THE TALL BUILDINGS REFERENCE BOOK

Edited by Dave Parker and Antony Wood
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As the ever-changing skylines of cities all over the world show, tall buildings are an increasingly important solution to accommodating growth more sustainably in today's urban areas. Whether it is residential, a workplace or mixed use, the tower is both a statement of intent and the defining image for the new global city.

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Chapter 1
A Brief History of the Twentieth-Century Skyscraper

Gail Fenske

From the time of its appearance in the late nineteenth century, the skyscraper represented the quintessentially intractable building type. It violated with arbitrary, uncontrolled heights historical notions of urban decorum, effected congestion, polluted the atmosphere with coal burning, cast shadows, and, as an instrument of advertising, disrupted the profile views of cities. The image of the city, previously dominated by communal symbols such as a spire or a dome, fell subject to the will of an individual or enterprise.

Still, even in the nineteenth century, architects and builders showed evidence of concern for the skyscraper's relationship to the urban environment, particularly as demonstrated by their regard for urban civility in design or for improving the public domain, whether as defined within the skyscraper itself or through its contribution to a city's surroundings. When the twentieth century drew to a close, the renewed interest in such a relationship distinguished designs for prominent skyscrapers around the world. The emphasis of architects and builders had shifted from the quest for height to a new set of competitive criteria, many of which were aimed at enhancing the aesthetic, spatial, and environmental experience of the skyscraper and the city.

Early Skyscrapers in Chicago and New York

The skyscraper emerged within the context of two distinctive urban environments, those of Chicago and New York. Chicago, from its founding in 1803, distinguished itself as a frontier city, the primacy of which stemmed from its geographic location astride the great waterways of the American mid-continent. The city's first plan of 1834, organized on a grid suggested less a community than a real estate lottery. In 1848 the Illinois and Michigan Canal opened, linking the city with the port of New Orleans, in addition to the port of New York via the Erie Canal. Shortly thereafter, the railroads—ten trunk lines converged on the city by 1856—further accelerated the pace of the city's development. By the end of the Civil War, the city's population had grown almost tenfold and it achieved renown as the livestock, lumber, and grain center of the world.

Founded as a Dutch trading colony in 1623, New York had risen to become by 1820 the nation's center of banking and finance and, during the 1850s, achieved distinction as the nation's pre-eminent import-export center and key port of entry for European luxury commodities. In New York, commercial activity clustered around Broadway and the adjacent Ladies' Mile, both
of which served as the settings for the ornate cast-iron framed and cast-iron embellished buildings that pre-saged the skyscraper. Similarly, Chicago’s State Street—or “that great street,” as it was known after the merchant Potter Palmer improved and transformed the street with his Palmer House Hotel—served as the main axis of commercial development. Given New York’s status as an import–export center, the city’s retailers sought distinction on Ladies’ Mile by placing primacy on a store’s permeability, both visually, as goods in show windows enticed passersby, and spatially, through accessibility to sidewalk crowds. In the interiors, they emphasized spectacular and luminous multi-story spaces. In service of such objectives, the new technology of iron seemed to offer limitless potentials. The most notable of New York’s “commercial palaces,” A.T. Stewart’s second store (1859–62), illustrated the capacity of the new iron construction to alter the character of an entire urban district and to promote a new standard of urban civility (Figure 1.1).

Chicago’s Great Fire of 1871, a disaster of epic proportions, destroyed most of the buildings in the city’s downtown, but by the early 1880s the city had begun to rise phoenix-like from the ashes to become the metropolis of the Midwest. Clearly circumscribed by the Chicago River, cable car lines, and then the elevated lines of the 1890s, Chicago’s downtown provided little in the way of space for horizontal expansion. By the early 1880s, the profit motive of the land speculator had driven the heights of buildings skyward, creating a new “ceiling” of height in office buildings, now called “elevator buildings”, because builders used the elevator to provide access to upper floors.

New York’s elevator buildings, which dated from the spectacular French Second Empire–styled Equitable Life Assurance Society Building (begun 1868, enlarged 1875–76, 1886–89) designed by Arthur Gilman and George Post, stood out in their urban surroundings with showy exteriors. Elisha Graves Otis had demonstrated the first elevator in 1853, but only in the 1860s did the new technology, whether steam powered or hydraulic, reach an advanced stage of development. The Equitable featured the earliest use in an office building of two steam-powered elevators, but, more important, its post-1889 interior, as the headquarters of the world’s wealthiest life insurance company, competed on spatial terms with Stewart’s second store: forty offices on two levels surrounded a monumental hall (Figure 1.2). The Equitable had widened the building to incorporate that interior along with an arcade of shops covered by a glass skylight, creating what contemporaries called a “micro-city.” Consequently, from the outset, fostering the quality of spatial graciousness within the urban domain—surely directed towards clients for the Equitable’s product as well as visitors—took pre-eminence in certain proposals for office buildings.

The Western Union and Tribune companies constructed elevator buildings in the city during 1872–75 that stood out as the city’s tallest. Both had recently risen to prestige and power in the two leading communications industries of the day—the telegraph (Western Union built the nation’s first telegraph line) and the
newspaper—and both utilized speculative finance to ensure their prominence on the urban scene. But the Tribune’s “mean accommodations” suggested little in the way of the Equitable’s enlightened approach to interior planning. Stylistically ornate and showy exteriors, moreover, achieved their effect as advertising through their very contradiction of existing conventions of urban decorum.

George Post’s New York Produce Exchange (1881–84) demonstrated that a building designed for commercial use might indeed contain an element of urban civility. Post, both an architect and an engineer, organized four stories of offices around a magnificent skylight exchange hall, utilizing “cage construction” for the inner court walls with the aim of opening up the entire interior to natural light. Post’s design may have inspired Burnham and Root’s Rookery in Chicago (1885–86), one of a series of office buildings financed by Peter and Shepherd Brooks of Boston (Figure 1.3). Noted for the grace and elegance of its iron-framed light court, the Rookery introduced a new level of graciousness and urbanity into the congested and rapidly modernizing downtown. Angled, perforated wrought iron beams, ornamentation in lace-like filigree, open balconies seeming to hang in midair, and a theatrical Piranesian stair announced a new cosmopolitanism in Chicago that alluded to the newest Paris department stores, among them the Bon Marché.

Post had experimented with cage construction in the light court of New York’s Produce Exchange, but William Le Baron Jenney used the construction as a nearly complete skeleton throughout the upper stories of the Home Insurance Building in Chicago (1883–85), albeit still as a cobbled-together arrangement of cast iron columns, wrought iron box columns, and wrought iron and steel beams with connections bolted throughout. This showed little in the way of a systematic approach to wind bracing, and with walls partially self-supporting, it was hardly a “pure” demonstration of “skeleton construction.”

Jenney’s students, William Holabird and Martin Roche, by contrast, took a systematic approach to the steel frame and its requisite terra-cotta cladding, making it an object of scrutiny in their Tacoma Building (1886–89; Figure 1.4). Rather than embed the iron skeleton within a clothing of masonry, they explored a rational and complementary relationship between frame and cladding. Given the lightness of the construction, they utilized two strategically placed masonry walls as reinforcement against the lateral forces of the wind.

During the late 1880s and early 1890s, Chicago and New York’s architects and engineers vigorously explored the problem of wind bracing, proposing an array of inventive solutions. Bradford Gilbert made significant
Chapter 2
Aesthetics, Symbolism and Status in the Twenty-First Century

Chris Wilkinson

When, in his 1896 article ‘The Tall Office Building Artistically Considered’, Louis Sullivan coined the phrase ‘form ever follows function’, he could not possibly have imagined some of the recent developments in form-finding for supertowers. Twists, curves, folds, tapers and cantilevers are just some of the geometric contrivances being explored in the quest for innovative new forms.

Of course, he was keen to divest buildings of the need for unnecessary architectural ornament, but his aesthetic wisdom held true for almost a century of ‘Modernism’, during which the form of most buildings was dictated by fairly simple structural principles. All this has been challenged more recently by new advances in sophisticated three-dimensional architectural form-finding programmes and speedy stress analysis modelling programmes for structural engineers.

It is clear that architecture is at a new turning point, at which almost all imaginable forms are possible, but decisions still have to be made on what is appropriate.

This situation is particularly relevant to the design of towers and supertowers, because with the huge financial investment required for these buildings comes recognition and status, but this can only be fully realized with a bespoke, individual architectural identity. As a result, exciting new architectural solutions are being explored at a time when they can be technically realized. This is entirely consistent with the evolution of the skyscraper, which has always been linked to new developments in construction technology and the expression of status and power.

Making a Statement

The symbolism of a tower relates very much to wealth, but this is relative and can always be judged against other towers in the vicinity, the city or the rest of the world, which is why there is so much competition in relation to height and identity. In the exclusive world of high-rise and super-high-rise it is not enough simply to have more than one hundred storeys – it is the overall visual impact which is vitally important. This esoteric problem raises the polemic of the architecture of towers and how it should be judged. Whilst aesthetics and beauty are fundamental, other criteria such as innovation, individuality, status, symbolism and context are important. Normal judgements related to scale and proportion can become challenging once buildings and their components substantially exceed human
dimensions. The visual appearance is more likely to be assessed in terms of form, structure and materials used for the enclosing skin. In these areas, the scope has greatly increased in the past decade and this has led to experimentation and innovation.

For instance, the extruded vertical form, be it rectangular or curved in plan, is being replaced by more complex geometries offering more interesting silhouettes on the skyline. Structural gymnastics facilitate options for folded crystalline forms or curvilinear organic shapes. Developments in curtain walling offer more freedom to explore these new forms, while also providing more energy efficiency and more sustainable solutions. Height is now more a factor of economics and aspirational intent than a technical restriction.

Breaking the Bonds

In earlier times, the height of buildings was severely limited by insufficient engineering skills, the use of natural materials, problems with fire safety, water pressure and the number of steps to climb due to access without lifts. As outlined in Chapter 1, the first real skyscrapers emerged in the USA only in the late nineteenth century.

For most of the twentieth century, New York was the capital of the skyscraper world, epitomising capitalism and the age of technology. The bright, shiny towers competing with each other for daylight and a share of the skyline were less important individually than as a composition.

The breakthrough in terms of architecture came in the early 1950s, with two projects that established an ‘international style’ for high-rise buildings, becoming a visual template for others to follow. These were SOM’s Lever House, designed in 1951, and the Seagram Building, designed in 1957 by Mies Van der Rohe in collaboration with Philip Johnson. Both were rectangular, simple forms clad entirely in repetitive curtain walling and they sat nearly opposite each other on Park Avenue, New York, both within their own urban piazzas. In a way, they brought many of the ideals of the Bauhaus to New York, but on a larger scale and with more commercial appeal.

Developers have seen the design of these two buildings, with their rectangular floor plates and central structural core, as representing the perfect office floor arrangement, due to flexibility and efficient net-to-gross floor area ratio. The preferred size of typical floor plans for high-rise towers has increased over the years, to suit modern office working practices, and the external appearance has taken on different iterations, but this basic form remains a popular option today for medium-high-rise towers in cities around the world.

With new technology, however, there has been a move towards more complex shapes in super-high-rise towers. This is mainly due to the inescapable fact that traditional rectangular frames with their central core need some form of additional external bracing to cope with the extra wind loads associated with super-high-rise towers. This can be achieved with a close grid of rigid columns on the perimeter, as pioneered on the New York World Trade Center Towers; the adoption of super-columns with outriggers, as in the Hong Kong International Financial Centre; some kind of external diagrid frame structure, as used on the John Hancock Center in Chicago; or the ‘tube in a tube’ approach, as pioneered by Fazlur Khan of SOM in the Sears Tower, Chicago.

Shaped by the Wind

A derivation of the structural concept has been developed in the recently completed Burj Khalifa in Dubai, also designed by SOM, which is now the undisputed tallest building in the world, with an impressive height of 828 metres. It uses stepped, tubular multiples arranged in a ‘Y’ shape which buttress the hexagonal central structural core, in what has been termed a ‘butressed core’ system. The chief designer, Adrian Smith, has claimed that the flower Hymenocallis is the inspiration for the shape, but it is also influenced by the practicalities of maximising view and light to the apartments and hotel rooms. The building’s surface area of over 1.8 million square feet (167,225 square meters) is clad with a repetitive glass and stainless steel curtain walling system that follows the curvature of the tubular forms and is broken every 30 storeys with a double-floor band of special horizontal cladding enclosing the plant rooms (Figure 2.1).

The architecture is hard to assess because the design is so dominated by its height and shape, but there is a clarity to the concept which has an integrity based on sound engineering principles. Stepping the tubes creates a tapering spiral form that seems to emphasize the building’s height in a ‘constructivist’ manner, and there are similarities to Frank Lloyd Wright’s visionary project for the Mile High Tower, which was sadly never constructed.
Standing Alone

Spirals occur frequently in nature and in the Burj Khalifa the geometry provides an elegant balance. The bulk of the accommodation is at the lower levels, which makes the base seem extremely broad. This has little or no effect on the building's context, however, because it sits very much in its own domain, relatively unrelated to the rest of the city. In this respect, it is not really an urban building, more a self-contained metropolis.

Construction of the Burj Khalifa is undoubtedly an incredible achievement, which has focused world attention on this comparatively small but ambitious United Arab Emirates principality. It is unfortunate, therefore, that the time it took to plan and construct such a major project affected its fortunes severely, due to the world's financial recession. There is nothing new here, as the same thing happened when the Empire State Building was launched during the great recession of the 1930s. It lay mostly empty for many years, earning the nickname the 'Empty State Building'.

Perhaps it is too early to judge the full significance of the Burj Khalifa, but with stories still emerging about poor conditions for the construction workers and concerns over its enormously high carbon footprint, the project has been described as a 'monument for an era of credit-fuelled over-consumption, both irresponsible and unsustainable'. Located on the edge of the desert, with a potential occupancy of 35,000 people, the tallest building in the world makes a symbolic statement about wealth and ambition – but its feasibility must remain questionable.

Symbolism and Tradition

Taipei 101 (Figure 2.2), which held the coveted 'world's tallest' spot from 2004 to 2010, has a very different aesthetic, being steeped in symbolism related to local traditions. Its architect, C.Y. Lee, was keen to establish the building as an icon of modern Taiwan by incorporating
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