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Yingchen Liu
Celso Rojas
Mario Salinas
Qing Yang

shenzhen stock exchange | OMA

Architects OMA

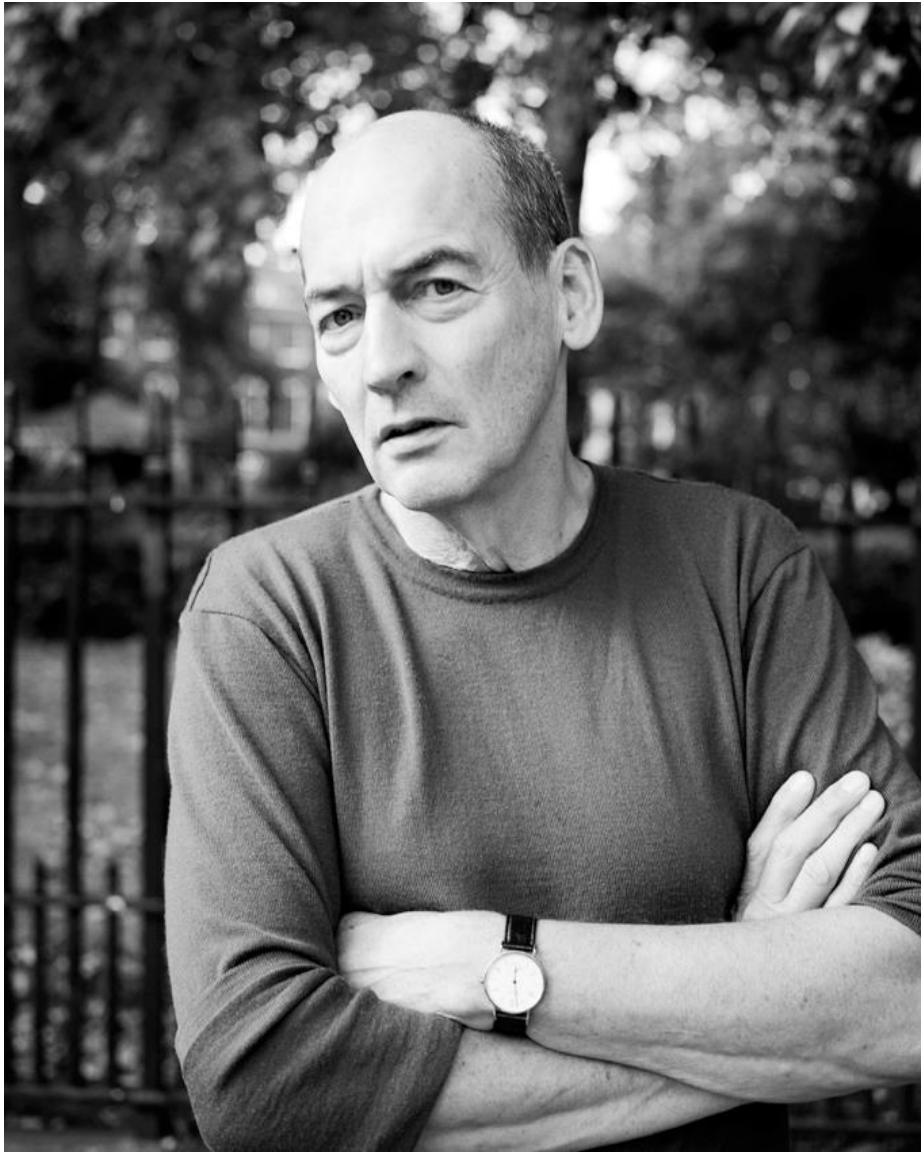
Engineer ARUP

Location Shenzhen, Guangdong, China

Year completed in 2013

Program Total 265,000 m²; 180,000 m² above ground: Shenzhen Stock Exchange's offices, Listing Hall, conference centres, a Chinese art gallery, a technical operations centre, canteen, and a restaurant / club, rental offices, a registration & clearing house, a securities information company, and a retail area; 85,000 m² below ground.

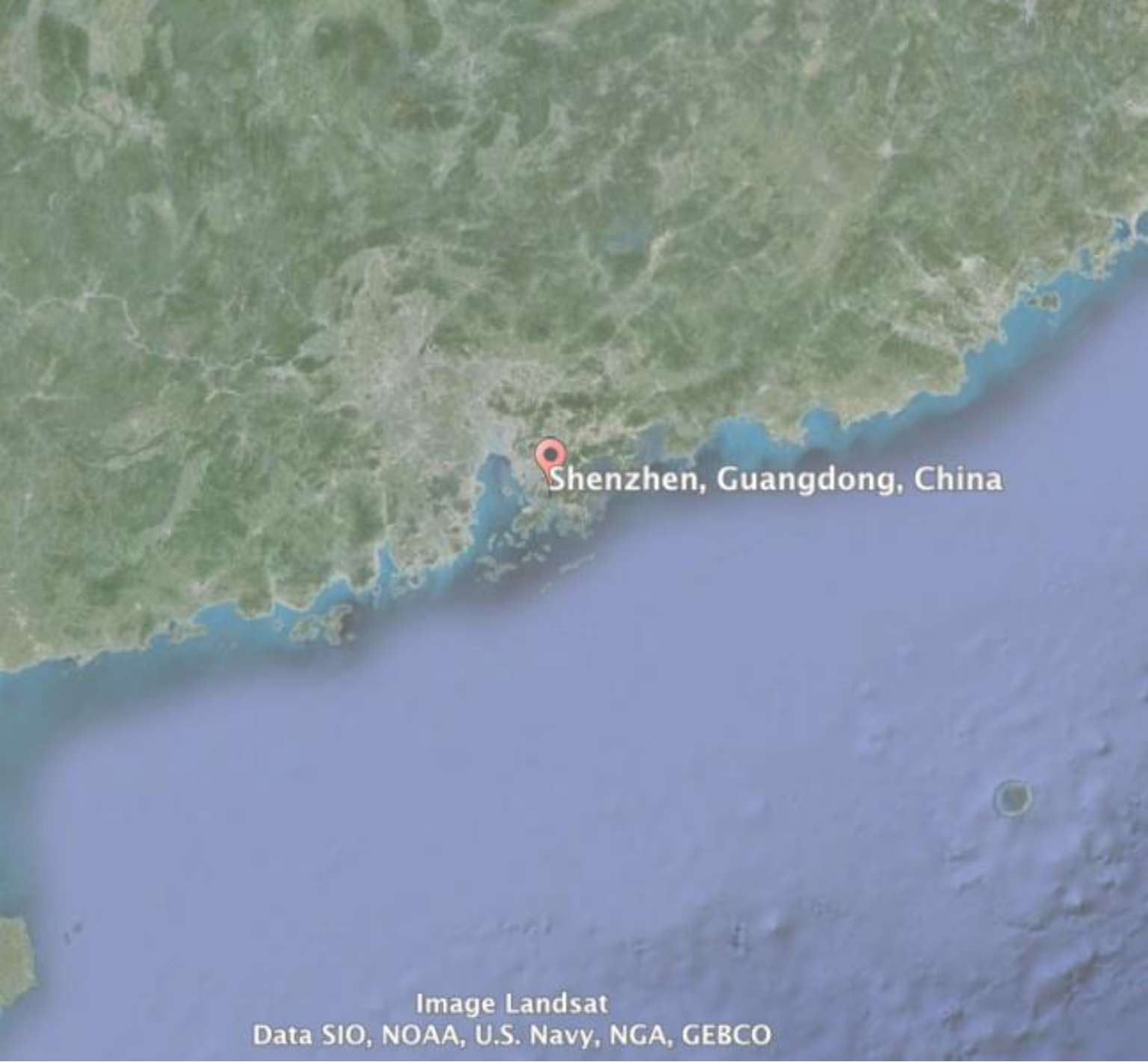
Owner SZSE, Shenzhen Stock Exchange



ARUP

architect

shenzhen stock exchange

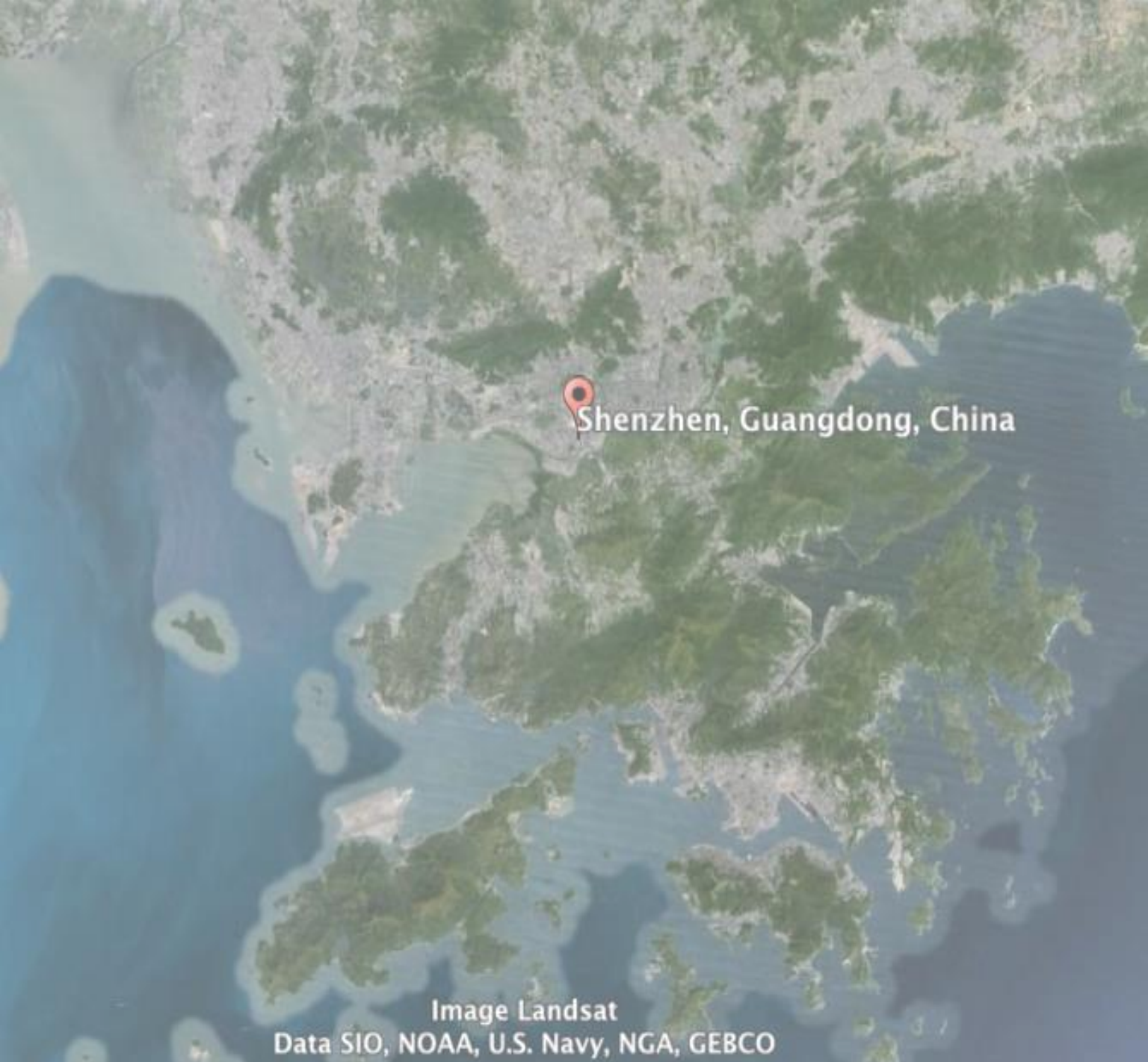


Shenzhen, Guangdong, China

Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

site

shenzhen stock exchange



Shenzhen, Guangdong, China

Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

site

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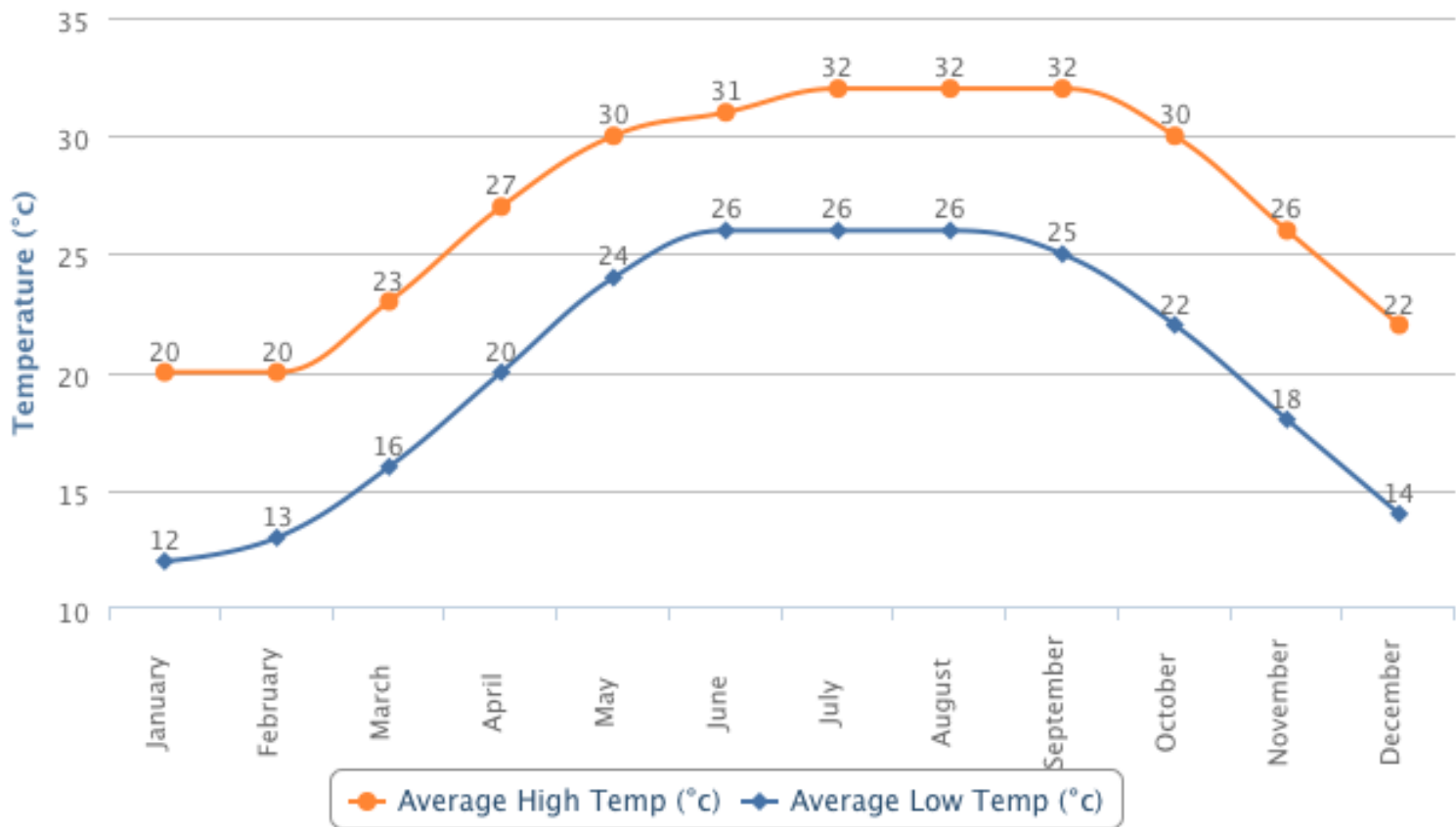


Image © 2013 DigitalGlobe

site

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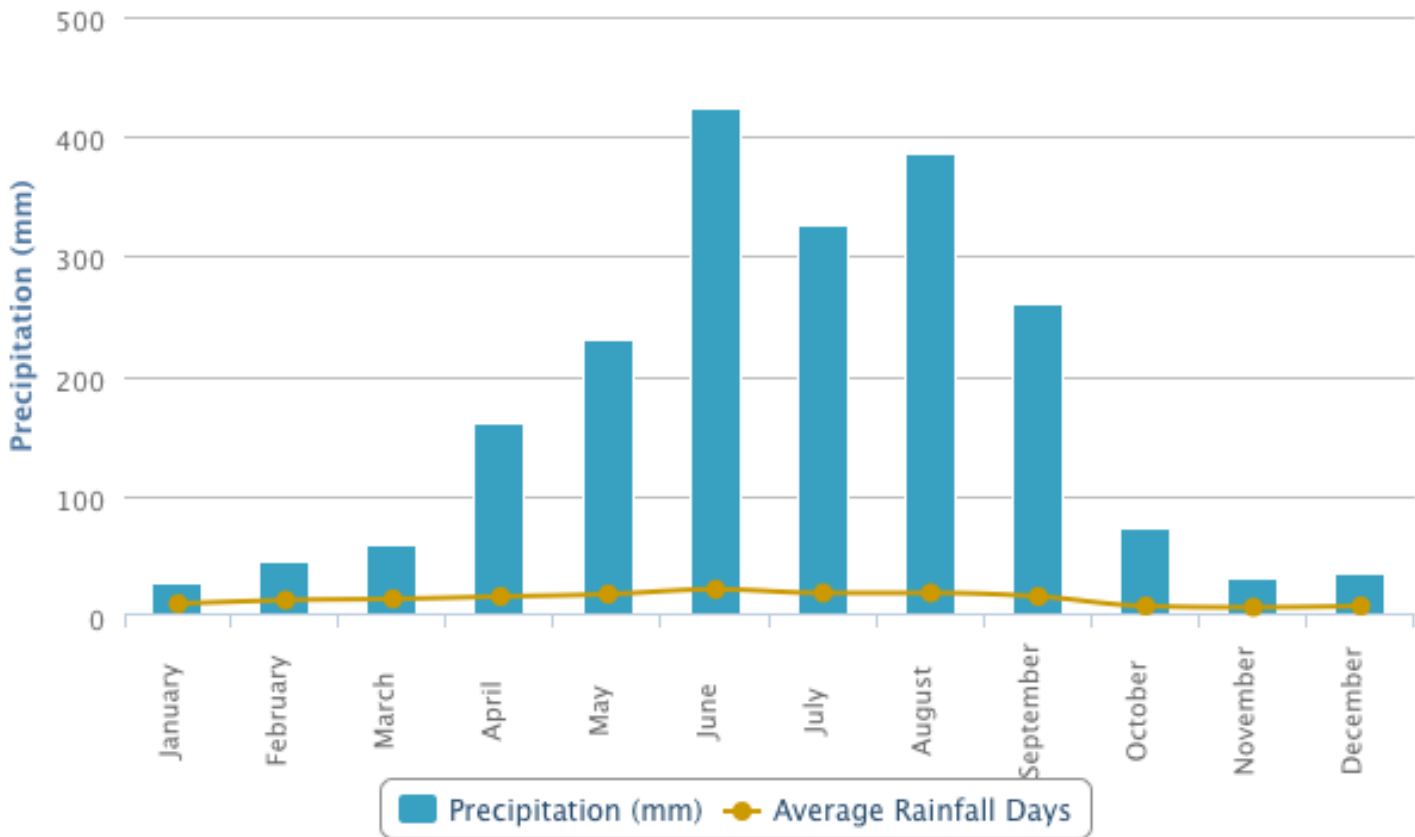
Average Temperature (°c) Graph for Shenzhen



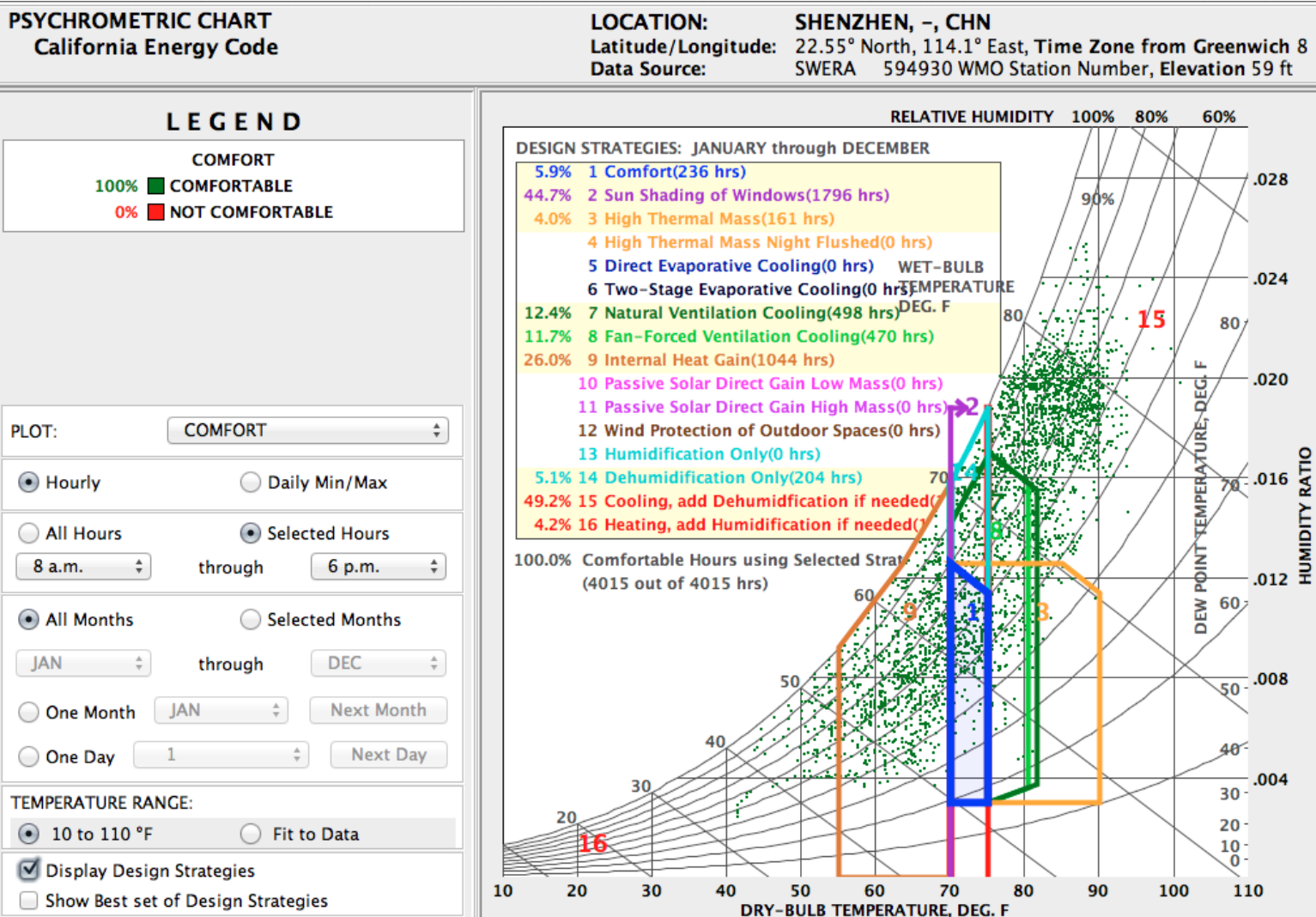
Average Rainfall (mm Graph for Shenzhen)



Average Rainfall Days



Comfort levels based on a 8:00am to 6:00pm working day



Comfort levels based on a 8:00am to 6:00pm working day

LOCATION:

SHENZHEN, -, CHN

Latitude/Longitude:

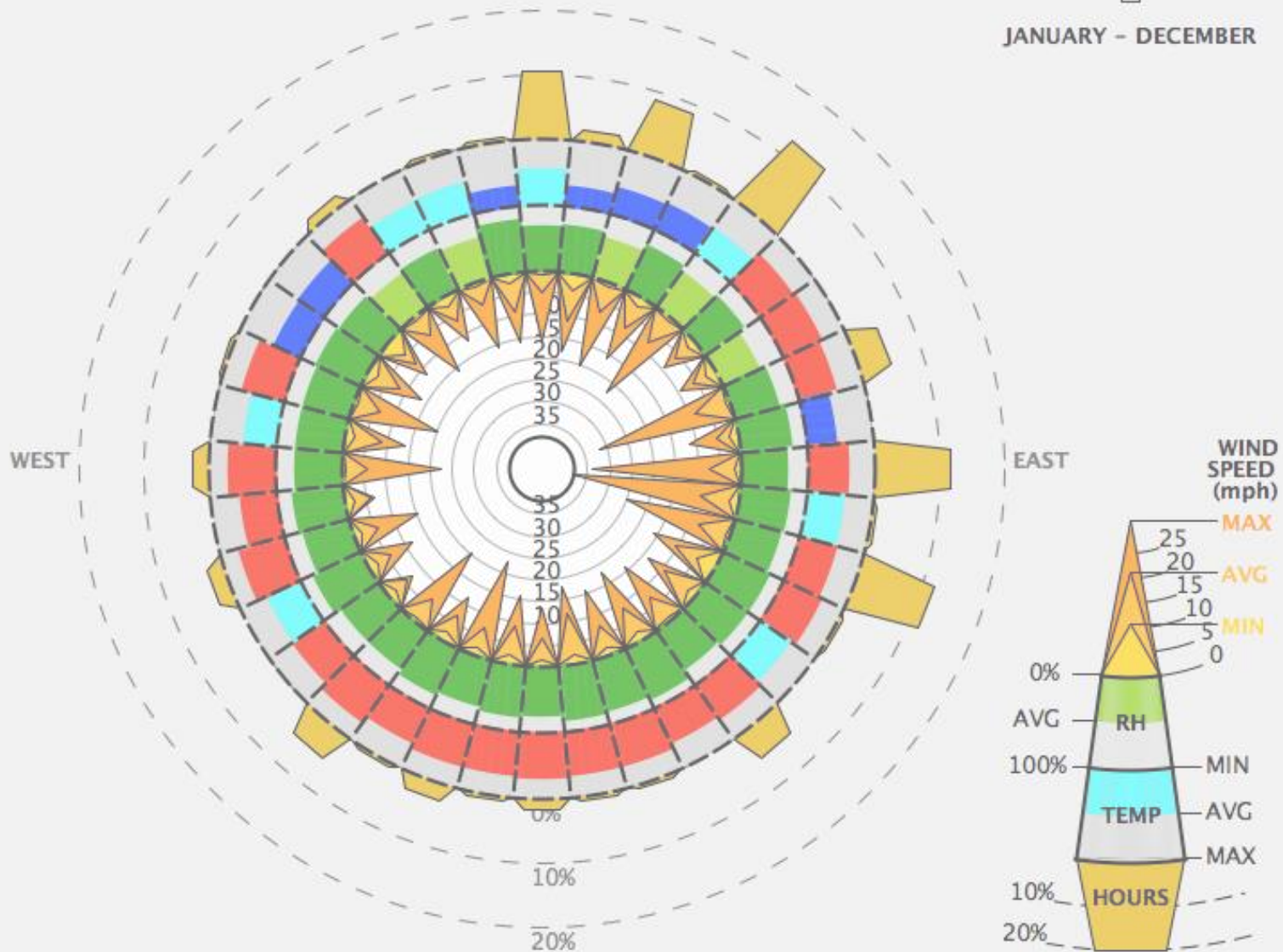
22.55° North, 114.1° East, Time Zone from Greenwich 8

Data Source:

SWERA 594930 WMO Station Number, Elevation 59 ft



JANUARY - DECEMBER



environment

shenzhen stock exchange

变革造就了一个城市。随着邓小平的创举，深圳于1979年建立了经济特区，开始了现代化的历程。
 A city founded on an experiment, Shenzhen began its modern period with Deng Xiaoping's creation of the first SEZ in 1979.



1984年 邓小平
Deng Xiaoping, Shenzhen 1984



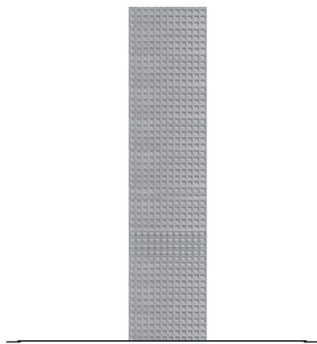
1990年12月1日 深圳证券交易所新馆落成
The opening of the Shenzhen Stock Exchange, 1 December 1990



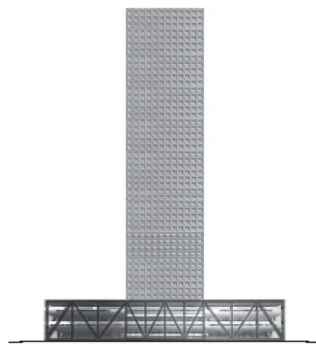
1985年8月10日 在人们排队申购新股的排队表
Workers lining up for an IPO Stock lot

concept

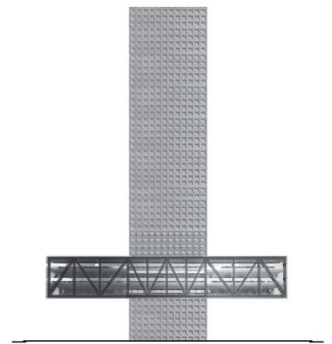
shenzhen stock exchange



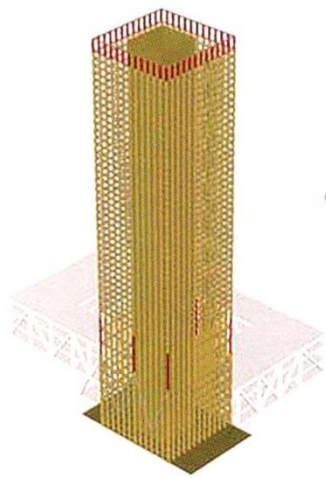
TOWER



TOWER + BASE

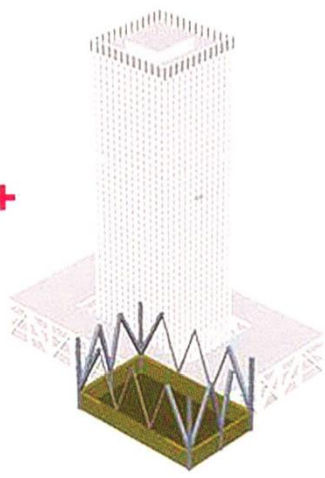


LIFTED!



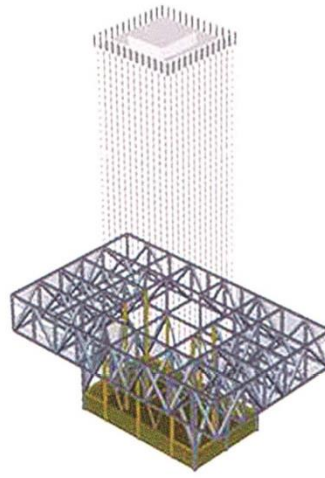
Core+Composite Perimeter Frame

+



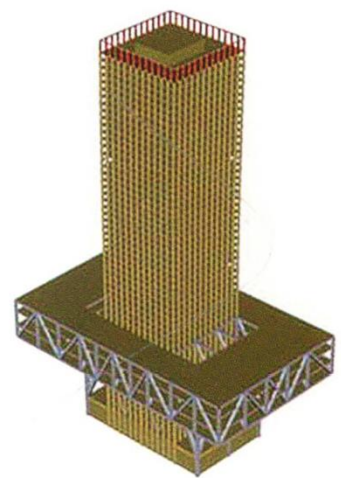
Outer trussed tube

+



Steelwork 3D mega-truss cantilevered Podium

=



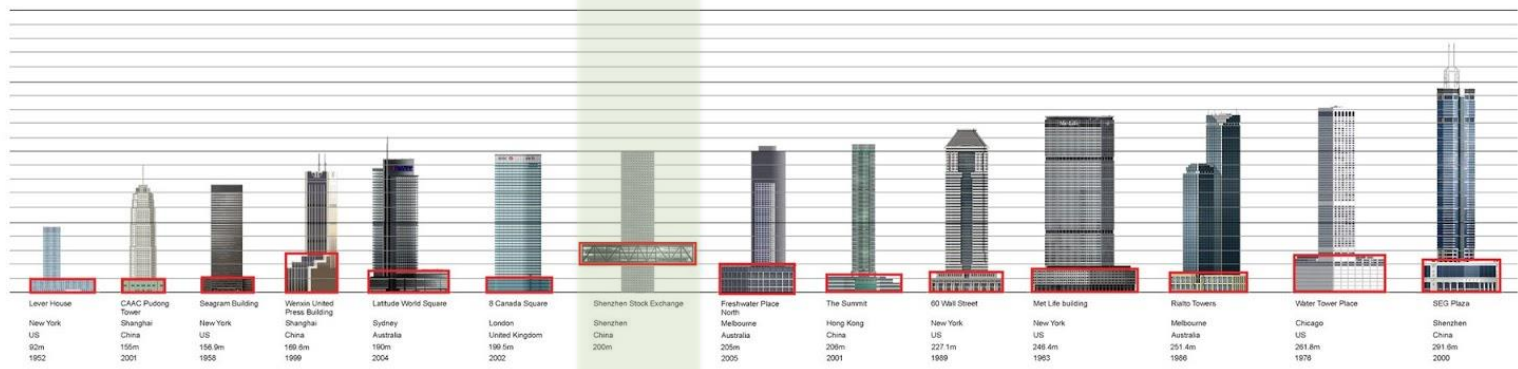
Components coupled together





concept

shenzhen stock exchange

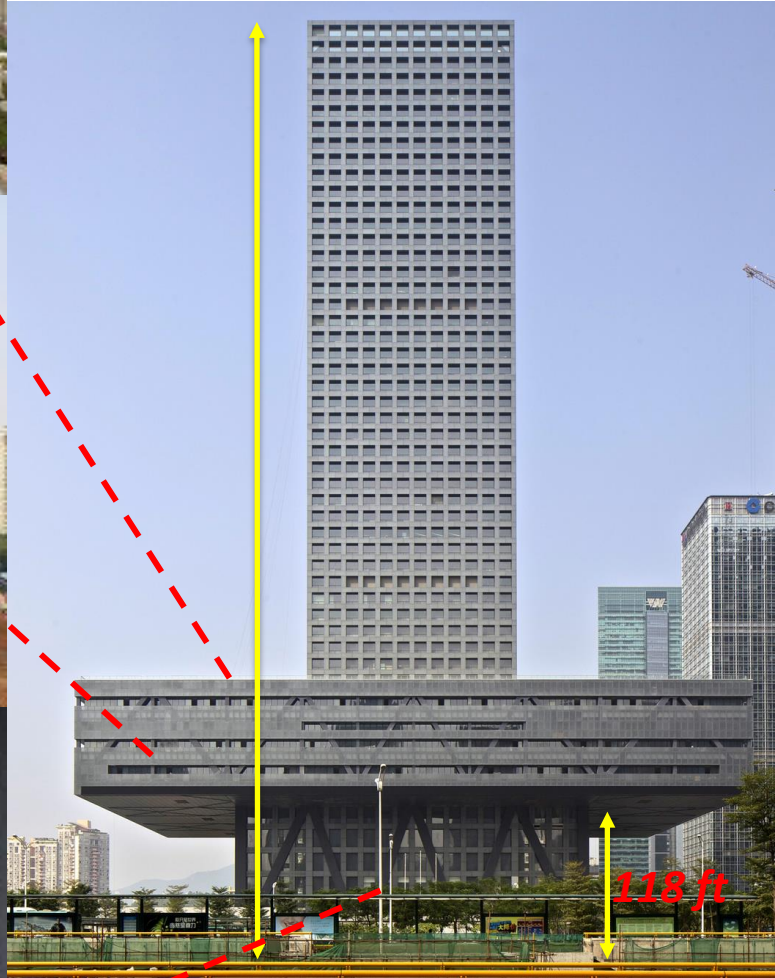


elevations

shenzhen stock exchange



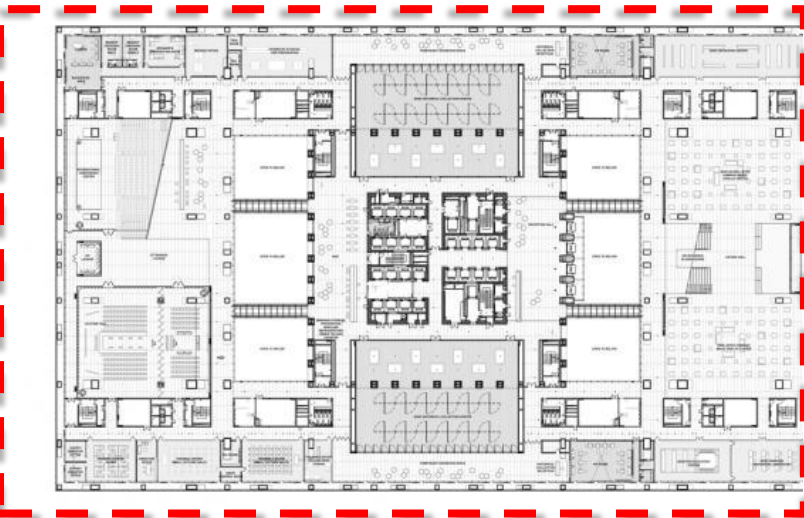
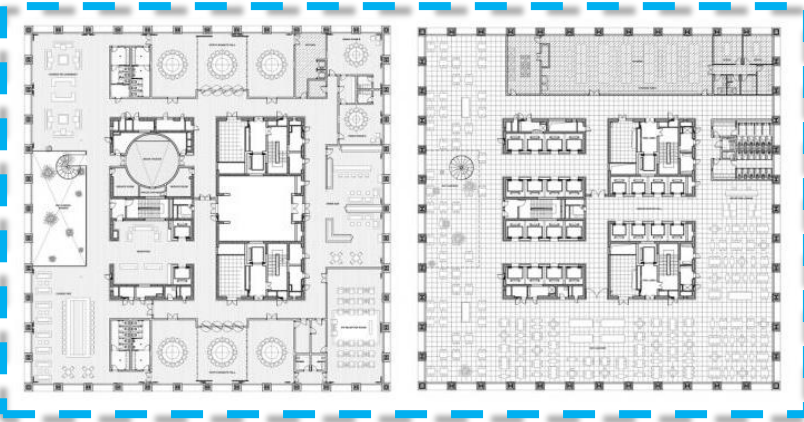
833 ft (46-stories)



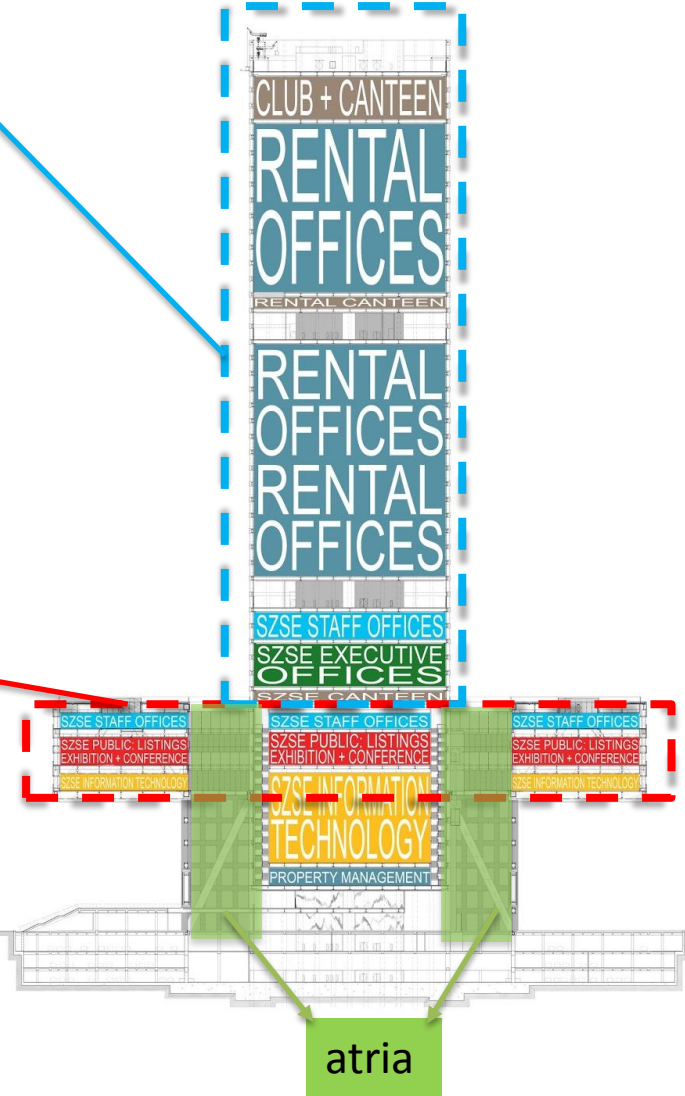
118 ft

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OFFICE&CLUB



Stock Exchange Function
15000 square meter/ floor



atria

Land property in Shenzhen:

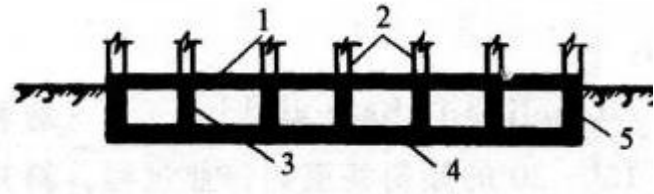
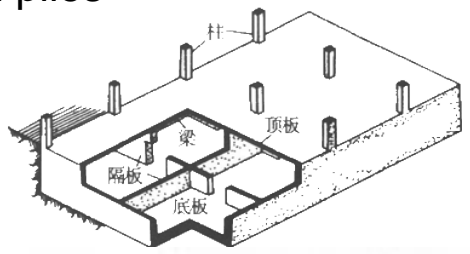
fairly soft soil/ shallow layers of hard rock

Foundation type:

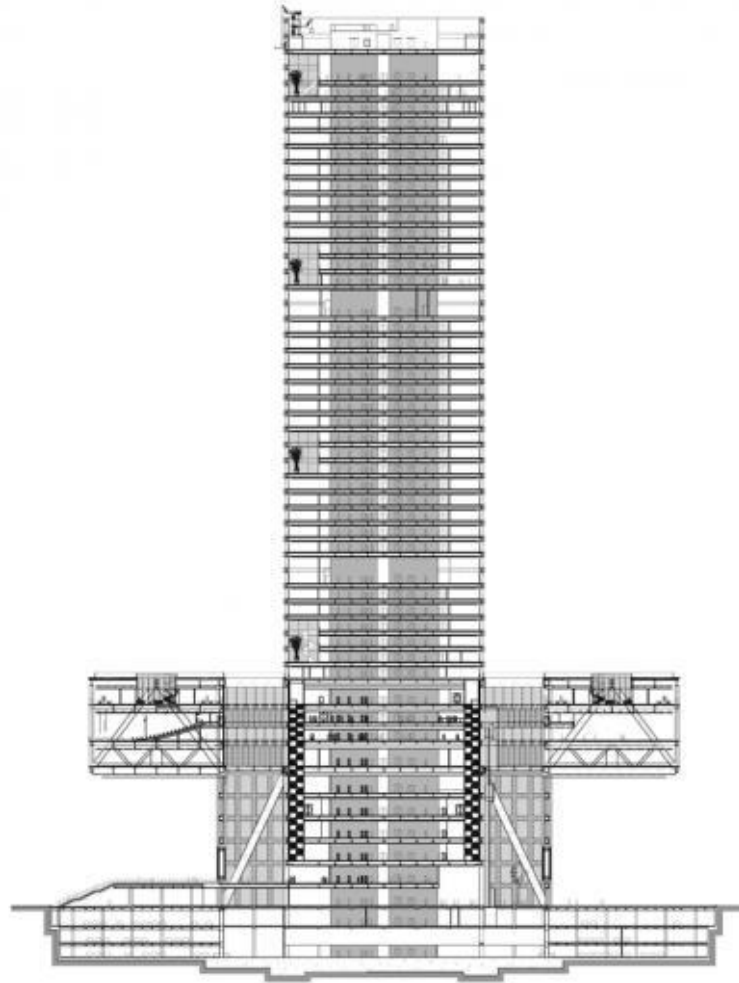
caisson [d=3.5m(11.5ft)]

Functions:

- 1) suitable for the typical soil in Shenzhen
- 2) hold the concentrated force from the above(atria corners, lifted part, above-box part)
- 3) collect force, not spread out them through piles



foundation

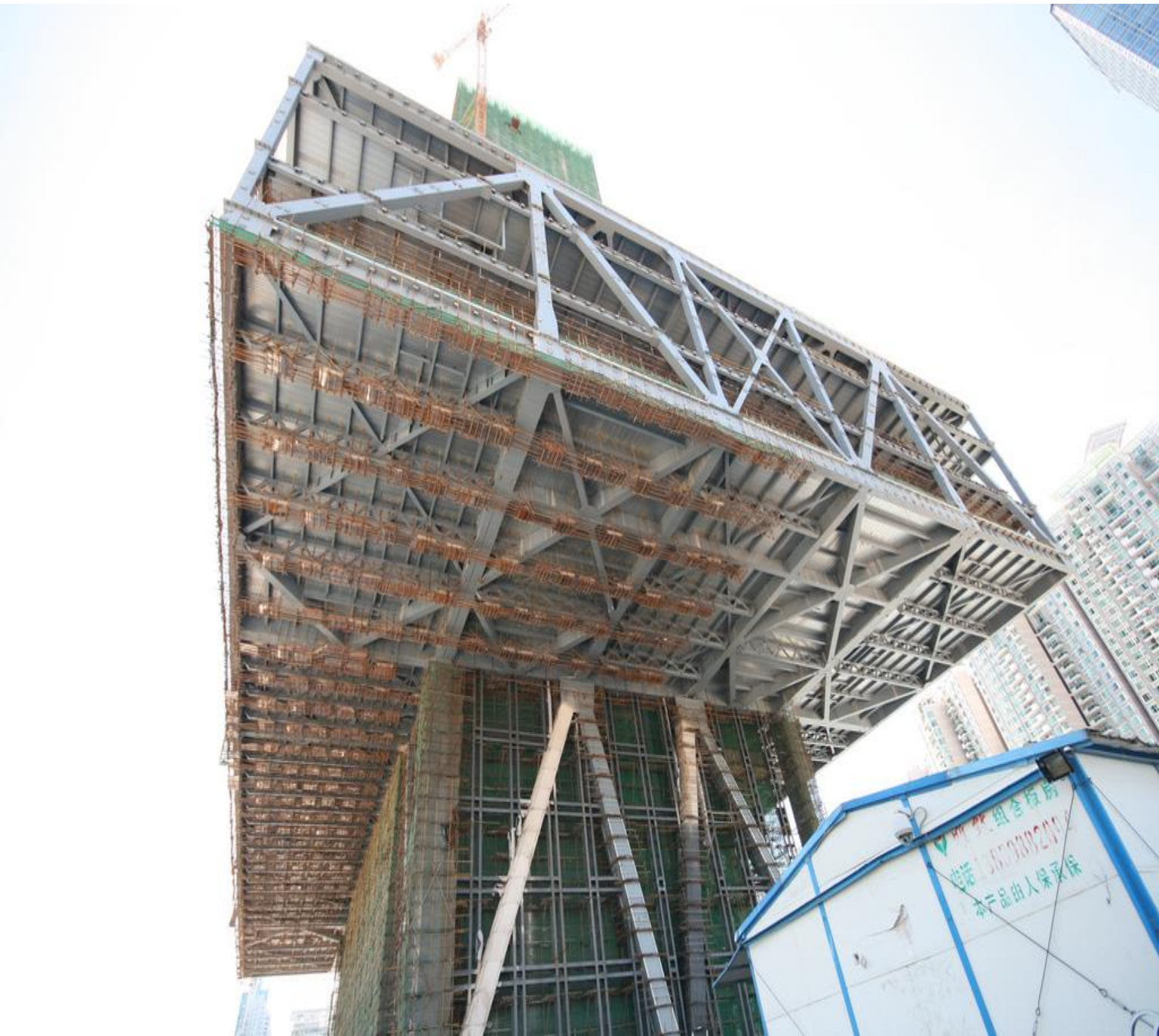


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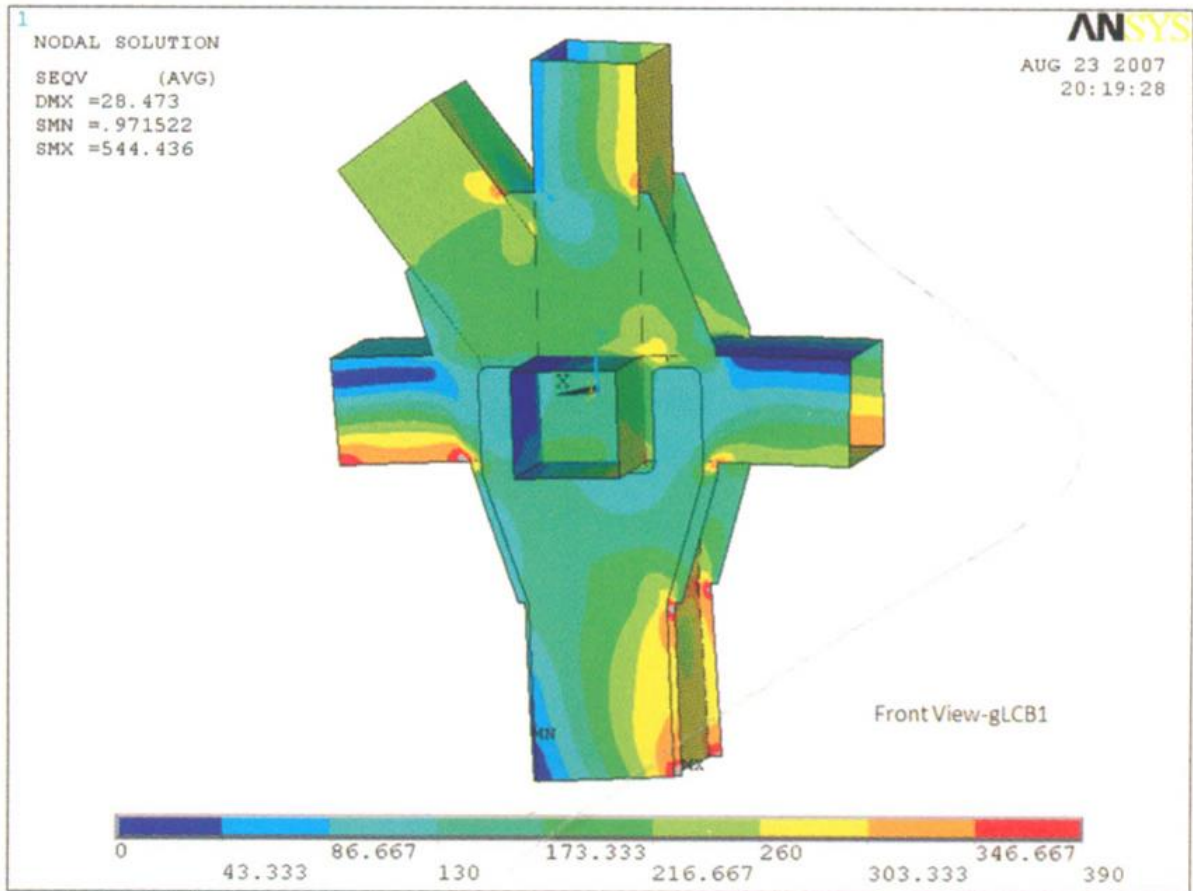
tower structure

shenzhen stock exchange



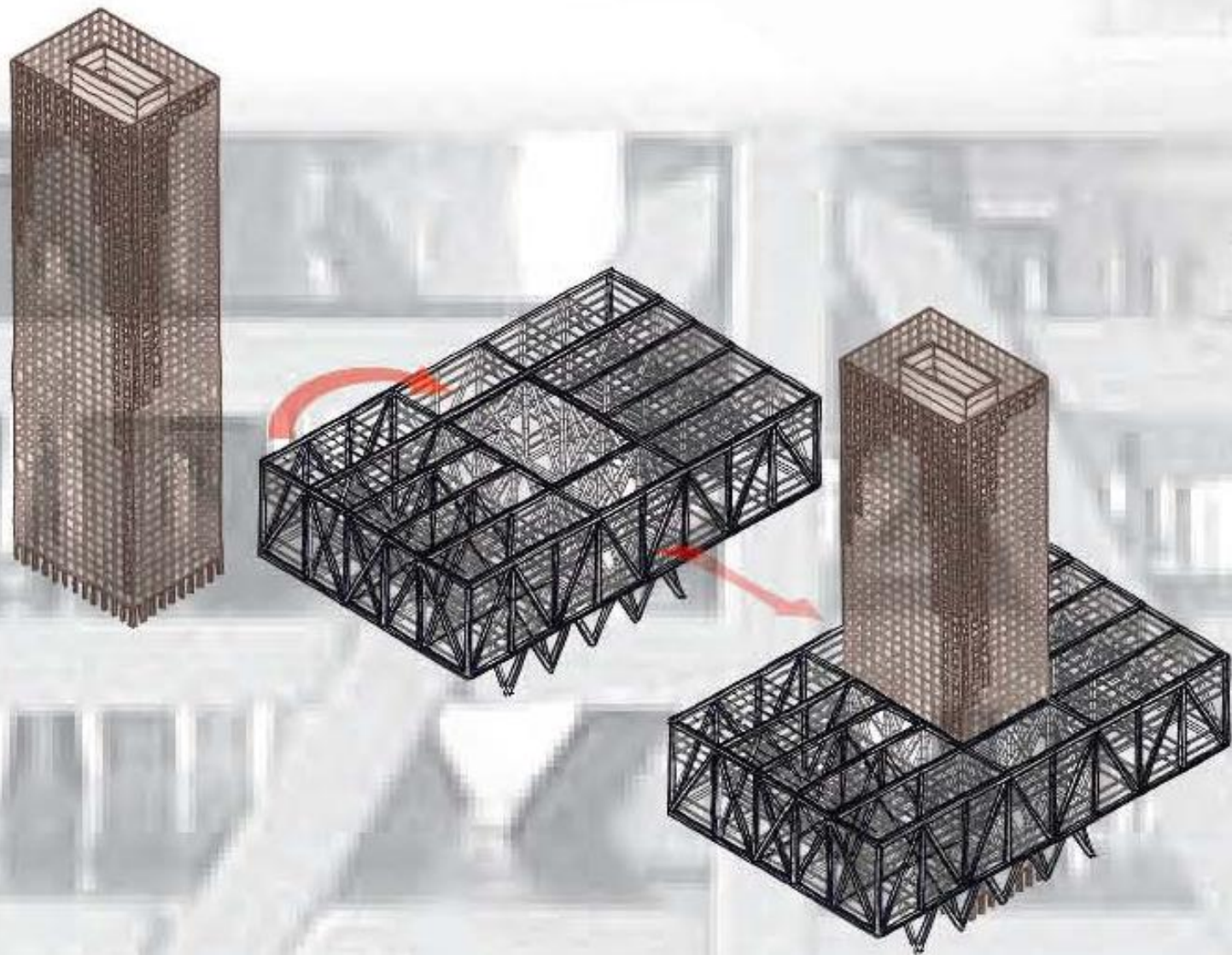
tower structure

shenzhen stock exchange



连接设计检查 \ Connection design checks

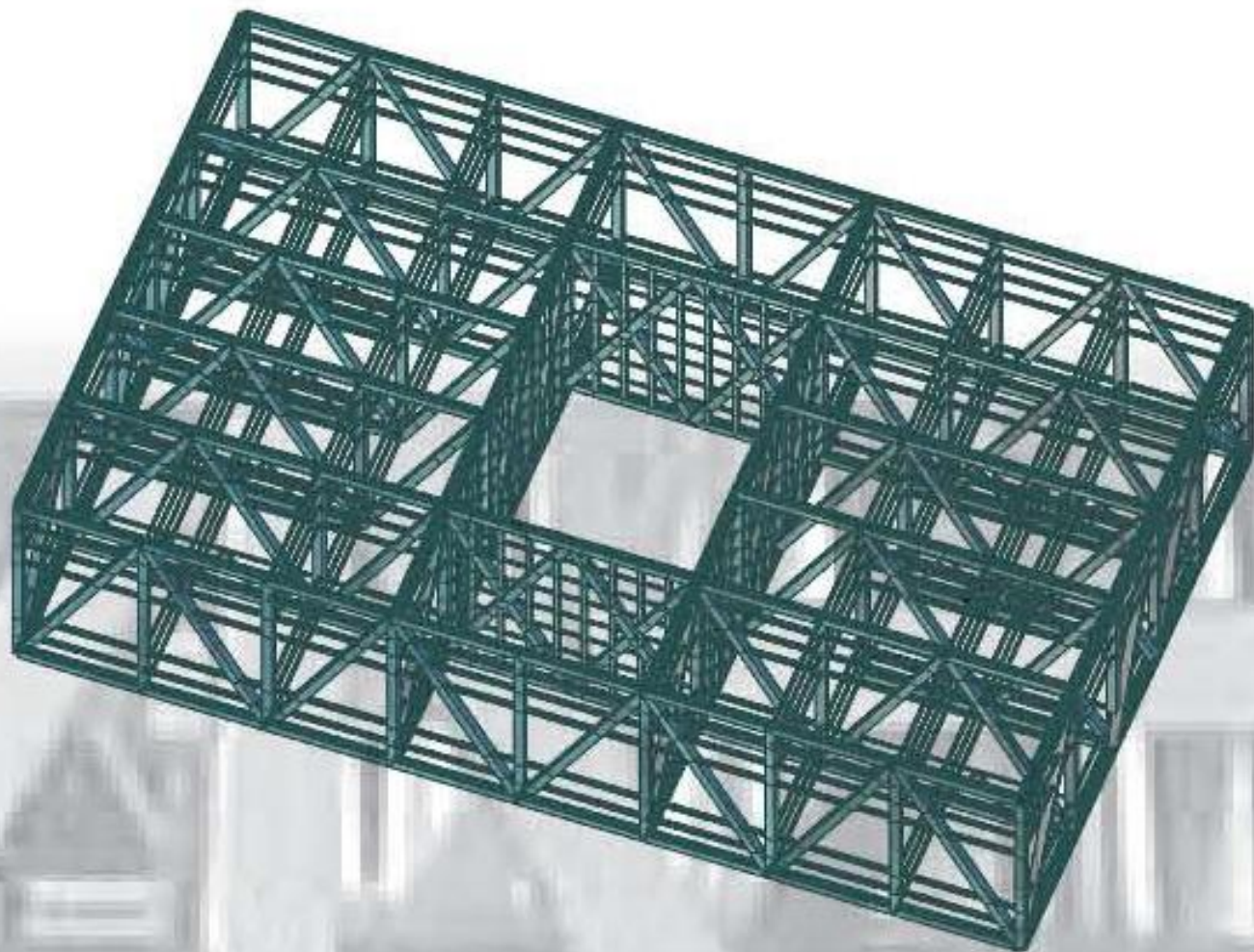
The synergy between the two forms with the massive reinforced concrete tower helping to anchor and stabilize the dynamic steelwork cantilevering platform



the box

shenzhen stock exchange

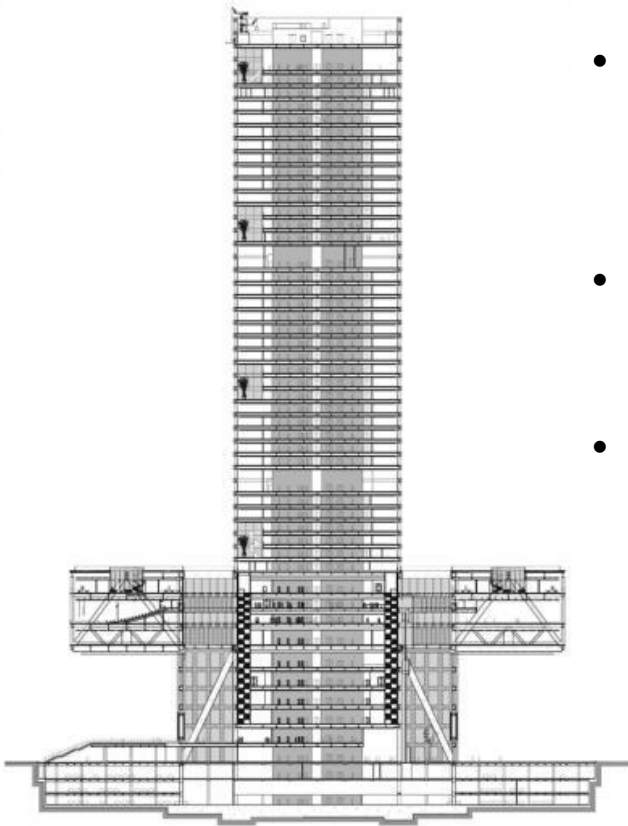
The truss system is held in place by the mass reinforced concrete tower with the main trusses positioned on each face of the tower superimposed on the orthogonal grid of the perimeter columns that support the tower.





tower structure

shenzhen stock exchange



- There is a 54 m by 54 m square tower that extends approximately 185 m in height above the floating podium level.
- A typical concrete-core and moment-frame system is used for the tower.
- At the lower levels of the tower, the steel braced frame around the atrium forms an outer steel trussed tube to support vertical and lateral loads from the cantilevering podium and contributes to the tower stiffness.



tower structure

shenzhen stock exchange

Table 3.2.2

seismic precautionary intensity	6	7	8	9
design basic acceleration of ground motion	0.05g	0.10(0.15) g	0.20(0.30) g	0.40g

Annotation: g is gravity.

Table 8.1.1 The highest allowable height of steel structure (m)

Structure type	6、7 (0.10g)	7 (0.15g)	8		9 (0.40g)
			(0.20g)	(0.30g)	
Frame	110	90	90	70	50
Frame with central bracing	220	200	180	150	120
Frame with eccentric bracing	240	220	200	180	160
Tube structure and mega frame	300	280	260	240	180

Seismic intensity	7	8	9
Seismic Zone	2A	2B-3	>4

Table 16- I

Seismic Zone	1	2A	2B	3	4
Z	0.075	0.15	0.2	0.3	0.4

Site class	Z				
	0.075	0.15	0.2	0.3	0.4
S_A	0.06	0.12	0.16	0.24	0.32Nv
S_B	0.08	0.15	0.20	0.30	0.40Nv
S_C	0.13	0.25	0.32	0.45	0.56Nv
S_D	0.18	0.32	0.40	0.54	0.64Nv
S_E	0.26	0.50	0.64	0.84	0.94Nv

Table 1: Approximate Fundamental Period Parameters

Approximate Fundamental Period Equation:			
$T_s = C_t h_n^x$ <i>(ASCE 7-05 Eqn. 12.8-7)</i>			
SEISMIC Approximate Fundamental Period Parameters			
Structure Type	C_t	x	Reference ¹
Steel Moment-Resisting Frames	0.028	0.8	Table 12.8-2
Concrete Moment-Resisting Frames	0.016	0.9	Table 12.8-2
Eccentrically Braced Steel Frames	0.03	0.75	Table 12.8-2
All Other Structural Systems	0.02	0.75	Table 12.8-2
WIND Approximate Fundamental Period Parameters			
Structure Type	C_t	x	Reference ¹
Steel Moment-Resisting Frames	0.045	0.8	Commentary Eqn. C6-14
Concrete Moment-Resisting Frames	0.023	0.9	Commentary Eqn. C6-15
All Other Structural Systems (h<400 ft)	0.013	1	Commentary Eqn. C6-18
All Other Structural Systems (h>400 ft)	0.0067	1	Commentary Eqn. C6-19
<i>Note 1: References are to ASCE 7-05</i>			

$$T = C_t h^x = 0.02 * (787.4)^{0.75} = 2.97$$

$$C = 1.25 S_E / T^{2/3} = 1.25 * (0.50) / 2.97^{2/3} = 0.30$$

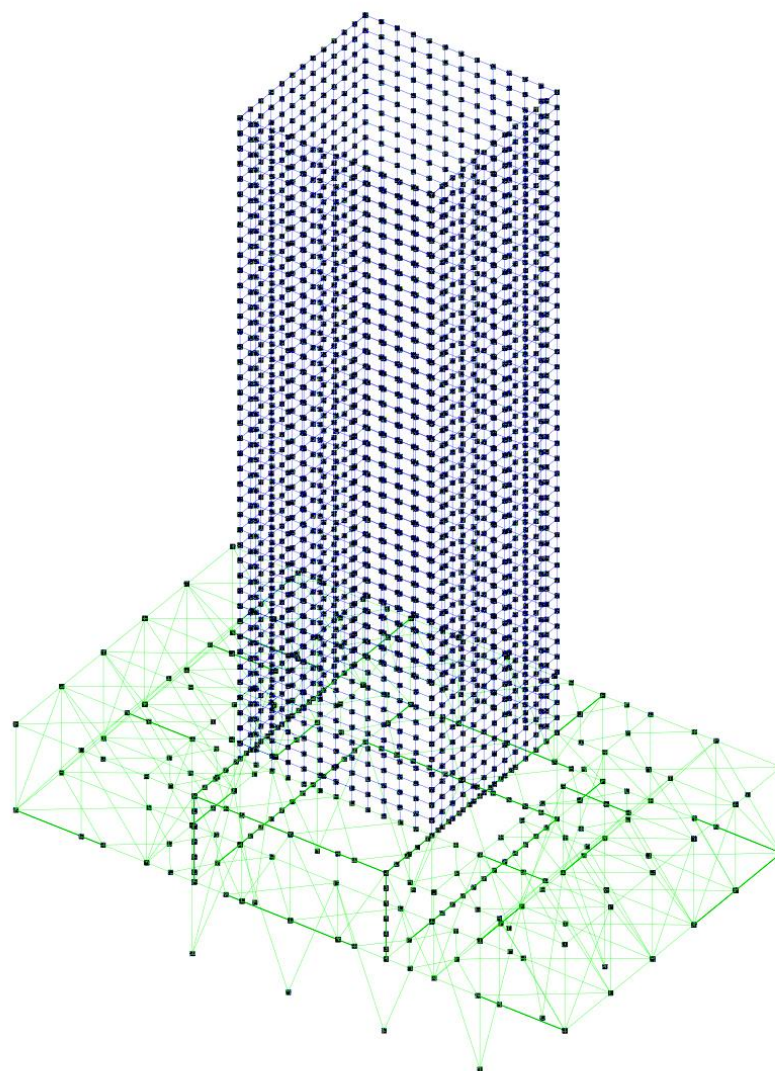
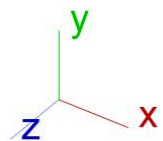
TABLE 5-14 STRUCTURAL SYSTEMS (UBC TABLE 23-O)

Basic structural system ^a	Lateral load-resisting system description	R_w
B. Building-frame system	1. Steel eccentrically braced frame (EBF)	10
	2. Light-framed walls with shear panels	
	a. Plywood walls for structures of three stories or less	9
	b. All other light-framed walls	7
	3. Shear walls	
	a. Concrete	8
	b. Masonry	8
	4. Centrically braced frames	
	a. Steel	8
	b. Concrete ^d	8
c. Heavy timber	8	

$$V = (ZIC/R_w)W = (0.15 \cdot 1.0 \cdot 0.30/8) \cdot 253135 \text{ kips} = 1423.88 \text{ kips}$$

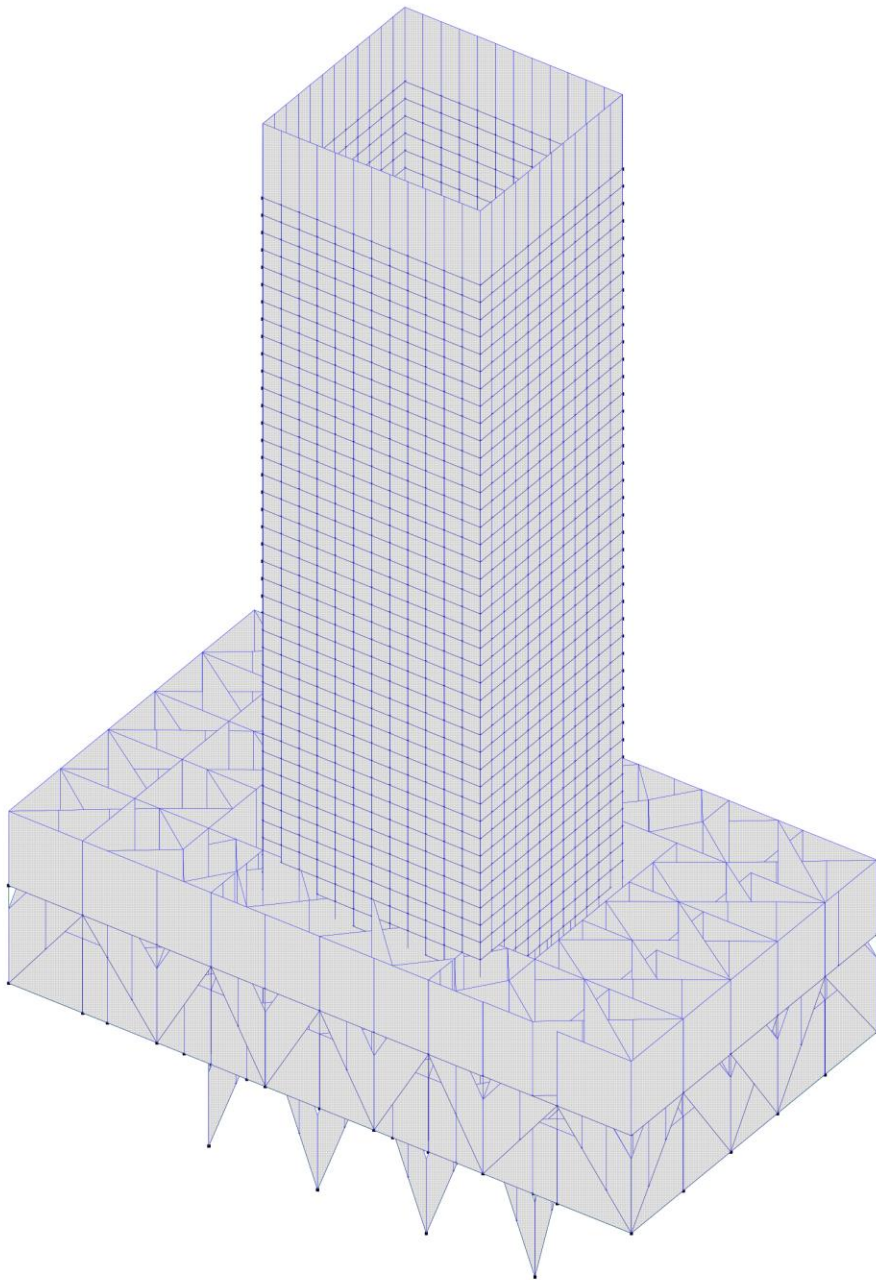
- Load of floor-slab:
421875KN+46095KN
- Load of core-tube: 90030KN
- Load of cantilever part: 280000KN
- Total Load: 1126000KN (253145Kips)

- $\omega_k = \beta_z \mu_s \mu_z$
- $\Omega_0 = 750 \text{KN/M}^2$
- $\beta_z = 2.107$
- $\mu_s = 2.4$
- $\mu_z = 0.8$
- Load of wind: 3034N/M^2



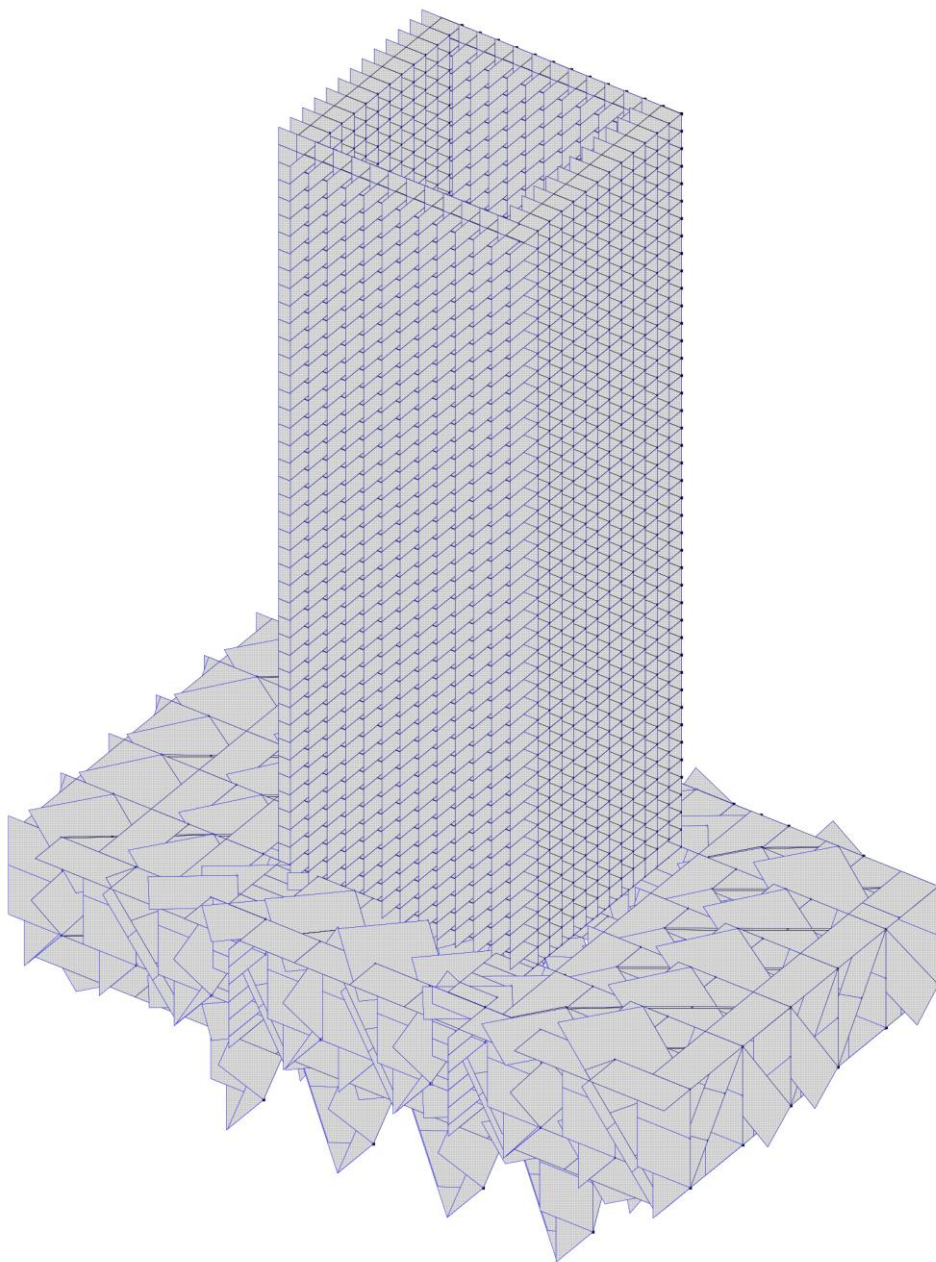
multiframe analysis

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multiframe analysis

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multiframe analysis

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