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Skybridges: State of the Art

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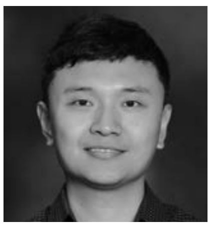

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Abstract

For more than a century, architects and urban visionaries have foretold of three-dimensional cities, with tall buildings linked by skybridges forming a new kind of urban fabric. Rapid urbanization and new technological advances have converged to reignite the potential of such constructions at the urban scale. An examination of the current state-of-the-art in skybridges in multi-building private developments provides lessons for translating best practices in architecture and programming to the next order of magnitude.

thyssenkrupp

This paper summarizes research found in the CTBUH Technical Guide *The Space Across: Skybridges and the Future City*, the culmination of a research project generously funded by thyssenkrupp Elevator.

Keywords: Infrastructure, Skybridges, Sustainability, Urban Design, Vertical Transportation

Introduction

As many architects and visionaries have shown over a period spanning more than a century, the re-creation of the urban realm in the sky through connections between buildings at height has a vast potential for the enrichment of our cities (see Figure 1). As the world rapidly urbanizes, greater thought needs to be expended on how horizontal space can be developed at height, particularly as public space is increasingly at a premium, energy consumption remains high and concerns about the effects of density and isolation on physical and mental health take new precedence. The authors of this paper received an 18-month research grant from thyssenkrupp Elevator to undertake a study of the potential use cases for skybridges in future three-dimensional cities. The output of that research, which includes design considerations at the building and urban scale, across architecture, engineering, development and construction disciplines, concluding with speculation on the potential urban future of the 3-D city, is captured in full in the CTBUH Technical Guide *The Space Across: Skybridges and the Future City*. This paper summarizes the key findings of the research into current skybridge design practice from an architectural design perspective.

Classification and Analytical Criteria

A **skybridge** is defined as "a primarily enclosed space linking two (or more) buildings at height." "Enclosed" means that the path of travel within the skybridge is

Figure 1. Since the turn of the previous century, urban visionaries have recognized the practical advantages of connecting tall buildings at height, at the city scale. Source: King's Dream of New York, Moses King, 1908; cover illustration: "The Cosmopolis of the Future" by Harry M. Pettit.

under shelter, and most often, surrounded by some kind of partition, whether solid, transparent, or perforated, on all sides. "Linking between buildings" refers to the bridge being physically connected and supported in its entirety between two or more separate buildings. "At height" refers to structures that are at least six full floors above grade, so as to distinguish them from typical pedestrian overpasses over roadways, canals and railways seen all over the world. Some exceptions to the above definitions may be made for illustrative examples of trends and special circumstances.

Typologies

The authors analyze two general types of skybridge structure: "enclosed circulation" and "enclosed programmatic."

An "**enclosed circulation**" skybridge primarily exists only to transfer pedestrians from one building to another (see Figure 2). It will typically at least be covered with a roof, and minimally decorated or furnished. It is the most common form of skybridge, as it practically serves the goal of passing from point A to point B without having to descend to ground level to pass between two buildings.

An "**enclosed programmatic**" skybridge has all the characteristics of the "enclosed circulation" skybridge, but has a distinct program that draws people to the space for a reason beyond passing from one building to another (see Figure 3). This can include common-use areas for occupants of the two buildings that adjoin the skybridge, such as gyms, recreation rooms, lounges, restaurants, etc., or other extensions of attached buildings' programs, such as office or residential space.

Measurement and Calculation Methodology

The primary mode of quantitative evaluation of skybridges in this research has been to examine their spatial relationships to attached buildings, both in the sense of how they appear as part of a composition of proportions, and in the sense of the proportion and intensity of programming that takes place inside the skybridges, relative to the rest of the complex in question. These properties are then examined collectively. The essential pursuit here is to quantify and compare in some way the range of methods for connecting buildings at height, as well as the reasons for doing so, and to come to some conclusions about how well the dual objectives of creating a striking and powerful symbol on the skyline is reconciled with that of making the best functional use of a skybridge in a given application.

The numerical values for each case study and its skybridge(s) were obtained from a digital model of the buildings, traced primarily from plans, elevations, and sections provided by the project stakeholders. The gross floor area (GFA) for each tower consists of the area of all floor plates within the enclosure of the tower from grade level to the top occupiable floor, excluding the podium footprint and any levels below grade (see Figure 4).

Figure 2. An "enclosed circulation" skybridge primarily exists to transfer pedestrians from one building to another. Shown here : Highlight Towers, Munich. © Rainer Viertlblock

Figure 3. An "enclosed programmatic" skybridge has some kind of distinct program that draws people to the space for a reason beyond passing from one building to another. Shown here: The lower deck of the skybridge at American Copper Buildings, New York City, which contains a hot tub and pool. © Max Touhey

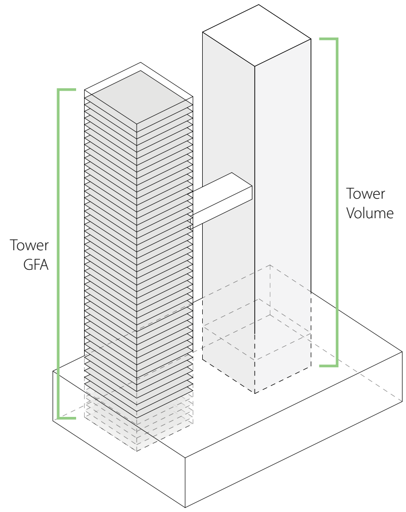


Figure 4. Diagram of the method used for obtaining gross floor area and volume of the towers connected to each skybridge under study.

The volume figure for each tower consists of any space within the building's enclosure from the building footprint at grade level to the highest point of the tower. The podium volume outside the tower is excluded from this calculation (see Figure 4).

The measurement criteria for the skybridges and comparisons to their adjoining towers' measurements are broken into span dimensions and functional dimensions. **Span dimensions** refer to the "span" portion of a skybridge: that which is identifiable as physically distinct from the towers to which it is attached. Length, width, height above ground floor, height of span, area and volume are all considered (see Figure 5). The "**functional**" skybridge dimension may extend beyond the "span" dimension to include all programmed area of the skybridge, which in some cases may extend into the footprint of the towers to which the skybridge attaches; or, it may have one or more dimensions that differ from the "span" of the skybridge.

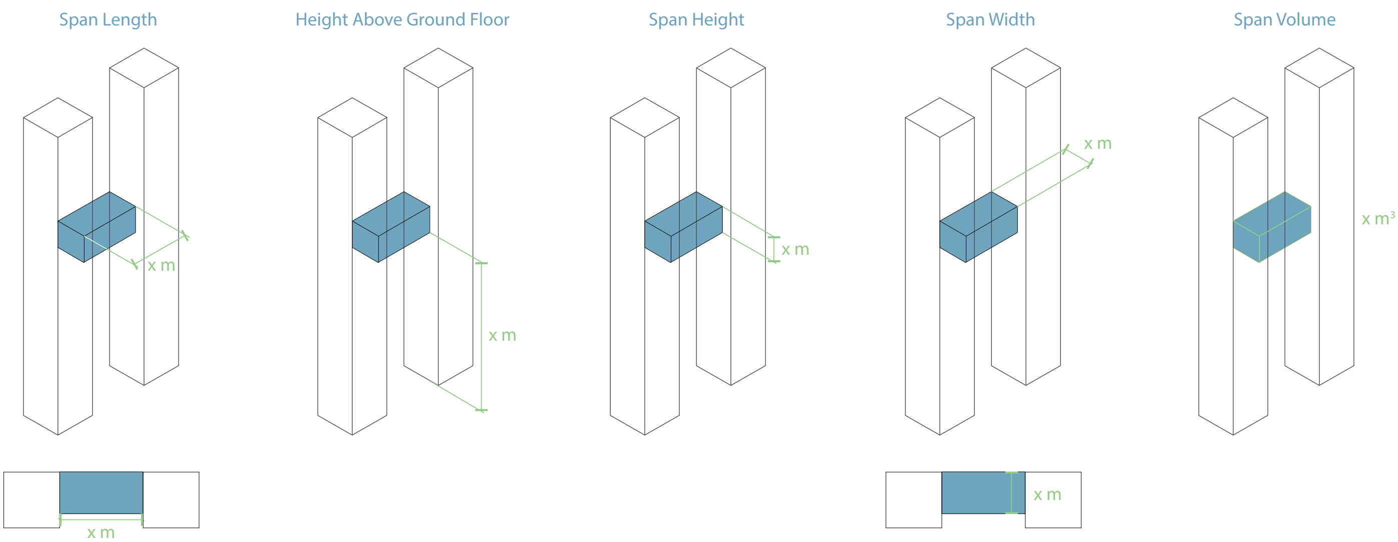


Figure 5. Calculation diagrams for determining the dimensions of the skybridge span.

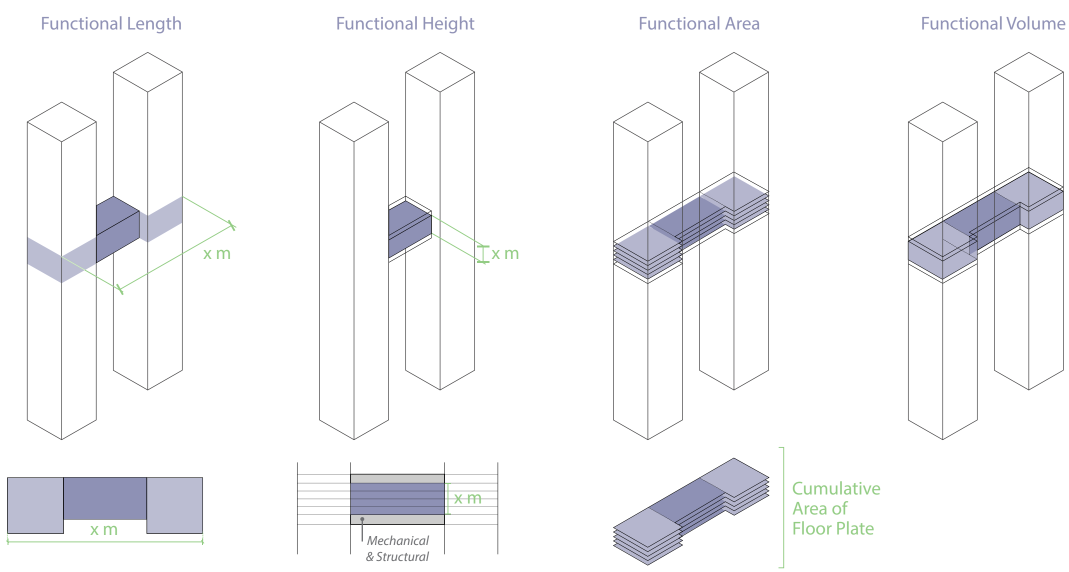


Figure 6. The "functional" skybridge dimension may extend beyond the "span" dimension to include all programmed area of the skybridge, which in some cases may extend into the footprint of the towers to which the skybridge attaches. Here, the calculation methods for determining functional dimensions are shown.

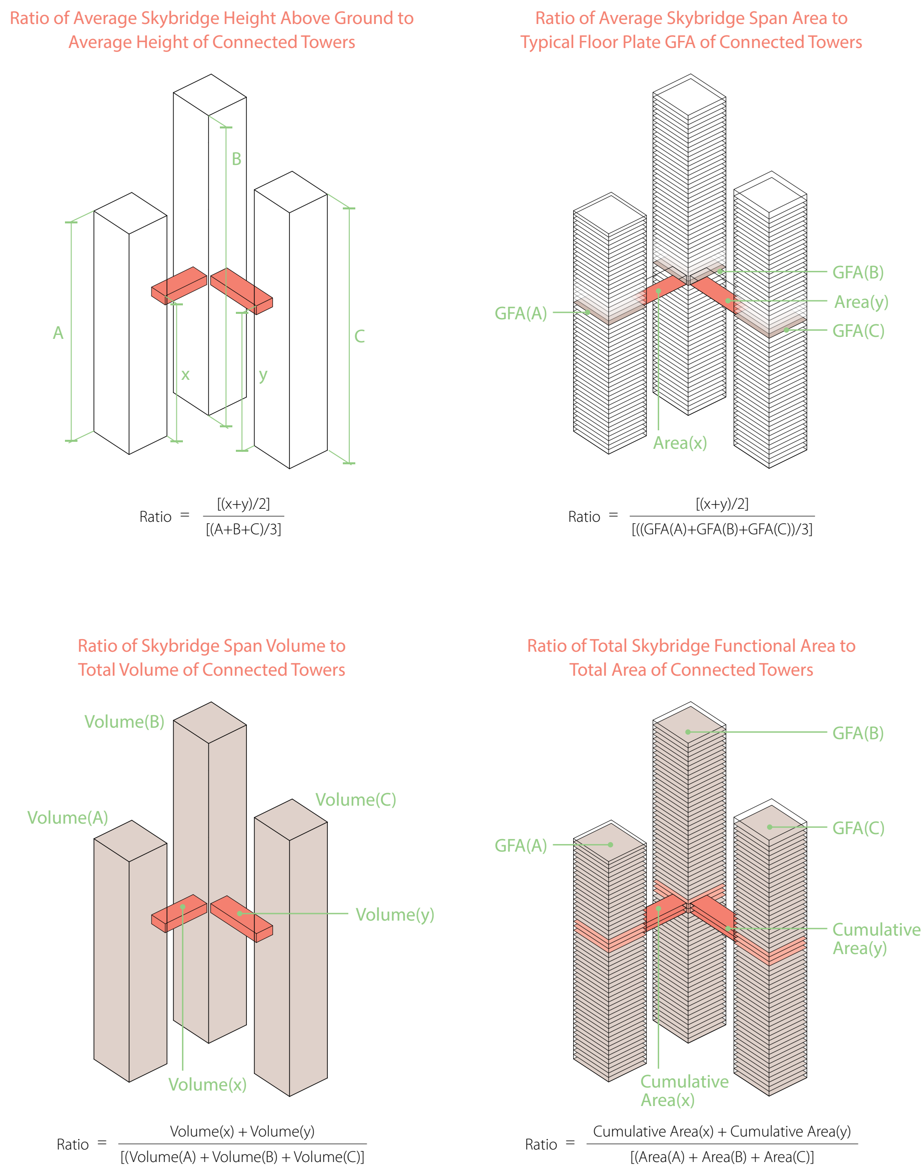


Figure 7. Diagrams illustrating the calculation methods for determining the ratios of skybridge span dimensions to the corresponding dimensions of the adjoining towers.

In many cases, the functional and span dimensions will be equal; however, as this research is premised on the idea that it is important to analyze how skybridges function as part of the 3-D composition of a network of towers, it is also important to identify cases where the "functional" skybridge dimensions differ from that of the span (see Figure 6). Length, width, height, area, and volume are again considered here.

After the survey of 15 case studies was completed, key ratios were tallied and analyzed. The purpose of this analysis is to quantify the spatial relationships between the dimensions of the skybridges and the towers to which they connect, and come to some conclusions about the degree of intensity with which the skybridge is being used. In other words, to what extent do pleasing external aesthetic proportions translate to efficient or opportunistic programming decisions?

Analysis of Case Studies

All case studies are analyzed in Table 1. The ratios calculated for each case study are presented in diagrammatic form in Figure 7.

Ratio of Average Skybridge Height Above Ground to Average Height of Connected Towers

This is an assessment of proportion, as well as a study of what might be considered the optimal height of a skybridge between two towers. If we simplistically think of two towers in an "H" configuration, consisting of two vertical bars with a horizontal bar between them, then at what proportion of the tower is the location of that bar?

This proportion is easily understood when there is only one skybridge in the complex. The highest figure belongs to Bella Sky, Copenhagen, where the bridge is located at 95 percent of the height of the adjoining towers, while Raemian Caelitus, Seoul, is the lowest, at 35.9 percent of its constituent towers' height—of course, in both these cases, there is only one bridge to consider. When it comes to projects with multiple skybridges, Buenos Aires' Torres El Faro's *average* skybridge height—considering all four skybridges—against the *average* height of its towers, is 62.6 percent.

The stories being told here are quite different, of course—the aesthetic and functional purpose of Torres El Faro's hinge-like four-skybridge configuration accentuates the symmetry and mass of two towers opening like a book, whereas the wildly diverging Bella Sky towers appear to be secured from toppling over in opposite directions by only the thinnest thread.

Neither of the extremes answers the question about the optimal functional placement of a skybridge, which would logically be close to the vertical and horizontal midpoint of the composition. This description applies to American Copper Buildings (New York City), Daesung D3 City, Raemian Caelitus and Raemian Yongsan (all in Seoul), Petronas Towers (Kuala Lumpur) and Tencent Seafront Towers (Shenzhen), all in the 34-to-58-percent range, corresponding with logical locations for elevator transfer lobbies, shared amenities, and at least in one case, balanced population loads for evacuation. Those projects placing skybridges at higher locations seem to be implying that reaching those skybridges and their amenities and views is worth the time it takes for more than 50 percent of the towers' collective population to reach them.

		American Copper Buildings, *New York City* 	Bella Sky *Copenhagen* 	Concord CityPlace Parade, *Toronto* 	Daesung D3 City *Seoul* 	Hangzhou Civic Center *Hangzhou* 	Highlight Towers *Munich* 
Overall Building Statistics	**Average Height of Connected Towers**	154 m	76 m	124 m	186 m	110 m	120 m
	GFA of Connected Towers	76,000 m^2	36,026 m^2	72,052 m^2	121,915 m^2	234,000 m^2	62,440 m^2
	Total Volume of All Connected Towers	255,200 m^3	119,862 m^3	210,216 m^3	442,242 m^3	328,764 m^3	244,553 m^3
	Typical Floor Plate GFA of Two Connected Towers	1,747 m^2	1,501 m^2	1,519 m^2	2,390 m^2	3,000 m^2	1,509 m^2
Skybridge Statistics	**Height of Highest Skybridge Above Ground Floor**	84 m	72 m	86 m	100 m	85 m	73 m
	Total Span Area of All Skybridges in Complex	163 m^2	71 m^2	235 m^2	308 m^2	4,296 m^2	82 m^2
	Total Functional Area of All Skybridges in Complex	568 m^2	71 m^2	764 m^2	308 m^2	7,222 m^2	122 m^2
Ratios	**Average Skybridge Height Above Ground Floor / Average Height of Connected Towers**	54.5%	94.7%	69.7%	54.1%	77.6%	45.1%
	Average Skybridge Span Area / Typical Floor Plate GFA of Connected Towers	9.3%	4.7%	15.5%	12.9%	23.9%	2.7%
	Skybridge Span Volume / Total Volume of Connected Towers	0.7%	0.2%	1.0%	0.6%	11.8%	0.2%
	Skybridge Functional Area / Total GFA of Connected Towers	0.7%	0.2%	1.1%	0.3%	3.1%	0.2%

Table 1. Table summarizing key statistics of the 15 projects researched. See "Measurement and Calculation Methodology" section for details on determination of ratios. For the full range of statistics and ratios, see the CTBUH Technical Guide *The Space Across: Skybridges and the Future City*.

Figure 8. The urban gateway formed by the skybridge at Raffles City Chongqing highlights that the proportion and scale of towers and skybridges are important factors in the success of a project. © Arch-Exist Photography

Ratio of Average Skybridge Span Area to Typical Floor Plate GFA of Connected Towers

The objective here is to measure the area of the skybridge portion that is strictly "floating in space" between towers, against the remaining combined plan area of the towers to which it attaches. In this calculation, for an individual skybridge, the sum of the areas of a "typical" floor plan, across the two towers adjacent to the bridge, is used as the comparative figure.

To reach a collective evaluation for projects with more than two towers and more than one skybridge, the average span area of all skybridges in the complex is divided by a "typical floor plate average" for all skybridge-connected tower pairs in the complex. The high- and low-ranking project averages are sustained when multi-skybridge projects are viewed against the average GFA of floor plates across all tower pairs connected to at least one skybridge. The average span area of Torres El Faro, Buenos Aires, is about 1.5 percent of its average connected floor plate and is thus the lowest figure in the group. Raffles City Chongqing's figure is 134 percent, because the average spanning area of all three skybridges is larger than the average area of the sum of the areas of the typical floor plates of the six towers to which they connect (see Case Study, page 12).

Ratio of Skybridge Span Volume to Total Volume of Connected Towers

This measure takes account of the fact that there is potential for skybridges to be "volumetric" spaces; that is, to go beyond the provision of views to the outside, and to have their own sensation of internal space, with multiple galleries along the edges and skylights, for instance. The skybridges that most closely fit this description, and holding the highest figure in this category, are those at Tencent Seafront Towers, with significant internal atria in each, comprising 8.2 percent of the volume of the connecting towers. Four of the case study projects are tied for lowest span-to-total volume ratios at 0.2 percent: Bella Sky, Highlight Towers (Munich), Petronas Towers, and Torres El Faro.

Linked Hybrid, *Beijing*	Nation Towers, *Abu Dhabi*	Petronas Towers, *Kuala Lumpur*	Proximus Towers, *Brussels*	Raemian Caelitus, *Seoul*	Raemian Yongsan, *Seoul*	Raffles City Chongqing, *Chongqing*	Tencent Seafront Towers, *Shenzhen*	Torres El Faro, *Buenos Aires*
61 m	251 m	452 m	118 m	158 m	160 m	273 m	220 m	160 m
241,117 m^2	161,746 m^2	427,353 m^2	88,680 m^2	129,701 m^2	122,284 m^2	500,800 m^2	242,370 m^2	53,308 m^2
763,408 m^3	704,174 m^3	1,483,704 m^3	301,512 m^3	402,304 m^3	479,564 m^3	2,280,400 m^3	1,125,516 m^3	199,759 m^3
1,096 m^2	2,813 m^2	4,856 m^2	2,900 m^2	1,799 m^2	3,057 m^2	7,819 m^2	6,490 m^2	1,159 m^2
50 m	203 m	170 m	82 m	57 m	76 m	226 m	155 m	156 m
2,280 m^2	349 m^2	249 m^2	157 m^2	370 m^2	299 m^2	10,491 m^2	3,833 m^2	98 m^2
4,321 m^2	1,092 m^2	682 m^2	194 m^2	407 m^2	322 m^3	11,546 m^2	15,645 m^2	119 m^2
69.9%	80.8%	37.6%	69.1%	35.9%	47.5%	82.8%	57.2%	62.6%
26.0%	12.4%	5.1%	5.4%	9.8%	9.8%	134.2%	29.5%	2.1%
2.6%	0.5%	0.2%	0.4%	0.6%	0.5%	6.1%	8.2%	0.2%
1.8%	0.7%	0.2%	0.2%	0.3%	0.3%	2.2%	6.5%	0.1%

= Highest value within each category

= Lowest value within each category

Ratio of Total Skybridge Functional Area to Total GFA of Connected Towers

This measure compares the programmed area of the skybridge that extends into the adjoining towers, compared to the total area of the towers. The objective here is to evaluate the extent to which the total programmed space of the project engages with its skybridge(s). Once again, Tencent Seafront Towers represents the high figure of 6.5 percent, due to the extensive integration of the program in its skybridges with that occupying the floor plates of the connected towers. The lowest score, at 0.1 percent, belongs to Torres El Faro, which has relatively small skybridges compared to the area of its neighboring towers, and three of its four skybridges are circulation-only.

Evaluation

In large part, evaluation of the skybridge project comes down to the intent of the design and to what degree it was implemented. This is a question that should be considered at both the urban and building scale, if not at several levels in between. Of course, the full intent cannot always be divined, but some useful observations can be made.

The urban scale in particular is a driving force in nearly all skybridge projects. By connecting buildings at height, an opportunity is created to form an urban gateway, a way of framing the city in a new perspective and guiding residents and visitors through a portal from one context into another. This is certainly the case in super-scaled projects such as Raffles City Chongqing, which is positioned at the intersection of two significant rivers at the most visible point in the city (see Figure 8). But it is also evident in smaller-scale projects, such as Concord CityPlace Parade, Toronto, where an otherwise typical high-rise development acts an instrument of site repair, as it uses its skybridge as a guidepost to pedestrians crossing between an area of the city's downtown and its developing lakefront, which are separated by high-traffic road and rail corridors. In these cases, the symbolic gesture of invitation represented by skybridge-linked projects, in which its composition and silhouette is perhaps the most salient factor—is clearly evident. Skybridge projects placed at prominent locations in the urban context are best positioned to exploit the potential of the typology.

> “The skybridges at Tencent Seafront Towers, with significant internal atria in each, comprise 8.2 percent of the volume of their connecting towers.”

At the next scale down, the skybridge's role as a continuation or reinforcement of the exterior architectural style of a project—or as a pronounced contrast with it—can be used to great effect. The sense of continuity provided by the thin skybridge at Bella Sky (see Figure 9) with its triangular, rhomboid, and trapezoidal windows and panels, counteracts the sensation of conflict engendered by the towers' leaning away from each other. The bright swathes of color that distinguish the exterior of the Tencent skybridges (see Figure 10) reinforce the physical role of the bridges in binding the towers together, as well as the social role of the "links" inside, bringing together employees from disparate work groups together for collaboration and recreation.

With respect to usage and programming, the experience of the skybridge from the inside can be evaluated along a number of dimensions, with the overarching question being, "Do I know that I am in a skybridge, and that this space plays a special role in this building complex?" To the extent that the answer is "yes," we can locate some exemplars in the case of virtually all of the "enclosed programmatic" skybridge projects, though some individual spaces and bridges are stronger in this regard than others.

A skybridge that maximizes its potential as a symbol or architectural feature at multiple scales; that performs a critical structural role that adds or returns leasable space to the project; that makes the most of its positioning between two towers as a host for interesting and unique programming, and that capitalizes on that positioning to provide efficient movement and great views, could be considered "successful."

Unquestionably, the final judgment on the appropriate proportion of functions, and what makes a "successful" skybridge-connected project, is a subjective one, into which the qualitative evaluation must also be factored.

Further perspective can be gained by viewing a skybridge in the context of the project into which it is built. Here, axonometric drawings of several projects, with the skybridge locations highlighted in green, are presented side-by-side (see Figure 11).

It is here that the emphasis on proportional ratios, particularly volume, are most visibly relevant. Even without knowing any of the figures, the skybridges at Raffles City Chongqing and Tencent Seafront Towers, for example, clearly comprise a substantial volumetric proportion of the overall complexes to which they are attached. It is unsurprising then, that these are also the projects that have among the most intensely and diversely programmed skybridges.

Of course, this does not tell the whole story. The relative volume of the skybridges connecting each of the towers of Linked Hybrid is comparatively small when compared to that of the towers themselves;

Figure 9. The skybridge at Bella Sky, Copenhagen, may not be structurally integral to the towers, but aesthetically, it appears to be holding them together as they tilt away from each other. © Adam Mork

Figure 10. The red horizontal striping of the skybridges at Tencent Seafront Towers, Shenzhen, is carried through onto the face of the connected towers. © NBBJ / Tim Griffith

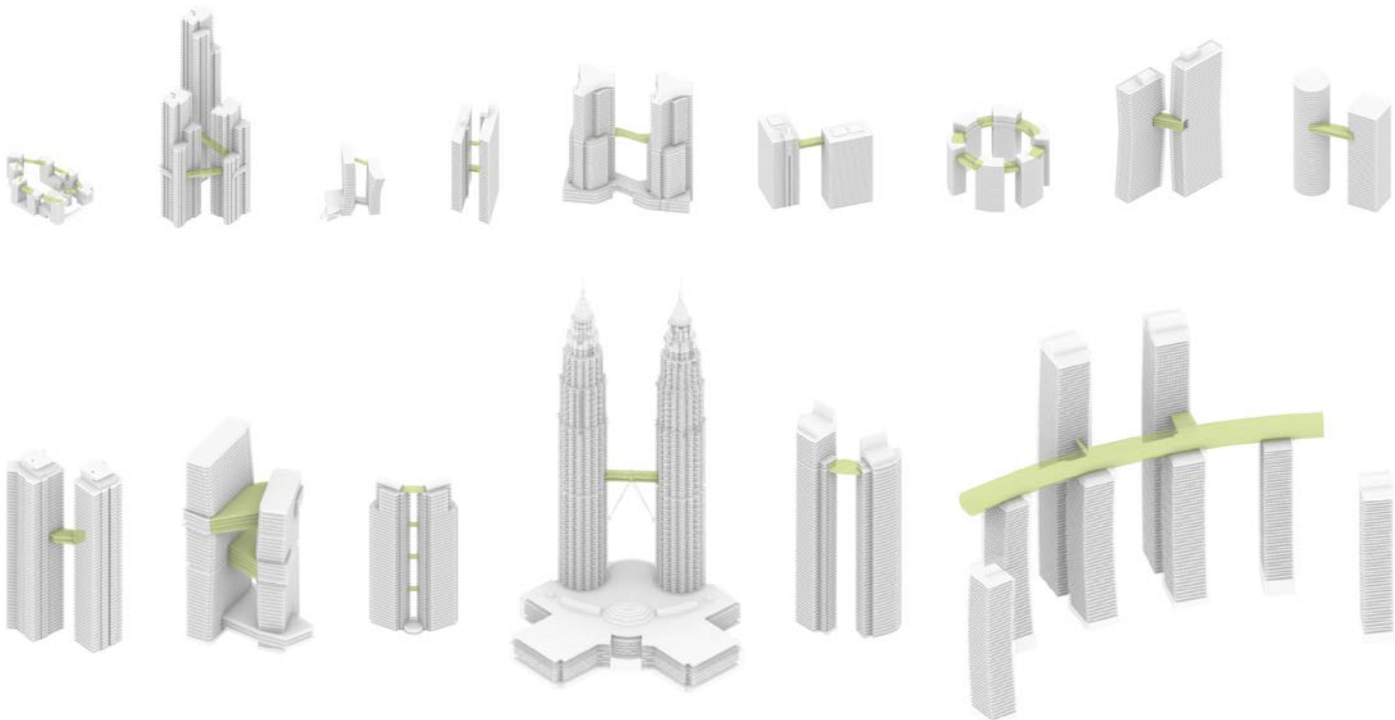


Figure 11. Scaled, axonometric renderings of all complexes studied during the project, with skybridges highlighted, ranked from lowest to highest skybridge. Top row (left to right): Linked Hybrid, Beijing; Raemian Caelitus, Seoul; Bella Sky, Copenhagen; Highlight Towers, Munich; Raemian Yongsan, Seoul; Proximus Towers, Brussels; Hangzhou Civic Center, Hangzhou; American Copper Buildings, New York City; Concord CityPlace Parade, Toronto. Bottom row: Daesung D3 City, Seoul; Tencent Seafront Towers; Shenzhen; Torres El Faro, Buenos Aires; Petronas Towers, Kuala Lumpur; Nation Towers, Abu Dhabi; Raffles City Chongqing, Chongqing.

however, it can be argued that this project has the most diverse programming of any of the projects studied (see Figure 12). There is, it seems, a dominant, but not absolute correlation between the skybridge-to-tower-volume ratio and the range of activities that take place in the given skybridge(s).

Conclusions: The State of the Art, and Potential Futures

What conclusions can we draw from this survey of skybridge "state of the art"? It seems there is not one central dimension of analysis that supersedes the others, and it may not be ideal to have a final "score" that ranks skybridges in terms of their overall quality. The purpose of this exhaustive exercise in spatial measurement and comparison, as well as physical on-site and photographic evaluation of all the case study projects, is to understand the full potential of skybridges as more than objects in space or utilitarian corridors, but as "habitat" in large-scale projects, and beyond this, potentially, in cities. To that end, those projects which seem

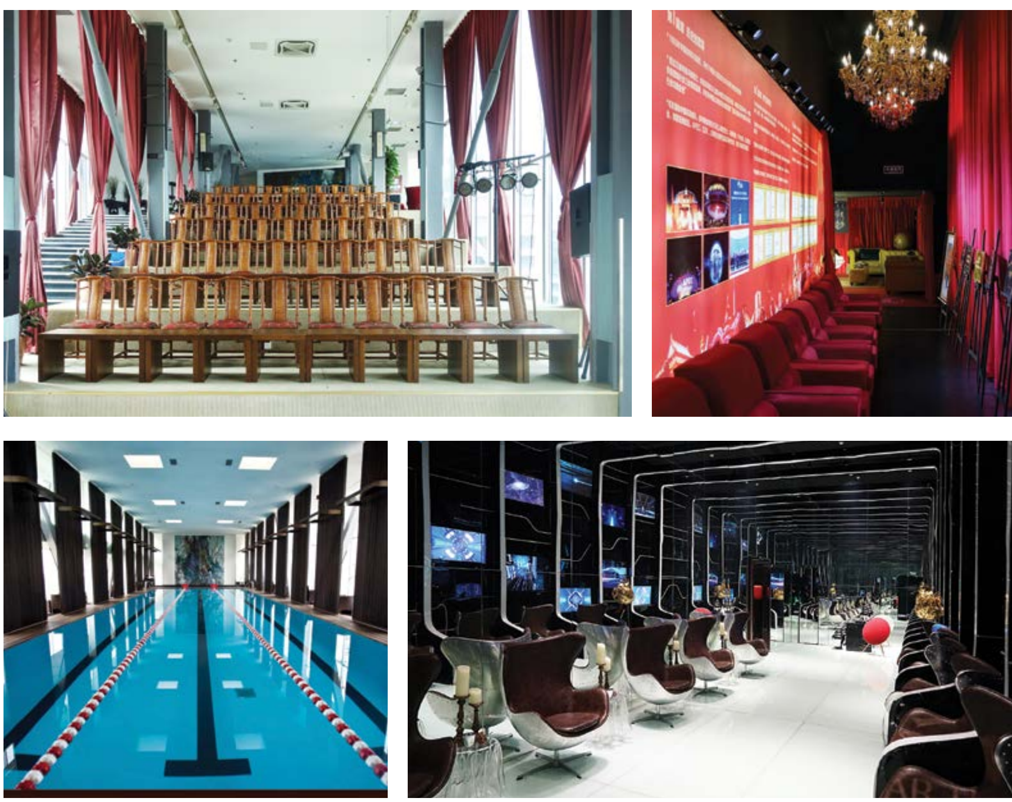


Figure 12. Linked Hybrid, Beijing contains an array of programs throughout its eight skybridges, including an auditorium (upper left); film production company (upper right); lap pool (lower left); and meeting rooms (lower right). © Daniel Safarik (upper left); Modern Land (all others)

Figure 13. The ultimate future of the 3-D city, with tall buildings and skybridges realized as key urban infrastructure, will require new levels of interdisciplinary and public-private cooperation. © WOHA Architects

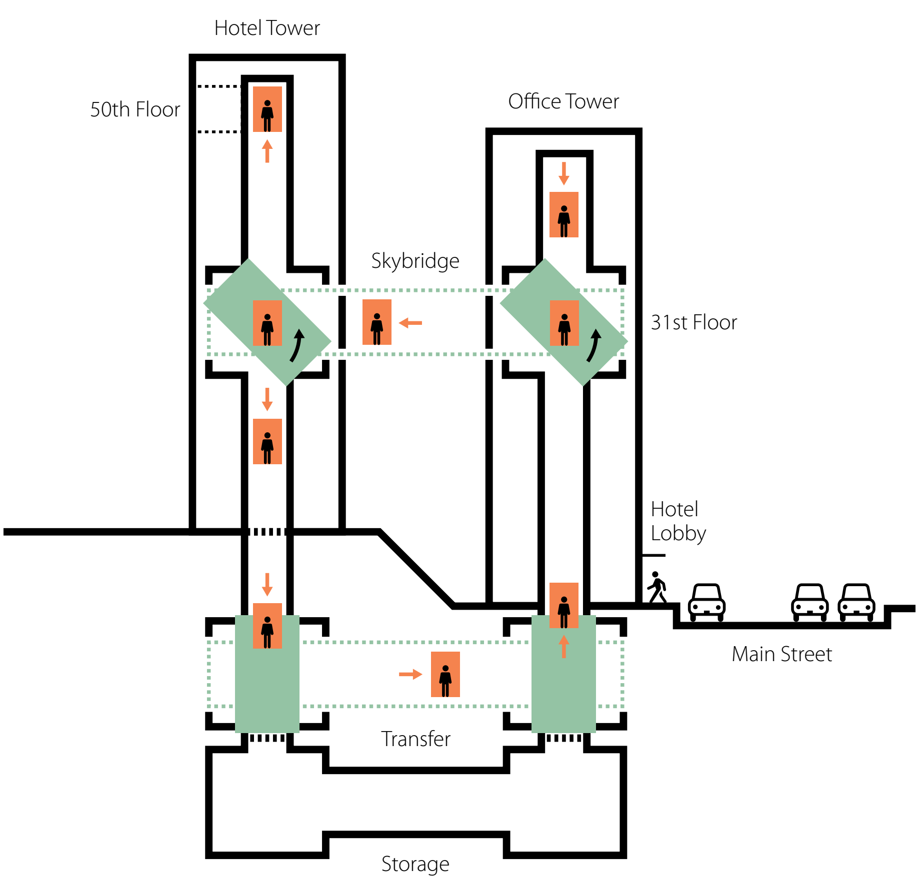


Figure 14. The advent of ropeless elevators, such as the MULTI system, removes a critical impediment to expanding skybridge networks at height: the capacity of shafts and cores to support single cabins and counterweights. This diagram shows a potential configuration in a mixed-use building pair.

to be taking advantage of all the dimensions of skybridges, at multiple scales, from both the interior and exterior, are getting the most value out of the considerable engineering and construction work (and thus cost) that goes into constructing skybridges in the first place. In a phrase, it seems to be about "fulfillment of potential."

Where might this potential take us next? Looking at the scale of the projects that have already been built, it seems clear that the practicalities of construction engineering are not the key impediments to realizing fully three-dimensional cities, where tall buildings and their skybridges are key pieces of infrastructure (see Figure 13). The advent of ropeless elevators also clears away an impediment to efficient vertical and horizontal transportation within and between tall buildings (see Figure 14). Thus, the primary obstacle to this kind of connectivity is not technological; it is political and economic. At present, very few developers see the "upside" of connecting their projects to those of others, absent guidance from government on how public rights-of-way and utilities will be threaded through these interconnections, and how public access will be provided and controlled. There are significant liability issues presented when a skybridge extends between two private buildings over a public right-of-way. And, there would likely need to be a "critical mass" achieved in terms of development of high floors of multiple connected buildings before there could be any profits to share. Here again, taxation and code incentives would likely need to be deployed to entice the initial set of developers to take on the risk in any given market; it is equally likely that, as with many large-scale developments of the recent past, a heavy public investment might also be required. Like any great change to urban geography, to become reality it would require the political will that stems from a frank reading of public needs and desires, and urbanization trends that are broadly deemed to improve quality of life and the competitiveness of cities. ■

visit skyscrapercenter.com/skybridges for interactive web study.

Skybridges of Significance

Linking tall buildings with horizontal spaces, whether purely for circulation or containing programming, has been a subject of fascination for as long as tall buildings have existed. In recent years, the physical extents and intensity of programming of these skybridges have increased substantially, adding to the iconicity and allure of building complexes around the world, as well as pointing to new paradigms for three-dimensional urban life.

This data study is derived from the CTBUH Research Project: *Skybridges: Bringing the Horizontal Into the Vertical Realm*, kindly funded by thyssenkrupp Elevator. It accompanies the research paper on page 36 and the CTBUH Technical Guide *The Space Across: Skybridges and the Future City*. For the purposes of all three studies, a "skybridge" is defined as "a primarily enclosed space linking two (or more) buildings at height."*

** "Enclosed" means that the path of travel within the skybridge is under shelter; "linking between buildings" refers to the bridge being physically connected and supported in its entirety between two or more separate buildings. "At height" is defined as "being six floors or higher above the ground floor".*

Skybridge Types:

- *Enclosed Circulation:* The bridge is intended predominantly for occupants to pass between two buildings.
- *Enclosed Programmatic:* The bridge contains unique programming or amenities that make it a destination on its own, such as office space, residential units, observatory, gym, restaurant, etc.
- *Building-as-Skybridge:* The skybridge is part of an architectural composition that makes two independent towers appear as a singular "arched" building; the interior is typically enclosed programmatic space.
- *Skyplane:* A horizontal plane, extending between or across the tops of two or more buildings at height, whose primary occupiable space is outdoors and on its top surface, often with plantings and park-like features.

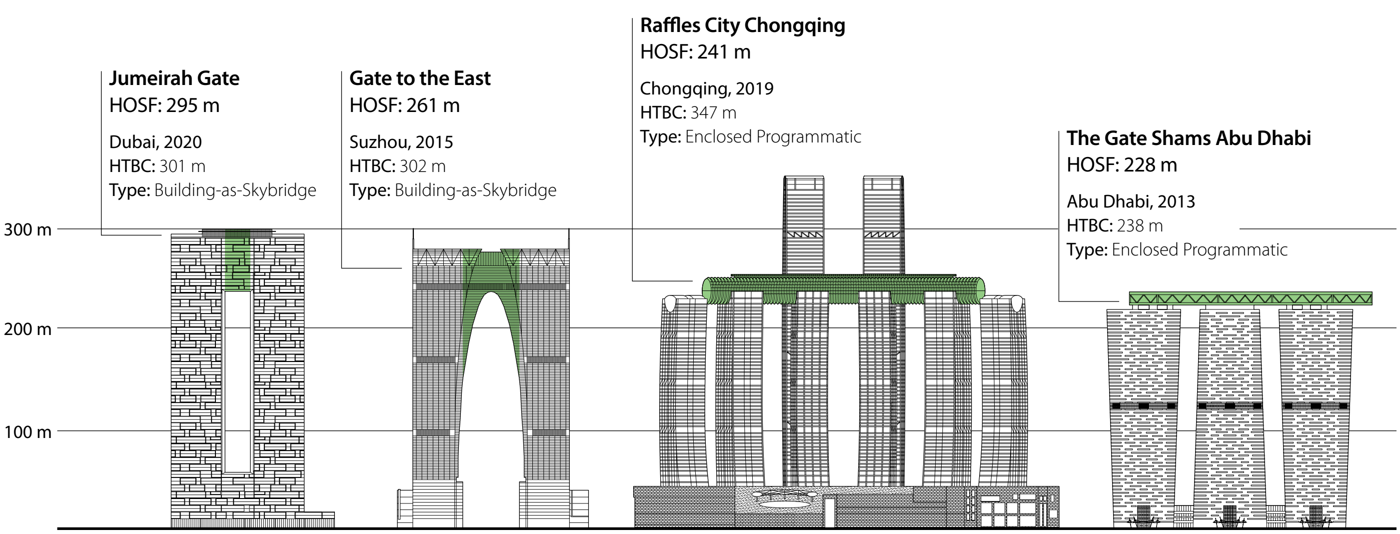
Average Height of Connected Towers: This figure takes the average architectural height+ of the two towers connected to an individual skybridge. In the case of projects with more than two towers and more than one skybridge, the figure refers to the average height of all towers connected to at least one skybridge, compared to the average height of all skybridges in the complex.

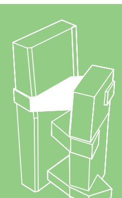
Highest Occupied Skybridge Floor in each complex: As with the general CTBUH Height Criteria, this is intended to recognize conditioned space which is designed to be safely and legally occupied by residents, workers, or other building users on a consistent basis. It does not include service or mechanical areas which experience occasional maintenance access, etc.

+ *See ctbuh.org/resource/height for full definitions of CTBUH Height Criteria.*

World's 10 Highest Skybridges

Notes: Heights in bold refer refer to Highest Occupied Skybridge Floor; HOSF = Highest Occupied Skybridge Floor; HTBC = Height of Tallest Building in Complex





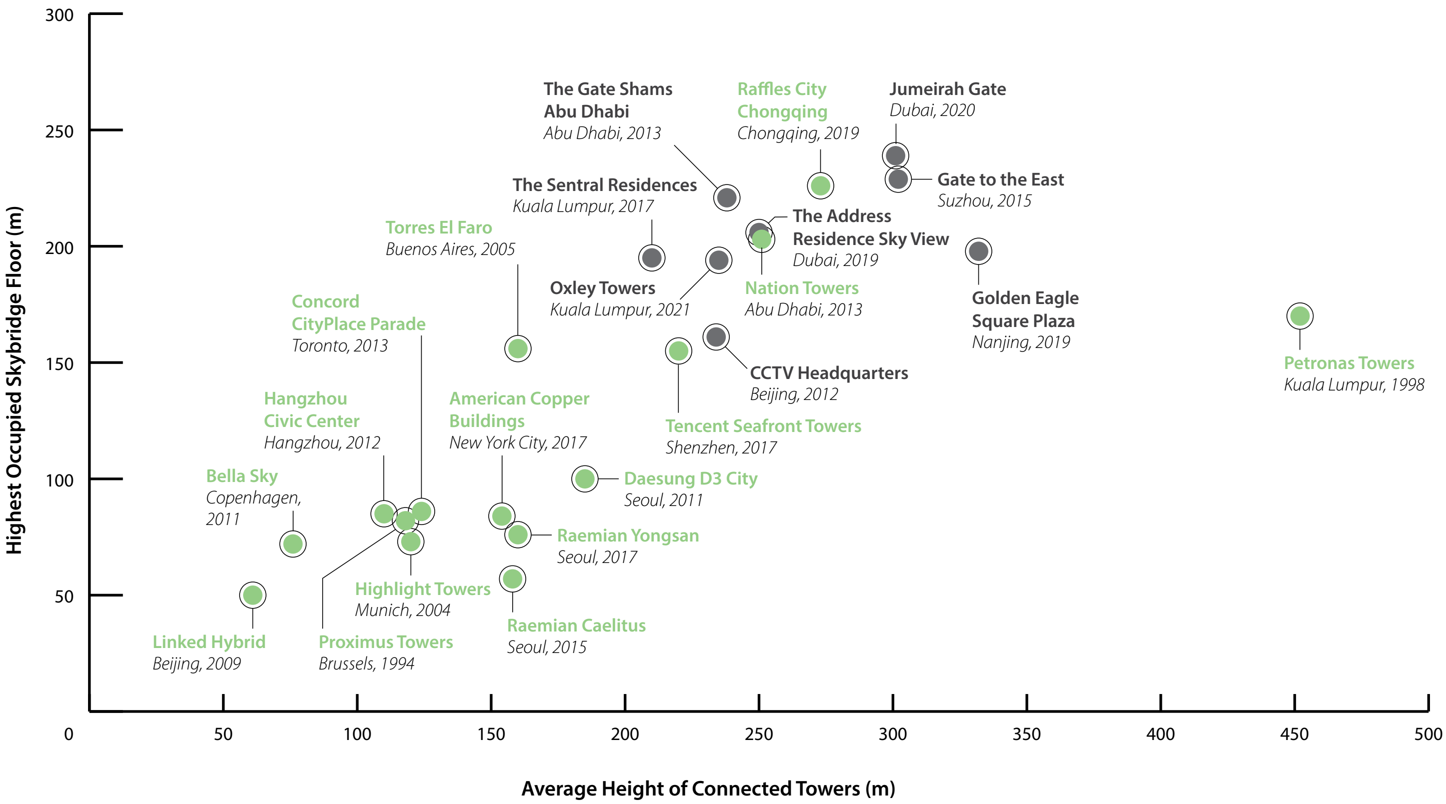
The upper skybridge at **Tencent Seafront Towers,** Shenzhen, weighs 3,000 metric tons, and was raised by a crane to 160 meters' height.

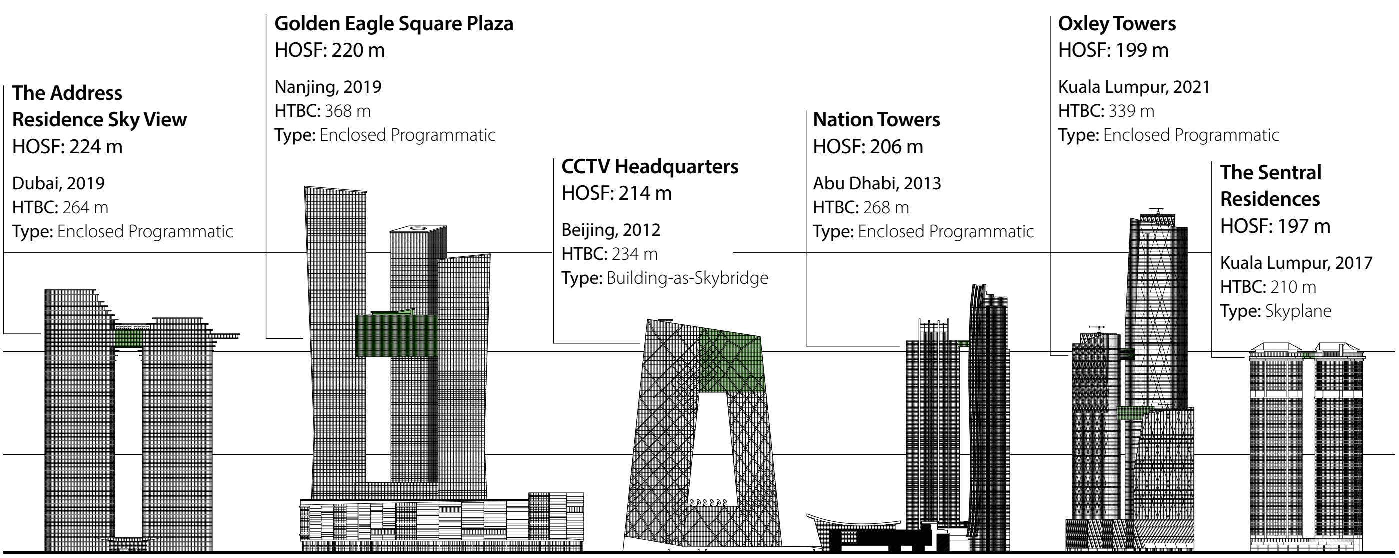
At **American Copper Buildings,** New York City, it is possible to swim between two buildings in a skybridge pool, 87 meters above the ground.

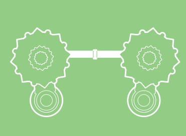
If flipped on its axis, the **Raffles City Chongqing,** Chongqing, skybridge would almost be a supertall building, at 296 meters.

Average Connected-Tower Height vs. Highest Occupied Skybridge Floor

● Project appears in the CTBUH Technical Guide *The Space Across: Skybridges and the Future City*







The skybridge at **Petronas Towers,** Kuala Lumpur, is structurally independent from the connected towers, keeping it steady, even if the towers sway in different directions.

The **Nation Towers**, Abu Dhabi skybridge contains a luxury four-bedroom hotel suite, complete with a spa.

The "clip-on" skybridges at **Highlight Towers**, Munich, were meant to be moveable to accommodate changing needs. So far, they have stayed put.