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Vertical Expansion Leads to Innovative Solutions

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Travis Soberg, AIA, LEED AP

Biography

Travis Soberg is an associate principal at Goettsch Partners, as well as the firm's director of sustainable design. Mr. Soberg brings 17 years of professional experience and has worked on some of the firm's most prominent projects. With the growth and expansion of the firm's international work, Mr. Soberg currently leads and coordinates many projects in China, including large-scale commercial office, hotel and mixed-use developments.

In leading the firm's sustainable design efforts, Mr. Soberg is an integral part of project teams. Some of his recent work in China includes the 92-story, 295,000-square-meter Tianjin R&F Guangdong Tower; the 44-story, 100,000-square-meter Grand Hyatt in Dalian; and a 66-story, 175,000-square-meter mixed-use tower that features the Park Hyatt Guangzhou.

In recognition of his efforts to promote sustainable design, Mr. Soberg received the 2010 AIA Chicago President's Citation for Services on the 2030 Challenge Committee. Mr. Soberg is a member of the AIA and a registered LEED Accredited Professional. He holds a Bachelor of Architecture degree from Penn State University.

Paul De Santis, LEED AP

Biography

Paul De Santis is a principal and senior project designer at Goettsch Partners. With 13 years of experience, he has risen quickly within the profession and, today, serves as the lead designer on the majority of the firm's work in China. Traveling frequently between the firm's Chicago and Shanghai offices, Mr. De Santis directs designs for large-scale office, hotel and mixed-use projects.

Recent work in China includes the 40-story, 121,000-square-meter Nexus Center office tower in Beijing; a 66-story, 175,000-square-meter mixed-use tower that features the Park Hyatt Guangzhou; the 37-story, 186,000-square-meter Grand Hyatt Chengdu at Chicony Plaza mixed-use development; and the 92-story, 295,000-square-meter Tianjin R&F Guangdong Tower, which will be one of China's tallest buildings.

Mr. De Santis has a deep respect and passion for the design process. He has been responsible for leading the design of several winning competition entries, and he has received numerous awards for his work. He was also recently recognized as Emerging Architect in the 2010 Best of Chicago edition of *Chicago Magazine*.

Mr. De Santis received a Bachelor of Architecture degree from Virginia Polytechnic Institute and State University, and he is a registered LEED Accredited Professional.

Abstract

The 57 story 300 East Randolph building has established a new standard for innovation in the Chicago skyline. Responding to the programmatic need to accommodate the flexibility for future growth, the 2.35 million square foot project was divided into two phases. Phase 1, completed in 1997, consists of 33 floors and 1.43 million square feet. Integral to the initial phasing concept is a 600 square foot atrium, which rises uninterrupted along the north side of the tower. Unique for a modern high-rise, the full-building atrium allowed an unprecedented vertical expansion of the Phase 1 building. Nearly a decade later, Phase 2 added an additional 24 floors and 920,000 gross square feet to the fully occupied original building. Through the innovative atrium strategy, the typical Phase 1 floors were unaffected by the expansion and were able to remain fully operational throughout construction of the expansion.

The large atrium space also brought other amenities to the tower beyond the functional benefit of vertical expansion: natural light is able to reach further into the office floors; interconnecting stairs facilitate easy and efficient access between floors; lounge spaces at every third floor provide informal meeting and social spaces; and separate tower floors are able to have a visual connection to other spaces, enabling a greater sense of community within the building. The lessons learned at 300 East Randolph have since inspired the inclusion of internal atrium spaces in other high-rise projects around the world. This paper will explore the principal design of 300 East Randolph and three projects influenced by its success.

Keywords:
Atrium, vertical expansion, Chicago, China, Abu Dhabi

Introduction

In 1994, health insurer Health Care Service Corporation (HCSC), with its Blue Cross Blue Shield of Illinois division, was investigating its headquarters real estate needs. The company had moved operations four times in 25 years and wanted to create a long-term real estate plan with flexibility to accommodate expected growth. Additionally, the company's operations were housed in several facilities scattered throughout the region. By consolidating their workforce, the company could streamline management and functions while fostering a greater sense of community among employees.

HCSC purchased land at the north end of Grant Park in Chicago, with the desire to locate the new headquarters building on this site. The challenge was to find a design solution that allowed them to meet their immediate space needs, consolidate their operations, and accommodate flexibility for future growth with an economical approach. A phased solution made sense financially and for accommodating growth over time. However, it traditionally meant building separate and disconnected facilities, as well as and additional land costs.

In order to achieve the client's desire for consolidated operations, Goettsch Partners proposed an innovative phasing solution for a high-rise building. Instead of building the first phase on the Grant Park parcel and later constructing a second phase on an adjacent site, the firm designed an initial building that could nearly double in height at a later date (see figure 1). This vertical expansion approach was unprecedented for a building of this size but one that made financial sense for the client. An analysis showed that vertically expanding the building - even with the cost of additional F.A.R. and structural premiums - would save approximately $15 million (USD) over the cost of purchasing and securing a neighboring parcel of land. More importantly, the proposal to expand vertically allowed the client to realize all of their goals and house their growing facilities under one roof (see figure 2).

Vertical Expansion

While the proposal to vertically expand a high-rise was groundbreaking, the methodology that enabled the idea was rooted in historic high-rise precedents. It is commonly accepted that early high-rise buildings were facilitated by the development of the elevator, and in that respect, 300 East Randolph is very similar. Without efficient high-speed elevators, a vertical expansion would be impossible. But it was another aspect of early high-rises that became the true catalyst of the vertical expansion concept: the full-building height atrium.

Full-building atriums and light courts were a necessity for pre-air-conditioned buildings in order to enable cross-ventilation and natural illumination. These inward-looking atriums achieved a required functional solution but also created a visual sense of community among the vertically isolated individual floors (see figure 3). For 300 East Randolph, incorporating a full-building atrium not only provided these opportunities to connect a community and bring natural light deep within the interior, it also facilitated the spatial requirements for the 16 additional elevators necessary to service the expansion floors without affecting the efficiency or planning of the existing floors (see figure 4).

With the conceptual strategy identified, the design was separated into two phases. Phase 1 was designed to meet the client's immediate needs and consisted of 33 floors totaling 1.43 million square feet; Phase 2 would ultimately add another 24 floors and 920,000 square feet. When fully realized, the total building would comprise 57 floors totaling 2.35 million square feet and reach a height of 743 feet.

The Atrium

The tower's 30,000 square foot floor plates are uniform in size throughout the building and are stitched together vertically by the full-building atrium along the tower's northernmost façade. Measuring 150 by 40 feet, the atrium is composed of five 30 by 40 foot structural bays. Two bays accommodate the two banks of eight elevators required for Phase 1 while two bays were reserved for the additional elevators in Phase 2, with the final bay reserved for an inter-floor communicating stair (see figure 5). The flexibility the atrium provided in its ability to absorb the additional elevators was invaluable to the success of the design solution.

By integrating the open shafts required for the Phase 2 elevators into the overall approach of the building concept, Phase 1 was allowed to remain operational throughout the construction of the

expansion. Phase 1 elevators remained functioning for tenants, building services and safety were unaffected, and no reconfiguration was required for the typical tenant floors. Thus, the atrium, along with the split-core arrangement, enabled the tower floor planning to remain highly efficient even after the expansion despite the addition of 16 elevators. Most importantly, while nearly 1 million square feet over 24 floors was constructed above the existing tower, 3,500 people were able to continue their daily work with only minimal disruption to their routines. As important as the initial financial phasing evaluation was, the ability to keep the Phase 1 tower fully operational and nearly untouched while Phase 2 was constructed above was crucial to the economic success of the design and a key factor to the selection of the atrium solution.

As modern high-rise buildings are seldom based on an interior spatial concept, 300 East Randolph is unique. Not only does the atrium serve a fundamental functional role, it also provides the headquarters building with a visual and physical connectivity. Despite the fact that 32 elevators occupy the atrium in the fully built configuration, it was critical that the space remain visually open. The elevator shafts are designed as exposed elements in order to maintain a high level of transparency and porosity for the building (see figure 6). This configuration ensures that natural light is able to filter through the atrium and reach the deepest portions of the occupied floors. It also enables visual connections throughout the atrium, promoting the same sense of community that was at the heart of the early modern high-rises and an important attribute in a headquarters office tower.

Within the atrium itself, the concept of a connected community is even more apparent. While four of the five atrium bays are dedicated to the passenger elevators, the fifth and central bay provides a communicating stair which knits together the independent office floors (see figure 7). The ability to descend through the atrium and walk between floors provides a rare sense of the building's overall arrangement. On either side of the central stair, glass-clad elevator cabs race through the atrium to their destinations. The cabs and counterweights provide a kinetic pulse of the building's activity. At every third floor, the central stair landing expands to fill the entire atrium bay, creating a breakout lounge for employees to use as informal meeting or social space.

Lessons from Chicago

The atrium concept is a unique solution to a unique challenge. While not every building requires the ability to expand vertically, the interior spatial arrangement that enabled the design solution is as relevant today as it was in the early 1900s. The opportunities for increased natural light and ventilation are especially significant, as high-rise buildings continually grapple with solutions for reducing their overall energy consumption. Additionally, as buildings increase in height and programmatic complexity, public amenity spaces similar to the parks and plazas of the urban city become increasingly important amenities within the high-rise spatial arrangement. The question becomes not whether atriums are relevant in the modern high-rise but how they can best adapt and evolve to support the needs and aspirations of today's buildings. In the following examples, we will look at three ways the 300 East Randolph atrium has influenced current projects around the world.

Al Mamoura

The 115,000 square meter office tower is sited in Abu Dhabi, United Arab Emirates, where the summer temperatures can reach 40° C with a relative humidity of 80%. Sand storms and sea salt permeate the air, relegating the façade to a protective veil that shields the building from the extremities of the climate. The challenge is to buffer the intensity of the climate and yet still provide natural light, ventilation and views. As in pre-air-conditioned high-rises, the full-building central atrium concept allowed the design team to provide these amenities and still protect the interior spaces from the intensity of the regional climate.

The 170 meter tall tower measures 55 by 51 meters in plan and is composed of split cores rising along the east and west sides, which protect the facades from the rising and setting sun. The use of split cores also vacates the central zone of the floor, allowing an 18 by 18 meters atrium to rise the full height of the building. Because the summer sun path is nearly directly overhead, natural light filters through the entire height of the atrium, offering controlled daylight to every tower floor (see figure 8). Utilizing the stack effect of the atrium, it is also possible to provide an element of natural ventilation throughout the building.

Suzhou Education Development Building

Built as a combination of government and speculative office, the Suzhou Education Development

Building consists of twin 100 meter and 70 meter tall towers connected by a cloistered cultural and retail podium (see figure 9). The towers' wedge-shaped plans sit radially along Du-Shu Lake, like boat prows, with their narrowest ends turned toward the water. The center-core plans provide an efficient and uniform interior arrangement while the wedge-shaped plans afford views across the lake from most locations in the building.

In response to the dramatic setting along the lake's edge, the interior of the typical tower floor is carved away at the narrow end to create a stacked series of three-story atriums, which run the full height of each tower. While it may seem counter-intuitive to create internal voids at the most prestigious location in the building, this spatial arrangement ensures that the best views are not simply monopolized by a select few but are open for all tenants to enjoy. Reinforcing this concept, an interior interconnecting stair provides access between floors and allows each atrium to function as a semi-public lounge, similar to the arrangement provided at 300 East Randolph (see figure 10).

Tianjin R&F Guangdong Tower

Located in Tianjin, China, the 500 meter tall mixed-use tower was inspired by the uncoiling geometry of a Chinese scroll. The unique form continuously erodes in response to the interior programmatic stacking of the tower as it spirals upward, ultimately culminating in a radially stepped pinnacle (see figure 11). Tracing and defining the edge of this uncoiled geometry is a series of two-story stacked, semi-public atriums. From the street, the use of the atrium as the defining geometric element not only emphasizes the architectural concept but also vertically extends the notion of the public realm from the ground plane, through the tower, and up to the sky.

From the interior, the double-height atriums serve as "sky gardens" and allow opportunities not commonly found in towers of this height. The semi-tempered atriums give tenants access to fresh air, sunlight and greenery without having to descend the tower and exit the building - a truly unique amenity for a super-tall tower and even more so for a multitenant office program. The garden spaces are also planned flexibly enough that they can be used as informal meeting spaces or as common areas where tenants may enjoy their lunch or a cup of tea and conversation (see figure 12).

Conclusion

Internal atrium spaces, including full-building atriums, have a long history in the high-rise typology. However, with the advent of air-conditioning and artificial lighting, these spatial voids were traded for more efficient and economical designs. At 300 East Randolph, the full-building atrium was reintroduced as a method for creating efficiency and financial economy in a unique, vertically phased design. The success of the dynamic interior spatial arrangement has since served as inspiration for the inclusion of similar interior atriums within modern high-rise buildings across the globe. While the reasoning and arrangement of the atriums has varied from project to project, the benefits of light, ventilation and community connectivity remain as strong as they were in the advent of the high-rise.