

The Space Within: Skyspaces in Tall Buildings

An output of the CTBUH Urban Habitat / Urban Design Committee

James Parakh, Daniel Safarik & Peng Du



CTBUH Technical Guides

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Chapter Titlepage Image: The Tower at PNC Plaza. © Connie Zhou Photography

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About CTBUH Committees

CTBUH Committees contribute to the Council in many ways, including generating / peer reviewing research outputs, judging awards, contributing data and images to our

Skyscraper Center database, and ruling on height criteria. Where a CTBUH Working Group forms for a period of time focused on a particular output (usually a publication),

a CTBUH Committee is a continual presence, focused on an essential aspect of the Council's mission – though individual committee members may change over time.

See more on other CTBUH Committees at committees.ctbuh.org

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8 Chifley, Sydney



20 Fenchurch, London



110 Bishopsgate, London



Grattacielo Intesa Sanpaolo, Turin



KK100, Shenzhen



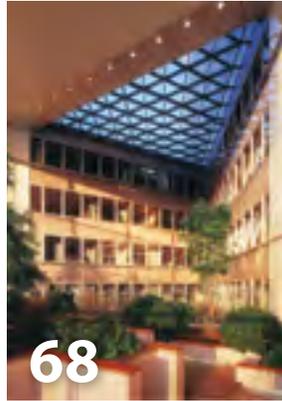
Mode Gakuen Cocoon Tower, Tokyo



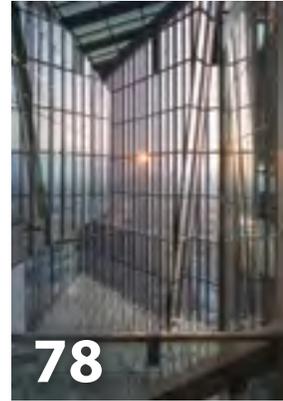
Abeno Harukas, Osaka



Ann & Robert H. Lurie Children's
Hospital of Chicago, Chicago



Commerzbank Tower, Frankfurt



European Central Bank, Frankfurt



FKI Tower, Seoul



Oasia Hotel Downtown, Singapore



Shanghai Tower, Shanghai



The Tower at PNC Plaza, Pittsburgh



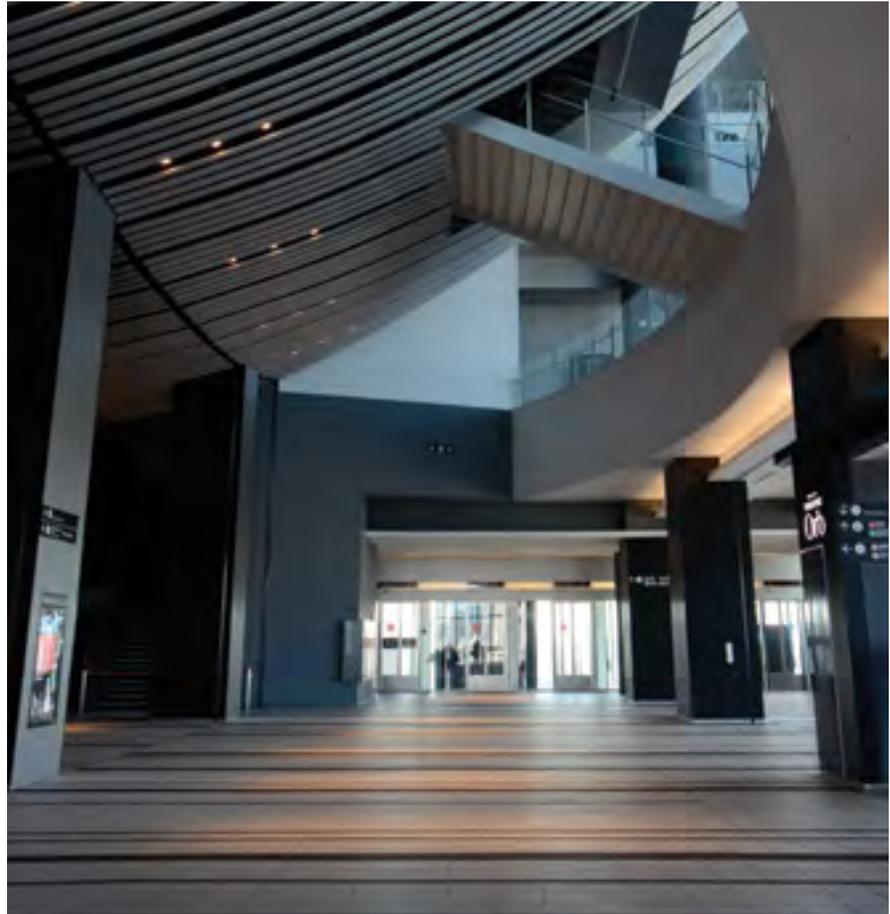
Torre Reforma, Mexico City

Introduction

The story of skyscrapers, throughout their 130-plus-year history as a building type, has been predominantly one of achieving new heights and creating an impression on the skyline. Commercial and symbolic objectives have conspired to make the skyscraper a kind of sculptural object, with a need for spatial and navigational efficiency driving most of the decisions about the interior experience, particularly in office buildings (see Figure 1.1), but also in many residential buildings as well.

There are a number of factors globally that are driving people to move into cities: Real estate is becoming more scarce and expensive, governments are controlling the extent of outward sprawl and in many cultures, urban areas and their amenities are offering a quality of life that draws both a younger and a senior demographic. As a result, a mix of uses within a single building is becoming more commonplace. The pressure has increased on developers and designers of tall buildings to create a more pleasant and comprehensive environment for inhabitants. While they can always offer a thrilling perspective on the city below, skyscrapers have long lacked the critical element that makes urban life desirable – a sense of civic life; of participation in the cities in which they are built. The experience of being in a skyscraper can be as isolating from the natural and urban environment as being in an airplane. The recycled air, lack of natural light (or control of it) and removal of a sense of scale or proportion has had deleterious and alienating effects on people's physical and mental health. Ill effects of frequent flying and long hours working in tall buildings – often compounded in people who have to do a lot of both – are similar.

There is, however, a growing recognition that incorporating a variety



▲ Figure 1.1: The sweeping lobby space at Shibuya Hikarie, Tokyo, is typical for skyscrapers, as it is intended to move large groups of people through at once – not necessarily to have them linger. © Terri Meyer Boake

of social spaces can improve the quality of life for those living and working in tall buildings. These spaces can also improve productivity. As residential units become smaller, they are often augmented by amenity areas which allow for interaction with neighbors. Conventional amenities, such as health club facilities and party rooms, are being augmented by child-friendly play rooms and even pet-friendly spaces within tall buildings. From a workplace perspective, individual workspaces have been getting progressively smaller, which reinforces the importance of creating larger social spaces where people can interact. In many instances, large corporate and

sterile office building lobbies are being transformed into gathering places with the addition of café pavilions, break-out or touch-down spaces, and even entertainment spaces offering a variety of lounge-type experiences such as games and televisions for watching sports and current events. These spaces help humanize the tall building and speak directly to how existing buildings may evolve.

Skyspaces are part of a logical progression and evolution of tall building common spaces. As the “front door” and main gathering space, ground-floor lobbies have long been rendered in expensive materials and



▲ Figure 1.2: The soaring atria of Atlanta's Hyatt Regency at the Peachtree Center set a precedent for future generations of tall building interiors. © (cc by-sa) Stan Satin

given expansive dimensions beyond what would be typically found in upper floors (particularly in hotels and residential buildings). In the 1960s, full-height atria in pioneering projects such as the Hyatt Regency Peachtree Center, Atlanta (see Figure 1.2), showed how spectacular an experience the views *within* a tall building could be, in addition to views *from* or *of* a skyscraper. This practice was repeated around the world by John Portman, the Peachtree Center's architect, as well as many others, to ever-more spectacular effects. The idea of volumetric spaces within tall buildings has since progressed from the lobby floor to spaces on high floors in skyscrapers.

In select cases, the recognition of the positive and beneficial effects of access to greenery, natural light, ventilation, visual variety, frequent interactions with neighbors and colleagues, and changes in scale and proportion throughout the day – combined with the impracticalities of returning to the ground level to achieve all these goals – has resulted in some astounding recent innovations in high-floor communal space in tall buildings. These "skyspaces", lobbies, atria, and other volumetric, multi-story communal spaces located at height in tall buildings, borrow some of the properties of soaring ground-floor lobbies and transfer them into sky.



▲ Figure 1.3: The Bow, Calgary, admits substantial daylight into its spacious ground-floor lobby, a move that is repeated on transfer floors higher in the building. © Nigel Young / Foster + Partners

They are increasingly important factors in the appeal of contemporary high-rise buildings and the improved quality of life that these spaces offer for the inhabitants.

However, a specific set of challenges and issues accompanies these spaces. Chief among these are:

Spatial Quality / Usage

Who uses the space? Is it well-populated? Are there enough activities and amenities to keep people returning? What is the trade-off in terms of traditional leasing revenue vs. the provision of a public or shared amenity? What kinds of parameters should be



Oasia Hotel Downtown

Singapore

Background / Overview

Oasia Hotel Downtown is located in the heart of Singapore's Central Business District, surrounded on all sides by even taller, monolithic high-rises, busy streets, and the world's second-busiest port immediately across a six-lane highway. Despite the surrounding tropical environment and its ability to support more species than any other biome on Earth, the financial district of Singapore is more of a "concrete jungle." The design team, however, built into the tower the ability to nourish vegetation. Upon completion in 2016, Oasia immediately began to support a tropical habitat of its own, and is slowly becoming a beacon of nature in the city's dense urban core.

Oasia is a mixed-use building, with the program split between office, hotel and hotel club functions. According to the architects, the tower acts "like a sandwich", with entire floors being dedicated to office space or hotel rooms. These layers are then stacked vertically and separated by – and "sandwiched" between – four expansive, multi-story urban verandas that are each open to the exterior on all four sides, with two sides as full-height urban windows (see Figure 2.12.1).

It is these very open-air sky gardens that make this building a one-of-a-kind environment, as their immense volumes carve out large portions of the building, making the structure highly porous, and giving occupants access to natural light, cross-ventilation, and the sensation of inhabitable "ground", despite being located far above street level. Supplementing this is the living façade of the building, home to more than 20 different species of plants that creep up the building, attracting birds,

insects, and even small animals to the skyspaces. The building becomes a living habitat in itself and brings a greater immersion in nature to the verandas suspended in the air.

Overview of Skyspaces

Oasia Hotel Downtown stands as a vertical, green sculpture (see Figure 2.12.2) with four distinct moments where a large, multi-floor piece has been "carved" out of one of its corners. These moments occur in a continuous sequence, progressing up the height of the building one after another (see Figure 2.12.3). Above the sixth floor, every occupiable floor in the building is adjacent to a skyspace. These spaces flip to the opposite corners to orientate towards different parts of the city. The terraces on floors 6-11 and 21-26 are located on the southwest corner, while the skyspace running from floors 12-20 is located on the northeast. The exception to this rule is the highest terrace, Skyspace 4, which is located in the center of the roof and takes up almost the entirety of its floor plate (see Table 2.12.1).

Access

The general public has access to the lobby on Floor 12, as well as the bar and pool on Floors 21 and 27, generating a social mixing effect between the building's tenants and passersby who can't help but take a peek inside. The lowest skyspace (Number 1, on the 6th floor) is reserved for office tenants.

Access to the three lower skyspaces in the building varies by the nature of the programmed environment surrounding the space. Since the 12th-floor space is the lobby of the hotel, any prospective guests, visitors, and even members of the public are welcome there. The 12th

Project Data:

Project Name

- ▶ Oasia Hotel Downtown

Location

- ▶ Singapore

Year of Completion

- ▶ 2016

Building Height

- ▶ 190.9 m

Number of Floors in Building

- ▶ 27 above ground

Number and Position of Skyspaces

- ▶ 3 sky terraces, one each on floors 6, 12, and 21; 1 roof deck on floor 27

Area

- ▶ Total Building gross floor area (GFA): 35,871 m²
- ▶ Total "Skyspace" area: 3,215 m²
- ▶ "Skyspace" percentage of total GFA: 8.96%

Volume

- ▶ Total Building volume: 433,795 m³
- ▶ Total "Skyspace" volume: 156,331 m³
- ▶ "Skyspace" percentage of total volume: 36.04%

Geographic / Climatic Data:

Geographic Position

- ▶ Latitude 1.3°N
- ▶ Longitude 103.8°E

Site Elevation Above Sea Level

- ▶ 16 m

Climate Classification

- ▶ Köppen Af; Equatorial, fully humid climate

Average Daytime Temperature during the Hottest Months (Jul - Sep)

- ▶ 31°C

Average Daytime Temperature during the Coldest Months (Dec - Feb)

- ▶ 29°C

Annual Average Relative Humidity

- ▶ 80.4%

Average Monthly Precipitation

- ▶ 179.2 mm

Prevailing Wind Direction

- ▶ Northeast

Average Wind Speed

- ▶ 2.5 m/s

Annual Average Daily Sunshine

- ▶ 5.7 hours

◀ Figure 2.12.1: External view of the 12th-floor sky terrace at Oasia Hotel Downtown. © K. Kopter

Walking Tours

Each year, CTBUH's Urban Habitat / Urban Design Committee, in conjunction with CTBUH headquarters, organizes a walking tour that takes place at roughly the same time in multiple cities around the world.

The past four annual tours have occurred at different times of year and times of day, across numerous time and climatic zones. Even when the premise is the same, the experience in each city and daylight condition was different. Yet, where the relationship between tall buildings and their cities is concerned, it is possible to draw some common themes and develop a sketch understanding about what is and isn't successful in the contemporary urban landscape. In this chapter, we provide an overview of the "Space Within"-themed walking

tours and draw out key lessons, relating these wherever possible to the broader themes in the Guide.

The Space Within walking tour took place in 15 cities on six continents on June 21, 2017. The goal of this walk was to experience at least one "space within" a tall building and explore the relationship between the tall building and its communal, volumetric interiors. This walk, spread across the world, was united by social media via the Twitter hashtag #CTBUHWalks, resulting in the sharing of hundreds of photos, movies, and in-the-moment observations. After the tours, coordinators and attendees prepared detailed reports of their respective journeys, affording insights into the unique conditions of each city, as well as common themes. Highlights from those reports are presented here.

Americas

Chicago

Led by Sara Beardsley, Senior Architect, and Joel Kerner, Architect, Adrian Smith + Gordon Gill Architecture

In Chicago, the walk combined observation of some existing spaces within tall buildings and highlighted some existing and several new projects along the West and South Loop, the city's core business district. Of these, only the first visit of the tour was to a location that could be described as a "skyspace" as defined in this Guide. However, the spacious interiors visited elsewhere on the tour proved instructive as part of a broader story about tall buildings and their communities.



▲ Figure 3.1: The roof garden in the Harold Washington Public Library, Chicago, is a pleasant gathering space at height, but one which is somewhat neglected due to poor wayfinding. © CTBUH



▲ Figure 3.2: The atrium at 311 South Wacker, Chicago, is a volumetric space at ground level, where a substantial amount of area is given over to public use during operating hours. It was originally intended to be connected to Chicago's Union Station via an under-river pedestrian tunnel that was never completed. © CTBUH



▲ Figure 3.3: James R. Thompson Center lobby. The volume of the space was meant to communicate the openness and accessibility of state government. © RainerViertlbock

The **Harold Washington Public Library**, executed in a historicist style that belies its construction in the 1980s, has a vaulted and gabled roofline with substantial glazed sections, creating a pleasant space on the building's 11th floor (see Figure 3.1). With planters containing small trees, hedges, and window boxes protruding into the marble-floored space, the image is one of gracious formality reminiscent of the Carnegie libraries, post offices and railway stations of the late 19th century. While it is a popular location for weddings and other special events, and it bestows a privileged view of the Willis Tower through its glass roof, the space seems rather forlorn on a typical day. One of the issues is that access routes are not well-signed; one must traverse 11 flights of escalators or take a somewhat hidden elevator to reach it.

A substantial atrium, readily perceived from inside and out, lies at the foot of **311 South Wacker**, the second stop on the tour. Originally intended to connect

three tall buildings, only one of which was constructed, the 26-meter-high atrium brings in light from two sides and above (see Figure 3.2). The east-west orientation of the atrium, and the exposed steelwork in what is otherwise a concrete-frame building with marbled interiors, alludes to the history and onetime intended future of the project. The atrium aligns almost exactly with the path of the Metropolitan West Side Elevated Railroad, which was torn down and replaced by the Congress (now Blue Line) rapid transit line in 1958. Additionally, a pedestrian tunnel was to have connected the atrium with Union Station across the Chicago River, but was never finished.

Another, yet again different formulation of the 1980s Postmodern style could be found next at the **James R. Thompson Center**, the 1985 state office building with a soaring glass atrium and glass-enclosed elevators (see Figure 3.3). The circular sub-grade lobby is a popular lunch

spot for downtown office workers, and an important transit hub and public-services facility. But the future of the building, plagued by poor thermal dynamics and deferred maintenance, is in question, as the budget-strapped State of Illinois debates whether and how to preserve or sell the property to a developer, which could result in its demolition and replacement.

One of the most interesting new spaces in a Chicago tall building has just opened at **150 North Riverside**, an office building completed in early 2017. The Space Within tour was able to experience the airy lobby and related public park space, both made possible by the building's unusual structure. In order to build on the site, the design team had to deck over active railway tracks and provide a public right-of-way alongside the river. The result, a slender tower supported by cantilevers that bows out in a "V" shape to achieve its full floorplate depth, allows a spectacular lobby to be created on one

Conclusion and Recommendations

The primary approach to quantitatively analyzing the relative placement and scale of the skyspaces has been to evaluate the tall buildings in this Guide on the basis of the relative amount of floor space (area) and volume in the building devoted to skyspaces, as opposed to other, specific programmed uses.

In Table 4.1 (see pages 180-181), which is referred to at the end of each Case Study, two rows of totals are provided for each Case Study building. The skyspaces totals represent the sum of skyspace figures for each building, added together.

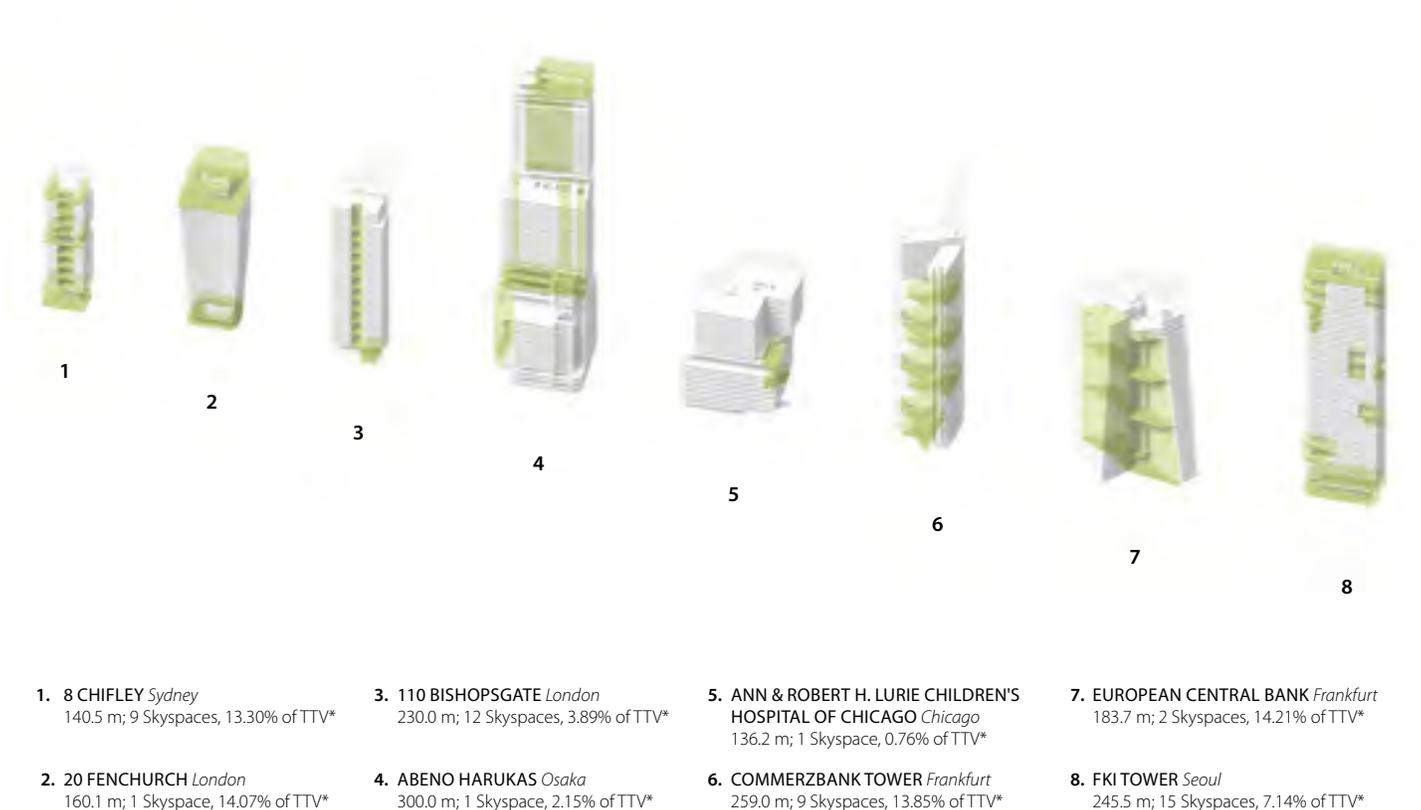
The Skyspaces and other volumetric totals add together the skyspace and “other volumetric space” figures for each building. In the rightmost group of columns, the total dimensions of skyspaces and combined spaces are divided by those same characteristics for the entire tower that contains them, with the result displayed as a percentage.

In each column, the highest and lowest values are highlighted for comparison.

Although these proportions are noted in the individual quantitative analyses for each case study, which are then

placed in context against their peers in the Guide, it should be noted that scale alone is not an absolute determinant of value. But considering that tall buildings have historically been conceived as “built equations” that are “machines for making the land pay” (Irish, 1989), fair consideration should be given to those commercial projects that derive value from a strategy other than packing as many people onto a floor as possible.

For example, there is not necessarily something inherently more valuable about a building that devotes 9 percent of the area and 36 percent of the



▲ Figure 4.1: This axonometric drawing of all 15 projects in this Guide shows the high variety of orientations and shapes of skyspaces.
* "% of TTV" refers to ratio of the volume of skyspace(s) to the Total Tower Volume (TTV). © CTBUH

volume of the building to skyspace use (as does Oasia Hotel Downtown, which is superlative in both categories). But as this unconventional approach was deemed to be worthwhile by the project's investors, that is worthy of both quantification and recognition; this is why the individual Case Study analyses refer to tall buildings with a significant proportion of communal space as "generous." This principle becomes clearer in a comparative diagram (see Figure 4.1). Some potential revenue was almost certainly surrendered in each case by not filling the floor with wall-to-wall,

double-loaded corridors; on the other hand, the special amenities offered in the form of the skyspaces also command a premium, and there are cost savings to be had from leaving some typically air-conditioned spaces open to the elements or as part of a double-skin façade/climate buffer zone.

It is also true that there may be more residual floor-space capacity for social uses in some programs than others, such as hotels, where there are typically fewer people per floor, or more area per person, than would be expected in an office building. Thus,

it would have been equally fair, if not fairer, to break apart the analysis into buildings by program type, such that office buildings would only be compared to other office buildings, for example. Of course, with many tall buildings pursuing a mixed-use model, including about half of those featured in this Guide, this analytical approach would also have been subject to exceptions. This is also why a collection of seemingly "low" scores for the Ann & Robert H. Lurie Children's Hospital, for example, has very little to do with the objective evaluation of its skyspace; the economics of space distribution of a



9. GRATTACIELO INTESA SANPAOLO *Turin*
166.3 m; 1 Skyspace, 4.26% of TTV*

10. KK100 *Shenzhen*
441.8 m; 4 Skyspaces, 3.90% of TTV*

11. MODE GAKUEN COCOON TOWER *Tokyo*
203.7 m; 36 Skyspaces, 8.56% of TTV*

12. OASIA HOTEL DOWNTOWN *Singapore*
190.9 m; 4 Skyspaces, 36.04% of TTV*

13. SHANGHAI TOWER *Shanghai*
632.0 m; 22 Skyspaces, 20.64% of TTV*

14. THE TOWER AT PNC PLAZA *Pittsburgh*
166.0 m; 13 Skyspaces, 4.67% of TTV*

15. TORRE REFORMA *Mexico City*
246.0 m; 10 Skyspaces, 7.03% of TTV*

It is becoming increasingly accepted that greater urban density is required to achieve more sustainable patterns of life, in order to reduce energy consumption and thus combat climate change. The concentration of people in denser cities – sharing space, infrastructure, and facilities – offers much greater energy efficiency than the expanded horizontal city, which requires more land usage as well as higher energy expenditure to facilitate infrastructure and mobility. However, the full implications of this push to greater density, especially vertical density, are not fully understood, and cities around the world – including both emerging and established skyscraper cities – are grappling with the question of how to move towards greater height and density while still maintaining a high quality of life. As the world population continues to urbanize, the need for urban amenities becomes amplified; cities must increasingly account for an expanding urban population.

The interiors of tall buildings provide an extraordinary opportunity to create habitable, communal space in increasingly dense and vertical cities. Although skyscrapers are typically celebrated for their visual impact on the skyline, or as places to view the city, the quality of their interior spaces needs to be more strongly considered. This is especially the case as, with climate change, the outdoors become less habitable for longer portions of the year.

This CTBUH Technical Guide thus analyzes how to approach urban habitat *within* tall buildings, highlighting case studies of large, multi-floor communal spaces at height, in locations around the world, in a broad mix of building functions, in different climates, and at different scales – to help readers understand the ingredients that make them successful, or the lack of ingredients that hold them back from their full potential.

This Technical Guide is the product of more than a year's research by the CTBUH Urban Habitat / Urban Design Committee, CTBUH staff, and a research team of architecture students from the Illinois Institute of Technology (IIT). It is part of a series of Technical Guides that provides practical state-of-the-art technical details on specific areas of skyscraper research, offering a wealth of knowledge essential for industry professionals, academic researchers, and all others interested in the relationship between skyscrapers and urban habitat.



Research Undertaken in Conjunction With:

