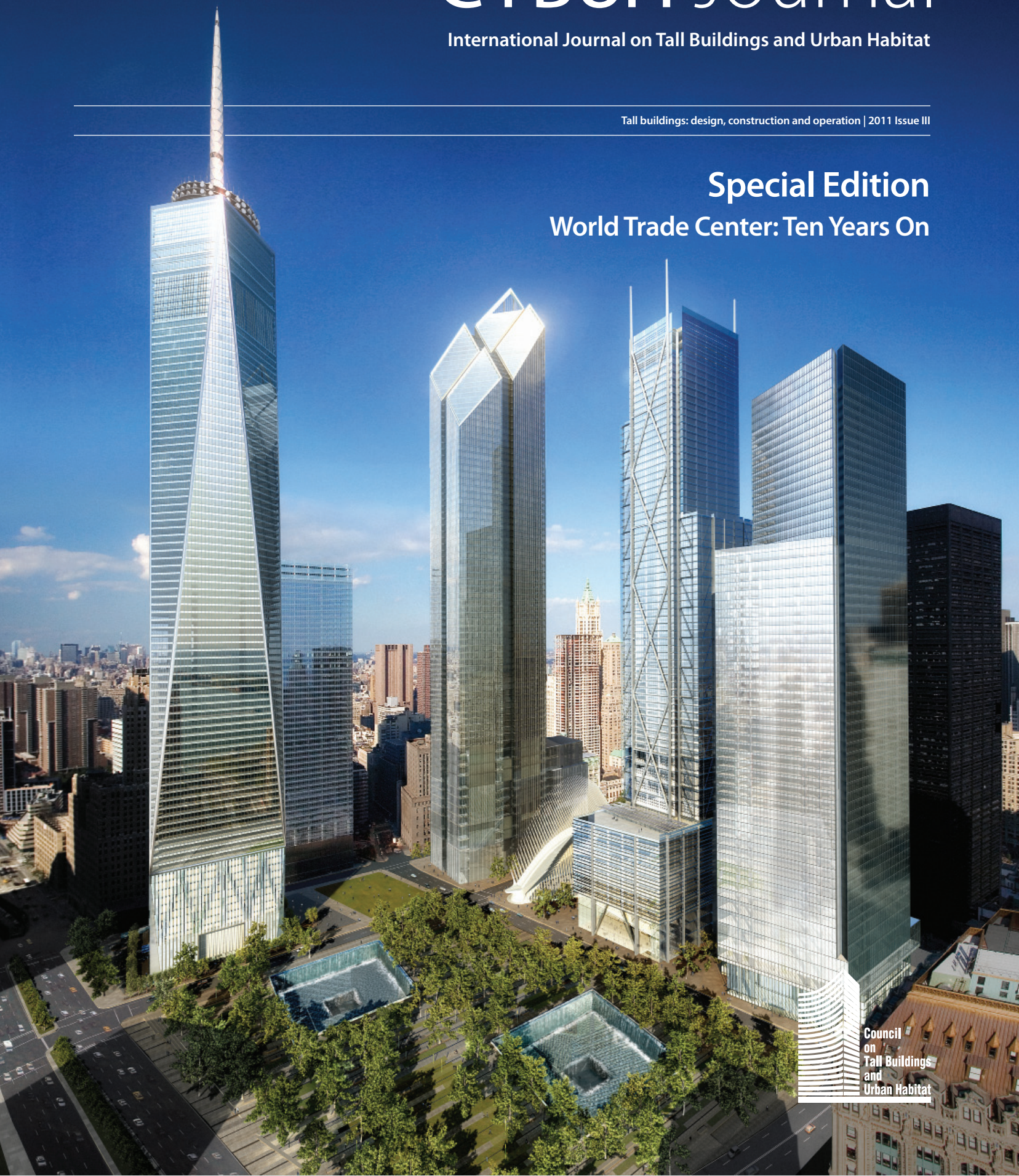
# CTBUH Journal

International Journal on Tall Buildings and Urban Habitat

Tall buildings: design, construction and operation | 2011 Issue III

## Special Edition

## World Trade Center: Ten Years On



Council on Tall Buildings and Urban Habitat

# This Issue



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Council on Tall Buildings and Urban Habitat
S.R. Crown Hall, Illinois Institute of Technology
3360 South State Street, Chicago, IL 60616

t: +1 312 567 3487
f: +1 312 567 3820
e: info@ctbuh.org
www.ctbuh.org



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*Front cover: World Trade Center site © Silverstein Properties/ dbox studio*
*Back Cover: World Trade Center site under construction © Jan Klerks*

Buildings are the backdrop in front of which we live our lives. They are markers of both place and time. They are also storage vessels into which we place tremendous amounts of energy, resources, and memories. Throughout the construction process, there are a few watermark events that we celebrate. We gather to break the ground, perhaps set the corner stone, commemorate topping-out of the structure, and celebrate the grand opening. In these moments, we wish the project good fortune, mark our achievements, and reflect on the successes of our combined efforts.

Frank Woolworth celebrated the grand opening of his Woolworth Tower in 1913 with a banquet. The commemorative book he published included a copy of the speeches given that night. During his own speech, he recalls asking how many floors were in his building. When nobody could give him a definitive answer, Mr. Woolworth climbed the stairs all the way to the top of his building so he could count the floors for himself. His building was, after all, the world's tallest building and he thought it only proper to know exactly how many floors it contained.

Another great celebration was the grand opening of the Empire State Building on May 1, 1931. Dignitaries and New York socialites turned out for the event. Grandchildren of former Governor Al Smith had the honor of cutting the ribbon and the show-stopper came when President Herbert Hoover – with the push of a button from his desk at the White House – turned on the building's lights. It was a triumphant day for American construction works too. When the project broke ground on January 22, 1930, Wall Street was still reeling from the Black Tuesday crash three months earlier. Despite a faltering global economy and growing Great Depression at home, they had built the world's tallest building in only 410 days.

Forty two years later, in the fall of 1972, One World Trade Center (WTC) officially surpassed the Empire State Building in height. The official ribbon cutting ceremony for the project followed on April 4, 1973 and commemorated the end of a process dating back to the mid-1940s. At a time when most developers in Manhattan were focused on Midtown, the WTC created a powerful economic stimulus to Lower Manhattan and further encouraged renewal of the surrounding urban areas.

The tragic events of September 11, 2001 were a painful reminder of just how much kinetic energy and human spirit we invest in the many little acts of designing, constructing, and occupying a building. It was deeply humbling for me to see that energy released back into the universe.

My comfort over the past few years has been watching the recovery and reconstruction effort: seeing energy and human spirit reinvested. I can see the WTC site from my office window now. Each day I witness construction progressing as another slab emerges or the curtain wall surrounds another floor. When I walk to lunch, I pass trucks carrying an assortment of building materials. On sunny days, I enjoy eating lunch in Zuccotti Park. There, I hear construction workers talking about the day's work or how the Yankees fared in yesterday's game. Life in New York carries on.

This year marks the 10th anniversary of the WTC disaster. We will pause once again to remember those lost and honor the efforts of so many, this time with gleaming new construction as the backdrop. While this edition of the Journal is devoted to the after effects of 9/11, we do not intend it as a retrospective or a memorial. Instead, we choose to focus on the progress being made to reconstruct the WTC site and surrounding areas, and view the impact of the event on disciplines around the world. We look forward to the WTC topping-out ceremonies and grand openings that mark the achievements of our industry toward rebuilding the WTC site and revitalizing Lower Manhattan.

Best Regards,

Charles Killebrew, *CTBUH Trustee*

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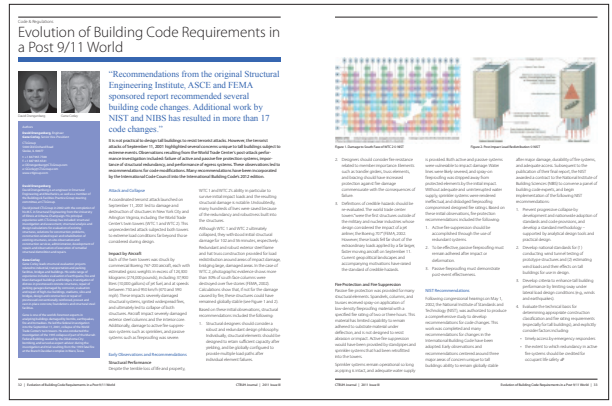

Evolution of Building Code Requirements in a Post 9/11 World

"Recommendations from the original Structural Engineering Institute, ASCE and FEMA sponsored report recommended several building code changes. Additional work by NIST and NIBS has resulted in more than 17 code changes."

"The WTC showed that we lack an adequate definition of competence… What we truly need is to legislate competence, not standardized solutions."

Jose Torero, page 36

# Global News

*The CTBUH Global News is an online resource and archive for all the latest news on tall buildings, urban development and sustainable construction from around the world. For comprehensive industry news, visit the Global News at:* ***http://news.ctbuh.org***

Empire State Building, New York © Jan Klerks

Conde Nast moving out from 4 Times Sq. © Tansri Muliani

Metropolitan Life Tower, New York © Marshall Gerometta

## New York City

Before we delve into the past, present, and future of New York, we would like to begin this overview of the Global News by wishing the **Empire State Building** a happy birthday! The 381-meter (1,250-foot) tall landmark in Midtown Manhattan turned 80 years old on May 1. With a recently completed green retrofit (see *Journal 2010 Issue III: Talking Tall*), which now makes the "grand dame" of skyscrapers New York's largest commercial purchaser of 100% renewable energy, the tower seems to have many good years ahead of her.

Down the road in downtown Manhattan, **One World Trade Center** has signed its first anchor tenant. New York based publishing giant Condé Nast agreed to move into 93,000 square meters (1 million square feet) of leased space, occupying floors 20 through 41. The Midtown based company is now the largest single tenant to be brought into Lower Manhattan in years. The deal, which involves almost 40% of the total office space available in the tower, is considered to be a catalyst for the development of the World Trade Center area. Also, the Port Authority of New York and New Jersey announced that there will not be a restaurant at the top of One World Trade Center – a change from the previous Trade Center which featured Windows on the World at the 106th and 107th floors of the North Tower. After careful evaluation, the Port Authority have decided that a restaurant is not the best and most practical use for the space. A public observatory will be developed as planned.

**...dignity**

> "The World Trade Center should, because of its importance, become a representation of man's belief in humanity, his need for individual dignity, his beliefs in the cooperation of men, and through cooperation, his ability to find greatness."
>
> *Minoru Yamasaki, the lead architect for the former World Trade Center describing his vision for the project. Remarks at opening ceremonies and dedication April 4, 1973.*

Another New York City landmark made the news recently, as clothing designer Tommy Hilfiger announced his plans to convert the 213-meter (700-foot) tall **Metropolitan Life Tower** at Madison Square Park into a luxury design hotel. The 102-year-old building, which was recently bought by Hilfiger for US$170 million, was planned to be converted into condominiums several years ago after ownership changed hands multiple times. Because of the economic recession and the strong development of the hotel sector around Madison Square, the 50-story tower, which is modeled after St. Mark's Campanile in Venice, will now be welcoming fashion-minded tourists in the near future. By attaching his name to a chain of hotels, Mr. Hilfiger is following in the footsteps of fellow designer Giorgio Armani, who opened the Armani Hotel in Dubai's Burj Khalifa in 2010.

Continuing with the topic of hotels, European based hotel group Yotel will soon open a 669-room hotel on 27 floors of the **1 MiMA Tower** (Middle of Manhattan), a 63-story glass building designed by Architectonica nearing

1 MiMa Tower, New York © Marshall Gerometta

completion west of Times Square. The hotel is a good example of combining height with density through smart design. Yotel is already known for the compact rooms it offers at airports in London and Amsterdam, reminiscent of a yacht cabin, or even the sleeping capsules found in Japan. Now it is taking the concept of compactness, combined with lofty looking design with a lounge atmosphere, to the "Big Apple." The hotel rooms feature a retractable queen-sized bed, a mini-workstation, and a bathroom with a monsoon shower, all in a 16-square meter (170-square foot) size space. 1 MiMA Tower also contains 151 condo units.

## Dubai's Supertall Neighborhood

Many may think that construction in Dubai is on the decline because of a tanking real estate market, but projects are still getting delivered in the Gulf State. The completion of supertall residential towers in Dubai Marina is an exciting process to witness, especially when you're into tall numbers. At 348 meters (1,142 feet) and 86 floors, **The Torch** became the world's tallest residential tower in April, surpassing the 323-meter (1,058-foot) tall Q1 Tower in Australia's Surfers Paradise for the title. The developer, UK-based Select Group, claims that more than 80% of the 676 apartments have buyers and were sold starting from close to US$3,000 per square meter (US$275 per square foot). **23 Marina** (389 meters/1,276 feet) is scheduled to become the next world's tallest residential tower, with the first residents scheduled to move in this August. By the end of the year, the Torch is expected to be exceeded in height by the nearby **Elite Residence** (381 meters/1,250 feet). **The Princess Tower** (414 meters/1,358 feet) is expected to take the title in January of 2012. If this was not confusing enough, eventually **Pentominium**, set at 516 meters (1,692 feet) high, and also located in the Dubai Marina, is scheduled to become the world's tallest residential building in 2014.

While on the topic of Dubai highlights, we would like to report that our friend French Spiderman **Alain Robert** faced his ultimate challenge by climbing **Burj Khalifa** on March 28. It took Robert little more than six hours to climb to the top of the 828-meter (2,717-foot) tall landmark. Most of the climbing was done during the dark evening hours because of the high temperatures during the day. The climb was to inspire over two thousand students who attended the opening ceremony of the 10th annual conference of "Education Without Borders" Conference. Being a pre-approved climb, Robert had to partially use a safety harness. Knowing Robert, we are guessing he will be back one day to do it again without one.

## China

In this day and age, no Global News report would be complete without an overview of the latest developments in China. So "buckle up" as we run through the latest synopsis of more record breaking numbers.

Located in the top section of **Hong Kong**'s tallest building, the 484-meter (1,588-foot) tall **International Commerce Centre**, the Ritz-Carlton Hong Kong opened on March 29, claiming the title of "world's highest hotel" as well as the world's highest swimming pool. The five-star hotel has 312 rooms and is located on floors numbered 102 to 118 of the supertall building. Even though the Chinese floor counting system leaves out some unlucky numbers as floor numbers, the hotel can indeed make some claim to fame, in addition to having some of the best panoramic views of the city. However, contrary to titles related to being the tallest building, as of yet there is no official CTBUH ruling on how the highest function should be determined. Whatever the ruling is, it will not alter the fact that this hotel has the "highest lowest" floor (if you know what we mean) and the highest hotel room.

Dubai Marina, Dubai © SkyscraperCity

# Case Study: One World Trade Center, New York

Kenneth Lewis

Nicholas Holt


Authors

Kenneth Lewis, Managing Director
Nicholas Holt, Technical Director

Skidmore, Owings & Merrill LLP
14 Wall Street
New York, NY 10005

t: +1 212 298 9300
f: +1 212 298 9500
e: somnewyork@som.com
www.som.com


Kenneth Lewis

Kenneth Lewis is a Director in SOM's New York office. He joined the firm in 1986 and has served on a diverse range of projects including mixed-use developments, commercial towers, corporate headquarters, and healthcare facilities.

Kenneth began his career at SOM as Senior Designer. He has managed and brought to successful completion several projects of enormous scale, complexity, and visibility, including the award-winning mixed-use Time Warner Center at Columbus Circle in New York and the 7 World Trade Center in Lower Manhattan, and Brookfield Properties' Hudson Yards Competition Entry. He is currently managing One World Trade Center. All of the projects Ken is managing are slated to achieve a Gold rating under the USGBC LEED® CS rating system. He was also closely involved in the development of sustainability design guidelines for the World Trade Center. He is active in the public realm, and his projects have been honored with numerous design awards.

Nicholas Holt

Directing the technical architecture team in SOM's New York office, Nicholas Holt oversees the detailed development and documentation for all of the New York office's projects. Since joining SOM in 1995, he has developed extensive experience working on high-rise and supertall commercial/mixed-use towers, financial trading facilities, health science projects and multi-family residential/hotel towers.

Nicholas is an industry leader in the practical application of Building Information Modeling (BIM) and the associated implementation of new project delivery models aimed at developing projects more efficiently and effectively. Recent examples are 250 West 55th Street, and the Mt. Sinai Center for Science and Medicine, which were among the first major projects in NYC to be designed and documented in a 100% BIM environment.

He also leads the Center for Architecture Science and Ecology (CASE), a research collaboration between SOM and Rensselaer Polytechnic Institute. With a focus on developing new sustainable materials and technologies, CASE blends private sector practicality, academic exploration and scientific rigor to seek emergent technologies and develop them for practical application in buildings.

> "While, in an era of supertall buildings, big numbers are the norm, the numbers at One World Trade are truly staggering. But the real story of One World Trade Center is the innovative solutions sought for the unprecedented challenges faced in building a project of this size on such a difficult site."

**The world knows what happened in Lower Manhattan on September 11, 2001. The twin towers of the World Trade Center and several other buildings were damaged or destroyed, and more than 3,000 people were killed. The ground smoldered for months. Rescue was replaced by recovery, which was followed by eight brutal months of removing thousands of tons of debris from what became known as Ground Zero. What most people do not realize is that reconstruction of the 6.5-hectare (16-acre) site began soon after the cleanup, due to the fact that the initial work began underground and was therefore out of sight.**

Now that buildings are emerging into the light of day, the ambitious redevelopment is clearly visible. One World Trade Center (1WTC), designed by Skidmore, Owings & Merrill, is rising on the northwest corner of the site. The National September 11 Memorial is also under construction and will be completed by the 10th anniversary of the attacks in September 2011. The Port Authority is developing a major transportation hub. Silverstein Properties, the previous developer of 1WTC, is building three additional office towers for the site.

Figure 1. One World Trade Center © SOM/dbox Studio

Even with all of these high-profile projects, 1WTC will dominate the site, not merely as New York City's (and North America's) tallest building, but as an icon representing perseverance, innovation, and urban modernism (see Figure 1). The US$3.2 billion tower, based on a revised 2005 design, now rises from a footprint measuring 61 by 61 meters (200 by 200 feet), set back from the site's northwest corner. Constructed of concrete and steel, the 104-story tower will include a multi-level observation deck and reach 417 meters (1,368 feet) above ground. A two-story ring supporting broadcasting services will support a spire, which will culminate at a symbolic 1,776 feet (541 meters) – 1776 being the year of American independence.

While, in an era of supertall buildings, big numbers are the norm, the numbers at One World Trade are truly staggering: 5,660 cubic meters (200,000 cubic feet) of concrete; 92,920 square meters (1 million square feet) of exterior glazing; 40,800 metric tons (45,000 US tons) of structural steel; and 241,550 square meters (2.6 million square feet) of office space.

Figure 2. Concourse below grade © SOM

But the real story of One World Trade Center is the innovative solutions sought for the unprecedented challenges faced in building a project of this size on such a difficult site.

## Site

The project team was confronted with unprecedented challenges. The site sits over a vast tangle of existing subterranean obstacles. The new tower must bridge existing PATH train tracks adjacent to existing subway tracks, as well as accommodate a planned network of new development. The new World Trade Center Transportation Hub alone will occupy 74,300 square meters (800,000 square feet) to serve 250,000 pedestrians every day. Broad concourses (see Figure 2) will connect Tower One to the hub's PATH services, 12 subway lines, the new Fulton Street Transit Center, the World Financial Center and Winter Garden, a ferry terminal, underground parking, and retail and dining venues.

The resulting underground challenges can be likened to a four-dimensional chess game. First of all, obstructions exist three dimensionally in overlapping planes at varying depths. Secondly, per the brief, the PATH train service was to remain operational and existing structures had to be preserved throughout excavation and construction. Threading steel members, conduits, and shafts through the maze required precision timing not only to avoid service or construction disruptions, but to ensure that subsequent development would not be obstructed.

Bridging over the tracks was certainly an engineering challenge. "We used state-of-the-art methods of analysis in order to design one of the primary shear walls that extends all the way up the tower and is being transferred at its base to clear the PATH train lines that are crossing it," explains Yoram Eilon, vice president at WSP Cantor Seinuk, the structural engineers for the project. "In addition, the layout of below grade structure and columns took into account the dynamic envelope of these train lines. The design of the structure also meets the Port Authority requirements that these lines remain operable during construction. In order to comply, we designed a steel structure that bridges over the tracks, which supported the wet concrete loads during construction and was eventually integrated into the permanent structure."

## Structural Design

The tower's structure is designed around a massive, redundant steel moment frame consisting of beams and columns

Twin Towers, New York © Scott Murphy

# World Trade Center: Ten Years On

"We are aware that, like everything else, the tall building world is forever changing, developing and improving. But now that we have researched the topic, we also believe it has obviously changed more than usual because of the events of 9/11. This very first themed issue of the CTBUH Journal attempts to answer how."

September 11, 2011, marks 10 years since the Twin Towers of the World Trade Center were destroyed. That we all know. In the days immediately following the events, we also knew that the world had changed. What we didn't know was how it had changed, or to what extent it was going to change. A decade later, we can now look back and reflect on how the world has changed. For this Journal, we set out to explore how the tall building world has changed because of the events on that day.

Immediately after the terrorist attacks, some people declared the end of the skyscraper. Looking at the hard data since then, it is safe to conclude that this has not been the case. Actually, the past decade has been the most productive 10 years ever when it comes to tall buildings. Of the current list of 100 tallest buildings in the world, half of those buildings have been built in the past ten years. Of the current 100 tallest residential towers in the world, an impressive 90% have been completed in the past 10 years. Also, since 9/11, almost 1,250 buildings of 150 meters (492 feet) and taller have been completed internationally, which is more than the roughly 1,125 buildings of that height or taller that were built throughout history prior to 9/11. In New York City itself, 21 new towers have entered the local list of 100 tallest buildings in the past ten years alone. Perhaps more influential than the events of 9/11, it eventually took a global financial crisis to slow down the development of tall buildings, and only noticeably so if your city is not in Asia.

To get a more in-depth understanding of the non-quantitative changes since 9/11, we reached out to numerous prominent people in the tall building world and asked them the same question: **How have the events of 9/11 changed the tall building world?**

Although we specifically didn't ask colleagues to share the experiences from the actual day of the events, many respondents described how they felt on that day. This reinforces that, even a decade after the events took place, the emotional impact was tremendous.

Some colleagues responded that, from a practical point of view, not a great deal has changed in their respective field of expertise since 9/11. The events have not necessarily affected their profession directly, nor has it changed the way their profession is regulated.

Others take another perspective on the topic. They reason that tall buildings were actually as safe before 9/11 as they are today, and the relevant suggestion then is that there is actually very little that can be done against flying airplanes into tall buildings. This point of view also suggests that whatever security measures you introduce at buildings, airports, hotels, and other places where people gather, someone can always find a way to overcome those safeguards. Some measures seem to be aimed more at creating a feeling of safety and security, instead of actually making buildings safer. It is the kind of acceptance which implies that whatever man creates, man can destroy, and that threats from entities with an inclination for intentional destruction need to be addressed in the political arena.

Other colleagues mention that the events of 9/11 have triggered productive debates within their professional community leading to changes in code, practices, procedures, theories and discoveries in an attempt to minimize the chances of things going wrong, through either accident or intent.

This Journal focuses on the feedback we have received regarding these issues. Planning and Design, Code and Regulations, and Safety and Security are the areas which have seen the most number of practical changes in the way the professions operate and are being regulated, through either code changes, educational policies or safety and security regulations. The variety of responses to 9/11 reveal that, even a decade after the events, there is not always consensus on what the lessons from that day should be.

For this special edition of the Journal, we also look at the former and future visions of the World Trade Center site to find out what can be learnt from comparing the two. Beforehand, the general consensus seems to be that the former World Trade Center, as embodied by their Twin Towers, was a revolutionary feat of engineering, and to those who appreciate it, a zenith of modern design. However given what we know today, the previous towers seem to be considered as uninspired buildings when urban and architectural issues are considered. The new One World Trade Center Tower is presented here as this Journal's Case Study.

We are aware that, like everything else, the tall building world is forever changing, developing and improving. But now that we have researched the topic, we also believe it has obviously changed more than usual because of the events of 9/11. This very first themed issue of the CTBUH Journal attempts to answer how.

To conclude, we would like to thank all who have contributed or otherwise helped to publish this special edition of the Journal. Your input is much appreciated, as always. ■

*The Editorial Team*

# Wider Impacts: Tall Buildings as a Viable Proposition

Leslie E. Robertson

William Baker

Eugene Kohn


Authors

Leslie E. Robertson, Founder

Leslie E. Robertson Associates
30 Broad Street, 47th Floor
New York, NY 10004

t: +1 212 750 9000, f: +1 212 750 9002
http://www.lera.com

William Baker, Partner

Skidmore, Owings & Merrill LLP
224 S. Michigan Avenue, Suite 1000
Chicago, IL 60604

t: +1 312 554 9090, f: +1 312 360 4545
www.som.com

Eugene Kohn, Chairman

Kohn Pedersen Fox Associates
11 West 42nd Street
New York, NY 10036

t: +1 212 977 6500, f: +1 212 956 2526
www.kpf.com

Leslie E. Robertson
Leslie Robertson was one of the chief structural engineers of the former World Trade Center in New York. He has since been structural engineer on numerous other projects, including the Shanghai World Financial Center and the Bank of China Tower in Hong Kong.

William Baker
William Baker is the Structural Engineering Partner for Skidmore, Owings & Merrill, LLP. Throughout his career, Bill has dedicated himself to structural innovation. His best known contribution has been to develop the buttressed core structural system for the Burj Khalifa.

Eugene Kohn
Eugene Kohn currently serves as the Chairman of Kohn Pedersen Fox Associates. In 1976, along with William Pedersen and Sheldon Fox, he founded KPF. Eugene has served as Partner-in-Charge of many of KPF's major domestic and international projects and is responsible for many of the firm's new commissions.


## Tall Buildings are Safe!

*Leslie Robertson*

My take on the development of the tall building world after 9/11 as a structural engineer has always been a straightforward one: tall buildings are safe. They were safe before 9/11, as they are safe today. If you look at some of the seismic regions, particularly where it comes to structural safety, tall buildings can be safer than low-rise structures.

Naturally 9/11 has directed a lot of attention to the safety of tall buildings, and a lot has been done to make buildings more secure. For all the measures that have been introduced at airports for example, I'm convinced that people with the wrong intentions still will be able to find a way to get in. You're dealing with people here. It's almost as if the more barriers you create, and the bigger the walls you build, the more creative they get to find ways around those walls.

From a structural point of view, it isn't realistic to think there is much you can do against large airplanes flying into tall buildings. Our job is to make buildings work, and I feel that on top of code, we should be adding our experience, sensibility and creative talents to advise clients on best practices. The goal is to produce structures that are more resilient and more robust. Especially when you work on projects in countries where tall buildings are a novelty, you sometimes find yourself working with a mixture of code adopted from other countries. I'm not suggesting that this produces unsafe structures. It means that the code hasn't been optimized for tall buildings in a certain context, which can be cause for overdesigned or inefficient buildings.

One issue related to the World Trade Center, which I raised, was parking. I recommended against including parking in the program of the tower to prevent people driving up too close to the core of the building. As designers, we shouldn't just be working towards complying with the code, but also try to find the best solution to make the buildings work given the circumstances.

## Downs and Ups

*William Baker*

Two days after the attack on the World Trade Center, I was asked by engineers with the Structural Engineering Association of New York (SEAoNY) to put together a group of Chicago structural engineers to come to New York and assist at Ground Zero. Because all flights were grounded, we had to drive to New York. These terrible opportunities allowed me to see first-hand the extraordinary destruction at the site of the World Trade Center. We knew tall buildings would continue to be built but could the very tallest of buildings – the skyscraper – ever fully recover from 9/11?

On September 11, 2001, I was scheduled to attend the kickoff meeting in Chicago between SOM and the Trump Organization for the new Trump Tower, proposed to be the world's tallest building and located in the heart of downtown Chicago. But taking into consideration the ensuing sentiments surrounding tall buildings, Trump Tower was quickly reduced in height and stands today as the tenth tallest structure in the world. It seemed that the fascination and glory that had previously been associated with skyscrapers had all but disappeared.

I was therefore intrigued when Emaar, a Dubai-based developer, approached SOM in 2003 regarding the designing and building of the world's tallest structure in Dubai. The building design initially began as a 518-meter (1,699-foot) tall tower and grew to a staggering 828 meters (2,716 feet), almost double the height of the ill-fated World Trade towers. In the years that followed the commission of Burj Khalifa, many other supertall structures were proposed and some were built.

Amidst the tragedy of 9/11, architects and engineers were presented with an opportunity to re-examine what we do and look for ways to improve. The industry has shifted, particularly regarding egress and the way we "tie the building together." Cores of new towers often exhibit hardened stairs and


© CTBUH Ramsey Collection

exit paths that are more generously sized to accommodate rescuers going up as well as inhabitants going down. It is probable that most engineers today pay greater attention to robustness and redundancy in their designs.

The events of 9/11 still cause us to pause. Ten years later, many of us find it nearly impossible to experience a high-rise structure without thinking about that day. Skyscrapers, however, have proven they have a place in post-9/11 design and development. It is not residual fear from the events of that day that has changed the way skyscrapers are developed. Instead the extraordinary growth of tall towers is more a reflection of a shift in the world's economy.

### Here to Stay

*Eugene Kohn*

I think the worst thing we could have done post 9/11 was to stop building important buildings, and particularly tall buildings, because we were afraid someone was going to attempt to bring them down. We have to make our buildings as safe as we can, without compromising their significance, their beauty, or the quality of life that goes on inside and around them. The bottom line is that a building's design shouldn't be the first barrier of defense against an attack from a jet, from unnatural forces. The responsibility for defending against such an attack lies elsewhere.

We can learn how future skyscrapers can be designed better by looking at the way buildings are being built in other parts of the world, such as Asia, South America, the Middle East, and even London. The building and fire codes in Asia, where we are currently designing a number of tall buildings, are more conservative than they are in the United States. These building codes require a reinforced-concrete core, refuge floors located every 13 floors, pressurized vestibules leading to the fire stairs, and special elevators for firefighters. Fireman's lifts in Europe allow the firemen to reach the top of the building quickly, which facilitates easier evacuation for those in need, handicapped people, etc., in lieu of walking up the stairs as in the World Trade Center.

I am confident that the tall building is here to stay. The proof is that we are still building them. In places like New York, Chicago, Hong Kong, and Shanghai, the skyscraper recognizes land value, density, and at times, ego. When you have large populations, without much land to build on, you've got to build tall. A city can't stay vital and deal with growth and the future if tall buildings are eliminated from their potential vocabulary. To replace the World Trade Center towers with 20 ten-story buildings means much more land would be used (over 20 times, including streets), allowing for less open space.

Fundamentally altering the way tall buildings are seen today, our work speaks to the promise of the tall building as a sustainable paradigm, in which individual buildings form part of a larger ecosystem of vertical centers linked by horizontal networks of public transportation (even connecting at upper levels with walkways). Rather than objects in isolation, transit-integrated tall buildings represent a sustainable model for future high-rise development. ■

## ...inverse

> "I would say that the magnitude and impact of 9/11 has proven to be roughly inversely proportional to the distance from Manhattan, and time since the event."
>
> *CTBUH Height Committee Chair Peter Weismantle, Adrian Smith + Gordon Gill Architecture*

# Tall Buildings in Numbers

## New York City Scrapers

By Nathaniel Hollister, Jan Klerks & Antony Wood (all at CTBUH)

New York's dramatic skyline, over a century in the making, has for years been the envy of cities around the world. From the very birth of the tall building typology, New York has been at the forefront of the scene. Even as recently as the 1970s, New York City alone contained over 50% of the world's 150 m+ buildings. The city's accomplishments, including both historic and under construction buildings, are impressive when examined in isolation as well as a part of the global whole. The study below examines the make-up and historical development of the New York City skyscraper.

By the end of 2011, 221 buildings 150 meters or taller will exist in New York City. This number, more than any other city save Hong Kong, makes up nearly 9% of the global total and 34% of the buildings in the United States.

In addition to these impressive figures, New York City has enjoyed a large number of records, including being the location of the first 150 meter building and the first supertall.

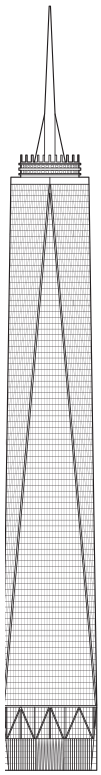
### Map: Location of New York City Skyscrapers

Including all buildings 150m+

Office · Hotel · Other · Residential · Mixed-use

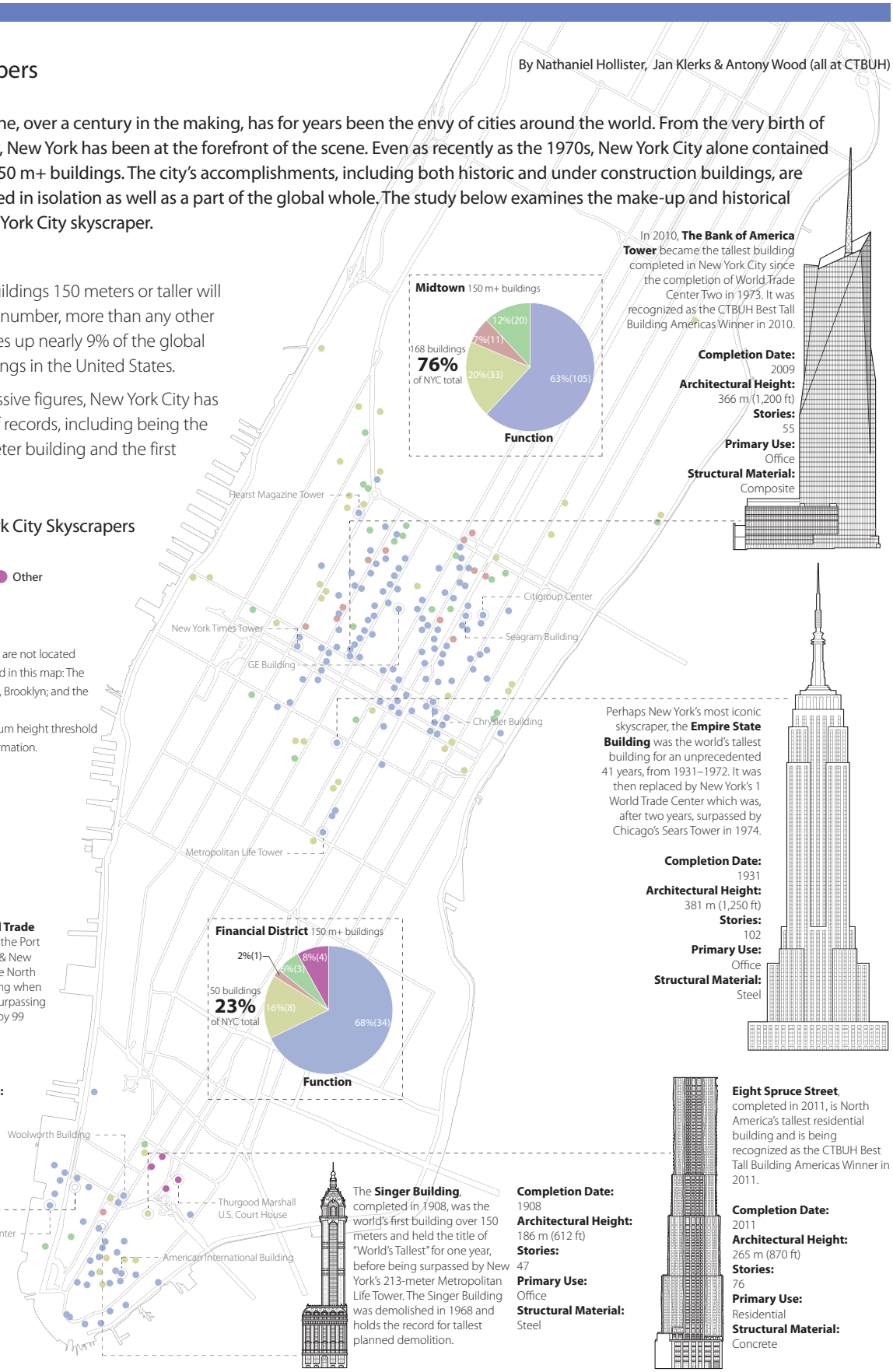
Notes:

1. Three of New York's 150 m+ buildings are not located in Manhattan and therefore not included in this map: The Brooklyner, Brooklyn; One Hanson Place, Brooklyn; and the Citicorp Building, Queens.
2. 150 meters was chosen as the minimum height threshold for this study to ensure accuracy of information.



New York's **One World Trade Center**, developed by the Port Authority of New York & New Jersey, is set to become North America's tallest building when it completes in 2013, surpassing Chicago's Willis Tower by 99 meters (325 feet).

**Completion Date:** 2013 (est.)
**Architectural Height:** 541 m (1,776 ft)
**Stories:** 104
**Primary Use:** Office
**Structural Material:** Composite




In 2010, **The Bank of America Tower** became the tallest building completed in New York City since the completion of World Trade Center Two in 1973. It was recognized as the CTBUH Best Tall Building Americas Winner in 2010.

**Completion Date:** 2009
**Architectural Height:** 366 m (1,200 ft)
**Stories:** 55
**Primary Use:** Office
**Structural Material:** Composite



Perhaps New York's most iconic skyscraper, the **Empire State Building** was the world's tallest building for an unprecedented 41 years, from 1931–1972. It was then replaced by New York's 1 World Trade Center which was, after two years, surpassed by Chicago's Sears Tower in 1974.

**Completion Date:** 1931
**Architectural Height:** 381 m (1,250 ft)
**Stories:** 102
**Primary Use:** Office
**Structural Material:** Steel





The **Singer Building**, completed in 1908, was the world's first building over 150 meters and held the title of "World's Tallest" for one year, before being surpassed by New York's 213-meter Metropolitan Life Tower. The Singer Building was demolished in 1968 and holds the record for tallest planned demolition.

**Completion Date:** 1908
**Architectural Height:** 186 m (612 ft)
**Stories:** 47
**Primary Use:** Office
**Structural Material:** Steel

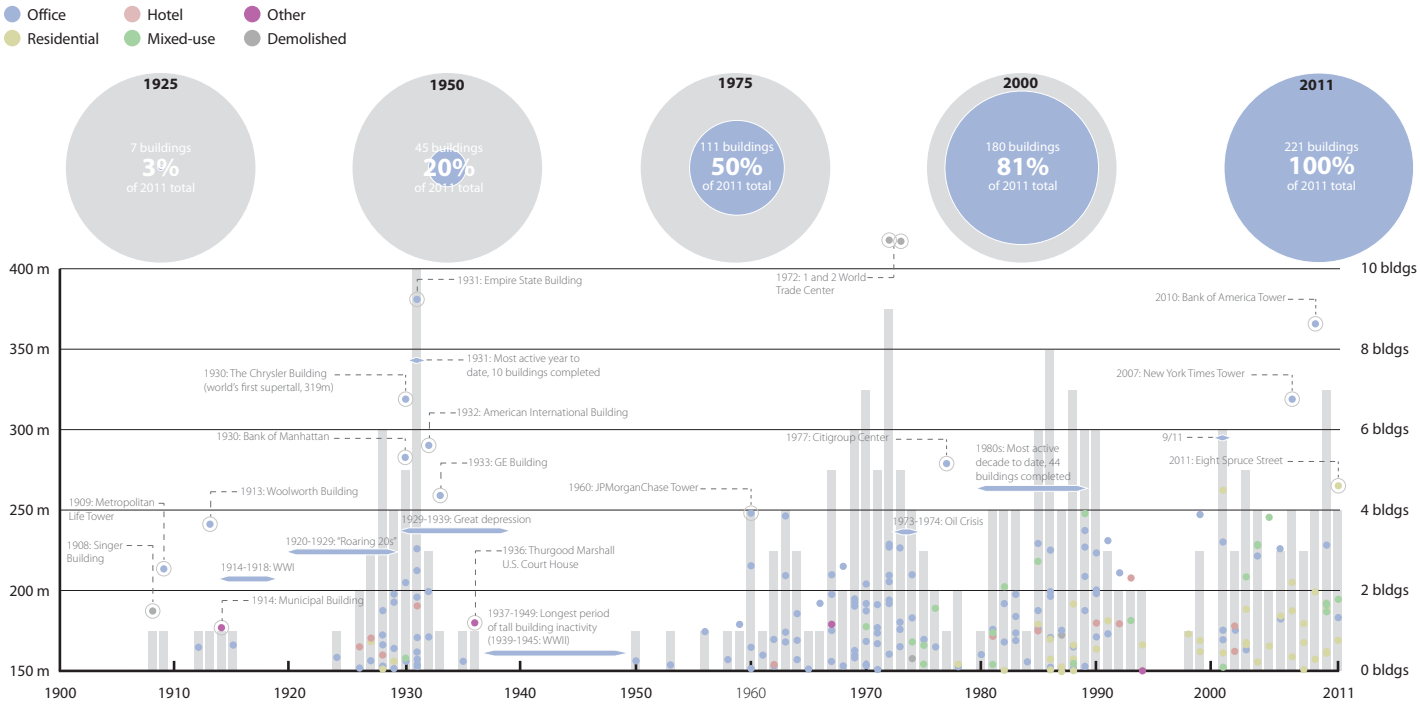


**Eight Spruce Street**, completed in 2011, is North America's tallest residential building and is being recognized as the CTBUH Best Tall Building Americas Winner in 2011.

**Completion Date:** 2011
**Architectural Height:** 265 m (870 ft)
**Stories:** 76
**Primary Use:** Residential
**Structural Material:** Concrete

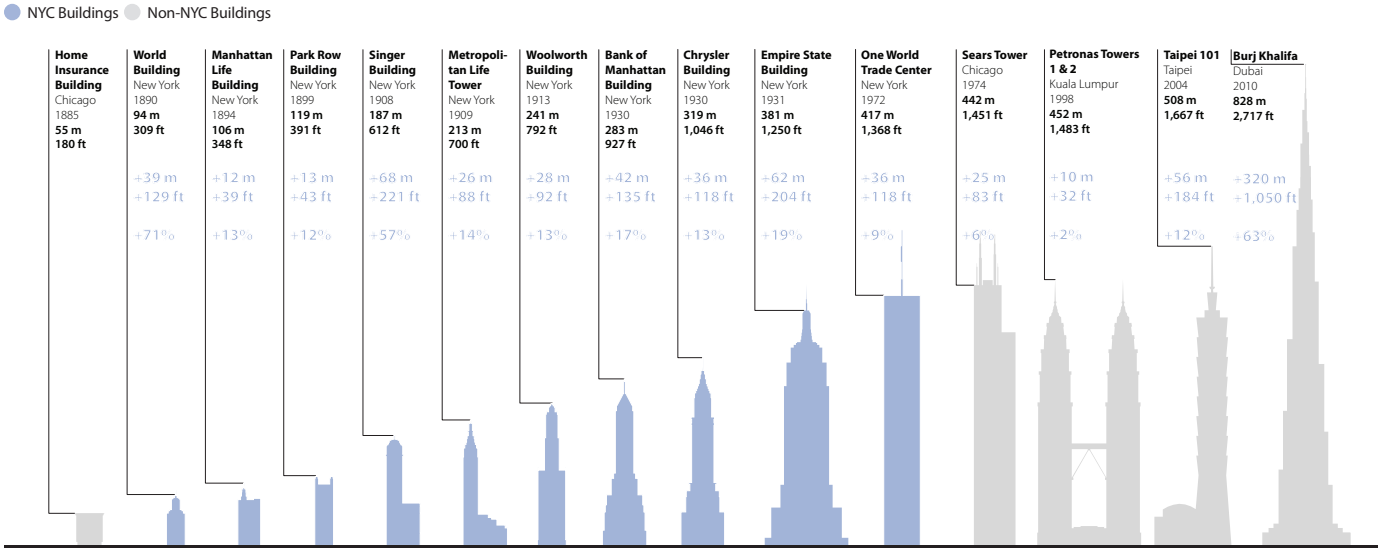
## Timeline of New York City Skyscraper Completion

Dots represent buildings: completion year and height; bars represent total number of buildings completed each year

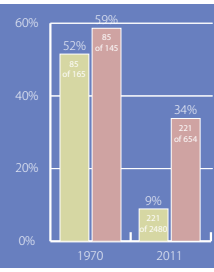



## History of the "World's Tallest Building"

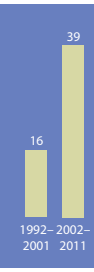
According to CTBUH Height Criteria: Height to Architectural Top




A remarkable 10 of the 16 skyscrapers which have enjoyed the title of the world's tallest were located in New York, giving the city the title for a combined total of 84 out of 126 years.




As late as 1970, New York City contained 52% of the world's 150 m+ buildings and 59% of USA buildings. These numbers are now at 9% and 34% respectively.




Far from slowing after the events of 9/11, 39 buildings 150 m+ have completed in NYC from 2002–2011, 18% of the city's current total.

# About the Council

The Council on Tall Buildings and Urban Habitat, based at the Illinois Institute of Technology in Chicago, is an international not-for-profit organization supported by architecture, engineering, planning, development and construction professionals. Founded in 1969, the Council's mission is to disseminate multi-disciplinary information on tall buildings and sustainable urban environments, to maximize the international interaction of professionals involved in creating the built environment, and to make the latest knowledge available to professionals in a useful form.

The CTBUH disseminates its findings, and facilitates business exchange, through: the publication of books, monographs, proceedings and reports; the organization of world congresses, international, regional and specialty conferences and workshops; the maintaining of an extensive website and tall building databases of built, under construction and proposed buildings; the distribution of a monthly international tall building e-newsletter; the maintaining of an international resource center; the bestowing of annual awards for design and construction excellence and individual lifetime achievement; the management of special task forces/working groups; the hosting of technical forums; and the publication of the CTBUH Journal, a professional journal containing refereed papers written by researchers, scholars and practicing professionals.

The Council is the arbiter of the criteria upon which tall building height is measured, and thus the title of "The World's Tallest Building" determined. CTBUH is the world's leading body dedicated to the field of tall buildings and urban habitat and the recognized international source for information in these fields.


**Council on Tall Buildings and Urban Habitat**

Council on Tall Buildings and Urban Habitat

S.R. Crown Hall
Illinois Institute of Technology
3360 South State Street
Chicago, IL 60616

Phone: +1 (312) 567 3487
Fax: +1 (312) 567 3820
Email: info@ctbuh.org
http://www.ctbuh.org

ILLINOIS INSTITUTE OF TECHNOLOGY



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