

# CTBUH Journal

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Tall buildings: design, construction, and operation | 2016 Issue I

## Case Study: Sky Habitat, Singapore

Looking at the Urban Habitat

The US Tall Wood Building  
Competition

Acoustic/Climatic Trade-Offs  
in Double Skins

2015: Year of 100 Supertalls

Talking Tall: Crowdfunding  
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### Urban Habitat

#### Tall Buildings "Other Half": The Urban Habitat



A growing number of tall buildings designed by the CTBUH through its international award programs and research initiatives are not just towers of steel and glass, but also vibrant communities. The Urban Habitat award program, which recognizes the best of the best in tall building design, is a testament to the industry's commitment to creating high-quality, livable spaces. This feature explores the challenges and opportunities of designing tall buildings that serve as true urban habitats, providing public space, community, and a sense of place. It highlights the work of architects and developers who are pushing the boundaries of what tall buildings can be, from their form and function to their impact on the surrounding urban fabric.

**44 Limiting transportation options to motor vehicles obligates people to experience a tall building as something that should only be entered and exited by car. There is little incentive to envision its common areas with retail, entertainment, or other services.**

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### Architecture/Design

#### New Heights for Renewables: The US Tall Wood Building Competition



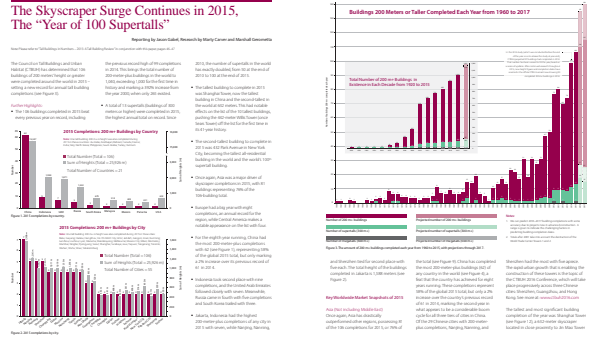
The US Tall Wood Building Competition, a joint effort by the United States Department of Agriculture (USDA) and the National Institute of Standards and Technology (NIST), is a landmark initiative in the construction industry. It aims to promote the use of mass timber in tall buildings, showcasing the potential of wood as a sustainable and structurally sound material. This feature provides an in-depth look at the competition, the challenges of wood construction at scale, and the innovative designs that are emerging. It also discusses the broader implications for the building industry and the environment.

**44 The decision to build tall in timber stems from the team's objective of environmental responsibility, and a belief that this new paradigm for urban construction might appeal to people who want to make their homes in a setting where climate consciousness is an evident priority.**

# 38

### A Year in Review, Tall Trends of 2015

#### The Skyscraper Surge Continues in 2015, The "Year of 100 Supertalls"



This section provides a comprehensive overview of the skyscraper industry in 2015. It features several data-driven charts and graphs that illustrate the significant increase in the number of tall buildings completed globally. Key highlights include the record number of supertalls (over 100 meters) and the continued growth in the number of buildings exceeding 200 meters in height. The text analyzes the factors driving this surge, such as urbanization, technological advancements, and market conditions. It also looks ahead to future trends and the challenges facing the industry.

“As city populations grow, it is increasingly important to not only provide great public spaces around buildings, but also in upper levels of tall buildings with public access and programming.”

Richard A Wilson, page 59

## Americas

Development in the United States' two biggest skyscraper cities, **New York** and **Chicago**, continued apace with a flurry of new proposals that would significantly transform their respective skylines. In Chicago, two towers have been proposed for the South Loop. A design at **113 East Roosevelt Road** would be Rafael Viñoly Architects' first project in the city, while the Chicago-based JAHN has presented plans for a supertall tower at **1000 South Michigan Avenue**. Located just two blocks from each other, the towers would serve to elevate an area of town that has yet to breach the 300-meter threshold.

Meanwhile, supertall construction in New York has moved beyond the skyscraping powerhouse of Manhattan with a proposal by SHoP Architects for Brooklyn's **340 Flatbush Avenue Extension**, which could claim the title of the tallest New York building outside of the island. Additionally, **10 Hudson Yards**, the first structure in the Hudson Yards mega development, has officially topped out at a height of 268 meters. The tower is due to complete later in 2016.

The speed and scope of development in New York, and the United States as a whole, has not come without a few unforeseen



10 Hudson Yards topped out in October. © Daniel Safarik

consequences, as evidenced by a national curtain wall shortage that left many projects scrambling to remain on schedule. While some companies resorted to importing glass from China or putting their projects on hold, Related Companies of Hudson Yards actually opened its own glass panel maker on-site, New Hudson Façades.

The Pacific Northwest is also the location of what could become the tallest building on

the West Coast. At 101 stories, **4/C** would also be the tallest building in **Seattle** and the city's first supertall skyscraper. The planned building follows a trend of supertalls in the United States that continue to make their mark on cities outside of Chicago and New York. Recently, the Federal Aviation Administration (FAA) approved the height of three supertalls in Miami: **300 Biscayne**, **One Bayfront Plaza**, and **1201 Brickell Bay Drive**. If completed, they would be among the tallest buildings in the city.

The trend of building at height outside of traditional skyscraper hot spots continues in Canada, as **Stantec Tower** in **Edmonton** is set to become the country's tallest skyscraper outside Toronto. The planned Ice District building has grown from 62 to 66 stories, and will reach a height of 251 meters.

Meanwhile, **Vancouver** continues to grow its impressive skyline with a number of new proposals. Japanese architect Kengo Kuma has designed a sleek "carved tower" for **1550 Alberni Street**, with a form that has sweeping reductions in volume along its height. Additionally, plans have been approved for **Brock Commons**, an 18-story student dormitory that would be one of the tallest wooden towers in the world.



1000 South Michigan, Chicago. © JAHN



300 Biscayne, Miami. © Kobi Karp Architects



Stantec Tower, Edmonton. © Stantec



1550 Alberni Street, Vancouver. © Kengo Kuma and Associates

As material innovations in structural design are taking place across North America, one South American skyline has been transformed by a skyscraper that is superlative in several respects. The **BD Bacatá** in **Bogotá**, is the world's first crowdfunded skyscraper project, having been financed by more than 3,500 individuals to the tune of US\$170 million. The 260-meter, 67-story tower recently topped out and is scheduled to complete in 2016 (see



Jiangxi Greenland Zifeng Tower, Nanchang. © Lv Henzhong



Xiamen Cross Strait Financial Centre, Xiamen. © TFP Farrells

Talking Tall, page 48, for an interview with Rodrigo Nino, founder of Prodigy Network, the crowdfunding firm that built BD Bacatá).

### Asia and Oceania

In China, major skyscrapers are advancing along all stages of development. In **Xiamen**, architecture firm TFP Farrells has been selected to design the **Xiamen Cross Strait Financial Center**, which will be the first development in a new financial district proposed under China's 12<sup>th</sup> Five-Year Plan. The four-tower complex will feature office, apartment, hotel, and retail space, along with an expansive, multilevel skybridge.



Goldin Finance 117, Tianjin. © Goman Ho

Further inland in **Nanchang**, SOM has completed construction of the **Jiangxi Greenland Zifeng Tower**, which was named the "favorite complete high-rise building" of 2015 by its developer, Greenland Group. The 56-story, 268-meter skyscraper features diagrid cladding and contains both offices and a hotel. The change in programming between office and hotel space is expressed on the exterior by an angled indentation on one side of the tower.

While not yet complete, **Goldin Finance 117** in **Tianjin** also reached a major milestone when it architecturally topped out in

### THEY SAID

“Tall buildings and heritage are absolutely not irreconcilable, as the recent history of the City of London amply demonstrates, but this requires more skill and commitment than is evident in too many towers now proposed across the capital. As ever, design quality is critical.”

*Paul Finch, editorial director of the Architects' Journal, in his article "Tall Buildings and Heritage are Absolutely Not Irreconcilable," The Architects' Journal, December 17, 2015.*

## Humanizing the Megascale



Jaron Lubin

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The principles set forth 48 years ago at the Montreal Expo 1967, embodied in the form of Habitat '67, which proposed an entirely different kind of "modern tall housing project," are now advanced in the 21<sup>st</sup> century in Singapore, with Sky Habitat. The shifted modules and balconies, combined with communal spaces at height, give the effect of a hillside village as much as a tall building. The Sky Habitat demonstrates what can happen to the tall housing typology when enlightened public policy meets inspired design.

### Introduction

Habitat '67 was an experimental housing project built as a central pavilion for Montreal's 1967 World Exposition (see Figure 1). With the Expo theme of "Man and His World," Habitat sought to reimagine urban housing in an increasingly crowded world. The goal of Habitat was to improve the standard of apartment living, particularly the sector of mass-produced affordable housing in the city. As an alternative to the stripped-down, Modernist towers proliferating in cities around the globe, the approach of Habitat was to "fractalize" the surface of the building, resulting in a structure that is permeable to light and air, with each apartment reading as an individual home within a larger collective organization. The stacking of prefabricated concrete boxes, one atop the next, results in an architectural typology more akin to a village hillside than to a solid wall. Aside from the formal association, the village metaphor

also describes the interweaving of interior and exterior spaces. Each home has an outdoor garden terrace on the rooftop of its neighbor below. The building also creates many open, communal spaces, which fosters a sense of vertical neighborhoods not common to this building type.

However, nearly 50 years later, the predominant residential building type in the city today remains that of a vertically extruded tall tower. Cities continue to be filled with towers that do not address the fundamental conditions of livability on several counts. First, at the urban scale, towers continue to be built as wall-like masses, one next to another, without the sensibility to relate to the surroundings or to the street life below. Second, the apartments within these towers are often small and interiorized, climate-controlled capsules, disconnected from the surrounding environment. At best, the apartments are designed with small balconies that are unusable as outdoor spaces. The social impact of this type of residential tower design is enormous. In addition, the economics of the current model of city building is not favorable, as cities become more crowded and the cost of living increases, while any particular sense of place is eradicated, and one's quality of life is at the same time diminished. Furthermore, there is a glaring lack of planning and regulatory policies set in place, as well as a lack of supporting governance structure, to change the course of this common model for city development.

A research-based examination of the housing typology that emerged from the original Habitat thesis has been ongoing for the past several years. The goal of the authors' firm has been to re-cast the original thesis, based on



Figure 1. Habitat '67, Montreal. © Timothy Hursley



Figure 2. Sky Habitat, Singapore. © Jaron Lubin

exploding urban densities throughout the world. A recently completed high-rise residential tower project in Singapore provides the opportunity to test the principles of Habitat in a new light (see Figure 2).

#### Concept and Objectives

In 2010, CapitalLand Residential Group acquired an approximately 11,997-square-meter parcel of land, centrally located in Bishan, a neighborhood 11 kilometers to the

“The economics of the current model of city building is not favorable, as cities become more crowded and the cost of living increases, while any particular sense of place is eradicated, and one’s quality of life is at the same time diminished.”

# The Other Side of Tall Buildings: The Urban Habitat



Daniel Safarik

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Daniel Safarik is the Director of the China Office and Asia Headquarters of the CTBUH. He is responsible for guiding CTBUH's initiatives in China and in Asia generally, including establishing events and awards programs, translation of CTBUH publications, and growing CTBUH membership, research, staff and influence in the region. His responsibilities include representing the Council at events and meetings, selecting and editing research papers, case studies and features for the CTBUH Journal, and managing content for CTBUH International Conferences. Safarik has co-authored or co-edited several of the Council's recent technical publications. He holds a Master in Architecture degree from the University of Oregon and a Bachelor's degree in journalism from Northwestern University.

A growing number of tall buildings recognized by the CTBUH, through its international awards programs and research, are noteworthy not so much because of their sheer height or engineering feats, but because of their contribution to the urban habitat. In 2014, this was further acknowledged by the formation of the Urban Habitat/Urban Design Committee and the inauguration of an Urban Habitat Award. This paper examines some of the projects that best exemplify the standards of integration and custodianship of their surroundings, highlighting both their common threads and pronounced differences.

## Introduction

Tall buildings have historically come under justifiable criticism that they stand aloof from their environments, as objects to be admired from a distance. Often, the ground condition is an afterthought. High walls; windswept, underused plazas; confusing entrances scaled for autos or placed above or below grade in a sealed-off condition; light pollution; wind downdrafts: all of these are symptomatic of pursuing only the most spectacular aspects of these buildings. Even if the impoverished ground condition can be ignored, the business-as-usual tall building design is problematic from an urban standpoint. Many tall buildings are airtight environments from top to bottom, and typically bear no relation to the cultural or climatic conditions in which they stand. This leads to homogeneity among towers from city to city and misses opportunities to exploit the special conditions of the location, particularly at height.

To identify and communicate the tall building designs that defy this trend, incorporating and enhancing their surroundings instead of rejecting them, the Council on Tall Buildings and Urban Habitat inaugurated the Urban Habitat Award and the Urban Habitat/Urban Design (UH/UD) Committee. The mission statements of these two programs help to focus an examination of the outstanding trends and principles at play in projects that foretell a positive future for a rapidly urbanizing planet, which by necessity will incorporate more tall buildings.

The Urban Habitat Award “acknowledges that the impact of a tall building is far wider than the building itself. Projects should demonstrate a positive contribution to the surrounding environment, add to the social sustainability of both their immediate and wider settings, and represent design influenced by context, both environmentally and culturally,” (Wood & Henry 2015). The UH/UD Committee “focuses on the role of tall buildings within a city and how those tall buildings affect the quality of life for those that live or work within or near them”.

Through this lens, it is possible to evaluate the merits of individual projects constructed to date and identify trends that repeat across them, thus generating an improved understanding of “urban habitat” in the context of tall buildings.

## Transportation Integration

The common refrain that skyscrapers are “built equations,” meant to maximize the value of a

“But the efficiency of a skyscraper will be greatly compromised, particularly from a total energy-consumption and a social sustainability standpoint, if it is not well-engaged with a variety of transport options that connect it to the wider region.”

given plot of land by multiplying the shape of that plot dozens of times into the sky, is of course fundamentally true. There is inherent efficiency in stacking rather than sprawling. But the efficiency of a skyscraper will be greatly compromised, particularly from a total energy-consumption and a social sustainability standpoint, if it is not well-engaged with a variety of transport options that connect it to the wider region. An over-localized focus (i.e., on-site efficiency alone, to the exclusion of surroundings) can lead to isolated towers in seas of auto parking, which contribute no more to the urban realm than sprawling, low-rise office parks. Limiting transportation options to motor vehicles, as many towers have done in North and Central America, obligates people to experience that building as something that should only be entered and exited by car. The resulting curtailment of foot traffic provides little incentive to enliven its common areas with retail, entertainment, or other services; nor to design details that are observable at eye level, as most people will approach the building at speed and from a distance. Indeed, there are abundant examples of auto-oriented, iridescent, and forbidding tall buildings, which only look impressive from a distance, both in the suburbs and in the centers of downtowns, to which they contribute mostly shadow and little life.

Transportation connectivity – at multiple levels, via multiple modes, and at both local and regional scales – is integral to the success of the urban interface of tall buildings. Two projects exemplify the importance of deep transportation integration.

### London Bridge Quarter – The Shard

Winner, CTBUH Best Tall Building Europe, 2013

Although The Shard, London, is best known for its arresting, jagged profile on the skyline, the fundamental lifeblood of the building – actually part of a large complex called the London Bridge Quarter – is its connection to the city's vast transportation network. The complex at the foot of the mixed-use tower contains a public plaza that leads into one of the busiest railway stations in the capital,

London Bridge Station, which was reconstructed as part of the program (see Figure 1). The 16-track terminus serves 120,000 people daily, many making connections between regional rail, the London Underground, and local bus systems. Several insensitively positioned 1960s office blocks were taken down to make way for the new development. By placing the retail frontage of The Shard and its smaller companion, The Place, along the pathway leading directly from the station to the street, there is now significant incentive to linger at this point of transfer and to make it a destination in and of itself. This naturally has follow-on implications for the economic viability of the tower. In short, the viability of The Shard as a project and its contribution to urban vitality are two sides of the same coin: a substantial integration with the transport network of the metropolis (Sellar 2015).

### Abeno Harukas, Osaka

Finalist, CTBUH Best Tall Building Asia & Australasia, 2014

Abeno Harukas is remarkable for its exploitation of a site on a critical node in the regional transport network, extending the amenities associated with a major rail hub upwards throughout

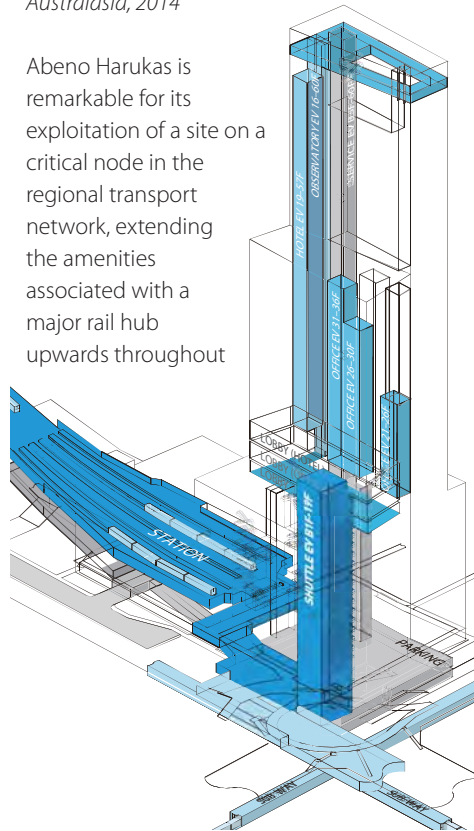


Figure 2. Abeno Harukas, Osaka, integrates circulation links into the heart of its program, defining its architecture. © Takenaka Corporation



Figure 1. The Shard, London, integrates public transport at its base. © WSP Group

its program (see Figure 2). Abeno Harukas is a firm stake in the ground against the trends of dissipation and suburbanization that have characterized Japan in recent decades, despite its reputation as a compact country.

The Abenobashi-Tennoji Station is the terminus of the Kintetsu Railway, which serves southern Osaka and the northern parts of Nara prefecture, processing more than 70,000 people per day. An additional 34,000 people per day visit the department store on the site, or enter the city's subway network here. Building a dense and multilayered 60-story building at this location formed a gambit for the commercial revitalization of the Abeno area, which had lost ground to other station hubs at Umeda and Namba (Harada 2015).

In addition to reducing the carbon impact of travelers who would otherwise be making multiple auto trips by situating the building on top of an existing rail nexus and department store, the developers had an opportunity to serve many functions within one building as commuters use the station. A hotel, office, school, clinic, art museum, and numerous public spaces are intertwined throughout the height and section of the tower. The intricate series of voids, outdoor gardens, and platforms within the structure obviate the cramped, hive-like potential of the packed program, transforming into something more akin to the variegation one experiences walking along a street as it



# New Heights for Renewables: The US Tall Wood Building Competition



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In a continuing effort to support the Obama Administration's climate strategy, the United States Department of Agriculture (USDA), in partnership with the Softwood Lumber Board and the Binational Softwood Lumber Council, announced the US Tall Wood Building Prize Competition in October 2014. The competition aimed to promote the architectural and commercial viability of engineered mass timber products in tall buildings in order to support employment opportunities in rural communities, maintain the health and resiliency of the nation's forests, and advance sustainability in the built environment. Two projects, one in New York City and the other in Portland, Oregon, won the competition. This paper chronicles the early design stages of both projects.

## Introduction

The competition's request for proposals called for entries by December 2014, and submissions needed to propose a project that would be eight or more stories tall and addressed the following criteria:

- Project specifics and details
- Business case for project
- Proposed wood solution
- Sustainability
- Rural economic ties

The winners of the competition, 475 West 18th in New York City and Framework in Portland, Oregon, are scheduled to receive US\$1.5 million for the incremental costs of pioneering wood construction techniques, including manufacturer research, incremental design efforts, materials testing,

and building code compliance. The competition requires that the winning project team attempt to source a share of the structural timber materials from rural manufacturers and sustainably managed forests in the United States, in order to promote environmental stewardship and economic development.

## Project Genesis

### 475 West 18th

The owner of the project site, 130-134 Holdings, is working with development manager Spiritos Properties; SHoP Architects; Arup as the structural, fire, and acoustic engineer; and Atelier Ten as the sustainability consultant, to manifest a uniquely distinctive building on a prominent corner of West

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Figure 1. 475 West 18th exterior corner detail, with the High Line Park behind. © SHoP Architects

Chelsea, opposite the forthcoming main entry to the High Line Park (see Figure 1). As the neighborhood surrounding the High Line has come to be known for its high-end architecture, a plan was developed for an innovative condominium of luxurious homes, designed to minimize its carbon footprint through tasteful and environmentally responsible material and system selection. The decision to build tall in timber stems from the team's objective of environmental responsibility, and a belief that this new paradigm for urban construction might appeal to people who want to make their homes in a setting where climate consciousness is an evident priority. The team was intrigued that wood, a natural and renewable material, was increasingly being used as an alternative to steel and concrete in the form of structural Cross-Laminated Timber (CLT) and Glue-Laminated Timber (Glulam). As an emerging building material of the 21<sup>st</sup> century, mass timber represents the missing piece in the construction of a healthy building, in which energy-efficient systems are already commonplace.

### Framework

Beneficial State Bancorp teamed with project^, a values-based real estate developer, and Home Forward, an affordable housing provider, to reenvision their existing Pearl District property in Portland, Oregon into Framework, one of the nation's first wood high-rise structures (see Figure 2). The building seeks to develop a model for a sustainable urban ecology by promoting social justice, environmental responsibility, and economic opportunity, thus yielding a broad advancement of these objectives at a national scale. This is achieved both during construction and through the programming of the building with affordable housing; office spaces for B-corporations (a type of for-profit corporation that has legally defined goals of societal and environmental benefit); a tall wood building exhibit; and retail uses that complement its residents and tenants.

The building is intended to promote a virtuous cycle from "forest to frame," in which tall wood buildings drive more wood products and wood product innovation from

sustainably managed forests, thus boosting rural economic development, which in turn supports the health of cities.

This structure is complemented by the fact that the Pacific Northwest region has deep ties to wood products and their development. Projects using mass timber products are receiving both City of Portland and State of Oregon support.

### Site and Climate

#### 475 West 18th

475 West 18th is located directly in the center of Manhattan's West Chelsea neighborhood, rezoned in 2005 by the New York City Department of City Planning to be a mixed-use manufacturing (largely art gallery/commercial office space) and residential area. New construction was to be concentrated along the long-dormant High Line elevated rail line. Redeveloped and opened in 2009, the High Line is now established as a highly successful urban landscape lined with a number of prominent buildings. Most new buildings in the West Chelsea zoning district are limited to a 36.6-meter maximum height, usually accomplished in 10 or 11 stories.

New York's climate has four full seasons, is somewhat moist in spring (with rain) and winter (with snow) and temperatures range from upwards 32°C in summer to below freezing in winter. It is not dissimilar to some routinely cold and wet climates in Europe, where tall timber buildings are more



Figure 2. Framework, Portland. © LEVER Architecture

common. As wood is a natural material that retains a degree of moisture, considerations must be made with respect to weatherproofing during delivery and erection in order to control its behavior and thus, its visual performance.

### Framework

Framework is located in the heart of the Pearl District, an area formerly occupied by warehouses and light industry. Undergoing significant urban regeneration for the past 20 years, the district is now known internationally for its upscale businesses and residences, and is home to several Portland icons, such as Powell's City of Books, the Brewery Blocks, and notable public parks.

Portland has a strong reputation as a well-planned city where public transit plays an integral role in the lives of residents, visitors, and tourists. The construction of the streetcar system in the Pearl District has contributed to mixed-use and high-density development over the past decade. The site itself sits at a streetcar stop. The city's small

“The decision to build tall in timber stems from the team's objective of environmental responsibility, and a belief that this new paradigm for urban construction might appeal to people who want to make their homes in a setting where climate consciousness is an evident priority.”

# Ventilation and Sound Attenuation Potential Of Double-Skin Façades in Urban High-Rises



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“The World Health Organization has suggested that environmental noise should not exceed 55 dB(A) and 40 dB(A) for daytime and nighttime, respectively, to prevent potential psychosocial effects.”

Airtight building envelopes and the indiscriminate use of heating, ventilation, and air-conditioning (HVAC) systems have historically prevented high-rise occupants from considering natural ventilation strategies. Even as a number of studies have revealed that natural ventilation can contribute to proper indoor air quality by reducing concentrations of indoor air pollutants, acoustical discomfort due to urban traffic noise transmission has become a significant factor in degrading the acoustic quality in urban environments. Specifically, the objective of this study is to suggest appropriate double-skin façade (DSF) air-cavity volume ratios, modeled by varying the thickness of vertical glass fins and the depths of air cavities, with the objective of controlling noise transmission loss and efficient heat dissipation. The scenarios of this simulation study are based on the spatial volume ratio and depth of DSF air cavities, and it shows diverse changes in air temperature, air velocity, and sound transmission loss for the two requirements.

## Introduction

The International Energy Agency states that the building sector in most member countries consumed approximately 40% of global energy. Airtight building envelopes have caused an increase in HVAC system energy demand, and indoor air quality (IAQ) has become a significant factor affecting the health of building occupants in urban environments. In the United States, HVAC systems account for 50% of building energy consumption (Pérez-Lombard et al. 2008), and HVAC systems are energy intensive systems comprised of large fans, ductwork systems, and air-conditioning and heating units (Khan et al. 2008). A well-developed natural ventilation strategy could be a cost-effective method for energy-efficient building design. However, urban traffic noise transmitted via ventilation windows deters building occupants from opening windows and justifies the use of mechanical ventilation systems (Nicol & Wilson 2004). Furthermore, increased urban traffic intensity as a consequence of accelerated urban population growth has become a major constraint that degrades the acoustical quality of urban environments. The World Health Organization (WHO) has warned that high external noise levels can contribute to numerous health problems such as sleep

disturbances, high blood pressure, and psycho-physiological symptoms.

## Transportation as the major source of urban noise

The United Nations reports that world urban population growth is expected to increase from about 3.8 to 6.3 billion people between 2014 and 2050, and Asian regions will be experiencing the highest increase of urban population growth, by about 60.5% from 2014 to 2050. Among Asian regions, the UN stated that South Korea is experiencing a higher urban population growth compared to other Asian countries. It indicates that 82% of the nation's population was urban as of 2014, which far surpasses the 37.5% average of the rest of the Asian region.

As a result of urbanization, the number of motor vehicles has gradually been increasing in cities, and transportation noise has become the major outdoor noise source, causing adverse health effects in urban environments (Muzet 2007, Berglund et al. 1999). The US Environmental Protection Agency estimated that 19.3 million people in the United States were exposed to a daily average sound level (Ldn) greater than 65 dB from highway traffic. In China, a survey showed that in cities with more than one

Kinds of effect	Symptoms
Physical effects	Noise-induced hearing loss, hearing impairment, threshold shift
Physiological effects	Startle and defense reaction, leading to potential increase of blood pressure
Interference with speech communications	Reduction in intelligibility of conversation, radio, music, television and others
Sleep disturbance	Difficulty in falling asleep, alterations in sleep rhythm, awakening
Psychological effects	Headaches, fatigue, irritability
Performance effects	Task performance, distraction, productivity
Annoyance	Feeling of displeasure; tolerances vary enormously; noise pulses more annoying than a steady noise

Table 1. The adverse health effects of noise.

Type	Short-term	Long-term
Behavioral	Sleepiness, mood changes, nervousness	Depression, mania, violence
Cognitive	Impairment of function	Difficulty in learning new skills, short-term memory problems, difficulty with complex tasks
Others	Hypothermia, immune function impairment	Susceptibility to viral illness

Table 2. Consequences of sleep disturbances.

million people in population, 71.4% of the residents were exposed to noise levels above 70 dB(A) due to the accelerated growth in the number of motor vehicles. In Egypt, 73.8% of respondents in a survey complained of annoyance from road traffic noise (Ali & Tamura 2002).

### Adverse health effects of noise

Environmental noise greater than the sound level of 55 dB(A) is regarded as a critical environmental problem in the European Union. Table 1 illustrates the adverse health effect of noise, and how symptoms such as physical, physiological effects and annoyance are highly related to Sound Pressure Level (SPL) in dB.

To quantify noise annoyance as subjective perception, a study regarding the relationship between SPL and noise annoyance was introduced (Kang 2007). The test group experiencing less than 55 dB(A) felt less annoyed; the test group exposed to noise between 55 dB(A) and 60 dB(A) was

children subjected to noisy environments have not only decreased attention spans, but also lowered task performance on cognitive assignments, compared to children in quiet environments (Hygge et al. 2003, Shield & Dockrell 2003). Ljung et al. (2009) discovered that traffic noise significantly diminishes reading and comprehension ability as well as basic mathematical performance in children. These psychological and physiological effects lead to decreased task productivity. Therefore, the WHO suggested that environmental noise should not exceed 55 dB(A) and 40 dB(A) for daytime and nighttime, respectively, to prevent potential psychosocial effects (WHO 2009). These effects of noise on the sleep process also contribute to the impairment of cognitive tasks and overall task productivity during the days following the disturbance, as seen in Table 2 (Stansfeld & Matheson 2003).

### Seoul metropolitan area acoustical quality

According to the Korea Research Institute for Human Settlements (KRIHS), Seoul's



Figure 1. Urban traffic intensity and airtight building envelopes in the Seoul metropolitan area. © Sanda

“somewhat” annoyed, and the test group exposed to greater than 65 dB(A) was “definitely” annoyed. It has also been discovered that nocturnal awakenings usually occur with noise levels greater than 55 dB(A) (Muzet 2007). Other studies have also demonstrated that

population density is the highest among the largest cities of the Organization for Economic Cooperation and Development (OECD) countries (see Figure 1). The World Bank data also showed that the number of motor vehicles per 1,000 people in South Korea between 2000 and 2011 increased by 43.9%. Along with the rapid growth of urban population and urban traffic intensity in the Seoul metropolitan area, Lee et al. (2011) suggested well-being indices for the healthy environments of high-rise buildings in South Korea, and they prioritized indoor ventilation performance and acoustical satisfaction as being most highly related to physical and mental health, respectively.

According to the quantitative data collection performed as a preliminary study in the six selected sites of the Seoul metropolitan area, it was found that the traffic noise levels exceeded the threshold of the national traffic noise guidelines, which require lower than 65 dB(A) and 55 dB(A) for daytime (06:00–22:00) and nighttime (22:00–06:00) respectively, as seen in Figure 2. Noise levels during the daytime were higher than at night due to the number of moving vehicles.

### Methodologies

Natural ventilation performance in buildings has been shown to be highly related to ventilation opening types. Increased wind velocity and complicated wind patterns due

# The Skyscraper Surge Continues, The “Year of 100 Supertalls”

Report by Jason Gabel, Research by Marty Carver and Marshall Gerometta

Note: Please refer to “Tall Buildings in Numbers – 2015: A Tall Building Review” in conjunction with this paper, pages 46–47

The Council on Tall Buildings and Urban Habitat (CTBUH) has determined that 106 buildings of 200 meters’ height or greater were completed around the world in 2015 (See full list, Table 1, page 44) – setting a new record for annual tall building completions (see Figure 3).

the previous record high of 99 completions in 2014. This brings the total number of 200-meter-plus buildings in the world to 1,040, exceeding 1,000 for the first time in history and marking a 392% increase from the year 2000, when only 265 existed.

has exactly doubled, from 50 at the end of 2010 to 100 at the end of 2015. It took 80 years for the first 50 supertalls to complete, from 1930 to 2010.

**Further Highlights:**

- The 106 buildings completed in 2015 beat every previous year on record, including
- A total of 13 supertalls (buildings of 300 meters or higher) were completed in 2015, the highest annual total on record. Since 2010, the number of supertalls in the world

- The tallest building to complete in 2015 was Shanghai Tower, now the tallest building in China and the second-tallest in the world at 632 meters. This had notable effects on the list of the 10 tallest buildings, pushing the 442-meter Willis Tower (once Sears Tower) off the list for the first time in its 41-year history.

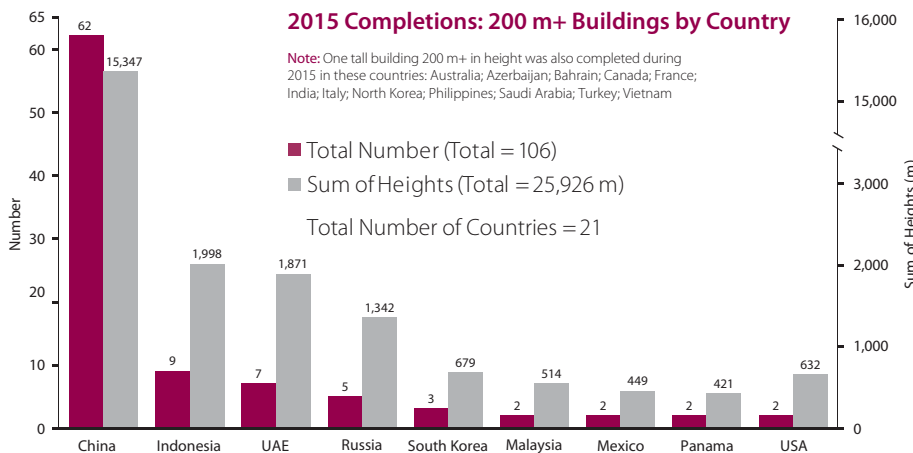


Figure 1. 2015 completions by country.

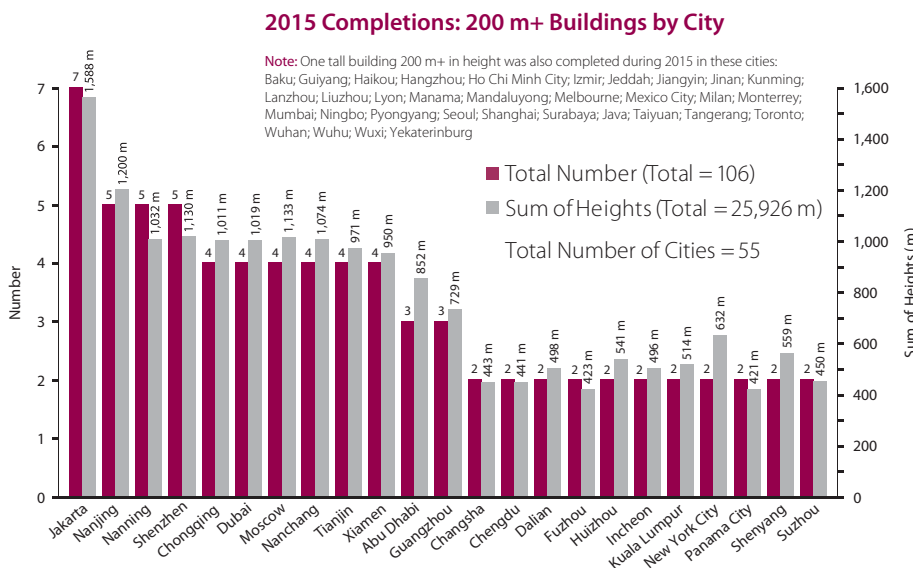


Figure 2. 2015 completions by city.

- The second-tallest building to complete in 2015 was 432 Park Avenue in New York City, becoming the tallest all-residential building in the world and the world’s 100<sup>th</sup> supertall building.

- Once again, Asia was a major driver of skyscraper completions in 2015, with 81 buildings representing 76% of the 106-building total.

- Europe had a big year with eight completions, an annual record for the region, while Central America makes a notable appearance on the list with four.

- For the eighth year running, China had the most 200-meter-plus completions with 62 (see Figure 1), representing 58% of the global 2015 total, and marking a 2% increase over its previous record of 61 in 2014.

- Indonesia took second place with nine completions, and the United Arab Emirates followed closely with seven. Meanwhile, Russia came in fourth with five completions and South Korea trailed with three.

- Jakarta, Indonesia had the highest 200-meter-plus completions of any city in

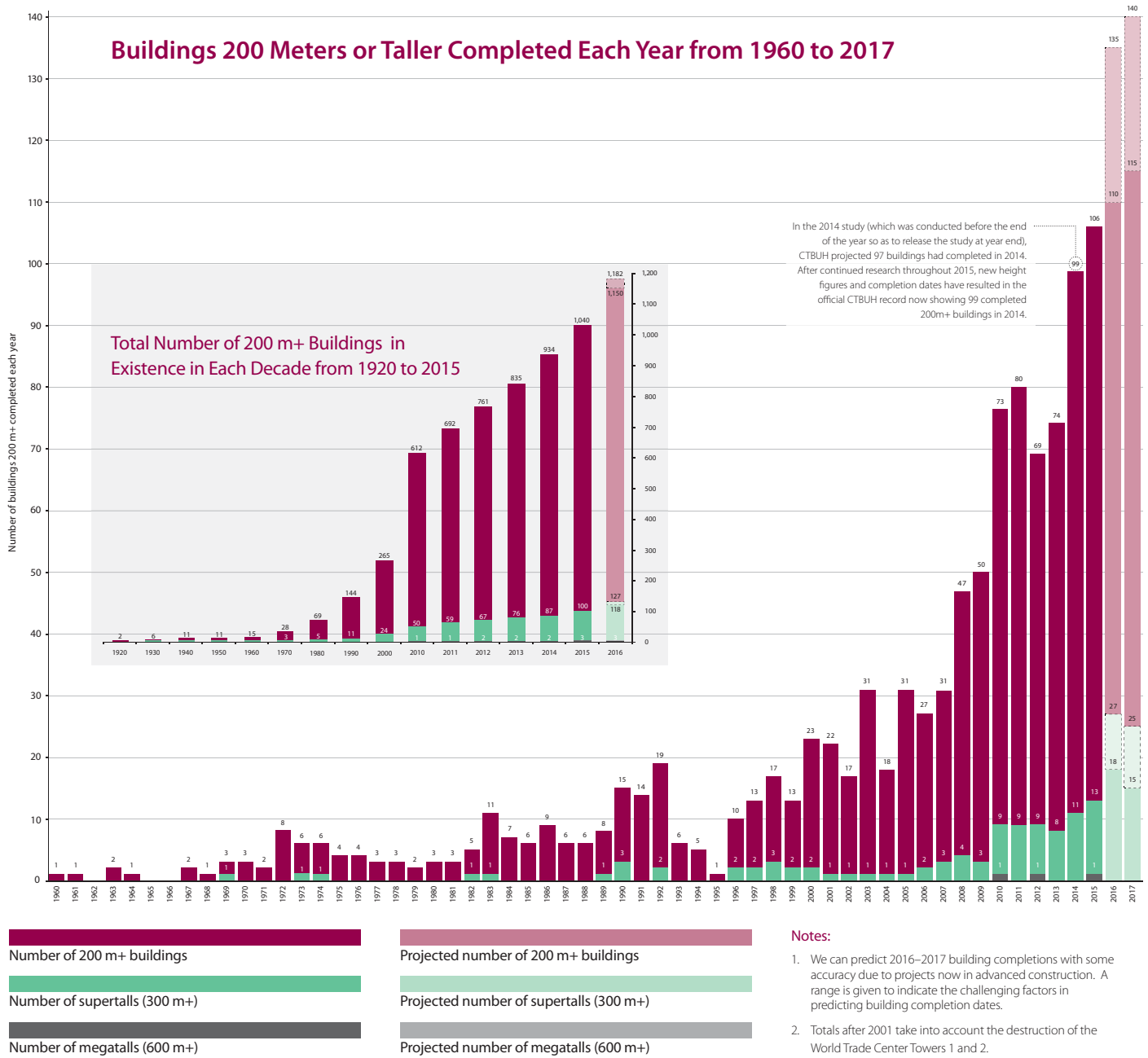


Figure 3. The amount of 200 m+ buildings completed each year from 1960 to 2015, with projections through 2017.

2015 with seven, while Nanjing, Nanning, and Shenzhen tied for second place with five each. The total height of the buildings completed in Jakarta is 1,588 meters (see Figure 2).

### Key Worldwide Market Snapshots of 2015

#### Asia (Not including Middle East)

Once again, Asia has drastically outperformed other regions, possessing 81

of the 106 completions for 2015, or 76% of the total (see Figure 9). China has completed the most 200-meter-plus buildings (62) of any country in the world (see Figure 4), a feat that the country has achieved for eight years running. These completions represent 58% of the global 2015 total, and a 2% increase over the country's previous record of 61 in 2014, marking the second year in a tall building completion boom cycle for all three tiers of cities in China. Of the 29 Chinese cities with 200-meter-plus completions,

Nanjing, Nanning, and Shenzhen had the most with five apiece. The rapid urban growth that is enabling the construction of these towers is the topic of the CTBUH 2016 Conference, which will take place progressively across three Chinese cities: Shenzhen, Guangzhou, and Hong Kong. See more at: [www.ctbuh2016.com](http://www.ctbuh2016.com)

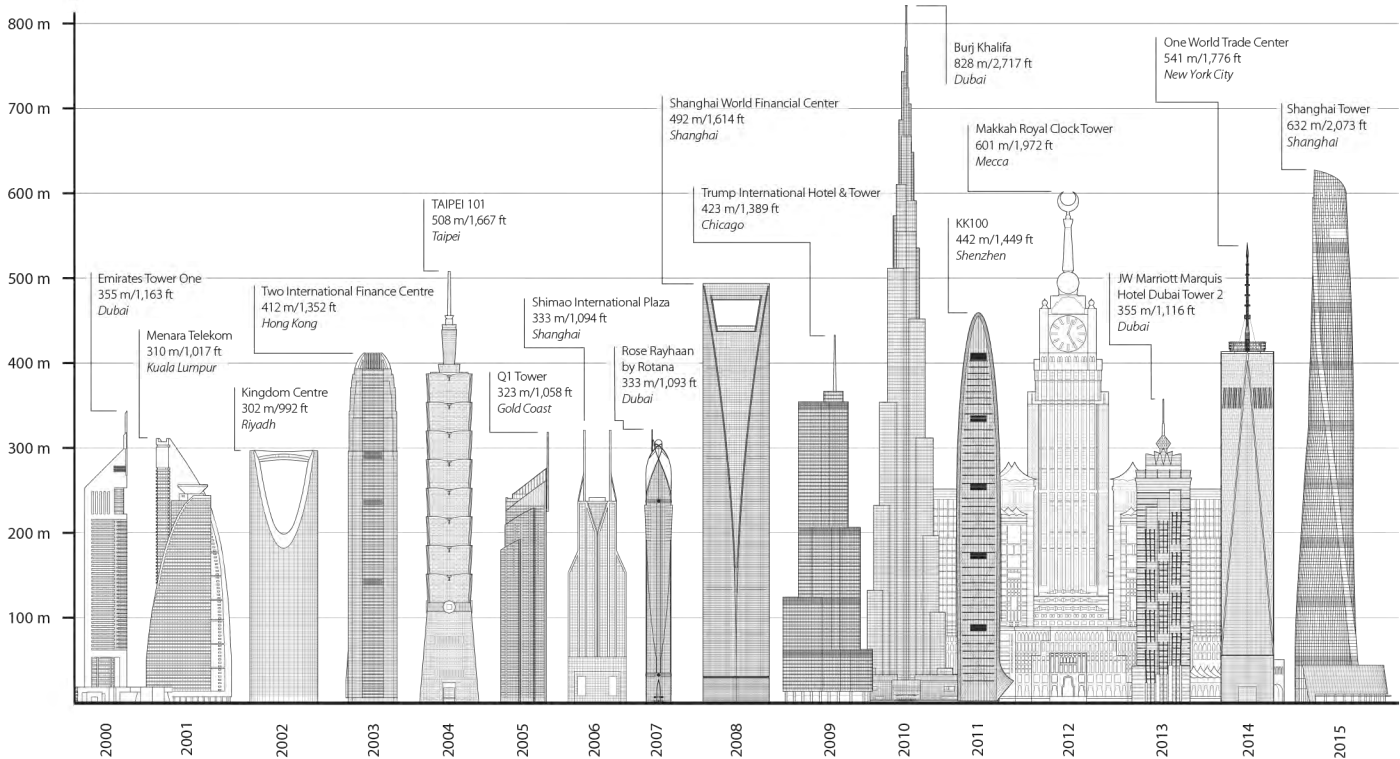
The tallest and most significant building completion of the year was Shanghai Tower (see Figure 12), a 632-meter skyscraper

## The Global Tall Building Picture: Impact of 2015

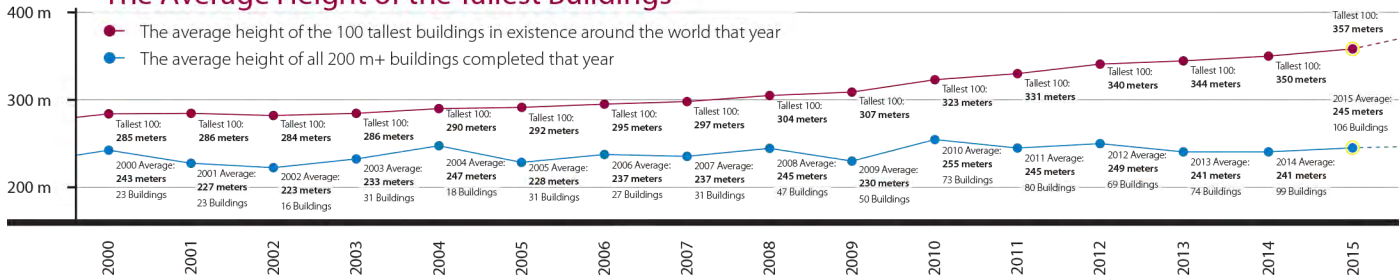
In 2015, 106 buildings of 200 meters' height or greater were completed, setting a new record for global tall building construction. This brings the total number of 200-meter-plus buildings in the world to 1,040, exceeding 1,000 for the first time in history and marking a 392% increase from the year 2000, when only 265 existed. Impressively, 13 of these buildings were supertalls (buildings of 300 meters or higher), the highest annual total on record. For more analysis of 2015 completions, see "A Year in Review: Tall Trends of 2015," pages 38–45.

### World's Tallest Building Completed Each Year

Starting with the year 2000, these are the tallest buildings completed globally each year.



### The Average Height of the Tallest Buildings



1996 = 13  
2000 = 24  
2005 = 29  
2010 = 50  
2015 = 100 Completed Supertalls

There are now 100 supertall skyscrapers in the world following the completion of 432 Park Avenue; the total number of supertalls has doubled from 50 to 100 in just five years

Shanghai Tower, Shanghai, at 632 meters, was the tallest building to complete in 2015, and is now the second-tallest building in the world and the tallest in China

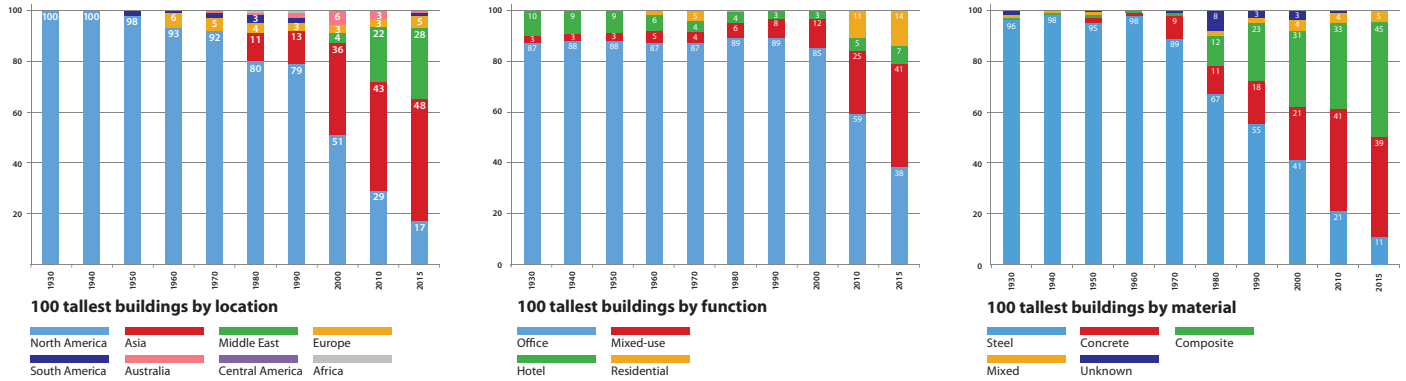
**Asia – 76%**

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

- 76% in 2015
- 77% in 2014
- 76% in 2013

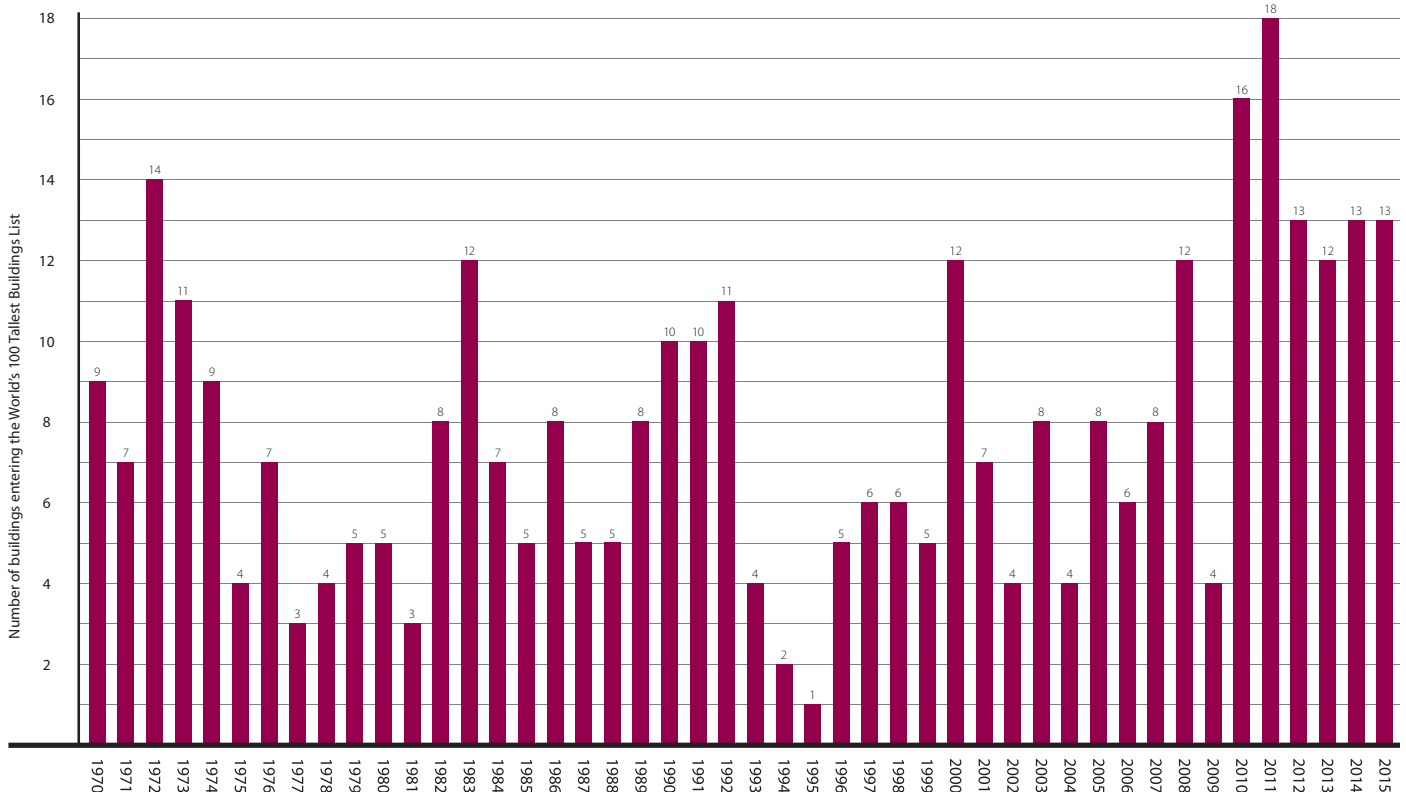
## World's Tallest 100: Analysis

As the graphs below show, we continue to see major shifts towards Asia, mixed-use function, and composite structures.



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

A total of 13 buildings made it into the global 100 Tallest list in 2015, a number that has remained relatively static over the past four years. With 18 to 27 supertalls projected to complete in 2016, it may not be long before we see the 2011 record of 18 entries broken.



Europe saw eight 200 m+ completions in 2015, the region's most of all time; Among the eight was the 354-meter OKO - Residential Tower, Moscow, the current tallest in Europe

# 52

There were 52 buildings completed with concrete structures in 2015, a dramatic increase over 2014, when only 39 were completed

Jakarta had a big year in 2015, completing seven 200 m+ buildings, more than any other city, the 258-meter Sahid Sudirman Center was the tallest of these seven



# The Power of the Crowd Rises



Rodrigo Niño

### Interviewee

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### Rodrigo Niño

Rodrigo Niño, CEO and founder of Prodigy Network, is helping to revolutionize the commercial real estate industry through crowd-investing. Niño, a Colombian native and a Manhattan resident, has proven Prodigy Network's crowdfunding model as an efficient and secure mechanism that enables smaller investors to invest in specific projects that were previously solely accessible to the very wealthy.

With this model, Niño has raised more than US\$330 million from 6,200 investors located across the globe, in 22 countries. Currently he is developing four commercial real estate projects in Bogota and four in Manhattan with a projected value of more than US\$950 million. Major money center banks like Deutsche Bank, CIBC, and Bank of America have provided traditional financing for Prodigy's Manhattan projects, giving further validation to Niño's model.

Beyond commercial real estate, Niño believes the crowd can finance the solution of many of its own urban needs in cities for a profit. As a proponent of the "crowd economy" as the main tool against inequality, Niño has spoken at worldwide conferences and was a noteworthy guest at NYU, MIT, Yale, Harvard University, and the AEDS gallery in Berlin. Niño is often featured in leading publications, including The Wall Street Journal, Businessweek, Forbes, The Economist, The New York Times, and Fast Company, among others.

The 67-story, 240-meter BD Bacatá skyscraper in Bogotá architecturally topped out in September 2015, and is on track to become the city's tallest building. Most remarkable, however, is the way it was financed – BD Bacatá is the world's first "crowdfunded" skyscraper. Through an Internet platform called Prodigy Network, more than 3,500 Colombian individual investors hold shares in the project, and some have already seen returns of more than 40%. The founder of Prodigy Network, Colombian native Rodrigo Niño, spoke to CTBUH Journal Editor Daniel Safarik about the inspiration and future plans for the New York-based real-estate crowdfunding platform.

### How did the idea of Prodigy Network and crowdfunded real estate development come about? Why was this considered to be an unmet market need?

Our inspiration for crowdfunding real estate came from our desire to give people access to investments that only the very wealthy had access to before. For nearly 100 years, regulations precluded the majority of people from investing in private real estate developments, leading to an industry that is now controlled by a very select group of individuals and institutions. In recent years, a monumental shift has started to take place thanks to regulations and financial technology, and now people can invest in institutional quality commercial real estate projects that were historically dominated by only a few.

We believe that this transformational shift will ultimately improve wealth distribution by leveling the playing field between institutional investors and the masses. This is the reason we crowdfund and believe that the industry will be successful as long as

people focus on delivering quality real estate to investors.

### How do you develop confidence in the market that this type of pooled investment is effective or superior to conventional vehicles?

It's a much different type of investment than most people are used to, but we've found success by focusing on institutional-quality assets in major markets and by partnering with experienced developers/operators. Most investors should have 5% to 20% of their portfolio invested in real estate, according to investment advisors, and our platform provides a great way for people to do just that. It gives people the chance to invest in a specific project that they can understand, and we've found that the simplicity of the investment helps build confidence.

### Can you walk us through a typical funding round for Prodigy Network, and how that looks different from a conventionally funded project?

The funding process varies from deal to deal, and as I mentioned before, we're very focused on large-scale investments in major markets, as we believe these are the best investment opportunities and have outperformed other markets historically. Many deals are coming through our platform that we analyze each week, as well as the ones that come through our relationships.

Generally speaking, we do a preliminary analysis of each opportunity before doing our full due diligence. If we like a deal, we'll underwrite it more thoroughly, and often

“Our belief is that crowdfunding has two main benefits: it gives investors access to institutional-quality real estate investments in developed markets like New York, and it enables projects that wouldn't have otherwise been possible in emerging markets like Colombia”

have a third party work with us in order to get an additional assessment. After underwriting the deal we'll go to contract and tie it up so we can then crowdfund the equity for closing. Meanwhile we'll secure debt for the closing. We have historically closed within 90 days to six months after securing the contract, depending on how much equity we need to raise. I would say the main difference between crowdfunding and a more conventional deal is the timing of the closing – we've needed to negotiate long closings in the past in order to raise the amount of capital we need to close – often in excess of US\$50 million.

**How many individual shareholders do you tend to have in a real estate project? How does this compare to comparable projects that are conventionally funded? How do things like voting rights work, and how does this affect decisions like program mix, and the design brief?**

For our projects in the United States, I would say we have approximately 100 to 400 investors per project with an average investment of US\$50,000 to US\$100,000 per investor. This is much different than a conventionally funded project, as most projects of that scale would have only a handful of institutional investors. While the number and size of investors is much different, our deals are structured very similarly to more conventional deals, and our

partners/lenders have become very comfortable with how we structure our projects.

Our clients are making passive investments in our projects, and they like the fact that they have a clear understanding of the business plan before making an investment. That being said, we define each investment in the beginning, and investors only have consent rights in the event we dramatically change the business plan – this hasn't happened yet. This structure has worked well for us, and gives our partners and lenders confidence, as a large investor base with voting/consent rights would most likely be a show-stopper for most lenders and partners.

**You're most well known for having funded a skyscraper in Bogotá, the BD Bacatá (see Figure 1). Why was this site and project chosen? What were some of the challenges in terms of financing, approvals, project management and construction?**

In Bogotá, traffic jams and mobility problems cause discomfort and desperation amongst its citizens. Every day, getting from one place to another gets more and more difficult – even the existing modes of transportation, such as taxis, are impractical. Needless to say, the real physical problems the people of Bogotá are facing today give them no time to think about pollution, and the lack of safety is something they've just come to accept.



Figure 1. BD Bacatá in July 2015. © Peter Angritt

The challenges mentioned above highlight the main reasons we did BD Bacatá – it presented an opportunity to fix many of these problems through a simple solution: reduce the distance you travel to work. Basically, make your commute shorter.

If a family can walk to work, to school, to the movies, to their favorite restaurant, and to the supermarket, there will be fewer cars polluting and congesting the streets. They will need fewer police, and they will be surrounded by a safer, more walkable environment. Life would be better this way.

Downtown Bogotá has 1.7 million commuters each day that leave the area at night, leaving it desolate (see Figure 2). If these 1.7 million people that congest the city during their "home-work-home" commute could live in downtown Bogotá, the story would be different. The quality of life of all the citizens would improve.

While the aforementioned solution seems simple, it was actually a challenge in Bogotá due to the absence of political consensus

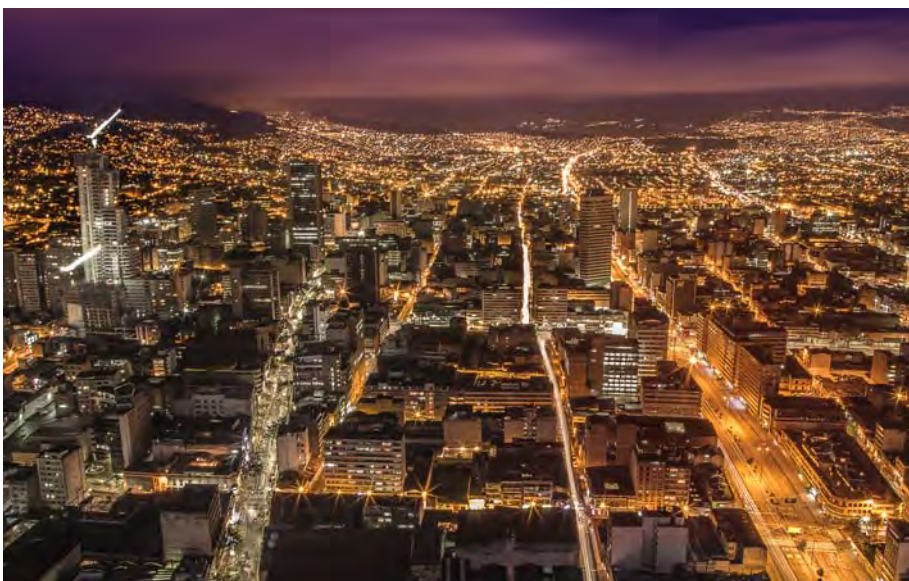


Figure 2. Downtown Bogotá at night.

# 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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