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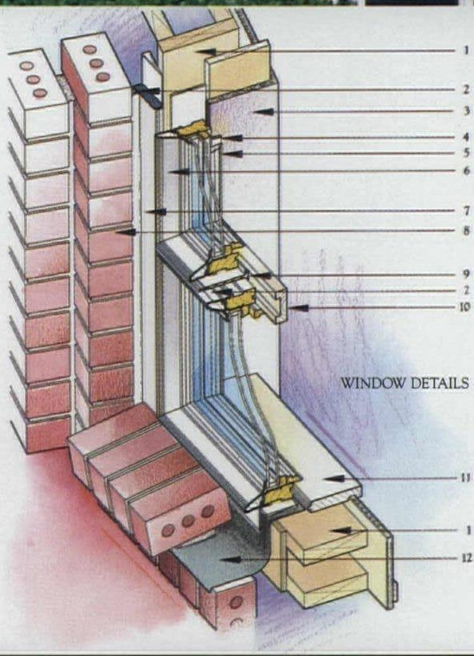

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Cover: *Museum of Modern Art, Frankfurt, Germany (page 62) by Hans Hollein. Photo by Richard Bryant.*

Progressive Architecture October 1991

PA

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Editorial
Accessibility Hurdles

By spurning established code-enforcement procedures, framers of the new Federal accessibility law have greatly complicated its implementation.

The Americans With Disabilities Act became law on July 26, 1990. Its purpose is to remove physical and other barriers affecting the 43 million Americans estimated to have some form of disability – a laudable goal and an especially important one to those whose lives will be made more pleasant and useful by the law. But, to the building community, the law's implementation and enforcement may prove troubling.

The act, known as the ADA, requires Federal agencies to promulgate regulations to carry out its intent. The law's scope includes employment, transportation, public accommodations, state and local government services, and telecommunications. On July 26, 1991, the Department of Justice issued final rules for accessibility in commercial and in local and state government facilities – the regulations that architects and other design professionals must follow in the design of most new and altered nonresidential buildings. The DOJ regulations include the ADA accessibility Guidelines for Buildings and Facilities (ADAAG), requirements developed by another agency, the Architectural and Transportation Barriers Compliance Board.

The ADA appears to venture boldly into the states' constitutional powers to regulate construction, and into the domain of the nation's voluntary standards process, which sets many of the technical criteria adopted in building codes. Building codes will likely continue to regulate accessibility in buildings; thus, for the present, the ADA will result in an additional layer of regulation, causing some confusion and added cost. Although the new rule resembles part of a building code, its foundation is the 1964 civil rights law. This appears to be Congress's rationale for largely bypassing the state and local building regulatory system.

Like it or not, the issue of who's in charge is clearly answered by the new regulations. From a practical perspective, however, it is unfortunate DOJ's regulations offer no viable system for interpretation, plan review, or inspection. For accessibility provisions, the code official as a single source of guidance and interpretations may be a convenience of the past.

Rather, the law's primary enforcement mechanism is through the courts – after building design and construction are complete. This is likely to result in more work for an overburdened court system and in increased liability for the building community. Many comments on the proposed rules recommended integrating the new regulations into the in-place state and local building regulatory process. Sadly, this has not happened, but it appears the Department of Justice may be open to this approach in the future.

The new ADA regulations allow the Attorney General to "certify" state and local building codes that meet or exceed the Act's minimum requirements. But this program, which requires hearings and lengthy review periods and must recur every time the code is updated, is likely to prove cumbersome, especially considering the thousands of local and state jurisdictions that amend and adopt codes and standards or confirm compliance. Model codes, upon which most local and state codes are based, cannot be certified under the new rules, thus denying an option that would surely facilitate implementation of the ADA.

Some states and localities may choose to adopt the new Federal accessibility standards and seek certification in order to reduce the burden on designers. It is doubtful however, that the state/local code agency will have the authority to interpret these standards. Further, although the ADAAG parallels the ANSI standard, it contains some "permissive" language, thus giving more latitude for interpretations. But with the voluntary standard for accessibility for the disabled, ANSI A-117.1, now being revised by its secretariat, the Council of American Building Officials, good opportunitites for coordination are available.

The Department of Justice indicates that it plans to work with the model codes and CABO to bring the provisions of the ADAAB and the ANSI accessibility standard closer together. However, DOJ also indicates that it cannot adopt private standards "wholesale," although other Federal agencies often adopt voluntary consensus standards as allowed and encouraged by Office of Management and Budget Circular A-119.

In the government's zeal to meet the letter of the law, many feel it has missed the best opportunity to meet the new law's intent effectively. In the best interests of those with disabilities and of the nation, one hopes that Justice is sincere in its pledge to work with the private sector, not only to provide for a single accessibility standard that will be kept up to date, but also to use the strengths of the in-place state and local building regulatory process. **David Harris** ■

The author, an architect and a member of AIA, is president of the National Institute of Building Sciences in Washington.

Views

The reader observations that follow are in some cases excerpted from longer letters.

Alexander's Manifesto

Failing to recognize any "mainstream theory of architecture" that I am familiar with from the list of failures in Christopher Alexander's Manifesto 1991 (P/A, July 1991, p. 108), I was left puzzled and not a little annoyed.

We, the architectural profession and society, are fortunate that there is a plurality in the ways our work is practiced and architecture is made. While most of us practice in ways Alexander seems to abhor, there is room in the profession for those like Alexander and Jersey Devil who prefer an ad hoc, hands-on process and who find clients willing to indulge them. We are all the better for the challenges we find in what they produce, as well as in how they produce it.

However, his insistence that his in the only way is not only pompous, elitist, and just plain silly, but also, and more seriously, shows an irresponsible blindness in his world view. His way cannot possibly provide the service the world needs from us in anything like the volume required today, not to mention in days to come. There are simply not that many of us, even in the entire world, to do it all his way.

Most architects I know, including myself, have actually worked with our hands, laid block, poured concrete, framed walls and pulled wire. To say, though, that we should not only do that on every job but also make it one of our major activities endorses poor stewardship of our time and other resources.

Alexander's ideas produce a lot of "warm fuzzies" in us all; we all probably would like to work the way he describes. Several of the points in his Hippocratic Oath are filled with the kind of idealism with which we all need to be challenged and to have continually restored in us. However, taken altogether his program smacks of the same kind of intellectual nostalgia expressed by the Agrarian and Fugitive writers of the 1920s and 1930s. Those writers may have produced much literature of great value but they failed to achieve their original goal, the reversal of the onrush of what they saw as destructive change in their region's way of life.

Frank Orr
Orr/Houk & Associates, Architects
Nashville, Tennessee

[For other reactions to Alexander, see Views, Sept. 1991, p. 11.]

Global Practice

As an architectural firm located in Portland, Oregon, that has operated in Third World Countries since 1971, we are very much in agreement with your editorial "Global Architecture" (P/A, Aug. 1991, p. 7). Our working experience on projects in the institutional and corporate sectors includes Sudan and Nigeria, with smaller assignments in Yemen, Egypt, Jordan, and the Caribbean. During the past 20 years our overseas work has represented 30 percent of our yearly volume, with a staff of 35.

There is a compelling need for true collaboration between U.S. and Third World architectural firms. The latter have been kept from real project participation in their own countries by greedy international firms for too long. This has resulted in a legislative backlash limiting the project involvement of foreign consultants in some Third World countries to as low as 20 percent.

In Sudan (1976) and Nigeria (1986), we forged long-term partnerships with local firms, sharing work on a 50 percent basis, thus providing local architects with the opportunity of gaining experience in a direct problem-solving approach while drawing on their own experience of local complexities due to culture, climate, and construction logistics. U.S. firms should not compete for work that can be performed by local firms, but rather add to the team the specialized experience in design and management not available in the local marketplace. There are two reasons: in a non-competing partnership both firms gain advantages that make them more competititive in the local marketplace, and local clients can limit their precious foreign currency expenditure to 50 percent or less.

While some of us have explored the common Third World/Industrialized World trading vehicle of bartering (exchanging services for export goods to be sold on the U.S. market) or have taken the risk of accepting payment in local currency, most U.S. firms pursuing work in the Third World are limited to projects financed by international or bilateral agencies, or by U.S. corporations. This is a very restricted and highly competitive market, especially when USAID is now rarely financing new construction.

The U.S. architect working on Third World projects needs an open mind towards the local culture, a willingness to learn, a commitment to extended periods of local presence, and creativity in problem-solving as much as in being a diplomat. It can be a rewarding experience; one returns with new insights to problem-solving at home.

Joachim C. Grube, FAIA
Yost Grube Hall Johnson, Architecture

Exploitation Response

I read your editorial entitled "Patterns of Exploitation" (P/A, May 1991, p. 9) and was surprised to be mentioned, by example, in a response by Mr. Alan Paradis in the August issue (Views, p. 9). We strongly take exception to the accusations made in the quoted excerpts as they certainly do not reflect our attitude towards student internships.

Arquitectonica traditionally accepts from eight to ten interns during the year, mostly during the summer months. The exact number fluctuates with our work load, insuring that enough productive work is available. As I am sure they would readily attest, interns who have worked at our office have been exposed to a variety of tasks in all phases of professional practice. Most have continued in their education and have advanced rapidly in their careers. We know this because many either return as full-time employees or keep us in touch with their whereabouts.

Many requests for intern positions are from design students abroad with no work permits and we must clearly specify that under U.S. law, we are not able to compensate them in terms of salary. Since interns are generally available for only six to eight weeks and often require exposure to the professional environment for scholastic credit, these terms are often quite acceptable. Certainly this early experience enhances their professional credentials for future positions by clearly differentiating their résumé from those of untrained peers.

Interns do require more guidance to proceed through their assignments than seasoned professionals and take up desk space in a limited size office. Nonetheless, we strongly support the process, as we believe it not only strengthens our ties to the finest new recruits but also benefits our profession as a whole.

Sergio S. Bakas, AIA
Arquitectonica
Coral Gables, Florida

Holocaust Memorial Consultants

Structural consultants for the Holocaust Memorial in Boston, by Stanley Saitowitz (P/A, Aug. 1991, p. 24), were Ove Arup Partners, Los Angeles.

Robert Irwin Credit

The painter Robert Irwin was mistakenly identified as William Irwin in Diana Balmori's Perspectives essay on landscape architecture (P/A, Aug. 1991, p. 94)

London Flat Credit

On the apartment in Knightsbridge (P/A, Sept. 1991, p. 128), designer John Pawson was assisted by Alejandro Fernandez. ■

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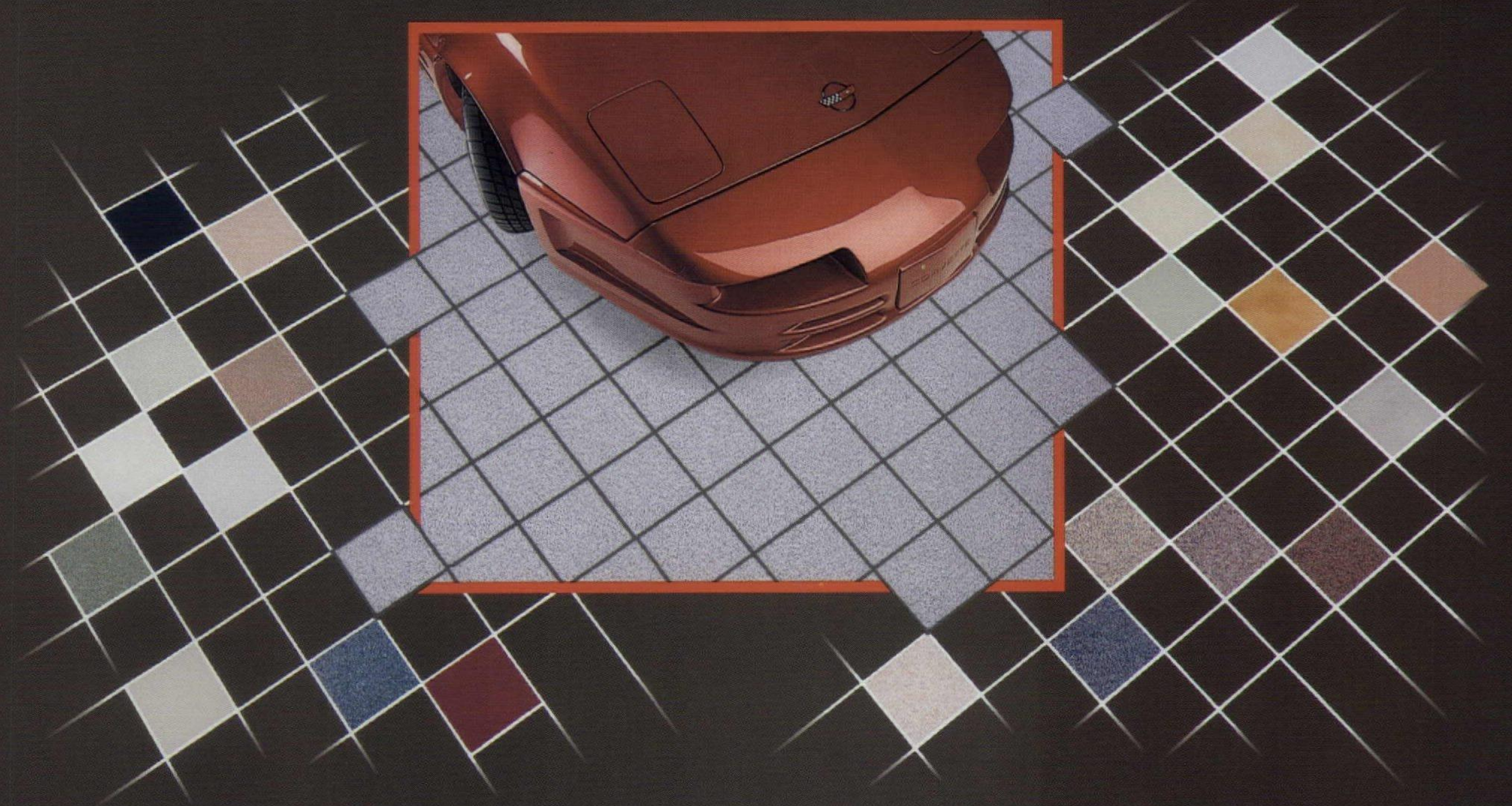

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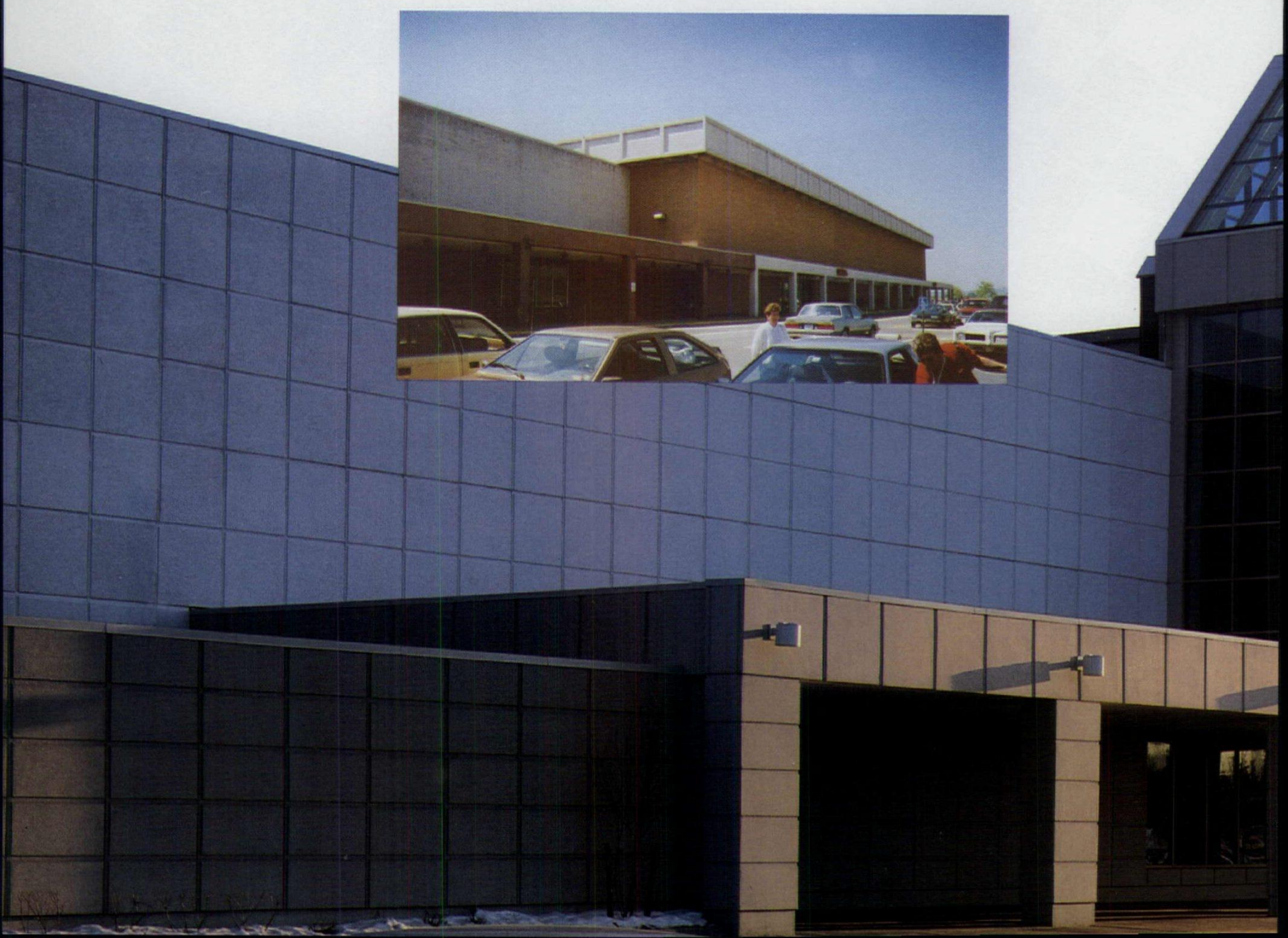

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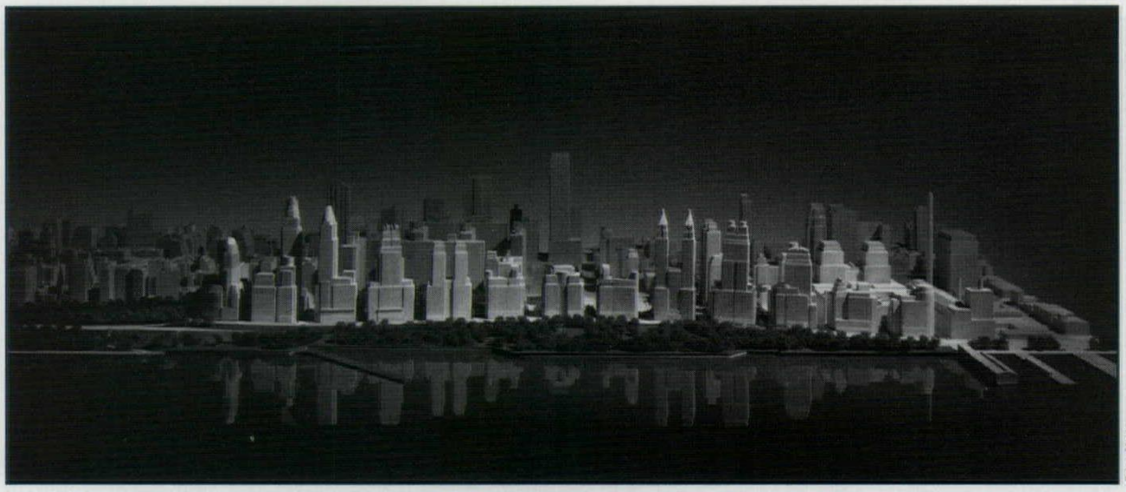
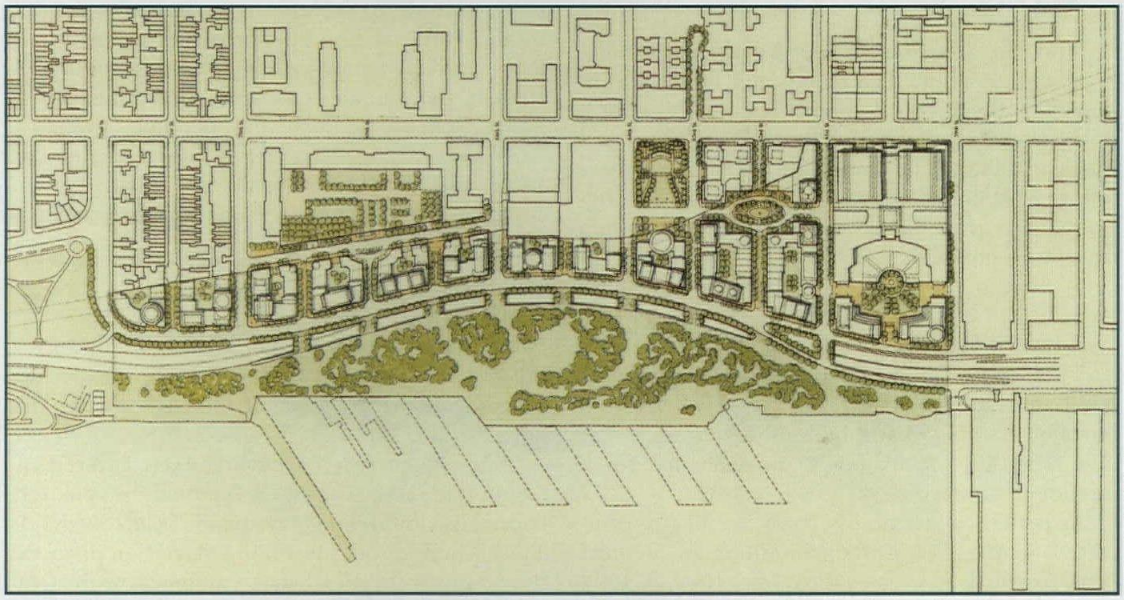


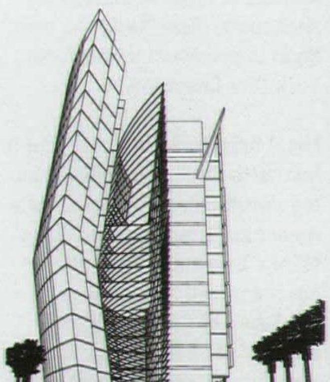
Brian Nolan



Skidmore, Owings & Merrill

Model of SOM/Willen Penn Yards scheme, seen from the west (top); plan showing curving extension of Riverside Drive (above).

In Perspectives (page 96), Alan Hess considers the city of Brasilia after 30 years, and Daralice Boles interviews Brazilian elder statesman Oscar Niemeyer.



In Projects (page 102), recent work by Ellerbe Becket. (Above: competition entry for Bin Laden headquarters, Jeddah, Saudi Arabia).

New Proposal for New York's Penn Yards

Even 60 years may not be enough time to settle the questions surrounding the 76-acre Penn Yards site on Manhattan's West Side. Ever since the Regional Plan Association's first consideration of the site in 1929, proposals by architects such as the Gruzen Partnership, Rafael Viñoly, Murphy/Jahn (P/A, Jan. 1986, p. 25), and Cooper Robertson & Partners have been plagued by difficulties. Now, while developer Donald Trump, with community and civic groups behind him, is poised to present the city with the latest solution – a collection of traditional apartment buildings, production studios, and green space by Skidmore, Owings & Merrill and Paul Willen – such problems as community opposition and economic hurdles remain.

Up to March, Trump seemed to be standing behind the Cooper Robertson-designed "Trump City," a 14-million-square-foot isolationist enclave that included a 150-story tower, nine 60-story apartment towers, and a six-block regional shopping mall. Opposition to the scheme was immediate and widespread; not only for the project's immensity and the resulting burden on the city's infrastructure, but also for its lack of green space. Critics also faulted the design for "turning its back" on the rest of New York.

In order to show positive alternatives, architect Paul Willen and planner Daniel Gutman, under the aegis of six civic groups, presented their Riverside Plan for the site last year. The 7.2-million-square-foot scheme proposed a 13-block southern extension of Riverside Drive with a row of traditional apartment buildings echoing those of Central Park West, a 23-acre park along the Hudson River, and, most significantly, the relocation of the elevated West Side Highway under the new Riverside Drive. While compelling, the scheme neglected many of the infrastructural modifications needed to make the project practical.

Trump's widely publicized financial woes turned out to be a boon for the civic coalition: In March he abruptly agreed to back the Willen/Gutman proposal, apparently because the unified support for the alternative scheme would speed city approval and thus speed returns on his massive investment. Concessions were made on both sides, resulting in an 8.3-million-square-foot proj-

Pencil Points

Daniel Libeskind's competition-winning design for the extension of Berlin's City Museum (P/A, Sep. 1989, p. 23) – to house documentation of the city's prewar Jewish population – may be postponed indefinitely. Berlin's financial woes and political bickering were cited as factors in the delay.

In other museum competition news, officials of the Museums of Scotland chose a Modern scheme by Benson & Forsyth, London, for a new museum building. In the same breath, officials announced that Prince Charles had resigned as president of the museum's patrons. The Prince denies that his action was linked to the winning scheme, citing, instead, unhappiness with the entire selection process.

Frances Halsband has been named Dean of the School of Architecture at Pratt Institute. A founding partner in R.M. Kliment & Frances Halsband Architects, New York, the new dean is president of the New York City Chapter/AIA.

Local municipalities may find it harder to limit affordable housing developments because of a recent decision by New Hampshire's Supreme Court; the court deemed zoning laws in the Town of Chester "exclusionary." The American Planning Association, an organization involved in the case, believes the decision will have a "national impact."

The Perth City Foreshore Urban Design Competition, sponsored by the State Government of Western Australia and the Council of the City of Perth, has been won by Carr, Lynch, Hack & Sandell, Cambridge, Massachusetts. The competition was initiated to revitalize the city's waterfront through new commercial and cultural development. A completion date was not announced.


Brian Nolan

SOM/Willen scheme as seen from the north.

ect and the donation of land by Trump for the highway relocation. The plan is now being administered by the Riverside South Planning Corporation, headed by former Battery Park City head Richard Kahan. The Corporation's first move was to hire Skidmore Owings & Merrill to work alongside Willen as architect. (Gutman will remain in a consulting position.)

SOM and Willen released a revised plan this summer that resolves many of the sketchy ideas of the original Willen/Gutman proposal. The team has attempted to integrate the scheme into the city in each direction: East-west city streets will be extended through the site where possible; Freedom Place, a desolate four-block stretch at the north end of the site, will be landscaped and highlighted by townhouse-sized buildings; and a small oval park – part of another already-approved development – will serve as the focus for apartment buildings at the south end. The Planning Corporation intends to submit the project for city review – a year-long process – this fall.

Of course, doubts remain. A Design Review Workshop held by community groups in June produced a report asserting that many relevant issues are still to be addressed, including subway station overcrowding, sewage plant capacity, traffic load, and air quality. Perhaps most significant, workshop economic consultant Allan Mallach suggested that the debate may be moot given the current recession. "Barring a return to the mid-1980s real estate market, the likelihood that this project will take place is remote." **Andrea Monfried** ■

The author is Deputy Editor of New York's Oculus *magazine.*

A Test for Seattle's Growth Restrictions

The Seattle City Council is considering a proposal that would breach the city's two-year-old limits on the height and bulk of downtown buildings (P/A, July 1989, p. 22) in exchange for a developer-donated park.

At issue is a site across from the nearly completed Seattle Art Museum building by Venturi Scott Brown & Associates (P/A, May 1990, p. 126). Before enactment of the growth limit (known as the citizen's alternative plan or CAP), Canada's Marathon Corporation had obtained permits to build two towers of approximately 30 stories each on the site.

Last year, in discussions with the council, Marathon offered to create a public park on half of the site if it were allowed to build a single 55- to 60-story tower – far exceeding the 450-foot height restriction. Its motivation was mainly that the taller building would allow the larger floor areas preferred by law firms and other premium tenants.

Two council members, enamored of the idea of more green space downtown, introduced an ordinance endorsing the tradeoff. But CAP supporters say such a deal would violate the voters' expressed will to slow the eruption of the city's skyline that began in the 1980s.

A group of seven local architects entered the dispute in late August, assembled by the self-consciously influential newspaper *Seattle Weekly*. In a published roundtable on the Marathon proposal, the group – three of whose members were from NBBJ, Marathon's architect for the project – suggested that more green space might be the last thing Seattle needs. Existing downtown parks are so plagued with drug dealing and other social problems that the mayor ordered them closed after dark this summer.

Instead, the group proposed a glazed "winter garden" terraced up the steep site, containing shops, restaurants, and other public-use facilities that would keep it alive day and night.

The winter garden plan may increase the lure of the tradeoff, but the price remains giving up on CAP in its first major test. The council measure still awaits a vote. **Donald Canty** ■

Campuslike HQ for Whittle in Knoxville

In an age of star designers, it is refreshing to see work that clearly reflects the will of a client, rather than the ego of the architect. Equally refreshing is an office building which refuses to succumb to the "corporate aesthetic." The Whittle Communications headquarters in Knoxville, Tennessee, is both of the above. Designed by Peter Marino and Associates, New York, the 250,000-square-foot complex accommodates 550 Whittle employees, as well as a mail center, bank, law office, the historic Bijou Theater, underground parking, and future retail space.

The design evolved out of a close collaboration between company chairman Chris Whittle and New York architect Peter Marino, who has also designed residences for Whittle. From the start, Whittle made clear his preference for a low, solid building that echoed brick urban architecture of the past. Project architect Larry Archer cites as sources of inspiration work executed by McKim Mead & White at the turn of the century and British Georgian architecture of the same period.

The buildings are arranged on the model of a college campus: A main building – with a central tower and arched pedestrian pathway – is flanked by two L-shaped wings that enclose a courtyard planted with grass, pin oaks, and magnolia trees. The courtyard is designed both for employees and for the public; the main axis through it is the old Market Street, converted in the 1970s to a pedestrian walkway. The courtyard acts as a green resting point between two landmarks linked by Market Street: the old Knox County Courthouse (currently under restoration) and the Tennessee Valley Authority headquarters six blocks away.

The Whittle project is seen by many as the cornerstone of major private development in Knoxville. According to Richard Cate of the Downtown Organization, heightened interest in Knoxville's downtown came only after Whittle's announcement of plans to build the new headquarters. During the project's four-year history (1987–1991), three Fortune 100 companies – IBM, Alcoa, and Kimberly Clark – located various divisions in Knoxville. Meanwhile, the city and county have contributed $15 million in new streets, sidewalks, lighting, and trees. "The scale and the amount of green brought back have been a tremendous improvement to the downtown," says Bruce McCarty, a Knoxville architect whose office overlooks the Whittle compound.

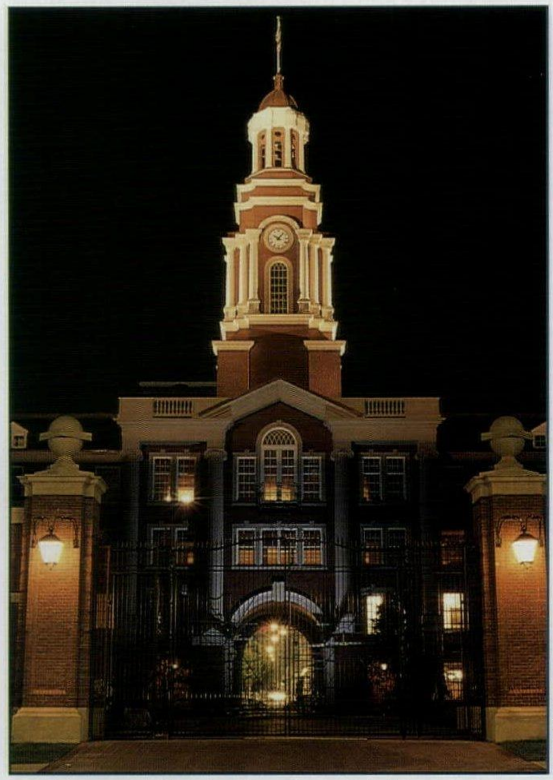
Marino and Whittle have created a group of buildings that show an alternative response to the cool office building that has dominated the American city and suburb in recent years; for Knoxville residents, it is a welcome change.

Stephen Case ■

The author, a student at the Yale School of Architecture, was an intern at P/A this summer.

Chris Berkey

Whittle headquarters: a corporate courtyard.



Tommy McNeese

Bell tower of Whittle headquarters at night.

Aalto Symposium Calls for "Deeper Functionalism"

The spirit of the honored architect hovered over the proceedings of the Fifth International Alvar Aalto Symposium, held August 16–18 in Jyväskylä, Finland. Not only was the symposium held on Aalto's university campus in the city containing some twenty of his buildings, but the stated theme of the weekend's lectures and discussions, "Functionalism: Utopia or the Way Forward?" was rooted in Aalto's humanistic outlook and designs. Over 500 participants (from Scandinavia, Europe, North America, the Baltic states, and Russia) gathered to hear lectures from an international array of architects and historians.

In establishing the focus of the symposium, the organizers hoped for a renewed consideration of "the position of architecture as part of the global system"; their belief being that a critical reappraisal of functionalism – the most recent ideal vision of architecture's social role – might provide answers to current architectural problems.

In a strongly worded opening lecture, Finnish educator Juhani Pallasmaa presented his view of *fin-de-siècle* culture as one increasingly detached from humanist origins. Highly critical of the self-proclaimed autonomy of artists and architects, Pallasmaa's thoughtful reappraisal called for a movement from "metaphorical functionalism" to a conscious engagement of "ecological functionalism." Mexican architect Ricardo Legorreta and Indian architect Balkrishna Doshi presented work that responds to different cultures and locales, yet with similar understanding of the necessity to adapt to local geographic and social conditions.

The second day concentrated on the historical aspects of functionalism as a period architecture. Göran Schildt, Aalto's biographer, examined Aalto's movement through the functionalist period. Riitta Nikula, of Finland's Museum of Architecture, gracefully summarized the life and the restrained, elegant work of Erik Bryggman, Aalto's

(continued on next page)

Washington Report

"It is our considered and careful conclusion . . . that the public, the students, and the entire profession of architecture . . . will be best served if, by January 1, 2001, there should be only one designation for the professional degree in architecture offered by all schools of architecture in North America."

So begins a one-page declaration signed this summer by the Five Presidents Council, which includes the heads of the American Institute of Architects, the National Council of Architectural Registration Boards, the American Institute of Architecture Students, the Association of Collegiate Schools of Architecture,and the National Architectural Accrediting Board. The declaration calls for a ten-year effort to establish a single professional degree in order to overcome "public confusion and misunderstanding about the proliferation of pre-professional, professional, and post-professional degree titles."

In apparent anticipation of concern about standardized courses of study, the report says ". . . the needs of the various constituencies served by architectural education will be best met by a diversity of program structures leading [to the designated professional degree]."

The declaration cites rising pressure to bring degrees (or at least degree nomenclature) into uniformity, and growing national and international demands for reciprocal recognition of professional qualifications, including accredited degrees. As seems to be Washington's pattern for dealing with bold proposals, the Five Presidents Council has formed a task force to continue examining issues.

Judging from comments heard during the AIA convention this past spring, where a draft version of the declaration was discussed informally, many architects appear to agree that degree nomenclature is in disarray. But few suggest that arriving at a single, universally recognized professional educational credential will be easy. Some decried the declaration as another chapter in the continuing push by educational institutions toward doctoral programs – an

(continued on next page)

Washington Report

(continued from previous page)

intention denied by drafters of the declaration and nowhere implied in the statement.

The dean of one large architecture school said that architects misconstrue the call for doctoral programs within some academic institutions, which he called both necessary to the health of the profession and appropriate for any academic discipline. "But that has nothing to do with the view that there should be only one recognized professional degree," he said, "which will almost certainly not be the doctorate."

Educators, practitioners, and some students remain concerned that architecture's stature is much diminished within universities, as other professions have emphasized graduate degrees and post-doctoral research. Doctoral programs, they say, better enable architecture to command resources and to retain academic standing commensurate with a professional program.

"The derisive perspective of architecture as a 'trade school' outside the academic mainstream must be eradicated," concluded a recent report by the AIAS, whose own council of presidents nonetheless refused to endorse the doctorate "as the terminal degree or as the accredited professional degree for entry into the profession."

The AIAS report, echoing views voiced by many practitioners and educators, stresses the need to retain a variety of educational offerings in architecture, but also urges schools to practice "truth in advertising" so as not to mislead students about the value and intent of academic programs.

The AIAS has backed a proposal calling for standard language to be included in all school catalogs as a condition of NAAB accreditation, so that "students [can] be fairly apprised of the type of education being offered and the future ramifications of embarking on [a] particular degree track."

With an element of idealism, the AIAS report seeks to guide the deliberations ahead: "The ultimate impact of a degree rests in the value of its content, not on the degree title conferred."

Thomas Vonier ■

Aalto *(continued from previous page)*

early partner. Wladimir Slapeta, Dean of Prague's School of Architecture, gave many participants a new vision of Czech architectural history in discussing the functionalist landmarks of Prague and Brno. An afternoon seminar combined project presentations by younger Scandinavian architects: Gudmundur Jonsson of Iceland, the Estonian Andres Siim, and the Finns Mikko Heikkinen, Markku Komonen, Pentti Kareoja, and Marjaana Kinnermä.

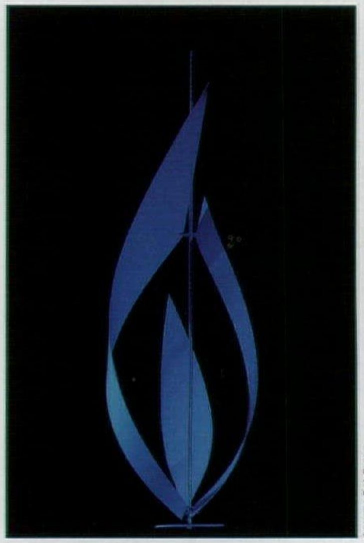
Concluding lectures attempted definitions and summaries, perhaps indicating the difficult nature of the symposium's initial propositions. "Functionalism, as originally conceived, is a weak tool for this time," maintained William J.R. Curtis, holding that more meaningful methods of moving forward are to be found in the continuity of the modern tradition. Steven Holl, presenting his recent "Edge of the City" projects (P/A, June 1991, p. 28) and Fukuoka apartment building (P/A, Aug. 1991, p. 61), suggested that substantial responses are to be found in studying the phenomenology of architecture and proposed a design process based on a poetic "negative capability."

Implicit in the weekend's discussions was an appeal for the assertion of a deeper functionalism, one less constrained by style, one clearly free of a meta-critical stance and more attuned to landscape, climate, local technologies, and cultural forms. Thus for many participants, an afternoon visit to Aalto's Säynätsalo civic center substantiated their thinking: Aalto's synthesis of the rational and emotional, collective and individual, technical and cultural, left an indelible challenge. **Peter MacKeith** ■

The author is an American architect practicing in Helsinki with the office of Juhani Pallasmaa, and teaching at the Helsinki Institute of Technology.

SEGD Looks at Los Angeles

The Los Angeles area seemed an apt venue for "Form, Function, Fantasy: Learning from Los Angeles," a national conference of the Society of Environmental Graphic Designers, held August 22–24 in Pasadena's Art Center College of Design. Los Angeles is a landscape of signs par excellence: The city "is like an advertisement for itself; none of its charms are left to the visitor's imagination," wrote the late Christopher Isherwood. Commercial images of sunshine and health on orange-crate labels and postcards helped spark the mass migration of Easterners to the city, observed Robert Jacob of the Laguna Beach office of the SWA Group. Today, signs are the landscape of Sunset Strip, and buildings themselves often turn into signs, such as the giant frankfurters and doughnuts collected and shown by Los Angeles graphic artist Jim Heimann.



Annette Del Zoppo

Model of chandelier designed by Sussman/Prejza for SOM's Gas Company Tower, based on their logo for the company.

Even in Los Angeles, however, graphics and modern architecture often conflict, as in the awkward retrofitting of high-rise buildings with corporate logos. A possible remedy, according to Tim Walker of the Santa Monica-based developer Maguire Thomas Partners, is to integrate graphics into architecture and bring the signage to street level. For the company's most recent project, Skidmore Owings & Merrill's Gas Company Tower in downtown L.A., Sussman/Prejza designed a new Southern California Gas logo and emblazoned it on columns, wall sconces, and chandeliers.

According to Deborah Sussman of Sussman/Prejza, Los Angeles owes much of its reputation as a design center to the legendary studio of the late Charles and Ray Eames, who moved to L.A. in 1940 not for Hollywood glamour but for seclusion, since the city at that time had virtually no design industry. Although Charles died in 1979 and Ray 10 years later, the Eames office remains arguably the most influential in Los Angeles. In a review of the Eameses' career, John and Marilyn Neuhart pointed out their significant shift in mid-career from furniture design to communications, primarily film making and exhibition design. Much of that work was prophetic; their multi-screen films and exhibitions dense with information anticipated the 'hypermedia' technology of today's interactive computer programming.

These days, the growing role of graphics in architecture has narrowed the gap between the two disciplines, according to Los Angeles architect Jon Jerde. He also stressed the growing importance of artificiality and "simulation" in architecture and planning. "We are all living in a simulated environment," he said. Los Angeles designer Syd Mead said the fantasy environments pioneered in California are fast invading commercial environments and even public space. In Singapore, Mead is designing a theme park in which lights and outdoor film projections are to be the primary design elements. "It's an odd thought, living in a software-driven television show," he said later in an interview, "but we'll get used to it, because we already live that way." **Morris Newman** ■

(News Report continued on page 22)

"Fremont Troll" Guards Seattle Bridge

He sits, glowering, beneath the north terminus of the Aurora Avenue Bridge across Lake Union in Seattle. One hand is wrapped around a battered Volkswagen – not a model, an actual car. He is the Fremont Troll (P/A, Oct. 1990, p. 133), named for the city's most delightfully funky neighborhood and created by a team affiliated with the University of Washington School of Architecture: Steve Badanes, Will Martin, Donna Walter, and Ross Whitehead.

The troll was conceived as a result of a competition held in the spring of 1990 by the Fremont Arts Council, who looked on the site as wasted space being put to less-than-wholesome uses. The site is a towering space between the bridge supports locally dubbed the "hall of giants" and called "cathedral-like" by Martin.

Martin recalls that the idea of a giant troll on this site seemed so obvious to the quartet of designers that it would be proposed by virtually every competition entrant. But only one other troll – a "Disneyesque" version – was among the 40 entries.

The winning troll was designed through use of cutaway models and built by what Martin calls a "modified ferrocement boat-building technique." Prebent steel rebars were used to make a very rigid frame, which was encased in 1″ × 2″ "rabbit hutch wire" and 1/8-inch-thick cloth. Then the concrete was applied, using a fine sand mortar mix, and layers of plaster were added for texture. "It ought to be there forever," says Martin.

David Jeffers

The Fremont Troll, with a real Volkswagen and a hubcap eye.

The troll, which measures 28 feet across and 18 feet in height, cost more to build than the $1500 competition award, the rest coming mainly through an energetic fund-raising drive by the designers. Although it was completed only late last year and is not easy to find, the troll already has become a popular attraction. Children especially love to climb on its deliberately grotesque limbs and visage. **Donald Canty** ■

AIA Poll on Top U.S. Architects, Buildings

The AIA has released the results of a survey of its members on the best American buildings and architects, conducted this summer at the AIA convention and in the AIA's Memo. 829 architects participated. The results follow, in order of finish.

The best American architectural works since 1980:

- Thorncrown Chapel, Eureka Springs, Arkansas (1980), by Fay Jones & Associates;
- United Airlines Terminal, Chicago (1987), by Murphy/Jahn (P/A, Nov. 1987, p. 95);
- High Museum of Art, Atlanta (1983), by Richard Meier & Partners;
- Vietnam Veterans Memorial, Washington, D.C. (1982), by Maya Ying Lin and Cooper-Lecky;
- 333 Wacker Drive, Chicago (1983), by Kohn Pedersen Fox and Perkins & Will (P/A, October 1983, p. 78);
- Master Plan for Seaside, Florida (1982), by Duany & Plater-Zyberk (P/A, July 1985, p. 111);
- Humana Building, Louisville (1985), by Michael Graves Architect (P/A, July 1985, p. 21);
- Museum of Contemporary Art, Los Angeles (1986), by Arata Isozaki & Associates (P/A, Nov. 1986, p. 83);
- World Financial Center, New York (1987), by Cesar Pelli & Associates (P/A, July 1985, p. 79);
- State of Illinois Center, Chicago (1985), by Murphy/Jahn Architects (P/A, Dec. 1985, p. 72).

The best American architectural works of all time:

- Fallingwater, Bear Run, Pennsylvania (1936), by Frank Lloyd Wright;
- University of Virginia, Charlottesville (1826), by Thomas Jefferson;
- Chrysler Building, New York (1929), by William Van Alen;
- Monticello, Albemarle County, Virginia (1775–1808), by Thomas Jefferson;
- Dulles International Airport, Chantilly, Virginia (1963), by Eero Saarinen;
- Gateway Arch, St. Louis (1965), by Eero Saarinen;
- Robie House, Chicago (1909), by Frank Lloyd Wright;
- Seagram Building, New York (1957), by Ludwig Mies van der Rohe with Philip Johnson;
- Trinity Church, Boston (1877), by Henry Hobson Richardson;
- East Wing of the National Gallery, Washington, D.C., by I.M. Pei & Partners.

The ten best American architects of all time: Frank Lloyd Wright; Louis Sullivan; Henry Hobson Richardson; Louis I. Kahn; Thomas Jefferson; Eero Saarinen; Ludwig Mies van der Rohe; I.M. Pei; Bernard Maybeck; and Frank Furness.

The most influential living American architects: I.M. Pei; Robert Venturi; Charles Moore; Michael Graves; Frank Gehry; Philip Johnson; Richard Meier; Fay Jones; Helmut Jahn; Cesar Pelli. ■

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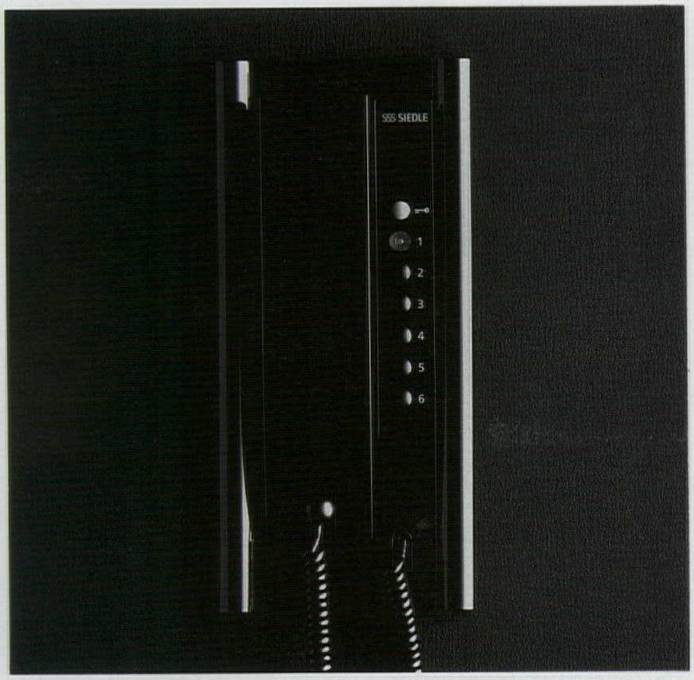

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Calendar

Exhibitions

Design Explorations: 2001
Through October 31

New York. Prototypes of winning designs in the "Design Explorations: 2001" competition, sponsored by *Metropolis* and Parsons School of Design, will be exhibited. Parsons School of Design Gallery.

Women's Work
Through October 31

San Francisco. Originally sponsored by the Organization of Women Architects and Design Professionals on behalf of the California Women in Environmental Design, this exhibition includes work by women architects and designers. AIA Office.

Britain's Independent Group
Through November 3

Buffalo. "The Independent Group and the Aesthetics of Plenty" originated at the Museum of Contemporary Art in Los Angeles (P/A, Sept. 1991, p. 138). Albright-Knox Art Gallery.

An English Arcadia
Through November 10

San Marino, CA . "An English Arcadia 1600–1990: Designs for Gardens and Garden Buildings in the Care of the National Trust," is a traveling exhibition presented by the American Architectural Foundation in collaboration with Britain's National Trust. Huntington Library.

Tadao Ando
October 3–December 31

New York. This exhibition chronicles the self-taught architect's sublime Modernist aesthetic. Museum of Modern Art.

Louis Kahn
October 20–January 5, 1992

Philadelphia. "Louis I. Kahn: In the Realm of Architecture," organized by the Museum of Contemporary Art in Los Angeles, is a major traveling exhibition making its debut in the city most associated with Kahn. The installation was designed by Arata Isozaki based on Kahn's unbuilt plan for the Mikveh Israel Synagogue. Museum of Art.

Competitions

Wood Design Award
Submission deadline
October 21

Washington, D.C. The American Wood Council has announced its call for entries for its 1991 Wood Design Award Program. Residential and nonresidential, new and remodeled buildings completed since January 1988 may be entered. All buildings "must have a dominantly wood appearance...wood members must form an integral part of the project's structure." Contact American Wood Council, 1250 Connecticut Ave., N.W., Suite 300, Washington, D.C. 20036 (202) 463-2760 or FAX (202) 463-2791.

AIA Awards Programs
Deadlines vary

Washington, D.C. The AIA's 1992 awards programs schedule has been announced: Thomas Jefferson Award (October 25); AIA/Concrete Reinforcing Steel Institute Design Awards (November 1); Institute Honors (November 4); Architecture Firm Award (November 4); ACSA/AIA Topaz Medallion for Excellence in Architecture (December 2); and National Concrete Masonry Awards for Design Excellence (February 10, 1992). Contact AIA, 1735 New York Ave., N.W., Washington, D.C. 20006 (202) 626-7586.

Chainlink Fence Design Award
Entry deadline November 1

Washington, D.C. The 1991–1992 Chainlink Fence Design Award Contest honors the innovative use of chainlink fencing. Contact Bill Hennessy, CLFMI Promotion and Design Award Committee, Chainlink Fence Manufacturers Institute, 1776 Massachusetts Ave., N.W., #500, Washington, D.C. 20036 (202) 659-3537.

CRSI Design Awards
Entry deadline November 1

Schaumburg, Illinois. The Concrete Reinforcing Steel Institute's 11th biennial competition, co-sponsored by the AIA, honors excellence in cast-in-place

(continued on page 28)

Calendar *(continued from page 26)*

concrete design. Structures completed in the United States between January 1, 1989 and November 1, 1991 may be entered. Contact CRSI, 933 N. Plum Grove Rd., Schaumburg, IL 60173-4758 (708) 517-1200 or FAX (708) 517-1206.

Conferences

Mixed-income Housing
October 17–18

Chicago. "Fulfilling the Promise of Mixed-income Housing" will bring together architects, developers, tenants, educators, and public officials to discuss the strategic, financial, and social issues facing initiators of mixed-income housing. The Housing & Society Trust and the Chicago Dwellings Association are cosponsors; the conference will be held in Chicago. Contact HST, Jeffrey J. Loustau, Coordinator, One Harbor Point Blvd., Boston, MA 02125 (617) 328-3100 or FAX (617) 328-5732.

Kahn and Philadelphia
October 18–20

Philadelphia. "Louis I. Kahn and the Philadelphia School: The Genesis of American Contemporary Architecture," sponsored by the AIA Committee on Design and the ACSA, "will reinvestigate the power" of Kahn in connection with the show of his work (see Exhibitions, above). Contact AIA Committee on Design (202) 626-7361; Karen Eldridge, ACSA (202) 785-2324; or AIA/Philadelphia Chapter (215) 569-3186.

Montreal Design Show
October 25–27

Montreal. The third edition of SIDIM, the Montreal International Interior Design Show, will be held at the Montreal Convention Center. Contact SIDIM, 5318 Saint-Laurent Blvd., Montreal, Quebec, Canada H2T 1S1.

A/E/C Systems Fall
October 28–31

Nashville. This conference and trade show on computer systems for architects, engineers, and designers will be at the Nashville Convention Center. Contact Sharon Price, A/E/C Systems Fall, P.O. Box 310318, Newington, CT 06131-0318 (800) 451-1196/(203) 666-6097 or FAX (203) 666-4782.

International Trends
November 8–9

San Francisco. The International Trends in World Markets Conference, sponsored by the AIA International Committee, is a forum for architects, developers, corporate executives, and consultants to discuss the nature of work abroad. Contact AIA, 1735 New York Ave., N.W., Washington, D.C. 20006 (202) 626-7300 or FAX (202) 626-7421.

Healthcare Design Symposium
November 14–17

Boston. "Imagining New Possibilites" is the theme of the fourth National Symposium on Healthcare Design, a conference and exhibit "dedicated to studying and producing quality, life-enhancing, cost-contained healthcare environments." Contact National Symposium on Healthcare Design, 4550 Alhambra Way, Martinez, CA 94553 (415) 370-0345.

AEC Expo East
November 19–21

New York. This annual trade show and conference on automation, management, and reprographic systems will be held at the Jacob Javits Center. Contact Expoconsul International, 500 College Rd., E., Princeton, NJ 08540 (609) 987-9400 or FAX (609) 987-9490.

Making Cities Livable
November 19–23

San Francisco. The 11th International Making Cities Livable Conference, sponsored by the Center for Urban Well-Being, will be held at the Stanford Court Hotel. Contact Suzanne H. Crowhurst Lennard, IMCL Conference, P.O. Box 7586, Carmel, CA 93921 FAX (408) 624-5126.

AIAS Forum '91
November 26–December 1

Miami. Forum '91, the annual educational symposium sponsored by the AIAS, will include lectures, panel discussions, workshops, and a tour of the host city; participants will stay at the Hotel Inter-Continental. Contact Carl Costello, AIAS, 1735 New York Ave., N.W., Washington, D.C. 20006 (202) 626-7472 or FAX (202) 626-7421. ■

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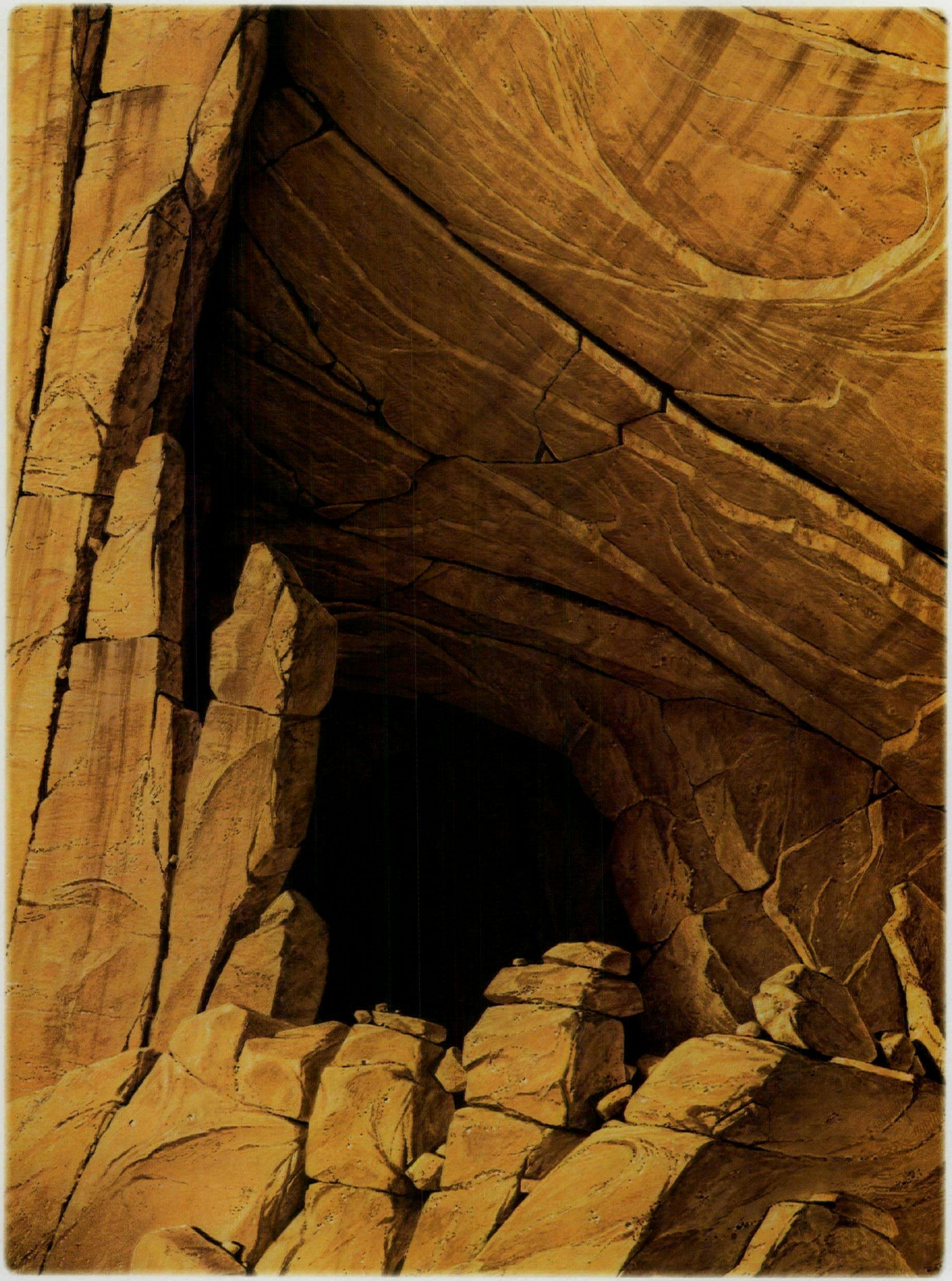

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Technics
Solving the Problem of VDT Reflections

Rensselaer researcher **Dr. Mark S. Rea** explains how to identify,

understand, and prevent lighting problems in computerized work environments.

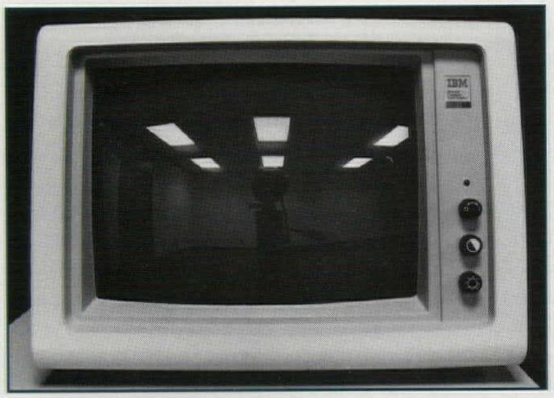
There are many problems associated with viewing visual display terminals (VDTs), but the main one is that of reflected images in the VDT screen. This is related largely to lighting, but it also relates to other aspects of the interior design; it is a pervasive problem that must be addressed by the architect. There are many different ways to solve the problem of reflections. The purpose of this article is to explain its nature, and with this understanding to solve it in effective and creative ways.

VDT displays commonly provide two competing images for the worker's attention (1). Not only does the VDT display provide a view of the electronically generated alphanumeric text, line drawings, or pictures, but it can also offer, through reflection, a view of the luminous environment surrounding the worker and the VDT. These two images are at different optical distances: The electronically generated image is close while the reflected image is usually much further away. These two images compete for the attention of the VDT operator and in doing so require repetitive focusing – or, more accurately – *accommodation* and *vergence* adjustments by the eyes.[1] In essence, all successful design solutions for VDT environments eliminate or reduce the quality of the reflected image while maintaining the quality of the electronically generated image.

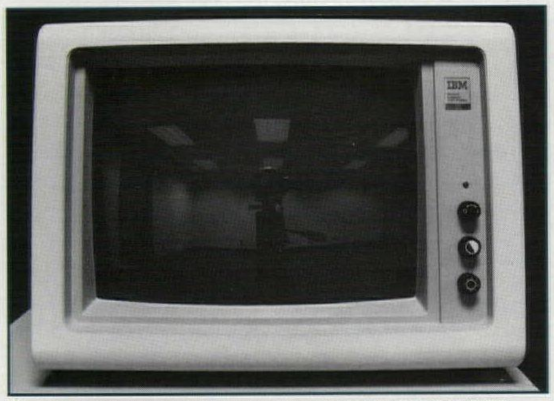
Two general strategies may be followed that address these issues. Bright, high-contrast, reflected images should be reduced below the threshold of perception, and distinct, sharply focused, reflected images should be reduced below the acuity limit of perception. Both of these strategies are based on fundamental properties of the human visual system, and both have specific design implications and recommended solutions.

Contrast Fundamentals

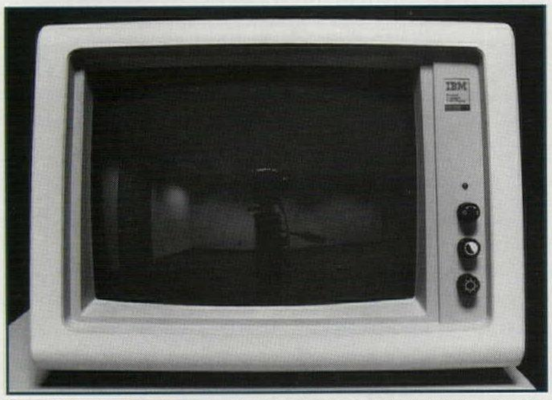
Why eliminate or reduce bright, high-contrast reflections? To be visible, an object must have a luminous (or color) contrast with its background, that is, the object must have a different brightness than the background has (see sidebar, 2). A mini-



1a CONVENTIONAL EXTRUDED LENSES.



1b 24-CELL ALUMINUM DEEP-CELL PARABOLIC LOUVERS WITH SPECULAR FINISH.

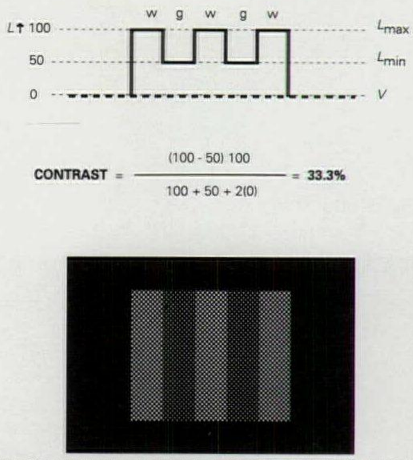


1c 1 1/2" × 1 1/2" × 1" (SMALL CELL) PARABOLIC PLASTIC LOUVERS FINISHED IN SPECULAR ALUMINUM.

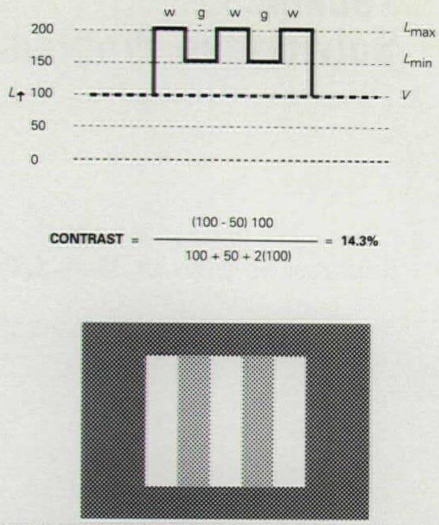
National Lighting Bureau

1 *Diffusers in direct-lighting luminaires control the distribution of light and reflections on computer screens (1a–c). Although aluminum-finished plastic louvers (c) virtually eliminate glare in this example, the energy consumption associated with them is twice that of specularly finished deep-cell aluminum louvers (b). While reducing reflected glare, the strong downlight of sharp cut-off luminaires tends to cast shadows across the face of bookcases and other furnishings that many find disturbing. More important, the performance of any type of shielding and diffusing medium with respect to VDTs depends on 1 the contrast between the luminaire and the ceiling and 2 the contrast between the reflected images of the ceiling and luminaires on the VDT screen and the VDT display.*

1 *Accommodation* is the ability of the eye to alter its focal distance with changes to the crystalline lens. *Vergence* is the change in positions of the optical axes of the two eyes brought about by the extraocular muscles. *Convergence,* for example, describes the process of bringing the lines of sight for the two eyes to a near point in front of the nose.



2a CONTRAST BETWEEN TWO IMAGES WITH A DIFFERENCE OF 50 cd/m² IS 33.3 PERCENT ON A DARK BACKGROUND.



2b CONTRAST BETWEEN TWO IMAGES WITH A DIFFERENCE OF 50 cd/m² IS 14.3 PERCENT ON A LIGHT BACKGROUND.

Calculating Contrast

2 Luminance contrast is a dimensionless value ranging from 0 to 100 percent and may be computed from the simple formula,

$$C = 100[(L_{max} + V) - (L_{min} + V)]/[(L_{max} + V)+(L_{min} + V)].$$

By rearranging,

$$C = 100(L_{max} - L_{min})/(L_{max} + L_{min} + 2V),$$

where C is contrast, L_{max} is the maximum luminance of an image (in cd/m^2), L_{min} is the minimum luminance of an image (in cd/m^2), and V is the luminance of the background on which the image is seen, or the luminance of the veiling reflection (reflected glare) superimposed on the image.

In illustration 2a, the solid lines represent the luminance profile of white (w) and gray(g) bars reflected in a black screen. For this example, the black screen luminance (V) equals 0 cd/m^2, the maximum luminance of the reflected white bars (L_{max}) is 100 cd/m^2, and the luminance of the reflected gray bars (L_{min}) is 50 cd/m^2, thus producing a contrast of 33 percent. If the same reflected image is seen on a lighter screen (V = 100 cd/m^2), the contrast between the same gray and white bars drops to 14.3 percent (2b).

mum contrast must be exceeded to produce perception; contrast values below this threshold are functionally invisible. Contrast threshold depends on a number of factors, including the size of the object, how long the object was seen – if for short durations – and the overall adaptation level of the visual system. Contrast threshold values between 2 and 5 percent can be taken as a representative range for all but the smallest objects seen in typical windowless, interior offices, which usually have luminance ("brightness") levels of about 50 to 250 candelas per square meter (cd/m^2). These contrast threshold values can be taken as performance criteria for defining the visibility, or rather invisibility, of reflected images in VDT screens.[2]

Most VDT screens are self-luminous; that is, they produce light by electrically stimulating phosphors in the VDT display. Dark background displays ("positive contrast displays") may have an average screen luminance of 5 to 10 cd/m^2 in the dark; bright background displays ("negative contrast displays") may have a comparable luminance of 100 cd/m^2 or more.

Glass or an untreated VDT screen will reflect about 8 percent of the light incident on it. An object with a contrast of, say, 33 percent and a maximum luminance of 100 cd/m^2 will produce a much more visible reflection in a dark background display (of 10 cd/m^2, for example) than in a bright background display (of 100 cd/m^2). In both cases, 8 percent of the light from the object is reflected from the screen. The (maximum) luminance of the reflection (8 cd/m^2) is close to the luminance of the dark background display and will be clearly seen. For the bright background display, however, this is a small amount of light relative to its self-generated light. Indeed, for the bright background display, the contrast of the *reflected* image described above would be 1.9 percent – below the more conservative contrast threshold criterion of 2 percent. Such a reflected image can be considered invisible.

Bright background displays work rather well in reducing many distracting reflections from the VDT environment, but, because the upper limit of luminance from this type of display is approximately 100 cd/m^2, they will not be effective for very bright, high contrast objects. Untreated windows and many forms of electric lighting will still produce reflections well above the more liberal contrast threshold criterion of 5 percent.

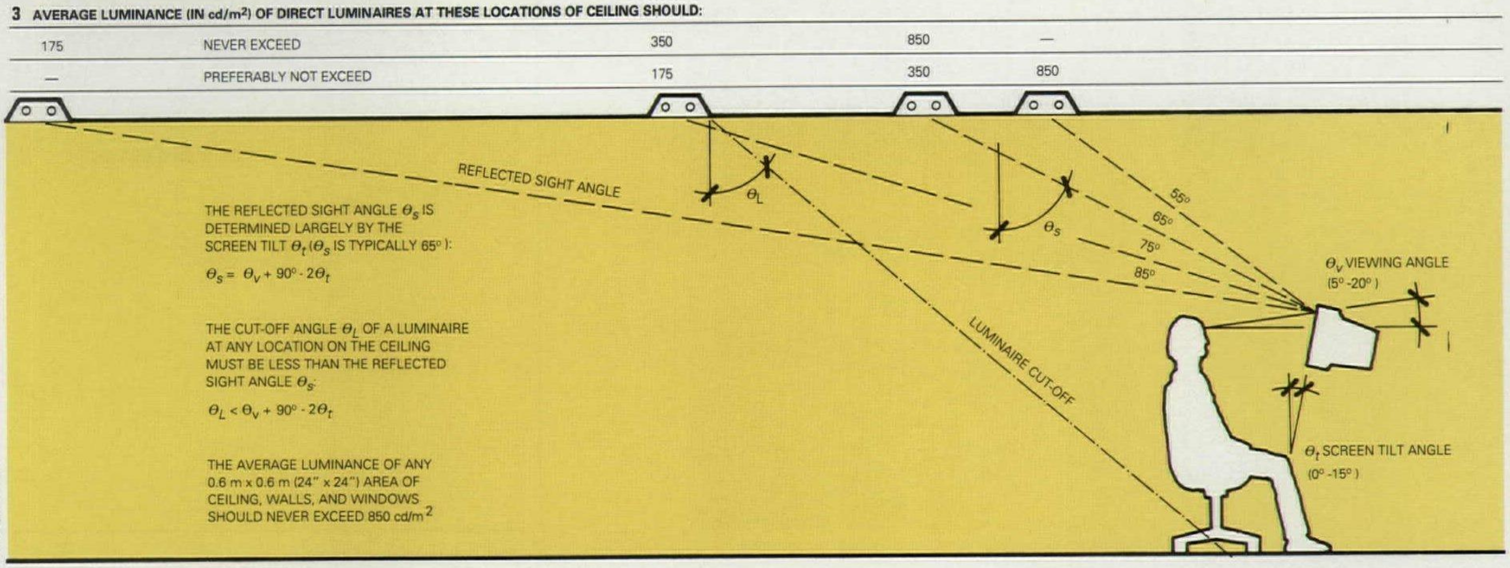
Direct Lighting Luminaires

The Illuminating Engineering Society of North America (IES), in its *Recommended Practice for Lighting Offices Containing Computer Visual Display Terminals* (IES RP-24–1989), states that the average luminance produced by direct lighting luminaires (3) should never exceed the following values (angles are expressed in degrees from vertical, that is, walls are 0° and horizontal ceilings are 90°):

- 850 cd/m^2 at 65°
- 350 cd/m^2 at 75°
- 175 cd/m^2 at 85°

These recommendations cannot be properly evaluated, however, without also considering the contrast of these fixtures against the ceiling. If, for example, the ceiling luminance was 350 cd/m^2, then the fixture would be invisible in any screen at 75° because it has no contrast with the ceiling. At 85°, it would have a contrast against the ceiling of 33 percent. However, the contrast of the reflection on a bright background display of 100 cd/m^2 would be only 5.8 percent – close to the more liberal contrast threshold criterion of 5 percent and probably acceptable to the VDT operator. At 65°, however, the contrast of the reflected image would be 13.5 percent, certainly visible and perhaps unacceptable to the VDT operator.[3]

Clearly, darker ceilings or VDTs with dark background displays would result in higher contrast images and would make the IES recommendations unacceptable. To be meaningful, therefore, *designers must specify both the absolute luminance of the luminaire and the luminance of the ceiling,* thus providing information on contrast.



Drawing: K. Labs

3 *To control reflections of luminaires in VDT screens, IES recommends that direct luminaires in the reflected visual field behind the VDT operator have cut-off angles no greater than 65°. The preferred maximum average luminance at 65° is 350 cd/m², and under no circumstances should the luminance exceed 850 cd/m². While useful as rules-of-thumb, these guidelines cannot prevent visible reflections under all circumstances.*

Indirect Lighting Luminaires

Indirect luminaires emit all light toward the ceiling. Interestingly, the *IES Recommended Practice* recommends contrast values for ceiling luminance produced by indirect luminaires. They suggest that the ratio of the ceiling luminance directly above the luminaire (normally the brightest area) to the ceiling illuminance between luminaires should never exceed 10:1 and, preferably, this luminance ratio should be limited to 4:1. They go further to state, as they do for direct luminaires, that the maximum luminance on the ceiling should not exceed 850 cd/m² for any 0.6 m x 0.6 m (24″×24″) area. Using the contrast equation presented in the sidebar, the 850 cd/m² maximum luminance, the preferred luminance ratio of 4:1, and assuming an 8 percent reflection from the screen, the contrast of the luminous ceiling reflected in a bright-background VDT display of 100 cd/m² will be 18 percent – well in excess of the contrast threshold criteria of 2 and 5 percent. Obviously, these recommendations will allow still more distinct reflections in a dark-background VDT display.

It should also be noted that the bottom of the indirect luminaire is relatively dark and the contrast of its image against the bright ceiling will remain high, perhaps 80 percent. Although the IES recommendations for indirect luminaires properly include specifications of both contrast and absolute luminance, they are, by the contrast threshold criteria presented here, inadequate for ensuring the elimination of reflected images in the VDT screen.

Direct-Indirect Lighting Luminaires

Direct-indirect luminaires provide light downward and upward. The IES makes the same recommendations for direct-indirect luminaires as for indirect luminaires, but adds that the luminance of the downward component should not exceed 850 cd/m². We have already seen that this value and the 4:1 ratio for ceiling luminance can exceed the contrast threshold criterion. However, one advantage of the direct-indirect luminaire is that the contrast between the ceiling and the underside of the luminaire can be significantly reduced. When properly adjusted with respect to the distance from the ceiling, the luminance contrast between the images reflected in the VDT screen of the ceiling and luminaires can be very low, while the luminaires still maintain a high ambient level of illumination.

Prescriptive guidelines like those provided by the IES must be carefully considered. It is usually necessary to make suitable luminance measurements and some simple calculations to properly assess the suitability of a given installation. A variety of light measurement tools known as luminance photometers can be used to measure the general luminance of the electronically generated display and the reflectance of the screen. These devices work much like the light meter in a 35 mm camera, the difference being that the calibrated luminance photometer provides a numerical measurement of brightness suitable for calculating contrast and visual response.

It is also desirable to calculate screen brightness in the design phase. With luminance data supplied by the luminaire manufacturer and the methods outlined above, it is fairly easy to determine whether a particular luminaire will be suitable for any of a variety of VDT applications. The impact of window glazings and coverings can be approached in the same way, but the variability of sky conditions and ground reflectances complicates the analysis. With a luminance photometer and a mock-up, however, it is possible to determine typical luminance values for alternative window glazings and coverings, and wall finishes.

Edges in the Visual Field

Why eliminate or reduce the distinctness of edges of illuminated areas or objects in the visual field? Up to this point, we have considered only the absolute luminance and contrast of the reflection without regard to the *spatial distribution* of this light. As will be shown below, our perception of contrast and brightness depends not simply on

2 These two values of adaptation levels come from an assumed reflectance value of 0.8 and assumed illuminance levels of 200 and 1000 lux. A unit of 1 cd/m² is sometimes called a *nit*; it equals 0.2919 footlamberts, a term that has fallen out of favor.

3 Glass reflects about 8 percent (0.08) of the light falling on it. In the case of a reflected sight angle of 85°, the allowable luminance of the luminaire is 175 cd/m². If the ceiling luminance is 350 cd/m², then the luminance of their reflected images is 0.08 × 350 and 0.08 × 175, so L_{max} = 28 and L_{min} = 14 cd/m². For a VDT with a bright background luminance V of 100 cd/m², the contrast C on the screen is:

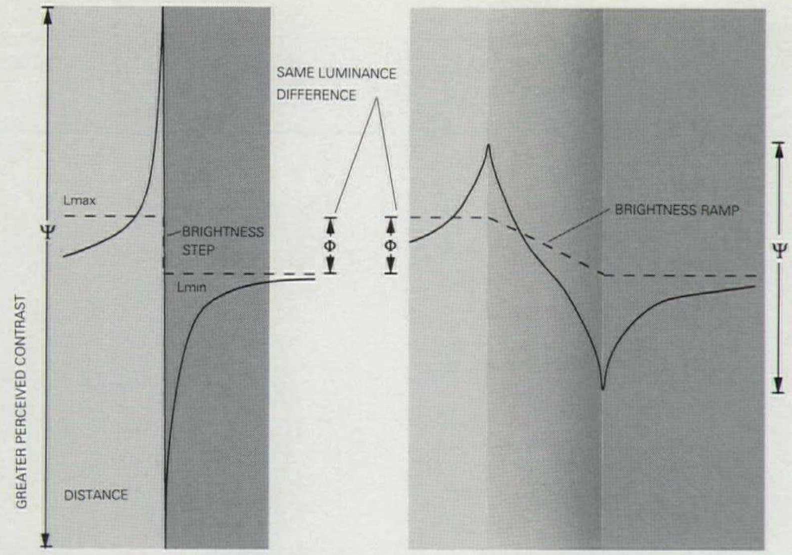
$$C = 100(28 - 14)/[28 + 14 + (2 \times 100)]$$

$$C = 5.78 \text{ percent.}$$

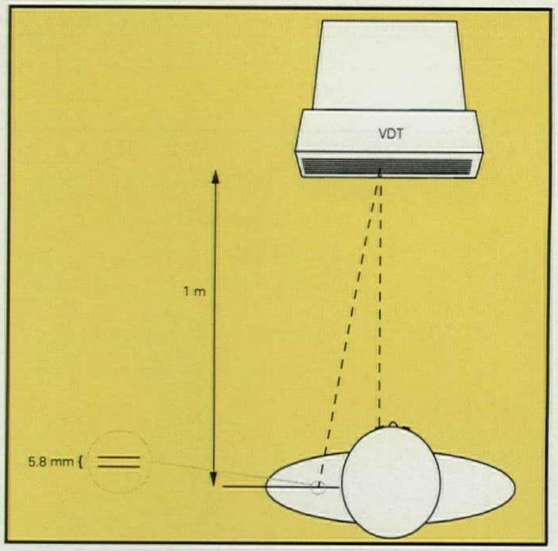
At a reflected sight angle of 65°, the allowable luminance of the luminaire is 850 cd/m² (greater than than of the ceiling). Its reflected image L_{max} = 0.08 × 850 = 68. The ceiling remains the same at 0.08 × 350 = 28, but it now becomes L_{min}. For the same VDT display as above, V remains at 100 cd/m², and the contrast on the screen is:

$$C = 100(68 - 28)/[68 + 28 + (2 \times 100)]$$

$$C = 13.51 \text{ percent}$$



4 EFFECT OF EDGE ON LUMINANCE (Φ) VERSUS PERCEIVED CONTRAST (Ψ).



5 TEST FOR "BLINDNESS" TO REFLECTED IMAGES

4 *In this illustration, the dashed lines represent the magnitude and spatial distribution of light at two types of edges. A rapid transition of light is shown on the left (a) and a more gradual transition is shown on the right (b). The two edges show a common luminance difference Φ, and thus have the same physical contrast. The perceived contrast Ψ between the two edges is not the same, however, because of the dimensional difference ("sharpness" of the edge) between the contrasting bodies. The faster the rate of change in luminance at the edge, the greater its perceived, or subjective contrast. Both blurring an image and physically "ramping" the luminance variation at the edge (as in the illustration on the right) will make an object appear to have less contrast.*

5 *Normal visual acuity is considered to be 20/20, which means, in effect, that a person with normal acuity can resolve a high contrast image (black target on a white background) one minute of arc wide. A pencil at a distance of 20 m is about one minute of arc wide. A person is considered legally blind if his or her acuity is less than 20/200. Although people with 20/200 acuity still see large objects, they cannot see small ones, because the retinal image is blurred and, as a result, contrast is lost. A person with 20/200 acuity can just resolve a high contrast object subtending ten minutes of arc – for example, a pencil at 2 m. If we take the definition of legally blind as a criterion for defining the quality – or lack of quality – of the reflected image, a*

(continued on next page)

physical luminance, but also on how that luminance is distributed across the retina in the eye.

Our visual system is designed to respond efficiently to edges of images focused on the retina. Edges are so important to the visual system that an architect can effectively represent the appearance of a building façade from a simple line drawing. Conversely, a defocused image – which has reduced the contrast and sharpness of the lines and edges – is very difficult to see; defocused images may cause an uneasy feeling that deters viewers from looking at them. Edges are so important to the visual system that it will, in fact, enhance their perceived or subjective contrast (4).

It is usually impossible to reduce the perceived contrast of the reflected image in a VDT screen through lighting alone. Indirect and direct-indirect lighting will help to some extent because the light pattern on the ceiling changes luminance gradually, as opposed to the abrupt change from bright to dark characteristic of direct lighting. Attention must be given primarily to the optical fidelity of the VDT screen when approaching this problem. Matte-surface screens that diffuse reflected light should be specified by owners and facility managers when purchasing hardware; although beyond the control of designers, they can, nevertheless, educate clients about these issues as they relate to lighting. Importantly, where the contrast of the reflected image is higher than the threshold contrast criteria offered above (which will often be the case), a matte-surface screen will reduce the subjective contrast of the reflected image, often making the reflection of such low quality that it will be unnoticed by the VDT operator. Although somewhat crude and unconventional, the quality of the image reflected in the VDT screen can be assessed with a pair of lines drawn on a white index card (5).

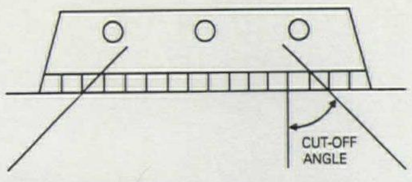
Design Solutions: Reducing Brightness

Knowing the essence of the underlying reasons behind the two strategies offered here – reducing brightness and subjective contrast ("sharpness of focus") – it is now possible to examine some practical solutions to the problem of multiple images in the VDT display. Lighting techniques and treatments to the VDT screen are complementary approaches. The first step is to reduce the absolute brightness of the reflected image; this will also tend to reduce the contrast of the image reflected in the screen. Reflections of ceiling luminaires and windows are of primary concern. Design measures include:

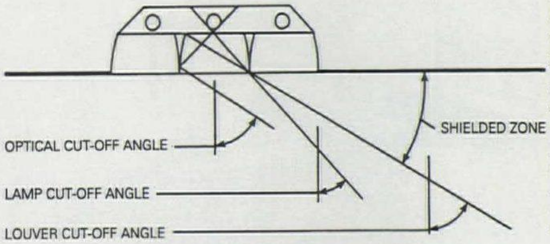
1 *Locate the VDT in a position that eliminates reflections from windows and luminaires.* This is difficult to achieve with curved screens, in that they provide a wide-angle view of the interior and reflections cannot be completely eliminated. Operators will see their own reflections if the VDT is placed in front of the window; brightly illuminated operators also create highly visible reflections (placing VDTs in front of windows also creates uncomfortable and visually debilitating glare for the operator). "Permanent solutions" are difficult to achieve because VDT workstations are frequently relocated. As a general rule, the design solution should not depend exclusively on an assumed VDT location.

2 *Turn the electric lights off or obscure light from windows that produces bright reflected images in the screen.* This is not a design solution, but it is probably the most common remedy chosen by operators where no consideration has been given to the VDT work environment. It should be noted that the employer often incurs the expense of new task lighting for work surfaces in these otherwise dark environments.

3 *Shield the screen from reflections using optical controls.* Perhaps the most common shielding approach is to provide sharp cut-off louvers for direct lighting ceiling luminaires. Both "egg-crate" (6) and parabolic louvers (7) are available from nearly every manufacturer of direct lighting luminaires. The luminance values of these louvers can range from near-zero upward, depending on the type and finish of the louver material as well as on the angle of view.



6 "EGG CRATE" LOUVER IN DIRECT LUMINAIRE



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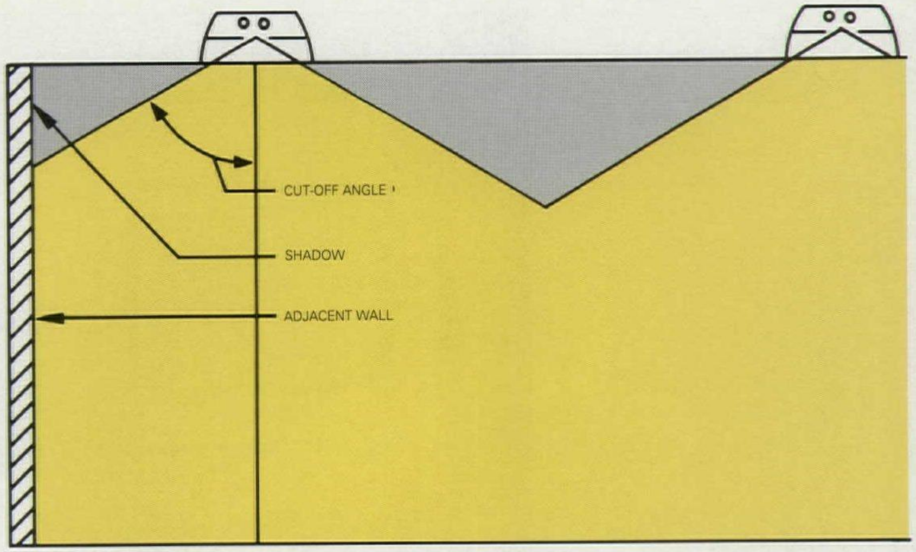
7 PARABOLIC LOUVER IN DIRECT LUMINAIRE



Illuminating Engineering Society of North America

8 SHADOWS FROM SHARP CUT-OFF LUMINAIRES.

Sharp-cut-off luminaires are not a panacea, however. Strongly directional down lighting will create very dark areas along the ceiling-wall juncture (8). They will also create high contrast images in VDT screens by producing strong shadows under shelves and bright horizontal surfaces. VDT screen treatments and supplemental lighting (wall washing and task lighting) may be required to overcome the objections of workers in the VDT environment.

Attachments to the VDT screen can also eliminate a direct view of the luminaires. Much like the black louvers sometimes placed on the rear window of "fast-back" sports cars, a screen mesh (9) will shade the screen from high angle illumination from ceiling luminaires, while providing a view of the display directly through the mesh. These meshes will not eliminate reflected light from windows because, like the VDT operator, the walls have a "direct view" of the screen though the mesh. Given the electric charge of the terminal, screen meshes also attract dust, which obviously will reduce the quality of the screen image and may, with poor handling, be compressed down so that direct viewing of the VDT display is obscured. Still, with proper maintenance, meshes can be effective in eliminating bright reflections from ceiling luminaires.

Circular polarizer attachments to VDT screens are a second approach to blocking reflections. In essence, the circular polarizer works like a key hole in a lock. Light passing through the circular polarizer is oriented in one direction, as a key has to be oriented to pass through a key hole. Reflection from the VDT screen causes the light to be reoriented and, in doing so, prevents the light from passing back through the circular polarizer "key hole" again. This technology has been used effectively for many years as treatments to radar screen installations.

Design Solution: Reducing Subjective Contrast

Reducing the prominence or frequency of sharp edges in the image will reduce subjective contrast. Attention must be given primarily to the VDT display, although lighting techniques can also be partially effective.

1 *Screens with matte finishes will diffuse the reflected light and physically reduce the brightness of the reflected image.* This approach tends to equalize the light reflected in any given direction. More important, perhaps, it reduces subjective contrast by eliminating well defined edges in reflected images. The matte finish does reduce the quality of electronically generated images to a small extent, but the visual advantages outweigh the disadvantages.

2 *Using a VDT with a bright background display will reduce the contrast of the reflected image* (9). A similar effect can be achieved by "washing" the surface of the VDT screen with light, but this is not recommended. This "solution" requires a task lamp and wastes electricity. Further, because there are limits to the brightness of the screen, too much illumination on the screen can reduce the contrast of the electronically generated image.

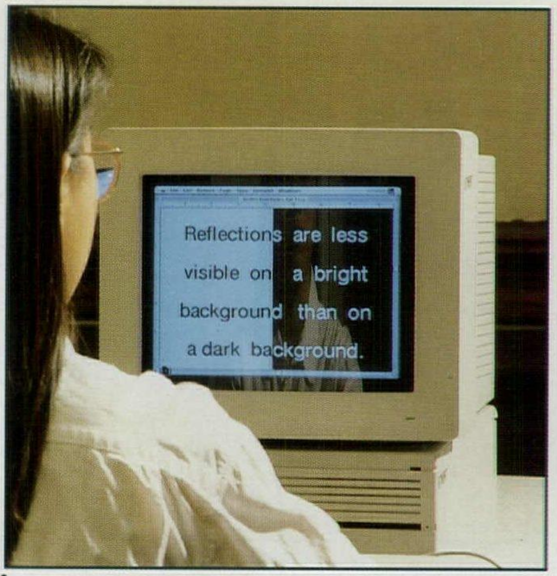
3 *Indirect or direct-indirect lighting can be effective.* Diffuse light created by indirect luminaires softens sharp shadows in the environment and thus reduces the subjective contrast of reflected images. The light reflected from the ceiling is typically of lower luminance than that produced by direct luminaires, and the distribution of the luminous pattern on the ceiling is less sharply defined. Nevertheless, the dark underside of a totally indirect luminaire can produce a high contrast, distinct, reflected image in the screen. Luminaires that combine direct and indirect optical control can often balance the brightness of the ceiling and the underside of the fixture, thereby reducing the contrast between bright and dark. Direct-indirect fixtures are ideal for producing a relatively high level of ambient brightness without producing a high contrast image of the fixture in the VDT screen. Obviously, the distance between the luminaire and the ceiling must be carefully considered, as should the material and finish of the optical control for the luminaire lens (10). Designers should know how to read and interpret photomet-

(continued from previous page)
person with 20/20 vision will be 'blind' to the reflected images produced by VDT screens meeting this criteria. Architects can use a simple test to determine if the VDT screen will render the VDT operator "legally blind" for the reflected image: On white cardboard, draw two black lines, the distance between them equal to the width of a pencil (approximately 5.8 mm). To perform the test, hold the card 1 m from the VDT screen and view the reflected image from the same distance (twice the optical distance). If the two black lines cannot be distinguished from each other, then the screen renders the operator legally blind for the reflected image. By this criterion, the screen would be acceptable.

6 *This example cross-section of a fluorescent direct lighting luminaire shows how an "egg-crate" louver blocks light leaving the luminaire at angles greater than the cut-off angle.*

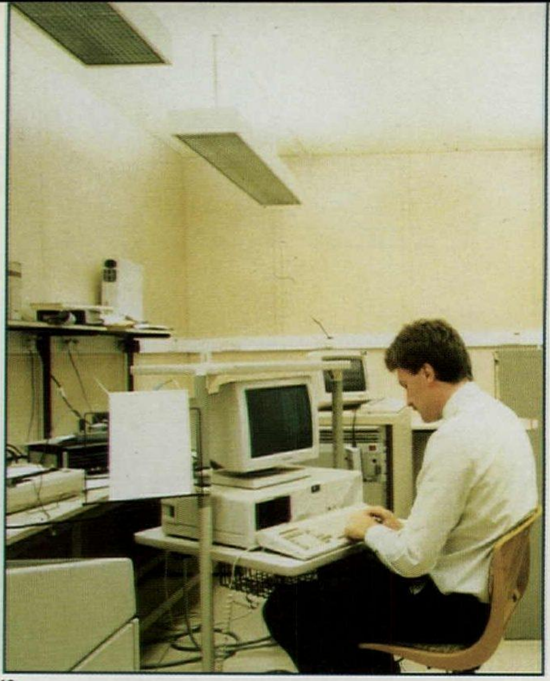
7 *The blades of a parabolic louver provide a physical cut-off in the same way as an "egg-crate" louver; however, a parabolic louver with a specular finish reflects all light from its curved blades at an angle equal to or less than the louver cut-off angle.*

8 *Luminaires with a sharp luminance cut-off are beneficial for work areas with VDTs, but may also produce shadows along the top of an adjacent wall.*



Eduard Hueber

9



10

9 *The luminance of the VDT display in part governs the contrast and perceptibility of reflected images in the screen (see 2). In this instance, the dark half of the screen clearly shows the reflected white blouse of the VDT operator, while the reflection (although present) is masked by the bright display.*

10 *Direct-indirect luminaires bounce light off the ceiling like indirect luminaires. They avoid a dark underside by emitting light downward. This reduces the difference in brightness between the luminaire and the rest of the ceiling in the reflected view on the VDT screen. The distance between the ceiling and the luminaire must be matched to the design of its optics.*

The author is the Director of the Lighting Research Center at the School of Architecture, Rensselaer Polytechnic Institute, Troy, New York. From 1978 to 1988, he worked at the National Research Council Canada, where he was manager ofthe Indoor Environment program. The Lighting Research Center was established in 1988 through a grant from the New York State Energy Research and Development Authority (NYSERDA). The mission of the Center is to change architecture by significantly improving lighting energy efficiency and lighting quality. The Center has an ongoing relationahip through its Partners Program with Niagara Mohawk Power Corporation, Northeast Utilities, PPG Industries, and the Genlyte Company, as well as NYSERDA.

ric reports for luminaires or seek assurances from the luminaire manufacturer that the criteria for brightness and contrast discussed here are met.

The architect should also consider splaying the inside edges of windows and skylights to reduce the sharp transition between the bright scene outdoors and the relatively dark interior wall.

Conclusions

Although there are several problems with the visibility of VDT displays, the main problem to solve is the occurrence of reflections on the screen. A basic understanding of the human visual system can guide architects and interior designers in the selection of VDT design alternatives. This knowledge empowers them to move away from prescriptive guidelines for VDT lighting and to provide more creative and effective design solutions. The following guidelines should minimize reflections in the VDT display, and at the same time provide adequate illumination for other tasks throughout the room.

VDT environments should normally be uniformly illuminated. Uniform lighting tends to reduce contrast and to lower absolute levels of luminance. Direct, indirect, and direct-indirect luminaires can all be used to achieve these results. The guiding principle in every case is to avoid very bright, high contrast, sharp-edge reflections in the screen.

- If sharp cut-off luminaires are used to reduce reflected images in the screen, the walls should also be illuminated.
- If indirect lighting is used, an adequate distance between the luminaire and the ceiling must be provided (these vary with design of the unit), and the luminaire should have a lightly colored finish on its underside.

VDT screens with a matte finish and bright-background displays will reduce the contrast of reflected images. Meshes and circular polarizer screen treatments can be used to block reflections from poorly designed electric lighting or skylights. Attention should also be given to VDT position, particularly with regard to windows. Reflected images from windows are a major problem to be solved in the VDT environment, and careful attention should be given to window treatments, again following the principle that very bright, sharp-edge reflections should be avoided. Splaying the interior edge of the window can reduce the subjective contrast of the image.

Finally, these general recommendations are only sensible in the abstract: Effective solutions depend on actual conditions. An understanding of fundamentals and the simple evaluation tools offered here enable the architect to go beyond a prescriptive approach to VDT visibility, and to begin to diagnose existing problems and to create better design solutions. **Mark S. Rea** ■

Recommended Reading

Guide on Interior Lighting, CIE 29.2, TLA Consultants (publications office of the U.S. National Committee of the Commission Internationale de L'Eclairage), Salem, Massachusetts (508) 745-6870, 1986, 114 pp.

IES Recommended Practice for Lighting Offices Containing Computer Visual Display Terminals, RP-24, Illuminating Engineering Society of North America, New York (212) 705-7916, 1990, 25 pp.

"Lighting the Display or Displaying the Lighting," P.R. Boyce, in *Work with Display '86,* B. Knave and P.G. Wideback, editors, Elsevier Science Publishers, New York (212) 589-5800, 1987, pp. 340–349.

Solving the Puzzle of VDT Viewing Problems, National Lighting Bureau, Washington, D.C. (202) 457-8437, 1987, 20 pp.

The NLB Guide to Office Lighting and Productivity, National Lighting Bureau, Washington, D.C. (202) 457-8437, 1988, 39 pp.

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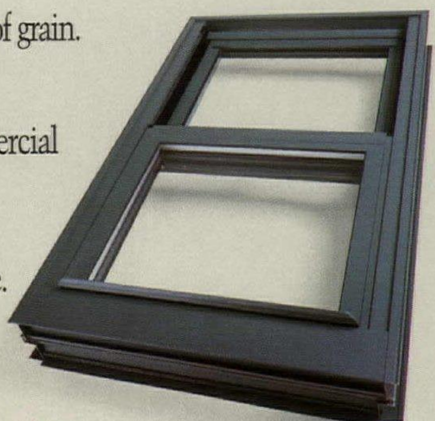

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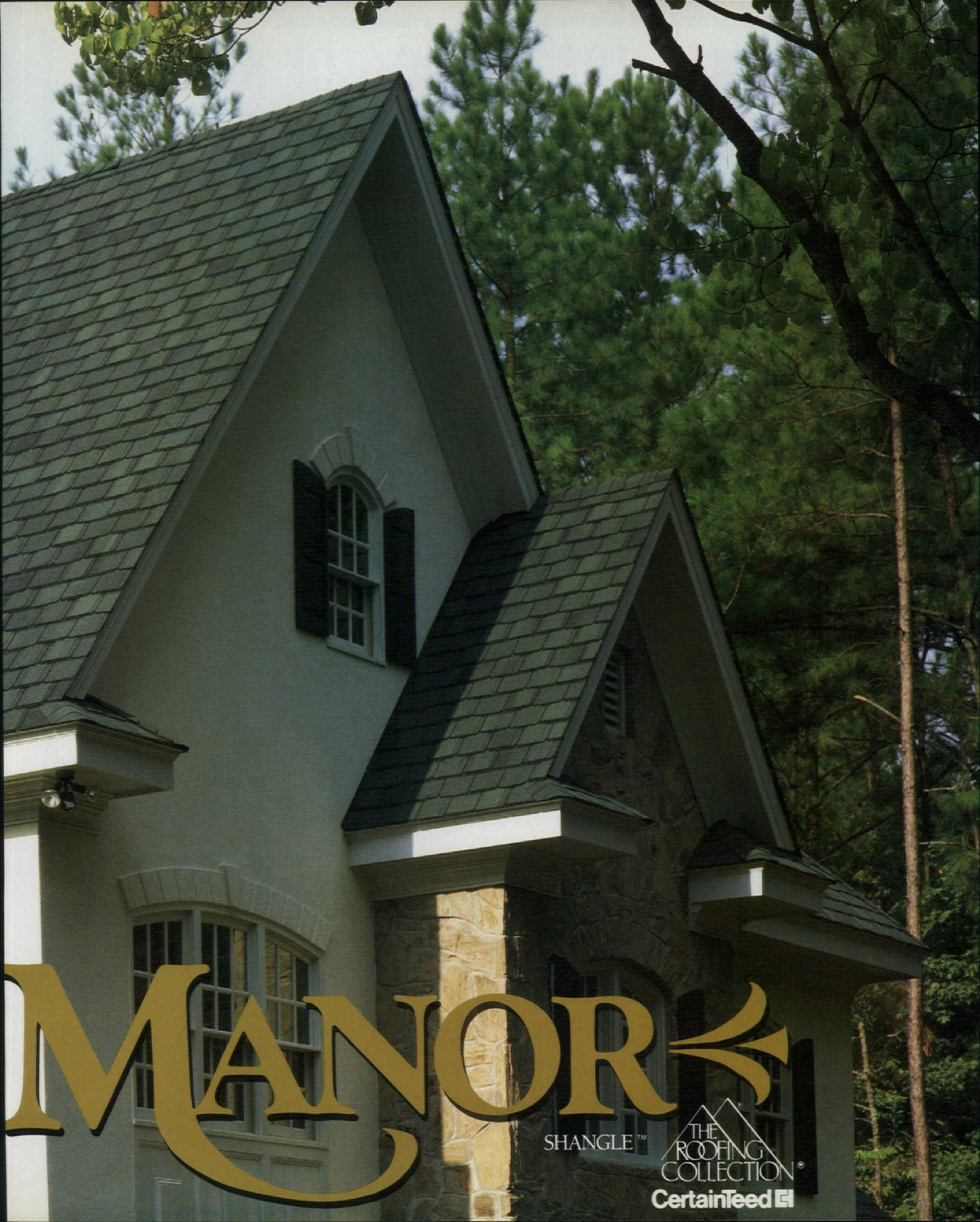
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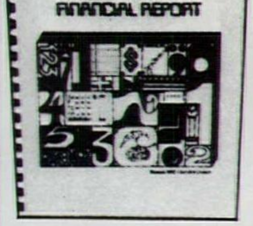

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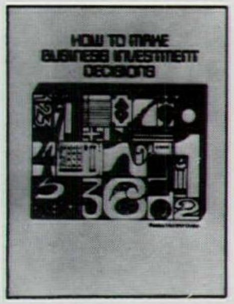

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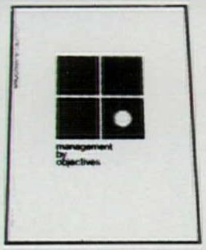

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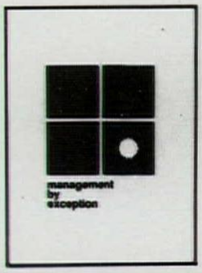

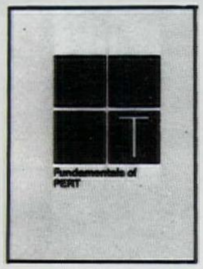

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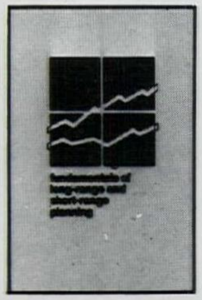

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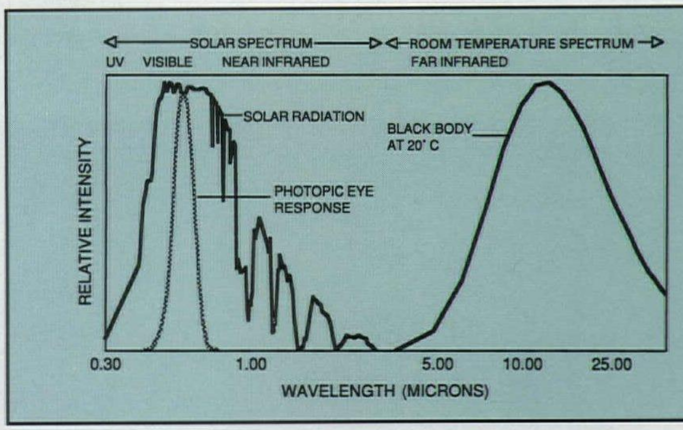
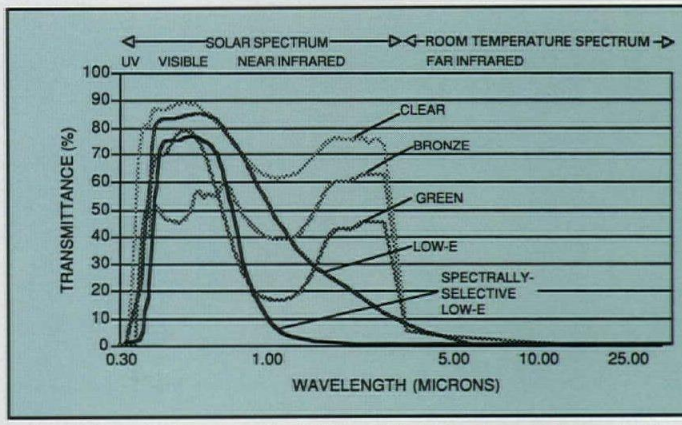
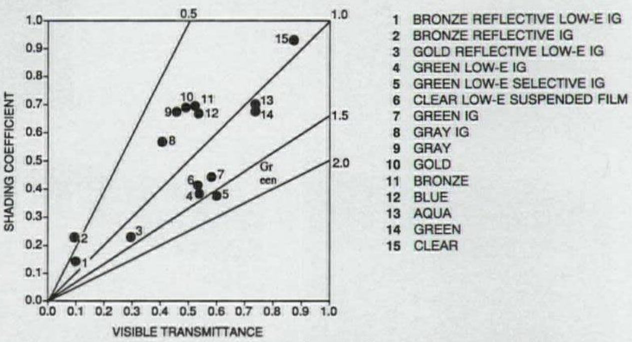
Building Science Brief 10/91
Coolness Performance of Glazings



1 *Less than half of the solar spectrum is visible to the human eye.*



2 *Spectral transmittance varies widely with glass color and low-e coatings.*



3 *Many glazings have K_e exceeding 1.0, but few exceed 1.5.*

The solar heating performance of glazings can be compared by a thermal performance factor (BSB 6/90) that relates U-values, shading coefficients, climate, and solar orientation to each other. Under cooling conditions, however, the daylighting-versus-heat gain trade-off exceeds other considerations, and it can be characterized by a numerical "coolness" performance score.

Coolness performance is becoming increasingly important as utility companies use it in energy-efficient design incentives programs. ASHRAE Standard 90.1 does not describe a coolness property of glazing as such, but it does, in effect, use the one defined below in trading off glazing properties for larger glazing areas.

The coolness performance index K_e is the ratio of the glazing's visible transmittance to its shading coefficient (both are published in glass catalogs),

$$K_e = T_{vis}/SC$$

where the transmittance T_{vis} spans the visible portion of the solar spectrum, between about 400 and 700 nm (1), and the shading coefficient *SC* is the ratio of solar heat gain through a glazing to the solar heat gain through 1/8″ clear glass under summer conditions. Researchers at Lawrence Berkeley Laboratory define K_e as the *luminous efficacy constant* because it is analogous to the luminous efficacy of electric light sources. As an indicator of light-to-heat ratio, glazings with high K_e values transmit "cooler" daylight than those with low K_e values – cooler, in that they convey less heat for the same amount of visible energy (but not necessarily "cooler" in terms of color temperature; see BSB 8/90).

Transmission of light without heat has always been desirable under cooling conditions, but in the past, low solar transmittance also meant low visible transmittance. Advances in low-e coating technology have recently made true spectral selectivity available (2). These coatings have high visible transmittance and the appearance of clear glass, but filter out much of the infrared spectrum.

Visible light accounts for about 45 percent of the energy of the solar spectrum. If a neutral glazing could be made that transmitted all – and only – visible energy, with no reflection or absorption by the material, it would have T_{vis} of 1.0 and a solar transmittance of about 0.45. Because the solar heat gain through 1/8″ clear glass is 0.86 of the incident solar energy, *SC* would be 0.45/0.86, or 0.52. The theoretical maximum value of K_e, therefore, is about 1.0/0.52, or 1.9. This exceeds that of any product currently made (3); no one knows how close to this limit glazings may ultimately reach. Southern California Edison's Design for Excellence program requires a minimum K_e of 1.0 for sidelighting and 0.7 for toplighting applications to qualify for incentives in new, non-residential construction.

In regions where the costs of lighting and cooling dominate the annual energy budget, a higher K_e tends to be better. In regions and for building types where heating costs dominate, the trade-off between reducing unwanted summer heat gain and usable winter solar gain must be considered more carefully. This can be done with many PC programs. While it is a compliance rather than a design tool, the software package ENVSTD21, included with ASHRAE Standard 90.1, helps explain the principles and the practical consequences of selecting the most appropriate glazing material for any non-residential project. **Kenneth Labs** ■

P/A thanks the staff of the Windows and Lighting Program of Lawrence Berkeley Laboratory, and Bradley Davids of Puget Energy Services, Bellevue, Washington, for their comments.

References

"Definition and Use of a Daylight Coolness Index," D. Arasteh, R. Johnson, and S. Selkowitz, *1986 International Daylighting Conference*, ASHRAE, Atlanta (404) 636-8400.

"Taking the Heat out of Sunlight," B.J. Davis, *1990 Summer Study on Energy Efficiency in Buildings* ACEEE, Washington, D.C. (202) 429-8873.

Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings, Standard 90.1, ASHRAE, Atlanta (404) 636-8400 (includes ENVSTD21 software).

Technics Topics
Distortion in Sealed Glazing Units

Researcher and consulting engineer **Armand Patenaude** introduces a solution to the problem of distorted images in glass façades.

During the days of single glazing, it was possible to design and build a reflective curtain wall or store front that behaved like a nearly perfect mirror. With the widespread demand for sealed insulating glazing units (IGUs), however, visual distortion of reflected images (1, 2) has become more than an annoyance to designers: Dissatisfied owners have sued and demanded corrective measures for glazings that failed to meet their visual expectations. This article offers a solution to the problem of visual distortion, and it suggests acceptable limits for distortion-causing deflection based on a laboratory study.

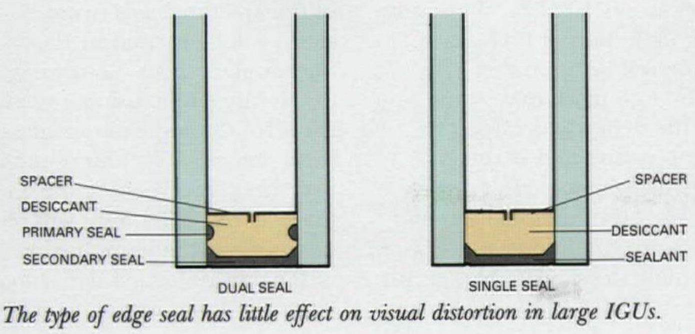
Nature of the Problem

Insulating glass units (IGUs) are made of two or more panes of glass separated by a spacer containing desiccant material (a molecular sieve) installed around the edge, and closed at the perimeter with a single or double seal (3).

Once assembled, sealed units are subject to differences in environmental pressure and temperature. A rise in barometric pressure and a drop in temperature will cause concavity, where the glass bends towards the middle of the gas-filled space between the panes, while a drop in barometric pressure and a rise in temperature will cause convexity, where the glass bows out from the middle of the gas-filled space (4).

The surface adherence (adsorption) or release of one or more of the gas filler components on the desiccant will produce the same effect. Because mean barometric pres-

1, 2 *Visual distortions are caused by changes in temperature and barometric pressure, which cause glass lights to bow in or out.*



3 *The type of edge seal has little effect on visual distortion in large IGUs.*

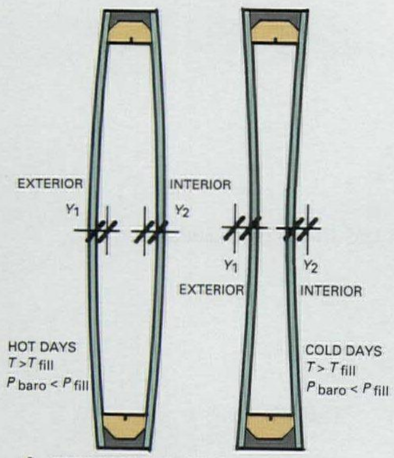
Tech Notes

The National Roofing Contractors Association has issued a one-page *Bulletin* 15–91, "Corrosion Protection for New Steel Roof Decks," that recommends decking be factory-galvanized (ASTM A 525, Class G-60 or G-90) or factory-coated with aluminum zinc alloy (ASTM A 792). The latter is said to provide better protection than a G-90 coating. NRCA, Rosemont, Illinois (708) 299-9070.

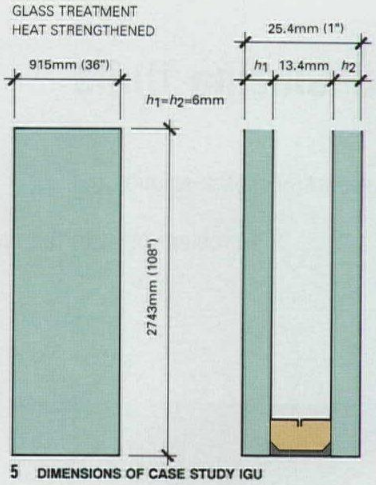
***Exterior Wall Systems,* STP 1034, contains 14 papers from two symposiums sponsored by ASTM Committee E-6. Subjects include design, drawings, performance tests, structural sealants, and a discussion by architect Herbert Beckhard on precast concrete systems he developed with Marcel Breuer. ASTM, Philadelphia (215) 299-5585, 234 pp., $49.**

***Quality Standards for the Professional Remodeler* includes skylights, decks, floors, ceilings, foundations, cabinets, and other construction in a guide to what NAHB and its trade association reviewers consider acceptable workmanship. NAHB, Washington, D.C. (800) 223-2265, 81 pp., $16.**

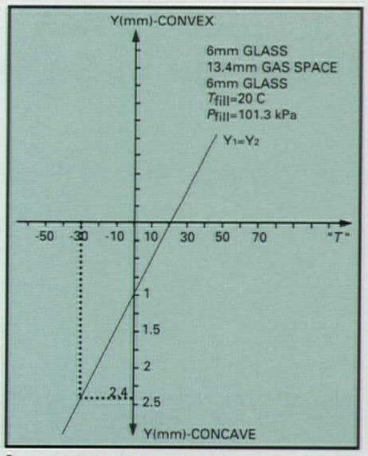
***Fiber Reinforced Concrete,* SP 039.01T, summarizes the state of the art in practice and performance. Chapters discuss what is known and research needs regarding polymeric, steel, glass, asbestos, carbon, and natural fiber reinforcements. Portland Cement Association, Skokie, Illinois (708) 966-9559, 48 pp., $22.50.**



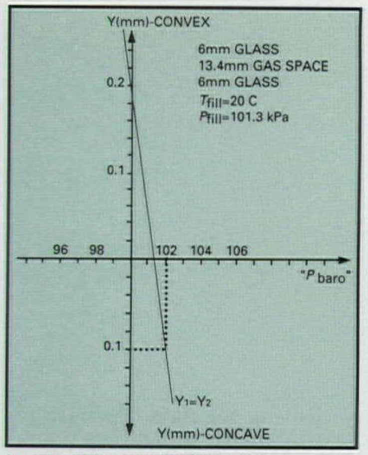
4 DEFLECTION OF Y_1 AND Y_2



5 DIMENSIONS OF CASE STUDY IGU



6 DEFLECTION AS A FUNCTION OF T



7 DEFLECTION AS A FUNCTION OF P_{baro}

sure changes with altitude, differences in elevation between the fabricating shop and the site can produce "built-in" distortions.

Even though the mechanical stress induced by pressure and temperature differentials in large IGUs is relatively small, warping glass panes will cause an unpleasant visual distortion of reflected objects or buildings. Such visual distortions are bothersome to the observer and detract from the aesthetic quality of a building. The distorted images are most apparent during daytime on the outside of curtain walls or large windows. The problem is much less obvious on the inside, because of the softer lighting, shorter viewing distances, and the fact that the glass is often hidden by curtains or blinds.

Control Parameters

As previously mentioned, once the assembly and sealing of insulating units are complete, the initially flat sheets of glass will eventually take on a concave or convex shape. The magnitude of the warp in each glass pane can be controlled within acceptable limits as long as the insulating glass design takes into consideration the following parameters:

- Glazing dimensions
- Thickness of each glass pane
- Thickness of gas space
- Difference between actual barometric pressure (P_{baro}) and gas space pressure at filling (P_{fill})
- Difference between actual temperature of gas space (T) and temperature of gas space at filling (T_{fill})
- The interface between glazing and frame members
- Adsorption or desorption of one or more components of the gas filler.

Case Study

Consider a typical IGU with dimensions of 36" × 108" (915 × 2743 mm), 1/4" (6 mm) thick lights, and a 1/2" (13.4 mm) wide gas space (5). The influence of temperature and pressure differentials on the center deflection of both glass sheets can be easily calculated* and graphed (6, 7). (Some glass manufacturers will perform such calculations as a service to designers.) The amplitude of deflection of both glass sheets will depend on their respective rigidity. Since the two glass panes are identical and have equal rigidity, the deflection on both sides will be identical and will be unaffected by the glass treatment.

In one particular case where the temperature of the gas-filled space could reach −22 F (−30 C) while the barometric pressure is 102 kPa, the resulting deflection of each glass pane will be approximately 1/10" (2.5 mm), that is, the sum of the deflections caused by temperature and barometric pressure combined.

For given temperature and pressure conditions, it is also possible to calculate and graph the influence of the gas space thickness (8) on the deflections of the glass panes. Notice that each pane's deflection increases with the thickness of the gas space. Therefore, by increasing nominal gas space thickness from 1/2" to 1" (13.4 to 25 mm), the resulting center deflection increases from 1/10" to almost 3/16" (2.5 to 4.6 mm).

Although most IGUs are fabricated with 1/2" spacers, the combined gas space of units containing suspended films is much greater. With respect to pressure distribution between the glass panes, such units behave as if the film were not there; the flexibility of the film allows the space it separates to pressure-equalize across it.

Improvement in the IGU Design

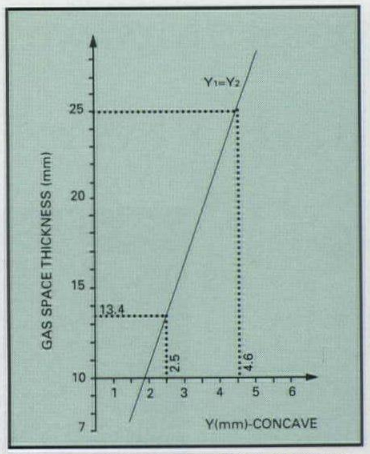
In a shop-sealed insulating unit, the deflection of each glass pane is inversely proportional to its rigidity, which in turn is proportional to the cube of the glass thickness. Consequently, visual distortion can be controlled by increasing the outside pane's thickness, while making the inside pane thinner. Such a modification will also increase the overall strength of the IGU, since most of the exterior loads (wind, snow) will be carried by the thicker glass sheet. Returning to the case study, using a nominal 5/16" (8 mm) exterior glass sheet and a 3/16" (4 mm) interior sheet, and keeping the air space at 1/2" (13.4 mm) will result in a substantial reduction of the outside pane's deflection (9, 10) and an increase in the inside pane's deflection. Although inside reflections are not normally as apparent (and therefore not as troublesome) as exterior reflections, increased deflection of the inside pane may not be acceptable under all circumstances.

For the same temperature and pressure used in the case study ($T = -22$ F and $P_{baro} = 102$ kPa), the outside pane deflection is 22 mils (0.56 mm) and the deflection of the inside pane is almost 3/16" (4.5 mm). The resulting distortion of outside reflections will be approximately five times less than in the standard unit. When compared to a standard unit, this modification will improve the acoustic performance of the unit (see P/A, Aug. 1991, pp. 115–120) and will not affect the thermal resistance.

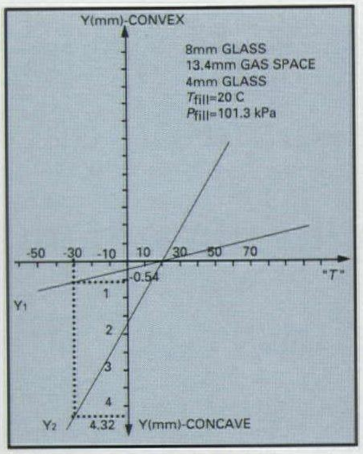
Acceptable Deflection Limits

To maintain the architectural lines of exterior glass walls, the designer should specify an acceptable limit for exterior glass pane deflection. Since this is a visual issue, the human eye is the best detection instrument. There is no accepted procedure or consensus about what is acceptable, and some people (both designers and clients) are more aware of or sensitive to distortions than others.

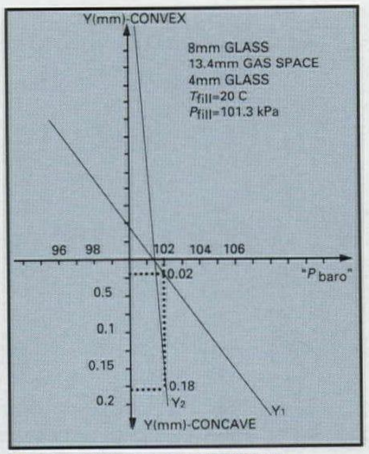
For a given sealed unit, the deflection of a glass sheet is limited by its smallest dimension. The straightness of a reflected straight line, therefore, can be expressed by the ratio of the deflection (Y) to the glass's



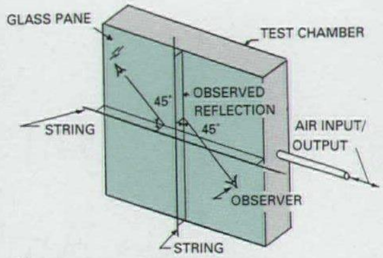
8 DEFLECTION AS A FUNCTION OF GAS SPACE



9 DEFLECTION AS A FUNCTION OF *T*



10 DEFLECTION AS A FUNCTION OF P_{baro}



11 DISTORTION VIEWING TEST SET-UP

smallest dimension (*L*). I suggest that the "*Y/L*" ratio defining the acceptable limits of deflection is on the order of 1/700 to 1/1000. (For small IGUs, the suggested values should be checked to ensure that stresses are kept low.) These figures were obtained from the subjective responses of five individuals, looking at an angle of 45° at a glass surface reflecting the image of two orthogonal strings. The glass was subjected to a uniform load under laboratory conditions (11).

Design Conditions

Because exterior distortions are most noticeable during daytime, the acceptable deflection limit should be established for the average design conditions to which the insulating unit will be subjected in summer and winter. Those design conditions will vary with the building's geographic location, orientation, and interior protection (blinds and shades, which affect the temperature of the gas space), and with the specifications of the sealed unit (thermal resistance, absorptivity, reflectivity, transmissivity, and the factors discussed above). The following weather data should be considered during daytime in summer (June and July) and winter (December and January):

- Average solar irradiation (orientation)
- Average outdoor air temperature
- Average wind speed
- Indoor air temperature
- Interior protection (blinds, shades, drapes, etc.)
- Average barometric pressure

With the exception of barometric pressure, all these factors affect the temperature of the IGU gas space. Weather data are readily available for most locations (in the *ASHRAE Fundamentals Handbook*, for example) and technical data on the glass can usually be obtained from the insulating glass unit manufacturers.

Conclusions

Current standards (CAN12.20-M89 and ASTM E1300–89) allow the designer or the manufacturer to determine the glass thickness required to resist loads from wind and snow. However, to ensure and maintain the acceptability of the exterior appearance of reflective curtain walls or any large glazed area, it is also important to limit the deflection "*Y*" of the glass to an acceptable value for normal use conditions. Our work suggests that the deflection should not exceed *L*/1000.

Deflections and distortions can be reduced by increasing the rigidity of the exterior glass pane relative to the inside pane. This approach also allows an improvement of the acoustical performance of insulating units and, because of the wind-load-sharing, a possible reduction in the total glass thickness required. Specifying an acceptable limit to exterior glass deflection in new designs can benefit all parties involved, allowing architectural features to be viewed as originally intended. **Armand Patenaude, PE** ■

The author is president of Patenaude-Trow Inc., Consulting Engineers, Montreal, and is vice president of Trow Inc. (Eastern Canada). He specializes in solving problems related to the building envelope, in particular to those related to windows and curtain walls. He is an active member of several standards-writing committees.

Related Reading

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Structural design of glass for buildings, CAN/CGSB-12.20-M89, Canadian General Standards Board, Hull, Quebec (819) 956-0425, 1989, 92 pp.

Standard Practice for Determining the Minimum Thickness of Annealed Glass Required to Resist a Specified Load, E 1300–89, ASTM, Philadelphia (215) 299-5585, 11 pp.

"Weather Data." Chapter 24, ASHRAE *Handbook*, 1989 Fundamentals volume, ASHRAE, Atlanta (404) 636-8400.

* These calculations are based on the fact that the mass of gas contained within IGUs is constant and that a change in barometric pressure surrounding the IGUs will cause the glass sheets to deflect until a new equilibrium state of both sheets is reached. The calculations disregard the influence of the glass-to-spacer interface and adsorption of gas filler by the desiccant.

4 *Deflections caused by temperature and barometric pressure changes are identical in IGUs with identical lights.*

5 *The following case studies all assume these dimensions.*

6, 7 *If the IGU is sealed at 20 C, a gas space temperature of −30 C produces a (concave) deflection of 2.4 mm. If sealed at a barometric pressure of 101.3 kPa, an increase to 102 kPa produces a (concave) deflection of 0.1 mm. These deflections are additive, for a total of 2.5 mm.*

8 *Increasing the gas space thickness from a standard 13.4 mm to 25 mm increases the deflection of each light under the foregoing conditions from 2.5 mm to 4.6 mm.*

9, 10 *"Unbalancing" the IGU by using thicker glass on the outside and thinner glass on the inside reduces exterior deflection (Y_1) and increases interior deflection (Y_2). The thicker exterior glass deflects only 0.54 mm at −30 C, and 0.02 mm at 102 kPa, while the interior glass deflects 4.32 mm and 0.18 mm under these same conditions.*

11 *Laboratory viewing assembly.*

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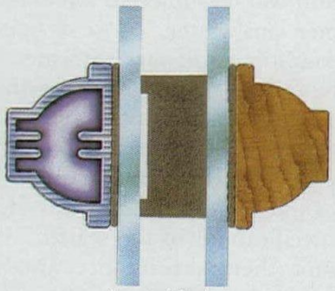

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Practice

C. Jaye Berger discusses some of the ground rules of arbitration.

Law: Arbitrating Fee Collection

Arbitration can be an excellent way for architects to collect unpaid fees from a client. It can resolve disputes much faster than a court case and is therefore much less expensive. However, there are certain pitfalls that design professionals should be aware of.

They begin with a Demand for Arbitration, which is filed with the American Arbitration Association, a non-profit organization that administers arbitration proceedings. Of course, the parties in a dispute can also handle these matters privately by selecting a mutually agreeable arbitrator and detailing in their contract how the hearing will proceed.

It is important to remember that arbitration must be the agreed-upon method of dispute resolution in your signed contract with your client. This provision is contained in the American Institute of Architects contract forms, but if you use a customized contract, be sure you have such a clause. If no arbitration provision is included in the contract, then it is very likely that your adversary will not agree to arbitrate when a dispute arises. I have seen only two cases where an arbitration clause was omitted from a contract and the parties voluntarily agreed to arbitrate after a dispute arose.

The American Arbitration Association requires that each side select an arbitrator from a list of attorneys, contractors, architects, interior designers, and property managers, all of whom work in construction-related firms. Usually there is only one arbitrator in a dispute, although for large cases, there may be as many as three. Mutually agreeable hearing dates are also selected. An architect is not required to be represented by an attorney, but having one is recommended so that your case is well-presented.

When the design professional initiates such an action, it is not covered by errors and omissions insurance. However, if your adversary files a counter claim alleging negligence in the design, the defense of that counter claim may be covered by your insurance carrier. In such a case, you could wind up having two sets of attorneys, although, if your attorney specializes in construction law, some insurance companies will allow that person to handle the entire claim.

Arbitration can be completed in a matter of months, depending on the number of hearings required and everyone's schedule. The process usually takes less time than litigation because there is not an extensive discovery period with depositions and interrogations.

Some criticize arbitration because they feel that arbitrators tend to render split decisions, but I do not find this to be the case. Also, in a worst case scenario, receiving half of what you are suing for in six months is better than receiving half after three years of litigation. Arbitration decisions are binding and can be appealed only in rare instances.

Hearings are held in conference room surroundings and tend to be conducted much like court cases, but not necessarily. The rules of evidence do not apply and the atmosphere can be more relaxed. The scope of examination is up to the arbitrator. Despite that, however, arbitration can have consequences just as grave as a court case. I have heard of instances in which parties ignored arbitration demands, thinking they were not binding; it is a very serious error, since arbitration is virtually non-appealable.

Arbitrators issue written awards that are sent by mail. If payment is required, the affected party usually has 30 days. If this deadline is not met, the award can be turned into a judgment and collected.

The advantage of arbitration is that it brings parties to the table, and they often reach settlements before the hearings begin. In one case where I was the arbitrator, the parties had to wait in my reception area while I finished a telephone call. By the time the call was over, the case had been settled.

Arbitration can be an excellent tool for collecting unpaid fees, and architects and engineers should seek legal counsel on how this procedure can help them.

C. Jaye Berger ■

The author is an attorney in New York who specializes in building, construction, real estate, and environmental law. She is currently writing a book about hazardous substances in buildings.

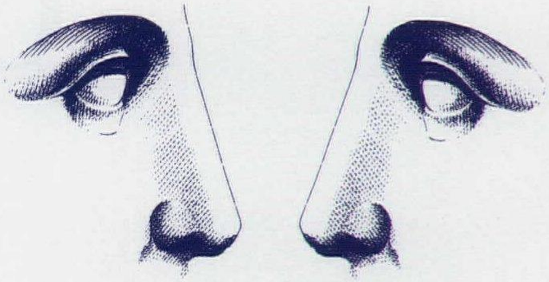
Practice Points

The strongest segment of the construction market currently is for institutional clients. *Building Design & Construction* reports that while commercial construction declined by 5.9 percent last year, institutional spending was up by 12.4 percent. The trend is particularly strong in new prison construction where a recent survey found that the states plan to spend a total of $6.8 billion on new prisons in the next two years, and the federal government has budgeted $458 million for prison construction in 1992.

A new Master Outline Specifications library is now available from the AIA Master Systems Division. The library, available in both a three-ring binder and on floppy diskette for either DOS or Macintosh systems, includes nearly 200 sections and conforms to the CSI manual of practice recommendations. The cost is $149; call (800) 424-5080 x7446 or (202) 626-7446 for details.

The University of Cincinnati's Center for the Study of the Practice of Architecture is making a series of working papers, entitled "Practices," available at a nominal fee. The papers,which will eventually be available as a periodical, were solicited from around the world. They explore intellectual, ethical, and business issues in architectural practice. Upcoming subjects include a directory of registered black architects, a comparison of French and U.S. practices, and analyses of projects by well-known architects.. Call (513) 556-3415 for information.

Nina F. Hartung analyzes the efforts of a firm to make client service its top priority.



Management: The Quality of Service

How many practitioners focus their firm's attention on the client's experience? One firm, Reese Lower Patrick & Scott, recently did just that, making client service a top management priority.

Background

Reese Lower Patrick & Scott is a 50-person architectural firm based in Lancaster, Pennsylvania, serving the institutional market. Annually, the firm has a two-day management retreat attended by the partners, associates, and other key staff and focusing on professional issues confronting the practice. Last year's retreat, for instance, dealt with project process and resulted in a move from a departmental structure to a project team structure. This year's retreat topic was Quality Service. The topic was chosen not because of problems in the practice, but rather because of successes. The firm had won several major commissions and was looking forward to a very busy 1991; the concern was how to maintain the level of service on which the firm had built its reputation while handling the anticipated heavy workload. The partners wanted to find ways to extend accountability for clients' satisfaction beyond the partnership, to make Quality Service part of the firm's culture.

Process

In preparation for the retreat, the consultant conducted two surveys concerning Reese Lower Patrick & Scott's performance on projects: The first was a telephone survey of clients and former clients, representing a cross section of building types and sizes; the second was a written, internal employee survey. The purpose of the surveys was to offer an opportunity for a candid review of the firm's performance on projects and to solicit recommendations for improving the quality of service provided. The internal survey also set the stage for a heightened awareness of quality service among the staff, especially those who would not be attending the retreat. The survey results were tabulated by the consultant and became the kickoff discussion for the retreat, the report card for the last few years. The content of the retreat became a healthy discussion about what worked, and why, on projects and what actions the firm could take to assure quality service in its clients' eyes.

Survey Results

Reese Lower Patrick & Scott had the good fortune of receiving very high marks from its staff and clients – evidence of their longsanding commitment to quality service. The firm has demonstrated a sincere interest in its projects and was perceived as caring and responsive. Despite the overall excellent evaluations, however, clients and staff did have recommendations for improved service, the majority of which fell into three categories.

1. *Communication.* Many of the concerns expressed by respondents were based on misunderstanding or miscommunication about what was going to happen on a project. Clients highlighted in particular the point that they are novices to the profession and that their perception of the architect's responsibility on a project does not always match the reality of the contract. Clients repeatedly cited direct, regular contact as important to their sense of being served by the architect. In fact, communication was cited twice as often as any other single element in the clients' definitions of quality service.

2. *Project Process.* In the course of the survey, the firm learned that the recent transition from a departmental structure to a team project structure had resulted in confusion, internally and externally. The firm understood the blips within the organization caused by the transition but were surprised to recognize the transition's impact on clients. Clients cited their desire for error-free drawings, faster turnaround, lower budgets, etc.

3. *Organization.* The survey also pointed to miscellaneous organizational issues that clients and/or staff felt would improve service. For instance one client suggested a "breakdown on the invoice so that it would be more understandable." Another client suggested the firm provide "staff training... to make architects more knowledgeable about our needs."

Action Plan

As a result of the retreat a series of steps was developed to help the firm sustain a high level of performance and quality in the eyes of the client. The list was extensive but highlighted here are some of the key decisions.

A committee was appointed to develop a Client Expectations Checklist that the Partners would review in detail with new clients. The purpose of the checklist would be to foster an understanding of the architect's role in the project versus the roles of the contractor, the consultants, and the owner. The checklist would also serve as the vehicle for documenting procedures, outlining possible project obstacles, etc. The goal was to eliminate the unknown for the client.

A new role, called Administrative Manager, was created to act as an internal and external liaison with the partners, and as an expediter of client communication with the top of the firm.

A committee of four was appointed to establish project standards and a project phase checklist to assure consistency on projects. The partners also agreed to plan regular project team meetings to facilitate communication among team members.

The firm instituted the "You Can Count On Me Award," a special monthly recognition of that employee who demonstrates client service above and beyond the call of duty. The award includes one day's vacation, $50, and where appropriate, lunch with the client.

Summary

The surveys and retreat reinforced for these architects that clients' satisfaction requires meeting or exceeding their expectations. Regardless of the technical excellence demonstrated on a project by architects, the clients' perception centered on their personal experience with the project and the architect assigned to them. Architects are as much in the business of managing a client's experience with respect to service as they are in the business of designing and building a structure. **Nina Hartung** ■

The author is with The Coxe Group, a consulting organization specializing in the management of architecture and other professional design firms.

h us since the beginning.

Today, 15 years later, with a staff of 45, our firm and its needs have changed and the relationship has changed. In the early years our primary focus was getting work in, making ends meet. We were required by our clients to have insurance and had to struggle to find a million dollars in coverage. Carolyn did a great job of finding alternative proposals for a small firm—she brought us the best of a terrible situation in terms of cost.

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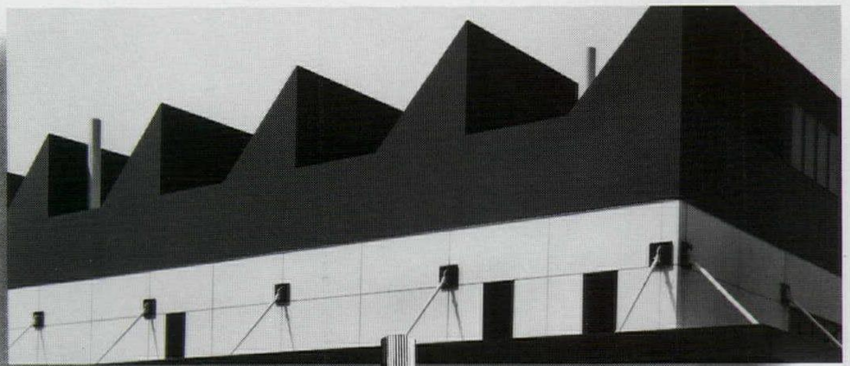

Winner: Commercial Category
South Coast Air Quality Management
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Diamond Bar, CA
Owner: South Coast Air Quality
Management District
Architect: Meyer & Allen Assoc.
Engineer: Hayakawa Assoc.
Engineer: Johnson & Nielsen
Consultant: Wheeler & Gray
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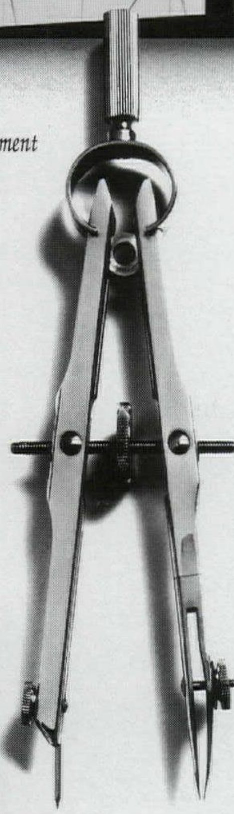

Winner: Industrial Category
Lark Industrial Park
Lancaster, CA
Owner: Richard Kravitz
Architect: Scott Ellinwood & Assoc.
Engineer: John D. Oeltman
Engineer: Cushman & Assoc.
Consultant: Robert Bein, William Frost & Assoc.
Consultant: Pacific Coast Land Design

Winner: Institutional Category
Emilie Ritchen Elementary School*
Oxnard, CA
Owner: Oxnard School District
Architect: BFGC Architects Planners, Inc.
Engineer: Charles Mistretta & Assoc.
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Consultant: Santa Barbara Electrical
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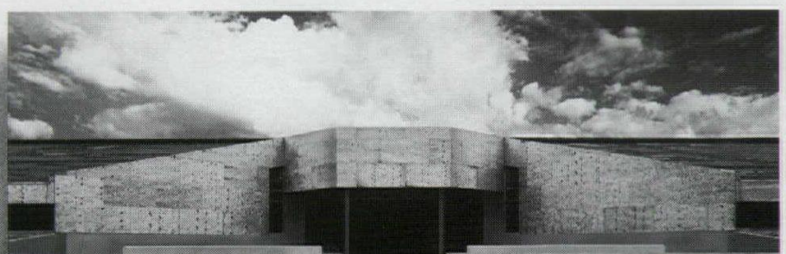
Consultant: TECH 5 Corporation
*Scheduled for completion December 1991.



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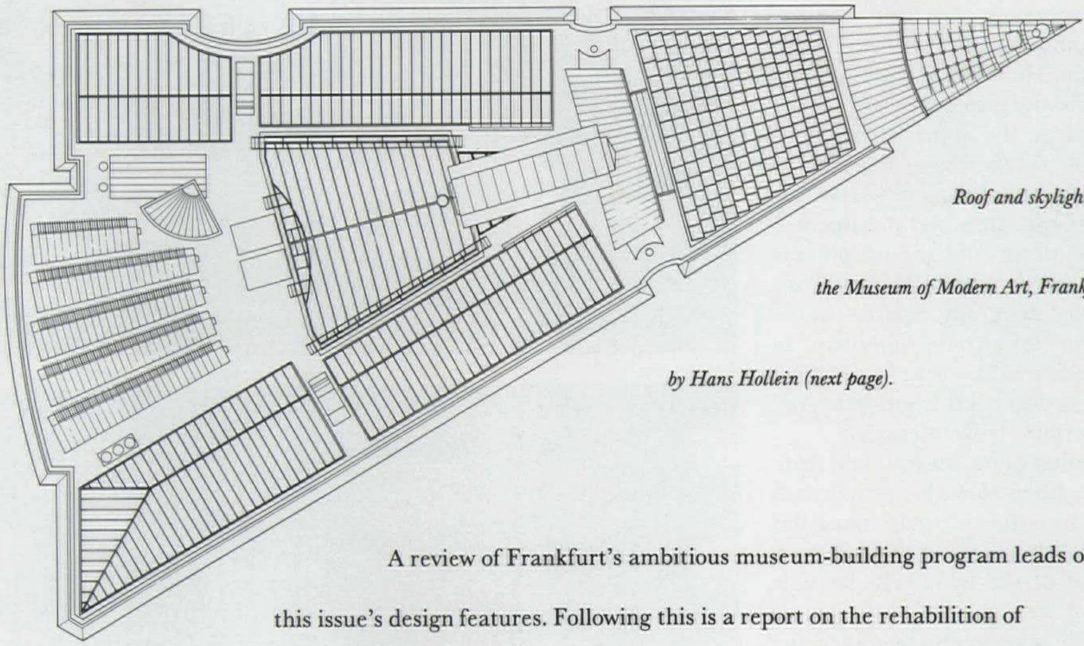


Roof and skylight plan of the Museum of Modern Art, Frankfurt, by Hans Hollein (next page).

A review of Frankfurt's ambitious museum-building program leads off this issue's design features. Following this is a report on the rehabilition of California's landmark Mission Inn and an examination of Carnegie Mellon University's first steps toward executing a restorative master plan. Perspectives articles focusing on Brazil and a survey of recent projects by Ellerbe Becket round out the design coverage.

Hewn from the City Block

On the following pages, Susan Doubilet evaluates Frankfurt's ambitious museum program.

Among the new buildings is the Museum of Modern Art, where Hans Hollein

has carved a series of eloquent spaces out of a constricted urban site.

Of the 13 sites for new museums in Frankfurt, eight are on the riverbank across the Main River from central Frankfurt. Many incorporate gracious 19th-Century buildings, and some sit on generous sites.

Not so the recently completed Museum of Modern Art, a commission won by Viennese architect Hans Hollein in a competition held ten years ago. Its site, near the old city walls, is a leftover triangle between busy streets emanating from the medieval town center and the 19th- and 20th-Century business district.

Hollein saw immediately that, to design a 40,000-square-foot museum on this difficult wedge of land, he would have to use virtually the entire zoning envelope. He realized the futility of trying to rationalize the site into a series of rectangles with left-over spaces, the approach taken by many entrants in the competition. Instead, he accepted the "given" street walls as raw surfaces to which he added a few apertures and ornaments.

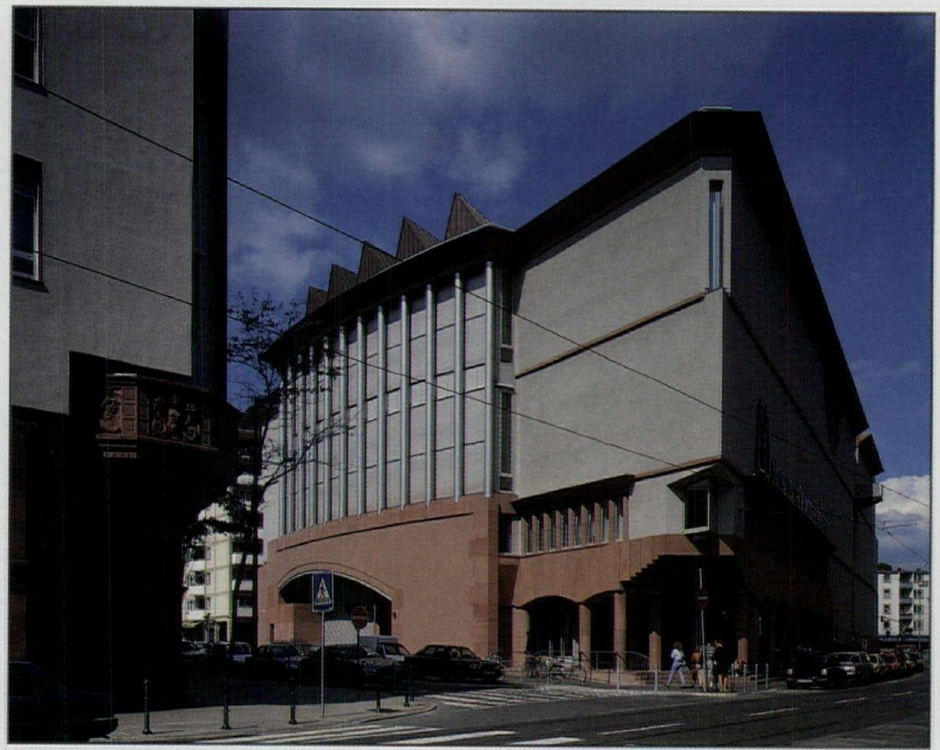
For his more recent design of the Guggenheim Museum in Salzburg, as yet unbuilt, Hollein was a reverse Michelangelo, designing spaces to be carved out of the center of a rocky mountain. In Frankfurt the city block was his rock; his mission, to release the interior spaces captive within it. And at the creation of interiors, Hollein excels.

He began by scooping out a central hall, trapezoidal in plan. Next, he exploited – rather than avoided – the site's acute corners to gain triangular and trapezoidal exhibition rooms of great drama. This scheme left most of the floor area divisible into rectangular galleries, neutral enough to please any curator. The scheme also rendered the floor plan almost perfectly symmetrical, and thus fairly predictable.

But then Hollein introduced a couple of twists, putting a spin on the experience of passing through the building. First, he set the entrance close to the historic and cultural city center, at a corner adjacent to the base (not the apex) of the triangle. This superimposed a diagonal path onto

(continued on page 66)

Floor overhangs subtly model the museum's plaster walls, but other exterior elements are bold. The sandstone entrance arcade (1) repeats a motif of nearby buildings. Convex and concave windows (2) contrast on one long wall. An articulated two-story window over a sandstone and stucco truck dock (3) form a lively composition with the cathedral steeple beyond.



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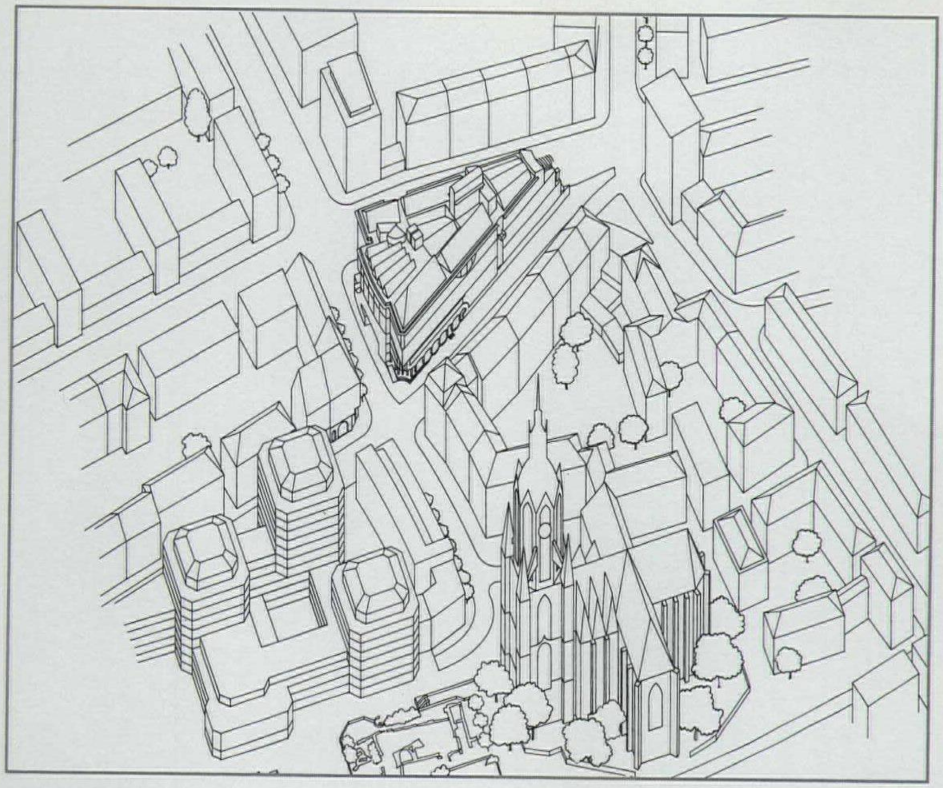
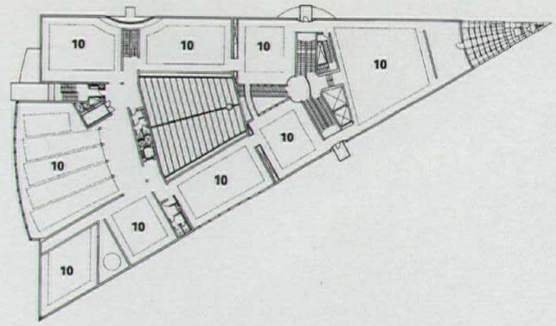
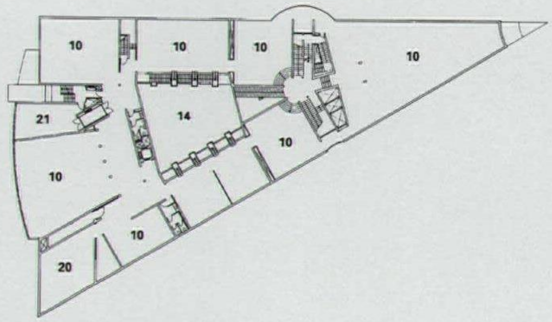


SITE AXONOMETRIC

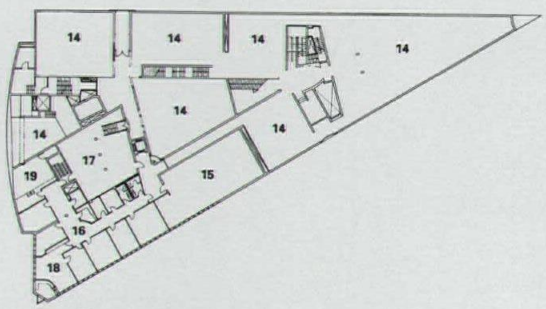


TOP FLOOR PLAN

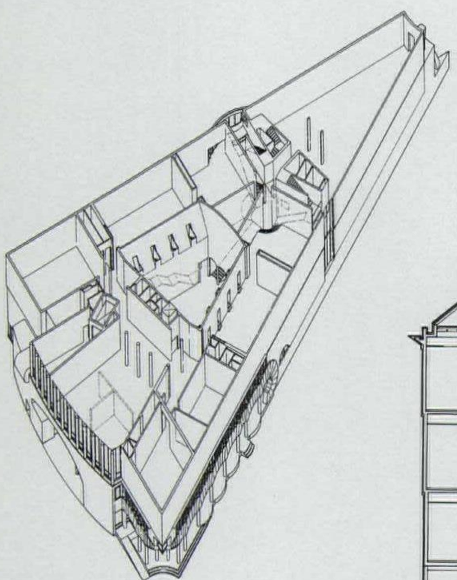


FIRST FLOOR PLAN

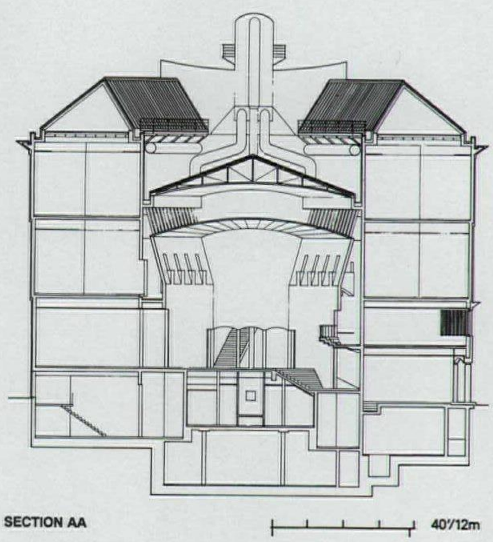
1 STORAGE
2 LECTURE HALL
3 FOYER
4 CENTRAL A/C
5 WORKSHOP
6 PHOTO LAB
7 MAIN ENTRANCE
8 LOBBY
9 CENTRAL GALLERY
10 GALLERIES, PERMANENT COLLECTION
11 TEMPORARY EXHIBITS
12 LOADING DOCK
13 ADMINISTRATIVE ENTRY
14 OPEN TO BELOW
15 LIBRARY
16 OFFICES
17 EXHIBITS WORKROOM
18 DIRECTOR'S OFFICE
19 VIDEO LIBRARY ARCHIVE
20 BEUYS GALLERY
21 RESTORATION



MEZZANINE FLOOR PLAN

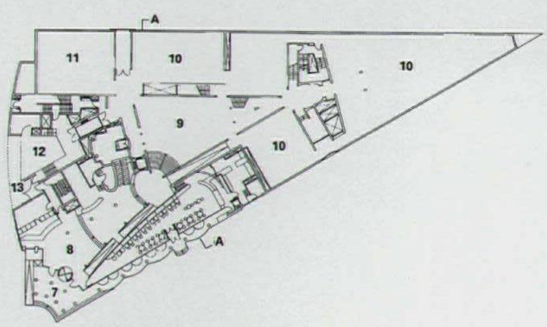


AXONOMETRIC, FIRST FLOOR

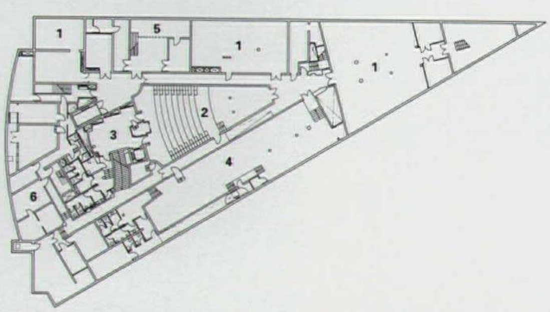


SECTION AA

40'/12m



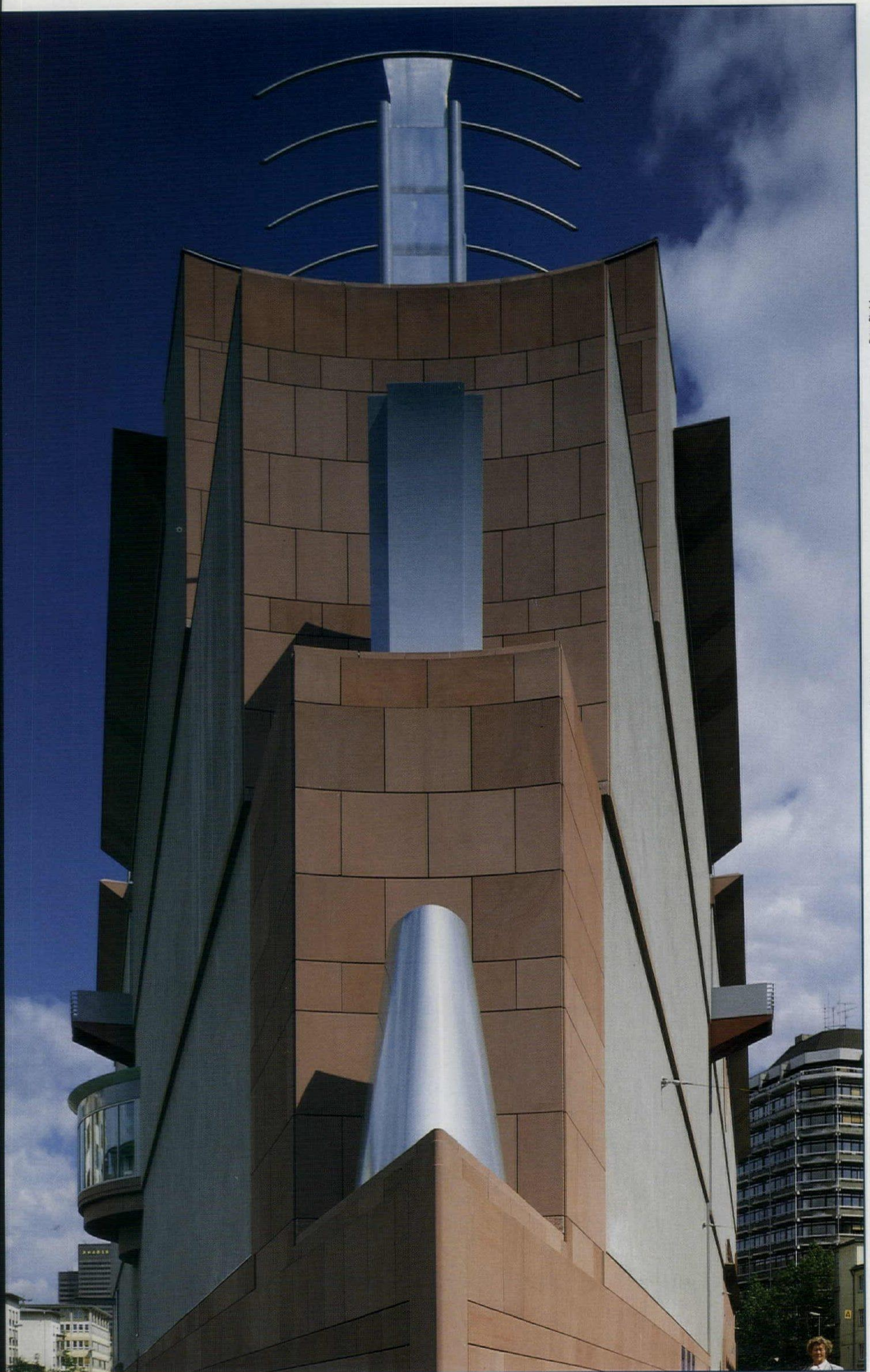
GROUND FLOOR PLAN



The pointed end of the building (4), visible from a distance, is modeled into stepped terraces. These are adorned with sculptures which conceal fire exit doors. The topmost sculpture consists of a series of stainless steel shield-like forms, a motif seen in Hollein's earlier work, and is intended to "date" this work. In the building's long north wall, concave and convex windows (5, 6) allow museum visitors to stand in one part of the building and see across to another, and to step "outside" the building envelope.

FIRST BASEMENT PLAN

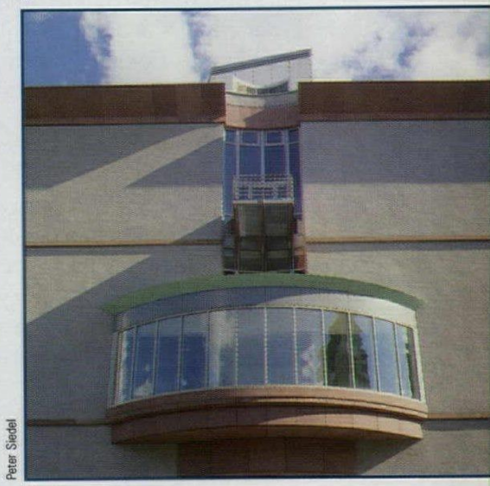
N 100'/30m



4

Peter Siedel

5



Peter Siedel

6

(continued from page 62)

a symmetrical plan (as on the deck of an aircraft carrier, says Hollein). Second, he located the primary stairs towards the narrow end of the site, and packed them tightly around a small ovoid landing. These act like a corkscrew drawing the visitor up through the building. The stairwell provides Piranesian views diagonally into adjacent spaces, its intense verticality contrasting with the horizontality of the galleries.

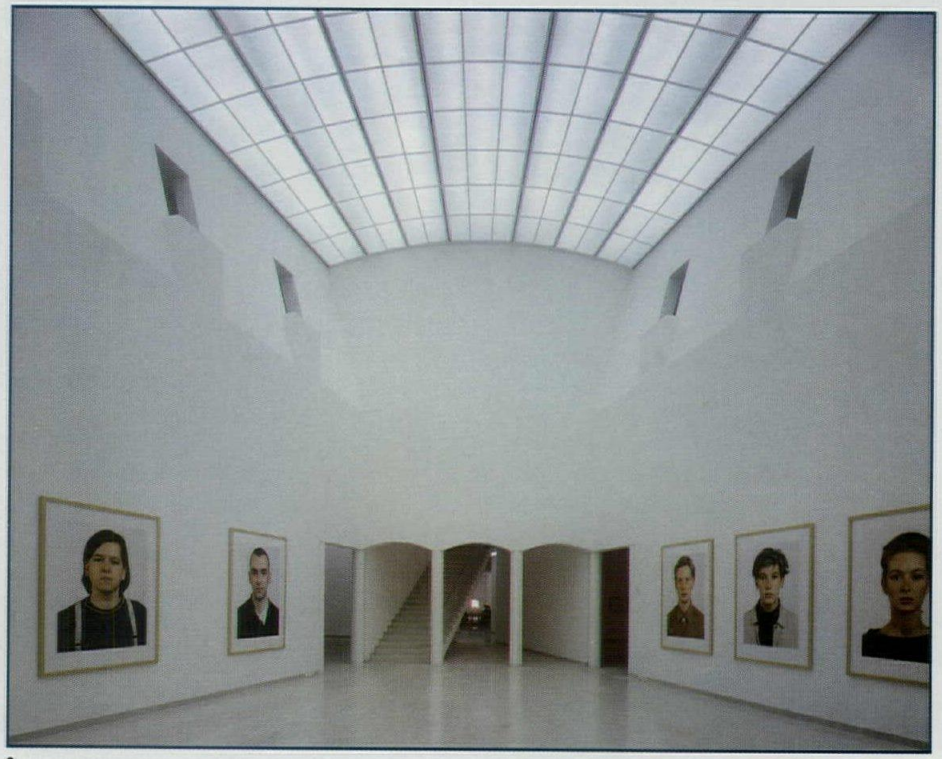
One of the finest interior spaces is the central courtyard; most dramatic of the galleries is the triangular ground floor room in the apex; and most provocative is the two-story Joseph Beuys room, in which no two surfaces seem parallel (though the floor and ceiling are, appearances notwithstanding).

With the layout and form of the museum spaces established, Hollein approached the lighting, working to further ideas developed for his design of the Abteiberg Museum in Mönchengladbach in the early 1970s. The introduction of daylight, no longer uncommon in museums, is again used extensively at Frankfurt in a variety of ways. Some galleries have skylights (with fiberglass as a filter sandwiched between glass layers); some have natural light from the side as well as from above (the Siah Armajani room, for example, has north-facing industrial shed roofs and a large window wall); and some are illuminated by artificial light only (notably the special environment spaces, designed by artists James Turrell, Nam June Paik, and others). As to artificial light, Hollein's attitude differs from the American approach, which relies heavily on incandescent spots. To achieve his ideal – a cool light, close to the daylight spectrum, with even distribution over the entire wall and little distraction from the light source itself – Hollein developed for Frankfurt a fluorescent tube wall-washer recessed in the ceiling.

The building's envelope was determined by zoning, but Hollein did, alas, determine physical

The central hall (8), used as gathering and exhibition space, feels almost like an exterior courtyard. The skylight occurs not at the top of the building but at a point calculated to provide fine proportions, and the upper walls lean back to allow small balconies to protrude, playing up the inside/outside theme. The main stairs (7, 9,) surround an oval landing, creating a vertical space that contrasts sharply with the galleries around it.

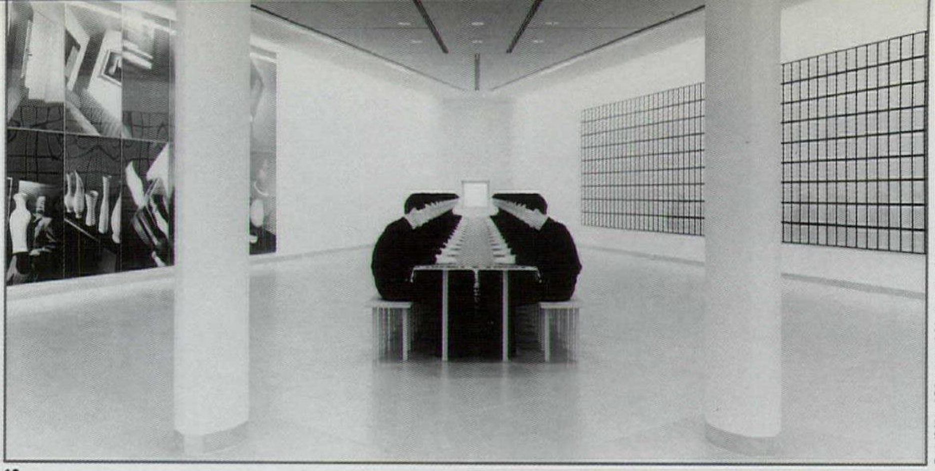
7



8

9

The drama of the ground floor triangular gallery (10) is enhanced by the installation of Katharina Fritsch's 50-foot-long "Company at Table." The concave window at the corner of the Warhol gallery (11) provides unusual views, but curators argue that it distracts from the artwork. Indirect lighting behind wall panels in the 100-seat lecture hall (12) gives the impression of daylight peeking out from behind curtains. Little bridges (13) allow access from the second story to the balconies overlooking the central room.



Rudolf Nagel/Museum of Modern Art, Frankfurt

10

form. While he explains that the schemes for both the interior and the exterior came quickly to him, the interior is brilliant and the exterior is not. For the latter, windows in a variety of shapes and sizes are located at various points on the walls, placed according to interior needs but with no unifying vision apparent on the exterior. Some elevations are fine – where large concave and convex windows contrast, for example – but all are dragged down by the inexpensive and unpleasant greenish gray plaster wall finish. Most lovingly designed is the building's apex with sculptures adorning little terraces, and the roof, a landscape of skylights and mechanical equipment only partially visible from the street. Most unappealing is the sandstone entrance arcade, its non-traditional form resembling the flaccid, grinning lips of a crocodile, poised to engulf passersby. Overall, the museum's appearance has earned it epithets such as "bunker" and "piece of cake"; but it may become the building that Frankfurters most love to hate, because of the excitement inside.

During construction, the present museum director, Jean-Christophe Ammann (who replaced the founding director, Peter Iden, a staunch Hollein supporter) reportedly feared that the architecture was too dominant, the galleries unsympathetic to the art. Today, Chief Curator Rolf Lauter still holds that a few rooms are problematic (a trapezoidal gallery puts the squeeze on works by Rauschenberg, Lichtenstein, and Rosenquist) but he feels that most are appropriately neutral and that others provide stimulating confrontation with the art. Hollein points out that it is a matter of learning to use the instrument he has provided, suitable not only for the museum's collection of Pop Art and more recent acquisitions, but "even for works by Velasquez or Titian." Indeed, this museum – Hollein's best work to date – reflects timeless lessons in the manipulation of light, movement, and space. If it is provocative, that, too, was part of its mission. ■

11

Peter Seidel

12

Project: *Museum of Modern Art, Frankfurt.*
Architect: *Prof. Hans Hollein, Architect, Vienna.*
Client: *City of Frankfurt am Main, Municipal Department of Culture and Leisure, Municipal Department of Science and Art.*
Site: *23,000-sq-ft triangular lot near the Cathedral in the historic center of Frankfurt.*
Program: *exhibition spaces with natural and artificial light to house permanent collections, temporary installations in about 44,600 sq ft; administration and library in about 6600 sq ft; 4500 sq ft for multipurpose rooms including workshops and lecture hall; 1075 sq ft cafeteria. Total approximately 97,900 sq ft.*
Structural system: *concrete slab foundation; reinforced concrete walls, steel-framed glass roofs.*
Major materials: *exterior walls of red sandstone, rockwall panel insulation, mineral stucco; roof skylights of glass fiberglass sandwich, blacktop, gravel; floors and stairs of light gray marble, waxed oak in offices, sealed concrete slab in mechanical spaces; interior partitions of gypsum plaster; ceilings of drywall, acoustic panels, and triple-layer security glass.*
Mechanical system: *A/C throughout public spaces with cooling towers on roof. Heating only in administration spaces connected to municipal industrial exhaust heating system.*
Consultants: *Dipl. Ing. Gert Rosenboom, Structural Engineers, structural; Fricke-Ruth-Kluck, Associated Engineers, HVAC and plumbing; Alois Zitnick, Office of Engineering, electrical; Werner Fütterer Engineers, elevators; ITA Engineering Company, building physics, acoustics; Dr. Ing. Hans Freymuth, Institute for Daylight Technology, Stuttgart, daylighting; Karlotto Schott, Institute for Façade Technology, exterior walls; Dr. Ing. P. Amann, Foundation Institute, soil engineering; König & Heunisch, structural engineering review; Bau-Real, consulting engineers, time scheduling; Projekt-Design, graphics and signage.*
General contractor: *Frankfurter Aufbau AG.*
Costs: *DM 60 million (approximately $37.5 million).*
Photos: *Richard Bryant, except as noted.*

Gaining the Edge

Gustav Peichl's addition to the venerable Städel Art Institute extends its cultural scope while enhancing its urban presence.

The Städel Art Institute, originally founded with a bequest in 1807, has since 1878 occupied an important position on the Schaumainkai riverbank. In that year, the somewhat fussy Neo-Classical building by Oskar Sommer was opened. A rear wing was added about 40 years later; and after major damage incurred during World War II, the side wings and interiors were handsomely rebuilt in a Modern mode by Joseph Krahn. Ever since the Institute's founding, its goal has been to add contemporary artwork to its historical collections as a cultural bridge between the past and the future; the 20th-Century acquisitions necessitated the recently completed extension.

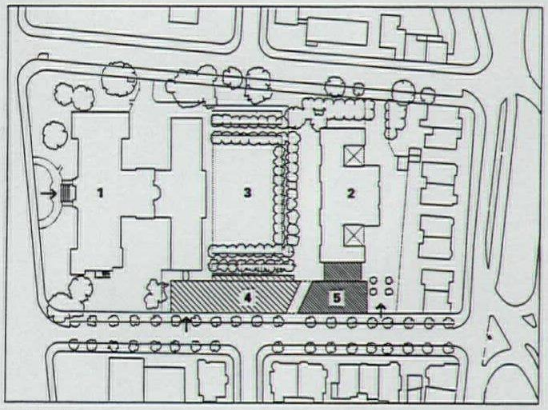
The new wing by the Viennese architect Gustav Peichl encloses the west side of the park-like garden behind the existing Art Institute building, the back of the site being bordered by the Städel School of 1908. In fact, Peichl's commission included a new wing to the school as well, and the two parts combine to form a very strong and serene façade along the quiet side street.

The museum itself consists of two parts: A three-story "hub" incorporates the entrance, a bridge to the original building, and access to the main galleries; a long two-story wing accommodates the major new gallery spaces. The primary axes of these two parts are perpendicular to each other, contained within one unified envelope.

By far the strongest design aspect of this building is its exterior presence, with a 200-foot-long street wall carefully detailed in bianco savannah marble. This choice of materials in itself makes a statement of independence, not attempting to blend with the sandstone of the original Institute. The square entrance façade of the "hub" with its row of windows near the top and its tall portal, is like a face, full of the personality found both in Peichl's well-known political cartoons (rendered under the pseudonym Ironimus) and in the organic, stucco-clad parts of his ORF ground relay stations (P/A, Mar. 1984, p. 72). A deep vertical reveal sets off this front from the mute façade of the main gallery wing, the latter articulated only by the pattern of the lush but understated marble. The expanse is extended by the new school wing, a country cousin clad simply in stucco, but with a jaunty upward swing to its roofline at the street corner. The rear of the museum wing provides a low-key backdrop to the garden, with one curve projecting sensuously out from its plane.

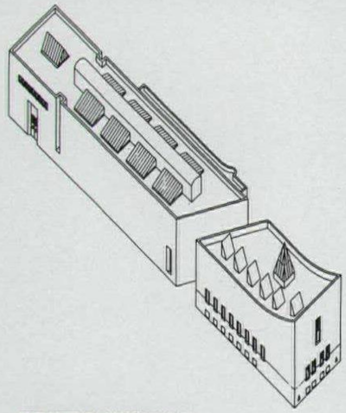
Helmut Heistinger

1



SITE PLAN

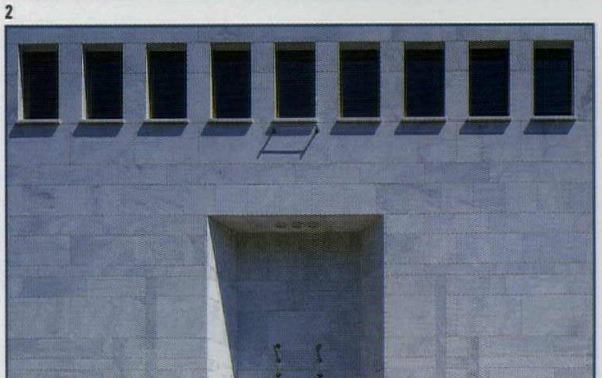
1 STÄDEL MUSEUM
2 STÄDEL SCHOOL
3 SCULPTURE GARDEN
4 NEW MUSEUM EXTENSION
5 NEW SCHOOL EXTENSION



ISOMETRIC, MUSEUM AND SCHOOL EXTENSIONS

The Städel Art Institute extension, shown with the Städel School addition in the foreground (1), forms a strong wall along both the sidestreet leading from the riverbank (3, 4) and toward the garden on the interior of the block (2). Details are spare, but the carefully patterned marble cladding is lush.

2



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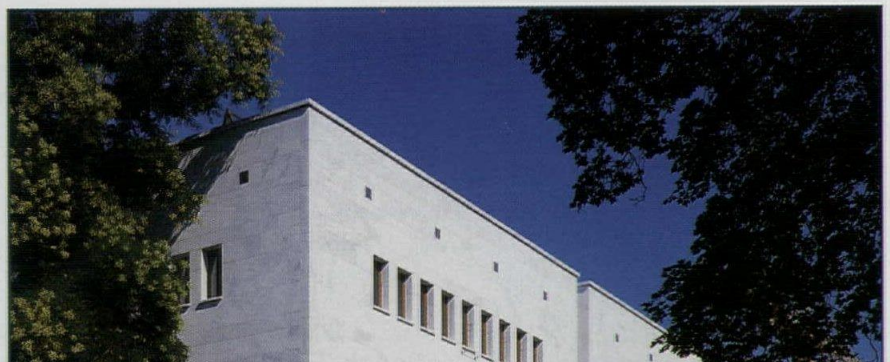


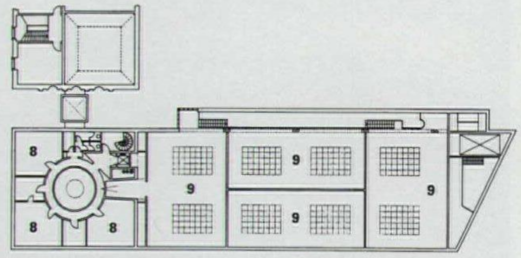
4

In the "hub" of the building, a circle of columns defines an entrance rotunda on the ground floor (7), while intimate galleries are packed around the central space above (5). Contrasting with these are large rectangular exhibition spaces in the extension's main wing (6).

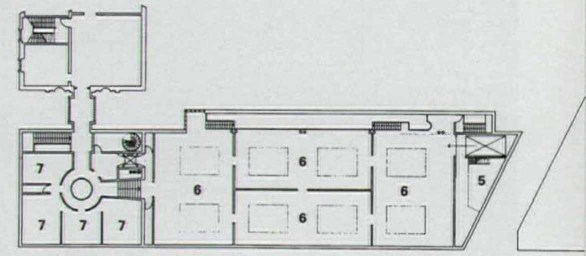
5

6

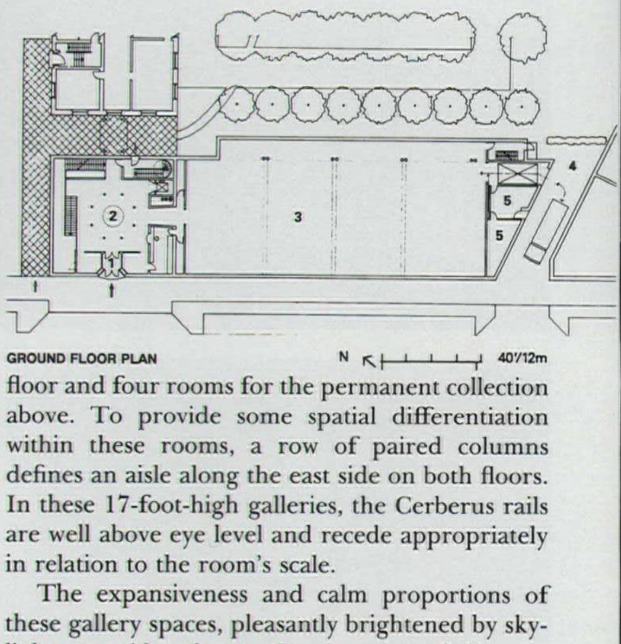
1 ENTRANCE
2 FOYER
3 TEMPORARY EXHIBITS
4 LOADING DOCK
5 STORAGE
6 EXHIBITION HALLS
7 SMALL GALLERIES
8 WORKROOMS
9 OPEN TO BELOW



MEZZANINE FLOOR PLAN



FIRST FLOOR PLAN



GROUND FLOOR PLAN

N 40'/12m

Project: *Städel Museum, Frankfurt.*
Architects: *Prof. Gustav Peichl, Architect, Vienna.*
Client: *Städelsches Art Institute.*
Site: *extending about 230 ft facing a street perpendicular to the riverfront boulevard and a garden on the interior of the block.*
Program: *extension to the Städelsches Art Institute with about 7850 sq ft permanent, and 6450 sq ft temporary, exhibition spaces; 2150 sq ft each for administration and lecture rooms.*
Structural system: *load-bearing brick walls with concrete columns.*
Major materials: *exterior, marble façades with oak windows and door; interior, plaster walls, stone, linoleum, and wood floors.*
Consultants: *Dipl. Ing. Dorn, landscape; Dipl. Ing. Rosenboom, structural; Petterson & Ahrens, mechanical.*
Costs: *DM 58 million (approximately $36 million).*
Photos: *Richard Bryant, except as noted.*

Fussy marble "pilasters" around the entrance somewhat mar the forthrightness of the façade, and this fussiness is brought into the foyer. Despite its small size, this lobby is distinguished by a rotunda, created by a circle of steel-sleeved columns and an oculus penetrating to the upper skylighted floor. The black and white marble floor is lively if clichéed, but it is the pencil-shaped marble newel post, the red-lacquered oversize handrails, the bumper guards around doorways, and the *stucco lustro* walls that give the otherwise modest space the qualities of a professionally wrapped gift package.

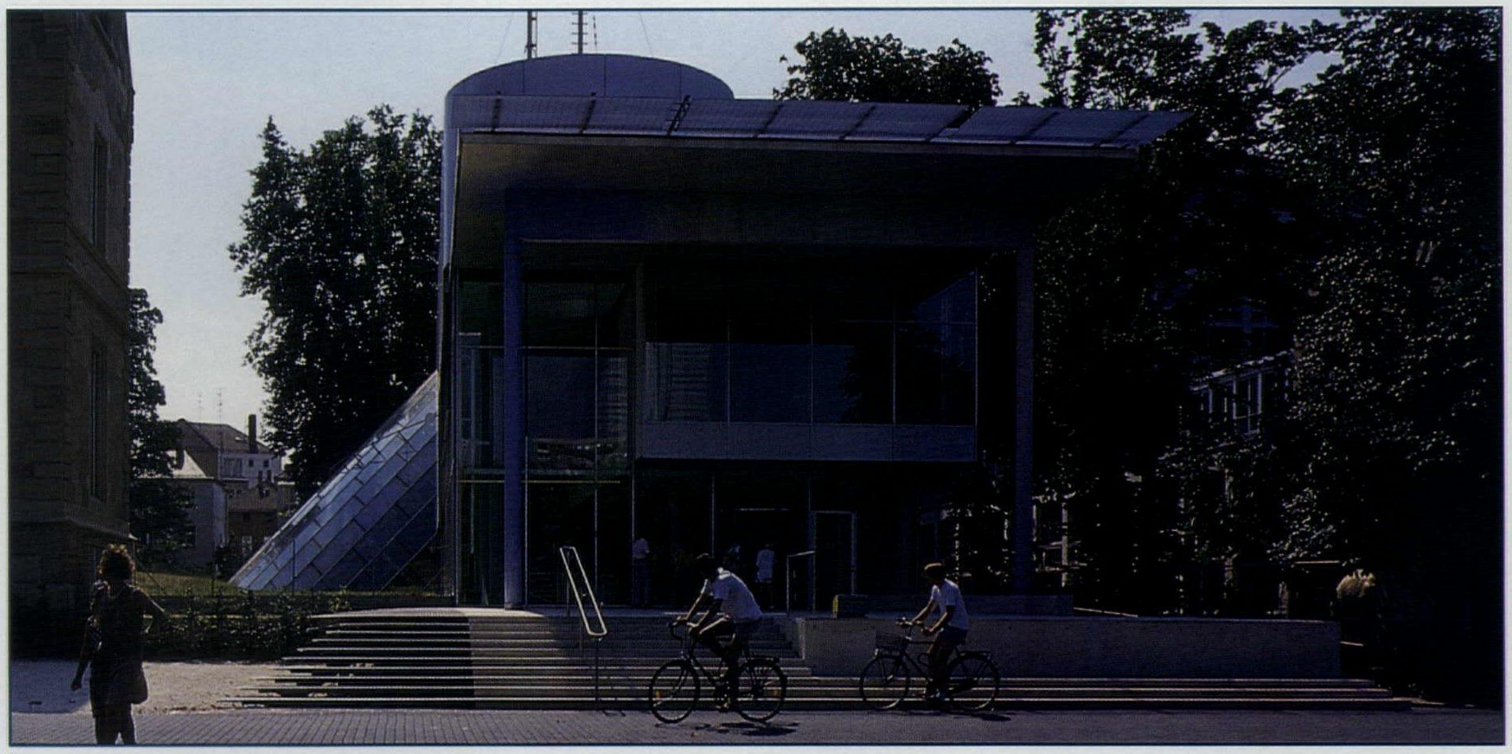
The second story of the "hub" wing contain small galleries surrounding the rotunda. The intimacy of these spaces is a pleasant contrast to the larger volumes of the existing and new galleries, but here again the smallness causes some of the details to seem overbearing. The overhead recessed spots are distracting, as are the too-glossy metal security "Cerberus" rails installed for hanging pictures.

The main gallery wing contains more satisfying spaces – the almost undivided 6000-square-foot expanse of the temporary gallery on the ground floor and four rooms for the permanent collection above. To provide some spatial differentiation within these rooms, a row of paired columns defines an aisle along the east side on both floors. In these 17-foot-high galleries, the Cerberus rails are well above eye level and recede appropriately in relation to the room's scale.

The expansiveness and calm proportions of these gallery spaces, pleasantly brightened by skylights, provide a key to the character of this museum. A few overdone details aside, it is a no-nonsense building that projects a sturdy urban presence. ■

A Lightweight with Substance

Behnisch & Partners design a slender, all but transparent pavilion for the German Postal Museum.



Richard Bryant

1

To offset the existing villa, the architect designed a slender three-story pavilion, rendered ephemeral by the extensive use of glass. The new pavilion is set back from the street (1) to provide a plaza overlooking the river. The museum's most idiosyncratic element is a rounded, sloping glass roof (2), which covers the vertical well linking the pavilion and the underground galleries.

The German Postal Museum by Gunter Behnisch & Partners incorporates an existing villa on the Schaumainkai riverbank, a configuration akin to Richard Meier's Decorative Arts Museum of 1985, albeit on a more constricted site. Unlike Meier, however, Behnisch did not favor a "contextual" approach. The Postal Museum defers architecturally to the original building by being "just" a glass pavilion. Using subterranean space under the entire site, it remains small relative to the villa, and it has no façade, as such, but presents itself as roof, floor, and columns.

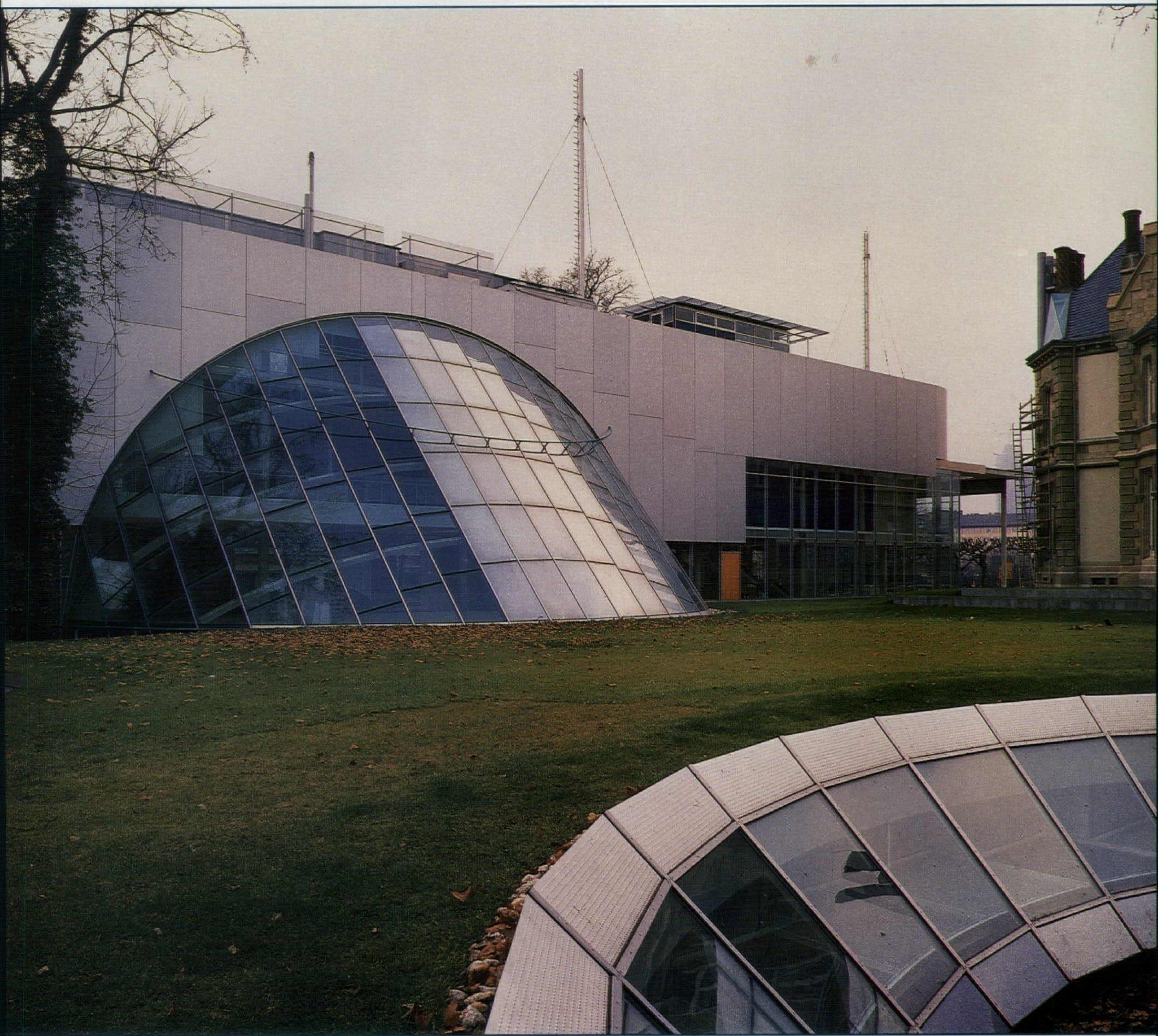
When one thinks of glass pavilion museums, Mies van der Rohe's 1965 National Gallery in Berlin comes to mind. Like the National Gallery, the Postal Museum has much of its exhibition space underground. Here, however, the exhilarating aspect of the design comes not from strict discipline and regular rhythms, but from variety in spaces, details, and in the play of protrusions and recesses in the glass envelope. Thus the architecture does not form a neutral container for the exhibits, as 1960s glass museums purportedly did; the contemporary building is at least as eye-catching as the museum collections.

Of all the new museums on the Schaumainkai, Behnisch's most generously offers itself up for use by strollers on the riverbank. Well over half of its ground floor is gathering space, a good portion of which is outside. The transition from outdoors to the interior is barely perceptible; the dividing plane is merely a thin glass wall.

The lobby space is spectacular in itself, with its finely detailed glass envelope and its two-story height along one side. But beyond this lobby is the most striking part of the entire building: the connection between ground level and underground gallery. A large glass-roofed opening was designed to introduce generous views and daylighting to the basement level. The slanted glass tube seems to thrust itself right through the ground and the wall, and take on a life beyond its actual physical limits. The effect on the basement space, however, is less beneficial than expected. Daylight floods the center of the gallery, overwhelming the exhibits and making video screens particularly difficult to see. The extensive adjacent areas are, by contrast, murky. Because the space is wide open, a distracting number of disparate artifacts compete for viewers' attention.

Dieter Leistner

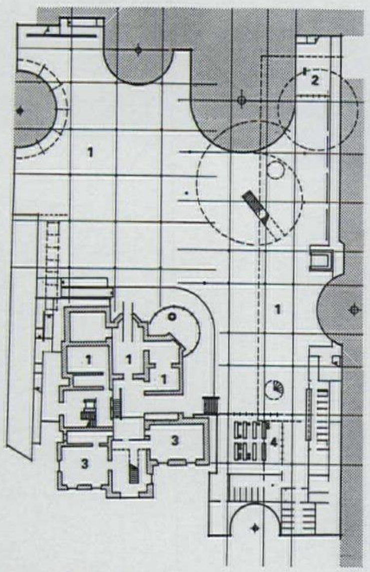
2



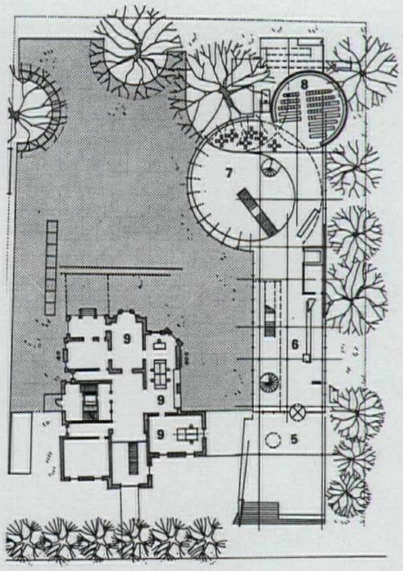
Thomas Delbeck/AMBIENTE

3

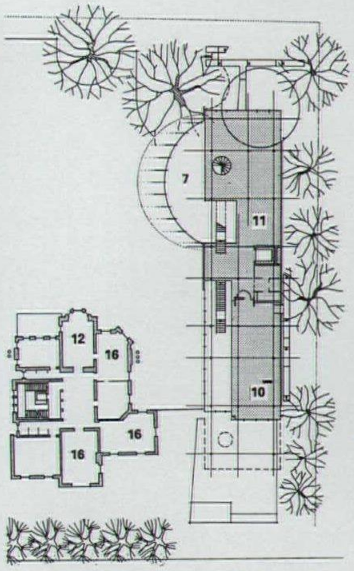
1 PERMANENT EXHIBITION
2 COURT
3 STORAGE
4 STUDY AREA
5 ENTRANCE
6 FOYER, INFORMATION DESK
7 OPEN TO BELOW
8 FILM PROJECTION
9 LIBRARY
10 POSTAGE STAMP GALLERY
11 SPECIAL EXHIBITIONS
12 DIRECTOR'S OFFICE
13 RESTORATION
14 PHOTO LAB
15 PHOTO STUDIO
16 OFFICES



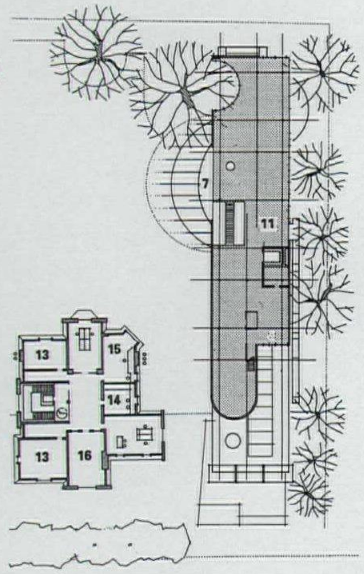
UPPER BASEMENT PLAN



GROUND FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

N 100'/30m

Thomas Delbeck/AMBIENTE

4

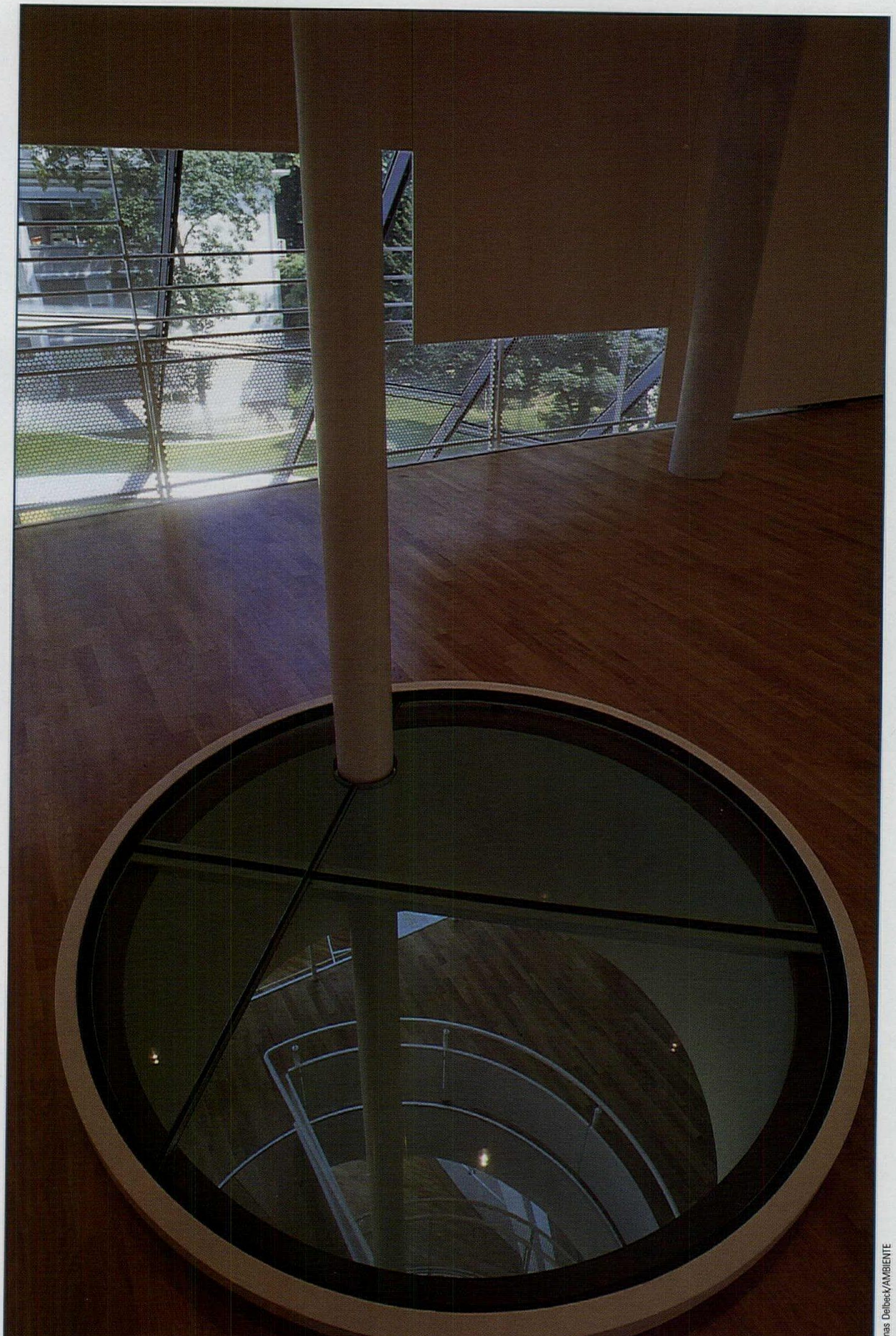
Behnisch explains that in the competition program for this museum and during the design development phase, square-foot requirements were given, but little direction provided as to the type of spaces needed, media to be used in exhibitions, and artifacts to be housed. He suggests that shades or curtains be used to limit daylighting, but basically feels that, at this late date, the museum curators should not ignore or fight the architectural concepts, but work with them.

The original villa, now used for museum administration, was partly destroyed in World War II. After discussing many alternatives, it was decided not to replicate the lost features on the façade, but to smooth out the damaged surfaces and to paint them over in an abstract representation of former surface activity. The choice of color unites the old and new buildings.

For years Behnisch taught at the School of Architecture at Darmstadt, and there is much talk in Germany of the Darmstadt School promoting a strain of 1950s Modernism. Behnisch demurs on the subject, but makes two related points. The Darmstadt School has been inclusive, he says, with an open attitude towards different points of view, which is the way he runs his office; the team determines goals, and individuals are given great freedom to achieve their objectives in diverse ways. Furthermore, he observes, architects of the younger generation in Germany favor various forms of Modernism as historical revival, having found the IBA brand of Post-Modernism a disappointment. The Postal Museum is a strong argument for their case. ■

Slender columns and steel profiles characterize the design, as seen in the lobby (3) and in the spectacular view from the underground level up the grand stairwell to the top of the three-story pavilion (4). The building has numerous types of stairways and a dizzying variety of handrails, changing not only from stair to stair but within single stairways, too. The architect explains that the program did not call for the design of exhibition screens or cabinets, so the designers found gratification in other details.

Project: *German Postal Museum, Frankfurt.*
Architects: *Behnisch & Partner, Stuttgart (Peter Schürmann, Felix Hessmert, Gothart Geiselmann, Christian Kandzia, project team).*
Client: *Oberpostdirektion, Frankfurt.*
Site: *the grounds of an existing villa on the riverfront.*
Program: *exhibition spaces of various sizes, lecture rooms, cafeteria, administration, storage, and parking. Net total approximately 89,000 sq ft.*
Structural system: *reinforced concrete foundation, columns, and slabs.*
Major materials: *solid walls, aluminum panels, insulation, concrete, gypsum board; transparent walls, insulating, partly reflective glass in steel frame; roof, three layers of bituminous roofing, insulation, moisture barrier.*
Consultants: *Behnisch & Partner in cooperation with Hans Luz & Partner, landscape; Schlaich, Bergermann & Partner, structural; Keppler, mechanical; Gackstatter & Partner, electrical.*
Costs: *DM 41 million gross (approximately $25.6 million).*



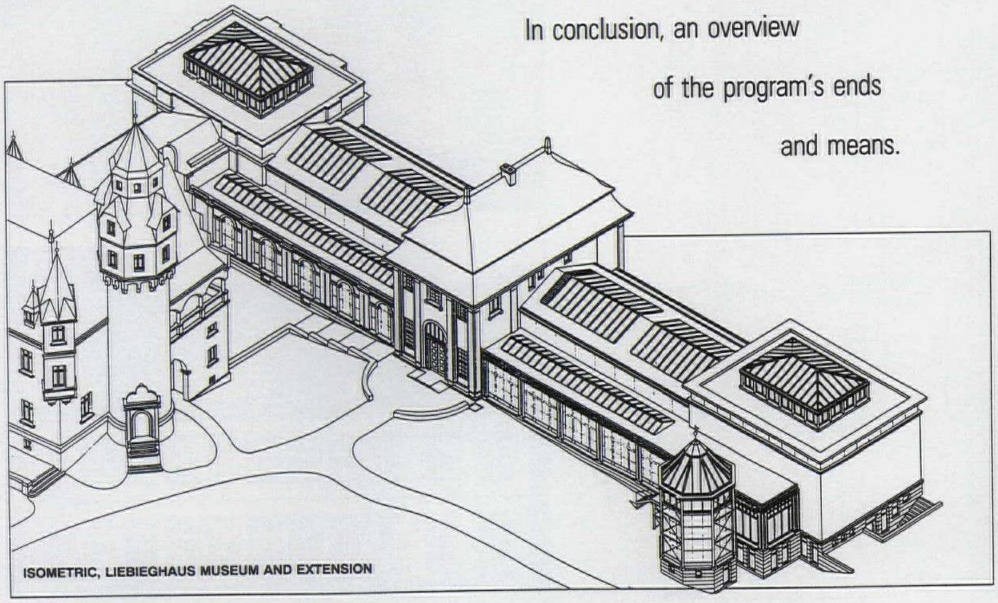
5

Thomas Delbeck/AMBIENTE

A glazed round opening in the floor at the third level (5) provides views down to a spiral staircase. Within the basically orthogonal pavilion design, circles form an important subtheme. The motif began with the need to establish retaining walls at a safe distance around trees pinpointed for preservation.

Cultural Evolution

Frankfurt's new museums were designed to meet a complex political and cultural agenda. In conclusion, an overview of the program's ends and means.



ISOMETRIC, LIEBIEGHAUS MUSEUM AND EXTENSION

1

The west wing of the Liebieghaus Museum of Ancient Sculpture (this page) has finally been built, some 80 years after the east wing, to designs by architects Scheffler & Warschauer. The new plan mimics the old one, except that the arcaded passageway along the east wing's front has become a stairway to the lower level in the west wing. A small tower dedicated to a single sculpture was added (1), inspired by the original medieval Villa Liebieg. Details of the new wing are patterned after those in the old, including terrazzo floors and cornice moldings, though the latter incorporate modern HVAC elements. New skylights replaced the old throughout the building.

Peter Seidel

Over a decade ago, Frankfurt committed itself to building 13 museums. This June, the twelfth one, Hans Hollein's Museum of Modern Art, was opened, and the imminent construction of Richard Meier's Ethnology Museum was officially announced.

To build this number of museums is a remarkable undertaking, but to complete them, through economic thick and thin and extreme political shifts (a conservative party initiated the program and a leftist party ultimately saw it through), is even more amazing. The achievement can be attributed to the multiplicity of goals that the museum-building program set out to achieve. The city, indeed the country, was ripe for new cultural institutions; Frankfurt had a number of planning and preservation aims which could be accomplished simultaneously; and the city had an image problem, which the cultural and planning agendas could redress.

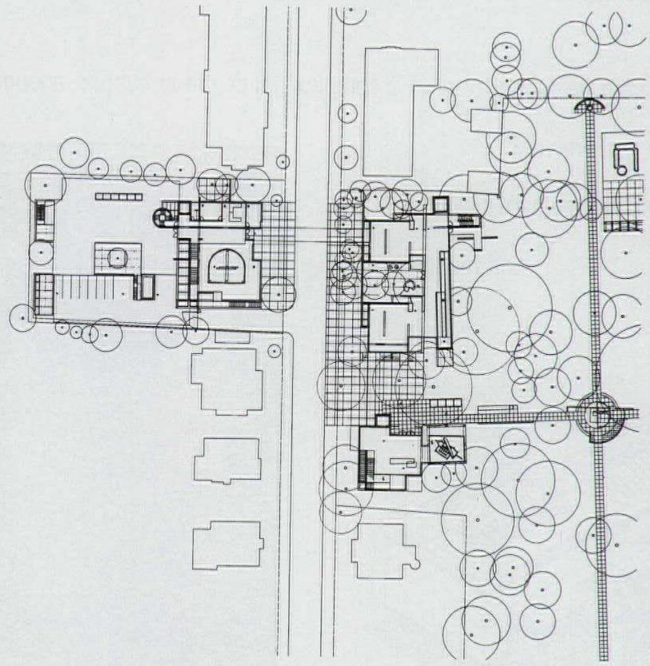
In the years following the Second World War, all efforts in West Germany had to be concentrated on sheer survival needs; construction dollars went, obviously, for housing, infrastructure, and industry. Next, religious buildings and theaters were restored or rebuilt, but existing museums were merely stabilized. In the late 1950s and 1960s a number of museums were built, but it was only in the late 1970s, when a high level of prosperity had been reached, that a new definition was sought for museums, and the museum boom in West Germany took off. More leisure time, with extended vacation periods, was available to most people, and even more was predicted. And now museums were seen not only as places for collecting and study, but as social centers and places of entertainment as well. The 1980s saw Stuttgart's acquisition of James Stirling's New Staatsgalerie (P/A, Oct. 1984, p. 70), Mönchengladbach's Abteiberg Museum by Hans Hollein, and Cologne's Museum Ludwig, among many others.

Frankfurt, too, decided to offer its populace more, and more appealing, museum space. It did so, however, with not one startling building, but many small ones. In this way, the city cleverly got more mileage from the program. Not only did the phased openings of museums keep up interest in the city for several years, it also spread the cultural hot spots over a wide area.

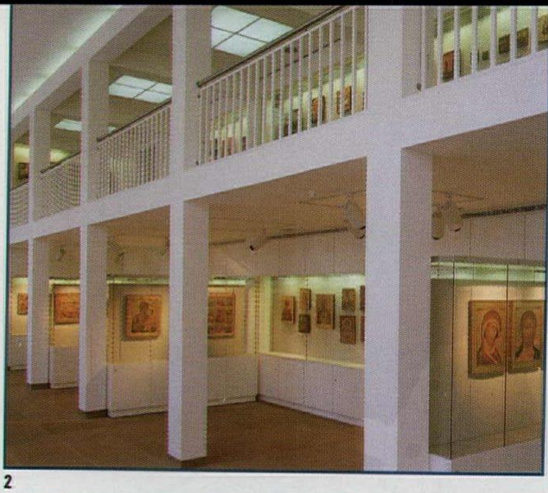
The geographical spread meant that preservation and planning objectives could be integrated in the program. Frankfurt, like many cities, had numerous villas whose original function was now defunct. Unlike many cities, it recognized that numerous collections could be handsomely housed in these gracious structures, once they had been renovated and, in most cases, extended. As it happened, the majority of these villas (and two existing museums that needed additions) were located in the *gemütlich* Sachsenhausen riverfront district across the Main river from the business center of Frankfurt.

The river, always a potential joy for city dwellers, was improved with better bicycle and pedestrian paths, bridges, and attractive landscaping; the view from the business district on the opposite riverbank was polished up; and Sachsenhausen achieved, through private, market-driven forces, new stature: still "left" bank, but with increased panache. Within the business district itself, several museum sites were pinpointed, so that culture would flow close to the core. Here, the city also gave private art enterprise a boost, buying up storefronts near the new museums and renting them to galleries at generously subsidized rates.

The city's big-hearted approach undoubtedly



GROUND FLOOR PLAN, MUSEUM OF ETHNOLOGY



2

Peter Seidel

3

Peter Seidel

The proposed Museum of Ethnology (plan above) by Richard Meier will complement his nearby Decorative Arts Museum (P/A, June 1985, p. 81). Oswald Mathias Ungers designed a small Icon Museum (2) in one section of the former Teutonic Knights House (3), a complex that had been extensively damaged during the war and was rebuilt to Ungers' design in the 1960s. The new two-story, six-bay loggia inserted within the tall space breaks down the scale to suit the artifacts, though the neutrality of the background divorces the icons from the image of their original context. The loggia's steel structure is clad in plasterboard, giving a somewhat soft edge to an idea based on precision. The loggia is set off effectively by indirect lighting.

had its calculated side. Having been passed over after the war as capital for West Germany, Frankfurt became its banking center. The proliferation of banks, a number of them in relatively massive buildings, earned the city the epithets "Bankfurt" and "Mainhattan." Clearly, a culture belt would do wonders for its image.

As the program itself took shape, enlightened politicians and intelligent city architects set a high standard for the design of the individual buildings. Like IBA – Berlin's International Building Exhibition of residential buildings (P/A, Feb. 1986, p. 93; Mar. 1987, p. 81; Oct. 1987, p. 72), which was being planned at about the same time – Frankfurt's program was based on architect selection through competition, some of the competitions being open to all-German or local architects, but many with a star-studded international list as well. As in IBA, "context" was an important *leitmotiv*. But here a single polemic was not emphasized by the organizers: Where Post-Modernism was seen as the approach for "living in the city" at IBA, for Frankfurt's museums a more eclectic attitude was assumed. Excellence was the goal; Modern and even high-tech modes were not automatically eliminated.

The popular favorite among the museums is Richard Meier's Museum of Decorative Arts, completed in 1985. The largest of the museums, located on the most generous of the sites and encompassing the most important of the villas, it extrapolates on the geometry of the original building. The actual forms and materials – glass and white enamelled metal – are modern, and the resulting clean yet complex building appeals not only to lay people but to the majority of German architects who still see Modernism as representing freedom. Meier's Ethnology Museum, to be located at the back of the Decorative Arts Museum's park, is designed in a similar mode – despite the director's protests against white, given its association in primitive cultures with death.

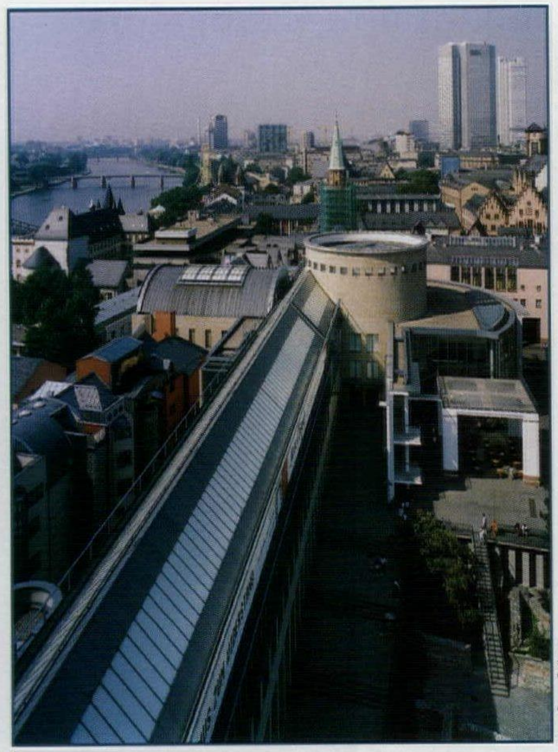
Of all the museums, the extension to the Liebieghaus Museum of Ancient Sculpture follows most conscientiously the city's goal of "building in the historical context." The original 1896 Villa Liebieg, a medieval folly, was donated to the city in 1909, and a two-wing Neo-Classical building was planned. The west wing was not built until recently, when architects Scheffler & Warschauer were commissioned to refurbish the existing wing and complete the ensemble. The new plan is almost identical to the old; the new façade treatment picks up the rhythms of the original with articulated steel structural members and polychromed marble panels. A small pavilion set into the lovely garden behind the building holds the museum's most valuable piece, the sculpture of Athena by Myron.

For the tiny (4200 square feet) Icon Museum in the former Teutonic Knights House, Oswald Mathias Ungers designed a typical Ungers structure, a rationalist white frame in the form of a two-story, six-bay loggia. It is less ambitious, and far less claustrophobic, than Ungers' German Architectural Museum in a nearby villa, a renovation completed in 1984. It is, in fact, a pretty artifact in itself, glowing with indirect light within the Baroque shell. Unfortunately, the Russian icons seem to lose soul within this cool framework.

Josef Paul Kleihues' Museum for Prehistory and Early History (P/A, May 1990, p. 85), a renovation of and extension to a Carmelite monastery, combines, on its exterior, transcendent parts – the taut street walls flanking the original transept – and awkward ones, such as the bulky entrance

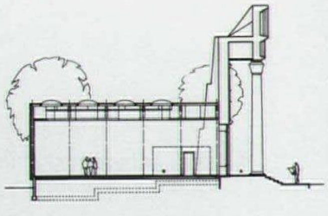
Helene Binet

4

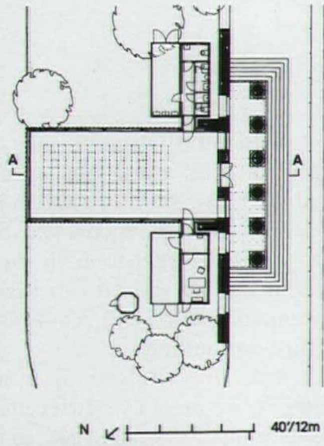


Hans Georg Göllner

5



SECTION AA



GROUND FLOOR PLAN,
PORTIKUS EXHIBITION HALL

wing; but the interior, with its steel-ribbed vaults, is uniformly intelligent.

The Schirn Art Gallery, designed by Bangert, Jansen, Scholz & Schultes, and completed in 1985, has a complicated program incorporating, in addition to the art gallery itself, a music school and workshops. These requirements do not, however, excuse the fact that the linear building interferes with views and access between the historic Römer Square at its one end and the cathedral at its other.

Both the Jewish Museum by Ante Josip von Kostelac, a renovation of the former Rothschild house completed in 1989, and the 1984 German Film Museum by Helge Bofinger & Partner, also a renovation, suffer from being crammed with a hodge-podge of permanent exhibit designs.

The simplest museum of all, nothing more than a decorated shed, is the Portikus Exhibition Hall by a pair of young architects, Marie-Theres Deutsch and Klaus Dreissigacker. Located at the end of the old city wall, it leans a 1400-square-foot shed against an important remnant, the front of the 1848 municipal library. This solution (which may eventually be replaced) is so laid back it serves as a strong, even polemical, contrast to the other twelve serious, highly designed new museums.

It can well be imagined that the completion of so many museums could not be achieved without struggles, clashes, and some dissent. Chief among the problems were the conflicting goals, on some levels, of the museum directors (who were not the prime clients) and the architects. To the directors, the collections were the stars, not to be upstaged in any way by the buildings. For the architects – well, they had been invited to Frankfurt precisely to do a star turn, and to provide a neutral shell would be an abdication. The provocative galleries in Hollein's museum, the open, overlighted spaces in Behnisch's, the whiteness of Meier's Ethnology Museum – these were accepted, but not without resistance. Political hangups and budget problems along the way to completion need not be chronicled here, though it can be mentioned that, even now, there is disdain in some quarters over the frivolity of the museum program, and protest against construction of the thirteenth museum which, according to the graffiti seen about, would "replace trees with concrete." These dissenters may be more pleased with the ongoing Frankfurt program to build carefully designed daycare centers, and the upcoming program to provide affordable housing.

Despite the conflicts, the museum-building program has been pursued without flagging of energy or lowering of standards, with a tenacity that may well be identified as "Germanic." To make a decision and follow it through, thoroughly and well, is admirable, but even more so are the results: a lasting contribution made to Frankfurt residents and to the world of art and architecture.

Susan Doubilet ■

The author, a former Senior Editor of P/A, works as a freelance journalist and architect in New Jersey. She has often covered German and Austrian subjects for P/A.

The Museum for Prehistory and Early History (4) designed by Josef Paul Kleihues in a Carmelite monastery has a vaulted roof of steel ribs replicating the original masonry structure over the nave. The Schirn Art Gallery (5) stands on an important site, between the historic Römer Square and the cathedral. Part of a complex that includes housing and shops, the Art Gallery building itself, designed by Bangert, Jansen, Scholz & Schultes, incorporates workshops and classrooms as well as exhibition space. The cruciform plan comprises a long arcade building and a rotunda. The Portikus Exhibition Hall (drawings above) by Deutsch and Dreissigacker contrasts the remains of a venerable civic building – the façade of the 1848 municipal library – with a one-room addition clad, like an industrial shed, in corrugated metal.

Return of a Destination

Once a known resort to many prominent travelers,

a unique hotel is brought back to splendor by ELS/Elbasani & Logan.

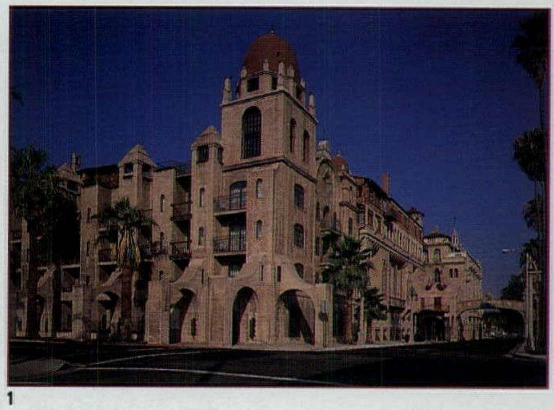
Difficult though it may be to imagine, the Mission Inn grew out of a two-story 13-room adobe house built in 1876 in downtown Riverside, California. It now covers a full city block, street-to-street-to-street-to-mall, forming an unforgettable image for downtown Riverside. What has developed since 1876 would have pleased Walter Mitty immensely.

The inn comprises four separate construction stages, in as many different architectural styles, spanning the years 1903 to 1931. Owner Frank Miller wanted it to become a destination and resort in the center of the citrus groves and missions surrounding Riverside; in that he succeeded, and for two decades the inn flourished. Its register would commonly include names like Carnegie, Rockefeller, Ford, and Roosevelt, broadening to include Lindbergh, Earhart, Cousteau, Salk, Nixon, Reagan, and Newman/Woodward; the list in the inn brochure is endless.

The Mission Wing, finished in 1903, was designed by architect Arthur B. Benton; its unreinforced brick and exterior plaster would obviously have been no match for today's seismic requirements. Four sets of two-story-high bay windows were added to the original wing at a later date, after some of the owner's travels, and have a Spanish motif with decorative painting.

The Cloister Wing by the same architect, built in 1910, took its inspiration from California missions. The Spanish Wing, built during 1913 and 1914 and directly influenced by Miller's extended travels in Spain, was an expression of his intention to make Riverside a center for Spanish art; this wing was designed by Myron B. Hunt. Exterior walls of the Rotunda Wing, designed by G. Stanley Underwood and completed in 1931, were of exposed unreinforced concrete; its design again showed Spanish influence, blended with the owner's impressions from a trip to the Orient.

Frank Miller's death in 1935 signaled the beginning of the inn's decline, disrepair, and finally, bankruptcy. Demolition was actually scheduled in 1976, but was averted by the Riverside Redevelopment Agency, a taxpayer-supported entity. That group bought the property for $2 million; it was declared a national landmark in late 1977, and was turned over to the Mission Inn Foundation for restoration. Costs exceeded expectations and the reach of volunteer fund-raising, however, and plans were put on hold until a developer bought



Eric Koyama

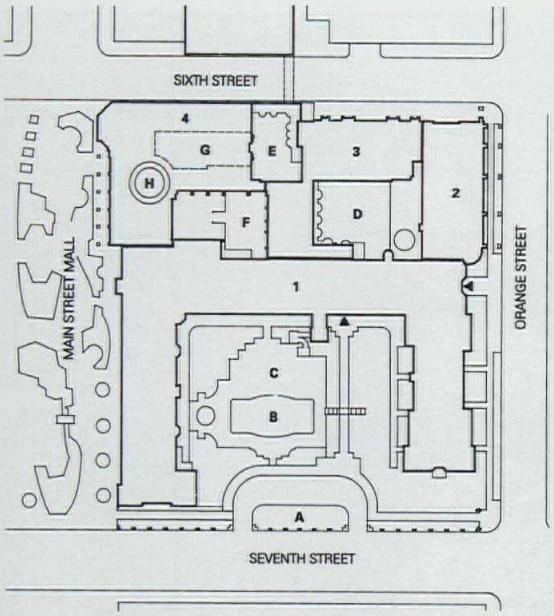
1

the inn in 1984 and returned to the restoration effort. The Carly Mission Partners, the developer, started work with its architects and contractor, beginning construction. In March, 1987, with approximately 20 to 25 percent of the construction accomplished, the initial architects were replaced by ELS/Elbasani & Logan, who did all new detailing and drawings for the project. The interiors consultant, A.T. Heinsbergen & Company, and the structural consultant, Johnson & Neilsen, remained on the job. In December 1988, Henzin Holding Corporation (a subsidiary of Chemical Bank, New York) took over the project.

As is obvious, the inn was in no shape to withstand earthquake, and would have been in danger of severe damage from any significant future occurrences. In the Mission Wing, unreinforced brick and wood walls required Shotcrete shear panels; one of the two layers of brick was removed and replaced with the same thickness of concrete; all exterior stucco, wood trim, and windows were removed. Between 20 and 30 percent of the wall framing was replaced because of rot or insufficient size, and steel was installed to reconcile loads from non-aligned corridor walls above with the columns below and to correct sagging corridor floors. Shear plywood, new roof sheathing, floor sheathing, and floor-leveling concrete floor topping were added; walls were then re-plastered to restore the original appearance. In the east-west

Seen from Sixth and Orange Streets (1) or from a 12-story building (2), the Mission Inn is a massive conglomeration of wings and styles, the dominant element in downtown Riverside. The U-shaped Mission Wing (2, foreground) was the first built (1903); the Rotunda or International Wing (1, and 2, far left) was the last (1931).

2



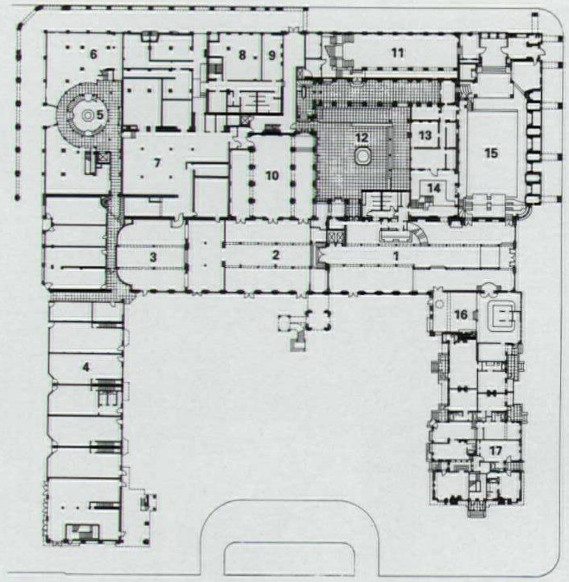
SITE PLAN N ↑ 100'/30m

1 MISSION WING
2 CLOISTER WING
3 SPANISH WING
4 ROTUNDA WING

A MAIN ENTRANCE
B SWIMMING POOL
C COURT OF THE BIRDS
D SPANISH PATIO

E ATRIO
F COURT OF THE ORIENT
G ST. FRANCIS CHAPEL
H ROTUNDA

1 REGISTRATION LOBBY
2 CALIFORNIA ROOM
3 DINING ROOM
4 RETAIL SPACES
5 ROTUNDA
6 LEASE SPACES
7 KITCHEN SUITE
8 EMPLOYEE DINING
9 PERSONNEL
10 SPANISH DINING ROOM
11 SPANISH ART GALLERY
12 SPANISH PATIO
13 OFFICES
14 RAMONA BELL COURT
15 MUSIC ROOM
16 BAR
17 HOSPITALITY SPACES
18 GALLERIA
19 ST. FRANCIS CHAPEL
20 ATRIO
21 HO-O-KAN ROOM
22 COURT OF THE ORIENT
23 MEETING ROOMS
24 COURT OF THE BELLS
25 GARDEN OF THE SKY
26 TERRACE
27 CHIME TOWER
28 ALHAMBRA COURT

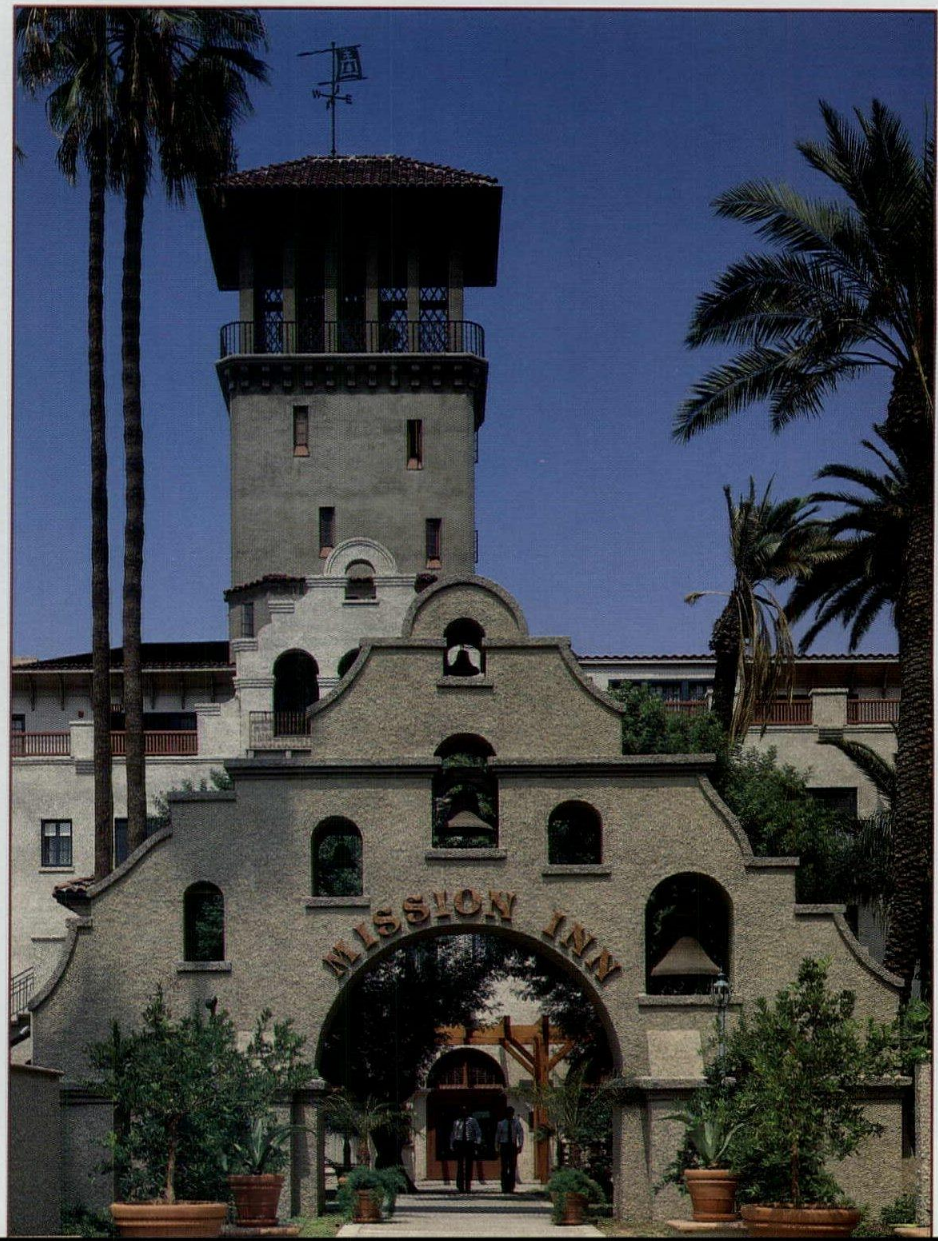


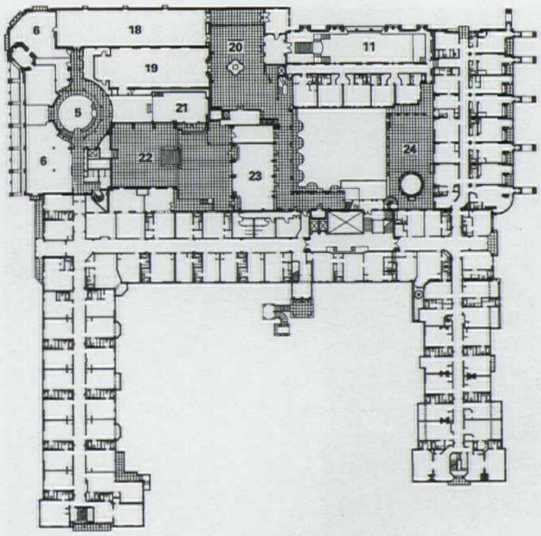
GROUND FLOOR PLAN N ↑ 100'/30m

portion of this wing, the first floor was raised 6 inches, and a horizontal steel tube truss was installed for the length of the building to gain diaphragm action and connect the north and south brick walls together. Original unbolted cast iron columns in the western façade were replaced with steel columns firmly anchored to an underground concrete beam running the length of the wing. New mechanical and plumbing work throughout the entire complex is hidden in soffits and chases.

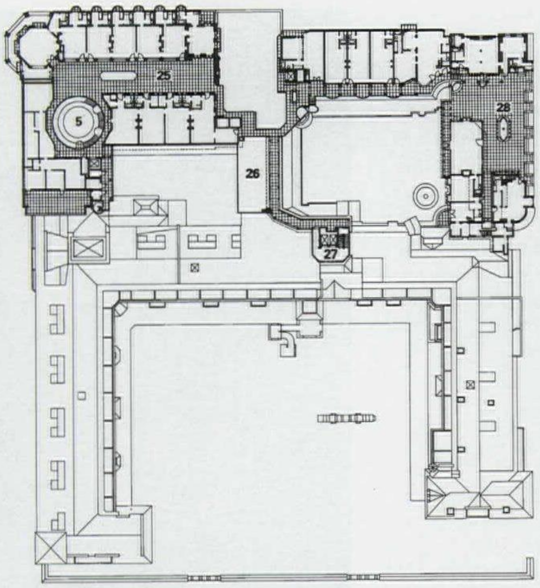
The Cloister Wing required new Shotcrete shear panels in the corridors on the first, second, and third levels. At the Music Room, stiffening was carried out with the adjacent beams, and drilled piers were put in on the Orange Street side to pick up part of the loading on existing columns and buttresses. Both the Spanish and Rotunda Wings also got a number of Shotcrete walls; on the fourth floor of the Spanish Wing (actually built later, with the Rotunda Wing), the inner layer of each of the exposed two-wythe terra-cotta tile walls was removed and replaced with Shotcrete. The concrete side was then refaced with newly-made flat tiles resembling the original and matching other remaining walls.

Throughout the complex, plaster walls were reinforced and replastered to match the existing finishes, with new concrete in the Rotunda Wing matched to the original patina. Lightweight cast concrete replicas replaced damaged ornamentation such as the finials capping Spanish buttresses. The Seventh Street Arches, patterned after those at Mission San Fernando, were deemed unsafe, and had to be entirely rebuilt. Casts of the original ornament were made to ensure authentic replication. Restoration of the finishes, with new furnishings and equipment, completed the task of bring-





FIRST FLOOR PLAN

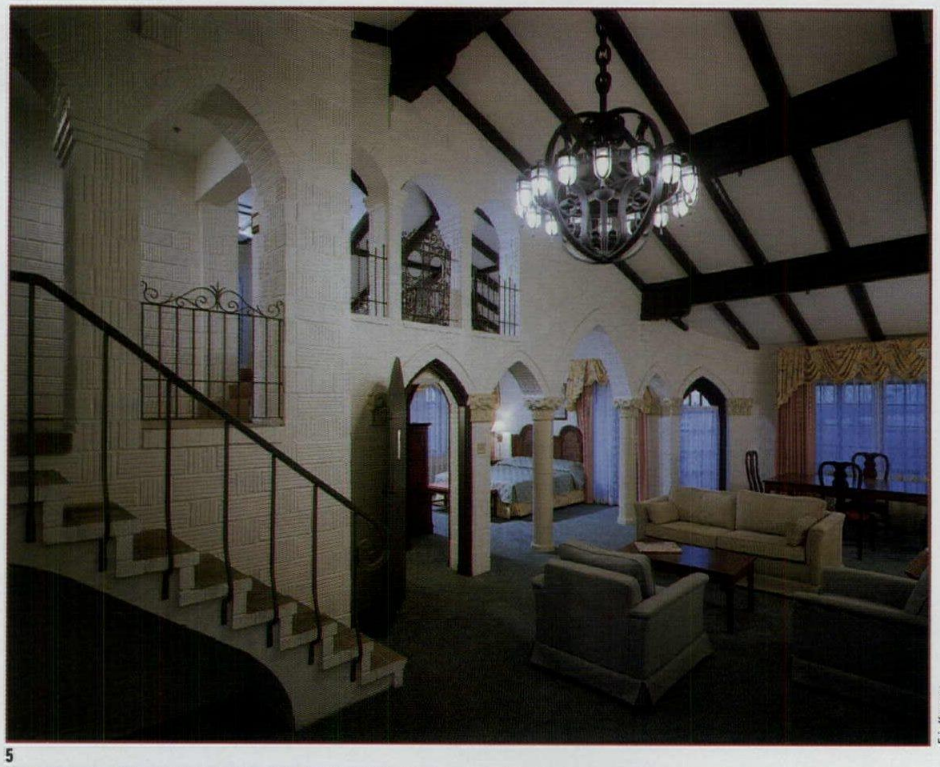


FOURTH FLOOR PLAN

Guests enter through the rebuilt arched bell gate from Seventh Street (3), and into the Court of the Birds, passing the swimming pool to the right. From there, guests arrive at the reception desk, with the grand stair behind it (4). Misaligned column loads had caused floors above the lobby to sag, a problem remedied by new structure in the ceiling. Floors and carpets also are new.

Eric Koyama

Guest rooms come in a seemingly endless variety of styles, configurations, sizes, and views. Some have two levels, with small loft spaces above (5), like this one on the upper level of the Spanish Wing. Where concrete shear walls have replaced one wythe of terra cotta tile, new flat tile in the same pattern is used for a facing. The Spanish Patio, open to the sky (6, 7), is lined on two sides by the Cloister and Spanish Wings, with an animated-figure clock in one corner, and idiosyncratic atypical details throughout. The original owner, Frank Miller, had a large collection of bells, some of which are are installed in the Court of the Bells (6, right).



Eric Koyama

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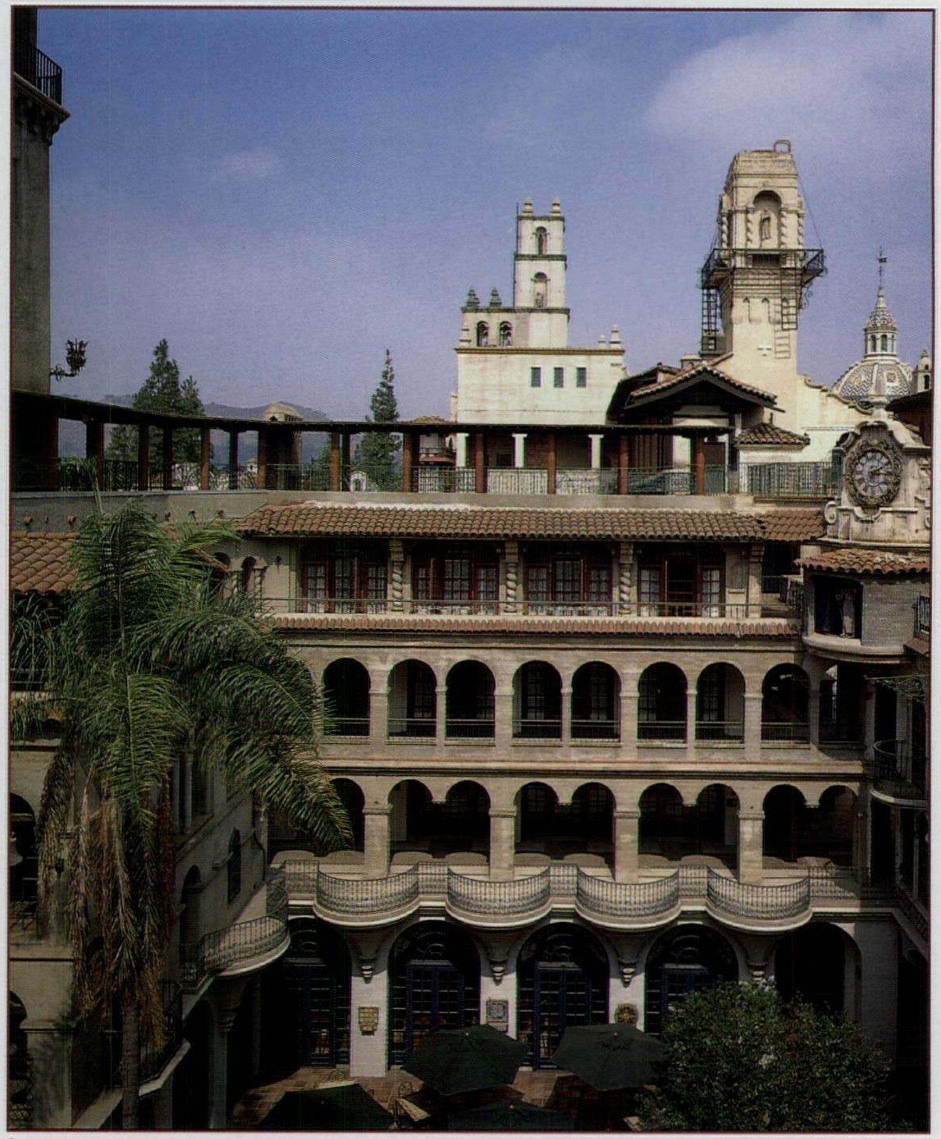
ing the 320,000-square-foot, 240-guest-room complex up to current standards.

And so the inn stands renewed, its furnishings – existing or replaced by the Heinsbergen firm with period styles – complete; its silverware and other appointments ready, its kitchen updated to today's highest level of quality, and its mechanical functions fully restored, it is waiting for an operator to take it over and run it. As of this writing, the inn, except for Steve Huffman and his continuing engineering/maintenance staff, remains unoccupied. Riverside, while apparently healthy and growing (according to recent published reports), gave up much of its resort status to the more recently popular Palm Springs area. Perhaps, with the right management team, the inn will again attract patrons like those who once made the resort so popular.

Over the almost 90 years since it evolved from a house, the Mission Inn was expanded, as noted, and between major expansions was the beneficiary of Frank Miller's love of collecting. From his trips he returned with parts of buildings, ideas for buildings, appointments for buildings, and various *objets*, including a large number of bells from all parts of the world. Because of his varied tastes, and his largess where the inn was concerned, the result was, predictably, a cultural hybrid. The complex fits no neat category, stylistically; yet it is a compelling mélange for all of that. Its restoration is a skillfully executed project, setting up a good possibility that Riverside, and the inn, will return to the destination list for the discerning traveler.

Jim Murphy ■



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Project: *Mission Inn, Riverside, California.*
Architects: *ELS/Elbasani & Logan, Berkeley, California (Barry Elbasani, principal in charge; Kurt Schindler, project architect; David Fawcett, Steven Heisler, Larry Mack, and Michele Vonk, project team).*
Client: *Chemical Bank,New York; owner's representative, Joseph L. Yousem Company, Los Angeles; owner's field representative, Steve Huffman.*
Site: *entire city block in downtown Riverside, bounded by Sixth, Orange, and Seventh Streets and the Main Street Mall.*
Program: *renovation of a 320,000-square-foot hotel, including upgrading seismic resistance, mechanical and electrical systems.*
Sructural systems: *Mission Wing, original wood frame/brick masonry structure reinforced with concrete and plywood shear panels, steel columns, and horizontal steel tube truss; Cloister and Spanish Wings, original concrete frame with terra-cotta masonry infill supplemented by new concrete shear walls; Rotunda (International) Wing, concrete shear walls added to original cast-in-place concrete for structural support.*
Major materials: *Mission Wing (exterior) cement plaster, wood trim, tile roofs, (interior) plaster walls, wood ceilings, terra-cotta walls; Cloister Wing (exterior) cement plaster, natural concrete, tile roofs, (interior) plaster walls, wood ceiling; Spanish Wing (exterior) cement plaster, natural concrete, wood, terra-cotta masonry, tile roof, (interior) plaster and terra-cotta tile walls, wood and plaster ceilings; Rotunda (International) Wing (exterior) natural concrete, terra-cotta masonry, tile roofs, and ceramic tile dome, (interior) plaster and terra-cotta tile walls, wood and plaster ceilings (see Building Materials, p. 152).*
Mechanical system: *central gas-fired boiler and chilled water, individual fan coil units for guest rooms and public spaces.*
Consultants: *Architectural Resources Group, historic consultant; A.T. Heinsbergen & Company, interiors; Johnson & Neilsen, structural; JCA, mechanical and electrical; EDAW, landscape; Grenald Associates, lighting.*
General contractor: *HCC Contractors.*
Costs: *not available.*
Photos: *Timothy Hursley, except as noted.*


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Eric Koyama

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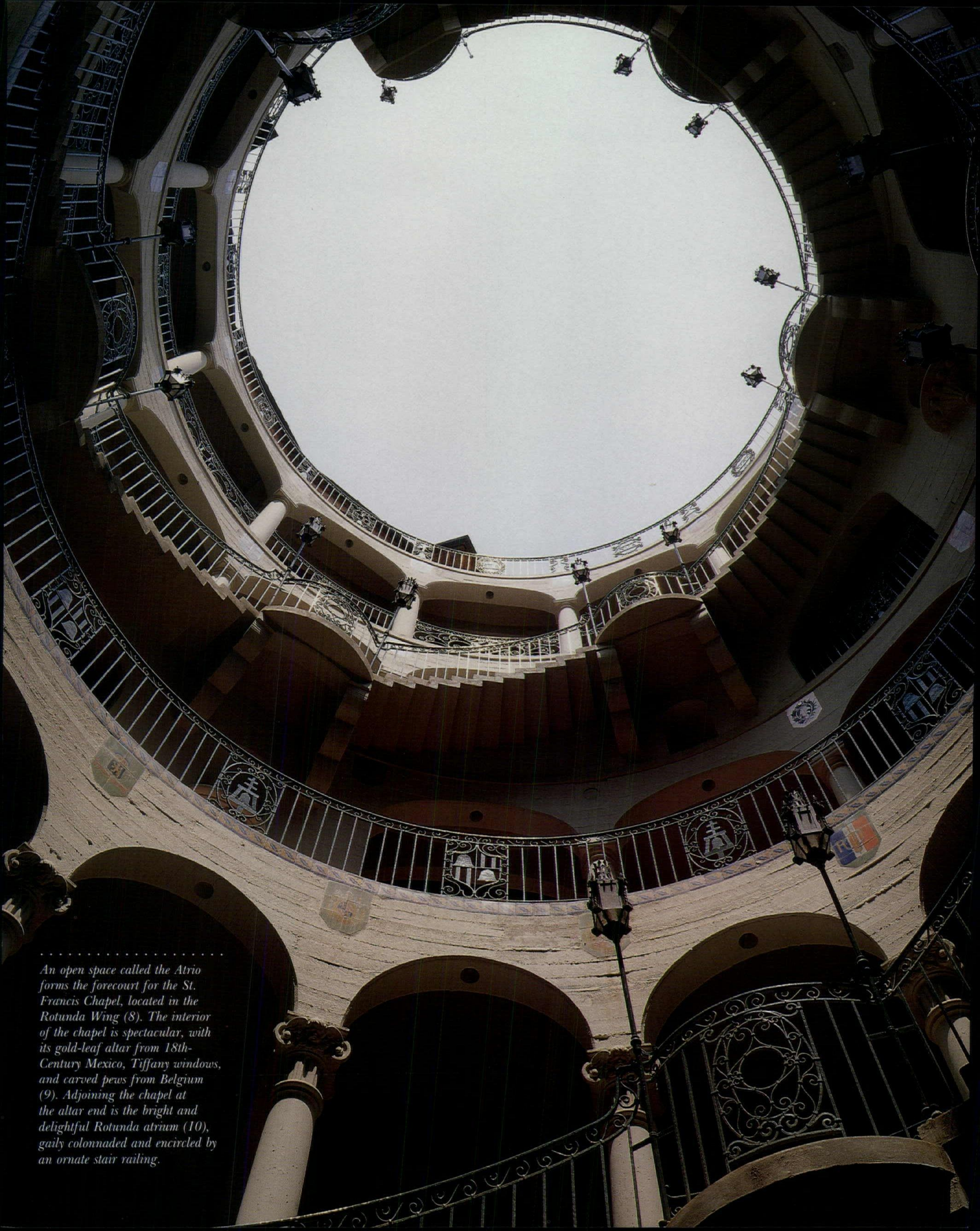
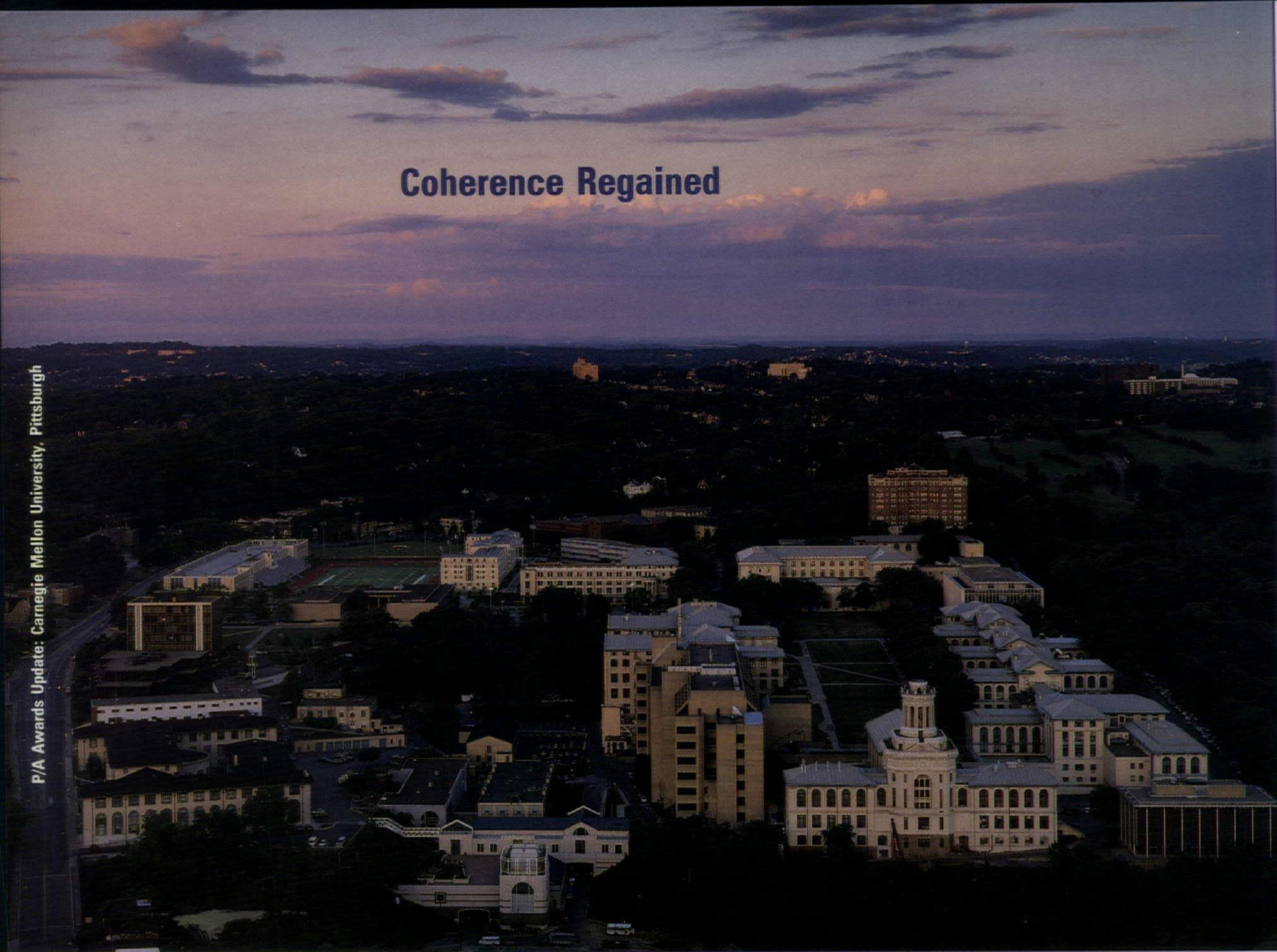


An open space called the Atrio forms the forecourt for the St. Francis Chapel, located in the Rotunda Wing (8). The interior of the chapel is spectacular, with its gold-leaf altar from 18th-Century Mexico, Tiffany windows, and carved pews from Belgium (9). Adjoining the chapel at the altar end is the bright and delightful Rotunda atrium (10), gaily colonnaded and encircled by an ornate stair railing.

Coherence Regained



P/A Awards Update: Carnegie Mellon University, Pittsburgh

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The first buildings constructed under Carnegie Mellon University's new campus plan display a learned respect for the school's original architect.

The East Campus project (1, upper left) is the first phase of a plan to connect the newer part of the Carnegie Mellon campus to the original quadrangle. The new buildings in this phase are a dormitory/dining hall (2) and a parking garage/stadium (3), built on either side of a field and track to create an "athletic quadrangle."

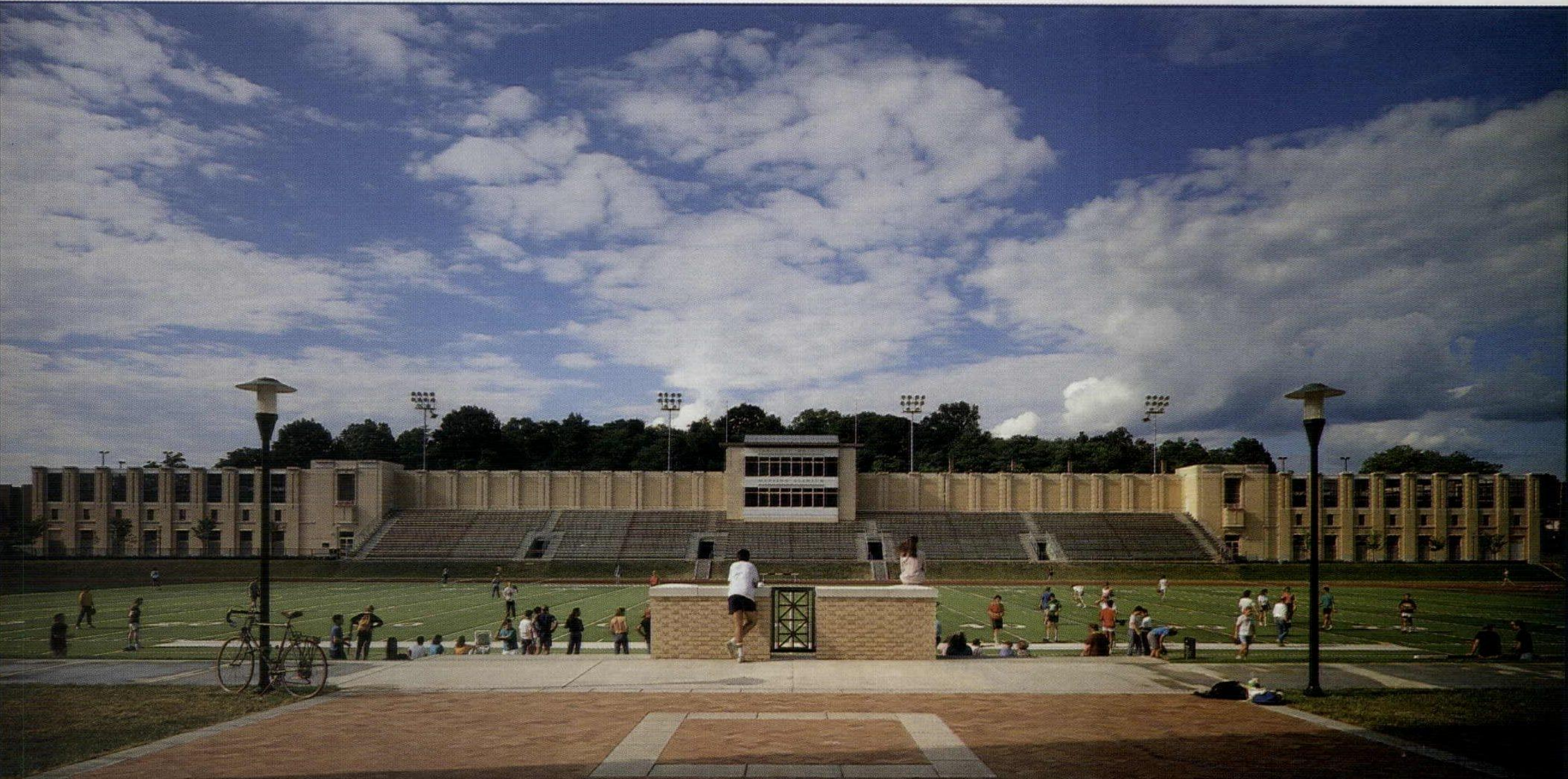
Carnegie Mellon University is notable not only for its amiable quadrangle plan – the result of a 1904 competition won by New York architect Henry Hornbostel – but also for the self-effacing but surprisingly rich Hornbostel buildings that support that plan. Michael Dennis, Jeffrey Clark, and TAMS Consultants clearly paid attention to their predecessor in their own 1987 competition-winning plan for the campus.

Their plan, cited in the P/A Awards (Jan. 1989, p. 113), called for new axes and well-defined outdoor rooms, reflecting both Hornbostel's precedent and Post-Modern urban design theory. Now, with the completion of the plan's first phase, the architects have shown an affinity for the quiet but quirky Hornbostel buildings as well.

The new buildings, a parking garage and a dormitory, might not stand individually as great architecture, and their interiors betray the budget problems that seem to plague university work. But they are successful as placemakers, strengthening every part of the campus they address. The parking garage presents a handsome face to Forbes Avenue, forming a strong campus edge, while the dormitory defines an important new pedestrian route between the main campus and some existing dormitories. Perhaps most inventive, though, is the siting of the buildings on either side of a playing field, forming what the architects call an "athletic quadrangle." The integration of the athletic field into the campus is quite successful, and the bleachers have become a popular gathering space.

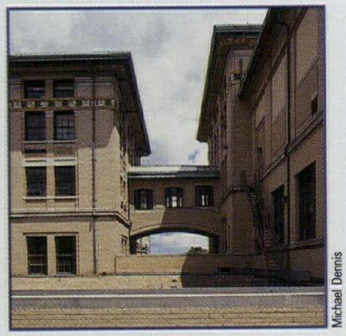
In the dormitory building, the architects used materials and forms similar to those of the Hornbostel buildings, but developed a language compatible with contemporary construction methods. Through the use of shallow relief, the articulation of the penthouses and the dining hall as separate volumes, and the lively brick and mullion patterns, the architects gave the buildings just enough per-

2, 3



Hornbostel's Campus

Henry Hornbostel came to Pittsburgh in 1904 after he won the competition for CMU's campus plan. He stayed for more than 30 years, founding the university's school of architecture and designing most of the campus buildings according to the plan he was constantly refining. The heart of this plan was a hillside quadrangle, with a power



Michael Dennis

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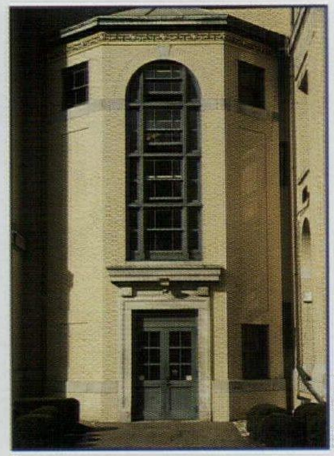
plant (topped by a round temple) at the lower end, the architecture and fine arts building at the upper, and a row of alternately protruding and receding façades on either side.

Hornbostel's buildings are almost always subservient to the plan, and at first seem unassuming and unremarkable. But their real energy is in the detailing. Hornbostel varied the treatment of the ubiquitous yellow brick by using subtle changes in color and coursing. The architecture



Michael Dennis

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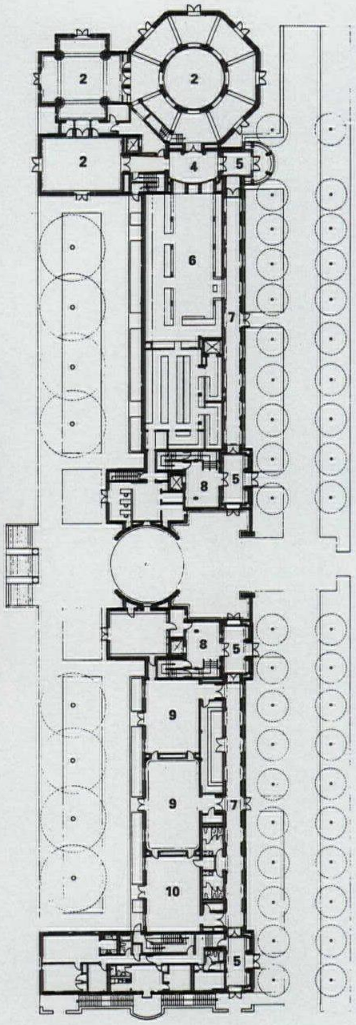
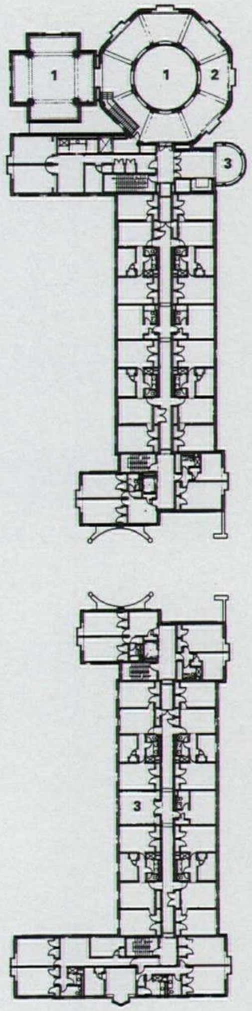
and fine arts building is the most engaging, with plans of landmarks such as St. Peter's and the Parthenon embedded in the floor.

Hornbostel's articulation of wall surfaces (4) and use of small subsidiary volumes (5) are among the ideas the East Campus architects borrowed.



FIRST FLOOR PLAN: DORMITORY

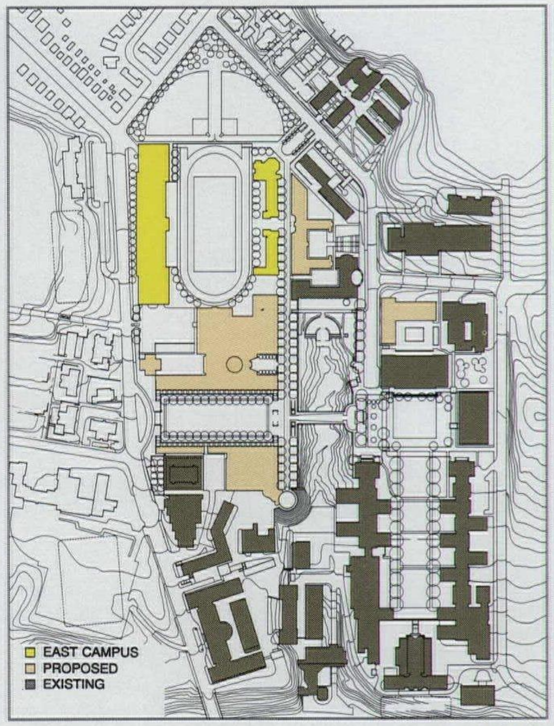
N 100'/30m



SECOND FLOOR PLAN: DORMITORY

The octagonal dining hall (6) serves not only the new dormitories but also the old ones across Margaret Morrison Street. The new building also defines a new pedestrian route to the main campus from these dormitories. On Forbes Avenue, the parking garage façade (7) is articulated as a semi-transparent fence, making it more palatable to neighbors who were at first opposed to the garage's location. The dormitory façade (8) is activated by a constant play of reveals and extrusions.

1 OPEN TO DINING
2 DINING
3 STUDY
4 DINING LOBBY
5 ENTRANCE
6 FOOD SERVICE
7 LOGGIA
8 DORMITORY LOBBY
9 MULTI-PURPOSE ROOM
10 COMPUTER ROOM



SITE PLAN WITH PROPOSED BUILDINGS

N 300'/100m

sonality to engage the viewer while still allowing them to recede into the campus.

The dining hall interior shows some of the same diversity of form and experience found outside. While the student rooms are generous but unremarkable, the dining hall is unusually innovative. Tables are dispersed in a two-story rotunda and in two relatively small rooms, allowing a choice of intimate or communal dining.

The next phase of the project, a student center, will begin soon with the demolition of Skibo Hall, the existing student center just west of the athletic quadrangle. Besides closing off the west end of the field, the new center, by Michael Dennis & Associates and UDA Architects of Pittsburgh, will extend the pedestrian street defined by the dormitory and will form one side of a new quadrangle. Future projects will complete that quadrangle and, if the entire plan is carried out, will restore a ravine that once ran through the middle of campus. CMU has displayed admirable vision in allowing this thoughtful plan to develop this far; if they see it to completion the university will have a campus scarcely equaled in consistent quality and coherence. **Mark Alden Branch** ■

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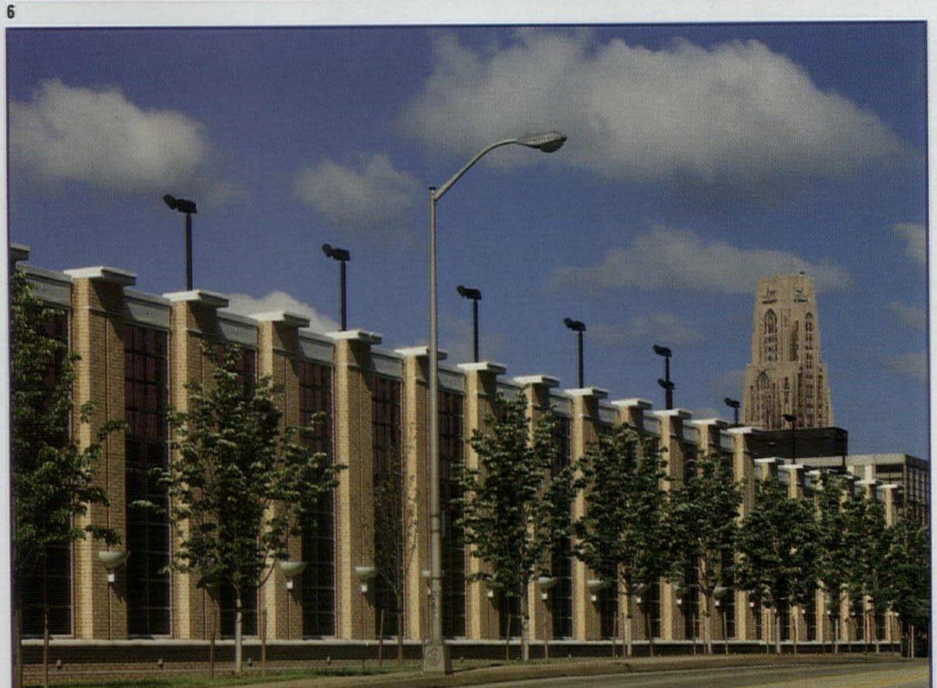

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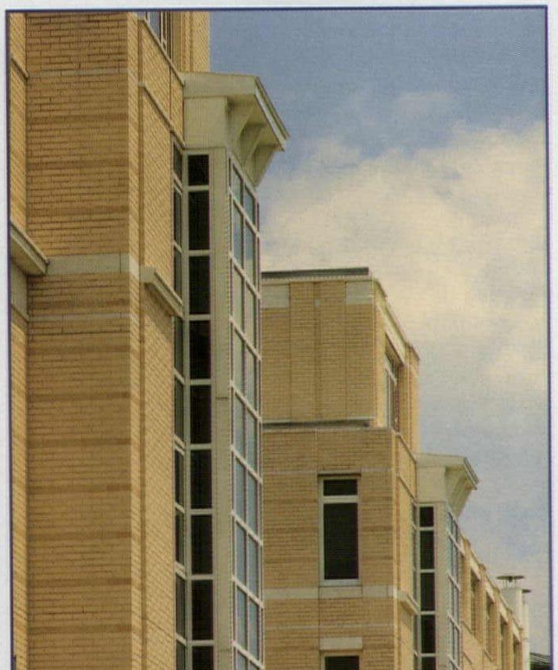

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Project: *East Campus, Carnegie Mellon University, Pittsburgh.*
Architects: *Michael Dennis, Jeffrey Clark & Associates, Boston, in association with TAMS/Architects, Engineers and Planners, Boston. For Dennis, Clark & Associates: Michael Dennis (now a principal of Michael Dennis & Associates), Jeffrey Clark (now a principal of Jeffrey Clark, Lawrence Borins & Associates), principals in charge of design; Erik Thorkildsen, project designer; Lori Geissenhainer, designer; Ed Bakos, Celeste Brown, Tim Downing, Richard Hougton, Jay Lampros, Maureen Ward, Maria Santos, project team. For TAMS: Chris Iwerks, principal in charge; Deborah Allen, project manager; David Lunny, Jonathan Knowles, Richard Streetman, Margaret Sledge, Shannon Scarlett, Tod Thiel, Chris Ingersoll, Umberto Guarracino, project team.*
Client: *Carnegie Mellon University.*
Site: *area of existing campus outside the original quadrangle.*
Program: *new dormitory/dining hall, parking garage, stadium, and playing fields.*
Structural systems: *concrete masonry and concrete bearing walls, precast plank slabs (dormitory); precast concrete floors, steel frame (garage).*
Major materials: *brick, aluminum windows, terne-coated steel roof, drywall, quarry tile floors, carpet (see Building Materials, page 152).*
Consultants: *Hanna/Olin Ltd., landscape; Simpson, Gumpertz & Heger, structural; AM-Tech Engineers, mechanical; A.M. Fogarty, cost estimating; DiGeronimo Associates, athletic consultant.*
Construction manager: *Barton-Malow/McAnallen.*
Costs: *$32,493,000.*
Photos: *Jeff Goldberg/Esto, except as noted.*

The interior arcades of the dormitory (9), with their vaulted ceilings and brick pilasters, most closely recall Hornbostel's work. The cross-axial dining pavilion (10) is less impressive without the brick veneer that was planned, then scrapped for budget reasons. Dining in the facility is scattered; students can eat on two levels of the rotunda (11) or in either of two other rooms.

9

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Perspectives

Alan Hess finds much that works in the Brazilian capital three decades after its founding.

Report: Back to Brasilia

"A city of Kafka," said Bruno Zevi. Simone de Beauvoir skewered its "air of elegant monotony." "A ceremonial slum of rusting metal, spalling concrete, and cracked stone veneers," sneered Robert Hughes. Brasilia, that architectural Rorschach test, embodied all the passions and most of the sins of Modern architecture at its inauguration 30 years ago. Now that the Brazilian capital has reached a less radioactive half-life, it is safe to journey back for another look. Clearly there were drawbacks to building an entire metropolis in the four short years of one president's term. Yet fears – and hopes – that it would crumble into Brazil's Planalto have proved unfounded. Brasilia has become a city.

It is always informative to see visions built. They usually fall short, but the reasons are always fascinating. A few cracked columns do not constitute a penetrating criticism of Brasilia; *all* of Brazil is rusting and spalling these days. Economic chaos takes a toll on visionary architecture. That sort of contradiction has always been part of Brasilia: Founded under a democracy, the city has spent most of its existence as the capital of a military dictatorship; behind the dazzling façades its offices are overstaffed, but underequipped; in a city designed for the car, most citizens still cannot afford one.

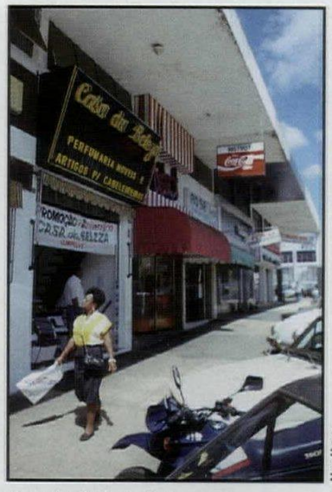
Brasilia cannot compete with the drama of Rio de Janeiro, where planeloads of affluent bureaucrats and lobbyists still head every weekend. But if it hasn't succeeded in turning itself into a great city it still has advantages. Notably unlike cosmopolitan São Paulo, the air is pollution-free – thanks to the fact that it has remained a one-industry town. Unlike Rio, the climate is comfortable year-round. The traffic is bearable, by Brazilian standards. It has a real downtown crowded with street markets and people. Brasilia has avoided many of the oppressive problems of other Brazilian cities, admittedly by foisting 2 million of the Federal District's 2.5 million people onto nearby satellite cities.

But Brasilia was never intended to be a model city; planner Lucio Costa saw it as an ideal national symbol. Though still politically controversial, its architecture clearly captures a national character and history. It is more than Modern.

First, Brasilia is a city wedded to the landscape. Towering clouds dominate the blue skies over a bowl-shaped horizon, yet nature's prominence does not dwarf Oscar Niemeyer's herd of white monuments visible in the distance; instead they focus the landscape's qualities. The bureaucracy may mirror Kafka's, but the city itself is anything but claustrophobic. Widely-spaced monuments allow distant panoramas to flow into the public spaces in ways Beaux-Arts planning never made possible. The rectilinear Congress towers, the shallow white domes and bowls of Senate and Assembly – these are abstracted echoes of their surroundings.

"Brasilia was never intended to be a model city; planner Lucio Costa saw it as an ideal national symbol."

Facing one of the esplanades.



Alan Hess

A typical shopping street.

Like the clouds, the entire city floats – in pools reflecting the sky, or on slender columns lifting buildings off the ground like ballerinas *sur pointe*. The congress roof is a white marble plaza floating above the Planalto, touching down ever so lightly at four corners. As in the best of Brazilian Modernism, Modernist pedantries have been invested with the romance of a place and the visual riot of Brazilian nature.

But once again the gap between symbol and reality is wide. The architecture may speak poetically of nature, but the reality is darker. The first highways tying Brasilia to Belem and Rio were the first major incursions of civilization into Amazonas. The capital's political founders meant the city as the symbolic spark for massive development of Brazil's interior – development which has had fearful consequences for the rain forest, the Indians, and the lower classes that trusted an economic miracle in the wilderness. The progress that gave Brasilia life has devastated nature.

"The street does not exist in Brasilia and never will," complained Simone de Beauvoir, but she was wrong. Streets in the Parisian sense may be absent, but today it is clear that streets in the Los Angeles sense are the glue that holds the city together. Lucio Costa's initial sketch for the city was a savvy transportation diagram that skillfully distinguished the dual functional and ceremonial roles of the car in the modern city. Brasilia was the first Roadside Capital.

The north-south axis is a functional service artery linking the banking, commercial, and residential sectors. Robert Moses (who should know) complained that Brasilia looked like a world's fair; whizzing through the rows of six-story residential blocks, one is reminded of Norman Bel Geddes's GM Futurama for the 1939 New York

View along the monumental axis, which is lined with ministry buildings and the cathedral and terminated by the Congress towers.

Fair. Motoring along a tree-lined parkway at a safe and efficient speed, you glimpse other cars negotiating smooth cloverleaves into the residential districts. Some streets are taxed at noontime rush hours, but Brasilia is still a dream of motoring long since forgotten in North America.

The *superquadras*, hallmarks of Brasilia's housing scheme, are surprises too. Instead of becoming desolate Pruitt-Igoes, they turned into real neighborhoods. Schools, churches, and shopping streets are all within an easy walk. Though suffering from a general lack of maintenance, the standardized six-story blocks aren't overwhelming; the car-less courts and gardens that tie several residential buildings into one superblock are a model of urban diversity.

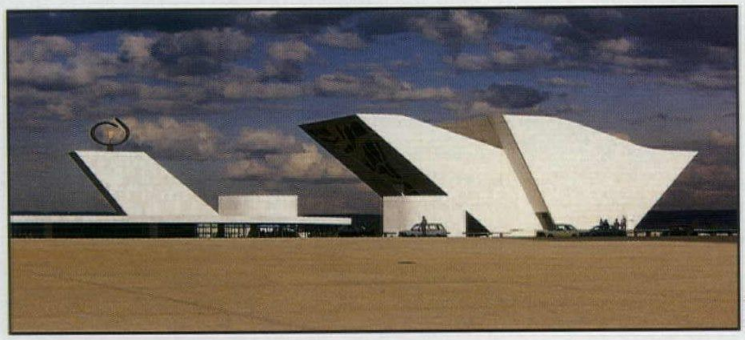
The city's other main axis, or Eixo Monumental, is a ceremonial boulevard properly viewed from a visiting potentate's motorcade. Costa and Niemeyer recognized that the vast landscape imposed a scale on the city that could only be matched by the rhythms and pace of the car.

Imagine Los Angeles built to the program of Washington, D.C. But instead of carwashes and gas stations, Brasilia applies the architectural rules of the road to ministries and monuments. The sprawl is artfully composed. North Americans may have invented the strip, but Brazilians first grasped its monumental potential.

The Cathedral is the perfect strip building, a bold symbolic form set off by itself. Appearing larger than it is, it warps space as it passes. Its warm gray concrete doglegs were recently painted blinding white, and the clear infill glass has been replaced with swirls of stained glass.

Beyond the Cathedral come the ministries, a dozen and a half identical blocks that form a rhythmic gateway down the esplanade. Strict zoning ordinances have, miraculously, survived several political administrations. The mushrooming bureaucracy's pressing need for office space has been filled with lower buildings stretching at right angles to the axis. The parade of ministries is accented by the two senior in rank, Justice and Foreign Relations, distinguished by rugged concrete arcades and water gardens by Roberto

"The progress that gave Brasilia life has devastated nature."



Alan Hess

The Pantheon, a recent design by Niemeyer.

"North Americans may have invented the strip, but Brazilians first grasped its monumental potential."

The author is an architect and critic for the San Jose Mercury News.

Burle Marx, recently restored. The vista is punctuated by the Congress towers (the closest thing to a billboard on this strip) at the broad Plaza of the Three Powers. Its delicate original buildings have been joined by a heftier, more sculptural new building by Niemeyer, a Pantheon.

The city plan's consideration of the car stands out more plainly today than at its inauguration, but so do its weaknesses. Though almost the only way to get from building to building is to drive, the connections are sketchy. Parked cars jam the small parking lots and streets in front of major buildings. Dirt paths worn by the shoes of petty bureaucrats criss-cross the grass esplanade. While the Planalto Palace has spectacular floating ramps to lead beribboned dignitaries from limo to lobby, the Foreign Ministry's ceremonial entry lacks even the pomp of an ordinary Brasilia bus-stop – which has large concrete leaves, also designed by Niemeyer, curling over themselves.

But Brasilia isn't finished; Washington, D.C., didn't look impressive 30 years after it was built, either. Large sectors of untouched native scrubland remind us of how much history Brasilia has in front of it. Travel the Monumental Axis away from the Plaza of Three Powers and the Brasilia strip becomes haphazard: Large unfinished projects – the convention center and football stadium – mix with major buildings in the middle of nowhere; the Armed Forces headquarters stands on a boulevard that can double as a landing strip.

Brazilians are still divided by Brasilia. Many in the upper class will never forgive Kubitschek or his capital for bankrupting the country. Though old enough to have its own ruins (Niemeyer's Brasilia Palace Hotel, gutted by fire, is a romantic modern ruin), Brasilia may be too young to judge. For now the Modernist Roadside Capital takes its place alongside Neo-Classical Washington, D.C., and the Neo-Gothic Houses of Parliament. As a backdrop for the theater of government, its crisp lines and distant vistas show up well on the evening news. **Alan Hess** ■

Calm eye to the future, **Oscar Niemeyer** takes stock of the architect's creative liberties and political limitations.

Interview: Oscar Niemeyer

At age 83, Brazilian architect and 1988 Pritzker Architecture Prize laureate Oscar Niemeyer is still practicing in his penthouse office overlooking Copacabana Beach in Rio de Janeiro, city of his birth. He continues to design alone, leaving the execution of his sketches to his architect granddaughter. His world-famous house in suburban São Conrado, empty since the architect moved to an apartment, has been named a city landmark and is to be renovated as a museum of his work. Daralice D. Boles, a former Senior Editor of P/A now living in Rio de Janeiro, visited Niemeyer at his office in March.

P/A: I would like to talk with you about the relationship of architecture to social problems, a subject that you have often addressed over the years. What do you consider to be the architect's specific responsibility with regard to problems of society at large?

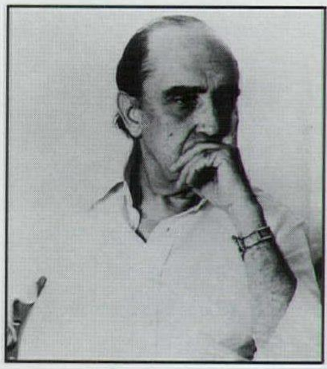
Oscar Niemeyer: The architect needs to study these problems as they relate to man, his country, and the world at large, so that he may learn to work in a more humane, more sensitive, and more comprehensive manner. For example, here in Brazil, if an architect were asked to build a new house in a favela or slum, he would do so. But if he were better informed, he would recognize that the favela is a social problem, the product of a vast migration from the countryside to the city. Knowing that, he would study his problem with greater profundity.

But in general, the architect has little influence in the life of the city. The architect works within the confines of an office; he has only those projects that are given him, thus he is not able to choose his own path.

The problems of Rio, as you know, are those of misery and discrimination. Brazil is a country with many poor people and few rich ones. It is this discrepancy that creates social problems, such as street assaults and robberies. On the other hand, the Brazilian bourgeoisie wants to show off a richness that in reality it does not have. This creates a disequilibrium: The man in the favela regards the city as an enemy. The poor cannot improve their condition and thus can only protest, while the rich are not prepared to regard the poor with greater humanity.

The problem in Rio is compounded by excessive density. A city built for two million inhabitants cannot serve 10 million. Circulation in the city is strangled; the avenues have become corridors. Forty years ago, Rio was a very different city, a romantic city, where one could walk at a leisurely pace, window-shopping. Now, to go to the center of the city is to descend into a teeming multitude of the afflicted. A city in theory can have as many as 30 million inhabitants, but it must be made for that number.

P/A: Do you believe that the architect has a greater responsibility than other citizens to address these issues?



Pritzker Architecture Prize

Oscar Niemeyer

"I pay no attention to critics. I do what I like. At the same time, I do not think of eternity. Everything finally ends."

Niemeyer: The architect has no influence. I have complained of this for a long time without success. The real power is real estate, which here in Rio has invaded the hills and green countryside with horrific results.

Now, if you wish to speak of architecture, we in this office are now producing an architecture that has a greater relationship with the old architecture of Brazil: a freer, baroque architecture tied more directly to our climate, an architecture that seeks to use technology in all its possibilities. For example, the library in the Memorial to Latin America in São Paulo has an expanse of 90 meters, the size of a football stadium. We designed a 90-meter beam that is supported by a series of concrete curves which in turn form the space of the library. We believe that there is thus a direct tie between the technology that permits unobstructed space and the space itself. The architect should be free to do what he wants without preoccupation with rules or other preconceptions. The curve is present throughout nature; there is no need to be afraid of it. Why should we have chosen a more rigid, quadrilateral form when the curve was the most practical solution?

P/A: Do you consider your work Brazilian?

Niemeyer: A French architect, Marc Emery, once said something that pleased me greatly: He said that Brazilian architecture was the only independent branch of modern architecture. I was also greatly pleased when Le Corbusier climbed the ramp of the Planalto in Brasilia and said, "Here, there is thought." Architecture must have thought behind it; if not, it is not architecture.

P/A: The Modern/Post-Modern debate that raged in the United States does not appear to have reached Rio in any meaningful way.

Niemeyer: The influence of the United States here in Latin America is not always for the best, even in terms of architecture. But the Post-Modernists are already finished. There was a time when I first started in architecture and they criticized my work as too baroque, saying that it was overdone and subtechnical. Now, however, those same functionalists, as I thought 40 years ago, have grown tired of always making the same thing. They went looking for a different architecture, and they ended up with Post-Modernism.

I play freely with structure. Formerly, when you saw a building under construction, you saw only the posts and beams; you had no idea how

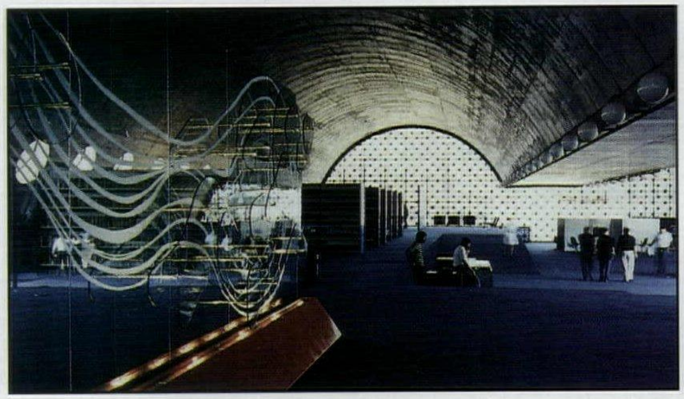
Memorial to Latin America, São Paulo: Overall views of the complex completed in 1988.

the building would turn out. But when I designed the Congress Buildings in Brasilia, when the structure was ready, the architecture was already there. In the President's Palace, when the columns were in position, the design itself was done. My architectural fantasies are always allied to a strong structure that is its own architecture.

"Architecture must have thought behind it; if not, it is not architecture."

P/A: In the book *Art in Brazil,* you wrote that of the two types of modern structures, steel and concrete, you preferred concrete because it showed itself, the way in which it was made. But steel too can be made self-evident.

Niemeyer: I do not like metallic structures because they require rectilinear designs. . . . I also do not like a type of overly professional architect. For me, the architecture itself is most important. Frank Lloyd Wright, for example, always strove to make something beautiful and inventive, within the technical possibilities of his age.



Interior of the library, part of the Memorial complex.

I would like to change what architects learn in school. Architects need to learn to write – not to make literature, but to know how to write clear, simple texts. I believe further that the architect must be schooled in the problems of his society. He must know how these problems are made manifest physically in the city. Those who live here in Brazil know that it is a poor country, without question. Only a very insensitive person could see the misery and feel happy. Thus I have this political preoccupation, which is finally more important than my architecture.

"Only a very insensitive person could see the misery [in Brazil] and feel happy. Thus I have this political preoccupation, which is finally more important than my architecture."

P/A: You still to a large extent represent Brazilian architecture to the world at large. What do you think of that position?

Niemeyer: I don't leave [this place]. It is they who come seeking me – journalists, architects. But after a certain age, you start to think that you need first to work, to talk to friends, to take a bit more pleasure from life. I pay no attention to critics. I do what I like. At the same time, I do not think of eternity. Everything finally ends.

P/A: What projects do you have under way now?

Niemeyer: I have just finished a theater in São Paulo and am now redesigning an annex to the Federal Supreme Court in Brasilia. I am also designing a theater complex for the interior of the state of São Paulo that will include two theaters for 1000 and 1500, an open-air theater for 10,000 and a theater school. I have other projects in Italy and France, including a music school.

P/A: In the United States more than here, there is great anti-Modern sentiment. Some critics argue that Modernism is a style like any other in architectural history and that it is now finished; others blame Modernism for many urban problems. What do you think of these criticisms?

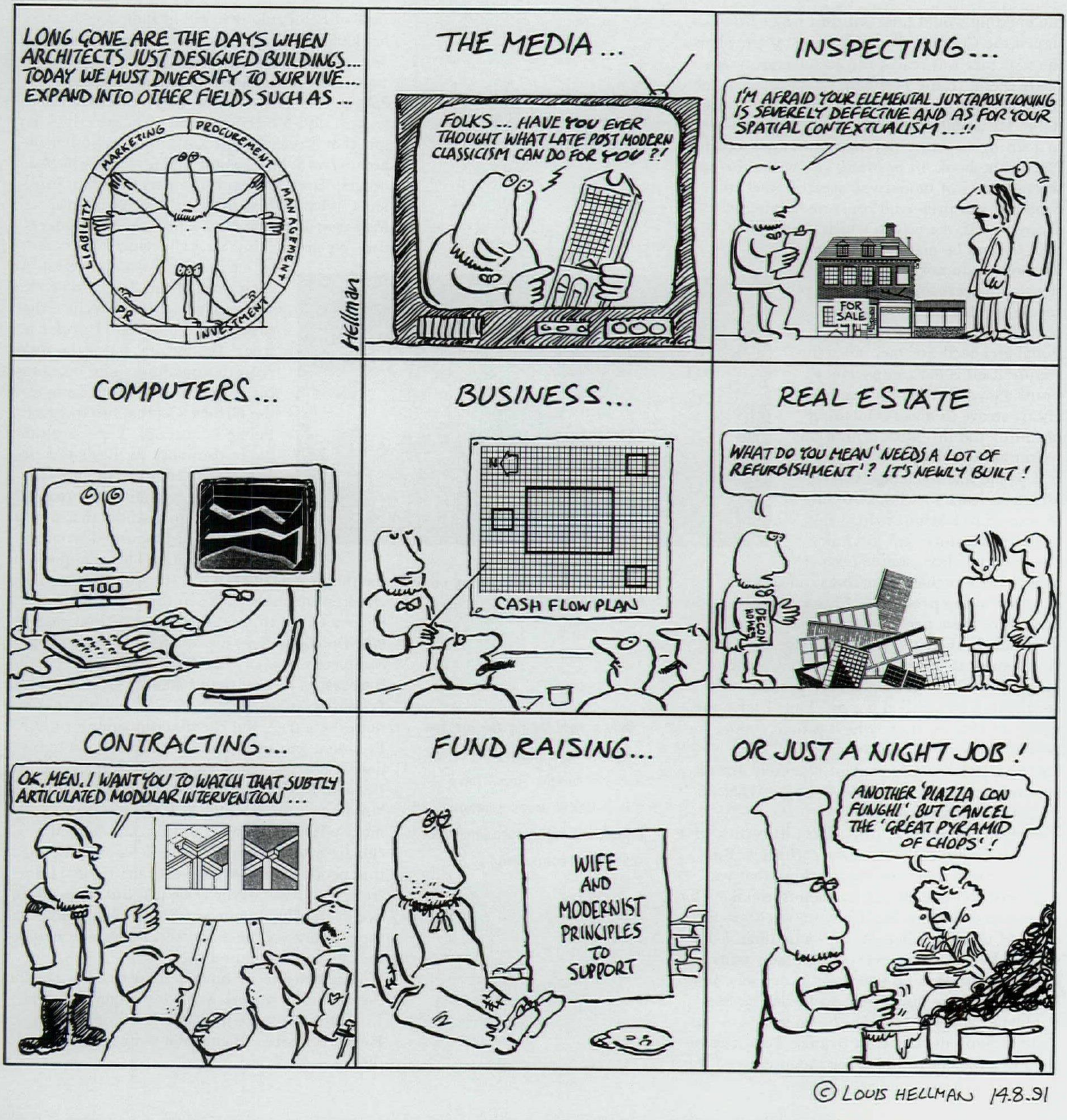
Niemeyer: It depends on what you call Modernism. We are making an architecture influenced by technology, by the materials we have available and the problems we are given, an architecture that clearly reflects its age. I prefer a freer architecture, but if the times require something more economical, we do it. Take, for example, the CIEP's (Centers for Integral Public Education). These are simple to construct, as they come prefabricated. But even though we were to use prefabricated parts, I had to design a school that would be readily distinguished from all other buildings. This is important for the propaganda of the schools, and for the children themselves. When the poor children enter a CIEP, they realize their lives can change.

P/A: Do you believe it possible today to build a completely new city like Brasilia?

Niemeyer: The first time I went to Brasilia with President Kubitschek, there was nothing there, not even a tree. But the determination of the President was such that soon I too began to believe it possible. Now, however, when I go to Brasilia, I think it a miracle. To build a group of buildings in three and a half years is easy, but to make a city is fantastic. Brasilia was created in a climate of optimism. Brazil as a whole believed that people could accomplish such things. I am from Rio; I will never leave [it]. But those who live in Brasilia do not wish to leave that city either. There you have schools, parks, greenery; the city is not polluted.

The struggle we have here in Brazil is not for the quality of materials but for original design. In France, in Italy, they cultivate originality. Here it is more difficult. We must fight for our design. ■

Punchline: **Louis Hellman** resurrects the Renaissance man for hard times.

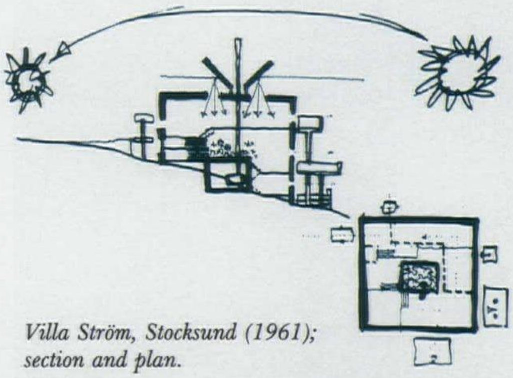


Books Social Forms

Ralph Erskine is the modest creator of some of

Modernism's most durable architecture – a good model for the 1990s,

shaped by social, ecological, and cultural values.



Courtesy Byggförlaget

Villa Ström, Stocksund (1961); section and plan.

Ralph Erskine, Architect *by Mats Egelius, Byggförlaget, Stockholm, 1990, 220 pp., illus., $70.*

Nearly 50 years of practice by Ralph Erskine have produced a significant body of architectural work. Nevertheless, his *oeuvre* remains largely unrecognized outside of Scandinavia and England, for two reasons: Erskine has not actively sought publicity, and the values his work represents have remained out of step with those held by the international architectural mainstream over the past decade.

This new monograph of Erskine's work appears when the last decade's values, shaped by the inequities of economic affluence, are being questioned. Erskine's architecture is shaped by social, ecological, and cultural values. It is an architecture that represents a conscious evolution of the ideals of the Modern Movement.

Born in England in 1914, Erskine emigrated to Sweden in 1939, a move inspired by his deeply felt pacifism (nurtured in Quaker schools) and by his sympathy for the egalitarian values of Swedish social democracy (values engendered by his Fabian-socialist parents). Erskine believes that architecture, like all human activities, must have an ethical and social base; his work lies not in the private, but in the public realm.

While Erskine's public work is quite varied, a large portion of it is housing. Sweden was essential in providing this opportunity: Here the construction of a post-war welfare state called for the equitable housing of its population. This culminated in the "Million-Dwellings Program" of the 1960s and early 1970s, to which Erskine was a major contributor. His work in housing is very user-focused with careful attention to collective spaces, especially outdoors. The image evoked is consistently the village and the common green rather than the city and the urban plaza. While Erskine's housing is an offspring of Modernism, it also embraces the vernacular in non-literal ways. He breaks down masses into human-scaled pieces (often shed-like structures) using materials such as wood and brick and a varied color palette. This work has influenced scores of younger Swedish architects.

The work of Erskine's that has received the most international attention is a housing complex not in Sweden, but in England: the Byker Wall at Newcastle-on-Tyne (P/A, Aug. 1979, p. 66). A project once immersed in controversy, it has stood the test of time and has become a very successful community. Erskine conceptualized the project in the late 1960s, and developed it over 11 years through an intensive user participation process with an on-site architectural team based in the working class community. Erskine is a fervent believer in the participatory design process and a master at group dialogue, with the dexterous graphic skills imperative for the success of this work method.

Forming a mountainous curved wall that embraces a "village" of low-scale housing, the Byker Wall is an audacious gesture that could easily have proved oppressive in less skilled hands. Its parentage is in the unbuilt Algiers and Rio de Janeiro projects of Le Corbusier, The Team X predilection for the linear, and the architecture profession's interest in megastructures during the 1960s. Erskine refined this large-scale type and gave it a human face by breaking down the Byker Wall's mass with his repertoire of materials, balconies, and galleries on the community side. This well articulated side stands in sharp contrast to the barrenness of the northern face of the structure. As in all of Erskine's moves, it is explained in terms of function. The Byker Wall is solar oriented, with its concave wall open to the south and an existing town. To the north lie not only the winter winds but a train line and a superhighway that was never built. Do these conditions really merit the starkness of the Byker Wall's north face? Part of the answer may lie more in a desire to retain formal clarity of the "hard" versus the "soft" edge rather than to express function.

Erskine claims to follow in the path of socially conscious Swedish functionalism. At the same time

(continued on page 153)

Books of Note

Museum Architecture Frankfurt 1980 – 1990 ***edited by Vittorio Magnago Lampugnani, Prestel/te Neues, New York, 1990, 200 pp., illus., $65.***
Equally ambitious in the cultural and corporate spheres, Frankfurt am Main is host to 13 new museums (pages 61–81). This catalogue discusses their stature in post-war Germany's boom town.

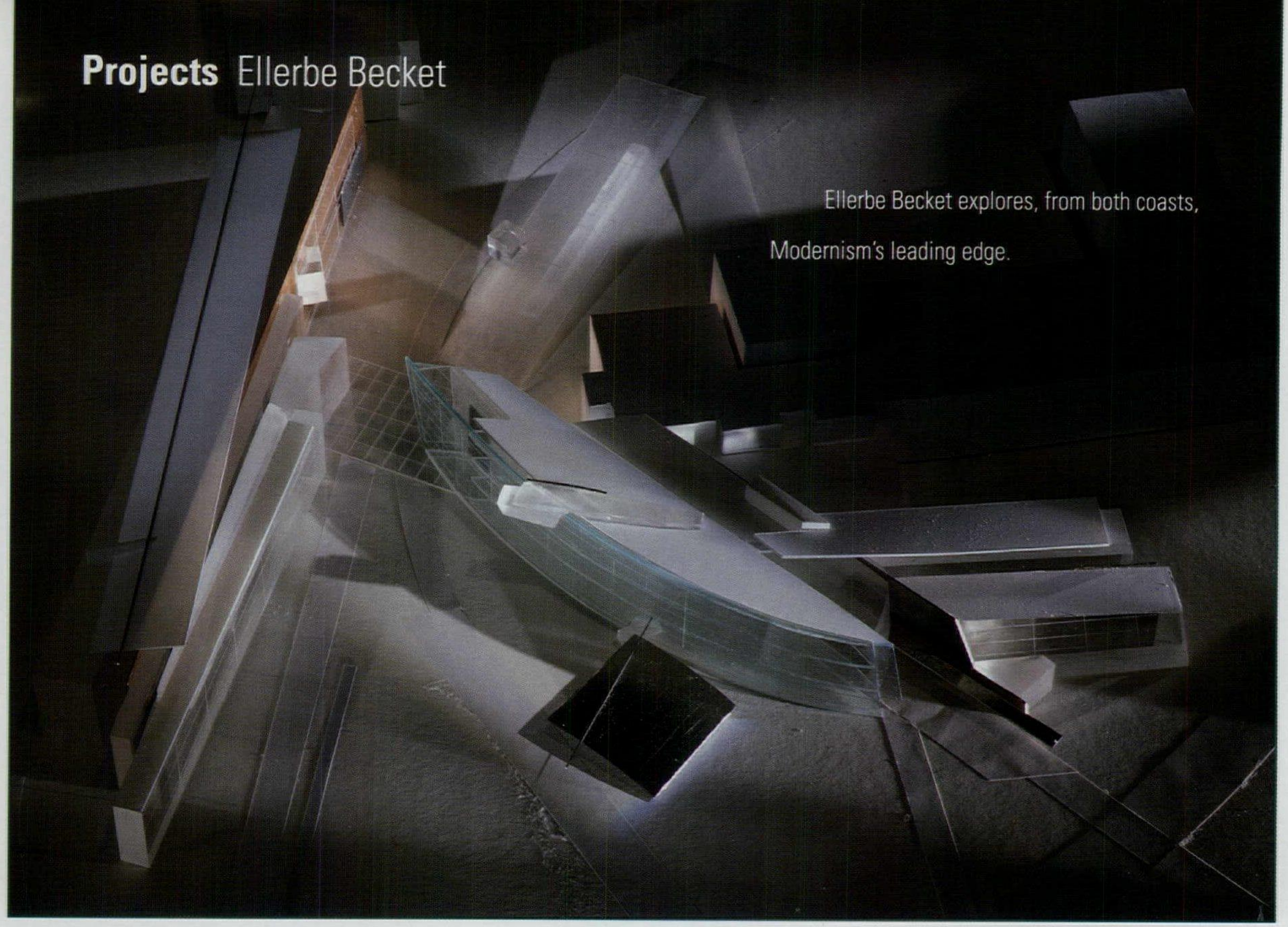
Modern Architecture in America: Visions and Revisions ***edited by Richard Guy Wilson and Sidney K. Robinson, Iowa State University Press, Ames, 1991, 217 pp., illus., $39.95.***
Nine essays by former students of the historian Leonard K. Eaton cover topics ranging from library architecture to Victor Hugo's impact on Frank Lloyd Wright; all share Eaton's contextualist perspective.

Rob. Mallet-Stevens: Architecture, Furniture, Interior Design ***edited by Jean-François Pinchon, MIT Press, Cambridge, Mass., 1990, 135 pp., illus., $30.***
The first English-language monograph on the Parisian architect, this illustrates his relation to the work of other early Modernists.

If You Lived Here: The City in Art, Theory, and Social Activism ***edited by Brian Wallis, Bay Press, Seattle, 1991, 312 pp., illus., $16.95 paper.***
This account of "town meetings" at Soho's Dia Foundation proposes an alliance of urban artists and their disenfranchised neighbors.

Projects Ellerbe Becket

Ellerbe Becket explores, from both coasts, Modernism's leading edge.



1 ACADEMIC BUILDINGS, STATE UNIVERSITY OF NEW YORK AT BINGHAMTON

Being a Modernist is hard: Abandoning received tradition, defying conventional ideas, denying universal truth – few Modern architects have embraced such articles of Modernist faith. Many have adhered instead to the certainty of Classical symmetry, Euclidean geometry, or Cartesian grids. Recently, however, some U.S. architects have ventured into the maelstrom of Modernism, exploring areas left untouched by their predecessors. Among these architects, surprisingly, is the second largest A/E firm in the country, Ellerbe Becket.

Peter Pran and Carlos Zapata in Ellerbe Becket's New York office and Mehrdad Yazdani in its Los Angeles office have grafted onto this solid, service-oriented firm a level of design experimentation that is almost unprecedented in such a large operation. This did not happen by chance: The firm realized, says Yazdani, "that it had to become competitive in terms of design." And it has. Ellerbe Becket has won NYC/AIA Design

photos: Dan Cornish/Esto

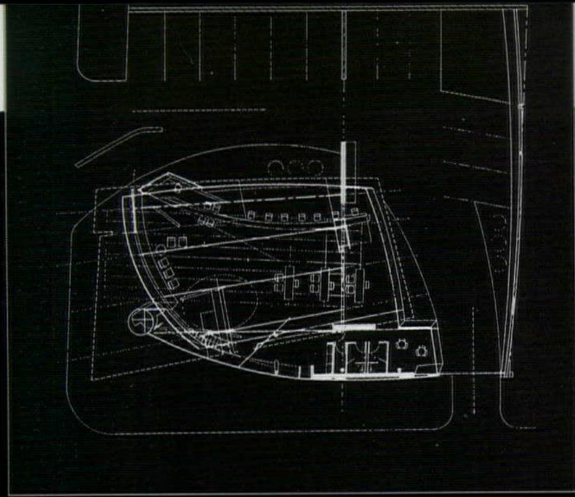
UPPPER FLOOR PLAN

2 RIKSHOSPITAL (MEDOC 2), OSLO, NORWAY

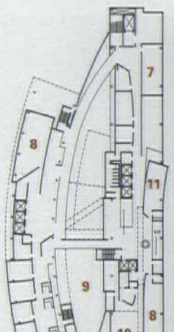
Awards six years in a row, and three consecutive P/A Awards.

In New York, Pran and Zapata have produced a series of buildings composed of curved surfaces and thin planes that seem about to fly apart or take off. "Almost all of our work involves the idea of movement," says Zapata, "and the sense of freedom that that implies." Some projects are literally about the movement of people or goods. Two academic buildings at SUNY Binghamton (1), totaling 130,000 square feet, comprise several fragmented forms that mark the departments housed within and define the path of students entering the campus's main quadrangle from the west. A similar expression of movement guides the design of the $400 million Rikshospital (Medoc 2) in Oslo, Norway (2). Winner of an international competition, the hospital was designed by a team consisting of Ellerbe Becket's New York and Minneapolis offices in association with Bergersen, Gromholt & Ottar, B.W.Project, and Gunnarsjaa & Kolstad of Oslo and Bo Castenfors of Stockholm. To fulfill the requirement that all spaces occupied for more than four hours have natural light, the architects placed diagnostic and treatment rooms in a ladder-like building punctuated by courtyards, and patient rooms in curved wings that fan out into the surrounding landscape. Public circulation, likewise, proceeds in broad, sweeping spaces, and departmental circulation in straight corridors.

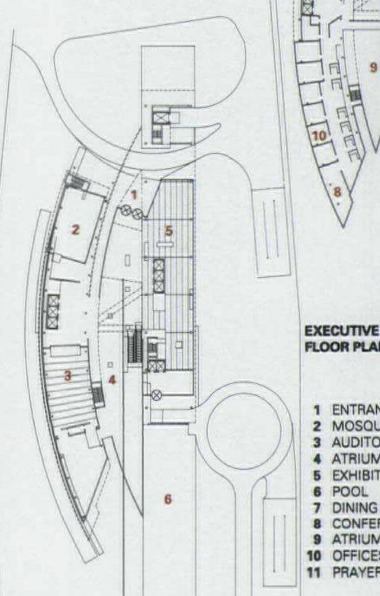
Pran and Zapata also have drawn from movement that occurs in nature. Their design of a 3500-square-foot bank in Quito, Ecuador, (3) is, in their words, a "response to the moving topography of the city of Quito." A curved, stainless-steel-clad roof covers the banking hall, rising like a hill over glass-enclosed service spaces. "The client," says Pran, "wanted to communicate through architecture, not through signage." The movement of the sun was a major determinant in the design of the 320,000-square-foot Bin Laden Headquarters in Jeddah, Saudi Arabia (4). The angled end walls of the 16-story building face east/west to protect it against the sun, while the two office wings embrace a central atrium.



3 BANCO POPULAR, QUINTO, ECUADOR

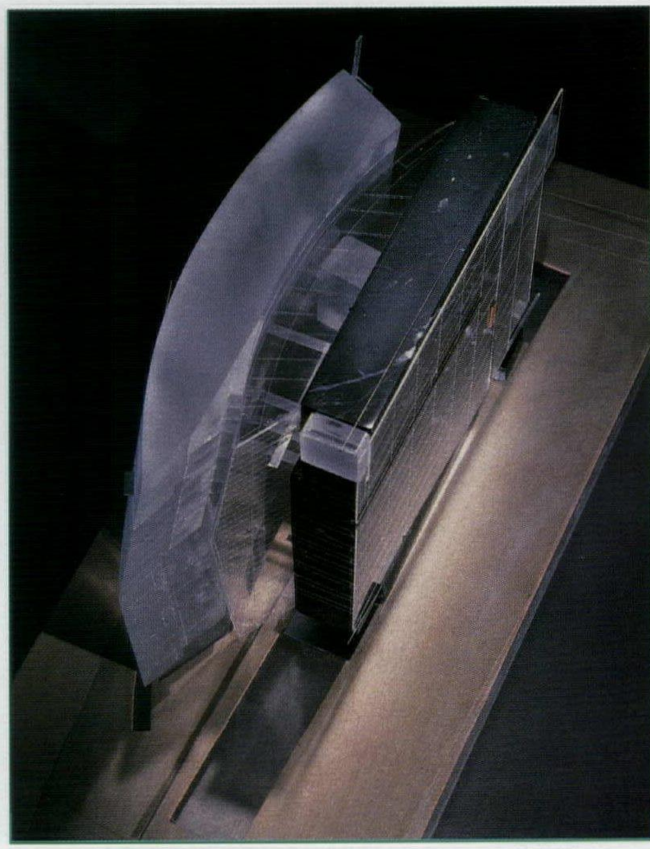


EXECUTIVE OFFICE FLOOR PLAN



1 ENTRANCE
2 MOSQUE
3 AUDITORIUM
4 ATRIUM
5 EXHIBITION
6 POOL
7 DINING
8 CONFERENCE
9 ATRIUM
10 OFFICES
11 PRAYER

FIRST FLOOR PLAN N 100'/30m



photos: Dan Cornish/Esto

4 BIN LADEN HEADQUARTERS, JEDDAH, SAUDI ARABIA

Pran and Zapata design with cardboard and metal models, whose loosely assembled quality is often retained in the finished projects. Mehrdad Yazdani, in contrast, uses painting as a way of exploring formal ideas. His work in the LA office is thus more volumetric than planar, more a series of colliding solids than fragmented surfaces.

Working with artist Robert Millar, Yazdani has designed a Metro station for LA's new Red Line subway that plays upon the idea of ground (5). "We had architecture below ground and on the ground," says Yazdani, "so we decided also to build above the ground, creating a canopy that seems to float."

The almond shape of the canopy appears in many of Yazdani's paintings (6) and in other designs, such as his competition entry for the new headquarters of LA's Rapid Transit District (7). Consisting of a number of intersecting volumes, the tower is streamlined, with a skin of stainless steel and glass.

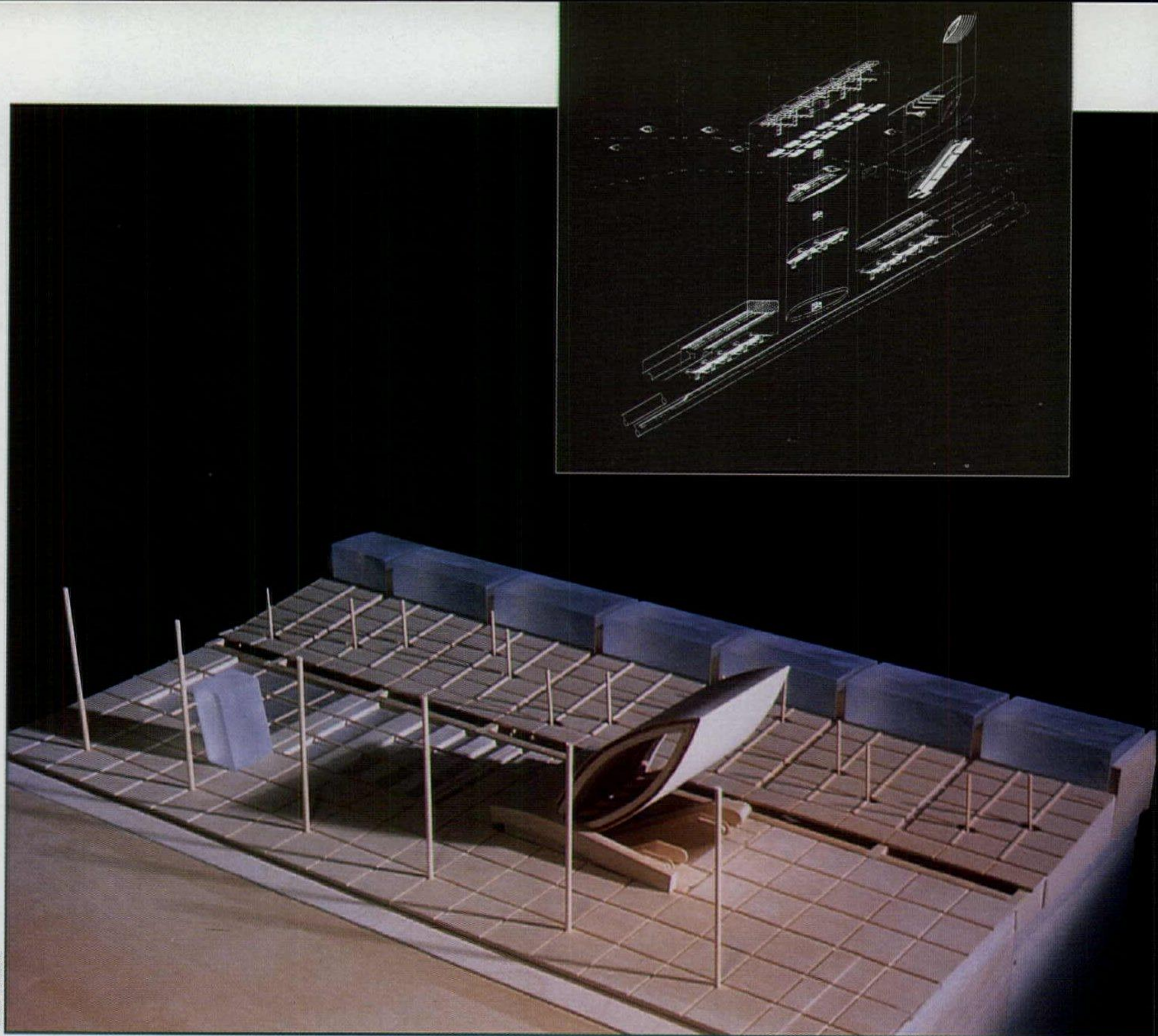
Yazdani's volumetric designs, like Pran's and Zapata's planar compositions, hark back to the early years of Modern architecture before it became codified and rationalized into its own, rigid order. The work echoes that of the Futurists, with their manifestoes on motion, and the Expressionists, with their interest in distorted forms.

These buildings, however, raise the question of just how far architects can go in following the more radical social implications of Modernism. It is commonly held that architecture, because of its dependence upon commissions from clients, is limited in its capacity to defy convention or question behavior. Accordingly, we accept striking disjunctions between daring forms and fairly traditional functions.

But has Modern architecture been too passive about questions of function? The Norwegian hospital, with its major rooms all having natural light, stands out as an example of a building where the radical form is joined by a fairly radical change in function. What if all building programs underwent such scrutiny? That is a question for the true Modernists among us.

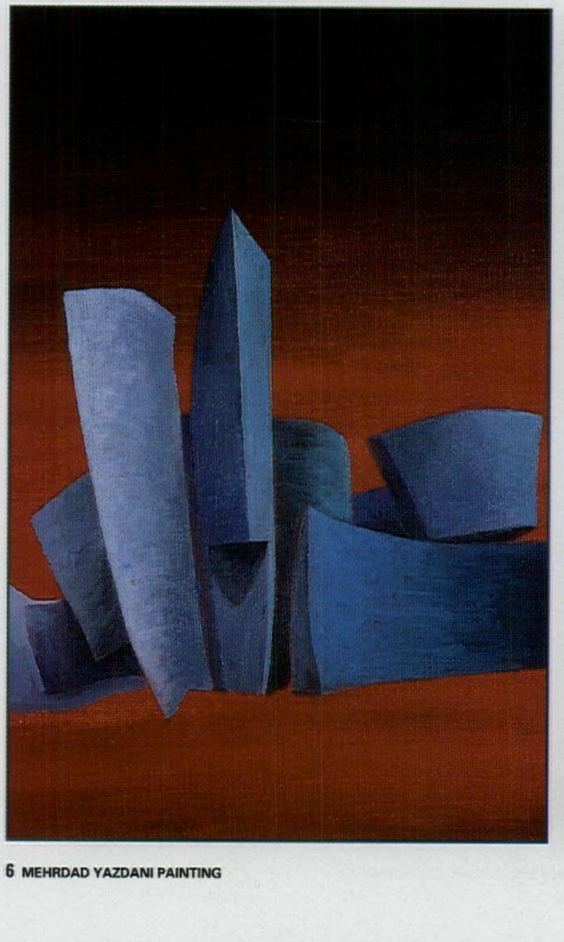
Thomas Fisher ■

(For credits, see p.152)

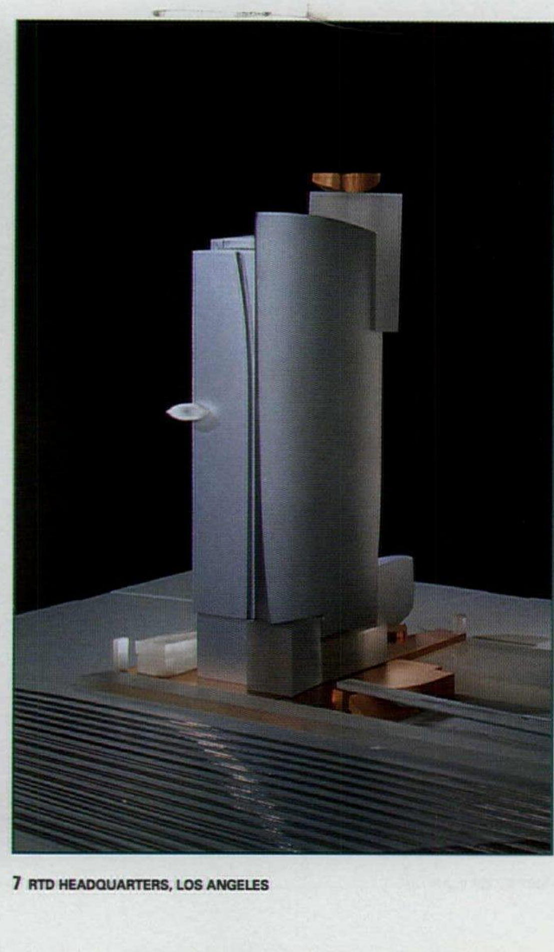


Adrian Velicescu

5 REDLINE METRO STATION, LOS ANGELES



6 MEHRDAD YAZDANI PAINTING



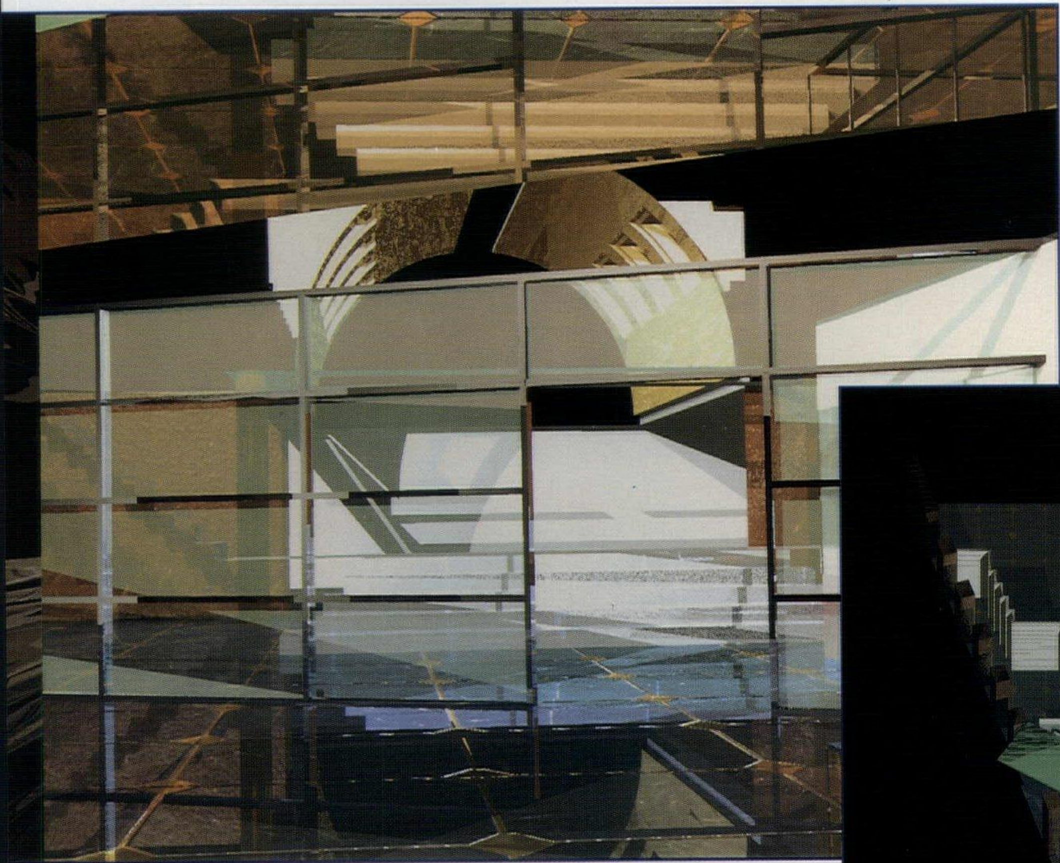
Tom Bonner

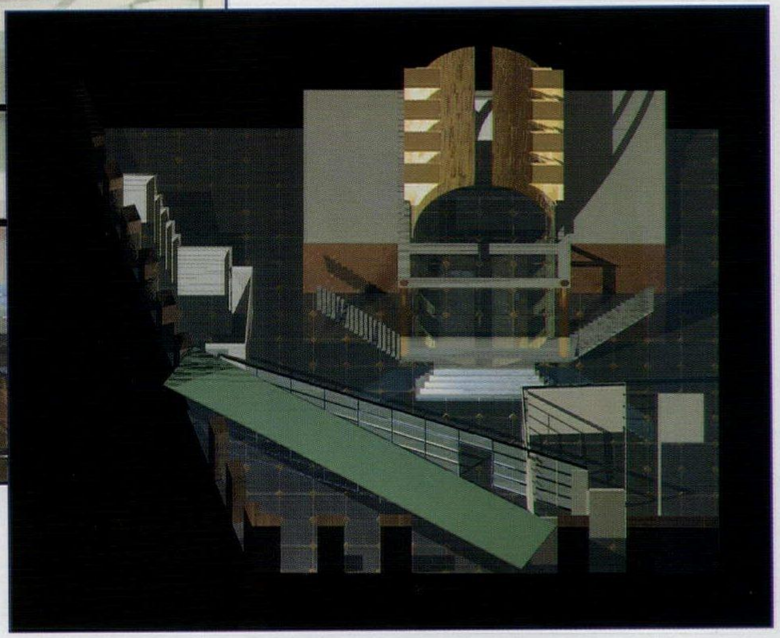
7 RTD HEADQUARTERS, LOS ANGELES

Computer Focus

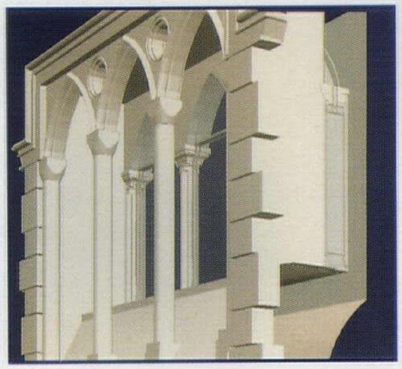
This focus takes stock of architectural computer technology and looks at some of its implications as we enter the last decade of this century.

Contents





These images of a religious school in Brooklyn and a new window for a church in Scarsdale, New York, are examples of a "silkscreen-like" technique for computer renderings that the firm of Peter L. Gluck & Partners, Architects, is now experimenting with.



In the six or seven years since the first PCs found their way onto the desks of design offices, the transformation that technology has wrought on design, administration, and production has been profound. All aspects of the design office have been touched – drafting, analysis, accounting, marketing and, increasingly, design. Computer networks are changing the way designers, project managers, and support staff communicate with each other. Most important, the clients themselves are automating and are beginning to demand as-built electronic databases from consultants in a format compatible with their computer systems. The following articles not only cover the technical and administrative aspects of computers as design partners, but also explore the realms of computer modeling, both current capabilities and limitations, and their potential effect on architecture. **Eric Teicholz**

Computer-Based Systems Integration

Michael Chusid reports on the first symposium on Building Services Automation-Integration.

For many architects, integration of computer-based systems still means figuring out which end of the cable plugs into their personal computer. But the topic was given much greater meaning at the First International Symposium on Building Systems Automation-Integration held in June at the University of Wisconsin-Madison. This week-long conference, initiated by Varkie Thomas of the Chicago office of Skidmore Owings & Merrill, was devoted to "the integration of computer-based systems for planning, design, construction, and operation of buildings." The conference offered bold predictions for computer technology and its effect on architecture.

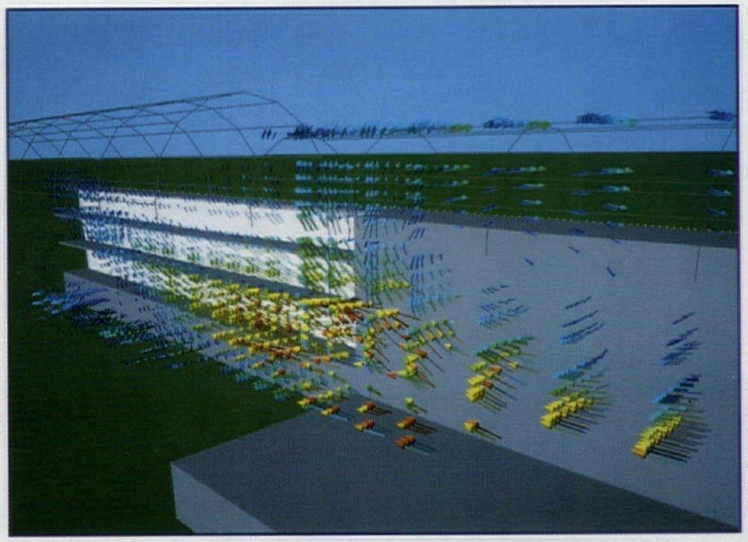
While an increasing number of architectural and construction tasks employ computers, the Symposium identified two major barriers preventing computer-aided design from achieving even greater productivity. First, computers have been applied essentially as "electronic pencils," speeding up manual processes but not changing the nature of the tasks. For example, specifications are written as though word processors are just fancy typewriters and CAD drawings replicate the types of lines and abstractions used in traditional drafting. Second, computerized information is still transferred from one application to another by manual methods, leading to increased costs and errors in data processing. For example, it is rare for an architect's CAD files to be passed along for a contractor to use in construction engineering, and electronic product data are not passed along to owners for use in automated facility management. To overcome these barriers, conference participants presented an amazing variety of new computer-based systems and concepts that are already available or under development in laboratories around the world. They also called for new paradigms, based on integration of information and the building team, for the organizational structure of the building industries.

Computers and Practice

Many designers still practice what Tor Syzertsen from the Norwegian Institute of Technology called "Pencil and Paper-Aided Design (PPAD)." But he predicted that computers will soon be such an intrinsic part of architecture that we will drop the phrase "Computer-Aided" from our description of design. He called for the creation of "knowbots" to automate routine architectural tasks, many examples of which were presented during the week-long conference.

The Intelligent Design Checker, for example, can review a set of drawings for compliance with building codes and other standards. Nayel Shafei from Prime Computers, Inc., described how the New York State Facilities Development Corporation uses the program to check compliance of hospital designs with National Fire Prevention Association standards and the New York State Life Safety Code. The Checker flagged so many violations in drawings submitted for final approval that the Facilities Development Corporation now requires architects to run the program during the design phase of projects, when corrections can be more easily made.

Architects typically design a building envelope and then pass it to mechanical engineers for an energy-use evaluation. This results in slow and costly iteration of design between architects and engineers. To improve this situation, both Larry Degelman of Texas A&M University and Edna Shaviv of the Israel Institute of Technology presented expert systems that integrate energy analysis and architectural design. Their systems allow architects to visualize buildings in 3D and simultaneously receive feedback on the energy consequences of design decisions. Both are using knowledge-based programs to suggest U-values, window placement, and design strategies to satisfy energy-code constraints.



The Building Design Partnership

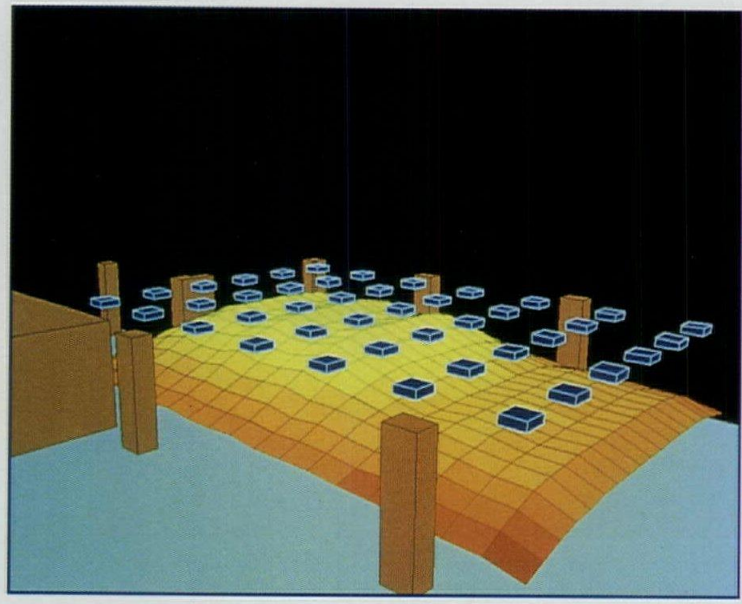
This atrium was modeled with Abacus Simulation software (Glascow) for daylighting and energy efficiency. Air-flow vectors and temperature gradation are shown to determine natural ventilation.

Mehdi Khalvati from ASG explained that CAD programs could become "integrated architectural systems." ASG software, which runs with AutoCAD, links graphic information to specification writing, cost estimating, and product information. In a software package that ASG distributes for Boise Cascade, wood beams are treated as objects that contain information about their performance characteristics and limitations rather than just as lines; the program can automatically size and arrange wood floor framing members.

Expanding upon this theme, a team from Carnegie Mellon University demonstrated ARMILLA, which incorporates expert systems with a CAD drawing tool to aid the design of a building's structural, HVAC, plumbing, and other systems. A knowledge-base of engineering rules automatically makes trade-offs to coordinate the placement of beams, ducts, and risers.

New Models for Architects

Traditional architectural drawings, even those produced with the latest 3D CAD programs, are abstract geometrical representations of building components; the meaning of the lines is determined by the architect.


SOM

Lighting visualizations like this are easier to understand than current photometric programs and can be connected to databases for fixture selection and specification.

The Intergraph Corporation

While holographic workstations like this are still conceptual, other developments are rapidly becoming commercially viable.

Computerized models, on the other hand, are constructed of "object-oriented" representations of each building space and component. "Object-oriented" is the computer equivalent of the architectural concern for the nature of materials; it is Louis Kahn's asking a space what it "wants to be." Object-oriented databases key building elements to information about what they are, their performance, and their relationships with other objects. Objects interact with each other according to knowledge-based rules and constraints. "Self-knowledge" enables objects to assert themselves to automatically generate designs or construction and facility management reports. Instead of the static abstraction of traditional drawings, this kind of computer model portrays a virtual reality that responds to changes in materials and conditions as would real buildings.

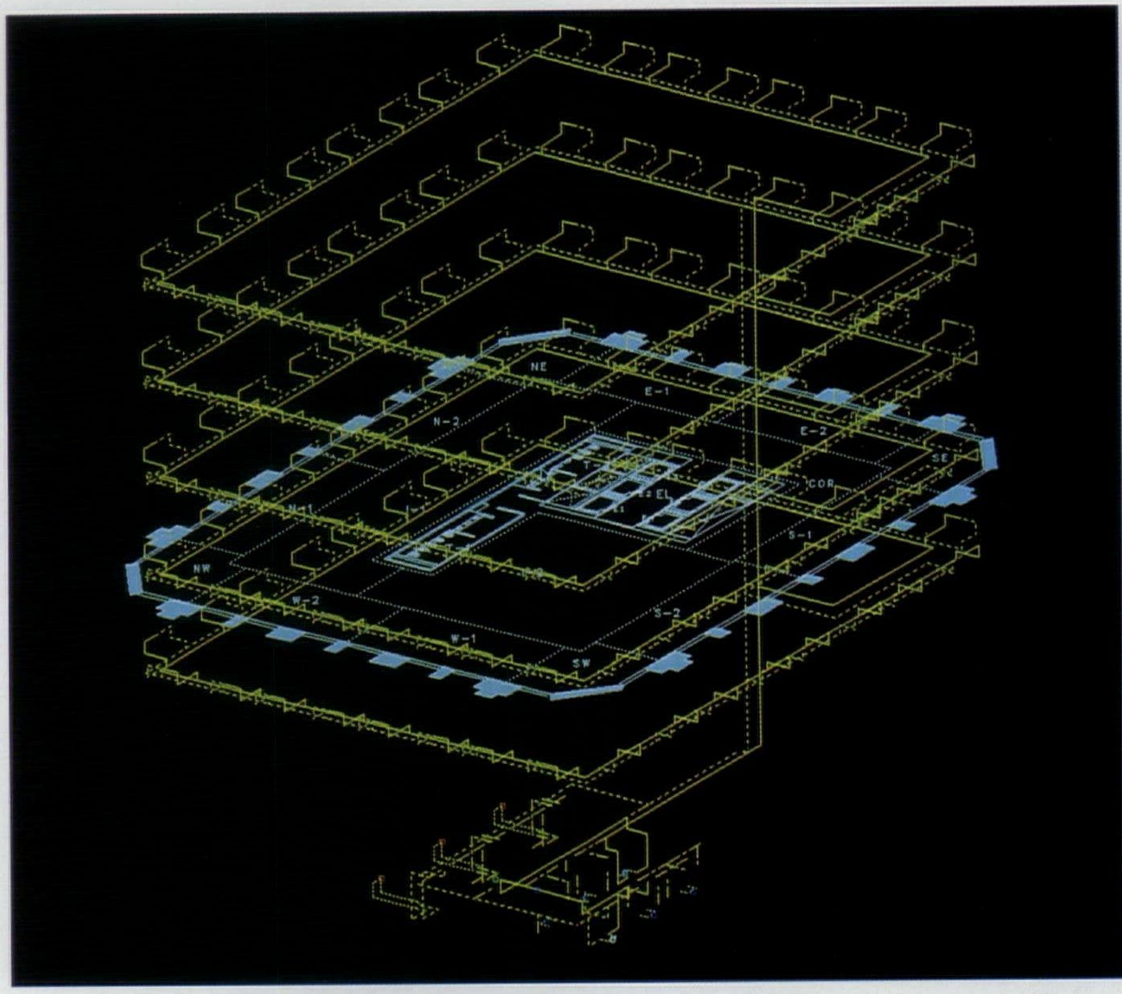
Visualization software that creates photographic-quality 3D pictures of buildings will be valuable for both client presentations and as construction planning tools. Simulations will enable designers and owners to predict operating loads more accurately and to optimize the structure's performance by adjusting for varying conditions, thus reducing the need to overcompensate for safety factors. And as new user interfaces are refined, architects may find themselves working in cyberspace environments that convey the illusion of being able to manipulate computer-generated items in the actual space.

Other developments in computer science presented at the Symposium that may affect architectural practice include neural nets, hypertext, artificial intelligence, and multimedia. Anticipation of these tools led to heated discussion about where the ultimate boundaries between human and machine capabilities might be. Some argued that creativity and aesthetics were not feasible or appropriate uses of computers. Shaviv countered with the example of a student with no architectural training who developed a program to draw housing plans based on code restrictions and a set of rules defining spatial relationships. "Some of the schemes the computer made were of great originality and beauty, designs a trained architect would never have dreamed of." Others argued that computers could stimulate human creativity by freeing designers from routine chores and presenting a greater range of options for them to consider. One software developer believed human intuition will remain an essential part of architecture; his program includes a "help key" that provides information unrelated to the task at hand to stimulate the user to make problem-solving breakthroughs.

The Need for a Standard

Developing the standard code necessary for object-oriented models will be an enormous undertaking and may not be practical in a fragmented industry that supports a multitude of incompatible computer and software systems. To overcome this, the Symposium struggled with standards and technical guidelines for exchanging computer-generated information directly between systems and across the building industry. Current exchange protocols like the Initial Graphics Exchange Specification (IGES) and AutoDesk's DXF format primaily exchange geometrical drawing data. New standards are required to accommodate the richer information environment of object-oriented models.

The leading proposed standard is the Standard for The Exchange of Product Model Data (STEP). STEP is being coordinated by the



SOM

Three-dimensional building models like this one from SOM will make it easier for designers to check for system performance and coordination, for contractors to plan construction activities, and for owners to adjust the system as demands upon buildings change.

International Organization for Standardization (ISO) and by the Product Data Exchange (PDES) in the United States. A PDES brochure explains that STEP "will provide a complete, unambiguous, computer interpretable definition of the physical and functional characteristics of each unit of a product throughout its life cycle. (It) will enable communications among heterogeneous computer environments; integration of systems that support design, manufacturing, and logistics functions/processes; and support automatic, paperless updates of system documentation."

Development of a comprehensive data exchange standard will be extremely costly but is of paramount importance to automation and integration; but funding for the construction industry's effort is problematic. Participants in the Symposium, however, felt that development of STEP is of such importance to United States competitiveness in global construction that they called for a government effort comparable to the building of the Interstate Highway system. "Who will be the President Eisenhower to make it happen?" one participant asked.

Life-Cycle Models

The ability to share a common building model will change the organization of building projects. Duvvuru Sriram from MIT called current design methods over-the-wall engineering. "The architect works on a design and then throws it over the wall to an engineer. The project is thrown over the wall to a contractor who uses the drawings as a sketchpad to figure out how the building will really be built, and it is eventually thrown to the building owner who has to figure out how to operate the facility." He proposed a knowledge-based management system and distributed databases that would facilitate collaborative design among all building team members.

Information must also be managed so that it has value throughout the life-cycle of a building. As information is gathered, from the earliest planning stages through demolition, it should be sorted for value and stored in an accessible electronic form. Instead of merely automating current procedures, every part of architectural practice must be reassessed. While putting product catalogs onto computer diskettes is a necessary first step, we should not lose sight of the need for an Electronic Data Interchange (EDI) system so that product data can flow directly from a manufacturer's catalog into a project database and then back into a manufacturer's production scheduling program without the time and expense of shop drawings. Owners will start demanding computer models for use in space planning, energy management, preventive maintenance, and operating systems; the quality of a building's database will be an asset they can carry to their bottom line.

The complexities of modern construction have created building teams with experts in many fields. Future architects may be able to work with fewer consultants as expert systems become more powerful and electronic databases provide easier access to specialized information. This should lead to leaner and more productive building teams, but will require new approaches to architectural education and practice. Ron Wooldridge of The Locke Group warned that "the good news is that 45 architects with computers will be able to do the work of 50 people working manually. The bad news is that the 45 may not be a subset of the current 50." He urged architects to use integration and automation to add value to their work and to develop the knowledge-based systems and databases that would enable their firms to regain competitiveness.

The final advice from the Symposium is to not become too married to the current generation of AEC computers and applications. Rapid changes are coming that may make your personal computer as obsolete as a slide rule. Firms that accept the challenge of automation and integration will have to weather a turbulent period of industry and professional realignment, but are likely to emerge more competitive than before. **Michael Chusid** ■

The author is a building product marketing consultant and has developed electronic catalogs for several manufacturers. A frequent contributor to P/A and a speaker at construction seminars, his offices are in Oklahoma City and in Glencoe, Illinois.

Conference proceedings are available from the University of Wisconsin Thermal Storage Applications Research Center; phone (608) 262-8045 or fax (608) 262-6209. A Second International Symposium on Building Systems Automation-Integration is scheduled for June 1992 in conjunction with the A/E/C Systems trade show in Dallas.

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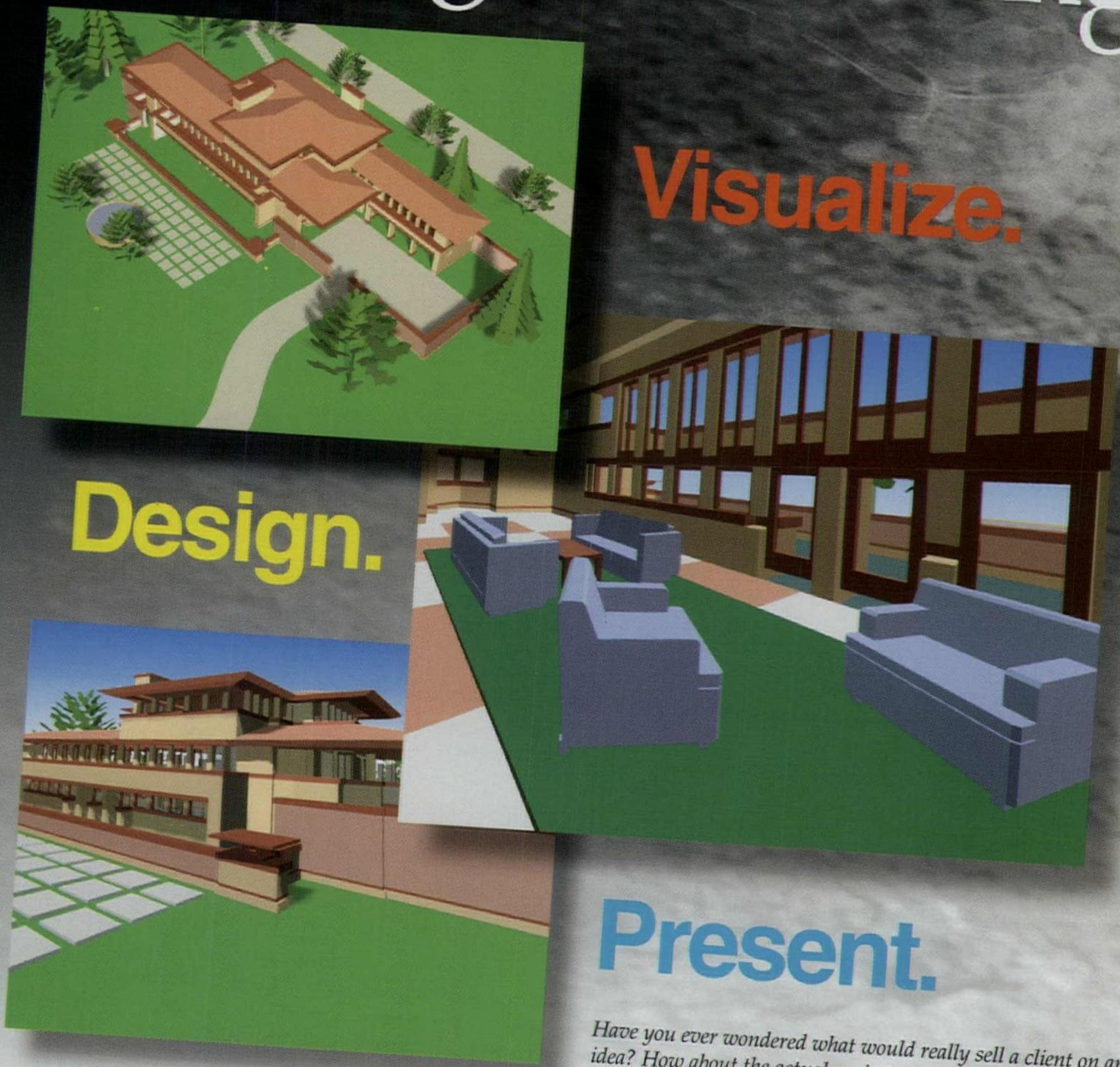

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Design Technology: The Next Wave

Architect **Mark Lauden Crosley** examines how new computer systems are becoming more responsive to architects' needs.

The often-reluctant relationship between architectural practice and computers has been marked by high expectations, disappointments, and successes. Everyone knows computers can do amazing things. Most architects know, too, that computers are like mules – they sometimes take some coaxing to get what you want out of them. New hardware and software options, however, offer a solution to disadvantages architects have found in the past.

The story is familiar: A firm buys a few computers expecting to gradually "automate" the office, starting with the drafting corps. Once the system proves its worth, everyone will take the plunge. Soon those pioneers have become "CAD Operators," specializing in drafting and little else. The firm neglects to add the software or provide training that would attract designers, and CAD becomes a high-tech drafting system while potential design and data management capabilities are left untapped.

There are plenty of CAD success stories, too. Typically, a firm makes sure that the staff at all levels, in all roles, can use a computer when it is appropriate. CAD is applied throughout the design and documentation process. As designers are producing drawings that can be used as construction documents, and drafters are able to explore design alternatives, these role distinctions break down. For these firms, CAD is beginning to transform architectural practice.

Not everyone feels comfortable with the hardware and software that are currently available for architects. Most CAD programs, even when geared toward architecture, still require significant training, and for occasional users, the relearning of a lot of complex commands. While firms often need a system manager or programmer, there should be no specialized "CAD Operators," only practicing professionals.

Developers of CAD programs are starting to realize that to make their products attractive to the broad range of architectural professionals, programs have to be accessible to the casual user. In both operating systems and hardware, some real improvements are in the works.

Cleaning Up the Interface

Apple's Macintosh proved the value of the Graphical User Interface (GUI), which enables an architect to keep several tasks on the screen at once. Now, years later, the similar Windows interface has become commonplace on DOS-based PCs. Some Unix workstations also offer similar interfaces. Even established CAD vendors like Autodesk, IsiCAD, CadKey, and Intergraph are scrambling to get their software running under Windows.

A GUI can keep tasks like cost estimating or rendering running behind the scenes while you work on something else. A less-noticed benefit of GUIs, however, has been an increase in standardization, making it easier to move graphics and other data back and forth between programs. All GUIs offer a "cut and paste" clipboard for transferring graphics and text between programs. However, these often strip important information from a drawing, so there continue to be serious problems in accurately moving drawings from one CAD system to another. Most GUIs also include ways to "cross reference" documents so that a CAD drawing used in a report will automatically be updated if the original drawing is changed. Schedules, specifications, and cost estimates can likewise be linked to drawings, though it is crucial that a database management or spreadsheet program be set up to handle CAD-based architectural data in a meaningful way.

Pen-Based Computing

Two companies have recently introduced GUI software that uses electronic pens, rather than keyboards, for input. Microsoft's Pen Windows and Go Corporation's PenPoint operating system can recognize hand lettering and various pen gestures, such as an "x" to erase a line. CAD programs will soon enable designers to sketch a fixture, and the system will insert a predrawn symbol.

A new kind of digitizing tablet from Wacom, combined with pen-based software makes "drawing board" computing possible for the first time. The tablet has a liquid crystal display built into its surface, so that a designer can work directly on a drawing, rather than having to look at a separate monitor. The tablet can even record differences in stylus pressure producing lines that vary in weight and thickness to emulate hand drawings.

Notebook-sized portables that incorporate this new input technology allow architects to do serious CAD work away from the office or on the job site. The Go PenPoint operating system is designed to work best on lightweight "tablet" computers such as the NCR 3125, with a screen and stylus, but no keyboard. Not only portable design pads, these tablet computers may also be used for marking up CAD drawings at client meetings or recording as-built conditions on the construction site.

Software for Architects

While CAD programs have offered high-powered drafting capabilities, they haven't truly streamlined the job of designing buildings. Most systems draw lines and curves and allow you to insert predrawn symbols, but few are based on representations of architectural forms and building materials. For example, if you change the width and height of your exterior walls, the computer ought to simultaneously adjust wall poche, door and window jambs, and modify your door and window schedules.

Several vendors, however, are working on systems like this. Softdesk Inc., whose Auto-Architect software works with AutoCAD, has previewed an "intelligent walls" capability that treats walls as three-dimensional architectural objects, rather than as lines. Another vendor, Vertex, sells architectural detailing software that provides a huge library of customizable "components" based on actual building materials. Details can be assembled from this "kit of parts" and automatically annotated, without drawing any lines or typing text. In the future "expert systems" software will act as a desktop consultant on building engineering.

Improved software is making it more attractive to use CAD during the early phases of design. In particular, some three-dimensional modeling programs are becoming much easier to use for schematic studies and design development. A 3D CAD system that has been conceived or customized for 3D architectural work

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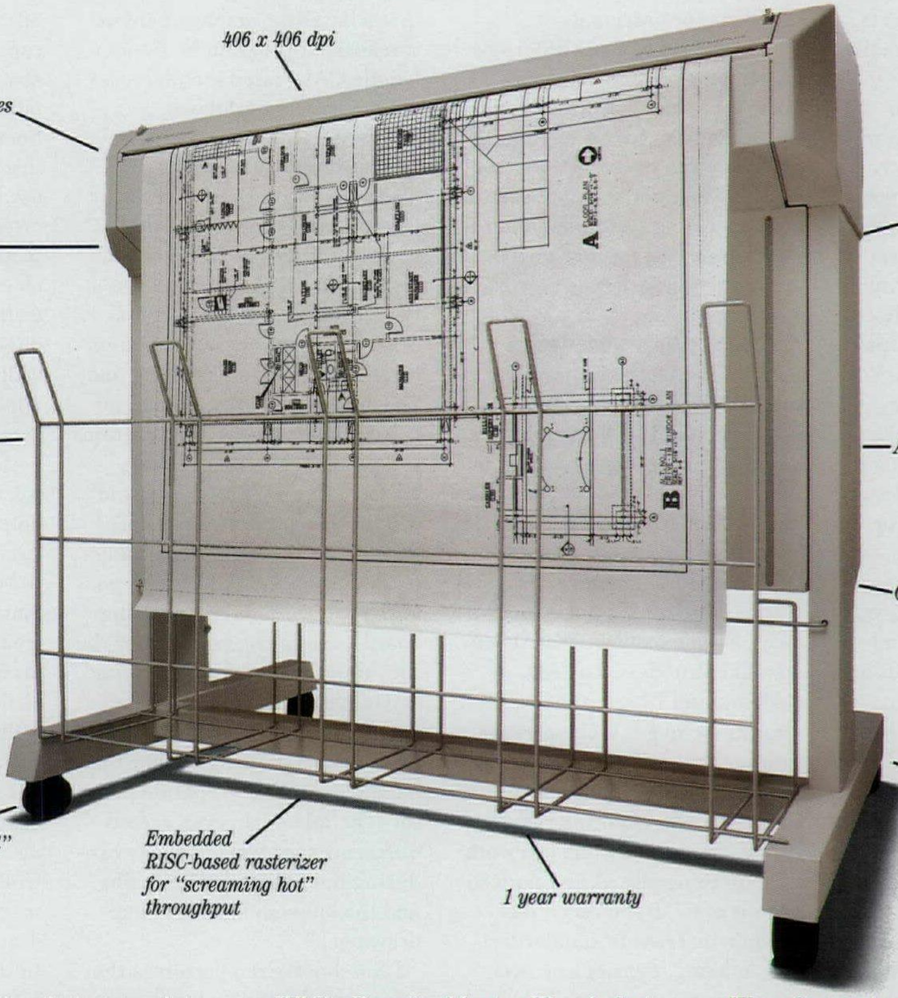

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"Building elements can be viewed in their true spatial relationships; when a window or door is moved in plan, the elevation will simultaneously change."

enables you to construct a model with little more effort than drawing plans; the computer does the tedious jobs of adding door and window headers to walls, constructing elaborate stairs, or laying out hip roofs. Such programs integrate 2D drafting and 3D modeling in one program.

The real benefits of 3D modeling come when plans, elevations, and sections are developed within the context of an electronic building model. Building elements can be viewed in their true spatial relationships; when a window or door is moved in plan, the elevation will simultaneously change. At any time, even during the working drawing phase, design changes can be quickly evaluated with shaded perspectives. Renderings also require little or no extra modeling.

Realistic computer rendering and animation have recently become possible on PCs, making 3D modeling a convenient way to evaluate and present a design. Most CAD programs provide simple shading capabilities, making hard-to-read wireframe views unnecessary. Numerous rendering programs for adding smooth shading, shadows, reflections and material textures to models are available, too. Since using texture mapping to simulate materials can be tricky and laborious, you may expect to see soon architectural software that creates models with materials assigned automatically, ready to render.

Animated walk-throughs of a building model can be created using products like Modern Medium's Renderstar, ASG's Model Vision and Autodesk's 3D Studio and Animator Pro, Paracomp's Modelshop II, and Dynaware's Dynaperspective. These can be used with standard PCs and Macs without the kind of training required by high-end rendering systems. Clients have been quick to realize the advantages of computer imaging: Their requests to see animated walkthroughs before approving a design are becoming common.

Particularly intriguing is StereoCAD's Realtime, which makes it possible to walk through a shaded model by pointing with a mouse (or a globe called a Spaceball), using a standard video display. A similar 3D view with more impressive shading can be generated while drawing in AutoCAD, using the Matrox MG-3D PC graphics board.

In the near future, expect to see "virtual reality" systems that enable designers (or clients) with stereo viewers to "walk" through a computerized three-dimensional model of a project [see page 126]. Using a virtual reality interface, it is possible to place or move windows, doors, and walls by "grabbing" them with your hand. The hardware for these systems is rapidly becoming affordable, and the display software has progressed beyond cartoonish images.

Putting It Together

The integration of three-dimensional modeling with drafting was once feasible only for individual designers, since a project had to be contained within one file. The recent addition of reference file capabilities to many major PC CAD systems now makes it possible for groups of designers and drafters to divide a building model into manageable chunks and to work on them simultaneously, viewing other's work over a computer network.

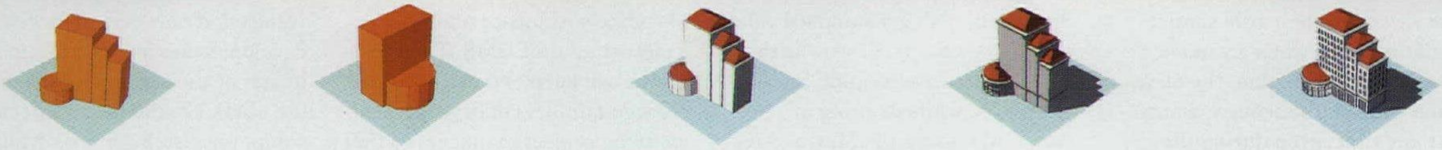
"Workgroup" computing, in which all the members of a team have access to project files via a network, is becoming practical and valuable for even small firms. Team members can quickly find the drawings they need, and can view (as reference files) work that is being done by others. One of the most difficult aspects of networking – drawing management – is being addressed by a new generation of drawing management software, typified by programs like Cyco's Autobase and ACS Telecom's AutoEDMS. These programs can keep extensive records of large numbers of drawing files, enabling project managers to find drawings by paging through views or by searching for specific text.

Perhaps the most frustrating aspect of using computers in architectural practice has been the inability of software developers to put data into formats that can be shared among users of different programs. It is often difficult, for example, to link CAD systems with software that can create specifications, schedules, and cost estimates, or do engineering calculations. CADvance and Intergraph's Microstation have direct links to database software, but users must usually create their own architectural database systems. Autodesk has recently introduced significant tools with which add-on software developers can link external programs directly to AutoCAD. Also, recent joint development ventures like those between ASG and Superspec, or Timberline and Architectural Synthesis, offer some hope for improved connections among software vendors and building product manufacturers.

Some companies claim to have integrated software for different disciplines, although most such software currently falls short of providing seamless interfaces or full drawing compatibility. Many software developers are working hard to achieve that goal. The AIA's CAD Layering Guidelines assist by providing a common framework for structuring drawings, and several CAD vendors have built the Guidelines into their architectural software to automatically layer drawings.

Problems like these are being resolved, if only because software developers are anxious to win the hearts of the architects who don't use CAD. Gradually, architectural computer systems are evolving to be both more useful, and less mule-like. Like drafting tables, the ideal computer system would be a familiar sight in archtitects' offices and ready to use when needed, but would not require constant attention or special raining to use. **Mark Lauden Crosley** ■

The author has an architectural practice in San Francisco and is a computer-aided design consultant to architectural firms and software developers. He represented the AIA on the CAD Layering Guidelines committee and is the author of The Architect's Guide to Computer-Aided Design (Wiley & Sons, 1988).



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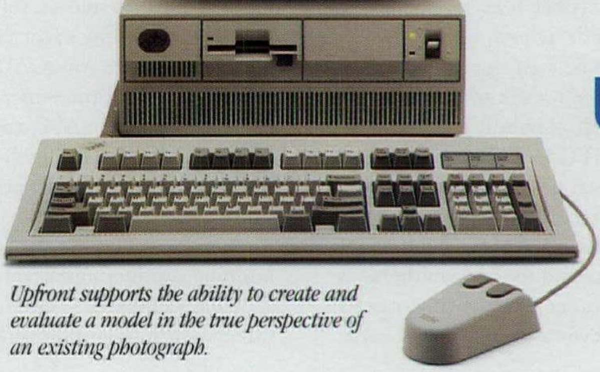

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Circle **No. 377**

Computer Modeling as a Design Tool

Kent Larson of Peter L. Gluck and Partners Architects in New York

relates his firm's experiences with 3D CAD.

The last decade has seen a revolution in the use of 3D computer modeling and visualization in science, engineering, product design, and medicine. Much of the most advanced and creative work in these fields would be impossible without computer modeling and visualization tools. Scientists use computers to find order in vast amounts of data, and to simulate phenomena impossible to visualize conventionally. Surgeons plan procedures while viewing 3D computer models assembled from CAT scans, and everything from the space station to automobiles to perfume bottles is designed, modeled, and animated using sophisticated workstations.

The computer articles and advertisements for software and equipment in the architectural press give the impression that 3D computer modeling is used in the same way by architects. The reality is that very few firms effectively use the computer as a design tool.

There are many reasons for this limited use of computer modeling in the design process, including cost limitations, the resistance of senior designers and faculty, and the availability of other useful media (drawings and models have served architects well). But the primary reason is that most architects have no general understanding of the different roles that a computer may play in the design process, and the advantages and disadvantages of the computer for each possible task. Is the graphic computer to be used as a tool for conceptualizing, visualizing a design, documenting ideas, or simulating lighting, materials, and movement through space? Or is it a presentation tool to show projects to clients or the architectural community? The techniques, tools, and personnel required for each task can be very different.

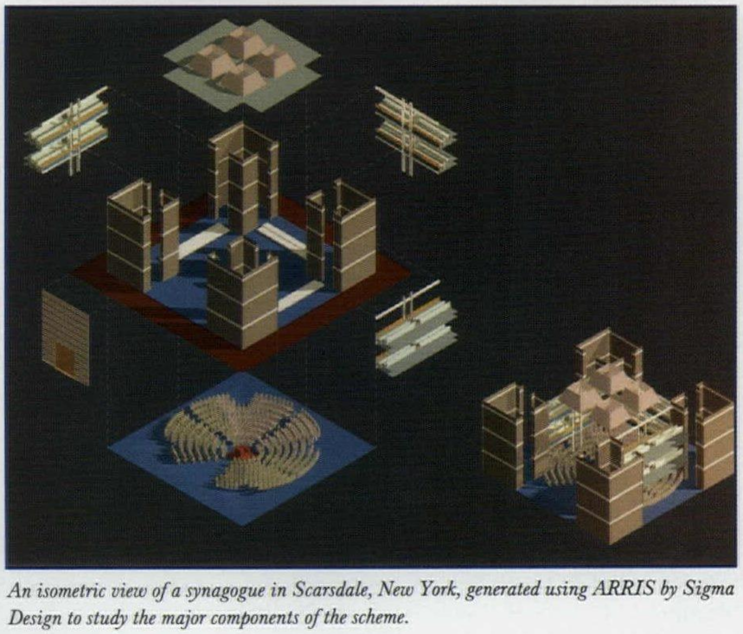
Our firm has experimented with the graphics computer throughout the design process primarily using ARRIS software by Sigma Design, Inc., on SUN Microsystems workstations. The project architect or I personally work at the computer to build and revise three-dimensional models. We have found that as a design tool, computer modeling is extremely efficient for some tasks and inappropriate for others. The following is an overview of what we have learned over the past three years using computer modeling and rendering techniques at various stages of the design process.

Conceptual Design

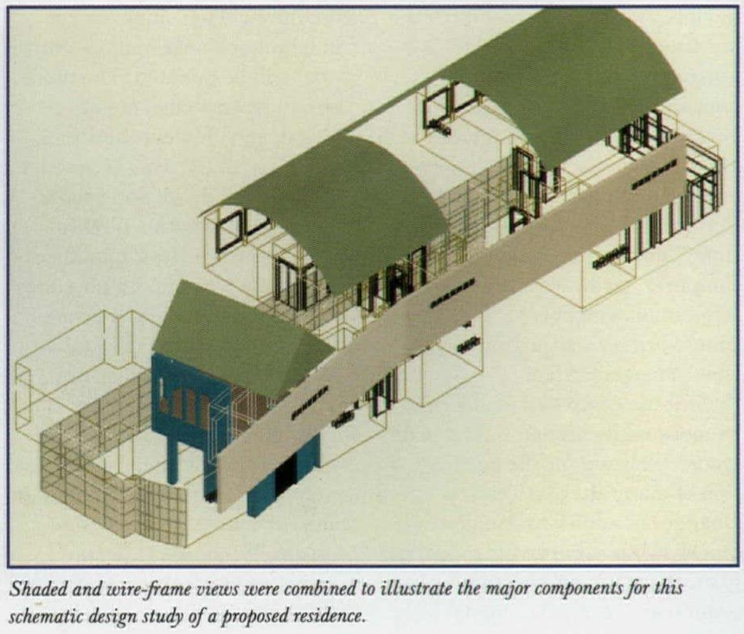
It seems unlikely that computers will soon replace the pencil as a tool to rough out conceptual design ideas. Freehand sketches are very efficient at exploring ambiguous forms and gross elements with a few simple lines. A powerful modeling program, on the other hand, is often more of a barrier than a help in the process of trying out ideas. Although there are some programs that try to duplicate the process of freehand sketching, they will have to evolve to be more helpful than a freehand sketch for preliminary design. Computers require precision and coordinates, and they tempt an inexperienced designer to incorporate an inappropriate level of detail in what should be a schematic study of major concepts. Nevertheless, computers are now becoming more useful earlier in the design process as the software is improving and becoming more intuitive, and as young architects who grew up with computers are beginning to advance in the profession.

Resolving Design Ideas

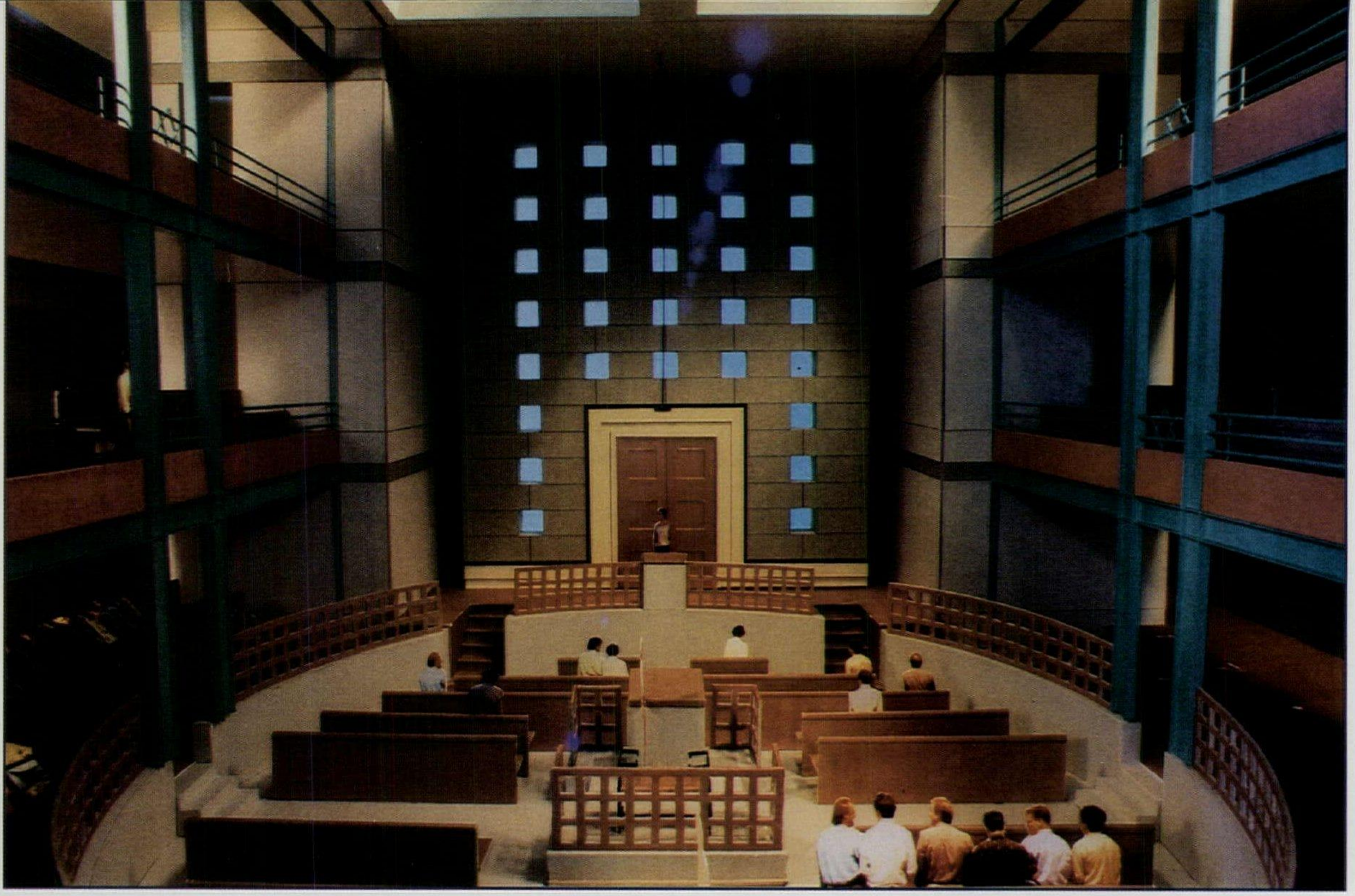
Designers who use computers properly can resolve design ideas quickly and can generate alternatives efficiently. Computers also encourage designers to think in three dimensions with interactive isometric or perspective models.



An isometric view of a synagogue in Scarsdale, New York, generated using ARRIS by Sigma Design to study the major components of the scheme.



Shaded and wire-frame views were combined to illustrate the major components for this schematic design study of a proposed residence.



A ½" scale wood and matte-board model of the final schematic design proposal was constructed for the preparation of a video presentation. The model was built with removable sections to allow a camcorder access to close-up views. The ten-minute video presentation was shown to the entire congregation using large video monitors.

On a fast workstation such as ours, we make revisions almost instantly. Slower, less sophisticated systems have the opposite effect; the tedious waiting for the computer to react breaks the continuity of thought and process.

Using a surface modeler like Arris at this stage is much like constructing chipboard sketch models, except that scale models are true three-dimensional abstractions of the building, allowing for a fairly accurate perception of form and relative scale. Computer models, however, are two-dimensional abstractions that can be viewed one screen at a time. Only the most expensive computer hardware lets us view large shaded models in "real time" without waiting for each view to be generated.

Still the computer model can be more easily revised than a scale model, allowing for the generation of many alternatives. Changes or additions can be made quickly while viewing the model in plan, elevation, perspective, or isometric. A computer model also can evolve as the design develops with an increasing level of detail, while a physical model must be reconstructed each time there are major changes to the design.

The best systems allow a design to be developed with objects or repeated items. A single column or window, for example, can be repeated, scaled, and rotated as required. That single object can be revised once and the entire model will be updated. The model also can be stretched or compressed, and elements added or deleted instantly. This allows the fine tuning of detail and proportion impossible with a physical model. We have often combined some of the best of both physical and computer models by generating computer plots of detailed building elevations, which are then pasted on chipboard and cut, folded, and assembled.

Which method is better for developing design ideas? It depends, of course, on the design problem. If the task is to study massing proposals for a high-rise building in an urban context, the computer model is probably ideal. Adjacent building massing, zoning envelopes, and shadow studies can be developed quickly and accurately. If the purpose is to study the forms of a preliminary house design, I would usually choose a chipboard or clay model.

Visualization

Computer models are much better than hand drawings for visualization of a design once it has been developed. Highly detailed multiple perspectives, isometric, and elevation views can be produced quickly and accurately. Again, I would not argue that a computer model is better than a detailed physical model at helping an architect to understand a design, but detailed scale models are not easily changed and take time to build. Rarely does an office or a design student build a highly detailed scale model until the design is set, and then it is usually to present the scheme, not to better understand it. With computer models, the limitation is primarily with the computer monitor and output devices. Even the highest resolution monitor available cannot display the fine detail of a view of the entire building or space. Color prints of high resolution images can be made by service bureaus, but these are now too expensive to be used regularly as check prints during the design process. Eventually high-resolution color printers will be cost effective for an office.

Presentation: Artful Images

In our practice we have found it difficult to generate computer images that are suitable for publication. This problem is equally apparent when students are preparing design studio presentations. Computer-generated shaded perspectives can look crude and lifeless next to a pencil rendering or a Beaux-Arts watercolor. Computers are capable of producing abstract, pristine, almost silkscreen-quality color images, but this potential has rarely been realized. CAD software companies seem to overemphasize photorealism, which has

A schematic computer model of the same synagogue scheme was prepared by the author using ARRIS. Wavefront Technology's Advanced Visualizer was then used to define materials, textures, reflectivity, and lighting. The final image was rendered on a Silicon Graphics IRIS 4D workstation by Mechthild Schmidt of Editel Graphics, New York.

only a limited use to architects. More attention should be placed on the development of software tools and computer rendering techniques that permit abstract images for the illustration of architecture.

A technique that we have found successful is to program the computer to generate dozens of line drawing perspectives and isometrics that would be difficult and time consuming to construct by hand. Our computer, however, is not always smart enough to delete multiple parallel lines when they converge into one dark mass, and the software routine of removing hidden lines often errs. Still this process is preferable to hand-constructed drawings. We have also used a combination of shaded and wireframe components to illustrate the parti of a design. Often, however, the seductive color images on our high-resolution SUN monitor look flat when printed because of the limitations of the printing technology.

Video Simulation

We have found that video images of a proposed design are the most effective way to communicate scale, light, materials, and movement through a space. A scale model looks like a dollhouse to most clients, but because most people have spent thousands of hours perceiving space on television, they seem to understand scale better by looking at a video image of the same model.

Videos can be created either with a scale model and a video camera, or with a computer model. Most of our formal presentations to clients lately have been videos of detailed "stage set" scale models made with a camcorder and macro lens. Since we normally construct a computer model for each project, the physical model duplicates work. A computer animation is the logical next step for this video presentation technique, but unfortunately high-quality animations are not easy to produce. An excellent "stage set" model can be constructed by two students in a week or two, but photorealistic computer animations require expensive hardware, sophisticated software, highly-trained staff, and time. Computer simulation of natural lighting conditions requires ray tracing or radiosity software and many hours of processor time for each second of animation. As a result, service bureaus often charge $800 to $1,000 per second for animations. As fast hardware becomes inexpensive, software becomes more capable and easier to use, and more people become skilled at simulating architectural space with computers, animation will become a more practical in-house tool for presentation. And I have little doubt that many clients, realizing how misleading the traditional media of architects can be, will soon demand photo-realistic computer renderings and/or animations of a proposed design prior to approval.

The integration of computer modeling into the design process of our firm has been an expensive, time-consuming, but mostly successful process. Our experience has made it clear that, whether architects like it or not, the computer will eventually be the principle design tool used by architects. It has already happened in most of the other design and engineering professions. Affordable solutions will be found for most of the technical limitations discussed above within the next several years. Computers now allow architects to do more accurate work in less time with fewer people. The design work may be even better when 3D computer modeling is a routine part of the process, although this is debatable. It will certainly mean that those firms that successfully integrate computers into their practice will be more competitive. **Kent Larson** ■

The author is a partner with Peter L. Gluck and Partners, Architects in New York.

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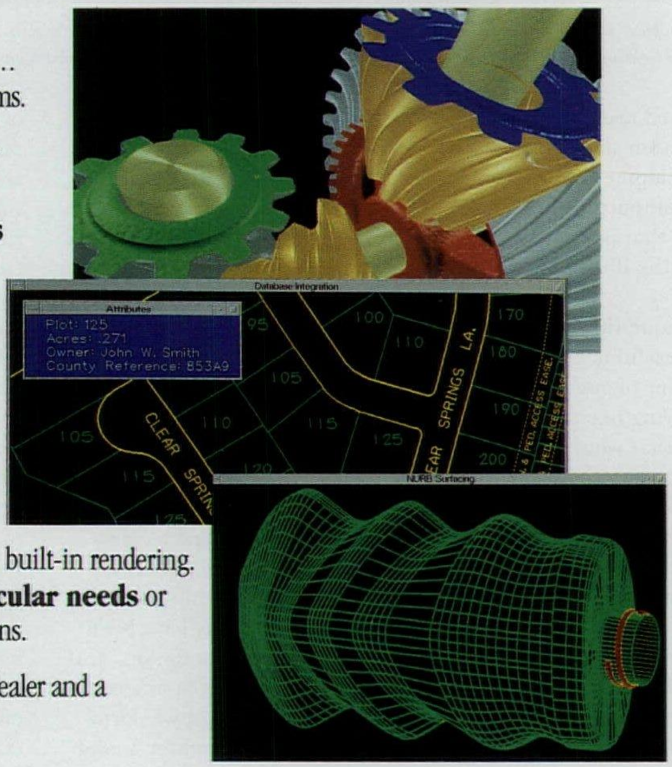

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Circle **No. 327**

Advanced Techniques In CAD Management

Hans-Christian Lischewski of Perkins & Will in New York discusses his experience with the management of computer systems for large firms.

When CAD systems were first introduced in the early 1970s to the architectural profession, we embraced them as high-tech marketing tools. During that period CAD systems were highly specialized, expensive devices. To function properly, they relied on mainframe or at least minicomputers. The system was operated by "Techies," architects specially trained to work the machine. In their air-conditioned and dimly lighted environment of electronic alchemy they performed simple drafting and produced crude massing models. Only a few firms ever challenged the database capabilities of their CAD systems. Managing these CAD operations was generally limited to the maintenance of the system, development of production standards, and scheduling workstations and staff for CAD production.

Integration of Computing Resources

Over the last few years we have observed a dramatic increase in the use of computers among all professions, and the architectural design and production environment has been no exception. Today, computers of all sorts are spread over the office. Alphanumeric terminals, PCs, Macs, and technical workstations are linked together with networks that support a wide range of computer applications within one office or among many branches located at different sites. Lower costs for hardware, better software performance, improvements in interface technology, growing computer literacy, a willingness among staff to work with electronic tools, and obvious gains in productivity are the main reasons for the rapidly growing computerization of the architectural office.

A New "D" In "CAD?"

Originally implemented to support a single task like CAD or word processing , computers are now integrated into larger "office automation systems." Michael O'Malley, president of Kinetic Designs, a New York-based architectural service bureau, suggests assigning "CAD" an additional "D" to stand for "Data." This recognizes that "Office Automation Systems" today require the management of not just CAD, but a variety of computer systems, including networks and communication facilities. Besides providing sufficient technical support for the hardware, systems managers must also implement, upgrade, and improve application software, and train office staff to operate it.

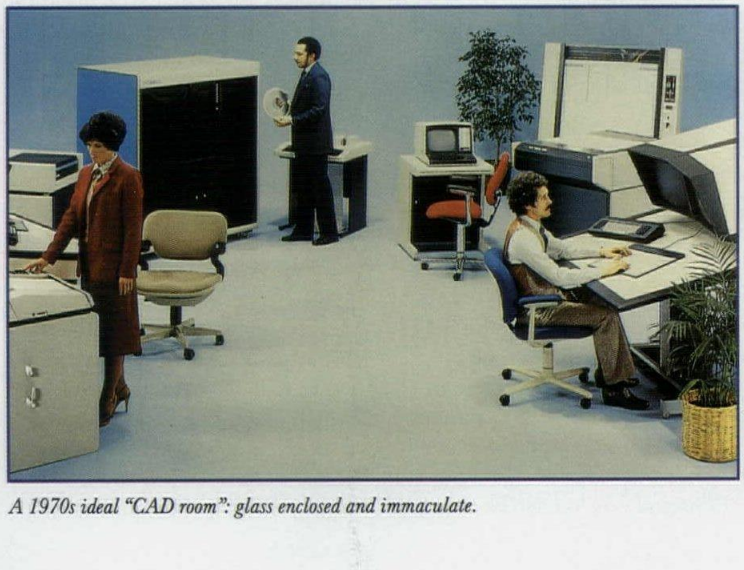
Top Priority: Maintenance

As a result of integrated architectural computing we are generating enormous amounts of data every day. Unlike paper-based documents, which can be neatly filed away into drawers and flat files, electronic data has to be managed on an ongoing basis. Because hardware is constantly changing, systems have to be upgraded, new versions of software have to be loaded, and staff has to become familiar with them.

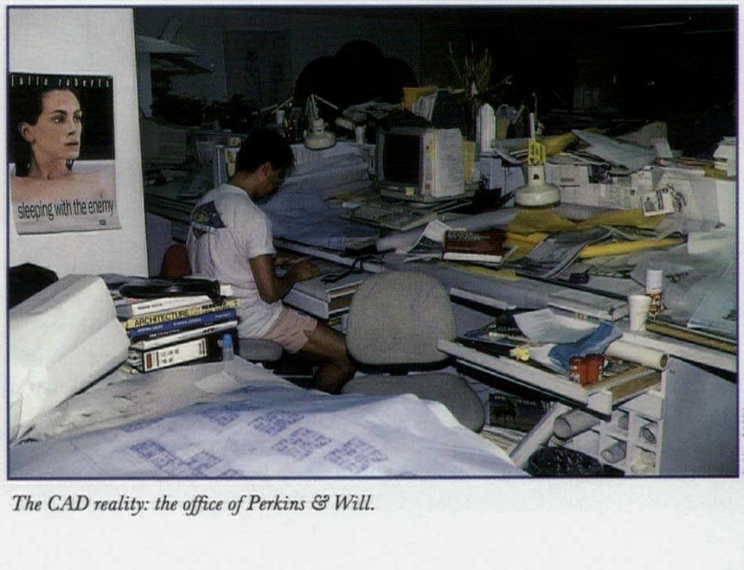
The cost of managing computerized operations is relatively low compared to the gain in productivity a properly functioning office automation system provides. Nevertheless, such management can still demand substantial funding. Unlike other professions that rely heavily on computing and employ a sufficient support staff for computers, architectural firms often under-budget these services. Many architects still see design as done on the drafting board and computers as just useful support tools. Many also think that the machines operate by themselves and do not need special care. This might be true for a small firm operating a word processing system and a few CAD workstations. To run smoothly, however, an integrated, streamlined office automation system with multiple operating systems and a variety of computers requires careful management and maintenance.

Optimizing the Benefits

Today we are taking advantage of the computer's capabilities to merge alphanumeric and graphics databases. This allows us to work simultaneously on technical workstations and PCs with similar project data. Electronically generated plans or renderings also can be exported into desktop publishing systems, providing a link between the design and marketing departments. Slowly, we have realized the potential of such integration.

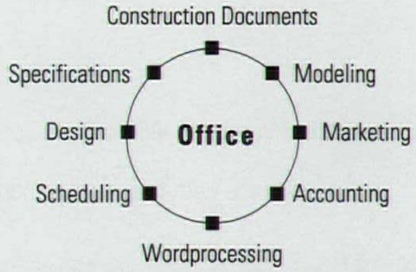

The Intergraph Corporation

A 1970s ideal "CAD room": glass enclosed and immaculate.



Perkins & Will

The CAD reality: the office of Perkins & Will.



Architectural CAD Today: Integration of all computer office procedures

This new information toolbox provides faster, clearer, better coordinated services. But we, in turn, might have to rethink from the bottom up how we structure, schedule, and execute our computer services. As the architectural office is changing from a people-intensive, manually operated environment to one that provides skill-intensive electronic tasks, more work will be done by fewer people in less time.

Advanced Management

Advanced office automation management begins with the development of an office automation plan. The firm has to analyze what tasks ought to be computerized and how they should be integrated. The feasibility of automation will depend on the building types produced by the firm, the degree of standardization, the availability of application software, and the costs of equipment. Expenses to employ technical staff, train employees, and develop and implement standards have to be weighed against the gain in overall productivity.

The immediate effect of integrated computerization will mostly result in procedures to set up and execute projects. More planning or design scenarios can be generated and evaluated.

Because building data generated graphically on CAD is more precise than what is needed during the design development phase, early revisions are generally more time consuming and costly. Management should be aware of this and should change the time scheduled for the design development phase.

However, once the preliminary design is completed, the use of parametric programs and intelligent data will speed up the process of generating construction documents. Less time will be needed in that phase, which should be considered when scheduling the project.

Training Productivity

A firm has to allocate training time and be prepared for the "learning curve" effect: Productivity will be low initially and will increase gradually. Management must be prepared to expect little during the initial phase of office automation and schedule activities accordingly. Meanwhile, architectural staff must undergo initial and continuous training. While basic training is generally an overhead item for a firm, continuous training can be stretched over a time period and billed to projects. Clients will benefit from the better skills and higher productivity of the architects working on their projects.

The key to using an office automation system successfully is its integrated use for all project phases. Those working with the computer need to know more than how to operate a specific drawing package. They must be familiar with database and spreadsheet programs, desktop publishing software, and scheduling software, to name a few applications. Further, they must be able to import/export data and to move from one operating system to another. Such skills are not learned overnight, and training has to be budgeted and scheduled to teach them. The productivity of an individual working with CAD will depend on both the architectural and CAD skills of the person. The availability of short-cuts such as symbol libraries, macros, standards, and integrated production procedures also have an effect on CAD efficiency.

Estimating productivity during the start-up phase is difficult because of the lack of experience. Once the staff has developed speed and is comfortable with the new system, it is advisable to monitor the time needed by an individual to perform certain tasks on specific buildings or drawing types. Estimates can then be based on previous projects, and can be made for a certain size and type of drawing. The learning curve of the individual and of the CAD team will change over time, although the productivity will gradually increase and estimates will become relatively easy. Firms with constantly changing staff must be more conservative with productivity estimates. An average time of three to five hours per week is recommended for continuous training of these necessary skills. Thanks to decreasing computer costs, today's trend of relying on trained, experienced architectural staff and not on operators is a step forward. Less communication is required between individuals, resulting in fewer mistakes.

Total Commitment

The long-term effect of computerization will be total dependence on the electronic medium. We should therefore be prepared. Learning how to type will probably still be necessary for most of us who work with the tool.

Another important issue to consider is liability. Is the architect liable for a database which suffered under conversion procedures and was handed to the client? Who is liable for "canned" details generated with a parametric program provided by a manufacturer? Although we rely on application programs and computer services more than ever before, we have to realize that they are not "flawless" and that errors can and do occur. Software vendors and service bureaus help us get the job done, but the liability is exclusively with the architect who signs the drawing after checking it for completeness and accuracy.

Compatibility with a client's computer system is already a major issue in the industry. Exchanges among different systems, such as DXF and IGES, are still limited, so before starting a project, you should define very clearly what file format can be used for in-house production and what format is expected by the client for the final product.

Billing of computer time has already become a matter of the past. On the other hand, you can bill special services generated on a computer. A graphic database, such as a set of floor plans, generated for a specific project should not be billed as an extra, but if the client requests a data format which was not previously agreed to, the conversion services should be billed. Special billable services can always be negotiated, especially when they exceed average architectural services.

New Markets

Such services also represent new possibilities for additional projects. A CAD system can generate visually attractive models, which if animated and put on videotape, can be used for promotional material, such as a brochure/videotape for fund-raising

"Each of these [new] services extends the traditional range of services architectural firms have offered, and can provide the basis for important new profit centers in firms, as well as help to justify the initial costs of the equipment."

or advertising. Several architectural firms, equipped with sophisticated electronic "visualization" studios have gone one step further, using their video animation capability to produce advertising pieces for consumer products. The profits from these services are respectable and are used to maintain and expand the firm's studio facilities.

Able to generate a database of a new building from the information generated during the working-drawing phase, a firm can offer a service to produce the as-built database of existing buildings. If the client doesn't have a computer system for in-house facility management, the architect can offer to set up a system at the client's location and to train staff. Both parties can benefit from this relation. Firms can use it to regulate the workflow of CAD, since the development of as-built building data can be scheduled over a longer time period and is not so subject to deadlines as other architectural services. And clients can concentrate on asset/facility management, using only a few workstations and PCs. This saves them time and money, and keeps the overhead of CAD-related expenses to a minimum.

A few architectural firms have taken this idea one step further, and offer geographic information data (GIS) for communities and larger public organizations. Each of these services extends the traditional range of services architectural firms have offered, and can provide the basis for important new profit centers in firms, as well as help to justify the initial costs of the equipment.

New Management Personnel

Once the decision to integrate a computer system is reached, firms have to define specific tasks that will allow for its successful implementation and maintenance. Such responsibilities have to be delegated to individuals who might work exclusively as computer support staff or do this on a part-time basis.

How much time these employees spend maintaining the computer operations will depend on the size of the firm and the degree of computerization. If a firm is committed to the use of computers for all phases and services, including planning, architectural design, interior design, and engineering, it may consider establishing a multifaceted configuration of hardware and software. A CAD workstation, for example, should be used exclusively for architectural design and the generation of drawing documents. However, any processing of alphanumeric data, such as word processing or spreadsheet applications, should be done on less expensive equipment. All systems need to be connected with networks to provide an optimum flow and exchange of information between departments and offices.

To maintain this system and offer state-of-the-art computer services, a clear structure of support staff needs to be established. A director of information services who coordinates all computer-related activities and oversees a technical staff should be responsible for the development and implementation of computerization throughout the firm.

Each office should designate individuals who are responsible for managing and maintaining computer support, and should employ an information system coordinator in charge of the management, development, and implementation of computer support systems. Such people would be knowledgeable about the systems in use. If they have an architectural background, they can also be put in charge of the architectural applications software: the CAD system. The development of standards, coordination of training programs, and their documentation are some other responsibilities of this job.

Depending on the size of the office, the information systems coordinator can be supported by a business applications manager who is responsible for business application software. Finally, technical support should be provided by a systems manager who is familiar with all hardware, the operating system, and the networking software.

A new position in the electronic architectural office environment is the production manager who enforces production standards and is in charge of quality control for all material generated on architectural application software. This person needs multiple skills; besides excellent familiarity with the capabilities of the system(s) and the integrated application software, the production manager has to be experienced in all phases of architectural design and production. As a coordinator of CAD production and the scheduling of CAD resources, he or she must be familiar with the individual technical skills of the staff.

It is becoming obvious that more and more architectural services rely on computer support. With new computer aids becoming available, the scope of our services will expand. And those familiar with the capabilities of a firm's computer support system will have a major influence in marketing, negotiating, and executing the services of the electronic architectural office.

Hans-Christian Lischewski ■

The author is an associate and director of computer applications with Perkins & Will, New York, and an associate professor and director of architectural computing at the Pratt School of Architecture. He is a frequent author, lecturer, and contributor to professional publications.

3D Design: Cyberspace and Beyond

Larry Yu explores new technologies for creating computer models that can be perceived in "real" time and space.

The use of computer modeling and visualization tools by architectural design firms has shown a tangible growth in the past five years. This "multimedia" software integrates sound and image processing with CAD-generated images to create impressive videos. So far, these techniques are too expensive and time consuming for most architects, so service bureaus have emerged that specialize in producing photorealistic renderings, sun path analyses, and other kinds of graphic presentations for architects.

Although high-end renderings have become almost photorealistic, they are still two-dimensional abstractions of three-dimensional models. Display systems that present images in three dimensions, however, are now available. For example, the CrytalEyes system from StereoGraphics comprises a pair of goggles with a very fast shutter over each eye, synchronized with a monitor that alternately displays images for the left or right eye. This creates a convincing 3D effect.

Virtual Reality

Combining real time graphics with 3D display systems is the first step toward achieving what many see as the ultimate goal of computer modeling – virtual reality – where the senses are immersed in a computer generated reality.

Virtual reality is the ultimate entertainment system; it is a movie that removes you from the theater, places you in the action, and allows you to interact with the imaginary space. It could potentially bridge the gap between "what you see" and "what you get" for three-dimensional design. Most displays are worn on the head, as goggles or helmets, with a monitor for each eye that eliminates all other visual stimuli. The Eyephone™ from VPL Research offers a pair of goggles with two displays, speakers, and sensors to determine the position and orientation of the head. VPL is a pioneer in developing commercial virtual reality, and their hardware accessories are fast becoming the standard virtual reality devices.

If the eyes are surrounded by the virtual image of a computer-generated building, the mind is there as well. But how can the body follow? Most graphic user interfaces have a mouse or other pointing device that moves a cursor around on the screen and selects commands. But such a two-dimensional interface removes the "reality" from the virtual world. The "mouse" for virtual reality simulations is often referred to as a 6D device, since it measures movement in three dimensions and rotates about three possible axes. These devices include modified joysticks that are twisted and pushed, and magnetic trackers, such as an electronic glove, that follow an object through the simulation.

VPL's PowerGlove™ can sense the position and orientation of each finger on your hand. The system converts gestures and movements into electronic signals. When you turn your hand and point, you see a computer-generated hand turn and point. VPL is currently working on a body suit that will track the entire body's movements. Such devices, for instance, translate your pointing forward into moving forward towards a wall. Tapping the wall twice could represent a command to add a door. Since there are many types of doors a virtual clipboard could appear in front of you offering buttons for several different kinds of doors. Press one button with your virtual hand, and a specific door could appear in front of you for examination.

Courtesy Autodesk, Inc.

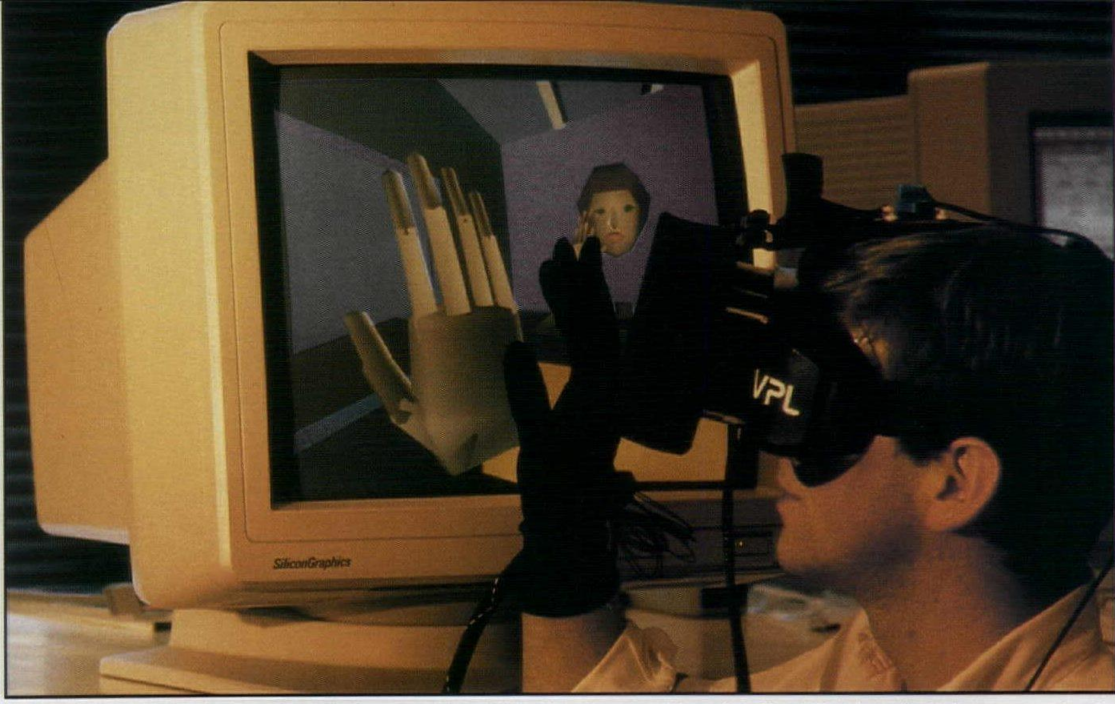
Autodesk's Cyberspace, with the aid of sensors in gloves, goggles, and microphones, enables our physical interaction with computer-generated "virtual reality".

An additional element being added to VPL gloves is the sensation of touch, or tactile feedback. If a glove could provide tactile feedback, you would feel an object in your hand as if you actually had something there. This is more important for applications like remote robot hand control, but it also helps to maintain an equilibrium between what the eyes see and what the body feels.

There is no reason that input has to be limited to these devices. In fact, many feel that a more powerful and natural means to input instructions is through a microphone. There is already software that can execute a command or a series of commands from words spoken into a microphone instead of keys pressed on a keyboard. However, each user must prerecord his or her own voice into the system; it is more difficult to match a spoken word digitally if a different voice gives a command. Considering the differences among voices and regional accents, this is an understandably difficult feature to make foolproof. Some have even suggested lip reading as a simpler solution.

A Design Tool?

A presentation of a virtual building need not be limited to one person. Several people can strap on equipment and enter into the virtual world, seeing each other's virtual bodies while the designer narrates a tour and music plays in the background. But the potential result is more than just MTV CAD. A virtual reality system can also aid in design. Walking through a virtual building layout, the designer can move a window by pulling on it, or can push a wall or raise a ceiling.



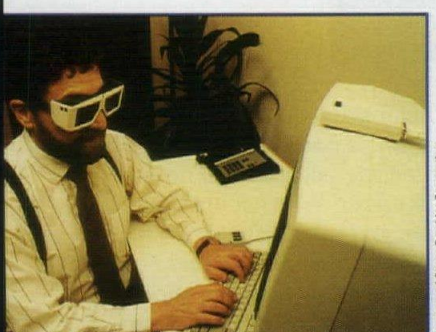
Courtesy VPL Research, Inc.

VPL Systems provides complete virtual environment systems including workstations, "Datagloves," and "Eyephones," which can convert hand gestures and head movement into electronic signals.

Shadows can be viewed as they change throughout the course of a day. The designer can retain a sense of scale while changes are being made, literally seeing "the big picture" as it is being painted.

System Requirements

Virtual reality systems require as a bare minimum the processing power of the high-end PCs or workstations such as those from Silicon Graphics, which are popular for their advanced graphic display speeds. It is important to consider that this technology has migrated to PCs and is not restricted to more powerful (and more expensive) machines. Most CAD software allows 3D building data to be output into a format that can be used with virtual reality software. In fact, Autodesk, the maker of AutoCAD, has a virtual reality software project of its own called Cyberspace. The name "cyberspace" derives from science fiction author William Gibson's books and stories which describe a decaying society where people plug themselves directly into global computer networks. All input and output is handled through direct neural connections into this hallucinatory "cyberspace," bypassing the need for display devices and body suits. Obviously, this is not something we are likely to see this century. But Autodesk's presence in what would seem to be a far-fetched field certainly lends credibility to the current research.



Courtesy of StereoGraphics Corporation

CrystalEyes goggles create 3D illusions.

These PC virtual reality systems at present suffer from common complaints, mainly that the views are "jumpy," that there is a lag between an instruction to move and its visual execution, or that the virtual world is a primitive representation of reality. To conserve processing power, current systems must model objects as fairly crude polygons with little complex imaging, so the virtual reality is certainly not emulating the "real" world by producing photorealistic 3D images. More powerful systems can add other features such as texture mapping and can be faster and smoother.

The Virtual Worlds Consortium, based at the University of Washington, holds roundtable forums to discuss avenues of further research and virtual reality benchmarks. This organization is headed by Tom Furness, formerly of the Air Force, which along with NASA has been active in exploring virtual reality for flight simulators, remote piloting utilities, and planetary exploration. These top-of-the-line virtual reality systems are certainly closer to "reality" than systems now available to architects, but can easily cost $1 million. Another topic being explored by the VW Consortium is the possibility of retinal displays, to place images directly in the eye of the viewer.

Other 3D Models

There are other ways a computer can model an architectural design with three perceived dimensions, without needing to strap hardware onto a person's body. For instance:

• Computers can create holographic projections like Princess Leia's message in Star Wars, but this "synthetic dynamic holography" requires tremendous computer power. Systems under development at such research sites as the MIT Media Lab utilize Cray supercomputers to provide the number crunching required, and even then only small and short animations are made.

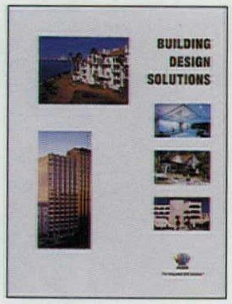
• Cylindrical displays that display an image from any angle in 3D: These "true volume imagers" rotate a 2D matrix of light emitting diodes (LEDs) or similar light sources inside a clear cylinder to create a 3D image. Systems being developed by Volumetric Imaging can even present the image with an opaque background regardless of what is on the other side of the cylinder, by using polarizing filters.

• CAD systems can produce models with processes often used in computer aided manufacturing (CAM) for product design. This "solid prototyping" generates models of 3D images by using lasers to fuse metal powders or light sensitive plastics, forming a physical model. However, this is difficult to implement when an object has many surfaces inside other surfaces as in the simplest house.

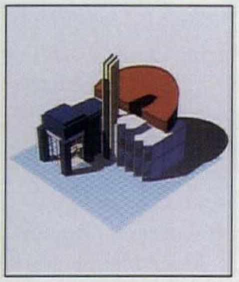
Computers entered the architecture market with CAD systems about 20 years ago and who would have guessed that the use of these systems would mature into important desktop tools? Likewise, creating a 3D model from a computer, whether using a 3D display device, assembling a physical model through CAD/CAM, or producing an artificial reality, is closer to existence than you might think. **Larry Yu** ■

The author is a technical writer at Graphic Systems, Inc. in Cambridge. He is the Editor of the GSI Report on Real Estate and Facility Management Automation.

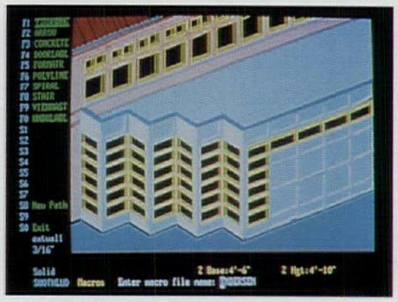
Computer Hardware/Software and Related Products Literature Digest



AEC Design Productivity. ASG Architectural is the hallmark of ASG's Building Design Solutions. Interface to the Pella Designer® library lets you draw doors, windows, and sunrooms parametrically. Version 5.0 adds versatile wall commands, automated roof design, faster door and window insertion, and automatic clean-up of lines and hatching. **ASG.** Circle No. 360

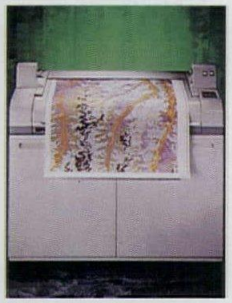


Upfront software allows you to work with form, light, and color in a true three-dimensional environment. Draw on any surface, line, or individual point. Realistic lighting and shadows automatically add depth and form to your design. There are no constraints. In any dimension, Upfront is the new standard in easy-to-learn, easy-to-use software.
Alias Software. Circle No. 361



Andersen® CADD-I® Version 2.0 is the most comprehensive CAD tool to help specify, draw, and tabulate Andersen windows. Its menu-driven program features three-dimensional drawing functions, nonlinear menu access, preselected defaults, four types of data reports, and fully-automated installation. It is compatible with AutoCAD 10 or later.
Andersen Corporation. Circle No. 313

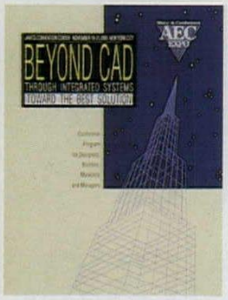
AutoCAD® Release 11 is a general purpose CAD program that runs on desktop computers, workstations, and networks. The program's open architecture and embedded high-level programming language make it uniquely flexible and versatile as a graphics standard for nearly every discipline. AutoCAD features easy-to-use pull-down menus, dialogue boxes, and icon menus.
Autodesk. Circle No. 362



For fast color plotting, the 68000 Series color electrostatics from Calcomp speed along virtually non-stop, completely unattended. Easy to use with front-load access, auto take-up reel, and the ability to accommodate four users, the Calcomp 68000 is ideal for high-demand environments where speed and quality are a must.
Calcomp. Circle No. 375

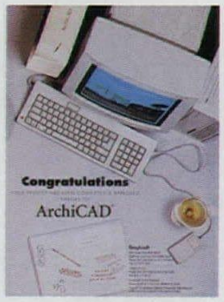
DynaPerspective is a powerful three-dimensional modeling, rendering, and animation program for the IBM or Macintosh platforms. This innovative, easy-to-use software lets you quickly bring your ideas to life, in breathtaking three-dimensional presentations. New Macintosh version now supports Pixar's MacRenderMan.
Dynaware USA. Circle No. 363

FastCAD 3D can take you from plan to presentation in a single package. Selecting, drawing, and editing entities have never been faster or easier. Why not optimize your design environment with FastCAD 3D's eight interactive windows, icons, and pull-down menus? Viewing three-dimensional objects is a snap from any position in hidden line, surface, and animation modes.
Evolution Computing. Circle No. 364

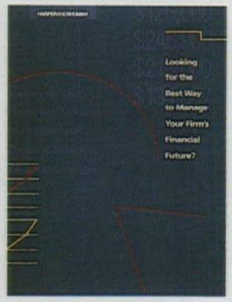


All the newest and best AEC automation, management, and marketing technologies under one roof — 1991 AEC EXPO Show & Conference, November 19–21 at New York City's Javits Convention Center. Beginning and advanced sessions, workshops. Hands-on training. New: AEC Integration Center. Free tickets and preview, call (800) 766-EXPO.
AEC EXPO EAST '91.

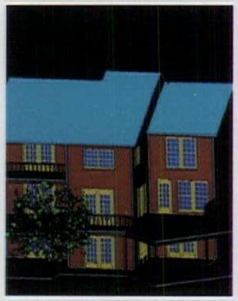
BIG D creates photorealistic renderings of three-dimensional DXF files. A graphical user interface allows for easy assignment of light, views, and materials. Rendering features include shadow casting, texture and bump mapping, reflections, transparency with refraction effects, parametric ray tracing, and unlimited point, spot, and directional lights.
Graphics Software, Inc. Circle No. 365



Use ArchiCAD to design your projects with incredible speed; get a materials list with a single click; take clients on a building walk-through with a few minutes preparation; produce photorealistic renderings for presentation; move right on to construction documents and detailing. All in the same program.
Graphisoft. Circle No. 366

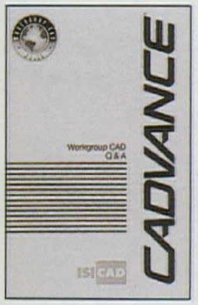


CFMS (Computer-based Financial Management System). Harper and Shuman develops, sells, and supports financial management software specifically for architects. The only system sponsored by the AIA, MICRO/CFMS runs on PCs and CFMS runs on the DEC VAX. A modular approach lets you buy only what you need.
Harper and Shuman Inc. Circle No. 367



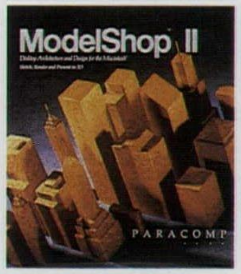
Thumbnail 3D is a unique AutoCAD add-on package that allows building designers and architects to move quickly from an initial concept to a true three-dimensional model without cumbersome three-dimensional modeling construction procedures. Developed by Integrated Computer Graphics, Thumbnail 3D improves productivity in residential and light commercial design.
ICG. Circle No. 368

MicroStation is a powerful, two-dimensional/three-dimensional microCAD software with more than 500 commands and features including rendering and hidden line removal — MicroStation PC for IBM-compatible computers; MicroStation Mac for Macintosh SE/30's and the Mac II family of personal computers.
Intergraph Corp. Circle No. 369

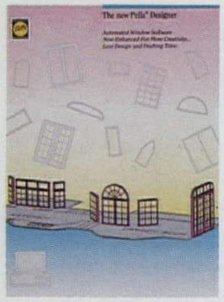


If you've wondered if you need CAD or what PC-CAD packages run on a network, then you'll want the "Workgroup CAD Q & A" handbook. It answers your questions and gives you information you need to understand how Workshop CAD can help. Compare CADVANCE, the first PC-CAD package designed for networks and certified by Novell, with other PC-CAD packages.
ISICAD, Inc. Circle No. 376

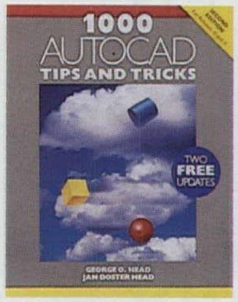
Marvin Windows' CAD software is designed to work with CAD Versions 2.52–11.0. The software lets design professionals draw and detail windows and doors in just a few keystrokes. It includes standard size symbols, elevations, and an architectural detail and specification manual on computer disk.
Marvin Windows. Circle No. 370



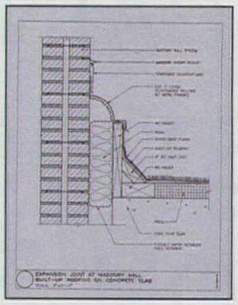
ModelShop II is a breakthrough in three-dimensional spatial design software. It is easy to use and offers all the modeling and animation features of other similar programs combined, including walk-throughs and fly-bys. ModelShop II is the tool of choice for architects, landscape architects, illustrators, exhibit and set designers, and urban planners.
Paracomp Inc. Circle No. 371



Pella®, the window manufacturer that brought you the first CAD window design package, now brings you an enhanced version of their Designer AutoCAD® package. Designer is a user-friendly, IBM-compatible, menu-driven computer program that works within existing AutoCAD or AutoCAD AEC® systems to detail Pella Products.
Rolscreen/Pella Windows and Doors. Circle No. 372



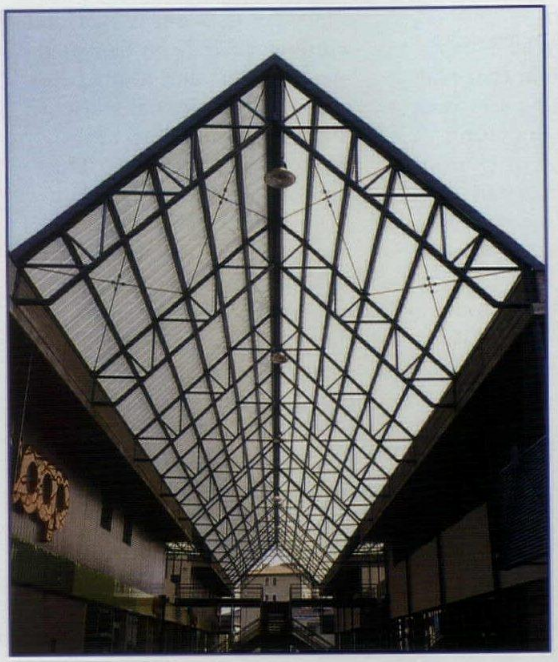
The Best Way to Stay Ahead of AutoCAD. Ventana Press offers six best-selling books and companion disks that give you never-before-published shortcuts and tips, an overview of commands and features, help for working in three dimensions, customizing AutoCAD, accessing and managing its powerful database, and using AutoLISP to solve simple drawing problems.
Ventana Press. Circle No. 374



The Vertex Detailer™ and Dynamics Details™ save hours of detailing time. You assemble building details rather than having to draw them using CAD primitives. Dynamic Details are pre-assembled details, ready to use and easily customizable. (Require AutoCAD.) Free demo disk.
Vertex Design Systems. Circle No. 373

New Products and Literature

New Products and Literature



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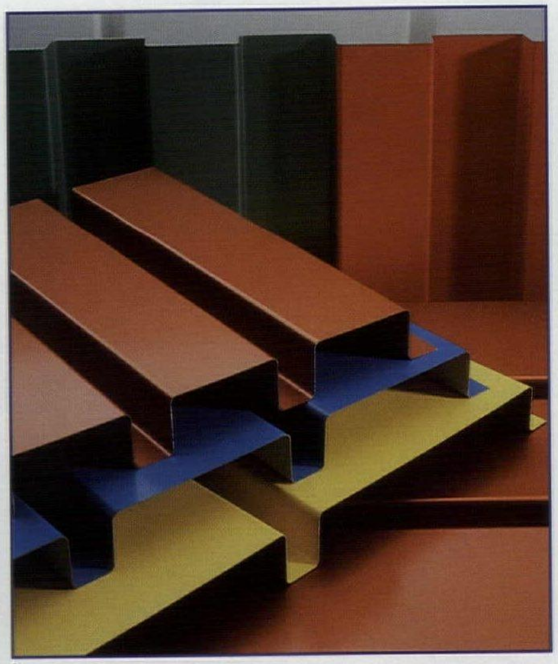


2

3

Building Products

1 Transparent Panel System
"Rodeca" is a transparent polycarbonate panel system manufactured in a variety of thicknesses and colors. Skylights, walkways, industrial glazing, suspended ceilings, partition walls, and greenhouses are among its many applications. Co-Ex Corporation.
Circle 100 on reader service card

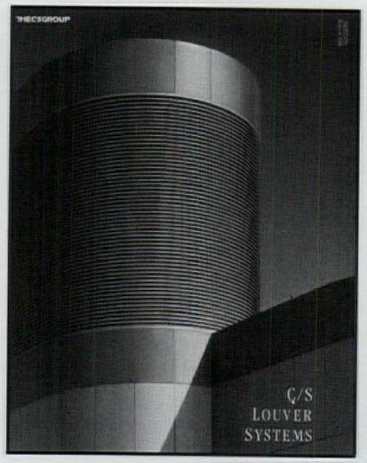
2 Metal Roofing/Wall Panels
"Verti-Line" metal panels for roofing and walls have 90-degree rib angles rather than trapezoidal profiles. Reveal and/or top pan widths can be custom designed. Panels have 1- to 1½-inch-deep reveals and lengths of 28 inches to 36 inches. Panels are fabricated in 18–26 GA galvanized G90 steel or aluminum and in a choice of paint systems. N.A.T.
Circle 101 on reader service card

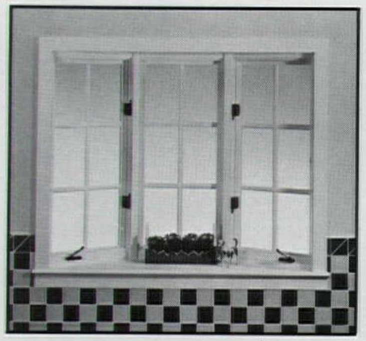
3 Colored Laminated Glass
"Saflex OptiColor System"™ is a laminated glass-plastic interlayer that combines sheets of pigmented polyvinyl butyral, producing an extensive collection of transparent and translucent colors. It has all the performance properties of laminated glass and is suitable for curtain walls, canopies, store fronts, signage, office interiors, partitions, and furniture. Monsanto.
Circle 102 on reader service card

(continued on page 136)

(continued from page 135)

Building Products





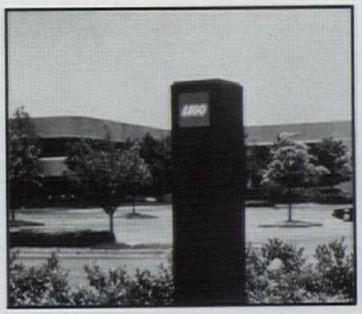
Commercial/Residential Sheathing
With "an 8.7 R-value per inch (at 75 degrees mean temperature)" new "Tuff-R® Blackore™ Insulating Sheathing" offers a thin profile insulation for residential and commercial projects. Sheathing is available in thicknesses of ⅜- and two-inches with R-values from 3.0 to 17.4 (at 75 degrees mean temperature); it is constructed of a modified-polyisocyanurate foam core with multi-laminate facers on both sides. Celotex.
Circle 103 on reader service card

Redesigned Louvers
This line of fixed louver systems has been redesigned; louvers now have "free areas of 48 percent." "C/S 55 percent High Performance Standard and Drainable Louvers" have been added to the line for applications where limited space and high air volume requirements exist; they have a patented external drainage system. The C/S Group.
Circle 104 on reader service card

Tile Underlayment
This brochure on "Floor-Board"™, a ¼-inch-thick interior underlayment for ceramic tile countertops and floors, describes performance characteristics and applications. "Floor-Board" is a companion product for "Wonder-Board"® and the company's interior tile backer-board. Glascrete.
Circle 105 on reader service card

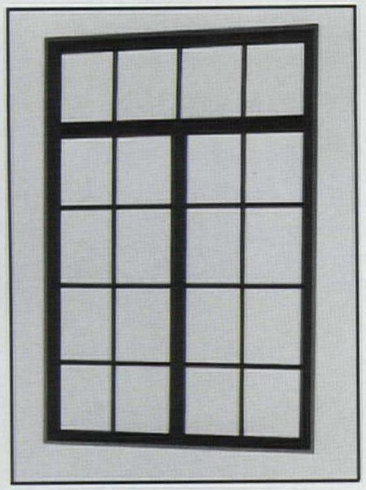
Bi-fold Glass Doors
"Opening Glass Wall"™ is a flexible door system that may be used as a single-entry door, swinging double-operating French doors, and as exterior bi-fold doors, which can be folded and fully opened. Douglas fir frames, multi-point locking systems, and insulated glazing are standard. Doors are applicable for commercial (store fronts, restaurants, offices) and residential (decks, solariums) uses. Nana.
Circle 106 on reader service card

Windows for Western Climates
The "Teton"™ series of wood windows have been designed to meet climatic and aesthetic demands of residential construction and remodeling in the Western United States. The windows have double weather-stripping around the sash and frame and standard ¾-inch, dual-pane, Low-E, argon-filled insulated glass. The line includes awning, tilt double-hung, sliders, casement, round-top, bow, bay, and radius windows, patio doors, and custom designs. Norco.
Circle 107 on reader service card



Modular Sign System
"Manhattan" is a new modular sign system for interior or exterior use. Signs can be illuminated; they have a maximum height of 16 feet, and maximum depth and length of seven feet. Fifteen standard panel sizes are five to 88 inches in height; they are fabricated from formed aluminum with a baked enamel finish in 50 colors. Words and graphics can be vinyl cut, silk screened, engraved, applied three dimensionally, or laser cut for backlit signs. Modulex.

Circle 108 on reader service card



Renovation/Restoration Window
The "590" is a heavy commercial casement and projected window that "replicates the steel windows used from the 1920s through the 1950s." It has a 2⁷⁄₁₆-inch frame depth, accepts insulating glass, and is available in a variety of coatings and colors. EFCO.

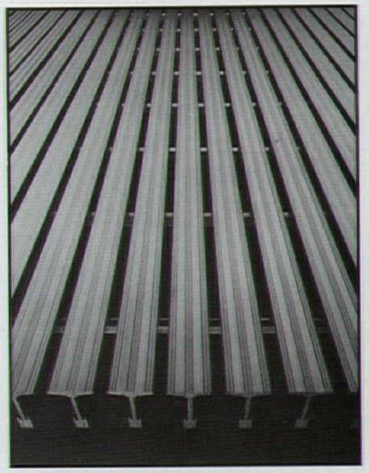
Circle 109 on reader service card

Elastomeric Waterproofing
Super Flex™ elastomeric waterproof coating systems offer a "completely water-tight" finish for above-grade exterior surfaces. The system can be used for new construction, renovation, and maintenance projects over properly cured and prepared concrete, masonry, stucco, brick, and exterior grade plywood or metal. A variety of textures and 10 standard colors are available. Proko.

Circle 110 on reader service card

Modified Bitumen Roofing
"Nord Black Bear" is a polyester-reinforced APP torch-applied membrane with a top surface of UV-resistant black granules. Membranes are one meter wide and 10 meters long; a four-inch selvage edge insures homogenous bonding at the side lap area. Nord Bitumi U.S.

Circle 111 on reader service card



Aluminum Grating
"Safe-T-Grid" is a new aluminum grating system based on a T-shaped extrusion used for the bearing bars. The top flange of the T provides a broad footing surface and, together with other structural elements "creates a rattle-free, high-durability grating." IKG.

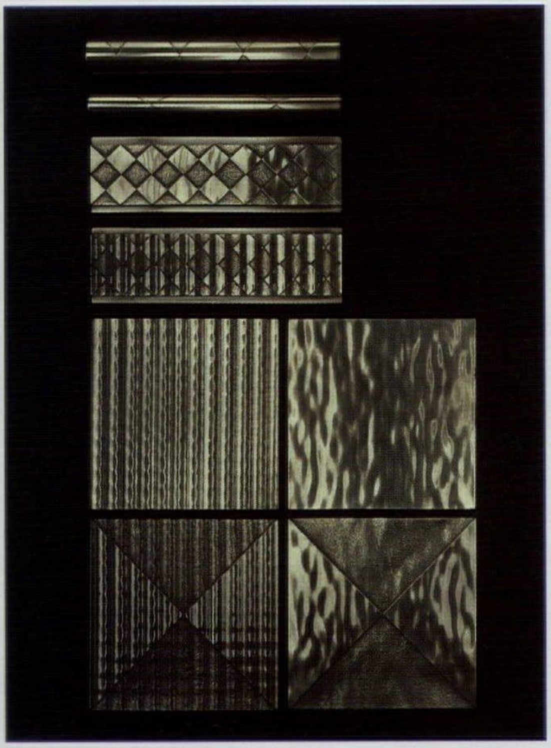
Circle 112 on reader service card

(continued on page 141)

Architect: Murphy/Jahn

Livingston Plaza, Brooklyn, NY

1



2

3

Interior Products

1 Inlaid Sheet Vinyl Flooring
"Fields" and "Forms" are compatible lines of inlaid sheet vinyl flooring suitable for commercial and institutional applications. "Forms" includes three patterns and "Fields" two designs: Random Fields in 12 colors and Fine Fields in 28 colors. Both can achieve a continuous, non-porous, watertight surface. Mannington Commercial.
Circle 113 on reader service card

2 Metal Wall Tiles, Trim
"Questech" tiles and trim are fabricated with an integrated metal composite of metal, polymers, and ceramic. Solid metal surfaces of bronze, pewter, or copper can be polished, sealed, or left to patinate; surfaces can be smooth or textured. Tiles are 4″ × 4″, 4″ × 6″, and 6″ × 6″ and trim pieces are eight- and 12-inches-long; both can be ordered in custom sizes. Intaglio Ltd.
Circle 114 on reader service card

3 Coordinated Laminates
"Sora" is a coordinated collection of Wilsonart® Brand Decorative Laminates. Each of the 15 products in the collection is named after a Japanese kite and is inspired by Japanese design. "Sora" is available in the standard range of laminate grades, finish options, and specialty products.
Ralph Wilson Plastics.
Circle 115 on reader service card

(continued on page 143)

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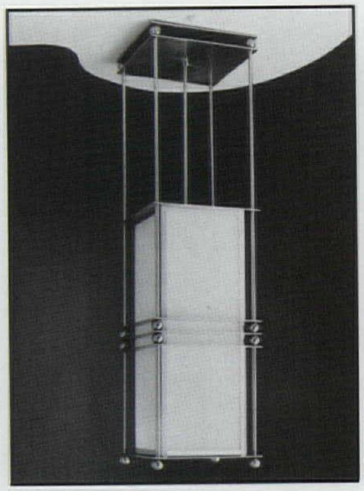
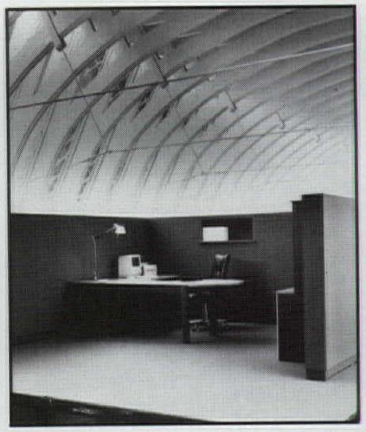
Interior Products





Plaster Cornice Moldings
A line of molded plaster cornices includes egg and dart, acanthus leaves, dentils, swags, cove cornices, and other traditional and contemporary designs; original cornices can be reproduced for restoration and remodeling projects. Classic Moldings.
Circle 116 on reader service card

Lighting Fixtures
"The Jeffrey C." lantern fixture, fabricated with satin aluminum and sand-blasted glass, is part of an extensive line of pendants, sconces, and flush-mounted lighting systems for commercial and residential projects. All models may be specified for incandescent or fluorescent sources. American Glass Light.
Circle 117 on reader service card

New Office System
"Project: fx" office system, recently introduced by a British company for a global market, was designed on "the concept of simplicity. . . independent elements. . . connected in many different positions." Desks and storage components can be positioned in various ways around the system's wall unit; all components can be assembled and joined using an Allen key. Project Office Furniture.
Circle 118 on reader service card

Steel and Wood Stool
The "Rockwood Stool" has a welded steel, sandblasted and polyurethane base, and a wood seat with a textured black finish. Two seat heights are available: 25 and 29 inches. Machine Language.
Circle 119 on reader service card

(continued on page 144)

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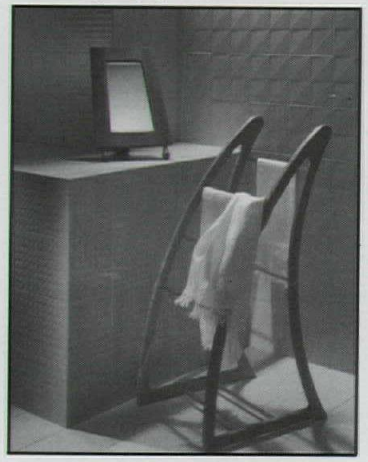


Textured Ceramic Tiles

The graphic surface texture of "Tekne" ceramic tiles, designed by Daniele Bedini, is achieved through the combination of four tile styles. White, metallic black, pale orange, green, and gray tiles can be ordered. Ceramica Bardelli.

Circle 120 on reader service card

Streamlined Lounge Chair

The "Spinnaker" lounge chair, designed by Tom Deacon, is part of a collection of 38 sofas, chairs, ottomans, and tables inspired by 1930s American designs. "Spinnaker" is 32 inches wide, 31 inches deep, and 30½ inches high. Design America.

Circle 121 on reader service card

Hardware Brochure

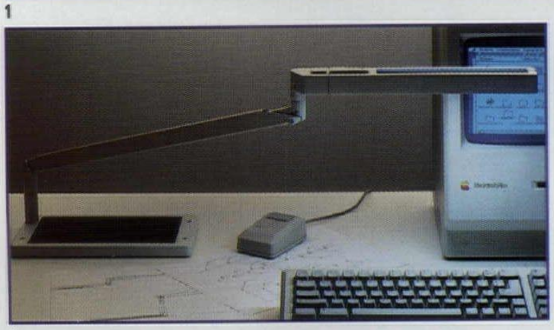
This brochure includes specifications for this line of hardware, which is available in solid brass, powder-coated "Porcelume"® aluminum, and "Aria"® solid-surfacing material. The company offers knobs, pulls, and accessories (pivots, catches, bolts). Colonial Bronze.

Circle 200 on reader service card

(continued on page 147)

Technics-Related Products

1



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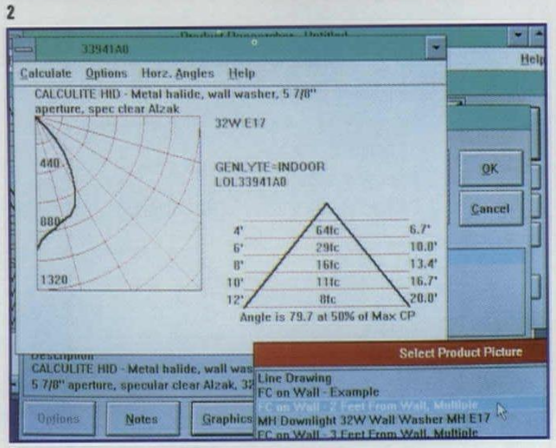

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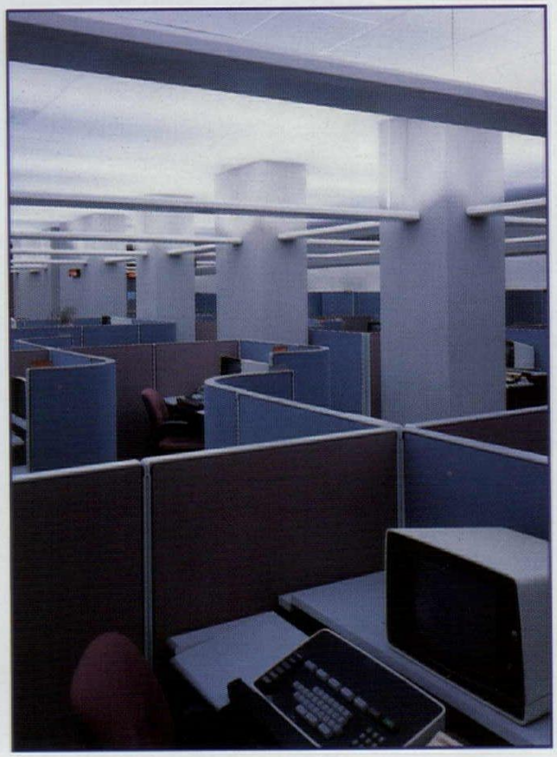

4

Office Lighting

Items in this section complement the Technics article on office lighting (p. 35).

1 Furniture-Integrated Lighting
A lensed-indirect lighting system from Peerless Lighting is integrated with the Context™ freestanding furniture system. Steelcase.
Circle 122 on reader service card

2 VDT Task Light
A new task lighting system uses a controlled beam to illuminate documents on work surfaces, but minimizes reflections on the screen and keyboard. A "pantograph-type" arm movement maintains a parallel distance to the work surface. Artemide.
Circle 123 on reader service card

3 Computer Lighting Resource
Electronic "Binders" for more than 12 lighting manufacturers are available on CD-ROM. The system includes CAD details and runs on a PC with Windows. Eclat.
Circle 124 on reader service card

4 Indirect Lighting
Low Ceiling Indirect Lighting (LCI™) fixtures are designed to supply even lighting in existing low-ceiling rooms. The fixtures are three inches deep and can be hung on a stem as short as nine inches. A full line of indirect fixtures is available for a range of office applications. Litecontrol.
Circle 125 on reader service card

(continued on page 148)

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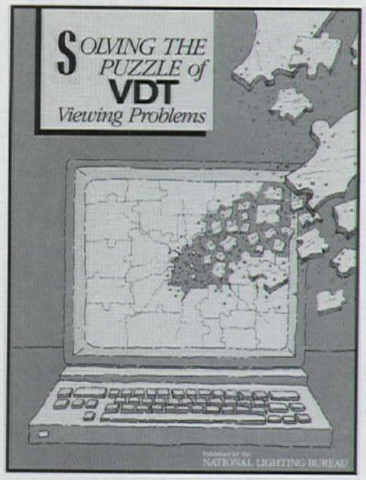
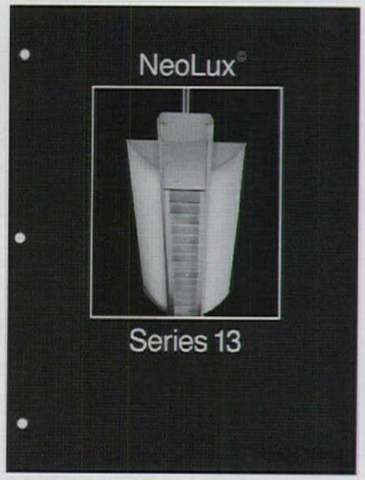


Lighting Information
Two brochures available at a nominal fee, *Office Lighting and Productivity* and *Solving the Puzzle of VDT Viewing Problems* offer suggestions for improving office productivity by reducing both glare and utility costs. National Lighting Bureau.
Circle 201 on reader service card



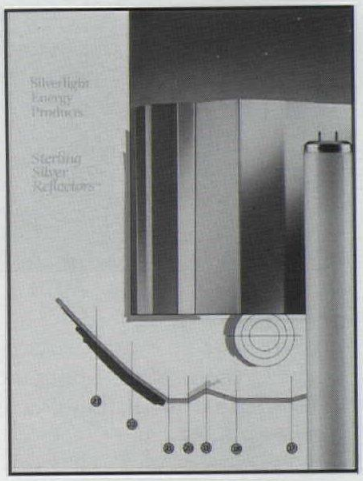
Direct/Indirect Lighting
"Series 13" Neolux© fixtures combine low-brightness parabolic direct lighting with wide indirect illumination. One-, two-, and three-lamp wall and ceiling models are available. Neoray.
Circle 202 on reader service card

Computer Screen Filters
8½ by 11-inch transparent filters are available in eight colors to block harmful light frequencies. A test kit determines the correct filter. Miller Institute.
Circle 120 on reader service card

(continued on page 149)

(continued from page 148)

VDT Task Lamps
New "Asymmetric Fluorescent Task Lighting" is designed specifically for computer workstations to distribute light across a single plane in one direction, helping eliminate glare and screen washout. Luxo.
Circle 127 on reader service card



Reflector Brochure
A color brochure describes how silver reflectors can reduce the number of fluorescent tubes needed to light a space while reducing glare. Silverlight.
Circle 203 on reader service card

Melanin Film
A new process uses natural melanin (the light-screening pigment in the retina) extracted from vegetables to filter ultraviolet rays and glare from fluorescent fixtures. Computer screen filters, fluorescent lamps, and sleeves and lenses to use with ordinary bulbs are now available. Natra Lite.
Circle 128 on reader service card

(continued on page 150)

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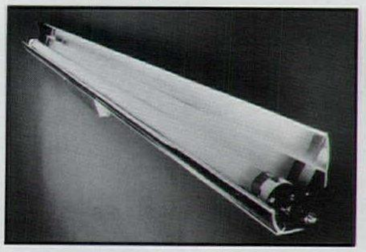
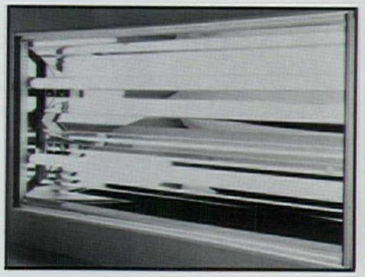
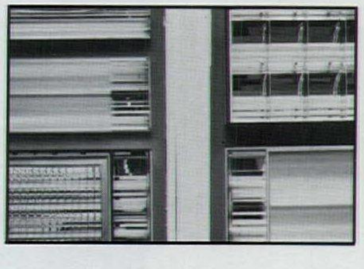


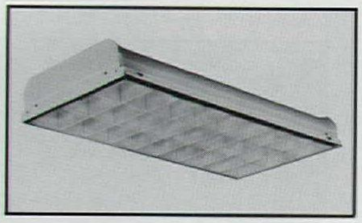
Concealed Fluorescents
An asymmetric lighting reflector uses a concealed fluorescent lamp for indirect wall or ceiling illumination. Elliptipar.
Circle 129 on reader service card



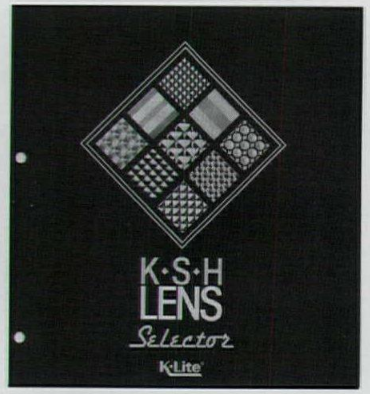
Mirrored Fixtures
A silver reflective material can be fitted into existing four-lamp fluorescent fixtures to provide the same amount of illumination with only two light sources. A brochure describes retrofit and new fixtures and potential energy savings. Specular +.
Circle 130 on reader service card



Silver Film Fixtures
More than 50 designs of lighting fixtures featuring a reflective silver film, comprise the new "Silverlux™" line of fluorescent units. 3M.
Circle 131 on reader service card



Louvered Fixtures
New "VDT Ultra" Luminaires are available in four ceiling configurations: grid, flange, z-spline/modular, and screw slot. Day-Brite Lighting.
Circle 132 on reader service card



Plastic Lens Selector
A brochure provides charts that explain the light distribution of 16 different plastic fluorescent fixtures. KSH.
Circle 133 on reader service card

Building Materials

Major materials suppliers as they were furnished to P/A by the architects for buildings featured this month.

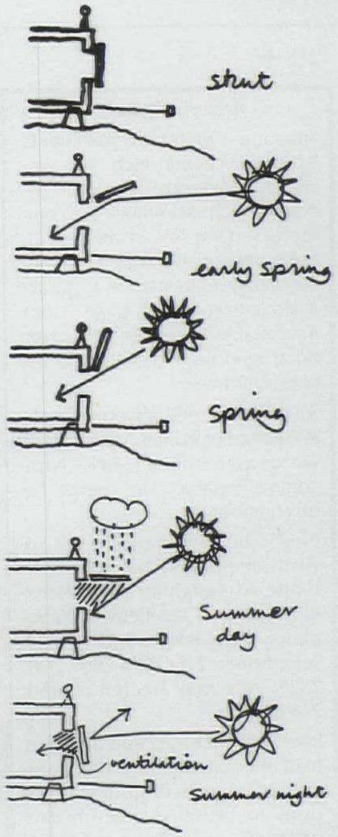
Project: Mission Inn, Riverside, CA (p. 82). *Architects: ELS/Elbasani & Logan, Berkeley, CA.* Clay tile: San Valle, Gladding McBean, and custom. Built-up roofing: Manville. Asphalt shingles: G.A.F. Walking decks: Dex-O-Tex, Mer-Kote. Exterior and interior paint/stain: Sinclair. Tubs, lavatories and water closets: American Standard, Kohler. Flush valves: Sloan.
(continued on page 152)

(continued from page 150)
Hinges: McKinney. Mortise locksets: Schlage locksets, Winfield keying system. Door closers: LCN, Sargent. Panic exit devices: Von Duprin. Specialty door hardware: Baldwin, Builder's Brass Works, Pemko. Washroom accessories: Bobrick. Sprinklers: Toro. Fire system: Edwards. Elevators: Amtech Reliable.

Project: East Campus project, Carnegie Mellon University, Pittsburgh (p. 90). *Architects: Michael Dennis, Jeffrey Clark & Associates, Boston; in association with TAMS/Architects, Engineers & Planners, Boston.* Dormitory/Dining Facility – Brick anchors: Hohman-Barnard. Caulking: Tremco. Copper fabric flashing: York. Dampproofing: Karnak. Light metal framing: Dietrich. Mailboxes: Bommer. Roofing, terne coated: Follansbee. Roofing, EDPM: Firestone. Rigid insulation: Dow. Skylight: Naturalite. Aluminum windows: Marmet. Aluminum entrances' PPG. Curtain wall: Wausau. Wood doors: Weyerhauser. Metal door frames: Steelcraft. Exit devices: Von Duprin. Flush bolts: Quality HW Mfg. Hold-opens: Rixson-Firemark. Electric strikes: Folger Adams. Pivots/closers: LCN, Sargent. Levers/Locks: Adams-Rite, Sargent. Cylinders: Best. Thresholds: Pemko. Paint: Tnemec, PPG. Acoustical tile: Armstrong. Gypsum board: Gold Bond. Fiberglass insulation: Owens Corning. Quarry tile: American Olean. Carpet: Charleston. Lockers: Mills Metal. Fire exits, cabinets: JL. Toilet partitions: Interion. Mirrors: McKinney. Elevators: Westinghouse.
Parking garage/Stadium — Penetrating sealer: Sinak. Traffic topping: Quaker. Joint sealer: Tremko. Waterproofing: Five Star. Sheet dampproofing: Sanneborn. EPDM roofing: Firestone. Coiling doors and shutters: Atlas. Aluminum louvers: Construction Specialties. Aluminum entrances: PPG. Paint: Tnemec. Parking equipment: American Parking Equipment. Elevator: Westinghouse. Toilet partitions: Knickerbocker. Plastic laminate: Wilsonart.
Press Box — Windows: Wausau. Terne coated steel roof: Follansbee. Acoustical and vinyl chloride tile: Armstrong. Rubber base: Roppe. gypsum board: USG. Light metal studs: Dietrich. Flagpole: Bartol. Plastic laminate: Wilsonart. Carpet: Charleston. Finish hardware: Sargent.

Ellerbe Becket Projects credits.
The following people at Ellerbe Becket worked on the projects featured on pages 102 and 103: Peter Pran, Carlos Zapata, Eduardo Calma, Curtis Wagner, Lyn Rice, Maria Wilthew, Helen Ferguson (NY), Tim Johnson, Paul Davis (Minn.), Mehrdad Yazdani, Louis Naidorf, Iris Steinbeck, Andrew Wong, Katherine Demetriou, Gary Frier, Vernon Pounds, Paul Kinley, Mike Kennedy, Dale Cohen, Bill Hansell, John Judge (LA), project designers; Jill Lerner, Ray Skorupa, Bob Zumwalt (NY), Tom Goffigon, Ignatius Chau (LA), project administrators; Bill Kidd, Ray Skorupa, Peter Grandine (NY), Ray Brovold, Duane Ramseth, Mike Medina (Minn.), medical planners; Mike Jones (DC), educational planner; Robert Millar, artist.

Books *(continued from page 101)*
he has an acute sense of composition and delights in the manipulation of form, often with bold expressionistic results. The undulating roof of the student building at the University of Stockholm in Frescati (P/A, Aug. 1984, p. 35) crawls over the landscape, supported by insect-like legs; it shelters a vibrant campus center. His library at the same university sports reading pods open to the sun, perched on pedestals outside the building. Spaces that are more organically than geometrically inspired, such as the university sports hall, convey a dynamic informality. Erskine's low-tech irony in the tree-like column/truss arrays of the Frescati library as well as his penchant for light scoops would probably make a true techno-functionalist like Norman Foster or Richard Rogers wince at their lack of architectonic dignity. But Erskine has no moral dilemma with conveying the whimsical or the ironic. His public buildings are celebratory, yet avoid the monumental; they break from the sterility often associated with social functionalism.



Courtesy Byggförlaget

Options for a reflecting and insulating shutter.

Today, as environmental and social concerns once again enter America's architectural agenda, it is refreshing to examine a body of work that has consistently addressed these issues while maintaining a commitment to good formal design. The work of Ralph Erskine affirms that a social agenda need not compromise aesthetic and cultural value.

"Erskine has no moral dilemma with conveying the whimsical or the ironic. His public buildings . . . break from the sterility associated with social functionalism."

At age 77, Erskine is not by any means ending his career, but he is winding it down; this monograph is a timely summary. It is the most authoritative publication on Erskine to date and will probably remain the definitive work. Much more thorough than a monograph by Peter Collingwood (1982), this book is organized both chronologically and thematically, with chronology dominant. It is a solid documentary of Erskine's work, and an interesting source of biographical information as well. Given the partisan nature of most monographs, it is short on criticism and insightful analysis. Nevertheless, this English edition improves upon the Swedish version published two years ago, and includes some projects not completed in time for the Swedish book. Both versions have a handsome folio format and are finely crafted books.

John Loomis ■

The author is an assistant professor at the School of Architecture at The City College of New York and an associate of KCA Architects.

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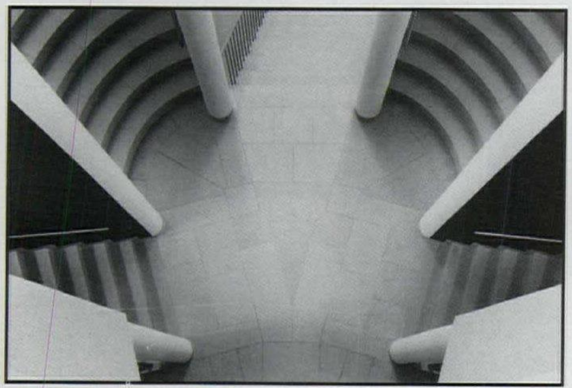


Peter Seidel

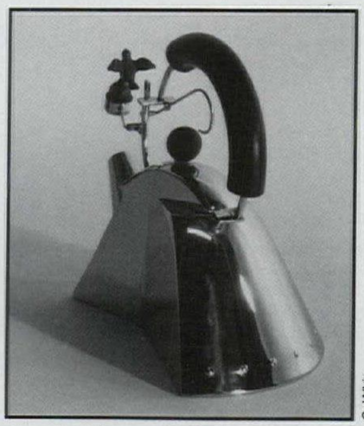
Stairwell of Hollein's museum: all gussied up?

Art for Architecture's Sake

To gauge the gulf that now separates the worlds of art and architecture, look at what art critics say about museums. Michael Kimmelman of the *New York Times* recently described Hans Hollein's Frankfurt Museum (p. 62) as "a maze of irregular spaces gussied up with windows, pillars, balconies, and staircases that vie with the art for attention . . . [with] rooms that upstage and subvert everything on view." One wonders if Kimmelman also begrudges having toilets in the basement or a cafe off the lobby. What lies behind such tirades by art critics against museum architecture? Is it just the sublimated rage of the art world, which seems to resent museums more as it has grown dependent upon them? Or is it that the art world has become so accustomed to seeing most art as a series of objects divorced from any particular place, that the place-making habits of architects seem simply an annoyance? Perhaps it is time that architects show some annoyance in return and ask the obvious question: Why are museums gussied up with all those paintings anyway?

Rehab in a Teapot

The Portland Building is not the only iconic 1980s design by Michael Graves undergoing renovation: San Diego architect Tom Grondona is now offering his "respectfully adapted" version (below) of Graves's familiar whistling-bird Alessi tea kettle. Grondona's version "accommodates our even more frenetic, competitive pace" through a couple of changes. He has added a trigger mechanism "to avoid having fingers scalded by removing the bird-whistle from its spout" and has sliced off part of the pot "in the spirit of water conservation." (To compensate for these changes, he has repositioned the handle.) A limited edition is available from his company, G-Whiz, for $2905, he says, "or $2755 with Alessi trade-in."



G. Whiz

Grondona's hot-rodded Graves teapot.

Rise of *Die Walküre*

For anyone who is moved to visit Carnegie Mellon University after reading our feature story (page 90), a visit to CMU's neighbor, the University of Pittsburgh, is worth the time, if only to see its "Cathedral of Learning," a 42-story Gothic tower by Charles Klauder completed in 1937. (It is visible in photos on page 93.) The building is like a downtown skyscraper that wandered out to a suburban campus, where it stands on top of a grassy hill. The upper part of the tower is filled with offices, but at the base are classrooms, an elaborate Gothic "commons room," and, most curiously, 19 "nationality rooms" furnished with materials from different countries and designed by architects from those countries.

The "cathedral" was built through the efforts of chancellor John Bowman, who wanted "a building that would inspire the city of Pittsburgh," according to Tim Ziaukus of the university. Ziaukus says Bowman also inspired the city to help pay for it: He persuaded schoolchildren to send in dimes and encouraged local citizens to "buy a brick in the cathedral." Bowman worked just as hard on his architect. After rejecting a couple of designs, Bowman played Wagner's *Die Walküre* for Klauder and told him, "I want *Die Walküre* in stone." He got it. ■

P/A in November. . .

What does "Modernism" mean after Post-Modernism? We speak of a revival of Modernism, but are we reviving the spirit of change and currency that characterized the Modern movement, or simply another historical style? Next month, P/A's annual issue on houses will consider these questions in the context of seven houses that define "Modern" in different ways. Among the featured houses will be two cited in the P/A Awards: the Crawford House in Montecito, California, by Morphosis (P/A, Jan. 1989, p. 84), and 30 Juniper Avenue in Toronto by Steven Fong (P/A, Jan. 1987, p. 94). Also included:

. . . a weekend house in Healdsburg, California, by Jennings & Stout

. . . an addition by John Lautner to one of his own houses in Los Angeles

. . . a house in Tel Aviv by Ada Karmi-Melamede

. . . a house in Santa Monica, California, by Mark Mack

. . . a house by Dale Jones-Evans in Australia.

A Technics Focus on Cladding in November will examine three aspects of wall systems: waterproofing, sealant joints, and stone anchors.