World’s Tallest Buildings

Edited by Antony Wood
Acknowledgements

The amount of input and support that the CTBUH received in the making of this book was unprecedented and, for that, the Council would like to express its deepest thanks to the many companies and individuals who collaborated on making it a reality. This publication would not have been possible without those who undertook the extensive work of submitting project information, confirming height data, and securing high-resolution imagery.

About CTBUH

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 Chicago’s Illinois Institute of Technology, CTBUH has an Asia Headquarters 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.”

About the Editor

Dr. Antony Wood has been Executive Director of the Council since 2006. Based at the Illinois Institute of Technology, Dr. Wood is a Research Professor in the College of Architecture and is also a Visiting Professor of Tall Buildings at the College of Architecture and Urban Planning at Tongji University, Shanghai. His field of specialism is the design, and in particular the sustainable design, of tall buildings. Prior to his tenure with CTBUH, Dr. Wood worked as an architect in Hong Kong, Bangkok, Kuala Lumpur, Jakarta, and London. His PhD explored the multi-disciplinary aspects of skybridge connections between tall buildings.
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In a world that is increasingly embracing tall buildings, we find ourselves at a point in history characterized by brand new cities, energy-efficient technologies, hyper-connected transportation systems, and ground-up economic reinvention. It is a world also challenged by dwindling natural resources, social upheaval, and climate-change-induced disasters. Against this backdrop, the dual effects of massive population growth and rapid urbanization are seeing the addition of more than 1 million new urban inhabitants every week, which is changing our cities immeasurably.

At the heart of urban change, both historically and in the future, is the skyscraper – both a testament to mankind’s desire to reach new heights (literally), and also quite possibly the key to our continued survival on the planet in light of the trends noted above. Today, nearly 55 percent of the world’s seven billion people live in cities. In 2050, the world population is expected to exceed 9 billion, with approximately 66 percent living in cities, meaning that there will be 2.4 billion new urban inhabitants over the next several decades.

We are perhaps fortunate to have observed the moment in history where cities became the preferred form of habitation, but this comes with a great degree of responsibility. The threat to the planet through climate change and the need for more sustainable patterns of life is now generally accepted. Denser, more concentrated cities are seen as an essential part of the solution since they reduce energy consumption and carbon emissions by limiting the suburban expansion of cities, transport, and infrastructure networks. Tall buildings are a key factor in creating denser cities by accommodating more people on smaller footprints of land. In addition, the investment in every tall building project – both financially and professionally – gives it the opportunity to embrace sustainable design and technologies that could lead the way for other, smaller, building types.

The tall building assists with sustainability issues, and also maximizes the return on land prices for parcels located in dense urban markets. These factors, in addition to the raw iconicity of these structures (see Figure 1), have led to an unprecedented era of tall building construction in recent decades. Figure 2 shows the progression of the "World's Tallest Building" over time since the creation of what is considered to be the first tall building, the Home Insurance Building in Chicago in 1885. We can see that the "World's
Figure 1: Diagram of the tallest 20 completed buildings in the world according to the CTBUH criteria of "height to architectural top" at time of book compilation (data as of mid-2015).

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Year Completed</th>
<th>Height (ft)</th>
<th>Floor Area (sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Insurance</td>
<td>1907</td>
<td>1,290</td>
<td>65,000</td>
</tr>
<tr>
<td>Bank of Manhattan</td>
<td>1958</td>
<td>1,393</td>
<td>165,000</td>
</tr>
<tr>
<td>Chrysler Building</td>
<td>1931</td>
<td>1,051</td>
<td>95,000</td>
</tr>
<tr>
<td>One World Trade Center</td>
<td>2013</td>
<td>1,272</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Sears Tower</td>
<td>1973</td>
<td>1,454</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Petronas Towers</td>
<td>1998</td>
<td>1,483</td>
<td>1,450,000</td>
</tr>
</tbody>
</table>

*While the Home Insurance Building was never the tallest building in the world, it is considered the first skyscraper constructed (frame non-load-bearing steel construction) and thus the first "skyscraper" as defined by the CTBUH.*

*Now known as the Trump Building, "Bank of Manhattan" was the building's name when it was the "World's Tallest Building."*

*Now known as Willis Tower, "Sears Tower" was the building's name when it was the "World's Tallest Building."*

Figure 2: History of the "World's Tallest Building," which illustrates the rapid increase in height that the world's tallest building has experienced over time (data as of mid-2015).
A History of the World’s Tallest Buildings by Decade

By Georges Binder

Note: Georges was the author of the previous edition of this recurrent CTBUH publication, entitled 101 of the World’s Tallest Buildings, produced in 2006. In the nine years since that edition, 73 of the 100 Tallest buildings in the book have changed, illustrating further the rapid development of the tall building over the past decade. In the piece that follows, Georges takes a slightly different slant on the history of the world’s tallest buildings, by examining the ten tallest buildings at the end of each decade over a 130-year period. In doing this, some of the larger-scale historic trends become clear…

Over the past century or so of tall buildings, as depicted decade-by-decade in the tables that follow, readers will witness a shift in the form, use, materials, location, and many other facets of tall buildings. Examining the tallest ten buildings over time reveals a series of milestone projects that represent the tallest achievements of their respective eras, and uncovers various shifts in tall building design from period to period. This approach allows us to not only examine the most impressive buildings of each era, but also to identify tall building trends, their evolving technologies, and the economic shifts they represent. Within small snapshots, we will see how the tall building evolved from an office building made of steel, located in the United States and New York City in particular, to a mixed-use building with a composite structure, located in Asia, and specifically in China. We will also see that the tallest buildings in the world are getting significantly taller and that numerous early tall buildings have now either been demolished or transformed to accommodate other uses.

1890: The Predominance of Publishers

The critical pieces of information we can glean from this time period include the emergence of all-steel building frames, the prevalence of early media companies in tall office buildings, and, of course, the complete predominance of tall buildings in the United States, especially in New York City.

Although it is still disputed which building actually assembled the first true metal-framed, multi-story building (rather than load-bearing masonry construction), to become the “first” skyscraper, history has traditionally recognized the 55-meter Home Insurance Building in Chicago (see Figure 1) with this honor. It is telling of how fast the skyscraper industry boomed in these early years that, as we can see from the list of the “Tallest Ten Buildings in 1890,” just five years after the completion of the Home Insurance Building, it did not even make the tallest ten list. Most tall buildings in this period still featured masonry structures, but there is a clear emergence of steel-framed buildings; such is the case with the World Building, the New York Times Building (now 41 Park Row), and the Pioneer Building. It is interesting to note that the outer bearing walls of the Auditorium Building (1889) were composed of brick, while all other structural elements, including the interior columns and girders, were made of iron. The Auditorium Building in Chicago is also an interesting early example of a tall building accommodating a variety of uses, including a hotel, an office, and a large theater.

Throughout the 20th century, people typically associated tall buildings with finance and big business. What may be less widely known is that many of the early tall buildings were actually headquarters for major media outlets, a fact made evident by several prominent tall buildings in New York City: the World Building, the New York Tribune Building, and the New York Times Building. This trend has persisted over time, with many large media companies still choosing to occupy tall buildings today. For example, Condé Nast has recently moved from the 48-story 4 Times Square to the 94-story One World Trade Center in New York; Rupert Murdoch is planning to move the offices of 21st Century Fox and

The Ten Tallest Buildings in 1890

<table>
<thead>
<tr>
<th>No.</th>
<th>Building Name</th>
<th>City</th>
<th>Stories</th>
<th>Height (m)</th>
<th>Year</th>
<th>Material</th>
<th>Original Use</th>
<th>Current Use (if changed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>World Building</td>
<td>New York</td>
<td>20</td>
<td>94</td>
<td>1890</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1955</td>
</tr>
<tr>
<td>2</td>
<td>Auditorium Building</td>
<td>Chicago</td>
<td>17</td>
<td>82</td>
<td>1889</td>
<td>Masonry</td>
<td>Office / Hotel / Theater</td>
<td>Educational / Theater</td>
</tr>
<tr>
<td>3</td>
<td>Midland Grand Hotel (now St. Pancras Renaissance London Hotel)</td>
<td>London</td>
<td>6</td>
<td>82</td>
<td>1873</td>
<td>Masonry</td>
<td>Hotel</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Washington Building</td>
<td>New York</td>
<td>13</td>
<td>79</td>
<td>1885</td>
<td>Masonry</td>
<td>Office</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Northwestern Guaranty Loan Building (later Metropolitan Building)</td>
<td>Minneapolis</td>
<td>12</td>
<td>79</td>
<td>1890</td>
<td>Masonry</td>
<td>Office</td>
<td>Demolished in 1962</td>
</tr>
<tr>
<td>7</td>
<td>New York Times Building (now 41 Park Row)</td>
<td>New York</td>
<td>16</td>
<td>73</td>
<td>1889</td>
<td>Steel</td>
<td>Office</td>
<td>Educational / Office</td>
</tr>
<tr>
<td>8</td>
<td>New York Produce Exchange</td>
<td>New York</td>
<td>14</td>
<td>73</td>
<td>1884</td>
<td>Masonry</td>
<td>Office</td>
<td>Demolished in 1957</td>
</tr>
<tr>
<td>9</td>
<td>Western Union Telegraph Building</td>
<td>New York</td>
<td>10</td>
<td>70</td>
<td>1875</td>
<td>Masonry</td>
<td>Office</td>
<td>Demolished in 1914</td>
</tr>
<tr>
<td>10</td>
<td>Pioneer Building</td>
<td>St. Paul</td>
<td>16</td>
<td>69</td>
<td>1889</td>
<td>Steel</td>
<td>Office</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: Home Insurance Building, Chicago (1885). Widely recognized as the world’s first skyscraper.

New York City noticeably leads the way in 1890, but there are several notable outliers. A fine example of this is the Northwestern Guaranty Loan Building (later named the Metropolitan Building), completed in 1890 in Minneapolis. The Minneapolis newspaper *Star Tribune* wrote that the building’s “open-air rooftop garden and observation tower were tourism magnets for more than a quarter-century.” In another article, the *Star Tribune* quotes the city’s mayor R.T. Rybak, stating “The Metropolitan Building is an important and vital architectural monument not because it is the first skyscraper west of the Mississippi, but because it is one of the first great skyscrapers built anywhere.” The article laments the loss of the building, which was demolished in 1962, and questions the reasons for demolishing such an iconic structure of the past.

1900: The Rise of Steel

With the turn of the new century, all buildings with a load-bearing masonry structure have completely disappeared from the tallest ten list, replaced by buildings featuring all-steel structures. In 1896 the American Surety Building (now Bank of Tokyo) was one of the first buildings in New York City to employ complete steel framing, curtain wall construction, and caisson foundation piers that carried a cantilevered steel foundation structure. The supremacy of these techniques remained dominant for decades to come. The years leading up to 1900 also featured many buildings topped by cupolas, small dome structures sitting atop larger domes or raised cylinders. The Park Row Building in New York is an example of this, featuring two multi-level cupolas (see Figure 2). The Manhattan Life Insurance Building is also crowned by a cupola. These features are unique to this decade and will mostly disappear in subsequent decades.

### The Ten Tallest Buildings in 1900

<table>
<thead>
<tr>
<th>No.</th>
<th>Building Name</th>
<th>City</th>
<th>Stories</th>
<th>Height (m)</th>
<th>Year</th>
<th>Material</th>
<th>Original Use</th>
<th>Current Use (if changed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Park Row Building</td>
<td>New York</td>
<td>30</td>
<td>119</td>
<td>1899</td>
<td>Steel</td>
<td>Office</td>
<td>Residential / Office</td>
</tr>
<tr>
<td>2</td>
<td>Manhattan Life Insurance Building</td>
<td>New York</td>
<td>18</td>
<td>106</td>
<td>1894</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1964</td>
</tr>
<tr>
<td>3</td>
<td>Empire Building</td>
<td>New York</td>
<td>22</td>
<td>97</td>
<td>1898</td>
<td>Steel</td>
<td>Office</td>
<td>Residential</td>
</tr>
<tr>
<td>4</td>
<td>St. Paul Building</td>
<td>New York</td>
<td>26</td>
<td>96</td>
<td>1898</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1958</td>
</tr>
<tr>
<td>5</td>
<td>Call / Speckels Building (now Central Building)</td>
<td>San Francisco</td>
<td>15</td>
<td>96</td>
<td>1898</td>
<td>Steel</td>
<td>Office</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>American Surety Building (now Bank of Tokyo Building)</td>
<td>New York</td>
<td>21</td>
<td>95</td>
<td>1896</td>
<td>Steel</td>
<td>Office</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>World Building</td>
<td>New York</td>
<td>20</td>
<td>94</td>
<td>1890</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1955</td>
</tr>
<tr>
<td>8</td>
<td>Commercial Cable Building</td>
<td>New York</td>
<td>21</td>
<td>93</td>
<td>1897</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1954</td>
</tr>
<tr>
<td>9</td>
<td>Masonic Temple</td>
<td>Chicago</td>
<td>21</td>
<td>92</td>
<td>1892</td>
<td>Steel</td>
<td>Office</td>
<td>Demolished in 1939</td>
</tr>
<tr>
<td>10</td>
<td>American Tract Society Building (now Park Place Tower)</td>
<td>New York</td>
<td>23</td>
<td>89</td>
<td>1895</td>
<td>Steel</td>
<td>Office</td>
<td>Residential</td>
</tr>
</tbody>
</table>
100 Tallest Buildings
At the forefront of worldwide skyscraper activity, Kingdom Tower represents an unprecedented exercise that dares to go beyond the 1 kilometer threshold, a height that seemed only to exist in fantasy just years ago. With no other 1,000-plus-meter height contenders in sight, Kingdom Tower is poised to be the tallest building in the world upon completion and will stand as a pinnacle of skyscraper design and engineering. Inspired by a bundle of leaves shooting up from the ground, it is intended to emanate the growth, prosperity, and regional emergence of its homeland on the global stage, a role that many of the world’s tallest buildings have played in their respective locales.

The multivariate form of the tower is rationalized by a “Y”-shaped plan and a continuously smooth taper, which will significantly reduce structural loads by eliminating the need for the complicated outrigger transfers and belt trusses required in a setback approach. Furthermore, each wing of the tower will terminate at a different height, allowing them to taper at different rates and establish a distinct three-part spire. The supporting structure for the building is comprised entirely of cast-in-place reinforced concrete walls, coupling beams, and conventionally reinforced plate concrete floor framing. Due to the continuous and uninterrupted vertical nature of the walls, a highly efficient jump form system is utilized that will permit a continuous and uninterrupted construction process.

A series of balconies interrupt the smooth exterior, serving to provide both a cool outdoor element for occupants and shading for the tower’s surface, reducing direct solar radiation. At the very top, a massive penthouse will allow a tenant to reside at the crown of the building. Originally designed as a helipad, a circular sky terrace protrudes from the 157th floor, a feature that will be the highest of its kind in the world.

Completion Date: 2018 (expected)
Architectural Height: 1,000+ m / 3,281+ ft
Height to Top: 1,000+ m / 3,281+ ft
Floors above Ground: 167
Floors below Ground: 2
Structural Material: Concrete
Primary Function: Residential / Serviced Apartments / Hotel / Office
See page 266 for project team
Shanghai Tower
Shanghai, China

632 meters

As the third tower in the trio of signature skyscrapers at the heart of Shanghai’s Lujiazui Finance and Trade Zone, Shanghai Tower embodies a new prototype for tall buildings. Placed in close proximity to Jin Mao Tower and Shanghai World Financial Center, the new tower rises high above the skyline, its curved façade and spiraling form symbolizing the dynamic emergence of modern China. But its twisting form goes beyond just creating a unique appearance; wind tunnel tests confirm a 24 percent saving in structural wind loading when compared to a rectangular building of the same height.

More than a landmark, the 632-meter, mixed-use tower offers a sustainable way of living in a vertical city, with a unique mix of restaurants, shops, offices, and hotels spaced throughout the building. The tower’s program is organized into nine vertical zones. Each of these vertical neighborhoods rises from a sky lobby, a light-filled garden atrium that creates a sense of community and supports daily life with a varied program catering to tenants and visitors. The sky lobbies function much like traditional town plazas and squares, bringing people together throughout the day. These civic spaces recall the city’s historic open courtyards, which merge interiors with exteriors in a landscaped setting.

Shanghai Tower is one of the most sustainably advanced tall buildings in the world. A central aspect of its design is the transparent second skin that wraps around the entire building. The ventilated atriums it encloses conserve energy by modulating the temperature within the void. The space acts as a buffer between the inside and outside, warming up the cool outside air in the winter and dissipating heat from the interior in the summer. The tower also notably employs a tri-cogeneration system, a grey water/rainwater system, and several renewable energy sources.

Completion Date: 2015
World Ranking at Completion: 2
Architectural Height: 632 m / 2,073 ft
Height to Tip: 632 m / 2,073 ft
Highest Occupied Floor: 561 m / 1,841 ft
Floors above Ground: 128
Floors below Ground: 5
Structural Material: Composite
Primary Function: Hotel / Office
See page 266 for project team

This Page
Left: Typical office floor plan – level 40
Right: Building section
Opposite Page
Top left: Context view
Middle left: View looking up at the twisting façade
Bottom left: A sky lobby atrium
Right: Overall view from the west

Next Pages
View of the tower’s base
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 country. It is a memorable architectural landmark for the city and the nation, and will connect seamlessly to the city with entrances on all four elevations and linkages to an extensive underground transportation network. Extending the long tradition of American ingenuity in high-rise construction, the design solution is an innovative mix of architecture, structure, urban design, safety, and sustainability.

The building is a bold icon in the sky that acknowledges the adjacent memorial. While the memorial, carved out of the earth, speaks of the past and of remembrance, One World Trade Center speaks of the future and of hope as it rises upward in a faceted form filled with, and reflecting, light. This tower evokes the slender, tapering triangular forms of great New York City icons, such as the Chrysler Building and Empire State Building, and replaces almost one quarter of the total office space lost on September 11, 2001.

As the tower rises from a cubic base, its 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 and then culminates in a glass parapet whose plan is a 150-foot-by-150-foot square, rotated 45 degrees from the base. Its overall effect is that of a crystalline form that captures an ever-evolving display of refracted light. As the sun moves through the sky or pedestrians move around the tower, the surfaces appear like a kaleidoscope, and will change throughout the day as light and weather conditions change.

**Completion Date:** 2014  
**World Ranking at Completion:** 3  
**Architectural Height:** 541 m / 1,776 ft  
**Height to Tip:** 546 m / 1,792 ft  
**Highest Occupied Floor:** 387 m / 1,268 ft  
**Floors above Ground:** 94  
**Floors below Ground:** 5  
**Structural Material:** Composite  
**Primary Function:** Office  
*See page 267 for project team*
As a product of man’s innate desire to reach new heights, physically and metaphorically, the skyscraper has come to represent the enormous strides that human development has taken over the past century. The tallest of these structures are dramatic, definitive components of the cities they inhabit and, as such, they have become the subject of a sometimes obsessive worldwide following. These monolithic structures represent mankind’s greatest architectural achievements to date, with each rising to help alleviate the most critical challenges of our time: population growth, urbanization, climate change, and sprawling cities.

100 of the World’s Tallest Buildings is a continuation of the highly acclaimed “100 Tallest” series produced by the Council on Tall Buildings and Urban Habitat (CTBUH)—the worldwide body responsible for defining and measuring skyscrapers. In this edition, the projected 100 tallest buildings in the world are examined in a collection of highly informative and visually engaging profiles. As seen in this book—which contains an unprecedented collection of high-resolution imagery, building drawings, and professional renderings—an entirely new breed of skyscrapers are taking shape around the world; one with twists and turns, horizontal connections, vegetated spaces, and myriad functions. Detailed descriptions of these projects are provided, along with precise height data and building metrics.

The CTBUH is the world’s leading resource for information on the inception, design, construction, and operation of tall buildings and future cities. 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.” Information and images in this book were acquired by the CTBUH from world-class architecture and engineering firms, owners and developers, construction companies, and consultants.