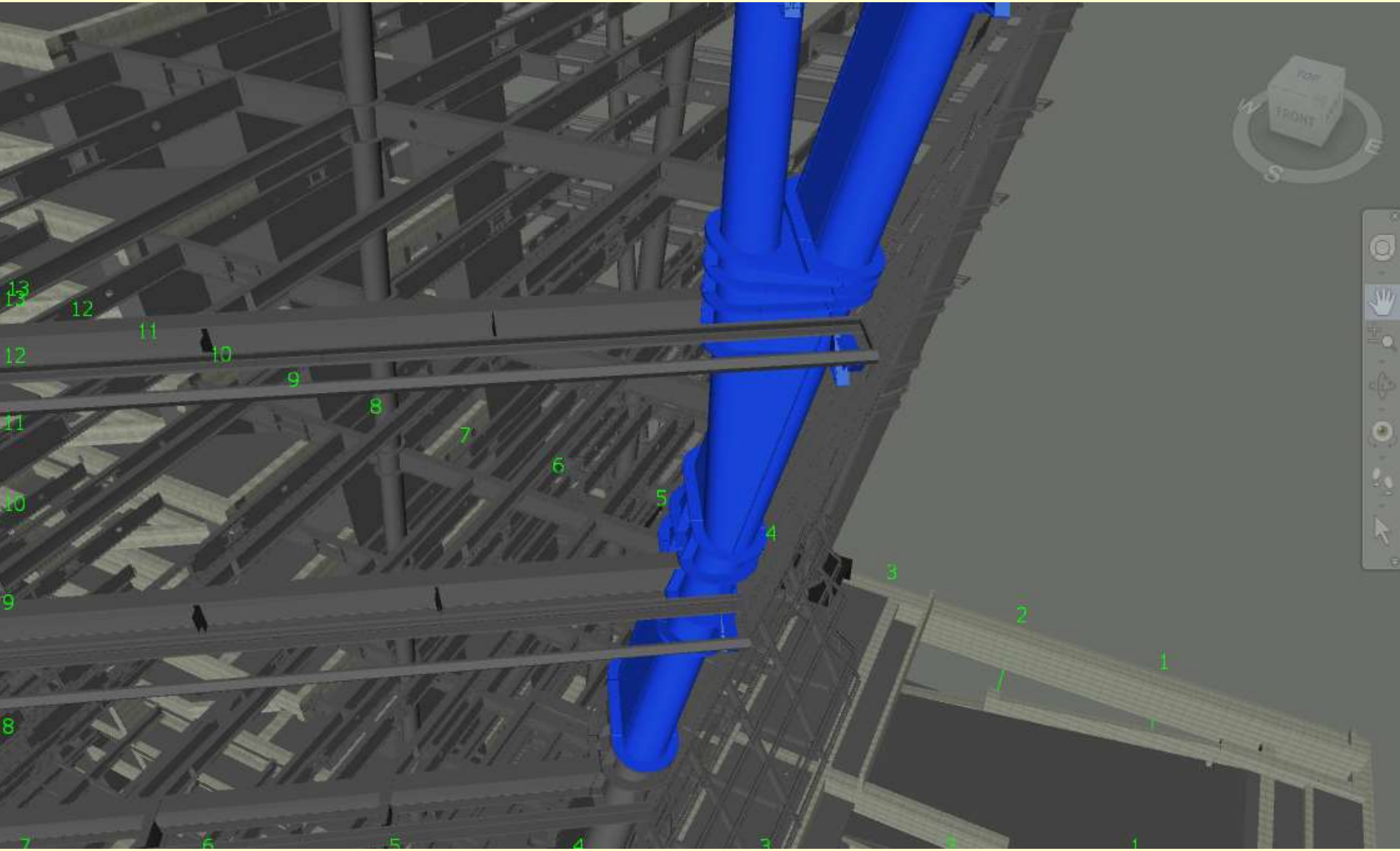
Detalhe do arranque das “Mega-colunas” em aço com núcleo em concreto



Detalhe do arranque das “Mega-colunas” em aço

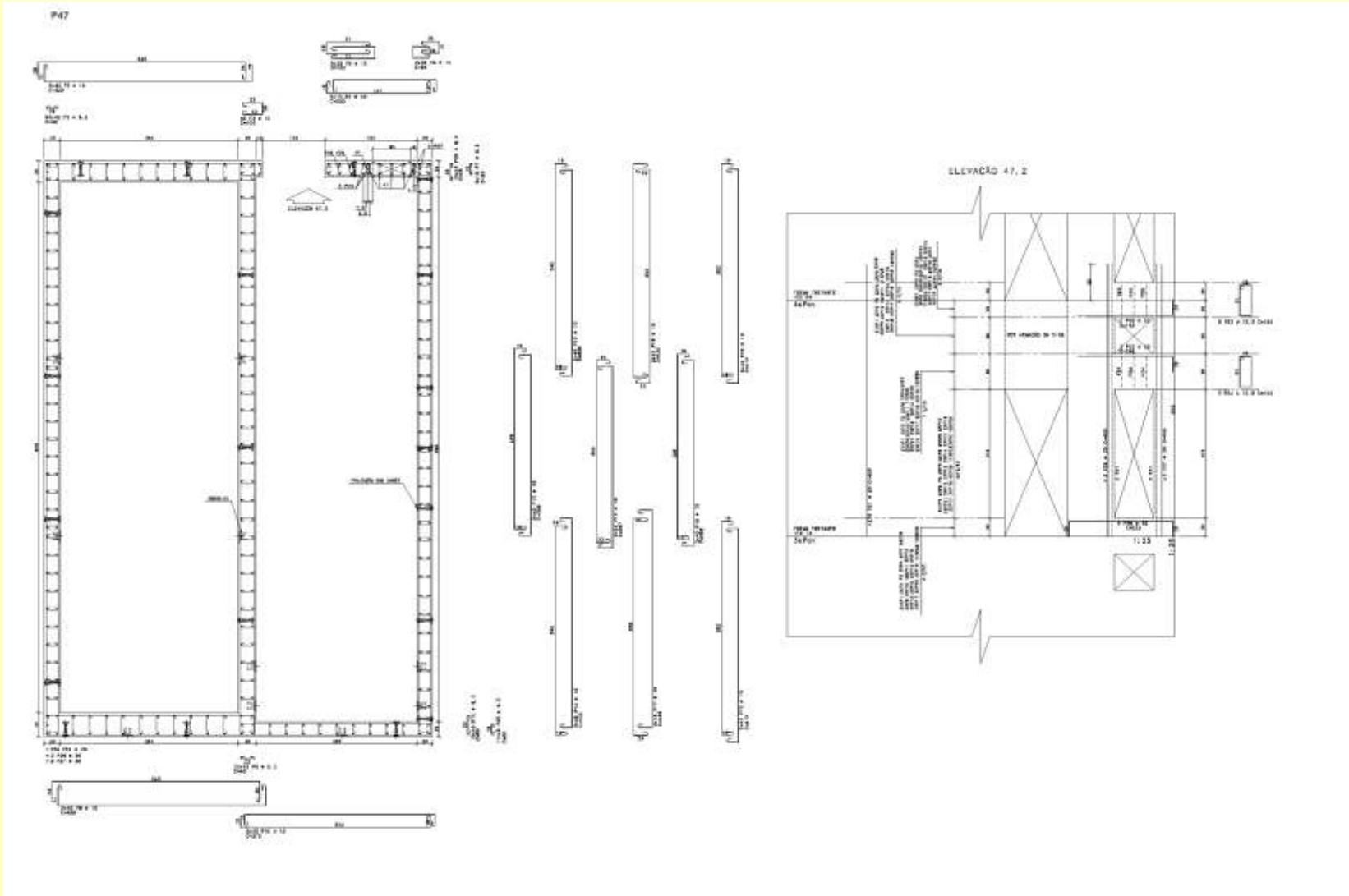


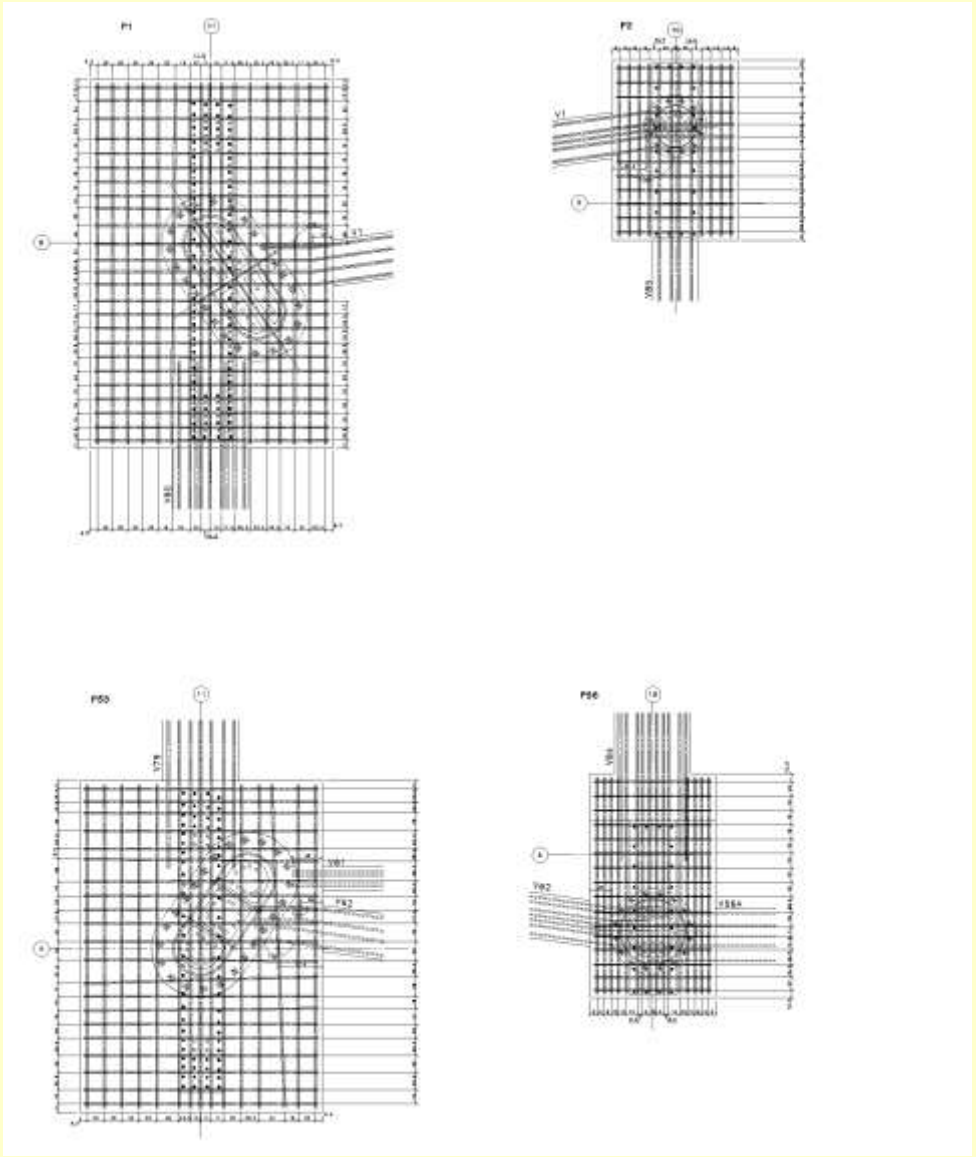
Detalhe das ramificações “Y” das “Mega-colunas”



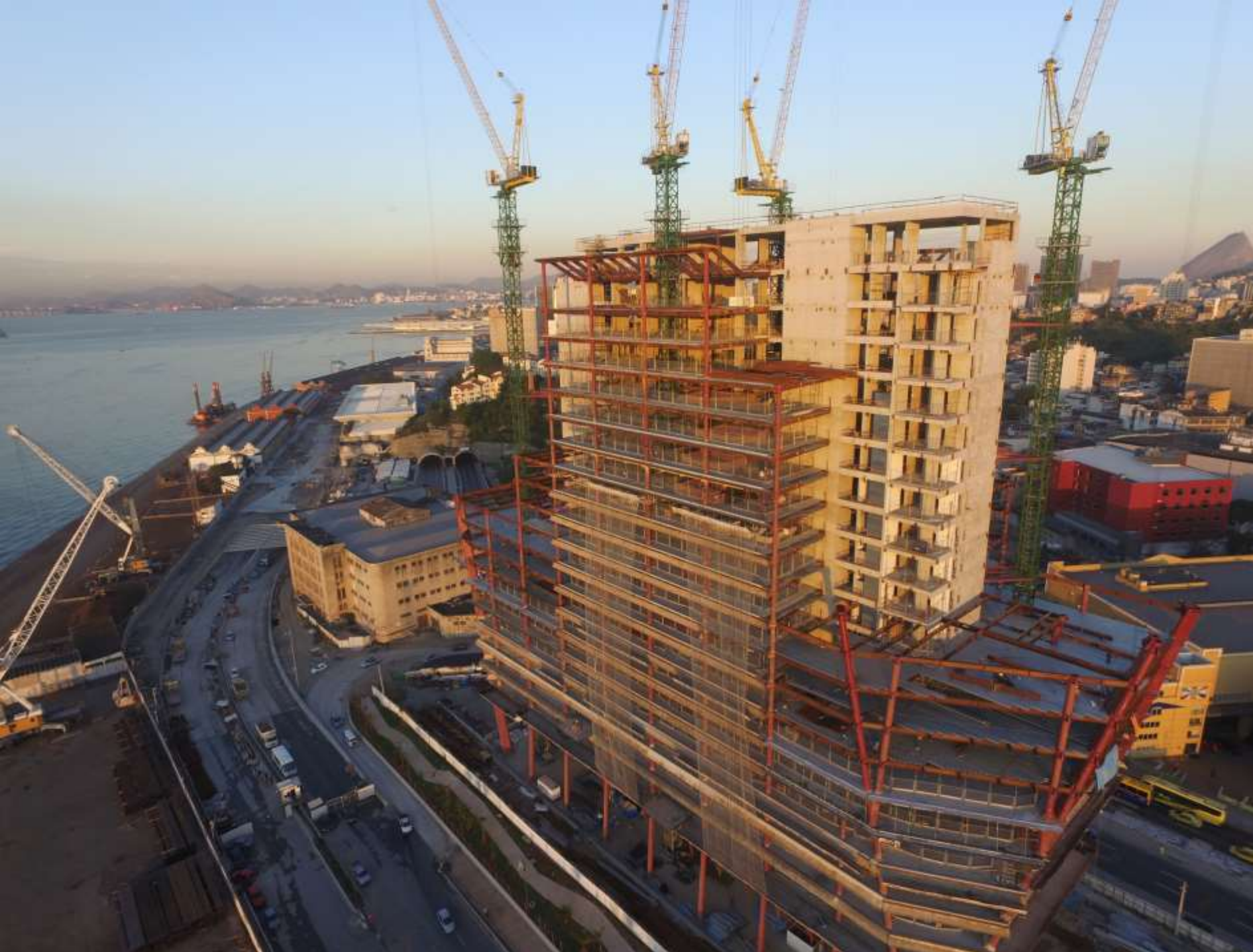
CUIDADOS COM INTERFERÊNCIA DE ARMADURAS

INSERTS E CONES DA FORMA TREPANTE

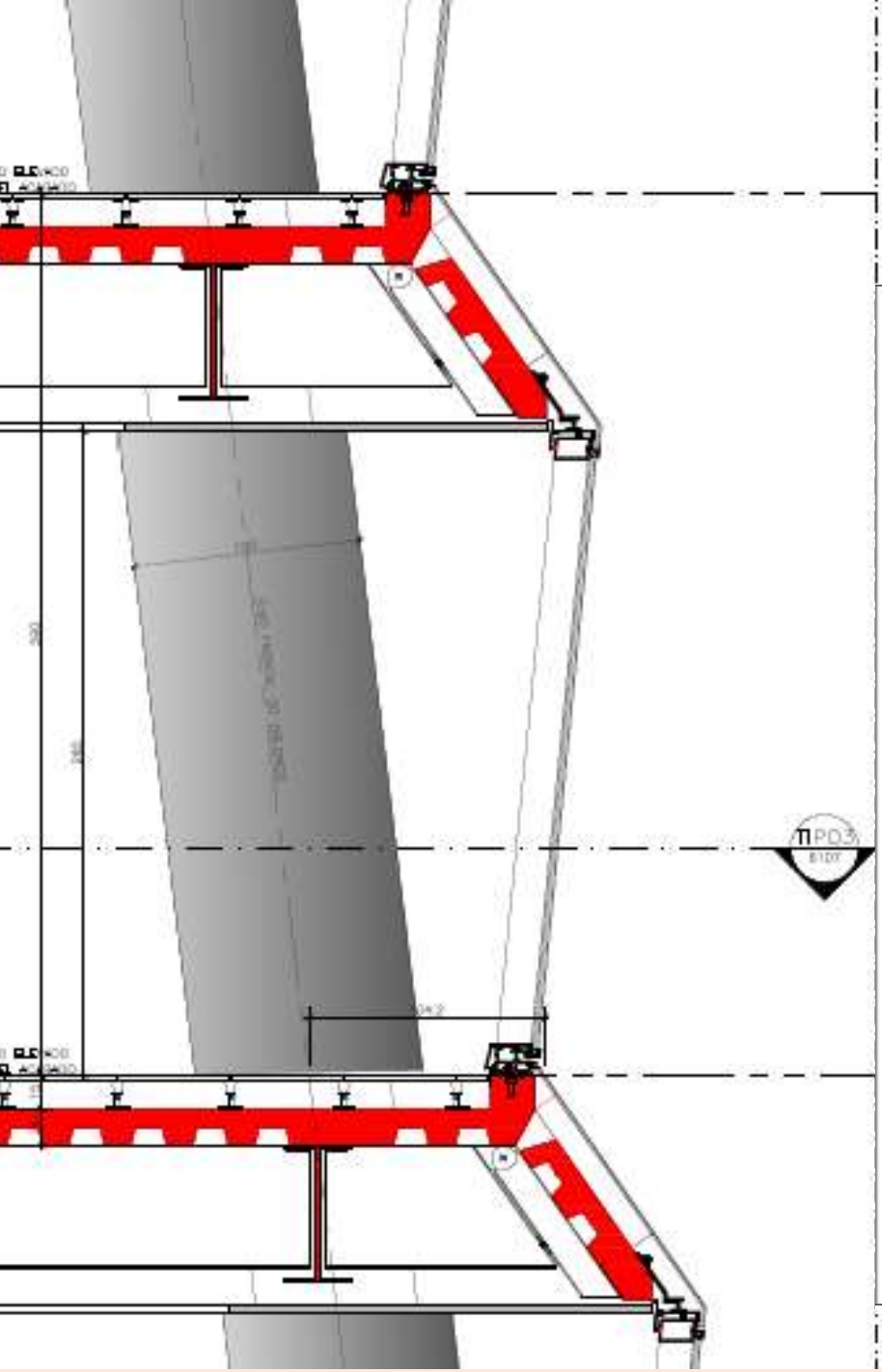


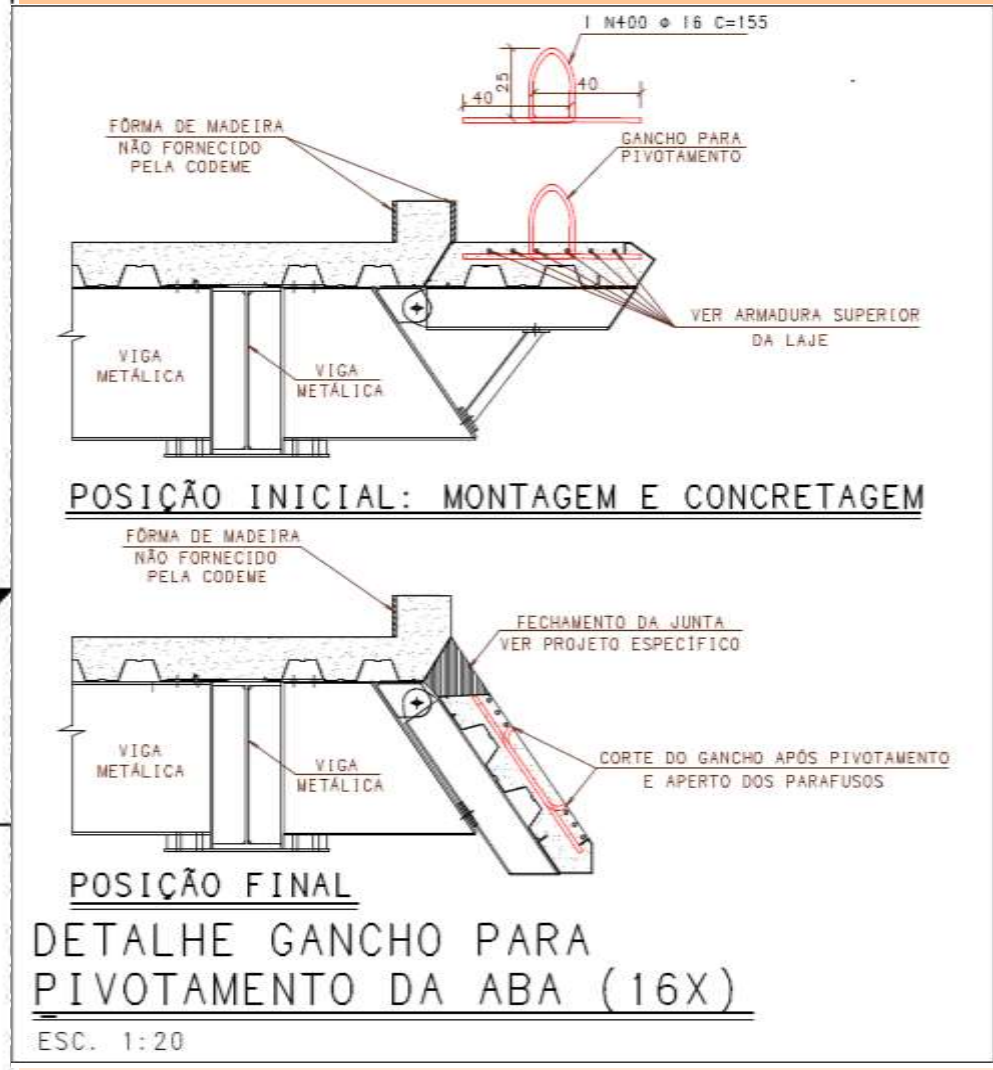


CHUMBADORES DAS COLUNAS METÁLICAS



DETALHE EXECUÇÃO DAS ABAS DAS FACHADAS

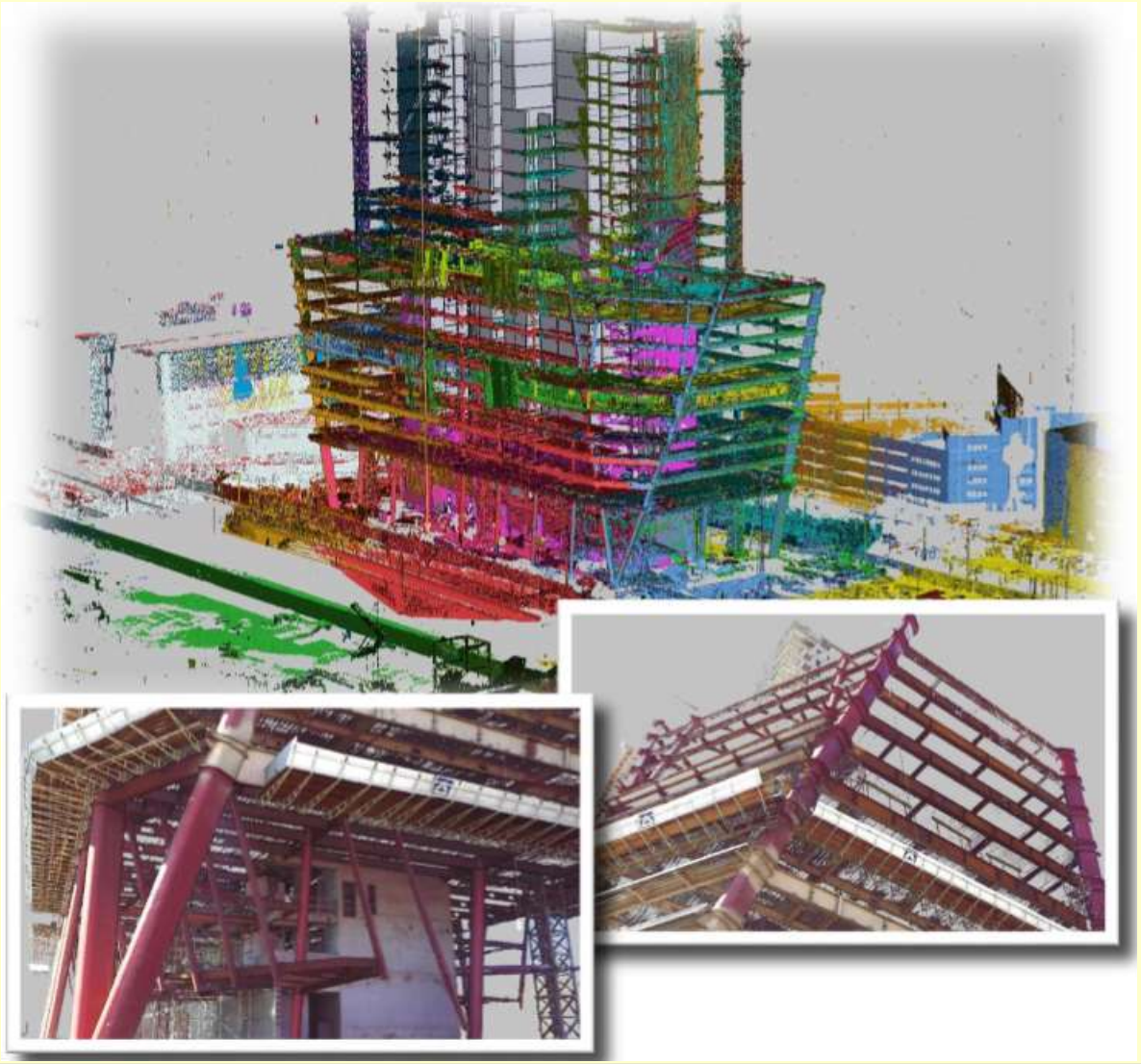




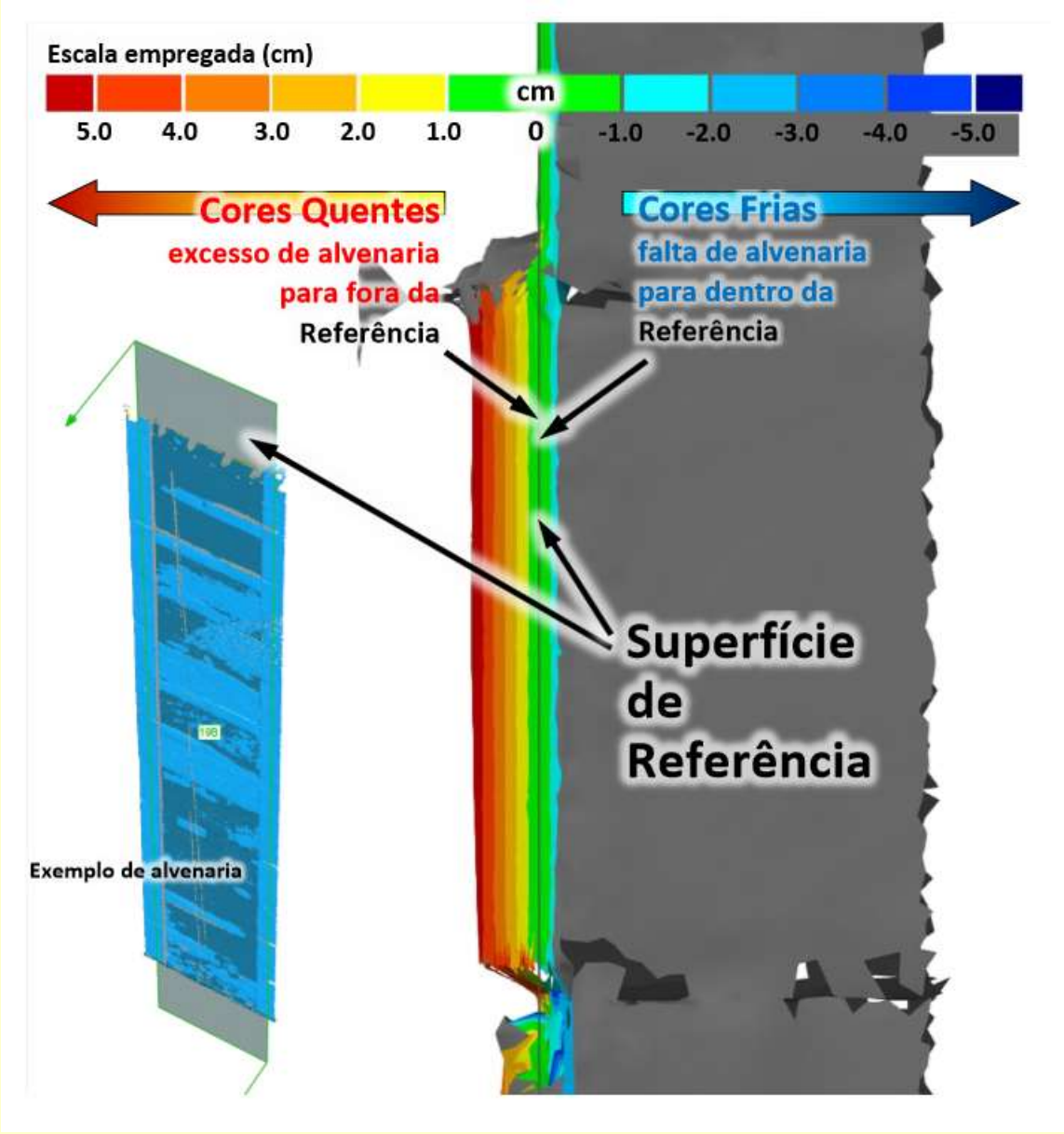
Tecnologias e soluções não convencionais

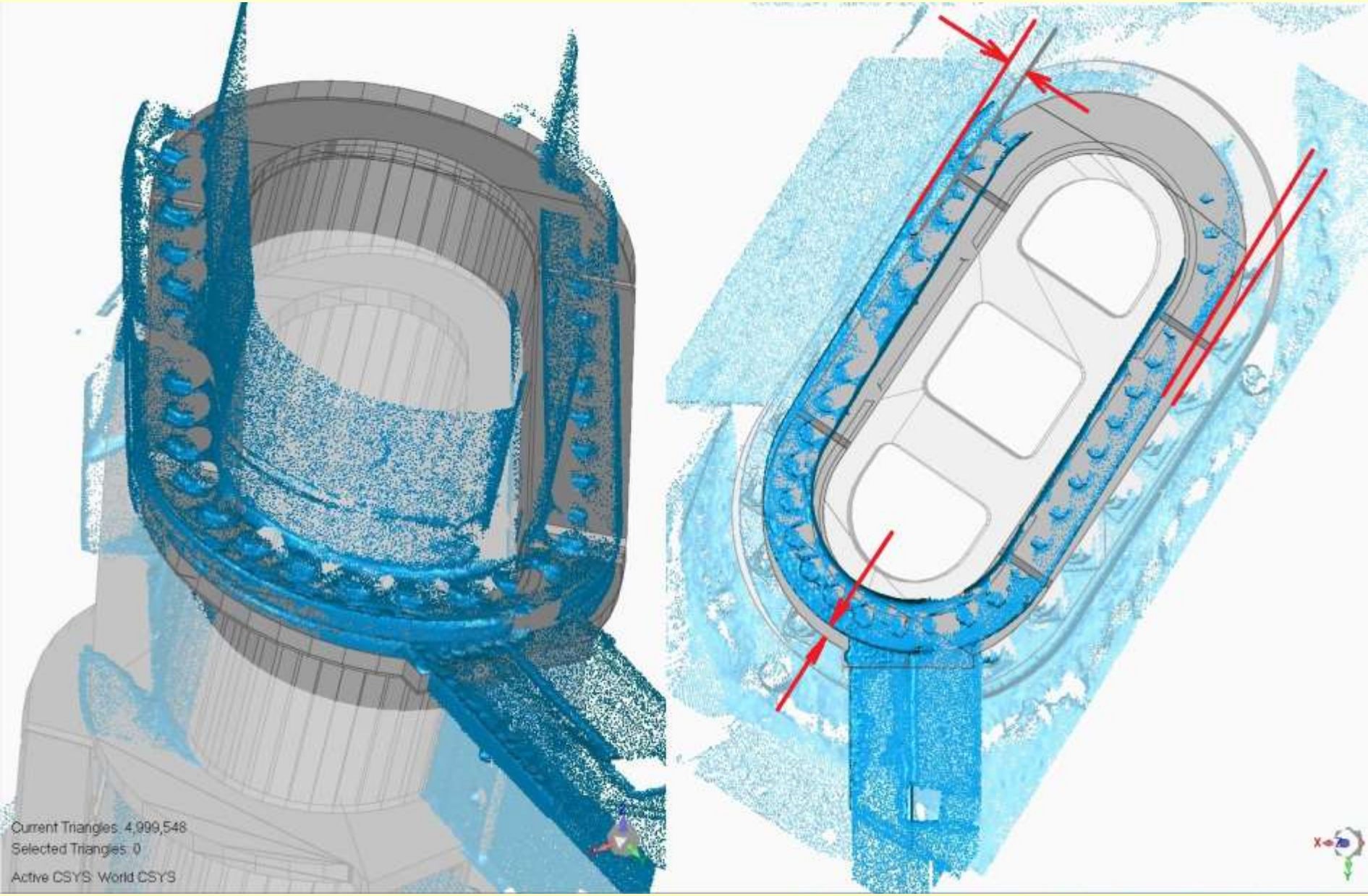
- BIM (foco na estrutura e fachada).
- Pilares de aço tubulares e concreto armado de alta resistência.
- Abas descendentes.
- Testes dinâmicos em fachada de grande dimensões.
- Scanner para controle de posicionamento da estrutura.

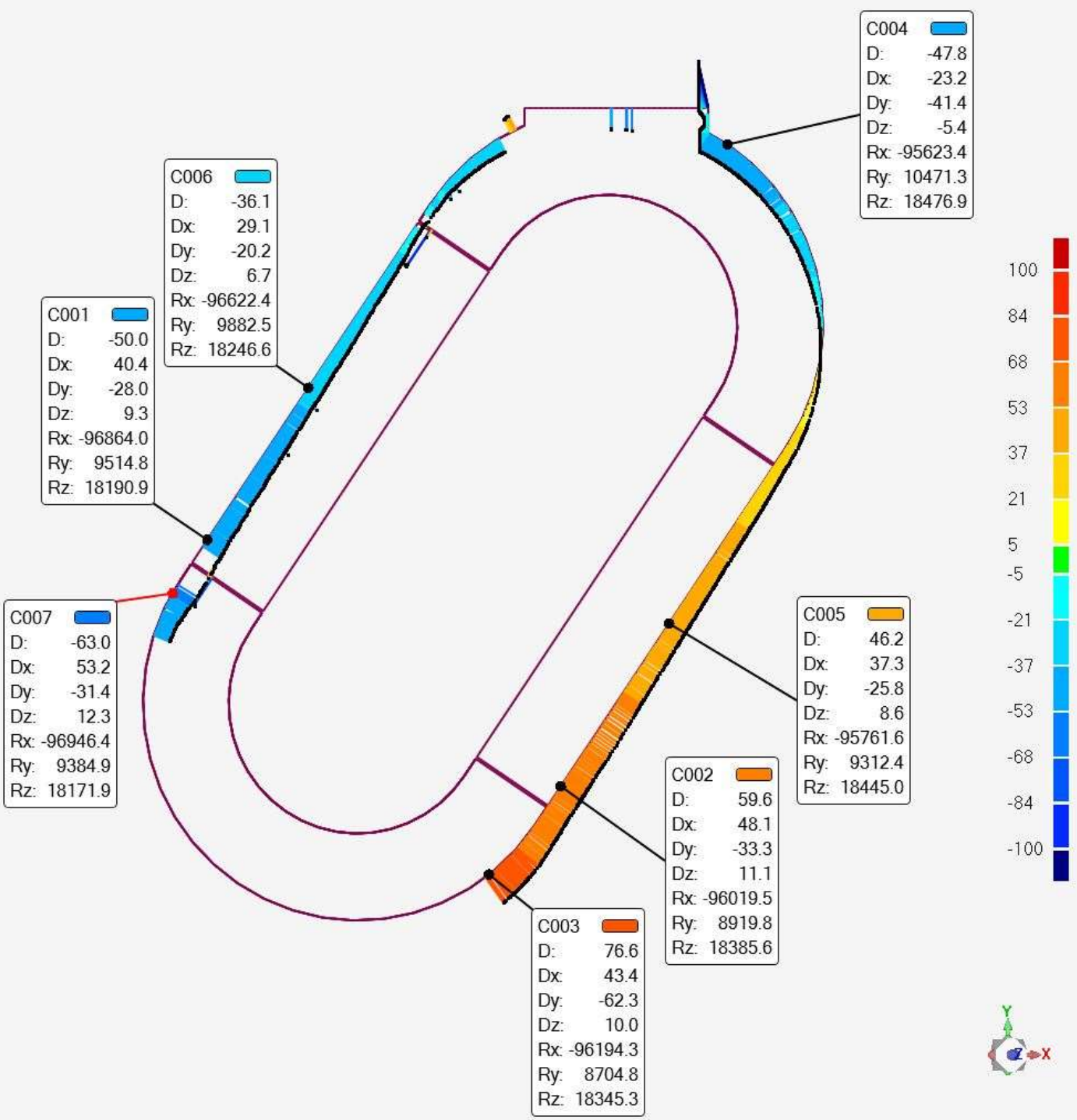
Nuvem de Pontos

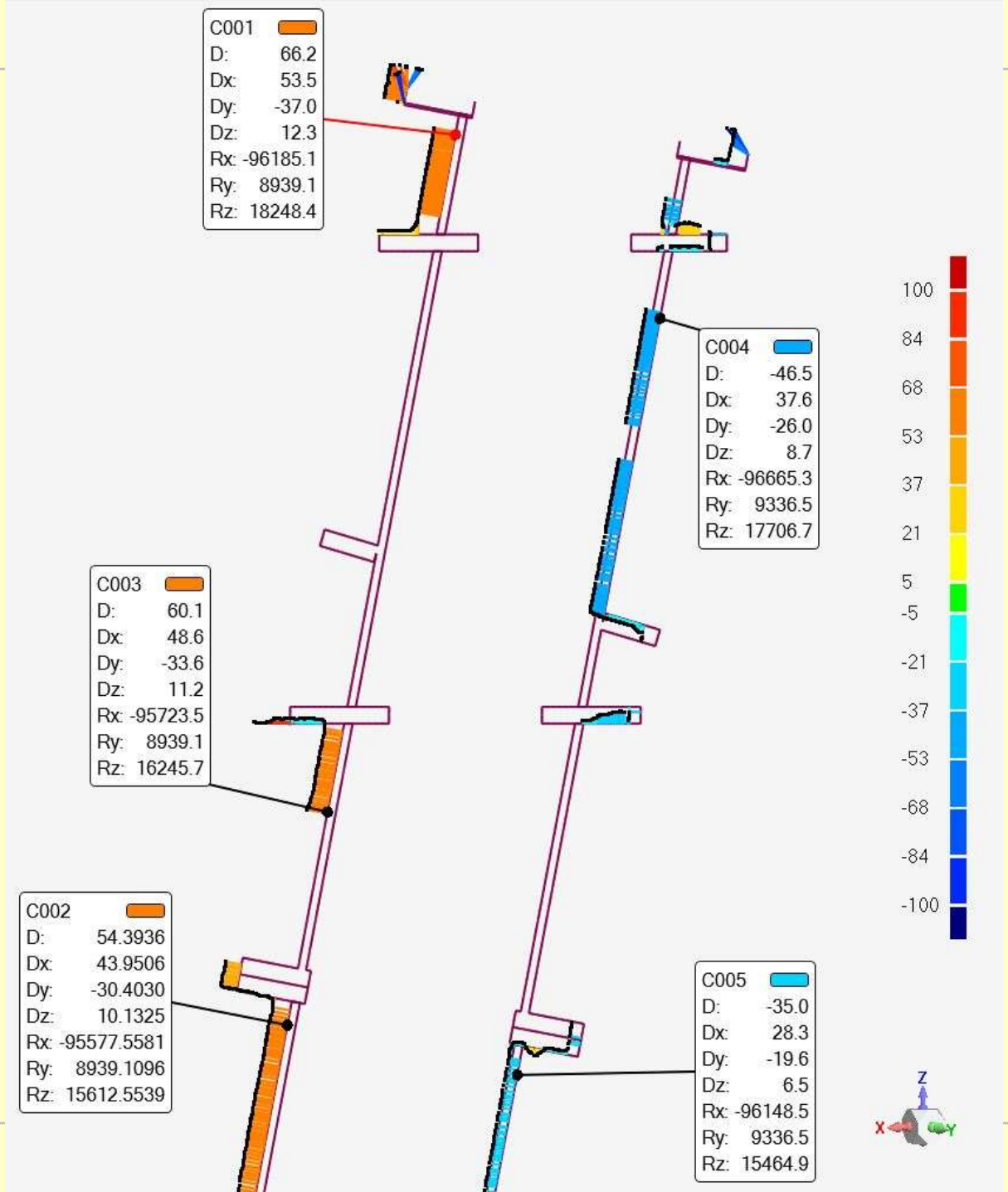


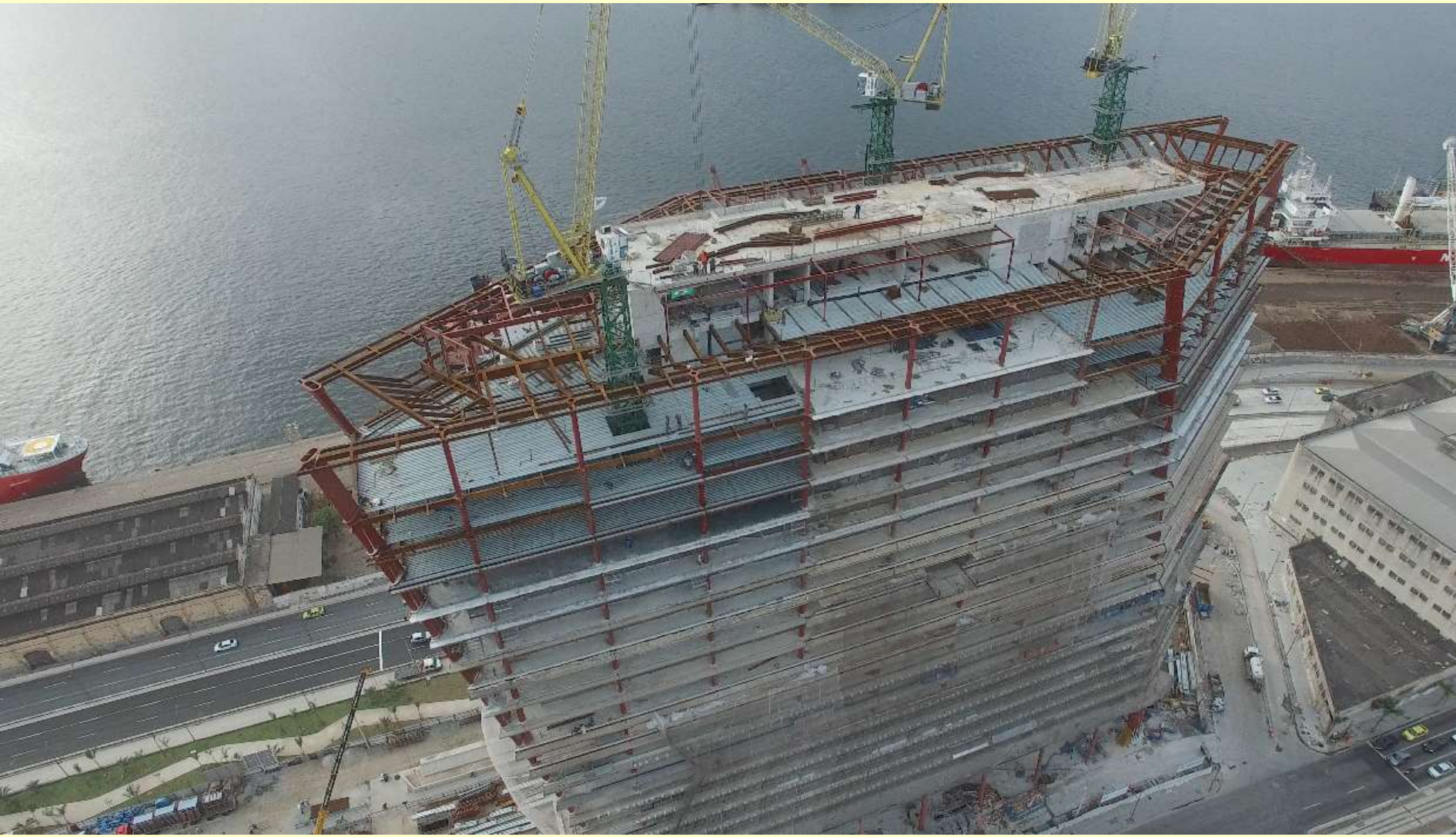
Escala de Cores




Current Triangles: 4,999,548
Selected Triangles: 0
Active CSYS: World CSYS


C004
D: -47.8
Dx: -23.2
Dy: -41.4
Dz: -5.4
Rx: -95623.4
Ry: 10471.3
Rz: 18476.9
C006
D: -36.1
Dx: 29.1
Dy: -20.2
Dz: 6.7
Rx: -96622.4
Ry: 9882.5
Rz: 18246.6
C001
D: -50.0
Dx: 40.4
Dy: -28.0
Dz: 9.3
Rx: -96864.0
Ry: 9514.8
Rz: 18190.9
C007
D: -63.0
Dx: 53.2
Dy: -31.4
Dz: 12.3
Rx: -96946.4
Ry: 9384.9
Rz: 18171.9
C005
D: 46.2
Dx: 37.3
Dy: -25.8
Dz: 8.6
Rx: -95761.6
Ry: 9312.4
Rz: 18445.0
C002
D: 59.6
Dx: 48.1
Dy: -33.3
Dz: 11.1
Rx: -96019.5
Ry: 8919.8
Rz: 18385.6
C003
D: 76.6
Dx: 43.4
Dy: -62.3
Dz: 10.0
Rx: -96194.3
Ry: 8704.8
Rz: 18345.3
100
84
68
53
37
21
5
-5
-21
-37
-53
-68
-84
-100
Y
X


C001
D: 66.2
Dx: 53.5
Dy: -37.0
Dz: 12.3
Rx: -96185.1
Ry: 8939.1
Rz: 18248.4
C004
D: -46.5
Dx: 37.6
Dy: -26.0
Dz: 8.7
Rx: -96665.3
Ry: 9336.5
Rz: 17706.7
C003
D: 60.1
Dx: 48.6
Dy: -33.6
Dz: 11.2
Rx: -95723.5
Ry: 8939.1
Rz: 16245.7
C002
D: 54.3936
Dx: 43.9506
Dy: -30.4030
Dz: 10.1325
Rx: -95577.5581
Ry: 8939.1096
Rz: 15612.5539
C005
D: -35.0
Dx: 28.3
Dy: -19.6
Dz: 6.5
Rx: -96148.5
Ry: 9336.5
Rz: 15464.9
100
84
68
53
37
21
5
-5
-21
-37
-53
-68
-84
-100
Z
X
Y



Quantidades

Area : 110.560 m^2

Subsolos, Térreo e Núcleo da Torre

Concreto 50 Mpa : 22.363 m^3

Armadura frouxa : 3.281.382 kg

Armadura Protendida : 85.879 kg

Estrutura Mista

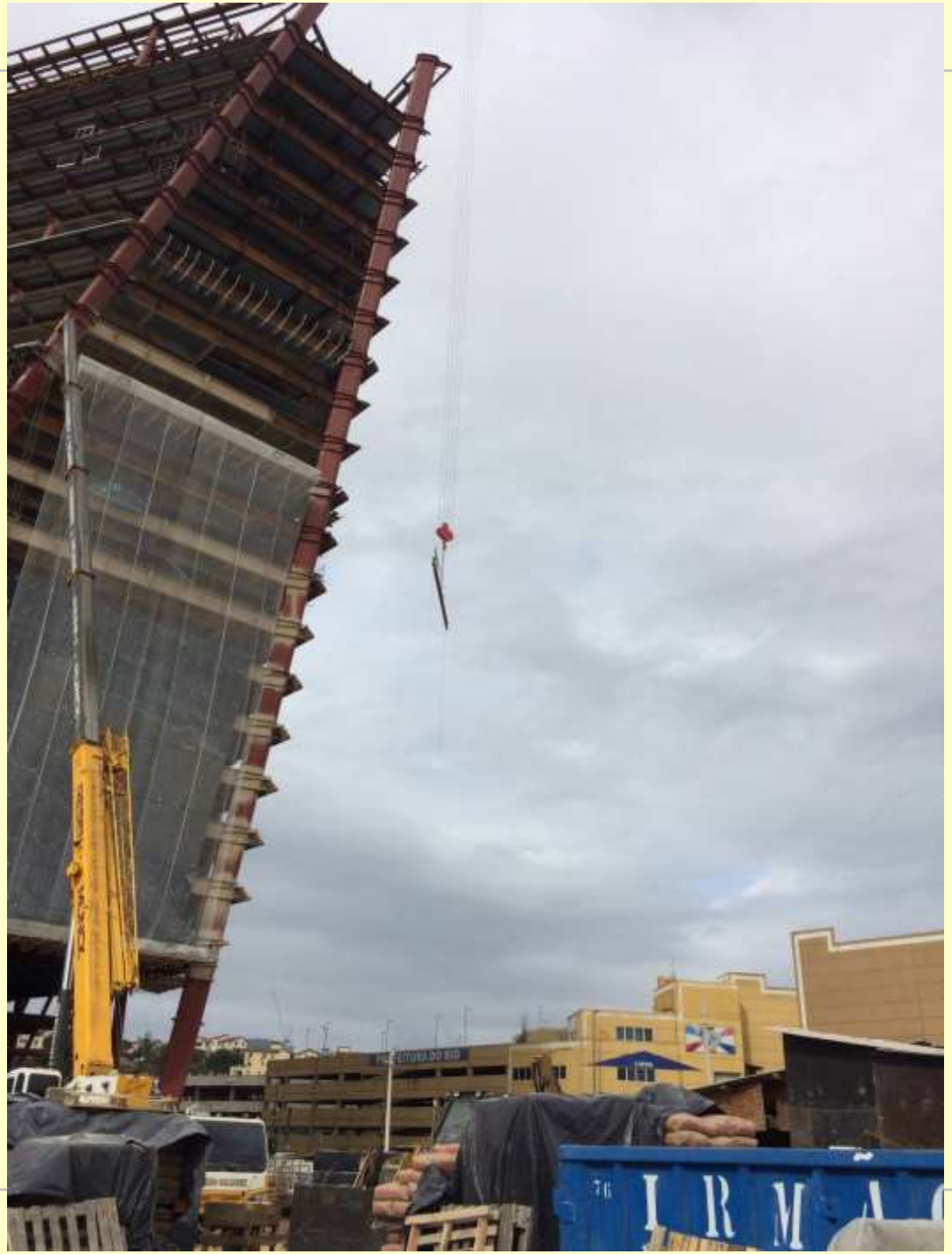
Aço : 4.500 ton

Concreto :

- Steel deck 35 Mpa : 8.063 m^3
- Pilares 50 Mpa : 1.137 m^3 (AUTO ADENSÁVEL – CONCRETAGEM 12m DE ALTURA)
  80 Mpa : 71 m^3

Armadura frouxa : 762.624 kg


Andre
Roberta
Pedro
Jorge
Suely
Stella
Heloisa
Mario Franco
ANiBAL


IRM

OBRIGADA

suelybueno@jkmf.com.br