

CTBUH Journal

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Tall buildings: design, construction, and operation | 2015 Issue IV

Special 2015 Conference Themed Issue: New York

Case Study: Hudson Yards, New York

Perspectives on the Skyscraper City

The Economics of Manhattan Skyscrapers

Luxury Superslims: Bane or Boon?

Adaptive Reuse: Reinventing Woolworth

Tall Buildings in Numbers: New York City

Ask an Expert: Modular Construction

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**Reinventing Woolworth:
Adaptive Reuse of a Historic Skyscraper**

Reinventing Woolworth: Adaptive Reuse of a Historic Skyscraper. The article discusses the adaptive reuse of the Woolworth Building in New York City. It features a quote: "The floor is framed within the depth of the terraces that rise up. In this situation, not only the progressive location gave movement from the site, but also the entire world of area around the new building, spouting from boxes to boxes, because the floor shape is so much and would otherwise not support itself if only a argument were left intact."

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**Tall Buildings as Extensions
Of Urban Infrastructure and Vitality**

Tall Buildings as Extensions Of Urban Infrastructure and Vitality. The article discusses the role of tall buildings in urban infrastructure and vitality. It features a quote: "The students were asked to develop a skyscraper that pushes the boundaries of what it means to build a truly "three-dimensional city" - creating programs, encouraging extreme density, and introducing thoughtful public space strategically throughout the building."

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**Tall Buildings in Numbers
New York: The Ultimate Skyscraper Laboratory**

Tall Buildings in Numbers New York: The Ultimate Skyscraper Laboratory. The article provides statistical data on skyscrapers in New York City, including a map and various charts.

“Only powerful concepts for how earth meets tower can begin to bring about an urbanism in which the public realm is continuous, truly public, and possesses the appropriate environmental conditions.”

Americas

Those who are joining CTBUH in **New York** for the 2015 Conference, and in six more North American cities on Conference-related Regional Tours, will have plenty to talk about with their tall-building brethren.

The world got a little more visibility into the United States' largest real-estate development, Hudson Yards, as new renderings revealed of its third-tallest tower, **35 Hudson Yards**, show an apparent change in cladding to terracotta, with an envelope defined by a series of setbacks that ultimately yield to a variegated crown at the top. One of the themes of the Conference is that high-rise development has now spread well beyond the traditional boundary of Manhattan Island. In Brooklyn, a controversial plan to build a 36-story tower on the site of the present Brooklyn Heights Library at **280 Cadman Plaza** is underway. The new tower is to include a reconstructed library at its base. On the other side of Manhattan in Jersey City, the Journal Square area continued its unprecedented revival, as the 203-meter residential tower **One Journal Square** was submitted to planning authorities.

In **Toronto**, cranes continue to dot the skyline, bringing to life projects such as the **Emerald Park Condos**, which is now nearing



35 Hudson Yards, New York. © Related/Oxford Properties

completion in North York. A need for student housing is driving projects such as the 47-story **Grid Condos**, across the street from Ryerson University. Meanwhile, design development continues on **The One**, which, if built as proposed, would be Canada's tallest building at 329 meters. While the height has held steady, the design, which would be visible from much of the city, has changed substantially.

Booms continued to rise over **Miami**, as the subtropical resort town matures into a regional

capital for both the United States and Latin America. Construction began on Zaha Hadid Architects' first project in the Miami, the sinuous **One Thousand Museum**, a 62-story luxury condo tower with no expense spared, including the first helipad on a residential building in the city. The appetite for construction continued along the waterline to Edgewater, where the 57-story **Elysee Residences** were announced. Placing just 100 units across the tower affords unobstructed views of the city and Biscayne Bay from each unit.

Chicago, the home of CTBUH headquarters, is also expanding its famous skyline. Local luminary Helmut Jahn's firm JAHN was rumored to be designing a condo tower at **1000 South Michigan Avenue**, adding energy to a burgeoning area south of the Loop business district. The always-competitive area north of the Chicago River saw several new groundbreakings, including **833 North Clark**, a 373-unit luxury development, and **9 Walton**, a similarly-scaled tower that was reportedly commanding up to US\$12.5 million for the highest and largest units. Existing towers also got the spotlight – the **Aon Center**, the city's third-tallest building, was sold for US\$712 million to 601W Companies, a New York private real-estate investment company. This news came just



280 Cadman Plaza, New York. © Marvel Architects



Emerald Park Condos, Toronto. © Roberto Portolesa



Grid Condos, Toronto. © Centre Court Development



One Thousand Museum, Miami. © Zaha Hadid Architects

after leasing five upper floors of the building to Kraft Heinz Co., which like a number of corporations recently, is moving its regional headquarters from the suburbs to the Loop.

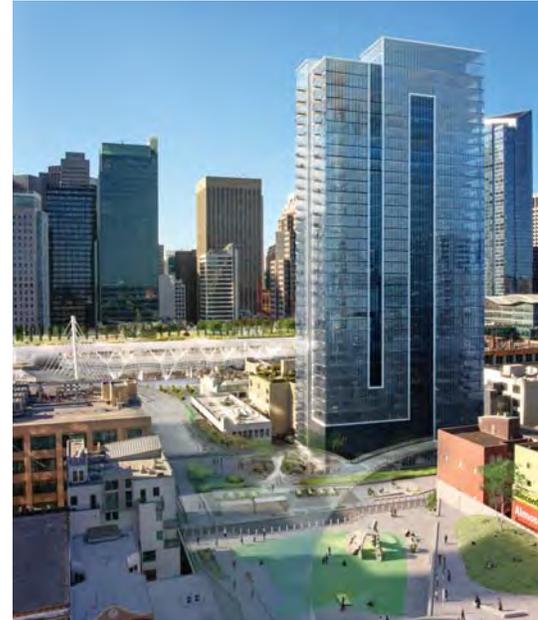
Always a place for creative architecture, **Los Angeles** has recently taken its ambitions vertical. A recent design unveiled by local hero Frank Gehry at **8150 Sunset Boulevard** claimed to be inspired by the Garden of Allah, an elaborate Spanish-Colonial style mansion-



8150 Sunset Boulevard, Los Angeles. © Visual House

turned-hotel that played host to famous citizens from 1913 until its demolition in 1959. The two-tower project, centered around a low-rise, sculptured anchor building, will mix uses across retail, entertainment, rentals, and condos. The city also attracted the visionary hand of MAD Architects of Beijing, which proposed **Cloud Corridor**, a complex of nine interconnected towers, with each floor plate accommodating gardens for each residential unit.

Further north, in **San Francisco**, construction began on the Hines-developed, Arquitectonica-designed **41 Tehama**, a 35-story residential development adjacent to the **Transbay Transit Center**, which is to contain 85% market-rate and 15% affordable units. In **Seattle**, an ambitious proposal has



41 Tehama, San Francisco. © Arquitectonica

been launched for a 60-story mixed-use tower that would feature an unusual 188-meter-high atrium that would let pedestrians walking below the tower see up to the sky. If built as planned, **888 2nd Avenue** would become the second-tallest building in the city at 271 meters.

Asia and Oceania

Hot off the heels of completing the current tallest building in Japan, **Osaka's** 300-meter **Abeno Harukas**, the tall tug-of-war with the capital appeared to head back in **Tokyo's** direction, where Mitsubishi Estate Co. unveiled plans for a 390-meter office building near **Tokyo Station**. The building, if constructed today, would be the world's 20th



Tokyo Station Tower, Tokyo. Source: Kyodo News.

THEY SAID

“Say what you will about ‘towers in the park,’ but such developments were predicated in egalitarianism, altogether different from towers looming over the park.”

Michael Sorkin, on the NYC Skyline, Architectural Review, August 5, 2015.

Manhattan's Last Frontier Becomes a Mini-City



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Marianne Kwok has more than 20 years of professional experience in architectural design for a variety of built commercial, residential, and cultural facilities in North America, Europe, and Asia. Since joining KPF in 1994, she has been the Senior Designer for some of the firm's most high-profile projects, including numerous corporate headquarters, mixed-use commercial developments, and master planning projects. These include Hudson Yards in New York, One Shenzhen Bay in Shenzhen, China, and the headquarters of Clifford Chance, State Street Bank, KPMG and Fitch Ratings in Canary Wharf, London.

Kwok received her Master of Architecture degree from the Harvard University Graduate School of Design and her Bachelor of Architecture degree from Cornell University, where she was the recipient of the Charles Goodwin Sands Memorial Silver Medal.

Hudson Yards is a mixed-use development built over rail yards on the west side of New York's Manhattan Island. As the largest real estate project ever undertaken in the United States, its unprecedented scale and sophistication provide a model for sustainable urban development and architectural interventions, which integrate a new neighborhood into a complicated existing infrastructure and surrounding context.

The Site

Hudson Yards is located between 10th and 12th Avenues, 30th and 33rd Streets. Eleventh Avenue bisects the project and divides it into the Eastern Rail Yards (ERY) and the Western Rail Yards (WRY) sections (see Figure 1). The greater Hudson Yards area expands to the north and northeast, but it is these two blocks over the rail yards that have earned the project the title of "America's Biggest Real Estate Development" (see Figure 2).

Historically, the West Side remained mostly undeveloped through the 19th century. Farmland was interrupted by the opening of the Hudson River Rail Road in 1851 (connecting New York City to points north), securing the area's importance to regional infrastructure connections. Before there was a rail connection west to New Jersey, train ferries would dock on piers built on the Hudson River. The rail lines at Hudson Yards would connect to tracks taking trains up and

down Manhattan. In 1904, the Pennsylvania Railroad began construction on the first tunnel under the Hudson River for passenger trains going to the new Pennsylvania Station, which opened in 1910. At the time, it was a feat of engineering to build a tunnel over tidal silt; the accomplishment was considered to have rivaled the nearby construction of the Brooklyn Bridge.

Freight trains continued to cross the Hudson by ferry, and because of the dangers presented by railroad operations at street level, including many pedestrian accidents, the High Line was built in 1931 so that freight railroad tracks would be above the street. The High Line opened in 1934, but was largely abandoned in the 1950s and officially decommissioned by 1980 due to the popularity and convenience of interstate trucking. The West Side Elevated Highway was built starting in 1929, resulting in a complete safety and maintenance debacle that separated the waterfront from the urban fabric, which was closed within 20 years of its opening in 1951. The area was further separated from the street grid in the 1970s, when the holding yards for the Long Island Rail Road (LIRR) commuter trains were built. The West Side Elevated Highway was dismantled; the High Line was abandoned; and the Henry Hudson Parkway was extended southward at-grade. This is the condition that existed until construction started on Hudson Yards in 2012.



Figure 1. Hudson Yards location plan showing the Eastern Rail Yards and Western Rail Yards.

CTBUH 2015 New York Conference

Hudson Yards, Related and Oxford Properties are Diamond Sponsors of the conference and will be exhibiting Hudson Yards in the "Americas Room."

KPF are also Gold Sponsors of the Conference sponsoring this special edition CTBUH Journal.

Since the 1980s, the area has been a hotbed for proposed development and design competitions to infill the urban fabric. In 2001, the New York Jets football stadium was proposed for the WRY. The idea gained momentum in 2004 when the Bloomberg administration made the stadium part of the city's bid for the 2012 Olympic Games. A plan to rezone the area was envisioned, which entailed improving the Javits Convention Center to the north, extending the No. 7 subway train from Times Square, creating Hudson Park and Boulevard on top of the subway extension, and developing a large public plaza outside the stadium on decking over the ERY. While New York lost the Olympic bid, the public investment in the area was heightened.

During this time, ERY was rezoned for 557,418 square meters of mixed-use, with a maximum set for residential and a minimum for commercial. This was joined by an 18,581-square-meter cultural facility, and 50% public open space. This facilitated the 2007 competition, with The Related Companies winning the right to develop Hudson Yards (both East and West). After gaining the rights to develop the site, Related rezoned the WRY to approximately 557,418 square meters as well, including a 9,290-square-meter K-8 public school.

Hudson Yards benefits from US\$4 billion of public investment in the surrounding area. This includes US\$465 million for the Javits Center renovation, US\$265 million for the Moynihan Station renovation, which would add space to the existing Penn Station by taking over part of the adjacent 1912 main US Post Office building, and most significantly, US\$2.4 billion for the No. 7 subway extension.

There are three adjacent parks that will meet the open space at Hudson Yards. The High Line, directly adjacent to the south and west, has received US\$150 million of public and private funding since the project was first conceived in 1999. Hudson River Park, across 12th Avenue to the west, connecting Battery Park City up to the George Washington Bridge, has received US\$440 million of public and private funding, and has seen continued



Figure 2. The skyline of Hudson Yards, New York, from the southwest when both the Eastern and Western Rail Yard halves of the development are complete.

“Hudson Yards is a mixed-use development in every sense. The Eastern Rail Yards is the first to be developed, with two office towers, a retail podium, a mixed-use tower including office, hotel, and residential, and a residential tower attached to an expandable cultural facility called the ‘Culture Shed’.”

Perspectives on the Skyscraper City

To commemorate the CTBUH 2015 International Conference, some of the most prominent voices in the New York tall building industry today – all of whom are speaking at the conference – offer their perspectives on the big issues that have emerged as the increasingly fluid and multi-directional flow of global capital has driven a skyscraper city resurgence. Key projects from around the city, highlighted here through mini case studies, accentuate and further exemplify these critical viewpoints.

Beyond the Baseline: The Sound Economics of “Green and Tall”



Alexander Durst, Chief Development Officer, The Durst Organization

While many agree that we must reduce greenhouse gases to stem global warming, there is little agreement as to how we can achieve this goal. The Durst Organization believes that developers

building for the future should always aim to implement the most effective and aggressive sustainable measures that economy allows. When it comes to building and operating tall buildings, the smart thing to do just happens to be the right thing to do.

Developers of tall buildings must recognize the lasting impact of their work. In the United States, buildings consume 70% of the electricity load, accounting for some 40% of carbon emissions. Both the scale of tall building construction and the impact of material used are massive. In addition to these important environmental considerations, tall buildings built today become profoundly integrated into the culture and economy of their cities for generations to come. Buildings built for the future must incorporate sustainability measures designed to last as well.

It is in a developer's best interest to keep ahead of the curve and provide buildings that are more sustainable than the market or legislation requires. A brief review of building regulations that have recently been implemented in New York City illustrates why it is smart to be an early and eager adopter of sustainable technologies.

In 2005, the City introduced Local Law 86, requiring projects that receive significant municipal funding to be LEED-certified. At that point, developers that had been building green for years were far better poised to secure City dollars than those scrambling to make sense of the certification process.

In 2009, Local Law 87 mandated that buildings of more than 4,645 gross square meters undergo regular energy auditing. Buildings that failed to meet efficiency standards were subject to expensive, bureaucracy-addled retro-commissioning. For buildings already operating near peak efficiency, it was “business as usual.”

In 2014, Mayor de Blasio challenged New York to reduce its carbon emissions 80% by 2050, outpacing Mayor Bloomberg's earlier commitment to a 30% reduction by 2030. Recommendations for reaching this benchmark include updating the NYC Energy Conservation Code within the next five years to reflect a target reduction in energy

consumption of 40% below ASHRAE's 2013 standards for commercial buildings.

The trend is obvious: building to a baseline means forever struggling to keep up with increasing legislative pressure. Meanwhile, regulatory bodies reward the more ambitious sustainable builders with funding, stretched codes and tax incentives. The benefits of early adoption generally far outweigh the long-term costs. It is possible, for example, to substantially reduce source energy consumption with on-site generation, micro-grid development, and other distributed energy methods. Such sustainable measures go well beyond what current regulations and market pressure demand. But buildings that employ these technologies will be able to supply energy efficiently to high-demand tenants well into the future.

Global temperatures, greenhouse gas emissions, and sea levels continue to rise. Developers can exhibit leadership by building to a standard that elevates the sustainable baseline and duly recognizes the scope and urgency of the challenge.

The High-Rise Tower as a Building Block for the Public Realm



Moshe Safdie, Founder, Safdie Architects

Though the skyscraper has been with us for over a century, we are yet to discover how to deploy it as an effective building block for contemporary urbanism. Before the age of towers, we could take for granted that buildings aggregated to create boulevards, streets, squares, and crescents – wholesome places for the public realm. Today, the dominant typology of towers

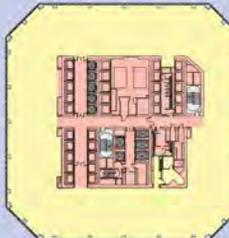
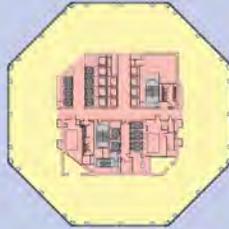
“Developers can exhibit leadership by building to a standard that elevates the sustainable baseline and duly recognizes the scope and urgency of the challenge.”

– Alexander Durst, *The Durst Organization*

One World Trade Center

Rising from the northwest corner of the World Trade Center (WTC) site, One World Trade Center recaptures the New York skyline, reasserts downtown Manhattan's preeminence as a business center, and establishes a new civic icon for the United States. It is a memorable architectural landmark for the city and the nation, connecting seamlessly to its surroundings with entrances on all four elevations and linkages to an extensive underground transportation network.

The tower's spire reaches the symbolic height of 1,776 feet, a nod to the year that the United States declared independence, and is topped with a large revolving beacon. Sited north of the National September 11 Memorial, the tower rises from a cubic base; its



Floor plans – 45, 75 & 90.
© Durst Organization

edges are chamfered back, resulting in a faceted form composed of eight elongated isosceles triangles. At its middle, the tower forms a perfect octagon in plan. It culminates in a glass parapet rotated 45 degrees from the base. A luminous glass curtain wall sheaths the tower on all sides from the first office floor to the observatory. Designers worked with industry experts to develop glass of unprecedented scale, which is capable of withstanding both wind loads at supertall height and stringent security requirements.

CTBUH 2015 New York Conference

Alexander Durst, Chief Development Officer of The Durst Organization will be discussing One World Trade Center in his presentation, "Efficient Energy Production for High Demand Tenants" during Session 1e: New New York Typologies, on Monday, October 26 at 11:15 am.



One World Trade Center, New York.
© SOM/James Ewing

Completion Date: November 2014
Height: 541 m (1,776 ft)
Stories: 94
Area: 325,279 sq m (3,501,274 sq ft)
Primary Function: Office

is still that of a singular, autonomous structure – experienced as a lone sculptural object in the cityscape. Alternatively, and becoming more common, (particularly in Asia) are clusters of mixed-use towers atop a podium, predominantly designed as self-contained, introverted, and privatized environments. Planning, zoning, and urban design guidelines have not provided the tools to accommodate and regulate the great inter-dependency of towers in the city, the impact on light and view, nor on each other and their surroundings, let alone getting towers to cluster in a complementary way in the city.

The challenge going forward is to recognize that towers are highly interdependent and require new planning tools to resolve their relationship. Moreover, their impact, as they collide with the ground, with or without podiums, is enormous. Only powerful concepts for how earth meets tower can begin to bring about an urbanism in which the public realm is continuous, truly public, and possesses the appropriate environmental conditions.

In this world of towers, designed as a collective – connecting, bridging, and creating urban places at various levels – opens up a new realm of possibilities for a better functioning and humane city. Tower design would then become considered as part of an assembly of towers, creating a new kind of urban fabric, rather than – as it is too often, a set of competing narcissistic sculptural objects. To be clear, in the traditional city the concepts of the public realm – streets, piazzas, gallerias, agoras, souks, and bazaars – were all formed by incremental, additive, individual structures, each a building block of the whole. This idea was so organically ingrained that it did not take major regulatory controls to achieve. Individual architects accepted that each incremental building activity was part of a whole. Somehow, we must now arrive at urban concepts that can deploy towers in a similar system of additive components of the urban whole.

Our predicament, perhaps skepticism, about the high-rise tower as an antagonistic

contribution to the urban fabric will prevail until we can come up with an equally compelling concept for how to deploy the high-rise tower as a building block for a well-conceived and understood public realm. Clearly, we must reinvent streets and piazzas into something more continuous, more three-dimensional, capable of cohabiting with public transportation and vehicular traffic. I am not speaking of the complex of towers separated by freeways of Le Corbusier's Ville Radieuse, or Hilberseimer's Ideal City, but rather of a more complex new urbanism of clustering high-rise buildings, in a morphologically sustaining and complementary way, considering issues of light, view, and shadow, connecting and bridging between them both at ground and upper levels. A new kind of public realm, in part climate-controlled, in part open, must be conceived as a continuous network, regardless of land parcelization and ownership. Tower design and placement should support, and in turn be sustained, by the surrounding development.

The Economics of Manhattan Skyscrapers



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Jason Barr is an associate professor of economics at Rutgers University, Newark, and the Director of Graduate Studies for the economics department. He received his Bachelor's degree from Cornell University in 1992, and his PhD from Columbia University in 2002. His research interests include urban and real estate economics. In particular, Dr. Barr studies the economic determinants of skyscraper height since the late 19th century. His work has appeared in prominent economics journals, such as the *Journal of Regional Science*, the *Journal of Economic History*, and *Real Estate Economics*, as well as the *CTBUH Journal*. He is the author of the forthcoming book, *Building the Skyline: The Birth and Growth of Manhattan's Skyscrapers*.

The skyline, as a collection of skyscrapers, is inherently an economic phenomenon. The heights, frequencies, locations, and shapes of skyscrapers are driven by the costs and benefits of their construction. Government policies, such as zoning, which are aimed at limiting building densities and locations, also influence the returns to skyscraper developers. The aim of this paper is to investigate the relationship between skyscraper construction and its underlying economics in New York City.

The Economic Theory of Skyscraper Height

In order to better understand the economics of skyscrapers, this section discusses the theory of skyscraper height (Barr 2010). The goal is to describe the key factors that drive skyscraper development and filter out many of the smaller details, in order to understand the market for building height in general.

The theory begins by assuming that a developer owns a lot of land in the city that is suitable for skyscraper construction. The profit from development is determined by several factors. First is the average price of space in the city. The relative income from different types of structures will determine which kind will be built. For this model, without loss of generality, the maintenance, operating, and financing costs are ignored.

For simplicity, assume that a developer has to choose between two kinds of structures: an office or a residential condominium (condo). The developer observes the average per-square-foot selling price of new condos, compares it to the average rents being paid for new office buildings, and makes a decision about which one will generate a greater income. For condos, the income comes directly from the sales of residential units. For offices, the income can come from the discounted flow of office rents, or from the sale of the building after completion.

Next, the developer has to consider how tall to build. To answer this question, one must consider three key variables. First is the base price. Second is the height premium; that is, the amount by which income rises with building height. In general, across structure types, height consumers are willing to pay

more to occupy the higher floors. While no research has studied the specific reasons for this, one would assume that the height premium is driven first by the better views and the lower street noise, and second, by the social status it confers upon those who occupy space above the majority of the tenants. Being on a higher floor signals that one has more resources to pay for the right, and thus will occupy a more favorable location in the social or economic hierarchy. This height premium is based on the assumption that elevators are able to deliver people rapidly and comfortably to the upper floors.

The third variable is the construction cost. For simplicity, assume that building costs rise at an increasing rate with the density of the building (the number of floors per hectare, for example). That is to say, if a builder has a smaller lot, then building taller will mean that more of the structure will be taken up by elevator shafts, and the narrowness of the structure will require a greater proportion of costs devoted to wind bracing (Ali & Moon 2007). If the developer has a large lot, then it can be assumed that construction costs per floor per square meter are not as great, because the developer has increased flexibility by designing a more efficient space.

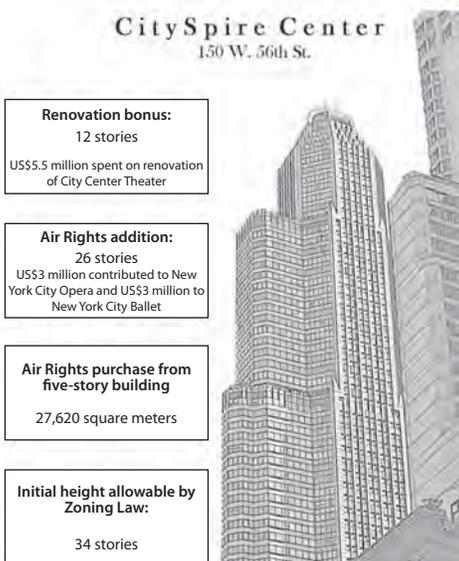


Figure 1. The CitySpire Center (1989), at 75 stories, was able to rise taller than the zoning law allowed because of the purchase of air rights and the provision of neighborhood amenities. Source: Scardino (1986).

CTBUH 2015
New York Conference

Prof. Jason Barr is the recipient of the CTBUH 2015 Research Seed Funding Award, sponsored in 2015 by Sun Hung Kai Properties for his anticipated research project entitled, **"Skyscrapers and Skylines: The Case of China."**

He is also a poster presenter on the subject of **"The Economics of Skyscraper Construction in Manhattan"** which can be seen on exhibit in the main ballroom foyer during the conference.

The costs of the structure are determined by several factors. First is the cost of materials and labor. As these rise, a builder is less likely to add height to the structure. Second is the time to build, which in New York can be quite long. Time to build includes the time needed to acquire lots and air rights; to get zoning and other regulatory permissions; to plan the project (such as creating the architectural and engineering designs); to establish the supply chain; and finally, to acquire financing and secure early tenants.

But costs are also impacted by technological change, which can improve the efficiency of the construction process and building design. In some sense, the costs of time, materials, and labor are “competing” against the technological changes. That is, technological innovation can lower the time and costs of building, but other forces are at work to increase them, such as rising wages and increased regulatory burdens. As discussed below, the net effect of the two in New York seem to balance each other, though materials and wage costs have risen faster than savings from construction innovations. This is not likely to be the case in other countries, such as China, where material and labor costs are significantly lower and regulatory hurdles are less, all else equal.

Zoning

In the absence of any zoning restrictions, the developer would then choose a height such that at the last floor, the additional or marginal revenue from it would just be equal to the additional or marginal cost of constructing that floor. In other words, the chosen building height is the one at which the income from the highest floor just equals the cost of providing it. All else equal, the height of the structure will be taller as the base price rises, the height premium is greater, and the lot size is larger. The height of the building will fall as costs increase.

New York City zoning regulations, however, limit the bulk of the structure by capping the Floor Area Ratio (FAR), which is the total usable floor area divided by the lot size. For commercial buildings in downtown or

“By transferring development (“air”) rights, the total block density is fixed by the FAR caps, but the distribution of the FAR is established by market transactions.”

midtown, the base FAR is 15; for residential buildings in Manhattan it can be high as 10. As-of-right FAR bonuses of 20% are allowed in the densest districts if the builder provides a plaza or other specified public amenity (NYC Planning 2011).

As an example, let’s say a developer has a lot of 2,000 square meters, and is in a FAR district of 15. The developer can choose to construct a 15-story structure, where each floor is 2,000 square meters; a 30-story structure, where each floor area is 1,000 square meters; or a 60-story structure with a 500 square-meter footprint. In other words, the developer can choose a short and bulky structure or a narrow and tall one, or something in between. The decision about how to allocate the floor area will be based on the underlying costs and benefits of doing so.

If the profit-maximizing height, as described above, produces a building density that is greater than the FAR limit, the developer must reduce the bulk to be in conformity with the law. If we assume that developer is going to build a glass box-type structure with the same floor area for each story, then the problem boils down to choosing the building footprint size. The building height (number of floors) is then derived from the footprint size (in square meters) times the FAR. On average, building height will be positively related to the FAR limit.

The Air Rights Market

Under New York zoning rules, if a landlord owns an older structure that has a lower FAR than the law allows, that owner can sell the difference between the maximum FAR and the building’s actual FAR to owners of adjacent lots. The idea is that by transferring development (“air”) rights, the total block density is fixed by the FAR caps,

but the distribution of the FAR is established by market transactions. In addition, specific landmarked districts allow for the sale of air rights from older, landmarked buildings to provide income for preservation (NYC Planning 2015). In this case, a developer can purchase more floor area for the structure; this is tantamount to raising the FAR limit imposed by the city, which will then generate a taller structure, since building height is positively related to the FAR limit.

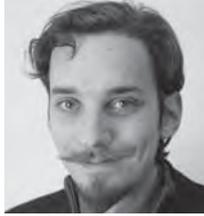
Figure 1 illustrates a case with the CitySpire Center (1989), at 150 West 56th Street in Manhattan. The developer acquired a plot of 2,250 square meters, and the maximum FAR was 15. The underlying economics would have meant that a 34-story building would be constructed. However, the developer, Ian Bruce Eichner, was able to acquire more floor area through two mechanisms. First was the purchase of air rights from a neighboring property (which gave the equivalent an additional FAR of about 12). Second, by providing several amenity bonuses, the developer was able to acquire more floor area by helping to improve nearby public institutions. In the end, the structure was able to rise 75 stories, and has an FAR of 29.

In summary, the theory predicts the following results. First, the type of structure will be determined by the relative income from different kinds of buildings at a particular location. Second, the height of the structure will be determined by the average price of space, the size of the height premium, and the costs and time of construction. Third, zoning rules will influence height; the greater the FAR cap, the taller the building. Fourth, air rights will influence height; when air rights are more abundant and/or relatively inexpensive,

Reinventing Woolworth: Adaptive Reuse of a Historic Skyscraper



Gary Steficek



Petr Vancura

This article presents a case study of structural and logistical issues involved in the adaptive reuse of an early 20th-century skyscraper, and outlines the case for achieving sustainability through such repurposing. Through skillful structural design, the redevelopment of the Woolworth Building serves as a case study of successfully repositioning an underutilized 1913 office tower to serve a new market – luxury residential. The Woolworth Building’s historic context, existing structural systems, and scope of the residential conversion are described, while particular technical concerns are explained.

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Petr Vancura

Petr Vancura is Director of Communications at GMS. Vancura’s experience includes construction engineering/management, real estate development, and urban planning. His current professional affiliations include National Institute of Building Sciences, Urban Land Institute, and American Planning Association.

Introduction

Downtown Manhattan’s iconic 1913 Woolworth Building (see Figure 1) has seen multiple iterations of structural design and redesign over 17 years. These actions facilitated the conversion of a tower once tightly packed with office spaces for dentists and barbershops, into spacious luxury homes. The former “Cathedral of Commerce” will be home to some of the most luxurious in the city, including a six-story, US\$110 million “Castle in the Sky” penthouse. Construction methods were designed around 100-year-old documents; modern structural systems interact with historic riveted framing and structural terracotta. This redevelopment project was governed by strict landmark preservation guidelines and provided opportunities to enhance the building’s historical value through new construction.

History

The Woolworth Building, an innovative and elegant early skyscraper, endures today as an iconic form on the New York City skyline. Commissioned by F.W. Woolworth in 1910, the building was designed by architect Cass Gilbert in Neo-Gothic style. Gunvald Aus and Kort Berle engineered the structure. The finished building was an engineering and construction feat of its time: 241 meters tall, 57 floors, 91 million kilograms total weight, 6 hectares of floor area, 5,000 exterior windows, 21,772 metric tons of steel, 17 million bricks, and 6,804 metric tons of terracotta. The construction cost US\$13.5 million at the time (almost US\$325 million in 2015 dollars). It remained the tallest building in the world until 1930.

The building’s terracotta façade started having problems immediately after completion, and was restored between 1977 and 1981 by the Ehrenkrantz Group, during which much of the ornate exterior terracotta cladding was replaced with concrete cast-stone panels, and Gothic ornaments were simplified or removed. More than 80% of the original terracotta still remains on the building. The Woolworth Company sold the building to the Witkoff Group in 1998, and Alchemy Properties purchased the top 30 floors in 2012.

“The floor is framed within the depth of the terracotta flat tile arch. In this situation, not only the penetration location gets removed from the slab, but also the entire swath of area around the new framing, spanning from beam to beam, because the floor shape is an arch and would otherwise not support itself if only a segment were left intact.”

CTBUH 2015
New York Conference

The Woolworth Building’s renovation will be the focus of a conference technical tour led by Alchemy Properties on Wednesday, October 28.

Project Scope

Residential conversion

The fundamental objective of the project is to renovate and convert the upper 30-story “tower” portion to luxury condominium apartments, without disrupting ongoing office use of the lower 28 floors, which will continue to be occupied throughout the reconstruction (see Figure 2). The structure and proportions of the historic building lend themselves to an attractive, traditional apartment layout, yet a number of upgrades to building infrastructure and services, as well as the addition of new amenities are required. An abandoned basement swimming pool will be restored, in addition to the creation of a new wine cellar.

The building’s 3.6-meter typical floor-to-floor heights are sufficient for residential layouts, so changes to floor elevations are not required. In fact, at some locations, the ceiling heights need to be reduced to achieve a more residential aspect ratio for the rooms.

New elevators

Early skyscrapers typically have an overabundance of elevators. At the time the Woolworth Building was designed, elevators were slower. The architecture therefore



Figure 1. The Woolworth Building, New York.
© Marshall Gerometta

provided for 26 smaller cabs and shafts. While the elevators themselves have been upgraded over the past century, the new residential conversion requires larger and higher-speed systems to swiftly connect residences at the top of the building to street level and sub-cellar amenity areas. The original 1913 elevator cars were 2.8 square meters in area, and traveled 3 meters per second; the new residential elevators are 3.7 square meters and will travel up to 5 meters per second. Placement for the new, larger elevator shafts is designed within existing structural constraints. A massive boiler flue, which extends the full height of the building, is combined with an elevator shaft that is no longer used, providing the necessary space for the new shafts. At the ground floor, these elevators will be accessed through a new residential lobby that replaces an existing Park Place storefront. Cass Gilbert’s ornate cruciform lobby remains to serve the building’s office tenants.

MEP systems

Compared to office buildings, residential buildings demand many more slab penetrations spread out irregularly throughout the floor to accommodate individual MEP services for each private residence. At the Woolworth Building, the systems serving the residential portion must also be independent of those that serve the lower office levels. Risers will bring services from street level to the 29th floor through former elevator shafts that are no longer in use. Two new fire water tanks – one of which is a custom-built doughnut shape to be installed just below the top observation deck – will serve the residential tower from the highest floor in the pinnacle.

Depending on the sizes of MEP penetrations and their proximity to other openings, certain portions of the slab need to be reinforced. In buildings where the floor slab is a concrete and metal deck, openings can be simply framed from beneath the slab. However, as is typical of construction circa 1910, the floor is framed within the depth of the terracotta flat tile arch. In this situation, not only the penetration location gets removed from the slab, but also the entire swath of area around the new framing, spanning from beam to beam, because the floor shape is an arch and would

otherwise not support itself if only a segment were left intact. The opening itself is then reformed by a patch of concrete and metal deck. While this does not affect the overall integrity of the building, it was a logistical issue that required planning in advance.

Stair replacement

Even larger portions of terracotta flat-tile arch had to be demolished in order to place a new set of egress stairs. While this work had been done previously, in 2007, as part of a renovation scheme to upgrade office space in the tower, the new residential use demanded that these stairwells be shifted south, away from the elevator, by approximately 1.2 meters to provide sufficient room for a common-area elevator lobby on floors with more than one apartment. The stairs themselves had to be demolished and rebuilt in the new position.

Truncation of existing elevators

Only three elevators serve the top-most office level at the 28th floor. Their shafts, which

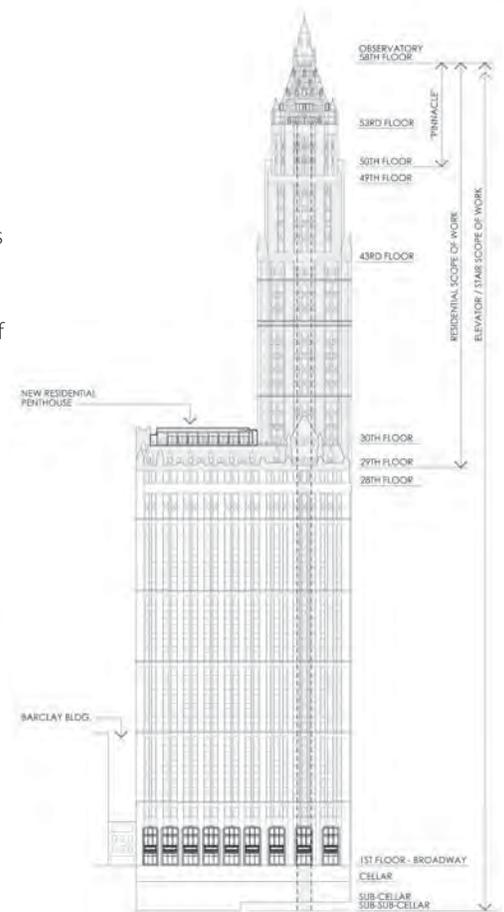


Figure 2. Scope of reconstruction work. © SLCE Architects

Tall Buildings as Extensions Of Urban Infrastructure and Vitality



Peng Du



Zhendong Wang



Elie Gamburg

This paper reviews the 2014 *Network 3D High-Rise Design Studio*, which was undertaken by the College of Architecture and Urban Planning (CAUP), Tongji University, with assistance from the CTBUH and Kohn Pedersen Fox Associates (KPF). The project site is located in Manhattan, New York City, one of the densest urban areas in the world. The studio was intended to explore what the three-dimensionality of cities means for tall buildings and their ability to locate extremely dense development atop major urban infrastructure, while also providing quality public space.

Introduction

As part of its mission, CTBUH connects numerous higher-education institutions around the world with professional expertise in the tall building field. In this case, KPF kindly funded the studio through its “Gold + Design Research Sponsorship Package” at the CTBUH Shanghai 2014 International Conference. Specifically, the studio that took place in the 2014–2015 academic year included a week-long visit by Tongji University students and professors to New York City, which included design workshops at KPF’s headquarters, site studies, tall building tours, etc. This collaborative design studio was intended to explore what the three-dimensionality of cities means for tall buildings and their ability to locate extremely dense development atop major urban infrastructure, while also providing quality public space.

The 3D City in New York

Manhattan is dense in both population and infrastructure (Koolhaas 1997). Density, programmatic variety, and verticality have long been the unspoken manifesto behind New York City’s urban form. At an average density of 26,717 people per square kilometer in 2010 (US Census Bureau 2012, 133), the borough of Manhattan in New York City has long been one of the world’s densest city centers. In terms of its mix of programs, social groups/uses, cultures, and building types/sizes the city has also long been one of the most varied.

CTBUH 2014 Student Design
Research Project Sponsor:

KPF



Figure 1. View from Midtown Manhattan looking south. © Anthony Quintano

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Elie Gamburg is a director at KPF. He has designed projects in US, Asia, Europe, and the Middle East, across a variety of programs, including academic, mixed-use, office, residential, retail, and many more. Gamburg is a graduate of Harvard’s Graduate School of Design, where he was awarded the Kevin V. Kieran Prize for highest academic performance.

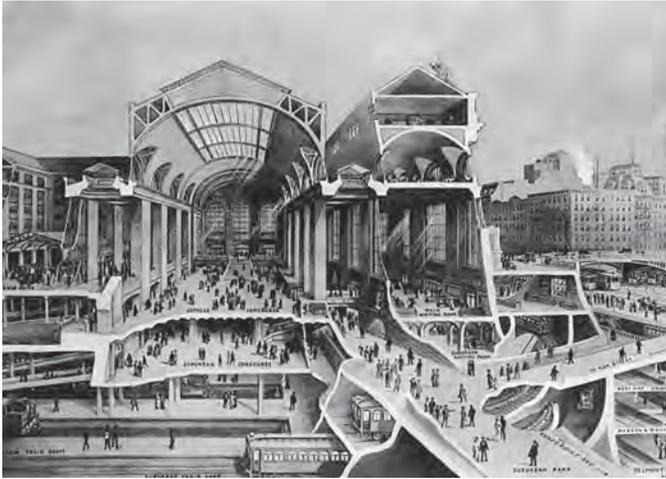


Figure 2. Section rendering of Grand Central Terminal (GCT).
Source: Scientific American, 1912.

Throughout the borough, offices, residences, and hubs of health, education, entertainment, and leisure are connected laterally by one of the world's oldest mass-transit systems, and vertically within some of architecture's earliest experiments in stacked, mixed-use buildings.

Important urban projects such as Rockefeller Center (at a major subway junction), the George Washington Bridge Transport Terminal + Residential Towers (at a bus and subway station), and both the new and original World Trade Center (at the terminus of a rail tunnel to New Jersey). All of these projects consist of a dense, mixed-use program comprising groups of towers atop major transit hubs.

Contemporary projects, such as the Hudson Yards redevelopment (see Case Study on page 12), the largest private development project in American history, Atlantic Yards/ Pacific Park and the AOL-Time Warner Center have continued this paradigm of relating high density, the provision of public space, and a mix of uses to transit hubs.

The objective of the Network 3D Studio was to explore the theme of tall, multifunctional urban projects connected to transit hubs, in order to find alternative design approaches for tall buildings; to create high-rise buildings that are inspired by the cultural, physical, and environmental aspects of place.

The Studio Project

The site

Grand Central Terminal (GCT) is a commuter railroad terminal at 42nd Street and Park Avenue in Midtown Manhattan in New York City. It is the hub of a vast network of connections, funneling 500,000 people per day directly up into a number of New York's grandest skyscrapers, down to a major subway hub, and out to the surrounding streets, which lead to some of the city's most important spaces and structures. At the heart of this network is Grand Central's "Great Hall" – a light-filled central gathering space. Through the skillful manipulation of section and the introduction of natural light through large apertures, the Great Hall appears to lie on street level, with direct connections to the streets beyond – but in reality is located more than a story below grade, directly on the upper track level (see Figure 2).

Recently, New York's Department of City Planning proposed a rezoning of East Midtown, including 73 blocks surrounding GCT. This re-zoning proposal offers an incredible opportunity to address the issues that have existed in GCT and its surrounding neighborhood for decades, such as: overcrowded pedestrian traffic and limited public/green space.

“The students were asked to develop a skyscraper that pushes the boundaries of what it means to build a truly ‘three-dimensional city’ – mixing programs, encouraging high density, and introducing meaningful public space strategically throughout the building.”

The project

The design studio's project was based on a real ongoing project, One Vanderbilt Place, designed by KPF in 2013 and expected to be completed in 2020.¹ One Vanderbilt Place is located at the corner of 42nd Street and Vanderbilt Avenue (see Figure 3). Located at the heart of Midtown Manhattan next to one of the most diverse and crucial networks of public space and transit in the city, One Vanderbilt offers a unique opportunity to truly push vertical urbanism into the third dimension, by introducing meaningful public space into its section, while adapting to the unique challenges of building vertically in an already dense, confined, and historically sensitive site.

The students were asked to develop a skyscraper that pushes the boundaries of what



Figure 3. One Vanderbilt Place, New York – location plan.
© Kohn Pedersen Fox Associates

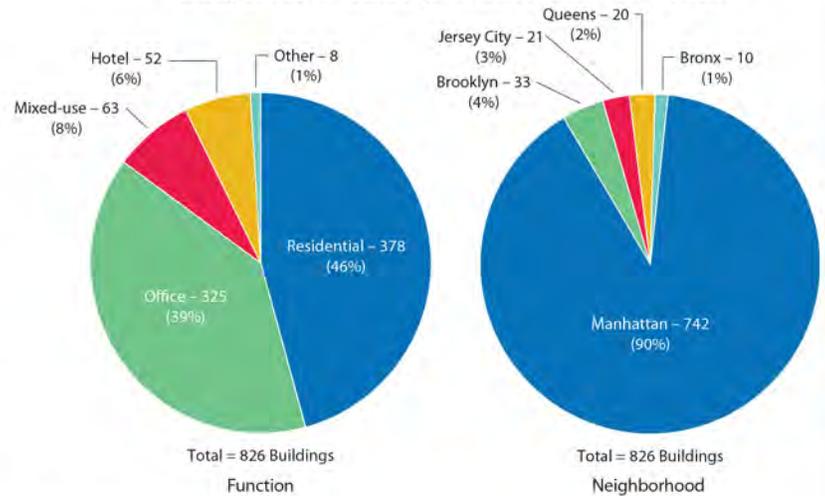
¹ When completed in 2020, One Vanderbilt Place is expected to be a 64-floor (above ground), 158,000-square-meter GFA office skyscraper. The tower will be 461.5 meters high, making it the city's third-tallest building, after One World Trade Center (541.3 meters) and Central Park Tower (541 meters). Source: CTBUH Skyscraper Center.

Tall Buildings in Numbers

New York: The Ultimate Skyscraper Laboratory

A timeline of skyscraper completions in New York uncannily resembles the boom and bust cycles of the United States in the 20th and early 21st centuries. The most active year was 1931, when the final excesses of the Roaring '20s were thrown skywards and frozen in concrete and steel. The scarcity of building materials clearly had their effects in the flat World War II period. The rise of multinational corporations may explain the relative surge in skyscraper construction in the 1970s, even as New York City itself endured its darkest financial hours. Then come the wild "Wall Street" years of the 1980s, followed by the lagged effect of the early 1990s slump. The singular event of 9/11 did not have nearly the dampening effect on skyscraper construction, compared to the financial crisis of 2008-9. The current boom demonstrates New York's persistence as a magnet for capital, and its standing as the ultimate skyscraper laboratory over time.

Study of 100 m+ buildings³ in the New York City region⁴

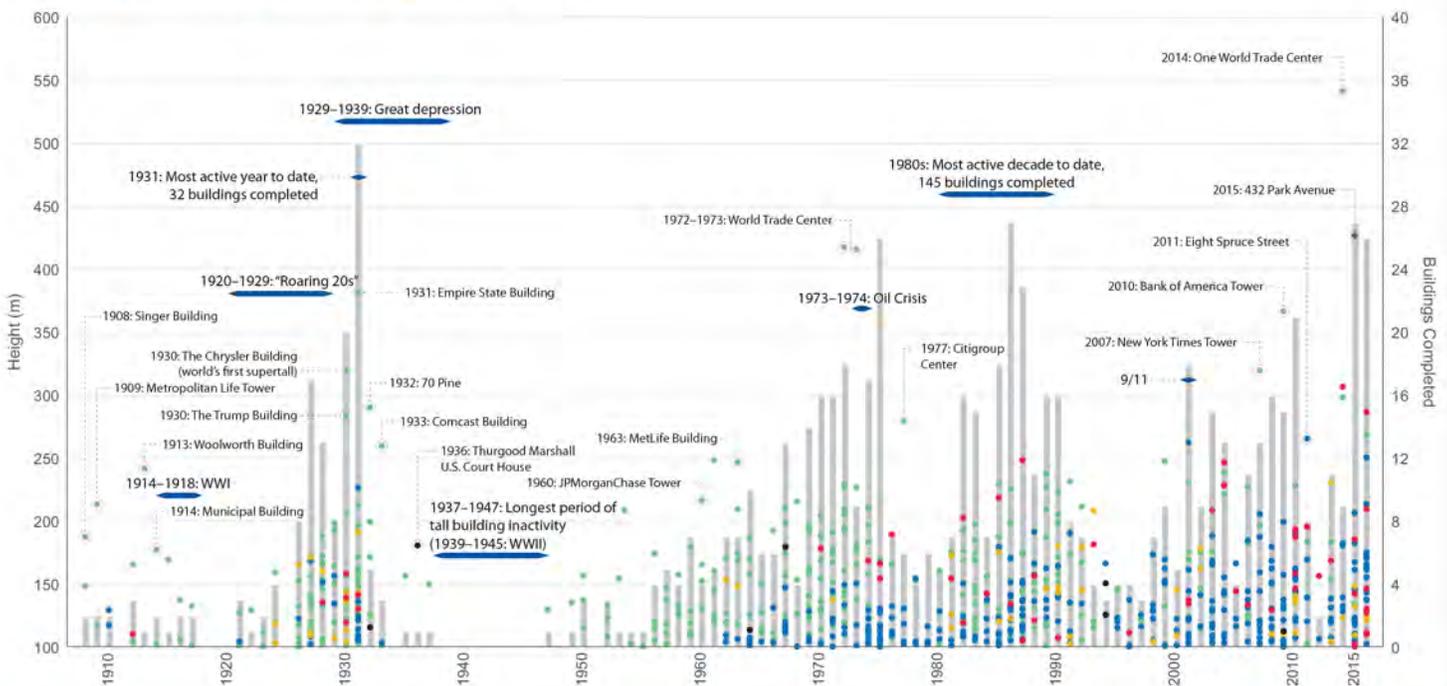


Timeline of Tall Building Completions over 100 Meters in the New York City Region⁴

Bars represent the total number of buildings completed each year. Dots represent a specific building and its height and function.

Note: chart begins in 1908 with the completion of the Singer Building, the world's tallest building at the time

● Office ● Residential ● Mixed-Use ● Hotel ● Other



Prior to the completion of One57 in 2014, there were only four supertalls in New York City and none along 57th Street. Currently, there are 4 supertalls planned for completion by 2019 along 57th street alone.



Skyline elevation of 57th Street, looking North. All supertalls are highlighted.

Although it was the world's tallest building for 41 years, from 1931-1972, there are now seven buildings in New York City that are complete, under construction, or proposed that will surpass the Empire State Building in height.

Along with the 64-story tower, One Vanderbilt Place will include improvements to Grand Central Terminal, including extra capacity for 65,000 passengers and a commuter waiting room.

Tall Building Locations in New York City

The recent skyscraper boom has been characterized by an increase in luxury residential construction, an increase in slenderness aspect ratios, and substantial construction in new locations away from Lower and Midtown Manhattan, in areas once considered “fringe,” such as Brooklyn, Queens and Jersey City. The research below examines the function and location of tall buildings over 100 meters, recently completed or under construction,³ in the New York City region⁴, with supertall buildings represented by larger dots.

VIA 57 WEST (142 m), planned for completion in 2015, is a housing project designed as a hybrid between the European perimeter block and a traditional Manhattan high-rise, with a courtyard allowing views towards the Hudson River.

When construction of **111 West 57th Street** (438 m) completes in 2018, it will challenge the boundaries of engineering with a width-to-height ratio of almost 1:25, using 15,000 PSI concrete and a pendulum damper to achieve this feat.

Upon completion in 2015, **432 Park Avenue** (426 m) will become the world's tallest residential skyscraper, surpassing the Princess Tower in Dubai, which currently stands at 413 m tall.

In 2009, the **Bank of America Tower** (366 m) became the first LEED Platinum-rated skyscraper. It was recognized as the CTBUH Best Tall Building Americas Winner in 2010.

53 West 53rd (320 m), also known as the MoMA Tower, uses an exposed, diagrid structural system and angular facets to create a unique silhouette on the New York City skyline.

Upon completion in 2019, **30 Hudson Yards** (387 m) will anchor the Hudson Yards development, touted as the largest private real estate development in United States history. But unlike most buildings in the complex, this particular tower will be devoted primarily to office space.

Although the developer has yet to release final design plans, **Central Park Tower** is expected to become the tallest residential tower and house the tallest occupied floor in North America, upon its completion in 2019.

Described by the architect as “houses stacked in the sky”, **56 Leonard Street** (250 m) will use cantilevered floor slabs to allow window walls over four meters and private outdoor balconies, upon completion in 2016.

Upon completion in 2011, **Eight Spruce Street** (265 m) was the tallest residential building in North America and was recognized as the CTBUH Best Tall Building Americas Winner in the same year.

Upon opening in 2020, **2 World Trade Center** (403 m) will be built with 7 volumes, of various size and depths, stacked on top of each other to accommodate the building's unique program.

New York's **One World Trade Center** (541 m), became North America's tallest building when it completed in 2014, surpassing Chicago's Willis Tower by 99 meters. It was recognized as the CTBUH Best Tall Building Americas Winner in 2015.

New York City Region⁴ Totals

Total Population:⁵ **8,421,602**
 Total Land Area:⁵ **822.1 km²**
 Population Density:⁵ **10,243.5 people/km²**

Building Totals:

Total 100 m+ buildings:³ **826**
 Tallest building height: **541.3 m (One World Trade Center)**
 Average height of 100 m+ buildings: **145.7 m**

Key:

● 300m+	● Office	● Residential
● 100m - 300m	● Mixed-Use	● Hotel

Footnotes

1. The focus on buildings over 100 meters is driven by the need to ensure accuracy of data, rather than suggesting that this is the threshold for a tall building.
2. All tall building data is from the CTBUH Skyscraper Center as of August 2015.
3. Graphics and statistics only include buildings complete or under construction, at the time of research (August 2015).
4. All references to the “New York City region” includes all five boroughs – Brooklyn, Queens, Manhattan, the Bronx, and Staten Island, as well as Jersey City.
5. All population data and land mass data is taken from the United States Census Bureau, 2010 Census.

Gaining Momentum at Hudson Yards



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Interviewee

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Jay Cross

Jay Cross is President of Related Hudson Yards, leading the financing, planning, and construction efforts of the 11.3-hectare Hudson Yards development on the west side of Manhattan. Cross has over 30 years of diversified real estate and business experience and has conceptualized and executed on some of the most high profile and impactful development projects in the United States, United Kingdom, and Canada. Cross has expertise across all aspects of real estate development, having begun his career at both contracting and architectural firms and held senior executive positions at real-estate development and investment companies, public entities and sports franchises with large-scale, complex urban development challenges. Cross holds a Bachelor's degree in Nuclear Engineering from the University of Toronto and a Master's degree in Architectural Technology from Columbia University.

On the cover of this issue, and on the Technical Tour agenda of the 2015 New York Conference, Hudson Yards is the largest private real estate development ever undertaken in the United States (see case study, page 12 for more details). The site, built over a working rail yard, will eventually hold more than 1.57 million square meters of commercial and residential space, with five office towers, public space, retail, a school, and 5,000 residential units. CTBUH Journal Editor Daniel Safarik spoke to Jay Cross, President of Hudson Yards, a joint venture between the Related Companies and Oxford Properties, to get a better sense of the developers' perspective on this massive project.

As the leader of the biggest real estate development in the United States, how are you feeling about progress right now?

I think we're generally thrilled with the progress. We have six buildings under construction in various stages. The infrastructure is well along, with the platform being built up above the railroad track. The leasing has been really outstanding. We think we have set a high water mark for leasing a big project in New York City. We haven't come to market yet with the residential offering, but we will be coming to market in the summer of 2016 with the first two residential towers. So I think everything is coming together as well as we could possibly have hoped. The concept of mixed use, which allows us to bring multiple buildings to market simultaneously that don't compete with each other, is really proving to be to be a great opportunity to all, while allowing us to complete as much as possible.

How close is the Hudson Yards of today to what was originally planned?

We're developing the Eastern Rail Yards (ERY) pretty much 100% in conformance with the 2005 zoning that had been done to support the Olympic bid. While it took a long time, bear in mind we are talking about not just our swath of land, but 40.4 hectares of land and 3.7 million square meters of floor space. Post-Olympics, the MTA [Metropolitan Transportation Authority] realized that a lot of value had been created. So they extended the Number 7 subway line and began an RFP process, out of which we were selected in the spring of 2008.

CTBUH 2015 New York Conference

Hudson Yards, Related and Oxford Properties are Diamond Sponsors of the conference and will be hosting the **Conference Closing Reception** at the Time Warner Center on Tuesday, Oct. 27 at 6:00 pm



Figure 1. Hudson Yards – view from 30th Street High Line, July 2015. © Jim Henderson



Figure 2. Hudson Yards viewed from its namesake river, September 2015. © Royce Douglas

From that moment, with a rudimentary master plan for half of the yards, we have made remarkable speed. Seven years later, to have roughly 650,320 square meters under construction, the deck over the yards 60% complete (see Figures 1 and 2), and to have more than 371,612 square meters of office space bought or leased – that’s moving very quickly. So now, we have got a lot of momentum. Opening the Number 7 subway will boost that momentum. So hopefully, we’ve got a tail wind at our back at this point.

The two halves of the development have quite different characteristics. Under construction now, you have the largely commercial ERY with a public space in the middle, and the largely residential Western Rail Yards (WRY) (see site plan on page 15, Figure 6). How are the two envisioned to interact, and, upon opening ERY first, how will the continuing construction on the WRY be accounted for in managing occupant expectations?

It’s very important to our master plan and development thesis that we develop the maximum amount of residential that the zoning will allow. But in order to get going, you want to do all your commercial development first. If you build 280,000 square meters of commercial, that’s one to three buildings that opens with three anchor tenants. If you build the same amount of residential, you have to feel confident you can bring 3,000 units to market at one time. That is very difficult.

The commercial calculus gives us density and gets the project off the ground. The next thing to deliver is the retail, because the commercial and residential tenants want to know they are moving into a full-amenity development. So, we focused initially on commercial, which by definition means the ERY. We then put the retail in the ERY as part of that commercial trust, to be able to demonstrate to both commercial and residential occupiers that they will have retail to support them. We signed Neiman Marcus about a year ago, and are now leasing out the balance of the retail center.

Next summer, we go to residential. On the ERY it’s two buildings and roughly 400 units coming to market first. That will not overwhelm the

residential market, but it will set the stage for the WRY. At the same time, it will complete a very important entourage of buildings on the ERY. So you’ve got three office buildings, the retail center, the Culture Shed, two residential buildings, and a hotel. So even within itself, you’ve got 650,000-plus square meters of development. Anyone who lives or works there won’t experience it as a construction site. The subway is on the north side, and the High Line is on the south. Everything is connected and done.

Eleventh Avenue separates the two halves. Keep in mind that it is a six-lane viaduct. We are going to beautify it with additional landscaping, but it is a wide street. So when we are building the WRY, we are pretty far away. In the context of New York, where there are construction cranes all over the place, cheek by jowl with existing buildings, I don’t think people are going to find the construction of the WRY to be particularly distracting.

It’s also worth pointing out that we plan to start the WRY as soon as 2017, so by the time ERY opens, a large amount of the infrastructure work on the WRY will have been done, and so it will be a question of building residential buildings one at a time, as quickly as the market will allow us to deliver them.

It would have been more of an issue to have everything still under construction on the Eastern half while tenants were moving in. As it is, the first tenants moving into 10 Hudson Yards (see Figure 3), the first building that will open, know that they are going to have, from late 2016, a good year and a half of construction around them. But in compensation for that they get a good “early bird” deal on the rent, and they are excited to be there.

We’ve been preparing tenants for what they will experience. It is part of every presentation and written into the leases themselves. Everybody is depending on everybody else. So from our point of view, we are keeping all the balls in the air, and they are all going to land simultaneously.

You have a new investment partner in Mitsui Fudosan of Japan, which has taken a stake in 55 Hudson Yards. Was it always part of the plan to have partners other than Related and Oxford, or did something change?

It’s very consistent with our plan. Initially, before the financial crisis, the plan was to raise all of the equity in one US\$2 billion fund. Then we would have our equity to build the infrastructure, and from the equity in each building, move forward.

Then the recession hit, and to get the first building going, we went to some more unorthodox financing schemes. We went to certain kinds of investors and lenders for the first building, and we got what we thought was a very effective combination of long-term investors, short-term investors and short-term lenders. We realized then that, that’s the way to do it. For each building there is kind of a unique grouping of investors and lenders that does not necessarily apply to any other building.

Our game plan has always been that Oxford and Related would fund the basic infrastructure on our own with no partners, and then, each building would be financed by the most optimal combination of financing available at the time. Every building has been financed differently and separately, and we don’t have



Figure 3. 10 Hudson Yards nearly tops out. Photo taken on September 18, 2015. © Royce Douglas

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,"



Council on Tall Buildings and Urban Habitat

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