Experience of China in the Construction of Super High-Rise Structures

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A general Review of Super High-Rise Structures in Hong Kong and China since 1990s

The Shanghai Tower

The Shanghai Tower

The Shanghai Tower

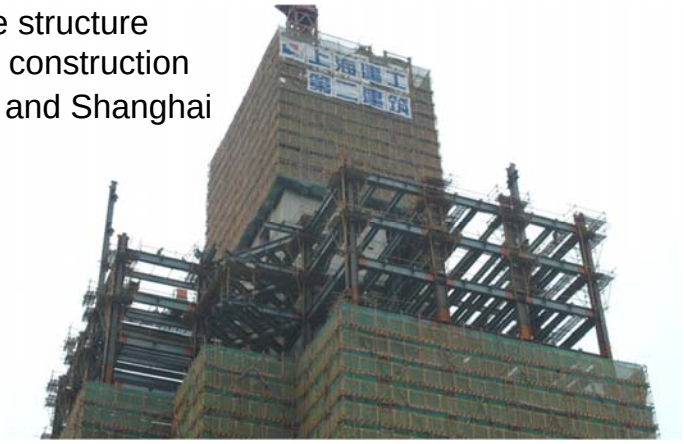
The Shanghai Tower


大家齐努力 共创文明城
中国建筑第八工程局

The gate of Suzhou
(entrance to Industrial Park)

The gate of Suzhou (entrance to Industrial Park)

Other high-rise structure recently under construction in Guangzhou and Shanghai



Guangzhou Tower (International Finance Centre 2006 – 2011)

Guangzhou Tower
(2006 – 2011)

Pearl River Tower
(2008 – 2012)

Other high-rise structure recently under construction in Guangzhou and Shanghai

Other high-rise structure recently under construction in Guangzhou and Shanghai

Other high-rise structure recently under construction in Guangzhou

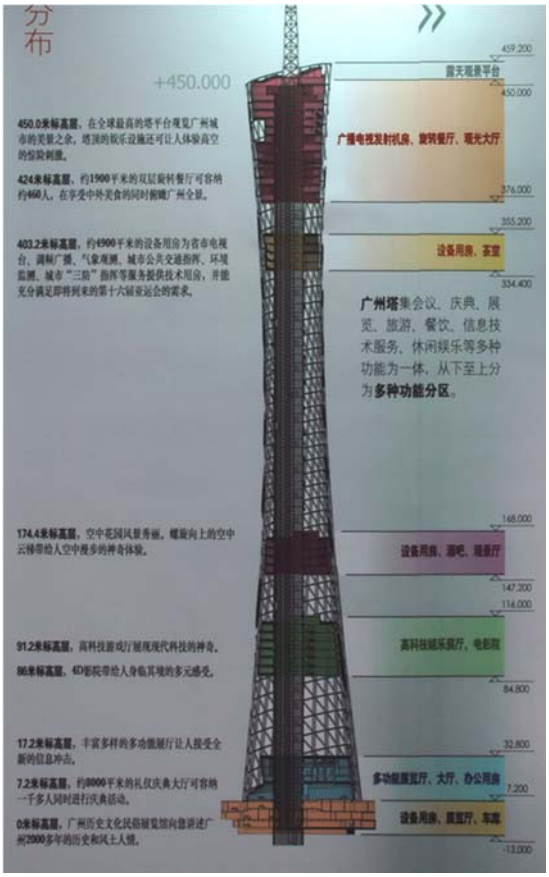
Other high-rise structure recently under construction in Guangzhou

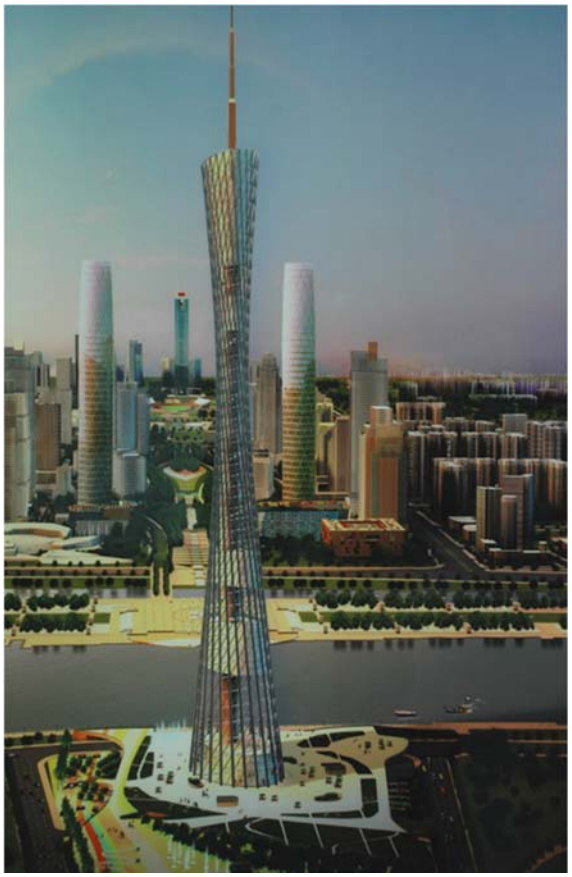
Other high-rise structure recently under construction in Guangzhou – the CTF Tower

Hong Kong Representing
High-Rise Projects

(please refer to separate file)

China Representing
High-Rise Projects





The Guangzhou Tower

Special feature of the tower structure

The structure consist of a open lattice-structure that is twisted over it's axis, therefore creating a tightening waist halfway up the building. This twist has created a slender grace-full profile.

The core of the television tower consists of a concrete elliptical shaft with a short and long diameter of 15.6m and 18.6m respectively, that has been constructed with a set of sliding formwork.

Columns and bracing

Columns rings and diagonals form together a web that varies over the section of the tower. The columns are all perfectly straight but lean to one direction, giving the tower a twisting look. They taper from bottom to top, so to further amplify the perspective view up along the tower.

At the bottom of the tower the columns are 2m in diameter, constructed of 50mm thick plated. At the top of the tower the column diameter is reduced to 1.1m with a plate thickness of 30mm.

The spiral rings are uniform at 800mm in size. They consist of straight tubes that run between columns fixing the web of nodes into a stiff web. They follow the curvature of the facade running along the inside of the web.

Design + Construction Team

Client: Construction Commission of Guangzhou Municipality

Architect: : Mark Hemel + Barbara Kuit
Structure : Arup **LDI** : Guangzhou Design Institute

Main Contractors: GMC Guangzhou SCG Shanghai

Facade Specialist: Jin Yue **Laminated Glazing:** DuPont
Facade Glazing: Shanghai Yaohua Pilkington
Lifts: Otis **Lighting:** Phillips
TV specialists RFT CMG Radio, Film +TV Design+Research Inst
Interior Designers: Jian Hua
Lighting Designers: Guangdong Godon Lighting

Research:
Shaking Table Test Test: EERTC lab, Guangzhou University
Wind Tunnel Test: Tongji University Shanghai
Structure Diagnostic Prognostic System: HK Polytechnic University

Guangzhou Tower

The mast

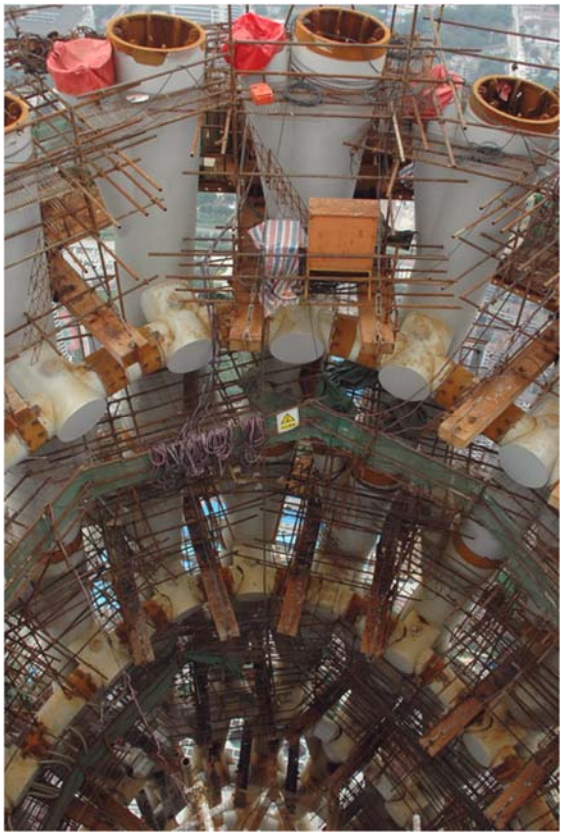
The tower core, ellipse shaped on plan, constructed using a set of climb form operated using a series of screw jacks.

Viewing the set-up of the climb form from an elevation position.

Viewing the set-up of the climb form with the lifting jack system

The shutter panel of the climb form

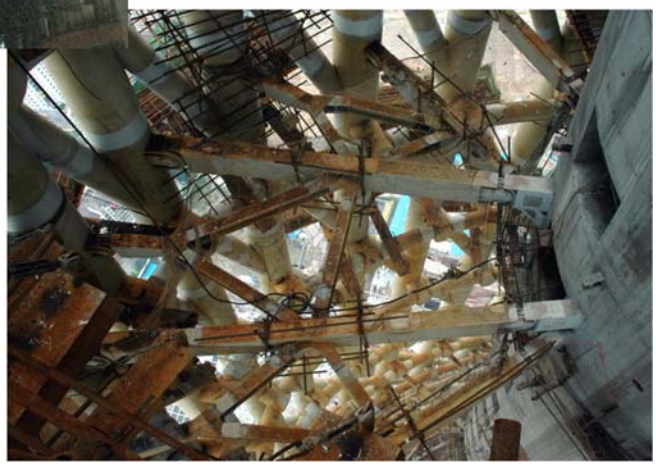
The lattice external frame constructed in steel tube using steel column and spiral rings



Closer view of the lattice frame and the steel columns and spiral rings

Tying the external lattice frame with the central core

Tying the external lattice frame with the central core



The tower top

The top deck at +460 m is designed as a sloping elliptical shaped of 54 by 42 meter. The top is shaved off diagonally towards the old city center. The deck will be used as a viewing deck with certain entertain facilities including a “Merry-go-round” provided.

The viewing cabin as a tourist attraction on the top platform of the tower

The Tower contains three intermediate decks (at levels approx. +425m, +155 and +60m) to be used as observation deck, restaurants, coffee and tea-houses, VIP/guest rooms etc.

Layout/interior detail of the deck structures

Some stiffening members to strengthen the tower structure against wind deflection

The base structure of the tower

Other features

A series of Tuned Mass Dampers are provided on the roof level to counteract the deflection of building by wind

Skyway

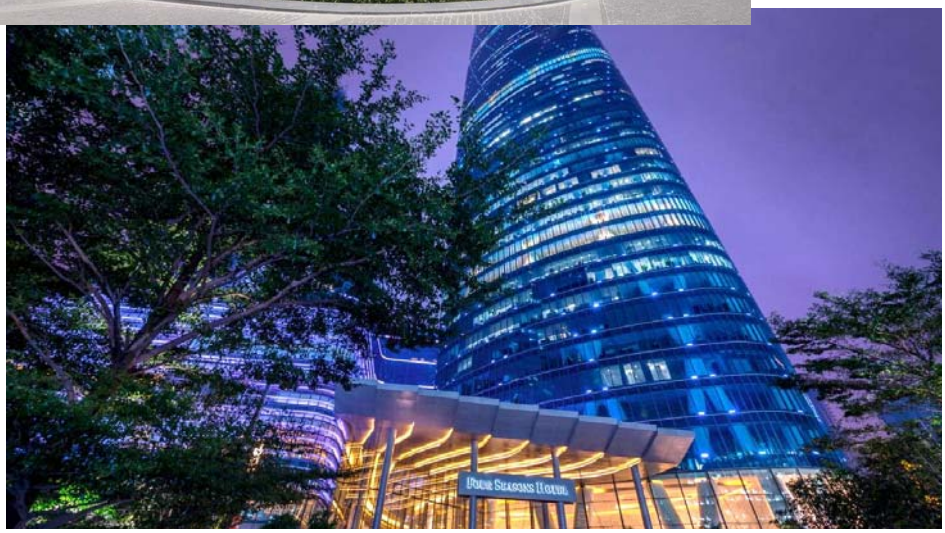
between level +170 meter and level +350 meter an open air staircase is provided to allow public all the way up through the narrow waist of the building. Here visitors can observe the structure and the size of the tower from close.

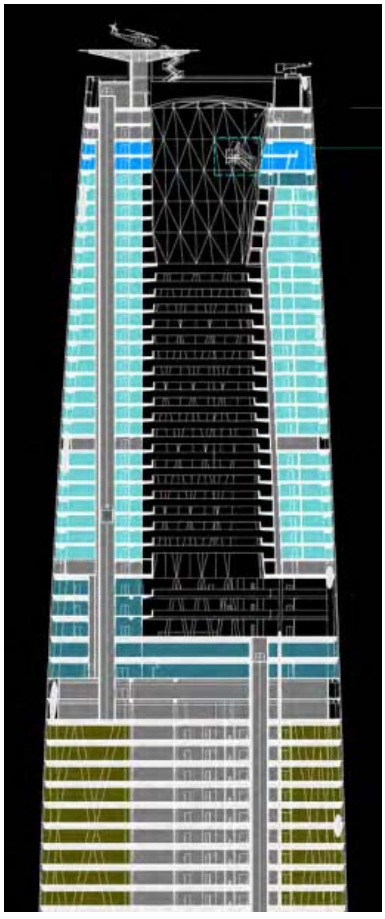
Guangzhou International Finance Centre

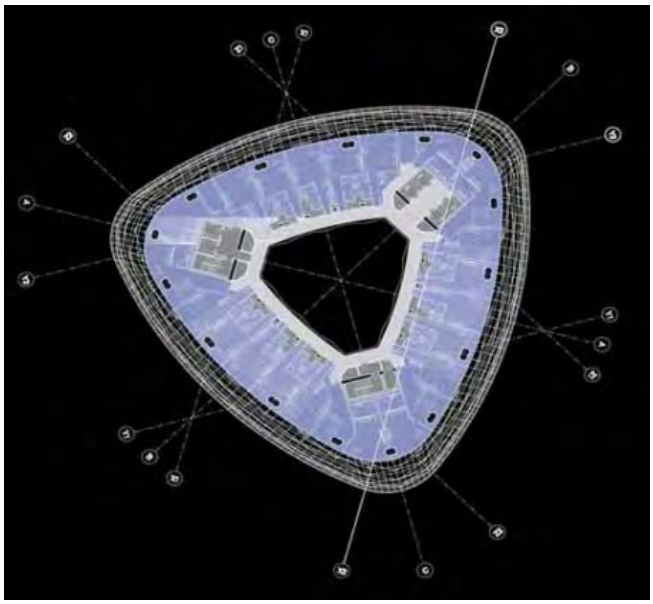
The new Guangzhou city axis

Guangzhou International Finance Centre,
forming a gateway to the new Guangzhou city axis

The completed building
in 2010 and 2011

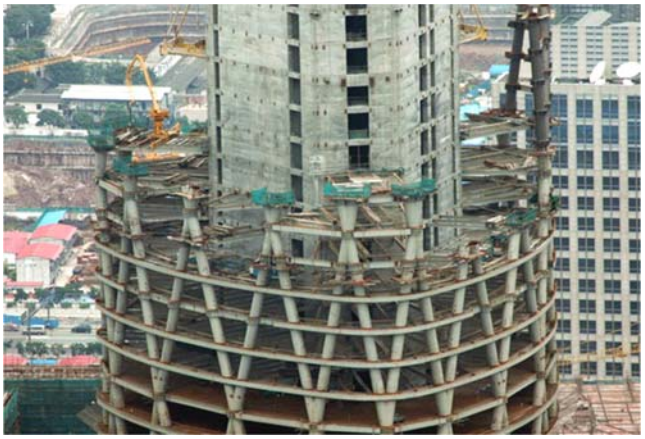






A brief illustration of the building layout and section on the top floors with a sky lobby and hotel reception (Four Season Hotel, from 67 – 100/F

The tower structure
breaking ground in 2008



Construction of the tower core

The core wall was constructed using a set of self lifting formwork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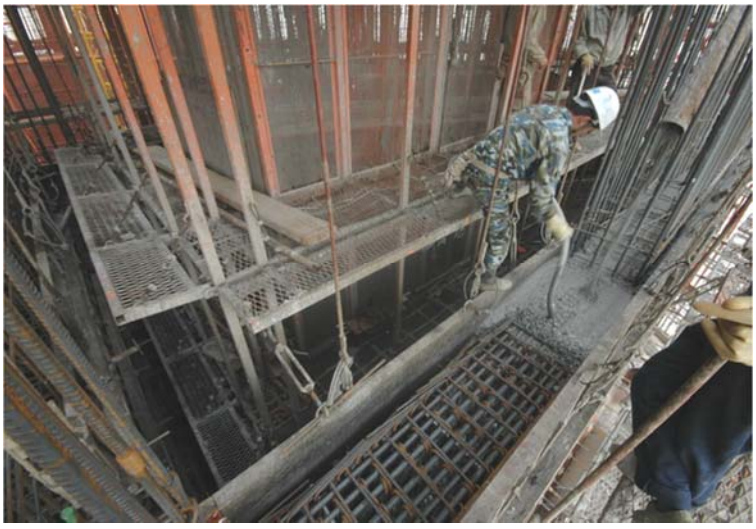
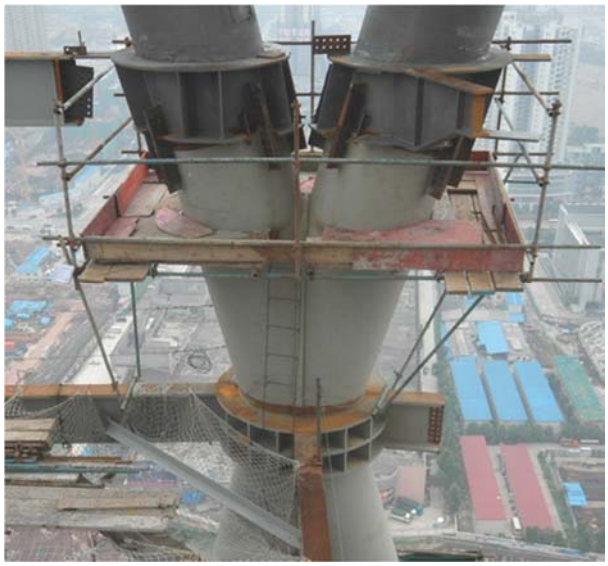
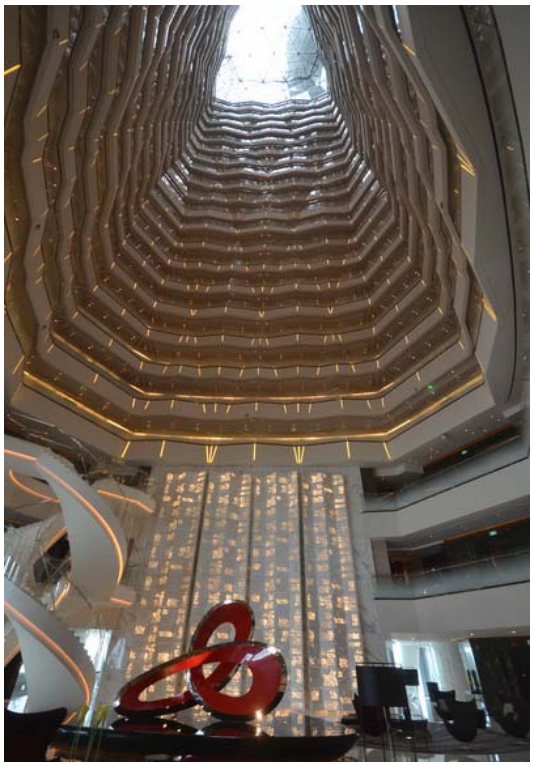


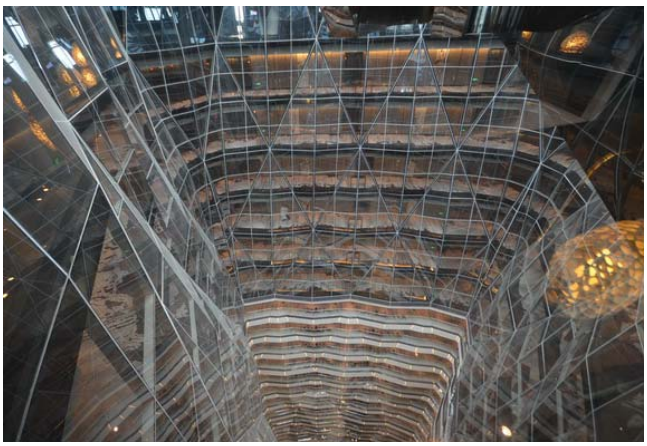
Construction of the floor deck/outer frame



Concrete-filled tube to improve fire resistant and rigidity

The atrium space for the hotel from 67 – 101th floors





The sky lobby as seen on the reception floor on 67/F and 100/F

Home Reception on 67/F

Other interior space

Curtain wall installation
using unitized system

Pearl River Tower

Pearl River Tower

Information from Skidmore, Owings & Merrill

Guangzhou, China

The 2.3-million square-foot Pearl River Tower redefines what is possible in sustainable design by incorporating the latest green technology and engineering advancements. The 309-meter tower's sculpted body directs wind to a pair of openings at its mechanical floors, where traveling winds push turbines which generate energy for the building.

The design for the tower incorporates a series of other integrated sustainable and engineering elements, including solar panels, double skin curtain wall, chilled ceiling system, under floor ventilation air, and daylight harvesting, all of which contribute to the building's energy efficiency.

Project Facts

Completion Year: 2011

Site Area: 10,635 m^2

Project Area: 214,100 m^2

Building Height: 309.60 m

Number of Stories: 71

Project Awards

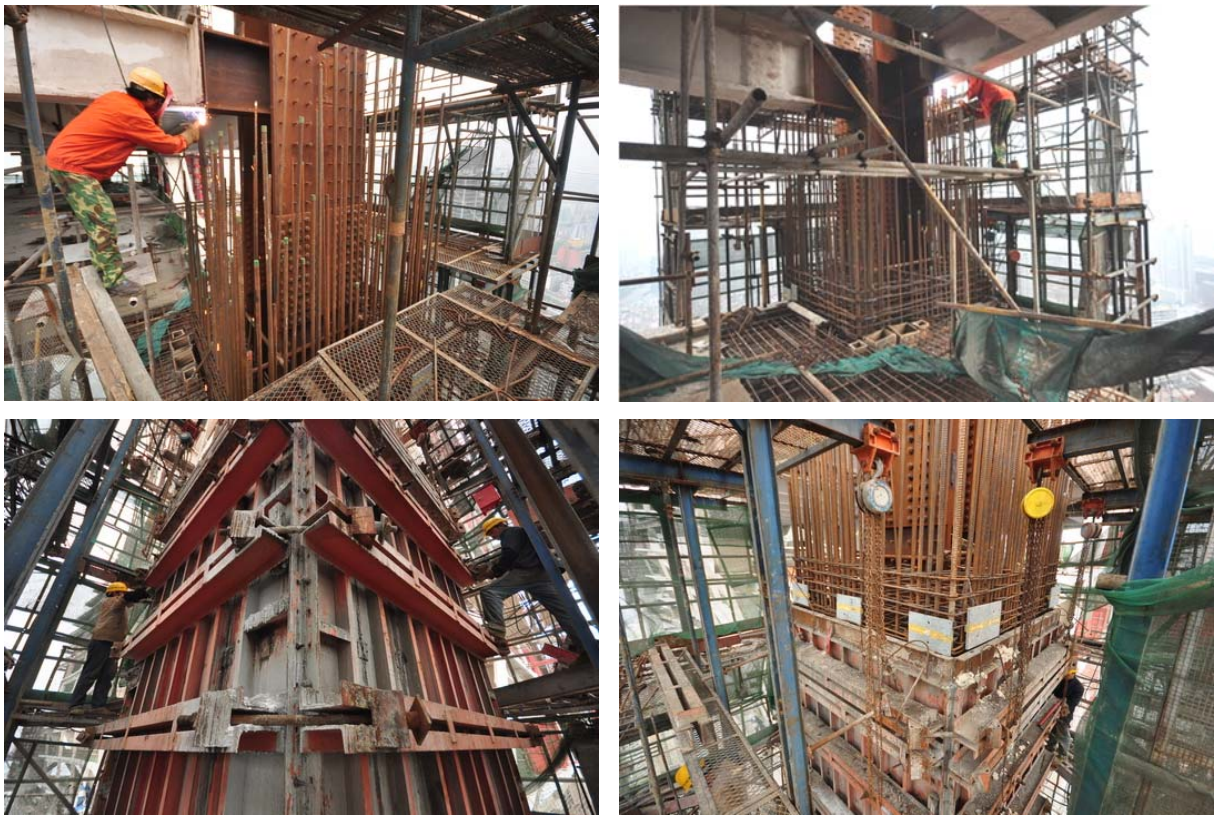
2010 • Chicago Athenaeum • Green Good Design Award

2008 • Spark Awards • Green, Carbon-Lowering & Environmental Category: Gold Award

The tower structure
breaking ground in 2009

The building core structure
and the external steel frame

The self-lifting form for the construction of the RC core wall



Construction of the composite column embedded with RC

"X" Bracing members

Other elements to stiffen structural steel or composite structure – use of bracing members

Other elements to stiffen structural steel or composite structure – use of rigger frame




Construction of the floor deck



A special structural feature, the rigger frame incorporated with the wind turbine provision

Close up view of the rigger frame

Close up view of the rigger frame

The completed structure
as seen in early 2011

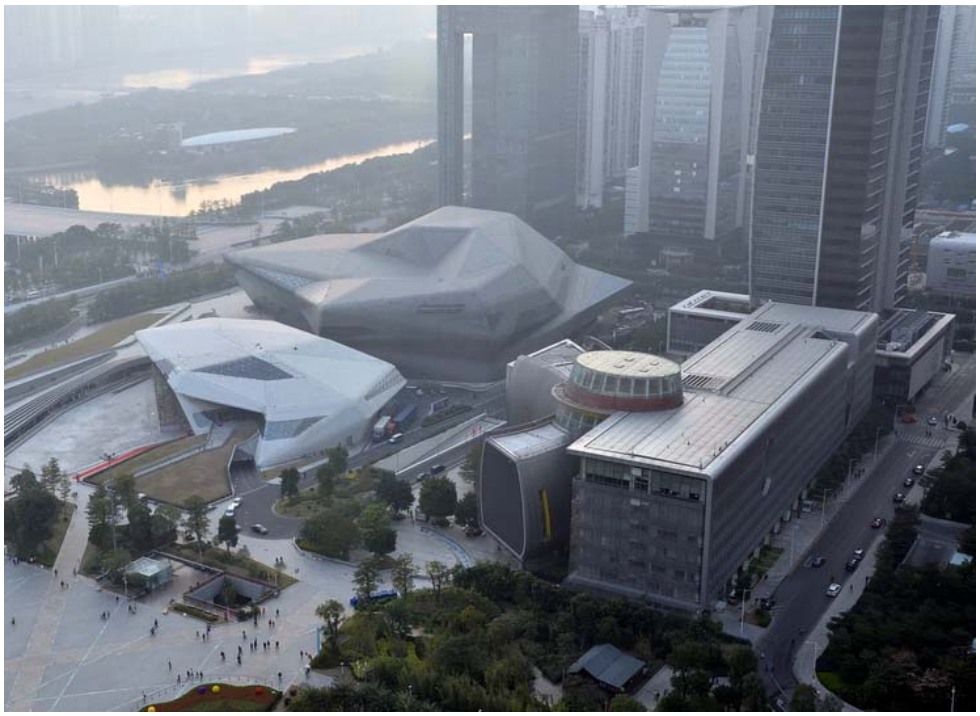
Other eye-catching building projects
in recent Guangzhou

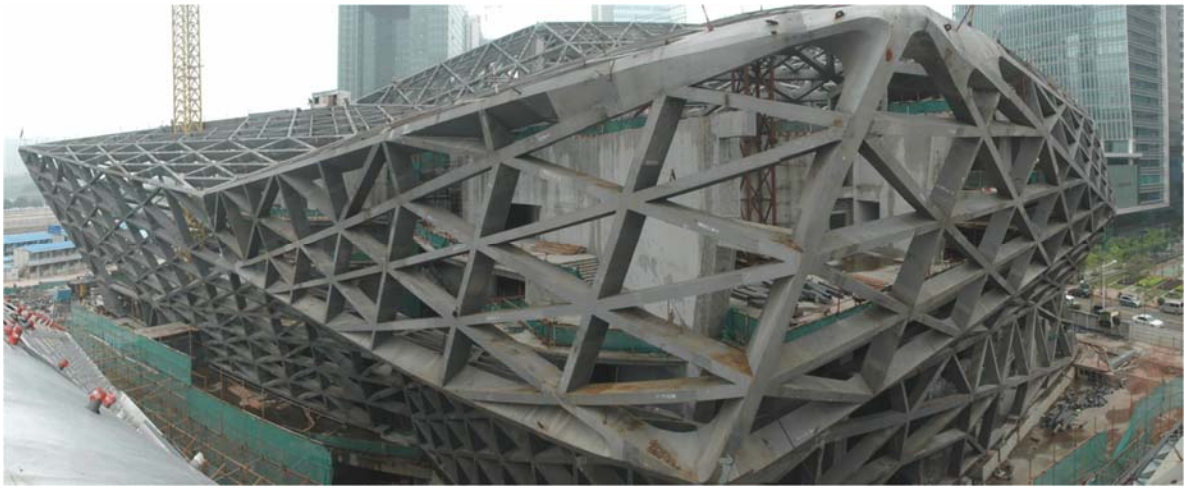
Guangdong Museum, 2007 - 2011

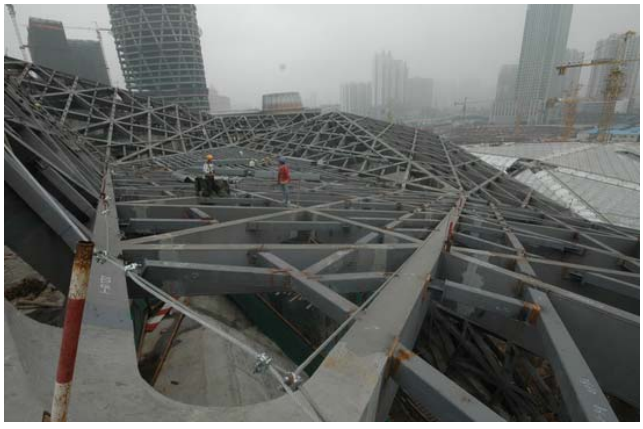
Guangdong Museum,
2007 - 2011

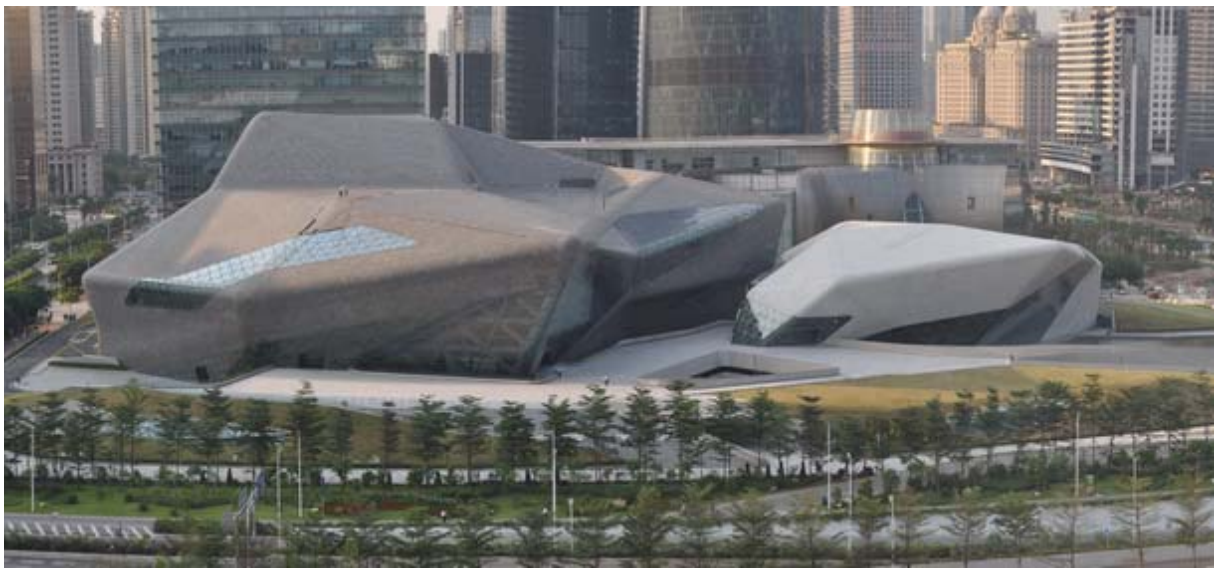
Roof truss fabricated on ground and jack to roof level and horizontal-slide to position

The gigantic truss frame on roof level that hanged the lower floors of the entire museum structure





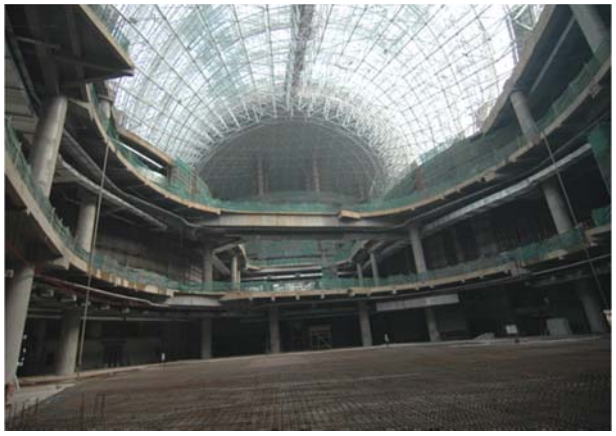


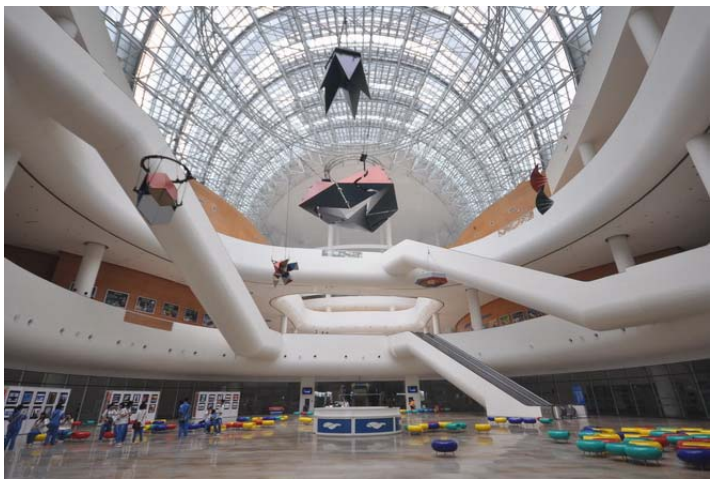


Guangzhou Opera House at Zhuiang Xincheng

Guangdong Science Centre, 2007 - 2010

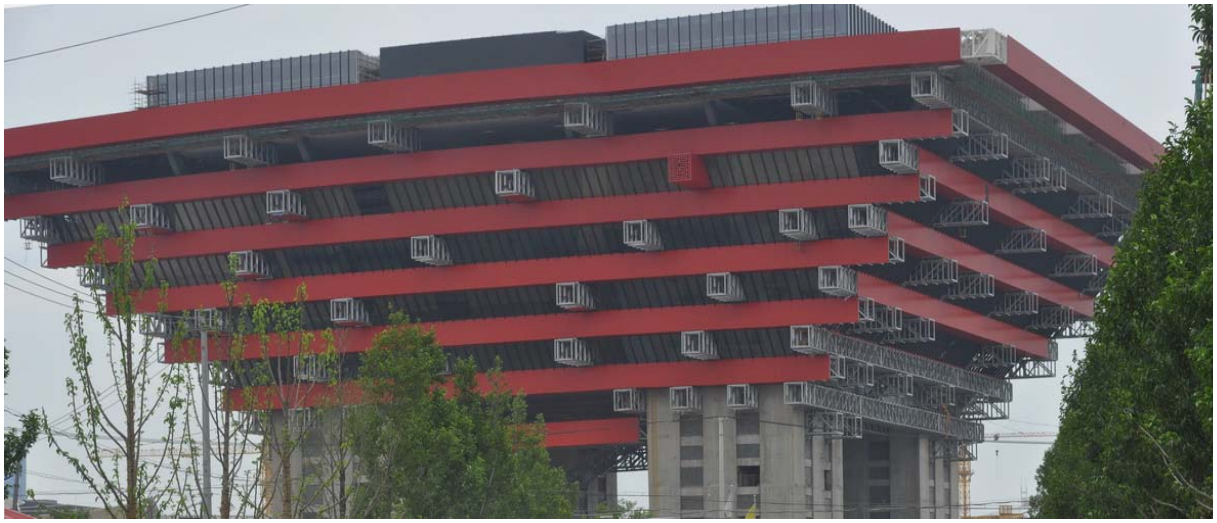
External view of the Centre

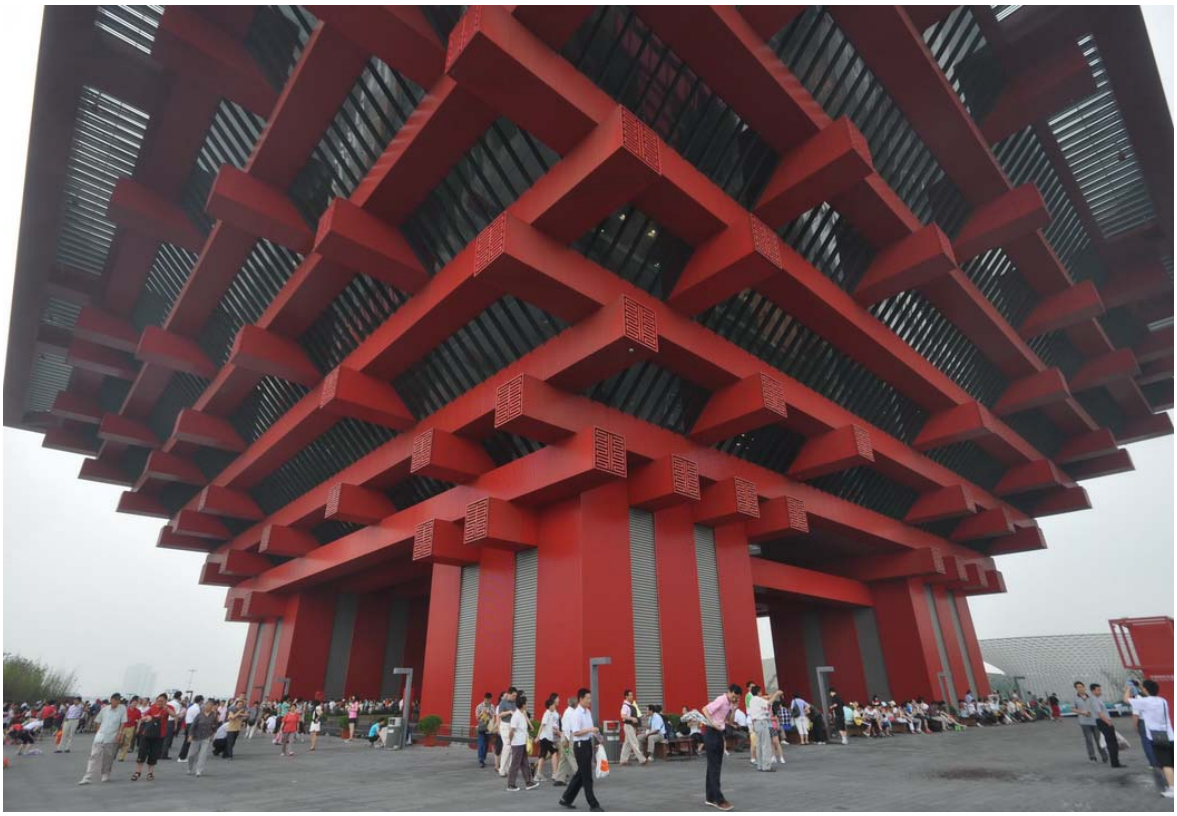




Roof truss of the Grand Atrium

The China Pavilion











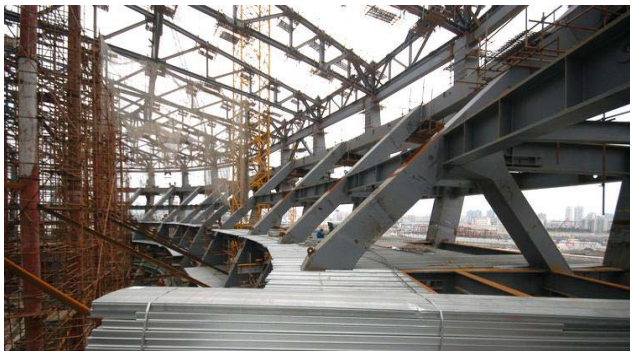


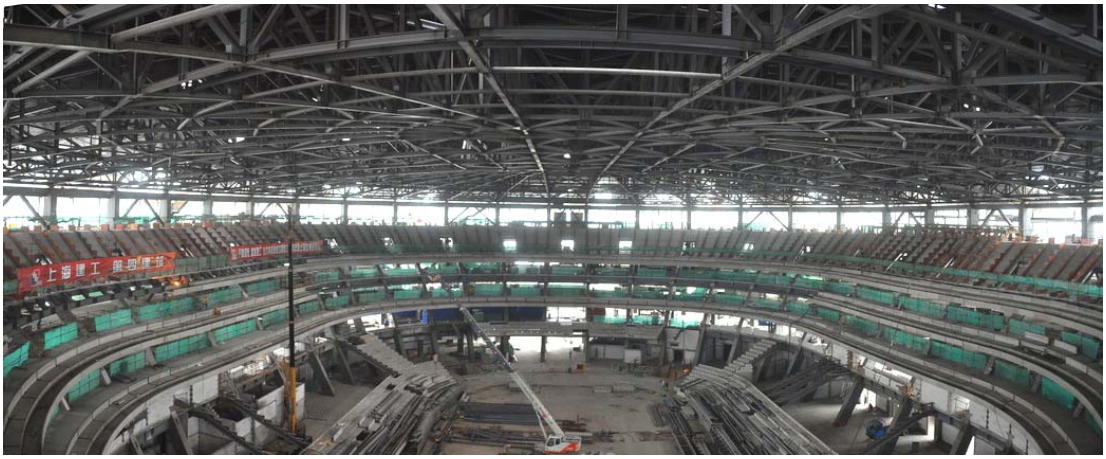


The cultural performance Centre

The Saudi Arabia Pavilion

The cultural performance Centre





End of presentation

There are more China cases, including the World Expo in Shanghai or the Asian Games in Guangzhou, to be continued ….