

# CTBUH Journal

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Advancing Sustainable Vertical Urbanism | 2023 Issue I

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AI and Robotics in High-Rise Hotels and Hospitals

Extending Existing Buildings with Mass Timber

Talking Tall: After Grenfell

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**Construction**

**Building Above Our Cities: Evaluating the Feasibility of Mass Timber Vertical Extensions**

**Abstract**  
This research provides a quantitative analysis of the feasibility of incorporating building for mass timber construction into the urban fabric of dense urban centers. The study is designed to assist the feasibility of incorporating mass timber construction into the urban fabric of dense urban centers. The study is designed to assist the feasibility of incorporating mass timber construction into the urban fabric of dense urban centers.

**Keywords:** Mass Timber, Vertical Extensions, Feasibility, Urban Fabric, Dense Urban Centers.

**Introduction**  
The construction industry is facing a significant challenge: how to meet the growing demand for high-quality, sustainable building materials in dense urban centers. Mass timber construction offers a promising solution, but its widespread adoption is hindered by a lack of understanding of its feasibility in these environments.

**Methodology**  
This study employs a quantitative analysis to evaluate the feasibility of mass timber vertical extensions in dense urban centers. The analysis is based on a comprehensive review of the literature and a series of case studies.

**Findings**  
The findings of this study indicate that mass timber construction is a viable option for high-rise buildings in dense urban centers. However, several challenges must be addressed to ensure its widespread adoption, including the need for improved building codes, enhanced fire safety measures, and increased public awareness.

**Conclusion**  
Mass timber construction offers a sustainable and high-quality building material for dense urban centers. By addressing the challenges identified in this study, the construction industry can unlock the full potential of mass timber and build a more sustainable future.

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**Economics/Financial**

**The Economics of Record-Breaking Height**

**Abstract**  
This paper examines the economic implications of record-breaking height in skyscrapers. It explores the factors that drive the construction of taller buildings and the resulting economic benefits and costs. The study is designed to assist the feasibility of incorporating mass timber construction into the urban fabric of dense urban centers.

**Keywords:** Skyscrapers, Record-Breaking Height, Economics, Financial, Urban Fabric, Dense Urban Centers.

**Introduction**  
The construction of record-breaking height skyscrapers has become a global phenomenon. This paper examines the economic implications of this trend, focusing on the factors that drive the construction of taller buildings and the resulting economic benefits and costs.

**Methodology**  
This study employs a quantitative analysis to evaluate the economic implications of record-breaking height in skyscrapers. The analysis is based on a comprehensive review of the literature and a series of case studies.

**Findings**  
The findings of this study indicate that the construction of record-breaking height skyscrapers has a significant economic impact. While the construction of taller buildings is driven by a variety of factors, including the need for increased office space and the desire for prestige, the resulting economic benefits are substantial.

**Conclusion**  
The construction of record-breaking height skyscrapers is a complex economic phenomenon. By understanding the factors that drive the construction of taller buildings and the resulting economic benefits and costs, we can better understand the role of skyscrapers in the global economy.

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**CTBUH Year in Review: Tall Trends of 2022**

**World Surpasses 2,000 Buildings of 200 Meters or Greater Height**

**Abstract**  
This report provides a comprehensive overview of the global tall building market in 2022. It highlights key trends, including the record-breaking height of the Jeddah Tower and the continued growth of the skyscraper market. The study is designed to assist the feasibility of incorporating mass timber construction into the urban fabric of dense urban centers.

**Keywords:** Tall Buildings, 200 Meters, Greater Height, World Surpasses, Buildings, Year in Review, CTBUH.

**Introduction**  
The global tall building market has reached a new milestone in 2022, with the world surpassing 2,000 buildings of 200 meters or greater height. This report provides a comprehensive overview of the market, highlighting key trends and challenges.

**Market Overview**  
The global tall building market is expected to continue its growth in 2022, driven by a combination of factors, including the need for increased office space and the desire for prestige. The market is expected to reach a total value of over \$1 trillion by the end of the year.

**Key Trends**  
One of the most significant trends in the global tall building market is the record-breaking height of the Jeddah Tower, which is expected to reach a height of over 1,000 meters. This trend is expected to continue in the coming years, as developers seek to push the boundaries of skyscraper construction.

**Conclusion**  
The global tall building market is a dynamic and rapidly growing industry. By understanding the key trends and challenges of the market, we can better understand the role of tall buildings in the global economy and the future of the skyscraper market.

“Please, if you love innovation and care about the future of the industry, beg for it to be properly regulated.”

## Americas

On Canada's western coast, a 48-story residential tower was approved in **Vancouver** by the City Council. The mixed-use residential tower at **1063–1075 Barclay Street** will replace 40 existing rental homes and will deliver 372 units, including 285 condos and 87 social housing units to the city. With 27 percent of the building's residential floor area dedicated to social housing, it has exceeded the 25 percent requirement. Over in **Toronto**, a 118-meter tower featuring 377 residential units has been submitted for planning approval at the corner of Bayview and Broadway avenues. The 34-story building at **1837–1845 Bayview Avenue** would incorporate a stepped podium of four to eight stories, and feature floor-to-ceiling glazing to draw in natural light.

On the East Coast, skyscraper activity abounds, with residential and commercial developments taking shape in **New York City**. In downtown Brooklyn, **One Willoughby Square**, a 35-story building designed by FXCollaborative (also the anchor tenant) opened in December 2022. The 168-meter development incorporates a

six-story public elementary school and a 9-meter-tall lobby. Also in downtown Brooklyn, **22 Chapel** has also reached completion, this time a residential development designed by CetraRuddy and reaching 74 meters in height. Of the 180 apartment dwellings, 25 are designated for affordable housing. A 464-square-meter branch of a recovery center is also housed within the building.

In the northernmost reaches of Brooklyn, **Eagle + West**, a pair of towers at the mouth of Newton Creek, have reached completion. Sharing a seven-story plinth, the stepped towers—the top-heavy western one made possible by two sloping columns, from which lower floors are suspended—feature a textured pattern on the windows and a maximum floor plate size of 1,021 square meters, offering a total of 79,961 square meters of residential space.

A 52-story supertall at **740 8th Avenue** in Midtown, Manhattan is progressing nicely, with excavation well underway. A suite of hotel rooms, as well as retail and restaurant space, will be topped off with an observatory and thrilling drop ride, featuring 79-meter tracks on the sides of the building's exposed

core at its midsection. The 325-meter building is expected to reach completion in 2027. Also in Manhattan, a seven-terraced office skyscraper, proposed to reach 411 meters, has been proposed for a 2032 completion date. Designed by Foster + Partners, **350 Park Avenue** will be anchored by Citadel, which will occupy about 54 percent of the building.

In **Boston**, the **Center for Computing & Data Sciences** at Boston University was completed to a final height of 93 meters. The new addition to the Boston skyline has been referred to as the "stack-of-books" building, in reference to its massing and dynamic silhouette. Its central atrium draws in activity from the avenue with a generous café in view of the street. Ninety percent of the building's heating and cooling needs will be addressed through 31 subterranean geothermal wells, and solar arrays in surrounding buildings will cover nearly a quarter of the academic building's energy usage.

In **Chicago**, developers are responding to incentives to convert vacant or underoccupied office buildings into residential space. Riverside Investment &



1063–1075 Barclay Street, Vancouver. © ACDF Architecture



22 Chapel Street, New York. © Depict CGI Ltd.



Eagle + West, New York. © Jason O'Rear/Courtesy of OMA

## Forging Vertical Neighborhoods



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### Abstract

*The David Rubenstein Forum at the University of Chicago is a space of discourse and intellectual exchange aimed at fostering the outward engagement of visiting scholars, researchers, and dignitaries from around the world. The building is composed of a two-story base and a slender, eight-story tower that provides the University with a 285-seat auditorium and much-needed multipurpose meeting spaces for workshops, symposia and lectures, among other activities. The tower is organized as a stack of neighborhoods, each coalescing around a private social lounge that offers a sense of community and identity. The neighborhoods are vertically stacked, rotated and oriented to their own unique perspective of Chicago, creating a panoramic, 360-degree form.*

**Keywords:** Campus Buildings, Conference Centers, Vertical Urbanism

### A Place of Intellectual Exchange

Chicago is the birthplace of the skyscraper and was the host of the 1893 World's Fair, which reimagined future urban habitats as buildings within parks, illuminated by hydro-electricity. The World's Fair prompted a new global optimism for future cities that would be greener, healthier, safer, and culturally active into the night.

The David Rubenstein Forum stands in the center of this history, as an icon dedicated to Chicago's rich tradition of academic and technological discourse. Its prominent location on Chicago's Midway Plaisance, across from Rockefeller Chapel, visually connects it to downtown Chicago and Lake Michigan, as well as the University Campus and adjacent Woodlawn community (see Figure 1). The Rubenstein Forum anticipates the needs of future generations, and is designed to provide meeting spaces for scholars to formally and informally exchange ideas across a variety of disciplines.

### A Progressive Retreat

The question of how to engage the public and provide an open piece of architecture was crucial in driving the design concept. Rather than turning its back to any of Chicago, the Rubenstein Forum addresses

multiple communities with components that are stacked, rotated, and oriented, not only toward downtown Chicago, but toward the neighborhoods of Woodlawn and Hyde Park in the South Side of Chicago as well. As visitors move progressively up the tower away from the street level, the spaces increasingly become more focused and formal, with distant views of downtown Chicago and Lake Michigan (see Figure 2).

### Design Principles

The Rubenstein Forum is an experiment in challenging the conventions of its building typology. Traditional convention spaces are no longer conducive to intellectual exchange and lack both a sense of community and privacy. From its form, which is vertical rather than horizontal, to its interiors, which are porous instead of inwardly focused, the Rubenstein Forum changes the paradigm of a traditional convention center and offers alternative solutions to that typology.

Four design principles drive the design of the Rubenstein Forum into a new type of building typology for convention centers: Forum, Social/Focus, Neighborhood, and Stitch (see Figure 3). Since ancient Rome, the forum has been the space for assembly that merges intellectual exchange with social



Figure 1. The David Rubenstein Forum, Chicago, is a 10-story conference center for the University of Chicago on the city's south side.

encounters, engaging participants in analytical and creative thinking. The design couples social and secluded spaces to encourage a continuation of intellectual exchange beyond the primary meeting spaces. It also establishes a new type of convening facility that is more personal and focused, providing conference spaces with their own communal social neighborhoods, in which discourse can continue informally throughout the day.

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**“The Rubenstein Forum is designed to provide meeting spaces for scholars to formally and informally exchange ideas across a variety of disciplines.”**

## World Surpasses 2,000 Buildings of 200 Meters or Greater Height

### Abstract

*This report shows that 147 buildings of 200 meters' height or greater were completed in 2022, a 25 percent increase from 2021, when 118 such buildings were completed. Disruptions to the supply chain, labor force, demand, and other factors have continued to delay the completion of in-progress skyscrapers. Nevertheless, more tall buildings are commencing work than ever before, and 2023 is set to be a blockbuster year for the industry.*

*(Note: The study sets a minimum threshold of 200 meters' height because of the completeness of data available on buildings of that height. Unless otherwise noted, all data within reported in this study is accurate as of 15 March 2023.)*

**Keywords:** Construction, COVID-19, Development, Height, Hotel, Megatall, Mixed-Use, Office, Residential, Supertall

### Introduction

As the world rounds out its third full year since the outbreak of the coronavirus pandemic, construction trends have begun to revert to their prepandemic norms. Projects that encountered erratic changes in timelines over the last few years have finally been seen through to completion. Although 2022 was not a strong year for supertall buildings—those 300 meters and taller—completions of 200-meter-plus buildings rose back to 147, from a recent low of 118 in 2021 (see Figure 1). Despite the ongoing challenges presented by supply chain disruptions and shortages of labor and materials, 2022 still saw the fourth-highest number of 200-meter-plus completions ever, surpassed only by the activity in the period 2017 to 2019. Additionally, 2022 was the first year since 2013 without a 400-meter-plus completion, and only the second year since 2007. With that said, 2022 did represent a major milestone for overall tall building construction, with the world surpassing 2,000 buildings of 200 meters or greater height for the first time, ending the year with 2,070 total complete buildings.

The tallest building to complete in 2022 was **CITYMARK CENTRE, Shenzhen**, 388 meters (see Figure 2). This is the first time that a Shenzhen building has held the title since **Ping An Finance Center**, which was the tallest to complete in 2017, at 599 meters. Shenzhen is the world's most prolific

skyscraper-building city, raising 130 buildings of 200 meters or greater in height since its first, **Shun Hing Square**, completed in 1996.

### Key Worldwide Market Snapshots

While the number of completions has begun to rise back to pre-2020 levels, significant timeline impediments to some projects have pushed the most notable intended 2022 completions into 2023. **Merdeka 118**, Kuala Lumpur, 679 meters, and **Wuhan Greenland Center**, Wuhan, 476 meters, have both seen delays in the final stretches of construction, but are currently architecturally topped-out, and represent at least two buildings of 400 meters or greater height expected to complete in 2023.

Although the average height of 200-meter-plus buildings has remained steady over time, floating between a low of 236.5 meters (2022) and high of 257.1 meters (2019), the construction period of these buildings has increased. Since 2010, the average completion time for a 200-meter-plus building has increased by 18 months, from 4.3 to 5.8 years. The precise causes for this have not been definitively identified, but even prior to the pandemic and the subsequent supply chain disruptions, overall completion timelines were slowly extending.

Despite these challenges, the most productive skyscraper-building countries

continued to pad their portfolios in 2022. Of the 147 completed, 86 buildings, or 59 percent, were completed in China alone. In the United States, seven completions were added to its collection, bringing the total number of 200-meter-plus buildings in the country to 235. Three of the four 200-meter-plus buildings in Brazil were completed in 2022 alone.

Even as construction schedules recover from the pandemic, the average height of new tall buildings is following a pattern of slow regression towards 300 meters since reaching a peak of 377 meters in 2019. Given the strict capping of tall projects in China—the locus of modern skyscraper construction—and the lack of any new projects over 500 meters begun in the last year, the focus of tall buildings in the foreseeable future will likely be in the 200- to 400-meter range.

### National Scale

Twenty-five different countries completed 200-meter-plus buildings in 2022 (see Figure 3), including three countries that have built their first such buildings: Kazakhstan, Switzerland, and the Netherlands. With 86 completions, China once again led the world in skyscraper construction, a distinction it has had every year since 1995, when only one 200-meter-plus building completed, the **Osaka World Trade Center** (256 meters) in Japan.

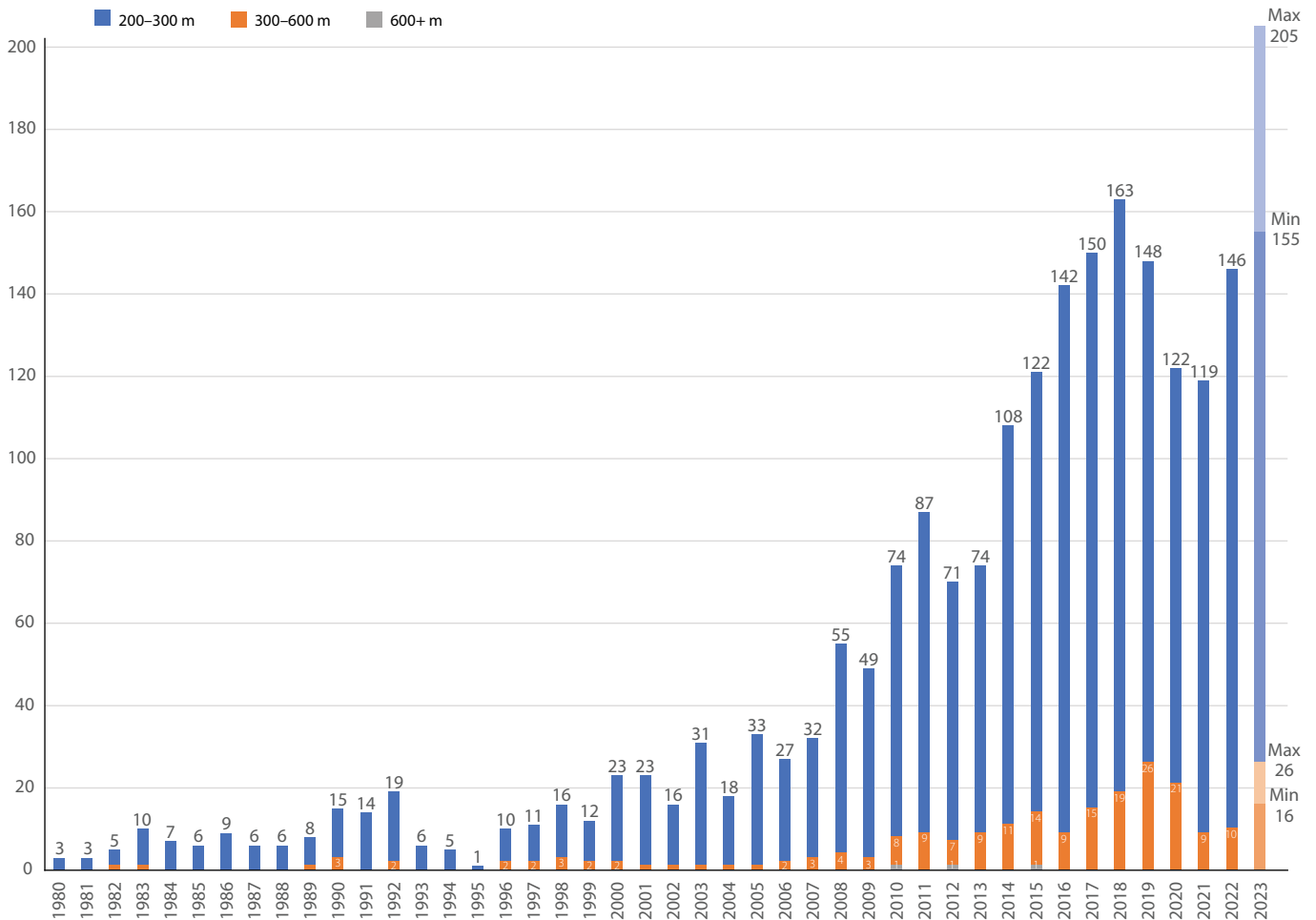


Figure 1. Number of 200-meter-plus buildings completed in each year from 1980 to 2022, with a 2023 projection.

### City Scale

Fifty-eight cities completed 200-meter-plus buildings in 2022, and 29 of those completed two or more (see Figure 4). For the top city title, three cities tied with 10 completions each: Shenzhen, Guangzhou, and Hong Kong. Some 14 percent of the world's 200-meter-plus buildings, or 283 of the 2,070 buildings, are in these three cities alone.

### Records

Two major milestones in 200-meter-plus buildings were reached in 2022. Firstly, the world has surpassed 2,000 total such buildings, ending the year with 2,070 total. Secondly, China surpassed 1,000 total, ending the year with 1,033 all-time completions, just two buildings shy of half the world's inventory of 200-meter-plus buildings.



Figure 2: The tallest completion in 2022 was CITYMARK CENTRE, Shenzhen, at 388 meters. © Shenzhen City Holdings Co., Ltd.

# About the Council

The Council on Tall Buildings and Urban Habitat (CTBUH) is the world's leading non-profit organization for all those interested in the future of cities. It explores how increased urban density and vertical growth can support more sustainable and healthy cities, especially in the face of mass urbanization and the increasing effects of climate change worldwide.

Founded in the USA in 1969, the CTBUH member network embraces more than a million professionals working in all building industry sectors in almost all countries of the world. With offices in Chicago, Shanghai, and Venice, the Council runs hundreds of multidisciplinary programs across the world each year, through its regional chapters and expert committees, its annual conferences and global awards program, through funded research projects and academic collaborations, and via its extensive online resources and physical outputs. The Council is perhaps best-known to the public as the arbiter of tall building height and the global authority that bestows titles such as "The World's Tallest Building." Operating on a global scale, CTBUH serves as a platform for both cutting-edge information-share and business networking for all companies and professionals focused on the inception, design, construction, and operation of cities, and the buildings they comprise.



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