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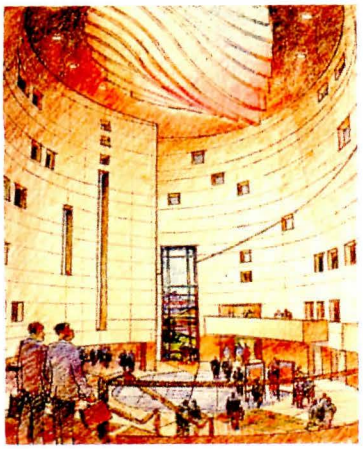
Green Realities

Architects must agree on standards to distinguish the green from the faux.



TOP: Clark County Government Center in Nevada, designed by Denver-based C.W. Fentress J.H. Bradburn and Associates, is indicative of public interest in the environment.
ABOVE: Entry rotunda, inspired by desert rock formations, screens intense daylight and supports water tank.

Architects who might not have known a VOC from a VCR just a few years ago are joining the green design movement and becoming the environment's newest champions. They are being spurred on to meet new challenges by an increasingly diverse group of clients. These new patrons of sustainable design are not limited to nature organizations such as the Audubon Society, but include corporations, restaurants, and retailers. Wal-Mart, for example, has just opened a new store in Lawrence, Kansas, which features reconstituted materials and an on-site neighborhood recycling center. State governments are also becoming green advocates; Washington, for instance, requires architects to meet strict indoor air quality standards when designing new state office buildings (pages 121-123). And at zoos and aquariums nationwide, exhibits are less focused on captive animals and more aimed at captive audiences—visitors who are cognizant of the world's endangered species and eager to learn more about saving them.

Although architects have come a long way since the 1970s in developing a holistic approach to the environment, green design still remains a matter of trade-offs among energy conservation, renewable materials, and site sensitivity, as well as the economic means to achieve these measures. As we discovered from the projects in this issue, no purely green architecture exists. A house cooled by ocean breezes in the Florida Keys (pages 58-61) may be energy efficient, but it is built with environmentally costly aluminum. The tropical woods certified as sustainably harvested for the National Audubon Society headquarters (pages 62-69) turned out to be technically flawed; temperate forest maple had to be substituted. High-tech greenhouses that shelter miniature rain forests may teach zoo-goers about endangered jungles, but they generate skyrocketing energy costs. And in moving into its green complex in Lawrence, Wal-Mart vacated a perfectly habitable, 86,000-square-foot building less than a mile away, with little explanation of how the older building would be recycled. In other words, what passes for environmental habitat may turn out to be environmental hype.

For architects, the task of specifying environmentally safe materials has never seemed easier, but practitioners are quickly discovering that many so-called "green" products are beset with false claims. Manufacturers tout recycled content and resource-efficient manufacturing processes (page 129), but no national regulatory standards exist for judging just how green these goods really are. Some products are rated independently of the industry by organizations such as Green Seal in Washington, D.C., and Scientific Certification Systems of Oakland, California; but each applies its own evaluation criteria. And the American Society for Testing and Materials' new standard for assessing the environmental performance of a building has yet to be approved. As a result, architects must conduct their own research to assess the environmental success of the products they specify for the sustainable projects they design.

For the environmental movement to succeed, this incremental research must be collected and translated into standards that benefit the profession and the public. Architects must not only demand voluntary green guidelines from the profession, such as the AIA's *Environmental Resource Guide,* but also tougher, industrywide regulations for building products, indoor air quality, and energy conservation. Developing these standards will require more participation from architects and a long-term investment in small-scale, project-specific solutions, rather than universal formulas based solely on technological advancements.

While a purely green building may be impossible to achieve, architects must help the industry, their clients, and the public reach a consensus on what realistically constitutes an environmentally sensitive design.

Deborah K. Dietsch

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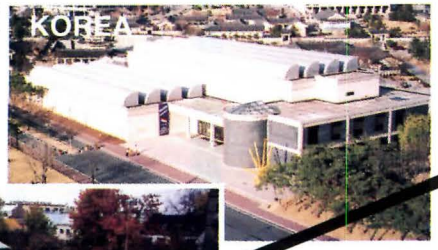

Housing Complex
United States Embassy
Tokyo, Japan
Architect: Harry Weese

Poudrière de l'Esplanade
Québec City, Québec
Architects: Denis St-Louis & Associés, Architectes

Arena
Stockley Park, Heathrow
Architects: Arup Associates

Dazaifu Treasures Museum
Tokyo, Japan
Architects: Satoh Total Planning and Architecture

JAPAN

Salegian Boys School Gymnasium
Tokyo, Japan
Architects: Sakakura Architects

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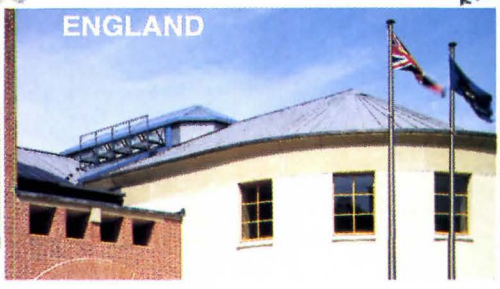
Architects: Tasso Katselas Associates

Epping Forest Civic Offices
Essex County, England
Architects: Richard Reed Architects



McClain Athletic Facility
University of Wisconsin
Madison, Wisconsin
Architects: Bowen, Williamson, Zimmerman

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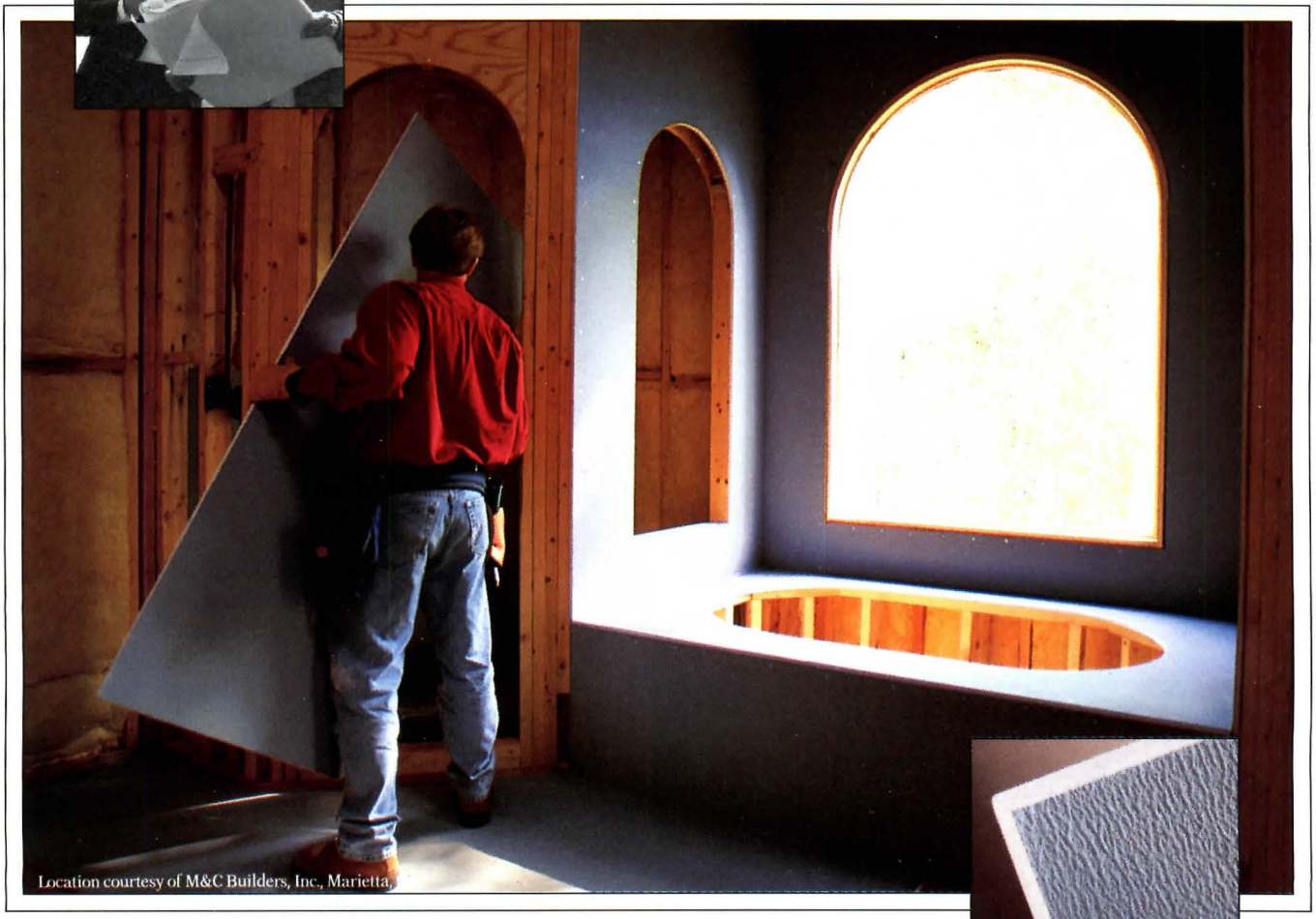

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Letters

Diversity in name only?

Is the AIA committed to diversity? It disturbs me that there have been a number of opportunities where the AIA has failed to seize the moment and act on its public policies.

In spite of requests from lesbian and gay members, and advice from its own expert panel on diversity to move its annual meeting out of Colorado, the AIA Board of Directors refused to move its fall meeting from that state (page 33, this issue). And at the March meeting, AIA President Susan Maxman structured proceedings to prevent lesbian and gay members from speaking. These actions give cause to question the board's intentions regarding diversity. AIA claims that it wants to expand its client base, membership, and the profession to include women, minorities, and openly gay men and lesbians. If the Institute is serious about attracting professionals with diverse backgrounds, it must respond to the needs of those people.

I salute the courageous board members who voted to uphold AIA public policy and move the meeting. Commendations are also due the diversity task force; the national staff; and chapters in New York, Seattle, and Los Angeles for their support. To the rest of the board, and especially to Susan Maxman, I say, shame on you.

Jeff Harris, AIA
Jeff Harris Architect
Seattle, Washington

Defining design

Your editorial in March (page 15) starts with the name Frank Gehry and ends with the name Frank Gehry, a high-profile architect. That you should devote publicity to the Egomeisters and their look-at-me architecture and ignore the solid work of the rest of the profession is unbelievable.

Milton Tony Sherman, AIA
Royal Palm Beach, Florida

The point you raised in your March editorial regarding the "too narrow a definition of design" that is fostered in our architecture schools is right on target. You put your finger on the importance of recognizing the interdisciplinary nature of the profession and the industry. It is time to return to the ideas of cooperative problem solving and being involved in every aspect of our country's life.

Jerome J. Sincoff, FAIA
Hellmuth, Obata & Kassabaum
St. Louis, Missouri

Privacy to heal

From a patient's point of view, any private room is better than semiprivate. Until they disappear, semiprivate rooms must be improved, but the "typical room" at Lakeland Regional Medical Center (March 1993, page 104) does not accomplish that. The inboard patient, with the curtains drawn, has no window and, with the curtains open, is assaulted by a view directly into the bathroom.

Dix Campbell
Dix Campbell Associates
Cambridge, Massachusetts

Correction

David Schaaf of Venturi, Scott Brown and Associates developed the caryakids for the Houston Children's Museum (April 1993, pages 46-51).

Events

June 12
Eighth annual conference of the Council of Federal Interior Designers in Chicago. Contact: Gary A. Johnson, (312) 353-4866.

June 14
Nominations due for the 1994 AIA Gold Medal award. Contact: Dennis R. Smith at AIA, (202) 626-7464.

June 14-17
NeoCon exposition at the Merchandise Mart in Chicago. Contact: (312) 527-7555.

June 16-July 2
Chicks in Architecture Refuse to Yield sponsors More Than the Sum of Our Body Parts, an exhibition at the Randolph Street Gallery in Chicago. Contact: (312) 427-9290.

June 17
Harmony by Design, a one-day symposium sponsored by INTERIORS and ARCHITECTURE magazines in conjunction with AIA Chicago and Allsteel, at the Merchandise Mart in Chicago. Contact: (312) 670-7770.

June 18-21
AIA annual convention coinciding with the Congress of the International Union of Architects in Chicago. Contact: (202) 626-7395.

June 24
Deadline for the Hermosa Beach Pier competition, sponsored by the Cabrillo chapter of the AIA. Contact: (310) 372-1375.

July 7-10
Carnegie Mellon University hosts CADD Futures '93, a conference. Contact: (412) 268-2368.

July 9
Deadline for Excellence in Design competition cosponsored by the AIA and the Cedar Shake and Shingle Bureau. Contact: (206) 453-1323.

July 12
The Electric Vehicle and the American Landscape, a presentation sponsored by the National Building Museum and the Capital Area Architects, Designers, and Planners for Social Responsibility. Contact: (703) 548-0099.

July 16
Binder submission deadline for the 1994 Gold Medal award of the American Institute of Architects. Contact: (202) 626-7464.

July 18-19
Under One Roof, a conference on accessibility, cosponsored by Abilities OT Services and the Maryland Office on Aging. Contact: (410) 358-7269.

July 19-29
Solar Home Design Principles, a program offered by Sustainable Technology International. Contact: (303) 963-0715.

July 21
Abstract deadline for Sustainable Strategies for Communities and Building Materials, sponsored by AIA's Committee on The Environment. Contact: (202) 626-7300.

July 30
Entry deadline for the awards program sponsored by the Long Island Chapter of the AIA. Contact: (516) 294-0971.

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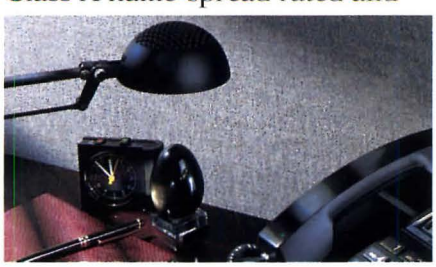

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Fumihiko Maki Wins Pritzker Prize

Japanese architect Fumihiko Maki, who is widely admired for his exquisitely crafted buildings and poetic use of light, form, and space, has been named the 1993 Pritzker Architecture Prize Laureate. The announcement was made April 26 by the Hyatt Foundation of Los Angeles. The annual prize was established in 1979 to honor the world's leading architects.

Maki is the second Japanese architect to receive this prestigious award, following Kenzo Tange's designation as Pritzker Laureate in 1987. In citing Maki for this distinction, an international jury, chaired by J. Carter Brown, praised the work of the 64-year-old architect as "intelligent and artistic in concept and expression, meticulously achieved. ... He uses light in a masterful way, making it as tangible a part of every design as are the walls and roof."

Maki graduated from Tokyo University in 1952 and, after receiving master's degrees in architecture from Cranbrook Academy of Art and Harvard School of Design, taught several years at Washington University and Harvard. In 1965, he returned to Tokyo to establish his office, Maki and Associates. As a member of the visionary group of young Japanese architects who called themselves Metabolists, Maki formulated many of the theories of urbanism and collective form which would become themes in his later built work. He is a self-described Modernist, but his early writings reveal a concern for the physical, social, and cultural context of buildings, which has distinguished his work from that of other Modernists of his generation.

There has been much speculation about the influence of Japanese and Western cultures on Maki's work. Maki himself has described the strong affinity he had as a child for the Western-style white houses of Tokyo. These houses, designed by the Japanese pioneers of Modernism, sharply contrasted with the muted browns and greens of traditional Japanese dwellings. To him, their white spaces suggested "visions of the future." Yet, however strong Maki's intellectual and emotional affinity for Western design, one cannot deny that his buildings reflect, in steel and glass, the fine-grained sensitivity to detail, process, complexity, and spatial nuance which are the hallmarks of traditional Japanese design. For Maki, the art and craft of building are inseparable. The dynamic stainless steel forms of the Fujisawa Municipal Gymnasium complex, for example, evoke fanciful images of insects, turtles, and Samurai helmets, but also record the story of a close collaboration between architect and contractor to develop a unique method of fabrication and installation.

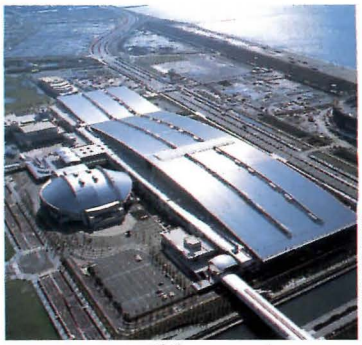
Maki's buildings are cool and elegant, exquisitely detailed abstract compositions. But even in the purest abstract forms, such as the Spiral building in Tokyo's Aoyama District (above), Maki uses light and spatial sequence to energize the place for the people who use it. For Maki, a building must be more than a beautiful object; it must also partake of the life of the place, enrich its culture, and contribute to its humanity.

Fumihiko Maki will receive the $100,000 Pritzker Prize on June 10 in Prague, a place for which he has a special affinity. Christian Norberg-Schulz has praised the city for its beauty and its rich, multilayered complexity. These words are a fitting description for Maki's work as well.

—Heather Willson Cass

Heather W. Cass, principal of Cass Architects in Washington, D.C., worked for Fumihiko Maki from 1974 to 1975.

FUMIHIKO MAKI: 1993 Pritzker Laureate.

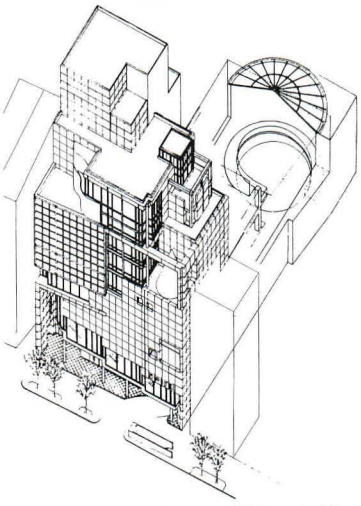


TOSHIHARU KITAJIMA

MAKUHARI MESSE: Chiba convention center.

TOSHIHARU KITAJIMA

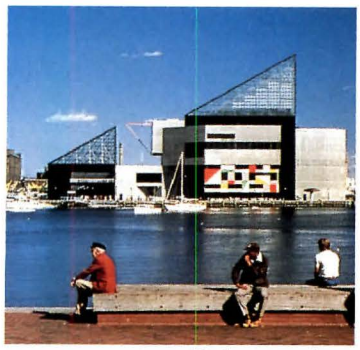
YUERBA BUENA GARDENS VISUAL ARTS CENTER: Under construction in San Francisco.



SPIRAL: Cubist collage for Tokyo infill.

TOSHIHARU KITAJIMA

SPIRAL: Aoyama Avenue facade.



BALTIMORE AQUARIUM: Harbor precedent.

HAMBURG AQUARIUM: Combines aquarium, retail complex, and parking garage.

OSAKA AQUARIUM: Cambridge Seven's first major Asian project.

NEW ENGLAND AQUARIUM: Bringing new life to Boston's harborfront.

PHOTOS: STEVE ROSENTHAL

Cambridge Seven Wins AIA Firm Award

Back in 1962, one formidable shortcoming threatened to eliminate architect Peter Chermayeff from being short-listed on the New England Aquarium project: Chermayeff was not affiliated with a firm that had experience in aquarium design. Undaunted by his inability to satisfy the major qualifying criterion, Chermayeff placed calls to his brother and five other talented designers, convincing them to join him and take a risk on the aquarium project. More than 30 years after their ad hoc firm produced the aquarium competition's winning design, Cambridge Seven is being honored this month with the 1993 AIA Firm Award. Traditionally, this honor is bestowed upon one firm that has consistently produced distinguished architecture for a 10-year period.

"A further important aspect of Cambridge Seven's work," according to Denise Scott Brown, chair of the AIA Firm Award jury, "is a thoughtful linking of graphics and exhibition design with architecture to create an overall design of communication."

This interdisciplinary quality of Cambridge Seven's work is a manifestation of Chermayeff's belief that integrating services and bringing different perspectives together creates better architecture. Indeed, the resumes of six of the seven original principals, who are still associated with Cambridge Seven, indicate expertise in architecture, graphics, urban planning, and exhibit design, as well as film-making.

Although Cambridge Seven's design portfolio has expanded to include buildings that range from aquariums to transportation facilities, the firm's basic philosophy has not changed. Principal Louis Bakanowsky, who heads the firm's associated graphics office in New York, is credited with the phrase, "one plus one equals three," which has come to mean looking for extra opportunities and introducing new concepts to produce new buildings.

Research and intensive interviewing of clients and users ensure that Cambridge Seven's designs accommodate those who will interact with the firm's structures. The Station Modernization Program for the Massachusetts Bay Transportation Authority, completed in 1968, is an excellent example of Cambridge Seven's penchant for designing from a user's perspective. The firm addressed a range of problems that grew from an analysis of how people experience transportation. Some of the ways the architects enhanced the traveler's experience include developing new signage, improving lighting, and simplifying circulation patterns.

In more recent years, aquarium and museum projects have kept Cambridge Seven busy despite the recession. The National Aquarium in Baltimore, which was completed in 1981, and the Tennessee Aquarium, which was finished in 1992, showcase the firm's ability to incorporate graphics into exciting design schemes. Unlike the New England Aquarium, many more professionals were consulted about specific environmental needs of the various plants, animals, birds, and reptiles. Principal Charles Redmon explains, "We have broadened our design team to include marine biologists and other scientists to ensure that the scientific validity is as strong as the creative design."

Another recent change, according to Principal Peter Sollogub, is an increasing involvement in international projects. The Osaka Aquarium and festival marketplace, completed in 1990, was Cambridge Seven's first major Asian project, and the firm is now designing a small residential community in Bangkok, Thailand. The Genoa Aquarium, in Genoa, Italy, is another ambitious international project. This structure, which is currently under construction, links the environments encountered by 15th-century Italian sea explorers to 20th-century habitats around the world.

In the future, Chermayeff asserts, "Cambridge Seven would like to contribute more to a dialogue about conservation of natural systems, habitats, and resources through our projects." The Alaska Sea Life Center, which is scheduled for completion in 1996, for example, will focus on environmental issues through a unique program that combines marine research, the treatment of injured marine animals, and educational exhibits. With this design, the firm has travelled far from its earlier goal of "breaking the box" in exhibit design. This year, Cambridge Seven is being celebrated for effectively bringing together different design disciplines to create structures that are conducive to interaction, exploration, and education.

—Katherine Eason

AIA Announces Interior Architecture Awards

Creative restraint and fidelity to context—historical, structural, or professional—distinguish each of the eight projects chosen for the AIA's 1993 Interior Architecture Awards of Excellence, announced this month. "Eclecticism still rules" this year's competition, maintains Paul Haigh, of Haigh Architects Designers in Greenwich, Connecticut, who chaired the jury of five: Eva Maddox, of Maddox Associates, Chicago; Thomas Moser, of Thos. Moser Cabinetmakers, Auburn, Maine; Deborah Sussman, of Sussman/Prejza, Culver City, California; and architect Harry Teague of Aspen, Colorado.

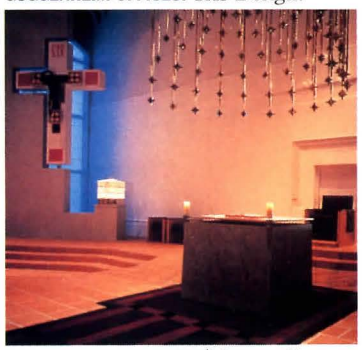
McClier's restoration of Daniel Burnham's Rookery Building, which also received an AIA Honor Award for architecture, drew plaudits for preserving subsequent remodeling by Frank Lloyd Wright and William Drummond. Respect for Wright's artistry also guided the excavation of below-grade space for offices within the Solomon R. Guggenheim Museum by TAS Design.

The 7,500-square-foot Manhattan showroom headquarters of Go Silk, a clothing manufacturer, was designed by Tod Williams/Billie Tsien & Associates. The ascetic enclosure furnishes an "appropriate mood" for the garments on display, the jury noted.

For the Origins Stores, Peter Forbes and Associates integrated natural materials to express the company's environmental ethos. Likewise, the World Neighbors headquarters in Oklahoma City by Elliott + Associates reflects the client's humanitarian activities with allusions to the Third World.

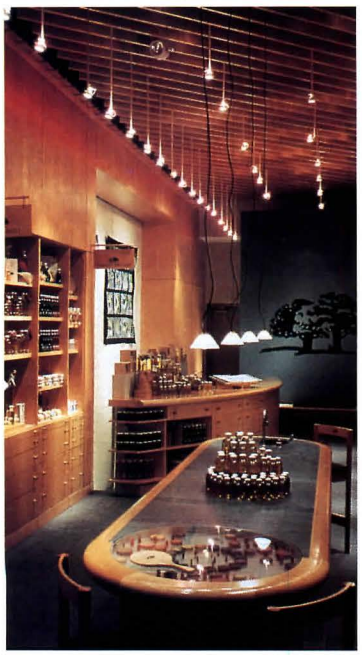
Jurors selected the Nativity Catholic Church in Rancho Santa Fe, California, designed by Moore Ruble Yudell and the Austin Hansen Group, for its unexpected scheme of delicate cloisters and gardens. Exuberant forms and colors turn a house in Lyme, Connecticut, by Centerbrook Architects into a "nontraditional and exciting" sanctuary for music, letters, and nature. The jury also recognized Valerio-Associates' structuralist adaptation of a 1940s manufacturing building owned by US Robotics, in Skokie, Illinois. For next year's awards, the AIA issued a single call for entries in May for its interiors, architecture, and urban design programs. —*Bradford McKee*

GUGGENHEIM OFFICES: TAS Design.



NATIVITY CHURCH: MRY/Hansen Group.

GO SILK: Tod Williams/Billie Tsien.



ORIGINS STORES: Peter Forbes.

US ROBOTICS: Valerio-Associates.

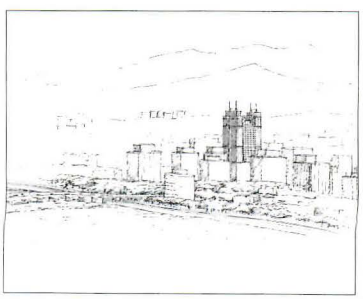
HOUSE IN LYME: Centerbrook Architects.

WORLD NEIGHBORS: Elliott + Associates.

ROOKERY BUILDING: McClier.

Details

Hardy, Holzman & Pfeiffer has received an $8.5 million commission to renovate and expand the biomedical library at the University of California, San Diego. **HHP** has also been signed on to design a fine arts center for California State University at Fullerton and a student center for Clemson University in South Carolina and will work with Ehrlich Rominger Architects on the Center for Integrated Systems at Stanford University, to be sited directly across from **Robert A.M. Stern's** Gates Computer Sciences Building. **Holt Hinshaw Pfau Jones** is designing the San Jose Repertory Theater, a 625-seat civic theater. **HHPJ** has also been commissioned to design the Lake Superior Center, a $30 million freshwater aquarium and environmental education center planned for Duluth, Minnesota. **Ayers, Saint & Gross Architects and Planners** has landed three academic commissions: a master plan for the urban campus of the George Washington University in Washington, D.C.; a master plan for the University of Virginia's School of Law; and a plan to improve the athletic facilities for the Virginia Polytechnic and State University. **Antoine Predock, Architect** has been commissioned to design an elementary school in Tucson, Arizona, with **Burns and Wald Hopkins, Architect**, Tucson. Partners **Robert Venturi** and **Denise Scott Brown** received the 1992 Philadelphia Award in May for their contributions to architecture and urban planning. **Kent Lovering Hubbell** has been named Chairman of Cornell University's Department of Architecture. He was Chairman of the Architecture Department at the University of Michigan. Hartford, Connecticut-based **Tai Soo Kim Partners** has won a competition to design a 40-story office tower (below) for the Tong Yang Corporation in Seoul, Korea.



SEOUL TOWER: Tai Soo Kim export.

UCSD Closes Architecture School

Only eight months after classes began at the new architecture school at the University of California, San Diego (UCSD), university officials decided in May to close the school.

"The problem we faced is that in order for architecture to develop into an outstanding school, it would need to receive substantial funding over the next five years for new faculty, staff, and facilities and for financial support for graduate students," explains Richard Attiyeh, dean of graduate studies and research at UCSD. "Given the difficult financial situation that the university faces, both this year and for the next several years, that would be virtually impossible."

The closing of UCSD means the loss of two master's degree programs: a three-year degree for students with no architectural training and a one-year series for those who already hold bachelor's degrees in architecture. The three-year program is already closed, and the first and only class to graduate from the shorter program will receive diplomas in December, following the fall quarter, the architecture school's finale.

UCSD had spent several years planning the school. In 1990, Adele Naude Santos was hired as dean (one of the few women deans of an architecture school), and she spent nearly two years prior to the start of classes last fall developing a multidisciplinary curriculum. Santos led the hiring of four founding faculty members: Dana Cuff, an expert in social aspects of architecture; Susan Ubbelohde, who specializes in energy-efficient design; Los Angeles architect Craig Hodgetts; and architectural historian William Curtis.

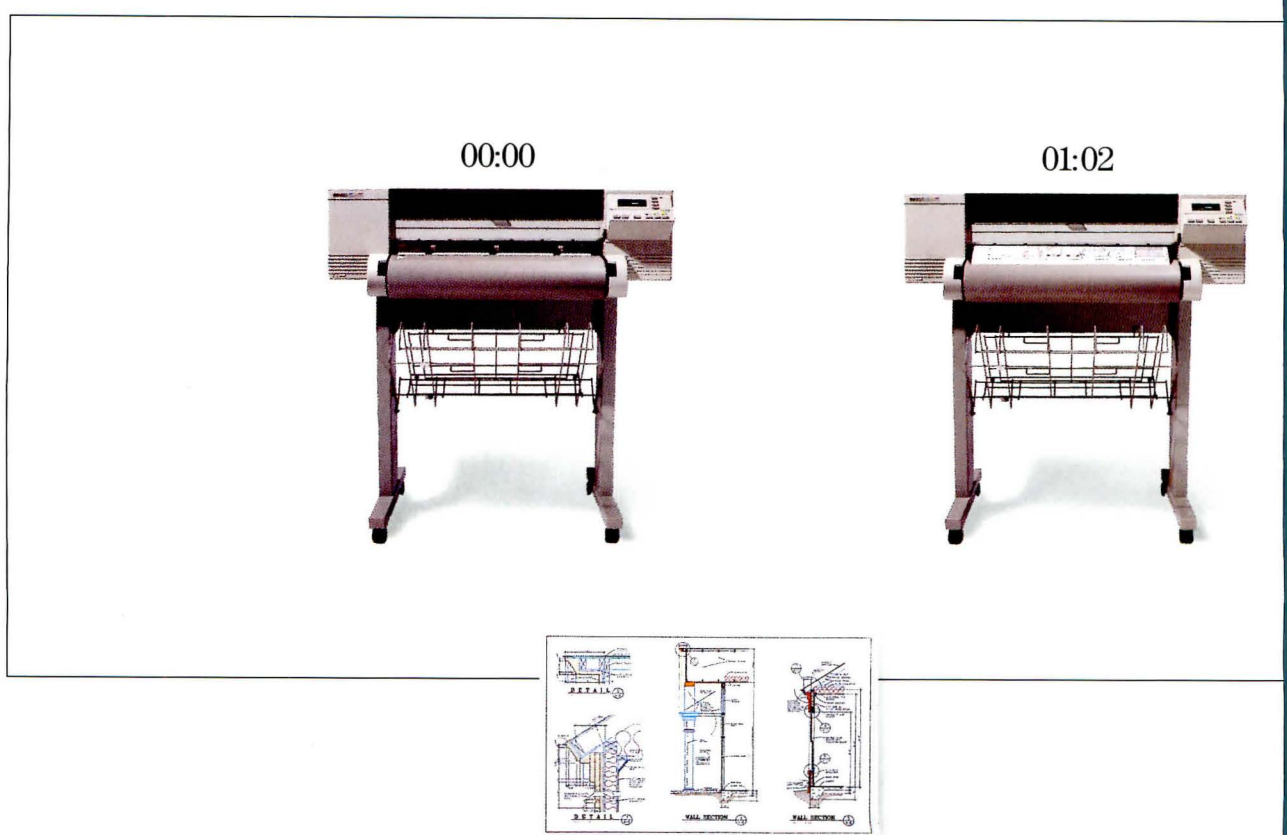
"It was obviously not a good time to start a school of architecture," laments Santos, who acknowledges wondering why university administrators didn't foresee budgetary woes earlier. "Two years ago it was clear that schools like UC Berkeley were advising some people I was recruiting that it was very risky to come down here. It was just a series of missteps done with the best of intentions, but that caused a lot of pain and problems for those here now."

"This was a campus decision, not a decision made at the university-wide level," Attiyeh explains, adding that local administrators didn't realize the depth of the university's financial crisis until this year. "Two years ago, we had the first in a series of budget cuts. But, we thought, we've had bad years before; the university will spring back." The thinking was the same last year, Attiyeh contends, and officials believed that the state economy would recover and that university funding would return to normal. "I don't think anyone foresaw how serious and long term the economic problems of California would be," he adds.

The architecture school's budget for the current year, $900,000, is modest in comparison to the estimated $20 million per month UCSD receives in state funding alone, about 23 percent of its operating budget.

UCSD Chancellor Richard Atkinson received more than 200 letters of support for the school from diverse sources, including local developers, city officials, and academics and architects from around the country. He declined to comment on the closing, but in a letter published in April in the *San Diego Union*, Atkinson stated, "Never before in its history, not even during the worst years of the Great Depression, has the university experienced financial cuts at the level it suffers now." Campuswide, UCSD is bracing for a budget cut of 9 percent beginning this fall.

Those opposing the department's closure believe the negative impact on San Diego will be immense. Ubbelohde complains that school officials and faculty members, including an all-faculty Academic Senate Council that voted unanimously to close the program, never comprehended the architecture school's rele-



vance to the campus and the surrounding community.

"The loss of the school is significant beyond words," maintains leading San Diego architect Rob Quigley, an adjunct faculty member at the school. "Who's to say what kind of impact it could have had on the way the region develops, on the quality of life in this city. All the affordable housing and other key programs identified with the school are now going to be abandoned, and there is nothing that can quite fill the void."

"What became increasingly clear is they [administrators and the academic senate] did not see architecture as being central to the mission of this campus," Ubbelohde adds. "It was by definition separate from the mainstream. It was a professional school, which made it suspect, and it was considered a luxury. They were absolutely clear about that."

Under Santos, the school developed a curriculum tailored to both the region and the times. Santos emphasized research, especially in low-cost housing and energy conservation. She also focused on the importance of building ties between San Diego and Mexico; the school presented a conference on border design issues last December.

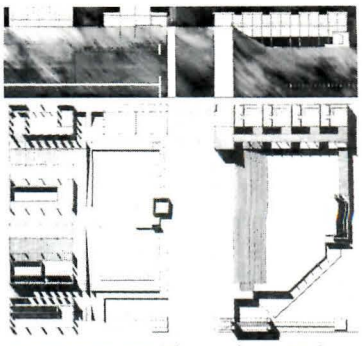
Santos quickly became a presence in the San Diego community. She met with public officials to explore ways of involving the school with local issues and was even nominated for a seat on the board of the Centre City Development Corporation, which oversees downtown redevelopment in San Diego.

Santos, who maintains practices in San Diego and Philadelphia, says she is weighing offers from other architecture schools. The four founding faculty are tenured, and it is likely that some of them will end up at other UC campuses. UC Berkeley, for example, has expressed interest in both Cuff and Ubbelohde. Fifteen students will transfer to UC Berkeley or UCLA, while seven will finish their academic programs at UCSD this year.

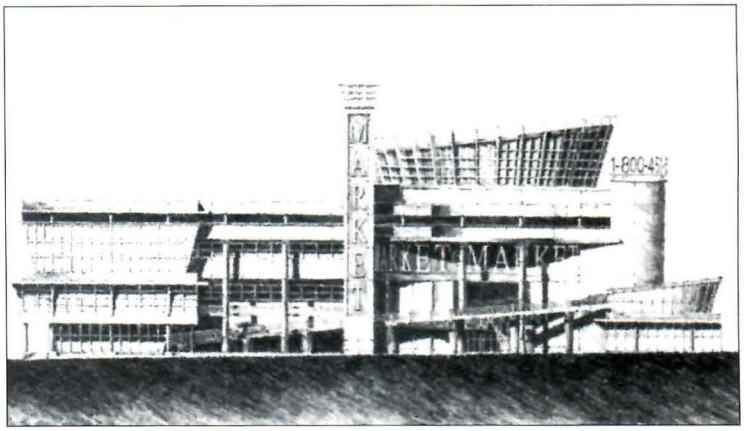
Meanwhile, Quigley and a few others involved with the school are hoping to keep "some entity in place, whether research or teaching, that can someday blossom into a school once again." —*Dirk Sutro*

ALAN DECKER

DEPARTING DEAN: Adele Naude Santos.



STUDENT PROJECT: Theater by L. Molina.



STUDENT PROJECT: Hypermarket by Marc Frederickson.

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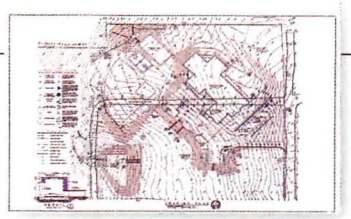


Museum Exhibitions Celebrate Chicago Fair Centennial

The political infighting that earned it the nickname "Beirut on the Lake" quashed Chicago's dream of holding a world's fair celebrating the 500th anniversary of Columbus's voyage to America. So this month, as thousands of architects arrive for the joint convention of the American Institute of Architects and the Congress of the International Union of Architects (IUA), the city is offering what tourism spin doctors are calling "a fair without a fair"—a series of museum exhibitions commemorating the centennial of the World's Columbian Exposition of 1893.

In truth, there is no substitute for a real fair, but these exhibitions still are likely to provide a fascinating diversion for conventioneers who want to break away from long-winded panel sessions and glimpse memories and memorabilia from Daniel Burnham's legendary White City.

The hard sell of yesteryear dominates an exhibition focusing on the fair's official photographer, Charles Dudley Arnold, who was recruited by Burnham to package the gleaming utopia. On view at the Art Institute of Chicago, "Constructing the Fair: Platinum Photographs by C.D. Arnold of the World's Columbian Exposition" presents the technically superb, monumentally scaled images of the White City that helped lure 27 million people—a figure equivalent to one-third of the nation's population—to the six-month event.

The show sheds new light on a spectacle that featured the first Ferris wheel, inspired the City Beautiful movement, and anticipated modern publicity blitzes with a marketing campaign worthy of Disneyland.

Arnold's photographs have proven more enduring than Burnham's dream city, influencing generations of architects and planners long after the fair disappeared. But the exhibition goes beyond familiar images of buildings and sculptures to rarely seen photographs of the exposition in process, an heroic transformation (as envisioned by Burnham) from unruly nature to orderly civilization.

A full two-thirds of the 100 photographs portray the fair under construction. The most dramatic photographs show the railroad shedlike interiors of the White City's temporary exhibition halls before their iron frames were covered with "staff," the lightweight mixture of plaster, cement, and horse hair that was applied to the structure like Beaux-Arts pastry.

The view from behind the lens is entirely different in an exhibition of photographs at the John J. Glessner House, the H.H. Richardson-designed mansion in the Prairie Avenue historic district on Chicago's South Side. Organized by the Chicago Architecture Foundation, "A Grand and Touching Sight: Prairie Avenue and the World's Columbian Exposition" presents 27 black-and-white photographs taken by 21-year-old George Glessner, son of a wealthy Chicago farm implement manufacturer. His images provide a striking series of snapshotlike views that have a dynamism and human scale absent from Arnold's static, monumental scenes. In one photograph, a french marine in a sailor suit strides with two companions in front of the fair's 277-foot Administration Building, a foreground building relegated to the background.

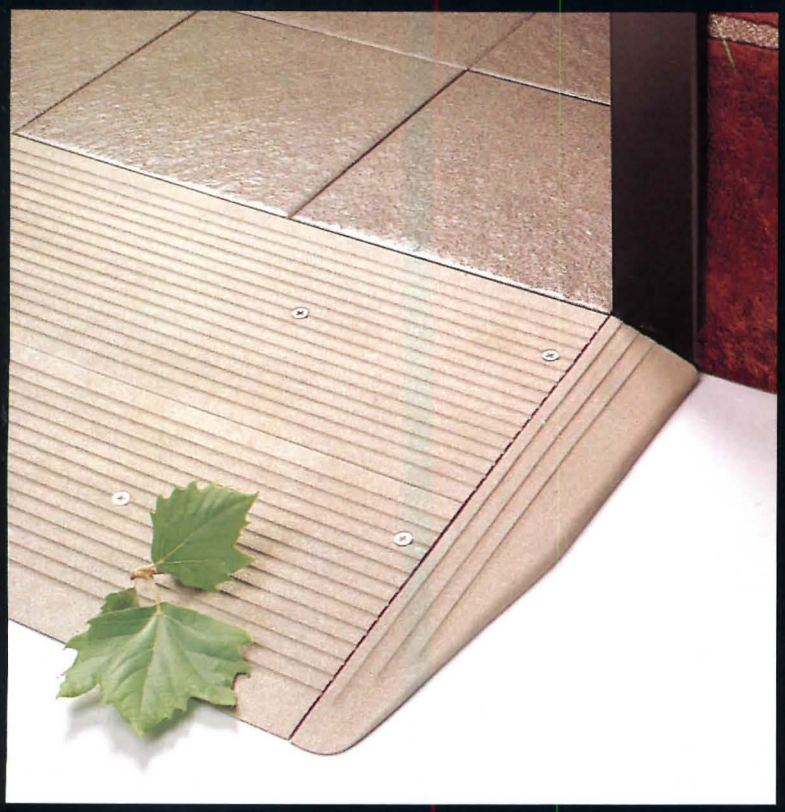
Also on Chicago's South Side, the Museum of Science and Industry—the lone remaining structure from the fair—chronicles its changing identities in "Building MSI: 1893 to the 21st Century." Originally delegated as the exposition's Palace of Fine Arts, its Neoclassical interior bulged with paintings and sculptures from throughout the world. The museum was recon-

structed before reopening in 1933 as a populist science and technology showplace. The exhibition takes the viewer through that transformation and lays out a reorganization plan that will bring the museum into the next century.

To the immediate south of the Museum of Science and Industry are more of the fair's legacies: the lagoons and wooded landscape of Chicago's Jackson Park, shaped for the exposition by Frederick Law Olmsted. A gilded 25-foot replica of The Republic, Daniel Chester French's 65-foot statue that presided over the fair's Grand Basin of the Court of Honor, sparkles within the park, not far from the spot where the actual statue once stood.

On the city's North Side, the Chicago Historical Society is presenting the most intellectually ambitious of the exhibitions, "Grand Illusions: Chicago's World's Fair of 1893." This show features a half-size recreation of McKim, Mead and White's Agriculture Building and more than 500 objects from the fair. Many of the artifacts

CONSTRUCTING THE FAIR: Art Institute's exhibit of Charles Dudley Arnold's photographs includes image of windmills.



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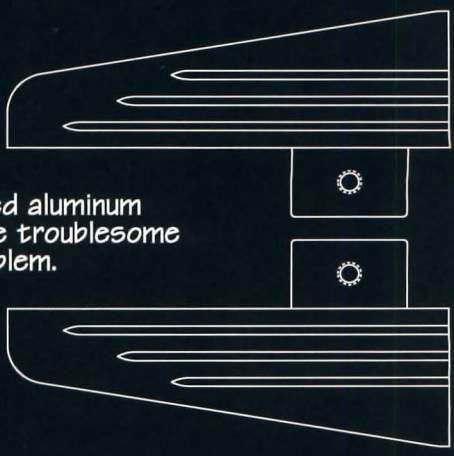

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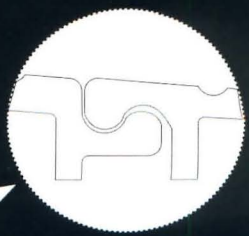

- Top plate is 7" wide, allowing for floor closer preparation.

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illustrate the view that the White City's outward display of harmony concealed cut-throat competition among commercial exhibitors trying to market their wares to the exposition's huge crowds, as well as the culture-at-large's discrimination against women, blacks, and non-Western peoples who were considered "uncivilized."

A few steps from the thunderous roar of the Loop's elevated tracks, the Harold Washington Library Center will host two architecture-related exhibitions. The first, "Seven Days at the Fair: A Celebration of the World's Columbian Exposition," is a lively, 150-object potpourri of photographs, memorabilia, and letters (including Burnham's signed cost estimate for the fair) assembled by the library's Special Collections staff. The second, "Put the City Up: Chicago Commercial Architecture, 1820-1892," was co-organized by the Chicago Architecture Foundation and the American Studies Center in Washington, D.C. This exhibit does not break any new ground, however, in explaining the growth of Chicago's brawling Gray City of skyscrapers that led Danial Burnham to envision his orderly White City.

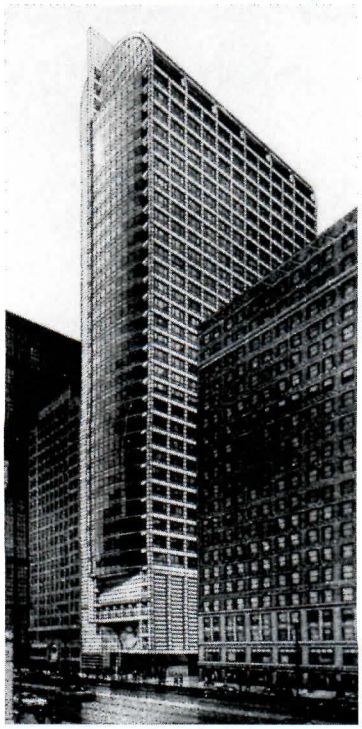
If all these exhibitions aren't enough, the Art Institute will open a blockbuster show, "Chicago Architecture and Design, 1923-1993: Reconfiguration of an American Metropolis," just before the start of the AIA-IUA convention. The exhibition is designed by Stanley Tigerman in collaboration with eight young Chicago architects: Howard Decker, Stephen Wierzbowski, Maria Whiteman, Kathryn Quinn, Ronald Krueck, Christopher Rudolph, Daniel Wheeler, and Darcy Bonner. Comprising more than 675 objects, it promises a sweeping, multidisciplinary look at the development of today's fragmented metropolis of edge cities and dying downtowns.

Life goes on in Chicago's Loop, but this Art Institute show is sure to underscore that the heroic age of Burnham is long past and that the metropolis outside the convention hall is not the visionary Chicago of 1893, but a city fallen from grace.

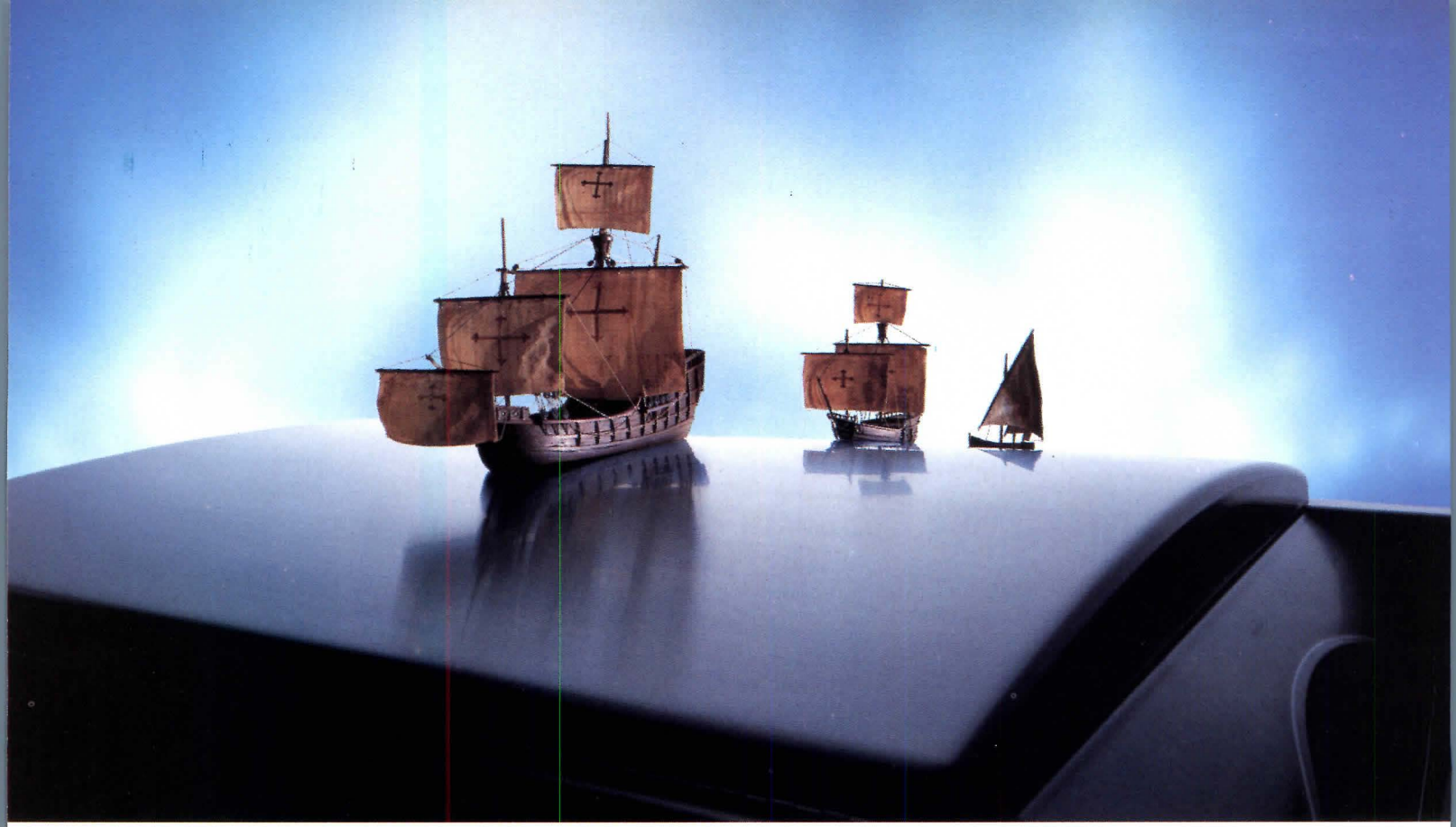
—Blair Kamin

Blair Kamin is the architecture critic for the Chicago Tribune.

MERCHANDISE MART: Ferriss drawing.



LASALLE STREET: Murphy/Jahn's tower.



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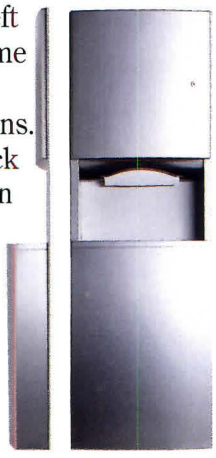

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Jewish Museum Expands on Fifth Avenue

For years, New York banking magnate Felix M. Warburg prized what an expert had assured him was Martin Luther's Bible. After Warburg's death, the bible was ascertained to be a contemporary forgery. "I was relieved that father had never known about this in his lifetime," wrote Warburg's son Edward in a memoir shortly after his mother donated the family's Neo-Gothic mansion, designed by C.P.H. Gilbert, to New York City's Jewish Museum in 1947.

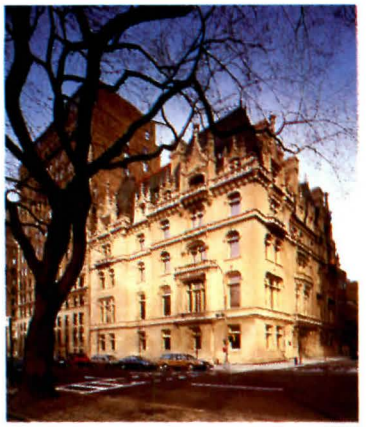
Perhaps Warburg would have been just as proud of the newest contemporary forgery on his premises—Kevin Roche John Dinkeloo Associates' addition to the museum, scheduled to open this month. The 30,000-square-foot expansion swallows a 1963 addition and sculpture court along a 50-foot stretch of Fifth Avenue to the north of the mansion. Moreover, the new addition replicates the scale, color, material, and detail of the 1908 mansion, offering no hint of its contemporariness.

Although Roche's decision to appropriate Gilbert's design concerned the context-conscious New York City Landmarks Preservation Commission because of the possibility of obscuring the original 1908 mansion by too careful a replication, the design was eventually approved. "When you analyze the nature of the architecture—height, modulation, scale, texture, the level of indentations and projections—you start to think of replicating it," explains Roche. "I couldn't see any sense in going halfway."

Roche faced the exterior with limestone from the same Indiana quarry that had supplied the mansion's original builders, combining elements from both facades of the mansion for the addition. "That required careful research and recomposition," says Roche. "They had to be adjusted to make them relate, so it was fairly tricky." The mammoth job of mirroring the intricately carved window frames, belt courses, balustrades, gables, and turrets was carried out by Cathedral Stoneworks, the group that is engaged in the long-term task of completing the Cathedral of St. John the Divine.

The removal of the museum's Fifth Avenue sculpture court allowed Roche to reopen the mansion's original main entry along 92nd Street. From the Fifth Avenue extension, the new addition moves straight back 100 feet, filling out the mansion to create a square in plan and doubling the museum's exhibition space to 25,000 square feet. Roche simultaneously restored and carved up what remained of the original interior, which had undergone several previous alterations.

Instead of a nudge-and-wink interpretation, Roche's faithful simulation is a welcome solution to the museum's dignified landmark. The restoration of Gilbert's Neo-Gothic confection and the new spaces set the stage for showcasing the Jewish museum's resources, a relationship between museum architecture and cultural heritage that will continue to evolve. —*Peter Slatin*



JEWISH MUSEUM: Roche's replication.

1926 An illustration of a Ludowici roof as proud owner's investment and architect's trophy component.

To the eye, the Ludowici roof on Southminister House in Mount Lebanon, Pennsylvania is beautiful indeed.

You might think that a pretty penny was paid for the roof on this former home, now owned by the Southminister Presbyterian Church as assistant minister's residence and activities center. But the life cycle cost of this roof would make it a thing of beauty in the eyes of even the most avid of penny-pinchers.

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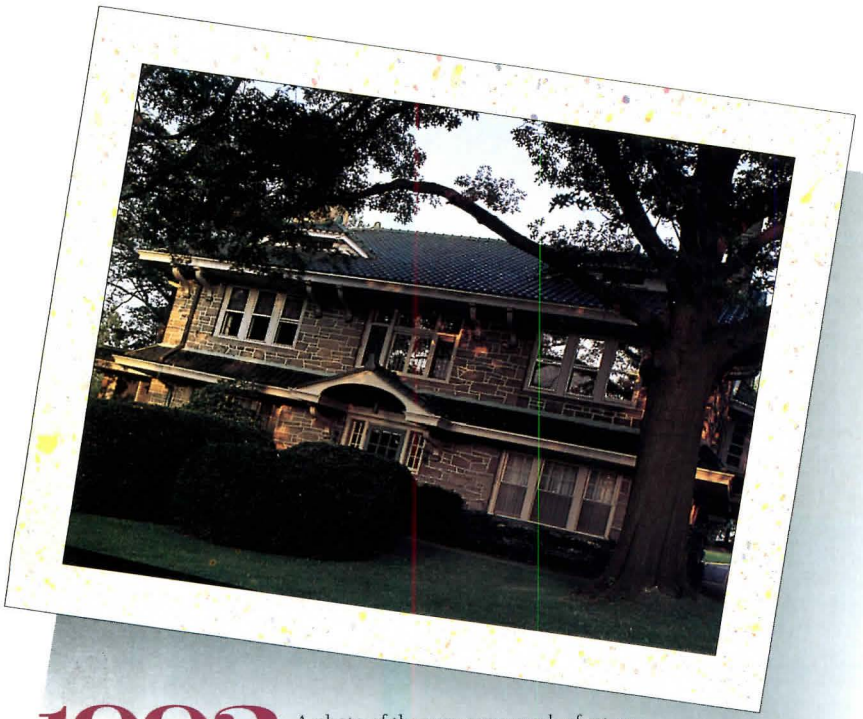

1993 A photo of the very same work of art as cost-efficient tile.

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AIA PROTEST: Organization of Lesbian and Gay Architects and Designers.

Colorado Boycott Spurs Controversy

Last November, Colorado became the first state in the nation to exclude homosexuals from protection against discrimination. Backed by Colorado for Family Values, a Colorado Springs-based group, Amendment 2 to the state constitution bans gays from filing discrimination claims. In January, a Denver judge issued an injunction that requires the courts to determine the amendment's constitutionality and renders it ineffective. This intermediary action does not repeal the legislation, however, and the courts will not reach a decision before this fall.

Amendment 2 immediately spawned Boycott Colorado, a Denver-based coalition dedicated to changing the law by urging travellers and organizations to avoid the state and asking consumers to boycott its products. Many organizations, including the National Education Association, the U.S. Conference of Mayors, and the American Public Health Association, have moved their meetings and conventions out of Colorado.

Surprisingly, the boycott has received mixed support from design organizations, which are generally against discrimination and encourage diversity. The 40-year-old International Design Conference in Aspen (IDCA), for example, which takes place each June, will meet as always, despite extensive lobbying by the New York-based Organization of Lesbian and Gay Architects and Designers (OLGAD).

Similarly, the AIA has come under fire from OLGAD and members of its own Diversity Panel for scheduling the fall meeting of its AIA Board of Directors in Aspen. During April's gay rights march in Washington, D.C., a group of protesters gathered in the courtyard of the Institute's headquarters to collect signatures on a letter opposing the Colorado meeting. According to Dan Lansner, OLGAD founder, the protesters succeeded in collecting signatures on more than 150 copies of the letter to AIA President Susan Maxman that reads, in part, "Until Amendment 2 is repealed or struck down by the courts, the AIA should stay out of Colorado."

Like the IDCA, the AIA Board opposes Amendment 2 but points out that many Colorado architects support its decision to meet in the state. Changing the meeting site, the Board contends, would hurt only Aspen, one of several cities that voted against the amendment. Boycott supporters, however, cite the AIA's own Code of Ethics, which opposes "any denial or abridgment of equal rights by the U.S. or by any state on account of gender, race, creed, ethnic orientation, age, disability, or sexual orientation."

Other professional organizations for designers simply express relief that they have no meetings scheduled in Colorado this year. "We don't have any events scheduled there, and we don't have anything planned in the near future," relates Joseph Pryweller, a communications specialist at the American Society of Interior Designers (ASID).

Meanwhile, Amendment 2 has created a backlash within the state: Telluride and Durango have both passed city legislation that protects every citizen, joining Aspen, Denver, and Boulder. "Denver is boycotting Colorado Springs," relates Rick Blair, a Denver-based designer, adding that Colorado for Family Values has taken its campaign to other states. "They are dangerous people," Blair notes, "but they don't represent the state as a whole."

—Heidi Landecker

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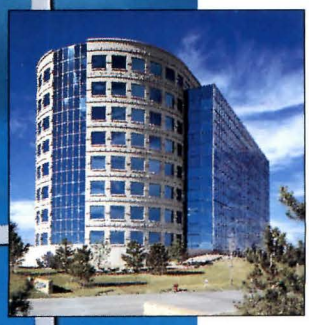

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Foreign Architects Receive Honorary AIA Fellowships

Architects from 10 foreign nations have been selected to receive honorary fellowship in the AIA by the Institute's Board of Directors. The 13 recipients, chosen for their distinguished, worldwide contributions to architecture and society, will be invested as honorary members of the AIA College of Fellows at ceremonies at the 1993 AIA Convention and the International Union of Architects World Congress in Chicago this month.

The following13 architects are the new Honorary Fellows chosen by the AIA's Board of Directors: Oriol Bohigas, Barcelona, Spain; Cesar X. Flores, Mexico City, Mexico; Jaime Lerner, Curitiba, Brazil; Olufemi Majekodunmi, Lagos, Nigeria; Motlatsi Malefane, Johannesburg, South Africa; Jose Rafael Moneo, Madrid, Spain; Jean Nouvel, Paris, France; Carl J.A. Nyren, Stockholm, Sweden; Philippe Robert, Paris, France; Witold Rybczynski, Montreal, Canada; Minoru Takeyama, Tokyo, Japan; Gino Valle, Udine, Italy; and Roy W. Willwerth, Halifax, Canada.

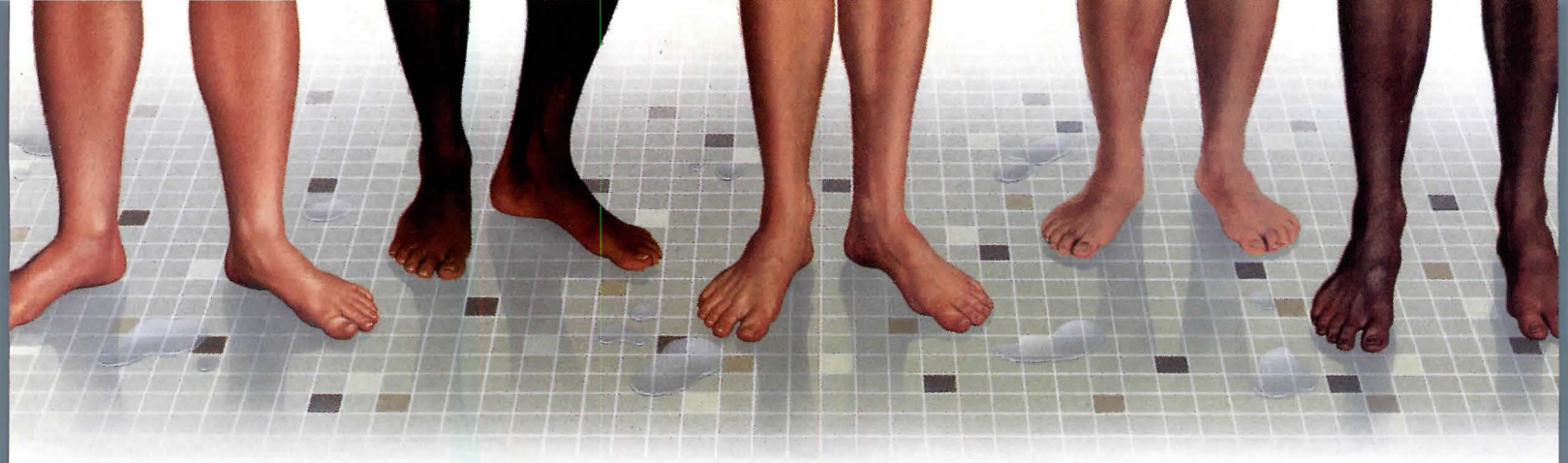
The AIA International Committee Steering Group screened this year's Honorary Fellows for recommendation to the Board through the Executive Committee. The steering group was chaired by Donald J. Hackl of Loebl Schlossman Hackl, Chicago. Other members include Benjamin E. Brewer, Jr., Houston, Texas; James Diaz of Kaplan\McLaughlin\Diaz, San Francisco, California; A. Eugene Kohn of Kohn Pedersen Fox, New York City; Carol S. Sakata of CDS International, Honolulu, Hawaii; and Robert A. Odermatt of the Odermatt Group, Orinda, California.

1993 AIA Fellowship Inductees Announced

At this month's AIA National Convention in Chicago, 111 architects will be inducted into the AIA's College of Fellows for their contributions to design, practical, and scientific aspects of the profession, as well as architectural education, training, and public service.

Of the 111 inductees, 8 are women—up from 5 last year—and 7 are minorities—down from 10 in 1992. In terms of state representation, California boasts the highest number of new AIA Fellows with 20; New York follows with 11; 10 new Fellows hail from Texas; and 9 are from the District of Columbia. Seven are from Washington; 6 are from Colorado; Illinois and Virginia each account for 5; Massachusetts claims 4; 3 are from Georgia. Arizona, Florida, Mississippi, Oklahoma, Oregon, Pennsylvania, and Utah each claim 2; and Connecticut, Hawaii, Iowa, Idaho, Indiana, Kansas, Maryland, Minnesota, Missouri, North Carolina, North Dakota, New Jersey, Nevada, Ohio, Puerto Rico, Rhode Island, and West Virginia are each represented by 1.

This year's Jury of Fellows was chaired by Mortimer M. Marshall of the Marshall Group Architects, Herndon, Virginia. Other jurors included A.P. DiBenedetto of DiBenedetto/Thompson Architects, Portland, Oregon; Robert E. Gramann of Gartner, Burdick, Bauer-Nilsen, Cincinnati, Ohio; Charles P. Graves of Charles P. Graves Architects, Lexington, Kentucky; James A. Greene, Winter Springs, Florida; William Kirby Lockard, Tucson, Arizona; and G.W. Terry Rankine of this year's AIA Firm Award Winner, Cambridge Seven Associates, Cambridge, Massachusetts.



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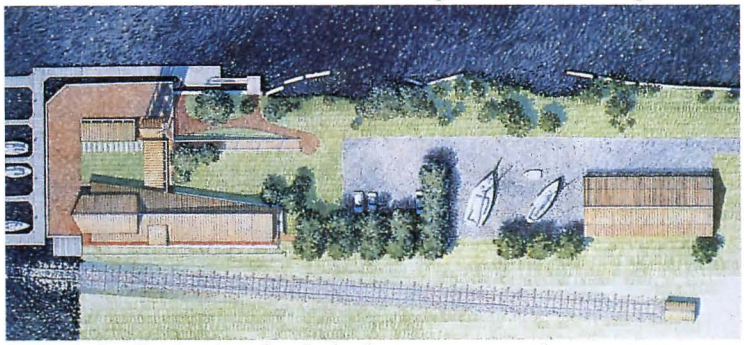
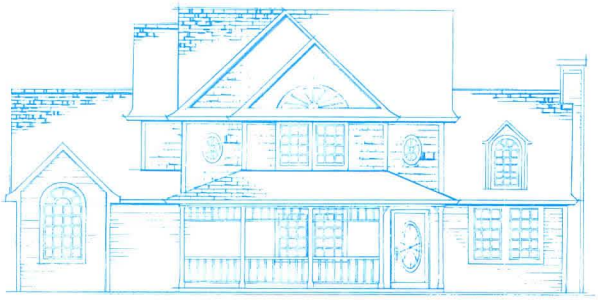
LEARNING CENTER AND OBSERVATION TOWER: Teaching children about the region.



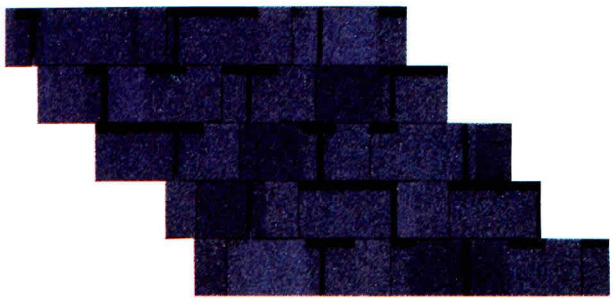
SITE PLAN: Pavilion is oriented on harborfront to capture sea breezes.

Environmental Education Pavilion
Baltimore, Maryland
RTKL Associates

For a waterfront site overlooking Baltimore's Inner Harbor, RTKL Associates designed an environmental learning center where children from throughout the region will learn about the Chesapeake Bay. Designed on a pro bono basis for a nonprofit organization called the Living Classrooms Foundation, the $950,000 complex will comprise an education pavilion containing a classroom, library, kitchen, gallery, and office space; a ship's chandlery for Inner Harbor boaters; and a 65-foot-tall observation tower. The building will be constructed of timber framing, wood sheathing, and local stone. To make the building as energy efficient as possible, RTKL will incorporate a windmill and solar cells to generate electric power; low-emissivity glass; and a doubly insulated metal roof. Passive cooling will be achieved through ceiling fans, operable windows, and breezes off the water. Construction is expected to begin in 1994.



THE PLAN



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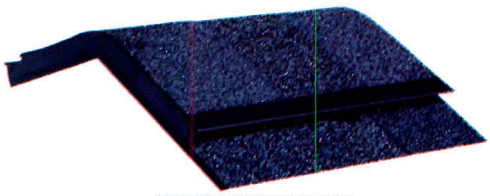
ROOFING



AIR VENT RIDGE VENTS
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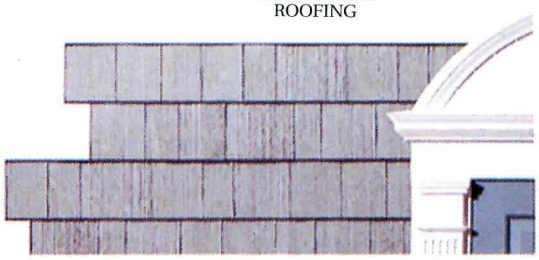

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Circle 19 on information card

Aquatorium
Chattanooga, Tennessee
SITE Projects

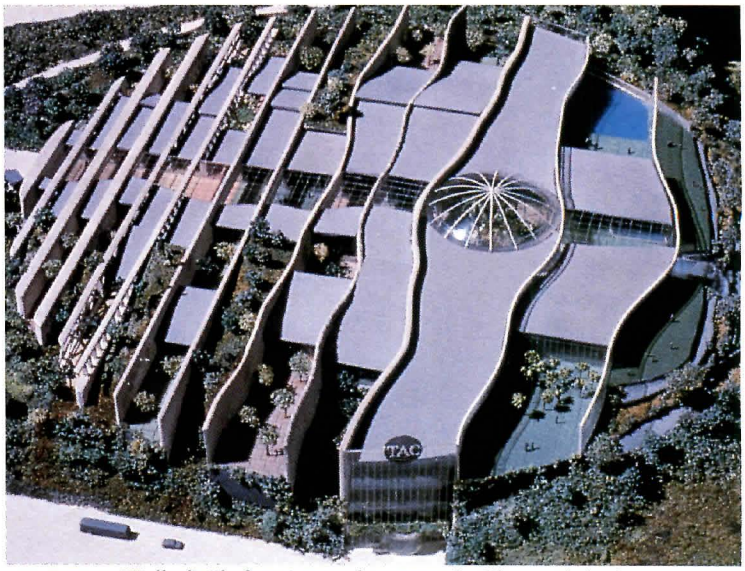
Unlike an aquarium, in which living species are put on display, the Aquatorium is a museum designed to demonstrate the value of water in the development of civilization. Its educational exhibits are intended to remind visitors how important water is to the life of every living creature and to urge its protection.

The scheme was developed as an entry for a limited design competition in Chattanooga, where civic leaders are seeking ideas for an environmentally oriented attraction as a follow-up to the successful Tennessee Aquarium (ARCHITECTURE, September 1992, pages 64-71). SITE proposed a project focusing on water to complement the aquarium and underscore Chattanooga's commitment to become a world environmental city. According to SITE Principal James Wines, the Aquatorium's design can be adapted to other sites should additional cities show interest.

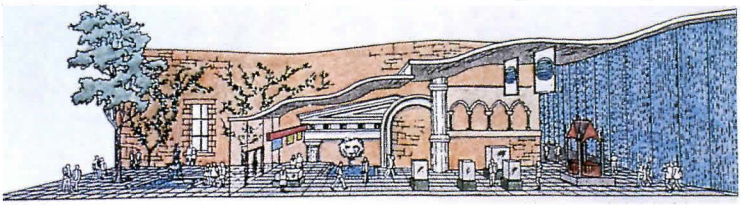
Originally planned for a hilltop site adjacent to the Tennessee Aquarium, the building's circular configuration is designed to be integrated into the landscape, creating the impression that the structure has risen out of the terrain to form the crest of the hill. The design extends the landscape banding of Ross's Landing Park and Plaza, the 2.4-acre park that SITE designed to surround the nearby aquarium.

This organizational feature defines a series of spaces, including public areas for special shows and receptions, exhibits, a swimming and health center, restaurant, theater, library, study center, and administrative offices. The centerpiece of the entry hall, positioned under a domed skylight, is a glass-enclosed rain forest garden.

In addition to sending an environmental message through its configuration and exhibits, the building is intended to contribute to a more sustainable environment through its materials. SITE has made a commitment to select the most environmentally sympathetic materials, specify the most efficient energy sources, and consider conservation and recycling during all phases of the Aquatorium project. —*E.G.*



AQUATORIUM: Walls divide functions and integrate building with landscape.

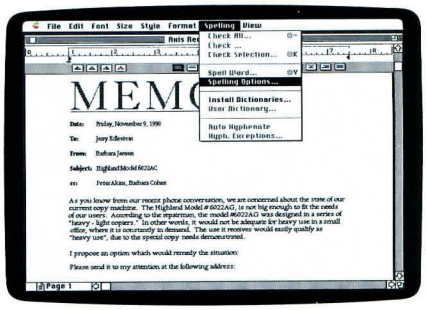


SECTION: Waterwall (right) divides exhibits from study center and library.

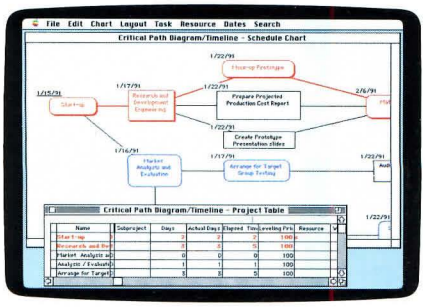
Who are you going to have to be today?

Designer?

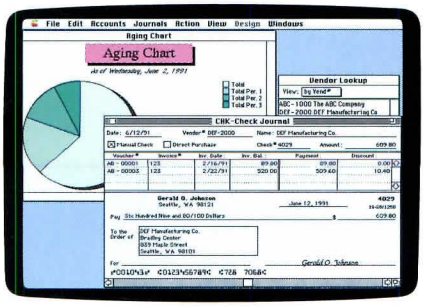
Marketing Manager?



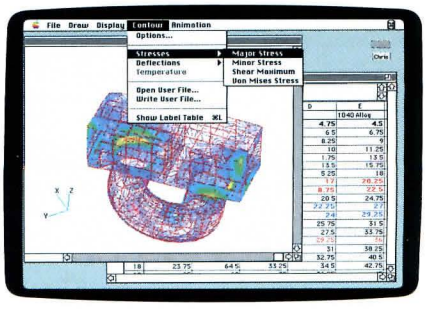
Administrator?



Project Manager?



Accountant?



Engineer?

ARCHITECTURE

BLUEPRINT FOR A GREEN FUTURE

With more architects involved, eco-sensitive architecture is moving into the mainstream.

ECO-CONSUMERISM: Wal-Mart store by BSW and William McDonough.

ECO-TOURISM: Kansas City Zoo's learning environment by BNIM Architects.

ECO-COMMUNITY: Pedestrian-oriented village by Peter Calthorpe.

Centuries from now, when natural resources are plentiful and the Earth is safe from environmental destruction, eco-historians may look back and conclude that the 1990s represented the turning point for the green movement. Asked to single out one meeting of environmentalists that helped turn the tide, they would surely point to the 1992 Earth Summit in Rio de Janeiro. But they would also have to credit the week in June 1993 when many of the world's leading architects gathered in Chicago for an international conference on sustainable design.

Future ecologists will also note a steady stream of corporate decisions in the 1990s that symbolize the greening of society. At McDonald's Corporation in Oak Brook, Illinois, executives of the world's largest food-service chain started banishing most polystyrene packaging in 1990, opting for recycled paper instead, and committed to spend $100 million annually for the purchase of recycled products to build, remodel, and operate more than 9,000 U.S. restaurants. In Lawrence, Kansas, Wal-Mart opened the first in a series of "Eco-Marts" in mid-1993; it features renewable construction materials, highly efficient lighting, and a recycling center right on the premises. For the North Carolina headquarters of the Body Shop, a successful chain of all-natural cosmetics, owners Anita and Gordon Roddick took their natural concept one step further and commissioned an Earth-friendly manufacturing and office complex for more than 100 employees.

If the eco-future is to turn out as brightly as these developments promise, intrepid planet-savers have more than a few hurdles to overcome. They include the high cost and low availability of many environmentally sensitive products and systems, and the need to sort out conflicting information about those approaches that work and those that don't. The task will not be easy.

From recent developments, though, it is clear that the push to save the environment has shifted from a peripheral issue to one at the center of the nation's agenda. Bombarded almost daily with news of pending environmental disasters—from global warming and ozone depletion to acid rain and endangered forests—more and more Americans are joining the effort to reverse the cycle of destruction before it's too late.

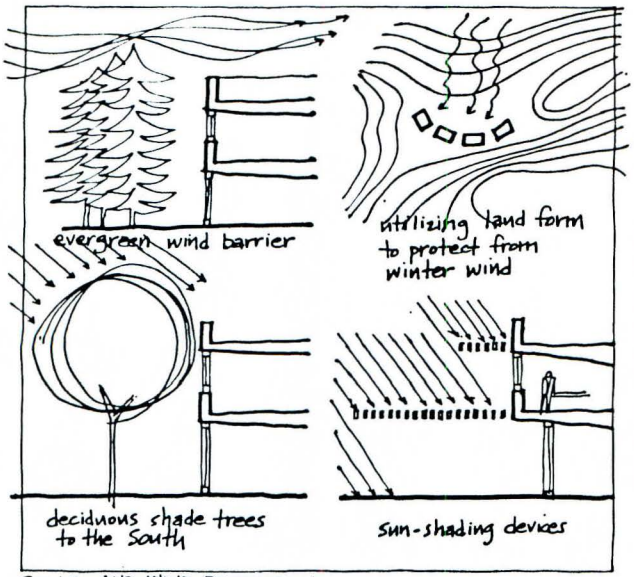
Sounding the clarion call for action in the United States is Vice President Al Gore, a passionate defender of the environment long before reaching the White House. In his 1992 best-seller, *Earth in the Balance*, Gore points out that man has become a "co-architect" of nature and possesses the power either to harm or heal the planet: "If we do not see that the human part of nature has an increasingly powerful influence over the whole of nature—that we are, in effect, a natural force just like the winds and the tides—then we will not be able to see how dangerously we are threatening to push the Earth out of balance."

Green goes mainstream

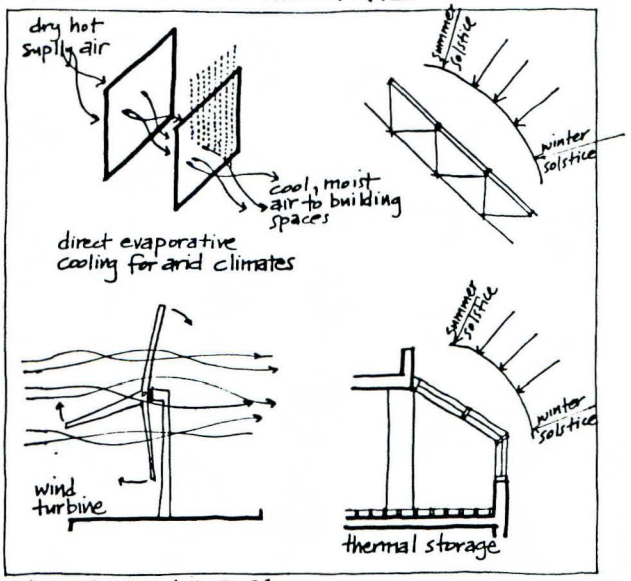
All around the country, architects are responding to Gore's warning and pushing environmentally sensitive design into the mainstream. In some cases, the impetus is idealism. In others, it's the need to respond to pressure from enlightened clients and governmental regulators, who, in turn, are bowing to pressure from the general public. Whatever the motivation, architects are discovering that the growing public concern about environmental issues and the demand for better approaches to shaping the built world have important implications for every phase of the design process, from siting and materials selection to use of more energy-efficient technologies.

In return, the increasing number of green projects for high-profile companies such as Wal-Mart and the Body Shop provides solid evidence that eco-conscious design is no longer an esoteric specialty practiced by a select few architectural "greenies." The roster of participants in the so-called "green architecture" movement now includes such internationally renowned designers as Frank

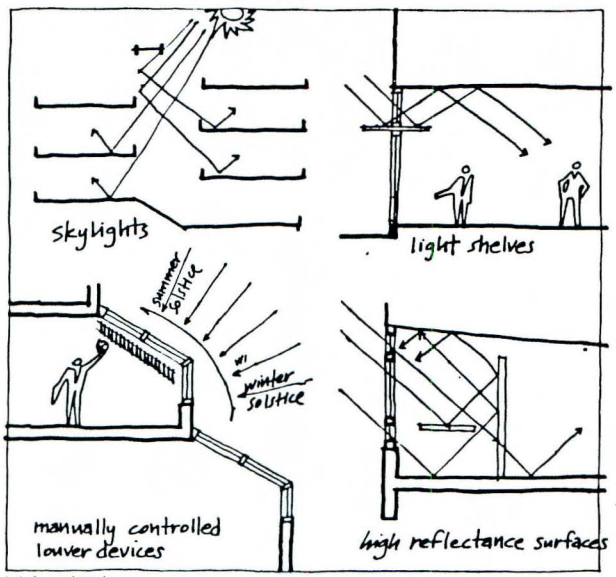
NATURE-DRIVEN TECHNOLOGIES: TOWARD A SUSTAINABLE ARCHITECTURE



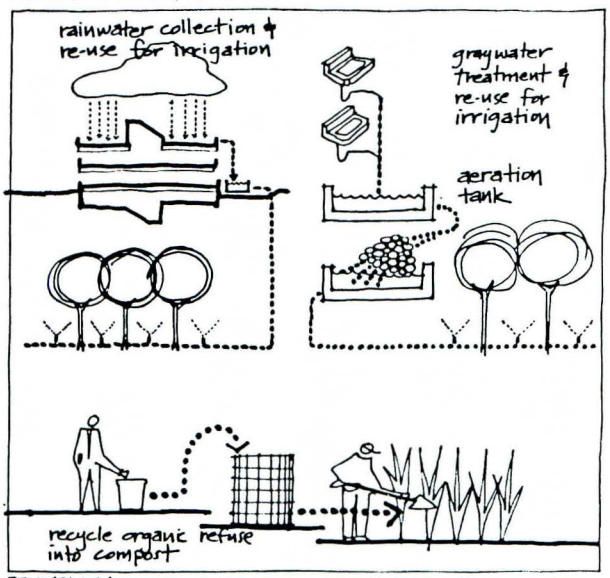
SOLAR AND WIND PROTECTION



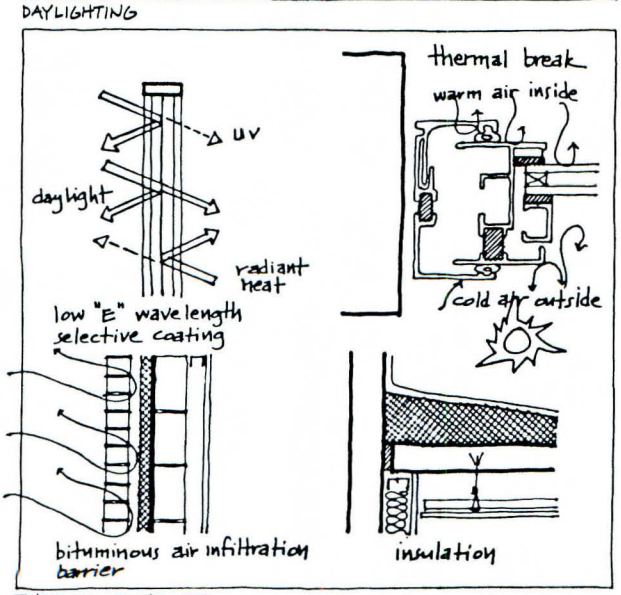
RENEWABLE ENERGY SOURCES



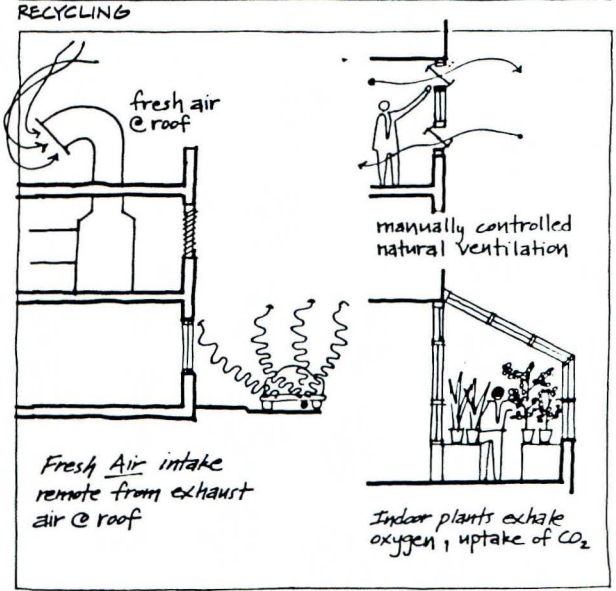
DAYLIGHTING



RECYCLING



THERMAL ENVELOPE



AIR QUALITY

Gehry, Henry Cobb, Robert A.M. Stern, and James Stewart Polshek; and large firms such as Ellerbe Becket; Hellmuth, Obata & Kassabaum; and RTKL Associates. These converts realize that the best solutions to environmental problems are not being handed out by professional or governmental authorities, as New York architect Billie Tsien told a recent conference on eco-tecture, sponsored by the Storefront for Art and Architecture. "It's the particular action you take on the buildings in your own office that will have the real effect," Tsien contends. "It's what you do at your own desk. It's at the end of your pencil."

One indication of the surge of interest in the field is the rapid growth of membership in the AIA's 3-year-old Committee on The Environment, which has attracted 1,000 members since its founding. More than 4,000 architects participated in at least one of the three videoconferences on sustainable design that the AIA has held this year, and many local AIA chapters are sponsoring their own seminars. The message at these events is clear: In the field of sustainable design, there *is* no such thing as a late bloomer.

The mainstreaming of the green architecture movement will get its biggest push ever when the AIA and the International Union of Architects meet in joint session in Chicago from June 18 to 21 to focus on the delicate balance between natural and built environments. Led by AIA President Susan Maxman, who has made the environment the top priority of her tenure, participants will issue a worldwide call for architectural sustainability. "As professionals who shape the built environment, we have an imperative to redefine our role on this planet from one of exploitation to one of stewardship," Maxman asserts. "We want architects to change the way they design, to think about everything they do in terms of what it means for future generations."

Many shades of green

Green architecture can take many different forms. Even without the stimulus of this month's international conference, architects have been tapping into the movement in a variety of ways. Unlike the solar-powered sheds and primitive yurts that epitomized the back-to-the-Earth design movement of the 1970s, today's green projects are everyday commissions for everyday people.

At one end of the spectrum are the "active" strategies—high-tech advances and materials that minimize energy consumption and save natural resources. They may involve the application of photovoltaic panels, as at the new Advanced Photovoltaic Systems factory in Fairfield, California (pages 74-81); energy-efficient glass; or certified lumber or recycled wood alternatives that don't deplete the rain forests. "The pace with which this has happened has accelerated of late," explains William Browning, senior research associate and director of Green Development Services at the Rocky Mountain Institute, a nonprofit research and educational foundation. "More and more architects are becoming aware of the technological possibilities of green architecture. It's a way of distinguishing yourself in the marketplace."

Others view sustainable design in terms of commonsense approaches to site orientation and passive heating and cooling strategies. For members of this low-tech group, sustainable design is the ultimate architecture of courtesy—designing with respect for the planet. They pay special attention to sun and wind conditions, shading from trees, natural ventilation, and local materials.

Eco-tourism boom

Some of the most highly visible environmental projects are didactic buildings that exemplify the green gospel in form and function, such as the Boyne River Ecology Centre (pages 52-57). Many are consciousness-raising public attractions such as aquariums, zoos, and natural history museums that simulate natural habitats and ecosystems. Their chief purpose is to educate people about the fragile state of the environment and encourage them to take action to protect it.

One example is the new national garden planned for the Mall in Washington, D.C., complete with an environmental learning center as its centerpiece. In Atlanta, visitors are flocking to the Graham Gund-designed Fernbank Museum of Natural History, which includes an exhibit of the state's mountains, plateaus, valleys, swamps, and coastal areas and serves as a microcosm of the earth's development. For the Kansas City Zoo, Berkebile Nelson Immenschuh McDowell of Kansas City and consultant Greg Franta of the Ensar Group have designed a new entry and education building with a multimedia "rite of passage" that transports visitors to the "Kingdom of the Animals"—encouraging them in the process to view themselves as being a part of nature rather than having dominion over it.

The increasing awareness of environmental issues has led to a groundswell of interest in eco-tourism. The U.S. Travel Data Center reports that nearly 7 percent of U.S. travelers, or 8 million Americans, have taken an

The growing number of green projects for such high-profile companies as Wal-Mart and the Body Shop provides solid evidence that eco-conscious design isn't an esoteric specialty practiced by a few "greenies."

The best solutions to environmental problems are not being handed out by professional or governmental authorities. It's the action you take on your projects at your desk. It's at the end of your pencil.

"eco-trip" to one of the U.S. National Parks or other nature preserves. Such interest has generated work for designers of a variety of back-to-nature projects. They range from upscale resorts in exotic locales, such as the Carambola Beach Resort on St. Croix, to nature trails, bike paths, and visitors centers, such as the one at Spring Lake Park in Northern California (pages 82-85). For architects, the primary challenge of these projects is to facilitate eco-trips without plundering the area that is the subject of the visit.

Other eco-sensitive projects are far more subtle in their outward appearance and have no specific educational mission, but they are no less green. They incorporate green features that most people will never recognize, such as photocell sensor-controlled lighting, cellulose insulation, and ozone-friendly air-conditioning systems. The National Audubon Society helped set the standard for eco-sensitive workplaces when it moved to a recycled department store in lower Manhattan (pages 62-69).

Finding a green niche

Robert Berkebile, founder and past chairman of the AIA's Committee on The Environment, states that there are essentially three ways that mainstream firms have begun to get involved in sustainable design. One is to form joint ventures with firms that have a strong track record for work in the field. When Pei, Cobb, Freed & Partners sought a design commission in North Carolina from the U.S. Environmental Protection Agency (EPA), the firm joined forces with Croxton Collaborative, headed by Randolph Croxton, a Pei alumnus and now one of the leading green architects. The team didn't win the EPA job, but both firms agreed to join forces again to pursue future projects. Recently, they were hired to design a 200,000-square-foot headquarters in Washington for the American Association for the Advancement of Science.

A second approach is for a company to joint venture with a non-architect who specializes in sustainable design. The Rocky Mountain Institute, for example, is working with Frank Gehry on a conference facility in Germany and with Robert A.M. Stern on a ski village in Aspen. Many designers are strengthening their teams by adding specialists in urban forestry and related subjects. Others have begun to work closely with power companies, which sometimes pay architects to come up with energy-saving designs that can be used as pilot programs.

A third way to gain expertise is to hire in-house staffers to coordinate green architecture efforts within the company. In response to the demand for more in-house specialists, many schools have begun revamping their curriculums to include a healthy dose of green design. Ball State University, the University of Virginia, North Carolina State, and Arizona State are among the leaders in this trend. The greening process is not unlike the way firms hired computer-aided design experts during the 1970s and 1980s. Adding in-house expertise takes a stronger commitment to the subject from the firm's principals than simply hooking up with the occasional joint venture partner, but it can also have the greatest impact in terms of changing the work patterns of an entire firm. "You have to have a person at the top who cares," Berkebile points out. With in-house experts, "You don't go back to your old ways when the consultant walks out the door."

Regional environmentalism

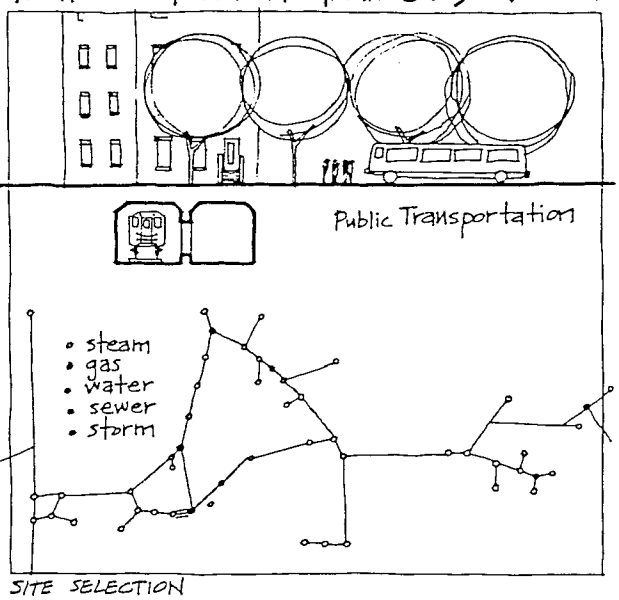
The ultimate extension of all of this activity is for entire regions to go green. Pedestrian-oriented communities proposed by Peter Calthorpe and Associates for Northern California; Haymount, in Virginia, by Andres Duany and Elizabeth Plater-Zyberk; and Celebration, in Florida, by HOH Associates and others, are demonstrating the possibilities for sustainable new communities. Now environmental sensitivity is being extended to entire cities as well.

Chattanooga, Tennessee, for example, was once one of the most polluted cities in the country, but civic leaders have made a concerted effort to clean up the river and the air. In 1991, they declared Chattanooga to be the Environmental City and announced plans not only to clean up their own environment but also to become a magnet for environmentally oriented companies. One of the first signs of this new effort was construction of Cambridge Seven Associates' $45 million Tennessee Aquarium, which celebrates the freshwater ecosystems of the Tennessee River (ARCHITECTURE, September 1992, pages 64-71). As a follow-up to the success of the aquarium, civic leaders held a limited competition to develop a second environmental attraction next door (page 39).

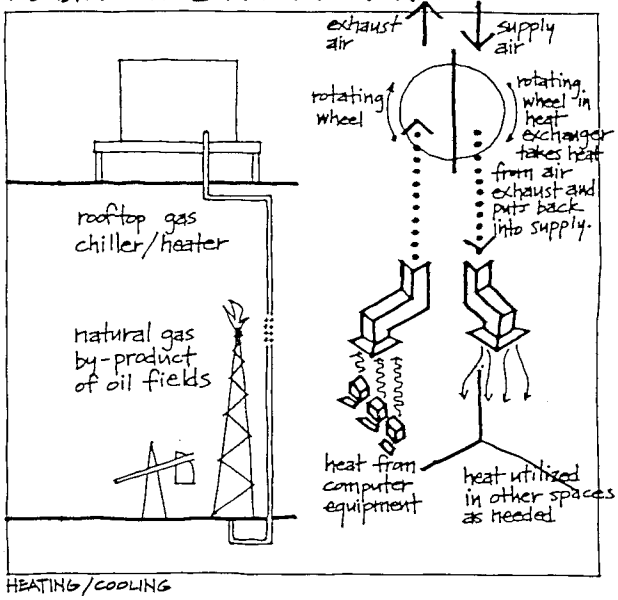
AIA President Susan Maxman is confident that citywide and regional efforts such as Chattanooga's will become more common as the green movement takes root. "Architecture is more than just about the design of facades," Maxman contends. "We are trained to look at the big picture, to see the forest from the trees. Now we must take that training further, to protect the forest *and* the trees."

—Edward Gunts

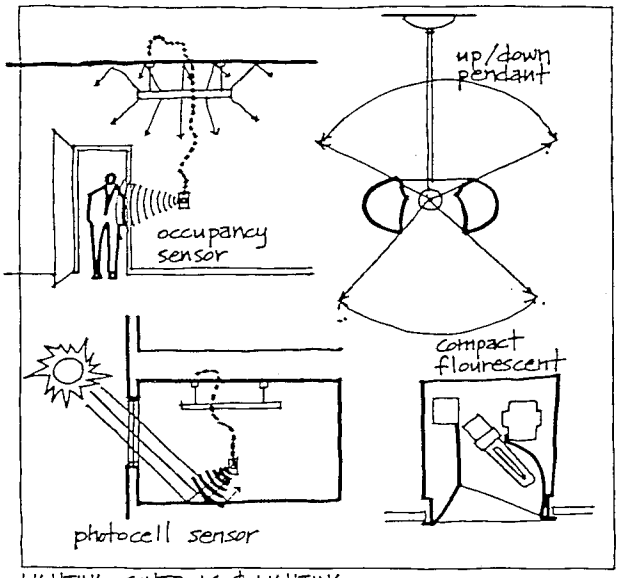
TECHNOLOGY-DRIVEN STRATEGIES: TOWARD A SUSTAINABLE ARCHITECTURE



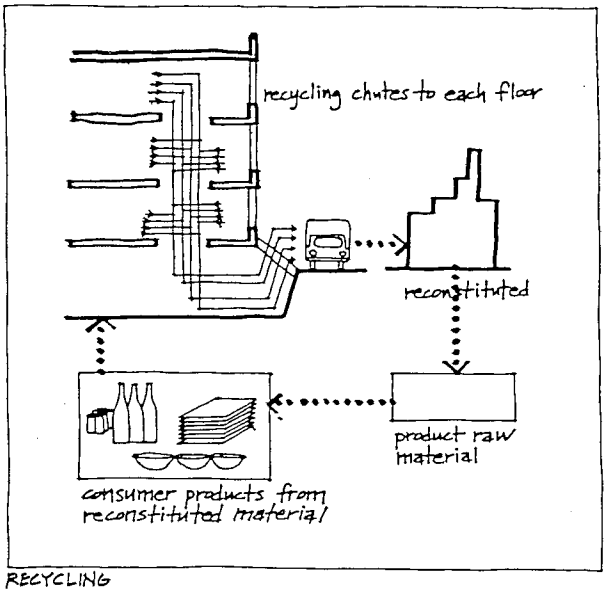
SITE SELECTION



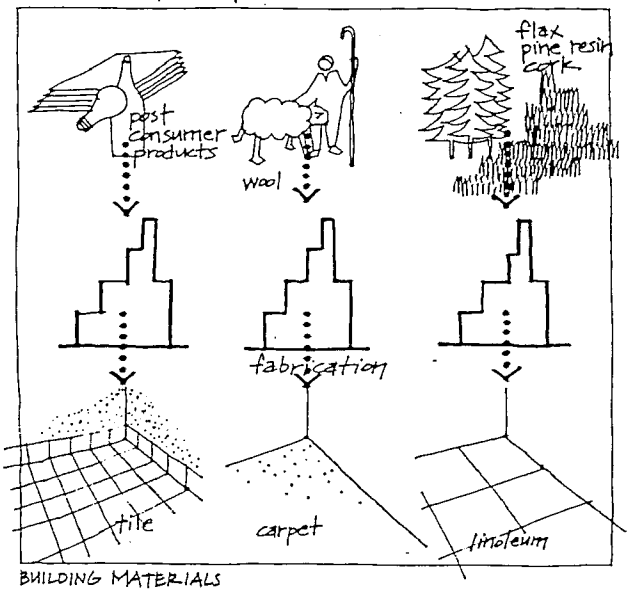
HEATING/COOLING



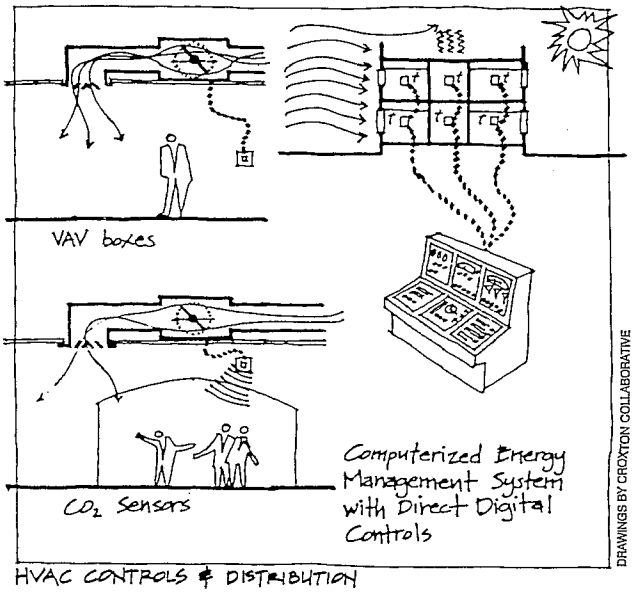
LIGHTING CONTROLS & LIGHTING



RECYCLING



BUILDING MATERIALS



HVAC CONTROLS & DISTRIBUTION

DRAWINGS BY CROXTON COLLABORATIVE

Boyne River Ecology Centre
Shelbourne, Ontario
Douglas B. Pollard Architects

CENTRE OF THE EARTH

TOP: View of Boyne River Ecology Centre from southeast shows entrance beneath curved canopy. Metal screens filter summer sun entering classrooms.
ABOVE: South facade is dominated by glazing of solar aquatic waste treatment room, which allows daylight to warm the interior of the facility.
FACING PAGE: Pitched roof is covered with sod. Lightning rod-topped lantern illuminates core of building; rooftop ducts are for air intake and exhaust.

A long tradition of teaching respect for God's green earth through nature walks and well-meaning lectures wasn't enough to satisfy Toronto's Board of Education in creating the Boyne River Natural Science School. The virtues of green architecture, the board reasoned, are best conveyed to students through firsthand experience.

They developed the idea for a new experiment in education—an ecology center that would embody up-to-the-minute principles of sustainability, low environmental impact, energy conservation, energy renewal, and healthy construction. The resulting Boyne River Ecology Centre, scheduled for dedication this month to coincide with the summer solstice, is a model of achievement for drawing on few resources and designing them to go a long way. "It was part of the initial concept of the building to reduce the consumption of energy as part of the strategy of conserving energy overall," explains Douglas Pollard, of the Toronto firm Douglas B. Pollard Architects, who designed the building in tandem with mechanical engineer Greg Allen of Allen Associates in Toronto.

The segmented, 16-sided form of the Ecology Centre draws on the tradition of Native Canadian lodges while providing a number of energy-related advantages. A round building is the most efficient form to warm using a central fireplace, since heat radiates outward; however, in this case, the infrequent need for a fire means that the fireplace serves a more ceremonial than a thermal function. The rounded form also allows for an efficient amount of the building's perimeter to be earth-sheltered. In addition, the center's nondirectional plan eliminates the need for corridors and space-consuming entry sequences. The Boyne River Ecology Centre is entered directly through a vestibule to the central circulation space, from which an arts-and-crafts room, nature studies room, and multipurpose classroom can be reached.

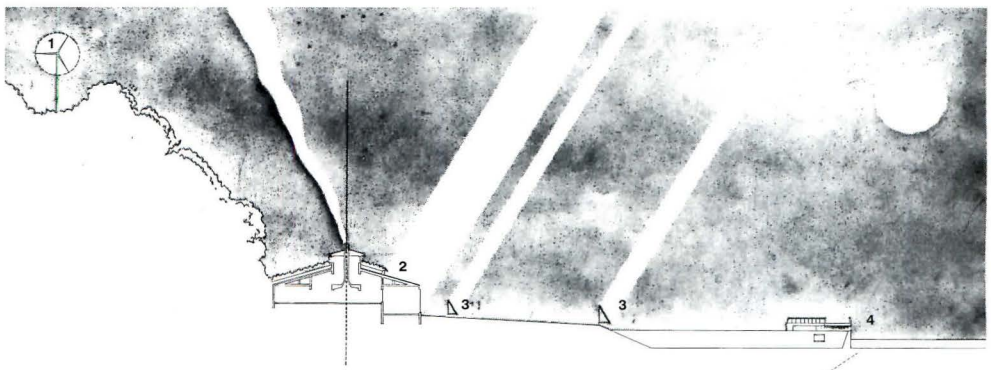
The center's high performance relies on a thermally efficient building envelope of glass and wood, which is dominated by the tempering effects of a large sod roof and an earth embankment that wraps the north-facing half of the building. Below-grade insulation applied to the walls, floor perimeter, and footings greatly reduces thermal losses, while evaporative cooling of the sod roof and ground exposure of the concrete slab floor temper the building in summer. Most of the exposed surfaces are south-facing windows, consisting of triple-glazed, double low-E, gas-filled units with low-conduction edge spacers and insulated frames. Virtual airtightness is achieved with a structural air barrier, non-CFC foam insulation, gasket detailing, and high-quality window seals.

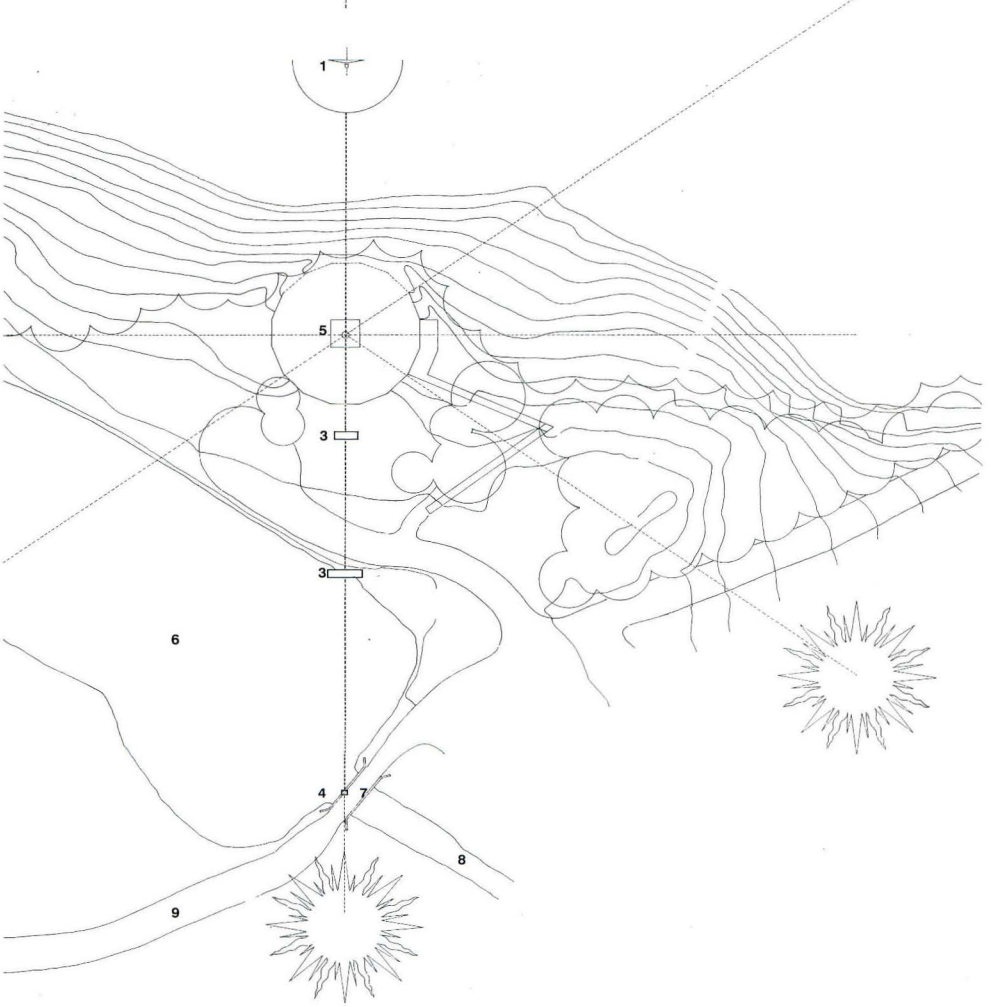
Because of the building's high thermal mass, large solar aperture, and high-performance windows, the center depends primarily on passive solar heating. A sunny vestibule/mud room on the east side of the building contributes further to solar gain and provides an ideal space for drying wet boots. Daylighting strategies include clerestories, light shelves, glass transoms, and translucent fiberglass ceilings in private spaces.

Backup heating is provided by the fireplace, which receives combustion air directly from outside through pipes beneath the concrete floor slab. Passive cooling is fostered through metal screens on the outside of the building (it is anticipated that they will someday be draped with vines) and natural ventilation, aided by interior partitions that stop short of the ceiling. Outside air is drawn into the building through the cupola and passes through an air-to-air heat exchanger, where it is warmed by outgoing air before being forced downward with high-efficiency fans to large perforated metal ducts on the classroom floors.

Pollard took full advantage of sun, water, and wind on the center's hillside site to generate a fully renewable electrical supply for the building. He placed a bank of photovoltaic cells unobtrusively behind the center, a small hydroelectric generator in a stream below, and a wind turbine atop a slender tower on the

BELOW: Rooftop solar panels heat water.
CENTER: Sod-covered roof is placed on axis with wind turbine and power plant.
BOTTOM: Small hydroelectric generator in nearby stream supplies electricity.
SITE SECTION: Steep site accommodates wind turbine, photovoltaics, and hydroelectric plant near the building.
FACING PAGE, TOP LEFT: Water trickles down corrugated fiberglass strips.
FACING PAGE, TOP RIGHT AND BOTTOM: Wastewater loses impurities as it flows through cylinders, a simulated marsh for filtering, and a display pond.



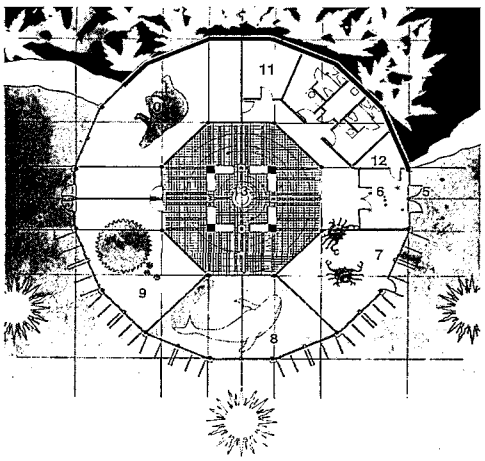


1 WIND GENERATOR
2 SOLAR HOT-WATER HEATER
3 PHOTOVOLTAICS
4 HYDROELECTRIC GENERATOR
5 SOD ROOF
6 POND
7 BRIDGE AND DAM
8 STREAM
9 ACCESS ROAD

SITE PLAN

SECTION: Smoke from fireplace exhausts through central chimney.
PLAN: Clay tile partition walls divide perimeter; center remains open for circulation and gatherings. Restrooms and storage are placed against hillside.
FACING PAGE, TOP: Classrooms feature linoleum floors, fluorescent lighting, and storage units shaped like crayons (left). Control panel and battery storage (right) demonstrate sustainability.
FACING PAGE, BOTTOM: Fireplace is sunken in center of circular enclosure.

NORTH–SOUTH SECTION



GROUND FLOOR

1 EARTH AGAINST NORTH SIDE INSULATES CONCRETE WALL
2 SOD ROOF
3 OPERABLE WINDOWS
4 GLAZED ROOF
5 ENTRANCE
6 VESTIBULE
7 NATURE STUDIES ROOM
8 SOLAR AQUATIC ROOM
9 ARTS-AND-CRAFTS ROOM
10 MULTIPURPOSE ROOM
11 BATTERY STORAGE
12 STORAGE ROOM
13 FIREPLACE ENCLOSURE

hill behind the Ecology Centre. Electricity from each of the three sources is stored in large batteries behind glass in a room at the rear of the center, where students can view the batteries but not tamper with them. Pollard notes that the diverse power sources are critical to year-round operation.

The primary electrical need is for task lighting, with compact fluorescents controlled individually by panels in each classroom. Larger fluorescent lamps are positioned above chalkboards in the classrooms, and low-voltage halogen lights illuminate circulation paths on the north side of the building. Restroom lights are triggered by motion sensors when someone enters the room; after seven minutes of stillness, the room goes dark. Hot water is generated in two ways: via solar collectors on the south roof and radiators placed beside the fire pit. The only other power requirements are for high-efficiency fans in the heat exchangers and a trickle pump used in the building's sewage treatment system.

The most ambitious aspect of the Ecology Centre is its solar aquatic waste treatment system, which releases cleaner water than it takes from the site. Isolated in a glass-enclosed space on the center's south facade, the waste treatment system is both a functional dividend and an important teaching tool. The brainchild of Falmouth, Massachusetts-based biologist John Todd, this "living machine" is designed to recycle the water from its 800-gallon-per-day capacity operation. Raw sewage cycles through four sealed equalization tanks before being pumped into the tallest of 17 clear plastic cylinders arranged in a spiraling configuration. Gravity alone draws the water from cylinder to cylinder; then into an interior marsh for filtering; and, last, to a display pond where native plants and animals are exhibited. As the water trickles down through the cylinders, diverse ecosystems develop as each tank progressively supports increased numbers of bacteria, algae, protozoa, aquatic worms, snails, clams, and fishes—as well as aquatic plant life.

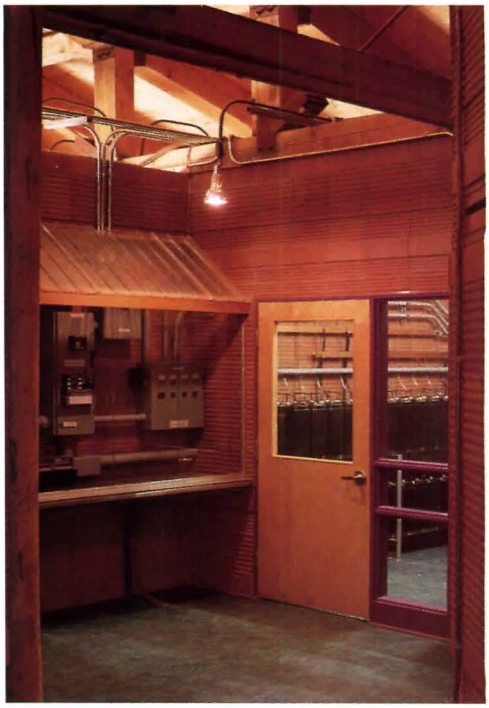
Pollard placed a high priority on the use of natural materials for the center. Materials for interior finishing were selected for durability; low gas-emission characteristics; and maintenance with nontoxic, mild soap and water, which keeps the indoor air healthy. The floor is covered in linoleum; room partitions are built of clay tile; the building is constructed of untreated timber framing; interior wood siding is finished with beeswax; paints are nontoxic; and all exterior stains are water-based.

In addition to its eco-sensitive features, the Ecology Centre exhibits a design sensibility that has less to do with backwoods simplicity than with urban sophistication. Pollard worked to challenge his client's preconceptions of a rustic building rendered in earth tones with a rich color palette. Curved fuchsia masonry walls that enclose the hearth in the building's core are punctured with triangular openings. Ten shades of linoleum used in the building are cut into a variety of playful forms, from trees on a mountaintop to a sweeping bird that appears Inuit-inspired.

Pollard's contemporary expression is appropriate, considering that the students who come here—some 70 miles from downtown Toronto—are children of the city. But while the surface embellishment of the Boyne River Ecology Centre can rightly reflect design attitudes of today, the real lessons to be learned from spending time in this humble place speak louder, and more profoundly, about the world tomorrow. —*Vernon Mays*

BOYNE RIVER ECOLOGY CENTRE
SHELBOURNE, ONTARIO

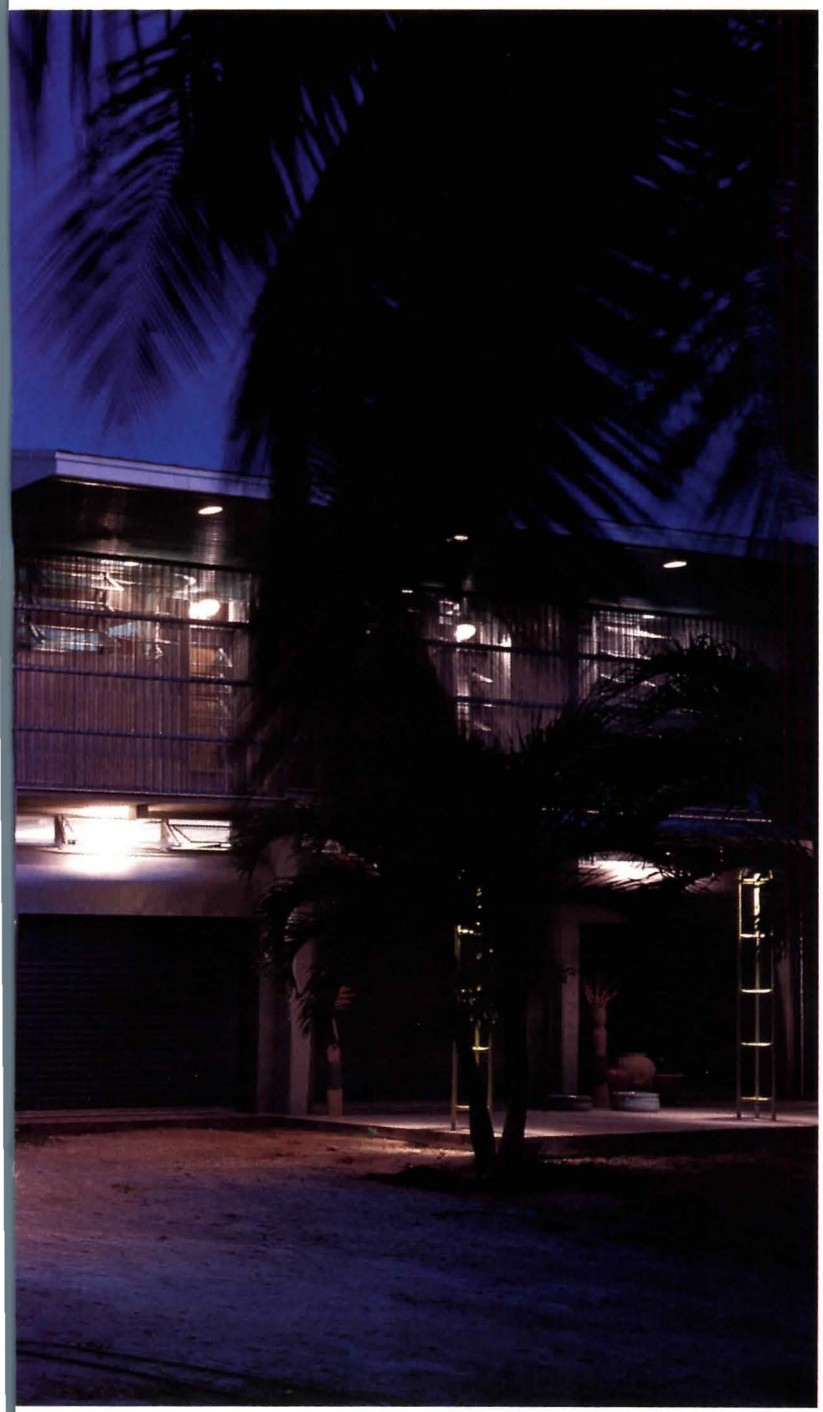
ARCHITECT: Douglas B. Pollard Architects, Toronto, Canada—Douglas B. Pollard (principal, project architect); Andrew Thorpe, William Weima (design team)
ENGINEERS: Allen Associates (structural/mechanical/electrical); Ocean Arks International (solar/aquatics)
CONSULTANT: Trehin Engineers
CONSTRUCTION MANAGER: Clemmensen + Associates
COST: $1.5 million (Canadian)
PHOTOGRAPHER: Jeff Goldberg, Esto

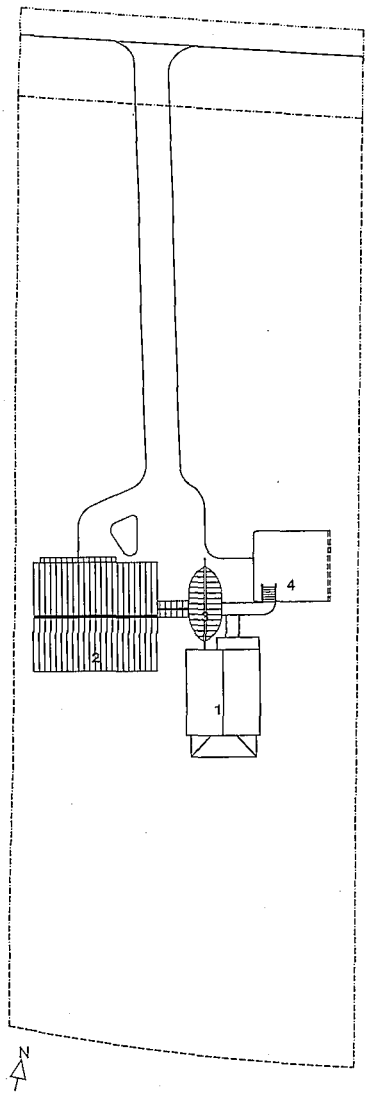


Levy/Kaminstein House and Studio
Islamorada, Florida
Jersey Devil, Architect

SEA BREEZE

THESE PAGES: Jersey Devil's live/work complex comprises a carport topped by an Airstream trailer (far left), an historic cottage, a stair tower, and a pottery studio beneath bedrooms and laundry.
BELOW: Galvanized steel stair tower links second-story bedrooms above pottery shed to cottage.
BOTTOM: Canvas canopy shades ocean-facing, southeast side of recycled 1936 cottage, which houses living room, kitchen/dining area, and office.





SITE PLAN

1 1936 COTTAGE
2 STUDIO/BEDROOMS
3 STAIR TOWER
4 1936 CARPORT

Like a coral necklace, the Florida Keys swing from the tip of the United States' southernmost peninsula, reaching toward Havana. Although linked by a well-travelled road to Key West, the Keys attract those who prefer to live on boats or distant islands, cut off from electricity and a freshwater pipeline. Such Thoreauvian conditions foster backwater communities where lighting, refrigeration, and electronic media are powered by photovoltaics, and water is collected in cisterns. Although August temperatures may climb to 100 degrees, inhabitants of these narrow islands are never far from ocean breezes, and for many who come here for the climate, such natural air conditioning is preferable to artificial climate control.

The latest house by Jersey Devil—a peripatetic band of design-build architects who camp out at their construction sites—is not in a backwater community, but along the main highway, with easy access to water and electricity. Yet for transplanted New Yorkers Ron Levy and Beth Kaminstein and their preschool-age daughters, Brieze and Stellar, the complex is a remote dwelling and studio.

Steven Badanes, who established the New Jersey-based firm Jersey Devil in 1972, is the first to admit that his latest house is far from sustainable architecture. "The materials are concrete blocks and aluminum," Badanes assents, "whose manufacture contributes to 20 percent of global warming." Yet the architect defends his materials as contextual, durable, and offering thermal mass as protection from solar radiation.

And in terms of energy usage, "the house is very sustainable," insists Jersey Devil partner James Adamson. The complex recycles a 1936 cottage and carport; includes a refurbished, existing cistern; features a solar-powered hot-water heater; and requires no air conditioning. In a climate where leather shoes grow mildew in closets, the last accomplishment is a tour de force.

The cottage, which encloses living and kitchen/dining rooms, is the point of departure for the four-part complex. Adjacent is a new building housing a ground-floor pottery studio and three bedrooms, two bathrooms, and a laundry above. To the east is a carport, and rising among these disparate elements is a 35-foot-tall stair tower, clad in corrugated, galvanized steel, which joins the living units and offers views of the Atlantic and Florida Bay. In combining bold metallic forms with vernacular materials, Jersey Devil has created a compound that is exactly right for the Keys, where tin roofs once were common. Wrapping the northwest side of the complex, a "living screen" of galvanized steel rib lath will support vines, providing shade, oxygen, and a buffer against highway noise and vehicular fumes. "The living screen makes the house breathe," Adamson maintains.

The program for the 2,400-square-foot new volume was dictated by the county, which requires that new living space be 10 feet above sea level. Jersey Devil tucked a pottery workshop into the first floor and placed three bedrooms above. A radiant barrier in the roof deflects solar radiation. On the second story, a vaulted plywood ceiling covers the living quarters; screened doors allow ocean winds to sweep through, follow the arch of the ceiling, and exit through opposite clerestories.

Badanes points out that environmentally responsible architecture requires trade-offs. For example, Jersey Devil chose hurricane-resistant, local concrete over more ecologically responsible fly ash masonry units, which would have required more energy to transport. "We're not exactly digging up marble in Vermont, shipping it to Italy, then cladding an office building," defends Badanes. Indeed, compared with firms designing large-scale projects, Jersey Devil has little to be ashamed of: The architects park their Airstream trailers on the site and walk to work. Adds Badanes, "We try to build our designs to last a long time, require no maintenance, and conserve energy. It's hard to cover all the bases, but we're doing the best we can." —*Heidi Landecker*

SITE PLAN: Complex is located between Highway 1 and Atlantic Ocean.
BELOW LEFT: Pottery studio in new building opens with roll-up doors.
BELOW CENTER: Balcony is flanked by steel rib lath "living screen."
BELOW RIGHT: Curved wall in shower directs ocean breezes.
SECTION: Vaulted ceiling directs air circulation through clerestories.
PLANS: Oval stair tower is the centerpiece of the four-part compound.

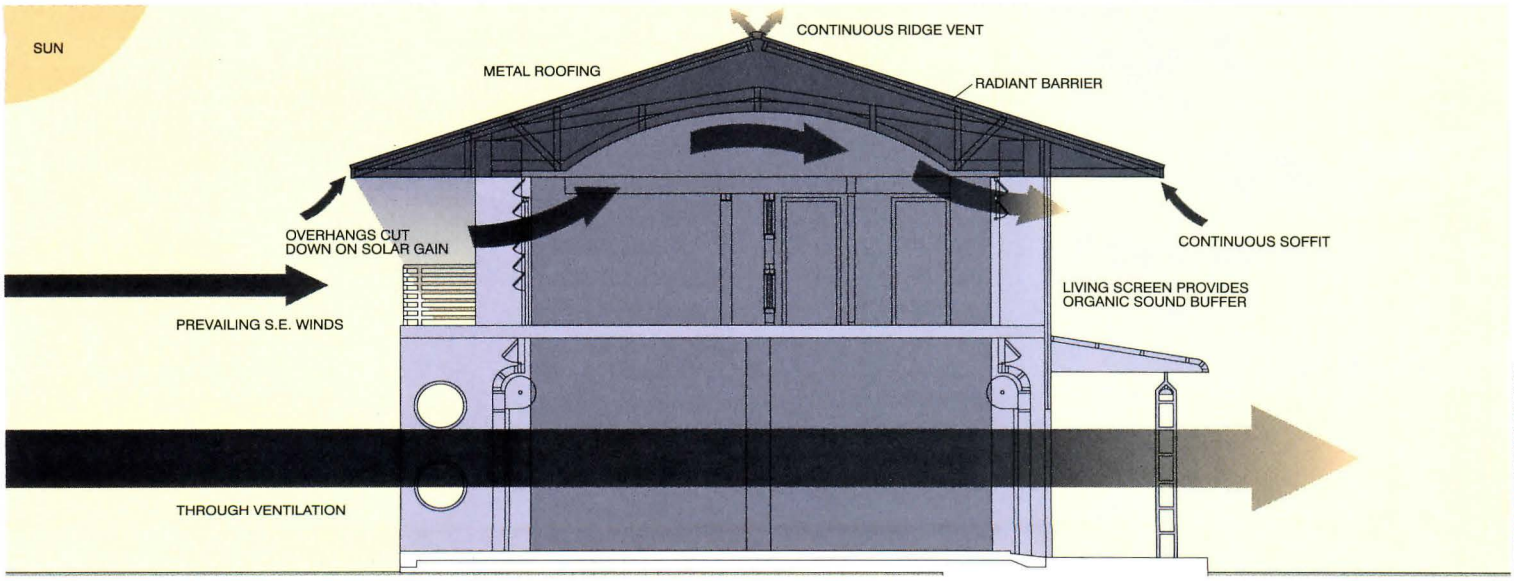
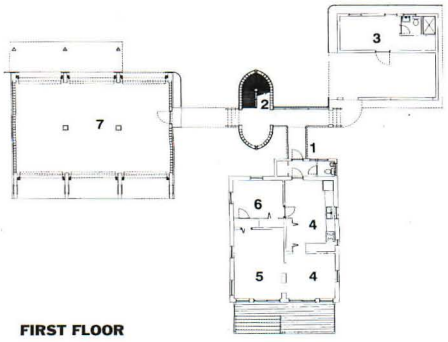
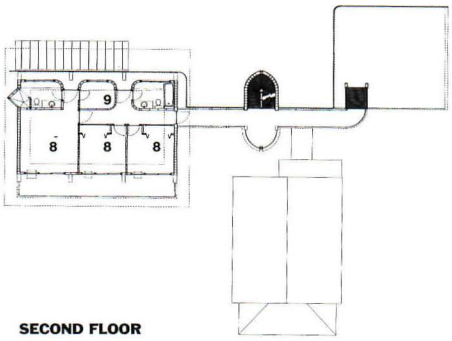


ILLUSTRATION BY RON CODDINGTON



FIRST FLOOR



SECOND FLOOR

1 ENTRANCE
2 STAIR TOWER
3 CARPORT
4 KITCHEN/DINING
5 LIVING ROOM
6 OFFICE
7 STUDIO
8 BEDROOM
9 LAUNDRY

LEVY/KAMINSTEIN HOUSE AND STUDIO
ISLAMORADA, FLORIDA

ARCHITECT: Jersey Devil, Architect–James Adamson, Steven Badanes (principals-in-charge)
ASSOCIATE ARCHITECT: Taxis, Inc.—Brad Schiffer
ENGINEER: Colville Consulting Engineers *(structural)*
GENERAL CONTRACTOR: Owners and Jersey Devil, Architect
PHOTOGRAPHER: Bill Sanders

National Audubon Society
New York City
Croxton Collaborative, Architect

URBAN OASIS

ABOVE: Croxton Collaborative recycled an 1891 department store in lower Manhattan into the National Audubon Society's headquarters. The masonry and brownstone facade was cleaned primarily with a water wash.
FACING PAGE: Reception desk is constructed of certified mahogany and maple. Reception area is daylit through skylight. Pilasters surrounding windows echo articulation of exterior.

When Peter A.A. Berle, president of the National Audubon Society, marshalled his environmental advocacy group to stop the construction of the James Bay dams in Quebec, the society's new offices in lower Manhattan proved a powerful weapon. Designed by New York's Croxton Collaborative, the Audubon Society headquarters is a model of energy efficiency, optimum indoor air quality, and resource conservation at reasonable cost. This achievement, Berle argues, proves eco-sensitive architecture can help reduce our growing appetite for electricity and, as a consequence, eliminate the need for ruinous hydroelectric developments such as James Bay.

The James Bay battle isn't over, though the dams project did suffer an Audubon-assisted setback when the state withdrew its contract to buy Hydro-Quebec power. More decisively successful is the Audubon headquarters, 97,000 square feet of renovated office space that sets a new national standard for an environmentally sensitive workplace.

At first glance, there's nothing militant about the interior design because the Croxton Collaborative's environmental innovations are virtually invisible. Instead of being located in a sleek, high-tech building, the society's offices are housed in a weathered, neo-Romanesque structure of brownstone, glazed brick, terra-cotta, and cast iron designed by George Browne Post, the architect of the New York Stock Exchange. Opened in 1891 as a fashionable department store on lower Broadway, the building more recently crumbled into disrepair, allowing Audubon to buy the building and its land for $10 million, a little more than the value of the land alone. The nonprofit organization's decision to recycle an old building instead of constructing a new one preserved tons of steel, masonry, and concrete, as well as the costs and consumption of new materials.

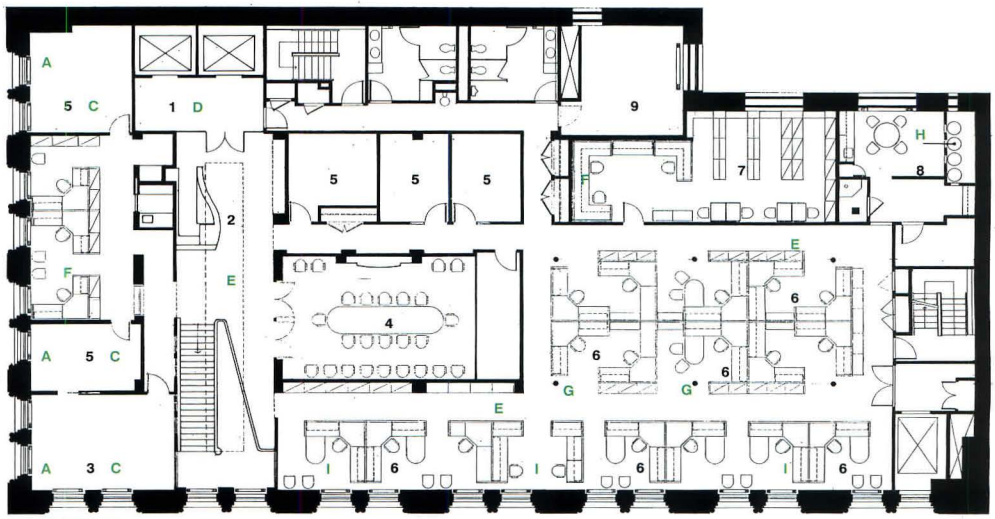
The Audubon Society occupies the upper five floors of the eight-story building, which features a new rooftop conference room and garden terrace. Architect Randolph R. Croxton and his partner Kirsten Childs, an interior designer, transformed each floor, divided by cast-iron columns, into airy work oases. Typical floors combine open, low-walled workstations and glazed perimeter offices, affording the society's 142 employees spectacular views of lower Manhattan's grand and gritty cityscape. Spiral stairways connecting floors not only encourage occupants to interact, but also reduce wasteful elevator operation.

Audubon's ultimate power stems from the Croxton Collaborative's commitment to a dense, nuanced layering of environmental strategies. The firm and its engineers, Flack & Kurtz, rejected high-tech hardware for hard-knocks knowledge of building systems. "Our success at Audubon," Croxton explains, "was achieved by upgrading the thermal shell, using a gas-fired heater/chiller and variable-speed fans and motors, and creating a highly efficient lighting system."

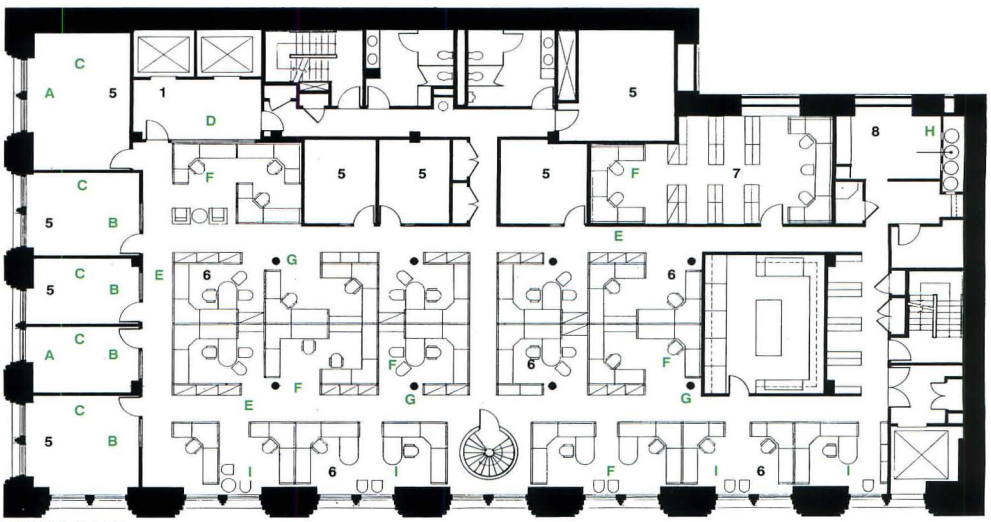
The result is a building that consumes 62 percent less total energy than if the architects had followed the 1990 New York State Energy Code. This design tactic translates into tremendous savings: For every $10 that Audubon would have spent on energy, the society now spends $4; the total savings, according to Croxton, will be $100,000 per year. This energy conservation was possible because the National Audubon Society decided to devote more of its $14 million building budget to high-quality environmental systems than to the luxurious materials and fitments that usually characterize a national headquarters. The strategy led to a market-price building that cost $142 per square foot for demolition, extensive site work, and construction.

While Croxton and Childs offer dizzying arrays of financial and environmental statistics to promote their environmental approach, they always return to a kind of philosophical questioning when discussing their design methods. "What are the consequences of deciding to build?" asks Croxton. Adds Childs, "What are the effects of our decisions

FACING PAGE: Ballasts above reception area power 40-foot-long tubular, metal-halide fixtures over stairway.
PLANS: Typical floor has both open and perimeter offices and spiral connecting stair. Eighth-floor plan shows reception area and main conference room.
BELOW: Richard Meier-designed wall sconces add sparkle to reception area.
CENTER: Undyed wool carpeting was applied with tackless strips.
BOTTOM: Floor tile in public lobbies incorporates 60 percent recycled glass.



EIGHTH FLOOR



TYPICAL FLOOR

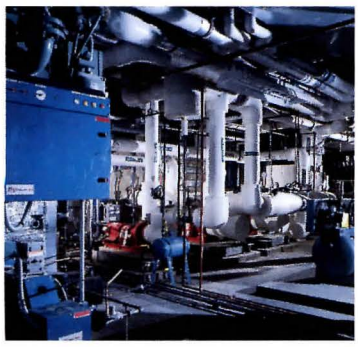
1 VESTIBULE
2 RECEPTION
3 PRESIDENT'S SUITE
4 CONFERENCE ROOM
5 OFFICE
6 WORKSTATION
7 LIBRARY
8 PANTRY/LOUNGE
9 MECHANICAL ROOM

A OPERABLE HIGH-PERFORMANCE WINDOWS
B PARTITIONS WITH CLERESTORY WINDOWS
C PHOTOCELL SENSOR-CONTROLLED LIGHTING
D FLOOR TILES INCORPORATE RECYCLED GLASS
E UNDYED WOOL CARPETS

F OFFICE FURNITURE TESTED FOR OFF-GASSING
G CAST-IRON COLUMN
H RECYCLING CHUTES
I OPEN OFFICES ALONG SOUTHERN EXPOSURE MAXIMIZE DAYLIGHT

BELOW: Rooftop was transformed into new penthouse by extending steel columns from existing cast-iron columns and floating a metal deck and concrete floor over the roof.
CENTER: Roof now supports stucco-faced conference room, elevator tower, and mechanical room, as well as aluminum-slatted terrace.
BOTTOM: In rooftop mechanical room, gas-powered heater/chiller doesn't emit ozone-depleting gases.

OTTO BAITZ PHOTO



on the people who work in our buildings?" Audubon's air-handling system, for example, balances technological efficiency with psychological well-being. In order to increase the flow of outside air within the offices, Croxton boosted the air-handling system to circulate 26 cubic feet of air per minute—substantially better than existing standards, but offering less energy efficiency than would be possible with less ventilation. The designers also replaced the windows with new operable units. "People feel trapped," Croxton contends, "when they can't open the windows."

Croxton made up for energy loss by specifying eco-savvy windows: Two layers of 1/4-inch clear glass enclose a double-coated, 2-mm-thick rigid polyester film, whose outer coating lets in 70 percent of the daylight. Moreover, Croxton and Childs varied the inner coat throughout the building in response to different orientations of the glass. Their strategy is designed to block the sun's heat in summer, retain indoor heating in winter, and maximize daylighting year-round.

Letting the sunshine in is not the only means of lighting the offices. Croxton designed a system of artificial illumination as the greatest source of energy savings, representing more than 40 percent of the total. The designers specified circular downlights, wall-mounted units, and ceiling pendants to add visual variety to the building. Office lights, controlled by heat-sensors, are activated when a visitor enters a space; and they are turned off six minutes after the room is vacated. Photoelectric cells allow perimeter lights to dim in accordance with natural light entering the windows.

Virtually all light fixtures in the building incorporate relatively new T-8 fluorescent tube lamps, which feature a phosphor coating that warms the light so that it appears close to the color of daylight. And because T-8s have electronic ballasts, they pulse 20,000 times per second, eliminating any sense of flicker. While this element may seem minor, it underscores the level of subliminal detail that the Croxton Collaborative considers in order to achieve a psychologically friendly office.

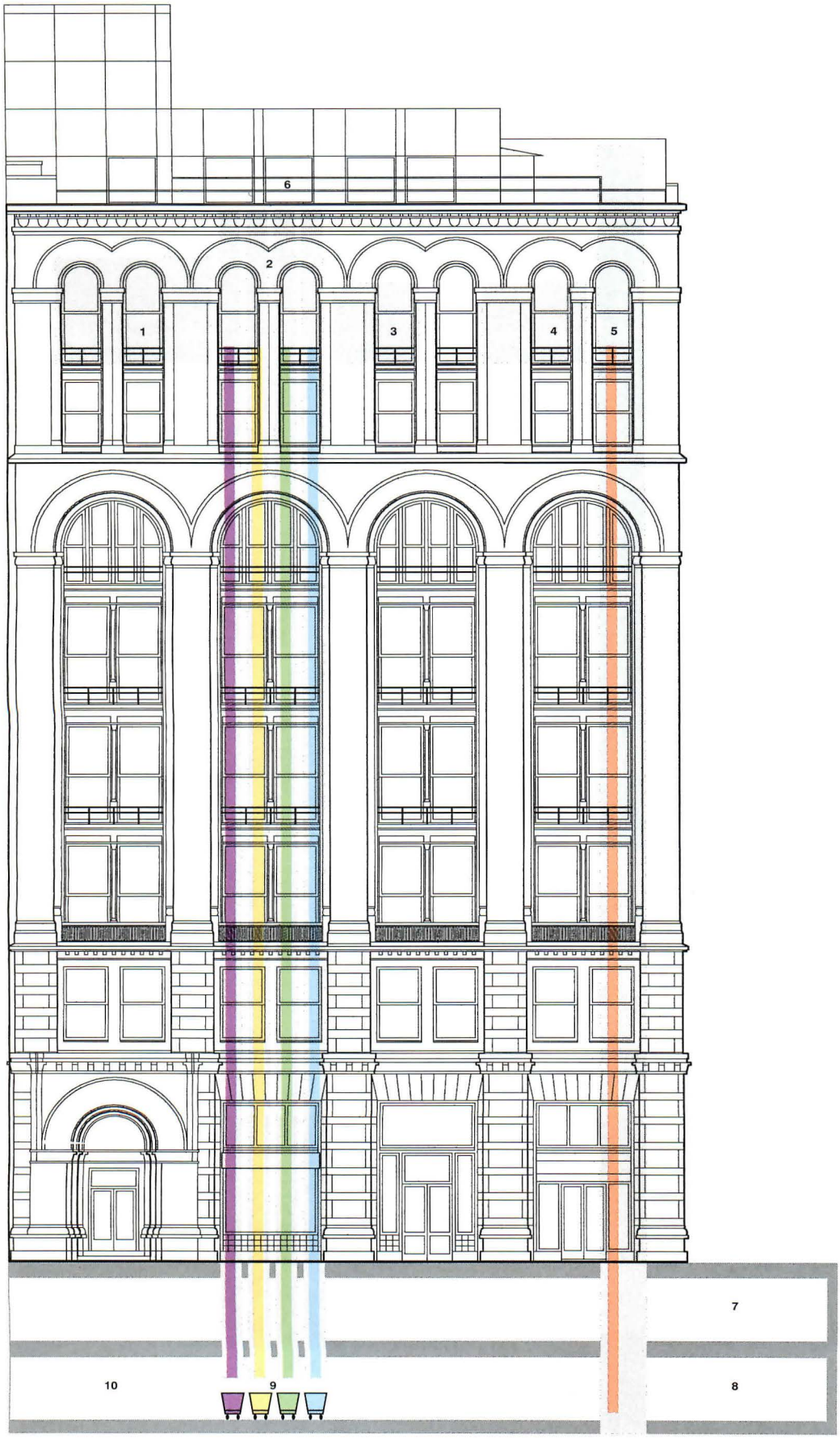
Similarly, materials were chosen with an eye to resource conservation. Croxton and Childs studied the toxicity and manufacturing history of every element. They fireproofed the existing walls with recycled cellulose and specified tile with recycled glass for public lobbies. They rejected plywood to level existing floors because it gives off formaldehyde gas and instead installed fiberboards of recycled newsprint. Paints without carcinogenic volatile organic compounds were applied to walls. And rather than simply specifying nonendangered woods, Childs worked with the Rainforest Alliance's Smart Wood program to choose species that are certified as sustainably harvested (pages 117-119).

Audubon's commitment to resource conservation extends to employees, who follow a precise recycling regimen. Each floor has a staff lounge outfitted with recycling chutes for high-quality paper; mixed paper; redeemable metal and plastic containers; and organic garbage, which is used as compost for the rooftop terrace. These chutes descend to a recycling center in the subbasement to process refuse before leaving the building.

While the Audubon headquarters is the largest and most sophisticated of Croxton Collaborative's eco-sensitive efforts to date, it's not the first. In 1988, the firm redesigned the offices of the Natural Resources Defense Council (NRDC), a nonprofit environmental group in New York's Flatiron District. NRDC's 31,500-square-foot renovation proved ideal training ground for the larger Audubon building. At NRDC, the firm and the client established the standard that all selected materials and systems be on the market for at least one year in order to prove their engineering and financial viability and that energy-efficient technologies pay for themselves in three to five years.

The National Audubon Society and NRDC are the Medicis of green architecture. "In both cases," Childs points out, "we had clients who actively sought to put their money where their mouths were, resulting in real-life buildings that prove eco-sensitive design is cost effective." For the average architect, who often faces such urban office renovations, the new Audubon headquarters proves that environmentally sensitive design is readily achievable with considerable vigilance and follow through. Both projects required the firm's constant surveillance, even when it came to routing out errant workers using toxic compounds on the job. Croxton and Childs are now collaborating with Audubon's chief scientist, Jan Beyea, on a manual based on the building's integrated approach to design.

Although it seems ironic and downright contradictory to create an environmentally friendly building in ultrapolluted, fossil-fueled Manhattan, the Croxton Collaborative's latest project proves that a green workplace can be built anywhere. All that's required of architects, owners, and occupants is a desire to expand design priorities and value our imperiled environment. *—Donald Albrecht*



WEST ELEVATION: Organic material, paper, cans, and plastics reach subbasement recycling center through chutes that extend from each floor of the headquarters.
BELOW: Chutes for recyclables are constructed of steel tubes enclosed in a fire-rated gypsum wallboard enclosure.
CENTER: Trash from each floor is collected from chutes in basement.
BOTTOM: Staff lounges on every floor are outfitted with recycling chutes.

OTTO BAITZ

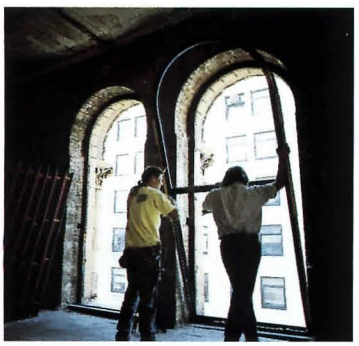
OTTO BAITZ

1 TYPICAL STAFF AREA
2 RECYCLING CHUTES
3 TYPICAL COPY ROOM
4 TYPICAL SERVICE LOBBY
5 SERVICE ELEVATOR
6 ROOFTOP VENT FOR CHUTES
7 BASEMENT
8 SUBBASEMENT
9 RECYCLABLES SEPARATED AND PACKED
10 ORGANIC MATERIALS TO COMPOST

ORGANIC MATERIAL
MIXED PAPER
ALUMINUM/PLASTIC
WHITE PAPER
NEWSPAPER/GLASS

FACING PAGE: Arched, operable windows are double-glazed with a wavelength-selective film between the two panes.
RIGHT: Fluorescent pendant fixtures over workstations provide ambient light.
SECTION: Low workstations at windows let natural light penetrate.
CENTER: The designers varied the inner coat of eco-savvy film in response to different orientations of the glass.
BOTTOM: The building was insulated with cementitious foam that is free of CFCs and formaldehyde.

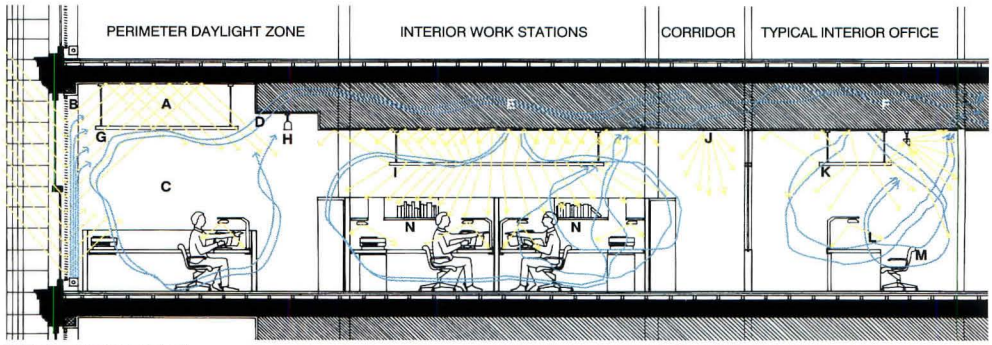
OTTO BAITZ



OTTO BAITZ

OTTO BAITZ

- A CEILING FIXTURES OFF AT 60-70 PERCENT OF OPERATION
- B HIGH-PERFORMANCE WINDOWS REDUCE NEED FOR PERIMETER HEAT AND REDUCE CONDENSATION AT WINDOWS; LOCAL DISCOMFORT IS REDUCED, THEREFORE NO PERSONAL HEATERS OR FANS ARE REQUIRED
- C QUANTITY OF OUTSIDE AIR IS 26 CFM/PERSON
- D INCREASED DISCHARGE POINTS ENSURE FULL MIXTURE OF AIR
- E VELOCITY OF AIR IS BELOW 500 FPM TO MINIMIZE MOISTURE CARRY-THROUGH (BACTERIA AND FUNGI)
- F HIGH NUMBER OF TOTAL AIR CHANGES/HOUR AND INCREASED FILTRATION CREATE COMFORT AND GOOD INDOOR AIR QUALITY
- G PENDANT, DIRECT/INDIRECT (2) 4-FT. LAMPS: 62 WATTS
- H 2-LAMP COMPACT FLUORESCENT MONOPOINT: 35 WATTS
- I PENDANT, DIRECT/INDIRECT (3) 4-FT. LAMPS: 89 WATTS
- J RECESSED 2-LAMP COMPACT FLUORESCENT
- K PENDANT, DIRECT/INDIRECT (1) 4-FT LAMP, 30 WATTS
- L NONTOXIC FINISHES ON WOOD SURFACES
- M SEATING WITH RECYCLED CONTENT
- N ADJUSTABLE UNDER-SHELF FLUORESCENT



NORTH-SOUTH SECTION

OTTO BAITZ

NATIONAL AUDUBON SOCIETY
NEW YORK CITY

ARCHITECTS: Croxton Collaborative, New York City—Randolph R. Croxton (director, architecture); Kirsten Childs (director, interiors); Lauren Reiter (project architect); John Van Aken (project manager); Thanne Dispenza (interior designer)
ENGINEERS: Robert Silman & Associates (structural); Flack & Kurtz (mechanical/electrical), Peter Flack (principal); Jordan Fox (project manager)
CONSULTANTS: Building Conservation Associates (restoration); Flack & Kurtz (lighting)
GENERAL CONTRACTOR: A.J. Contracting Company
COST: $13.9 million; $142/square foot
PHOTOGRAPHER: Jeff Goldberg/Esto, except as noted

Moore House
Northern Connecticut
Alfredo De Vido Associates

IN NATURE'S ARMS

Richard and Noriko Moore camped out on their northern Connecticut land for seven years before deciding what kind of house they wanted to build and where to site it. Living like hobos in a small tool shop with only a wood-burning stove and a propane burner, they finally decided on a south-facing knoll overlooking a pond they built in 1983. But to the couple who had come to know every oak tree and stone fence on their 37 acres, building a house on top of the hill seemed too intrusive; they decided to build within it. "We didn't want a house sitting on the terrain; we wanted it to be of the terrain," Richard Moore, a graphic and industrial designer, explains.

To help him design an earth-sheltered house tucked into the knoll, Moore contacted New York architect Alfredo De Vido, who has been designing passive solar houses for two decades. Although De Vido had never before built an earth-sheltered structure, his collaboration with the Moores was natural: Both architect and designer once lived in Japan; and Noriko, a weaver, is Japanese. De Vido and Moore had also collaborated on an energy-efficient demonstration house commissioned by Con Edison in Briarcliff, New York, in 1981.

Constructed on the south side of a concrete retaining wall that keeps the knoll at bay, the one-story post and beam house is supported by oak timbers that were cut from the site and allowed to weather a year. To clad interior and exterior concrete walls at the entrance and southeast facade, Richard Moore hand-picked fieldstones from local fences, built by Connecticut farmers who cleared the land two centuries ago. The roof, which provides extra insulation against New England's freezing winters, comprises multiple layers of plywood, pine planks, absorbent clay panels, polyethylene sheet, gravel, fabric, and earth and weighs as much as 250 pounds per square foot.

The 2,200-square-foot house is arranged along a 60-foot-long, east-west corridor that divides living spaces from garage, entry court, and studio. All the rooms are positioned south of the spine except the studio, which is separated by a stone-faced partition from the adjacent entrance court. A two-car garage occupies the northeast corner of the site.

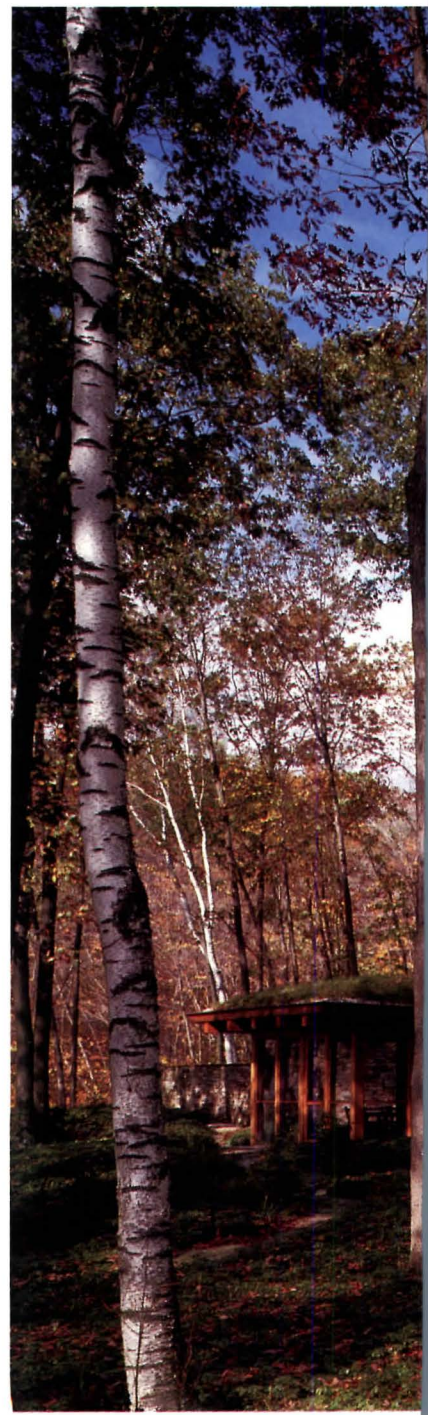
An earth-sheltered house evokes images of a dark, gloomy cave. But De Vido installed no fewer than 33 skylights and faced the southern facade entirely with glass, opening the view to the pond and its surrounding clearing in the woods. Even on a misty spring afternoon, the house is suffused with natural light.

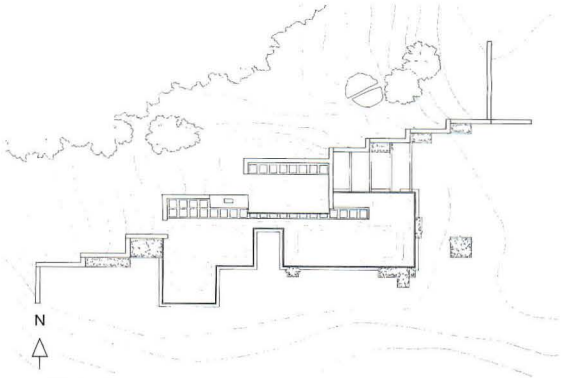
The central spine is daylit and ventilated by skylights, which are operable. When windows in the living room are open during hot summer days, the open skylights along the corridor siphon warm air up and out, keeping the air circulating. A 3-foot roof overhang along the south-facing window wall also shades the facade from the sun. No air-conditioning system has been installed in the house, and according to Moore, artificial cooling is unnecessary.

In winter, heating is accomplished by a conventional oil-burning forced-air system, as well as a radiant heat system that warms the slate floor. The insulation provided by the earthen roof means fuel savings for the Moores, who occupy the house most of the winter.

Die-hard conservationists might argue that the Moore house fails the test of sustainable architecture because of its southern pine ceiling panels and cherry parquet floor, both of which travelled long distances to Connecticut. Concrete, which requires energy to manufacture, constitutes the entire north side of the house. Yet by building primarily with local materials and creating a structure that nestles in the forest rather than intruding upon it, De Vido has achieved one of the most difficult challenges of architecture. The Moore house is so in tune with its site that it is not even visible from its own driveway. As Malcom Wells, the guru of the earth-sheltered movement, writes in *An Architect's Sketchbook of Underground Buildings,* "Rather than stand alone in contrast to nature, underground architecture lies in her arms."

—Heidi Landecker



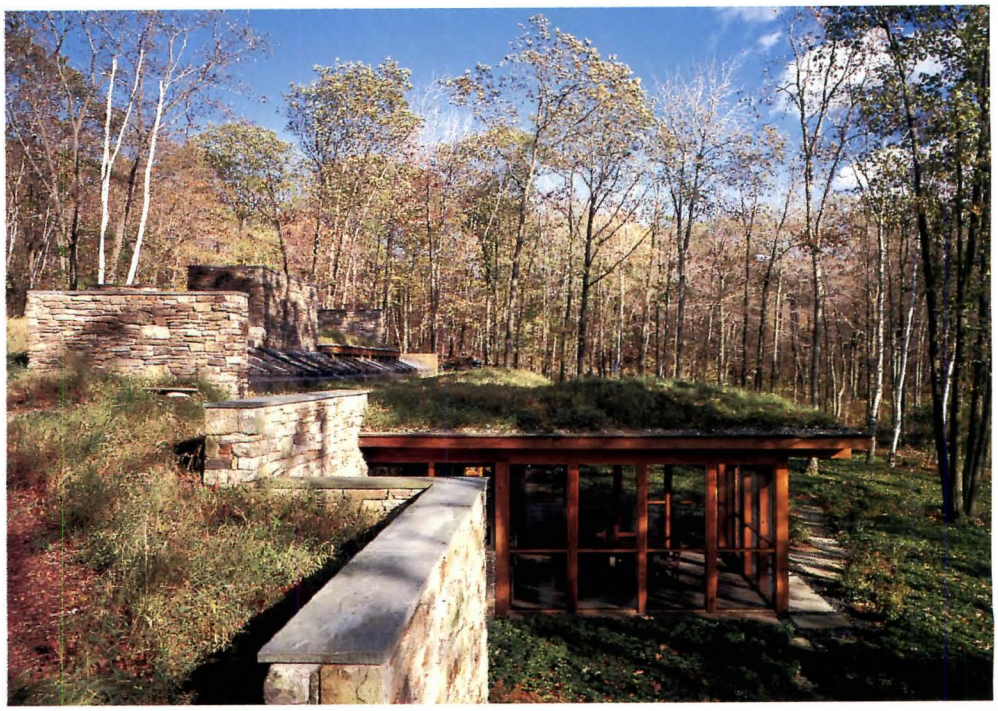


SITE PLAN

SITE PLAN: Concrete retaining wall zigzags along the north side of the house, holding back a woodland knoll. Skylights punctuate east-west corridor, with living rooms positioned on south side, studio on the north.

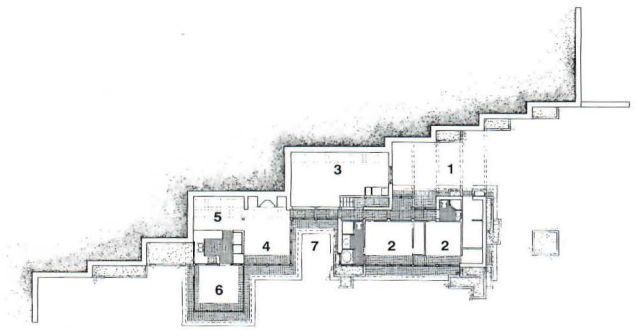
BELOW: Constructed of oak timbers from the site and native fieldstone, the earth-sheltered house exposes south-facing windows. Roof vegetation includes *indigenous grasses, plantings,* and wildflowers.

TOP: Concrete retaining wall is clad in fieldstone. Parapet wall adds support for earth-covered roof. Fireplace chimney extends behind skylights.
BOTTOM: Entrance court is inserted between retaining wall and bedrooms.
PLAN: East-west spine culminates in dining room. Living room and master bedroom embrace garden court.
ROOF DETAIL: Water-absorbing bentonite, polyethylene, extruded polystyrene, gravel, fabric, and earth form multiple layers over structure of pressure-treated plywood and 2-by-6, tongue-and-groove pine decking.
FACING PAGE, BOTTOM LEFT: Oak timbers in living room are spaced on 3-foot, 4-inch column grid. South-facing windows give way to forest site. Fabric ceiling panels by weaver Noriko Moore screen lighting.
FACING PAGE, BOTTOM RIGHT: Along skylit corridor, natural elements include slate floors, fieldstone fireplace, and oak beams. In dining area, sandblasted concrete retaining wall is exposed.



MOORE HOUSE
NORTHERN CONNECTICUT

ARCHITECT: Alfredo De Vido Associates, New York City—Alfredo De Vido (principal); David Cook (project assistant)
LANDSCAPE ARCHITECT: Edmund Hollander Design
ENGINEER: Paul Gossen (structural)
GENERAL CONTRACTOR: Richard Moore
PHOTOGRAPHER: Norman McGrath



1 ENTRANCE COURT
2 BEDROOM
3 STUDIO
4 LIVING ROOM
5 KITCHEN/DINING ROOM
6 SCREENED PORCH
7 GARDEN COURT

FLOOR PLAN

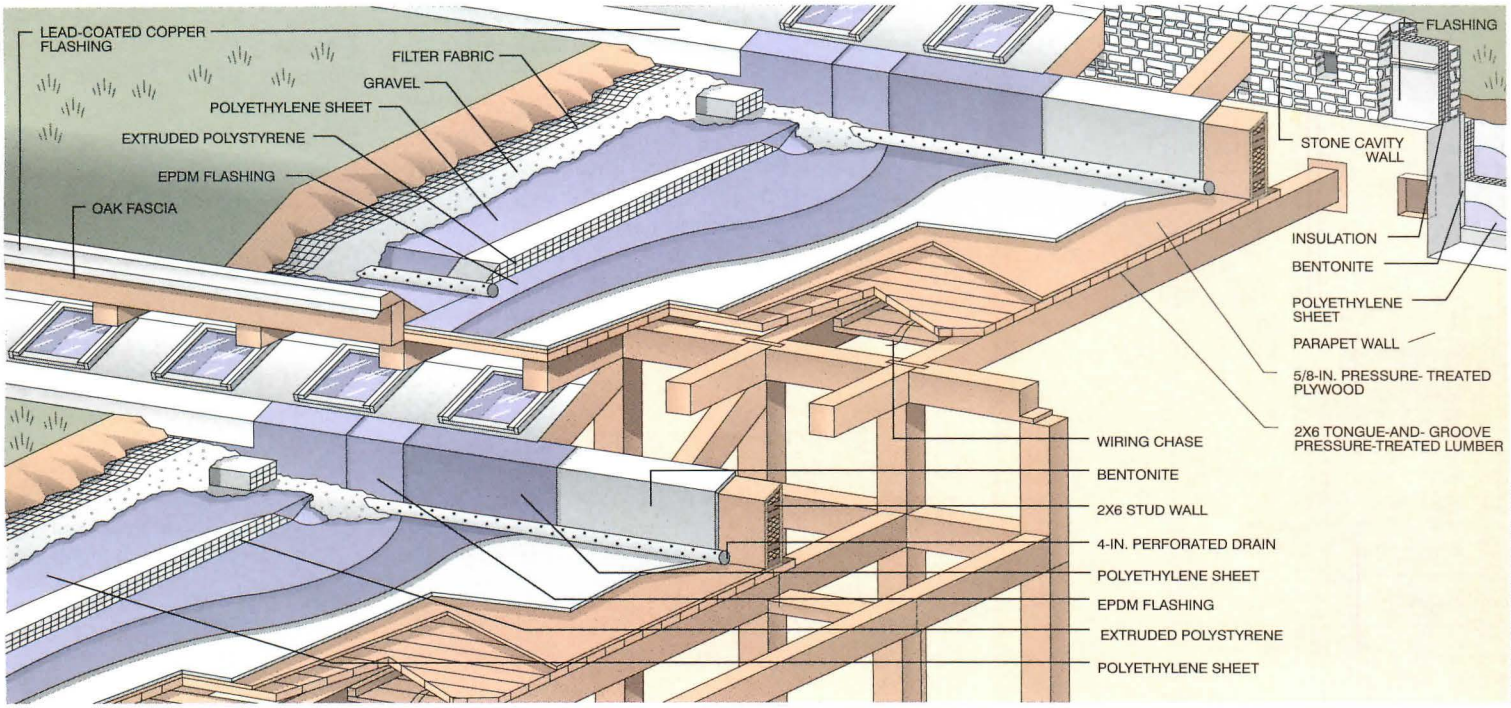
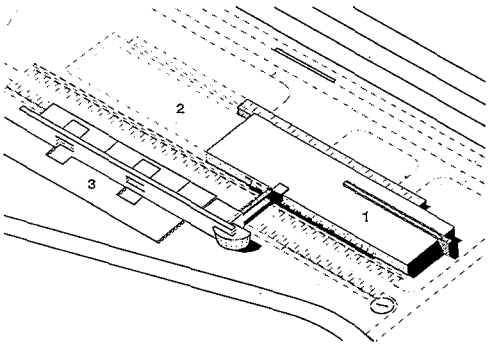


ILLUSTRATION BY RON CODDINGTON

Advanced Photovoltaic Systems
Production Facility
Fairfield, California
Kiss Cathcart Anders Architects

POWER PLANT



SITE AXONOMETRIC

1 PRODUCTION FACILITY
2 FUTURE EXPANSION
3 PROPOSED TRAINING CENTER

ABOVE: Kiss Cathcart Anders' scheme for the 69,000-square-foot Advanced Photovoltaic Systems factory includes doubling of assembly line to west and future training center to south.
FACING PAGE, TOP: South elevation shows tilt-up concrete panels; PV-powered cube over entrance; roof screen; and PV-studded awning.
FACING PAGE, BOTTOM: Light emerges from factory at dusk through irregular pattern of glass block. Cubic visitors' center and control room over factory entrance symbolizes prototypical application of PV-paneled curtain wall.

Few ideas seem as environmentally sound as tapping directly into the sun's radiation to produce electric power. Photovoltaic (PV) technology does exactly that: When sunlight hits a photovoltaic panel, the molecules of its light-sensitive silicon become excited, resulting in an electrical current that is routed into circuits. First developed to power satellites in the early 1960s, photovoltaics perfectly marry technological progress to environmental protection.

But PV applications have been hampered by the cost of the panels, as well as the costs of their physical support, power conversion from DC output to AC current, wiring, and installation. As a result, the technology has never been able to compete with other forms of electricity generation in utility grid-connected applications. The commercial applications of PV panels have been limited to powering remote lighting or electrical equipment.

Now, New Jersey-based Advanced Photovoltaic Systems (APS) is betting photovoltaic science has finally crossed a crucial threshold of practicality. The company's new factory in Fairfield, California, designed by Kiss Cathcart Anders of New York City, will begin producing light-sensitive PV modules by the end of the year. The company plans to market the modules to architects as a standard building material, to be installed like glass curtain wall. To this end, APS has formed its Architectural Engineering Support Division and hopes to have 10 demonstration buildings in design by the end of the year.

The Fairfield plant, located in a nondescript business park halfway between Sacramento and San Francisco, has a potential 10-megawatt-per-year production capacity—equal to some 2.5 million square feet of PV panels per year. This output makes it one of the largest facilities of its kind in the world. The modules it will produce employ APS' patented "Eureka" system: A glass substrate is coated with tin oxide, which serves as a transparent electrode, and then covered with three layers of silicon and a coating of aluminum film. The actual process of applying the thin film of light-sensitive silicon is very similar to producing many conventional reflective or thermal-resistant glass panels.

According to Omi Walden, chief executive officer of APS, the company counts on its automated assembly line and a new scale of production to reduce unit costs and hopes a larger, more convenient panel size will create new applications for photovoltaics. The company's most revolutionary idea, however, is integrating PV modules into building design.

Gregory Kiss, principal of Kiss Cathcart Anders Architects, of New York City, has worked on the planning and design of some half-dozen PV factories since the early 1980s, including facilities in Port Jervis, New York; Birmingham, Alabama; Manchuria, China; and Split, Croatia. Last year, Kiss and his partners were commissioned by the National Renewable Energy Laboratory in Golden, Colorado, to study the architectural applications of PV panels. Based on this research, Kiss Cathcart Anders devised a number of configurations for PV panels in commercial construction. The architects studied the integration of panels as curtain wall spandrel glass; as light shelves or window awnings; as roof panels; and as skylights (page 80). Kiss explains that the new APS panel size, which measures approximately 2.5 by 5 feet, fits conveniently into many of these common building assemblies.

More importantly, Kiss points out, while utility-scale applications—such as desert arrays producing massive amounts of power—may be the ultimate goal of some PV panel manufacturers, buildings offer the advantage of "free" infrastructure now. A major cost of large-scale applications of PV panels has been the massive framework required to hold the modules in place. This expense is avoided if the modules are integrated into a building and further reduced if the PV modules actually replace other components, such as metal cladding or curtain wall glass. And the most obvious benefit of architectural applications

JEREMY GREEN

RIGHT: Except for 12 panes of vision glass, the facades of the 529-square-foot cubic control room and visitors' center are clad in photovoltaic modules.
BOTTOM: Stainless steel reflectors form an awning on south elevation to shelter sidewalk and shade windows.
FACING PAGE: PV modules are mounted on steel tubes behind stainless steel awning and supported by aluminum, C-shaped extrusions on the back of the panels. Tin oxide forms a transparent electrode on the glass substrate, which is covered with three layers of silicon, and a coating of aluminum film.

of PV modules is reduced electrical bills from the local utility for the building owner. This advantage occurs during the peak of electrical consumption, when the sun is hottest and air-conditioning loads are greatest.

To demonstrate the architectural applications of PV panels, Kiss Cathcart Anders, working with engineers Ove Arup & Partners of San Francisco, integrated more than 200 Eureka modules into the exterior of the APS factory: as sections of vertical curtain wall on a cubic volume; as an awning over the entrance; and in a large skylight, in conjunction with clear glass, over the control room. Although most panels face south, the design is intended to show that PV panels can generate significant amounts of power in every orientation. Altogether, the modules provide enough power to light and air condition a control room and visitors' gallery in a 23-by-23-foot, glass-enclosed cube located prominently above the main entrance. Symbolizing a prototypical commercial application of PV modules, this cubic volume is sculpturally integrated into the main facility, which is constructed of tilt-up precast concrete panels.

In functional terms, the building is organized around a U-shaped production line, housed in the main manufacturing block, and a bar of mechanical services along the building's north wall, expressed as a low volume punctuated by diagonal setbacks to screen vents and service access. Since the factory is located along a major state highway and will be in operation day and night, the architects designed the building so that light would shine through an irregular pattern of glass-block squares embedded as aggregate in the tilt-up concrete panels on all four elevations. Artificial light is reflected along the service bar's stainless steel panels from concealed sources, giving the plant a clean, high-tech image.

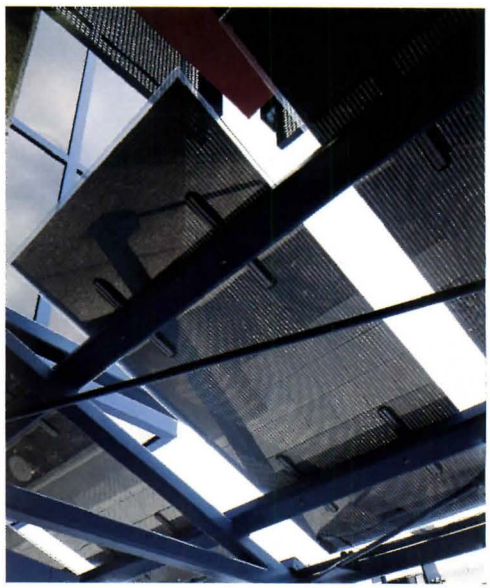
The possibility that PV modules may become a standard building component in the not-too-distant future is clearly of interest to the major investor in APS' Fairfield plant, the pension fund for the Sheet Metal Workers International, one of the nation's major building trade unions. Pension fund Chairman Edward Carlough notes that if union workers can create a niche for themselves installing modules, the factory will be a successful investment, promising a growth industry and new applications for union trade skills. APS plans to build a demonstration and training center for the sheet metal workers across the parking lot, to be connected to the facility by a pedestrian bridge.

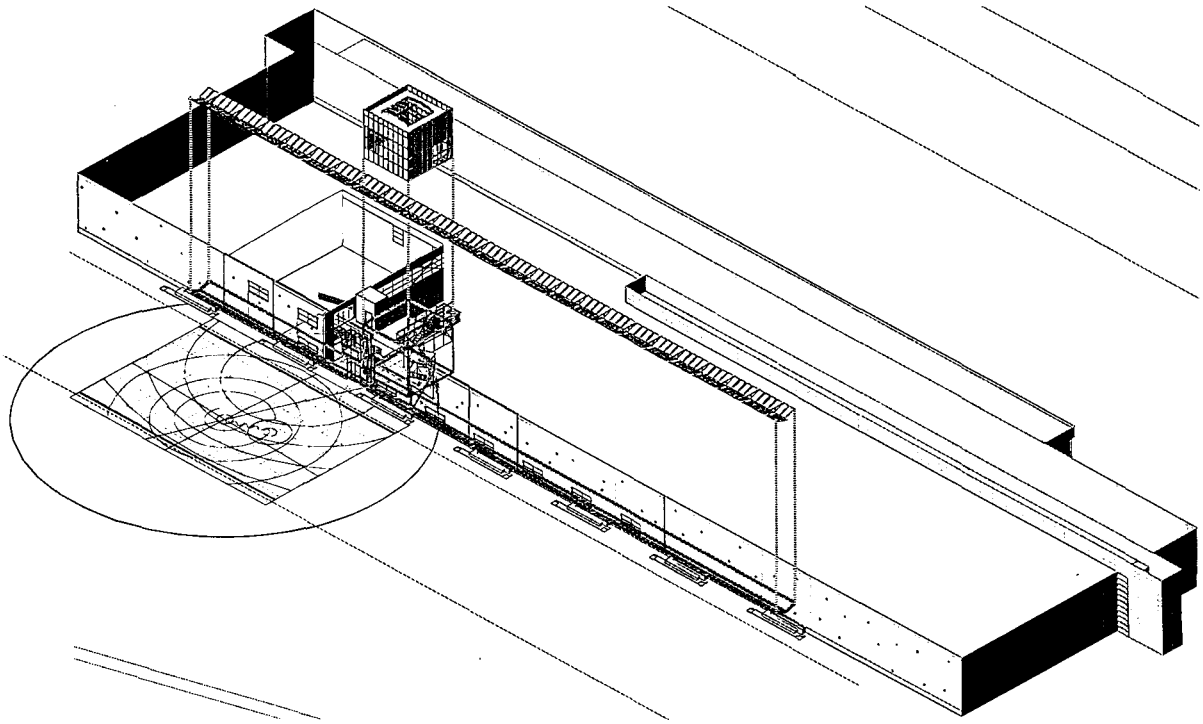
CEO Omi Walden claims her company's panels are comparable on a per-square-foot basis to other specialty glazing systems—especially if the modules are considered early in design development. Ron Matlin, director of APS' Architectural Division, performed extensive market research on photovoltaic panel applications. His investigation of such factors as availability of sunlight and local electric rates has determined that commercial applications of PV panels currently make sense from west Texas to California, and in other particularly sunny areas such as Hawaii.

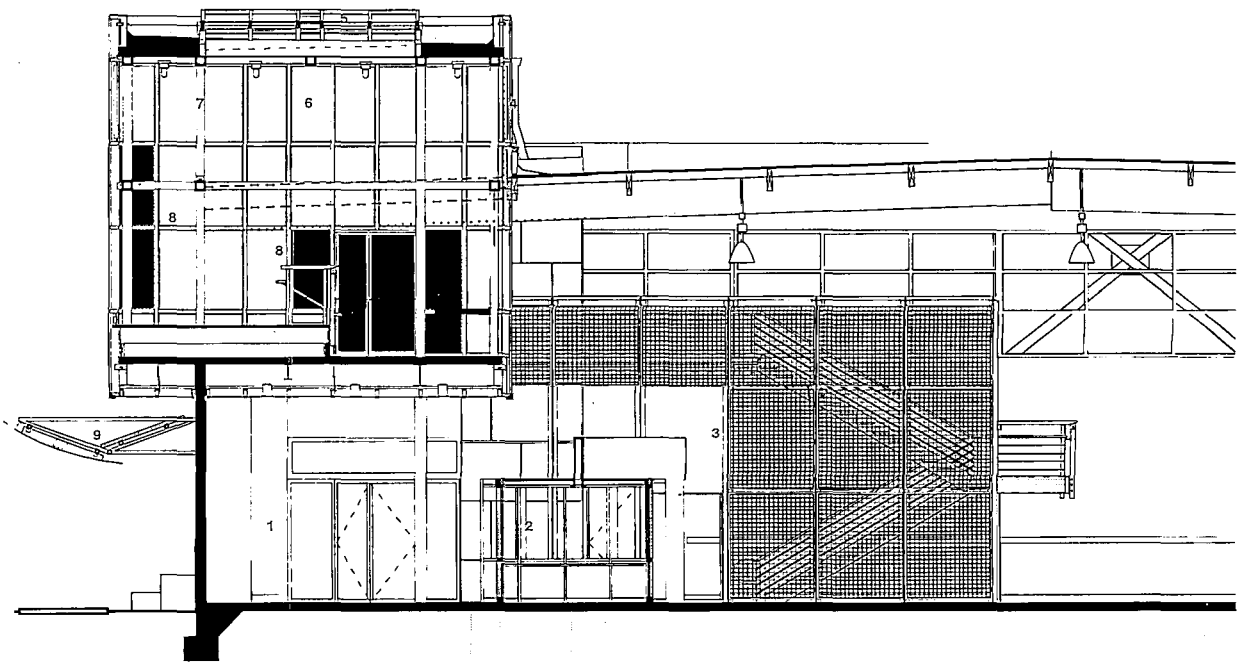
While basic curtain wall glass costs from $10 to $20 per square foot, PV glass is considerably more expensive, approximately $25 to $30 per square foot. And although these prices may change, depending on geographic location, the expense of installing PV modules in a standard commercial building ultimately proves cost effective when utility bills decrease more than the amortized construction costs increase.

The success of the PV panels, however, will not only depend on their economic and technical performance, but also on their ability to spark architects' imaginations. As Kiss asserts, "In the conservative world of building products, it's exciting when something really new comes along. This new photovoltaic technology could create a whole new design vocabulary for architects." —*David Moffat*

David Moffat is editor of Traditional Dwellings and Settlements Review, *a publication of the Center for Environmental Design Research, Berkeley, California.*







1 ENTRANCE LOBBY
2 RECEPTION CUBE
3 WIRE MESH SCREEN
4 PV CURTAIN WALL
5 PV SKYLIGHT
6 CONTROL ROOM
7 ORIENTED STRANDBOARD
8 TEMPERED VISION GLASS
9 PV AWNING

NORTH-SOUTH SECTION

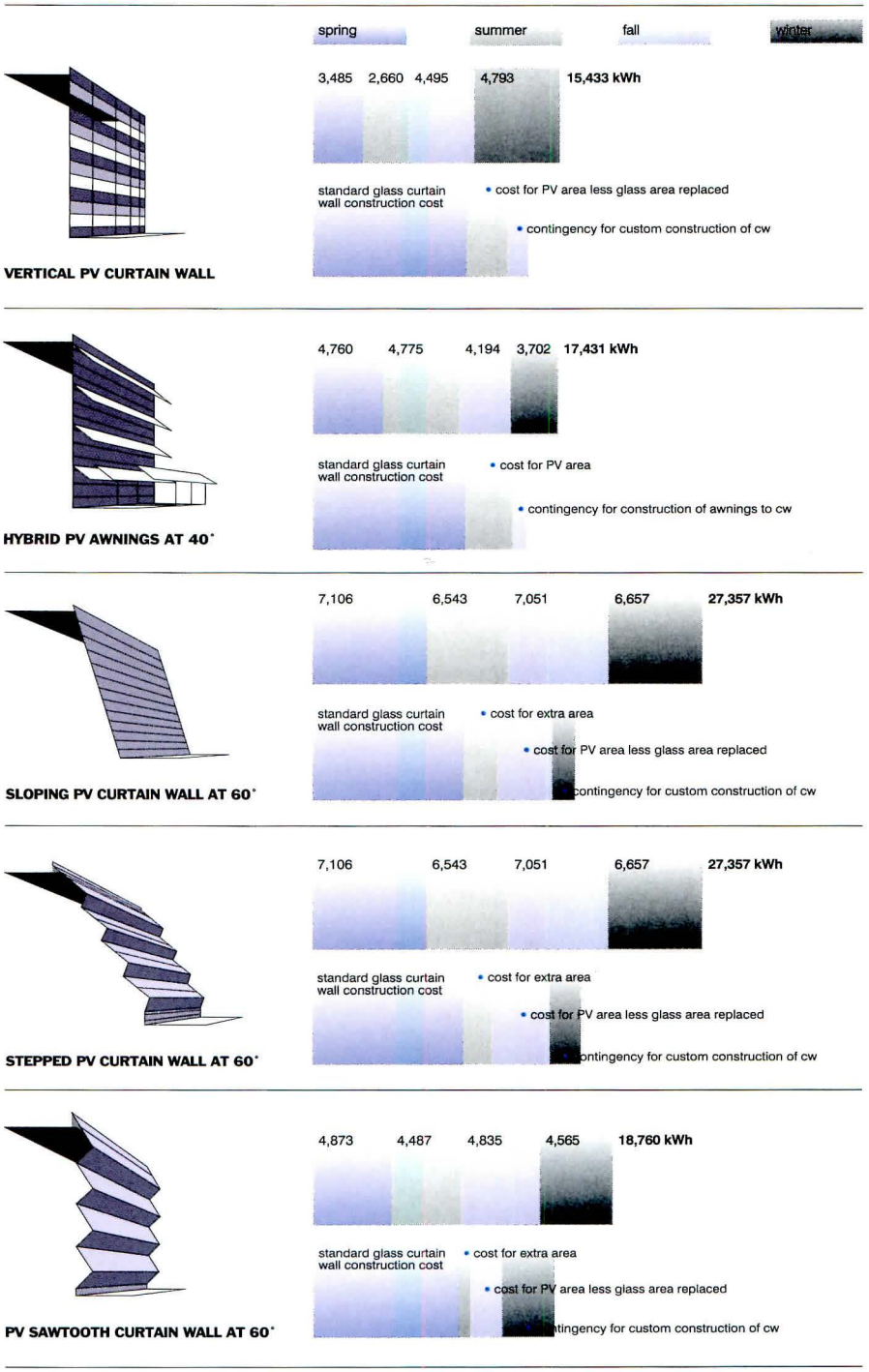
LEFT: Visitors' center and control room overlook PV module production area. Oriented strandboard panels ventilate plenum behind PV curtain wall of steel-framed cube. Handrail is shaped in stainless steel with wire intermediaries.
BOTTOM: Reception desk below control room is housed in rotated cube. Curved stainless steel-clad wall separates entrance and waiting areas from controlled-access production areas. Stair is shielded by wire mesh screen.
AXONOMETRIC: PV elements are integrated into design of curtain wall, cube, and entrance awning. Stainless steel-clad mechanical service bar for production is to rear.
SECTION: Control room and visitors' center integrate PV panels into skylight and curtain wall.

ADVANCED PHOTOVOLTAIC SYSTEMS PRODUCTION FACILITY
FAIRFIELD, CALIFORNIA

ARCHITECT: Kiss Cathcart Anders Architects, New York City—Gregory Kiss (principal-in-charge); Peter Anders, Brenda November, Colin Cathcart, Keith Hone, John Loomis, Laura Kurgan, Judy Choi, Chuck Felton, Amy Nanni, Susan Gross (design team)
LANDSCAPE ARCHITECTS: Bissell & Karn
ENGINEERS: Ove Arup & Partners (structural/mechanical/electrical); Pam Ehart (project manager); Bissell & Karn (civil)
GENERAL CONTRACTOR: Devcon Construction, Inc.
COST: Withheld at owner's request
PHOTOGRAPHER: Richard Barnes, except as noted

Building-Integrated Photovoltaics
Kiss Cathcart Anders Architects

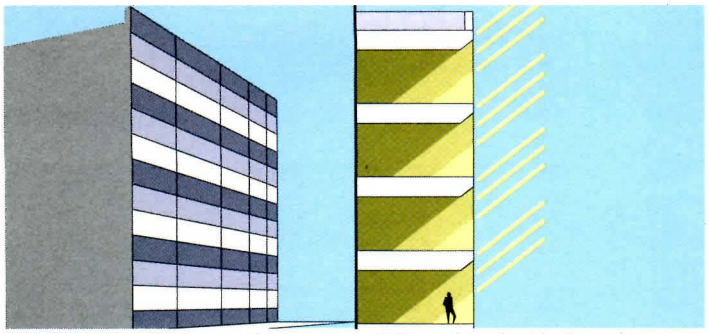
PHOTOVOLTAIC PROTOTYPES



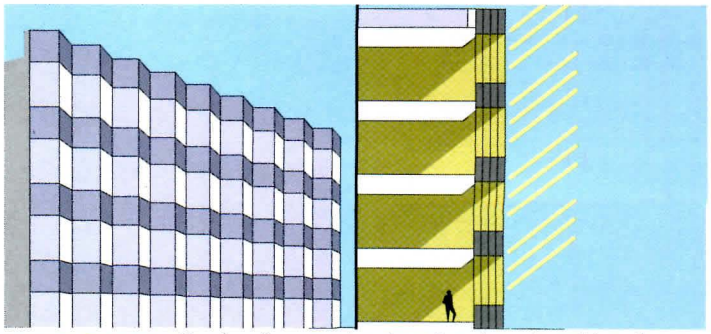
Last summer, the National Renewable Energy Laboratory in Golden, Colorado, commissioned Kiss Cathcart Anders to study the architectural applications of photovoltaic (PV) modules. The architects' resulting report, "Building-Integrated Photovoltaics," released in January, outlines a variety of ways PV modules might be integrated into typical commercial construction.

In the report, the architects present each application with a discussion of the cost advantages and disadvantages, drawings that outline various applications (these pages), and statistics (left) citing comparisons between conventional construction and PV technology. For example, the report notes that angled PV panels generate 35 percent to 60 percent more energy than vertical ones, but angled curtain wall is generally more difficult and costly to construct. Incorporating the modules as part of the building skin would displace more materials. However, such a "mounted" or double-skin installation could potentially generate more power and would avoid difficult weatherproofing details. Photovoltaic panels are presently opaque, although the report notes that transparent modules are being developed for such applications as windows, atriums, and skylights. While increased transparency reduces output, it increases the benefits of daylighting.

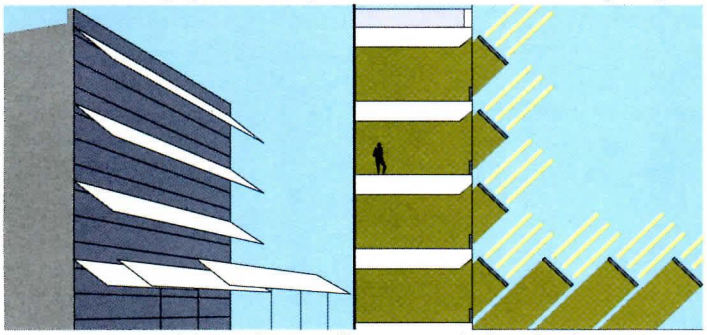
Not surprisingly, Kiss Cathcart Anders found that PV applications that generate the most power, such as angled curtain wall and roof panels, involve the most complex detailing, resulting in higher costs. Yet, as with most energy-saving technologies, the initial investment yields long-term payoffs—assuming, of course, that maintenance (for instance, keeping the panels clean in urban, dusty, or polluted environments) does not deplete long-term savings. If only a small percentage of the U.S. market for commercial glass were converted to photovoltaics, this increase would yield the approximate energy equivalent of one nuclear power plant in one year, or 200 to 500 megawatts. —*D.M.*



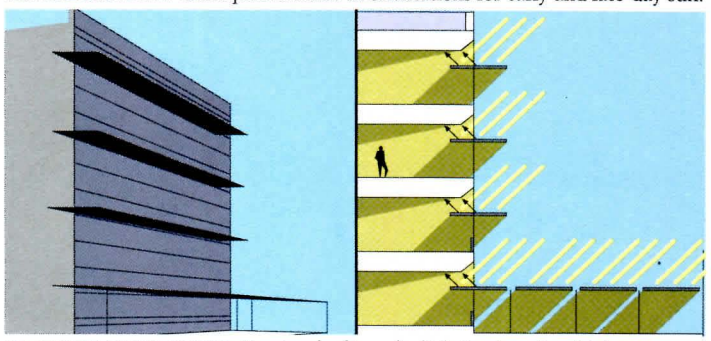
VERTICAL FLUSH: Opaque and transparent PVs combined with clear glazing.



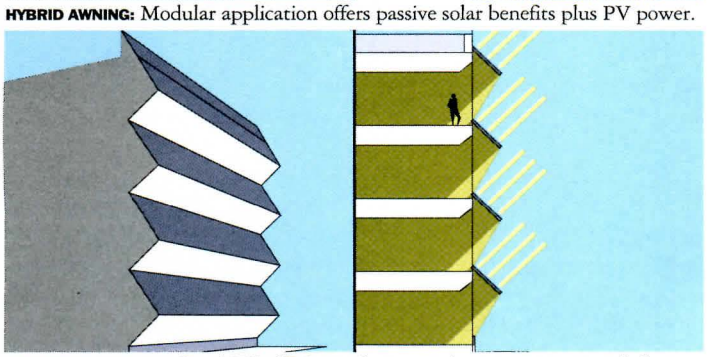
VERTICAL SAWTOOTH: Good performance in orientations for early and late-day sun.



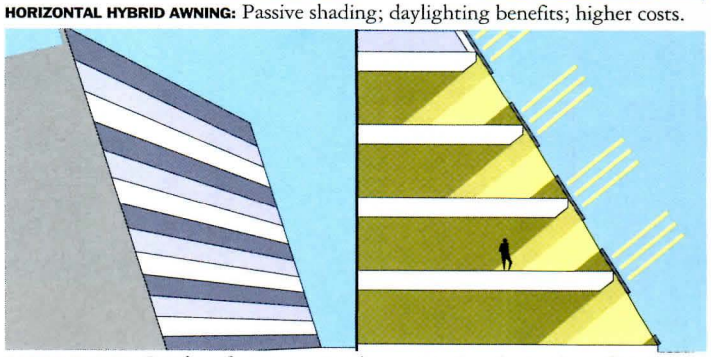
HYBRID AWNING: Modular application offers passive solar benefits plus PV power.



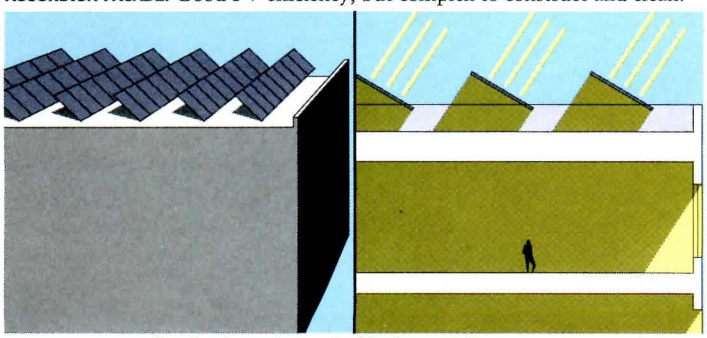
HORIZONTAL HYBRID AWNING: Passive shading; daylighting benefits; higher costs.



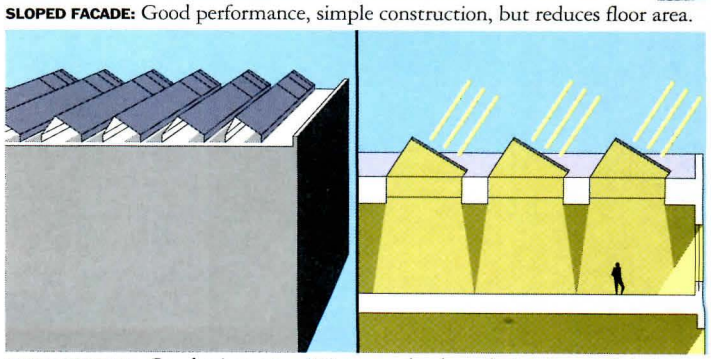
ACCORDION FACADE: Good PV efficiency, but complex to construct and clean.



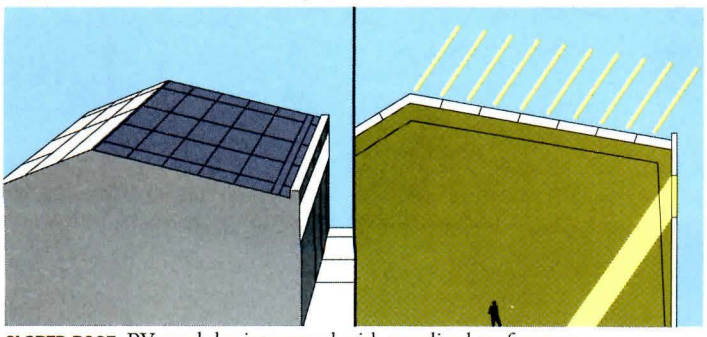
SLOPED FACADE: Good performance, simple construction, but reduces floor area.



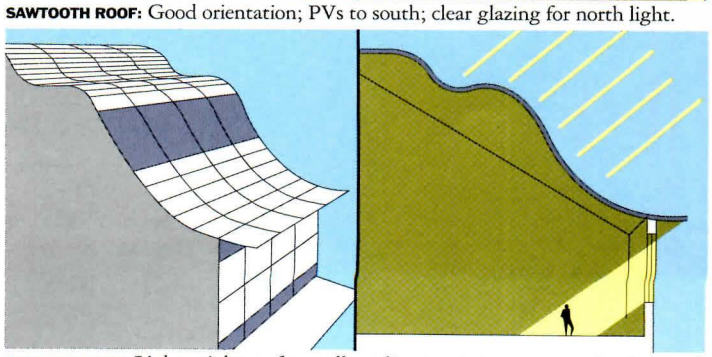
ROOFTOP ARRAY: Good orientation; suitable for retrofit or new construction.



SAWTOOTH ROOF: Good orientation; PVs to south; clear glazing for north light.



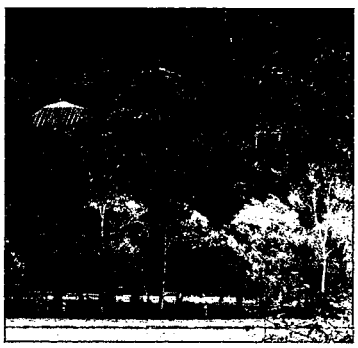
SLOPED ROOF: PV modules integrated with panelized roof system.



FLEXIBLE ROOF: Lightweight roof or wall application; integrates weather barrier.

Spring Lake Park Visitors Center
Santa Rosa, California
Obie G. Bowman, Architect

PYRAMID OF THE SUN



ABOVE: View across Spring Lake, a flood control reservoir and park in Sonoma County, shows the visitors center (left) and deck (right).
FACING PAGE: Obie Bowman nestled the pyramidal center into the sparsely forested landscape. He screened the exterior with redwood louvers and clad the southeast elevation in solar panels.

To discover a glass and wood pyramid in a California forest of oak and buckeye is unusual, but the Spring Lake Park Visitors Center suits its site. Camouflaged with translucent, insulated glazing, the center whispers its welcome from the hillside. Ten miles from downtown Santa Rosa, Spring Lake Park comprises a 320-acre flood control district and nature preserve, with more than 750,000 visitors annually.

In 1988, a Sonoma County-appointed architectural selection board decided to create a park visitors center that would exemplify a sympathetic relationship between architecture and nature: in this case, the native oaks and grassy meadows of the local terrain. The building would function as a learning tool for environmental awareness, as well as house exhibits on Native American history, plant and animal lore, and the regional water system. Based on his 20-year reputation for designing environmentally sensitive houses at Sea Ranch, local architect Obie G. Bowman was chosen to site and design the center.

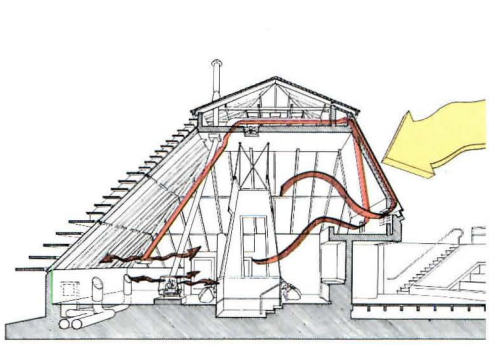
Bowman selected a relatively open, sunny spot on the northwest slope of an ancient lava flow overlooking the man-made Spring Lake. Because of the volcanic soil, trees in this area are fragile. To avoid the environmentally devastating effects of construction, Bowman fenced off the surrounding forest, leaving a single path from a parking lot at the site's edge, which served as the staging area. He also watered the site to reduce dust and mulched to support the trees. An arborist advised Bowman to encircle the trees with low walls, so that if the grade was raised, these rings would keep the ground around the trees at its natural level and allow the trees to take in oxygen. Additionally, the client, Sonoma County Water Agency, wrote into the contract that fines would be imposed for any tree damage. Only three trees were uprooted while building the 2,000-square-foot pyramid, and the architect wove them into a canopy over the nearby Storyteller's Cavern, a gathering place formed with large boulders removed from the site.

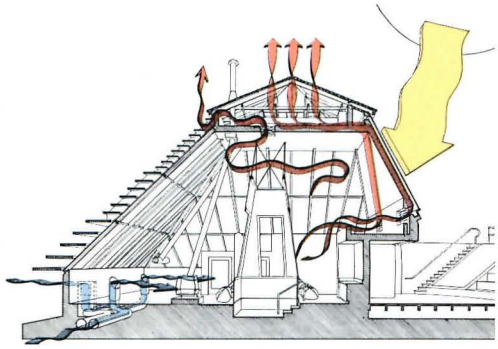
Bowman's response to the "push and pull" of the building's functional requirements is self-effacing, environmentally sensitive, and logical. He chose a pyramid not for its historical resonance or spiritual power or even its echo of the nearby hills, but for its efficient shape: A pyramid is a simple form to frame. The sloping structure rests on concrete retaining walls set into the grade to lower the building profile, increase energy efficiency, and harmonize with the site. A rigid steel frame supports walls of insulated glazing, capped by a cedar-shingled attic. Because of its stability and weather- and insect-resistant qualities, Bowman specified redwood for exterior louvers to screen the sun. These tiered fins change scale like the surrounding trees, whose leaf canopies become thinner as they rise higher.

The pyramidal form is also derived from the building's mechanical system: Custom-designed solar panels cladding the southeast elevation dictated the pitch of the walls. These panels function as an efficient ambient heating system by warming the air in the pyramid. On overcast days and before direct sunlight strikes the panels, a wood-burning stove supplies heat, while a catalytic converter removes particulates from the heated air. During the summer, as vents in the base on the north side draw air into the visitors center, a ceiling fan blows hot air out through attic eave vents, further reducing temperatures. The complex includes an attached, below-grade storage and office workroom, with a skylight and a sod roof, located west of the pyramid, and an amphitheater to the south. The main space contains a circular reception desk and an 8-by-14-foot, fabric-covered pavilion that houses educational exhibits.

Bowman's methodical approach to site selection, design, and construction has created an environmentally sensitive visitors center. While the architect admits his design is grounded more in logic than in lore, the panoramic views of the nature preserve from the observation deck transcend the ordinary.

—Justin Henderson





TOP LEFT, HEATING SECTION: Wood stove supplements solar heating system. Sunlight heats air trapped between glass and metal on solar panels. Warm air rises into attic, where supply manifold blows it into ducts that carry air down into building interior. Air is drawn back into panels through filtered intake manifold.
TOP RIGHT, COOLING SECTION: Cool air is drawn in through ground-level intake vents and passes through underground tubes for further cooling. Ceiling fan discharges hot air into ceiling through eave vents. Automatic louvers vent hot air to exterior of building.
RIGHT: Bleached redwood louvers are arranged to mimic the thinning of the leaf canopy in the forest.
BOTTOM: Anchored by stones from the site and surrounded by environmental exhibits, fabric pavilion serves as a teaching area for children.
FACING PAGE: Wood stove backs up solar heating system; fins screen direct sunlight without blocking views.

SPRING LAKE PARK VISITORS CENTER
SANTA ROSA, CALIFORNIA

ARCHITECT: Obie G. Bowman, Architect, The Sea Ranch, California–Obie G. Bowman (principal-in-charge); Fiona O'Neill (project architect)
ENGINEERS: Dennis Fagent Associates (structural); Sonoma County Water Agency (mechanical, civil)
GENERAL CONTRACTOR: Christianson-Williams-Bohn
COST: $730,000; $200/square foot
PHOTOGRAPHER: Richard Barnes

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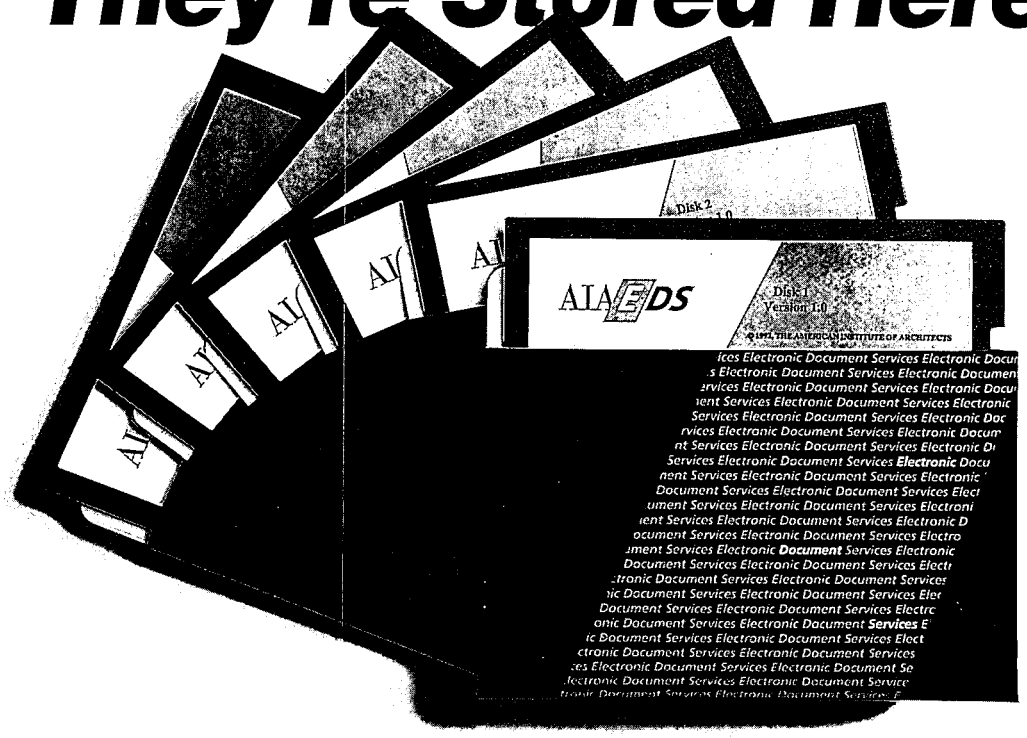

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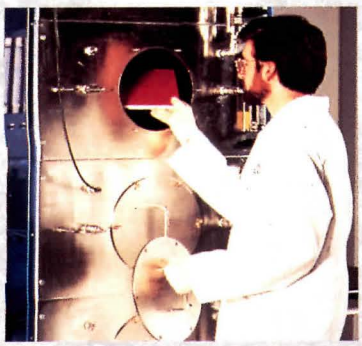
Technology & Practice



TOP: Laboratory technician places paint sample in environmental test chamber to measure its level of volatile organic compound emissions.
ABOVE: Logging clear-cut in Oregon's Mount Hood National Forest illustrates the need for sustainable harvesting practices in Pacific Northwest.

This month's Technology & Practice section extends our coverage of sustainable architecture. As illustrated by the articles that follow, architects are faced with numerous choices and responsibilities in specifying materials and developing techniques for creating environmentally sensitive buildings. As pointed out in our roundtable with members of the AIA Committee on The Environment, the range of important environmental decisions facing an architect today is expanding, from air quality and wood furnishings inside a building to the energy efficiency and conservation of an entire site.

Land Stewardship

Where and to what extent is it most appropriate to build? Architects reveal their strategies for reducing the impact of development on regional ecosystems by identifying, conserving, and even restoring a site's natural resources.

Architecture in the Balance

Six members of the AIA's Committee on The Environment discuss the role of the architect and the progress of the profession in developing a regulatory, economic, ethical, and esthetic framework for sustainable architecture.

Survival of the Forests

Specifying timber and wood products has become a major challenge for environmentally conscious architects seeking to preserve old-growth trees and rain forests. We report on the status of forestry practices, wood certification and conservation programs, and the ways architects can determine sustainable species and sources of domestic hardwoods and tropical timber.

Indoor Ecology

The offices and workplaces where we spend most of our time are becoming increasingly unhealthy. Our feature on indoor air quality presents methods for reducing exposure to airborne toxins and carcinogens from furnishings, finishes, and fixtures.

Energy Design Software

Computer programs from the Lawrence Berkeley Laboratory and the International Energy Agency assist architects in more accurately predicting a building's energy performance to improve lighting, heating, and cooling efficiency. Our article details new software for integrating energy efficiency in the design process.

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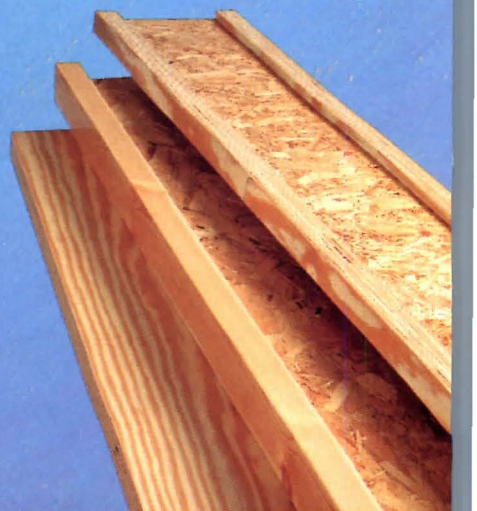

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Circle 63 on information card

Eco-sensitive transit schemes reshape urban infrastructure.

Electric Auto Contest Sparks Powerful Ideas

By 1998, 2 percent of all vehicles sold in California will have to meet zero emission standards. Maine, Massachusetts, New Jersey, and New York have also recently enacted similar standards. To achieve such stringent air quality regulations, the major automobile manufacturers are now designing and refining electric automobiles and improved battery technologies. However, they have devoted far less attention to how and where electric vehicles will be recharged.

Recognizing the need for infrastructure to support such alternative modes of transportation, the Edison Electric Institute, Electronic Data Systems, Hughes Power Control Systems, and General Motors Electric Vehicles Institute, along with numerous state and city electric power companies, recently sponsored a design and planning competition titled, "The Electric Vehicle and the American Community." Steven G. Cecil of the Boston-based architecture firm Cecil & Rizvi organized the competition.

Participants were required to submit schemes illustrating concepts for electric "filling stations" in tandem with suggested zoning, energy, and transportation policies for a community of their choosing. Acting Assistant Secretary of the U.S. Department of Energy Robert San Martin announced the winners of the nationwide competition this May in Washington, D.C., in conjunction with the 1993 National Electric Vehicle Ride & Drive, a demonstration to the public and Congress of existing and emerging electric vehicle prototype technologies.

From the more than 100 entries, the sponsors awarded $100,000 in prizes, distributed among four categories. The grand prize was awarded to a Cambridge, Massachusetts-based team for proposing drive-up recharging units at major transit points and residential curbsides. Parking garages retrofitted with solar panels would generate power for the recharging stations.

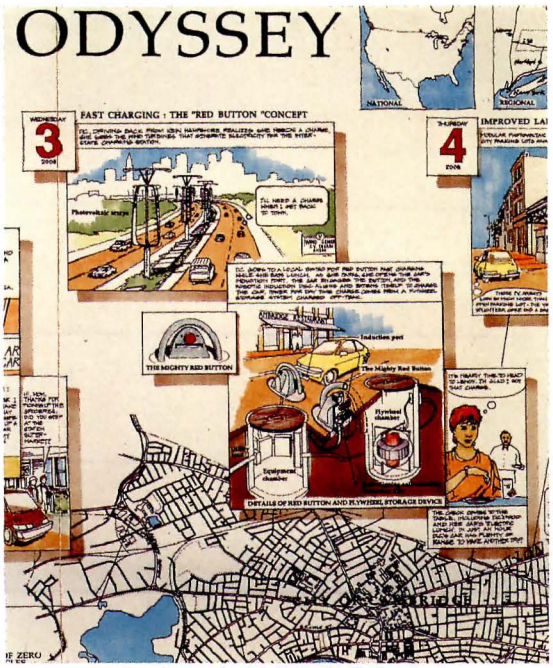
Three first-place awards recognized schemes for large-, medium-, and small-scale communities. A Denver-based team won for its concept of "smart" roadways with embedded plates for transmitting energy to the cars. For mid-sized El Cajon, California, the winning entry by a San Diego-based team presented an entire urban vocabulary of support elements—including sign systems, stations, and solar power collectors—to signal the location of electric vehicle services and "clean air zones" for electric transit.

Garages for electric cars would no longer need special ventilation to exhaust fumes; and the Keene, New Hampshire-based winners developed a network of multipurpose, local, electric vehicle service facilities incorporating other commercial services. These buildings would be identified to motorists by a graphic icon, which received a separate logo design award (below).

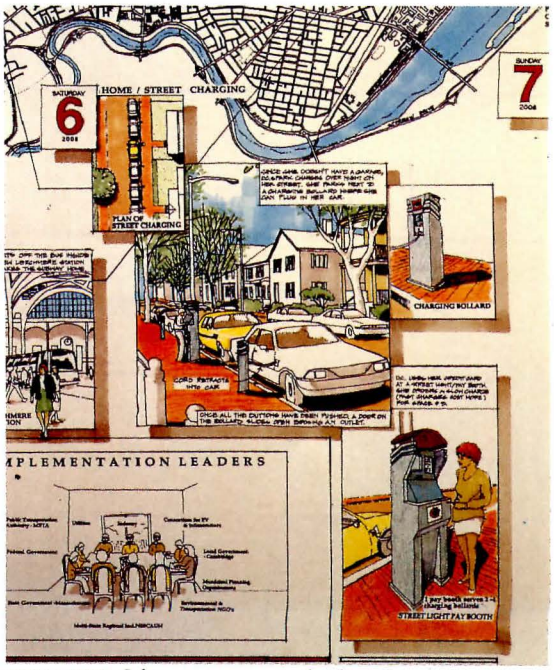
Additional awards honored proposals for Philadelphia and Lancaster County in Pennsylvania, the Crenshaw District of Los Angeles, and Sutter Bay in California, and for vehicle designs and battery exchange concepts. Honorable mentions were presented to participating teams from Sacramento and Orlando.

The seven-member jury included Anthony Downs, senior fellow of the Brookings Institute; James J. MacKenzie, senior associate of the World Resources Institute; Paul MacCready, chairman of the board for Monrovia, California-based AeroVironment; Denise Scott Brown, principal of Philadelphia-based Venturi, Scott Brown and Associates; Karen B. Alschuler, principal of San Francisco-based Simon Martin-Vegue Wenkelstein Moris Architects and Planners; Daniel Sperling, director of the University of California-Davis Institute for Transportation Studies; and Thomas Larson, former administrator of the Federal Highway Administration.

A catalog, touring exhibition, and a seminar at the Smithsonian in Washington, D.C., this month will further disseminate the creative ideas presented by the winning entries. For further information contact: (617) 267-9035. —*M.S.H.*



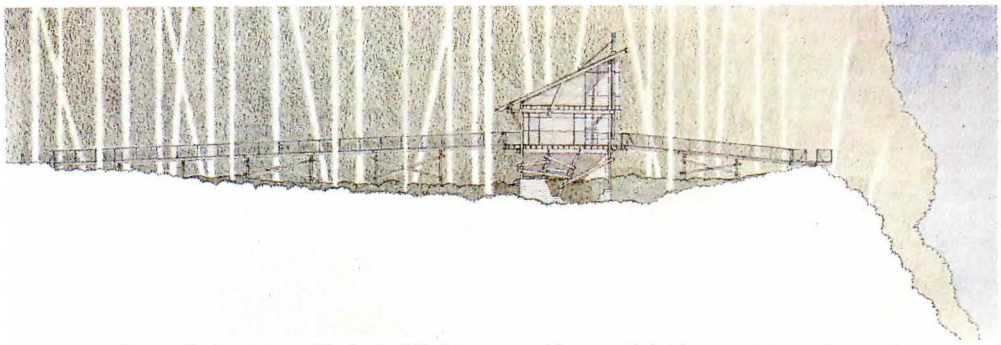
GRAND PRIZE: On the road with "Ms. D.C. Sparks."



GRAND PRIZE: Scheme proposes curbside recharging.

SEPARATELY,
WE WERE
RECOGNIZED FOR
INNOVATION
AND QUALITY.

TOGETHER,
WE ARE SETTING
A NEW
STANDARD.



PAULK HOUSE: James Cutler designed Seabeck, Washington, residence with bridge to minimize devastation.

Land Stewardship

Studying the ecological limits of a site is becoming an important consideration in the design process.

Before beginning the design of any new project, architect James Cutler always heads to the building site with his surveying equipment in hand. There he spots all the trees himself and shoots the grades with a transit, often calling upon his client to hold a rod. Although Cutler claims to be a mediocre surveyor, the Bainbridge Island, Washington-based architect, known for his environmentally sensitive designs, says he always takes the time to do his own surveying because the exercise physically engages him in the site. "We treat something better when we know it," he explains.

Cutler is just one of a wave of architects, landscape architects, planners, and environmental professionals, sometimes referred to as "land stewards," who are working to reestablish a genuine consideration for the land, its history, and its ecological limits. Nearly a quarter of a century after the publication of Ian McHarg's ecological manifesto *Design With Nature*, these designers continue to grapple with the best ways to mitigate damage to the land by maximizing open space, protecting slopes and waterways, saving land with the best soils for agriculture, and confining new development to land that has already been altered by human intervention. These professionals are acutely aware of the long-range effects of their design and development decisions and of the need to give environmental considerations top priority. "Architects need to understand biology and ecology and integrate it into what they do," says Sim Van der Ryn, principal of Sausalito, California-based Van der Ryn & Associates and architecture professor at the University of California at Berkeley.

Learning from the site

The first and most important step in any effort to design in accordance with the natural environment is a simple one: spend time at the site observing the life already there, advises Bice C. Wilson, principal of New York City-based Meridian Design Associates. By sitting quietly and watching, says Wilson, an architect may begin to understand the interrelationships between the plants and animals that inhabit the site. By looking for clues, the architect can determine how animals travel across the land, learn about their habitats, and observe changes in sunlight and wind movement. If a builder cuts down too many trees beside a stream or pond, for example, shade will be lost; the water temperature will rise; and the fish will die.

Another good way to learn about a site and its environmental attributes is to talk to neighbors and longtime residents, says Karl Kehde, a Morris Plains, New Jersey-based consultant who has developed the Land Use Forum Network, a nonprofit organization that fosters communication among developers, local officials, and residents.

To become effective land stewards, architects must broaden their approach by considering the land in larger bioregional terms, maintains Jim Bell, an ecological designer and director of the Ecological Life Systems Institute in San Diego.

Surveying watersheds and soils

One essential step toward predicting the effects of a development option on the surrounding environment, explains Bell, is determining the proposed project's location within its watershed. A watershed is a geographic region in which rain and groundwater flow in one direction to a river, lake, or ocean. Each site within the watershed is affected by water travelling from above the site toward its eventual destination at a lower elevation. New development will change areas below it within the watershed. Watershed maps should be available from the local Planning Department or from the state Department of Water Resources or its equivalent agency.

Soil information can also be valuable in determining the ecologically appropriate approach to the development of a site, says

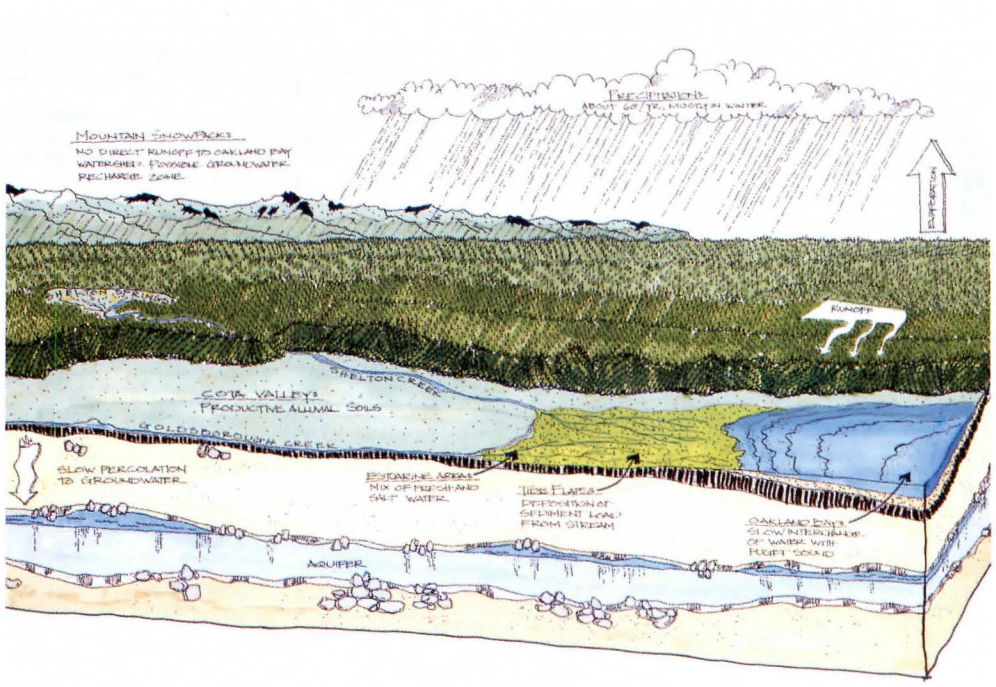
Imagine Shelton
A Design Demonstration Project for Washington State
Washington Council, AIA

In 1991, Washington adopted a Growth Management Act requiring every community in the state to produce a comprehensive plan for its future growth. The citizens of Shelton, a town of about 7,500 in a forested valley on the lower Puget Sound, responded with a vision based on a strong desire to preserve their city's natural attributes.

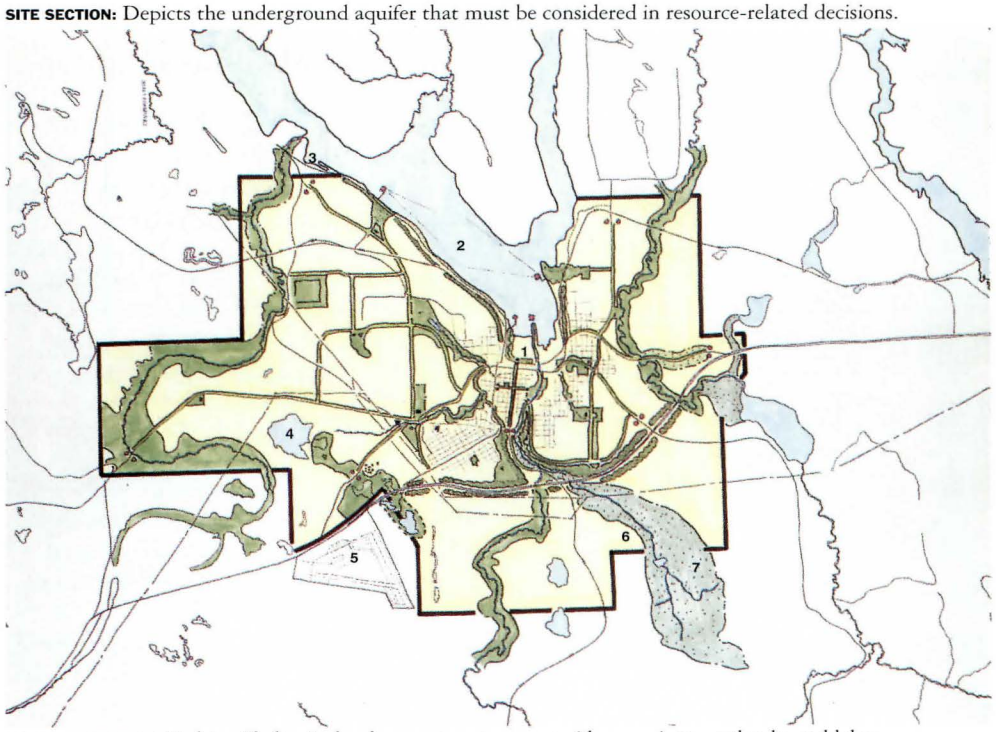
The community-based project included about 80 citizens working with a professional architectural and planning team that included Davidya Kasperzyk, a Seattle-based architect and bioregional planner; Ronald Thomas, director of the Seattle-based Community Design Exchange; and urban planner Christopher Peregine. The group met in three sessions over a six-month period. The project began with a town meeting to determine citizens' design preferences and included a day-and-a-half-long design charette to develop priorities and solutions. By creating overlays for a perspective sketch of the region drawn from aerial photos, participants were able to explore and visualize their design ideas in three dimensions.

Many of the group's environmental goals focused on preserving the water resources central to Shelton's historical development around the milling and logging industry in the late 1800s. Protecting the local Oakland Bay Watershed, preserving local stream and creek corridors, as well as providing public access to the waterfront were listed as top priorities by the group.

The need for Shelton to develop an environmentally sensitive plan is particularly timely because the town is currently under extreme development pressure, largely due to its proximity to the fast-growing state capital, Olympia. Using a base map assembled from topographical maps obtained from the U.S. Geological Survey, the group developed a framework for expanding the city to 40,000 people with future city boundaries linked to natural geographical features. The plan emphasizes restoring the vitality of Shelton's historic center, structuring new pedestrian-oriented residential areas around compact centers, and marking civic edges and entrances.



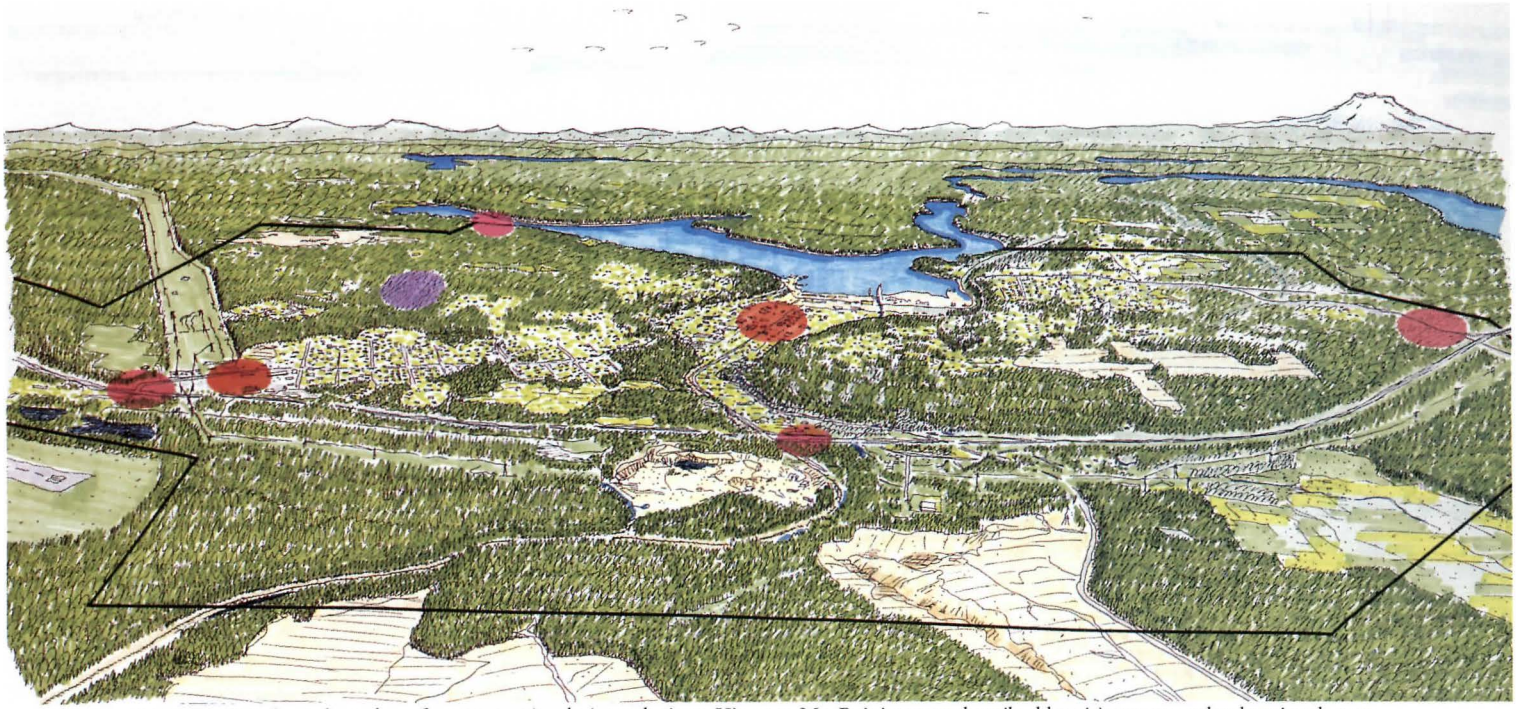
SITE SECTION: Depicts the underground aquifer that must be considered in resource-related decisions.



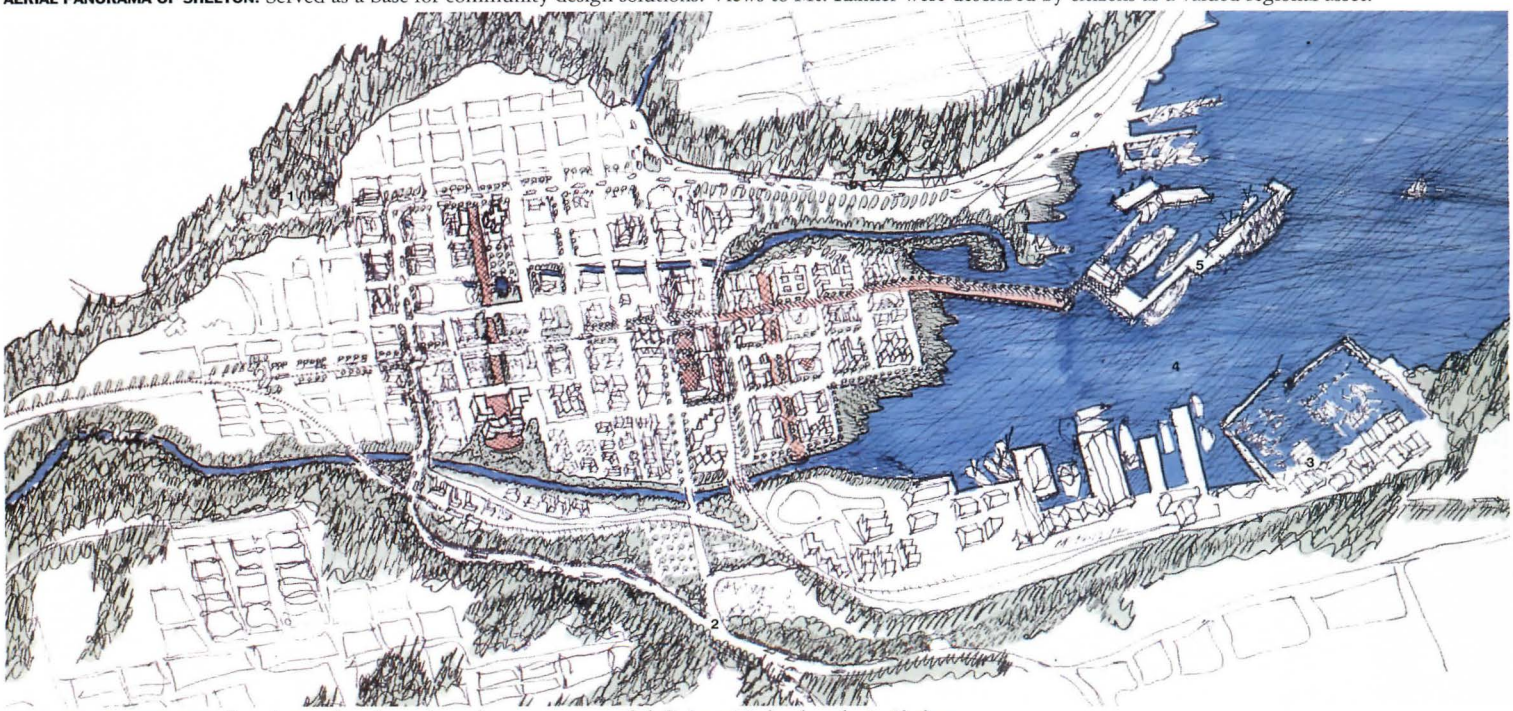
BIOREGIONAL PLAN: Linking Shelton's development to stream corridors, ravines, wetlands, and lakes.

1 SHELTON
2 OAKLAND BAY
3 BAYSHORE
4 ISLAND LAKE
5 SANDERSON FIELD
6 COFFEE CREEK
7 SHELTON VALLEY

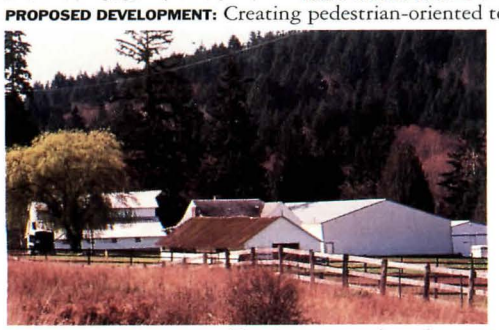
AERIAL STUDY: Shows integration of buildings into site.



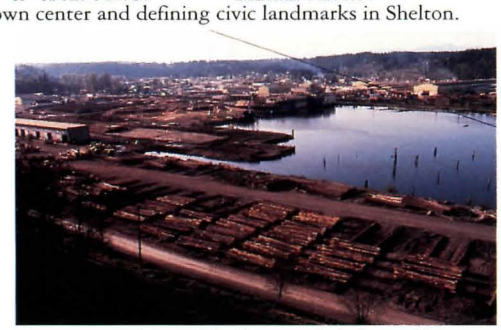
AERIAL PANORAMA OF SHELTON: Served as a base for community design solutions. Views to Mt. Rainier were described by citizens as a valued regional asset.



PROPOSED DEVELOPMENT: Creating pedestrian-oriented town center and defining civic landmarks in Shelton.



PRESERVATION GOAL: Rural landscape on edge of town.

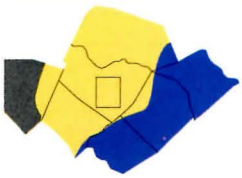


SHELTON NOW: Town is built around timber mill.

1 PROTECTED SLOPES AND WATERWAYS
2 REFRONTED STATE ROUTE CREATES PEDESTRIAN TOWN CENTER
3 MARINE INDUSTRIES
4 FORMER ESTUARY WILL UNDERGO REHABILITATION
5 RAIL AND FERRY TERMINALS REDUCE *DEPENDENCE ON AUTOS*

Regional Resource	Business Resource	Resources Element	Green Building Blocks	Green Demonstration House

CLIMATIC RESOURCES

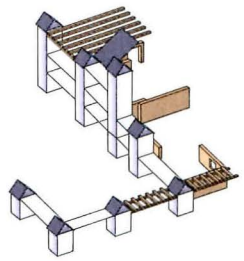


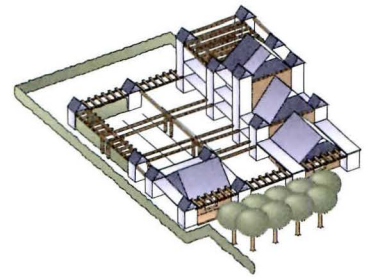
- 67° GROUND TEMPERATURE
- 68° GROUND TEMPERATURE
- 69° GROUND TEMPERATURE

CLIMATIC PRODUCTS

SOLAR HEAT-COOL

- SOLAR RADIATION
- NOCTURNAL RERADIATION
- VENTURI SHAPE WIND CATCHMENT
- SOLAR SHADE TRELLIS
- SHADE PLANT BED
- SOLAR WATER HEATING
- DIRECT AND INDIRECT SOLAR DEHUMIDIFICATION
- HEAT EXCHANGER
- THERMAL WALL STORAGE
- WATER THERMAL STORAGE





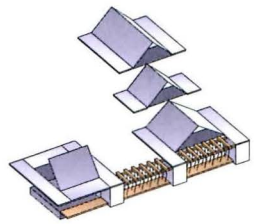
WATER QUALITY POTENTIAL

- 32" ANNUAL PRECIPITATION
- 33" ANNUAL PRECIPITATION
- 34" ANNUAL PRECIPITATION
- 35" ANNUAL PRECIPITATION

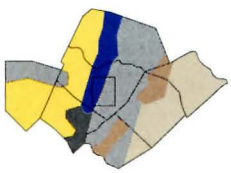
WATER CONSERVATION

WATER HARVEST

- PRECIPITATION
- ROOFING
- GUTTERING
- PHYSICAL FILTRATION
- BIOLOGICAL PURIFICATION
- NONTOXIC PIPING
- STORAGE TANKS



MATERIAL RESOURCES

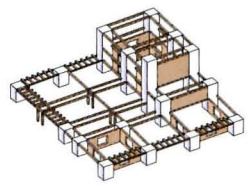


- LIMESTONE BEDROCK
- CHALK
- CALCRETE
- NEAR SURFACE LIGNITE
- DEEP BASIN LIGNITE

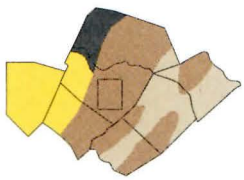
BUILDING MATERIALS

MATERIALS

- NATIVE HARDWOODS
- NATIVE SOFTWOODS
- GRASSLAND PLANTS
- FLY ASH CEMENT
- COAL ASH AGGREGATE
- ORGANIC WASTE PRODUCTS
- ORGANIC FIBER PANELS
- SULFUR
- CALCAREOUS & LOAM MATERIALS
- RECYCLED STEEL

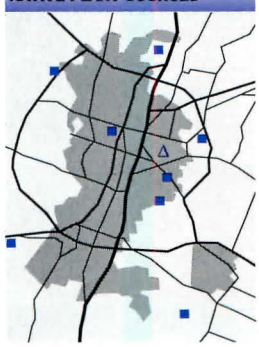


VEGETATIVE AREAS



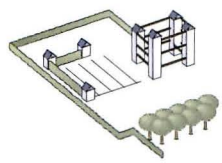
- POST OAK SAVANNAH
- BACKLAND PRAIRIES
- CROSS TIMBERS AND PRAIRIES
- EDWARDS PLATEAU

NATIVE PLANT SOURCES



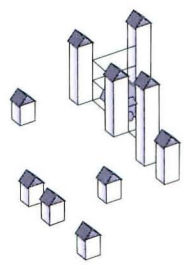
WASTEWATER LANDSCAPE

- ULTRA LOW WATER AND COMPOST TOILETS
- LOW WATER APPLIANCES
- GRAY/BLACKWATER PIPING
- GRAY/BLACKWATER TANKS
- PHOTOVOLTAIC PUMPING
- WASTEWATER LAWNS
- LIVING FENCE ORGANIC WASTEWATER TREATMENT
- GRAYWATER FED AGRO FORESTRY
- HERBAL LAWN GARDEN



SOLAR ELECTRICS

- SUN
- PHOTOVOLTAIC PANELS
- HYBRID ELECTRIC CAR AUXILIARY
- LOW VOLTAGE WIRING
- LOW VOLTAGE MECHANICAL EQUIPMENT
- LOW VOLTAGE APPLIANCES
- NATURAL & LOW ENERGY LIGHTING
- BATTERY STORAGE



Advanced Green Builder Demonstration Home
Austin, Texas
Center for Maximum Potential Building Systems

Creating a building in harmony with its surroundings is the goal of the Advanced Green Builder Demonstration Home project designed by the Austin-based Center for Maximum Potential Building Systems. Pliny Fisk III, codirector of the center, hopes that the house will become a blueprint for regionally appropriate housing. The project is funded by the Governor's Energy Office and the Lower Colorado River Authority in conjunction with the City of Austin Green Building Program. Fisk based the design on a methodology (facing page) that relates the building to resources within the surrounding community and region. Although planned for an 8,600-square-foot site within the Austin city limits, the house will be totally independent of the city's water, sewer, and power grids. It will depend entirely on rainfall, on-site waste treatment, and solar energy.

Fisk's theory of sustainable design recognizes the importance of supporting the building through electricity, water, and other resources at the smallest possible scale so that the environmental consequences of every action can be more easily understood. Indigenous plants will play a pivotal role in the building's ongoing support systems. All water to be consumed will be collected on the roof and purified as it passes through "polishing beds" containing gravel and aquatic vegetation. Ornamental reeds and vines to shade the building will also be grown in these beds.

Wastewater from the house will be treated by a microbial rock plant filter: a lined trench layered with stones and gravel containing a variety of plant species, such as the calla lily, iris, and tuberose that thrive in wetlands. Graywater from the filter system will be transferred, via a solar photovoltaic powered pump, to a subsurface irrigation system that waters a low-maintenance turf area of prairie buffalo grass. The nutrient-rich graywater will also be recycled to irrigate fruit-bearing trees such as pear, fig, and persimmon. Even a 150-foot-long "living" fence of woody and thorny plants around the site will be sustained by graywater.

John P. Tandarich, a soil scientist and archaeologist with Hey and Associates, a Chicago-based environmental consultant. Because soil is formed over decades and is deposited in layers, examining it can provide an accurate history of a piece of land and its use. In addition, soil characteristics help determine if the land is permeable or prone to flooding, the type of plants it can support, and whether the land is well-suited for construction.

Tandarich recommends that architects interested in soil quality obtain pertinent sections of the National Cooperative Soil Survey, available to the public through local soil and water conservation district offices. These reports, developed by the U.S. Department of Agriculture's Soil Conservation Service, in cooperation with local agencies, contain maps, soil descriptions and classifications, and soil management information. In sensitive areas, it may be advisable to retain a soil scientist to determine the specific site characteristics.

Defining a wetland

Soil surveys often provide valuable clues whether a piece of property should be classified as a wetland. Although wetland preservation is currently regulated at the federal and state levels and often at the local level, about 300,000 wetland acres providing wildlife habitats are lost in the United States each year, according to the U.S. Fish & Wildlife Service. The federal government defines wetlands as areas inundated or saturated by surface water or groundwater frequently enough to support vegetation adapted for life in saturated soil. Wetlands are characterized by the presence of specific types of hydric soils, particular vegetation types, and hydrology indicators, according to the Army Corps of Engineers, the group that enforces federal wetlands regulations for the U.S. Environmental Protection Agency.

The regulations affecting wetlands are complex: The same piece of property may come under conflicting federal, state, and local wetlands definitions and rules. Architects, therefore, should treat wetlands with extreme caution, warns Mark Simon, principal of Centerbrook Architects in Essex, Connecticut. Simon points out that some wetlands do not appear to be flooded at all times of the year. To find out if a piece of property is classified as a wetland, an architect should begin by checking with the local Planning Department. Several national wetlands maps are also available. The U.S. Fish & Wildlife Service has completed a wetland inventory for 75 percent of the country and created maps that are overlaid on U.S. Geological Survey (USGS) topographic maps and are available from regional USGS offices.

For large tracts of land that contain extensive natural wetlands, or other environmentally fragile systems, it may be advisable to call in additional professionals with specific expertise. Biologists can be retained to study bird and animal habitats; hydrologists can analyze the attributes of the water present at the site; and archaeologists and soil scientists can study the history of the site.

Xeriscaping for dry climates

Environmental stewardship can be equally challenging and important, however, for land that suffers from a lack of water. One current method to create an esthetically pleasing, planted landscape while using the smallest possible amount of water is called "xeriscaping," a term that combines "xeros," the Greek word for dry, and landscaping.

Xeriscaping is based on seven principles that when applied together can reduce water consumption significantly, according to Petaluma, California-based landscape architect Ali Davidson, past director of the Roswell, Georgia-based National Xeriscape Council and the California Xeriscape Foundation.

Xeriscaping requires the architect to first analyze and plan the landscape, grouping high water-use, moderate water-use, and low water-use plants together in separate zones. Turf areas, which are water-intensive, should be limited and treated as design elements. The soil should be analyzed and improved, if necessary, and appropriate plants should be selected, depending on site conditions. The xeriscaping system also calls for efficient irrigation—separate drip irrigation systems for each water-use zone—and the use of mulches to retain moisture and limit weeds.

No matter what area of the country a project is sited in, architects must develop more creativity to make a positive contribution to the health of our environment, asserts Robert Berkebile, principal with Kansas City, Missouri-based Berkebile Nelson Immenschuh McDowell Architects and founding chairman of the AIA Committee on The Environment. "We speak about reducing the impact of what we build, but frankly, that isn't good enough anymore," says Berkebile. "What we have to begin to do is design in such a way as to shrink the footprint of what we build and give life back to what we develop. The first step is to be more sensitive to the important contribution that an undisturbed site is making to our well-being." —*Virginia Kent Dorris*

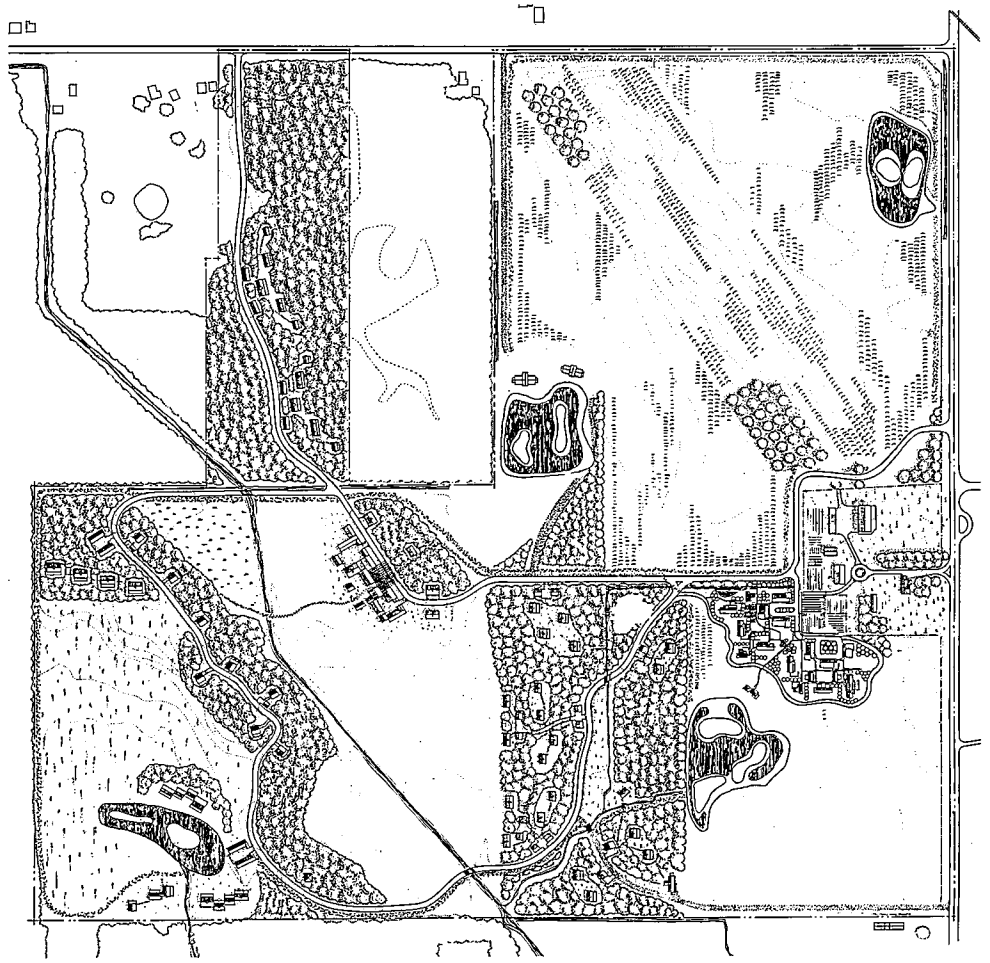
Tryon Farm Development
Michigan City, Indiana
Chicago Associates Planners and Architects

If Tom Forman had chosen to follow conventional wisdom when he began to develop a 162-acre farm near Lake Michigan for housing, the Chicago architect and developer undoubtedly would have sliced up the property into a 1-acre-lot subdivision in accordance with local zoning. Forman, president of Chicago-based developer Chicago Associates, and the property's owners, however, had different ideas about what a development should be for an area of the country rapidly losing its open space and wildlife habitats.

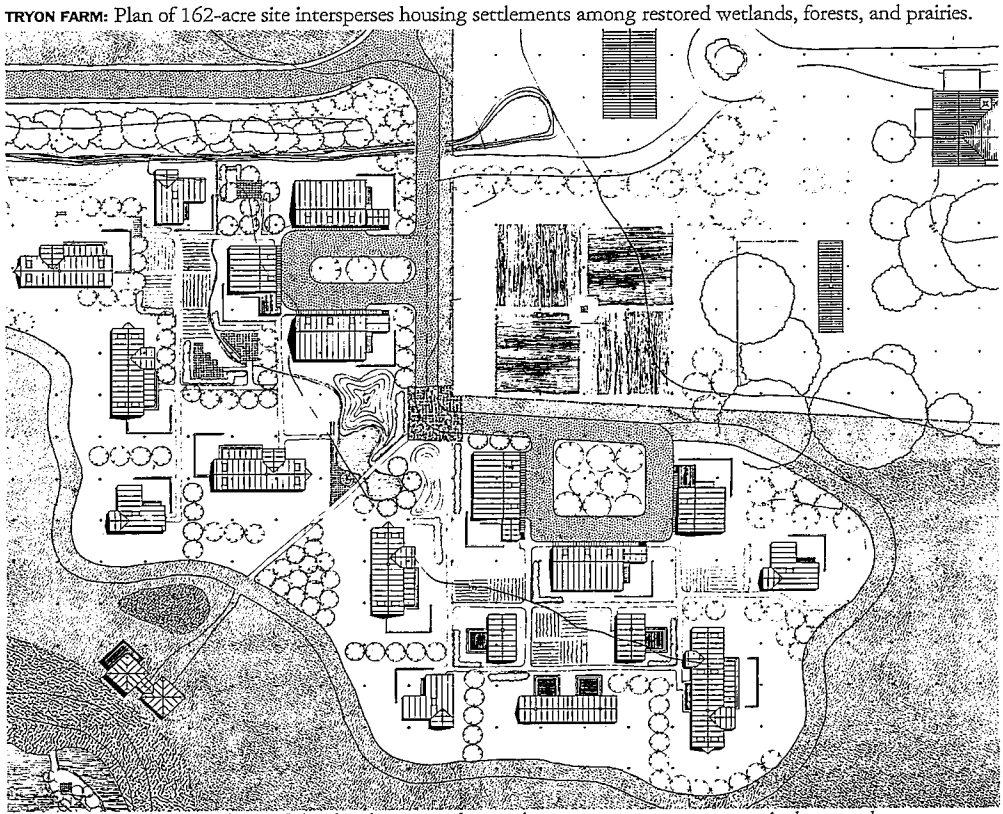
Chicago Associates designed a plan for the Tryon Farm site that restores and preserves 134 acres of wetlands, forests, fields, and prairies, based on a desire to enhance and protect the site's natural, presettlement features. Housing will be clustered in groups of up to 30 units each, built around existing traditional farm roads to minimize disruption to the land.

The Tryon farm landscape is characterized by dune-swale topography, created by glacial movement that left high, sandy dunes separated by low, wet swales. Farming began on the site in the late 1800s. At that time, much of the land was cleared by Charles C. Tryon to raise hay, popcorn, cattle, and hogs. When the farm passed into new ownership in 1943, more land was cleared for agriculture. Under the new development plan, wetland areas that had all but disappeared during the property's century as a farm are being regraded, rehydrated, and replanted. Native birds and other wildlife that had previously abandoned the area have already begun to return.

The housing settlements, to be built in stages over the next seven years, will occupy just 28 acres of the property. With most of the ecological restoration of the site complete, the first settlement is now being constructed. Individual homeowners will own just the land beneath their house plus about five feet around it, but will share cooperative ownership of the remaining open space with their neighbors and will have a stake in a communal garden. The site's open fields, prairies, and woodlands will be protected by deed from further development.

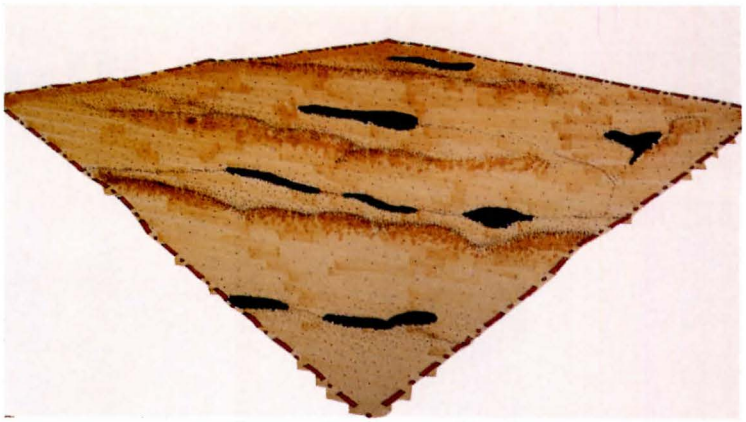


TRYON FARM: Plan of 162-acre site intersperses housing settlements among restored wetlands, forests, and prairies.

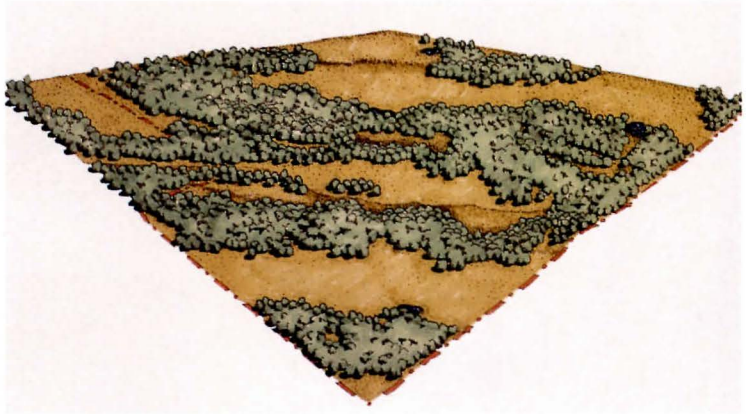


HOUSING PLAN: The first phase of the development clusters houses to preserve cooperatively owned open space.

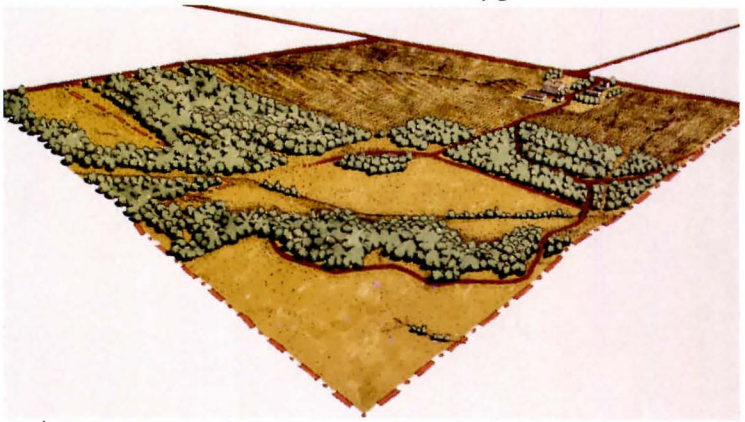
TRYON FARM: Aerial view reveals site conditions before restoration.



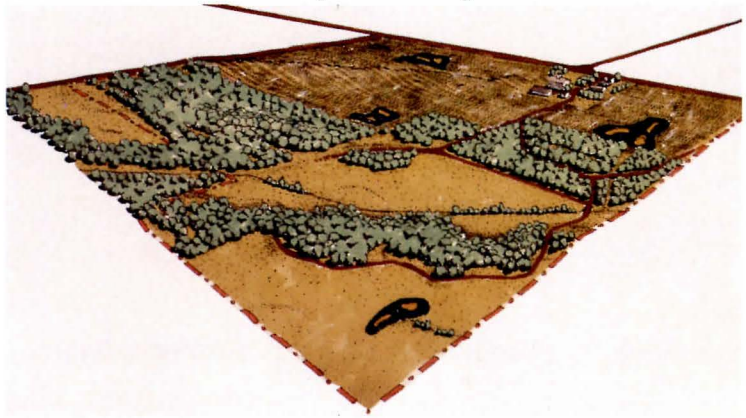
FARM BEFORE SETTLEMENT: Dunes and swales formed by glaciers.



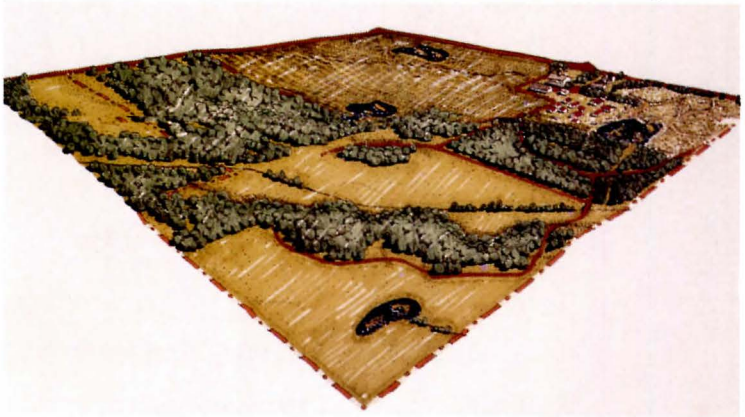
LAND DEVELOPS VEGETATION: Dunes sprout trees and grasses.



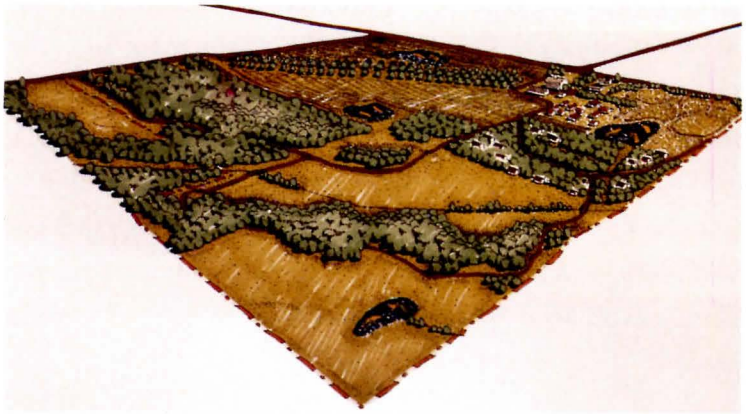
INITIAL DEVELOPMENT: Land is cleared and wetlands are drained for farming.



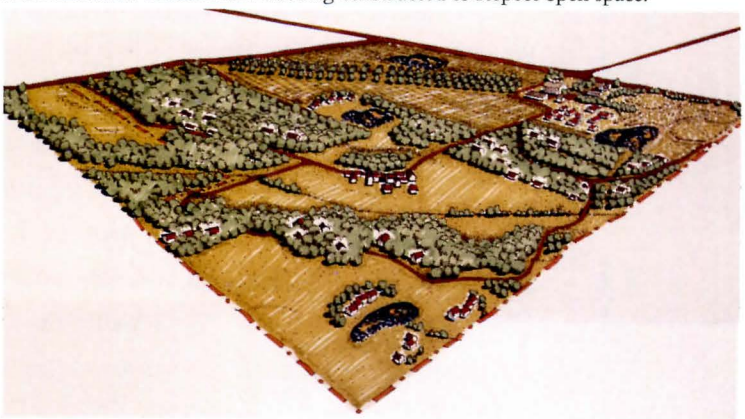
RETURN TO NATURE: Wetlands reinstated on site.



REDEVELOPMENT BEGINS: New housing constructed to respect open space.



LANDSCAPE RENEWED: Stand of trees planted (background) to reforest site.



SITE RESTORED: Housing is integrated into landscape.

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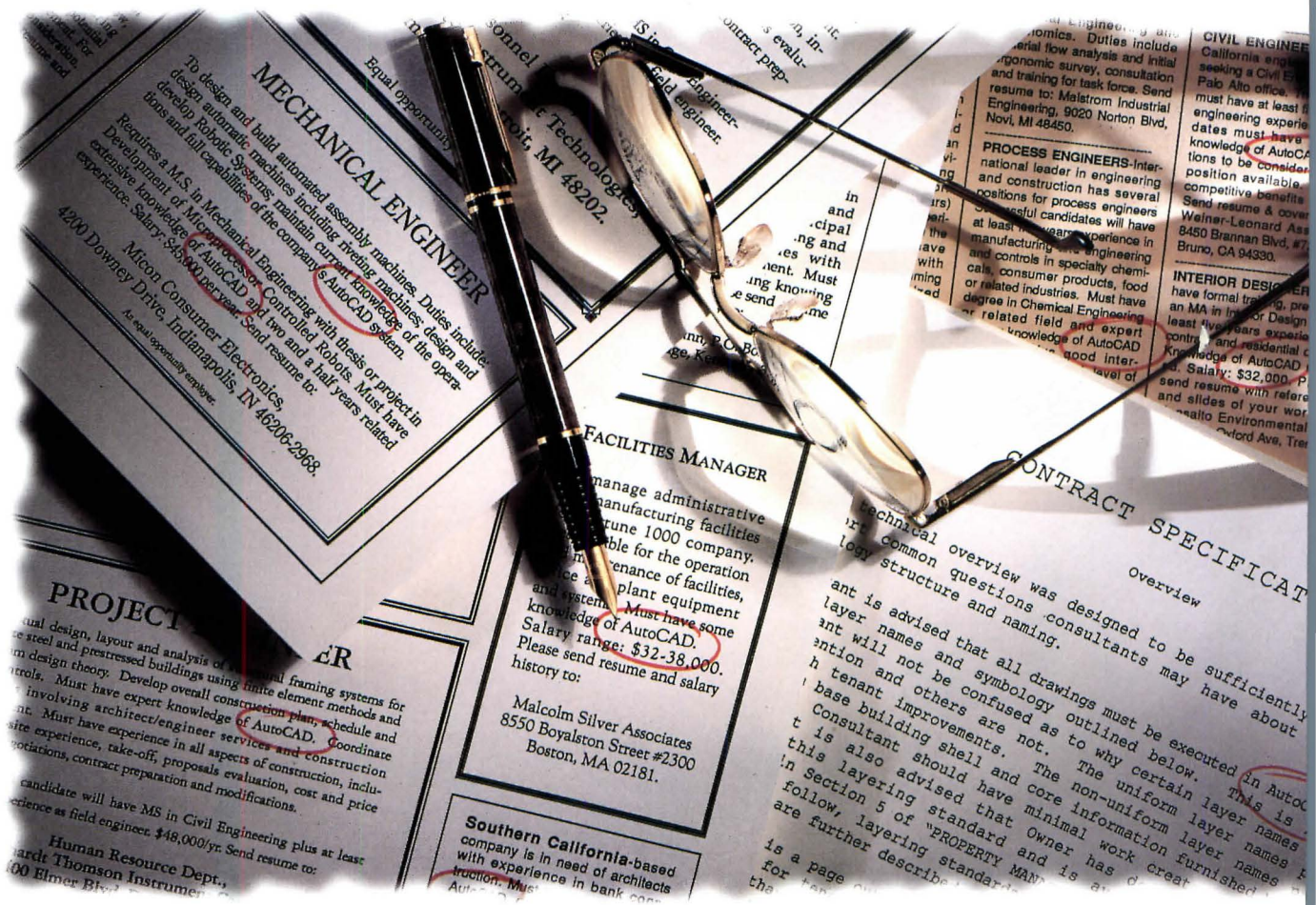

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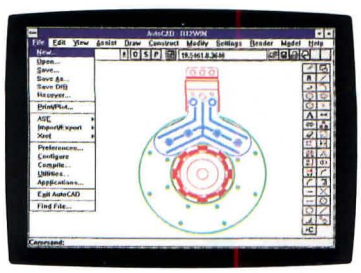

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Architecture in the Balance

Six members of the AIA's Committee on The Environment discuss sustainable architecture.

ROUNDTABLE PARTICIPANTS: (Front row, left to right): Robert Simmons, Frederic Lyman; (Back row, left to right): William Browning, Gail A. Lindsey, Robert Berkebile, Harry T. Gordon.

The three-year-old AIA Committee on The Environment (COTE) is striving to help architects promote sustainable design practices through educational efforts and its *Environmental Resource Guide*. ARCHITECTURE invited architects Robert Berkebile, Harry T. Gordon, Gail A. Lindsey, and Frederic Lyman and scientific advisors William Browning and Robert Simmons—all COTE members—to share their experiences with the committee as well as their firms' activities and research efforts. The committee members voiced opinions on the evolution of environmental awareness since the 1970s, noting that eco-sensitive architecture now demands a more comprehensive approach to design than the technology-driven conservation efforts of the past. To help restore balance to the Earth, the group concluded, architects must become advocates for more sustainable design by questioning manufacturers as to the contents of their products and their effects on the health of building occupants and on the environment. More fundamentally, they must understand the long-range impact of their design decisions.

How do you define sustainable architecture?

ROBERT BERKEBILE: It is design that improves the quality of life today without diminishing it for the next generation.

ROBERT SIMMONS: Sustainability is beyond surviving; it's having a high quality of life—higher than it was before.

GAIL LINDSEY: It's not that easy to define because it involves different levels of personal, professional, community, and global factors. We have to get the personal definition first and be comfortable with that. As Girl Scouts, we were always told that when we left the site it should be better than when we got there.

WILLIAM BROWNING: Sustainability is not saying you can't use a natural resource like wood anymore. It's saying, we will continue to use wood, but we need to think about how we harvest the wood.

How is the environmental movement in the 1990s different from the 1970s?

BERKEBILE: It's clearer now that these environmental problems and their solutions are going to be a permanent part of our daily lives. It's not good enough for us to merely diminish the environmental impact of what we do; we have to restore the environment by each decision we make. When we develop a site, we have to add to its biodiversity rather than take away from it.

HARRY GORDON: In the '70s we were trying to design buildings that were better places and used less energy. Now we're thinking in terms of life-cycle assessments and looking not only at energy use, but also at the waste produced, and the scarcity of materials and how that affects the design process.

SIMMONS: Are your clients demanding those kinds of services more?

GORDON: They are beginning to, and we are trying to broadly inform our clients and fellow practitioners about what the issues are and how they can be part of the solution.

FREDERIC LYMAN: Public opinion has changed without our efforts.

SIMMONS: But if architects don't respond to these needs, some other profession will. Architects are uniquely qualified to do this job.

Why are they uniquely qualified?

SIMMONS: They are leaders of the design team. They are qualified to think through the alternatives and resolve them in advance to the extent that we don't create the pollutant in the first place. Architects have a capacity to work with and coordinate people; they operate on the left side and the right side of the brain. The left side is more analytical and allows you to understand the technical stuff, and the right side deals with the capacity to express and to create from the heart. Architects are very uniquely positioned. It's in their interest to develop new markets.

What are some of the basic steps that architects in small firms could take to integrate more sustainable practices into their daily office routines?

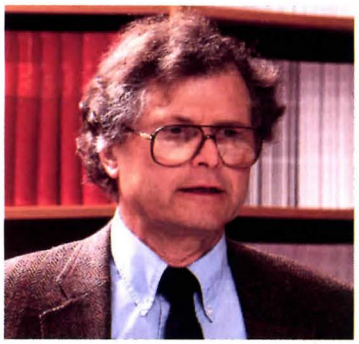
BROWNING: Just asking the questions and working with corporations, developers, and a lot of other players in the building process.

BERKEBILE: We as architects are missing a powerful opportunity if we don't begin asking questions and accepting the fact that we don't have all the knowledge. We're finding a lot of the best information is coming from nontraditional sources, such as biologists and geologists and people whom architects have previously ignored.

LINDSEY: There is a quote that one of my students wore on a T-shirt that said, "Intelligence solves problems; genius doesn't create them." We need to think in longer terms. After I had told a group about really looking at each step of the architectural process, one architect came up to me and said, "I just never thought past seeing the truck carrying recycled cans drive away." We really have to make that connection of where things go, but we're trained very young not to know the cycles.

BERKEBILE: One of the resources that the Committee on The Environment is trying to put

WILLIAM BROWNING: As Senior Research Associate of the Rocky Mountain Institute in Snowmass, Colorado, and director of the Institute's Green Development Services, Browning promotes efficient resource management.



FREDERIC LYMAN: As President of the Malibu Township Council, Lyman strengthened his conviction that architects should be involved in their local governments to promote sustainable design and to help determine U.S. policy.

ROBERT SIMMONS: As Visiting Fellow at the University of Colorado, Simmons is Senior Policy Advisor for EPA's Pollution Prevention Program. He is currently writing a book, *Continued Success: Creating a Sustainable Future.*

forward to help architects is the *Environmental Resource Guide.* By no means is it a perfect document; nor is it complete; but it begins to put information in the hands of architects so they can ask the right questions.

Asking the right questions involves a process of investigation, and that takes time, and time is money. Is sustainable design more expensive than conventional design?

BROWNING: There are two ways of addressing a green building. First, there's a collection of band-aids: better windows; efficient appliances; or an eco-home package which adds, in some cases, five, six, or seven thousand dollars to the cost of the house. Meanwhile, the building may be oriented without any attention to the sun. Some environmental features that are low in cost could have been integrated into the design. Really good windows are more expensive than the older windows. The shell might cost slightly more because of the increased levels of insulation and the thickness of the walls. But the HVAC system can be dramatically downsized, and typically the downsizing more than makes up for the added costs. So you wind up with a good green building at about the same cost as a conventional building.

SIMMONS: Part of the reason why more clients are asking for environmentally sound buildings is because it saves them money, and it makes money. Even if you set aside the value and the critical necessity of sustainability for our society as a whole, the advantages of a better quality of life and a happier place to work in are clear. If you do the right thing energywise, you will save money and make money. You may have extra costs from the beginning. You may need to hire the services of architects and other firms who are smart enough to figure out the right thing to do. But in today's industry, the fastest growing profitmaker is taking these energy-efficient steps. Other countries are moving faster than the United States.

BERKEBILE: It's not just energy efficiency, but resource efficiency, and the first resource is the people. So we're designing more productive and healthier environments.

BROWNING: Increasingly, utilities are offering rebates to the architect and the developer. They give you the equivalent of how much energy you save in three years, and that's split among the architect, the developer, and the mechanical engineer. Even if you're saving a dollar per square foot, and the building improves its performance, people are happier there, and absenteeism goes down even 1 percent, then you just paid for everything.

For a firm that is just beginning the process, it's probably difficult to sell a higher fee on that basis if they don't already have proven credentials. But maybe it's appropriate for that firm to consider this as part of their continuing education. So they get the standard fee, and they invest in continuing education. And then after some credentials, they can request and expect to receive a higher fee because they're delivering more of a product. They're affecting the client's bottom line. That's significant.

LINDSEY: It could be like computer time. Just a few years ago, a lot of small firms were wondering how to efficiently use computers. There was down time, but once you start using the system, the economics work out.

LYMAN: It's interesting that in this time of recession, most of the people on the Committee on The Environment appear to be busy.

GORDON: But none of us produces a perfect building. Each building we do is part of the learning process; each one gets a little bit better. It's important for architects who are trying to produce environmentally sensitive buildings to look for partners in the design process who share their ideals. You have to have the cooperation and the real involvement of the other disciplines, particularly the engineers and the interior designers, because each has a role in making better buildings. If they don't take advantage of the benefits of systems integration, then the costs of the project are increased.

We've been able to produce cost-efficient buildings by spending more money on the envelope but taking it out of mechanical systems or getting elements to perform more than one function. The sprinkler system can become part of the HVAC hydronic distribution loop, or the exhaust air from a building can be used to temper an atrium. These are cascading benefits, but in order to achieve them, architects and engineers have to be in harmony.

How do you achieve that harmony?

GORDON: To some extent, it's trial and error. Architects really need to interview their consultants, ask them questions about their philosophy with respect to environmental concerns. It's a process of sorting out and finding people whose ideals are the same and whose way of working together is not competitive.

BROWNING: It's dialogue. An interior designer, for example, will come up with ideas that an architect never thought of, and that dialogue improves the process. It's building an interactive team, as opposed to taking the drawings

and throwing them over the wall to the consultants and saying, "Here, do this."

SIMMONS: It's a cooperative effort and a process that asks the right fundamental questions. What is the environmental impact of this decision I'm about to make when I pick up my pencil? Answers are different in every location for every application and for every client.

How do you convince your clients that environmental sensitivity is important?

BERKEBILE: A step at a time. I think clients are often more interested in environmental issues than architects imagine they might be. The way we're consuming, the way we're wasting, and the way we're polluting is clearly not sustainable, worldwide. We all know that. Design has proven that many times over. The only question is how long we continue on this path without destroying human life.

In this country, we consume 18 to 22 tons of raw materials per person per year. That is 20 times the rate of the average world citizen. That is twice the rate of Japan, in second place. If you just take it on economic terms, we're being slaughtered globally economically, because we're only half as efficient as Japan. It's impossible to assume that we as architects can convert that particular client from that particular habit to being green the very next day. But you have to at least expose them to the facts and consider making the shift. We're discovering that some of the people who have been the largest polluters are changing more dramatically than those who are considered green at the moment. And that's what's happening to clients' behavior.

BROWNING: Clients might not be able to verbalize a lot of their concerns in environmental terms. They're so used to having a headache when they return home from work that they begin to think it's a part of life, rather than asking the question, "Is my headache coming from stress, and if so, is that stress coming from working in a sick building?"

SIMMONS: Most people in this country spend 95 percent of their time breathing indoor air rather than outdoor air. For most communities, it's the highest health risk. That awareness has yet to come, and still there's an incredible demand from the public to be concerned about indoor air quality.

LYMAN: It behooves architects to get to know their local government, not just the building department and the architectural committees. They should find out what their neighbors want. That way, you'll be better off talking to clients because you'll know the public climate.

Environmental problems and their solutions are a permanent part of our daily lives. It's not good enough for us to merely diminish the environment by each decision we make. When we develop a site, we have to add to its biodiversity rather than take away from it.

How can we change the industry to get more sensitive building product manufacturers?

BERKEBILE: They're changing already. The main way is to let them know what we want, and we've been pretty unclear about that. We've been selecting products based on color, durability, and cost—that's about it. Now that they know we're interested in environmental issues, they are already starting to change.

Look at the changes in carpeting since we began research on materials. They're fairly significant. A lot of other manufacturers are beginning to ask AIA, "We're looking at new product lines. What do you expect? What do you want?" And they're asking us to be more specific. So architects all over this country are asking, "What is this made of? Where does it go after use in this building? And how is that going to affect our health and the Earth?"

BROWNING: Then the manufacturers start looking at the process. They discover that they produce waste and that if they don't have to get rid of the waste, they save money.

BERKEBILE: Herman Miller is a great example. They have eliminated 90 percent of waste out of their manufacturing line.

GORDON: The questions that the architect asks begin to influence the people who make the products. We've seen terrific advances in the materials we used in the building envelope, particularly glazing, and I think we will continue to see those to a large extent. As better products become available, it's going to be possible to produce much better buildings. The interior environment is going to be a better place to be because we're able to control daylight, shading coefficient, and U-value more or less independently. We've seen terrific advancements in lighting, and we'll see a lot more. Architects and lighting designers are beginning to take back the process of lighting design from electrical engineers. We had abdicated a lot of that responsibility, particularly in the commercial sector. Now we can begin to use light as part of the palette.

BERKEBILE: A triphosphorous coated lamp uses a fourth of the energy of the incandescent, and it has 10 times the light. So by the time you factor in buying 10 other lamps and the labor to install the 10 lamps and the waste that's involved, and when you factor in the quality of that light, it's closer to sunlight than the incandescent lamp. That would improve the health of the user. You've increased the efficiency dramatically through that whole process, and everybody wins. The environment wins significantly if you calculate all the pollution that was generated by all the energy that powered the 10 other lamps.

GORDON: People are voluntarily responding to recycling programs in their communities. Low-flush toilets and low-flow plumbing fixtures have been in short supply because there's been a high demand for them. I hope that they're indicators of change on the part of people and the way that they look at products.

SIMMONS: Energy-efficient lighting fits the same category. And it illustrates a significant part of this emerging paradigm. When they're ready to occur, changes can happen very fast.

There seem to be inherent conflicts in specifying certain materials. For example, do you specify tropical woods to help the economy of an indigenous culture, or do you ban tropical woods because it means the destruction of tropical forests?

LYMAN: Sustainable forestry has improved tremendously in the last year. The Rainforest Alliance has their Smart Wood program, and a company called Sea Star Trading is now involved in sustainable logging operations; more seem to be appearing in the tropics. Also, I've been able to find one or two temperate forestry systems. There seems to be more and more interest on the part of logging companies to develop sustainable systems.

BERKEBILE: There are still faux green products out there, including so-called sustainable, tropical woods. It's still not a perfect world, but we should continue to demand certification. The more requirements we give, the healthier and more responsible each of these suppliers will become.

To become advocates for more sustainable design, architects should pick one thing that you can do with a project on your boards right now. Start somewhere: whether it's specifying material that has a recycled content, or designing to improve site orientation.

Are building codes, zoning, and other regulations changing to accommodate more environmentally sensitive design, or do you view them as barriers to achieving sustainability?

SIMMONS: If we develop partnerships for voluntarily providing solutions to these problems, then we won't have to be regulated, because the public will be demanding them. There's no way we can take problems this complex and regulate all of them. It's too expensive; it's absolutely impossible.

BERKEBILE: It's also too slow.

GORDON: We're going to see standards being voluntarily established by the profession. In addition, regulations are also coming into the process. The Energy Policy Act, for example, just set regulations relative to energy and water use. The Clean Air Act set standards that affect architectural coatings. And we're likely to see standards affecting air pollution. As practitioners, we look to a combination of regulations imposed from above and voluntary participation from our own ranks.

BERKEBILE: We have to recognize that there are a number of land use laws and zoning and code ordinances in every major city in this country that prevent us from providing sustainable development. I think we have to consider challenging those archaic laws and changing them. Zoning laws were created decades ago to increase property values, and in terms of meeting those goals, they've been fairly successful. Property values did increase. But when those laws were created, we didn't know about limited resources, and we didn't know about pollution. We didn't recognize it was going to consume vast amounts of real estate, and it would create separation and isolation and the variety of other evils that we are now discovering. It's a very different world than it was when we created those laws.

BROWNING: With energy codes, more and more are performance based. Rather than saying you will use this R-value in this wall, [the new codes say] you'll not have more than X number of Btus per square foot per year. That allows enormous creativity.

LINDSEY: We need to start looking at tax incentives for preservation. When we talk about sustainable development, I think of a sign over a preservation foundation in North Carolina that says, "Renovation—the ultimate in recycling." Tax incentives have to start showing up in government policies.

BROWNING: There's a marked opportunity in renovation and recycling to really differentiate yourself in the marketplace—not just doing a cosmetic renovation, but improving the performance in the building in unusual ways. We know of a developer in Los Angeles who had a 20-year-old office tower and was going to do a gut rehab. He took it a step further and saved 75 percent of the energy in the building with a less than six-year payback on it. That's a pretty incredible way to differentiate your product in the market.

What can architects do to get involved in public policy that promotes sustainable development?

BERKEBILE: My impression is the new administration will be very interested in sustainable strategies. Al Gore, for example, has been very supportive of the AIA's environmental initiative and the *Environmental Resource Guide.* This is a brilliant opportunity for architecture and for professionals to participate in helping define a new future for this country.

LYMAN: It disturbs me that architects have not taken the positions in the U.S. government that it seems to me they should. Most of them have been taken by attorneys. To have attorneys in charge of the Department of Housing and Urban Development is ridiculous. We had one architect who was Assistant Secretary of the Department of Housing and Urban Development a few years ago, and he told me that he had the highest rank in government of any architect since Thomas Jefferson. Certainly the Department of Housing and Urban Development, the Department of the Interior, the Department of Transportation, and the Department of Energy should be run by architects, and we should certainly be working for other positions of importance. We should be getting the profession of architecture involved in determining U.S. policy.

The architectural profession should be organized as an ombudsman for entire areas. Citizens should be able to turn to an architect and say, "I don't like this park being turned into a parking lot. Won't you help us out?" We can start that out on a volunteer basis, and as it becomes clear how significant and important architects are in the development of the communities, then perhaps we'd even be paid for that service.

Is the educational system changing to promote environmental sensitivity?

SIMMONS: The architects of the future are going to be more politically involved in their community. Ball State University is an incredible example of a student population that is demanding to help their school develop a very progressive program.

LINDSEY: Teaching at North Carolina State University, I found that the students actually started a petition and said that they had to have an environmental architecture studio.

BERKEBILE: Just two or three years ago at the AIA convention I did a survey, and about 90 percent of all the students there did not have any kind of environmental design available in their schools. Most of them could take an environmental course in another department, but they couldn't take it in architecture school. Since then, the Committee on The Environment had the opportunity to talk with educators. Their initial response was, "We know there's more interest on the part of the students, but we don't have room for another course." They thought of this as just one new subject, they didn't think of it as being integrated into the curriculum. But now that's starting to change. Ball State, the University of Virginia, and others are developing really good programs. I think many schools are starting to add a new course or two, or starting to influence the design studios.

How is green architecture affecting esthetics?

BROWNING: I remember a line from the essay in your May 1991 issue, "Maybe this hasn't caught on because there is no discernable style associated with green architecture." There probably never will be a style for green architecture. It's a process; it's not a style.

BERKEBILE: If you design in an environmentally sensitive way, buildings will tend to take on the characteristics of their region, the climate, the materials that are available, the local culture. That will affect architecture and

the way it looks. I don't think New Eco will ever be identified as a style.

GORDON: There will be flexibility in the buildings that architects produce. They won't really have an identifiable look like in the '70s. The kind of architectural style will appear appropriate for a particular location.

BROWNING: I think the most sustainable architecture will turn out to be the most beautiful.

BERKEBILE: We're redefining what beautiful is. That's the issue.

BROWNING: These are intelligent buildings that truly respond to where they are.

SIMMONS: And respond to their occupants. The public will be asking architects for more, not less. They're going to want beauty; they're going to want esthetics; but they're also asking architects to give them a higher quality of life. Architects who rise to the occasion will be successful; those who don't will not.

BERKEBILE: Bucky Fuller said you can't make significant change by force. If you want to change something, you have to make the thing you choose to change obsolete. The sooner we offer examples that touch the heart and cause the spirit to soar, the sooner we'll get to a new approach to architecture.

BROWNING: Look at a building like Thorncrown Chapel. It's 2 by 4s and glass. And yet they carried everything in so they wouldn't damage the site. It's a very simple building. It is sensitively sited, and people come from hundreds of miles to sit in this little church.

BERKEBILE: Now they have to build a bigger church to house all the people.

What are some models of sustainable design to inspire architects?

BERKEBILE: Well, there are a very few, but they're growing. There are a lot on the drawing boards. We're all working on this, and it is improving all the time. And I think some of the projects that have been touted worldwide don't really achieve their goals.

BROWNING: The Rocky Mountain Institute is a good example of energy conservation, and there are entire subdivisions of new towns that are incredibly environmentally responsive. Haymount, Virginia, minimizes use of energy in buildings. They're doing ecological restoration on the site, connecting wildlife corridors that have been broken, and they're going to landscape the development with all native or edible food-producing species. They are mixing incomes and businesses into the neighborhood. And a utility in Germany has hired Frank Gehry Associates to design a green building; so it goes from Haymount's Neocolonial to Gehry's Descontructivism.

BERKEBILE: I think that's significant. There are other well-known, widely published architects who are beginning to look at these issues. Harry Cobb and others are starting to read the *Environmental Resource Guide.* That's going to make a significant difference in the shift that's already underway.

SIMMONS: The creative window is open for architects to come up with sustainable solutions. Probably 5 to 10 years from now we'll look back, and the examples that are out there now will only be about 10 percent of what's going to be there. So the opportunity to create totally new ways of living with higher success in terms of economic payback and the ability to produce a higher quality of life will really be there.

LINDSEY: There's the issue of the humanistic, hands-on appearance and the technology. It's not to go one way or the other, but an interconnectedness in using both.

BROWNING: Enduring designs are really good designs. They tend to stick around. I'm part Native American, and quite frequently in Native American cultures, there is no differentiation between utilitarian object and art. The beautiful pottery you see in the Southwest are utilitarian objects, and they endure.

What is one small step architects can take to become advocates for more sustainable design?

LINDSEY: Figure out what north, south, east, and west mean.

SIMMONS: Join their local AIA sustainability group, and if there isn't one, create it.

BERKEBILE: Read the *Environmental Resource Guide.* Sign up for our teleconferences. Go to the convention in Chicago in June. Those are all crash courses in sustainable design. They teach you what kinds of questions to ask and show you the best examples of what's available.

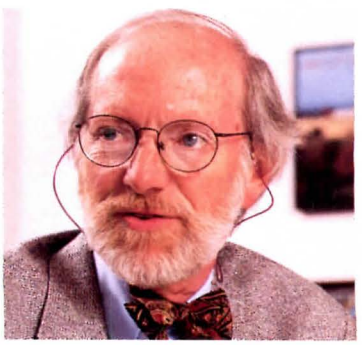
BROWNING: Go find the local environmental group that's stood up and said nasty things about you and one of your projects in recent months. Find out what the local ecosystem is, what the local environmental concerns are, and how those can be addressed.

GORDON: Pick one thing that you can do with one of your projects that's on the boards right now. Start somewhere: whether it's specifying material that has a recycled content, or designing to improve site orientation or indoor air quality. Just pick something and get started.

BERKEBILE: Architects have an incredible opportunity to expand their role in the building environment and to provide better service and to help restore this planet to balance.

HARRY T. GORDON: As Principal of Burt Hill Kosar Rittelmann, Washington, D.C., Gordon has won national awards for sustainable projects, is the author of *Commercial Building Design*, and lectures on environmental design issues.

GAIL A. LINDSEY: As founding Principal of Design Harmony, in Raleigh, Lindsey is involved with eco-sensitive projects. She teaches sustainable architecture at North Carolina State and Duke University.



TERRY ASHE PHOTOS

ROBERT BERKEBILE: Principal of Berkebile Nelson Immenschuh McDowell in Kansas City, Berkebile was founding Chairman of COTE and was instrumental in developing the AIA's *Environmental Resource Guide.*

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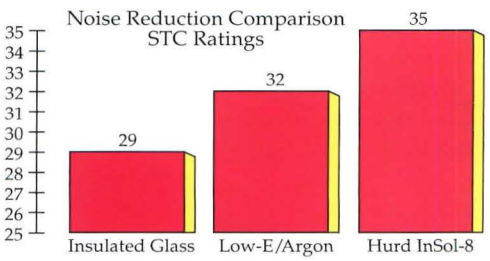

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Survival of the Forests

Saving our forests requires more than boycotting tropical woods and endangered species.

STEVE TERRILL PHOTOS

LEFT: Only 5 to 10 percent of old-growth forests in the pacific Northwest remain, such as Douglas firs in Oregon's Columbia River Gorge.
RIGHT: Logging operations such as this clear-cut in Mount Hood National Forest, Oregon, can fragment the forest ecosystem, endangering wildlife. The spotted owl, whose habitat has been jeopardized in this region, is considered an indicator species, revealing the health of the forest ecosystem.

Architects specifying Douglas fir for a roof truss or Swiss pear for a hotel lobby rarely consider the tree's age, its biological links to other species, or its origins—whether a mature Oregon forest or an Indonesian tree farm. They rarely consider whether the trees were clear-cut or selectively felled. They rarely consider whether the trees were harvested by heavy machinery or how many miles of roads were built to get the trees out of the forest. Such considerations, however, are at the heart of the conflict between environmentalists and the timber industry, a controversy President Clinton attempted to resolve—with little success—during the forest conference held in Portland, Oregon, this April.

For architects, the battle over forest preservation has resulted in greater deliberations over the environmental impact of specifying wood. Architects must not only consider whether a species comes from sustainably managed forests—those in which timber companies respect ecology, stable timber yields, and local economies—but also whether wood suppliers' environmental claims are accurate.

Endangered wood species

The condition of the world's forests varies depending on region and forest type, but tropical forests appear to be the most severely threatened. The United Nations Food and Agriculture Organization estimates that 42.5 million acres of tropical forest are denuded each year, 54 percent more than a decade ago. Whether these forests can recover remains an open question, but the obstacles seem formidable. In contrast to nutrient-rich soils of temperate or boreal forests, the sustaining agents of tropical forests mostly reside in trees, making it difficult for cleared forests to regenerate. Replanting efforts in tropical countries, therefore, are sporadic at best. The UN agency predicts that if current land-use practices continue, tropical forests may disappear by the middle of the next century.

In 1992, Brazilian rosewood was banned from trade under the 1975 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). In 1990, Herman Miller had already stopped producing its Eames chair with Brazilian rosewood, substituting cherry and walnut. Other endangered species, including American mahogany, sapele, teak, iroko, and ebony, have been listed by environmental groups such as the New York-based Rainforest Alliance.

In contrast, more resilient temperate and boreal forests are larger today but less healthy and biologically varied than they were 100 years ago, according to a report by the World Wildlife Fund. Temperate woods such as redwood, western red cedar, and Douglas fir—if they are logged from old-growth forests—are on the endangered lists of independent environmental groups, such as the Rainforest Action Network.

Architects can help to preserve endangered woods by specifying materials from "certified" companies. Sponsored by environmental groups, these certification programs

SCOTT LANDIS PHOTOS

TOP: At the Yanesha Forestry Cooperative in the Palcazú Valley of Peru, labor-intensive logging techniques minimize disruption of the rain forest habitat.
CENTER: Yanesha workers prepare a log cradle to be drawn by oxen.
ABOVE: A selection of lesser known Peruvian hardwoods—cachimbo, tornillo, and chontaquiro amarillo—are stacked and ready for export.

evaluate both tropical and temperate timber-harvesting operations for environmental practices and certify those responsible.

Certification efforts

For example, as part of the Rainforest Alliance's Smart Wood program, logging companies and wood product manufacturers pay a fee to have their products evaluated for environmental impact. Companies that meet certain standards receive a label endorsing their products. According to the Alliance's natural resource expert Richard Donovan, a species may be mismanaged in one region but well-managed in another. "Buying from the well-managed region can encourage responsible timber harvesting," Donovan observes. "Architects need to pressure suppliers for woods that have been independently certified for sustainable management."

In a recent evaluation of the Collins Almanor Forest in Northern California, Oakland-based Scientific Certification Systems (SCS) evaluated sustainability of timber resources, forest ecosystem management, and local socioeconomic conditions. Each category was scored using an index of 0-100. While the SCS's broad criteria are similar to those in the Rainforest Alliance's Smart Wood program, the Oakland group's approach is more like a nutritional label than a flat-out product endorsement. "We moved away from a system that designates one enterprise as sustainable and another as nonsustainable. There is no neat, tidy line you can draw in the sand," explains Deborah Hammel, SCS's director of forestry programs. "The best a timber cutter can do is be conservative and use known techniques that have a low impact on the forest."

A myriad of certification organizations have cropped up around the globe, including the UK-based Soil Association; the Silver Forest Foundation in Canada; and the Institute for Sustainable Forestry in Redway, California. In order to create a level playing field among certifiers worldwide, forestry and wood specialists have established an international body called the Forest Stewardship Council (FSC). The council's mandate is to set worldwide forestry standards "by promoting widely respected principles of good forest management," according to Jamison Ervin, FSC's interim board coordinator. Using these principles, the FSC plans to accredit certifiers like SCS or the Rainforest Alliance, who, in turn, certify forest-product companies. "Without uniform standards, certification doesn't mean very much. Anybody can look at a forest and certify it," explains Ervin.

Sustainable practices

Architects have also begun their own research on sustainable sources of timber. New York practitioner William McDonough, for example, designed a roof deck with sustainably managed Douglas fir and southern yellow pine for the environmentally conscientious Wal-Mart store in Lawrence, Kansas. "We couldn't find a well-managed source of domestic timber that fit our specifications, so we created one from scratch," explains McDonough. He cofounded a trading company called the Timber Source, which enlisted the Oregon-based Rogue Institute for Ecology and Economy to monitor a harvest of Douglas fir and ensure protection of watersheds and local animal and plant species.

Pamela Wellner, conservation coordinator at the Rainforest Action Network in San Francisco, agrees that architects should only specify independently certified, sustainably managed wood, but she worries that few sustainable sources exist. Wellner cites a study by the Yokohama-based International Tropical Timber Organization, which concludes that truly sustainable timber operations can be found in less than 1/8 of 1 percent of rain forests.

Wood boycotts

Meanwhile, architects in Baltimore, Maryland; Santa Monica, California; and Bellingham, Washington, are being forced by ordinances in those cities to forgo specifying any tropical wood in publicly funded projects. Richard Donovan of the Rainforest Alliance, however, cautions that such boycotting of tropical wood may not lead to rain forest preservation. Tropical forests are often cleared for agriculture, mining, or fuel, regardless of whether markets exist for commercial timber. Donovan acknowledges that boycotts may be appropriate where the extinction of a species due to logging is imminent, or where a forest's nontimber economic value is significant, providing local people with latex, medicine, or tourism.

Rather than impose blanket boycotts of tree species, or of whole tropical regions, Donovan recommends that architects specify wood on a case-by-case basis. He notes that while mahogany is overexploited in Brazil and Bolivia, the Rainforest Alliance has approved and certified several Honduran sources of mahogany.

The AIA takes a similar position, maintaining that it "makes more sense to support sustainable forestry than to ban all tropical woods," according to AIA's Committee on The Environment founder Robert Berkebile. In the absence of independently certified sus-

tainable sources, Berkebile recommends that architects consider specifying salvaged or recycled woods, or temperate woods from second-growth forests.

Ensuring quality

As Croxton Collaborative Codirector Kirsten Childs discovered, specifying certified wood does not always guarantee quality. For the firm's renovation of the National Audubon Society's headquarters in Manhattan (pages 62-69), Childs considered Honduran mahogany veneers and a little-known tropical veneer called breadnut, certified by the Rainforest Alliance. When the mahogany veneers were delivered to a New York mill, however, they had been sliced unevenly, making the wood extremely difficult to finish, and frustrating millworkers who already had stocks of beautiful, though uncertified, mahogany in their shop. Likewise, the certified breadnut flitches were cracked throughout, with saw marks through them. "They were completely unusable," Childs complains. "We had to compromise and use American hard maple from conventional sources for contrasting hardwood edges."

Steve Loken, a builder and the director of the Center for Resourceful Building Technology in Missoula, Montana, contends that overharvesting of old-growth forests in the Pacific Northwest has affected the quality of temperate lumber, because the wood that timber companies are processing for domestic markets is coming from younger, immature trees that lack the fine grain and strength of older trees. "The quality of plywood has diminished so much over the past 8 to 10 years that I don't use it anymore. It has big knots and voids in it," Loken asserts. He recommends salvaging and recycling woods from job sites or salvage companies over purchasing new timber or plywood.

Alternatives to wood

Architects should also consider adhesively bonded lumber for beams, bench tops, and stair treads. Such timber, constructed of small pieces and sections of wood glued together, produces less waste.

Other alternative wood-efficient products include oriented strandboard, waferboard, and melamine-face chipboard. Some timber industry analysts, however, argue that wood alternatives may have worse ecological implications than managed logging. A 1976 study by a National Research Council Committee on Renewable Resources for Industrial Materials compares the environmental impacts of wood, steel, aluminum, brick, and concrete block. The study concludes that wood, in addition to being the only renewable resource, requires less energy to produce and creates less damage to air and water. "The answer lies in finding the best way to harvest trees rather than not cutting trees at all," admits Shelley Hershberger, manager of industrial markets at Western Wood Products Association's Portland headquarters.

A forest database

The environmental issues that play a role in evaluating wood are now becoming more accessible to architects. Tree Talk, an educational foundation in Burlington, Vermont, for example, is amassing computerized data on forest and tree species that will enable architects to make quick, intelligent decisions regarding hundreds of wood species. An IBM-compatible computer program called Forest Resource Information System, or FORIS, available this fall, will also enable architects to evaluate the environmental impact of various wood species. An architect may learn, for example, that Douglas fir is harvested in a variety of ways—some with substantially worse environmental effects than others. A practitioner might also discover that a species is typically logged by clear-cutting of old-growth stands, but is also available from less damaging, selective harvests. The architect could then search the database for a particular source that supports the more environmentally responsible harvesting method.

Another resource is the American Institute of Architects' *Environmental Resource Guide,* an in-depth quarterly analysis of the environmental impact of various building materials. A recent edition focuses on tropical woods, addressing their life-cycle environmental costs from forest extraction through manufacture, use, and disposal.

In general, architects specifying wood should research their suppliers. If a wood is listed as endangered by an environmental group or government agency, it should be avoided unless suppliers can provide independent documentation that the wood originates from a sustainable source. Recycled or salvaged woods in the desired species are a good alternative if sustainable virgin sources are unavailable. By applying pressure on suppliers, architects can help to force the timber industry to correct environmentally damaging forestry practices. —*Michael Wagner*

Michael Wagner, a New York-based writer, frequently covers environmental issues.

Suggestions for further reading

Federal Forests and the Economic Base of the Pacific Northwest: A Study of Regional Transitions, by H. Michael Anderson and Jeffrey T. Olson, The Wilderness Society, Washington, D.C., 1991.

No Timber Without Trees, by Duncan Poore, Earthscan, London, 1989.

Primary Source, by Norman Myers, W.W. Norton, New York, 1984.

Rainforest Destruction: Causes, Effects, and False Solutions, by the World Rainforest Movement, Penang, Malaysia, 1990.

Tropical Hardwoods, the U.S. Role in the International Tropical Timber Trade, by Mike Roselle and Tracy Katelman, Rainforest Action Network, San Francisco, 1989.

The Wood User's Guide, by Pamela Wellner and Eugene Dickey, The Rainforest Action Network, San Francisco, revised, 1992.

Wood vs. Non-Wood Materials in U.S. Residential Construction: Some Energy-Related International Implications, a working paper by Peter Koch, Wood Science Laboratory, Corvallis, Montana, 1991.

World Resources 1992-93, A Guide to the Global Environment—Toward Sustainable Development, a report by the World Resources Institute, Washington, D.C., 1992.

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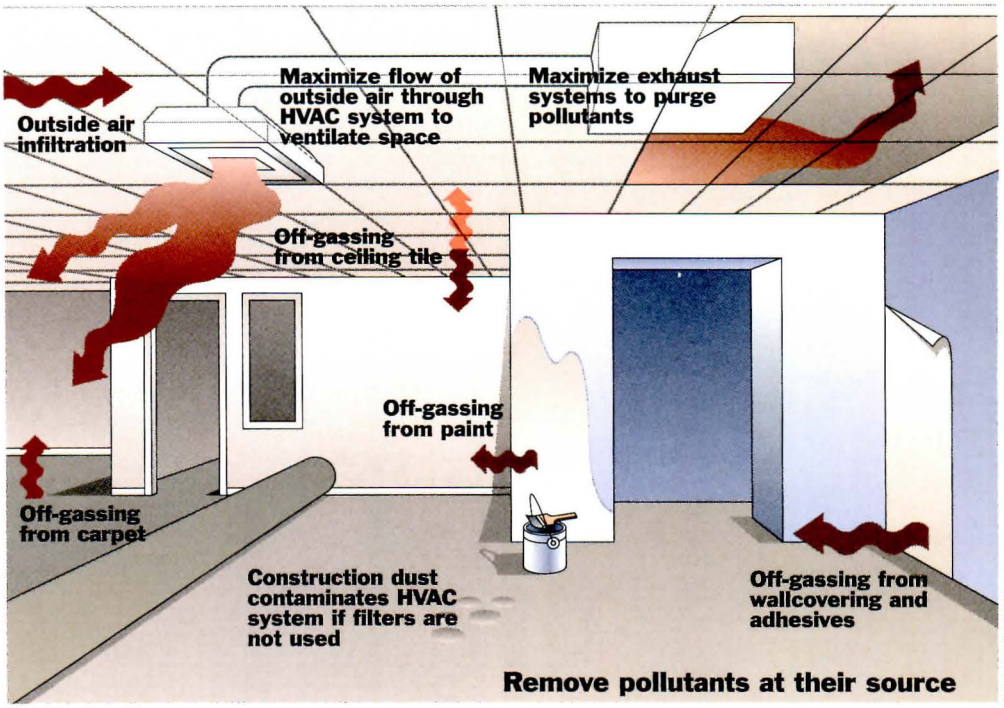


RIGHT: Many pollutants are off-gassed from construction materials and finishes. Inadequate ventilation further compromises indoor air quality.

The average American spends nearly 90 percent of an average day indoors, and new studies indicate that this habit may mean exposure to more air pollutants than if more time was spent outdoors. The World Health Organization estimates that 30 percent of all new and remodeled buildings in this country suffer from poor indoor air quality. The U.S. Environmental Protection Agency (EPA) ranks indoor air pollution as the fourth largest environmental risk to public health and estimates that American businesses lose more than $60 billion annually due to absenteeism and low productivity. As a result, increasing attention is now being paid to rescuing the white-collar workplace from airborne contaminants and numerous other types of indoor pollution.

Worker symptoms

The term "building-related illness" has been coined to describe occurrences of bronchitis, asthma, Legionnaire's Disease, Pontiac Fever, and other symptoms that can be traced to specific airborne contaminants in buildings. For the ailing worker, merely vacating the affected environment fails to alleviate these illnesses. More temporary and pervasive ailments such as headaches; eye, nose, and throat irritation; dizziness; nausea; and fatigue, which disappear outside the workplace, are categorized as "sick-building syndrome." But many of these symptoms cannot be attributed to any specific cause. While the hazards of asbestos and radon have been quantified in buildings, the effect of thousands of individual low-level pollutants and their interactions with one another have not been determined. The science of measuring air is precise enough to identify the presence of particles and gases. However, associating the health effects of prolonged exposure to such toxins with specific threshold levels is not as exacting. With the causes of sick-building syndrome difficult to pinpoint, how can architects be expected to improve indoor air quality through design efforts?

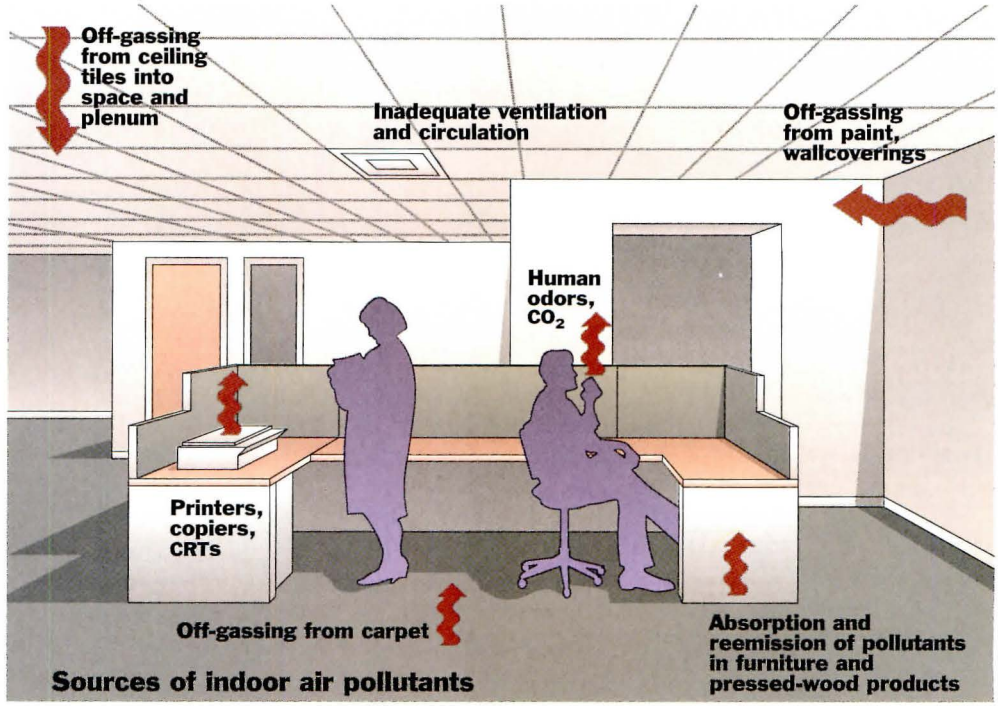
Ventilation standards

As awareness of indoor pollution rose in the 1970s, many design and construction professionals initially placed much of the blame on more tightly sealed building envelopes and on reduced ventilation rates designed to enhance energy efficiency. In 1981, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) reduced minimum recommended ventilation rates in commercial spaces from 15 to 25 cubic feet per minute (cfm) per person down to 5 cfm in its ASHRAE Standard 62-1981.

In response to increasing complaints over discomfort and reported cases of sick-building syndrome, ASHRAE revised its 1981 levels. In 1989, the society published ASHRAE Standard 62-1989, Ventilation for Acceptable Air Quality, boosting outside air supplies to 15 to 20 cfm per person. However, the ASHRAE standards, which serve as design guidelines for buildings, ranging from

RIGHT: Potential workplace pollutants include office equipment such as copiers and printers. Upholstered furniture, fabric finishes, and carpets absorb and later emit volatile organic compounds.

FACING PAGE: Physically separating pollutants and providing a sufficient supply of filtered air throughout the space limit exposure to those sources that cannot be otherwise eliminated.



Sources of indoor air pollutants

Indoor Air Pollutants & Sources

Pollutants	Sources
Volatile organic compounds (VOCs)	Paints, stains, adhesives, dyes, caulks, cleaners, pesticides, building materials
Environmental tobacco smoke	Cigarettes, cigars, pipes
Formaldehyde	Environmental tobacco smoke, urea-formaldehyde resins, particleboard, plywood, furnishings, upholstery
Pesticides	Pesticide application, indoors and outdoors
Asbestos	Asbestos cement, insulation, building materials
Biological contaminants (bacteria, viruses, fungi, mold, spores, pollen)	Humans, animals, improperly maintained or designed HVAC systems
Polycyclic aromatic hydrocarbons (PAHs)	Tobacco smoke, kerosene heaters
Combustion gases (carbon monoxide, nitrogen dioxide, sulfur dioxide)	Tobacco smoke, infiltrated exhaust, combustion appliances, kerosene heaters

houses, to dry cleaners, warehouses, and office towers, place the responsibility for determining pollutant levels and appropriately higher ventilation rates in the hands of the architect and mechanical engineer. Therefore, prescribed minimums frequently become design maximums, and even under ASHRAE's revised standard, neither the air quality nor the operating performance of the building's mechanical system is monitored. Similarly, operable windows do not ensure adequate air supply or distribution; unfiltered outside air may not be clean and contaminant-free.

Preventing toxic sources

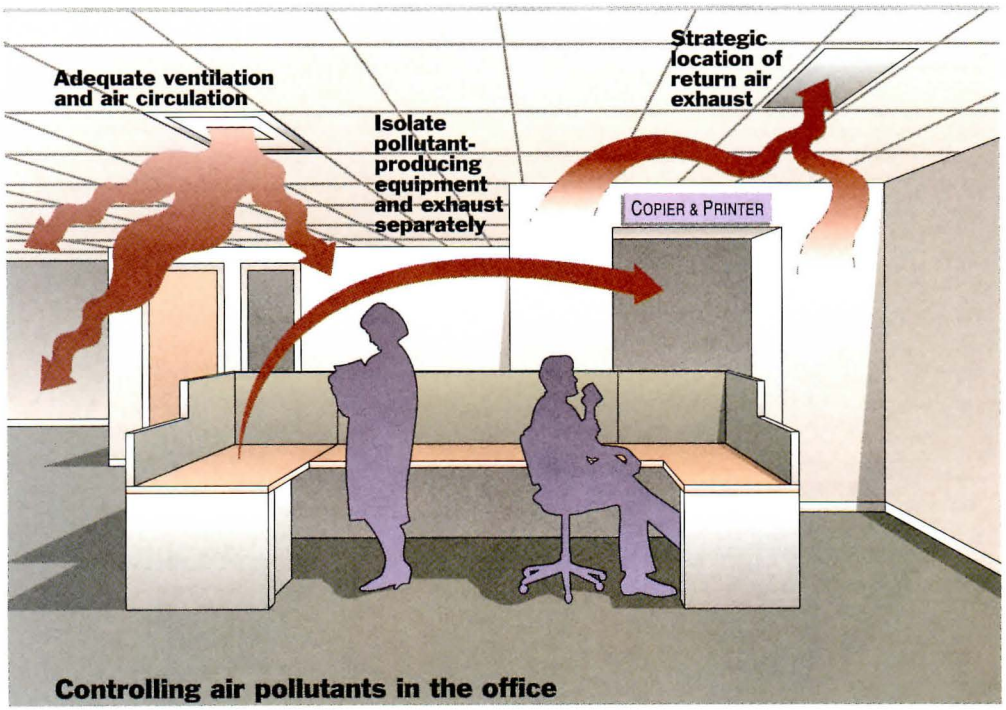
Hal Levin, a Santa Cruz, California-based architect and publisher of the *Indoor Air Bulletin*, points out that ventilation is not the only solution to improving indoor air quality and that ventilation must be analyzed in tandem with other building elements. Within an office, for example, potential pollutants include volatile organic compounds (VOCs) from paints, sealants, caulks, stains, polishes, and adhesives; composite-wood products such as particleboard, which often contains formaldehyde; biological contaminants such as molds, fungi, viruses, and bacteria, which flourish in high humidity; and combustible gases such as carbon monoxide and tobacco smoke.

By focusing attention on those materials that emit the strongest pollutants and comprise the greatest interior surface area, architects, as specifiers, play a critical role in determining and limiting the extent of toxins introduced into the buildings. Activities such as printing, smoking, and food preparation, as well as commonly recognized sources, such as copying machines with chemical toners, should be isolated. They should each be placed in a separate space with a dedicated air-handling system providing one pass of filtered outside air to reduce exposure. Sources such as pesticides, cleaning agents, and chemicals are beyond the means and control of the architect, as is the continued operation and maintenance of the facility. Even occupants and their clothes potentially harbor chemicals and odors that can only be controlled by diluting the sources with ventilation.

Environmentally sound installation

The sequence of installing construction materials and finishes also contributes to the eventual severity of indoor pollutants. Off-gassing of volatile organic compounds from newly installed materials and furnishings is greatest during the initial few months of occupancy, according to Marilyn Black, principal of Air Quality Sciences, an Atlanta-based environmental testing laboratory. Finishes such as carpet, fabric wallcoverings, and upholstery can act as "sinks," absorbing and later emitting irritants and contaminants originating from other sources. Ideally, fabric furnishings should be installed after "wet," VOC-emitting products, such as paint, have cured.

In addition to specifying nontoxic products, architects can also reduce pollutants by airing materials, finishes, and furnishings in a



Controlling air pollutants in the office

well-ventilated space before installation. Contaminants can be further flushed out of the building with a constant supply of outside air to purge and reduce their concentration before final occupancy and after evenings, weekends, and holidays when mechanical systems are frequently shut off, allowing pollutant levels to build up. Since temperature and humidity also affect pollutant levels, a preventative technique called "baking out" has been developed. With this method, the building is heated above normal comfort levels to draw out VOCs from new products. Unfortunately, such high temperatures may also damage materials and finishes.

Government regulations

According to Robert Axelrad, director of the EPA's Indoor Air Division, the federal government has taken a nonregulatory, voluntary approach to addressing the problem of indoor air pollution, encouraging the building industry and product manufacturers to adopt their own comprehensive emission standards. Although Congress has proposed federal legislation to address indoor air quality, no law or code currently governs pollutant levels. With the exception of the Occupational Safety and Health Administration (OSHA) standards establishing indoor air guidelines for the industrial workplace, no regulations stipulate pollutant concentration levels within residential or commercial buildings.

As a result of the federal government's hands-off policy, state governments are developing standards for cleaner indoor air. Last year, Washington was the first state to institute specific indoor air quality guidelines for construction materials, office furnishings, and equipment placed in newly constructed buildings. Several other states, such as California, Alaska, Florida, and New Jersey, are now following suit.

Washington precedent

Completed last June, the Natural Resources Building in Olympia marks the first structure to comply with Washington's indoor air quality standard. Designed by Denver-based architects C.W. Fentress J.H. Bradburn and Associates, the 354,000-square-foot government building houses laboratory and office space for agencies of the state's departments of natural resources, fisheries, and agriculture. Two more government office buildings for Washington's Department of Labor and Industries (ARCHITECTURE, February 1993, pages 48-53) and the Department of Ecology have subsequently been designed according to the same guidelines.

Washington required manufacturers of the products specified by Fentress to provide test data, indicating that the finishes, furnishings, and equipment placed in the building met prescribed VOC emission standards. Contractors were instructed to lay the carpet 30 days before installing the furniture, so that the upholstery would not absorb VOCs from carpet adhesives. They were also required to flush-out the building with 100 percent outside air 24 hours a day for 60 days after all finishes and furnishings were installed. Employees then moved into the building while the interiors continued to be supplied with outside air for another three months.

Fentress and his team also designed rooms for reprographic equipment and provided them with dedicated exhaust. The architects located exhaust stacks downstream from air intakes to take advantage of prevailing winds and further remove potential contaminants from the building's interior. Despite 20 cfm ventilation rates, the Natural Resources Building is targeted to meet an ambitious goal of consuming 30 percent less energy than is stipulated by Washington's energy code.

The Washington Department of General Administration has monitored and documented the project from conception through occupancy and is still compiling and analyzing seasonal performance data. The agency hopes the results, which should be issued in a report this summer, will assist the EPA in defining design and construction standards for achieving better indoor air quality.

Assuring a healthy indoor environment is a complex and rigorous task. Without standardized materials testing procedures and a more precise determination of the causes of sick-building syndrome, achieving a quality indoor environment still requires an empirical design strategy. But, rather than rely solely on ventilation rates, architects can improve the air in the workplace by eliminating toxic finishes and furnishings. —*Marc S. Harriman*

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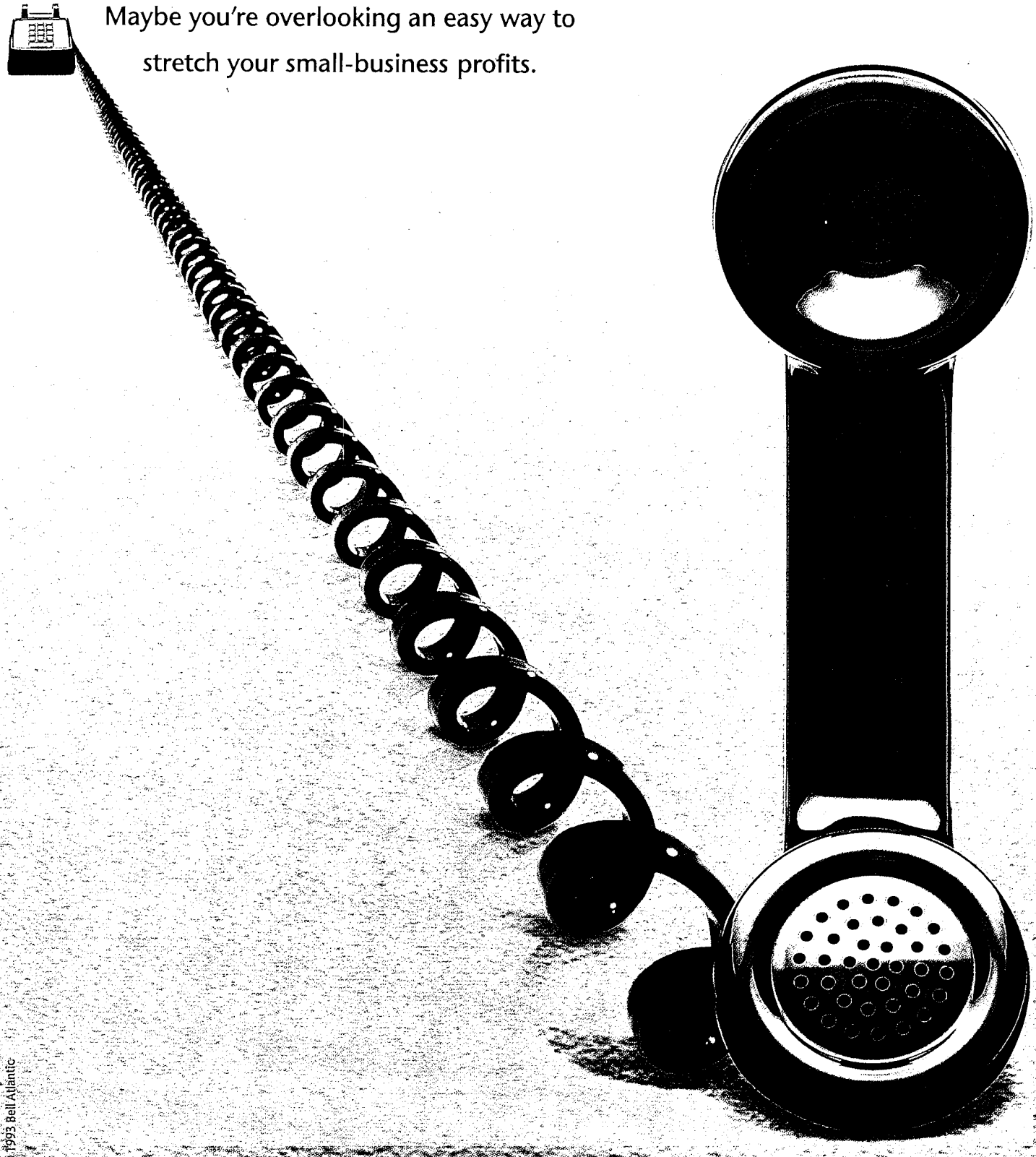

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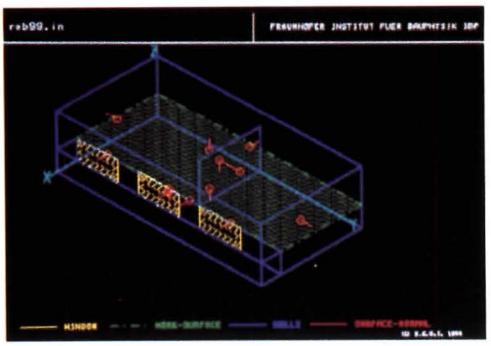
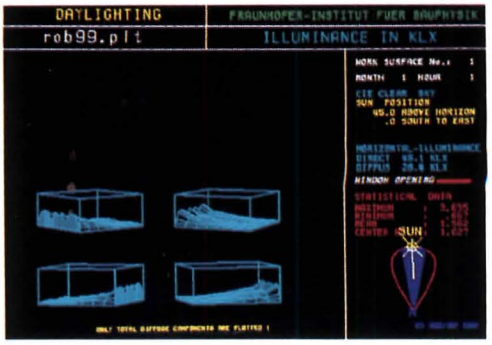
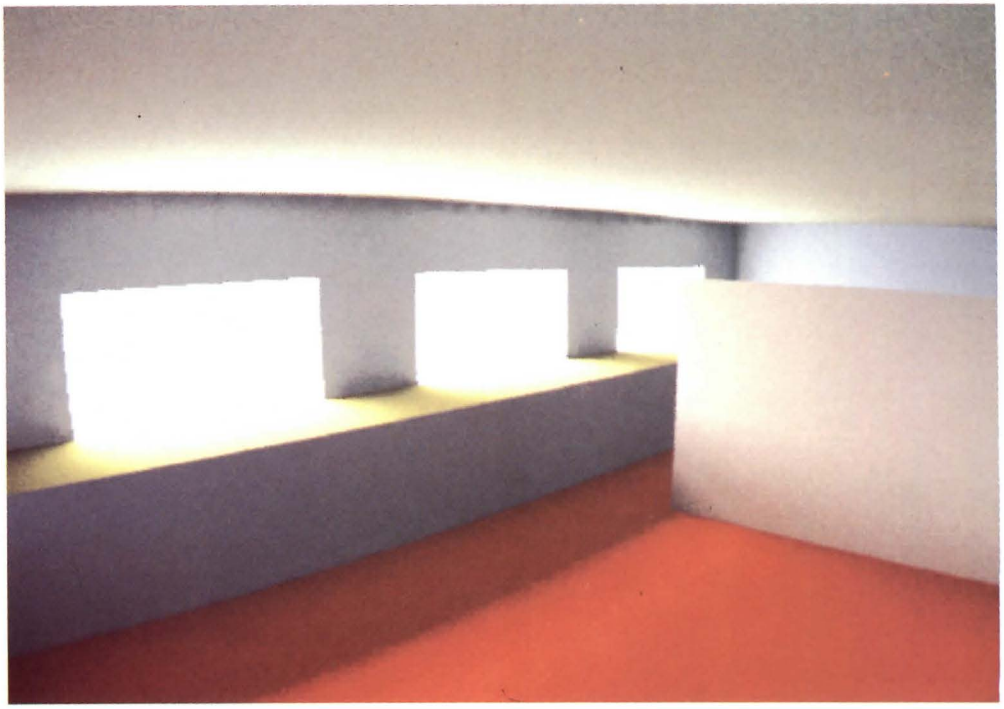




Energy Design Software

A new generation of programs helps architects create energy-efficient building designs.



TOP LEFT AND RIGHT: Superlite calculates light distribution in a geometrically defined room and displays illuminance levels in four isometric views. **RIGHT:** Geometric and illuminance data are exported to Radiance for rendering. Superlite, Radiance, and other analysis programs are combined within ADELINE, due out later this year from the International Energy Agency.

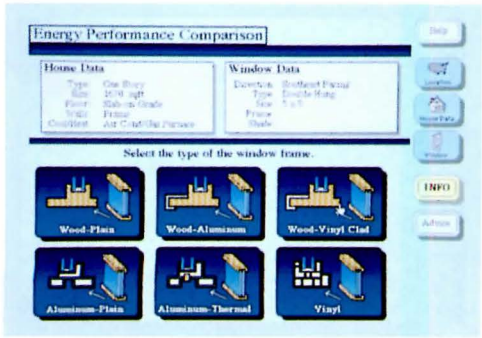
Now that environmentalism is again part of government policy, it's time for architects to brush up on concepts and practices that might have been neglected over the past decade. Under President Clinton's proposed Btu tax, alternative sources and energy efficiency will become more attractive to building owners, who, increasingly, will demand that architects integrate low-energy design features in buildings.

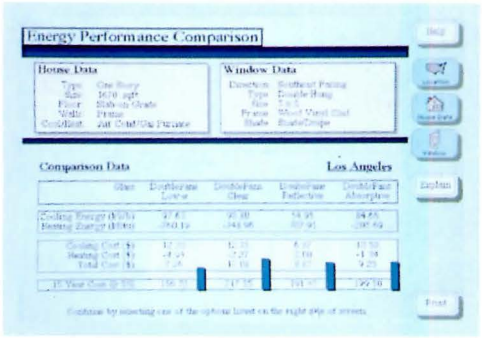
Such practice is easier said than done because the most truly energy-saving features are neither collectors tacked onto roofs nor expensive mechanical systems. Instead, they are embodied in the fundamental form, materials, and orientation of buildings, which are established very early in design. Yet most energy analysis software can only be applied during later phases of project design, because it requires detailed information not usually available until design development.

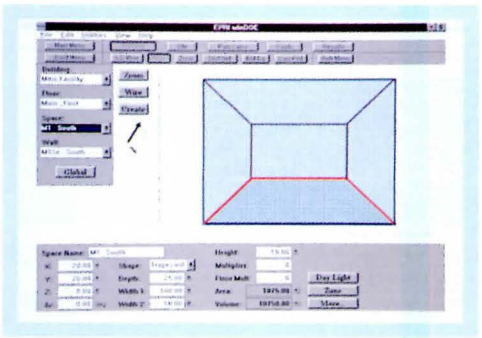
Stephen Selkowitz has been working to change this situation. He is the Director of the Building Technologies Program at the U.S. Department of Energy's Lawrence Berkeley Laboratory in Berkeley, California. "We realize now," Selkowitz explains, "that to make energy software effective, we have to make it accessible, not only to the junior designer who is comfortable with computer-aided drafting, but to the principal who is comfortable with charcoal sketching and who makes important energy-related decisions before the design ever gets to hard lines on the computer." Selkowitz's group in Berkeley, in collaboration with other researchers from California and around the world, is now producing a new generation of software to create what they hope will be a renaissance in energy awareness and sustainable building design.

Complex thermal behavior

The flagship of the Lawrence Berkeley Laboratory (LBL) software is DOE-2, which accurately simulates thermal behavior in complex buildings by computing lighting, heating,







TOP: Consumers can select window frames from a touch-screen monitor with software that calculates residential fenestration performance.
CENTER: The information kiosk compares the long-term cost savings for four window types.
ABOVE: A Microsoft Windows version of DOE-2 will ease some of the complexity of the mainframe version through a graphic display of the building and a clear layout of the required variables.

and cooling loads for every hour in a year. Fifteen years old and still growing, this software is used by engineers and energy analysts to size building systems and choose energy efficiency measures. The most recent version, DOE-2.1E, adds procedures to analyze evaporative and desiccant cooling, gas heat pumps, ice storage, custom glazings, complex utility rate structures, and more. In spite of its power, this software has serious drawbacks for architects. It requires detailed information about a building's physical plant, so it is more suitable for engineers fine-tuning a building during design development than for architects seeking feedback during schematic design.

One solution, cosponsored by the Department of Energy and the Electric Power Research Institute (EPRI) and planned for release in 1994, is a PC version of DOE-2 that will have a Microsoft Windows interface. Input screens will display zoned building plans, fenestrated elevations, and all the required quantitative variables, showing their defaults or current values. Some of DOE-2's traditional complexity will be simplified through a library of generic buildings, so an architect can simulate a building after specifying only a few basic characteristics such as size, function, and location. As the design develops and the user provides more specific input, the simulation improves in accuracy.

Glazing analysis

Another in the family of LBL's software offerings is Window 4.0, which analyzes the thermal performance of glazing materials. Based on optics, heat transfer, and empirically generated spectral data, this DOS-based program allows the architect to specify an assembly of up to six glazing layers, gas layers, frames, spacers, and mullions for any tilt and environmental condition. An extensive library of materials with their performance characteristics is available for compiling into the fenestration system. The output consists of U-values, visible transmittance, and shading and solar heat gain coefficients.

Window 4.0 is useful for architects in designing window assemblies and in demonstrating that they comply with energy codes. Vladimir Bazjanac, a Berkeley-based architect, creates libraries of glass types with Window 4.0 for input to DOE-2. Both programs now recognize the angular dependencies of glazing, that is, that the transmittance of solar radiation through glass depends on the angle at which it strikes. "This advancement improves the accuracy of DOE-2," Bazjanac claims, "and we no longer need to rely on the accuracy of the manufacturers' data for glass performance." Because architects can demonstrate the efficiency of high-performance glazings, they enjoy more flexibility in the design of glazed areas and have greater choice in specifying other materials.

Output from Window 4.0 may also be applied to Resfen, which analyzes the annual energy performance of residential fenestration. An architect provides information about the house's location, size, orientation, construction, and mechanical systems, along with window performance coefficients; and the system computes the energy consumed, its cost, and the peak loads. The program displays comparative long-term cost savings for several window types. On the Macintosh, the PC version of Resfen has a "multimedia" format that combines graphic input procedures, written explanations of technical points, and short video clips of experts giving advice. Fitted with a touch-screen monitor, this will become a point-of-sale information kiosk for consumers in large building-supply stores. Similar systems for Microsoft Windows and for commercial fenestration analysis are currently under development.

The kiosk format finds favor with Gregg Ander, chief architect with Customer Energy Services at Southern California Edison (SCE), the country's largest electric utility. SCE demonstrates its commitment to energy efficiency through Ander's group, which provides technical and design assistance to architects. These services include computer simulations with DOE-2, model building for daylighting analysis, and evaluations to verify design performance. SCE has sponsored kiosk projects in the past, which Ander sees as an effective way to transfer technology from technical organizations to practitioners. He finds that architects reluctant to try computers are willing to work with a kiosk. "It helps loosen them up," Ander notes. "But computers are getting more user-friendly, and it's only a matter of time before everyone is completely comfortable with them."

Linking lighting programs

LBL researchers are collaborating with the International Energy Agency to create ADELINE, or Advanced Day and Electric Lighting Integrated New Environment. Due out later this year, ADELINE is a framework that will link several existing programs that have been developed at LBL and in Europe. ADELINE will import data from Scribe Modeler (or other CAD programs with the proper translators) and assist the architect in assign-

ing photometric properties to interior materials and surfaces. Then the program prepares input files for Superlite, which calculates and displays the interior distribution of electric light and daylight, and for Radiance, which produces high-resolution renderings of interior perspectives. The Radiance program calculates the many interreflections in a space and renders the scene with more accuracy than is possible with more conventional ray-tracing or radiosity methods. As a result, it can identify areas of underillumination and overillumination, or glare. Finally, ADELINE moves the output from Superlite to DOE-2 for a complete building simulation.

Radiance user Charles Erlich is a Principal of Space and Light, a consulting service for architects and lighting designers. He enjoys the accuracy of Radiance and its ability to apply manufacturer-supplied data about light fixtures in a rendering. However, Erlich explains, the biggest obstacle between Radiance and widespread use is that it requires expertise with the Unix operating system. The ADELINE interface will make it more accessible. "Very few architects get into building analysis," Erlich asserts. "Even those who know what a U-value is may not know how to put all that information together into a cohesive building simulation. But ADELINE, with its modeler and its linked utilities, should produce the impetus to make people want to learn it."

An electronic consultant

Ease of learning is one of the goals of the Energy Design Advisor (EDA), an ambitious multimedia tool for designers. Also cosponsored by EPRI, this program will integrate CAD with information about energy-sensitive design, pertinent site data and energy standards, rule-of-thumb procedures for preliminary design, and electronic libraries of historic precedents and building products. Most notably, EDA will offer expert advice on satisfying a variety of energy, comfort, cost, and esthetic criteria while providing the architect with continuous feedback about design performance. Masked by EDA's friendly face, the powerful DOE-2 will work "behind the scenes," calculating energy performance evaluations of the preliminary designs under consideration.

LBL researcher Konstantinos Papamichael, who spearheads EDA development, notes that neglecting pertinent information is the source of many problems in architectural design. So, his goal is to use the computer as a medium for increasing the number of factors an architect can consider at once without being overwhelmed. "We're not trying to make design easier," Papamichael insists, "we're trying to make it richer." The EDA is unique in that it is geared toward the principals of architecture firms who may have ignored computers in the past because of their lack of support for preliminary design. Though not scheduled for completion until 1995, portions of the EDA will be available sooner, and its creators invite feedback on their progress.

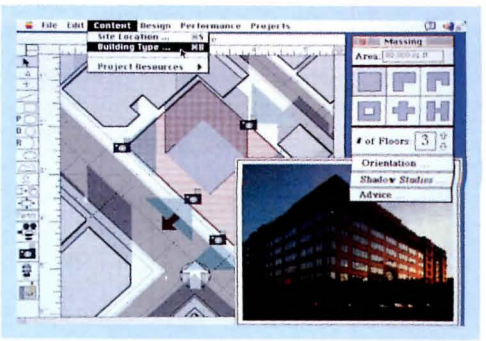
Sibyl Fickett-Jones, an architect with MBT Associates in San Francisco, is one of several practitioners who has seen and commented on LBL's early prototypes. Fickett-Jones is looking forward to the EDA's visual display of the lighting and energy consequences of a building under design and to a certain independence from engineers. "Architects need to understand the approximate energy use in the building," Fickett-Jones argues. "Since the architect is usually the team manager, it's good to know what the general parameters are, so you can direct your consultants."

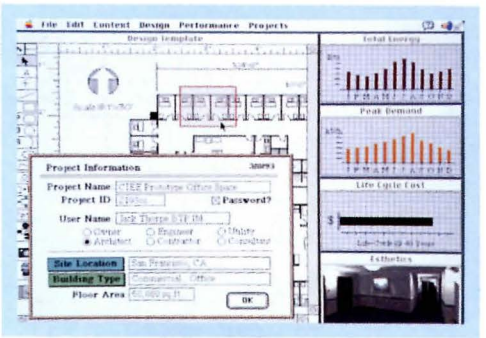
Lower costs for owners

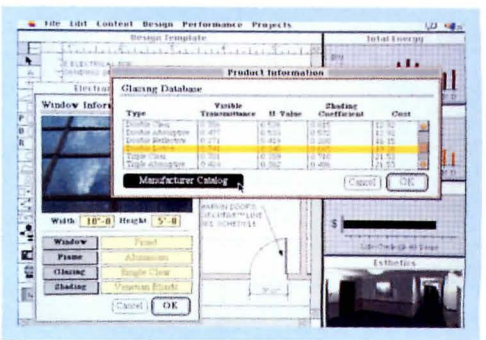
However, even architects eager to change their practices may be held back by owners who only give lip service to energy efficiency. According to Bazjanac, those responsible for the funding and construction of large commercial and public buildings are typically not responsible for the future building's operation. So, savings in operation provide no incentive for them. Bazjanac notes: "There's a misconception that architects don't know how to or don't want to design energy-efficient buildings. But the architects' hands are tied unless the owners insist on long-term savings." Bazjanac believes that LBL's design tools are important because they "provide opportunities to convince those who control funding that buildings can be leaner and that the first cost of energy-efficient buildings may, in fact, be lower."

Ander also encourages architects to look for innovative ways to persuade reluctant owners to embrace energy efficiency and to finance the extra work that will be required. "We need to develop a new paradigm of how we do business at all levels of society," says Ander. "For example, risk takers in the profession with excellent managerial and technical skills can offer to work for a competitive fee, but with a bonus one year after the building operates the way it's designed to." With such opportunities, aided by the "carrot" of accessible software and the "stick" of the Btu tax, architects are bound to change the way they approach energy-efficient design.

—B.J. Novitski







TOP: The Energy Design Advisor (EDA), a multimedia project under development, combines CAD with site-level shadow studies and photographs. **CENTER:** EDA compares the energy performance of the building under design with that of similar buildings and offers expert advice and feedback. **ABOVE:** EDA makes building product manufacturer information accessible during design.

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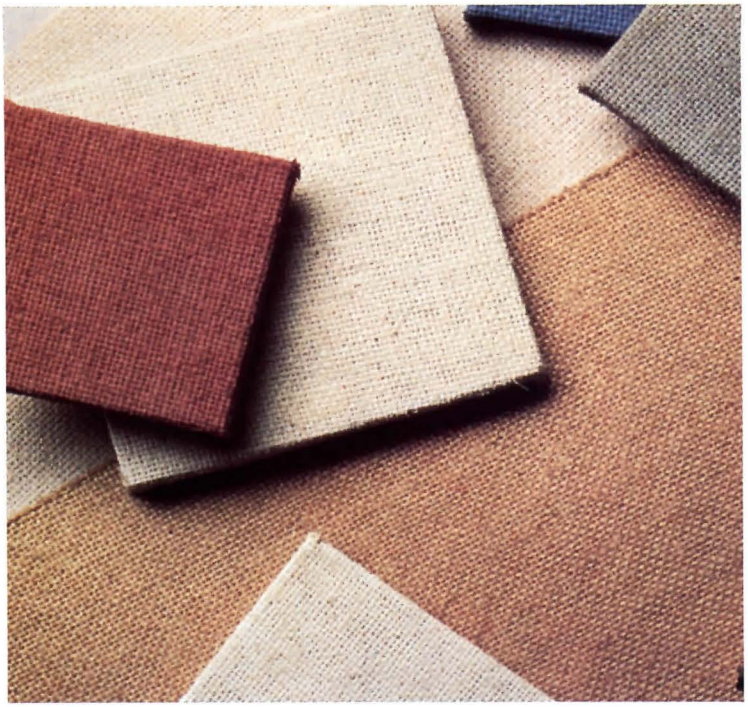
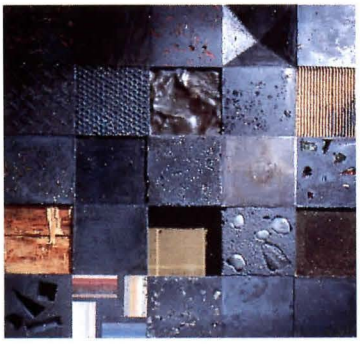
Products

Manufacturers are stepping up efforts to develop earth-friendly products.





TOP: Homasote offers interior burlap panels composed of heavy-weight jute fabric laminated to 100 percent recycled paper for residential and commercial construction. The fiberboard comprises recycled newspaper converted into a wood fiber pulp mixture that is molded, pressed, and dried. The fiberboard does not contain formaldehyde or asbestos, and the burlap can be painted with a water-based latex paint. *Circle 401 on information card.*

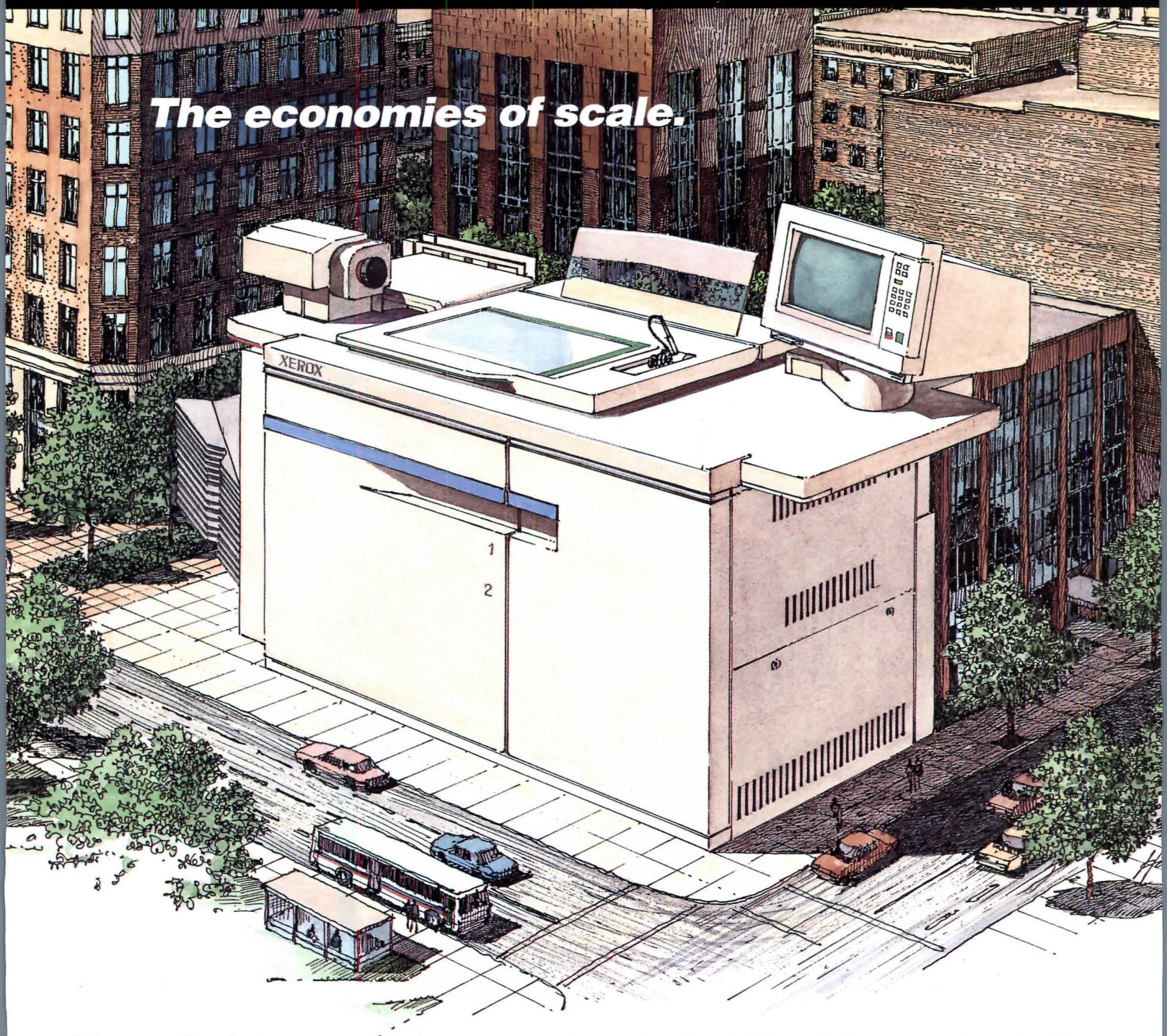
ABOVE: Syndesis, a Santa Monica-based design firm, manufactures, fabricates, and installs Syndecrete, a cement-based, precast composite of natural minerals reinforced with a polypropylene fiber, a waste product from carpet manufacturing. The lightweight surfacing product often incorporates such recycled materials as metal shavings, plastic regrinds, glass chips, and scrap wood and contains no resins or polymers. *Circle 402 on information card.*

ABOVE: PermaGrain Products introduces Armstone Confetti, a floor tile consisting of 95 percent damaged or substandard marble. The discarded stone is ground and cast to form tiles in a variety of sizes. Tones are created solely by the stone mixture. The tile is suitable for commercial and residential applications requiring durable, abrasion-resistant surfaces. Confetti tile is polished to increase the life span of the material, which does not contain surface pores or fissures to collect dirt and stains. *Circle 403 on information card.*

TOP RIGHT: Herman Miller continues a long-term commitment to recycling with AsNew, remanufactured office furniture produced by subsidiary Phoenix Designs. Phoenix Designs buys back Action Office open-plan office systems from original Herman Miller customers and then disassembles, refurbishes, and resells them under the AsNew brand name. Recycled metal components are sanded and repainted; and edge moldings, laminate surfaces, fabrics, and electrical components are replaced. The remanufactured pieces are offered at substantially lower prices than new Action Office systems and carry a one-year warranty. *Circle 404 on information card.*

ABOVE: Intersource Technologies offers E-Lamp, a compact fluorescent bulb that generates light using radio waves, mercury vapor plasma, and light-emitting phosphors. The E-Lamp has a life span up to 20,000 hours and produces four times the lighting intensity per watt of electric power of incandescent bulbs. *Circle 405 on information card.*

XEROX



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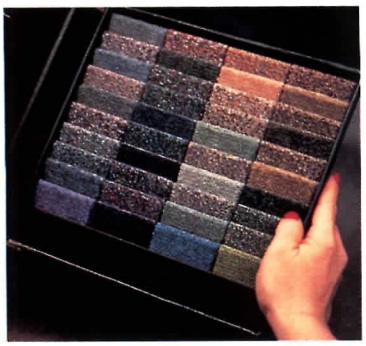


Recycled carpets

Milliken & Company, a charter member of the Encouraging Environmental Excellence program directed by the American Textile Manufacturers Institute, pursues its commitment to develop and manufacture environmentally responsible products such as Milliken carpets (above). The company recycles 85 percent of the plastic, paper, cardboard, and solid wastes used; is eliminating the use of chlorinated solvents; and has reduced its use of 17 industrial toxic chemicals in the manufacturing process.
Circle 406 on information card.

Efficient fluorescent

GTE introduces the Sylvania Octron fluorescent lighting system, which comprises high-efficiency T-8 lamps and electronic ballasts. These ballasts are purported to save $75 per two-lamp fixture in the first six years of operation as compared to standard fluorescent lamps. The T-8's use of a rare earth mineral—triphosphor—as the lighting element produces warm, high-efficiency illumination suited to work environments.
Circle 407 on information card.

Energy design research

Energy Tools is a publication produced by the AIA/ACSA Council on Architectural Research highlighting products developed and tested by the U.S. national energy laboratories. The publication is organized into four sections, each covering the particular lab's activities and research, with fact sheets on products developed by the lab. These reviews provide information on operation, application, and benefits of products ranging from daylighting and passive solar design to thermal bridging and moisture control.
Circle 408 on information card.

Recycling chutes

Leland Home Recycling Systems introduces a system for recycling household trash (above). The 4- and 6-inch-diameter chutes of noncorroding PVC can be mounted flush against an interior wall and sloped toward a storage bin attached to an exterior wall. The recycling system is designed to eliminate odors, insects, and penetration of outside air.
Circle 409 on information card.

Gas conversion system

Gas-Fired Products offers Seahorse, a hot-water conversion system for homeowners who want to convert from electric hot-water heating to gas. Seahorse systems are located outside to eliminate space and venting problems associated with the conversion. The system heats water through a self-contained gas burner and uses the existing electric water heater tank for storage.
Circle 410 on information card.

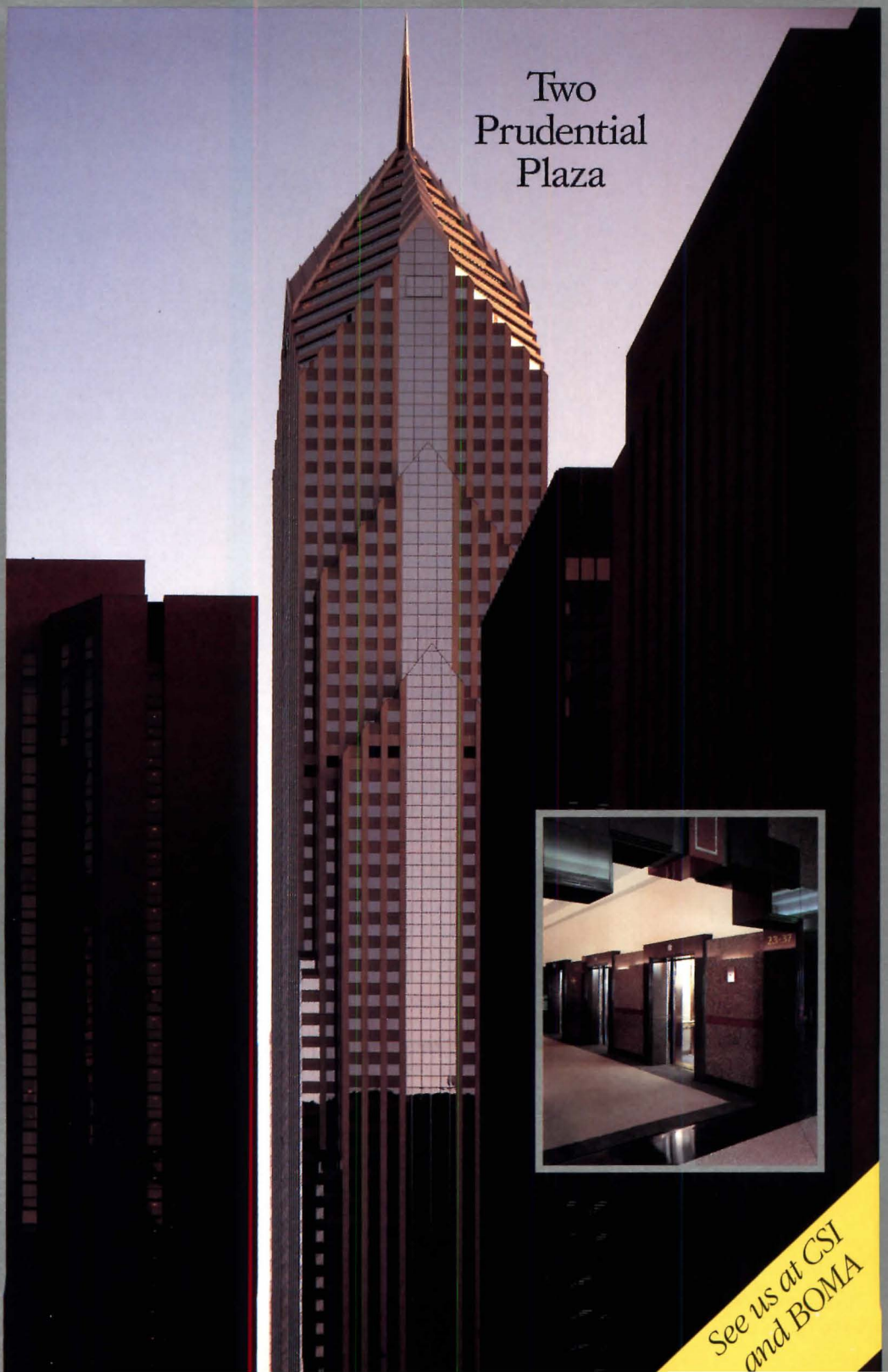
Asphalt paving

ReClaim converts asphalt roofing debris into RePave, a permanent patching and surfacing material for roads. The cold-mix asphalt bonds to wet or dry surfaces and can be applied to driveways, bridges, ramps, and parking lots.
Circle 411 on information card.

Environmental initiatives

The Geon Vinyl Division of the BFGoodrich Company, a manufacturer of vinyl compounds and resins, offers a brochure outlining the company's health and safety initiatives. *Embracing the Environmental Challenge* explains the company's waste management efforts and commitment to recycling; advancements in environmental technology; and health and safety programs.
Circle 412 on information card.

How'd Dover do, Turner? "Outstanding!"



When a tough customer like Turner Construction gives a subcontractor an award, you better believe it's well-earned. Of 300 Chicago firms Turner worked with during a one-year period, only five received their "Outstanding Performance" Award. Dover was one of those five. And proud of it.

The project that earned the award for Dover was Two Prudential Plaza, an elegantly powerful 64-floor building served by a total of 29 Dover elevators. Dover met every elevator date, including a client-requested expedite. It was, according to Turner's citation, an "outstanding accomplishment!"

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CFC substitute

Polyisocyanurate Insulation Manufacturers Association (PIMA) announces the development of polyisocyanurate insulation using HCFC-141b, a chlorofluorocarbon (CFC) substitute. The association purports that this substitute incorporated into the manufacturing process will reduce CFC-caused depletion of the ozone layer by 89 percent. PIMA reports that buildings constructed with polyiso insulation will save 58.6 million barrels of oil for heat and air conditioning, compared with more conventionally built structures.
Circle 413 on information card.

Resource guide

The Center for Resourceful Building Technology publishes a yearly guide to resource-efficient building elements. The guide provides a listing of product information, environmental publications, and demonstration programs. Included with a description of each item are the manufacturer's address and telephone number. Topics addressed range from resource efficiency and recycled products to foundations and sustainable forestry.
Circle 414 on information card.

Roofing insulation

Dow Chemical's Styrofoam roofing insulation (above) is an extruded polystyrene that uses 90 percent less chlorofluorocarbons (CFCs) than standard roofing insulation. Styrofoam meets strict CFC standards, as well as density and R-value requirements. Styrofoam is constructed of polystyrene plastic with a closed cell structure that resists moisture.
Circle 415 on information card.

Reprocessed materials

Metropolitan Service District (Metro), a regional government agency in Oregon, offers a reference index of products made from recycled materials. The index is organized into seven categories, ranging from packaging and containers to building and construction materials and solvents to reprocessed fuel. Each entry lists product and manufacturer information and suggested uses for the product.
Circle 416 on information card.

Thermally efficient insulation

Air Krete, produced by Palmer Industries, is a lightweight insulating foam designed to create thermally efficient, acoustical insulation. Air Krete seals concrete block cores and cavities between masonry units, curtain walls, and firestop spandrels. The product can also be used as insulation between an exterior skin and interior finishes.
Circle 417 on information card.

Air filtration system

Aseptair is an air filtration system developed by ATC/Flanders for central air-conditioning systems. Aseptair filters are purported to collect 99 percent of airborne particles and microorganisms larger than 1/50,000 of an inch in diameter.
Circle 418 on information card.

Reclaimed carpets

Du Pont Flooring Systems has founded a recycling program called the Partnership for Carpet Reclamation. The program created a network of companies that collect, consolidate, and distribute used carpets. Since its inception, the partnership has collected more than 2 million pounds of consumer-discarded carpet and reintroduced the material as reinforcing fibers in plastics, asphalt, and carpet cushions.
Circle 419 on information card.

Plastic roof panels

GE Plastics and McDonald's McRecycle USA program recycles Noryl resin, a product of GE plastics, which is collected from computer housings. The resin is recycled to produce roof panels for McDonald's restaurants. Nailite Corporation manufactures the panels from a resin consisting of 52 percent reclaimed Noryl resin and 48 percent virgin plastic. The roofing panels resemble cedar shakes and can be installed over existing asphalt shingles. They are affixed with standard roofing nails and can be molded and painted.
Circle 420 on information card.

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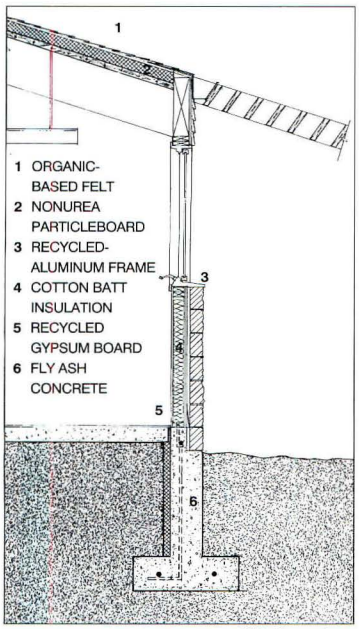
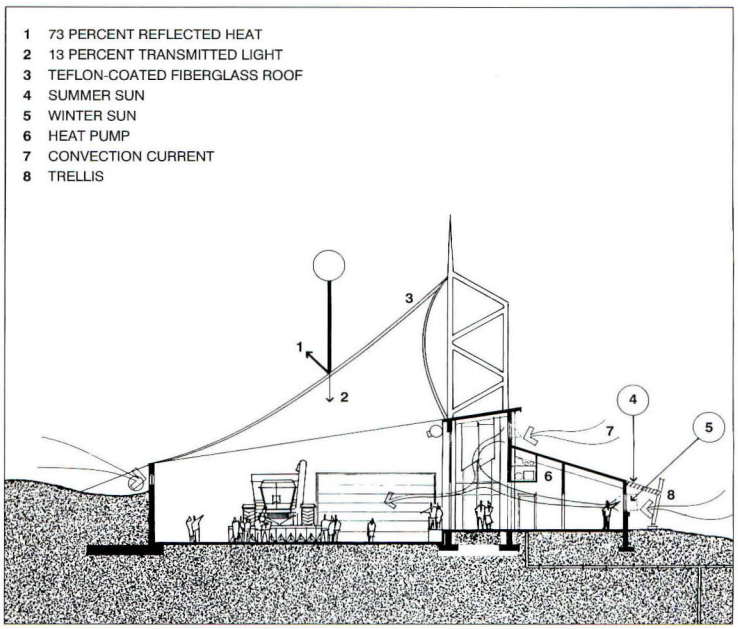


NEBRASKA RESEARCH CENTER: Wall section.



NEBRASKA RESEARCH CENTER: North-south section.

Sustainable Architecture

CSI Section 13060

Eco-Sensitive Design and Material Specifications

We oriented the University of Nebraska/Lincoln's Agricultural Research Center in Mead, Nebraska, to take advantage of the site's topography, a southeastern-facing hillside that provides optimal exposure for passive solar heating in the winter. A wood-lattice screen attached to south-facing glazing will block heat gains in the summer. By tucking the northern edge several feet into the hillside, the earth's natural insulating properties will maintain a stable, 55-degree Fahrenheit ground temperature throughout the year.

The sloped roof deflects winter winds from the north. We outfitted the windows with operable transoms to induce convection currents that passively cool the interior and specified a geothermal heat pump to minimize fossil-fuel consumption when heating the building. Over the exhibition space, a translucent, Teflon-coated fabric roof reflects 73 percent of the solar heat in the summer, while the fabric's 13 percent translucence virtually eliminates the need for artificial illumination during the daytime. At night, the underside bounces uplighting from triphosphor fluorescent fixtures equipped with parabolic reflectors and energy-saving ballasts.

Beyond employing energy-conscious strategies, we also detailed and specified materials and finishes to minimize airborne contaminants and provide optimal indoor air quality: organic-based felt and nonurea particleboard decking for the roof underlayment; a linseed oil finish for interior wood surfaces; nontoxic, natural-based paint; cotton batt insulation; and a jute pad beneath formaldehyde-free carpet, to be installed without adhesives to minimize off-gassing of volatile organic compounds.

We minimized consumption of raw materials and reduced waste by specifying the following: wood framing from certified sustainable forestry sources; insulated, recycled-aluminum windows; concrete containing fly ash (a by-product from burning coal); and gypsum wallboard composed of recycled newspaper.

Tom Findley, AIA
Douglas N. Roeder
Leo A Daly, Architects/Engineers
Omaha, Nebraska

Project Coordination

CSI Section 01040

Heating and Structural System Dependencies

To provide maximum headroom in the basement of a house, we located the steel beam supporting the floor flush with the floor joists rather than beneath them. A steel beam needs lateral support to prevent it from overturning, so a wood nailer is usually placed on top of the steel beam.

In this case, however, the owner installed a hydronic radiant heat system, consisting of flexible hose fastened to the bottom of the wood subfloor. During the next year and a half, the heating system caused the moisture content of the wood joists to be reduced by as much as 10 percent more than is typically expected, while the steel beam was unaffected.

The resulting shrinkage between the wood and steel members created severe ridges in the floor, as well as cracked tile floors and uneven settlement of the walls, tile thresholds, cabinets, and door frames above the supporting beams. Had we been consulted about the heating system, we could have foreseen the potential problem and specified a wider, thicker flange for laterally supporting the beam. This wider flange would have enabled us to eliminate the wood nailer, providing ample clearance between the top of the beam and the bottom of the subfloor to account for the wood joists' shrinkage.

Providing a complete construction document package, including mechanical and electrical plans, is essential to ensure a project's success. Architects must continue to educate clients on the importance of our complete services to prevent such construction deficiencies.

Joerg Hensel, AIA
Hensel & Associates
St. Clair Shores, Michigan

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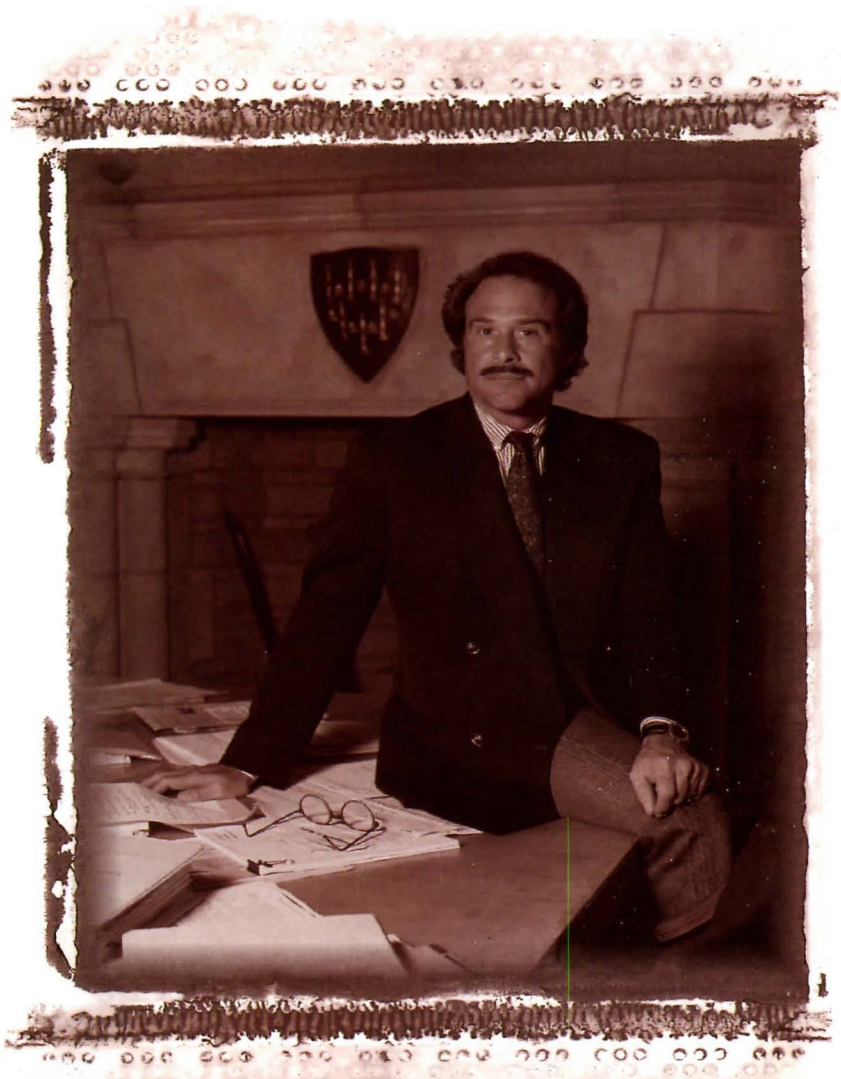

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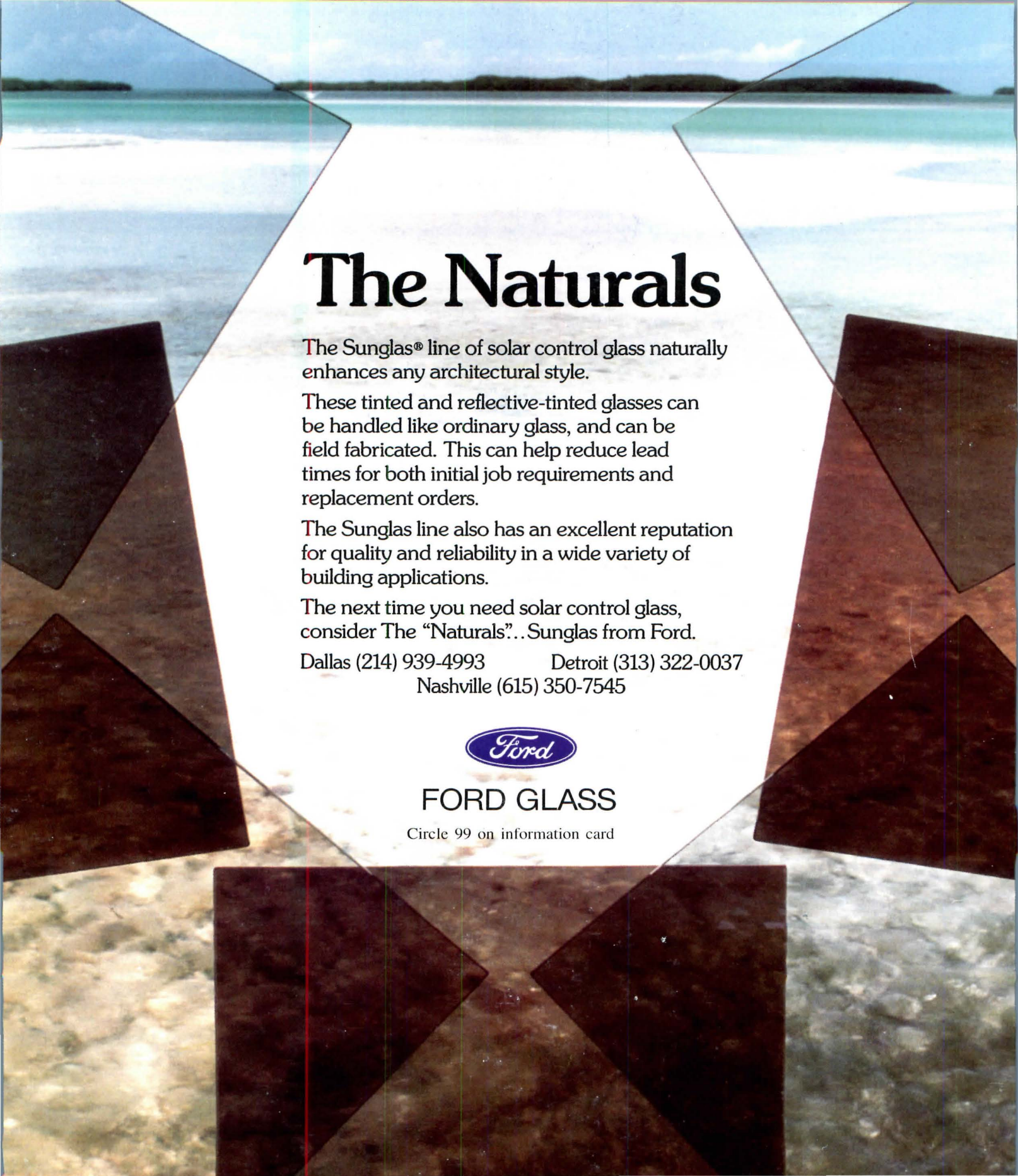

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