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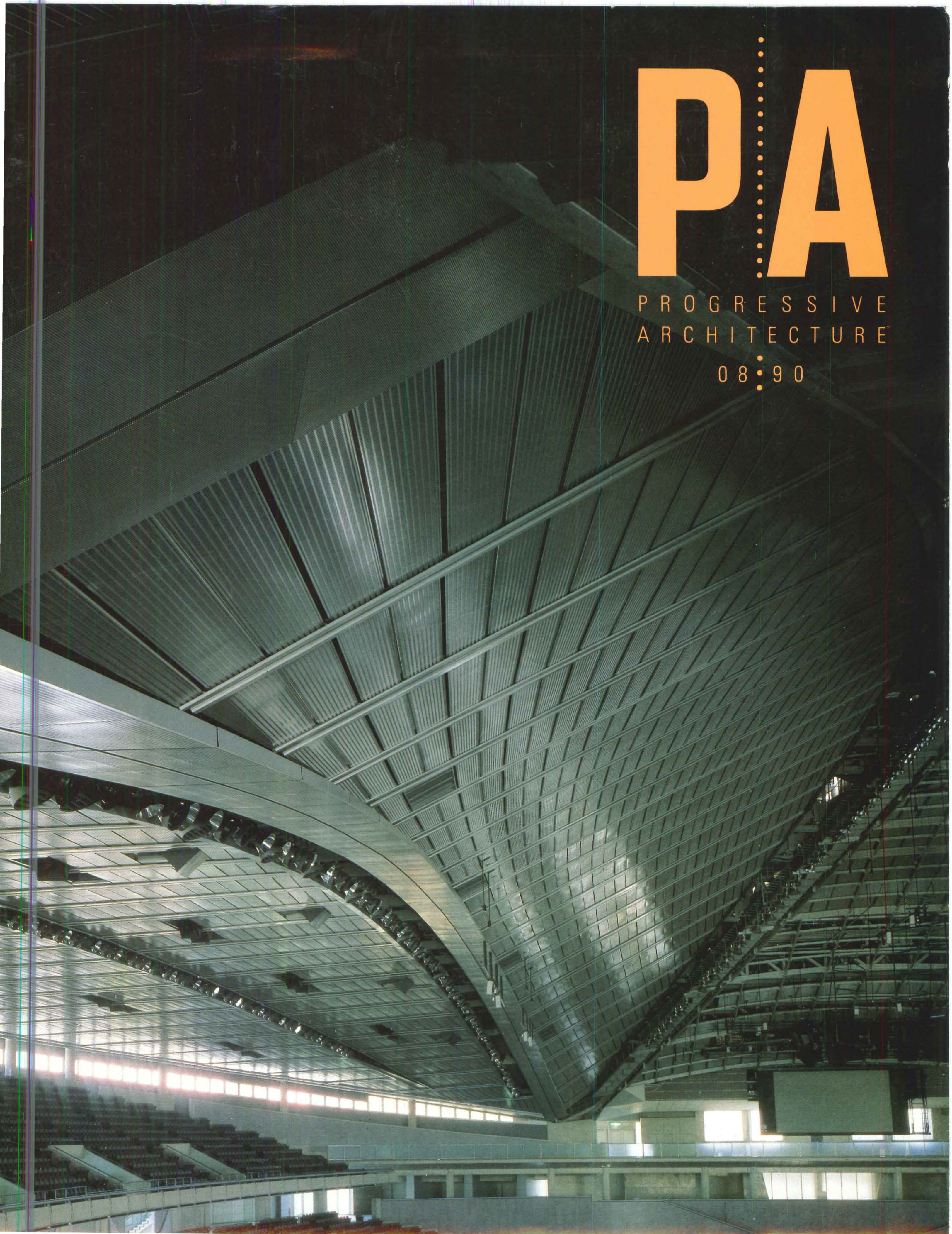

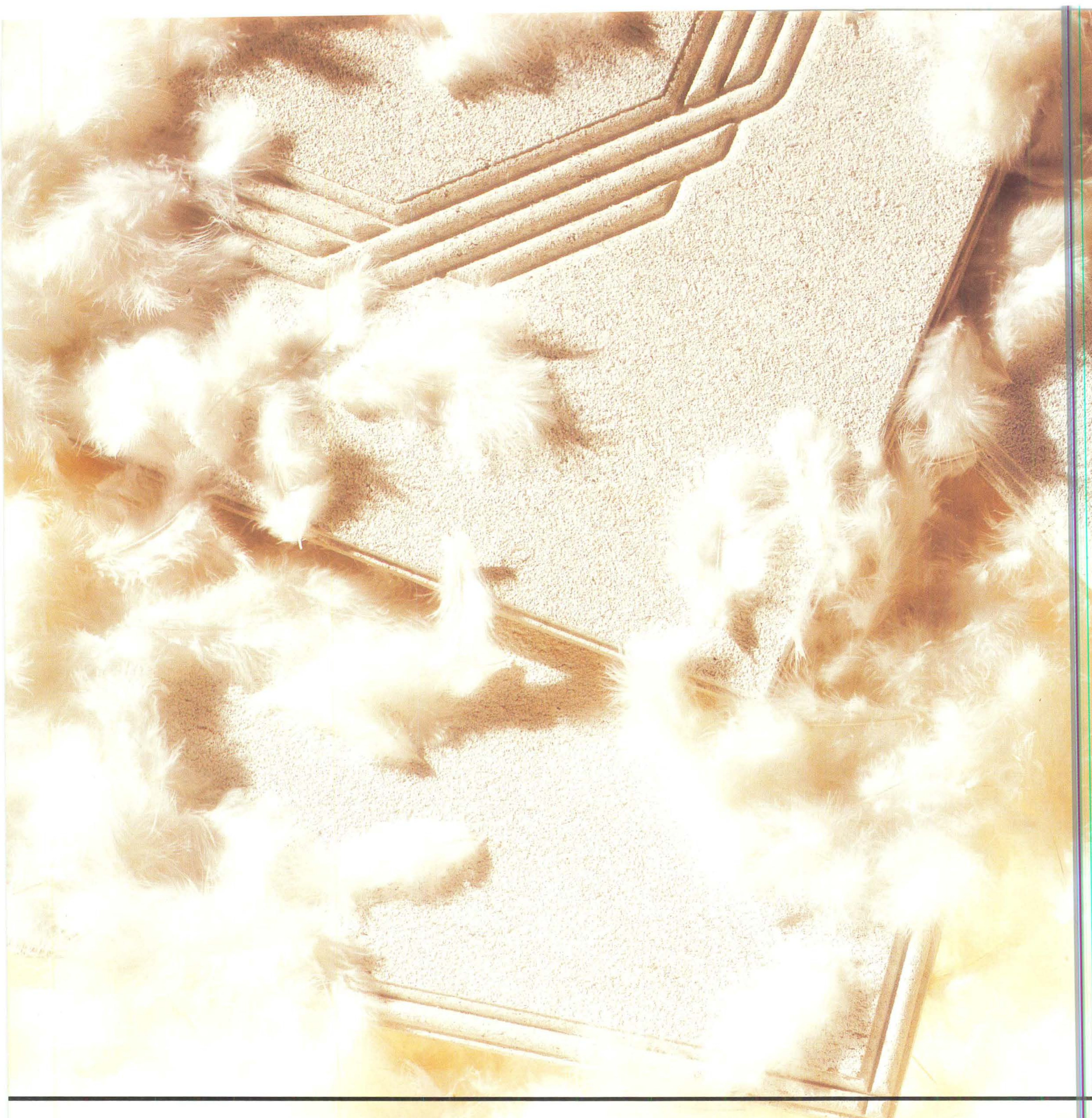

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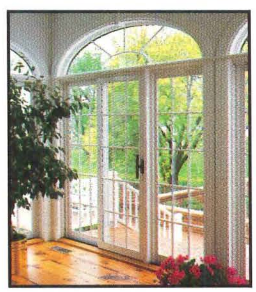

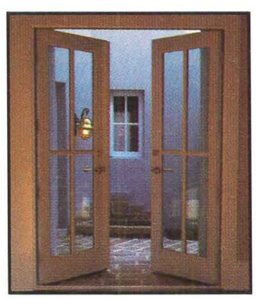

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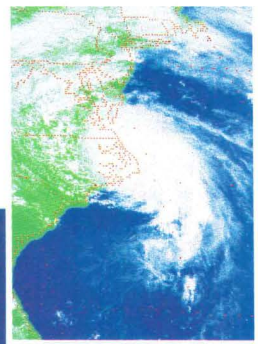

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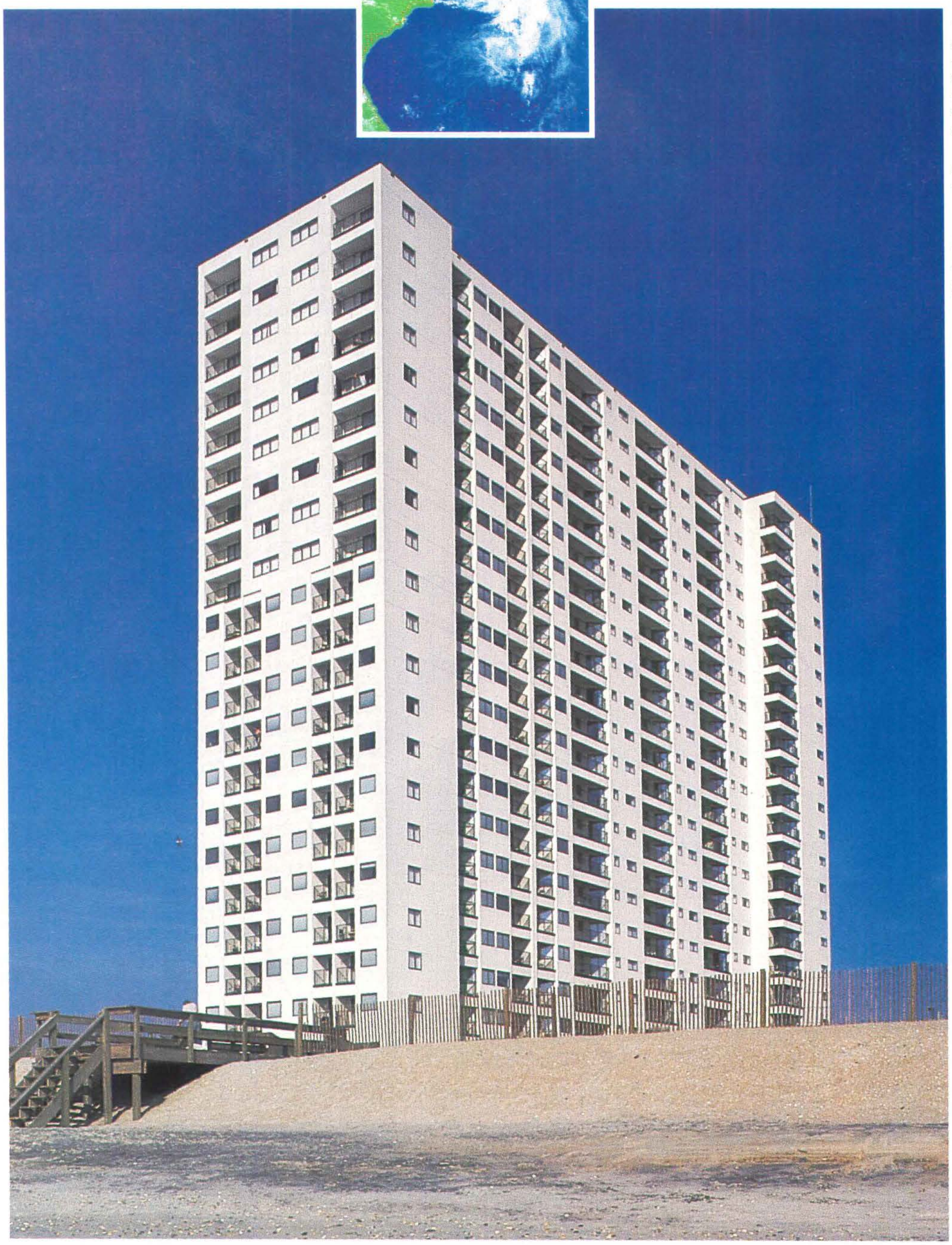

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P/A

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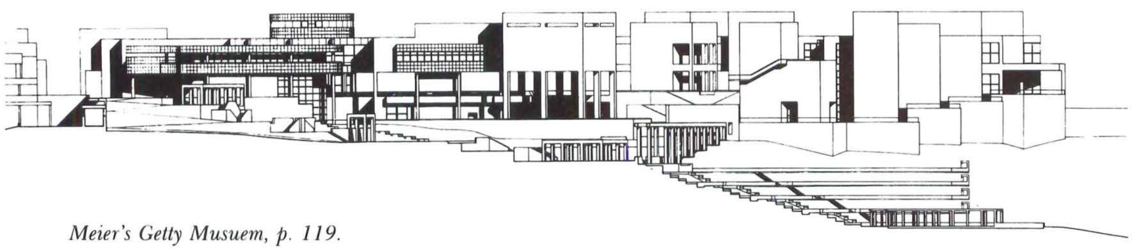

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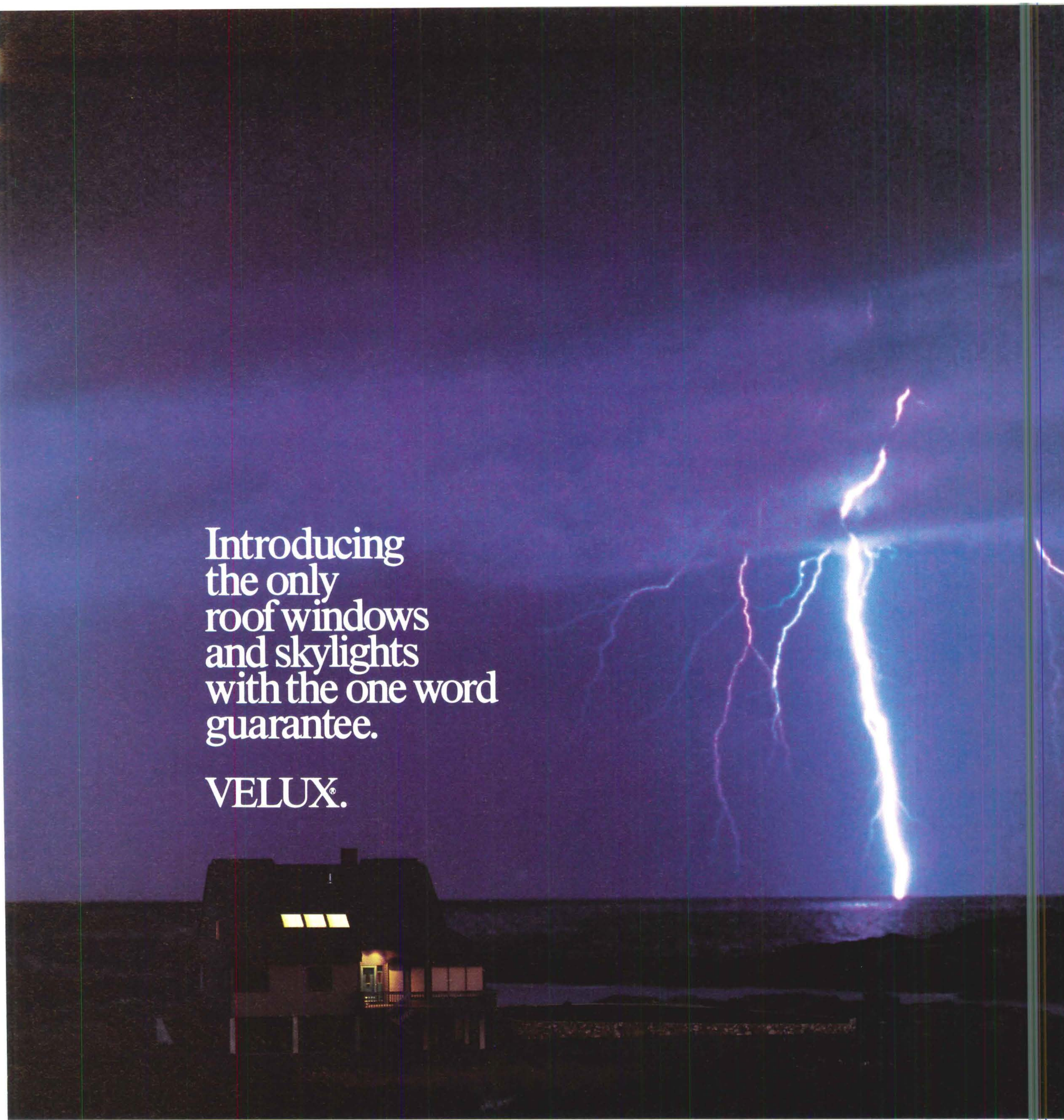
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Editorial: International but Japanese

In Japanese architecture, we cannot help looking for Eastern and Western influences, but we will be misunderstood if we confuse Modernism with Westernization.

If we are to learn from the fine current work of some Japanese architects, we may have to cut through some misconceptions. It is all too easy to see Modern buildings in Japan as fragments of Western culture, adopted by a nation known for its skill at adaptation. The Japanese do, of course, make cultural borrowings freely and enthusiastically – everything from the Big Mac to the string quartets of Mozart – but the forms and technologies of Modern architecture belong to no particular country.

It is true that Modern architecture, as such, sprang up in the industrialized nations of Europe and America, but the traditional architecture of Japan played a unique inspirational role; no other country could provide a body of historical work where ideas of geometrical abstraction, skeleton structure, exposure of materials, and elimination of ornament had been applied so knowingly.

And we should remember that by the time Modern architecture emerged in the West, around the end of the 19th Century, Japan was already a burgeoning industrial power. It is easy to assume from Japan's centuries-long isolation that it had been a technologically primitive nation, but even when Commodore Perry's fleet arrived there in 1853, Japan had a well developed merchant class and a technology comparable to that of Western Europe around 1800 – only a few crucial decades earlier.

The Japan scholar Fosco Maraini has made the bold assertion (in *Japan: Patterns of Continuity,* 1971) that "the Japanese have been modern since prehistory." He argues that, notwithstanding centuries of other-worldly Buddhist teachings, the Japanese remain attached to the Shinto view that "this world is the ultimate reality." Hence they have been uninhibited in embracing modern science and technology, without the ingrained resistance that has not yet subsided in the West and Middle East.

The belief that "the phenomenal is also the real," Maraini points out, also supports Japan's eclectic cultural borrowing. "If all is sacred, then all is accepted." But, while the absorption of the modern is essentially Japanese, cultural imports from the West, he maintains, remain superficial: "Wearing a Western suit. . . playing golf, going to cocktails – all are habits that have practically no effect on the basic sense of identity."

Japanese attitudes toward this two-pronged revolution have swung widely during these decades. The novelist Junichiro Tanizaki has represented these complex reactions eloquently in his many works: In his 1924 novel, *Naomi,* he chronicles the infatuation of Tokyo's younger generation for Western social dancing in Flapper-era regalia; his nonfiction *In Praise of Shadows* of 1933, on the other hand, commends the serenity of the Japanese house before the invasion of electricity.

Ironically, the American occupation of 1945–1957 forged new cultural links to the West by bringing thousands of Americans there, making Tokyo and other centers far more cosmopolitan than they had been. Today, another cycle of close contact is being generated by the thousands of Japanese businessmen assigned to the U.S. and bringing with them children who will spend formative years here.

Japan has long since developed its own particular brand of English language; certain terms such as "salaryman" (a white-collar worker) are almost exclusive to Japan. The slogans found on every bomber jacket in Tokyo include such inventions as "Action Attack," "Hellokitty," and "Burden Art." English has become so commonplace that better establishments reach out to French or Italian for cachet: A tearoom/pastry shop designed by Tadao Ando is called Mon Petit Chou; his new complex of boutiques and showrooms in Tokyo is called Collezione. Nevertheless, both places are indisputably Japanese.

The work of Fumihiko Maki, featured in this issue, represents modernity with hardly a hint of the West. That may be why, though lacking traditional imagery, they seem Japanese in spirit.

Maki himself has had more sustained contact with the West than any of his colleagues. After earning a Master's of Architecture at Harvard, he spent several more years in the U.S. teaching and designing; his first completed building was at Washington University, St. Louis, and one of his current projects is an arts center for San Francisco (P/A, Oct. 1989, p. 28). Maki's outlook may be totally international – viewing with equanimity all that humankind has built – but in this respect, as in others, he remains quintessentially Japanese. ■

corporated from the original group of investors. CADworks is an employee-owned Delaware corporation, based in Cambridge, Massachusetts.

The DRAWBASE CAD/database software is developed on an ongoing basis (Release 107 will ship in the third quarter of this year) by CADworks Incorporated and distributed around the world through value-added resellers and distributors to architects, facilities managers, and mechanical designers.

Albert W. Moulton
President and CEO
CADworks Incorporated Cambridge, Massachusetts

July Names and Orientation

Incorrectly spelled in the July issue were the names of: William Sherman of Albert Pope and William Sherman, Architects (p. 26); Professor Lee Hodgden (p. 99); and William Worn of Florian Wierzbowski Architects (p. 101). On page 75, the north arrow should have been turned 180 degrees.

Battery Park City Clarification

Our coverage of the North Residential Area of Battery Park City in New York in the last P/A Awards issue (Jan. 1990, pp. 120–121) calls for some clarification. This Citation winning plan is by Cooper, Robertson + Partners. P/A's presentation, however, gave visual prominence to the overall Battery Park City plan, winner of an earlier P/A Citation (P/A, Jan. 1984, pp. 136–137), which was by Cooper, Eckstut Associates. Of the two partners in that firm, Alexander Cooper is now a partner of Cooper, Robertson + Partners, and Stanton Eckstut is now a principal of Ehrenkrantz, Eckstut & Whitelaw – all of New York.

'Getting Paid' Credit Extension

The Practice article "Getting Paid" (June, 1990, p. 55) was cowritten by Dr. Nancy Hubbard, Assistant Professor of Architecture, and Robert Greenstreet, Dean of the School of Architecture & Urban Planning, both at the University of Wisconsin-Milwaukee.

DRAWBASE Clarification

This letter is intended to clarify some confusing references to our company in the June issue of Progressive Architecture. In this issue, our product DRAWBASE was mentioned in two articles, one by Eric Teicholz, (p. 145), one by Mary Dolden (p. 151).

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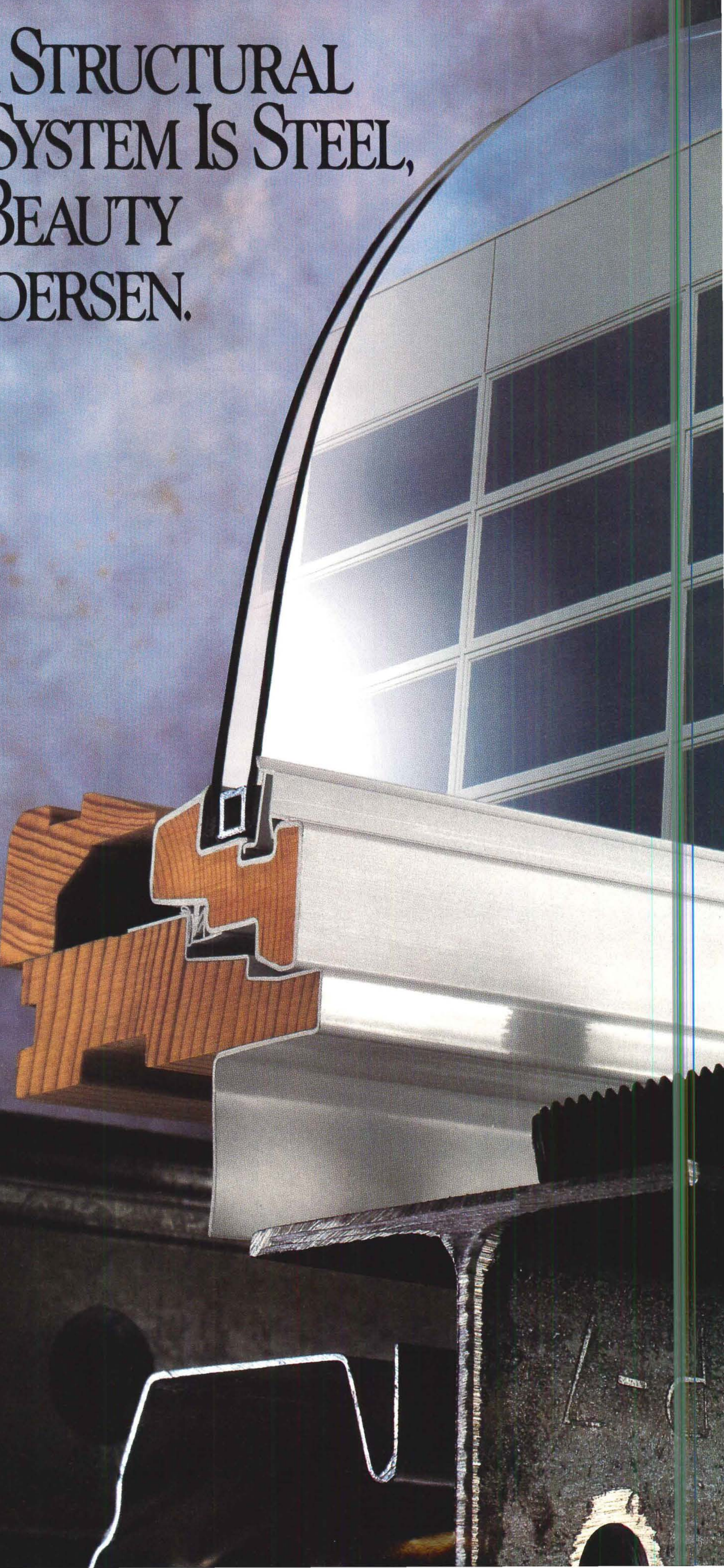

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P/A Awards Program

Architecture

Urban Design

Research

Progressive Architecture announces its 38th annual P/A Awards program. The purpose of this competition is to recognize and encourage outstanding work in architecture and related environmental design fields before it is executed. **Submissions** are invited in the three general categories of architectural design, urban design, and architectural research. Designations of first award, award, and citation may be made by the invited jury, based on overall excellence and advances in the art.

JURY FOR THE 38TH P/A AWARDS

Architectural Design: *Ralph E. Johnson,* AIA, Senior Vice President and Design Principal, Perkins & Will, Chicago; *Rem Koolhaas,* AA, Principal, Office of Metropolitan Architecture, Rotterdam, and Professor, Technical University, Delft; *Samuel Mockbee,* FAIA, Partner, Mockbee-Coker-Howorth Architects, Jackson, Miss. and Memphis, Tenn., and Adjunct Faculty Member, School of Architecture, Mississippi State University, Jackson; *Adèle Naudé Santos,* AIA, Principal, Adèle Naudé Santos Architect, Philadelphia, and Dean, School of Architecture, University of California, San Diego.

Urban Design: *Eric R. Kuhne,* AIA, Principal, Eric R. Kuhne & Associates, New York, and Adjunct Professor, New Jersey Institute of Technology, Newark; *Dean Macris,* Director of Planning, Department of City Planning, San Francisco.

Research: *Dana Cuff,* Associate Professor of Architecture and Planning, University of Southern California, Los Angeles, and Director, CLEW Associates, Berkeley; *Donald Watson,* FAIA, Principal, Donald Watson, FAIA, New Haven, Conn., and Dean, School of Architecture, Rensselaer Polytechnic Institute, Troy, New York.

Judging will take place during October 1990. Winners will be notified, confidentially, before October 31. Public announcement of winners will be made at a ceremony in New York in January 1991, and winning entries will be featured in the January issue of P/A. Clients, as well as professionals responsible, will be recognized. P/A will arrange for coverage of winning entries in national and local media.

Turn page for rules and entry forms.

Deadline for Submissions: September 5, 1990

Entry form: 38th P/A Awards Program

Please fill out all parts and submit, intact, with each entry (see paragraph 14 of instructions). Copies of this form may be used.

Entrant:
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I certify that the submitted work was done by the parties credited and meets all Eligibility Requirements (1–7). All parties responsible for the work submitted accept the terms of the Publication Agreement (8–9). I understand that any entry that fails to meet Submission Requirements (10–18) may be disqualified. Signer must be authorized to represent those credited.

Signature________________________________
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Eligibility

1 Architects and other environmental design professionals practicing in the U.S. or Canada may enter one or more submissions. Proposals may be for any location, but work must have been directed and substantially executed in U.S. and/or Canadian offices.
2 All entries must have been *commissioned, for compensation, by clients with the authority and the intention* to carry out the proposal submitted. In the case of design competitions, the submitted design must be the one the client intends to execute. (For special provision in Research category only, see Item 6.)
3 Prior publication does not affect eligibility.
4 Architectural design entries may include only buildings and complexes, new or remodeled, that are scheduled to be completed after January 1, 1991. Indicate *schedule* on synopsis page (Item 12).
5 Urban design entries must have been accepted by the client who intends to base actions on them. Explain *implementation plans* on synopsis page (Item 12).
6 Research entries may include only reports accepted by the client for implementation or research studies undertaken by entrant with intention to publish or market results. Explain basis of eligibility on synopsis page (Item 12).
7 The jury's decision to premiate any submission will be contingent on verification by P/A that it meets all eligibility requirements. For this purpose, clients of all entries selected for recognition will be contacted by P/A. P/A reserves final decision on eligibility and accepts no liability in that regard. Please be certain entry meets above rules before submitting.

Publication agreement

8 If the submission should win, the entrant agrees to make available further graphic material as needed by P/A.
9 In the case of architectural design entries, P/A must be granted the first opportunity among architectural magazines for feature publication of any winning project upon completion.

Submission requirements

10 Entries must consist of legibly reproduced graphic material and text adequate to explain proposal, *firmly bound* in binders no larger than 17″ in either dimension (9″ x 11″ preferred). No fold-out sheets; avoid fragile spiral or ring bindings. Unbound material in boxes, sleeves, etc., will *not be considered.*
11 No models, slides, films, or videotapes will be accepted. Original drawings are not required, and P/A will accept no liability for them.
12 Each submission *must include* a one-page synopsis, in English, on the first page inside the binder, identifying the project and location, clarifying eligibility (see Item 4, 5 or 6), and summarizing principal features that merit recognition in this program.
13 To maintain anonymity, no names of entrants or collaborating parties may appear on any part of submission, except on entry forms. Credits may be concealed by any simple means. Do *not* conceal identity and location of projects.
14 Each submission must be accompanied by a signed entry form, to be found on this page. Reproductions of this form are acceptable. All four sections of the form must be filled out, *legibly.* Insert entire form, intact into *unsealed* envelope attached inside back cover of submission.
15 For purposes of jury procedure only, please identify each entry as one of the following: *Education, Houses (Single-family), Housing (Multiple-unit), Commercial, Industrial, Governmental, Cultural, Recreational, Religious, Health, Urban Design, Applied Research.* Mixed-use entries should be classified by the larger function. If unable to classify, enter *Miscellaneous.*
16 Entry fee of $90 must accompany each submission. An early submission fee of $75 per entry will be accepted for entries postmarked August 22 or earlier. (Canadian offices please send drafts in U.S. dollars.) Fee must be inserted into *unsealed* envelope containing entry form (Item 14 above). Make check or money order (no cash, please) payable to *Progressive Architecture.*
17 P/A intends to return entries intact, but can assume no liability for loss or damage.
18 Deadline for sending entries is September 5, 1990. Early submission deadline is August 22 (Item 16). Any prompt method of delivery is acceptable. Entries must show postmark or other evidence of being en route by midnight, September 5 (August 22 for early submissions). Hand-delivered entries must be received at street address shown here, 6th floor reception desk, by 5 p.m. on specified date.

Pointers for submissions
based on recent jurors' observations

- *Document site and surroundings with photos and drawings.*
- *For additions and remodelings, clearly indicate old and new.*
- *If design projects involved substantial research, explain it concisely.*
- *For research entries, indicate applicability to design.*
- *For buildings and urban design, give basics of funding, rental of space, etc., as applicable.*

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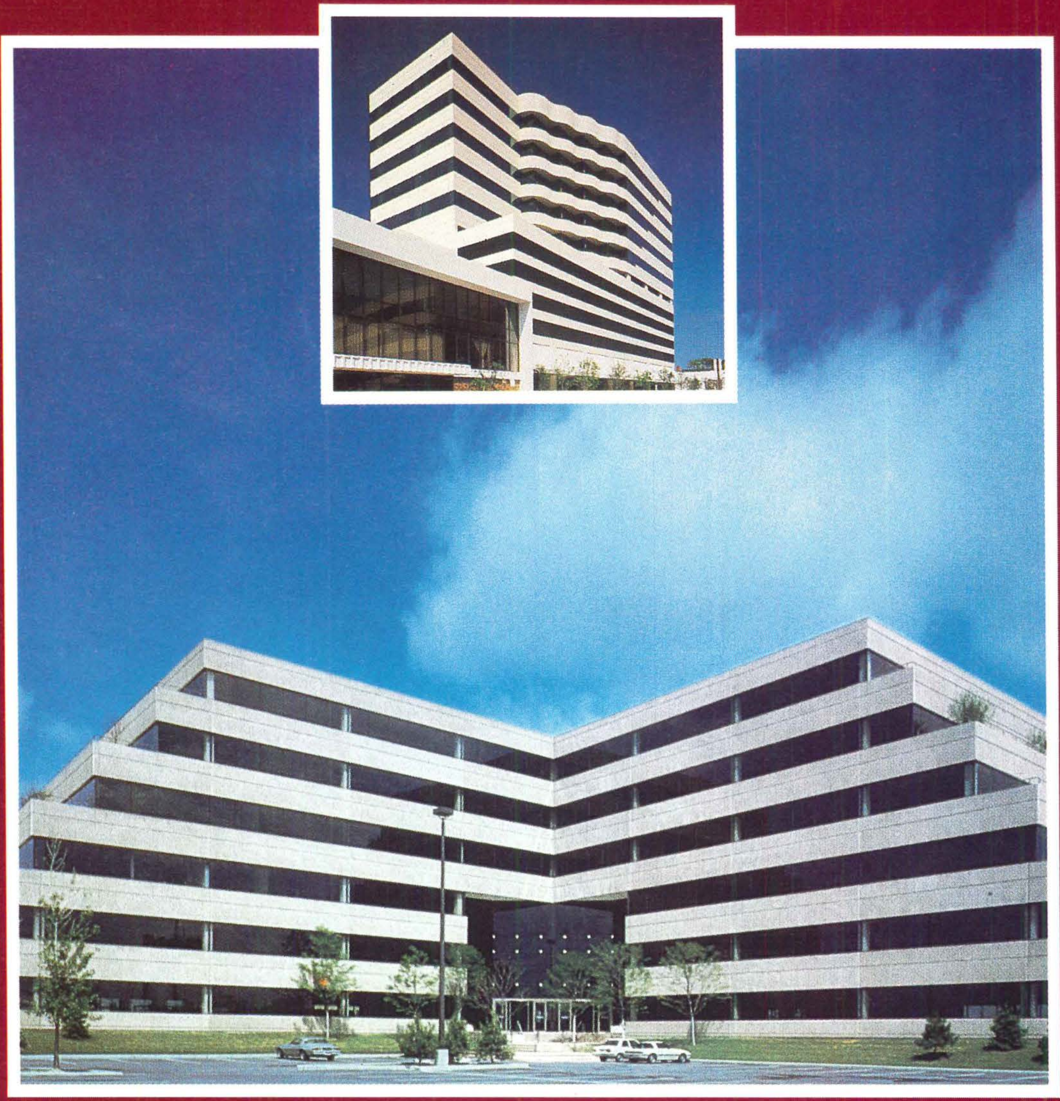

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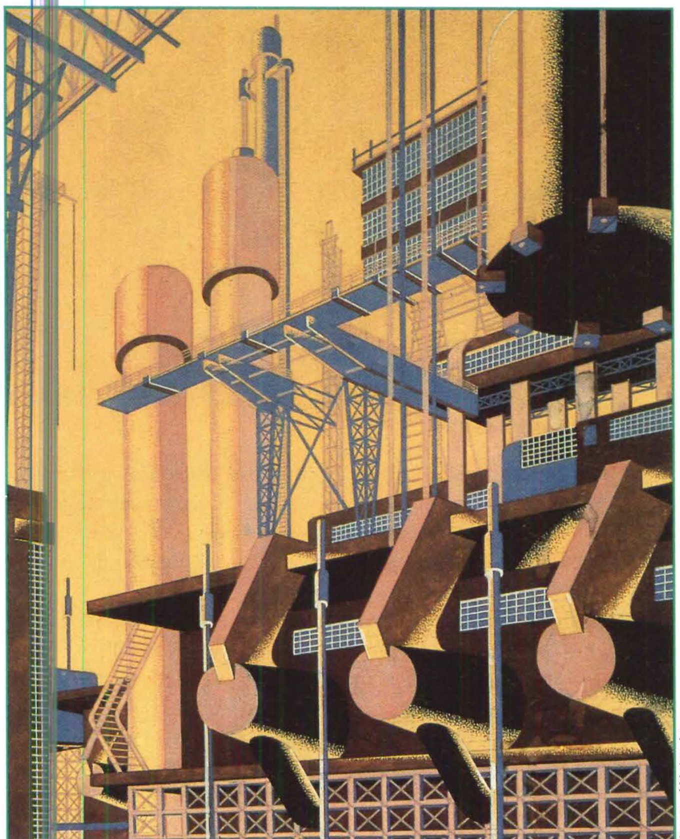

Museum of Modern Art

Iakov Chernikov's "Architectural Fantasy" (1928–31) from avant-garde show at MoMA.

Drawings of the Russian Avant-Garde at MoMA

Two years ago, the brief but brilliant Modern Movement of the Soviet Union was paired with Deconstructivism at New York's Museum of Modern Art (P/A, Aug. 1988, p. 25). Today, this Soviet work returns in its own exhibit: From now until September 4 (or next summer at the Canadian Centre for Architecture in Montréal), visitors can see 150 original Constructivist and Rationalist drawings on loan from the Shchusev State Research Museum of Architecture in Moscow.

Stuart Wrede, director of MoMA's Department of Architecture and Design, curator of the exhibit, avoided a flaw that critics assailed in the Deconstructivist show: Here, form is not divorced from content. This exhibit is a solid documentary – North America's first extensive survey of the Shchusev's original drawings by Ginsburg, Melnikov, Leonidov, and their colleagues in Leninist Russia. The drawings, mostly competition entries, have an economy of means that gives them great strength, both as graphic and as architectural works.

While the iconoclastic projects are compelling, the problem of placing them in context remains as much an issue today as it was for the Soviet public of the 1920s. Catherine Cooke's essay in the exhibition catalogue (Abrams, $37.50, cloth; $24.95, paper) traces the sources, maturation, and eclipse of the Soviet Modernists, and describes how Russian cities were unlikely places to build some of the Modern Movement's most radical structures.

At MoMA, a symposium showed that historians disagree on the place of the Soviet avant-garde, as five scholars engaged in a lively debate outlined by two positions. Christina Lodder and Anatole Senkevitch, Jr., said that the avant-garde architects active during Lenin's leadership made a decisive break with their precursors, while Jean-Louis Cohen countered that the basic concepts of Constructivism were in place before 1914. Frederick Starr's address was the most strident – a challenge to the hallowed status of the Soviet avant-garde. Jeffrey Kipnis said that the evening's roundtable was a valuable, if belated, supplement to the Deconstructivist show. The Soviet Modernists were both radicals and active participants in all aspects of the profession – a model for today's avant-garde. **Philip Arcidi** ■

Whimsical Winners for a Gateway Gas Station

In an unusual design competition for a usually ordinary building type, fantastical fossils and crustaceans raised the eyebrows of seven jurors and the citizens of Portland, Maine. When planners of this ordinarily conservative coastal town decided that a 1950s Mobil station sat at the ideal location for a visual gateway to the city's revitalizing downtown, they convinced the station's owner, the C.N. Brown Company, to sponsor a competition. The problem attracted 160 entries from 26 states.

Submissions ranged from the functional and contextual to the outrageous. Although Portlanders expected a stately station that would work within Portland's architectural context (a national landmark courthouse and a 35-acre Olmsted park are across the street), the bold, iconic entries attracted the most critical acclaim. A jury of seven, headed by Steven Izenour of Venturi, Scott Brown & Associates, chose two winners: one by Willis Pember and Peter Blanda of Philadelphia and the other by William Collet of Cambridge, Massachusetts. Pember and Blanda's scheme calls for giant lobsters that rest atop four round parasol-like canopies inspired by Eliot Noyes's 1964 prototype Mobil station. Pember and Blanda,

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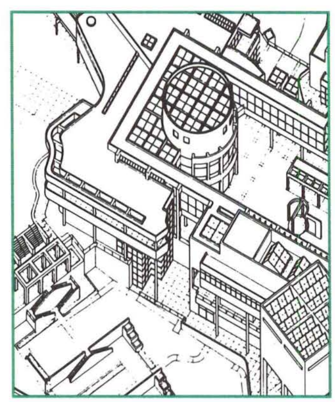
Sylvia Lavin exposes the abuses of "critical theory" in architecture. Perspectives, page 113.



Richard Meier's Getty Center (above), seen in newly published drawings, will be a collage of familiar images. Projects, page 119.

Pencil Points

British architect James Stirling has won the second Praemium Imperiale for architecture. The $100,000 prize was established last year by the Japan Art Association for five fields not recognized by the Nobel Prize. I.M. Pei received the first architecture prize last year (P/A, Nov. 1989, p. 25). Other winners for this year are Leonard Bernstein, Federico Fellini, Spanish painter Antoni Tapies, and Italian sculptor Arnaldo Pomodoro.

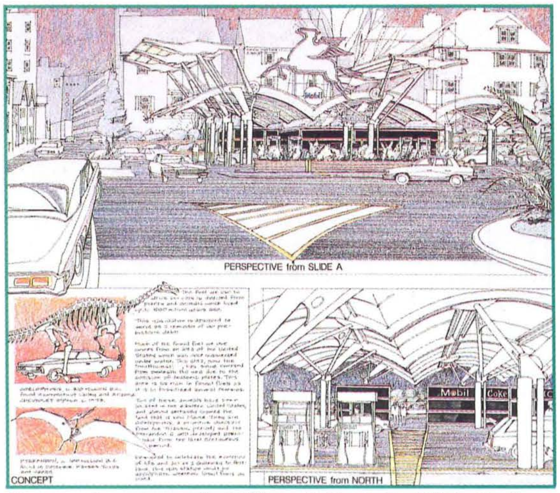
Architect Adele Naudé Santos of Philadelphia has been named founding dean of the new school of architecture at the University of California, San Diego.

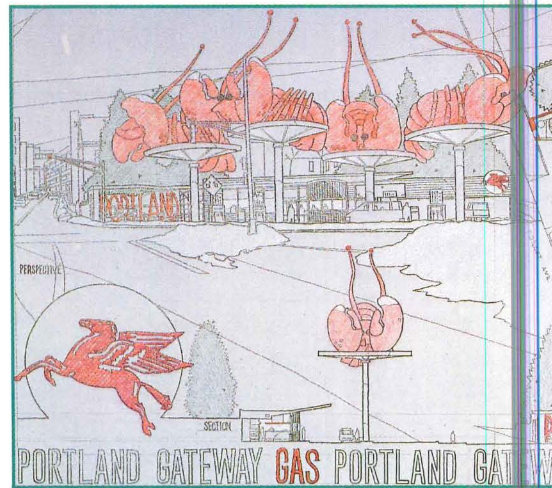
Hellmuth, Obata & Kassabaum/San Francisco, in association with Ng Chun Man & Associates of Hong Kong, will design a $4.1-billion airport for Hong Kong. The project will replace the existing Kai Tak Airport.

Sotheby's International Realty is marketing an unbuilt house in Malibu, California, by Coop Himmelblau of Vienna and Los Angeles. The characteristically fragmented forms of the project, known as 'Open House,' can be viewed in a four-color brochure from the realtor. The asking price? $3.8 million, 'including architects' plans, fees, and completed project.'

'A Beginner's Guide to Architectural Services,' a 12-page booklet now available from the AIA, explains to potential clients how – and why – to work with an architect. The booklet is available for two dollars a copy (less in bulk orders) from the AIA Public Affairs Department (202) 626-7460.

First place in the 1990 International Student Design Competition, sponsored by AIAS and GE Superabrasives, went to Christopher J. Schroeer of the University of Oregon. Competitors designed a hypothetical museum of modern art in Helsinki.





Gateway Gas winners by William Collet (left); Willis Pember and Peter Blanda (right).

Gas Station *(continued from previous page)*
who immediately knew that they wanted to use lobsters in this Maine project, found it a simple visual trick to transform Noyes's streamlined canopies into serving platters.

Collet's submission, titled "Homage to Fossil Fuels," features a dramatically arched roof over which two winged canopies and a red neon Pegasus fly. The canopies, which mimic the pumping motions of oil drills when the wind blows, are shaped to be reminiscent of the extinct creatures that made the gas station possible.

Both winning entries received $2000 in prize money and local notoriety, but no commission to be built. Both the oil company and the citizens found the winning designs (especially the lobsters) too outrageous. To make their scheme more palatable to the owners, Pember and Blanda suggest that the lobsters could be inflatable, floating above Portland on only special occasions.

Perhaps the most interesting result of the whole process has been that the public reaction has been enormous. This summer entries were on display in Portland where the townspeople voted for their favorites. Theo Holtwijk, competition organizer says, "We are all [service station] customers everyday; it is rare that most people go into a courthouse, a city hall, or corporate headquarters." C.N. Brown is still deliberating on the future of the gas station.

Julie Meidinger ■

Cheering Restoration of Boston's South Station

A vendor's cry of "newspaper?" joins the chorus of "Now leaving on Track Two." The aroma of fresh-brewed coffee mixes with the fresh flowers, and banners fly above handsome benches. Any of these staples of the festival mart would hearten the railroad buff. But the $48.8-million restoration of Boston's South Station is enough to stir broader sensibilities. The refurbishment and expansion of this 100-year-old train station (originally designed by Shepley, Rutan and Coolidge, heirs to H.H. Richardson) completes the northern terminus of Amtrak Northeast Corridor line with a grand flourish.

Steve Rosenthal

New concourse of South Station, Boston

Linked to the city transit system with a 15-foot-wide escalator and tunnel system, the station reinforces an urban nexus and revives a grand space, blending the best of Boston's 19th-Century walking tradition with the animation of the 20th-Century's foodcart formula of design.

It was a collaboration of long duration (ten years) and complex architectural credits (The Stubbins's Associates/CPS/Domenech & Hicks for restoration and the new building envelope, and Stull & Lee with Prellwitz/Chilinski for interior fittings and graphics).

Stubbins' use of granite from the original quarry and brick from the still-functioning 19th-century brick company allowed the firm to replicate the texture and method of the old "head house" on its new wings. Inside, the grim concourse that almost succumbed to the wrecking ball a decade ago now stretches 35 feet high, with large windows that open to the 11 bays for its commuter rail and Amtrak lines.

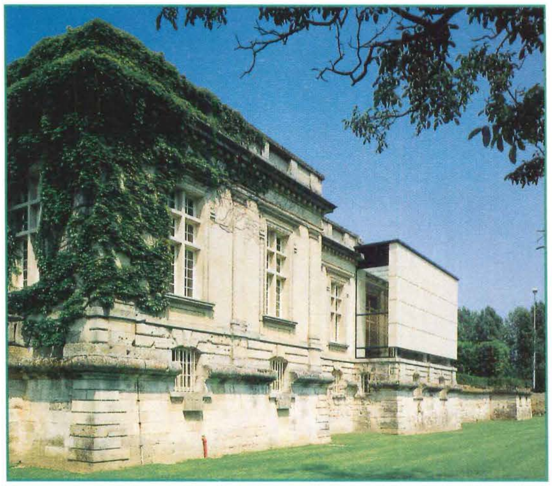
Within this half-acre greeting room, the reserved combination of patterned terrazzo floor, granite walls, and trussed ceilings frames and emphasizes the animated food booths and services. Skylights bring light to the waiting platform, and in the ticket room elegant marble booths and a pristinely restored ceiling lend grace.

The interior fittings for this gaze-and-graze emporium boast spirited Parisian kiosks and vivid signage, a zesty blend of the calculated and the spontaneous by retail architects Prellwitz/Chilinski. Unlike

Union Station, Washington's stunning parallel, the eateries don't interfere with the space or the flow of 50,000-plus commuters.

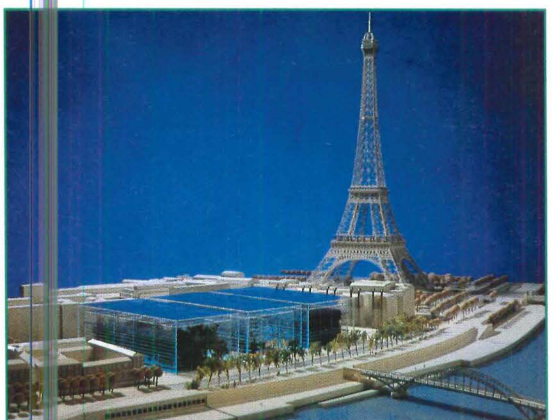
Sometimes the makeover does impinge on the monumental grandeur of the old train room; second-floor corridors or connectors for upstairs office floors obscure the view of the old arches. Banal picnic benches and trash cans are cause for concern, as is the more serious threat of a proposed office tower above the site by Jung/Brannen.

But for now the vitality of this well-used place and the care of the architects and the MBTA and Beacon Companies client is cheering. Today's South Station is a welcome sign that a complex project inspired by the public spirit of the 1970s can struggle through the privatist 1980s and emerge as a princely public space for the 1990s. **Jane Holtz Kay** ■



Steve Rosenthal

Restored South Station façade



Winning grand projet: three "jewel boxes."

Grand Projet Near the Eiffel Tower

Billed as the last of the *grands projets,* the design for the Centre de Conferences Internationales de Paris has just been unveiled by President Mitterrand. The winning project in a competition open only to architects registered in France, is by 41-year-old Francis Soler. The project, which covers approximately 24,000 square meters, will sit on the Seine near the Eiffel Tower, linked by an existing pedestrian bridge to the Palais de Tokyo. The site links this meeting center for world leaders to other monuments of Paris. It has the sort of visibility, program, and opportunity that has made each of the *grands projets* the focus of international architectural discourse.

Soler has designed three, equally sized glass "jewel boxes." The first box is the greenhouse, where the press will gather amid trees and birds. The central box is a glass-enclosed entry hall, empty except for a circulation core that leads to the final box and underground services. The third box is a solid volume within a glass shell. The solid, representing the "compression of Caesar" encloses the important conference rooms. The three boxes – green, void, solid – are connected by skewed glass bridges. With two of the three boxes containing virtually open space, it is difficult to describe the architecture in terms of scale, composition, façades, or academic references. The project seems frozen at the conceptual level, but is definitely to be built. **Claire Downey** ■

The author is a freelance writer temporarily based in Paris.

Kudos for an American Museum in France

The French professional architecture journal, *Le Moniteur,* recently surprised people by awarding its prestigious 1989 "Equerre d'Argent" (Silver T-square) prize for the year's best building to an obscure country museum built in the remnants of a 17th-Century chateau, an hour north of Paris. Officially the "Musée National de la Coopération Franco-Américaine," it is known as the American Museum at Blérancourt.

A shrewd choice it was, because the ensemble of the renovated pavilions, along with a new wing (the Florence Gould Pavilion), a sculpture court, and three new American gardens (one inspired by a design of Thomas Jefferson's) is everything that the renovation and addition to an historic building should be.

The ruins of Salomon de Brosse's early 17th-Century chateau de Blérancourt (the prototype for his Luxembourg Palace in Paris) had been partly rebuilt in a derivative style during the 1920s for J.P. Morgan's daughter Anne. She, along with a host of Social Register francophiles and French aristocrats, founded a museum there commemorating the World War I American Field Service Ambulance Corps.

The dynamic Paris firm of Yves Lion and Alan Levitt (a Canadian) has renovated it and designed the new pavilion. They respected both the 17th-Century and later 1920s work while creating a new volume that is unashamedly modern.

The new pavilion, a smooth cube of buff-colored local limestone matching the older stone, is delicately connected to the 17th-Century splayed moat foundations and to the 1920s superstructure by shadowed bands of clear glass, horizontal and vertical, held by fine slate-gray anodized aluminum frames. Visually, the old and new kiss rather than collide. From the gardens, the new pavilion seems to float above the old foundation, its volume perfectly balancing the older masses.

Inside the new wing, the light from the continuous floor-level "clerestory" band is softly diffused by the grey-veined white Carrara marble paving. The light-

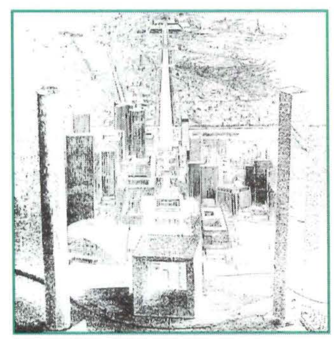
(continued on next page)

Student Designs: Otis Competition

Winners have been announced in the second annual student competition sponsored by the AIA, the ACSA Research Council, and Otis Elevator. This year's competition program was a headquarters building for a hypothetical investment bank at La Défense in Paris.

Winners are:

- **First Place ($12,000): Mauri Korkka, Tampere University, Finland;**
- **Second Place ($4000): Lee Calisti, Voon-Lee Chia, John Cooney, David Gamble, Fritz Johnson, Michael L. Lambert, John F. Orsini, Kent State University;**
- **Third Place ($1500): Lara Jenkins, Chris Heinz, Kansas State University; Charles Michael Breau, Syracuse University. Honorable mentions ($500) were awarded to:**
- **Shiou-Hee Ko, Swaroop Patel, Miguel Da Silva, Jerry Di Fierro, Mike Harshman, Rice University;**
- **Hans Ekke Butzer, Fred Andrew Lowrance, Louis Clyde Waddell, University of Texas at Austin.**



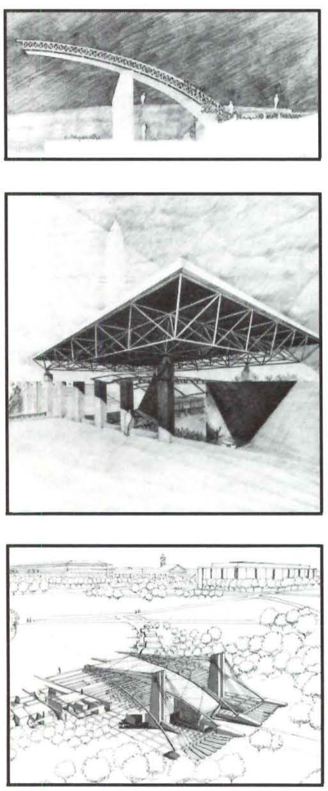
Otis winner by Mauri Korkka

Jurors were David Childs, *Skidmore Owings & Merrill, New York;* Oriol Bohigas Guardiola, *Martorell-Bohigas-Mackay, Barcelona;* William Holzbauer, *Vienna;* Francois Pinson, *Centre National des Industries et des Techniques, Paris;* and Michael Wilford, *James Stirling Michael Wilford & Associates, London.* ■

Student Designs: NRCA Competition

Six student projects were honored recently in "Capitol Ideas," the third hypothetical student competition sponsored by the National Roofing Contractors Association and the American Institute of Architecture Students. The competition program was a performing arts amphitheater on the Mall in Washington, D.C., that would "feature the roof as the primary structural and design element." The competition drew 151 entries. Winners were:

- First Place ($5000): Amy Dryden and Katie Kosut, University of Texas, Austin;
- Second Place ($3000): David LeClerc, Southern California Institute of Architecture;
- Third Place ($1000): J. David Genet, University of Texas, Austin. Honorable mentions ($400) went to:
- James M. Brown, Oklahoma State University;
- Jeb Thornburgh and Philip Aguilar, Washington Alexandria Center;
- Kevin Richard, Wentworth Institute of Technology. ■



NRCA winners by Dryden and Kosut (top); Genet (center); Thornburg and Aguilar (above).

J. M. Monthiers

Château de Blérancourt, now a French-American museum.

Museum *(continued from previous page)*

ing is superb throughout: Walls are lighted by baffled, edge skylights, supplemented by skillfully designed artificial light. There is neither gloom nor glare; the lighting reveals the art as well as the architecture.

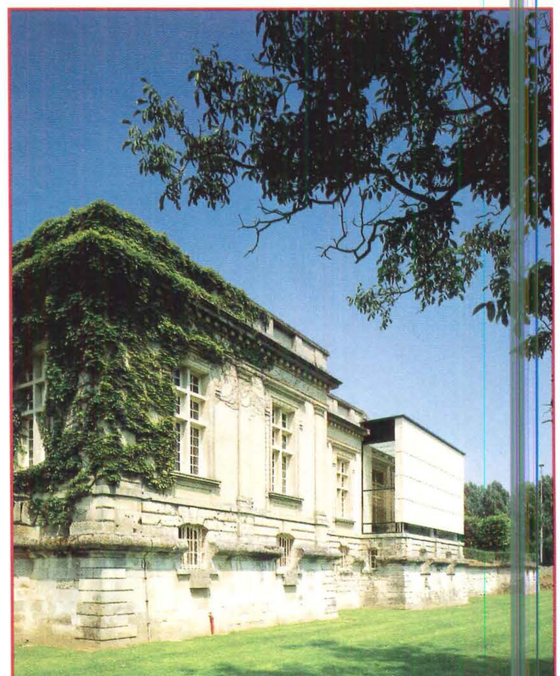
The beautifully crafted, pale interiors with American sycamore and European hornbeam walls and stairs, and pale gray brushed stainless steel grillwork and railings, are serene and warm. The spaces, as one moves from the new pavilion with its cantilevered mezzanine level into the gutted 1920s wing with its high French windows, and down a graceful stair to the stone-vaulted, clerestory-lighted 17th-Century cellars, form a seamless composition. The architects achieved this by concentrating all stairs and mechanical services in a free-standing, long central core that penetrates the old and new spaces, leaving the exterior envelope unencumbered.

American landscape architect Madison Cox created the surrounding gardens of American flora. The one inspired by Jefferson peaks in springtime, another in summer; the third is an autumn-foliage arboretum.

The museum is now the American Department of the French National Museum system and expects to become the major American art collection in Europe. Altogether, the ensemble is a masterful embassy to Europe of American art, architecture, and landscaping, a true French-American cooperative venture.

Barbara Shortt ■

The author is a New York architect who writes frequently on French architecture.



J. M. Monthiers

Lyon & Levitt's addition (right) to museum.

Rail Plans for Houston, Dallas

Rail transit will help ensure the economic survival of Houston and Dallas in the next century. That's the new consensus among big employers, financiers, and land developers in both cities, where growth has heretofore been based on endless freeways and suburban sprawl. If current rail plans go forward as expected – and many questions of financing and logistics must first be solved – they can potentially act as the first centralizing force to affect Texas cities since the 1920s. Indeed, some developers in Houston are even willing to bet their own money that rail transit can create economically viable pedestrian-scale urban villages and reshape the city's urban form.

In Dallas, work on the 20-mile first leg of a light-rail system is scheduled to start this summer. Due for completion in 1995, it will link downtown to the mostly white northern suburbs and the predominantly minority areas of Oak Cliff to the south, at a cost of $625 million. By 2010, Dallas Area Rapid Transit will add 46 more miles of light rail line, reaching residential areas in all quadrants. DART's earlier plans to sell bonds for a 93-mile heavy-rail line with a downtown subway were defeated by voters in 1988; the first $6.5- billion plan is intended to be "pay-as-you-go," with most of the funds coming from DART's sales tax subsidy. Some $350 million for the plan will come from sales of development rights around transit stations. Local architects and urban

(continued on page 37)

Rail-linked urban villages in Houston proposed by Decoma Group.

"Do not-a-be fooled.

The 'little miracles'

you are about to see

are not-a-miracles.

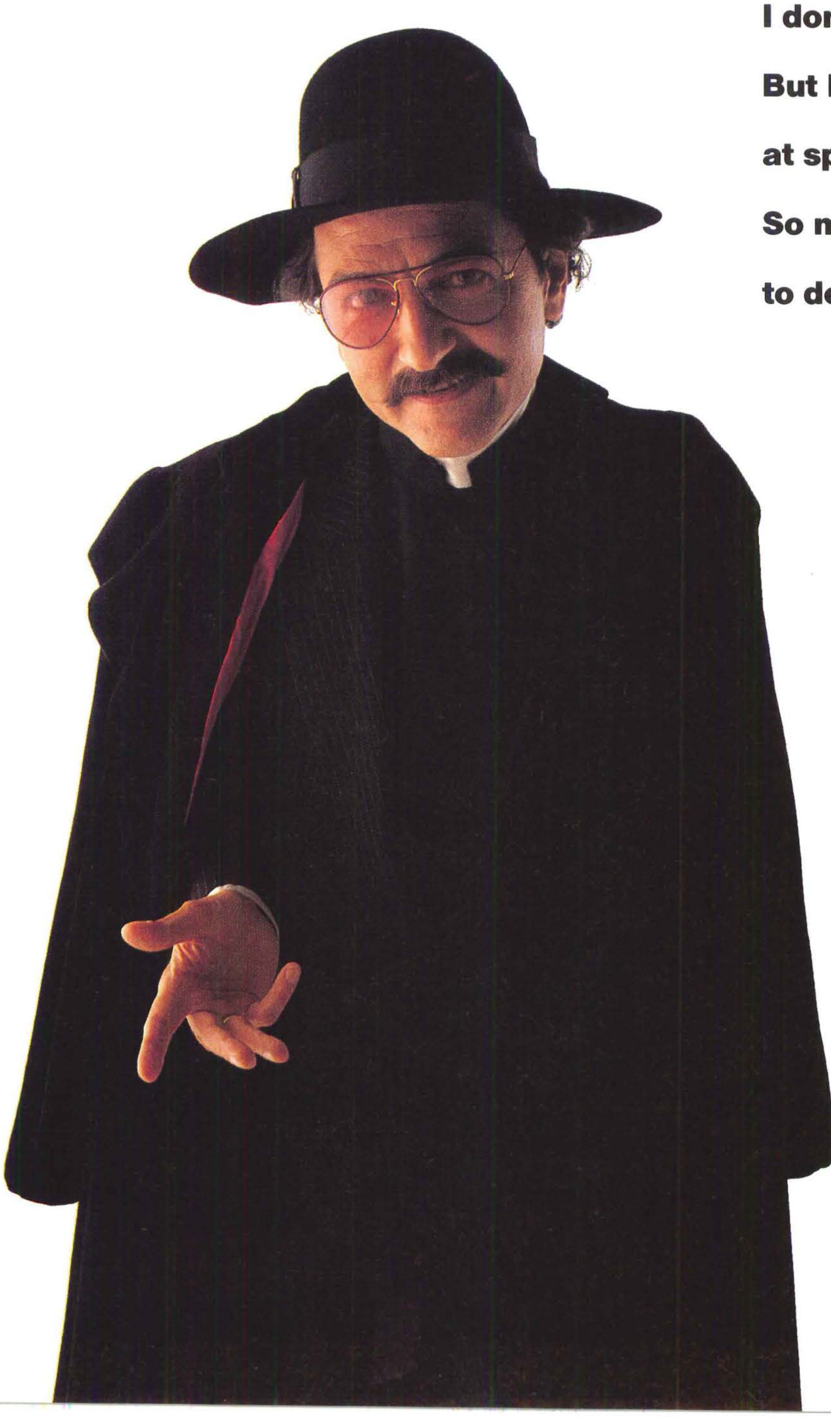
I don't think.

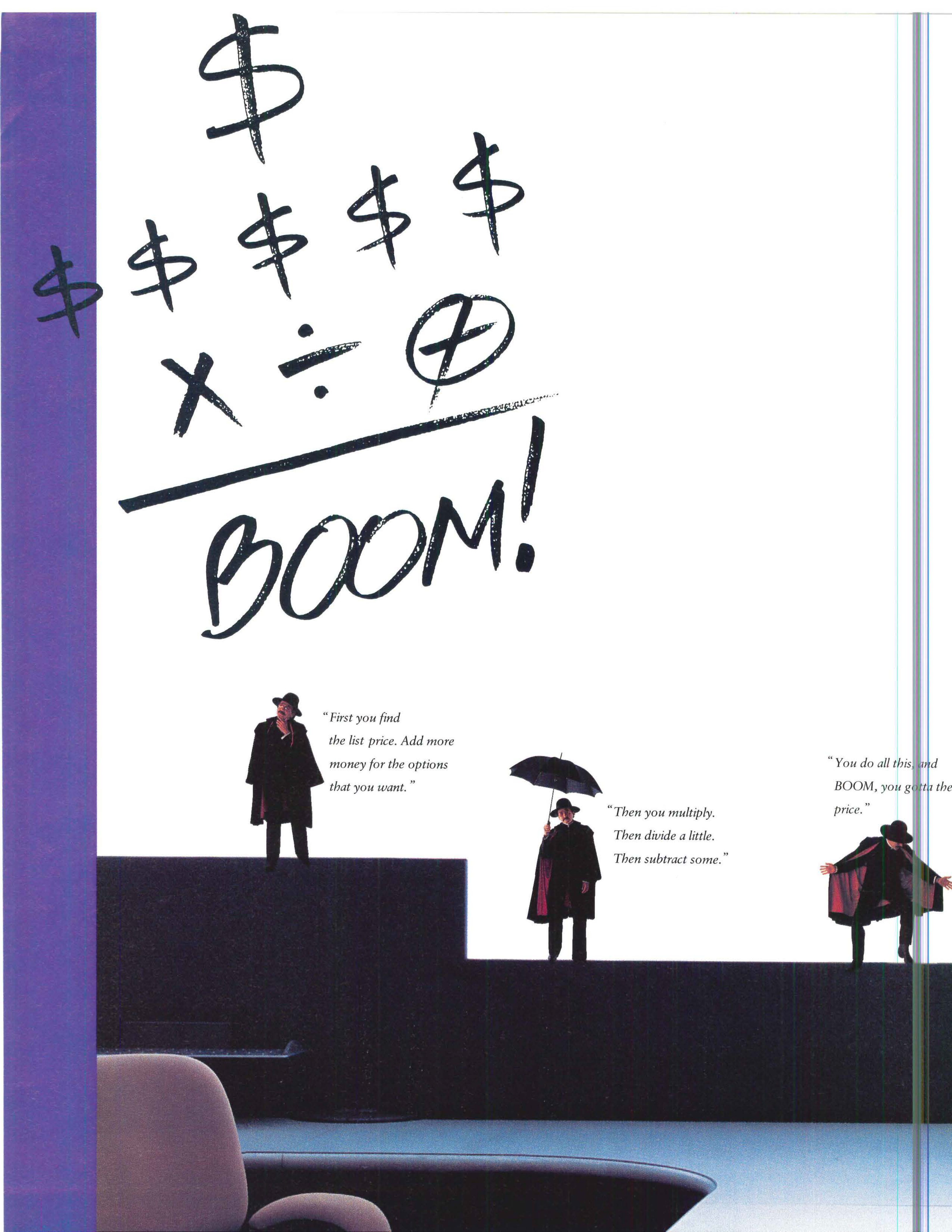
But I'm-a not too good

at spotting miracles.

So maybe you ought

to decide-a-for yourself."

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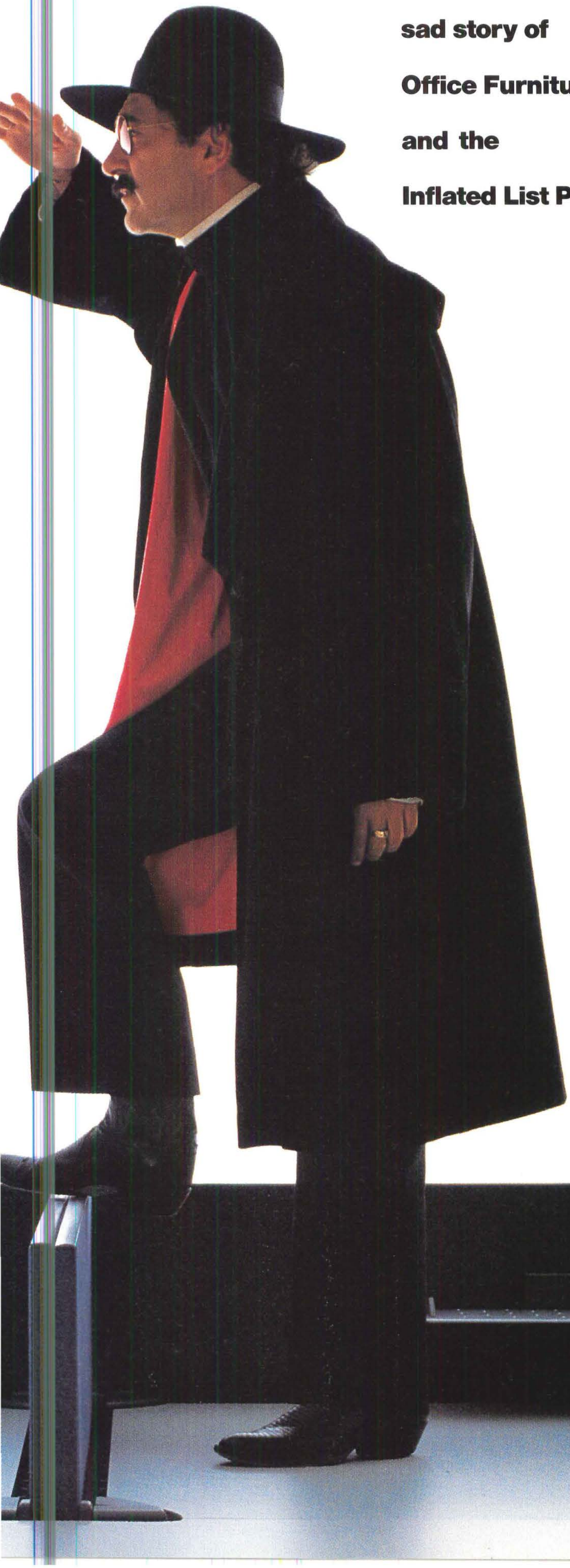
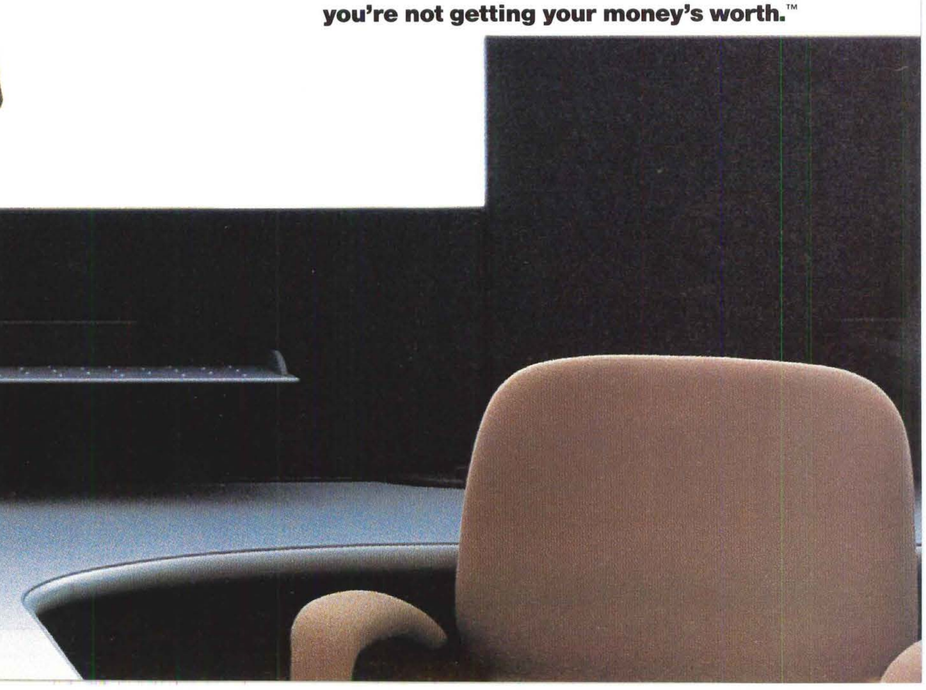
BOOM!
"First you find the list price. Add more money for the options that you want."
"Then you multiply. Then divide a little. Then subtract some."
"You do all this,
BOOM, you
price."





Texas Rail *(continued from page 32)*
planning activists applaud this and other aspects of the DART plan but, nevertheless, regard it as compromised by attempts to keep costs down. For example, because the DART plan routes train lines along existing freeways and railroad rights of way, critics charge that it will, in the short term, undercut its own ridership projections while promoting sprawl development. The Metropolitan Transit Authority in Houston has federal funds committed to a planned rail system, along with a large sales tax reserve. What Metro doesn't have is a workable rail plan. Voters in a nonbinding referendum approved a plan for a $1-billion "connector" light rail system that would link downtown with the Galleria, Greenway Plaza, and the Texas Medical Center; critics, among them Metro's board chairman, charged that it would attract almost no new ridership, and the plan was abandoned last year. Next, the Metro board solicited proposals from private firms to build and operate a rail system and were swamped by the worldwide response they received.

Details on most of these "privatization" proposals are sketchy as yet; only one, promoted by Houston's Decoma Group, has been made public. The group, which includes architects Pierce Goodwin Alexander & Linville and CRSS, proposes a $650-million elevated light-rail along Metro's basic alignment. According to Leo Linbeck, Jr., of Linbeck Construction, spokesman for the group, their main interest is in developing the land around the potential stations into a series of pedestrian-scaled urban villages in which mixed-income housing, schools, and essential services would be within five minutes' walk. Such a plan would attract few suburban riders, Linbeck admits, but he says it would create new, relatively dense neighborhoods inside Loop 610 for up to 300,000 new riders who would otherwise be in their cars. The Decoma Group proposal may be doomed before its urban notions can be put to the test, however. In March, the Metro board embraced the concept of a radial system – instead of the connector system – to draw suburban ridership. The radial system adopted by Metro is almost identical to a plan put forward earlier this year by University of Houston professor Shafik Rifaat and an urban design studio he heads. Rifaat's plan also calls for the development of urban villages but would use them to channel growth both in outer suburbs and in the inner city. The approaches are incompatible, says Linbeck: "If we can't build the whole thing, as we have proposed it, we're not interested."

Evaluating the privatization proposals may take the rest of the year, and political wrangling may draw the process out even further. It is clear, however, that if Houston authorities ever get to the point already reached in Dallas, rail transit could become the most important new urbanistic force in Texas's two biggest cities. **Joel Warren Barna** ■

(continued on page 38)

NEOCON 22: A Mixed Bag

The annual furnishings fair held at Chicago's Merchandise Mart in June was marked by extremes of quality and taste. Most manufacturers, in deference to the uncertainty that has plagued the industry in recent months, kept product introductions and showroom displays quite modest relative to the extravaganzas of previous years; Knoll's showroom, however, was an exception with its hatching chicks, dozing puppies, piles of pennies, walls of clocks, and stacked video screens.

Haworth's new showroom struck a somewhat more subtle architectural note with a series of structures designed by Margaret McCurry. The miniature steel buildings inserted into the vast showroom space were inspired by Midwestern industrial and agricultural types such as refrigeration plants, breweries, and water towers. KI, too, distinguished itself with a striking – and gratifyingly simple – display, delivered for the third consecutive year by Massimo Vignelli. To showcase the company's tables, the New York designer created a raised illuminated plinth set back from the bustling hallway by a broad vacant strip of blackened concrete. This device rendered the tables weightless, hovering on the edge of an abyss.

Notable among the new products were Vecta's "Ballet" seminar and conference tables designed by Douglas Ball, with graceful X- or K-shaped bases, and the generously proportioned multiple seating by Michael McCoy, Dale Fahnstrom, and David Vanden-Branden, an extension to the D3 seating line, which was launched last year.

One of the most thrilling designs of the entire fair was previewed as one of the office accessories introduced by Details, a new division of Steelcase. It is a prototype of a task lamp, by Stephen Copeland, which departs from conventional lamp design in two important respects: Instead of basically identical, assembled mechanical joints, the lamp will employ molded ball-and-socket joints for virtually unlimited movement. If successful, that anatomically inspired engineering innovation – coupled with biomorphic form – will produce the rare design that truly integrates art and technology.

Other products, while not entirely new, are worth mentioning if only because many launches, rushed through the works to make the market, seem half-baked by comparison: Antonio Citterio's AC office chairs for Vitra, seen in Milan last year and now making their U.S. debut, are stylish and carefully considered in every detail. Likewise, the "Allegis" office and task chairs, designed by Babcock & Schmidt of Bath, Ohio, for the Harter Group, are as brilliantly innovative in engineering and articulation as any ergonomic chairs available. (Allegis was previewed at Designer's Saturday last fall under the name "Allegro.") Similarly outstanding pieces: ICF's variegated and shapely "Decisions" sofa, by Pelikan Design; Jasper Morrison's sofa for Palazzetti; and Herman Miller's Hollington chaise and ottoman ensemble, designed by Geoff Hollington, which does the company's Eames legacy proud. **Ziva Freiman** ■

Calendar

Exhibitions

Communicating Ideas Artfully
Through August 17

Minneapolis. A collection of presentation drawings and models documents methods and media used to depict architectural projects. The show was curated by P/A Executive Editor Thomas Fisher and will travel nationally. International Market Square.

Competition × 3
Through August 17

New York. Competition-winning designs for the Korean War Veterans Memorial, National Peace Garden, and Women in Military Service for America Memorial are exhibited. National Institute For Architectural Education.

Coop Himmelblau
Through August 18

Santa Monica, California. "Six Projects for Four Cities" is a presentation of recent work for sites in Los Angeles, Melun-Senart (near Paris), Vienna, and Sapporo, Japan. The exhibition is scheduled to travel internationally. Richard Kuhlenschmidt Gallery.

Stanley Saitowitz
Through August 19

Minneapolis. Fourth in the Architecture Tomorrow series is "Geological Architecture: The Work of Stanley Saitowitz." The California architect expounds on his ideas of architecture as creation of landscape and horizon with an interactive installation: ". . . building models float on a glass surface supported by a wood and steel landscape consisting of a ramp, a bridge, and a stairway." Walker Art Center.

Russian Constructivism
Through September 2

Seattle. "Art Into Life: Russian Constructivism 1914–1932" offers a visual history of the work of artists, architects, designers, photographers, and others who flourished in the heady days of post-czarist, pre-Stalinist Russia. The show is organized by the Henry Art Gallery, USSR Ministry of Culture, and the E.V. Vuchetich National Art Production Union, in association with the Walker Art Center; it will be at the Walker in Fall 1990. Henry Art Gallery, University of Washington.

Russian Avant-Garde
Through September 4

New York. Over 150 original works on loan from the Shchusev Architecture Museum in Moscow, shown for the first time in the United States, offer a look at one of the richest collections of Constructivist projects from the 1920s. Museum of Modern Art.

The Doghouse
Through October 14

New York. The Cooper-Hewitt, in collaboration with Eyes for the Blind, invited architects and designers to submit proposals for doghouse designs for exhibition in the museum's garden; 24 realized schemes are on display. Braille labels, large-type signage and brochures, and specially designed paths are planned in an effort to make the show accessible to sight-impaired visitors. Cooper-Hewitt Museum.

The Chicago Skyscraper
Through December 31

Chicago. A selection from the Art Institute's permanent collection of drawings and models of Chicago's wealth of iconoclastic skyscrapers – from Burnham & Root's Rookery Building to Murphy/Jahn's Northwestern Terminal tower. The Art Institute.

Competitions

Brickell Bridge
Registration deadline August 20, submission deadline November 20

Miami. A two-stage design competition for the "architectural enhancement and illumination" of the 70-year-old Brickell Avenue Bridge is being sponsored by the Downtown Development Authority of the City of Miami, through the New World Center Foundation. Contact Clyde Judson, Downtown Development Authority, 1818 One Biscayne Tower, Miami, Fla. 33131.

Kiosk Designs
Entry deadline September 1

Washington, D.C. Student and professional landscape archtitects are invited to enter designs for an "interpretive" kiosk at public recreation sites nationwide. Competition sponsors, the American Society of Landscape Architects and the American Recreation Coalition, require a design that is "inexpensive, durable, easy to construct, and visually appealing." A jury will choose one student and one professional design; each winner will receive a $1000 honorarium. Contact Raymond Freeman, FASLA, American Society of Landscape Architects, 4401 Connecticut Avenue, N.W., 5th Floor, Washington, D.C. 20008–2302 (202) 686-2752.

Home of the Year
Entry deadline September 1

New York. "Homes, apartments, or vacation places" are eligible for *Metropolitan Home's* 1990 Home of the Year Contest. Contact The Awards Committee, *Metropoltian Home,* 750 Third Avenue, New York, New York 10017.

Schoolyards Competition
Registration deadline September 1, Submission deadline October 1

New York. An international student competition for the design of two elementary schoolyards is sponsored by the Children's Environments Research Group. First prize is $1000; winning and selected entries will be displayed at the Schoolyards Conference in New York, October 1990. Contact Rosario Mora/Schoolyards Competition, Children's Environments Research Group, City University Graduate Center, 33 West 42nd Street, New York 10036 (212) 642-2970 or FAX (212) 642-2971.

P/A Awards
Entry deadline September 5

Stamford, Connecticut. The 38th annual P/A awards (see p. 15) recognize unbuilt projects in the categories of architectural design, urban design, and applied architectural research. Projects must be scheduled for completion after January 1, 1991. Winning entries will be featured in the January issue of P/A. Contact Awards Editor, *Progressive Architecture,* 600 Summer Street, Stamford, Connecticut 06904.

American Wood Council
Submission deadline September 15

Washington, D.C. The American Wood Council has announced its 1990 Wood Design Awards Program. Residential and nonresidential, new and remodeled buildings with "a dominant wood character," and completed since January 1987 are eligible. Contact American Wood Council, 1250 Connecticut Avenue, Washington, D.C. 20036 (202) 833-1595.

A Gateway for Venice
Enrollment deadline September 15

Venice. An international competition for the "radical restructuring" of the Piazzale Roma area of Venice is sponsored by the Venice Comune in collaboration with the Venice Biennale Architecture Section. Registered architects and engineers are eligible. Contact "Concorso de progettazione <<Una porta per Venezia>> per la sistemazione di Piazzale Roma," Segreteria del concorso, Settore Architettura dell'Ente Autonomo La Biennale di Venezia, Ca'Giustinian 1364/a – San Marco – 30124 Venezia, Italia tel. 41 5226514 or FAX 41 5236374.

Prince Frederick Town Center
Entry deadline September 20

Prince Frederick, Maryland. The historically sensitive Prince Frederick town center is the site for a competition sponsored by Calvert County Historical Society, The Maryland Historic Trust, and the Chesapeake Bay Chapter/AIA. Expansion of existing buildings, new construction, a network of streets integrated into existing neighborhoods, parking facilities, and public facilities are programmatic requirements. Professionals, students, and "anyone else interested in urban design" are eligible. Contact Sally McGrath, Department of Planning and Zoning, Courthouse Annex, Prince Frederick, Maryland 20678 (301) 535-2348.

(continued on page 42)

(continued from page 40)

Shinkenchiku Competition
Entry deadline September 17–24

Tokyo. "The House is an Electronic Device for Living in" is both an updated version of Corbusier's words and the theme for the 1990 Shinkenchiku Residential Design Competition. Winners will be announced in the March 1991 issue of *The Japan Architect;* details on the competition are in the magazine's March 1990 issue. Entries will not be returned. Contact Entries Committee, Shinkenchiku Residential Design Competition 1990, Shinkenchiku-sha Co., Ltd., 2–31–2 Yushima, Bunkyo Ward, Tokyo 113, Japan.

Concrete Building Awards
Entry deadline September 28

Skokie, Illinois. All types of new or remodeled concrete buildings – cast-in-place, concrete masonry, and precast concrete – may be entered in the 1990 Concrete Building Awards program sponsored by the Portland Cement Association. Buildings in the U.S., Canada, and Mexico, completed between September 1988 and September 1990, are eligible. Contact Glen Simon, PCA, 5420 Old Orchard Road, Skokie, Ill. 60077 (708) 966-6200 or FAX (708) 966-8389.

City of Samarkand, USSR
Registration deadline
September 30

Samarkand, USSR. An international ideas competition has been launched by the City of Samarkand (located in the Soviet republic of Uzbek) "for the Ulugh Beg Cultural Centre and the revitalization of the city's historical core." The USSR Union of Architects, The Aga Khan Trust for Culture, and the Uzbek SSR Union of Architects are sponsors. Contact Samarkand Competition Secretariat, 32, Chemin des Crêts-de-Pregny, 1218 Grand-Saconnex, Geneva, Switzerland (22) 798 9070 or FAX (22) 798 9391.

Conferences

APT Conference
September 2–9

Montréal. Participants in the Association for Preservation Technology's annual conference will tackle the theme "Preserving for the 21st Century"; the effects of time and climate, environmental pollution, and energy concerns are among the planned topics of discussion. Training courses (September 2–5), a conference (September 5–8), and a symposium (September 8–9) are scheduled. Contact APT Montréal 1990, c/o Conference Office, McGill University, 3450, rue University, Montréal, Québec, H3A 2A7 (514) 398-3770 or FAX (514) 398-4854.

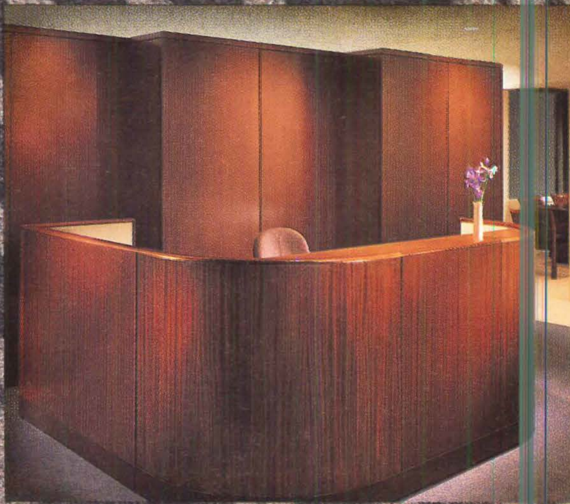
Downtown Association
September 8–12

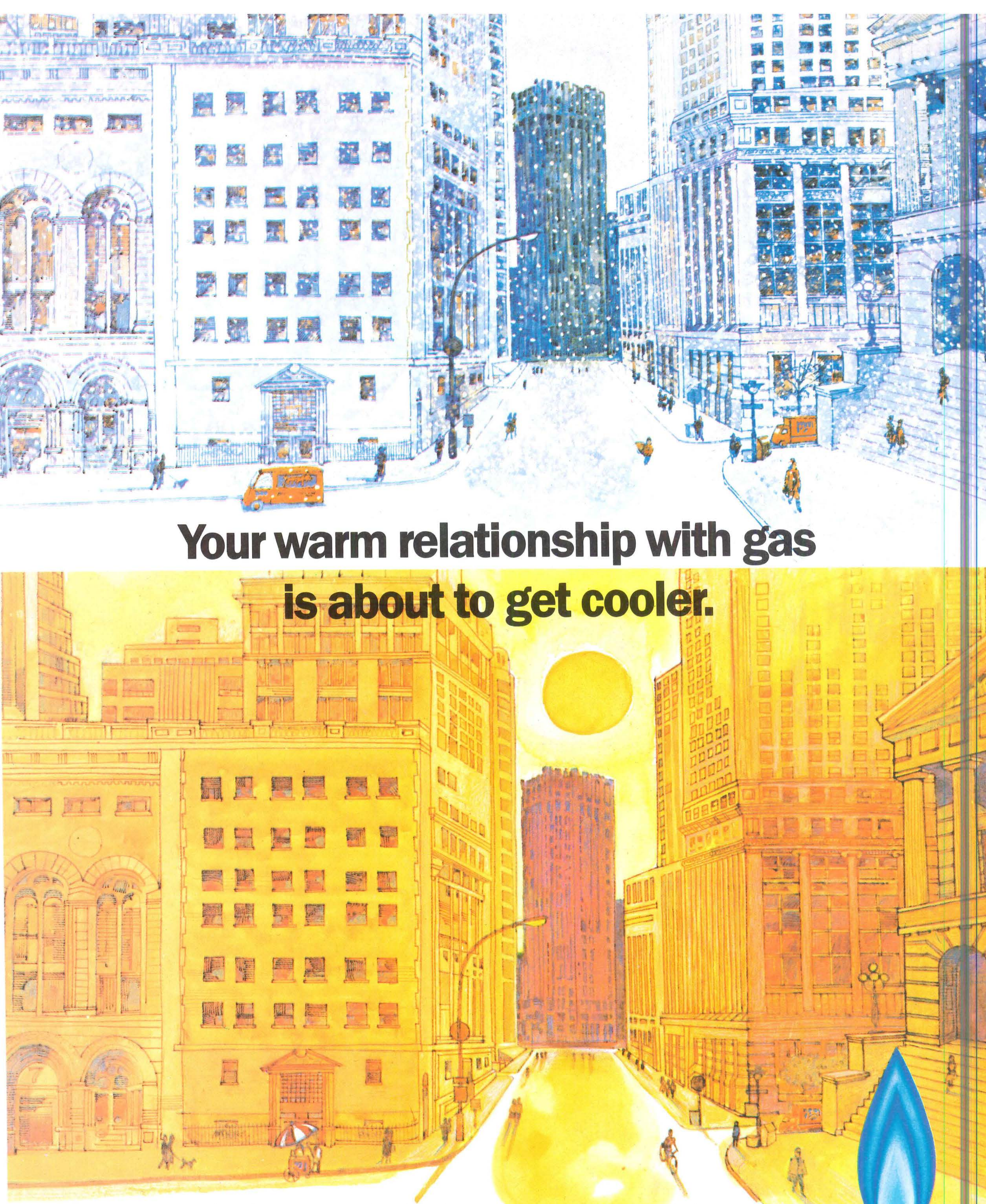
Edmonton, Alberta. The 36th Annual International Downtown Association Conference, sponsored by the Edmonton Downtown Development Corporation, will be held at the Convention Centre in Edmonton. "Learning How To Compete Effectively" is this year's theme. Contact International Downtown Association, 915 15th Street, N.W., Suite 900, Washington, D.C. 20005 (202) 783-4963 or FAX (202) 347-2161.

Waterfront Center Conference
October 11–13

Washington, D.C. Forty exhibits, "shirt sleeve" sessions, and announcement of the annual Excellence on the Waterfront project award winners are among the scheduled events at the eighth annual Waterfront Center conference on urban waterfront planning, developments, and culture. Contact Waterfront Center, 1536 44th Street, N.W., Washington, D.C. 20007 (202) 337-0356.

CETRA





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The Rain Screen Wall

Technics

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Engineer and researcher **Dale D. Kerr** reviews the history of and recent developments in a concept of cladding design too little known in the U.S.

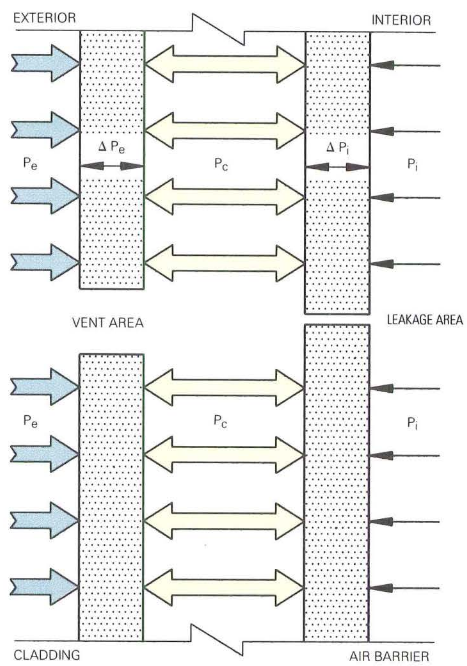
Architects are all familiar with cladding systems that rely on overlapping components (shingles, clapboards, and louvers – watershed *systems) and on watertight surfaces (EIFS and many panel claddings –* barrier *systems) to keep water out. Cavity walls have appeared in recognition that not all surfaces and joints can be made watertight, and that some provision for internal drainage is necessary. The next evolutionary step in cladding design is the* rain screen principle, *which puts the air in the cavity to work in resisting wind-driven water infiltration. Because many cladding systems and components (including window and door sash) already incorporate cavities, rain screen design does not necessarily increase cost or complexity of construction. It does, however, require greater understanding of how claddings behave under wind pressure. This is a current topic of research in Canada, so we've asked one of their leading consulting firms to describe current thinking and findings about the concept.* **Kenneth Labs**

Over the years, many methods have been used to prevent the rain penetration of walls, some more successfully than others. The forces that cause rain penetration to occur include kinetic energy of the raindrop, gravity, capillarity, and air pressure. Cladding researchers and diagnostics investigators are increasingly recognizing air pressure as the major cause of water penetration problems, and they are looking more carefully at an idea that's been around for several decades – the rain screen – to devise more specific design guidelines and detailing standards.

For rain penetration caused by an air pressure difference to occur, three conditions must exist: 1) there must be water on the surface of the wall; 2) there must be an opening through which the water can pass; and 3) there must be a force (an air pressure difference) to move the water through the opening. Theoretically, if any one of these three conditions is eliminated, rain penetration will be greatly reduced.

The first condition, water on the surface of the wall, cannot be eliminated. Although large overhangs may prevent some rain from reaching the walls of a building, it is not possible to keep rain off the walls, particularly the walls of tall buildings. Most traditional methods of preventing rain penetration have concentrated on eliminating the second condition, openings through which the water can pass. In other words, the outside surfaces and joints are sealed. This is called a *face-sealed system*. However, as water will pass through even the tiniest imperfection, the seal must be perfect and must remain perfect – a difficult condition to achieve given the nature of construction activity, the aging of coatings or sealants under temperature cycling and ultraviolet radiation, and the differential movement of building components.

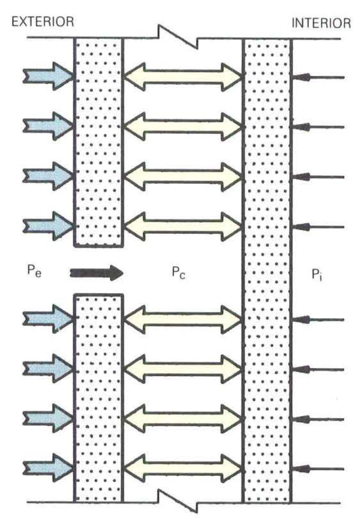
The final condition that must exist for rain penetration to occur is an air pressure difference across the wall. Such an air pressure difference is created by



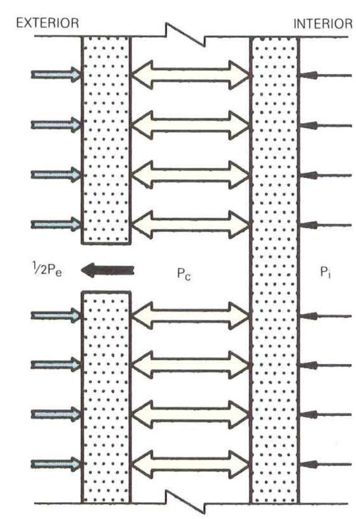
1. ANATOMY OF A RAIN SCREEN WALL.

1. Under an applied wind pressure (P_e), air flows into the cavity causing the cavity pressure (P_c) to increase until $P_c=P_e$ and $\Delta P_e=0$. When the entire wind pressure is felt by the air barrier, ($\Delta P_i=P_c-P_i$), pressure equalization has occured.

2. In situation (a), when pressure equalization occurs, $P_e=P_c$, and there is no driving force to cause water to penetrate the cladding. In situation (b), the exterior load has decreased. Until pressure equalization occurs, $P_c > P_e$, so there is a net negative load on the cladding, causing outward air movement.



2a. PRESSURE LOADING OF CAVITY.



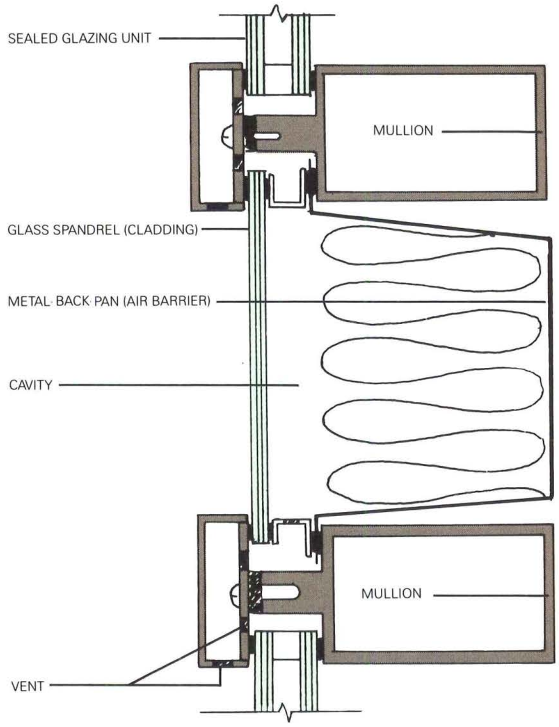
2b. PRESSURE UNLOADING OF CAVITY.

A Rain Screen Case Study

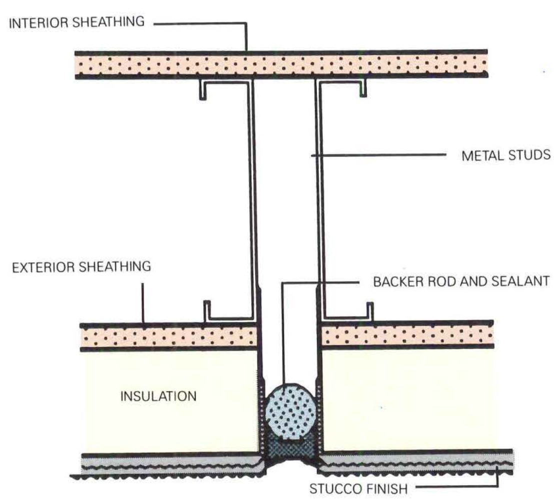
Figure 3 shows a typical curtain wall section. The cladding is the glass spandrel panel, and the cavity is the space between the spandrel and the metal backpan. The air barrier incorporates the back of the sealed glazing unit, the shoulder of the mullion, the metal backpan, the shoulder of the next mullion, and the back of the glass. The spandrel glass should experience a much lower load than the metal backpan if the design functions correctly.

In a typical curtain wall as shown, the spandrel glass may have an area of 1.2 m^2. If the allowable leakage of the backpan is 0.3 liters/second per m^2 as per AAMA guidelines, then the equivalent leakage area in the backpan is 54 mm^2 (assuming a flow exponent of 0.5 and an orifice constant of 0.6). For 95 percent of the applied wind load to transfer to backpan, the vent area should be at least five times the leakage area of the backpan, or 270 mm^2. The venting area normally used in such a typical wall is less than 100 mm^2. However, if the air leakage of the backpan is reduced to, say, the recommended Canadian limit of 0.1 l/s per m^2, then the requirement for vent area is reduced to only 90 mm^2.

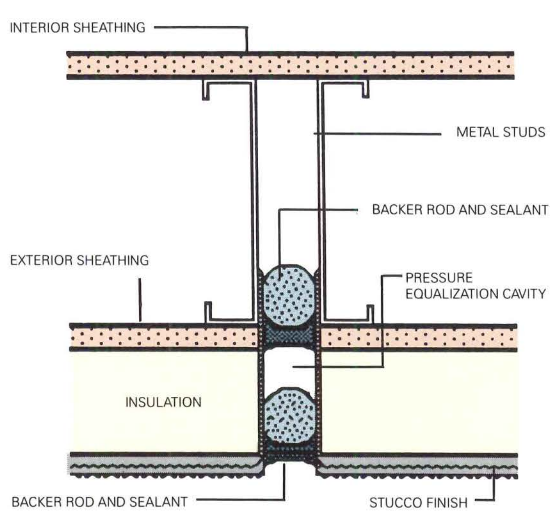
Another implication of recent research is the significance of the rigidity of the backpan. Typically, 20 or 22 gauge sheet metal is used for the backpan. Stiffness is provided by attaching rigid insulation to the back or, occasionally, by providing metal stiffeners. Generally, specifications do not limit the deflection of the backpan, or if there is a limit provided, it is usually specified to prevent noise due to movement of the backpan or to prevent interference with the firestopping. Consideration should be given, however, to the change in volume of the cavity caused by deflection of the backpan. The larger the backpan, the larger the change in volume. Since the vent area is not usually adjusted to a significant extent for different panel sizes, perhaps the deflection limit for larger panels ought to be less than for smaller panels, meaning that a deflection limit related to length should not be used.



3. CASE STUDY CURTAIN WALL (SEE SIDEBAR).



4a. ONE STAGE EIFS PANEL JOINT.



4b. TWO STAGE EIFS PANEL JOINT.

stack effect, mechanical ventilation, and wind. While it is not possible to eliminate these forces, it is possible to counteract them by using a pressure-equalized design, or *rain screen wall.*

Historical Perspective

The rain screen concept is not new. An annotated bibliography on the rain screen principle was prepared by the Division of Building Research of the National Research Council Canada in 1985, to consolidate the research done to date [1]. This bibliography provides a historical perspective on the development of the rain screen concept.

One of the first references to a "rain screen" was made in 1946, in a paper by C.H. Johansson, "The Influence of Moisture on the Heat Conductance for Brick." It was not until much later, however, that researchers began to understand how to apply the fundamental laws of physics to the development of a practical rain screen. In 1962, Oivind Birkeland of the Norwegian Building Institute wrote "Curtain Walls," in which he stated,

> "The only practical solution [to the problem of rain penetration] is to design the exterior rain-proof finishing so open that no superpressure can be created over the joints or seams in the finishing. This effect is achieved by providing an air space behind the exterior finishing, but with connection to the outside air. The surges of air pressure created by the gusts of wind will then be equalized on both sides of the exterior finishing."

In 1963, G. Kirby Garden of the Division of Building Research, National Research Council Canada, wrote *Canadian Building Digest 40,* "Rain Penetration and Its Control"[2]. This publication, which remains a prime reference source, popularized the terms "open rain screen" and "rain screen principle." However, Garden himself in a later paper[3] stated that,

> "The term 'open rain screen' is unfortunate because designers are misled into thinking that they are only dealing with rain penetration. The term 'two-stage weathertightening' used in Europe, is more appropriate, for it suggests that the entry of water is controlled at an outer layer or first stage but that air leakage must be controlled at a second stage or inner layer. It also indicates that air leakage control is necessary to gain the rain penetration control."

Rain Screen or Pressure-Equalized Design

A rain screen wall incorporates two layers separated by an air space or cavity, as shown in Figure 1. The rain screen wall minimizes the air pressure difference across the outer cladding of the building by transferring this pressure difference to the inner layer of the wall. The section of the wall across which the pressure difference occurs is not exposed to rain and, as a result, rain penetration is reduced. To effect this transfer of air pressures, the inner layer of the wall must be airtight; it can be referred to as the *air barrier*. An advantage of the rain screen design is that it is often easier to seal the inner face than it is to seal the outside of the wall – and the seal will last longer because it is not exposed to the harsh exterior environment. Since the inner layer of the wall is airtight, stack effect and mechanical ventilation, which are generated inside the building, are effectively controlled at this plane.

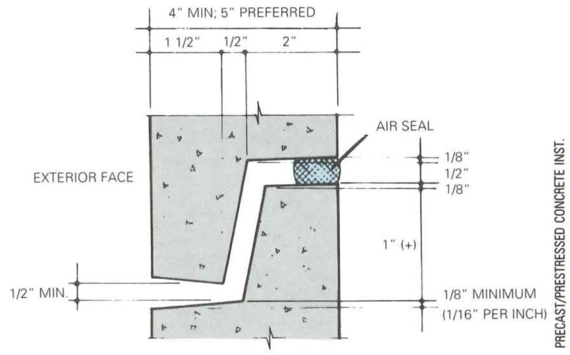
When wind blows on a building, a pressure difference is created across the walls, forcing water on the surface to penetrate any openings through it. The outer layer, or cladding, of a rain screen wall is vented to allow air to flow through it into the cavity. Thus, the pressure in the cavity increases until it equals the applied wind pressure. This phenomenon is called *pressure equalization.* Rain penetration through the cladding is markedly reduced as the force of the wind on the cladding – which would drive rain into the cavity – is reduced. The wind pressure will be exerted on the air barrier, but since water should not reach the air barrier, rain penetration should not occur.

An advantage of pressure-equalized wall design is that, theoretically, no wind load should be imposed on the exterior cladding, and it should be possible to design the exterior cladding to be much lighter than it is traditionally; in a real situation, however, the wind is extremely dynamic and variable so that the pressures being applied to the wall are constantly changing. An ideal rain screen wall would pressure equalize instantly. Research at the National Research Council Canada[4] has shown that there is a time lag between the application of the wind load and pressure equalization in the cavity. As a result of this time lag, a pressure difference does occur across the exterior cladding. In designing a rain screen wall, we want to minimize both this time lag and the load on the cladding. The two parameters used in assessing the quality of a rain screen wall, therefore, are "peak cladding load" and "time to equalization."

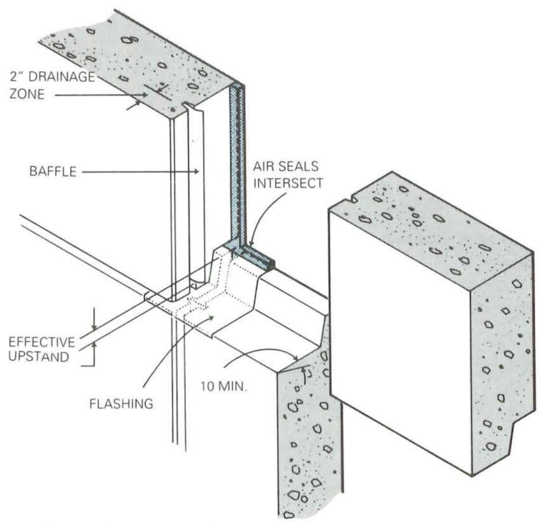
Another factor to consider is the effect of a decrease in wind pressure. On a single layer wall, as long as the wind pressure is positive, there is always a driving force pushing water into it. In a rain screen wall, under gusting wind (or dynamic) conditions, the cavity pressure can exceed the positive wind pressure (Figure 2). Such a situation occurs after the cavity pressure increases to match that of a high wind, and then the wind suddenly decreases. Until pressure equalization occurs, the cavity pressure will exceed the external pressure, creating a negative load on the cladding. A negative load will tend to force water out of openings in the cladding, further reducing the likelihood of rain penetration. In the case of decreasing wind, it may be desirable to have a much longer time to equalization. Perhaps the "ideal" rain screen wall would equalize instantly when the wind gusts but would experience a delay in equalization when the external wind load is decreased. Such a wall may have one-way baffles on the vents in the cladding, so that air can enter the cavity easily, but is restricted in exiting the cavity. Research has not yet progressed to such sophistication in design.

Parameters Affecting Pressure Equalization

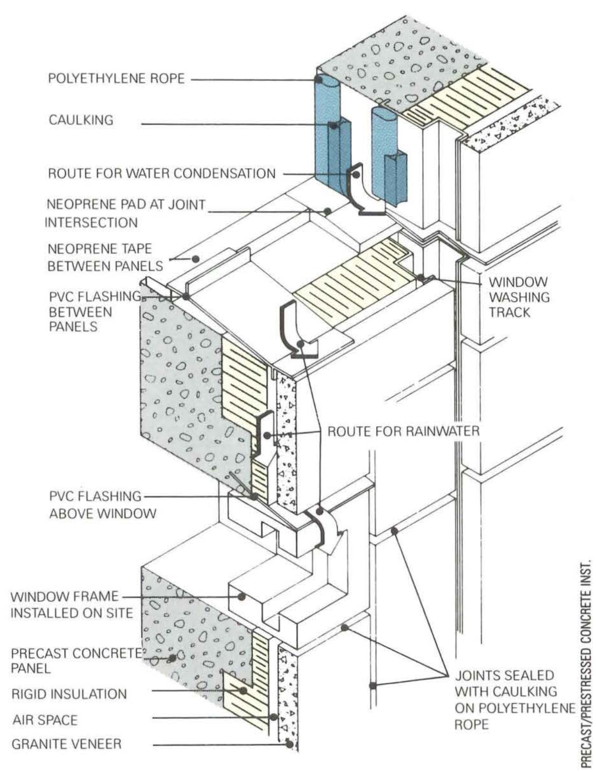
Although rain screen walls are used extensively in Europe and Canada, little is known about the param-



5a. TWO-STAGE PRECAST CONCRETE PANEL JOINT, HORIZONTAL.



5b. ISOMETRIC OF JOINT SHOWN IN 5a.



6. TWO-STAGE JOINT IN GRANITE CLAD PRECAST CONCRETE.

4. *Panelized EIF systems are face-sealed assemblies, in principle, but their joints can be detailed in two stages to create an internal air pressure equalization cavity. A conventional single stage joint is shown in (a), while (b) illustrates one of a variey of two-stage joints preferred by the authors of Construction Specifications Canada's TEK-AID 07195,* Air Barriers, *among others. In order to perform as a rain screen, the outer seal should be open and drained at the base of the panel, with some form of flashing incorporated along the horizontal joint (see also P/A 10:89).*

5a. *Precast concrete panels can be formed to create a pressure equalization cavity by following recommended dimensions – like these, from the Precast/Prestressed Concrete Institute's manual,* Architectural Precast Concrete, *1989.*

5b. *The exploded view of a two stage joint in precast concrete is from an influential 1973 publication of the National Research Council Canada that promoted the rain screen principle to Canadian architects,* Walls, Windows, and Roofs for the Canadian Climate.

6. *Two-stage joints can also be used with composite assemblies – this detail from PCI's* Architectural Precast Concrete *shows a granite veneer suspended in front of a precast structure, with a pressure equalization cavity between the two. (Tolchinsky & Goodz, Architects, Montreal)*

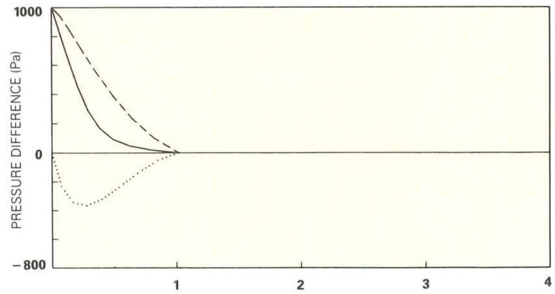
7. *The example simulations are based on an 8' x 8' area of brick wall, with a 3/4-inch cavity and a concrete shear wall back-up. For the basic conditions, both the cladding and air barrier are assumed to be rigid and air barrier is assumed to be perfectly airtight. This figure shows the effect of a decrease in wind pressure from an existing steady value of 1000 Pascals (Pa) The cladding pressure is negative because the cavity pressure exceeds the wind pressure, producing an overall negative load on the cladding.*

8. *With a larger vent area, the air in the cavity can exit more quickly, allowing the cavity pressure to follow more closely the external wind pressure. As a result, the peak cladding load and time to equalization are reduced.*

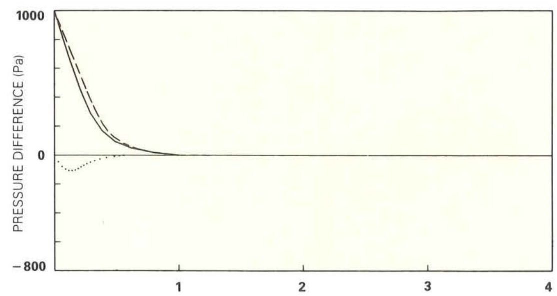
9. *When the initial cavity volume is increased fivefold, the effect on peak cladding load and time to equalization are dramatic. The peak cladding load is nearly doubled and the time to equalization nearly tripled.*

10. *An increase in cladding flexibility (representative of a very flexible cladding) decreases the peak pressure on cladding, but increases the time to equalization by almost 200 percent.*

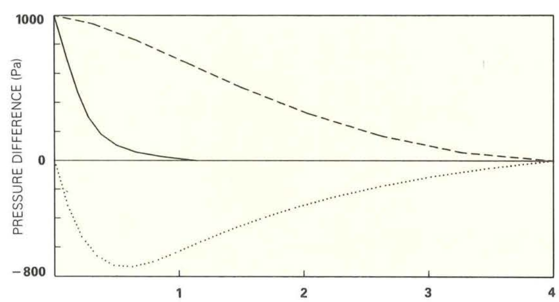
11. *A slight increase in the flexibility of the air barrier (about one-fifth that of the cladding in the previous example) increases the cladding pressure by approximately 40 percent and also almost doubles time to equalization.*



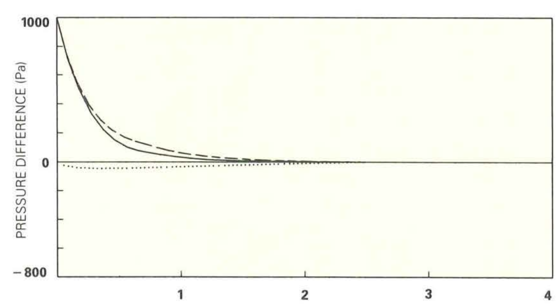
7. BASE CASE CONDITIONS.



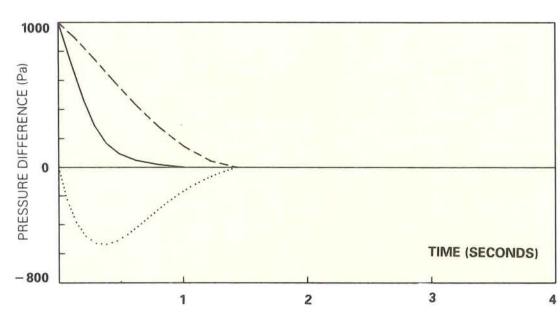
8. VENT AREA INCREASED.



9. CAVITY VOLUME INCREASED.



10. CLADDING FLEXIBILITY INCREASED.



11. AIR BARRIER FLEXIBILITY INCREASED.

eters that affect the rate at which pressure equalization will occur. These parameters include:

- leakage area of the air barrier
- leakage area of the cladding
- compartmentalization of the cavity
- cavity volume
- stiffness of the air barrier
- stiffness of the cladding
- rate of the applied load
- magnitude of the applied load.

The effect of changes in these parameters for the most part is speculative since virtually all analysis of cladding behavior is based on steady-state conditions. But wind is extremely variable, and under dynamic loading, it is difficult to predict the behavior of the wall. For example, consider a situation where a positive pressure is applied to a rain screen wall: Movement of air into the cavity causes the pressure in the cavity to increase to match the external pressure. The mass of air required to achieve equalization depends on the volume of the cavity. The rate at which equalization will occur depends on the rate at which air can enter the cavity. The driving force causing air to enter the cavity is the pressure difference across the cladding. However, as air enters the cavity, the pressure difference decreases. Because the flow rate is proportional to the pressure difference, as air flows into the cavity, the flow rate decreases.

Another facet of the wall design which will cause the pressure in the cavity to increase is a decrease in the volume of the cavity. Both the cladding and the air barrier will deflect under the applied load, which will change the volume of the cavity. When it is considered that these deflections also vary as the pressure differences vary, it is clear that the situation is extremely complex. In the absence of design information about these parameters, the cladding of a rain screen wall is usually designed for the entire wind load. Recent field measurements[5] and wind tunnel studies[6] indicate that it may be feasible to design the cladding of a rain screen wall and its anchors for a smaller percentage of the total wind load.

Over the past year, Morrison Hershfield Limited has been researching the pressure equalization performance of rain screen walls[7] under the sponsorship of the Canada Mortgage and Housing Corporation. One of the products of this research is a computer simulation model. While this model is still undergoing some fine tuning and verification, preliminary results promise that it will be a valuable design tool. To demonstrate the use of the computer program and the effect of changing the input parameters, a number of example simulations were run, modeling decreasing wind load. First, some basic conditions were established that are typical of an 8′ × 8′ area of brick wall with a 3/4-inch cavity and a concrete shear wall back-up (see Figure 7). Each input parameter was then varied. The effects on pressure equalization of changing the parameters are discussed below.

Airtightness. The ability of the cavity pressure to equalize with the exterior pressure depends on the relative airtightness of the cladding and the air barrier. If the two layers have similar leakage characteristics, each layer will experience the same pressure difference. As the air barrier is made more airtight, it will experience a greater pressure difference than the cladding. In the ideal case, the air barrier would be perfectly airtight and the pressure drop across the cladding would be zero. However, it is generally impossible to make and maintain absolute airtightness. For 95 percent of the wind load to be carried by the air barrier, it is recommended[4] that the venting area of the cladding be five to ten times greater than the leakage of the air barrier. Figure 8 shows the effects of increasing vent area.

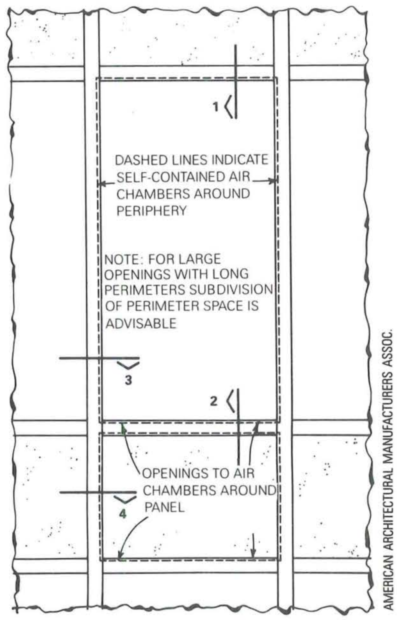
The absolute air leakage through the wall is also important. The effectiveness of the rain screen is reduced as more air is allowed to leak through the air barrier, regardless of its airtightness in relation to the cladding. Air leakage also has important implications in regards to energy utilization. The standard set by the Architectural Aluminum Manufacturers Association specifies that air leakage through a curtain wall should not exceed 0.3 liters per second per square meter of wall (0.06 cubic feet per minute per square foot) for a pressure difference of 75 Pascals (equivalent to a 25 mph wind) across the curtain wall. For Canadian conditions, it is suggested that the acceptable rate be one-third of the AAMA rate or better.

Compartmentalization. The action of the wind flowing around a building creates a distribution of pressures and suctions over the building surfaces. If the cavity of a rain screen wall is continuous either horizontally or vertically, and there are openings to the cavity in areas of different pressure, lateral flow of air within the cavity is possible. In such a system, pressure equalization does not occur, and rain penetration to the cavity remains uninhibited.

To prevent this lateral flow of air, the cavity must be divided into compartments. The size of the compartments should be based on the spread of pressure contours on the surface. Where the pressure contours are closest together, such as at the extremities of the walls, the pressure variations are the greatest, and the compartments should be small. Where the pressure contours are further apart, such as towards the central portion of a building face, the pressure variations are lower and the compartments could be larger. Garden[2] suggested that these compartment closures occur no more than four feet apart at the sides and top of the building. At a distance of 20 feet from the sides or top of the building, the distance between the closures could increase to 10 or 20 feet in both the horizontal and vertical directions. At the very minimum, the wall cavity must be closed at all corners of the building and at the roof to prevent air from the windward side of the building being drawn through to the high suction areas on the adjacent faces.

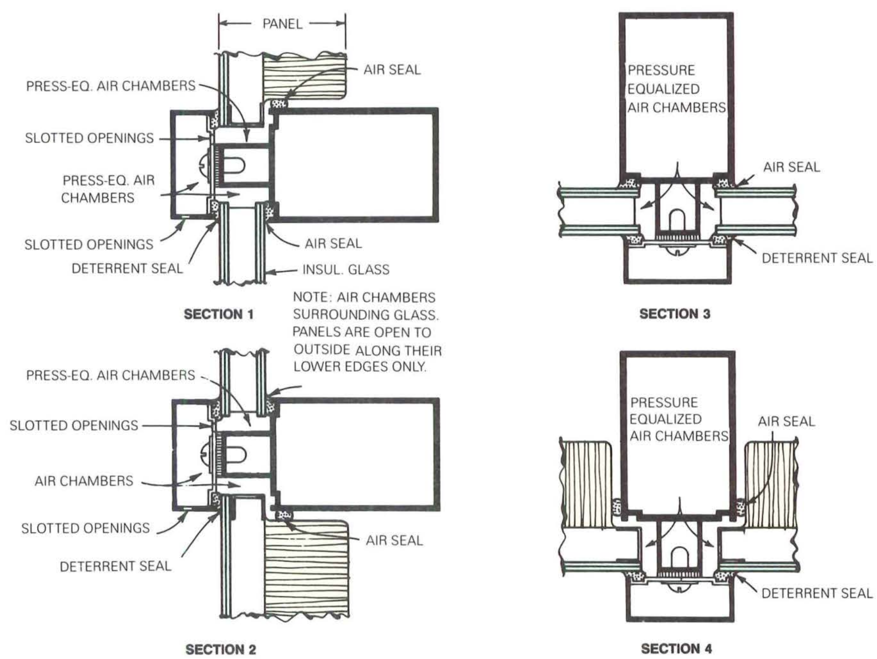
As part of the research conducted by Morrison Hershfield Limited[7], a model building was tested in a wind tunnel to determine the effects of compartmentalization. One of the most significant results of this research was that the compartment seals experience in excess of two times the wind load. This suggests that the compartment seals must be designed for high pressures and should not be considered only as baffles to the flow of air from one cavity to the next.

Cavity Size. Another factor to consider in sizing the



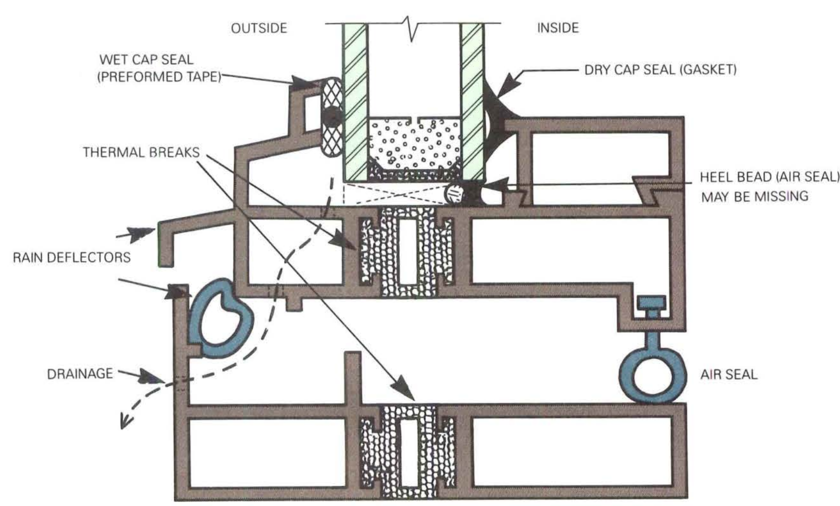
AMERICAN ARCHITECTURAL MANUFACTURERS ASSOC.

12. PRESSURE-EQUALIZED CURTAIN WALL, ABOVE AND BELOW.



12. *The rain screen concept is best known in the U.S. within the curtain wall industry, largely because of the American Architectural Manufacturers Association's* Aluminum Curtain Wall Design Guide Manual *(1979). This detail appears in the* Manual *as an application of pressure equalized design to a stick system curtain wall.*

13. *Canadian researchers and manufacturers are investigating the application of rain screen principles for off-the-shelf products, like this aluminum awning window (from* Window Performance and New Technology, *a 1988 publication of the National Research Council Canada). The research show that an airtight heel bead is essential to the pressure equalized performance.*



NATIONAL RESEARCH COUNCIL CANADA

13. PRESSURE-EQUALIZED ALUMINUM WINDOW.

compartment or cavity is the relative venting area in the cladding. Pressure equalization depends on the movement of air into or out of the cavity. A larger cavity will require more air movement for equalization to occur. The area of vent openings limits the rate at which air can move into or out of the cavity, which in turn limits that rate at which pressure equalization will occur. Figure 9 illustrates the results of increasing the cavity volume.

Rigidity. The rigidity of both the cladding and the air barrier becomes important under dynamic loading conditions. Under steady-state conditions (constant loading), the movement of the layers of the wall ceases and they come to rest. However, a gusting load on the wall can cause deflection of both the cladding and the air barrier. The deflection of these elements results in a change in the volume of the cavity. Figure 9 illustrates the result of changing the initial cavity volume (before volume change due to deflections). Figure 10 illustrates what happens when the flexibility of the cladding is increased and Figure 11 illustrates what happens when the flexibility of the air barrier is increased. These figures represent only one condition; the results may be considerably different for different flexibilities. It is clear from these figures, however, that the rigidity of both the cladding and the air barrier can play an important role in the pressure equalization performance of a rain screen.

Wind Loading. The magnitude of the wind and the rate at which the wind load changes are beyond our control. There are very few data correlating peak cladding load and time to equalization with rates of wind loading. Research at the Institute for Research in Construction in Canada[5], which involved field measurements, revealed that pressure changes on the walls of a building vary between 1500 and 4000 Pascals per second. Further research[4] revealed that rapid changes in loading resulted in higher loads on the cladding. This is an area where further research is needed. Designers need statistical meteorological data on which to base their designs.

Summary

When asked how this paper should be concluded, a colleague said, "there is no ending." He meant that much more research is necessary to provide sufficient data for the rational design of rain screen walls. While we have a general understanding of how a rain screen wall functions and the parameters that affect peak cladding load and time to equalization, we are not quite at the stage where we would be comfortable designing the cladding and its anchors for a reduced wind load. However, given the economies of construction which could be realized and, of course, the economies in eliminating the effects of rain penetration, a better understanding of pressure equalization is clearly desirable. **Dale D. Kerr.** ■

The author is Manager of Building Science Services at Morrison Hershfield Limited, a consulting engineering firm established in 1946, with offices across Canada in Toronto, Ottawa, Halifax, Montréal, Calgary, and Edmonton, and a testing and research laboratory in Ottawa, Ontario. She has been investigating rain screen walls since 1985.

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4. U. Ganguli and R.L. Quirouette, *Pressure Equalization Performance of a Metal and Glass Curtain Wall,* NRCC 29024, National Research Council Canada, Ottawa (613) 993-2463, 1987.

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Additional Reading

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"The Prevention of Rain Penetration Through External Walls and Joints by Means of Pressure Equalization," I.R. Killip and D.W. Cheetham, *Building and Environment,* volume 19, number 2, 1984.

Air Barriers, TEK-AID 07195, Construction Specifications Canada, Toronto (416) 922-3159.

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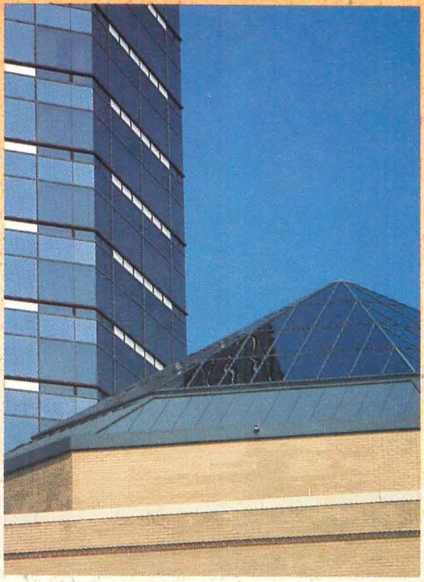

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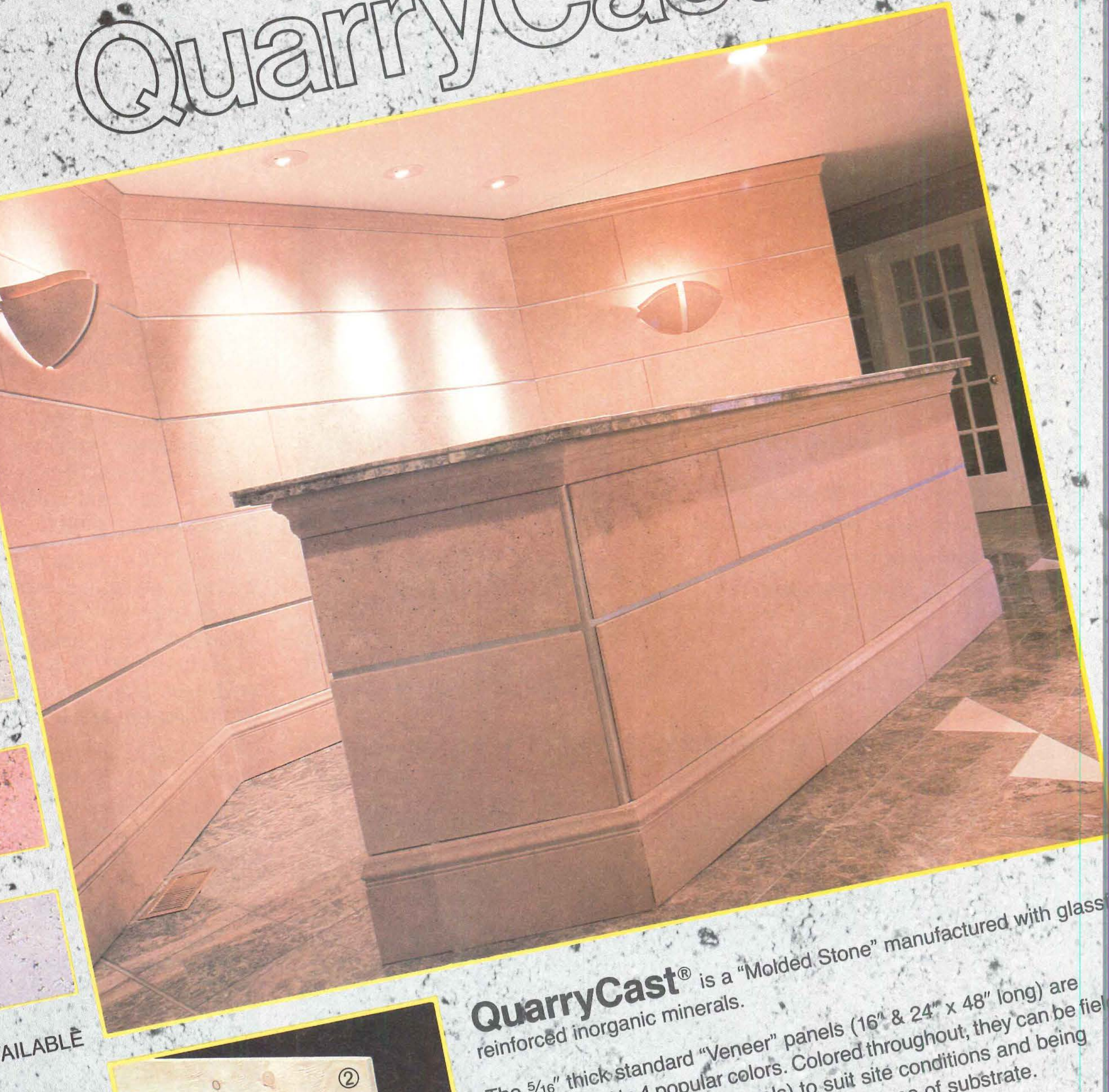

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Technics Topics

Here's how architects can take interior photos just like the pros – well, almost.

Filters, Films, Photos

Most architects have taken or seen interior photos awash in either a sickly blue-green pall or suffused with an uncanny orange glow – yet photos taken by professionals always seem so natural. What do they know that we don't? Four things: filters, films, light sources, and the need to experiment and record results.

Films and Incandescent Light

Slide films are formulated – or *balanced* – for correct color rendition under light sources of three different (Kelvin) color temperatures: Daylight films are designed for 5500 K and tungsten films are designed for either 3200 K (Type B) or 3400 K (Type A) lamps. Daylight films used outdoors in full shade, on overcast days, or indoors under a skylight respond with a bluish tone that can be corrected with the warming effect of an 81A or 81B filter (in photographic parlance, "warm" and "cool" have the colloquial meanings of yellowish and bluish, respectively, contrary to the fact that yellow light has a lower color temperature than blue light), or at least with a skylight (1A) filter. Daylight films respond to tungsten light with excessively yellow results. While this can be remedied, the required 80A filter increases the exposure by two stops.

Tungsten films are balanced for photoflood lamps, which have higher color temperatures than general service tungsten lamps, so photos taken with Type A or B films under normal incandescent lighting will appear slightly yellow (more so with Type A than Type B films). For some purposes, this may be acceptable – or even desirable – but for accurate color rendering, bluish 82 series filters are necessary.

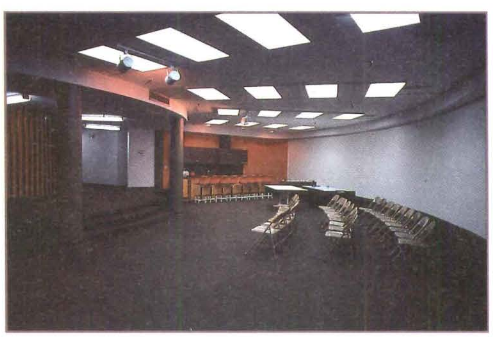
Fluorescent and HID Lamps

Manufacturers assign "correlated color temperatures" to fluorescent lamps to indicate the color temperature of the incandescent lamp that they most closely resemble. Fluorescent lamps do not produce the smooth spectral distribution of a black or gray body radiator, and films do not mimic the exact color response of the eye, however, so the "color temperature" of fluorescent (and HID) sources has no photographic validity. Color-correcting filtration for fluorescent lighting is found by trial-and-error testing of films,

(continued on page 56)

1 *Kodachrome 64 (daylight), unfiltered.*

2 *Kodachrome 64 with 30M CC filter.*



3 *Ektachrome 200 (daylight) with 40M CC filter.*

4 *Kodachrome 64 with the same 40M CC filter.*

Tech Notes

***AWNSHADE 1.0* by Ross McCluney calculates the unshaded fraction of rectangular windows with exterior shading devices for any sun position and illuminance. Output can be printed and plotted. The DOS-based program is available on 3 ½" or 5 ¼" disk. Florida Solar Energy Center, Cape Canaveral (407) 783-0300, $25.**

The Flat Glass Marketing Association has revised its *Sealant Manual,* the companion to its *Glazing Manual.* The *Manual* addresses all types of fixed glazing systems with details, tables, and graphs. FGMA, Topeka (913) 266-7013, 40 pp., $20.

***Tall Buildings: 2000 and Beyond* is the Fourth World Congress of the Council on Tall Buildings and Urban Habitat to be held November 5–9 in Hong Kong. The schedule reads like a who's who of architects, engineers, and developers. CTB, Lehigh University, Bethlehem, PA (215) 758-3515.**

***Architectural Precast Concrete Cladding: Its Contribution to Lateral Resistance of Buildings,* proceedings of a 1989 conference of the Precast/Prestressed Concrete Institute, is now available. PCI, Chicago (312) 786-0300, 312 pp., $50.**

***ASTM Standards on Masonry* compiles masonry, mortar, cement, and related specs and tests from three volumes of the *Annual Book of Standards* into a single, soft-cover document. ASTM, Philadelphia (215) 299-5400, 197 pp., $35.**

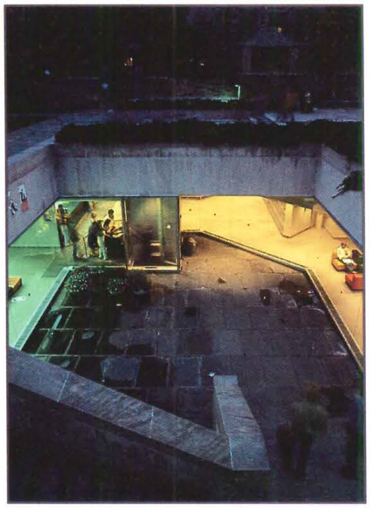
(*continued from page 55*)
lamps, and filters. A few manufacturers have taken on this burden, and some results are given in the tables. Shutter speeds of 1/60 second or longer should be used with fluorescent and HID lamps, and all exposures should be bracketed liberally.

Filters

Three categories of filters are used for artificial light photography: *Light balancing* filters (81 and 82 series) produce subtle changes in color balance for warmer or cooler rendering; *conversion filters* (80 and 85 series), in effect, convert the color temperature of tungsten sources to match daylight, and daylight to match tungsten light; *color compensating* (CC) filters are used to compensate for deficiencies in the spectral qualities of light sources. CC filters are made in cyan, magenta, yellow, red, green, and blue. They are graduated in densities denoted in steps of ten. A 40M filter is equivalent to two 20M filters stacked together. However, magenta and yellow filters of equal density combine to produce red of the same density; similarly, cyan and magenta combine to yield blue, and cyan and yellow yield green. A 30M and 20Y used together is equivalent to a 20M, 10M, and 20Y, or 20R and 10M, for example.

Color balancing and color correction filters are available in most photo stores, while color compensating filters are found in stores that cater to professionals. They are made in square gels, optical plastic, and gels cemented between glass. These slide into square filter holders that mount on the lens, and this allows several filters to be stacked together. Kodak, Tiffen (Hauppauge, New York (800) 645-2522), and Hitech (Atelier Distributors, Chicago (708) 866-7960) are among the makers of CC filter systems.

Some filter makers supply "FLB" and "FLD" filters for fluourescent light photography to the amateur market. These are compromise solutions, as may be inferred from the filter requirements given here (photographer Joseph Molitor disclosed in his book *Architectural Photography* that he routinely packs 20 or 30 color compensating gels in the CC20 to CC50 range). Gels are easily cut with scissors and mounted in an ordinary screw-in filter ring, after removing the stock glass lens. This is a convenient way of keeping a useful 30M and 40R close at hand.



Photos: K. Labs

5 *Unfiltered rendition of mixed sources as seen by Kodachrome 64 at twilight.*

Viewing the Results

Experimenting with different filters is wasted work if these are viewed on a light table with deficient spectral characteristics. ANSI Standard PH2.31, *Direct Viewing of Photographic Color Transparencies,* specifies – among more detailed requirements – that the illuminator should have a correlated color temperature of 5000 K and a color rendering index (CRI) of at least 90. Among fluorescent tubes that meet these standards are the Macbeth "Prooflite," Duro-Test "Optima 50," Sylvania "Design 50," and General Electric "Chroma 50." With proper attention to these details, architects will be sure to present their work in its best light. **Kenneth Labs** ■

Additional Reading

Color Photography Under Fluorescent and High-Intensity Discharge Lamps, E-104, and *Existing Light Photography,* KW-17, Eastman Kodak Company, Rochester, New York (800) 242-2424.

P/A would like to thank Vance Roth, VRA Photography.

Suggested Filters for Photography under Fluorescent and HID Lamps

General Electric	Ektachrome 64(D) Ektachrome400(D) Kodachrome 64(D)	Ektachrome 200(D) Ektachrome 100(D) Kodachrome 25(D)	Ektachrome 160(TB) Ektachrome 50(TB)	Kodachrome 40(TA)
Cool White	40M + 10Y	30M	60R	50R
Deluxe Cool White	20C + 10M	20C + 10M	20M + 40Y	10M + 30Y
Daylight	50R	40R	85B + 40M + 30Y	85 + 40R
White	4M	20C+ 30M	60M + 50Y	40M + 30Y
Warm White	20C + 40M	40B	50M + 40Y	30M + 20Y
Deluxe Warm White	60C + 30M	60C + 30M	10R	(none)
SP 30	(not tested)	35M + 05B	35M + 05Y	(not tested)
SP 35	(not tested)	35M + 05Y	40M + 15Y	(not tested)
SP 41	(not tested)	30M + 20R	10M + 40R	(not tested)
SPX 30	(not tested)	15M + 15B	25M + 05Y	(not tested)
SPX35	(not tested)	30M	10M + 30R	(not tested)
Unknown	30M	10B + 10M	50R	40R
Metal Halide	40M + 20Y	30M + 10Y	60R + 20Y	50R + 10Y
Sylvania	**Ektachrome 64(D)**	**Ektachrome 50(TB)**	**Ektachrome 160(TB)**	**Kodachrome 40(TA)**
Cool White	40M + 10B	70M + 60Y	60M + 50Y	20M 10B
Deluxe Cool White	10M + 30B	30M + 40Y	20M + 30Y	05M + 10B
D 30 (Warm Lite Del.)	40M + 20Y	50M + 60Y	30M + 60Y	40M + 10Y
D 35 (Deluxe White)	10M + 50B	50M + 20Y	40R	40M + 30B
D41 (Lite White Del.)	50M + 30Y	60M + 80Y	40M + 80Y	50M + 40Y
D 830 (Royal White)	30M + 40B	50M + 20Y	30M + 05Y	10M + 30B
Deluxe Warm White	05M + 40B	20M + 10Y	10M + 05Y	10G + 60B
Natural White	10M + 20B	20M + 30Y	10M + 20Y	10G + 30B
Design 50	05M + 10Y	40M + 60Y	30M + 60Y	30M + 20Y
Octron 3100	30M + 20Y	30M + 40Y	35M + 40Y	30M + 10Y
Octron 4100	40M + 20Y	40M + 60Y	40M + 50Y	50M + 10Y
Metal Halide, 3KMS	20M + 10Y	20M + 30Y	10M + 30Y	20R
Metal Halide, M400	30M + 10B	50M + 60Y	40M + 50Y	05G + 30B

Sources: "Exposure and Filter Starting Points with Fluorescent and HID Lamps," General Electric Company, "Guides for Inital Tests When Exposing Color Films with Fluorescent or HID Lamps," *Tech Bits*, Issue 3, 1984, Eastman Kodak Co., *Color Photography Under Electric Light*, Sylvania Engineering Bulletin 0-334. General note: Kodak suggests bracketing up to CC20 from the tabular values in the M/G and Y/B directions, and subtracting CC10Y if there are diffusers on the lamps.

Conversion and Light Balancing Filters

To obtain 3200K from:	To obtain 3400K from:	Use filter(s):
2490	2610	82C +82C
2570	2700	82C+82B
2650	2780	82C+82A
2720	2870	82C+82
2800	2950	82C
2900	3060	82B
3000	3180	82A
3100	3290	82
3300	3510	81*
3400	3630	81A*
3500	3740	81B*

To convert:	To:	Use filter:
3200K	5500K(daylight)	80A
3400K	5500K	80B
3800K	5500K	80C
5500K	3400K	85*
5500K	3200K	85B*

*These filters are yellowish or amber; all others are bluish.
Source: *Existing Light Photography*, KW-17, Eastman Kodak, Co., Rochester, New York..
Note: Filters can be added to combine light balancing and conversion characteristics. For instance: To use daylight (5500K) film with a 100 watt tungsten lamp of 2900K, 82B and 80A filters are required.

Color Temperatures of Various Light Sources

Source	Color Temperature (K)
Open shade (skylight)	12000-18000
Overcast sky	7000±
Electronic flash	5500-6000
Photographic daylight[1]	5500
Sunlight (mean noon)	5400
Carbon arc lamps	5000-5500
One hour after sunrise; one hour before sunset	3500-3700
500 W photoflood (34 l/w)	3400
250 W ENH slide projector lamp [175 hrs][2]	3250
500 W photoflood (27 l/w)	3200
Tungsten halogen, general service[2000 hrs][2]	2950-3050
200 W incandescent lamp (20 l/w)[3]	2980
100 W incandescent lamp (17.5 l/w)[3]	2900
75 W incandescent lamp (15.4 l/w)[3]	2820
40 W incandescent lamp (11.8 l/w)[3]	2650
Candlelight	1800

[1]Sunlight and skylight combined - the conditions for which daylight photographic films are balanced.

[2]These are generally representative values and may vary with lamp manufacturer and design service life.

[3]*Lighting Handbook*, Reference Volume, IES, New York, 1984.

Source: *Existing Light Photography*, KW-17, 1987, and *Kodak Filters for Scientific and Technical Uses*, B-3, 1973, Eastman Kodak, Co. Rochester, New York.

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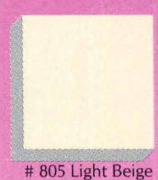
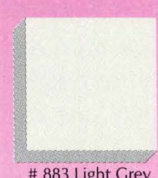

805 Light Beige


752 White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Building Science Brief 8/90:
Color Temperature

Color temperature explains why dimming a tungsten lamp changes its color, in addition to reducing its brightness, and it explains why long-life incandescent lamps are yellower than normal service lamps of the same wattage. Although fluorescent lamps do not have true color temperatures, they are described in terms of (correlated) color temperature, so the expression is an important and pervasive one in the language of lighting.

All materials emit and receive radiant energy, and we sense the radiation from objects warmer than body temperature as heat. As the temperature of a material increases, the wavelengths of the emitted energy decrease. After crossing the threshold of sensitivity of the eye, some of the radiation is sensed as light, and the material is said to *incandesce*.

The radiation emitted by a heated body is distributed in a curve (Figure 1) described by Planck's Radiation Law. For a theoretically perfect radiating material – called a *black body* – the wavelength at which the most energy is emitted is given by Wien's Displacement Law:

$$WL_{max} = 2{,}898{,}000/T_K$$

where the wavelength WL_{max} is given in nanometers (nm), T_K is the temperature on the Kelvin scale, and 2,898,000 is a constant with units of nm/K.

The eye perceives wavelengths of energy between 400 and 700 nm as color, with 700 nm at the violet end of the spectrum, and 400 nm at the red end. The wavelengths at which radiant energy is emitted by an incandescent body determine its color. The eye has developed under sunlight, and the wavelength of its greatest color sensitivity is 555 nm. Because we accept sunlight as "white" light, plugging 555 nm into Wien's relation suggests that 5200 K is the temperature of a white light source. Although "whiteness" is relative (the eye adapts under different situations), this is not too misleading a generalization, and temperatures between 4900 K and 5500 K characterize light sources we perceive as white.

No material behaves exactly like a black body, but color characteristics of incandescent light sources can be compared to one, and *color temperature* can be defined as the temperature at which a black body must be operated in order that its output be the closest approximation to a color match with the output of an incandescent light source under consideration. Many materials do behave much like black bodies, and the chief problem of incandescent lamp design is that all of them melt before they reach the desirable range of 4900 to 5500 K. As a result, incandescent sources have color temperatures lower than sunlight and appear yellow by comparison.

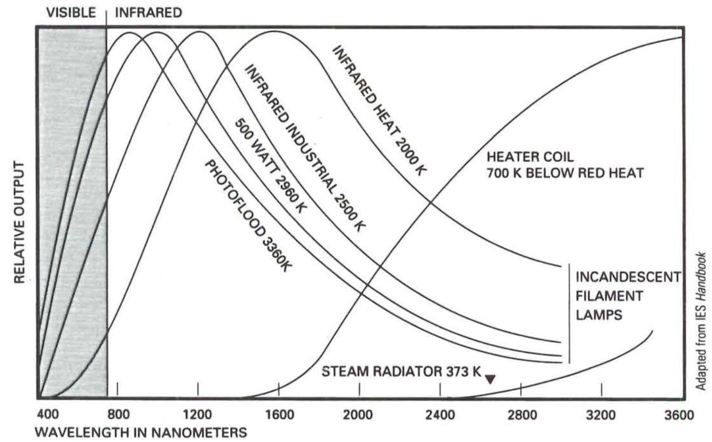
Tungsten has a melting point of 3655 K. The lumen output, efficacy (lumens per watt), service life, and color temperature of tungsten lamps are all interrelated and are a function of filament temperature. Long life (2500 hours) lamps are less efficient and have lower color temperatures than normal service (750 to 1000 hours) lamps of the same wattage. The whitest and brightest are photofloods, which at 3200 and 3400 K, can have a service life as short as three to six hours.

Tungsten halogen lamps use a gas fill that promotes redeposition of evaporated tungsten back on the filament. This prolongs filament life and allows it to operate at a higher temperature, thereby increasing its efficacy and color temperature; a 100 watt (1000 hour) general service tungsten halogen lamp has an efficacy of 17.5 to 18 l/w, and a color temperature of 2950–3050 K, while ENH lamps for 35 mm slide projectors (250 watts) have a color temperature of 3250 K and a life of 175 hours.

Strictly speaking, color temperature can only be used to describe incandescent light sources. While "correlated color temperature" borrows from the concept, it is a visual approximation with no direct basis in black body physics. **Kenneth Labs** ■

Recommended Reading

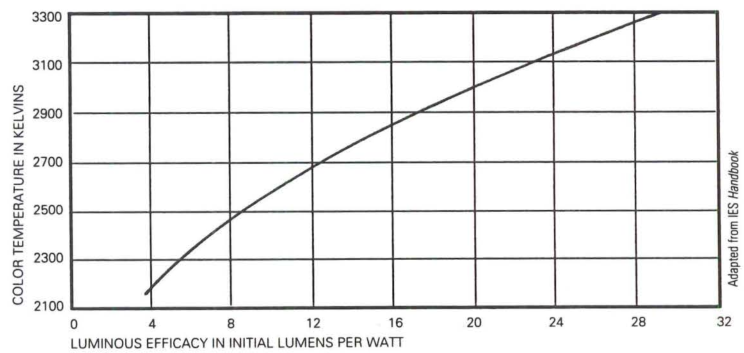
IES Lighting Handbook, Illuminating Engineering Society, New York (212) 705-7926.



1. Spectral power distribution of various infrared sources. Most of the visible energy of incandescent sources falls in the red-green half of the visible spectrum, which explains their characteristically yellow appearance.

Watts	Temperature (degrees Kelvin) Filament	Color	Lumens (approximate)
25	2583	2550	260
40	2738	2770	465
60	2772	2800	835
100	2849	2870	1620
150	2872	2900	2700
200	2899	2930	3800
300	2938	2940	5900
500	2944	2960	9900

2. Characteristics of 120 volt incandescent lamps. Source: *Primer of Lamps and Lighting*, W. Allphin, Chilton Co., Philadelphia 1959.



3. Color temperature versus efficacy. A general service 100 W A-19 lamp operates at 17.4 l/w; a 100 W long-life lamp at 14.9 l/w; a 100 W PAR-38 at 12.5 l/w, and a 100 W tungsten halogen lamp at 17.5 to 18 l/w.

A. The Westin South Coast Plaza, Costa Mesa, CA. **B.** 1600 Riviera Bldg., Walnut Creek, CA. **C.** Municipal Courthouse, Los Angeles, CA. **D.** Thomas Jefferson Bldg., Washington, D.C.

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William Lohmann discusses new guidelines for rebidding projects.

Specifications: Bidding and Rebidding

The bidding process in the United States has always been troublesome. It is costly for bidders, relies upon fairly complete bidding documents, extends the design and construction period, and often fails to achieve the owner's expectations. When the normal process collapses, it frequently leads to the even more troublesome step of rebidding.

Rebidding can usually be avoided if normal precautions are taken during design development and the original bidding period. *The Architect's Handbook of Professional Practice,* published by the American Institute of Architects (AIA), and the Construction Specifications Institute (CSI) *Manual of Practice* both offer guidelines for bidding.

Bids can be rejected for several reasons – the original bids are not responsible to the bidding documents, the owner has received only a single (or no) bid, the project scope or requirements have changed, or other special circumstances have occurred. The most common reason is that the bids exceed the budget estimate. Even if the bids are valid, as indicated when the high and low bids are within a reasonable range, they may be rejected.

The Construction Industry Affairs Committee (CIAC) of Chicago focused on rebidding recently because the number of local rebid projects seemed to be growing.

Contractors in the CIAC felt that unreliable budget estimates were largely to blame for the cost discrepancies, a touchy subject, which was barely mentioned in the final recommendation. Early drafts suggested that owners and design professionals would do well to pursue the following guidelines for budgets:

1. Have the budgets prepared by skilled estimators.
2. Base the budget figures upon reasonably complete documents (not per square foot, cubic foot, or other "averages").
3. Also base them upon the owner's perceptions of the work (including scope, warranties, and life cycle maintenance).
4. Update the budget figures as the design progresses.
5. Develop them further through discussions with contractors during the construction document phase.
6. Inform the owner of their relative accuracy (plus or minus some percentage).

The major thrust of the CIAC recommendation, which was finally released in November 1988, after thirteen drafts, was to urge consideration of other alternatives for cost reduction before rebidding a project. Cost reduction discussions could be held with one or more of the orginal bidders, if they were assured that the information received from each would remain confidential and not be made known to the other bidders. New bids could be taken by substantially changing the scope of the work or when a significant lapse of time has occurred after the original bid. Taking new bids could also justify extending invitations to contractors who had not previously submitted bids.

When rebidding is considered necessary for cost reduction, substantial changes should be made in the project – reduced scope, less expensive materials, or deferred portion of the work. They should effect a significant reduction (at least 10 percent) in the rebids. It is a delusion to think that bids might come down without changes; if anything, they will be higher.

The final CIAC guidelines for the rebidding process are four simple but essential steps:

1. Send a notice of rebidding a project to all firms (and only those firms) that originally submitted bids.
2. Revise the bidding documents prior to issuing them for rebidding. Any of the following forms, issued as an addendum, is recommended:
   a. A written statement of the revisions, with as much relevant information and detailed descriptions as is practical, with the original drawings and specifications unaltered.
   b. Clarification sketches accompanied by specification revisions, with the original drawings unaltered.
   c. Revised original drawings and specifications, clearly indicating the extent of the revisions.
3. Issue a new bid form to ensure that the revised bids will be consistent with each other and submitted in the same format.
4. Receive, review, and evaluate the revised bids in the same manner as the original bids.

The CIAC rebidding guidelines (except possibly the first one) are applicable to public as well as private work. They outline a fair approach to rebidding, which will go far in establishing a trusting relationship with the bidders and may save the owner and design professional from a potential lawsuit. **William Lohmann** ■

The author is Vice President, Specifications, for Murphy/Jahn in Chicago.

Practice Points

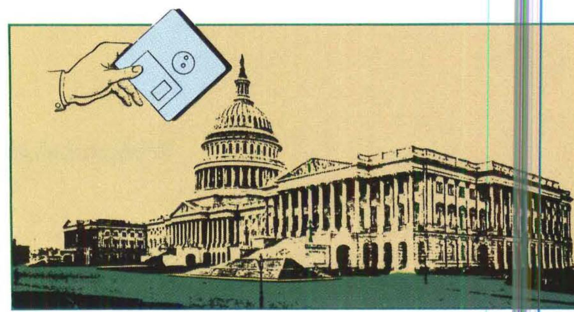
"Zoning for Childcare" is a report recently published by the American Planning Association that examines how zoning issues such as location, parking, noise, and play space affect childcare facilities in different kinds of neighborhoods. To order call (312) 872-0611.

The number of architectural positions nationwide has dropped by 9 percent. According to a survey of want ads in major newspapers, hiring in the Northeast has dropped 47 percent in the last two years, while the number of architects wanted in Los Angeles, San Francisco, and Seattle has doubled in the same period. For details contact ARCHMAR (212) 244-0360.

Stymied by construction delays? A new book from R.S. Means, *Construction Delays: Documenting Causes, Winning Claims, Recovering Costs,* examines what causes delays and ways to avoid them. For ordering information call (800) 448-8182.

***Construction Savvy,* a catalog published quarterly by the Construction Bookstore in Gainesville, Florida, lists thousands of books, audioscassettes, codes, and office tools for the construction industry. Call (800) 253-0541.**

Real estate planning is a valuable service that architecture firms can offer their clients in slow-growth times. To explore the subject, the AIA Corporate Architects committee will present "Managing Real Estate Assets in the 90's" on October 3–5 in Chicago. Call (202) 626-7539.



Eric Teicholz presents a case study of CAD at the Capitol.

Computers: The Architect of the Capitol

One of the most advanced installations of computers for design and facilities management is at the highest level of government: the Office of the Architect of the Capitol (AOC). The current Architect of the Capitol, George M. White, FAIA, oversees a domain that includes over 12 million square feet of facilities that house more than 35,000 people. While the architectural and engineering diversity within AOC is considerably more varied than that in most traditional A/E practices, its use of computers provides a model for firms and facility managers.

Automating for facility management can be broken into phases: 1) the loading of an intelligent database; 2) the management and distributuion of the database to all potential users; and 3) the integration of the database with traditional facility management functions and across different computer platforms. The AOC is completing the first phase of this effort and beginning implementation of the second. But most important, the leading phases have been planned so that the resultant data integration will be achieved in the final phase.

System Configuration

The system was built around an Intergraph Model 250 CPU, a Micro VAX-based processor, with 13 megabytes of memory and 2.1 billion bytes of hard disk storage. Two dual screen color VAX-based workstations, and four desktop color workstations utilizing UNIX operating systems were acquired with the initial system. Several additional UNIX-based desktop workstations have been procured since, the newer ones utilizing Intergraph's Clipper RISC chip, along with 10 PC-based platforms, running Bently Systems' MicroStation software. System communication is via Ethernet communication over standard and fiber optic cables.

Input Methods

The system was procured, in part, to provide a "corporate memory" of renovations and alterations, as well as of the original construction. A set of "on-line," readily accessible "as-builts," are continuously updated to produce a living database that contains the maximum amount of historic information, such as the construction materials contained in walls and information on where door openings have been closed, lintels left in place, or chases covered up.

Although scanning in drawing was a quicker short-term solution to inputting information, this "quick fix" was rejected because: Scanning images depends first on a clean set of drawings, requires extensive editing to retrieve final usable drawings, and is only as accurate as the original draftsman. The AOC, instead, decided upon a parametric input approach, linking the database to graphic files.

An evolutionary approach was adopted for the inputting of floor plans by first laying out column grids and building perimeters. Major core areas were then defined, often only by outline. Once floor geometry was established, typical suites were developed as "prototype cells" and placed around the plan, precisely tied to column grids. Connecting areas and atypical spaces were bypassed and left for future input as time allowed. This system permitted early use of the suite plans for engineering and interior design work even before the entire floor was complete.

The architectural as-builts are maintained on-line for access from any location on the network. Reference file access enables AOC's interior designers to attach a floor plan under an active furniture plan, scale a suite up to a larger scale, turn off the display of areas beyond the suite border, rotate the suite to correct for unusual corridor angles dictated by Washington's street plans, and then accurately place furniture and partition layouts. Standard file protections are available, and additional levels of security are imposed as the network warrants. The space planning/facility layout software is just now coming into full use. In the past the AOC has utilized the architectural software to design and place furniture. Recently, it has procured a bar-code furniture inventory system for tracking entitled "QBIC," which supports database linkages to PC-based graphics workstations.

A major disappointment has involved the use of Intergraph's HVAC software. Although the package sizes and places ductwork in drawings with great precision, it does not easily accommodate the odd duct sizing and routing often necessary in historic buildings. Thus ducts and fittings placed by the software must frequently be altered to suit as-built conditions. Newer software that supports placement of sized ducts and fittings with associated ASHRAE characteristics is being investigated.

Future Plans

Distribution of the system out of the AOC office and into the superintendent offices in the Capitol, Senate and House Office Buildings, Library of Congress and Supreme Court is currently being completed. Initially this support will be through PC platforms, but eventually a blend of PC's, workstations, X-terminals, and remote server platforms is envisioned. These will permit fuller use of database files and reporting capabilities and will support the higher speeds required for database query operations.

While Intergraph's workstations have migrated to relational database linkages over the past few years, the system is not accessible from all platforms. Bently Corporation's announcement that the PC-based software will support Oracle databases in the future holds great interest because of user hooks within the graphics files that will permit system-wide query regardless of hardware platform.

Increasingly, the AOC's design activities are moving to workstations from manual drawing boards. Architectural and engineering drawings, layouts, and systems will be developed and detailed on CAD workstations. Space and furniture planning will expand the use of CAD software and databases and, with the introduction of 3-D presentations, will be presented to their clients via computer screens or color plots. The AOC is the oldest architectural office in the U.S., but the computerization of its facilities has made it one of the most advanced. **Eric Teicholz** ■

The author is an architect and President of Graphics Systems Inc. in Cambridge, Massachusetts.

Susan Neuberger Weller explores the ways in which firms can protect a design from being copied.

Law: Protecting Your Designs

As an architect or designer, your designs are your business. If you can't recoup your investment in and profit from your designs, you won't be in business for very long. Thus, you should be asking yourself: How can I protect my designs from being stolen and used by others? The answer is: trademarks, copyrights, and patents.

Copyrights

The good news is that architectural plans and models can be protected by copyright, so that no one can copy them without your permission. The bad news is that, although a copyright will protect against the unauthorized copying of the plans themselves, it will not prevent a third party from constructing the building depicted in the plans. A copyright generally will not protect the design of an object that is intrinsically functional. Since an architectural structure is generally considered to be a functional, rather than an artistic, object, it cannot be protected by the copyright laws.

Copyright protection might be available, however, for sculptures or ornament that is added to a structure. These items are considered to have a separate and independent existence apart from the building, and, in most cases, they are not considered functional objects.

In the future, you also may be able to use the copyright law to protect your planned designs. Legislation is now pending in Congress that would provide copyright protection for "architectural works," defined as "the design of a building or other three-dimensional structure, as embodied in that building or structure" (see P/A, May, 1990, p. 26). If the legislation passes in its current form, it would allow the imposition of judicial sanctions against the unauthorized user of a building design but would prohibit injunctions to stop construction or to initiate destruction of an infringing building. Hearings have been held on this legislation, and it may pass this year.

Thus, the first step in your creative effort is not a problem. Your plans are yours exclusively to keep. Now for the hard part: trying to protect the design itself from being stolen.

Trademarks

Trademark law has long been used to protect both interior and exterior building designs. Federal trademark registrations exist not only for such famous exteriors as the Howard Johnson's restaurant and the old McDonald's drive-in, but also for many less famous designs.

Of course, there are certain hurdles that must be cleared before the trademark law will protect a design. First, a design can be protected as a trademark only if it is not primarily functional. The U.S. Patent and Trademark Office, which issues federal trademark registrations, and the courts have become more flexible in recent years on this functionality issue. If alternative designs exist for accomplishing the same utilitarian purpose, functionality will usually not defeat a trademark. Basically, a design will pass muster as long as the functional feature is not essential to using the article (that is, the function can't be performed any other way), and that feature does not affect the cost or quality of the article in an anti-competitive way (that is, a competitor can't make the product economically without the design).

Second, a design cannot be protected by a trademark unless some consumer recognition of the design has developed. If a particular architectural style has come to be associated with a specific source, such as the McDonald's building, the requisite recognition should exist. Under this standard, the design of many unique, one-of-a-kind, custom buildings will not be protectable until they have achieved some element of "fame." Achieving this type of recognition can take time, leaving the building design unprotected in the interim.

This does not mean, however, that blatant copying can always go unanswered. If copying occurs, and the design thief is trying to create or infer that an association exists between you, your design, and his operation, a claim for unfair competition may be possible. Misrepresentation about the source or sponsorship of a trademark design usually gives rise to proprietary claims by the designer. Moreover, in some courts, evidence of copying will sometimes clear the "consumer recognition" hurdle, with the court presuming that the design was copied for its "fame."

Although trademark law can protect designs, it usually can't help you if you can't wait for your design to become famous. If more immediate help is needed, you should look to design patents for protection.

Design Patents

Design patents are available to protect not technical genius, but the ornamental design of any article of manufacture, including architectural and industrial designs.

Although design patents are useful, they are still not the answer to every prayer. While it is possible to obtain a design patent in less than six months, it can take longer. To be patented, a design also must be "original"; it cannot be "obvious" when compared to earlier publicly known designs or an obvious combination of known designs. It is this "originality" requirement that is usually fatal to design patents.

Patented designs, however, need not be "famous," as do trademarks, to be able to stop infringers. In fact, they do not even have to be in use at all by the owner. They just simply must not be obvious.

Designs protected by design patents also cannot, like trademarks, be primarily functional. If the function can be performed by a different design, the design is usually patentable; if a design is functional, its utilitarian features should be protected by a utility patent.

If you plan ahead, you can obtain patent protection for your architectural designs – even if fame eludes you. Frank Lloyd Wright ensured that his name was associated with his designs. He protected himself and his property, much of which continues today to produce royalties through license agreements. You should do no less – and should do it by design.

Susan Neuberger Weller ■

The author is an attorney with the law firm of Squire, Sanders & Dempsey, Washington, D.C. and practices in the area of intellectual property law.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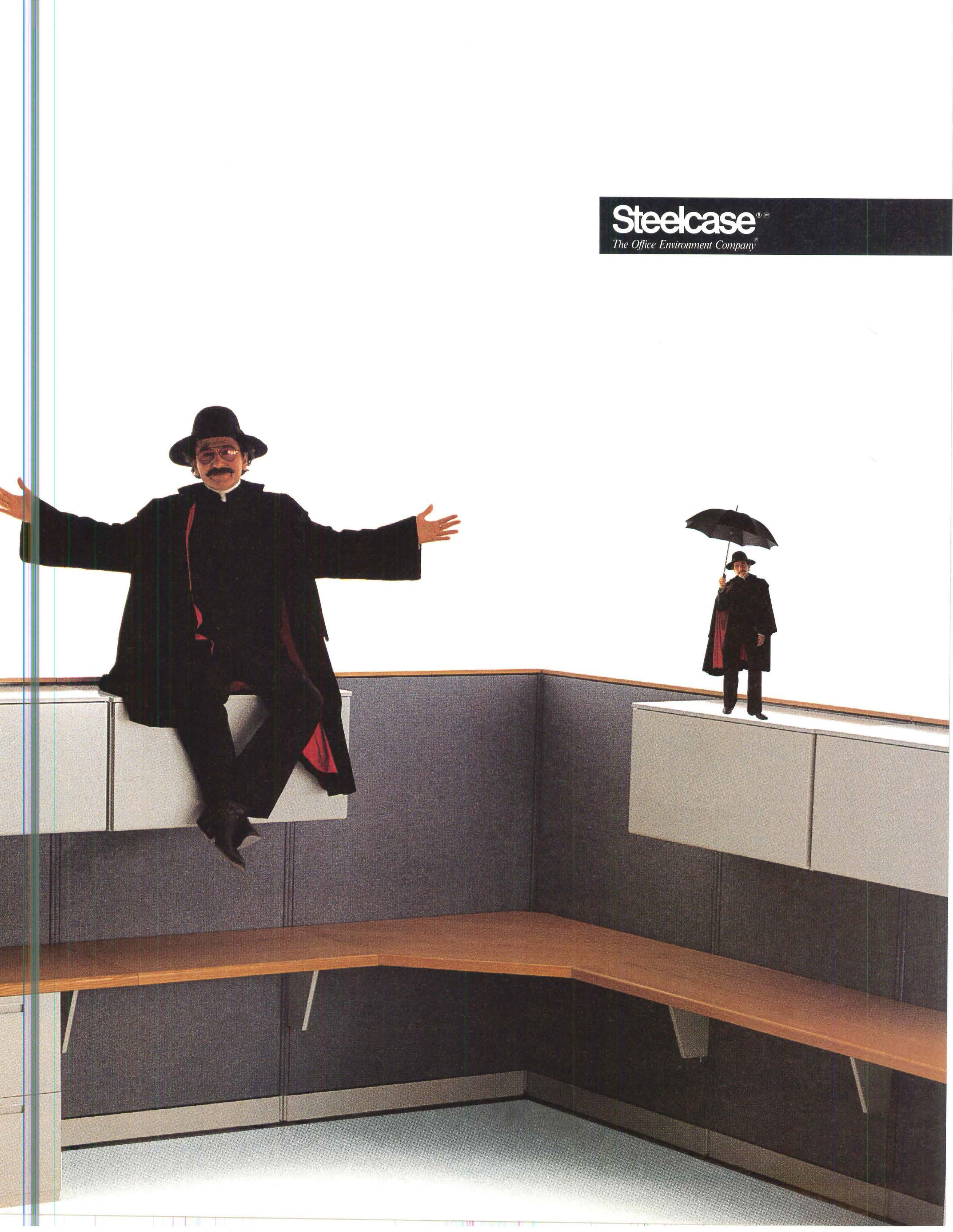
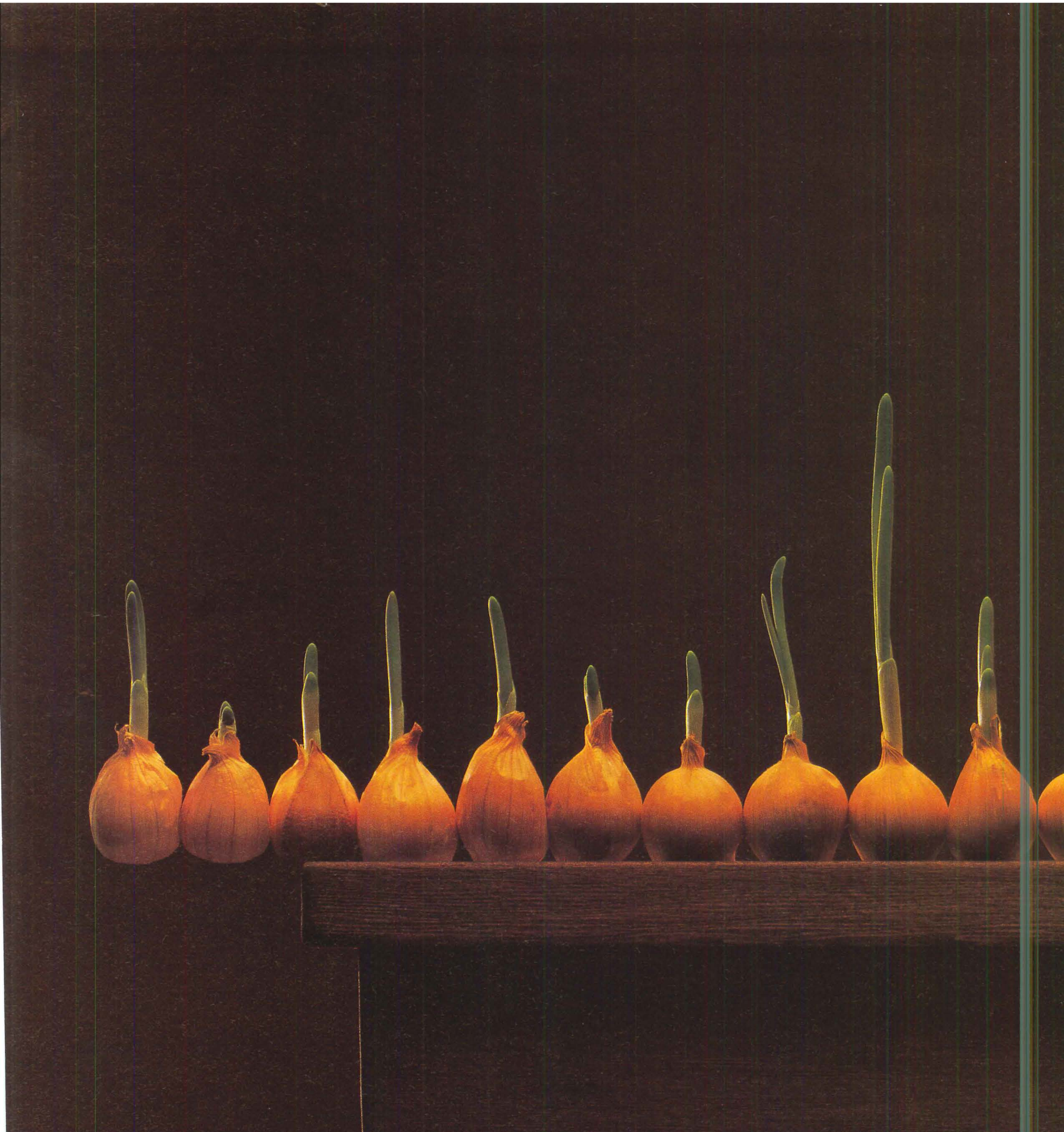
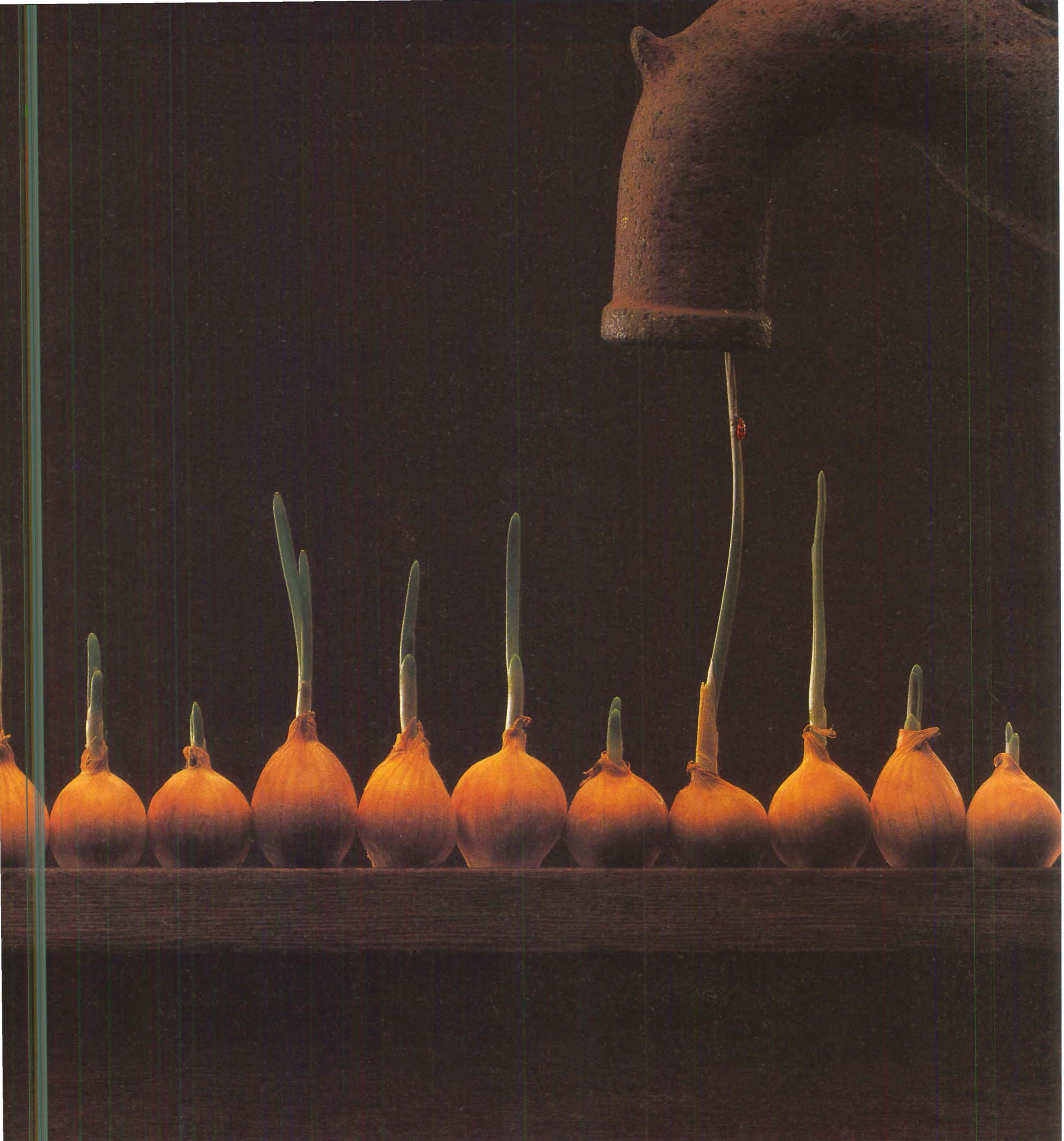

Steelcase
The Office Environment Company





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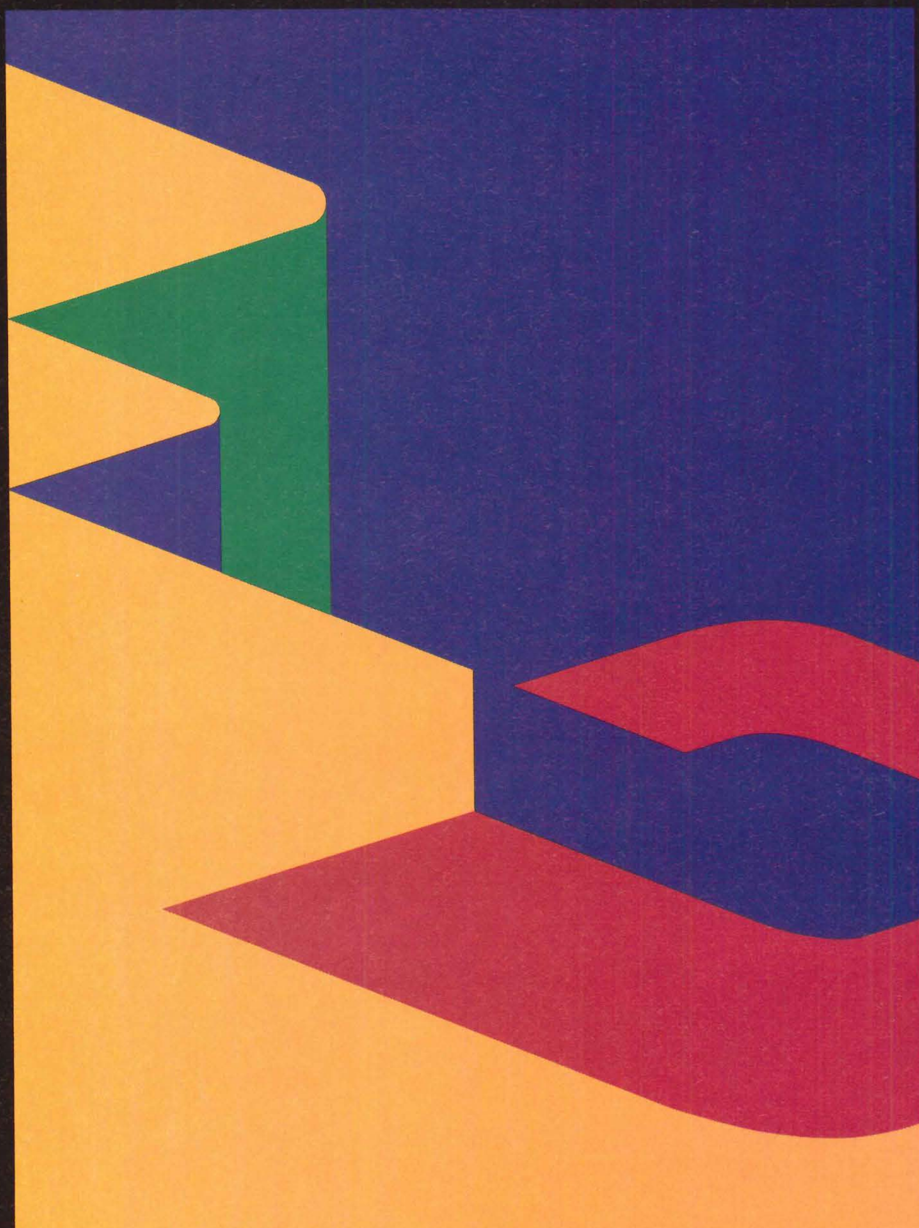

Design

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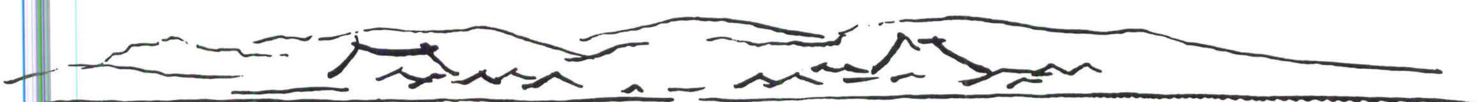
This month, a feature on two landmark complexes by Fumihiko Maki is followed by an article on architectural photography, an inquiry on laboratories, and a portfolio of schools.



A sketch by Maki and an elevation of his convention center illustrate his conception of the main exhibition hall as a "mountain range" backdrop for the buildings in front of it.

Two Landmarks for Tokyo

Maki demonstrates his design principles at metropolitan scale in a convention center (this page) and a gymnasium complex (page 82).

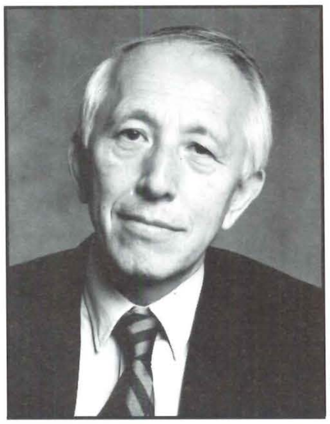
Introduction

Although Fumihiko Maki helped introduce the word "megastructure" into the lexicon of the 20th Century nearly three decades ago, that building form is not associated with his own work. Even during the 1960s, when fellow Metabolists and Kenzo Tange were enamored of grandiose schemes worthy of that label, Maki produced little that could be called a megastructure. He has been essentially an empiricist and gradualist, wary of the one-shot solution.

The megastructural approach was seemingly invalidated in the 1970s, in part by the advent of the energy crisis, but in the last few years it has made something of a comeback in Japan, thanks to the enormous accumulation of capital and a boom in huge development projects, particularly on the waterfront of Tokyo Bay. Schemes eerily reminiscent of Metabolist proposals currently are being floated, some quite literally on the water.

Maki is leery of many of the waterfront development projects. He argues that they really have not been thought through and are being pushed largely because of the failure of Japanese government policy, which has permitted land prices to rise so high that large-scale inland redevelopment is now prohibitively expensive. He is disturbed because an opportunity is being lost. The current building boom in Tokyo "is a chance that comes along once in maybe 300 years. It has to be seen for what it is; a rare moment in time for a city. It's not going to last forever. We ought to do things properly, but people don't have a historical perspective. [Architects] have a lot of jobs now, and we are certainly enjoying ourselves. But everyone's so busy that many things are being designed and built irresponsibly."

In two recently completed works, the Makuhari Messe (also known as Nippon Convention Center) and the Tokyo Metropolitan Gymnasium, Maki has had to address the problem of locating a large enclosed space in an urban context. The convention center, in particular, is megastructural in its proportions, if not in its organization, and is part of an extensive development project on land reclaimed from Tokyo Bay. It thus gave Maki a chance to show that a giant waterfront project can possess those qualities that were notably lacking in the megastructure of yesteryear: diversity, flexibility, and human scale.


Kerry Pickett

Fumihiko Maki

Convention Center

Makuhari is an area on Tokyo Bay halfway between Tokyo and Chiba City (and on the expressway to Tokyo International Airport), which is being developed by Chiba Prefecture into a new center for international trade and cultural exchange. The Makuhari Messe is the centerpiece of the development, with an exhibition hall, a multipurpose "event hall," and an international conference center. All around it are office buildings, a waterfront park, a hotel, and parking areas, either constructed or in the works. Maki's proposal won a 1986 competition among seven invited firms, and the building was occupied a mere three years later.

The "central mall," a circulation spine nearly a third of a mile long, extends east to west across the 43-acre site . The public moves along the second level of the spine, leaving the ground level free for vehicles that service the exhibition hall.

To the north of the mall are the conference center and the multipurpose hall, as well as the lobby and the main approach to the whole complex. To the south is the 581,000-square-foot exhibition hall, which can be divided into eight units by movable partitions 33 feet high, so that conceivably eight separate exhibits can be accommodated. So far the biggest exhibit at the Messe (the name is derived from the German word for "fair") has been the Tokyo Auto Show, which attracted more than 200,000 people daily.

The exhibition hall is covered with a curved roof, with a radius of approximately six-tenths of a mile. Over 100 feet tall at its highest point, the roof has a structural system that Maki describes as "space beams" infilled with space frames. An effort has been made to make the structure appear as insubstantial as possible, for example by the use of specially designed aluminum mullions with open webs.

One problem Maki encountered in the exhibition hall was that of natural light. In the original scheme, there were large areas of glazing on the north and south sides of the hall, but many exhibitions did not require natural light and indeed demanded only highly controlled artificial lighting. The compromise solution leaves only a narrow band of glazing directly under the roof in addition to the toplights above the "space beams."

The development of the entire Makuhari area is an attempt to create a city from scratch, and Maki saw the prototypical Japanese community, a village nes-

(continued on page 76)

On a reclaimed site along Tokyo Bay, the Nippon Convention Center (or Makuhari Messe) is the first completed part of a vast recreational and business development. The juxtaposition of its tortoise-shaped event hall against the vault of the 1700-foot-long exhibition hall is clearly seen (at least for now) from the expressway that connects Tokyo to Narita International Airport.

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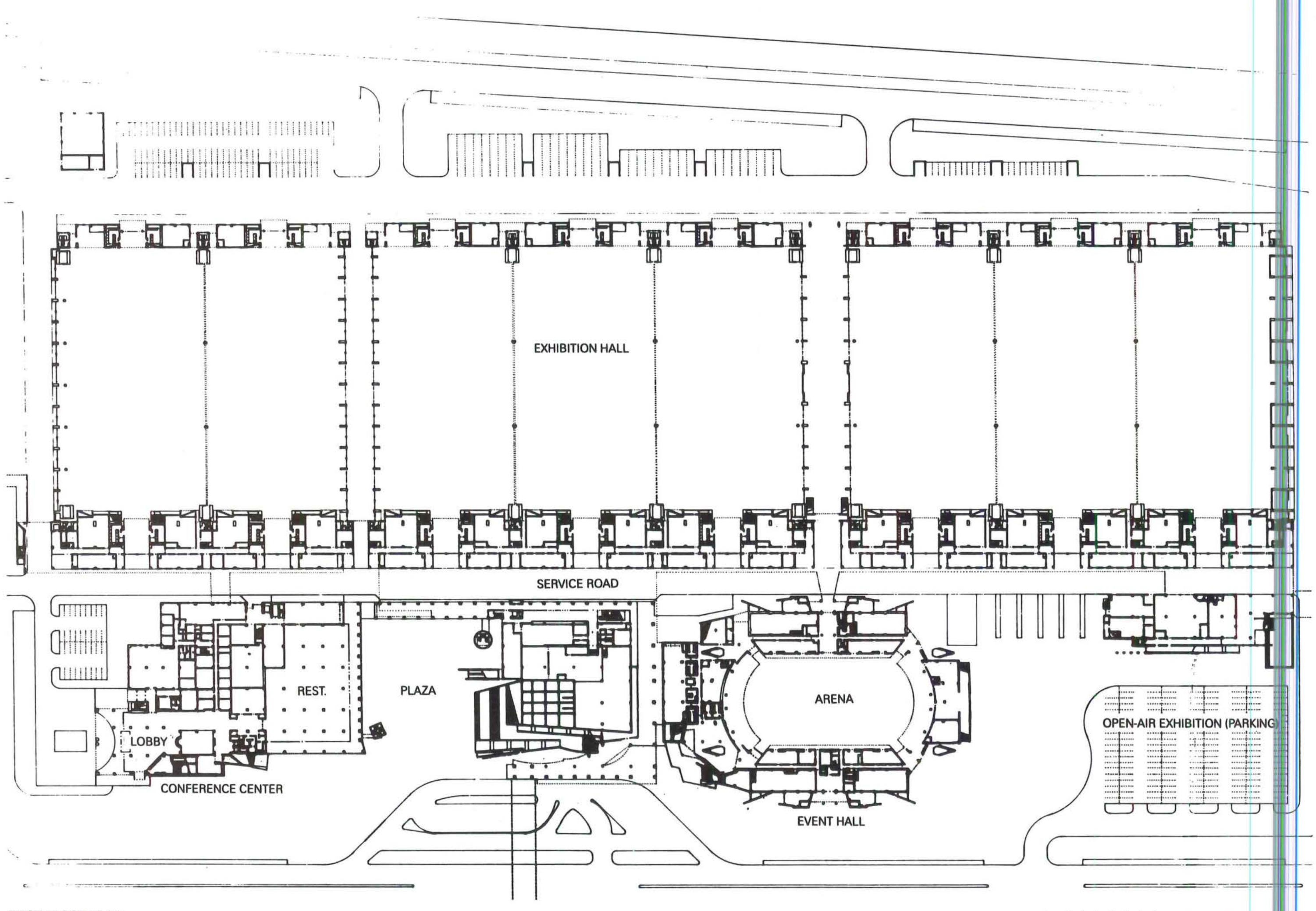
Fumihiko Maki

(continued from page 74)
tled among hills, as an apt metaphor for a project that is to initiate and set the direction for future urban growth. The site, being reclaimed, is resolutely flat. The huge volume of the exhibition hall, with its distinctive silhouette, introduces a man-made "mountain range" into this otherwise featureless environment. The other components are designed as discrete "foreground" elements, situated against the "background" of the exhibition hall.

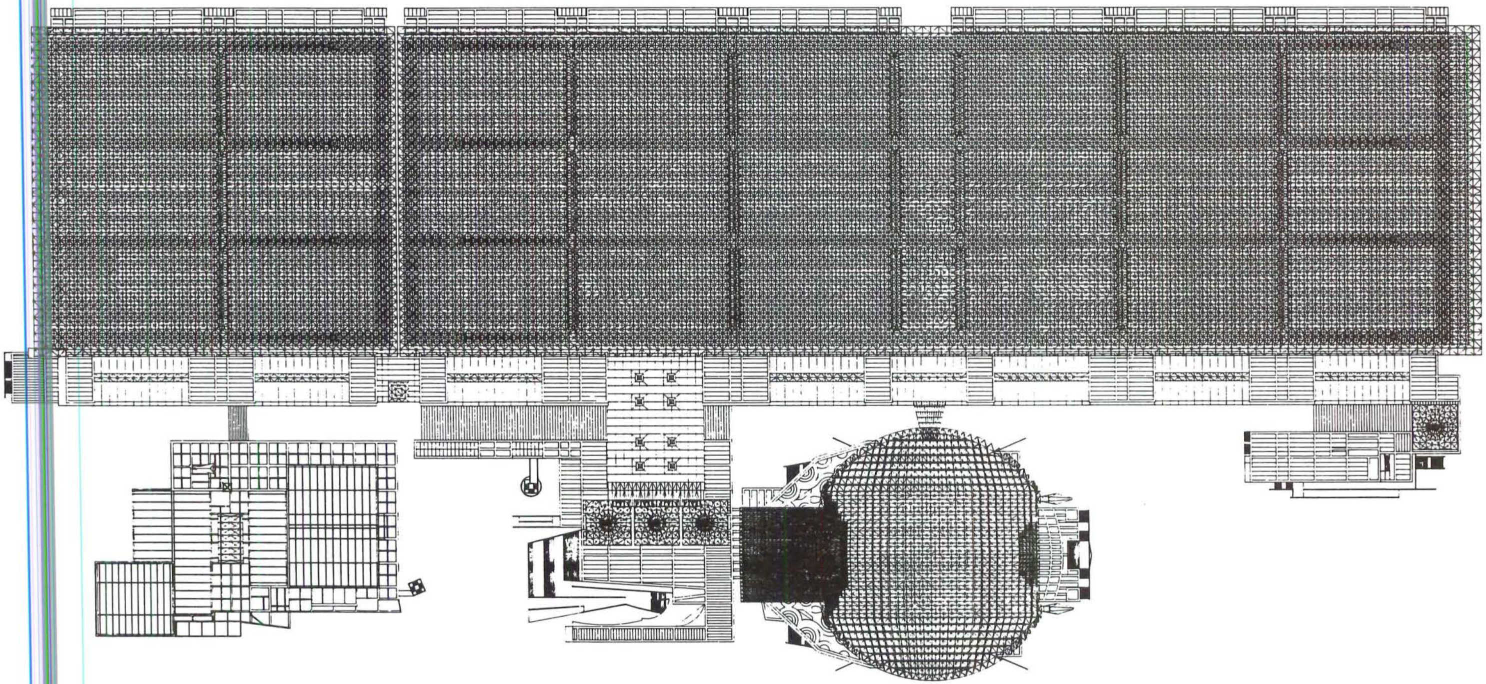
The foreground structures help to restore a human scale and by their variety suggest something of a real community. This scale and diversity are what were missing in the design of megastructures.

Ultimately what distinguishes the project from a megastructure, however, is the de-emphasizing of the links between constituent elements, for it was the connecting circulation and mechanical system that was so glorified in megastructural schemes. The central mall in the Messe, for all its length, is quite obviously a space of secondary importance.
(continued on page 82)

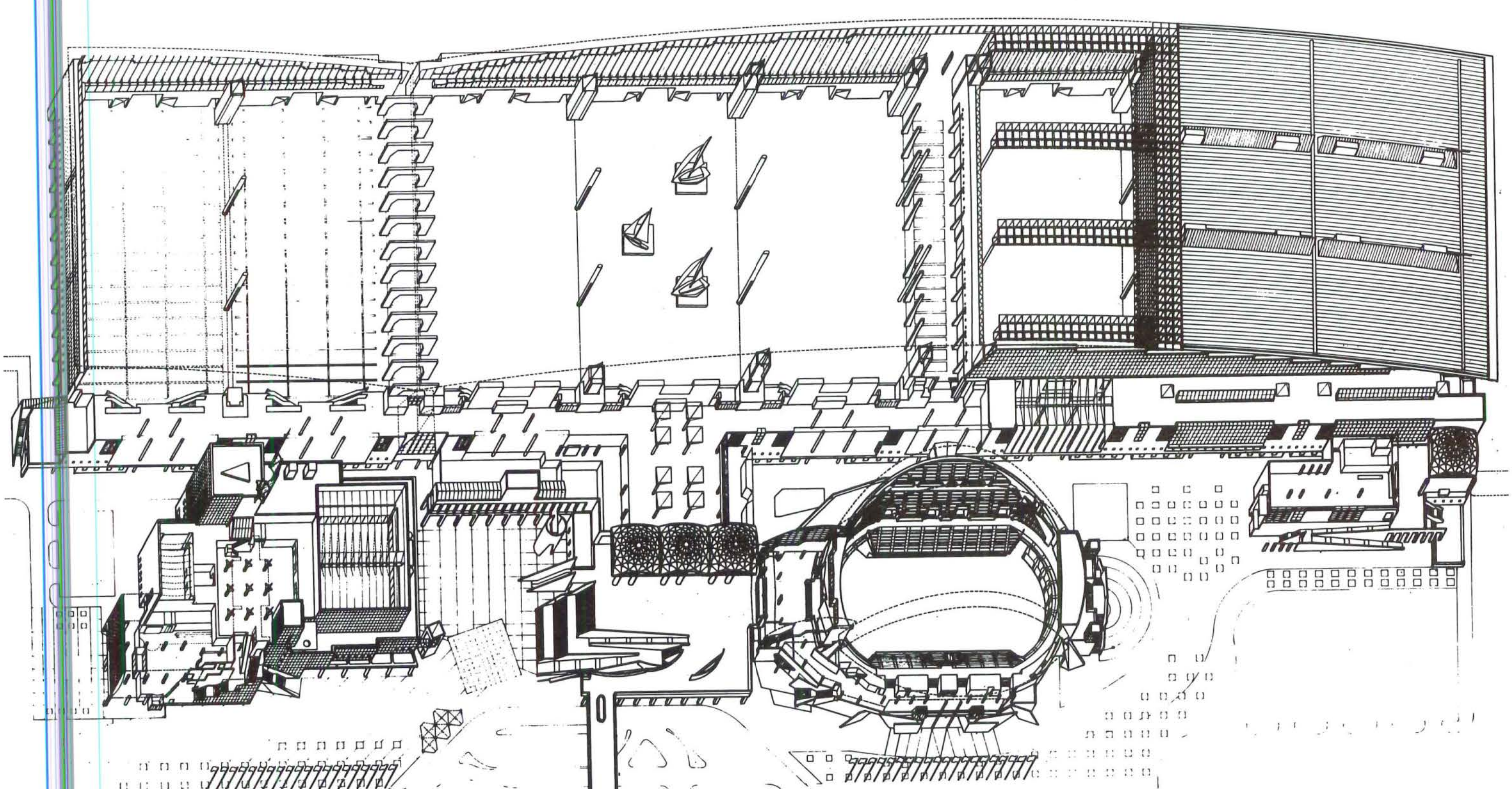
A red-framed canopy welcomes visitors at the convention center's main entry. The public circulation spine is at the second level (axonometric, facing page), above service routes.



FIRST FLOOR PLAN



ROOF STRUCTURE PLAN



CUTAWAY AXONOMETRIC

The 60m × 40m (197' x 131') structural bays of the exhibition hall (1) are framed by preassembled "space beams" supporting a space frame infill (roof plan, preceding page). Glazed transoms above the movable partitions preserve the unity of the space, and slivers of sky are visible at the tops of the side walls. Clad on the exterior with glass (2) these walls enclose an insulating layer of air. At the high point of the arc-shaped roof (3) is a passage for service and emergency egress. From this point, clerestory windows step down toward the low points in the curve (5). Visitors arriving at exhibitions on the upper level (4), get a broad overview before plunging into the crowds.

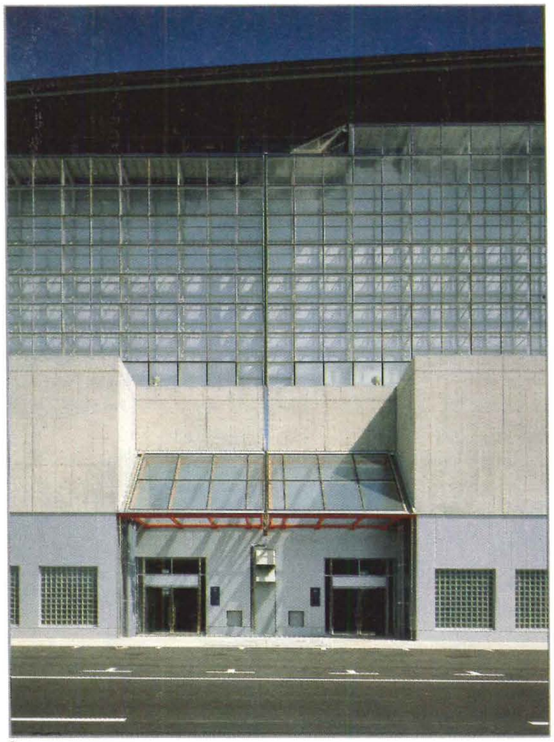


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Photo below: Taisuke Ogawa

The lecture halls, ballrooms, and restaurants of the conference center are linked by cascading stairs (1) and indirectly lighted lobbies (2) reminiscent of those in Maki's Spiral Building (P/A, April 1986). The structural vaults of the event hall (3,4) are similar in geometry and stainless cladding to the gym at Fujisawa (P/A, June 1985), though the structural systems differ.

Project: *Nippon Convention Center (or Makuhari Messe), Chiba Prefecture, Japan.*
Architects: *Fumihiko Maki and Maki & Associates (Fumihiko Maki, principal in charge; Iwao Shida, Tomoyoshi Fukunaga, Keisuke Yamamoto, project architects; Katsuhiko Nishida, Jun Aoki, project planning; Kei Mizui, Katsuo Nagasaki, Takao Masuda, Tetsuya Mori, Masaaki Yoshizaki, Yasushi Ikeda, Noriko Kawamura, exhibition hall team; Hirochika Kashima, Akira Uenishi, Makoto Nakajima, Takeyuki Iwamoto, event hall team; Jun Watanabe, Shigekazu Miyamoto, Gary Kamemoto, Akio Narita, Hiroaki Sakakibara, Keiko Hirasawa, conference center team).*
Client: *Chiba Prefectural Government and Nippon Convention Center.*
Site: *173,191 sq m (42.8 acres) of flat, reclaimed land along Tokyo Bay.*
Program: *exhibition hall (1,063,300 sq ft), event hall (167,000 sq ft), conference center (179,700 sq ft); total gross floor area: 131,043 sq m (1,410,000 sq ft).*
Structural system: *reinforced concrete and steel frame; precast floors; exhibition hall roof, preassembled "space beams" with space frame infilling; event hall roof, curvilinear space frame.*
Major materials: *stainless steel roofing; glass curtain wall, aluminum, exposed concrete.*
Mechanical systems: *chilled water and steam from central plant.*
Consultants: *Toshihiko Kimura and Structural Design Group Co., structural; Sogo Consultants, Nippon Telegraph and Telephone, mechanical; Equipe Espace, landscape; GK Sekkei Associates, graphics and signage; NHK Engineering Services, acoustics; Theater Engineering Institute, lighting and theatrical.*
General contractor: *Shimizu Construction Co., Kajima Corp., Takenaka Corp., Tobishima Corp., Mitsui Construction, exhibition hall; Obayashi Corp., Asahi Construction, event hall; Taisei Corp., Shin Nihon Corp., conference center.*
Costs: *45,000,000,000 yen (about $300 million).*
Photos: *Toshiharu Kitajima, except as noted.*


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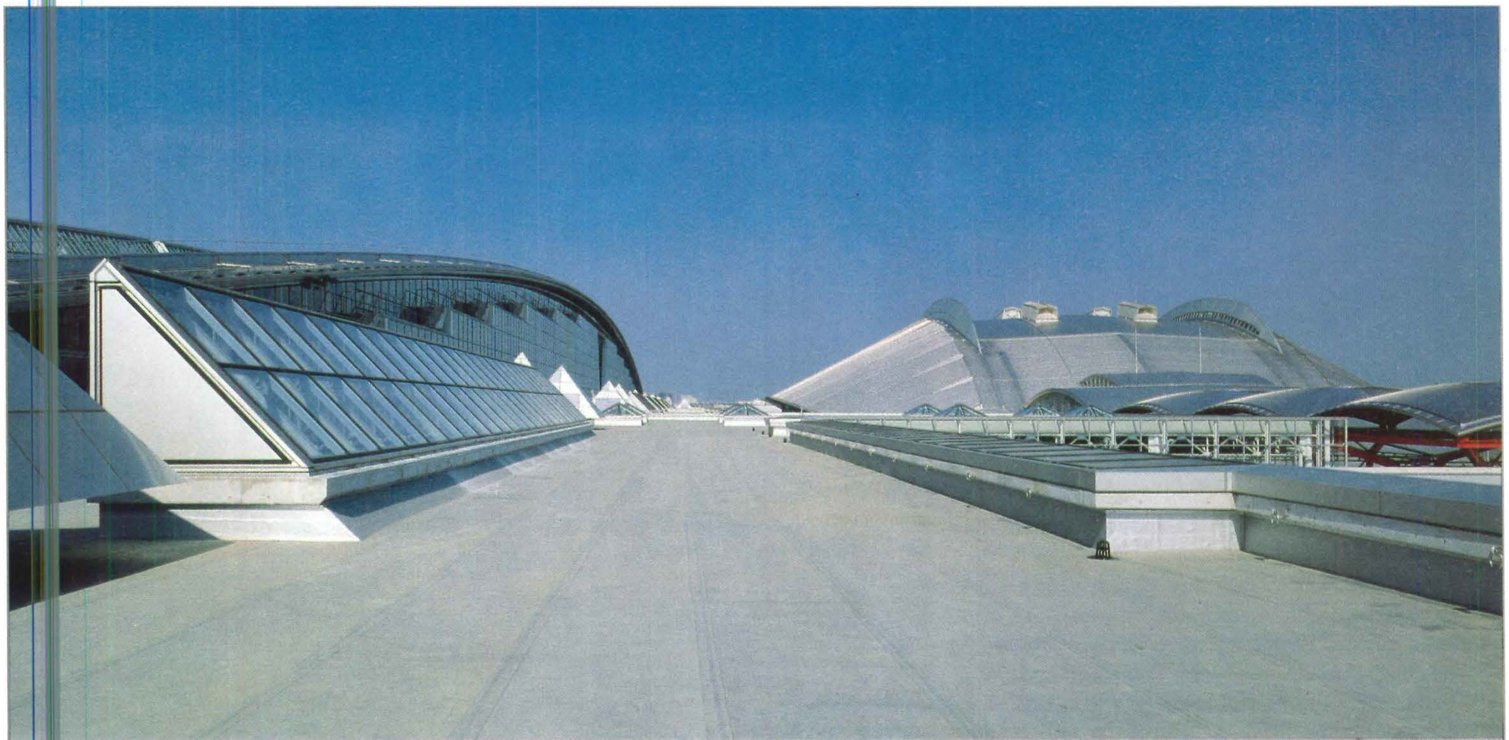
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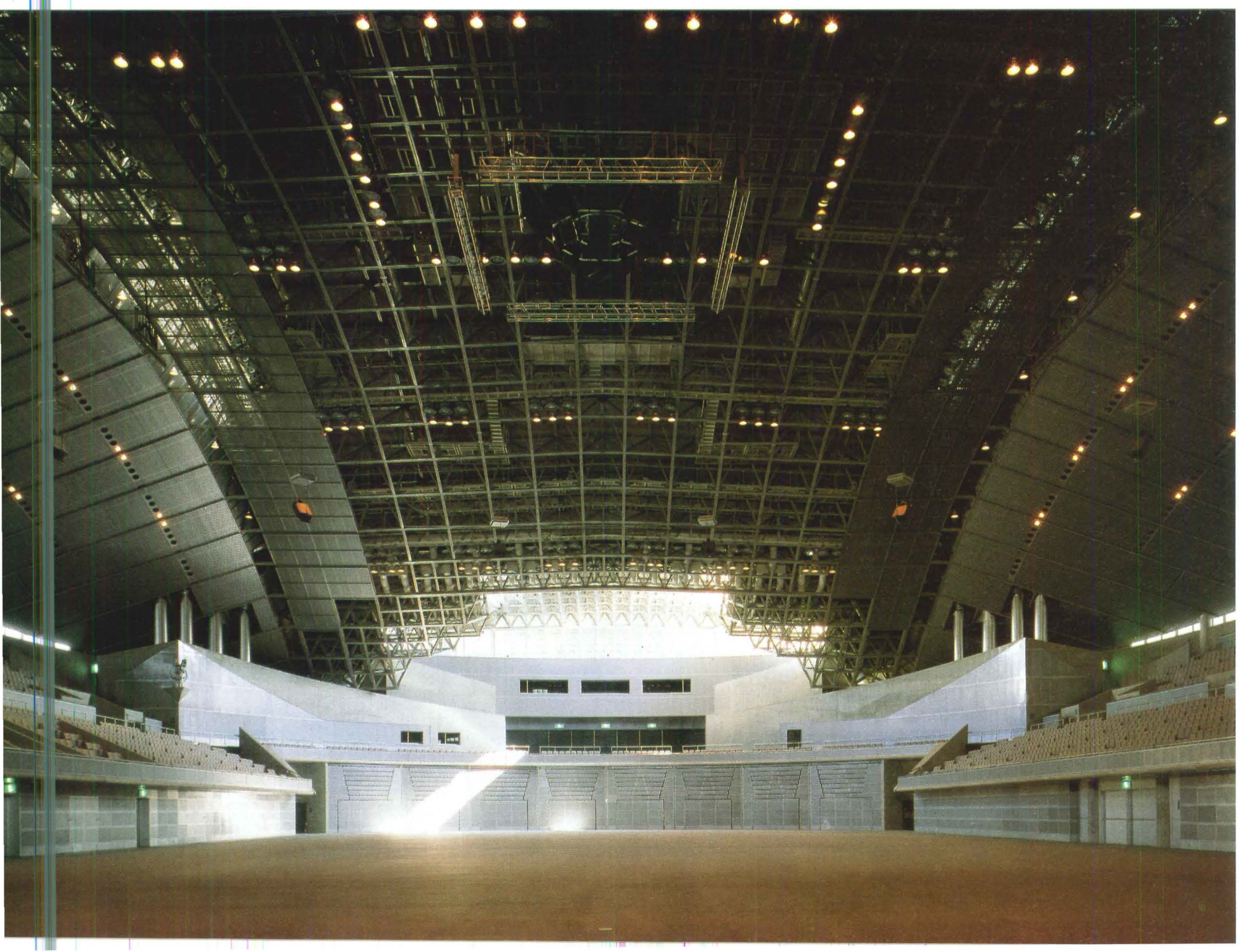


Metropolitan Gymnasium

The Tokyo Metropolitan Gymnasium replaces a smaller facility dating from the 1950s at one end of the outer gardens of Meiji Shrine in the middle of the capital. The site of eleven acres is bordered to the north by a raised expressway and a railway station, to the west and south by small condominiums and office buildings, and to the east by the national stadium.

The site, though generous by Japanese urban standards, had to satisfy an ambitious program that called for doubling the floor area of the old facility. Besides the main arena, there is a smaller so-called sub-arena, a physical fitness center, and pools. A demand that the gymnasium not exceed a height limit of approximately 100 feet, because of its location in a park, made the problem more difficult.

The solution is a tightly integrated complex, but an illusion of structures standing independently in an open space has been created by means of a pedestrian deck built over the circulation areas and some of the minor athletic spaces. To meet the building height requirement, the floor of the main arena has been lowered some 20 feet below the ground level at the northwestern corner of the site. The result is that at the deck level much of the total building volume is hidden, leaving visible only the roofs and upper portions of the major spaces. Each roof has its own distinctive form, and, as in the case of the ziggurat over the sub-arena, an abstract, sculptural quality.

There is considerable through traffic on the pedestrian deck, and people also come just to sit and relax, especially at lunch hour. Maki explains that the circulation path over the site has been designed much like a traditional Japanese stroll garden, and, indeed, as an observer moves over the deck, new scenes unfold continuously. At no single point is the complex revealed in its entirety, and the shape of the main arena contributes to this drama. The rim of the roof over the main arena, now rising, now falling, is not unlike the edge of the pond around which the path in a traditional garden is organized.

The main arena, in plan a circle nearly 400 feet in diameter, is spanned by three arches, with a tension ring on the periphery. Structurally it is quite different from the 1984 Fujisawa Municipal Gymnasium (P/A, June 1985, pp. 71–80) by the same architect, but there are formal similarities, both inside and outside. As in Fujisawa, the exterior form of the roof over the main arena is very complex and difficult to compre-

(continued on page 84)

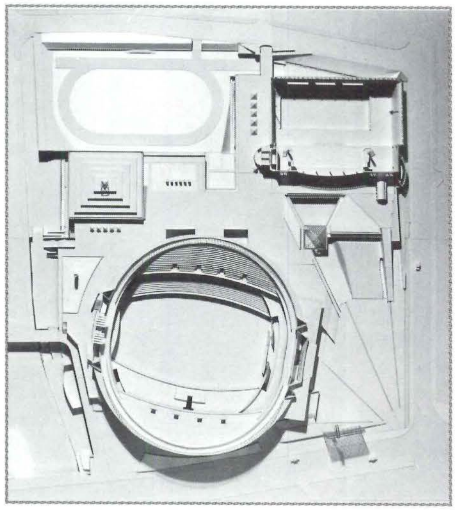
1

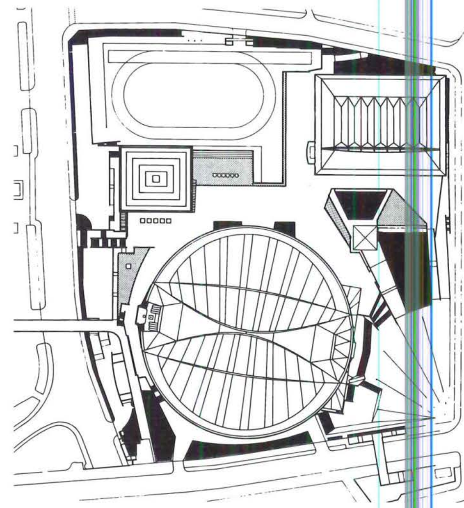
2

Photos 1, 2: Taisuke Ogawa

3

On public park land within sight of the towers of Shinjuku (1), the gym complex includes three major structures embedded in a plaza-topped podium. Main public access is from a street-level plaza at one corner of the site (2) – which happens to face a small institutional auditorium by Maki (bottom of photo). The athletes' entrance to the varied facilities is under a glazed pyramid (3).





SITE PLAN N 100'/30m

(continued from page 82)

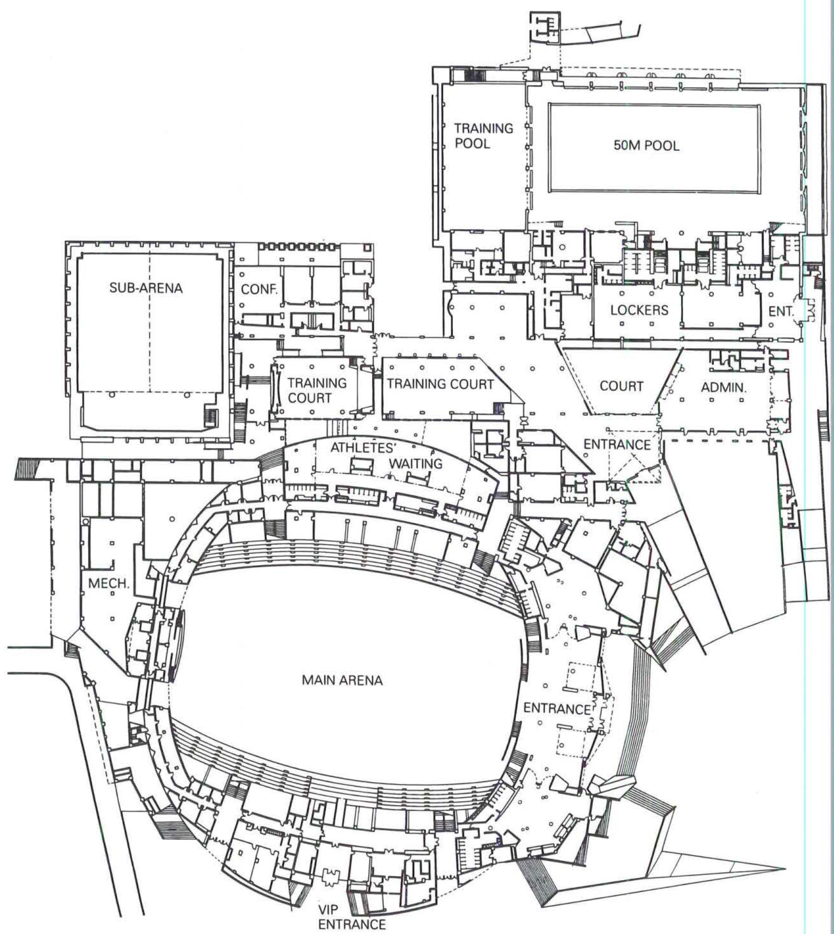
hend, once an observer has shifted even slightly off the principal axis. The way the joints of the stainless steel cladding change directions adds to the difficulty of correctly reading the building form.

Inside the main arena, the ceiling pattern reinforces the separation of the space into several distinct areas, and here a comparison with another well-known Japanese gymnasium is revealing. Kenzo Tange's Yoyogi Gymnasium, built for Tokyo Olympics of 1964, reflected the Japanese agenda of that time – economic development and acceptance once more into the community of nations. The 1964 Olympics enabled the Japanese to showcase the progress the country had made since the Second World War. Tange's gym, with its heroic, faintly traditionalist silhouette and sweeping interior space, was a symbol of a society that was united, in which individuals made sacrifices for the common good.

The Tokyo Metropolitan Gymnasium, on the other hand, makes an entirely different statement. The building, like the society it serves, has a profile that is no longer so easy to ascertain. There is a less obvious unity and a greater acknowledgement of the parts that make up the whole. It too has a traditionalist aspect but in its method of organization and not in any reference to the curving roofs of the architecture of the past.

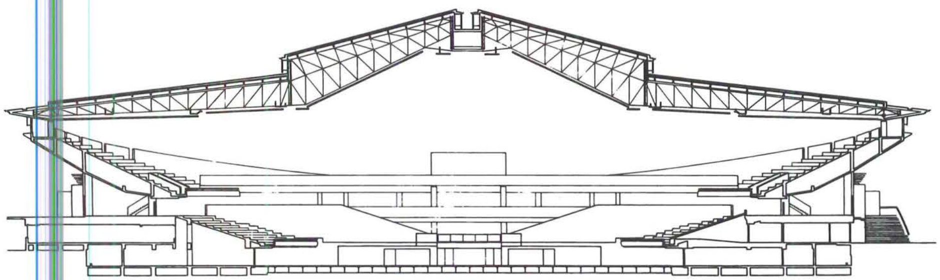
In the Messe, Maki was dealing with what he calls a "new animal," for which no established architectural precedent exists. Having recently marked the 25th anniversary of his office, he continues to welcome new challenges and is eager to explore hitherto unfamiliar building materials and types. "I don't mind if I occasionally fail," he declares, "as long as I can learn something and am given a second chance." He does not need to add that a second chance was precisely what an architect did not get with a megastructural approach. **Hiroshi Watanabe** ■

The author is an architectural critic based in Tokyo and the writer of a forthcoming book on Japanese architecture.



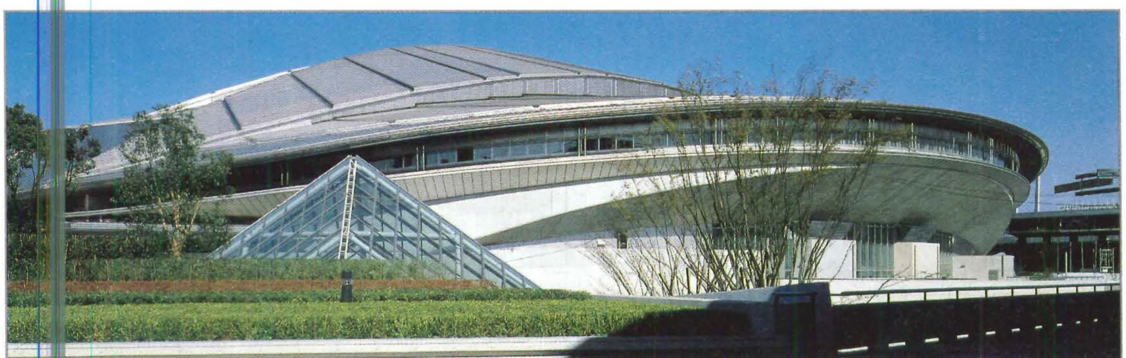
LOWER LEVEL PLAN N 100'/30m

The swooping roof of the main arena (1,2) is supported mainly on two pairs of trusses that divide surface in to five zones of differing curvilinear geometry (site plan, facing page). A cross section of this structure (this page), looks deceptively simple, with none of the complex curves showing. A band of glazing following the undulating perimeter of this roof gives it an appearance of hovering.



MAIN ARENA CROSS SECTION

40'/12m



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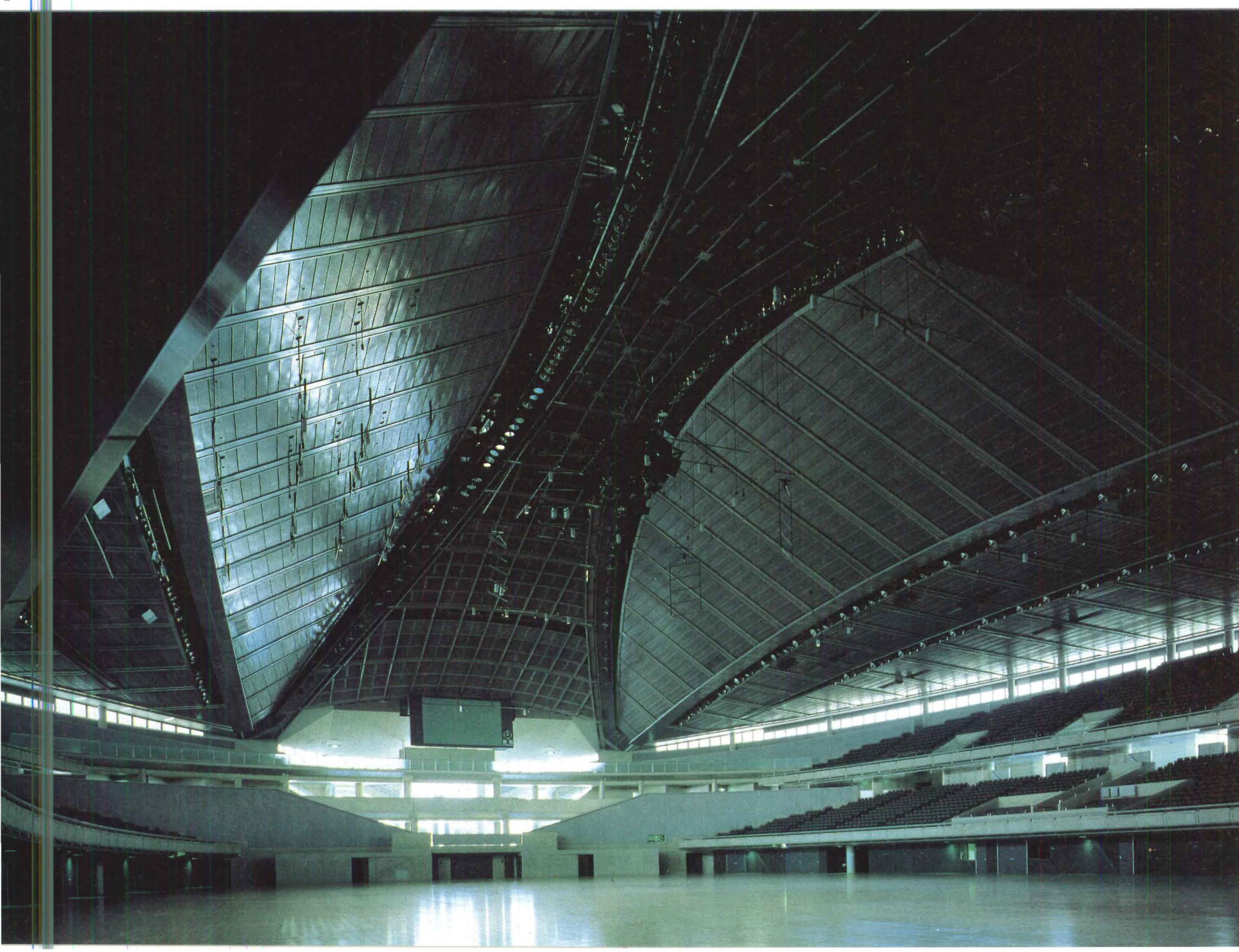
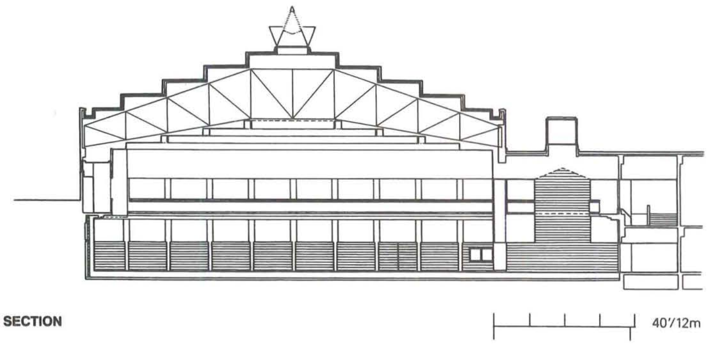


The stepped pyramid envelope of the sub-arena, clad in blue ceramic tile (1) adds an elegant surprise among the more structurally expressive superstructures. Inside (2), pierced screens provide subtle natural lighting. The asymmetrical structure of the swimming pool allows for an expanse of translucent skylight over both pool and stands (3). At the end of the pool, an outward-curving wall (4) dissolves the building envelope in daylight.

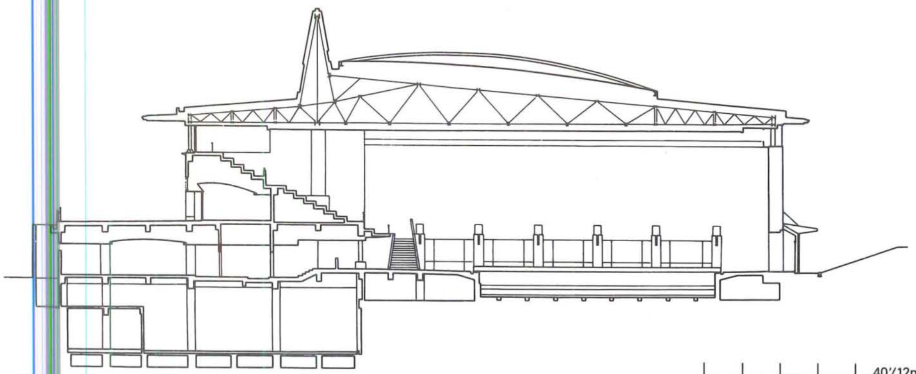
Project: *Tokyo Metropolitan Gymnasium, Tokyo.*
Architects: *Fumihiko Maki and Maki & Associates (Fumihiko Maki, principal in charge; Tomoyoshi Fukunaga, Katsuhiko Nishida, Yuzo Yamanaka, Norio Takata, Toshihide Mori, Kei Mizui, Hirochika Kashima, Kenichi Nakamura, Masaaki Yoshizaki, Kunio Okada, Chizuko Ito, design team; Reiko Tomuro, restaurant interior).*
Client: *Tokyo Metropolitan Government.*
Site: *45,800 sq. m. (11.3 acres) of park land in center of city, previously occupied by gym and pool.*
Program: *10,000-seat arena, indoor pool with seating for 900, sub-arena, and various support facilities; total floor area: 43,971 sq m (473,315 sq ft).*
Structural system: *reinforced concrete, lower portions; steel frame.*
Major materials: *exposed concrete, ceramic tile, stainless steel roofing.*
Mechanical system: *gas-fired heater/chiller.*
Consultants: *Equipe Espace, landscape; Toshihiko Kimura Structural Engineers, structure; Sogo Consultants, mechanical; Fujie Atelier, furniture; NHK Engineering Services and Yamaha, acoustics.*
General contractor: *joint venture of Shimizu, Tokyu, Konoike, Dai-Nippon, Katsumura, and Ogawa.*
Cost: *about $146 million.*
Photos: *Toshiharu Kitajima, except as noted.*



SUB-ARENA CROSS SECTION

1

2



SWIMMING POOL CROSS SECTION

3

4

Maki's Latest: American Views

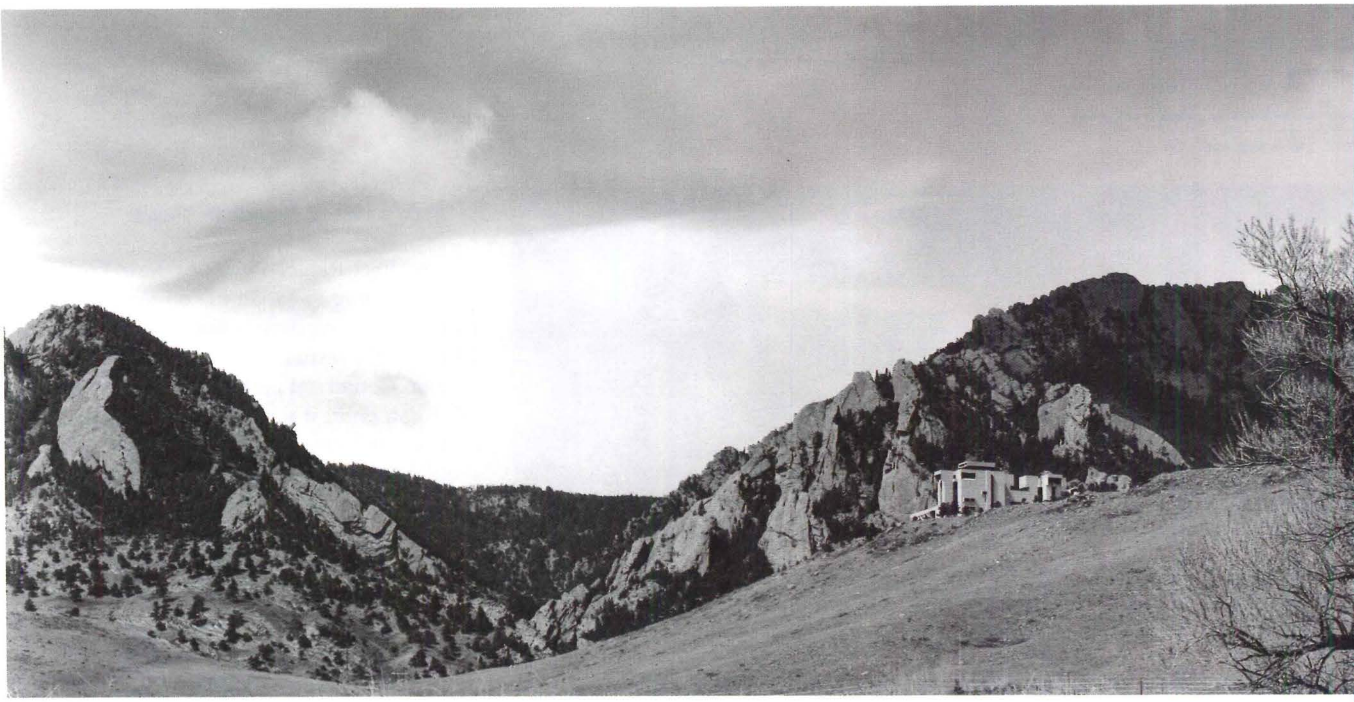
Architect Rafael Viñoly of New York, who has been traveling to Japan in connection with his competition-winning Tokyo Forum scheme (P/A, Jan. 1980, p. 27) responds enthusiastically to the Convention Center. "The building floats! It resolves itself in an endless dialogue between the roof and the architectural elements that make its scale understandable." And the quality of the construction, Viñoly observes, "is almost magic."

Boston architect Andrea Leers, who has visited almost all of Maki's buildings, finds the latest ones "certainly freer, more expressive, more intuitive than anything he has done so far," but they also maintain the virtues of earlier work. From Japanese tradition, she believes comes his celebration of construction and materials. ("In traditional architecture, it was the warmth and glow of wood, and in Maki's architecture it is the shimmering quality of metal, but it's the very same sensibility.") From his education in the West, she hypothesizes, comes "a feeling of effortless planning, an absolutely sure arrangement of parts—and beautiful spaces, satisfying, gracious to use." She is also pleased to find in these works familiar Maki devices such as the "stair promenade," and partially transparent screens.

On the whole, Leers observes, Maki's work belongs to the aristocratic tradition of "refinement and subtle appreciation" associated historically with Japanese palaces. The opposing (but related) ascetic tradition of the teahouse is exemplified in buildings by Tadao Ando (P/A, February 1990, pp. 83–97).

In his introduction to these buildings (p. 74), Hiroshi Watanabe speaks of Maki's rejection of the megastructure concept, even for complexes of such size. My own observation, visiting these sites, is that he goes beyond that to resist any arbitrary formal consistency. In a non-dogmatic way, he lets the varied parts of these complexes take their own forms. In both projects, he has used the occasion of long-span spaces to develop steel-clad roof constructions similar in spirit to the great helmet of his Fujisawa gym (P/A, June 1985, p. 71–80) – though the actual structural systems vary. In more finished interior spaces, such as those of the conference center in the convention complex, he introduces frankly ornamental devices similar to those in his Spiral buildling (P/A, April 1986, pp. 87–95). Maki has allowed these two complexes to become fragments of city fabric, with all the variety that implies. **John Morris Dixon** ■

Image Building



1

Architectural photography has come to define how we see buildings and increasingly how we design them.

Architecture has become inseparable from the photography of it. We know most buildings through the photography that appears in books and magazines. And even when we visit noted buildings, we can't help being affected by the photos we have seen of them. As in so many other areas of our social and political life, images often seem more real than the things themselves. Buildings have begun to merge with their likenesses.

This might not be a concern were it not for the sameness of so much architectural photography. "Most of us work in a similar way," says photographer Tim Street-Porter. "There is a predictability to what we produce." That is not to say that such photography is dull; on the contrary, the best architectural photographers are able to find enticing compositions and dramatic views of even mediocre buildings. But architectural photography does follow a fairly strict set of conventions. What those conventions are, why they exist, and what effect they have on the way we think about architecture are all questions that have received little attention within the architectural profession, which serves as the primary client group for this photography, or in the architectural press, itself the major outlet for this work.

Art or Journalism

Architectural photography has wavered in this century between two poles – the expressive "artistic" tradition of Alfred Stieglitz and the clear-sighted documentary approach of Walker Evans. Those two positions have shaped the way photographers define their craft – as art or journalism. They have affected the way photographs are composed – emphasizing either perspective or elevation, as Cervin Robinson puts it in his excellent book *Architecture Transformed.* And they have influenced the debate over the merits of color versus black and white photography.

There may not seem much to that debate, given the almost universal use of color photography in today's magazine features, client presentations, and marketing brochures. The debate continues, however, because it is central to the question of what architectural photography has become and what it should be. Cervin Robinson has suggested that the rise of color photography has revived an earlier preoccupation among architectural photographers with the expressive possibilities of light. The move from black and white to color, in other words, has represented a shift away from the Walker Evans tradition back to that of Stieglitz.

Balthazar Korab

2

If that is true, then it is a change that seems forced on many photographers. Many still shoot buildings in black and white as well as in color, the former for use in press releases and newspaper stories. And many photographers echo the comment of Julius Shulman that "black and whites are more dramatic," while "color only adds a veneer, a false surface to the photograph."

The common view among photographers is that the magazines were pushed by advertisers to use color photography, but that is strongly disputed by editors. P/A's editor, John Morris Dixon, who witnessed the shift from black and white to color photography in the magazines, argues that "it was the editors, not the advertisers, who pushed for more color photography because it gives more information about buildings."

Whatever the reasons for the widespread use of color photography, it has burdened photographers with many technical problems. Because of its difficulty, "color photography," says photographer Steven Rosenthal, "separates the men from the boys." To compensate for the mix of artificial light sources in buildings, photographers, says Rosenthal, "must make double and triple exposures, filtering each source separately."

This has several ramifications. For example, the convention in architectural photography of not showing people is partly the result of this time-consuming, multiple-exposure process and of the relatively slow speed of the color film typically used in large format, 4x5 cameras. "You either have to pose people," says photographer Norman McGrath, "which is difficult to make look natural, or you end up with blurred images as people move, which can look artful or messy." The frequent bracketing of color photography, where the same view is taken at various exposures, also works against the inclusion of people. "The chances that the best exposure is also the one with the best pose of people becomes small," says Cervin Robinson.

This convention of uninhabited spaces also reflects a desire to not date photos by fashions in clothing and to keep the viewer's attention focused on the architecture. "If people look unnatural or odd in any way," says Norman McGrath, "your eye is immediately drawn to them." People are mainly needed, say many photographers, to give scale to a particularly scaleless building or to give some life to large public spaces, such as airports or shopping malls.

The widespread use of color photography has

Architectural photography embraces both romantic and classical ideals. In Ezra Stoller's photograph of I.M. Pei's Center for Atmospheric Research (1), the asymmetrical composition, the dominance of nature, and the strong side lighting of the building are all characteristic of Romanticism. In contrast, Balthazar Korab's photograph of Louis Kahn's Salk Institute (2) represents a classical sensibility, with its symmetrical composition, frontal view, and architectural framing of nature.

Cervin Robinson

3

A tradition more specifically that of architectural photography emerged in the early 20th Century with the atmospheric, pictorial approach of Alfred Stieglitz and the clear-sighted, documentary approach of Walker Evans. Cervin Robinson, who was Evans's assistant, carries on that tradition in his photo of Louis Sullivan's Merchants National Bank (3), which is shown in elevation and whose monumentality is juxtaposed to the ordinary elements of the streetscape. Christian Korab's depiction of Cesar Pelli's Norwest Center (4) recalls the Stieglitz tradition, showing the building disappearing into the fog.

affected architectural photography in a more profound way, however. Solving the technical problems of color photography takes so much time and attention, notes Robinson, that the diversity of expression tends to get lost. "You can appreciate the skill of many photographers today," he says, "but there are not as many individual voices." Others agree with this sentiment. "Because of all this technical activity," says Steven Rosenthal, "we are working too much with our left brain and not enough with our right." But some see the lack of diversity in architectural photography as inherent in the genre. "Its the nature of shooting large static objects," says Tim Street-Porter. "The expressive possibilities are just not as great as they are, say, in fashion photography or portraiture."

The fault may lie not with color photography or even with architecture but with the demands placed on commercial photographers to document buildings completely. Where documentation is not at stake, architecture has proven to be a powerful subject for photography. Witness the high quality of the images premiated each year in the AIA's photography competition, the arresting architectural abstractions of art photographer Judith Turner, or even the results when commercial photographers are freed from documentation, such as Cervin Robinson's recent series of architectural photographs commissioned by the Cleveland Museum of Art for its collection. "Architecture has come into its own as a subject for photographers," says Judith Turner, "and it deserves to."

Architectural photography, as a fine art, has reinvigorated black and white work. "If you are doing archival-quality photography," says Turner, "it must be black and white. Color fades." Another force favoring black and white are the small-circulation architectural journals that have arisen in recent years, which almost never print color photographs. Black and white images are beginning to be seen as more serious. Also, "in a sea of color," says Cervin Robinson, "black and white is now the way to grab people's attention."

Architecture Versus Interiors

The legacy of Stieglitz and Evans is perhaps most clearly seen in the difference between what photo editor William Nabors calls "interior" and "architectural" photography. "Interior photography," he says, referring to the work that often appears in the consumer interior magazines, "is warm and cozy. It strives for atmosphere and loves diagonal composi-


Christian Korab

4

Paul Warchol

5

John Hall

6

The difference between architectural and interiors photography is apparent in Paul Warchol's (5) and John Hall's (6) varied interpretations of this New York apartment by Wayne Berg. Warchol's photos are primarily spatial, with furnishings playing a secondary role, while Hall's shots focus on the objects in the room and give little information about the space they stand in.

The handling of light remains one of the main differences between black and white and color photography. As Julius Shulman's photo of an A. Quincy Jones house shows (7), the main challenge of black and white work is balancing interior and exterior lighting conditions. In color photography, as indicated in Steve Rosenthal's photo of Cambridge Seven's National Aquarium (8), compensating for the color temperatures of various light sources is the problem (see Technics Topics, pp. 55–59).

tions." In contrast, architectural photography, such as that in the trade press, "is more abstract, classicizing, and axial in composition."

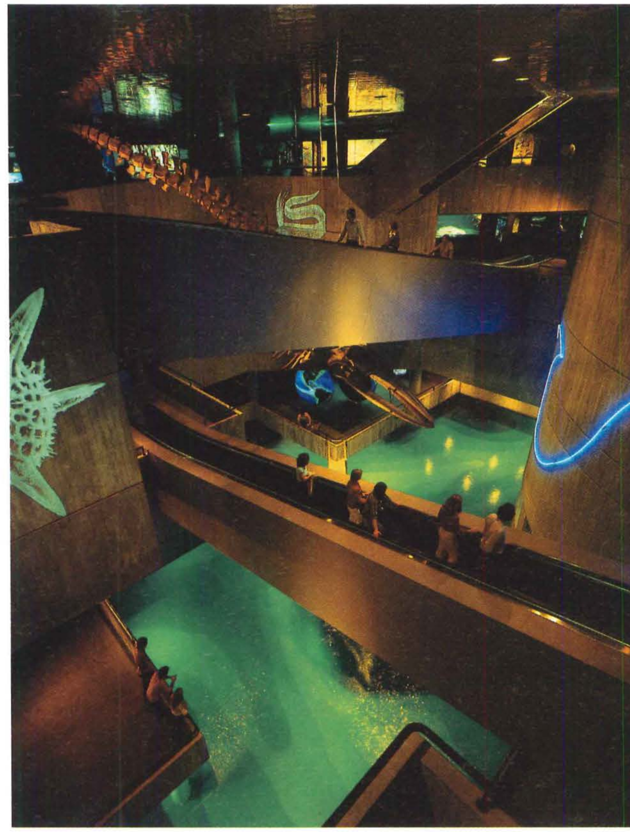
Such a distinction is not hard and fast. The consumer magazines do show images that are not cozy or tightly cropped, just as the trade press includes photos that are detail views or that have diagonal compositions. Still, the distinction is useful because it defines two very different intentions.

There is quite a range within interior photography, from the contrived lighting and overstuffed compositions of Jamie Ardilles-Arce to the clearly lighted, narrowly framed vignettes of Lizzie Himmel. What such photography has in common is its focus on the objects – the furnishings and fabrics – within a room; the effect is almost claustrophobic. Consumer magazines like this work, claims Nabors, because it helps them "to sell stuff," while lay readers, he says, like the "voyeuristic" aspects of the photos. "The growth of these magazines in this decade," he adds, "is a mirror of our rampant consumerism. Their rise was absolutely consistent with American culture in the 1980s."

Architectural photography seems to pursue different, although perhaps no less self-interested ends. While its main intent is to capture the form and space of buildings, it often has, as its subscript, the selling of an architect's work. Some photographers are quite blunt about this. "We're selling architecture," says Julius Shulman. "Our role is to convey the architect's ideas," says Ezra Stoller, "even if we're not sympathetic to them."

Techniques opposite to those of interior photography are often used to convey architectural ideas. For example, the wide-angle lense is a common tool of architectural photographers because it allows them to capture the full breadth of a building's exterior or the complex spatial qualities of its interior. "There is no way," says Steven Rosenthal "to capture architectural space, the sequence of spaces, and how they relate to each other without a wide angle lense." But most photographers recommend caution in its use. "Extreme wide angle views," says Julius Shulman, "can distort or misrepresent a building, making it appear smaller and more objectlike on the outside and larger on the inside." Such distortions, Ezra Stoller says, are the sign of an inexperienced photographer. "Starting photographers, out of a sense of insecurity, often use the widest lense possible to get as much in the photo as they can." *(continued on page 94)*

7



Steve Rosenthal

8

Commissioning Photographers

The best way to find a photographer is perhaps the most obvious: Look for photographs you like. "We look at photo credits in the magazines," says Barbara McCarthy of Gensler Associates, "and are continually building a list of photographers in various regions." Reviewing the portfolios of photographers and seeking out the recommendations of other architects and designers are also effective.

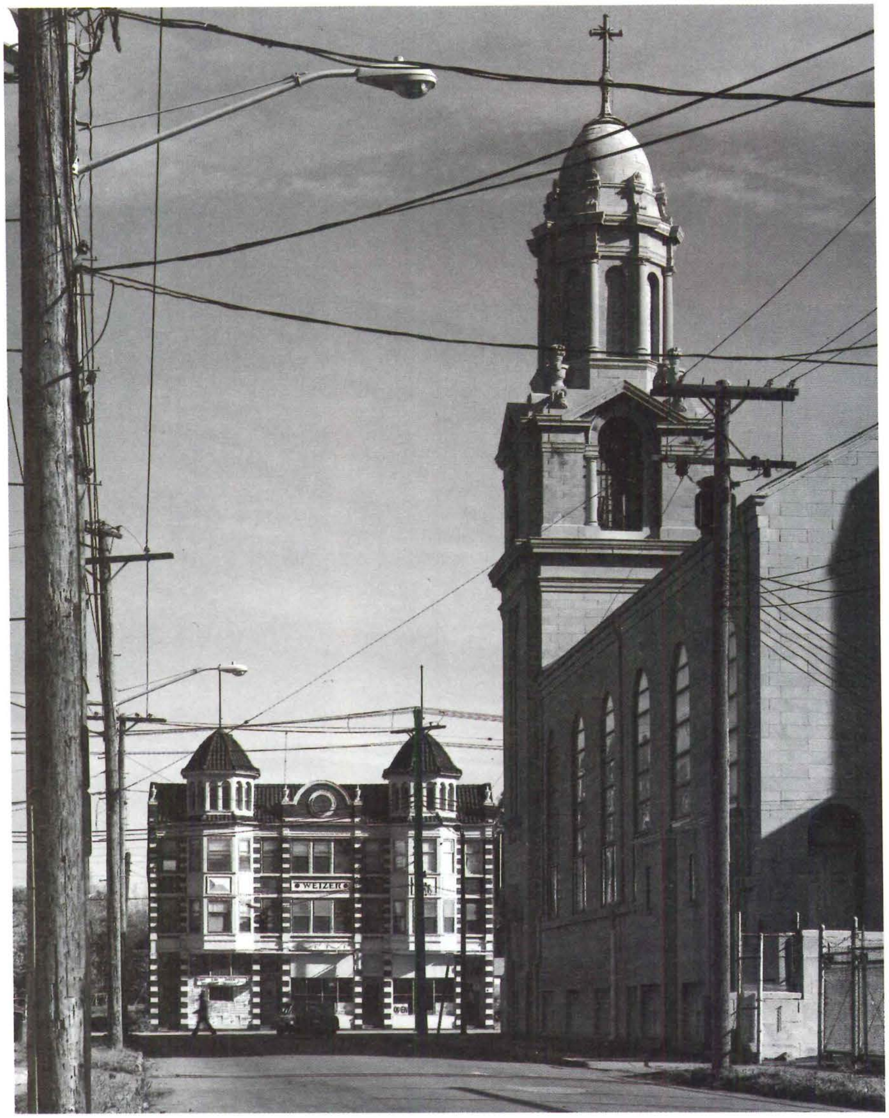
Once a photographer agrees to shoot a project, there is a lot of preparatory work needed on the part of the architect. A list prepared by Esto Photographics includes such questions as: Is construction complete, landscape complete, and all debris removed? Are the fountains working, the flags up, and the windows clean? Have clients and tenants been notified? Is there access to the interiors during the day or only at night? What lights are available? Are there nearby buildings to shoot from?

Perhaps the most important preliminary step for the architect is to walk through the building with the photographer, describing the ideas and goals behind the project, pointing out the better views and those areas of the building to be avoided, and discussing what is expected from the shoot. "It is important that architects treat the photographer as a colleague," says Erica Stoller of Esto. The intended use of the photography also should be communicated at that time. "If you're going to use the photos mainly for marketing purposes," notes Barbara McCarthy, "then documenting the building is most important. If you want to use them to get published, then more dramatic, more spatial shots should be taken." Good photographers, of course, can do both.

Many firms have a staff member accompany the photographer during the shoot to arrange access to the building, even though most photographers have their own assistants to help carry equipment and set up a shot.

The act of shooting a building is a slow process. Photographers working with color film typically shoot three to four interiors or six to seven exteriors in a day. Although dollar amounts vary considerably, fees range from $1000 to $2000 per day plus travel, hotel, and materials costs. Beginning photographers may even be willing to shoot a project on spec for much less money. Time spent waiting for the weather to change is often billed at half the daily rate.

The American Society of Magazine Photographers has suggested standard contract language. Most photographers retain copyright and ownership of the photos. Rights are typically granted to architects and the building client for publicity purposes – presentations, brochures, press releases, magazines – with the caveat that the photographer be credited. If a shoot was done for a very low fee, the photographer may charge the architect for all residual use of the images. Magazines usually pay photographers "use fees" and museums often pay "exhibition fees" that are somewhat lower. "It is essential that you determine the extent of the rights up front," says Barbara McCarthy, "and to let photographers know of any limitations imposed by the building owner on the release of photos." And one final caution: Never lose transparencies. As the above shows, they are precious commodities. ■



Cervin Robinson

9

Architecture remains an important subject of fine art photography (see P/A, July 1990, p. 23). Cervin Robinson's commissioned work for the Cleveland Museum of Art (9) questions the idealization and reductivism of much architectural photography. In contrast, the glowing abstract photographs of Fumihiko Maki's Tepia Buildings by Judith Turner (10) are about as reduced as one can get, while the soft sepia tones of Steven Brooke's photos of Venice (11) tend to idealize its dense and often gritty fabric.

(continued from page 92)

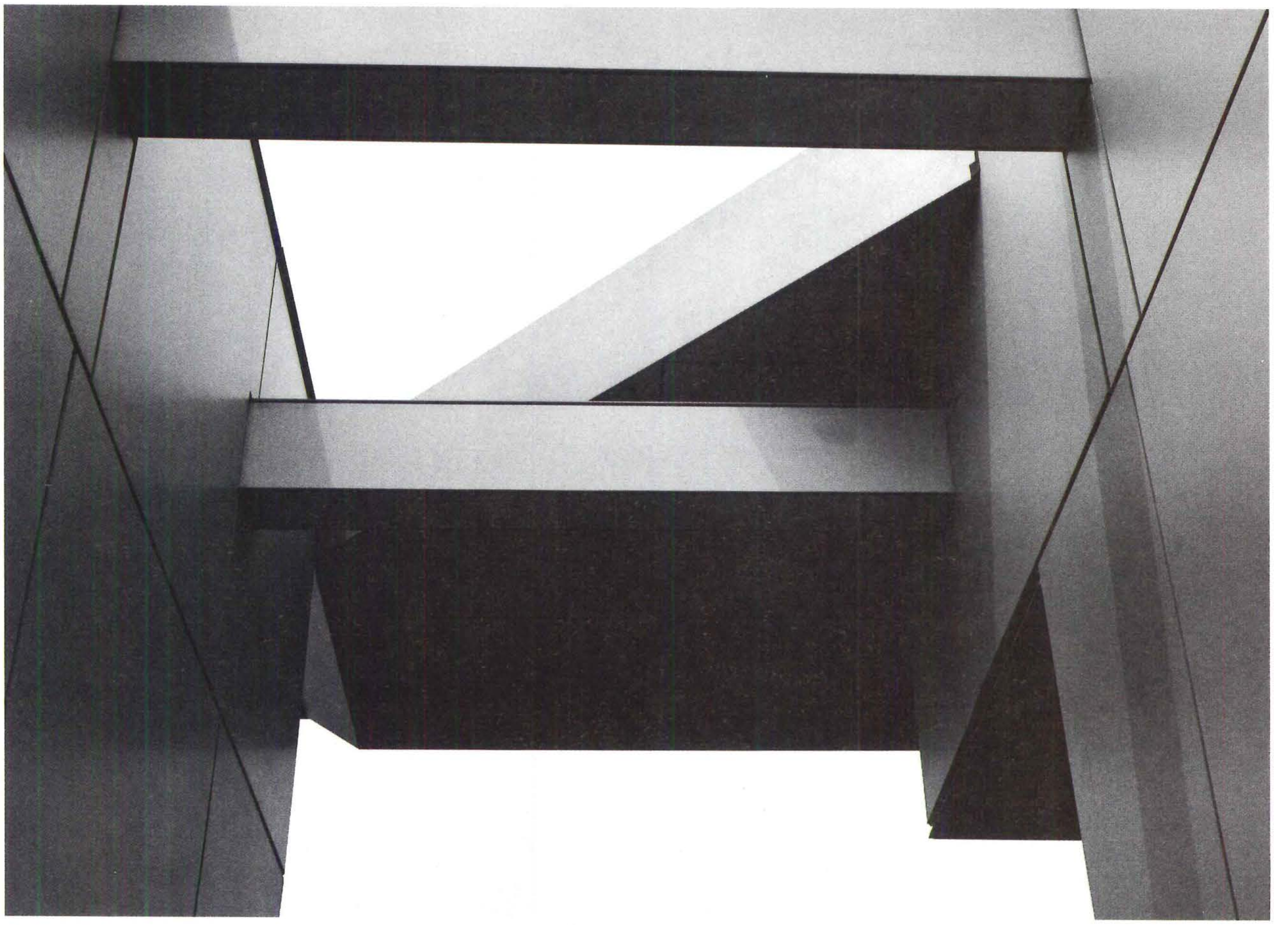
Other distinguishing characteristics of architectural photography include the taking of buildings from odd or elevated angles and the elimination of incompatible furnishings or jarring elements in the building's context. "Most misleading aspects of architectural photography are quite conscious," says Norman McGrath. "By isolating a building from its context or shooting it from high up in a neighboring building, the design can usually be more readily evaluated." The same goal underlies the removal of inappropriate furnishings or objects in a space. "You want to get close to the architect's perception of a space," adds McGrath, "not necessarily close to the reality."

Architectural photography, as a result, has essentially remained a Modernist art form. The Post-Modern liking for juxtaposition, contradiction, and the messy vitality of real life seems to have had little impact on the genre. Whether the conservatism of such photography stems from its marketing role or from its growth during the Modern Movement is difficult to say. But it raises a question as to whether some revolutions in the arts are simply incompatible with certain art forms.

The Ethics of Photography

Not all photographers see themselves as primarily aids in the marketing efforts of architects. Steven Brooke, for example, thinks that photographers have an ethical responsibility not to promote bad architecture. "I will not shoot buildings that are irresponsible urbanistically, that wreck neighborhoods, or that are simply ugly. Because architectural photography, in no small way, idealizes buildings, then it becomes a form of promotion." Brooke also suggests that photographers should not be co-opted by architects to avoid certain shots. "We should reserve the right to be critics."

Some photographers see an ethical issue in not misleading viewers by, say retouching photos or using unnatural lighting effects. Others see an issue in their having a degree of independence in shooting a building. Much of this has to do with the relationship between photographers and their clients, be they architects or magazines. Almost all photographers agree that good communication with the client is important but few like having the client second-guessing them during a shoot. "It is good to have the architect with you" during a shoot, says Norman McGrath, but some "can be overbearing, not giving



Judith Turner

10

you enough time to explore things." Put another way: "If I don't see a shot," says Ezra Stoller, "than no amount of talk with the architect will make a difference. My job is to see things the architect never saw."

Tensions in a photographer's relationship with magazines have mainly to do with how photos are treated. "Cropping is not well liked by photographers," says Steven Rosenthal, "especially when the decision is based not on the building, but on the magazine's graphic look." Some photographers and editors are strongly divided on this issue. "I never allow my photos to be cropped," says Judith Turner. Yet, says John Dixon, "It is unrealistic for a photographer to think that all 4x5 images will appear in exactly that proportion."

Who's right or wrong on these issues depends upon whether architectural photography is viewed primarily as art or illustration. If it is an art, than the architect and magazine become more like patrons than clients, paying photographers to interpret buildings as they see fit. It is far more common, however, to view such photography as illustration, guided by the documentation needs of architects and by the layout needs of magazines. Architectural photography, in this light, is much like the architecture that it

Steven Brooke

11

12

Although relatively rare in architectural photography, the human figure does play an important role. The presence of figures can suggest movement or relieve the emptiness of public spaces, as in Balthazar Korab's photo of Mies van der Rohe's National Museum (12). The human figure also can provide needed scale to otherwise scaleless buildings, as in Ezra Stoller's view of SOM's Kitt Peak Observatory (13).

documents – something created out of a number of functional and contextual constraits.

Architecture After Photography

That leads to one last question: How much has photography itself been an influence or constaint on architecture? "The conventional wisdom," says William Nabers, "that photography has contributed to the flattening and simplifying of building façades and details is probably all true." If we know buildings mainly through photographs, than it seems obvious that we would be influenced by the two-dimensional quality of the medium, with its limited tonal range and its poor rendering of certain lighting sources.

There are other effects, however, that may be less obvious but no less significant. For example, the convention in architectural photography of leaving out people or cropping out jarring elements certainly has some effect on what we think looks right in a building and, perhaps, on the balance between formal and functional concerns. Some buildings are quite obviously designed with photography in mind. As Cervin Robinson notes, "Buildings that get published often have clues – details or overall views that photograph well." What is best for the magazines, he adds, "may not always be the best for the client."

We think of architecture in this century having been primarily influenced by such technologies as steel, concrete, and glass. But the technology of photography may end up having the greatest impact of all, if not on the form of buildings, at least on how we view them and, therefore, how we think about them. One could even argue that Modern and Post-Modern architecture, for all of their differences, succeeded in part because of their memorable imagery, powerfully conveyed on the printed page. What we think of as architectural has become what we see as photogenic. **Thomas Fisher** ■

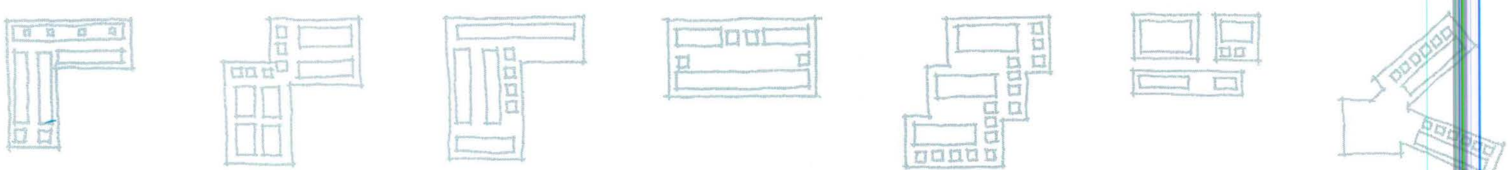
Ezra Stoller

13

Inquiry: Laboratories

Technology may be the first consideration in laboratory design, but it is by no means the only one.

A portfolio of seven buildings surveys the ways architects approach this building type.



Who Gets the Commissions?

A company makes a hefty wager when it builds a laboratory: A pharmaceutical firm, for example, will commit tens of millions of dollars in the hope of producing a single new medication. Deadlines, budgets, and quality control are primary, and aesthetics follows almost every other concern. Architectural beauty means little if a laboratory is inadequate or cannot be adapted for subsequent research programs.

Laboratory commissions go to architectural firms with proven competence in this field, but clients don't rely on portfolios alone. They want to know that principals will be directly involved throughout a project, with a strong team of associates and consultants.

While architectural specialists are designing most of the $2 to $3 billion worth of laboratory construction underway each year (according to Richard R. Rietz's estimate), they're vulnerable to a boom and bust pattern: By the mid 1990s, the present burst of activity will be followed by a dry spell unless a new initiative develops momentum.

Information in this sidebar came from conversations with Dr. Richard R. Rietz, a national laboratory planning consultant, and Duncan Finlayson of CUH2A Architects.

To emend an aphorism of Louis Kahn, we might describe laboratories as buildings that both serve and are served by science. Laboratories are both a means to advance science and the product of modern technology: They often call for state of the art engineering, with special foundations and mechanical systems tailored for sensitive laboratory experiments.

Few buildings are more expressive of the ways Modern architecture has sought the appropriate representation of technology. Today, there is no consensus on how laboratories should look: some are metaphors of the mechanical processes within; others have façades that refer to the context or other building types. The coexistence of both approaches reflects a debate that transcends architecture: Society at large sees science as an integral part of our culture, but people recognize its limitations. We depend on telecommunications, cars, and microchips, but we also sense that our ecosystem is imperiled.

Scientists and architects no longer see technology as the single inspiration for laboratory design. Robert Frasca, at Zimmer Gunsul Frasca Partnership, notes that many researchers' ideal lab "would have the feel of a collegiate Gothic building and the technological sophistication of a space ship. They're happy when a laboratory's technology is invisible, but readily available." James Collins describes a parallel approach at Payette Associates: "After years of building laboratories, we're no longer enthralled by a laboratory's technical wizardry; we're more concerned with creating a safe, humane environment for those who work there, day in and day out."

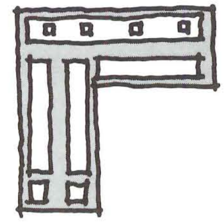
In Kahn's day, laboratories and the scope of architectural design were relatively uncomplicated: A forthright representation of structure and space seemed the most appropriate way to build a laboratory, or most any structure. Today, both scientists and architects prefer laboratories that are more densely layered. They still admire Kahn's precepts but consider them part of a broader package of design issues to resolve. Since Payette Associates and Venturi, Scott Brown & Associates built Princeton's Lewis Thomas Laboratory in 1986, box-like buildings with flat façades that screen machinery have gotten renewed attention in the architectural press; they are an efficient alternative to Kahn's sculptural laboratories.

Many architects still follow Kahn's method closely. John MacAllister of Anshen & Allen finds it an economical way to integrate the utilities within a laboratory and produce a building that synthesizes its functional, spatial, and aesthetic qualities. The engineers at Ove Arup & Partners, consultants on many laboratories, likewise consider technical factors the leading design determinant. Sharlene Silverman, director of the Los Angeles office, sees each laboratory building "as a huge lung" that takes in fresh air to clean the spaces within, and then exhausts dirty air.

The technical and programmatic demands of each laboratory depend on the nature of its research. Dampening the vibrations of footsteps makes it expensive to build acoustics laboratories more than one story tall; chemistry laboratories may require a total change of air every minute. Mechanical systems are by far the costliest components of any laboratory. Standards for the physical safety of researchers are becoming more stringent, as carcinogens in chemicals and hazards in microbiology labs come to light.

As architects refine the complex systems in laboratories, they continue to rely on a concise range of plan diagrams, differentiated according to the relationships between laboratories and offices, circulation routes, and mechanical services. In this portfolio, we present three basic configurations, each illustrated by two or three specific examples, with a planning rationale that is easily traced to program requirements. Correlations with the enclosing envelope, however, defy simple categorization. Here, architects follow a number of design directions; relating science to design aesthetics remains an open issue. **Philip Arcidi** ■

MEDICAL RESEARCH AND LIBRARY BUILDING, INDIANA UNIVERSITY SCHOOL OF MEDICINE

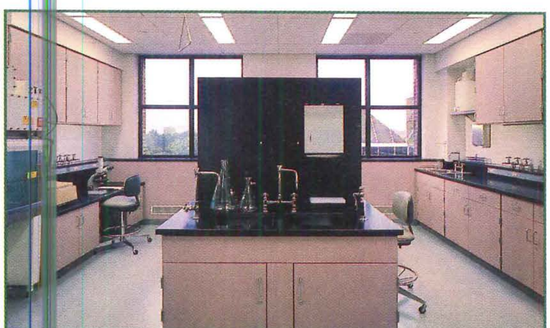


Perpendicular Wings
A Perimeter of Laboratories

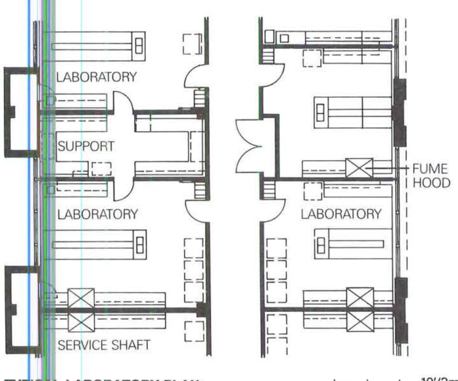
Project: Medical Research and Library Building, Indiana University School of Medicine, Indianapolis.
Architects: Ellerbe Becket, Inc., Minneapolis.
Associated Architects: Boyd/Sobieray Associates, Inc., Indianapolis.

Initially, it seems contradictory to find laboratories with massive brick walls built around a library of glazed pyramids; glass seems more appropriate for a technological program, and libraries are usually clad in masonry. Here, a site planning strategy and a functional rationale guided the selection of materials. Ellerbe Becket designed the laboratory wings as a gatepost that enframes the entry to the medical complex, as well as the library. A masonry enclosure made the building look more substantial and the spaces inside more flexible: Service shafts are incorporated in the brick façade, and the laboratories within (designed on a 30' x 30' module) can be extended laterally without any interfering mechanical services. All laboratories have windows, with offices adjacent for easy access.

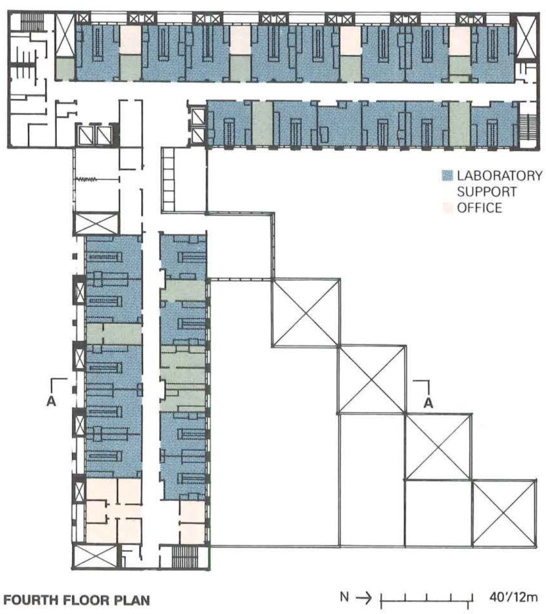
The main entrance, at the junction of the research wings and the library, aligns with a route to the University Hospital; it also provides a vertical link for the entire building: Conference rooms and lounges are stacked on the upper levels, providing a central place for scientists to discuss their work.



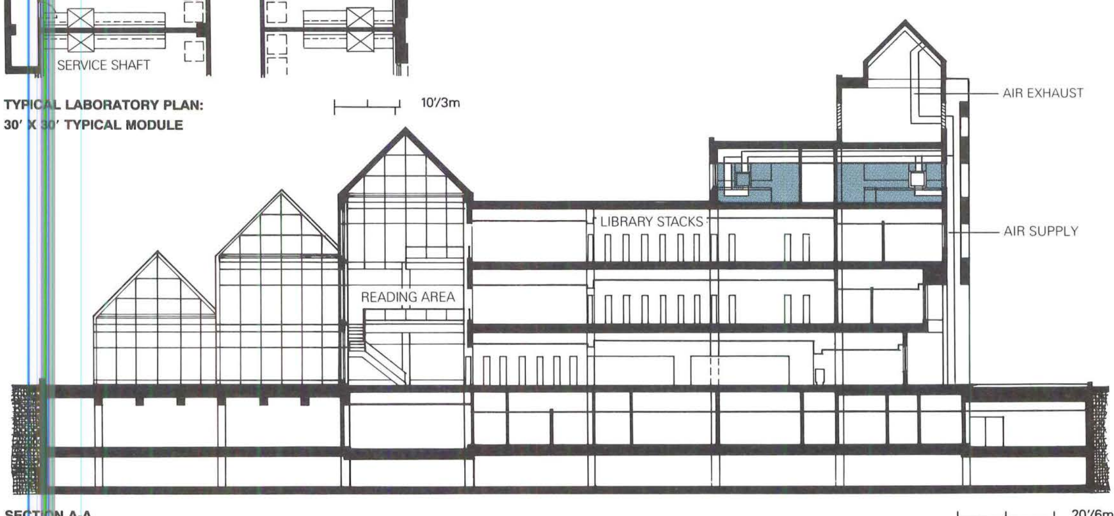
TYPICAL LABORATORY



TYPICAL LABORATORY PLAN:
30' X 30' TYPICAL MODULE

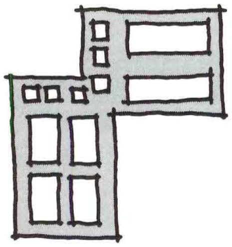


FOURTH FLOOR PLAN



SECTION A-A

Program: *a 214,000-sq-ft building, comprising a library and postdoctoral research facilities.*
Structural system: *cast-in-place reinforced concrete pan and joist floors; steel tube construction for the glazed library towers.*
Photos: *Jim Hedrich/Hedrich Blessing.*



Perpendicular Wings
Two Programs, Two Plans

Project: Chemistry and Biological Sciences Research Laboratory Building, University of California, Los Angeles.
Architects: Anshen & Allen, Los Angeles.

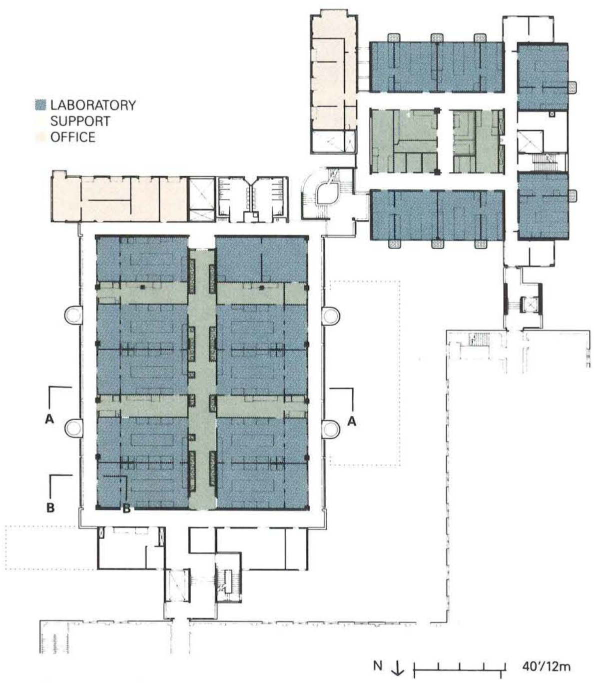
"In laboratory design, chemistry and microbiology are two disciplines that couldn't be farther apart," according to Thomas Chessam, project architect at Anshen & Allen. Microbiologists move between their laboratories and offices frequently; chemists don't. Fume hoods are the controlling factor in chemistry labs, which have the toughest standards for recycling air.

Anshen & Allen follows Kahn's method of integrating the program, structure, and space of a laboratory in a highly sculptural building. Inside and out, service modules are aligned with the ventilating system's machinery and shafts. There are economic dividends to this approach, as well: The building is very efficient, because every element serves multiple functions.

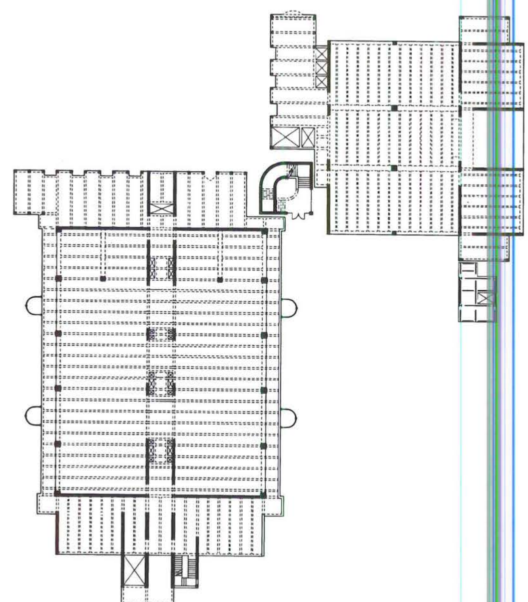
Chessam describes the building's concrete slabs as a mediating material that runs through every floor. The laboratory façades will be enclosed with glass, and the air shafts clad in metal. The concrete slabs are to be screened by panels of sandstone veneer in front of the offices. Here, the façades will have a scale and finish that enhances the building's corner plaza, which adjoins one of the campus walkways.

Program: *a 159,000-sq-ft chemistry and microbiology laboratory.*
Laboratory Planning Consultants: *McLellan & Copenhagen, Inc.*
Structural system: *ribbed concrete slab braced by lateral resisting shear walls.*
Photo: *Mark Loman.*

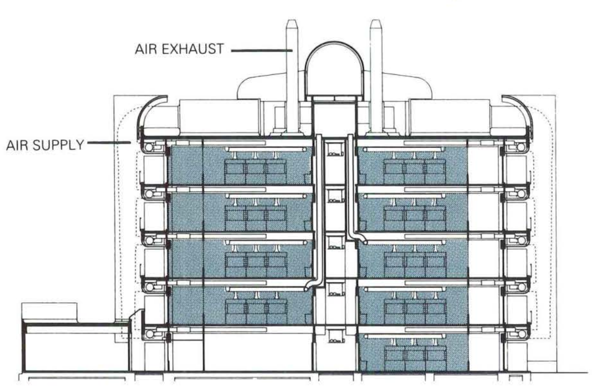
CHEMISTRY AND BIOLOGICAL SCIENCES RESEARCH LABORATORY, UNIVERSITY OF CALIFORNIA, LOS ANGELES



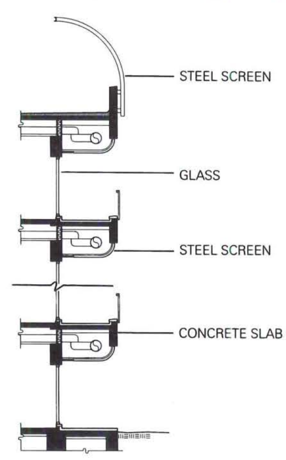
TYPICAL FLOOR PLAN; 11' X 22' CHEMISTRY MODULE; 10'6" X 21' MICROBIOLOGY MODULE



STRUCTURAL PLAN, INDICATING RIBS, COLUMNS, AND SHEAR WALLS



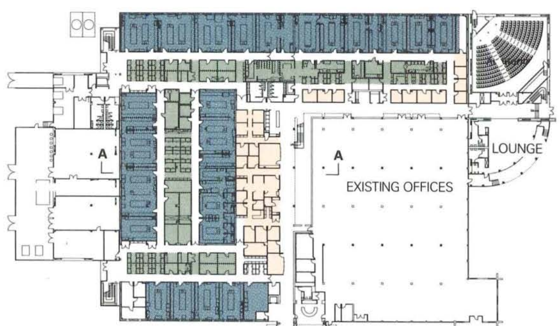
SECTION A-A



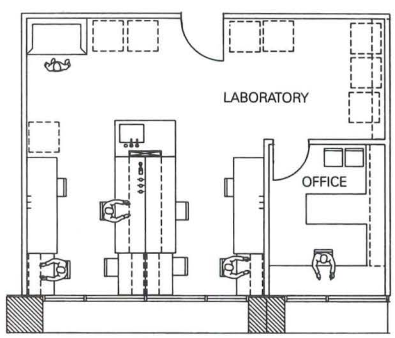
SECTION B-B

GENENTECH BUILDING 5; VIEW OF LOUNGE AND AUDITORIUM

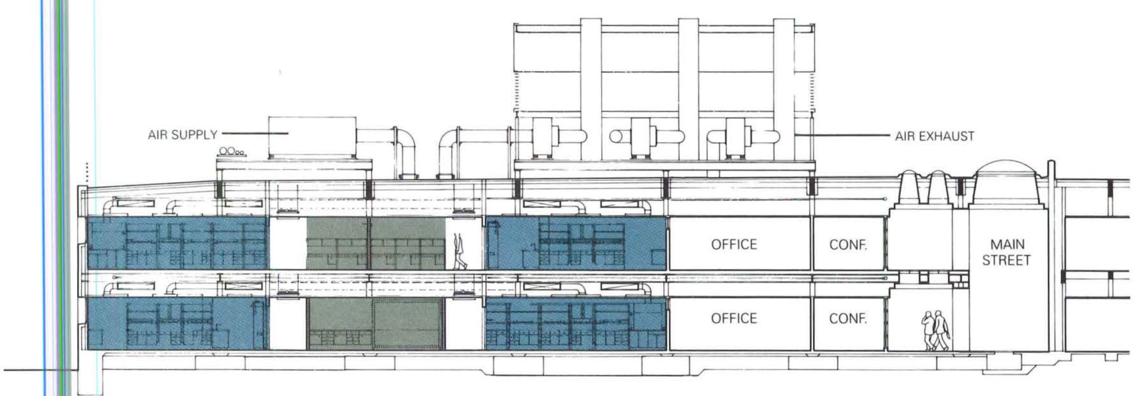
DOUBLE-HEIGHT "MAIN STREET"



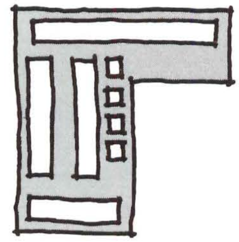
FIRST FLOOR PLAN



TYPICAL LABORATORY PLAN; 30' X 30' MODULE



SECTION A-A; AIR HANDLERS MOUNTED ABOVE EXISTING ROOF ON NEW STEEL FRAME



Perpendicular Wings Warehouse Infill

Project: Genentech Building 5, South San Francisco.

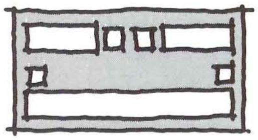
Architects: MBT Associates, San Francisco.

In this retrofit of a tilt-up concrete warehouse, the standard sequence of laboratory design was reversed: The building shell was already in place, with an exceptionally broad floor plate and a cramped floor-to-ceiling dimension. To bring in sunlight, MBT Associates placed two double height, skylighted "main streets" alongside offices that Genentech had already installed in the building; a grid of secondary hallways provides those in the middle of the building a glimpse of distant sunlight cast from windows or the skylights of the interior streets.

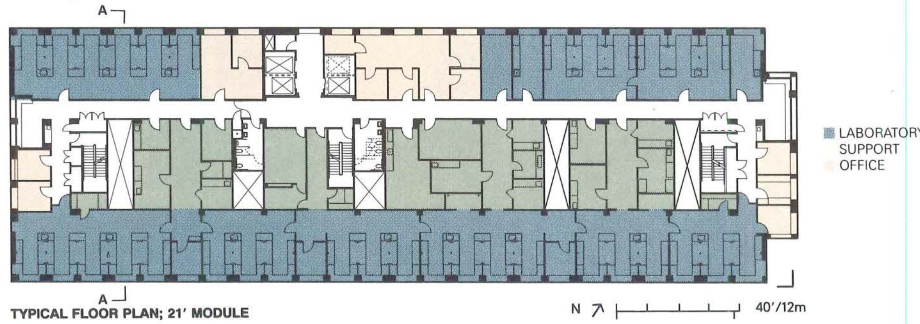
The homogeneous character of the warehouse, despite the mechanical challenges it imposed, proved surprisingly appropriate for the working environment at Genentech, a company that prefers to distribute functions throughout a building, without regard for hierarchy.

Mike Hearn, the project architect, says that this job gave him a new perspective on laboratory design: The minimal corporate structure at Genentech and the lively work environment in Building 5 proved that laboratories can succeed without an intricately predetermined structure. "It threw sophisticated theories out the window."

Program: *rehabilitate and expand a tilt-up concrete warehouse into a 133,000-sq-ft office and laboratory.*
Laboratory Planning Consultants: *Research Facilities Design.*
Structural System: *existing 3 1/2" hardrock concrete slab; reinforced tilt-up concrete walls; new three-inch metal deck.*
Photos: *Jane Lidz, David Wakely.*



CLINICAL RESEARCH BUILDING, SCHOOL OF MEDICINE, UNIVERSITY OF PENNSYLVANIA



TYPICAL FLOOR PLAN; 21' MODULE

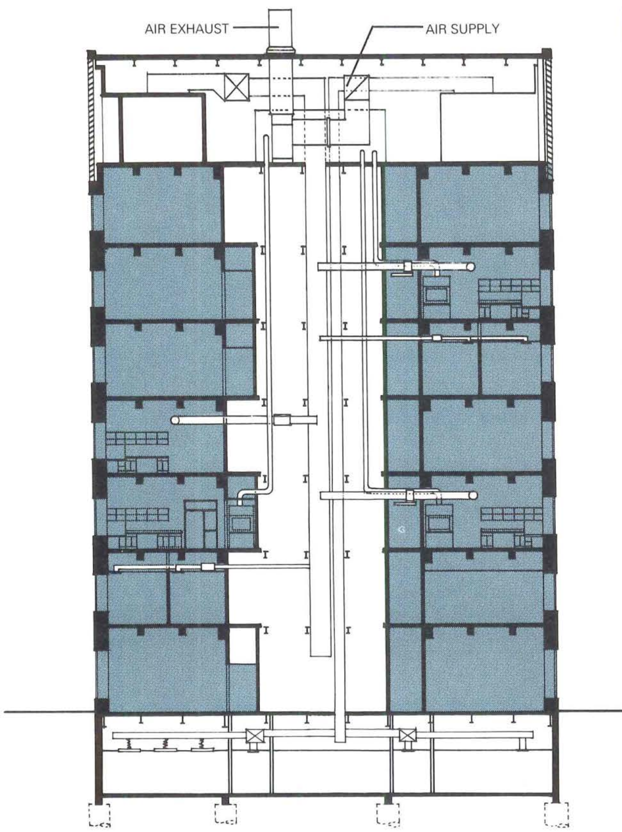
Basic Box Loft-like Rooms

Project: Clinical Research Building, School of Medicine, University of Pennsylvania, Philadelphia.
Architects: Payette Associates, Boston.
Associated Architects: Venturi, Scott Brown & Associates, Philadelphia.

Not far from Kahn's Richards Laboratory, a series of cubes with open floor plans, is a new counterpart that takes cues from tradition – a laboratory of distinct rooms, with facades of mullioned windows and patterned brick, enclosed by a tightly stretched, textured envelope. Payette Associates, responsible for the interior, finds individual rooms more flexible than Kahn's open plan: Scientists want to differentiate offices and laboratories and are more likely to move machines and personnel than knock down partitions. Enclosed rooms made it feasible to juxtapose different research departments on the same floor. The floor plan is both simple and comfortably scaled; here, human factors are more obvious than technical ones.

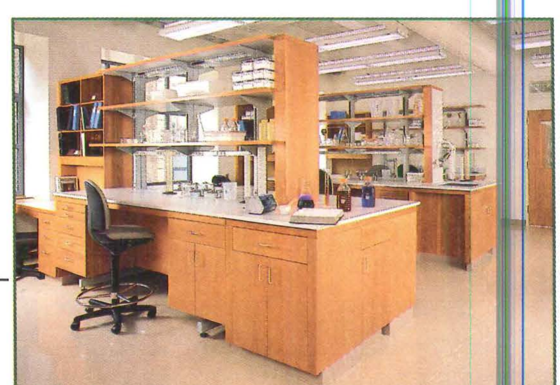
In emulation of 19th-Century mills of New England, Venturi, Scott Brown & Associates clad the exterior with familiar materials, subtly altered in scale and rhythm. At close range, the texture of the brick and the modulation of the windows can be discerned by pedestrians. From the Schuylkill Expressway, which runs nearby, the large academic shield functions as a sign on this decorated shed.

Program: *a 205,000-sq-ft research laboratory shared by ten departments and institutes.*
Structural system: *steel frame and composite slab.*
Photos: *Matt Wargo.*



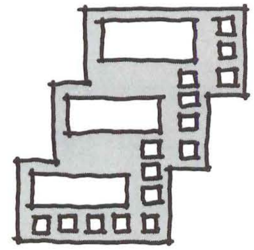
SECTION A-A

TYPICAL LOUNGE



TYPICAL LABORATORY

NATIONAL CENTER FOR PHYSICAL ACOUSTICS, UNIVERSITY OF MISSISSIPPI, OXFORD; ADMINISTRATIVE BUILDING IN FOREGROUND

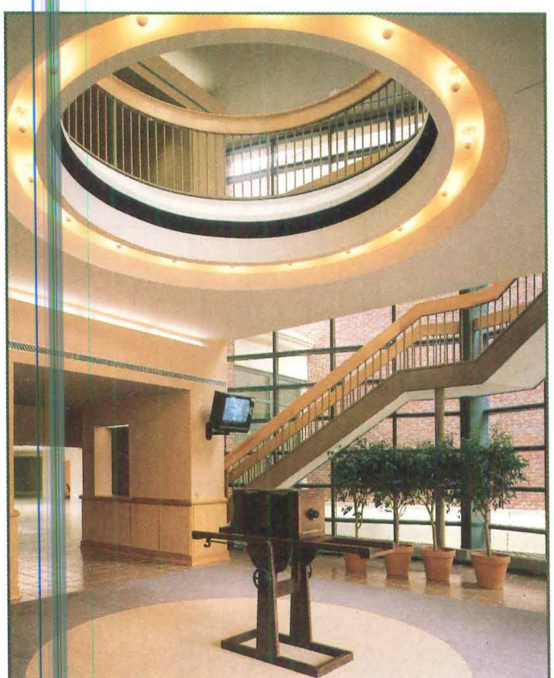


Basic Box
Staggered Alignment

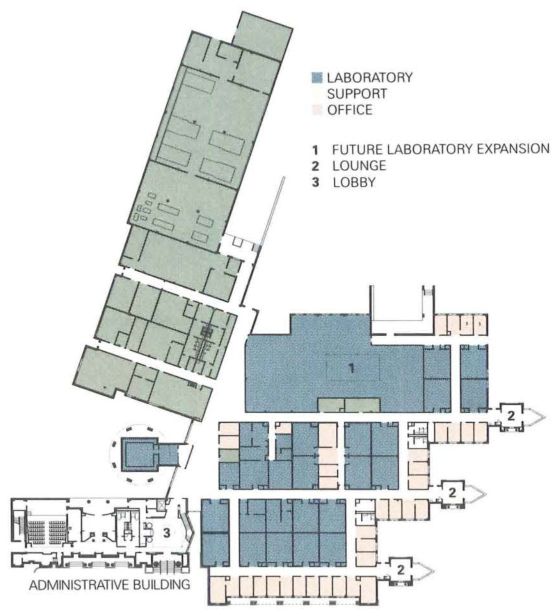
Project: National Center for Physical Acoustics, University of Mississippi, Oxford.
Architects: Haines Lundberg Waehler, New York.
Associated Architects: Mockbee Coker Howorth Architects, Jackson, Mississippi.

Multiplied by three, the box-like diagram provided a convenient structure for physical acoustics laboratories at the University of Mississippi. They comprise a single story, so that no overhead footfalls disturb laboratory equipment, and are built on an exceptionally thick concrete slab. The staggered plan shortens the distance between laboratories, and three adjoining pavilions provide gathering spaces at the end of each long hallway. These small, pedimented structures break up the scale of the contiguous laboratory structure on the northeast elevation, where a new road will soon be built. Like the administrative wing, they use the campus's Classical vocabulary, as requested by the University Chancellor.

Physical acoustics does not call for intricate plumbing and exhaust systems, but conditioned air has to be piped in slowly (so that it makes no background noise) through 42-inch-wide ducts, set below grade. For maximum insulation from vibration, four laboratories are built on floating slabs, mounted on springs that isolate the rooms from vibrations in the surrounding building.

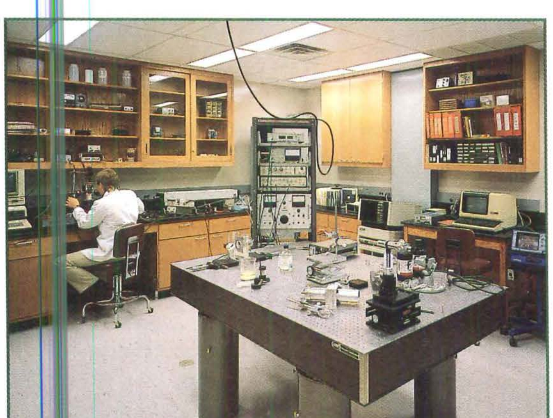


LOBBY, ADMINISTRATIVE BUILDING

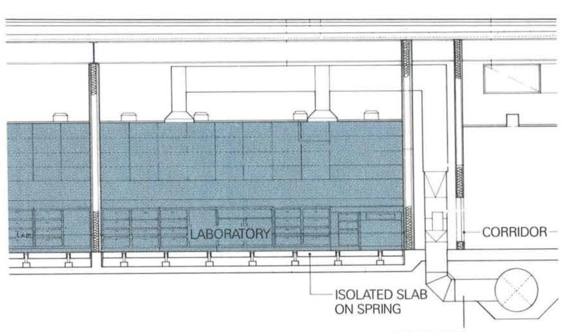


FIRST FLOOR PLAN

N ↗ 100'/30m



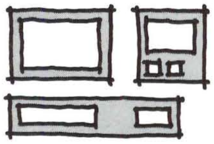
TYPICAL LABORATORY; 20' X 25' MODULE



LABORATORY ON FLOATING SLAB, SECTION

10'/3m

Program: *an 81,600-sq-ft facility with noiseless and vibration-free laboratories.*
Acoustical consultant: *Lewis S. Goodfriend & Associates.*
Structural system: *8-inch slab on grade, steel frame, 5-inch fill on metal deck for roof.*
Photos: *Timothy Hursley.*



Trunk Line Corridor Teaching and Research Space

Project: James L. Knight Physics/Chemistry Building, University of Miami, Coral Gables, Fla.
Architects: Spillis Candela & Partners, Inc., Coral Gables.

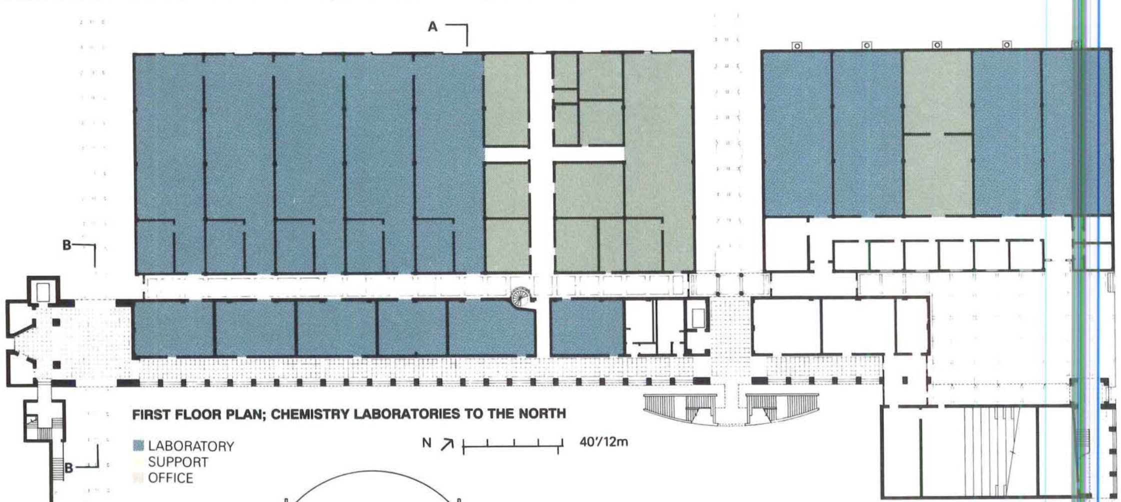
Seen from above, the University of Miami's newest laboratory is as lucid as a parti diagram: Laboratories are set behind a three-story classroom and office building, which provides a monumental wall for a new science quadrangle. The adjacent laboratories have a smaller scale that defers to the suburban context.

The rigorous plan is organized around two parallel axes: A front arcade is lined with undergraduate laboratories, classrooms, and a lecture hall. A glass roof covers the hallway in the rear, which separates the research laboratories from the more heavily used front rooms.

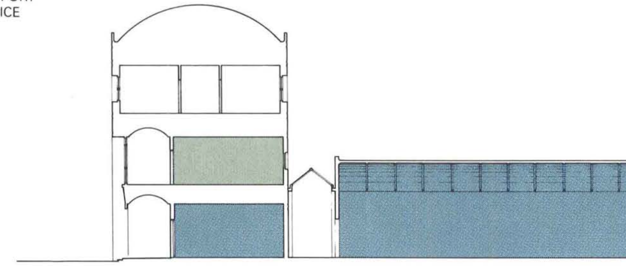
Each physics laboratory has load-bearing walls, with trusses that span the 30′ width; the arced space above holds mechanical equipment. The laboratories are simple shells in which one can maneuver large pieces of machinery. In this building, technical support systems were easily accommodated, and the elementary components of architecture – walls, arcades, and roofs – provide a powerfully reductive image.

Program: *an 80,000-sq-ft building for undergraduates, faculty offices, and graduate research laboratories.*
Structural system: *steel frame in multistory building, load-bearing CMU walls with exposed steel trusses in adjacent laboratories.*
Photo: *Aerial Visions.*

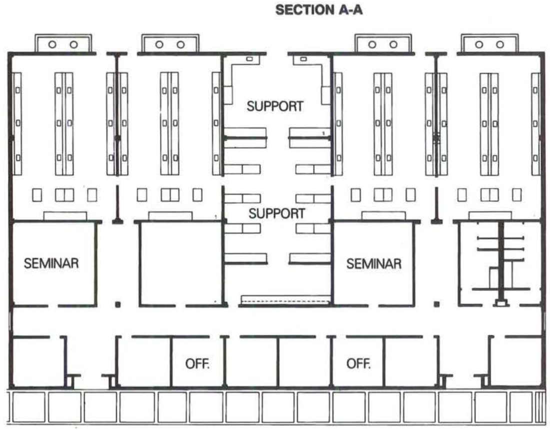
JAMES L. KNIGHT PHYSICS/CHEMISTRY BUILDING, UNIVERSITY OF MIAMI, CORAL GABLES



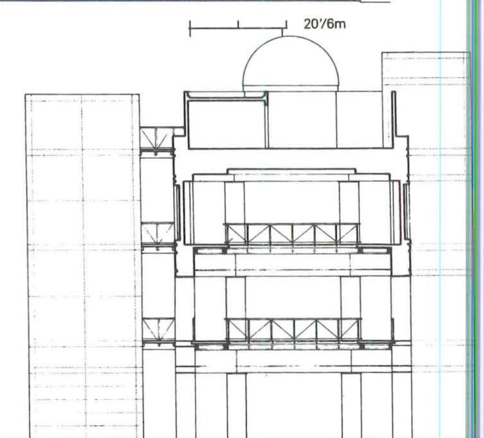
FIRST FLOOR PLAN; CHEMISTRY LABORATORIES TO THE NORTH



SECTION A-A

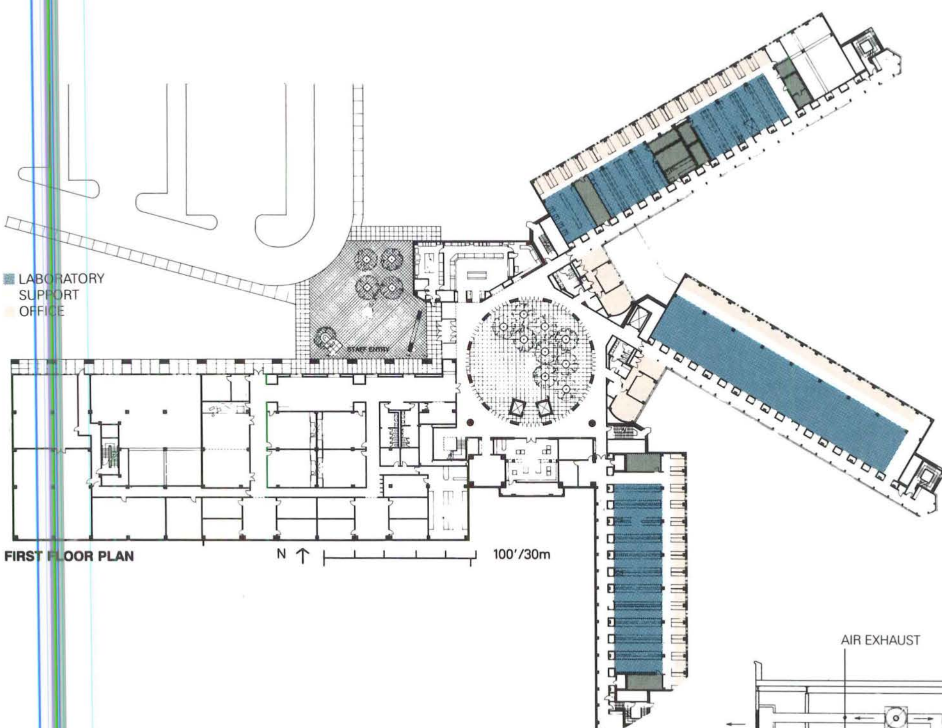


CHEMISTRY LABORATORIES FLOOR PLAN N 40′/12m

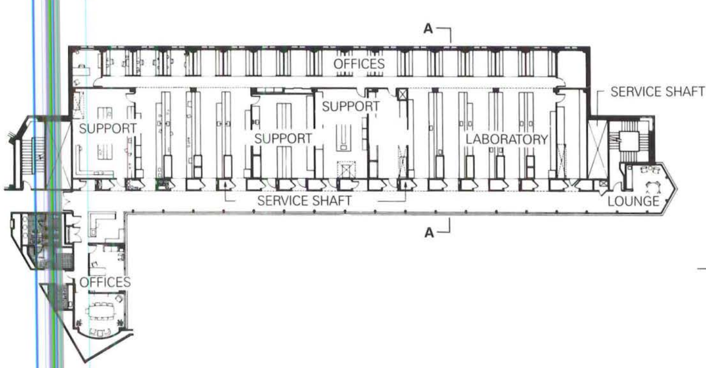


SECTION B-B 20′/6m

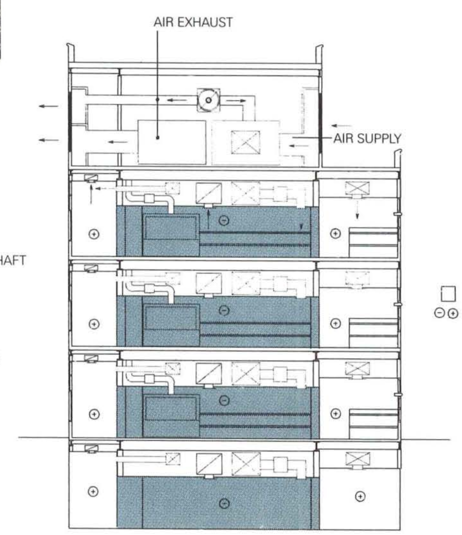
ROBERT M. SCHAEBERLE TECHNOLOGY CENTER, NABISCO BRANDS



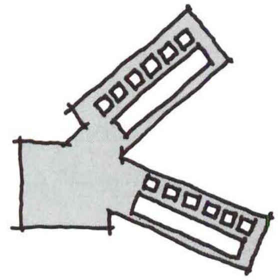
FIRST FLOOR PLAN



TYPICAL LABORATORY WING FLOOR PLAN, 10'-8" MODULE



SECTION A-A



Trunk Line Corridor Radial Plan

Project: Robert M. Schaeberle Technology Center, Nabisco Brands, East Hanover, N.J.

Architects: CUH2A, Princeton, N.J.

This building is a diagram of a corporate union of scientists, engineers, marketers, and management. It was conceived by Michael Landau, the design architect, as an interactive environment that would attract scientists to Nabisco Brands. An atrium anchors the complex, with a pinwheel of laboratories that overlook a bucolic site.

In each wing, a single-loaded corridor provides the main axis, where scientists emerge from the laboratory benches to meet visitors or proceed to conference rooms. Because this is a business setting, where researchers are less autonomous than their academic counterparts, the laboratories (designed for food testing) comprise open banks, flanked by a narrower hallway lined with workstations. Services and air exhaust were simple to resolve – mechanical shafts line the public corridor, and return air ducts occupy the deep plenum above the laboratory benches.

The façades of each laboratory wing are veneered with coated aluminum panels around the laboratories and granite on the workstations' side. Conference rooms are stacked in angled corner bays, whose parapets screen roof-mounted air handlers. On the granite façades, three dark bands align with the lintels of the continuous windows on the aluminum-clad side, and square windows mark the spacing of the workstations.

Program: *a 415,000-sq-ft building for corporate offices and research laboratories.*

Structural system: *composite steel frame with metal deck and concrete fill.*

Photos: *©Wolfgang Hoyt/Esto.*

Discipline and Anarchy

A small school in Paris by Francis Soler, Architect, proves it's possible to be disorderly and still have a wholesome effect on the street.

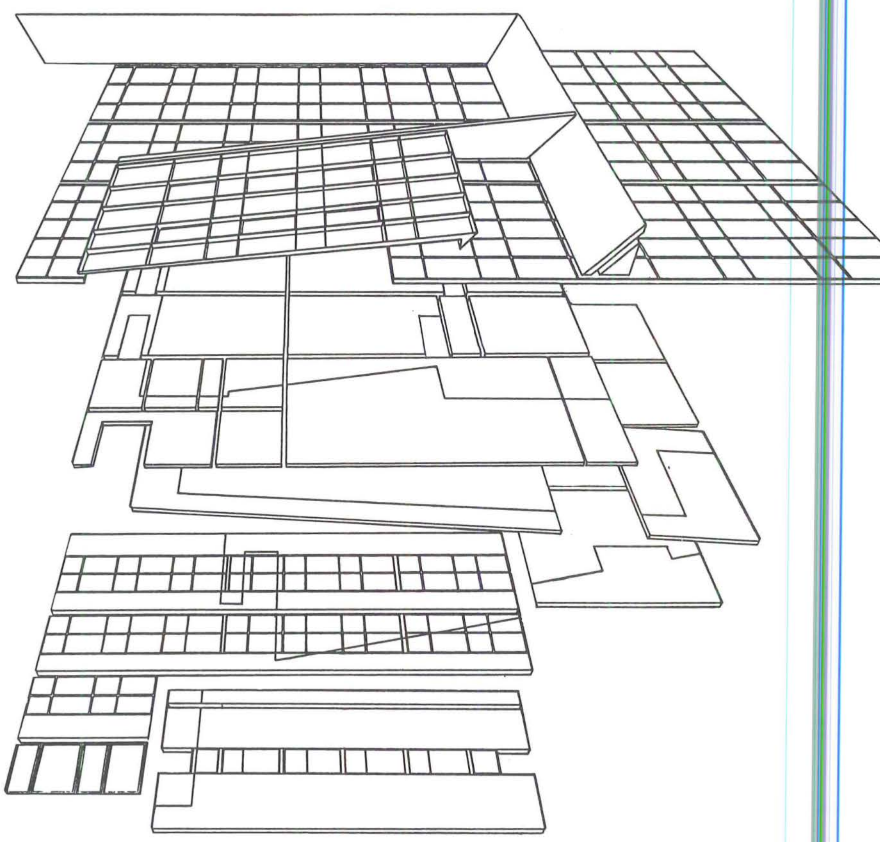
Finally, in the form of a small public building we see a specimen of "fragmented" architecture that strives – and manages – to reconcile disharmony with the need to present a civic front.

Of all the so-called Deconstructivist projects of recent years, few have proposed strategies that are considerate of, or viable in, the urban fabric. Francis Soler's small institutional edifice is unusual in that it does not shirk its public role.

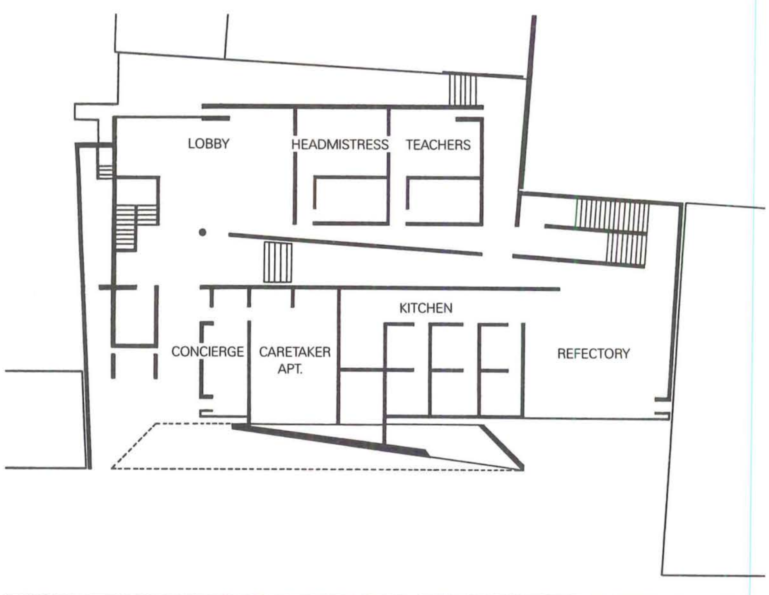
The 14,000-square-foot nursery school is located on a quiet, predominantly residential street in one of Paris's moderate-to-low-income neighborhoods. In addition to classrooms, a small gymnasium, and a refectory, it includes a duplex apartment for the headmistress and a caretaker's flat, programmatic requirements not uncommon to this type in France.

The school's fractured curtain wall façade is a "transposition" of the "inert state" of institutional education and "the exceptional dynamism of the children" who receive it, according to Soler. Since graduating from the École d'Architecture in Paris in 1975 the forty-year-old architect has proceeded through many winning competition schemes to carve himself a niche among France's young builders of small public projects, parks, and housing.

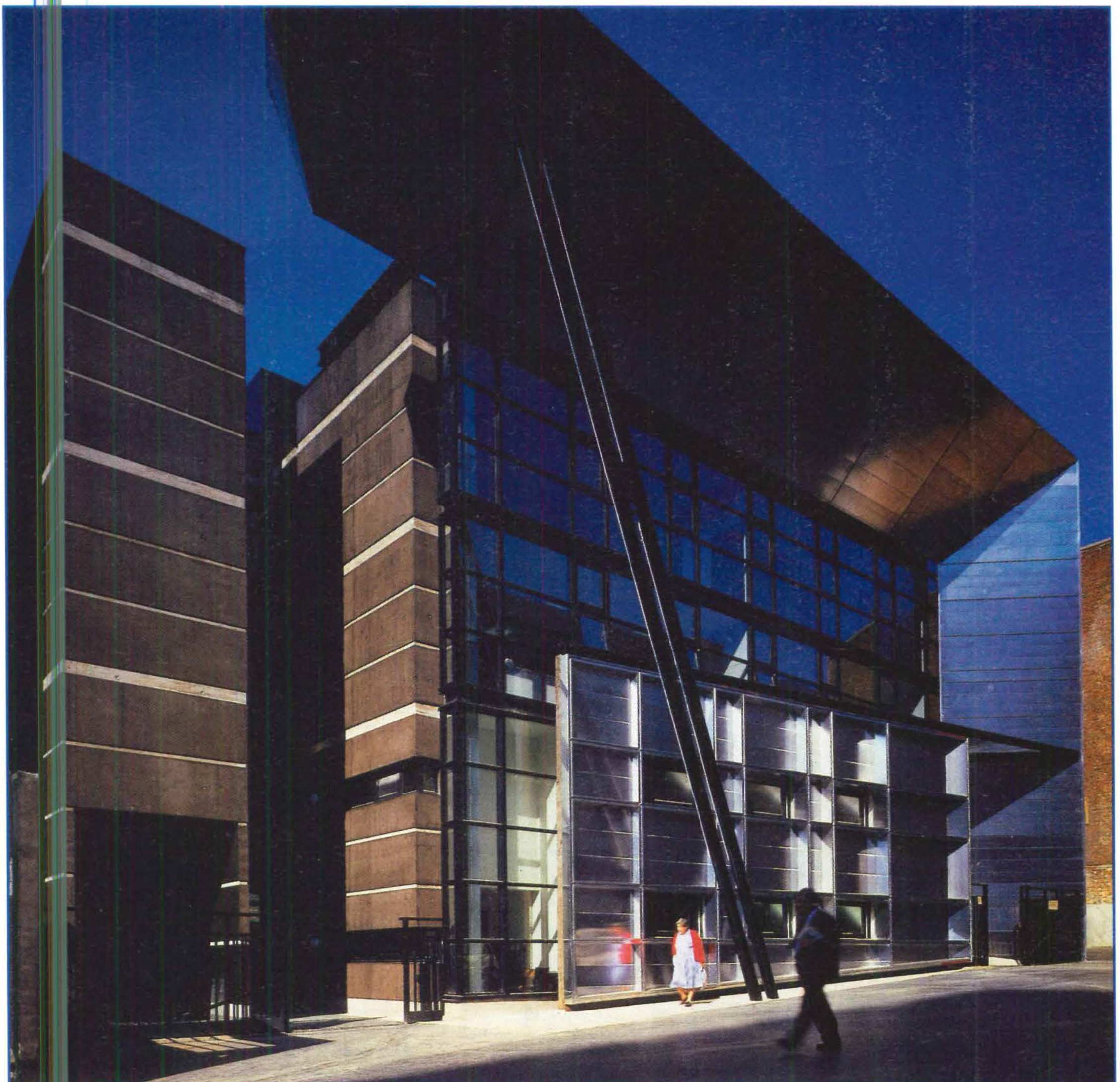
The Pelleport school's façade serves another metaphorical function, "symbolic of the destabilization of pedagogy," Soler explains, "a sign of the times in which we live." Such statements are reminiscent of much of the rhetoric attached to Deconstructivist architecture. Yet Soler has taken care to preserve a benign, and unmistakably public, presence on the street through careful proportioning of the façade's components and through placement of the school's communal functions directly behind it. In this, the architect draws inspiration from Parisian urban traditions in which disparate buildings still contribute to a "coherent" street wall. **Ziva Freiman** ■



WORM'S EYE PERSPECTIVE OF PLANES PARALLEL TO STREET



GROUND FLOOR PLAN



1

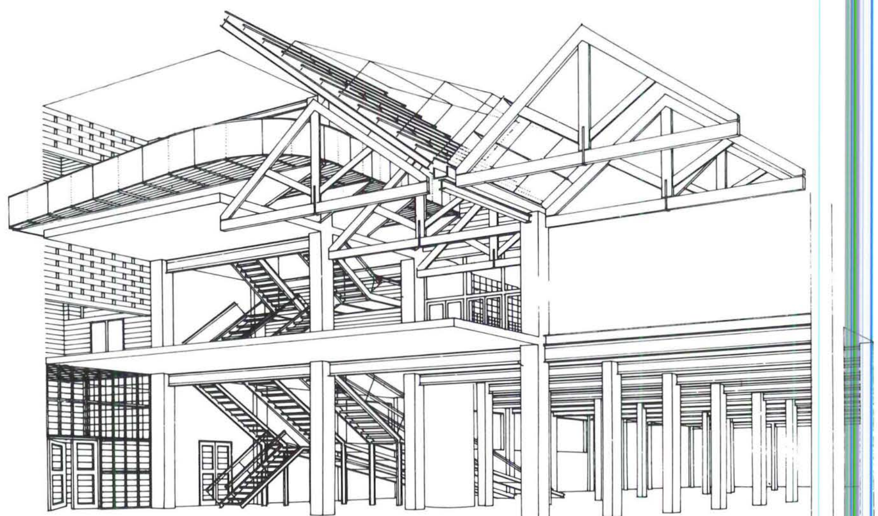
2

The façade of the building is the culmination of a strategy of layered transparent and opaque planes that produced the organization of the floor plan, as shown in the worm's eye perspective on the facing page. The placement of the school refectory on the street, behind a glazed wall, (1) effectively reinforces the school's participation in life on the street. The interiors, represented here by the lobby, (2) are remarkably restrained and quite serene in comparison to the building's forceful front. A local artist was commissioned to erect the lobby's sculptural centerpiece.

Project: *Pelleport School, Paris*
Architects: *Francis Soler, Architect; Alain Le Houedec, project architect.*
Client: *Jean Godfroid, director, Direction de l'Architecture de la Ville de Paris.*
Program: *14,000 sq-ft nursery school with six classrooms, playrooms, restrooms, refectory, headmistress and caretaker apartments.*
Structural system: *reinforced concrete.*
Major materials: *Exterior, varnished concrete; aluminum skin; glazed curtain wall with aluminum profiles, asphalt paving. Interior floors epoxy resin, painted concrete.*
Consultants: *BETOM, structural. General Contractor: Enterprise Toussaint.*
Photos: *Georges Fessy.*

Inclined Planes, Calibrated with Care

A glazed entry façade and stairway, each a composite structure, are the highlights of a high school converted from a factory.



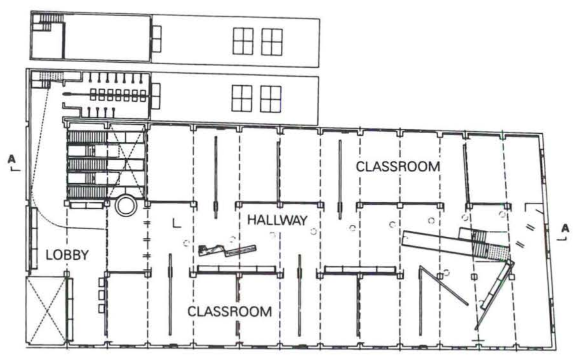
LA LLAUNA SCHOOL, PERSPECTIVE FROM FIRST FLOOR ENTRY

When Enric Miralles & Carme Pinós rehabilitated the La Llauna school, they focused their efforts on strategic interventions – a response to the tight time frame and budget they were given. They built a pair of new structures that tie together the stacked floors of the school: a glazed entry façade and a stairway/ ramp structure. Both are simple forms that handsomely juxtapose the old and the new.

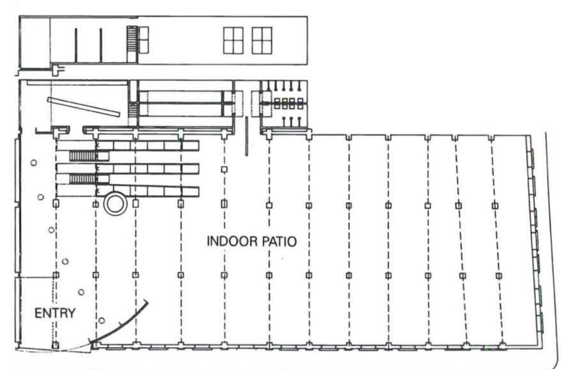
La Llauna's new street façade has large planes of glass that are curved and canted around a masonry pier, which is part of the original structure. The front door is a bowed glass wall that rolls open, and the level above has a bay angled in front of the pier. The topmost level of glass, parallel to the canted bay, is recessed behind the plane of the façade, and frames a view from an upstairs lobby.

Inside, directly ahead of the entrance, is a bank of three stairs that has ramps on the lowest half flight; this enables students to flow directly into the enclosed first floor "patio". From the second floor lobby, the stair looks like a skeletal pedestal for a cantilevered balcony (see perspective above). Like the glass façade, the balcony almost touches the original structure. This close fit (which necessitated an inclined balcony floor) seems to be a deliberate move: It justified the anomalies of the new construction and established correspondences with the original building.

Like other Modernists emerging in Spain, Miralles & Pinós have rediscovered the poetic beauty of architecture that is abstract and tectonically forthright. At the same time, their buildings have an Expressionistic character that evokes Antoni Gaudí and Barcelona's *Modernismo* of a century ago. Miralles & Pinós's elegant fusion of these sources looks deceptively easy: Their architecture is lucid but can't be justified on purely rational terms; it is ordered by a judicious eccentricity. **Philip Arcidi** ■

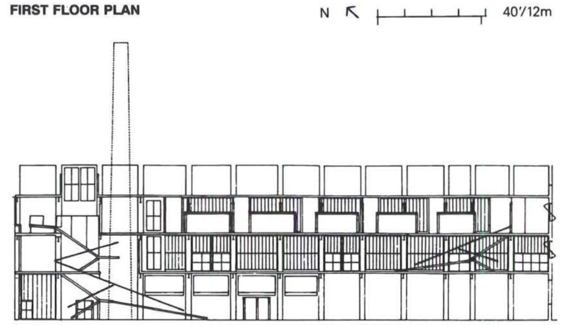


SECOND FLOOR PLAN



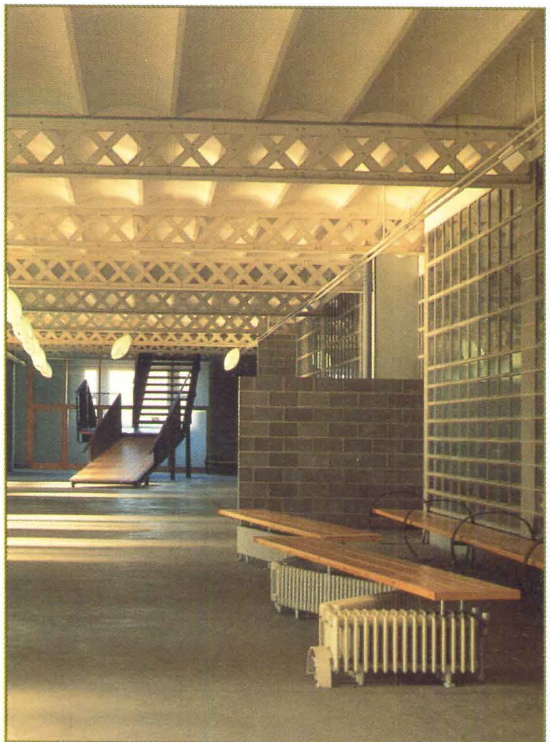
FIRST FLOOR PLAN

N 40'/12m



SECTION A-A

1



2

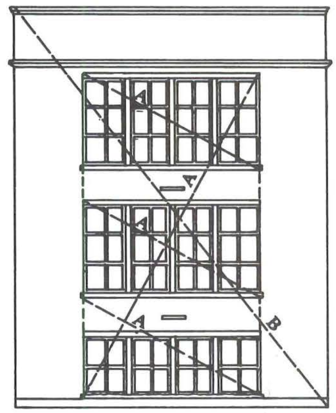
A tripartite glass and steel entry façade maximizes the sunlight and open space available in the high school's crowded neighborhood (1). In the hallway on the second floor (2), rectilinear walls of concrete and glass block are complemented by angular and curved forms. The benches that flank the walls have bowed steel supports; their detailing is minimal but animated by an intuitive sense for modern materials. The main stairway (3) that rises from the first floor to the cantilevered balcony is both industrial and organic in character, with wire mesh, wood, and steel rails juxtaposed against the shallow arches and latticed beams of the factory. The section (opposite page, bottom) shows that some handrails are not parallel to the steps or ramp, a design option restricted in the United States but in compliance with Spanish building codes.

3

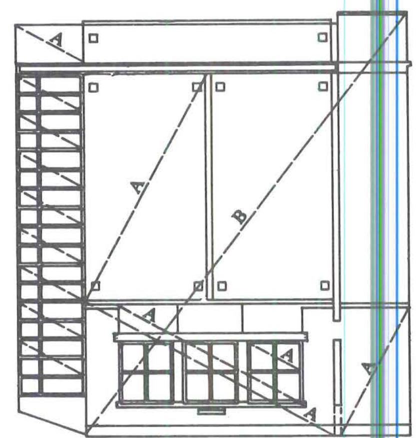
Project: *La Llauna secondary school, Badalona (near Barcelona), Spain.*
Architects: *Enric Miralles & Carme Pinós, Barcelona.*
Client: *City of Badalona.*
Site: *a vacant factory in a crowded industrial district.*
Program: *install a public high school (approx. 54,250 sq ft) within the existing building, with common areas and rooms for classes, seminars, and science laboratories.*
Structural system: *existing steel frame was reinforced and expanded.*
Major materials: *steel and wood ramps, stairs, and balcony; CMU and concrete-enframed glass block partitions.*
Consultants: *Robert Brufau and Agusti Obiol, structural.*
General contractor: *Construcciones Montmelo; Bartolome Castells, builder.*
Photos: *Ferrán Freixa.*

A Lesson in Tectonics

In these additions to an elementary school in Nashua, New Hampshire, Chris Iwerks of TAMS explores various compositional ideas, based upon the logic of plan and structure.



EXISTING BUILDING
TYPICAL CLASSROOM BAY PROPORTIONS



NEW CLASSROOM WING
FACADE PROPORTIONS

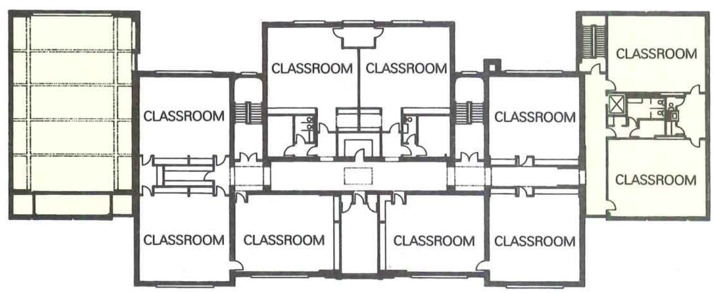
10'/3m

"I am interested in the work of early Modernists such as Behrens and Berlage" says Chris Iwerks. They represent for him a middle ground between those who see architecture as primarily an exercise in composition and those who see it as primarily determined by technology or function. "They were among the last Modernists who argued that composition must dominate, but still be informed by the tectonics of building," says Iwerks. "They never separated architecture and construction."

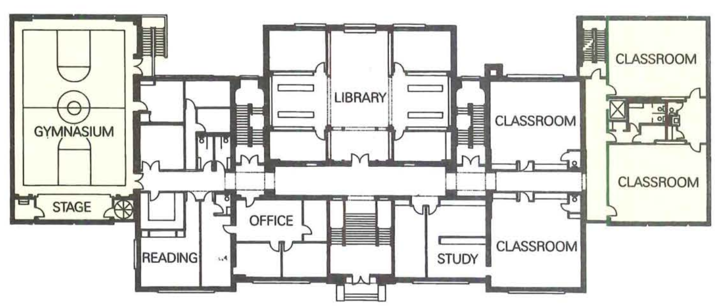
Their influence is evident in these two small additions to an elementary school, for which Iwerks served as the project designer and principal in charge. The compositional idea of the classroom and gymnasium additions is simple. The brick side walls of the existing school appear to have been pulled away from the building and two concrete block masses inserted into the void. A glazed "zipper" separates the new from the old.

The façades of the two additions have been carefully proportioned, although their composition is not merely an exercise in graphic design. The three-part division of each façade has a functional logic, expressing the plan's division into support areas, teaching spaces, and a circulation zone. The façades' treatment also reinforces their structural role. Frequent reveals, for example, accentuate the thickness of the walls, while deep lintels above the lower windows highlight the walls' load-bearing function.

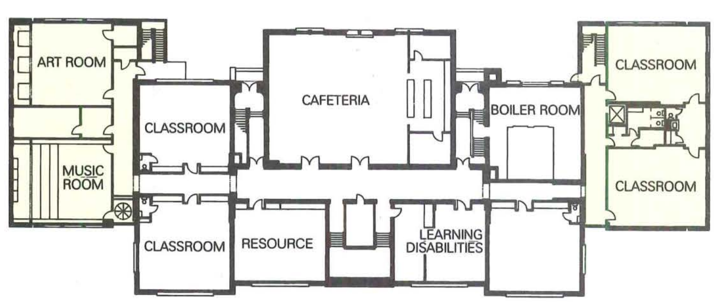
The straightforward expression of plan and structure here is refreshing when all around us are the excesses of Post-Modern architecture that result from a separation of form and function, and of compositional ideas from their basis in construction. What Behrens and Berlage knew we have had to rediscover: Architecture cannot live cut off from its roots in building. **Thomas Fisher** ■



SECOND FLOOR PLAN



FIRST FLOOR PLAN



GROUND FLOOR PLAN ■ ADDITIONS N 20'/6m

1

Classrooms and a gymnasium were added to either side of this 1920s school, which was renovated at the same time. The proportions of the older façades were used as a basis for the proportioning of the new wings, and the brick panels of the original building prompted the use of concrete block panels on the blank end walls of the additions (1). The gymnasium wing is identifiable by its edge monitors and high windows (2). These additions show what can be done with a small budget and a lot of attention to detail.

2

Project: *Mount Pleasant Elementary School, Nashua, New Hampshire.*
Architects: *TAMS Consultants, Boston (Chris Iwerks, principal in charge, project designer; Deborah Allen, project architect; Andrew Fauntleroy, Matthew Donnelly, Margaret Minor, Robert Levitt, Regan McClellan, Betsy Williams, project team).*
Client: *Nashua School District.*
Site: *small 2.6-acre site in residential area, with lawn in front and paved playground in back.*
Program: *add 17,000 sq ft to include a gymnasium and stage, art and music rooms, and six classrooms; renovate existing 36,000-sq-ft building.*
Structural system: *concrete spread footings, block bearing walls, steel floor framing with steel deck and concrete slabs.*
Major materials: *brick, split-faced concrete block, aluminum windows, terne-coated stainless steel monitors (see Building Materials, p. 175).*
Mechanical system: *gas-fired hot water system; ceiling mounted, forced hot air system in gym.*
Consultants: *Bay State Design, structural; AM-Tech Engineers, mechanical.*
General contractor: *John B. Sullivan Corp.*
Costs: *$2,850,000 ($54/sq ft)*
Photos: *William T. Smith*

Selected Detail

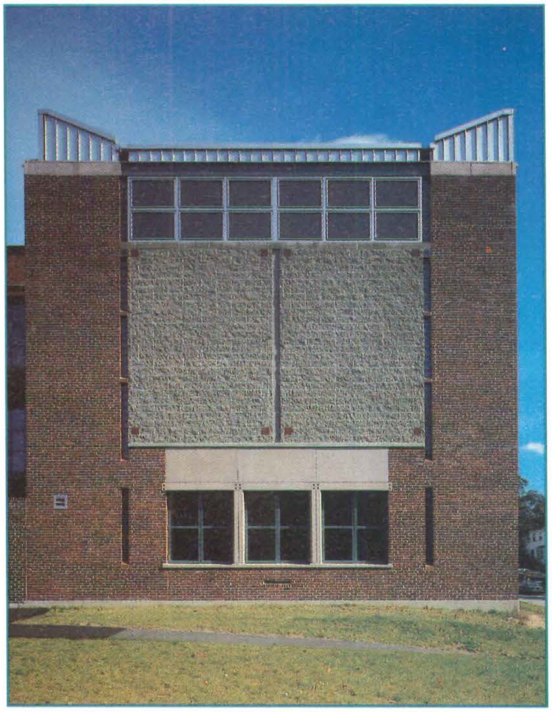
Wall Section
Mount Pleasant Elementary School, Nashua, New Hampshire

Schools contain a variety of often conflicting functions, some of which are quite noisy, such as gymnasiums and music rooms. In suburban schools, the solution to this problem has been to spread the building out, using distance to separate conflicting activities. But in urban schools, on tight sites, other methods must be sought. At the Mount Pleasant Elementary School by TAMS, one of the two new wings contains a gymnasium and auditorium stacked above a music and art room. Acoustical separation among them became a concern.

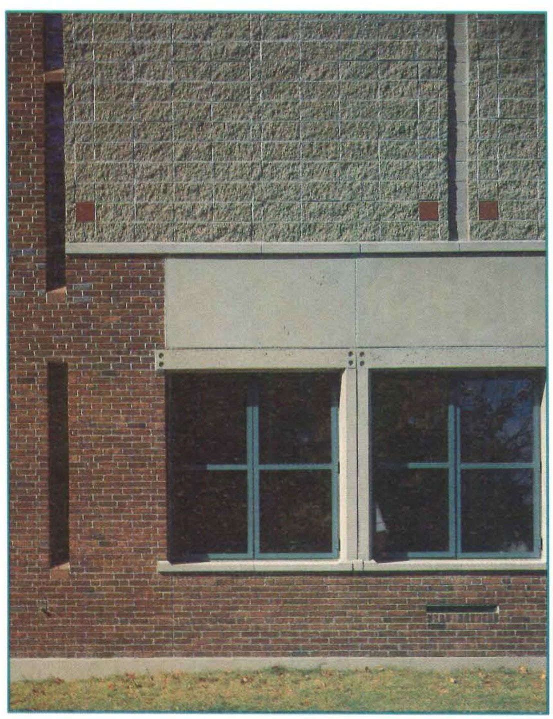
As this wall section shows, a floating slab isolates the gym from the music room below. Consisting of a concrete slab laid on top of half-inch mineral board and two-inch rigid insulation, this floating assembly sits upon a second concrete slab poured over a steel deck. The floating slab also is isolated from the concrete block bearing wall to prevent sound transfer through the structure. The stepped concrete slab in the music room sits on grade.

Another element of note is the perimeter skylight in the gymnasium. Sloped toward the roof, the skylight is tied into the building's parapet and expressed on the exterior by standing seam metal siding. Within the skylight's housing sits a motorized series of louvers that allow the gymnasium to be darkened for movies or performances on the stage. Acoustical panels above the louvers reduce reverberations.

The stacking of functions in older urban schools proved to be less than ideal because of the transfer of sound and impact noise. But such construction methods now make the stacking of activities once again feasible. ■

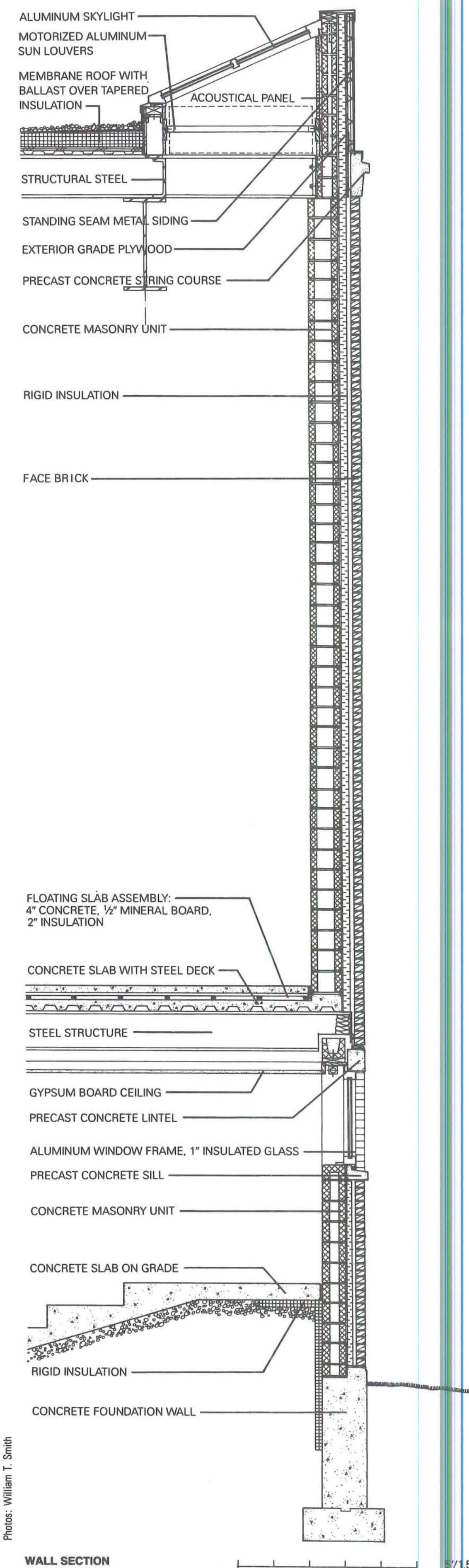


Rear wall of gymnasium wing.



Detail of window and wall.

Photos: William T. Smith



WALL SECTION

Drawing: Shannon Scarlett

Perspectives

Sylvia Lavin analyzes and evaluates the current theory boom.

Essay: The Uses and Abuses of Theory

It has been argued that a little theory, even if wrong, is better than no theory at all. Such a provocative stance may encourage reflection, but it fails, ironically, to consider the consequences of a call to theoretical arms at any cost. The contemporary architectural profession, from elite practitioners to first-year students of design, from the most academic to the veritably popular press, and from speculative developments to rarified museum exhibits, is in the midst of a theory frenzy. Something called "theory," most particularly but not exclusively in the form of verbal texts, is everywhere, effortlessly infiltrating each nook and cranny of the profession. Kant, Foucault, and Derrida are the Holy of Holies in architecture school studios, having displaced Le Corbusier and the Acropolis. Journals, symposia, and other architectural events are as likely to invite discussions of any number of theoretical strategies – feminism, structuralism, deconstructionism – as they are to focus on design history, process, or even on designs themselves. Which books architects have read seems more pertinent to know than what buildings they've built. In fact, trying to provoke "a little theory" seems superfluous to say the least because today there is a whole lot of theorizing going on.

"The profession. . . is in the midst of a theory frenzy. Something called 'theory' is everywhere, effortlessly infiltrating each nook and cranny."

Taking note of this phenomenon is simple, or rather inescapable, because it characterizes not only contemporary architectural debate, but contemporary debate about culture in general, politics, law – in fact most aspects of human endeavor. Evaluating this phenomenon, however, is more complex, particularly in the context of architecture. Over the course of the last several years, the simple presence of theory in architecture has progressively been transformed into a complex pressure to theorize. Practitioners feel an overwhelming obligation to know the latest "ism," or risk being branded with some of the oldest isms in the book: philistinism, academicism, conservatism, and trivialism. Coercion certainly gets results for there is no doubt that there is more and wider ranging conversation about architectural theory now than at many points in the past. However, threats that at first succeed, and succeed well, often fail in the long run – having a tiger by the tail means taking a chance on being bitten. The theoretical tiger is an exciting creature. The obligation to hold on to its tail, to be identifiably theoretical, can quickly become a burdensome intrusion into one's freedom to do what one wants to do. And if the tiger starts to bite, more serious backlashes will clearly follow.

Scars from this battle are quickly surfacing. Some are cosmetic, like the ones borne by architects whose language is filled with technical vocabulary incomprehensible to the nonprofessional – parti, entasis, pilotis – but who routinely complain about obscurantist theorists who speak of or discourse on narrativization, simulacra, and *parole* versus *langue*. Conversely, there are architects who embrace a cacophony of jargon appropriated from other disciplines hoping it will pass as theory when really it is just nonsense. Other effects of the theory-go-round are more substantively disturbing, particularly when they feed on certain predispositions toward the life of the mind and the role of the architect. On the West Coast there has always been a healthy dose of skepticism toward the hegemony of the intellect, especially in the form of "movements" coming from the East and Europe. Although often mistaken for skepticism toward the intellect itself, the mounting pressure to theorize is transforming this principle of mistrust into a dogmatic rejection of any and all theory. In extreme cases, the result is a militant formalism and a coy denial of the presence of cognitive and rational action in the design process. Some even claim that no theory is better than any theory, even if the theory is right.

On the East Coast, traditionally more receptive to, even greedy for, outside intellectual influence, the reverse pitfall seems nearby. Contemporary critical theory's realization of the fact that criticism is not an objective science but rather a creative art has become another justification for the artist's right to take liberty with sources. Architects not only excuse and explain away their misreadings of theoretical texts, but celebrate them. An often deliberately misunderstood text by some – preferably French – literary figure is now to be heralded as a fundamental component of the subjective design process. One cannot avoid reading the writing on the wall in such cases – a lot of theory, especially if wrong, is the only valid way to make the "right" kind of architecture.

Theory in architecture is clearly a mixed blessing today. Having been central to the profession's ability to move beyond the sterility of late-Modernism by way of Robert Venturi's *Complexity and Contradiction*, it has since become equally central to and princely in a Machiavellian labyrinth where some

"One cannot condemn theory for being theoretical...

nor does it belittle architecture to be architectural, and concerned with actual form."

architects feel they have no place. However, it is not the presence or absence of theory that will help decide the fate of the profession, nor the relative "rightness" or "wrongness" of a given theory. Before any determinations of this sort can be made, an all too common sophism must be neutralized. One cannot condemn theory for being theoretical, for being concerned with conceptual principle, nor does it belittle architecture to be architectural, and concerned with actual form. Right or wrong, it is in the nature of these respective beasts to be what they are. But it is here, at the level of this basic truism, that certain peculiarities of architectural tradition obstruct any attempt to define architectural theory in even a simple or schematic way.

Architecture has always considered itself the most intellectual of the visual arts and has substantiated this claim and represented this self image in a body of theoretical literature infinitely more expansive than that devoted to the other visual arts. Thought of as unfettered by the inherent tendency to mimic reality and conform to the image of terrestrial objects, architecture could pursue more fully abstract ideas, through both built and written texts. At the same time, however, the need for this theoretical apparatus was paradoxically connected with the perceived need to liberate architecture from its material servitude. While painting and sculpture were thought free to imitate nature and create beauty, architecture had to contend directly with technology, economics and physical matter, and had to attend to the satisfaction of myriad pedestrian functions and mundane concerns. A desire to resolve or at least provide a framework for dealing with this internal conflict between the real and the ideal gave birth to the domain of architectural theory.

This condition of origin sheds light on several distinctive features of theory in architecture. Ever since a hierarchy of the arts was established in antiquity, one not yet thoroughly toppled, literary theory has reigned as King of all theory. From this lofty position, literary theory imposed its principles and became the model for theories of art in general. This theoretical empire, until recently, tended to be devoted to exegesis, to interpretation and ultimately to critical evaluation of texts and objects of art written or created by someone other than the theorist. Architectural theory, on the other hand, from Vitruvius to Peter Eisenman, has traditionally been written by and for architects. In fact, architectural theory used to be defined as nothing more than a set of rules established to guide the architect in the realization of a design. However conceptual in principle and intention architectural theory may be, and however indebted to literary theory it has been, architectural theory has always distinguished itself by remaining firmly grounded in the thoughtful processes of making.

"Theory has a ring of resistance to it, an aura of the avant-garde... [it] appears to offer architecture the radical weaponry once offered by a flat roof and a little exposed concrete."

Over the past several decades, the field of literary theory and criticism has undergone a significant transformation that is changing its relationship to and consequently altering the unique character of architectural theory. Through a process of progressive expansion, literary theory has appropriated into its domain the results of research in all sorts of disciplines, from psychoanalytic theory to sociology, political theory to historiography. One result of this systematic inclusion has been the ever more frequent exclusion of the field's original object, namely literature. Indeed, the transformation has been so successful that literary theory, when deemed worth the paper it's printed on, is now called "critical theory." However, the loss of focus on literature is only a result, the cause of which is rooted in a desire to move the field toward an ever more immaterial realm, to ally theory with the purest order of analytic and cognitive abstraction. Literary theory is becoming philosophy, a metamorphosis intrinsically neither good nor bad but problematic when it comes into contact with architecture.

The production of theory, particularly contemporary critical theory, demands an "impersonal consistency" of thought, but the production of architecture demands a "personal consistency" of thought: It might even be said that it demands a "personal inconsistency," and not of intellection but of intuition and inspiration. Thus, although critical theory can aspire to the philosophical, the practical roots of architectural theory set it antagonistically apart from philosophy. On some peculiar level, the very concept of "critical architectural theory" is an oxymoron.

If this is the case, then why the overpowering will to theorize the discipline and why the prodigious success of this will in recent years? The disparate nature of the various theories presiding over architecture reveals that the answer to this question lies not in the theories themselves, but in the function of architectural theory within contemporary practice. The pervasiveness of the phenomenon alone is sufficient proof that some role is being per-

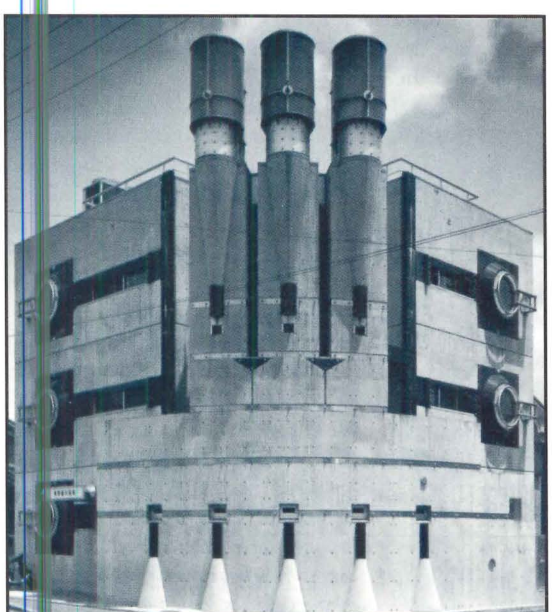
(continued on page 179)

The first of an occasional series of essays on attitudes toward technology considers **Shin Takamatsu's** dark vision of the machine.

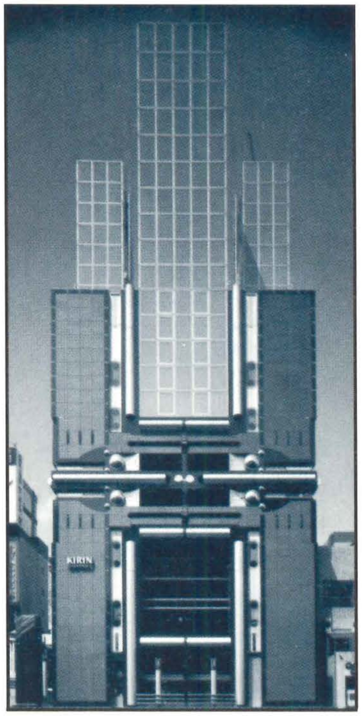
Attitudes Toward Technology: Shin Takamatsu

The menace of technological advance has been a frequent theme in modern arts and literature. Distrust of technology is common enough to our culture that the premise of errant machines wreaking havoc with our lives – be it a computer canceling our credit or an android turning on its maker – is familiar if not expected. While the dark side of technology has rarely found architectural form in Western culture, where architects have alternately embraced the machine as savior or rejected it entirely, Japanese architect Shin Takamatsu has for the last decade been celebrating both the wonder and the menace of industry and technology in his buildings.

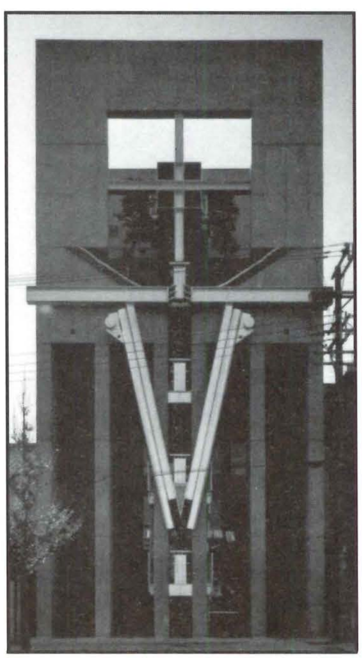
Anton Furst, designer of the movie sets for *Batman* (P/A, Sep. 1989, p. 21), cited Takamatsu as one of the inspirations for his sinister interpretation of Gotham City. Like Batman, Takamatsu works mostly at night, and like the film's creators, he has expressed a vision of a world where technology and the built environment are barely (if at all) under control.



Defensive stance: Pharaoh dental clinic in Kyoto.



Kirin Plaza: machine made friendly in Osaka.



Ining '23 in Kyoto: an implication of moving parts.

Takamatsu first captured widespread attention in the West with his Ark and Pharaoh dental clinics in Kyoto (P/A, Oct. 1987, p. 95), completed in 1983 and 1984, respectively. In his earlier works, he had explored the potential of combining the traditional Japanese architectural vocabulary with modern materials such as steel and concrete. But in the dental clinics (places that, at least in the West, are by definition associated with a certain degree of menace) his inspiration was the machine – not the sleek high-tech visage of the microcomputer, but the wheezing, grinding machine of the Industrial Revolution. Although the buildings seem, on one hand, armored and protective of their inhabitants (Takamatsu says Pharaoh adopts a "defensive stance" in response to its site at a busy intersection), they are made to seem dangerous through the implication that they are made up of moving parts. They look capable of being fired up and of spinning, churning, and burning, as fuel, whatever ventures inside.

Similar expressions of motion can be found in Week (1986) and in Ining '23 (1987), two mixed-use commercial buildings in Kyoto, although Week, with its red steel trim, hints at a more celebratory vision of modernity, which has also shown up in other recent works, such as Kirin Plaza (1987), a six-story collection of bars and restaurants commissioned by Japan's largest brewing company for a cacophonous urban setting in Osaka. Kirin Plaza is a narrow box trimmed and bound with polished metal details and topped by four translucent light towers; in this building the machine vocabulary is cleaned up and made friendlier, as if the designs of Takamatsu's machines are now in the hands not of engineers but of industrial designers or 1950s auto manufacturers.

Takamatsu's darkest references to industrial society can be found in Dance Hall, a 1985 discotheque interior in Nagoya that is finished throughout in rusted steel. A sculptural element at the entrance to the basement space confronts visitors with a sharp shard of glass pointed at them. In a city that was virtually destroyed in World War II, such a place suggests a post-apocalyptic world, hinting at the theme of nuclear destruction that has been posited from *Godzilla* to *The Road Warrior* as the ultimate price of technology.

Takamatsu is but 42 years old, and he has already begun to explore themes that have little to do with technology; his most recent preoccupations seem to be with pure geometries and with Classical forms. But in all of his work, there remains a certain distrust of rationalism and a cynicism about promises of a brighter tomorrow. **Mark Alden Branch** ■

James Wines and **Joshua Weinstein** of SITE discuss their method of working and the meaning of their architecture.

Interview: James Wines, Joshua Weinstein, SITE

James Wines of SITE is an environmental artist who has made architecture his subject matter, deflating, over the last 20 years, many of the conventions and aesthetic prejudices of the profession. Wines and his partner, architect Joshua Weinstein, discuss the ideas and motives behind their work with P/A editor Thomas Fisher.

P/A: How would you define the differences between your idea of "de-architecture" and that of deconstruction theorists?

Wines: As I understand it, deconstruction theory uses written texts as a resource for different kinds of readings, often going beyond the intended meaning of the author. Architecture is not really a good discipline for this idea, since architecture is usually about the construction of objects, . . . not about their interpretation. De-architecture is a critical attitude that is similar to Deconstruction. It takes a context which is loaded with meanings and uses the language of architecture to change, alter, and transform those meanings.

P/A: One difference between your work and that of the Deconstructivists has to do with the accessibility of your buildings to the public's understanding.

Wines: We like using images that are so obvious that no self-respecting architect would ever use them. I hate being obscure; the most wonderful things are the most obvious.

P/A: Jacques Derrida once said that critics are radical about everything except the form and methods of criticism itself. Do you see a parallel with architects who, however radical, become very defensive when confronted by your questioning of their forms or methods?

Wines: Our work comes from an attitude that anything is possible, which is much more akin to the thinking of artists than of architects. We always look for the other side of the meaning of something, not wanting to simply reinforce what people already know. When many architects want to create a dynamic space, they will do such things as twist a form or slant a wall, but it's still within normal parameters. We try to go beyond what is accepted. At the Best store in Milwaukee, we took the side off of the building, letting the products spill outside and cutting through the walls to expose the ductwork and other stuff normally hidden from view. It's more dynamic than if it had been designed in a careful way.

Dorothy Alexander

James Wines

"There is a line that has been drawn around architecture in terms of what is acceptable. That has gone on for a long time, and it is really destructive."

P/A: The keeping of systems hidden in buildings raises the point that most professions often protect their turf by mystifying what they do. Where do you stand on this?

Wines: I have tremendous respect for architects who brought to their work such a level of perfection that they gained a kind of mystical stature. The fanaticism with which one pursues something really gives it its power. My favorite architects are those who have been absolutely simple, absolutely mystical, although their work is never just an exercise in form. There has got to be something else going on. But if being mystical only means playing by the rules, then you can get trapped. If you don't play by the rules, you won't get fooled by them.

P/A: You talk in your book about the influence of Venturi and Scott Brown's theoretical writings, and certainly your early Best showrooms could be thought of as decorated sheds – boxes to which façades were applied. How do you distinguish your work from theirs?

Wines: Basically, I'm interested in work that has a psychological component. The Best showrooms were boxes invaded by attitudes and meanings. By treating them as boxes – by keeping within certain limitations – we didn't have to do a great deal to change the psychology of the situation. The façades were intended to trigger unexpected meanings rather than serve as signs or symbols. They were there for psychological reasons, not theoretical reasons. The Pop Art that has influenced the work of Venturi and Scott Brown has a psychological aspect and a lot of cross referencing, but I think it is hard to translate into architecture. Architecture, it seems to me, is primarily about the way things are built and used and about the prejudices people have regarding those two things. That is where our work begins. We ask

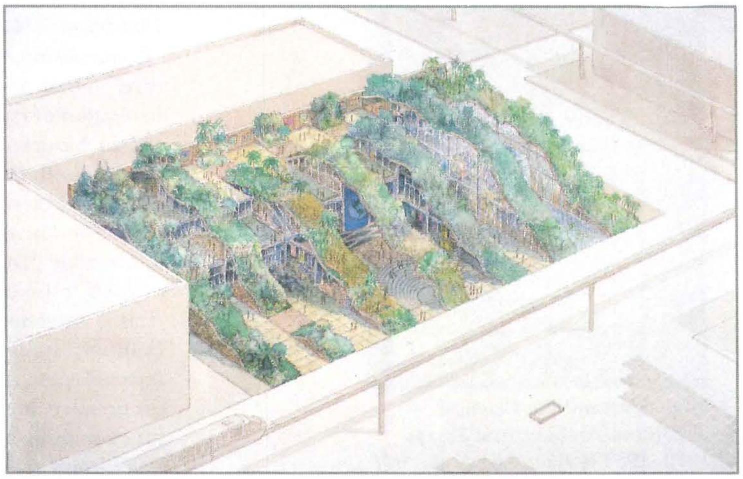
Arch at Sawyer Point Park, Cincinnati, 1987. Terrarium within a Roman-style arch.

"And because buildings have [to meet] such a low threshold of expectations, there are the intellectual architects who say: Oh my God, we've got to prove that it isn't as simple as they think."

ourselves: What does this mean? What does the use mean? What is the archetype that people have about this building type? What are their prejudices? Then we look at how we can nudge those around, how we can play with them to change them.

P/A: Your work also seems to be a commentary upon the expectations of the profession and the public.

Wines: So much of the art of this century is about that very issue. Most artists attempt to extend or examine people's values. No true artist just paints a painting; it is always about something. The subject matter of our work is architecture, and I don't think that should be offensive to people, but it often is. There is a line that has been drawn around architecture in terms of what is acceptable and what is not. This has gone on for a long time, and it is really destructive.



8560 Sunset Blvd., West Hollywood, California, 1990. Shopping center based upon the recreation of a Hollywood hill.

P/A: I am interested in the aspects of your work that deal with issues such as illusion and reality, inside and out, weight and levitation, artifice and nature. How conscious are these dialectics?

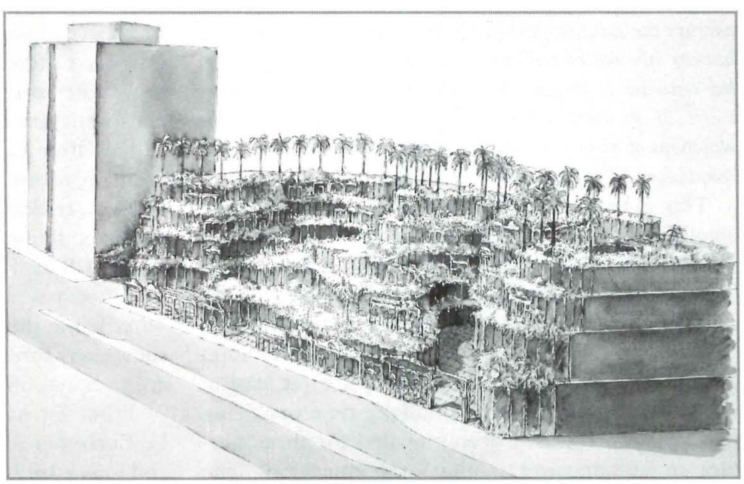
Wines: Josh and I work together very closely; we take exactly that dialectical approach, asking in every case: What if the opposite were true? It is a critical way of working, but it also seems totally chaotic.

Weinstein: The whole process by which architecture is taught is that you get a problem and begin to analyze the program and the site. There is very little room, up front, for discussion about cultural meaning, the meaning of life, whatever. That is where architecture should begin.

P/A: Why has this happened?

Weinstein: I think the public's expectations of architecture are so much lower than they are of art.

Wines: And because buildings have [to meet] such a low threshold of expectations, there are the intellectual architects who say: Oh my God, we've got to prove that it isn't as simple as they think. So, without changing anything, they begin to assign a lot of esoteric meaning to architecture and use a lot of obscure language to describe and analyze it.



World Ecology Pavilion, Seville World Expo, 1992. Contoured pavilion on the global concern for the environment.

P/A: Frederic Jameson has made the distinction between parody, which questions or twists accepted assumptions, and pastiche, which he calls "blank parody," not questioning assumptions but simply applying them. Would you make the same sort of distinction between your work and that of Post-Modernists?

Wines: The architectural language you use – Modernism, Historicism – doesn't matter as long as you use it in a vital way. In every cliché, there are endless possibilities because it is so loaded. To imitate the Villa Savoye is one thing, but to take its imagery, which is constantly being recycled, and invert or twist its meaning is potentially quite wonderful. Using history as a resource can be bad or very good based on your ability to manipulate its language. The history of art is full of examples of clichés turned into something new. The essence of the matter is: Why is architecture this bland little road that we all have to travel along?

P/A: I think that mass media have become so pervasive that some architects play to the media's image of an architect; they no longer do buildings, but create images of what the public thinks a building should be. Are we all just playing parts in some giant sit-com?

Wines: One of my favorite movie directors is David Lynch, who uses sit-com scripts as part of his imagery. He plays off of your expectations. An architect can be a victim of the media unless, like David Lynch, you seize it and work with it as subject matter. It requires an artist's detachment; the ability to look objectively at almost anything. What makes Lynch's movies artwork is that he is making a Hollywood film and unraveling one at the same time – dissecting it to let you see the underside of it. It's a powerful way of making art – and architecture. ■

Books

Joan Ockman discusses Alan Colquhoun's views on form and symbolism in architecture – a fundamental, yet unresolved aspect of Modernism.

Books of Note

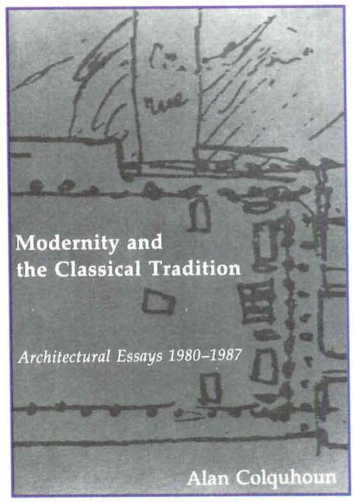
The Genius of Japanese Carpentry: An Account of a Temple's Construction *by S. Azby Brown, Kodansha International, New York, 1989, 156 pp., illus., $24.95.*
Brown watched Japanese carpenters design and build a Buddhist temple for a thousand-year-old sanctuary; photographs and drawings document their painstaking craftsmanship.

The Building Envelope: Applications of New Technology Cladding *by Alan Brookes and Chris Grech, Butterworth Architecture, Boston, 1990, 192 pp., illus., $45.00.*
Photographs, detail drawings, and references describe 33 recent buildings, each an enlightening case study of building technology.

Takefuma Aida: Buildings and Projects, *Princeton Architectural Press, New York, 1990, 104 pp., illus., paper, $24.95.*
A well-read architect, Aida is familiar with the debates of his Western counterparts; this monograph shows how he has applied them to Japan.

Money Matters: A Critical Look at Bank Architecture, *McGraw-Hill, New York, 1990, 300 pp., illus., $49.95.*
A catalogue for the Museum of Fine Arts, Houston, this book highlights the connections between typology and image.

See Tech Notes (p. 61) for listings of other publications of interest.



Modernity and the Classical Tradition: Architectural Essays 1980–1987 *by Alan Colquhoun, MIT Press, Cambridge, Massachusetts, 1989, 250 pp., illus., $29.95.*

Has Modernity Changed the Language of Architecture?

. . . all systems of thought, all ideological constructs, are in need of constant, conscious criticism; and the process of revision can come about only on the assumption that there is a higher and more universal standard against which to measure the existing system. History provides both the ideas that are in need of criticism and the material out of which this criticism is forged. An architecture that is constantly aware of its own history, but constantly critical of the seductions of history, is what we should aim for today. (Alan Colquhoun, "Three Kinds of Historicism")

This is the conclusion to the first essay of Alan Colquhoun's new collection of his writings, *Modernity and the Classical Tradition: Architectural Essays 1980–1987.* To understand the serious and deeply engaged thinking of one of our best contemporary critics of architecture, it is necessary to realize that Colquhoun is something of a rarity in this discipline (at least in the Anglo-American context): a long-time practicing architect who has also been engaged for three decades in architectural writing and education. The present book follows his *Essays in Architectural Criticism: Modern Architecture and Historical Change* (1981); likewise, this reassesses the Modern Movement and its legacy in relation to Classical thought, historical transformation, and architectural language as a system of cultural representation.

The first section of the book consists of four major essays – "Three Kinds of Historicism," "Vernacular Classicism," "Composition versus the Project," and "Rationalism: A Philosophical Concept in Architecture" – that seek to define the role of history in the formation of cultural values. Colquhoun connects the rise of Modernism to the change in the meaning of history itself. Prior to the Enlightenment, history was a cumulative repository of authoritative models for imitation; by the 19th Century it had become an irreversible process advancing toward an increasingly evolved technical civilization. This historical break or "crisis" came to fruition at the beginning of the 20th Century, when the dominant aesthetic movement rejected past architectural values and norms for a progressive ideology that embraced the theory of functionalism and the politics of social reform. As Colquhoun argues, the empirical failure of this latter "master narrative" combined with the philosophical vacuum left by the collapse of traditional values engendered the contemporary crisis of Post-Modernism, with its various attempts to recover an earlier vision of history. These topics appear in the shorter essays that form the third section of the book.

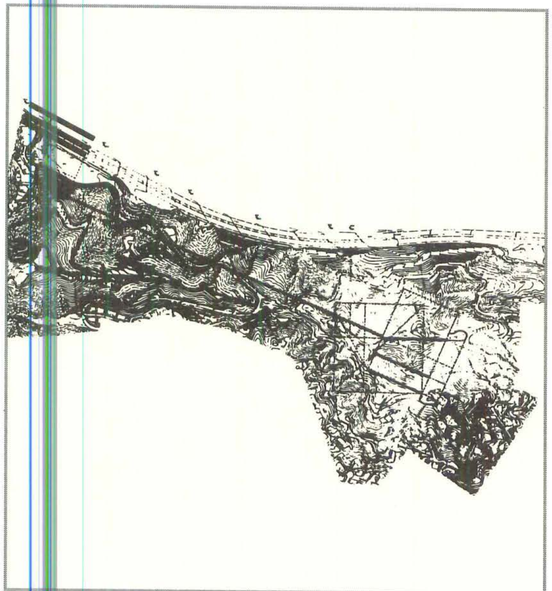
The middle section is devoted to three studies of Le Corbusier, in which Colquhoun views the work of the Swiss-French architect as paradigmatic of the unresolvable contradictions between traditional architectural meaning and positive reason. Despite the fact that the essays were written over a period of years and for different occasions, their grouping and the recurrence of Colquhoun's historical thesis reflect a consistent and succinct, though nuanced, critical position. Often Colquhoun tends to elaborate his argument in terms of oppositionally paired definitions. This is a critical strategy that can clarify and enframe complex theoretical territory, and many of these essays will likely become required reading in history and theory seminars in architecture schools. On the other hand, this strategy's limitations are those of the short essay form itself; on occasion complicated issues are oversimplified in the effort to synthesize.

From this standpoint, the excellent set of essays on Le Corbusier offer a more sustained type of analysis and successfully elucidate the complexity of the architect's career and work. In "Architecture and Engineering: Le Corbusier and the Paradox of Reason" and "The Significance of Le Corbusier," Colquhoun

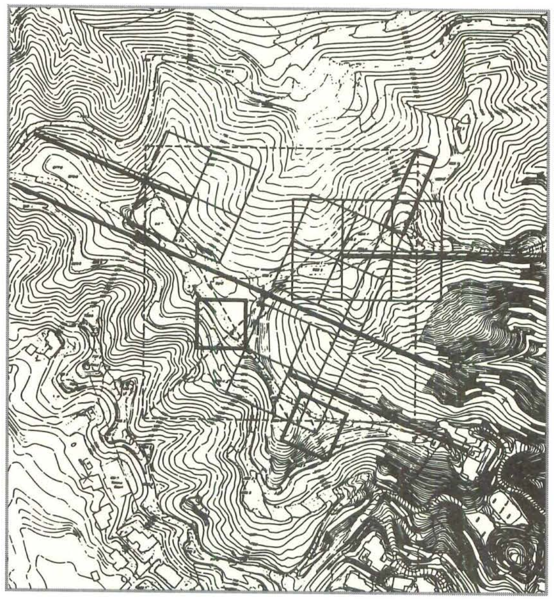
(continued on page 177)

Projects

Newly published drawings of **Richard Meier's Getty Center** depict a hilltop Meierland.



SITE DIAGRAM SHOWING MAJOR AXES



SITE DIAGRAM SHOWING BUILDING PLACEMENT

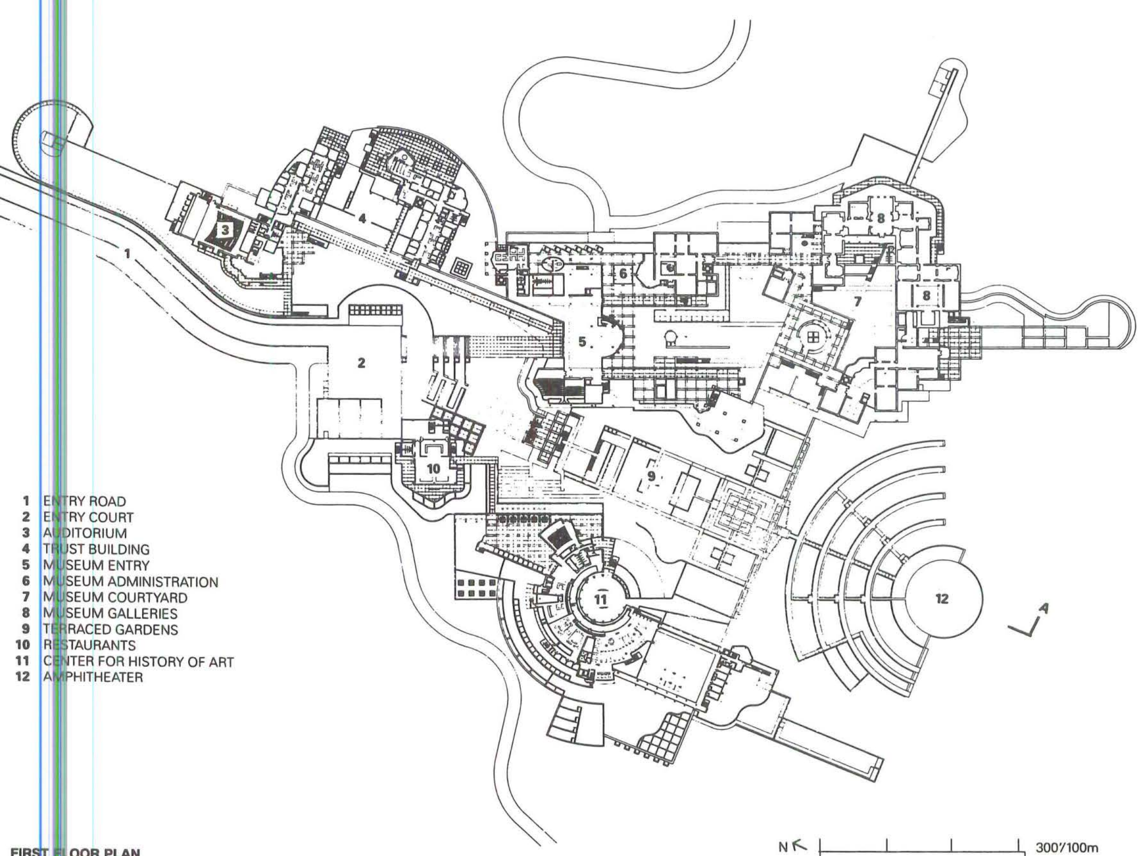
Although the J. Paul Getty Center does not plan to release Richard Meier & Partners' long-awaited design for the center's new facility until this fall, the drawings shown here were recently published in *Richard Meier: Building for Art* (Birkhauser, Boston, $75.00).

The campus-like arrangement of the center was determined partly by the existence of two ridges separated by a ravine. The ravine runs almost due north and south, setting up a secondary axis to the main orientation, which is aligned with the grid of the city. The two axes also correspond to the directions of the adjacent San Diego Freeway, which bends to the east next to the site. On a smaller scale, curves derived from site contours are introduced into the composition.

Visitors will enter at the bottom of the site, park their cars, and take a tram 246 feet up to the center's entry court.

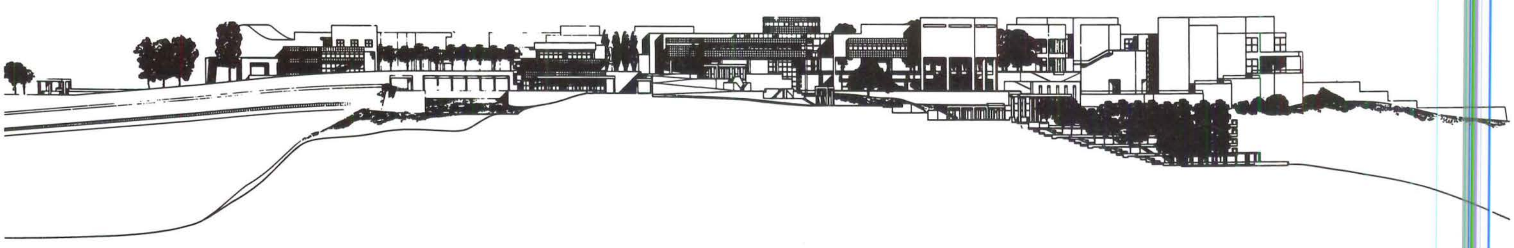
The buildings themselves are a veritable Richard Meier museum, including virtually every trademark device the architect has employed: sinuous piano curves, ramps, open metal stairs, square grids of cladding panels, cylindrical rooms. Offices for the Getty Trust and an array of related concerns are in the northernmost building (top left in plan), which also includes a curved-profile auditorium. The most public space, the museum itself (top right in plan), is arranged around its own courtyard and includes a glazed entry rotunda. On the other side of the ravine is the Center for the History of Art and the Humanities (bottom in plan), dominated by a partially circular volume that houses a library and offices.

Construction is expected to begin next spring and finish in 1995. **Mark Alden Branch** ■

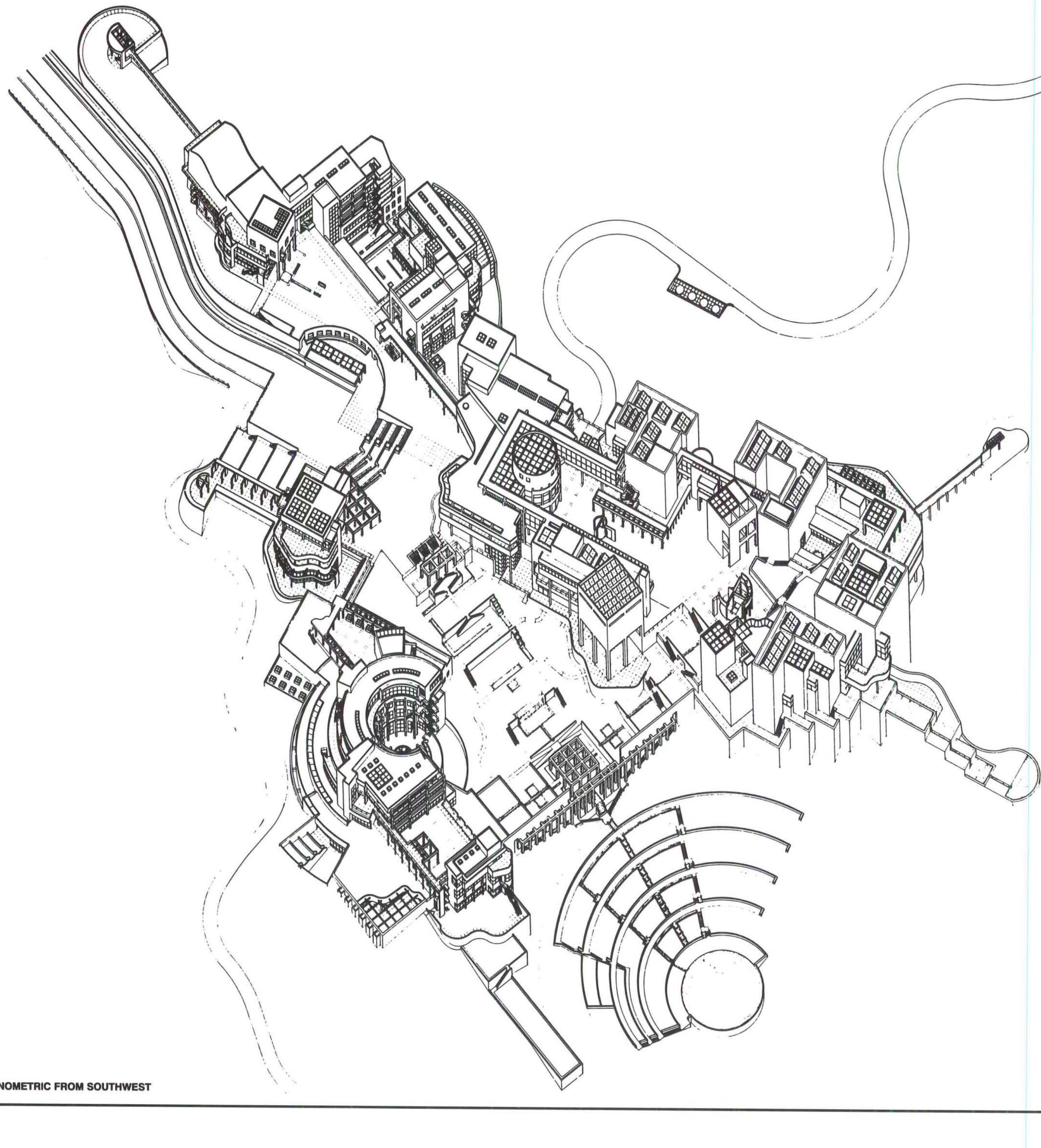


1 ENTRY ROAD
2 ENTRY COURT
3 AUDITORIUM
4 TRUST BUILDING
5 MUSEUM ENTRY
6 MUSEUM ADMINISTRATION
7 MUSEUM COURTYARD
8 MUSEUM GALLERIES
9 TERRACED GARDENS
10 RESTAURANTS
11 CENTER FOR HISTORY OF ART
12 AMPHITHEATER

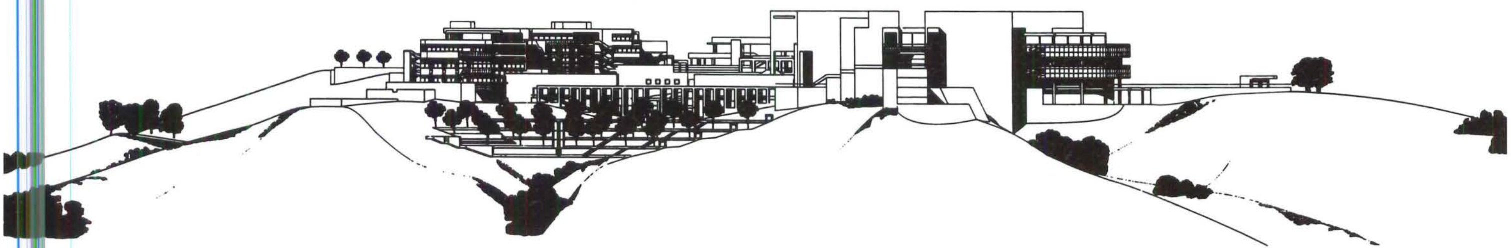
FIRST FLOOR PLAN



SECTION A-A

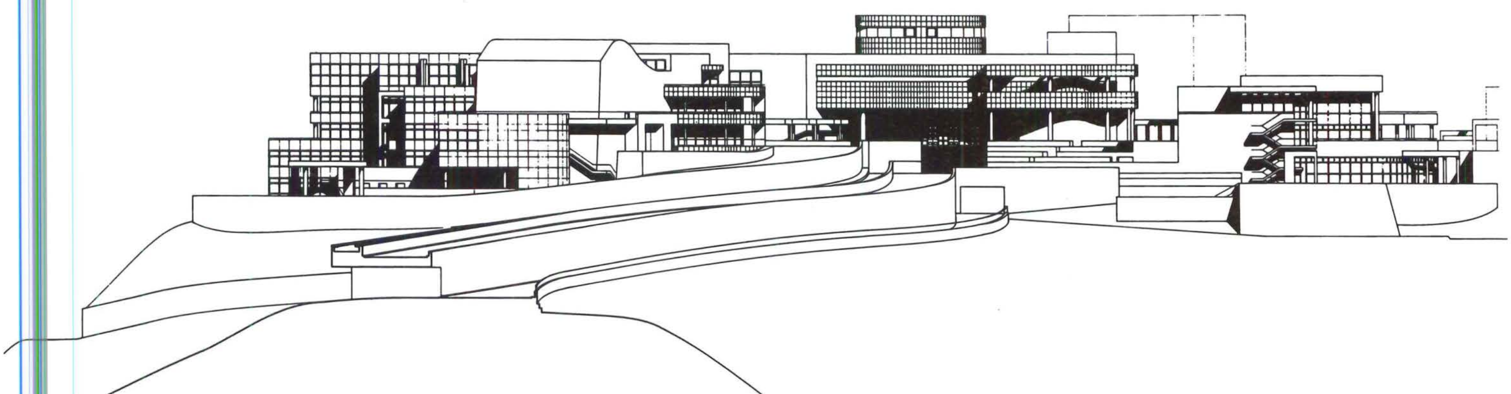


AXONOMETRIC FROM SOUTHWEST



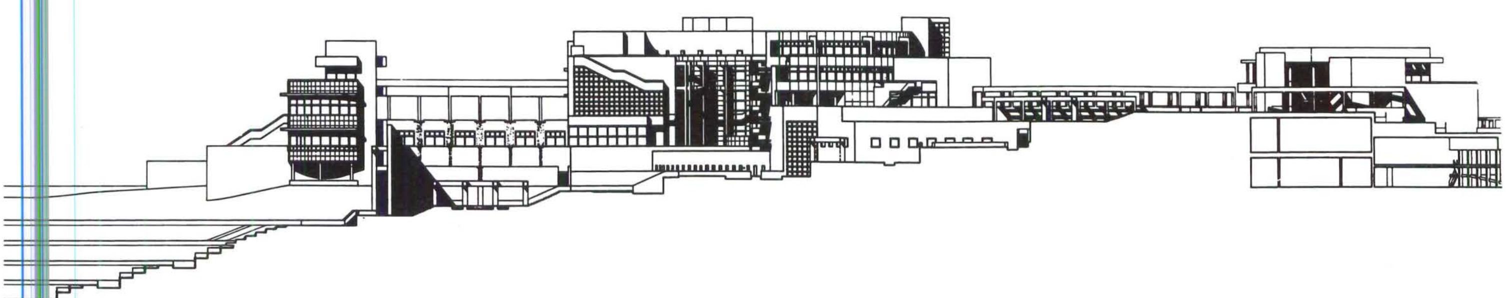
SOUTH ELEVATION

300'/100m

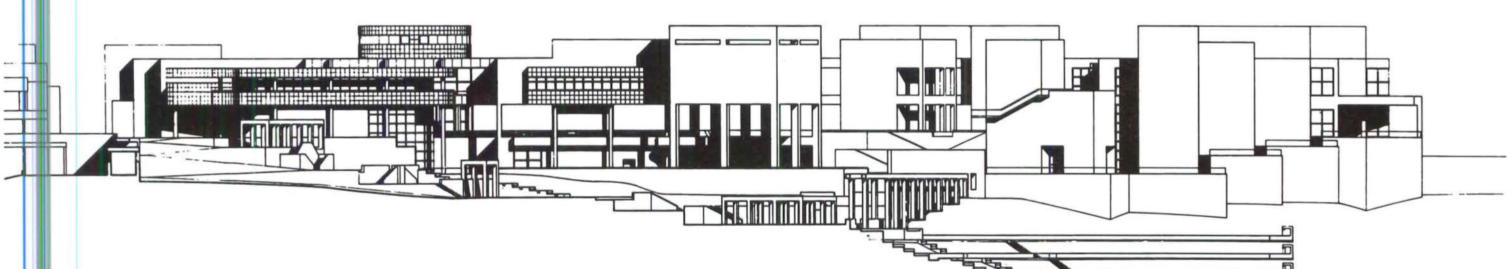


NORTH ELEVATION

100'/30m



EAST ELEVATION, CENTER FOR HISTORY OF ART



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Technics Focus:
Low-Slope Roofing

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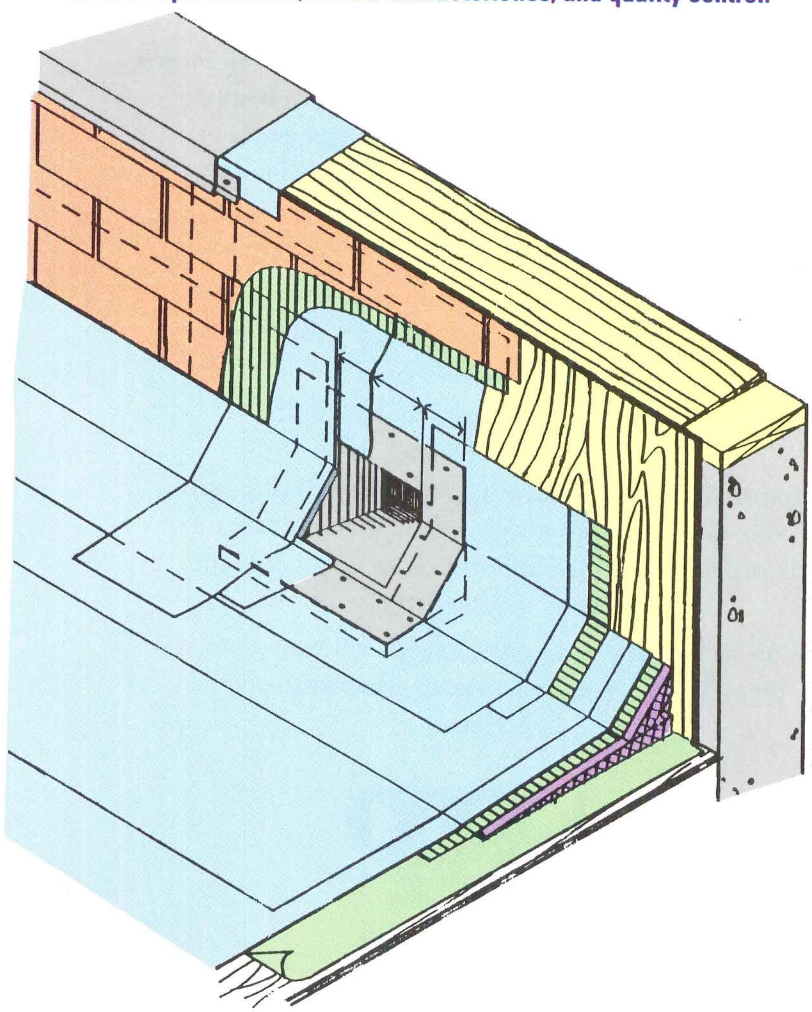
Low-slope roofing covers 1200 square miles of buildings in the U.S.

Four experts address issues for the 1990s, including wind uplift,

air and vapor barriers, failure characteristics, and quality control.



All roofing design issues – drainage, wind uplift, expansion and contraction, air and vapor transport, and thermal continuity, to name just a few – require special attention to detail at the roof edge.

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No purchase necessary. For prize eligibility your entry must be received by September 4, 1990. To receive the correct ranking of information sources and complete rules, send a self-addressed stamped envelope (WA residents need not affix return postage) to: ABP's Survey Rankings and Jackpot Rules, 675 Third Avenue, Suite 400, New York, N.Y. 10017. Sweepstakes open only to residents of the 50 United States and District of Columbia. Employees as of 9/4/90 of all trade and consumer media organizations, the American Business Press, its agencies, the D.L. Blair Corporation and members of their immediate families are not eligible.

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Roof Color and Other Considerations

Oak Ridge National Laboratory's Roofing Research Center is spotlighted.

ORNL's Roof Thermal Research Apparatus

Architects don't give much thought to research and researchers — both seem far removed from practice and everyday dealings with clients, consultants, and contractors. But even consultants gain their expertise somewhere, and not all of it is learned on the job. In the roofing field, an increasingly important body of information is issuing from the Roof Research Center, dedicated in 1988 at the Oak Ridge National Laboratory (ORNL), in Oak Ridge, Tennessee. ORNL administers the Department of Energy's Building Thermal Envelope Systems and Materials program, and its Roof Research Center performs contract research, in addition to carrying out work for DOE's Office of Buildings and Community Systems. Most of the work performed by the Center is available through the National Technical Information Service in Springfield, Virginia (703) 487-4659.

ORNL has recently taken on the role of coordinating an industry-wide series of workshops that has been formalized as the Roofing Industry Committee on Wind Issues. The 129-page *Proceedings of the Roof Wind Uplift Testing Workshop,* held in May 1989, is ORNL document CONF-891173 (NTIS #DE90008041). It contains 16 papers and lists research issues ranked by participants in an earlier ORNL workshop. Topping the list were evaluation of test methodologies, edge metal detailing, air retarders, fastener pullout and fatigue, and correlation between rooftop windspeed, direction, and building geometry.

How much effect does roof color have on roof temperature and heat gain? In an experiment using ORNL's Roof Thermal Research Apparatus (see photo), daytime temperatures of a black single-ply membrane were found to exceed those of a white one by 40 to 50 F, while nighttime temperatures were within 1 F of one another. During the summer, the black membrane's temperature regularly peaked at 180 F, exceeding air temperatures by 80 to 90 F, while the white membrane rarely exceeded 135 F. During clear, February days, the black membrane peaked at 110 F, while the white one rarely exceeded 80 F. For the R-7.5 test assembly, cumulative heat gain during a week in July was three times greater for the black membrane, while cumulative heat loss for a week in February was 1.27 times greater for the white. Over the 75-week study, the reflectivity of the white membrane decreased from 80 percent to 70 percent. *The Impact of Surface Reflectivity on the Thermal Performance of Roofs*, ORNL/TM-10699, 38 pages, was sponsored by DOE (NTIS #DE90004472).

"Spending Dollars Wisely on Roof Slope" is the title of the summary of the *Decision Guide for Roof Slope Selection,* ORNL-6520, an 80-page report prepared by the Laboratory for the Air Force Engineering and Services Center (NTIS #DE89005706). Based on an analysis of existing Air Force buildings, it offers a life cycle method for comparing the cost of increasing roof pitch against savings in maintenance and increased service life of BUR roofs. The report concludes that increasing roof slope to 1/4 inch or 1/2 inch per foot is cost effective, whereas slopes of 1 inch per foot or more are not. The manual notes that an earlier Air Force report claimed that 90 percent of problems encountered with its BURs were problems with flashings.

ORNL is entering a new era in the 1990s with two new facilities. The indoor Large Scale Climatic Simulator can accept roof specimens up to 12 feet square. It can cycle air temperatures between -40 F and 150 F, and infrared lamps can raise the roof surface temperature above 180 F. It has been used recently to study convection within loose fill, glass fiber attic insulation, and to explore the performance of radiant barriers and multilayer reflective insulations. Future work will look at the thermal behavior of cathedral ceilings and the moisture behavior of roofs where an existing roofing has been covered over with a single-ply reroofing. The Roof Mechanical Properties Apparatus will initially be used to study the effects of different installation practices on the performance of roof assemblies using polyisocyanurate foams made with alternative blowing agents. P/A will continue to follow work at Oak Ridge and other important research centers and will report on findings that are of special interest. **Kenneth Labs** ■

Roofing Library

How's your roofing library? Not what it ought to be? We asked Dick Fricklas, technical director of The Roofing Industry Educational Institute, to recommend a selection. The comments are ours.

Roofs: Design, Application, and Maintenance, M.C.Baker, Polyscience Publications Inc., Montréal (514) 226-5870, 1980, 360 pages, over 700 illus. One of the finest building technology books in any field.

NRCA Roofing and Waterproofing Manual, National Roofing Contractors Association, Rosemont, Ill. (708) 299-9070, 1989, 800 pages. Contains 74 pages of details, over 300 pages on low slope, and 120 pages on steep roofing. A steep price, too — $120, but it's the standard reference.

Manual of Built-Up Roofing Systems, 2nd ed., C.W. Griffin, McGraw-Hill (800) 2-MCGRAW, 1982, 484 pages. BUR is holding its own between 30 and 40 percent of the commercial market, and this tells all.

Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractors National Association, Vienna, Va. (703) 790-9890, 1987, 358 pages. More than you ever wanted to know about gravel stops, copings, gutters, flashings, and metal roofs — until you need to ask. Loaded with details.

Building Materials Directory, Underwriters Laboratory, Northbrook,Ill. (708) 272-8800, updated annually, over 1000 pages, $15.50. Contains fire and wind ratings of roof assemblies.

Approval Guide, Factory Mutual Engineering Corporation, Norwood, Mass. (617) 762-4300, updated annually, over 900 pages, $25. Another catalog of rated building assemblies.

Project Pinpoint

William Cullen explains the NRCA'S program for identifying potential roofing problems.

A 1989 NRCA technical report gives a comprehensive description of Project Pinpoint's scope, operation, and limitations. It is available from NRCA, under the title, *Project Pinpoint Analysis: Trends and Problems in Low-Slope Roofing 1983-1988.* The NRCA can be contacted at its new address: 10255 W. Higgins Road, Suite 600, Rosemont, Illinois, 60018, (708) 299-9070.

Project Pinpoint is an effort by the National Roofing Contractor's Association (NRCA) to analyze problems in low-slope roofing. The two major questions it asks are: What are the current trends in membrane and thermal insulations used in low-slope industrial and commercial roofing in the United States? What are the more common problems experienced with roofing membranes and thermal insulations reported in 1989?

Perhaps the most dramatic trend in roof membrane use over the past seven years involved the decline of the conventional built-up roofing system and increased application of the EPDM rubber and the polymer-modified bituminous materials.

Of the five most common problems the respondents reported for the more widely used membrane systems in 1989, seam defects appeared to stand out for the elastomeric materials. Blistering and splitting were frequent problems reported for the built-up category, and shrinkage and embrittlement defects dominated the membrane problems in the thermoplastic area. The primary objective of Project Pinpoint is to provide an early warning procedure for the identification of problems so that they may be addressed and eliminated before they reach epidemic proportions. A second purpose is to provide baseline information of trends in material, construction, and design of low-slope roofing in the United States.

The project involves an annual survey of nearly 2300 NRCA contractor members regarding the design, material, and application of commercial and industrial roofing in the United States. (The NRCA also collects baseline data four times each year on jobs that are actually under construction.) The survey asks contractors about problems that they have encountered during the year, information that is then processed and analyzed by the NRCA. The processing capability of NRCA's computer, combined with some 260,000 data points collected on 13,000 roofing projects now in the data bank, reflect an information source that is unlike any other in the world.

NRCA initiated Project Pinpoint in 1974. The first Pinpoint report, prepared in 1977, presented data on 512 jobs under construction along with 40 problem roofs. In 1989, data were received on 674 new projects and on 900 jobs that experienced problems. The following examples illustrate the types of information that can be obtained from an analysis of the data. Similar information on trends and problems can be developed with various design, material, age, and exposure parameters of roofing systems.

Roof Membrane Materials

Data collected over the past several years help identify current directions in materials used for applying roofing materials. Reports of jobs under construction show that EPDM and polymer-modified bitumen membrane types have increased significantly since the early 1980s. In fact, these generic membrane categories, combined, amounted to about 50 percent of the total membrane market for 1989 as Table 1 shows. Perhaps the more dramatic trend over the same period is the decline in the use of bituminous built-up

Membrane Type	Baseline Number	Baseline %	Problem Number	Problem %
Built - up	263	39%	353	39%
PVC	21	3%	85	9%
EPDM	229	34%	280	31%
Modified Bitumen	100	15%	100	11%
Others	61	9%	82	9%
Total Roofs	674	100%	900	99.6%

1 Distribution of membrane baseline type and problem information.

Bituminous Built-up Roofs		
Ranking	**Problem Type**	**% Of Problems** *
1	Blistering	24%
2	Splitting	22%
3	Ridging	18%
4	Slippage	6%
5	Wind Related	3%

2 Five most common problems reported for bituminous built-up roofs.
* *Does not add to 100%.*

Polymer Modified Bituminous Membrane Roofs		
Ranking	**Problem Type**	**% Of Problems ***
1	Seam Defects	36%
2	Shrinkage	11%
3	Blistering	10%
4	Embrittlement	8%
5	Wind Related	3%

3 Five most common problems reported for polymer modified bituminous membrane roofs. * *Does not add to 100%.*

Elastomeric (EPDM) Membrane Roofs		
Ranking	**Problem Type**	**% Of Problems ***
1	Seam defects	50%
2	Puncture / Tear	21%
3	Shrinkage	13%
4	Wind Related	10%
5	Blistering	5%

4 Five most comon problems reported for elastomeric (EPDM) membrane roofs. * *Does not add to 100%.*

membranes, the most common membrane in the United States for over 100 years. Figure 8 graphically illustrates the decline in built-up membrane use from nearly 60 percent in 1983 to a low point of some 36 percent in 1988. However, recent data indicate that these membranes made a noticeable upward turn during 1989. The use of EPDM advanced from 23 percent in 1983 to 45 percent of the market share in 1988, only to decline during 1989. Figure 8 also gives data indicating that the polymer-modified bituminous materials registered a constantly increasing rate from 10 percent in 1983 to 15 percent in 1989. The use of PVC membranes declined slightly to 3 percent in 1989. The "other" category, as used here, includes such materials as CPE, CSPE, PIB, and neoprene, which steadily increased to 9 percent in 1989.

The information here is drawn from more than 900 roofing projects exhibiting problems during 1989 to exemplify Project Pinpoint's capabilities. Table 1 shows a breakdown by problem roof types. Bituminous built-up membrane roofs led in this category, making up 30 percent of the total number of problem roofs the respondents reported. EPDM systems accounted for about 31 percent, even though they had a much larger market share. Polymer-modified bitumens and polyvinyl chloride membranes comprised 11 percent and 10 percent, respectively. CSPE membrane were identified as problem roofs in about 5 percent of the cases. All other membranes, collectively, fell into the 3 percent range.

The frequency of specific problems experienced in 1989 may also be of interest. Tables 2, 3, 4, and 5 identify the five most common problems reported for bituminous built-up, polymer-modified, elastomeric, and thermoplastic membranes. The values are expressed as a percent of the total number of problems reported for each generic membrane material type. For example, blistering, splitting, and ridging lead in the built-up category. Seam defects, puncture/tear and shrinkage are the top three problems for the rubber-like membrane types. In fact, seam defects compose 50 percent of the problems reported with EPDM and other rubber membranes. Polymer-modified bitumens also rank high in seam deficiencies with nearly 36 percent of problems reported for these materials. Membrane shrinkage and material embrittlement along with puncture/tear defects account for a large percentage of problems for thermoplastic membranes.

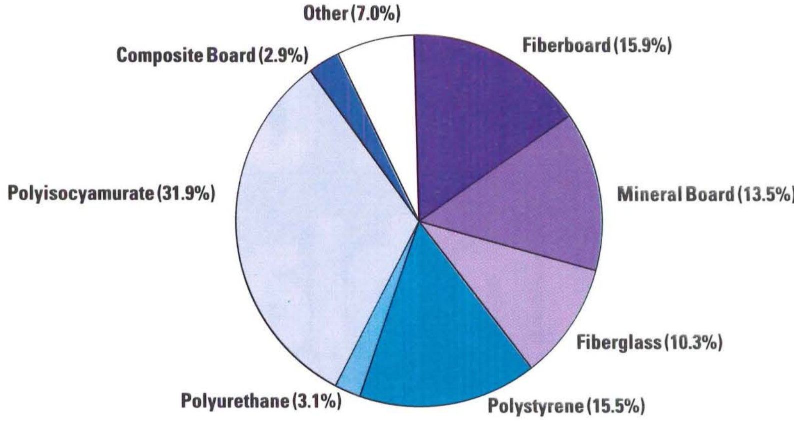
These examples show that Project Pinpoint data can reveal the strengths and weaknesses of the various membrane materials as well as the other components of the roofing system. This information is helpful to the designer, manufacturer, applicator, and researcher; once problems are identified, ways and

Thermoplastic (PVC) Membrane Roofs		
Ranking	**Problem Type**	**% Of Problems ***
1	Shrinkage	42%
2	Embrittlement	29%
3	Puncture / Tear	17%
4	Seam Defects	9%
5	Wind Related	3%

5 Five most common problems reported for thermoplastic (PVC) membrane roofs. * *Does not add to 100%.*

Problem Job Information	Built-up	EPDM	Mod. Bit.	PVC
Number of roofs	244	264	71	76
Wood fiber	15%	30%	20%	5%
Mineral Fiber	17%	5%	11%	3%
Fibrous Glass	22%	1%	23%	4%
Polystyrene	2%	22%	9%	33%
Polyurethane	3%	3%	3%	12%
Polyisocyanur	11%	24%	14%	22%
Composite Brd.	5%	-----	4%	3%
Other Insuls.	25%	16%	15%	18%

6 Cross comparison between membrane and insulation types on 1989 problem jobs, expressed as a percent of problem jobs reported over insulated membranes.



7 Baseline Data, Insulation Types, 1989.

means can be explored to reduce or avoid the incidence of specific problem areas. A word of caution is worthy of mention. The total inventory of the various generic membrane types must always be taken into account, or the problem may be misleading. Problem information is not necessarily comparable to baseline data over a brief period. However, baseline data are reliable indicators of the inventory of projects constructed in the United States during the past decade. A ratio of problems to total inventory of roofing types provides the more accurate picture.

Thermal Insulations

Project Pinpoint data from 1983 show that 22 percent of roofing projects under construction were not thermally insulated. However, over the next seven-year span, a significant increase in use of thermal insulation was evident. Nearly 90 percent of projects reported in 1989 were insulated.

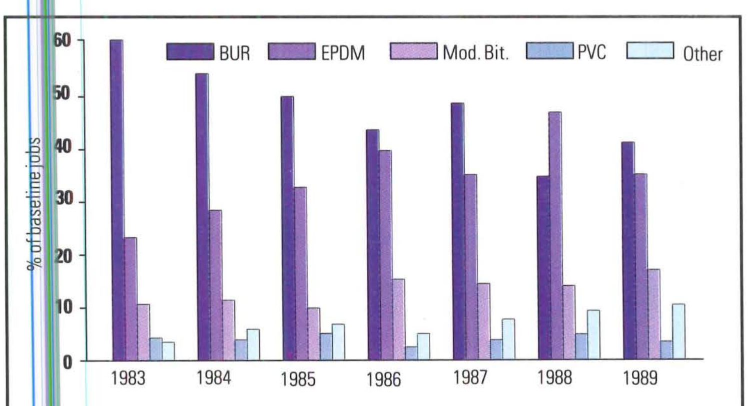
Polyisocyanurate materials achieved a considerable gain in market share. Figure 7 shows a distribution of thermal insulation used during 1989. Polyisocyanurate comprised almost 32 percent of insulations used for low-slope roofing in 1989, up from 5 percent used in 1983. Conversely, polyurethane products, the older generation of the polyisocyanurate, declined in use to 3 percent. Polystyrene materials accounted for 15 percent of the 1989 insulation market, up considerably from 1983. Fibrous glass products had a 10 percent market share in 1989, but exhibited a declining trend from 1983 to 1989. Some of the other conventional insulation materials of past decades, such as mineral and wood fibrous board products, have remained at stable levels of around 10 percent from 1986 through 1989.

In reviewing the problem data with respect to insulations, certain correlations between generic membrane and insulation types can be made. Table 6 summarizes the problem frequency as it relates to combinations of membrane type and the major insulation types. Data currently stored in the NRCA computer data bank provide information to make similar cross tabulations among three or more parameters.

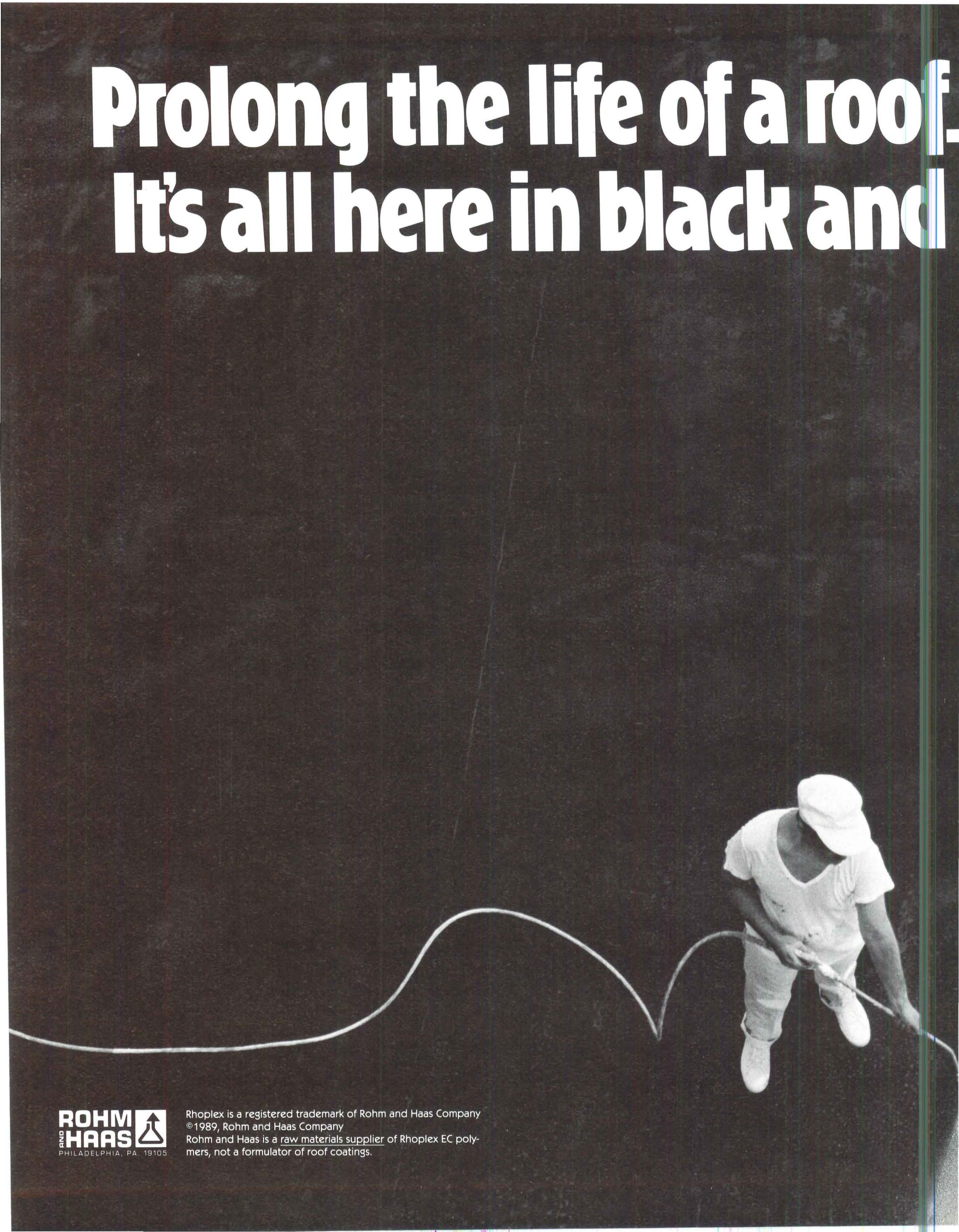
Project Pinpoint data can be analyzed to correlate general or specific problems with such components and application variables as the structural deck, insulation attachment, project type, membrane attachment, and the like. The data bank includes information on product manufacturer, applicator, roof age, problem severity, litigation, and location. It is possible to relate these variables to each other as well as to other information in Projects Pinpoint's data bank.

Computer processing provides several options for treating these data to obtain meaningful information. Although base information, collected over several years, indicates trends that occurred with membranes and thermal insulations, the precision or bias of the data and survey process has not been determined. However, we believe the information that NRCA contractor members supplied is a reliable indicator of trends and problems that have occurred in the United States roofing industry. **William C. Cullen** ■

The author is a research associate of the National Roofing Contractors Association. He served as a staff member of the National Bureau of Standards (now the National Institute for Standards and Technology) for 37 years and is a Fellow of the ASTM. He is 1948 Graduate of Canisus College, Buffalo, New York with a BS degree in Chemistry.



8 Baseline trends in membrane use.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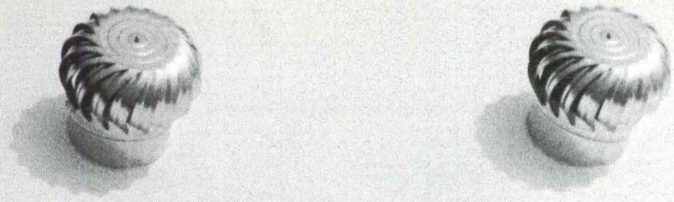


Design + Review + Monitoring = Success

Roofing expert **Carl Cash** examines the steps involved in successful design and construction of roofing

The work needed for the successful preparation, development, and execution of the roofing portion of any project may be divided into three parts. The first part is the design itself. The other two parts are the frequently ignored quality control steps of peer review and monitoring the roofing work. Neglecting either one of these areas will lower the probability for a durable roofing system. Neglecting both of these areas can result in a disaster involving lawyers, roofing consultants, and other characters that you will not appreciate at the time, as well as taxing your relations with clients and reducing current and future income.

Success cannot be achieved without a plan that starts with your proposal to the owner, which should provide both enough time and the appropriate fees for the following procedures:

1. Design development: The selection of the roofing system and flashing details required by the exposure, use, and value to the owner, and the preparation of the detailed contract documents required.
2. Design review: Having the roofing system design checked by someone expert in the field, either inside or outside your organization.
3. Monitoring the roofing work: Watching the progress of the work to increase the probability of compliance with the plans and specifications, to warn all concerned of any problems while they are small and correctable, and to keep track of the job progress. This includes submittal review, evaluation of alternatives, and daily observation of the roofing work.

Design Development

Effective roofing and waterproofing design requires certain functions independent of the thermal and waterproofing materials selected. The functions include (from the structural deck at the bottom to the material exposed to the weather at the top): a structural deck sloped to drains, an air barrier over the structural deck, a layer to attenuate the structural deck movement to the membrane, a layer (or layers) of thermal insulation, a roofing or waterproofing membrane, a drainage layer, and an appropriate wear course. It also includes spacing the rooftop penetrations away from the perimeter and away from each other, and the provision of appropriate and complete flashing details. On new construction, there is no excuse for failing to slope the structural deck to the drains. Any other drainage solution represents economic waste, since it requires the additional cost of tapered materials to slope the surface of the membrane, and frequently increases the cost of extra drains to remove the water from the membrane surface.

In remedial work, if the slope of the structural deck is inadequate, the drainage pattern must be modified with tapered materials and additional drains. On all remedial work, be sure to check the load-bearing capacity of the structure for actual live and dead loads, drifted snow load (if appropriate), and the load caused by water when the primary drains are blocked.

Application of a new roofing system over an existing system is rarely justified. Seldom are owners interested in reroofing buildings that have not leaked. If the old system leaks, its materials are wet, and the only sure way to remove this moisture is to remove the materials that contain it. Removing the existing materials also allows inspection of the structural deck.

The use of an air barrier is a relatively new concept. An effective air barrier acts as a vapor retarder (to prevent the migration of moisture into the roofing system) and retards the flow of air into voids within the roofing system. Reducing this air flow lessens the probability of the dislocation, flutter fatigue, and loss of the roofing materials due to wind. To maximize the effectiveness of the air barrier, provide air barrier seals at all perimeters and penetrations.

An attenuation layer should be provided to prevent the transfer of structural movement from the structural deck to the membrane. Liquid or sheet-applied membranes, intended to be applied directly to the structural deck, must have provision for controlled adhesion to permit localized delamination to respond to structural movement. The fully adhered systems that rely on release materials installed over potentially moving joints require the identification of every moving joint, including cracks in the structural deck, before installation. This is often not practical, since joint locations and crack movements are not predictable.

Thermal insulation serves as an attenuation layer in many systems. It should be installed in at least two staggered layers to minimize heat loss through the insulation joints. Staggered layers of insulation usually provide a smoother surface for the installation of the membrane than a single layer of the same total thickness.

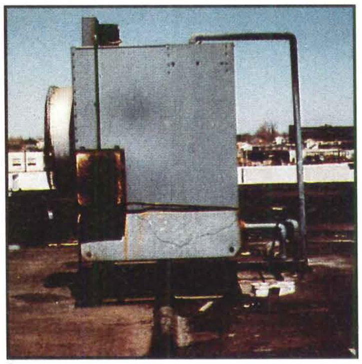
On "nailable" decks (including corrugated metal), mechanically fasten the lowest insulation layer to the deck. Fully adhere the upper layers to discourage fastener "backout." Hot, steep asphalt is a good insulation adhesive, because the adhesion can be checked during installation (unlike cold adhesives that require

Material Selection

Assuming that the material under consideration meets all the Building Code requirements, here are some less technical criteria for separating the potentially effective roofing materials from those which probably will not perform as desired:

- Avoid unrealistically promoted materials (e.g., roofing that allegedly can be applied under water, over snow, etc.).
- Avoid materials advertised as "cure-alls" or which are claimed to make your roof "just like new" (cure-alls and tonics to "restore life" only exist in fiction).
- Avoid materials that have not proven themselves by local performance for at least five years (it should not be your goal to experiment with your client's funds). Avoid materials with magical or undefined components.
- Avoid materials where the technical data, application data, and lists of local applications are "unavailable" or are "just being revised," or are "proprietary."
- Avoid roofing materials that claim "low cost" or "new" as their most important attribute. "Low cost" can translate to mean "low quality"; "new" frequently means "untested."
- Be careful of untested combinations of materials, even if they are satisfactory by themselves: asphalt and coal tar pitch are destructive to each other; the bond between thermoplastic (bitumen), and thermosetting (rubber) materials is frequently impermanent.
- Avoid systems that cannot be maintained with normal roofing maintenance procedures and materials (systems that require special materials, tools, or training, for permanent repairs).

1 *An HVAC unit restricts the movement of the expansion joint.*
2 *Broken blisters in sheet lead roofing attest to the power of trapped water.*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2


3

Flashing Requirements

The specific flashing requirements will vary with each system and type of roof, but the following general principles apply to all systems:

- Support wall base flashing and the perimeter "gravel stop" by treated wood nailers fastened to the structural roof deck (not the wall), so that differential movement will not cause the flashing to fail.
- Mechanically fasten the roofing membrane at every penetration and at each perimeter.
- Extend the flashing at least four inches over the general traffic surface and at least eight inches over the roofing surface.
- Provide expansion joints in the roofing system at all changes in the structural system or material, over all structural expansion joints, and at all major reentrant (inside) corners.
- Be sure all expansion joints are linear and extend through the flashing on the perimeter of the roofing.
- Locate all penetrations at least 5 feet apart. Rooftop equipment, expansion joints, or other penetrating equipment should not block drainage.
- Elevate the roofing membrane at each penetration (except drains) to minimize the leakage potential.
- Avoid scuppers (except as emergency overflow drains), pitch pockets and reglets, where possible.
- Fasten the metal counterflashing within all reglets (if reglets must be used). Do not use lead wedges.
- Do not use exposed fasteners.

a substantial curing time). The top insulation layer should be fiberboard or perlite board to strengthen the upper insulation surface. To avoid blistering, a top layer of fiberboard or perlite insulation must be used directly under built-up roofing membranes where urethane, isocyanurate, polystyrene, or phenolic foams are used as the lower insulation layers.

Installing the thermal insulation under the membrane often is preferred to the protected membrane system, where the insulation is installed over the membrane. In a protected membrane system, the quantity of insulation must be increased by approximately 25 percent to make up for the heat loss due to moisture in the exposed insulation. Also, the almost constant layer of moisture at the interface of the roofing membrane and insulation, similar to ponded water, will decrease membrane performance.

Use of a protected membrane system is appropriate where the danger from exposure to mechanical damage is greater than what – in my experience — is a potential 50 percent loss in the life of the membrane. The only type of insulation suitable for use over the membrane is extruded polystyrene.

The roofing membrane provides the waterproofing in the system and frequently provides most of the roofing system's mechanical strength. Its principal function is to transport storm water to the drains or drainage system. Conceptually, it is an open pipe, and, like any other effective drainage pipe, it must be installed on a slope. The variety of materials that can be used as or in a roofing membrane is perhaps greater now than at any other time in history.

Experience has shown that the only reliable test for performance is the material's successful survival of weather exposure. There is no body of knowledge or group of test methods that can accurately predict performance. It follows then, that the principal criterion for the selection of a roofing membrane is your experience with its performance. Note the emphasis on "your experience." You may wish to rely on the experience of other design professionals, but reliance on the claims by the sales personnel of a roofing materials manufacturer or distributor is questionable.

Do not rely on warranties. The warranty period has no relationship to either the proven or expected system performance. These marketing tools almost always limit the manufacturer's liability, increase the owner's cost, and give the designer a false sense of security. The drainage layer can be the aggregate layer (in a built-up roofing membrane), the ballast aggregate layer (in loose-laid single ply), the layer of drainage fabric or the space under pavers (in plaza systems), or just the surface of the membrane (in fully-adhered systems). The function of the drainage layer is to permit the free drainage of storm water to the drains. Slotted or chamfered insulation or pavers do not provide adequate drainage when installed directly on the membrane. The wear course selected depends on the expected mechanical abrasion. The least protection is provided by membranes without surfacing (i.e., no wear course). Progressively better protection is provided by built-up roofing aggregate, ballast aggregate, and plaza deck pavers (for light traffic). Provide walkways to service all rooftop mechanical systems. Walkways should not interfere with the drainage.

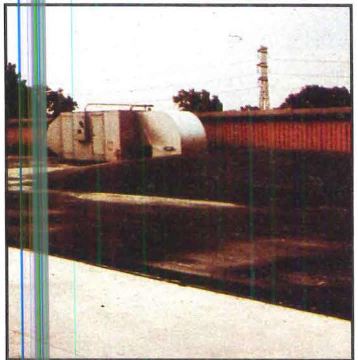
Design Review

The prior section is a primer on the design and selection of roofing systems. It just scratches the surface of the many facets of roofing design. Few, if any, of these principles are taught in engineering or architectural schools. Architects are somehow expected to absorb the knowledge required to design effective roofing systems. Aside from a professional who specializes in roofing design, one of the most effective tools for roofing design improvement is the design review process. The mere "threat" of design review tends to intensify the attention paid to the roofing system design, thereby resulting in improvement.

The effectiveness of the design review process depends on the timing (the involvement of the reviewer early in the design process is best), and the individual reviewer's experience and dedication. While design reviews can be performed "in house," a more detailed and critical review will probably be obtained from one of the many independent design professionals who specialize in roofing technology. Some designers have the design for the entire building envelope reviewed.

Do not depend on review by the owner or his design personnel. Their knowledge of roofing systems is generally limited and inadequate. The maintenance personnel should be consulted about their opinion of the proposed roofing systems, and what maintenance skills are available. This is particularly important when the group responsible for capital expenditures is separate from the group responsible for maintaining the roofs.

Commitment to full design review costs both time and money, but provides you with the opportunity to



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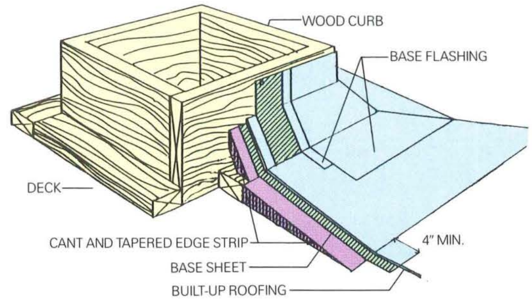


TYPICAL CURB FLASHING

3 *The roofing split extends the end of the expansion joint that was not carried through the edge of the roof.*
4 *Internal air pressure (the lack of an air seal) created this huge EPDM bubble.*

set your organization apart from the proposals of others who are less committed to excellence in roofing design. At the same time, you will reap the long-term rewards of fewer roofing problems and greater client satisfaction.

Monitoring the Roofing Work

Just as the design work is enhanced by the design review, the roofing contractor's work is enhanced by monitoring the roofing work. Competent full-time monitors can increase the assurance that the work will comply with the contract documents. Intermittent monitoring, frequently used to cut costs, can result in intermittent compliance with the contract documents. Neither the quality nor the quantity of the monitor's work changes the duty of the contractor to comply with the contract documents, but a good monitor should make the contractor's work both easier and more productive.

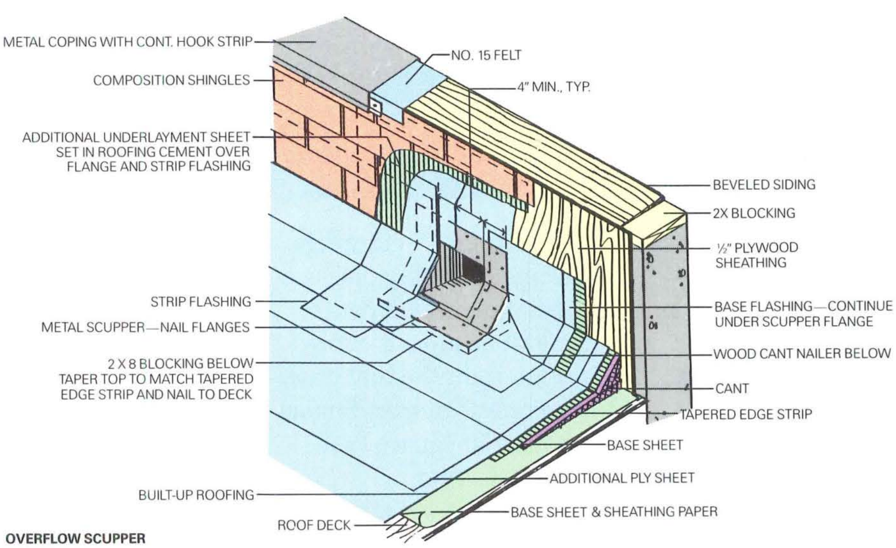
Structure contract documents to increase the effectiveness of the monitor. Include specific requirements for a pre-job meeting, storage of materials, protection during and after construction, application tolerances and reporting. The tools that the monitor requires are a complete set of the pertinent specifications and drawings, the standards cited in the specifications, a list of approved subcontractors and material suppliers, and copies of approved shop drawings and submittals. The monitor should provide copies of the daily progress report to the roofing contractor, to the architect, and to others that the architect may direct, not more than 24 hours (one work day) after the work. The monitor should also provide a weekly progress report together with an estimate of the time to job completion. **Carl G. Cash** ■

The author is a principal at Simpson Gumpertz & Heger, Inc., Consulting Engineers, Arlington, Massachusetts, where he specializes in field and laboratory investigations of roofing systems. Cash is a Fellow of the ASTM and is chairman of Subcommittee D08.20, Non-Structural Roof Systems.

The Role Of The Monitor

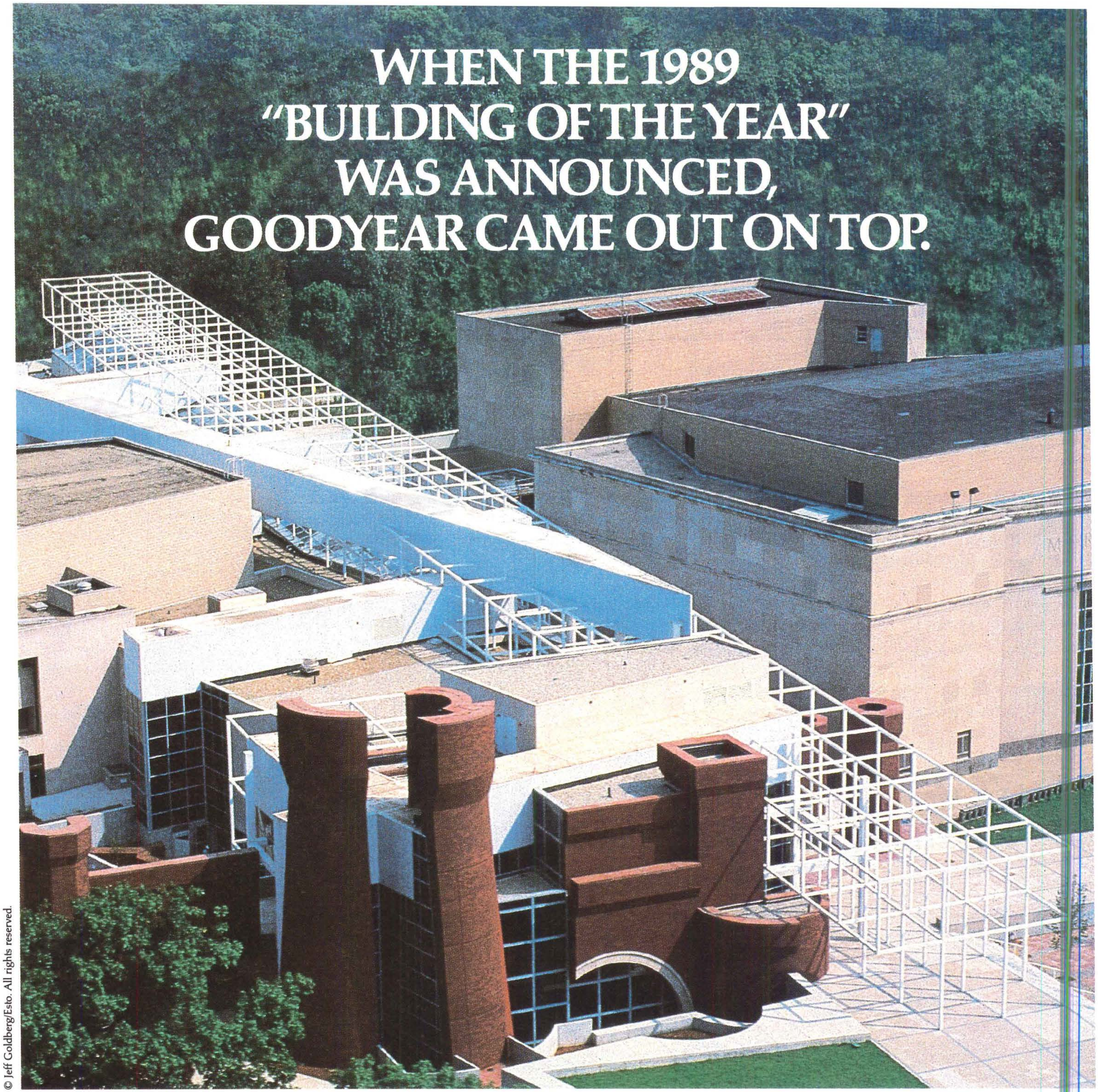
The monitor can check:

- All materials when they arrive at the job site to verify that they are of the type and grade required by the contract documents and to identify selected materials for laboratory testing and others for a "retained sample" file.
- The storage of the roofing materials to help assure that the stored materials do not overload the deck and are appropriately protected from moisture and wind.
- The deck preparation, including the presence of blocking at all penetrations, drain elevation, deck attachment and deck sidelap attachment.
- The application of materials for proper quantities and location. Check compliance with joint tightness, and adhesion of the components.
- The temporary seals at the edges of the new work and the temporary membrane protection, and the flashing as it proceeds.
- The monitor should report: the weather, the number of workers on the job, a running "punch list" for use by the contractor (so that the work can be completed promptly) all visitors to the work, and all conditions observed that might admit water into the building to the roofing contractor at once.
- The monitor should also confirm verbal instructions with a written report that must also list all actions taken to correct the work.



OVERFLOW SCUPPER

1 SCUPPER OPENING MUST BE THREE TIMES THE AREA OF THE DRAIN, MINIMUM.
2 SCUPPER INLET TO BE 2" ABOVE CLOSEST DRAIN.



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Air Barriers and Vapor Barriers: Are They of Any Use in Low-Slope Roofs?

The National Research Council Canada's **Madeleine Z. Rousseau** describes issues that architects work with on a daily basis — knowingly or unknowingly

This is a question the construction industry keeps asking itself. The confusion is probably more obvious with low-slope roofs than with exterior walls. In recent decades, vapor barriers have been expected to control condensation, regardless of how moisture finds its way to the cold side of assemblies. When failures occur, vapor barriers are assumed to be at fault. The industry is more familiar with vapor barriers (or vapor retarders) than with air barriers, and many arguments could be avoided if opponents of one or the other would first define their terms. The debate is usually trivial because common low-slope roofs automatically have a vapor barrier, since many roof deck materials have low permeability to water vapor. What the roof will not have without proper design, quality of execution, and inspection, is an *air barrier* – because air leakage control is not just a matter of using materials with low permeability to air.

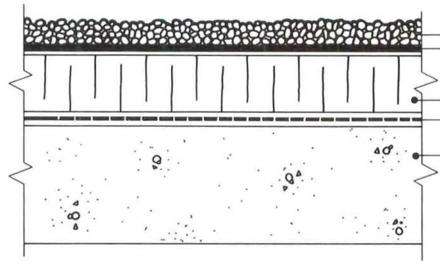


FIGURE 1.
CONVENTIONAL ROOFING SYSTEM

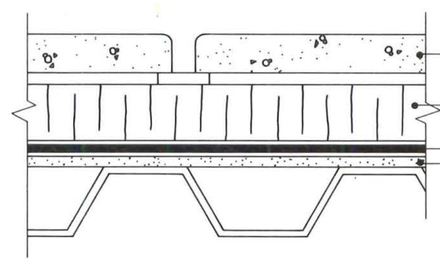


FIGURE 2.
PROTECTED MEMBRANE SYSTEM

Figure 1. In a conventional roofing assembly, a vapor barrier is required on the warm side of the insulation. Either the vapor barrier or the roofing membrane can serve as part of the air barrier system – if properly detailed.

Figure 2. In a protected membrane roof, the roofing doubles as the vapor barrier, but still requires special detailing to serve as part of an air barrier envelope.

Vapor Barriers

Diffusion of moisture through a material is a function of its permeance to vapor as well as the vapor pressure difference across it (vapor diffusion does not involve any movement of air). The lower the vapor permeance of the material, the lower the diffusion through it. Many materials used in low-slope roof construction have low-vapor permeance (see Table 1). Concrete or corrugated steel roof decks have a very low permeance; when on the warm side of the roof assembly, they can perform as vapor barriers. One may argue that because metal decks are not sealed or made continuously airtight, they cannot be considered effective vapor barriers. In fact, vapor barriers do not have to be sealed and completely continuous to control vapor diffusion. The air barrier assembly controls air movement and must be continuous and sealed. It is important to understand which material and assembly is designed to do what, so that the right materials get sealed to other air barrier components of the enclosure — walls and skylights, for example.

In conventional roofs, a vapor barrier on the warm side of the roof assembly reduces moisture transfer by diffusion before it reaches the insulation, so it does not condense at the cold side of the assembly where it could stay trapped underneath the roofing membrane (Figure 1). In protected membrane roofing (PMR), protection of the insulation against diffusion of indoor air is not as critical, since the insulation is exposed to rain. When a thin film of water is present on the PMR membrane, the vapor pressure at the interface between it and the insulation may be higher than that inside and outside the building. Because the membrane has very low permeability to vapor, most vapor diffusion will likely be up through the insulation. To reduce trapping the evaporating rain in the insulation, allowing air circulation at the outside face of the insulation is suggested (Figure 2).

Air Barrier Assembly

About 25 years ago, investigations of moisture damage in buildings indicated that concealed condensation problems were not eliminated by the use of vapor barriers when air leakage through the assembly was not controlled. Exfiltration of moist indoor air carries much more moisture into roof assemblies than diffusion of water vapor does. Maxwell Baker of the National Research Council calculated that under the typical winter conditions that Canadian houses are exposed to, 400 times more moisture can be transferred by air leakage than by diffusion through a Type 2 vapor barrier. In high-rise buildings, air leakage is even more significant, since larger forces are at work to displace air, including wind, mechanical ventilation and stack effect.

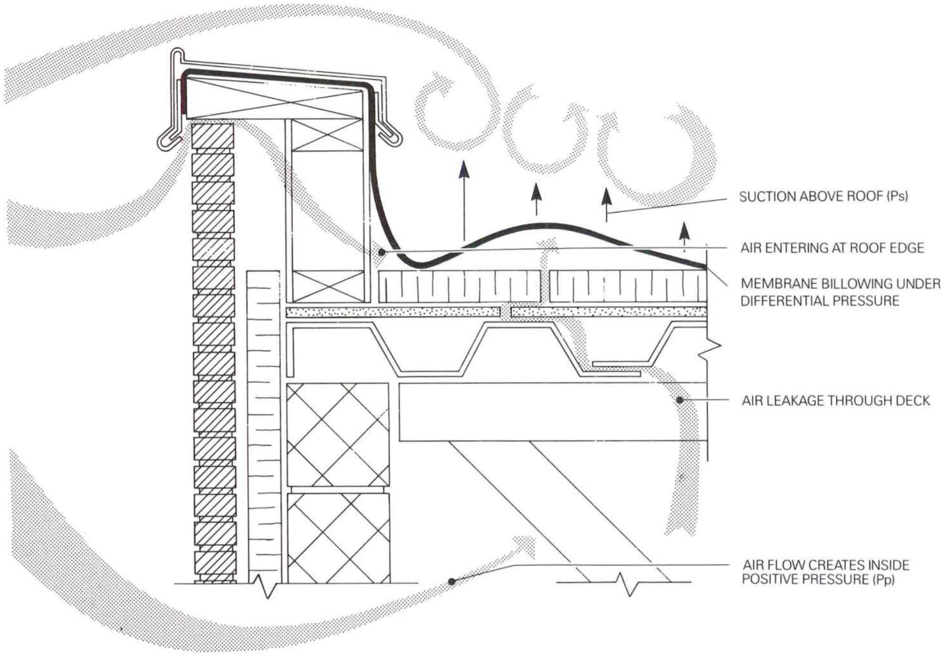


Figure 3. Membrane billowing due to uplift and interior positive pressure.

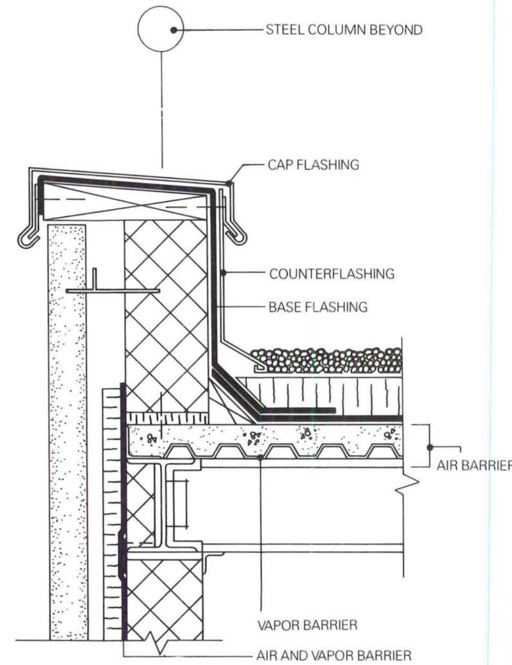


Figure 4. Continuity of Air Barrier.

An air barrier assembly controls air flow through the building envelope. An air barrier is not a material; you cannot buy one. It must be designed and built. Over the whole building enclosure, the air barrier assembly will be made of windows, doors, metal, masonry, concrete, sealants, and other materials. Because air barriers minimize air flow through a roof or wall assembly, low permeability to air is necessary. But this is not enough. The air barrier system has to sustain loads induced by wind, stack effect, and mechanical ventilation without deforming excessively, popping out of its attachments, or opening up at joints.

Besides its low air permeability, the air barrier assembly must be: (1) rigid, (2) strong and fastened to the structure, (3) continuous, and (4) durable. The joints must not only be designed and built to "appear airtight" but should remain airtight when short, high pressure loads (wind gusts that last seconds) or continuous, low pressure loads (stack effect) occur. This demands joints made of an airtight material, supported rigidly on both sides (for flexible materials) and mechanically fastened.

Flexible membranes can be part of an air barrier system as long as they are supported by rigid and structural materials on both sides, otherwise excessive deflection can fatigue the membrane and the joints, and reduce its adhesion and durability. A loose-laid and mechanically fastened membrane installed on a conventional roof without ballast may billow out under suction because of wind and pressure from underneath (Figure 3). This billowing can cause moist air to enter the roof system. Moisture may condense at the underside of the membrane before the air returns to the building as the membrane flattens out. Stiffening the air barrier membrane will avoid this change in volume and "moisture pumping."

The air barrier does not have to be placed on the warm side of the wall or roof assembly, even though this location provides dimensional stability and increased durability. To minimize "through-flow" of air, the air barrier can be located anywhere within the wall or roof assembly, since air will not flow *into* a roof assembly if it cannot flow *out* somewhere. However, other factors such as the vapor permeability of the materials used, the ease of detailing and of building a continuous assembly, the sequence of construction, the ease of inspection and maintenance, and durability should be considered in the selection of the location of the air barrier. Construction Specifications Canada has recently published an information and specifications booklet in their "TEK-AID" series called *Air Barriers,* which suggests a maximum allowable air-flow rate through the air barrier assembly of 0.1 liters/second per square meter at 75 Pa.

Air Barrier in Low-Slope Roof with Concrete Deck

Concrete decks (whether cast-in-place or concrete topping on a steel deck) can act as the air barrier of the assembly since it offers the low air permeability and the rigidity required. If so used, it will have to join continuously with the other airtight components of the enclosure, such as roof drains, wall, and skylights. The roofing membrane also has low air permeability, but the rigidity and structural support required must be obtained either by adhesion to a substrate mechanically fastened to the structure or by adequate ballasting. The wall/roof junction is another critical interface, and is probably easier to detail with concrete than steel. With concrete as the air barrier, continuity of airtightness demands that it be connected to the air barrier element of the wall in an airtight and structural fashion (Figure 4).

Air Barrier in Low-Slope Roof with Steel Deck

Even though sheet steel is airtight, a steel deck is not airtight because of the numerous holes and discon-

Material	Thickness (mm)	Permeance (perms)	Permeance (ng/Pasm²)
Polyethylene sheet	0.15	0.08	4.6
BUR membrane	9.5	0.01	0.57
Modified bitumen	3.7	0.06	4.0
EPDM	1.4	0.06	4.0
PVC	1.0	0.09	5.1
Concrete	100.0	0.8	46.0
Metal Sheathing		0.0	0.0
Metal Foil (no holes)		0.0	0.0
Gypsum board (plain)	9.5	50.0	2860.0
Thermal insulations			
Rigid glass fiber	50.0	56.0	80.0
Extruded polystyrene	50.0	0.6	0.8
Bead polystyrene	50.0	1-3	1.5-4.5
Cellular glass	50.0	0.0	0.0

*Table 1. Permeances of common materials used in roofing. *See note below.*

tinuities in it. Underlay materials with low air permeability can be made into airtight rigid assemblies if all perforations and joints are sealed. If mechanically fastened to the deck, they offer the support required.

In a protected membrane roof, the membrane (combined with the underlay if the membrane is fully-adhered) can provide the airtightness required while the underlay, the insulation, and ballast provide its support and rigidity. In a conventional roof, the membrane can be used as air barrier material and will need ballasting unless it is fully adhered to the insulation. When the membrane is used as the air barrier component, it is critical that the it gets sealed to stacks, skylights, walls, and other penetrations – otherwise moist indoor air can circulate in the flutes of the metal decks with potential for condensation.

When the detailing of the interface between the roof and the wall does not provide airtightness, the flutes of corrugated steel decks can become channels for the exfiltration of moist indoor air into parapets and soffits where it might condense. It is critical that the air barrier of the roof be connected to the air barrier of the wall in a airtight and structural manner.

Conclusion

Vapor barriers can unknowingly be put in a roof assembly, but an air barrier assembly must be designed. The air barrier controls air leakage — the most significant mechanism of moisture transfer that should be controlled in any climate. Understanding of the function of each material in an airtight assembly is necessary to obtain a continuous system over the whole envelope. **Madeline Z. Rousseau** ■

The author is an architect and an associate at the Institute for Research in Construction at the National Research Council Canada, specializing in performance of building envelopes with regard to heat, air, and moisture problems.

References

Roofs that Work, Building Science Insight '89, National Research Council Canada, Ottawa (613) 993-2463, 1989.

Vapor Barrier, Sheet, for Use in Building Construction, CAN2-51.33-M80, Canadian General Standards Board, Hull, Quebec 1980.

Roofs, Maxwell Baker, Polyscience Publications, Montréal (514) 226-5870, 1980.

Air Permeance of Building Materials, Doru Bumbaru *et* al, Canada Mortgage and Housing Corporation, Ottawa, 1988.

Testing of Air Barrier Systems for Wood Frame Walls, W.C. Brown and G. F. Poirier, Canada Mortgage and Housing Corporation, Ottawa, 1988.

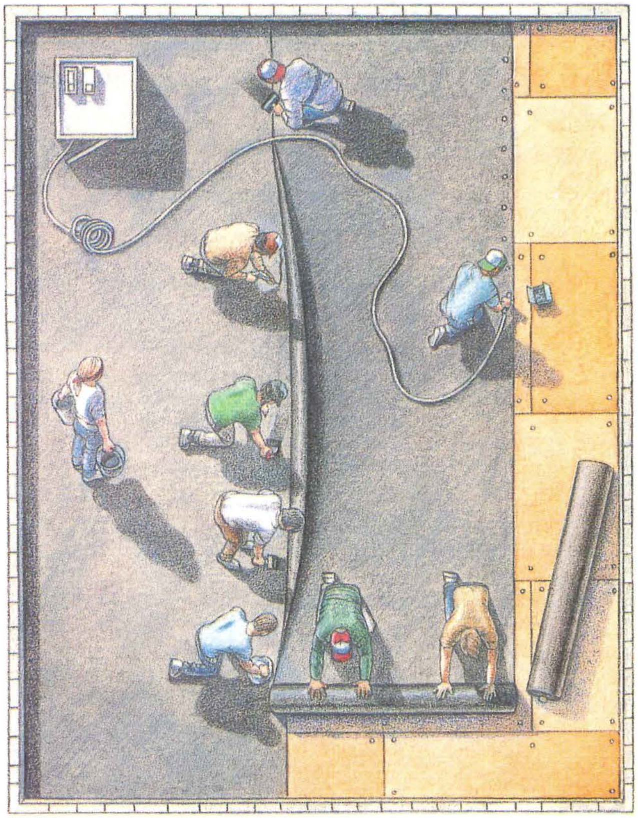
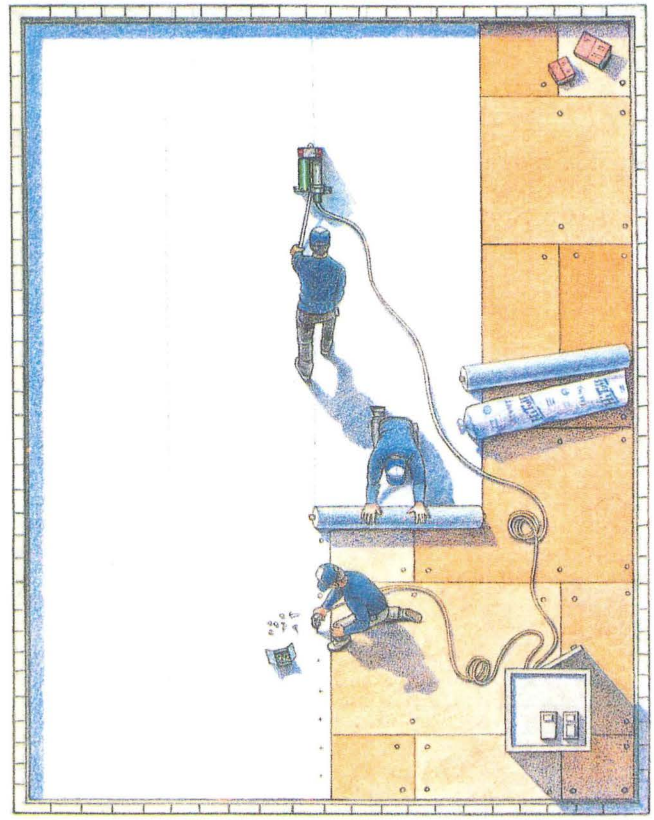
Air Barriers, TEK-AID 07195, Construction Specifications Canada, Toronto (416) 922-3159, 1990.

Construction Details for Air Tightness, NRCC 18291, National Research Council Canada, Ottawa (613) 993-2463, 1980.

**Note:* Type 1 vapor barrier has a maximum permeance of 15ng/Pa(s)m²; Type 2 vapor barrier has a maximum permeance of 60ng/Pa(s)m² (Canadian General Standards Board).
Source: Roofs that Work *(1989)*.

Material or Composite Wall Assembly	
Below 0.005 L/s per m² at 75Pa: (close to detection limit)	
■ 9.5 mm plywood sheathing	
■ 38mm extruded polystyrene insulation	
■ 38mm extruded polystyrene insulation + 3M tape at joints (with or without tape at nail heads)	
■ 25mm foil-backed urethane insulation board	
■ 24 and 42mm phenolic foan insualtion	
■ 28mm phenolic foam insulation + 3M tape at joints and nail heads	
■ 13mm cement board	
■ 13mm foil-backed gypsum board	
■ aluminum foil on Kraft paper backing	
■ 1.3mm modified bituminous self-adhesive membrane	
■ 2.7mm modified bituminous torched-on membrane	
■ 13mm interior gypsum board painted with 2 coats of latex paint with joint of paper tape and joint compound	
Between 0.005 and 0.1L/s per m² at 75 Pa	
■ 0.15mm (6 mil) polyethylene film sandwiched between 11mm plain fiberboard and 13mm interior gypsum board	0.006
■ 8mm plywood sheathing	0.007
■ 16mm waferboard	0.007
■ 13mm moisture resistant gypsum board	0.009
■ 11mm waferboard	0.011
■ 13mm particleboard	0.015
■ 13mm exterior gypsum board + Perm-A-Barrier tape at joint	0.015
■ 28mm phenolic foam insulation + 3M tape at joints	0.018
■ reinforced non-perforated polyolefin geotextile	0.019
■ 11mm asphalt-impregnated fiberboard (with joints untaped) covered with 76mm sprayed polyurethane foam on one side	0.019
■ 13mm gypsum board	0.020
■ 11mm asphalt-impregnated fibreboard (with joints untaped) covered with 76mm sprayed polyurethane foam on one side	0.025
■ 16mm particle board	0.026
■ 3.2mm tempered hardboard	0.027
Between 0.1 and 1 L/s per m² at 75 Pa	
■ 25mm expanded polystyrene type 2	0.12
■ 30 lb roofing felt	0.19
■ 15 lb non-perforated asphalt felt	0.27
■ 15 lb perforated asphalt felt	0.40
■ spunbonded olefin film on one side of glass fibre semi-rigid board	0.49
■ 11mm plain fiberboard	0.82
■ 11mm asphalt-impregnated fiberboard	0.83
■ spunbonded polyolefin film	0.96
Above 1 L./s per m² at 75 Pa	
■ 3mil perforated polythylene (4.3-4.5 perforations /cm²)	3.2-4.0
■ 25mm expanded polystyrene insulation, type 1	12
■ 15mm by 127mm tongue-and-groove wood planks (8joints)	19
■ 152mm glass fiber insulation	37
■ 75mm vermiculite insulation	70
■ 38mm spray-on cellulose insulation	87

Air Permeability of materials and assemblies.
Source: Air Permeance of Building Materials *and* Testing of Air Barrier Systems for Wood Frame Walls.

Wind At The Edge

Consulting architect **Charles Goldsmith** reviews recent events and recommendations for wind uplift resistant roofing

It doesn't matter how good the roof membrane is — when the edges and flashings fail during a wind storm, the roof covering will usually follow. Hurricane Hugo proved that. Industry experts have repeatedly observed that flashings and edge metal release before the roof covering fails (Figure 1). In some cases, even the wood blocking that held the metal edges pulled away from the building structure (Figure 2).

What lessons were learned as a result of Hugo? If nothing else, experts agree that there has not been enough industry testing of flashing, fastening, and metal edges to simulate the dynamic effect that winds and temperature changes have on roof coverings and, in particular, on metal edges. A limited amount of static testing of edge metal has been conducted but this is primarily by individual manufacturers, and the results have been used only internally for product development. A survey by this writer has found little, if any, thermally-conditioned dynamic testing to simulate the real world environment. The importance of dynamic testing was effectively demonstrated during the Roof Wind Uplift Testing Workshop held in November 1989 at Oak Ridge, Tennessee. The workshop participants reviewed European standards for roof uplift resistance, which included fatigue testing using the latest dynamic test procedures from Europe [the *Proceedings of the Roof Wind Uplift Testing Workshop* are available from the National Technical Information Service at (703) 487-4650 for $23; the stock number is DE-90008041]. This workshop led to the formation of an industry-wide committee to deal with wind-related roofing issues and task forces dedicated to evaluation and standardization of dynamic test methodologies, and the promulgation of edge metal and air barrier detailing.

Current Guidelines

But hurricanes and high winds won't wait for task force reports, and 21st-Century buildings with aerodynamic spoilers and wind screens on every rooftop are still in the future. The question remains: Can architects prevent future roof failures caused by wind? Where is the design professional to go when looking for the proper basis for design, even adjusted for the calculated wind conditions?

It should be recognized that today's flashing and edge metal detailing was derived by trial and error, and is an art rather than a science. Much of the published information on the subject has yet to be tested in any simulation of the real life conditions of fatigue or climatic changes, yet there is still a lot of information published on this subject.

Professional trade groups, such as the National Roofing Contractors Association (NRCA) and the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) issue manuals of suggested details for flashing and edge metal. Agencies, including Underwriters Laboratories (UL), have issued classification cards covering uplift testing of the roof covering. Factory Mutual (FM) has published loss prevention data sheets covering perimeter flashing and blocking based on wind engineering criteria. To say that this data has not been adequate would ignore the thousands of installations still serving their intended purposes. Yet we spend millions of dollars replacing installations that have failed at wind velocities below code design conditions. We need to know how to use the published information properly.

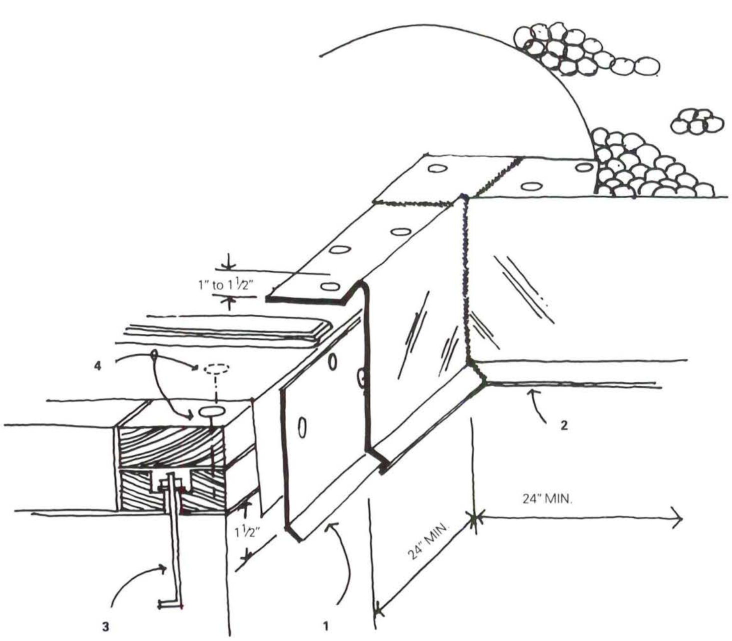
Figure 1. NRCA

Figure 2. NRCA

Wind Behavior

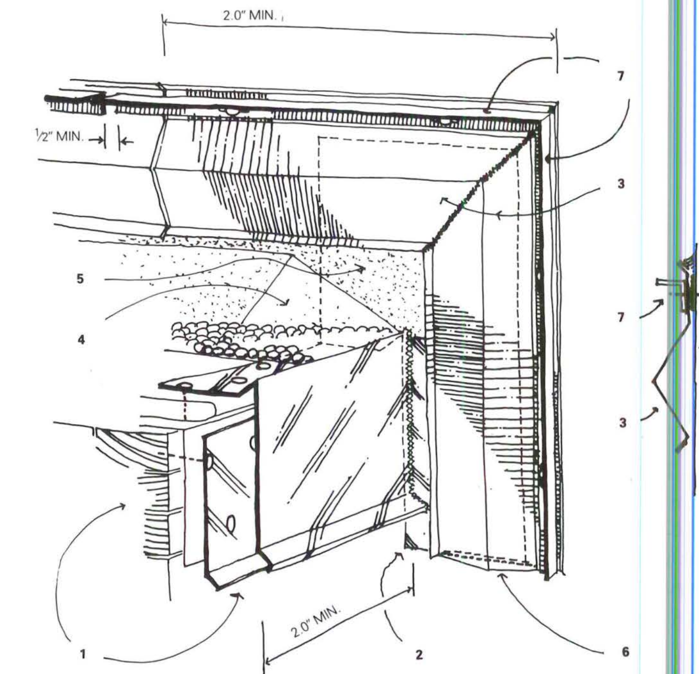
Before general guidelines and details can be useful to the design professional, some basic wind engineering information is in order. Wind affects the roof covering in a number of different ways. As wind flows toward and over a building, it creates a negative (suction) force on the roof, tending to separate the roof components from the body of the structure. This suctional force on the membrane can be added to by the direct positive pressure of the wind as it finds its way through openings and cracks in the windward side of the building and infiltrates the deck to the roof covering. Winds from a corner direction can create tornado-like vortices that cause the highest uplift pressures at roof corners and edges. These varying effects are usually built into the model building code requirements for wind loading, and coefficients are added to provide for the corner and edge effects.

Uplift forces can be formidable, with negative pressures ranging from a low of 10—20 pounds per square foot (psf) for a single story inland building to a high in excess of 200 psf for tall structures on the Florida coast. The design professional needs to learn how to interpret local building code provisions for wind uplift. It is



GRAVEL STOP

1 22 GAUGE CONTINUOUS CLEAT; FASTEN 3" O.C. TURN UNDER ½"
2 24 GAUGE GRAVEL STOP; FASTEN @ 3" STAGGERED; SHOP FABRICATE ALL CORNERS
3 FASTEN INTO SOLID SUBSTRATE WITH MIN. + ½" @ 24" O.C.
4 RING SHANK NAILS @ 12" O.C. STAGGERED



TYPICAL GRAVEL STOP TERMINAL

1 FOR GRAVEL STOP, CLEAT, BLOCKING, ETC., SEE TYPICAL GRAVEL STOP, DETAIL 1
2 END PLATE OF 24 GAUGE GALVANIZED METAL; COPE OUT TO MATCH FASCIA PROFILE AND SHOP SOLDER; GALVANIZED PAINT ALL CUTS
3 MITER CUT AND SHOP SOLDER COUNTERFLASHING; MITER CUT 1 x 1 x ⅛ FASTEN OVER COUNTERFLASHING @ 8"
4 TAPER CANT TO FACE OF GRAVEL STOP
5 CONTINUE BASE FLASHING TO LAP GRAVEL STOP END PLATE AND SECURE UNDER COUNTERFLASHING
6 CLOSE END; SOLDER ALL EDGES
7 PREFAB TERMINATION BAR; FASTEN @ 8" O.C. THROUGH OVAL HOLE

not sufficient to specify "conform to code." Each building requires its own case-by-case calculation.

As the base velocity pressures are calculated for wind speed and height, and the additional code coefficients for terrain, use, gust, and edge influence are added, the basic wind uplift pressures can, in some geographic areas, be increased by a factor of 3.0 or more. This can increase the required wind resistance beyond recognized industry standards. The wind uplift resistance values of roof components, based on Factory Mutual and Underwriters Laboratories testing (in the field of the roof) stop at 90.0 psf without safety factors. Using a minimum safety factor of 2.0 brings the values down to a use factor of 45.0 psf, hardly enough to satisfy some severe wind uplift conditions. Under these severe conditions, standard details may not be adequate. The design professional should review the test data, therefore, from individual manufacturers or design with products to meet uplift conditions specific to the job. It is imperative to match the code uplift requirements with the product wind resistance information. It is not sufficient to merely specify "meet Factory Mutual I-90." An FM or UL designation of 90 does not mean 90 mph. In other words, the architect must match up requirements with the product. Do not assume that published test results of fastener performance will be applicable on your building until you have correlated your conditions with those on which the test data were based. Once this correlation has been verified, then you may be confident that your design will perform under anticipated wind conditions.

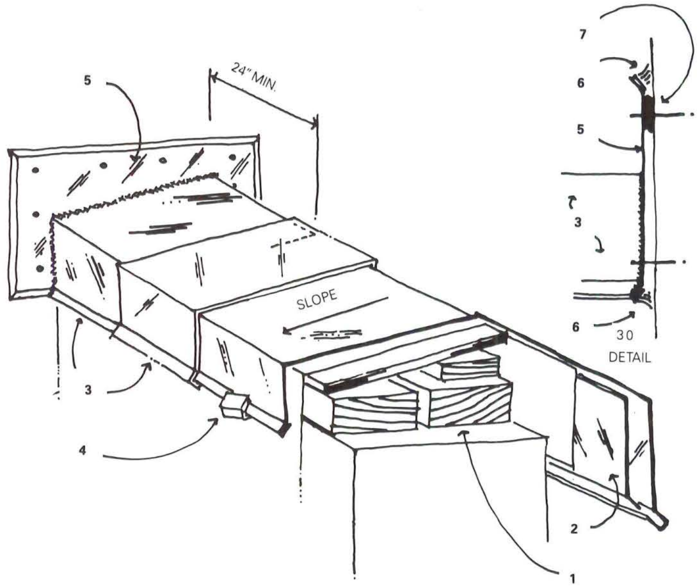
Some product testing of prepared roof coverings stops at an actual wind velocity of 60 mph by UL. It should be remembered that most roof covering materials used today have not been tested to the extreme wind uplift pressures required by codes. Moreover, most roof edge flashing details have never been actually tested at the uplift pressure levels used for testing the field of the roof covering. This may account for much of the high-dollar value of wind loss claims at wind velocities below building code requirement.

Most wind testing is specific. The designer should become familiar with wind uplift testing procedures used by the manufacturer before specifying the roof covering product, and should verify that the testing methods conform to the building configurations and details of any given project.

In addition to the effects of wind, the designer needs to be aware that severe weather changes can affect edge metal, inducing forces strong enough to eventually loosen the fastener and cause flashing failure and subsequent wind loss. Metal temperatures climb well above 150 F and cool down during rain, sometimes causing a temperature change in excess of 100 F. This force acts at each temperature change.

The thicker the metal, the higher the force against the fastener. A 10' piece of 26-gauge galvanized gravel stop exerts a horizontal force in excess of 3800 pounds while a 22-gauge piece exerts a force of over 6300 pounds. Following industry recommendations, the potential temperature-induced force is over 150 pounds against each fastener in a 22-gauge gravel stop. The metal must be either be restrained from moving or allowed to expand and contract freely. You can't do both. Movement usually can be restrained by using at minimum a 10-gauge fastener placed on 3 inch centers in staggered rows.

Metal expands from and contracts to the middle of



COPING CAP

1 P.T. LUMBER (AT FRONT EDGE TO PROVIDE SLOPE)
2 CONTINUOUS CLIP FASTEN AT 3" O.C.
3 COPING CAP WITH 6" JOINT COVER CAP SET INTO TWO ROWS OF SEALANT, EACH SIDE
4 REVERSE CLIP @ 24" O.C.
5 END PLATE OF 24 GAUGE GALVANIZED METAL; COPE OUT TO MATCH PROFILE; SHOP SOLDER; FASTEN TO WALL AND SEAL AT ALL EDGES
6 SEALANT
7 SEALANT TAPE TOP AND TWO SIDES

its length, causing maximum movement at the ends, unless totally restrained. Designers must provide for this condition by ending all flashing with some termination device securely welded, soldered, or attached to its end. It is not advisable to have metal end at 45-degree corners where the forces converge. All metal flashing at corners, "L's" and "T's" should be welded or soldered at joints and should extend 24 inches beyond that joint before meeting another piece of metal. If metal edges are designed to expand and contract freely, the material must be heavy enough to support itself, lie flat, and not allow water underneath. A 1/2 inch expansion gap with a 6 inch joint cover should be provided between any two 10 foot pieces of metal.

Success Is In The Details

Some general recommendations are:

- Test pullout resistance of the specified fastener *in situ;*
- Match fastener materials and metals to prevent corrosion;
- Specify all fasteners securing metal as ring shank, deformed, or threaded to help prevent backout;
- Secure all roof edge metal flanges with fasteners staggered to restrain the metal from movement;
- Secure galvanized iron thicker than 24 gauge and extruded metals through oval holes to prevent the dislodgement of fasteners;
- Specify all galvanized sheet steel as minimum ASTM A-527 G90 (zinc coating thickness);
- Provide continuous wind cleats at all roof-edge gravel stops (except at gutters);
- Specify wind cleats to be one gauge heavier than the metal they restrain and fastened in the same way;
- Avoid penetrating the top surface of flashings;
- Specify dry lumber edge blocking (19 percent maximum moisture content) to prevent shrinkage;
- Design blocking wider than the flange it supports;
- When clips, cleats, or folds are designed into a metal roof covering system, verify that all test results for the exact configuration match the code uplift requirements;
- Consult manufacturers of proprietary edge metal for their details and fastening requirements.

Will the standard details work? In tribute to the roofing industry, the fact that there has not been more loss of roof covering because of wind is an indication that roofing products can perform better than present testing methodology indicates. And it indicates that the suggested industry details, although not always tested, do perform satisfactorily under most conditions.

Charles B. Goldsmith ■

The author is principal of C.B. Goldsmith and Associates, an architecture, forensic architecture, and roofing consulting firm in Clearwater, Florida. Goldsmith sits on ASTM Committee D-8 (Roofing, Waterproofing, and Bituminous Materials) and the Wind Engineering Research Council. He is task force chairman of the new Roofing Industry Committee on Wind Issues.

Recommended Reading

In addition to the workshop proceedings discussed in the text, see the roofing library listings on page 125.

Roofing Directory

Associations

The Aluminum Association
900 19th St NW, Suite 300
Washington, DC 20006
(202) 262-5100

American Institute of Steel Construction
1 East Wacker Dr
Suite 3100
Chicago, Il 60601-2001
(312) 670-2400

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400

American Iron and Steel Institute
1133 15th St NW, Suite 300
Washington, DC 20005
(202) 452-7100

Asphalt Roofing Manufacturers Association
6288 Montrose Rd
Rockville, MD 20852
(301) 231-9050

Copper Development Association
Greenwich Office Park 2
Greenwich, CT 06836
(203) 625-8210

Factory Mutual Research Corp.
1151 Boston Providence Tpke
PO Box 9102
Norwood, MA 02062

Institute of Roofing & Waterproofing Consultants
51 West Seegers Rd
Arlington Hts, IL 60005
(708) 640-1113

Metal Building Manufacturers Association
1230 Keith Bldg
Cleveland, OH 44115
(216) 241-7333

Midwest Roofing Contractors Association
8725 Rosehill Rd, Suite 210
Lenexa, KS 66215
(913) 579-6600

National Institute of Standards and Technology
Administration Bldg, Rm A 629
Gaithersburg, MD 20899
(301) 975-4040

National Roofing Consultants Association
10255 W. Higgins Road, Suite 600
Rosemont, IL 60018
(708) 299-9070

National Roofing Contractors Association
10255 W. Higgins Road, Ste 600
Rosemont, IL 60018
(708) 299-9070

National Tile Roofing Manufacturers Association
31-27 Los Feliz Blvd
Los Angeles, CA 90039
(213) 660-4411

North East Roofing Contractors Association
148 State St
Boston, MA 02109
(617) 227-0220

Red Cedar Shingle & Handsplit Shake Bureau
515 116th Ave NE, Suite 275
Bellevue, WA 98004
(206) 453-1323

Roof Consultants Institute
7424 Chapel Hill Rd
Raleigh, NC 27607
(919) 859-0742

Roofing Industry Educational Institute
14 Inverness Drive East
Building H, Suite 10
Englewood, CO 80112-5608
(303) 790-7200

Roof Research Center
Oak Ridge National Bldg 3147
PO Box 2008
Oak Ridge, TN 37931-6070
(615) 574-4345

Rubber Manufacturers Association
Roofing Products Division
1400 K Street NW, Ste 900
Washington, DC 20005
(202) 682-4815

Sheet Metal & Air Conditioning Contractors National Association
8224 Old Court House
Tysons Corner
Vienna, VA 22182
(703) 790-9890

Single-Ply Roofing Institute
104 Wilmot Road, Suite 201
Deerfield, IL 60015
(708) 940-8800

Society of the Plastics Industry
1275 K Street NW, Ste 201
Washington, DC 20005
(202) 371-5200

Underwriters Laboratory
333 Pfingsten Road
Northbrook, IL 60062
(312) 272-8800

Roofing Accessories

Air Vent
4801 N. Prospect
Peoria Heights, IL 61614
(800) 247-8368

A-Tech Fastener Corp.
PO Box 3453
Syracuse, NY 132220
(800) 242-1155

Composite Technology
1005 Blue Mound Road
Ft Worth, TX 76131
(817) 232-1127

Construction Fasteners
Spring & Van Reed
Wyomissing, PA 19610
(215) 376-5751

Creative Construction Components
523 Baldwin Street
Elmira, NY 14901
(607) 732-4965

Custom Curb, East
3005 South Hickory Street
Chattanooga, TN 37407
(615) 629-6241

Custom Curb, West
4705 West Jefferson
Phoenix, AZ 85043
(800) 251-3001

CWR Manufacturing
PO Box 2669
Syracuse, NY 13220
(800) 362-6226

Envirospec
PO Box 86, Station U
Toronto, Ontario
Canada M8Z 5M4
(416) 252-2090

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Roofing Directory Continued

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lanover Architectural Products
240 Bender Road
Hanover, PA 17331
800) 426-4742

V.P. Hickman
75 Sweeten Creek Road
P.O. Box 15005
Ashville, NC 28813
704) 274-4000, Ext. 109

Lomanco Ventilation Products
PO Box 519
acksonville, AR 72076
501) 982-6511

Roofblok
PO Box 2624
Fitchburg, MA 01420
508) 582-9426

J-Flow Roof Drain Systems
PO Box 6489
Buffalo, NY 14240-6489
716) 854-1521

Built-up and Modified Bitumen

AFM
Box 246
Excelsior, MN 55331
800) 255-0716

American Hydrotech
Time-Life Building
541 North Fairbanks
Chicago, IL 60611
312) 337-4998

B.T.L. Weatherproofing
284 Watline Avenue
Mississauga, Ontario
Canada L4Z IP4
(800) 387-9598

Celotex
(See Single-Ply)

GAF Building Materials
1361 Alps Road
Wayne, NJ 07470
(201) 628-3000

Garland
3800 E. 91st Street
Cleveland, OH 44105
(216) 641-7500

GS Roofing
5525 MacArther Blvd
Suite 900
Irving, TX 75038
(214) 580-5600

Hickman Systems
29100 Hall Street
Solon, OH 44139
(216) 248-7760

Karnak
330 Central Avenue
Clark, NJ 07066
(201) 388-0300
(800) 526-4236

Koppers Industries
1301 Koppers Building
Pittsburgh, PA 15219
(800) 558-2706

Manville
PO Box 5108
Denver, CO 80217-5108
(800) 654-3103

MBTechnology
188 S. Teilman Street
Fresno, CA 93706
(800) 621-9281

Owens-Corning Fiberglas
Fiberglas Tower
Toledo, OH 43659
(419) 248-8000

Siplast
Xerox Center
222 West Colinas Blvd
Irving, TX 75039
(214) 869-0070

Soprema Roofing
2181 Northlake Parkway, Suite 107
Tucker, Georgia 30084
(404) 938-3878

Tamko
220 West 4th Street
Joplin, MO 64802
(417) 624-6644

Tri-Ply
1250 Fourteen Mile Road
Clawson, MI 48107
(313) 288-9780
(800) 445-9856

U.S. Intec/BRAI
PO Box 2845
Port Arthur, TX 77643
(800) 624-6832 (Tech Hotline)
(800) 231-4631

Metal Roofing

AEP Span
5100 East Grand Avenue
P.O. Box 26288
Dallas, TX 75226
(214) 827-1740

Aluma Shield
405 Fentress Blvd
Daytona Beach, FL 32014
(615) 637-1711

ASC Pacific, Inc.
Tacoma, Wash.
(800) 874-8741

Berridge
1720 Maury
Houston, TX 77238
(713) 223-4971

Bethlehem Steel
Industry Marketing
Bethlehem, PA 19105
(215) 352-5700

ECI
PO Box 968
Stafford, TX 77497
(713) 445-8555

Fashion
15450 West 108th Street
Lenexa, KS 66219

Follansbee Steel
Follansbee, WV 26037
(800) 624-6906

Merchant & Evans
Crossroads Industrial Community
100 Connecticut Ave
Burlington, NJ 08016
(609) 387-3033

Metal Building Components
PO Box 38217
Houston, TX 77238
(713) 445-8555

Metal Sales
10300 Linn Station Road
Louisville, KY 40223
(502) 426-5215

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Roofing Directory Continued

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Moncrief-Lenoir
PO Box 2505
Houston, TX 77252
(713) 225-1441

Petersen Aluminum
955 Estes Avenue
Elk Grove Village, IL 60007
(800) 323-1960

Revere Copper Products
P.O. Box 300
Rome, NY 13440
(800) 448-1776

Star Manufacturing
PO Box 94910
Oklahoma City, OK 73143
(405) 636-2010

Vincent Metals
724 24th Avenue, S.E.
PO Box 360
Minneapolis, MN 55440
(612) 378-1131

Single-Ply Roofing

Bond Cote Roofing
PO Box 71
West Point, GA 31833
(800) 368-2160

Burke Rubber
2250 South 10th Street
San Jose, CA 95112
(408) 297-3500
(800) 669-7010

Celotex
One Metro Center
4010 Boyscout Blvd
Tampa, FL 33607
(813) 873-4000

Carlisle Syntec Systems
PO Box 7000
Carlisle, PA 17013
(717) 245-7000

Colonial Roofing
150 South Connell Ave
Dyersburg, TN 38024
(901) 285-4353

Cooley Roofing Systems
50 Esten Ave
Pawtucket, R.I. 02860
(401) 724-0490

Dunlop Construction Products
2055 Flavelle Blvd.
Mississauga, Ontario
Canada L5K 1ZB
(516) 487-6767

Duroplast Roofing
525 Morley Drive
Saginaw, MI 48601
(800) 248-0280

Dynamit Nobel/Hüls America
Trocal Roofing
2 Turner Place
Piscataway, NJ 08855
(800) 343-9319

Firestone Building Products
525 Congressional Blvd.
Carmel, IN 46032
(800) 428-4442

Gen Corp Polymer Products
Building Systems Division
PO Box 875
Toledo, OH 43896-0875
(419) 729-3731

Goodyear Tire and Rubber
1144 E. Market Street
Akron, OH 44316-0001
(800) 231-5887 (Ohio)
(800) 992-ROOF

W.R.Grace & Co.
62 Whittemore Ave
Cambridge, MA 02140
(800) 242-4476

Continued on page 160

Roofing Directory Continued

Continued from page 158

International EPDM
Rubber Roofing Systems
5110 Angola Road
Toledo, OH 43615
(800) 248-1558

JPS Elastomerics
395 Pleasant Street
Northhampton, MA 01061
(413) 586-8750

Kelly Energy Systems
PO Box 2583
Waterbury, CT 06723
(203) 575-9220

Klober Plastics
17891 Sky Park Circle, Suite D
Irvine, CA 92714
(714) 252-0102

Koppers Industries
(see built-up)

Manville
(see built-up)

Nord Bitumi U.S.
105 Morris Avenue
Springfield, NJ 070781
(201) 467-8669

North American Roofing Systems
9700 North Michigan Road
Carmel, IN 46032
(317) 875-5434

Republic Powdered Metals
2628 Pearl Road
Medina, OH 44256
(216) 225-3192

Sarnafil
Canton Commerce Center
100 Dan Road
Canton, MA 02021
(800) 451-2504

Seal Dry/USA
486 S. Opdyke Road
Pontiac, MI 48057
(800) SEAL-DRY

Siplast
(see built-up)

Synergy Methods
50B Tiffany Street
PO Box 119
Danielson, CT 06239
(203) 774-3348

Tremco
10701 Shaker Blvd
Cleveland, OH 44104
(216) 292-5000

A wine warehouser had a better use for a bucket than a leaky roof.

When Quality Beverage Company, a major distributor in the Southwest, decided to expand their Houston distribution warehouse, they'd already had their fill of the water ponding and leaking problems of traditional built-up roofing. Quality Beverage principals Anthony and Michael Saragusa said roof maintenance on their main 250,000-square-foot facility was too costly.

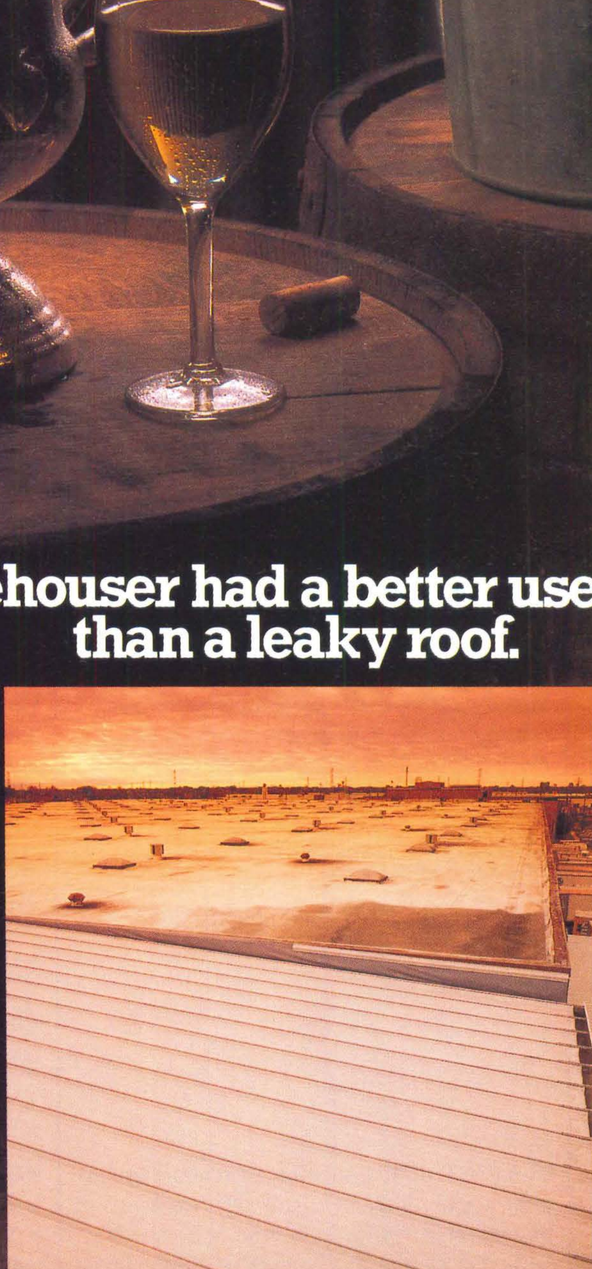
So the architects for the new 115,000-square-foot warehouse, Wahlberg Wright & Waite of Houston, contacted metal-roofing manufacturers.

ECI Building Components won the contract for several reasons, according to architects Paul Wahlberg and Jim Waite.

First, the product. ECI Standing Seam with Versalok.® Even with 132 skylights, ECI backed the new roof with a 20-year Weather-Tightness Warranty.

Second, the service. Key ECI personnel worked hands-on with the architects to work out special design requirements. ECI met every delivery deadline and arranged for and supervised the installation.

At ECI, we're proud of testimonials from our customers. And we can furnish you with many more so you can specify quality ECI roofing with the confidence of our warranted products and professional service.



Quality Beverage Company's old roof had severe ponding and leaking problems causing high yearly maintenance costs.

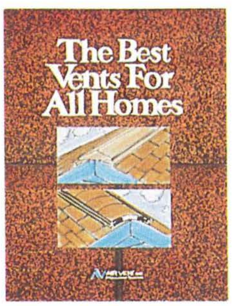
ECI
BUILDING COMPONENTS, INC.
Quality, American Style
1-800-6699-ECI
ECI is an employee-owned company.

Offices and plants: Houston, Texas/Amarillo, Texas/Jemison, Alabama/Lodi, California/Tualatin, Oregon/Lakeland, Florida/Williamsburg, Missouri. See the Yellow Pages under "Roofing Contractors" for the ECI Authorized Builder in your area. Versalok® is a registered trademark of ECI Building Components, Inc.

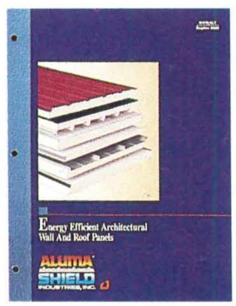
Circle No. 356

Roofing Products Literature

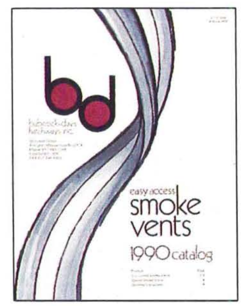
AFM's EPS board foam plastics are recylclable, free from CFCs and HCFCs. AFM's Contour Taper Tile®, slope-to-drain system, and Perform® roofing systems use EPS foam insulation. The high R value of EPS reduces fuel consumption and its pollutants. For free copies of the new AFM literature call (800) 255-0176 or write AFM Corporation, Box 246, Excelsior, Minnesota 55331. **AFM Corp.** Circle No. 439



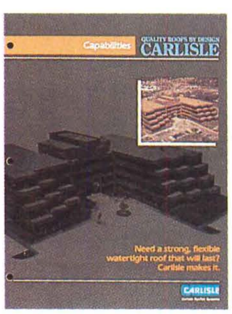
Ridge Ventilation. Catalog features all Filter-vent ridge vent products and new Shinglevent II. Explains benefits of soffit to ridge ventilation system. Discusses importance of protecting new shingle warranties through adequate ventilation. Research data shows why baffle and patented filter are critical to vent performance. Includes technical drawings, specifications, and complete product list.
Air Vent. Circle No. 438



Product brochure describes complete line of prefabricated polyurethane insulated metal panels for wall and roof systems. Seven new panel products are now available for specific application to the industrial/commercial building market. Brochure also describes Aluma Shield's addition of a second computerized continuous line maufacturing system. For more information telephone (904) 255-5391.
Aluma Shield Industries. Circle No. 414

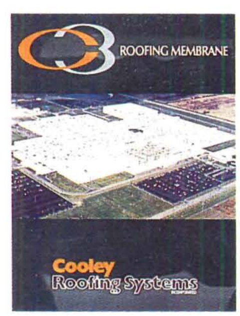


Babcock-Davis Hatchways manufactures a complete line of Access Hatches and Smoke Vents. Catalogs provide specifications and architectural details on patented Roof Hatches, Flush Interior and Exterior Floor Hatches, Gutter-Type Sidewalk Hatches, Ceiling Hatches, and UL Listed Automatic Smoke Vents. Babcock-Davis Hatchways, 50 Lowell Street, Arlington, Massachusetts 02174.
Babcock-Davis Hatchways. Circle No. 413

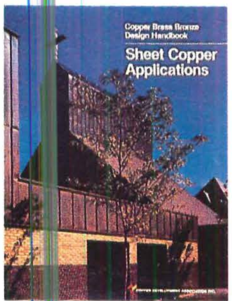


Carlisle Syntec Systems is the leader in the EPDM single-ply roofing industry with innovative designs, reinforced sheets, new fastening systems, and roofing related accessories. Discover Carlisle's "Capabilities" in this 12-page booklet which includes the Sure-Seal® and Brite-Ply™ Mechanically-Fastened and Fully-Adhered EPDM Roofing Systems.
Carlisle Syntec Systems. Circle No. 437

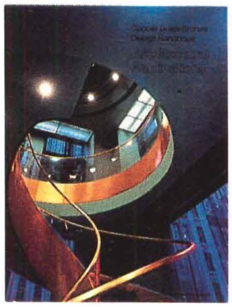
DEKFAST Roof Insulation Fastening Systems offer a wide range of Factory Mutual approved fasteners for both new construction and reroof applications. Their exclusive fastener coating "SENTRI" provides exceptional protection against corrosion. All components are manufactured to exacting quality standards and distributed via CFI Service Centers throughout the U.S. and in Canada.
Construction Fasteners Incorporated. Circle No. 427



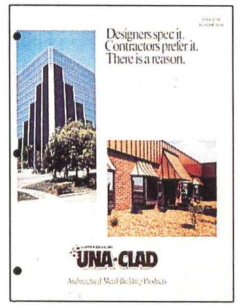
New brochure describes Cooley Roofing Systems' C3®, a new tri-polymer (CPE, PVC, ELVALOY) hot-air welded, mechanically-fastened, single-ply membrane roofing system. For fast, economical installation, C3 comes in widest roll available, and does not require any seam sealing. C3 is available in white, silver, smoke, and desert tan.
Cooley Roofing Systems. Circle No. 436



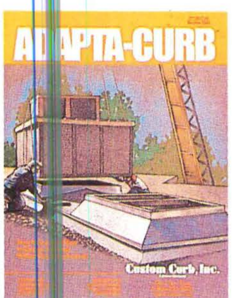
A 56-page brochure which describes in words, photos, and detail drawings how leading architects use copper in outstanding contemporary buildings. Sheet copper fundamentals, design, details, specifications for professionals. Publication No. 401/0. Price is $4.00 each copy from Copper Development Association, P.O. Box 1840, Greenwich, Connecticut 06836. **Copper Development Assoc.**



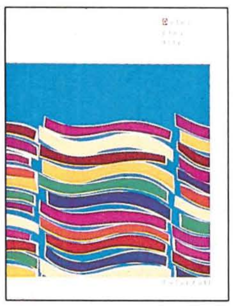
"Architectural Applications: Copper/Brass/ Bronze Design Handbook." This 32-page booklet is a comprehensive guide to selecting, fabricating, finishing, design, installation, protection, and maintenance of 11 principal alloys in major end-use applications. Publication No. 405/7R. Price is $4.00 each copy from Copper Development Association, P.O. Box 1840, Greenwich, Connecticut 06836. **Copper Development Assoc.**



Copper Sales is a national metals service center which serves the critical needs and requirements of the architectural industry. Quality roofing systems, panels, column covers, tile facsimile, and other architectural metal products are available in a wide range of materials, gauges, finishes, and colors. **Copper Sales.** Circle No. 426

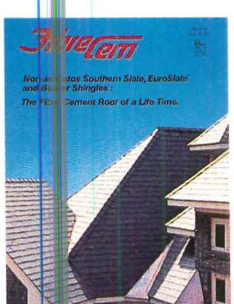


Informative new brochure illustrates the many configurations and options available with Adapta-Curb System that allows equipment to be changed without disturbing the roof. It is designed for retrofit as well as new construction applications. The brochure outlines features and methods possible for easy addition or replacement of HVAC units and other roofing equipment. **Custom Curb.** Circle No. 425

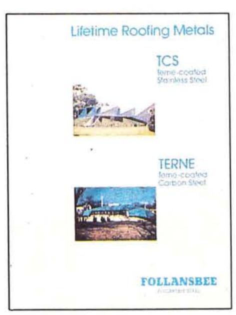


Deleo Clay Roof Tiles are the perfect compliment to any architectural style. We offer colors from traditional reds to sea green. Or consider the earthen appeal of our through-body colors. Try using color tiles alone or in blends. For more information call (714) 674-1578. **Deleo Clay Tiles.** Circle No. 435

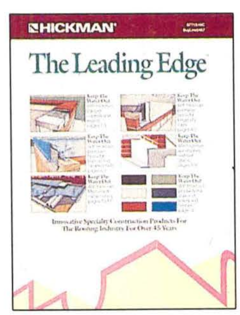
A Practical Solution to Roof Paver Stone Applications. New bulletin shows a better way to transform a roof into a patio, terrace, balcony, walkway, plaza podium, promenade, or just plain roof deck, using the Pave-El Pedestal System. Designed to elevate, level, and space paver stones for drainage in any weather, Pave-El reliably protects roof paver stone, membrane, and insulation. **Envirospec.** Circle No. 434



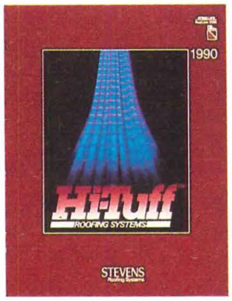
Roofscaping™ by FibreCem. Flexibility and versatility of slate-simulated non-asbestos fiber cement roofing shingles in achieving striking and eye-appealing Roofscaping™ designs for added beauty, value, and distinction are described. Southern Slate™, EuroSlate™, and Beaver Shingle™ highlighted. Lower in cost than natural slate. Easy to install. Fifty-year warranty. UL Rated Class A Fire Resistant and UL Class 60 Uplift Resistant. Call (800) 346-6147. **FibreCem.** Circle No. 424



Follansbee Lifetime Roofing Metals – TCS (terne-coated stainless steel) and terne metal. Brochure illustrates roofing metals in industrial, commercial, institutional, and residential projects. Applications feature standing seam and batten seam roofs designed by prominent architects and expressing innovative design and expression of form with metal roofing. **Follansbee Steel.** Circle No. 412

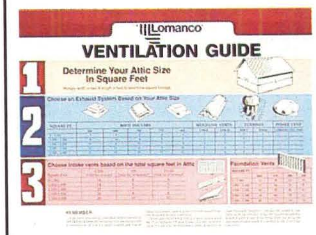


For over 45 years, the W.P. Hickman Company has been designing and manufacturing innovative roofing products that keep the water out at the roof edge. Products include parapet copings, reglets, perimeter fascia, Microzinc® roofing, accessories and roof drains. Choice of 24 gauge galvanized steel and prefinished aluminum, both with Kynar® 500 finish. **W.P. Hickman.** Circle No. 423

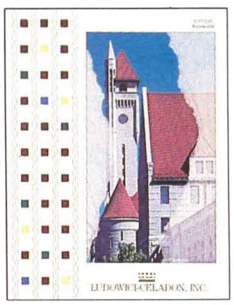


Hi-Tuff Roofing Systems Brochure. An updated 1990 brochure featuring the Hi-Tuff Roofing System, includes charts, diagrams, and photos providing information on the company, its history, and its single-ply roofing systems. Brochure features detailed technical information on system components, selection criteria, installation specifications and more. A pocket-sized version is also available.
JPS Elastomerics. Circle No. 433

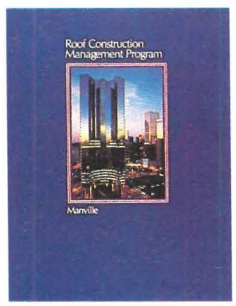
Klober Vent Tiles add to the aesthetics of a tile roof because the Vents are exactly the same shape and color of the roof tiles. Their design insures that water will not get under the roof. For a 20-page catalog write to: Klober Plastics, 17891 Sky Park Circle, Suite D, Irvine, California 92714 or call (714) 252-0102 or FAX (714) 252-0104.
Klober Plastics. Circle No. 422



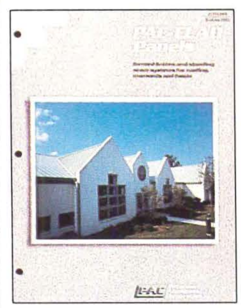
Select the proper amount of ventilation products from this ventilation guide which is now available from Lomanco, the nation's largest full-line residential ventilation manufacturer. All information is based on current building codes. Various ventilation products and the problems associated with the lack of ventilation products are described.
Lomanco. Circle No. 431



An eight-page, full-color brochure features clay roof tile installations throughout the country. Commercial, residential, and institutional projects are included in addition to a display of standard color selections for tiles listed. Ordering information, limited warranty and specification guidelines are included. **Ludowici Celadon.** Circle No. 432



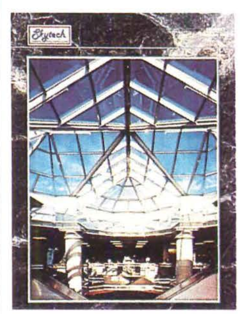
Manville's Program unifies the functions of design, specification, contractor qualification, application, guarantees and annual maintenance inspections. Geared to large new construction projects as well as roof repair and replacement. Permits exceptional up-to-20-year guarantee.
Manville Roofing Systems Division. Circle No. 430



PAC-CLAD PANELS. Petersen Aluminum offers a full-color, 20-page brochure featuring their complete line of quality metal roofing products. PAC-CLAD Kynar 500®, backed by a 20 year warranty, is available from stock in 18 standard colors. For more information call (800) PAC-CLAD. **Petersen Aluminum.** Circle No. 421

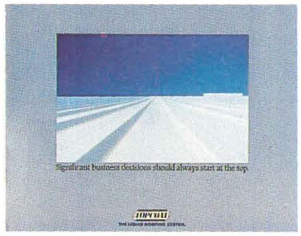
Sarnafil, a roofing systems manufacturer for over 25 years, has published a Design/Specifications Manual. The manual includes highly instructive, full-color cutaways of the "new" mechanically fastened Sarnafast disk attached system as well as the Sarnafil adhered, IRMA, bar and ballasted systems. Five attachment systems offered by Sarnafil are also highlighted. Call or write Sarnafil Roofing Systems at (800) 451-2504, 100 Dan Road, Canton, Massachusetts 02021. **Sarnafil.** Circle No. 429

The Siplast 24-page catalog describes the complete line of Siplast high performance roofing systems in detail. Clear illustrations show specifications amd details. Also, a Product Information Chart, and a variety of information on approved roofing contractors, roof insulations, deck construction, reroofing, approvals/classifications and guarantees provide the user with complete Siplast Roofing System information. **Siplast.** Circle No. 420

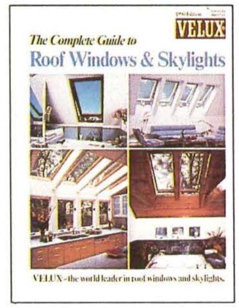


Skytech Systems offers new 12-page color brochure which provides detailed architectural drawings, design specifications, and photographs of custom skylights for a variety of commercial uses. Also included are fabrication, execution, and installation highlights plus warranty information. Units are shipped from factory complete, ready for installation. Skytech Systems, P. O. Box 763, Bloomsburg, Pennsylvania 17815. **Skytech Systems** Circle No. 415

Supra-Slate II, the first of Supradur's asbestos-free products, is available in a vast array of colors. Supra-Slate II, virtually indistinguishable from real quarry slate, will continue the reputation already established by Supra-Slate as the standard of the industry. Product literature providing specification data and application instruction can be obtained by contacting Supradur at (800) 223-1948, in New York at (914) 967-8230. **Supradur.** Circle No. 419

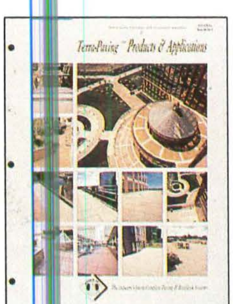


TOPCOAT is the original Liquid Roofing System designed specifically for the retrofit of metal roofing. Forms a flexible, monolithic membrane able to withstand expansion and contraction inherent to metal roofing. Watertight 10-Year System Warranty available. Call for more information (800) 313-0009. In Massachusetts (508) 668-4128. **Topcoat Liquid Roofing System.** Circle No. 418

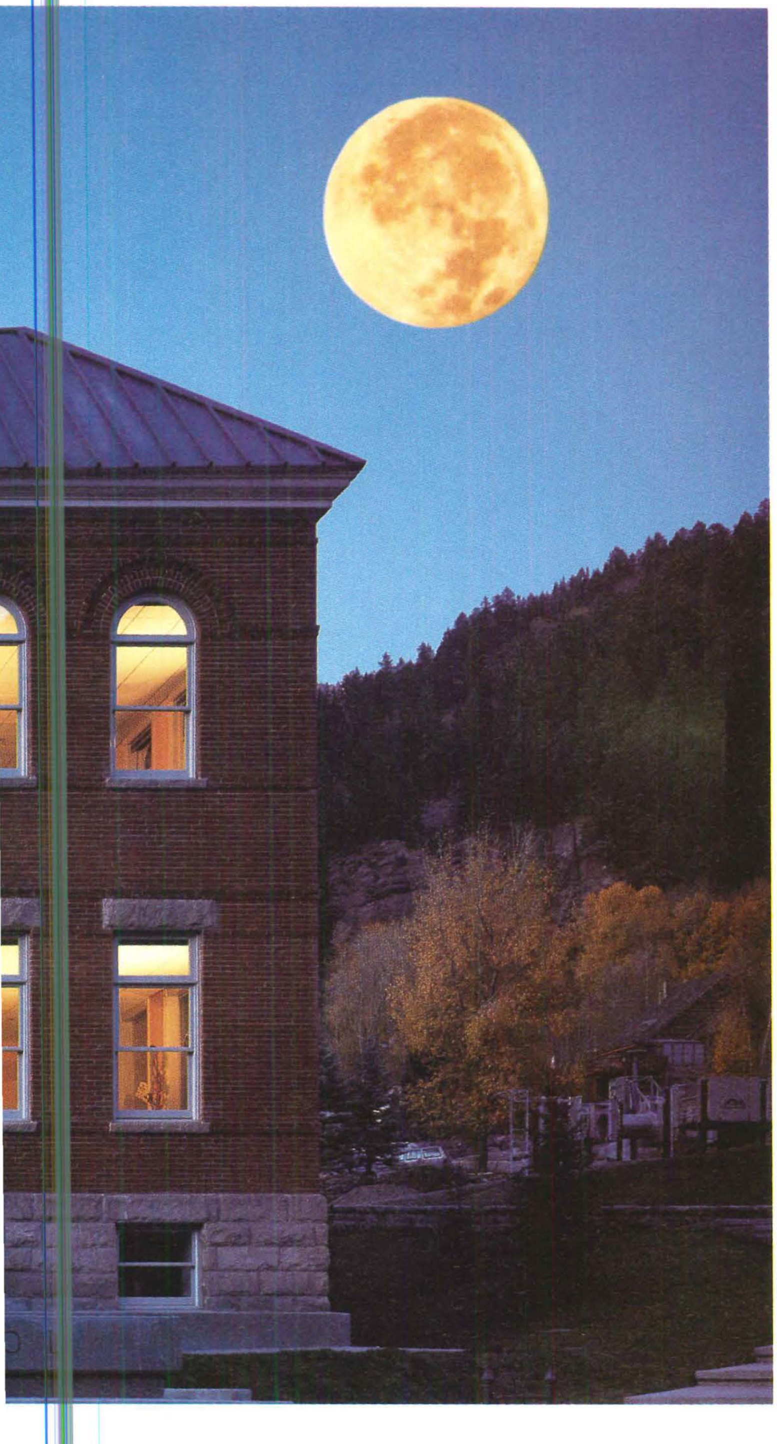


Velux-America, Inc. – 28-page, full-color brochure features detailed information and design ideas on quality VELUX roof windows and skylights. Included is a wealth of information on sizing, choosing models and accessories, and installation for design professionals. **Velux-America.** Circle No. 416

Retrofit Roof Drain Brochure. Solve the problem of replacing existing broken roof drains without entering buildings, cutting ceilings, removing roof decks, and dislodging the existing drain. A six-page, full-color brochure explains features and how they help. U-Flow Roof Drain Systems, P.O. Box 6489, Buffalo, New York 14240–6489 (716) 854-1521. **U-Flow Drain Systems.** Circle No. 428



Terra System One™ Complete Deck System is the nations leading Roof and Plaza deck system. It includes superior quality concrete pavers in several sizes and limitless colors, the Terr-Adjust patented paver pedestal, Terra-Tabs paver support/spacers, Terra-Shims, and Terra System One Mix. Ideal for use over Single-Ply installations or on grade. Call (800) 388-8728. **Wausau Tile.** Circle No. 417



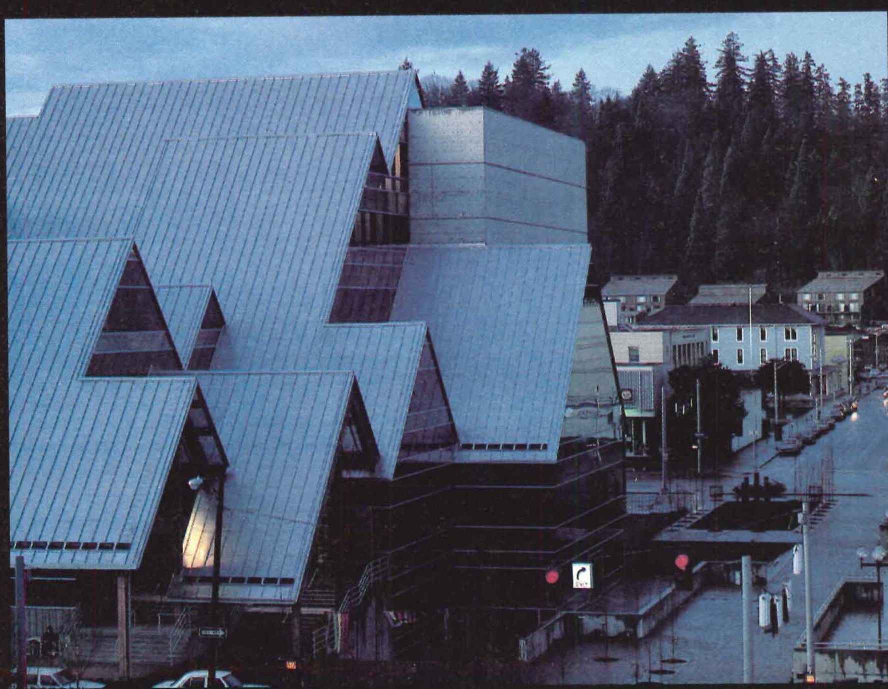
The TCS roof. elegant simplistic adaptive

There is, in the remarkably simple lines of a TCS standing seam roof, an expression of architectural character unmatched by other types of roof forms. As it serves its essential function of providing shelter, TCS, terne-coated stainless steel, gives the Hult Center for the Performing Arts a bearing of elegance. And, under most atmospheric conditions, TCS will weather to an attractive, warm gray.

TCS is readily adaptable to all types of structures and allows maximum creative latitude to the designer at relatively modest cost.

Aesthetics aside, however, TCS has outstanding functional characteristics—great tensile strength combined with light weight and a low coefficient of expansion; exceptional resistance to corrosive attack and a durability measured in generations rather than years.

We will be happy to send you substantiating evidence. Call us at 800/624-6906.



Hult Center for the Performing Arts, Eugene, Oregon.
Architects: Hardy, Holzman, Pfeiffer Associates, New York, NY.
Roofer: Acme Roofing, Eugene, Oregon.
Photograph by Timothy Hursley.

TCS is available in Europe and in the Pacific Rim.
For more information, see our catalog in Sweets

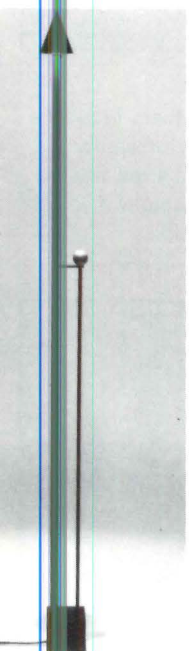
FOLLANSBEE

FOLLANSBEE STEEL • FOLLANSBEE, WV 26037
FAX 304-527-1269

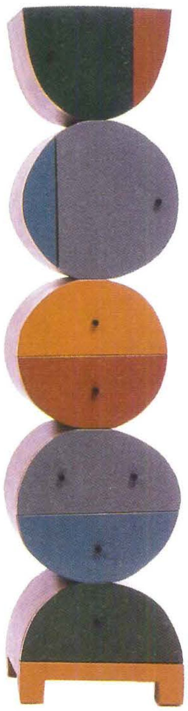
Circle No. 353

New Products and Literature

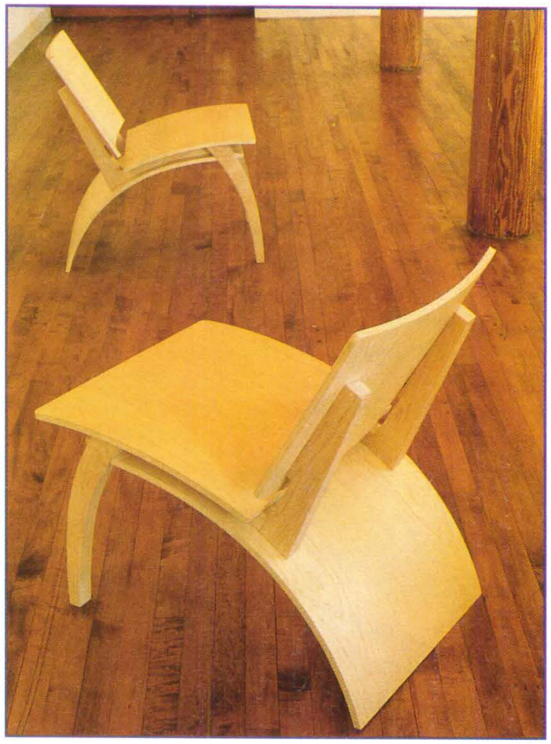
1 *Circle 100 on reader service card*



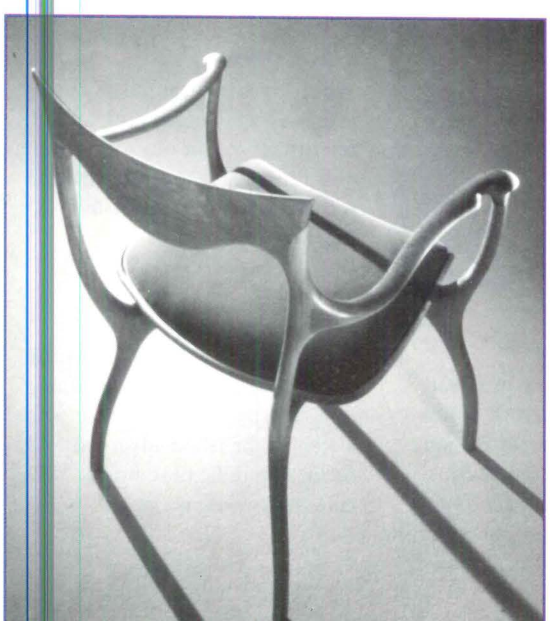
2 *Circle 101 on reader service card*



3 *Circle 102 on reader service card*



4 *Circle 103 on reader service card*



5 *Circle 104 on reader service card*

6 *Circle 105 on reader service card*

Diva sofa from Dialogica (1); Strala floor lamp from Portico (2); Dancer Cabinets from Godley-Schwan (3); Series II Chairs by Scott Blair (4); Hypnos chair from Ceccotti (5); and Large Black Ottoman from Domestic Furniture (6).

New Products and Literature

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Review: ICFF 1990

Year two of the International Contemporary Furniture Fair, held at the Jacob Javits Convention Center in New York in May, clearly illustrated the potential and the problems currently propelling and restraining furniture design in the United States.

The fair, sponsored by *Metropolis* magazine and George Little Management, is billed as a venue where furniture designers can make contact with manufacturers and the public.

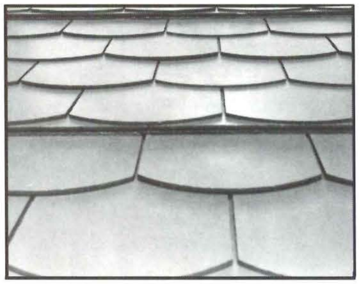
Although no overall trend was visible, there was a somewhat isolated tendency (both conscious and unintended) to look to the 1950s and before. New York-based Dialogica's provocative Diva sofa – "like a Diva in the opera" – was inspired by the energy and overtness of the 1920s (1). Six-foot-tall walnut Dancer Cabinets, produced directly from freehand drawings by New York's Godley-Schwan, are in a variety of amorphic forms with lacquer-colored fronts (3). New York-based Scott Blair's Series II bent wood chairs, with their shifting planes and hand-crafted/machine-age stylizing, offered respectful homage to obvious predecessors (4). Large Black Ottoman, by Domestic Furniture, Los Angeles, confronts rather than welcomes with its exaggerated girth and height (6). Ceccotti, from Italy, offered the Hypnos armchair, its solid cherry-wood structure embracing tenets of organic design (5). Toronto's Portico showed the Strala lamp with a ball that twists on light, winner of a P/A furniture competition (P/A, May 1987, p. 117) (2).

Described as both "boring" and "better than Milan" by attendees, the ICFF is a promising venue; at the moment, however, it is a venue without definition.

Abby Bussel ■

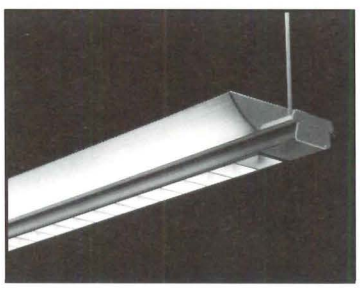
Stainless Steel Sink
A new sink by New York designer David Zelman has a stainless steel bowl basin supported by tubular steel framework. Towel rails are on either side of the basin. Hastings.
Circle 106 on reader service card

Craftwood® Tinted Veneers
Twelve colorwashed, book-matched, flat-cut oak veneers have been introduced to coordinate with ColorQuest® solid color laminates. Veneer sheets can be ordered with high-pressure phenolic laminate backer or flexible and semirigid paper backers. Ralph Wilson Plastics.
Circle 107 on reader service card



New Ribbon Row Roofing
Roofscaping(SM) is a ribbon row roof design installed with simulated slate nonasbestos fiber-cement Beaver Shingles(SM); a double-thick half slate is installed every seven to ten rows to diversify roof patterns. FibreCem.
Circle 108 on reader service card

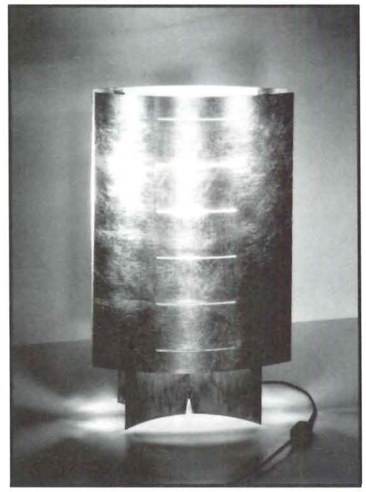
Wood Panel Directory
The 1990 "American Plywood Association Membership and Product Directory" contains names of the 57 APA member manufacturers, and lists manufacturers of structural wood panels, and mills and assigned mill numbers. American Plywood Association.
Circle 200 on reader service card



Ceiling Mounted Lighting
NeoLux can be mounted on ceilings nine feet and higher. It is recommended for office, classroom, and open space applications; and uses one, two, or three T8 or T12 lamps. Neo-ray.
Circle 109 on reader service card

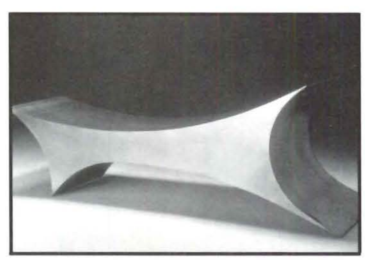
Standing Seam Roof System
CRP16 straight-rib standing seam roof panels have been introduced. They are permanently bonded together on-site with a portable seaming machine and can be ordered in Galvalume™ or premium extended life fluorocarbon finish. The Ceco Corporation.
Circle 110 on reader service card

Portable Fitting Rooms
A five piece portable fitting room can be installed by two people; white panels with black extrusions are standard. Optional accessories include hooks, mirrors, and corner benches. Thrislington Cubicles.
Circle 111 on reader service card

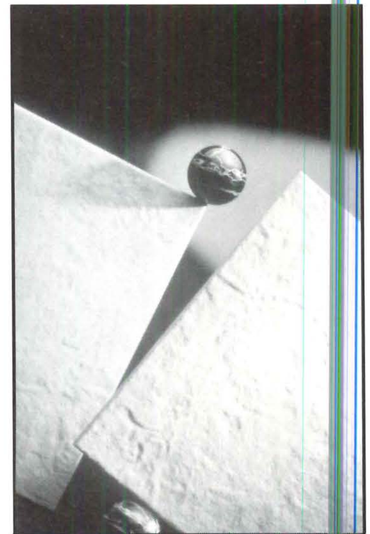


Ambient Table Lamp
The Sumo table lamp by architect David Baird is constructed of gold-leaf-covered metal screens on an oxidized steel base. The lamp is 21 ½″ × 13″ × 4 ½″. Ziggurat.
Circle 112 on reader service card

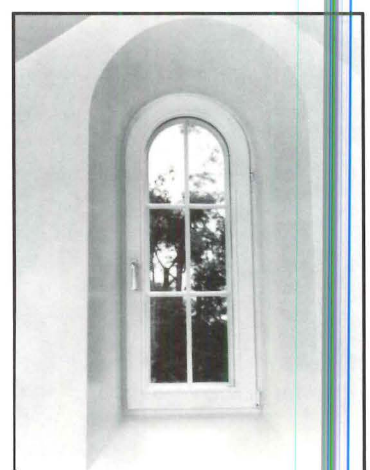
Roofing Products Brochure
The 1990 Commercial Roofing Products Brochure has four categories: SBS Modified, Fire Rated SBS Modified, Fiberglass-Based, and Organic Felt. Tamko.
Circle 201 on reader service card



Chaise and Foot Stool
Venlet chaise longue and foot stools are constructed of aluminum or steel; a powder-coated finish in custom colors is also available. The chaise is 27 ¼″ × 23 ½″ × 73″ and the foot stool is 20″ × 18 ½″ × 29 ½″. Uniquely Australian.
Circle 113 on reader service card



Residential Tile
Catene Montuose from Monoceram is suitable for interior and exterior residential applications. Square-foot tiles come in five colors. Tile Group Italia.
Circle 114 on reader service card

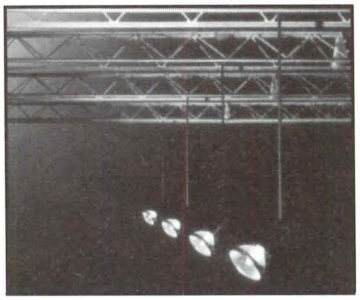


Custom Windows
Windows are designed to customer specifications and can be manufactured in any size, shape, and finish. Soundproofing and security glazes are available. Tischler und Sohn.
Circle 115 on reader service card

Halogen Floor Lamp
The Totem halogen floor lamp from Sirrah has a built-in dimmer, a gray sandstone base, and a stem in brushed silver or gold, or in a metallic blue finish. IPI.
Circle 116 on reader service card

(continued on page 172)

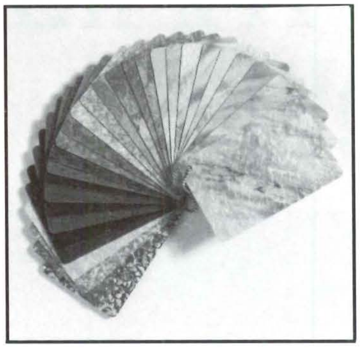
(continued from page 170)



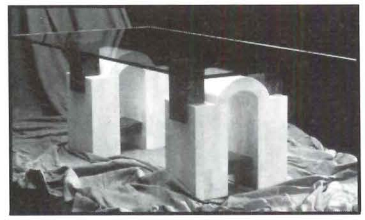
Low Voltage Lighting
The Structurella low-voltage lighting system can be suspension or wall mounted. (A photograph of this product was published incorrectly, P/A, June 1990, p. 187; the system should have been shown in a horizontal position.) Targetti.
Circle 117 on reader service card

Terrazzo Flooring Brochure
Thinset terrazzo floor systems – available in epoxy, polyester, or polyacrylate – are described in a new brochure. General Polymers.
Circle 202 on reader service card

Faucet Brochure
Product and installation photographs illustrate kitchen and lavatory faucets, and kitchen sinks and accessories in a new brochure. Moen®.
Circle 203 on reader service card



Laminates Inspired by Nature
Falsi is a new line of laminates inspired by the natural textures and colors of marble, slate, granite, and cobblestones. A new finish called MAGMA suggests the surface of "cooled molten stone." Abet Laminati.
Circle 118 on reader service card



Marble Tables
Classico marble tables, pedestals, and bases are for residential and commercial use. Verastone.
Circle 119 on reader service card

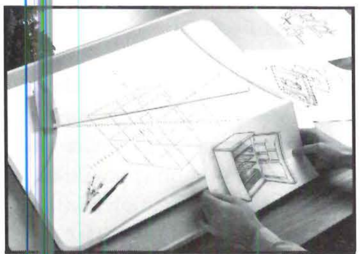
Optimax ® Upgrade Kit
The Paramax luminaire can now be upgraded to an Optimax® Light Control System to improve glare control in computer-intensive areas. Lithonia Lighting
Circle 120 on reader service card

Single-ply Roof Membrane
HyChoice™ is a .045-inch-thick, reinforced roofing membrane. Installation is through a heat-welded seaming process. Carlisle SynTec Systems.
Circle 121 on reader service card

Handmade Wallcoverings
A new wallcovering by designer David Goldberg is called Fifty-Fifty; nine colorways are available. David Goldberg Design.
Circle 122 on reader service card

(continued on page 173)

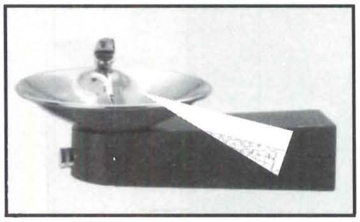
(continued from page 172)



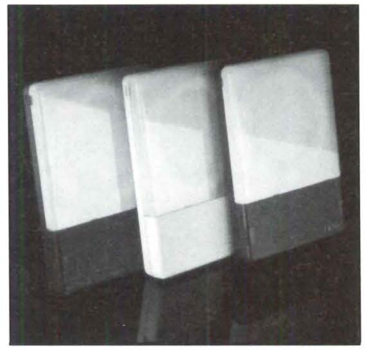
Drawing Boards
The P3 system employs a T-square that rotates in curved channels to produce 3-point perspective drawings. DPI.
Circle 123 on reader service card

Open Cell Ceiling System
The Magnagrid Ceiling System is constructed of U-formed aluminum blades; 24″ × 24″ panels are standard. Several cell sizes and colors, perimeter supports, and other accessories are available. Alcan Building Products.
Circle 124 on reader service card

Commercial Windows
The CommerciaLine™ Window series has been expanded with the introduction of two new windows. Projected, casement, top-hinged, and fixed-vent options are available on the new 5200 (nonthermal) and 6200T (thermal) models. Kawneer.
Circle 125 on reader service card



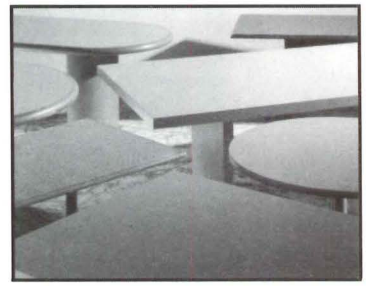
Drinking Fountains
Stainless steel, polished bronze, and cast iron drinking fountains and electric water coolers can be specified in a variety of colors and styles. Haws.
Circle 126 on reader service card



Emergency Lighting
Practica Bella® is an emergency light which is installed on a mounting bracket – equipped with multipolar connectors – which is attached to the junction box. Beghelli.
Circle 127 on reader service card

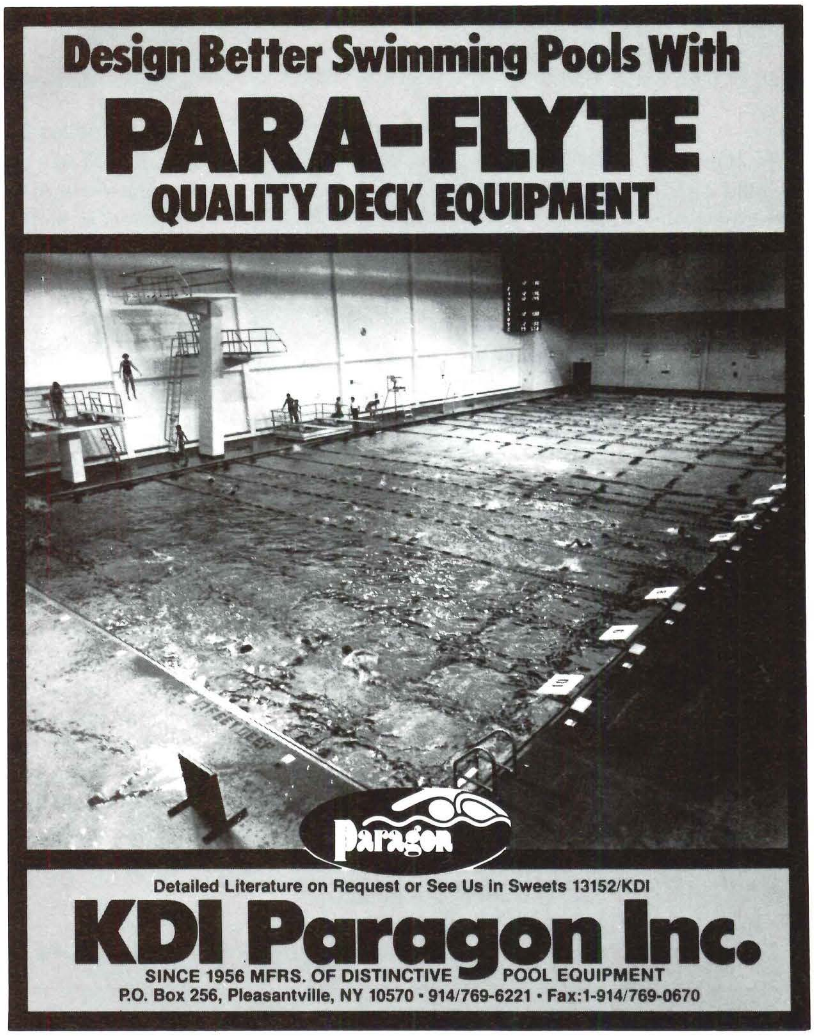
Lockset Lever Design
The 30H Series has a #16 forged lever and comes in a heavy gauge steel lock case. The lever is curved without a return for "handicap usage." Best Lock.
Circle 128 on reader service card

Feltbacked Roofing System
Feltbacked MOD-EPDM roofing system now comes in 10-foot-wide sheets in lengths of 50 and 100 feet. Syenergy Methods.
Circle 129 on reader service card



Conference Tables
Finishes of wood, laminate, or metal, a variety of edge profiles, chrome or powder-coated metal bases, and round, rectangular, racetrack, or boat-shaped tables can be ordered. HLF.
Circle 130 on reader service card

(continued on page 174)



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Computer Software

Intelligent Designer
CEDAR (Conceptual Engineering Design and Reporting) combines parametric modeling, geometric analysis, engineering calculations, and documentation capabilites. It runs on IBM-compatibles with Microsoft Windows software. MCAE Technologies.
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PC Networking
CADVANCE® for work groups allows a group of PCs to interact on a network in conjunction with Novell's Netware 386 server. ISICAD.
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Drawing Management
The FastTrax system is a raster-based document-management system that stores, retrieves, and prints scanned documents using a Macintosh® IIx computer and optical storage devices. Du Pont.
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Scan to CAD
The SCAN scanner-interface module converts scanned images into a CAD format. Accugraph.
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AutoCAD Librarian
The Drawing Librarian keeps track of CAD information created in AutoCAD. In addition to storing information, it allows users to "red line" current drawings without altering them. Softsource.
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AutoCAD Fonts
X-fonts offer a choice of 28 fonts for AutoCAD users, including hand-drawn characters and lettering in the style of Frank Lloyd Wright. Autograf Utilities.
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CAD for Clients
Design Your Own Home: Architecture is an easy-to-use and inexpensive drawing package for Macs and PCs that includes a library of standard fixtures. Abracadata.
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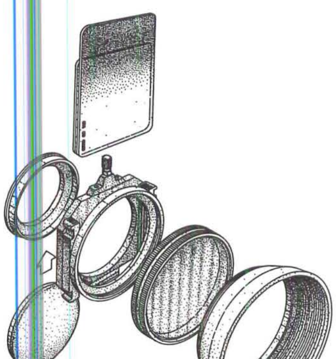
Technics Related Products



Lens Adapters
The Hitech System adapters and lens holders for 35mm cameras hold any size or shape filter. Hitech.
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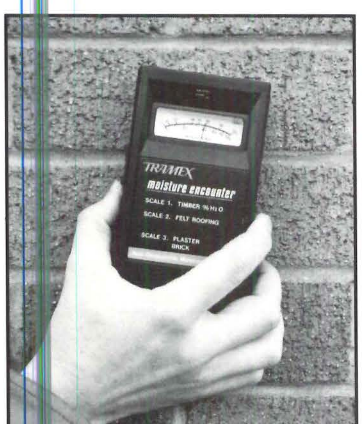
Light Color Specifications
GE's *Lighting Application Bulletin: Specifying Light and Color* explains the selection of lamp light colors for specific applications. General Electric.
Circle 204 on reader service card



Moisture Detector
The Moisture Encounter detects moisture in most building materials electronically without damaging surfaces. Tramex.
Circle 139 on reader service card

Aluminum Guide
The *Aluminum Curtain Wall Design Guide Manual* explains the application of the rain screen principle to curtain walls. American Architectural Manufacturers Association.
Circle 205 on reader service card

Concrete Design Manual
The second edition of *Architectural Precast Concrete* is a comprehensive design manual that includes a discussion of rain screen joints. Precast/Prestressed Concrete Institute.
Circle 206 on reader service card

Lighting Brochure
Color Is How You Light It is a brochure that explains the relationship of lighting selection to the visual color of environments. Sylvania.
Circle 207 on reader service card

Building Materials

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

Mount Pleasant Elementary School, Nashua, New Hampshire (p. 110).
Architects: TAMS Consultants, Boston. Structure: steel frame, masonry bearing walls. Floors/roof: steel deck, concrete slabs. Exterior walls: brick, concrete masonry units. Windows: EFCO. Hollow metal doors: Curries. Wood doors: Algoma. Acoustical tile ceilings: Armstrong. Rigid insulation: Dow. Roofing: EPDM. Public address system: Bogen. Security/Fire system: Simplex. Metal lockers: Medart. Chalk boards: Claridge. Basketball backboards: Medart. Elevator: Stanley. Stair treads: Johnsonite. Exterior lighting: Bega. Classroom lighting: Staff. Lavatories and water closets: Kohler. Water fountains: Elkay. Fan coil units: Carrier. Gas hot water system: Bradford White. Skylights: Zome works. Acoustical floor: Peabody.

Books *(continued from page 118)*

shows how the instrumental and symbolic values of architecture came into conflict in Le Corbusier's work, with the eventual ascendancy of the latter. The heroic program of Modernism had momentarily allowed for the construction of a collective myth of technologically enlightened modern life, permitting a "metaphoric" reconciliation of rationalism and idealism. However, the avant-garde's subsequent absorption into the ideology of industrial capitalism led Le Corbusier largely to retreat, by World War II, from his earlier concerns with mass housing and rationally engineered production into a poetics of monumental individual buildings and a reinterpretation of vernacular sources (a partial exception being the postwar *unités d'habitation).*

"As Colquhoun argues, the empirical failure of [Modernism's] 'master narrative' combined with the philosophical vacuum left by the collapse of traditional values engendered the contemporary crisis of Post-Modernism, with its various attempts to recover an earlier vision of history."

In "The Strategies of the *Grands Travaux,"* Colquhoun analyzes the "plenitude of meaning" in four of Le Corbusier's major public projects of the interwar years, the Centrosoyus, League of Nations, Salvation Army, and Palace of the Soviets. Conversely, Colquhoun also reveals the architect's failure to extend this same multivalency to the design of the city. Although some of Colquhoun's critique of Le Corbusier's urban theory is familiar, his argument is original in demonstrating the sensitive inflection of the *actual* urban projects – each an assemblage of object-like volumes containing discrete functional types – to their idiosyncratic sites. Paradoxically, however, less is more: As Colquhoun argues, the buildings retain their representational and symbolic potency only so long as they continue to function as "other" to their fields. Once they begin to compose a more extensive urban fabric, they dissolve into fragments of a total order, and "the social meanings that the architecture of the city ought to provide" are neutralized or rendered alienating.

In comparison to the first two sections, some of the essays of the third section appear slighter or limited by their recent historical perspective. Nonetheless they exhibit Colquhoun's characteristic careful reasoning and willingness to grapple with difficult questions. The thesis tendered in "Regionalism and Technology," for example, is an interesting one, and it would be worthwhile to test it beyond the American and British skyscrapers he cites. In distinction to the regionalist theories put forward by thinkers from Augustus Pugin up to Kenneth Frampton – the idea of an authentic architecture culture capable of resisting the leveling process of universal technology – Colquhoun poses the less regressive idea that architecture cannot help reflecting the differences emanating from "the most obvious and banal divisions of the modern political world." Whereas elsewhere ("Classicism and Ideology") Colquhoun is at pains to refute a blanket attachment of ideological meaning to particular stylistic manifestations – specifically, the association of Classicist architecture with authoritarian regimes – here he argues oppositely, though without contradiction, "that the approach to technology in relation to architecture is influenced by deep-seated national obsessions."

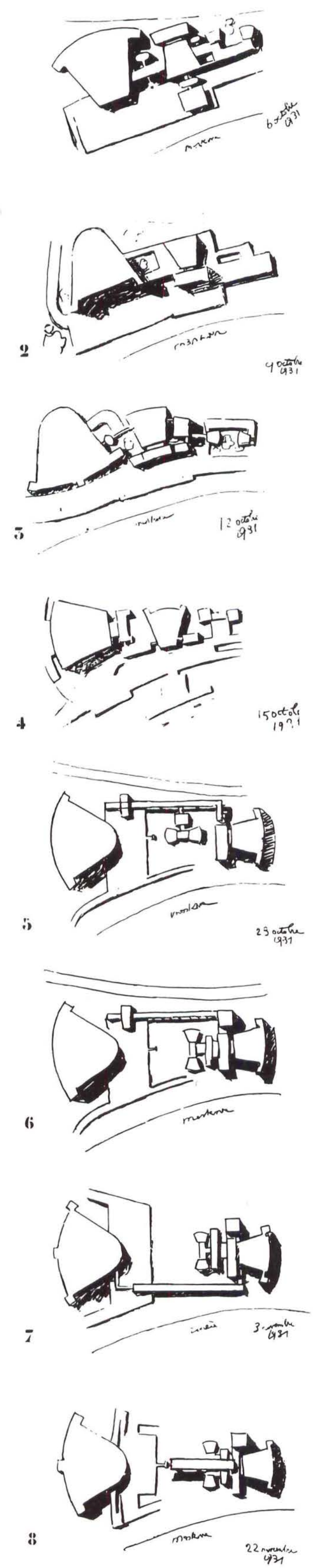
Colquhoun's own critical position, in fact, is finely poised between two poles. One of these is an unnostalgic attitude toward social reality. Economics, politics, and technics are seen as motivating forces that, if no longer determining in the old Marxist sense, nevertheless place clear historical limits on form-making. The other pole is that of typology, an instrument that has the capacity to mediate this reality external to the discipline. Colquhoun defines type as a preexisting and conventionalized system of norms or rules that translate recurrent human needs into material form. This application of a semantic-structuralist analysis of language to architecture allows him to view architecture as a system of representation that has a considerable degree of autonomy. It can express symbolically the values, meanings, and ideologies of human culture, as well as comment on its own disciplinary tradition. Colquhoun concludes, "to say that the past cannot simply be repeated, to acknowledge that modern life has its own exigencies equivalent to those that gave the traditional city its original meaning, is not the same as saying the break in modern society is so complete and inexorable that no traditional values whatever can be relevant to it" ("Twentieth-Century Concepts of Urban Space").

"Colquhoun analyzes the 'plenitude of meaning' in four of Le Corbusier's major public projects of the interwar years. . . . Conversely, Colquhoun also reveals the architect's failure to extend this same multivalency to the design of the city."

Colquhoun's rigorous but open-minded essays represent a desire to *conserve through criticism* what is still vital in the traditions of Modernism and Classicism. They reflect their author's articulate passion for an ongoing culture and practice of architecture.

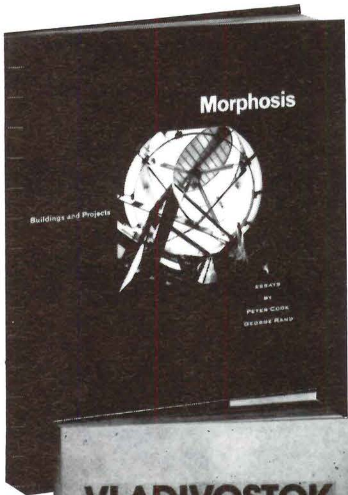
Joan Ockman ■

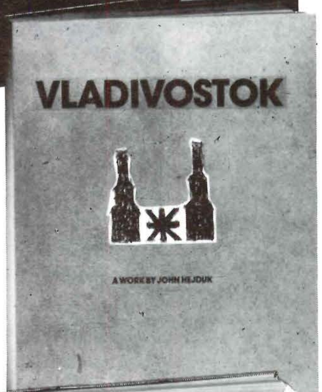
Joan Ockman teaches History and Theory and is Director of Publications at Columbia Graduate School of Architecture, Planning and Preservation.

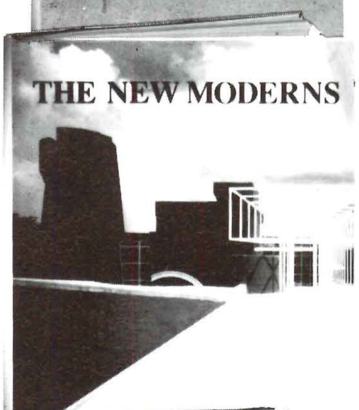


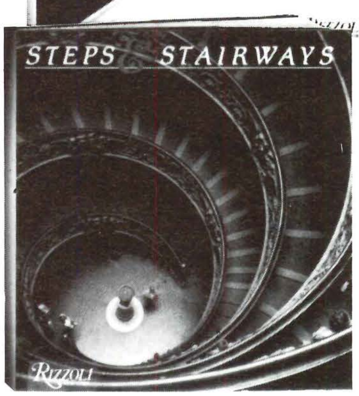
Le Corbusier, Palace of the Soviets competition, Moscow, 1931, successive variations of the design.

IMPORTANT NEW *RIZZOLI* ARCHITECTURE BOOKS









MORPHOSIS: Buildings and Projects
Essay by Peter Cook and George Rand. Documents the award-winning work of Thom Mayne and Michael Rotondi, partners in the firm Morphosis, recognized as the leader in avant-garde architecture in California. 240 pages. 8″ × 11″. 300 illus. 100 in color. Hardcover: 1030-5. $53. Paper: 1031-3. $38

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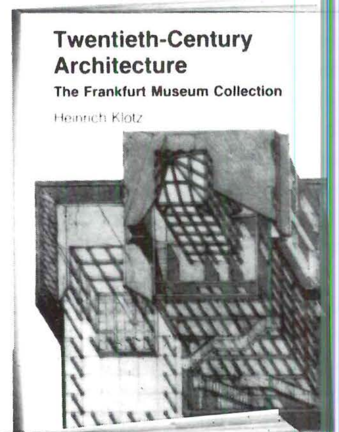

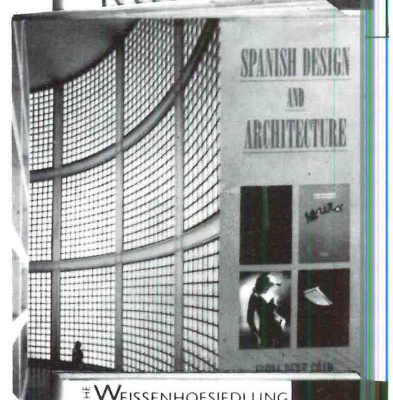

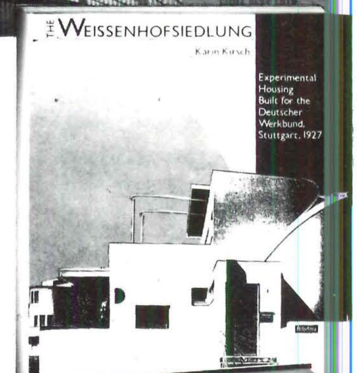

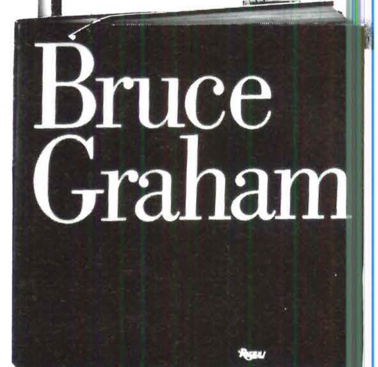

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RIZZOLI INTERNATIONAL PUBLICATIONS

"Over the course of the latest several years, the simple presence of theory in architecture has progressively been transformed into a complex pressure to theorize."

(continued from page 114)

formed by theoretical discourse that appears unavailable to architecture in any other form. One of the most important aspects of that role is subversion. Theory has a ring of resistance to it, an aura of the avant-garde, and the allure of the radical. As the "establishment" came to recognize the political and economic value of even the outer limits of progressive cultural forms over the course of the 20th Century, fewer and fewer ways to assert independence and even fewer ways to establish a critical platform remained. Theory, particularly after the 1960s, as it ingested more and more disciplines, allied itself with the political left and most particularly when it came to call itself "critical theory," assumed the identity of strategic arms set to attack the status quo. Critical theory appears to offer architecture the radical weaponry once offered by a flat roof and a little exposed concrete.

The degree to which critical theory can make good on its promise to architecture is unclear. For example, an explicit aim of critical theory was to undermine the tyranny of Western philosophical traditions, particularly metaphysics. True enough, critical theory has profoundly upset the philosophical apple cart but apparently only to set it upright again by reestablishing itself as the new philosophy, albeit in disguise. When architecture absorbs critical theory, it absorbs this illogical posture as well. Specifically, because critical theory ingested other disciplines in order to demonstrate the intellectual comprehensiveness of its reach, architecture's attempt to ingest critical theory constitutes an attempt to demonstrate the universality of its stature. Thus, generating architecture's will to theorize seems to be the idea that by using the radical power of theory, which contains within it the sum of all human discourse, architecture will become both revolutionary and universal. This has an ominously familiar ring. It would seem in fact that critical theory has seduced architecture into thinking it can realize the failed goals of the Modern Movement.

This irony, that within the very fabric of the theory being used to dismantle the doctrines of architectural convention lies a nostalgic desire to repossess the heroic age of Modernism, begets further ironies. Unlike many other disciplines where "theory" and "Post-Modern" go together to form a unified and progressive front, contemporary architecture has been polarized into the Post-Modern tradition and the theoretical avant-garde. The function of the polarization has been to establish a critique of the enormous success Post-Modernism enjoyed under Ronald Reagan and through Prince Charles. To accomplish this critique, however, Post-Modernism had to be reduced to the level of pure style and had to be transformed into something epitomizing the absence of theory. Although Venturi might be said to have belonged to a day of theoretical innocence, when a "gentle manifesto" might indeed have been gentle, he and others were at the forefront of the reintroduction of theoretical discourse into the profession. In fact, it may even be that the desire to reduce Post-Modern architecture to the level of intellectually vapid decoration reveals a hidden desire to protect architecture from confronting Post-Modern complexities in any fundamental way.

It has been said in the context of literary criticism that "the resistance to theory is a resistance to the use of language about language." Perhaps contemporary architecture's prodigious appetite for theory is an appetite for the use of language about architecture. While Post-Modernism helped establish the idea that architecture was like a language, theory is taking it a step further, asking: Why only like a language? Why not language itself? Yet the desire to use language about architecture suggests a desire to stabilize architectural discourse through the abstract grid of language, just as Modernism attempted to stabilize architecture using the abstract grid of scientific production and technology. Moreover, this transubstantiation of architecture into language knowingly contains within itself the seeds of failure, for if anything has been learned from critical theory it is that words themselves have forms – audio, visual, and conceptual – and thus constitute not textual bedrock but verbal quicksand. In its disingenuous handling of this fact, the contemporary version of architectural theory not only masks a yearning to return to the heroic security of Modern ambitions, but reduces those ambitions to mere representations and shallow caricatures of their former selves. Indeed, the very success of theory has transformed it into another commodity, just as the success of Post-Modernism ultimately forced columns and keystones to stop serving as signs of traditional architecture and start flashing as lucrative addenda on buildings and shopping malls. As theory becomesa mirror image of the architect's ubiquitous Armani suit, it loses its potential to make a serious contribution to the world of architectural ideas.

What distinguishes theory from other impulses that the Post-Modern world turns into fashion, however, is not only its affinity to haute-couture fashion in particular, but its presumption to full disclosure and utter self-consciousness. Of the many intellectual pedigrees that have been and could be invoked by architecture, "critical theory" alone claims to have emerged from the age of innocence and entered the age of shrewd self-knowledge. It is precisely theory's use as an architectural commodity – through which power relationships are manipulated to effect change on the superficial level of word and image rather than on a more substantive level of elemental structure and condition – that is irresponsible both in theory and in practice. As theory outsmarts itself out of reputable existence, the domain where the thinking and making of architecture meet, where the ideal and the real collide, fades in the whirling motion of a tiger biting its own tail. The abuse of theory is the tiger's raw energy. But while theory can be abused, it is not inherently abusive. When that distinction is recognized, a little theory – if and only when right – might yet help stop the tiger's vicious circularity.

Sylvia Lavin ■

The author, a critic of contemporary architecture, holds a Ph.D in architectural history from Columbia University, and is assistant professor of history and theory at USC's School of Architecture.

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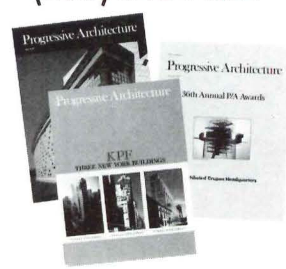


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You've all seen the model apartments that are used to market condominiums and co-ops. They're usually decorated to the nines with chintz-covered sofas, lots of throw pillows, and weighty art tomes on the glass-topped coffee tables. Such a model, complete with closets full of Ralph Lauren clothing, can be found in New York's Police Building, the former headquarters of the police department that was recently converted into co-ops. But when architects Smith-Miller + Hawkinson were commissioned to do a sort of "alternative" model, an urban dwelling of the future that will be in our annual interiors issue in September, the results were very different. Imagining the lifestyle of the young Wall Street types likely to live in the building, they accessorized accordingly: Instead of exotic pastas and flavored vinegars, the kitchen cabinets contain nothing but Chinese take-out containers and coffee cups from Greek diners. And in the closets, no tweedy suits, just white disposable paper jumpsuits. But lest you think the exercise is hyperbolic, the architects applied many of the apartment's ideas in another space in the building, this one for clients who apparently saw a little of themselves in the model.

. . .

Stamford, Connecticut, our place of work — and for a few of us, our home as well — will soon emerge from New York's shadow; we're going to be in the movies. Touchstone Films, a division of Disney, has been filming Bette Midler and Woody Allen, under Paul Mazursky's direction, at the Stamford Town Center, our downtown shopping mall. The word on the street (or, more aptly, in the mall) is that the Town Center's palatial marble interior, with tiers of slick storefronts overlooking a lofty atrium, beat out dozens of other contenders because of its good sight lines. So in June, mallgoers were startled to see Christmas decorations dragged out of storage to make the place look like a Beverly Hills mall in December. The film, *Scenes from a Mall*, will be an ironic moment of fame for our town; unless you read the credits, you won't know it was filmed here. But then, does it really matter where a mall is, once you've arrived to spend money or make movies?

Mall/movie set in downtown Stamford -- or is it Beverly Hills?

. . .

The fact that this month's Technics coverage includes articles by two Canadian authors is no great coincidence; we admire Canadian building science, and read a lot about it. Although they've been on the metric system for about ten years now, we couldn't help noticing in a recent National Research Council publication that they haven't yet completed the transition: "The conventionally built house has a full basement, 2.4-meter ceilings, 2-in. x 6-in. stud walls with a 6-mil. polyethylene vapour barrier . . ." But don't laugh too quickly; we recently read that the U.S. General Services Administration has outlined a policy and plan for its transition to the metric system. So as the U.S. continues to inch — sorry, centimeter — toward metric, those who want to get a jump on the system can order the Metric Handbook for Federal Officials, publication #PB 89-226922, from the National Technical Information Service at (703) 487-4650. It'll run you $20 (American).

. . .

Despite the fact that uncertainty over perestroika has made building in the Soviet Union even more difficult recently, Soviet architects/artists Alexander Brodsky and Ilya Utkin seem content. We found the pair in New York at the print shop of the gallery that recently mounted a show of their engravings (P/A, May 1990, p. 25), working feverishly to finish signing a limited edition of prints before returning to Moscow. After the signing, all that was left was for Brodsky to etch the word "Cancelled" (which he dutifully copied from a slip of paper) across the 30-odd beautifully engraved copper plates. During that time, and amid a few rounds of celebratory tequila shots, Brodsky, who is more fluent in English than his partner, filled the onlookers in on the fruits of their increasing celebrity in the U.S. Besides the New York exhibit, they have prepared an installation for the Tacoma Art Museum (below) that will be in place until September 9, when it travels to Boston. The Tacoma exhibition has led to a commission to design a pedestrian bridge in that city, and, in a development Michael Graves might envy, one of the Brodsky/Utkin engravings has shown up as a label on wine bottles from a California vintner. "We hope to build in the Soviet Union someday, but we don't expect things to change soon," says Brodsky. **In the meantime, the somewhat bewildered Russians are learning how far one can go in America without building.**

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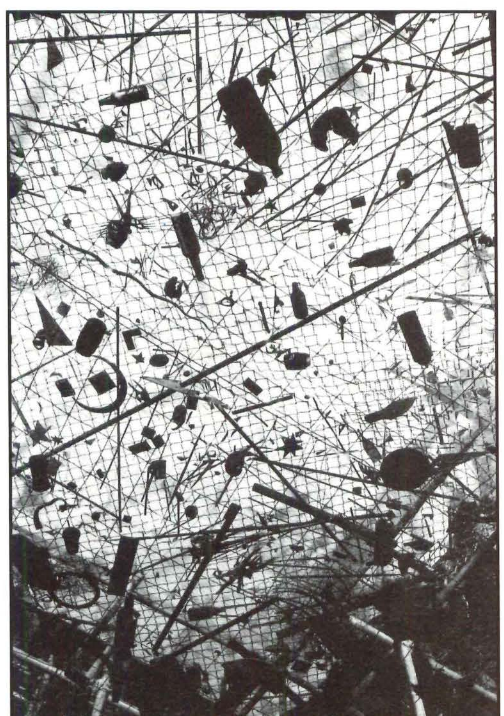

Ceiling of Brodsky and Utkin's Tacoma exhibit, with assorted objects set on wire grids.

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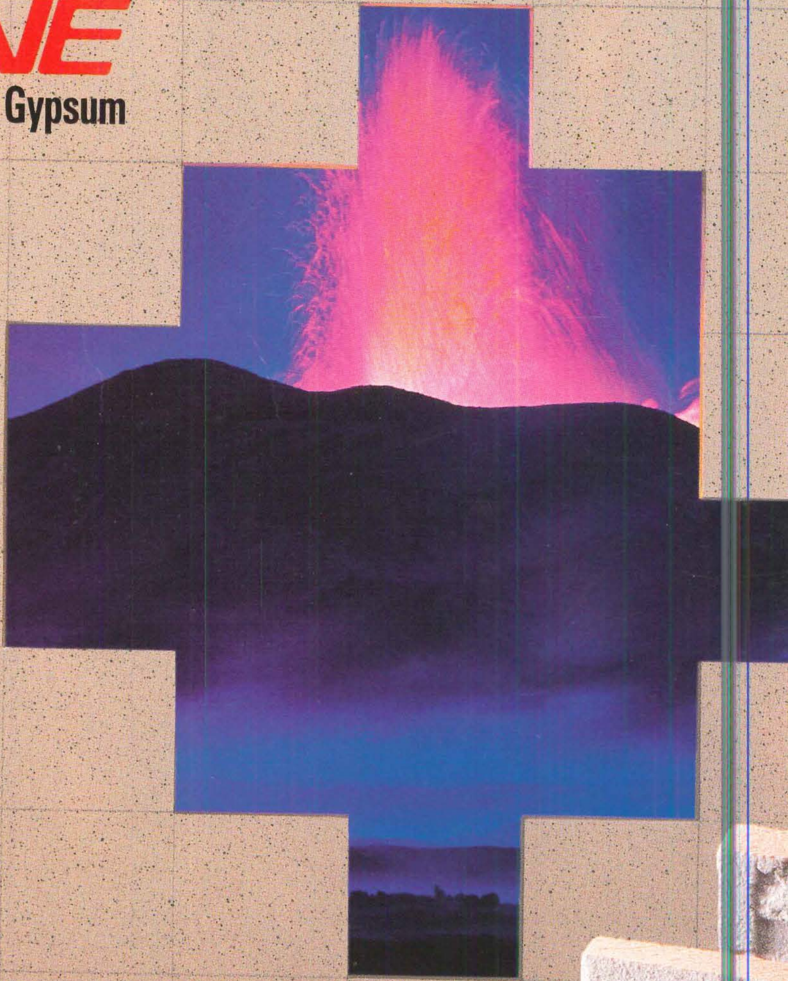

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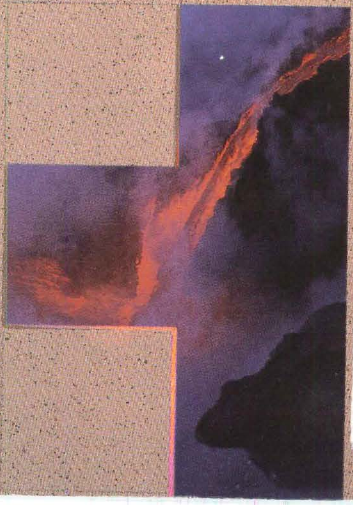

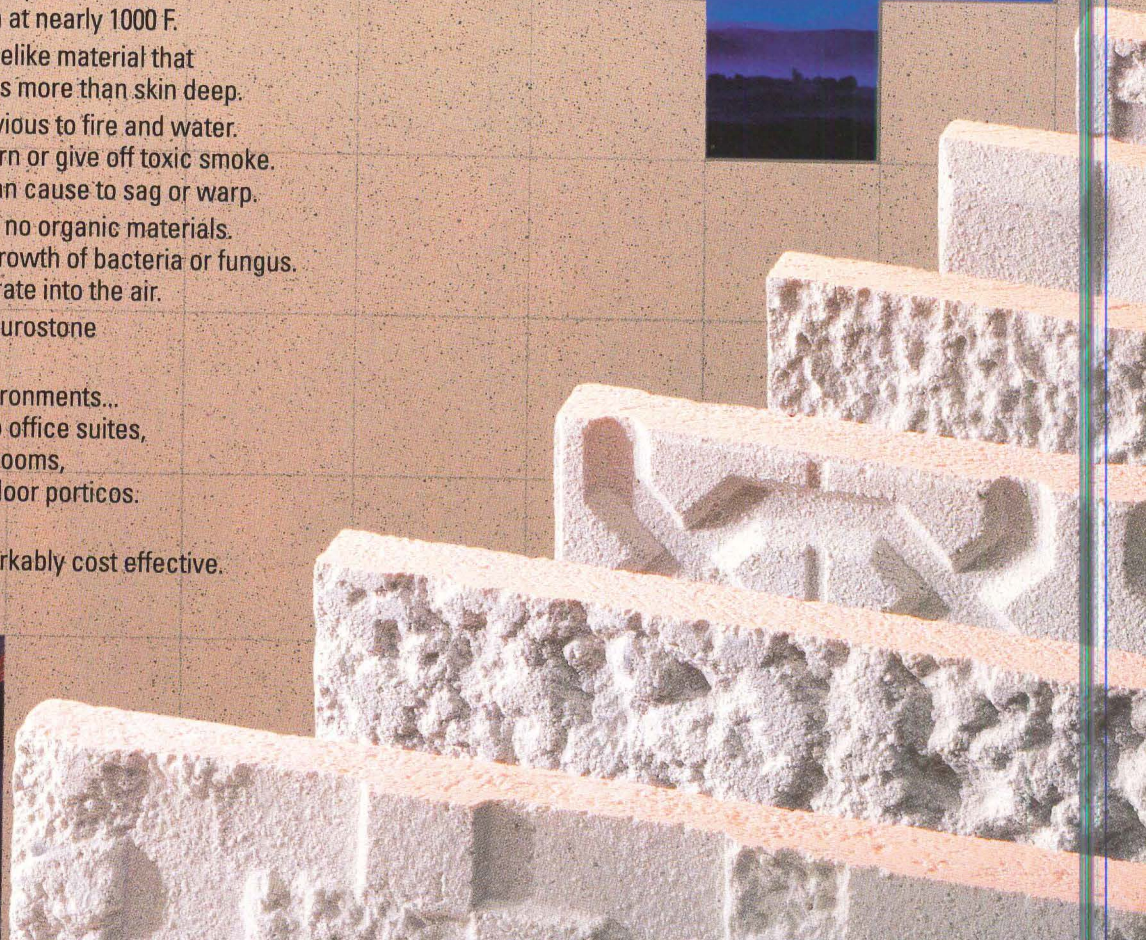

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