TALL buildings + URBAN habitat

Volume I

Editors:
Steven Henry & Antony Wood
The projects profiled in this book are those submitted to the Council on Tall Buildings and Urban Habitat’s 2018 Global Awards program (see page 274).
Contents

6 Introduction

AMERICAS
16 35XV, New York City
20 150 North Riverside, Chicago
24 American Copper Buildings, New York City
28 City Hyde Park, Chicago
30 Enbridge Center, Edmonton
32 Gaia Building, Quito
36 Grove at Grand Bay, Miami
38 Hotel EMC2, Chicago
40 Jersey City Urby, Jersey City
42 Madison Square Park Tower, New York City
44 Metropolitan, Quito
46 Porsche Design Tower, Sunny Isles Beach
48 River Point, Chicago
50 Shirley Ryan AbilityLab, Chicago
52 The Globe and Mail Centre, Toronto
54 Three Alliance Center, Atlanta
56 Torre KOI, San Pedro Garza García
58 University of Chicago Campus North Residential Commons, Chicago
60 Wilshire Grand Center, Los Angeles
62 30 Park Place, New York City
69 609 Main at Texas, Houston
71 615 South College, Charlotte
88 Scott, Toronto
92 AQWA Corporate, Rio de Janeiro
64 Biscayne Beach, Miami
54 BRIC Phase 1, San Diego
56 CF Calgary City Centre Phase I, Calgary
58 Cielo, Seattle
62 Equus 333, San Pedro Garza García
66 Hotel Las Americas Golden Tower, Panama City
70 INDEX Condominiums, Toronto
72 Jade Signature, Sunny Isles Beach
74 L’Avenue, Montreal
76 Level BK, New York City
80 Northwestern Mutual Tower and Commons, Milwaukee
84 Optima Signature, Chicago
88 Park Avenue West, Portland
90 Ten Thousand, Los Angeles
92 The Collection, Tower, Honolulu
96 The Encore, New York City
100 The Hub, New York City

ASIA & AUSTRALASIA
72 1 William Street, Brisbane
74 35 Spring Street, Melbourne
76 161 Sussex Street, Sydney
78 Chaoyang Park Plaza, Beijing
82 City Center Tower, Taguig City
84 Eq. Tower, Melbourne
86 FV, Brisbane
88 Guangzhou CTF Finance Centre, Guangzhou
90 Hangzhou Gateway, Hangzhou
92 Huangshan Mountain Village, Huangshan
96 Light House, Melbourne
98 Lotte World Tower, Seoul
102 Marina One, Singapore
106 Namdaemun Office Building, Seoul
108 Ping An Finance Center, Shenzhen
112 Poly International Plaza, Beijing
116 Raffles City Hangzhou, Hangzhou
118 Tencent Seafront Towers, Shenzhen
122 The Tembusu, Singapore
124 Tsinghua Ocean Center, Shenzhen
126 Zhengzhou Greenland Central Plaza, Zhengzhou
128 1 Parramatta Square, Parramatta
130 Gravity Tower, Melbourne
132 Green Residences, Hangzhou
134 IM tower, Tokyo
136 Kyobashi EDOGRAND, Tokyo
140 Nakanoshima Festival Tower West, Osaka
144 Ningbo Bank of China, Ningbo
148 One Avighna Park, Mumbai
152 Parnas Tower, Seoul
156 Rosewood Sanya and Sanya Forum, Sanya
158 Shenyang K11, Shenyang
162 Talan Towers, Astana
164 Telkom Landmark Tower 2, Jakarta
168 The Summit - Plot 554, Suzhou
172 The Suzhou Modern Media Plaza, Suzhou
176 Upper West Side, Melbourne
180 Urbana Tower 2, Kolkata
184 Zhongzhou E-CLASS, Shenzhen
EUROPE
138  A’DAM Toren, Amsterdam
140  Angel Court, London
144  Axis, Frankfurt
146  Canaletto, London
150  Dollar Bay, London
152  New’R, Nantes
154  The Silo, Copenhagen
158  Tribunal de Paris, Paris
162  Upper West, Berlin
164  White Collar Factory, London
166  Arena Tower, London
De Verkenner, Utrecht
Federation Tower, Moscow
Millennium Center 1, Sofia
Q22 Tower, Warsaw

MIDDLE EAST & AFRICA
170  Azrieli Sarona, Tel Aviv
174  Beirut Terraces, Beirut
178  Rothschild Tower, Tel Aviv
182  Zeitz MOCAA, Cape Town
186  Britam Tower, Nairobi
Iran Telecom Research Center, Tehran
Landmark Group Headquarters, Dubai
The 118, Dubai
The Shahar Tower, Givatayim

URBAN HABITAT
190  Barangaroo South/International Towers, Sydney
194  City Tower Musashikosugi, Kawasaki
196  Dua Menjalara, Kuala Lumpur
198  Greatwall Complex, Wuhan
202  National September 11 Memorial, New York City
206  Oasia Hotel Downtown, Singapore
210  SKYPARK, Hong Kong
214  SOHO Fuxing Plaza, Shanghai
218  The Pavilia Hill, Hong Kong
220  Univ360 Place, Seri Kembangan
222  Wolf Point West, Chicago

CONSTRUCTION
226  56 Leonard, New York City
228  111 Main, Salt Lake City
230  461 Dean Street, New York City
232  The EY Centre, Sydney
234  Warsaw Spire, Warsaw

A LOOK FORWARD

INNOVATION
238  3D-Printed Building
240  CAST CONNEX High Integrity Blocks
242  Hickory Building Systems
244  High-Resolution CFD for Wind Loading Tall Buildings
246  Hummingbird Tuned Liquid Column Gas Damper
248  Lean Core + Prefab Blade Wall System
250  MULTI
252  Timber Construction at Tallwood House

A LOOK BACK

TEN YEARS ON
256  Bahrain World Trade Center, Manama
Manitoba Hydro Place, Winnipeg
San Francisco Federal Building, San Francisco
258  Comcast Center, Philadelphia
259  Hong Kong Polytechnic University Community College, Hong Kong
Mode Gakuen Cocoon Tower, Tokyo
261  The Red Apple, Rotterdam
Boutique Monaco, Seoul
262  Poly Real Estate Headquarters Towers, Guangzhou
Tornado Tower, Doha
Torre Cepsa, Madrid
264  New York Times Tower, New York City
Hegau Tower, Singen
266  Lumiere Residences, Sydney
267  Newton Suites, Singapore
268  Shanghai World Financial Center, Shanghai

LIFETIME ACHIEVEMENT
270  Larry Silverstein
272  Aine Brazil
274  About the CTBUH & its Tall Building Awards Program
276  Index of Buildings
277  Index of Companies
281  Image Credits
283  CTBUH Organizational Structure & Members
The 150 North Riverside site is located prominently at the confluence of the three branches of the Chicago River and less than one block away from one of Chicago’s busiest commuter train stations. With exposed railroad tracks on the west side of the site and the city requirement for a public right-of-way on the east side, the remaining area on which to build was considered impossibly narrow, and the site sat undeveloped for decades.

Utilizing a unique core-supported structure with a very small footprint at grade, the design resolves the site challenges and provides a Class A office tower with efficient, column-free floor plates. The building’s unusual core-supported design results in a 221-meter tower resting atop a base that is merely 12 meters wide. The building’s narrow height-to-base ratio of 20:1 is among the world’s thinnest. In consideration of this, the building also contains the first-ever application of a 12-tank tuned liquid mass damper (TLMD) at the tower’s top to manage both building drift and acceleration. With a total of 605,665 liters of water, the TLMD also provides city-approved fire protection storage tanks to supply the building’s sprinkler system, a creative dual purpose that is a Chicago first. The 16 sloping columns at the cantilevers feature the largest rolled-steel shapes ever used in a high-rise building in the US. The shapes are 1,092 millimeters deep and weigh 1,377 kilograms per meter.

This narrow building footprint accomplishes several strategic goals, in addition to facilitating column-free office space. It also creates a dramatic interior space in the lobby, while allowing for more than 75 percent of the property to be unenclosed outdoor space. The tower’s limited footprint and the angled sweep of its underside appear to usher the river past the site, breaking down the tower’s considerable mass and presenting a balanced composition.

Tenants and visitors enter through a dramatic, 27-meter-high lobby enclosed by a glass-fin wall hung from the structure above. The lobby features the “150 Media Stream,” a one-of-a-kind curated multimedia wall that showcases the work of local and other digital artists. The

| Completion Date: January 2017 |
| Height: 221 m (724 ft) |
| Stories: 51 |
| Area: 136,010 sq m (1,463,999 sq ft) |
| Primary Function: Office |
| Owner/Developer: Riverside Investment & Development |
| Architect: Goettsch Partners (design) |
| Structural Engineer: Magnuson Klemencic Associates (design) |
| MEP Engineer: Cosentini Associates (design) |
| Main Contractor: Clark Construction Group |
| Other CTBUH Member Consultants: CBRE (property management); Permasteelisa Group (façade) |
| Other CTBUH Member Suppliers: ArcelorMittal (steel); Schindler (elevator) |

46-meter-long, site-specific installation provides a lobby focal point while also addressing the transition between the opaque wall over the parking deck and the glass-fin wall above, using 89 LED blades, carefully choreographed in varying lengths and widths.

Building amenity spaces include a restaurant, bar, fitness center and conference center — all with water views. The condensed lobby and elevator cores open the majority of the 8,093-square-meter site as a landscaped public park, plaza and riverfront promenade.

Outside, the park and plaza provide more than 300 linear meters of seating, multiple assembly/event spaces and 110 meters of at-grade Riverwalk frontage, which has already become one of the most populated walkways for downtown commuters. Those who negotiate the grade change of the landscaped plaza on the west side of the tower find themselves in the unique position of being outdoors and at eye level with Chicago’s famous elevated train, without being in a station.

The structural acrobatics performance has paid off commercially as well as urbanistically, taking what was once deemed an unbuildable site and creating an optimal mix of leasable floor space, public outdoor space, and semi-public indoor space.
Joining the ranks of the world’s top 10 tallest buildings, at number 5 at the time of completion, Lotte World Tower offers one of the world’s most complex stacks of mixed-use programming. The development is an example of success in the quest to reconcile the programmatic spectrum of the city into a “vertical village.” Components within the tower and adjacent podium and connected buildings in the complex include: a transit center, parking, public square, lakeside park, generous indoor public spaces, retail, aquarium, movie theaters, concert hall, food and beverage services, healthcare, roof gardens, conference spaces, office space, hotel, residences, and an observation deck. A network of 121 elevators strings together this array of programs. Over 10,000 people work in the tower, several hundred live in the tower, and an estimated 110,000 visit the complex every day for retail and entertainment.

As a major presence on the Seoul skyline, the building aspires to represent the sweep of Korean artistry and technology, referencing both the country’s artistic traditions and its prominence in the technology and electronics sector. The design of the tower offers a strong, simple, and coherent architectural statement, with a sleek and subtle compound curve, emphasized by mullions running from the ground up the tapered body of the building. The curved line of the building references the gracefulness of dynastic periods in Korean art, inspired by traditional Celadon ceramic vases, bowls, and cups.

A coordinated design process was essential for the complex to successfully host such a diversity of interconnected programs. For instance, a 2,036-seat concert hall — normally a feature that would be placed on the ground floor — is placed atop the eighth floor of the retail podium. Careful interior circulation planning ensures that it functions well amidst all the other uses converging on the site. Visual continuity is established through its use of the same curved geometries as the tower’s exterior and the scoop of public space at the ground level.

Some tall building critics have observed that the emphasis on verticality may come at a price: the fragmentation of cities into soaring towers divorced from any sense of neighborhood context or community. In the case of Lotte World Tower, the client and project team went to great lengths to frame the development, not as a self-contained city, but as an integrated part of its surroundings, woven into the fabric of Seoul rather than simply affixed to it. With its elevated “sky street” and abundance of vertical and horizontal connections, the development encourages connectivity to the urban environment with its walkability and major public spaces, including a landscaped lakeside park ringed by restaurants and seating and a major roof garden on top of the podium.

The tower reflects sustainability concerns by providing leadership in energy conservation and environmental stewardship. The development generates up to 14.5 percent of its own energy consumption through several innovative features, including wind turbines at the top of the building, an array of photovoltaic cells on the podium roof, and a geothermal mass system that uses the constant earth temperature 200 meters below the site to warm the complex in winter and cool it in summer. In the interest of structural efficiency and material economy, the tower is supported by a combination of the core and eight megacolumns located on the perimeter, in conjunction with a blended lateral force-resisting system, which consists of shear walls, outrigger trusses, and bracing.
The new Paris Courthouse accommodates up to 8,000 people per day. The building consists of a plinth five-to-eight-stories high, on top of which stands a tower of three superimposed parallelepipeds, whose section diminishes as the tower gets higher, creating a distinctive stepping profile.

The plinth gathers the public services, including 90 courtrooms. The building is entered at the ground floor level, from the piazza, into the monumental public lobby, where the flow of visitors and employees are greeted and directed. This rectangular space is the full height of the plinth, up to 28 meters, and is notable for its slender steel columns and the amount of natural light that enters via skylights and through the glazed façade that looks onto the piazza. Via this monumental room and the two small atria on either side of it, natural light can penetrate the heart of the building.

Meanwhile, the eighth floor has a 7,000 square-meter planted terrace; the staff restaurant opens onto this large garden. The tower’s outline breaks in two places, on the 19th and 29th floors, where "hanging gardens" have been created.

When the competition for the project was first launched, the French government suggested dividing the law courts into two separate buildings: one for the public functions and the second for the offices. The key idea from the design team was to house all these spaces in one single, important building, which would be capable, by its size and importance, of becoming the starting point for the redevelopment of the area around the Porte de Clichy.

One of the other design ideas was to build a courthouse that would be in line with a new vision of Justice that is modern and humanistic. The façades’ transparency, as well as the lobby’s dimensions, enable the public spaces to be open and communicate service to the citizens. Both the general public and users benefit from warm spaces, in particular the public cafeteria and the exterior green terraces.

The building rises out of an L-shaped site, between the city ring road (Peripherique) and Martin Luther King Park. The principal building’s axis follows the north-south diagonal of the Park, giving structure to the Clichy-Batignolles development area. The south façade turns towards Paris, and the north façade towards Clichy. This diagonal terminates a "visual corridor" that leads towards the north, between the east façade of the building and the Maison des Avocats, extending to Clichy. The office façades on the eastern and western sides give views towards Montmartre and the Eiffel Tower; the north and south facades, which are narrower, look towards central Paris or towards Clichy and Mont-Valérien. Thanks to this orientation, the building symbolically opens onto the City.

Sustainable development was one of the main concerns of the project. In terms of energy, the building is high-performing, thanks to thermal inertia, natural ventilation, and the integration of 2,000 square meters of photovoltaic panels. These add a distinctive interruption to the smooth glass of the façade, and express the government’s commitment to sustainable electricity generation in a clear design move.

This low-energy building uses about 70kWh/m²/year, and in some parts even 50kWh/m²/year, which is about half of the consumption of the most recent office buildings in La Défense. The building is the first high-rise in France to meet the "Plan Climat Paris" requirements.
Since 1924, one of the most identifiable structures in Cape Town, South Africa, was a massive grain storage and silo complex, constructed by the South African Railways and Harbours Company on the downtown waterfront. The building had sat unused since 2001, as the owners and community sought out a way to repurpose it. Shortly after a design concept was developed, an initiative began to create Africa’s first international museum dedicated to contemporary African art. It was decided that the grain silo could be transformed into a new home for the Zeitz Foundation’s art collection, which could act as a founding collection upon which the new museum could build. The top portion of the taller building was transformed into a luxury hotel, while the bottom portion of the elevator building and the storage annex would become the new museum.

The two major parts of the complex were connected by a central atrium carved from the silo’s cellular structure. Main circulation routes are housed within the atrium, via cylindrical lifts that run inside two bisected concrete tubes. The remaining internal tubes were removed to make space for 80 climate-controlled gallery spaces that were deliberately pared back to create a platform for the art on show.

By focusing on the history of the structure, specifically the many billions of kernels of grain that journeyed through the building over the decades, it was decided that the form of the atrium’s volume should take the shape of a grain of corn. The shape was scaled up to fill the 27-meter-high volume and translated into thousands of coordinates. In order for the building to retain its structural integrity, a new concrete building had to be cast inside the old shell. The 170-millimeter-thick concrete tubes were lined with inner sleeves of reinforced concrete, following the atrium shape to reveal the curved geometries of the 4,600 cubic-meter space.

Retaining existing steel and concrete allowed for limited additional wall and ceiling finishes, and is in accordance with international best practice for sustainable museum design. When a survey uncovered that the original walls were not perfectly vertical, it was decided to cast the new walls with varied widths to achieve a fixed vertical inside of the tube. New walls were cast in the final atrium shape and used as a guide to trim the old walls by using handheld double-disk saws.

The cut sweeps through the concrete at varying angles. Numerous iterations were explored to ensure that none of the angles were too oblique, which could have caused the concrete to chip during the cutting process. Small chamfers were applied to sharp edges and gradually tapered out as the angle grew in width. Both surfaces were polished together into one continuous surface. The old and new concrete can be identified by the varying textures resulting from the difference in historic and modern aggregate mixtures. The almost archaeological attempt to showcase the original silo’s exposed spaces and textures was made possible through the use of modern construction materials and techniques.

From the outside, the greatest visible change to the building’s original structure is the addition of the glass windows inserted into the geometry. These multi-faceted windows bulge outward as if gently inflated. By night, this transforms the building into a glowing beacon in Table Bay.
Envisaged as a “tropical tower” in the concrete jungle, the Oasia Hotel Downtown incorporates lush greenery on its façade and terraces, rejecting the notion that to build more densely means to retract into increasingly insular and sterile shells. The Oasia, by contrast, is like a giant tree — soft, layered, breathing, shading — providing respite and relief to its occupants, neighbors and city: a true vertical urban habitat. The tower stands out with its plant-covered façade of red and green and is a contrast to the sleek grey and blue high-rises, but it connects to the green of Singapore’s cityscape.

Offices, hotel and club rooms are located on different strata, each with its own sky garden. These additional “ground” levels, open-sided for formal and visual transparency, create generous public areas for recreation and social interaction throughout the high-rise, despite the high-density location. Relocating the tower’s core to four corner supports allows for a unique 360-degree view of the city, and opens the tall, yet sheltered gardens to allow breezes to pass through for cross-ventilation that doesn’t require air conditioning, making them functional, comfortable tropical spaces. The hotel has swimming pools and sitting areas, as well as the main lobby in the sky gardens, while the office portion of the building also has its own dedicated sky garden and a swimming pool, where people can enjoy the green during a break from work. Passersby use the shaded walkways that the building provides to shelter from the sun and rain.

Landscaping is used extensively as an architectural surface treatment, and forms a major part of the development’s material palette, both internally and externally, achieving an overall Green Plot Ratio of over 1,000%. The tower’s red aluminum mesh cladding is designed as a backdrop and sun-shading “skin,” revealing itself in a dynamic dance with the changing growth, attracting animals and insects. Instead of a flat roof, the tower is crowned with a tropical bower; living, diverse and floral.

Planting is one of the best ways to combat the urban heat island effect, as plants store solar energy as chemical bonds rather than converting it into heat. Twenty-one species of creepers sit in fiberglass planters that are easily accessible via walkways behind the aluminum mesh façade screen. Another 33 species of plants and trees were selected, providing a total of 54 species of plants and trees to improve biodiversity — both through plantings and by providing habitat for squirrels, small lizards and butterflies — in the downtown city center.

The site is located in Tanjong Pagar, which is home to iconic heritage sites, and borders the Central Business District on one side and Chinatown on the other. The contrast of the old and modern Singapore is reflected in the design of the building: the color red is very auspicious in Chinese culture and the permeable façade lets the interior light shine through at night, giving the tower the look of an illuminated abstraction of a Chinese lantern.
Landscaping is used extensively as an architectural surface treatment, and forms a major part of the development’s material palette, achieving an overall Green Plot Ratio of over 1,000%.

Left: This section drawing shows the three distinct “Sky Terraces” that distribute public realm throughout the building.
Opposite Top: Despite its rooftop location, the Sky Terrace on the 27th floor is adequately protected by a large awning and encircling façade.
Opposite Bottom Left: An exterior view of the Sky Terrace demonstrates its porosity and integration with the building façade.
Opposite Bottom Right: The Sky Terraces bring greenery and common outdoor spaces to height in the building.
MULTI

MULTI, the world’s first rope-less, multi-directional elevator, ushers in the end of the exclusive 160-year reign of rope-dependent elevators, harnessing the power of linear motor technology to move multiple cars in a single shaft, vertically and horizontally. The system follows a powered track, and cars can change direction through an exchanger device, which shuttles the car from one shaft to another, or rotates to take the car in a new direction. The cars’ motorized wheels follow the power rail independent of the passenger cabin. At intersections, the exchanger, laid flush with the track, rotates to match the new direction and locks in place, like a vertically oriented railway turntable. The car’s motor assembly rotates in sync with the exchanger, while the cabin floor stays level.

The MULTI elevator system has been extensively tested at the 246-meter Aufzugsturm in Rottweil, Germany. Three of the 12 elevator shafts at the test tower are devoted to testing MULTI.

The potential that can be realized from this innovation is extensive. In a typical high-rise building, more than 50 percent of the footprint needs to be reserved for transportation and service facilities. Because it does not need ropes, MULTI requires fewer and smaller shafts than conventional elevators, and can increase a building’s usable area by up to 25 percent, adding rentable/leasable space. Instead of one cabin per shaft moving up and down, MULTI offers the potential to operate multiple cabins in a loop, much like a metro system inside a building. This results in a higher transport capacity – up to 5 percent – as well as reduced waiting times for passengers (an elevator cabin can now be available every 15 to 30 seconds). MULTI also requires up to 60 percent lower peak power levels when compared to conventional elevator systems, which allows for better management of a building’s energy needs, and reduces investment costs in the power supply infrastructure.

Traditional elevators with one single cabin in a shaft not only restrict mobility and space; they also limit the height of the building – with traditional wire suspension or ropes, the limit is around 600 meters. Considered solely as a factor of elevator capacity or capability, the potential heights and floor-plate sizes of tall buildings is now theoretically unlimited. Perhaps most exciting, the introduction of a multi-directional elevator opens up infinite combinations of vertical and horizontal building design opportunities. Because of its ability to move horizontally at any angle, the system can support traffic through and between buildings of previously unseen intricacy.

While further research is underway to fully unlock the potential of MULTI in future high-rise designs, the first installation has been announced. The new 140-meter East Side Tower in Berlin, expected to be completed by 2021, will utilize a MULTI elevator system.
The introduction of a multi-directional elevator opens up infinite combinations of vertical and horizontal building design opportunities.
Tall Buildings are changing the fabric of cities around the entire globe. After a century of development in which tall buildings were largely commercially driven “machines to make the land pay,” deeper agendas are now afoot. These agendas are aimed at creating more socially, culturally, and environmentally appropriate buildings that deliver greater urban density and more sustainable cities into the future.

Providing a global overview of tall building design and construction in a given year, this book explores the projects, technologies, and approaches currently reshaping skylines and urban spaces worldwide. Discover how tall buildings are evolving into better stewards of the urban environment through contemporary design practices, advanced construction techniques, and a greater emphasis on human comfort.

The Tall Buildings + Urban Habitat series is produced by the Council on Tall Buildings and Urban Habitat (CTBUH), the global authority on the inception, design, construction, and operation of tall buildings and future cities.