



# SHANGHAI TOWER

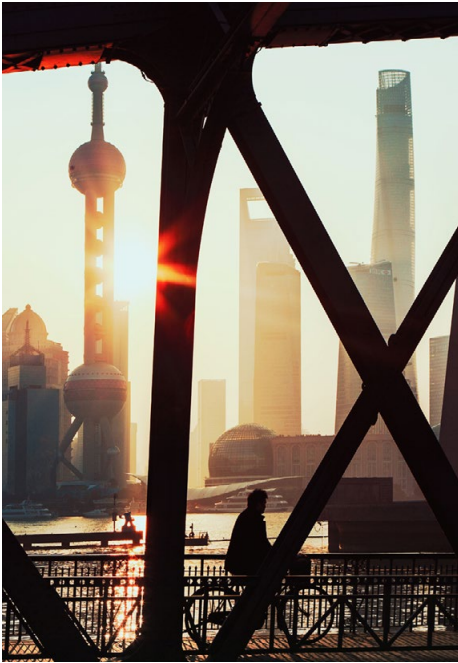


# What is Shanghai Tower?

Shanghai Tower is the new symbol of Shanghai—a gateway to China and Asia. The 121-story tower speaks to Shanghai's place in the world order and to its transformation as a global metropolis. Yet its impact extends beyond its role as an icon for a global financial capital. Shanghai Tower's location in China, the leader in construction of supertall buildings, places it at the center of discussions about the future of cities.



# Urban Context



---

Shanghai Tower is the most forward-looking of the three towers that anchor the Lujiazui commercial district. Designed by a local team to embody the city's rich culture, the 632-meter-high (2,073 feet) mixed-use building completes the super-highrise precinct that includes the Jin Mao Tower and the Shanghai World Financial Center. Shanghai Tower's rounded triangular footprint is derived from its relationship to the two towers. It's also a response to the bend in the nearby Huangpu River.

# Then and Now



1990



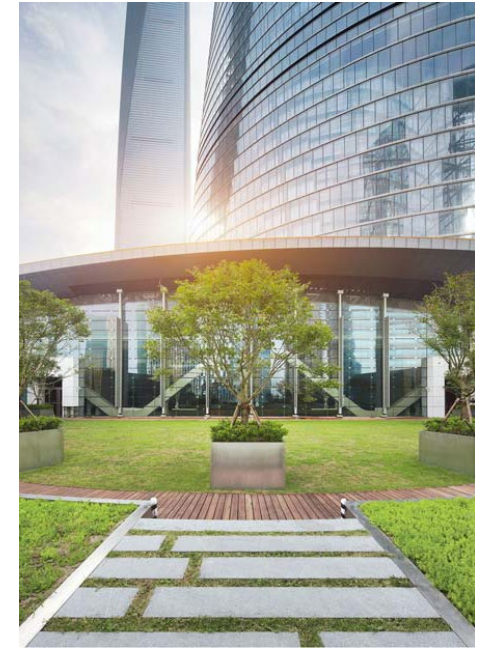
2005

2016

Shanghai Tower embodies the dramatic transformation of the city's Pudong district. In little more than a quarter-century, a low-rise district of prosaic factories, warehouses and rice fields has developed into a high-powered global financial center, with Shanghai Tower as the unifying landmark. The tower is a community in itself, able to accommodate a population of 30,000 people at a time. It engages the city through the connective tissue of parks, plazas, streets, sidewalks and transit.



# Vertical Urbanism



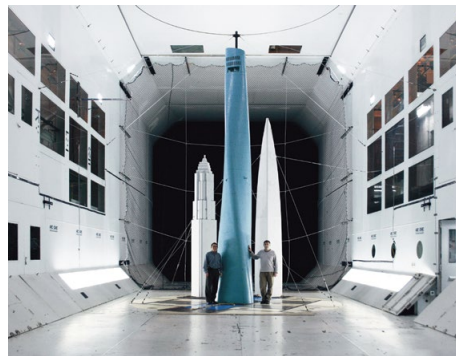
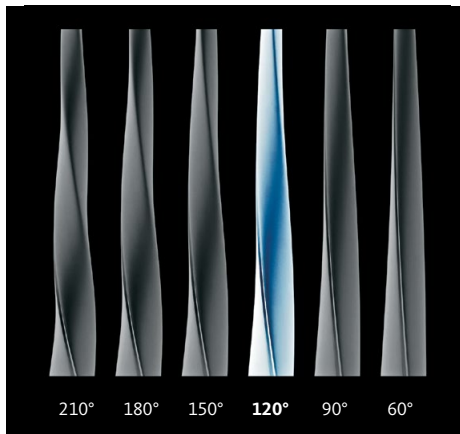
---

Shanghai Tower takes inspiration from the city's tradition of small-scale courtyards and neighborhood parks, recasting them in high-density urban form. The tower is designed to embrace and stimulate the life of the city. It draws on the Chinese people's affinity for indoor-outdoor living, a lifestyle reflected in the city houses known as *shikumen*, whose narrow alleys and courtyards are a canvas for social life. Shanghai Tower embodies this same planning concept, but applies it vertically rather than horizontally. Its gathering spaces are the 21 sky gardens that set the building apart from any highrise ever built.

## DESIGN STRATEGY

# Form and Function

During the design process, the architects anticipated that three key strategies—the tower's asymmetrical form, its tapering profile and its rounded corners—would allow the building to withstand typhoon-force winds that are common in Shanghai. Using wind tunnel tests, the architects and structural engineers refined the tower's form, examining its proportions and studying the optimum rotation for deflecting the wind. The ultimate solution, which reduced building wind loads by 24 percent, resulted in a lighter structure that saved \$58 million in costly materials.



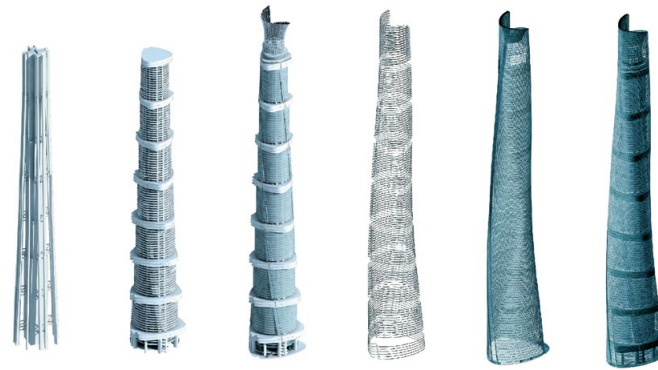
Wind tunnel study rotation models (left)



# Structural Features

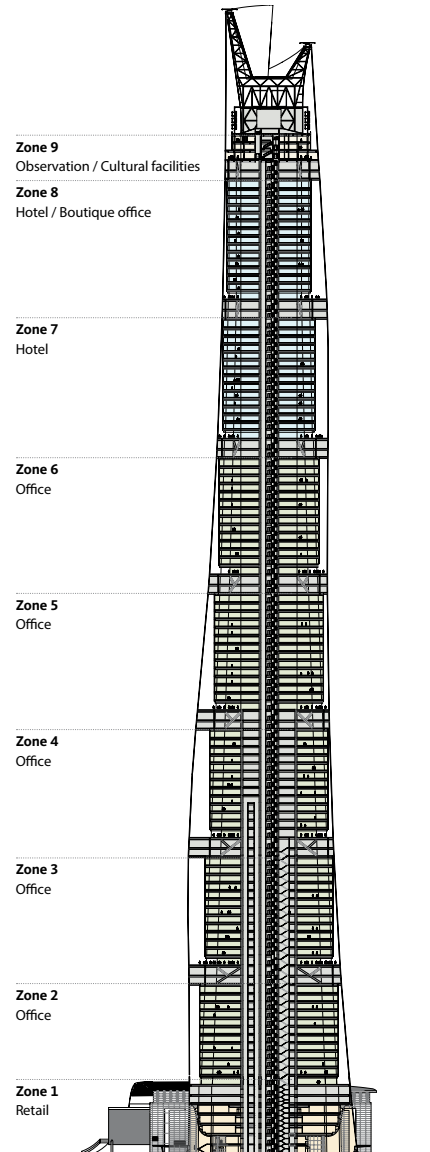


The tower highlights technologies that raise the bar for the next generation of super-highrise buildings. Shanghai Tower's structural design responds to many challenges presented by its location: a windy climate, an active earthquake zone and clay-based soils. The heart of the structural system is a concrete core. The core acts in concert with a system of steel outriggers and supercolumns, with double-belt trusses that support the base of each vertical neighborhood. The refuge and mechanical floors that extend outward at the base of each zone mark the divisions of the building.



Main structure and building systems

# Building Program



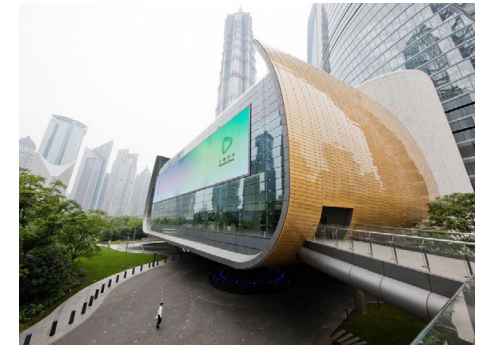
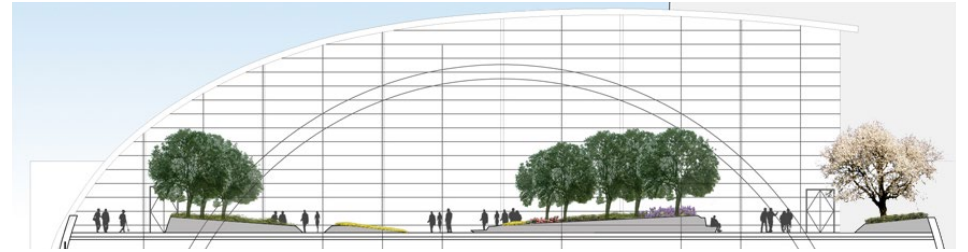
Shanghai Tower is a city within a city comprising nine vertical zones, essentially nine smaller buildings stacked on one another. Each zone is 12 to 15 stories tall. These divisions help to organize the building's mixed-use program, while simplifying its heating, cooling and vertical circulation. The mixed-use tower meets the ground with a six-level retail podium. Next are five zones (70 floors) of Class A commercial office space. Above that are two zones that house a luxury hotel. At the very top are indoor observation floors and, on floor 121, an open-air observation deck. A high-speed elevator takes visitors from the base of the building to the summit in under two minutes.



# Retail Podium



The tower meets the ground with a six-level retail podium that houses shops, cafés, restaurants and parking. In addition, the podium houses a conference center whose multifunction hall—the largest gathering space in the zone east of the Huangpu River—will attract audiences to concerts, performances, art exhibits and social events. An underground walkway connects the tower to the adjacent supertall buildings and a transit station that serves the site.

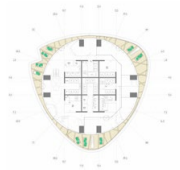




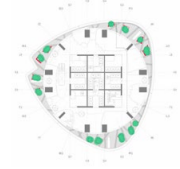
# Sky Gardens



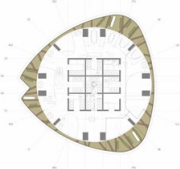
Level  
68



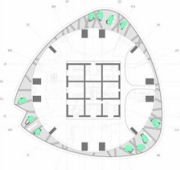
Level  
52



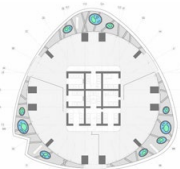
Level  
37



Level  
22



Level  
08



The design incorporates two independent curtain walls: the outer skin that is cam-shaped in plan and the inner one that is circular. These two wall systems created the possibility for Shanghai Tower's one-of-a-kind sky gardens that are spaced throughout the building. The light-filled atria serve much as plazas and squares do, bringing people together in places that everyone shares. The shops and restaurants on these levels offer destinations where people mix every day. The gardens provide a spatial and social experience that distinguishes Shanghai Tower from any other highrise.

# Commercial Office Space / Luxury Hotel

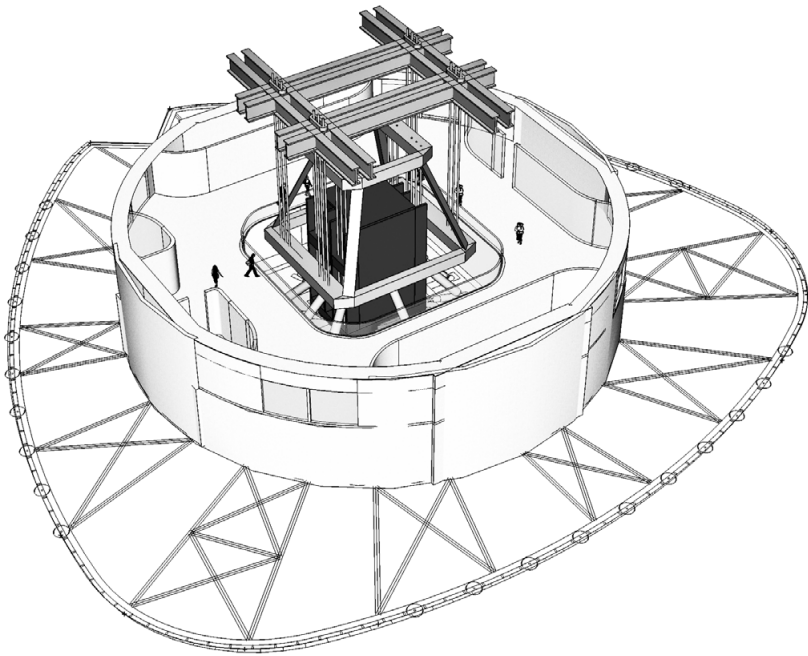


Rising above the retail podium, five zones of the building (about 70 floors) are dedicated to Class A commercial office space. Above that, the next two zones will accommodate a luxury hotel.

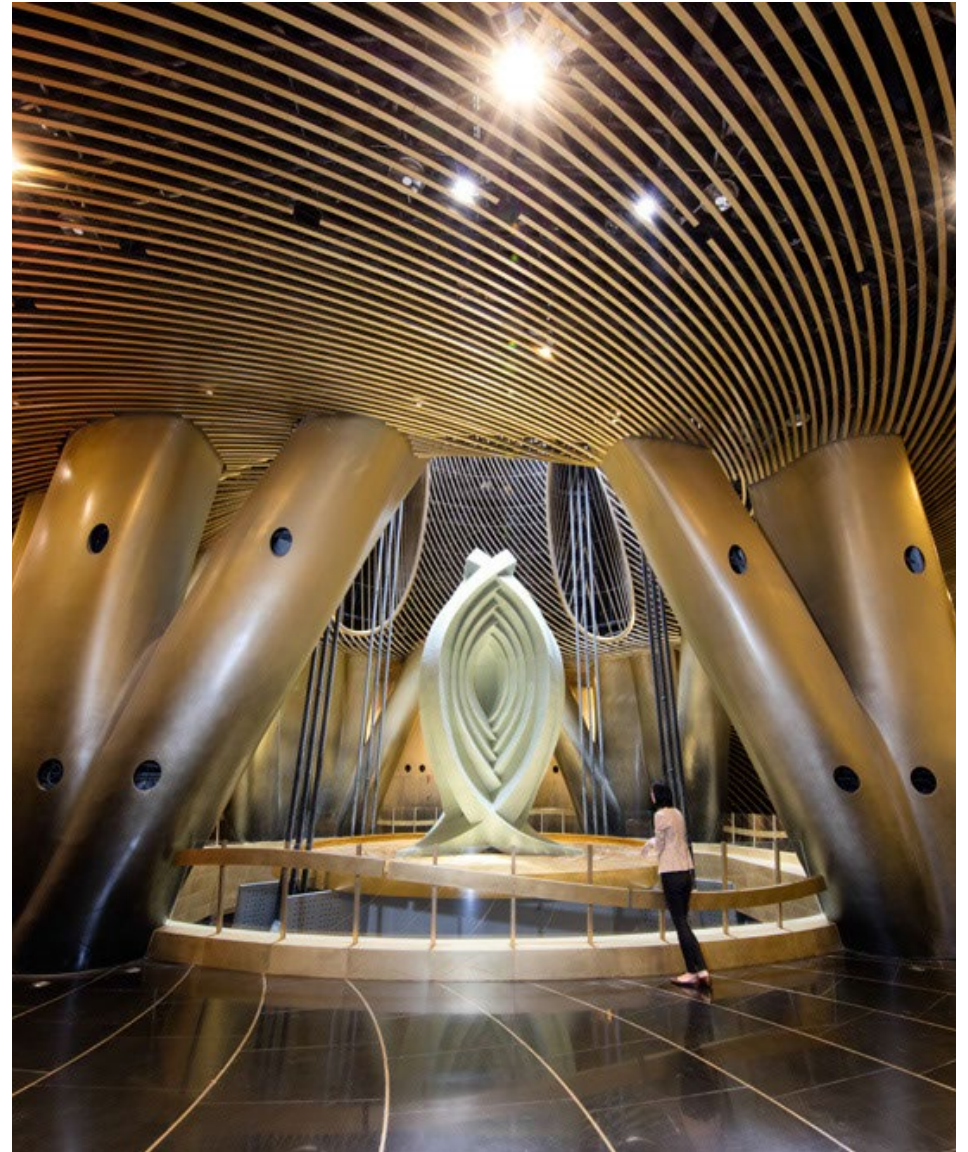
## DESIGN STRATEGY

# Observation Levels

Topping off the tower are the observation levels for tourists, with amenities including a restaurant, café, gift shop and, on the 121st floor, an open-air observation deck where visitors walk among the wind turbines that are integrated in the building's crown. On a platform above, people can view the massive tuned mass damper—a 1,000-metric-ton (1,100-ton) assembly of steel plates suspended by thick cables. The focal point of this gallery is a contemporary sculpture that glides with the back-and-forth movements of the counterweight.



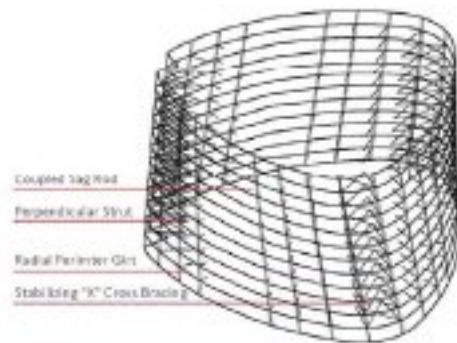
1,000-metric-ton tuned mass damper near the top of the tower improves occupant comfort



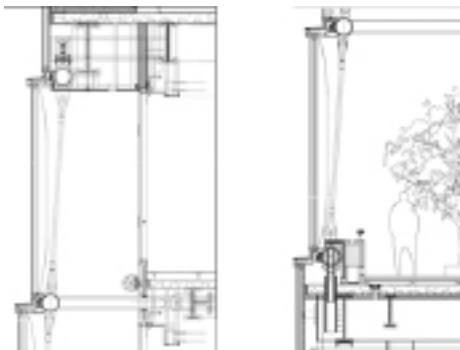
## DESIGN STRATEGY

# Curtain Wall

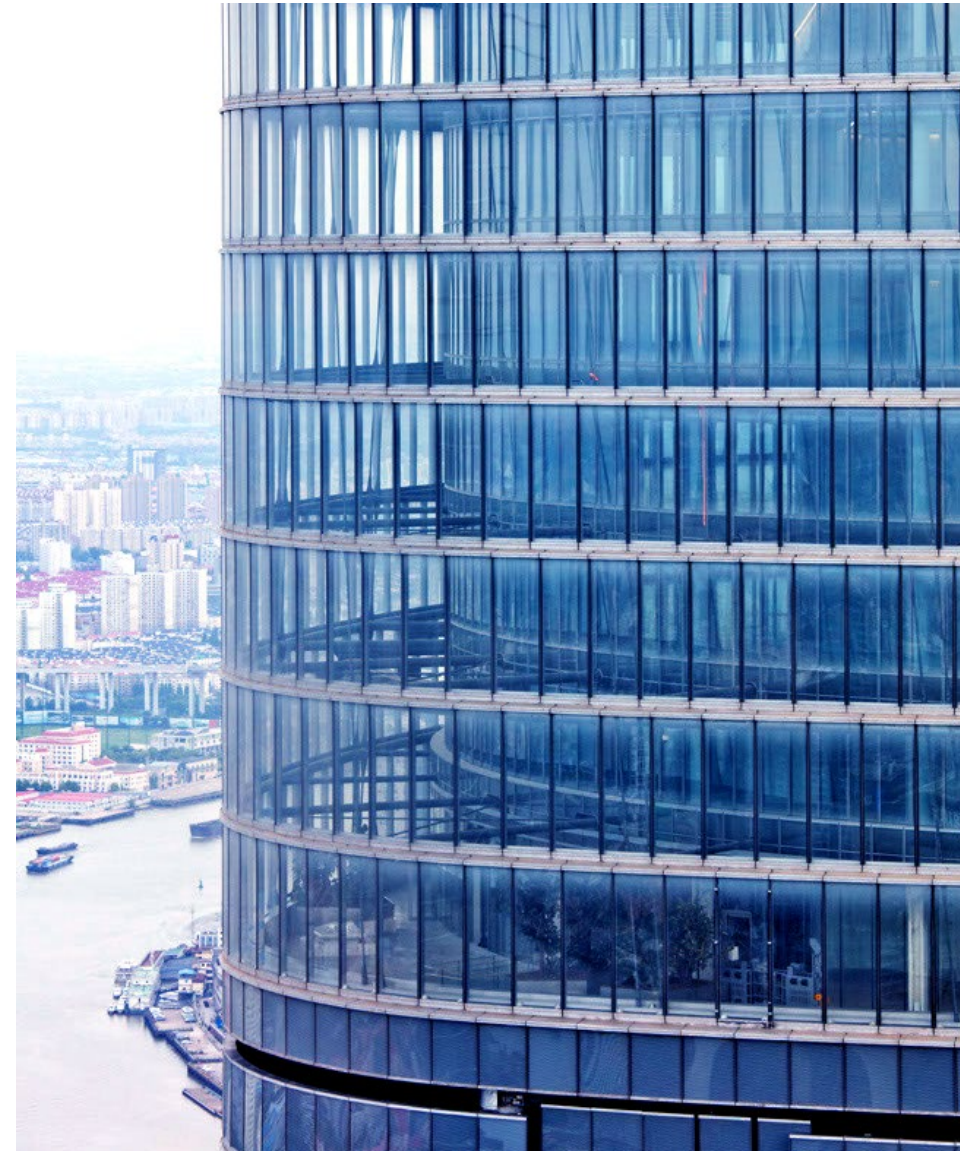
The complex shape had design implications for the building's outer skin. Designed with 20,000+ curtain wall panels—including more than 7,000 unique shapes—the façade would have been challenging to envision using traditional computer-aided design tools. With parametric software, however, the team was able to study many alternatives and create a system that balances performance, constructability, maintenance and design.



Curtain wall support system



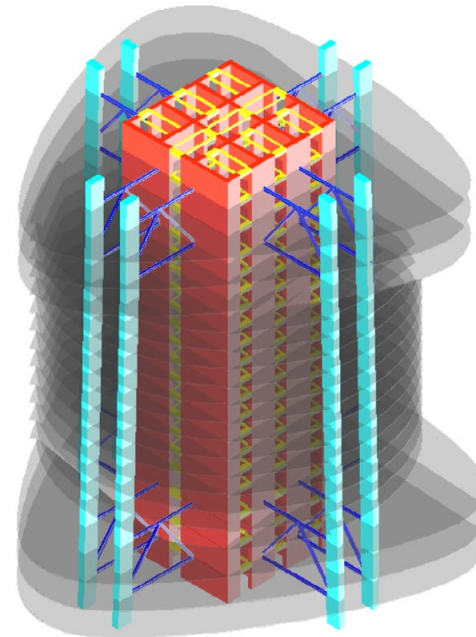
Typical atrium top & bottom curtain wall connections



# A Construction Challenge



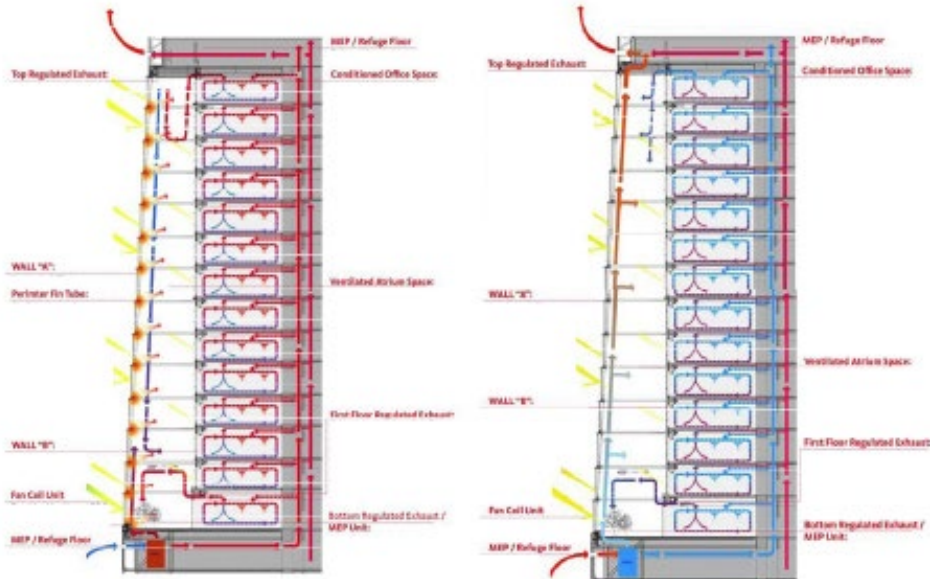
Unlike a more conventional building, in which the walls are built from the ground up, the outer curtain wall of Shanghai Tower was most efficiently constructed from the top down within each zone. A system of rods and cables suspended from above solved a difficult design challenge. On the exterior, a deep V-notch in the façade makes the spiraling geometry readily apparent, while confusing the winds that swirl around the building.



Reinforced concrete core, super composite column, and steel outrigger truss

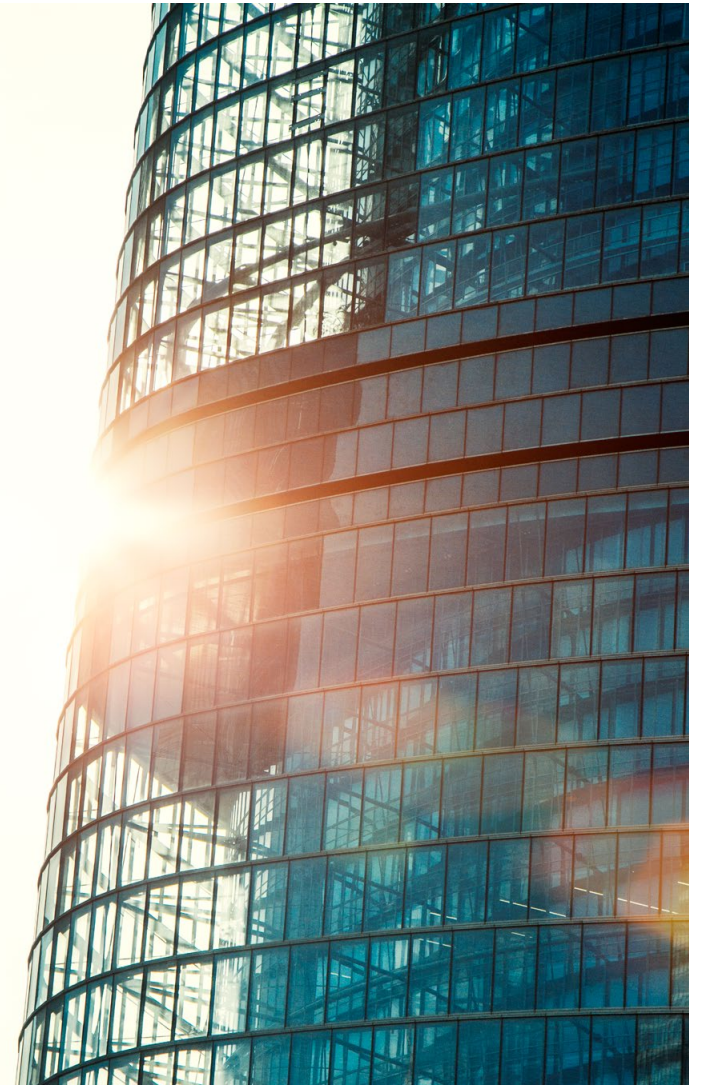
# Transparent skin

Shanghai Tower is one of the most advanced sustainable tall buildings in the world, designed to achieve both LEED Platinum certification and a China Green Building Three Star rating. A central aspect of the design is the transparent second skin that acts like an insulating blanket, reducing energy use for heating and cooling. Both the inner and outer curtain walls have a spectrally selective low-E coating that also reduces cooling loads.



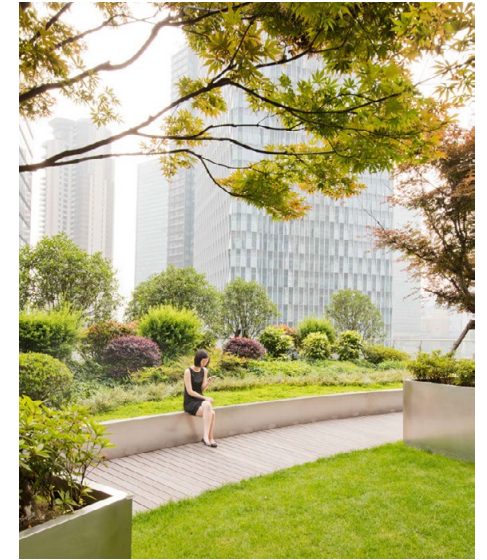
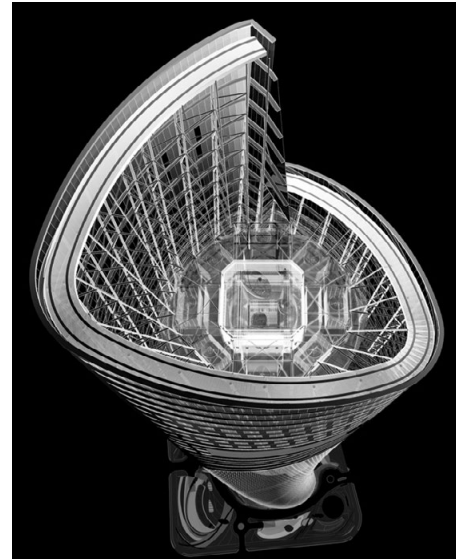
Atrium energy performance: winter concept

Atrium energy performance: summer concept





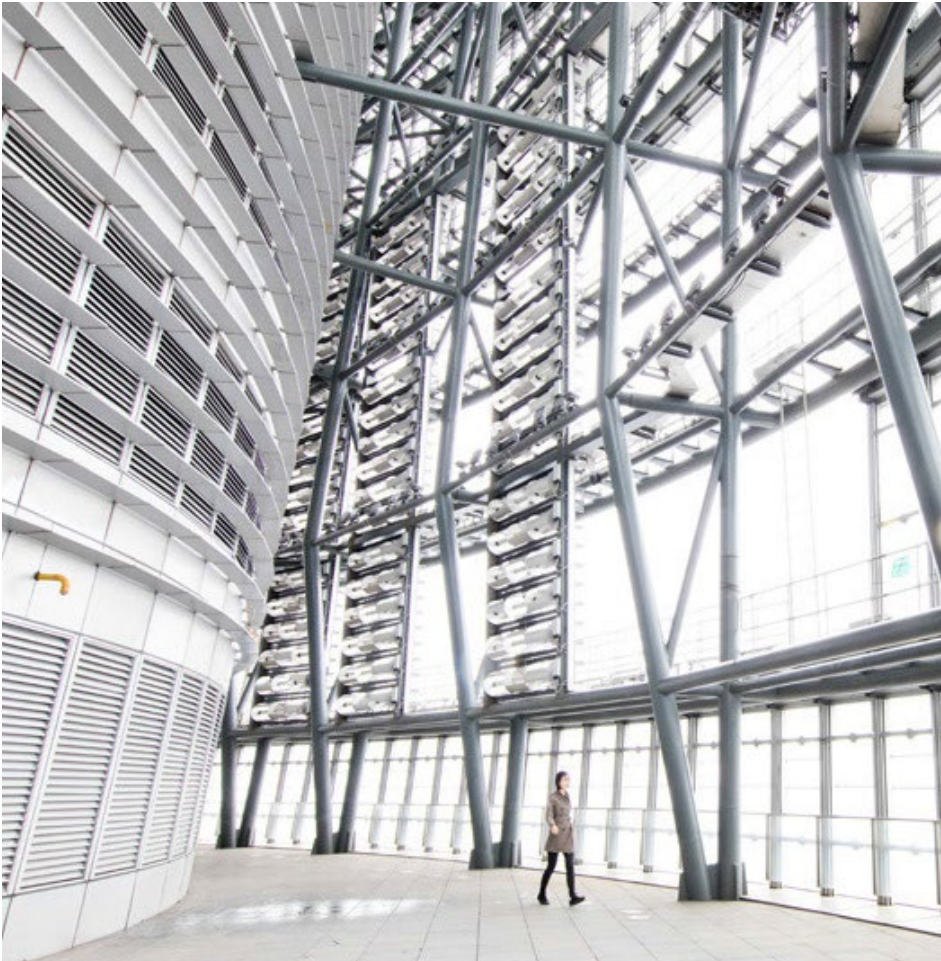
# Water conservation practices



---

The tower employs state-of-the-art water conservation practices. This includes water harvesting in the crown and on the podium terrace. The water is repurposed for landscape irrigation and other uses.

# High-efficiency building systems and power generation



Shanghai Tower incorporates intelligent building controls that lower energy costs by monitoring and adjusting systems such as lighting, heating, cooling, ventilation and self-generated power. Lighting controls alone are calculated to save more than \$556,000 each year in energy costs. Two-hundred seventy wind turbines at the top of the building provide power for exterior lighting of the building, while a 2,130-kW natural gas-fired cogeneration system provides electricity and heat energy to the low-zone areas.



# A Game Changer

Overall, the design team's comprehensive approach addresses key issues of resilience and urban design that challenge cities today. By housing a mix of uses, conserving resources, meshing with regional mass transit and providing human-scaled spaces that add delight to daily experience, Shanghai Tower presents new ideas for how tall buildings can be sustainable and people-centered.

