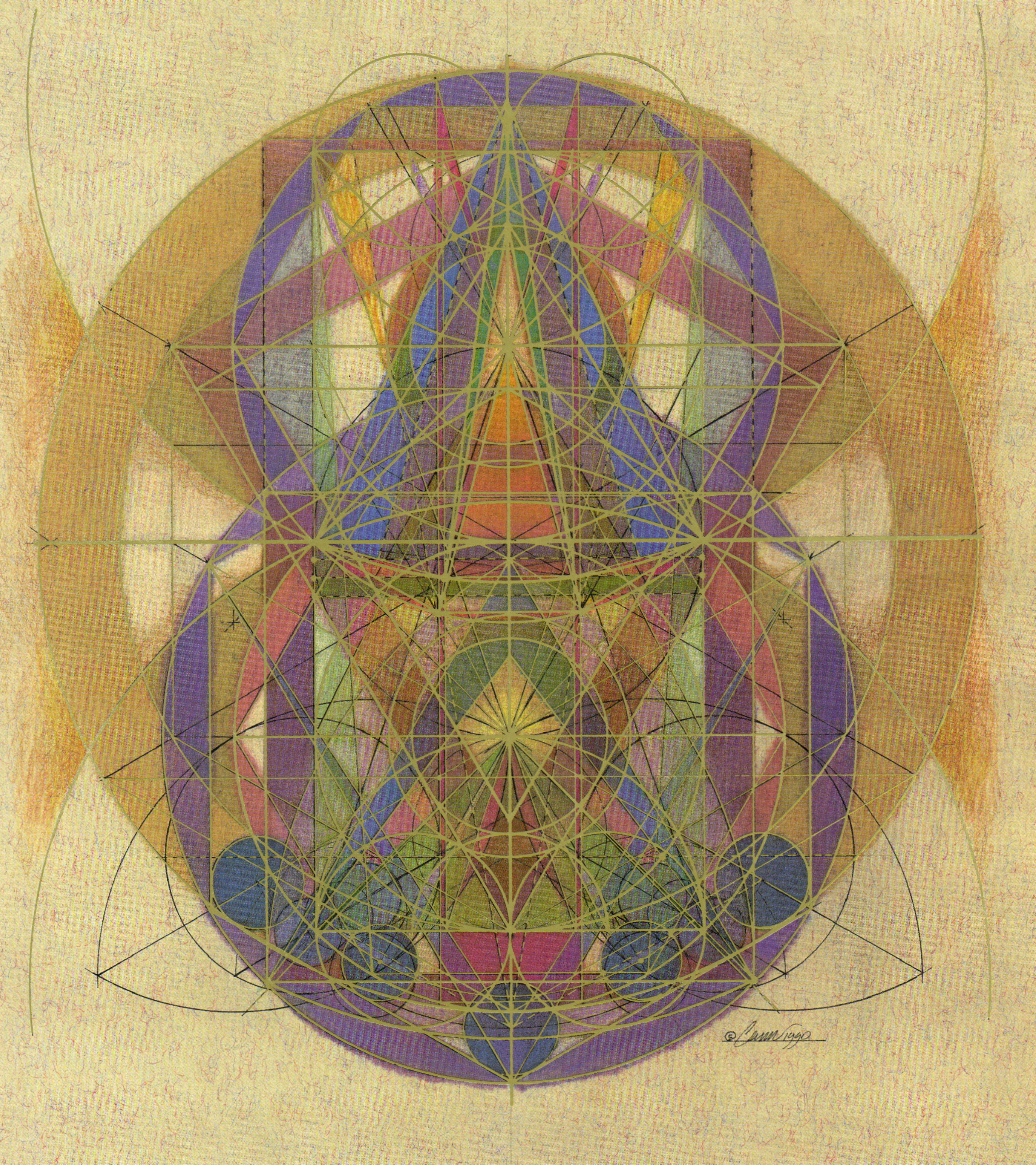
MAY 1990 ▪ SIX DOLLARS

ARCHITECTURE

INCORPORATING ARCHITECTURAL TECHNOLOGY



TECHNOLOGY & PRACTICE ANNUAL ▪ INVISIBLE ARCHITECTURE

EDITOR'S PAGE

GRASSROOTS TECHNOLOGY

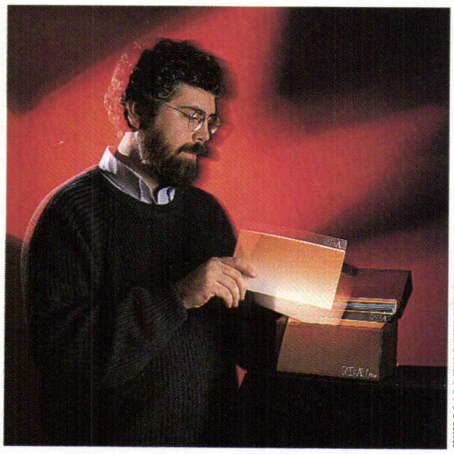
LAST MONTH, I VISITED THE CENTRAL OKLAHOMA CHAPTER OF THE AIA IN OKLAhoma City. During a meeting with chapter president Rand Elliott, our discussion turned to the future of architecture. Rather than analyzing the next design "ism," however, Elliott focused on adjustable building technology as the real challenge of the next century. "Steel will become so expensive that structural members will be constructed of plastic," the Oklahoman predicted. "Robotics will enable building exteriors to act like human skin in adjusting to changes in the weather. Window glass will automatically become transparent or opaque according to the sun." Elliott's interest in technology is being echoed across the country by a grassroots movement of architects who are turning away from 1980s structural "dishonesty." Instead of fashioning curtain walls from stone panels to simulate solid masonry construction or precasting concrete into classical orders, these practitioners are exploring new applications of materials and building systems. Many architects now feel that technology must become more responsive in meeting the social changes affecting the workplace and home without sacrificing the human scale of Postmodern design.

An example of this humane attitude toward technology is Frank Carson (top right), whose geometrical explorations featured in this issue question the fundamental ways in which architects approach proportion. Other evidence of the grassroots approach to technology is found on the last page of this magazine every month in the NEAT file. As demonstrated by Michael Crosbie (right), who edits the feature, the NEAT file is intended to be torn out of the magazine, folded, and stored in a card box as a handy reference guide. The many architects who have already written to us about their experiences in design and construction offer practical lessons in building technology. To encourage you to send in your own helpful hint, we offer $100 for every NEAT idea published. ■

—DEBORAH K. DIETSCH

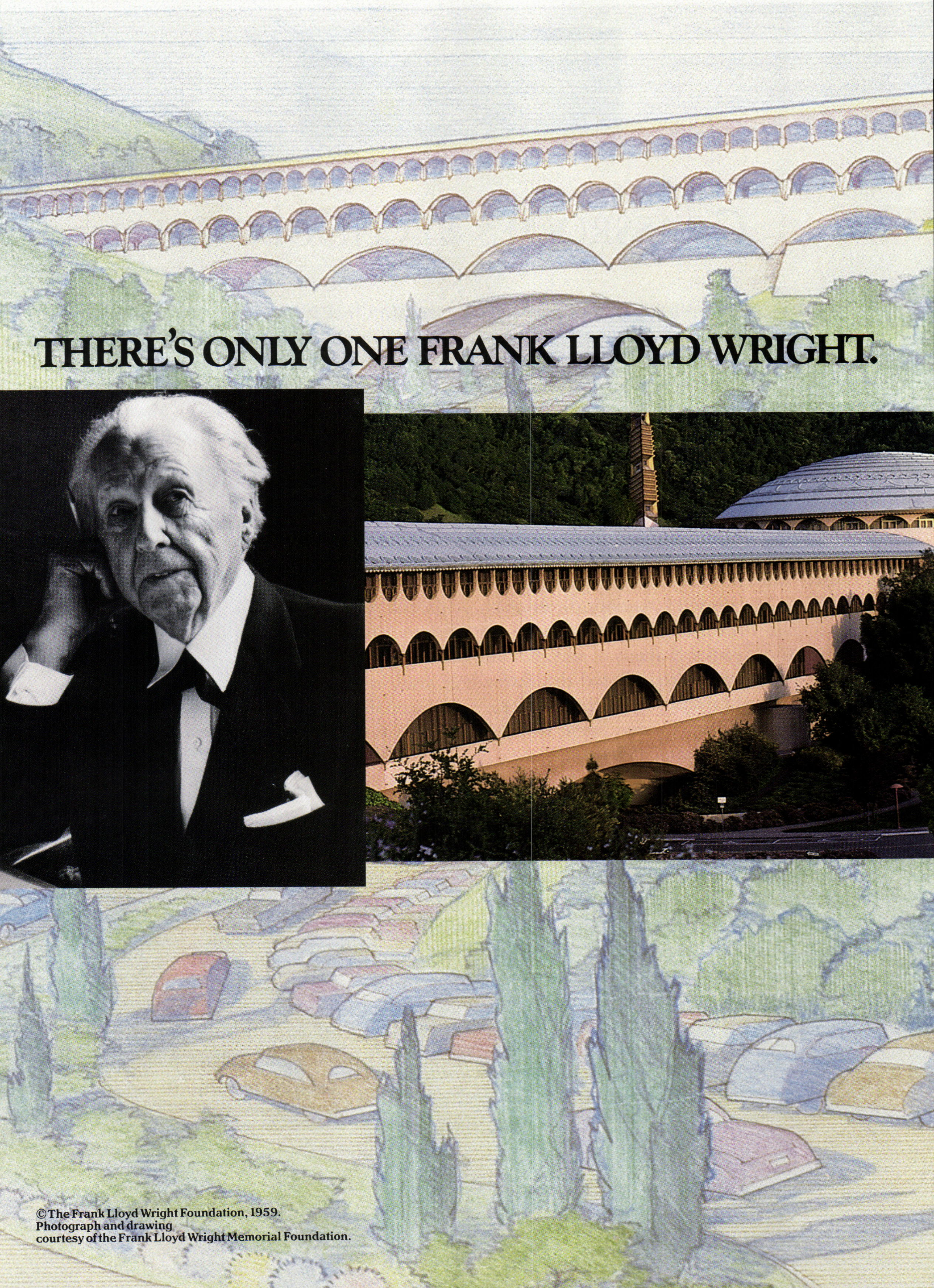
WILL GIBSON

Frank Carson proposes a proportional system through geometric analyses that is more sympathetic to human scale than a modular grid.



WILLIAM WHITEHURST

Senior editor Michael Crosbie demonstrates the insertion of a NEAT idea into a card file for future reference.


THERE'S ONLY ONE FRANK LLOYD WRIGHT.
©The Frank Lloyd Wright Foundation, 1959.
Photograph and drawing
courtesy of the Frank Lloyd Wright Memorial Foundation.

LETTERS & EVENTS

Slave Wages

It seems that neither you nor Sylvester Damianos has noted the biggest problem facing the profession in "maintaining a level of leadership" (February 1990, page 13). How does Damianos expect architects to "act as a partner with HUD in determining innovative solutions to housing, especially in the area of design," when HUD pays architects slave wages? I think Damianos' agenda is noble, but upside down.

Peter J. Stewart
Louisville, Colorado

New, But Not Improved

Your picture on page 53 (February 1990) says it all. You really have no eyes to see. Archbold Hall at Choate Rosemary Hall shows how wondrously well, with human scale, we used to design when we knew how. The new science center designed by Pei Cobb Freed shows how much we have lost. Is this really the best in American architecture or are you just putting us on—or do you know the difference?

Jerome Morley Larson, Sr., AIA
Red Bank, New Jersey

No Fads, No Fashion

How gratifying to read (February 1990, page 56) of Pei Cobb Freed & Partners' place at the top of the list of "architects that exert...the most positive influence on current design." The firm is, in my opinion, to be applauded for its continued adherence to a Modernist ethic.

With almost 40 years' practice as an architect, my severest criticism of the profession is the tendency of some practitioners to be "different." In their search for an audience to practice as stylists in the manner of Manhattan dress designers or Detroit automakers, periodically creating a "new look" to assure a market for their product rather than to create a serious, lasting architecture.

There will, of course, always be certain building programs in which "theater" has a role. And I have no wish to limit innovation. But the Postmodernists with their paper cutouts and classic ornamentation pasted over Modern structures are guilty of gimmickry and cuteness in striving for public attention.

Richard K. Albyn, FAIA
Pisgah Forest, North Carolina

Collage and Conflict

Looking at the March cover, I wonder if I have lost my sanity or am I looking at the world through the distorting mirrors of an architectural fun house. It seems ironic that a project (Yale University Psychiatric Center, designed by Frank O. Gehry & Associates and Allan Dehar Associates) dedicated to bringing reality to its patients distorts scale, juxtaposes normal ordering systems into conflicting relationships, and presents the user a cold, industrial material palette. As a collage of architectural objects, the project does exhibit an interesting composition; however, in the matters of character, appropriateness, and purpose, the project presents an image of artistic self-gratification rather than sensitivity to the needs of the users.

Alan W. Brunken, AIA
Professor of Architecture
Oklahoma State University

Lead Dangers

The use of lead-coated cladding for two projects appearing in the March 1990 issue has alerted me that architects may not be aware of the detrimental effects of utilizing lead for exterior surfaces. Exposed to the environment, a significant portion of the lead will oxidize and inevitably make its way into the groundwater and into the aquifiers. The deleterious consequences for animal life of exposure to environmental lead are well documented in scientific literature. The architectural community would do best to avoid the use of lead for exposed surfaces.

Joseph M. Phillips, Jr., ACS, AIA
Denver, Colorado

Corrections

Hoover Berg Desmond are the architects of Light of the World church (March 1990, page 107).

The photographer of the Memphis Brooks Museum (March 1990, pages 122-127) is Mick Hales.

MIT Press was incorrectly listed as the publisher of *A Vision of Britain* by HRH The Prince of Wales (February 1990, page 41). The book is published by Doubleday.

The 1990 AIA Component Award winning project Underground Atlanta (March, 1990, page 58) was a joint venture between Cooper Carry & Associates and Turner Associates/Architects & Planners, Inc.

May 19-22: "Pushing the Limits," the National Convention and Design Exposition of the American Institute of Architects, to be held in Houston, Texas. Contact: AIA, (202) 626-7395.

May 27-June 1: "Cultures & Technologies," the 17th Congress of the International Union of Architects, to be held in Montreal, Canada. Contact: Congress Secretariat—UIA XVII, c/o Société La Clé, 640 Saint-Paul Street West, Suite 102, Montreal, Quebec, Canada, H3C 1L9. (514) 876-1055.

June 12-15: NEOCON will be held at the Merchandise Mart in Chicago, Illinois. Contact: Mary C. Tasch, Communications Coordinator, at (312) 527-7552.

June 12-15: A/E/C Systems 1990 Conference to be held at the Georgia World Congress Center in Atlanta, Georgia. For more information call (800) 451-1196 .

June 14-16: Lighting World show and conference for architectural, commercial, industrial, institutional, and decorative lighting, to be held at McCormick Place North, Chicago, Illinois. Contact: Denise M. Bigo or Cynthia E. Schieber at (212) 819-0755.

June 17-22: "Growing by Design," the 40th International Design Conference in Aspen, Colorado, will explore the important relationship between design and children. Contact: Deborah Murphy, IDCA, P. O. Box 664, Aspen, Colorado, 81612. (303) 925-2257.

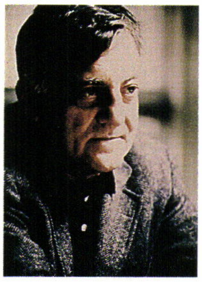
June 18-29: "Changing Roles? Urban Management and Housing in the Third World," the biennial International Shelter Workshop presented by the Massachusetts Institute of Technology School of Architecture and Planning. Contact: Nabeel Hamdi or Reinhard Goethert, MIT, Dept. of Architecture, 77 Mass. Ave., Building N52-492, Cambridge, Massachusetts, 02139. (617) 253-8376.

June 29-July 1: The 34th Annual Construction Specifications Institute Convention and Exhibit, to be held in Chicago, Illinois. Contact: CSI, 601 Madison Street, Alexandria, Virginia, 22314-1791. (703) 684-0300.

NEWS

TECHNOLOGY UPDATE ▪ IBM ARCHITECTURE ▪ MOMA SYMPOSIUM ▪ AIA ACCOLADES

Aldo Rossi Wins Pritzker Prize



ITALIAN ARCHITECT ALDO ROSSI HAS been elected to receive the 1990 Pritzker Architecture prize, joining a dozen architects already singled out for their contributions to humanity and the built environment through the art of architecture. In a period of diverse styles and influences, the awards jury cited Rossi for eschewing "the fashionable and popular to create an architecture singularly his own."

Born in Milan in 1931, Rossi graduated from the Polytechnic University of Milan in 1959. His career as a theorist began during the years he worked on the leading Italian architecture magazine, *Casabella*. His books, *Architecture and the City,* published in 1966, and *A Scientific Autobiography,* published in English in 1981, are fundamental texts in contemporary urbanism. "Out of this theoretical base came designs that seem always to be a part of the city fabric rather than an intrusion," said the jury. "He uses his talents and ability to solve design problems in memorable and imaginative ways."

In recent years, Rossi has completed a number of projects including Toronto Lighthouse Theater, the Il Palazzo Hotel complex in Japan, and housing projects, museums, schools, cemeteries, and theaters in Italy. In the U.S., he has completed two projects: a monumental arch in downtown Galveston, Texas, and a house in Mount Pocono, Pennsylvania. According to the jury, Rossi has been able to "follow the lessons of classical architecture without copying them; his buildings carry echoes from the past in their use of forms that have a universal, haunting quality."

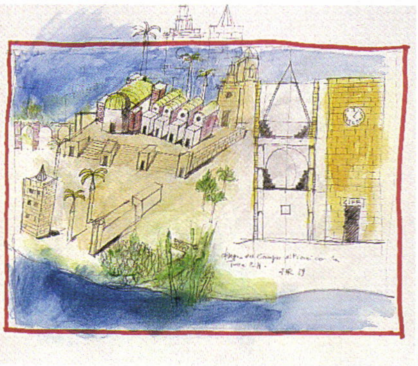
Rossi's drawings and paintings have won him acclaim, and his product designs for such objects as a coffee pot, toys, clocks, and furniture added another dimension to his career. In addition, he has taught in Italy, and served as a visiting professor at Harvard, Yale, Cooper Union, and Cornell.

The prize, consisting of a $100,000 grant and formal citation, will be presented in Venice in June by Jay A. Pritzker, president of the Hyatt Foundation, which established the prize in 1979.

—LYNN NESMITH

One of Rossi's projects in Japan, the Sapporo Restaurant and Beer Hall (below), is scheduled to begin construction this year. The University of Miami school of architecture (bottom left) is under construction.

NED MATURA



NED MATURA

The Festival Arch in Galveston, Texas (above) is a portal with four stanchions stationed at the head of city's historic main street.

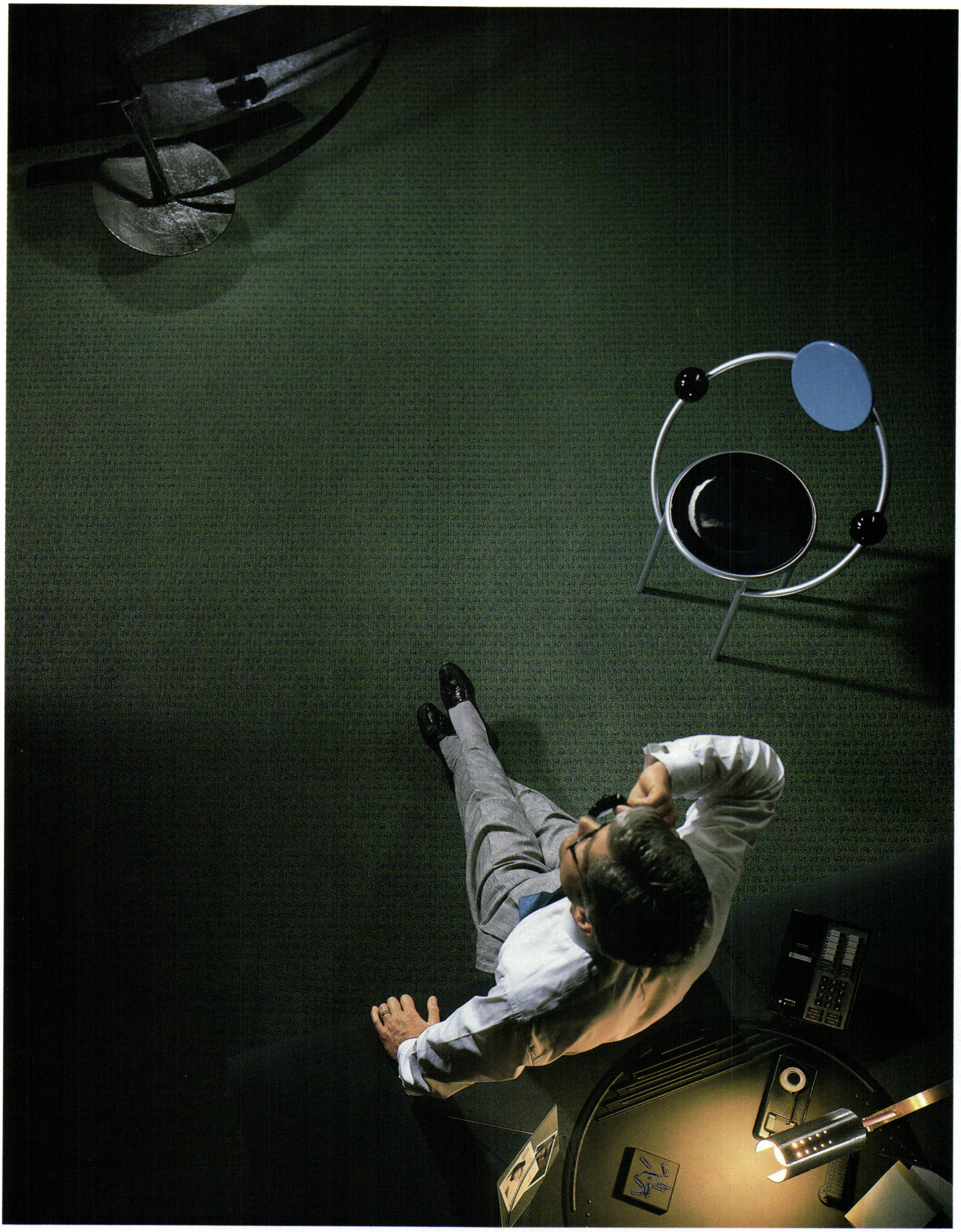
AIA BRIEFS

Deane Evans, AIA, has been appointed director of the AIA/Association of Collegiate Schools of Architecture Council on Architectural Research. Evans was formerly a senior partner at Steven Winters Associates in New York City. The Council's mission is to promote and coordinate research relevant to the teaching and practice of architecture.

New legislation sponsored by the New Jersey Society of Architects (NJSA), permits licensed architects only to design all building types and clearly defines the practice of architecture as distinct from engineering. The legislation, effective in May, also establishes a five-member joint committee of architects and engineers to resolve disputes between the two professions concerning the scope of practice issues. Responding to complaints by the NJSA, the State Board of Architects has sent cease and desist orders to over 20 contracting firms that falsely advertise architectural services. The New Jersey State Board is sending out rules and regulations and a roster of licensed architects to municipalities and all architects registered by New Jersey.

A joint committee between the National Society of Professional Engineers and the AIA met recently to begin development of inter-professional practice guidelines. The meeting was arranged in an effort to forge better understanding of the respective and, at times, overlapping practices of the two professions. Guidelines acceptable to both organizations are expected to issued by July, 1990, and each group will communicate the guidelines to their memberships.

Harvey Gantt, FAIA, former mayor of Charlotte, North Carolina, and principal of Gantt Huberman Architects, is a leading contender in the Democratic primary for the North Carolina Senate seat currently held by Jesse Helms. If elected, Gantt would be the only architect in the U.S. Congress.



DETAILS

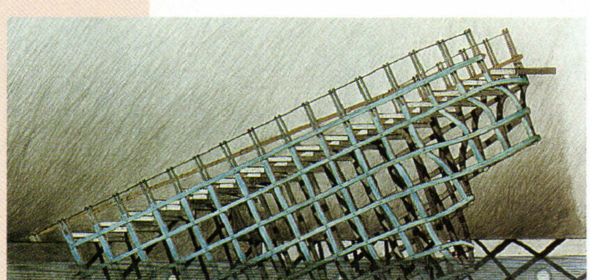
Richard Keating, FAIA, partner-in-charge of the Los Angeles office of Skidmore, Owings & Merrill, resigned from the firm effective October 1. He plans to stay in L.A., but has yet to decide whether to start his own firm or join an established practice.

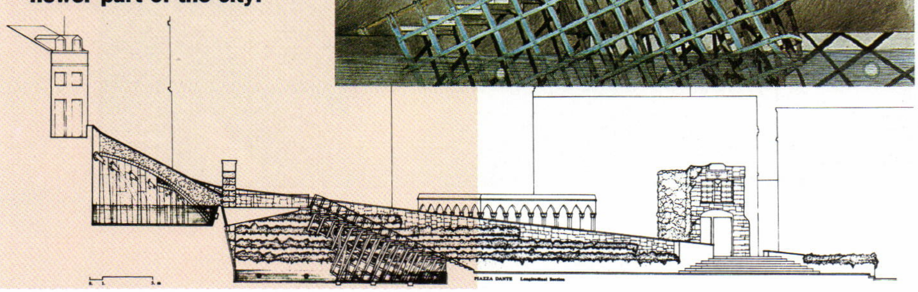
Chicago mayor Richard M. Daley endorsed new guidelines in March for a park-like development along the Chicago River, to be incorporated into the formal zoning process, pending city council approval. His long-range plan is to form a continuous, public greensward from Lake Michigan to the western fringes of downtown.

Stephen Kliment, FAIA, has been appointed *Architectural Record's* new editor-in-chief, replacing Mildred F. Schmertz who resigned in March. Kliment comes from John Wiley & Sons as editor-in-charge of architecture and design books, and was previously editor of the Whitney Library of Design.

Officials from San Mateo County and the Bay Area Rapid Transit (BART) system have agreed to build a 10.3-mile rail system running from South San Francisco to San Francisco International Airport. The $590-million, mostly above-ground system will include three stations ending within a mile of the airport.

Machado and Silvetti Associates of Boston won the international competition for the design of a plaza in Genoa, Italy (below, and close-up rendering of stairs, right). The plaza will be constructed in honor of the 500th anniversary of Christopher Columbus's discovery of America, near the house where Columbus is said to have lived. Known as Piazza Dante, the stepped plaza will join Genoa's medieval gates with the newer part of the city.

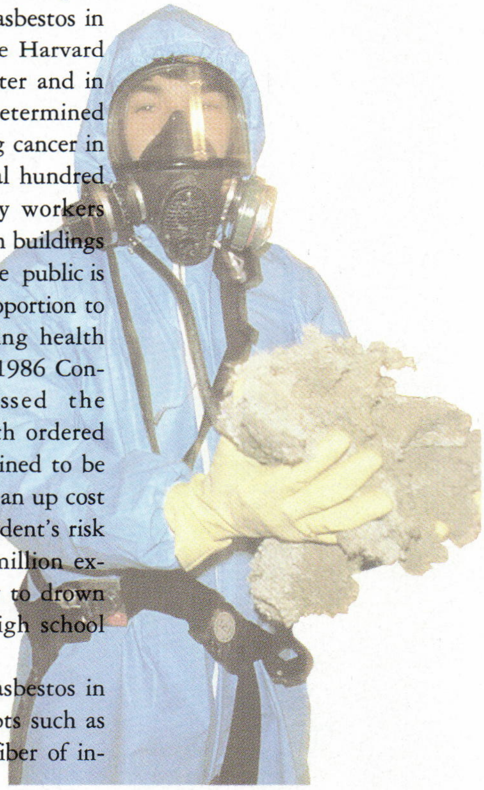




Asbestos Abatement: Rip-Out or Rip-Off?

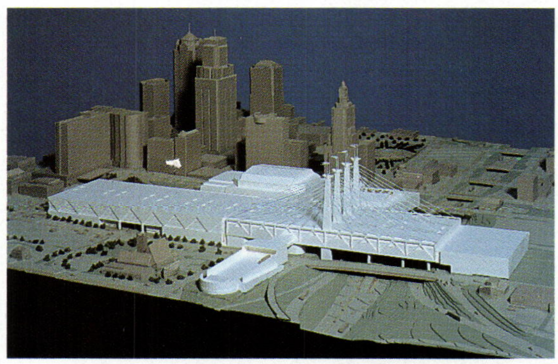
TECHNOLOGY UPDATE

A NUMBER OF STUDIES ARE RE-EXAMINING THE RISKS of low-level exposure to asbestos in buildings. A recent report in *Science* magazine concludes that the "risk from asbestos in buildings is miniscule." Findings published by the Harvard University Energy and Environmental Policy Center and in the *New England Journal of Medicine* also have determined that there is little evidence of increased risk of lung cancer in persons exposed to asbestos concentrations "several hundred or thousand times lower" than those inhaled by workers decades ago. They concluded that "fear of asbestos in buildings among the public is out of proportion to the existing health risk." In 1986 Congress passed the Asbestos Hazard Emergency Response Act, which ordered abatement programs for every U.S. school determined to be unsafe, estimated to be 35,000 buildings with a clean up cost of $6 billion. But the *New England Journal* put student's risk of exposure at "approximately 0.25 deaths per million exposed," figuring a student is 72 times more likely to drown and 25 times more likely to be killed playing high school football than die from asbestos-related diseases.



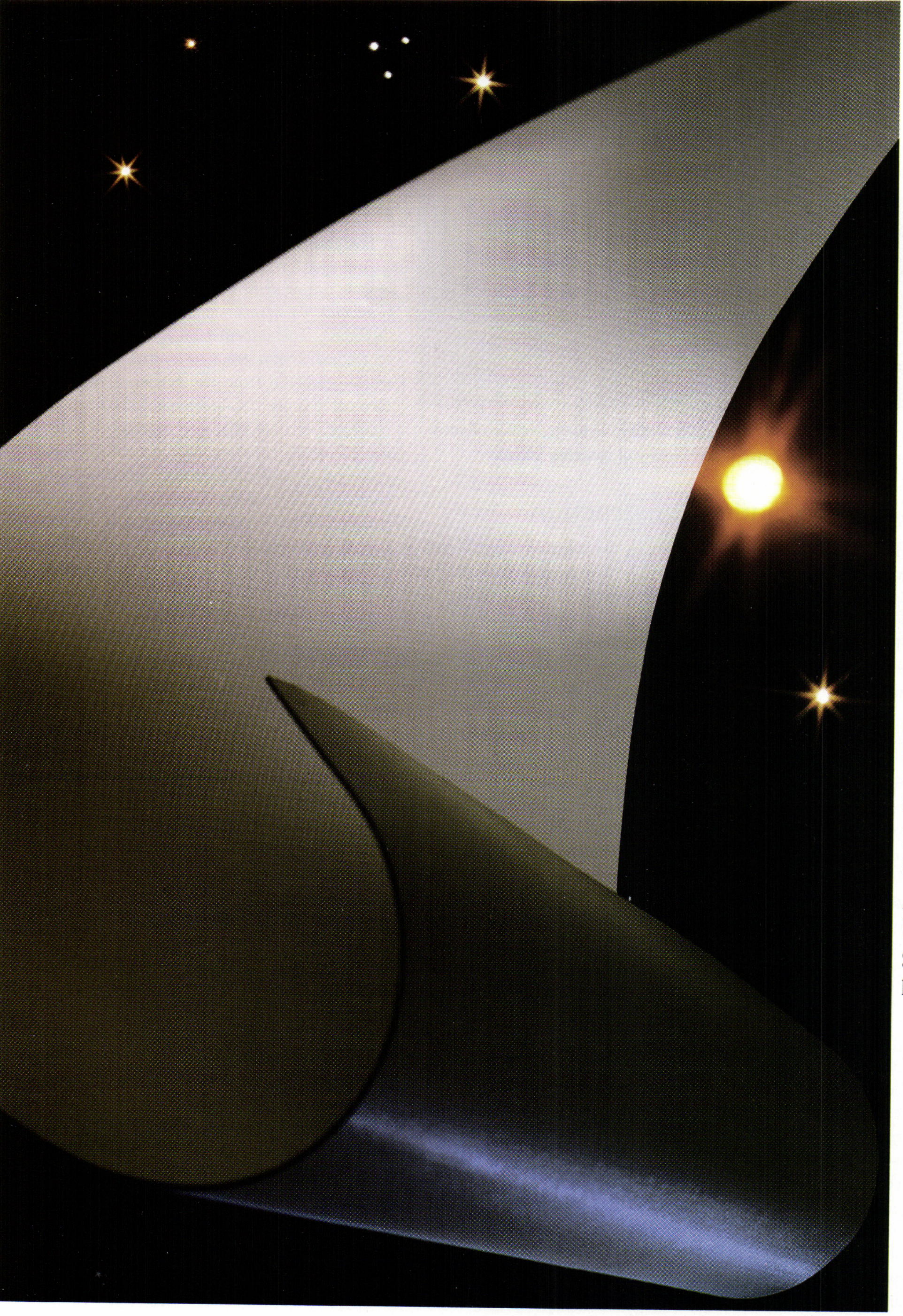
The *Science* article also said that panic about asbestos in buildings "has been fueled by unsupported concepts such as the 'one fiber theory,' which maintains that one fiber of inhaled asbestos will cause cancer." The report also argued that the removal of previously undamaged or encapsulated asbestos can lead to increases in airborne concentrations of fibers, sometimes for months after abatement.

In an article in *American Spectator,* Michael Fumento likened asbestos to a "sleeping dog," and suggests that the most cost-effective and safest tactic in most cases is to let the dog sleep. He maintains that this hands-off approach will save lives and perhaps hundred of billions of dollars. —L.N.



Kansas City Cables

The Kansas City, Missouri, firm Howard Needles Tammen & Bergendoff is expanding Kansas City's Bartle Hall Convention Center to 670,000 square feet over the Crosstown Freeway (above). The current size of the exhibit hall will be doubled, and 73,000 square feet of meeting room space will be added. The focus of the design is an expanded roof support that calls for four 200-foot-high cable-stayed concrete pylons in slip-form construction, each supporting 16 cables, with eight on each side. The cable stays will attach to the roof girder at 45-foot intervals. A new entrance for the facility will be connected by an elevated walkway to both exhibit halls and a municipal auditorium. Completion of the expansion is scheduled for 1993.



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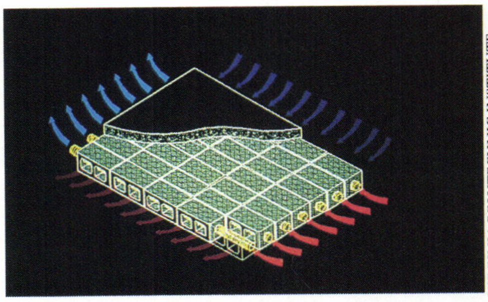
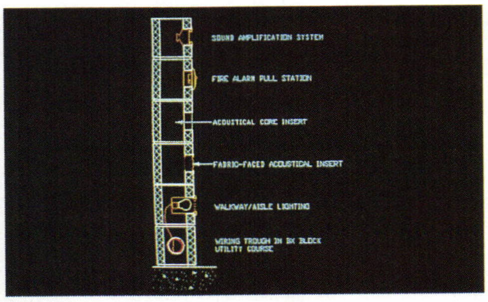
NEWS





VIRGINIA POLYTECHNIC INSTITUTE

CADD drawings reveal concrete block applications in the VPI facility, including radiant floors (left), and load-bearing walls that will carry mechanical and electrical systems (right).

Concrete Research Facility Under Construction

A FACILITY DEVOTED TO THE RESEARCH and development of concrete masonry materials is being built on the Blacksburg, Virginia campus of Virginia Polytechnic Institute and State University. The laboratory will enable university students and researchers to study the performance of masonry products under a variety of test conditions. It is being constructed entirely of newly developed products by the National Concrete Masonry Association's Innovative Design and Research division (IDR). Architect and IDR director Jorge Pardo is serving as consultant for technical services; Robert Schubert, director of VPI's Environmental Systems Laboratory, is a programmatic consultant, and associate professor of architecture and urban studies Jack Davis is the designer, assisted by graduate student William Galloway.

The one-story building is divided into three distinct modules. The first module contains a laboratory, conference room, and research lab, while a second houses support and utility facilities, a lecture hall, and an amphitheater. The third structure serves as a lab for testing, constructed with high ceilings and dropped floors to accommodate a variety of conditional experiments. A small facility located to the north is used for radon research, featuring demountable wall panels. Its interior can be reconfigured to simulate any type of terrain in the country to gauge the effect of tracer gas from the soil, and can be used for testing waterproofing methods in foundations. An open module without walls accommodates exterior testing of the construction of assemblies, and will eventually be enclosed when more modules are added.

Over 15 concrete masonry products are being used in construction. They include biaxial block for the walls, a pre-formed masonry block with horizontal cavities to facilitate installation and connection of utilities, wiring, and mechanical systems. Interlocking footer blocks are used for the foundations. Formwall, a dry-stack system, serves as the finish for poured concrete walls; and floors and roofs are comprised of the spanlock system, which integrates discrete concrete masonry components into a soundproof and fire-resistant horizontal building diaphragm. Over 30 architecture students are helping with the construction of the facility. In conducting construction and productivity studies as part of a research program, they will document how quickly the facility is built and gauge what bugs are being worked out of the system. The 7,000-square-foot facility is to be completed this summer. —A.G.L.

TECHNOLOGY UPDATE

Rules for Radon

A HANDBOOK PROVIDING THE LATEST information on the construction of radon-resistant foundations is available from the National Concrete Masonry Association (NCMA). The information is based on current construction practices and the latest research gathered from the National Association of Home Builders (NAHB) under contract with NCMA, and highlights radon mitigation in concrete masonry block construction. The handbook also includes basic recommendations for design and construction of slabs, below-grade walls, crawl spaces, and split-level foundations.

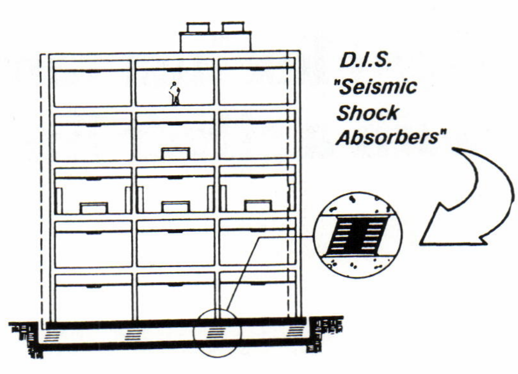
Since most tests were conducted on one- and two-family homes, the publication is written primarily for residential construction, although many of the recommendations are appropriate for commercial structures. Information for larger buildings can be sought from the EPA and the NAHB Research Center.

"Building Radon Resistant Foundations" (TR-104) retails for $6, with a NCMA member price of $3, and a discount for quantity ordering. Contact the publications department, NCMA, 2302 Horse Pen Road, P.O. Box 781, Herndon, Virginia, 22070-0781, or call (703) 435-4900. —A.G.L.

Earthquake-Resistant Device Installed in California

The Rockwell International Information Systems Center in Seal Beach, California, is being retrofitted with seismic isolation bearings. The installation represents the first of its kind in California and only the second in the country. The earthquake-resistant system was chosen because the 22-year old, eight-story building houses sensitive communications and computer equipment, and is located less than a mile away from a geologic fault.

Designed by Dynamic Isolation Systems, the isolation bearings consist of a lead core with steel load plates and steel reinforcing plates separated by layers of rubber. The top cover of the device is also made of rubber. By placing the load-bearing pads between the bottom of the building columns and the foundation (section, below), ground movement from a quake is dissipated and the building moves uniformly. Isolators were installed between the first and second floors of the center to cause the least disruption of work and equipment. A jacking mechanism transfers loads from the upper portion to the lower portion of the foundation while the columns are cut and the isolators are installed (top right). The project is scheduled to be completed in mid-1991.



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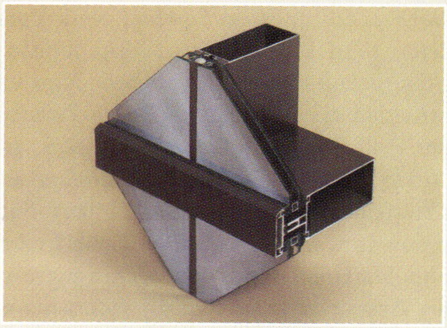

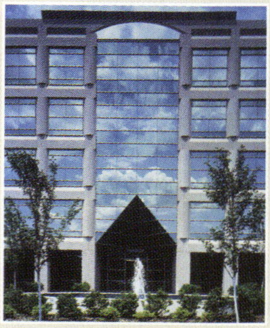

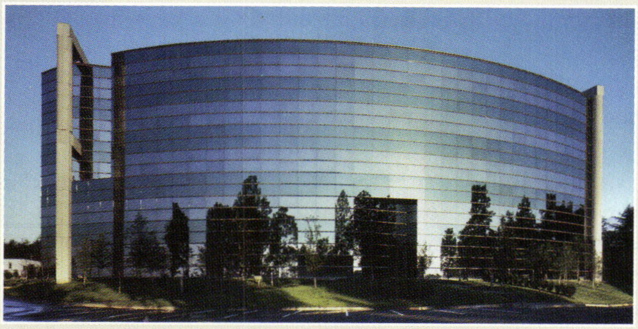

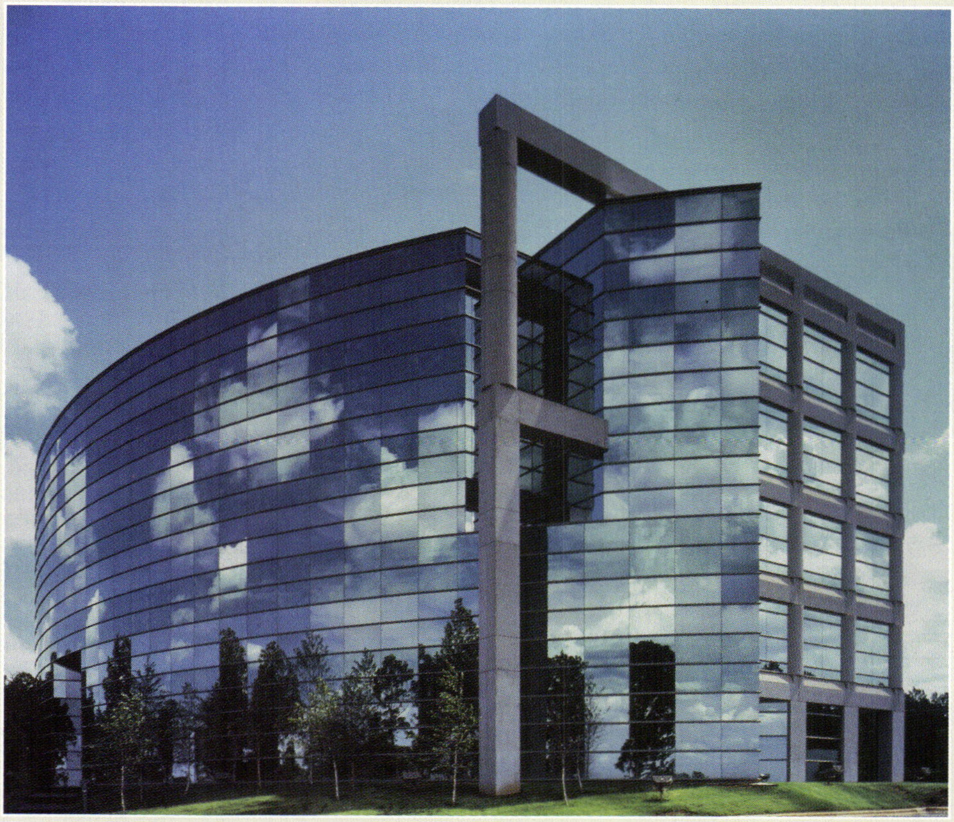

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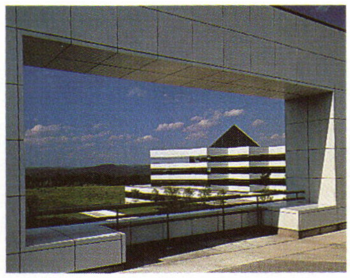
Big Blue on Display at National Building Museum

IT'S LIKE STROLLING THROUGH AN ABBREVIATED HISTORY OF American corporate architecture. "Building By Design: Architecture At IBM," on exhibit at the National Building Museum in Washington, D.C., displays the fruits of "Big Blue's" building program in more than 200 photographs, models, and drawings for over 60 buildings around the world. A surprisingly large number of the commissions have surpassed the safe and sound to become inspired.

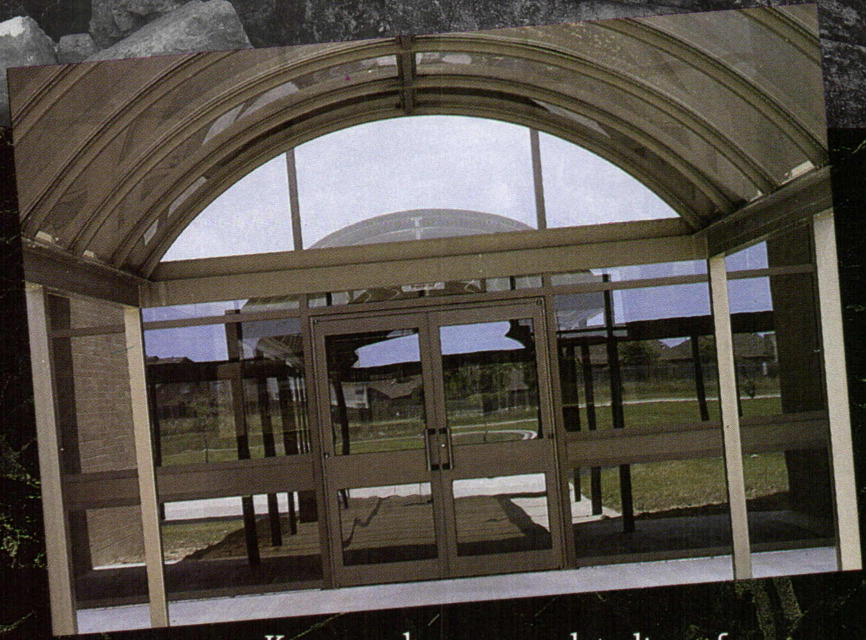

WOLFGANG HOYT

The company's architecture and design program was initiated by founder Thomas J. Watson, who, in 1956, acted on his belief that "good design is good business" by hiring Eliot Noyes, chairman of the design department at the Museum of Modern Art from 1940 to 1945, as design and architecture consultant. Noyes rejected corporate images "as a very superficial practice," but believed in "company character and design programs that can both identify and express that character." Noyes brought into the IBM fold graphics designer Paul Rand, who originated the striped blue IBM logo (hence the nickname "Big Blue"), as well as exhibits designer and filmmaker Charles Eames. Under Noyes's stewardship, IBM built designs in the '50s and '60s by Eero Saarinen, Marcel Breuer, SOM, and Gunnar Birkerts. "We were trying to look like what we produced," said Watson. "We were on the cutting edge technologically and wanted to be on the cutting edge architecturally."

By the late '60s, IBM's design program began to decline as IBM exploded in size and became more bureaucratic. When Gerald McCue became architecture consultant in 1979, he was startled at "the mixed quality of IBM architecture around the globe." McCue revived IBM's design program, and in the '80s, IBM erected buildings by Edward Larabee Barnes, I.M. Pei & Partners (complex in Somers, New York, shown left), John Burgee with Philip Johnson, Mitchell/Giurgola Associates, and others. Now under construction are buildings by Kohn Pedersen Fox, Cesar Pelli, Pei Cobb Freed & Partners, and British firms Edward Cullinan Architects and Michael Hopkins & Partners, among others. Such complex downtown projects as Pei Cobb Freed's tower for Minneapolis and Hartman Cox's Franklin Square on Washington's Pennsylvania Avenue represent IBM's increasing efforts to solve complex urban design problems through joint ventures with developers.

For its design patronage, IBM was named this year's winner of the annual honor award by the National Building Museum, where the exhibit will be on display through September. —A.O.D.

Long after everything else has gone to ruins, it's worth noting that the entrance still makes a monumental impression.



Kawneer has a complete line of aluminum entrance systems, each a timeless classic in its own right.

Kawneer

The designer's element.

Circle 43 on information card

Islamic Architecture Discussed at MoMA

AS PRINCE CHARLES'S RECENT EXPLOITS have demonstrated, no one can better call attention to contemporary architecture than a royal building buff. Yet the Prince is merely following in the footsteps of a regal predecessor—the Aga Khan, who founded an award for architecture in 1976 to promote architectural excellence in the Islamic world. With a total value of $500,000, the last round of prizes was given out last year in Cairo. Recipients ranged from the Modern Arab Institute in Paris (right) to the traditional Sidi el-Aloui School in Tunisia.

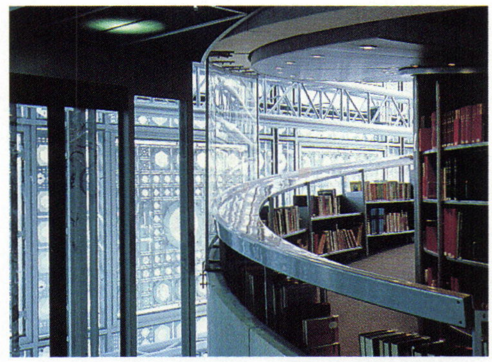
On March 14 an international panel of scholars and architects convened at the Museum of Modern Art in New York to shed some light on the Aga Khan Awards and the state of architectural Islam. The first speaker was Secretary General of the Aga Khan Awards, Dr. Said Zulficar of Egypt, who spoke eloquently about the plight of the Islamic world. An ugly breed of Modernism has transformed much of the Third World, he said, suggesting that an architecture derived from Islam's cultural history would better serve its basically traditional societies.

Historian/critic Kenneth Frampton then introduced the panel: Abdel Wahed El-Wakil, a two-time Aga Khan prize-winner; Oleg Grabar, professor of Islamic art at Harvard; architect Raj Rewal of Delhi; Renata Holod, professor at the University of Pennsylvania; Mohmet Doruk Pamir, an architect from Istanbul; and critic Michael Sorkin.

Though the panel reached no formal consensus, it agreed on general points. While traditionalism is far from the answer to Islam's architectural problems, it can serve as a useful tool in informing design decisions. However, the developing city requires a certain amount of Modernist building types such as the office tower. Furthermore, car emissions necessitate open spaces and air-conditioning, which rule out the narrow-alleyed *medina* or *suq* that make up the traditional Islamic city. Islamic architecture's cultural content often remains a secondary consideration to functional demands.

The Aga Khan Award itself was duly praised as an important contributor to improving international architecture. It is hoped that the Award will inspire a higher quality of design, especially in developing countries. Indeed, many of the prize-winning buildings stand as oases amidst architectural deserts.

—STEVE BODOW



AIA Honors Achievements in Design

IN RECOGNITION OF SIGNIFICANT CONTRIBUTIONS to the built environment and the profession of architecture, the American Institute of Architects will present its annual Institute Honors, Honorary Membership, and Honorary Fellowship during the national convention to be held May 19-22 in Houston, Texas. In addition, 62 architects will be awarded AIA Fellowships.

Institute Honors will be presented to 10 people, projects, and institutions for "distinguished achievements in design." This year's winners are:

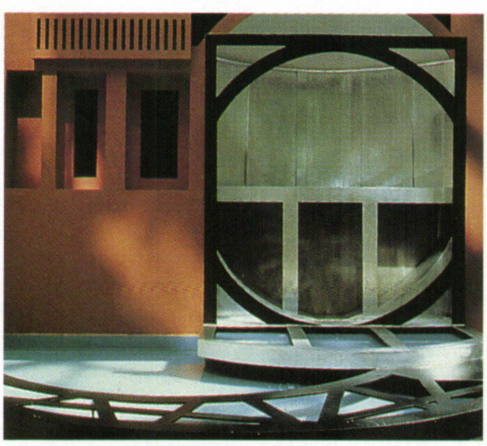
Photographer **Timothy Hursley** of The Arkansas Office, a photographic studio he founded in Little Rock, Arkansas, in 1982. "His images exist with a life of their own," said the awards jury. "He brings an increased appreciation of the art of photography and the art of architecture to all who view his work."

Artist **Jackie Ferrara.** The New York City-based artist is known for her monumental sculptural forms, including the Laumeier Sculpture Park Project in St. Louis and the General Mills Sculpture Garden in Minneapolis.

Mechanical engineer **Marvin Mass.** Senior partner of the New York City-based Cosentini Associates, Mass has pioneered innovative designs in the areas of climate control, chilled water storage, and integrated systems design.

A · I · A ACCOLADES

Artist **Mary Miss.** Exploring the boundaries between art and landscape, Miss was a major contributor to New York City's "South Cove," a three-acre network of pedestrian walkways in Battery Park City. The jury cited her "consistent language of building components which interact with our environment in a provocative manner."



A sculpture by Mary Miss (above) was recently installed in Boston, Massachusetts.

A 1980 photograph by Timothy Hursley (above) of Philip Johnson's studio in New Canaan, Connecticut, is one of the photographer's personal favorites.

Landscape architect **Peter Rolland.** During his 25-year practice, Rolland has collaborated with numerous architects on projects ranging from private residences to the new Parliament House in Canberra. According to the jury: "Rolland has the special talent to bring the world of nature into partnership with the world of building in ways which create architecture of special significance."

Model builder **Joseph Santeramo.** A model maker for Philip Johnson and John Burgee since 1967, Santeramo began his model-making career as an apprentice in 1945 when he was 16 years old. The jury selected Santeramo's work "to honor him as a true craftsman at a time when the value of craftsmanship in architecture is being rediscovered."

Landscape architect **Emmet Wemple.** A practicing landscape architect and a faculty member of the University of Southern California since 1953, Wemple is honored for creating "superb and subtle bridges between Mother Nature and the built environment."

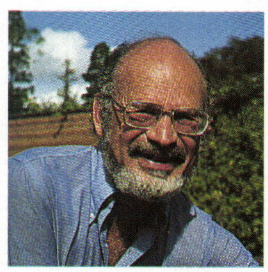
Corning Incorporated. From its early commitment to quality architecture to its recent Steuben Glass Collection, "Archaic Vessels," designed by Michael Graves, Corning stresses a comprehensive and strategic investment in design.

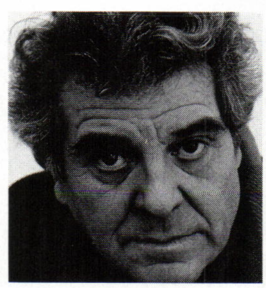
Taos, New Mexico. Considered the oldest inhabited community in the U.S., the original portion of the Paso Pueblo is over 1,000 years old, and appears much the same as when the Spanish explorers discovered it in 1540. "This is an outstanding and rare example of the maintenance of a traditional life style in the historic setting of building and landscape," said the jury.

Association for the Preservation of Virginia Antiquities, the oldest statewide preservation association in the country. Now celebrating its centennial year, the Association has served as a model for like-minded organizations in other states.

Education Awards

RAYMOND KAPPE HAS BEEN AWARDED the 1990 ACSA/AIA Topaz Medallion for Excellence in Architectural Education, the highest honor bestowed by the Association of Collegiate Schools of Architecture (ACSA). Kappe, an internationally recognized and frequently published Los Angeles architect and educator, is the director of the Southern California Institute of Architecture. Located in Santa Monica, the school was founded in 1972 by Kappe, and is internationally known for its innovative approach to architectural education.





Kappe (top) was awarded the Topaz award, and Ferrari (above) was also honored.

Olivio Ferrari, alumni distinguished professor at Virginia Polytechnic Institute and State University at Blacksburg, Virginia, won the 1990 Distinguished Professor Award from the Association of Collegiate Schools of Architecture. Ferrari joined VPI's faculty in 1965, and founded the college of architecture and urban studies' study abroad program. His numerous awards include the university's Wine Award for teaching excellence, the Virginia Society/AIA's teaching award, and the college of architecture's Excellence in Teaching Award.

AIA Names Honorary Members

SIX MEN AND FOUR WOMEN HAVE BEEN selected Honorary Members of the AIA in recognition of their outstanding contributions to the architectural profession and the allied arts and sciences. The 1990 Honorary Members are:

Rae Jackson Dumke, executive director, Michigan Society of Architects and Detroit Chapter AIA;

Paul Gapp, architecture critic, *The Chicago Tribune;*

Paul Goldberger, architecture critic, *The New York Times*;

Ginny Ward Graves, educational consultant, Prairie Village, Kansas;

Lloyd Kaiser, president, QED Communications, Pittsburgh;

Martha Miller, executive director, Central Arizona Chapter/AIA, Phoenix;

Philip A. Morris, executive director, *Southern Living* magazine, Birmingham, Alabama;

Senator J. Strom Thurmond, U. S. Senator, South Carolina;

Carolyn Hewes Toft, director, St. Louis Landmarks, St. Louis, Missouri;

John Zukowsky, curator, department of architecture, Art Institute of Chicago.

International Architects Named Honorary Fellows

TWELVE ARCHITECTS FROM TEN NATIONS have been named Honorary Fellows for their notable contributions to the fields of architecture and design. Honorary Fellowships are conferred upon architects of "esteemed character and distinguished achievements" who live outside the United States. The 1990 Honorary Fellows are:

Gaetana Aulenti, Rome, cited as "perhaps the most renowned architect in Italy today," whose major projects include the Musée D'Orsay in Paris;

Essy Baniassad, Halifax, president of the Royal Architectural Institute of Canada and dean of the architectural faculty of the Technical University of Nova Scotia;

Jacob Blegvad, Aalborg, former president of the Danish Federation of Architects, whose award-winning practice is complemented by his writings and drawings;

David Davies, London, cited as the first British architect to integrate architecture, urban design, engineering, interiors, and graphics into a "one-stop consultancy;"

Kiril L. Doytchev, Sofia, Bulgaria, leading educator, writer, inventor, and principal designer of Bulgaria's health care delivery system and architect of major medical facilities from East Berlin to Vietnam;

Dato I. Hisham Albakri, Kuala Lumpur, president of the 31-nation Commonwealth Association of Architects, whose inspiration and design talents have helped Malaysia compete in the international community;

Daryl Jackson, Melbourne, cited as "one of the important Australian architects," who was responsible for construction of the Parliament House in Canberra;

Reiichiro Kitadai, Tokyo, president and founder of the Japan Institute of Architects, a leading architect whose firm GKK Architects & Engineers has designed many award-winning buildings in Asia;

Jorge Nunez Verdugo, Mexico City, president of the Federation of the Colleges of Architects of the Republic of Mexico;

Yuri P. Platonov, Moscow, president of Union of Architects of the USSR, cited for his "leadership to the profession, creative achievement as a talented architect, and deep commitment to public service;"

Eva H. Vecsai, Montréal, president of Ordre des Architectes du Québec, who has succeeded in "making Modernism into a language that is expressive, contextual, and symbiotic;"

Wu Lianyong, Beijing, cited as one of the "pioneers of architecture and urban planning in modern China," a distinguished architectural educator, renowned painter, and prolific author.

College of Fellows

THE AIA HAS NAMED 62 ARCHITECTS TO its prestigious College of Fellows, the highest honor bestowed upon a member with the exception of the gold medal. It is conferred on members with ten years' good standing who have made notable contributions to the profession in such areas as architectural practice, construction, design, education, government, industry, historic preservation, literature, public service, research, service to the profession, or urban design.

The 1990 Jury of Fellows was chaired by Samuel A. Anderson, FAIA. Other jurors were: Ellis W. Bullock Jr., FAIA; John F. Hartray Jr., FAIA; J. Robert Hillier, FAIA; William H. Kessler, FAIA; Paul Neel, FAIA; and James D. Tittle, FAIA.

Continued on page 45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College of Fellows

Continued from page 43

The 1990 Fellows are:
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Ronald Arthur Altoon, Los Angeles, CA;
Christopher Arnold, San Mateo, CA;
Douglas Henry Austin, Del Mar, CA;
Michael John Bednar, Charlottesville, VA;
Walter Scott Blackburn, Indianapolis, IN;
Richard H. Bradfield, Atlanta, GA;
Adrienne Green Bresnan, New York, NY;
Joseph Bresnan, New York, NY;
M. J. Brodie, Washington, D.C.;
Theodore R. Butler, Minneapolis, MN;
Brent E. Byers, Dallas, TX;
Edgardo Contini, Los Angeles, CA;
Christopher Coover, Phoenix, AZ;
Clifford Jack Corgan, Dallas, TX;
Alex Cvijanovic, Watertown, MA;
Norman R. De Haan, Chicago, IL;
Panayotis Eric Devaris, Basking Ridge, NJ;
Mary Elizabeth Olenick Dougherty, Newport Beach, CA;
William Eng, Champaign, IL;
A. Bruce Etherington, Honolulu, HI;
James R. Foster, San Antonio, TX;
Leslie M. Gallery, Philadelphia, PA;
Truitt B. Garrison, Houston, TX;
Dean W. Graves, Overland Park, KS;
Robert E. Greager, Pleasant Ridge, MI;
John Only Greer, Bryan, TX;
Gerald Gurland, West Orange, NJ;
William John Hawkins, III, Portland, OR;
R. Curtis Ittner, St. Louis, MO;
Jon Adams Jerde, Los Angeles, CA;
Richard E. Kaeyer, North Salem, NY;
Michael Kwartler, New York, NY;
Carroll James Lawler, Jr., West Hartford, CT;
Kermit James Lee, Jr., Syracuse, NY;
Diane Legge, Chicago, IL;
Lawrence J. Leis, Louisville, KY;
Walter Henry Lewis, Champaign, IL;
Robert H. LeMond, Fort Worth, TX;
Robert Callan Mack, Minneapolis, MN;
Virginia S. March, Mobile, AL;
Phillip T. Markwood, Columbus, OH;
Noboru Nakamura, Orinda, CA;
Ede I. Nemeti, Houston, TX;
Charles Harrison Pawley, Coral Gables, FL;
Thompson Edward Penney, Charleston, SC;
G. Gray Plosser, Jr., Birmingham, AL;
Harry Granville Robinson, III, Wash., D.C.
Larry D. Self, Dallas, TX;
Mark Simon, Essex, CT;
Clifton Murray Smart, Jr., Fayetteville, AR;
Colin Louis Melville Smith, Lincoln Center, MA;
Christopher J. Smith, Honolulu, HI;
Charles W. Steger, Blacksburg, VA;
Sidney W. Stubbs, Jr., Mount Pleasant, SC;
Wilbur H. Tusler, Jr., San Francisco, CA;
Edward Keith Uhlir, Chicago, IL;
Robert L. Vickery, Charlottesville, VA;
John Vinci, Chicago, IL;
Merle T. Westlake, Lexington, MA;
Chester A. Widom, Santa Monica, CA. ■

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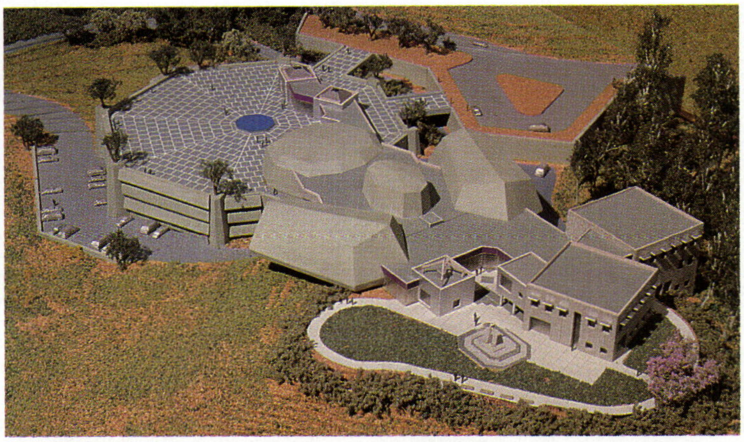
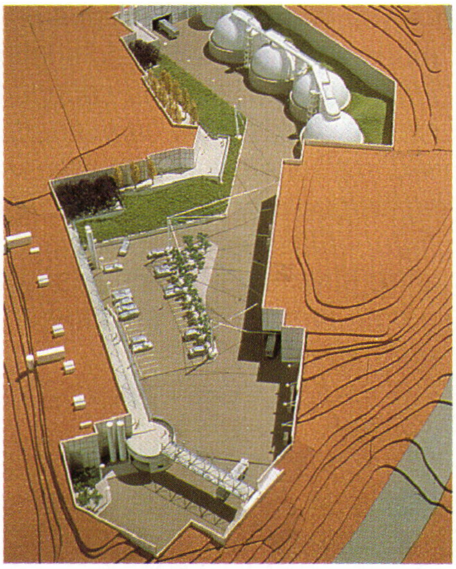


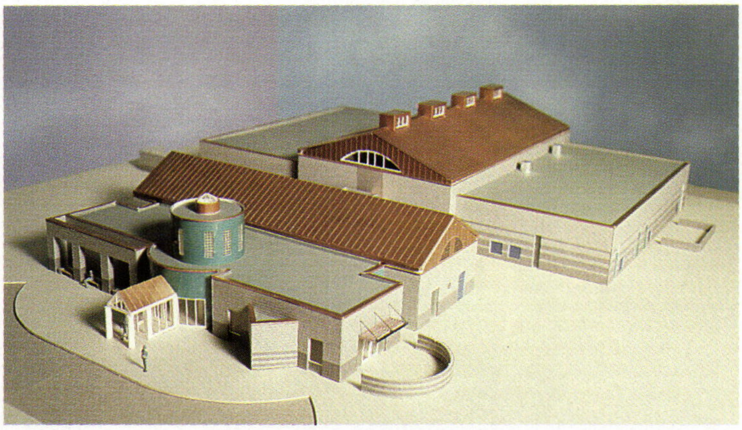
A 35,000-square-foot addition (above) to Lawrence Hall will include expanded exhibition space and a conference center. The architects created a series of clustered forms to reduce the building's apparent bulk and the visual impact of development on its hillside side.

SIMON MARTIN VEGUE WINKELSTEIN MORIS OF SAN FRANcisco, California, a five-year old firm, has recently designed three projects that meld high technology and sensitive design. Although diverse building types, the trio shares a complex and highly technical program. Each solves the problem of integrating a large structure within an environmentally sensitive site.

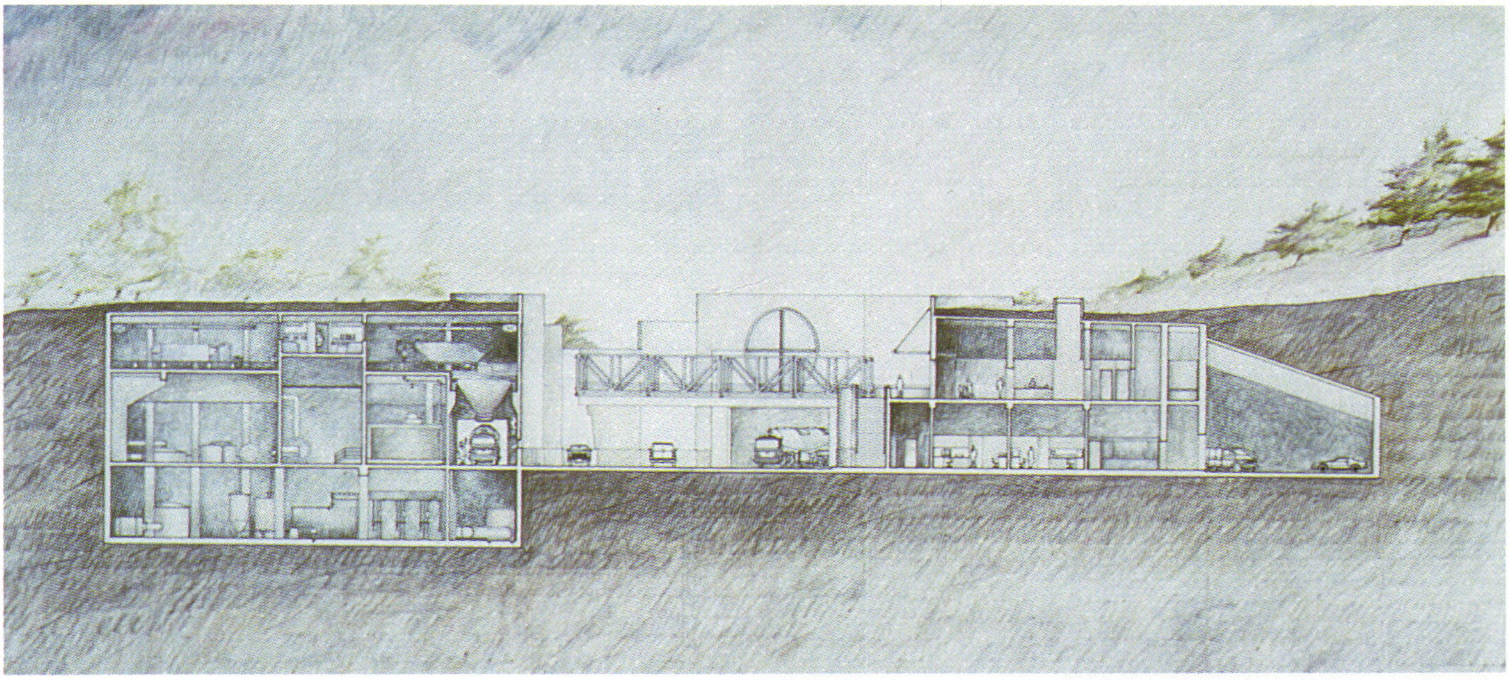
Founding principal Cathy Simon says she is dedicated to specific program-driven projects and tries to avoid a signature style. The Oceanside project (below and bottom) will be constructed partially underground to screen the massive industrial facility from the highway and adjacent zoo with landscaped roof berms to help mitigate noise. The Contra Costa plant (below right) is located on the grounds of a former vineyard and employs an array of romanticized forms for this large facility. A major addition to Anshen + Allen's 1965 Lawrence Hall, it reflects changes in programmatic, environmental, and scientific conditions.

Located on 43 acres and surrounded by park land, the Oceanside Control facility takes the form of a canyon whose walls are composed of submerged building facades (section below) and linked with retaining walls. A bridge spanning the canyon (right) provides an emergency "escape route" and frames a window to the Pacific Ocean with views to the underwater outfall 4.5 miles offshore.





Developed to serve two rapidly growing counties outside San Francisco, the Contra Costa Water Treatment complex (above) is comprised of a 6,100-square-foot control building, a 15,416-square-foot operations building, basins, and auxiliary structures.



No matter how many times you may have done it before, constructing a kitchen is rarely an entirely smooth process.

Particularly when it comes to selecting the built-in appliances.

At first sight, it might seem quite logical to specify a refrigerator from one company, a dishwasher from another, and an oven and a cooktop from yet two more.

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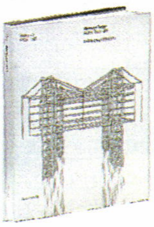
BOOKS

PROCESS AND INVENTION

Norman Foster, Foster Associates: Buildings and Projects. Volume 2, 1971-1978; Volume 3, 1978-1985

Edited by Ian Lambot (Watermark Publications Ltd., P.O. Box 18, Chiddingfold, Surrey, England. £37.50 each)



ANY ATTEMPT TO UNderstand the work of Norman Foster through the convenient analysis of "style" will fail. Foster has little interest in it and his architecture has little to do with it. The two volumes under review will introduce you to an architect who continues to approach architecture as problem-solving—or more precisely, problem-framing. For the secret of Foster's success, according to Martin Pawley, who writes with great insight into the architect's work in Volume 2, is Foster's ability to "seize the initiative from his client by challenging the precepts of the brief...learning more about his client's needs than the client knows himself."

Many architects, of course, routinely talk a client out of what the client wants in order to design a building that the architect wants. But this is not Foster's method, which is more akin to psychoanalysis. Foster listens to his clients, analyzes their program, questions their conceptions about a solution, and usually finds an answer that is closer to what the client intended, and is architecturally brilliant to boot.

As Foster himself describes it: "Clients tend to put problems to us in building terms but, with analysis, the solutions to those problems often emerge as not architectural at all. In this sense we are a new kind of architectural office, a bridge between the potential of new ideas and their realization in practical terms. Each project, for us, is a kind of challenge to do more with less."

A perfect example of this approach is a project for the Berco Corporation, which hired Foster in the early 1970s to design a new building. After analyzing the client's needs and organizational structure, the architect convinced the client that what was needed was more efficient use of their existing building, not a new one. Architects, especially young, struggling ones, are not supposed to do such things.

In another instance, a few years later, Foster was asked by IBM to analyze its brief for the construction of temporary shelter for its head office in Britain. Foster convinced IBM that it actually would be cheaper to construct permanent quarters instead of the "huts" IBM had in mind. In another case, the recent King's Cross redevelopment project, Foster was given a small piece to design in a larger master plan designed by another architect, and ended up talking the client into commissioning Foster to design an entirely new master plan from scratch.

No other architect is as reminiscent of Norman Foster as Eero Saarinen. Like Saarinen, Foster pokes at a project, continually testing, inventing, modeling, commiserating with a band of bright associates, turning convention on its head. And like Saarinen's methods, Foster's way of working is "closer to the omnivorous methodology of industrial product development, and farther away from the traditional architect's manipulation of visual images," as Pawley writes.

This emphasis on process, on understanding a problem at its core, and then inventing ways of solving it, has molded the very nature of Foster's practice, allowing it to adjust to the demands of a project's size and scope. So successful is this approach that it has allowed the de-

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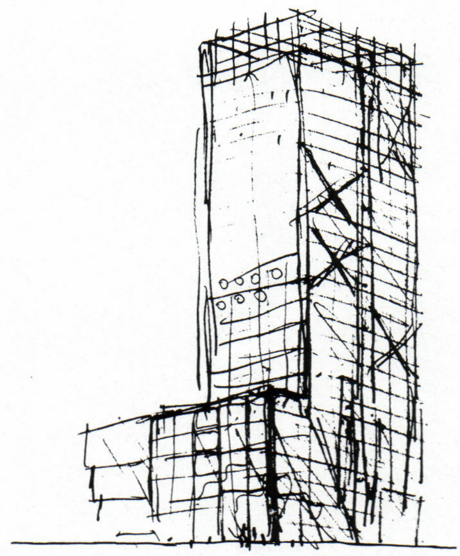
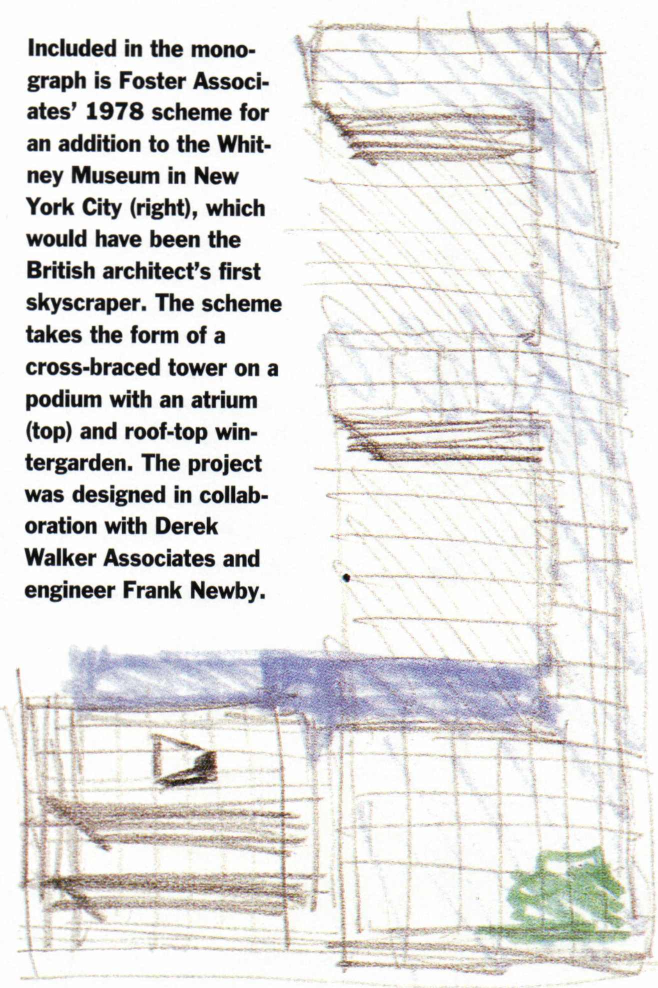




Included in the monograph is Foster Associates' 1978 scheme for an addition to the Whitney Museum in New York City (right), which would have been the British architect's first skyscraper. The scheme takes the form of a cross-braced tower on a podium with an atrium (top) and roof-top wintergarden. The project was designed in collaboration with Derek Walker Associates and engineer Frank Newby.

ABOUT THIS ISSUE

INVISIBLE ARCHITECTURE

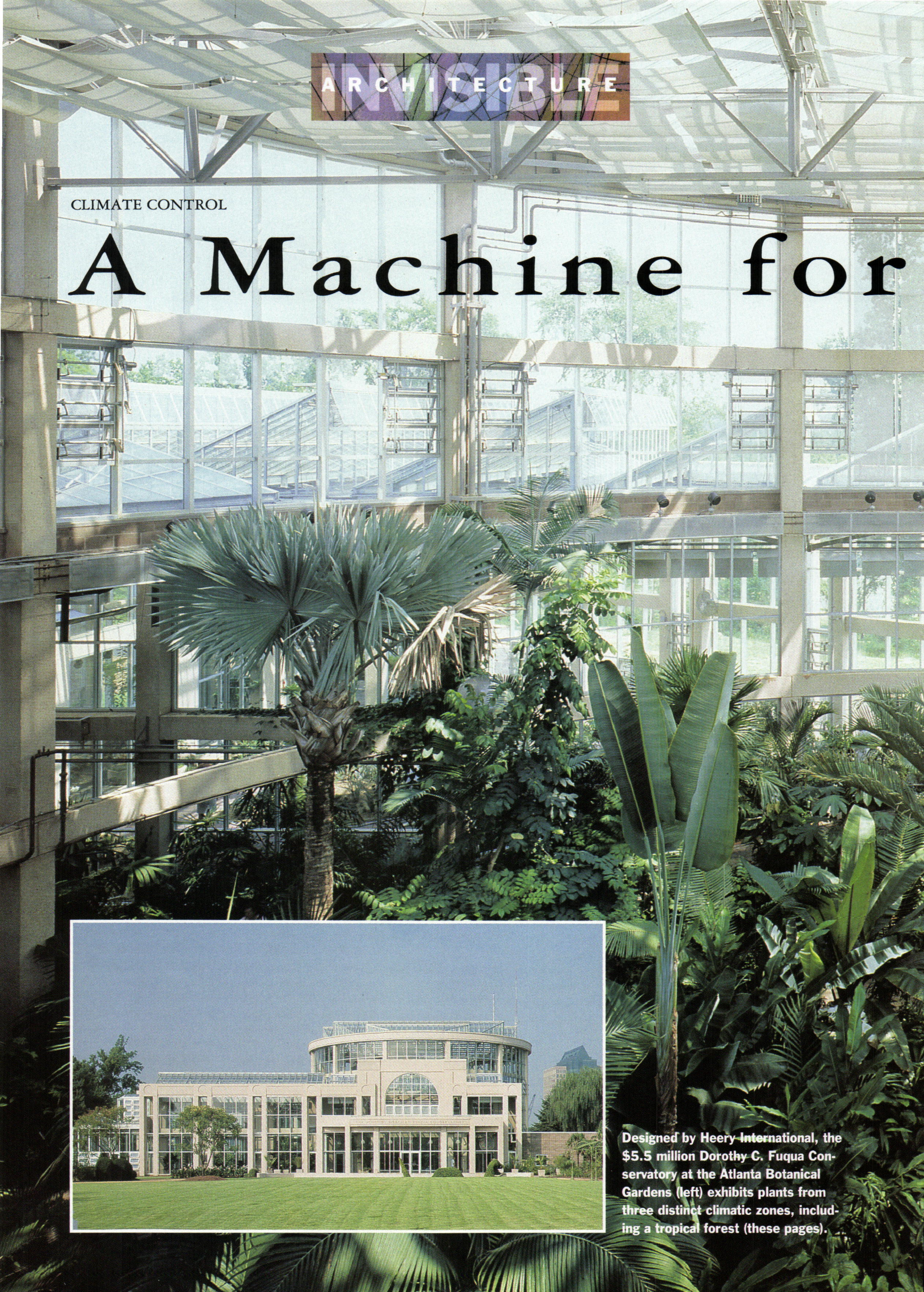
EVERY YEAR, ARCHITECTURE DEVOTES AN ENTIRE issue to technology and practice. This year, we focus on the aspects of a building that are unseen but are important determinants of design nevertheless. Our theme, invisible architecture, refers to the sophisticated technological networks embedded within a building that typically require the expertise of a specialized consultant. Our topics range from the latest security systems designed for American embassies to the sophisticated mechanical systems devised to control a conservatory's microclimates; from innovative seismic devices to telecommunication developments. To urge architects to become more involved with the invisible aspects of architecture, we offer a profile of projects undertaken by Ove Arup & Partners, a British engineering firm that recently opened offices in the U.S. The firm's collaborative, interdisciplinary approach emphasizes the creative potential of engineering, and its important role in the early stages of design.

In addition, we include articles on innovative approaches to the "invisible" principles of design and practice that question the very foundation of architecture. A discussion of zoning for solar access underscores the importance of nature's role in architecture, pointing out that daylight is more crucial to successful urban design than even the most sensitive, contextual architecture. We also outline other spatial explorations in a profile of the Sasakawa International Center for Space Architecture headquartered at the University of Houston. Though the results of this program have yet to be realized, the students and faculty involved in developing structures for outer space are changing the way we think about architecture on earth.

INVISIBLE ARCHITECTURE

CLIMATE CONTROL

A Machine for



Designed by Heery International, the $5.5 million Dorothy C. Fuqua Conservatory at the Atlanta Botanical Gardens (left) exhibits plants from three distinct climatic zones, including a tropical forest (these pages).

Growing

PEACH TREES ARE BLOOMING IN Georgia, and meanwhile a new building on Atlanta's skyline has been completed to house both tropics and desert. The Dorothy Chapman Fuqua Conservatory at the Atlanta Botanical Garden, a 16,000-square-foot walk-in terrarium, combines three distinct climatic settings, two public exhibition areas, and separate propagation greenhouses at the edge of Atlanta's Piedmont Park. Donated in large part by Atlanta entrepreneur J. B. Fuqua in honor of his wife, the $5.5 million conservatory sits on a high ridge in an area previously occupied by older city greenhouses. Siting determinants for the design included an earlier master plan by Atlanta landscape architect E. L. Dougherty and a Modernist "garden house," administrative center, and meeting room, designed by Atlanta architect Anthony Ames.

The 23,000-square-foot conservatory completes the north-south axis of the 60-acre botanical gardens. Its design is intended to recall the "romantic character of older conservatories...such as at Biltmore House," according to Heery International project architect Gordon Smith. To achieve permanence, the designer created an exoskeleton of concrete, composed of granite chips, black sand, and mica aggregate with circular ornamental motifs and a large neo-Palladian window. The window opens onto an entry space just outside the 80-foot diameter drum that is the building's dominant architectural feature.

Set inside this outer skeleton is the metal core of a greenhouse structure made of anodized aluminum and clear glass, its curtain wall containing many operable windows. The metal structure rises up and beyond the concrete frame at the rotunda roof, where large, opposing metal trusses and concrete planks vigorously cap the circle.

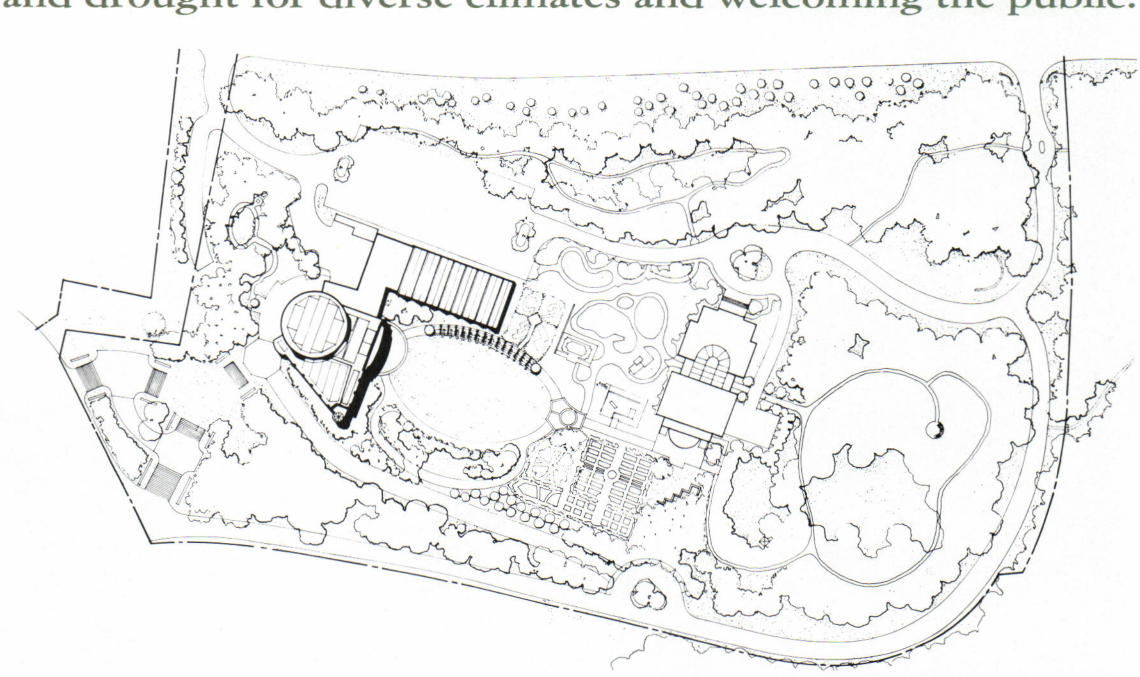
Underlying the roof is an implicit dichotomy between the urbanity of the conservatory and the machine of the greenhouse. Combining such opposites in one composition produces a built-in tension that is both earth-grounded and actively assertive. The inner metalworks seem at odds with the exterior's Neoclassical vocabulary—a concrete cage, trying to break free.

Plan, siting, and the accomplishment of a technically complex program overshadow esthetic concerns, for the Fuqua Conservatory succeeds in a difficult mission—providing heating and cooling, water and drought for diverse climates, while welcoming and informing the public.

Inside the conservatory, a computer balances earth, wind, and fire, allowing the regal *Bismarckia nobilis* palm to flourish in a 50-foot tall tropical rotunda, while through a clear wall, the succulent "living stone" plant grabs the arid ground, mimicking desert pebbles in a smaller desert and Mediterranean house. "The whole system is interactively controlled by a personal computer with greenhouse software," explains Gordon Smith. Sensors throughout the spaces poll each minute,

The Fuqua Conservatory succeeds in a difficult mission—providing heating and cooling, water and drought for diverse climates and welcoming the public.

The conservatory faces north (above), terminating the south end of the botanical garden's main axis (right). Visitors enter a garden house designed by Anthony Ames (right in site plan), walk along a large elliptical lawn that fronts the conservatory, and pass under an elegant arbor. Within the concrete and curtain-wall structure (facing page), anodized aluminum-framed windows open for ventilation.



measuring light, humidity, and temperature, maintaining a constant 75- to 85-degree Fahrenheit temperature range.

As the computer monitors each environment, the architects called on nature to aid the mechanical systems, particularly ventilation. In the Fuqua Conservatory, primary ventilation is introduced through convection: air, which enters through screened openings at the lower levels, is warmed and rises through the sawtooth greenhouse roof and the operable glazing, which surrounds the building. Air is additionally admitted through camouflaged outlets on the conservatory floor.

When the space does overheat, fog cools the environment. Circling the rotunda are small stainless pipelines displaying 220 nozzles of a fog-injecting system. Quick cooling is possible, as the system sprays a cloud-like mist into the atmosphere, immediately changing the climate from sauna to rain forest. As the cool fog drops, the warm air rises, creating air movement; evaporating mist further lowers the temperature and maintains the necessary humidity levels. Even the drier desert spaces receive some fog.

Atlanta has cold days, too. Since one hard winter freeze could kill Australian eucalyptus, fin-tube radiators bearing 215-degree water introduce auxiliary heat for all spaces. Recycled, heated air also rises from toadstool-like floor ducts. The reliable Georgia sun and the glass walls do the rest. When the sun proves too fierce, a system of strategically-placed, electronically-controlled shades masks its full power. The east, west, and south elevations are protected by open mesh fiberglass shades, guided on stainless steel wire to ensure air movement.

Plants, rooted in simple beds of sand, thrive in the conservatory, filling the tropical rotunda to near-maximum capacity. Three to six feet of river sand rest on a foot of gravel, filter fabric, and a french drain, and are topped with a foot of organically enriched soil to provide the growing medium for both 30-foot palms and diminutive orchids.

Visitors admire the blossoms as they cross the rain forest's dark soil on meandering pavers, pass a waterfall, and brush past large-leafed plants en route to the Mediterranean/desert house. Beyond the tropics lies an orangerie, a long, rectilinear room located on the north side of the complex. Tropical fruit trees such as mango and papaya are housed in this 650-square-foot structure, which doubles as additional exhibit space adjacent to the entrance of the conservatory.

Flying freely above visitors are birds, selected according to the insects they hunger for. Other animals thrive at the conservatory, or are eaten. Like a childhood terrarium that guarded a pet turtle, the Fuqua Conservatory houses limited ecosystems—combinations of climate, plant, and animal life—that are specific to the plants showcased by the museum. The conservatory features more than 30 insect-eating plants in a special exhibit area, where carnivorous pitcher plants and sundews maintain their appetites, including the 12-inch-tall pitcher plant *Nepenthes truncata*, which lures insects, frogs, and lizards into its five-inch mouth.

Pitcher plants and orchids are propagated in the 10,200-square-foot greenhouses adjacent to the exhibit space. Like their public kin, these private spaces are divided into three computer-controlled climate zones. The greenhouses line the entrance path to the conservatory, but they are working spaces, tantalizingly visible but inaccessible to the public.

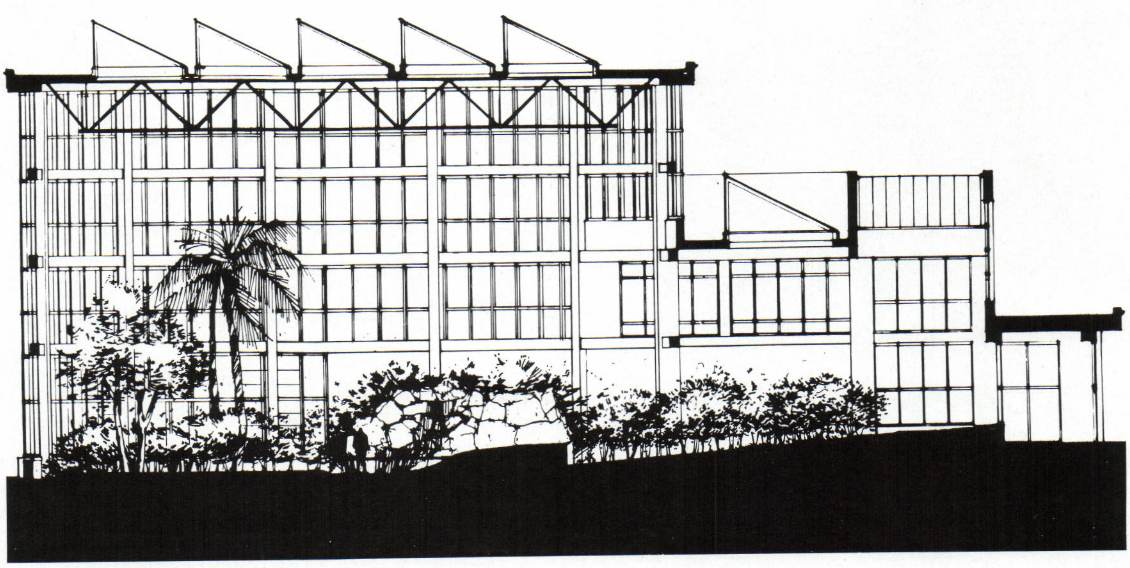
Atlanta Botanical Gardens director Ann Crammond credits the building and plant collections, with "doubling our visitation." One incident sums up the building's contribution: busloads of schoolchildren, crouched over small tropical plants in intense concentration, break into smiles as misters spray fog into the air above. The conservatory and its machine work. ■

—Robert A. Ivy

COTTON ALSTON

BRIAN GASSEL

The architects called on nature to aid the mechanical systems of the conservatory, particularly ventilation, introduced through convection.

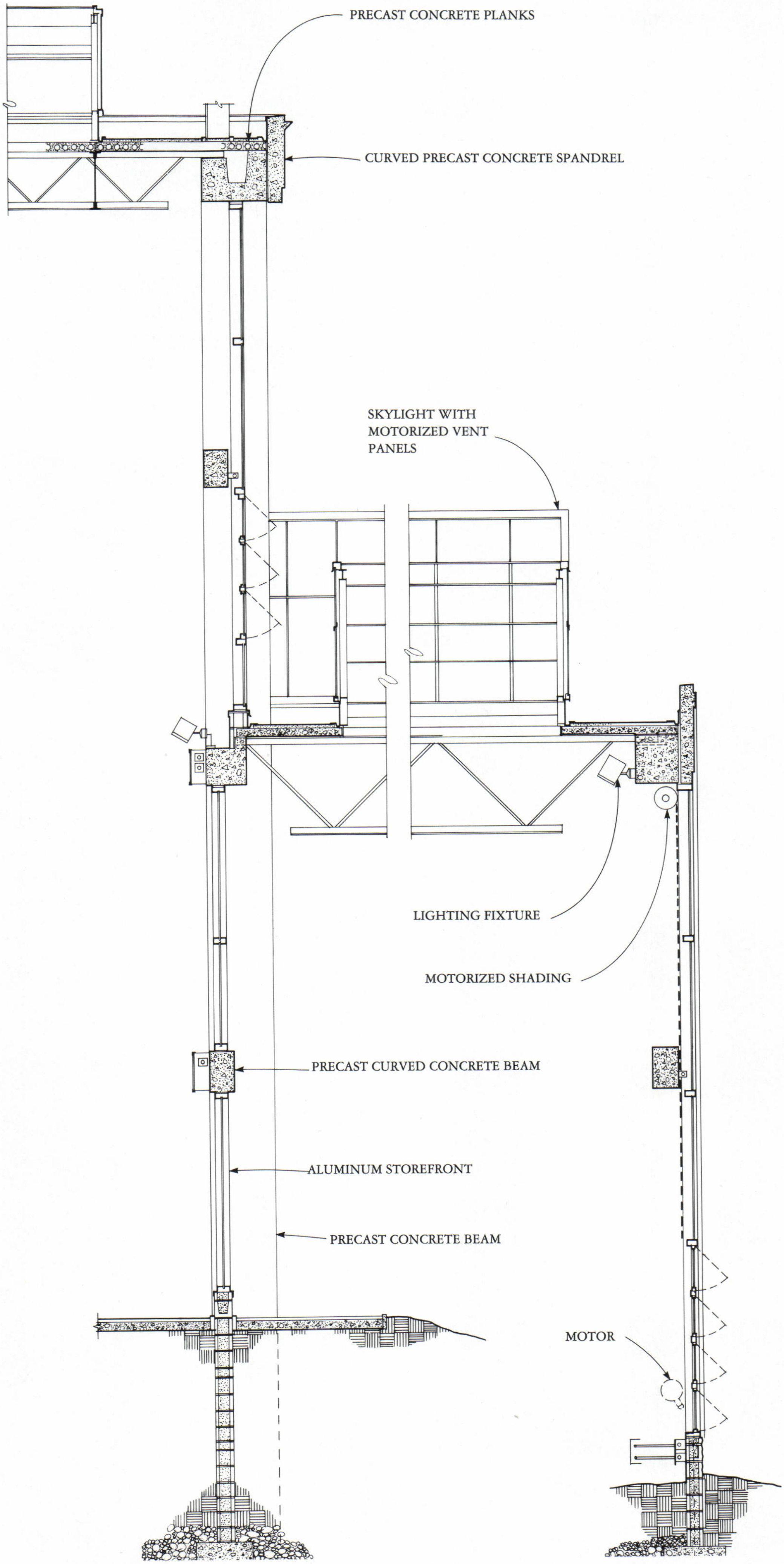


The centerpiece of the exhibit area is an 88-foot diameter, 50-foot tall tropical rotunda (facing page), which houses full-sized palm trees, orchids, and a waterfall. Steel trusses span its circular cap, topped by operable sawtooth skylights (section). Interior plantings thrive in the humid climate (top), producing a dense forest atmosphere. The orangerie (above), a tall, rectangular room on the north side of the building, showcases tropical fruit trees. The architects relied on air movement and solar gain for primary heat and ventilation—the classic greenhouse effect, in which air rises from low windows to escape through rooftop monitors.

All plants (below) grow in three feet of river sand, aided by one foot of organic nutrients. A system of skylights and shades (section) aids in controlling heat gain. The desert/Mediterranean exhibit area (facing page) features unusual succulents, its cacti and herbs cheek by jowl with the adjacent tropical environment (visible through window, facing page).


BRIAN GASSEL


BRIAN GASSEL



BRIAN GASSEL

THE DOROTHY CHAPMAN FUQUA CONSERVATORY
ATLANTA BOTANICAL GARDEN
ATLANTA, GEORGIA

ARCHITECT: Heery Architects & Engineers, Atlanta, Georgia—Gregory Peirce (principal-in-charge); Gordon Smith (project architect/designer)
LANDSCAPE ARCHITECT: Edward L. Dougherty & Associates
ENGINEERS: Heery Architects & Engineers (structural, mechanical/electrical)
CONTRACTOR: Batson Cook of Atlanta/B. R. Mitchell (joint venture)
PHOTOGRAPHER: Timothy Hursley

INVISIBLE ARCHITECTURE

PROPORTION

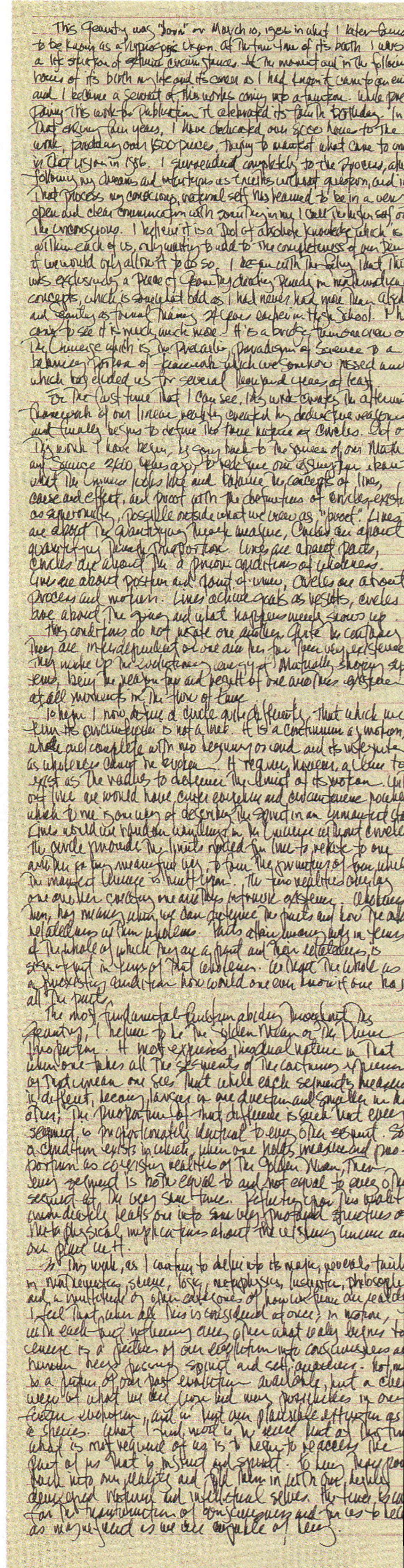
Toward a New Geometry

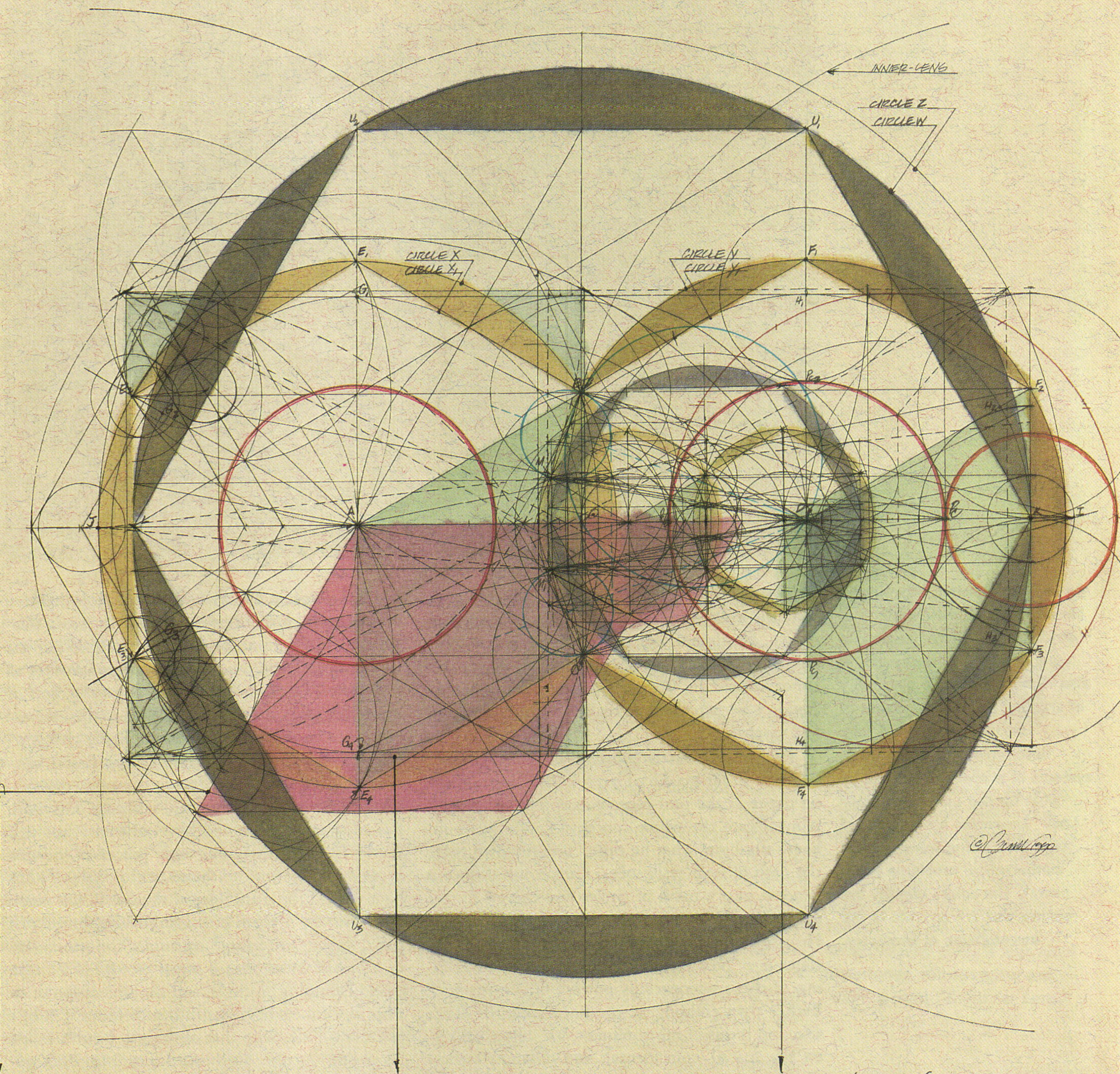
Exploring the golden mean, artist Frank Carson gives fresh insight into architecture that is harmonious with nature and human scale.

THE WORLD OF MATHEMATICS AS DEFINED BY PYTHAGoras in 500 BC, then Euclid and Aristotle over 2,000 years ago, still exerts an intense power over architecture and civilization. Aristotle's book called *The Organon,* or the *Instrument of Reason,* sets out 14 canons implying that nothing in math is acceptable unless it is proven logically. *Quod erat demonstrandum*; the philosopher's dictum set us on a seductive path that has driven the course of history ever since. Thus, civilized Western society developed a pattern of rational thinking. We have learned to build up cases of evidence to prove a fact. The word "build" has great meaning in the context of this magazine's readers too, because building is a process of accumulation in a rational way, from the ground up. The way architects go about their work reflects a deeply rooted reliance upon a system of linear logic, perhaps best exemplified by the repetitive, geometrical grid.

A rational mathematical approach to the world caused us to adopt rules. The linear concept, thinking of everything in a straight line, from beginning to an end, was one. The nature of everything being understood in terms of bigger than, lesser than, or equal to, was another. Measurement has been our guiding principle. And in adopting this course, it blinded us to a more complex and richer reality. It became harder and harder for us to recognize any circumstance that we couldn't measure and prove. The inexplicable aspects

Carson's investigations reveal a doubled cube (facing page) and a system of "proof by coincidence," or an expression of coincidental alignments between geometries.





The Doubling of the Cube –

This problem reads, from the time of Pythagoras, that one must generate the edge of a second cube such that that cube's volume would be twice that of an original cube, or in effect, to generate a second line from a given line whose length would be $\sqrt[3]{2}$. This is an irrational number existing as a power above the second power, and proven in Cartesian mathematics to be impossible to generate using the tools of Euclidian geometry. In this instruction, though a relative to the other two problems, that length is generated favorably to six decimal places using the theory of Pythagoras and the irrational number for the $\sqrt[3]{2}$ to 9 decimal places. It is possible that its accuracy is beyond 6 decimal places but by the nature of the number used there is little way of knowing that or not. A much more developed analysis of a certain function I apparently discovered is needed before we can be certain exactly how accurate the results is.

The Squaring of the Circle.

Probably the most metaphysical of the three problems. This problem is to generate the edge of a square that when the square is complete its area would equal the area of a given circle. This means that one must generate a line whose length measures the radius of the given circle times the $\sqrt{\pi}$. π is a unique irrational that has eluded man from the beginning and considered the most impossible proportion to actually achieve in geometry.

I feel that the problem was worded incorrectly. It should read, to generate a square whose area is proportionate to a given circle, one to one. [illegible] to be the issue.

The squaring, when achieved, generates a configuration of golden rectangles which I am finding to be more than a little intriguing.

This configuration also yields an accuracy to 6 decimal places, at least. I feel it is well beyond that, possibly being perfect.

The Trisection of the Angle.

The most classic of the three, and the first one that I felt I had solved. This problem was the discovery I made most significantly – the Inner-Lens. The inner lens is an arc which lies between points B and C between the arc BC of circle Y and the chord BC shared by circles X and Y.

I originally thought that the Inner-Lens was a configuration with one angle. Then I realized in March of 198[illegible] that its center moves to a different [illegible] the changing angle. I found [illegible] as one changes the [illegible] an infinite number of Inner-Lens / PC [illegible] for any angle. [illegible] now is to discover which is the best one.

I feel that I have solved this problem for any angle, completely. However, [illegible] This is still hypothetical. Until [illegible] and I analyze [illegible]. This [illegible] is dedicated to [illegible], the eternal [illegible].

U.S. Embassy
Caracas, Venezuela
Gunnar Birkerts & Associates, Architects

Set into the side of a mountain overlooking the city of Caracas, the new chancery building will be clad with the indigenous granite of its hillside site. The large parcel of land allowed flexibility in siting the structure, but the mountains rising behind the chancery mandated additional security considerations. "On any embassy project, you determine the security requirements, then you design the building," claims Birkerts, "rather than starting with a concept and trying to fit in security." The chancery's carved facade (above) is detailed with structural posts and colonnades shading the entrances. The small apertures in the wall shield interiors from strong south sunlight, while admitting natural light within the mandated limitations for exterior windows. The building is scheduled to begin construction later this year; a future phase will include a new ambassador's residence and an American recreational center.

SECURITY

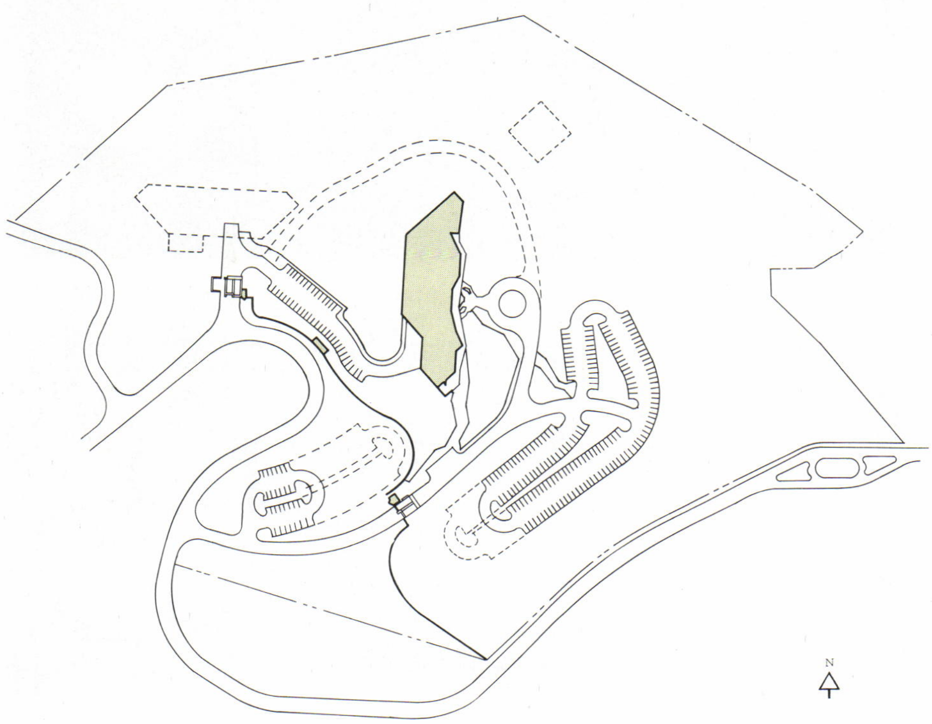
Safe Diplomacy

New safeguards established by the U.S. State Department are changing the way American embassies are designed.

THE BERLIN WALL HAS COME tumbling down, but the State Department continues to build barriers around U.S. enclaves throughout the world. Despite *peristroika* and *glasnost,* security for our embassies across the globe is being maintained at unprecedented levels. While security remains a major consideration in the design of new embassies, the architects of these outposts of diplomacy are striving to enhance protection through vocabularies appropriate to foreign locales.

Approximately 10 embassies built under sweeping new security requirements mandated in 1986 are now in use and very successful, according to Richard Dertadian, who heads the State Department's Foreign Buildings Operations division. Commenting on the upgraded facilities, Paul Weidlinger, whose engineering firm helped develop the State Department's guidelines, says: "Our objective has always been to deter terrorism. Fortunately, there have been no bombings against any of the new facilities. In that regard, we have been successful."

The Foreign Buildings Operations, which oversees the construction of our country's embassies, changed drastically during the last decade. Follow-

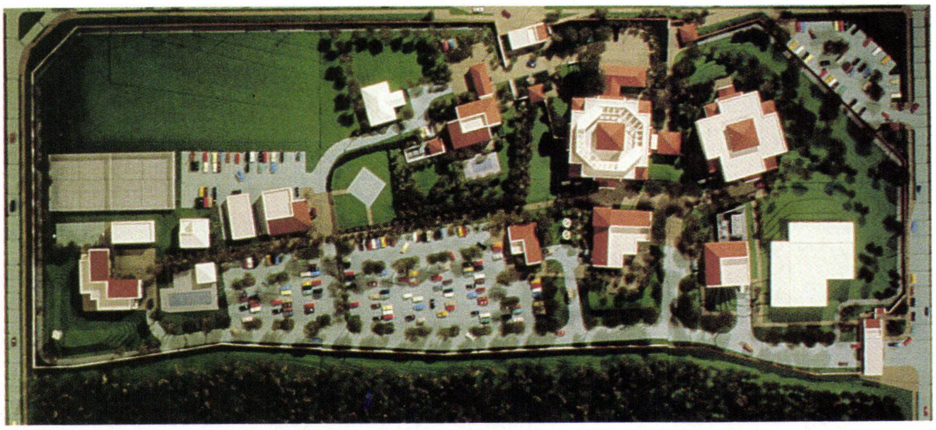


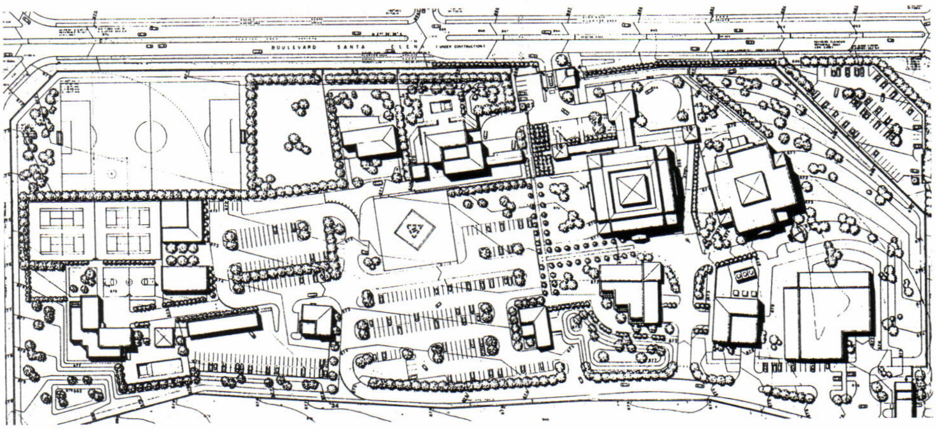
U.S. Embassy
San Salvador, El Salvador
CRSS, Architects
With J.A. Jones Construction Company

Following a limited design/build competition, the embassy complex, now under construction, will replace existing facilities seriously damaged in the 1986 earthquake. Located on a 26-acre site in a newly-developed suburban section of San Salvador, the project is comprised of 11 new buildings, including a chancery (left in photo below), Agency for International Development office building (center in photo below), and the ambassador's residence (far right in photo below). Responding to the suburban context, the architect clustered the buildings in a village-like setting and used simple forms and indigenous materials (above right). Although the large site allowed substantial setbacks, the entire building envelope will be constructed with a tall, anti-ram wall with high blast resistance.

ing numerous terrorist attacks on U.S. complexes during the 1970s and 1980s, the State Department charged an advisory panel with setting criteria for protecting Americans on diplomatic business overseas. The findings, released in 1985, recommended a massive program to renovate or replace our embassies and auxiliary structures in foreign countries. Shortly thereafter, Congress authorized billions of dollars and the State Department reorganized to meet the challenge.

In addition to expanding the Foreign Buildings Operations, a new Bureau of Diplomat Security Services was created to implement the tougher requirements, and the State Department hired Sverdrup Corporation as a program management consultant on 22 projects.



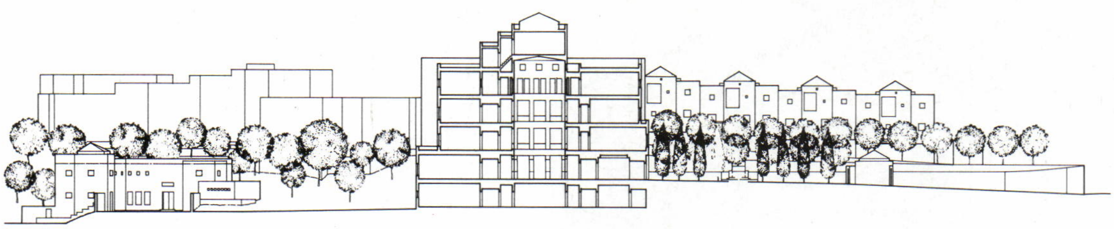


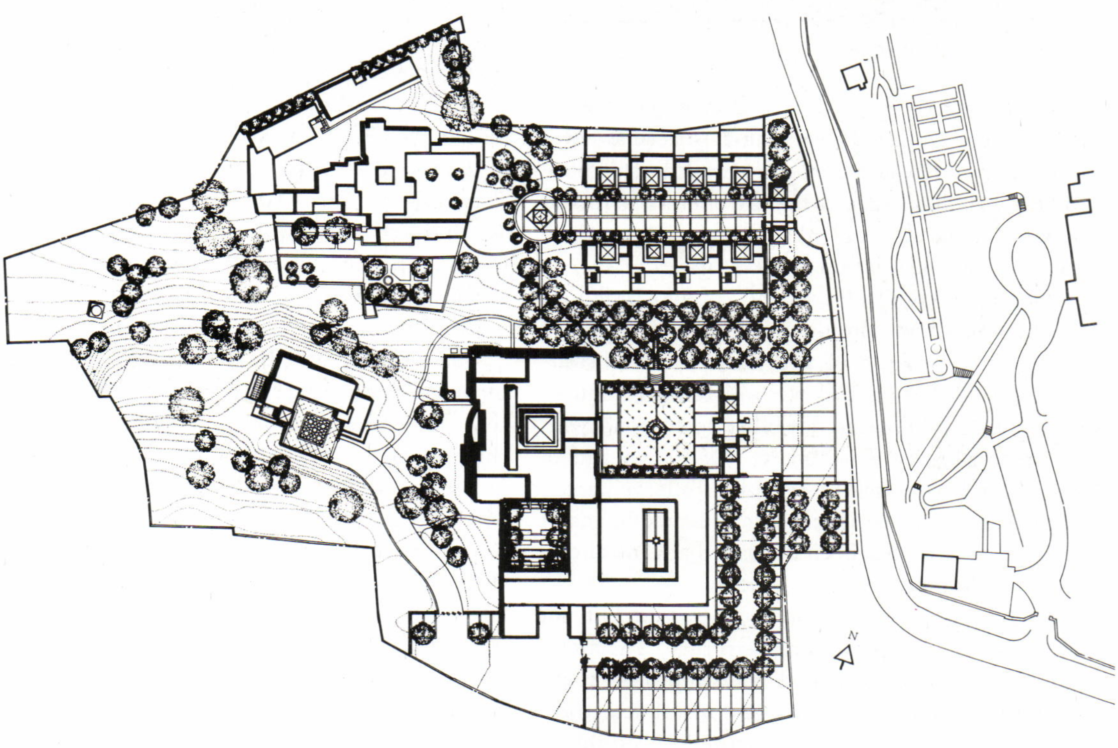
"We are searching for ways to create a safe environment to conduct foreign affairs," explains Greg Bujac, the State Department's deputy assistant secretary for countermeasures and physical security. "Embassies are in a sense public buildings and receive visitors, but we would be ill advised not to include security requirements." Yet the overambitious requirements of the report have gradually evolved over the past five years according to economics rather than changes in the international political climate. "We are looking at specific threat levels as an indicator of how much security is required to maximize a building's effectiveness while keeping costs down," says Bujac.

In determining security needs, the consensus is to protect people, information, and a building—in that order. Integration of security requirements early in the design stage is crucial. "Yet security in connection with architecture is a relatively new concept," notes Robert A. Taylor, vice president of System Planning Corporation.

"Prior to 1980, security was always an applique put onto a building after the construction was completed," Taylor claims. "About this time, people started taking advantage of the fact that the buildings themselves, and the way they were positioned in different environments, could really enhance the security of the whole facility." Incorporating security early in the process is much more efficient and cost-effective. "When you start from scratch, the security is not as obvious or obtrusive, and can become almost invisible," says Dertadian.

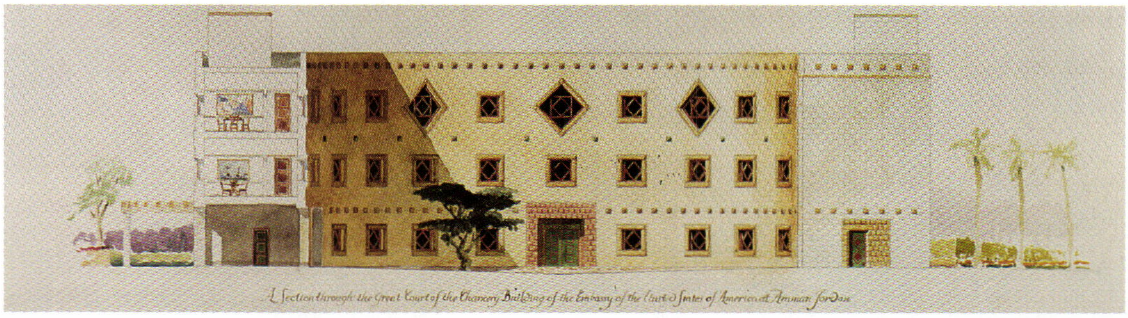
Most security experts agreed that siting is also important. The new requirements call for significantly larger sites, in some cases as large as 15 acres so the buildings can be set back 100 feet. Christopher Degenhardt, president of the landscape architectural firm EDAW, Inc., points out: "Although these requirements dictate huge sites, the distance comes from a very real relationship between what is a reasonable risk and the explosive potential of a car bomb." In tight urban sites, the relationship to the existing street pattern and threats from nearby buildings becomes especially critical.

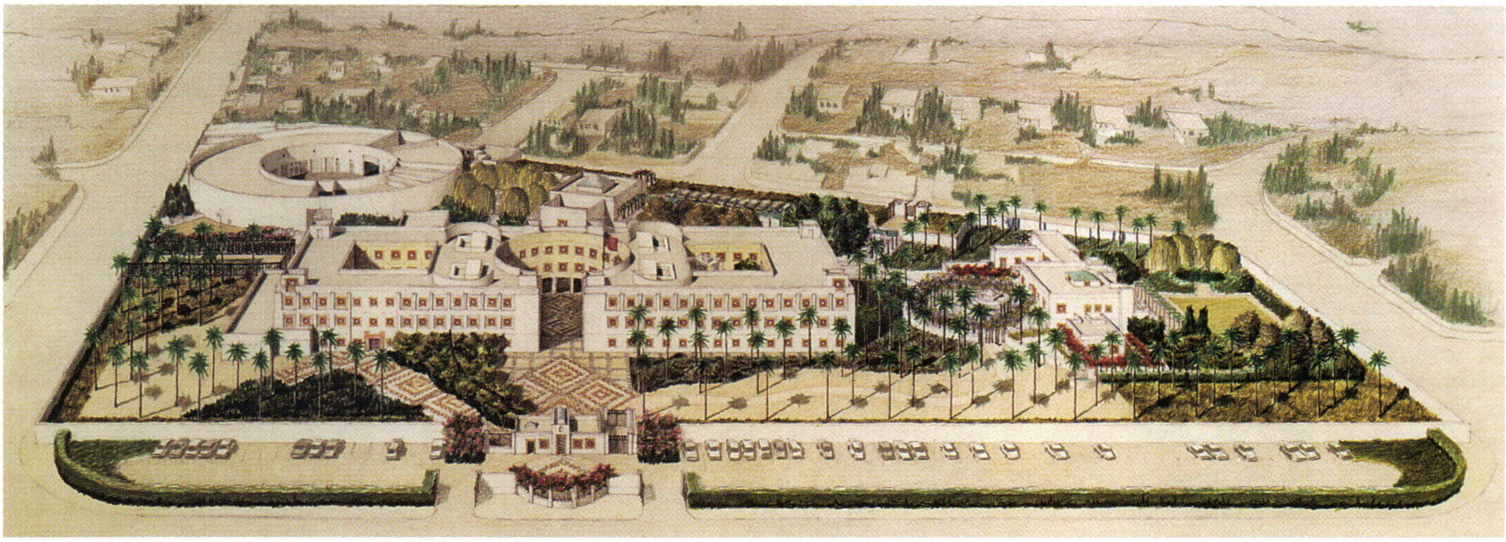


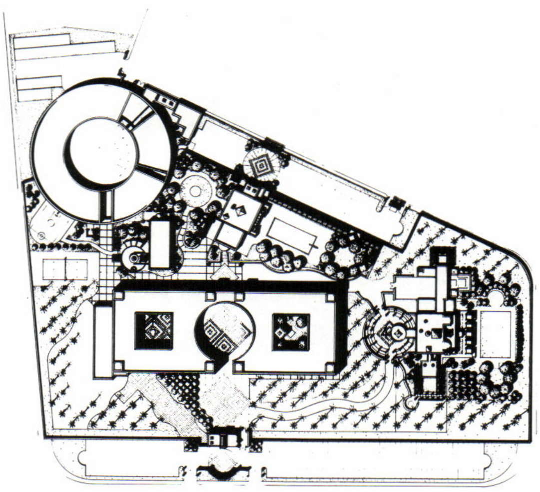


U.S. Embassy
Algiers, Algeria
Keyes Condon Florance, Architects

The new embassy's site plan (left) provides for the required 100-foot setbacks from a nine-foot-high perimeter wall, which complies with the State Department's anti-personnel design standards. A ceremonial entrance opens onto a landscaped courtyard on axis with the chancery (taller structure in model above); a secondary sally port provides vehicular and pedestrian access to staff housing (top right in site plan). The chancery is vertically organized and subdivided to provide a clear separation between public spaces and controlled access areas (section). Exterior openings are kept to a reasonable size to comply with requirements aimed at preventing bomb blasts and forced entry.







U.S. Embassy
Amman, Jordan
Perry Dean Rogers
& Partners, Architects

The architects emphasized bold geometric forms, stone detailing, and landscaping to meet the symbolic, programmatic, and security requirements of a new diplomatic enclave in Amman. The large drum (right and above), with an interior vehicular drive, serves as a secure sally port and provides a strong visual design element for the sharply angled corner of the site. Located on a 13-acre parcel, the 200,000-square-foot complex (above) scheduled for completion next year, will be constructed primarily of native white stone with decorative accents. Responding to demands for windows no larger than 15 percent per bay, the architects created a fenestration pattern reminiscent of traditional Middle Eastern architecture (top). A series of interconnected interior gardens will provide safe circulation throughout the compound, which includes a chancery, consular offices, ambassador's residence, Marine guard quarters, and an American community center.

Protecting the perimeter wall of an embassy is also a major concern. One security specialist notes that as an ameliorative effect, a wall doesn't have to be a wall and suggests the use of earth berms or moats. But in any wall, the "weak link" is at the access point; the solution is fewer entries.

Dertadian confirms that the Foreign Buildings Operations is now considering threats according to specific sites instead of applying the same standards to all. "However, we will require that all new sites will allow us flexibility to respond with increased security if necessary," Dertadian added. Not all embassies will be relocated to large parcels outside the city. To insure our presence in major capitals, security has been upgraded at central embassies in Rome, Paris, and London.

The design of the facility is important but not the only factor in preventing terrorism. The architecture must be augmented with improved training for the operators of X-ray and metal detectors.

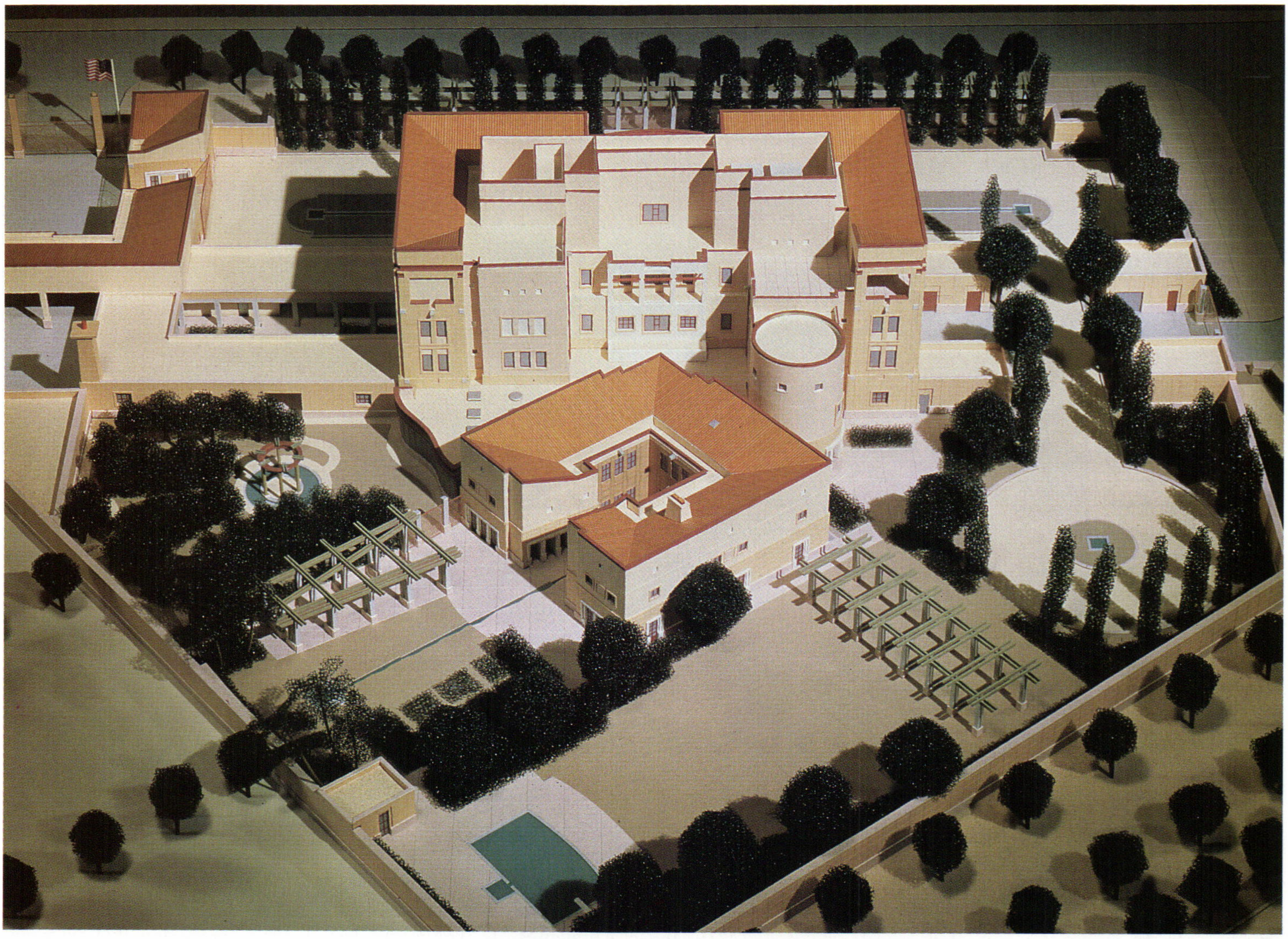
In 1986, the State Department brought in Sverdrup Corporation to help manage the multibillion-dollar design and construction effort. Sverdrup is also developing a unique system of technology transfer. "We have some rather sophisticated information management, scheduling, estimating, and project control systems," says Sverdrup's W. Donald Kingsley. "Our system will allow the State Department to incorporate these procedures in future projects."

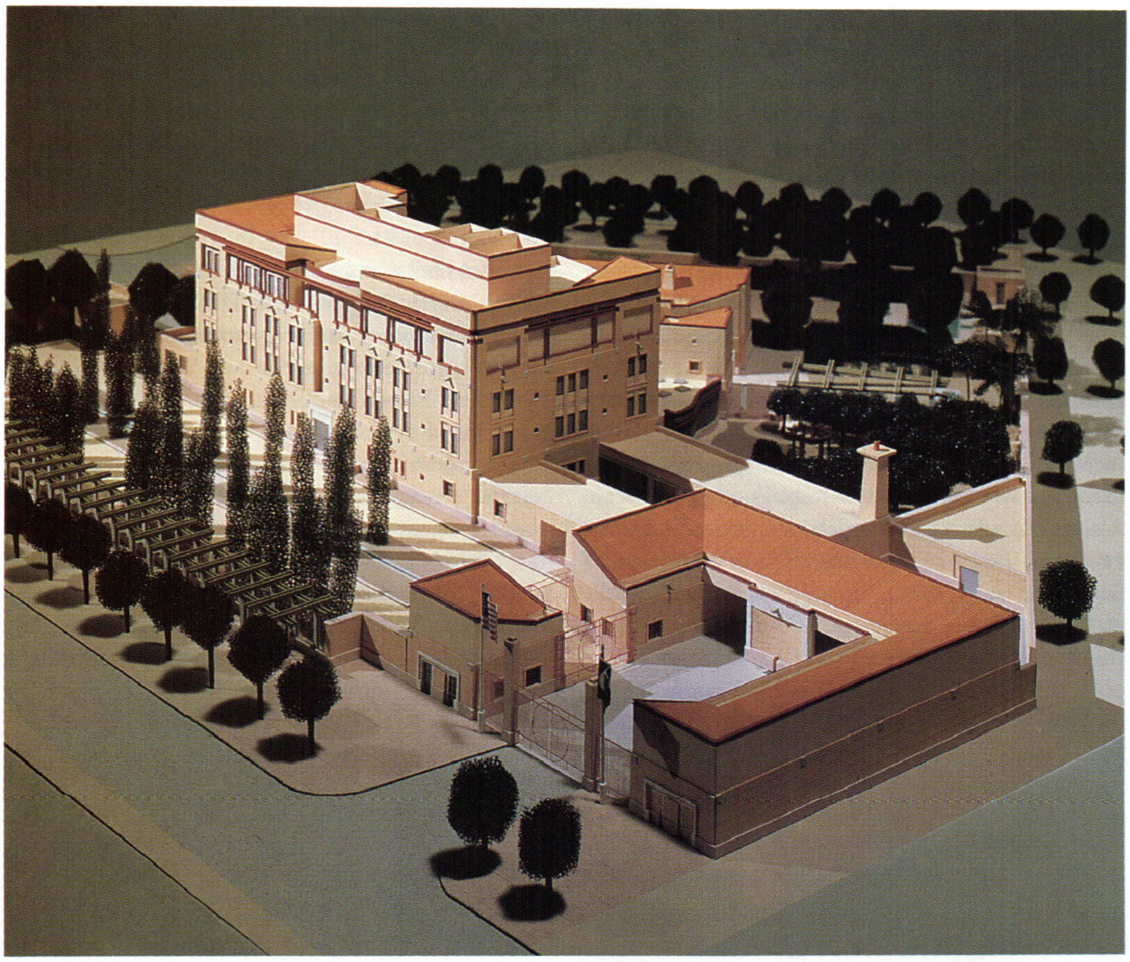
Washington architect Stuart L. Knoop of Oudens & Knoop maintains: "The State Department is the vanguard in security planning. Ten years ago, architects would say architecture in a democratic society is supposed to be open and free. Now it is our responsibility to consider security as a part of every program."

Architects, however, are often caught in the middle. Lee Polisano, Kohn Pedersen Fox's partner in charge of the Nicosia embassy maintains: "A clear disparity exists between the various forces in Washington. Although it was a remarkable and unique experience working on the embassy, there is a belief that these buildings can be executed without the ongoing participation of their authors."

Since World War II, the State Department has maintained a rich tradition of hiring the best architects for embassy projects, credited in part to a three-member architectural review board founded in 1954. Bill Lacy, chairman of the board from 1985-1989, says: "It is a tribute to the present administration of Foreign Buildings Operations that the board continues to fulfill its original mission as effectively as it does." But he warns that "the exclusive emphasis on security has put too much stress on engineers' and technocrats' delivery systems without enough regard to what is being delivered." ■

—LYNN NESMITH





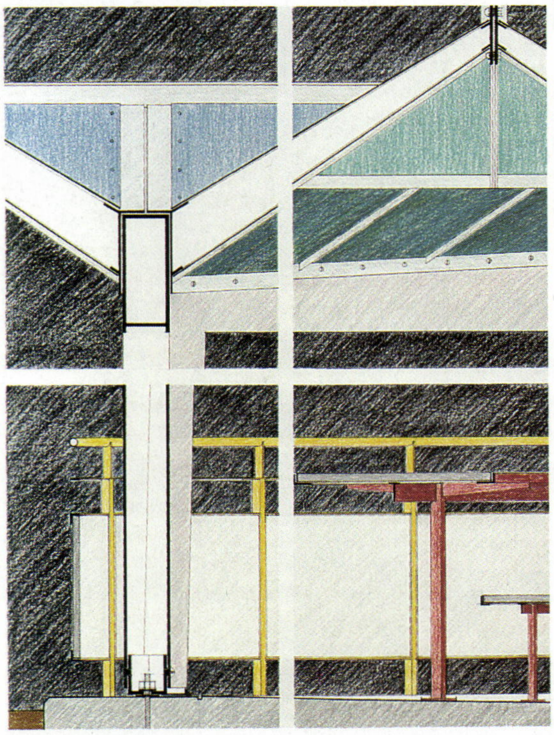
U.S. Embassy
Nicosia, Cyprus
Kohn Pedersen Fox Associates, Architects

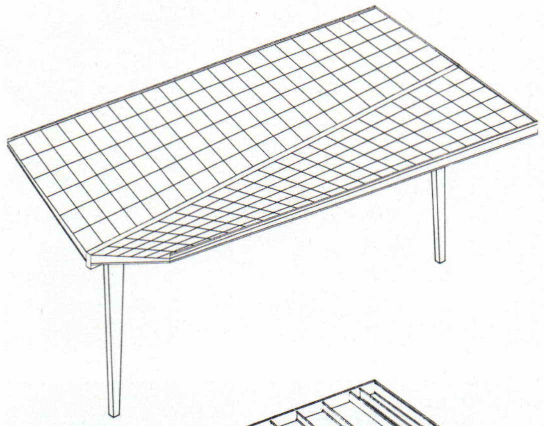
KPF created a traditional embassy enclave within the confines of an oddly-shaped site, defined by the prescribed perimeter wall and a setback of 100 feet. The chancery's ceremonial entry fronts Nicosia's Embassy Row (top of photo above), while an entry pavilion with a protected courtyard (left) will ensure controlled access. The ambassador's residence (foreground in photo above) is oriented for privacy toward the rear of the site facing an existing olive grove and monastery. A circular component mediates between the chancery and residence. Landscaped outdoor spaces provide a transition from public processional courtyards to the ambassador's informal private garden. Totalling 71,000 square feet of space, the complex is scheduled for completion next year.

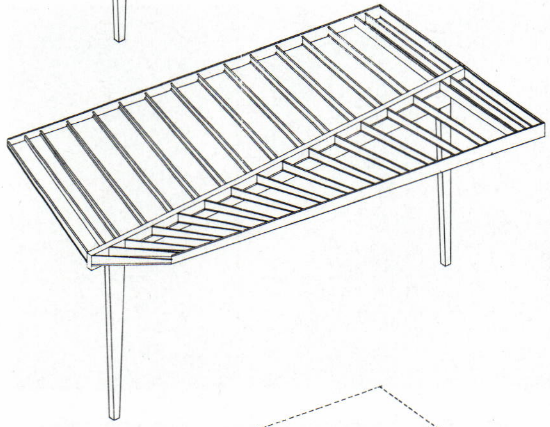
Arup's interdisciplinary team approach eliminates the cost and time delays that can result from using separate consultants.

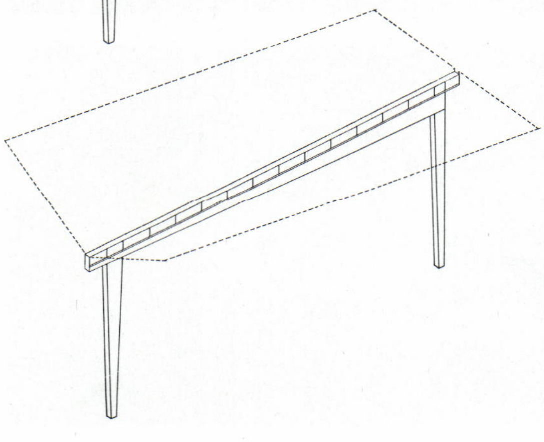
School Lunch Shelters
Los Angeles, California
Angelil/Graham, Los Angeles

The designers were asked to devise shelters at 50 schools within the Los Angeles Unified School District that would protect children from sun and rain while eating lunch. The structures had to fit many sites, yet be mass-produced with simple construction techniques. The solution was based on repetitive structural units that could be variously configured for different sites. One of the criteria the designers set for themselves was that children should be able to comprehend the constructions easily. Each shelter has a concrete base that can be fitted to different sites by use of stairs, ramps, guardrails, benches, landscaping, and other devices. Roof units can be assembled to allow for diverse sizes, configurations, and orientations. The roof units themselves consist of an assembly of parts, including a three-hinged arch (top right), a double curved roof surface (center right), a cantilever (lower right), and a frame (bottom). Each steel roof unit is to be shop-fabricated and assembled on site, with the units pin-connected into the concrete bases and bolted together. Fabrication and installation is to be completed in 1992.









concern with design, ability to give and take in discussions and drawing sessions, to communicate, and coordinate tasks. "Often engineers spend their time showing how a design can't work. Arup's works with us rather than trying to bite us," says Langston Trigg, an architect and client for the Lucille Packard Children's Hospital at Stanford University. David Neuman, campus architect for Stanford, adds: "Because they participate in developing the parti and feel a sense of ownership over the design, they aren't defensive with the architect." He also notes that Arup's interdisciplinary team approach eliminates cost and time delays, and frustration that can result from using separate consultants who are out of sync with each other.

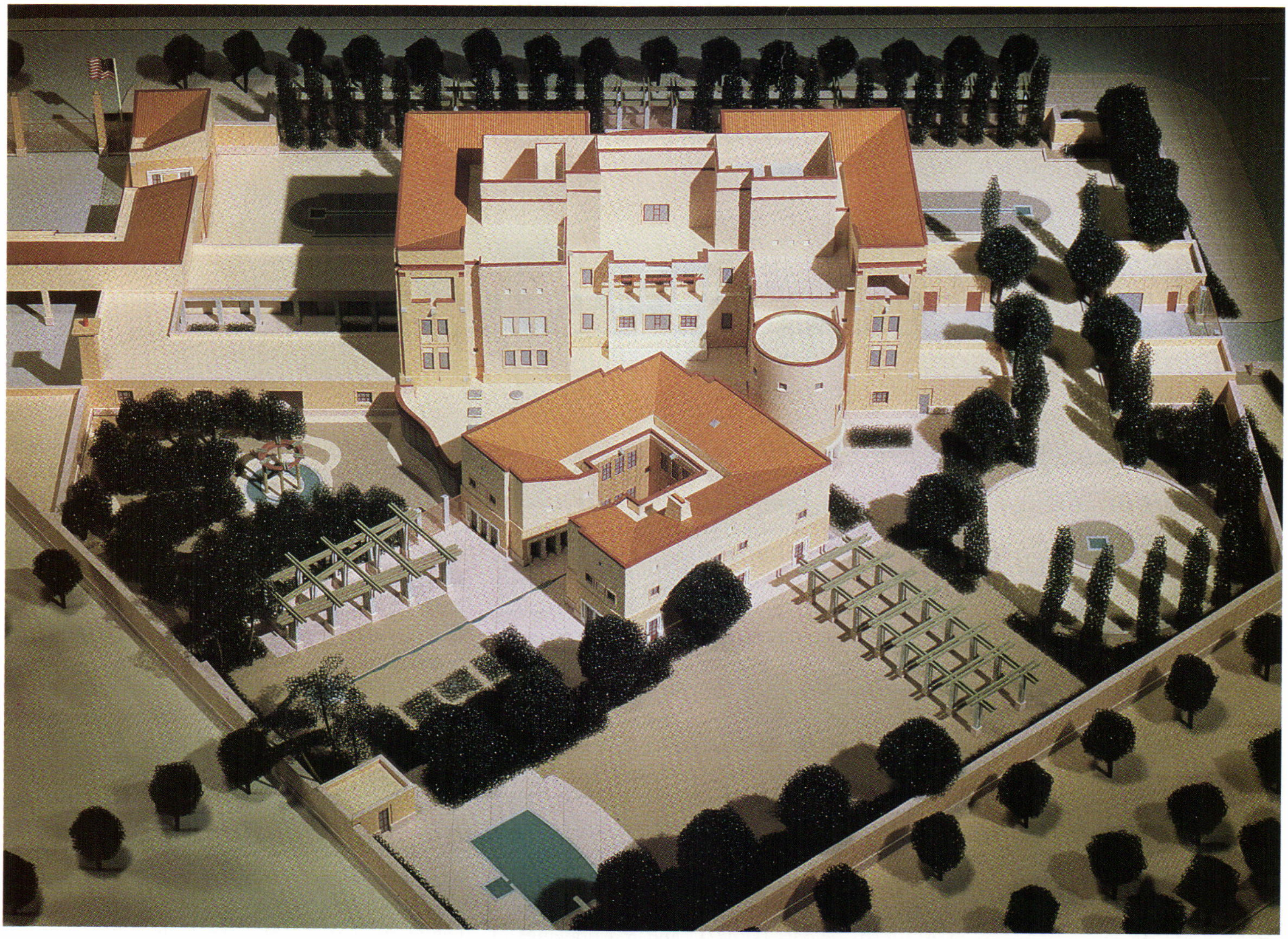
Not everyone is as enthusiastic about Arup's approach as they are about Arup's as a firm. Matthys Levy of Weidlinger & Associates says that avoiding coordination and communications problems "all depends on who runs the job and how they run it. It's a management, not a technical problem." Lev Zetlin of Zetlin Argo claims the team approach is harder to administer. Oddly, no one complains that it is regularly less cost-efficient. In fact, Budd asserts that Arup's approach "enables us to trade off one cost against another, both in design terms and fees." He says that since all members of the team understand the overall intent, they work toward a goal rather than against each other on individual segments of the work.

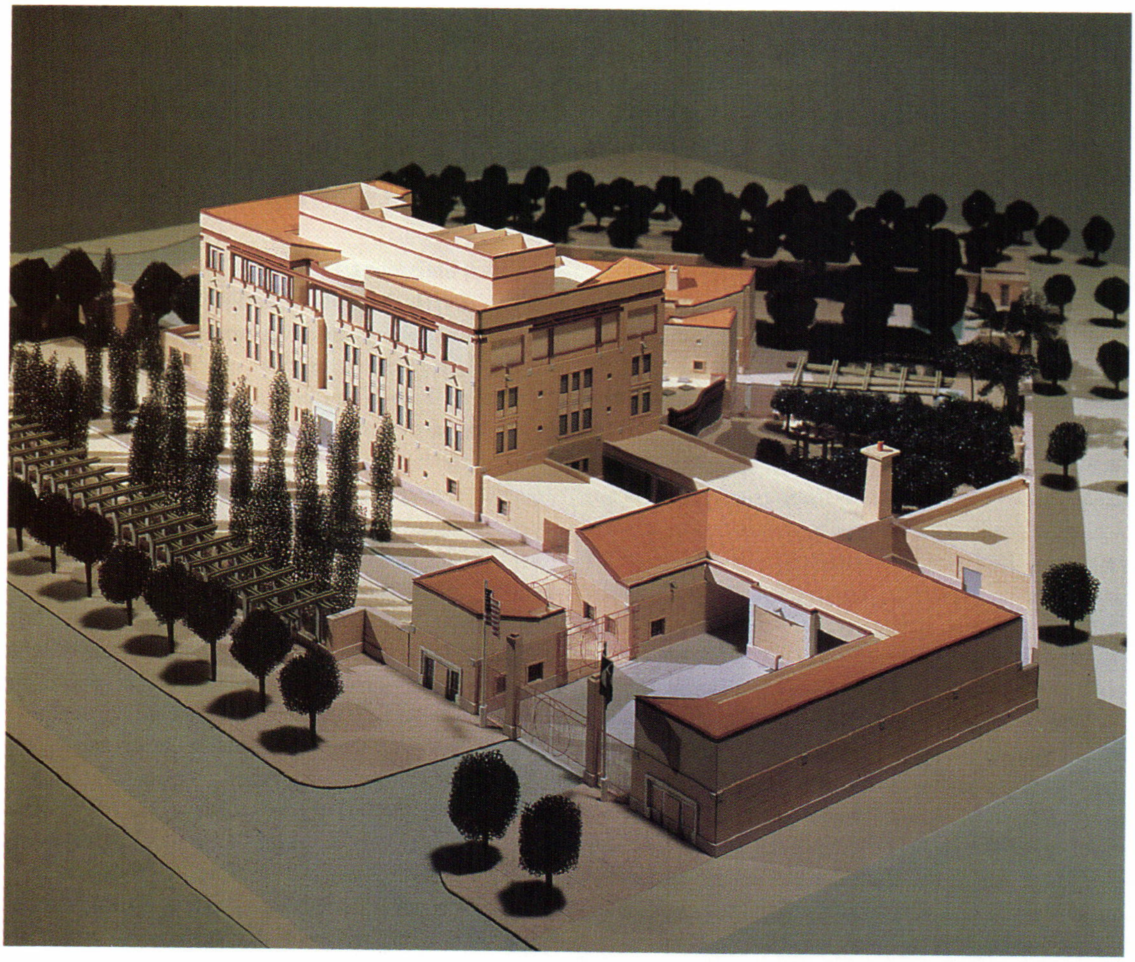
"Usually, we're wary of firms that sell themselves as doing it all. Something usually suffers," adds Wendell Wickerham of Shepley Bulfinch, "Most firms don't have the resources of Arup's." Zetlin adds that most engineering firms are too small to be able to work in teams, and in most instances there is too much enmity and jealousy between engineers of different disciplines for them to work smoothly together. Budd further explains: "Working the way we do requires flexibility and a broad perspective, and many engineers feel more comfortable building fences around themselves, sticking to their specialties. It's easier to say, 'My system works,' and leave it at that."

Working on an aggressive, interdisciplinary team also requires a "special caliber person," according to Jofeh. He explains that "it requires more commitment and effort; you have an easier life if you just let the architect produce the scheme and slide the columns and beams in to fit." There is also the argument that interdisciplinary teams often don't attract the best individual specialists, because "engineers feel they'll have less voice and future," contends Levy of Weidlinger.

The consensus seems to be that the Arup's approach can produce better buildings, but only if its engineers are the best and committed to design, as Arup's are. "The bottom line about them," says Arup's client Langston Trigg, "is that I'd look forward to working with them again." ■

—Andrea Oppenheimer Dean





U.S. Embassy
Nicosia, Cyprus
Kohn Pedersen Fox Associates, Architects

KPF created a traditional embassy enclave within the confines of an oddly-shaped site, defined by the prescribed perimeter wall and a setback of 100 feet. The chancery's ceremonial entry fronts Nicosia's Embassy Row (top of photo above), while an entry pavilion with a protected courtyard (left) will ensure controlled access. The ambassador's residence (foreground in photo above) is oriented for privacy toward the rear of the site facing an existing olive grove and monastery. A circular component mediates between the chancery and residence. Landscaped outdoor spaces provide a transition from public processional courtyards to the ambassador's informal private garden. Totalling 71,000 square feet of space, the complex is scheduled for completion next year.

SECURITY

Blast-free Design

A computer modeling program simulates bomb attacks to minimize potential destruction of structures and their inhabitants.

UPI / BETTMANN NEWSPHOTOS

EVEN THOUGH COMPUTER modeling can simulate and analyze natural forces like ground motion, wind shear, and snow loads on a variety of structures, unnatural forces—like acts of terrorism and sabotage—will never be predictable. But a new computer program can now estimate terrorist induced devastation, as long as the weapons used are mechanical devices, like bombs.

Combining an assortment of CADD programs already on the market, including Intergraph Microstation, DataBase Plus, and MathCAD, BombCAD was developed by the Everett I. Brown Company Architects & Engineers in conjunction with the Lorron Corporation, security specialists with years of first-hand, post-blast analysis. Running the system on a Compaq 386 computer, the BombCAD team renders both 2D and 3D drawings of buildings to simulate bomb detonations and to assess the magnitude of destruction should the buildings become targets for terrorists. Although most who subscribe to the service remain anonymous, the client list so far includes NASA's Kennedy Space Center at Cape Canaveral, Florida, the Department of the Treasury, as well as embassies and foreign industries, and a nuclear power plant on the California coast.

Two basic types of analyses are offered for a fee that depends on the extent of evaluation. For a "forward" BombCAD analysis, plans are drawn complete with detailed information about the properties of the primary structural elements, their location within the facility, building materials used, and site data such as topography, landscaping, and roads. Other variables that influence the extent of damage are entered into the "threat" data base, such as the altitude of the facility, the air/ground burst model (a formula derived from the bomb size relative to its distance from a solid object), and the bomb's TNT-weight equivalent.

The placement of a bomb is as crucial as its weight in determining the potential risk to a structure or personal safety. Dr. Ronald Massa, the Lorron Corporation's security expert who previously developed another proprietary bomb analysis program now incorporated into the BombCAD system, then determines the site's most vulnerable locations. Once determined, the building is "blown up" on-screen.

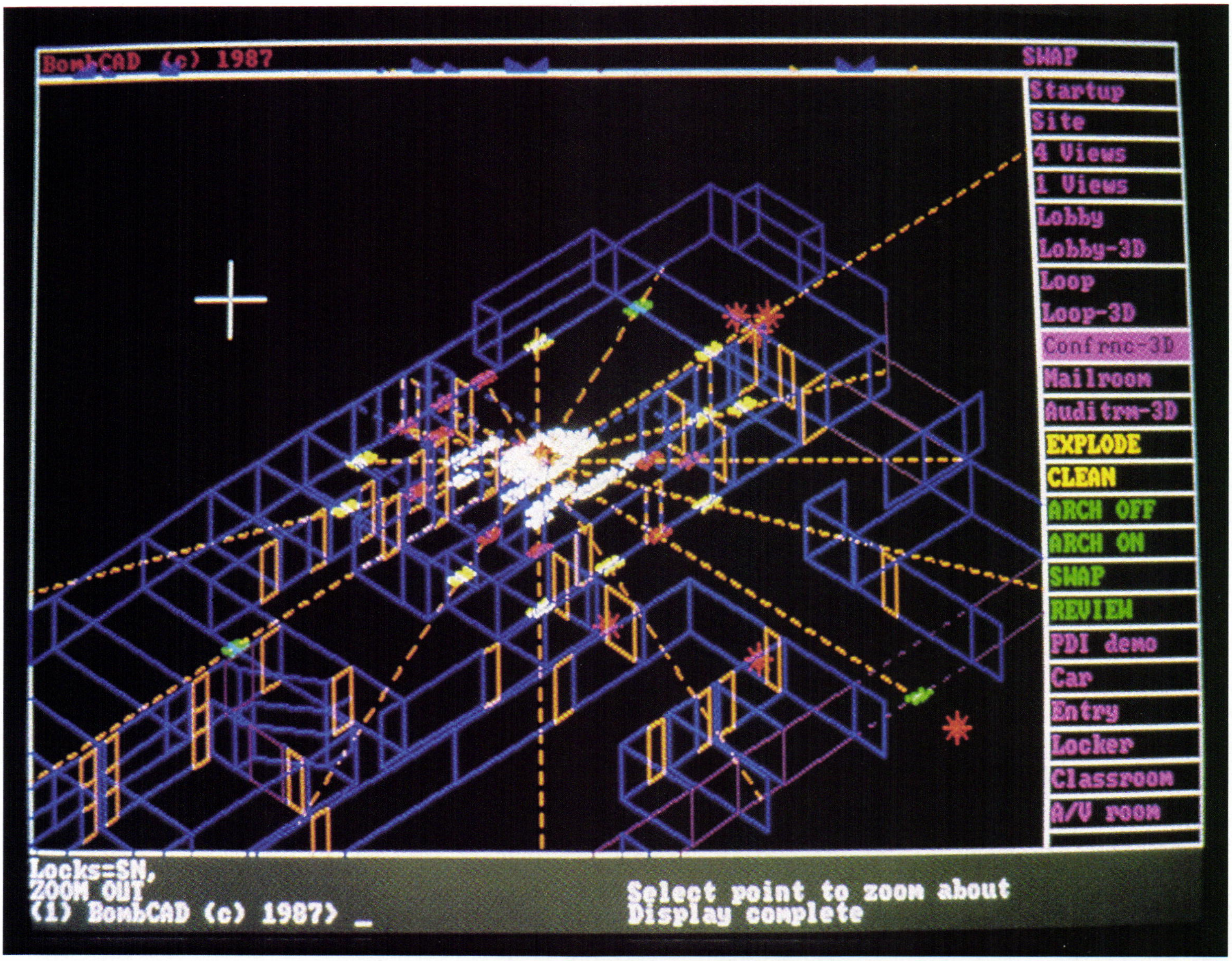
Through multiple explosions of the same facility under identical circumstances, unpredictable variables like the weight of the bomb and the location of the blast can be altered for comparative results. For each explosion, the program will determine specific quantifiable results such as peak positive incident and reflected overpressure (the total force exerted on the structure), positive phase duration (duration of the initial blast), time of arrival, and shock front velocity. These results determine a "zone of involvement," which outlines the extent to which the explosion affects the building's structural integrity.

Working with identical fields of data, a "reverse" BombCAD analysis is helpful in determining those "zones of involvement" before the building has completed the design stage. The client can specify the dimensions of a "box" that must sustain negligible damage, and the permissible extent of destruction to the area. The BombCAD team will then sketch out a variety of schemes using materials and layouts able to withstand a blast, which not only improves safety but economic efficiency, since the architect can then redirect often limited resources to allow both buildings and people to survive.

Program limitations

ALTHOUGH THE BOMBCAD ANALYSIS OFFERS insight into potential devastation from bombs, the system's greatest limitation, as Wally Howard of Everett I. Brown readily admits, is that "there is not a lot of evaluated data that will tell us exactly how materials will respond." Up until now, the relative strengths of building materials under this type of stress have been determined solely from Dr. Massa's investigations, field tests, and military studies. Even the extensive results from the military may not be applicable, however, since the magnitude of those blasts is generally beyond the capacity of a bomb that can fit in a briefcase, or even a car. Additional field tests are now underway to examine the responses of a greater variety of building materials, especially those commonly used abroad, such as ceramic blocks and terra cotta, in countries where a higher incidence of terrorism offers a potentially lucrative BombCAD market.

Among other variables that will also undoubtedly affect the accuracy of the analysis are con-

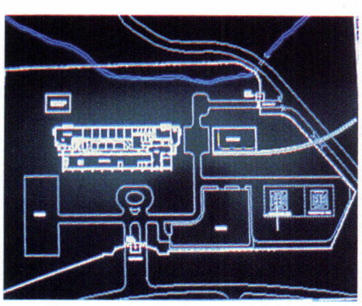


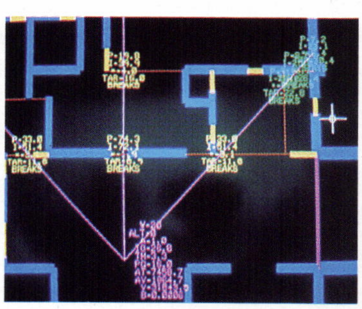
struction methods and workmanship. As with all computer models, however, certain assumptions have to be made in order to generate any valuable conclusions, even if they are limited in scope. And like many other computer modeling programs already on the market, the service generates a variety of scenarios within minutes, providing data that previously was only available from obscure sources—and even then after weeks of labor-intensive calculations.

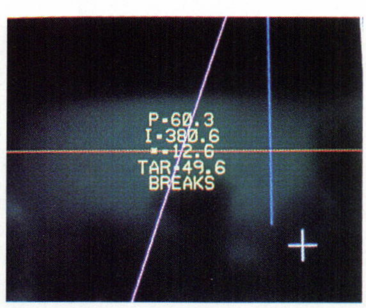
Currently, plans must be redrawn on the BombCAD system, extending the analysis by several weeks—which could prove to be even more costly if occupants' safety depends on the expediency of the analysis. Tests have been successfully completed, however, allowing BombCAD to import existing CADD drawings saved in an IGES or DFX format. This transfer would provide another practical feature, since the stripped down, post-analysis drawings could be sold back to the client and imported into an architect's or engineer's own CADD system.

While the value of its service is indisputable, BombCAD is not so much a brilliant program as a mechanized illustration of the union between engineering know-how and security savvy. In the future, this type of computerized integration of architecture and allied industries will most likely ensure the longevity of a building in the real world, where unnatural forces unpredictably deliver a devastating blow. ■

—GREGORY LITTLETON



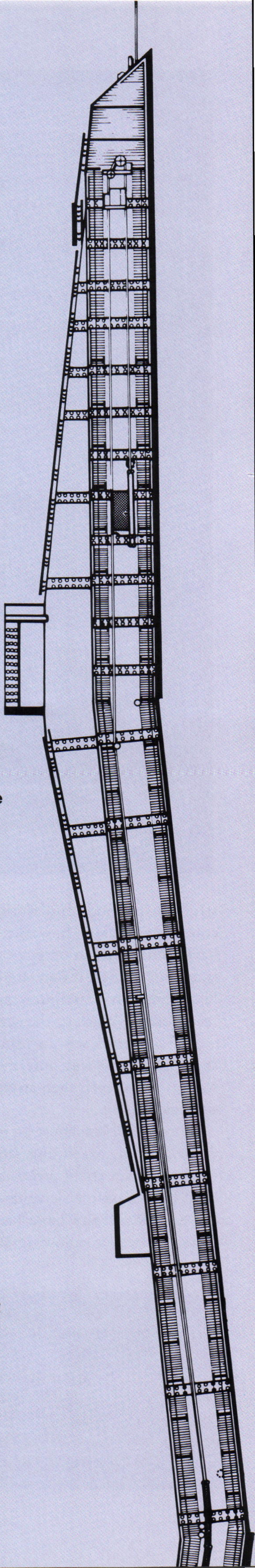




Both site plans (far left) and three-dimensional views of a facility are redrawn on BombCAD before the bomb is exploded (above). Radials illustrate the effects of the blast on specific elements. The red type (left center) lists the bomb data (W=bomb weight, ALT=altitude, A=air burst coefficient), and data blocks appear on the screen (left) where the structure is affected, listing pressures and impulses that determine whether the structure withstands the blast or "breaks."

Zig-zag Elevator
Mitsubishi Electric Corporation

Mitsubishi encountered several challenges when attempting to install 17 elevators that could navigate the angled pylons of the Hitsuishi-Jima and Iwakuro-Jima Bridges in Japan. The development of the "zig-zag" elevators resulted in a total of four engineering breakthroughs. In order to thread cables smoothly through the angled shaft and to maintain continuous upward movement, a traveling deflector sheave was developed. The sheave is active only on the portion of the shaft where the car is traveling upward and away from the top anchor position of the cable. The elevator's counterweight had to bypass the angles smoothly; Mitsubishi developed a centipede-shaped counterweight that flexes in three places. The movement of the counterweight is automatically regulated to slow around the angles, thus reducing shock. Passenger comfort is assured by a revolutionary control device that subtly alters the angle of the cab floor—a seesaw effect undetectable to the passenger—which keeps the floor horizontal at all times.



CIRCULATION

Making It to the Top

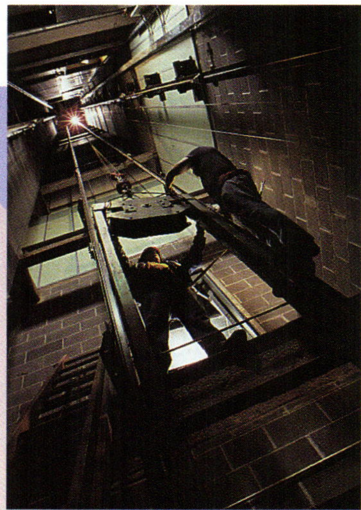
ELEVATORS HAVE COME A LONG WAY SINCE ELISHA Graves Otis invented a safety mechanism in 1854 that turned dangerous hoisting devices, until then considered useful only for moving freight, into safe, economical conveyors of people. Since then, elevators have evolved from simple, slow-moving platforms hauled by rope and power-driven drums to highly sophisticated high-speed transporters. More recently, elevator manufacturers have increasingly focused their efforts on developing computer-based control systems.

One reason for this focus is that elevators can be programmed to transport people much more efficiently with computers than with traditional hard-wire relay systems. Why has this trend become important? With the shift from farming and manufacturing to a service-based economy in this country, and the concomitant increase in people working in offices, developers and architects have been forced to devise solutions enabling more efficient control over building traffic patterns. "There are simply many more people today using elevators than there were ten or fifteen years ago," says Bill Lewis, a partner with the elevator consulting firm Jaros, Baum & Bolles based in New York City. In response to these changes, a variety of technological choices is now available to architects and developers to help them accommodate diverse traffic flow patterns.

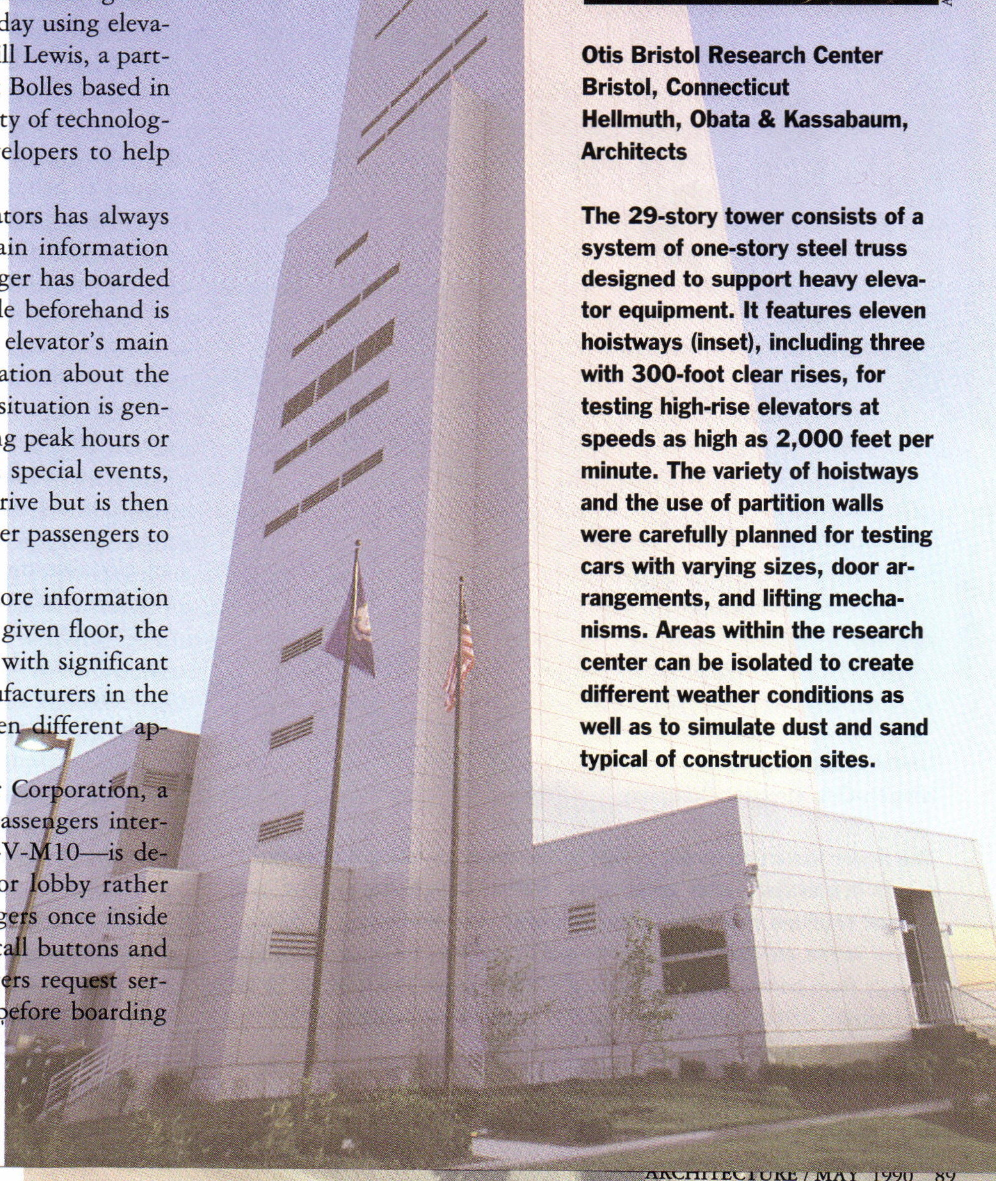
A basic drawback to traditional automated elevators has always been that their control systems are unable to obtain information about a passenger's intentions until after the passenger has boarded the elevator. The only information typically available beforehand is that an up or down call has been registered in the elevator's main processor. An elevator, for example, has no information about the number of people waiting or their destinations. This situation is generally not a problem during off-peak hours, but during peak hours or conventions, seminars, and other heavily trafficked special events, one is forced to wait not only for the elevator to arrive but is then taken through a maze of delays while waiting for other passengers to exit before reaching the desired floor.

Industry researchers have long believed that if more information was available to an elevator prior to its arrival on a given floor, the overall system would operate much more efficiently with significant reductions in passenger waiting time. Elevator manufacturers in the United States, Switzerland, and Japan have all taken different approaches to developing systems to achieve this goal.

One system, developed by the Schindler Elevator Corporation, a Swiss manufacturer, significantly changes the way passengers interact with elevators. The system—called the Miconic-V-M10—is designed with keyboard panels located in the elevator lobby rather than the call button panel typically used by passengers once inside the cab. Other traditional devices such as up/down call buttons and hall lanterns have been eliminated. Instead, passengers request service by entering the desired floor on the keyboard before boarding



AL FERREIRA PHOTOS



Otis Bristol Research Center
Bristol, Connecticut
Hellmuth, Obata & Kassabaum, Architects

The 29-story tower consists of a system of one-story steel truss designed to support heavy elevator equipment. It features eleven hoistways (inset), including three with 300-foot clear rises, for testing high-rise elevators at speeds as high as 2,000 feet per minute. The variety of hoistways and the use of partition walls were carefully planned for testing cars with varying sizes, door arrangements, and lifting mechanisms. Areas within the research center can be isolated to create different weather conditions as well as to simulate dust and sand typical of construction sites.

INVISIBLE ARCHITECTURE

ENGINEERING

Imported Ingenuity

Renowned for spectacular high-tech designs, the British engineering firm, Ove Arup & Partners, applies its technical teamwork to U.S. projects.

OVE ARUP & PARTNERS IS DISTINGUISHED FOR COMBINING brains with backbone and an eye for stunning designs. In a move welcomed by American architects who know their work, the British engineering firm has recently opened full-service, multi-disciplinary offices in San Francisco and Los Angeles, and a fledgling structural engineering consultancy in New York City.

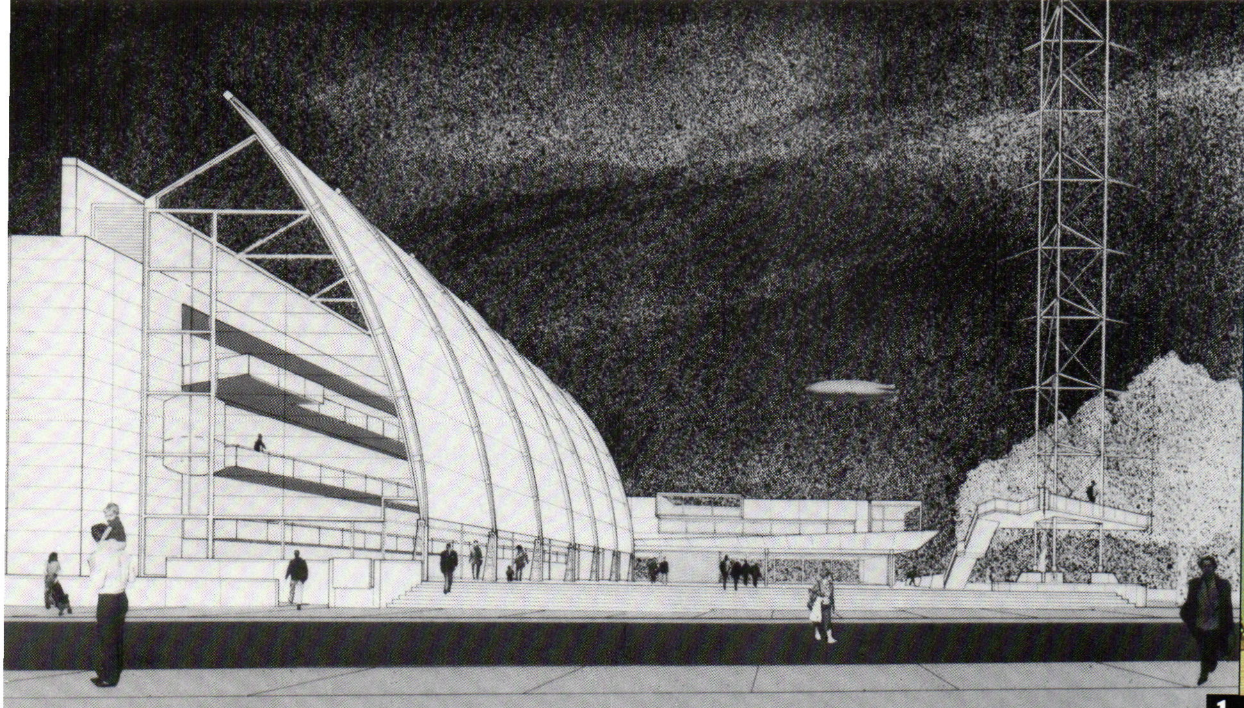
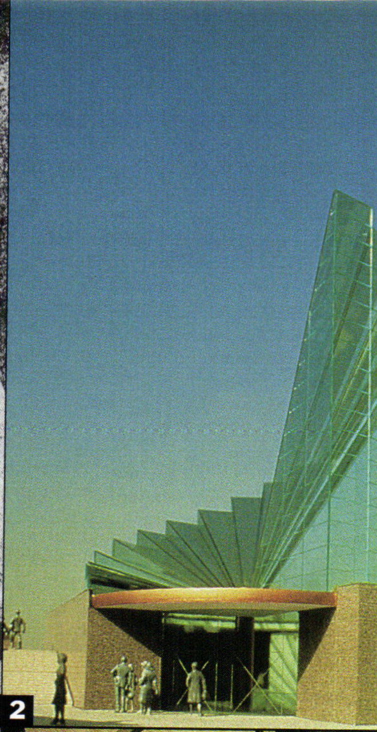
3

Widely known as Arup's, the firm was launched in London in 1946 by the Danish-born visionary engineer, who gave it his name and worked for the practice until he died at 92, two years ago. Arup had made his mark collaborating with the Tecton Group on the London Zoo's famed Penguin Pool of 1933, a seamless joining of form, function, and concrete technology. Ove Arup's objective in founding the firm, says Peter Budd, managing principal of the California practice, "was to create 'total architecture,' working with interesting architects on very good buildings." The results have been better than good. The firm's recent achievements include collaboration with, among others, Renzo Piano and Richard Rogers on the Centre Pompidou in Paris, James Stirling and Michael Wilford on the Staatsgalerie in Stuttgart, and Norman Foster on the Hongkong and Shanghai Banking Corporation's headquarters in Hong Kong. Because Arup's interdisciplinary teams enter the design process at early stages, technical issues often become strong design determinants.

Arup's has grown to over 4,000 employees, based primarily in Britain and such former British colonies as Singapore, Australia, New Zealand, Malaysia, Nigeria, Qatar, and Zimbabwe. In 1985, the firm spawned an office in San Francisco at the invitation of Derek Parker, CEO of Anshen + Allen, who "was frustrated with the usual American engineer's lack of interest in quality, creativeness, and in cooperating with architects at early stages of design." After meeting Jack Zunz, then chairman of Arup & Partners, and collaborating with the engineers in London on a project, Parker promised Arup's work if they opened a San Francisco office. That office now employs 30 engineers (three Brits, 27 local recruits).

Ove Arup & Partners is currently involved with a diversity of projects (right and facing page), including:
1. National Inventors Hall of Fame, Akron, Ohio
James Stewart Polshek & Partners, Architects
2. California Plaza Dance Gallery, Los Angeles
Arthur Erickson, Architects
3. Ove Arups & Partners California Office, Los Angeles
Charles and Elizabeth Lee, Architects
4. Cerritos Community Arts Center, Cerritos, California
Barton Myers Associates
5. Clovis Community Hospital, Clovis, California
Anshen + Allen, Architects
6. Riding Ring and Stables, Connecticut
Cooper, Robertson + Partners
7. Seiwa Classic Golf Clubhouse, Chiba, Japan
Morphosis, Architects
8. Los Angeles Unified School District Lunch Shelters
Angelil/Graham, Architects

3: TOM BONNER 5: JANE LIDZ

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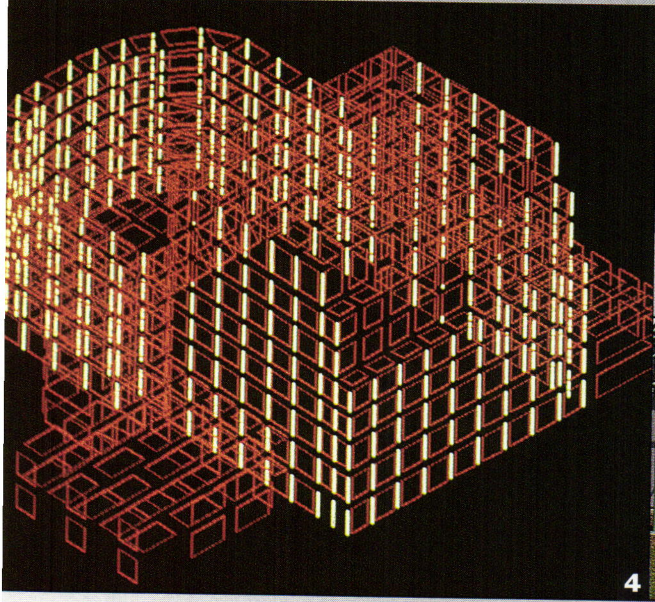

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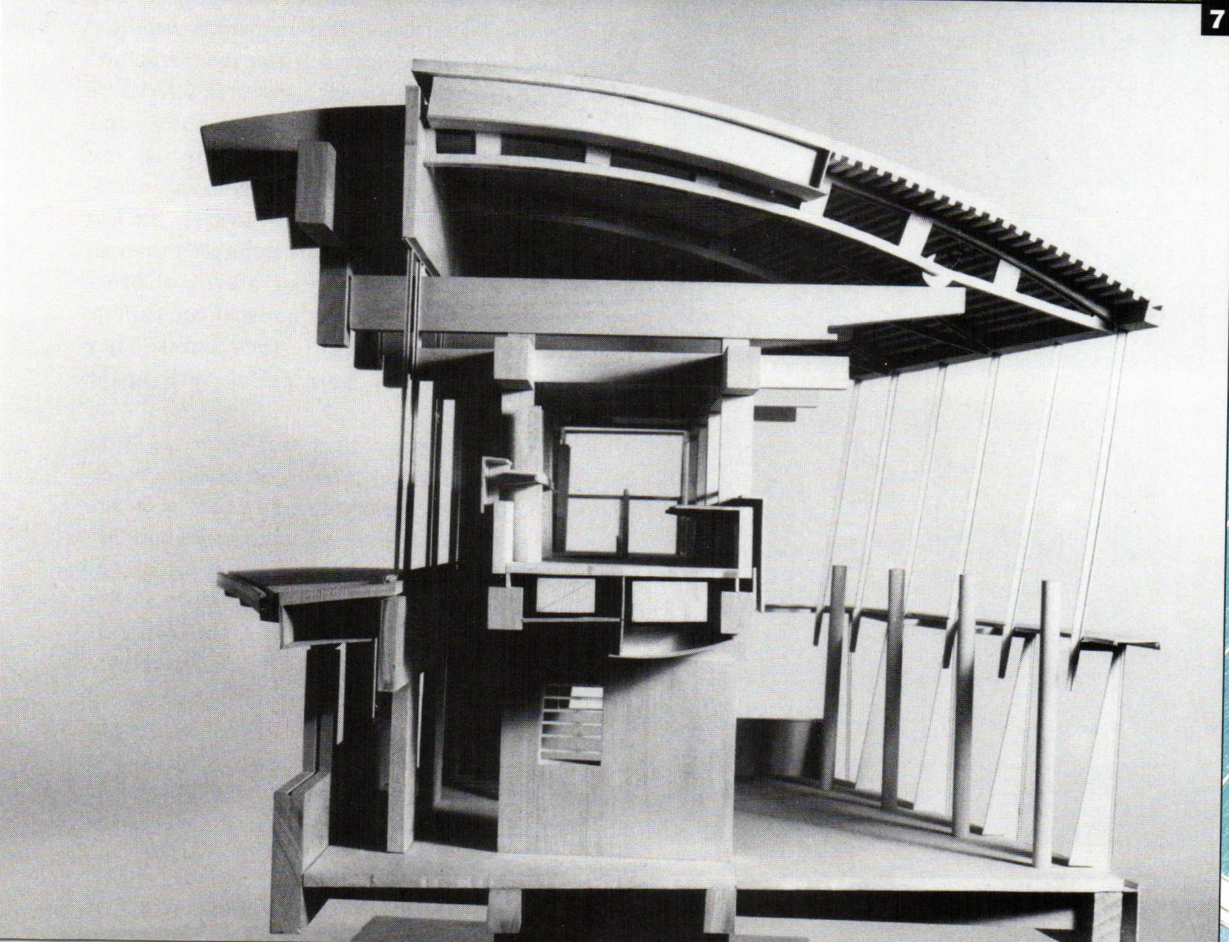
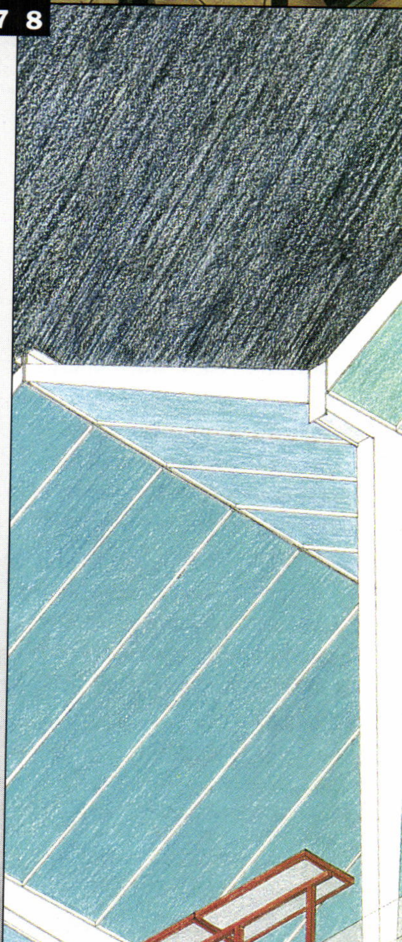



Arup's is unusual for exploring ideas and pushing them to their limits. They make major conceptual contributions early in the design process.

JANE LIDZ PHOTOS

Clovis Community Hospital
Clovis, California
Anshen + Allen Architects

The initial concept for this complex was as a single building, but since a hospital's different functions require different design treatments, the design team recommended "unbundling" the project into its constituent parts and organizing them as separate buildings along a linear "medical mall" (bottom right). For diagnosis and treatment, the designers created a two-story building (top, right of the canopied entrance) that could accommodate a variety of complicated systems and easily be changed over time. Administration and support services are located in a single-story, steel frame building (above right, left of entrance). In-patient rooms are housed in a three-story, elliptical wing with flattened ends that has narrow floor-to-floor dimensions and a manmade lake as forecourt (right, center). The mechanical plant accommodates one of the first applications for hospital use of a cooling system that employs ice, frozen at night when energy is cheap, for air-conditioning during the day when energy is costly. The complex was designed to evolve as the needs of the hospital change. Associate engineers on Arup's first California project included: Rutherford & Chekene, structural; JYA Consulting Engineers, mechanical; and O'Mahoney & Myer, electrical.

In 1986, the firm initiated a Los Angeles branch, which, with 42 engineers (six Brits, 36 local recruits), is already larger than the San Francisco office. Arup's California has, to date, completed six projects, four by the Los Angeles office, two by San Francisco. It has 12 projects under construction; eight by the Los Angeles office, four by San Francisco. Between them, the two California offices have collaborated with, among other architects: Anshen + Allen, Morphosis, Arthur Erickson, Moore Ruble Yudell, Mitchell/Giurgola, Barton Myers, Shepley Bulfinch Richardson and Abbott, and ELS/Elbasani & Logan. Structural engineer Peter Budd, who is managing principal of Ove Arup & Partners California, is at 40 the oldest of the firm's four California principals. Two of the remaining three work in Los Angeles: Alan Locke, a 32-year-old Scotsman, is in charge of mechanical engineering; Chris Jofeh, 38, is Locke's counterpart in structural engineering. Peter Lassetter, 35, a structural engineer, directs the San Francisco office.

A year and a half ago, Arup's also added a 15-person New York office to its global cache. Because it is made up only of structural engineers, the New York offspring departs from the interdisciplinary methods for which Arup's is known, but fits into the firm's broadly inclusive approach.

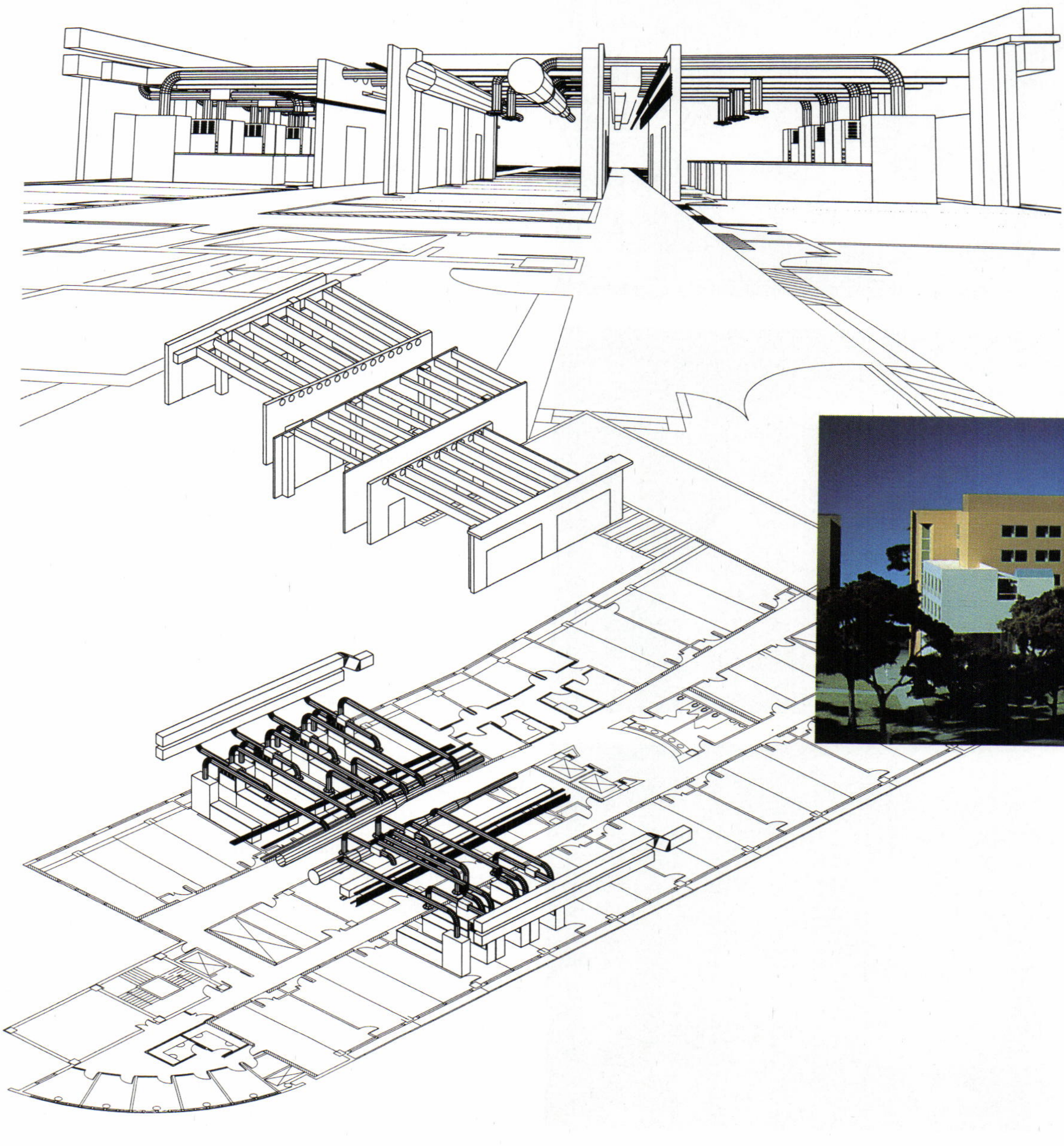
Arup's distinguishing characteristics readily reveal themselves at the Los Angeles office. It was designed by Charles and Elizabeth Lee, young architects working for a group of young engineers. Fascinated with industrial materials and expressive structures, the Lees' office for Arup's is an open space, organized into bays, each for a team of four to six engineers working together on a project. The feeling is of greater sophistication than is usual for a group of building engineers. Team members quietly confer or concentrate on computer screens or handmade drawings. One man pokes another and chides: "Your ducts are in the way of my columns," which is as it should be in an interdisciplinary office that works in teams. In fact, the Los Angeles office feels more like an architect's than an engineer's workplace. As Thom Mayne of Morphosis points out: "Arup's is unusual for exploring ideas and pushing them to their limits. They make major conceptual contributions early in the design process."

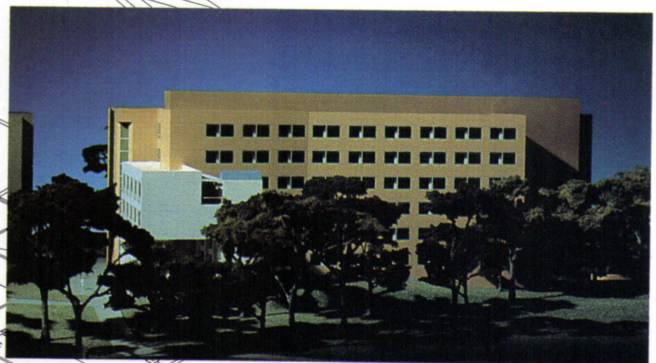
Founder Ove Arup's ideas and values continue to guide the firm. Arup insisted on quality, on esthetics, on creating an organization that was "human and friendly, in spite of being large and efficient," and on its "having a conscience," as he said in a 1970 speech. "I can't see the point in having such a large firm with offices all over the world unless there is something which binds us together," he maintained. Mario Salvadori of Weidlinger & Associates, a venerable engineer in his own right, says of Arup's founder: "He had exceptionally wide interests and incredible structural knowledge. He was an excellent judge of human nature, sur-

JOCK POTTLE PHOTOS

Sciences Building
University of California at San Diego
Mitchell/Giurgola Architects, New York

The six-story, precast building houses biology and chemistry laboratories and support facilities, and provides conference and seminar spaces in a three-story wing perpendicular to the lab building. A row of laboratories lines the east- and west-facing perimeters of the building (below). Bordering each row of laboratories are corridors, which are separated by a long, central core containing elevators, restrooms, and support services (top left). As with all laboratory buildings, the principal problem was to distribute and vent large quantities of air without crossing supply and exhaust. The solution was to integrate mechanical and structural systems to accommodate large ducts and numerous piped services mainly in thick walls (drawings). They brought the supply air in through spandrels in recessed windows, while drawing exhaust out through a hood in each laboratory, into the building's interior, and up through an exhaust shaft. To avoid redirecting chemicals from the exhaust stack back into the laboratories or adjacent buildings, the engineers conducted numerous wind tunnel tests.

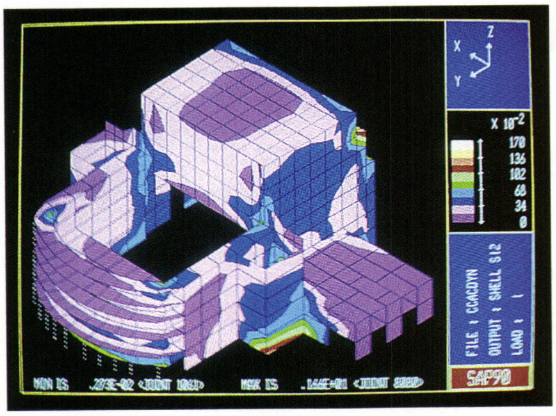


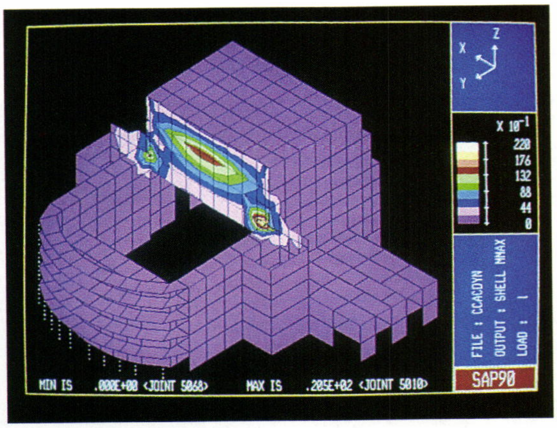


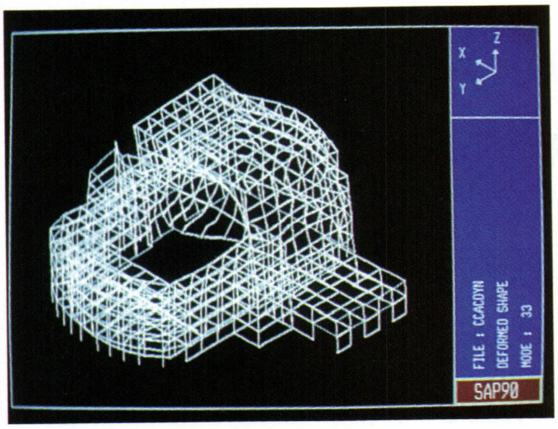
Many engineers have been beaten into submission. Not Arup's. They respect themselves and others' ideas, which makes them incredible collaborators.

Cerritos Community Arts Center
Cerritos, California
Barton Myers Associates

The centrally located festival hall (above), containing a multipurpose theater, community rooms, and ancillary spaces, is the first building block of Cerritos' new town center. The challenge was to give the theater different configurations, each with a recognizable identity, and to ensure that the building would be seismically sound. The solution employs hydraulic lifts to move roofs, boxes, and seats to create a sophisticated multipurpose theater. The space will have five possible configurations: a 1,450-seat hall for musicals, dances, and the like; a 900-seat space for a community theater when the stage is moved forward and the second balcony is closed; an 1,850-seat concert hall for major symphony orchestras, musicals, and large community functions; a 5,000-square-foot flat area when the orchestra floor and pit are raised flush with the stage; and an 1,850-seat theater-in-the-round. The designers studied output from a seismic response spectrum analysis showing shell element shear and bending stresses (upper two drawings, right) and the structure's mode of vibration (bottom right) to better understand how Myers' irregular building would perform in an earthquake.







rounded himself with good people, and gave the firm its tone."

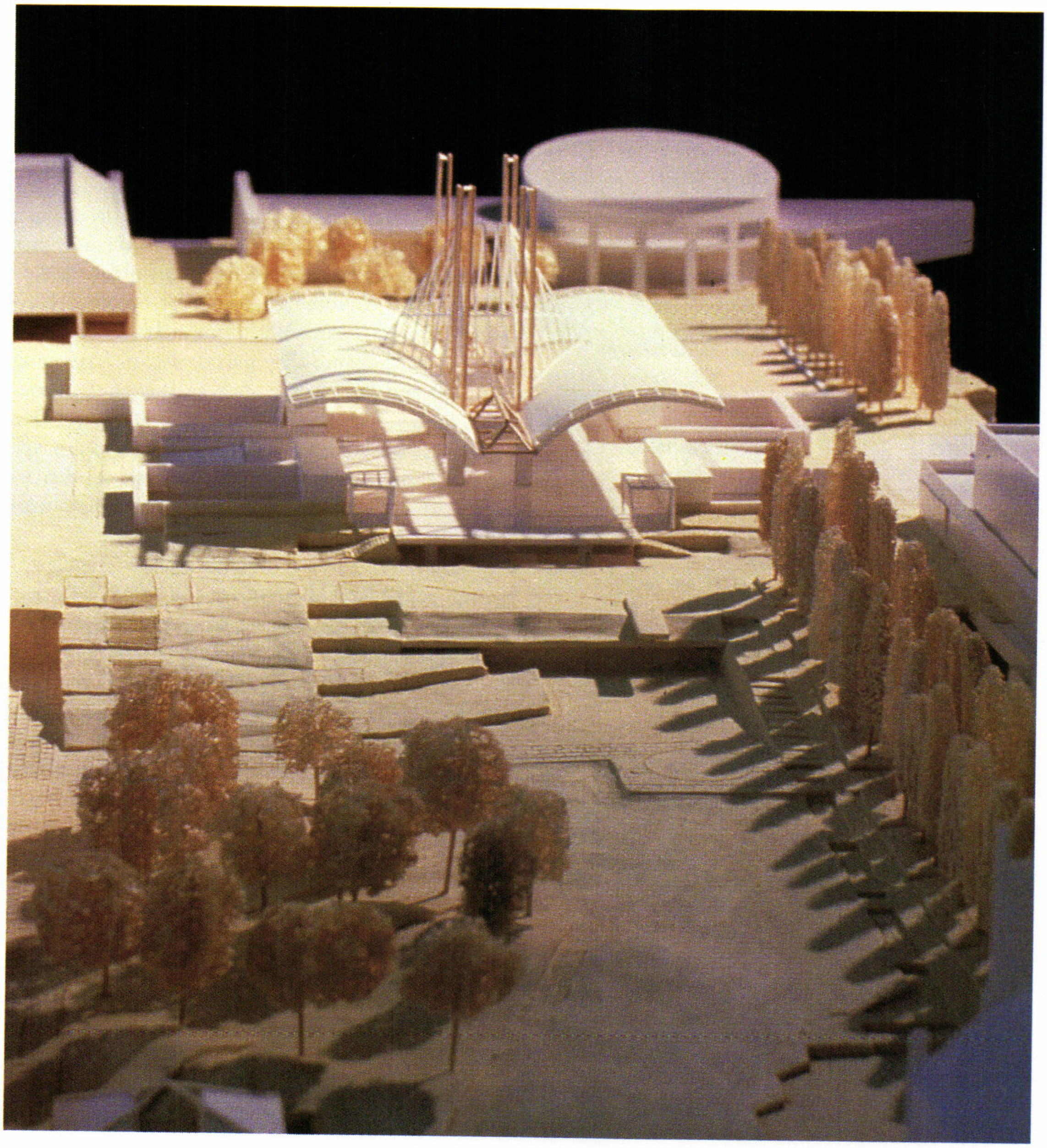
Derek Parker of Anshen + Allen describes Arup's California as comprising "cultured, broadly educated people accustomed to seeing beyond their discipline. They are articulate, and presentable to clients. Unlike your usual engineers, they challenge us rather than being reactive or passive." Ann Gray, executive director of design development of Paramount Pictures, for whom Arup's California is designing a film archive in collaboration with Holt Hinshaw Pfau Jones, adds: "Arup's engineers are real artists, so architects like them. It's as though many engineers have been beaten into submission. Not Arup's. They have a lot of enthusiasm and confidence about their position on the team; they respect themselves and others' ideas, which makes them incredible collaborators. It's unusual, especially in a large firm. Arup's provides services you associate with a small practice."

These comments would have pleased the founder. In his so-called "key speech" of 1970, Arup talked of creating "an organization that will allow gifted individuals to unfold." He insisted upon recruiting the best young people, even if Arup's had "no immediate use" for them. As a result, the firm tends to attract and hire generalists interested in design, who delight in unusual problems, says managing partner Budd. His colleague Locke recalls that two things impressed him about Arup's when he was job hunting: "They paid my expenses for the interview, and they were less interested in my technical ability than in me as a person. At age 20, most people don't have much technical know-how, anyway."

The firm creates loyalty by emphasizing teamwork rather than stardom, avoiding "boss complexes and pomposity," as Ove Arup insisted, and by all but eliminating ownership. Arup's is owned by its employees, with senior partners acting as trustees, but only until they reach retirement age when they turn the task over to the next generation. Central control in London tends to keep hands off its satellites, while providing them with vast resources that include a huge library and such specialists as acousticians, environmental engineers, economists, and urban planners.

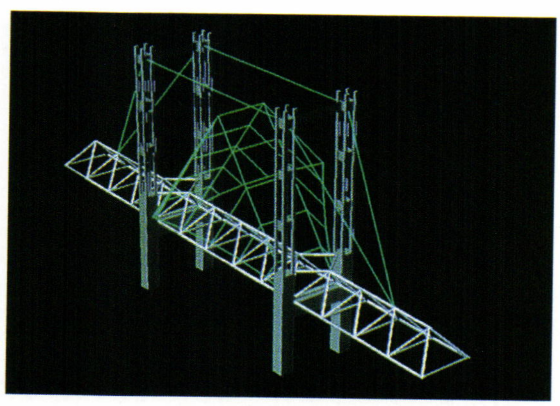
"It's a very free organization, very caring, not very structured. You can find your own niche here," says Jofeh. Budd adds: "You're exposed to different ideas and views, which keeps the brain turning over and makes it interesting." Locke elaborates: "As soon as you get fed up there's a new job to do, another architect with a new set of problems and ideas. I've never stopped learning. That's why I stay." Indeed, Arup California's four principals have all been with the firm their entire professional lives.

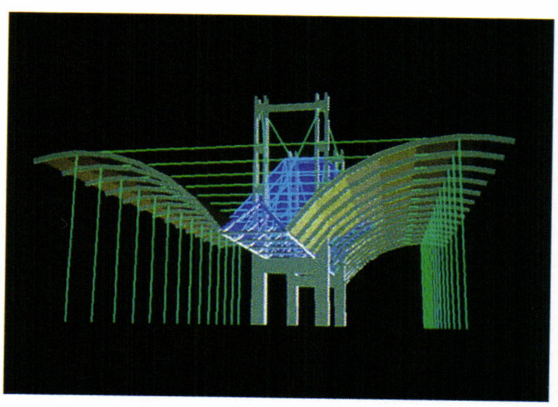
Clients and architects with whom Arup's has worked have only good things to say. What they value most is the firm's ability to collaborate, its

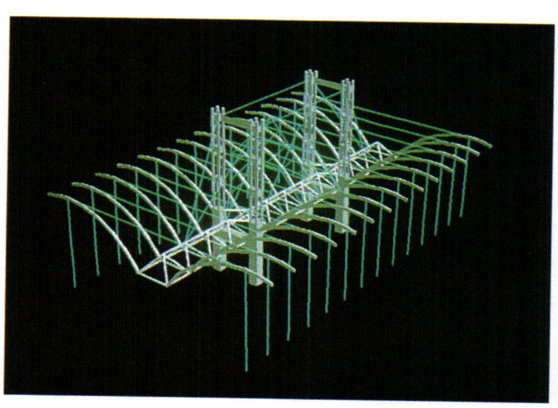


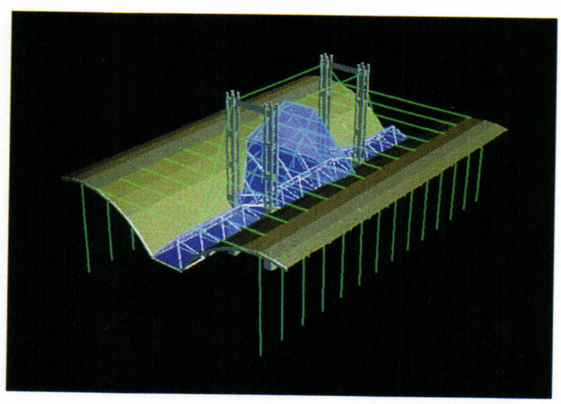
Crystal Pavilion
Yerba Buena Gardens
San Francisco, California
MGA Partners

Crowned with a distinctive steel paneled roof, the glass-walled pavilion is located at the edge of Yerba Buena Gardens (left), which stretch over the roof of the expanded Moscone Convention Center. Meant as a meeting place and marker, the pavilion bridges the street beneath it as well as the gardens and the convention center. Its location directly above a clear span section of the existing convention center left only four column locations available for supporting the pavilion without compromising the space beneath it. The roof was crucial to the design, and, according to Jeff Blaevoet of Ove Arup & Partners, had to be constructed of prefab elements; yet be stable enough for wind, gravity, and seismic loads; and contribute to passive environmental control of an indoor garden and a naturally ventilated meeting place. The engineers' solution was a roof partially suspended from four masts located at the inner edges of winglike supports. Running along the roof's center line is a diamond-shaped skylight whose contours and dimensions were calculated to allow optimum use of daylight, and assure adequate light levels for plantings. Computer analyses and modeling were extensively used in developing the design, utilizing software developed by Arup. The four drawings at left analyze structural behavior under seismic and gravity loads during early to late phases of construction (counter clockwise from top right).





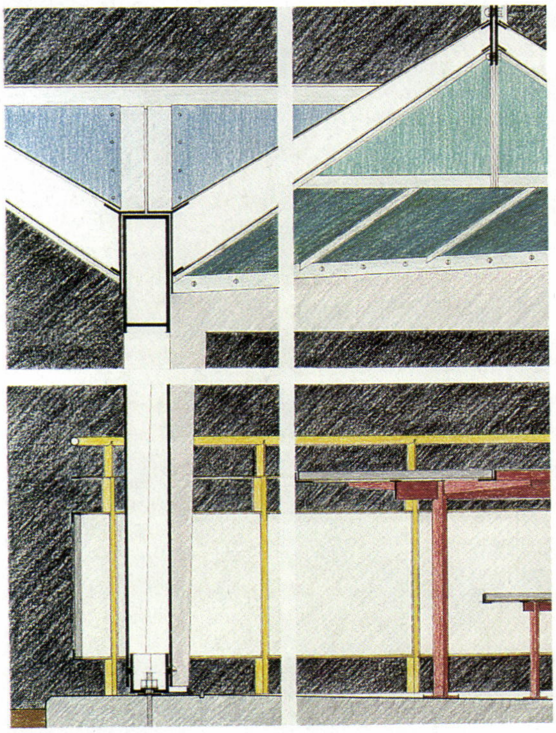


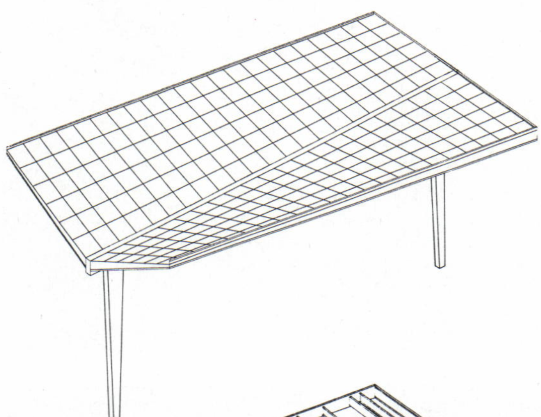


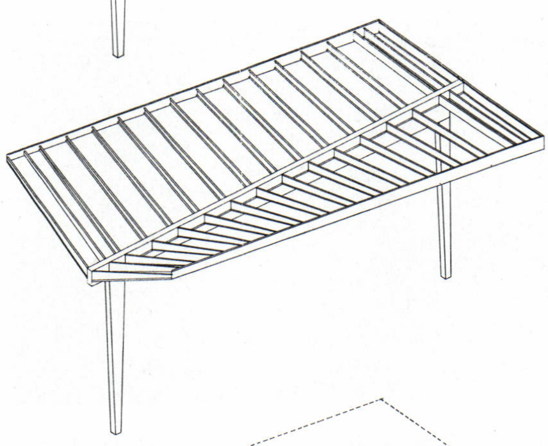
Arup's interdisciplinary team approach eliminates the cost and time delays that can result from using separate consultants.

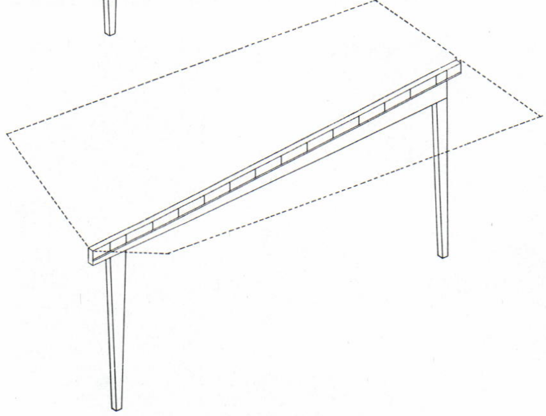
School Lunch Shelters
Los Angeles, California
Angelil/Graham, Los Angeles

The designers were asked to devise shelters at 50 schools within the Los Angeles Unified School District that would protect children from sun and rain while eating lunch. The structures had to fit many sites, yet be mass-produced with simple construction techniques. The solution was based on repetitive structural units that could be variously configured for different sites. One of the criteria the designers set for themselves was that children should be able to comprehend the constructions easily. Each shelter has a concrete base that can be fitted to different sites by use of stairs, ramps, guardrails, benches, landscaping, and other devices. Roof units can be assembled to allow for diverse sizes, configurations, and orientations. The roof units themselves consist of an assembly of parts, including a three-hinged arch (top right), a double curved roof surface (center right), a cantilever (lower right), and a frame (bottom). Each steel roof unit is to be shop-fabricated and assembled on site, with the units pin-connected into the concrete bases and bolted together. Fabrication and installation is to be completed in 1992.









concern with design, ability to give and take in discussions and drawing sessions, to communicate, and coordinate tasks. "Often engineers spend their time showing how a design can't work. Arup's works with us rather than trying to bite us," says Langston Trigg, an architect and client for the Lucille Packard Children's Hospital at Stanford University. David Neuman, campus architect for Stanford, adds: "Because they participate in developing the parti and feel a sense of ownership over the design, they aren't defensive with the architect." He also notes that Arup's interdisciplinary team approach eliminates cost and time delays, and frustration that can result from using separate consultants who are out of sync with each other.

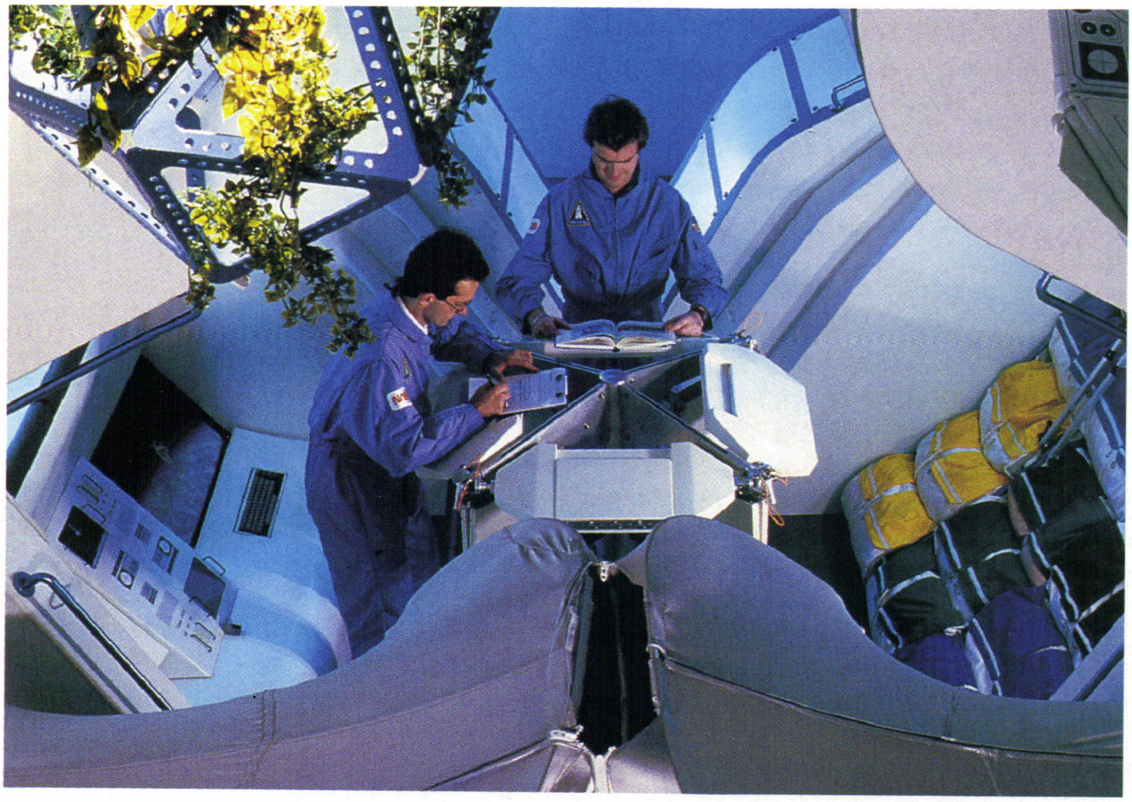
Not everyone is as enthusiastic about Arup's approach as they are about Arup's as a firm. Matthys Levy of Weidlinger & Associates says that avoiding coordination and communications problems "all depends on who runs the job and how they run it. It's a management, not a technical problem." Lev Zetlin of Zetlin Argo claims the team approach is harder to administer. Oddly, no one complains that it is regularly less cost-efficient. In fact, Budd asserts that Arup's approach "enables us to trade off one cost against another, both in design terms and fees." He says that since all members of the team understand the overall intent, they work toward a goal rather than against each other on individual segments of the work.

"Usually, we're wary of firms that sell themselves as doing it all. Something usually suffers," adds Wendell Wickerham of Shepley Bulfinch, "Most firms don't have the resources of Arup's." Zetlin adds that most engineering firms are too small to be able to work in teams, and in most instances there is too much enmity and jealousy between engineers of different disciplines for them to work smoothly together. Budd further explains: "Working the way we do requires flexibility and a broad perspective, and many engineers feel more comfortable building fences around themselves, sticking to their specialties. It's easier to say, 'My system works,' and leave it at that."

Working on an aggressive, interdisciplinary team also requires a "special caliber person," according to Jofeh. He explains that "it requires more commitment and effort; you have an easier life if you just let the architect produce the scheme and slide the columns and beams in to fit." There is also the argument that interdisciplinary teams often don't attract the best individual specialists, because "engineers feel they'll have less voice and future," contends Levy of Weidlinger.

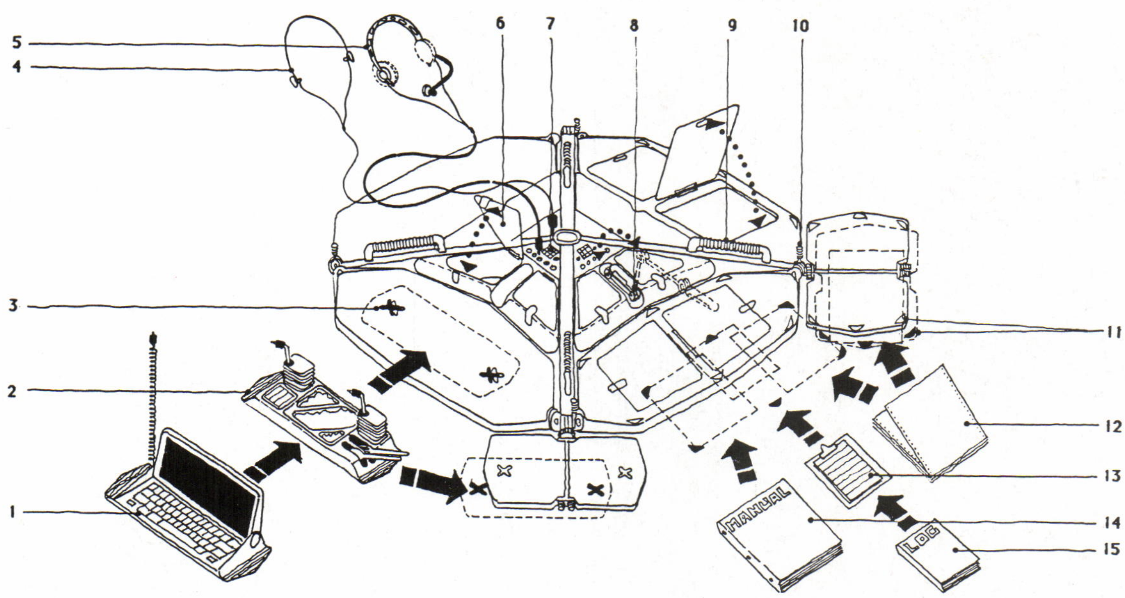
The consensus seems to be that the Arup's approach can produce better buildings, but only if its engineers are the best and committed to design, as Arup's are. "The bottom line about them," says Arup's client Langston Trigg, "is that I'd look forward to working with them again." ■

—ANDREA OPPENHEIMER DEAN



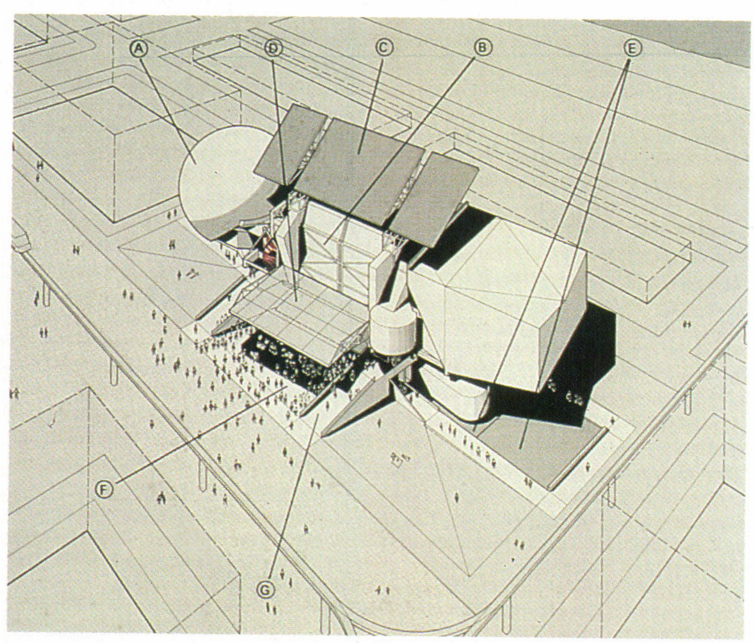
NASA Wardroom Table
Future Systems, in association with NASA Ames Research Center in Mountain View, California

Ove Arup & Partners provided preliminary structural analyses to determine the design performance for a table, to be used by a crew of eight astronauts in microgravity (left). The table is comprised of a group of independent elements, with different surfaces, that can be rotated, unfolded, and angled to suit a range and mixture of uses (below right), including: a combined portable computer and eating surface (1, 2); earphones and headsets (4, 5); storage pockets (6, 7); task lighting (8); handholds/push-offs (9); object restraints (3, 11); and a writing surface with stowage compartments (12-15). The primary design objectives were to provide a compact, efficient, and safe design. The project was part of a 3-year space habitability research contract awarded to Southern California Institute of Architects.



US Pavilion, 1992 World's Fair
Seville, Spain
Holt Hinshaw Pfau Jones

For the projected pavilion's "Rediscover America" theme, the San Francisco-based firm proposed the world's first level loading IMAX theater, seating 300, and a second large format, special effects, domed theater—dubbed LFX. These are contained in a fiber structure (A). A command unit (B) contains all vertical circulation, queuing areas, exhibit decks, building services, and the primary structural frame. The pavilion's "sails" (C) harness the Spanish summer sun, while providing shade. In front of the central command unit is an entrance ramp and outdoor performance balcony (D), which is cooled by an overhead fan canopy that also circulates air. The landing frame (E) straddles evaporation panels and cooling points, which, by recirculating chilled water over broad areas, cools and humidifies the hospitality area beneath it.



DESIGN GOES TO SPACE

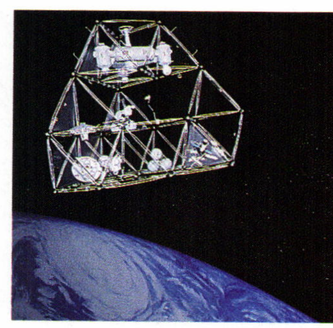
INVISIBLE ARCHITECTURE

NASA and a program at the University of Houston are developing innovative structures for living in space.

"FOR THE NEW CENTURY, BACK TO THE moon. Back to the future. And this time, back to stay. And then, a journey into tomorrow, a journey to another planet; a manned mission to Mars." President Bush's words last July, on the 20th anniversary of that exhilarating first step onto the moon, has given a new impetus to NASA and alerted the nation's aerospace contractors. Yet unlike the extraordinary fever in the 1960s that drove the Apollo program, the 1990s are a time for a broader and more meaningful agenda for space exploration that intriguingly parallels developments on earth. Missions to the moon and Mars will be international efforts and nations will join together in populating planetary habitats. Recycling, waste management and efficient use of energy are program goals, and construction materials and techniques will be selected with at least a nod toward their applicability on earth.

Appreciation and respect for architecture's role in benefiting space exploration and, in turn, planetary missions' impact on the profession is also growing. Leading the way is Houston, site of NASA's Johnson Space Center, where architectural graduates are working on both lunar and Mars exploration and managing sub-systems engineering for NASA's latest program, Space Station Freedom. The city is also home for two individuals with a passion for space, Larry Bell and Guillermo Trotti, who have crafted an unusual integration of architectural teaching, entrepreneurship, and professional practice.

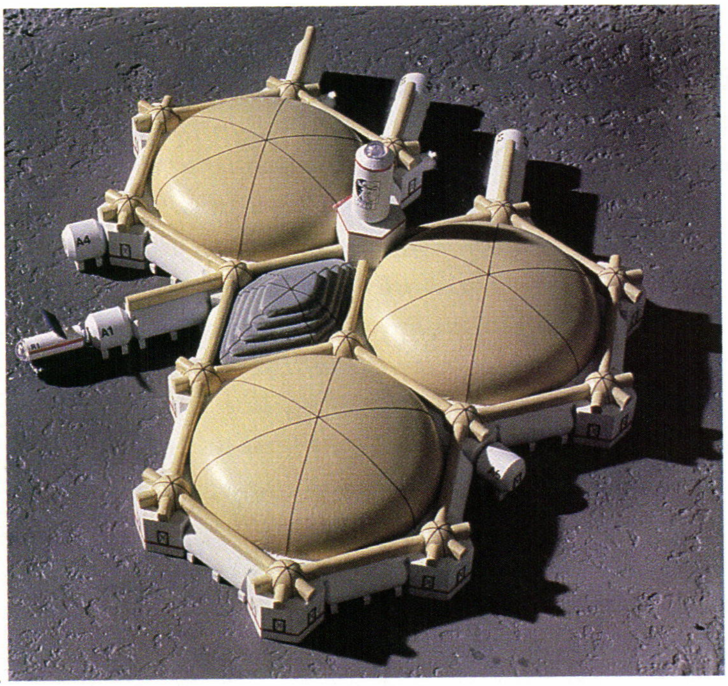
Three years ago, Larry Bell, University of Houston professor of architecture, established the Sasakawa International Center for Space Architecture (SICSA). SICSA is housed in the University of Houston's new Philip Johnson-designed College of Architecture, endowed with a $3 million gift from Rkyoichi Sasakawa of the Japan Shipbuilding Industry Foundation, and staffed with consultants like Colonel Gerald Carr, former Skylab Astronaut-Commander. Under director Bell's and associate director Trotti's leadership, the center's 15-plus graduate students from different disciplines (30 percent are from abroad) have worked on some $4 million worth of a variety of contracts for space habitat planning, lunar surface systems design, and space and planetary simulations. Taking courses in international aerospace law and planetary geology, students acquire a holistic approach to space study. Earth-based preconceptions are abandoned, design details are considered only in the broader context of the program, and meaning is reduced to the basic purpose of a space mission. The students learn to argue their cause with engineers by documenting design choices and evaluating options in space. Design is quantified in precious cubic meters in conditions where there is no gravity and therefore no "up," maximum equipment dimensions are governed by hatch size, and costs are measured in many thousands of dollars per payload pound and per minute aloft. Students investigate future lunar technologies and in situ materials where glass manufactured outside an atmosphere containing moisture behaves like metal, and basalt can be transformed into building blocks. They also research submarine life and small Antarctic stations as analogs for living in space. Classroom discussion is enriched by experiences gained from touring the Soviet Union with an exhibition of SICSA work, while the realities of the working for space are brought to life via active relationships with corporations such as Brown & Root, U.S.A. and General Dynamics for lunar and Mars exploration studies.



EAGLE ENGINEERING

In addition to its financial clout and associated NASA intern programs which lead to challenging full-time jobs, SICSA has developed a high profile by displaying its sophisticated models at the Houston Museum of Natural Sciences (above right). It is the first non-engineering college to be accepted and funded by the NASA/Universi-

SICSA's lunar base comprises inflatable domes made of fiber glass (below). Vehicle (center right) is intended for a mission to Mars, while framed construction (center left) is designed as a lunar outpost. Habitat on Mars (bottom) features a barrier against galactic radiation and solar flares.



JIM OLIVE

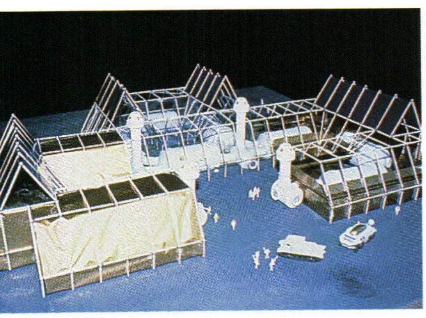
ties Space Research Association's advanced design program.

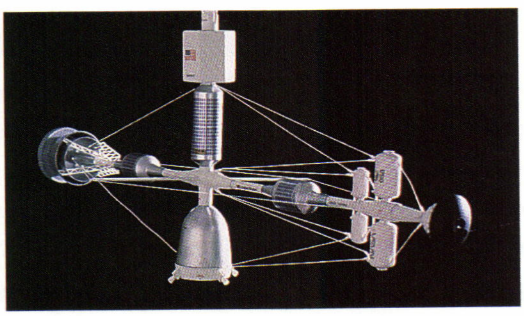
SICSA's latest effort, masterminded by Bell with characteristic foresight and energy, is a full-size space station mock-up about to be mounted on the lawn outside SICSA's quarters. Donated by Grumman and financed by a $60,000 NASA/Johnson Space Center grant, the module will serve as setting for SICSA's Abodes Program which will research alternative building options and psychological/social issues of space living.

Bell and Trotti's first commercial venture was co-founding Space Industries Inc. in 1982, a company that is developing a privately funded orbiting space lab called the Industrial Space Facility (two launches are listed on the 1992 shuttle manifest). Financed with tens of millions in private capital, the company, led by CEO Maxime Faget, has acquired ownership of several other companies including Payload Systems Integration, that operates the parabolic-flying KC-135 aircraft used by NASA for microgravity research. Four years ago Bell and Trotti started their own firm, Bell and Trotti, Inc. (BTI) to take advantage of Space Station Freedom opportunities. With Boeing, Grumman, and ILC Space Systems as clients, BTI designed and built mock-ups and undertook numerous crew systems research studies for the internal configuration of the habitation module and design for wardroom, crew quarters, galley, shower and personal hygiene areas. Bell and Trotti are currently working on detailed design of the space station galley and wardroom in support of ILC Space Systems.

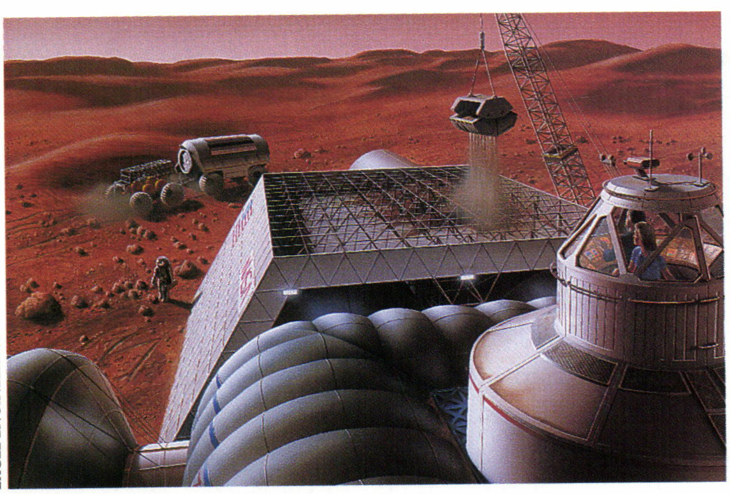
But as Trotti points out, NASA contracts generate less profit than privately-sponsored projects because of government controls and procedures. Moreover, the volume of space work is episodic and fluctuates between program phases. As a result, BTI has diversified into entertainment and other fields while keeping its links with space. Through extensive contacts in Japan, the firm has earned a high profile by producing major exhibits for Japanese space theme parks. In the U.S., its projects include the set design for Disney's moon-based television series "Plymouth" and the fabrication of a Challenger Center simulation lab linking command control and crew for school children in Houston. At the Texas Medical Center, researchers using a BTI-designed artificial gravity simulator are investigating ways to counteract body de-conditioning that occurs both in space and during permanent bedrest. BTI is undertaking master planning for the new facility at the U.S. South Pole Station, and the firm is also one of seven invited to bid for the design of a spectacular technology center and museum in Saudi Arabia.

Yet it is within engineer-driven NASA that the benefits of holistic architectural training can be most effective. Serving as client to all its contractors, NASA is responsible for maintaining expertise so that it is qualified to define requirements and estimate funding for future programs that must be supported commercially. When a program is set up such as Space Station Freedom, project groups are assembled to research criteria in order to review all proposals for contracts. Because NASA has traditionally been staffed by engineers, there was, until recently, few in-house who were qualified to evaluate architecture-driven proposals. Moreover, little value was placed on creating a supportive environment for the crew itself. Conse-





NASA has consolidated human factors/design specialists into a single division and plans to elevate architects to a higher position within the space program.



EAGLE ENGINEERING

Construction on Mars is depicted in Mars red (page 98). SICSA spaceport model with habitation module and repair docks is on display at a Houston Museum (previous page, inset).

quently, from Mercury through Apollo, astronauts flew glorious, relatively brief missions and ignored discomfort. With longer trips, however, habitat became a crucial issue—particularly after astronauts complained about drab colors and low light levels following 80-plus-day stays aboard Skylab. NASA responded by both hiring graduate architects at several levels and consolidating its human factors/design specialists into a single Man-Systems Division based at the Johnson Space Center. The next step is to elevate architecture to a higher position within the program.

Rod Jones, who joined NASA/JSC in the mid-80s during preliminary schematic design for the Space Station Freedom habitation module, is now one of three architect-trained sub-system engineering managers in Man-Systems, responsible for different components that will directly affect the crew. In addition to his wardroom assignment, Jones is also manager of internal architectural integration of all sub-systems and nodes of the module which includes communicating implications of layout scenarios. Former SICSA student Laurie Weaver, sub-system manager for crew quarters, space station cupola, and the assured crew return vehicle, has, for example, flown the KC-135 to research sleep restraints and run her own packaging studies of clothing and personal items.

When the first element of Space Station Freedom is launched in March, 1995, NASA will have already geared up for lunar Mars exploration. By then, SICSA current and future graduates using data from U.S. and Soviet flights will be collaborating with professionals from other disciplines studying the enormously complex problems of establishing manned outposts on other planets. Already, several alumni are applying their rigorous holistic training both at NASA and in corporate settings, and are proving themselves equally as competent technically as their engineering brethren.

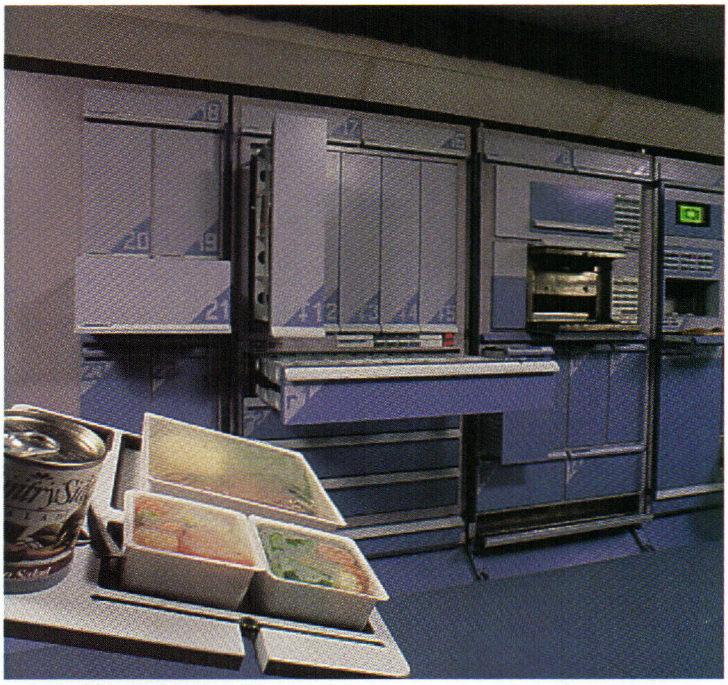
Nathan Moore in NASA's Man-Systems Division is investigating habitation concepts that include the special requirements of the cramped construction trailer that will serve as initial accommodation during outpost construction. His questions concern anthropometric issues at 1/6 lunar gravity and 1/3 Mars gravity and how they affect hardware: how does human locomotion change? What are comfortable ceiling heights and sitting positions? How should flooring be surfaced? Kriss Kennedy in Systems Engineering Division at the Johnson Space Center is studying interior design of a lunar outpost (interior colors and textures will probably be changeable) and is building a full-scale model of a circular inflatable structure to test psychological/social issues of 30- to 90-day confinement.

Focusing on site planning for planet surface systems, Larry D. Toups at Lockheed's New Initiatives Support Department has already produced a comparative catalog of lunar construction techniques that includes a methodology for their evaluation. Tom Polette, also at Lockheed in the same department, is looking into standardized ways the NASA centers can evaluate habitats. One of his studies at SICSA, in collaboration with Toups, was lunar-based agriculture and the phased approaches needed to grow plants as a source of both food and acceptable air quality.

Clearly, space architecture is for those who have the foresight and patience to wait decades before seeing their work fly; but it is also an irresistible pursuit for those in love with the unknown. It is a specialty that will require new AIA rules regarding time spent in professional practice in order for practitioners to receive official recognition. But the value of space architecture as a discipline is indisputable, establishing parameters for designing habitats in other extreme environments such as polar regions and the oceans. Perhaps more importantly, designing for space presents new ways of solving design problems right here on planet Earth. ■

Karin Tetlow

Karin Tetlow is a New York-based writer on programming, health care, and technology.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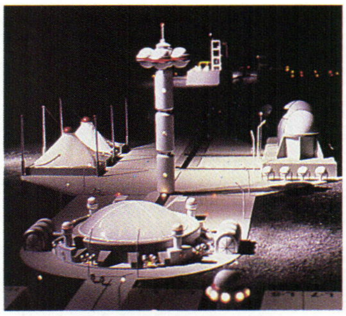
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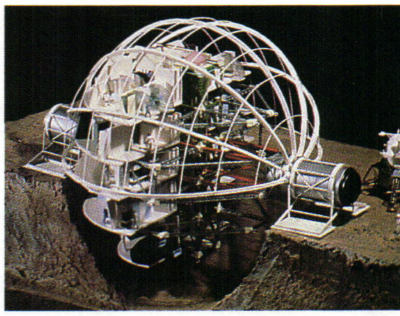
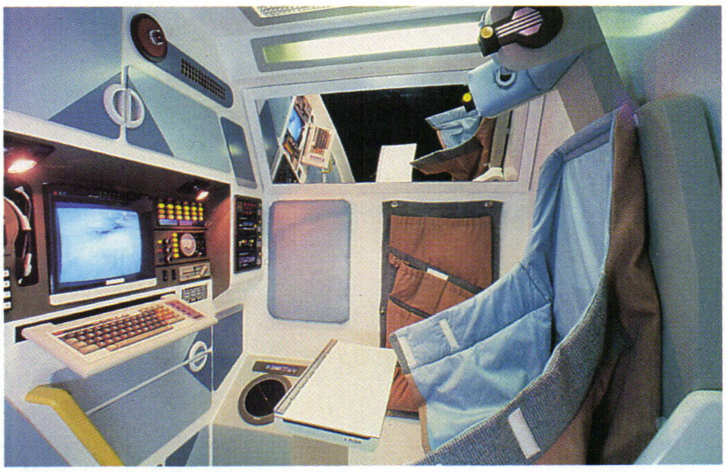



JIM OLIVE

Bell & Trotti designed a full-scale mock-up for a Space Station Freedom galley and table under contract with ILC Space Systems, Inc. (below). For the moon, SICSA designed an inflatable module (center left). The lunar base module designed and built by Bell & Trotti for display in Sapporo, Japan, measures 50 feet in diameter (center right). Interior of lunar outpost crew's sleeping quarters was also conceived and constructed by Bell & Trotti for Japanese exhibition (above).

New York's solution

NEW YORK AND SAN FRANCISCO HAVE adopted the country's most ambitious solar retention regulations. Indeed, New York City's 1916 zoning resolution, the first comprehensive zoning ordinance promulgated by a major U.S. city, contained a "sky exposure plane" provision devised to encourage sun penetration into windows and preserve views of the sky. The regulations resulted in tiered wedding-cake architecture with uniform street walls and upper-story setbacks.

This effective bulk control system, however, was steadily eroded by the city's practice of granting height and setback waivers for providing indoor public amenities, as permitted under the 1961 zoning resolution. Developers wishing to maximize their building envelopes constructed atrium-type spaces and thus sought relief from the bulk and height controls. Such tinkering thoroughly undermined effectiveness of any sky exposure plane. Furthermore, height and setback rules were relaxed for some projects involving transfers of air rights for landmark structures. New York's great building boom in the 1960s, coupled with these incentive zoning provisions, steadily deprived midtown Manhattan of sunlight, so that by midafternoon, the great bulk of midtown was in shadow.

The 1982 midtown zoning resolution introduced a two-tier system of height and bulk regulation. According to the rules of the "prescriptive tier," buildings must comply with stipulated street-wall heights and daylight angles, measured from the center of the street. Taller buildings must be set back further to avoid breaking the sun access plane. A system of trade-offs, called "encroachment and compensation," allows for design flexibility. For a building found to encroach into the space above the plane, compensation must be provided or a bulk reduction made elsewhere on site. The rules vary. For instance, additional compensation is needed on corner sites, where the projected impacts from encroachment are thought to be greater.

Whereas the first option is considered "as-of-right," the second approach, or "performance tier," measures effects and thus permits greater design diversity. Under this alternative approach, building proposals are judged on a daylight evaluation chart, or Waldram diagram, a device first used in England that measures the amount of daylight a proposed building would block as viewed by a person on the street. Proposals failing to meet the more traditional setback requirements may now be built if they achieve the requisite scores on the daylight evaluation chart.

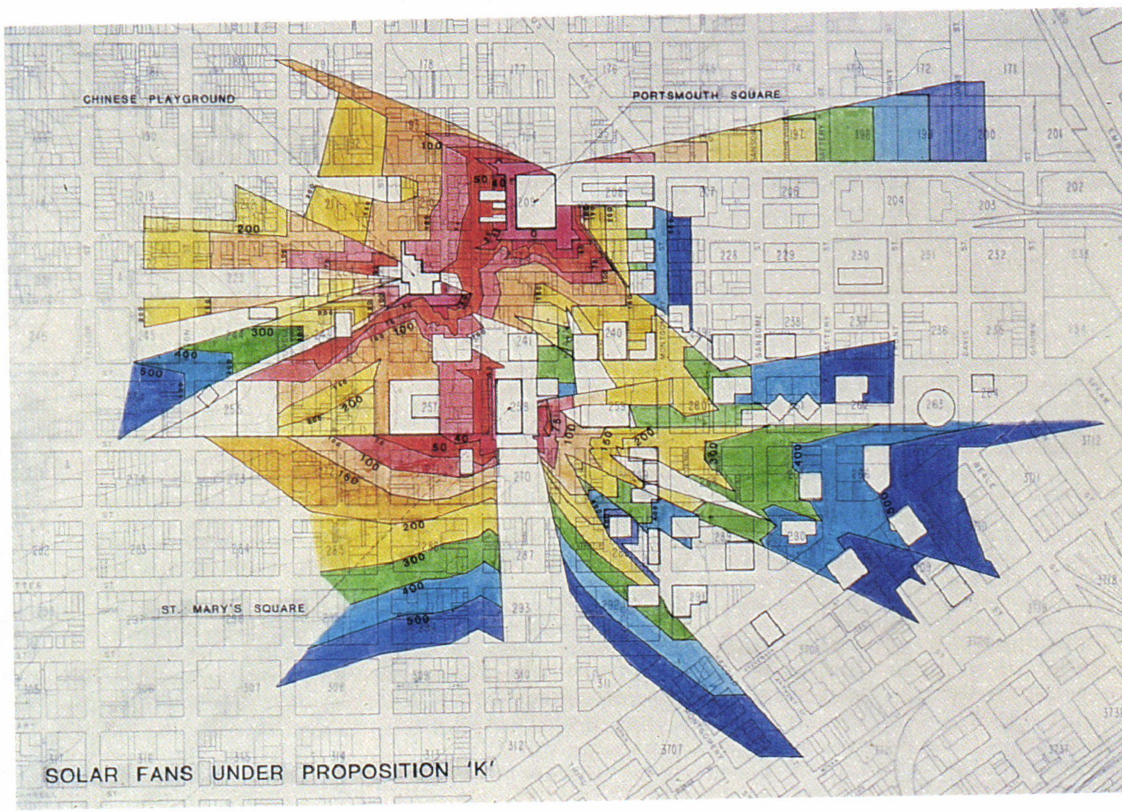
Rather than having to conform to a setback curve that relates building to angles of visibility from the street, a structure is gauged according to the amount of "sky" left unobstructed. The diagram is divided into a number of squares that represent equal units of the sky. When a proposed building is plotted in the diagram, it earns a score based on the number and location of the squares—the increments of sky—that are blocked by the building mass. Scoring rules vary with street width, and the level of acceptable daylighting performance is based on the existing urban context.

Shadows in San Francisco

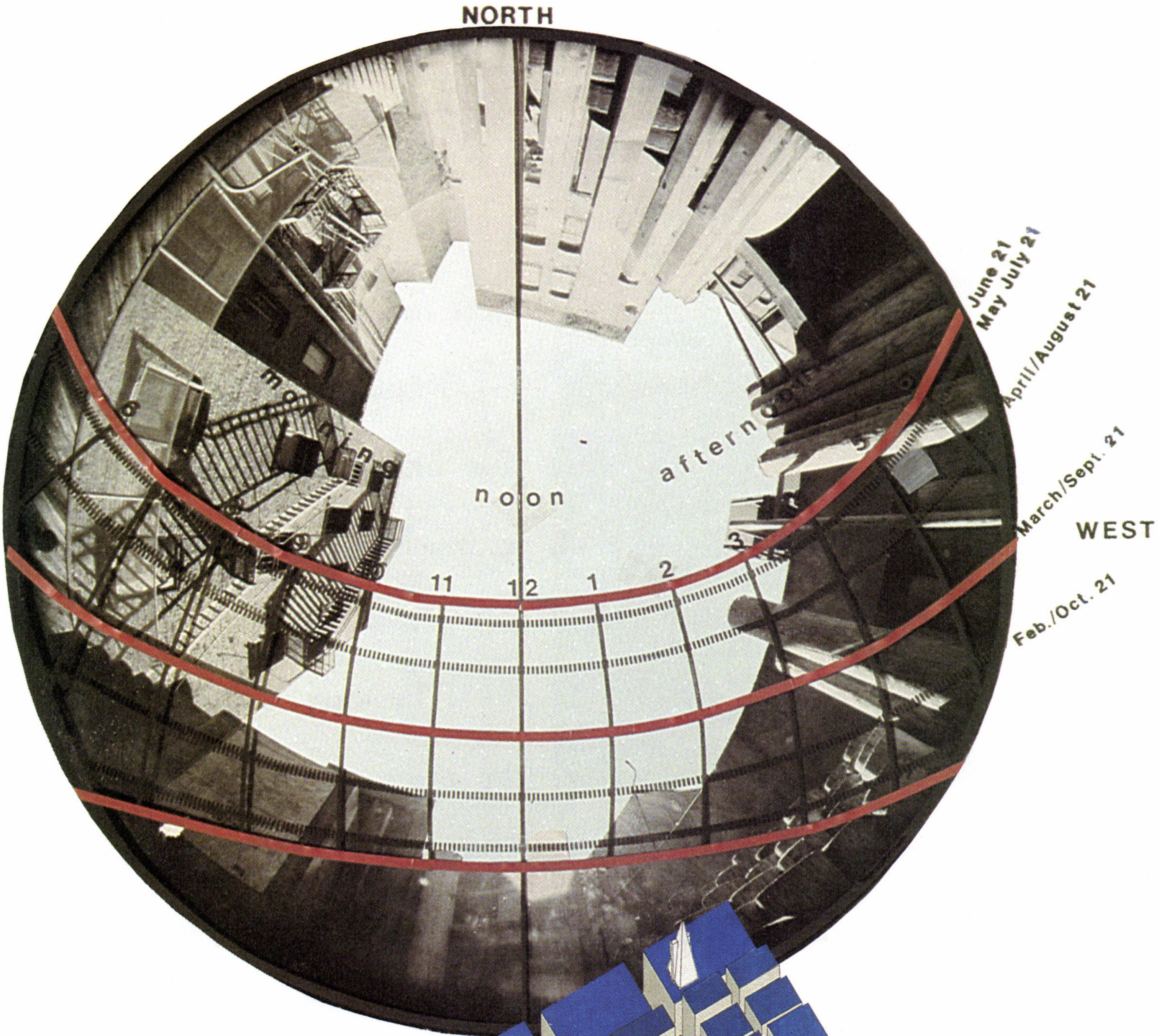
SURROUNDED BY WATER, SAN FRANCISCO IS a city where wind, clouds, and fog are climatic constants for much of the year. Sunlight preservation and shadow reduction, therefore, were addressed in the city's 1985 Downtown Plan. Several provisions aim to prevent new building from cast-

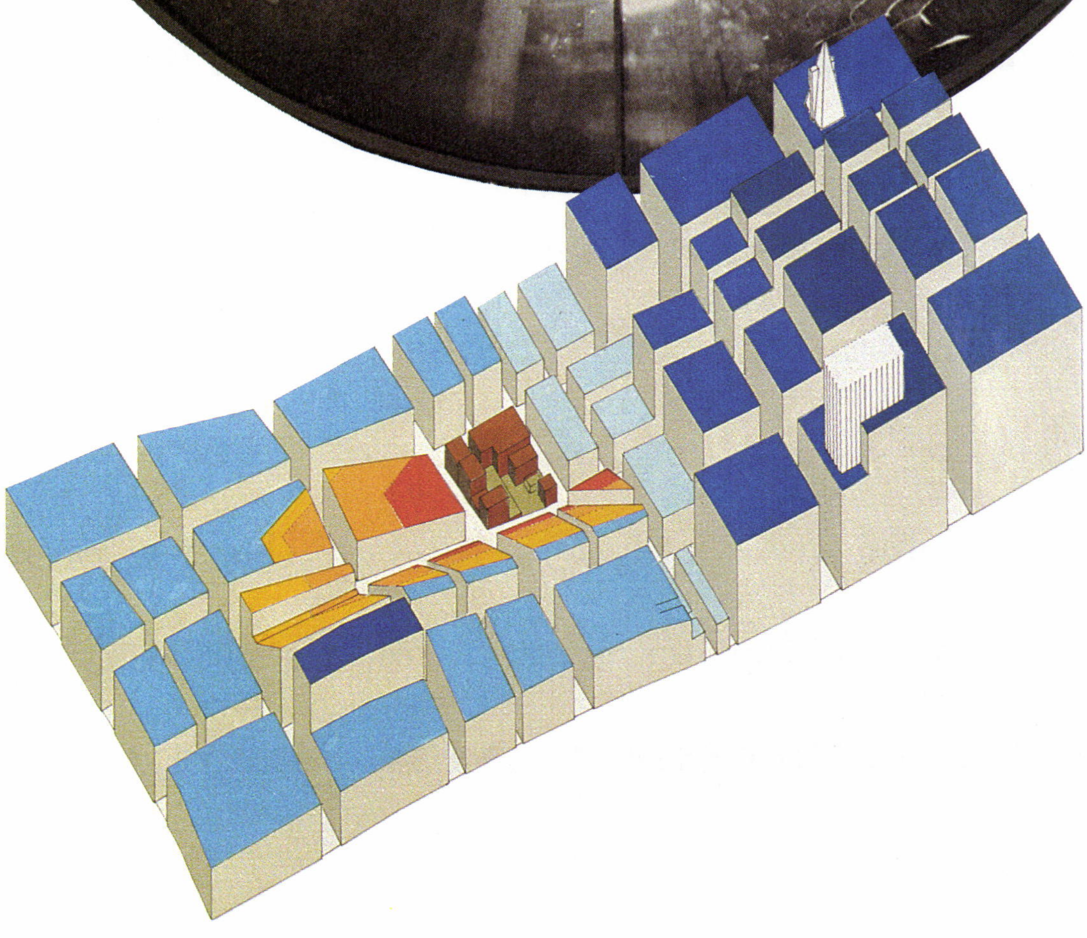
Continued on page 155

Under San Francisco's 1984 Sunlight Ordinance, Proposition K, building heights are required to follow cutoff planes, or "solar fans," cast by the passing sun rather than the traditional method of defining building heights based on contour lines. Drawing (right) illustrates the "solar fans" for three public spaces in San Francisco's downtown retail district.



COURTESY OF PETER BOSSELMANN / ENVIRONMENTAL SIMULATION LAB





Fish-eye view of the sky above San Francisco's Chinese Playground (above), illustrates the existing buildings and the allowable building heights (shown in gray) prior to the passage of Proposition K. Computer generated drawing (left) illustrates the "Solar fan" for the Chinese Playground. Blocks in blue illustrate allowable building heights prior to Proposition K; orange and yellow areas indicate heights under the new ordinance.

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SEISMIC INNOVATION

All Shook Up

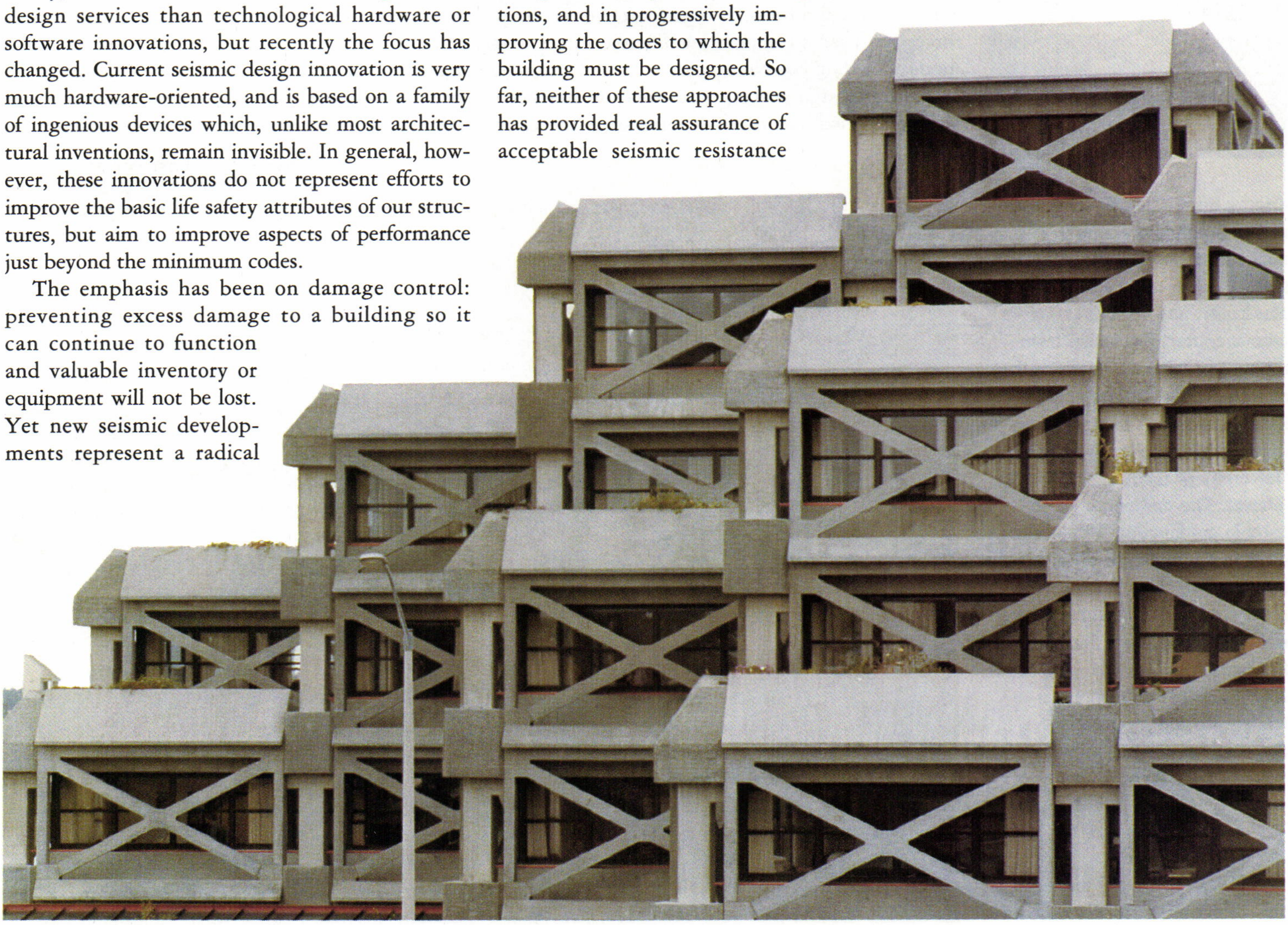
ALL TECHNICAL INNOVATION in today's world is difficult, especially in the building and design industries. Implementation of seismic innovation is particularly problematic because it deals with risk and possible death and injury. In today's litigious environment, it is professionally safer to stay with the status quo than to experiment.

At the same time, life safety problems associated with seismic issues provide a kind of reverse market incentive: better seismic hazard mitigation, through code or ordinance, is beginning to spur a limited market for seismic innovations. Until recently, this market was aimed at more specialized design services than technological hardware or software innovations, but recently the focus has changed. Current seismic design innovation is very much hardware-oriented, and is based on a family of ingenious devices which, unlike most architectural inventions, remain invisible. In general, however, these innovations do not represent efforts to improve the basic life safety attributes of our structures, but aim to improve aspects of performance just beyond the minimum codes.

The emphasis has been on damage control: preventing excess damage to a building so it can continue to function and valuable inventory or equipment will not be lost. Yet new seismic developments represent a radical change in philosophy from that of traditional design, which essentially opposes an earthquake with a very strong building attached firmly to the ground. One severe weakness of this approach has been the problem of amplification, which particularly affects modern flexible structures. When firmly attached to the ground, a building tends to resonate with the ground motion when its period of vibration coincides, and earthquake forces greatly increase in the higher floors of the building. This result is what seismic design should be trying to avoid.

Innovation in traditional seismic design has been concentrated mainly in improving the strength and predictability of the building and its connections, and in progressively improving the codes to which the building must be designed. So far, neither of these approaches has provided real assurance of acceptable seismic resistance

An early use of energy dissipation devices is revealed on the exterior of a government office building in New Zealand (below). While the intersection of the cross braces incorporates a device of some delicacy, which might be more interesting if expressed, the building architects chose to conceal the actual mechanism for reasons of construction simplicity.



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requiring renovations, and corporations with huge turn-overs.

Perhaps the most intriguing development that affects all users of telecommunications equipment is the growing problem of computer ailments caused by viruses. While such destructive diseases injected by vandal technocrats into the nation's major data bases make headlines, the small one- and two-workstation offices are also getting hit with crippling viruses that can be contracted from infected uses through computerized bulletin boards or contaminated discs. IBM/DOS and Macintosh software writers have been busy coming up with both "disinfectant" programs that detect and repair specifically named bugs in programs, and "vaccines" that protect against computer-related infection. Research scientists are excited by the possibilities for studying these artificial phenomena in hopes of learning more about the complexities of biological cell life.

New standards

THE DEVELOPMENTS THAT WILL HAVE THE broadest and most immediate impact on architecture, however, are new standards that will make telecommunications the fourth building utility. They will lighten the load of architects who will be able to focus their talents on design, rather than on consultations concerning basic telecommunications requirements.

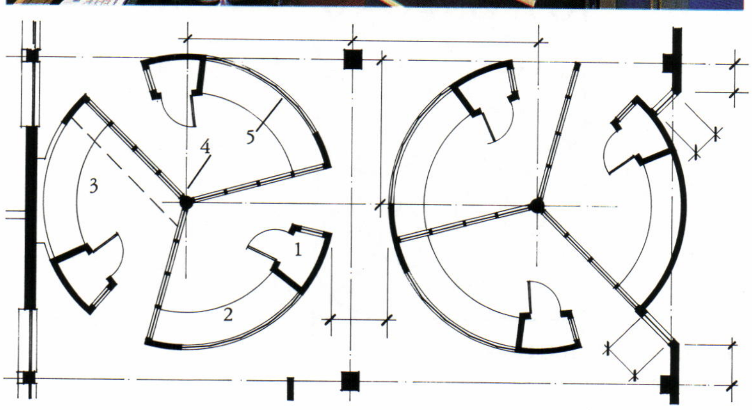
Working for four years with all industry players, the Electronic Industries Association (EIA) and the Telecommunications Industries Association (TIA) have developed two documents that are expected to receive approval this year and be incorporated into ANSI standards. Both documents recognize that buildings and communications systems are dynamic and that the latter includes environmental controls in addition to voice, computer data, and video. EIA/TIA-569 covers commercial building standards for pathways and spaces; EIA/TIA-568 addresses commercial building wiring standards. The former provides dimensions, size, configuration, and location for horizontal and backbone (high-rise) pathways, work stations, telecommunications closets, equipment rooms, and entrance facilities.

EIA/TIA-568 specifies office building and campus wiring standards for horizontal and backbone channels. Most controversial is the listing of three different media—shielded and unshielded copper, and coaxial cables—for horizontal wiring pathways. Critics question why the choice of three media is called a standard, and argue the merits of shielded versus unshielded cables. Since fiber connections to the office desk top are not widespread, EIA/TIA decided to wait review in five years' time before including it as a standard. Fiber, with the three kinds of copper, is specified for backbone channels.

As the international telecommunications industry has changed history in recent months by becoming a player in global politics, so, on another level, will they affect and continue to affect practice and design. Architects who ignore this revolution—and it has only just begun—will not be able to stay in the game. ■

—KARIN TETLOW

Developments in the field that will immediately affect architecture are new standards that will make telecommunications the fourth building utility.



Each of AT&T's eight circular modules is 18 feet in diameter, housing PC monitors and a stacked main frame computer (below right), subdivided into three private offices by opaque black glass partitions, sand blasted on one side to a height of six feet (below). Each office contains a built-in work surface with drawers, files and wire management features, bracket mounted floor-to-ceiling adjustable shelving, an enclosure for main frame computers, and a switched occupant-controlled task ambient multi-source lighting system. Provision has been made for future installation of a loft/bunk/ storage area within each office. Circular forms baffle and redirect sound, thus creating greater privacy. Round work stations (below) have a stacked mainframe console (1); CRT-PC programming desk with under-surface swing-away keyboard (2); window wall mounted return (3); power and communications column (4); and wire management tray behind and below work surface (5).

CLADDING SYSTEMS

Against the Wall

ARCHITECTS AND ENGINEERS have amassed a formidable body of technical knowledge on virtually every aspect of building materials and construction. Yet many recently completed buildings perform poorly in keeping out the weather, compared to those built years ago.

Curtain wall leakage and related structural problems in relatively new buildings account for an increasing percentage of building problems. In 1970, only 20 percent of court cases against architects involved exterior facade failures. By 1980, however, the figure had increased to 33 percent. Unfortunately, many of the building facades now being constructed will not last more than 20 years without undergoing a major overhaul.

The incidence of building envelope failure in relatively new buildings—those less than about 15 years old—is primarily the result of a trend toward lightweight, inexpensive wall construction. In the past, massive, solid facades of older structures incorporated built-in redundancy that provided a backup system to help these walls resist premature degradation, even when not properly maintained. Many contemporary buildings, however, rely on tenuous, marginal methods for preventing water from entering into walls, and are less able to withstand the degrading effects of moisture entry when it occurs. Some of the newer curtain wall systems are unproven, and architects and specifiers often rely upon building product manufacturers' statements and warranties that may reflect wishful thinking rather than proven performance. In the end, architects and owners who employ unproven materials are allowing their building projects to become field laboratories for these products.

Sealant problems

RELIANCE ON AN EXPOSED SINGLE BARRIER OF sealant to prevent water penetration into a wall is the single most common source of current building facade problems. Despite substantial improvements in the weathering resistance of sealants, they are generally unreliable as the sole barrier against water penetration.

A single sealant barrier works only if the seal is perfect. But perfect seals require perfect substrates for the sealant, and perfect field workmanship—both are unrealistic expectations. A design that depends on such perfection is doomed to failure.

Contact between incompatible materials is a common cause of failure. Incompatibility may be chemical, leading to sealant breakdown, or physical, leading to the loss of adhesion. The plasticizer in some vinyl products can migrate to the sealant interface and cause loss of adhesion a few months after the job is complete; silicone window-frame sealants will not bond to urethane window perimeter sealants, for example.

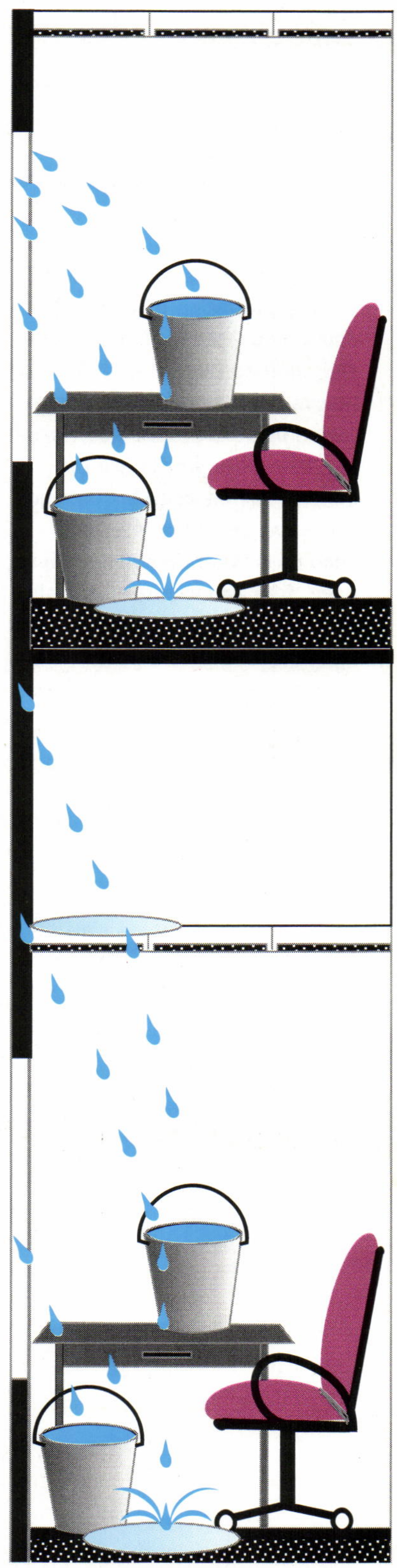
Sealant substrate contamination and subsequent loss of sealant adhesion are difficult to avoid entirely, since invisible films of airborne debris can accumulate between cleaning, priming, and sealant application. Even wiping a surface with solvent to clean it prior to sealant application can lower its surface temperature, thereby causing a film of moisture condensation that will impair or prevent sealant adhesion.

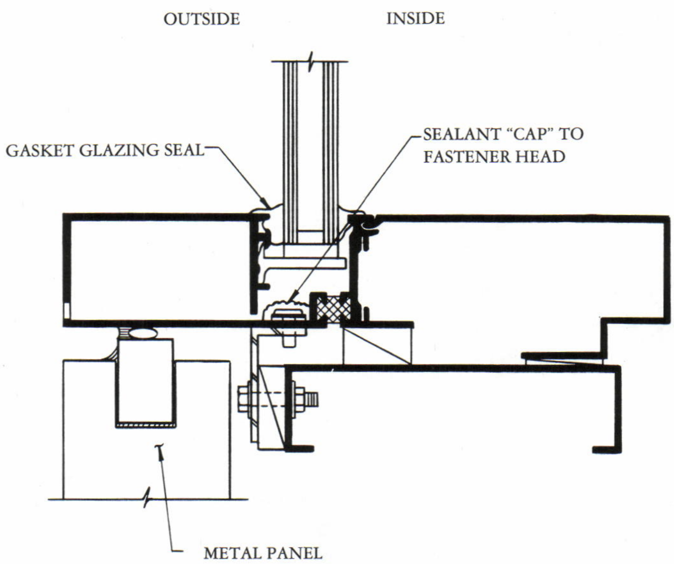
The ability of the sealant joint to resist water entry will still be limited even if the sealant adheres to the substrate perfectly. Problems such as hairline cracks in concrete, openings between metal-to-metal joints, and porous brick/masonry substrates are unavoidable conditions that allow water to bypass the sealant. Even wall designs that reliably resist leakage generally include internal drainage systems that collect the water penetrating the outermost seals and redirect it to the building exterior.

Transfer of design responsibility

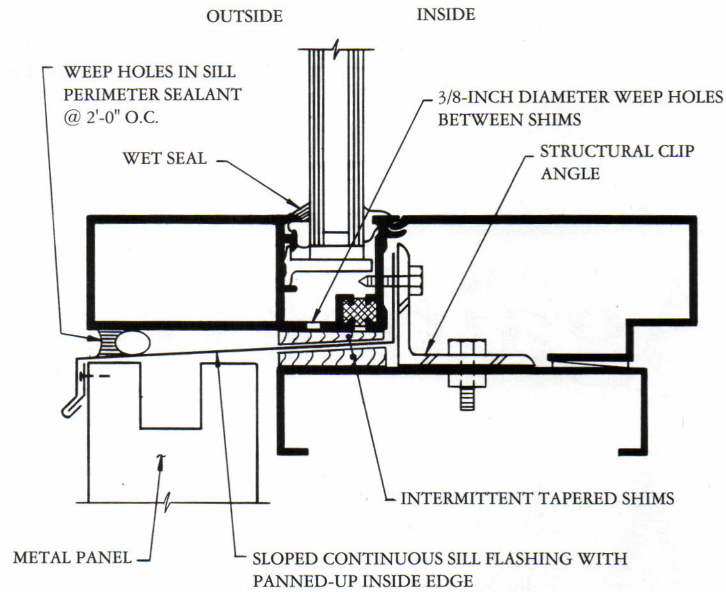
DIFFICULTIES OFTEN ARISE WHEN A DESIGNER gives free rein to the contractor to complete the detailed design of a curtain wall system. As a result, details may be unduly influenced by the cost estimated by the contractor in the preparation of a bid, and by the means employed to expedite construction. Complete detailing by architectural designers helps contractors bid and build in a manner consistent with the architects' and owners' expectations, and avoids "extras" or compromises.

Especially dangerous is the tendency to treat important issues, such as waterproofing, as a responsibility to be shared between the system manufacturer and the architectural designer. Our experience in building, investigating, repairing, and reconstructing envelope design has taught us to





Typical window sill curtain wall construction.



Improvements to window sill (left) avoid leakage.

Window systems susceptible to water penetration (above left) could be substantially improved with drained through-wall flashing (above right) to eliminate dependence on sealants for waterproofing. Isometric details are required to show complex flashing transition details at locations such as masonry openings (facing page, top) and window jamb/sill intersections (facing page, center and bottom).

regard waterproofing as a central issue in designing every building facade element. If waterproofing is treated as an incidental issue that can be addressed after construction, water penetration and consequent deterioration are virtually certain.

Value engineering

THE SUBSTITUTION OF LESS COSTLY BUT "equally good" elements, materials, and details for those specified in the original design poses another problem. Developers, pressed by time and economics, often permit ill-considered substitutions that may come back to haunt them. Often, as a result of substitution decisions, quality suffers disproportionately to savings.

One building on the East Coast is currently undergoing removal and replacement of its facade at an expense in excess of the original cost of the building. During original construction, the lead-coated copper through-wall flashings were "value-engineered" out of the job, in favor of plastic concealed flashings for a cost savings of $7,000. The use of plastic flashing contributed to premature replacement of the walls, which had to be refitted with the lead-coated copper flashings originally specified, at a cost many times the initial savings.

Limitations of testing

MOCK-UP TESTS OF PROPOSED CLADDING SYStems can help identify major design errors and various installation problems, such as sequencing, coordination of trades, tolerances, and clearance requirements. But such tests cannot verify important performance aspects and can be misleading. We have investigated many failed wall and skylight systems that "successfully" passed pre-construction tests. Mock-ups reveal little about a wall's long-term performance, since they do not reflect what really happens onsite during construction, when installers are pushed to complete work quickly in adverse weather, away from the constant scrutiny of the architect. Test results are useful, but are not a substitute for proper design based on a thorough understanding of the technical fundamentals governing a building component's performance.

The window, door, and curtain wall industries rely heavily on product performance certification testing as a means of establishing the suitability of a product for a given application, and for ranking product capabilities. The American Architectural Manufacturers Association and the National Wood Window and Door Association have developed certification test standards that are referenced in almost all window and curtain wall product specifications in the U.S. If a window is certified to be leak-free under a 6-psf pressure differential, the specifying authority expects the certified products to exhibit that performance consistently.

But performance tests, like mock-up tests, typically do not evaluate durability and may lead to a false sense of security. Conformance to a laboratory test standard at the time of manufacture does not ensure satisfactory performance in the field. This discrepancy is particularly true of window assemblies that rely on sealants in the frame corners for watertightness. The sealants perform satisfactorily during laboratory testing, but subsequently fail due to factors not replicated in the laboratory test, such as racking of the frame during transportation or installation, loss of sealant adhesion when immersed in water for prolonged periods, and splitting of the sealant from thermal movement of the window frame sections.

Architects who employ unproven materials allow their buildings to become field laboratories for new products.

Details, details

OUR EXPERIENCE SHOWS RELIABLE, DURABLE, watertight walls require the use of sound fundamental design concepts and quality execution of all critical details of construction. Both the architect and those responsible for installation must meticulously address all details of construction. More than any other factor, this scrutiny can determine the difference between success and failure.

The following details substantially improve the weathertightness of exterior walls:

- Panning up through-wall flashings at back edges and ends;
- Providing proper support for sealants to assure the optimum joint depth and geometry;
- Sloping surfaces to drain water;
- Tooling mortar joints at the proper time to consolidate the surface and reduce water infiltration;
- Proper preparation of substrates for adhesion to sealants.

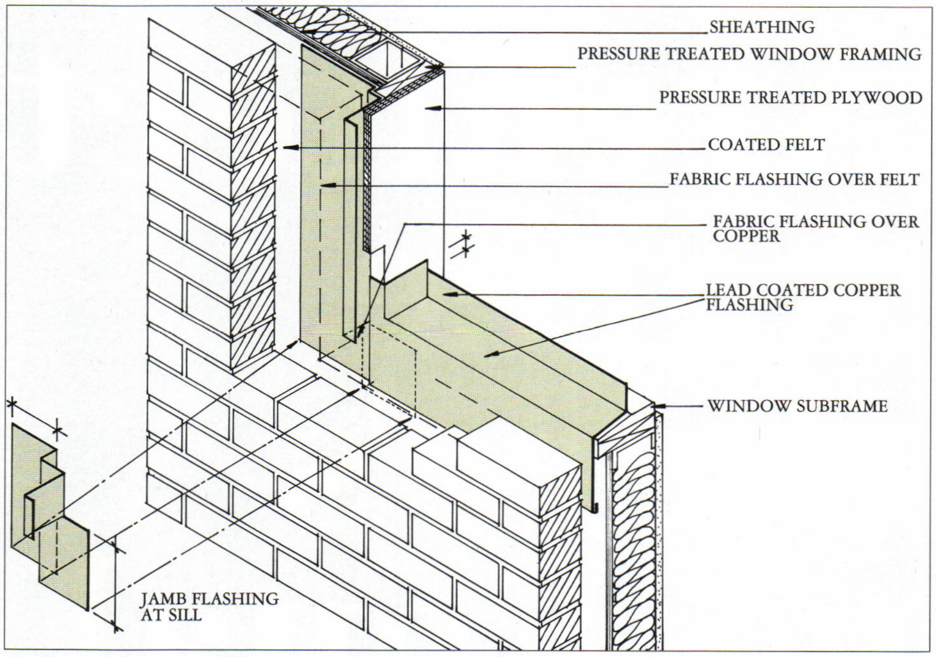
Many wall designs work well in the orderly, two-dimensional world of the architectural cross-section, but fare poorly in the complex, three-dimensional real world of construction. Transitions between horizontal and vertical joints and intersections between wall components are not always adequately considered and depicted in design drawings. Since water moves laterally within walls and wall components to the most vulnerable corners and joints of a building envelope, designers should show the critical terminations and intersections of these components by isometric detail in the architectural drawings.

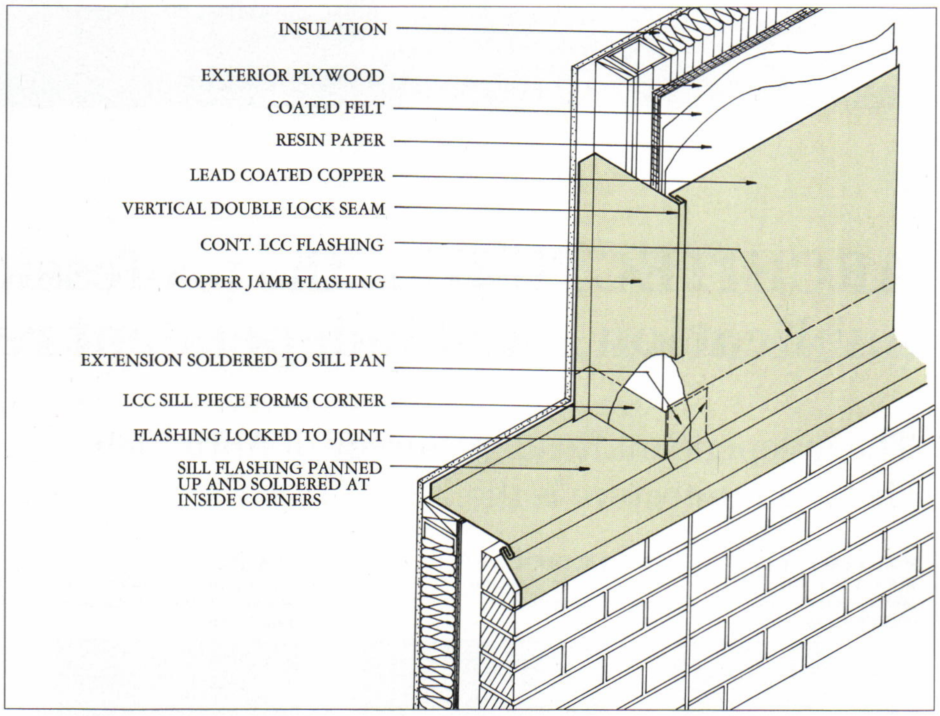
A curtain wall system, no matter how impressive on paper and how persuasively presented by the manufacturer, should not be considered fully reliable until it has withstood the test of time. Even proven materials, when used in novel combinations, must be regarded as "new." The early development of flexible steel studs to support a rigid brick veneer was still an unproven technology, for example, even though brick veneer and steel stud walls were successful in separate applications for many years. Within a few years of its introduction, some brick veneer/steel stud systems suffered from veneer cracking and excessive water entry into the wall cavity, due to the difference in bending stiffness between the brick veneer and the steel-stud backup.

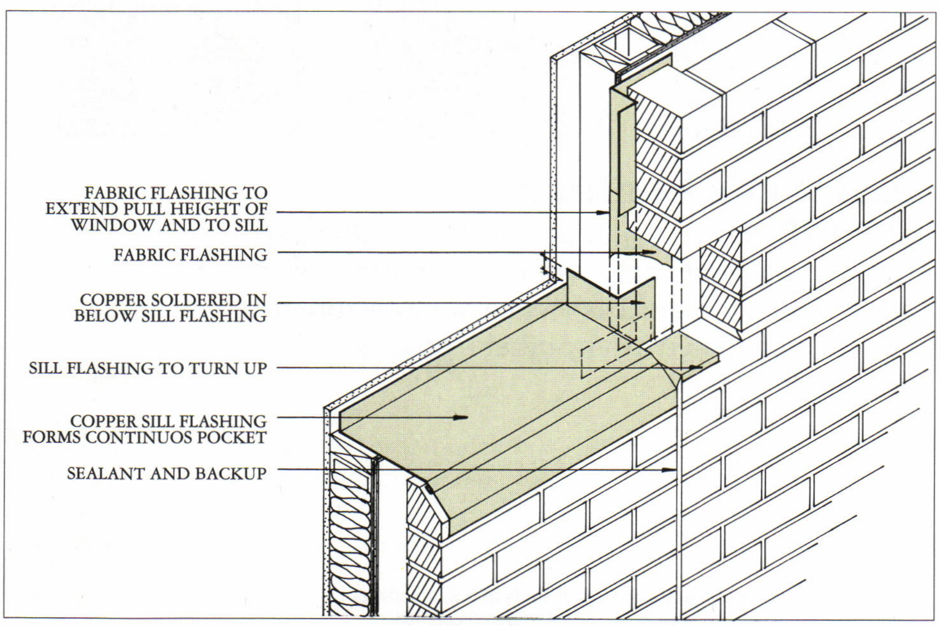
Such an untested system may seem to offer initial advantages in terms of cost, construction expediency, and even overall esthetics. But the decision to use these unproven materials or technologies should not be made without assessing the consequences of using building walls as a field laboratory for experimentation. ■

—RAYMOND W. LATONA AND THOMAS A. SCHWARTZ

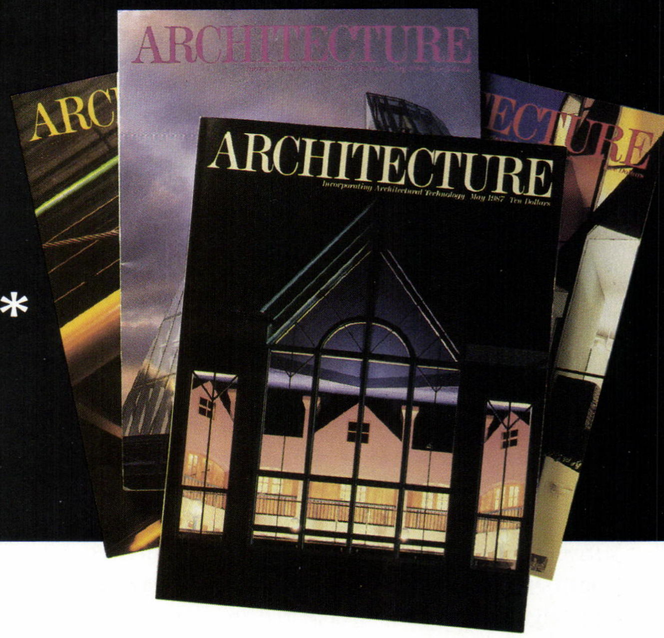
Raymond LaTona is principal-in-charge of Simpson Gumpertz & Heger Inc., Engineers/Architects in San Francisco, California, and Thomas Schwartz is a principal of Simpson Gumpertz & Heger Inc., Consulting Engineers, Arlington, Massachusetts.







Architects Agree there's no Equal*



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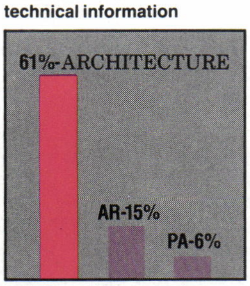

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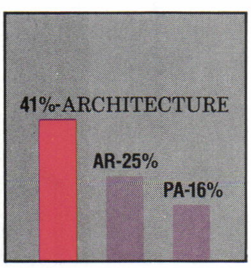

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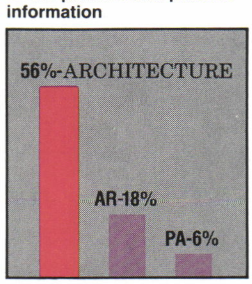

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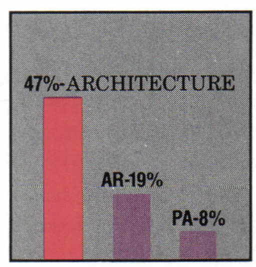

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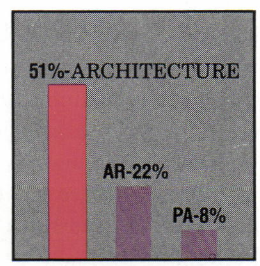

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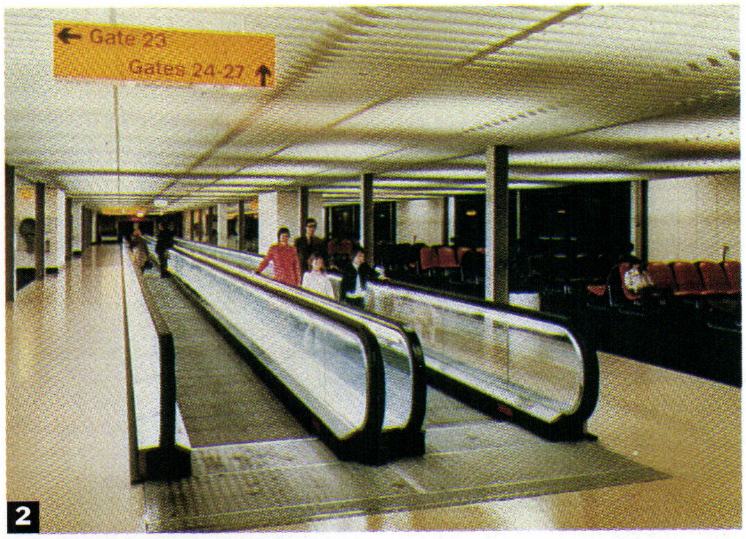
PRODUCTS

1. The SWE escalator system is available in three standard widths and includes a bank brake for smooth, accurate stopping and a handrail belt drive system for synchronized speed and reduced handrail wear. Schindler also offers two models of Compaveyor conveyor systems. Schindler Elevator Corporation. Circle 401 on information card.



2. and 3. O&K escalators and passenger conveyors are tested in practical installations to select the optimum traffic flow patterns to meet the architectural requirements of each installation. This is done by measuring the estimated number of passengers per hour for passenger capacity. Depending on different step widths, a number of potential designs can then be configured. A range of balustrades and fascia panels, as well as lighting, are available as options. O&K Escalators Limited. Circle 402 on information card.

On the Move

Advanced systems for passenger transport.

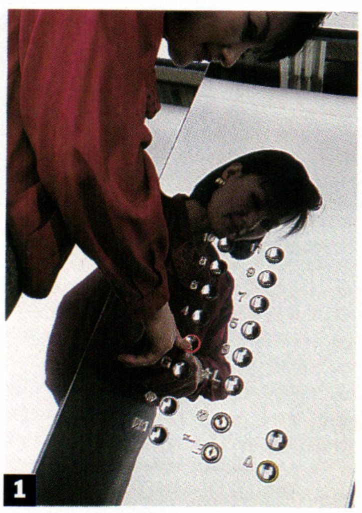
ESCALATORS AND PASSENGER CONVEYORS MUST BE DURABLE and reliable to move a high volume of constant pedestrian traffic with comfort, safety, and speed. Two companies that have expanded and improved their escalators and conveyor systems are offering a wide range of architectural features and design options for commercial and high-rise facilities. The Schindler Group merged with Westinghouse Elevator Company in January to become the Schindler Elevator Corporation. Schindler offers design and lighting features such as clear or tinted safety glass for balustrades, textured paint finishes, lights at entrances and exits, and under-handrail lighting for glass balustrades. O&K escalators and autowalks not only feature a variety of design options but offer a control and monitoring system called OK-tronik 301. This individual modular device plugs into a rack and chassis frame on the main system and monitors power, security, motor, and presetting directions and operation services.

—Amy Gray Light

GOING UP

Sophisticated controls enhance elevator efficiency.

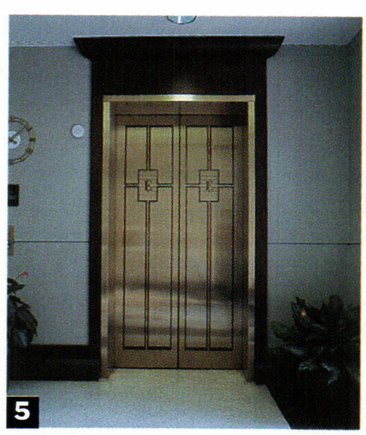
A WIDE RANGE OF CAB, ENTRANCE, AND FIXTURE DESIGN options are available from elevator manufacturers to enhance architectural treatments in the lobby of a building. Special features such as acoustical steel or wood can be installed in cabs to mask sound while providing a touch of elegance. But the biggest innovation in elevators is the microprocessor control, now offered by most companies as an industry standard. Microprocessor control units act as the elevator's brain, linking information such as call allocation, door controls, speed sensing, and position indicators into a main computer network. Both Mowrey and Montgomery elevator companies employ microprocessor controls, and Dover Elevator Systems now offers two versions of their DMC-I controller. The DMC-I/M control system can be used on old hydraulic elevators, and the TIII/M system is designed to work on traction elevator systems. United Technologies/Otis Elevator uses Elevonic 411 control software to monitor each elevator in the building, and has options such as channeling and an advanced dispatching system. Schindler Elevator Corporation's Epoch II also has a drive-control multi-loop feedback system, and it can be applied to banks of one to eight cars. —A.G.L.



1. Elevonic 411's motionless buttons use light-emitting diodes to illuminate the button pressed. Panels and buttons are available in bronze or stainless steel with mirror or satin finishes. Otis Elevators. Circle 403 on information card.

2. Montgomery offers four elevator models, all with programmable solid state and energy-efficient controls. Montgomery Elevator Company. Circle 404 on information card.

3. The Florida firm Vander Ploeg & Associates chose Mowrey's ME300 series for their Pylon Corporate Center because of its stainless steel and plastic laminate design. Custom glassback cabs are available at additional cost. Mowrey Elevator. Circle 405 on information card.



4. The Epoch II dispatching system assigns cabs based on the quickest estimated time of arrival. Schindler Elevator Corporation. Circle 406 on information card.

5. The Artifax photo-etching process creates designs such as logos, artwork, or custom signage on flat surfaces of cab doors, swing returns, wall panels, entrances, or signal fixture panels. Dover Elevator Systems. Circle 407 on information card.

1

2

3

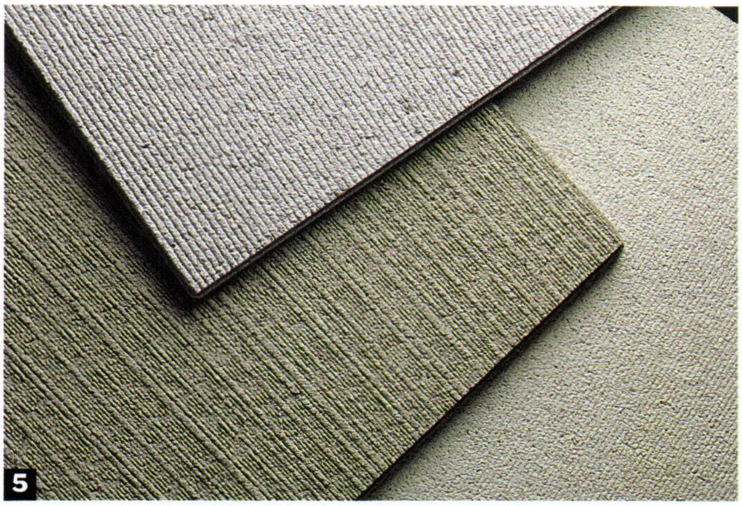
1. Smith/Kranert/Tomblin & Associates, Huntsville, Alabama, chose Syllables System A for the Huntsville Civic Center. Panels were installed around each coffer, accentuating the circular pattern of the chandelier. Armstrong World Industries, Inc. Circle 408 on information card.
2. Masonry blocks are installed with closed tops on surface to absorb noise. Trenwyth Industries Inc. Circle 409 on information card.
3. Enkasonic is a 3-D matting that consists of a nylon filament. Akzo Industrial Systems. Circle 410 on information card.

CEILING SILENCERS

Acoustical treatments control reverberation and noise.

AS SOUND STRIKES A SURFACE, IT IS TRANSMITTED, REFLECTED, or absorbed. Sound-absorbing products usually contain materials such as low-density fiberglass to help reduce noise and vibration in a room. Their performance depends on the thickness and the properties of the facing. Armstrong's Syllables sound-absorbing panels can be combined to create individualized installations to achieve a good acoustical performance (NRC of .50-.60) without the need for fissures, holes, or deep scoring. RPG Diffusor Systems, creator of the QRD diffuser (ARCHITECTURE, June 1989, pages 109-112), developed a rotating, triangular absorbing prism panel with reflective and diffusive sides for applications where variable acoustics are desired. USG's Linear Expressions panels provide sound control combined with a Class A fire rating. Eckel Industries' Acoustic Lay-In panels upgrade 2- by 4-foot lay-in ceilings with fabric panels that harmonize with wall surfaces. Akzo's Enkasonic matting diminishes impact noise in the flooring of multi-family buildings and dwellings by resiliently separating the floor from the ceiling below. Trenwyth's Acousta-Wal sound-absorbing blocks can be used indoors or out, depending on the degree of control desired. —A.G.L.

4



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4. London's BBC studio uses a fractal diffusor for reflection, absorption, and diffusion. RPG Diffusor Systems Inc. Circle 411 on information card.
5. Ceiling panels incorporate parallel lines to create the textured look of stone. USG Interiors. Circle 412 on information card.
6. Acoustical lay-in panels are designed for interior ceilings where maximum sound absorption is required. Eckel Industries. Circle 413 on information card.

Books *from page 58*
sign and execution of a project like the Hongkong Bank by an architect who had previously never built anything over three stories.

These two volumes cover 15 years of Foster's practice. Volume 2 includes projects such as the Willis Faber & Dumas office building in Ipswich, the Sainsbury Centre for Visual Arts in Norwich, and the Renault Distribution Centre in Swindon—all very different, and all quite beautiful. More than half of Volume 3 is devoted to the Hongkong Bank. "Our aim was to try and explain the full process of design; to show the inspiration, development, and exploration of ideas that underlies each project using, wherever possible, only the original sketches, drawings, and models by which their design was progressed," writes the book's editor and publisher Ian Lambot.

These two volumes are packed with process, including construction photos rarely found in architectural monographs. The writers and publishers of run-of-the-mill architectural vanity books, for which there seems an insatiable market, should study these two volumes as guides to raising their efforts from glossy, coffee table paper weights to comprehensive studies of an architect's work. Volume 1, covering the years 1964-1971, and Volume 4, dedicated to the years 1982-1989, are due out later this year.

—MICHAEL J. CROSBIE

The Prince of Wales: Right or Wrong? An Architect Replies
Maxwell Hutchinson, with a foreword by Richard Rogers (Faber & Faber, $8.95)

IN 1963 I CAME ACROSS AN ARTICLE about the Post Office Tower in London, and I knew then that if I were to see Europe, I had best do it before it disappeared. That I went to see old buildings and cities, not new ones, was too obvious to require reflection. But I never doubted that something valuable was being killed. The recent furor churned up by Prince Charles's running battle with the British architectural establishment is a clear reminder, if one were needed, that things have indeed gone terribly wrong.

We know that Modern architecture is out of style, except for its persistence on paper, where it has always most happily resided. We know that developers, corporations, governments, and most by third-rate architects have combined to extend a paltry Modernist fabric over vast areas of our planet, including Great Britain. We know that Modernism and Great Britain have produced a particularly regrettable mix, and that the things many love about the place are in peril. We wonder if this must continue in an irreversible trend. We suspect that stylistic revivals as such represent no settled alternative.

Now an architectural argument of real consequence has been joined there, comparable to philosophers abandoning Positivism to wrestle with the human condition. It is an extravagant spectacle. We know that His Royal Highness the Prince of Wales has brought it about with a good deal of polite, nasty talk of Modern buildings looking like carbuncles and old wirelesses. And we know that the British architectural establishment is scared to death, mad as hell, and they're not going to take it anymore, with all due respect.

Imagine their shock. Since World War II, architecture had been taking a normal, Modernist course. No one was especially happy about it, but few people were screaming for it to stop. Inertia is, in the absence of anything else, everything. Then, boom. The Royal Child, suddenly a regular architectural Damion, erupts all over the nursery. Looking back we see that it could perhaps not

Continued on page 149

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Books *from page 147*

have happened anywhere else. The ingredients for architectural foul weather were all there: the social and cultural power of the Royal Family, able if it wishes to question just about anything; the political and economic power of the professional establishment, with governmental authority blessing wholesale development in a stiff tradition of private property and capital enterprise; the Prince himself, serious, upright, looking for a cause he could really get behind; the old Tory axis of the aristocracy and the working classes, sundered economically by Attlee but remaining a solid emotional and patriotic front underneath; the improbability of reaching mutual accommodation in the English tradition of things; how, we now ask, could it have been otherwise? Old money, like the working classes, never bought Modernism anyway. The constituency of the avant-garde has always been new money, and the avant-garde.

So here is this person with unique social power; a graceful man, if not absolutely equal to the discrimination required in this predicament, complaining loudly of how ruinous his part of the world has remained since the Enlightenment and the Industrial Revolution had promised so much. He wrote a book—a rather good book—in which he stated his preference for the "traditional." He likes small, he likes "human scale" (that means low buildings to him); he likes houses with gardens; he likes Victorian, Georgian and Classical; he likes Sienna, Venice, and Paris; local materials, hand crafts, diversity, ornament, attention to detail, discriminating observation of the past, "harmony," a "community approach," respect for the landscape; and above all, he likes "character," which he understands to be that special something ("irrational, intuitive") that lifts the spirit. He sees none of this in Modern architecture. Buildings shouldn't look like machines; they should look like buildings. And he wants not so much to "live in a glorified Disneyland" as to foster open discussion, challenge fashionable theory, strip away "dogma" and "get back to fundamentals." For this he proposes 10 "principles" (commandments, of course) each of which seems perfectly acceptable.

But it becomes more serious. Because, you see, Charles has not merely written a book. He has called into question, before a sizable segment of the kingdom, the reputations of a number of architects, who heretofore had only to answer to each other, if at all. And he has broadcast his critical dismay over a number of major projects approaching construction in London. Leaning on a succession of developers, county councils, and selection committees, he has actually halted or substantially deflected their course in several instances, and in the process has become de facto czar of British architecture. If the Prince doesn't like it, it may well not fly.

Answering fire, predictably merging into protective fusillade, is presently heard from one Maxwell Hutchinson, the current president of the Royal Institute of British Architects, in the form of a little paperback equipped with a commendably brief foreword by Richard Rogers.

The book is like an exercise in courtroom advocacy, with all the strategic omissions and weighted readings that implies. Part wounded sneer, part historical defense, part bureaucratic apologia, it occupies far too great a length, beneath which lurks the disturbing notion that only Modern architecture is "rational," in tune with progress and technology and the spirit of the times. This is a pretty dated and misleading proposition—it's hard to imagine it still being trotted out. Whatever would Karl Popper think? It's pure historical determinism.

This dreadful doctrine owes a bit to 18th-century mechanics and a bit to 19th-century

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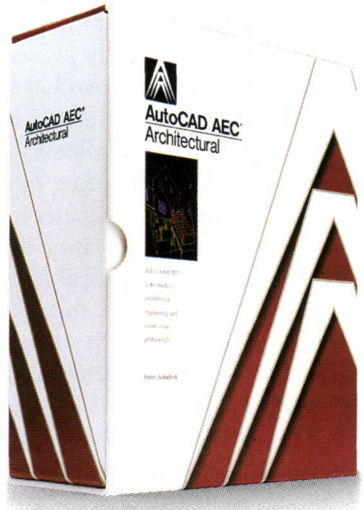
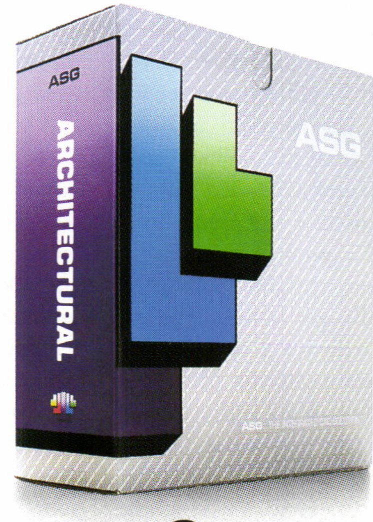


Before.

AutoCAD AEC Architectural is the No. 1 selling architectural package. It offers capabilities undreamed of just a few years back. It began, however, as a product called AE/CADD, created by the founders of ASG.



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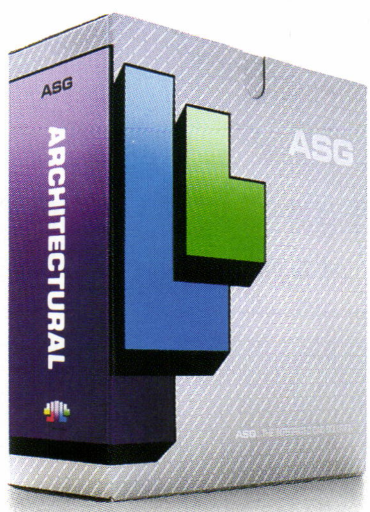

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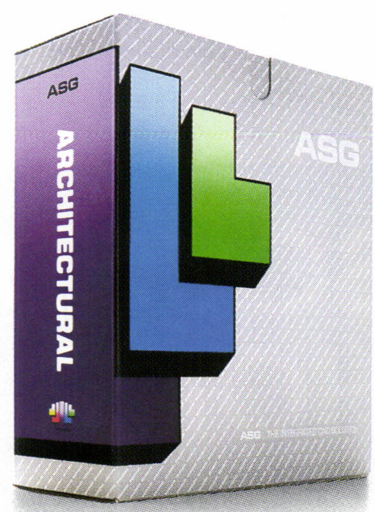

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Books *from page 149*

Hegelian prescription, of which it is a 20th-century hangover. Its technical name is historicism. It maintains that trends and events result from the inexorable rhythm of history, whose laws are manifested in the spirit of the time, and cannot be altered by human will. Thus it tends to support the status quo, which for us has long been rooted in the idea of technological progress. Historicism supporting Modernism seems paradoxical, but the paradox is only semantic.

This is no mere technical point. It is fundamental to a comparison of the two positions. Hutchinson's argument is suffused with historicist evasions. For instance, although both books misuse the words "rational" and "irrational," I take the Prince to be operating ingenuously (with all due respect), whereas Hutchinson discriminates beautifully when it behooves his argument, and I can't imagine this to be mere carelessness on his part.

So, as he claims the "rational" for Modern architecture, I am bound to point out that it is irrational to pretend, as he does, an exclusive relation between contemporary technology and Modernist form. Current technology allows Modern architecture, but doesn't mandate it. By the same token, it is completely rational, under most any acceptable use of the word, to employ Modern technique as a means to whatever stylistic end one could wish. Frank Lloyd Wright always took this view, to the endless annoyance of Modernists everywhere. What Detroit tool and die maker, not to mention his counterpart in Honshu or Stuttgart, could not with breathtaking ease stamp or mold any capital—Doric, Ionic, Corinthian, Tuscan, Etruscan, Composite, Roman or Greek, Rustic or otherwise, that anyone could unearth?

No, the argument is not between practical Modern "rationalism" and a silly, esthetic Royalist appeal to wistful "irrationality," as Hutchinson would have it. These are code words for an all-out stylistic war between vested interests, pure and simple. But the Prince's argument is openly esthetic while Hutchinson's tries to pass as a response to necessity.

An esthetic argument is a metaphor for stalemate, for dilemma; in this case one side nostalgic for the past, one nostalgic for the future. How to get beyond it? I'm not sure one should want to. The Prince cannot halt the architectural establishment completely, the establishment cannot blunt the power of the Prince. In an argument of this scale, resolution is no blessing. It's the argument that's important. Besides, who wants a czar?

If traditional architecture involves understanding how to do it, and Modern stuff involves wondering how to do it, England was never so good at either one. Traditional England was great at villages, okay at cities, prisons, churches, grand houses, and isolated cottages, but wretched at suburbs, housing, hotels, and office buildings. (The new terrace housing projects along "traditional" lines that Charles so favors are shockingly bad.) Number antagonizes excellence. The sheer numbers at work in our affluent culture lay ever open the probability of implacable mediocrity, whatever the style. But this situation is unprecedented, and serious challenges from each side may well have effect. It could be the first compelling scene for architecture and society in a long time, if indeed the bickering can rise to dialogue. If, indeed.

—William Ellis, AIA

William Ellis practices and teaches architecture in New York City.

Continued on page 152

Books *from page 151*

Light, Wind, and Structure: The Mystery of the Master Builders
Robert Mark (MIT Press, $19.95)

OVER THE LAST FEW DECADES STRUCTURAL theory has made, in great part due to the computer, a quantum jump that permits solutions we could only approximate until a short time ago. Robert Mark of Princeton University has dedicated his refined knowledge of structures, his exceptional skill in model testing, and his interest in historical monuments to conduct, with the help of his students and associates (and the computer), studies on the behavior of the most significant examples of architectural monuments that have so far eluded structural theorists.

In this magnificently illustrated book, he presents the results of his structural research on Roman, Byzantine, French Gothic, 17th-century English, and Modern monuments, adding as a bonus some interesting considerations on the relationship between structure and light. Guided by a sleuth's compulsion, Mark has left no stone unturned to explain how the Pantheon and Hagia Sophia domes really work, how and why the French Gothic cathedrals evolved to reach the climax of Beauvais, the subtlety of the design of St. Paul's Cathedral by Wren, and the variety of more or less correctly designed high-rise structures of our time. His conclusions are peppered with strong opinions, with which at times the reader may not entirely agree, but which are always based on incontrovertible evidence mostly discovered by the author during his investigation.

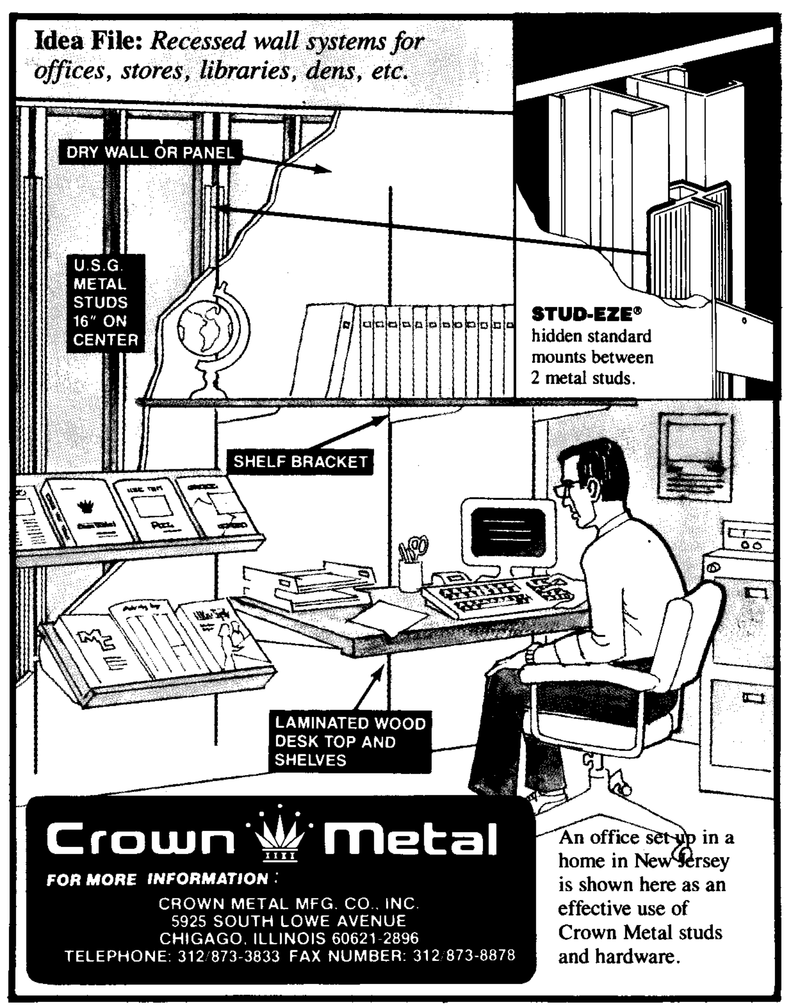
One of Mark's fascinating observations concerns the windows around the bottom of the dome of the Hagia Sophia, which permit it to float miraculously over its supports. By his calculations, the windows also limited the dome's opening to an angle of about 52 degrees, so that the correctly supported dome would not develop significant tensile stresses dangerous in a tile structure. And just as interesting is the non-linear analysis by computer of the Pantheon's dome, taking into account the development of vertical cracks discovered and documented in 1934 by Alberto Terenzio, superintendent of the Monuments of Latium.

Mark has used stress analysis on plastic models by polarized light in many of his studies of Gothic cathedrals, but is aware that photoelasticity (in its original, elementary, and practical methodology) can only demonstrate elastic behavior; he uses it as an important indicator of weaknesses in the cathedral's unelastic behavior.

This book should be carefully read, first of all by architectural historians, who have so far (more or less intelligently) tried to guess how the old monuments stood up and can now find out why they do. It should be of interest to architects and architectural students who will learn that, on the basis of experimentation and intuition, one can conceive a sound structure even without the use of higher mathematics (as I have preached for over 40 years). Perhaps it is too much to hope that structuralists may become fascinated by this book, because it deals with a past that seems to be rapidly receding in our technological era, but they should because they will find in it the solutions of some of the most engaging structural riddles they have ever encountered. The book's exceptionally modest price should even attract the generally cultured reader. ■

—MARIO SALVADORI, HON. AIA

A noted structural engineer, Mario Salvadori has authored several books on structural theory.



Proportion *from page 77*

the golden ratio, 1.62 to 1. Three hundred years later, a dissertation by Luca Pacioli, illustrated by Leonardo Da Vinci, marvelled at the golden mean as the inherent, organic proportion informing everything that grows, including the human body. For example, the distance between the crown of the nose to the chin, the bones of the fingers, the head to the navel, to the soles of the feet, all roughly correspond to a 1.6-to-1 proportion. Da Vinci's famous drawing enclosed this geometry within a circle and a square, thus uniting the rational and non-rational. "One of the reasons that geometry is such a powerful language," says Carson, "is the accuracy with which abstract concepts can be described. For example, the square root of two can never be resolved numerically—it is what is known as an irrational number. Whereas, the hypotenuse of a right-angle triangle with a side length of one, has a length of exactly the square root of two. Geometry has a power that numbers don't."

History shows that the divine proportion has been a lodestar to which numerous artists and architects have turned for inspiration in their creative endeavors, consciously or unconsciously. This attraction may simply occur because it simply "feels" right and there is a natural affinity with it, since it relates to an underlying universal proportion.

It is well known that buildings such as the Parthenon, Chartres, and other Gothic cathedrals have employed this proportion. Leonardo Da Vinci apparently used the golden ratio as a matrix for his paintings and sculpture, including the Mona Lisa. With the rise of scientific and industrialized society over the past 400 years, (which has been associated with a deductive, "masculine" mode of reasoning), the philosophies and knowledge of the past (much of which relied upon inductive, intuitive, and more "feminine" reasoning) were swept aside. To be sure, those with passionate belief in the inductive, intuitive mode of reasoning also scoffed at the rationalist view and helped to build the chasm between the two schools of thought. However, Carson stresses: "It is important that we don't deny one type of reasoning in the favor of the other. I see scientific reasoning as being focused—we did our homework, we graduated. Now let's get back to life and take a look at the cosmos, because it's all a part of the same story. We must be all-inclusive."

Carson's attitude is not unique. Einstein himself discovered that time and space are curved and there are no straight lines in the universe. Werner Heisenberg's principle of uncertainty tells us that we can't measure a system without changing it, which suggests that we need to look at systems in a more holistic way. Bertrand Russell articulated the point of view in his own way: "In mathematics we never know what we are talking about, nor whether what we are saying is true." Scientists in many disciplines are beginning to find circumstances which defy the logical linear way of thought. One mathematician, Benoit Mandelbrot, has managed to isolate through intense magnification the "random" patterns of nature. While looking chaotic and unstructured, they apparently have an underlying harmonious connection in their formation. And these organic structures of nature are inherently curved in spirals, and not composed of straight lines, indicative of Carson's geometry. For example, the shape of conch shells, the layering of pineapple skin, pine cones, and flowers, even the reproductive habits of rabbits and bees, when analyzed in pattern formation, express the golden ratio of 1.6 to 1.

Another physicist, Frijof Capra has observed that as we approach the subtler levels of physical reality, the concept of distinct parts no longer works. The observer and the phenomenon observed become reflections of each other in the context of a whole. The implication is that the answers to the ultimate nature of physical reality are more metaphysical than physical, and modern (linear) science does not have the tools and models to grasp reality at this level. This paradigm shift offers the promise of deeper insights into the nature of reality, but challenges us to develop a new language, new mathematical tools, and new constructs.

> Measurement must yield its dominance of our thinking to a marriage between relationship and proportion.

Perhaps because of the sheer pace of this century, and the adrenaline rush experienced by building, building, building, seemingly picturesque notions such as divine proportion have been tossed off as irrelevant to the projects at hand, and not of the "real" world. The golden ratio has not been guiding architects and designers—builders of society's environment. Would this explain our often intuitive feeling that something has gone wrong somewhere? That things are not all that they should be today? We find ourselves living in environments composed of boxes piled endlessly on top of one another and set into perpendicular grids with stop lights. "Often," says Carson, "our only moment of freedom or choice is the yellow—or golden—light when we have a brief moment of respite. Our rational selves are satisfied with this way of life, but the heart has no place to live."

The values of referencing the golden proportion are obvious. Building in harmony with nature, with ourselves, with the proportions of the universe, can contribute to an architecture that supplies the optimal comfort to its users, simply because it relates to the organic proportions of those users, and is in every sense a building of superior "golden" esthetics. The Carson geometry, relying so crucially on the figure of the circle, will also serve to reposition our view of the world. It may, says Carson, helps us to feel less "beside ourselves, meaning that we have stepped outside our true nature." The history of linear thinking, he claims, has helped to belittle the meaning of circular forms. "We talk about going around in circles as a way of explaining that we are confused," he says. "Our language indicates our desire to disassociate from this configuration. Yet the circle is the underlying form that shapes everything, including ourselves. We cannot get away from curves. Curves express wholeness. And this presents us with problems. For it suggests that there may be no beginning and no end. It is like the serpent eating its own tail, a sacred formation in ancient civilizations, which alludes to an eternal, cyclical motion. But this idea of cyclical existence is something we, in our culturally-developed, industrialized, and scientifically directed society, find hard to accept."

In architecture, the curves of domes and minarets are crowning formations that express the highest resonances of the built environment. Frank Lloyd Wright, for example, represented the universal rhythm in the spiralling Guggenheim museum, and Le Corbusier similarly explored the perfect ratio at Ronchamp. Cooper Union's Professor Jean Le Mée, in a recent paper "Design, Product and Success," states: "The thinking of designers has to be expanded from the linear A-to-B type to include the traditional cyclic thinking of the ancient world, and stretched as a helix along the irreversible axis of entropic and living time. The human being is multidimensional, living in several spheres: physical, biological, social, psychological, cultural, and spiritual." Le Mée's vocabulary and his grammar reinforce the work of Frank Carson. They serve as a reminder that tapping into the geometry of the universe can only add a layer of information that gives depth and life to architecture. ■

—Beverly Russell

Solar *from page 104*

ing new shadows on selected street and open spaces during times of peak pedestrian use. For example, sidewalks on the north side of Market Street must remain sunny after 11 a.m. from March 21 to September 21, which limits street-wall building height to 119 feet. Behind the street-wall, a building may rise higher as it gets farther back from the street, up to the limit of the "sun access angle plane"—a concept that clearly echoes New York's 1916 code.

San Francisco's 1985 Downtown Plan contains an additional shadow limitation provision: "New buildings and additions to existing buildings...shall be shaped, consistent with the dictates of good design and without unduly restricting the development potential of the site in question, to reduce substantial shadow impacts on public plazas and other publicly accessible spaces...In determining the impact of shadows, the following factors shall be taken into account: the amount of area shadowed, the duration of the shadow, and the importance of sunlight to the type of open space being shadowed."

In 1985, the city enacted a sunlight ordinance, Proposition K, based on the citizen initiative. It virtually mandates year-round, all-day sun access for approximately 70 open spaces and parks within the jurisdiction of San Francisco's recreation and parks commission. The regulation's major bailout language is an exemption for "shading or shadowing" where "the impact would be insignificant." In 1989, the city planning commission enacted criteria for determining significant shadows; however, for four years, the shadow ban prohibited new buildings from casting any shadows on existing city-owned parks or open spaces, or on those designated for acquisition by the city. As many planners pointed out, the passage of Proposition K threw something of a monkey wrench into the city's solar planning works. Approved by voters in June 1984, the initiative superseded the 1985 Downtown Plan.

Proposition K grew out of sun studies conducted by Peter Bosselmann, director of the Environmental Simulation Laboratory at the University of California at Berkeley. In 1981, he was asked to evaluate the shadow effects of a proposed 132-foot condominium on a small playground in Chinatown. His team merged pictures of a variety of building envelopes reaching the then-allowed height of 160 feet with photos of the playground during late afternoon when children would be likeliest to use it, namely, after school hours.

Bosselmann's studies involved using the sky simulator, or "artificial sky," developed at Berkeley. The facility copies a range of outdoor sky and sun conditions for testing

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architectural scale models. Electronically controlled light sources with a dome reproduce the light distributions expected from clear and overcast skies, and also test skies of uniform luminance. As well as simulating light from the sky, the model has a computer-driven sun that can introduce direct sunlight into the equation. The sky simulator allows designers to make both quantitative and qualitative evaluations of daylight in their building designs.

Beyond testing sunlight availability for public parks and plazas, the facility analyzes the performance of architectural devices to control daylighting, glare, or solar heat gain and validates newly developed computer models for predicting interior illumination.

In response to the studies conducted by Bosselmann's team, the planning commission passed a resolution curbing heights in the area of playgrounds, and the board of supervisors later upheld the resolution in interim zoning that reduces the heights from 160 to 50 feet. Bosselmann states that this resolution departed from the traditional method of defining building heights according to contour lines. Rather, building heights were to follow "cutoff" planes based on the path of the sun, called solar fans. Bosselmann also notes that in the early stages, San Francisco planners studied the two sun access measurement techniques in New York's 1982 Midtown zoning ordinance, but rejected them as too complicated.

The planning commission then ordered solar fans for all open spaces in the downtown. By this time, however, the much-politicized "sun for open spaces" movement had gathered such momentum that the city was pressured into ordering more comprehensive studies to evaluate tall buildings' effects on sun, wind, and temperature during different seasons and different times of day.

When the results of Bosselmann's studies, conducted over a four-year period, were published, work on the Downtown Plan had reached a critical stage, and environmental advocates pushed the issue of sunlight in parks and squares onto the 1984 primary ballot. The initiative passed by more than 60 percent. As an amendment to the city charter, Proposition K exceeded the intentions of the planning department and seemed to take on a life of its own.

Proposition K requires shadow measurements for nearly every daylight hour, unlike the city's environmental impact reporting procedure, which generally limits analysis to four designated days of the year at 10:00 a.m., 12:00 noon, and 3:00 p.m. The city has had to allocate more than $200,000 toward designing a three-dimensional data base and computer system for simulating shadows on the affected parks and squares. Parcel-specific data must be compiled within a one-foot accuracy range and must also account for pre-existing shadows.

Peter Bosselmann and his team at the Environmental Simulation Laboratory have compiled data bases for the 14 downtown parks and squares covered by the ordinance, including approximately 1,000 buildings that already cast shadows on these spaces. Bosselmann also prepared preliminary studies for some 56 additional public spaces elsewhere in the city, which do not appear to be significantly affected by Proposition K.

Shadow ban in action

THE FIRST SIGNIFICANT TEST OF THE city's sunshine law was a 24-story office tower at Pine and Kearny Street. Proposed by developer Walter Shorenstein, the building would have shadowed the adjacent St. Mary's Square in Chinatown. In fact, any building on that site exceeding six stories probably would have violated the shadow constraints.

Three weeks after Proposition K was passed, the project architects, Skidmore, Owings & Merrill, produced an alternative design six stories shorter and proposed expanding the park so there would be no net loss of sunshine. Shorenstein rebuffed the suggestion that the city purchase the site for a public park but proposed swapping a piece of it for exemption from Proposition K. Rejecting his revised design and subsequent proposal, the city refused to approve the shadow-creating structure. Shorenstein announced in May 1985 that he would construct a six-story parking garage on the site, yet today, the site is still vacant.

Proposition K also left its imprimatur on two projects approved in the 1987 office development limitation program that has come to be known as "the beauty contest." The larger of the two is the speculative office tower at 235 Pine Street, in the center of the financial district. Extensive shadow studies indicated the building would shade a small portion of St. Mary's Square, three blocks away, for three minutes in the early morning on 20 days out of the year. To make matters worse, expansion of the parking garage roof located beneath the square called for more shadow testing only one year later. The results dictated that the building's height drop 52 feet to 25 stories.

A second survivor of the 1987 design competition, 343 Sansome Street, was even more dramatically changed by the city's shadow limits. The 24,000-square-foot site for Gerald Hines Interests' third project in downtown San Francisco was bought in 1983 for $1,000 a square foot.

Philip Johnson, who consulted with John Burgee Architects, designed the original 350,000-square-foot, 25-story office project in conformance with the 1985 Downtown Plan. The plan had slashed the prevailing FAR in the area from 14 to 10; a later amendment reduced the FAR to 9. Studies showed that impermissible shadows might be cast on several downtown parks, as well as on Maritime Plaza, a public open space in the financial district. To comply with Proposition K, seven stories were eliminated. But seven were not enough. Even the reduced design violated the shadow ban by shading an air vent in Maritime Plaza. Three more stories had to be lopped off. The sharp reduction from 25 to 15 stories necessitated a drastic shift in architectural approach and a serious overhaul of the design.

The de facto height limits created by Proposition K are generally far more severe than those set out in the San Francisco Downtown Plan. Although the planning commission recently implemented criteria for determining when shadows are "insignificant" under Proposition K, these criteria are highly restrictive. For example, new shadows are permitted on only three of the 14 downtown parks. The amount of new shading allowed on Union Square may not exceed 1/10 of a percent of the existing shaded area. Although the criteria were derived by Bosselmann's team, some critics question whether the system is accurate enough to make such precise determinations.

Another criticism of Proposition K is that it fails to distinguish materially between shadows cast at different times of the day. Whereas most downtown parks and public open spaces are used most heavily during midday lunch hours, the ordinance contains no tiering mechanism reflecting use variations. Instead, all shadows are treated as if they have identical impact.

Environmental simulation

FOR MORE THAN 20 YEARS, PETER Bosselmann has been using the technique of pre-visualization in his Sim Lab movies to project the experiential effects of proposed development alternatives. Using cardboard stage sets of building, streets, neighborhoods, pedestrians, signage, and trees, complete with moving cutout photographs of crowds, he predicts the effects of new development on sun access, on the perceived scale of surrounding buildings, on traffic flow, and on open spaces.

Built to the same scale as model railroads—1/16th inch to one foot—Bosselmann's simulated developments incorporate the standard fixtures of model train sets. Buildings are made interchangeable to test for alternative development patterns. To test possible changes in the San Francisco skyline, for instance, the Bosselmann team used a model created in 1935 as a WPA project.

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With constant updating, this model can show past, present, and future skylines.

Besides collecting specific data, the Sim Labs films have been used to recommend zoning changes. Bosselmann's films analyzing aspects of San Francisco's zoning were broadcast on public television and widely believed to have influenced city commissioners and citizens alike to pass San Francisco's Downtown Plan.

In 1985, after Bosselmann's San Francisco studies had been completed, his team studied more that 20 sites around New York's Times Square, where $2 billion worth of development is planned. In contrast to the environmental impact statement done for this area in 1984, which cost almost $1 million, the Sim film was finished within two months with a total budget of $25,000. The film ultimately recommended a package of specific zoning changes, and the city has implemented some of the changes suggested. In 1987, the New York City Board of Estimate voted a zoning requirement to preserve the glitz around the square, mandating a 50-foot setback at approximately the four-story level (50 feet) to accommodate the giant neon screens. The signs' size must be directly proportional to the frontage length of each new project, at the rate of 50 square feet of signage for every foot of Times Square frontage. In exchange, buildings are permitted to rise higher than the 50-foot setbacks.

These advanced simulation techniques would be particularly useful to those downtowns devising incentive zoning systems. Cities could use the films to visualize and anticipate the effects of given bonus alternatives. They could discover how a certain block, district, or entire downtown would look and "feel" if developers took advantage of the full bonus potential. ■

—TERRY JILL LASSAR

Terry Jill Lassar is research counsel at the Urban Land Institute. The article is adapted from her recent book Carrots & Sticks: New Zoning Downtown.

ADDENDUM

The associate architects for five of the 1990 Honor award projects published in the March issue are:

Residential blocks and tower; Berlin, West Germany
Associate Architect: Moritz Müller

First Interstate Bank Tower; Dallas, Texas
Consulting Architect: Harry Weese & Associates

Clos Pegase Winery; Napa Valley, California
Associate Architect: Richardson Butler Associates

Mexx International, B.V.; Voorschoten, The Netherlands; Local Architects: Henk van der Meent Architects; Alphen aan den Ryn

Capital High School; Santa Fe, New Mexico
Architects: Perkins & Will and Mimbres, Inc.

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