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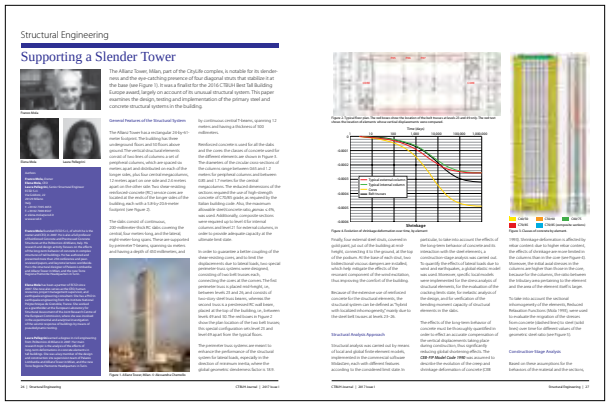

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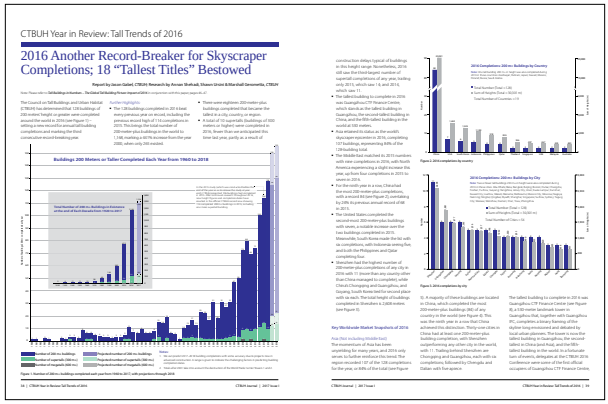

> "The larger the stream of profits in absolute terms from participating in a city's economy, the greater will be the capital deployed and the labor utilized to generate those profits. In other words, the stock of floor space in general, and skyscraper floor space in particular, adjusts to the level of GDP."

Barkham, Shoenmaker & Daams, page 20

Global News

Visit the daily updated online resource for all the latest news on tall buildings, urban development, and sustainable construction from around the world at: ***http://news.ctbuh.org***

Americas

Several notable skyscraper developments made headlines in **Miami,** starting with news that carmaker Aston Martin is partnering with a developer to bring **Aston Martin Residences** to Biscayne Boulevard at the mouth of the Miami River. The sail-shaped building will feature 390 luxury apartments across 66 stories. Additionally, Foster + Partners announced plans for a pair of connected skyscrapers in the city's Financial District, known as **The Towers.** At 320 meters, the planned development would not only contain the tallest skyscraper in Miami if built today, but also the city's first supertall building.

Aston Martin Residences, Miami.
© G&G Business Development and Aston Martin

The Towers, Miami. © Foster + Partners

Meanwhile, in **New York City,** details emerged on the **Waterline Square** complex. Located on the city's fast-expanding Westside, the multi-tower development is set to feature buildings designed by Richard Meier & Partners, Kohn Pedersen Fox Associates, and Rafael Viñoly Architects, bringing together the work of three renowned architecture firms as part of the larger transformation of the area.

Further up the Henry Hudson Parkway, news broke that the **Trump Place** apartment complex is planning to drop the US President's name from three of its buildings after residents voiced concerns over remarks Trump made during the campaign. The three buildings will now go by their street addresses to assume a more neutral identity.

In Brooklyn, tenants have begun to move into **461 Dean Street,** which, now complete, is the world's tallest volumetric modular tower, comprising 930 steel modules fabricated at an off-site factory in the Brooklyn Naval Yard. The tower is also the first building to be completed in the nine-hectare Pacific Park complex.

Across the country, several proposals are making headway in **Los Angeles,** as the City of Angels continues to densify its downtown core. Architects filed plans to begin construction on the residential **8th and Fig Tower**. The 42-story downtown tower is set to include 436 apartments, adding much-needed residential density to LA's growing core. The project team is aiming for a 2020 occupancy date.

Additionally, the developer behind **222 West Second Street** by Gensler recently released additional information for their project. The 30-story cantilevered stacked-box development would be located above an under-construction subway station, thereby aiding the city's attempts to improve public transportation through the addition of a significant transit-oriented development.

Waterline Square, New York. © Noë & Associates

461 Dean Street, New York. © SHoP Architects

8th and Fig Tower, Los Angeles. Courtesy of Johnson Fain

Le Phare de Québec, Quebec City. © GroupeDallair/GraphSynergie

Gensler is also involved in a project to deliver **Québec City**'s tallest tower. **Le Phare de Québec** has gone through a number of proposals, with the developer now settling on a mixed-use tower featuring cultural space in the form of a 750-seat multi-media concert hall in addition to a public observation deck at the top of the tower.

In **Toronto,** a developer is working to rezone a downtown site to allow for twin 72-story skyscrapers at **2 Carlton Street.** A development application has been submitted to the city for the project, which is set to feature residential and retail programming along the busy Yonge Street corridor.

Orion Towers, Gold Coast. © Woods Bagot, courtesy of Orion International Group

Asia & Oceania

Down under, a two-tower development by Fender Katsalidis Architects and Cox Architecture has been proposed for **308 Exhibition Street** in **Melbourne.** Taking advantage of the city's climate, the podium for the complex will feature extensive greenery. Additionally, a curving two-story skybridge will connect the towers with communal amenity spaces.

Located just a few blocks away, **383 La Trobe Street** has received planning approval from Victoria's planning minister. The 242-meter tower, set to accommodate 488 residential units, was approved, despite its plot ratio exceeding the parameters outlined in the city's interim planning controls.

As development in Melbourne remains strong, **Sydney** has been keeping pace. Recently, the last of the three **International Towers** by Rogers Stirk Harbour + Partners completed as part of the Barangaroo South master plan. The trio of office buildings is designed to maximize sustainability, receiving a six-star rating, the highest, from the Green Building Council of Australia.

Further north, **Gold Coast** is competing with Australia's larger cities with news that a development application has been filed for another dual-tower development, **Orion Towers** by Woods Bagot. At 328 meters, the taller of the two towers would be the tallest building in the Southern Hemisphere, terminating a few meters short of the height limit mandated by Australia's Civil Aviation Safety Authority.

383 La Trobe Street, Melbourne.
© Atelier Jean Nouvel, courtesy of Sterling Global

Another height record is on the verge of being broken in India, with news of construction on the 70-story **Vrindavan Chandrodaya Mandir** in **Mathura.** Upon completion, the Hindu temple will become the tallest religious structure in the world, a record held by the Vatican's St. Peter's Basilica for nearly 400 years.

Vrindavan Chandrodaya Mandir, Mathura.
© InGenious Studio

Mexico's New Tallest is an "Open Book"

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Architect Julieta Boy is currently the project manager at LBR&A Arquitectos, where for the last eight years she has been leading the development and construction of Torre Reforma, Mexico City's tallest building. She holds two Master's degrees, one on Ephemeral Architecture from the Universidad Politécnica de Cataluña, Spain in 1996, and the second in Architecture Design from the Universidad Nacional Autonoma de Mexico in 2008.

For more than 20 years, Boy has been a key contributor to the work of Rivadeneyra Arquitectos, Becker Arquitectos and LBR&A Arquitectos, in which she has specialized in development of corporate, urban and residential projects. As an independent practitioner, she has developed single and multifamily living projects. Boy has been a frequent contributor to publications specializing in construction and architecture, including *Enlace y Obras*.

> "The building is organized into 14 four-story clusters, 'buildings within the building' that allow users to interact with the city on a larger scale, and within their workspaces on a smaller scale."

Torre Reforma is not only the tallest building in Mexico City, but is also representative of innovation and leadership in the high-rise building industry, which has begun a shift away from a generation of all-glass façades. Here, high seismic conditions and the presence of a historic building on the site resulted in a highly distinctive hybrid "open-book" form, comprising two exposed concrete shear walls and floor plates enclosed in a dramatically cantilevered steel diagrid. Torre Reforma received a Finalist recognition in the Best Tall Building Americas category of the 2016 CTBUH Awards.

Context

It is important to understand Torre Reforma within the arc of Mexico's brief but dynamic high-rise history. The modern story starts with the Torre Latinoamericana, completed in 1956 at 204 meters and 44 stories, overcoming many engineering challenges in the process, as it is sited in a seismic zone with soft soil. For many years the tallest building in Mexico and Latin America, it was surpassed – almost 30 years later – by the Torre Ejecutiva Pemex (1982, 212 meters, 54 stories) and the Torre Mayor (2003, 225 meters, 52 stories). In 2016, the Torre Reforma surpassed all others in the capital, at 246 meters and 55 stories, including the recently finished Torre BBVA Bancomer (235 meters, 50 stories), signaling a turning point for vertical urban growth in Mexico City.

Figure 1. General view of the new tall buildings on Paseo de la Reforma, with the Torre Reforma at the right. © Alfonso Merchand

Torre Reforma is one of the most prominent skyscrapers in a developing area, in which many others are expected to be built. Currently, there are several skyscrapers of more than 200 meters under construction in Mexico City, most of them on Paseo de la Reforma (see Figure 1). Demographics is the main driver: 8.9 million people reside in the central city and 21 million people total live in the metropolitan area. With 26.3% of Mexicans aged between 15 and 29, almost two million young people enter the Mexican economy every year. The bowl shape of the city's enclosing valley limits the potential of horizontal sprawl. Thus, Mexico City's downtown will definitely have to build upwards as it grows.

The Site and the Skyscraper

Located on Paseo de la Reforma, one of Mexico City's most renowned avenues, Torre Reforma is part of a cultural, historical, and financial district, and is restricted to a 2,800-square-meter site – extremely small for a high-rise building containing 87,000 square meters of space.

Diverging from the standoffish-icon model for skyscrapers, Torre Reforma embraces its surroundings. The existing historic house on the site was integrated, becoming part of the main lobby (see Figures 2 and 3). The commercial areas at the ground floor and the first basement allow for the street activity

to flow into the building. Reflecting an understanding that a skyscraper is a vertical continuation of the city, the building has an array of services that includes sporting facilities, open spaces and terraces, bars and restaurants, gardens, an auditorium, and common meeting rooms.

Torre Reforma is also accessible in a practical sense, as it is well connected to urban infrastructure and services. Its strategic location is surrounded by important avenues such as the aforementioned Paseo de la Reforma, Avenida Insurgentes – the longest avenue in Mexico City – and the Circuito Interior – an urban freeway connecting the city's central neighborhoods. At the ground level, the sidewalks are expanded and made accessible for all users, giving priority to pedestrians over vehicles. The existing infrastructure of the neighborhood includes two subway stations, public buses, and multiple public bicycle stations. The historic house retains its urban value, serving to transfer from human scale at pedestrian level to a high-rise building scale. Torre Reforma therefore not only improves the visual quality of the city's skyline, but also the street level experience for pedestrians.

Figure 2. The historic hacienda-style house at the base of the tower has been incorporated as part of its lobby.

Figure 3. Torre Reforma, Mexico City rises above the hacienda.

Reaching for the Sky: The Determinants of Tall Office Development in Global Gateway Cities

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Richard Barkham is a specialist in macro and real estate economics. Prior to taking up his position with CBRE, Barkham was a Director of Research for the Grosvenor Group. He was also a non-Executive Director of Grosvenor Fund Management, where he was involved in fund strategy, risk analysis and capital raising. Barkham holds a PhD in economics from the University of Reading.

Dennis Schoenmaker is global economist for CBRE, working together with the global chief economist in providing the latest insights on economics and the real estate market. Schoenmaker obtained his PhD from University of Groningen where he gained extensive knowledge of property valuation, commercial real estate research, investment, and development.

Michiel Daams is a post doctoral researcher in economic geography and real estate at the University of Groningen. Daams has extensive experience as an academic consultant to various public institutions and industry firms. His geospatial and statistical data-analyses have generated new insights into urban development processes and value-creation in various real estate markets.

There are numerous hypotheses about the social and economic processes that lead to the development of skyscrapers, but empirical evidence is scarce. In this article, the authors take an initial look at the determinants of office skyscraper development in cities across the globe. Ultimately, the aim is to better understand why cities have different amounts of floor space in skyscrapers. Is it only geographic and economic processes at work, or are other regulatory or behavioral factors at play?

Skyscrapers are widely believed to reflect a city's wealth and its global competitiveness. Indeed, certain cities promote the construction of skyscrapers to enhance their "brand." The race for the tallest skyscraper in the twentieth century led to the development of the Empire State Building in New York, and in the twenty-first to the development of the Burj Khalifa in Dubai and Shanghai Tower in Shanghai. From an urban economics perspective, the high price of land at the center is due to scarcity and the premium occupiers pay for access. Skyscrapers reflect the optimal allocation of capital to this very expensive land resource. It is also possible that skyscrapers create productivity gains due to within-building agglomeration economies. Here, density of employment fosters frequent face-to-face contact and knowledge sharing, which in turn leads to product and process innovation. So, there are numerous hypotheses about the social and economic processes that lead to the development of skyscrapers, but empirical evidence is scarce.

In this article, the authors take an initial look at determinants of office skyscraper "development" in cities across the globe. In doing so, the authors depart from the regional or national scope that the few earlier studies on skyscrapers have adopted (Barr et al. 2015; Helsley and Strange 2008) by examining the geographical and economic factors that theory tells us lead to development of skyscrapers in a global context.

The authors' data on skyscrapers is from the CTBUH Skyscraper Center database: specifically, its record of skyscrapers with an office use function. Rather than looking at the total number of skyscrapers, or merely their individual or aggregate height, the authors use the number of floors in the total stock of office skyscrapers in a city as a proxy for the total internal floor space of this type of building. This is the dependent variable.

The sample from CTBUH's database includes 2,358 skyscrapers[1] with an exclusive or mixed office use from 83 countries worldwide. The geographical distribution (see Figure 1) illustrates that the United States and Asia, with cities such as New York, Tokyo, Shanghai, and Hong Kong, have the most skyscrapers, defined, for the purpose of this paper, as office buildings of 100 meters' or greater height. Between 2000 and 2015, skyscraper development has been most concentrated in cities within fast-growing emerging markets such as China (see Figure 2). Nevertheless, in terms of number of floors, New York still tops the list, followed by Tokyo, Hong Kong, Dubai, Chicago, Sydney, and Shanghai.

The hypothesis is that four factors explain the quantum of space within skyscrapers: the Gross Domestic Product (GDP) of the city, the land area of the city, the global connectedness of the city, and the presence of land-use regulations that place restrictions on individual building height for aesthetic or public safety reasons. In the next section each of these is first examined in turn, then in a multivariable framework.

Drivers of Skyscraper Development

While a city's GDP is both cause and consequence of skyscraper development, in

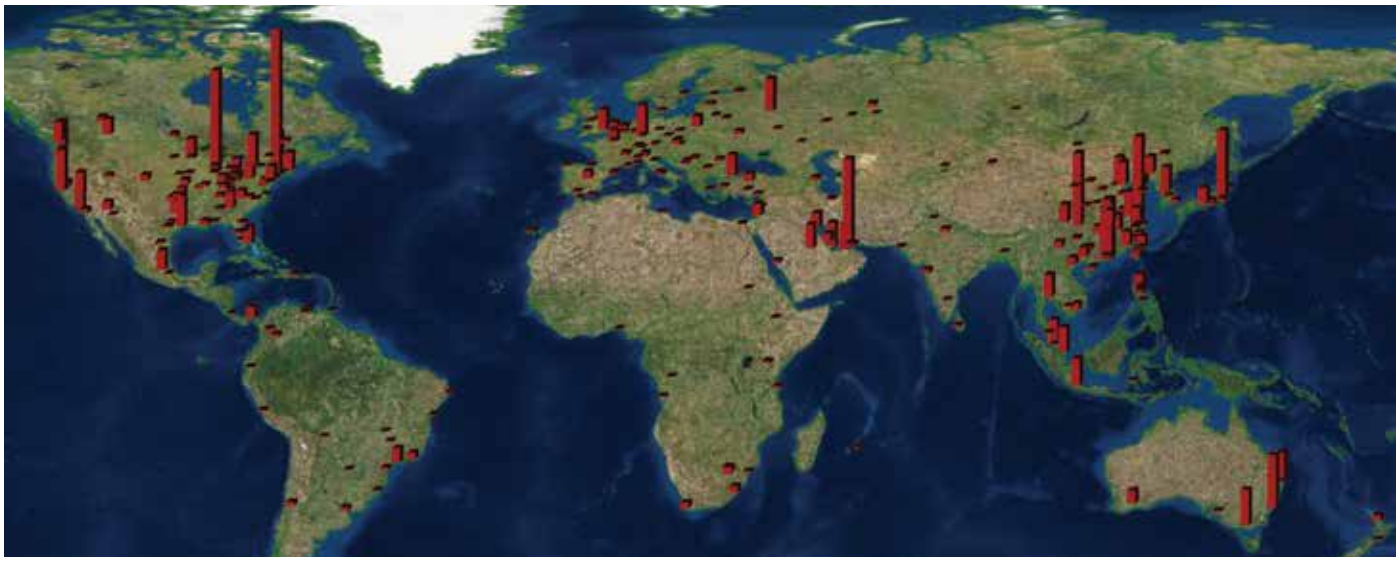

Figure 1. The total number of skyscrapers[1] as of the end of 2015. Source: CTBUH & CBRE Research 2016.

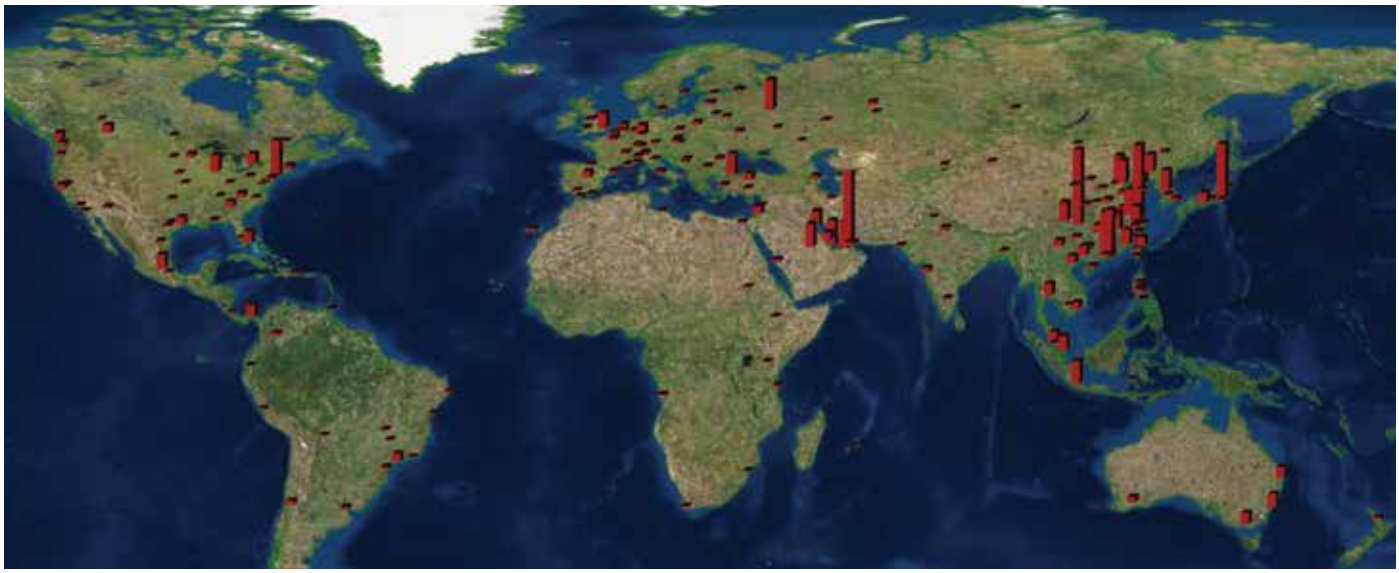

Figure 2. The development of new skyscrapers[1] between 2000 and 2015. Source: CTBUH & CBRE Research 2016.

this analysis the authors consider it principally as a causal factor. The larger the stream of profits in absolute terms from participating in a city's economy, the greater will be the capital deployed and the labor utilized to generate those profits. In other words, the stock of floor space in general, and skyscraper floor space in particular, adjusts to the level of GDP. In Figure 3 the authors show the univariate relationship between GDP and skyscraper floor space by means of a scatter diagram, and find a correlation of 0.64 (106

> "Hypothesis: Four factors explain the quantum of space within skyscrapers: the GDP of the city, the land area of the city, the global connectivity of the city, and the presence of land-use regulations that place restrictions on individual building height."

[1] In this research a skyscraper is defined as a tall office building higher than 100 meters. Only buildings of such height and with exclusively office use or at least a mixed use that includes offices are taken into account.

[2] Please note that the authors use a logarithmic scale to display the variables in all scatter diagram figures. GDP is in millions of US$.

Supporting a Slender Tower

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Franco Mola founded ECSD S.r.l., of which he is the owner and CEO, in 2007. He is also a full professor of Reinforced Concrete and Prestressed Concrete Structures at the Politecnico di Milano, Italy. His research and design activity focuses on the effects of the long-term behavior of concrete in complex structures of tall buildings. He has authored and presented more than 250 conference and peer-reviewed papers, and keynote lectures worldwide. He is the structural designer of Palazzo Lombardia and Allianz Tower in Milan, and the new Torre Regione Piemonte Headquarters in Turin.

Elena Mola has been a partner of ECSD since 2007. She now also serves as the CEO, human resources, project management supervisor, and earthquake engineering consultant. She has a PhD in earthquake engineering from the Institute National Polytechnique de Grenoble, France. She worked as a grantholder at the European Laboratory for Structural Assessment of the Joint Research Centre of the European Commission, where she was involved in the experimental and analytical investigation of the seismic response of buildings by means of pseudodynamic testing.

Laura Pellegrini earned a degree in civil engineering from Politecnico di Milano in 2007. Her main research topic is the analysis of the effects of long-term deformations in concrete elements in tall buildings. She was a key member of the design and construction site supervision team of Palazzo Lombardia and Allianz Tower in Milan, and the new Torre Regione Piemonte Headquarters in Turin.

The Allianz Tower, Milan, part of the CityLife complex, is notable for its slenderness and the eye-catching presence of four diagonal struts that stabilize it at the base (see Figure 1). It was a finalist for the 2016 CTBUH Best Tall Building Europe award, largely on account of its unusual structural system. This paper examines the design, testing and implementation of the primary steel and concrete structural systems in the building.

General Features of the Structural System

The Allianz Tower has a rectangular 24-by-61-meter footprint. The building has three underground floors and 50 floors above ground. The vertical structural elements consist of two lines of columns: a set of peripheral columns, which are spaced six meters apart and distributed on each of the longer sides, plus four central megacolumns, 12 meters apart on one side and 2.4 meters apart on the other side. Two shear-resisting reinforced-concrete (RC) service cores are located at the ends of the longer sides of the building, each with a 5.8-by-20.6-meter footprint (see Figure 2).

The slabs consist of continuous, 200-millimeter-thick RC slabs covering the central, four meters-long, and the lateral, eight-meter-long spans. These are supported by perimeter T-beams, spanning six meters and having a depth of 450 millimeters, and by continuous central T-beams, spanning 12 meters and having a thickness of 500 millimeters.

Figure 1. Allianz Tower, Milan. © Alessandra Chemollo

Reinforced concrete is used for all the slabs and the cores: the classes of concrete used for the different elements are shown in Figure 3. The diameters of the circular cross-sections of the columns range between 0.65 and 1.2 meters for peripheral columns and between 0.85 and 1.7 meters for the central megacolumns. The reduced dimensions of the sections required the use of high-strength concrete of C70/85 grade, as required by the Italian building code. Also, the maximum allowable steel/concrete ratio, ρsmax ≤ 4%, was used. Additionally, composite sections were required up to level 4 for internal columns and level 21 for external columns, in order to provide adequate capacity at the ultimate limit state.

In order to guarantee a better coupling of the shear-resisting cores, and to limit the displacements due to lateral loads, two special perimeter-truss systems were designed, consisting of two belt trusses each, connecting the cores at the corners. The first perimeter truss is placed mid-height, i.e., between levels 23 and 26, and consists of two-story steel truss beams, whereas the second truss is a prestressed RC wall beam, placed at the top of the building, i.e., between levels 49 and 50. The red boxes in Figure 2 show the plan location of the two belt trusses; this special configuration sets level 23 and level 49 apart from the typical floors.

The perimeter truss systems are meant to enhance the performance of the structural system for lateral loads, especially in the direction of minimum inertia, where the global geometric slenderness factor is 18.9.

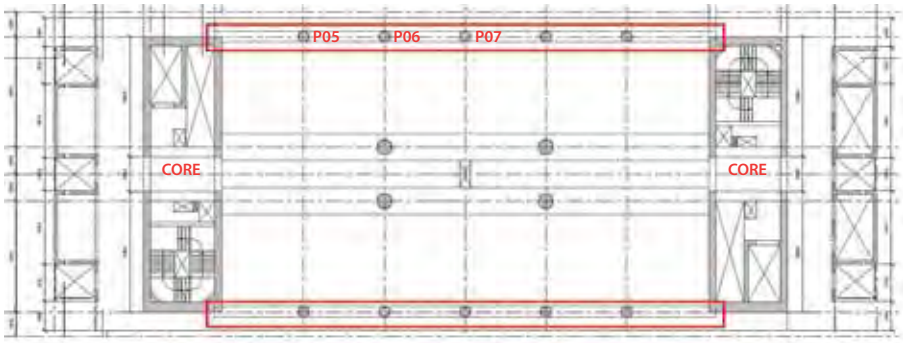

Figure 2. Typical floor plan. The red boxes show the location of the belt trusses at levels 23 and 49 only. The red text shows the location of elements whose vertical displacements were compared.

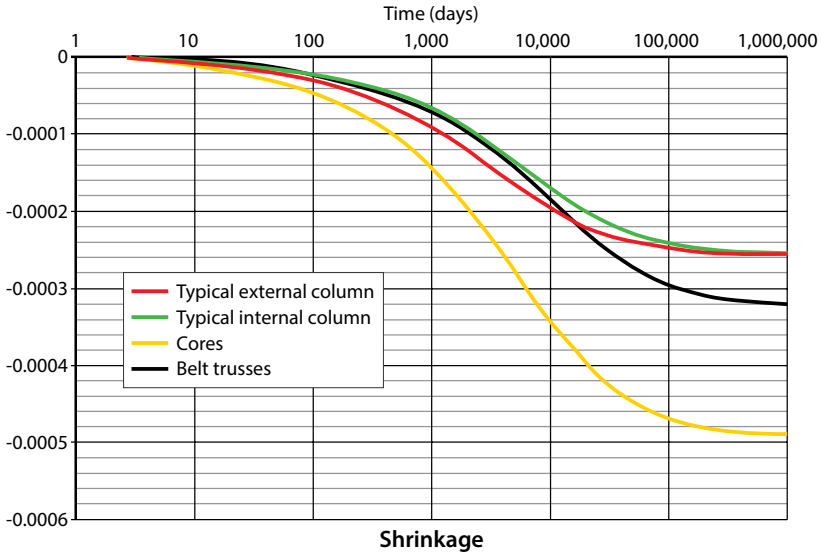

Figure 4. Evolution of shrinkage deformation over time, by element

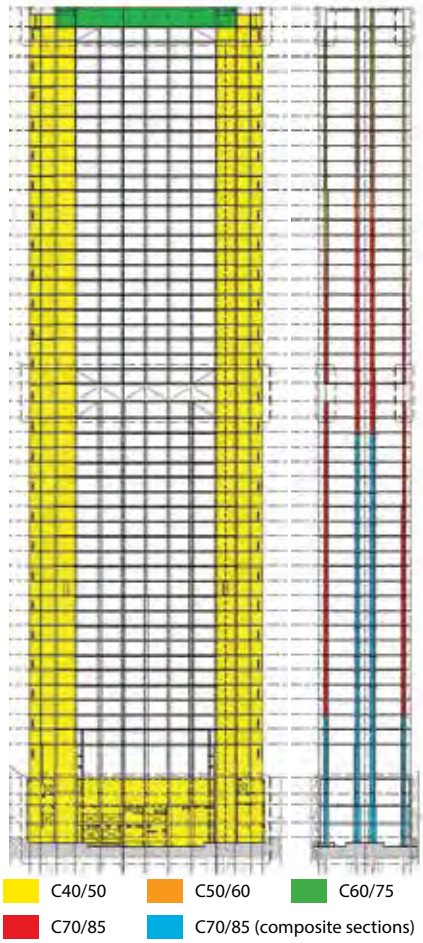

Figure 3. Classes of concrete by element.

Finally, four external steel struts, covered in gold paint, jut out of the building at mid-height, connecting it to the ground, at the top of the podium. At the base of each strut, two bidirectional viscous dampers are installed, which help mitigate the effects of the resonant component of the wind excitation, thus improving the comfort of the building.

Because of the extensive use of reinforced concrete for the structural elements, the structural system can be defined as "hybrid with localized inhomogeneity," mainly due to the steel belt trusses at levels 23–26.

Structural Analysis Approach

Structural analysis was carried out by means of local and global finite element models, implemented in the commercial software MidasGen, each with different features according to the considered limit state. In particular, to take into account the effects of the long-term behavior of concrete and its interaction with the steel elements, a construction-stage analysis was carried out. To quantify the effects of lateral loads due to wind and earthquakes, a global elastic model was used. Moreover, specific local models were implemented for the stress analysis of structural elements, for the evaluation of the cracking limits state, for inelastic analysis of the design, and for verification of the bending moment capacity of structural elements in the slabs.

The effects of the long-term behavior of concrete must be thoroughly quantified in order to effect an accurate compensation of the vertical displacements taking place during construction, thus significantly reducing global shortening effects. The *CEB-FIP Model Code 1990* was assumed to describe the evolution of the creep and shrinkage deformation of concrete (CEB 1993). Shrinkage deformation is affected by rebar content: due to higher rebar content, the effects of shrinkage are more limited in the columns than in the core (see Figure 4). Moreover, the initial axial stresses in the columns are higher than those in the core, because for the columns, the ratio between the tributary area pertaining to the element and the area of the element itself is larger.

To take into account the sectional inhomogeneity of the elements, Reduced Relaxation Functions (Mola 1993), were used to evaluate the migration of the stresses from concrete (dashed lines) to steel (solid lines) over time for different values of the geometric steel ratio (see Figure 5).

Construction-Stage Analysis

Based on these assumptions for the behaviors of the material and the sections,

From Unseen to Iconic: Contextual Designs For China's Large-Scale Mixed-Use Complexes

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As the high-rise phenomenon moves from first- to second- and third-tier cities in China, high-density vertical urban developments are shaping the future identities of these cities by way of their strategic locations, massive scale, significant functional mix, and large social, economic and environmental impact. Meanwhile, infill projects in more established skyscraper cities have begun to reflect a new consciousness about cultural continuity and the integration of historic structures. In both cases, a clearly defined overall architectural identity, merged with an impressive range of functions, circulation choices and sense of scale, together form the fundamental linkage of these projects to their sites. If this is done successfully, such projects will become essential exemplars of twenty-first century urban destinations, without erasing the cultural and environmental history that inspires them.

"Unseen" Planning Logic Drives the Design

When designing large-scale mixed use projects, especially when there is a large retail component of the program, the overall planning of the project becomes very important. Naturally, in commercial projects, the driving force of the design is financial, and other objectives will need to be reconciled with that. The first objective is to determine how to make the retail center work: What's the market positioning of the project? How big does this retail component need to be? Where should it be placed on the site? What's the circulation pattern? All of these questions need to be asked and answered clearly before the design team can move on to place the office, hotel, and residential tower components.

Changsha's Meixi Lake Jinmao Plaza (see Figure 1) is a good example of a project that started with the retail planning. The shopping center needed to be no less than 100,000 square meters. The main frontage of the shopping mall needed to face the major city road in order to get enough urban presence. One of the main entrances needed to directly connect with the subway in order to absorb incoming customers. The main concourse leads the flow of people to the other side of the site, connecting with the two iconic twin towers of the project, as well as to the neighboring Meixi Lake Culture Center, designed by Zaha Hadid Architects (ZHA).

The luxury hotel and office on the south side face the lake directly (see Figure 2). The podium of the tower includes hotel amenity functions, which are also oriented toward the lake view. The office tower on the north side has a slight offset to avoid overlooking into the windows of its south-side twin. The rest of the site was planned with residential towers to form two distinct communities, both of which take advantage of maximum lake frontage and views.

Figure 1. Meixi Lake Jinmao Plaza, Changsha.

Chengdu Yintai Center also provides a good example of a project in which retail priorities shape the overall design. The total development area is about 540,000 square meters, with the shopping center component comprising around 160,000 square meters above ground and 30,000 square meters underground. Given the proportion of the project's overall floor area devoted to retail, the first priority of the planning of the project was, again, how to make the shopping center work.

The project is located in south Chengdu, occupying a strategic location at the intersection of Tianfu Avenue and Yizhou City park, the central park of a new financial district. The map of the financial district clearly identifies several important aspects of the site: the most valuable retail frontage will be along Tianfu Avenue and the main thoroughfare Jinhui First Street at the north side; the park on the south side of the site provides great urban and green views, as well as open space for pedestrians and sports activities for the whole district (see Figure 3).

Given these strong edges of activity, the design team began to lay out the shopping center main frontage along the west and north side of the site, then created an internal path from the southwest corner of the site all the way to the northeast corner of the site, which comprises the main concourse of the shopping center and sets a major anchor at the center of the site. To take full advantage of the south-facing park view, two 180-meter luxury residential towers totaling 100,000 square meters are placed at the south side of the site directly facing the park. Another 220-meter tower consisting of 100,000 square meters of luxury apartments and a Waldorf-Astoria Hotel is placed at the most prominent location of the site along Tianfu Avenue, facing the park directly. Lastly, two 200-meter office towers totaling 160,000 square meters are placed at the northeast corner of the site, forming the impression of a gateway to the site (see Figure 4).

While the two preceding projects reflect new-build conditions and thus the

Figure 2. Changsha Meixi Lake Jinmao Plaza's office towers, with Meixi Lake in the foreground and Culture Center to the right.

Figure 3. Chengdu Yintai Center, Chengdu – location map and circulation connections.

Figure 4. Chengdu Yintai Center – view from southwest.

2016 Another Record-Breaker for Skyscraper Completions; 18 "Tallest Titles" Bestowed

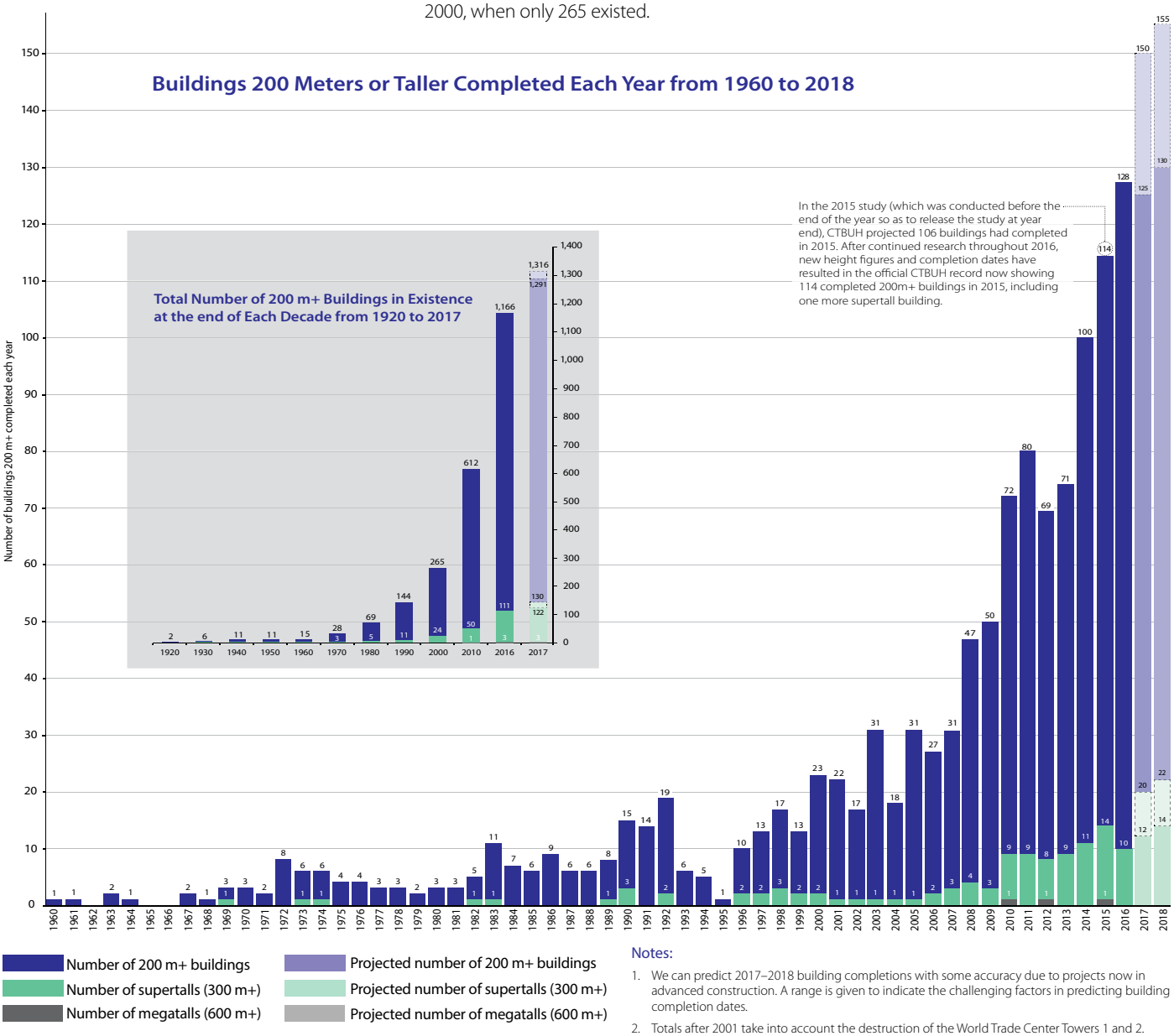
Report by Jason Gabel, *CTBUH;* Research by Annan Shehadi, Shawn Ursini & Marshall Gerometta, *CTBUH*

Note: Please refer to ***Tall Buildings in Numbers – The Global Tall Building Picture: Impact of 2016*** in conjunction with this paper, pages 46–47.

The Council on Tall Buildings and Urban Habitat (CTBUH) has determined that 128 buildings of 200 meters' height or greater were completed around the world in 2016 (see Figure 1) – setting a new record for annual tall building completions and marking the third consecutive record-breaking year.

Further Highlights:

- The 128 buildings completed in 2016 beat every previous year on record, including the previous record high of 114 completions in 2015. This brings the total number of 200-meter-plus buildings in the world to 1,168, marking a 441% increase from the year 2000, when only 265 existed.
- There were eighteen 200-meter-plus buildings completed that became the tallest in a city, country, or region.
- A total of 10 supertalls (buildings of 300 meters or higher) were completed in 2016, fewer than we anticipated this time last year, partly as a result of



Notes:

1. We can predict 2017–2018 building completions with some accuracy due to projects now in advanced construction. A range is given to indicate the challenging factors in predicting building completion dates.
2. Totals after 2001 take into account the destruction of the World Trade Center Towers 1 and 2.

Figure 1. Number of 200 m+ buildings completed each year from 1960 to 2017, with projections through 2018.

construction delays typical of buildings in this height range. Nonetheless, 2016 still saw the third-largest number of supertall completions of any year, trailing only 2015, which saw 14; and 2014, which saw 11.

- The tallest building to complete in 2016 was Guangzhou CTF Finance Centre, which stands as the tallest building in Guangzhou, the second-tallest building in China, and the fifth-tallest building in the world at 530 meters.
- Asia retained its status as the world's skyscraper epicenter in 2016, completing 107 buildings, representing 84% of the 128-building total.
- The Middle East matched its 2015 numbers with nine completions in 2016, with North America experiencing a slight increase this year, up from four completions in 2015 to seven in 2016.
- For the ninth year in a row, China had the most 200-meter-plus completions, with a record 84 (see Figure 2), overtaking by 24% its previous annual record of 68 in 2015.
- The United States completed the second-most 200-meter-plus buildings with seven, a notable increase over the two buildings completed in 2015. Meanwhile, South Korea made the list with six completions, with Indonesia seeing five, and both the Philippines and Qatar completing four.
- Shenzhen had the highest number of 200-meter-plus completions of any city in 2016 with 11 (more than any *country* other than China managed to complete), while China's Chongqing and Guangzhou, and Goyang, South Korea tied for second place with six each. The total height of buildings completed in Shenzhen is 2,608 meters (see Figure 3).

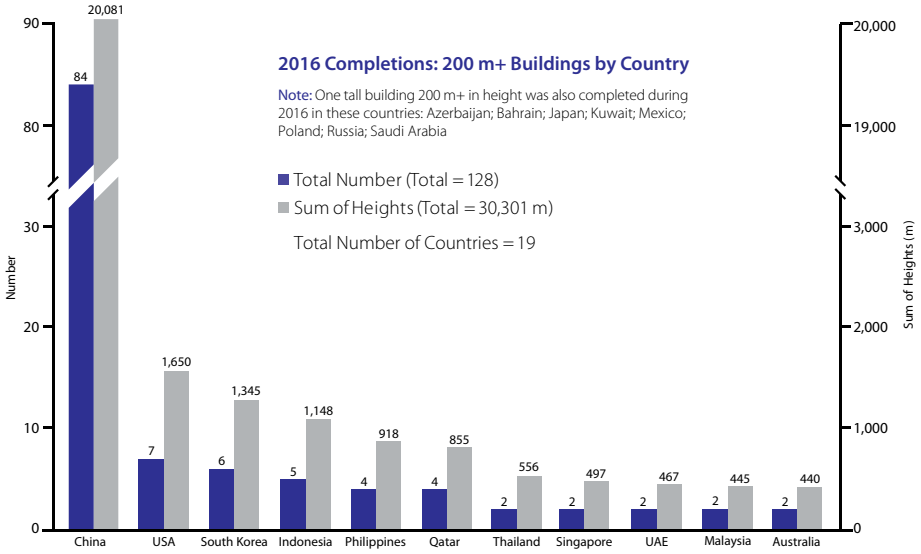


Figure 2. 2016 completions by country.

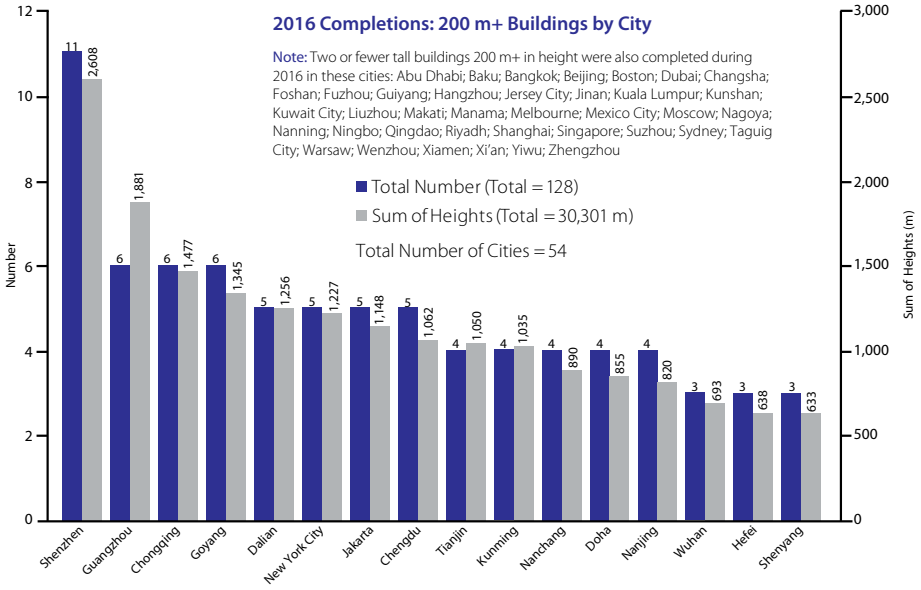


Figure 3. 2016 completions by city.

Key Worldwide Market Snapshots of 2016

Asia (Not including Middle East)

The momentum of Asia has been unyielding for many years, and 2016 only serves to further reinforce this trend. The region recorded 107 of the 128 completions for the year, or 84% of the total (see Figure 5). A majority of these buildings are located in China, which completed the most 200-meter-plus buildings (84) of any country in the world (see Figure 4). This was the ninth year in a row that China achieved this distinction. Thirty-one cities in China had at least one 200-meter-plus building completion, with Shenzhen outperforming any other city in the world with 11. Trailing behind Shenzhen are Chongqing and Guangzhou, each with six completions; followed by Chengdu and Dalian with five apiece.

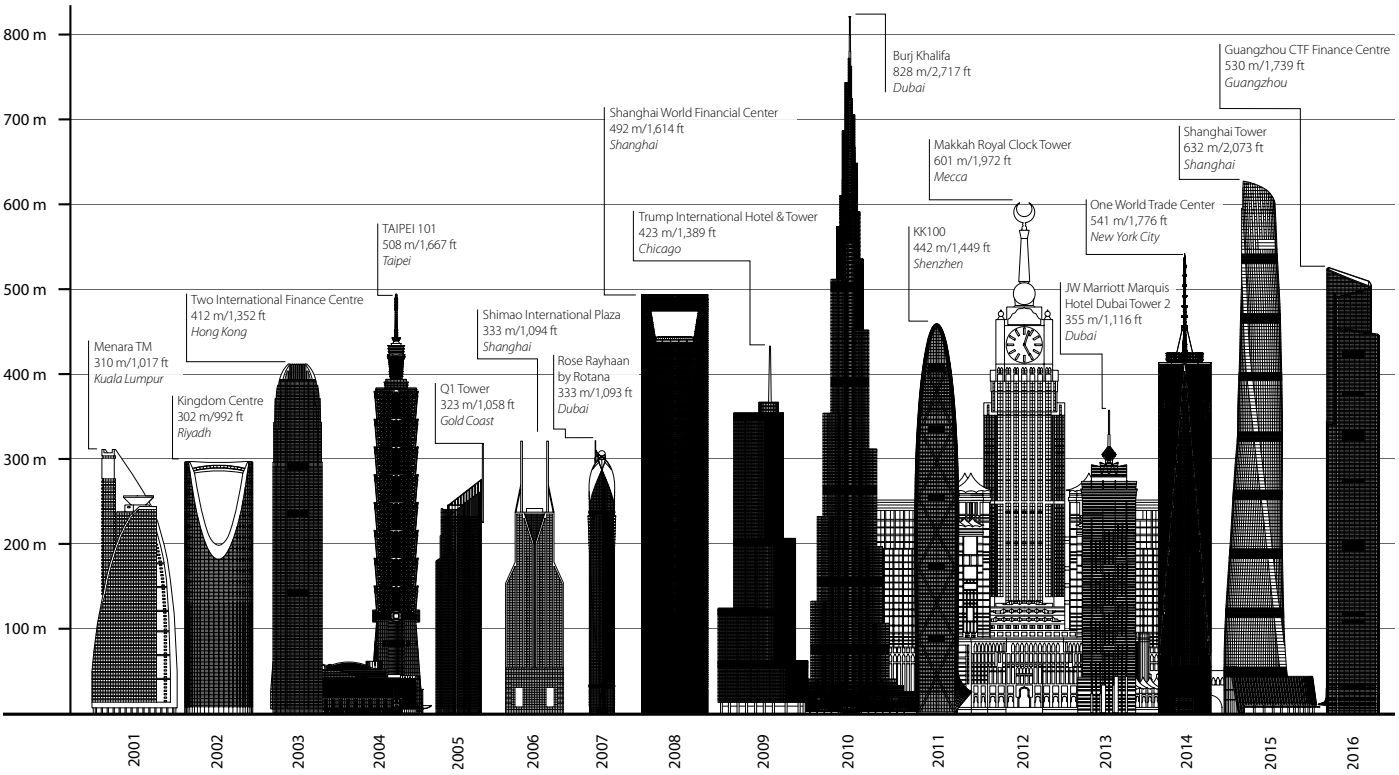
The tallest building to complete in 2016 was Guangzhou CTF Finance Centre (see Figure 8), a 530-meter landmark tower in Guangzhou that, together with Guangzhou IFC, completes a binary framing of the skyline long envisioned and debated by local urban planners. The tower is now the tallest building in Guangzhou, the second-tallest in China (and Asia), and the fifth-tallest building in the world. In a fortunate turn of events, delegates at the CTBUH 2016 Conference were some of the first official occupiers of Guangzhou CTF Finance Centre,

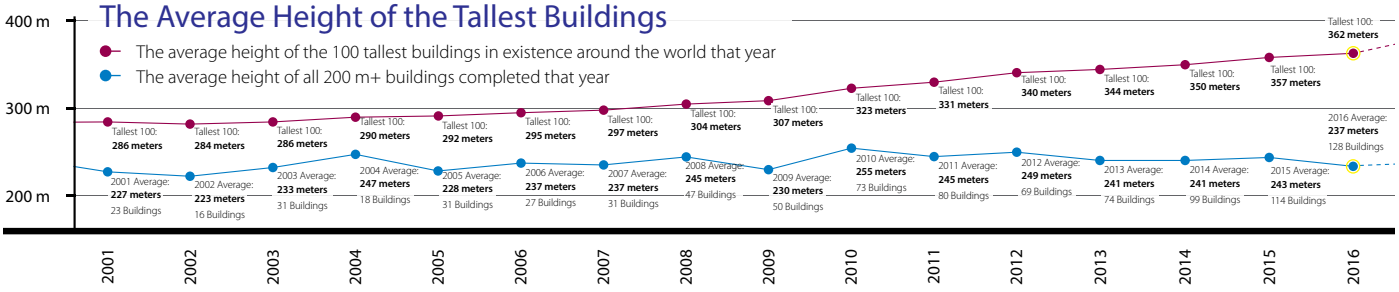
The Global Tall Building Picture: Impact of 2016

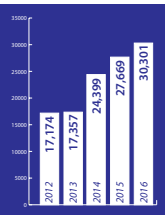
In 2016, 128 buildings of 200 meters' height or greater were completed, setting a new record for annual tall building completions and marking the third consecutive record-breaking year. This brings the total number of 200-meter-plus buildings in the world to 1,168, marking a 441% increase from the year 2000, when only 265 existed. "Tallest" titles also reigned supreme in 2016, with 18 completed buildings becoming the tallest in a city, country, or region, while Asia retained its dominant status with 107 buildings, representing 84% of the total. For more analysis of 2016 completions, see "CTBUH Year in Review: Tall Trends of 2016, and Forecasts for 2017," pages 38–45.

World's Tallest Building Completed Each Year

Starting with the year 2001, these are the tallest buildings that have been completed globally each year.







The total height of the 200 m+ buildings that completed in 2016 is a record 30,301 meters – that's almost 37 Burj Khalifas.

Guangzhou CTF Finance Centre, Guangzhou, at 530 meters, was the tallest building to complete in 2016, and is now the **fifth-tallest** building in the world.

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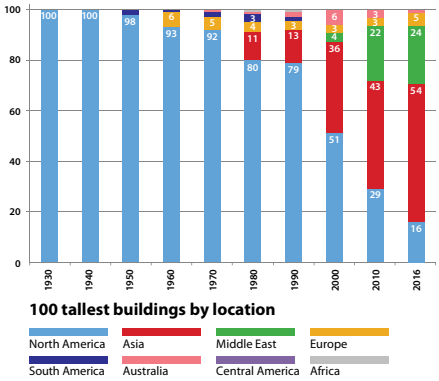
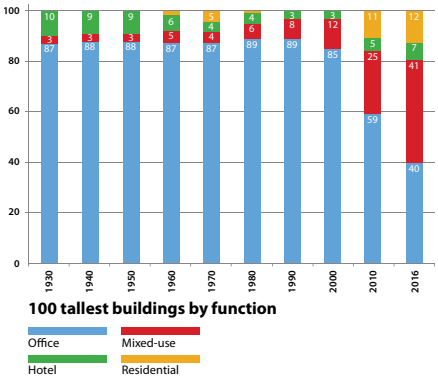
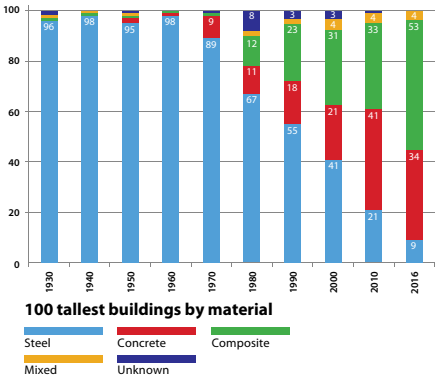
In 2016, there were eighteen 200 m+ buildings completed that became the tallest in a city, country, or region.

World's Tallest 100: Analysis

As the graphs below show, Asia and the Middle East continue to ascend, while the mixed-use plurality deepens, along with the rise of composite structures.

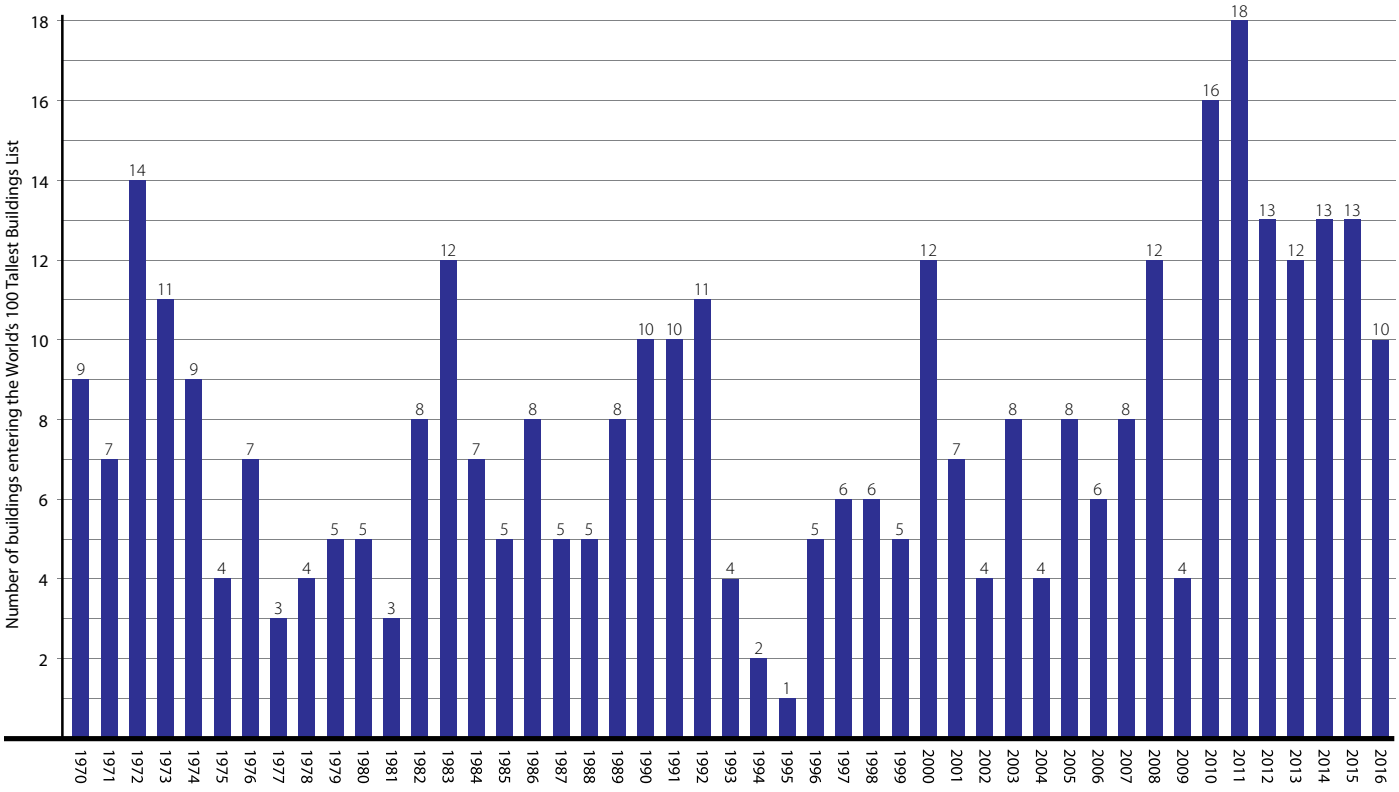




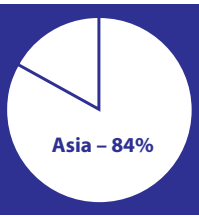


Number of Buildings Entering the World's 100 Tallest by Year

A total of 10 buildings made it into the global 100 Tallest list in 2016, the fewest to do so since 2009, when only four buildings entered the list. Given the high number of supertall buildings expected to complete in 2017, an upward swing is plausible for the coming year.



The United States saw **seven** 200 m+ completions in 2016, the country's highest since 2009. The tallest of these seven was 30 Park Place, New York, at 282 meters.



For the fourth year in a row, at least 75% of all 200 m+ building completions were located in Asia.

The 246-meter Torre Reforma, Mexico City, completed in 2016 to become the tallest building in Mexico and the **sixth-tallest** in Central America.

Fusing History and Height in Modern China

Albert Chan

Interviewee

Albert Chan, Director of Dev. Planning and Design
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Albert Chan is the Director of Development Planning and Design at Shui On Land. Chan manages the conceptualization, site feasibility and master planning of the "Tiandi" mixed-use communities and the design of large-scale mixed-use developments. Chan has more than 25 years of experience in planning, design and development, including 15 years in China. He also focuses on new product development and chairs the Sustainable Development Committee. Prior to joining Shui On, Chan worked at the New York City Department of Design and Construction. His education includes an MArch from Berkeley, an MS (urban design) from Columbia University, and an MBA from New York University.

Albert Chan is the Director of Development Planning and Design at Shui On Land, based in Shanghai. Shui On Land is the developer of several successful "Tiandi" ("heaven and earth") mixed-use projects throughout China. Its Wuhan Tiandi project recently won the 2016 CTBUH Global Urban Habitat Award. Chan has previously served on the CTBUH China Awards Jury and has recently joined the CTBUH Advisory Board. In this interview with CTBUH Journal Editor Daniel Safarik, Chan discusses his development philosophy and thoughts on the urban habitat.

What does it mean to you for Wuhan Tiandi to win the CTBUH Urban Habitat award?

Of course it is a great honor, and it was very gratifying to be recognized. In China it is especially meaningful because it has been developing at such a great pace and so many new things have been built, but often, architects don't think about the totality of the community. It's more about single buildings.

Architects spend a lot of energy looking at the façade, the inner workings of the building, and how to resolve the top. But if you look back before we had tall buildings, the emphasis of how the building related to the surroundings was very important. Sometimes I think that, as we have built so quickly, we have forgotten about that. But it's actually critical. If you get it right, the place has vitality for a long time. But if you get it wrong, even if you have great buildings, you won't have vitality.

For CTBUH to look at environment and context is very meaningful, and I am very happy for the project to be recognized. I want to point out that the development took 13 years, and so many parties were involved, all of whom did a great job. Then, even after it's built, how it is being operated is also part of what makes it successful.

Having sat as a juror in the China Awards program and now as a winner in the Global program, what are your thoughts on these programs?

I applaud CTBUH for being in China and involving Chinese architects. One interesting aspect I noticed was that the Chinese and foreign jurors valued some things differently. For the Chinese counterpart, the culture part was important to them – what makes a tall building a signature for a city, and particularly, what makes a good one in China? I think they asked themselves that question, and the foreign jurors did not pursue that as much. It could be an incredible debate, just that subject alone. That was quite enlightening to me.

I also think both programs would benefit if we talked about the urban habitat *even more*. In the China Awards, I think what happens when a tall building reaches the ground was not discussed as much as it could have been. That would bring an enrichment of the criteria, and maybe bring the ground-plane design level up for future buildings. It's about the emphasis.

What are your objectives for your participation in the Advisory Group?

CTBUH has a lot of experts already. But it seems you have more expertise in tall

Figure 1. Shanghai Xintiandi, Shanghai. © (cc-by) ChinaUli2010

Figure 2. Wuhan Tiandi, Wuhan. © Shui On Land

buildings than urban habitat. I am lucky to have had the opportunity to help realize some of these communities. My contribution to CTBUH, and maybe through CTBUH to the design community as a whole, can be bringing together the idea of tall buildings and urban habitat, looking at how they can be better integrated to make great places. The time and physical scale of our projects are unusual in the sense that we are interested in creating vibrant, mixed-use urban communities by phases. Shanghai Xintiandi is a 19-year-old project (see Figure 1). Not many people can work on a project for 19 years. So that would be my unique contribution.

How did incorporating human-scale features and traditional architecture into your developments become your signature?

There are several principles we adhere to.

First, we believe mixed uses make the area more vibrant. We always try to create pedestrian, transit-based environments, not car-based. When people arrive in a place on foot and walk the streets, the place is alive. When they drive their cars into the basement, there is no one on the street.

We also like to be sustainable. Most of our developments are LEED-ND (Neighborhood Development) Gold-rated. From the technical angle, we want to create small blocks and a dense street network. That is how you actually achieve mixed use and walkability. They go hand in hand. It sounds obvious, but very few developers do it. The government typically sells a big piece of land, and very few developers will carve it up and make streets. The government regulates allowable land use, site area, gross floor area (GFA), and floor area ratio (FAR). But they never talk about the size of the lots and the streets. There is no form-based code for the block scale.

We want to create landmark places. By "places," we mean something like a plaza or the street itself. For us, being a community developer, we have to have nice streets and squares, parks, and sometimes even a lake – all public. But, very few developers do this, because they really just focus on buildings.

Lastly, it's really important that the project relates to the cultural context: we want the project to fit into the neighborhood, not be like an alien that dropped down. That's why we do preservation. It's actually a small part of the production of the company, but it has been recognized because so few companies do it.

How have these principles come into play in your major projects?

Shanghai Xintiandi was not a landmarked area. The only buildings that needed to be preserved were the meeting place of the Communist Party – three small buildings, not the whole two blocks. But we preserved and adaptively reused more buildings in two whole blocks, because we saw what that could do for the overall neighborhood. At Wuhan Tiandi, we have several historic buildings, but we also preserved the old trees (see Figure 2). That added much to the project. The scale of the neighborhood is developed based on this principle. Sometimes it's tall, sometimes short, because uses are different. The land we develop can be in very dense areas, and sometimes the real estate needs to be tall to be commercially successful. For me, it's a success when one of our new developments feels like a community that has always been there.

How have you localized some of these principles?

The relationship between old and new, tall and short is different in each master plan. For example, in Taipingqiao (Shanghai Xintiandi), we have a 3.5 FAR. Even within that, we will build a 60-story tower, currently under design. It's the same in Chongqing.

In Wuhan, if you look closely, the residential development is quite dense, some exceeding 3.0 FAR, in the courtyard housing. Each lot is about 10,000 square meters, which is unusually small for China, containing one or two mid-rise towers that form part of the street wall. Then you have a small community park next to it.

So the relationship is that the low-rise commercial and the mid-rise residential form the enclosure of the park. Then you have the taller towers coming out in the background, and you can see the river. The towers are positioned so that they are not overshadowing the public places. That is very much a function of the master planning process. We take care to make sure that the places we build are nicely scaled, so that the tall buildings are not all over the place, where it feels like a canyon.

What's different about this compared with master planning as it is typically practiced in China?

For one thing, we adhere to it and don't change it all the time. It's really about the interaction of the master plan with the execution. This is really important in China, because the government has some nice master plans, but as years go by, they change or don't follow them.

With respect to the creation of public places in China, many involved don't quite understand the scale – not the architect, developer, government planner or master planner. That is something that comes from experience. It is very important to have the

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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