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## Towards Sustainable Vertical Urbanism

Edited by Daniel Safarik, CTBUH Editor

The survival of humanity on this planet relies on a radical repositioning of our cities. In the face of unprecedented global population growth, urbanization, pollution increase and climate change, it is no longer enough to simply create buildings that minimize their environmental footprint. The reduction of operating and embodied energy consumption in every single building is, of course, vitally important – but even this is likely not enough to mitigate the huge issues at stake. We need to start considering how every building can start working with others in a harmonious urban whole – by maximizing urban/building infrastructure, sharing resources, generating

and storing energy, and looking for completely new ways to improve the building's contribution to the city; physically, environmentally, culturally, and socially.

Cities thus need to be thought of, and buildings planned for, in all three dimensions – they cannot just be vehicles for isolated programs and expressed as products of two-dimensional zoning plans and height limits. Each stratified horizon of a tower has an opportunity to draw from the characteristics of the city and external environment, both of which vary widely with height. Wind, sun, rain, temperature, and urban grain are not the same

through 360 degrees of plan or 360 meters of height, and our buildings need to both recognize, and draw opportunity from, that.

This primary subject of debate at the 2014 Conference is encapsulated in the highlighted presentations shown here. The discussion will drive thinking beyond just buildings, to considering cities as a whole. What best practices are some cities in the world already doing, and what else can be done? How can we work together to rethink our cities; to develop them beyond a collection of disparate icons, towards a vision of a connected, maximized, *Sustainable Vertical Urbanism*?

### The Future Three Tallest Buildings in China

Opening Plenary - Wednesday, 17<sup>th</sup> September, 9:15 a.m. – 10:45 a.m.

#### Shanghai Tower: Building a Green, Vertical City in the Heart of Shanghai

Jianping Gu, President and Board Director, Shanghai Tower Construction and Development Co., Ltd.

The Shanghai Tower is one of the most ambitious skyscraper projects ever undertaken on the planet, let alone in China. While the distant silhouette and the proximate detail of the tower will be immediately distinctive, the purpose of the building is not simply to be seen as an iconic landmark; it is much more than that. Because it incorporates many advanced techniques, it will be a learning laboratory for the next generation of skyscraper designers. The building provides a vision of vertically-integrated space through the signature design move of a double façade that contains numerous sky gardens – filled with vegetation, the potential for socializing, and relief from the isolative nature of tall buildings without the necessity of descending to the ground.

The statistics around the tower are formidable. Upon opening in 2015, at 632 meters it will be the tallest building in China, the second-tallest in the world, and one of only three megatall buildings of 600 meters or greater height in the world. Its sinuous double-skin façade and 14-story atria set into nine zones will redefine the experience of being in a tall building.

From the outset, the ambition behind Shanghai Tower was to make it one of the world's greenest and best-performing tall buildings, including a stringent requirement for an energy saving rate of 54% over the Chinese Efficiency Standard, and that investments in green technology pay back in 7–10 years. Passive solutions included the glass curtain wall's curvature, which reduced wind load by 24%, offered low reflectivity and, with louvers, a high shading coefficient. Active solutions include combined cooling and heating power (CHP), and grey and rain water recycling.

Because of the new paradigm in structural and façade design envisioned by the project team, a new system, consisting of a hinges and vertical sliding joints, was devised for establishing the twisted and tapered outer curtain wall system, which is held at varying distances away from the main structure.

But why do this? What is the return on investment? An expanded return on investment (ROI) calculation considers that sustainably designed buildings can reduce sick time by two to five days annually and increase productivity by 4.8%. When one is designing a skyscraper to accommodate more than 30,000 people, the value of that productivity increase justifies the extra expense involved in sustainable design. The real ROI for Shanghai Tower is borne out by the unique spatial experience created by the double façade. The double façade integrates and synthesizes energy benefits, vertical transportation, fire and life safety requirements, mechanical planning, and structural design, all while providing users with additional amenities and an experience that is unique in the world of high-rise buildings.



Shanghai Tower. © Tansri Muliani



**Ping An Finance Center:  
The Development and Construction of a Megatall**

*Thomas Tsang, CEO, Shenzhen Ping An Financial Center Construction and Development Ltd. Co.*

Located at the center of Shenzhen, the Ping An Finance Center (PAFC) is a “transit-integrated tall building” that will occupy a major node in the increasingly connected megacity of Hong Kong/

Shenzhen/Guangzhou: home to 120 million people and one-third of China’s trade value. By 2017, Hong Kong and Shenzhen will be only 15 minutes from each other by train, and in Shenzhen, PAFC is strategically located at the terminus of the under-construction XRL line to Hong Kong, as well as Shenzhen Metro lines 1 and 3.

PAFC will be 660 meters tall, comprising 460,665 square meters of floor area across 115 levels, with a daytime population of 17,000. And yet, despite its size, it will also have significant sustainability credentials. With an extremely dense program and well-chosen materials and mechanical engineering strategies, PAFC is predicted to sustain an 18.25% energy savings beyond ASHRAE standards, and a 46% annual savings in energy costs over a conventionally constructed commercial office building of the same scale.

PAFC’s design symbolizes its owner’s image and title – “Ping An” is the combination of the Chinese characters for “peaceful” and “safety,” while

evoking the entrepreneurial spirit of Shenzhen. The design also epitomizes efficiency. Its stretched, needle-like shape is streamlined and notched with continuously tapering corners, for both aerodynamic performance and visual effect, as well as

returning the maximum possible number of square, functional floor plates on a compact site. Overall, PAFC achieves a 32% reduction in overturning moment and 35% reduction in wind load compared to China code, due to the shape of the tower.

All of these design elements were validated with performance-based evaluations, rather than design assumptions made on current code, and further optimized and compared through sophisticated use of BIM.



Ping An Finance Center, Shenzhen.  
© Kohn Pedersen Fox

**Suzhou Zhongnan Center: Rising Above Engineering Challenges**

*Dong Shen, Executive General Manager, Zhongnan Group*

The Suzhou Zhongnan Center will be a 729-meter-tall building, containing 375,000 square meters of gross floor area across 137 floors. The project site is located just west of the Jinji Lake central business district (CBD), on 16,573 square meters of land adjacent to Century Plaza and Suzhou Center. It is a building of virtually unprecedented scale and scope, even within China. Its extreme height, difficult soil conditions, and widely varied program require an advanced level of thinking beyond typical tall building planning, design and construction.

The design of the tower is intended to reinforce local Jiangnan culture, referencing its pagodas and springs, with the remainder of its geometry

defined by its diversified program functions. Across nine zones, the tower contains retail, restaurants, entertainment functions, offices, luxury apartments, a seven-star hotel, and an observatory.

The most notable design feature of the tower is its tapering form and needle-like apex, with a consistent look broken only by the louver systems at mechanical floors. The podium attaches to the tower via a translucent façade, lit by fritted glass to the outside. It lifts up its canopy in a welcoming “flying lantern” gesture, creating a public plaza at ground level.

Existing code provides very little basis for the structural design of a building of Zhongnan Center’s height or complexity. Both wind loads and seismic conditions had to be accommodated. Thus, the team undertook performance-based design to enhance and tailor the special design elements to match stakeholder objectives and ensure safe, economical construction, while addressing issues such as seismic waves, wind-induced serviceability design, life-cycle cost, material weight, and story drift reduction. This required in-house development of structural optimization software – a move that saved more than 2,000 metric tons of steel over the original design.

The Suzhou Zhongnan Center tower is not just intended to be a high building; it is intended to be a high-performance building in every sense of the word. Measured in increments as minute as millimeters to massive as kilonewtons, it demonstrates the immense effort of coordination that goes into such projects and the incredible attention to detail required of all practitioners.



Suzhou Zhongnan Tower, Suzhou. © Zhongnan Group

## Rethinking the Skyscraper

### Modular Tall Building Design at Atlantic Yards B2

David Farnsworth, Principal, Arup

Session 12: Prefabrication and Other Construction Advances, Thursday, 18<sup>th</sup> September, 11:15 a.m. – 12:45 p.m.

The Atlantic Yards B2 Modular Residential Tower in New York City will be the tallest volumetric modular building in the world when completed in early 2015. In volumetric modular construction, complete portions of a building are assembled in a factory and delivered to site, where they are assembled together to create a building.

The challenge was to develop a new modular construction methodology and system that was optimized for the construction market conditions in New York, could withstand the loads associated with going 32 stories tall, and could deliver quality at a price competitive with conventional flat-slab construction.

The building contains 930 modules in total with 225 unique types, so in a sense it is “mass customization” more than it is “mass production.”

The basic floor plate is divided into modules that can be fabricated prior to shipping. Using a conventional base of reinforced concrete slabs and perimeter walls and a steel-framed plinth, it was possible to lift the basic modular blocks into place. Module weight ranges from approximately 7 tons for the smallest and lightest to 24 tons for the heaviest.

The units are constructed in “group technology work cells,” consisting of a group of six to eight modules placed adjacent to each other in a geometry that matches exactly the positioning of the modules on-site. Once on-site, the roof of the module below provides a safe work platform for the steel workers and “wet” trades, of which there are very few. The project is currently rising at a rate of six modules per day.



Atlantic Yards B2, New York. © SHop Architects

### The Public Meaning of Skyscrapers

David Gianotten, Partner, OMA

Closing Plenary, Thursday, 18<sup>th</sup> September, 3:45 p.m. – 5:30 p.m.

The notion that a skyscraper's only measure of achievement should be its ultimate height needs to be challenged. They need not be isolated tall objects that paradoxically create isolation and a defensive environment within density.

Instead, they are necessary components within a specific urban context.

The skyscraper typology can constantly be reinvented to generate new meaning. On the physical level, it can provide a new public space in the urban context. At the metaphorical level, a skyscraper with an unconventional gesture can coincide with the ambition of a city to move forward. Two examples are useful:

The Shenzhen Stock Exchange places all of its trading functions within a raised podium, which is a cantilevered platform floating 36 meters above the ground. The building can thus be read as an emblem of the stock market: the speculative euphoria that drives the market lifts the podium up to 36 meters. But it also is designed to interact with the city, through a public plaza at the base.

Likewise, the CCTV Headquarters in Beijing was conceived in the new millennium when China was juggling with the meaning of its ancient power and new prominence. CCTV, and thus its new headquarters building, embodied the vision of China to both open up and preserve its core traditions. By pushing the skyscraper typology beyond its typical vertical limit, the building captures a moment of history in China's development, when the country had a strong urge to move into a new era with new connections to the world. The building was designed to be perceived differently with different perspectives.



Shenzhen Stock Exchange, Shenzhen. © OMA/Philippe Ruault



### Rethinking Skyscrapers in China and Elsewhere

Hayano Yosuke, Principal/Partner, MAD Architects

Session 2: Rethinking the Skyscraper, Wednesday, 17<sup>th</sup> September, 11:15 a.m. – 12:45 p.m.

The pursuit of height is indicative of the worship of power and capital. Only if cities around the world free themselves from the competition for height and the mania for technology, and treat people as the main object of concern, while caring about humanity and nature, can a new and humanistic urban civilization be remodeled.

During the rapid urbanization process that has taken place in the last decade, many of the large-scale and high-profile construction projects in China's biggest cities have been assigned to foreign architects. And some of the results have been dreadful. Modernization has been misinterpreted as synonymous with "progress", and Western architectural authorities have re-colonized China through architectural exports. In modern China, little has been done to maintain the harmonious relationship between the city's spirit and nature, or to succeed in remodeling a humanistic lifestyle.

This phenomenon exists in parallel with confusion over religious and cultural values, and the loss of established traditions. If large-scale urban

construction is undertaken before a city's cultural ideology is complete, it is essential to reflect on the question of whether the city's spirit has reached an appropriate level of maturity, and whether the city has the ability to find a path through a modern reality that is unprecedented in its complexity. In the next round of city development, the happiness of its residents should come first.

The challenge of imagining a future city should be a discussion about spirit and ethics, rather than a debate over technology. The spirit and culture embodied in architecture are what render it truly ageless. Ideas of "greening" are construed from a technological, social and economic angle, rather than from a cultural standpoint.



Taipei Huanshan, Taipei. © MAD Architects



### Space Formations

Ole Scheeren, Principal, Buro Ole Scheeren

Session 2: Rethinking the Skyscraper, Wednesday, 17<sup>th</sup> September, 11:15 a.m. – 12:45 p.m.

As architecture keeps expanding vertically, with ever-taller buildings emerging across the world, and with the skyscraper having become the predominant typology of hyper-growth, we need to investigate and understand the consequences of vertical stratification and generate alternative typologies of spatial quality and communal responsibility.

As an example, The Interlace, Singapore, subverts the vertical expansion paradigm by placing 31 apartment blocks, each six stories tall and 70 meters long, stacking them in hexagonal arrangements around eight large-scale open and permeable courtyards. This yields an extensive network of communal gardens and spaces, swimming pools and sun decks, children's playgrounds, barbecue areas, spa gardens, performance spaces, and other amenities are situated within landscaped areas. All apartments receive ample levels of daylight throughout the day, while the unique massing of the project provides a sufficient level of self-shading in the courtyards.

In a similar alternate strategy to combat the increasing number of isolated individual towers that favor exclusion over social connectivity, the Duo Towers of Singapore form a kind of "urban poché," strategically co-opting adjacent buildings and symbiotically inscribing the two towers into their context. The two towers form a civic nucleus by way of their public transit connections, public observation deck, and extensive landscape areas.



DUO, Singapore. © Buro Ole Scheeren

“Modernization has been misinterpreted to be synonymous with ‘progress,’ and Western architectural authorities have re-colonized China through the export of their architecture.”

Hayano Yosuke, MAD Architects

## Tall Buildings and the Urban Habitat



### “C.I.T.I.E.S.” of the Future: Sinar Mas Center as Exemplar

Toon Ming Chua, Director of Design Department, Sinar Mas/Shanghai Jingang North Bund Realty Co., Ltd.  
Session 1: Developing Tall in China, Wednesday, 17<sup>th</sup> September, 11:15 a.m. – 12:45 p.m.



Sinar Mas Center. © SOM

Vertical urbanization vertical solution solves one set of problems, and generates others. The challenge today is to fulfill the conditions/expectations of “C.I.T.I.E.S.”: C – Center; I – Inhabitants; T – Technologies; I – Integration; E – Ecology; S – Sustainability. The Sinar Mas Center design is an instructive exemplar of the C.I.T.I.E.S. concept.

From the standpoint of urbanism, the multiple entrances to the 422,791-square-meter complex weave Sinar Mas Center’s mixed-uses into the fabric of the city, exemplifying Center and Integration. From a program perspective, the podium comprises three floors of above-grade structure that tie together the larger project elements while creating a series of landscaped plazas that engage the surrounding district and welcome guests, workers and visitors to the various portions of the complex.

Technologies, Ecology, and Sustainability all come together in the project’s sun-shading system. Perforated aluminum sunshades reduce

solar heat gain by day and reduce light pollution by night. Spandrel panels on both towers are acid-etched to provide a neutral, non-reflective surface that reinforces the predominant reading of each primary structure as a glass monolith.

A city has all the properties of C.I.T.I.E.S. when: the city center is a manageable size, with maximum travel times of 30 to 45 minutes from end to end; residential units and public amenities are integrated into the city, ensuring a livable community and supporting the work environment; and green spaces are located throughout the city, facilitating social interaction. The “human factor” is elevated above all else when decisions are being made.

### Architectural Heritage Makes it Possible for People to Linger: The Core Concept Behind the Bund Finance Center (BFC)

Yang Wu, President, Bund Finance Center

Day 3 Plenary: Thursday, 18<sup>th</sup> September, 9:15 a.m. – 10:45 a.m.



China’s new building projects are almost invariably desperate emulations of Western architectural philosophies. Blindly copying the architectural styles of foreign cities while ignoring the historical context, and has undermined the distinctiveness of many Chinese urban areas once steeped in historical or cultural significance, causing their material or spiritual treasures to diminish. We must change our attitude toward a city’s architectural, cultural and historical heritage and innovations.

Urban context is the root and soul of a city. The Bund in Shanghai is such a place. Its architecture embodies the essence of the nation’s financial and cultural history. As part of the architecture in the Bund’s financial center today, the BFC also bears the succession and development of Shanghai’s history and context.

The BFC project is located in a favorable position where the new and old Bund meet with rich cultural heritage, wide-open viewing space, convenient land and sea transport networks, a diverse financial industry, and comprehensive travel package services. It creates a hub for the Old City, the Bund, and the newly developed financial district.

The overall design focuses on facilitating pedestrian passage and serves as a textural continuation of the Bund’s architectural legacy. Building height steps up from lower buildings along the river to skyscrapers on the south side, maintaining coherence with and extending the skyline of the century-old group of buildings known as the “Bund International Architecture Exhibition”. Commercial spaces combine retail for luxury goods, concept stores for international brands, luxury malls, and Michelin-starred restaurants. On the façade, classic stone and copper details are fused with modern glass curtain walls to pay tribute to the “International Architecture Exhibition.” Its art center is inspired by the traditional Chinese opera stage. The building is encircled by a set of moveable screens that can adapt to a variety of indoor functions, either enclosing the interior space or opening up to reveal a panorama of Pudong.

Two or more clusters are linked with an interacting mechanism in order to meet the needs of all clusters while operating under an ingenious common platform. Its essence lies in creating a comprehensive ecosystem with powerful growth potential.

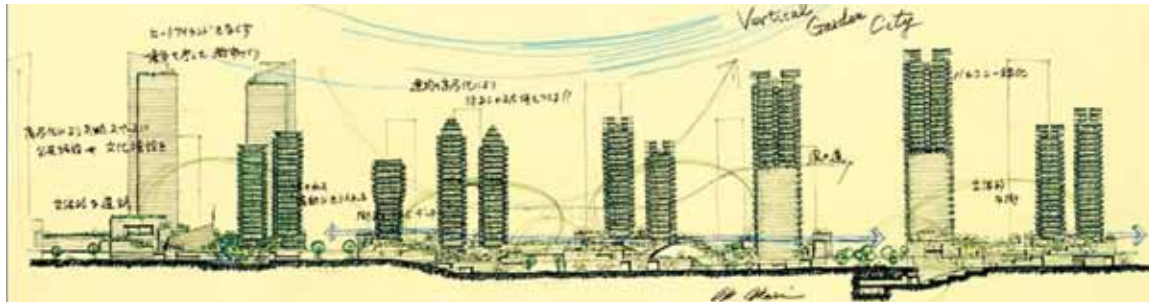


Bund Finance Center, Shanghai. © Bund Finance Center

## Urban Design and Nurturing Cities

Kazunari Kano, Group Executive Officer, Mori Building China

Session 7: Rethinking Urban Design, Wednesday, 17<sup>th</sup> September, 3:45 p.m. – 5:15 p.m.



Vertical Garden City – Minoru Mori's sketch of an ideal city. © Mori Building

The “Vertical Garden City” is a concept of compact cities that integrate land subdivided over previous decades, with high-rise structures that open up green recreational areas. The ideal compact city has functional diversity and nurtures encounters among people.

To achieve this, three central missions of urban design-- safety and security, environment and greenery, and culture and art -- must be crossed

with seven essential development skills. To provide an inviting urban environment, the seven development skills are: a

thorough consideration of the superblock typology, improving the resilience and disaster-prevention functions of developments, using the low-rise portions flexibly, considering the environment's role throughout, reorganizing road functions to better serve the human population, enriching the means by which people travel to, from and within the project; and constructing three-dimensional streets.



## Emerging Urbanization and High-Rise Design Philosophy in China

Junjie Zhang, President, East China Architectural Design and Research Institute (ECADI)

Session 4: Tall Buildings and Urban Design in China, Wednesday, 17<sup>th</sup> September, 1:45 p.m. – 3:15 p.m.

Facing rapid population growth, China has encountered many issues, such as poor integration of in-city production, inefficient use of constructible land, irrational urban/town distribution and sizes, pollution, traffic and other issues typical of highly populated areas.

Chinese policy has begun to take cues from sustainable urban development initiatives in other countries, including Europe's “compact city” concept, and the US' Congress for the New Urbanism and the Smart Growth Alliance. These include planning and policy frameworks that establish ecological protection and construction, natural resources and orderly development, guide the protection and rational use of land resources, and establish requirements to improve the efficiency of urban land use and for maintaining population density in urban areas. This has been crowned with the National New-Type Urbanization Plan of 2014–2020, which lays out in 31 chapters a programmatic document for China's future development of urbanization, advocating positive interaction between industrialization and urbanization while promoting urban development and industry support and unity.

The above has strong implications for supertall design in China, which can additionally be informed by the CTBUH Roadmap on the Future Research Needs of Tall Buildings. This includes incorporating more primary industries such as agriculture in high-rises, and secondary industries as well, such as energy-saving and environmental protection technologies. It also means creating a “compact hybrid,” incorporating the city's comprehensive functional areas into high-rise building complexes. But in order to maximize the conservation of land resources, it is necessary to efficiently interweave the diverse social functions and lifestyles. Good

examples of this lie in the Beijing CBD East expansion, the Tianjin Binhai Yujiabao New Area financial district and the Wuhan Wangjiadun Central Business District.

From further analysis of the National New-Type Urbanization Plan and CTBUH Roadmap, several guiding principles come to light. High-rise population composition should be based on characteristics of different groups, including aspects based on physiological, psychological, life quality, infringement protection and social inclusion factors. High-rise operators should also set goals to provide special supporting facilities and public services products, in order to fully embody their responsibilities in serving the urban infrastructure.



The Tianjin Binhai Yujiabao New Area financial district. © SOM



“We are moving from 2D mono-use to 3D multi-use of land; hermetically sealed structures to breathable, verdant towers; from the hardware of urbanity to the ‘heartware’ of community.”

Mun Summ Wong, WOHA

**CTF Towers:**

**The Challenge to the New Skyline**

Wing Ip (David) Ho, Head of Design Department, New World Development Co., Ltd.

Session 1: Developing Tall in China, Wednesday, 17<sup>th</sup> September, 11:15 a.m. – 12:45 p.m.



Two supertall towers developed simultaneously by Chow Tai Fook – the Guangzhou CTF Finance Centre and the Tianjin CTF Finance Center – offer great insight on the challenges and

opportunities of developing tall in different cities across China; urbanistically, economically, culturally, environmentally, physically and socially.

The Guangzhou CTF Finance Centre, located in China’s third-largest city and cultural hub of the Pearl River delta, will be the city’s tallest building, accommodating more than 30,000 people in a 530-meter tower. Sculpted at four major transition points, the concept is of a simple, elegant crystalline tower form that reflects its multiple uses and urban context. It



Guangzhou CTF Center. © Tansri Muliani

will be the tallest terracotta-clad tower in the world, and this required forging into new territory. Expert panel review and testing were held to procure approval from the authorities.

The Tianjin CTF Finance Center is also a 530-meter tower in an important location, the Tianjin Economic-Technological Development Area (TEDA). Containing offices, serviced apartments, and a luxury hotel, the 97-story tower tapers dramatically to minimize the surface area exposed to the external elements. Its aerodynamic shape greatly reduces vortex shedding and diminishes structural wind loads.

**Sustainability in the Context of Tall**

**The Tropical Skyscraper: Social Sustainability in High Urban Density**

Mun Summ Wong, Principal, WOHA

Day 3 Plenary: Towards “Sustainable Vertical Urbanism,” Thursday, 18<sup>th</sup> September, 9:15 a.m. – 10:45 a.m.

The tall building industry is now seeing a paradigm shift from piecemeal initiatives to integrated infrastructures, from 2D mono-use to 3D multi-use of land. We are moving from hermetically sealed structures to breathable, verdant towers; from the hardware of urbanity to the “heartware” of community.

The future green high-rise city is already underway today in small increments. It is helpful to think of the future as consisting of “tropical urban community building blocks,” areas with good visual connectivity that promote a sense of informal community surveillance and shared ownership.



Several projects, including the School of the Arts, Singapore, and BRAC University, Dhaka, Bangladesh, are built on a “Club Sandwich” typology, organizing programs of diverse natures into distinct, self-sustaining strata, each with their own unique quality and character. This opens up the ground level by considering it as an essential layer of the city that can be replicated within and between buildings in the sky.

Additional projects deploy a “Vertical Village” typology, established around the basic building block of community – the family unit. Projects such as Duxton Plains, Skyville @ Dawson, and Kampung Admiralty, Singapore, are public-housing vertical villages designed with clear social goals and a strong community agenda. These include community living rooms, roof gardens, and flexible layout schemes for multi-generational families.



Park Royal on Pickering, Singapore. © WOHA/Patrick Bingham-Hall

## Tall Building Operation Towards Sustainability

Cathy Yang, General Manager, Tower Division, Taipei Financial Center Corp.

Technical Workshop: Building Management & Operation, Tuesday, 16<sup>th</sup> September, 9:15 a.m. – 12:45 p.m.



Successful supertall building operation includes nurturing a mix of revenue sources to maximize operating return (recognizing that many tall building projects start off deeply in debt), updating systems and services, and prioritizing customer satisfaction.

Taipei 101, designed in 1999 and completed in 2004, was designed to be a “green” building at the time, but before LEED was widely used in Asia. Initial pre-LEED green investments included a dual-layer, low-e glass curtain wall, and systems for energy management and control, garbage and rainwater collection. However, management was determined to keep the building as an example of green leadership in operation. Through a two-year process, Taipei 101 received the LEED Platinum Existing Buildings certification. Management changed all exit sign lights from T8 to LED, added light switches in the service lift lobby, added motion sensors for lighting in refuge rooms and two-way switches in mechanical rooms, and changed all auto parking lights from halogen to T5 tubes. The fire system water pipe pump pressure was not up to standard and motors needed to be replaced. The chilled water pipe insulation was not sufficient and created lots of condensation requiring new insulation.

It’s also vital to remember that construction is a manufacturing business, but property management and operation is a service business. At Taipei 101, dedicated service centers were set up for the office and for the shopping mall to immediately respond to customer’s requests and complaints, which are then well documented.

Supertall developments are not a short-term profit undertaking. The stakeholders for supertall buildings are not only the owners and occupants, but also the general public and government. Supertall buildings are city landmarks, and they have to pursue sustainability and stand the test of time.



Taipei 101, Taipei. © Taipei Financial Center Corp.

## Vertical Communities: A Harmonious Mix

Sam Cuccurullo, Executive Managing Director, CBRE

Session 5: Occupiers & Tenants, Wednesday, 17<sup>th</sup> September, 1:45 p.m. – 3:15 p.m.



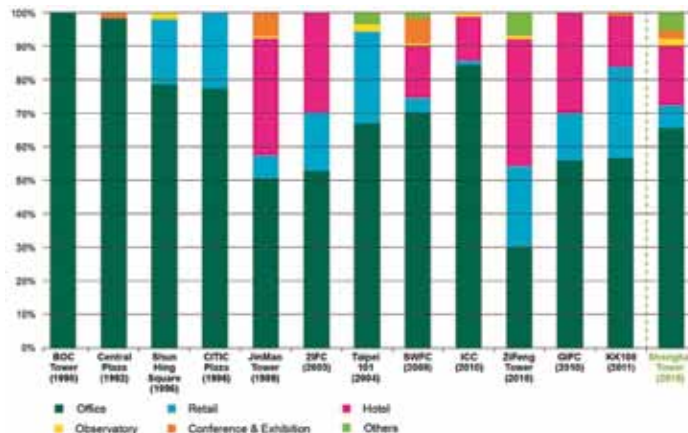
The number of uses within supertalls is increasing, from more or less pure office to six or more different uses. Regulatory requirements, commercial and operational considerations are key drivers for

adding uses in supertalls. But without taking into account human factors like interdependence, cohesiveness and “we-feel,” a mixed-use supertall can be viewed solely as a stack of uses linked by elevators.

In order to build harmonious vertical communities, we need to take on some key issues. This includes increasing the degree of interdependence of uses within a supertall. This will substantially affect the cohesiveness of users, hence affecting their “we-feeling.” We commonly describe multiple uses in a building, but are the four uses serving four different groups of people, or is there crossover?

For instance, do hotel guests use the retail areas for food and beverage as well as shopping? Do office workers use sky lobbies not only for transit, but also have their lunch there? Are observation decks used by tourists and locals? The Smart Growth America Leadership Institute has a Smart Growth Project Scorecard for low-rise developments. Can vertical developers adopt something similar?

In the past two decades, practitioners in the supertall field have done an excellent job in hardware. Now it is time for us to have a closer look at people.



Proportion of uses in the top 12 completed supertalls in China, including Hong Kong and Taiwan, versus a constructing supertall – Shanghai Tower. © CBRE



## Life Cycle Analysis: Are We There Yet?

Don Davies, Senior Principal, MKA

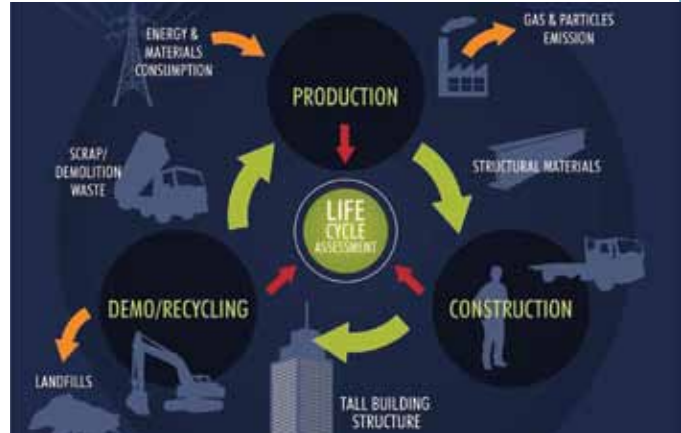
Technical Workshop: Considering the Whole Life Cycle, Tuesday, 16<sup>th</sup> September, 9:15 a.m. – 12:45 p.m.

Life cycle analysis (LCA) tracks the consumption and emissions throughout a material or product's life cycle and reports its environmental impact, such as greenhouse gas emissions or global-warming potential. Its use in design has been limited due to the disconnect between the time and effort needed to do LCA and the pace of building design process. However, the arrival of new software such as Tally and wider use of BIM means LCA is now nearing the point where it can be credibly used during the decision-making process of building design.

Impacts are measured through environmental product declarations (EPDs), which declare the environmental impacts of a product over its expected life, similar to a nutrition label on food. Materials suppliers and the industry are pushing EPDs on several fronts; however, there are issues with this. For instance, the World Steel Association assigns what is likely too high of a carbon credit for recycling steel.

Still, multi-phase LCAs can be conducted fruitfully. Similar to project cost estimating, an LCA starts with an estimate and becomes an iterative process of increasing accuracy. It is important not to stop with the initial model – final results can change by 30% or more, requiring more detailed investigation to achieve relevance for structure.

Tally is a just-released LCA module for Revit software to quantify the environmental impact of building materials for whole-building analysis, as



Life Cycle Analysis. © MKA

well as conduct comparative analyses of design options. It is a major advancement, greatly simplifying initial LCA project modeling; however, it does not provide the ability to directly model LCA data for anything other than products specified within its database.

In this paper and presentation, several case studies of tall buildings in San Francisco and Seattle are examined for the use of LCA.

## The 21<sup>st</sup> Century Metropolis and the System Thinker

Luke Leung, Director, SOM

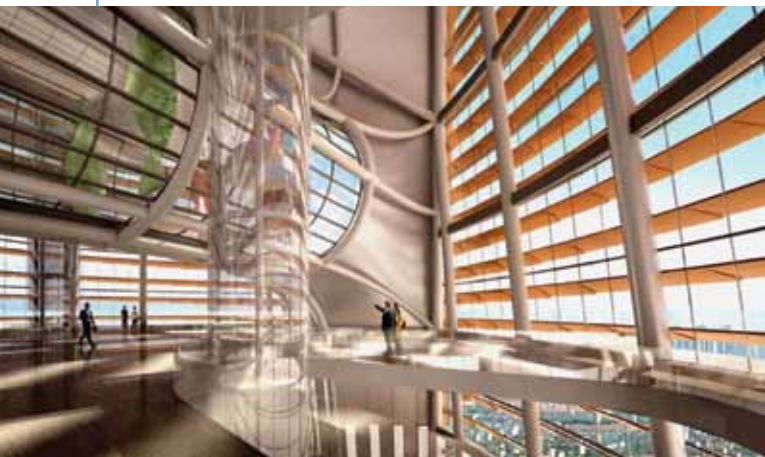
Session 8: The Sustainable Threshold for Tall, Wednesday, 17<sup>th</sup> September, 3:45 p.m. – 5:15 p.m.

Buildings, districts and cities must be sustainably designed not only as individual components, but also as parts of larger networks. Increasing connectedness within cities will decrease resource consumption, despite the higher energy utilization intensity (EUI) of tall buildings, and lead to higher qualities of life that include longer life expectancies, higher productivity, and enhanced resiliency. Such cities can also create positive feedback loops to further strengthen sustainability.

The benefits of urban connectivity include decreased resource consumption, and a higher quality of life. The 100 largest US cities use 23% less electricity per home than the US average. When cities double in population, nearly every available measure of economic activity increases by 15%.

How can designers promote this connectivity? It all starts with infrastructure. Examples abound: From Chicago, where a central cooling plant cools over 100 downtown buildings using ice created with off-peak electricity, centralizes capital costs, and increases leasable space in downtown buildings. In Toronto, a district heating and cooling system reduces electricity demand for the city by 61 MW and eliminates 79,000 metric tons of CO<sub>2</sub> per year.

With the growth in technology, and especially big data, digital connections through social media and other online communities are changing the landscape of how people interact and connect. These systems can be used to create positive feedback loops along with physical infrastructure. As the city grows, more people are drawn to it and leverage the benefits of a connected city, which attracts even more people. In so doing, we can create a "Silicon Valley of Sustainable Design" in our cities, fostering the development of new technologies, processes, and ways of life.



Vision of a future city. © SOM

## From China to New York...

Closing Plenary, Thursday, 18<sup>th</sup> September, 3:45 p.m. – 5:30 p.m.

There is little doubt that China will continue to be the epicenter of global skyscraper activity for the immediate future. But not all of the skyscraper construction in the world is taking place in China. In fact, in New York, where the “death of the skyscraper” was proclaimed a scant decade ago, vast new mixed-use projects, extremely slender residential skyscrapers, and global capital flows – including from China – are fast taking root and heading skywards. This is having as much of an effect on the urban landscape on the ground plane as it is on the skyline. Thus, the closing plenary of the 2014 Conference will highlight a clear path to the 2015 Conference, which will take place in New York on the theme *Global Interchanges: Resurgence of the Skyscraper City*.

The CTBUH 2015 New York Conference will examine dual phenomena – the motivations and mechanisms that are enabling multi-national investment scenarios, and the technical innovations that are driving new heights, forms, materials and construction techniques. The conference aims to examine what it all means for the skyscraper of the future, which will be more adaptable to the sustainable and technological challenges of the age.

“As the converse of density, the carefully planned porosity of constructed mass allows for essential relief from some of the challenges arising from extreme compaction.”

James von Klemperer, *Kohn Pedersen Fox*



New York skyline. Source: imgur.com



### The Logic of Luxury: New York's New Super Slender Towers

Carol Willis, Director, the Skyscraper Museum

The recent exhibition “SKY HIGH & the Logic of Luxury” at The Skyscraper Museum New York examined a dozen super-slim, ultra luxury residential towers on the rise in Manhattan. These pencil-thin buildings – all 50 to 90+ stories –

constitute a new type of skyscraper, even in a city where tall, slender structures have a long history. More than a dozen such remarkable buildings are underway in New York City, and there will be more.

While some owners will enjoy their aeries as a primary residence, many apartments are being purchased as investments by wealthy individuals, LLPs, and by international buyers. There is no one style that dominates across the eight examples demonstrated here, but the common thread is the extraordinary slenderness ratios (up to 1:23) and the engineering involved in achieving those ratios, in order to optimize views. The rationale is pure economics – some of these apartments are selling for close to US\$100 million.

This is a trend worth examining, as the peculiarities of New York real estate have sculpted the particular shapes we see, but the phenomenon of skylines engineered to reflect the desires of capital flows seeking safe investments is a global one.



Left to right: 432 Park Avenue, One57, 111 West 57th, Four Seasons at 30 Park Place, 56 Leonard, Hudson Yards Tower D. Source: The Skyscraper Museum

## Urban Density and the Porous High-Rise: The Integration of the Tall Building in the City – From China to New York

James von Klemperer, Principal, Kohn Pedersen Fox



Jing An Kerry Centre, Shanghai. © Kohn Pedersen Fox

As the converse of density, the carefully planned porosity of constructed mass allows for essential relief from some of the challenges arising from extreme compaction. Three projects in Shanghai, Seoul, and New York demonstrate how the insertion of public open spaces, addition of varieties of public use, and connection of public circulation routes into tall structures can allow city life to flow effectively through otherwise dense environments.

Three examples underscore this point. The Jing An Kerry Centre in Shanghai can be thought of as a built investigation of superblocks, clusters and grids, which instills the urban grain within the project by offering up buildings at a graduated scale on an organic grid. The Lotte Supertower in Seoul achieves porosity by way of sectional variety, continuity of interior space and between its base and tower morphology, and deploying its large base as a general community asset. One Vanderbilt, a supertall under design in New York City, offers a porous public room at its base, intrinsically linked to transit and generously providing a visual portal to Grand Central Terminal.

All **156 papers** presented at the 2014 Shanghai Conference can be found in the **2014 Shanghai Conference Proceedings** book, and three **CTBUH "In Detail"** books available from the CTBUH Web shop at: <https://store.ctbuh.org>



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*The CTBUH "In Detail" series provides an in-depth, full-color exploration of some of the most important tall buildings in the world, drawing from the multi-disciplinary expertise of the practitioners directly involved in bringing these buildings to life.*