

CTBUH Journal

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Special 2016 Conference Themed Issue: Megacities

SOM and China: Evolving Skyscraper Design

Cities to Megacities: Perspectives

Megacities: Setting the Scene

Shifting the Urban Gravity of Business Districts

Rethinking Cities for the Age of Global Warming

How Do Aviation Rules Affect Tall Building Height?

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Architecture/Design

SOM and China: Evolving Skyscraper Design Amid Rapid Urban Growth



China's rapid urban and economic growth has challenged designers, engineers, and planners to create and collaborate across the world's fastest growing country. Skidmore, Owings & Merrill (SOM) has been practicing in China for more than two decades, working with residents and policymakers to shape urban environments. The firm's integrated, interdisciplinary approach has produced some of the most iconic buildings in the country, and continues to give form to the evolution of the country. Through a series of related projects in China, this case study explores how practices have evolved to help Chinese cities become more vibrant and growing.

Key Takeaways:

- The rapid urbanization and economic growth in China has led to a massive increase in the number of tall buildings.
- SOM has been practicing in China for more than two decades, working with residents and policymakers to shape urban environments.
- The firm's integrated, interdisciplinary approach has produced some of the most iconic buildings in the country.
- Through a series of related projects in China, this case study explores how practices have evolved to help Chinese cities become more vibrant and growing.

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Urban Design

Shifting Urban Gravity, from "Central" To "Core" Business Districts



The concept of a central business district (CBD) is becoming increasingly antiquated. As cities evolve, the concept of a central business district is changing. This article explores the concept of a central business district (CBD) and how it is evolving. It discusses the challenges of maintaining a CBD in a city that is growing rapidly and how to adapt to the changing urban landscape.

Key Takeaways:

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- This article explores the concept of a central business district (CBD) and how it is evolving.
- It discusses the challenges of maintaining a CBD in a city that is growing rapidly and how to adapt to the changing urban landscape.

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Architecture/Design

Garden City, Megacity: Rethinking Cities For the Age of Global Warming



The 20th-century city, developed in response to industrialization and urbanization, is now facing a new challenge: global warming. This article explores the challenges of maintaining a city in the face of global warming and how to adapt to the changing urban landscape.

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Figure 1: A tall building in China, likely a skyscraper.



Figure 2: A city skyline, likely a megacity.



Figure 3: A city skyline, likely a megacity.

“Twentieth-century cities were planned as collections of segregated components, which were measured in terms of their economic productivity. The value of buildings was assessed only by capital cost efficiency, rather than their overall contribution to the city...”

Americas

High-rise development in **New York** is continuing apace, with a number of significant tower proposals moving forward after clearing various legal hurdles. In Midtown, a settlement between developers has cleared the way for **One Vanderbilt Place** by KPF, potentially the third-tallest building in the city, to be built next to Grand Central Terminal. On the east side, the Department of City Planning is proceeding with an application to build **247 Cherry Street**, a 305-meter residential tower that has been embroiled in litigation over its air rights. While the legal action remains pending, the planning department will review the application and determine a course of action.

Meanwhile, the iconic **Empire State Building** has been in the news, with reports that the Qatar Investment Authority has invested \$622 million in the tower for a 9.9% ownership stake, part of the country's goal of investing \$35 billion in US assets.

As the New York market remains strong, development across the Hudson in **Jersey City** is keeping pace. The city has recently approved plans for a 72-story tower at **30 Journal Square**, just one of several towers that are planned for the long-neglected



One Vanderbilt Place, New York. © KPF

Journal Square area. The development will feature 741 residential units, in addition to office space.

While the New York region remains the undisputed skyscraper capital of the United States, it has received some healthy competition from **Miami**, which is in the midst of its own high-rise building spree,



Brickell Flatiron, Miami. © Ugo Colombo

with several towers under construction or recently completed. Despite concerns that the condo boom might be beginning to wane, strong sales for the **Brickell Flatiron** have spurred construction of the tower; 55% of its 549 units are currently under contract, accounting for \$75 million in sales in 2016.

Similarly, construction on Zaha Hadid Architects' **One Thousand Museum** is continuing on pace, buoyed by strong confidence in the project. The structure has reached above the 15th floor, giving onlookers a view of the unique exoskeleton that defines the project. Further south in the Coconut Grove area, another high-profile project recently wrapped up, with the announcement that the **Grove at Grand Bay** is preparing for opening. The two-tower complex features twin, twisting 94-meter residential buildings.

Along with Miami, another US city in the midst of a high-rise boom is **San Francisco**, with projects rising up and down Market Street, centered on the gestating **Transbay Transit Center**. With construction poised to begin on Foster + Partners' and Heller Manus Architects' **Oceanwide Center**, new renderings have been revealed for the 21-story **Waldorf Astoria Hotel** that will be built as part of the mixed-use complex.



One Thousand Museum, Miami. © Zaha Hadid Architects



30 Journal Square, Jersey City. © Ismael Leyva Architects'



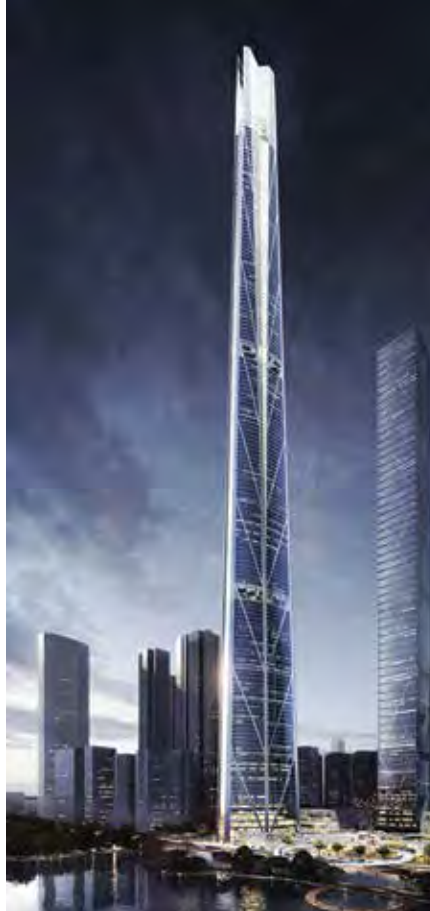
Stantec Tower, Edmonton. © Ice District JV

While construction across cities in the US remains strong, a new tower is set to rise in oft-overlooked **Edmonton**. The under-construction **Stantec Tower** is set to anchor the growing Ice District and will be the tallest skyscraper in western Canada upon completion. The tower recently reached a construction milestone when crews completed the concrete pour for its foundation.

Asia & Oceania

Although tall by most standards, the 251-meter Stantec Tower would be underwhelming when compared to bKL Architecture's proposed **H700 Shenzhen Tower**, which at 739 meters could become the tallest tower in **Shenzhen** and China, and the third-tallest worldwide, assuming it would complete after the 1,000-plus-meter **Jeddah Tower** in **Saudi Arabia**. A planning package for the megatall tower was recently resubmitted to Shenzhen planning authorities for approval.

Once the tallest tower in China, **Jin Mao Tower** by Skidmore, Owings & Merrill has spruced up its public offerings with a new skywalk outside the 88th floor. The 60-meter-long, 1.2-meter-wide fenceless, transparent walkway will offer stunning – and



H700, Shenzhen. © bKL Architecture

adventurous – views of the surrounding cityscape for those willing to be lashed to the building with ropes.

While China has long been home to some of the world's tallest buildings, KPF's **Lotte World Tower** will soon propel South Korea's **Seoul** to join that list. Developers recently announced that the 556-meter tower will be completed on schedule, and have organized a celebratory concert to recognize the hard



Lotte World Tower, Seoul. © Lotte Corporation

THEY SAID

“While the beautiful aesthetic created by large expanses of façade glazing is not disappearing anytime soon, increasingly stringent energy codes are pushing architects to seriously reconsider just how much glass they can afford.”

Ornamental Metal Institute of New York on new energy goals with façade design. From “Too Transparent?” Architectural Record, May 2016.

work of the many people who helped construct the tower.

Meanwhile, across the Sea of Japan, a number of projects are transforming neighborhoods in **Tokyo** and **Sapporo**. In the capital, the recently completed **Tokyo Garden Terrace** complex by KPF and Nikken Sekkei adds a pair of high-rises to the Kioicho neighborhood in the city's Chiyoda ward. Along with the new construction, the



Tokyo Garden Terrace, Tokyo. © 江戸村のとくそう

SOM and China: Evolving Skyscraper Design Amid Rapid Urban Growth



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Scott Duncan

Throughout his 16-year tenure at SOM, Scott Duncan has developed a body of work recognized by The American Institute of Architects, MIPIM Asia, World Architecture Festival, The Municipal Art Society of New York, and The Chicago Athenaeum. He offers extensive experience in the design and implementation of complex projects around the world – including large-scale mixed-use, transportation, commercial, hospitality, and residential developments in Asia. Duncan's most recent large-scale project, the Pertamina Energy Tower in Jakarta, is the world's first supertall tower for which energy is the primary design driver.

Yue Zhu

As a Senior Technical Designer and Associate Director in the Chicago office of SOM, Yue Zhu has experience in architectural design, technical expertise, urban design, and sustainable design. He has participated in the design and construction of commercial and civic buildings in North America, Europe, and Asia and he has extensive experience and expertise in Chinese projects, including many high profile high-rise buildings and multi-use urban development projects in China.

China's rapid urban and economic growth has challenged designers, engineers, and planners to innovate and collaborate to meet the needs of a changing country. Skidmore, Owings & Merrill (SOM) has been practicing in China for more than two decades, working with residents and policymakers to shape urban environments. The firm's integrated, interdisciplinary approach has produced work at all scales that addresses the challenges of urbanization and gives form to the aspirations of the country. Through a survey of notable projects in China, this case study expresses how practices have evolved to help Chinese cities become more vibrant and compelling.

Introduction

The largest-ever human migration – the movement of people from rural to urban China that began in the 1980s – has created burgeoning, vibrant cities across the country. The question of how best to build cities for prosperity, social cohesion, and a healthy environment demands an integrated approach that considers how people can live well, both now and in the future.

SOM was founded as an interdisciplinary practice and brings together design, technical design, structural engineering, urban planning, MEP, interiors, and project management practitioners to create buildings and cities that are sustainable, well-executed, and enduring. An integrated way of working enables the firm to meet the challenges posed by rapid urbanization and to develop and utilize research that can make urban living greener and more enjoyable.

After three decades of working in China, SOM's projects in the country have become some of the firm's most iconic and innovative, joining a global portfolio that includes the Burj Khalifa in Dubai, the Willis Tower in Chicago, One World Trade Center in New York, and the Canary Wharf master plan in London. Though global in scope and experience, solutions are sought that are responsive to site, context, culture, and history. The firm's past and ongoing work in China speaks to how an integrated approach can help answer pressing questions of urbanization, environmental sustainability, and livability by

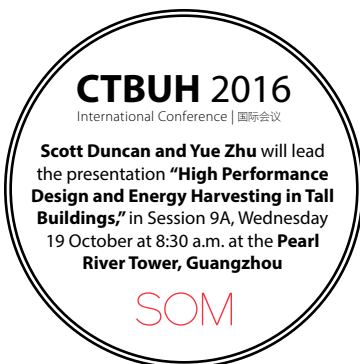
focusing on practical, sensitive, and lasting design solutions.

China in the 1980s

Economic liberalization and rapid population growth of major urban centers in the 1980s initiated a massive construction boom. Urban growth required dedicated master planning and intensive land redevelopment: Beijing, Shanghai, and Guangzhou were among the first cities to implement new strategic master plans amid surging demand for the construction of complex buildings and capital infrastructure projects. The rapid pace of construction raised questions about the technical constraints of existing methods and introduced a dialogue about how architecture can meet the needs and aspirations of a rapidly changing society.

SOM Arrives in China Amidst its Transition to a Market Economy

Chinese cities boomed in the 1990s, as did demand for design, structural, and planning services. SOM established its presence in the country through monumental projects that clearly demonstrated a deep sensitivity to China's cultural history and market needs. The most notable projects during this phase were the Industrial and Commercial Bank of China (ICBC) Headquarters in Beijing and the Jin Mao Tower in Shanghai (see Figure 1).



The ICBC Headquarters on Chang'an Street in Beijing was completed in 1999 – its stone base, structural steel frame, and glass façade with a monumental roof inspired by historical forms creatively incorporated traditional Chinese elements into a modern architectural expression. Technical innovation was also inherent to the building: the steel frame structure was the first of its kind in China, heralding the growth of the steel construction industry.

In the same year, the 88-story Jin Mao Tower was completed in Shanghai. Jin Mao was a monumental success for China and it became a symbol of the country's ambitions. The building embodied a way of working that interprets local cultural inputs into a modern supertall architectural expression. This cultural sensitivity was carefully integrated with the numerous technical complexities of supertall design by including a performative exterior wall that uses delicately textured shading elements against the unitized glass curtain wall as well as the first megacolumn and outrigger truss system in China. Jin Mao was a soaring demonstration of how architecture could synthesize sensitivity to history and local culture with structural and design excellence.

Both ICBC and Jin Mao demonstrated how thoughtful design resulted in substantially improved buildings and, in turn, more vibrant cities.

SOM's China Practice Evolves

Entering the new century, SOM's practice in China stepped forward with the evolution of the firm's principles, paralleling China's own achievements. The Poly Corporation Headquarters in Beijing demonstrated a deliberate consideration of the relationship between architectural form, context, and environmental responsibility (see Figure 2). An L-shaped layout with a large atrium connects the floors, increasing the feeling of community in the building, while the world's largest suspension-cable curtain wall system and lightweight structural members welcome natural daylight into the atrium



Figure 1. Jin Mao Tower, Shanghai, 1999. © Hedrich Blessing

“The rapid pace of construction in China raised questions about the technical constraints of existing methods and introduced a dialogue about how architecture can meet the needs and aspirations of a rapidly changing society.”

Cities to Megacities: Perspectives

The CTBUH 2016 International Conference is being held in the three cities of the Pearl River Delta, the world's largest "megacity," projected to have 120 million inhabitants by 2050. The conference brings together some of the leading thinkers on urbanization, design, development, and the environment. They stand together – not only on stages in a convention hotel, but also high up in the most representative high-rise buildings in Shenzhen, Guangzhou, and Hong Kong – delivering the very best of the knowledge we have so far accumulated about this extraordinary phenomenon in which human civilization is now participating, and offering insights on the way forward. Some of the most prominent voices at the Conference are collected here, alongside short profiles of some of the exemplary projects featured in the Conference program.

Tall Buildings and Context: Appropriate High-Rise Vernaculars

Day 2 Plenary Panel Discussion

Tuesday 18 October, 9:15–10:45 a.m., Shenzhen



Yansong Ma, *Founder & Principal, MAD Architects*

Winy Maas, *Co-Founding Director, MVRDV*

Yan Meng, *Principal & Co-founder, Urbanus*

Patrik Schumacher, *Principal, Zaha Hadid Architects*

Jerry Yin, *President, SOHO China Ltd.*

The issue of skyscraper form and expression being appropriate to cultural and social context is currently a hotly debated topic in China, as well as other parts of the world. Some believe that skyscrapers are starting to homogenize cities architecturally, and often deny hundreds of years of vernacular traditions in a place, replacing these traditions with coldly calculating real estate equations that simply extract the greatest amount of floor space from a building's footprint. As such, countless cities around the world now hold claim to a number of towers conforming to the extruded glass box

typology, and this building type is considered to be perhaps the greatest contributor to skyline homogeny. However, in practice, it can be difficult to pinpoint exactly what makes a building contextually appropriate, and thus the basis upon which to measure appropriateness can be difficult to define. Gathering together some of the most prominent and inventive practitioners reshaping the skylines of China and beyond, this plenary panel discussion examines this challenge through a variety of lenses, from both the developer and architect viewpoint.

“Skyscrapers have always been about power, but they should also be about society. As our global society increasingly becomes an urban one, then development of skyscrapers should be taking a critical new direction.”

– Winy Maas, *Co-Founding Director, MVRDV*

Towards a Forest City

Plenary 3: Cities to Megacities: The Future

Tuesday 18 October, 3:45–5:15 p.m., Shenzhen



Stefano Boeri, *Founder/ Partner, Stefano Boeri Architetti*

Shijiazhuang, capital of Hebei province, a metropolis of three million in northeast China, is the city with the nation's highest rate of air pollution. The government of Shijiazhuang has asked Stefano Boeri Architetti

to design a new city for 100,000 inhabitants. Both a city of new generation, capable of becoming a model of sustainable growth, as well as a small vertical town of public and private buildings, residences, offices, laboratories, museums, and schools, it will be completely covered horizontally and vertically by millions of plants and trees. Due to the great extension of its surface, the Forest City (see image below) will be able to absorb and use renewable energy and transport sustainable networks, which would make a huge contribution to the absorption of CO₂, the reduction of energy consumption and global warming. Its results will be quite evident.



Forest City, Shijiazhuang, China. © Stefano Boeri Architetti

Assessing the Urbanization of the Pearl River Delta

Session 2B: Megacities – Setting the Scene

Monday 17 October, 11:45 a.m.–12:45 p.m., Shenzhen



Peter Kindel, Director,
Skidmore, Owings & Merrill

With the world's urban population expected to increase by roughly 2.5 billion people by 2050, developing an understanding of megalopolises is critical to understanding and shaping this trend. The

Pearl River Delta, with over 55 million people, is one of the most populous urbanized areas in the world. This presentation explores its growth, the resulting social and environmental effects, as well as strategies for the region's future. It presents historic and current urbanization facts of the Pearl River Delta, comparing it to other urbanized regions of the world. Questions regarding the future viability of megalopolises have global applicability, and the authors will summarize key issues and future strategies for the Pearl River Delta.

Do We Need 700-Meter High-Rise Buildings?

Session 2A: Development Drivers

Monday 17 October, 11:15 a.m.–12:45 p.m., Shenzhen



Jovi Chu, Design Director,
Shum Yip Land Co. Ltd.

In the era of globalization, the importance of urban and urban areas is increasing progressively. Through analysis of dense urban high-rise building complexes, as

well as research on the relationship of those structures to a city's social organization, one can develop a thesis that the source and vibrancy of high-density cities arises from the opportunity for social proximity to build positive relationships among residents. Based on the principle of sustainable development, we can discuss how to deal with space and development models, and to ultimately build a high-density vertical city that raises the standards of livability.

Ping An Finance Center, Shenzhen

Ping An Finance Center, located in Shenzhen's Futian District, represents a new generation of the prototypical Asian skyscraper: very tall, very dense, and hyper-connected. The building rises from a prominent location, connecting seamlessly to neighboring commercial and residential properties, as well as the Pearl River Delta's high-speed rail corridor. At its final height of 599 meters, the tower symbolizes a city that has witnessed unprecedented urban growth, from 300,000 people to approximately 10 million – in the 35 years since becoming China's first Special Economic Zone. The shape of the tower is that of a taut steel cable, outstretched by the sky and the ground at once. At the top of the tower, the façades taper to form a pyramid, giving the tower a prismatic aesthetic.

Completion Date: 2016

Height: 599 m (1,965 ft)

Stories: 115

Area: 459,525 sq m (4,946,286 sq ft)

Primary Functions: Office/Hotel

CTBUH 2016

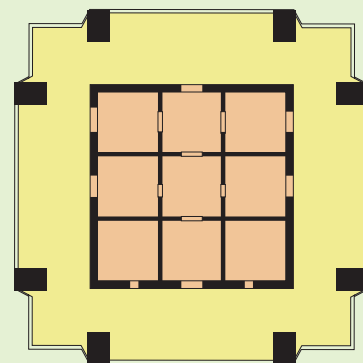
International Conference | 国际会议

Ping An Finance Center will be featured in many sessions at the Conference, particularly in Session 9B: *World's Tallest Buildings: Technical Challenges*, Wednesday 19 Oct. at 8:30 a.m. It will also host the **VIP Networking Reception**, Sunday 16 Oct. at 6:00 p.m.

中国平安
PING AN



Ping An Finance Center, Shenzhen. © Fang Jian



Typical floor plan. © CCDI

Saudi Arabia, Jeddah City, and Jeddah Tower

Session 6B: Jeddah City and Jeddah Tower

Tuesday October 18, 11:15 a.m.–12:45 p.m., Shenzhen



Mounib Hammoud,
CEO, Jeddah Economic
Company

The Kingdom of Saudi Arabia has embarked on an ambitious project to construct the world's tallest building, Jeddah Tower. Surrounding the kilometer-plus building will be a new city built out of the desert on the outskirts of Jeddah. Together, Jeddah Tower and Jeddah City are designed to become a new global

destination for Saudi Arabia, introducing new forms of engagement with the country through a changing economic model. Previously reliant on oil, the Kingdom is developing Jeddah as a means of reorienting its economy towards a global model based on business and tourism. The instantly iconic Jeddah Tower will be the new anchor of this changing economic model, attracting investment to the region through its status as a symbol and icon for the country. The surrounding Jeddah City will not only benefit from that investment, but also reorient design in the region towards a more sustainable and vernacular architecture.

Megacities: Setting the Scene



Daniel Safarik



Shawn Ursini



Antony Wood

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Shawn Ursini has been with the Council since March of 2015 and serves as editor for The Skyscraper Center database.

Antony Wood has been Executive Director of CTBUH since 2006, responsible for the daily operations of the Council. Wood is also a Research Professor in the College of Architecture at Illinois Institute of Technology, Chicago and a visiting professor of tall buildings at Tongji University, Shanghai.

The rise of the megacity presents unprecedented opportunities to understand the human urbanization phenomenon, and to observe the effects of multi-core, polycentric cities growing together to effectively become one. This paper establishes the criteria for defining such megacities, discusses their characteristics and locations, and assesses the impact they are having and will have on tall buildings, urban development, transportation, infrastructure, and quality of life.

Note: Please also refer to the Tall Buildings in Numbers study on pages 52 and 53

Introduction

Anyone concerned with the development of human civilization in the 21st Century will likely have heard the term “megacity.” It is – as it should be – increasingly prevalent in both mainstream and academic discussions of the great trends of our time: urbanization, rising technological and physical connectivity, increasingly polarized extremes of wealth and poverty, environmental degradation, and climate change. It is a subject as large and far-reaching as its name implies. This introduction sets the scene on how megacities and the built environment are growing together, and examines the implications for those who plan, design, develop, and operate tall buildings and urban infrastructure.

What is a Megacity?

In order to rationalize the data CTBUH collects – predominantly on skyscrapers and large urban developments – with that collected by other organizations, first a definition that reflects a distillation of the prominent literature on the subject should be set forth:

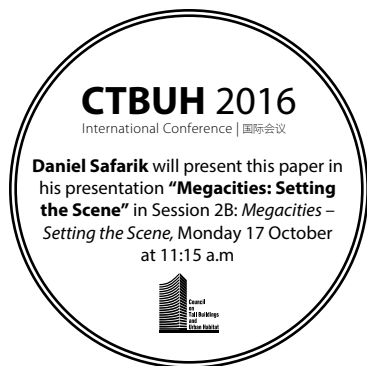
A megacity is an urban agglomeration with a total population of 10 million people or greater, consisting of a continuous built-up area that encompasses one or more city centers and suburban areas, economically and functionally linked to those centers.

A megacity is typically, though not always, polycentric, with multiple nodes of concentrated urban activity and high-density development, rather than being centered around one large primary central business district (CBD). Indeed, a telltale sign of a

megacity, and an indicator of its polycentric nature, is the tendency of residents and urban planners alike to refer to more than one “CBD.” Even if there is a consensus about the location of the “center of town,” development and transportation patterns strongly suggest otherwise; it should be thought of as an interwoven web, rather than a series of concentric zones.

The polycentric pattern is often the result of established urban centers traditionally separated by distance and their own identities eventually merging together through a continuous spread of urban and suburban development. A key aspect of the megacity is that these linkages of urbanity fuse the agglomeration together, not only physically, but also economically, functionally, and often, culturally.

In a megacity, the extent of urban development spread will not be described by a single radius or a compact, circular shape; in other words, it is asymmetrical and polymorphic. This is due to a variety of factors, including but not limited to; uneven development patterns, geographic obstacles, transport corridors, and political boundaries. While green spaces and “undeveloped” land may separate urban centers, this does not necessarily indicate that there is a definitive economic, cultural or political division between cities and their relationship within a megacity. In other words, there may be considerable amounts of open space contained within a megacity (see Figure 1). Open spaces could be the result of geological features such as mountains and bodies of water, military installations or protected greenbelts. Meanwhile, “leapfrog” development has a tendency to create long,



narrow strands of development along transportation routes, which then fill in perpendicularly to those corridors over time.

For the purposes of the 45 megacities noted in this study (see Table 1), it should be clearly noted that the cited population, area, and density figures are the result of existing political boundaries which can dilute density numbers, because they may encompass open spaces and adjacent hinterlands potentially available for future development lying beyond highly built-up areas. For example, if a district, county, prefecture or other political jurisdiction adjoins a heavily built-up area, and a distinctly dense tendril of urban land penetrates into what is otherwise a rural political unit, along a watercourse, highway or railway, the entire surrounding political unit is typically counted in area and population figures. Thus, the “Los Angeles” megacity in this study extends all the way through open desert to the Colorado River and the border with Arizona, because the political entity of Riverside County, California – heavily urbanized in the west and sparsely populated in the east – is included.

In step with the theme and site of the CTBUH 2016 Conference, the primary benchmark for a megacity in this study is the Pearl River Delta region of southern China, the world’s largest megacity (see Figures 2 and 3). Drawing a line around the boundaries of the Pearl River Delta’s urban centers would encompass a span of up to 367 kilometers from southwest to northeast (that is, from the southwestern-



Figure 2. Example of undeveloped space comprised of mountains and farms within the urbanized area. © (cc-by) Doc Searls



Figure 2. The Pearl River Delta megacity boundaries. Source: www.citypopulation.de



© Popolon



© James Antrobus



© Tansri Muliani

Figure 3. The Pearl River Delta megacities (from left to right): Hong Kong, Guangzhou, and Shenzhen.

Shifting Urban Gravity, from “Central” To “Core” Business Districts



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Tim Blackburn was appointed General Manager, Development & Valuations in 2015. His responsibilities include business development for investment and trading properties in Hong Kong. Having joined the Swire Group in 1994, his previous position was Managing Director of The China Navigation Company, the deep-sea shipping arm of the Swire Group. He has held senior positions with Hong Kong Aircraft Engineering Company (HAECO), Steamships Trading Company and James Finlay, and has worked for various Group companies in Hong Kong, Singapore, the United Kingdom, Australia, and Papua New Guinea.

In the age of the multi-million inhabitant city, the traditional concept of a single Central Business District (CBD) is becoming increasingly unrealistic. As we are seeing in megacities as dispersed as Shanghai, New York, and London, the concept of multiple core business centers – drawing on their own unique flavors and infrastructure – has become de facto urban planning policy. The three conference cities of Shenzhen, Guangzhou, and Hong Kong exemplify this urban trend perfectly. The historical urban centers of these cities have now dispersed to numerous nodes simultaneously as the conventional concept of the CBD has gradually evolved from a single, concentrated business district to multiple “core business districts.” And as cities stand to increase their populations into the tens of millions, this seems inherently sensible. This paper charts the development of the multi-CBD city, especially in the context of Hong Kong, and explains the philosophy and execution of this new type of CBD.

Introduction: The Traditional CBD And its Contemporary Challenges

The traditional central business district is a phenomenon that arose at the end of the 19th century. As corporations grew and contemporary inventions such as the telephone and the elevator came into common use, it made sense to concentrate multi-story office buildings near to each other. This facilitated meetings and information exchange. A typical CBD would cover approximately 20 minutes’ walking distance in all directions from a main transportation center, such as a railway

station or ferry pier. “Classic” CBDs might include: Chicago’s Loop, which is named after the elevated railway that surrounds it and connects it to outer regions; New York’s Financial District, famed for its towering skyscrapers clustered around narrow streets laid out in the early 1800s by the city’s first settlers and surrounded by water on three sides; and the City of London, the traditional banking core of that metropolis, commonly called the “Square Mile.”

Today, traditional CBDs retain strong cultural identification as the focal points of their cities and generally support high rents and



Figure 1. Hong Kong Central view from Victoria Peak. © Terri Meyer Boake

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Tim Blackburn will present this paper
in his presentation “**Shifting Urban
Gravity, from ‘Central to Core’
Business Districts**” in Session 2A:
Development Drivers, Monday 17
October at 11:15 a.m



commercial activity. Since the turn of the last century, a growing global taste for urban living has revived and even transformed some CBDs, in particular, from weekday business-only districts to 24/7 mixed-use, “live-work-play” environments.

At the same time, the existing stock of buildings in traditional CBDs struggles to keep up with contemporary demand for higher specifications, including technological connectivity and flexible workspaces among other necessities. A combination of several factors, including sound planning principles enabling greater densification above major transportation nodes and investment in mass transit infrastructure, has been the catalyst for the creation of new core business districts – away from the traditional city center, but still fundamentally designed to take advantage of the efficiencies of density and access to efficient mass transportation networks.

Hong Kong Central

Hong Kong’s Central fits the traditional definition of a CBD (see Figure 1). True to its name, Central is the historical center of the city for banking and commerce, the location of the Hong Kong Station/Airport Express rail link, and the point of embarkation for the famous Star Ferry to Kowloon. This area is densely populated, not only with offices, but with support services, restaurants, and institutions, such as the Hong Kong Club. These well-established amenities, connected by an extensive network of pedestrian footbridges underpinned by access to the MTR railway network, have reinforced Central’s “centrality.”

However, Central also has several significant limitations that have curtailed further growth. Its building stock, which averages between 40 and 50 years of age, while relatively expensive, is not ideally suited to meet future demand, and premium or Grade “AAA” space is limited. As the demands of modern companies have evolved, the need for high-quality design and specifications and fit-for-purpose accommodation has grown. For example, office buildings with extra or redundant

power supplies, resilience against disasters and business disruptions, higher ceilings, larger floor plates, raised floors, CAT-5 telecom provisions, and other technological amenities have been increasingly in demand. Moreover, the diverse ownership structure of property in Central limits the opportunity for a more holistic approach to improving and upgrading the overall aesthetics of the area.

Pacific Place – An Early CBD

In the 1980s, the capacity and quality constraints of Central were becoming apparent, but there were no obvious greenfield alternatives for development in the area. Swire Properties decided to acquire a site as part of a former military barracks just east of Admiralty, a steeply inclined location on the south (or “wrong”) side of Queensway that had confounded previous development attempts. The resulting Pacific Place development (Hong Kong’s first fully integrated mixed-use development) cleverly assembled office and hotel towers and a retail mall on a hillside location that has become the connective tissue between three distinct districts previously divided by heavy traffic, topography, and incompatible land use (see Figure 2). The residential areas between mid-levels and the Peak, the bright, dense streets of Wan Chai, and the corporate/banking core of Admiralty were now linked through a series of under- and above-ground pedestrian walkways that protected occupants from inclement weather and busy traffic, and yet safely connected them with their surroundings in



Figure 2. Pacific Place, Hong Kong – first fully integrated mixed-use development.

new ways, via carefully placed skylights, ramps, view corridors, and lobbies. Importantly, these walkways connect directly to the Admiralty MTR station, further establishing Pacific Place as an attractive alternative to the traditional CBD.

Taikoo Place, Hong Kong

The gravity shift that began in the 1980s with Pacific Place has continued eastwards along Hong Kong Island, following many of the same principles, while moving up several orders of magnitude in scale. Swire Properties’ redevelopment of the Island East area began in 1972 with Taikoo Shing, a high-rise development cluster which was among the first privately funded housing schemes in Hong Kong on this scale (see Figure 3). Now home to over 60,000

“A traditional CBD would cover approximately 20 minutes’ walking distance in all directions from a main transportation center, such as a railway station or ferry pier. New York’s Financial District, Chicago’s Loop, and London’s ‘Square Mile’ are good examples.”

Garden City, Megacity: Rethinking Cities For the Age of Global Warming



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Mun Summ Wong is the co-founding director of WOHA, an internationally-acclaimed architectural practice in Singapore. Wong graduated from the National University of Singapore in 1989 and is now a Professor in Practice at his alma mater.

Richard Hassell graduated from the University of Western Australia in 1989, and was awarded a Master of Architecture degree from RMIT University, Melbourne, in 2002. Together with Wong, WOHA conducted a design studio at the Singapore University of Technology and Design in 2016.

Alina Yeo first joined WOHA as an intern in 2002 before returning permanently upon completion of her Master of Architecture in 2005 from the NUS and was made Associate in 2014.

The 20th-century city developed in response to industrialization and population growth, with a planning vision encoded in regulations that limited evolving with the times. The 21st century city needs to respond to pressing current issues – climate change, resource scarcity, rapid urbanization, and digital technology. Championing sociable architecture and sustainable cities, the authors have developed prototypes for the 21st century, devising a building rating system that measures indices of greenery, community, civic generosity, ecosystems, and self-sufficiency. This paper shares the authors' strategies and vision for the 21st-century Garden City Megacity that is hyper-dense, connected, and vibrant, with a diverse, beautiful, and generous public realm, yet self-sufficient in energy, water, and food.

Introduction

Cities are growing at a phenomenal rate, with the number of megacities in the world having more than tripled in the past 25 years. The rush toward urbanization is expected to continue, with population and land-use growth projected to add 2.5 billion people to the world's urban population by 2050, 90% of which will be concentrated in Asia and Africa. Caught in an unprecedented growth spurt, these cities are undergoing an "urban puberty" phase and are rapidly outgrowing their infrastructure. Contributing about 70% of the world's carbon emissions, cities are causing an escalating rise in global temperatures that will lead to inevitable crisis if governments, urban planners, and architects fail to urgently rethink the way that cities are planned.

Since 2001, the authors have designed and built a series of prototypes as part of a process of urban re-evaluation, adopting the Asian megacity as an ideal testing ground for new urban typologies and architectural strategies. Reimagining the early 20th-century garden city, the authors propose that a multi-layered, high-density, high-amenity 21st-century megacity that is dense and vertical, yet sociable and sustainable, is the only way forward. The "Garden City Megacity" is built on a series of "Macro-

Architecture Micro-Urbanism" strategies that radically intensify land use, multiply green space, and integrate climate-specific solutions to reduce the environmental impact of cities and improve the quality of life for people.

Layering Cities

Over the last two centuries – as towns became cities and cities became megacities – land has been taken for granted, as an infinite horizontal site for building, farming, and mining. The combined effects of land exploitation, exploding megacity populations, rapid urbanization, and economic growth have led to the degradation of land quality and quantity, the depletion of non-renewable energy sources, and the rise of global warming. Land scarcity is also reflected in the competition to meet the conflicting needs of a city, resulting in high land costs and stark trade-offs between various land uses.

The authors propose visualizing a city in terms of layers – as a three-dimensional matrix, rather than as a two-dimensional grid (see Figure 1). This calls for innovative land use solutions that involve a replanning of cities – vertically, not horizontally. On top of reclaiming, restoring, and re-energizing our

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Mun Summ Wong will present this paper in his presentation "**Garden City, Megacity: Rethinking Cities for the Age of Global Warming**" in the Opening Plenary: *The Sustainability of Density & Vertical Urbanism*, Monday 17 Oct. at 9:15 a.m.



Figure 1. Axonometric diagram of the "Layered City."

existing land, new land must be created. The use of land needs to be intensified by layering urban (and rural) environments – residential, recreational, commercial, agricultural, and infrastructural – above and below the existing ground level of the city.

These strategies for "layering cities" aim at offering a good quality of life for people by creating highly dense urban environments that are also highly vibrant, humane, and resilient in the sustainable long term. The

“Visualize a city in terms of layers – as a three-dimensional matrix, rather than as a two-dimensional grid. This calls for innovative land use solutions that involve a replanning of cities – vertically, not horizontally.”

layered approach introduces “multiple ground levels” of various functions at strategic horizons in the sky (see Figure 2). This achieves high-density, high-amenity developments where civic, community, and green spaces are multiplied over the same limited land area. Complementary programs of the right proportions are also integrated into vertical, mixed-use “cities within cities” that generate a 24/7 live-work-play vibrancy. To ensure human-scaled “domesticated structures,” the authors’ designs take references from the surrounding district and incorporate external spaces (e.g., sky streets/parks) into the high-rise, recreating the proportions of neighborhood streetscapes (see Figure 3).

To further foster a sense of identity and belonging, concepts of neighborhood and community that are specific to the unique culture and context of the project are first

studied and then translated into the contemporary high-rise as a system of “sky villages.”

“Layering Cities” also necessitates innovating the way in which both architecture and infrastructure/urbanism are combined in large-scale, radical yet synergistic ways. This “both-and” concept requires a strategic rethinking of building typologies, with considerations for energy production, water rights, air rights, and biodiversity indices to support self-sufficient townships and natural ecosystems in our cities. The traditional “bar graph” skyline, for instance, is picturesque but problematic. It gives visual interest at a distance, but the ground level can be very repetitive. The varied heights of buildings also overshadow each other, presenting a self-shading problem that is a disaster for solar collection in cities. To overcome this, the authors propose an “inverted skyline” (see Figure 4), which creates opportunities for



Figure 2. The layered approach introduces “multiple ground levels” of various functions at strategic horizons in the sky.

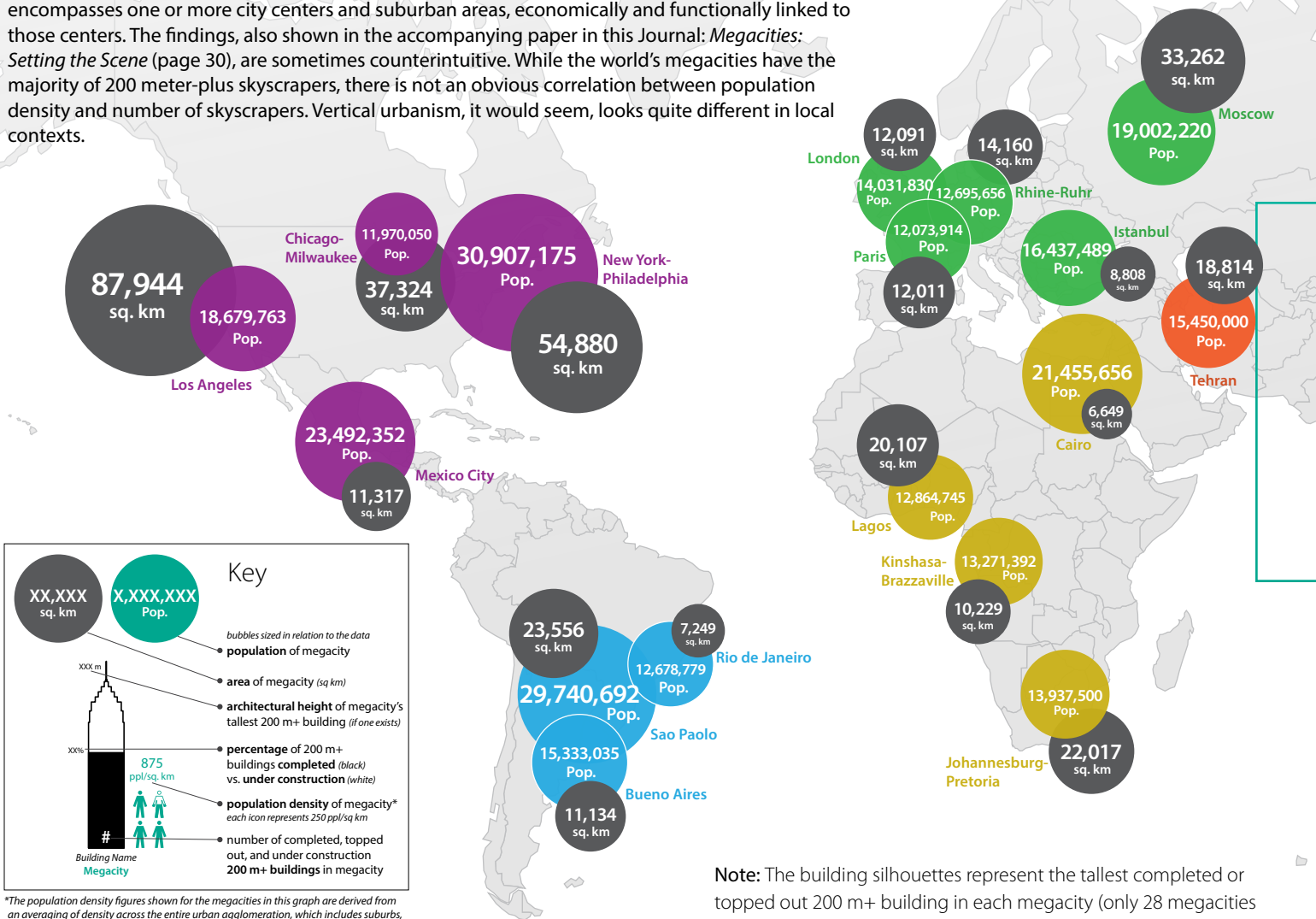


Figure 3. Sky streets and parks recreate the proportions of neighborhood streetscapes at height.

Tall Buildings in Numbers

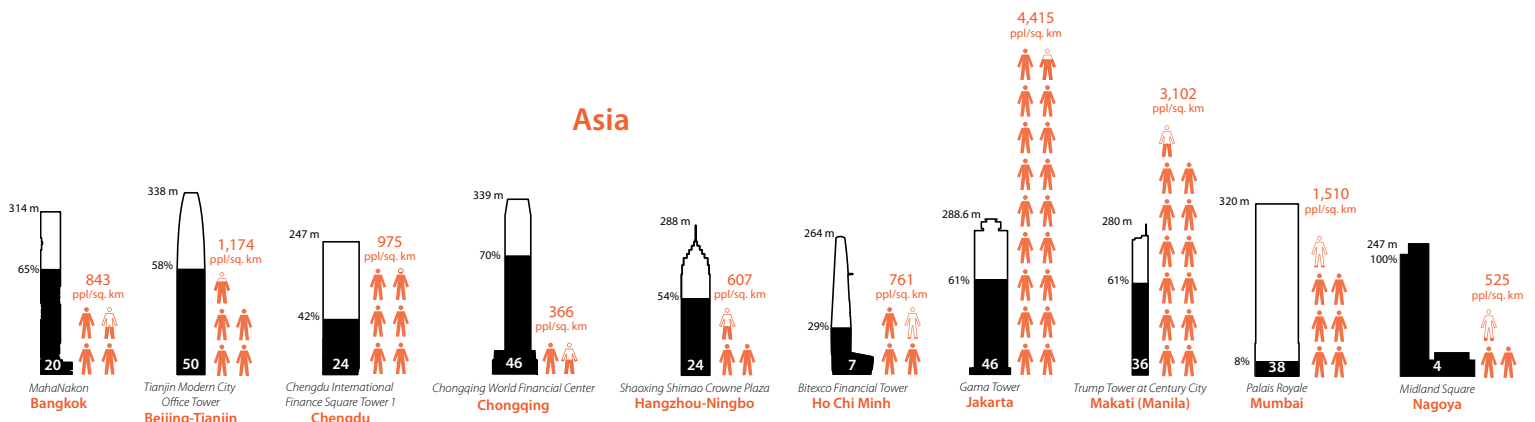
Tall Buildings and Megacities

In this study, CTBUH undertook an examination of the populations, areas, densities, and several measures of skyscraper activity in the world's 45 "megacities" – defined as urban agglomerations with a total population of 10 million people or greater, consisting of a continuous built-up area that encompasses one or more city centers and suburban areas, economically and functionally linked to those centers. The findings, also shown in the accompanying paper in this Journal: *Megacities: Setting the Scene* (page 30), are sometimes counterintuitive. While the world's megacities have the majority of 200 meter-plus skyscrapers, there is not an obvious correlation between population density and number of skyscrapers. Vertical urbanism, it would seem, looks quite different in local contexts.



*The population density figures shown for the megacities in this graph are derived from an averaging of density across the entire urban agglomeration, which includes suburbs, semi-rural areas and open spaces located within the existing administrative boundaries of one or more metropolitan areas for each location. As such, densities are not necessarily representative of any particular municipality within each megacity, or the typical density found within the built-up areas of each agglomeration.

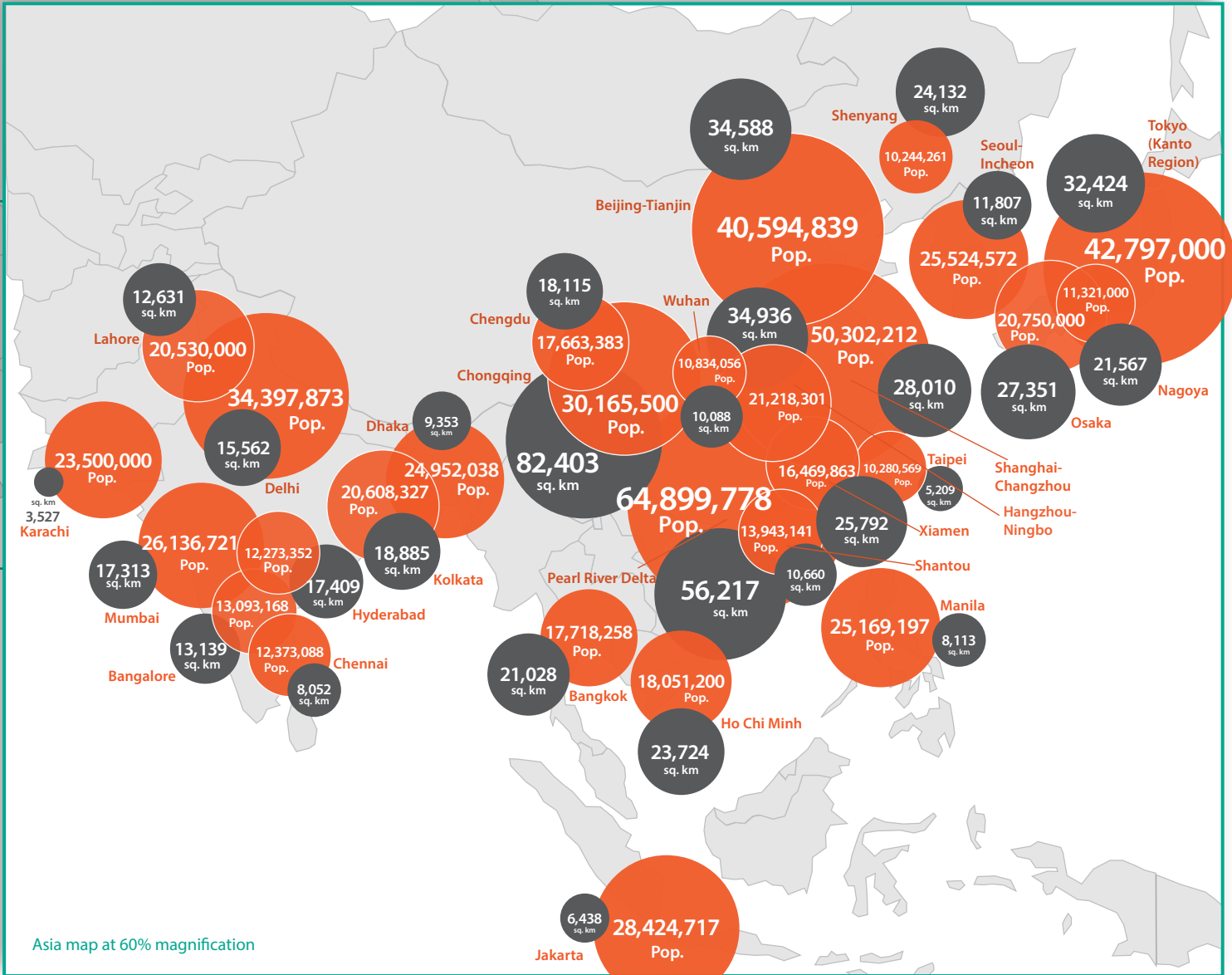
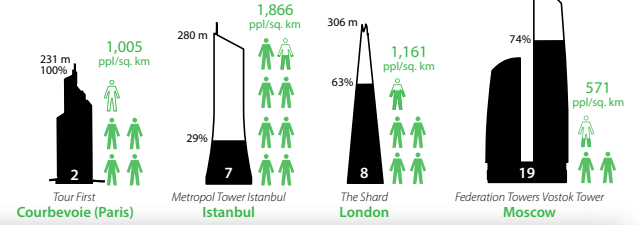
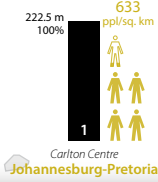
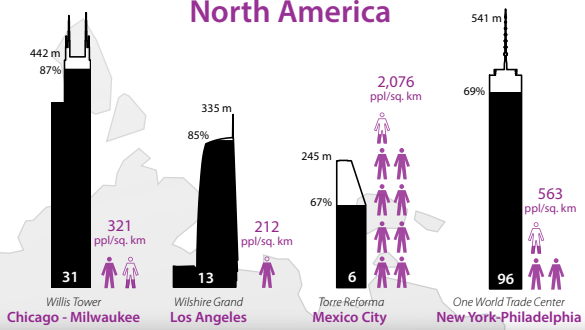
Asia



North America

Africa

Europe



Megacities: Design Challenges and Responses



Scott Duncan



Philip Enquist

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Scott Duncan

Throughout his 16-year tenure at SOM, Scott Duncan has developed a body of work recognized by The American Institute of Architects, MIPIM Asia, World Architecture Festival, the Municipal Art Society of New York, and the Chicago Athenaeum. He offers extensive experience in the design and implementation of complex projects around the world – including large-scale mixed-use, transportation, commercial, hospitality, and residential developments in Asia. Duncan's most recent large-scale project, the Pertamina Energy Tower in Jakarta, is the world's first supertall tower for which energy is the primary design driver. The iconic headquarters building is targeting GBCI Platinum Net Positive Energy Consumption, and it won a 2014 Best Futura Mega Project Award from MIPIM Asia.

Philip Enquist

Philip Enquist is leader of the firmwide city-design practice of SOM. Enquist and the urban planning studios have improved the quality and efficiency of city living on five continents by creating location-unique strategic designs that integrate nature and urban density within a framework of future-focused public infrastructure.

Enquist's design perspective continues to expand from innovating sustainable urban forms that enhance city living with walkable, transit-enabled districts humanized by their natural amenities to rapidly changing urban regions within larger ecosystems like North America's Great Lakes basin and China's Bohai Rim. Enquist is currently serving a five-year appointment as a Governors Chair for the State of Tennessee collaborating with Oak Ridge National Laboratory and the University of Tennessee on the subject of Energy and Urbanism.

As this issue and the International Conference are focused on the megacity phenomenon, this edition of Talking Tall features two people who have designed tall buildings, large projects, and entire urban areas in some of the world's largest and most critical megacities. Scott Duncan and Philip Enquist, both at SOM, spoke with CTBUH Journal Editor Daniel Safarik on the big issues that will face city-makers in the coming century.

In your experience designing buildings and communities in the growing metropolises of Asia, what do you think has been the biggest improvement you've seen in terms of urban sustainability?

Enquist: I would say that the expansion of next-generation transportation infrastructure, including international airports, national high speed rail, bus rapid transit, intermodal hubs, renewed interest in bicycles and walkability – has done the most to make cities in Asia, particularly China, more accessible and less car-centric.

Duncan: Government advocacy requiring our buildings to save energy and water, or to preserve open space, has had a major role in promoting sustainability in our cities. I find it fascinating that many of the cities where we are working impose limits on energy or water as a way of addressing overburdened utility infrastructure. For them, it is a pragmatic response.

What remains as the most persistent challenge to achieving a sustainable urbanism?

Enquist: Asian cities have been growing at an unprecedented speed, and often the human dimension – scale, livability, access to jobs, striking a balance with ecosystems – is overlooked. The challenge is developing urbanism that is human, healthy, and in balance with natural systems.

What do you think the European, North American, and Asian planning paradigms have to teach each other in terms of achieving what you'd define as "sustainable urbanism?"

Enquist: It would be difficult to talk about Asia as having a single paradigm – Singapore has brought so much to the conversation

about water, compactness, mix of use, and preservation of open space, Japan has done exceptional work controlling urban growth and supporting it with public transit, and China has of course brought tremendous enthusiasm for planning as a driving discipline, not to mention massive investment in transportation infrastructure.

I believe that North American cities have led in advocacy and action by nonprofits and community initiatives, positive actions that are driven by "bottom-up" efforts. Great things have been accomplished by small groups of committed people including: historic preservation, open space designation, human rights, wildlife preservation, urban growth boundaries, and affordable housing initiatives. Our work on the Great Lakes and St. Lawrence River watershed has engaged with many nonprofits and local citizens who have dedicated their lives to larger environmental issues and rallying communities around critical issues (see Figure 1). We also see public/private partnerships being formed to construct infrastructure such as regional rail. Our All Aboard Florida project will connect West Palm Beach, Miami, and Orlando, all as a partnership between public and private interests. It's a powerful model.

Duncan: Europe is and has been ahead of the rest of the world in conserving energy resources and ecological habitats, all carefully controlled through legislation and government oversight. Europe's density and relative conurbation – it's almost a megaregion in itself – has demanded that. We have collaborated with engineering teams from Copenhagen on US inner-city urban design projects, such as Chicago's Southworks steel plant redevelopment, to

reach for higher goals in energy efficiency, carbon reduction, and water reuse.

What are the implications for architecture and planning of a human population that is increasingly becoming coastal and urban in an age of climate change?

Enquist: The implications are potentially disastrous... catastrophic. We need an entirely new way of thinking about urbanized areas and long-term resiliency. Scott and I have been studying how sea level rise will affect our cities. A recent study from the Harvard Center for the Environment speculated that a one-meter sea level rise would impact 37% of the world's population. One major implication of all of this will be the migration of large human populations to areas that are more resilient. In the United States, we have intact, viable, well-planned inland cities that would benefit tremendously from an influx of population.

We often discuss ideas such as an "urban homestead act" where the federal government could encourage population growth toward the post industrial cities of the Midwest and Great Lakes region. These were once far larger cities that are free from coastal threats and have access to fresh water. If you look at cities such as Detroit, Cleveland, Erie, Toledo, Chicago, they have all had much higher populations in the past. Many of these cities offer great urban neighborhoods, transit infrastructure, and access to remarkable open space systems and cultural amenities. Repopulating these cities could be part of a larger resiliency initiative at the scale of a nation.

Continuing on this theme, there is, depending on your perspective, a "doomsday scenario" or a grand opportunity that may require new habitat for hundreds of millions of people to be built further inland and away from coastal flooding threats. Do you think we have the tools today to design entirely new cities from scratch, knowing what we know now? What do we still need to figure out?

Duncan: We do have the tools. A question we debate often is how many more "new" cities we actually need, or if the world needs



Figure 1. The Great Lakes Century Vision – a 100-year "call to vision" that outlines measures to protect the lake system and promote sustainable development in the 21st century. © Skidmore Owings & Merrill

new cities at all. Maybe the future of "citymaking" will be more of a "renovation and expansion" project, where we look at how to outfit our cities with enhanced support systems – green infrastructure or "the internet of things," for example. Many of us have been experimenting with the potential of sensors and other forms of technology to make our cities more sustainable.

Enquist: I agree that we have the tools. The digital world is quickly evolving. The physical world is slow to adjust. We have not reconciled the two worlds. In building cities quickly – because we can – I think we need to figure out how to retain the human dimension, and how to build dense urban environments that balance market pressures with livability, and how to create places that support a 24-hour lifestyle.

The better cities, frankly, have been the cities that have grown slowly, layering many generations of built form. Before new cities are built, we should see how existing cities can adjust, increase residential populations, strengthen infrastructure systems, and provide a new generation of jobs.

Duncan: Equally important is developing strategies for the non-urbanized areas, everything that is not a city. So much of the damage we have done to ecosystems has been through misuse of land. Cities are, in some ways, not the problem.

When you look back at projects you've designed in a place that you consider to be a "megacity," where do you feel like you've had the greatest impact as a result of that project, and why?

“How many more ‘new’ cities do we actually need? Maybe the future of ‘citymaking’ will be more of a ‘renovation and expansion’ project, where we look at how to outfit our cities with enhanced support systems – green infrastructure or ‘the internet of things,’ for example.”

About the Council

The Council on Tall Buildings and Urban Habitat is the world's leading resource for professionals focused on the inception, design, construction, and operation of tall buildings and future cities. A not-for-profit organization, founded in 1969 and based at the Illinois Institute of Technology, Chicago, CTBUH has an Asia office at Tongji University, Shanghai, and a research office at Iuav University, Venice, Italy. CTBUH facilitates the exchange of the latest knowledge available on tall buildings around the world through publications, research, events, working groups, web resources, and its extensive network of international representatives. The Council's research department is spearheading the investigation of the next generation of tall buildings by aiding original research on sustainability and key development issues. The Council's free database on tall buildings, The Skyscraper Center, is updated daily with detailed information, images, data, and news. The CTBUH also developed the international standards for measuring tall building height and is recognized as the arbiter for bestowing such designations as "The World's Tallest Building."



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