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BUILDING TYPE BASICS FOR

office buildings

Stephen A. Kliment, Series Founder and Editor

A. EUGENE KOHN AND PAUL KATZ
Kohn Pedersen Fox

With chapters by LESLIE ROBERTSON and SAW-TEEN SEE,
NORMAN KURTZ, JOHN VAN DEUSEN, DEBRA LEHMAN-SMITH,
JOSEPH KHOURY, JOHN MCCORMICK, and FRANKLIN BECKER

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Despite the apparent simplicity suggested by its standardized floor areas, the modern office is one of the most complex of building types to finance, plan, program, and design. More than most other building types, it must not only accommodate the rapidly evolving demands of workers, it has to combine in a single building the often conflicting demands of structure; heating, ventilation, and air-conditioning (HVAC); communications; electrical systems; plumbing; space division; and safety and security.

Other concerns unique to offices are the building's prominence in the landscape or cityscape and the image it presents to occupants and the public. And before a line is even drawn, an owner or developer must see eye to eye with legions of lawyers, accountants, real estate consultants, bankers, and city officials on the feasibility of the project. Once the office building is occupied, it is subject to a continuous pattern of alteration and renovation, the ease or difficulty of which often depends on the caliber of flexibility the architect incorporated into the design.

This volume in the Wiley "Building Type Basics" series provides answers, guidelines, and cautionary advice, as well as lessons to be learned from actual completed buildings, in order to steer architects and their specialty consultants, developers, members of corporate boards, and financial institutions toward making sound decisions early in the planning cycle. Office Buildings is, like the other volumes published in the Wiley series to date, not a lavish coffee-table book heavy on color photography and weak on usable content. Rather, it contains practical information that architects, their clients, and consultants require in their work, especially in the crucial early phases of a project.

Like the other volumes in the series, Office Buildings is tightly organized for ease of use. The template for the volume is a set of twenty questions most commonly asked about a building type in the early phases of its design. A complete listing of these questions is printed on the inside of the front and back covers of this volume. The list also serves as an index to the pages that provide answers to each question. The fact-filled text is supplemented by diagrams, drawings, lists, and illustrations.

Students at architecture schools will also find the volume useful, as a kind of Cliffs Notes, to get a head start on an assigned studio problem.

Office Buildings is made up of three parts.

Part I comprises an introductory essay by A. Eugene Kohn, partner of Kohn Pedersen Fox (KPF), in which Kohn provides a historical perspective for the office building that extends to this day. Paul Katz, also a KPF partner, then defines the planning and architectural basics of office building design, including such issues as floor area measurement (categories), core configuration, module selection, floor-to-floor height, and coordination of design, structure, HVAC, space division, and other systems. Part I also discusses such intangible influences as building location, markets, “exit strategies”
(a corporate ownership concept that anticipates an eventual move out of a building), adaptability, and long-term value of an investment.

Part II offers contributions from key members of a consultant team — Leslie Robertson and Saw-Teen See on structural systems, Norman Kurtz on MEP systems, Debra Lehman-Smith on interiors, Joseph Khoury on curtain wall design, and John van Deusen on vertical transportation. Franklin Becker contributes an essay on the workplace as idea, addressing such matters as workplace attitudes, organizational ecology, options, and values.

Part III is a detailed casebook of nine completed office projects. The buildings featured as case studies were chosen to cover a total range of office building configurations, types of ownership, and locations. High-rise, mid-rise, and low-rise structures are included, as well as owner-occupied and investment buildings, domestic and overseas locations, and offices as part of multiple-use complexes. Each case study includes photographs, floor plans, sections, details, and an explanatory, analytical text.

This volume was to go into production during the momentous and tragic week when the World Trade Center was destroyed and the Pentagon damaged. Although the manuscript contained material on safety and security, the authors decided that the subject called for more detailed treatment. Accordingly, the chapter on structures was revised. In addition, John McCormick, a code expert and authority on building security, has written a chapter on this crucial topic. Along with a review of fire protection and detection issues and life safety concepts, especially as they bear on high-density occupancy venues such as high-rise buildings, John McCormick takes up the critical issue of penetration of fire-rated construction.

I hope you find this volume both helpful and inspiring.
ACKNOWLEDGMENTS

The book is based on a course, “The Design of Office Buildings,” taught at the
Harvard Graduate School of Design as part of the school’s professional development
courses in spring and summer.

For a book of such broad scope, there are necessarily many who make essential
contributions—of their time, ideas, writing, editing, and administrative skills.

I would therefore like to thank all the authors, whose chapters together provide
a complete understanding of the design of an office building.

John Morris Dixon deserves tremendous gratitude for his editing, for his contribu-
tions to the organization and the graphic content of the book, for writing the
case studies, for keeping all the authors on track, and for keeping the book concise.

The idea for this book originated with Stephen Kliment, in his role as editor of
Wiley’s “Building Type Basics” series. He participated in our strategy sessions for
the book, reviewed all materials, was an important critic, and deserves a great deal
of thanks and credit.

We would also like to recognize—for their many efforts in relation to preparing
drawings, organizing photographs, making valuable suggestions, and performing
many other tasks—from the New York office of KPF, Tomas Alvarez, Eric Howeler,
Doug Hocking, Duncan Reid, Roger Robison, Rob Whitlock, Ian Luna, Thomas
Tsang, and, from KPF London, our partner Lee Polisano and Marjorie Rodney-Goodin.

We are grateful as well for the efforts of Kelly Dougherty and Denise De Lorey of
LSM, Diane Peck of Flack & Kurtz, and Charo Loanzon of Joe Khoury’s office.

The case study project examined in the course and featured in this book is the
Headquarters of Gannett/USA Today, designed by KPF. We had an exceptional client
throughout the design and construction. In addition, during the course and for the
book, we were fortunate to have the enthusiasm and input of Nancy Hauser of Gannett.

The Gerald Hines office of Washington, D.C., was the development manager for this
wonderful project, and we recognize Greg Spivey of Hines for his key contributions to
the project’s success, to the course, and to the case study.

Administrative support from Delva Cameron and Nicola Barry was invaluable in so
many ways, and we thank them.

Thanks are also due to the editorial and production staff at John Wiley & Sons,
above all Amanda Miller, executive editor, David Sassian, associate managing editor,
and Nyshie Perkinson, editorial program assistant, for their commitment to quality.

Finally, Harvard University’s Graduate School of Design made the course possible
and is very supportive of this book. We recognize Corlette McCoy, director, executive
education, and Margaret Moore de Chicojay, program manager.

Thank you.

A. Eugene Kohn
ACKNOWLEDGEMENTS

In the preparation of this work, the author has had the opportunity to work closely with many individuals who have contributed to its success. The author would like to express gratitude to...

[Further text discussing contributions from various individuals and organizations]
PART I
ARCHITECTURAL ISSUES
CHAPTER 1
INTRODUCTION

A. EUGENE KOHN  Kohn Pedersen Fox

When we say “office building,” we are talking about a great variety of structures. We may mean anything from a two-story suburban building to a 100-story urban high-rise. The building we have in mind may be constructed purely on speculation, to house whatever tenants choose to locate in it, or it may be built to suit the specific needs of a corporate headquarters.

Whatever its size or type, the office building is a complex building type and is affected by many forces. Its most important role is as a home for the people who work there—not for all of them eight hours a day, but perhaps four or possibly twelve hours—and its design greatly affects their performance.

The number of individuals and firms involved in the design of a speculative or corporate office building is significant. Obviously, there are the architects and their many consultants: the structural, mechanical, electrical, plumbing, civil, acoustical, special lighting, parking, and food service consultants, to name a few. Preservationists are added to the team when historic buildings are affected by or incorporated into the design. Building owners rely on real estate brokers (for tenants), financial advisers, and the bankers and investors who provide the money for the project. They also have their consultants, who may include construction managers, real estate attorneys, accountants, public relations advisers, and others. These people influence the design in various ways, many of them dealing with the community and the approval process and—of utmost importance for investment buildings—attracting tenants.

To arrive at a superior design, it is essential to work with the client organization and its consultants. It is crucial not to settle too quickly on a scheme. The most effective way to gain the client's confidence is to listen. When the client team is convinced that the architect has listened and grasped its objectives, there is a much greater likelihood that the architect can raise the sights for the project by generating alternatives, overcoming caution, improving design quality, and, in some cases, even increasing the budget.

\* DG Bank Headquarters, Frankfurt, Germany, 1993, by Kohn Pedersen Fox Associates. A mix of uses that includes offices, apartments, and a winter garden is expressed in a variety of volumes related in scale to the varied neighborhoods around the building. Photo © Dennis Gilbert/KPF.

\* JR Central Towers, Nagoya, Japan, 1999, by Kohn Pedersen Fox Associates. A mixed-use complex at the high-speed railroad station includes offices and a hotel in complementary towers rising from a retail podium, all of the parts linked by a fifteenth-floor "sky street." Courtesy Taisei Corporation/KPF.
LOCATION AND DESIGN
Office building design is affected in many ways by location—by whether its site is in a rural, suburban, or urban area and by local zoning and building codes. In terms of geographic distinctions, there are relatively minor differences within the United States and Canada due to local codes and cultures. The principal differences are in mechanical design, responding to North America's sharp variations in climate.

Differences in design criteria for other countries can be dramatic. In the last ten years of office development, it seems that the United States has been concerned with workplace efficiency, productivity, and communication technology; Europe with energy conservation, environmental concerns, and employee access to natural light and air; and Asia with filling a great demand for space, as well as the symbolic importance of tall buildings.

In Germany, Holland, and Belgium, for example, every worker must be near a window, so the maximum allowable distance from the core to the exterior wall is 25 ft (8 m). In the United States office floor areas began expanding after World War II, as air-conditioning and improved artificial lighting became the norm. Today American and Asian office floors often have dimensions of 55 ft (17 m) from core to exterior wall, with even greater dimensions for trading floors.

In Europe natural ventilation is not only desired but required. The cost of energy is approximately six times the cost in the United States and has a significant impact on the design of mechanical systems, exterior walls (double walls, for instance), and other components, justifying higher first costs through subsequent savings in operating costs.
While U.S. office buildings have become increasingly dependent on air-conditioning and artificial lighting systems, these systems have been improved in their performance worldwide. Other significant technical advances have occurred in recent decades, such as the greater strength of structural steel and concrete, new high-performance glass, and improved curtain wall design. We now have high-speed elevators capable of traveling 1600 ft per minute and sophisticated control systems that provide superior service. The most recent system, whereby passengers select their floors before entering the cab, makes the most efficient use yet of the elevator cabs and the space they take up in a building, such as Miconic X.

INTERIOR LAYOUTS
Floor layouts within the typical North American office building have also been evolving. In the 1960s the typical office building was composed primarily of private offices. The status of the individual occupying an office was reflected by the size of the room (number of window modules wide) and its furnishings. Today most U.S. companies—and to varying extents those all over the world—use predominantly an open plan. In IBM’s new Armonk headquarters (see pages 18–19) only 20 percent of the employees are in private offices.

Today conventional open-office layouts are giving way to innovative concepts such as hoteling, whereby staff members have personal lockers and may be assigned to a different workstation each day. This “nonterritorial” concept allows for some staff to be working in lounges or even in cafeterias. And there is a (continued on page 8)
AAL Headquarters

In the early 1970s, Bill Pedersen as senior designer and I as partner in charge for John Carl Warnacke designed the Aid Association for Lutherans (AAL) headquarters in Appleton, Wisconsin. The client, with Ware Travelstead acting as its programmer and representative, inspired a unique building. An entirely open-plan office landscape, featuring unique workstations designed by George Nelson, is interspersed with trees and landscape in the numerous atrium courtyards. Raised floors used throughout serve the interior distribution of communication and power lines, enhancing a very flexible scheme.

The design features a roof of more than 250,000 sq ft that is totally skylighted, providing daylight to all the workers in the partially one-story double-height space, partially two-story structure. This lighting concept is democratic, not limiting the enjoyment of natural light to those located along the window wall.

The building is planned for growth by extending the work space, like the branches of a tree, at the end of each linear module. The work space and amenities of AAL are gathered around a circular landscaped garden that gives a sense of place and of community. Amenities include a choice of several eating experiences and menus, and recreation areas including pool and card tables, movies, and other features, as well as physical workout areas.

Since the completion of this building, many corporate headquarters have been built, but except for more advanced communications technology and possible mechanical systems, there have been few advances beyond it. In fact, many companies and architects are now discovering the virtues of high ceilings, atriums, daylight, and the introduction of landscaping in interiors, all found in the 1970s at AAL. -A.E.K.
Aid Association for Lutherans.
Office spaces are punctuated by garden courts and illuminated with daylight dispersed by cylindrical diffusers. Photo © KPF/Elliot Fine.

Aid Association for Lutherans, Appleton, Wisconsin, 1974, by John Carl Warnecke & Associates. The circular geometry of the cafeteria, seen in the central court as well, suggests the unity of the workforce in an extensive low-rise building. Photo © KPF/Elliot Fine.

Aid Association for Lutherans. The floor plan shows work spaces under linear skylights, surrounding a central court, with shared facilities, including the half-circular cafeteria, at one corner. Courtesy KPF.
in the United States is the increased emphasis on the employee's environment, accompanied by and partly in response to advancing computer and communications technology. There has been a realization that the work environment is critical to the performance of companies, how they communicate ideas, and how they can attract the best talent. As salaries become more competitive, the type and quality of the workspace becomes a more important part of recruiting and retaining an excellent staff.

Increasingly, a corporation or user can decide what kind of environment it wants to create for its culture. Low-rise buildings are normally adapted better to corporate headquarters. In such buildings there is a possibility of visually interconnecting floors through the use of atriums and the potential to have high ceilings without the significant cost penalty imposed by increasing the height of many floors in a high-rise.

All sorts of amenities, including child care, fitness centers, convenience retail stores, a variety of coffee bars and dining facilities, and even concierge services, can be program components of a corporate office building. The building can become a small city with a number of neighborhoods, indoor "streets" with amenities, and a major enclosed or exterior space creating a sense of place—a focal point.

IMPACT OF MARKET FORCES
One of the strongest forces in the design of an office building is the real estate market. The effect is most apparent on investment buildings, but the market strongly affects corporations as well, in their decisions to move, consolidate dispersed offices, renovate, build anew, sell, and so forth. Any proposal for an
office building is driven by a user type, such as investment banks, professional firms, or high-tech companies. The needs of these users normally dictate the floor size and the marketable location of the building.

Real estate developers respond to market demand, and they are vulnerable when the supply coming on the market exceeds the demand or follows after the demand has weakened. This is what happened in most large American cities in the late 1980s, when many of the buildings constructed were delayed responses to demand that was fading. It took about ten years, until the late 1990s, before demand for office space rose enough to justify construction of new office buildings in our major cities.

The first wave of investment buildings built after a deep and long recession is usually conservative in approach, with cost the key concern, because of the uncertainty of the real estate market and the caution of lenders. If the economy stays strong, developers will increasingly want to build something special to compete in an active and competitive marketplace. In such circumstances, the real estate broker can be the architect’s ally in persuading the client to upgrade the building’s quality. The downside of a lively office market is that developers will want their buildings designed and completed “yesterday.”

The highs and lows of demand affect not only the quantity of office building space constructed, but also its evolution. While office building construction languished for a decade in the United States, construction of many office buildings in Europe and Asia incorporated technical advances such as energy-efficient glazing and more efficient elevator systems. And because many of these overseas buildings were shaped by U.S. design teams, the expertise of these designers has been enhanced so that they are now introducing to the U.S. market advances proven abroad.
Procter & Gamble

Working with Procter & Gamble (P & G) officers and their team in the 1980s afforded Kohn Pedersen Fox (KPF) a chance to see one of the great American corporations at work. Before P & G decides to market any product, it researches every detail, testing three times or more to make sure it will achieve the company's goals of excellence. This was certainly true with the selection of the architect and the design process for its expanded headquarters in Cincinnati. Key P & G executives worked along with KPF, analyzing numerous alternatives, to solve the challenging problem of adding a new, larger structure to an existing building from the 1950s. The scheme developed through this painstaking process created an expanded P & G campus in the heart of its home city. The new building was able to establish its identity on the skyline, while the dignity of the old building was not diminished, allowing those who remained there to feel proud of their location.

One way the new and old P & G structures were made to be equal parts of a larger whole was by creating an important and welcoming open space around which these buildings are situated. Interaction between employees working in the old and new parts of the headquarters was accomplished by a bridge connection and the location of alternative dining experiences in both buildings. The development of a signature architectural presence on the city skyline was the subject of extensive study and review, finally leading to the distinctive twin tower scheme.

An internal goal of management, one that was very difficult for the staff and a number of vice presidents to accept, was to create an all-open office plan, instead of giving vice presidents private offices as in the existing buildings. An internal atrium helped to make the new large floor plates more successful, but it took more than one year of presentations and selling before the open plan was accepted, and even then not wholeheartedly. Placing the vice presidents in open offices along the atrium gave them some status and more privacy. There was resistance, but eventually the staff came to enjoy the open plan with its flexibility, and they began to fully appreciate the qualities of the new building.

The design process was made more effective and enjoyable by the hands-on approach of P & G's president/CEO John G. Smale and board chairman Brad Butler, who met with us once a month during the design phase for review and approval, and by the outstanding day-to-day leadership of the company's project manager, John Lehigh.

My partner, Robert Cioppa, and I visited the P & G campus in mid-1999, and it looked as good then as it did when it was just finished. The mature gardens make the public open space look even better. With the exception of carpet replacements and some new paint, there have been no changes to the building. It is beautifully maintained. –A.E.K.
EFFECT OF GOVERNMENT PLANNING
San Francisco is one major city that has imposed a cap on office building construction, allowing only 900,000 sq ft per year. The establishment of this quota has generated competition among rival proposals that amounts to a beauty contest judged by local officials. To some extent, the imposed cap has had the intended effects of discouraging new construction and limiting the office population of the city, but it also caused an extreme escalation of rents that affected the entire Bay Area market for new and existing buildings.

Sometimes governments can have an unexpected negative effect on office building development through zoning and tax laws—for instance, by prompting developers to attempt to beat the deadline for a proposed change to the zoning or tax laws. In New York in the late 1980s the city down-zoned the west side of Midtown from 18 FAR to 15 FAR (floor area ratio, meaning total building floor area as a multiple of site area). This step caused a panic among developers, who saw a loss of potential project value, and they immediately had large buildings (maximizing the 18 FAR) designed for their sites and started construction to beat the deadline. Most of these developers would have been better off losing the 3 FAR, because in many cases they lost entire buildings and sites to their financial partners when the market became overbuilt, rents dropped below pro formas, and tenants became rare.

SPECULATIVE VERSUS CORPORATE BUILDINGS
The planning and design of investment office buildings from the mid-1950s to the mid-1970s was typically based on statistics, with little apparent concern for the users or the public. In this investment—or speculative—office market, the goal was to design the most efficient and economical building, however mundane. Most architects did not regard these buildings as architecture.

When Kohn Pedersen Fox Associates was founded in 1976, its partners shared a conviction that serious architectural consideration of the investment building could benefit owners, users, and the
public. From the beginning, the firm served both corporate and investment clients, treating the two kinds of projects with equal care. "Spec" buildings received the same attention as other efforts in terms of their sensitive relationship to context, memorable exterior form, efficient and appealing office floors, entrance and lobby sequences, public amenities, and meticulous detailing. Of crucial importance, of course, is presenting a persuasive case to the investment client that the additional effort will have long-term benefits in terms of recognition and revenues.

Investment office buildings numbered among the proudest landmarks of American architecture from the 1880s (Chicago'sMonadnock and Reliance Buildings, for example) through the 1930s (New York's Empire State and Chrysler Buildings). The apparent success and widespread recognition of early KPF spec buildings, such as 333 Wacker Drive in Chicago, proved that investment buildings could again be counted among landmark business locations.

Even today, however, many in the real estate business see buildings as assets from which to profit, not necessarily as workplaces for people. Of particular concern are the large real estate investment trusts (REITS) and capital funds investing in real estate and development, because they look at buildings primarily as products to generate a financial return. A building conceived strictly as a financial instrument takes on a different character from one that is viewed as a place of work—a source of productivity and a home during working hours—as well as an important component of the urban or suburban environment.

It is most critical to realize that the tenants and their willingness to pay for quality also influence the product. There obviously must be a balance between the two goals—one is short-term economics, and the other is the quality of the building and the work environment. The best developers and REITS strike this balance. They are confident that companies will pay higher rents for quality buildings, thus yielding a proper return for the investor, the risk taker.

In the design of a corporate headquarters the architects are exposed to a company’s history, culture, growth potential, and leadership styles. Usually, the project is overseen by the CEO, president, chairman, and/or head of corporate real estate, who are talented and very successful people. Finding out what such leaders aspire to in terms of inspiring employees, enhancing productivity, and establishing a public image is not only fascinating for the architects, but also valuable for their future performance.

OFFICE BUILDINGS OF THE FUTURE
Everything we build today must make allowances for continued technological advancement, particularly in communications systems, air-conditioning, and lighting. For office buildings of the future, we can expect improvements in materials, curtain walls, and construction methods, and — through more advanced computer applications — a reduction in the time required for design and construction.
In regard to program and planning, we can expect office buildings to include more hotel-type features, with lobbies containing a concierge service, a variety of food services, and meeting areas with computer capability. The lobby will no longer be a dead space during non-rush hours but will include interactive functions, perhaps 24 hours a day and seven days a week. Larger floor plates will remain the rule—where permitted—laid out and equipped for adaptability to various work space concepts.

There are several unpredictable developments that may affect the office building of the future. (The intensified threat of terrorism will surely affect safety requirements; see pages 23–24, “After 9/11,” and Chapter 9 of this book, on safety and security.) One development with a potentially major impact would be a serious, prolonged shortage of energy. That would cause American developers to adopt some of the energy-conserving concepts now prevalent in Europe, such as double walls, operable windows where

❖ Rodin Pavilion. Glass with various degrees of translucency forms the walls and roof of the structure designed for sculpture display. Photo © KPF/Kim Yong Kwan.
climate permits, higher temperature thresholds before air-conditioning kicks in, and night cooling of the concrete structure to reduce the next day's energy demand. In the United States it is still a difficult economic decision to make exceptional first-cost investments for the sake of energy conservation.

Widespread environmental concerns and rising interest in the "green building" could also be the big change in the United States. Maximizing the use of materials from renewable sources and materials that return to nature when disposed of could have a significant effect on office building design. The use of recycled and recyclable products in office furnishings, already a feature of some product lines, could become more common without causing major changes in design possibilities or cost.
Ford Foundation. Offices overlook the greenery of the building's winter garden. Photo © Esto/Ezra Stoller.
IBM Headquarters

While working on the IBM headquarters in Armonk, New York, with Louis Gerstner, CEO, and Swanke Hayden Connell as interior designers, we saw how a company could be reorganized to meet the challenges of the twenty-first century. IBM under Gerstner wanted to shed its old culture, to reduce the luxurious amount of space per person provided in its previous headquarters, and to create a more democratic environment with a predominantly open office plan. Senior people were assigned small offices adjoining conference rooms. With an average of 75 sq ft per person and workstation partitions of glass above a low wood partition, all staff members are able to see their neighbors, to feel like a team, and to enjoy the view of the surrounding natural wooded environment. Gerstner located his own office in the center of the building, well related to all.


IBM World Headquarters: Angular building forms clad in stainless steel appear to rest lightly on a stone base. Photo © Esto/Peter Aaron.
The IBM staff has numerous opportunities to gather and talk—in breakout areas, at the café, in dining areas, at the fitness center, and in the galleries installed in circulation areas. Museum-like displays of the history of IBM’s products support team identity.

The boomerang-shaped form of the building fits snugly into its wooded site, atop a rock formation with a steep ravine below. In contrast yet in harmony with nature, it is clad in stainless steel and glass, befitting an advanced technology corporation. Despite its high-tech look, however, the building does not necessarily embrace today’s advanced technology; specifically, it does not have raised floors for communications links, because Gerstner believes wireless equipment will soon render these obsolete.

A distinctive aspect of this project was Gerstner's decision to reduce the number of headquarters staff to make it manageable in size, then to make no allowance for expansion or any concessions to an exit strategy such as selling or leasing the building to others.

Designing its headquarters has been part of IBM's strategy for success. This is more than a building: It is a home for its employees, a friendly place to conduct business, efficient and team-oriented, intended as a center for ideas and leadership. It establishes an image for a highly successful and profitable twenty-first-century IBM. —A.E.K.
Just as buildings must have built-in flexibility to accept upgraded mechanical, electrical, lighting, and communications systems, they must also be flexible to accommodate continually changing concepts of the way work is to be accomplished. The current trend toward warehouse-like space that is highly flexible, where workers can spend any hours they like, bring the dog or cat, and so on, may or may not become the standard. In any case, such a building is not revolutionary in terms of its architectural envelope. The increased density of people per square foot, which seems to satisfy users as well as management, is likely to be a long-term trend.

BELOVED OFFICE BUILDINGS
It is fascinating to contemplate that New York's Chrysler Building, which is almost 70 years old, has greater value today than ever before. The nearby Seagram Building, at some 43 years of age, continues to demand the highest rents despite being behind technologically. Maybe the real reason that the design of the office building, like that of the home, changes slowly is that human beings and their habits change very slowly—certainly not at the speed of technology.

Then too, Chrysler and Seagram are prime examples of architectural icons that make unique contributions to the urban scene. An individual or a company can aspire to be located in these buildings. The experience of entering the Chrysler lobby or walking across the Seagram plaza can be a source of pride and joy. Ultimately, the greatest thing any building can do is make you feel good.

(continued from page 16)
Two forces will act to moderate any quantum leaps for most owners of office buildings, however, whether they are investment or corporate properties:

1. Strong concerns about cost and a reluctance to tie up large sums of capital in real estate
2. Designing for an exit strategy so that many companies can use the same building if the initial owners or tenants decide to leave
Beloved Office Buildings

 Chrysler Building, New York City, 1930, by William Van Alen. The world's tallest building for only a few months, at 1048 ft, it is a perennially popular icon, embodying the exuberance of pre-Depression years. Photo © Museum of the City of New York/Corbis.

 Seagram Building, New York City, 1958, by Ludwig Mies van der Rohe and Philip Johnson. It remains one of the most admired office buildings of the past half century because of its elegant proportions and meticulous details. Photo © Esto/Ezra Stoller.

World Bank Headquarters. Atrium as setting for after-hours banquet. Photo © KPF.
AFTER 9/11

As this book was in progress, an unprecedented act of terrorism took place on September 11, 2001, in New York City. Terrorists hijacked two commercial airliners and intentionally crashed them into both World Trade Center towers, two of the world's tallest office buildings.

After resisting the initial impact of a B-767 fully loaded with fuel, the North Tower withstood the jet fuel fire, with temperatures of up to 2000°F, for well over an hour, while the south tower remained standing for a little less than an hour. During that time the majority of the people in the towers were able to escape. (The normal occupancy was about 50,000, but many had not yet arrived at the time of the impact.) The collapse of the towers then killed approximately 3,500 people remaining in them, including hundreds of firefighters and emergency workers who had entered the buildings or were gathered at their bases. (See Chapter 4, on structural systems, for a fuller explanation of the collapse.)

The destruction of the World Trade Center towers started debates on the future of tall buildings, particularly structures of 100 or more stories. Are such buildings safe? Can they be made safer?

Among the issues being discussed is whether exceptionally tall buildings, as attractive targets for terrorism, would any longer appeal to occupants. (Height is not a requirement for a terrorist target, as is apparent from the September 11 attack on the five-story Pentagon building in Arlington, Virginia.) More pragmatic issues include the maximum height of a building that can be evacuated before structural systems fail, and what steps can be taken to make the structure and escape routes more effective in case of natural or human-made disaster.

I have participated in these debates with many architects and engineers. One of the first steps was to consider the advantages of tall buildings in our dense urban areas and to review fire safety codes and structural solutions in tall buildings around the world. In Europe and East Asia the codes are more conservative than in the United States. They include such requirements as dedicated firemen's lifts — fireproof and pressurized — and fire stairs with pressurized vestibules. In Japan there must be fireproof corridors leading to fire stairs.

In Hong Kong there must be a fireproof refuge floor (its only use) every 25 stories, and in China refuge floors must occur every 13 stories. These floors, with their own air systems and communications serve as places of assembly in emergencies, where people can gather to be evacuated in an orderly way following instructions. They are safe havens, like the compartments in a naval vessel that can be isolated from parts of the ship that are taking on water.

Also in China, Hong Kong, and Japan, two-hour fire-rated partitions drop from the ceiling to separate areas of 10,000–20,000 sq ft to confine fires. In Germany such fire-rated partitions between subdivisions of floors are permanent, with fire doors for circulation under normal conditions.

As a result of these discussions following September 11, I am sure that codes for fire safety, exiting, and structural systems in the United States and other countries will be reviewed and eventually modified.

It is critical that we not abandon the construction of tall buildings, which are essential to dense urban areas.
High-density urban development encourages economic and cultural activity and the conservation of land and resources. Tall buildings related to transportation nodes make efficient public transportation possible and provide efficient work environments for large organizations that may occupy 400,000–1,000,000 sq ft.

Tall buildings also offer exceptional resistance to earthquakes, high winds, and even car or truck bombs. (Witness the 1993 attempt to bring down a World Trade Center tower with explosives in a basement.) Because these buildings have great structural mass at their bases, they resist such attacks far better than smaller structures.

Views of and from tall buildings have a positive role in identifying organizations and cities such as New York, Chicago, Hong Kong, and Shanghai. Many become widely recognized icons.

We cannot design any of our buildings—tall or otherwise—as fortresses to stop airplanes or missiles from penetrating, because to do so would create a working environment like an underground bunker. We can, however, consider how to design exterior walls and central cores to limit damage from such impacts and prevent subsequent total collapse.

We are seeing a major change in the corporate location strategies of investment banks, stock and bond traders, and other users of large spaces who until recently concentrated their offices in Lower Manhattan. Some have had to relocate their workforces to other parts of Manhattan and the New York metropolitan area, and a more dispersed pattern is likely to prevail. The New York City region, not just the Wall Street district, will become the world’s leading financial district.

It is possible that the concept of mixed use in tall buildings—with retail, offices, hotel, and residences sharing towers—will become less popular than it has recently been in the United States and Asia. Living above a high-profile office occupant may give residents concern for their safety, and office tenants may be concerned about who might occupy or gain access to apartments or hotel rooms above.

In the weeks after September 11 the threat of biological warfare has raised other concerns. The fear is that diseases can be introduced into an air-conditioning system to affect occupants throughout the building. Another advantage of tall buildings is that each floor can be supplied directly with outside air, drawn far above the ground.

Terrorist action is probably going to be a real threat for years to come. The built environment all over the world will obviously reflect what has taken place and will be influenced by our success at thwarting terrorists. We must not allow their actions to influence us to give up the rich interaction of high-density cities or to isolate ourselves in fortresses. We must show the world that we will continue to live a full life in an environment of free interaction, which will continue to include prominent office towers, some of them recognized as icons.
The office building may well be the defining building type of our lifetime. After the home, it has become the most important setting for modern adult experience. Throughout the twentieth century, the proportion of the workforce employed in offices has steadily increased, and mid-century prophesies of shorter work weeks have not proven accurate. One of the few artworks dedicated to the modern workplace, Edward Hopper's Office at Night, although painted in 1936, is an indicator of the psychological and social importance of the modern work environment. Hopper's image deftly captures the tension between the economic and social dimensions of our lives.

The relationship between economic growth and the design of the workplace— in which the architect's role is decisive—has gotten little scholarly attention. In fact, relatively recently, the great historian Nikolaus Pevsner in A History of Building Types, published in 1976, did not consider the office building a separate type but a subset emerging from a number of older types: government buildings, banks and exchanges, warehouses, and factories. Admittedly, Pevsner's book focuses particularly on the development of building types during the nineteenth century, following the rapid urbanization caused by the Industrial Revolution. Especially germane to this subject is the discussion on the emergence of utilitarian types influenced more by function and material (or technology) than by style. These earlier types were, in various respects, precursors to today's office building.

- Government buildings appeared when the bureaucracy outgrew the more symbolic city halls and other seats of government. Government offices as such were being built in architecturally distinct form in the late 1500s, when the Uffizi (originally government offices, now a museum) was constructed in Florence. It was characterized by extensive, repetitive work spaces, expressed in a regular pattern of windows.

- Banks and exchanges developed when banking and trade demanded organizations with employees, which happened as long ago as the Middle
Ages in Europe (and at least as early in other parts of the world). In the fifteenth century these establishments took architectural form in the palazzo of Florence’s banking families. Evolving from family palaces, they afterward retained characteristics of the palazzo, including imposing façades, prominent central entrances, and differentiation in the scale of various floors.

- Warehouses occurred in the most ancient civilizations, and they contributed to the development of the modern office building when, at some undetermined time, they spawned the concept of leasing floor areas to a variety of tenants.

- Factories emerged with the development of printing. Pevsner cites the earliest in Nuremberg in 1497, illustrating the connection of information technology to the advance of architectural invention. Factory buildings were innovative in terms of construction (steel frames, large scale, long spans, fireproofing) and social reform and urban planning (utopian factory towns). Of particular importance to the office building type is the early use of glass and metal curtain walls in two early modernist examples: the AEG factory by Behrens (1908) and the Fagus factory by Gropius and Meyer (1911).

The office building, as a structure reserved for commercial offices, emerged in Chicago and New York around 1880 with the development of the fireproofed steel frame and the elevator. It was contemporaneous with the emergence of the modern urbanized, capitalistic state. Since then, each economic growth cycle has seen an evolutionary transformation of the office building.

By about 1900 the principal characteristics of the office building type were emerging. Three American buildings of that time exemplify the three fundamental but often conflicting concerns that are relevant to this day: the needs of the individual employee, the functioning of the organization, and the identity of the company with the building.
• The Guaranty Building, Buffalo, New York, 1896, is architect Louis Sullivan's quintessential expression of the office building as a cellular structure of individual offices. This building with homogeneous space on repetitive floors anticipates post-World War II North American speculative office buildings. Tenants could take as much space as needed.

• The Larkin Building, Buffalo, New York, 1904, by Frank Lloyd Wright, accommodated substantially the entire company staff in one vast "organic" space—the ultimate expression of corporate unity. (Of these three archetypal buildings, the Larkin is the only one to have been demolished, perhaps because its unusual one-big-room concept had little appeal to other corporate managers. The Johnson's Wax Headquarters in Racine, Wisconsin, of 1936, also by Wright, is similar in concept and does survive.)

• The Woolworth Building, New York City, 1911–1913, by Cass Gilbert, perfected the concept of a corporate skyscraper as a "Cathedral of Commerce," proclaiming the power of its owners (in this case a retail chain) as an icon in the city skyline.

Until the Great Depression of the 1930s put an end to new construction for almost 25 years, there was an unprecedented building boom in this type, particularly in New York and Chicago. For an in-depth understanding of this period, see Form Follows Finance, by Carol Willis (1995). This work traces the development of the American office building, focusing on the regulatory and entrepreneurial forces that to this day...


(1952, Skidmore, Owing & Merrill) and, a few years later, the masterpiece of this period, the Seagram Building (1958, Mies van der Rohe and Philip Johnson), structures that introduced the tower-in-the-plaza concept for office buildings. None of these three buildings followed the forms typical of New York buildings governed by the zoning regulations. These buildings used considerably less than the available zoning area. In 1961 the zoning regulations were changed to allow for the tower block on a plaza, which could fully utilize the zoning area. The prototype of the modern office block thus established was quickly adopted throughout the United States and in much of the world.

Unlike the design of houses and cities, which have emerged from centuries of history and are as different as the various languages spoken, the design of modern office buildings has developed from a few models within the last century, and the various office buildings around the world may be viewed as many dialects of essentially the same language.

Within a relatively short period, innovations in the three “stories” defined by Pevsner—function, material, and style—transformed the prototype. The possibilities were suddenly enlarged, and for architects the challenges were greater. The office building has indeed taken its place as a key building type and is central to any debate on modern architecture. The purpose of this book is, rather than to pursue theoretical discussions on the office building, to outline the practical
considerations common to this building type, which will be of use to anyone involved in creating an office building.

Although there are no universal prototypes or formulas for responding to a client’s specific needs or to local influences such as climate, culture, codes, or construction methods, the fundamental elements that need to be considered in every office building are identical.

The first decision to be made is the total floor area of the building. As the preceding brief historical review begins to show, the development of the type is closely linked to the utilization of area. This is clearly the fundamental factor in the cost, the potential value to the owner, and the approval by building authorities. There is, in fact, no one way to measure floor area, but a variety of ways, from the point of view of the zoning officials, the engineers and cost estimators, and the tenants or corporate users of the building.

And these ways of measuring area vary from place to place as well.

The basic unit of measure—in effect, the currency—of all commercial property is floor area. The Builder Owners and Managers Association (BOMA) has established a means of measurement, “Standard Method for Measuring Plan Area in Office Buildings,” initially developed in 1952. It may seem that the idea of area is universal and absolute. But a closer examination reveals that even this fundamental concept can be confusing, because each interest group in the development process has a different interpretation of it.

The architect and client must establish at the outset a common definition of area. The four most common methods of calculating area, and some of their variations, are discussed in the following section.

- Uffizi, Florence, Italy, 1560–1580s, Giorgio Vasari. Extensive offices assembled of repeating modular sections, later adapted as an art museum. Photo © Bettman/Corbis.

- Larkin Building, Buffalo, New York, 1904, by Frank Lloyd Wright. Solidity of the office staff expressed in a single vast room. Courtesy Buffalo and Erie County Historical Society.
CALCULATIONS OF AREA

Governmental authorities typically define the maximum size of a building in zoning gross floor area (zoning GFA or ZFA). Zoning area is usually measured to the exterior of the building wall. In many jurisdictions, the ZFA is fixed for every site. In New York, for instance, the ZFA is established by multiplying the site area by the maximum FAR (floor area ratio; that is, the ratio of ZFA to site area) for that location. Floor area allowances can be transferred from nearby sites that meet certain qualifications or can be increased by bonus percentages in return for amenities such as public passages or open space, but all this is mathematically calculated in terms of the established FAR for the site.

In many other locations, however, there is a degree of negotiation in establishing the allowable GFA for a particular site. In London and in Washington, D.C., for instance, the prime concern has been to protect key views to landmarks such as the domes of St. Paul’s Cathedral and the U.S. Capitol, and floor area is negotiable.

In some cities the mechanical rooms, shafts, and mechanical floors can be excluded from the zoning area. In others, all area must be included, even below-grade spaces. Regulations covering the measurement of building area obviously play a part in the design of the significant elements, such as the exterior wall and mechanical systems, because building owners need to maximize the area developed on their property, especially when land prices are high in proportion to the project cost.

To establish costs, contractors and estimators measure the construction area, often called the construction gross floor area (CFA). This includes all the areas of the building, including the basements, mechanical floors, loading areas, and penthouses. In New York, a rule of thumb is that the construction gross floor area of a typical office floor is about 5 percent greater than the zoning floor area at any given floor. Typically, this construction gross floor area is the largest measured area and is the basis for the engineering calculations as well as fees.

Landlords and agents are typically most concerned with the rentable (leaseable) area of the building. The rentable area is calculated differently in every market. The landlord measures the efficiency of the office building by dividing the total rentable office area on the office floors by the zoning area of those floors.

In New York, however, rentable area of a floor is measured to the center line of the exterior wall. Depending on the design of the curtain wall, this can make a difference of 2 percent, as compared with the measurement to the inside of the glass as practiced in London, for instance. In New York the rentable area can also end up being greater than the construction gross because of an unusual concept, the “loss factor.” This factor is a percentage by which the actual rentable area is increased when the lease is negotiated between owner and tenant. It was developed during the 1970s, when companies were leaving New York because of high rents. Landlords wanted to keep the published rents down while retaining the ability to raise rents in the future. Application of the loss factor in leases caused the total rentable office space in New York to grow during the 1990s without any new buildings being built, as in an improving market landlords could increase the loss factor percentage when negotiating leases.

Generic plan illustrating three methods of floor area calculation, used by zoning authorities, owners, and office tenants. Courtesy KPF.


Fagus Factory, Alfeld, Germany, 1911, Gropius and Meyer. Early demonstration of the unadorned glass curtain wall, illustrating the key elements in industrial buildings. Photo © Ruggero Vanni/Corbis.
In Hong Kong, as another example, rentable space is measured to the inside of the glass, but the ZFA is measured to the edge of the floor slab—and the exterior wall is allowed to project up to 300 mm (1 ft) beyond the slab without being included in the ZFA, which can increase the rentable area by almost 4 percent.

The facility managers for the tenants are most interested in the usable area. This is the area that the tenant can utilize for day-to-day functions. Often, it is referred to as the “carpeted” area, inasmuch as it excludes the toilets, vestibules, multi-tenant corridors, elevator lobbies, and the like. In evaluating the space, the facility manager typically hires an independent interior designer to determine the number of employees who can be housed on a floor. The architect often prepares test layouts for hypothetical tenants to assure the developer that the proposed typical floor will adequately serve the targeted tenant type.

1. Core Configuration
The core of the building comprises all of the elements of the office floor that serve the “usable area.” In early office buildings these elements tended to be dispersed on the floor rather than concentrated, as is now typical. The elements now included are the fire stairs, elevator shafts and lobbies, toilets, machine rooms for the air-handling units, electrical and telephone closets, and a number of risers for air, water, electricity, and communications. Many of the key structural elements, such as the shear walls that provide lateral bracing, are integrated into the core; elevator shaft walls and stairwells are ideal for this purpose. Depending on the client’s or tenant’s requirements, the area of the core elements can vary greatly for buildings of equivalent total area, affecting efficiency.

The starting point in designing the core is usually to lay out a prototypical floor that is the most efficient and largest possible on that site, given the owner’s leasing depth (exterior wall to core) requirements and special program needs. This floor plate must then be tested with hypothetical interior layouts, and the likely worker population per floor must be determined, to establish a typical floor that meets the owner’s needs. This determines the approximate number of floors and their areas. With this information, the architect, with the assistance of the elevator consultant or, often, the manufacturer, can provide options for the elevator system and the number of shafts. Until the number of elevators and the floors each group serves is established, the core development cannot progress.

The core design and coordination is an iterative process that continues through to the working drawing phase, but the
essentials of the core have to be established and approved as early as possible. Buildings planned for single users have different priorities, typically requiring a greater level of service in elevators than those for multiple tenants, and that is often reflected in the arrangement of the core elements. In recent years, however, North American corporations have increasingly been requiring an "exit strategy" that allows the building to be easily converted to a rental property.

The location of the core or cores in a building is affected by several factors, and buildings can be categorized by where the cores are placed:

Center-core building
A center-core building is the most typical office building type, particularly for high-rises. The advantages of this type include the following:

- Central structural core to resist wind loads, opening up the perimeter for light and views
- Mechanical services located in the center of the floor
- Ease of construction
- Flexible arrangement for multitenant situations

The center-core configuration may not be the most appropriate for buildings with smaller typical floor plates, buildings with certain site conditions, or buildings with special functions such as trading floors that are not suited to central-core configuration.

Side core building
A side-core is typical for smaller office floors or those built up to a party wall. The advantages of this configuration are as follows:

- The core can open to the exterior environment, allowing for natural ventilation of the common spaces.
- The core can shade the office space from the harshest sun.
- The mechanical system can easily introduce fresh air at each floor.
- The usable area is homogeneous and can usually be organized into one space.

This building type is often very attractive to users without cellular offices and has until recently been the standard in Japan and Korea. However, on large floor plates its use is limited, usually because travel distances to the fire stairs and elevators do not meet time or code requirements.

Multicore building
Multiple cores are common in low-rise buildings, those with very large floor plates, and those with narrow floor plates. These configurations are quite usual in Northern Europe, where cellular offices are the norm, building depths are often limited to 15 m (50 ft) glass to glass, and sites are irregular.

The advantages of multicore configurations are as follows:

- Travel distances to the core are short.
- The floor plate can be adjusted to difficult site conditions and contexts.
- Building elements can be smaller in scale.

The disadvantages include the likelihood of more total elevators and a more complicated lobby and circulation design, requiring a greater area.

2. Floor Plate
The size and shape of a building's floor plate have the greatest impact on its
ARCHITECTURAL ISSUES: THE OFFICE BUILDING TYPE

DEPTH-TO-CORE AND PLANNING MODULE

Depth-to-core measurements, structural bays, and planning modules, as illustrated on a typical office floor plan, with a linear core and an asymmetrical layout that takes the adjacent building into account by maximizing leasing depth on the other three sides. Note that the low-rise elevators are located to open up desirable space on the higher floors. The linear floor plan illustrated here is the most efficient for multitenant buildings in most markets. Courtesy KPF.

internal effectiveness and its external character. Two major determinants of the floor plate are the client's desired leasing depth and the internal planning module. Leasing depth is the dimension of the usable area between the outside wall and the core or the multitenant corridor. In some cases the leasing depth will be measured to another exterior wall, if it is a windowless party wall, or to another window wall, in which case the leasing depth is half the wall-to-wall dimension.

Determining the leasing depth can be one of the most frustrating aspects of office building development. It is always difficult for the developer to anticipate the market's ideal leasing depth two years or more prior to leasing. In build-to-suit structures, this is much easier, because the user determines the preferred leasing depth at the outset of design. The difficulty with build-to-suit owners is that there is usually little leeway for the variations in this depth typical in high-rise towers (as elevator shafts drop off). The space that varies is less efficient because it is unlikely to conform to the owner's workspace modules. The leasing depth varies considerably in different markets, for reasons to be discussed later. In Northern Europe the leasing depth is typically no more than 8 m (about 25 ft), and in Tokyo it is now typically 18 m (almost 60 ft).

Planning modules are the basis for the design of the vast majority of office interiors. Because furniture systems and tenant space standards usually correspond to the module, it is essential to lay out as many of the building elements as possible on the planning grid—in particular, columns and exterior wall mullions—as
this will greatly facilitate the efficient and flexible use of space. The leasing depth must also accommodate the desired planning module.

The modules of lighting and air supply/return systems often do not match the exterior wall module. These are usually coordinated with the 2-ft grid of typical ceiling systems, whereas the typical planning grid in the United States is 5 ft (1.5 m).

**Typical planning modules**

<table>
<thead>
<tr>
<th>Location</th>
<th>Typical Grid Size</th>
</tr>
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<tbody>
<tr>
<td>United States</td>
<td>5 ft (1.5 m) module now the standard, although older buildings typically have smaller modules.</td>
</tr>
<tr>
<td>Japan</td>
<td>1.6 m and 1.8 m (5'3&quot; and 5'11&quot;)</td>
</tr>
<tr>
<td>Europe and Asia</td>
<td>1.2 m (3'11&quot;), and 1.5 m (5'0&quot;)</td>
</tr>
</tbody>
</table>

Considered together, leasing depth and planning module will determine a rectangular and repetitive floor plate, which almost all developers and users prefer. But floor plates are also affected by other considerations, such as site configuration and zoning regulations. In high-rises, upper floors necessarily vary, as elevator shafts are reduced, and they may also be affected by setbacks required by zoning.

3. **Floor-To-Floor Height**

The floor-to-floor height of an office building is typically the same on all the occupied floors except for the lobby and those with specially designated functions, such as trading floors. In low-rise buildings extra floor-to-floor height usually comes at little additional cost, whereas in higher buildings additional floor-to-floor height entails significantly greater costs of structural systems, cladding, mechanical risers, vertical transportation, and so forth. The major factors governing the floor-to-floor height are discussed in the following paragraphs.

*The intended finished ceiling height,* which is typically 2.6 m or 2.75 m (8'6" or 9'0"), although the trend during the 1990s was to increase this height to allow for:

- Reflective artificial lighting, particularly in offices with intense use of computer screens
- Reflective ceiling lights, which require an additional 10 in. (25 cm) of depth, as compared with standard fluorescent lights
- Greater office depths, where higher ceilings allow sunlight to penetrate farther and provide psychological relief

*The depth of a raised floor, if used.* The standard raised floor is 150 mm (6 in.), but variations are frequent. Although raised floors are accepted in most parts of the world, provisions for raised floors in U.S. speculative office buildings are very much the exception, the actual floor not being provided by the owner.

*The structural depth,* which is dependent on the depth to core and the structural material. Obviously, the deeper that dimension, the deeper the structure and the greater the floor-to-floor dimension. Deep floor structure can actually reduce floor-to-floor height if the mechanical ducts run through the structure (as in One Raffles Link, pages 251-262) rather than below it.

*The air delivery system,* which can be either in the ceiling zone below (or partly passing through) the structure or — increasingly in Europe and for single-user
buildings—in the raised floor. The larger the exterior-to-core depth, the deeper the air supply ducts.

The ceiling system, usually integrated with the lighting system, which requires at least 1.5 m (5 ft). The sprinkler system—now a standard feature (.07 m or 3 in.). Typically it can be threaded between the ceiling lights.

Tolerance for deflection. Deflections result from building movement and vibrations. The tolerance required is dependent on the structural system, the height of the building, and the local codes, but should be no more than 1 in. In the United States and Asia, the floor-to-floor height of typical high-rise office buildings is between 13'0" and 13'6" (4.0 to 4.2 m). For buildings with shorter structural spans and concrete construction, as in Germany and France, the typical dimension is 3.75 m (12'4").

4. Exterior Wall Systems
The exterior wall has been an area of continuous innovation and experimentation for architects, as it requires consideration of the aesthetic, technical, and functional performance of the building. The technology of the curtain wall and the materials used in its fabrication have improved rapidly over the
last decade, particularly as the limitations in the design and longevity of earlier systems began to be addressed. The exterior envelope of the building

- Controls the interface of the interior with the surrounding environment
- Affects the utilization of the interior space by the tenants
- Usually defines the aesthetic character of the office building

Particular attention must be given to the interior environment immediately adjacent to the exterior wall. Difficulties often arise with regard to solar glare, radiant heat and cold, condensation, acoustic pollution, and air supply. There are no universally acceptable levels of human comfort. In the United States, for example, there is an unquestioned expectation of all-year air-conditioning, whereas in Europe there is greater acceptance of warmer interiors in summer months. In Japan the standard of lighting is direct fluorescent tubes. Proposals for indirect lighting are rejected on the assumption that office workers there strongly prefer bright, direct lighting, a condition unacceptable in the United States and Europe.

The wall is usually designed to meet interior partitions precisely at mullions. This is one of several reasons why the wall is typically dimensioned to match the interior planning module. Despite the long-predicted demise of the private office, almost all office buildings still have to be planned for at least some perimeter offices. Single-use buildings are exceptions, as they are typically planned either for all perimeter offices or for none.

The primary material of the curtain wall is glass, usually supported by an aluminum frame. Sometimes masonry elements such as precast concrete, brick, stone, or ceramic tile are used. Recently, the overwhelming aesthetic preference has been to utilize much greater expanses of glass than ever before. The increased emphasis on transparency, while allowing natural light to penetrate into the space and affording views from the interior, increases the solar heat gain and glare considerably.

Various adhesives, fasteners, gaskets, tubes, sealants, and fireproofing materials are required to complete the system. The great increase in the number of available glass types expands options and complicates the final selection and procurement of glass. The appearance of the glass is difficult to predict under various light conditions, so a visual mock-up, if possible, is often helpful. Glasses used today often have soft coatings that reduce the nonvisible spectrum entering the building and heating the interior. These coatings are nearly invisible and thus very appealing to architects, who previously used tinted or reflective glass to achieve these properties. In the future these coatings will be hard, applied by a pyrolytic method, and therefore will not need to be used only on the inner surfaces of insulated glass lites.

The last decade has seen unprecedented developments in glass technology, and these can be expected to continue, with innovation led as before by needs of the automobile industry. Future innovations in the structural properties of glass and coating technology promise new opportunities that will further transform the design of curtain walls.

An area of great interest is the active wall—that is, a curtain wall with multiple layers allowing air to pass between the surfaces, often with operable windows and
shading devices built in between the layers. These walls are designed to minimize or eliminate the need for air-conditioning in office buildings. The increased cost of the walls is offset by the decrease in the expenditure on mechanical equipment and the lower energy costs. This is indeed possible in Northern European countries with benign climates, shallow leasing depths, low occupancies, and high energy costs.

Currently, a number of large commercial developments in Japan are using these systems for the first time, but because of certain drawbacks, including greater maintenance demands and the loss of the rental space to the thickness of the double wall, these systems have not been widely adopted outside Europe. In the United States and some other countries the relatively low cost of energy has discouraged such systems. As public officials become more aware of the need for energy savings in commercial buildings, these systems will become more common in other markets. (See also Chapter 7.)

5. Elevators and Mechanical Systems
The critical system in design, as well as in the procurement process, is the elevator system, because it requires a longer lead time than any other equipment. In establishing the number and types of elevators, it is important not to rely on rules of thumb or elevator company representatives—except for relatively small buildings—but to include an independent elevator consultant early in the process. It is almost impossible to improve the elevator service of a building later.

The mechanical specifications of a building are studied very carefully by prospective tenants and their advisers. The owner must make adequate provisions but also consider the running costs of these systems. Each air-conditioning system has ramifications in the planning of the entire building.

It is essential to chart all the systems that require vertical distribution—usually through the core—everything from rainwater drainage to telecommunications. During the schematic design phase, the core of the office building is developed to contain these vertical systems, without necessarily fully coordinating all of them with the structural and architectural layout of the core. Sufficient coordination must be done early on, primarily to establish the dimensions of the core and to confirm the viability of the scheme.

In addition to the mechanical areas on the office floors, there are mechanical equipment needs distributed throughout the building and necessary links to the utility infrastructure. The building's mechanical equipment must be separated from usable office space to avoid acoustical and electromagnetic interference with operations. There must also be convenient access to this equipment for maintenance.

The location and design of mechanical facilities can affect the exterior wall, where there may be a substantial requirement for intake and exhaust louvers. The locations of the centralized mechanical areas are governed in some cases by local zoning regulations, so as to be exempt from the building's zoning gross area.

In recent years the area taken up by the mechanical equipment has increased.
partly as a result of the greater demands of the new technology. In fact, in some recently constructed financial services buildings in New York, up to 20 percent of the construction floor area is dedicated to mechanical equipment, although the typical proportion is closer to 12 percent.

Except for the elevators, final design of most of the numerous necessary systems takes place only after most of the architecture and the structure design has been done. Because the mechanical systems are typically enclosed between the architectural and structural elements, care must be taken to make allowance for all these systems in the early phases of the design.

6. Structural System
To complete the schematic design, certain structural elements should be determined to allow the design to proceed without later adjustments in key dimensions:

- The type of construction must be confirmed. In some areas and for certain building configurations, either steel or concrete is virtually inevitable. In other situations, a comparative evaluation of steel and concrete structure is of value.
- Column sizes, location, and spacing affect the quality of the rental spaces and exterior wall design. Interior columns are typically viewed negatively but often cannot be

![Representative framing plan for a typical floor, assuming a post-tensioned concrete floor slab, with dashed boxes representing predesigned slab openings for possible stairwells between floors. Note that the elevator and stair shafts are ideal for shear walls, allowing for small perimeter columns. Note also the absence of corner columns to maximize the views from internal offices. Courtesy KPF.](image-url)
Architectural Issues: The Office Building Type

Avoided, so their locations have to be considered.

- The core typically provides resistance to wind by means of shear walls. These affect the design and location of the primary elements in the core such as elevators.

- The determination of a structural grid assumes that the needs of garages and loading areas at the base of the building have been determined, so that the relationships of lower-floor and typical-floor structural systems can be considered.

- The preceding decisions should be summarized in a framing plan for the typical floors. Unfortunately, this is often neglected, but even minor adjustments in the framing plan during the later phases can have wide repercussions.

For many tall buildings, a wind tunnel analysis should be performed in the initial phases. Its findings can affect not only the structural system, but the floor plate shape and size, the exterior wall details, the location of mechanical intakes and exhausts, and the design of plazas and entrances.

It is the architect's responsibility to coordinate the various consultants' work and the architectural design. In most building projects today the structural design is completed prior to the rest of the engineering and architecture. In fact, the below-grade structure is often bid (rendered) separately before the above-grade design is final.

In the case of steel structures, the lead time is much longer than with concrete, and there is far less flexibility to make subsequent changes during design and construction. However, steel-framed office buildings have a number of advantages, the most important of which is the relative ease of modification after completion.

Besides tolerating changes later in the design and construction process, concrete has the advantage of greater weight, which can be useful for damping building movement, particularly in taller structures. Concrete also has excellent thermal storage characteristics, and there are systems that use this property to cool the building when chilled water is run through pipes embedded in the floor slabs. Although concrete construction is available, usually at lower cost, in most markets, it also has a number of disadvantages, particularly for larger projects. Concrete structural members are larger than comparable steel members, and the erection process is slower and more labor intensive.

Some buildings use combinations of concrete and steel, utilizing the advantages of both. In high-rises a core is often constructed in slip-formed concrete and the floor beams and perimeter concrete are steel. In mixed-use projects it is not uncommon for the podium housing retail and parking to be built of concrete, with steel-framed office floors rising from there, and even concrete residential or hotel floors above the offices.

It is important to note that the most elegant or efficient structural system is very often not the most desirable one to meet the client's needs. The most obvious example is that owners typically prefer to minimize structural elements on the perimeter of the building, even though that can be the most efficient location for lateral bracing. From the owner's viewpoint, the leasing value and flexibility of the interior space is usually the governing
consideration, overriding possible structural savings.

7. Code Conformance
The codes that most affect the initial stages of the design are those governing the bulk of the building—its height and setback from streets and property lines. Cities have different codes governing these issues. In some cities they are carefully prescribed (as in New York and Hong Kong), and elsewhere they are negotiable (as in San Francisco and London). These codes originated to preserve sunlight and fresh air for the streets and adjoining buildings. In some cities there are height restrictions to preserve important view corridors, particularly in historic and capital cities where certain views are of particular importance, such as Washington, Paris, and London, where the development of tall office buildings is strictly controlled. The other codes that define the design of an office building are the fire codes established to save lives in case of fire. These codes also vary considerably from city to city. Certain fire codes require elevators adjacent to the escape stairs for access to every floor by firefighters (United Kingdom, Hong Kong, and Singapore). Many codes require the stairwells and vestibules to be pressurized. Both of these requirements increase the size of the core. Some cities do not allow elevator lobbies to serve as a means of escape, and some even require a fire-protected corridor between the two escape stairs (Paris and Tokyo), thus significantly reducing the efficiency of the floor. In China and Hong Kong there is a requirement for ventilated refuge floors within a specific number of stories, where people can congregate in the case a floor has to be evacuated. Interestingly, none of these precautions are in place in New York, the world’s largest office market. Perhaps the most significant code requirement that affects the shape and size of the floor plate are the rules relating to the maximum travel distance to the escape stairs—rules found universally, but with different specific distances. These essentially limit the leasing depth and floor size. Even with a small floor plate, however, these requirements can create the need for unanticipated corridors in multi-tenant layouts, reducing the efficiency of the floor.

8. Parking and Loading
In a typical suburban office building in the United States, the area dedicated to parking is equal to or often even greater than that of office space. The developer standard is normally three to four cars per 1000 sq ft of office floor area. Each car typically requires 300 sq ft for surface parking, which includes parking space and driveway; and 350 to 400 sq ft for structural parking, which includes allowances for ramps. Whether on the surface or structured, parking greatly increases the complexity of the planning and demand for land. In urban locations where parking is allowed, it usually has a significant effect on the structural design. Ground-floor loading areas, particularly on small sites, can affect not only structural design, but even the location of the cores. Where codes or clients require off-street loading, it can greatly complicate the design of the building.

Some of the densest cities have begun to limit parking spaces as a way to discourage an increase in cars. In Manhattan, for instance, new office buildings cannot add parking spaces
beyond the existing number. One of the greatest challenges facing the workplaces of the future is for them to become less dependent on the automobile. There is little advantage in designing environmentally sensitive buildings that require large parking structures for employee vehicles that consume unconscionable amounts of fuel.

9. Area Schedule
The apportioning, measuring, and analysis of the areas of a building should be constantly updated. An area schedule must be developed to confirm that all of the zoning area has been used, but not exceeded. An ongoing record must also be kept of total rentable area, the efficiency of the building, and the total construction area of the building.

As mentioned earlier, the apportioning of the areas is particularly important in order to determine the elevator design, as the location of the usable spaces determines the location of the population.

The area schedule is essential to determine the cost estimate. The owner must approve the sizes of all the floor plates. Nearly every building will have floors of different sizes in terms of rentable area.

All owners are concerned with the building efficiency. Efficiency is a relative notion depending on a number of factors besides skillful design and coordination, such as the building services standards required by the owner, the method of calculation, and whether the building is for a single user or multiple tenants. Therefore, all charts comparing efficiency of office buildings are of limited value.

10. Cost and Schedule
The prime motivation for commissioning almost all speculative (not for a corporate owner user) office buildings is profit. Therefore, clients will expect cost and schedule to outweigh other issues. The owner's first priority is to maintain the budget, which is probably part of a financial model behind the decision to proceed with the project. The architect, however, must make it clear that a design is a first essential to confirm the validity of the client's proposed budget and schedule.

Monitoring the cost of the design is typically the final responsibility of the client, who usually calls on a combination of in-house experts, consultants such as project managers, quantity surveyors (in the British Commonwealth), cost estimators, and general contractors. As the design develops, it is imperative that the cost of the project be monitored continuously, a procedure that may seem obvious but is often neglected. At the end of each design phase, the architect should request confirmation that the design meets the client's budget before proceeding to the next phase.

One pitfall in regard to cost is that the budget is often determined on the basis of the cost of a comparable existing building, but often during the design process the program expands and standards are upgraded without an increase in budget. Another danger is the expectation that the client's negotiating skills can lower subcontractor prices. Moreover, because office buildings are usually planned during periods of economic growth, construction prices are likely to be rising.

All building projects involve a balance between short-term capital expenditures
and long-term costs of operation and maintenance. The approach to first cost is likely to vary among clients, depending on whether the building will be owned over the long term or sold once it has been leased. Many design innovations—particularly in the area of energy consumption—involve anticipated operating savings. Costs and payback period must be calculated and made clear to the client.

The schedule is critical too, because the financial model always assumes a delivery date and a commencement of income. If the building is preleased, as is increasingly typical, there will be financial penalties, as well as damaged reputations, if completion is delayed. In some cases the schedule may in fact be the foremost consideration—particularly in markets where the land cost is high relative to construction cost. Schedule concerns may affect design, particularly in the choice of systems that shorten construction time. Even the sequence of producing design documents can significantly influence the time required for bidding and construction.

LOCATION AND MARKETS
During the twentieth century a fundamental pattern of the preceding five millennia of human history was changed, as the proportion of urban to rural populations was reversed. This process first took place in the developed world and is now apparent across the developing world. In fact, today more than one million people a day are migrating to cities around the world. The image of the future in these places inevitably includes the high-rise building to support many aspects of life, in particular the workplace.

Despite the convergent pressures of globalization, each country—often each city—tends to develop unique
characteristics in the design of office buildings that are resistant to foreign fashions or technological developments. These result from a combination of priorities specific to that place, including climate, geography, local culture and religion, economic history, local codes, and construction practices. A consideration of these distinctions is instructive for office building designers, even if they are not working on overseas commissions.

The world today can be divided into four major markets for office buildings, each with distinct regional characteristics: the United States, Europe, Japan, and Asia.

For the present, all other markets can be considered derivatives of those. Significantly, the Asian market is rapidly increasing in size and eventually will probably be the biggest, especially in tall and large projects.

At the risk of oversimplification, we can see these four markets as having certain characteristic power relationships and design priorities.

In the United States, the performance of mechanical systems, which can account for more than 25 percent of an office building budget, is considered vital to competitive survival. Competitive advantage—at both corporate and personal levels—is the primary concern in office building design. This is manifested in the almost obsessive need for efficiency in the design of the typical floor plate and in the redundancy of power and telecommunications systems. Air-conditioning is often required first for computers, then for employees. In the United States, employee mobility is an accepted fact, and there is hardly any expectation of organizational stability. The typical lease in the United States is 10 to 15 years, allowing tenants to move easily.

In continental Europe it is established by law that every office worker is entitled to work in natural light. This effectively limits the depth-to-core dimension to 8 m (about 25 ft). There is also an almost exclusive use of cellular offices, as well as an overwhelming cultural preference for natural ventilation and an acceptance of summer temperatures that American workers would find uncomfortable. The temperate climate of Northern Europe accommodates these priorities. As a source of natural light and ventilation, and as a key energy-conserving feature,
the exterior wall is a crucial component, justifying greater design consideration and greater investment in this region than in other parts of the world.

London is a laboratory of the modern office building. As London's office stock undergoes rapid rebuilding within a rich historic context, almost the entire range of possible office building types can be found there, from the conventional North American center-core high-rise through the shallow, naturally ventilated continental European type. This range in quality and type cannot be found anywhere else. Tenants in London have long leases of 25 years, making it potentially difficult to move but allowing owners to invest in higher-quality buildings.

In Japan, pervasive concern about earthquakes gives highest priority to structural stability. In fact, the bulky proportions of so many buildings probably have a comforting effect on many Japanese people, which those who have not grown up with the fear of earthquake devastation cannot understand. The more the buildings have the proportions of sumo wrestlers, the better. In terms of power relationships, contracting companies—some of them more than 200 years old—are granted enormous authority. Owners and architects generally accept their determinations of cost, design feasibility, and details. One of the reasons the contractors are so powerful in Japan is that building owners are not invoiced for construction as it proceeds, but pay only when a building is completed.

The maintenance of buildings is a national priority in Japan. Coupled with what to Westerners must seem as an obsession with hygiene, this tradition of caring for buildings results in spotless but dated structures still in use, where the linoleum floors are paper thin from endless polishing. One need only enter a fire stair, open a service closet, or walk on the roof of even a modest building to recognize that this is not just good management, but a cultural phenomenon. The landlord of commercial property in Japan washes every window in a building at least once a month.

The developments in Asia tend to be larger and more ambitious in scale, taller and bigger than seen elsewhere. Until the economic crisis in 1998, the majority of high-rise office buildings were being built in the cities of Asia. Although the quality of their commercial development is mixed, Hong Kong and Singapore in particular exhibit the best examples of integrated infrastructure and urban planning, and some of the most advanced construction, surpassing the achievements of Europe, the United States, and Japan.

TENANTS, OCCUPANTS, AND INTERIOR ENVIRONMENT

Before finalizing the typical floor plate, it is good practice to develop test layouts of the interior design for hypothetical tenants to be sure the design is sufficiently flexible to meet a variety of needs. The tenant’s facility manager will be concerned with the head count, or the number of employees or desks that can be positioned on the floor.

The owner will also be concerned that the design can accommodate multiple tenants in a practical, attractive, and efficient way. If excessive corridor space is required to link possible tenant subdivisions of the floor to the elevator lobby, fire stairs, and rest rooms, the efficiency of the floor will be too sharply reduced.
What is the strategy of the tenants filling these office buildings? Today corporate policies influencing the design of the office building are primarily related to the interior environment and less to the exterior image of power that was a prevalent objective in the 1980s.

The corporate strategy of most companies relative to their real estate is to preserve valuable capital resources—to reduce expenses while increasing productivity and revenue. The typical objectives of a United States company are as follows:

- Limit costs, to avoid tying up capital in real estate.
- Maintain the same standards wherever the company operates globally.
- Attract the best people to work for the company and keep them.
- Get these people to communicate and interact with each other, both in person and electronically.

Partly as a result of these pressures, an entirely new model of office tenancy is emerging. In a concept pioneered by companies such as Regus, we are beginning to see office space marketed similarly to hotel space.

Could the success of U.S. corporations over the past ten years be partially attributable to the American workplace? Or is there no correlation between the productivity of the corporation and the design of its workplace? Japanese and European corporate workplaces have not changed as rapidly as those of American enterprises. In Japan the persistence of traditional organizational patterns and life-long employment has, at least until now, discouraged workplace change. Ironically, the heightened European concern for workplace quality has tended to perpetuate the established pattern of cellular offices along exterior walls, and innovation takes the form of increased employee amenities.

The great engine of change today is, of course, the creation of the electronic workplace, which has revolutionized the way we work, communicate, entertain, inform, and so on. Although the electronic revolution has radically affected the design process, vastly expanding analytical capacities, our repertoire of design solutions, and our building team communications, its greatest effects on building design are less tangible. The real challenge for workplace design is to see the implications beyond the obvious ones.
ADAPTABILITY AND
LONG-TERM VALUE

Architects and developers tend to conceive buildings for hypothetical scenarios of the first year or two to speed the initial leasing, whereas not enough time is spent considering the entire life of the building, or how to sustain the building in the distant future, assuming that the future is at all predictable.

It is hardly easy, of course, to design buildings that satisfy today's requirements, much less to try to anticipate the requirements of the years to come. This is particularly true of the office building, which is subject to cyclical changes in the commercial world. When we consider the period of business cycles and the uncertainties of currency and interest rate fluctuations, which affect the demand for space and cost of construction, respectively, we can understand the risk involved over even the few years required to design and construct office buildings. One method of promoting the building's value in the more distant future is to consider the adaptability of the design to the broadest range of subsequent occupancy.

Long-term adaptability of buildings is sometimes fortuitously integrated with urban growth and regeneration. Today the most desirable housing in New York is in renovated office buildings in the Wall Street area, where wonderful structures dating from 1890 to 1940—with floor plates too small for today's office market—are being transformed into apartments and so creating true mixed-use neighborhoods. In Chicago, the 1894 Reliance Building, a pioneering curtain-walled office building, has just been renovated as a chic hotel (named The Burnham, for its architect), as has another modern landmark, the 1932 PSFS Building (now the Loew's) in Philadelphia, and in London obsolete office buildings from the 1960s are being transformed into trendy hotels such as The Sanderson and St. Martin's Lane. In Midtown Manhattan, Lever House, the 1952 icon of the post-World War II modern office building, though obsolete technologically, is being renovated as office space that is leasing for rents equal to the highest in the city, demonstrating the value of location and architectural uniqueness.

TRENDS

Three major issues seem to be driving the design of office buildings today and in the near future, as discussed in the following sections.

Provisions for New Technology, Especially Communications
Electronice technology has, on the one hand, made it more important for cities, especially those with established infrastructure, to quickly absorb the
and time. We see the possibility of decentralized work not only in the developed economies but also in the developing world. The Internet has the potential to slow, if not reverse, the migration to large cities by bringing opportunities to secondary cities and rural areas around the world.

Companies can organize in such a way that not all work need be done in the inner city but can be done in or near the workers' homes, reducing their commutes and the cost to the organization as well. In the developing world we can already see the benefits of work being outsourced, with the help of electronic communications, to lower-cost but literate labor pools, increasing the need for knowledge workers and for new office buildings there. State-of-the-art buildings are now being proposed in places we would not have imagined only a few years ago.

New technology and e-commerce will have a profound effect on how we build, use, and maintain buildings. The air-conditioning demands of electronic equipment are far more critical than those of employees, because such equipment often needs cool air 24-hours, and mechanical inadequacy can be devastating. With the introduction of wireless technology into mechanical equipment, buildings will operate based on higher levels of information. Companies will be able to monitor buildings owned, space rented, and equipment installed.

"Green" Aspects and Sustainability
As we see in Europe, "green" environmental and ecological concerns can lead to exciting opportunities in the design of exterior walls and to a high ratio of envelope-to-floor area, but such features
drive up the initial costs of buildings. Apparently, these costs are justified in Europe in terms of lifecycle costs. The following factors have contributed to the development of green office building design there:

- Social priorities favoring the ecologically sensitive
- The relatively high cost of energy
- A preference for cellular offices
- Workers’ legal right to work within 25 ft (8 m) of natural daylight
- A strong preference for natural ventilation over uniform air-conditioning
- A relatively temperate climate

It is unlikely that buildings with these characteristics will be commercially viable in other parts of the world unless some of the listed conditions are in place. But there is no doubt that we can learn from the investigations performed for European office buildings and integrate some if not all of these concepts. Ironically, many of these ideas were developed by U.S. firms during the oil crisis of the 1970s.

Human comfort issues are manifested in a variety of features that often work together, such as the exterior wall that not only allows for higher energy savings but also provides natural ventilation, affording greater individual control.

Assuming fuel prices increase in the future, we may see governments in America and Asia adopting stronger energy conservation policies and more educated workforces pressing for green buildings. The solutions in these markets, however, will have to fit the building standards prevalent there, notably large and deep floor plates.

The health effects of working in office buildings, especially the impact of mechanical ventilation, is a subject of growing concern in the United States. There are also concerns about the environmental impacts of much of the technology and new materials being introduced into the workplace.

**Changing Role of the Office Building**

The office building is playing a vital role in defining the changes occurring in cities around the world. In nearly every city new office buildings are adding to the density of the urban core. Even European cities, which until recently opposed high-rise office buildings as foreign and insensitive, are now embracing them.

Some urban areas in the United States and Europe will soon approach the hyperdensity that we associate with Asian cities such as Tokyo and Hong Kong, which continue to increase their own density—made possible by new technology and increased investment in infrastructure.

Meanwhile, the overlap of work, leisure, and home has created what is sometimes referred to as the “experience economy.” The compression of discretionary time results in a great proliferation of places for mixing business, entertainment, and dining. A typical example—combining business, art, recreation, and culture—is the new museum, catering to the business world with high-end restaurants rather than mere cafeterias. Breakfast, lunch, and dinner business meetings and functions happen in museums and themed restaurants. Increasingly, eating, socializing, and active recreation and fitness facilities are being given ample, prominent spaces within the corporate office itself.

A number of social factors are at play here, including the following:
The breakdown of conventional hours for work
- The weakening of traditional family structures
- The change in food and dining culture
- The increased emphasis on health

The ideas about public space that were developed in the 1980s could not take hold until the late 1990s, as retailing and lifestyles had not yet sufficiently evolved. Barnes & Noble, Starbucks, and the Gap have in some ways made these planning concepts possible. During the 1990s retail developers and architects renewed an emphasis on an architecture of placemaking. Although the resulting projects were typically heavily themed, the success of these developments did renew interest in traditional urban experiences.

Consider how mixed-use development has changed since the 1980s, when projects such as Copley Place in Boston or 900 North Michigan in Chicago were built. They turned inward, away from the street, in the manner of suburban shopping malls, and their various functions were distinctly separated. In new developments, the retail opens to the street, the office space is secondary to ground-level
activity, and all of the uses share the place-making function. Increasingly, office tenants feel they need to be connected with these vibrant urban places. In New York, this trend can be seen in the drift of corporate uses to areas that are vital with retailing and cultural activities, such as Times Square.

Buckminster Fuller stated that the largest waste in our society was the office building, which used up so much of our resources and was used only eight hours a day. Today, however, the place of work operates all hours of the day all week, and the building it occupies may accommodate numerous other commercial, cultural, and entertainment facilities, thus greatly extending the usefulness of its common spaces and service infrastructure, as well as expanding its role in the larger community.

It seems that the global economy and its pervasive technology are indeed driving toward a convergence of building standards in different markets, and superficially office buildings worldwide do share common elements and are occupied, bought, and sold by powerful institutions. However, possibly stronger forces of context, culture, and climate operate to maintain significant distinctions and variations. Moreover, each building results from the personal motivation, imagination, and decisions of willful individuals, thus ensuring ongoing diversification and evolution of the type.
Office Building Checklist

Listed below are the principal matters addressed by architect and client in the earliest stages of the planning and design of an office building.

Overview of Issues
1. Description of project
2. Project scope
3. Development objectives
4. Planning criteria
5. Specifications
6. Building structure
7. Building envelope
8. Building services
9. Vertical transportation

1. Description of Project
   - Site location
   - Dimensions of site
   - Planning requirements governing design (FAR, height and setback, bulk, street wall requirements, open space, etc.)
   - Legal constraints such as property easements and covenants
   - Unique conditions such as existing structures or foundations, environmental pollution, required subway connections, etc.
   - Approval process
   - Construction budget and schedule
   - Bidding process (guaranteed maximum price [GMP], design build, fast track, etc.)
   - Client organization chart and responsibilities (architects’ role relative to client, owner’s representative, developer, construction manager [CM] and general contractor [GC])
   - Description of consultant team
     - architect(s)
     - structural engineer
     - mechanical engineer
     - cost consultant (or quantity surveyor)
     - vertical transportation engineer
     - geotechnical engineer
     - civil engineer
     - parking consultant
     - acoustic engineer
     - curtain wall consultant
     - exterior wall maintenance consultant
     - lighting designer
     - landscape architect
     - specification writer
     - code consultant
     - graphic and signage design
     - fountain consultant
     - wind tunnel laboratory
     - curtain wall testing facility
   - building maintenance system (BMS) and security
     - telecommunication systems, including satellite
     - concierge services
     - vertical transportation
     - car parking
     - Other uses in project
       - retail and entertainment space
       - cultural program such as galleries, exhibition or museum space
       - hotel program

2. Project Scope
   - Description of building use(s)
   - Anticipated area of each use and number of floors (stacking diagram and program)
   - Target tenant types and sizes (for example, large multifloor financial institutions with trading requirements require a very different building than smaller service business.)
   - Key design issues for the tenants, possibly including:
     - regularity of floor plate shape
     - efficiency of floor space
     - flexibility of layout—raised floor, easy divisibility, cable management
     - building services:
       - 24-hour operation
       - maximum capacity and redundancy
       - backup cabling
       - quality and reliability of power systems
       - vertical duct availability for power and communication cabling

3. Development Objectives
   - Ownership objectives (lease buyback, own, exit strategies, build to suit)
   - Level of finish (shell and core, full build-out, partition and finish)
   - Target tenant mix
   - Level or grade of the building relative to competition and/or other buildings in that market or elsewhere
   - Design priorities
     - flexibility and quality of interior workplace
     - maximizing views
     - creating column-free space
     - distinctive and memorable form
     - integrating (or contrasting) with immediate context
     - utilizing most advanced technology available
     - respecting environmental considerations
     - level of finish in lobbies and elevators
     - minimizing approval period
     - minimizing construction period
   - Target efficiency or total net renewable (usable) space in the building:
     - 76-80% mid-rise
     - 80-84% high-rise
85–90% low-rise
- Relationship of other uses and parking to office space

4. Planning Criteria
- Plot ratio (New York City very defined, but often negotiated)
- Building height (governed in London and Washington)
- Car parking (not permitted in New York City, but critical in many cities)
- Loading (varies from city to city)
- Design occupancy (varies from market to market and building to building, but is a critical aspect of decision making. It is unwise to compare efficiencies of buildings without taking this into consideration. On a trading floor, one can anticipate a density of 70 sq ft (7 sq m) net rentable per person. In Asia the design densities are often less than 100 sq ft (10 sq m), whereas in the United States they are usually greater, closer to 140 sq ft (14 sq m).
- Environmental standards (notably in Europe, Hong Kong, and Singapore)
- Typical floor criteria
  - floor plate size
  - floor plate configuration—shape requirement for corner offices, number of tenants per floor core position dimension, glass to core wall planning grid column layout natural light finished ceiling height raised floor ceiling type (lighting, acoustic tiles, and plenum requirements)

5. Specifications
- Office space
  - floor loading
  - raised floors
  - ceilings
  - walls
  - lighting
  - sprinklers
  - air-conditioning
  - toilets
  - cleaner closets
  - pantries
  - electrical closets
  - telecommunication and TV distribution closets
  - service elevator and lobbies
- Public space facilities
  - public space finishes
  - building management main lobby
  - reception and security desks
  - elevator lobbies
  - carport, elevators, and lobbies
- Spandrel material (stone, metal panel, precast)
- Available suppliers
- Critical dimensions
  - sill height
  - column location
  - mullion spacing
- Storefront
- Louvers for mechanical equipment
- Shading methods (exterior louvers, blinds)
- Window washing

8. Building Services
- Air-conditioning
- Ventilation
- Fire services
- Plumbing and drainage
- Electrical services—high voltage and low voltage distribution
- Lighting
- Standby power
- UPS
- BMS
- Security systems—closed-circuit TV (CCTV) and access alarm and control
- Communication
- Telecommunication system and distribution

6. Building Structure
- Substructure (define special conditions, top-down construction, effect on schedule)
- Superstructure (concrete or steel)
- Floor loads
- Environmental considerations such as flooding, hurricanes/typhoons, earthquakes, snow and ice

7. Building Envelope
- Base, shaft, top zones
- Exterior wall systems (unitized, stick, etc.)
- Glass criteria and character color
  - reflectivity
  - insulated or monolithic coatings

9. Vertical Transportation
- Elevator service criteria:
  - maximum interval (typically 30 sec)
  - 5-min handling capacity
    - (typically 12.5%)
  - loading assumption (typically 80%)
  - population density
- Service elevator requirement
- Car parking access
- Escalators
- Double-deck elevators
- Security controls
- Emergency power